



25th International Ornithological Congress

22 to 28 August 2010

Campos do Jordão, SP, BRAZIL

> Abstracts of the 25th International Ornithological Congress

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25th International Ornithological Congress 22-28 August 2010 (www.i-o-c.org)

ABSTRACTS
of the
25th International Ornithological Congress

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Cristina Yumi Miyaki, Elizabeth Höfling and Reginaldo José Donatelli

22-28 August 2010

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PLENARIES



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The early evolution of birds: recent discoveries and ongoing arguments

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The paleontological evidence related to the origin and early evolution of birds has been dramatically increased by the addition of numerous exceptionally well-preserved fossils in recent years. Many new fossils of lineages closely related to the origin of birds have documented that various features previously considered to be exclusively avian — from skeletal structures to feathers — first evolved within the dinosaurian ancestors of birds. Indeed, a wealth of data from diverse lines of evidence has cemented the notion that birds are phylogenetically nested within maniraptoran theropod dinosaurs. Numerous exquisite fossils of a wide range of basal Mesozoic birds have also been discovered in recent years. These archaic lineages have filled the enormous anatomical and phylogenetic gap that existed between the Late Jurassic *Archaeopteryx* — the oldest and most primitive known bird — and the Late Cretaceous *Hesperornis* and *Ichthyornis*, both iconic lineages much more closely related to modern birds than the former. Phylogenetic inferences of this new diversity of Cretaceous birds have clarified the overall sequence of evolutionary transformations related to the fine-tuning of modern avian flight as well as modern developmental patterns. These findings have also documented that birds acquired a diversity of ecological specializations early in their evolution that to a great extent match those seen today among living birds. This plenary talk reviews the evidence in support of the dinosaurian origin of birds, provides an overview of the remarkable morphological and ecological diversity evolved during the early history of birds, and explains how the newly discovered fossils clarify the evolution of the flight capabilities as well as growth and developmental patterns of modern birds.



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Bird migration and the conservation of the global environment

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Migratory birds encounter habitat destruction, hunting, chemical pollution, and collisions with aircraft and wind turbines during their migration. These birds may carry the viruses of some infectious diseases such as West Nile fever and avian influenza. Therefore, it is important that we try to expand our understanding of their migration routes, stopover sites and destinations, migration patterns through time, and habitat use. In the early 1990s, satellite tracking became available for the study of birds. For nearly 20 years I have collaborated with Russian, Mongolian, Chinese, Korean, Indian and American scientists on satellite tracking of migrating birds. Satellite tracking is especially well suited to Asian-based research because of the extremely large land area, sensitive political situations, and many urgent conservation problems in the region. We have studied the migration of about 20 species using satellite tracking in Asia, and concentrated especially on certain taxonomic groups, including cranes, storks, swans, geese, ducks, and hawks. In this presentation, I review the results obtained from our work under four broad categories: migration routes, relative importance of each stopover site, habitat analysis using satellite images, and migration route selection. I then report on conservation applications and achievements emerging from this work, and discuss future possibilities. During the course of these studies, I have also realized that bird migration and migration studies connect not only nature in different countries but also people living along the migration routes. People in different countries can share by watching the same flocks of migrating birds, and by cooperating to protect target species and their habitat. This is really a wonderful and exciting aspect of ornithology. The data obtained through satellite tracking can help show people that they need to cooperate to conserve a shared resource.



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Fine feathers do not make a fine bird. Or do they? - Implications for sexual selection in Neotropical birds

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Darwin's ideas of sexual selection, condensed in his controversial book *The Descent of Man, and Selection in Relation to Sex* initially produced much skepticism and debate. However, over the last four decades, a multitude of studies have shown that sexual selection provides the evolutionary force that shapes traits involving communication, behavior, morphology, and reproductive strategies. In general, traits that appear to defy explanation through natural selection are often explainable when sexual selection is invoked. Bird diversity reaches its pinnacle in tropical regions, and includes a wealth of biological interactions and systems, the study of which could undoubtedly contribute empirically to support the theory of sexual selection. Historically, however, research on these aspects of tropical biology has been greatly neglected. This is a pity because the tropics provide an extraordinary testing arena for many concepts, given that tropical birds are very different from temperate birds in terms of ecological conditions and, consequently, their natural history. Thus, generalizations in the literature concerning birds may be oversimplified, as they are based upon studies restricted to temperate birds. I will discuss the evolution of sexually selected ornamental traits in a Neotropical passerine, the blue-black grassquit, and how these are associated with the bird's mating system and physiology. Sexual communication in this species involves an iridescent, nuptial plumage and the exhibition of a complex visual and acoustic mating display. We have learned that grassquits reproduce in small, aggregated territories, are socially monogamous, but have high rates of extra-pair fertilization with intensive paternal care. Ongoing research is investigating the links between this species' ecology and its phenotype, physiology and mating behavior. I hope that the insights gained so far through the study of this small and abundant bird illustrate the variability of traits and mechanisms in Neotropical birds just begging to be studied.



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Through birds' eyes

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Understanding what information is available to an animal is key to understanding its behaviour. We might think of a bird as “a wing guided by an eye”, but birds do far more than fly and they have access to a wider range of sensory information than that provided by their eyes. Individual sensory systems are subject to many limitations and evolutionary trade-offs, and the different sensory systems used by a bird may provide information that complement each other in specific ways, and there may be trade-offs between different types of sensory information. It now seems clear that individual sensory systems do not always provide the information that we assume to be necessary to complete a task, and that these tasks are often achieved through a suite of integrated sensory adaptations and behavioural strategies. This talk will take a comparative approach to explore these themes from a number of different perspectives. For example, how do the sensory capacities and behavioural adaptations of nocturnal birds (owls, oilbirds, kiwi) match the challenges posed by foraging in nocturnal environments? What are the factors that limit sensory performance in aquatic foragers (penguins, cormorants) and how are they overcome by behavioural as well as sensory adaptations? What are the compromises and trade-offs that determine the visual fields of birds? How is binocular vision traded against comprehensive visual coverage of the world that surrounds the head, and what is binocular vision for? How are the various visual field configurations found in birds related to different foraging strategies, such as pecking (ground feeding passerines, pigeons), lunging (herons, hornbills), filter feeding (ducks, flamingos), and probing (long-billed shorebirds)? Finally, what are the sensory and perceptual factors that make some birds more prone to collisions with obstacles, such as power wires and wind turbines? These topics will be discussed to give insight into the ways that vision in birds has evolved to meet the visual challenges posed by different behavioural tasks and environments. The message is simple; birds may share the same environment with us but they live in quite different worlds. Penetrating these worlds can lead to many insights into the behaviours of birds and into the relationships of birds with their environments. However, fully penetrating these worlds is easier said than done, but we can occasionally glimpse the world through birds' eyes.



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Avian strategies for living at high elevation: life history variation and other factors enabling persistence

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In temperate alpine systems in North America, over 90 bird species live and breed successfully in harsh and variable conditions. Temperatures during the breeding season can vary by up to 50 deg C daily, and regularly approach freezing at night. Our research on multiple fitness-related traits and indicators of competitiveness for ptarmigan and songbirds reveals that most birds living in alpine habitats are not young or inferior individuals that have been excluded from higher quality low elevation habitats. As elevation increases, mountain birds have less than half as much time to breed, and they produce 50-60% fewer offspring compared with birds at lower elevations. Alpine songbirds have 15-20% higher annual survival than conspecifics living at lower elevations, offsetting at least partially their seasonal reproductive disadvantage because they have more years to reproduce. Their offspring also have high survival and natal philopatry with up to 20% of fledglings returning as first time breeders. It is unknown whether the switch to a slower lifestyle for alpine birds is the result of plasticity or genetic differences between high and low elevation populations. Several factors enable persistence in the alpine. Birds at high elevation tend to be larger-bodied, and are able to make physiological and behavioural adjustments to avoid severe stress responses and breeding failure due to hypoxia, delayed breeding or storm events. The majority of alpine birds in temperate areas are elevation-generalist species with wide ecological niches in contrast to tropical areas that tend to have more endemism and alpine specialists. Alpine habitats are experiencing globally significant increases in warming, habitat up-shifting and extreme weather. With slower lifestyles, alpine birds may be reasonably well buffered against extreme weather events that cause occasional breeding failure, but would be particularly vulnerable to climate change impacts that reduce their survival.



Basic approaches and the fate of hornbills in Thailand: a prototype for hornbill-people relationship

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Hornbills, the largest and most conspicuous birds of Asian tropical forest, are an ideal flagship species. Budo Mountain (190 km²) supports six sympatric hornbill species, among these, Rhinoceros and Helmeted hornbills are locally endangered. Because they rely on a cavity in a large tree for nesting, the combined forest encroachment and poaching would extirpate them from the area. To achieve the goals (increase and sustain hornbill populations), two phases of approaches, i.e. an immediate and long-term, are set. After an intensive campaign starting in 1994 onward over 40 villagers (ex-poachers/illegal loggers) from 13 villages around Budo and urban people were convinced and invited to participate in research and conservation programs, i.e. hornbill nest adoption, and no less than 1,774 nest-years of adoption have been accounted. Within 90 km² of tropical rainforest, villagers have located 169 nest trees, which were dominated by trees in the family Dipterocarpaceae (53 %), 38 nests were used annually. Despite difficulties within the area, including natural aspects and situations of social unrest, cumulatively, 1,340 nest cavity-years have been watched over by villagers, and over 464 chicks have fledged (70% breeding success). The program is considered successful in terms of poaching eradication and the dissemination of a hornbill conservation message to the public, and has led to the establishment of the Budo Hornbill Conservation & Education Center in 2004 on a piece of land donated by a villager's family. The Center provides educational and conservation lessons to schoolteachers, children, teenagers and villagers in the surrounding area for approximately 400 individuals per year. (Key words: hornbills, Budo Mountain, nest adoption, community, sustainable conservation).



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The two hemispheres of the avian brain: their differing roles in perceptual processing and the expression of behaviour

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The left and right hemispheres of the avian brain are specialized to carry out different functions. As a result, birds respond differently to stimuli that they see with the left eye, and process primarily in the right hemisphere, than they do to stimuli seen by the right eye, and processed primarily in the left hemisphere. The right hemisphere attends to novel stimuli, which easily distract it from ongoing functions, and assumes control in emergency or stressful conditions. The left hemisphere attends to learnt categories and controls behaviour in routine, non-stressful situations. This division of function extends to processing of auditory, olfactory and even magnetic stimuli. Evidence for this comes from a number of avian species and it has been shown in both laboratory and field tests. Knowledge of these specializations is relevant to understanding the behaviour of birds in the wild since birds respond in different ways to stimuli on their left and right sides (e.g. preferential response to predators and conspecifics on the left side and to prey or food grains on the right side). Evolution of this apparently disadvantageous lopsidedness will be discussed. Individual differences in the strength of lateralization within a species are determined by exposure of the embryo to light and by the levels of steroid hormones *in ovo*. The importance of these influences on lateralization will be discussed in terms of mechanisms and behaviour in the natural habitat. The potential importance of hemispheric dominance in the welfare of birds will also be considered.



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Seasonal timing in a warming world

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Climate change has led to shifts in seasonal timing of reproduction in many bird species. While this can be viewed as an adaptation to a warming world, these shifts often do not match the shifts in the phenology of the birds' food. To understand why species do not change their seasonal timing at a higher rate we need a better understanding of the mechanism underlying timing of reproduction. As climate change shifts the abiotic conditions outside the range to which populations are adapted, seasonal timing will be under selection in many species. To predict how fast natural selection will lead to genetic changes we need to measure this selection on timing using long-term data on wild populations and we need to estimate the heritability of the mechanism underlying timing by studying reproducing birds under controlled conditions. I will illustrate this approach with our work on the great tit (*Parus major*) using a unique combination of datasets: our long term field studies (1955-present) to study selection and to carry out experiments under natural conditions, our 36 climatized aviaries to study the genetic basis of the cues used by the birds to time their reproduction and our work on the great tit genome to identify the genes involved in timing of reproduction. Our experiments in the aviaries show that temperature is causally involved in reproduction, that there is genetic variation in temperature sensitivity and that selection may thus lead to genetic changes in this sensitivity. However, field experiments show that perhaps the energetic costs of egg production are hampering a further advancement of laying dates. We use annual routine modelling in combination with quantitative genetics to predict at what rate micro-evolution will happen under different IPCC climate scenarios. It is likely that for most of these scenarios the rate of adaptation is too low to match the rate of climate change, which will have severe negative effects on population viability. Linking climate scenarios to population viability is needed if ecological impacts are going to be incorporated in decisions on future greenhouse gas emission goals.



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The challenge hypothesis: behavioral ecology to neurogenomics

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Male song sparrows (*Melospiza melodia*) are territorial year-round; however, neuroendocrine responses to simulated territorial intrusions (STI) differ between breeding (spring) and non-breeding seasons (autumn). In spring, exposure to STI leads to increases in plasma levels of luteinizing hormone and testosterone (consistent with the challenge hypothesis), but not in autumn. This suggests that there are fundamental differences in the mechanisms driving neuroendocrine responses to STI between seasons despite apparently identical behavioral responses. Microarrays were used to test the hypothesis that gene expression profiles in the hypothalamus after territorial aggression differ between the seasons. Free-living territorial male song sparrows were exposed to either conspecific or heterospecific males by STIs in spring and autumn. Behavioral data were recorded, whole hypothalami were collected, and microarray hybridizations were performed using the resources of the Songbird Neurogenomics Initiative, University of Illinois. Over 150 genes were differentially expressed between spring and autumn in the control birds and 59 genes were significantly affected by STI in autumn, but only 14 genes in spring. Real time RT-PCR was performed for validation and indicated that STI drives differential genomic responses in the hypothalamus in the breeding vs. non-breeding seasons. The results suggest major underlying seasonal effects in the hypothalamus that determine the differential response upon social interaction. Functional analyses indicate specific genes that may be involved in the mechanisms of differential neuroendocrine responses to aggressive interactions in different life history stages.



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Uganda's avifauna in the living landscape: rural livelihoods and biodiversity conservation

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Birds in East Africa, occur within heavily fragmented, human-inhabited landscapes, posing ecosystem conservation challenges. Studies were carried out in five rural sites with rare and endangered birds within poor human community landscapes in Uganda. Processes of stakeholder engagements, key visitor attractions and preferences and socio-economic status, community attitudes towards visitors and conservation were evaluated. This paper examines tourism trends in the context of wildlife based specifically on avi-tourism at local and global levels. The study documents bird-tourism as a relatively new product and previously neglected tourism resource within the living landscape of East Africa. Birds have increasingly gained popularity with visitors and local communities in the last decade, a shift that favors rural community empowerment and conservation. Public and private Non-Government Organization communities networks viewed as strategic linkages for rural development and biodiversity conservation will be discussed. Through tourism, sub-populations of wetlands and tropical rain forest birds were found to be the principle precursors for rural infrastructure developments, direct and indirect socio-economic and gender empowerment, policy changes and overall environmental stewardship amongst the rural communities. The study so far reveals an annual increase of about 5% in visitation rates to avi-tourism managed sites. The level of conservation awareness amongst local communities on bio-diversity conservation has increased greatly. Limiting factors for the adoption of concepts in avi-tourism for development and biodiversity conservation by key players are highlighted with the view of sharing the East African Model to developing but resource-rich nations. It is argued that birds within rural community landscapes shall continue to have significant impacts on development and conservation policies.



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SYMPOSIA



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S1 Avian social complexity

Convenors: Thomas Bugnyar, Austria; Isabella B. R. Scheiber, Austria; Kees van Oers, The Netherlands

Two experimental tests of social cognition in a precocial bird, the greylag goose (*Anser anser*)

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Animals living in stable social groups are likely to face significant cognitive demands. Social species should recognize other individuals and maintain social relationships between themselves and others despite dynamic changes in age, reproductive status or dominance rank. Only very few studies of social-domain related cognitive abilities exist in birds relative to mammals, and these focused on altricial birds, mainly corvids and parrots. Furthermore, these studies were conducted primarily in the laboratory or with birds kept in aviaries. We study social cognition in a free-ranging, socially intact flock of precocial greylag geese, a species known for its complex social system. Relative to corvids, the ecological environment of geese is simple; therefore, their cognitive abilities should have evolved mainly in context with their social life. We used two-choice tasks to study two questions pertaining to social cognition. First we questioned, whether siblings were able to recognize each other individually. We taught handraised juvenile geese to associate individual siblings with geometrical patterns. During tests we paired a focal with one of its siblings and presented two cups with patterned lids. Only the cup with the pattern corresponding to the sibling present was baited. Ten focal individuals significantly chose the cup corresponding to the sibling present. This result can only be explained by individual recognition, but cannot be explained by familiarity or phenotype matching. In a second experiment, we investigated performance in a transitive inference task, a well-established operant procedure, in which the ordering of a set of arbitrary stimuli can be inferred from a series of dyadic comparisons. Here we used baited cups with a random order of up to seven coloured lids. Not only did geese correctly infer unknown colour pairs, they were capable of memorizing their learned sequence long-term, i.e. two and six months.



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Raven Machiavellian Intelligence

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Complex social life has been proposed as one of the main driving forces for the evolution of higher cognitive abilities. Until recently, this theory has been tested mainly on mammals, i.e. primates, whereas little attention has been paid to birds. Indeed, birds provide a challenge to the theory since they face morphological and ecological constraints (like a high mobility due to flight) that differ from those of mammals and key concepts like linking group size with the degree of sociality/complexity seemingly do not apply. Here we illustrate the potential of ravens *Corvus corax* for engaging in cooperative and deceptive manoeuvres, whereby they judge the others' expertise and even differentiate between knowledgeable and ignorant individuals. We then discuss how social relationships may fit to the ravens' Machiavellian nature and to their life in non-breeder groups with a high degree of fission-fusion dynamics.



Larger groups are more successful in innovative problem solving in house sparrows

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Group living offers well-known benefits to animals, such as better predator avoidance and increased foraging success. An important additional, but so far neglected advantage is that groups may cope more effectively with unfamiliar situations through faster innovations of new solutions by some group members. We tested this hypothesis experimentally by presenting a new foraging task of opening a familiar feeder in an unfamiliar way to house sparrows in small and large groups (2 versus 6 birds). Group size had strong effects on problem solving: sparrows performed 4 times more and 11 times faster openings in large than in small groups, and all members of large groups profited from this by getting food sooner (7 times on average). Independently from group size, urban groups were more successful than rural groups. The disproportionately higher success in large groups was not a mere consequence of higher number of attempts, but was also related to a higher effectiveness of problem solving (3 times higher proportion of successful birds). The analyses of the birds' behavior suggest that the latter was not explained by either reduced investment in antipredator vigilance or reduced neophobia in large groups. Instead, larger groups may contain more diverse individuals with different skills and experiences, which may increase the chance of solving the task by some group members. Increased success in problem solving may promote group living in animals, and may help them to adapt quickly to new situations in rapidly changing environments.



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Insights into cooperative breeding from studies of Florida scrub-jays

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At some level, almost all animal societies have evolved in response to constraints related to reproduction and parental care. Species that practice cooperative breeding, wherein potentially reproductive individuals forgo breeding to assist other individuals in rearing offspring, are relatively rare among birds, but they offer profound insights into the evolution of complex animal societies. We are just beginning to scratch the surface with regard to understanding the physiological mechanisms that promote cooperative breeding. Here we relate some of our results from a long-term study of Florida scrub-jays, a species in which about half of the breeding pairs are likely to have “helpers at the nest.” We have found that reproductive hormones are generally lower in helpers than in breeders, and corticosterone levels (which may be indicative of chronic stress and breeding inhibition) are not significantly elevated in helpers. In addition, prolactin appears to mediate alloparental behavior in helpers: prolactin levels in helpers that feed nestlings are positively correlated with provisioning. Breeders in territories with helpers produce heavier offspring throughout the nestling phase, and survival to nutritional independence and overwinter in the presence of helpers are enhanced. Experimental removal of helpers shows that some of these effects are not simply due to greater territory quality or breeder experience in territories with helpers. We also discuss the fitness effects of cooperative breeding for helpers and breeders, as well as current research in our lab to determine the impact of food supplementation on helper provisioning strategy.



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The influence of personality as a part of the social environment

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Personality can be defined as consistent individual differences in a range of behavioural characteristics and variation in personality is known to affect fitness. Apart from an individual's own characteristics, its behavioural decisions also interact with variation in the personality of conspecifics, like mates, offspring, neighbours and flock members. Individuals are part of a complex social network. Moreover, the interaction between personality and social environment might play an important role for selection on and the maintenance of variation in personality. In this talk, we will give examples of how the personality of individuals interacts with that of their social environment, and how these interactions influence life-history traits and fitness through social interactions and cooperation. We also tested whether the interaction between own and neighbour personality on fitness may affect selection. The examples will elaborate on how personality is involved in social complexity. We thereby show how personality as an environmental source of phenotypic variation can help to maintain variation in personality traits.



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S2 Developmental stress and birdsong: current evidence and future directions

Convenors: Scott A. MacDougall-Shackleton, Canada; Karen A. Spencer, UK

The Developmental Stress Hypothesis: evolution and mechanisms

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The Developmental Stress Hypothesis posits that the honesty of bird song is maintained by costs accrued during development, rather than at the time of adult song production. Song is learned, and the neural systems underlying song learning and production are developing early in life at a time of nutritional and other stressors. Thus, adult song may reflect the early developmental conditions of a male and/or how well that male was able to cope with developmental stressors. Substantial evidence in support of the Developmental Stress Hypothesis has accrued over the last decade but much remains to be done. We will review the current evidence in support of the Developmental Stress Hypothesis and highlight future directions. We note that birdsong is potentially an example of a larger class of sexually-selected indicators of developmental conditions. Future issues include resolving whether song indicates developmental stability or developmental environment, examining the effect of stress on female songbirds, and exploring the neuroendocrine mechanisms by which stress modifies song development.



Does developmental stress affect female mate choice preferences?

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Early developmental stress has been shown to affect various secondary sexual traits in male birds, including song output. Reductions in song complexity are thought to be associated with neural changes in the song control system. Although female birds use the same nuclei for assessing song, the effects of developmental stress on female preferences remain largely unaddressed. This study tests whether developmental stress affects the ability of females to discriminate between potential mates on the basis of visual and acoustic signals. Female zebra finches were raised under control or nutritional stress conditions. In adulthood, female mate choice preferences were assessed for i) visual preferences using an Amsterdam apparatus and ii) acoustic song preferences using song playback. The influence of nutritional stress on mate choice preferences was tested. In the visual choice experiment stressed females showed no agreement in preference ranking of males, either with each other or with controls, but control females also showed no significant agreement in preference ranking of males. Interestingly, stressed females were found to be significantly less active than controls. In the acoustic choice experiment, overall females preferred song from unstressed males, but stressed and control females did not differ in their degree of preference. Although our findings suggest that rearing environment has long term fundamental effects on adult behaviour, we did not find clear cut differences between experimental groups in mate choice preferences.



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Corticosterone and dehydroepiandrosterone have opposing effects in the adult songbird brain

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Acute stress differentially affects corticosterone and dehydroepiandrosterone (DHEA) levels in the jugular versus brachial plasma of adult song sparrows (*Melospiza melodia*), suggesting that the neural endocrine response to stress may be distinct from the systemic response. DHEA, an androgen precursor synthesized in the adrenals, gonads or brain, has antiglucocorticoid properties in the rat hippocampus when administered at supraphysiological levels. Nonetheless, little is known about the role of DHEA in the stress response. Using captive adult male song sparrows, we examined the effects of physiological doses of corticosterone and DHEA on adult neuroplasticity. In HVC, a critical song control nucleus, corticosterone and DHEA had independent, additive effects. Corticosterone decreased and DHEA increased HVC volume, HVC neuron number (NeuN+ cells) and recruitment of new cells (BrdU+ cells) into HVC. Importantly, co-administration of DHEA completely reversed the neurodegenerative effects of chronic corticosterone treatment. In the robust nucleus of the arcopallium (RA), DHEA increased RA volume, but this effect was blocked by co-administration of corticosterone. There were similar antagonistic interactions between corticosterone and DHEA on BrdU+ cell number in the hippocampus and ventricular zone. This is the first report on the effects of corticosterone treatment on the adult song control circuit, and HVC was the most corticosterone-sensitive song nucleus examined. Within brain regions that are particularly vulnerable to corticosterone, such as the songbird HVC and rat hippocampus, DHEA appears to be a potent native anti-glucocorticoid.



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The effects of developmental stress on cognition and song-system functioning in European starlings (*Sturnus vulgaris*)

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The developmental stress hypothesis proposes song learning is the indicator mechanism that females use to assess how successful a male was in the early stages of development. Only high quality males will have enough resources to ward off starvation, predation and disease, yet still manage to properly develop the brain nuclei responsible for song learning. However, it is also possible that early stressors influence a number of neural and cognitive systems. Support for the developmental stress hypothesis has been found in many species, yet no study to date has manipulated stress and measured global cognitive abilities in conjunction with song learning in the same bird. In this study we examined whether singing behaviour is correlated to global cognitive functioning, and if both are impaired by early stress. European starlings were caught as nestlings and juveniles. One group of subjects underwent a food deprivation manipulation, while the others were fed *ad libitum*. After treatment, birds' cognitive abilities were assessed with a foraging and social observation learning task. In the spring of 2010, males' song repertoires will be quantified and analyzed in accordance with their performance on the cognitive tests. Future results will be discussed.



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Dealing with urban noise: a comparison between oscine and suboscine species

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Bird acoustic communication can be impaired by urban noise. A number of strategies birds use to deal with this problem have been reported in several oscine species. These include increasing the song minimum frequency, which would make songs more salient in the presence of noise. Song development in oscines involves vocal learning, and this process has been related to their generally remarkable song variability. In contrast, sub-oscines do not learn their songs, and it could be hypothesized that these species may thus lack the capacity of adopting some of the adaptive strategies described for oscines, which may render sub-oscines more vulnerable to acoustic pollution. In this study, we recorded the songs of a wide sample of oscine and sub-oscine species living in urban habitats in three different countries, and analyzed their song frequency with respect to the level of ambient noise. We hypothesized that oscines, but not sub-oscines, would show a positive relationship between noise level and minimum song frequency. Additionally, we predicted that birds with higher song frequencies would not show such relationship. Our preliminary analyses confirm that most oscines were found to increase their song pitch with increasing levels of noise, whereas sub-oscines did not. We also found that changes in song frequency in the presence of noise were more likely in oscines with particularly low pitched songs. These preliminary data suggest that sub-oscines may be less acoustically adaptable compared to oscines, or that they must resort to other strategies to make their acoustic message detectable in urban environments.



S3 Avian vocal learning and development

Convenors: Gisela Kaplan, Australia; Isabelle George, France

Evolution of song culture: how social interactions shape song development

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Would culture resembling existing ones evolve in an island colony of naïve founders? This cannot be studied experimentally in humans; we performed the analogous experiment using socially learned birdsong. Zebra finch isolates unexposed to singing tutors during development, produce song with characteristics that differ from the wild-type song found in laboratory or natural colonies. In tutoring lineages starting from isolate founders, we quantified alterations in song across tutoring generations in two social environments: sound isolated chambers with tutor-pupil pairs, and an isolated semi-natural colony. For both tutor-pupil only and isolated colony settings, songs evolved toward the wild type in 3-4 generations. Therefore, species-typical song culture can evolve de novo. Although the progression toward wild type song culture takes place even in an impoverished environment, no innovation and invention of new syllable type were observed in a one-to-one song tutoring setting. In contrast, in a colony environment, in the presence of females, we observed invention of new syllable types across generations. To explore the role of female zebra finches (who do not sing) in the development of song culture, we compared auditory responses to songs across males and females using functional MRI. We found that isolate males show no song specific BOLD responses in auditory brain areas. In male zebra finches, the development of song-specific auditory responses required social or song learning experience during development. In contrast, isolate females showed song-specific BOLD responses similar to those observed in experienced colony raised males. Therefore, females might have an important role in the development of song culture, since they show song-specific responses prior to experience. Our ongoing experiments in controlled social environments test how social interactions with males and with females might affect the development of song culture across generations.



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What female starlings can tell us about song learning and perception

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Birdsong has become a privileged model to study the neural bases of vocal learning and, as such, has been extensively studied during the 3-4 last decades. However, to date, studies on song learning have been mostly concerned with males alone. Yet, females can provide us valuable insights into the context of vocal learning and of disruption and acquisition of auditory perception. Thus, we have recently shown that young female starlings need to experience a direct contact with an adult female in order to learn song, and that they show neither social bond with nor vocal copying from males. Using this peculiar property, we could show that social segregation can, as much as physical separation, alter the development of a central auditory area. In this paper, we will present our latest findings in the study of song perception and learning in female starlings, at the behavioural and neural levels. We will discuss these findings in relation to the role of social influences and selective attention not only on song learning but also on the development of central auditory processing.



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Ontogeny and function of birdsong in high/low latitudes

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Tutored song practice in developing songbirds is an adaptive behaviour in species in which males sing to attract a female. Such vocal dimorphism is associated with climate (harsh winters, high levels of migration), strong competition for nest sites, partners, and territories, short learning time and short life span. However, 80 percent of passerines live in low latitudes (Southern Hemisphere) or in the tropics and many have long breeding seasons, are long pair bonding or cooperative breeders and some of them are even vocally monomorphic. Such differences have important implications for the learning and function of song. This paper will present the ontogeny of song of a major songbird, the Australian magpie (*Gymnorhina tibicen*) as a model case of such southern hemisphere species in light of their vocal development of untutored song. Magpies are vocally monomorphic and both sexes sing, especially outside the breeding season. Magpie nestlings and juveniles practise song only when adults are absent and 'rehearsal' does not lead to the 'crystallization' of song and remains plastic. Cracticidae, to which modern magpies belong, date back 19 million years. Indeed, in all likelihood, many of the species surviving the Cretaceous-Tertiary boundary were on the continents of the southern hemisphere. Hence, song of early songbirds may not have been linked with reproduction and this coupling may have been a later evolutionary step. This paper will demonstrate alternative learning styles and repertoire uses that have, so far, not been fully explained or understood. Interestingly, development of the magpie's song has parallels to human vocal learning and is therefore of great interest for comparative purposes.



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Divergence of mate recognition systems and adaptive phenotypic traits in response to recent anthropogenic habitat changes in an oceanic island (São Tomé) endemic passerine (*Speirops lugubris*)

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Adaptation of communication systems to local environments predicts that when environments differ ecologically, divergences in communication systems will occur. This, in turn, may lead to the evolution of pre-mating barriers, which have been thought to be one of the most important mechanisms in reproductive isolation. Global anthropogenic environmental change is therefore expected to affect signal evolution. We examine the effects of recent anthropogenic change in the divergence of some phenotypic patterns of *Speirops lugubris*, an endemic passerine of Sao Tome Island. Data on plumage colorimetrics, song and morphology were collected from individuals on both primary forest and shade forest plantations, a habitat less than 200 years-old. Results showed no plumage color differences between habitats, however those in shade forest plantations were significantly smaller than birds in undisturbed forest. Song structure diversity was high, with very few song types shared between individuals. Nevertheless, the physical properties of the songs related to vegetation structure characteristics that differed between habitats. This observed change in a small island population suggests that mate recognition signals, a fundamental trait for fitness, are able to respond quickly to habitat changes.



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S4 Sexual behaviour of tropical birds

Convenors: Leonida Fusani, Italy; Barney Schlinger, USA

The proximate and ultimate causes of courtship behavior in golden-collared manakins

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Males of the golden-collared manakin (*Manacus vitellinus*) perform elaborate courtship displays that are among the most spectacular in the animal kingdom. During a long breeding season, male manakins aggregate in leks, and each male clears a small court on the forest floor where he perform his displays. These behaviours are the result of sexual selection, which is particularly intense in lekking species in which females choose their mate mainly on the basis of behavioural and morphological features. In the last years, we have studied the proximate and ultimate causes of courtship behaviour of golden-collared manakins. We found that these behavioural specializations are accompanied by unique morphological and physiological specializations involving the muscular, neural, and hormonal systems. Also the control of courtship by androgens differs in its pattern from that described in lekking species of temperate zones: Manakins have elevated androgen levels at the beginning of the displaying season but low levels during the following months although displaying activity does not change. Detailed analyses of the behaviour using high-speed videography showed that male displays require an amazing accuracy in neuromuscular coordination. Indeed, females mate preferentially with males who can perform their displays at a faster pace and yet maintaining a perfect control of their posture. All together, these studies reveal evolutionary and physiological mechanisms that underlie the spectacular courtship displays of manakins.



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Behavioral and hormonal perspectives on continuous partnerships and territoriality in male and female buff-breasted wrens

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More than 90% of bird species are monogamous, with one male and one female pairing exclusively during at least one breeding attempt. Many tropical birds extend their partnerships outside of breeding, remaining continuously paired on territories throughout the year. I have studied proximate and ultimate consequences of continuous pairing and territoriality in male and female buff-breasted wrens (*Thryothorus leucotis*). More than being paired continually, buff-breasted wrens display extreme monogamy: partnerships are long-lasting and often permanent, and divorce and extra-pair fertilizations are rare. Yet, little opportunity exists to select among potential mates, new partners are accepted without overt competition, and fidelity occurs with mate guarding. Coupled with extreme mate fidelity is a high degree of fidelity to territories, with most individuals living on only a single territory through their lifetimes. Males and females both sing and aggressively defend their territory, but whereas males behave aggressively to all intruders, female aggression is greater towards other females. Hormonal studies of territorial aggression have found that male wrens, unlike most temperate species, do not have elevated testosterone after aggressive encounters. By contrast, territorial females challenged by intruding females showed elevated testosterone levels, suggesting that female but not male territorial aggression is regulated by androgens. Study of this tropical species has revealed unexpectedly ambivalent acceptance of long-term partners, combined with sex-specific territorial aggression and regulation. These results suggest that the benefits of continuous territoriality may outweigh benefits from continuous pairing.



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It takes two to tango: reproductive skew and social correlates of male mating success in a lek breeding bird

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Variance in reproductive success among individuals is a defining characteristic of many social vertebrates. Yet, our understanding of which male attributes contribute to reproductive success is still fragmentary in most cases. Male-male reproductive coalitions, where males jointly display to attract females, are of particular interest to evolutionary biologists because one male appears to forego reproduction to assist the social partner. By examining the relationship between social behavior and reproductive success, we can elucidate the proximate function of coalitions in the context of mate choice. Here, we use data from a four-year study of wire-tailed manakins (*Pipra filicauda*) to provide molecular estimates of reproductive skew and to test the hypothesis that male-male social interactions, in the context of coordinated displays, positively influence a male's reproductive success. More specifically, we quantify male-male social interactions using network metrics and predict that greater connectivity will result in higher relative reproductive success. Our data show that four of six leks studied had significant reproductive skew, with success apportioned to very few individuals in each lek. Metrics of male social affiliations derived from our network analysis, especially male connectivity, measured as the number of males with whom the focal male has extended interactions, were strong predictors of the number of offspring sired. Thus, network connectivity is associated with male fitness in wire-tailed manakins. This pattern may be the result of shared cues used by both sexes to assess male quality, or the result of strict female choice for coordinated display behavior.



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Doomed mate choice in Darwin's finches

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Intraspecific interactions are influenced by extended phenotypes, but evidence for an extended phenotype that honestly reflects the producer's genotype is scarce. Avian nests are a prime candidate to examine evidence for extended phenotypes, because both nest building and avian morphology are highly heritable. An extended nest phenotype may be used in mate choice under assortative pairing, whereby the genotype and morphology of the nest builder is signalled to the choosy sex. We examine evidence that nest size is an extended phenotype influenced by stabilising and directional effects in Darwin's small tree finch (*Camarhynchus parvulus*), which has previously been shown to have assortative pairing for two heritable phenotypic traits: bill and tarsus length. We show that male tarsus length predicts nest size. Compared to younger males, older males built smaller nests that were more uniform in size and shape. Larger nests had more *Philornis downsi* parasites, and nestling mortality increased significantly with parasite intensity. Our study indicates that nest size is subject to stabilising effects with increasing male age, resulting in an adaptively favoured extended phenotype under high fitness costs of parasitism. We also examined the social ecology of mate choice: females preferred nests built by old males in heterospecific aggregations with high canopy cover. These nesting aggregations experienced low predation but high parasitism. The ecological trap from heterospecific nesting aggregations appears to be offset by selection for smaller tarsus length and nest size with consequently lower parasite intensity.



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Size and color dimorphism in hummingbirds

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Sexual dimorphism is a common phenomenon across birds, and is usually manifested in color patterns, overall body size or size and shape of specific body parts. Such dimorphism is typically explained by sexual selection, with males and females differing in attributes that allow them to maximize reproductive success. However, ecological variables are also invoked as causing sexual dimorphism. We explore the effect of ecological factors on the evolution of size and color dimorphism in hummingbirds (Family Trochilidae) - a large avian family occurring across a wide variety of habitats, altitudes, and latitudes in the New World. Hummingbirds display mixed patterns of size dimorphism, with males being both larger and smaller than females across species. Dimorphism in color patterns (head, neck, wing, tail and overall) also vary across species. We investigate the effect of natural selection on the evolution of these diverse dimorphism patterns in hummingbirds, and determine the effects of habitat types occupied, latitude, climate and diet within a phylogenetic framework.



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S5 Recent advances in the breeding biology of Psittaciformes

Convenors: Juan F. Masello, Germany; Robert Heinsohn, Australia

Comparative breeding biology of Psittaciformes in the Neotropics

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A 2002 review showed that for 92% of parrot species there was a lack of breeding biology data, which are necessary for the identification of specific threats and the evaluation of conservation measures to be taken. Such a lack of information is of particular concern, as Psittaciformes have become one of the most endangered orders of birds. But, Psittaciformes also offer great opportunities for evolutionary biology research, until recently little explored. Their unique feather pigments, the suggested strong innate immunity, their flexible investment in current reproduction and a widespread monogamy make them, also from a research perspective, a unique order of birds. Conversely, parrots are among the most difficult birds to work with in the field. This is one of the reasons why so little is known about the biology of wild populations compared to the wealth of information available for captive species by the veterinary sciences. The difficulties of fieldwork on parrots usually lead to low samples sizes, which in turn reduce the chances of publishing the results. Consequently, a large amount of field data on this group is published in internal reports with very little chance of dissemination. Nevertheless, in recent years, a relatively large amount of information on the breeding biology of Psittaciformes has been made readily available, Neotropical species accounting for approximately 70% of the research. I will here review this recent research, identify gaps in our knowledge of the breeding biology of Neotropical parrots, and propose lines of future research.



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Breeding biology and mating systems of Psittaciformes of the Old World

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Psittaciformes has become one of the most endangered orders of birds. However conservation efforts for this order, especially identification of threats and evaluation of potential remedial measures, are hampered by the lack of good breeding biology data for most (92%) parrot species. In many cases the lack of data is for good reasons as parrots are among the most difficult birds to study in the field, including difficulties in catching the birds, accessing their habitat and nest sites, and following their movements over wide ranges. Even when studies are conducted they often lead to low sample sizes and low publish-ability of the research, and much important data remains hidden in internal reports to agencies. The low productivity of such studies may also be a particular deterrent for post-graduate students. In recent years, more studies on the breeding biology of Psittaciformes have been published, with Neotropical species accounting for approximately 70% and Old World studies making up 30%. Complementary to the review presented on Neotropical parrots in this symposium I will summarise and critique the recent research on the breeding biology and mating systems of Old World Psittaciformes. These studies include excellent field studies of the breeding biology of highly endangered species together with analyses of the evolutionary ecology of parrot species with some of the most unusual mating and social systems known among birds. I will also identify gaps in our knowledge of the breeding biology of Old World parrots, and propose the most productive avenues for future research.



Breeding success of hyacinth macaws *Anodorhynchus hyacinthinus* (Aves, Psittacidae), Pantanal of Miranda, MS, Brazil

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Breeding success is a parameter commonly used to measure the population growth of organisms. The objective of this study was to assess the reproductive success of *Anodorhynchus hyacinthinus*, an endangered species in the Pantanal of Miranda over ten breeding seasons (1997-2007). In this period 672 breeding pairs were monitored in 489 nests with 892 eggs. The results showed that the breeding period in this region is from July to January. The average clutch size was 1.9 ± 0.1 eggs per pair, with 65% of hatching success. The average hatchling size was 1.5 ± 0.5 chicks with survival rate of 63%. Only one chick flew in most nests (76%). The reproduction rate was 0.6 young per nest, while the reproductive success was 1.0 nestling per couple. Although the number of nests, eggs and chicks have varied over the years, this variation was not significant. The loss of nestlings was significant. There is an inverse relationship between atmospheric temperature increase and reproductive success. The results show a positive trend in growth of the hyacinth macaw in the region, for every 100 couples that produce offspring four young are effectively increased in the group. We discuss the factors that affect the reproductive success like environmental climate changes, food resources availability, disputes and competition for nests, predation and loss of eggs/young and the nests management being done that is leading the increase of the species in the region.



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Ecology and management of the Cuban parakeet (*Aratinga euops*)

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The Cuban parakeet or catey is an endemic psittacine to the Cuban Archipelago. The species is considered in 2009 by IUCN Red List category as a vulnerable species. Currently the population is decreasing and presents a high level of isolation along the entire species distribution area. This research evaluates the current population status and distribution of this species in the main island of Cuba. Data on nesting biology, reproductive success and chick development is presented comparatively between two localities in two distinct habitat types where the species occurs. According to our data, the catey is seemingly better adapted to the savannas with palms than to the low mountain forests, however the first habitat type is the most disturbed. We analyzed the results of the main management actions that have been developed in different protected areas and we evaluate the perspectives and challenges that represent the long term conservation of this species. The main causes for the decline have been identified in most of the cases, however practical and efficient conservation measures are needed.



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Neonatal development and survival of hatchlings of the indigo macaw *Anodorhynchus leari* in the Canudos Biological Station, semi-arid of Bahia, Brazil

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During the reproductive seasons of 2008-09, roosts and 30 nests of the indigo macaw *Anodorhynchus leari* were recorded on the sandstone cliffs of the Canudos Biological Station in Canudos, Bahia state, Brazil. We accessed ten active nests in two separate sites (A and B), through vertical descent (rappel), to study neonatal development and survival rate of hatchlings. 69% of the eggs found within the nests were fertile, and of these, 92% (63% of the total) hatched. 22 nestlings were then captured, measured and banded. The smallest chick hatched with 22.6 g and 8.5 cm of total length (TL). Banding was only done on nestlings over 37 cm (TL), when tarsus width and weight were over 0.86 cm and 655 g. Feather growth was recorded with 300 photographs. The mean incubation period was 103 days, and the mean TL and weight, by the end of feather growth, were 957,5 g and 56 cm. 16 nestlings survived until achieving flight capacity, resulting in a 73% post-hatching survival rate. For the deceased nestlings (n=6), cause of death was equally divided between natural death, predation, or fall from the nest. The nestlings from site B left the nest c. 25 days earlier than those of site A, due to lower competition for nesting cavities during the initial occupation by the parents. These results provide additional information on the indigo macaw's natural history and reproductive rate, as well as contributing to perfect the conservation strategies for the species nesting sites.



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S6 Evolution of avian breeding systems: conflict and cooperation

Convenors: Tamás Székely, UK; Jan Komdeur, The Netherlands

Mating system in the evolution of avian genomes

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Females and males of many birds exhibit a striking array of sexual dimorphisms, ranging from the primary differences of the gametes and gonads to the somatic differences often seen in behaviour, morphology, and physiology. These differences raise many questions regarding how such divergent phenotypes can arise from a genome that is largely shared between the sexes.

Recent progress in genomics has revealed some of the actual genetic mechanisms that create separate sex-specific phenotypes, and the evidence indicates that thousands of genes across all portions of the genome contribute to male and female forms through sex-biased gene expression. Related work has begun to define the strength and influence of sex-specific evolutionary forces that shape these phenotypic dimorphisms and how they in turn affect the genome. Additionally, theory has long suggested that the evolution of sexual dimorphism is facilitated by sex chromosomes, as these are the only portions of the genome that differ between males and females. Genomic analysis indicates that there is indeed a relationship between sexual dimorphism and the sex chromosomes, however the connection is far more complicated than current theory allows.



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Birds of a feather: neural motivation systems evolve in predictable ways in relation to avian sociality

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As evidenced by their phylogenetic distributions, components of social organization change vary rapidly over evolutionary time, and thus behavioral variables such as mating system and grouping (“sociality”) are prone to repeated divergence and convergence. Given this, plus the complexity of relevant neural mechanisms, we cannot assume that convergence in social structure has been produced by convergent modifications to the same neural characters. However, using five estrildid finch species that differ selectively in their species-typical group sizes (all biparental and monogamous) we have demonstrated that neural motivational systems evolve in predictable ways in relation to sociality. These systems include nonapeptide circuits that encode social valence (positive-negative) and dopamine circuits that encode “incentive value” and drive appetitive social behaviors. These systems exhibit functional and anatomical properties that are biased towards gregarious species, whereas other aversion-related systems show biases towards territorial species. Combined, these findings suggest that selection on species-typical group size may reliably target the same neural motivation systems.



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Reproductive skew and selection on female ornamentation in social species

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Males are typically more ornamented than females. Sexual selection theory notes that because sperm are cheaper to produce than eggs, and because males generally compete more intensely for reproductive opportunities and invest less in parental care than females, males can obtain greater fitness benefits from mating multiply. Therefore, sexual selection typically results in male-biased sex differences in secondary sexual characters. This generality has recently been questioned, because in cooperatively breeding vertebrates, the strength of selection on traits used in intrasexual competition for access to mates or other resources linked to reproduction is similar in males and females. Because selection is acting with comparable intensity in both sexes in cooperatively breeding species, the degree of sexual dimorphism in traits used in intrasexual competition should be reduced in cooperative breeders. Here we use the socially diverse African starlings to demonstrate that the degree of sexual dimorphism in plumage and body size is reduced in cooperatively breeding species as a result of increased selection on females for traits that increase access to reproductive opportunities, other resources, or higher social status. In cooperative breeders such as these, where there is unequal sharing of reproduction among females, and where female dominance rank influences access to mates and other resources, intrasexual competition among females may be intense and ultimately select for female trait elaboration. Selection is thereby acting with different intensities on males and females in cooperative versus non-cooperative species.



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Functional organization of Blyth's reed warbler (*Acrocephalus dumetorum*) song

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Song of Blyth's reed warbler consists of series of more or less complex acoustic constructions, many of them are based on imitations of other birds' voices. Singing males usually repeat series of rather simple elements that they have heard from the neighbour male. In 2009, in Kostroma region (Russia) we demonstrated to birds records of natural and artificial songs (the latter included fragments of some allopatric birds' voices). We found that males were not actually copying other birds' songs, but used resembling constructions from their own repertoires. Such songs produced by males in conflict situations usually lacked the most complex elements. Nevertheless, some bachelors in the end of breeding season gave inadequate reactions by producing more complex songs. Our results show that song of Blyth's reed warbler includes two sorts of elements that are usually based on imitations, mixed with each other and do not form a strict sequence: (1) rather common (shared by many individuals) and less complex addressed presumably to males, and (2) quite unique and more complex addressed to females. Blyth's reed warbler is socially monogamous bird, although extra-pair copulations are common, and several (rare) cases of polygyny were recorded. We suppose that differences in functional and structural song organization between existing Acrocephalinae species indicate that the complex song in this group was evolved quite recently in its evolutionary history after the loss of short and stereotypic babbler-like song. Investigations were supported by the Russian Fund of Fundamental Researches (grant #07-04-01363).



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Evolution of avian breeding systems: conclusions and future directions

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Birds exhibit a diverse array of breeding systems, ranging from lifelong monogamy, cooperative family-breeding, polygamy to short promiscuous pair bonds, and this diversity makes birds an excellent model system for investigating the evolution of social behaviour. We will overview some of the major research programmes on avian breeding systems, and provide directions for future studies. Researchers use a variety of approaches (mathematical modelling, experiments in behavioural ecology, neuro-endocrinology & genetics, phylogenetic analyses) and we will integrate their perspectives into a cohesive study of avian breeding systems. In addition, we will overview recent advances, approaches and research methodologies in evolution of breeding systems. We anticipate new synthesis will emerge with regards to (i) cooperative behaviour, ecology and life-history theory; (ii) mate choice, sexual conflict and pair bonds, and (iii) parental care strategies and negotiation over care between parents.



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S7 Studying birds in the context of the annual cycle: carry-over effects and seasonal interactions

Convenors: Peter Marra, USA; Jennifer Gill, UK

Carry-over effects in migratory birds: consequences for individual performance on breeding areas

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Migratory birds spend different parts of the annual cycle in geographically disparate places. The conditions and selective pressures at winter locations are likely to affect individual performance during the breeding season, and vice versa. Such inter-seasonal effects are poorly understood within most avian migration systems, in large part because it has been difficult to determine the connections between specific summer and winter populations. Stable isotopes have contributed enormously to our ability to link events in the annual cycle and research has begun to uncover the ecological and evolutionary significance of these connections. For example, because migratory organisms spend different parts of the annual cycle in geographically (and ecologically) separated locations, the dynamics of summer populations are likely to be strongly influenced by events on the wintering grounds and vice versa. Simple mathematical models illustrate the effects of density-dependence on population dynamics. Events on wintering grounds are also likely to affect both arrival time and body condition of individual birds on the breeding grounds, and these parameters are likely to have important consequences for breeding behaviour, natal dispersal and annual survival. In this talk, I will describe through several specific examples how understanding seasonal interactions and carry-over effects is essential to our basic understanding of migratory bird biology. Finally, I will emphasize how it is essential to study biological phenomena in the context of the entire annual cycle.



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Carry-over effects in migratory birds: individual-based drivers and population-scale patterns

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Carry-over effects in migratory birds can potentially arise through different individual-based or environment-based drivers, and the consequences of carry-over effects for individual fitness can be influenced by the relative importance of these different drivers. Similarly, carry-over effects can have significant consequences for population-level processes, such as population growth, distribution and range expansion potential, and the relative importance of individual or environmental drivers of carry-over effects can influence these processes. In this talk, I will describe how different drivers of carry-over effects might operate and explore some of the population-level consequences of carry-over effects. Carry-over effects have now been identified in many different migratory bird species, and the life history characteristics of individual species are likely to influence the role of different carry-over drivers and their broader implications. Consequently, I will also explore how variation in life history and environmental landscapes may impact on the mechanisms determining carry-over effects and their population-level implications.



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Seasonal interactions of weather and resources on the demography of Florida scrub-jays (*Aphelocoma coerulescens*)

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Although seasonal interactions and carry-over effects have received considerable attention in migratory birds, they also are relevant for understanding sources of annual variation in the demography of non-migrants. Florida scrub-jays are cooperative breeders with year-round territories containing all of their annual resources. In the fall, jays cache acorns to be recovered as winter food. The size of the oak mast is, in part, determined by summer weather one or two-years previously (for red or white oak species, respectively). The annual acorn crop has a large influence on survival of breeders; when mast is small survival is relatively low. Adult survival also is lowest in years affected by disease epidemics, but these also occur when acorn mast is relatively small. Epidemics occur when jays are harvesting acorns, thus the combined energy expended to harvest a scarce resource and fight off disease might exacerbate the probability of mortality. When breeder mortality is high, the subsequent breeding season is delayed and the mean clutch size greatly reduced. Both per capita nest success and fledging productivity are reduced during late breeding seasons and reproduction is further depressed by an increased proportion of inexperienced breeding pairs and reduced group size. The reduction in productivity following high adult mortality can lead to an overall reduction in density, but this may eventually increase the per capita reproductive rate through negative density dependence. Climate change could affect the size of acorn crops, with subsequent effects on jay demography, likely affecting the extinction risk of small, isolated populations.



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The consequences of carry over effects in migratory wildfowl: from individuals to populations

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In recent years, a small number of studies have shown that carry over effects may explain a significant amount of variation in the life history parameters of individuals. However, few studies have managed to demonstrate the impacts of these on population dynamics. Here we investigate whether the signal of individual behavioural decisions (choice of overwintering and breeding sites, invest in reproduction or not) is detectable and important at a population scale. We use two migratory wildfowl populations with differing life histories (and thus density dependence acts in quite different ways) to investigate how carry over effects associated with different traits influence population processes. We have large resighting databases of individually marked whooper swans *Cygnus cygnus* and light-bellied brent geese *Branta bernicla hrota* which also contain information on site selection within and among years/seasons, site quality, associations with other individuals, individual quality measures (mass corrected for body size, fat stores) and productivity. Whooper swans are clearly limited by the availability of suitable breeding territories, whereas brent geese are limited by non-breeding season processes such as availability of high quality breeding and staging habitat. We will present data illustrating how carry over effects associated with different traits (e.g. winter site selection/itinerancy, strength of connectivity, demographic status and phenology) interact with density dependence and differentially drive population dynamics.



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Modelling bird migration in the context of the entire annual cycle

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Theoretical models are important in summarising knowledge of complex systems, such as, indeed, migratory behaviour, and providing insight in the functioning of these systems. As such they are ideal tools to describe the present and predict the future, notably in relation to hypothetical changes in model parameterisation (e.g. in order to simulate environmental change). As a variety of approaches have been developed for modelling migratory behaviour of birds (as well as other migratory animals), we first review these models identifying their fundamental assumptions as well as their general benefits and drawbacks. In particular, we will evaluate the potential of theoretical approaches to identify carry-over effects. Although models are ideal tools in highlighting sensitive periods and processes during migration or within the whole annual cycle, their validity should ideally be scrutinized by accompanying experimental research. This, however, is not an easy task if dealing with such complex and spatially and temporally extended behaviour as migration. Here, we present a few examples, where we and others have managed to combine theoretical and empirical, (semi)experimental efforts and show their encouraging results, advancing our understanding of carry-over effects in migrant birds.



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S8 Maternal antibodies in eggs: linking ecological and evolutionary implications

Convenors: Thierry Boulinier, France; Jennifer Grindstaff, USA

Evolutionary implications of maternal antibody transmission

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Immunologists have revealed many of the proximate mechanisms of maternal antibody transmission and utilization, but until recently little research addressed the environmental and evolutionary forces underlying differences among individuals or species in maternal antibody transmission. Similarly, maternal effects theory has generally neglected the mechanisms by which mothers influence offspring phenotype. Although the environmental cues that generate maternal effects and the consequent implications for offspring phenotype are often well characterized, the physiological and developmental processes through which the maternal effect is transmitted are frequently unknown. Integration of the proximate mechanisms of maternal antibody transmission with evolutionary theory on maternal effects provides an opportunity to characterize a maternal effect from the level of genetic differences to physiology, and ultimately to differences among individuals and species. During this talk, I will address the potential for maternal antibody transmission to act as a transgenerational induced defense and the necessity of identifying both the benefits and costs associated with induced defenses. Second, I will address the use of artificial selection experiments with captive birds to study the response to selection on maternal antibody transmission and likely correlated effects. Finally, I will discuss useful approaches to comparative studies of wild birds to begin to understand variation among species in antibody transmission.



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Maternal transfer of antibodies in the zebra finch (*Taeniopygia guttata*) - Female timing and effects on offspring immunity

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According to the principle of maternal effects, females have a unique possibility to affect their offspring's phenotype and fitness by providing non-genetic factors such as nutrients, hormones and antibodies. In birds, maternal secretion and absorption by the offspring mainly occurs prenatally through the egg yolk. The newly born offspring experience the same environment, and hence the same infections and parasites, as their mothers. Transmission of antibodies could consequently be vital, since the offspring's endogenous immune system is not yet developed to defend them against infections. Some studies implies that the antigens transmitted from female to offspring reflect the mother's entire immunological experience, whereas other studies indicate that it is the mother's antibody diversity and concentration at the time of egg laying that determine what will be transmitted to the offspring. After the offspring's neonate stage, there are two contrasting hypotheses for how maternal antibodies may affect the offspring's endogenous immune responses. The 'offspring immunity enhancement hypothesis', propose that maternally transferred antibodies work as 'templates' which instruct the offspring's endogenous immune system and hence enhance the offspring's own specific responses to the transferred antigen. The alternative hypothesis proposes that the offspring's endogenous antigen specific antibody production is suppressed by maternally derived antibodies. We have experimentally tested these hypotheses for maternal antibody transmission, and results indicate that timing has an effect, but also that maternally transferred antibodies affect the developing immune system of the offspring early in life.



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Factors affecting the evolution of maternal antibody allocation differ across taxa: yolk antibodies in Passeriformes and Charadriiformes

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The optimal level of yolk antibody deposition depends on the potential benefit to offspring immunity and the costs to both mothers (energetic) and to offspring (immune development). From a life history perspective, the potential negative impact of maternal antibodies on adaptive immunity is more costly for species with longer lifespans and protracted developmental periods. From an ecological perspective, there is higher benefit of yolk antibodies for species with high nestling parasite loads or endemic disease pressures. The balance of these selection pressures could produce contrasting relationships between yolk antibody levels and ecological characteristics. Separate phylogenetic analyses of yolk antibody evolution in neotropical songbirds and north Pacific seabirds revealed opposite relationships between yolk antibodies and nestling period. I suggest that this is because life history and immune development considerations weight most heavily in the neotropical songbirds, whereas nestling parasite loads are the most important consideration in the evolution of yolk antibodies in the seabirds. In both analyses the phylogenetic signal of the yolk antibody character was not strong; models using a star phylogeny had a better fit to the data, suggesting the character is very labile. Life history, nestling parasitism, and body size all seem to be important determinants of the evolution of yolk antibody levels, but more information is needed on the developmental trajectories of immune function across species in order to fully understand how maternal and neonatal immune interactions influence yolk antibody deposition strategy.



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Eco-epidemiology issues linked to the transfer of maternal antibodies

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The maternal transfer of antibodies has been well examined in domestic birds, where it has been shown to provide chicks with temporary protection against parasites. However, evidence of its role as a maternal effect increasing offspring fitness in natural conditions is lacking. Besides its consequences at an individual level for the fitness of the chick, the transfer of maternal antibodies might also alter the proportion of naïve individuals that will be exposed to a disease agent. Hence, it is likely to have implications for the ecology of host-parasite interactions and the epidemiology of wildlife diseases, in particular the zoonoses circulating in wild birds (Influenza, West Nile Virus, Lyme Borreliosis). During this talk, I will address two questions: (1) the use of the transfer of maternal antibodies to investigate the spatio-temporal variability of parasite exposure and its consequences on the epidemiology of wildlife diseases (2) the effect of passive immunity on the development of chick immune response and the techniques that can be used to avoid potential confounding factors linked to maternal vaccination when studying the effect of maternal antibodies on offspring fitness.



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Sexual selection in female birds: plumage coloration and maternal antibody transfer in the blue tit (*Cyanistes caeruleus*)

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A large number of bird species presents a weak sexual dimorphism and the occurrence of female ornaments has traditionally been explained by genetic correlations with male ornaments. However, more and more studies suggest that some female traits could rather evolve through sexual selection. Indeed, female ornaments like plumage coloration could convey a signal of their quality and be involved in male mate choice especially in monogamous species with a high male investment in the reproduction. Moreover, female ornaments could signal their status to other females to avoid costly fights for the access to reproduction and therefore be involved in female-female competition. Here, we tested experimentally that the UV blue cap and the yellow chest in female blue tits could be under sexual selection. First, we experimentally investigated the hypothesis of female-female competition. In spring 2009 we simulated the intrusion of females with amplified and diminished UV blue cap in the territory of established pairs. We measured the level of aggressiveness and tested the link between female aggressiveness, her own coloration and the intruders' coloration. We expected that less colorful resident females would be less aggressive in front of the amplified UV blue cap intruders. Second, to test the hypothesis that female coloration convey a signal of quality, we vaccinated 22 females with an inactive antigen (Newcastle Disease Virus: NDV) and collected feathers to measure their coloration before egg laying. After clutch completion we collected eggs to analyze their content in anti-NDV antibodies and carotenoids. We found that bluer females transmitted more anti-NDV antibodies into the eggs and that yellow brighter vaccinated females transmitted more carotenoids into the eggs. These results confirm that female coloration in blue tits can be a signal of quality and emphasize the fact that different colorations can convey different kind of information



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S9 Physiology and ecology of seasonality: are physiological measurements valid proxies for timing of life-history events?

Convenors: Tony D. Williams, Canada; Marcel E. Visser, The Netherlands

Linking measures of pre-breeding sexual recrudescence to egg laying dates

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Understanding complex environmental challenges such as climate change requires the integration of disciplines that often evolved in independent ways. A key example is the timing of avian reproduction for which we need to integrate the (neuro-) endocrine mechanisms linking the perception of seasonal environmental cues to the behavioural decisions of when to breed and their fitness consequences. While the mechanistic approach has historically been the domain of physiologists, the timing of breeding and its fitness consequences are rather the prerogative of ecologists. As a consequence, the studies on seasonal sexual development and those on laying dates have been largely independent and in the few cases where these topics have been investigated simultaneously, they were hardly correlated. There are several potential candidates for physiological proxies of laying dates. However, the inter-individual variation in the physiological components underlying timing, the primacy of male-focussed studies in physiology and the trend to concentrate research effort on the central regulation of the reproductive system may partly explain why the currently used proxies are of limited value when studying avian timing of reproduction. I will give some insights on how the different disciplines could be reconciled in the hope of building bridges between disciplines that, after all, share many common interests.



Campos do Jordão 2010 25th International Ornithological Congress 22-28 August 2010 (www.i-o-c.org)

Gonadal and hormonal measures of breeding state: What they do and do not tell us about the regulation of reproduction?

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Avian species from temperate regions tend to breed seasonally and exhibit marked changes in reproductive physiology. In species such as the European starling these changes in reproductive state are regulated by photoperiod: long days stimulate gonadal growth but also set in motion the regression of the gonads while days are still long (photorefractoriness). The photorefractory state dissipates in response to the experience of short days that renders the birds responsive to long days once again (i.e. photosensitivity). This variation in reproductive physiology has traditionally been assessed by measures of gonadal size. Gonadal size can vary several hundred-fold in seasonally birds. In the laboratory, studies typically focus on changes in the male testis because it exhibits the full degree of recrudescence and regression as is observed in the field. In captive females, the ovary usually fails to exhibit the exponential phase of development that results in ovulation. It is often impossible to discern reproductive state solely based on an examination of the gonad. For example, short day photosensitive birds may exhibit a gonad similar in size to long day photorefractory birds. Variation in gonadal size is controlled by the release of pituitary gonadotropins that are in turn regulated by the gonadotropin-releasing hormone (GnRH) system. Variation in reproductive state is reflected more reliably by variation in the brain content of the GnRH protein such that GnRH expression is high in photosensitive and even higher in photostimulated birds but low in photorefractory birds. With the recent cloning of the gene coding for the precursor protein of GnRH the timing of the physiological switch mediating variation in reproductive state can now be assessed more precisely. Interestingly, gonadal changes during the onset of photorefractoriness reasonably reflect variation in GnRH mRNA expression while this is not the case when investigating the onset of photosensitivity.



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First –day release and Dio2: a test of latitudinal variation in photoperiodic control of reproduction in great tits (*Parus major*)

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Timing of breeding is regulated to coincide with periods of resource abundance. Lengthening days during winter is invariant from year to year, and heralds the arrival of spring well in advance. Therefore, day length is a potent regulator of reproductive activation in temperate species. The threshold for photo-induction varies latitudinally among populations of great tits, with northern populations requiring longer days to induce gonadotropin secretion and testis growth than southern populations. We make use of these population differences in photoperiodic threshold to test the recently proposed model of photo-induction in quail. Namely, that gonadotropin-releasing hormone release is mediated by a local increase in triiodothyronine (T3) as a result of up-regulation of type 2 iodothyronine deiodinase (DIO2) and down-regulation of type 3 (DIO3) enzymes within basal hypothalamic cells. As southern populations are photostimulated by shorter day lengths, we predict that increases in expression of key genes involved in the photo-induction pathway will occur earlier after lights on in southern than northern population birds during one long day. We isolated total mRNA from brain tissue punches through the medial basal hypothalamus. We measured expression of several genes relative to a control using quantitative real-time PCR. These data will be the first to measure changes in gene expression during photo-induction in any wild population. Furthermore, we aim to pinpoint where along this physiological cascade that natural selection has acted to alter timing of breeding.



Temperature as a predictive cue in timing of reproduction

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Temperate zone birds that breed in seasonal environments, like the great tit (*Parus major*), need to match their reproduction with conditions that facilitate a successful rearing of their young. For several species, synchrony with a narrow food peak is essential for reproductive success. As there is interannual variation in the timing of the food peak, as well as a general advancement of spring due to climate change, birds need to be phenotypically plastic to cope with this environmental variability. Little is known about which supplementary cues are important for the decision to start laying. Spring temperatures are closely related to the time of laying in the field, but it is unknown whether this is a direct causation or if the timing of the season is perceived via spring phenology or food. Over several years we performed experiments in climatized aviaries to look at direct effects of temperature on reproductive development, laying behaviour and moult in pairs of great tits. As plasticity in laying is heritable, we made use of birds from our long-term pedigreed Hoge Veluwe population to estimate a genetic component of the mechanisms underlying the behavioural decisions. We followed both sexes throughout early reproductive development up to the end of moult and estimated how traits are affected by specific temperature regimes. Additionally, we will present how temperature interacts with other supplementary cues from the environment. Our overall aim is to predict if birds are able to cope with climate changes, which are already disrupting the connectivity between predictive environmental cues and phenological events.



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Ecology of adaptive strategies that help reduce the physiology conflicts in avian migrants

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I propose to present evidence from experiments on overwintering population of two Palearctic-Indian latitudinal migratory finches, the blackheaded bunting (*Emberiza melanocephala*) and redheaded bunting (*Emberiza bruniceps*), that the bird's timekeeping mechanism in interaction with day length regulates seasonal rhythms of migration and reproduction such that physiological conflict between them is reduced. Initiation and termination of the body fattening and testicular cycles are separately regulated photoperiodic events; e.g. the response curves of body mass and testis are not overlapping. A response-specific photoperiodism is adaptive, since body fattening, critical to spring migration, precedes gonadal recrudescence. Also, the migration as indicated by the nighttime migratory restlessness under experimental situations (e. g. intense locomotion under caged condition - called *Zugunruhe*) appears to be regulated by a separate circadian oscillator. Interestingly, the changes in temperature do effect the photoperiod induces responses, as does living with the conspecifics. And, food availability appears to determine the initiation of gonadal growth during the photosensitive phase as well as the recovery from the photorefractory phase. All these results emanating from laboratory investigations correspond to the predicted role of ecological factors in physiology of seasonal life history stages of birds. * Supported by DST-IRHPA Center for Excellence grant.



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S10 Conservation and avian communities

Convenor: John W. Fitzpatrick

Demographic responses to post-fire habitat succession compound the endangerment of Florida scrub-jays, *Aphelocoma coerulescens*

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Florida scrub-jays are rapidly disappearing throughout their small geographic range. The species is confined to oak scrub typically maintained low and open by wildfire. We describe a 20-year experiment at Archbold Biological Station in which an overgrown tract of scrub was thoroughly burned, followed by complete fire suppression. Jay density increased during years 1-6, remained stable in years 7-9, then declined steadily to near-zero by year 20, documenting for the first time a complete fire-cycle for this species. Maximum density exceeded long-term mean density, but persisted only a few years. Breeding density increased mainly via immigration, and the subsequent decline was caused by reluctance of potential recruits to pair with widowed breeders as the habitat became overgrown. This behavioral response explains how an ecologically specialized bird species exhibits rapid demographic shift toward instability under fire-suppressed conditions. The response appears to be adaptive, as first-year survival of juveniles is significantly higher during early post-fire conditions than in later stages of habitat succession. Fire suppression by humans is pervasive in remnant fragments of Florida scrub-jay habitat, hence the species will soon be extirpated everywhere except where conservation management promotes prescribed burning.



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Fire and dieback disease impact woodland avifauna in a Mediterranean hotspot

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The south-west Australian global biodiversity hotspot is dominated by proteaceous vegetation and supports a rich avifauna. Fire is a common and natural influence on these ecosystems but has increased in frequency and intensity as a result of a drying climate and human intervention. In addition to fire, proteaceous woodlands are susceptible to the soil-borne dieback disease *Phytophthora cinnamomi*, which causes dramatic and permanent changes to vegetation structure and composition. Our study investigated the impacts of both fire and dieback on the avifaunal communities of Banksia woodlands north of Perth, Western Australia. For fire we observed bird abundance and species richness on a monthly basis for 12 months. We surveyed 20 two hectare plots that differed in time since last fire (1 – 26 years). Individual species responses to fire were variable, with species, such as the yellow-rumped thornbill, occurring more frequently in recently burnt habitat whereas splendid fairy-wrens were more frequently observed in long-unburnt habitat. For dieback we compared bird species richness, abundance and composition between seven die-back infested, one hectare plots and seven die-back free plots. The impact of dieback on the avifaunal community was immense, and results clearly indicated a change in species composition and density due to dieback. These changes were strongly associated with changed vegetation structure and plant species composition following dieback infestation. Our results underline the serious impact that fire and dieback disease can have on the avifauna of Mediterranean woodlands.



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Structure and change of Amazonian bird communities after wildfire: a ten year study

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Forest wildfires are one of the major threats to humid tropical forests. The effects of wildfires on tropical forest birds remain poorly understood, and most studies have examined mainly short-term effects. In this study, we examine longer-term responses of fire disturbance on an Amazonian bird assemblage, investigating on how understory birds reacted to forest regeneration one, three, and 10 years after widespread surface fires. The bird community was sampled along the Arapiuns and Maró river catchments of western Pará, Santarém, in central Brazilian Amazonia (2°44' S, 55°41' W). The bird community was surveyed in 1998, 2000 and 2008 using mist-nets in eight plots (four in burned and four in unburned sites). Our results showed that observed species richness, abundance and composition changed over time, and the differences of three sampling periods within treatments (burned or unburned forests sites) were significant ($p < 0.02$). MDS ordination showed consistent differences in bird composition both within and between burned and unburned sites (ANOSIM, $p < 0.001$) in the three years of sampling. Insectivorous ant-followers such as *Dendrocincla merula*, *Phlegopsis nigromaculata*, and *Willisornis poiciliotus* increased over time in regenerated burned forests. Regarding species of conservation concern, we found an increase in species abundance of sensitive and habitat specialist species in burned sites over the ten year study period. Our findings indicate that, although the bird community seems to be recovering in terms of abundance, the overall community composition of post-burned and unburned sites remains very different, and has not recovered after 10 years of forest regeneration.



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Lianas, not arthropods, limit understory insectivorous birds in Central American rainforest fragments

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Tropical rainforest understory insectivorous birds (UIs) are highly vulnerable to forest fragmentation, with declines often attributed to direct effects of decreased patch size. Yet UIs have nearly disappeared from larger fragments, e.g., 1600ha La Selva Biological Station, while persisting at smaller nearby reserves, e.g., 354ha Reserva Tirimbina. Our research supports an indirect-effects hypothesis with three components: (1) Collared peccaries are locally suppressing liana regeneration, (2) UIs forage selectively in dense liana tangles, and (3) UI declines correspond with loss of liana tangles. Research was conducted at three sites: La Selva (LS, >14.3 peccaries/km²), Tirimbina (RT, <3 peccaries/km²), and Refugio Bartola (RB, <3.6 peccaries/km²). Liana cover and density were significantly higher at RB and RT compared with LS, and within LS were significantly greater within experimental mammal exclosures. At RB and RT, where UIs persist, the ruddy-tailed flycatcher (*Terenotriccus erythrurus*), golden-crowned spadebill (*Platyrinchus coronatus*), and dot-winged (*Microrhopias quixensis*), and checker-throated antwrens (*Myrmotherula fulviventris*) all selected foraging sites with high liana density and cover. Yet LS retains only 0-30% of these species' preferred microhabitats. Direct food-limitation is unlikely as arthropod abundance was significantly greater where the birds have declined (LS vs. RB). This research highlights the important role of indirect effects in rendering even large forest tracts unsuitable for remnant species. This is the first study to our knowledge to show that UIs are vulnerable to loss of foraging microhabitats.



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Contributions to population growth rate in a wild songbird

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We examined hypotheses about factors contributing to population growth rate (r) in an island population of song sparrows (*Melospiza melodia*) over 5 decades (1960-2000) using structural equation models. Vital rates accounted for 96% of the variation in r , with adult and juvenile survival exerting about three times more influence than immigration or reproduction. In years without population crashes (36 of 38 yrs), however, the influence of juvenile survival on r increased by 24%, whereas the influence of adult survival declined by 60%. We next estimated the total effect of density and extrinsic (spring temperature, winter severity, brood parasitism) factors on each vital rate and on r . Although spring temperature strongly influenced laying date, and brood parasitism influenced nest success, neither of these factors had large impacts on r because the direct effect of reproduction on r was small. In contrast, population density had a large effect on r because it influenced fledging rate, immigration and juvenile survival. Winter severity had a large influence on both juvenile and adult survival, but only when two crash years were included. Our results suggest that, in most years, this population is regulated by intraspecific density, but destabilized by infrequent crashes caused by late-winter freezes. Our results demonstrate that a full understanding of the contribution of vital rates to variation in r will often be essential to predict population growth rate and design effective plans for conserving declining species.



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S11 Reintroduction and the restoration of avian populations

Convenors: Christine Steiner São Bernardo, Brazil; Philip J. Seddon, New Zealand

Reintroduction as a conservation tool for threatened Galliformes: the red-billed curassow *Crax blumenbachii* case study from Rio de Janeiro state, Brazil

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Seventy-three of the 280 species of Galliformes are at risk of extinction, and all of them are threatened by human factors (mainly hunting, deforestation). Reintroduction is increasingly proposed as a conservation measure although there is limited post-release monitoring to determine success. Systematic radio-tracking of released red-billed curassows *Crax blumenbachii* in Brazil has allowed detailed information of ecology and behavior of the species. The information obtained through post-release monitoring will guide future management of the species, as well as inform other reintroductions.



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Strategic directions in reintroduction biology: the challenge of setting restoration goals

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When the last members of a species have been lost from parts of their historical range often the only option for restoration is through reintroduction; the translocation and release of captive or wild-caught individuals. Since 1990 increased collaboration between reintroduction practitioners and researchers has stimulated an exponential increase in peer-reviewed publications related to wildlife reintroductions; there is now a field of reintroduction biology. Although much of the research so far has addressed questions retrospectively based on available data, in recent years a more strategic approach has seen research and monitoring directed towards improving reintroduction success. Increasingly reintroduction projects are moving away from a single species focus, towards ecosystem restoration involving the translocation of multiple species. Some of the key questions that have been proposed for reintroduction biology (Armstrong & Seddon Trends in Ecology and Evolution (2008) 23:20-25) relate to reintroductions at the ecosystem level. Here a main challenge facing reintroduction practitioners is the extent to which restoration targets should be dictated by historical states, for instance, is there a case to be made for moving species outside their recorded range?



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Conservation of the California condor: are self-sustaining populations possible?

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After 36 years, and tremendous efforts, the California condor (*Gymnogyps californianus*) Recovery Program has achieved success beyond what many believed possible. There are roughly as many birds in the wild now as there were 70 years ago and nesting pairs are established at five release sites. However, the program's success required unprecedented levels of human intervention on behalf of an endangered species, and condors continue to depend on humans to overcome some obstacles to their persistence. Their ability to overcome others they have yet to fully confront remains uncertain. For example, mortality due to lead poisoning appears to have been a significant factor in population declines during the 20th century, and continuing exposure to lead requires daily management actions (e.g. monitoring foraging behavior, proffering 'clean' carcasses, blood lead level testing, chelation therapy). Whether the birds could be self-sufficient foragers were the lead threat removed, or would instead continue to require supplemental food provided by humans, has yet to be determined. We discuss these and other issues that determine the potential for condors to transition from the heavily human reliant populations of today to less reliant or even self-sustaining populations in the future.



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Reduced founder size and carrying capacity lead to loss of genetic diversity and inbreeding in island reintroductions: insights from four avian reintroduction programs in New Zealand

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Avoiding the detrimental effects of inbreeding and maintaining of genetic diversity have received considerable attention in captive breeding programs, but less so for reintroductions of wild populations. The number of individual birds translocated and released into protected areas, for example, is often small, as is the size of the protected habitat. Small founder size and final population size can result in population bottlenecks, which are associated with increased rates of inbreeding and loss of genetic diversity, both of which can have significant long-term consequences on the viability of reintroduced populations. Here we examine rare pedigree data and associated measures of inbreeding and genetic diversity from a total of 40 population-years of four bird species reintroduced on two different islands in New Zealand. Although reintroduced populations founded with small numbers suffered more inbreeding and loss of gene diversity as predicted, several other factors including bias sex ratio at release and subsequent skewed breeding success also contributed. Despite one reintroduced population initially reaching three times the level of inbreeding as another closely related species, the long-term estimated rate of increase in inbreeding was approximately a third of the other species as a consequence of the larger carrying capacity of the available habitat. Our results indicate that the development of long-term management programs for small-scale sanctuaries for highly threatened species is an urgent problem. More specifically, long-term strategies and guidelines need to be in place to ensure the crucial goal of minimising inbreeding and maintaining genetic diversity in reintroduced populations is attainable.



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Importance of long term population monitoring in the evaluation of houbara bustard reinforcement program

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The assessment of reinforcement program effectiveness implies long term studies to monitor life history parameters in released and recipient populations, and to evaluate the magnitude of both individual-based and environmental stochasticity. Over twelve years, to restore and secure sustaining populations of the north African houbara bustard, the Emirates Center for Wildlife Propagation released about 30 000 captive-bred birds in Morocco. Life history parameters such as nesting effort, clutch size, nest survival, hatching rate, chick survival, and adult survival were measured from individual monitoring of 1400 released and 300 wild radio tagged birds. We analysed the variation of each parameter according to bird origin (i.e. released or wild), age and year. Survival and breeding performance did not differ between wild and released birds. Within both bird categories, breeding parameters were positively related to female age, but also varied significantly between years due to environmental stochasticity. Finally, life history parameters were incorporated into a population dynamic model to project population viability. The analysis uncovered a strong yearly deterministic increase (12%) and a high viability of restored populations. Additional models suggested that both individual based and environmental stochasticity are essential in the estimation of extinction rate under various population management strategies.



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S12 Habitat fragmentation in tropical forest birds

Convenors: Luiz dos Anjos, Brazil; Thomas W. Sherry, USA

Loss of birds from tropical forest fragments: what are the mechanisms?

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Even large fragments of tropical forest lose bird species over time. The speed of disappearance and permanence of these losses depend on a variety of factors, but the pattern of species loss appears more universal. What we still do not understand is what mechanisms lead to local extinction in fragmented tropical landscapes. This paper reviews data currently available to test some of the leading hypotheses, such as altered predator population dynamics leading to meso-predator release, sensitivity of some birds to altered microclimatic conditions in fragments, and the constraint of poor dispersal ability in failing to maintain a meta-population in fragmented forest landscape.



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On the sensitivity to forest fragmentation and abundance of bird species: implications for conservation in the Brazilian Atlantic rain forest

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Species with low abundances may be more sensitive to forest fragmentation. Abundance can be measured by several metrics, including both local density and distribution (e.g. occupancy), each of which may differentially influence the degree to which bird species respond to habitat fragmentation. Our study encompasses three forest ecosystems of Atlantic rain forest: SF, MF, and DF. We compare the distribution and abundance of birds in large, continuous areas of each forest types, and with distribution and abundance in a fragmented landscape of SF. We first established patterns of abundance for bird species in three types of forests, then tested the hypotheses that 1) bird species most prevalent in SF will be least vulnerable to population declines in fragmented SF and 2) species with stronger affiliations with DF or MF, and therefore low densities in SF, will be relatively more sensitive to fragmentation. We used a recently developed technique, Rank Occupancy-Abundance Profiles (ROAPs) to evaluate species' distribution and abundances. Of the eighty-seven forest bird species recorded, 39 species were sensitive to forest fragmentation of SF. As predicted, a higher proportion of bird species with greater overall abundance in DF relative to SF showed greater sensitivity to fragmented SF; by contrast, species more abundant in MF relative to SF did not show increased sensitivity to fragmentation. We suggest that the evolutionary history of these forest types could play a role in the differential response of bird species to forest fragmentation of SF, which has implications for conservation.



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Genetic signature of Afrotropical rainforest fragmentation in seven sympatric bird species that vary in historical and current mobility

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Habitat loss and fragmentation are considered to be key drivers of biodiversity loss, especially in tropical rainforests. Habitat fragmentation can affect genetic population structure by restricting geneflow, reducing effective population size, and increasing genetic drift. Here we apply a Bayesian clustering algorithm to study the genetic population signature of past habitat fragmentation in seven sympatric, forest-dependent bird species of a Kenyan cloud forest archipelago, and compare their levels of historic (genetic differentiation) and current (mark-recapture) mobility. Species significantly varied in current genetic population structure - with more mobile species showing lower genetic differentiation and least mobile ones showing strongest evidence of mutation-drift and migration-drift disequilibria - and in presumed loss of mobility over time. Taking into account potential pitfalls when linking historical and current levels of mobility, results of this study indicate that historic loss of mobility, rather than current mobility per se, may be the strongest predictor of population viability. If confirmed by future studies, this may explain why poor dispersers continue to persist in fragmented landscapes, while more mobile species may be in higher need of conservation than presently assumed.



25th International Ornithological Congress 22-28 August 2010 (www.i-o-c.org)

When fragmentation means extirpation: uncontrolled hunting as a driver of forest hornbill (Bucerotidae) declines in West Africa

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Much of West Africa has been deforested during the last 50 years, and Ghana in particular has lost more than 80% of its original forest cover to human encroachment. Nine forest hornbill (Bucerotidae) species are known to Ghana's Upper Guinea forests, which are now extensively fragmented and under tremendous pressure from illegal hunting, logging, and farming. The majority area (~75%) of Ghana's remaining c. 15,000 km² forest is allocated as concessions to logging companies, while less than 10% is under active wildlife protection. We present results of hornbill surveys in their previously known ranges in Ghana in forest fragments of varying size (51-482 km²) in logging concessions and wildlife protection areas. Only two of nine forest hornbill species were frequently encountered in forest fragments allocated as logging concessions. Three species, including the two largest hornbill species, were detected only in wildlife protection areas. Upper Guinea endemics black-and-white-casqued hornbill (*Bycanistes subcylindricus*) and yellow-casqued hornbill (*Ceratogymna elata*) are almost certainly locally extinct in many forest fragments in Ghana. We conclude that uncontrolled hunting may be driving local and regional extirpations of forest hornbills even where suitable habitat remains, particularly in fragments with high edge-to-area ratios in densely populated areas. Other factors that might drive extirpation include a lack of suitable nesting trees due to unsustainable logging of large canopy trees. These findings highlight the necessity of active protection for the survival of forest hornbills in West Africa, and of controlling human access and activities in forest fragments for tropical forest bird conservation.



Campos do Jordão 2010 25th International Ornithological Congress 22-28 August 2010 (www.i-o-c.org)

Mechanisms of bird community change in Central American lowland forest fragments

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Flagship lowland tropical rainforest reserves in Central America are losing bird species despite connection to large tracts of upland forest (in the case of La Selva Biological Station = LSBS, Costa Rica) or being situated in a largely forested landscape (Barro Colorado Island, Panama), but why? We review evidence for various mechanisms of population decline and resulting community changes, based on (1) the guilds that are declining at particular sites, (2) comparison with the bird community in a similar but non-fragmented control area (Indio Maiz Biosphere Reserve, Nicaragua), and (3) focused hypothesis tests. We tentatively eliminate several mechanisms found to be important elsewhere, particularly island biogeography (stochastic population-size related effects), and effects of habitat edge and climate change, although further examination of these hypotheses is certainly warranted. Mechanisms that are supported, all of which are indirect, include increased nest predation in fragments, forest maturation (habitat change), isolation of forest fragments in deforested matrix strongly limiting dispersal of understory specialists, and indirect plant community changes in response to a keystone herbivore, the collared peccary (*Pecari tajacu*). The latter mechanism appears to operate idiosyncratically (LSBS) by altering vegetation substrates on which forest understory insectivores are specialized. This plethora of indirect fragment-disintegration mechanisms, even in such large (1,500 ha) research reserves, makes it challenging to predict how future fragmentation and climate change will impact tropical forest landscapes.



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S13 Tools for our future: landscape approaches to bird research, conservation and habitat restoration in a changing world

Convenors: Andrew Huggett, Australia; María Elena Zaccagnini, Argentina

Landscape ecology of forest songbirds as a guide to proactive forest management through conservation targets

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Proactive conservation planning is still possible in some forest regions of the world. In Canada, virgin boreal forest is still being accessed for timber and silvicultural intensity is increasing in areas subjected to pre-industrial forestry. Emulating natural disturbance is thought to reduce potential impacts of forestry, but a rigorous test of this paradigm is necessary. Previous research also suggests that a matrix of managed forest tends to buffer the effects of old forest loss and fragmentation, but there are notable exceptions. My colleagues and I have used point count data from four forest regions to determine whether regions with high-intensity natural disturbance regimes host fewer species sensitive to old forest cover at the landscape level. We also focused on the brown creeper (*Certhia americana*) and the ovenbird (*Seiurus aurocapilla*) to investigate processes underlying their response to management intensity. The creeper, a partial migrant, required high densities of snags and large-diameter trees for nesting and foraging. Its fledging success was also influenced by distance to the nearest forest edge. Ovenbird return rates and recruitment into marked populations suggested a moderate response to experimental selection harvesting and to landscape structure. Both species showed threshold responses to habitat structure and amount. For the creeper, the threshold density of large trees associated with the presence of a nest was nearly twice as high as that linked to the mere presence of the species. This research has led to improvements in old forest conservation policy and our threshold-detection approach is applicable to conservation and management elsewhere in the world.



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Bird conservation in the Atlantic Forest: extinction debt and immigration credit in dynamic landscapes

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The Atlantic Forest has one of the highest levels of biodiversity and endemism but has also undergone a huge forest loss. This extremely fragmented scenario coupled with the fact that this forest is progressively becoming dominated by young secondary forest is driving species extinctions. On the other hand, landscape changes can create opportunities for immigration of new species, and thus can partially compensate local species extinctions. Empirical evidence suggests that extinction and immigration processes can occur with a substantial delay following landscape modification, which means that some species will become extinct even without any further landscape modification. The goal of this study was to investigate the long-term effects of landscape modification on birds considering the importance of delayed events and the reduction of the forest age. We studied three landscapes that underwent a dynamic change in the amount of forest cover and connectivity, and in forest age. Birds were surveyed in 53 forest fragments and landscape history was investigated using forest cover maps from 1962 to 2005. Initial results indicated that species respond differently to delayed events. Life-history characteristics investigated, such as endemism, food guild and ability to use different habitats, had a limited capacity to discriminate species according to their response to past or present-day landscape structure, suggesting that time-lag responses are controlled by complex processes. Furthermore, historical land-use and the age structure of forest stands considerably improved our capacity to understand present-day bird species distribution. We discuss the importance of extinction debt and immigration credit for bird conservation in the Atlantic Forest.



25th International Ornithological Congress 22-28 August 2010 (www.i-o-c.org)

Landscape ecology and forest bird conservation: integrating disciplines to understand key ecological processes in fragmented habitats

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Many forest bird species occur in human-modified landscapes and their persistence may rely on effective conservation efforts across scales. Landscape ecology as an interdisciplinary science, provides a variety of tools and theory frameworks to study populations in spatially-explicit contexts. However, we need to go beyond the description of patterns to understand how landscape changes influence ecological processes. Dispersal encompasses a complex of behaviors and is a key ecological process that is frequently disrupted by landscape changes. Two new research areas, landscape genetics and behavioral landscape ecology promise significant advances to fully understand these processes. I provide empirical examples that link population genetic and behavioral data with landscape structure analysis, on two endemic birds: *Aphrastura spinicauda* (temperate rainforest – Chile) and *Pyriglena leucoptera* (Atlantic forest – Brazil). I emphasize using molecular tools and experimental approaches to understand dispersal and habitat selection in human-modified landscapes. We showed that genetic signature of subdivided populations is observable within the time scale of anthropogenic fragmentation and that population and behavioral responses to landscape changes vary across human-caused ecological gradients. Moreover, dispersal capacity is not a fixed species-specific trait, as landscape models of animal distributions currently assume; we show that it is landscape context dependant and different among populations of the same species. If landscape ecology is to contribute to bird conservation, we should consider the interaction between the dynamic nature of landscapes with the capacity (or lack thereof) of species to track those changes, and future land cover scenarios in the face of climate change.



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Lessons from the heartland: restoring landscapes for threatened and declining birds in the Southwest Australia world biodiversity hotspot

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We are living in the “Sixth Great Extinction” - a time of unprecedented decline and loss of species and their habitats, threatening our own persistence on Earth. Many species have become, or are about to become, members of the “next wave” of predicted extinctions. Globally, one in eight bird species is currently threatened with extinction while 190 bird species are critically endangered. Once common and widespread species are sharply declining in number and contracting in distributional range as their habitat is substantially reduced, lost, degraded, or becomes increasingly disjunct. In the highly fragmented Western Australian wheatbelt - part of the Southwest Australia global biodiversity hotspot - about 70% of woodland bird species have declined since European settlement. Many of these have been ground-foraging insectivores and hollow-nesters. In this paper, I report on how a ten-year, science-informed landscape design is helping to restore and re-connect key habitat for declining and threatened birds in a 181,000 ha salt-affected wheatbelt landscape of Western Australia - Buntine-Marchagee Natural Diversity Recovery Catchment. I present results on focal bird species abundance, richness and use of woodland and shrubland habitat linkages planted under this design and adjacent remnant indigenous vegetation. I also outline monitoring and evaluation requirements and identify priorities for further research. I conclude by demonstrating the utility of this practical approach for bird conservation in fragmented landscapes worldwide.



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Monitoring the impact of agriculture and climate variability on birds of the Argentine pampas: a long-term, large-scale approach

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Agricultural production in many Latin American ecosystems is increasingly being expanded and intensified to meet global demand for food and biofuels. Conversion of indigenous vegetation to agricultural and other uses changes the extent, composition, and connectivity of habitat and landscape. This can reduce the heterogeneity and quality of habitat across local to landscape scales; negatively affect avian species and the ecological services they provide, and their potential ability to adapt to climate change. We implemented a large (255,000 km²) and long-term scale (8 years in 2009) bird monitoring program within the Argentine pampas to relate distributions of birds to land use, agricultural management and climatic factors. Results suggest that at large scales, gradients of agricultural industrialization, productivity and climatic conditions affect avian distributions and communities, with warmer and wetter areas having the highest species richness. Community occupancy of insectivores, raptors, and granivores functional groups was negatively associated with the area in annual crops, with insectivorous birds being sensitive to reduced core habitat area. Assuming species richness of functional groups as a surrogate for ecosystem health and in turn, the availability and quality of ecological services, the effects detected in our study may significantly impair the provision of ecological services by avian communities. Opportunities exist to expand monitoring into other ecosystems and countries to improve the quantity and quality of biological and ecological information. This will facilitate improved decision making for natural resource management under a changing global climate.



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S14 Ornithology, conservation action and policy: bridging the gaps

Convenors: Jaqueline Goerck, Brazil; Stuart Butchart, UK

Evidence-based bird conservation: Brazil as a case study

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Bird conservation practitioners in Brazil have difficulties in obtaining relevant information for their work and yet, they are constantly being asked for action when problems are detected. Like other applied sciences, conservation should be based on results of sound research. Even though scientific work underpins bird conservation practice in developed countries, this is still not a reality in the developing world. We reviewed ornithological literature in Brazil from 2000 that mentioned conservation to verify how these studies proposed to contribute to the cause. More than half (53%) of all bird publications in the country mentioned conservation and 15% had the word in the title or as a keyword. 44% of the papers used the word only in the introduction, but did not provide further insights into its practice. Some studies (20%) implied that the data were relevant for conservation, but there was no explanation on how they could be used. The remaining 36% attempted to provide suggestions based on results, but only 0.3% had clear and detailed guidelines that could be readily used by conservationists. Even though ornithologists are becoming aware and willing to contribute to the conservation of species (a 9-fold increase of such publications since 2000), evidence-based bird conservation is still at its primary stages in Brazil. In addition to a greater commitment of the ornithological community to conservation, more effective mechanisms for technology transfer to and between practitioners need to be devised if we are to change the sad status of country with the highest number of threatened birds in the world.



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Bird indicators influencing policy: a global perspective

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Birds are valuable biodiversity indicators for a variety of reasons. Data based on birds are used to produce a number of different types of indicators, including: Red List Indices (showing trends over time in the extinction risk of sets of species, based on movement of species between categories of the IUCN Red List); Important Bird Area (IBA) indices (showing trends in the condition of IBAs, threats to them and conservation responses in place, including official protection); and Wild Bird Indices (showing mean population trends of sets of species representative of particular habitats). These complementary indicators have different strengths and weaknesses, and all require further development and expanded datasets to underpin them. Nevertheless they have had substantial impact and are widely used in different policy contexts. Bird-based indicators have been adopted or used as measures by the UN Millennium Development Goals, and international agreements such as the Convention on Biological Diversity, Convention on Migratory Species and Convention on International Trade in Endangered Species. They have also had impact at the regional scale (e.g. being used by the European Union), and national scale (e.g. UK Farmland Bird Index). The challenge now is to improve their coverage and availability in developing countries, and raise awareness among governments in such countries of the value of bird-based indicators in monitoring policy impacts on the environment.



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Conserving the red-billed curassow: an integrated approach

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The red-billed curassow (*Crax blumenbachii*) is an endemic bird of the Brazilian Atlantic Forest. Due to illegal hunting and habitat loss, the species is considered threatened with extinction, and included in the “Endangered” category both by the IBAMA (Brazil’s National Environment Agency) and by the IUCN. Currently, there is a large conservation program for the species involving nine different organizations including the academic sector, government bodies, non-governmental organizations and local communities. The program is based on two main strategies: I- to implement actions on habitat protection, research, reintroduction, education and dissemination, and II- to integrate the work of all organizations to optimize efforts and budgets. Regarding the first strategy, fortunately, most of the remaining red-billed curassow habitat is currently preserved under officially established Protected Areas, totaling 145,326 hectares of forests. Nevertheless, the species can rarely be found in these areas due to the strong traditional culture of hunting among local communities. In the short term, it is crucial to increase surveillance and implement reintroduction projects in reserves where the species is locally extinct and hunting is controlled. In the long term, it is necessary to engage local communities in the conservation of the species through educational and dissemination campaigns. While this first strategy is based on on-the-ground activities, and directly linked with the species and the threats to it, the second strategy is linked with organizations directly involved in implementation of the program, and is crucial to successful conservation of the species.



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Research effort allocation and conservation of restricted-range island birds

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Conservation research can be a crucial step to prevent extinctions, but an uneven research effort might compromise the success of this colossal task. We used the extinction-prone island restricted-range bird species (RRSs) and the Endemic Bird Areas (EBAs), identified by BirdLife International to assess how research is being allocated, measuring research effort with Web of Knowledge (WoK). Conservation relevant literature tended to be less skewed than non relevant, for both island RRSs and EBAs. The distribution of research effort was very uneven: 5% of the RRS and of the EBAs held half of the publications while 58% of the RRSs and 37% of the EBAs had no conservation relevant study dedicated to them. Research effort tended to be higher and more evenly distributed amongst species with a higher threat status. The global distribution of research effort was highly biased towards a limited number of places (Hawaii, New Zealand, Central America), while many RRSs rich areas were very poorly studied (South East Asia, South Pacific, most Atlantic islands). 48.5% of the variation in research effort on island EBAs remained unexplained after our analysis, with the spatial component alone being responsible for most of the explained variation (47.9%). As most conservation strategies are highly context dependent, we strongly advocate for mechanisms that help diluting these inequities on conservation relevant research effort.



Conflicts between biodiversity conservation and development: a case study in Yancheng Biosphere Reserve, China

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The zonation (core, buffer and transition) of a biosphere reserve is intended for reconciling trade offs between conservation and development. We studied the effects of development in the three zones of Yancheng Biosphere Reserve (eastern China) on the endangered red-crowned cranes *Grus japonensis*, the waterbird communities and the economic benefits to local communities. Results showed that the proportion of cranes in the core, buffer and transition zones was largely associated with the proportion of developed land area and the total number of cranes in the reserve as a whole. Developments in the transition zone reduced and degraded the wetlands, and disadvantaged cranes and waterbirds. In contrast, the transformation of natural wetlands into artificial ones in the core zone has, to date, continued to support cranes and waterbirds. This has brought economic benefits to the local communities, but at the cost of the integrity of the wetland ecosystem. Accordingly, the red-crowned cranes became increasingly concentrated in the core zone and switched to feeding predominantly in artificial habitats. This study indicated that zonation of the reserve and the lack of an overall ecosystem perspective for reserve management have led to a fragmented consideration of conservation and development, and contributed to the over-exploitation of the reserve. The loss of ecosystem integrity across the reserve as a whole highlights the need for an ecosystem-based approach to future management combined with the restoration of natural wetlands.



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S15 Nesting biology of grassland birds

Convenors: Jim Herkert, USA; Miguel Ângelo Marini, Brazil

Nesting biology of Neotropical savanna (Cerrado) birds

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The nesting biology of tropical birds remains poorly understood, with detailed studies of a few species or in only a few regions, mostly rainforest. This scarce data helped develop theories and paradigms which were seldom tested in other tropical regions. Here I present data on eight years of monitoring of ~2000 nests of ~40 species in a permanent 100-ha plot inside a 10,000-ha reserve and its surroundings. The area lies in the central Cerrado (15o S), a Neotropical savanna with highly seasonal rain precipitation. As expected, most species in the region have clutch sizes of two eggs, but most social and migratory species have clutch sizes of three. Timing of nest initiation is triggered by the onset of rains, demonstrating behavioral flexibility. Contrary to expected, the breeding period lasts from three to four months, similarly to temperate species. Nest success is usually low (~20-30%), but varies considerably among species and between years. Birds, especially curl-crested jays (*Cyanocorax cristatellus*), are the most important nest predators. A disturbed Cerrado has lower nest success and higher rates of nest parasitism by the shiny cowbird (*Molothrus bonariensis*) than the plot in interior of the reserve. Also, several anthropogenic activities, such as garbage disposal, roads, and frequency of nest monitoring are affecting nest success. This study shows that some paradigms about the tropical-temperate dichotomy should be revised, such as low clutch sizes and the apparent long duration of the breeding period in tropical regions. Their naturally low nest success and potential influence from disturbances should help guide conservation plans. Further studies in other tropical biomes, besides rainforests, are still warranted to understand properly the life-history of birds.



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Breeding biology of migratory seedeaters from grasslands of southern Brazil: plumbeous seedeater (*Sporophila cf. plumbea*), tawny-bellied seedeater (*S. hypoxantha*) and black-bellied seedeater (*S. melanogaster*)

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Sporophila comprises a diverse group of small tropical and sub-tropical "tanager-finches" widely distributed in the Neotropics. Most of the species inhabit open to semi-open grasslands. The breeding biology, or even basic information such as nest description or number of eggs, remains unknown for some of these species in Brazil. Since 2007 we are conducting a study on breeding biology of three migratory species/populations that breed in reminiscent grasslands located in northeastern Rio Grande do Sul and southeast Santa Catarina states: the yellow bill population of plumbeous seedeater (P), the tawny-bellied seedeater (TB) and the black-bellied seedeater (BB). At now a total of 135 nests were monitored. Nesting occurs from November to March with peak in December/January. It starts after birds arrive at their breeding sites, which is coincident with the period of seed availability. Birds present fidelity to the breeding sites and some of them return to the same territory in subsequent years. The construction of nest takes four days on average. Females are uncharged of nest construction and lay two eggs. Incubation period is 11.5 days on average and nestling care period varies among species: 9 (TB) to 11 (BB) days. Only females incubate eggs although males help rising nestlings and fledglings. Daily nest survival rates during incubation were 0.94 (P; n=54), 0.95 (TB; n=22), 0.96 (BB; n=21) and during nestling period were 0.93 (P; n=47), 0.93 (TB; n=24), 0.95 (BB; n=23). Overall nesting success was 34.4 % (n=41) and 27.2% (n=94) in the breeding seasons of 2007/08 and 2008/09, respectively. The lowest success was 27% (P) and the highest was 38% (BB). Nest survival rates were not statistically different among species or species/year. Long term research will allow us to answer different questions and will contribute to a better understanding of the breeding biology of these regionally threatened birds. Also, it will promote conservation strategies for grasslands species in south Brazil.



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Breeding behaviour and reproductive success of a Neotropical threatened grassland bird: the strange-tailed tyrant, *Alectrurus risora*

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The strange-tailed tyrant, *Alectrurus risora*, is a tyrant flycatcher that inhabits savannas, wet grasslands and marshes in southern Paraguay and north-east Argentina. During the last century, its original range has contracted by 90% in association with conversion of natural grasslands to agriculture. At present, it is classified as 'vulnerable' and further decline in range and number is expected because suitable habitat is subject to current extensive agricultural intensification and afforestation. Knowledge of the factors that affect the reproductive success of threatened species is necessary for accurate assessments of the extinction risk of their populations. We studied the breeding biology and analyzed factors that affect nest survival of strange-tailed tyrants in a protected area of the humid Chaco, Formosa Province, Argentina. Our study comprised eight consecutive breeding seasons and the monitoring of 199 nests. This species has a social polygynous mating system, with males owning contiguous territories with up to three females. Females bred in the same area over several years, but males rarely remained in the area in consecutive years. Modal clutch size was three eggs and decreased with time of breeding. Hatching rate and chick survival were 0.86 and 0.89, respectively. Nest survival (modelled with MARK) was 0.2 and decreased with age of the nest and time of breeding. Females had on average 2.3 nesting attempts per season and in most cases reneating occurred after a failed attempt. Considering nest survival, number of nesting attempts and number of chicks that fledged in successful nests, each female fledged approximately 0.9 chicks per breeding season. Turnover of males across breeding seasons, reneating attempts by females and low variance in number of chicks fledged in successful nests may reduce the effects of polygyny and high nest failure on variation in reproductive success of males and females.



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Avoid nest predation when predation rates are low, and other lessons: testing the tropical-temperate nest predation paradigm

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Nest predation is the most important cause of nest failure in most birds and latitudinal differences in life histories imply that nest predation has influenced life history evolution. All else equal, natural selection should favor reduction in nest predation, yet evidence is equivocal. With Monte Carlo simulations, we examine the combined effects of variation in nest predation rates, breeding season length and renesting intervals on the annual number of young fledged. Simulations suggest that selection most strongly favors a reduction in nest predation when breeding seasons are short and predation rates are low (temperate). Conversely, selection favors reduction in renesting intervals when breeding seasons are long and nest predation rates are high (tropical). Reducing already low rates provides a proportionately greater increase in annual nesting success than does the same reduction at high predation rates. Thus, tropical species may increase reproductive success not by avoiding predation in subsequent nesting attempts, which is largely beyond their control, but rather by reducing renesting intervals. We suggest that the emphasis on nest predation avoidance has biased our perspectives for alternative hypotheses of how birds should respond to nest predation and the life history consequences of those alternatives.



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Population differences in reproductive biology of free-living Cassin's sparrows, *Aimophila cassinii*

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Seasonally breeding birds use various proximate cues to regulate their reproductive cycle. In relatively stable seasonal environments, the primary cue used often is day length. In less predictable environments such as Southwest USA deserts, supplementary factors associated with weather (e.g., monsoon precipitation) may also play an important role. Little is known regarding the specific role and mechanisms by which effects of these factors are integrated to regulate the activity of the reproductive system. To begin addressing this question, we compared seasonal changes in reproductive morphology (testis size and cloacal protuberance: CP) and prebasic (post-breeding) molt in Cassin's sparrows, *Aimophila cassinii*, belonging to two geographically separate populations (Arizona and Colorado) that employ temporally different breeding strategies: Colorado birds breed in spring whereas Arizona birds initiate breeding in response to summer monsoon-associated environmental changes. These populations were found to exhibit quantitatively similar time courses of seasonal changes in testis and CP sizes as well as prebasic molt, but exhibited a temporal shift in breeding activity so dramatic that Colorado birds were in the first stages of prebasic molt when Arizona birds were just becoming reproductively active. We are currently conducting additional experiments aimed at determining the neuroendocrine basis of these intraspecific population shifts in seasonal reproductive timing.



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S16 Bird conservation on agricultural land

Convenors: Chris Elphick, USA; Mark Whittingham, UK

Bird conservation and ecology in European agricultural systems

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Over the past few decades populations of European farmland bird species have declined more rapidly than avian species living in other habitats. I briefly review the body of evidence charting the decline of European farmland birds and the research to understand which specific components of agricultural intensification are linked to declines in specific species. I then move on to describe: A) the types of agri-environmental schemes that have been put in place across Europe to try and aid bird populations (and other taxa) and assess the outcomes of these schemes; and B) the influence of organic farming on bird populations. Finally I consider how the future agricultural policy landscape may be shaped by the 'ecosystem service' agenda and the predicted influences of climate change.



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Bird functional diversity in tropical forest and agricultural ecosystems

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Although most bird species avoid agricultural areas, nearly a third of all birds occasionally use such habitats, often providing important ecosystem services like pest control, pollination, and seed dispersal. Combining literature review with a meta-analysis of world's birds, I compared tropical bird species that prefer forests, agricultural areas or both, with respect to body mass, diet, habitat and resource specialization. Compared to primary forests, in agro-forests species numbers of large frugivorous and insectivorous birds (especially terrestrial and understory species) often decline. In contrast, nectarivores, small-to-medium insectivores (especially migrants and canopy species), omnivores, and sometimes granivores and small frugivores do better, frequently by tracking seasonal resources. However, changes in guild species numbers do not necessarily translate to changes in relative abundance, biomass or function, and more studies are needed to quantify these important measures. The findings suggest that the replacement of forests and agro-forests with simplified agricultural systems can result in shifts towards less specialized bird communities with altered proportions of functional groups. These shifts can reduce avian ecosystem function and affect the ecosystem services provided by birds in agricultural landscapes.



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Bird conservation in agricultural grasslands: the impacts of land-use management strategies on moist highland grassland biodiversity in South Africa

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South African grasslands house many threatened and endemic plant and bird species giving them high conservation value. However, ca 60% of the biome has been irreversibly transformed and only 2.2% is formally conserved. Many endemics are centred in the moist highland grasslands (MHGs) of north-east South Africa, of which only 1.5% is conserved. Livestock farming is the only potentially environmentally friendly land-use, yet farmers lack guidelines about the biodiversity impacts of varying burning and stocking regimes. We studied the diversity and reproductive success of grassland-restricted birds across several land-management practices in MHGs to assess their relative impacts. We used reproductive performance as a measure of conservation value because it sends a more honest biological signal than do simple measures of diversity and abundance. Vegetation biomass (kg/ha) along with vegetation architecture close to the ground were critical for nesting success and acted as surrogates for nest concealment. In support of this, grassland bird specialists were restricted to biennially burnt areas with low stocking rates. However, fire frequency is the key driver of nesting success, and repeated annual burning has strong negative impacts on these grassland specialists. The future conservation of endemic species such as yellow-breasted pipit *Anthus chloris*, buff-streaked chat *Oenanthe bifasciata* and sentinel rock-thrush *Monicola explorator* requires an enlarged conservation area network and a large-scale change in farming management.



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Pest control services in coffee farms as a tool for bird and habitat conservation

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Documenting the ecosystem services provided by birds can be a powerful tool for avian conservation. In agricultural lands, birds provide regulating ecosystem services, especially pest control. To harness economic forces for conservation of birds and their habitats, ornithologists must (1) document the economic value of ecosystem services provided by birds, and (2) clarify bird movements and relationships among agricultural lands and surrounding natural habitats. Working in Jamaica, West Indies, we documented that insectivorous birds reduce pests of coffee and increase volume of marketable fruit, yielding an economic benefit of US \$44-310 per hectare per year. Using radio telemetry on a principle pest predator, the black-throated blue warbler (*Dendroica caerulescens*), we learned that most birds commute 60-700 m from diurnal foraging territories within coffee habitat to nocturnal roosting sites within natural forests. In addition, the warblers established their territories significantly closer to farm edges and patches of uncultivated vegetation within the farm than expected by random chance. These results establish links between the provisioning of an economically valuable ecosystem service and natural vegetation both within and outside coffee farms. Using individual based models, we simulated how a changing landscape composition could affect pest control services. This approach could be useful for conservation planners by providing estimates of the economic value of forested habitats within agricultural landscapes.



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Positive developments in sustainable agriculture; improving the delivery of biodiversity standards for birds

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Crop production has been blamed for significant losses of biodiversity on intensively managed farmland, especially in Europe. However, a current strategic imperative, for both food security and resource protection has renewed the demand for viable, sustainable systems of commodity-production. Success relies not just on research, but also on the effective delivery of modified practice. This requires close collaboration between practitioners, industrial stakeholders and research partners. This paper uses data between 2000 and 2008 (and potentially new data to 2010 – unavailable at the time of writing) to demonstrate a positive response by bird populations (including species of high conservation concern), on *commercially viable* farmland, to integrated mosaics of cropped and non-cropped habitats. The methods include replicated field trials and carefully-measured, systematic observations of birds. These findings show bird populations recovering through relatively simple modifications to management practice. The results provide an evidence-base for good practice and the basic principles of success in delivering sustainably-improved conditions for biodiversity in unprotected, commercially-managed landscapes. Emphasis is placed on the importance of long-term commitment towards integrated research (to properly identifying salient problems), underpinned by a functioning partnership between policy, research and practice. From the outset, the knowledge and experience of practitioners (e.g., farmers) is recognised as strongly improving the delivery of management objectives, using skills and techniques familiar to them.



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S17 Bird conservation and free-ranging domestic cats: problems and solutions

Convenors: Nico Dauphiné, USA; Oscar Beingolea, Peru

Impacts of domestic cats on birds in New Zealand: an overview

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Cats in urban areas occur at much higher densities than in naturally regulated feral populations, although only about 21% of them return more than one prey item per month. In New Zealand there have been published studies documenting the prey caught by domestic cats in three separate and different-sized cities (Auckland, Christchurch and Dunedin), with home ranges determined in two of them, and in urban fringe and rural landscapes. Whether birds are the most frequently taken prey probably depends on the density of available prey: proportionately more birds are taken where birds are more abundant. Although cats penetrated adjacent vegetation fragments and expanded their home ranges into open green space on the edges of the cities, they did not catch more birds, preferring garden habitat. Predation pressure by domestic cats may therefore be reduced in less densely populated areas. Cat home range size appears to be constrained by cat density. The potential for cat-exclusion zones was investigated in rural and urban-fringe landscapes. Domestic cats living in rural areas had larger home ranges than those living in city suburbs, and large variation between individuals would necessitate wide buffers greater than >4.2 km wide.



25th International Ornithological Congress 22-28 August 2010 (www.i-o-c.org)

What's the matter, cat got your bird? Contemporary problems and management solutions to addressing free-ranging outdoor cats

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Domestic cats (*Felis catus*) have been major drivers of bird extinctions and declines mainly as a result of their predatory behavior, but also due to their harboring and transmission of wildlife disease and competition with native avian predators. Clear evidence exists for the negative impacts of cats on island bird populations, and while the effects of cat predation on continental bird population dynamics remain intensely debated, it is nonetheless a major source of avian mortality. Specifically, cats are opportunistic and indiscriminate predators that must consume 5-8% of their body mass in animal matter daily, with birds typically representing 20-33% of their diet. Worldwide there are ~600 million domestic cats, and the largest national population is in the United States. Considering that the number of cats in the US has tripled over the past 40 years, from approximately 30 million to 90 million, there is growing concern about their impact on native bird populations. However, managing outdoor cats in urban and other densely human-populated areas is complicated because it entails both human dimensions and alternative management approaches. In this context, public debate about cat management may be highly contentious, and social factors often drive management decisions to a far greater extent than scientific research. The challenge is therefore how to effectively control outdoor cats for the protection of birds while addressing social considerations. Using case study information from Hawaii, Michigan, and other locations, we explore the history of the domestic cats, how they impact birds, and current solutions to the problem.



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Predation and long term impact of feral cats on seabirds in the tropical western Indian Ocean

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Feral cat (*Felis catus*) predation is a major threat to seabird populations. In the western Indian Ocean, numerous islands hold feral cat populations and declining seabird colonies. We will present our research conducted on two contrasting islands of the western Indian Ocean: a small, flat uninhabited island (Juan de Nova) and a large, mountainous and inhabited island (La Réunion). Both islands hold major seabird colonies and Réunion Island is the only breeding place of the endemic and endangered Barau's petrel (*Pterodroma barau*). Our results show both chick and adult seabirds are preyed upon by cats. Seabirds represent the main prey item of cats during seabirds breeding season. Feral cat populations are maintained after the seabird breeding season because they shift their diet to introduced rodents, a phenomenon described as the "hyperpredation process". Both field-based data and population modeling show that cats negatively impact seabird populations. Cat predation may limit rodent populations especially when seabirds are absent from the colonies. Such complex interaction may lead to the release of rodents after cat control or eradication ("mesopredator release effect"). However we demonstrated that the demographic long term effects of cat and rat predation on seabirds are dramatically different: cats reduce both adult survival and breeding success whereas rats decrease only breeding success. Knowing that long-lived seabirds are more sensitive to changes in adult survival than to changes in breeding success, the long term impact of cat predation on seabird dynamics is by far more negative than that of rat. These results are developed and discussed in the light of conservation options of endangered endemic seabirds.



Campos do Jordão 2010 25th International Ornithological Congress 22-28 August 2010 (www.i-o-c.org)

Assessing the effects of introduced predators, light-induced mortality of fledglings and poaching to model the dynamics of the largest Cory's shearwater *Calonectris diomedea* population in the world

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Many seabird species, and especially Procellariiformes (albatrosses and petrels), are currently suffering population declines. Cory's shearwater is a petrel which breeds in the Mediterranean and the north-eastern subtropical Atlantic, and which is considered "Vulnerable" in Europe due to recent declines. In the Azores archipelago, Atlantic ocean, the introduction of mammalian predators by man has led to petrels being extirpated from the nine main islands, except for Cory's shearwater which still breeds in high numbers on coastal cliffs. Currently, the Azorean population of Cory's shearwaters represents 65% of the world population of the species. However, its dynamics remains unknown, although (1) censuses conducted in 1996 and 2001 revealed a decline in numbers by 43%, (2) poaching of nestlings occurs, and (3) fledglings suffer urban light-induced mortality upon departure to sea. At sea, fishery mortality of adults has proven to be dramatic in the Mediterranean, but nothing is known for the population from the Azores. To fill this gap, we conducted a 7-year demographic survey on a mammal-free islet in the Azores, using capture-mark-recapture of the breeders and estimation of breeding success. We also determined the importance of urban mortality using the data from the rescue campaigns annually conducted in the archipelago. Urban mortality concerned 6.3% of fledglings, but its importance greatly varied among islands. When rescue campaigns occur, the rate might drop to 0.5%. Overall, our simulations concerning the next 50 years suggest that Cory's shearwater numbers in the Azores will decrease by 36 to 44%, depending on whether or not rescue campaigns are conducted. Numbers should decrease even in the absence of poaching and urban mortality. Given that annual adult survival rate is high (> 0.93), the most likely cause of decline is low breeding success on the main islands, possibly associated with low survival during the first year at sea.



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Current research and policy needs for the conservation of bird populations threatened by domestic cat predation

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The domestic cat is listed by the International Union for the Conservation of Nature (IUCN) as one of 100 of the "world's worst invasive alien species". Approximately 600 million domestic cats worldwide kill large numbers of native small wildlife, including a wide range of bird species. Cat predation has been implicated in at least 33 bird extinctions, and cats are among the most important threats to many currently Critically Endangered bird species. Unrestrained cats may also threaten a host of more common bird species, many of which show declining trends. Oceanic islands have provided the most obvious showcase for the documented negative ecological impacts of cats and highlight the increasing vulnerability of birds confined to "islands" of fragmented habitat. The continuous predation pressure exerted by novel predators, especially when they are maintained at exponentially high densities, has contributed to numerous local extirpations. Despite overwhelming evidence of such negative effects, well-funded organizations in countries including Italy, the UK, and the USA, promote the maintenance of feral and free-ranging cats through trap-neuter-release (TNR) and similar programs, often placing large numbers of cats in or near important bird habitat. The international perspectives of the preceding presentations, together with examples from the published literature, will form the background for a participatory discussion of current research and policy needs for the conservation of bird populations threatened by domestic cat predation. The symposium goal will be to identify critical constraints in study design and strategic use of research results for the development of effective conservation policies.



Campos do Jordão 2010 25th International Ornithological Congress 22-28 August 2010 (www.i-o-c.org)

S18 Avian diseases: emerging infectious diseases in wild birds

Convenors: Fumin Lei, China; Alexander Shestopalov, Russia

On protection of wild birds and their wetland environments under the current pandemic HPAI H5N1 viruses

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The outbreak of highly pathogenic avian influenza (HPAI) H5N1 disease has led to great poultry lost, wild birds death and society attention. The HPAI H5N1 viruses from 2003 to update have already infected large areas of the global continent coving 62 countries of the world. H5N1 viruses were inspected and isolated from both healthy and dead corpses of wild birds, from both migratory and local residential species, which suggest that wild birds are vectors and may be natural hosts of this killing disease. On the other hand, wild birds including the global endangered or threatened species have also been killed by these viruses and are still under the threat. HPAI H5N1 may be becoming a new disaster in threatening the already threatened wild bird species. Wetlands may be most possibly the natural epidemic disease reservoir of AI because they may maintain the viruses and spread them through wild bird migration, of course, these wetlands with their wildlife are therefore may face the risk of HPAI H5N1. All these remind us wild birds and their habitats especially waterfowls and wetlands conservation are seriously challenged by HPAI H5N1 prevalence, and a conservation strategy is urgently necessary. The risk for introduction of H5N1 in and out of the Qinghai Lake as a case for example would be high during spring (April and May) and autumn (September and October) through birds migration or movement, while but species diversity and abundance were different at each wetland around the Lake. The results suggest the species, location and time schedule for usefully advising the further surveillance and monitoring program around the Lake with higher priority.



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Surveillance of avian influenza (AI) viruses in Indonesian birds

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Highly pathogenic avian influenza (HPAI) has been panzootic in several countries around the world especially in Asia including Indonesia. Although the role of wild birds in spreading HPAI is still debated, some evidences have showed that wild birds are potential as carrier and reservoir. In Indonesia, the data of avian influenza in wild birds is still lacking as most efforts are invested in poultry and backyard farming monitoring. Considering the biggest human cases take places in Indonesia, it is important to reveal the role of wild birds in the scheme of AI outbreak. We have conducted surveillance and monitoring on West Java and South Sulawesi since the hotspots of Avian Influenza occurred in those areas. We sampled a total of 110 bird species (78 resident species and 23 migratory species) out of 1598 Indonesian bird species. Samples were examined by Agar Gel Precipitation (AGP), Hemagglutinin Inhibition (HI) test, Reverse Transcriptase-Polymerase Chain Reaction (RT-PCR) and Immunohistochemistry test (IHC). The results indicated that the AI viruses were detected in 17 bird species (10 resident species and 7 migratory species). However, no viruses could be isolated from RT-PCR positive samples which could be due to very low virus titres.



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Malaria, oxidative stress and immunocompetence in the tropical Seychelles warbler (*Acrocephalus sechellensis*)

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Parasites have detrimental effects on their host's physiology and fitness. The malaria blood parasite has been shown to increase oxidative stress, immune activation and reduce host fitness. Studies have also linked malarial resistance to variation at the Major Histocompatibility Complex (MHC) in humans and birds. Avian malaria can, therefore, be a model for examining how parasite-mediated selection may shape immunocompetence and genetic variation. However, little is known on how avian malaria affects physiological mechanisms underlying fitness under natural ecological conditions. To remedy this, it is important to investigate the physiological consequences of infection in wild living birds. Here we examine the link between malarial infection (a single haemoproteus strain found in 40% of individuals) and physiological measures in an isolated island population of the Seychelles warbler. A lack of dispersal allows individuals to be followed throughout their lives, consequently extensive life history data are known for nearly all birds. MHC variation is also screened for. We predict infected birds to have higher oxidative stress, an activated immune system, lower survival, and that MHC variation would be a significant factor in how individuals react to infection. We will present our results and discuss how they integrate with previous findings in this and other species, and what they may imply for evolutionary and conservation ecology. To our knowledge this is the first *in vivo* study investigating the relation between avian malaria and oxidative stress.



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Dynamics of mycoplasmal conjunctivitis in house finches

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The epidemic of mycoplasmal conjunctivitis, caused by a novel strain of *Mycoplasma gallisepticum* (a bacterium causing disease in poultry), began in 1994 and caused a considerable reduction in house finch *Carpodacus mexicanus* abundance in eastern North America. The epidemic is continuing to spread and has now reached southern California. In western North America, where house finches are native, disease prevalence is much lower than in eastern populations and the impact on house finch numbers seems to be minor. We will report on experimental results testing three hypotheses that explain why the behaviour of the epidemic in east and west is different: (1) house finches are genetically more variable in their native western range than in the eastern introduced populations; (2) *Mycoplasma gallisepticum* has evolved as it spread and has become less virulent in the west; (3) bird community composition plays a role on the dynamics of the disease. We established that western birds are more genetically variable than eastern birds and we found that *Mycoplasma gallisepticum* has evolved rapidly since 1994 and that the house finch strain is distinct from various poultry strains. We therefore tested hypotheses 1 and 2 in a common garden experiment exposing eastern and western house finches to various strains of *Mycoplasma gallisepticum*. We found that many passerine species are exposed to *Mycoplasma gallisepticum*, but that some (such as the American goldfinch *Carduelis tristis*) are competent reservoirs, while others (such as the house sparrow *Passer domesticus*) are not. Community composition could thus have an effect on disease dynamics.



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S19 Structuring processes and determinants of diversity in cavity nesting bird communities

Convenors: Kathy Martin, Canadá; Tomasz Wesolowski, Poland

Nest site limitation and the community structure of cavity-nesters across an anthropogenic gradient in the Atlantic forest

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The production and loss of tree cavities are key processes structuring communities of cavity-nesting birds where nest sites are limiting, yet very little is known about how cavities are produced, or how long they last, in the tropical rainforests that harbour the highest diversity of cavity-nesting birds. Nest site limitation is supported by evidence from temperate forests, but several authors have suggested that it is an artifact of forest management, and that cavities are not normally limiting for populations of cavity-nesters in mature forest. Through a nest-box addition experiment in the subtropical Atlantic forest of Argentina, we determined that nest-sites limit the breeding density of secondary cavity-nesters (SCN) in both logged and primary forest. Although the Atlantic forest has a high diversity of both excavator and SCN species, excavated cavities made up only 20% of the cavities used by SCN. SCN depended primarily on cavities created by heart-rot decay in large live trees. Excavated cavities were in dead branches or dead trees and had a much lower probability of surviving from year to year. The critical nest site resource that maintains this diverse community of cavity-nesting birds appears to be cavities created by heart-rot decay in large live trees, because these cavities are available for use in multiple years.



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Tree cavities: origin, longevity and disappearance – a global perspective

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The majority of cavity nesting birds in most communities is nonexcavators, that must acquire cavities that are formed by other agents/processes. The role of these agents can vary widely across climatic zones and continents, but they influence cavity availability by altering hole formation rates, persistence periods, and decay rates. These differences combined would result in qualitative and quantitative variation in supply of cavities for local nonexcavator assemblages in different parts of the world. This variation in cavity availability affects life history traits, population densities, species richness, of nonexcavator avifauna in different forest types/continents, as well as the structure of local cavity webs. Using data from nonmanaged forests in Australia, Americas and Europe I shall review intercontinental variation in: 1) the major cavity-formation and deterioration agents; 2) rates of cavity origin and disappearance; 3) cavity persistence times. Finally I shall attempt to use the observed intercontinental contrasts in cavity supply to explain differences among local cavity-nester avifaunas.



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Resource pulses change diversity and function of cavity-nesting communities in disturbance-driven forest ecosystems

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Disturbance-driven systems often experience perturbations that influence diversity and function within communities. In our 15-year study of cavity-nesting vertebrates, we examined how a community-wide, multi-annual pulse of food caused by an outbreak of mountain pine bark beetles regulated populations in mixed forests of British Columbia, Canada. We found that species richness and population densities increased in all three nesting guilds (primary excavators, facultative excavators and secondary cavity nesters). More species of bark insectivores were detected for a given density following the outbreak. However, the mechanism that drove populations varied across guilds. Breeding densities of primary excavators (woodpeckers) increased with bark beetle abundance across sites, but their fecundity did not change. The increase in woodpecker populations resulted in increased cavity availability. The facultatively excavating red-breasted nuthatches (*Sitta canadensis*) tracked availability of both bark beetles and cavities across sites, and at high densities, instead of excavating, they reused more old cavities and were able to initiate nests 9 days earlier. The secondary cavity nesting mountain chickadees (*Poecile gambeli*) used more cavities excavated by woodpeckers and nuthatches, and increased in both density and fecundity during the peak of the beetle outbreak. The lack of a response in fecundity by excavators suggests that woodpecker populations may not be limited by food availability. The flexibility in fecundity of nuthatches and chickadees may allow them to respond more rapidly to resource pulses than woodpeckers. In the post-epidemic phase (2006-2009), woodpecker populations declined, but facultative excavators and secondary cavity-nesters suffered population collapses to below pre-epidemic levels. Communities may stabilize at pre-epidemic conditions or be re-assembled to a new norm.



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Designing habitat for cavity-nesting birds in Australian eucalypt forests: a landscape approach

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Cavity-dependent fauna pose special challenges for conservation in forests because useful cavities take many decades to form. In Australia there are no woodpeckers and the main agents of cavity formation are termites and fungi. This paper synthesises data from studies by the author and colleagues, to address questions about cavity management in complex landscapes. Many Australian birds are cavity-dependent, and they can form high proportions of the bird community (e.g. 30% in mature forests of river red gum; over 50% on individual study sites). Cavity-dependent birds can be especially numerous in agricultural and peri-urban landscapes, where cavities provide safe refuge from interspecifically territorial native birds such as noisy miners. Cavities can be scarce in regrowth forests, and prescriptions are applied to conserve and regrow old cavity-bearing trees. Different bird species benefit from different spatial patterns of tree retention, and generally the number and quality of retained trees are more important than their spatial arrangement. Recent work shows that useful cavities can sometimes form at an earlier age (60-80 years) than previously thought.



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Hollow-using birds in the Austral Temperate forests of Patagonia

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Inventories of hollow-using fauna as well as research on what constitutes a potential nest tree have been conducted for the last decades in the Northern Hemisphere and Australia. Contrarily, in Neotropical forests, only incipient research has been conducted on the hollow resource and the hollow-users. We examined the composition and general habits of the avifauna that use hollows in the Austral Temperate forests of northern Andean Patagonia. We assembled data from both literature sources and field observations, starting in 1998. We present a species list, the types of cavities used (woodpecker or natural origin), features of the hole nesting sites (typical height, depth, location on trunk or branch, etc.) and alternative sites known for some hollow-using species. Among other findings, we listed two previously unknown cavity-users, one of which behaved like open nester or cavity nester depending on the environmental conditions. Cavities excavated by different woodpecker species were used by different secondary users, according to body size. Magellanic woodpecker (*Campephilus magellanicus*) cavities were used by the Austral parakeet (*Enicognathus ferrugineus*) in a much higher proportion in young lenga (*Nothofagus pumilio*) stands than in mature lenga stands, due to a differential availability of natural holes. Last, we found that about half of the Patagonian forest birds are hollow-users, which is a high proportion compared to most other forests worldwide. The selection pressures that probably gave rise to a widespread hollow use among the Austral Temperate birds are probably related to the low temperatures that can occur year-round.



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S20 Ecology and distribution of bamboo specialist birds

Convenors: Juan Ignacio Areta; Argentina; Kristina Cockle, Canada

Bamboo specialist birds of the Neotropics: focus on the Atlantic forest, a hotspot for bamboo specialists

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Although bamboos occur in many regions, most birds that specialize on bamboo seem to occur in the Neotropics. Specialization on bamboo seeds, shoots and insects, has arisen in at least 15 families of Neotropical birds. The Atlantic forest region is a hotspot for bamboo specialist birds, with 13 species occurring in the Atlantic forest of Argentina. We predict the abundance and distribution of these species to vary quasi-cyclically over time, in response to the availability of their preferred bamboo resources, which depend on the deep-time dynamics of changing bamboo flowering overlap. Specialists on seeds of *Guadua*, like Temminck's seedeater (*Sporophila falcirostris*), which has the lower mandible much thicker than the upper mandible, occur in Argentina every ~15 years when one of the two *Guadua* seeds. The uniform finch (*Haplospiza unicolor*) with a thinner, conical bill, also exploits *Guadua* seeds but has a broader niche, feeding primarily on *Chusquea ramosissima* seeds, which are always available somewhere in the region. The blackish-blue seedeater (*Amaurospiza moesta*) apparently feeds primarily on green bamboo matter, and secondarily upon seeds, especially in *Merostachys* bamboo; we do not expect large population fluctuations. The white-bearded antshrike (*Biatas nigropectus*) is an insectivore almost always found in *Guadua trinii*; we predict its populations to increase over the vegetative phase of *G. trinii*, but decline sharply when it dies after flowering en masse. The most specialized bamboo-users like *S. falcirostris*, *B. nigropectus* and the purple-winged ground dove (*Claravis godfrida*) should experience the largest population fluctuations and be the most vulnerable to stochastic extinction.



Estrildid finches and bamboo

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The great Poaceae family of grasses saw its beginnings in the Ethiopian region during the Miocene era, some 25 million years ago. The Estrildidae tropical grassland finches evolved to exploit the abundant food source of the endless grasslands. Grasses spread around the world. One subfamily, the bamboos and rices of the Bambusinae, adapted particularly well to a humid, tropical forest environment. Some of the estrildid finches followed them across Asia. The rices were in some ways like typical grasses but the bamboos evolved virtually unique defence strategies against their mammalian and avian predators. The bamboos produce nutritionally-rich seeds that can germinate very quickly, and support a virtually instant growth spurt to have the smooth, hard and inedible stems typical of the woody bamboos. These seeds are characterized by being large and hard and unusually-shaped. Some estrildid finches followed the grasses into the forest and a few adapted to the eccentric bamboo seeds by growing strong, odd-shaped bills that are able to extract, manipulate and open the seeds. The woody bamboos developed variations on a predator satiation strategy. That is, they provide more seeds than the predators can possibly consume, thereby guaranteeing there will be sufficient surviving seeds to produce new plants. It is then such a long time before the plants seed again that none of the birds that found the original supply could possibly still be alive to remember the location to return, or lead younger birds to feed. The ephemeral nature of the over-supply of seeds prevents the predator becoming an obligate, although the nature of the bill adaptation ensures it remains a specialist-in-waiting. The bamboo-seed-specialist finch is recognizable by its morphology, but is it recognizable by its behaviour? The presentation looks at these estrildid finches to see whether there is a recognizable behaviour among the bamboo-seed-specialists-in-waiting and if so, what it might mean.



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Occupation and occurrence patterns of birds associated with bamboo in the southern Brazilian Atlantic Forest

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The present study evaluated changes in abundance of birds associated with bamboo in areas within a same remnant with different availability of this microhabitat. The occurrence of these species in other Seasonal Semi-deciduous Forests fragments in Northern Paraná state was also analyzed. The measure of abundance for the birds was obtained with 25 days of point count sampling along five established trails, three of them situated in areas with presence of bamboo and two in areas where this microhabitat was not present in the Parque Estadual Mata dos Godoy. In the other fragments, each transect was sampled for two days to verify the presence of species and their possible occurrence in association with bamboo. Nineteen species associated with bamboo were analyzed, fourteen of which occurred only in areas where the microhabitat was present. The total abundance of species was higher in the areas with presence of the microhabitat. For some species, the abundance varied presumably due to differences in the cover of bamboo in the understory. According to the percentage of their occurrence in bamboo, birds were classified as restricted, highly, moderate and poorly associated. A negative correlation between the degree of association with bamboo and the occurrence in fragments was observed.



Kaempfer woodpecker *Celeus obrieni*, a new bamboo specialist?

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Kaempfer woodpecker *Celeus obrieni* is one of the most enigmatic and unknown woodpecker species of neotropics. It was discovered in 1926, described in 1973 and rediscovered in 2006 on north-central Brazil. Since that, new records have been made promoting studies related to its unexplored biological and ecological requirements. We have been following at least 20 individuals in the western Tocantins State, and seeking for new specimen all around its potential distribution area in central-west region of Brazil. Today we have more than 30 records in different regions, all of them on cerrado vegetation type: cerradão - dense cerrado and riverine forests mixed with bamboo genus *Guadua*. Our data indicates that Kaempfer woodpecker inhabits areas with *Guadua paniculata* combined with trees 5-15 meters high, a feasible ideal condition for its reproductive requirements. Despite some author information that *Celeus obrieni* inhabit areas of *Cecropia* sp. our studies showed that 97% foraging attempts occurred in bamboo, the remainder on other tree species including trumpet trees. To the current days, our observations have identified eight foraging strategies and showed that Kaempfer woodpecker use both green and dry bamboo stems to find food and water. To emphasize its dependence on *Guadua* bamboo, all foraging attempts focused on ants, resembling the description made to *Celeus spectabilis*, specialized in feeding colonial ants nesting on bamboo. Even though we have found other woodpecker species like *Celeus flavescens* inhabiting the same habitat and *Verniliornis passerinus* and *Picumnus albosquamatus* feeding on Bamboo, our data indicates that *Celeus obrieni* seems to be the unique Cerrado woodpecker specie dependent on Bamboo mixed with cerradão and riverine forests, so that, it is a condition that deserves ecological advantages by exploring an specialized niche as well as disadvantages in face of Cerrado destruction, a combination of factors that make Kaempfer woodpecker a critically endangered species.



Bird communities of two bamboo die-offs in Southeastern Peru

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Our research took advantage of a post-flowering die-off of bamboo in an established bird census plot to investigate the response of bamboo-dwelling birds to a natural transformation of their habitat. In 1984-1986 SR and JT generated spot maps for a 90 ha forest plot in terra firme habitat near Cocha Cashu Biological Station, Manu National Park, Peru. Two mapped bamboo patches in the plot totaled approximately 30 ha. In 2001-2002, the bamboo flowered and died. In 2009, JS revisited the plot and generated spot maps for the former bamboo patches and adjacent forest. By 2009, trees had grown up in the former bamboo patches creating second-growth stands surrounded by mature forest. Many bamboo specialist species were no longer present but few new species had invaded. We conclude that spatial heterogeneity in western Amazonian forests caused by recent bamboo die-offs is not important for the maintenance of high bird diversity in these forests. This result contrasts with (but does not contradict) previous research demonstrating the importance of some disturbance regimes (e.g. treefall gaps) to avian biodiversity in neotropical forests. We also note that the departure of the bamboo specialists is probably not attributable to competition from invading species, but rather is a direct consequence of the changed habitat. A few bamboo specialist species, including *Automolus melanopezus*, *Myrmeciza goeldii*, *Hemitriccus flammulatus*, and *Ramphotrigon fuscicauda*, persisted in the die-offs. Their choices of microsites suggested that vegetation structure is an important determinant of habitat suitability for these specialists.



25th International Ornithological Congress 22-28 August 2010 (www.i-o-c.org)

S21 Adaptation and endemism in and environmental threats to coastal marsh avifaunas

Convenors: Russell Greenberg, USA; Juan Pablo Isacch, Argentina

Bird responses to environmental threats of coastal marshes: ongoing and predicted changes

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Tidal marshes associated with well-protected shorelines of low relief at mid to high latitudes are found at the margins of all major continents except Antarctica. Saltmarshes embody environmental characteristics of both terrestrial and marine communities and provide besides both a highly productive and harsh environment for the few breeding species. Coastal marshes structure, function and persistence are severely threatened by a number of environmental threats including: sea-level rise and associated changes in salinity, increase in storm frequency, alterations of hydrology, the advent of invasive plant and animals, and economically driven activity such as burning, grazing, pollution and harvesting of marsh plants. Around the world saltmarshes are mainly inhabited by a relative low number of specialized bird species. Environmental threats on saltmarshes can be largely detrimental for the bird populations considering their specialized habits. Adaptability of saltmarsh birds to predicted changes would depend on that changes keep marsh vegetation structure or that they can inhabit alternative habitats. Challenges to conserve saltmarsh birds will involve mitigating effects of sea level increase by generating alternative habitats and promoting land use practices not so detrimental for saltmarsh birds. We will explore for land uses of coastal marshes looking for the responses and the adaptability of specialized marsh birds to ongoing and predicted changes. We will show the case of SW Atlantic saltmarshes where main threats for birds are cattle grazing, fire and eutrophication.



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Bill size and dimorphism in tidal marsh sparrows: island-like processes in a continental habitat

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Avian taxa endemic to tidal marshes are almost entirely restricted to North America. Emberizidae has been the most successful group in colonizing and differentiating in North American tidal marshes. Most of this local endemism is at the level of subspecies and representing at least 7 different colonization events involving 5 species and three genera. Previous research has shown parallel evolution of large bills among the different tidal marsh sparrows. Conditions favoring population divergence can be similar to conditions that increase their sexual dimorphism or overall variance. We tested for parallel increases between dimorphism and overall increase in bill size in tidal marsh sparrows. Bill size showed the following patterns in tidal marsh sparrows compared to non-tidal species: 1) an increase; 2) a greater increase in males than females; 3) an increase in sexual dimorphism; and 4) greater variation in females. A high degree of sexual dimorphism in bill size is consistent with the hypothesis that low levels of interspecific and high levels of intraspecific competition select for intra-specific niche divergence. Alternatively, increased sexual selection in tidal marsh sparrows, vis-à-vis high densities and hence increased male-male competition, may account for the differentially large increase in bill size in males. Both hypotheses depend upon processes, particularly increases in population density, that are similar to those often reported for island passerines. However, the low species diversity and increased intraspecific competition of salt marsh faunas are probably a result of abiotic constraints (tides and salinity) rather than the isolating distances of island biotas.



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Habitat selection of tidal marsh birds at Chongming Dongtan in the Yangtze Estuary as influenced by *Spartina alterniflora* invasions

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The exotic *Spartina alterniflora* (hereafter, *Spartina*) has spread rapidly on the east coast of China and greatly changed the native tidal marsh vegetation over the last 30 years. To understand the effects of *Spartina* invasion on the local bird communities, the habitat use and selection by birds were studied in breeding, migratory and wintering seasons at Chongming Dongtan. Results indicated that both species richness and abundance of birds were lower in *Spartina* habitat than in native habitat. In breeding season, the lower abundance of tidal marsh nesters in *Spartina* habitat might be caused by lower food availability and unsuitable nest sites in *Spartina* compared to native habitat. Although some species could utilize *Spartina* habitat, the spread of *Spartina* has led to degradation and loss of suitable habitats for most bird species. In migratory season, the dense *Spartina* stands restricted waterbird movement and useable food was insufficient for most birds. This may affect the food acquisition and energy replenishment of birds during migration stopover, and may eventually affect their migration and breeding success. In wintering period, the *Spartina* habitat was composed of relatively lower and denser vegetation and provided less food for birds than the native *Phragmites australis* habitat. Wintering bird abundance was negatively related to plant density in the *Spartina*, and positively correlated with overall arthropod abundance and plant height. Our results suggest that the alteration of habitat structure and reduction in food resources are probably the proximate causes for the lower avian richness and relative abundance in exotic *Spartina* than native habitat at Chongming Dongtan.



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Abiotic drivers of sexual selection in the tidal marsh: a case study using swamp sparrows

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Darwin's initial definition of sexual selection as a process discrete from natural selection profoundly impacts our current understanding of mating system evolution. The majority of current studies investigating the causes of sexual selection focus on social interactions intrinsic to a species' natural history, largely ignoring extrinsic ecological or environmental factors. We suggest that these extrinsic processes in the tidal salt marsh increase the intensity of sexual selection for a wetland bird, *Melospiza georgiana*, by influencing the heterogeneity of relative male quality. Tides limit the spatial availability of nesting locations safe from flooding, and salinity gradients limit nestling growth rates. As a result, male territorial quality and reproductive fitness vary more widely in a tidal salt marsh than they do in freshwater wetlands. We show how this initial environmental difference affects individual density and the intensity of sexual selection on male aggression, male signaling, and the endpoint of the tradeoff between territorial maintenance and offspring care. The tidal salt marsh possesses a number of mating systems that are unique for emberizid sparrows, and we posit that ecosystem heterogeneity may be a driver in the evolution of these and other sexually selected traits.



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Effects of sea-level rise on saltmarsh-specialist birds

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Many saltmarsh birds are habitat specialists, often found nowhere else. Many are also threatened due to coastal development and the restricted nature of saltmarsh habitats, and climate change is likely to exacerbate this threat. As climate changes, saltmarsh habitats are expected to shrink due to the speed of sea-level rise and the limited ability of marshes to migrate inland. Long-term persistence of many saltmarsh birds, therefore, is in doubt. Saltmarsh sparrows *Ammodramus caudacutus*, for instance, already suffer high levels of nest failure during high spring tides, which wash out nests and drown chicks, despite a range of adaptations that facilitate survival during flood tides. Nest survival is strongly related to the peak tide height within a tidal cycle. Projections show that a 30-cm increase in tidal maxima would make reproduction impossible for this species. Combined with sea-level rise predictions, this result alone suggests the population will cease to be viable within 30-60 years. Additionally, habitat trajectories for the core of the species range indicate that 70-90% of high marsh nesting habitat will be lost by 2100. Similar problems of habitat loss and reduced nest survival are likely to be faced by other saltmarsh-nesting taxa, many of which we predict will decline or face extinction within the next few decades.



25th International Ornithological Congress 22-28 August 2010 (www.i-o-c.org)

S22 Resolving the avian tree of life

Convenors: Allan J. Baker, Canada; Scott Edwards, USA

Rapid radiations and incomplete lineage sorting tangle the branches of the Avian Tree of Life

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Rapid radiations throughout the tree of life potentially can make gene trees discordant by incomplete lineage sorting across short internal branches, and mislead recovery of the species tree. An example of this general problem in phylogenetics is the rapid flowering of modern bird orders in the late Cretaceous, complicating attempts to resolve ordinal relationships and igniting a debate as to whether the flightless ratites are monophyletic or polyphyletic. Using 29 genes and 23 retroposon insertions we show that polyphyly of the ratites is an artefact of ancient incomplete lineage sorting and the use of concatenated sequences in phylogenetics. When the joint posterior distribution of gene trees and the species tree are estimated using a coalescent framework, the extant ratites are shown to be monophyletic, as in classical morphological studies. Rapid radiations of bird orders and other branches of the tree of life are also prone to these problems and will likely require species trees methods for resolution. Examples are also presented where incomplete lineage sorting tangles relationships in tip clades and populations, and the effects of sample size are investigated.



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Biogeographic patterns in “landbirds” indicate parallel ecological adaptations at several systematic levels

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Despite their unique dispersal abilities major groups of birds do exhibit distributional patterns that are best explained by large scale geological events, such as plate tectonics. An ancestral area analysis of the large neoavian “landbird”-clade lends support to the hypothesis that major groups of landbirds independently have evolved similar ecological adaptations in different continents. Several of these groups have subsequently dispersed to other areas of the world and their convergently evolved morphological similarities have long been problematic for avian systematists. As the true systematic relationships gradually become known thanks to the increasing use of molecular data we also begin to realize how common parallel evolution is in birds.



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Species trees: a new paradigm in avian systematics

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Molecular phylogenetic studies of birds now routinely employ multiple loci, and when variation in the topology of different loci is explored, almost inevitably data sets exhibit gene tree variation from locus to locus. Although such variation can have many sources, one of the most ubiquitous is incomplete lineage sorting, the natural stochasticity of gene trees and gene tree-species tree discordance that arises from genetic drift and the failure of gene lineages to coalesce during short internodes that accompany rapid speciation events. Although such variation can be disconcerting to systematists, in fact it represents a potent source of phylogenetic information, particularly when the focus is on the species tree, the overarching tree of populations, lineages and species that contains the gene trees that have traditionally been the focus of systematics. Here I review basic concepts of gene tree variation and species tree reconstruction, emphasizing that gene trees and species trees are different statistical entities that require different types of molecular sampling to maximize resolution. I review new Bayesian and maximum likelihood methods for estimating species trees from multilocus molecular data and recent studies from our lab employing the species tree approach, particularly in Australo-Papuan fairy wrens (*Malurus*) and Neotropical flycatchers (*Elaenia*). In addition to focusing on species rather than genes as the appropriate unit in phylogenetics, species trees provide a natural bridge between phylogeography and phylogenetics as well as a much better statistical description of DNA sequence variation than does the supermatrix or concatenation approaches.



Campos do Jordão 2010 25th International Ornithological Congress 22-28 August 2010 (www.i-o-c.org)

Phylogeny of the genera of New World blackbirds (Icteridae) endemic to South America, as inferred from whole mitochondrial genome sequences

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Over a decade ago, mitochondrial DNA data revealed a previously unrecognized radiation of blackbirds in South America by allying its many enigmatic (mostly monotypic) endemic genera with one another and with species that had long been misclassified in genera, particularly *Agelaius*, distributed outside that continent. Extraordinarily, this clade comprises morphologically divergent taxa that occupy habitats as diverse as marshes, savannahs, arid canyons, dry woodlands and wet montane forests. Despite strongly supporting the monophyly of this group, molecular data have thus far been inadequate to resolve its basal relationships, with results of individual analyses differing depending on taxon and gene sampling. The phylogenetic pattern consisting of a number of distantly related lineages separated by poorly supported internodes has been suggested to indicate a hard polytomy resulting from rapid adaptive radiation. Alternatively, lack of resolution may simply reflect inadequate character sampling. We have resolved this question for mitochondrial data in this group by sequencing the complete mitochondrial genomes of 16 of 19 ingroup species, along with representatives of seven closely related outgroup genera. We show that although a number of divergence events are closely spaced, most nodes are well resolved when an adequate sample of characters is available. Although this group likely represents an adaptive radiation, we strongly reject the notion of a hard polytomy. This well resolved and well supported phylogeny can serve as a robust hypothesis for comparisons with data from multiple nuclear loci.



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Supermatrix, Supertrees, and individual gene phylogenetic analyses in assessing deep avian phylogeny

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Phylogenetic relationships among bird orders have been one of the major topics of concern and discussion among avian biologists. Recent independent analyses, both under morphological and molecular grounds, are still incongruent in many respects. Here we reassess molecular data from recent works on the subject, using alternative approaches, namely non-homogeneous evolutionary models under maximum likelihood and Bayesian frameworks. One of the main justifications for such models is in minimizing the effect of statistical inconsistency (i.e., recovering an inaccurate topology with high confidence). Recent papers have shown that the magnitude of inconsistency may be larger than expected for real data sets, when well-established morphological data sets are compared to molecular data sets for the same taxa, exhibiting different topologies. Another debatable issue is whether supertree or supermatrix methods should be considered the choice when several data sets are available. New programs under a Bayesian framework allow a good compromise between these two approaches. The behavior of non-homogeneous molecular models, supertrees, supermatrix, and other methods that in theory should minimize topological inaccuracies were tested here, and its impact on disagreements between morphological and molecular frameworks, regarding avian phylogeny, is discussed.



25th International Ornithological Congress 22-28 August 2010 (www.i-o-c.org)

S23 Wild journeys: status and prospects of tracking individual, long-distance migrants

Convenors: Martin Wikelski, Germany; Kasper Thorup, Denmark

Health status and global tracking of migrant lesser black-backed gulls *Larus fuscus*

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Migration involves physiological, social and ecological costs that only animals in prime physical condition are supposed to withstand. Migration can also be a health challenge for many animals because they are supposedly exposed to pathogens and parasites from the different habitats they cross during a vulnerable period of extenuating physical conditions. We studied long-distance migrant lesser black-backed gulls breeding in Finland and wintering in East Africa as a study system to address these questions. We examined associations between disease status and immune parameters in relation to migratory pattern and activity on an intercontinental scale. Adult birds caught in their breeding grounds were sampled for health parameters and equipped with a light-weight satellite telemetry device which allows real-time geographical positioning and effective monitoring of movement on a global scale. We predicted that individuals with impaired immunity or those already suffering from current or chronic diseases would experience higher costs as a consequence of migration (less efficient migration patterns, longer time to reach wintering grounds, or even death during the journey). Our study allowed us to examine how natural selection can act during the migratory phase, and/or whether individuals showed any carry-over effects from migration towards their subsequent reproductive period. Understanding the links between disease ecology and animal migration can be a major contribution to the current research efforts in emerging diseases, in particular clarifying the role of animal movement as a dynamic component in epidemiological models of some of the main threats for wildlife and human health.



Campos do Jordão 2010 25th International Ornithological Congress 22-28 August 2010 (www.i-o-c.org)

Tracking migratory songbirds across the Gulf of Mexico via automated radio-telemetry systems: behavioral strategies for crossing large geographic barriers

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Many fundamental questions regarding the strategies that small migratory birds employ to traverse geographic barriers remain unanswered. We radio-tagged 44 *Catharus ustulatus*, 25 *Dumetella carolinensis*, and 9 *Vireo olivaceus* in Alabama, USA during fall 2008-09 to study their movements across the Gulf of Mexico using three Automated Radio-telemetry Units (ARUs) in southern Alabama and seven ARUs in the northern Yucatan Peninsula, Mexico. Most birds carrying large fat deposits, especially *C. ustulatus*, departed Alabama in a southerly direction on the day of capture, whereas most lean birds departed in a northward direction. In 2009, many lean birds remained in the area for extended periods before departure. In general, low energy and inclement weather were predictors of reverse migration, i.e., northward movement in the fall, and tracked individuals moved up to 50 km inland from the coast. Birds may reverse migrate to refuel for a trans-gulf flight, rather than initiate circum-gulf navigation. Flights between Alabama and the Yucatan Peninsula ranged from 22-29 hrs in duration. Birds arriving in the peninsula departed Alabama in a range of directions (162-214 degrees), and individuals following a “western” route across the gulf had longer flights. Arrival locations in the peninsula were 173-182 degrees from departure locations, suggesting that birds’ true locations of arrival on the other side of the gulf can be quite different than predicted from their departure directions. Our results provide valuable insight into strategies used by migratory songbirds when crossing geographic barriers.



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Tracking purple martin (*Progne subis*) and wood thrush (*Hylocichla mustelina*) migration using go-locators

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The size and weight of conventional transmitting devices make them unsuitable for tracking long-distance migrations of small songbirds. In 2007 and 2008 we took an alternative approach to tracking songbird migration by mounting 1.6 g light-level geo-locators on purple martins and wood thrushes from northwestern Pennsylvania, USA. In 2008-2009 we retrieved geo-locators from five returning purple martins and fourteen returning wood thrushes, and we analyzed sunrise and sunset times to reconstruct migration routes and estimate wintering locations. Both species made rapid spring migrations, with one purple martin migrating 7,500 km from central Brazil to Pennsylvania in 13 days. Most wood thrushes made the migration from their Central American wintering grounds to Pennsylvania in 13-15 days, and showed strong connectivity between their breeding and wintering areas. Both species migrated across the Gulf of Mexico, and long stop-overs on the Yucatan Peninsula of Mexico were common. In 2009 additional purple martins were marked with geo-locators (1.1 g) in Pennsylvania, Texas, and British Columbia, and wood thrushes were marked in Costa Rica on their wintering grounds. We report our latest connectivity results and their implications for the conservation of Neotropical migratory birds.



Campos do Jordão 2010 25th International Ornithological Congress 22-28 August 2010 (www.i-o-c.org)

Honey buzzard (*Pernis apivorus*) migratory flight characteristics revealed with high resolution GPS tracking

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Honey buzzards are long distance raptor migrants that cross migration bottlenecks like mountain passes and narrow sea-straits in very large numbers. They are generally diurnal soaring migrants, although radar studies have revealed that migration may occasionally extend into the late evening hours and include flapping flight. We conducted a pilot project using a high resolution, flexible GPS tracking system to study the migratory behaviour of honey buzzards. We measured the location of several adults at an unprecedented 30 minute interval throughout the entire autumn from their breeding site in the Netherlands to their wintering sites in west Africa as well as their spring migration back to their breeding grounds. We present an analysis of the migration routes, the daily flight schedule, flight speeds, habitat selection during stopover, stopover frequency and duration and flight altitudes. Furthermore we studied relationship between meteorological conditions, flight altitudes, flight speeds and route. Detours from the primary axis of migration can be directly linked to local meteorological conditions and topography. Regional and seasonal differences in migratory behaviour along the tracked routes are also shown and discussed.



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Individual and population specific migration routes and migratory connectivity of European Montagu's harrier (*Circus pygargus*) populations – results from satellite tracking

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Protection of staging sites during the non-breeding season is essential for effective conservation of long distance migrants. Little was known on migration and wintering of the threatened Montagu's harrier (*Circus pygargus*) until satellite tracking made it possible to investigate migratory connectivity between breeding and wintering areas. Tracked harriers (n = 30, 2005-2009), from NW-Europe (Netherlands, Germany, Denmark) and NE-Europe (Poland, Belarus) used three pathways during autumn migration into the Sahel zone: via Spain or Italy (NW-European birds), or via Greece (NE-European birds). Spring routes were similar to autumn routes, except for eastern migrants via Greece, which returned via Italy. Migratory connectivity was high: Individuals used similar pathways during consecutive years and were mostly site faithful. The longitudinal distribution of birds in the breeding areas was mirrored in the wintering areas. Despite the segregation of breeding and wintering areas, there was some overlap in wintering areas of birds from NW- and NE-Europe, as well as a certain proportion of (female) breeding dispersal within the NW- and NE-European breeding ranges. Daily distances travelled were highest above the Mediterranean Sea and the Sahara desert. A concentration of tracks and slow travel speeds suggest a potentially important stopover site in eastern Morocco. In this study, satellite telemetry revealed high migratory connectivity between breeding and wintering grounds as well as the location of important non-breeding season staging areas, that deserve priority in year-round species conservation strategies.



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S24 Avian brood parasites and their hosts

Convenors: Fugo Takasu, Japan; Wei Liang, China

Cuckoos and their hosts in a multi-cuckoo species system in China

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Cuckoo-host systems are among the best-studied of all brood parasite systems, but the geographical coverage of these studies is spotty. With the exception of Japan, the cuckoos of Asia, in particular China, are much less well known. During a period of 2002-2009, by reviewing the literatures, collecting the nests and photos of cuckoos and their hosts, totally 9 species of cuckoos and 40 species of their hosts referring to 19 provinces in China, were confirmed. These hosts belong to 10 families and the Sylviidae accounts for 50%. Many of them are parasitized by the common cuckoo *Cuculus canorus*, which account for 45.0% (18 species in 6 families). As to the egg color, 46.2% of hosts laid pale color eggs and 53.8% laid spotted eggs. The eggs of common cuckoo in China are polymorphic, with at least 6 morphs being found, and most of them are mimetic to their hosts. With field observation and experiments, we shown that, hosts use and eggs color of cuckoos, and host defenses in a multi-cuckoo system, China, were much different from other places. Among them, the great tit (*Parus major*) and green-backed tit (*P. monticolus*) exemplified the problem: though listed as unsuitable hosts in Europe and often accepted non-mimetic eggs, populations of them in China could reject non-mimetic eggs at a rate of 100%. When why they reject non-mimetic eggs is still open to question, we suggest that size do matter for avian brood parasitism in a multi-cuckoo system.



25th International Ornithological Congress 22-28 August 2010 (www.i-o-c.org)

Spatial variation in host selection among common cuckoos (*Cuculus canorus*) in Europe

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The brood parasitic common cuckoo (*Cuculus canorus*) is a generalist that utilizes more than 100 host species throughout its European range. However, individual females specialize on one or a few hosts, and parasite races often mimic the appearance of host eggs. In any one area only a small fraction of potential host species is commonly parasitized. Here we investigate spatial variation in host use by the common cuckoo throughout Europe, relying on a database of 25,000 cases of parasitism collected in the period 1890 - 2009. Reliable estimates of the size of the breeding population for all potential hosts and common cuckoos exist for all European countries, enabling us to test whether host use is as expected from their relative abundance. These analyses showed evidence of an Allee effect with rare host species suffering disproportionately from parasitism. Furthermore, we analyse factors associated with distribution and abundance of cuckoo host races, allowing tests of hypotheses relating to the evolution of host races and host specialization by parasites.



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High consistency of egg rejection responses in a brood parasite host

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Models of brood parasite-host coevolution explicitly assume high repeatability of egg rejection responses in host individuals. Thus, “acceptors” always accept whereas “rejecters” always eject and/or desert alien eggs. To date, this crucial assumption of high individual repeatability of egg rejection decisions has been rarely tested. Here, we explored repeatability of egg rejection in the blackbird (*Turdus merula*), a species known to reject foreign eggs at intermediate frequencies. Blackbirds, both in the native Czech Republic and introduced New Zealand populations, showed very high consistency in their responses to both poorly and closely mimetic alien eggs within the same breeding attempts. Tested individuals responded significantly faster to second than to first trials. We did not find any effect of blackbird female age on either rejection probability or latency to respond. These results confirm both a critical assumption of co-evolutionary theory regarding host-parasite interactions and the role of experience to fine-tune individual egg rejection decisions



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Why does the host eject cuckoo nestlings instead of the eggs?

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Since avian brood parasitism usually reduces hosts' reproductive success, hosts often exhibit strong defense mechanisms. Typically, the hosts show some anti-parasitism behaviour only at the egg stage (especially egg rejection), and thus it was thought the evolution of nestling ejection behaviour is maladaptive for hosts. However a recent study reported that an Australian warbler species physically ejects parasite cuckoo young from its nest, which has never been observed in any other brood parasite system. Curiously this host does not reject dissimilar foreign eggs despite the egg rejection seems to be a better strategy for this species because, if successful, there is no risk of own eggs being ejected by cuckoo young. This puzzle seems not be sufficiently explained by the two previously proposed hypotheses, evolutionary lag hypothesis and constrain hypothesis. Here, we propose a new hypothesis, egg dilution effect hypothesis, which argues that cuckoo eggs act as insurance of host eggs through dilution effect against parasitism by multiple females and thus it is more beneficial for hosts to accept cuckoo eggs even if the hosts are capable of discriminating cuckoo eggs from their own. The conditions of this hypothesis fit the nature of the host species.



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Mother to eggs communication

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Avian hosts pay a high cost for rearing brood parasites and thus continuously evolve strategies to detect them, while the brood parasites evolve ever more efficient means to deceive their hosts. Until recently, this evolutionary arms race was believed to end once the host accepted the egg of the brood parasite into its nest. Superb fairy-wrens (*Malurus cyaneus*) have taken the race a step further because they are one of the few birds known to desert nestling cuckoos. Previous research found that the begging calls of cuckoo nestlings differed from those of superb fairy-wren host nestlings in lowest frequency, with cuckoo/host call matching occurring several days after hatching. In 2007, we made the extraordinary discovery that female wrens call to their unhatched eggs, and upon hatching the nestlings develop begging calls that closely match the lowest frequency of key elements in their mother's incubation call. Current field experiments test (1) the response of females to begging calls that do not match their maternal incubation calls; and (2) if the call matching is innate (with nestlings matching their mother's calls because of shared genes) or if the key elements are learnt with the mother fine-tuning the begging calls of her offspring. We suspect we have uncovered the vocal cue that females use to recognise their own nestlings and thus detect the presence of an intruding cuckoo nestling.



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S25 Paleontology: fossil evidence for the early evolution of extant birds

Convenors: Gerald Mayr, Germany; Julia Clarke, USA

Fossils and the historical biogeography of birds

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The early Cenozoic fossil record of birds shows that many higher-level taxa have a complex biogeographic history. Stem group representatives of taxa whose distribution is today restricted to the Old World were found in the New World, whereas stem group representatives of taxa that were considered endemic for the Southern Hemisphere occurred in Europe and North America. Coexistence of, e.g., stem group Coraciidae/Brachyteraciidae (rollers) and Coliidae (mousebirds) in the early Eocene of North America, and of stem group Todidae (todies) and Trochilidae (hummingbirds) in the early Oligocene of Europe exemplifies the significant shifts in the distribution areas of these taxa. Climatic cooling during the Cenozoic certainly played a role in the disappearance of frugivorous or insectivorous taxa with poor migration capabilities from northern latitude habitats. However, climatic reasons alone are unlikely to have led to the complete extinction of, e.g., Cariamidae (seriemas), Nyctibiidae (potoos), and Trochilidae in the Old World. It is notable that these taxa are today restricted to areas that were isolated during the Cenozoic, and non-climatic ecological factors, such as competition with other avian groups or predation by mammals, are probably played a major role in the historical biogeography of birds. The talk will outline our current knowledge of the historical biogeography of selected taxa and discuss possible explanations for the observed patterns.



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The Mesozoic record of ornithurine birds and the early evolution of crown clade Aves

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Extinct parts of Aves are being sought at an unprecedented rate as internal calibration points for molecular divergence dating approaches and cited to support/refute macroevolutionary hypotheses based on those and other estimates. Currently debated hypotheses relate the diversification of Aves to the break up of Gondwana, to the Cretaceous/Tertiary mass extinction and to Paleogene climate shifts. Other hypothesized patterns in early avian diversification include ecological constraint on the appearance of crown birds and successive waves of diversification and replacement. The Mesozoic fossil record of ornithurine taxa is essential to approaching these questions. Ornithurine taxa are also critical to understanding the emergence of the morphologies and life history characteristics uniquely shared by all living birds. Here, recent advances in our understanding of Mesozoic Ornithurae are reviewed, and a new synthesis of relevant fossil data informing the age of the base of crown Aves is presented. New early Paleogene data are also discussed with reference to estimating broader proposed patterns of avian diversification.



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***Diogenornis fragilis* Alvarenga, 1985, restudied: a South American ratite closely related to Casuariidae**

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Diogenornis fragilis, from the Middle Paleocene of Rio de Janeiro, Brazil, is represented by various portions of the skeleton of several individuals but has heretofore been known only from the original description. A restudy of all existing material and comparison with all ratite families, indicates that *Diogenornis* is much more closely related to the Australian Casuariidae than to the South American Rheidae. Among the most important osteological characters relating *Diogenornis* to the Casuariidae and distinguishing it from the Rheidae are: beak with a narrow and pointed maxilla; atlas with the *arcus atlantis* forming an overhang cranially; femur with the *trochlea fibularis* large and oval, the popliteal fossa shallow, and the *linea intermuscularis caudalis* prominent and similar to *Casuarius*; tibiotarsus with *condylus medialis* not undercut proximally as in *Rhea*, but very similar to *Casuarius* and *Dromaius*; tarsometatarsus with *sulcus extensorius* very deep, the hypotarsus prominent as in *Casuarius*, not expanded plantarly in the extreme proximal portion as in *Rhea*, and with a noticeable tendinal groove in the medial side as in Casuariidae (absent in Rheidae). The presence of a ratite related to the Casuariidae in the Paleocene of South America, corroborates hypotheses of a Gondwanan origin of these birds, the close relationship among the Rheidae-Casuariidae-Dromaiidae and the importance of the Transantarctic biotic interchange between South America and Australia in the beginning of the Cenozoic.



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New insight into the origin and affinities of penguins (Aves: Sphenisciformes) from the Palaeocene of New Zealand

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It has been suggested based on significant morphological disparity between penguins and their sister taxa, as well as molecular sequence data, that the penguin lineage diverged during the Late Cretaceous. The oldest fossils identified as stem lineage penguins of a single taxon, *Waimanu* come from the late Early and early Late Palaeocene Waipara Greensand of New Zealand (58-61.6 Ma). The specimens importantly retain a combination of plesiomorphic seabird morphologies and apparent penguin apomorphies key to understanding the transition to wing propelled diving. Here we present data from both a reanalysis of previously described *Waimanu* remains and study of four newly-discovered and remarkably well-preserved partial skeletons that allow a taxonomic reassessment of specimens referred to *Waimanu* and new insights into recent controversy concerning potential affinities of penguins and other seabirds. It has been proposed that the enigmatic Plotopteridae, known from the Late Eocene–Early Miocene of the northern Pacific rim, may be the sister taxon of penguins and that this clade may be more closely related to traditional parts of the pelecaniforms (i.e., Suloidea) or even possibly the ciconiiforms, procellariiforms or gaviids but has not addressed the placement of position of plotopterids. Phylogenetic analyses incorporating character data from the new Palaeocene specimens offers a new address of these competing hypotheses with paleobiogeographical implications.



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A combined phylogenetic analysis of extinct and extant Alcidae (Aves, Charadriiformes): the contribution of fossils to the resolution of avian systematic relationships

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Alcidae have the richest fossil record among Charadriiformes; however, previous phylogenetic analyses of alcid relationships have been overwhelmingly restricted to extant taxa. The evaluation of 25 extinct alcid species along with 52 extant species of alcids and charadriiform outgroup taxa represents the most inclusive taxon sampling of this clade. Systematic relationships were estimated through combined phylogenetic analyses of morphological characters (i.e., osteological, myological, integumentary, behavioral) integrated with mitochondrial and nuclear DNA sequence data (i.e., RAG-1, ND2, ND5, ND6, COI, cyt-b, 12S, 16S), and the results of different methods of phylogeny estimation (i.e., parsimony, Bayesian) were compared. Dense taxonomic sampling in combination with the total evidence approach adopted in this analysis resulted in a well-resolved phylogenetic tree that represents the most robust hypothesis of alcid relationships to date. The results of this analysis indicate that incongruence between previous analyses of alcid relationships is partly due to the exclusion of extinct taxa. Although the majority of extinct alcid species are known from isolated skeletal elements, inclusion of these species facilitates investigation of the timing and sequence of morphological character changes, and demonstrates the utility of combined analyses for resolving phylogenetic relationships. Phylogenetically analyzed fossil taxa also provided robust calibration points for divergence estimation, thus further refining estimates of the timing of cladogenetic events in Alcidae.



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S26 Migrant responses to environmental conditions: integrating ecological and physiological approaches

Convenors: Marilyn Ramenofsky, USA; Barbara Helm, Germany

Ecological background to bird migrations

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Two types of avian migratory behaviour have long been recognised. In obligate migration, all main aspects are viewed as under firm internal (genetic) control, mediated by day-length changes. Obligate migrants typically show high annual consistency in the timing, directions and distances of their migrations. Each individual behaves in the same way each year. Obligate migrants often leave their breeding areas before food-supplies collapse, their movements being 'anticipatory'. Typically, they exploit foods which are predictably absent from the breeding areas during winter. Examples include insectivores, such as barn swallow and common cuckoo, which migrate long distances. In contrast, facultative migration is viewed as a direct response to prevailing conditions, especially food supplies, and the same individual may migrate in some years but not in others. It occurs in populations whose food supplies in breeding areas vary greatly between winters. Within a population, depending on prevailing conditions, the proportions of individuals that leave the breeding range, the dates they leave and the distances they travel, can vary greatly from year to year. Extreme facultative migrants include irruptive finches which depend on sporadic tree-seed crops, and owls which depend on periodic peaks in cyclic rodent populations. This talk will consider the ecological conditions that underlie these types of movements, arguing that the predictability or otherwise of food supplies has a major influence. Obligate and facultative migrants also respond differently to potential proximate cues that control migration, with facultative migrants being more directly dependent on prevailing food supplies.



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Physiological and behavioural responses in migrants to environmental cues

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To understand how migrants respond to environmental cues, we compare species with rigid or obligate versus flexible or facultative schedules to identify the physiological mechanisms regulating physiological and behavioral responses to environmental cues. For example, obligate migrants, who travel across the equator rely on endogenous rhythms to time onset of vernal migration. Others that remain in either the northern or southern hemisphere depend upon the annual change in daylength or photoperiod to initiate the vernal phase of migration. Many facultative species appear to rely upon local cues in the environment such as food resources, predators etc. to time migratory movements. We will review the known physiological and behavioral responses to environmental cues that coordinate migratory movements in obligate and facultative migrants and draw comparisons across the strategies. In general, the physiological control mechanisms involved include perception of the environmental cue and transduction by the neuroendocrine and endocrine systems regulating migration. Clearly, there are huge gaps in our knowledge in this area but taking such an approach will help to identify common and divergent pathways. Understanding the physiological mechanisms underlying the divergent migratory patterns will be vital for knowing how migrants respond to current environmental cues and anticipating their reactions to future conditions.



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Interactive effects of land use change and climate change on European passerines?

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Species are experiencing several concurrent anthropogenic changes in their environment. Understanding the respective and relative roles of current environmental change drivers on population trends is of great importance for an improved conservation prioritization and as a fundamental question in global change biology. Predictions about future population trends will depend on whether environmental changes have additive, negative or positive interactive effects on populations. I combine existing time series on population size of European passerines on a country level with large scale GIS data sets to estimate habitat and climate change's impact on population trends in a multiple regression framework. This is one of the first analyses that tries to correlate quantitative estimates of environmental changes with country level species trends, and thereby also one of the first to account for and investigate the variation in species within continents. The most important result will be a quantification of whether special priority should be put on protecting species that are subjected to more kinds and more severe environmental changes. In addition the country level results would inform the appropriateness of predictive analyses of species responses to global change where homogeneity of species niches across continental scales is often assumed.



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Environmental factors trigger changes in diel activity patterns in Eurasian reed warblers during breeding period

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Songbirds are generally considered diurnal, although many species show nocturnal activity during migration seasons. From a breeding-range perspective, such migratory species appear to be diurnal because they are observed to nest and feed their young during the day. But are they really exclusively diurnal? We tested how a passerine long-distance migrant, the Eurasian reed warbler, schedules movements during the breeding period by tracking birds in two situations. (1) Birds were monitored after simulated nest loss and during their search for alternative locations, and (2) birds were translocated to remote reed beds and tracked during homing. The simulated unpredictable events disrupted breeding, forced birds to move over relatively long distances, and triggered rapid change in diel activity. Birds resorted to nocturnality to find their way home and to search for new places to breed. The reasons for nocturnal movements are poorly understood. Among the presumed advantages, the reduced predation pressure at night stands out because it is advantageous for movements on local as well as global scales. Predation may be particularly relevant for inhabitants of fragmented habitats which encounter unfavorable conditions when crossing gaps in their preferred habitat. Therefore, similar selection pressures around the year may have favored the evolution of a general circadian mechanism for switches to nocturnality. We suggest that in reed warblers, nocturnality is based on a circadian mechanism that does not differ in principle between migratory and non-migratory seasons. So, the whole annual circle of nocturnality may be represented as interaction between two separate circadian oscillators, differ only in degree of coupling between them during different annual stages.



Do dietary protein and access to drinking water limit body mass increase in migrating passerine birds refueling at a stopover?

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We examined how dietary protein and water availability influence refueling in blackcaps (*Sylvia atricapilla*) during a migratory stopover. We deprived freshly caught birds of food for 1-2 days, simulating in-flight starvation, and refed them for six days in two experiments: 1) birds were fed one of two diets differing in protein concentration (3% or 20%); 2a) birds were offered mealworms (~60% water) *ad libitum*, and either water *ad libitum*, 0.5 h/day access to water or no water; 2b) birds were offered an insect-based diet (~33% water) *ad libitum*, and either water *ad libitum* or 0.5 h access to water twice a day. Using repeated measures ANOVA, we found no differences between the protein diet groups in their rates of change of body mass (mb), pectoral muscle size index (PMI) or lean mass (ml) ($F_{1,24}=0.24$; $F_{6,102}=0.63$; $F_{2,34}=1.52$, all NS); water intake was significantly different between the water availability regimes on both diet groups ($F_{2,28}=27.6$, $p<0.00001$; $F_{1,21}=24.2$, $p<0.0001$); The rates of change in mb, PMI, ml and fat mass were not affected by water availability when birds ate mealworms ($F_{2,28}=0.33$; $F_{2,28}=0.49$; $F_{2,28}=1.92$; $F_{2,28}=1.94$, respectively, all NS), but were positively affected in birds provided the insect-based diet ($F_{1,21}=20.25$, $p<0.001$; $F_{1,21}=4.90$, $p<0.05$; $F_{1,15}=9.85$, $p<0.01$; $F_{1,15}=9.23$, $p<0.01$, respectively). We conclude that the rate of refueling in blackcaps is not necessarily limited by dietary protein, but is positively correlated with drinking water availability when food water content is low.



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S27 Phenotypic changes in islands birds

Convenor: Sonya Clegg, Australia

Song divergence among contiguous populations of Darwin's small ground finch, *Geospiza fuliginosa*

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Evidence for adaptive divergence amid high gene flow has been shown in Darwin's small ground finch, *Geospiza fuliginosa*, inhabiting the altitudinal extremes on the island of Santa Cruz in the Galápagos Archipelago. Specifically, genetic data showed little differentiation between populations. However, birds that inhabited the humid forest highlands had long beaks and gleaned insects, fruit, and unripe seed from the understorey, whereas birds that inhabited the arid wooded lowlands had short beaks and picked the ground for ripe seed. Previous studies have also highlighted the capricious nature of divergence in this system, governed by fluctuations in the climate (i.e., greater disruptive selection during drought years). Here, we examine evidence for reproductive isolation across populations that show phenotypic differences. We use song data because song characteristics have been shown to correlate with morphology. First, we examine variation in male song characters in relation to beak morphology and habitat type, and second, we conduct playback experiments to test for the intensity of response to local versus non-local songs. We show differences in song characteristics across habitats within a single island, and furthermore, different intensity of response to playback across habitat type. In the lowlands, birds responded more strongly to local song than birds in the highlands. These findings are comparable to our finding on the strength of assortative pairing across habitats, which was stronger in the lowlands.



Sedentariness in an island population of common blackbirds (*Turdus merula*): a result of phenotypic plasticity, genetic drift or adaptation?

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Birds colonizing islands often differ in life-history, behavior and morphology from their mainland counterparts, but the relative roles of variation in selection pressures and founder effects in generating this divergence are largely unknown. Island phenotypes could derive from a small fraction of founders, and thus divergence may arise stochastically through genetic drift. Here, we analyze the phenotypic character and genetic structure of a population of common blackbirds on Heligoland Island, North Sea. This population was founded as recently as 1983 and held almost 100 territories by 2007. Capture-resighting analyses of color-banded and radio-tagged individuals show that the majority of blackbirds bred on Heligoland are year-round residents. This sedentariness is reflected in wing morphology, with island birds showing shorter wings than migratory conspecifics from the mainland. Behavioral assays in hand-raised blackbirds held under controlled laboratory conditions suggest that island sedentariness has a genetic component. Using microsatellite markers, we further reveal that genetic immigration of migratory blackbirds passing Heligoland is negligible. The lack of inherent migratory disposition in the island population indicates that sedentariness has evolved and is not a phenotypic plastic response to the geophysical barrier. We discuss the degree to which phenotypic divergence of island dwelling birds reflects local adaptation or has resulted from genetic drift guided by random selection. Funded by Deutsche Forschungsgemeinschaft (German Research Foundation).



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Family resemblance in an island bird population: inheritance of morphology, behavior and life history

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Determining how different biological traits are inherited in natural populations requires information on relatedness among individuals. Taking advantage of a strongly philopatric population of savannah sparrows (*Passerculus sandwichensis*) breeding on Kent Island, an isolated island in the Bay of Fundy, New Brunswick, Canada, we were able to quantify lifetime reproductive success for 1079 breeding birds over a 17-year period, assess rates and consequences of inbreeding, and construct social pedigrees going back as far as 12 generations and genetic pedigrees over three years. Compared to other island populations (e.g., song sparrows on Mandarte Island), inbreeding is uncommon. Based on parent-offspring regressions and animal model analyses, the heritability (h^2) of morphological traits is moderately high, whereas h^2 of life history traits such as clutch size and longevity is relatively low. These results are consistent with the prediction that the relative amount of additive genetic variation is reduced for traits that are closely related to fitness, but they may also reveal fundamental differences in the degree to which – and the mechanisms by which – different types of traits are passed on between generations.



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Natural selection in island birds: the recurring pressures of insular life

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Island populations often exhibit pronounced phenotypic shifts compared to mainland forms with shifts typically attributed to natural selection following colonization of new environments. Recurrent features of island populations, such as changes in the levels of inter- and intraspecific competition, may produce similar selection regimes across islands. This in turn may contribute to the generation of patterns such as the 'island rule', where medium body size is favoured. Understanding how natural selection produces phenotypic change is therefore necessary to address how divergence leads to speciation and how broad-scale biogeographic patterns are generated. However there are substantial gaps in our empirical knowledge on mode and tempo of natural selection following island colonization, and the selective consequences of common island population features. Using an island population of silvereyes *Zosterops lateralis* in Australia, I examined selection following colonization and the likelihood that shifts in island competitive regimes underlie selection for body size changes. Patterns of microevolutionary change over three timescales indicated variation in selection regimes, with much of the increase in body size occurring in the first few hundred generations. An increase in intraspecific competition due to high population density is a potential selective mechanism as body size was found to be a significant predictor of success in aggressive interactions. Whether these findings for silvereyes reflect general explanations of divergence in island bird populations awaits further empirical studies. However examining how common insular features influence avian differentiation is likely to prove valuable in understanding the generation of repeated phenotypic patterns.



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Invasive bloodsucking fly larvae threaten Darwin's finches in the Galápagos Islands

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Parasitic larvae of an introduced fly, *Philornis downsi*, are killing nestlings of the iconic Darwin's finches. Darwin's finches are one of the fastest evolving vertebrate groups and are incredibly adaptable to the harsh conditions of the Galápagos Islands. But since becoming a haven for tourists, these islands have suffered from significant habitat destruction and exotic pest invasions. Here, we present video footage from within wild finch nests showing how *P. downsi* larvae parasitises its host and causes widespread nestling mortality. Larvae reside in the nest base and emerge at night to feed by external attachment on the blood and tissues of nestling birds and by entering through the beak to feed internally. Nestlings in heavily parasitised nests cannot rest during the night due to the severity and number of larvae actively seeking attachment for feeding, and any surviving fledglings are commonly found with irreversible morphological damage. We show the new behavioural adaptations of parent and nestling finches against larval parasitism, and discuss the effects of parasite intensity on parental care and nestling growth rates. *P. downsi* parasitism is a serious threat to range-restricted species of Darwin's finches, especially those in moist highland forests of elevated islands, where we find an average of 40-50 larvae per finch nest and high levels of nestling mortality. The status of Darwin's medium tree-finch was recently re-evaluated from "vulnerable" to "critically endangered" because we found that *P. downsi* parasitism causes mortality in >40% of its nestlings, and its sole population on Floreana Island is declining. We discuss the results of our study in the context of developing control measures for *P. downsi*, and conservation programs for Darwin's finches.



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S28 Harnessing the power of research networks to reveal and contrast avian life cycle patterns and life history evolution

Convenors: Robert G. Clark, Canada; Viviana Massoni, Argentina

Using research networks to evaluate hypotheses in evolutionary ecology: a perspective from the Western Hemisphere

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Integrated programs of research, education, and international collaboration are required to address many fundamental yet unresolved questions about life history variation: why do basic reproductive parameters vary so predictably from the tropics to high latitudes? Understanding the relative roles of organismal and environmental causes for biotic gradients, over time scales from the physiological to the geological, is increasingly urgent in these times of rapid global change. Of the many life-history contrasts between temperate and tropical birds, explanations for differences in reproductive allocation reflected in clutch size remain elusive. Females at higher latitudes tend to lay more eggs in their clutches, and hypotheses generally have been of three types: (1) Environmental hypotheses have centered around ecological effects that vary with latitude, such as extremes and seasonality of temperatures and solar radiation. (2) Historical hypotheses have explored how Quaternary fluctuations in glaciation and sea level have driven natural selection on life-histories, including both reproductive allocation and movement. (3) Organismal hypotheses have explored how inherited differences in physiology and anatomy have molded the suite of life history tactics available to organisms across the arctic-tropical spectrum. These hypotheses are currently being tested using a research network focused on *Tachycineta* swallows, and comparisons with results of European studies of *Ficedula* flycatchers and other birds will provide perspective and guidance for future research and allow an exploration of how differences in movement patterns may have influenced differences in reproductive biology.



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Integrating Palearctic research to link large-scale movements and demography of migratory birds in changing environments

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Environments are far from stable and large environmental changes during short periods may be too rigorous for a successful adaptive response. Thus, it is crucial to determine whether and how avian species adapt to environmental changes and whether these adaptations are sufficient to prevent population decline. Current European demographic networks on *Ficedula* flycatchers are addressing how long-distance migrants adapt the timing of their annual cycle events to maintain synchrony with climate change. By reviewing results from these studies that cover the whole geographic breeding range of the species, new insights are obtained regarding: (1) whether populations vary in the strength in their response to climate change; (2) how selection for breeding date has been changing in different populations, and whether this is due to climate change; (3) the possibility that 'epigenetic' effects produce offspring adjustments in timing of migration and subsequent breeding date (providing an easy way to "adapt" to climate change); and, (4) how important latitudinal or altitudinal dispersal is to adapt the timing of the annual cycle to climate change: if late-hatching individuals also arrive too late on natal areas they may continue migration north until they reach an area with the right phenology. These movements are currently studied with the use of stable isotopes from feathers, collected by a large network of flycatcher researchers.



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The power of research networks in studying geographic variation in plumage coloration

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The maintenance of variation in fitness-related traits that should be under directional selection is a fundamental problem and a major unresolved issue in biology. We study mechanisms maintaining both geographic and within-population variation in the plumage coloration of a passerine bird, the pied flycatcher (*Ficedula hypoleuca*). The males in this species exhibit a plumage trait complex where the dorsal coloration varies from dull brown to black, with brown males having also smaller forehead patches and lower feather UV-reflectance than black males. It has been suggested that the brown phenotype is selected for in areas of sympatry with the closely related collared flycatcher (which is black) because it reduces hybridisation and interspecific competition. The black phenotype may be selected for in allopatric areas, but conclusive evidence for this is lacking. With the help of a Europe-wide network of collaborators, we have collected standardized data on plumage coloration patterns in different parts of the species' range and on the strength of fecundity selection on male traits in different populations. Through the same network we have also collected molecular genetic data for analysing the population genetic structure of the species, which appears to exhibit interesting patterns. The results of these studies should provide a better understanding of the evolution of plumage coloration patterns in a spatial ecology context and of the factors maintaining the huge variation in coloration.



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Variation in relative egg and yolk size in *Tachycineta* swallows: insights from a network spanning the Western Hemisphere

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The number and quality of eggs can strongly affect offspring fitness. However, there is no clear pattern in egg-related fitness tradeoffs across several bird taxa. Geographically, relatively larger eggs are generally found in the tropics and southern hemisphere relative to those in northern temperate zones. Egg size variation might be driven in part by variation in how females cope with downturns in ambient temperature and food availability which, as a consequence, might affect nest attentiveness. However, relative egg size alone may not accurately reflect the maternal investment in the egg, as only the yolk contains the energy that embryos need to grow. Here we describe patterns of egg and yolk size variation across a broad geographic gradient encompassing 11 study sites along an 8400 mile range in the Western Hemisphere from Alaska to Argentina. We developed standardized protocols to compare relative egg size (corrected for body mass), ambient temperature during egg development and food availability. In addition, we estimated yolk area using standardized digital-candlers (Ovoluxes). This approach allowed us to address the following questions: 1) Is there a relationship between number and quality of eggs within *Tachycineta* swallows? 2) How does parental investment in egg and yolk size vary geographically? 3) Does relative yolk size vary with latitude? 4) Is there variation in seasonal changes in egg and yolk size across sites? This work has been done within the *Golondrinas de las Americas* network (<http://golondrinas.cornell.edu>), which provides a distinctive opportunity to explore life history variation in relation to latitude and phylogeny. We will also discuss the challenges and rewards of international standardization and collaboration within this network.



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Variation in extra-pair paternity in *Tachycineta* swallows: evolutionary history and current ecology

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We explore here the genetic mating system of five species in the swallow genus *Tachycineta* residing in North, Central and South America (*T. bicolor*, *T. thalassina*, *T. albilinea*, *T. leucorrhoa* and *T. meyeni*) using the Golondrinas de las Americas network. *Tachycineta* swallows show high variation in genetic breeding system, ranging from one of the highest rates found in any socially monogamous passerine in *T. bicolor* – with extra-pair young in up to 89% of nests – substantially lower rates in *T. albilinea* – with extra-pair young in 26% of nests. These striking differences in mating system make this genus a model group for studying diversification of life history strategies and extra-pair paternity in birds in a phylogenetic context. Likewise, the broad distribution of the *Tachycineta* genus can help us untangle other contributing ecological factors. Thus, we tested the relationship between extra-pair paternity and increased opportunities for finding extra-pair mates by exploring the effects of current ecological variables such as nest density and synchronous breeding on paternity. We found white-rumped swallows to have 78% of nests with extra-pair young, Chilean swallows to have 12% of nests with extra-pair young and violet-green swallows to have extra-pair young in 75% of nests. Neither current ecological factors nor evolutionary history were good predictors for the observed variation in genetic mating system. We discuss our results in light of life history theory.



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S29 The avian embryo's role in life-history evolution and incubation behaviour

Convenors: Christopher R. Olson, USA; Jan-Åke Nilsson, Sweden

Optimising incubation: parent and offspring perspectives

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Incubation used to be considered as an inexpensive and somewhat unimportant phase of avian reproduction, with the real action taking place either during courtship or after the chicks hatch. However, we now know that the conditions that pertain during avian incubation have profound effects on parents and offspring over varying time scales and at both proximate and ultimate levels. For many birds, incubation is a relatively costly phase of reproduction, and investment levels need to be optimized in order to resolve a number of life history trade-offs. From the parents' viewpoint, investment in incubation of the current clutch needs to be balanced against the investment required later in the same breeding event, and also in subsequent breeding events. In addition to clutch size, many aspects of parental behaviour, such as nest site selection, nest construction and the extent to which incubation is shared between partners, could influence the demands of incubation, and hence the resolution of these trade-offs. Consequences for the offspring, though less well studied, are likely to be substantial. Conditions experienced *in ovo* influence embryonic growth and development, which will have important consequences for the resulting phenotype and for performance in later life. I will discuss our understanding of these aspects of avian incubation using data from a range of field and laboratory studies.



Incubation period: a strategy of parent or embryo?

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Length of the incubation period varies by a factor of more than three among species laying eggs of the same size. The egg period influences losses to time-dependent mortality factors, which places embryos under strong selection to develop more rapidly. The costs of long development periods must be balanced by advantages in terms of survival of the incubating adult or survival of the developing chick later in life. One hypothesis posits that parental risk selects for reduced nest attendance and, consequently, lower average incubation temperature, which results in slower embryo development. However, it is unclear whether the total heat requirement of an embryo for hatching leads to a fixed total parental attendance, and risk, at the nest. Moreover, nutritional needs and foraging time for the parents are likely to be minimized during the incubation period. Long incubation periods would appear to be strategies for maximizing lifetime reproductive success under certain conditions because they are associated in many species with asynchronous hatching, which is a strategy of the parent that minimizes evolutionary response of embryo development to sibling competition. However, benefits to the chick are unknown. Slow growth might reduce oxidative stress on the embryo and result in a higher quality neonate. Slow growth might also benefit individual quality in other ways that extend the maximum potential life span. For this reason, it is not surprising that embryo growth rate is strongly correlated with the rate of aging in birds. Several ideas concerning the evolution of development periods in birds are addressed through analysis of comparative data and modelling of the fitness costs and benefits of change in the length of the incubation period and its potential consequences for other aspects of the life history.



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Causes and consequences of variation in egg temperature during incubation

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Egg incubation is an important maternal effect in birds and embryonic development can occur only within a relatively narrow temperature range. However, the causes of egg temperature variation and its subsequent consequences for early development and nestling performance have rarely been assessed. Using captive zebra finches (*Taeniopygia guttata*), we show that clutch temperature is compromised during incubation in low ambient temperatures and with enlarged clutches, despite a compensatory increase in parental metabolic rate. Building on this, we examined effects of experimentally induced variation in incubation temperature on embryonic development and post-hatching performance in free-breeding blue tits (*Cyanistes caeruleus*). We show that the length of the incubation period and the probability of embryo mortality increased in low incubation temperatures. Moreover, tarsal growth rates decreased predictably with incubation temperature, with nestlings having been incubated in less favorable thermal environments displaying significantly shorter tarsi at both one and two weeks of age. In addition, nestlings from low incubation temperatures showed elevated basal metabolic rates prior to fledging, suggesting that thermal conditions during embryonic development are important in determining post-hatching patterns of energy usage. We argue that optimal investment in incubation can be energetically constrained, resulting in considerable variation in incubation temperature between nests, and that such differences in developmental temperature may have profound effects on offspring phenotype and incubation parameters. Therefore, it is possible that females, via their direct influence on egg temperature, can substantially influence nestling fitness already at the incubation stage.



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Photoperiod and the pace of development

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Life history traits vary geographically; for example, temperate breeding birds typically have higher metabolic rates, larger clutches, and shorter incubation periods than tropical birds. Food, temperature, and predation may be important selection pressures driving latitudinal patterns. We explored the potential role of circadian rhythms, set by different photoperiods, on metabolic and development rates of avian embryos. In a common garden experiment, we incubated the eggs of temperate-breeding house sparrows under identical temperature and humidity conditions but with different photoperiod treatments. Embryos incubated under the temperate (18L:6D) treatment to pipped in 11-12 days, while embryos incubated under the tropical (12L:12D) treatment to pipped later. Embryo metabolic rate, estimated based on CO₂ production, was higher during the day light hours than during night hours. We combined these lines of evidence into a model to explore whether temperate and tropical photoperiods could account for the slower pace of life in the tropics.



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How much control do parents really have? Why incubation strategy is so important in wild zebra finches

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The age hierarchy of offspring within a brood can significantly influence competition dynamics, affecting growth and survival. Mechanisms used to control the levels of asynchrony reveal important information about how intrafamilial dynamics and resource distribution are manipulated by both the parents and offspring. We manipulated the hatching pattern of wild, free-living zebra finch broods, which usually hatch synchronously. Artificial incubators were used to create synchronous and 2-day asynchronous nests. Chicks were measured every second day and filmed with infrared nestbox cameras to obtain parental feeding and chick begging behaviour. Chick developmental time from embryo to hatching did not differ with position in the laying order, suggesting that hatching pattern is determined only by the incubation behaviour of the parents. Within asynchronous nests, older chicks begged significantly more and received both significantly more regurgitations and more food per regurgitation from their parents than their younger siblings. This resulted in chicks from asynchronous nests having a fledgling weight that decreased with their position in the hatching order. Overall zebra finch parents seem to do little to control sibling competition and resource distribution once chicks have hatched asynchronously, with differences only becoming exacerbated with time. As asynchronous hatching significantly reduced post fledgling survival predictions, it suggests that pre-hatching mechanisms, such as incubation behaviour and egg order effects, are important in ensuring synchrony and therefore maximal fitness for parents in wild zebra finches.



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S30 Avian functional genomics: a new approach to understanding genome - behavioural - environmental interactions

Convenors: Peter Sharp, UK; Claudio Vianna de Mello, USA

The Avian genome revealed – new technologies and insights in avian biology

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Our knowledge of avian genomes has increased rapidly over the past few years, culminating in the publication of the chicken genome in 2004, a milestone in avian genetics and evolutionary biology. Recent advances in sequencing technology now make it possible to produce draft sequences of any vertebrate genome. In the next few years the genome sequences of the turkey, mallard, zebra finch and possibly other birds will join the chicken with completed genome sequences. I will review some of the insights and new directions in avian biological research these new resources enable. Comparative analysis of avian genomes reveal the history of genome reorganisation, the structure of genes, the diversity of protein coding genes, the nature of gene regulatory regions, etc. The availability of genome sequences provides the ultimate map on which to chart genetic variation, such as single nucleotide polymorphisms or copy number variants. This information has been used to create ultra dense genetic mapping tools of millions of markers to locate trait genes in both domestic and wild birds. These resources also spawn technologies such as whole genome expression chips to monitor the expression of genes. These tools have been used to characterise host-pathogen interactions, such as the differences in the responses of ducks and chickens to avian influenza. The availability of annotated genomes in public databases provides the critical information from which to interpret whole genome studies using genetic mapping or gene expression tools, combined with sophisticated bioinformatics. These genome sequences promise to be valuable resources for ecological and evolutionary studies of other bird species – in this new genome era.



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The birdsong transcriptome in zebra finches: novel insights into vocal communication mechanisms

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The recent availability of novel tools for functional genomics in the zebra finch, including extensive EST databases, microarrays, BAC libraries, the recent completion and assembly of the genome sequence, and the emerging availability of methods for transgenesis are rapidly changing the ways in which the molecular basis of vocal communication and learning can be approached in this species. Combined with brain expression analysis of specific transcripts of interest, and more traditional neuroanatomical tract-tracing studies, these novel tools are allowing us to: 1) dissect the portions of the songbird transcriptome involved in the brain's response to vocal communication signals; and 2) determine the unique properties that characterize auditory and vocal song-processing circuits. In my presentation I will emphasize the recent insights into the physiological role and mechanisms involved in the transcriptional response to song stimulation, as well as the neurochemical and molecular properties that define the song control circuitry. I will also discuss how further insights can be gained through comparative molecular and genomic analysis with other avian organisms representing vocal learners and non-learners.



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Functional genomics analysis of photoperiodic response

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Organisms measure daylength and adapt to seasonal changes in the environment by altering their physiology and behavior. Although this photoperiodic response attracted people for long time, the underlying mechanism remained unknown at the molecular level until recently. Japanese quail (*Coturnix japonica*) has been proved to be an excellent model to study vertebrate photoperiodic response. The availability of the chicken genome sequence allowed a system-level analysis of photoperiodic time measurement in quail, and this approach uncovered the key event in the photoperiodic signaling cascade that regulates seasonal reproduction. Long day stimulus induced expression of thyrotropin (thyroid stimulating hormone: TSH) in the *pars tuberalis* of the pituitary gland. And *pars tuberalis* thyrotropin was found to trigger local thyroid hormone catabolism in the mediobasal hypothalamus, which increases the activity of the reproductive neuroendocrine system resulting in gonadal development. Since well known function of thyrotropin was to stimulate the thyroid gland, a traditional hypothesis-driven approach would not have been expected to predict this discovery. Thus, a functional genomics approach, which is a discovery-driven approach, has the potential to provide new insights for all branches of ornithology.



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The genetics of migration in the willow warbler *Phylloscopus trochillus*

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Migratory birds possess an inherent time schedule and at least an inherited initial migratory direction to cope with the challenge of migration. To find their species- or population-specific winter quarters migratory birds combine information from these prerequisites into a spatiotemporal orientation programme. Our knowledge about the genetic basis of directional information today is mainly based on two types of experiments: crossbreeding and displacement experiments. However, we currently do not know the number and/or identity of genes involved in controlling migratory traits or the magnitudes of their effects. In this study we focus on identifying genes/genomic regions and signalling pathways that are responsible for quantitative trait variation in the context of within-population differences in migratory strategies in the willow warbler *Phylloscopus trochillus* exhibiting a distinct migratory divide in central Scandinavia. The work presented here is based on genetic characterisation of WW2, a marker derived from AFLP studies that shows variable allele frequency distribution: frequency variation at this locus coincides with the change in migratory direction both in Scandinavia and east of the Baltic Sea. We suspect that the locus might be linked to a gene encoding for intraspecific variation of the migratory programme, which would be a useful tool to investigate how selection is acting on migratory direction. We will establish the width of the selected gene region around WW2 and map its location within the willow warbler genome, using the published zebra finch genome as a reference. These results will give us a better understanding of location and putative function of genes that are in linkage disequilibrium (and thus physically close) to the segregating WW2 locus.



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Genome-wide SNP discovery in the Florida scrub-jay

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Evolutionary biologists have long been interested in understanding the genetic basis of fitness-related traits in natural populations. Identification of genomic regions responsible for ecologically relevant traits is a prerequisite for answering many questions on the genetics of adaptation. Population or quantitative genetic studies aiming to detect such genes are rarely conducted in populations with a known ecological context or selective agent. The Florida scrub-jay (FSJ) is a federally threatened bird that has been studied since 1969. In fall 2008, our population experienced the highest recorded monthly breeder mortality since the study began. Similar episodes of high mortality have occurred in 1979, 1989, and 1997. These years of high mortality appear to be caused by outbreaks of encephalitis viruses, and the FSJ system provides a unique opportunity to study the selective effects of arboviral epidemics on a natural population. We used next-generation sequencing to discover thousands of single nucleotide polymorphisms (SNPs) across a few hundred genes of the FSJ. Briefly, reduced complexity libraries for unrelated individuals were generated from cDNA and sequenced to high depth with the Illumina Genome Analyzer. Resulting reads were assembled using guided *de novo* methods and genome sequence information from chicken and zebra finch. SNPs were identified using Maq, and annotation performed by aligning to the zebra finch genome. These genome-wide SNPs will be used to identify genotype differences between survivors and non-survivors of past epidemics to provide insight into mechanisms of natural selection in the FSJ and pinpoint genomic regions influencing survival.



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S31 Complex functional-morphological adaptations of birds to flight

Convenors: Andrei V. Zinoviev, Russia; Dominique G. Homberger, USA

***This symposium is dedicated to Walter J. Bock and Evgeny N. Kurochkin to honor their contributions to the evolutionary biology and history of birds**

Adaptive co-evolution of avian hind limbs and flight in birds

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Modern birds comprise a compact group with the relatively uniform bauplan. As an important locomotor module, their hind limbs underwent considerable modifications on the way from theropod ancestors to neornithine birds. Viewed as a sequence of modifications through time, these changes can be divided into preadaptive ones, and those directly related to the flight ability. As bipedalism and the adducted position of the hind limbs appeared in the archosaurian lineage long before the emergence of the first bird, these features should be considered prerequisite. The enlargement of the pectoral girdle and the reduction of tail have shifted the center of gravity cranially away from the ancestral position between the acetabula of the pelvic girdle. This changed aligned the femur more horizontally as the first feature directly related to the flight. The mechanical decoupling of the tail and hind limbs allowed a reduction of caudofemoral muscles. This reduction is expressed to this extent only in birds and is, thus, the second feature that is a prerequisite for the acquisition of maneuverable flight. The reduction of the powerful caudofemoral retractors of the femur transmitted the function of femoral retractors on muscles, starting from postacetabular portion of the pelvis, thus making them more powerful, and requiring more space for the origin. This requirement was achieved by a caudal expansion of the postacetabular pelvis, the third feature that is related to flight. In addition, a cranial expansion of the preacetabular part of the pelvis, to which the powerful Mm. iliiothrochanterici attach, is necessary to counteract the supination imposed on the femoral shaft by the caudofemoral retractor muscles. As the avian ancestor became volant, selection against an increase in body weight became especially strong. The decrease in body weight through the reduction of the tail and the associated bulky caudofemoral muscles is a fourth flight-related feature. The anisodactyl foot, which is a unique and ancestral characteristic of birds can be considered as a prerequisite for the appearance of flight, but not directly related to it.



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The multiple functions of the avian plumage

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Various functions have been ascribed to the plumage of birds, such as thermal insulation, ornamentation for communication, and flight, and these unique functions have often been implicated in having driven the evolutionary origin of birds and avian flight. The plumage, however, serves multiple functions, even within the more circumscribed context of flight. Foremost among these is the function to render the avian body aerodynamically streamlined. Birds are maneuverable, but unstable flying machines for which turbulent airflow is an inherent problem. The feather barbs of the superficial contour feathers create a ribbed surface, which generates microturbulent airflow that helps attach the laminar airflow to the body and, thereby, prevents the bird from stalling and falling. In addition, contour feathers may serve as temporary turbulators in particular locations of the body, where turbulent airflow may develop during flight. The smooth dermal depressor feather muscles play a crucial role in controlling the degree of elevation of such contour feathers. They have evolved by division from the erector feather muscles specifically in response to a regime of aerial locomotion for which turbulent airflow is a problem. Among reptiles, only squamates with imbricated epidermal scales possess dermal erector muscles in contrast to reptiles with plate-like, non-imbricating epidermal scales (e.g., crocodylians and dinosaurs), which are devoid of dermal musculature. Hence, it is unlikely that birds originated evolutionarily from an ancestor with plate-like epidermal scales. Rather, they may have taken origin from a small, arboreal lizard-like reptile with imbricated scales and dermal musculature.



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The unique design of the bird lung and its contribution to flight

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Because flight is highly energetically costly, a significant metabolic barrier separates volant from nonvolant vertebrates. Demonstrating the extreme selective pressure under which it has originated, in the Animal Kingdom, active (powered) flight has evolved in only two phyla: chordates and arthropods. Insects, the now extinct pterodactyls, birds and bats, chronologically in that order, are the only taxa that have achieved powered flight. The avian respiratory system is uniquely structurally highly specialized and functionally remarkably efficient. Deeply inserted into the ribs and the vertebrae, the lung has been rendered virtually inflexible between respiratory cycles. In a synchronized bellows-like manner, the air sacs ventilate the lung continuously and unidirectionally in a caudocranial direction. The flow of air in the parabronchus is oriented perpendicular to that of the venous blood, creating cross-current- and multicapillary serial arterialisation systems. The intense subdivision of the exchange tissue has produced air capillaries, the terminal respiratory units, which range in diameter from 5 to 20 microns. For animals of the same body mass, a bird has a relatively thinner blood-gas barrier and the respiratory surface area and the pulmonary capillary blood volume are greater than in a mammal. These and other specializations have enhanced respiratory efficiency, thereby allowing flight over long distances and at high altitudes.



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The avian navigational system

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Because of their ability to fly, birds can move faster than other animals. As a consequence, they have more extended home ranges than e.g. mammals of equal size, and some species cover extremely long distances during their annual migration. This requires highly efficient navigational abilities. The magnetic compass forms the backbone of the navigational system of birds. Magnetic compass orientation is widespread among animals, but recent analyses suggest that the avian magnetic compass, based on radical pair processes in the right eye, may be unique to birds. Celestial compass mechanisms, based on experience, supplement the mechanisms of directional orientation, with the magnetic compass providing the reference for the respective learning processes. The magnetic compass is also involved when young, inexperienced birds determine their home course by reversing the route of outward journey. Experienced birds instead use their navigational 'map', a mental representation of the course of the local navigational factors that is also based on experience; here, too, the magnetic compass may be involved in the learning processes. By combining innate and learned components, the avian navigation system is very powerful: it can be perfectly adapted to the local situation and ensures the orientation of the birds' extended flights.



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Flight adaptations for mastering forest habitats by passerine birds

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Aerodynamic wing characteristics that determine flying capabilities are similar for Passerines and Non-Passerines. Therefore, the differences in the flight apparatus of both groups are solely due to the differences in body size, flight mechanics, and energetics. In fact, the relationship between the power that passerines are able to generate for flight and the power that they actually use is very efficient due to the small body size of passerines. As a result, passerines have more power than they usually spend for flight. This removes strict limits on changes in wing configuration, allowing this group to adapt to various ecological niches. Due to their generally smaller body weight, passerines have a lower flight speed by 10-20% than non-passerines. Moreover, passerines have a more energy-consuming type of flight, and their wings work actively using energy only during the down-stroke. Thus, the morpho-physiological characteristics of the order Passeriformes, the majority of which are forest birds and probably originated in forests, are marked by a small body, elevated metabolic rate, and a modified mode of flight with reduced speed and greater maneuverability. This condition is advantageous only with a body weight of <200 gr and becomes increasingly disadvantageous with a body weight approaching the limit of 800 gr. Our study on 15 families of tropical passerines from South-East Asia supports this hypothesis and reveals a variety of flight-dependant strategies for mastering the forest habitats by passerine and non-passerine birds.



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S32 Flight in the air and in the water: a synthesis of biomechanical, physiological and behavioural studies

Convenors: Yutaka Watanuki, Japan; Henri Weimerskirch, France

Scaling of wing and foot stroke cycle in diving and flying seabirds

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Mobile ability of birds is restricted by physical and physiological aspects and is affected by scaling effect. Procellariiforms can stay in the air only when lift produced by their wings is equal or exceeds gravity, though penguins can be almost free from gravity when they swim in the water. When descending in the water, however, buoyancy can act as drag because penguins inhale the air to store oxygen for their long dives and keep the air in feathers. Alcids and cormorants are adapted to both swimming and aerial flight. They should choose stroking frequencies for both in the air and water, respectively. These three types of seabirds regulate stroke cycle depending on the media (water or air), and size of propeller and body mass. Recent developments of animal-borne accelerometers have enabled us to investigate fine-scale movements of birds under natural condition. Study of different sized Procellariiformes indicated that each individual has two modes of flapping. High and low frequencies decreased with size, but with different slopes, which intimates the margin between the metabolic power available and the mechanical power required to flight decreases with body size and there is a maximum size of flying animals as predicted by theoretical studies. In case of swimming specialists, flipper stroke frequencies of penguins were proportional to $mass^{-0.29}$. Foot-propelled diving cormorants stroked their feet at same frequencies with similar sized penguins, but alcids that use their wings for both swimming and flying stroked at lower frequencies than other swimming specialists of the same size, suggesting a morphological trade-off with wing size and stroke frequency.



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Practically penguins: energy costs during flying and diving for a bird with high wing-loading, the thick-billed murre

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Animals moving between different media face tradeoffs in form between maximizing function in one medium relative to the other. Auks are an excellent example of this trend because they move between air, land and water, and their extremely high wing-loading reflects tradeoffs between effective movements in water vs. air. To investigate the energy costs associated with flying and diving in free-living seabirds, we measured physiological costs using doubly-labelled water and biomechanical costs using animal-borne accelerometers. Flight costs (588 kJ/h) were higher than expected from biomechanical modelling while dive costs were lower than expected (92 kJ/h). Indeed, flight costs were among the highest mass-specific metabolic rates ever recorded for a sustained activity in a vertebrate while dive costs were only marginally higher than would be expected for penguins, which do not fly and hence do not compromise underwater efficiency for flight efficiency. We suggest that the discrepancies between mechanical and metabolic costs represents differences in muscle efficiency relating to the compromises in contraction rate between air (high wingbeat frequency) and water (low wingbeat frequency). To examine how energy constraints influence life history, we examined the effect of age on biomechanical and physiological costs. While activity patterns did not vary with age, energy costs declined with age, suggesting increased energy efficiency in older birds. Thus, long-lived auks have apparently evolved mechanisms to limit the impact of form on function. We suggest that function constrains form in auks, and this constraint also acts on the life history of the bird.



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Could wind drift compensation be a passive aerodynamic action?

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Migrating birds can compensate for lateral wind drift by partly heading up into the wind even in the absence of stationary landmarks, e.g. over water, above clouds or at night. Yet no known sensory mechanisms can account for their ability to measure wind speed and direction aloft without access to visual cues. Here I explore aerodynamic yaw theories for man-made airframes, and on this basis investigate whether wind drift detection and compensation amongst flying birds could simply result from passive aerodynamic responses to prevailing relative airflows. By analysing the biometrics of migrating birds, I show that their wing and body design enable aerodynamic forces to yaw them passively upwind. In fact, when I experimentally expose house martins to relative cross-winds, they consistently show the expected up-wind yawing response, which offers a mechanism for wind drift detection or even passive wind drift compensation. This explanation dispenses with any need for more complex and unknown sensory mechanisms and breaks with the aeroecological paradigm that migrants fly in an ocean of steadily moving air, unaffected aerodynamically by the wind dynamics that surround them.



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Stroke during flight and dive in seabirds with different movement modes

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Seabirds exhibit high ability of flight and dive. To move in the air and water they stroke wings or foots to compensate drag, buoyancy, and gravity by contracting muscles repeatedly. Thus these activities are the most energy consuming. Comparison among species with contrasting movement modes would give a cru for further understanding of the regulation of stroke for energy sparing. The change of the cycle duration of wing or foot stroke during flight and dive in the wild were compared among cormorant/shags that dive with foots and fly with wings, alcids that dive and fly with wings, and penguins that dive with wings. During descent the increase of stroke cycle of foots (0.2 to 0.6 s) in shags followed the decrease of buoyancy and was greater than that of wings in alcids (0.35 to 0.40s) and penguins (0.4 to 0.5 s). All groups did not stroke when they were ascending from 60 m depths. During flight stroke cycle of wings increased quickly at take off and was maintained in a range after that and longer in shags (0.15-0.17s) than alcids (0.10-0.11s). Species variation of these stroke behaviors may have some connections with body size, wing and web areas and breast muscles.



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Passerine flight altitudes studied by a network of weather radars

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Recent validation studies have shown that Doppler weather radar can extract reliable near real-time bird density altitude profiles that closely correspond to the density profiles measured by dedicated bird radar. We used a network of several weather radars to study the flight altitude selection by passerines, using radar data and numerical weather prediction model output covering several autumn and spring migration seasons. Weather radars combine a high sensitivity with a high temporal resolution, which enables us to resolve heading adjustments during the often rapid ascents at dawn and dusk of passerines, even when migration traffic rates are low. Migration layer formation at high altitudes (2-4 km) is found to occur when birds can make use of favourable high altitude tail winds or when birds avoid unfavourable low level jets. Strong seasonal difference in altitude profiles are observed between spring and autumn migration, with layer formation being nearly absent in autumn. Differences in the prevailing winds during both migration seasons are important to explain seasonal differences, but also possible behavioural differences are discussed. Using a network of weather radars we observed how mesoscale variability in weather conditions structures the timing and altitude profile of bird migration within single nights. Birds maintained altitudes that reflect the wind conditions directly after take off, which can result in multi-layered bird density altitude profiles when weather conditions are distinct at different take off sites.



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S33 Functional morphology and terrestrial locomotion of birds

Convenors: Anick Abourachid, France; Elizabeth Höfling, Brazil

The limbs: a key to bird evolutionary success

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Birds are very diversified tetrapods, the largest group in terms of number of extant species. They present many diverse appearances in shape and size but most of this diversity is provided by the shapes and colours of the feathers and of the beak. Under the feathers, the skeleto-muscular system is the rather constant throughout the bird group. The adaptation to the flight is an explanation for this uniformity. The biomechanical constraints of flight are sufficiently demanding to model the body with an aerodynamical shape. The more obvious morphological adaptations for flight are the wings, but the trunk is always rigid, the tail very short and the neck is flexible, since all these features are correlated with flying behaviour. The limbs always have three long bones, and all the birds walk on their fingers. This limb structure is a striking plesiomorphic feature. This limb structure is also one of the key features in the successful adaptive radiation of birds. Most of them use their limbs in their daily activities: when moving on the ground, in trees or even in water, looking for food, but also for flying, during take off and landing. The multi-purpose potential of the limbs are the result of the skeletal architecture of a body with three segmented flexed limbs. This configuration provides mechanical properties that allows the use of the limbs as propulsive, shock absorber, or paddling tools. It is the association of diverse modes of locomotion - walking, hopping, flying and swimming - that have enabled the birds to colonize almost all the environments on Earth.



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Morphological and kinematical comparisons between the teal (*Callonetta leucophrys*) and the quail (*Coturnix japonica*)

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Most of birds have at least two locomotion modes (among walking, running, jumping, swimming or flying). Even if different mechanical strains (gravitational, hydrodynamical, and aerodynamical strains) are involved in those locomotor behaviours, the same structure must meet each of the environment constraints and accomplish different locomotor movements. Thus, the body shape is the result of a compromise between biomechanical and kinematical strains. It seems that birds' abilities to several locomotor behaviours are supported by minor skeleton shape modifications, compared to those observed within other taxa. This study aimed at finding those morphological adjustments, especially in the adaptation to swim. For that, two species of birds have been compared: a walking bird, the quail (*Coturnix japonica*) and a walking and swimming bird, the teal (*Callonetta leucophrys*). A comparison of the three-dimensional skeleton kinematics of the walk has raised several motions differences. They have been linked to the dissimilarities revealed by a geometrical comparison of the hindlimbs' joints morphology among walking/walking and swimming birds. Moreover, the three-dimensional skeleton kinematics of swim gave new insights about the prominence of the joints morphology in the adaptation to swim, particularly the intertarsial joint. This study lays the foundations to understand the morpho-functional balance that allows Anatidae to move in both a terrestrial and an aquatic environment and to find relevant morphological patterns on birds' skeleton that would help to predict the motions they are able to do.



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The biomechanics and energetics of a common behaviour in poorly-adapted species: analyses of pedestrian locomotion in penguins

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The deterioration of resources in the Southern Ocean may enhance the sensitivity of long-lived species such as the king penguin *Aptenodytes patagonicus* to energy-dependent factors. As some individuals must walk kilometres to their nest upon returning from the sea, I measured their energy expenditure, how it is related to their pedestrian gait, and how it can vary against different factors such as body mass, terrain and the presence or not of conspecifics. While experiments of king penguins on a treadmill have been conducted previously, no information is published on the energy expenditure of individuals in their colony, and little is known about their energy expenditure during ontogeny. Additionally, penguins are an interesting model to study with regards pedestrian locomotion since, unlike many other avian species, their morphology has evolved as a trade-off between diving and walking, but flying. The study took place within a penguin colony on Possession Island, in the Southern Indian Ocean, focusing on male adults and their emancipated chicks during pedestrian locomotion in three conditions: on a treadmill, in the wild alone, in the wild within the colony. During treadmill walking, heart rate, body motion and gait were measured allowing assessment of how these change with different walking speeds and inclines, coupled with assessment of the mechanical work done by the bird. Two cameras enabled quantification, as well as a virtual reconstruction of skeletal movements during pedestrian locomotion. While free in the colony, the same variables on the same individuals were recorded, using the same loggers and a GPS.



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Ecomorphology and phylogeny of hummingbirds (Trochilidae): can the major clades be characterized morphologically and ecologically?

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This study maps morphological characteristics onto a recently published phylogeny of the hummingbirds to determine whether the different major clades exhibit particular suites of characters, and whether these correspond to occupation of particular elevations, habitats or foraging modes. I measured nine morphological characters of bills, wings, tails and feet and calculated five aerodynamic parameters for over 3500 live or recently dead hummingbirds representing 163 species in seven of the eight major clades. A discriminant analysis using these characters correctly classified (to clade) ca. 85% of the species, indicating that each clade does possess a particular morphological “signature” that relates to characteristic adaptations for feeding from particular types of flowers, tactics for foraging for arthropods, and occupation of high vs. low elevations among the included species. I also identified convergent adaptations for some of these features in species of clades with different “signature”. Examples include *Panterpe* and *Eugenes* of the Mountain-gem clade, morphologically convergent with high-elevation species of the Coquette and Brilliant clades respectively; the long, slightly recurved bill of *Doryfera* of the Mango clade, convergent with *Coeligena* of the Brilliant clade for feeding at pendant flowers; and the curved bills of some *Campylopterus* species of the Emerald clade, convergent with the Hermit clade for visiting flowers with curved corollas. The relatively large feet of some coquettes of low and middle elevations might represent a preadaptation for occupation of the high elevations inhabited by most species in this clade.



S34 Information and decision making by migrants during stopover

Convenors: Frank Moore, USA; Fernando Spina, Italy

Decision making in relation to different strategies of migration

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Spring migrants are under a strong selective pressure towards an early arrival on the breeding grounds. This is one of the reasons why spring migratory routes are often shorter than post-nuptial ones, and migration speed is higher. The ensuing breeding season affects overall duration of return migration and stopover behaviour and duration. Migrants confronted with the crossing of ecological barriers represent an interesting model system to investigate the potential trade-off between stopover decision as well as and duration vs. time-minimizing strategies. Through a large-scale and long-term project on songbird spring migration across the Mediterranean stopover behaviour on small islands has been investigated in detail. While migration timing is found to be generally correlated with climate conditions both in sub-Saharan and in North Africa, the daily abundance of staging migrants correlates with meteorological conditions birds experience both at departure and at stopover. The effects of these conditions vary across species and correlate with morphological adaptations to prolonged flights. A general pattern of protandry is found both in dimorphic and monomorphic species. Both sexual size dimorphism and sexual dichromatism play a role in determining the degree of protandry and these aspects will be discussed in the case of monomorphic and dimorphic species. Data on stopover duration and mass changes during stopover will help understanding the reasons for staging even when time-minimizing. Also sex and age have a role in selecting meteorological conditions at departure in staging migrants.



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Effect of dietary antioxidants on fatty acid preferences of migratory passerines

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Fatty acids are an important fuel source for birds during migration and fatty acid composition of foods can influence songbird diet choice. However, the extent to which preference for and consumption of these fatty acids depend on availability of dietary antioxidants remains unexplored. We used paired-choice experiments to test two hypotheses: (1) songbirds prefer diets with a higher ratio of 18:2 to 18:1 (no. carbons: no. double bonds), and (2) songbird preferences for certain dietary fatty acids depend on concentration of dietary antioxidants. We offered European starlings (*Sturnis vulgaris*) and hermit thrushes (*Catharus guttatus*) a series of paired diet choices that differed in fatty acid (18:1, 18:2, 18:3) and antioxidant (vitamin E) composition. Total dry food consumption did not differ between paired choices or prior diet choice (LSD ANOVA, all $p > 0.20$). Proportion of dietary 18:2 to 18:1 chosen by European starlings and hermit thrushes depended on the concentration of vitamin E (LSD ANOVA, all $p < 0.001$). We discuss how these results combined with recent complimentary studies suggest that diet preferences of birds for certain ratios of fatty acids will predictably change the fatty acid composition of fat stores and in turn affect energy expenditure during long-duration migratory flights. We also discuss how these diet preferences for certain fatty acids may influence choice of diet during migration given that wild fruits differ in fatty acid composition.



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How weather conditions affect migratory decisions in spoonbills

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Spoonbills *Platalea leucorodia*, that breed in The Netherlands, show year-to-year variation in migratory decisions, as indicated by the timing of departure from the breeding or wintering grounds and the number and duration of stopovers. These decisions are likely to be influenced by the weather. Moreover, there is large individual variation in migration distances and wintering sites. Spoonbills become very faithful to their chosen wintering sites from their 2nd winter onwards. Therefore, the migratory decisions made during the 1st year of life are of crucial importance, as they determine the life-long wintering site choice of an individual. During this study, we investigated the role of weather variables (wind speed, wind direction and temperature) for migratory decisions. We combine the data from colour-ringed birds in the period 1982-2009 with data from 17 birds (11 juveniles and 6 adults) equipped with a GPS-satellite transmitter in 2008 and 2009. The resightings of colour-ringed birds give information about many individuals over many years, but of low resolution, whereas the information from the transmitted birds gives high resolution data over a short time span, with a GPS-position every 4 hours during 2 autumn and spring migration periods. The combination of these two data sources gives valuable insight into the importance of weather conditions favourable for spoonbill migration and illuminates its role for life-long wintering site choices.



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Broad scale stopover movements in a migratory passerine

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A complete understanding of migratory behaviour on stopover depends upon knowing whether individuals undertake long-distance movements prior to subsequent migratory flights. We examined the spatial extent of stopover movements in a migratory passerine, and how movement varies with age, capture site, body condition (fat), sex, and stopover duration. We radio-tagged 80 black-throated blue warblers (*Dendroica caerulescens*) at three sites with contrasting habitats (peninsula, coastal, inland) along the north shore of Lake Erie at Long Point, Ontario, Canada, during fall 2009. Birds were monitored manually and with five automated receivers equipped with directional antennas that sampled an area of ~20x40 km. We detected non-migratory movements of greater than 2 km in 41% of individuals. The propensity and extent of movement differed considerably across the sites. The proportion of birds that moved more than 2 km was 64% at the peninsula (mean=12.4 km±13.0 SD), 31% at the coast (mean=7.5±2.6), and 30% inland (mean=3.2±1.2). Propensity to move was related to capture site, age and fat (binomial glm). Distance travelled from the capture site was also best predicted by capture site with some influence of age, fat and stopover duration (gaussian glm). Non-fat birds (particularly adults) and those captured at the peninsula moved farthest. Departure from a stopover site thus does not always imply resumption of migration: some individuals may instead re-locate to preferred areas in the broader stopover site. The observed frequency of such movements has profound implications for the study of stopover behaviour and ecology.



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Habitat selection by red-backed shrikes in two different anthropogenic landscapes: does preference match adaptiveness?

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Habitat selection is assumed to be an adaptive behavioural trait. Individuals are, therefore, often supposed to have perfect knowledge about habitat quality and, hence, to be free to choose the best available habitats in order to maximise fitness. Organisms often rely on indirect cues for predicting local habitat quality and migratory birds are especially concerned by the use of such cues, because of time-constrained habitat choices. In rapidly changing anthropogenic landscapes, cues may become decoupled from the underlying habitat quality. Behavioural mistakes may lead to non-adaptive habitat selection as poor-quality habitat may be preferred over good breeding habitat (i.e., ecological or evolutionary traps). Using the red-backed shrike (*Lanius collurio*) as a model species, we studied during two years habitat selection in anthropogenic landscapes composed of a mixture of agricultural and forest plantation habitats. The latter landscape has recently been colonised due to altered forestry management creating gaps that may structurally mimic their original habitat (i.e. natural forest gaps). We show that habitats in forest landscapes are selected first, but important fitness-components (i.e. number and quality of nestlings) have reduced values compared to those in agricultural landscapes. Predation rates were found to be higher in forest landscapes. Insect food resources and microclimate were less favourable in forest compared to agricultural landscapes. We discuss the results in the framework of ecological trapping in the “new” forest habitat, and also explore whether this issue can be of wider significance to other bird species.



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S35 The magnetic compass: calibration and sensory mechanisms in migratory birds

Convenors: Rachel Muheim, Sweden; Henrik Mouritsen, Germany

The magnetic compass and its interactions with celestial cues

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Birds use both magnetic and celestial compasses to find their way during migration. The priorities and interactions of these compass cues are still the subject of intense debate. I will review our current knowledge about how the magnetic compass of migratory songbirds influences migratory behaviour and how it interacts with celestial information. We previously showed that birds recalibrate their magnetic compass by polarized light cues from the region of the sky near the horizon at sunrise and sunset. They make these recalibrations during both spring migration, when approaching their breeding grounds, and during autumn migration, when migrating towards the wintering grounds. Thus, there is good evidence that the magnetic compass is updated on a regular basis by both juvenile and adult birds. We proposed that birds average sunrise and sunset calibration to obtain a true geographic reference system that is independent of latitude and time of year. This requires that they remember the calibration information from the two occasions, the mechanism of which is still unclear.



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The mechanisms underlying the two magnetic senses in birds: from behaviour to molecules and cognition

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It has long been known that migratory birds can use a magnetic compass for finding their way during migration and there is evidence supporting the idea that birds could also make use of a magnetic map. Nevertheless, many aspects of magnetic compass orientation in migratory birds are only beginning to be understood. Since the last congress in Hamburg, significant progress has been achieved, including, in particular, new knowledge about the physiological mechanisms, sensors and pathways underlying the magnetic senses of birds. It is now evident that birds do indeed have two magnetic senses, one located in the birds' visual system, and one where the information is being transmitted through the ophthalmic branch of the trigeminal nerve. In my keynote address, I will summarize the substantial physiological and molecular evidence published in the last 4 years on how the molecular, physiological and cognitive magnetic compass mechanisms work, and point out in what directions additional research is urgently needed.



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Localization of cryptochrome1 in the retina of birds

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The avian magnetic compass is an inclination compass located in the right eye of birds. It is a chemical compass based on radical pair processes in specialized photopigments. The alignment of the receptor molecules in the magnetic field affects the balance between the singlet and the triplet states of the radical pair and thus can be used to detect magnetic directions. One molecule that can form radical pairs is cryptochrome. Various cryptochromes are found in plants and animals, of which two types, cryptochrome 1 and cryptochrome 2, have been identified in the avian retina. The presentation will specify the conditions under which a receptor in the retina can detect magnetic field lines: receptors must be arranged in the various directions in space, and the receptor molecules must be firmly fixed in position. Molecular evidence suggests that cryptochrome 2 is probably located in the nucleus, where it is not fixed; hence it is no candidate for detection of the magnetic field as it cannot generate a neuronal signal. Cryptochrome 1 has been located in the retina of several bird species, including the domestic chicken and European robin. Our immunocytochemical data in chicken and robin localize cryptochrome 1 in a subset of photoreceptor cells. Our current work is addressing the distribution of these cells across the retina and the cellular compartment to which the cryptochrome is bound.



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Do magnetic pulses affect the orientation of migrating birds?

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A number of experiments have demonstrated an effect of manipulations both of the magnetic field and of the magnetic sense on the directional tendencies of migrating passerines that display migratory restlessness in orientation cages. Field tests of the role played by this cue in migration have been much rarer however, and where carried out, more confusing, with some experiments failing to show an effect of manipulation of the magnetic field. Here we show that two migrating passerine birds treated with a strong magnetic pulse designed to alter the magnetic sense, migrated in a direction which differed significantly from that of controls. A second test, designed to indicate whether the magnetite is used as a polarity compass, while still disrupting the orientation only of the crucial experimental group, did not clearly support a receptor based on freely rotating magnetite chains. As magnetic pulses are thought to alter the magnetisation of magnetite in the sensory cells of these animals, this indicates that a magnetite based magnetic sense plays a role in determining their direction of migration in naturally migrating birds. Our results generally support those of the previous laboratory studies, but also reveal some interesting differences, highlighting the importance of study of migration in a natural setting.



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Magnetic field changes activate the trigeminal brainstem complex in a migratory bird

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The upper beak of birds, which contains ferro-magnetic structures that have been suspected to function as sensory receptors for magnetic stimuli is innervated by the ophthalmic branch of the trigeminal nerve (V1). However, because of the absence of replicable neurobiological evidence, a general acceptance of the involvement of the trigeminal nerve in magnetoreception is lacking in birds. Using an antibody to ZENK protein to indicate neuronal activation, we here document reliable magnetic activation of neurons in the two brain regions known to receive primary input from the trigeminal nerve, i.e. the principal (PrV) and spinal tract (SpV) nuclei of the trigeminal brainstem complex. Significantly more neurons were activated when European robins (*Erithacus rubecula*) experienced a magnetic field changing every 30 seconds for a period of 3 hours (CMF) than when robins experienced a compensated, zero magnetic field condition (ZMF). Under CMF conditions, ablation of V1 significantly reduced the number of activated neurons. Tract tracing of V1 showed overlap of primary afferent terminations with activated neurons in SpV and PrV. Together, these results show that magnetic field changes activate neurons in brain regions known to receive primary input from the trigeminal nerve and that V1 is necessary for that activation. We therefore conclude that V1 transmits magnetic information to the brain in this migratory passerine bird.



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S36 Bird migration in the Southern Hemisphere: lessons from South America

Convenors: Kim Smith, USA; Victor Cueto, Argentina

Bird migration research in South America and its potential to contribute on the world stage

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Although South America is home to the world's third-largest bird migration system (in terms of number of species) and is the global epicenter of bird diversity, information on the basic pattern of bird migration across that continent is lacking or is pertinent only at a local scale. Until such basic data are gathered and analyzed at a large geographic scale, questions on the causes and consequences of migration can't be addressed. I argue that, beyond providing a better understanding of how and why South American birds migrate, research on bird migration in South America also presents a unique opportunity to foster a better understanding of various aspects of the biology of migratory birds at a global scale. Many migratory bird species have closely related congeners in both Northern and Southern hemispheres. We therefore can employ a comparative approach to the study of migratory patterns at a much larger spatial scale -- across migratory systems -- to ask such questions as: What are the constraints to survival and reproduction of species that migrate in different migratory systems? What adaptations have migratory species evolved to migrate under different situations? How does climate change affect migratory bird species in different hemispheres? Such a framework offers an avenue to pursuing questions that are difficult to answer when studying patterns in a single migratory system on only one continent.



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Austral migration and its implications for bird conservation in South America

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The Austral migration system has received scant attention as either a major global migration system or a regional conservation issue. The latter is despite the fact that both numerically and proportionally, there are more threatened Austral migrants than threatened Boreal migrants (which receive considerable conservation attention). Approximately 380 species have been considered to have austral migrant populations. Of these, 18 are considered globally threatened with extinction and 14 as near threatened. We analyze patterns of threat for both globally and nationally threatened austral migrants. At particular risk is a group of species – typified by several species of seedeater *Sporophila* – that rely on grassland habitats in central South America. These species breed primarily in the grasslands of north-eastern Argentina, southern Paraguay, southern Brazil and Uruguay and winter in the campo grasslands of the Cerrado region (of central Brazil). In both areas, grassland habitats are rapidly being converted for agriculture and agroforestry, and overgrazing and frequent fires pose major threats. With only 7% of the original cover of the Atlantic Forest now remaining, and most of that highly fragmented, forest migrants (altitudinal, latitudinal and longitudinal) are another group of high concern. Finally, a group of species dependent on High Andean wetlands are increasingly threatened by habitat changes. In contrast to the situation for boreal migrants, regional conservation initiatives for austral migrants are few and significantly under-resourced. Many globally threatened austral migrants would benefit from stronger regional cooperation.



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“Aves Internacionales”: a new and ongoing initiative to study bird migration across South America

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Hundreds of bird species annually migrate across South America. Yet, progress in understanding how and why these species migrate has been hampered by numerous challenges to research on the continent. For example, there is as yet no standardization in census or banding protocols between South American nations. In order to address this, a group of ornithologists from Argentina, Bolivia and Colombia have been working together as part of the Aves Internacionales Network to standardize measurements among workers and to document the timing of migration of various species across latitudes. We present preliminary data from this effort showing that there are clear patterns of timing of movements. Collaboration among migration researchers from various South American countries will be imperative to producing the basic data necessary for describing migration as well as for testing hypotheses about the evolution and regulation of bird migration on the continent.



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Do Neotropical austral migrants use stopover sites “*en route*” to their breeding areas? Evidence from the Monte desert, Argentina

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Stopover sites are essential for a successful journey during the migration of birds. However, there is no evidence of use of stopover sites by South American migrant landbirds. We compared site fidelity, breeding activity and fat accumulation of one resident species (greater wagtail-tyrant - GWT) and two migratory species (white-crested Elaenia -WCE- and southern scrub-flycatcher - SSF) to evaluate whether these migrants use mesquite woodlands in the Monte desert as stopover sites during spring migration. We mist-netted birds in mesquite woodlands at Ñacuñán Biosphere Reserve, Argentina, during five breeding seasons (2004-2008). Birds were banded with numbered and colored bands. After net sampling, color-banded birds were searched for at least 10 days or until no new banded individuals were observed after searching for at least 10 person-hours. We captured 103 GWT, 75 WCE and 43 SSF. We recaptured or re-sighted more than 40 % of GWT and 7 % of SSF, the latter of which exhibited breeding site fidelity. In contrast, we never recaptured or re-sighted WCE. The three species had a similar percentage of individuals with a cloacal protuberance (GWT 12 %, SSF 18 %, and WCE 13 %), but individuals with an incubation patch were recorded only among GWT and SSF (88 % and 53 %, respectively). WCE had low (48 %), medium (29 %) and high (23 %) fat accumulation. In contrast, GWT and SSF were mainly characterized by low fat accumulation (93 % and 91 %, respectively). Our results suggest that SSF uses Monte desert woodlands for breeding. In contrast, WCE appears to use these woodlands as stopover sites “*en route*” to its breeding areas in the southern Patagonian forests.



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Survival estimates and longevity records of resident birds and migrants in a Guatemalan rainforest – an 18 year study

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Birds were mist-netted and banded during the northern winter for 18 consecutive years at multiple study sites ranging from sea level to 1000m on Cerro San Gil on the Atlantic slope of Guatemala. Survival estimates of resident species were uniformly high, such as 0.75 ± 0.19 for bright-rumped attila (*Attila spadiceus*), 0.74 ± 0.11 for northern bentbill (*Oncostoma cinereigulare*), 0.71 ± 0.15 for scaly-throated leaf-tosser, 0.66 ± 0.22 for slaty antwren (*Myrmotherula schisticolor*), 0.65 ± 0.06 for stub-tailed spadebill (*Platyrinchus cancrominus*), 0.65 ± 0.07 for tawny-crowned greenlet (*Hylophilus ochraceiceps*), 0.64 ± 0.15 for buff-throated foliage-gleaner (*Automolus ochrolaemus*). The migratory species, on the other hand, had survival estimates either close to 50% or much lower. Longevity records were also much higher for resident species than for migrants, with six resident passerine species reaching very close to or beyond ten years of age.



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S37 Across the great divides: how ecological barriers affect the biogeography and ecology of long-distance passerine migration

Convenors: Scott McWilliams, USA; Ulf Bauchinger, Israel

Passerine bird migration and ecological barriers: comparing the Old World to the New World

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Landmass distribution and habitat availability differ between ecozones and may influence the evolution of migration systems. We used GIS to define habitat availability and the presence of ecological barriers for passerine birds that seasonally travel within the Afro-Palearctic and the Nearctic-Neotropic migration system. We then used this information to test the hypothesis that ecological barriers influenced key aspects of passerine bird migration (e.g., breeding and wintering distribution, migratory distance, pace of migration, fuel load). Habitat availability in the subtropical latitudes seems especially important in explaining differences in the pattern of seasonal movements of passerine birds in the Old World and New World. Bird species that occur on both continents as well as ecologically similar species provide opportunities to determine the extent to which individual attributes associated with migration (e.g., wing morphology, fat loads) are related to distance traveled and the need to cross ecological barriers.



Campos do Jordão 2010 25th International Ornithological Congress 22-28 August 2010 (www.i-o-c.org)

A comparison of geographic barriers and other challenges of migration in South vs. North America

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I provide a broad comparison of avian migratory systems in North and South America, with the goal of understanding and predicting fundamental differences in migratory strategies of species in the two continents. I start by contrasting the distribution of land mass, which decreases towards the equator for north-temperate breeders and increases towards the equator for south-temperate breeders. I next contrast geographical barriers, which are prominent in the Northern Hemisphere (e.g., the Gulf of Mexico) but not in the Southern Hemisphere. Finally, I compare climatic seasonality in North America, which is largely defined by variation in temperature, with seasonality in South America, which is largely defined by variation in rainfall. With these differences in mind, I then examine data available on migration in the two hemispheres and make predictions about how geography and seasonality may lead to currently unexplored differences in migratory strategies of birds in North and South America.



Campos do Jordão 2010 25th International Ornithological Congress 22-28 August 2010 (www.i-o-c.org)

Do Siberian-African migrants cross the Central Asian deserts in autumn?

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Quite a few avian species that are traditionally referred to as European-African migrants have breeding populations well east of the Urals: garden warbler, willow warbler, sedge warbler, pied flycatcher, to name just a few. Several lines of evidence show that Siberian-African migrants do not cross Central Asian deserts in autumn. Capture data from the arid regions of Central Asia suggest that numbers of these species at autumn stopovers are much lower than in spring. Migration traffic rate of African migrants over western deserts just east of the Caspian Sea, as estimated by moon-watching observations, is 2.6 times higher in spring than in autumn (on average, 1150 and 450 birds/km•night, respectively). Capture data suggest an even greater difference, 5.4-fold (Bolshakov 2003). Our moon-watching observations on the NW edge of the desert north of the Caspian Sea showed a mean migration traffic rate of passerines heading towards the S – SW (i.e. towards African winter quarters) of ca. 10850 birds/km•night. Finally, orientation tests done with hand-raised pied flycatchers from West Siberia showed a westerly orientation in Emlen funnels during the initial part of autumn migratory season (mean 269°). Together with few ring recoveries, it indicates movement to Europe circumventing the Central Asian deserts and highlands from the north. It should be however noted that at least for birds wintering in West Africa, like the pied flycatcher, the shortest great circle route is the one across Europe, i.e. flight north of Central Asia is not actually a detour.



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Spring migration phenology and plasticity of habitat use by Neotropical migratory birds across an elevational gradient within the Madrean Archipelago, Arizona, USA

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Avian migration phenology and plasticity of habitat use across large ecological and elevational gradients are poorly understood for en route Neotropical passerines, particularly in arid mountain regions of the southwestern United States. Migration patterns are closely linked with temporospatial factors such as regional plant phenology and distribution of dominant vegetation communities, factors highly responsive to climate change. The Madrean Archipelago in southern Arizona, USA, provides vital "stepping stones" for millions of migratory birds, linking migration corridors of the Sierra Madre Occidental of Mexico with the Sierra Nevada and Rocky Mountains of the US. We examined comparative 1) temporal abundance and 2) plasticity of habitat use of migratory birds during spring migration across an elevational gradient of five vegetation communities: montane conifer forest, pine-oak and oak woodland, mesquite bosque, and lowland riparian forest, and 3) temporal and spatial correlations of bird and plant phenology. We surveyed 450 points comprising 43 point-line transects across three mountain ranges once each week for 10 weeks between 1 March and 15 May, 2009. Avian species exhibited a range of plasticity of habitat use, with low plasticity primarily associated with either lowland riparian or high elevation forests; examples include *Dendroica petechia* and *D. occidentalis* respectively. Temporal abundance patterns of migrants were correlated with phenology of plant species indicative of vegetation communities. We link our observational models of migration and plant phenology with local climate change models based on remote sensing data. High elevation and riparian forests are extremely vulnerable to climate change, posing potentially significant temporal and spatial loss of stopover habitat, and threatening the migration success of bird species with demonstrated low plasticity of habitat use.



25th International Ornithological Congress 22-28 August 2010 (www.i-o-c.org)

Effects of simulated magnetic displacements on fuelling decisions in juvenile wheatears (*Oenanthe oenanthe*)

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Several studies of naive migratory birds have shown that the birds rely on endogenous migration programs during their first migratory journey. In addition to these studies recent experiments exposing migrants to altered magnetic fields have found innate responses to external cues, demonstrating that ecologically relevant fuelling decisions may also be determined by the magnetic field experienced by the birds. I will present data from several experiments where naive migratory wheatears have been exposed to altered magnetic fields, simulating different geographical displacements. Individual body mass and food intake were monitored throughout the experiments to investigate possible impact of the magnetic displacements on fuelling decisions. One group of birds was kept in the ambient magnetic field of south central Sweden as a control, and the other groups were displaced to positions along or parallel to the west of their natural migration route from Sweden to West Africa. I will present fuelling data from all the different experiments and I will discuss possible causes and consequences of differences in body mass increase observed between the groups.



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S38 Climate change and long-distance migrant landbirds

Convenors: Robert Robinson, UK; Charles M. Francis, Canada

Climate change and migrant landbirds: an Afro-Palaeartic perspective

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The journeys of migrants span the globe, linking distant areas and, in many cases, heralding the change of seasons. In recent years, however, there has been much concern over the conservation status of these species in Europe, particularly of the longest distance migrants. Migrants may be affected not only by processes, such as habitat loss, on both the breeding and wintering grounds, they also need to migrate between these areas, requiring synchrony in departure cues and arrival conditions as well as a coherent network of intermediate stopover sites. Changing climates thus have the potential to adversely impact the conservation status of migratory species, both through altering habitat suitability and changes in the timing of seasonal events. Understanding the population impact of these changes requires an understanding of the underlying demography. I present results of recent work quantifying survival and reproduction in migrants across Europe in an effort to identify causes of population change in migratory species, drawing comparisons and contrasts with similar work on migratory landbird population dynamics in the Nearctic.



Campos do Jordão 2010 25th International Ornithological Congress 22-28 August 2010 (www.i-o-c.org)

A comparison of climate change effects on migratory passerines in the Nearctic vs. Palearctic

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Climate change is emerging as one of the principal threats to bird populations and communities. Much research into the ecological effects of climate change has focused on birds because they are taxonomically well-understood, relatively easy to count and have been monitored for extended periods. In many species of birds, climate change has resulted in earlier arrival and/or onset of breeding, phenological mismatches between the availability of arthropod prey and birds' energetic demands for reproduction, and poleward shifts in breeding distributions. Little attention, however, has been given to the key question of whether shifting climate regimes are affecting species in similar ways and at similar rates in the eastern and western hemispheres. Here, we compare and contrast climate change impacts on passerine species that migrate between the Nearctic and the Neotropics (N-N) versus those that migrate between the Palearctic and the Afrotropics (P-A). We first highlight common patterns, then discuss differences between these migration systems in terms of bioclimatic conditions between breeding grounds and winter quarters, the phenology of migration, habitat structure in breeding area, and species' life histories. We conclude by providing hypotheses for how climate change could differentially affect N-N and P-A migratory passerines in the coming century.



Campos do Jordão 2010 25th International Ornithological Congress 22-28 August 2010 (www.i-o-c.org)

How do long-term changes in arrival of long-distance migrants relate to population trends?

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One consequence of climate change for birds is an increasing mismatch between timing of food requirements and food availability. Recent studies indicate that such a mismatch is strongest for long-distance migratory birds and in habitats with a highly seasonal food peak, such as deciduous forests, compared to less seasonal habitats, such as marshes. Furthermore, forest inhabiting migrant species arriving latest in spring seem to have declined strongest, probably because their mismatch with the peak in food supply is greatest. Some long-distance migrants have advanced their timing of breeding, but this seems insufficient because it is hampered by the date of the species' arrival at the breeding grounds. Here, we evaluate the generality of this 'closing window' for other long-distance migrants, by relating changes in arrival date since the 1980s with population trends in the Netherlands. We use frequent and standardized visits in a large number of study plots across the country to assess long-term changes in timing of arrival and vocal activity. We hypothesize that populations of migrants arriving earlier and advancing stronger show smaller declines. Furthermore, we evaluate if this response differs between marshland and forest birds, and hypothesize that the costs of not advancing their arrival are higher in seasonal forests than in less seasonal marshes.



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Shifts in the timing of migration of barn swallows (*Hirundo rustica*) in South Africa revealed by two bird atlas projects: earlier departure and later arrival

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The first Southern African Bird Atlas Project (SABAP1) took place from 1987-1991, and the second (SABAP2) commenced in 2007. Both projects involved large-scale, year-round collection of presence-absence data by citizen scientists: SABAP1 collected seven million records and SABAP2 project (<http://sabap2.adu.org.za>) one million records annually. Within SABAP2, mini-projects have been conducted to target the collection of high-quality data to quantify the timing of arrival and departure. This facilitates fine-scale analysis of the phenology of migration, especially in relation to climate change. This presentation provides a case study on the timing of migration of the barn swallow (*Hirundo rustica*). Arrival of the barn swallows in South Africa is characterised by a steady increase in abundance with reporting rates increasing in the north of the country approximately two weeks earlier than the south, over a distance of c. 1600 km. Arrival takes place mainly in October and November. In contrast, departure on northward migration is more abrupt, with the entire area being vacated in a period of about one month, mainly in April. The data quality is adequate to enable comparisons in the timing of migration between the two projects, enabling the impacts of earlier springs in Eurasia to be measured. Our results demonstrate that departure from South Africa is taking place 11 days earlier than it did one and a half decades earlier, and that arrival is delayed by nine days. Residency time has therefore decreased by 20 days.



Similar arrival time responses of migrants to climate changes during warming and cooling periods

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Most studies dealing with climate change effects on arrival times of migratory birds have shown advancing spring arrival trends. Also, birds arrive earlier in warm springs and, in Europe, after winters with high North Atlantic oscillation index. Reported changes are quite recent, 20th century having experienced also cooling and another warming period. To understand effects of current climate change, it is important to study these also during other periods of climate change. We studied how first arrival dates of 13 Finnish bird species were related to temperature and NAO during two warming periods (1910-1939 and 1970-1999), and one cooling period (1940-1969). Most temperature-period and all NAO-period interactions were statistically non-significant, indicating similar effects of temperature and NAO on arrival dates during the three periods. Over the periods, most species responded to temperature and NAO arriving earlier in warm springs and after high- NAO winters. These effects were more pronounced in short-distance migrants. In most species the year-period interactions were non-significant indicating similar arrival time slopes between the periods. Significant effect of period was found in most species, which is best explained by more efficient search for first arrivals in the latest period. These results suggest that it is not advisable to apply linear methods to long time series. We also recommend to check long arrival time series for changes in observing activity. Our results also support the hypothesis that birds show phenotypically plastic responses to variation in climate, responding to climate change relatively fast.



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S39 Why do males arrive before females in spring? Proximate and ultimate causes of protandry, and its response to current environmental change

Convenors: Francisco Pulido Delgado, Spain; Timothy Coppack, Switzerland

The mechanisms underlying protandrous migration in birds

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Protandry, the earlier arrival of males relative to females at the site of reproduction, is a common phenomenon found in many migratory bird populations. While the sex-specific costs and benefits of early arrival have been widely discussed, the mechanisms underlying differential timing of migration remain largely unknown. Here, we review recent studies investigating the proximate causes of protandry, focussing on passerine birds. In these species, protandrous arrival at the breeding sites seems to be a consequence of habitat and geographic segregation among males and females during the non-breeding period, and of differences in the initiation of spring migration. Experimental evidence in the garden warbler (*Sylvia borin*) suggests that protandry arises from sexual differences in photoperiodic responsiveness. This mechanism is hardwired, and is obviously resilient to changes in temperature, which is corroborated by the fact that in most species the degree of protandry has not changed despite a recent advancement of migration in spring. However, if the differential response to photoperiod is the main control mechanism underlying protandry, a change of photoperiodic conditions, e.g. via shifts in wintering latitude, will result in changes in protandry. Moreover, adaptive evolution of the photoperiodic response could modify the degree of protandry in the future if climate change affects the costs and benefits of arrival time differently in males and females. This evolutionary process is likely given that additive genetic variation in the photoperiodic response has been demonstrated in populations of migratory birds.



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Adaptive explanations for protandry in birds: bridging the gap between theory and data

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The precise adaptive function of protandry remains elusive despite years of theoretical and empirical research. It seems possible that there is a mismatch between theory and data: on the one hand, theory has not adequately addressed how protandry should be affected by traits easily measured in the field; on the other hand, robust tests of clear theoretical predictions are lacking. Here I review the underlying assumptions and predictions of the several adaptive hypotheses for protandry that seem most relevant to birds. I will then focus on the mismatch between theory and data as they relate to the mate opportunity hypothesis. In particular, recent empirical work has used a positive relationship between sexual selection intensity (as reflected by the degree of sexual dichromatism) and increased protandry as support for this hypothesis. Yet existing mathematical models do not explicitly address the role of sexual selection intensity and instead point to other influential variables such as the sex ratio of the breeding population and the mating period of individual males.



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Large individual variation in migration pattern in a population of European hoopoes migrating to sub-Saharan Africa

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Knowledge of spatial and temporal migration pattern of individuals is fundamental for disentangling carry-over effects from one season to the next. However, information on ranges during the non-breeding season is very rare for the majority of long-distance migrants. Current development in geolocalisation tools now allow for continuously tracking of small birds from the breeding to non-breeding areas and back. We tracked autumn and spring migration of European hoopoes (*Upupa epops*) from their breeding site in central Europe by very-light GLS devices. In our pilot study in 2008 tags had no negative effects on return rates of individuals to the breeding grounds. Four individuals showed three different migration routes: two females migrated from central Europe via the Iberian Peninsula, crossing the Sahara desert and over-wintered between Mauritania and western Mali. On their spring journey, they crossed Algeria, and the Balearic islands, and thus, realized loop migration pattern across Africa. In contrast, males used different routes with one male on autumn migration crossed the Mediterranean Sea via Corsica/Sardinia and over-wintered in eastern Mali, another male migrated along the Apennine Peninsula. Mean daily migration speed differed between seasons with 81-118km per day and 122-163km per day on autumn and spring migration, respectively. Currently, 60 birds are equipped with GLS tags and more than one third of birds is expected to return to their breeding sites in northern spring 2010. In our talk, we will present the latest information on their migration as well as over-wintering regions, and establish one of the first detailed non-breeding ranges of a small Palaearctic-African long-distance migrant.



Overtaking on migration: does longer distance migration always incur a penalty?

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For migratory shorebirds the timing of arrival on the breeding grounds is of great importance as it can strongly influence breeding success. Early arrival can improve access to higher quality resources and breeding locations, and can also increase the potential number of breeding attempts. Previous studies have shown that arrival dates appear to be linked to winter conditions and/or to conditions experienced during migration in several species. Understanding individual variation in arrival dates therefore requires information on both wintering conditions and migration routes and timings. Icelandic black-tailed godwits winter in coastal areas from the British Isles to Iberia, and use a range of estuarine and freshwater habitats during winter. The long-term marking and tracking of individual black-tailed godwits has shown that the major arrival locations in the west and east of Iceland contain individuals from all parts of the winter range, and that the birds that winter furthest from the breeding grounds tend to arrive first. Birds from the southernmost sites also do not fly directly to Iceland, but often migrate via the Netherlands, adding an extra c. 1000 km (c. 25%) to their journey. Here we explore the links between winter conditions and migration routes and timings of individuals from the extremes of the range, in England and Portugal. This population-scale analysis allows us to identify who has pole position and the environmental conditions that influence who wins the race to Iceland each spring.



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Does the mate opportunity hypothesis explain protandry in the eastern kingbird?

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Among migratory passerines, males typically arrive at the breeding grounds prior to females (protandry). Protandry may result from male dominance over females at either a latitudinal scale, with males wintering closer to the breeding grounds than females, or at a local-habitat scale, with males precluding females from occupying high quality winter habitat. Alternatively, protandry may arise because selection favors early arriving males that acquire the highest quality breeding territories (rank advantage hypothesis) and/or have the most mating opportunities (mate opportunity hypothesis). During a 4-yr study in Oregon, we found that male eastern kingbirds (*Tyrannus tyrannus*) arrived on the breeding grounds 5 d before females. Several lines of evidence suggest that neither sexual differences in physical condition nor social dominance by males explains protandry in kingbirds. Because both male and female kingbirds are at risk of being forced into non-breeding populations and the reproductive success of both sexes likely depends upon territory quality, we argue that male and female kingbirds should be under equal levels of selection for early arrival and thus we reject the rank opportunity hypothesis. Instead, as predicted by the mate opportunity hypothesis, we found that the earliest arriving male kingbirds sired more extra-pair young than later arrivers. Thus, we propose that protandry in kingbirds evolved due to enhanced mating opportunities for early arriving males that arises from decreased sperm competition early in the season and increased time to pursue extra-pair fertilizations later in the season.



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S40 Energy metabolism in migrants: metabolic adaptations and hormonal regulation

Convenors: Susanne Jenni-Eiermann, Switzerland; Christopher G. Guglielmo, Canada

Role of the glucocorticoid hormone corticosterone during migratory flight and fuelling

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Most migrant birds do not fly in one flight bout from their breeding to some wintering grounds, but alternate between flight and stopovers. During stopover, birds generally try to build up fuel stores, while during flight fuel stores are partly or completely consumed. Little is known about the hormonal regulation of the energy metabolism during migration and findings so far were often conflicting. During the last years the glucocorticoid hormone corticosterone was discussed as a candidate which might orchestrate the energetic needs during migration. It is important to distinguish between two main functions of corticosterone: the regulation of metabolic processes in accordance with the demands of the particular life-cycle stage and its role to cope with acute stressful events. An overview shall be given of studies investigating the role of baseline corticosterone concentrations and corticosterone concentrations as a response to a threatening event in actively flying birds as well as in resting and (re)fuelling birds. Measurements of corticosterone in free-ranging birds with different migration strategies (long- and short distance, irruptive migrants) caught out of migratory flight showed elevated baseline levels supporting the hypothesis of McEwen and Wingfield, that corticosterone is increased during more demanding stages of life, in this case migratory flight, to promote energy supply by proteolysis and gluconeogenesis. However, experimental studies investigating red knots, *Calidris canutus*, flying up to 10 h in a wind tunnel, did not show any significant change in corticosterone baseline levels in comparison with resting birds. The question whether baseline corticosterone is increased and the stress response is suppressed seasonally during the migratory period to promote food intake and fuel deposition is controversially discussed in the literature. Our data also showed conflicting results. Free-ranging passerines caught out of flight and during resting and foraging reacted with a similar increase of corticosterone to handling. The red knots however flying in the wind tunnel showed an increase during resting and a clear-cut decrease when caught out of flight.



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Fuel metabolism during endurance flight in birds and bats

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Birds, and probably bats, fuel migratory flight with a mixture of mostly fat and some protein. Both of these metabolic substrates present challenges across multiple levels ranging from the biochemical to ecological. Fat is very energy dense, and is a very space and weight efficient way to store energy. However, the extremely low solubility of fatty acids makes them difficult to transport from stores to sites of oxidation. As a result, only a small fraction of the energy for typical mammalian endurance exercise (running) is provided by fatty acids; they simply lack sufficient transport machinery. To fly birds and bats must exercise at twice the rate of energy expenditure of a running mammal, and to migrate they must have about 20 fold greater capacity for lipid transport and oxidation. I will discuss recent findings on migration-related modulation of membrane and cytosolic fatty acid transporters in flight muscles, and the effects of omega-3 and omega-6 fatty acids in fat stores and membranes on exercise performance. Some amount of protein is also required to make new glucose, compensate for anaplerotic flux, and provide water if water losses are high (such as at altitude). Since protein is stored in muscles and organs, its use for fuel can negatively affect flight and subsequent refueling at stopover. Catabolism of wet protein should provide five times more water than fat, but the hypothesis that birds catabolize more protein under dehydrating conditions has not been tested. We used magnetic resonance body composition analysis and respirometry to show that water restricted birds catabolize more lean mass under resting conditions, but not when metabolic rate is elevated by shivering. I will discuss plans to test the water hypothesis in flying birds using a new hypobaric climatic wind tunnel.



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In-flight physiology and energy expenditure of northern bald ibises (*Geronticus eremita*) during human-led migration

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One of the “unknowns” in the understanding bird migration is how long-distance migrants perform flights of over 100-hour durations. Moreover, these birds complete each migratory journey with repeated flight bouts to allow for intermittent refueling in stopover areas. They must then alternate between physiological stages of flight and refueling. The physiology of birds in these stages is unique; migratory flight is characterized by prolonged bouts of energy expenditure at up to seven times basal metabolic rate, while refueling is characterized by unusually rapid energy deposition. Solutions to the physiological challenges associated with alternating between intensive exercise without feeding, and intensive feeding associated with refueling at stopover sites are difficult because the underlying physiological processes are incompatible. The control mechanisms used to change physiological states throughout migration probably reflect a combination of reactions to exogenous factors with underlying endogenous control mechanisms. Determining how birds overcome these physiological challenges and combine exogenous and endogenous mechanisms is one of the most demanding topics of bird migration research. Previous studies have either used birds flying freely in wind tunnels, or investigated the physiological state in migrants just after landing with unknown previous flight histories. For this study we took advantage of a human-led migration project with northern bald ibis. Because these birds are tame, with foster parents, we were able to bleed them immediately prior to and after flights that were experimentally set as short or long. In addition we bleed birds one day after to document recovery. Blood chemistry was documented and we used the doubly-labeled-water technique to assess in-flight energy expenditure and that during subsequent stopover.



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Patterns of adrenal activity in migrating northern bald ibises (*Geronticus eremita*) during human-led migration

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During migration birds repeatedly go through suites of physiological changes associated with pre-flight preparation, flight performance, post flight recuperation and conditional adaptation to extended periods of exercise. Cause and effect associated with these changes are directly lined to of fluctuations in energy resources and use. Nonetheless, the cascade of effects are presumably regulated by mediators that could link metabolic, somatic, neural and immune functions. One potential mediator is the adrenal and the accompanying levels and secretion patterns of glucocorticosteroids. In line with this, morning and evening excretion patterns of corticosteroids were examined in free-living *G. eremita* before and during a human-led migration. One focus was on the seasonal and diurnal changes in excretion patterns and their relationship with body mass fluctuations. A second was the acute changes in steroid excretion associated with long and short migration bouts. The latter focus entailed the analyses of fecal material collected before and after flight. The changes in adrenal activity have been compared with acute and long term changes in body mass, flight characteristics and blood chemistry parameters collected over the season and around individual migratory flights. The results demonstrate that both the levels and temporal (circadian) patterns of adrenal steroid secretion may play an important role in coordinating the physiological preparation, adaptation and responses to migration in the northern bald ibis.



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Using measurements of heart rate to interpret the energetics of birds during flight

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Energy is the universal currency of life but our ability to measure energy turnover in free-ranging animals is limited. Measurements of heart rate have been used successfully in a small number of animals to determine rates of oxygen consumption but only following quite elaborate calibration experiments. Re-evaluation of a number of studies that report the relationship between heart rate and rate of oxygen consumption, of birds and mammals during periods of flying, swimming or running, reveals that energy consumption is generally proportional to heart rate squared. A new physiological constant, oxygen pulse per heart rate, is invariant during species-specific exercise, while heart mass is the structural scaling factor that primarily determines the average difference in this relationship between animal species, covering at least 3 orders of magnitude of body size. Thus, it is possible to obtain reasonably accurate interpretations of the heart rate recorded from species of wild birds and mammals during their primary modes of exercise. Heart rate measurements, interpreted as rates of oxygen consumption by applying the heart rate squared proportionality, support the unexpected low metabolic scaling exponent for birds carrying additional mass, and provide a lower value for the energetic savings achieved during V-formations, during flight.



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S41 Inferring global change impacts on avian diversity with GIS and remote sensing

Convenors: Susan Cameron, USA; Paul F. Donald, UK

Composition of the fragmented landscape and the responses of functional groups of birds to the consequences of forest fragmentation in the Inland Brazilian Atlantic Forests

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The forest fragmentation is one of the greatest threats to forest birds. In this context, this project aimed to determine the variations in richness and functional groups in 17 remnants of Semi deciduous forest in the northwest state of São Paulo, Brazil, checking if the differences are related to the variation of landscape structure. The landscape was mapped in a radius of 5 km, in the surroundings of these remnants and from this vegetation maps were selected four descriptors (PLAND, ED, CORE and CLUMPY). The relationship between descriptors and functional groups (species per trophic guilds, strata, forest dependence and richness) were determined by linear regression. Seven groups and the richness showed some relation to the metrics. Functional groups that are specialist forest such as forest dependent, understory species or specialized guilds such as small ground insectivores and carnivores, were related to clumpiness index (CLUMPY), the core are distribution (CORE) and the landscape percentage (PLAND) possibly because they require larger areas to survive or they depend on lower forest strata which are better represented in these areas. The small understory insectivores were related only to the PLAND. For the ground frugivores the CLUMPY has become an important factor in its distribution in these fragmented landscapes. The hundred meters defined as forest edge was important for the large canopy frugivores and omnivores which were positively related to the CORE. The total richness species had a positive relationship with the PLAND, CORE and to CLUMPY. The reduction of forest areas made the few forest remnants the main responsible for maintaining the diversity of species habitat-specialists, like the northwest visited remnants, which were recorded functional groups of species dependent on these environments. Each functional group showed a different response to landscape structure, suggesting a different sensitivity of these groups to the forest fragmentation.



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Using observations of birds to investigate distributions in dynamic systems

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Birds and the environments in which they live are dynamic, often with local or long-distance movements of birds as habitats change within and across years. However, species-distribution modeling typically attempts to describe static or average habitat associations. We work with data from the Avian Knowledge Network to develop models that describe dynamic year-round distributions of birds, and identify changing habitat associations. We can create models of species distributions across the United States that match the expectations of experts, even for seasonally migrant bird species. These models identify patterns including strong associations of migrants with specific landscape features, and different timing of movement of birds nesting in different regions. Both the dynamic nature of the birds and the presence of largely volunteer observers need to be considered during construction of these species distribution models. Spatio-temporal variation in bird distributions and habitat associations needs to be accounted for by building and combining spatially- and temporally-isolated sub-models, even though a feature such as "day of year" in a global model would theoretically produce an accurate model from the entire data set. This discrepancy between theory and practice is due to variation in density of observations across the continent and among seasons: patterns found in data-rich regions overwhelm information from data-poor regions. Failing to account for unevenly-distributed data yields misleading model predictions and validation. We also found varying probabilities of detection within species; thus modeling variation in the detection process is required. We present a semi-parametric modeling framework that accounts for the challenges noted above.



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Integrating current distribution, physiology and paleoenvironment to uncover patterns of Pleistocene bird diversity

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Understanding how species have responded to past climate change is critical to developing effective conservation management strategies in our changing world. Linking large databases of species' current distribution with current and historical climate databases make it possible to develop spatially explicit hypotheses about historical patterns of diversity. Of particular interest is uncovering the relative importance of Pleistocene glaciation in determining patterns of extant diversity in North American Passerines (Corvidae, Fringillidae, Cardinalidae and Icteridae). We apply two correlative models (Maximum entropy and Generalized Linear Models) and an ecophysiological model to predict current and historical distributions for each species. We develop hypotheses of each species' range during 3 time periods (present day, the last glacial maximum 20 kya, and the last interglacial 120 kya) and then sum these models to assess range stability and putative refugia for each species. Across species, the models suggest 3 major refugia: Pacific Coastal, Desert Southwest, and Southeastern. Furthermore, we correlate mtDNA structure with stability areas for a subset of species. The stability areas (putative refugia) have high spatial correlation with mtDNA lineages. These results suggest it is possible to use widely available data to predict historical ranges. However despite the presence of widespread refugia, our results indicate that predicting the response of any one species is difficult due to idiosyncratic responses, therefore current conservation planning efforts should consider individual responses to climate change.



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Land cover changes in Important Bird Areas in Africa assessed by remote sensing

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Land-cover change is the single greatest threat to biodiversity. The Important Bird Area (IBA) network comprises sites of objectively identified importance for bird populations. Some, but not all, fall within the Protected Area (PA) network. Despite the significance attached to IBAs and PAs, including their central role in CBD reporting, their effectiveness in preventing anthropogenic land-cover change remains uncertain. The proposed project will use higher resolution remote sensing data to track land-cover changes on a large sample of sites of bird conservation importance in Africa and in buffer zones surrounding them. The sample will be stratified to include sites of high nature conservation value that fall within and outside the Protected Area network to assess whether rates of change in PAs differ from those in other areas of recognised conservation importance. We will first assess whether rates of land-cover change differ between IBAs falling within and outside Protected Areas and buffer zones outside each. The results will generate the most comprehensive assessment ever undertaken of the efficacy of IBAs and Protected Areas in Africa, with implications for the global PA network. Then we will identify predictors of land-cover change within PAs and IBAs to identify indicators of success and assess future conservation priorities. The results have implications for a wide range of bird conservation stakeholders, from local managers to government policy makers. Finally, we will present long-term (>40 years) indices of integrity for IBAs in Africa. These indices will contribute to biodiversity reporting at sub-regional and continental scales.



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S42 Corticosterone – long-term impacts on life-history

Convenors: Jesko Partecke, Germany; L. Michael Romero, USA

Here today, not gone tomorrow: long-term effects of corticosterone

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There is a growing body of evidence from across animal taxa that perinatal exposure to elevated levels of glucocorticoids can have profound long-term effects upon physiological and behavioral phenotypes. Several avian studies have revealed that hypothalamo-pituitary-adrenal (HPA) axis programming of the adult phenotype, as indicated by increased stress responsiveness, can be explained by nestling or even yolk corticosterone levels. Developmental exposure to corticosterone may also have effects upon avian 'personalities' or coping styles, and evidence from studies of mammals suggests that these long-term effects are mediated epigenetically via altered expression of relevant DNA sequences. Although there does not appear to be a consistent across-species pattern, developmental exposure to elevated corticosterone levels may shape adult coping style with such exposure often resulting in adults that are more timid than those individuals that as nestlings experienced relatively low corticosterone levels. Recent work in Florida scrub-jays (*Aphelocoma coerulescens*) has found that baseline corticosterone levels in 11-day-old nestlings explained 84% of the variation in 'personality' when those individuals were tested approximately seven months later. The overall fearfulness, or 'personality', scores at 7 - 8 months of age are based upon tests that evaluated and combined jays' responses to two startle and one neophobia stimuli. Concurrent research to determine those factors that contribute to nestling corticosterone levels, both within and among broods, suggests that nestling body condition and maternal attentiveness at the nest, respectively, are the primary mediating factors. Ongoing research in our lab suggests that there are fitness costs associated with elevated corticosterone during development.



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Stress physiology: ecological and evolutionary consequences of an urbanizing world

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Humans are dramatically altering environmental conditions throughout the world. One of the most striking man-made environmental changes is the existence and rapidly ongoing spread of urban areas. Animals which have successfully colonized cities seem on the one hand to benefit from the urban ecosystem. However they are also confronted with many novel and potentially stressful situations. These factors may create a selective environment that may favor individuals which are also able to cope with 'urban stresses'. Among the physiological coping mechanisms used by vertebrates to ensure survival under adverse environmental conditions is the acute stress response, characterized by the release of glucocorticoid steroid hormones. These glucocorticosterone levels are increasingly being used as physiological indices of the relative condition or health of individuals and populations thriving in urban areas. In this talk I will present an overview of existing data relevant to answering what we already know about the physiological stress response of urban avian species and its potential fitness consequences. Furthermore, I will discuss to what extent the observed changes are the result of micro-evolutionary changes or of phenotypic plasticity. I will outline a synthesis by including the concept of reaction norm to elucidate why some species are thriving in urban areas while other species do not. Finally, I will emphasize that future studies in urban ecology should link the concept of the study of behavioural syndromes with the underlying physiological mechanisms in order to understand the entire magnitude of the ecological and evolutionary consequences of a rapidly urbanizing world.



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Corticosterone, feather quality, and long-term consequences

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The majority of passerine species studied to date have lower corticosterone concentrations during the pre-basic molt. One explanatory hypothesis postulates that the decrease in corticosterone serves to minimize the protein degradation effects of corticosterone so as not to interfere with the protein deposition critical in producing new feathers. Recent evidence supports this hypothesis. Stress-induced increases in corticosterone do not alter molt rate or overall feather quality, but exogenous corticosterone does. The impact of degraded feather quality can be profound. Numerous studies indicate that poorer feathers degrade flight performance, thermoregulatory ability, and overall survival. Clearly, corticosterone concentrations in the range attained after exogenous administration ought to be avoided. Such concentrations would produce poorer feathers and thus have long-term impacts on further life-history stages. Consequently, many avian species seem to be modulating their corticosterone responses to stress in order to avoid interfering with proper feather development. The physiological mechanisms appear to entail a coordinated decrease in corticosterone synthetic capacity combined with differential regulation of corticosterone release at the level of the brain. The result may be an example of a classic physiological trade-off – balancing immediate survival (via a stress response) with long-term survival (via a robust set of new feathers). It is interesting that, in this case, long-term survival appears to take precedence.



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Correlates of hypothalamic-pituitary-adrenal axis regulation and neophilia to invasion and range expansion

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Animals can be attracted to (neophilia), fearful of (neophobia), or indifferent to novelty, but those that minimize neophobia or enhance neophilia are most likely to exploit unfamiliar resources, making them more successful as invaders. Evidence suggests that differential reactivity of the hypothalamic-pituitary-adrenal (HPA) axis mediates responses to novelty: individuals that are attracted to novelty release less glucocorticoids (GCs) in response to a stressor than neophobic individuals. We investigated the relationships between GC regulation and response to novelty in house sparrows (*Passer domesticus*), a successful invader of nearly every continent. We measured HPA regulation (baseline GCs, GC response to restraint, dexamethasone-induced negative feedback, and maximal adrenal output), hippocampal expression of glucocorticoid receptors, expression of 11-beta-dehydrogenase, a GC metabolizer found in the liver, and related these measures to an individual's response to novelty in captivity. We found that individuals that released more GCs in response to restraint were also slowest to interact with a novel object while individuals with the most rapid negative feedback approached and consumed novel food most quickly. Gene expression studies are ongoing. These results demonstrate linkages between HPA regulation and behaviours previously indicated important to range expansion. We are currently assessing the relevance of these results (characterized in captivity on an establish population) in house sparrows along an invasion gradient in Kenya. We predict birds closest to the invasion front will be more neophilic and have a greater capacity to regulate their HPA axis than birds at the site of introduction in Mombasa.



Links between stress sensitivity and feather coloration

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Feathers are multi-functional structures (serving flight, insulation, aerodynamic body shape, protection against radiation, water, mechanical impact, etc.) and the quality of feathers is an important component of the quality of the individual and thus its fitness. Moreover, feathers by their coloration and shape are the most important component of the appearance of birds. Because in many cases feather quality is linked to its coloration, feather coloration is an important means of honest quality signalling and thus lends itself to sexual selection. In the case of melanin, one of the most important colour types, the colour pigment is in itself an important component of feather resistance to wear and tear and at the same time has been shown to be under sexual selection. Recent findings suggest that melanin-based plumage coloration is linked to the sensitivity to stress. A new hypothesis suggests a mechanistic link between melanogenesis and the hypothalamo-pituitary-adrenal-axis via the POMC-gene. The link between feather coloration and stress sensitivity has an environmental and a heritable component. Studies in barn owls have shown that exogenous corticosterone affects the phaeomelanic coloration of body feathers. Hence, feather coloration may be a sign of stress experienced during feather growth. On the other hand, recent findings have shown that melanin-based plumage coloration and stress sensitivity covary and both are partly heritable. In addition, melanin-based plumage coloration and stress sensitivity may covary with other traits. Therefore, genetic variability between individuals in stress-sensitivity and covarying traits may be signalled through melanin-based plumage coloration. The covariation between various traits and melanic plumage coloration possibly is a reason for the maintenance of plumage polymorphism in heterogeneous environments.



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S43 Molt and the ecophysiology of the post-breeding period

Convenors: Steven Portugal, UK; Alastair Dawson, UK

Molt and Avian life histories

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Many aspects of primaries renewal have links to important components of avian life histories. Primary length increases as the 1/3 power of body mass, but primary growth rate increases only as the 1/6 power of body mass, constraining the way large birds molt. Because flight feather growth rate increases so slowly with body mass, growing more primaries simultaneously is the principle way to reduce the time spent molting. With their larger power reserves, small birds can grow several adjacent feathers simultaneously in a single wave of primary replacement; large birds usually feature multiple waves of replacement or simultaneous replacement of the primaries. A few studies suggest that rapid molts generate feathers of lower quality and, thus, that feather quality is likely to be the currency linking larger breeding investment in one year with reduced survival or lower breeding success the following year. For several large birds that do not replace all their primaries each year, increased breeding effort results in fewer primaries being replaced. Thus, reproductive effort constrains the extent of primary replacement. Reciprocally, new data for an albatross shows that females with over-worn primaries are more likely to skip breeding than females with normal primary wear and that females with overworn primaries that attempt to breed fail more often than females with normal primary wear. Thus, for one large bird that cannot replace all its primaries every year, feather condition affects both the decision to breed and the likelihood of success. Finally, many life history variables affect the duration of complete primary molts, including needs for high flight efficiency, the absence of constraints on the time available for molting, and, possibly, special needs to grow high-quality feathers.



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Phenotypic plasticity amongst moulting Anatidae

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In contrast to most birds that undergo sequential wing moult, the simultaneous loss and replacement of all flight feathers amongst Anatidae and other waterbird species (such as grebes and auks) renders them flightless for several weeks and particularly susceptible to predation, a factor likely to favour most rapid progression of moult. To reduce mortality risks, moulting Anatidae often aggregate in areas with low levels of predation risk and/or anthropogenic activity. However, such situations do not necessarily offer adequate food resources and moulting birds have limited capacity to move elsewhere. Moulting Anatidae have been observed to undergo remarkable phenotypic and behavioural changes to cope with their flightless condition. Phenotypic changes associated with the simultaneous moult of remiges include fat and body mass loss, increased rate of metabolism and modification of muscular architecture as well as major morphological changes to organs and the digestive system. However, the degree of plasticity seems dependent upon habitat, the need for ease of escape from predators and the extent to which food resources can fulfill energetic and nutritional requirements for the re-growth of flight feathers. We are only just beginning to understand the evolutionary significance of contrasting moult strategies amongst the Anatidae, but this analysis will present some cross-species comparisons to attempt to better understand their remarkable diversity.



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How does the timing and duration of molt vary with latitude?

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In many bird species, latitude affects the timing and duration of breeding and other events in the annual cycle. Within species, breeding typically begins later in the year at higher latitudes. This may constrain the time available for post-breeding events, particularly molt in those species that molt in their breeding area. How does the timing and duration of molt vary with latitude? It is generally believed that birds molt more rapidly at higher latitudes, but empirical data are scarce. We analysed over 8000 BTO molt records for blackbirds (*Turdus merula*) from the British Isles, possibly the greatest number of records in existence for one species. Females started to molt later than males, but molted more rapidly. Within each sex, birds at higher latitudes started to molt later, but molted more rapidly, and finished molt earlier than lower latitude birds. The mid-point of molt occurred at the same time at all latitudes. To investigate the control of molt at different latitudes, captive birds were held under photoperiodic regimes that simulated different latitudes: starlings (*Sturnus vulgaris*) 9°N and 52°N and siskins (*Carduelis spinus*) 40°N, 55°N and 70°N. Within each species, molt occurred at the same time and rate irrespective of simulated latitude. In siskins there was a wide spread in molt start dates and molt duration was less in birds that started to molt later. This combination of field and experimental data provide a clearer explanation of how breeding activity and the annual cycle in photoperiod act in concert to control the timing and duration of molt.



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Heat stress in the cold? Energetics and thermoregulation in moulting king penguin (*Aptenodytes patagonicus*) chicks

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Moult is thought to be energetically demanding for two reasons: first, for synthesis of new feather material, and second, for an impaired insulation causing increased heat loss and thereby extra (compensatory) thermoregulatory heat production requirements. Cost for thermoregulation will depend largely on the specific mode of moult and, furthermore, may be particularly relevant for species inhabiting cool, rainy and windy environments. Moult is especially intense in penguins, because the complete plumage is changed relatively rapid (ca. 1 month). We have quantified both energetic and thermoregulatory responses to moult in free-living king penguin chicks on Possession Island (Crozet Archipelago) by measuring heart rate (as an index of energy expenditure) and various body temperatures from body core to periphery. Daily mean and minimum heart rate increased steadily since onset of moult and reached average values at the most intensive moult stage two to three times higher than before moult. At the same time, core body temperature increased by two degree Celsius. Subcutaneous temperature, which was well below core temperature before moult, reached core levels during moult, reflecting improved blood perfusion to the skin and increased heat loss. The fact that core temperature is increased during moult despite increased heat loss implies that heat produced in the process of feather synthesis is more than sufficient to substitute any loss incurred by impaired insulation. In fact, these results suggest that moulting king penguin chicks may face costs from heat stress rather than cold-induced thermoregulatory costs.



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Food specialization and moult adaptations in annual cycles in cardueline finches (Fringillidae, Carduelinae)

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The subfamily Carduelinae is remarkable for a wide scope of variability in the extent of specialization on eating seeds: from high specialization limited on consumption of seeds of one plant all year, to using wide range of food with well pronounced seasonal preference not only in the certain annual cycle periods, but also for raising different broods in the same breeding season. Field investigations and experimental study of photoperiodic control of seasonal events have shown that it is precisely the food specialization plays an important part in transformations of annual cycles and development of different strategies of moult. Unpredictable crop and features of bearing of the main food plants lead to development of unique features of annual cycles in some species such as: breeding and moult overlap; prolongation or recrudescence of sexual activity in moulting birds in response to high seed crop in late summer or early autumn; two stages of postjuvenile and post-breeding moult divided by periods of migratory activity; high intraspecific variability of the extent of postjuvenile moult (from complete inhibition of this event to “sectoral” or even complete moult); moult and migration overlap. The comprehensive analysis of the features of moult allowed to reveal common and species-specific regularities and ways of evolution of this seasonal event in the subfamily as whole, as well as to explain its “atypical position” in the annual cycle in certain species. In despite of high importance of plumage renewal for birds, moult is the most flexible seasonal event of the annual cycle. Precisely owing to this event, maximum realization of breeding potential is provided under conditions of high variability of food resources in time and space.



Campos do Jordão 2010 25th International Ornithological Congress 22-28 August 2010 (www.i-o-c.org)

S44 Novel ecological mechanisms in individual and population ecology

Convenor: Bettina Mahler, Argentina

There is more to it than meets the eye – melanin-based colouration has temperature-dependent effects on breeding performance in the pied flycatcher

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Variation in melanin-based colouration is often associated with differences in temperature-related physiology and behaviour. This may maintain variation in plumage colouration if success of different phenotypes varies with different environmental conditions and creates fluctuating selection. Male plumage colouration of the pied flycatcher (*Ficedula hypoleuca*) varies from completely brown to black. We used 25-year data set to examine whether different male phenotypes are adapted to breed in different environmental conditions. The effects of temperature on the relative success of different male phenotypes varied between different phases of breeding. In cold weather conditions females that had paired with black males laid larger clutches than females paired with brown males and the survival of nestlings of black males was dramatically lower than in brown males. Our results indicate that melanin-based colouration is associated with temperature-dependent breeding performance and that variable weather conditions may thus maintain variation in phenotypic characters of male pied flycatchers. Climate change may alter colour frequencies in this species, but as the effects between different phases of breeding are variable, the effects may compensate for each other or be additional. On the other hand wide variation in plumage colouration and correlated life-history traits may enhance possibilities to adapt to changing conditions.



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Evolution and mechanics of feather-generated courtship display sounds of some bee hummingbirds

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In addition to vocalizations, birds produce communicative sounds using non-vocal mechanisms such as with the wings or tail. The mechanics of these sounds are poorly understood, and their potential contributions to acoustic and behavioural diversity are perhaps under-appreciated. In the field, we used high-speed video and sound recordings to obtain the kinematics and acoustics of the courtship displays of some 'bee' hummingbirds. Moreover, we tested the ability of the tail-feathers to generate sounds matching the display sounds, using a wind tunnel. We present the results of this comparative analysis, to show how feather-generated sounds vary with feather size and shape across the bee hummingbird phylogeny. Implications for the behavioural aeroacoustics and flight of all birds will be discussed.



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β -keratinolytic bacteria in the plumage of the bare-eyed thrush and inhibitory effect of its preen gland oil on bacterial growth

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We studied the diversity of β -keratinolytic bacteria from the plumage of bare-eyed thrushes (*Turdus nudigenis*), and the inhibitory effect of its preen gland oil on bacterial growth. We isolated and identified 18 bacterial strains from 40 thrushes in Venezuela. Of these, only *Bacillus cereus* was capable of fully degrading thrush feather fragments in 14 days. *Hafnia alvei*, *Enterobacter cloacae* and *Klebsiella oxytoca* fragmented feathers but did not fully degrade them in the same time period. To test for inhibitory effects of the thrushes' preen oil on those four bacterial strains, we exposed an inoculum (1:10,000) of each strain to a spread line of thrush oil on feather medium. We found that growth was inhibited in all strains except *K. oxytoca*. Nonetheless, bacterial growth was not inhibited when culturing strains in an aqueous feather medium to which preen oil had been added. These results suggest that the inhibitory effect of the oil was not of a chemical nature (bacteriostatic). In a final experiment we removed, by means of solvents, the preen oil of naturally spread thrush feather and compared the possible degrading effect of *B. cereus* against non manipulated controls and controls to which we had removed the oil and re-applied it manually. *B. cereus* degraded oil-free fragments faster. We conclude that the preen oil of bare-eyed thrushes has an inhibitory effect on growth of feather degrading bacteria naturally present in its plumage, and propose that this effect is due to its action as a physical barrier rather than to bacteriostatic properties.



Increased plumage darkness of shiny cowbird females in the subtropics: an adaptation to bacterial degradation?

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The shiny cowbird (*Molothrus bonariensis*) is a sexually dichromatic species, in which males are black blue iridescent and females are dull brown. However, in some subtropical areas of its distribution females show a plumage polymorphism that ranges from dull brown to dark brown and black. Plumage melanization has been shown to protect feathers from bacterial degradation, decreasing the effects of harmful bacterial activity and thus plumage damage. In this study, we tested whether bacterial feather-degrading activity is acting as the selective force to increase darkness in female shiny cowbird's plumage. First, we compared differences in feather-degrading activity among bacterial strains isolated from subtropical (more humid) and temperate (less humid) zones where dark females are present and absent, respectively. Second, we studied the degradation of female feathers belonging to different color morphs when exposed to *Bacillus licheniformis* and to bacterial strains isolated from subtropical and temperate zones. We did not find differences in bacterial activity between locations or differences in susceptibility to bacterial degradation between female's brown feathers and female's darker feathers. These results suggest that female plumage polymorphism in shiny cowbirds did not arise as a defense to bacterial feather-degrading activity but has probably been driven by a different selective force.



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Blackness of feathers reflects individual quality and oxidative insults: an experiment with greenfinches

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Eumelanin-based black pigmentation increases feather stiffness and resistance to abrasion and bacterial and ectoparasite-induced degradation. In wild-caught captive greenfinches (*Carduelis chloris*), the darkness of black tips of tail feathers appears a condition-dependent trait, as the feathers of older birds were darker than those of yearlings. Birds with originally darker black feathers also retained higher body mass in captivity and developed lower intensity of intestinal coccidiosis than the birds with lighter black feather tips. Because melanogenesis is affected by an important intracellular antioxidant, glutathione (GSH), we asked whether the manipulation of this antioxidant levels can reveal the mechanism responsible for honesty of melanin-based ornaments. We injected greenfinches with an inhibitor of GSH synthesis, BSO. After treatment, experimental birds had 40 % lower levels of GSH in erythrocytes than sham-injected control birds. Inhibition of GSH synthesis also caused oxidative damage as judged by the 12 % higher levels of malondialdehyde (an end-product of lipid peroxidation) in plasma of experimental birds after treatment. During the experiment, birds whose GSH levels were reduced grew tail feathers with 18 % darker black tips than control birds, corroborating that development of eumelanin coloration requires low GSH levels. Because reducing GSH synthesis increased oxidative damage, darkness of black feathers can honestly signal individual quality by advertising an ability to cope with oxidative stress.



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S45 New views on the production and behavioural action of steroids in the avian brain

Convenors: Jacques Balthazart, Belgium; Gregory F. Ball, USA

Local steroid synthesis in the avian brain: rapid regulation by social cues

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When measuring steroids, researchers have traditionally focused on circulating steroid levels, as estimated by plasma samples. Circulating steroid hormones can be locally metabolized within the avian brain to either more active or less active signaling molecules. Also, the avian brain can synthesize sex steroids, such as androgens and estrogens, de novo from cholesterol or from inactive precursors in the blood (“neurosteroids”). Thus, steroid levels in the blood and brain can differ dramatically. In birds, local steroid synthesis has been implicated in the control of territorial behavior, vocal communication, and neural plasticity. Recent data indicate that aggressive interactions rapidly increase androgen synthesis in the brain of non-breeding male song sparrows (*Melospiza melodia*). In contrast, aggressive interactions do not affect circulating androgen levels in the non-breeding season. These data suggest that the “Challenge Hypothesis” operates at a local level for much of the annual cycle.



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Rapid changes in brain estrogen production acutely modulate male sexual behavior

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Estrogens influence physiological and behavioral processes through their binding to nuclear receptors that act as transcription factors to produce slow and long lasting effects. Along with these genomic effects, estrogens also produce rapid and short-lived actions through an interaction with the cell membrane. While the existence of non-genomic actions has been extensively demonstrated at the cellular level of investigation, little attention had been accorded to the functional significance of these effects. In vitro studies revealed that testosterone aromatization into an estrogen can change rapidly in the medial preoptic area, a region involved in the control of male sexual behavior, suggesting that this behavior could be acutely regulated by locally produced steroids. Pharmacological investigations indicate that the injections of estradiol rapidly and transiently stimulate male sexual behavior in quail or mice expressing a low level of copulatory behavior, while the blockade of estrogen synthesis rapidly reduces the expression of this behavior in males fully expressing the behavior. Finally, brain aromatase activity also appears to change rapidly following sexual interactions. These recent data thus provide an example of functional significance for both the rapid effects of estrogens and the rapid modulation of its production in the brain.



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Buttons and glue: constitutive and inducible estrogen provision in the passerine brain

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Steroids such as estrogens are provided to the homeotherm brain via peripheral synthesis and vascular distribution (endocrine), and by neuronal synthesis in discrete brain regions (paracrine and autocrine). These modes of delivery underlie the considerable influence of estrogens on neural structure and function. We have recently described the presence of aromatase (estrogen-synthase) in presynaptic boutons of the zebra finch (*Taeniopygia guttata*) forebrain. Importantly, some estrogen-sensitive brain areas contain abundant presynaptic, but extremely low or undetectable somal aromatase expression. Thus, discrete synaptic targets may be provided with high levels of estrogen in relative exclusion from adjacent cells and perhaps neighbouring areas of the same cell (synaptocrine). These findings suggest that more areas of the avian brain may be provided with locally synthesized steroid than previously appreciated. We have also discovered that areas devoid of neuronal aromatase expression can be induced to express this enzyme in astroglia following mechanical damage or neuroinflammation. Glial aromatase is inducible in the undamaged brain in response to an inflammatory challenge and in the absence of detectable apoptotic cell death. Surprisingly, we have yet to find a brain area in the zebra finch that does not express constitutive or inducible aromatase. Indeed, through a variation of cell type, ultrastructural compartment, and inductive signals, we are beginning to entertain the hypothesis that in the songbird, perhaps any and every brain area is capable of estrogen synthesis. These findings underscore the pluripotent influence of local and targeted steroid provision on passerine neuroanatomy and neurophysiology.



Cellular mechanisms mediating rapid changes in brain aromatase activity

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Aromatase activity (AA) is rapidly modulated following sexual interactions in the hypothalamus-preoptic area of male Japanese quail in a manner that is not compatible with changes in enzymatic concentration. There are also discrepancies between measures of AA and the concentration of the corresponding mRNA and protein in various physiological situations suggesting the existence of post-translational regulation of the enzymatic activity. Conditions promoting protein phosphorylation (presence of high but physiological concentrations of Ca²⁺, Mg²⁺ and ATP) inhibit AA within min and this effect is blocked by kinase inhibitors, indicating that it is mediated by phosphorylation of one protein, presumably aromatase itself. Similarly, in hypothalamic explants maintained *in vitro*, depolarization (addition of KCl) or addition of compounds affecting intracellular Ca²⁺ concentration or of glutamatergic agonists rapidly and reversibly inhibit AA. These rapid modulations in enzymatic activity are not limited to the hypothalamic quail tissue. AA is rapidly down-regulated by phosphorylating conditions in quail ovary homogenates. To further analyze the mechanisms underlying these rapid controls of AA, we expressed human or quail aromatase in the HEK293 human kidney or in Neuro2a rat neuroblastoma cells. The enzyme displays normal kinetic characteristics (e.g., Michaelis-Menten constant, $K_m = 9.5$ nM) and AA in HEK293 was rapidly and reversibly inhibited following depolarization of intact cells with 100 mM KCl. It was also inhibited in cell lysates exposed to phosphorylating conditions. We are currently investigating the contribution of single amino acid residues of the aromatase protein to this enzymatic control. Putative phosphorylation sites in the enzyme sequence have been modified (replacement of Serine or Threonine by Alanine) by site-directed mutagenesis and we analyze their contribution to the basal AA and to rapid changes in this activity.



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Brain-generated estrogen regulates the auditory coding of songs

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Estradiol (E2) impacts an array of brain functions including reproductive behavior and learning. More recently, accumulating evidence suggests that E2 may impact auditory physiology. We directly tested this possibility in a series of studies carried out in the songbird caudomedial nidopallium (NCM), an auditory forebrain area with selective responses to conspecific songs. To test the impact of E2 in the physiology of NCM, we combined bilateral multi-electrode recordings and local pharmacological manipulations in awake birds. We found that infusions of E2 in NCM instantaneously increased song-evoked discharge rates of single units in a dose-dependent manner. In contrast, local blockade of estrogen receptors (ERs), or inhibition of aromatase, markedly suppressed hearing-driven firing rates in a dose-response manner. These data indicate that locally-generated E2 increases hearing-regulated neural activity in NCM. To test how E2 increases these neural responses, we carried out patch-clamp recordings in an NCM slice preparation. We found that E2 decreased mIPSC frequency, and blockade of ERs and inhibition of aromatase increased the frequency of these events. These manipulations neither affected mIPSC amplitude, nor any parameters of mEPSCs, suggesting that E2 modulates neuronal excitability in NCM by suppressing local inhibition via a pre-synaptic mechanism. To determine the functional relevance of E2s modulation of NCMs physiology we used a decoding method and computed mutual information rates to establish how manipulations directed at E2 actions in NCM neurons influence the effectiveness of the neural coding of songs in awake birds. We found that brain-generated E2 increased the information that NCM neurons carry about stimulus structure to facilitate the neural discrimination of songs. Consequently, E2 enhanced the effectiveness of the neural coding in NCM. Overall our results provide the first direct demonstration that brain-generated E2 modulates auditory processing in real-time by enhancing neuronal gain and auditory coding efficiency, via a non-genomic action of this hormone in a classic neurotransmitter system.



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S46 Biological clocks in birds: from behaviour to molecules

Convenors: Vinod Kumar, India; Vincent Cassone, USA

Molecular physiology of Avian circadian and photoperiodic clocks

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The avian circadian clock is a multi-oscillatory system composed of oscillators and photoreceptors in the retina, pineal gland and hypothalamus. The complex interactions among these components are critical for temporal integration of daily and seasonal events. Recent work on the molecular biology of circadian clocks has raised questions about the systems level integration of biological clocks. This paper will reconcile molecular responses to pineal melatonin on a circadian and photoperiodic basis. The prevailing data in vivo and in vitro suggest that the molecular clockworks underlying rhythmicity are only loosely coupled to physiological outputs of this system. For example, while pinealectomy and exogenous melatonin has relatively little immediate effect on clock gene expression, repeated melatonin administration eventually entrains clock gene rhythms. The picture that emerges is that melatonin, through its membrane bound receptors and cytoplasmic second messenger systems, interacts at the transcriptional level with the expression of some, but not all of the canonical clock genes. At another level, while it is clear that pineal melatonin does not influence gonadal cycles in songbirds, new results from our laboratory clearly show a role for the pineal gland in daily and seasonal control of song. Supported by NIH P01 NS39546.



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Novel molecular mechanisms underlying diurnal locomotor rhythms in birds: coordination of melatonin with 7alpha-hydroxypregnenolone, a newly discovered avian neurosteroid

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Melatonin regulates diurnal changes in locomotor activity in vertebrates including birds, but the molecular mechanism for this neurohormonal regulation of behavior is poorly understood. Our recent studies have demonstrated that 7alpha-hydroxypregnenolone, a previously undescribed avian neurosteroid, mediates melatonin action on diurnal locomotor rhythms in quail. We first identified 7alpha-hydroxypregnenolone as a novel avian neurosteroid in quail brain. We then found that 7alpha-hydroxypregnenolone acutely increased quail locomotor activity. Subsequently, we characterized diurnal changes in 7alpha-hydroxypregnenolone synthesis and locomotor activity in quail. 7Alpha-hydroxypregnenolone synthesis and locomotor activity in males were much higher than those in females. Only males exhibited marked diurnal changes in 7alpha-hydroxypregnenolone synthesis, and these changes occurred in parallel with changes in locomotor activity. Finally, we identified melatonin as a key component of the mechanism regulating 7alpha-hydroxypregnenolone synthesis. Increased synthesis of 7alpha-hydroxypregnenolone occurred in males *in vivo* after melatonin removal via pinealectomy and orbital enucleation (Px plus Ex). Conversely, decreased synthesis of this neurosteroid occurred after melatonin administration to Px plus Ex males. Taken together, melatonin appears to regulate synthesis of 7alpha-hydroxypregnenolone, a key factor for induction of locomotor activity, thus inducing diurnal locomotor changes in male birds.



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Role of food availability in regulation of daily and seasonal responses in birds

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Periodic geophysical environment changes are linked with the availability of food. We, therefore, have been interested in understanding the role of food availability in regulation of daily and seasonal responses in the non-migrant Indian weaver bird (*Ploceus philippinus*) and Palaearctic-Indian migrant buntings (*Emberiza melanocephala* and *Emberiza bruniceps*). We have found that the timing and duration of food availability influences seasonal gain in body mass, rate and magnitude of gonadal growth and pattern of molt in birds exposed to a variety of experimental conditions. We have also shown that the food supply shorter than optimally required during a life history stage can have consequential effects on the succeeding life history stages. The food availability influences the synchronization of daily activity including Zugunruhe (migratory restlessness) in migratory birds. The timing of the food supply drives the pattern of daily locomotion to the extent that day active Indian weaver bird becomes "night active" if the food was available only during the night. However, the light masks zeitgeber effects of food when they are present together, and the pineal clock which is involved in regulation of daily activity pattern is not directly involved in the food induced synchronization. * Supported by DST-IRHPA Center for Excellence grant.



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When the light is never turned off: diversity of daily activity patterns in Arctic breeding birds

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Birds time their daily activities through an endogenous clock that is synchronized by the light-dark cycle. However, in polar environments the strength of this Zeitgeber is greatly reduced during summer and winter. In summer the sun never sets, so that only small diel changes in light intensity, polarization patterns and sun azimuth can be detected. How do birds keep time under such weak environmental rhythmicity? We studied daily activity patterns in free-living populations of three shorebirds and a songbird using an automated radio-telemetry system. First, we identified arrhythmic activity patterns in the polygynous pectoral sandpiper *Calidris melanotos* and in the polyandrous red phalarope *Phalaropus fulicarius*. In these species, mating is highly competitive, and the competing sex was continuously active for a period that could last as long as two weeks. Second, we found a free-running rhythm in both sexes of the socially monogamous semipalmated sandpiper *Calidris pusilla* during incubation. Finally, in the Lapland longspur *Calcarius lapponicus* we found a robust circadian rhythm with a long day and a short night. Our study highlights the diversity of daily activity patterns in arctic-breeding birds and emphasizes the plasticity of the circadian system and the importance of the social context. Our results suggest that birds breeding in the high arctic adopt daily timing strategies that reflect selective pressures related to competition for mates and optimal foraging times.



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Circadian organization in arctic-breeding songbirds

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Polar environments are defined by extreme annual variation in photoperiod, resulting in the sun remaining above or below the horizon during the majority of the summer and winter, respectively. Year-round arctic residents, such as svalbard ptarmigan (*Lagopus mutus hyperboreus*), cope with these conditions by becoming behaviorally arrhythmic. In contrast, songbirds that migrate to the Arctic to breed exhibit daily rhythms of activity despite the lack of a light/dark cycle that is encountered on their wintering grounds. It is hypothesized that synchronization of rhythms occurs through increasing the range of entrainment to low-amplitude *zeitgebers*, such as small diel changes in light intensity or the spectral quality of sunlight (color temperature). We examined if these environmental cues have the capacity to synchronize activity rhythms and clock gene expression in the Lapland longspur (*Calcarius lapponicus*). At Barrow, Alaska (71 degrees N), timing of activity offsets in free-living longspurs was correlated with declines in light intensity and color temperature. In captivity, birds exhibited free-running activity rhythms in constant bright light (1300 lux) or dim light (0.1 lux) and failed to entrain rhythms to daily changes in light intensity or color temperature. We have cloned the *pPer2* timekeeping gene in this species and are examining spatial and temporal variation of clock gene expression in the hypothalamus in relation to activity rhythms. Alternative *zeitgebers* that might synchronize rhythms, as well as the ecological factors that likely promote circadian rhythmicity, are considered.



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S47 Physiological control of phenotype: insights from the tropics and Southern Hemisphere birds

Convenors: Katherine L. Buchanan, Australia; Michaela Hau, Germany

Hormonal and non-hormonal control of a Tropical phenotype: case study of a Neotropical manakin

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Sexual selection can be especially intense in tropical species leading to conspicuous sex and species differences in anatomy, morphology and behavior. The proximate mechanisms producing these phenotypes are largely unknown but it is likely that they develop under both endocrine and genetic influences. To better understand processes producing “tropical” phenotypes, we investigate the golden-collared manakin (*Manacus vitellinus*) of Panama. Compared to females and young males, adult males possess a brightly-colored plumage and they perform an athletic and energetically costly courtship display. Manipulations of gonadal sex steroids have no effect on the development of the adult male plumage suggesting that this trait is under direct genetic control, presumably the developmental expression of sex-chromosome specific genes in feather follicles. By contrast, sex steroids exert significant control over expression of male courtship behavior and do so by impacting multiple androgen-dependent neuromuscular systems. Testosterone (T) stimulates courtship in non-breeding males and androgen receptors (AR) are expressed at unusually high levels in the manakin brain, spinal cord, syrinx and, notably, in many skeletal muscles and heart. AR expression in these tissues is greater than levels present in similar species with minimal courtship displays. The evolution of widespread skeletal and cardiac muscle androgen-sensitivity likely enables T to enhance muscle size and physiology required for physically intense courtship. Moreover, given the overall mass of this AR-dependent musculature, the “costs” of T are likely greater in manakins compared to birds with minimal courtship displays. Our data suggests that the remarkable phenotypes of other tropical birds probably depend on unique patterns of tissue gene expression that includes heightened tissue sensitivity to hormonal signals. Supported by NSF IBN 0646459.



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Physiological bases of life history variation in birds: lessons from Australian avifauna

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Substantial progress has been made in identifying physiological attributes associated with differences in life history components between avian species (e.g., slow versus fast pace of life; seasonal versus flexible breeding schedules; extent of partitioning between breeding and moult) as well as within species (e.g., maternal effects on offspring gender, behavioural characteristics, physical quality). The distinct range of climatic zones within Australia and its mix of highly endemic and recently introduced bird species affords the opportunity to critically examine predictions based mainly on studies in new world tropics and north temperate locations. Outcomes emerging from recent Australian studies show that: a) old-endemic species with reduced fecundity do not show reduced metabolic rates; b) the apparent cost of moult in species displaying moult/breeding overlap is indistinguishable from species partitioning these life stages; c) interspecific differences in life span are not always consistent with the oxidative stress theory of aging; d) one species with conspicuous differences in colour morphology has correspondingly distinct behavioural and physiological traits that reinforce maintenance of these morphs in sympatric populations. Progress on Australian life history research will be summarised and future directions explored.



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The role of testosterone in an equatorial bird, the rufous-collared sparrow (*Zonotrichia capensis*)

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Our understanding of the role of testosterone in birds has dramatically increased in the past few decades. From the hormone's role in mediating aggression, to growth of the song control system, we probably know more about testosterone than any other hormone. However, almost everything we know is from studies on mid- to high latitude species. While these studies have been informative, the resulting conclusions may not be representative of the majority of species. The majority of bird species are tropical and thus face very different challenges and display more varied life histories than species from higher latitudes. For the past decade, I have studied the behavioral role of testosterone in an equatorial population of the rufous-collared sparrow, *Zonotrichia capensis*. In high elevation population, breeding is seasonal and occurs during an extended period of 3-4 months. In contrast to many tropical birds, testosterone levels in males are high during the breeding season with levels comparable to high latitude species. However, territorial aggression is not associated with increases in testosterone levels as predicted by the challenge hypothesis. In addition, blocking testosterone's actions does not result in a decrease in aggression. In contrast to the lack of a behavioral effect of testosterone on aggression, the hormone has a strong effect suppressing male paternal behavior. Thus testosterone's behavioral role in this equatorial bird contradicts much of what we understand about the hormone based on studies of high latitude species. Future studies of this species and other tropical birds will continue to elucidate and expand our understanding of the behavioral role of testosterone in birds.



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Social status shapes phenotype in a tropical passerine bird: experimental evidence and proximate mechanisms

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Social status determines phenotype in a range of organisms, but this linkage has not yet been experimentally established in birds. We used a removal experiment to demonstrate that social status shapes phenotype in the red-backed fairy-wren (*Malurus melanocephalus*). In this cooperatively breeding Australian passerine, males exhibit three distinct types that differ in morphology and behavior: red/black breeders, brown breeders, and brown helpers. Brown breeders are phenotypically distinguished from brown helpers by the presence of larger cloacal protuberances (sperm storage organs) and darker bills. We experimentally created breeding positions for brown helper males by removing red/black breeding males from their social groups, thereby inducing a shift in status from brown helper to brown breeder among the replacement males. Relative to controls, replacement males exhibited a rapid and pronounced increase in cloacal protuberance volume and bill darkness after this switch, and limited production of red/black plumage. Replacement males also exhibited significantly higher post-removal androgen levels, which in turn are known to affect bill darkness, plumage color and cloacal protuberance volume in this species. These findings support the hypothesis that an individual's social status influences hormone-dependent morphological characters, and alterations of status can lead to rapid changes in these characters.



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Evolutionary physiology of reproductive seasonality: comparative studies in tropical birds

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Research on tropical bird species has been instrumental in documenting the degree of variation in reproductive seasonality among avian taxa. Using physiological approaches to understand the timing of breeding in tropical birds have been particularly useful to reveal the degree of interspecific variation in the proximate mechanisms responsible for regulating such a complex phenotypic trait. In this presentation I will argue that comparative studies that include tropical species can help us resolve four major questions about the evolution of the physiological processes that regulate timing of breeding: How is reproductive seasonality adapted to different environments? What are the selection pressures that shape reproductive seasonality? Where in the complex physiological system that regulates reproductive seasonality do we find interspecific variation, and which parts have remained conserved? How fast can complex physiological systems evolve? I will present an overview of existing data relevant to answering these four questions, drawing on examples from a variety of tropical passerines from the South American, African, and Australian tropics, as well as from selected temperate zone species. I will combine a synthesis of existing data with conceptual considerations of how physiological traits and their reaction norms may evolve. Finally I will outline areas in which we lack sufficient data to understand the evolutionary physiology of timing of breeding. I will emphasize that future studies should continue to include tropical bird species in comparative studies as tool to increase our understanding of micro-evolutionary processes in reproductive seasonality.



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S48 Linking individual variation, demography and population dynamics

Convenors: Steven R. Beissinger, USA; Ken Norris, UK

Linking individual variation, demography and population dynamics: Identifying causes of skewed OSRs and population feedbacks through Infanticide

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Population dynamics arise from underlying demographic processes, which themselves are influenced by differences among individuals filtered through the lens of environmental variation. While stochastic annual variation in demographic rates has assumed an important role in modeling population dynamics, the role of individual variation is often neglected. Individual variation in demography results from social systems, which are both a cause and a consequence of demography. I examine the links and feedbacks between social system, demography and population dynamics in green-rumped parrotlets, and how these processes lead to strongly male-biased operational sex ratio (OSR) and infanticide. In Venezuela, up to half the parrotlet males and 20% of the females do not nest annually. Social status greatly affects both survival, as breeders survive at a 20% higher rate than nonbreeders, and reproductive success, as EPFs by nonbreeders are few. We present a framework to decompose the roles of different life-history traits on OSR using perturbation analyses of two-sex matrix population models. Female local juvenile survival contributed the most to the male-biased OSR, likely due to a higher dispersal rate, indicating that a sex difference in philopatry has a stronger influence on OSR than a sexual difference in the cost of reproduction. Infanticide occurred frequently and in several contexts: when a mate dies, when another pair takes over a nest site, and in the absence of either situation. Infanticide occurs more frequently at highly productive nest sites and often causes pairs to abandon nest sites, offering the opportunity for nonbreeding pairs to become breeders. Infanticide rate is density dependent, indicating a population feedback loop.



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The population dynamics of threatened species - field laboratories in environmental change

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Population studies on threatened species can provide incredibly detailed insights into the link between individual traits and population dynamics. Here, long-term data on the Seychelles magpie robin (SMR) and Mauritius kestrel (MK) are used to describe variation in the behavioural and life history traits of individuals, explore the factors shaping this variation and assess the implications of individual variation for population dynamics. In SMRs, intense social conflict for breeding opportunities has a detrimental impact on population-level demography, and models show that social conflict has significantly delayed population recovery. In MKs, variation in life histories was induced by egg harvesting for captive breeding, leading to short-term demographic costs but longer-term demographic compensation. Models show that this compensation buffered population growth against the demographic costs of harvesting. More recent work on MKs has revealed variation between individuals in phenotypic plasticity with respect to breeding phenology in relation to rainfall, but there are limits to this plastic response. This variation is environmental induced. Climate change has altered rainfall patterns, delaying breeding. Limits to phenotypic plasticity have important implications for the population dynamic consequences of climate change. These studies reveal a rich array of mechanisms linking individual variation to population dynamic consequences, and show that population dynamic studies must consider the implications of individual variation if we wish to understand the impact of environmental change on populations.



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Ecological constraints predict individual variation in extra-pair offspring in socially monogamous birds and sex differences in fitness variances

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Selection and stochasticity (demographic and social) affect (1) individual encounters with potential mates e , (2) individual survival probabilities s , (3) individual re-mating latencies l , (4) population size n , and (5) the distribution of fitness w . In turn e , s , l , n , and w are sufficient to predict within-individual variation in reproductive decisions beginning with whom to accept or reject as mates as well as the distribution of multiply-mating males and females, and sex differences in fitness variances. Previously, we proved the switchpoint theorem, SPT (Gowaty & Hubbell 2009 *Proceedings of the National Academy of Sciences* 106, Supplement 1: 10017-10024) that says that individuals trade time available for reproduction off against fitness, and adjust their reproductive decisions flexibly and adaptively. Here we apply the SPT to predict extra-pair offspring among individuals of socially monogamous birds. We demonstrate a method for partitioning fitness variances into components due to stochasticity and selection. We use long-term field data on e , s , and l from populations of eastern bluebirds *Sialia sialis* and northern bobwhite *Colinus virginianus* to predict within-sex fitness variances and within-populations patterns of extra-pair matings. (2) We use microsatellite data to describe individual variation in genetic parentage and calculate observed fitness variances for females and males. Finally (3) we compare observed fitness variances with those predicted from the SPT to evaluate which sex in each species is under stronger sexual selection.



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Social networks as a tool for demographic analyses

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Social network approaches provide a framework for assessing multi-player and indirect interactions. Network analysis yields quantitative metrics (e.g., degree, betweenness, information centrality) that one can apply to demographic and life history studies. By quantifying the structural role of individuals, or different classes of individuals, network metrics provide a rigorous basis for distinguishing categories of individuals whose future vital rates (survival or fertility) can be very different. Distinguishing such functionally distinct social roles helps address one of the fundamental problems of demography -- undetected heterogeneity leading to Simpson's paradox. Simpson's paradox arises when the pattern of the whole differs from the "true" pattern in each of the components due to a "mean of means" effect. In the present context, heterogeneity would arise when the vital rates of birds that "matter" differ greatly from vital rates assessed as population means. Demographic consequences example 1: I used network models to show that early network connectivity can affect the likelihood of becoming a potential breeder (displaying male) nearly five years later in lek-mating long-tailed manakins. Example 2: Dispersal is a risky business. In philopatric species, tendency to disperse may depend upon how well-connected an individual is in its natal social network. Social network analyses of cooperative breeders, and even of more conventional breeding-pair territorial species, should therefore enhance our ability to discriminate between types of individuals whose demographic fates (e.g., probability of breeding or survival) may depend strongly on complex social interactions that are readily distilled into quantifiable variation by network models.



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The starvation-predation risk trade-off as a predictor of survival and population dynamics in birds

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The starvation-predation risk trade-off provides a framework to link individual behaviour to demography. By measuring how individual birds trade-off minimising predation risk with minimising starvation risk, through behaviours such as vigilance versus foraging, solitary versus group feeding, choice of safe/unprofitable versus risky/profitable foraging areas, or by minimising versus maximising body reserves, it is possible to predict individual survival and population dynamics. I demonstrate this with three examples of where such trade-offs predict survival: vigilance with grouping behaviour in grey partridges *Perdix perdix*; choice of foraging location in redshank *Tringa totanus*; and choice of foraging group size in redshank. I also demonstrate this with examples of how trade-offs with respect to mass regulation under increasing predation risk and foraging unpredictability predict population trends in 26 common European bird species. Having established the link between behavioural trade-offs and population demography, it should theoretically become possible to use such behavioural measures as indices of the quality of the environment and changes in the environment. I demonstrate this possibility with an empirical example of great tit *Parus major* mass regulation patterns changing as environmental conditions ameliorate through climate change.



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SA01 Behaviour and Behavioural Ecology



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Natal dispersal in the north African houbara bustards: the role of parent's quality and environment

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Natal dispersal in birds is a key life-history trait in both evolutionary and conservation biology. Dispersal distance has been shown to correlate with properties of the individual in response to environment, or with properties of its parents, many of which have a substantial heritability. Such relationships are rarely highlighted as both the phenotypic correlates of dispersal and parental contribution in offspring dispersal behaviour are necessary. In addition it is often difficult to distinguish what is learned from what is inherited. Here, we used 9 years of radio-tracking data from 1400 VHF tagged juvenile houbara bustards (*Chlamydotis undulata*) reared in captivity (no parental care) and released in Morocco to reinforce declining wild populations (Emirates Center for Wildlife Propagation). Of these, 395 individuals were closely monitored for three months after release and 136 until their first breeding attempt. We investigated their propensity to emigrate (i.e. distances to the release site) – an important component of natal dispersal process - during three months after release and their effective natal dispersal (distance to first nest -for female and display site -for male), relative to various environmental factors, individual properties and their parent's quality (204 dams and 191 sires). We found that the propensity to emigrate predicted the future natal dispersal and showed that while some environmental factors (e.g. ambient air temperature) acted on juvenile's emigration, this parameter was also positively related to sires' age and quality (display intensity). Although dam's age and quality (number of eggs produced) did not predict offspring emigration; they affected their bodyweights, which in turn positively stimulated emigration. This study provided new insights on the evolution of natal dispersal in birds. We discussed its consequences on the genetic structure of the populations, and importance in the restoration program of houbara bustard.



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Benefits of purple martin (*Progne subis*) extra-pair mate choice: are extra-pair young more fit than within-pair young?

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Approximately 75% of socially monogamous passerines pursue extrapair mating with the frequency of extrapair paternity varying among and within taxonomic groups. One mechanism of mate choice, the good genes hypothesis, states that mate choice should seek the high-quality males to improve the overall genetic quality of offspring. The purple martin (*Progne subis subis*) is a Neotropical migratory swallow that is a colonial, secondary-cavity nester known to have an extra-pair mating system. To test the good genes hypothesis, we collected nesting data, determined social parentage and blood sampled adults and young for subsequent parentage analysis using microsatellite markers. We then monitored the reproductive success, survival and recruitment of within-pair and extra-pair young over subsequent years. We used Program MARK to model survival for our 2006 and 2007 cohorts. We found that second-year (SY) males have higher rates of cuckoldry than do after-second-year (ASY) males, similar to an earlier study. Of the offspring that had SY social fathers, extra-pair offspring had higher survival rates than within-pair offspring but that this was not the case for offspring with older social fathers. We argue that our data support the good genes hypothesis of mate choice by showing an adaptive advantage to extra-pair mating behaviour.



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Differences in repertoire composition in common nightingales *Luscinia megarhynchos* between first year and older birds – findings from field and laboratory

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Age-dependent changes in the song of oscines are a common feature. Song characteristics reveal a broad spectrum ranging from stereotypy throughout life time to vocal plasticity within or across years. Common nightingales *Luscinia megarhynchos* show profound changes in repertoire size and composition between their first and second breeding season. To investigate mechanisms involved in such differences we compared the song of one year old and older birds of a Berlin nightingale population. We found that certain song types that were frequently sung by older birds did not (or only rarely) occur in the repertoires of one year old birds ('mature' song types). We conducted learning experiments with hand-reared nightingales to address reasons for the lack of 'mature' song types in the repertoires of yearlings. The acquisition success of 'mature' song types was not lower than for tutored control song types (frequently found in both age groups in the wild: 'common' song types). Interestingly, the analysis of song type use revealed that all males sang 'common' song types more often than 'mature' song types. Findings from these laboratory experiments suggest that the lack of certain song types in the repertoires of yearling birds in the field cannot be explained by developmental or motor constraints. Instead, they invite considering more the actual use of song types instead of the potential to use song types. We discuss this outcome in terms of explanations for the avoidance to sing certain song types. In the context of a communication network where signals transfer information about the quality of the sender the performance of younger males may be tuned to avoid a direct comparison with older males.



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Modelling mixed-species bird flocks: the importance of seasonality and prey abundance

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Mixed-species foraging flocks of insectivorous birds occur in forests worldwide. Flock participants might benefit from reduced predation risk, increased foraging efficiency, or both. Given differences in the behaviour of participant species, different species are likely to contribute, and also receive different benefits to and from the group. We modelled the amount of prey consumed by flock participants as a product of time spent foraging and foraging rate. Flock participants in our model were either gleaners (which flush prey, and are poor at detecting predators) or salliers (which benefit from flushed prey, and are good at detecting predators). We modelled vigilance time to arrive at time available for foraging. Foraging rate was modelled as the effect of competition and facilitation (through prey flushing) on search time. Our model predicts that the benefit for a gleaner increases from joining more salliers and fewer gleaners, and the benefit for a sallier increases from joining more gleaners and fewer salliers. Observed mixed-species flocks are therefore optimal for neither gleaners nor salliers, but the foraging efficiency of both can be higher than when not in a flock. Model predictions remain robust to a wide range of parameter values except prey abundance. At low prey abundances, the model predicts a cost to participants; at intermediate prey abundances, certain flock compositions are predicted to be beneficial; at high prey abundances, mixed-species flocks are always predicted to be unstable. Fluctuations in insect populations might explain why flocks occur year-round in some habitats, but only seasonally in others.



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Leap displays of the blue-black grassquit: visual and vocal tradeoffs

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Males of many bird species produce complex communication displays in order to maintain territories and attract mates. During the breeding season, male blue-black grassquits (*Volatinia jacarina*) produce conspicuous “leap displays”, which include both a visual component (the leap) and a vocal component (the call, “tiziú”). We videotaped and audio-recorded leap displays of 10 territorial male grassquits at a field site in Brasília, using a mini-DV digital camcorder and a directional microphone. From these recordings we quantified three display parameters: leap duration, maximum leap height, and call duration. We predicted *a priori* that leap duration would correlate positively with both leap height and call duration, following the reasoning that birds should have more time to leap higher or call longer during extended leaps. We found a generally positive relationship between leap duration and leap height, although the relationship does not appear to be linear. Moreover, contrary to our predictions, the relationship between leap height and call duration was negative, such that birds that leaped only briefly produced calls of the longest duration. This latter result appears to be explained by our observation that visual and vocal components of the display are partly decoupled, such that the call only begins as the bird descends, reaches maximum amplitude as the bird lands, and continues on afterwards.



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Determinants and consequences of brood overlap in the double-brooded barn swallow

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Brood overlap can be an optimal solution to the intra-seasonal trade-off in the allocation of time between successive broods. In line with life-history theory the extent of brood overlap should be adjusted according to the individual costs and benefits of overlapping broods. Phenotypic quality traits can affect these costs and benefits. In barn swallows (*Hirundo rustica*) male tail streamer length is such a phenotypic quality trait, which is related to reproductive decisions, resulting in females mated with long-tailed males showing higher annual output than females mated with short-tailed males. We predict that the extent of brood overlap in barn swallows is positively associated with the food availability in the inter-brood interval, with the number of first-brood survivors, and with the male's tail ornamentation. Using radio-telemetry we assessed the duration of post-fledging care and juvenile survival of 60 first broods, and we quantified brood overlap with unprecedented accuracy. Brood overlap of pairs with highly ornamented males was increased. Furthermore, brood overlap depended on the reproductive value of the previous brood with stronger overlap in larger families. Short duration of post-fledging care, but not brood overlap affected fledgling survival in first broods, whereas short inter-brood interval was associated with high clutch sizes in the second brood. Thus, pairs with long-tailed males managed to increase clutch size and survival of the second brood by an early onset without incurring survival costs in the first brood. This is in line with the hypothesis that brood overlap enforces the differentials in the annual reproductive output between individuals varying in phenotypic quality.



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The effects of food availability on extra-pair paternity and brood sex ratio of a small passerine

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In the UK supplementary feeding of birds is widely promoted by conservation NGOs and the media resulting in US \$390-430 billion being spent annually. The effects of such feeding on mate choice behaviour of woodland birds are unknown. During 2008 and 2009 such effects were investigated in Worcestershire, UK by examining rates of extra-pair paternity and brood sex ratio of a socially monogamous small passerine, the blue tit *Cyanistes caeruleus*. We found that supplementary feeding influenced incidences of extra-pair paternity and brood sex ratio, results that we discuss in relation to a landscape scale. We consider their implications for a wide range of species that are food supplemented by humans. Our results create new concerns about the wholesale feeding of birds, especially with respect to its potential influence on the genetic structure of avian populations.



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Unsuspected sexual dimorphism in the diamond firetail: a case of quality females and choosy males?

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Colour variation is a widespread phenomenon in bird species whose evolution and adaptive function has been hotly debated since Darwin. Age and sex may be signalled by colour, such as with sexual dichromatism. Indeed, dimorphic species have long been the main referential example for studies testing the theory of sexual selection. Most studies have focused on ornamented males and female choice. In contrast, female ornamentation has been largely ignored, in part because it is less common. Many monomorphic birds are brightly coloured and have striking plumage patterns. Here we provide evidence of sex-specific morphological and integumentary differences in the colourful yet apparently monomorphic diamond firetail, *Stagonopleura guttata*. The species has been notoriously difficult to sex in the hand. We found two traits that can be used to sex this largely monomorphic bird: (1) at the onset of the breeding season, males have brighter beaks with higher reflectance, and (2) females have significantly more white flank spots. In both sexes, birds lift their wings to reveal the white flank spots during feeding as well as during social interactions. Here, we examine the behavioural and social context of flank signalling, and found increased signalling under agonistic conditions. Females with more spots win more agonistic interactions. Why do females have more spots than males? Future work will examine carotenoid investment into eggs in relation to female spot number, given that females can access higher quality food with agonistic interactions. In a pilot study looking at male mate choice for female spottiness, we found no effect of female spot number but a male preference for females with higher UV bill reflectance. We discuss these findings in a southern hemisphere context: longevity and unpredictable breeding conditions may select for high quality females and choosy males.



Do top predators protect passerines in boreal forests?

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Nesting in association with predators or aggressive species is an antipredator strategy adopted widely by small birds to reduce the risk of nest predation. Top predators may offer "protection" for small animals breeding in proximity to their nests, due to active defence or hunting of other predators surrounding the nest. Our field experiment aimed to determine if Ural owls (*Strix uralensis*), a large and aggressive boreal species, provide protection to passerines. We placed pied flycatcher (*Ficedula hypoleuca*) nest boxes in Ural owl nest-sites and in currently unoccupied owl sites. In each forest patch we settled treatment and control boxes. Treatment boxes appeared normal during habitat choice but a panel was removed during late incubation revealing an enlarged entrance hole. This novel experimental design allowed us to study Ural owl protection to open cup nesters (simulated by treatment boxes) and cavity nesters (control boxes) compared to control patches. Ural owl protection of passerine nests seems to be determined by the density of voles, the main prey of Ural owls. In boreal forests, voles show a high-amplitude 3-year population cycle with subsequent increasing, decreasing and low population densities. We expect that in years with decreasing and low vole abundance, Ural owls will shift to hunt alternative prey, as small predators, giving thus indirect protection to passerines. In contrast, in years with increasing vole density, Ural owl protection of passerines will decrease due to abundance of the main prey. The effect of vole cycle phase on passerine predation risk and its implication to protective nesting associations has been neglected so far.



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Effects of sex-biased emigration and mortality risk on dispersal success of an endemic forest bird: Implications for fragmented landscapes management

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Animal dispersal is a key process ruling population dynamics. Dispersal affects the habitat connectivity for a species, altering population demography and genetics. This process should be sex-biased for some species and, in fragmented landscapes, the distance between habitat patches may be crucial to dispersal success. Using radiotelemetry and translocation experiments, we assessed if the dispersal behavior of an endemic rainforest bird (*Pyriglena leucoptera*) is affected by inter-patch distances and sex. We analyzed three response variables: emigration impetus, time spent in the release patch before dispersal and completion of inter-patch movement. Results showed that dispersal movements are strongly affected by the inter-patch distance. Increasing distance reduced the probability of emigration and increased the time spent in the patch. Dispersal was sex-biased, since females presented both a higher emigration impetus and a higher efficiency during the inter-patch movements (only males were predated in the matrix). These results suggest that both sex-biased emigration and predation risk in the matrix are important factors to determine the ability of individuals to make connections in the landscape. As a consequence, in highly fragmented landscapes it is expected that the colonization rates of empty patches may decrease, as many patches may be accessible only for females, reducing the species incidence in the landscape. Thus, we suggest that management of highly fragmented landscapes must be addressed by restoration practices aiming the intensification of the species dispersal flux, considering sex-biased movement restrictions.



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Female song preferences in common nightingales (*Luscinia megarhynchos*)

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In birds, it is generally assumed that one of the main functions of male singing is the attraction and stimulation of females. Following the “honest signalling theory”, song should reliably encode information about the quality of a male (e.g., age, motivation to participate in raising offspring, competitive abilities). Additionally, female preferences for “sexy” song patterns may have shaped the structure of acoustic signals by sexual selection. We investigated the song characteristics relevant for female mate choice in common nightingales (*Luscinia megarhynchos*), a species where males possess large song type repertoires and engage in diurnal and nocturnal solo singing bouts and singing interactions among neighbouring males. Some song features in nightingales correlate with quality indicators such as body measures and age. Although it has been assumed that especially the nocturnal song serves mainly to attract females, the song characteristics females use to decide among potential mates remained in the dark hitherto. To identify song features that are of relevance in female mate choice we conducted playback experiments in the field and in the laboratory to test female preferences for different song characteristics. In multiple experimental sessions, we tested the effect of certain song-types/categories and of repertoire delivery on female response patterns. In addition, we tested whether females gain information from male-male singing interactions and base preference decisions on performance roles of males in interactions. Our results suggest that even in a large repertoire species such as the nightingale, females may use multiple song characteristics for mate choice decisions.



Vocal steps and clines - dialectal variation in the song repertoire of the New Zealand grey warbler (*Gerygone igata*) at three spatial scales

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Studies of spatial and temporal change in avian song repertoires have focused mostly on northern hemisphere species, so further investigation of southern hemisphere species is warranted to test concepts derived mostly from their northern counterparts. Addressing this, we examine dialectal patterns of male song in the endemic New Zealand grey warbler (*Gerygone igata*; family Acanthizidae), relating our results to hypotheses advanced to interpret spatial variation in bird song (e.g. acoustic, genetic and social adaptation). We measure relationships between repertoire elements and distance in *G. igata* on 3 spatial scales: (i) macro-geographically across the main islands of New Zealand; (ii) meso-geographically over ca. 600 km² around Wellington city; and (iii) micro-geographically amongst adjacent males in a ca. 250 ha study site at Zealandia (Karori Sanctuary) in Wellington city. We identify the extent of gradual (“clinal”) change in song repertoires within habitat patches and stepped changes between habitat patches and regions. We also assess the extent of temporal change in *G. igata* song by comparing repertoires within the Zealandia study site over a period of seven years. Finally, to assess change and evolutionary trends on a wider geographic scale, we compare songs of *G. igata* with those of other Australasian gerygones, including the endemic and allopatric Chatham Island warbler (*G. albofrontata*), from eastern New Zealand.



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Fitness consequences of individual variation in nest defence in a passerine with biparental care

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Although it has been shown that parents can dynamically adjust parental investment based on offspring need and future reproduction, a large portion of the variance in parental nest defence behaviour remains unexplained. One hypothesis is that variation in parental behaviour is due to differences in personality. We examined the consistency in nest defence aggressiveness over two years (2008 and 2009) in a species with biparental care, the tree swallow (*Tachycineta bicolor*). Using generalized linear mixed effect models with individual as a random effect (83 males, 83 females), we investigated the variation in number of attacks towards a human intruder measured 6-8 times over the course of the breeding season. Number of attacks varied from 0 to 102 over each 5 min. sampling period. Controlling for variation in weather, date, stage of the nest, and number of eggs in the nest, we found high repeatability of nest defence among individuals in both sexes. Surprisingly, we found that male, but not female, aggressiveness was correlated to reproductive success. More aggressive males tended to fledged more young and have heavier chicks with longer tarsus at 9 d of age. There was no difference between sexes in nest defence aggressiveness. Complete nest failure and nestling mortality was significantly higher in 2008 than 2009 and the strength of the relationship between nest defence and reproductive success was stronger in 2008. We suggest that variation in nest defence can be partly explained by consistent differences in personality and that male parental care plays an important role in years with severe weather conditions.



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Social environment influences phallus size in waterfowl

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Genital traits can be under strong sexual selection and the social environment is predicted to influence genital phenotype, particularly if individuals can strategically invest in reproductive traits under different social conditions. We tested the hypothesis that the intromittent phallus in waterfowl plays a role in male-male competition, so that a longer phallus allows males to out-compete other males in overcoming female anatomical barriers to fertilization. We predicted that conditions that increase male-male competition would increase phallus size, or accelerate its growth. We tested this hypothesis experimentally by studying the seasonal growth and peak phallus size in two species of ducks. We divided ruddy ducks (*Oxyura jamaicensis*) and lesser scaup (*Aythya affinis*) into two groups: a high competition group (2 social groups 5-7M: 3-5F), and a no competition group (10 pairs 1M:1F). We found that as predicted phallus size and growth rate were significantly greater in the high competition groups than in the pair treatment, but we also found differences between the two species in the magnitude of the effect depending on age and body size. This is the first vertebrate study where plastic changes in genitalia have ever been reported. Plasticity in waterfowl genitalia can occur because of the seasonal changes that genitalia undergo each year. Genital phenotypic plasticity in waterfowl suggests that males are investing strategically in penis length when competition levels are high.



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Niche separation of African parrots

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Several taxa of African parrots, represented by different origins and colonisations of the continent, are segregated by body mass, and differ markedly in Hutchinsonian ratios. Greatest distributional overlap occurs between the large-bodied species (*Psittacus* and *Poicephalus*) where niche separation equates with forest type, altitude and feeding specialization. Several species of different body mass inhabit specialized habitat types e.g. afro-montane yellowwood forest and semi-arid scrub. All of the small *Poicephalus* parrots are allopatric although four species show partial distributional overlap with the similarly-sized African rose-ringed parakeet (*Psittacula krameri*). In addition, the degree of dietary specialization in the *Poicephalus* species is inversely correlated with body mass. Most *Agapornis* species are also allopatric except for sympatric equatorial red-faced lovebird and swinderns lovebird, which are separated by habitat and diet. Dietary specializations of the African psittacines include feeding primarily on figs, grass seeds or the kernels of yellowwood fruits.



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Behavioral and physiological coping styles in house sparrows

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Animal personalities or coping styles are behavioral tendencies showing individual consistency over time and across different situations. Such individual variation is thought to be adaptive, as bold and shy individuals may be more successful in constant and unpredictable environments, respectively. We explored the existence and adaptive significance of personalities in one of the most common model species of behavioral studies, the house sparrow (*Passer domesticus*). Birds were confronted with novel objects, novel food and predation risk in captive tests that were repeated four weeks later. Sparrows showed significant individual consistency both across different test situations and over time in their behavioral responses to novelty and risk. Moreover, urban birds were less bold in all situations: they spent less time near novel stimuli and approached the feeder later after exposure to predation risk than rural birds. We also explored behavioral variation among free-living sparrows in their natural environment in a novel object test and its relation to their physiological coping style as assessed by their hormonal response to capture-restraint stress. We found individual variation in behavioral responses to novelty, part of which was related to hormonal differences: birds that hovered more in front of the novel object before entering the nestbox mounted lower stress response. Our results demonstrate consistent individual tendencies, interpretable as personalities, in house sparrows both in captivity and in the wild. These tendencies may include not only behavioral but also physiological coping styles, as birds with lower stress response seemed more explorative. Shy or proactive behaviors may be adaptive for urban birds due to the spatial and temporal heterogeneity of their habitats.



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Cohabiting: how a bird responds to a large reptilian room mate?

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An oft cited, classical example of a mutualism between a bird and a reptile is the sharing of a burrow by a seabird, such as the fairy prion (*Pachyptila turtur*), and the tuatara (*Sphenodon punctatus*), a reptile confined to New Zealand. In reality, this relationship involves a delicate balance between a predator and potential prey. Why does a bird share it's home with a predatory reptile and how can it possibly benefit from the association? Associations between individuals of two species may be in a constant state of flux and can range from antagonistic to mutualistic depending on the ecological circumstances. We quantified the effect a resident burrowing reptile, the tuatara, has on the behaviour of a burrowing seabird, the fairy prion, particularly in respect to breeding behaviour. Excessive disturbance of burrow-nesting animals may lead to changes in behaviour, which for nesting seabirds can include desertion or hatching failure. We therefore used an automated detection system to monitor activity in burrows. Time spent in the burrow, changes in incubating shifts and feeding were compared between birds occupying burrows with a resident tuatara, and birds occupying tuatara-free burrows. Our results show that behavioural adaptations by fairy prions in response to tuatara may facilitate co-occurrence in the burrow. Considering the effects non-avian conspecifics have on a bird during different stages of it's breeding season is crucial to understanding the behavioural ecology of the bird.



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Direct cuckoo nestling ejection by hosts: co-evolutionary arms race at nestling stage

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Discrimination of parasite young by hosts and mimicry of host chick have rarely been reported. Here we report the first cases of cuckoo nestling ejection by the hosts of little bronze-cuckoo, *Chrysococcyx minutillus* (LIBC) whose hatchlings bear a strong resemblance to hatchlings of the large billed gerygone, *Gerygone magnirostris* (LG), but not those of the mangrove gerygone, *G. levigaster* (MG). This is a very exciting finding as it can be an effective anti-parasite behaviour by hosts at the nestling stage, if employed before parasite nestling has a chance to evict host young. However, knowledge on breeding biology of Australian gerygones, is scarce but it is important information for understanding the evolution of this behaviour in these *Gerygone* species. Here we report the breeding biology of LG and MG which are the main hosts of the LIBC with notes to nestling ejection.



Host eviction vs. host tolerance by avian brood parasites

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Some brood parasitic birds evict or destroy all host eggs and/or chicks from their adopted nests, while others either don't at all or only do it partially. It has been suggested that for one parasite, the brown-headed cowbird *Molothrus ater*, tolerance of host chicks may be adaptive, since parasite growth rates were steeper in nests where some host offspring remained than in those where the parasite chick was raised alone. In another partial tolerant, the shiny cowbird *M. bonariensis*, growth rates of parasites as a function of number of host's offspring were found to be a function of relative size between parasite and host: additional chicks of smaller host species were beneficial to the parasite while chicks of larger host species were not. We model this on the basis of a tradeoff between two known effects of begging: the induction of a delayed increase in parental provisioning that benefits all brood members, and the increase in the proportion of total provisioning instantaneously captured by the begging chick. We assume that both functions are non-linear, and that the effectiveness of begging in both respects differs between host and parasite chicks as a function of their relative body mass. For some parameter combinations the model predicts that the parasite's maximal intake occurs at either extreme (namely no host left or as many as possible), while for others intake is maximal at intermediate brood sizes. The model formalizes previous verbal arguments and provides a predictive tool to compare dyads of parasite-host species.



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Quantifying landscape connectivity from movement behaviour in a fragmented cloudforest in the Taita Hills, SE Kenya

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Fragmentation of natural habitats, and its consequences, is recognized as one of the most important threats to biodiversity. The cloudforests of the Taita Hills are an example of a highly fragmented Afrotropical forest ecosystem embedded in a human-dominated landscape. The majority of the bird species confined to these forests have been shown to be negatively affected by its fragmentation. Among these species are the endemic Taita Thrush and Taita Apalis, which consequently are listed as critically endangered. Successful emigration and immigration can mitigate the negative effects of habitat fragmentation on the viability of bird populations. This process depends on species' perceptual - and behavioural characteristics and the quality and configuration of the intervening matrix. However, in the study area, the matrix consists predominantly of small-scale agricultural land suspected to impede inter-population movements of forest birds. In a first step to quantify landscape connectivity for forest birds, we translocated 20 individuals of Cabanis's greenbul and white-starred robin into the matrix, and subsequently collected high resolution information on habitat-use and movement behaviour of homing individuals using continuous radio-tracking. Plotted on a high resolution landcover-map, these data are currently used to calculate a measure of habitat preference for individual steps, which will form the basis for further research into the relationship between matrix habitat and forest bird movements. Ultimately, this project aims to model viability of the threatened forest bird populations for different scenarios of reforestation in the Taita Hills, the presented work represents the first step to achieve this goal.



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The relationship between egg size, yolk size, and egg temperature in tree swallows, *Tachycineta bicolor*

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Variation in the size and quality of eggs can have important long-term consequences for the survival of offspring. However, egg size per se is only a coarse predictor of the quality of an egg, as yolk and albumen levels in an egg can vary. Using a non-invasive technique via standardized digital photographs, we measured yolk mass of tree swallows, *Tachycineta bicolor*, in Lancaster, PA. We first tested for what factors explained variation in yolk mass. Earlier-laying females laid small eggs with large yolks, relative to later-laying females, which laid large eggs with small yolks. There was a weak effect of laying order on yolk mass but not on egg mass; eggs laid early in the sequence tended to have larger yolks. We then tested for a relationship between yolk mass and egg temperature. Early-breeding females maintained higher egg temperatures even though ambient temperatures were colder. When controlling for timing of breeding, females incubating eggs with large yolks maintained higher egg temperatures, while larger egg mass was associated with lower egg temperatures. These results suggest that early-breeding tree swallows are better able to secure resources to produce high quality eggs and still maintain high quality developmental conditions. Cross-fostering of eggs is needed to better understand the link between female quality and egg quality.



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Vocal and anatomical evidence for two-voiced sound production in the greater sage-grouse

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Greater sage-grouse, *Centrocercus urophasianus*, have been a model system in studies of sexual selection and lek evolution. Mate choice in this species depends on acoustic displays during courtship, yet we know little about how males produce these sounds. Here we present evidence for previously undescribed two-voiced sound production in the sage-grouse. We detected this 699double whistle700 (DW) using multi-channel audio recordings combined with video recordings of male behavior. All 28 males we examined produced at least one DW during observation. Using recordings from six additional populations throughout the species700 range, we found evidence of DW in all six populations, suggesting that the DW is widespread. To examine possible mechanisms of DW production, we dissected two male and female sage-grouse; the syrinx in both sexes differed noticeably from that of the domestic fowl, and had two sound sources where the bronchi join the syrinx. Additionally, we found males possess a region of pliable rings at the base of the trachea, as well as a prominent syringeal muscle that is much reduced or absent in females. Experiments with a live phonating bird will be necessary to determine how the syrinx functions to produce the whistle and the possibility of single-source biphonation. We conclude that undiscovered morphological and behavioral complexity may exist even in well-studied species.



Conspecific copying in the nest site selection of the collared flycatcher (*Ficedula albicollis*)

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Copying choices of other individuals is likely to be common in nature, but only a few studies have examined this in free-living animals. Thus, the generality of this phenomenon lacks empirical evidence. The major difficulty for field experiments is to find a behavioral choice that is repeatable, measurable, free of innate preference and can be manipulated. We solved this problem by using simulated preference towards arbitrary geometric symbols, manipulating and monitoring the nest-site choices of migratory cavity-nesting collared flycatchers. Arriving birds were faced with a choice between paired nest-boxes (5 m apart) with alternative symbols (triangle or circle) attached around the entrance hole. Each forest patch included 40 box-pairs, some free and some occupied by earlier individuals. One symbol was randomly assigned to be “preferred” on a patch and other females were nesting in boxes with this symbol. Hence, earlier settled birds had seemingly chosen one symbol and rejected the other. Symbol choices of arriving birds were recorded, and in case of “not-preferred” choice the symbols were switched in the box-pair to match the assigned preference of the patch. Our experiment shows that females copy the nest-site characteristics of conspecifics. Surprisingly, copying was as prevalent in early as in late arriving females, although the number of observable tutors increased as more birds settled. Immigrant females, new to the patch, and particularly juvenile immigrants, showed the strongest copying of conspecific behavior. Females that had nested in the same forest patch in the previous year did not copy conspecifics. Our results show that behavioral traits assumed to be genetically determined, such as nest-site selection, can be adopted from others. Less experienced individuals, in terms of local knowledge and age, copied the behaviors of earlier settled birds. This implies that conspecific copying may lead to reinforcement of local adaptive behavioral traditions.



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Conditional strategies in communication networks: stranger effects on neighbor interactions

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In competition over mates or resources, territorial individuals often act conditional upon their neighbors' behavior: i.e. individuals retaliate upon agonistic neighbors, and tolerate non-agonistic neighbors. Conditional strategies such as Tit for tat are believed to be adaptive when the state of the neighbor changes (e.g. through successful pairing or lost interactions with intruders). In songbirds conditional singing strategies have been shown by simulating intrusions of neighbors. However, whether neighbors also act conditional in natural interactions, for instance when the state of one of the interactants changes, has not been studied to date. Here we tested for effects of interrupting strangers on natural interactions between neighboring male nightingales (*Luscinia megarhynchos*). Interacting males were confronted with agonistic or moderately singing opponents using playback experiments (i.e. played back songs either overlapped or alternated with the song of the focus males). This study provides new insights into the implications of adaptive singing strategies in communication networks and its role in the evolution of territorial signaling.



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Geographic variation in the repeatability of a personality trait in *Zonotrichia capensis*

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Animal personalities are consistent differences between individuals in sets of interrelated behaviors. These behavioral associations can be adaptive, although the mechanisms driving intra and interpopulational differences in personalities remain largely unknown. A possible source of geographic variation in personalities is interpopulational differences in the strength of selection acting upon specific personality traits. This can be measured indirectly by quantifying the repeatability of each behavior, as repeatability generally sets an upper limit to trait heritability. However, currently no information exists on geographic variation in repeatability of potential personality traits. We quantified repeatability in exploratory behavior, a common component of personalities, across three populations of rufous-collared sparrow (*Zonotrichia capensis*), originating from both arid and mesic habitats. Exploration speed was highly repeatable across all populations. However, the amount of exploration via hopping was only moderately repeatable in two populations and not at all in the mesic population. Similarly, exploration diversity was only repeatable in the two arid populations. Population origin and trial number, but not experimental protocol (i.e. using laboratory-housed vs. recently captured individuals), influenced variability in exploration. Our findings provide unique insights into why personalities may vary between populations and highlight the value of quantifying interpopulational patterns of repeatability in personality traits (FONDECYT 1090794, ICM-P05-002, PFB-23-CONICYT).



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Post conflict heart rate and behaviour in greylag geese (*Anser anser*)

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In group living vertebrates, agonistic encounters are among the most potent stressors. Individuals may engage in social coping strategies (e.g. post conflict behaviour, such as “consolation” or “reconciliation”), to decrease the negative effects of agonistic interactions (e.g. motivational, decreasing the stress responses), at least in theory, because outside primate species, there is hardly any evidence for this. In the present study we investigate how heart rate (HR) during agonistic interactions and the subsequent behaviour of individuals are related. Twenty-five greylag geese have been implanted with sensor-transmitter packages. We analysed 143 agonistic interactions and also two minutes time periods before and after these encounters. Frequencies of behaviours shown after an agonistic encounter (shaking, preening, vigilance) were indeed, significantly related to the HR during the encounter. Also, the tendency of focal individuals to approach their partner after he was involved in a conflict could be predicted by the HR of the focal during the encounter. This indicates that “consolation” plays an important role as a social stress coping strategy in greylag geese. To our knowledge this is the first study actually quantifying the physiological response to single agonistic encounters and linking this to post conflict behaviour.



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Enhancing nestling detectability in dark cavity nests: a supplemental function of egg teeth in birds

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Many woodpeckers which nest in cavities and some seabirds which nest in burrows possess calcareous "egg teeth" on both the upper and lower bill tips which persist for weeks after hatching. I tested the hypothesis that these structures, together with the pale flanges of nestling northern flickers *Colaptes auratus* increase the detectability of offspring in dim ambient light. I measured the reflectance of egg teeth and flanges of 20 flicker nestlings from 10 broods. Reflectance of flange skin peaked in the UV spectrum which is not visible to most woodpeckers whereas reflectance from egg teeth was highest in the visible spectrum and approached a remarkable 100% reflectance. There was no difference in brightness of egg teeth or flanges between the largest and smallest nestling within a brood, suggesting brightness does not signal nestling quality. In an experiment, I painted the egg teeth and flanges of some nestlings in a brood with black paint and compared their weight gain over a 4 hour trial period to control nestlings, UV-blocked nestlings, and nestlings painted with white paint. Some feeding trials were conducted in dim ambient light, while in other trials light was allowed to enter the tree cavity. Black-painted nestlings gained less mass than all other nestlings in dim light conditions, but not in the bright light conditions. This is consistent with the hypothesis that bright (reflective) mouth colours in woodpeckers function in detectability, and not in signalling of nestling quality.



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Using geolocation to understand habitat selection and foraging behavior of an endangered tropical seabird: the Barau's petrel (*Pterodroma baraui*, Indian Ocean)

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A central issue in animal ecology is to assess how animals use their environments. Animals select habitats based on a number of factors including food availability, environmental parameters, predation risks etc. Understanding how and why animals select different habitats can have direct conservation applications, including the selection of protected areas. We used Argos transmitters, geolocation tags, and activity recorders to study foraging habitat use and selection of the Barau's petrel, an endangered endemic seabird of Réunion Island (Indian Ocean). During the breeding season, Barau's petrels intensively used subtropical waters south of Madagascar (28 to 36°S), ~ 2300 km from Réunion Island. Birds consistently foraged in the vicinity of a huge seamount (the Walker's Bank) where they probably benefited from rich productive waters associated with upwelling related to the seamount. After the breeding period, birds migrated eastward (70° to 110°E) to oligotrophic tropical waters in the middle of the Indian Ocean. During this part of their cycle we found no relationship between habitat use and bathymetry or productivity. However, significant differences in activity between the breeding and non-breeding periods were found. During post-breeding season, activities at night changed synchronously with the lunar phase: during the full moon, birds spent up to 80% of their time at night flying whereas during new moon they spent 90% of their time sitting on water. We did not find this pattern during the breeding season, when petrels were central place foragers. Our results indicate that Barau's petrels clearly segregate habitat use between the breeding and non-breeding periods. Foraging behaviors also changed between periods with a strong relationship with the lunar cycle during the post-breeding. These results help us understand the at-sea distribution and foraging behavior of Barau's petrel and can help us to identify potential marine Important Bird Area's (IBA's) in the tropical Indian Ocean.



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Tactical allocation of effort among multiple signals in sage-grouse: an experiment with a robotic female

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Males in many avian species have complex, multi-component sexual signals, and there may be tradeoffs between different signal components. By adjusting their signaling behaviors, males may be able to produce more attractive courtship displays in the face of these tradeoffs, but this possibility has not yet been tested. In this study, we examined adaptive adjustment of display behaviors during courtship in lekking greater sage-grouse (*Centrocercus urophasianus*). We measured the potential tradeoff between display quantity (display rate) and quality (a temporal feature of vocalizations) in a wild population of sage-grouse using controlled approaches of a robotic female to experimentally induce changes in male display rate. We found that males who are more successful in mating can increase quantity without a decline in quality, with only unsuccessful males expressing a tradeoff. Our results suggest that successful males avoid a tradeoff by strategically adjusting their display rate-saving energy by displaying at low levels when females are farther away and higher levels as females approach. Thus to be successful, males may need both the ability to produce attractive signals, and the skills to effectively allocate their limited display energy by responding to female behaviors.



Saffron finch females lay bigger eggs when mated with yellow, mature plumaged males

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Females are expected to make the reproductive effort that maximizes their own fitness, and often use available information regarding the quality of their mates. In sexually dichromatic birds male color is frequently associated with indicators of quality and/or attractiveness that females may accrue for their progeny. In addition, for many species with delayed plumage maturation, color is an indicator of age and/or experience. The saffron finch *Sicalis flaveola* is a sexually dimorphic species with delayed plumage maturation: during their first potential breeding season, males look like females, grayish, with breast and flanks whitish, streaked brownish, but are able to reproduce as successfully as mature plumaged males which are golden-yellow color. We studied whether females investment in egg size was dependent on the color of their mates in a nest box assemblage placed at Chascomús, Buenos Aires, Argentina (35°64'S, 58°01'W), from 2005 to 2008. Adults were trapped, measured and color banded, and their eggs measured and weighed on the day they were laid. We used generalized lineal mixed models, and included pair identity and brood within pair identity as random factors, and egg laying order as a repeated measures factor. Egg size increased with laying order regardless of the clutch number of the pair (first, second or third in the season). Females mated to yellow, mature plumaged males, laid larger eggs than females paired to pale, immature plumaged males, and this result was unaffected by males and females body condition, structural size, or lay date. Our results suggest that either: a) mature plumaged males are in position to select for better, more experienced females that lay larger eggs, or b) females differentially allocate resources into their eggs according to the social partner they acquire.



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Dynamic understory bird communities in Amazonian rainforest fragments: A 25 year record shows repeated extinctions and colonizations

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Bird species richness in forest fragments typically shows an area effect, but temporal variation in assemblages cannot be identified without repeated samples. Temporal dynamism could distinguish between steady decay in species and communities rescued by recolonization. These processes, in turn, determine a fragment's conservation value in a landscape context. We estimated extinction and colonization rates from repeated samples of understory birds in 11 rainforest fragments of 1-100 ha from before their isolation in the 1980s through 2007. Between preisolation and two years after isolation, fragments showed area-dependent extinction rates of 10-80%. Extinction rates declined over time, to 10-20% by 25 years after isolation. Fragments also showed area-dependent recolonization, with especially high turnover in 1-ha fragments. Beginning about five years after isolation, recolonization roughly balanced extinction, facilitated by second-growth development in the matrix. By 25 years after isolation, 15 species accounted for over 50% of extinctions; these species seldom recolonized after initial extinction. In contrast, >50 species sometimes occurred in fragments, apparently recolonizing from nearby continuous forest. In this system, post-isolation communities appear to be largely driven by turnover, especially in 1- and 10-ha fragments. Our results suggest that a significant portion of the forest avifauna will use second growth and small fragments, even if fragments contain a reduced subset of forest species at any given time.



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Bird communities and biodiversity conservation in complex landscapes of farmland, tree plantations and embedded remnant forest

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Rural landscapes can change rapidly in response to economic and climatic drivers, adding to the challenge of conserving biodiversity. The Green Triangle in south-eastern Australia is part of a biodiversity hotspot, and many birds have declined as native eucalypt forests have been cleared for farmland. Recently many new "forests" have been added as tree plantations of native eucalypts and exotic pines. We examined the role of tree plantations in conserving bird diversity, using twin benchmarks of cleared farmland and remnant native forest, and whether they can enhance remnant forest patches by buffering them from agents known to degrade patches in farmland. We compared bird communities in 150 sites in forest, farmland, plantations and remnant forest patches in cleared farmland or embedded in plantations of blue gum (*Eucalyptus globulus*) or monterey pine (*Pinus radiata*). We analysed data in relation to these habitats, and site and landscape variables reflecting land use change. Total bird abundance was highest in forest and least in cleared farmland. Species and guilds tended to be most common in remnant patches embedded within a matrix that they used for feeding. This research identifies species that can or cannot adapt to these sorts of landscape



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Why Northern wheatears (*Oenanthe oenanthe*) do not return after restoration of coastal dune grasslands in the Netherlands

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The Northern wheatear is an insectivorous ground-dwelling, trans-Saharan migrant which breeds from Canada via Eurasia to western Alaska. The species suffers large scale declines in Europe where breeding numbers dwindled by at least 50 percent since 1980. The Netherlands witnessed declines up to 90 percent since the early 1980s, from 1900-2500 pairs to around 200 nowadays. Because of this unfavorable conservation status, we have undertaken a broad based study to pinpoint bottlenecks on the (former) breeding grounds, because the appearance of these have changed dramatically during past decades. Increased atmospheric deposition of nitrogen and decreased grazing by rabbits (due to rabbit disease outbreaks) altered preferred short-grown dunegrasslands to tall-grass savannahs, the latter being unsuitable for Wheatears. Subsequent measures successfully restored the original short-grown dune grasslands, but wheatears did not return as breeding birds in these apparently suitable re-created habitats. To investigate possible causes for the lack of population restoration, we determined population dynamics, breeding habitat requirements, food intake, abundance of soil and litter invertebrates, and management practices in breeding and former breeding areas. We concluded that restoration management itself imposes new problems for Northern wheatears ranging from loss of habitat heterogeneity and hence bulk prey species to rendering food sources unavailable by altered soil structure.



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Program for monitoring macaws, parrots, parakeets and parrotlets (Psittacidae) in Caracas, Venezuela: a cooperative study using the Internet

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Venezuela's capital is an exceptional place for seeing parrots. Despite being one of the most endangered groups in the world, 30% of Venezuela's 50 parrot species roam freely in this urban landscape. In 2007, we began a web-based parrot monitoring program: http://www.avesvenezuela.net/html/prog_psit/intro.php. With the participation of average citizens who like watching parrots, we collected information on presence, distribution and other ecological data, and as of 2009 have received over 300 reports. *Ara severa* and *Ara ararauna* were both widespread throughout the city and moved daily in flocks of 2-20 individuals between roosting areas (parks and green areas near water) and foraging areas. They ate flowers and seeds of at least 20 species of urban trees and frequented bird feeders. *Roystonea oleracea*, a common palm in Caracas, was the only tree species reported to be used by macaws for nesting. *Aratinga wagleri* and *Pionus menstruus*, were more seasonal, occurring mainly between June and September. Only one exotic species was reported *Psittacula krameri*. It is uncommon, but has lived in Caracas for over 20 years. This overpopulated city provides suitable habitat for this assemblage of birds and this unusual situation causes people to care more for these birds, opening an opportunity for new conservation strategies, including the preservation of nesting and roosting sites around the city, deterrence of nest poachers, and helping the public create a bond with the natural world.



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The effects of urbanization on the species and functional diversity of breeding bird community in Hangzhou, China

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To understand the effects of urbanization on the avian community, we used the line transect method to survey the bird richness and abundance on 90 survey lines, located by stratified random sampling in the different areas of urbanization level between March and August 2007 in Hangzhou, China. We categorized each recorded bird species to a functional group based on nesting requirements from field surveys and literature, and measured the habitat variables on each survey line, including disturbance, vegetation coverage and building index, to produce the urbanization synthetical index. The species and functional diversities were estimated based on Shannon-Wiener index. The results showed that urbanization significantly reduced the species richness, species diversity, functional richness and functional diversity. While the models of the relationships between species richness or diversity and urbanization was linearity, and the relationship between functional richness or diversity and urbanization was a quadratic slope. It suggested that the responses of the bird species richness or diversity and the functional richness or diversity to urbanization were different, and the functional richness and diversity was more sensitive at high levels of urbanization. In addition, the regression analysis of species diversity and functional diversity showed the model of relationship between species diversity and functional diversity was quadratic. The linear relationship between species diversity and functional diversity could only exist at low diversity levels across the urban gradient, and the increasing species richness would not lead to an increase in functional diversity at higher level of species diversity.



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Effects of habitat parameters on species and the occurrence of breeding birds in the woodlots of agricultural landscape, Lithuania

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Recent dramatic decline of many farmland bird populations over West Europe and still insignificant decline in East Europe is recognized. Despite some research, this phenomenon of East Europe is not fully understood and explored in landscape planning. Long-term studies of breeding bird communities (of 355 woodlots, 0.01-20 ha) in agricultural landscape of Lithuania have been performed using mapping method (8-10 repeated counts per breeding season). Mathematical modeling was applied when analyzing the data. It has been revealed that the larger the woodlot, the more irregular its shape with longer perimeter, the richer its species composition of the woody vegetation and the more diverse its vertical and horizontal structure are, the greater overall breeding population abundance are. With the increase of the woodlot area, number of species has been growing more rapidly in coniferous predominated forest stands than in the deciduous ones. In the small woodlots (up to 0.8 ha) tree species composition has less influence on the number of breeding pairs. On woodlots of non-reclaimed landscape number of species per 1 ha was on average up to two times less in comparison with reclaimed areas. The disturbance effect on bird populations has fully shown through several years after the reclamation. A moderate increase of woodlot fragmentation has no significant influence on occurrence of most species. However, density of populations in danger of local extinction on woodlots of non-reclaimed areas has been several times higher than in the reclaimed ones. Our results indicate that woodlot area, vegetation structure and soil hydrological regime are indeed important factors affecting the occurrence of most bird species.



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How suitable is a highly fragmented landscape for forest bird species?

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Ecological niche modeling could be an important tool helping the understanding of species distribution pattern in fragmented landscape. This study aimed to analyze the potential distribution of a forest bird species, flavescent-warbler (*Basileuterus flaveolus*), in a present landscape and in a condition simulating an expansion of forest along over the drainage network. The species was surveyed in 122 random points in a highly fragmented agricultural landscape (170,000 ha), in southeastern Brazil, between April to September 2006 and January to March 2009. Both models (present and simulated model) were generated by Maxent with 70% of dataset (N = 18) sampled by bootstrapping with 10 random partition with replacement. Seven environmental variables (land cover, landscape diversity, fragment distance, water distance, elevation, slope, aspect) with 20-m spatial resolution were used in modeling. Threshold of 10 percentile training presence were used to reveal the suitable areas for the species occurrence. Model was evaluated by the AUC value and by the proportional binomial test. The potential distribution area for this forest species was restricted to the small and isolated forest remains (about 20,000 ha). The little increase in the forest availability (about 6%) led to an increase about 46% of suitable area for the species occurrence (52% of forest, 23% of cerrado and 33% of silviculture). Both models were statistically significant ($p < 0.05$) with a high AUC value. Results suggested that vegetation restoration by the improvement of landscape connectivity by drainage network as demands Brazilian Federal Law could improve the landscape suitability not only for this species, but probability for forest bird species in general. (FAPESP Procs. Nos. 2005/00405-4, 2008/03500-6).



Quantifying rarity in Amazonian birds

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The distinction between rare and common species is fundamental in research and management decisions. Nevertheless the definition of these categories often relies on a mix of sampling methods, biological processes and subjective impressions. We tested if classifications of bird rarity based on ornithologist's perceptions are the same when we estimated forest-site occupancy accounting for imperfect detection. We selected ten species pairs whose members are phylogenetically related and one member is reported to be rarer than the other. On three different occasions 10 observers sampled 760 ha of primary terra-firme forest with point counts. Playback and autonomous recording were also used as complementary approaches. All observers were trained prior to data collection using memory-improvement software and their ability to identify birdcalls was quantified prior to each sampling season. We could not reject the null hypotheses that rare species have the same occupancy as common ones because we only found a significant difference in occupancy in five out of 10 pairs. Nonetheless, when the difference was significant it always had the same sign as predicted in the ornithological literature. Only two of the study species, *Dendrocolaptes picumnus* and *Cyphorhinus arada*, have an estimated occupancy below 50% of sampling points. Although our occupancy estimates are qualitatively compatible with the published rarity classifications, our results demonstrate the usefulness discussing rarity and commonness based on quantitative estimates that account for detection failure and that present an assessment of uncertainty about the estimate.



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Spatially-extensive and reliable data for avian nesting success in boreal forests: can we have our cake and eat it too?

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Canada's boreal forests are famous for their role as major breeding grounds for billions of songbirds. Yet, our understanding of avian reproductive patterns over large temporal and spatial scales remains rudimentary or nonexistent for this region. Our knowledge is limited mainly because reproductive success is highly difficult and/or labour-intensive to measure in boreal forests. In most years since 1995, we have conducted behavioural surveys of songbirds in landscapes managed for timber at Forêt Montmorency, Québec, Canada. Each year we lured birds ($n > 1000$) to playbacks of chickadee mobbing calls, to enable sighting and assessment of parental status (mostly adults carrying food). Preliminary analysis of single-visit surveys suggests wide variation in nesting success and timing among years, possibly related to rainfall, but little or no association between forest stand characteristics and nesting success. However, we know that proportions of birds reaching the brood stage are underestimated, given that parents do not carry food or faeces all of the time. To deal with this challenge in the detection of parental activity, we propose a design for monitoring parental activity based on repeated visits, which enables unbiased estimation of detection probability as well as the true probability of parental status. This design could be implemented in national surveys such as breeding bird atlases to obtain quantitative estimates of avian nesting success in the region.



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Bird community in the understory of native forests and old *Eucalyptus* plantations

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The Atlantic Forest is one of the most devastated and species-rich ecosystems in the world, which makes urgent the necessity to conserve the remaining forest patches and restore degraded ones. *Eucalyptus* plantations may contribute to this goal if managed adequately. Old stands of *Eucalyptus* potentially harbor a high biodiversity, but really old stands are seldom available for study. We compared the bird community at the understory of three *Eucalyptus tereticornis* stands in regeneration for more than 90 years (55-232 *Eucalyptus* trees/ha) with three fragments of secondary native forest embedded in the Floresta Estadual Edmundo Navarro de Andrade (FEENA), a mosaic formed by *Eucalyptus* stands with different ages and species located in SE Brazil. *Eucalyptus* stands had a well-developed native understory. Forest fragments were surrounded by plantations. From May to September 2009 ten mist nets were used to capture, mark and recapture birds for a total sampling effort of 11,520 net.hours.m² at each habitat (i.e. *Eucalyptus* and native forest), resulting in 166 captures of 35 bird species. An analysis of similarity (ANOSIM) indicated that the composition of the bird community was not significantly different between habitats ($R=0.44$, $p=0.098$). Number of captures were higher in native forests (98 vs. 68), but rarefaction analysis showed that species richness was higher on *Eucalyptus* stands. Diversity (Shannon's $H' = 3,141$ in *Eucalyptus* stands vs. 2,619 in native forests) and Equitability ($J' = 0.9327$, and 0.8137, respectively) were also higher in *Eucalyptus* stands. These results show that old *Eucalyptus* plantations have a bird community similar in composition and as diverse as nearby native forests, thus subsidizing the use of *Eucalyptus* in buffer-zones and restoration of degraded areas.



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Integrating technology with monitoring to identify important areas for conservation – a case study from the United Emirates

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A new breeding colony of the greater flamingo *Phoenicopterus roseus* was discovered in April 2009 in Abu Dhabi, United Arab Emirates. Flamingos have bred in the UAE only on two previous occasions and the first ever successful breeding led to the establishment of one of the first protected areas in the country. The new breeding colony was discovered using cue from the locations of the satellite tracked birds and also from the routine ground monitoring of important areas for bird concentration. We discuss the importance of integration of routine monitoring with effective use of satellite tracking of important and flagship bird species in identifying important sites for conservation planning. Discovery of the flamingo breeding colony and regular assessment of breeding status of other nationally important bird species has allowed identification and inclusion of such important areas into broader land use and development plans setting aside areas for conservation. Identification and integration of key conservation sites into local level land use planning is critical given the rapid development which has significant conservation implications for the long-term survival of important wintering and breeding sites for birds.



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The breeding ecology of a successful island colonizer: the red-fronted parakeet (*Cyanoramphus novaezelandiae*) and conservation challenges for parrots in New Zealand

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Since 2004 we have studied aspects of the breeding biology of red-fronted parakeets throughout the New Zealand archipelago to better understand reasons for its decline on the mainland and the factors that contribute to its unmatched ability to colonize remote islands. In the absence of alien nest-predators, red-fronted parakeets nest in over 10 cavity types, lay large clutches, have an extended breeding season and can successfully fledge chicks from two broods nearly simultaneously despite hatching asynchrony. Clutches have an even sex ratio and these proportions do not change during the hatching and fledging periods, suggesting an equal reproductive return from male and female juveniles. Fledglings can pair up and successfully breed within a year of hatching even on islands substantially different in structure and composition. Taking advantage of such great reproductive potential we have established two new populations via translocation into an island and a predator-proof fenced peninsula. During these translocations we detected Feather and Beak Disease Virus (Pbfd) for the first time in the wild on red-fronted parakeets. This finding represents a novel conservation challenge in a country where all parrot species are endemic, under categories of threat and potentially susceptible to infection by alien diseases.



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Floater dynamics are key in assessing risks posed by novel sources of mortality

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Monitoring protocols for threatened birds typically focus on breeder numbers as indicators of population health, ignoring sexually mature, non-breeding “floaters”. The latter, however, provide an important demographic buffer, and understanding floater population dynamics is key in assessing risk levels and conservation reaction times when populations are exposed to a novel threat, such as introduced predators. We explore floater dynamics of two territorial species - the African black oystercatcher *Haematopus moquini* and the Aldabra flightless rail *Dryolimnas [cuvieri] aldabranus* - assessing the extent to which floaters buffer breeder numbers and the time window they provide for taking conservation action following arrival of a novel source of mortality. Among the oystercatchers, floater numbers vary more than do breeder numbers because floaters, regardless of their abundance, cannot force territory compression by breeders. During periods of stability in breeder numbers, floater numbers increase. However, following mass breeder mortalities, which happen occasionally, breeder numbers recover rapidly, vacancies being filled from the floater pool. Understanding this dynamic makes it possible to model the effects of increased frequency of mortality events. The rails are confined to four islets on Aldabra Atoll. On the largest island of Malabar breeder numbers have remained stable for >30 years. Even if cats were introduced, breeder numbers would continue to remain stable for about 11 years, making it impossible to detect an effect of the predators if breeder numbers alone were monitored. However, once breeder numbers started to decrease, the population would face a high risk of extinction within <10 years.



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The European kestrel *Falco tinnunculus*; predator prey dynamics in response to grassland vegetation height

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Previous studies suggest that Kestrels hunt primarily over grassland. We studied 7 kestrel pairs over 3 years, and monitored the habitat they selected to hunt over; results from compositional analysis show they significantly prefer hunting over cut grass to all other habitat types available to them. This is presumably due to the improved accessibility of their small mammal prey; however, small mammals require a degree of cover and can therefore be expected to disperse to areas of greater safety when this cover is compromised. We investigated the temporal aspects of this “cut-grass effect” by carrying out live trapping of small mammals in grassland plots, under different vegetation treatment regimes: - not cut, cut with cut-grass left in situ (treatment 1), and cut with cut-grass removed (treatment 2). Our preliminary results show that prior to treatment, the animals were equally distributed between control and treatment, after treatment 1 the ratio was approximately 75:25, and after treatment 2 it was 91:9. Our work is designed to inform how to maximise the benefits of grassland for kestrels and we discuss how our findings may be incorporated into agri-environment schemes.



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Homogenisation of suburban bird assemblages: an Australian perspective

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Much of the research on homogenisation of urban bird assemblages has focused on identifying traits of invading species or invaded habitats, and on a relatively small group of commensal or synanthropic bird species common to centres of cities throughout the Northern Hemisphere. Less attention has been paid to suburban areas within large cities of the Southern Hemisphere, states of flux in assemblages, and to spatial and temporal disjunctions within cities. The research reported here was conducted in Melbourne, Australia; a metropolis of approximately four million people covering some 880,000 ha, established in 1835. Melbourne is built on lava flows to the west, sedimentary hills to the east, and sand sheets to the southeast. Data on bird occurrence were extracted from the Birds Australia Atlas II database, and aggregated into species lists within 1-km² grid cells. Patterns of species abundance and distribution were examined using ordination, hierarchical cluster analysis, and guild analysis. Relationships with environmental and human demographic gradients were also analysed. Due to the effects of strong geographic differences in topography, geography and rainfall, which related strongly to bird assemblages organised by foraging, nest substrate and dispersal guilds, the data were partitioned into eastern and western subsets and re-analysed. Bird assemblages of recently developed areas of Melbourne in the west appeared to be in a state of flux, in the early stages of converging towards the more established suburban and urban assemblage patterns evident in the older parts of eastern Melbourne. Urban areas may need to be environmentally partitioned before the pattern of their bird assemblages can be fully understood.



Are existent protected areas effective for bird conservation? An analytical framework or assessing connectivity and restoration priorities in the Atlantic Forest of Brazil

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Rapid rates of habitat change and growing exploitation of natural resources threaten avian biodiversity worldwide. One example is the Brazilian Atlantic Forest (AF), a global biodiversity hotspot with around 1020 bird species. Most remaining patches of the AF are embedded in a mosaic of secondary growth, pastures, and agricultural land. The AF's reserves currently protect less than 2% of its original extent and many were established in an ad hoc manner. We implement a three-stage framework for conservation planning in the AF. First, we use radar remote sensing to quantify forest fragmentation in the Serra do Mar subregion of the AF, which has the biggest remaining forest fragments and faces many different kinds of threats. Next, we utilize the principle of complementarity to prioritize new sites to augment the AF's existing reserves. This results in a more economical set of protected areas by reducing the extent to which new sites duplicate the biodiversity contents of existing protected areas. Finally, to increase the probability that avian populations in the AF will persist in the future, we design corridors to establish connectivity among that AF's conservation areas. These corridors can facilitate dispersal among forest stands in canopy-dwelling birds with a metapopulation structure or provide egress if a conservation area is destroyed. We validate the framework using data from Important Bird Areas assembled by SAVE Brasil/BirdLife International. Insofar as deforestation in the AF is similar to land conversion in other biodiversity hotspots, our methodology is applicable to conservation efforts elsewhere in the world.



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Bird community disarray in eastern Australia: the relative roles of landscape properties and interspecific competition

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Landscape change in eastern Australia has had significant impacts on bird communities. Apart from the loss of most woodland, millions of hectares are dominated by a single, highly aggressive species, the noisy miner *Manorina melanocephala*. The interactions between the impact of the noisy miner and landscape-level habitat loss are poorly understood. We combined data from seven bird assemblage datasets across 2,000 km of eastern Australia to examine the role of noisy miners and landscape transformation in driving bird community changes. We also explored the potential implications of bird community changes on the provision of ecological services. In all cases, the proportion of small passerines in the avifauna declined rapidly with increasing noisy miner density until a threshold density of miners was reached, beyond which only 10-15% of birds were small passerines. However, the rate of this decline was dependent on the amount of remnant native vegetation in the landscape. A threshold in landscape-level native vegetation cover was evident at 30%, below which the proportion of small passerines in sites with few noisy miners depended on the remnant vegetation cover. However, the proportion of small passerines in sites with high noisy miner density was independent of vegetation cover. The ecological implications of this widespread bird community disarray are likely to include changes to predation pressures on particular invertebrate guilds and reduced pollination services and seed dispersal. Combined, the effects of landscape change and interspecific competition are causing significant shifts in the dynamics of eastern Australia's woodlands.



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Environmental factors associated with the presence and abundance of selected bird species in the Bogota wetlands, Colombia

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The Sabana de Bogotá is a large highland plateau in the eastern Andes of Colombia. Due to its isolation from other high elevation wetland areas in the continent, its deteriorated remnant wetlands support a high incidence of endemic taxa (3 spp., 7 ssp.), four of which are endangered in the country. My objective was to identify and quantify wetland characteristics that best explained the presence and abundance of seven selected bird species. Using GIS and high definition images, I measured several landscape characteristics and vegetation cover in 19 diverse wetlands in the Sabana along with the abundance seven focal species of birds through point counts. Wetlands ranged from 2.7 to 254Ha, in urban, semiurban and rural matrices and vegetation cover from less than 10% to 100%. In rural wetlands open water was dominant, whereas in semiurban and urban environments vegetation cover is higher with bulrushes and emergent plants dominating. *Fulica americana* and *Gallinula chloropus* were the most widespread species, being found in 90% of the wetlands. The globally endangered *Rallus semiplumbeus* and *Cistothorus apolinari* were found in 63% and 21% of the wetlands respectively. They were associated with the presence of bullrush, as was also *Chrysomus icterocephalus*. *Oxyura jamaicensis* and *Gallinula melanops* (both locally endangered), along with *F. americana*, were associated with the presence of open water in mainly rural areas. Rural and urban wetlands hold different sets of birds compensating at the regional level to support a larger number of species. The largest wetlands hold important numbers of birds and special conservation measures should be taken mainly in Gualí, the only wetland studied with a significant population of the declining and highly endangered Apolinar's wren.



Can physiological measures provide clues to the cause of declining tropical finch populations?

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More than a quarter of Australia's granivorous birds have declined in abundance or experienced severe range contractions in the tropical savannas over the last 50 years. It is widely assumed that grazing by exotic herbivores and increased fire frequency, intensity, and extent have altered savannah habitats, but the impacts of changed land use on grass seed-eating birds remains poorly defined, in part due to the difficulties of monitoring highly mobile finch species. Consequently, we opted for the novel approach of monitoring health indices of declining and non-declining finch species in areas of differing grazing and fire histories, and characterized the seasonal grass layer productivity and cover of these sites. Habitat surveys indicate that both grazing and frequent intense fires lower the productivity and ground cover of important grasses. All finch species displayed seasonal variations in health indices, with declining species surveyed in 'disturbed' areas often showing signs of poorer health. The endangered Gouldian finch (*Erythrura gouldiae*) was recorded as having up to 10% higher haematocrit, 60% higher stress hormone levels (corticosterone), and significantly lower body condition in grazed habitat compared to birds in conservation managed habitat. In contrast, non-declining species rarely exhibited these indicators of poor health. Correlations between finch health indices and grass layer characteristics suggest that increases in both grazing and intense fire adversely affect finch populations. These findings highlight the utility of health measures in determining the sensitivity of birds to environmental pressures as well as the threat of intensified grazing and frequent fire to savannah biodiversity.



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Understanding demographic and behavioral mechanisms that drive avian responses to urbanization

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Although numerous studies have documented shifts in avian communities in urbanizing landscapes, the ecological mechanisms that drive these changes are poorly understood. I examined the extent to which urban-associated changes in bird communities were linked to population-level demographic or individual-level behavioral processes. From 2001-2009, my students and I studied bird communities in 33 riparian forests distributed along a rural-to-urban landscape gradient in Ohio, USA. Over the 9 years, we surveyed birds and nest predators, monitored >3000 nests, determined condition, annual survival, site fidelity, and reproductive productivity of >500 banded birds, and quantified habitat characteristics. Most resident species were positively related to urbanization, whereas most Neotropical-Nearctic migrants were negatively related to urbanization. Although nest predators were most abundant in urban landscapes, nest survival of 5 species was not consistently related to urbanization. Survival and body condition of both residents and migrants, as well as reproductive rates of residents, were similar across the gradient. However, urban migrants fledged fewer young over the season than rural counterparts, possibly a consequence of settlement bias given that urban forests were settled later in the season by smaller individuals. Densities of residents were consistent with resource-matching, and urbanization promoted habitat attributes selected by many resident birds. Collectively, these findings indicate that urban-associated changes in bird communities are not the consequence of strictly demographic processes. Rather, behavioral decisions made at individual levels also play an important role in generating landscape-scale patterns.



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Hormesis, oxidative stress and life-history evolution

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Exposure to environmental stressors is traditionally viewed as a negative experience. However, recent evidence, mainly from cellular-level studies, challenges this view, and suggests that exposure to low levels of stress can have beneficial consequences, termed hormetic effects. These are thought to occur by the activation of genes coding for protective proteins, such as antioxidant enzymes and protein chaperons. An important consequence of hormesis is that it gives rise to wider margins within which stress tolerance and adaptation occur, and is thought to help mitigate the consequences of oxidative stress. However, we currently know very little about the occurrence and fitness consequences of hormetic effects at the organismal level, which could play an important role in determining the outcome of life history trade-offs in differing environmental conditions. We will discuss how the link between hormesis and oxidative stress has clear potential to help us understand avian life-histories and phenotypic plasticity, and present results of experiments that we are currently conducting in which early exposure to stress in birds is experimentally manipulated.



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Moving hybrid zones and introgression

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Hybrid zones are narrow regions of contact where closely related species meet and interbreed. Many of them can be seen as examples of ongoing speciation. With a spatial computer simulation I show that introgression of a marker gene from one bird species into another in most cases will produce a temporary movement of a hybrid zone and that the zone should stabilize after introgression. The reason that the movement will be temporary is that advantageous genes will cross species barriers more readily than neutral genes. Still, gene flow is much more rapid within parental populations than between species. The gene will first be common in the donor population at one side of the hybrid zone but rare in the receiving population. The donor population will then have a fitness advantage and the zone will move accordingly. When the gene has crossed the species barrier and has become common also in the receiving population, the advantage disappears and zone movement will stop. The simulation parameters are based on data from the Danish part of the hooded *Corvus cornix* and carrion *C. corone* crows in Europe. These species look very different but interbreed in a 70 km wide zone that stretches across much of the continent. Even though mating is assortative hybridization is still relatively common with around 30% of the individuals in the zone being hybrids. In some parts of Europe this zone has been moving the last 100 years whereas it seems to be stable in others.



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Evolutionary relationships of blood parasites in the avifauna of Socorro Island, México

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The Socorro dove (*Zenaida graysoni*), endemic to Socorro Island, was last reported in the wild in 1972. The Island Endemics Foundation is planning the reintroduction of this species to its former habitat. Recently, the European Breeding Program for this species sent several doves to North America to establish a small population at the Rio Grande Zoo in Albuquerque, New Mexico. This will be the first known attempt to reintroduce a bird species extinct in the wild to its former island range. In order to assess the disease threats the Socorro dove may face, Socorro ground doves (*Columbina passerina socorrensis*) and mourning doves (*Zenaida macroura*) of Socorro Island, as well as the Socorro doves in captivity were screened for the avian haemosporidian blood parasites *Plasmodium*, *Haemoproteus* and *Leucocytozoon*. Here we report and compare the evolutionary relationships of haemosporidian blood parasites from birds of Socorro Island, the mainland, and other island populations. We found all three blood parasite genera in the mourning doves and Socorro ground doves, and we discuss the implications for the reintroduction of the Socorro dove. In addition, we study the diversity of mosquito species of Socorro Island. We identified 1) *Aedes taeniorhynchus* (Wiedeman) and 2) *Culex quinquefasciatus* (Say); both species are known vectors for avian malaria parasites. These species are not endemic to the island, and therefore they must have been introduced by human activity sometime during the past fifty years.



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Diversification of the South American avifauna in time and space

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With the development of digital distribution databases and comprehensive molecular phylogenies it is now possible to analyze diversification processes in time and space. We present results for the New World suboscine radiations by contrasting geographical patterns representing old and recently diversified subgroups. Species representing early radiations are mainly represented in the tropical rainforest biome while more recent radiations mainly took place in the open biomes of southern South America and the Andean high plains. The most terminal radiations have mainly occurred in the Andean cloud-forest and onwards to scrubby habitats in the tropical lowlands. These trends are interpreted in terms of niche conservatism and adaptive shifts in some lineages in response to new environments arising as a consequence of environmental change during the Neogene.



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When parrots reveal their true colours: population divergence in the circular overlapping crimson rosella?

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Population divergence and speciation are thought to arise from an interaction between neutral processes (e.g. drift), differences in selection across populations, and reproductive isolation on one hand, and the homogenising effects of gene flow on the other. Rare cases of ring species (RS), or circular overlaps, offer an excellent opportunity to study this in nature, because they show how clinal variation along chains of interconnected populations may lead to species-level differences. We studied the circular overlapping crimson rosella (*Platycercus elegans*) parrot complex of south-eastern Australia. We compared variation in phenotypic traits, including plumage coloration and body size, across several populations defined by neutral genetic variation (microsatellite markers and mtDNA sequences) to evaluate the relative roles of neutral processes and selection in population divergence in this unusual species complex. Pigment-based, yellow-red plumage coloration varies greatly between rosella populations, and hitherto has been the only trait used to define this group. We found that pigmentary coloration was strongly associated with environmental conditions including climate, and was not congruent with microsatellite genetic variation, indicating a role for natural selection. Further, only pigmentary coloration offered support for RS predictions. Another major finding was that ultraviolet-blue coloration, generated by feather nano-structure rather than pigments, also varied geographically, but that this variation was not congruent with pigmentary coloration. Instead, we uncovered evidence that structural coloration may provide important sexual signals, and it was strongly associated with assortative mating. Our results suggest that population history, natural selection and sexual selection interact to promote population divergence in this species, even in the presence of ongoing gene flow.



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Scanning for signs of selection and chromosomal rearrangements on the Z-chromosome in closely related European *Ficedula* flycatcher species

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The process of speciation is commonly viewed as the gradual build-up of incompatibilities between genomes of diverging populations and it has been hypothesized that divergent selection may enhance this differentiation process. Accumulating evidence also suggest that sex-chromosomes play a key role in driving reproductive isolation. Furthermore, chromosomal speciation models postulate that chromosomal rearrangements may be drivers of reproductive isolation by reducing gene flow in inverted regions. We investigated the Z-chromosome of the pied flycatcher (*Ficedula hypoleuca*) and the collared flycatcher (*F. albicollis*) to assess the importance of selection and chromosomal rearrangements in the speciation process. Seventy four genes evenly distributed along the Z-chromosome were scanned for patterns of genetic variation that might correspond to ongoing or past selection events. Genetic maps of the Z-chromosomes of the two species were constructed with a subset of these genes. Population genetic methods were used to assess the levels of variability within loci, an island model was applied to detect loci with higher than expected differentiation between species and genetic maps were compared to look for signs of inversions. A handful of regions showed patterns indicative of directional selection. Interestingly, two of the regions harbor genes known to affect plumage coloration in birds, perhaps pointing towards a role for sexual selection in the speciation process. Analyses of the genetic maps discovered extensive colinearity but indicated that some smaller regions might have undergone inversions, possibly acting as barriers to gene flow in the diversification process.



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Revisiting latitudinal patterns of plumage showiness

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Most studies on geographical variation in bird plumage examine sexual dichromatism in passerines. Yet for biologists interested in the evolution of ornamentation, focus should expand beyond sexually dichromatic species with one sex (usually males) more ornamented than the other. Few studies address monomorphic brightness; and we are still far from understanding the origin and evolution of female brightness. Furthermore, preliminary analyses show that including only passerines overestimates the degree of dichromatism in temperate regions. Here I test whether measuring only sexual dichromatism in studies of geographical plumage variation (passerines and non-passerines) underestimates the incidence of female brightness by ignoring monomorphic species. Observers naive to questions about monomorphic or dichromatic brightness ranked the brightness and complexity of male and female plumage in all species of breeding birds of the US & Canada and Panama using field guides. From these data, I gathered the 100 species with the showiest plumage from each region and compared the expected and observed counts of (1) monomorphically bright species, (2) dichromatic species with showy males and showy females, and (3) the sum of these two categories in each region. Previous studies may have systematically underestimated female brightness. Specifically accounting for female showiness in species with showy males adds a level of resolution ignored by previous studies on latitudinal variation in plumage coloration. Given that many investigators use male showiness and female dullness as a metric of sexual selection, this study highlights the importance of studying selective pressures that lead to the evolution of female brightness.



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The comparative study of bird brains

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Even when the effects of body size are taken into account, brain sizes vary greatly among bird species. One of the most intriguing questions in the comparative study of bird brains concerns the role of ecological factors in modifying brain size. The task at hand is to explain the tremendous variation in brain size, especially the forebrain, among birds. Comparative studies have found numerous correlates of brain size. Among them are position in the precocial - altricial spectrum, innovation rate, colonization success, survival, immune defence, nocturnal activity, eye size, allomaternal care, maximum rate of population increase, and migratory behavior. Most of these studies cast the comparative net far and encompass all extant bird orders, and often are biased towards temperate zone species. However, attempts to identify causal relationships or to relate evolutionary historical narratives are rare and/or controversial. One of the reasons is that the relationships between overall brain size vs. relative size changes in neuronal compartments and their behavioural correlations remain largely unknown. The analysis of data on migratory behaviour, brain sizes, and brain architecture demonstrates these difficulties. It also shows that the migration associated reduction in brain size evolved rather quickly. This contributes to the difficulty to resolve the problem whether reduction in brain size preceded or followed the evolution of migratory behaviour. So far, the data from several bird families and divergence order analyses indicate that the former is true. Thus, my discussion will focus on the particular question how migratory behaviour and brain size are causally linked, and address the general issue of evolutionary interpretations of brain size correlates.



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Why do we know so little about mechanisms underlying avian reproduction?

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Recent evolutionary analysis of large, long-term population studies' data has shown that the traits which contribute most to individual variation in lifetime fitness in birds are longevity, clutch size and laying date (but not, for example, egg mass or chick growth). The critical importance of many of these traits, such as clutch size, has been recognised for over 60 years yet our current understanding of the physiological basis of variation in these key fitness-related traits remains poor. In this talk I will explore the reasons for this lack of progress, highlighting and contrasting the challenges and opportunities for specific life-history traits. For example, although there has been a large amount of experimental, physiological work on seasonal breeding we currently lack a basic model for the mechanism(s) underlying female control of onset of egg-laying (the key determinant of timing of breeding). In contrast, a very comprehensive model for physiological control of clutch size was proposed over 20 years ago but virtually no experimental work has been directed towards testing this model. Longevity (senescence) is a rare example of current mechanistic research being directed at a key life-history trait. Currently much of the research effort in avian physiological ecology is being directed at traits for which there is little or no evidence of long-term fitness consequences (e.g. minor egg components, such as hormones or antibodies). I aim to show how an evolutionary perspective should not only be driving our research focus, but should also dictate specific ecologically-relevant experimental design. Future progress in integrating avian evolutionary biology and physiology will require a major shift in research focus.



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Long-term fitness consequences of yolk androgens for parent and offspring generation in a wild population of collared flycatchers (*Ficedula albicollis*)

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Hormonal environment during early development in the egg may have long-lasting effects on behaviour and phenotype of the offspring, with subsequent consequences for fitness. Yolk androgens have been shown to have various effects on chicks, but long-term fitness consequences for either the offspring or the parents, a prerequisite for studying the adaptiveness of these maternal effects, has been little studied. We experimentally elevated yolk androgen levels in the eggs of the collared flycatcher (*Ficedula albicollis*) in a wild population (island of Gotland, Sweden) in a large sample (120 androgen-manipulated and 120 control nests). We studied the effects of yolk androgens on recruitment, natal dispersal, timing and success of breeding, phenotypic traits (e.g. plumage coloration, structural size) and feeding effort of the offspring during two subsequent breeding seasons following the manipulation. Environmental conditions differed between the two seasons, which also allowed us to study the effects of early hormone environment on performance in varying conditions. If we find differences in performance of birds from androgen-treated and control groups, this might indicate that mothers could adaptively allocate yolk androgens to adapt their offspring to forthcoming conditions. To reveal possible fitness costs also on the parent generation, we investigated the effects of high androgen levels on breeding success the season following the manipulation. This is one of the first studies where androgen levels have been manipulated in large scale in a wild population and fitness consequences both on offspring and parents have been investigated.



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Evolution of the avian plumage color gamut

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In biology, the “gamut” refers to the diversity of phenotypes mapped to a sensory space - i.e., a quantified model of the range of achieved sensory signal phenotypes within a clade. The avian plumage color gamut consists of the achieved diversity of plumage color visual stimuli of birds. We used tetrahedral avian color stimulus spaces to estimate the avian plumage color gamut from a taxonomically diverse sample of avian species representing all types of plumage coloration mechanisms. Bird plumage colors occupy only a small fraction of the possible colors that birds can observe. The various classes of feather pigments are constrained to occupy much smaller portions of the available color space than are various classes of structural colors. The repeated, phylogenetically independent evolution of structural colors in many lineages of birds has permitted evolutionary expansions of the color gamut into portions of the color space that cannot be achieved by pigmentary mechanisms alone. The limits on the breadth of the avian plumage color gamut are likely caused by physical constraints on the available pigmentary and structural coloration mechanisms. Novelty in coloration mechanism have likely evolved to expand the gamut of possible communication signals multiple times in independent clades. In particular, structural colors have provided critical mechanistic innovations to achieve broader signal diversity.



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Do pathogens induce fitness consequences in their hosts? Separating cause, effect and mechanism

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Pathogens have been suggested to entail costs for the infected individual as a result of immediate tissue damage and/or carry-over effects arising from trade-offs between investment in immune defences and tissue repair and other demanding activities, including migratory preparation and reproduction. Infection may, therefore, have consequences for individual fitness and population life history strategies. Using avian influenza virus in migratory waterfowl as a model system, we assess whether infection with this naturally-incurred disease has fitness consequences for the individual, and whether these can be attributed to the cost of immune defence or tissue repair. Natural infected individuals were in reduced condition at the time of capture (early winter), and remained in poor condition prior to spring migration. Stable isotope analysis revealed that these naturally infected birds had utilized similar migratory strategies and foraging habitats prior to infection as uninfected individuals, indicating that the observed differences may be more “cause” than “effect”. Experimental infections with a wild-type virus (low pathogenic H4N6 avian influenza virus) were then used to assess whether infection could indeed cause changes to condition and behaviour during migratory preparation, and whether such consequences may go on to affect an individual’s migration and reproduction throughout an annual cycle. This experiment, together with results from novel immune challenges in the same species, suggest that both the recruitment of immune cells and the ensuing disease process may entail small changes to host condition in the short term, but that these small changes early in winter entail significant carry-over effects during spring migration.



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Karyotypic evolution in Accipitridae (Aves, Falconiformes) based on chromosome painting using *Gallus gallus* whole chromosome probes

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Accipitridae have atypical chromosome morphology among birds, and diploid numbers vary from 54 to $2n=82$. However, species with $2n=66-68$ are the majority. Accipitridae that have been studied by comparative painting include old world vultures (*Gyps fulvus*, *Gyps rueppelli*, both with $2n=66$, and *Gypaetus barbatus*, $2n=60$) and the harpy eagle (*Harpia harpyja*, $2n=58$). We analyzed the karyotype of *Asturina nitida* and *Leucopternis albicollis*, both with $2n=66$, using whole chromosome probes derived from *Gallus gallus* (GGA). The results confirmed that there are several fissions of the larger chromosomes in these species, following the findings observed in old world vultures and harpy eagle. Hence, chromosomal reshuffling in these species included extensive rearrangements involving GGA chromosome 1–5 paints. In contrast, chromosomes 6–10 hybridized only to a segment within a larger, fused chromosome. GGA chromosome 4 probe hybridized to only two chromosomes in all these species and others from different orders, suggesting conservation of the putative avian ancestor. The presence of a few pairs of microchromosomes points to fusion events, as confirmed in harpy eagle. In conclusion, these common chromosomal characteristics suggest the occurrence of several fissions and fusions among both the macro- and microchromosomes during the karyotypic divergence of Accipitridae and reinforce the phylogenetic proximity among species of this group.



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The effect of corticosterone on resistance to West Nile virus in an avian reservoir

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West Nile virus (WNV), a mosquito-borne flavivirus, has emerged as a significant threat to animal and public health in North America. Despite extensive research on many aspects of WNV ecology, little is known about intraspecific variation in host competence and susceptibility to the virus. Stress is known to suppress or alter immune function but the functional significance of reduced immunity is not fully understood. Using northern cardinals (*Cardinalis cardinalis*), a competent avian reservoir of WNV, we simulated chronic stress by administering corticosterone. We hypothesized that elevated corticosterone in cardinals would lead to reduced resistance when experimentally infected with WNV. Wild-caught cardinals (n=19) were held in a biosafety-level three containment facility, randomly assigned to treatment groups, given either a corticosterone (n=10) or sham (n=9) implant, and then inoculated with WNV. Throughout the experiment we measured body temperature, mass, virus titer by plaque assay, cytokine expression via RT-PCR, baseline corticosterone by enzyme immunoassay, and antibody titer, following seroconversion, via plaque-reduction neutralization test. Five of the 10 corticosterone birds died within 11 days post-infection whereas only 1 of 9 sham-implanted cardinals died. We observed no significant treatment effect on virus titer. Regardless of treatment group, the individuals that died had significantly reduced fever response during peak viremia compared to survivors. Here we begin to explore the potential impact of environmental stressors on a host organism ability to serve as a reservoir for a pathogen as well as on their ability to resist disease.



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SA04 Macroecology



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Climate change impact studies on bird populations benefit from combining results of citizen science and autoecological studies

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Climate change is one of the prime threats to avian biodiversity worldwide. To understand its real impact we need to study large scale patterns in changes in distribution and abundance of species as well as demographic rates in local ecological conditions. In this research there is a complementary role for professional ornithologists and volunteer bird counters. Professionals study in detail the mechanistic processes of adaptation to climate change in interaction with ecological changes, e.g. how does it affect local demographic rates. However, their local, detailed studies cannot easily be translated to larger spatial scales. The importance of data from volunteer networks is that they allow us to describe large-scale patterns on multiple species, with less detail. We show examples of collaborations between professional and volunteer networks in Europe in describing and unravelling the effects of climate change on bird populations. These data show that climate change is one of the probable causes for the decline of long-distance migratory songbirds. The approach enables to scale up and down the various data sources. We believe it to be essential in order to understand the processes explaining impacts of global change. The results could also prove valuable in public awareness campaigns, examples are climate change indicators. Ultimately this combination of knowledge and data can contribute to the design of strategies for mitigating and compensating the negative impacts of climate change.



The richness of urban waterfowl species in Europe with addition of the original data

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The pattern of distribution of the urban bird species in Europe and the factors responsible for it are rather obscure. We analyze the waterfowl fauna of the sixteen European cities on the basis of data presented by Kelcey & Reinwald (2005). The additional data have been collected over 12 seasons (1998-2009) in Moscow. The two main questions will be addressed: 1) Does the S-W – N-E gradient exist in the richness of urban waterfowl species in Europe? 2) What factors (natural and anthropogenic) determine this gradient (if any)? The amount of native breeding species tend to be greater in large cities and correlates with the city area ($r_s = 0.65$, $p = 0.006$, $n = 16$). The abundance of native urban waterfowl species increases northward in Europe ($r_s = 0.87$, $1088=0.00001$, $n = 16$), i.e., the number of such species is larger in the cities of more severe climate zones. The same is true for the regional native species richness. The area of the city is of subordinate importance for the native species richness. This effect is possibly determined by the habitat properties. The extensive area of swamps and other wetlands in the north-eastern part of Europe is a natural refuge for breeding and molting of a large amount of the native European waterfowl species. Some of these species penetrate into the cities. Only the density of human population in the region affects the amount of alien urban species ($r_s=0.51$, $p=0.039$, $n=16$). Climate warming may favor further increase in abundance of wintering and breeding species of birds in eastern European cities, e.g., in Moscow. Natural factors are responsible, first of all, for the pattern of distribution of the native species in the European cities. Anthropogenic factors affect mostly alien species.



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Can habitat and energy gradients explain bird species richness in the arid shrublands of the Little Karoo landscape, South Africa?

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Studies that examine broad-scale spatial patterns in biodiversity are becoming increasingly important as these patterns can be used to identify the most effective schemes for *in situ* conservation. The aim of the study was to determine which energy and/or habitat factor most strongly explain the gradient found in bird species richness and to assess if the determinants of large-scale patterns found in species richness (i.e. macroecology) can be applied in an arid landscape to the conservation of biodiversity on vegetation-unit scale. Bird species richness and habitat heterogeneity was sampled in five vegetation units (ten sites per unit) found from a mountain peak to an open valley plain in the arid Little Karoo (South Africa). Observed total richness in the shrublands was very low and ranged from eight to 16 species per vegetation unit, but 20 of the 31 species recorded was endemics. Topographic and growth-form heterogeneity could not explain the observed species richness, but the most species were found at the lowest elevations. In spite of the low rainfall (270-410 mm) in the study area, species richness was negatively related to rainfall and positively to temperature. The mean annual potential evaporation, as a predictor of energy availability, was also positively related to species richness. It was thus the higher energy availability associated with the higher temperatures, and not rainfall per se, that was supporting more species. Conservation efforts should therefore focus on lower-laying and hotter vegetation units. Macroecological principles could thus be applied to this arid landscape to conserve biodiversity on a vegetation-unit scale, but needs to be investigated for a larger vegetation-unit sample.



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Gradient in avian species richness in the Himalayas

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Causes for the considerable variation in species diversity around the globe are subject of much debate. Recently, so-called historical hypotheses have been given renewed prominence because they can be tested using dated molecular phylogenies. In such hypotheses adaptation to the warmer, moister climatic conditions of the globe over long time spans have resulted in relatively few species which have been able to adapt to colder, drier regions. This hypothesis can be tested using molecular phylogenies by asking how often species from warmer, moister regions have split off new species into colder, drier regions. We used this approach to ask why the number of passerine bird species in the southeastern Himalayas is more than twice the number than that in the northwestern part. All passerine species (over 400) were studied. We estimated phylogenetic relationships among the study species and the ages of species and clades based on over 2000 bp of two mitochondrial genes (cytochrome *b*, NADH dehydrogenase 2). We also used ecological data to assess historical causes for the fading out of species numbers. Under the ecological hypothesis, dispersal into the colder, drier northwestern habitats is difficult due to less finely subdivided niches, so extension to the northwest of the Himalayas should have occurred relatively rarely. Further we ask, whether species occupying colder, drier habitats in the southeast (or close relatives of these species) do preferentially occur in the northwest. We studied species mean elevational position and mean morphology as two measures of niche differentiation comparable across locations. Under the historical hypothesis variance among species in these traits should be similar in each location whereas under the ecological hypothesis, variance should be lower in the northern site than the southern site; these alternatives can be tested using the ecological data.



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Impact of climate and land-use change on bird distributions in Germany

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The ranges of species are not only determined by climate, but also by land-use, a factor rarely considered in species distribution models (SDM's). We tested whether SDM's of European birds that included climatic and land-use variables fitted current distributions better than climate-only models. Additionally, we compared predictions for future bird distributions using climate-land-use models and climate-only models. We selected land-use variables for each species from a database assessing the importance of 17 land-use types for birds and we applied a backward selection algorithm to reduce model complexity. Models calibrated on a European scale were projected into the future using climate change scenarios for Germany. Two future land-use scenarios were applied: At one extreme, we left current land-use constant; at the other extreme, we assumed that land-use adjusts instantaneously to climatic conditions. We further calculated future bird distributions assuming no and full dispersal ability of the species. The results indicate that for most species, SDM's could be improved by including land-use variables in the models. Predictions of range shifts from climate-land-use models differed substantially from climate-only models. In general, climate-land-use models predicted less range loss and less range gains. Nevertheless, differences in predicted future distributions between the no and the full dispersal models were more pronounced than between climate-only and climate-land-use models. These results demonstrate that land-use modifies climate change impacts on future bird distributions, but that most uncertainty is caused by the difficulty in judging adequately the dispersal ability of the species.



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Advances in bird monitoring on U.S. Department of Defense lands

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The Department of Defense (DoD) Partners in Flight program is improving the process for making the right decisions about where, when, and how to monitor birds on the nearly 12 million hectares of military lands. The DoD monitors birds to ensure compliance with various federal laws and regulations as well as for stewardship and management. The roadmap for this military-land monitoring is found in the recently completed DoD Coordinated Bird Monitoring (CBM) Plan. Recently, weather surveillance radar and automated acoustic technologies both have been used as research tools to improve monitoring capabilities and quality of data collected on DoD lands. WSR-88D radar was used to identify migratory bird stopover hotspots across the nation, and as an aid to developing migration forecast models to guide decisions about military aircraft training when large numbers of migrants are predicted to move through airspace. Also, automated recording devices were deployed on military bases across the country to monitor nocturnal migratory activity, identify species of concern, and document migratory phenomena unobservable by other means. The CBM Plan was designed to insure bird monitoring supports the military training mission and relevant legal requirements, while utilizing standardized protocols and data management as well as new and emerging technologies. This talk will provide an overview of the CBM effort, and how results from recent radar and acoustics research support the DoD CBM plan.



Campos do Jordão 2010 25th International Ornithological Congress 22-28 August 2010 (www.i-o-c.org)

Climatic influence on the abundance of long-distance migratory landbirds in Eastern Europe

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Numerous publications discussing fluctuations of passerine numbers in different European regions in the last decades of the 20th century are often contradictory. Some researchers suggest a considerable, often dramatic, decline of long-distance migrants. In some cases, it is explained by the impact of global warming, which causes severe droughts at stopovers and in winter quarters of European birds in Africa and thus increases mortality rate of migrants. In contrast, other published data suggested that numbers of long-distance migrants, did not decline in some European regions or even significantly increased in many cases. Our analysis of long-term dynamics of breeding and autumn numbers in passerine species showed that since the middle of the 1970s, abundance of many species started to grow significantly and reached a maximum by the middle of the 1980s in Baltic countries and in the Ukraine. In the early 1990s, significant decline started in many species in Baltic countries. Finally, in the late 1990s a new considerable increase was recorded in a number of species in the Baltic region. What can explain the long periods of increasing and declining numbers recorded in many passerines in Eastern Europe? I suggest that such a similar pattern of number fluctuations in different regions could be related only to a very important ambient factor, acting on vast areas. Such a key factor could be the spring temperatures. I believe that this governed the long-term fluctuations of passerine numbers in Eastern Europe via breeding success rates. If the climate in the future will be even warmer, as most specialists predict, it will strongly influence population numbers in a lot of species. One can safely assume that rising spring air temperatures will cause not only rising abundance of long-distance migratory landbirds in Eastern Europe, but also an expansion of breeding ranges towards the north in many passerines.



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Cultural inheritance as a mechanism driving site fidelity in an arctic migrant, the light-bellied brent goose (*Branta bernicla hrota*)

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Site fidelity is an important feature of populations that can cause groups of individuals to become geographically isolated over time, and in doing so propagate genetic divergence among them. High levels of site fidelity also have important demographic implications, as individuals remaining faithful to the highest quality sites at certain stages of the annual cycle may possess greater fitness and make a disproportionate contribution to recruitment. As a precocial species, juvenile brent geese spend the entire first year of life shadowing the migratory decisions of their parents, and in doing so gain knowledge of a limited number of sites along the flyway. If juveniles use this experience to inform patterns of site choice in adult life, it represents a mechanism by which social information transfer among individuals can maintain geographic separation between different groups at a population level. Moreover if such patterns are maintained year-round it suggests a means by which migratory connectivity could arise. We genotyped 1128 geese and used these data to assign birds to familial clusters. We then calculated home ranges for each family member using a 6 year re-sighting database to test the degree to which parental home range and site fidelity determines those of its offspring on the wintering and staging grounds. We present these data on culturally-mediated site fidelity in light-bellied brent geese and discuss its implications for genetic structure and demography.



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Distribution and habitat associations of Palaearctic-African migrant birds in West Africa - implications for the diagnosis of declines

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There is widespread concern about the declines in Palaearctic-African migrant birds. The extent to which these declines may be driven by changes in the African wintering habitats remains unclear. Desertification, drainage and agricultural intensification have all increased in the wintering areas over the period of population decline, but their potential effects on these species' wintering habitats are unknown, largely because we have so little information on what habitats these birds require, or how and when they use them. We present new field data on Palaearctic-African birds and their habitats in west Africa on a large temporal and spatial scale, namely throughout winter along a north-south transect across a suite of biomes from dry Sahelian woodland in Burkina Faso to lowland tropical forest in Ghana. Data have been gathered from intensive point counts, mapping birds and habitats, and ringing programmes, at 5 discrete locations along this north-south transect on 4 occasions between October and March. We use these data to quantify seasonal patterns of distribution and habitat use and to develop habitat association models that can be used to assess what environmental changes might be driving the observed declines.



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SA05 Migration and Orientation



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Displacement orientation experiments with two subspecies of willow warbler (*Phylloscopus trochilus trochilus* and *P. t. acredula*) in SW and SE Sweden

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Willow warblers in Sweden belong to two different subspecies. *Phylloscopus trochilus trochilus* breeding in south is expected to migrate southwest to wintering areas in West Africa, while *P. t. acredula* breeding in the north - to south and southeast to wintering areas in Southeast Africa. During the autumn of 2009, we performed orientation cage experiments with willow warblers captured at two different localities - Stensoffa Ecological Field Station, SW Sweden and at the southern tip of the island of Öland, SE Sweden, to examine their migratory directions. The nominate subspecies is dominating during migration in SW Sweden while both subspecies are passing through Öland in fairly equal numbers in autumn. The birds caught and tested in SW Sweden were transported and tested at Öland and vice versa. For identification of the subspecies affiliation of the experimental birds feather and blood samples were collected. Under natural sky the willow warblers tested in SW Sweden were unimodally oriented to WSW (257°) and the birds caught at Öland, facing an ecological barrier - the Baltic Sea, showed axial mean orientation (169° /349°). In simulated total overcast conditions and after the displacement the willow warblers tested at both sites failed to show significant directions. The percentage of not active and disoriented birds was higher at Öland in comparison with those from SW Sweden (14% and 23% under natural sky and 19% and 43% under simulated total overcast), respectively. The orientation of the willow warblers according to the stable isotope signatures and genetic markers will be discussed.



Orientation of migrant birds on the Faroe Islands

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To what degree migrant passerines are able to correct for orientation errors or wind drift is still largely unknown. The Faroe Islands in the northwest Atlantic Ocean is far off the normal migration routes of birds from north and northwest Europe. Nevertheless, several species occur regularly on autumn migration. We studied the departures of such migrants stopping over on the Faroe Islands in the northwest Atlantic Ocean using small radio transmitters. Each departure was followed for as long possible with automatic and manual radio tracking equipment allowing the direction of onward migration to be determined. Two species groups could be distinguished: (1) birds normally migrating east to southeast in Europe and (2) birds normally flying southwest to south. Despite often strong winds (exceeding the birds' airspeed) from different directions, birds from the first group departed rather consistently in westerly directions opposite their normal migration direction indicating that these birds are continuously flying in the "wrong", opposite direction. For the second group, birds departed in southwest to east directions with some departures suggesting that birds were correcting for wind drift. However, in many cases these departures were in strong winds and may be the result of inability to cope with the strong wind.



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Surprising migratory movements and site fidelity unraveled by satellite-tracking of snowy owls

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The snowy owl (*Bubo scandiacus*) is a top predator of the tundra well known for its periodic irruption in temperate North America during winter, which is believed to be a consequence of the cyclic fluctuations of lemmings, their primary prey. We studied annual migratory movements and site fidelity of adult females by tracking individuals with satellite transmitters over a 2-year period. We marked 12 owls in the eastern Canadian Arctic (Bylot Island) in 2007 and 4 in the western Arctic (Herschel Island) in 2008. Birds showed a considerable variation in their migratory movements but only 2 migrated to temperate areas in winter, all others wintering in arctic or subarctic regions. Many eastern birds showed a short, south-east oriented fall migration and spent from 1 to 2.5 months on the sea ice along South Baffin Island, suggesting that it is an important wintering habitat. We are examining whether these birds were using polynyas where wintering seabirds are potential prey. Western birds did not use sea ice and made a short south-west oriented migration to 7 central Alaska. In summer 2008, 8 of the 9 eastern owls settled throughout Baffin Island at an average distance of 671 km from their previous year breeding site and we confirmed that 7 of them were breeding. This is the longest mean adult breeding dispersal distance ever reported in birds. Over two consecutive years owls showed a higher fidelity to their wintering than to their breeding area. Our results suggest that owls may be vulnerable to the impacts of climate change affecting both the terrestrial and marine ecosystems.



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Regional breeding and migration strategies based on intensive volunteer census and demographic monitoring

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Effective conservation requires in-depth knowledge of the life history strategies of migratory and resident birds which we have blended into a unique combination of census and demographic data. Recently new analytical tools have appeared on the scene, that can provide critical information on the interactions between demographics, habitat and climatic dynamics, interactions with other species, and the timing of bird movements and physiological events. In our region we likely have the densest concentration of monitoring stations in the world: about 120 mist-netting stations and over 20,000 census stations in an area of about 500 kilometres on a side. Operating these stations regularly from early spring through late autumn, and applying new statistical visualization and analytical tools, gives us reliable information for many species and their conservation. We demonstrate through power analyses how these answers would be impossible without the availability of this large complex of data sets generated by a multitude of observers. Coupled with the demonstration of web-based data, it provides several powerful tools to the investigator and to the analyst. We have discovered that within a species, regional differences can be as profound as those between species, and as critical to their survival. For example we have found plasticity in migration and dispersal strategies can show that species have a surprising amount of ability to adapt to different climatic conditions between years, an ability hitherto thought to be the provenance of birds in much more stochastic environments.



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Regulation of seasonal movements in irregular partial migrants: the role of photoperiodic conditions

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Many aspects of migration of regular migrants have been extensively studied, both in the field and experiments. To the contrary, the experimental studies of irregular migrants are almost lacking. Consequently, the existing concept about the environmental factors affecting the movements of such species is based only on correlative observations in the field. While discussing the seasonal movements of irregular migrants, the species numbers, food resources, social behaviour etc. are taken into consideration. The role of photoperiodic conditions, well known from field and experimental studies of regular migrants, generally escapes one's attention. We studied the locomotory activity of the long-tailed tit (*Aegithalos c. caudatus*). In some years this species is almost absent on migration route, whereas in other years vast numbers pass across Europe, forming the picture of the irruption. The birds in the first experiment were kept under different light regimes from early age (22-30 days old). It was revealed that the photoperiodic conditions affect the following aspects of migratory state of the long-tailed tit: the age of the onset of migration, timing and intensity of migratory activity, the dynamics of diurnal activity. In the second experiment we found that photoperiodic conditions affect the locomotory activity in birds already in migratory state. While the daylength decreased, the activity grew. We conclude that, as in regular migrants, in the long-tailed tit photoperiod is the important environmental factor that determines the timing and level of locomotory activity during migration. Using the daylength as a cue, individuals of different hatching dates migrate within optimal period of the season and adjust the speed of movements to their individual timing and location on the route. The study was supported by RFBR grants 04-04-48998à, 09-04-01087a.



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A test on the Perdeck paradigm does not support an innate “clock and compass” in ducks

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The ontogeny of navigation mechanisms, despite being crucial for the understanding of animal movement and migration, is still poorly understood. Several previous studies, mainly on passerines, indicate that juvenile, inexperienced birds do not correct for displacement during autumn migration. We tested this hypothesis in a displacement experiment with juvenile mallard ducks (*Anas platyrhynchos*) equipped with solar-powered GPS-devices. We displaced 19 ducks from a common stopover site in the Southeast of Sweden to the Lake of Constance, about 1000 km to the south-south-west. Nineteen other ducks were released in Sweden as controls. The displaced animals responded to their translocation by remaining at the Lake of Constance all winter long, instead of migrating further south west, as ducks in the control group did. Next spring, a mixed response was observed, in which some ducks migrated back to the species specific breeding grounds, whereas the majority started migrating towards the Swedish stopover site. These results are not easily interpreted in terms of the “Perdeck Paradigm” for navigation during migration.



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Body condition is associated with adrenocortical response in the barn swallow (*Hirundo rustica* L.) during early stages of autumn migration

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We measured the baseline and stress-induced levels of corticosterone in barn swallows during early stages of autumn migration in order to better understand patterns of corticosterone secretion associated with migratory physiology. We found out that barn swallows clearly responded to the capture and handling stress by increasing the corticosterone level. This acute response was related to the energetic condition: barn swallows with high residual body masses reached their highest levels of corticosterone around 30 minutes, and the detected corticosterone peak was down-regulated when measured at 60 min of capture. By contrast, light swallows experienced higher peak values of corticosterone than heavy ones, and still continued to increase their levels after 30 minutes. We suggest that the adrenocortical response of barn swallows in better body condition was reduced in order to protect skeletal muscles from the hormone's catabolic activity, which is what the second assumption of the migration modulation hypothesis (MMH) proposes. Further, the baseline levels of corticosterone correlated negatively with the magnitude of adrenocortical response. Our data did not show elevated baseline levels of corticosterone in the course of autumn. This is likely to be contradictory to the first assumption of the MMH, which suggests that the baseline levels of corticosterone are elevated in birds preparing for migration to facilitate fuelling. We found only weak relationships between corticosterone levels and temperature and rainfall. This may be due to the fact that weather conditions during our study were exceptionally warm and dry.



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Breeding phenology and numbers of waders on the Taimyr Peninsula, Siberia, in relation to varying Arctic environment

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Understanding variation in breeding dates and nesting numbers of tundra waders (Sub-order: Charadrii) is instrumental for evaluation of impacts of climate change on reproduction of Arctic birds. We collected data on dates of clutch initiation and breeding densities of waders at the northern Taimyr, Siberia in 1990-1992 and at the south-eastern Taimyr in 1994-2003, 2008-2009. Median dates of clutch initiation significantly depended on dates of snowmelt and mean air temperatures in the period 1-15 June in all common species of waders. All species of waders bred earlier relative to the timing of snowmelt at the northern study site. In the north of Taimyr large monogamous waders with bi-parental incubation bred earlier compared with other wader species, while in the south among-species differences were slight. Breeding numbers of waders correlated with air temperatures early in the season at the northern Taimyr, with the lowest numbers observed in the latest season 1992. Breeding numbers of waders did not show clear relationship with analyzed abiotic factors at the south-eastern Taimyr, although the lowest numbers were observed when warm and dry conditions prevailed early in the season. Total breeding numbers of waders followed a decreasing tendency at the south-eastern Taimyr in the period from 1994 to 2009, and this might tally with the increasing June air temperatures on Taimyr during the last two decades. Continuation of warming trend in early summer may initially lead to an increase in breeding numbers of waders in the north of the Taimyr Peninsula and a decrease in the south.



Spatial and temporal distribution of south polar skuas in the wintering areas of the North Pacific and North Atlantic Ocean

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During three Antarctic summer seasons (2007-2009), 109 south polar skuas (*Catharacta maccormicki*) and brown skuas (*C. antarctica lonnbergi*) were equipped with GLS-loggers on King George Island (South Shetlands). More than 80% of these breeding birds were caught again after one or two years and the GLS-data were processed. Whereas all brown skuas overwintered in the area of the South Atlantic, all south polar skuas migrated to the Northern hemisphere. For the first time, we are able to show the overwintering area of south polar skuas located in the North Atlantic between 40°-50°N and 30°-60°W as well as in the North Pacific between Japan and the Gulf of Alaska, mostly in areas without published observations before. South polar skuas leave the breeding area between mid-March and the end of April, arriving in the Atlantic wintering places between April 21 and June 4. The return migration, which occurs between September 15 and December 11, is faster, and in some cases as short as three weeks long. From our data, a small number of birds overwintering in the North Pacific, left the breeding grounds 9 days earlier and arrived between April 21 and May 23. The return migration for these individuals was recorded as being between September 9 and December 6, and therefore not much different to the return of the other birds. Further results investigate the similarities and differences between the overwintering areas between the years and individuals and are discussed in relation to the oceanographic features encountered during the migration and in the overwintering areas.



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SA06 Morphology, Ecomorphology, Evo-devo and Development



On *Alipiopsitta xanthops* plumage variation

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Alipiopsitta xanthops, the yellow-faced parrot, is a green, yellow headed parrot. The chest plumage may vary from a complete green to an orange-yellow coloration. Authors have given contradictory information on it, relating either to gender, age or as genetics. However, as far as we know, no specific studies have been done on the species plumage. From over 300 pictures taken from museum specimens and fledglings, as well as wild populations observations at Brasilia and EMAS National Park, Brazil, we describe the plumage variation found on *Alipiopsitta xanthops*. We found no differences in the proportion of yellowish chests (YC) between the two natural populations. Yellowish chest individuals were collected all over species distribution. We found differences between the proportions of YC in museums (32%) and wild populations (8.7%; $p < 0.01$) indicating that individuals were not randomly collected. We also found a skewed sex ratio on museums, as females represents only 25% of the specimens. This could either reflect the wild population sex ratio or that those males are more easily catchable. We found that 37% of museum males had yellowish chest, while only 18% of females had it, but it represents no statistical difference (Fisher exact test $p = 0.12$; $n = 16$ females; $n = 49$ males). However, yellowish chest males have more yellow-orange on the chest ($t = 1.81$; $p = 0.04$). None of the 16 observed fledglings presented yellowish chest. The yellow head coloration slowly grew over the 14 days of observation of the fledglings. Instead of disagreeing with any of the authors, the present work confirms they were all right, as the plumage variation seems to be related all - age, gender and also by genetics. Not by a single characteristic.



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Identifying trends in avian ecomorphology with applications to Mesozoic birds

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As members of the most taxonomically diverse group of organisms, the Archosaurs, modern birds are strikingly diversified. They occupy a wide ambient range, and thus display a variety of lifestyles and adaptations. Skeletal morphometrics are a reasonable proxy to understand avian ecomorphological trends. This study presents an analysis of 500 modern bird species, for which ten forelimb and hindlimb measurements were collected. Each species was assigned a primary ecological category based on foraging habits and secondary categories based on other behaviors, such as migration or nesting location. The data was fit to recent molecular phylogenies of modern birds to correct for a phylogenetic signal in the data. Covariation between the two sources of data was analyzed using multivariate statistics. Analyses reveal large differences in ecomorphospace occupation between terrestrial and arboreal birds. Migratory tendencies and diving techniques further contribute to enhance clustering patterns within the main categories. In addition to enhancing our understanding of modern ecomorphology, the results of this study can be applied to the fossil record of birds. Our growing understanding of morphological diversity among Mesozoic birds offers unprecedented opportunities to apply rigorous morphometric techniques to better understand basal bird ecology. By comparison with the known ecologies of modern birds we have been able to quantitatively analyze potential ecologies for basal birds such as *Archaeopteryx* and *Confuciusornis*. The results of this study allow us to differentiate early birds specialized for a particular ecology from more “generalist” birds.



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Does selection history affect stress sensitivity of bilateral trait development in Afrotropical cloud forest species?

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Developmental theory predicts positive relationships between ambient stress and fluctuating asymmetrical (FA) development of bilateral body traits, and negative relationships between fitness and FA. As a consequence, body FA has been widely advocated as a universal biomarker of population health and individual quality in avian biology. Subsequent empirical studies, however, revealed significant heterogeneity in relationships between FA, stress and fitness, thereby questioning their overall robustness and generality. One potentially important - yet largely neglected - cause of this heterogeneity is variation in underlying selection history among traits. If populations underwent recent directional selection in some traits, but not in others, their development may be destabilized through the loss of canalizing modifiers, thereby rendering these traits more sensitive to developmental stress compared to non directionally-selected ones. To test this hypothesis, we measured a series of external and internal (through harmless X-rays) traits on 249 individuals of five cloud forest species in a fragmented Afrotropical biodiversity hotspot, and compared these with similar measurements on 237 museum specimens collected in the same localities between 1934 and 1948. Earlier, we showed a strong temporal increase in tarsus FA over this time interval in bird populations of a severely disturbed forest fragment, but not of a more intact (control) site. Here we test (i) whether different bilateral traits vary in their level of directional change, and (ii) to what extent such directionality co-varies with trait sensitivity to forest disturbance. Evolutionary-ecological results of this study are discussed within a framework of increased mobility costs under decreased landscape connectivity.



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Comparative osteology and syringeal morphology of antpittas (Grallariidae) and antthrushes (Formicariidae)

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Data on osteology and syrinx morphology of Grallariidae and Formicariidae, recently split by molecular phylogenies, are scarce. Diagnostic anatomical features distinguishing these families are poorly known. The aim of this work was to identify these features by the comparative study of skeletons from four species of antpittas (representing the genera *Myrmothera*, *Hylopezus*, and *Grallaria*) and four species of antthrushes (representing the genera *Chamaeza* and *Formicarius*) and syringes from two species of antpittas (*G. varia* and *H. macularius*) and three species of antthrushes (*F. colma*, *F. analis*, and *C. ruficauda*). Additionally, we studied skeletons and syringes from 27 and 9 species, respectively, representing all the Furnarioidea families (except Melanopareidae and Scleruridae). We found five osteological and four syringeal differences between antpittas and antthrushes, respectively: *Processus rostromedialis palatini* reduced vs. long; Vomer with flat vs. cylindrical condyles; *Foramen orbitonasale mediale* lacking projection in its ventral margin vs. with projection; presence of bony bar between *Foramen obturatum* and *Fenestra ischiopubica* vs. absence; hypotarsal channel conducting tendons of *Musculus flexor perforatus digiti IV* and *M. flexor perforatus digiti III* totally ossified vs. channel with plantar limit not ossified; *Membrana tracheosyringalis* lacking 4-5 ventral supporting elements vs. with these elements; 15-21 supporting elements cranial to *Mem. tracheosyringalis* dorsally narrowed vs. only 3-6 narrowed elements; cartilaginous edges of the first 3-4 A elements not fused vs. fused; *M. sternotrachealis* originating on *Proc. craniolateralis sterni* vs. on intercostal muscles.



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Self-assembly of spongy color producing feather nanostructures by phase separation

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The non-iridescent structural colors of avian feather barbs are produced by spongy beta-keratin and air nanostructures. The size of the air cavities determines the predominant hue produced. There are two major classes of these nanostructures characterized by air channels or air spheres in the medullary keratin. These two shape classes are identical to the two morphologies produced by mechanisms of phase separation, or the process of unmixing of complex aggregations of molecules. Channels appear like the forms produced by spinodal decomposition - the mechanisms of phase separation in an unstable mixture; whereas spheres resemble the shapes produced by nucleation and growth, the process of phase separation by a metastable mixture. We investigated these nanostructures using Small-Angle X-ray Scattering (SAXS) at Argonne Labs. The SAXS data provide a powerful characterization of the distribution of air cavity and keratin bar sizes. Comparing the SAXS data from channel and sphere type feather nanostructures we were able to test the hypothesis that these structures were formed by phase separation of beta-keratin from the cytoplasm of the medullary cells. The SAXS profile of channel type nanostructures is identical to data from a spinodal decomposition of a polymer mixture. Similarly, the SAXS data from sphere type nanostructures shows good agreement with an amorphous assemblage of polystyrene spheres that assemble by nucleation and growth. These data confirm that color producing protein nanostructures self assemble by phase separation. Future work will focus on the mechanisms for the arrest of phase separation at the correct size scale to produce the appropriate structural color.



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Developing dichromatism: the ontogeny of iridescent and non-iridescent feathers in blue-black grassquits (*Volatinia jacarina*)

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The honest advertisement hypothesis posits that male ornamentation is costly to produce and therefore that females may obtain reliable information about male quality from its elaboration. Iridescent structural colours in feathers are produced in the barbules by laminar arrays of materials differing in refractive index, which are organized during development in a precise scale to reinforce certain wavelengths. The properties of coloration produced by these thin-film structures can be affected by minute, nanometer-scale differences of its structural organization, which has led to the suggestion that appropriate expression of iridescent colours can be costly. However, the mechanisms of this organization remain unknown. We addressed this question by comparing the morphology of developing male (iridescent) and female (brown) blue-black grassquit feathers. Light microscopy and SEM revealed that melanin deposition in barbule cells occurs early in both sexes' feathers, with no noticeable differences in early and mid-stages of development. During these stages, barbule cells are densely packed with melanosomes, which decrease in concentration as development proceeds. During late development in females, barbules grow into hook shapes and melanosomes remain unorganized. In males, however, barbules stretch elliptically and melanosomes appear to be passively organized into light-scattering nanostructures. It revealed no evidence for cellular machinery actively mediating this process. Our results suggest that colour-producing structural organization is probably a result of drying patterns and keratinization, which are most likely not mediated by cell function, therefore suggesting a major role for keratin polymerization and self-assembly in this process. We discuss the consequences of our findings to sexual selection and the evolution of iridescent coloration.



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Convergent and alternative solutions to nectarivory: morphological traits and feeding apparatus functioning in nectarivorous birds

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Opportunistic nectar consumption is widespread because this highly energetic resource is easy to find. Efficiently securing enough of it to subsist on is more difficult. Some groups have achieved nectar-feeding specializations that allow them to thrive in mutualistic associations with plants. Studies have described repetitive evolution of morphological traits associated with nectarivory. However historical contingencies on each group (e.g. frugivory or insectivory as ancestral conditions) have imposed different constraints on nectar-feeding adaptations. Consequently, nectarivory is achieved by similar but not identical structural changes. The focus of our work was to provide a comprehensive overview of convergent traits and mechanisms for nectar feeding in birds, as well as alternative solutions to attain efficiency given the different morphological constraints of each group. We examined bills of around 1500 specimens representing 300 species from 20 independent clades of specialized nectarivores under high magnification (50x). Samples came from 7 museum collections in South, Central and North America. We surveyed tongue morphology in representatives of 15 of the 20 clades using alcohol-preserved specimens, and combined high-speed videography (500 fps) with stereoscopy to study tongue-fluid interactions. We report previously unnoticed morphological convergences among several taxa of nectar-feeding birds: flexible tomia, forwardly directed serrations and internal projections presumably involved during tongue extrusion. Finally, we propose novel mechanisms of nectar extraction, and provide evidence that, contrary to current consensus, capillarity is not the sole process driving nectar intake in some groups.



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A phylogenetic hypothesis for representatives of the Ramphastidae (Aves: Piciformes), based on morphological syringeal characters

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Toucans, toucanets and aracarís belong to the family Ramphastidae that is endemic to the Neotropics. About 33 species are distributed in six traditional genera. In this study, a new phylogenetic hypothesis is proposed for representatives of this family based on syringeal characters. The syrinx, that produces vocal sounds of birds, consists of modifications of the respiratory tract, and it includes skeletal cartilaginous elements, membranes, muscles and nerves. A sample of 22 species comprising 18 from five genera of the Ramphastidae, and four from three genera of the sister family Capitonidae were studied. Three equally parsimonious trees were founded, with a length of 92, and consistency index of 0.73, and retention index of 0.88. The monophyly of the family was confirmed and supported by seven synapomorphies, but the Neotropical barbets were indicated as paraphyletic. According to the topology of the cladogram, *Bailloni bailloni* should be included in the genus *Pteroglossus*, as proposed in previous molecular studies. With this inclusion, all genera are monophyletic, with the following relationships: *Aulacorhynchus* (*Ramphastos* (*Pteroglossus* + *Selenidera*)), which is partially congruent with previous studies. Relationships among the species of *Pteroglossus* were also evident, although the Bremer index was low in strict consensus: (*P. beauharnaesii*, *P. bitoquatus*, *P. azara*) (*P. incriptus* (*P. viridis* (*P. bailloni* (*P. aracari* (*P. pluricinctus*, *P. castanotis*)). The superspecies *P. aracari* hypothesized by Haffer was the only one confirmed as a monophyletic group. Funds: CAPES, CNPq.



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Links between stress sensitivity and ageing patterns in an extremely very long-lived bird, the wandering albatross

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How does corticosterone (CORT) mirror ageing? Although age is known to affect the stress response in rats and humans, critical data on the age-related patterns of the stress response in wild animals is missing. We focused on an emblematic long-lived seabird, the Wandering Albatross, with extraordinary lifespan (up to 60 years old). We studied free-living individuals aged from 6 to ≥ 48 years and addressed pivotal questions of current gerontology: (i) does age affect the stress response? (ii) Do males and females exhibit different age-related patterns? (iii) Does breeding status matter? (iv) Are hormonal, cardiovascular and behavioral responses regulated independently? We tested whether CORT, heart rate (HR), and behavioural responses to handling stress varied among 106 breeding birds and 60 non-breeding birds, while accounting for sex differences, which are a hallmark of human and rat ageing. HR and CORT responses were lower in old breeding males than in middle-aged breeding males. Baseline CORT level was lower in old breeding females than in middle-aged breeding females. HR and CORT were lower in old breeding males than in old non-breeding males. HR and CORT stress responses did not vary with age among non-breeding birds. The proportion of 'fearful' birds decreased with age in non-breeding males, but not in females. Thus, stress elicited different effects in albatrosses depending on sex, age and reproductive status, as in rats and humans. Interestingly, there was no detectable age-related decline in immunity, oxidative stress, antioxidant defenses and parasite burden. Overall, our findings suggest that ageing might strongly affect stress sensitivity in wild animals.



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Feathers are pre-adapted for sound production

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Recent research which discovered the highly-refined resonating properties of the sound-producing feathers of *Machaeropterus deliciosus* indicate that it was not the frequency or pitch of the resonance that had evolved for sound production per se. Rather, the Q factor--the *quality* of the resonance, or its tendency to oscillate at maximum amplitude at certain specific frequencies with minimal dampening--appears to be the feature which has been selected for by choosy females. Here I present the results of research examining the resonant properties of several series of homologous feathers from a suite of species, including several members of the *Pipra/Machaeropterus* clade, which examines this hypothesis of pre-adaptation in more detail. Early results indicate that indeed not the pitch, but the Q factor of the feathers of these birds has co-evolved with sound production in this clade.



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SA07 Nutrition, Energetics and Foraging



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Heritability of basal metabolic rate in free-living pied flycatchers (*Ficedula hypoleuca*)

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Though basal metabolic rate (BMR) is a most examined energetic trait, which is often considered to be an indicator of competitive ability of an animal, very little is known about its heritability. The heritability value of a trait makes it possible to predict a trait's response to selection. Several results from our previous investigations give indirect evidence of significant heritability of BMR in free-living male pied flycatchers: 1) the positive correlation between resting metabolic rate (RMR) of chicks and BMR of their true fathers in cross-fostering experiments; 2) relatively high repeatability of BMR in males and females over considerable time intervals (1-3 years). In this study we use BMR measurements of different relatives (parents and offspring, full sibs and half sibs) in natural population of pied flycatcher in Tomsk (Western Syberia; 56°20'N, 84°56'E) in 2008-2009. We present the first attempt to estimate BMR heritability in free-living populations of endotherms. Consequences of our results for BMR usage in intra-population evolutionary studies will be discussed.



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The potential role of various southern African frugivores as dispersers of alien invasive fruit and their effect on germination rates

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Some of the worst alien plant invaders are those which bear fleshy fruit. Whether or not native avian frugivores enhance alien invasive seed germination is poorly studied, particularly in an African context. The aim of this study was to determine if generalist avian frugivores enhance seed germination of alien species by either pulp removal or seed coat abrasion, or if they serve as dispersers only. We considered four fleshy-fruited alien invasive plant species namely: *Solanum mauritianum* Scopoli (bugweed), *Cinnamomum camphora* L. J. Presl. (camphor), *Lantana camara* L. (lantana), and *Psidium guajava* L. (yellow guava). Red-winged starlings (*Onychognathus morio*), speckled mousebirds (*Colius striatus*), and dark-capped bulbuls (*Pycnonotus tricolor*) were fed the respective alien fruit diets after which seeds were removed from their excreta and planted. Concurrently manually pulp removed seeds and whole fruit were planted as controls. Daily germination counts were carried out for all, when germinated seedlings were removed. *Solanum mauritianum* and *C. camphora* germination % varied significantly between frugivores but *L. camara*, and *P. guajava* did not. Pulp removed and ingested seeds' germination % did not vary significantly for all plant species, suggesting that seed coat abrasion was not enhancing germination. Pulp removal did result in significantly earlier germination for plant species which take longer to decompose (*L. camara* and *P. guajava*) and higher germination % than whole fruit controls of *C. camphora* and *L. camara*. Seed retention time (SRT) during trials was recorded. All SRT's were significantly different between bird species fed on the respective alien fruit diets, except for *C. camphora*. These frugivores are therefore important for pulp removal in fruit with tough, waxy exocarps and serve only as dispersers of alien invasive fruits.



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Where do common swifts *Apus apus* find the calcium for eggshell production?

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Although large birds, such as chickens, draw skeletal calcium for eggshell formation, it is assumed that small birds cannot do this. This assumption is based on studies of passerine species breeding in calcium-poor acid areas, and is supported by recent work on eggshell structure and pigmentation in relation to local calcium availability. For such birds, calcium must be obtained daily by increased ingestion of dietary calcium, e.g. by consuming small snails, which may represent a specific diet shift to increase calcium consumption. While such a shift may be possible for many small birds, it is unlikely to be so for all. Such must be the case for the common swift *Apus apus*, a small (c. 40g) non-passerine, whose diet consists entirely of airborne invertebrates taken on the wing, few of which are rich in calcium. Further evidence that calcium is a limiting nutrient for breeding common swifts in the UK lies in the fact that they typically lay three thin-shelled (for their size) eggs and replacement eggs and second clutches are very rare. We therefore tested the hypothesis that common swifts might draw on skeletal calcium for eggshell formation, as do larger non-passerines, through examination (mass/size ratio and translucence) of skeletons of sexed common swifts collected at different times of the year and held by the Natural History Museum at Tring UK. We found a reduced density of the sternum and pelvis in females after laying compared with pre-laying or later during autumn migration. Such seasonal changes were not seen in males. We also found a reduction in the relative mass of femur bones in females (but not males) between pre- and post-laying stages. We conclude that female common swifts probably draw skeletal calcium for eggshell formation.



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The impact of divergent hydrographic conditions along the West coast of Spitsbergen (European Arctic) on zooplankton communities and chick provisioning by planktivorous little auk (*Alle alle*)

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Little auks are the most numerous seabirds in the Arctic. Quality and quantity of their food on the West Spitsbergen Shelf are much affected by distribution of water masses. Composition and abundance of zooplankton were studied simultaneously with feeding ecology of little auks in two sea areas near the colonies in Magdalenefjorden and Hornsund in 2007 and 2008. In spite of Atlantic conditions on Magdalenefjorden shelf, there were similar numbers of Arctic *Calanus glacialis* CV in the plankton preferred by little auk, as on Hornsund shelf, influenced by Arctic waters. In both colonies parents fed their chicks mainly on *C. glacialis*, but its proportion was greater in food loads in Hornsund. In Magdalenefjorden, some birds undertake extra foraging effort and brought alternative food, such as ice associated amphipod *Apherusa glacialis*. Longer duration of foraging trips and higher number of feedings in Magdalenefjorden could result from less favorable feeding conditions close to the colony as indicated by lower rate of valuable *C. glacialis* to Atlantic *C. finmarchicus* (1:14 in 2007 and 1:6 in 2008) than observed near Hornsund (1:1 and 2:1). The present warming has already shown, that parent birds exposed to less favorable foraging conditions have higher energy expenditures, but are still capable of providing sufficient energy to their chicks. With continuing influx of the Atlantic waters to the Arctic seas it is only a matter of time that foraging of little auks on the West Spitsbergen Shelf becomes unprofitable.



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The regulation of body temperature during winter nights

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Small birds spending the winter at temperate latitudes have to cope with short foraging days, reduced food availability and an increased cost of thermoregulation due to a high surface area to volume ratio and high body temperatures (passerine average 42.5C). However, such birds may substantially reduce metabolic demands and consequently daily foraging needs by entering a state of controlled hypothermia (an active down-regulation of body temperature below the normothermic set-point) during the night. We show that the degree of hypothermia depends on both short- and long-term environmental cues, and by performing an experiment we show that when food availability is high, blue tits (*Cyanistes caeruleus*) do not enter hypothermia even though individuals with less food do so. The finding that hypothermia is not used routinely during the night is somewhat puzzling, as reduced energy expenditure would augment survival probability by reducing both the risk of overnight starvation and predation related to diurnal foraging. Thus, hypothermia is probably connected to costs against which its benefits are traded-off. Such potential costs may include a higher susceptibility to predation when in a hypothermic state. By experimentally manipulating the perceived risk of predation, we test the hypothesis that birds reduce the depth of hypothermia if predation risk is high and discuss the role of predation in shaping energy allocation decisions among birds wintering at high latitudes.



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Novel GPS tags provide new insights into foraging strategies of pelagic seabirds at three Bering Sea colonies

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Black-legged kittiwakes (*Rissa tridactyla*) & thick-billed murrelets (*Uria lomvia*) are 2 of the most abundant breeding seabirds in the Bering Sea. Both species nest in colonies on St. George, St. Paul and Bogoslof islands. The size of these 3 breeding colonies spans 2 orders of magnitude, with St. George being largest and Bogoslof smallest. We deployed GPS tags on kittiwakes & murrelets nesting in these 3 islands in 2009. We found foraging distance from the colony for both seabird species was far greater at the largest colony than at the smallest colony, consistent with density-dependant limitation on food resources. Despite overlapping foraging distances, foraging areas used by birds nesting on the Pribilof Islands and Bogoslof were non-overlapping. Also we discovered both species nesting on the Pribilof Islands engage in 2 types of foraging trips: short, daytime trips to provision chicks, and long, overnight trips to self-feed. In kittiwakes, there were gender differences in the prevalence of these 2 types of foraging trips, males foraging more during the day, close to the colony and females foraging more at night. The use of novel, small GPS devices has revealed new information on the importance of density-dependent competition for food resources among colonial seabirds during the breeding season, when they are restricted to central place foraging.



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Differential use of macrophytes by waterbirds at a Central European lake

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Lake Constance, the second-largest lake in Central Europe, supports a vast number of waterbirds during the winter season. Monthly peak numbers in winter reached 250.000 birds in recent years, with up to 80% of all birds comprised by tufted duck *Aythya fuligula*, pochard *A. ferina*, and coot *Fulica atra*. Numbers were four times lower in the 1960s due to larger human impact, lower trophic levels and very limited mussel availability. During the moulting period, waterbird assemblages are much smaller, encompassing some 25.000 birds, and with a wider range of dominant species including red-crested pochard *Netta rufina*. Waterbirds at the lake may prey on invertebrates (here mainly the introduced zebra mussel), may specialize on grazing charophytes (stoneworts), or may feed on a mixed diet. The species and individuals also vary in the spatial use of the lakes depth levels. In enclosure studies at (Lower) Lake Constance we concentrated on the temporal and spatial consumption by waterbirds of macrophytes during the winter months (senescence phase) as well as during summer (growing phase). We found a high grazing pressure on unprotected stonewort stands by waterbirds during the moulting period and a near-complete depletion of stands down to depths of some 2m below surface in winter. Furthermore, there was a clear preference for different depth levels, with shallower levels grazed first and foremost in both periods. We also report on isotope analyses of tissue, feather and blood samples of waterbirds at Lake Constance. This aims to establish the isotope method at the lake to differentiate between individual short- and long-term food preferences and how these differences may relate to the various types of food items and water depths chosen.



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Impact of plankton- and fish-eating seabird colonies on Arctic tundra ecosystem - a comparison

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Many arctic terrestrial ecosystems suffer from a permanent deficiency of nutrients. Marine birds, that forage at sea and breed on land, transport considerable amounts of organic matter from the sea to the land, and thus sustain terrestrial ecosystems. This matter, mainly in the form of guano but also as lost prey items, eggs, dead chicks and adults, initiates the emergence of local tundra communities, increasing primary and secondary production and heterogeneity of plant communities. Moreover, the chemical composition of guano depends on seabird diets and may influence soil properties in a different way near planktivorous and piscivorous birds colonies. To test this hypothesis, we studied tundra plots in the vicinity of two large colonies of seabirds in Hornsund, SW Spitsbergen - a colony of plankton-eating little auks and a mixed colony of fish-eating Brünnich's guillemots and black-legged kittiwakes. We found: higher guano deposition, higher ion content (NO_3^- , NH_4^+ , PO_4^{3-} , K^+) and lower value of soil pH close to both colonies compared with the control areas; gradual decrease of nutrient contents in the soil along the colony-sea axis; significantly higher heterogeneity of ornithogenic plant communities in comparison with control areas; much higher content of phosphates and the dominance of scurvy grass *Cochlearia groenlandica* near fish-eaters compared with plankton-eaters' colony; higher biomass of vascular plants in direct proximity of planktivorous little auks in comparison with piscivorous' colony.



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Ecophysiology of fuelling in European robins *Erithacus rubecula* during migration

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Most migratory bird species migrate by alternating flight bouts and stopovers. Recent studies report an absence of a clear relationship between bird's energetic condition on arrival at the stopover site and their stopover duration. This means that some lean birds stop over just for one day whereas some fat individuals stop over for a comparatively long time. Moreover some data show that during prolonged stopover lean birds gain body mass (bm) while fat individuals lose mass or keep it stable. On the Courish Spit (Eastern Baltic) I found that lean robins *Erithacus rubecula* increase bm with the average rate of 0.065g/day in spring and 0.13 g/day in autumn. The corresponding values for fat birds were -0.11 and +0.011, respectively. To study the reason for the difference in fuelling rate in lean and fat robins I conducted an experiment which simulated stopover behavior under natural conditions. In autumn 2008 and spring 2009 I captured robins just after landing at our study site and transferred them to individual cages where bm changes, amount of food eaten (meal worms), faeces production and amount of locomotion activity were monitored on the daily basis. Lean birds gained bm nearly linearly during the whole experiment (10-12 days) with an average rate of 0.1 g/day. Fat robins lose bm for two to three days and only then start to gain bm. This difference is explained mainly by the difference in food amount consumed during the first two days with lean robins feeding at a maximum rate while fat individuals – at a minimum rate. Subsequently food consumption was indistinguishable between groups. Apparent digestive efficiency was similar for both fat and lean robins. I will also discuss the contribution of locomotion activity to the observed pattern of bm dynamic and report the findings comparing the digestive tract development in lean and fat robins.



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Climate change increases the likelihood of catastrophic avian mortality events during extreme heat waves

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Birds inhabiting hot desert environments face significant thermoregulatory and water balance challenges. Occasionally, extreme heat waves cause catastrophic mortality events involving thousands or even millions of birds; the most recent such episode took place in western Australia in January 2009. Increases in maximum air temperature of 3 - 5 °C are predicted for many of the world's hot deserts, as well as greater heat wave frequency and duration. A model of evaporative water loss rates in desert birds reveals that predicted increases in air temperature will cause large fractional increases in water requirements during very hot weather. By the 2080s, water requirements for evaporative cooling in small species during the hottest part of the day will be 50 – 100% higher than at present. Birds typically respond to high environmental temperatures by curtailing activity and retreating to shaded microsites, and these elevated water demands will be manifested as severely reduced survival times with birds reaching their dehydration tolerance limits much sooner. In addition to increased dehydration risk, higher maximum air temperatures will also increase the likelihood of fatal hyperthermia, when birds' capacity for heat dissipation is overwhelmed. As frequency distributions of daily maximum temperatures shift towards higher values, there will be increases in the number of days per year on which birds approach or exceed their dehydration tolerance limits and/or experience lethal body temperatures, with catastrophic die-offs occurring more frequently and over wider areas. Our capacity to predict where and when these mortality events will occur is currently hampered by a paucity of data on avian acute dehydration tolerance, as well as by the absence of precise meteorological and physiological data for previous die-offs.



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SA08 Physiology, and Cell and Molecular Biology



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Keeping it simple: paracellular absorption of glucose in birds

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Small birdsface strong selection pressure to digest food rapidly as a means of reducing digesta mass carried during flight. One way they may do this is by rapidly absorbing a high proportion of glucose via the paracellular pathway i.e. transfer between epithelial cells and therefore not mediated by transporter proteins. Paracellular absorption provides a non-saturable absorptive process that automatically compensates for acute changes in dietary nutrient concentrations. We investigated the effects of food concentration (and therefore intake rate for birds that compensatory feed) on the bioavailability of radiolabelled L-glucose at two dietary sugar concentrations (250 and 1000 mmolL⁻¹) in three passerines: the Australian New Holland honeyeater and silveryeye and the African whitebellied sunbird. L-glucose bioavailability was higher in the nectarivorous honeyeater and sunbird compared with the frugivorous silveryeye, but increased with diet sugar concentration in all species (honeyeaters: 37 vs. 81%, sunbirds: 53 vs. 71%, and silveryeyes: 22 vs. 42% for 250 vs. 1000 mmolL⁻¹ sugar diets, respectively). We conclude that all three bird species show extensive absorption of L-glucose, which would reflect significant non-mediated glucose uptake on natural (D-glucose) diets. The relative contribution of paracellular to total glucose absorption also increases with diet concentration, most likely due to increased digesta retention time. In conclusion, significant absorption of water-soluble nutrients via the paracellular pathway may compensate for the reduction in intestinal absorptive surface area associated with flight, whilst allowing birds to satisfy high energy requirements.



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Avian seasonal metabolic variation in a subtropical desert: basal metabolic rates are lower in winter than in summer

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Most small birds inhabiting temperate latitudes in the Holarctic increase basal metabolic rate (BMR) in winter, a pattern thought to reflect the up-regulation of metabolic machinery required for enhanced winter cold tolerance. In contrast, patterns of seasonal BMR variation in birds inhabiting subtropical latitudes are largely unknown. In this study, we investigate seasonal BMR changes in species from subtropical latitudes, and analyse global variation in the direction and magnitude of these responses. We estimated winter and summer BMR in five species resident in the Kalahari Desert, using flow-through respirometry to measure O₂ consumption and CO₂ production in birds held overnight in a field laboratory. In all five species, mass-specific BMR was significantly lower in winter than in summer, with mean reductions of 23% in African scops-owls (*Otus senegalensis*), 30% in pearl-spotted owlets (*Glaucidium perlatum*), 35% in fork-tailed drongos (*Dicrurus adsimilis*), 29% in crimson-breasted shrikes (*Laniarius atrococcineus*), and 17% in white-browed sparrow-weavers (*Plocepasser mahali*). An analysis of global variation in seasonal BMR changes reveals that their magnitude and direction vary with latitude, ranging from pronounced winter increases at high latitudes where winters are extremely cold, to the opposite pattern in warmer, subtropical environments. Our empirical results for five species, taken together with the analysis of global variation, raise the possibility that seasonal metabolic variation in species from subtropical and possibly also tropical environments may be related to winter energy and/or water savings, rather than cold tolerance.



Global variation in house sparrow immune functions

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Traits that enable organisms to colonize new areas remain enigmatic. One hypothesis is that invading hosts experiencing less threat of parasitism would prosper if they sacrificed costly immune responses. We predicted that inflammation would be dampened in invading organisms, as the costs of this immune defense are exceptionally large. To test this hypothesis, we compared inflammation among 7 populations of one of the most broadly distributed animals, the house sparrow (*Passer domesticus*) using an identical protocol. Birds from native (Germany and France), long-established but introduced (~150 years ago; all North American), and actively invading (Kenya and Panama) populations were either injected with complete Freund's adjuvant (CFA) or left untreated (as controls) and twenty-four hours later, haptoglobin (Hp), nitric oxide (NO), and body mass change were measured. Haptoglobin, a hepatic protein with strong anti-inflammatory and anti-oxidant effects, was elevated by CFA, but introduced populations had more circulating Hp than native ones independent of CFA. Nitric oxide, a broadly effective antimicrobial molecule, exhibited a gradient from native (highest) to invading (lowest) when one exceptionally high North American population was excluded. Body mass was not significantly affected by CFA or invasions status. In sum, inflammatory responses differed by introduction history, suggesting that adjustments of some immune functions may facilitate some range expansions.



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Stress-induced reproductive inhibition: sites and mechanisms of action for acute stress on the hypothalamo-pituitary-gonadal axis

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Acute stress in birds can inhibit reproductive functions, but the exact mechanisms responsible remain poorly understood. Mammalian testes contain specific glucocorticoid receptors and activation of these receptors can rapidly decrease testosterone (T) synthesis. Suppressive effects of stress on avian reproduction may likewise result from direct inhibitory actions on testicular endocrine function. To test this hypothesis, we used free-ranging adult male rufous-winged sparrows, *Aimophila carpalis* in breeding condition to (a) measure effects of acute stress induced by capture and mild restraint for 30 min on plasma T and (b) determine the plasma T response to ovine luteinizing hormone (oLH) administered either immediately after capture or after 30 min of mild restraint stress. Acute stress increased plasma corticosterone and decreased plasma T by 30-50%. Birds receiving an oLH injection increased their plasma T 2-3 fold within 15 min of treatment compared to control (saline-treated) sparrows. However, the amplitude of this increase did not differ whether sparrows received oLH immediately after capture or 30 min later. Thus, acute stress can rapidly decrease plasma T, but this decrease does apparently not result from loss of testicular sensitivity to LH. Additional studies are warranted to investigate the role of the hypothalamus and/or anterior pituitary gland in the mediation of acute stress effects on the avian reproductive axis.



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Heterothermy is related to the lunar cycle in a nocturnal insectivorous bird

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Many studies have shown that endotherms become more heterothermic when the cost of thermoregulation becomes too high or when energy shortages limit thermoregulatory capacity, but few studies have investigated how foraging success and heterothermy are related. We measured winter skin temperature of freckled nightjars (*Caprimulgis tristigma*) in the winter-rainfall succulent Karoo Desert, South Africa, during a single lunar cycle. Nightjars were highly active and foraged for moths when moonlight was available, but became heterothermic when no moonlight was available during the night. In simple regression analyses, the magnitude of heterothermy was significantly related to both % moon illumination and air temperature. However, when both environmental variables were included in a single multiple regression analysis, the relationship between air temperature and the magnitude of heterothermic responses became non-significant. These results suggest that heterothermy in this nightjar population is related to the possible reduction in foraging success associated with the lunar cycle, even though absolute food abundance was high throughout winter. Further, our study is one of the first to report an environmental variable being more important than air temperature in the expression of heterothermy.



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Oxidative damage and protection: mechanisms in a long living bird species

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The regulation of oxidative stress in long-lived animals may largely differ from that of short-lived ones. Still most of the researches concerning oxidative stress has been done on a few model species, which are mostly small and have short lifespan. We used breeding common gulls (*Larus canus*), long-living colonial seabirds, to measure different markers of oxidative damage and protection. We found that levels of lipid peroxydation markers were positively correlated with total oxidant status (TOS) and negatively correlated with plasma carotenoid levels. The importance of carotenoids as antioxidants has become a much debated issue lately, but these findings support the role of carotenoids as protectors against membrane damage. The level of plasma carotenoids was negatively correlated with total antioxidant capacity (TAC), which suggests some compensatory mechanism between fat-soluble and water-soluble antioxidants. TAC was also negatively correlated with an intracellular endogenous antioxidant, glutathione, and positively correlated with pro-oxidative amino acid homocysteine. These findings indicate that there are multiple mechanisms to remain oxidative balance and thus different markers of oxidative damage and protection must be studied in order to make conclusions about oxidative status of an organism.



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Badge size and the immune function in male house sparrows during the annual cycle: coccidians enforce the honesty of a plumage ornament

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Birds use status signals in their social interactions during the whole annual cycle, which assumes the honesty and costliness of these signals in terms of physiological and behavioural maintenance. The role of the melanin-based signals in intra- and intersexual social interactions are well established, however, the mechanism maintaining their honesty is still under continuous debate. Here, we report results of a correlation- and experimental study about the variable effect of *Isosporan* coccidians on the condition and the size of the melanin-based badge of male house sparrows (*Passer domesticus*). Contrary to our expectations, in the first experimental year the badge size increased in the infested birds related to the control group, manipulated with a coccidiostatic drug. On the other hand, we found a negative correlation between the parasite infestation rate and the size of the badge in the second study year, suggesting an inter-annual variability in the signaling properties of this ornament. Furthermore, we measured the major components of the immune system (innate, acquired, cellular, humoral) during the annual cycle, and we correlated each one of them with the badge area of the house sparrows. Our results show that only a limited number of immune variables explain the variation of signaling properties of the badge in this species during mating, breeding, molting, and wintering periods. Among eight immune variables measured, humoral immune activity correlated significantly and negatively with the badge area during breeding, indicating the honesty and costliness of this signal in terms of reduced immunocompetence. Interestingly, different components of the immune system, related to the relationship between badge and immune functions, correlated with the badge area and the coccidian infestation, highlighting the complexity of the relationship between the badge area and parasitism, mediated by the immune system.



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Effect of temperature on photoperiod induced daily and seasonal behaviors in migratory and non migratory passerine finches

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We have investigated the effects of temperature on photoperiod induced daily (circadian) and seasonal behaviors, namely activity-rest cycle and migratory restlessness (Zugunruhe), body fattening and testicular growth and regression. In one study, migratory male blackheaded bunting were exposed to 11.5 h, 12 h and 13 h light per day at 25.5 ± 1.7 C (low temperature) or 39.2 ± 2 C (high temperature). Activity levels were high in low than in high temperature in all photoperiods. However, a significant difference in body fattening and testicular cycle occurred only in 13L:11D; early growth in low and early regression in high temperature. A similar second study on migratory male redheaded bunting confirmed the temperature effects on photoperiodic response to 13L:11D. The last study compared daily and circadian activity response of migratory male redheaded bunting and Indian weaver bird to 13L:11D at low (25.0 ± 1.3 C) and high (39.0 ± 1.2 C) temperatures. There was a significant difference between responses of two species both in the light dark and in constant light conditions. Together, these results show that temperature plays an important role in regulation of photoperiod induced daily and seasonal behaviors in birds. Supported by DST-IRHPA Center for Excellence grant.



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Physiological capacity to deal with varying energy requirements on a nectar diet: immediate and longer term responses in sunbirds and honeyeaters

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Avian nectarivores face extreme physiological challenges due to their diet, and these animals are masters at processing and assimilating sugars and water. Nectarivory has evolved many times in birds but is best known in three unrelated lineages on different continents: the hummingbirds, honeyeaters and sunbirds. Despite their convergent morphology and behaviour, these birds retain unique physiologies. We investigated factors that influence the abilities of sunbirds and honeyeaters to modulate their intake of sugars and water for comparison with established data for hummingbirds. This talk identifies the roles of digestion and absorption capacity, electrolyte balance and preformed water loading in modulation of nectar intake by these birds. We have recorded some spare capacity in sunbirds and honeyeaters in terms of their ability to increase energy intake; increases in digestive enzyme expression may contribute to this capacity. We have also recorded short term responses to diet changes; electrolyte availability (in particular sodium) coupled with modulated water handling may effect these changes. In conclusion, rapid switches between extremes of diet concentration testify to the physiological capacity of avian nectarivores.



Corticosterone stress response in greater rheas (*Rhea americana*) to transport and immobilization

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When environmental stimuli are perceived by birds as threatening, stress responses are triggered, with activation of the adrenal axis and corticosterone secretion. Studies on stress physiology in greater rheas have been recently initiated with the aim of detecting elements that explain the species behaviour as well as of developing conservation strategies. The previous results have shown that in response to a challenge with ACTH the species exhibits a plasma corticosterone increase much higher (about 40-fold) than those observed in other birds. In this study, corticosterone response to two acute stressors (transport and immobilization) commonly involved during translocation of animals was investigated in captive greater rheas. Adult rheas (5 females and 7 males) were transported for 30 minutes and three-month-old juveniles (15 females and 18 males) were immobilized for 15 minutes. Plasma corticosterone was determined using the ¹²⁵I-Corticosterone radioimmunoassay validated for this species. The greater rhea exhibited a considerably high response to these two acute stressors. Corticosterone concentration increased more than 30 times after transport and 16 times after immobilization. Such a high response, similar to that observed after the ACTH challenge, could be due to the fast running antipredatory strategy of this species, where they probably need a greater amount of available blood glucose to maintain the running capacity for long periods during their flight-type stress response.



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SA09 Population and Individual Ecology



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Seasonal variation in survival of nestling tree swallows (*Tachycineta bicolor*): tests of alternate hypotheses

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Two primary hypotheses have been advanced to explain why late-breeding birds typically experience lower reproductive success but the veracity of these ideas has not been fully resolved. The quality hypothesis predicts that early breeding individuals are of higher quality and thus produce more surviving offspring whereas the date hypothesis asserts that environmental quality declines within the breeding season (with seasonally declining food supply being the primary cause of reduced offspring survival, i.e., food limitation hypothesis). We tested the quality and date hypotheses by combining short-term experiments with mark-recapture analyses obtained from >14,000 nestlings over 19 years. To control for parental quality, hatching date of some clutches was delayed by 4 days. Concurrently, brood size manipulations were applied to control and delayed nests to alter food available to each nestling. Delayed nestlings were lighter than control nestlings (consistent with the date hypothesis); enlarged broods contained lighter nestlings in both delayed and control nests as predicted by the food limitation hypothesis. Mark-recapture analyses confirmed that late-breeding individuals produced fewer surviving offspring and also that survival was negatively related to nestling body mass irrespective of hatching date. Thus, a seasonal decline in offspring survival appears to be causally related to hatching date, an effect that is at least partially mediated by food availability. Our findings have important implications for population dynamics of temperate-breeding insectivorous birds, for which food availability is intricately linked to local climatic conditions.



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Habitat selection and the perceptual trap

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The concept of ecological traps was introduced over three decades ago. An ecological trap occurs when, by various mechanisms, poor habitat is more attractive than good habitat, thus coaxing individuals to settle there despite a resultant loss of fitness. Empirical work on such traps has increased dramatically in the past decade, but the converse – avoidance of good habitat because it is less attractive – has remained largely unexplored. Even so, depending on conditions (growth rate, strength of habitat preference, and mortality rate) such perceptual traps can be more limiting than ecological traps to population persistence. An example from field experiments with the lesser prairie-chicken (*Tympanuchus pallidicinctus*) lends empirical support to the concept, and several other potential examples suggest that these traps are perhaps more prevalent than has been appreciated. Unlike an ecological trap, which may be negated by increasing habitat quality, conservation biologists will be hard pressed to negate a perceptual trap, which will require determining cues an animal uses to select high-quality habitat and then devising a means of enhancing those cues so that an animal is lured into the habitat.



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Observed selection against inbreeding in island populations of blue tits (*Cyanistes caeruleus*) and great tits (*Parus major*)

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Since 1955, all great and blue tits breeding on the island of Vlieland have been followed through the ringing of nestlings and identifying the parents. In both species, over 80 % of the breeding birds were ringed as nestlings and pedigree information is relatively complete. In both species, common ancestors are known in over half the pairs where both female and male are local birds. In blue tits, average detected inbreeding levels have dropped from $F = 0.07$ in the first decade to $F = 0.03$ at present together with the growth of the population to about 60 pairs. In great tits, average detected inbreeding levels have dropped from $F = 0.03$ in the first decade to $F = 0.01$ at present. These data allowed to calculate selection differentials on F over several stages in the reproductive cycle. The selection differentials on F are proportional to mean F , which is expected if inbreeding depression is due to rare recessives. Although there is consistent selection at the egg hatching stage (about 7 % reduction of F in blue tits and 8 % in great tits), the main reduction in F (about 35 % in blue tits, 17 % in great tits over the last 30 years but not in the first 20 years) is achieved in the recruitment phase, that is between fledging and recruitment into the population as breeding birds. Data on selection against inbreeding and thus slower increase of realized inbreeding are very rare and can only be measured in natural populations.



Can the escape from pathogens be responsible for the expansion of the house sparrow (*Passer domesticus*) in Brazil?

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The escape from the effects of natural enemies such as predators and pathogens is frequently employed to explain the success of non-indigenous species (i.e the enemy release hypothesis, ERH). Parasites have a negative effect on hosts population dynamics (e.g abundance and density), and therefore non-indigenous species can experience demographic release and become a pest. We used molecular markers and microscopy to determine prevalence of avian malaria (*Plasmodium* spp. and *Haemoproteus* spp.) in the introduced house sparrow and native birds in central southeast Brazil to test the ERH. Generalized mixed models were fitted by Laplace approximation considering a binomial error distribution and logit link function. Location and species were considered as random effects and species categorization (native or non-indigenous) as fixed effects. House sparrows had 6.2% prevalence (4 out of 66) while native birds had 33.3% prevalence (18 out of 53). Our model gave support to the ERH with house sparrows being significantly less parasitized than native birds, the latter presenting a 7.8 fold increase in prevalence. Additionally, house sparrows from Brazil showed less malaria prevalence when compared with data from native regions in the literature ($X^2 = 20.82$, $df = 2$, $P < 0.01$). Since native birds from the same localities were also positive for avian malaria, the low prevalence found in house sparrows cannot be attributed to a lack of vectors. Therefore, it is possible that house sparrows from Brazil might have experienced a demographic release from blood parasites during its introduction in Brazil.



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Carry-over effects of an experimentally decreased body condition on the immune system, survival and reproductive success in skylarks (*Alauda arvensis*)

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Evolutionary theory predicts that birds maximise their fitness by finding the optimal balance between survival and reproduction. The interplay between these two aspects is likely to be the body condition of an individual. In order to understand the links between body condition, reproductive effort and survival we did a handicap experiment in skylarks. We manipulated the body condition of adult birds away from the optimum by attaching an extra weight (10% of their body weight) for a period of 6-8 weeks during the breeding season. We studied two levels of possible effects: a) direct physiological consequences that might affect the survival of the bird and b) effects on behaviour with possible consequences for the reproductive success. To understand the direct consequences of the treatment we measured indices of the immune system before and after the treatment as well as reproductive success by means of success rate, structural size of the nestlings and their immune system. To shed light on carry-over effects and their mechanisms we estimated survival of the birds after carrying the extra-weight for 6-8 weeks to the following year. In returned individuals we measured the same parameters of the immune system again to search for physiological carry-over effects and once more their reproductive performance. Furthermore we measured the recruitment rate of nestlings. All measurements were compared between control and experimental groups as well as between individuals within groups. We did find effects on survival, reproductive output and immune indices. This study shows carry-over effects of a compromised body condition on survival and reproductive performance as well as their possible mechanisms by a changed immune system. These processes represent ways of gradual decline of body condition, survival and reproduction, with major consequences for the population dynamics of birds.



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Patterns of avian succession in restored mine pits: how applicable are state-and-transition models derived from vegetation succession?

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Recently, state-and-transition models have gained popularity as a way to conceptualise succession in restored areas. This is probably because they are useful for management by identifying desirable ecosystem states that do not require management and deviated states that require management to drive them onto desirable pathways. All models developed so far have been based on vegetation succession and it is unclear whether these models are also appropriate for conceptualising faunal succession in restored areas. To address this issue, we examined the congruence between avian succession and state-and-transition models derived from vegetation succession in restored mine-pits in south-western Australia. We assessed bird communities in 7 replicate pits in each of 4 desirable states and 3 deviated states, as well as unmined forest, using fixed-radius point counts. Bird communities in each desirable state were significantly different from each other, and from unmined forest, indicating that the desirable states did represent different stages of avian succession. However, there were no significant differences in bird communities between the three deviated states and their respective desirable states of the same age. Therefore, the state-and-transition model, as currently developed, does not form an appropriate basis for managing these mine-pits to ensure avifaunal return and avian succession that converges on the unmined reference community. We propose that this is because the variables used to identify the deviated states (legume and eucalypt density) were not variables that had a strong influence on structuring bird communities. State-and-transition models may be appropriate for conceptualising succession in restored areas but, if they are to accurately represent patterns of faunal succession, they will need to be based on vegetation characteristics that have a strong influence on structuring faunal communities.



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Resiliency of understorey insectivorous birds to edge effect in a fragmented tropical rainforest

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Edge effect has great impacts on the persistence of understorey insectivorous bird species in isolated forests. We examined the abundance insectivorous birds along the edge-interior gradient in an isolated lowland tropical rainforest in Peninsular Malaysia. The study was conducted between May 2007 and April 2008 using Distance Sampling Point Count method. Results showed that the most striking changes on the understorey bird community (i.e. relative abundance, density, diversity, and composition) occurred within 25 m to 400 m of the forest edge to the interior. The association between the birds and the micro-environmental factors separated two completely different groups of birds: (1) forest interior-specialist species such as the short-tailed babbler and black-caped babbler which used the forest interior habitats discriminately and tended to avoid the microclimatic fluctuations close to the edge; and (2) forest edge-specialist species such as the yellow-vented bulbul and cream-vented bulbul which preferentially used the edge. In terms of feeding guilds, interior-specialist guilds such as terrestrial insectivores and sallying insectivores and the edge-specialist guilds such as arboreal foliage gleaning insectivores and terrestrial insectivores-frugivores were separated based on their sensitivity to the edge effects. The environmental conditions, vegetation structure and composition along the edge-interior gradient resulted in different responses of the understorey birds. The forest edge-specialist species were associated with the high light intensity and shrub cover, and they could be the best indicators of the edge habitat condition. The forest interior-specialist species were associated with high relative humidity and leaf litter cover and thus, could be the best indicators of the forest interior habitat condition.



Live fast, die young: fitness consequences of developmental stress

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There is growing international interest in how environmental conditions experienced during development can shape adult phenotypes and the extent to which such induced changes are adaptive. The majority of studies conducted to date have focused on the detrimental effects that early developmental stress exerts on adult traits; however, it is likely that the effects of such physiological adaptations are dependent upon the conditions experienced by the individuals later in life. Here we present data from an experiment that tracks behaviour, breeding success and survival in sibling zebra finches that experienced either "stressful" or "benign" post-natal developmental conditions. Importantly adult birds were allowed to breed under both "benign" and "stressful" environmental conditions in order to determine the potential adaptive significance of developmental stress. Females that had experienced developmental stress exhibited reduced incubation effort, whilst current environmental conditions affected male incubation effort. There were no effects of developmental or adult breeding conditions on female breeding success. However, males from benign developmental conditions exhibited significantly higher chick success than developmentally stressed males under benign breeding conditions, when food was plentiful. Under stressful breeding conditions this advantage was lost. Finally, birds that had experienced developmental stress showed elevated mortality rates. We found no evidence for elevated reproductive success when developmental conditions matched those experienced in adulthood. Overall these results suggest that developmental conditions constrain fitness by reducing survival.



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A multi-disciplined approach to future conservation of the southern ground hornbill (*Bucorvus leadbeateri*) in Africa

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Southern ground hornbills (*Bucorvus leadbeateri*) (SGH) are co-operative breeders that occur in groups of 2-9 individuals. Long life spans, large territory sizes (100km²), and low reproductive rates render them vulnerable to threats such as loss of habitat, poisoning and loss of suitable nesting sites. SGH are listed as vulnerable in the red data book of South Africa and of least concern globally. However, recent research has shown that in South Africa the species needs to be re-categorised as endangered while similar trends seem to be occurring in other parts of the species range. Results on a study conducted in a non-protected area within the northern part of South Africa as to the availability of suitable nesting sites, the influence of rainfall and seasonal invertebrate availability on group movements, territory size, the mapping of habitat features and the identification of threats will be presented. Genetic variation in natural and captive populations is also being investigated using nuclear and mitochondrial gene loci. Measures of genetic variation within and across the species range can be valuable to inform us on the impact of processes such as fragmentation and the distribution of adaptive and neutral genes. This research provides a sound understanding of the extent and causes of genetic variation and dispersal of natural populations and will impact on the future conservation of SGH within South Africa and Africa.



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Intrinsic and extrinsic mechanisms underlying the demographic response of the ovenbird (*Seiurus aurocapilla*) to experimental selection harvesting

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According to a recent meta-analysis, the ovenbird is one of the species most sensitive to partial harvesting in deciduous forests of North America. However, distributional studies may not always reflect the true demographic response of species to habitat alteration. Therefore, we monitored banded ovenbird populations before (1 year) and after (4 years) the experimental removal of 30-40% of tree basal area through selection harvesting to measure the demographic response and identify the intrinsic and extrinsic mechanisms underlying the observed pattern. We measured density, productivity, return rate, recruitment, age structure, food abundance and biomass, and the incidence of potential nest predators in 5 pairs of study plots (1 treated, 1 control; 25 ha each). In the first year post harvest, density and productivity were ca. 40% lower in treated plots than in controls and this difference persisted over the three subsequent years. Lower density in treated plots during the 1st year post-harvest mainly reflected a lower recruitment rate of territorial males (17.9%) than in controls (49.0%), which itself was driven by a lower recruitment rate of experienced breeding males. Densities remained stable during the two following years post-harvest due to a large increase in recruitment rate (ca. 50%). These results highlight the importance of recruitment in population dynamics and the age-specific response of individuals to habitat alterations. Results from the 4th year post-harvest will be presented and we will analyse causal relationships among the various components of habitat quality and population parameters.



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Density dependence and environmental factors explain population fluctuations in red-backed shrikes

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Animal populations fluctuate due to the combined effects of density-dependent and -independent processes. The study of these processes is complicated because population sizes are typically not known exactly, as population counts are subject to sampling variance. We analyzed time-series from six Central European populations of the migratory red-backed shrike *Lanius collurio* and assessed the strength of density dependence, process and sampling variance with state-space models. In addition, we evaluated factors presumed to operate on the breeding grounds, at stopover sites in Eastern Africa during fall and spring migration and in the wintering grounds in southern Africa. We found consistent evidence for negative density-dependent population regulation. Further, process variance contributed substantially to variation in population size, while sampling variance did not. Rainfall in the Sahel during fall migration and in the South African wintering areas were positively related to population size in the following spring in four of six populations. In contrast, environmental conditions on the breeding grounds were not related to population size.



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Survival from fledging to independence in the Florida scrub-jay (*Aphelocoma coerulescens*)

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Factors influencing variation in survival during the first year is one of the least understood aspects of the avian life history, yet mortality during this period is higher than during any other time. Non-migrants that have short distance dispersal and high detection probability offer the best opportunity to study factors influencing post-fledging survival. We used weekly census data collected on 2440 fledgling Florida scrub-jays (*Aphelocoma coerulescens*) over 35 years to model survival from fledging to nutritional independence (~day 85 post-hatch). We modeled survival against hierarchical parameters from individual nestlings, territories, and for the annual cohort. Year was included in all models to account for annual variation in timing of breeding and overall survival. We used Akaike's information criterion to evaluate a variety of *a priori* candidate models that may influence survival during this critical period. Three models obtained 99% of the weight. The most supported models included residual nestling mass and nest initiation date. Nestling mass and earlier fledging dates had a positive influence on survival to independence, but a strong annual effect was evident. The presence of helpers in the territory was in the third model and had a significant positive effect on fledgling survival. Predation has been the leading explanation for post-fledging mortality. We suggest that while food may not generally be limiting, early weight gain is important and may influence vulnerability to predators later in life. Therefore, understanding how the bottom up process of early food acquisition influences susceptibility to predators after fledging is an important step in describing avian life histories.



Different foraging niches in skuas of the maritime Antarctic

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Species with similar foraging preferences often differ in realized foraging niches when occurring in same areas or breed in sympatry. Herein, the extent of niche separation can vary greatly. We studied realized foraging niches of sympatric breeding brown *Catharacta antarctica lonnbergi* and south polar skuas *C. maccormicki* during three reproduction periods in the Antarctic by GPS data loggers. The approach provided detailed information about spatial and temporal foraging patterns of individuals, which allowed for estimations on realized foraging niches of individuals, sexes and species. Brown skuas have more variable food sources and individual preferences in comparison to south polar skuas. Brown skuas breeding near penguin rookeries mostly feed exclusively in these rookeries. Brown skuas breeding away from penguin rookeries still prefer terrestrial food (penguins) at distances up to 45km, or they are specialised predators on flying bird species, e.g. cape petrels, or forage at the open seas like south polar skuas. South polar skuas forage exclusively at sea with core areas in nearby sheltered bays. However, some individuals carried out spectacular foraging trips to the continental shelf with trip lengths up to 500km and distances from the nest up to 120km. We recorded no differences between the sexes in several parameters of foraging activity in brown skuas but significant differences in south polar skuas. There is a full niche overlap in the near sheltered bays but for distances beyond 40km at sea south polar skuas are foraging alone. In contrast brown skuas claim all areas of terrestrial food. This pattern may have evolved because of past competition or because of size differences between the species.



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Partitioning local and global climate effects on survival of North American tree swallows (*Tachycineta bicolor*) over the annual life cycle

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Given concerns about climate impacts on avian fitness we evaluated apparent survival rates for banded, migratory tree swallows marked at seven study sites across North America over 7 to 32 year periods during 1975-2008. Capture-recapture histories were analysed using Program MARK; the most parameterized model incorporated effects of sex-specific, linear and non-linear relations between survival and overwinter climate indices, local spring weather and previous fledging success. Competing models were compared with Akaike's Information Criterion, adjusted for over-dispersion. On 6 sites spanning from Atlantic to Pacific Oceans, survival was positively related to warm winter (Dec-Feb) weather. At 4 sites, survival was higher in years when birds experienced warmer conditions for 30 days prior to egg-laying. Survival was also positively associated with greater prior fledging success at 5 sites, a pattern that was most pronounced in females. Higher female survival may occur when conditions favour higher reproductive success, or reproductive failure could provoke permanent emigration. Across sites, 2-4 local factors or winter conditions were associated with survival, and higher occurrence of poor winter weather or spring storms reduced survival. Thus, multiple processes occurring at different times and places must be considered when modelling population dynamics of swallows and likely other migratory birds.



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Condition-dependent breeding dispersal of Eurasian kestrels under temporally fluctuating food abundance

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Costs and benefits of dispersal can vary in space and time, depending on environmental factors and individual state. Condition-dependent dispersal strategies are therefore expected to evolve in temporally fluctuating environments. We examined factors affecting breeding dispersal distances in Eurasian kestrels (*Falco tinnunculus*) subsisting on multi-annually and cyclically fluctuating voles as their main food. We attempted to avoid traditional bias in dispersal studies (i.e. finite study areas and variation in trapping probability) by having a large study area and by taking into account distance-specific detection probabilities. A total of 1730 males and 2162 females were trapped at nests during 24 years in our main study areas, and these data were complemented with observations of long-distance dispersal from the nationwide ring recovery data. After correcting for detection probability, the estimates of mean dispersal distances for both sexes increased roughly two-fold, being clearly higher for females than males. Both sexes showed a condition-dependent dispersal pattern by dispersing longer distances when food was scarce. The response was age-dependent in females, as old females dispersed less when food was abundant, but yearling females dispersed evenly far, regardless of vole densities. Our results thus show that the dispersal distances of kestrels at northern latitudes depend both on phenotype (gender and age) and environmental conditions (temporal variation in vole abundance). Correcting for detection probability was necessary to reveal the condition-dependence, which highlights the importance of applying these methods in dispersal studies.



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Breeding population dynamics of the great-spotted woodpecker (*Dendrocopos major*) influenced by seed crops of an introduced pine and winter severity

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Avian population size is often correlated with winter food supply and climate, which strongly affects survivorship and the composition of breeding populations. In this study, a marked breeding population of the great-spotted woodpecker was monitored in a fragmented forest landscape (40 km²) in Hokkaido, Japan, from 1999-2001 and 2005-2008. The demographic composition (i.e.-resident breeder, juvenile immigrant, and adult immigrant) was estimated from survival, emigration, and immigration metrics based on monitoring data. Winter food supply (i.e.-human-introduced Korean pine seeds) and severity (temperature) were considered as possible environmental factors affecting population dynamics. The breeding population size fluctuated three-fold (12-34 pairs) and breeders typically exhibited strong site-fidelity to their previous breeding site, and their survival rate was strongly correlated with the seed crops of Korean pine. In four of the five years, the population was found to be maintained by immigrants, compensating for loss of breeders during the winter. Most of these immigrants were natal dispersing juveniles, a fraction of which was assumed to be from a continuous forest near the study site. For such immigration to occur, the population dynamics should vary in these two habitats, which was a possibility given the difference in abundance of Korean pine in these two habitats. The population dynamics of great-spotted woodpeckers might be complicated by varying responses to winter food and winter severity by individuals of varying age. From the conservation perspective, management of Korean pines and consideration of larger scale processes such as source-sink dynamics may be required for maintenance of the studied population.



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Survival of boreal and temperate forest parids in changing climate conditions

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Environmental changes over long time periods, and at a larger geographical scale, strongly affect population dynamics and persistence. In the last decades there has been increasing evidence that anthropogenic climate change, global warming, is affecting the Earth's biota. The North Atlantic Oscillation (NAO) is a large-scale climate phenomenon correlating with annual variation in local climates over large areas. Positive NAO in winter (WNAO) are associated with strong wind circulation in the North Atlantic causing an increase in temperatures and precipitation in northern Europe. The NAO accounts for changes in local weather conditions, but the main reason for the increased interest in this phenomenon lately is its obvious connection to the observed climate change. Long term data allows comparisons of how different demographic traits change through time with changes of climate conditions. Therefore, we modelled adult survival and population growth rate (λ) in relation to WNAO with long term capture-mark-recapture data sets from four Parid populations in northern Finland: Siberian and willow tit are boreal coniferous forest specialists, blue and great tit are southern deciduous forest specialists and newcomers in the north. We found that species with different colonization histories have various responses to winter conditions. The original boreal species have lower adult survival and λ with increasing WNAO. Great tit has expanded northwards during 20th century. They survive the best in moderate winters. Very cold winters with negative WNAO but warm and wet winters with positive WNAO had negative effects in λ , too. Blue tit has expanded its breeding range to north during latest three decades. Warmer winters do not have negative influence on this species survival and λ .



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Signals in the breast band of the bar-throated Apalis (*Apalis thoracica*)

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Optimal models of territoriality propose that high-quality individuals occupy high-quality territories from which they derive proportionally high fitness benefits. In some species, such individuals signal their status through morphological features such as bib size. Such signals are located at different spots in different species and may convey one or several messages. Identifying such morphological traits and their fitness correlates may be a useful approach to understanding population-level processes. This study explored the signals in the bib size (a black breast band across the white chest) of the bar-throated Apalis, *Apalis thoracica*, in relation to individual and territory quality, parental reproductive effort and fitness. Our results revealed breast band size in the species as signalling individual and territory quality as well as reproductive effort and fitness with males with large breast bands achieving the highest direct fitness. Multiple measures of breast band size over several years also point to an age-related pattern of territory occupancy in which the oldest birds (with the largest breast bands) occupy the highest quality territories, conforming to models of optimal territory occupancy.



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Patterns of reproductive traits and natural selection in two hole-breeding passerines

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Temporal changes in timing of breeding and other reproductive traits have been observed in a number of bird species during the recent decades of climate warming. Few studies, however, have examined the mechanisms behind the observed changes, the role of natural selection in them or the determinants of the selection. Here we present trends and patterns in reproductive traits and in natural selection in two hole-breeding passerine species, the pied flycatcher (*Ficedula hypoleuca*) and the great tit (*Parus major*). Our long-term data from South-Western Finland (Northern Europe) revealed few divergent patterns compared to earlier studies on these species. Among other things, we found out that, although largely ignored recently, population density as a factor altering the availability of critical resources has a remarkable impact on many of the reproductive traits as well as on the natural selection. Here we also examine and discuss different methods of measuring natural selection in a population with low recruitment rate.



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Multiple changes in breeding phenology of great and blue tits in relation to climate change

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Previous work in different European countries has shown that some populations of great and blue tits (*Parus major*, *Cyanistes caeruleus*) have strongly advanced their laying date in response to changes in food supply due to warmer spring temperatures and the advanced timing of tree budburst. In a Belgian oak-beech forest both great and blue tits have advanced their first-egg dates by more than 11 days over the past 30 years, considering only first broods. In addition we found significant changes in several other components of the breeding phenology, including a decrease in laying interruptions, a decrease in nestling development time (as estimated by plumage development), and a lower incidence of second broods. Because of these effects the average fledging date of all nestlings has advanced by an additional 4 days in blue tits and 7 days in great tits after accounting for the earlier onset of laying. Analyses of selection differentials showed no change in selection on any component of breeding phenology, indicating that both species are well able to track changes in their food supply. This is confirmed by indirect estimates of annual food peak dates based on temperature profiles and variation in nestling weight. Our results are similar to recent work on great tits in Wytham Woods (UK) but in striking contrast to the well-studied and geographically much closer Hoge Veluwe (NL) population. We will discuss possible explanations for these markedly different responses between populations experiencing a similar climate shift.



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SA10 Population Genetics and Phylogeography



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Genetic population structure of two migratory avian influenza vectors - tufted duck and common pochard

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The global epidemiology of Highly Pathogenic Avian Influenza (HPAI) virus H5N1 has received high attention and has been extensively studied since its outbreak in 2006. However, little information is available to what extent key vectors, such as migratory birds are involved in the spread of HPAI. Phylogeographic and population genetic approaches could help identifying boundaries among breeding populations and wintering groups of migratory birds. Hence they allow one to document movement patterns and to assess the risk of H5N1 introduction by AI vectors quantitatively. In this talk, we will present the first population genetic analysis of tufted ducks (*Aythya fuligula*) and common pochards (*A. ferina*), two long-distance migrants through Eurasia. HPAI H5N1 has indeed been confirmed in both species in the wild. Our range-wide study examines genetic differentiation between European, Central Asian and East Asian breeding populations based on mitochondrial and microsatellite markers. We investigate population structures on the continental and regional scale. Further, we determine potential breeding populations of ducks sampled on different European wintering grounds, including samples of H5N1 positive ducks. We detected high genetic variation but little genetic differentiation even between East Asian and European populations. The weak signal of population structuring in both species suggests gene flow across large geographic areas and may be the evolutionary consequence of high vagility and frequent population admixture. Our results imply that the propensity of intercontinental transmission of HPAI virus through migratory waterbirds might be higher than previously thought.



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Phylogeography of a small cosmopolitan shorebird: the *Charadrius alexandrinus* superspecies complex

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How did cosmopolitan birds spread across the world? Since oceans restrict their dispersal only few terrestrial taxa species on distant continents without the help of humans. The Kentish plover *Charadrius alexandrinus*, is a small shorebird that forms an allopatric superspecies complex with the red-capped plover *C. ruficapillus* and the white-fronted plover *C. marginatus*. These plovers are found in similar habitats (i.e. temporal salt lakes and sandy beaches) of all continents except Antarctica and exhibit unusual diverse and flexible breeding behaviour including polyandry, polygyny and monogamy. We used 27 microsatellite and 3 mitochondrial markers to investigate population differentiation of 24 breeding populations from 6 continents. First, we show that in contrast to the current taxonomy, Eurasian and American Kentish plover populations represent different lineages with large genetic differences and we propose to recognize the American populations as separate species the snowy plover *C. nivosus* and split of the Kentish plover. Second, within the continental Eurasian and American subspecies, the populations showed no genetic differentiation over several thousand kilometres. However, a number of island populations showed genetic differentiation from the mainland populations. Finally, we infer the origin of the species complex, and estimate the colonisation routes that lead to their present day distribution. Taken together, our work demonstrates utility of multiple genetic markers to reveal the population histories of species with wide intercontinental distributions.



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Species limits and phylogeography of two species of Atlantic forest endemic antbirds

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The Atlantic Forest (AF) is one of the top five biodiversity hotspots in the world. Preliminary phylogenetic and phylogeographic studies of endemic birds suggest that complex processes occurred during the history of the AF. The squamate antbird (*Myrmeciza squamosa*) and the white-bibbed antbird (*Myrmeciza loricata*) are insectivores that occupy the lower forest stratum, and their combined geographic distributions cover most of the AF. Thus, they are good models for studying patterns and processes of diversification in the AF. Despite being parapatrically distributed, they show little morphological divergence and similar vocalizations. This pattern is contrary to the prediction of character displacement in parapatric and sympatric sister species, and also raises doubts about reproductive isolation in this species pair. Data on partial ND2 sequences of 30 individuals collected in the states of São Paulo and Rio de Janeiro, where sympatry may occur, show reciprocal monophyly and a high degree of divergence (5% of uncorrected divergence). Interestingly, the level of genetic diversity in the squamate antbird, which occurs in the southernmost portion of the AF, is an order of magnitude lower than in the white-bibbed antbird. Thus far, these results suggest that the squamate and white-bibbed antbirds may be independent evolutionary units that may have been affected by past forest fragmentation. Addition of ten specific anonymous nuclear loci and further sampling localities will allow us to estimate migration rates and times of divergence, and evaluate historical demography in these species based on genome-wide data. Funds: FAPESP, CNPq, and CAPES.



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Impact of social mating systems on patterns of autosomal and sex-linked variation in blackbirds (Icteridae)

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Differences in variance of reproductive success between males and females of bird species are expected to affect levels of polymorphism at autosomal and sex-linked loci. In particular, high variance of male reproductive success, as expected in polygynous species, should depress levels of polymorphism in male-associated markers (such as the Z chromosome of birds, 2/3 of which reside in males). We sampled sequence polymorphism at 11 autosomal and 12 Z-linked intron loci, in three species of blackbirds (Icteridae) that represent social monogamy (*Agelaioides badius*), small harem polygyny (*Agelaius phoeniceus*), and large harem polygyny (*Psarocolius decumanus*), with the expectation that Z polymorphism would be reduced relative to that of autosomal loci in polygynous species. In contrast to expectation, we found very little evidence for reduced Z variation, with autosomal/Z ratios consistent with differences in ploidy, and the greatest departure shown by the apparently monogamous species. We discuss the implications of these results for our understanding of mating systems and for the utility of different subsets of the genome in phylogenetic reconstruction.



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Patterns of geographic variation of the genus *Ergaticus* (Aves: Parulidae)

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The genus *Ergaticus* (Parulidae) represents a group of birds endemic to the mountain systems of Mesoamerica. Traditionally, two species are recognized: *E. ruber* and the monotypic *E. versicolor*. *E. ruber* populations are divided in three subspecies, all of which are distributed allopatrically, each restricted to the mountain range where it occurs, and in some cases showing remarkable differences in the coloration patterns. By using three mtDNA markers (ND2, cytochrome b and a fragment including ATP8 and partial ATP6), the phylogeographic pattern of the populations within the genus is analyzed. The results suggest high levels of genetic differentiation and strong geographic structure, showing correspondence with the geographic limits of most populations. Four well differentiated clades were found: 1) Sierra Madre Occidental; 2) Mexican Transvolcanic Belt plus Sierra Madre del Sur in Guerrero; 3) Sierra Madre del Sur in Oaxaca; and 4) the mountains of Chiapas and Guatemala. For the populations of Guerrero and Oaxaca there is a lack of concordance between coloration patterns and the groupings obtained in the analysis. The levels of genetic divergence observed are explained as a result of considerable isolation times of the populations, separated by the lowlands between the mountain ranges, which acted as geographical barriers given the highly specific habitat requirements of the group. Also, a Mesoamerican origin for the genus is suggested.



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Evolutionary consequences of population cycling: positive selection in the common murre mitochondria

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Historically, mtDNA variation was considered neutral but the emerging consensus recognizes the importance of selection in shaping intraspecific mtDNA variation. Although consistent with the presence of selection, evidence cited in support of non-neutral mtDNA evolution remains inconclusive because it either involves comparisons of already divergent haplotypes or cannot reject alternative explanations for the observed patterns of mtDNA variation. Thus, it is important to determine whether selection could affect small amounts of mtDNA variation that exist within natural populations. In this study we take advantage of a natural experiment - one of the periodic mass die-offs of the common murre *Uria aalge* in the Eastern North Pacific to determine whether closely related mtDNA haplotypes differ in the probability of surviving such a dramatic demographic event and thus differ in their fitness. We found very little mtDNA variation and lack of its geographic structuring among 7 common murre breeding colonies sampled in Alaska. A single mtDNA haplotype dominated in both live and dead birds. The comparison of this haplotype's frequency between live common murres sampled on breeding colonies prior to the decline phase of a population cycle (73.2%; 95% confidence interval 65.4% - 81.1%) and dead murres sampled during the population collapse (59.1%, Fisher's exact $P = 0.01$) showed that carriers of the dominant haplotype were significantly less likely to die than carriers of other haplotypes. At the same time, the ratio of replacement to synonymous substitutions did not differ between live and dead birds indicating that replacement substitutions were as likely to be eliminated as synonymous substitutions. These results are inconsistent with either genetic drift or purifying selection but support the possibility of positive selection on the dominant haplotype.



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Phylogeography and landscape genetics of the Madagascar plover (*Charadrius thoracicus*); its relationship to the conservation of endangered waterbirds within Madagascar

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Madagascar is a global hotspot of biological diversity and is one of the world's highest conservation priorities due to the extremely high level of threat that human activities pose to its natural environments i.e. siltation, conversion to rice-paddies, utilization as shrimp farms. To conserve threatened species one needs to understand their dynamics (and/or habitats) i.e. distribution, population size, and long-term population vulnerability. The major objective of our study was to address these issues using advanced conservation science/methodologies (*i.e.* assessing current/past distributions and population size/structures, reconstructing evolutionary origins/centres of diversity, predicting the impacts of future ecological changes using spatially explicit meta-population models) using four endangered waterbirds as model organisms. Our study included four endemic Malagasy waterbird species representative of the aquatic habitats diversity in Madagascar; I will present preliminary findings on one of these species (Madagascar plover; *C. thoracicus*) and discuss the implications these may have in the conservation management of other endangered waterbirds both nationally within Madagascar and worldwide.



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Cryptic diversity and the geographic differentiation of *Henicorhina* woodwrens

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The avifauna of the montane Neotropical Region is characterized by a high diversity and endemism. Understanding the spatial patterns of such diversity is an important goal if we want to develop hypothesis on the evolutionary history of this group. The four species of the genus *Henicorhina* (woodwrens) are small birds that inhabit the understory of both lowland and montane forests. Two species, *leucosticta* and *leucophrys*, replace each other altitudinally along their large distributional range. The other two species inhabit the highest elevations on mountain ridges (*leucoptera* and *negreti*). The relatively recent discovery of these two species and the geographical vocal variation in the genus suggest that diversity in this group of birds might be more extensive than its morphological differentiation indicates. In order to explore such geographic differentiation, we sequenced the mitochondrial ATPase 6 and 8 genes from more than 300 individuals along the complete distributional range of the genus, including the four species currently recognized. Our results indicate an early divergence among lineages leading to *leucosticta* (with *leucoptera* nested within it) or *leucophrys* (with *negreti* nested within it). We found a deep genetic structure, with divergences as large as 20% (corrected p-distances) within both *leucosticta* and *leucophrys*. Elevational and slope replacements correlate with such genetic structure highlighting the importance of geography on such differentiation. Our findings uncover previously unsuspected cryptic lineage diversity within these common woodwrens.



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Evidence of cryptic differentiation within the eastern tapaculo *Scytalopus speluncae* complex (Aves, Rhinocryptidae)

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The *Scytalopus speluncae* complex ranges along the Brazilian Atlantic forest. Their populations are clinging to survival in the region because they have small geographic ranges, intraspecific territoriality and poor dispersal capability that make them highly susceptible to local isolation. Increasing our understanding of distribution and genetic population structure of this group would also help to guide conservation strategies effectively. Using Cytb and NADH subunits 2 and 5 mitochondrial partial gene sequences, of more than a hundred individuals covering most of distribution of the complex, we investigated their phylogenetic relationships and divergence time applying a relaxed Bayesian approach. We corroborate the presence of three very divergent cryptic clades, each one composed of well-differentiated geographically structured subclades. One clade is distributed from the south along the highlands from Rio Grande do Sul to Paraná states, a second is found in the mountain ranges of Serra da Mantiqueira, Serra do Caparaó and Serra dos Órgãos and the last comprises populations farther north of the distribution in the Bahia state. With our additional samples we found two new deep subclades in previously non-sampled regions. The average mitochondrial divergence between the three clades is 10.3% and among their subclades 3.7%. Interestingly, these divergences are similar to the divergence values found between several eastern *Scytalopus* species pairs. Some of these subclades showed evidence of population structure and some of rapid diversification. The overall results suggest that despite their morphological conservatism, *S. speluncae* is a very diverse taxon with a long history of population structure and divergence, and that it should comprise several cryptic species.



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Genetic structure of greater white-fronted geese in wintering and stopover sites in Japan and Korea

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Identification of management units is central to wildlife management and conservation. Management units specify the boundary for appropriate monitoring and regulation of human activity. It is particularly difficult to directly determine the management units of a species with high dispersal capacity, however, it can be inferred by its genetic structure. Greater white-fronted geese, which have been steadily increasing in number in Japan and Korea, are such examples of a population with ambiguous limits for management. Investigating the genetic structure of this population may provide an important clue in determining the management units. The purpose of this study was to investigate the genetic structure of the geese in the wintering and stopover sites of Japan and Korea. DNA was extracted from deciduous feathers collected at 18 wintering sites and 2 stopover sites. Each sample was characterized using 8 dinucleotide repeat microsatellite loci. The level of among-population divergence (H_E , H_O , R_S) was estimated, and pair-wise F_{ST} between each habitat were calculated. The number of genetic clusters constructed from all samples was estimated using a model-based Bayesian approach implemented in STRUCTURE version 2.2. The genetic diversity was similar and the genetic differentiation was poor between all sites. The pair-wise F_{ST} was significant in only 3 of the 153 pairs of sites. Regarding the STRUCTURE analysis, 3 out of the 4 prior models estimated a single cluster. The results suggest that there is sufficient exchange of individuals; and the management unit should be considered the same in Japan and Korea.



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Testing the Riverine Barrier Hypothesis at local and regional scales in Amazonia

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At the local scale avian diversity reaches its peak in the Amazon rainforest, though the processes underlying the generation of this diversity are still not fully understood. The Riverine Barrier Hypothesis is one of the primary Amazonian speciation hypotheses, and posits that differences between populations may accrue in allopatry as a consequence of geographical separation by rivers. Any river effect is predicted to be related to (i) river width (ii) the frequency of transfer of genes across rivers through the creation of oxbow lakes and (iii) species ecology. However, the effect of rivers as barriers remains in dispute. This study tested whether rivers act as barriers to gene flow in birds at local and regional scales. AFLP analyses of gene flow levels across rivers of differing widths were carried out in two sedentary understory antbird species with contrasting ecologies: *Hypocnemis subflava*, a bamboo patch specialist, and *Myrmeciza hemimelaena*, a habitat generalist. Results show that levels of gene flow differ depending on river width and ecology, with *H. subflava* showing higher gene flow across rivers than *M. hemimelaena*. For the regional scale analysis range distributions of all Amazonian bird species and subspecies were analysed in relation to twenty Amazonian rivers. Rivers were found to be more important in shaping range distributions of understory versus canopy, and terra firme versus floodplain, species. The frequency of oxbow lakes was related to the strength of the barrier effect. Overall this study shows that the effect of rivers on shaping the population genetic structure and range distributions of birds in Amazonia varies depending on both the geographical nature of the river, and the ecology of the species in question.



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Genetic introgression in two Neotropical *Elaenia* flycatchers

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Interspecific genetic introgression is a common but little-explored phenomenon, occurring when two species hybridize and some of the genetic material of one species enters the gene pool of the other. In some cases, introgression can reach significant levels, such that the dominant genotype of the donor species replaces that of the recipient species over numerous loci, particularly for mtDNA. The incidence of genetic introgression in nature has often been underrated, and evolutionists have only slowly realized that introgression may be an important mechanism in speciation, in the maintenance of genetic diversity and in the introduction of advantageous novelties into the gene pool. Another reason why introgression may become an important topic of the future is the impact of human-induced climate change, which is rapidly shifting vegetation boundaries and creating new hybrid zones, with unknown consequences for the genetic integrity of species. Using novel anonymous markers, we have analyzed a complex of Neotropical *Elaenia* flycatchers for which mitochondrial introgression has already been shown. We selected 25 anonymous nuclear markers from across the genome to test for the incidence of introgression in this complex. Our results suggest substantial heterogeneity among loci in their propensity to introgress. These results furnish important new insights into the mechanisms of introgression in *Elaenia* and suggest future avenues for the rapid diagnosis of genetic introgression between bird species.



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Multi-locus analysis of genetic differentiation among migrant and resident populations of the Asian houbara bustard throughout the Middle-East and Central Asia

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The Asian houbara bustard *Chlamydotis macqueenii* inhabits the deserts and steppes of the Middle-East and Central Asia. Residents are found in the southern part of the range (the Middle-East) in populations that have been greatly fragmented and reduced due to sustained human pressure. In the north, birds migrate from breeding grounds located between western Kazakhstan and Mongolia to wintering areas mainly in Iraq, Iran and Pakistan. We first summarize the results of extensive satellite tracking data showing evidence of partitioning in migration routes and wintering areas (migratory connectivity). In this context we then explore phylogeographic structure among migrants and residents across the range using 16 microsatellite loci. We identify weak but significant differentiation between populations using FST and individual based-assignment methods. A cluster of 3 separate groups is supported by AMOVA (FCT = 0.045, P < 0.05) and phylogenetic reconstruction: a Central Asian group of migrants and residents, closely related to a resident population from Egypt, and a third, highly differentiated, from Yemen. Lack of differentiation within the Central Asian group suggests that migratory connectivity is not sufficient to prevent ample gene flow among migrants, and between migrants and residents in Pakistan. A significant heterozygote deficit, found only in the northern migrant populations, suggests a recent geographical expansion, probably from southern residents, and into the northern range of the species. Finally our findings of distinct genetic groups in the remnant populations of residents from Egypt, but most importantly from the Arabian population of Yemen, are particularly relevant for the management of this species.



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Divergence in the southern African arid-zone: genetic and morphological variation in the Karoo scrub-robin

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The arid-zones cover one third of earth's land surface and support high levels of endemism, yet the evolutionary mechanisms generating and maintaining such diversity still remain poorly understood. Speciation is a continuous phenomenon, which starts with differentiation at the population level. Therefore, describing intraspecific patterns of genetic and phenotypic variation along heterogeneous landscapes provide the first insights into the actual evolutionary processes underlying diversification: geography vs ecologically based selection. If geography is a key factor, theory predicts gene flow to decrease with geographical distance or be prevented by barriers. Alternatively, if selection is relevant, then gene flow will be reduced between different selective environments. Furthermore, if traits are adaptive, individuals sharing the same ecological space but different sides of the geographical barrier would be more similar than individuals that despite geographically close occur in different environments. We examined behavioural (dispersal patterns), molecular genetic (mtDNA and nDNA), ecological (climatic variables) and morphological data in the Karoo scrub-robin to test the relative roles of geography and ecological features in promoting population divergence in arid ecosystems. Its distribution along an aridity gradient, which encompasses three distinct biomes characterized mainly by different precipitation regimes, makes this endemic bird an interesting study system. Our results support the predominant role of ecological-based factors shaping population differentiation by driving morphological divergence in the southern-African arid-zone.



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SA11 Species and Population Conservation



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Reproductive success in white-tailed eagle (*Haliaeetus albicilla*) at an on-shore wind farm in Norway

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Despite producing electricity without emission of greenhouse gases, wind power plants are not free from environmental impacts. They demand substantial areas and have proven to have impacts on birds in general, and raptors in particular. Increased mortality from collisions with turbines, disturbance leading to displacement and loss of or reduced habitat quality are presented as the main impacts on birds. Most effort has been put into documentation of collision and collision risk assessments, while few studies have investigated the effect on breeding birds. We investigated the effect on breeding success in white-tailed eagle at an on-shore wind farm in coastal Norway, where eagles bred in good numbers before a wind power plant was built. In more detail we investigated whether the local breeding success changed over time when comparing pre-construction data with post-construction data controlling for the distance from the turbines. Twelve years of data from altogether 52 white-tailed eagle territories were analyzed using a generalized linear mixed model. We found a significant effect of the interaction between time period and distance to turbines, showing that the territories within, or close to, the wind farm in the time period after development experienced significantly lower breeding success than the same territories before development. This effect was caused by increased adult mortality from collisions, increased disturbance and loss of habitat. Results from this study emphasize the importance of choosing the right locations for wind power plants.



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Farmland birds, predation and observer effects in The Netherlands

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Farmland bird populations in The Netherlands have shown an accelerating decline in recent years, despite extensive conservation efforts including reserves, agri-environment schemes and protection of c. 150,000 nests by volunteers each year. Although agricultural intensification is the main cause underlying these declines, there is a growing concern that the ongoing decline of grassland-breeding shorebirds in recent years is caused or aggravated by increasing predation. Predators are often accused of causing widespread breeding losses, and calls for management of these species are made. Our field studies showed that in total 22 species could be identified as predators of eggs or chicks of which red fox, common buzzard, grey heron and stoat were the most frequent. There was much variation in predation levels and species involved in predation of clutches between sites and years. Protection of nests by volunteers do decrease losses caused by agricultural practices, but at the same time nest controls by those volunteers result in extra losses due to increased predation rates. These observer effects are larger in sites with high predation losses. Searching for nests by volunteers may therefore not always benefit the hatching success of farmland birds. The statistical detection and impact of these observer effects on the survival of nests will be discussed. First results indicate that on average each visit results in 15% extra losses.



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Designating priority areas for farmland bird conservation from spatially incomplete survey data

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Farmland birds are amongst the most threatened group of (bird) species in Europe. Most species show a large-scale decline. The High Nature Value Farmland-initiative (HNV) of the EU intends to designate high-priority areas for the conservation of farmland birds and take conservation measures. However, information on the nature value of farmland has mainly been inferred from land use characteristics instead of distributions and (spatial) trends of priority species. The EBCC monitors the change in the abundance of farmland birds (and many other species) on sample sites with the Pan-European Common Bird Monitoring Scheme (PECBMS). This scheme offers perfect possibilities for the designation and monitoring of HNV-areas. Although the current resolution of the scheme (countries or sometimes regions) offers limited possibilities for the local or regional spatial analyses, the EBCC aims for producing output on a much finer scale. More detailed information on the driving forces on changes in local numbers can also be obtained from geostatistical models used to create abundance and trend maps. Results of a HNV study for a number of countries will be presented, as well as provisional European maps for a selection of farmland bird species.



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Crowned-eagle (*Harpyhaliaetus coronatus*) conservation in Southeastern and Central Brazil

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The crowned-eagle is considered threatened of extinction along all its range, which great part of it within Brazilian territory. Since 1997 we collected and gathered data about crowned-eagle distribution and breeding areas in Southeastern and Central Brazil (mostly Minas Gerais and Goiás) and defined local and regional conservation issues faced by the species. The crowned-eagle was registered at 16 localities, of which 9 were breeding areas. Active nests were found in 4 of these areas. In 3 areas there were inactive nests and in 2 we detected couples, but nests weren't found. Other 4 areas were characterized as potential breeding sites. All breeding localities were at river valleys and had deciduous forests surrounded by pastures as the main local vegetation, except for the nest found in Goiás State. Here we point deforestation in breeding sites as the main threat and hunting and persecution as secondary. Despite the high number of breeding areas here described, actually a result of increasing studies, it's important to emphasize that none of these areas are within a Conservation Unit boundary. Environmental education programs, captive breeding and reintroduction of captive born individuals are important strategies for species conservation and, therefore, priority areas for reintroduction needs to be established. To precisely evaluate the crowned-eagle conservation status in southeast and central Brazil it's necessary to survey new areas, to invest effort on these known breeding sites and to legally protect all these localities.



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Assessment of long term reintroduction success: regulation of restored populations of vultures in France

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The ultimate goal of reintroduction is to restore a viable population but behind the settlement and growth of a newly founded population, its long term viability can only be assessed when this population suffers regulation. For long lived species this may imply large time scales. Griffon vultures *Gyps fulvus* evolved in Europe as commensals of extensive pastoralism. The French populations declined in the 20th century, with one remnant population in the Pyrenees. Since 1980, vultures were reintroduced in the Massif Central and in the Southern Alps. Feeding stations (FS) were established and provisioned with carrions from nearby farms, but vultures can also find carrions in fields. Thanks to long-term monitoring program involving colour-ringed birds, we compared population dynamics of natural and reintroduced populations. The reintroduced populations are still increasing and colonizing new sites. However in the oldest reintroduced population, where adult survival and productivity is maintained at high level, the recent decrease in juvenile survival reveals density-dependent population regulation. These patterns are comparable to those measured in the natural population. The mechanisms of this regulation may play through foraging behaviour. At large FS close to the main colony, adult birds are strongly dominant over younger individuals which can only access to low-quality food remains. We present the first results of GPS tracking of vultures, combined with behavioural observations of dominance at FS at various distances from the main colony. Young birds rely in FS farther from the colony, where food is deposited less regularly and competition is less intense. The demographic consequences of this competition for food help to project the possible future of these populations and provide recommendations for their long term management.



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Estimating bird extinctions from species-area curves overestimates true extinction rates

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Conservation biologists use species-area relationships (SAR) “run backwards” to predict loss of species from habitat destruction. However, the statistics of accumulating species by adding nested geographic areas are different from the statistics of losing species when area is reduced, except in the special case when species are randomly and independently distributed (He, F. & S.P. Hubbell 2010 *Using species-area curves overestimates extinction rates from habitat loss Nature*, subm). In general, one needs to add less area to encounter the first individual of a species than one must subtract to eliminate the last individual of the species. Usual analyses show more species persist than expected from the SAR, and some predict that this “extinction debt” will come due when diversity reaches its final equilibrium with habitat loss, erroneously concluding that these species are deterministically destined for extinction. However, most if not all of this excess of species is apparent, not real; most extinction rates estimated this way are too high. We illustrate this sampling problem with data from the geographic distribution of NA birds.



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Using ecological niche modeling to predict the distribution of the white-collared kite *Leptodon forbesi* in the Atlantic Forest of northeastern Brazil

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The white-collared kite *Leptodon forbesi* is a recently validated but little known species endemic to the northern Atlantic Forest in Brazil. Due to the critical degree of deforestation of its natural habitat, and the subsequent necessity to determine its conservation status, there is great need for research regarding the current distribution of this raptor. To determine areas of environmental suitability, and predict the distribution of the species, we applied an ecological niche modeling technique (MaxEnt) that combines a set of environmental variables including climatic and remote sensing data and 34 recent and documented observations in Atlantic Forest fragments in the states of Alagoas and Pernambuco. Our model suggests that the mean diurnal range of temperature and precipitation of the coldest quarter seem to play an important role in defining the species distribution (42% and 29% of contribution to the resulting model, respectively). Mapping habitat suitability will help guide field surveys in areas of likely occurrence, allowing a more efficient effort in determining the realized distribution of the species and an evaluation of the suitability of currently protected areas for the species. This study has three main purposes: (1) defining the species current distribution and conservation status; (2) evaluating the efficacy of current protected areas; and (3) validating of the modeling technique.



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Distribution, ecology and phylogenetic relationships of a new species of *Grallaria* (Grallaridae) from the Cordillera Occidental of the Colombian Andes

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The antpittas (genus *Grallaria*) are secretive birds from the understorey of humid forests of the Andes that remain among the least-known groups of Neotropical birds. We studied habitat use, elevational distribution, habitat requirements and the phylogenetic affinities of a new species *Grallaria* found in high Andean forests in the northern sector of the Cordillera Occidental of Colombia. We combined study of the composition structure of vegetation structure with visual surveys along transects in different habitats. Results suggest that the new species favors the undergrowth of primary and secondary cloud forests dominated by *Chusquea* bamboo and mature oak forest in an elevational range of 2500-3200 m, where it forages on the leaf-litter and perches low. Vocalizations and phylogenetic analyses of mitochondrial DNA sequence data suggest that the new species, *G. milleri*, and *G. kaestneri*, form a well-supported clade to the exclusion of all other antpitta species for which sequences are available. The montane forests in the area are of particular interest for conservation and management. These factors, in combination with the restricted geographic and ecological distribution of the new species, make it an important priority for conservation action.



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SA12 Systematics, Biogeography and Paleontology



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Distribution and diversity of Neotropical manakins under paleoclimates predicted by ecological niche modeling: the interplay among interglacial and glacial periods

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According to Haffer's refugia hypothesis, forest species were isolated in reduced forested areas that resulted from climatic fluctuations during the Pleistocene, when drier-cooler and hot-wet climates alternated leading to retraction-expansion dynamics of tropical rainforests and drier habitats and, as such, promoting changes in the distribution and patterns of species diversity. Because of a general consensus on the relevance of multiple hypotheses contributing to the maintenance of geographical distributions in the Neotropics, together with a lack of evidence for refugia, the role of paleoclimatic fluctuations on the history of Neotropical biota has been largely neglected. Here we modeled the ecological niches of 43 species of manakins (Pipridae) and reconstructed paleo-distributions in two cenários predicted for the Pleistocene: an interglacial period ca. 200,000 ybp (LIG) and the last glacial maxima ca. 18,000 ybp (LGM). We tested if the location, reduction, and fragmentation of inhabitable areas during past climates were congruent with predictions by the refugia hypothesis. Further, we tested if refugia location or, alternatively, the temporal stability of suitable areas that results from the interplay among climates explained current patterns of species diversity in the family. Interglacial distributions were mostly similar in area and location to current distributions, whereas species distributions during the LGM were highly retracted and spatially coincident with areas proposed by Haffer as refugia of higher diversity. In fact, forest species experienced stronger shifts in their LIG-LGM distributions and fragmentation of their ranges than species from drier woodlands. Stability among time periods was a better predictor of present patterns of distribution and diversity than the location of refugia, corroborating previous observations on the relevance of areas that remain inhabitable over geological time scales for the persistence of biodiversity.



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Innovative mapping of changes in bird distribution in Britain and Ireland over 40 years and four atlases

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Bird Atlas 2007-11 is the third breeding and second winter atlas of birds in Britain and Ireland and allows innovative analyses of distribution and abundance change over 40 years that span a period of intense land-use and climate change. With over 11,000 participants the Bird Atlas project is already the largest Atlas to date in Britain and Ireland, involving timed visits and casual recording to provide proof of breeding, species lists and effort-controlled measures of range and abundance. Around 90% of the records have been submitted, validated and summarized online. The presentation will examine the opportunities these data offer to assess applied issues, in particular the monitoring of range change. Significant range changes are already apparent with several species showing increasingly fragmented ranges and others showing rapid northward range expansion. A comparison will be made of different techniques for estimating range change that quantify and account for potential temporal and geographic differences in recording effort.



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Islands: the beginning of the colonization road for a major passerine bird radiation

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A central paradigm in island biogeography is the uni-directional “downstream” colonization of islands from continents (source to sink) based on the assertion that less diverse island communities are easier to invade than the biologically more diverse continental communities. However, several cases of reverse “upstream” colonizations (from islands to continents) have recently been documented, challenging the traditional view, although most cases have simply been a matter of one or a few species within large island radiations back-colonizing the mainland. Thus, in terms of colonization directionality, “upstream” colonization remains the exception to the rule. Here we use molecular phylogenetic data, divergence time estimates and lineage diversity distributions to reconstruct origin, pattern and tempo of speciation within a widespread and species-rich (> 700 species) passerine bird radiation (core Corvoidea). Our analyses demonstrate that the origin of this radiation dates back to the late Eocene/Oligocene, and was centered in the emerging proto-Papuan archipelago. Our findings demonstrate that contrary to previous island biogeography dogma, islands may in fact be the beginning of the colonization road for a major songbird radiation that subsequently invaded all other continents. That reverse colonization may be the rule rather than the exception alters widely held perceptions of the role of dispersal and establishment in biogeography.



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Speciation of Sino-Himalayan passerines: molecules, morphology and songs

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The Himalayas and adjacent Chinese mountain ranges are one of the most important Eurasian biodiversity hotspots. We used an integrated approach combining molecular, morphological and bioacoustic markers for studies of intra- and interspecific diversification of Old World warblers (*Phylloscopus*), long-tailed tits (*Aegithalidae*), bullfinches (*Pyrrhula*), kinglets (*Regulus*) a.o. In most study groups a molecular clock calibration suggests two or more independent successive invasions into the Himalayas: At least one early Pliocene invasion of (sub)tropical species to the Himalayan foothills and another more recent Pleistocene invasion of boreal species to the temperate and subalpine mountain belt. Cryptic differentiation was found in several *Phylloscopus* and *Seicercus* warblers and most recently in 2008 two taxa were newly described in this group. In some cases genetic material from type specimens was analysed in order to reliably evaluate taxonomic questions. Unlike in the case of cryptic species, marked morphological differences among currently accepted SE *Aegithalos* species mask their unexpectedly low genetic differentiation that equals intraspecific genetic variation within N Palearctic *Ae. caudatus*. Breeding distributions of target species were compiled on the basis of georeferenced collection sites from all analyses and from the literature. The projects summarized were repeatedly funded by the German Ornithologists' Society (DO-G), Feldbausch Stiftung and Wagner Stiftung at the Department of Zoology, University of Mainz.



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Multilocus comparative phylogeography of Australian birds: its future as a testing ground for phylogeography

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A recent review of Australian avian phylogeography (Joseph and Omland *Emu*, 109: 1-23) synthesized findings from studies of mesic, xeric, tropical and pelagic Australian birds. It pointed to particular challenges of understanding the effects of the Pleistocene climatic cycles on shaping present distributions of avian diversity in Australia. With Gaynor Dolman, we have used comparative multilocus phylogeography to dissect the history of the southern Australian avifauna and estimate key parameters (divergence times, past and present population size, migration rates). We analysed the phylogeography of eleven southern Australian bird species in four broad ecological categories. The species are broadly co-distributed either in arid and semi-arid regions or in its more mesic habitats. MtDNA (ND2) divergence from four previously described phylogeographic breaks across this range vary from substantial to none. Similarly, idiosyncratic patterns of diversity and population expansion/stability emerged. Species of more arid zones show variable historical responses depending on ecology and, perhaps, increased adaptability to different habitats, compared with species in more mesic environments. Further insight into these patterns came from our multi-locus coalescent analyses using IMA in two species. This allowed us to probe the history of concordantly located phylogeographic breaks in those two species. Australian avian phylogeography is set for a productive future generating empirical studies and as a testing ground for theory.



A total evidence phylogeny of Furnariidae

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Furnariidae is a Neotropical group of birds with dull coloration and adapted to all biomes. There is great controversy about the systematic position of Furnariidae species, genera and subfamilies. The general objective of this research was to study the variation of morphological, behavioral and molecular characters of furnariids, in order to obtain a phylogeny which synthesizes the relationships between the main taxa that compose this family. For this purpose, we have made a detailed anatomical comparative description of their osteology (74 characters) and syringeal morphology (26 characters); and we have also added molecular (7760 sites) and nest (22 characters) data for the main genera. In this way, this study comprises one of the largest sets of characters of a very diverse Neotropical family of birds. The total evidence cladistic analysis showed that dendrocolaptids should be considered together with furnariids in a monophyletic group. Dendrocolaptidae appeared as paraphyletic because of the position of the genus *Sittasomus* (Dendrocolaptidae) which was placed as the sister group of the monophyletic group Furnariidae. On the other hand, genus *Geositta* (Furnariidae) was not placed as an outgroup of Dendrocolaptidae as was suggested by previous studies. None of the subfamilies traditionally recognized were recovered. *Synallaxis*, *Asthenes*, *Phacellodomus*, *Geositta* and *Cinclodes* were showed as monophyletic groups in the analyses of the studied species, but *Upucerthia*, *Automolus* and *Phylidor* appeared as polyphyletic or paraphyletic groups. Moreover, each pair of monotypic genera *Phleocryptes-Spartonoica*, *Anumbius-Coryphistera*, and *Pygarrhichas-Xenops* were placed as being sister species. Regarding the evolution of characters, the plesiomorphic state of the scored morphological characters were the ones we have found in dendrocolaptids, in contrast with what would have happened if those characters were mapped in the previous existing molecular phylogenies.



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Location of contact zones and phylogeographic breaks in Amazonia: implications for the diversification process

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Geographic regions containing a disproportionately high number of contact zones and phylogeographic breaks are suitable to study the role of ecological and physical barriers in the speciation process. We used a multidisciplinary approach including geographic information systems, population and landscape genetics, bioacoustics, and traditional museum-based specimens to study distribution patterns in 87 pairs of closely related taxa that replace one another on the Rio Negro basin, in Amazonia. We found that phylogeographic breaks cluster along well-defined barriers, such as large rivers (Branco, Negro, and Orinoco) and non-forested areas. Contact zones cluster on the western edge of the Gran Sabana, the Branco/Negro interfluvium, and on the Negro and Orinoco headwaters. Most pairs studied (65) do not come into direct contact because of physical barriers. Several species, however, do come into contact and either hybridize (9 pairs) or occur in parapatry or partial sympatry (13 pairs). We found that the average genetic distance between each pair (a proxy for the time they remained isolated) is a good predictor of whether a given pair will hybridize or not. The average genetic distance between pairs that hybridize is significantly lower than between those that occur in parapatry or sympatry. In this case, competitive exclusion and character displacement (use of slightly different habitats) may be responsible for maintaining species identities in those pairs that have already achieved reproductive isolation. Our results suggest that physical barriers play a major role, not only in the diversification process, but also on the maintenance of avian diversity in Amazonia.



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Phylogeography and population history in *Rhegmatorhina* (Aves; *Thamnophilidae*) and implications for Amazonian historical biogeography

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The Amazonian endemic genus *Rhegmatorhina* comprises five species with distributions limited by the Xingú, Tapajós, Madeira, Amazonas, Japurá and Negro rivers. Phylogenetic relationships among and demographic history within lineages that have distributions delimited by the main Amazonian rivers may help understanding the role of river formation and river dynamics on the origin of diversity. We sequenced three mitochondrial genes (cytb, ND2 and ND3) and one nuclear intron (BFib7) for 119 individuals representing all taxa recognized within the genus. We performed phylogenetic analyses using MP, ML and Bayesian Inference, molecular clock dating applying rates of molecular evolution, and population genetic analyses estimating historical demography and gene flow. The phylogenetic analyses reveal seven well supported mitochondrial lineages, with the most basal split corresponding to the Madeira river and dating to about 1.87 mya (SE 1.67 - 2.07). Three distinct lineages occur within the Madeira-Tapajós interfluvium. *R. berlepschii*, endemic its lower portion, shows strong signal of recent population expansion and is sister to *R. gymnops* from the Tapajós-Xingú interfluvium, indicating a recent split between lineages at opposite banks of the lower Tapajós river, followed by expansion of *R. berlepschii* in the Madeira-Tapajós region. Diversification of the genus occurred during the Quaternary, agreeing with further evidence that points to a dynamic recent history within the Amazon Basin, influenced by the recent evolution of its drainage system.



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Molecular phylogenetics and the pattern and timing of diversification of toucans (Family: Ramphastidae)

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Phylogenetic studies of Neotropical birds indicate that the timing and patterns of diversification are complex and diverse. Ultimately the comparison of patterns from multiple groups with different dispersal abilities has the potential to shed light on the mechanisms of diversification affecting Neotropical birds. The toucan family (Ramphastidae) has been used as a model to construct generalized hypotheses of diversification patterns in the Neotropics. We reconstructed the phylogeny of nearly all species of toucan and used a Bayesian relaxed-clock framework to calibrate this phylogeny to examine both the pattern and timing of diversification in this model group. The data matrix totalled 3340 base pairs and included sequences from cytochrome oxidase I, cytochrome b, ND2, beta fibrinogen intron 7, and a fragment of the proto-oncogene c-myc. Phylogenies constructed from these sequences were well resolved and well supported. Reconstructions of biogeographic history on the toucan phylogeny uncover a number of interesting patterns. For example, reconstructions of cis and trans Andean distributions suggest several independent dispersal events between these broad biogeographic regions. We compare this and other biogeographic patterns to those already published for other Neotropical bird groups.



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Biogeographic history of the family Cotingidae

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Historical processes involved in the origin and diversification of Neotropical biotas are poorly understood. Cotingas (Cotingidae) in spite of its diversity and eye-catching appearance are among the least studied avian groups of the Americas. Using its phylogeny and the Phylogenetic Analysis for Comparing Trees (PACT), I studied basic issues of their biogeographical history. I also used available phylogenies of other Suboscine taxa groups as comparison to obtain a general overview of the processes intervening in the establishment of the Neotropical biodiversity. Cotingids distribution database was constructed using information of different collections and other data sources. The database was used to obtain potential distribution maps for all the species and then a Parsimony Analysis of Endemicity (PAE) based in 1° x 1° degree grids was made in order to obtain areas of endemism. These areas were used as the historical units in the PACT, in which Cotingidae, Tityridae, Pipridae, and Tyrannidae taxonomic area cladograms were compared. Several dispersion and vicariance events between the Guianan Shield, Andes, and Amazon Basin, were recognized and were considered of major importance in the establishment of the diversity of the Tyrannoidea in the Neotropics. For Cotingas, two events out of Amazonas to Andes were identified in the most plesiomorphic branch of the general area cladograma, and many events into the Amazon from which they reach Mesoamerica (via the northwestern Andes), the Atlantic Forest and the peripheral aridlands. The evolution of these biotas reflects more than a single vicariance event. Diversification processes of the more ancestral lineages must have occurred mainly in the Miocene-Pleistocene, while recent speciation events and actual distributions were established in the Pleistocene.



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New tools and new molecules lead to a comprehensive reconstruction of recent evolutionary events: lessons from *Melithreptus* and *Entomyzon*

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The evolutionary history of Australian birds has gained attention recently through powerful insights from new molecular and analytical tools. These methods have refined understanding of the evolutionary significance of historical barriers (Carpentarian, Nullarbor, Eyrean) and their roles in shaping past divergence and current population structure. As a consequence, conflicts among gene trees have become challenges to integrating systematics and phylogeography. We used multiple loci to reconstruct relationships in a group of closely related honeyeaters (Meliphagidae), *Melithreptus* and *Entomyzon*. After comparing results with the current classification, we investigate influences of past events on current distributions. All study taxa were sequenced for the mtDNA gene, *ND2*, which is widely used in resolving relationships at this taxonomic level. Further, we sequenced a subset of the data for ten non-coding nuclear loci. Conflicts among gene trees occurred at different depths of the phylogeny. Accordingly, we analysed our data using a combined framework. This included a species tree approach (BEST) to reconcile deeper relationships and a population approach by fitting an isolation-with-migration model (IMa) to the data to reveal recent evolution in the group. Relationships between *Melithreptus* and *E. cyanotis* support the current understanding of these genera as closest relatives. Within *Melithreptus* the molecular data revealed a number of discrepancies in our current understanding of the species history supporting the need for a revision of systematic relationships within this group. Phylogeographic analysis suggests that there were several historical events in the north and south of Australia throughout the Pliocene and Pleistocene that shaped the current distributions of both genera.



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Phylogenetics and biogeography of North and South American New World quails (Odontophoridae)

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There has considerable debate about the phylogenetic and biogeographical relationships of New World quails (Odontophoridae) to the balance of gamebirds (= Galliformes). Traditionally they were placed with, or near the, Old World quails (Perdiciinae that fall within the pheasant-like galliforms Phasianidae). Early DNA-based studies suggested that other than megapodes (Megapodiidae) and cracids (Cracidae), they were sister to the balance of the Galliformes (= phasianoids), and may have colonized Africa during the breakup of Gondwana. This molecular study based on four mtDNA and two nuclear molecular markers, confirms that: 1. guineafowls (= Numididae) and not New World quails are basal phasianoids; 2. the northern New World quails are probably the result of a dispersal event from Africa and those from South America dispersal from North America.



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Phylogeny and biogeography of fluvicoline tyrant flycatchers

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The tyrant flycatcher subfamily Fluvicolinae contains ca 125 species exhibiting a wide array of ecological adaptations. It has its greatest diversity in South America, characteristically inhabiting open to semi-open habitats outside the Amazon Basin, and also contains one of only three lineages of tyrant flycatchers that have diversified to any extent in North America. Based on a multi-locus molecular phylogeny, we investigate the historical biogeography and the evolution of ecological adaptations in Fluvicolinae, both in broad terms and on a finer scale within these clades. Fluvicolinae is shown to consist of four principal clades, all exhibiting modifications of a fundamentally similar search-and-sally foraging technique, but relatively little overlap in habitat preferences and, to some extent, in geographical distribution. This indicates a great deal of adaptive flexibility inherent in the search-and-sally foraging technique, but also relatively strong niche conservatism in terms of broad habitat characteristics. The nearly complete species level phylogeny is also used as a basis for a new classification of Fluvicolinae. The more pertinent changes involve the genera *Ochthoeca* and *Xolmis*, both found to be non-monophyletic in the current study.



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SA13 Other Subjects



Low pathogenic Avian Influenza in an important Central European waterbird area: what we learn from mute swan antibody screening

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Lake Constance at the border of Germany, Switzerland and Austria was one of the first waterbird areas in Central Europe affected by the high pathogenic Avian Influenza (HPAI) virus H5N1 in 2005. Also, it regularly harbours low pathogenic forms of the virus (LPAI) circulating in the waterfowl populations. For Central European freshwater wetlands there is almost no data available about phenology and prevalence of LPAI. However, LPAI is regarded as the ancestor of HPAI which seems to potentially evolve after LPAI entered poultry holdings. Therefore we investigated antibodies and active virus shedding of abundant resident mute swans. Active virus shedding was < 3% but antibody prevalence reached from 12 % in first year birds to over 90% in adult swans. Infections were detectable already in late summer when first migrating ducks arrive for moulting at the lake. Among pulli out of 10 families with at least one bird with positive serology not a single case was found where all siblings showed antibodies. This indicates that infection risk is moderate even under close contacts as they exist among sibling pulli. Among isolated virus AI H5N2, H6N8 and at least 5 more subtypes could be identified, including low pathogenic H5N1. While screening of resident birds that are easy to access helps to understand abundance and phenology of pathogens in wild bird populations there still is a methodical limitation because AI antibody tests are not evaluated for wild birds. In our study we frequently used at least two types of ELISA tests and from these results we estimated the error rate to at least 10%.



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Conserving birds and biodiversity on U.S. military lands

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The United States Department of Defense (DoD) manages nearly 12 million hectares of land for its primary mission of providing realistic training opportunities and military preparedness. The more than 400 military installations also harbor an incredible diversity of wildlife and natural resources. Compared to other U.S. federal land management agencies, DoD hosts a disproportionate amount of biological diversity due to a combination of factors, including DoD regulations, past and present land use, and location - installations are found in nearly every state and ecosystem, from deserts to tundra to coastlines. Sustaining the military mission and protecting biodiversity present unique challenges and opportunities for military natural resource managers. Preserving the mission and biodiversity both depend on good stewardship of the land. DoD is a key partner in Partners in Flight, the North American Bird Conservation Initiative and other partnerships. Bird conservation is incorporated into installation Integrated Natural Resource Management Plans, and focuses priority species and habitats identified by Partners in Flight bird conservation plans, state Wildlife Action Plans and the US Fish and Wildlife Service. A coordinated bird monitoring strategy provides the framework to ensure monitoring programs are developed and conducted properly while integrating DoD monitoring into the larger regional and national context. The DoD Partners in Flight program has developed a strategic plan for bird conservation on DoD lands that pulls all these priorities together, along with measurable goals for conservation actions that benefit birds and ensuring the sustainability of the military mission.



Abundance and breeding success of ciconiiforms in a mixed heronry in a Brazilian subtropical estuary

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The abundance and breeding success of *Platalea ajaja*, *Ardea alba*, *Ardea cocoi*, *Nycticorax nycticorax*, *Nyctanassa violacea*, *Egretta thula*, *E. caerulea* and *Bubulcus ibis* was evaluated in a heronry located in the Patos Lagoon estuary (32°01'25"S;52°09'13"W), southern Brazil. The abundance was evaluated by census from a point 20 m higher and 150 m distant from the heronry, and by counting the active nests. Positive identification of *E. thula* and *B. ibis* nests was difficult until the nestlings were 4-5 days old, so the nests success of these species was analyzed together. A total of 215 nests containing eggs were marked and their contents checked weekly. A nest was considered successful if producing at least one fledgling (15 days olds). About 3020 breeding pairs were estimated (744 *P. ajaja*, 941 *B. ibis*, 903 *E. thula*, 190 *A. alba*, 178 *N. nycticorax*, 22 *A. cocoi*, 18 *E. caerulea*, and 15 *N. violacea*) nested from middle September to early March, including a second pulse for *E. thula*, *E. caerulea* and *B. ibis*, started on middle December. The higher percentages of successful nests were observed for *A. cocoi* (100%) and *A. alba* (75%) and the lower for *N. violacea* (0%) and *E. thula/B. ibis* (20% in the first pulse). The mean number of fledgling per successful nest varied between 2.28 (*A. alba*) and 1.50 (*E. thula* second pulse). Predation was the main cause of nest losses (apparently, more than 70%) for all species. The number of *E. thula* and *B. ibis* might be overestimated, because several breeding pairs which nested in the second pulse might have nested in the first, and started a new breeding attempt after the loss of their clutches. Mammalian predators such as *Procyon cancrivorus* and *Didelphis albinventris* may be an important cause of nest failure, especially for those species which build their nests close to the ground. Research disturbance could have contributed for the lower nesting success of *E. thula/E. ibis* in the first breeding attempt.



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Island-mainland adaptive divergence in the superb fairy-wren (*Malurus cyaneus*): environmental, morphological, and genetic variation

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Adaptive divergence in phenotype and/or behaviour shaped by ecological conditions is common on islands, which tend to be geographically isolated, have a more stable climate, fewer species, and fewer resources compared to the adjacent mainland. Passerine birds tend to follow the “island rule”, with smaller birds having a larger body and/or bill size on islands, and sometimes a wider ecological niche. Genetic differentiation often follows ecological divergence (depending on trait heritability) as a result of local selection, restricted gene flow between populations, and genetic drift. In this study, we examined phenotypic and genetic variation across 7 parks on an island and the adjacent mainland in a sedentary passerine, the superb fairy-wren (*Malurus cyaneus*), representing two currently recognised subspecies. We also examined the role of geographic distance, climate, and prey availability as predictor variables for phenotypic variation and genetic structure. We found that island birds had a significantly larger body size and smaller bill shape compared to mainland birds, but bill length did not differ between regions. Molecular genetic analyses revealed two discrete genetic clusters, comprising mainland and island, with significant divergence, isolation by distance, and little or no gene flow between parks. Phenotypic variation was significantly correlated with maximum temperature, and bill shape correlated with prey size and availability.



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A recent outbreak of DDF affects breeding success of black stork in Eastern Europe

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In the second half of the 20th century, DDT and its isomers have played a significant role in the declines of many populations of avian top consumers, until these substances were banned. In 2008, we discovered that the current use of DDT is significantly affecting breeding success of the black stork in Latvia. All 15 failed eggs which were tested in the lab using gas-liquid chromatography contained DDT or its isomers. In 2009, we made a special inventory to determine actual egg loss. DDT impact appeared to be even more significant than initially anticipated and apparently increased from year to year since 2007. In order to identify the possible origin of DDT, failed stork eggs were collected in other parts of the species range with the help of colleagues from Poland, Germany, Czech Republic and Estonia. Comparative egg measurements were also taken at museum collections in Sweden, UK, Belarus, Latvia and Germany. We found a significant difference in the Ratcliffe index between black stork eggs collected recently and those collected before 1947 of birds using the eastern flyway, suggesting Eastern Africa to be the most probable source of DDT usage. There is also a significant difference in eggshell thickness between eggs from museum collections and recently failed eggs, with recent eggshells being 12% thinner on average. We discuss further possible implications of current DDT usage and call for an international research cooperation concerning the resurgence of DDT which is likely to also affect other species.



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Evolutionary photonics of amorphous feather barb nanostructures

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Non-iridescent structural colors in avian feather barbs are produced by quasi-ordered/amorphous photonic (color-producing) nanostructures of beta-keratin and air. These nanostructures occur in one of two 3D nanostructural classes: disordered array of air spheres in solid keratin or as tortuous, interconnected channels of air and keratin. Physical characterization of organismal structural color production requires precise 3D knowledge of the nanostructure. However, current techniques based on Fourier analysis of electron micrographs and tomograms do not provide sufficiently accurate data for the rigorous analysis of structural color production or for evaluating the signal content of these ornaments in the lives of birds. We use Small Angle X-ray Scattering (SAXS) to characterize the spatial organization of avian barb photonic nanostructures. We have assayed distinct structurally colored plumage patches from all extant Avian genera (except in Psittacidae) with barb structural color, at the Advanced Photon Source, Argonne National Labs. We use single scattering theory to successfully predict the optical reflectance directly from SAXS structural information, which are not only congruent with optical reflectance measurements, but offer substantial improvements over past analyses. Using SAXS, we also quantitatively distinguish between the two classes of barb nanostructures. Phylogenetic analyses suggest barb structural colors have convergently evolved at least 40 independent times within the avian phylogeny. We discuss these results in light of the putative self-assembly of these barb nanostructures through the phase separation kinetics of beta-keratin from the cellular cytoplasm and their technological implications for photonics and biomimetics.



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Adjusting the circannual clock: modularity and phase-specific responses to environmental cues

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Seasonal activities of many species are embedded into a recurring, annual cycle, and often persist as circannual rhythms in complete absence of temporal information. Under natural conditions, these rhythms are synchronized by zeitgebers (i.e., synchronizing cues, predominantly photoperiod) and modified by further factors. Annual schedules can differ greatly between species and locations, implying that responses to calendrical cues undergo evolutionary adjustment. Data from the field and lab strongly suggest modularity of the (circ-)annual cycle, i.e., that it consists of separate physiological processes that can be individually adjusted. Furthermore, the action of the zeitgeber on these processes depends on the phase of the annual cycle. Thus, for example, after breeding moult can be adjusted in response to photoperiod while the reproductive system is non-responsive. These aspects of the circannual clock are demonstrated by comparative studies of a widespread songbird taxon, the stonechat (*Saxicola torquata*). Stonechats have adjusted their annual cycles to the diverse environments which they inhabit, and they breed, moult and overwinter under a wide range of photoperiodic conditions. The findings from Stonechats highlight the great evolutionary flexibility of a clock that consists of modules, which in turn are adjusted to assume correct phasing with respect to local conditions. This opens new research questions for molecular studies of the annual clock, e.g. concerning the regulation of photoperiodism in different target tissues associated with seasonal activities. Furthermore, responses of the fractions of the annual cycle to environmental cues can be conceptualized as seasonally changing reaction norms, thereby linking chronobiological approaches to evolutionary ecology.



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Spot the difference! Structural versus visual function of eggshell maculation

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Pigmentation and patterning of the eggshell clearly sets birds apart from their reptile ancestors. Nonetheless, it has proven difficult to identify an adaptive function of eggshell maculation, which could explain its widespread occurrence and diversity across avian taxa. Generally, adaptive hypotheses have emphasized either a visual function (e.g. camouflage or egg recognition) or a structural function (e.g. physical protection or enhanced gas exchange through the shell) of speckling but support for either comes mostly from correlational studies only. In this study we test the divergent expectations regarding the structural make-up of the speckles. Namely, that the underlying shell structure of speckled regions should not differ from that of the adjacent plain areas if spots have a purely visual function, whereas a structural function of speckling requires visible spots to coincide with a difference in shell surface composition. We used the heavily speckled and apparently camouflaged eggs of black-headed gulls (*Larus ridibundus*) to investigate how function, visual appearance and structural composition of speckles are linked. We first ascertained the vapour permeability and thickness of plain and speckled shell fragments and then characterised the appearance and structure of the same fragments using digital macro photography, colour opponent texture analysis and scanning electron microscopy. Surface structure matched some but not all of the visible speckling, still plain and speckled areas did not differ in permeability or thickness. These findings for a ground nester support a visual rather than structural function of shell maculation, even where speckling coincides with structural differences.



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A participatory research program as a tool for bird conservation in a rural landscape

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A major challenge for bird conservation in rural landscapes is involving human communities in the conservation process. Cenicafé, the research branch of the Colombian coffee growers association, in collaboration with the U.S. Forest Service and The Nature conservancy, has been conducting a participatory research program that is having a positive impact on bird conservation. It includes bird inventories with coffee farmers, their families, and extension personnel; an educational program on bird identification, ecology, and conservation; and the production and distribution of educational materials. It includes communicating research results to participating communities; creating opportunities to discuss research emphasis and the significance of bird inventory results; and accompanying local conservation initiatives. After five years, with the participation of 29 communities, we have significantly extended the frontier of bird information for the Colombian Andean region, recording 448 bird species, including 30 migrants and 22 endangered taxa. We have distributed more than a hundred thousand copies of educational bulletins and several thousand copies of posters of birds; and conducted workshops for farmers and extension personnel. We have accompanied several regional initiatives that include developing a management plan for oak-forest remnants, conducting environmental education programs, and supporting birding groups. In a process of evaluating the effects of the program on farmers' attitudes towards birds and conservation, we have identified actions beyond the scope of the program, in forest conservation and bird education campaigns, and the use of research results to support environmental certification processes and marketing campaigns.



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50 years of the Operation Baltic bird migration study program

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In 1961 at the Polish Baltic coast there was started a bird migration study network and it works continuously till now. So, it is the longest time-span in the World covered by the bird migration stations network running with the stable methodological routine. The network was set by a group of biology students from the University of Warsaw following the old idea of the Operation Recovery born in US in late fifties. In contrary to that, we continued work 50 years and collected an enormous database of the data about 1.5 million ringed birds and years of visual observations. Most of caught birds were measured with a standard set of measurements (wing-length, tail-length, wing-formula, fat-score, body mass) and some special data. Seasonal dynamics and long-term number dynamics of passage migrants are available too. These are especially valuable as the data can be evaluated in a context of the global warming. Even long-term morphological changes can be followed using that material. Since fifteen years we study directional preferences of nocturnal migrants using new, so called Busse orientation cages. On the area of Central Europe, where different populations migrate in different directions, this method is very useful for studies on populational differentiation of migrants. The Operation Baltic is the basis for a wide international network - SEEN (SE European Bird Migration Network) covering east European bird migration flyway from Central Europe, Scandinavia and northern Russia via southeastern Europe, Middle East and Eastern Africa. In this project there are engaged around 40 sites dispersed along the migration route.



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From bird watchers' notebooks to Bayesian models: using historic data to detect bird species declines

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To detect population declines we often rely on historic species lists, the most common biodiversity information available. However, these lists are of variable quality and not standardised. We use List Length Analysis, a Bayesian modification of the method introduced by Donald Franklin in 1999. This method uses presence-only data and assumes that the length of a species list is surrogate for average detectability, all else being equal. In theory, if a species is declining, its relative abundance, compared to that of other species within the community, will decline and therefore higher effort is required to find it (ie. it will appear less frequently on shorter lists). We tested the strength and assumptions of List Length Analysis in three ways, by applying it to (1) a "virtual" community based on real parameters to check robustness and sensitivity of the method, (2) an 8-year dataset with rigorous desing and collection, count data simplified into presence/absence and we compared the results to simple regression and (3) a 40-year, ad-hoc, volunteer-collected dataset with presence/absence data. In conclusion, List Length Analysis is useful for modelling relative abundances from species lists, as we were able to detect declines and increases, and estimating the magnitude and certainty of those changes was straightforward. Further, we can calculate the probability that there has been a decline of a given magnitude. The list length method proved most robust for moderately common species. This method has the capacity to alert us to species declines and lays the groundwork for using invaluable historic datasets.



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The eggshells view of avian life history: how shell permeability and characteristics fit species breeding biology

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A carefully controlled gas exchange across the eggshell is essential for the development of the avian embryo. The diffusion of gases and water vapour across the eggshell has been demonstrated to influence such factors as the incubation period, nesting season and incubation constancy of species in a way that optimizes gas diffusion for the developing embryo. In addition, the eggshell's physical properties such as thickness, pore density, shape and size also influence the rate of permeability. We tested the link between eggshell permeability and the physical characteristics of the shell, with the species' life-history traits and nest environment. We measured the permeability rates and shell thickness of c. 250 bird species, sampling almost all species that breed in the British Isles. The eggshells were made available through a partnership with the Natural History Museum (Tring, UK). We used a method that standardized permeability measurements for eggs ranging over two orders of magnitude in size. Fragments of eggshell were glued on top of water-filled Eppendorfs and placed in desiccators at constant temperature. The Eppendorfs were then weighed daily and any mass loss was assumed to be a result of water evaporation. Using a phylogenetic analysis, eggshell permeability rates (expressed as $\text{mg day}^{-1} \text{ torr}^{-1}$) were linked to the egg and nest traits, to explore the relationship between eggshell permeability and these traits across a wide range of bird families.



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Mechanisms and functions of song (amplitude) variation: bioacoustics, testosterone, and reproductive success in rock sparrows (*Petronia petronia*)

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Acoustic signals play a crucial role in the reproductive behaviour of many species. In birds, song repertoire sizes have been found to be indicators of male quality and thus affecting the reproductive success of the singer by female choice. However, a potentially important performance related song parameter, song amplitude, has been neglected. Recent studies have shown that song amplitude varies considerably between males, and they suggested that song amplitude is sexually selected. If a signal trait is under sexual selection, then variation in this trait needs to be related to fitness. However, this critical data, linking song amplitude and fitness, is still missing to date and thus the question of if and how song amplitude is sexually selected remains an open one. On a proximate level, the vocal performance of a male could be affected by the hormonal status of the singer, e.g. song amplitude could be affected by his testosterone levels. Here we present the results of a field study on the relationships between male song characteristics, hormonal status and fitness. For this purpose, we studied a population of rock sparrows (*Petronia petronia*) in the French Alps. Over a period of two years, we recorded the songs of males, measured their plasma testosterone levels and determined individual fitness as the genetic breeding success by genotyping all available young and parents using eleven microsatellite markers. The results of our study will show whether song amplitude (along with other song parameters) reflects a male's endocrine status and reproductive success, and thus be a first test whether song amplitude is an honest signal of male quality or status.



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Spring migration in wood thrush (*Hylocichla mustelina*): carry-over effects into the breeding season

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Carry-over effects due to wintering habitat quality have been inferred in Neotropical migratory passerines via use of stable isotopes. However, variation in the energetically costly spring migration which precedes the breeding season in these songbirds has high potential to explain the breeding behaviour of individual birds once they reach their breeding territories. Departure date, choice of route and speed of spring migration dictates arrival times on the breeding grounds, may also influence the physiological condition of an individual upon arrival. Both arrival time and physiological condition play a role in territory and mate acquisition in addition to annual reproductive output. We used geolocators to determine spring migratory routes of wood thrushes (*Hylocichla mustelina*) breeding in northwestern Pennsylvania, USA. Most individuals in our population use a similar migration route, crossing the Gulf of Mexico and continuing up the Mississippi Valley. Departure date from the winter territory (Nicaragua/Honduras) varied from 17 March to 21 April and spring migration speed ranged from 100-318 km/d. Upon arrival to the breeding grounds wood thrush were caught using mist-nets and corticosterone levels measured prior to nest-building. These individuals were then radio-tagged and monitored throughout the breeding season to document their reproductive output over the entire breeding season. Data will be presented linking spring migratory strategy and pre-nesting corticosterone levels to determine if stress levels associated with specific spring migratory strategies influence reproductive output in this passerine.



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Singing from the skies: bird song structure and individual variation on genetically different “sky-islands” of southern India

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Birds use breeding songs as important signals to attract mates. Considerable variation is known to exist in song structure across different scales of geographical separation, from differences between neighbors in a habitat to populations across continents. The high elevation regions of Western Ghats in southern India form ‘sky-islands’ containing the unique Shola habitat. Species on such sky-islands are often specifically adapted to such habitats that are also confined to these islands, and populations on different islands may be geographically isolated. Recent studies also show that forest fragmentation can intensify this by affecting species dispersal and eventually increasing isolation. We examined genetic differences between populations of a threatened, endemic bird, the white-bellied shortwing, *Brachypteryx major*, on different islands using mitochondrial and nuclear markers. We then examined shortwing song variation across two most genetically distant islands and between two genetically close populations on a single island that are separated by recent deforestation. We recorded songs from 23 individuals from three populations from two islands. Songs were digitized and characterized by 11 parameters. We reduced the data to 5 Principal Component scores and tested for differences between populations with nested MANOVA and ANOVA and classified songs with a Discriminant Function Analysis. We found all three populations to be significantly different from each other with most difference between the genetically distinct populations across the two islands. We also found significant song-variation within each population, with most individuals only singing songs that were typical of that population while a few sang songs typical of a different population. Our results imply that cultural differences can arise quickly between recently isolated populations while corroborating accepted patterns of congruence between song and genetic divergence across islands.



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SA01 Behaviour and Behavioural Ecology



The ability to rise a stress-response is linked to melanin-based coloration in barn owls

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Sexual selection theory posits that ornaments can signal the genetic quality of an individual. Eumelanin-based coloration is such an ornament and is hypothesized to signal the ability to cope with a physiological stress-response since the melanocortin system regulates eumelanogenesis as well as physiological stress responses. The ability to react to stressors varies markedly between individuals. We examined in free-living barn owls (*Tyto alba*), whether the degree of melanin-based coloration, a heritable trait, covaries with the ability to mount a stress-response. We found that individuals with larger eumelanin spots had a lower stress-response than individuals with smaller eumelanin spots. In a further step we investigated whether the regulation of the main stress-hormone in birds, corticosterone, and the effects of this hormone varies between individuals with more or less eumelanin coloration. We mimicked a hormonal stress signal through implantation of corticosterone-releasing pellets in nestling and male breeding barn owls. The increase of corticosterone due to corticosterone implants and the effects of the implants on growth rate were stronger in nestlings with small eumelanin spots than in nestlings with large spots. Corticosterone-treated males with small eumelanin spots reduced nestling provisioning rates more than controls, and also more than corticosterone-treated males with large spots. These results together suggest that more eumelanin birds are less stress-sensitive and are better able to regulate corticosterone. The link between stress-sensitivity and eumelanin-based coloration may contribute to the maintenance of genetic variation in coloration in this population. In favourable environmental conditions more stress-sensitive, less eumelanin individuals may have a greater reproductive output, while in sub-optimal environmental conditions less stress-sensitive darker eumelanin individuals may attain a greater fitness.



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Habitat use by four species of migratory shorebirds (Charadriiformes) on Atalaia Beach in Sergipe, Brazil

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The Atlantic coast of Sergipe (north-eastern Brazil) is on the migration route of at least 17 species of migratory shorebirds. Here, we analyze behavior and habitat use of the four most common migratory shorebirds (*Arenaria interpres*, *Calidris alba*, *Calidris pusilla*, and *Charadrius semipalmatus*) on 5 km of Atalaia beach over a 13-month period in 2008-9. In addition to records of the location of each species every 500 m along the beach, behavior was noted. In a total of 928 records of the four species, bands of up to 1075 *C. pusilla*, and mixed flocks of up to 1500 individuals were noted. *Calidris alba* and *Charadrius semipalmatus* were the most abundant species overall, with 65.9% of the sightings, and 59.8% of the individuals recorded. The two more common species were relatively uniformly distributed along the beach while *A. interpres* was found primarily in the 3 central sectors, 4-6 (67% of records), while *C. pusilla* was relatively common in external areas, with 56% of records from sectors 2 and 9. A major influence on the behavior of all four species was the presence of leftovers of food (e.g. peanuts, coconuts, shrimp) dropped by beachgoers, in particular in sectors 5, 6 and 9. As a result of this, 41% of foraging was recorded on the upper beach, rather than the intertidal zone, and the majority (67%) of records refers to these 3 sectors. While possibly beneficial over the short term, the exploitation of leftovers as a dietary resource may be potentially deleterious for these migratory birds, given their small size and sensitive metabolisms.



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Hierarchy of dominance and resource sharing among hummingbirds (Trochilidae) in central-western Brazil

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Dominant species are those that defend territories from other individuals of the same or another species, while subordinate species furtively use the nectar within territories defended by dominants. We identified hummingbird species in the study area and defined the dominance hierarchy among species and investigated resource sharing. The study was carried out on the edge of a forest vegetation in central-western Brazil, (14°38'48.39"N, 57°26'06.51"W). The observations for five months between 2007 and 2008 totaling a sampling effort of 87h in three food resources: *Inga edulis* Mart. and *Calliandra surinamensis* Benth. (Mimosaceae) between 6:00 and 9:00 in the morning, and *Leonotis nepetaefolia* (L.) WT (Lamiaceae) between 15:00 and 18:00h. We identified four species: *Anthracothorax nigricollis* Vieillot 1817, *Polytmus guainumbi* Pallas 1764, *Thalurania furcata* Gmelin 1788, and *Phaethornis pretrei* Lesson & Delattre 1839. The dominant species is *A. nigricollis* (90% of attacks), followed by *T. furcata* (7%) and *P. pretrei* (3%). Sharing was observed only in *C. surinamensis*, in which there was intra-and interspecific, and *A. nigricollis* tolerate more *T. furcata* (27%) and *P. pretrei* (55%) than *A. nigricollis* (18%). *P. guainumbi* was not listed, because this was not observed interacting with any other individual. We conclude that resources are widely available, since four species of hummingbirds were observed, confirming the importance of conservation of plant species as their resource base.



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Behaviour, vocalizations and evolutionary implications of hybrid greater prairie-chickens and sharp-tailed grouse (*Tympanucus* spp.) in southwestern Minnesota, USA

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Hybridization provides insight into the process of evolution following the break-down of genetic isolation. In southwestern Minnesota, a reintroduced population of greater prairie-chickens (*Tympanuchus cupido*) hybridized with sharp-tailed grouse (*T. phasianellus*). A previous study of prairie-chickens revealed that females preferred more aggressive males, and that this behaviour intensified when females were present. Using observations of hybrids and “pure” individuals on mixed-species leks, I tested three evolutionary hypotheses that might elucidate the presence of hybrids: 1) parental forms differ in their aggressive behaviour; 2) male behaviour will be similar when females of their own species or those of different species are present; and 3) hybrids will be more active than “pure” individuals due to hybrid vigor. During the 2009 breeding season, I recorded vocalizations and conducted 10 minute focal observations to quantify behaviour of particular males on 4 leks. One lek consisted entirely of sharp-tailed grouse; two leks had both species and hybrids, and one lek had prairie-chickens, a hybrid, and one back-cross prairie-chicken. The display behaviour and vocalizations of hybrids were intermediate between the parental species. Supporting my predictions, successful sharp-tailed grouse fought more than successful prairie-chickens when females were not present. Time spent displaying and fighting did not differ according to the sex of the female present on the lek. Hybrid males had similar levels of activity compared to either parental species. These observations suggest that isolating mechanisms may be weak in these species, despite their lek-mating breeding system.



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Vocal characteristics of oscine birds associated with forest habitat in New Zealand

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Opportunities exist in New Zealand for new investigations of bird vocalisations that examine southern hemisphere species that may differ in their patterns of vocal behaviour from those in the Northern Hemisphere. Environmental selection pressures drive evolutionary divergence, while both natural selection and sexual selection may shape the physical characteristics of avian vocalisations, such as their spectral and temporal structure. Selection pressures vary between habitats and sound transmission properties associated with local microclimate and vegetation structure may be important. As many species can use the same acoustic space, there is selection pressure on individual species to optimise sound transmission in a particular habitat. Different wavelengths of sound are absorbed and reflected to a lesser or greater degree by different objects. In deciduous or tropical forest, the optimal sound window occurs between 1.5 kHz and 2.5 kHz, sound within these frequencies surviving and travelling better than sound of higher or lower frequency. The acoustic adaptation hypothesis predicts that avian vocalisations diversify in different habitats as a product of selection for efficient sound transmission. This concept is examined in an investigation of vocalisations of a forest bird community in Zealandia (formerly Karori Wildlife Sanctuary), New Zealand. Further, the hypothesis that species in complex dense forest community show spectral segregation and/or temporal or spatial avoidance is examined: do they sing at a different frequency, at different times, or in different places?



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Territorial and social behaviour is different in young birds originated from first vs. replacement broods in whinchat (*Saxicola rubetra*) and first vs. second broods in common stonechat (*S. torquata*)

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The dependence of natal dispersal distance, survival and recruitment on hatching date in small passerines in temperate zones of the northern hemisphere is widely known. Less attention was paid to the distinction between juveniles of different generations e.g. originated from first vs. replacement or first vs. second (last) broods. In our study of whinchat (*Saxicola rubetra*) and common stonechat (*S. torquata*) in north-eastern Ukraine in 1993 – 2008, a striking difference was found in territorial and social behaviour of juveniles descended from different generations. Such difference manifests itself in terms of family group retention, in formation of post-breeding groups and in time duration of juveniles in their natal area. In the common stonechat first brood families break up significantly earlier (when young birds are 36 – 39 days old) than second (last) brood family groups (43 - 45 days). Juvenile common stonechats from first broods were never observed in post-breeding groups while second (last) brood young are prominent in their formation. In the common stonechat juveniles originated from second (last) broods stay in natal area significantly longer. Similarly, young whinchats from subsequent broods remain longer near parent territories than first brood juveniles. In whinchat the recruitment rate was found to be higher in juveniles originated from replacement broods than from first broods. Not solely hatching time but relations with parent birds and changes of social context in the course of breeding season play role in the origin of behavioural and life-history differences in young birds of different generations in whinchat and common stonechat.



Artificial incubator of the collared forest falcon egg (*Micrastur semitorquatus*) and the successful introduction of a chick in natural nest with three chicks in the southern Pantanal, Brazil

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The collared forest falcon (*Micrastur semitorquatus*, family Falconidae) nests in hollow trees made by other species of birds. It is found in the Pantanal and breeds from September to November, laying 1 – 3 eggs. Here we describe the handling process of an egg and the chick of the falcon, in 2007 in the Pantanal, Miranda, Mato Grosso do Sul. During nest monitoring by the Hyacinth Macaw Project (9 September 2007) an egg of *M. semitorquatus* was found (60g). In the next survey, the nest had been abandoned. On 9 October 2007 the egg was taken and placed in an incubator in which it hatched after 3 days. The chick weighed 40g, total length was 10.5 cm, wing length 2.15 cm, bill length 1.53 cm. Eyes opened 5 hr after hatching. The chick was fed in the incubator for 3 days. When it reached 51g, the chick was placed in a different collared forest falcon nest with three chicks of similar size. The pair fed and cared for the all four young which all survived to fledging. Thus, artificial incubation and rearing and relocating young birds can be successfully used in the case of nesting problems. Nonetheless, it is still necessary to know more about the biology of this species and its relationship with the environment.



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Variables affecting egg and yolk mass of white-rumped swallows (*Tachycineta leucorrhoa*)

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Egg size can have important consequences for nestling survival through nestling hatch weight and growth rate. Although females may vary their investment in egg size according to body condition or the environment, yolk size may have the greatest importance for embryo growth and development. We nondestructively estimated yolk mass using candling and digital photographs of white-rumped swallow eggs at Chascomús, Buenos Aires Province, Argentina during the 2007 breeding season. We used that estimate to evaluate the effects of date of egg laying, environmental conditions, laying order, female condition and food abundance on egg and yolk mass. We also examine whether egg mass can predict yolk mass accurately. Both egg and yolk mass increased with laying order ($p < 0.001$; $p < 0.001$; $N = 55$ nests), while egg mass increased with female condition ($p = 0.01$) and temperature ($p = 0.02$), and yolk mass increased with insect abundance ($p = 0.005$). Egg mass explained only 30% of the variation in yolk mass ($p < 0.001$, $N = 230$). Egg and yolk mass increased with laying order, in agreement with the Brood Survival Hypothesis, but the observational nature of the data does not allow us to confirm that hypothesis. Food abundance influenced yolk mass probably because yolk deposition depends on lipids and proteins contained in food. Egg mass did not accurately predict yolk mass because: a) it explains only 30 % of the variation in yolk mass, b) the amount of increase with laying order was slightly different than that for yolk mass and c) egg mass and yolk mass are affected differently by different variables.



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Neighbour-stranger recognition in the pied bush chat (*Saxicola caprata*)

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There is a generalization that the recognition ability of birds on the basis of song is weaker in species with larger song repertoires. Experiments were conducted to determine whether territorial male pied bush chat, a bird with large song repertoires, discriminates between neighbour and stranger. Study was carried out in the natural habitat of the subjects during their peak breeding phase (April-June) in 2009 in Haridwar (29°55' N, 78°08' E) town of Uttarakhand state, India. Seven males were tested for each song category and in all the cases songs were broadcast from the territory boundary shared by the subject male and the neighbour. Subjects responded aggressively to the songs of both categories *i.e.* they tried to approach the loudspeaker faster and came closer, increased the song rate and song complexity and flew more often. Males seemed equally aggressive to the both song categories, as we found no significant difference in responses between treatments. The results of the present study support the hypothesis that large song repertoires hinder individual recognition by song in birds.



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Genetic evidence of extra-pair fertilizations in the hyacinth macaw, *Anodorhynchus hyacinthinus*

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Through advances in molecular techniques, such as microsatellite analysis, high rates of extra-pair mating were found in various avian species, even some considered strictly monogamous. One example is the family Psittacidae in which species are usually considered to be permanently monogamous. However, few studies have examined extra-pair fertilization in parrot species. In our study, we used seven microsatellite loci to estimate relatedness between pairs of chicks of hyacinth macaw, *Anodorhynchus hyacinthinus*, to test if pairs are strictly monogamous. We analyzed samples from chicks found in the same nest in the same breeding season, from the Pantanal wetland, Brazil. The results of the relatedness index r indicated that in three out of 16 nests analyzed (19%) the chicks were probably either half-sibs or unrelated, suggesting both extra-pair fertilization and nest parasitism. This is an unexpected result for the hyacinth macaw, and it reinforces the importance of aggregating genetic data in behavioral studies. Funds: FAPESP, CNPq, and CAPES.



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Territory stability and turnover in an endemic species of the Atlantic Forest, the marsh antwren *Stymphalornis acutirostris* (Thamnophilidae)

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Year-round territoriality with permanent pair-bonds is a common breeding system in tropical passerines, and new mates may be found at any time of the year. Few studies have focused on pair formation in Neotropical birds, and stable territories are rarely recorded in insectivorous birds, such as the marsh antwren (*Stymphalornis acutirostris*), a monogamous species with year-round territoriality. We color banded marsh antwrens on the tidal-marsh covered Jundiaquara island (11.6 ha), in Guaratuba bay, southern Brazil. From May 2006 to April 2008 we recorded the positions of pairs in relation to a grid of 25 m intervals. All territories in the island were delimited ($n = 14$) and both years were similar with territories varying from 0.4 – 1.1 ha (0.7 ± 0.2 ha). Territories were similar in area, shape and location despite some adult turnover. Females, males and both sexes ($n = 2$ in all cases) switched territories at some time during the study. Territory turnover was due to disappearance of one pair member ($n = 5$), divorce ($n = 3$) and death ($n = 1$). New pairs formed either with floaters, adults that were previously paired or by one bird reared on the island. One adult disappeared for 314 days before returning and forming a new pair. Female replacements occurred after 36 – 75 days ($n = 3$; = 39.5), and males replacement after 32 to 36 days ($n = 4$; = 33.8). We suggest that, in this species, territory boundaries are stable and the configuration probably due to occupation history.



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Comparison of individual features in single calls and duets of white-naped cranes (*Grus vipio*)

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Individual vocal features were shown for many avian and mammal species of different groups. Vocal recognition of mates or relatives was also proven for many species. Reliability of individual recognition varies for different call types depending on call function. In some species, vocal recognition is asymmetrical because those vocal parameters most important for individual recognition differ between mates or relatives. For instance, males may use temporal while females use energetic call parameters for individual recognition. We assume that when a mated pair vocalizes in duet that the duet is more reliable for vocal recognition than single calls due to such asymmetry because the duet combines both male and female features. In addition, the crane duet is the territorial call. The “dear enemy” hypothesis proposes that the level of territorial aggression is greater with strangers and lower with neighbors. Thus, it would be useful for neighbor notification to have individual features in loud territorial calls. So, we can expect that the duet provide information about identity of the pair for neighbour recognition. Vocal repertoire of white-naped cranes includes single calls and duets. We describe the vocal repertoire of white-naped cranes to investigate individual features of each single call type and the duet. We described five single call types: guard call, quack, rumble, bark and boom. Discriminant analysis resulted in up to 80% correct assignment to individual based on single calls and in duets, individual recognition was 97%. Thus, both duet and single calls have individual features and the duet is more reliable for vocal recognition. We suggest that pair-specific duets may serve for neighbor recognition. In addition, duet of the white-naped cranes may be used for population monitoring. This study was supported by the RFBR (07-04-00609).



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Breeding datas of red-browed amazon (*Amazona rhodocorytha*) in Southeastern Brazil

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The red-browed parrot or “chauá” (*Amazona rhodocorytha*) is a threatened species endemic to the Atlantic Forest of southeastern Brazil. They measure about 37 cm, have a red forehead, orange lores, with some red in the wings and tail. It is found in the forests of the coastal lowlands and nearby uplands. In the states of Espírito Santo and Minas Gerais it has been monitored for over three years by the Chauá Project in Aimorés, Itueta and Resplendor, Minas Gerais and Baixo Guandu, Espírito Santo. We monitored 38 nests in cavities in snags and live trees, with a minimum DAP of 113 cm and varying from 1.5 - 25.0 m in height. Nests were in forests (N = 30) or grassland (N = 8). Cavity height was 1.5 - 19.0 m and cavity depth 0.30 – 5.0 m. We used climbing equipment to reach nests. Nesting material comprises wood, feathers and soil. The breeding season is August through November. Two to four white eggs are laid and are incubated for 28 – 32 days. Nestlings are fed 6 – 8 times per day and leave the nest after ~45 days. When young parrots leave the nest they are assisted by the parents. We measured, banded and took blood samples from 18 parrots (11 male, 4 female, 3 uncertain sex). We placed 8 radio transmitters to monitor movement patterns. These data are important to know more about breeding biology of this species for conservation strategies.



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Cold and fat or warm and lean? Effects of a brood-size manipulation on *Tachycineta leucorrhoa* chicks

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Life history theory predicts trade-offs between investment in the number of offspring and their condition. We evaluated this trade-off by manipulating the brood size of White-rumped Swallows and monitoring the thermal environment experienced by nestlings, nestling body condition, and feeding rates, in Chascomús, Buenos Aires, Argentina. From 2006 to 2008 we created 31 triads on the hatch date, each triad consisting of a reduced brood (2 nestlings), an enlarged brood (7 nestlings) and a control brood (5 nestlings). We continuously monitored the nest cup temperature (T_n) and air temperature (T_a) at 5 triads starting on the hatch date. Nestlings were weighed every two days and feeding behavior was recorded on days 4 or 5 and 11 or 12. The mean T_n of 2 nestlings broods was lower than that of 5 and 7 nestlings broods, but this difference disappeared when nestlings were 11 days old. As expected, 11-day nestlings had higher body temperatures and greater ability to thermoregulate than 5-day nestlings. Nestlings growing in reduced broods had greater body mass than those in enlarged and control broods. Although adults rearing nestlings of enlarged broods increased the number of feeding visits to the nest during the entire nestling period, the feeding rate per nestling was greater only in reduced broods. This may explain the greater body condition of reduced brood nestlings throughout the entire nestling period. The experimental reduction in brood size created a cold but food-abundant environment for the nestlings, while the reverse occurred when brood size was increased. Further consequences of each type of deprivation await study.



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The effects of social environment on avian gonadotropin inhibitory hormone (GnIH) during the breeding season

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Less than a decade ago, a new neurohormone was discovered in the hypothalamic area of the brain responsible for reproduction. This neurohormone was first shown to inhibit gonadotropin release in quail and was thus named gonadotropin inhibitory hormone (GnIH). We now know GnIH has the potential to affect many points of the reproductive axis in vertebrates. GnIH is regulated by photoperiod and by stress, and integrates these environmental cues to modulate reproduction. Social status also influences reproduction, but the neuroendocrine mechanisms underlying this phenomenon are not well understood. No study to date has investigated the modulation of GnIH, and thus the reproductive axis, by changes in social circumstance. Here we examine how variations in social conditions affect GnIH during the breeding season. We experimentally manipulated the presence of nesting environments for male and female European starlings (*Sturnus vulgaris*) and examined effects on hypothalamic GnIH expression. European starlings are socially monogamous cavity nesters that depend on other animals to make the cavities in which they nest. Thus, they can experience limited and unpredictable nest site availability from year to year. By limiting the number of nestboxes per enclosure and thus the number of social pairing and nesting opportunities, we observed that males and females which outcompeted others for nestboxes during the nestbox acquisition period had significantly fewer numbers of GnIH neurons than those without nest boxes. This relationship subsequently reversed between nestbox-occupying pairs and those without nests during the egg incubation period. In other words, incubating birds had greater numbers of GnIH neurons than those without a nestbox. GnIH neuron numbers did not change between the two time-points in birds without nestboxes. We propose that the large changes in hypothalamic GnIH in response to social status during the breeding season are involved in regulating the substages of this critical life-history stage. This is the first report of any effect of social circumstance on GnIH in any organism. Because GnIH presence and function appear to be conserved throughout most vertebrates studied, our findings open potential new avenues of research into the neural mechanisms that mediate social effects on reproduction across vertebrate classes.



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Description of the vocal repertoire of *Basileuterus flaveolus* and *Basileuterus hypoleucus* (Passeriformes, Parulidae) from Central Brazil, Uberlândia-MG

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Vocalization is usually the first indication of birds in the environment. Vocalizations are divided into songs and calls. The genus *Basileuterus* is widely distributed in Brazil and birds are about 13 cm and found in forests, where they may sing at any time of the year. The objective of this study was to characterize the vocal repertoire of *B. flaveolus* (flavescent warbler) and *B. hypoleucus* (white-bellied warbler) in three remnants of semi-deciduous forest in central Brazil, near Uberlândia in the state of Minas Gerais at the Ecological Station of Panga (39 ha), Glory Experimental Farm (30 ha) and São José ranch (22 ha). Recordings were taken from November 2008 to February 2009. Each fragment was visited eight times between 7:00 – 11:00h. A directional Sennheiser ME67 and a MiniDisc MZR700DPC were used to record. Songs were analysed using Avisoft - SAS Lab-light 3.74 and Raven Pro 1.3. We estimated the following parameters: duration, number of notes, low, high and maximum frequency and number of notes per second. A total of 454 vocalizations were analyzed. Each species had one type of loud song, one type of call in *B. flaveolus* and 3 types of calls in *B. hypoleucus*. We conclude that these birds have a small and simple vocal repertoire, and is important to know this repertoire, since it facilitates the identification of this species, which is often hard to see. Support: CAPES and FAPEMIG.



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Reproductive behavior of the tawny-browed owl (*Pulsatrix koeniswaldiana*) in a nest at União Biological Reserve, Rio de Janeiro, Brazil

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The tawny-browed owl (*Pulsatrix koeniswaldiana*) inhabits tropical rainforest and open woodland, where it is uncommon. Little is known about its ecology and virtually nothing is published about its breeding biology. This work describes the nest of tawny-browed owl found on 17 September 2009 and the reproductive behavior observed during 22h, in seven sessions that varied from 90 – 360 minutes. The nest was found at the União Biological Reserve (22°27'S, 42° 02'W) in the municipalities of Casimiro de Abreu, Macaé and Rio das Ostras, in the state of Rio de Janeiro. It was in the hollow trunk of a 5m tall, 2.3 m DBH, dead avocado tree (*Persea americana*, Lauraceae). The nest entrance was 4.5 m above the ground, below which (3.5 m) there was a lateral opening in the tree. Incubation period and hatching day could not be determined, but one week after the single egg was found 11 October the egg had hatched. Sex of the breeding pair was determined by their vocalization. The female remained in the cavity all day and at night, left the nest either when the male arrived (n = 9) or on her own (n = 3). When arriving on a limb near the nest the male called a shortened version of the usual contact song and the female made begging calls that sounded like a cat. We never saw the male feed the female, but the male was never seen entering the nest. Another pair was heard twice singing nearby. At that time, the female left the nest and joined the male, apparently to react to the intruders.



The use of auxiliary arenas by the lek-forming white-bearded manakin (*Manacus manacus*)

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The lek organization of the white-bearded manakin (*Manacus manacus*) was first described in the 19th century and has been extensively studied since then. Males aggregate in display grounds all year round to attract females and mate. Each resident male has an oval arena on the ground (0.2 - 0.9 m diameter) actively cleared from litter and delimited by two or more saplings. The number of arenas and the distances among arenas of neighboring males may vary from 2 to 70 and 0.9 to 21.5 m, respectively. The use of more than one arena by a given resident male during a single breeding season has never been reported. Here, we report the use of auxiliary arenas by males during a field work conducted in the lowland forest (restinga) in southeastern Brazil. On 16 – 17 August, and 25 September 2009, between 6:25 - 17:00h, we observed the lekking behaviour of three males. Auxiliary arenas were used by two males (M1 and M2). M1 displayed during 15.7 min (2.5% of day-time observations - dto) in four auxiliary arenas and 2.7 min (0.4% of dto) in the principal arena. Auxiliary arenas were 1.4 m, 2.0 m, 2.1 m and 2.4 m distant from the principal arena. M2 displayed during 1.68 min (0.3% of dto) in three auxiliary arenas and 26.8 min (4.2% of dto) in the principal arena. Auxiliary arenas were 1.0 m, 1.5 m, and 2.0 m from the principal arena. M1 cleaned two auxiliary arenas, picking up dead leaves and twigs. Territoriality is considered one of the main factors involved in the attraction of females and mating success of dominant males. Probably, the use of auxiliary arenas increases the male's display area and consequently their mating chances, or in the case of arena displacement by other males, auxiliary arenas allow that recently subordinated males remain near hotspot areas in the lek.



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Nest site selection and nesting success: competition between Chinese egrets and little egrets breeding at Wuzhishan archipelago, eastern China

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The Chinese egret (*Egretta eulophotes*) is a globally Vulnerable species. A breeding colony of 100-200 pairs was found in Wuzhishan archipelago, a natural reserve in eastern China since 2002. But after 2005 the breeding population began to decrease, when the little egret (*Egretta garzetta*) arrived and its population gradually increased, forming a big mixed breeding colony. In order to gain insight into the underlying causality of the decrease of breeding Chinese egrets, nest-site selection and nesting success of Chinese egret and little egret were studied at two small islets of Wuzhishan archipelago, from May to August of 2008 and 2009. We found that (1) Nest sites under or inside shrubs were preferred, and were a nonrandom subset of the available habitat; (2) Preferred nest sites have greater nesting success. Frequent typhoons and strong sunshine might be the major factors influencing the observed patterns in nest-site selection. These preferred sites can provide better shelter from strong wind and sunshine; (3) Such good nest sites at the two small islets were limited; (4) Little egrets enter breeding habitats earlier than Chinese egrets, thus the little egrets occupied more preferred nest sites and had greater nesting success; (5) There were competition for nest site between Chinese egrets and little egrets at Wuzhishan archipelago, and the Little egrets is much likely to exclude the Chinese egrets in the near future. Control of breeding little egrets is required for the conservation of the vulnerable Chinese egrets at Wuzhishan natural reserve.



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Differences in egg morphology and coloration between screaming cowbird eggs laid in nests of two hosts

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The screaming cowbird (*Molothrus rufoaxillaris*) is one of the most specialized brood parasites. This species uses a single host, the bay-winged cowbird (*Agelaioides badius*) in much of its distribution, although in northern Argentina and southeastern Brazil they may also parasitize the chopi blackbird (*Gnorimopsar chopi*). Recently found is that mtDNA haplotype frequencies differ between screaming cowbird chicks from nests of both hosts. This indicates that nest choice by parasitic females is not random and that individual females preferentially parasitize nests of one host. Here, we examined whether females that use different hosts lay eggs that differ in morphology and coloration. We measured screaming cowbird eggs laid in bay-winged cowbird and chopi blackbird nests and analyzed their coloration using reflectance spectrometry. Parasite eggs laid in bay-winged cowbirds were significantly longer and wider than those laid in chopi blackbirds. We classified parasite eggs in two different morphs, “green” and “brown”, according to background coloration. Green eggs had greater reflectance and green-chroma, and lower red-chroma than those classified as brown. The proportion of green eggs was significantly greater in chopi blackbird nests than in bay-winged cowbird nests. On average, parasite eggs laid in chopi blackbirds had greater reflectance and UV-blue chroma than those laid in bay-winged cowbirds. Our results indicate that the genetic differences found between screaming cowbird females that use different hosts are associated with differences in the size, color and brightness of their eggs.



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Corridors increase connectivity for an endemic understory bird in fragmented Atlantic forest

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Land cover created by human activities in agricultural landscapes may act as barriers to forest species movement. Isolated populations are more prone to local extinction due to stochastic processes. Forest corridors may be useful tools to increase connectivity in fragmented landscapes, but empirical evidence is scarce, especially in tropical forests. We experimentally tested the hypothesis that corridors increase connectivity for an endemic understory bird (*Pyriglena leucoptera*, Thamnophilidae) through experimental translocations and radio-tracking. Individuals from continuous forest were released in forest patches (1 – 2 ha) smaller than their home ranges. Release patches were divided in two treatments: i) isolated - patches completely surrounded by field matrices (n = 8), ii) corridor - patches (n = 7) surrounded by field matrices but connected by a forest corridor to a larger patch. Two individuals (1 male, 1 female) were released in each patch. We measured time until birds leave the release patches (dispersal time) and if individuals succeed in dispersal, i.e., reach a nearby patch. We used survival models to analyze dispersal times and model selection procedures based on AIC. We found evidence for both additive and interactive effects of treatment and gender on dispersal times. We also found shorter dispersal time for corridor than for isolated birds, and that isolated females dispersed faster than males. Also, isolated birds were more often unsuccessful during dispersal. Our results provide evidence that the studied species is reluctant to cross field matrices, and that forest corridors increase its movement probabilities in fragmented landscapes.



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Interactions among prey availability, health status and provisioning behaviour of blue-footed boobies in Galápagos: implications for response to environmental change

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Provisioning behaviour and health status are closely related within individuals and consequently within populations, but there are few studies that examine these two facets of breeding ecology in an integrated manner. The capacity to find food during chick-rearing influences the physiological condition of breeding adults and their offspring whilst at the same time, the adults' physiological condition influences their ability to forage. Here we present individual-based information on the provisioning behaviour and health status, as indicated by haematological parameters and blood parasite prevalence, of blue-footed boobies (*Sula nebouxi*) under conditions of contrasting prey availability in the Galápagos archipelago. Our analysis indicates not only the interactions among these factors but also the consequences for nestling growth and survival, along with potentially longer-term effects, for instance on population-level recovery from El Niño events.



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When the six-banded armadillo enters in the wrong hole!

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Some birds show defence behaviour against potential predators called mobbing. Some species of birds exhibit different types of this behaviour and include an alarm call, a visual display or an attack. Mobbing behaviors are common against predators like owls and falcons but may also be seen with other animals. During field work in the city of Caçu, Goiás state, (22K 0478211 UTM 7953602) in west central Brazil, we observed an interaction between the burrowing owl (*Athene cunicularia*) and a six-banded armadillo (*Euphractus sexcinctus*). The armadillo was foraging through the grassland formation near the owl nest. On the top of an old mound, two *Athene cunicularia* were observing the armadillo. The owls vocalized alarm calls, flew over it and attacked with their claws. The armadillo, probably, decided not to attack the nest anymore and went away, but the owls continued to attack until the armadillo was gone. *Euphractus sexcinctus* is a potential predator of eggs and young owls and might represent a threat to the burrowing owl nest. The owls apparently attacked the armadillo to defend their nest against predation. This is the first record of a mobbing behaviour by owl against armadillo.



A nest monitoring system used for the toco toucan (*Ramphastos toco*) and the hyacinth macaw (*Anodorhynchus hyacinthinus*) in the Pantanal

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Many avian studies used remote monitoring systems that are useful when direct observations are not possible. When the nests are in tree cavities, nests are difficult to monitor without disturbance. We describe a system installed in the Pantanal to monitor two species: the toco toucan (*Ramphastos toco*) and the hyacinth macaw (*Anodorhynchus hyacinthinus*). Two nests were monitored in 2008 using small infrared cameras (DC 12 Yoko[®] NTSC $f = 3.6\text{mm}$) inside the nests. A small hole was made in the tree, near the camera, to pass the cables. The camera was connected to a 24 h time-lapse video recorder (Kodo[®] Mobile VCR) that was at the bottom, 2 m from the tree. The position of the camera was selected using a LDC monitor (TFT-TM 9030 9.2rdquo Active Matrix TFT) and a 12 volt car battery powered the equipment, all of which was in plastic containers. Batteries and the tapes were changed every 24 h. System installation required approximately 2 h but will vary depending on conditions. Almost 800 h were recorded and we monitored the nestlings of the toucans and the incubation period for the hyacinth macaws. The system experienced some problems but proved reliable.



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Costs and benefits of flocking behaviour in wedge-billed woodcreepers in eastern Ecuador

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Mixed-species flocks of understory birds are characteristic year-round throughout much of the Amazon Basin. Anecdotal evidence supports a primarily anti-predator defence function for these flocks, and flock followers are believed to benefit from the vigilance of attendant *Thamnomanes* antshrikes. Flock followers may be obligate members, facultative members, or transients, each with its own balance of costs and benefits associated with flock membership. The wedge-billed woodcreeper (*Glyphorhynchus spirurus*) is a facultative flock member and thus spends time foraging both with a flock and alone. Scanning and foraging rates for in and out of a flock will be compared within individuals. If this species benefits from the vigilance of antshrikes within flocks, it is expected to exhibit decreased scanning rates and increased foraging rates when it is foraging in a flock. However, there may be energetic costs associated with keeping up with a moving flock, such as increased perch change frequency or increased distance flown between perches. Variation in overlap between woodcreeper and mixed-flock territories will also be presented and its implication for territory quality discussed.



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Effects of a bushfire on the recovery and vocal repertoire of a population of superb lyrebird (*Menura novaehollandiae*) in the Australian Capital Territory, Australia

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A summer bushfire in 2003 was widespread west of Canberra (in south-eastern Australia) with destruction of almost all vegetation within a 1,600 km² area of temperate eucalyptus forest. We examined the effects of the bushfire on a population of the ground-feeding superb lyrebird over a period of 5 years starting 5 months after the fire. The rate of recovery was documented by walk counts and by sound samples taken every 30 minutes over a seven day period once a month. Seminal studies on the vocal repertoire of the superb lyrebird had been conducted at the same study site 40 years previously. With access to the original recordings we have been able to compare mimicry at the two time points. In addition, we report on the differences in call frequency between years as the population recovers and we report on the variation in the daily calling pattern with changes of season in this winter breeding species.



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High pre-fledging but low post-fledging success of shiny cowbirds parasitizing bay-winged cowbirds

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The shiny cowbird (*Molothrus bonariensis*) is one of the most generalist brood parasites at the species level. However, shiny cowbirds rarely parasitize the bay-winged cowbird (*Agelaioides badius*), which is sympatric with many of the primary hosts of the shiny cowbird. The low frequency of parasitism in bay-winged cowbird nests cannot be explained by antiparasitic defenses because bay-winged cowbirds neither reject parasite eggs nor show differential aggression toward shiny cowbird females. We tested the hypothesis that shiny cowbirds do not use bay-winged cowbirds because reproductive success of the parasite is lower than when parasitizing other hosts. The study was conducted in the Province of Buenos Aires, Argentina, between 2003 and 2009. We artificially parasitized bay-winged cowbird nests with shiny cowbird eggs or newly hatched chicks and followed their fate throughout the host nesting cycle. Our results showed that shiny cowbird egg survival, hatching success and chick survival were similarly high in bay-winged cowbird nests and in two primary hosts of the same study area, the chalk-browed mockingbird (*Mimus saturninus*) and the house wren (*Troglodytes aedon*). Shiny cowbird chicks in bay-winged cowbird nests grew faster and reached a greater asymptotic weight than host chicks, and growth parameters were comparable to those observed in the primary hosts. However, shiny cowbird fledglings did not receive further parental care from bay-winged cowbirds once they left the nest, indicating that mimicry between parasite and host young is critical for the parasite's post-fledging survival. Low post-fledging survival may explain why shiny cowbirds rarely parasitize bay-winged cowbirds.



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Plumage coloration, body condition, and immunological status in yellow-billed cardinals in absence of blood parasitism by haemosporidia

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Ornamental carotenoid coloration is commonly considered to provide more reliable information about individual quality than melanin-based ornaments because of its confirmed nutritional and metabolic constraints. Recent findings suggest, however, that melanin-based coloration may indeed signal body condition. Several studies have noted the depressing effects that parasites have on the expression of plumage ornaments. Here we investigated two plumage ornaments in yellow-billed cardinals, *Paroaria capitata*: the carotenoid-based colour of the red head and the melanin-based colour of the badge. We investigated associations between body condition, nutritional condition during molt, parasitism, immunological state and coloration of plumage ornaments. Cardinals were mist netted in Brazilian wetland during molt in the dry season. Both optical microscopy and PCR assays were used to evaluate infection status by blood parasites. None of the examined individuals was infected. Lymphocytes were positively, and heterophils negatively, related to body condition. Concerning plumage ornaments, we found that head plumage brightness was positively associated with male heterophil count. Conversely, heterophil count was negatively related with the red chroma of male head. Moreover, we found that both hue and UV chroma of the female badge were negatively associated with heterophil count. Elevated heterophil counts are known to indicate response to stressors. Our results suggest that factors other than blood parasitism could be affecting immune system in the cardinals. Results also suggest that both melanin and carotenoid colors serve as signals reflecting individual quality in terms of health.



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Neighbor-stranger song discrimination in male song wrens (*Cyphorhinus phaeocephalus*)

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The ability of territorial individuals to perceive and respond to grades of social threat is critical in the maintenance of long-term territories. Many Northern hemisphere bird species can discriminate between the vocalizations of familiar neighbors and unfamiliar non-neighbors (strangers). Yet very few studies have examined vocal neighbor-stranger discrimination of territorial birds in tropical rainforests, where long-lived residents may experience huge floater populations. Along a 6-km stretch of rainforest in Panama, we tested neighbor-stranger song discrimination in male song wrens (*Cyphorhinus phaeocephalus*), which defend relatively small, year-round territories. Relative to neighbor playbacks, stranger playbacks elicited more search behavior (flights around the speaker), faster onset of singing (shorter singing latency), and quicker approaches to the speaker. Whereas overall singing rate of males in response to neighbor and stranger songs did not differ, we discovered that the sustainment of individual singing decreased as a function of stranger song distance from the focal territory. Together, these results suggest that male song wrens perceive differences between neighbor and stranger songs, using aggressive behaviors when responding to strangers and functionally-deterrent singing behavior when responding to neighbors.



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Social dominance relationships and phenotypic correlates of dominance in captive groups of grey-cheeked fulvetta (*Alicippe morrisonia*) in Taiwan

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We investigated whether flock members form linear dominance hierarchies during the non-breeding season in captive grey-cheeked fulvettas. We also used sex, age, body condition and fat score to predict the individual dominance rank which was determined by observation of agonistic interactions in six cages. Corrected Akaike's Information Criterion (AICc) was used to make inference about the weighted support for the importance of individual predictors through comparison within a set of candidate models. We found that grey-cheeked fulvettas formed linear dominance hierarchies in each captive group we studied. Age and body condition index were the best predictors of dominance rank. Our results indicated dominance rank generally increased with body condition index. Hatch-year birds (HY), dominate adults (AHY) and sex had no effect on dominance. HY had heavier body mass, better body condition and higher fat score than AHY. Body size measurements were not different between sexes. We cannot reject the hypothesis that HY dominating AHY results from better body condition and fat score. Physiological traits might have been responsible for the non effect of sex in domination ability in grey-cheeked fulvettas.



Lek behaviour of five species of hermit hummingbirds (Phaethornithinae)

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Hermit hummingbirds tend to form leks, some of them spectacular in size with more than a hundred lekking males. Although the subfamily comprises more than 30 species, lek behaviour is known for only nine species. We report for the first time the lek behaviour in five species (*Phaethornis eurynome*, *P. idaliae*, *P. pretrei*, *P. squalidus*, and *Ramphodon naevius*) studied in the Atlantic forest of southeast Brazil. We investigated (i) lek size (number of displaying males and lek area), (ii) daily and seasonal dynamics of lek activity, (iii) lek attendance by territory owners, (iv) calling frequency, (v) the number and height of perches used for calling, (vi) the size and spatial distribution of lekking territories, (vii) the number of visits made by conspecifics to territories and (viii) the kinds of displays given by territory owners and visiting birds. In general, studied leks of *Phaethornis* spp. conform to those already reported in the literature, with three to 32 lekking males clumped (on average 8-21 m from each other), and displaying all day in the forest understory (< 2 m height). *Ramphodon*, however, differs from all other species by having a shorter period of lek activity (only 50 min exclusively at dawn and early morning), and a more loose lek structure, with some males displaying clumped while others displayed solitarily. *Ramphodon* is a traplining forager, but, differently from other hermits, it behaves aggressively over its feeding routes, excluding conspecifics and other hummingbird species from its main flower sources. Such a territorial behaviour may preclude lek attendance all day long, as proposed for some non-hermit hummingbirds, and is likely the cause for the peculiar lek behaviour of *Ramphodon*.



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Foraging tactics of the blue manakin *Chiroxiphia caudata* on understory fruiting plants in a southern deciduous Atlantic Forest area

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In this study we describe new data on foraging tactics of the blue manakin (*Chiroxiphia caudata*) on shrubs and lianas in a forest in southern Brazil and the interaction of this species, when foraging with other frugivorous species. For this, we tested three hypotheses: predation, interspecific competition and arrangement of fruit. We analyzed the feeding behavior of seven species of plants in the understory over a year. The blue manakin tactics used foraging for fruit in flight and on the perch with the same frequency in most species tested, except *Psychotria* whose fruits were mostly harvested in flight. Of the three hypotheses tested, the most plausible was the provision of fruit on the plant, and secondarily to inter-specific competition.



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Communication between the male and female brown thornbill (*Acanthiza pusilla*) during incubation and feeding of young

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The calls of the brown thornbill are obvious, varied and well known. There is little detailed knowledge however, of the repertoire. For example what is the function of the different calls, do both sexes produce all calls, and when are the different calls used? We have a unique opportunity to investigate these questions, as one of us (MG) is doing an ecological study on 10 ha which entails colour-banding a variety of bird species (including the brown thornbill) and finding as many nests as possible. Each year between 8 and 13 nest of the brown thornbill are found, and due to continuous colour banding efforts, at least one individual of each pair is always colour-banded. Only the female incubates, for approximately 20 minute periods during the day, the pair regularly feed together, the male accompanies the female back to the nest and there is a lot of communication at the nest site. We therefore can station ourselves and recording equipment at a nest and record all sounds. And most importantly we can identify which bird makes each call, and what behaviour accompanies each call. With 2 people we can follow the male when he is away from the nest, record his calls and relate them to any vocalization by the female at the nest. This report is preliminary, but we have identified at least 7 distinct calls that are used at the nest and assigned a behaviour to at least one of them.



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Distress call of *Sturnella militaris* (Aves: Icteridae) for different predators

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Distress calls are harsh vocalizations used by birds in situations of extreme stress. These alarm calls can be highly specific regarding the kind of predator. *Sturnella militaris* is found in swamps in non forested areas and has a distress call. We examined whether *S. militaris* has different distress calls in response to different kind of predators. We used a stuffed hawk and stuffed owl as models in 17 points in São Nicolau Farm, Cotriguaçu, Mato Grosso. Models were exposed with and without their vocalizations. We used a box as a control, with and without hawk and owl vocalizations, using playbacks. Models were exposed for 5 min, with 10 min intervals between exposures. We analyzed the sonogram of distress calls recorded in Cool Edit 96® program. Distress calls as a response to hawks and owls were compared by t-test. In 17 *S. militaris* individuals, 7 gave distress calls as a response only for hawks and 2 only for owls. Three called as a response to the box and owl song, and 4 fled after the owl call. Birds responded with a distress call for the hawk model before the song, but for owls, they only called as a response to the owl vocalization. *Sturnella militaris* distress calls are simple songs varying between 2000-4000 KHz to hawk and 2000-8000 KHz to owl. Time intervals between distress calls are different to hawk and owl ($p < 0.001$) indicating that *S. militaris* have different vocal response to different kind of predators. This supports the hypothesis that some species distinguish their predators and the kind of risk by codifying information for the other species or predator throughout distress calls.



Acoustic signalling in the cooperative-breeding field flicker (*Colaptes campestris*)

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The use of acoustic signals in communication can be crucial for birds as sounds may encode a variety of information in a short period of time and can be transmitted omnidirectionally and over greater distances than visual signals. However, the costs and benefits for individuals engaged in the process may vary with signaling behaviour, signal content, and the conflict between signalers and receivers. Therefore, selection pressure varies among species, habitats and social contexts, potentially resulting in optimal acoustic characteristics for different circumstances. In the case of social bird species, a complex repertoire can be extremely important, since intra- and inter-group contexts may require differences in signal traits. We characterized the acoustic repertoire of the field flicker, a facultative group-living species, in a population in Central Brazil, associating signals with possible functions. During three years of field work we banded 134 birds from 29 groups. There were no records of drumming, suggesting birds rely solely on vocal calls for communication. The repertoire includes seven different calls for which we assigned one or more of the following categories: begging call, distress call, alarm, mobbing call, flight call, territorial defence call, group coordination call, long-distance and short-distance contact call. The variety of behaviours associated with the calls suggests a possible multiple signaling function. Nevertheless, some calls present introductory notes, and their role will be discussed. No difference in the repertoire was found between sexes or age of birds, except for the begging call, which was exclusive of nestlings, with all calls being used throughout the year. These findings present an interesting scenario, allowing us to discuss the impact of habitat and social roles on the evolution of acoustic communication through a complex vocal repertoire and the lack of drumming, a widespread behaviour among woodpeckers.



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Energetic consequences of sexual dimorphism in cognitive abilities

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Episodic memory involves the ability to recall individual past events, involving what, where and when an event was experienced. Mostly of the research on complex cognitive abilities in animals, was developed with an experimental psychology perspective, where the ecological and evolutionary context was not a central issue to explain why these abilities appeared. Additionally, sexual differences in episodic-like memory in non-human animals remain unknown. In green-backed firecrown hummingbirds with territorial males and opportunistic females, we evaluated the ability to recall in novel situations, the location, nectar quality and renewal rate of the best rewarding flowers among several less rewarding flowers with identical visual cues. The greater cognitive performance of males seems to be closely related to different resource exploitation strategies and with different selective pressures on males and females. Cognitive performance varied among individuals and sexes implying dramatic differences in the energy gained. Our results strongly suggest that complex cognitive traits can be modified by selective forces from the environment inhabited by individuals and therefore, are potentially tied to their survival probability.



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Principles of camouflage as seen in ducks

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Two camouflage strategies used by animals to prevent predation are background pattern matching, or crypsis, and disruptive colouration. However, even if an animal is fully cryptic, any disparities between the phase of the pattern on the animal and the background, or its shadow, might give its location away. Despite detecting the camouflage, the predator must be able to recognize the animal as potential prey. Disruptive colouration works against shape recognition by using high-contrast markings to break up form. We investigate which camouflage strategies are being used by different species of ducks using calibrated digital photographs bearing in mind how predators might see them. We evaluate the closeness of background matching for different duck species/sexes in different habitats. We also determine within-duck colour patch contrasts at different spatial frequencies and viewing angles. These data can be used to examine whether particular colour patterns act as disruptive camouflage.



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Biology of the Restinga tyrannulet

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The Restinga tyrannulet (*Phylloscartes kronei*) is a poorly known and globally threatened species in the family Tyrannidae. From August 2008 to July 2009, we studied the tyrannulet at Ilha Comprida, São Paulo, Brazil. A total of 613 foraging maneuvers, associations with mixed species flocks, stomach contents of five specimens and complementary data on its natural history were gathered. The tyrannulet foraged 0.5 – 15m above the ground mainly using sally-strikes to green leaves to capture prey. It also mostly used branches with living foliage as start and return perches and only in 20% of the aerial maneuvers did they return to their starting point. The mean capture frequency was 2.12 captures/minute. Individuals were found mainly in pairs or alone. *P. kronei* was observed following mixed species flocks eleven times (3% of total contacts with the species) and the flocks contained three to 16 bird species and four to 27 individuals. Roosting behavior of an individual under a leaf of *Myrcia ilheosensis* was noted. In September and October 2008, individuals were found carrying nest material and in November and December of this same year pairs were found feeding one or two juveniles out of the nest. Both parents fed the juveniles. The stomach contents and survey observations showed that food items of the Restinga tyrannulet are mainly arthropods (77% of total items found in stomachs), including Coleoptera (Anobiidae, Coccinellidae and Curculionidae), Hemiptera (Heteroptera), Hymenoptera (Formicidae, Chalcidoidea and Microhymenoptera), Lepidoptera (caterpillars and adult Heterocera), Orthoptera (an adult Tettigoniidae of genus *Anaulacomera*), Araneae and few small fruits, such as seeds of *Clusia criuva* and *Ternstroemia brasiliensis*. Financial Support: CNPq.



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Low amplitude song as a signal of aggressive intent in black-throated blue warblers (*Dendroica caerulescens*)

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Whether animal signals contain reliable information has emerged as a central question in the study of animal communication. Many signals given during agonistic interactions have been suggested to convey levels of aggressive intent of signalers, but whether such signals actually predict subsequent aggressive behavior remains unresolved. Prior studies of acoustic signals in birds have generally assessed the reliability of threat displays using indirect response measures such as approach to a playback speaker. However, this method does not allow aggression to be assessed directly because the subjects have no opportunity to engage in attacks. In this study, we assessed the aggressive content of vocal signals in black-throated blue warblers using a direct measure of aggression. We presented territorial males with a brief period of conspecific song playback, recorded vocal responses of focal birds, and then revealed a taxidermic mount giving subjects a chance to attack. We found that birds that attacked the mount had given prior to attack more low amplitude “soft” songs than nonattackers. By contrast, four other vocal parameters – total number of songs, rate of song type switching, and number of two non-song vocalizations, failed to predict whether birds would attack the mount. Soft song was an extremely reliable predictor of attack, correctly classifying in a discriminant function analysis 95% of males as attackers or nonattackers. These data are consistent with recent findings for emberizid sparrows suggesting the potential generality of soft song as a reliable signal of aggressive intent.



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Differences of nest vigilance intensity among predator types in relation to nest position by male Daito white-eye *Zosterops japonicus daitoensis*, Japan

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In birds many kind of predators cause nesting failure. It is inferred that efficiency of nest protection differs in relation to characteristics of nesting position and predators. Daito white-eye *Zosterops japonicus daitoensis* is an endemic resident in the Daito islands, southern Japan. They build open nests and nesting failures are chiefly caused by predation. Predators are identified as bull-headed shrike, black rat and the brown-eared bulbul. We examined experimentally whether males change nest vigilance behaviour in response to predator types, and whether nest position influences vigilance. We conducted experiments in 2007 and 2008 in Minami-daito Island. Experiments were performed in later nestling stage. We randomly presented stuffed models of the 3 predators and a brown box as the control to nesting male. We recorded male's vigilance behaviors (alarm calling, perch change and wing flicking) during 3 minutes. Vigilance intensity (VI) was greatest against shrike, and decreased in the order of rat, bulbul and control. As males selected higher positions for nesting sites, their VI against shrikes also increased. Shrikes often perch on a high branch and never used shrub layers. VI against rats decreased with distance between nest and tip of branch. Rats chiefly fed around tips of branches, only moving hurriedly near trunk. VI against bulbuls were not related to nest characteristics. Mobbing individuals other than parents increased with VI significantly. We suggest that VI was affected by nest position at which each predator appear more frequently, and cooperative mobbing with neighbors indirectly may decrease nest predation.



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Conspecific visitors to the pied flycatcher *Ficedula hypoleuca* broods: nosey passers-by or helpers?

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Visitors by strangers to pied flycatcher nest-boxes during the brood-rearing period are common, but the role of this phenomenon in the life of the population is still obscure. The nature of these visitors and their relationships with the nestbox hosts in the pied flycatcher population near Moscow was analyzed on the basis of data collected over 15 breeding seasons. Data on 1050-hour visual observations of 268 pairs, 17 single females, and three single males feeding nestlings were used for the analysis. A total of 760 visits of strange pied flycatchers to nest-boxes of known parents were noted, of which 94% were by males. Cryptically coloured males visited strange nest-boxes relatively more often in comparison to conspicuous males. Females and young birds were rare visitors (5 and 1%, respectively). The reaction of the hosts, including single parents, to the presence of the strangers was usually aggressive. Both bachelor and paired males of various ages were among the visitors. They visited strange nest-boxes both before and after hatching of their own young. Most of the adult birds and all young ones behaved as “inspectors”, one male performed sexual display in the presence of the host female, and the rest of the visitors tried to feed nestlings. Of these visits, only nine males and a female were “helpers.” The visitors’ role in the population is hardly an important factor in the rearing of conspecific young. At the same time, information gained by visitors inspecting strange nest-boxes could be useful for their future life.



On energetics of mating behaviour of pied flycatcher (*Ficedula hypoleuca*) males

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Estimation of energy cost of mating behaviour may provide valuable clues for understanding diversity of reproductive strategies in birds. To attract female pied flycatchers, males perform exaggerated advertising behaviours accompanied by inspection and demonstrations of nest holes. We study how different styles of male mating behaviour were related to basal metabolic rate (BMR), and whether they were a significant portion of maintenance energy expenses. Bachelor males temporarily removed during the pre-nesting period were divided into two samples. Males from first sample (n = 137) were one by one tested in open field (OF) indoor aviary (2X2X4m) with artificial trees and nest boxes. Their BMRs were measured at night just before or after OF tests. Males from the second sample (n = 68) after OF tests were also put in outdoor aviaries where they were exposed to females in an adjoining room. Their BMRs were measured the next night. Males that frequently entered nest boxes in OF and/or with exposure to females had lower BMR than other males. Increased BMR was peculiar to males with increased rates of circle flights in the OF. Circle flights are negatively correlated with nest box activities. On average, males which passed both tests (OF plus stimulation by female) had greater BMR than males tested only in OF. The results suggest that contact with female may lead to short time BMR increase in males. Low (or lowered) BMR is peculiar to males who already switched over purposeful forms of mating behaviour.



Basal metabolic rate and style of exploratory behaviour in great tit (*Parus major* L.)

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Mode of exploration of novel environment by birds as examined in open field (OF) tests is a heritable trait. In nature fast and slow explorers markedly differ in patterns of social competition, searching behaviour, dispersal distances and the means of getting reproductive success (Dingemanse *et al.*, 2002; Drent *et al.*, 2003; van Oers, 2003). These differences in life history strategies may be associated with difference in allocation of daily energy expenses during the same phases of the annual cycle. According to the energetic model (Gavrilov, 1997) basal metabolic rate (BMR) may serve as indicator of working capacity of an animal and its ability to perform long term energy consuming behaviours. Recent studies of BMR variation in free living and captive birds found high heritability in this physiological trait (Bushuev, 2009; Nilsson *et al.*, 2009; Tieleman *et al.*, 2009). We investigated the relation between BMR and personality behavioural traits in young great tits, using standard OF tests in late autumn. On average, great tits differing in exploration scores did not differ in BMR. However, fast and slow explorers showed opposite trends in BMR change during their subsequent winter stay in contact with heterosexual partners in outdoor aviaries. This feature was peculiar for males but not females. The results suggest that different personalities differ in factors influencing BMR plasticity. The functional consequences of such asymmetry are discussed in terms of energetic models.



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Differences in repertoire composition in common nightingales *Luscinia megarhynchos* between first year and older birds – findings from field and laboratory

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Age-dependent changes in the song of oscines are common. Song characteristics reveal a broad spectrum ranging from stereotypy throughout life time to vocal plasticity within or across years. Common nightingales *Luscinia megarhynchos* show profound changes in repertoire size and composition between their first and second breeding season. To investigate mechanisms involved in such differences we compared the song of one year old and older birds of a Berlin nightingale population. We found that certain song types that were frequently sung by older birds did not (or only rarely) occur in the repertoires of one year old birds ('mature' song types). We conducted learning experiments with hand-reared nightingales to address reasons for the lack of 'mature' song types in the repertoires of yearlings. The acquisition success of 'mature' song types was not lower than for tutored control song types (frequently found in both age groups in the wild: 'common' song types). Interestingly, the analysis of song type use revealed that all males sang 'common' song types more often than 'mature' song types. Findings from these laboratory experiments suggest that the lack of certain song types in the repertoires of yearling birds in the field cannot be explained by developmental or motor constraints. Instead, they invite considering more the actual use of song types instead of the potential to use song types. We discuss this outcome in terms of explanations for the avoidance to sing certain song types. In the context of a communication network where signals transfer information about the quality of the sender the performance of younger males may be tuned to avoid a direct comparison with older males.



Egg ejection behavior of bar-headed geese: anti-infection or any other evolutionary concerns?

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Some breeding pairs of bar-headed geese *Anser indicus* discard one or a few eggs from their nests in early egg-laying. At the colony of Bird Island in Qinghai Lake in May 2008, 84 discarded eggs and un-discarded eggs were collected and incubated. Eggs were classified as passively ejected (PEE, $n = 45$) when they were apparently accidentally dislocated from the nest, or actively ejected eggs (AEE, $n = 39$) otherwise. PEE can be comprehended as consequents of nest sites competing and likelihood of brood parasitism. We mainly focused 39 AEE and several hypotheses including clutch size, egg quality, sterility, infanticide, and, especially on presumed infection avoidance. None of these hypotheses explained egg ejection behavior except for infection-avoidance with some highlights. Haemagglutination inhibition (HI) assay for maternal antibody levels of avian influenza H5N1 virus in yolk of AEE showed that the AEE mean PLOTS (1.84) were lower than PEE (2.05) although no significant ($F = 0.675$, $P = 0.413 > 0.05$) tested by SPSS16.0 one-way ANOVA. This results can be interpreted that the bar-headed geese discarded the early eggs with lower maternal antibody level and have a lower survival ability in high infection risk environment with nest density increasing gradually in early egg-laying season in order to get chance in limited time to lay a re-paired egg evolutionarily although the sample size of this study was obviously small and further confirmable tests are needed.



The impact of testosterone in a highly aggressive bird: the brown skua (*Catharacta antarctica lonnbergi*)

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The importance of testosterone for bird behaviour has been examined many times. However the debate on the correlation between aggression and testosterone concentration in the blood is still under study. Variance in concentration of the circulating testosterone fits within the “Challenge Hypothesis” which suggests that the modulation of testosterone is initiating behavioural patterns that favor reproductive success. Aggressiveness increases with the beginning of the reproduction cycle and varies depending on the species until there is a total decline after offspring fledge or the end of territorial behaviour. But is testosterone the exclusive initiator that releases and modulates this aggressiveness? We collected blood samples during the entire reproductive cycle of the highly aggressive brown skua (*C. a. lonnbergi*) on King George Island, South Shetland Islands, Antarctica. The concentration of testosterone and androstenedione were measured in the plasma of both sexes of breeding birds, territorial non-breeders and non-territorial non-breeders. Aggressiveness was scored on a five-point ordinal scale and compared with the testosterone levels measured in the plasma. Additionally both partners of ten nests were sampled in a small time span of three days in a specific time of the breeding cycle (50-60 days after the hatch of the chicks) to compare intra- and extra-pair differences. Furthermore we are able to calculate the impact of individual aggression with our long-term data set to the breeding success, the access of food and territory as well as to the mating patterns.



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Neural correlates of sickness behavior in songbirds

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During the course of an infection, animals experience profound changes in their physiology and behavior. These nonspecific symptoms include weakness, lethargy, adipsia and decreased appetite, and are collectively called “sickness behavior”. What are the neural pathways in songbirds affecting the expression of these behaviors? To answer this question, we injected a group of male zebra finches (*Taeniopygia guttata*) with lipopolysaccharide (LPS), using as a control a different group injected with vehicle. LPS is a non-pathogenic component of the cell wall of gram negative bacteria, capable of inducing sickness behavior. The birds’ behavior was registered pre and post-injection and approximately 2h after injection, we collected their brains. The brains were processed immunohistochemically for the protein products of Immediate Early Genes (IEGs). Additionally, since sickness behavior interferes with reproduction, we measured the brain expression of gonadotropin-releasing hormone and gonadotropin-inhibitory hormone. Our results show LPS injection induces sickness behavior and differential IEG expression in treatment animals versus controls. This is the first time in songbirds that neural correlates of sickness behavior have been described.



Parental investment amplifies effects of genetic complementarity on growth rates in song sparrows

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Life history theory predicts that individuals paired with attractive mates may invest more in offspring. Such differential investment may amplify the effects of genetic quality on fitness. Attractiveness can include “good gene” and “complementary gene” components, but how the latter affects parental investment remains unknown. We found that song sparrow (*Melospiza melodia*) nestlings with genetically dissimilar parents grew faster than did nestlings whose parents were genetically more similar to one another. A cross-fostering experiment revealed complementary gene effects on growth; nestlings produced by genetically dissimilar parents grew faster than their adoptive “siblings” reared in the same nest but produced by parents that were more genetically similar. To explore whether parental investment exaggerates these complementary gene effects on growth, we monitored parental nest visits. Maternal visits were negatively related to genetic similarity between mates, suggesting that females adjust levels of care according to the expected genetic diversity of their offspring. Together, these findings support the idea that parental investment can amplify complementary gene effects on fitness.



Ethogram of *Buteo albicaudatus* Vieillot, 1816 (Aves: Falconiformes) in captivity

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Ethograms have been essential to examine environmental enrichment and its influence on activities in captive birds. We used ethograms to study behavioral patterns of one captive individual of *Buteo albicaudatus* at the Sabiá Municipal Park Zoo, Uberlândia, Minas Gerais, in September and October 2009. The flight cage was 12.3 m² and 2.80 m tall. Fifteen hours of observations that occurred from 7:30am to 6:30pm. Instantaneous sampling was the method used. Behavior was recorded at 3 minute intervals. These data were plotted in points (270 total points). Pieces of meat were offered at 13:00 and once a week the hawk received live prey (chicks). *B. albicaudatus* behavior included 32 acts grouped in five categories: maintenance (83%), alimentation (8%), locomotion (4%), miscellaneous (4%) and vocalization (1%). The hawk was on its perch in 53% the records. We recommend that the bird be moved to a larger enclosure that allows it to fly. Furthermore, we suggest the implementation of environmental enrichment (alimentary and behavioral).



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Food availability and breeding behaviour in a threatened Amazon parrot: insights from short-term manipulations of brood size and food availability

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When food is limited, offspring may conflict with each other and their parents over the optimal way in which food is distributed between family members. The resolution of such conflicts can determine the quantity and quality of offspring produced and the success of a breeding attempt. Therefore, understanding the link between food availability and reproductive output, requires insight into the way in which intra-familial conflicts are resolved under differing conditions of resource availability. Many parrots show marked hatching asynchrony and as a result, nestlings differ in both their ability to manipulate the distribution of food and their reproductive value to parents. We explored the influence of brood size and food availability on patterns of nestling growth and survival in the threatened yellow-shouldered Amazon parrot, *Amazona barbadensis*. Last hatched nestlings showed lower growth and survival rates than their first hatched siblings, and this pattern was unmodified across natural gradients of brood size and food availability. A series of short-term experimental manipulations of brood size and food availability were used to control for variation in parental and environmental quality, and revealed that patterns of food distribution between nestlings responded rapidly to fluctuations in food availability. Detailed investigations of these processes can be critical for understanding limits to breeding success and inform approaches to parrot conservation.



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Saffron finch female choice in captivity: they like the king's bright crown

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Carotenoid based coloration is often involved in sexual selection for condition dependent characters. Saffron finch (*Sicalis flaveola*) males are golden with olive-streaked black upperparts, and develop an orange crown only during the reproductive season. During the summer of 2007 and 2008, we allowed 27 different females to choose between differently colored males in captivity. To do so, we ranked adult yellow plumaged males according to the brightness of their crown (measured with a spectrophotometer USB2000, and using the PC1), placing a brightly colored male and a dull colored male at the extremes of a mate choice chamber. Females could choose between staying close to one of the males and remaining at a neutral zone where no males could be seen; the mating chamber did not allow males to see each other. To control for chamber position effects we let females choose during 30 min and rotated the male position for another 30 min. The initial position of each male was random and data was analyzed with paired t-tests. There was no significant position effect, i.e. females did not show preference for staying at the right or left side of the cage ($t = -0.86$, $df = 26$, $p = 0.40$), but females did prefer the company of males with brightly colored crowns over the company of males with duller crowns ($t = 2.24$, $df = 26$, $p = 0.03$). These results suggest that the orange coloration of Saffron Finch male's crown is potentially the subject of sexual selection by females.



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Bowers of the great bowerbird (*Chlamydera nuchalis*) unburned after fire: is this an adaptation to fire?

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Fire plays an important role in the evolution of life-history characteristics of organisms living in fire-prone regions. Although there are many reports of plants exhibiting adaptations to reduce the harmful or lethal effects of fire, little is known about fire-resistance mechanisms among animals, other than fleeing responses. Here, we report observations that may represent a type of fire adaptation in a bird species: bowers of the great bowerbird remained unburned after fire. If a bower is destroyed by fire or other mechanisms during courtship and breeding season, the male may lose the opportunity to mate with females, thereby reducing his apparent fitness. Therefore, traits that minimize the damage to bowers from fires may be beneficial. By measuring the unburned areas surrounding bowers after fires, we showed that the survival of bowers after fires is unlikely to be solely related to chance. Though we cannot dismiss a possibility that unburned bowers are by-products of sexual selection, our observations are consistent with the hypothesis that bower resistance to fire is an adaptation of the great bowerbird.



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Genetic mating system of the roseate spoonbill and the wood stork (Aves: Ciconiiformes)

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The use of molecular genetic tools in the study of avian mating systems revealed that they vary among and within species. Neotropical, non-passerine species are understudied in the literature. Among those, waterbirds are a challenging group, because sampling of adults is very difficult, thus the collection of complete family samples for parentage studies is often almost impossible. Here, we characterize the genetic mating system of two Neotropical waterbirds based on analysis of genetic data on progeny arrays. We computed pairwise relatedness values for 158 roseate spoonbill (*Platalea ajaja*) nestling dyads from 65 nests and 192 wood stork (*Mycteria americana*) nestling pairs from 82 nests sampled at Brazilian breeding colonies, based on data on four and nine polymorphic microsatellites, respectively. The three different relatedness estimators had low sampling variances, low type II error rates and low misclassification proportions, demonstrating their power to confidently assess relationship categories. Maximum likelihood sibship identification and hypothesis testing analysis identified unrelated nestlings in 62% of roseate spoonbill nests and in 70% of wood stork nests. Results point to the occurrence of a mating system different from genetic monogamy in natural populations of these species. This study contributes to gaining insights into relevant aspects of the reproductive behaviour of both species. We suggest that the same genetic approach will be useful for studies in other species in which it is difficult to obtain data on complete families. Keywords: mating system, microsatellites, relatedness, waterbirds.



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Duet structure and individual differences in the moustached wren *Thryothorus genibarbis* song

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The moustached wren *Thryothorus genibarbis* is a common South American species found in dense undergrowth thickets at forest edges. Males and females coordinate their vocalizations in precise antiphonal duets that are the species-specific signal uttered in territorial defence all year long. We described the species duetting structure and the differences between pairs of the same locality (Santa Bárbara, PA, Brazil: 1°12'17"S, 48°18'5"W), some neighbours, others out of aural contact. The repertoire is made of 4 note types per pair. Some pairs show small variations in the structure of these notes, up to 10. Among 4 neighbouring pairs, only one note type (6%) was shared. The duet songs presented the same syntax for all analysed pairs: order in which the notes were sung was ABB CD or sometimes CD ABB alternatively. These four note types (A to D) differ between the pairs in all physical parameters measured: temporal parameters (duration of notes and intervals and rhythm) and maximum and minimum frequencies, as shown by Kruskal-Wallis non parametric test. A cluster analysis considering these physical parameters have shown no evidences of similarities between neighbours. The C note aggregates most of the differences between pairs, especially considering the values and shape of its frequency modulation. These results indicate that the song syntax of the duets is a species-specific parameter and that it is possible to identify the pairs by the note structure.



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How many bird species had their home ranges or territories studied in South America?

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This study aimed to assess the representativeness of the South American avian species richness in studies that investigated home ranges or territories of birds on this continent. Scientific articles (n = 64) published between 1975 and 2008 were reviewed. Their study areas were in 10 countries. A total of 229 species had their home ranges or territories studied. It is only 6% of the 3,625 bird species found in South America. Thirty five species were investigated in more than one study. Most (77%) of the species studied were Passeriformes, while 23% were non-Passeriformes. About 9% of the 1,857 South American Passeriformes species were studied. Families with greater numbers of species studied were *Thamnophilidae*, *Furnariidae*, *Tyrannidae*, and *Thraupidae*. Thirteen families, such as *Hirundinidae*, *Poliptilidae*, *Mimidae*, and *Motacillidae*, had none of their species studied. Only 3% of the 1,768 non-Passeriformes species were studied. Orders with greater numbers of species studied were *Piciformes*, *Galbuliformes*, *Cuculiformes*, *Trogoniformes*, *Strigiformes*, *Falconiformes*, and *Galliformes*. Twelve orders had no species studied, such as *Tinamiformes*, *Procellariiformes*, *Pelecaniformes*, *Ciconiiformes*, and *Columbiformes*. Despite numerous studies, knowledge of home ranges and territories of South American birds is very poor, when we consider the total species richness of this continent. We urge researchers to study home ranges and territories of birds in South America. Information on home range and territory size of species is extremely desirable not only to improve the knowledge of their biology, but also to provide us with important data for future conservation and management strategies.



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Diving behaviour of chinstrap penguins in relation to sex: which sex dives harder for chicks?

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The chinstrap penguin *Pygoscelis antarctica* is a monogamous species and the male and female in a pair take turns foraging during chick guarding periods. Sex difference in diving ability due to difference in body size predicts that the foraging strategy should differ between males and females. Therefore, it can be predicted that foraging effort such as dive duration, dive depth, number of dives in a bout should be different between sexes. We recorded diving behaviors of 9 pairs of chick-guarding chinstrap penguins on King George Island, Antarctica. We examined whether there are any differences predicted in diving behavior between sexes. We found that: (1) there are differences in diving behaviours between birds of the same pair but (2) there are no differences in diving behaviours between males and females, and (3) the differences between mates seemed to be due to the difference in timing of foraging trips. These findings suggest that chinstrap penguins may adjust their diving behaviour to foraging condition which may vary seasonally and diurnally but the adjustment does not depend on the sex.



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Visual signalling in wild orange-winged Amazon (*Amazona amazonica*)

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Most species perform several types of gestures for visual communication. Because visual display operates only over short distances, it is well suited for targeting a specific audience, avoiding predators. The orange-winged Amazon uses sophisticated visual signals, in spite of its large vocal repertoire. The aim of this work is to describe the visual communication of this species during nesting. Data were recorded through focal observations during 132 visits in four breeding seasons (2005 to 2009, from October to January between 05:40 and 11:00 and 15:30 and 18:30) in Santa Bárbara do Pará, Brazil (1°12'17"S; 48°18'5"W). We identified two categories of visual signals: (1) agonistic rituals, observed in disputes over nest sites between two or more pairs, which raise their wings and spread open and lower their tails, increasing their apparent size, besides vocalizing; (2) gestures by the male to encourage the female to enter or leave the nest, observed when the male perches at or near the nest tree and, apparently after checking for predators, signals to the female in nearby tree; he raises himself up momentarily and quickly bending his head back by about 45 degrees, until she joins him; then the male makes a downward head movement, bend his head up and raise his body again; the female answers with a downward head movement and a raising of her body, before entering the nest; the downward head movement is also used by the male when he perches at the nest tree and signals to female, which is inside the nest, until she leaves the cavity. Thus, this species uses conspicuous body movements in the agonistic rituals, when they want to frighten competitors, or discreet gestures, avoiding to attract predators, when the parrots are near the nest.



Dispersal and foraging behavior of crested ibis, *Nipponia nippon*, after release in Japan

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Japanese populations of crested ibis (*Nipponia nippon*) have been extinct in the wild since 1981, when all 5 ibises were captured on Sado island in order to recover the population through captive breeding. Even though the last ibis captured in Japan died in 2003, captive populations from China have been increasing. Reintroduction program of crested ibises began on Sado Island, where captive populations exceeded 100 birds in 2007. Ten ibises (5 of each sex) were released in the autumn of 2008. Eight ibises settled and wintered on the island, but a female immediately dispersed to Honshu, main island of Japan. Ibises were effectively foraging loaches, frogs, newts and earthworms in the paddy or bank. Searching and eating bouts shared 60-80% in a foraging session, and vigilance bout was gradually decreasing as the season progressed. As food items become scarce in winter, they might decrease vigilance to increase food intakes. Among them, 4 males and 3 females survived 1 year later. No breeding pair, however, was established prior to February. Three females wintering left the Sado and dispersed to Honshu probably to seek for males and breeding sites. Hard release might adversely affect mating behavior because it prevent from forming the flock in the critical period of mating in 2008. Then, 20 ibises consisting 8 males and 12 females were released by soft release in the autumn of 2009. The perspectives of establishing breeding population of crested ibises in Japan will be discussed.



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Ethogram of *Rupornis magnirostris* Gmelin, 1788 (Aves: Falconiformes) in captivity

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Rupornis magnirostris is the most common hawk in Brazil. It feeds on insects, lizards, snakes, birds and small mammals and they inhabit fields, savannas, forest borders and urban areas. Extremely territorial, announces its presence in high circulating flight while vocalizing. We studied the behavioral pattern of five captive individuals of *R. magnirostris* describing its ethogram. The data collection was performed at the Parque Municipal do Sabiá Zoo, Uberlândia, Minas Gerais, in September and October 2009. The flight cage is 12.3 m² and 2.8 m high. We performed 15 hours of observations that occurred from 07:30-18:30. Instantaneous sampling was the method used. The behavior of each individual was recorded at 3 minutes intervals. These data were plotted in points (1329 total points). Pieces of meat were offered at 13:00, and once a week the hawk received live prey (chicks). *R. magnirostris* showed 61 behavioral acts grouped in eight categories: maintenance (47%), locomotion (22%), vocalization (10%), miscellaneous (10%), alimentation (4%), alert (2%), social contact non-agonistic (1%) and social contact agonistic (1%). Perching was frequent (36%). The non-dominant individuals are restricted to a small part of the enclosure. Thus, we suggest that the birds be moved to a larger enclosure. We suggest the implementation of environmental enrichment (alimentary and behavioral). Were observed nesting behavior by a pair. We recommend keeping one pair in each captivity and the providing of nesting resources.



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Foraging behavior of *Tigrissoma lineatum* (Aves: Ardeidae) in natural grasslands in seasonally flooded region of Pirizal, Pantanal of Poconé, Mato Grosso, Brazil

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Tigrissoma lineatum forages in shallow water and uses various techniques to capture prey. The species is common in the Pantanal, however studies on foraging behavior are scarce. In this study we compare aspects of foraging behavior in three natural seasonally flooded fields, located in the region of Pirizal (16°15'S, 56°22'W). In July 2009, we conducted observations of foraging behavior of *Tigrissoma lineatum* in continuous sessions of three hours in the morning and late afternoon, totaling 33 hours of observations. We recorded the number of attempts, capture success and agonistic encounters. After observing behavior, we measured water depth in areas where individuals were foraging. To compare changes in time and capture the depth of the flooded fields, we used analysis of variance (ANOVA). Agonistic encounters occurred in two fields, where we recorded intraspecific and interspecific interactions. Considering the average time to obtain food items, there was no difference ($p = 0.157$, $F = 1.987$) between the areas. Although water depth did not differ ($p = 0.003$, $F = 6.63$) between the floodplains. This may indicate that the depth variation is not a factor correlated with capture success in the fields. The irregular intervals and relatively long show a chance encounter with their prey because of their behavior. Thus, the results reflect a behavior and demand for food expected characteristic of the species, which involves morphological processes and behavior evolution.



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New aspects of behavioral repertoire of *Syrigma sibilatrix* pairs (Ciconiiformes: Ardeidae) and nestlings during reproduction

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The whistling-heron, *Syrigma sibilatrix* Temminck, 1824, is a strictly diurnal bird that inhabits open, natural and anthropogenic areas. This study describes new records of the behavior of a pair of *S. sibilatrix* and their nestlings during reproduction. The study was conducted at Umuarama campus of the Universidade Federal de Uberlândia, Uberlândia - Minas Gerais. We performed 160 hours of observation at 2008. We used the *ad libitum* sampling method. During nest construction we made a greater effort to collect, since 2007 these behaviors were not recorded. Although this species is not sexually dimorphic, it was possible to distinguish male and female adults through behavior (copulation), which allowed the identification of small distinct characteristics of individuals. Thus, the behavioral acts and categories were reported separately for male and female. The behavioral acts of adults were grouped in these categories: nest building, incubation, parental care, nest maintenance, maintenance, miscellaneous, not agonistic social contact, alert and agonistic social contact, locomotion and vocalization. The parents spent a similar effort during construction, incubation and parental care. The nestlings behavioral acts were grouped into categories: alimentation, locomotion, not agonistic social contact, maintenance, miscellaneous and alert and agonistic social contact. One of the nestlings survived till 45 days reaching the juvenile phase. The species has been trying to reproduce in this area for 4 years without success.



Feeding behaviour of the plain parakeet (*Brotogeris tirica*) in the interior of São Paulo state, Brazil

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Most parrots are generalists and their diet consists of flowers, fruits and seeds. One of their specializations is being a seed predator. *Brotogeris tirica* range distribution is from the coastline of the states of Sergipe to Santa Catarina. This study was done between September 2008 and July 2009, at the Fazenda Santa Elisa (22°52'18"S, 47°04'35"W), of the Instituto Agrônômico de Campinas, located at Campinas, São Paulo. This goal was to obtain data about the feeding behaviour of the plain parakeet. The aspects covered in this study were: the plant species used as food, the food items of its diet (fruit pulp, flower and seeds), the methods for obtaining food as well as the variation in the size of the feeding flocks. During the study we observed 11 plant species that make part of their diet. From these, the Plain Parakeet fed on the seeds of 4 species; the fruit of 7 and the flowers of 2. The foraging methods varied according to the plant species and the morphology of the food item. The size of the feeding flocks is varied, with some of them having *Brotogeris chiriri* as well. During this study we observed from only one individual feeding to flocks of approximately 15 birds on the same feeding place. We have also observed 2 individuals of parakeets of 2 distinct species, a *Brotogeris tirica* and a *Brotogeris chiriri*, with typical pairing behaviour, feeding, arriving and departing the feeding site together without any signs of aggressiveness or competition to one another.



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Habitat influence on territorial and mate-guarding calls of the yellow-breasted boubou (*Laniarius atroflavus*)

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Little is known scientifically about the call of the yellow-breasted boubou (*Laniarius atroflavus*) endemic to the Afromontane forests of the Nigeria-Cameroon highlands. Field observations demonstrated a diversity of functions in this species' limited vocal repertoire. The study presented here investigated the influence of habitat on vocalisation, as part of a larger ongoing study. *L. atroflavus* was studied in forest, forest edge and riparian fragment microhabitats for habitat influences on vocalisations. The patterns and functions of calls were observed from focal observations and recordings within identified territories. Average call rate, call duration, female responsiveness (duetting and mate guarding), bandwidth and amplitude of the recorded calls are being analysed as indicators of a habitat influence on the call of this species. Results indicate a trend of differences across microhabitats. However, analyses are still ongoing.



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New evidence for lack of song learning in Neotropical suboscine passerines

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Unlike oscine passerine birds, suboscines (suborder Tyranni) are believed to develop normal song without acoustic models. If confirmed that Tyranni song is indeed innate, as found in the few existing studies of North American fluvicoline flycatchers (Tyrannidae), then the marked geographical variations of Neotropical Tyranni song may be considered a reliable indicator of genetic variability. We studied song development in captive, hand-raised chicks of two species of Amazonian suboscines: two thrush-like manakins (*Schiffornis turdina*; parvorder Tyrannida, Tityridae) and six northern slaty antshrikes (*Thamnophilus punctatus*; parvorder Furnariida, Thamnophilidae), of both sexes, taken from the nests at 4-18 days of age. They were isolated from parental song types and tutored daily with a diagnosably distinct geographic song variant (different subspecies or sister species). Five individuals never sang, producing only begging and other calls, but three individuals (two *S. turdina* and one female *T. punctatus*) began singing within two days of fledging. These songs were most similar, but not identical, to parental song, being shorter (*S. turdina*) or with more notes (*T. punctatus*). Early songs by *S. turdina* were highly variable, but variability diminished over time. Our study failed to detect imitation of tutored vocalizations (interpreted as learning from adults) in either of these two phylogenetically distant suboscine species. However, we observed “improvement” in song over time, approaching untutored parental song. It is unclear whether more auditory feedback (practice) would be sufficient to perfect song, or if a parental tutor (actual learning from a model close to internal template) is necessary.



***Mionectes olivaceus*: a lekking species?**

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The tyrant flycatchers (Tyrannidae) are one of the largest and most diverse families of birds in the Neotropics. Although monogamy is the predominant social system in the family, classical polygyny has been suggested in *Alectrurus*, and a lek breeding system has been described only for *Mionectes*. The reproductive system in this genus has been extensively studied in populations of *M. oleaginous*, but few data are available for *M. macconnelli*, *M. striaticollis* y *M. rufiventris*. For *M. olivaceus*, only opportunistic observations of males in aggregated exhibitions in Panama and Colombia have been recorded. This study aims to fill this gap by describing the reproductive behavior of a population of *Mionectes olivaceus* resident at National Park Yacambú, Lara-Venezuela. We studied, between 2005 and 2009, 23 exhibition arenas, each one with one to five males in aural contact. Male displays include singing on low-rise perches. These perches, as well as the singing territories, are maintained between years, even when the territorial male is not the same. Male territories include canopy areas with large abundance of fruits suggesting that males are unable to monopolize the resources and control access to females. Such characteristics are associated with leks, as breeding systems, and we suggest that the reproductive system of this population of *M. olivaceus* can be defined as a lek with variable aggregation. Furthermore, an overview of continuous variation in the aggregation can yield insight into the evolution of leks.



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A comparison of behaviors and interactions during feeding in a hummingbird community in southern Brazil

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Hummingbird species may either interact when using the same nectar source, or ignore each other when using different sources. In this experimental study, we examined interactions among species of various body sizes at a common resource - hummingbird feeders. Monthly, March 2008 - June 2009, a video camera filmed birds at hummingbird feeders for 90 min sessions. Videos were analyzed to determine the duration of each visit, how many times the bird appeared to drink and interactions when other birds came to the same feeder. Interactions included chasing or being chased or disappearance from the video. Ten species were filmed visiting the feeders, with a total of 2436 focal individuals and 646 interactions (both inter and intraspecific). The number of focal individuals per session varied from 16 - 613 and the number of species varied from 2 - 8. Interactions also varied widely, with a minimum of 1 and a maximum of 213 per session. Six behaviors were easily defined while visiting the feeders (hover, perch, approach, leave, flee and defend) and the species varied widely in their use of each. *Leucochloris albicollis*, the most commonly seen species, strongly interacted with itself and with the similarly sized *Colibri serrirostris* (both weigh ~ 6.2 g). The largest species, *Florisuga fusca*, rarely interacted, perhaps due to its large size. Also, the smallest species, *Chlorostilbon lucidus*, was rarely involved in interactions. Interactions also vary seasonally, probably due to the greater or lesser abundance of interacting species. Hummingbirds do not have a clear dominance hierarchy and their willingness to interact may depend upon their hunger at the time: if they just arrived at a feeder they are more likely stay than if they have already fed. Thus, interactions appear to be a complex combination of resource use (those that use similar resources are more likely to interact), satiety, abundance and body size (which may be linked to resource use).



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Short and long term effects of elevated testosterone levels on reproductive success and survival in captive female European starlings (*Sturnus vulgaris*)

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Testosterone (T) mediates the expression of many fitness-related behaviours in male vertebrates. Although most female vertebrates produce significant amounts of T, the role of T in female fitness is poorly known. To explore possible costs and benefits of high T in female songbirds, we examined short and long term effects of experimentally elevated T in female European starlings, housed in large outdoor aviaries. We measured effects on several reproductive variables (focusing on the egg-laying stage) both during the year of manipulation (MY) and the second year (SY), and on several physiological parameters during the non-breeding season in between. Both during the MY and SY, elevated T did not cause negative effects on reproductive performance: the proportion of females breeding, date of pair formation, nest building, interval between nest completion and appearance of the first egg, clutch size and the number of (experimentally induced) replacement clutches did not differ between T- and Control females. During the MY, T-females even laid larger and heavier eggs than C-females. Elevated T-levels did not affect weight during the following autumn and winter, but delayed the moult of contour wing feathers and disturbed the moult of the body and throat feathers. Our results obtained in a captive situation with *ad libitum* food availability seem to contrast to previous results in free-living European and spotless starlings, where elevated T did negatively affect breeding performance by delaying the onset of laying and decreasing clutch size.



Parental cooperation in zebra finches: do parents behave consistently

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Parental care is vital for offspring survival but demanding in terms of time and energy for the caring parents. In majority of avian species both parents appear to care for the young, although neither the function nor the mechanism of biparental care are fully understood. We investigated a biparental species, the zebra finch *Taeniopygia guttata*, in an aviary experiment. We focus on the cooperation between parents, and tested the parental behaviour in two contexts. First, we carried out a mate choice experiment, and found that approximately 55% of females exhibited consistent preference. Then half of the females were paired with the male they preferred, whereas the other half was paired with the non-preferred male. Pilot analyses suggest that the females did not cooperate differently according to partner preference. Second, we tested the behaviour of male and female parents during incubation and brood rearing, and compared the parental behaviour in regards to time spent on incubation, frequency of chick feeding and intensity of nest defence. Taken together, our experiment suggests that biparental care is an excellent model system to investigate cooperation between two unrelated individuals, because this is a context where evolution is expected to hone both individuals behaviour, and the payoffs for each action (cooperate or defect) are clearly defined.



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Division of labour in brood-rearing ruddy shelducks (*Tadorna ferruginea*): functional or temporal?

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Behaviour of ruddy shelducks (Anseriformes) that have biparental care, was studied in the brood-rearing period in the Middle Volga region (Russia), Askania-Nova Nature Reserve (Ukraine), and Moscow. The structure of activity budgets were very similar in males and females, except for vigilance, the proportion of which was 1.6 times greater in males than in females. No other significant differences in budgets were found, indicating that the decrease in the vigilance time in females was the consequence of slight increase in time spent on a number of other activities rather than on a particular one. Correlations between the same activities in males and females are very strong ($r = 0.49$ to 0.96 , $p < 0.001$). Time spent on threats by males positively correlated with that spent on attacks and foraging by females; negative correlation was found between the male locomotion time and female rest time. In the most cases dependence of different activities upon various factors (brood size, the age of the young, the type of habitats, etc.) was similar in both adults. However, strong correlations did not mean high synchronization: the cases when activities of male and female were timed, exceeded 50% of all registrations of their activities only in locomotion and social demonstrations (modified Jaccard formula, $p < 0.05$). Strong correlations along with poor synchronization of parents' activities imply that the temporal component in the division of labour in brood-rearing ruddy shelducks is more pronounced than the functional one.



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Does feeding ecology and predation risk influence the behavioural response of ducks to the flightless period of moult?

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Many different behavioural changes have been observed in waterfowl during the flightless stage of wing moult, with birds frequently becoming inactive and reducing time spent foraging. Increased predation risk, elevated energy demands of feather re-growth and restriction of foraging opportunities are commonly cited reasons for these changes. We determined whether foraging mode influenced how moulting ducks respond behaviourally to wing moult, by studying captive populations of both dabbling and diving ducks (15 species in total). The time budgets of the birds were recorded during wing moult (July-August) and non-moult (typically November-January) with behaviour being recorded under six categories. Overall, time-budgets of the captive ducks changed significantly during moult compared to non-moult. In all species studied, foraging and general locomotion decreased significantly during moult compared to non-moult periods, while maintenance and rest increased significantly. Moulting diving ducks underwent a greater reduction in time spent foraging and in locomotion compared with dabbling ducks. These are likely to be a response to a greater energetic cost of foraging in diving ducks. Increased resting in both diving and dabbling ducks also reduces their likelihood of detection by predators, while allowing them to remain vigilant.



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Diet and habitat selection of the threatened African grass-owl (*Tyto capensis*) in the Highveld of South Africa

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Habitat loss has been implicated as a major cause for the decline of the threatened African grass-owl (*Tyto capensis*), a poorly studied species in South Africa. The diet and habitat selection of breeding grass-owls was investigated at six nest sites scattered throughout the Highveld Grasslands of South Africa. Data on various vegetation parameters were collected within a 1 km radius of each nest. The nests were all situated within wetland fringe vegetation. Tall and dense stands of cotton wool grass (*Imperata cylindrica*) were particularly favoured for breeding. Pellet analysis revealed a preference for small mammals, with eight small mammal species contributing 96% of the diet of grass-owls. Small mammal abundance, as determined by live trapping, did not account for the overall diet composition, with the vlei rat (*Otomys irroratus*) contributing over 90% of the prey items consumed by owls. The selection of wetland associated species by grass-owls in this study confirms their dependence on wetland areas, emphasising the need to conserve this habitat type within a highly transformed grassland biome.



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Video camera system used to monitor incubation at the Andean condor (*Vultur gryphus*)

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The Andean condor (*Vultur gryphus*) is an endangered species and so there is a strategy for their conservation in South America. Studies were carried out in natural environment and in captivity to obtain more information about their biology. To increase knowledge about their behaviour and to improve the captive breeding programme a video camera system was used during the breeding season of 2007, for a pair of Andean condor in the Biopark Temaikèn, Escobar, Argentina. The equipment gave more accurate information, with less interference, on the participation of the male and the female during the period. The egg was incubated for 94% of the time (710hs). The male (47%) helps the female (53%) during parental care and no difference was observed ($U = 495$, $p \leq 0.05$) between them. Basically the male and the female spent the same amount of time in the nest during the day ($U = 564$, $p = 0.86$) and the night period ($U = 432$, $p = 0.07$). The egg was found broken with 34 days of incubation and although we had this valuable monitoring tool, we could not infer the cause of breakage. It is important to learn more about parental behaviour and possible problems in reproduction to improve the conservation of this species.



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Social and genetic polygyny in the strange-tailed tyrant (*Alectrurus risora*)

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The strange-tailed tyrant (*Alectrurus risora*) is a globally threatened flycatcher that inhabits savannas, wet grasslands and marshes in southern Paraguay and northeastern Argentina. This species is highly sexually dimorphic, with males having a long tail with modified outer feathers, a contrasting black-and-white plumage and notable bare red skin on the throat during the breeding season. Variation in the extent of sexual dimorphism and dichromatism among birds is attributed to sexual selection and differences in mating system. On the basis of observations of unbanded breeding birds it has been suggested that this species is socially polygynous. However, the predominant mating system of tyrant flycatchers is social monogamy with biparental care of the chicks. We examined the social and genetic mating system of strange-tailed tyrants and evaluated the extent of parental care by females and males. During five consecutive breeding seasons we followed the nesting attempts of banded females and males and collected blood samples from chicks and parents in a protected area of the humid Chaco, in Formosa Province, Argentina. The social mating system was polygyny. Males defended contiguous territories of 2-2.5 ha that included the territories of 1-3 females. Females bred in the same territory over several years, but males rarely remained in the area more than one year. Parental care was provided exclusively by the female, who builds the nest, incubates the eggs and broods and feeds the chicks without male's assistance. Genetic analysis of 8 microsatellite loci confirmed that males were polygynous, but also showed extra-pair fertilizations.



Nest and nest site selection by the marsh antwren *Stymphalornis acutirostris* (Thamnophilidae)

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Stymphalornis acutirostris is an endangered species inhabiting tidal marshes in southern Brazil, being the only Thamnophilidae restricted to marshes. We describe nests for the first time, and evaluate nest site selection by *S. acutirostris* in Jundiaguara island, Guaratuba bay, state of Paraná, specifically on tidal marshes characterized by four vegetation physiognomies. We carried out approximately 1,000 h of nest searching from 2006 to 2009. For all nests after use, vegetation structure was sampled in 1 m² plot centered at the nest. Results were compared with paired plots randomly set inside each territory. The nest (n = 87) is an open cup constructed with plant fibers and arthropod silk, supported by herbaceous plants (8 plant species, n = 73 nests), shrubs (1 species, n = 1), trees (1 species, n = 4), vines (2 species, n = 2), and combinations of herbaceous plants and trees (n = 4) or herbaceous and vines (n = 3). The nest presents external maximum and minimum diameters of 73.5 ± 22.0 mm and 64.5 ± 17.8 mm, respectively, internal maximum and minimum diameters of 51.4 ± 14.1 mm x 43.6 ± 11.9 mm, respectively, height of 6.7 ± 1.6 mm, and incubation chamber depth of 4.2 ± 0.9 mm. The height from nest to the ground ranged between 0.3-2.2 m (= 1.2 ± 0.4 mm; n = 86). The species nested only in three vegetation physiognomies. Nest sites (n = 79) had higher and denser plant cover than random plots in all physiognomies. Denser sites provide supports for nest fixation and higher sites are selected likely to avoid high tides, which were common causes of nest failure.



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The benefits of many close neighbours: Darwin's finches in mixed species nesting associations had higher nest defence response and lower nest predation

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There is high nest predation (55-58% of all nests) in Darwin's small tree finch, *Camarhynchus parvulus* in the Galápagos archipelago. Intriguingly, the spatial nesting pattern of this species varies, with both mixed nesting associations (46% of nests) and solitary nests (54% of nests) in the same habitat. We tested variation in nest defence behaviour with experimental playback of the sounds of potential predators. We predicted greater nest defence towards predators in mixed associations than solitary nests, and that the risk to individuals defending nests would be lower in group nesting associations. We used five different playback calls: familiar threat (Galapagos hawk, *Buteo galapagoensis*); introduced potential threat (smooth-billed ani, *Crotophaga ani*); unfamiliar non-threat (American robin, *Turdus migratorius*); unfamiliar sound (submarine); and silence (speaker control). The results were consistent across years: (1) total nest defence response in mixed associations was greater to the hawk playback, and was comparably low across all other stimuli; and (2) contrary to our expectation, individual birds showed greater nest defence response in mixed associations, but produced more whistle vocalisations at solitary nests. Whistle vocalisations, compared with alarm calls, are presumably more difficult for predators to locate.



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Foraging strategies of a hummingbird community during the winter season in a highland forest in Western Mexico

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We described the foraging behaviour of a hummingbird community inhabiting a highland forest in Jalisco (Mexico). We tested the hypothesis that both the composition of the hummingbird community, and the abundance of floral resources modify the foraging strategies of the hummingbirds. The community we studied was composed of 11 species (4 residents, 3 latitudinal migrants, 3 altitudinal migrants, 1 occasional), that exhibited large differences in their dominance status and foraging strategies. We found all the possible combinations of these characteristics, from highly dominant territorial species to subordinates trapliners. These differences in the dominance status and resource use were principally related with the species, sex and age of the individuals, the number of flowers in the area, and the abundance of the migratory species. The aggressive species preferred the places with more flowers, and started the majority of the fights, attacking even birds that did not visit the flowers; the subordinate hummingbirds did not start fights, and these happened during their visits to the territorial hummingbirds' flowers. The resident species lost many of the fights at the beginning of the winter, but won more fights at the end of the season when many migrant species had diminished their numbers. The relationship between dominance status and foraging behaviour could affect the role of the different hummingbird species as pollinators.



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Reproduction of the yellow-browed woodpecker in Santa Teresa, state of Espírito Santo, Brazil

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Available data on woodpecker's behaviour and reproduction are sparse, lacking information for over half the species of the family. Much of what is known about the Neotropical genus *Piculus* is owed to studies on the golden-olive woodpecker whereas the information about the yellow-browed woodpecker (*Piculus aurulentus*) is limited to the height of a nest found in Argentina. We studied the reproduction of the yellow-browed woodpecker at the Estação Biológica de Santa Lúcia, monitoring it from August 22 to October 15 (86 h of observations). The tree of the nest was chosen after a display performed by both adults, which excavated the nest altering 1,5h shifts. It was at a height of 2 m in a decomposing avocado tree 14 cm in width. An entrance measuring 5 x 4 cm (width and length) led to the nest chamber (9 x 34, width and length), which was filled with 4,5 cm of wood chips. Female's incubation shifts were 1/5 longer than male's. The male slept in the nest during both incubation and brooding periods, which lasted 21 and 26 days, respectively. Two eggs were laid. The young, completely naked at hatching, acquired a plumage similar to the female's. Food was carefully shared between the chicks by both adults. Before leaving the nest the young slept without the company of the male. At this time they were able of vocalizing the characteristic call of the species ("eeeww"), which was emitted from the nest entrance. The data gathered herein agrees with the general pattern found in woodpeckers, although they deviate somewhat from those known about the golden-olive woodpecker, thus revealing a diverse breeding pattern within the *Piculus* genus.



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Vocal convergence as a mechanism for the long term maintenance of vocal dialects of the yellow-naped amazon (*Amazona auropalliata*) in Costa Rica

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The yellow-naped amazon (*Amazona auropalliata*) exhibits 3 vocal dialects in northern Costa Rica, which have shown geographic and temporal stability. Genetic estimates of gene flow from these populations support the hypothesis of dispersing individuals vocal matching local dialect upon arrival for the maintenance of vocal dialects. We experimentally simulated dispersal within and across dialects to investigate this hypothesis. We tracked 47 radio-collared individuals in 2006-2009 in 3 different sites at 2 different vocal dialects in northern Costa Rica. Twenty individuals were transferred across dialects, eight were transferred within the north dialect, and 19 were released in the same trapping site in the north dialect. We tracked the vocal performance of radioed individuals and the capability of transferred individuals for engaging in local movements. We recorded one instance of convergence to the local dialect by a juvenile six weeks after translocation across dialects. This bird showed strong pair bond formation with a resident bird. None of the transferred adult birds showed evidence of vocal convergence to local dialect. Little aggression towards transferred individuals was observed, and within few days they were following the movements of local birds regardless of call type differences. 32% of these birds returned their original capture site within 10 days. Our results provide experimental support to the vocal convergence hypothesis for maintenance of dialects, and suggest that vocal matching occurs only in juveniles. Pair bond formation may be a more important force favouring vocal convergence than the need to integrate into social groups.



Cleaner birds: an overview for the Neotropics

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Several bird species feed on a variety of external parasites, dead and wounded tissue, organic debris, blood and blood clots, secretions and the insects they attract from the body of other vertebrates (hosts or clients). We present an overview of putative cleaner birds from the Neotropics based on field records, literature, and photo survey. We found that twenty seven bird species in 16 families practice cleaning even if very occasionally. The birds range from the Galápagos ground-finch *Geospiza fuliginosa* to the widespread black vulture *Coragyps atratus*. Clients are mostly large herbivores such as capybaras, deer, and livestock, but also include medium-sized herbivores such as iguanas and tortoises, and carnivores such as boobies and seals – a few bird species peck at wounds and secretions of these latter marine mammals. However, no carnivorous terrestrial mammal client is recorded to date except for a domestic dog, from whose hair black vultures picked organic debris. Some clients adopt particular inviting postures while being cleaned, while others are indifferent or even disturbed by the activity of cleaning birds. Capybaras, giant tortoises, and iguanas are among the inviting clients, whereas boobies try to dislodge the ‘vampire’ finch *Geospiza difficilis*. Most Neotropical cleaner birds may be grouped in one broad category (omnivores that dwell in open areas and associate with medium-sized to large herbivores). A restricted category accommodates the blood-drinking *Nesomimus* mockingbirds and the *Geospiza* finches of the Galápagos Islands, as well as the tussock bird *Cinclodes antarcticus*, the sheathbill *Chionis albus*, the skua *Stercorarius antarcticus*, and the caracara *Phalcoboenus australis* of Patagonia (omnivores that dwell in open areas and associate with marine birds or mammals). Additional records of Neotropical cleaner birds will mostly fall in the broad category, whereas some *Cinclodes* species may be recorded to act as cleaners in the restricted category.



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Social links of parasite burden in free-living greylag geese (*Anser anser*)

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The immune system does not come for free; resources need to be allocated to optimize fitness. The extent of this allocation may vary during different annual or diurnal phases or between individuals, depending on sex, social status or “personality”. We examined presently intestinal parasites (e.g. *Coccidia* sp., *Ascaridia* sp., *Capillaria* sp., *Amidostomum* sp.) relative to seasonal phase, sex and social status in greylag geese. Most intestinal parasites were found during the mating season, decreasing during the actual reproductive phase (egg laying, raising goslings). Females had a significantly greater parasite burden than males and family individuals (males and females) had significantly more intestinal parasites than individuals without young. Our results indicate that greylag geese, living in complex social groups, have a constrained immune function during socially stressful periods (mating season), when a high number of agonistic encounters and other social challenges take their toll. Also, individuals with offspring show a greater parasite burden, which may be caused by additional stress associated with raising offspring (e.g. increased vigilance behaviour). The sex difference in parasite burden may be caused by an increased energetic demand during the reproductive phase for the females shown by heart rate recordings that mainly the females invest energetically into offspring (e.g. egg building, incubation). To explore causal links between social stress and parasite burden as an indicator of immune status, we plan to experimentally manipulate social stress in greylag geese.



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Heart rate reflects metabolic output in a bird with a complex courtship display

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Studies on intersexual selection seek to identify criteria used by females for choosing a mate that reflect male quality. The golden-collared manakin (*Manacus vitellinus*) of Panama has a polygamous breeding system in which males perform a complex, physically intensive courtship display. Using an arena created on the forest floor, male displays include rapid, precise and acrobatic jumps between saplings accompanied by the production of mechanical wing noises. Males differ in the rate at which components of the display are performed and females distinguish subtle behavioral differences preferring males that perform faster and more frequently. We hypothesize that a) properties of the display reflect male condition and serve as an indicator of genetic quality, the basis for female mate choice and b) that males express a greater heart rate while courting reflecting the greater metabolic rate associated with elevated displaying activity. If heart and metabolic rate are increased during displaying, then courtship activity would represent a good proxy of condition for females. We monitored heart rate of wild breeding males over the course of one or more days. Birds were collected from leks and miniature transmitters were attached that transmitted heart rate as amplitude modulation of the carrier frequency. After release, most males appeared to behave normally. Overall, we have collected data from 26 males. From 20 of these, we determined a daily distribution of the heart rate and estimated maximum heart rate. In general, heart rate was lowest at night and during mid-day periods of inactivity. Courtship activity peaked in the early morning and early afternoon and heart rate was elevated at these times. Data from 6 individuals for whom we have collected both heart rate data and detailed behavioral observations allow us to determine the high metabolic costs of mechanical sound production and other features of the male display.



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Tree selection for nests and roosts of the Japanese pygmy woodpecker *Dendrocopos kizuki*

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This study examined tree selection for nests and roosts of the Japanese pygmy woodpecker *Dendrocopos kizuki*, which is the smallest of all Japanese woodpeckers. Selection for small size may be to reduce predation risk and/or competition with secondary cavity users. Cavities were searched during three years since 2006 in breeding and winter seasons at the forest near urban area of Sapporo city, Hokkaido, Japan. Forty-four cavities were measured and availability of tree species was examined at the study site. The trunk's diameter at the breast height, the tree's decay stage and tree species were selected by GLMs as factors that influenced tree selection usage. Manly's alpha preference index indicated a strong preference for *Alnus hirsuta* and *Populus maximowiczii*, suggesting that these trees, which are within their excavation ability, may have been selected to lower predation risk, and thus, leading to a greater reproduction success.



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Factors that influence the observation of the black hawk-eagle (*Spizaetus tyrannus*) on Santa Catarina Island, in the south of Brazil

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The black hawk-eagle (*Spizaetus tyrannus*) is one of the largest species in the Falconiformes, but it is not easy to find and it is little studied. Therefore, to improve study of the black hawk-eagle on Santa Catarina Island and to better the knowledge of its biology, this study analyzed factors that influence observation of the species, such as weather, foraging, territorial behavior with time intervals, activity time comparison with the short-tailed hawk (*Buteo brachyurus*) and its yearly frequency. Trends exist regarding weather (cloud cover and atmospheric pressure), showing that the greater register of the species occur when the weather is good, because favorable conditions make the observation easier. The foraging of the black hawk-eagle happened with the maximum deviation from 10:01 – 12:00 h, showing a preference for territorial behavior. Comparing to the activity time of the short-tailed hawk, with this one there was no significant variation, keeping a watching uniformity during the day. Regarding yearly frequency, there were more detections from June to October, characterizing a yearly period in which the species becomes more evident due to the home range, reproductive displays that call the attention, with greater frequency of vocalizations to the territorial and reproduction defense. We conclude that the methodology of gathering results of the extended studies should be taken into account by adapting the results taken from weather, time and favorable months for a greater detection of the black hawk-eagle on Santa Catarina Island.



Do pollination and seed dispersal by birds influence the abundance of *Heliconia acuminata* in a fragmented landscape?

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Heliconia acuminata (Heliconiaceae) is pollinated by hummingbirds such as *Phaethornis superciliosus* and its fruits are dispersed by birds such as manakins and thrushes. Although these birds are more or equally abundant in forest fragments than in continuous forest, previous studies report greater abundances of *Heliconia* in continuous forest sites. Here we test whether the variation in *Heliconia* abundance among forest fragments of different sizes is consistent with differences in observed rates of pollination or seed dispersal, or alternatively by some abiotic factor such as light. We sampled six areas of the Biological Dynamics of Forest Fragments Project, located 80 km from Manaus Brazil, where we followed 124 flowering individuals of *Heliconia* to assess pollination rate (number of unripe fruits /flower), production and consumption of ripe fruits. At each visit we counted the number of flowers, unripe and ripe fruits as well as fruit removed by birds (based on cut patterns observed during feeding experiments). We used hemispherical photos to quantify the light environmental of each plant. Fertility (flowers/plant) increased with fragment size. We found no differences in pollination rate inferred from the number of developing fruits (1ha = 88%, 10ha = 82%, 10ha = 65%, 100ha = 60%, CF = 85%). However, the number of ripe fruits per plant and rates of fruit ripening were considerably greater in fragments (1ha = 8.5%, 10ha = 7%, 100ha = 1%, CF = 3%). Despite greater average light levels in larger fragments, spatial heterogeneity in light availability did not account for variation in fertility and fruit production between plants. Over 90% of ripe fruits were eaten by birds, irrespective of forest fragment size. Our results suggest factors other than pollination and seed dispersal contribute to the variation in *Heliconia* abundance in this fragmented landscape. Variation in fruit ripening suggests physiological effects or differences in abundance of herbivorous among forests.



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How to measure complex songs: informational entropy applied to an Amazonian thrush

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Oscine songs usually have individual and micro-geographical variations that are evidence of vocal learning. Female mate choice is based on various characteristics, especially song complexity, that may reflect male genetic quality. Many authors consider song repertoire size to represent male fitness and test if males with larger repertoires are more successful in soliciting copulation and gain selective advantage over males with smaller repertoires. Song complexity can be better evaluated through its sequencing (or syntax) and its informational entropy that takes into account the proportion of the note type utterances. Studies that consider only the repertoire size neglect other relevant information of song quality. In order to calculate variation of the entropy values in relation to the repertoire size, we analyzed songs of the pale-breasted thrush *Turdus leucomelas*, a common species in urban areas and forest edges in the Belém region. The repertoire size of the 30 individuals that were analyzed varied from 5 to 40 note types and non-conditioned entropy values from 1.66 to 5.09 (N = 60 notes per individual). It appeared that the same repertoire size can produce different informational entropy values: for instance, of two individuals with 27 note types one had an entropy index of 3.78, lower than of an individual with only 17 note types, and the other an entropy index of 4.55. We also found individual variation in the note structures and their syntax, evidencing vocal learning and creative capacity.



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Cowbird egg ejection by birds from a Neotropical savanna

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Brood parasites have several strategies that may help them have high breeding success, but that may decrease host breeding success. Thus, it is advantageous for host species to be able to recognize their own eggs and remove parasite eggs from their nests. Some egg ejectors acquire the ability to recognize their own eggs and identify parasite eggs through an imprinting process, which is poorly developed in species that accept parasite eggs. Since little is known about brood parasitism in tropical regions, we conducted an egg ejection experiment in a lightly disturbed reserve in the cerrado (savanna-like habitat) of central Brazil. We studied egg ejection behavior of host nests ($n = 14$ species; $n = 35$ nests; 1 - 8 nests each species) artificially parasitized by eggs mimicking shiny cowbird (*Molothrus bonariensis*) eggs. We found that eight species accepted eggs and six did not. This major acceptance rate may be because hosts lack the necessary genetic variation or have not been exposed to parasitism long enough to evolve egg discrimination and ejection behaviors (evolutionary lag hypothesis). Since a few species, such as *Tyrannus savana*, *Neothraupis fasciata*, *Turdus leucomelas*, *Turdus amaurochalinus*, *Patagioenas picazuro* and *Cyclarhis gujanensis*, ejected parasite eggs, it is possible that this ability has evolved only recently in these host populations. Egg ejection behavior was present and absent in species from two families, *Tyrannidae* and *Thraupidae*, suggesting a species-specific response. An evolutionary lag may persist if mutations that affect egg discrimination and ejection do not evolve or do not become widespread in their populations.



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Preliminary data of radio telemetry in red-browed Amazon (*Amazona rhodocorytha*) in Southeastern Brazil

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The red-browed Amazon or “chauá” (*Amazona rhodocorytha*) is threatened parrot endemic to the Atlantic Forest of Brazil. They are about 37 cm, weigh 450-550 g and are found in forests of the coastal lowland and uplands. In the states of Espírito Santo and Minas Gerais this species is monitored through the Projeto Chauá for more than 3 years in the cities of Aimorés, Itueta and Resplendor, Minas Gerais; Baixo Guandu, Espírito Santo. Eight telemetry collars were installed in young parrots (about 25 days old) in 3 nests. The equipment used was Telonics model MOD-065, 13.5-22.0 grams with survival sensor. We used climbing equipment to access the nest to install the transmitters. The search for telemetry signal was performed daily by land and by overflights. Monitoring was October 2008 to October 2009 (12 months). Survival rate was 87% with one parrot dying 5 days after leaving the nest. In the first month the young parrots remains close to the nest with parents and slowly begin moving farther from the nest. The young are dependent on parents who feed them and help in foraging for 6 months. After this period, we observed that families no longer fly together but rather they began to form pairs with other individuals of the same species. Daily movement ranged 3 – 20 km and were always sighted within forest fragments feeding on fruits, flowers and seeds. During the night, they slept in pairs or small groups in forests. This monitoring program is very important to know more about the behavior of this species and for conservation.



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Microhabitat utilization for foraging and singing by the Tropical mockingbird (*Mimus gilvus*) in shrubby restinga vegetation

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The Tropical mockingbird is widely distributed throughout the Americas, with a close association to the Atlantic coast. At the southern limit of its distribution, in Rio de Janeiro and Espírito Santo states, Brazil, the bird is restricted to shrubby *restinga* vegetation and is categorized as threatened. The main goal of this study was to investigate microhabitat utilization by this bird when foraging and singing. We conducted fieldwork on a grid of 25ha, at Restinga de Jurubatiba National Park, Rio de Janeiro, which we visited monthly from Jun/07 to May/08. Each month we went through the grid once in the morning and once in the afternoon, recording feeding and singing events. For each event we recorded microhabitat features: on shrub or on open sandy ground, location on shrub (inside or on the edge), shrub height and strata. The majority of the feeding events was recorded on shrubs (77%, n = 176). Shrubs of 2-4m height were used more frequently (85%). Medium strata (43%) and ground (1%) were the most and the least used, respectively. About 86% of the events were recorded on the edge of the shrub (n = 110). Singing events were recorded only on shrubs (n = 332). The most and the least used shrubs had 4m (45%) and 6m height (2%), respectively. Only medium (6%) and upper strata (94%) were used for singing. About 97% of the events were recorded on the edge of the shrub. Our results show the affinity of the Tropical mockingbird to exposed microhabitats for foraging and singing. Foraging at exposed microhabitats allows the species to monitor its territory when foraging, optimizing its time and energy budget. Although, being more exposed may enhance the birds' susceptibility to predation. Funding: CAPES, CNPq, PELD-site5.



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Vocal differences between Argentinian subspecies of ultramarine grosbeak (*Cyanocompsa brissonii*) and their possible causes

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There are two subspecies of ultramarine grosbeak (*Cyanocompsa brissonii*) in Argentina. The subspecies from the Chaco (*C. b. argentina*) is larger than the eastern subspecies (*C. b. sterea*) and both differ in color. In this study we present a spectrographic analysis of their song variation and compare these patterns with those in other related species. We found significant differences between the songs of both subspecies in acoustic frequency (maximum frequency, minimum frequency, bandwidth and emphasized frequency), but in general we did not find differences in their temporal variables. The only exception was in the rate of frequency inflections (i.e. rate of changes in the direction of the frequency modulation of the notes). These differences are consistent with previous findings in other groups showing the existence of a negative relationship between acoustic song frequencies and body size. In addition, differences in the rate of frequency inflections might be related to other morphological and biomechanical features of the beak. The comparative analysis of these results using phylogenetically independent contrasts showed that at least some of these patterns of song variation are rather general in the tribe Cardinalini.



Jumping behaviour explains the fat-tailed dispersal distance distribution in the red-cockaded woodpecker (*Picoides borealis*)

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The “fat-tailed” distributions of dispersal distances are a well documented phenomenon in birds and many other organisms that evidence long distance movements that seemingly contradict normal dispersal behaviour. Such distributions have been of great interests to theoreticians who have suggested that fat tails might be caused by rare movement modes that widen dispersal kernels. The behavioural underpinnings of these extreme dispersal events have not been previously described, however, despite occasional observations of long distance movements. We report radiotelemetry-based observations of a rare long distance movement behaviour that fattened the dispersal distance distribution tail of the endangered red-cockaded woodpecker. Two modes of dispersal behaviour have previously been described in this cooperatively breeding species: (1) dispersal by helpers retained on their natal territory for 1-10 years, which involves short distances and delayed dispersal; and (2) dispersal by juveniles, which occurs in fall or spring of the first year and involves longer distances than helper dispersal. Here we describe two distinct modes of dispersal within the juvenile class, (a) foraging from a natal area before dispersing to breeding territories, and (b) making jumps to distant locations, after which birds again conduct short-distance searches. The former accounts for the bulk of dispersal by juveniles, whereas the latter, much less common behaviour accounts for the fat tail in the distribution of dispersal distances. Jumping-like behaviour potentially could be widespread in birds and thus account for the fact that avian dispersal distance distributions typically have fat tails.



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Adaptive behavioural responses of piscivorous birds to invasive aliens in Lake Victoria

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Great cormorant (*Phalacrocorax carbo*) and pied kingfisher (*Ceryle rudis*) showed flexible foraging behaviour after the upsurge during the 1980s of introduced Nile perch (*Lates niloticus*) in Lake Victoria. Both species survived by optimally changing their foraging locations and prey species after their traditional prey, cichlid fish, had been virtually eradicated by Nile perch, and were replaced by dagaa (*Rastrineobola argentea*), a small pelagic cyprinid whose populations grew rapidly. After a partial recovery of the former fish species composition, following a decline in Nile perch from over-fishing in the 1990s, the birds now combine both foraging strategies. In the early 1990s, water hyacinth (*Eichhornia crassipes*) invaded the lake. Cichlids started to use the hypoxic water under the vast hyacinth mats as a refuge against predation by oxygen-sensitive Nile perch. Before the hyacinth invasion, little egrets (*Egretta garzetta*) were not abundant. Hunting birds typically stood still on the shoreline waiting to catch a cichlid. The emergence of the hyacinth was followed by an immense influx of little egrets, strolling the mats to catch the cichlids below. Surprisingly, the disappearance of the hyacinth in 1998 did not cause a collapse of the egret population. The birds began to exploit the increased stock of dagaa, using a new hunting technique. Cruising over the water, up to several kilometres offshore, they search for surface-dwelling juvenile dagaa, which are caught on the wing. Due to their adaptive behavioural responses, cormorants, kingfishers and egrets could successfully cope with the changing environment in Lake Victoria, caused by invasive alien species.



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Social behaviour and parasite burden in cooperatively breeding carrion crows (*Corvus corone corone*)

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Group living is associated with various costs, including social stress. In long-term, stress may affect immune status and consequently susceptibility to parasites. One way of dealing with social stress and minimizing adverse effects onto health may be a secure social embedding (e.g. having social allies). Here, we provide first observational evidence for the correlation between social behaviour and parasite burden (coccidia, *Capillaria* sp.) in carrion crows. Individuals infected with coccidia were involved in agonistic interactions more frequently and individuals infected with *Capillaria* were involved in significantly less sociopositive behaviours (e.g. allopreening, sitting close) than non-infected individuals. Overall, our results suggest that stressful agonistic interactions negatively influence individual health, whereas sociopositive behaviours have the contrary effect. To gain a better insight in the causality of such parasite-behaviour interactions, future experiments investigating behavioural changes after manipulation of parasite burden are planned.



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Buzz elements and quality indication in the song of nightingales (*Luscinia megarhynchos*)

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Mate attraction and territory defence are the two main functions of song in male songbirds and individual variation in song characteristics affects reproductive success through mate choice and male-male competition. For example, repertoire size traditionally has been identified as a key feature that encodes male quality. But song is a multifaceted behaviour and there is increasing interest in identifying other constraints that could serve as an indicator of male quality. We investigated whether buzz elements as physically challenging components of some song types in the singing of nightingales hold the potential to communicate individual quality. Buzzes are syntactically and acoustically peculiar elements which are produced by very fast repetitions of sound subunits in a narrow and rather low frequency range. By comparing spontaneous singing of free living nightingales we could show that buzz elements were produced different among individuals. To inquire into sources for such differences and potential functions, we investigated in learning experiments if the buzz elements are precisely copied from a tutor model. Furthermore, we addressed in playback experiments whether male and female nightingales respond differentiated to buzz songs. In particular females did indeed respond with behaviour indicating a greater arousal level when hearing buzz songs. Further evidence that buzzes are important in communication and might serve as an indicator of quality comes from playback experiments with buzzes of different vocal proficiency. In summary, our results suggest that the acoustic fine-structure of certain song elements in nightingales may function to convey information about individual quality.



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Sex-related changes in stress level and body mass in little auk (*Alle alle*) during the breeding season

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Biparental care in seabirds is regarded as an adaptation to high costs of foraging and food transport to the nest. Although parental activities of males and females are similar, their investments are not always the same and is reflected in their body condition. Investigation of sex differences in parental care of seabirds is important to understand the evolution of parental strategies in that group. Here, we compared changes of body mass and stress level (heterophil/leucocytes ratio) of males and females of monogamous seabird - Little Auk (*Alle alle*) in the course of breeding season. The study was carried out in three breeding colonies on Svalbard (Bear Island, Hornsund and Magdalenefjorden) in 2003-2008. Body mass of both sexes was the greatest during the incubation period and decreased significantly in the course of chick rearing. Males were significantly heavier than females only during the chick rearing period. Greater stress level was recorded for females at the beginning of incubation. However, since the stress level decreased in females and increased in males in the course of the period, at the end of the incubation both sexes had similar stress level. The greatest stress level was recorded for both sexes during the mid chick rearing. At the end of chick rearing period males had significantly greater stress level than females. Stress level results suggest that allocation in parental care during the incubation and chick rearing period is rather male-biased.



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Behavioural adjustments in response to increased predation risk: an experimental study in the tufted duck

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Birds modify their behaviour to deal with environmental perturbations and especially with predation risk. Data in the literature only focus on specific behaviours and rarely consider the overall adjustments in response to these perturbations. Therefore, the aim of this study was to determine the global behavioural response of captive tufted ducks to an imposed disturbance. Fourteen ducks maintained in an outdoor aviary were intensively disturbed (4x15 min daily) at one-month intervals during one-week sessions with a radio-controlled car. Sleeping, vigilance, foraging and preening behaviours were recorded with food intake, body mass and wing loading over the week before, during and after disturbance. The disturbed group was compared to an undisturbed control group. Behaviour of control birds did not change during the three weeks. In the disturbed group, vigilance decreased after disturbance ending and sleeping time increased during and after disturbance sessions. Conversely, preening and foraging durations were lower during these two weeks in disturbed birds than in controls. Food intake declined in disturbed group and became lower than in control birds until the end of disturbance. Non-linear body mass loss and wing loading decreases were greater in disturbed than in control birds. Disturbed ducks seemed to adjust the foraging behaviour and food intake in order to reduce their body mass. This regulation agrees with the improvement of escape flight capabilities. Concomitantly, increased sleeping and reduced vigilance durations allowed compensating the energetic costs associated with the high of take-off flights frequencies and the spontaneous reduction of food intake.



Does the long-tailed cinclodes *Cinclodes pabsti* Sick, 1969 (Aves: Furnariidae) select nest sites randomly?

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Cinclodes pabsti has a relict distribution in southeastern Brazil, in the higher elevations of southeastern Santa Catarina and northeastern Rio Grande do Sul. It is found in temperate grassland, open grassland, agricultural land, and rocky hills, usually near water. The area of occurrence of this species is becoming increasingly degraded by anthropic actions while almost nothing has been published on its reproductive biology. Here, we present such data by analyzing some aspects relevant to nest site selection for this species. From August of 2008 to January of 2009 pairs of *C. pabsti* we recorded nesting in burrows dug in cliff faces along a 130km of road cuts between the municipalities of São José dos Ausentes, Bom Jesus and Bom Jardim da Serra. For each nest observed, we noted its coordinates, compass orientation, height and width of its entrance, and the distance from the bottom and the top of the road cut. We found 99 nests located in holes in basaltic rock ($n = 6$), organic ($n = 15$) and clay soils ($n = 78$). The distances of the nests from the top of the road cuts varied from 12 to 260cm and to the bottom of the road cuts from 4 to 420cm. The diameter of the nests ranged from 7 to 14 cm. In terms of cardinal location, we found 25 nests facing east, 15 west, 14 south, 12 southeast, 11 north, 18 northwest and southwest (9 each) and 4 northeast. Although we have no evidence of site selection accordingly to its cardinal location, the high number of nest used in the eastern and the fact that, within this location, nests were used non-randomically suggests a preference for this location. We suggested that such preference is related to the maximization of the direct solar radiation received by the nest, which may confer a thermoregulatory advantage for the nestling.



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Habitat use by four species of migratory shorebirds (Charadriiformes) on Atalaia Beach in Sergipe, Brazil

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The Atlantic coast of Sergipe (northeastern Brazil) lies on the migration routes of at least 17 species of migratory shorebirds. Here, we analyze the behavior and habitat use of the four most common migratory shorebirds (*Arenaria interpres*, *Calidris alba*, *Calidris pusilla*, and *Charadrius semipalmatus*) on a 5-km stretch of Atalaia beach over a 13-month period in 2008-2009. In addition to records of the location of each species in 500 m sections of the beach, we also noted behavior. A total of 928 records of the four species were collected, including bands of up to 1075 *C. pusilla*, and mixed flocks of up to 1500 individuals. *C. alba* and *Charadrius semipalmatus* were the most abundant species overall, with 66% of the sightings, and 60% of the individuals recorded. Whereas the two more common species were distributed relatively homogeneously along the beach, *A. interpres* was found primarily in the 3 central sectors, 4-6 (67% of records), while *C. pusilla* was relatively common in external areas, with 56% of records from sectors 2 and 9. A major influence on the behavior of all four species was the presence of leftovers of food (e.g. peanuts, coconuts, shrimp) dropped by beachgoers, in particular in sectors 5, 6 and 9. As a result, 41% of foraging was recorded on the upper beach, rather than the intertidal zone, and the majority (67%) of the records refers to these 3 sectors. While possibly beneficial over the short term, the exploitation of leftovers as a dietary resource may be potentially deleterious for these migratory birds, given their small size and sensitive metabolisms.



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Exploring the extent of mechanical sound use in tropical bee hummingbirds

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In order to better describe the use of mechanical sounds in the bee hummingbird clade, we observed and recorded the displays and sounds of two Costa Rican hummingbird species, *Selasphorus flammula* and *S. scintilla*. We recorded the displays with both an audio recorder, and a high-speed camera (500 fps), and we provide examples of the displays and display sounds of these poorly described species. The volcano hummingbird (*S. flammula*) and the scintillant hummingbird (*S. scintilla*) both perform display dives to females, and the scintillant also performs a second display, akin to the shuttle display of North American species. Based on our recordings we hypothesize that the volcano is using a combination of vocal components and mechanical tail sounds to produce the display sound, whereas the scintillant is using a combination of mechanical wing and tail sounds. The hypothesized mechanical sounds are distinct from previously described hummingbird feather sounds. Future research will explore how shape influences the sounds that a feather can produce, and will compare the evolution of mechanical display sounds with the growth and evolution of feather shape.



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SA02 Community and Landscape Ecology and Conservation



Replacement of functionally equivalent species of *Turdus* and *Elaenia* in the seed disperser - *Podocarpus parlatorei* interaction

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Functionally equivalent species perform a specific ecosystem service or function with a similar outcome. It was hypothesized that functional equivalence in plant-seed disperser interactions allows the replacement of species in their mutualistic function. When equivalent species are related, they share traits relevant to the interaction through common evolutionary history, which could result in taxon and character-dependent equivalent interactions. We compared 3 populations of *P. parlatorei* to look for supraspecific functional relationships in seed dispersal in Andean montane forests. *Turdus* spp. and *Elaenia* spp. were among 27 species recorded feeding on *P. parlatorei* at all 3 sites combined. Species within both genera were analyzed through ordination based on foraging morphology. Also, species within a genus were similar in fruit-handling behaviour and moved seeds in similar ways, although important habitat preferences existed among species. In each site, 1-2 species of *Elaenia* and 1 species of *Turdus* were the main seed dispersers. Within genera, species from different sites were more similar in their dispersal function than to the co-occurring frugivores. This relationship was stronger when within-site species of *Elaenia* or *Turdus* were clumped by genera. The interactions between *P. parlatorei* and its dispersers could be explained by functional characters of the interaction, suggesting that functional relationships with dispersers could be more relevant at the supraspecific level. However, intrageneric differences in habitat preferences and in seed-deposition sites, could have significant consequences on the recruitment of this tree because its strict requirements for establishment.



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Birds of Guanabara Bay, Rio de Janeiro, Brazil

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Birds were counted and monitored in Guanabara Bay, Rio de Janeiro. Between August 2005 and August 2007, during 25 boat censuses, ten areas were studied (Estrela, Surui, Iriri, Copororoca, Guapi and Guaraí Rivers, Canal Boca Larga and Cajaibas de Dentro islands and Cajaibas de Fora islands), and an additional four censuses were carried out by helicopter (June and December 2006, March and September 2007). Each aerial census was conducted in the morning and afternoon. The total bird species richness (including review of the literature) was 199 species, of which 71 are water birds and 128 are land birds. In the field we found 112 species of which 45 were aquatic and 67 terrestrial. Among waterfowl, the family Ardeidae was the most species rich with nine species, followed by Scolopacidae with six species and Anatidae with five species. The cormorant (*Phalacrocorax brasilianus*) was the most abundant species, present in 100% of the counts. The rivers that had the greatest richness and abundance of aquatic species were Iguacu and Estrela and the greatest abundance were recorded in the dry season (May-September) and transition (from February to April and October). Piscivorous species predominated (47%) and those that feed on aquatic invertebrates (36%), totaling 83% of the water birds of the bay. We registered 16 migratory species, including 12 visitors from America, two visitors from the South and two Wandering. This region is important for the survival of migratory birds that use it, during the wintering, as a point of feeding and rest. Among the 15 endangered species in the state of Rio de Janeiro to record for the Guanabara Bay, 10 were observed during this study.



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On variations in numbers of frugivorous and omnivorous bird species in a fragmented landscape of the Brazilian Atlantic Rain Forest

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We verified the influence of size and connectivity of forest fragments on species numbers of frugivorous and omnivorous birds in 24 well preserved fragments in the Atlantic Rain forest (11-656 ha). Birds were recorded during four visits in each fragment in spring and summer. Regression were used to determine the association between the number of bird species and size of the fragments and a RxC test for independence (G-test) was used to evaluate significance between the proportion of frugivores and omnivores and two levels of connectivity (connected and no-connected). We divided the bird species according to their body size in “small” (< 80 g) or “large” (≥ 80 g). There was no difference in the proportion of frugivorous and omnivorous birds in isolated and no-isolated fragments ($G_{adj} = 0.023$, $P \leq 0.05$). Numbers of frugivores decreased at a greater rate than omnivores with decreasing fragment size. However, when separated by body size, we found that small frugivores were not affected by fragment size ($r^2 = 0.03$); only large frugivores were affected ($r^2 = 0.214$). The opposite was found for omnivores, with large species not affected by area size ($r^2 = 0.092$) and small omnivores being affected ($r^2 = 0.151$). Small species depend on small territories and/or home ranges, which may explain the results found for frugivores. But this is not expected for omnivores.



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Bird responses to landscape heterogeneity in highland mountain forests of central Argentina

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Polylepis forest is of particular international concern because of its extraordinary biodiversity and many endemic species. To date, the uneven and dwindling distribution as well as forest degradation is worrying and has particular importance on bird conservation. We took a landscape approach to analyze the relationships between avifauna and landscape features in *Polylepis australis* fragments of central Argentina with different degrees of degradation: forest and shrubland. Bird data were collected in woodlands ($n = 105$) and shrublands ($n = 67$) using 10-min point counts located 150 m apart. Vegetation characteristics were estimated from a Landsat 5 TM image. We calculated NDVI as a measure of plant productivity and volume and 4 texture measures (mean, contrast, homogeneity and uniformity) to characterize differences in vegetation distribution among patches. Also, we calculated 2 fragmentation measures (patch area and connectivity) and 3 variables indicative of human disturbance: proportion of eroded land (as an indicator of long-term soil loss) and distances to roads and human settlements (as an indicator of long-term livestock impact). We tested bird-habitat relationship for overall bird species and for selected guilds using logistic regression. Bird richness was negatively related to elevation and erosion (Nagelkerke's $R^2 = 55\%$). Avian assemblages were dominated by disturbance-tolerant species, i.e. species that use edges and open lands. Occurrence of disturbance-sensitive species was determined by the forest presence and connectivity (Nagelkerke's $R^2 = 48\%$) while disturbance-tolerant species were only related to connectivity of *Polylepis* fragments (Nagelkerke's $R^2 = 61\%$). We concluded that in *P. australis* forest of central Argentina the long-lasting human impact is contributing to a homogenization of regional avifauna toward species resilient to human disturbance.



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An evaluation of bird diversity and endemism in *Polylepis* forests in Cochabamba, Bolivia

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Polylepis forests are found at higher altitude areas of the Andes and are considered one of the most threatened ecosystems of South America. Usually found as forests' relicts in fragmented landscapes its reduction and potential loss are imminent because of severe human use (grazing) or reforestation programs. Due to its ecological and socio-economic importance, carry out research becomes a priority. This study aimed to determine richness, density and to identify endemic bird species or with distributional range restricted to *Polylepis* forests in Cochabamba, Bolivia. Four sampling sites were identified, characterized and visited \geq two times during one year applying standardized techniques. A total of 134 bird species were recorded. Forty-eight species were registered for first time and we recorded eighteen new records for several bird species at these high altitudes. At one site, we recorded and collected a possibly new subspecies. *Ochthoeca fumicolor* ssp, was recorded at 4350 m in *Polylepis pepeii* forests - a new record at this elevation. *Podiceps occipitalis occipitalis* was recorded at one site which is considered the second record for Bolivia and first for Cochabamba. This record is the highest recorded for this species (4000 m), which until this was 2500 m in Argentina.



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Conservation of birds of prey: are artificial nests of help?

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Modern forestry has changed forest habitats in many ways. Forest structure has become younger, area of old forests fragmented and suitable nest-trees with woodpecker holes or old trees with strong branches have been removed. Birds of prey, in particular, are susceptible to such a loss as they need cavities for breeding or stout trees to support their twig nests. Artificial twig nests and nest boxes can compensate this need, but are they of equal quality with natural ones? Man might choose the nest location differently than the bird. Common birds of prey have been monitored for 28 years in Finland, northern Europe. Every year, volunteer raptor ringers inspect many potential nest sites. In 2008 this included a total of 43,400 nest sites that include 5790 natural and 1620 artificial twig nests, 21,980 nest boxes for owls, 6055 nest boxes for small falcons and 4820 natural holes. Ringers also return detailed nest data on bird of prey nests with information on breeding success (of 870 nests in 2008). Since the beginning of the birds of prey survey in 1982, nest data on about 20,000 diurnal raptor and 13,800 owl breeding attempts has been collected. I examine the data on nests to investigate 1) does breeding success differ between natural and artificial nests, 2) does the bird choose a different nest habitat than the ringer and 3) what is the lifespan of different nest types. The results are applicable when planning conservation practices for birds of prey.



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Temporal variation in a plant-seed disperser network in Subtropical Andean Montane forests

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Plant-seed disperser mutualistic networks are strongly structured, yet little is known about how this structure changes through time. We studied the temporal variation in structure properties of a mutualistic network of 15 bird and 21 plant species and we evaluated the effects of species abundance and ecological and morphological traits of birds and plants to determine the interaction patterns of the mutualistic partners. Since September 2008 we sampled bimonthly the abundance of ornithochorus fruits, abundance of fruit-eating birds and fruit consumption in Yungas forests, Argentina. Global network connectance and richness ratio (bird:plant) were lower than seasonal connectance and richness ratio values, although these last two properties were more similar to global values in autumn when fruit consumption was highly skewed because of a hyperabundant fruit species. Birds and plants showed striking similarities but also differences in the temporal variation of their network properties. The pairwise interaction frequency had the largest effect over the interaction properties of both groups of species. The abundance of mutualistic partners had a larger effect on quantitative than on binary network properties. The species identity and ecological and morphological traits explained a small fraction of the temporal variation in the interaction properties, and were more important for birds than plants. These findings showed that some attributes of plant-seed disperser network structure and network properties of the mutualistic partners vary through time, suggesting that temporal dynamics in the relative importance of the mechanisms contribute to network structure.



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Sodium versus toxin adsorption: what drives avian geophagy in South America?

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The intentional consumption of soil, known as geophagy, has been recorded for many bird species on all continents except Antarctica. However, South America is considered the area with the largest numbers of sites, species, and individuals. Since the 1970s various teams studying avian geophagy in Peru have generated two principal theories as to why birds consume soil: 1) protection from dietary toxins and 2) sodium supplementation. Our research over the last 10 years has looked at these theories using data on soil composition, soil consumption, bird behavior, bird diets, and spatial distribution of clay licks at local and continental scales. Consumption rates for different soils within heavily used clay licks are correlated more strongly with sodium than with toxin binding. The birds do not use clay licks exclusively in the mornings before toxic foods are consumed. Nutritional analyses show that the soil provides a high percentage of the sodium in the diets of scarlet macaw chicks. The cliffs used as clay licks contain greater levels of sodium than those not used by birds. In South America, clay licks are concentrated in the western Amazon Basin in areas with high rain fall and far from oceanic inputs of sodium where environmental sodium levels are predicted to be the lowest. These lines of evidence suggest that geophagy among South American birds is driven more by the search for sodium than the protection from dietary toxins.



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Avian composition in two habitats of the Southern Pantanal, Miranda-Abobral region, Mato Grosso do Sul, Brazil

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We performed a quantitative and qualitative survey to examine the influence of habitat heterogeneity on the composition of bird community in the southern Pantanal. In this study we considered two dominant habitats of the Miranda-Abobral Pantanal: a) dense, diverse and stratified gallery forest and b) tecoma savanna with only two stratifications, the upper with *Tabebuia aurea* (Bignoniaceae) and lower with herbaceous vegetation. We also used three sampling methods in both habitats: 1) transects of 50 meters on sides (20 hours), 2) point-counts with 50 meters distance (20 hours) and 3) mist nets (110 hours). We sampled 172 species in 20 orders and 45 families, embracing 37.5% of 463 species recorded to the Pantanal complex. The predominant trophic guilds to the gallery forest were insectivores and omnivores, respectively, and insectivores and granivores to the tecoma savanna. 116 species were detected in the gallery forest and 106 in the tecoma savanna (51 species were found in both environments). 65 species were found only in the gallery forest and 55 in the tecoma savanna. As a result, the similarities indices of Jaccard and Sorensen were low: 0.459 and 0.298, respectively. These low values are influenced by different vegetation composition between these areas, mainly due to the greater diversity of microhabitats and the presence of water (Miranda river) in the gallery forest. Equitability was 0.879 and 0.802 and Shannon-Wiener diversity 3.92 and 3.87, respectively for the gallery forest and tecoma savanna. These values indicate a high diversity of species in both habitats as well as an equally specimens distribution. In conclusion, all these data indicate strong habitat selection for birds and that vegetation heterogeneity is important to maintain high bird diversity in the Pantanal. Finally, the high richness and low similarities values detected in both habitats lead to consider both areas as priorities in further conservation strategies in the southern Pantanal.



Hummingbird diversity in southern Brazil: temporal changes and habitat use

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Trochilidae (hummingbirds) is the second largest bird family in the Neotropics. Here, we studied the temporal changes in richness and abundance, as well as the habitat use of hummingbirds in southern Brazil. The survey was carried out in the southern coastal plain in the state of Rio Grande do Sul (31°48'S, 52°25'W). Censuses were carried out between March 2008 and April 2009 through six fixed transects (TR) up to 2800 m in length, twice a month in the morning for 1 h (n = 144 h). The TR were: 1) a patch of Restinga forest; 2, 5 and 6) edge of patches of Restinga; 3) human altered areas at the UFPEL; 4) *Eucalyptus* spp. plantation. We found: *Hylocharis chrysura*, *Stephanoxis lalandi*, *Florisuga fusca*, *Anthracothorax nigricollis*, *Leucochloris albicollis*, *Chlorostilbon lucidus* and *Thalurania glaucopis*. *Hylocharis chrysura* was the only species staying in the area throughout the year, while *F. fusca* was found from July to October. The remaining species were found occasionally year-round, what could be explained by their migratory patterns and/or low densities. Regarding annual abundance, *H. chrysura* accounted for 95% of contacts, *F. fusca* 3% and other species pooled 1% (n total = 1293 contacts). During winter, *H. chrysura* and *F. fusca* reached the greatest abundance. Data suggest spatial segregation: *H. chrysura* and *F. fusca* were abundant and able to explore all habitats; *S. lalandi* and *T. glaucopis* occurred only in forested habitats; *L. albicollis*, *A. nigricollis* and *C. lucidus* preferred open areas. Richness and abundance were high during the *Eucalyptus* flowering period, at TR 4, suggesting the influence of this exotic species in the structure of the assemblage. The hummingbird assemblage analyzed was dominated by *H. chrysura*, a species with high potential for competition and exploitation of resources in southern Brazil.



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Birds associated with water and riverine habitats from Balbina lake 20 years later: an evaluation of Willis and Oniki's predictions

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Construction of hydroelectric plants contributes largely to biodiversity loss. The lake of the Balbina Hydroelectric, in Central Amazon, was formed in 1987 by a dam in the Uatumã River and flooded 2.360 Km² of primary forests. In order to evaluate the impact of the Balbina lake on waterfowl and birds associated with riverine habitats, we conducted four surveys from March to November 2009. We recorded species considered common to anthropogenic areas, such as *Coragyps atratus*, *Cathartes aura*, *Milvago chimachima* and *Tyto alba*, which had not been recorded before the lake formation. Species such as *Atticora fasciata*, *Chordeiles rupestris*, *Ochthornis littoralis*, *Opisthocomus hoazin*, recorded in the region before the hydroelectric construction have not been found in our surveys. The absence of these species may be attributed to changes in the landscape, such as alteration in riverine vegetation, disappearance of rapids and rocky islands, besides changes in micro-habitats such as sand beaches. Some species that forages in open areas (e.g. *Pandion haliaetus*, *Falco ruficularis* and *Progne tapera*) or use tree trunks for foraging or nesting (e.g. *Dryocopus lineatus*, *Melanerpes cruentatus* and *Ara ararauna*) were commonly found. Piscivorous species and those nesting in cavities in river banks, such as *Chloroceryle amazona* were common, indicating their benefit from the increased availability of margin habitats. This study confirms some alterations predicted by Willis e Oniki in their pioneering study on the composition of the avifauna at the Balbina region, notably the presence of species that benefit from human altered areas and the absence of specialized species.



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An efficient strategy for sampling birds in the Amazon: an experience with Portable Autonomous Recording Devices

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Ornithological studies in the Amazon must inevitably address two fundamental problems: a highly diverse fauna and a dense vegetation cover that forces the observer to identify birds based mostly on their vocalizations. These problems raise serious logistic limitations and require creative solutions. We report on the relative performance of standard point accounts and Portable Autonomous Recording Devices (PARDs) in assessing the bird fauna of an Amazon forest site. Our comparison centers on three questions: Do species richness estimates from PARDs and point counts differ? How do these estimates differ from the number of species that can potentially occur in the area? Which species were exclusively recorded with each technique? Our test was based on sampling of 55 points in 760-ha area of terra-firme central-Amazon forest over the period of two months. We detected 161 species in point counts, obtaining a jackknife richness estimate of 200 (SE = 9.65). The PARDs recorded vocalizations for 133 species, leading to a richness estimate of 148 (SE = 7.0). PARDs recorded 10 species that were never noted in point counts, including some rarely seen terra-firme birds such as *Frederickena viridis* and *Phaethornis ruber*. Point counts reported 38 species that were never recorded by the PARDs. Our results indicate that PARDs placed in the understory are a poor option for registering canopy birds. Nevertheless, PARDs could register some species that were not detected in point counts and they offer the remarkable advantages of allowing a large number of simultaneous samples at peak calling time for a large number of points and leaving a permanent record of the raw identification data.



Understory avifauna response to fire suppression in an Amazonian savanna

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Savannas are adapted to fire, and fire suppression can lead to an increase in woody species. The avifauna is known to be related to vegetation structure, therefore directly affected by vegetation changes. We examined the changes in the understory avifauna in an Amazonian savanna in a period of 23 years, to evaluate the effects of fire suppression in the bird community. The study area was a 30 ha savanna patch located in a peninsula in the Tapajós River, surrounded by patches of semi-deciduous forests, riparian vegetation and fresh-water beaches. The area had a regular fire regime from at least 1986 until 1997. Since then, no fires occurred in the area. We censused the understory avifauna in September 2009 using four linear netlines, each one with 20 mist nets of 12.0 x 2.0 m mesh size 36 mm, opened early morning and evening, accruing a total of 800 net-hours. We compared this survey with surveys made from September to December 1987 and September to November 1996, using the same method. The total species richness did not vary in the surveys. However, there were differences in the relative abundance of some species. The most abundant species in all surveys was *Elaenia cristata*. A typical grassland species, *Ammodramus humeralis*, was amongs the most abundant species in 1987 and 1996, but was absent from the study site in 2009. Some species considered rare in 1987 and 1996, such as *Ramphocelus carbo*, were amongs the most abundant in 2009. A species never registered before in the area, *Pachyramphus rufus* was moderately abundant in 2009. We suggest that some species associated with forest borders are colonizing the area, and restricted savanna-adapted species may have been locally extinct or moved to neighboring savannas that have a regular fire regime.



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Structure and diversity of bird communities in a protected Andean oak forest - Cordillera Oriental, Colombia

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Patches of oak forest along conservation corridor of Andean Cloud Mountain Forest and Paramo are protected in a few national parks in Cordillera Oriental of Colombia. The most southerly protected area of this corridor is the “Santuario de Flora y Fauna de Iguaque”, which suffers from anthropological pressure. We evaluated richness, composition and structure of forest birds at the SFF Iguaque and its surroundings to analyze habitat restriction to oak/mixed forest and sensitivity to disturbance to establish conservation priorities for birds in the area. Five sites were surveyed between 2700-3500 m with 94 sound-recording/hours and 2327 mist-net/hours. A total of 92 species of which 75 were forest dwelling were registered with Emberizidae as the most common family for all sites. According to the richness estimators Chao2 and MMMean, species detection ranged between 73.5-95.1%. Fifteen species were shared among all five sites of which only ten were abundant everywhere. The most important habitat was Evergreen Mountain Forest followed by Secondary Forests, no difference was found with elevation within forest. Twenty species were considered highly sensitive to disturbance, all exclusively forest dwellers, and ca. 50% of all other species were of medium sensitivity. Three nearly-endemics were found: *Chlorostilbon poortmanni*, *Atlapetes albofrenatus* and *Myioborus ornatus*, with only one near-threatened species, *Eriocnemis cupreovertris*. Sites were complementary inside the SFF Iguaque, which has ca. 40% of all forest species recorded for the oak conservation corridor. The protected area is of great importance for the region as a water source and a great conservation opportunity for various species including birds. Research that includes population dynamics and movements across areas of oak/mixed forest to the north, and the whole corridor are needed.



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Bird-vegetation relationships in highly transformed habitat: the Pampas grassland

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Pampas grasslands are one of the priority ecosystems for conservation in our country due to the profound transformation due to agriculture and cattle ranching development. The objective of this work was to analyze the relationship between the presence and relative abundance of grassland birds and the environmental variables; and to study their association with the productive use of land. In this regard, we have conducted bird counts and have registered measures of vegetation along transects arranged in patches of grassland located in both, private lands with livestock management and patches of the National Park Campos del Tuyú, east of Buenos Aires Province, Argentina. The bird diversity was greater in grazed environments. However, some species were strongly associated with unmanaged environments. The density of red-capped wren-spinetail (*Spartonoica maluroides*) and the sedge wren (*Cistothorus platensis*) was greater in the National Park than in the private fields. We also noted that these species correlated positively with high coverage *Spartina* sp. and greater average height of vegetation. On the contrary, there was no differences between private fields and the National Park sites in the abundance of species such as the great Pampa-finch (*Embernagra platensis*) and grassland yellow finch (*Sicalis luteola*), known as more generalist in their habitat use. Therefore, diversity would be favored by habitat heterogeneity generated by the livestock management, but this would affect species whose requirements appear to be more stringent. Whereas red-capped wren-spinetail and sedge wren are described as locally scarce, these results reinforce the value of protected areas in this region.



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Capture-recapture analysis of a hummingbird community in the Atlantic Forest of southern Brazil

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Survival is fundamental for understanding population dynamics and other ecological processes in birds. Population dynamics and processes are poorly understood for many tropical birds, especially hummingbirds. Hummingbirds in temperate regions are known to migrate and southern birds may also show seasonal patterns of abundance. The first step in understanding seasonality and population dynamics is a capture-mark-recapture program. In a rural area in fragmented Atlantic forest in southern Brazil, we have captured 12 species and 1998 individuals in a total of 2859 captures since 2004. Seasonal shifts in the hummingbird community are clear, with monthly captures including from a minimum of 5 to a maximum of 10 species and captures vary from 80 to 394 per month. Three species are captured throughout the year and three species are found in 6 or fewer months each year. To date, apparent annual survival rates vary from low (~55%) to nearly 100% and we are carrying out survival analyses to better understand this variation. We can identify birds that were born within one year of capture and we find that, surprisingly, first year birds are as likely to be recaptured as are adult birds. We suggest that migration patterns may confound survival analysis of these species and that our sampling location is between the summer and winter ranges of most species. Of the individuals that have been recaptured, only 6 individuals (in 3 species) have been captured in 6 or more months, while 381 individuals (in all 12 captured species) have been captured in only one or two months. Here we describe capture-recapture analysis for this hummingbird community.



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Using ecological niche models (enm's) to evaluate the potential distribution of the Worthen's sparrow

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Currently, the use of enm's integrated to Geographical Information Systems (gis) as biogeographical analysis tools allows the predictive modeling of habitat suitability and potential distribution animal and plant communities of conservation concern. The Worthen's sparrow (*Spizella wortheni*) is an endemic and threatened bird species in Mexico, historically it occurred in ecotones between grassland and bushy areas from north to central Mexico; actually its distribution range has been severely reduced due to habitat modifications for productive purposes. The presence and breeding of this bird has been confirmed in a few localities in northeastern Mexico; however recent discoveries of new populations suggest that its distributional range could be larger and fragmented populations could be present within a surface of 7000-15000 km². Taking into account bioclimatic variables and presence data we used two enm's, domain and maxent, to generate maps of potential distribution for this species. Our results suggest that there are several potential localities where the presence of the Worthen's sparrow is highly probable, and maybe some of them could be functioning as corridors between the known subpopulations.



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Effects of fire on avifaunal diversity and abundance in a Sudan savanna habitat in the Yankari Game Reserve, East-central Nigeria

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We studied the effects of fire on bird diversity and abundance in a Sudan savanna habitat in the Yankari Game Reserve, East-central Nigeria. Point count was carried out at 700 points laid out systematically within 7 grids of 4 km² each, covering both burnt and unburnt areas. A bird survey at each point used the point count method. A total number of 7350 birds of 133 species in 46 families were recorded. Mean number of birds per point was 10.50 ± 0.23 , mean number of birds in burnt points was 10.45 ± 0.26 and 10.79 ± 0.47 in unburnt points. There was a greater bird diversity at burnt than unburnt points, there was also significantly greater bird diversity and abundance between points managed with early than late, relative to the end of the wet season, burns. This study shows that both fires itself and the timing of the fires affects the diversity and abundance of birds. In this respect, and if managed burning is carried out, early fires should be the main option in the Yankari Game Reserve and possibly elsewhere.



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Impact of eucalyptus afforestation in grasslands of southern Brazil: lessons from bird assemblages

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Conversion of natural grasslands into industrial eucalyptus plantations is expanding in southern Brazil. Environmental impact analysis predicted reduction of grassland biodiversity in these areas. We used an impact-reference study design to assess impacts of afforestation on grassland birds at eleven sites in southern Rio Grande do Sul state between 2006-2009. Each site was sampled only once in late spring or early summer, following a snapshot natural experiment approach. Per site, five 500 x 100 m strip transects were allocated in young eucalyptus stands 4-7 m tall and five in adjacent natural grasslands. We recorded 446 individuals and 54 species in eucalyptus stands and 1006 individuals and 60 species in grasslands. There was a significant difference ($p [Q_b \text{ null} \text{ ge } Q_b \text{ obs}] = 0.001$) between bird assemblages in eucalyptus stands and grasslands. Eucalyptus bird assemblage fitted a Zipf model (AIC = 207.08, AIC weight = 0.731), while grassland assemblage fitted a preemption model (AIC = 267.9, AIC weight = 0.999). Overall turnover rates were greater in transects within eucalyptus stands ($Bh1 = 21.7$) than in grasslands ($Bh1 = 13.7$). Cluster analysis revealed a clear segregation between grassland and eucalyptus samples ($r = 0.804$). Similarity between both assemblages was 44%. The majority of species recorded in eucalyptus stands were forest and edge species. Only six of these displayed signs of territoriality and appeared to be regularly using plantations. Urgent conservation of grassland remnants is necessary to compensate habitat loss in south Brazil.



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Avian diversity and survival in relation to habitat quality in a rainforest mosaic

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Widespread habitat destruction and alteration worldwide has made regenerating forests increasingly important for conservation. However, how communities and species respond to habitat alteration and subsequent regeneration is not well understood, particularly in relation to the separate effects of habitat alteration and fragmentation. We used community- and individual-based metrics to assess the value of regenerating forests for birds compared to primary forest in the Ecuadorian Chocó. The study area is mosaic of largely undisturbed (primary) forest interdigitated with altered (selectively logged) and secondary forests (extensively logged) left to regenerate naturally 12-18 yrs ago. Species diversity was high and comparable across habitat types. Altered and primary forests had communities similar in species composition, richness and abundance, while secondary forests had greater abundance and richness and distinct composition. Annual survival rates did not differ among habitats. Our results highlight how selectively logged forests can regenerate to closely resemble original conditions, while extensively logged forests seem to regenerate towards a distinct climax state but can still house diverse communities. Habitat fragmentation, conversely, may have a very different effect, especially if mature forests cease to act as sources of colonists for fragments. Future work will sample largely deforested surrounding areas that contain isolated forest patches.



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Structure and organization of an Atlantic Forest bird community in Paraguay

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The Atlantic Forest of South America is a priority terrestrial “hotspots” for biodiversity conservation, due to its high level of diversity and endemism, and as one of the most threatened ecosystems in the world. In Paraguay, this ecosystem is the most affected by deforestation. Less than 20% of its surface is remaining, highly degraded and fragmented. Numerous studies on distribution and biogeography of birds have been developed in the country, but no studies have examined patterns based on natural assemblages of bird species. This knowledge is essential to understand how disturbances of habitat may affect its bird communities. To describe the structure and organization patterns of a bird community of primary lowland Atlantic Forest, field surveys were conducted from August 2004 to December 2007 at San Rafael National Park (SRNP), site of greatest concern for threatened and restricted-range birds of the Atlantic Forest in Paraguay. Bird censuses were carried out using 10 - minute unlimited point counts in a plot of 100-ha of primary forest. A total of 152 bird species were recorded in the plot during the study, which is 63% of the birds that occurs in forested areas in the park. The cumulative curve of number of species of the 440 counts did not reach a plateau, suggesting that more species will be recorded with further effort. Guild composition shows preponderance of insectivorous with 49% species; 27% are omnivores and 15% frugivores. Population densities were estimated for 84 species, from which 8% had population densities of ≤ 2 individuals/km², while the most abundant (10%) had between 150 and 500 individuals/km².



The intertidal birds in the Estuarine Complex of Paranaguá, Paraná State – Brazil

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The intertidal region is a feeding and resting environment for many bird species, giving great importance in the maintenance of various populations. This study evaluated the bird community present in the intertidal Estuarine Complex of Paranaguá (ECP) (48 ° 25'W, 25 ° 30'S), Paraná State, Brazil. The study was conducted from September 2008 to August 2009, being the ECP divided in five sectors established from the saline gradient: Antonina, Paranaguá, Ilha do Mel, Laranjeiras and Guaraqueçaba. The intertidal area of the ECP was divided in 216 transects geo-referenced measuring 1000m. Before each sample, five transects per sector were chosen randomly. The censuses were conducted monthly using a boat that was moving at a constant speed of six kilometers per hour. Information on the number of species and number of individuals were recorded. Throughout the study 39 species were observed, totaling 9417 contacts. The mean number of individuals by census was 41.48 ± 339.53 and species of 2.55 ± 1.90 . The more frequent species were *Egretta caerulea* (44%); *Phalacrocorax brasilianus* (34%); *Ardea alba* (27%) and *Egretta thula* (26%). greater values of relative abundance were observed for five species: *P. brasilianus* (82%); *E. caerulea* (7%); *Larus dominicanus* (1%); *E. thula* (1%) and *A. alba* (1%). *P. brasilianus* presents the greater percentage due to a flock with approximately 5000 individuals resting in the intertidal. The Paranaguá sector had the greater mean number of individuals 134.21 ± 766.86 and Antonina the greater mean number of species 3.70 ± 1.93 . The number of species recorded is a reliable assessment of the community in this environment. It registered a trend towards stabilization of the curve cumulative of species since the fifth sampled month.



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Foraging areas of Cayenne, royal and South American terns breeding in northern Patagonia, Argentina

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Cayenne (*Thalasseus sandvicensis eurygnathus*), royal (*Thalasseus maximus*) and South American terns (*Sterna hirundinacea*) breed sympatrically in Patagonia, Argentina. Very little is known on the breeding foraging areas and feeding patterns of these species and thus studies are needed to understand their role in coastal ecosystems and develop adequate management strategies. We present information on the use of foraging areas by these species at a mixed species colony in the Punta León Protected Area (43° 04' S, 64° 29' W), and in the Punta Loma Protected Area (42° 49' S, 64° 53' W), Chubut, Argentina. Radio-transmitters were deployed on eight nesting adults of each species, which were tracked during the late incubation. Feeding areas were identified during foraging trips by means of radio-telemetry from the coast, using two fixed tracking stations for each colony, consisting each of two attached 9-element Yagi antennae. Terns foraged mostly between the colony and the first 15 km from the coast, and 35 km away from the colony. However, lack of signal reception in some of these trips, indicate that foraging can also take place in waters further away. In general, individual birds were consistent in the use of one particular area. Implications for foraging area partitioning between terns and the coastal management and conservation guidelines will be discussed.



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Spatial distribution of birds across a gradient of coastal environments in southern Brazil

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Environmental gradients are ideal scenarios to evaluate how habitat features affect community structure. We analyzed bird distribution, composition, species richness and abundance along a gradient of three adjacent coastal environments in southern Brazil: sandy beaches, partly vegetated sand dunes and grasslands. Sampling was conducted in January and February 2009. Birds were counted in 18 strip transects 500 x 120 m allocated in each environment. In each transect the proportion of water and bare sand was visually estimated, the number of shrubs counted and vegetation height measured. A vegetation heterogeneity index was calculated using these values. Relations between assemblage structure and environmental variables were evaluated using Canonical Correspondence Analysis and Monte Carlo Multiple Linear Regression. The first three canonical axes explained 90% of the variance between environmental variables and species data. The canonical relationship between the two matrixes was highly significant ($p = 0.001$; 1,000 permutations under compact model). There was a strong correlation between assemblage structure and environmental variables in the first three axes ($r = 0.97$; 0.91 ; 0.82). The first axis reflects the proportion of bare sand, while the second is associated with vegetation heterogeneity. There was no relationship between abundance and the explanatory variables ($r^2 = 0.13$; $p [r^2_{\text{null}} \geq r^2_{\text{obs}}] = 0.06$). The same variables explained 22% of the species richness ($r^2 = 0.22$; $p [r^2_{\text{null}} \geq r^2_{\text{obs}}] = 0.006$). Species richness was negatively associated with the proportion of bare sand (regression coefficient = -0.05 ; $p = 0.02$).



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Vegetated field borders as habitat for insectivorous birds and the effects of pesticides along soybean cycle in Entre Ríos, Argentina

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The intensification of agriculture generally results in the simplification of landscapes at both spatial and temporal scales, affecting biodiversity and its associated ecosystem services. Agricultural intensification affects many species of birds through the loss of habitat and the effects of pesticides. Spatial heterogeneity, contributed to by vegetated borders of cultivated fields, has been shown to benefit insectivorous birds and enhance the ecosystem services they provide. We compared the occupancy of six functional groups of potentially beneficial insectivorous birds (ground omnivorous, ground insectivorous, insectivorous foliage gleaners, insectivorous salliers, aerial foragers and omnivorous generalists) in Entre Ríos, Argentina during the spring and summer, in vegetated field borders with differing vegetative structure and in the interiors of soybean fields. We also explored temporal occupancy patterns in relation to herbicide and insecticide applications and crop stage. We surveyed birds in 20 randomly selected soybean fields over two years (October and December 2007-2008 and February and March 2008-2009) throughout the soybean cycle. During each survey, at each site, we conducted line transects in field interiors (n = 60) and borders (n = 79) with different vegetation structure and estimated the proportional occupancy of each functional group, at each site, in the four seasons using occupancy models. Aerial foragers and common ground omnivores within agroecosystems occupied field borders and field interiors despite pesticide applications. The other groups in general were positively associated with field borders with shrubs or native trees and did not show strong inter-season variations. These results suggest that vegetated field borders are an important habitat for potentially beneficial insectivorous birds in this agroecosystem.



Birds associated with the aquatic habitat in the Estuarine Complex of Paranaguá

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This study evaluates the bird community associated with the aquatic habitat in a bay. The study area is located in the Estuarine Complex of Paranaguá (612km²), the main axes, Paranaguá-Antonina bay and Laranjeiras-Guaraqueçaba bay (48°25'W, 25°30'S). The area was divided, for sample collection, in five sectors established from the saline gradient, where geo-referenced points were plotted distancing 2000m of each other. During September 2008 and August 2009, bird census were conducted in transects measuring 1.66km explored by boat with a constant speed of 10km/h. Monthly five transects randomly selected were conducted in each sector and explored, two watchers in the bow of the boat collected the sample data, each watched a 900 and 200m radius area. Data recorded was the number of individuals and species of birds present and the presence of dolphins. The bird community was composed of 10 species, emphasizes to, *Fregatta magnificens*, *Sula leucogaster* and *Phalacrocorax brasilianus*, register in more than 60% of the census. Quantitatively *P. brasilianus* represented 88% of the contacts, mainly due to the registration of flocks with more than 1000 individuals. The mean number of individuals by census was 95.86 ± 469.29 and the mean number of species by census was 2.61 ± 1.31 . In a valuation of the sectors, the sector 5 had the greater mean number of individuals by census 214.14 ± 798.70 and the sector 1 had the greater mean number of species by census 2.79 ± 1.07 . A total of 19 bird flocks in foraging activity were observed. Dolphins were observed interacting with monospecific and mixed flocks in 68%. The number of species can be considerate a representative sample of the community that use the aquatic habitat at the ECP because the cumulative curve of species leaned to stability at the second sampled month.



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Composition and abundance of bird species in different sizes of *Araucaria* forest patches in southern Brazil

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In the Atlantic forest, many studies proposed that large areas tend to have more species than small areas. In the highlands of south of Brazil, there are different sizes of forest patches surrounded by grasslands. The main goal of this work is to evaluate the composition and abundance of bird species that occur in *Araucaria* forest patches located in northeast plateau of Rio Grande do Sul State, in southern Brazil. We sampled 10 patches of different sizes from December of 2008 to March of 2009. The method used was point count with unlimited-radius during 15 minutes. We used the contact number to calculate the species abundance and nine guilds were selected to evaluate the composition. Linear Regressions were used to evaluate if there is dependence between composition and abundance of birds species and log-transformed patch area. A total of 57 bird species was found. There was not significant difference between composition and abundance of bird species in the patches of different areas. However, species that need great quality of habitat were only found in large patches. We found two species threatened of extinction in Rio Grande do Sul: *Grallaria varia* and *Amazona pretrei*. *G. varia* was only found once and its occurrence can be strongly related to the presence of cattle in the sampled areas. In the composition analysis, we found a significant increase in terrestrial granivores and canopy insectivores with an increase in the area. Taking in to consideration the analysis of groups, we note that some have a greater sensitivity with a decrease of patch area.



Habitat selection by a raptor assemblage in southeast Brazil: biofuels deserve the green energy label?

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Biofuels are considered by some governments and environmentalists as the remarkable alternative to solve two critical problems in the actual world scenario: reducing the dependence on fossil fuel and lowering the CO₂ emissions. However, the effects of replacement of natural areas by plantations on biodiversity, in general, are considered secondary or even unconsidered. Thus, we studied the habitat selection by a raptor assemblage in a heterogeneous landscape (151866 ha), where sugar-cane plantations (ethanol feedstock) represented the largest portion (22%), to examine possible effects of this monoculture in the raptor assemblage. The study site was located in central state of São Paulo (22°15'S; 47°49'W), southeast Brazil, peripheral area of the Cerrado Region. From September 2005 to February 2007 we surveyed birds monthly by vehicle (25-30 km/h), from seven roadsides routes of 14 km each, 3 days/month, totalling 378 samples and 5292 km. We made 2131 records of 15 species (five Falconidae and 10 Accipitridae) in nine different habitats. Only 207 records (10%) from six species were reported for the sugar-cane plantations, where *Caracara plancus* presented 80%, *Rupornis magnirostris* 7%, *Falco sparverius* 6.3%, *Milvago chimachima* 4%, *F. femoralis* 2% and *Elanus leucurus* 1%. According to Bailey confidence intervals, all six species recorded in the sugar-cane rejected this habitat, possibly because of the absence of perches, prey accessibility and low prey abundance in the first stage of cultivar. Our data reveal that the increment of sugar-cane plantations affect negatively even the more common raptor species. We suggest that biodiversity conservation should be taken into account when planning expansion of this monoculture.



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Indirect effect of forest remnants on natural pest control service for agricultural landscape: evidence from artificial prey

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Over the past few decades the consequences of habitat fragmentation is growing concernly, and there is particular important to understand how the fragmentation may affect the biodiversity ecological service. We tested the hypothesis that the forest remnant size in agricultural landscape indirectly affects the herbivory, through the effects on natural predator populations. From 2008 and 2009, we conducted our study in seven fragments (range 6 ha to 105 ha, mean 49.28 ± 36.60 ha) in Southern Minas Gerais, Brazil, where birds were sampled by point counts, and insectivory estimation were evaluated by artificial model predations. Results show that although there were many potential predators (e.g. wasps, ants, birds and mammals), birds were the most important taxon on Lepidoptera larvae model predation (ANOVA and Tukey HSD test: $F_{2,36} = 10.6$; $p = 0.00024$). The simple regression analysis supported the hypothesis that the patch size affected the number of larvae predation by overall taxa (birds: $R^2 = 0.67$, $p = 0.00021$; wasps: $R^2 = 0.79$, $p = 0.000014$; ants: $R^2 = 0.46$, $p = 0.004$), but we did not find specific relationship with the abundance of understory insectivorous bird species. These findings suggest that natural pest control service (mainly from birds) for agricultural landscape declined with remnant reduction, which has implication not only for human welfare, but also in strengthening the economic justifications for conserving the remaining natural habitats and biodiversity in agricultural landscapes



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Effects of wildfires on Amazonian avifauna functional diversity

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Fire is becoming a common phenomenon in Amazonian forest modifying vegetation structure and altering community functioning. In particular, fire is known to affect patterns of bird diversity in tropical forests, but we have little understanding of the consequences of this for functional diversity (FD) of assemblages. For example, under high frequency fire could act as an environmental filter selecting functionally similar species. Here, we used body mass, dietary and foraging traits on 152 bird species to calculate FD in forests under three disturbance levels: unburned, burned once and burned twice. We tested for differences in FD among fire frequencies. We also tested if observed levels of FD were different from random. Bird assemblages in once-burned forests reached similar FD levels of unburned forests. However, burning these forests twice was enough to reduce FD. In general, there was no evidence of fire selecting species functionally more similar than expected by chance. Nevertheless, 30% of unburned sites and 17% of the sites burned only once had greater FD than expected by chance. Despite the greater species turnover, bird FD was similar in unburned and burned once forests, indicating that species complementarity can be maintained by different species compositions. Even if we observed some greater FD values than expected by chance - indicating that competition or micro-habitat diversity might be important for community assembly - in most cases FD was not different from random. These results provide evidence for neutral theories of biodiversity where processes such as dispersal and survival rates are more important than functional traits to the assembly of these bird assemblages.



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Calculation of farmland bird populations on the basis of abundance and landscape systematization

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Information on populations of breeding birds in the context of land-use and biotope structures in various agricultural landscapes is of particular interest in habitat evaluation. For this reason, a new methodological approach was developed using the abundances (territories/10ha) of breeding birds and spatial landscape data for the calculation of bird populations. Starting with a GIS based systematization and spatial marking off of the landscapes of the federal state of Brandenburg (30,000 km²) Germany, the agricultural landscape was defined of the spatial location and subdivided into specific agricultural landscape types. Getting representative abundance data, the territory mapping method was used on 65 randomly chosen and stratified field plots, each 1 km². The calculation results using the abundances and landscape data were partly surprising. In comparison to former estimations, for example, the population of Skylark is 20% lower, actually about 323,000 territories, while the population of Corn bunting with actually 28,000 territories is much greater. In conclusion, there is still a need for further development of such abundance and landscape based calculation methods.



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Long-term effects of the nutrient supply of the great cormorant (*Phalacrocorax carbo*) on nutrient dynamics in a forest soil

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Aquatic birds often have a great influence on the terrestrial ecosystem by transferring nutrients from aquatic ecosystems to land. Bird-derived nutrients partly leach out from the land but partly remain in the terrestrial area, which affects the nutrient dynamics of the colonized area for a long time. Because our previous research shows that the nitrogen decomposition process is influenced by large amounts of nitrogen supplied by the cormorants, we investigated the long-term effects of nitrogen supply on the nitrogen decomposition process in forest soils. The nitrogen stable isotope ratio and nitrogen content of the soil and herbs were analyzed in three cormorant colonies in temperate forests in Japan, each of which has different colonization history. Nitrogen isotope ratios in the forest floor were high in all three colonies compared with forests never colonized. Nitrogen isotope ratios of the soil and herbs in a recently colonized colony showed a linear increase with never occupied, occupied, and abandoned areas, but those in once previously colonized colonies did not differ between occupied and abandoned areas. The nitrogen decomposition process was thought to differ among three colonies because of the different relationship between nitrogen isotope ratio and N content of the forest floor and mineral soil in each colony. As the isotope ratio of the soil was not significantly different between the forest floor and mineral soil and nitrogen isotope ratio and N content were not correlated in previously occupied areas, the nitrogen decomposition process should be changed in these areas. These results show that nitrogen supply by the cormorants should affect the nitrogen decomposition process in a forest for a long time, at least for several decades.



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High bird richness in Viruá National Park, Roraima, Brazil

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Viruá National Park (VNP), located in the Brazilian state of Roraima, contains more than 510 recorded species to date and is one of the richest areas for birds in the country. Here we present the results of our ornithological expeditions there since 2001, based on audio-visual and mist-net surveys and vouchered by recordings, photographs, and collected specimens. VNP is dominated by Amazonian *campinas* and *campinaranas* on an extensive floodplain influenced by muddy-, clear-, and black-water rivers, forming a complex mosaic with *várzeas*, *igapós*, and hilltop “islands” of *terra firme* forest. The patches of *terra firme* have a typically Guianan avifauna, although somewhat depauperate, perhaps due to their isolation. The Rio Branco *várzeas* are impressively rich and contain the endemic *Cercomacra carbonaria*, the only Brazilian population of *Arremonops conirostris*, and isolated populations, including *Synallaxis propinqua*, *Cercomacra nigrescens*, and *Stigmatura napensis*. *Campinas* and *campinaranas* are less diverse, but with a unique avifaunal component (e.g. *Myrmeciza disjuncta*, *Hemitriccus inornatus*, and *Dolospingus fringilloides*). Several pairs of species parapatric elsewhere (e.g., *Pyrilia barrabandi/caica*, *Capito auratus/niger*, *Celeus grammicus/undatus*) co-occur within VNP. We estimate that a total of 600 bird species should be found in the area with further sampling. With its notable species richness, unusual species, and scenic variety, VNP emerges as an important area for Amazonian bird conservation, research, and tourism.



Beached dead seabirds found on the coast of Rio de Janeiro, Brazil: results of a year-long monitoring survey

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Approximately one hundred species of seabirds occurs in Brazil, including 17 taxa considered threatened on national scale. Several of them use the Brazilian coast only during migration. Much still needs to be known about the ecology of migratory seabirds along the Brazilian coast. The present study aims to contribute for the understating of the distribution patterns and seasonality of seabirds wrecked on the coast of Rio de Janeiro. From November 2008 to October 2009, beach monitoring surveys were conducted for recording beached, dead seabirds in two areas along the coast of Rio de Janeiro State: (A) Massambaba (22°56'14"S, 42°28'25"W; 22°58'15"S, 42°1'59"W) and (B) Quissamã (22°12'30"S, 41°28'28"W; 22°5'47"S, 41°8'5"W). A total of 207 carcasses of seabirds were recovered, belonging to 16 species and 8 families. 4 taxa are considered resident, 4 are northern migrants and 8 are southern migrants. Area A presented a much greater diversity of species (16 against 2) and abundance by carcass recovered/km (0.25 against 0.01). Although Area A and B are located only 100 km apart, the discrepancies in the results could be explained by the extreme variation in physical and oceanographic conditions when comparing both areas. Area A is characterized by seasonal coastal upwelling and Area B is influenced by the discharge of Paraíba do Sul river, with turbid waters. Our results indicate the importance of coastal and offshore waters of Rio de Janeiro as a wintering ground for *Spheniscus magellanicus*, *Thalassarche chlororhynchos*, *Puffinus puffinus* and *Calonectris borealis*. A noteworthy record is of the 4 *Calonectris edwardsii*, a poorly known species in Brazil.



Birds in silviculture systems of the southern Brazil: composition, richness and assemblage structure

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Today, development and its compatibility with ecological integrity are important. One good example for this is the forest industry. South America has little knowledge about this area comparatively to North America. This study examines questions about the ecology of bird assemblage in five different treatments: 8 year old pine stands with and without understory, 25 year old stands with and without understory, 27 year old stands with and with understory, 30 year old *Araucaria angustifolia* stands with understory, and > 50 year old native old second growth forest. In every treatment we have 4 plots with 6 point counts. Using abundance data we run Correspondence Analysis to species and to guilds. We used ANOVA to test richness, after using Rarefaction, between different sites. The results show that exist difference between all kinds of pine stands and native forest, but no have difference between *A. angustifolia* stands and native forest. Correspondence Analysis demonstrates a clear gradient between the treatments studied when we consider species or guilds. Species that occur in edge ambient tend to be more frequently observed in plantation. Plantations with understory was more richness, abundance and diversity that the plantations without understory. Therefore, we believe that the understory maintenance in silviculture systems have a relevant importance in the permanence and conservation of birds that occupy this part of forest ambient.



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Land-use changes and biodiversity on an endemism rich island

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São Tomé island (Gulf of Guinea, West Africa) holds a remarkably unique avifauna for such a small island: 20 endemic species and eight endemic subspecies in just 854 km². Primary, secondary and shade forests cover 90% of the land area in similar proportions, and its southwest forests are the second most important for avian conservation in Africa. However ongoing intensification of agroforestry is threatening this unique biodiversity. To understand how endemic taxa respond to land use changes, we measured bird abundance across a gradient of intensification (primary and secondary forest, shaded and unshaded plantations). Abundance and richness did not show obvious trends along this gradient, but species composition changed. Many of the endemics occurred across the entire gradient (e.g. São Tomé paradise flycatcher *Terpsiphone atrochalybeia*, São Tomé sunbird *Anabathmis newtoni*), but forests had a greater percentage of endemic taxa and were the stronghold for most of the threatened endemics (e.g. São Tomé oriole *Oriolus crassirostris*, Giant sunbird *Dreptes thomensis*). Within the plantations, shaded crops had an avifauna more similar to the forests, while unshaded plantations held the greatest percentage of non endemic taxa. Our results show that it is crucial to protect the agriculturally inactive forests to maintain the full community of endemic birds on São Tomé. In addition, a shift from shade to unshaded plantation might also have deleterious effects on the endemics.



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A spatial model for selection of habitat restoration sites for fairy pitta (*Pitta nympha*) after the construction of Hushan Reservoir in western Taiwan

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The ongoing construction of the Hushan Reservoir in Yunlin County, western Taiwan has resulted in the loss of substantial forest habitats for the vulnerable fairy pitta (*Pitta nympha*). Restoration of lost habitat will be the main strategy to mitigate the negative effects that the construction of the Reservoir has had on the forest ecosystem and on the fairy pitta population it has disturbed. The purpose of this study was to build an adaptive spatial model for selecting and prioritising restoration sites by considering the forest ecosystem concerned and the specific habitat requirements for the target species, the fairy pitta, simultaneously. We determined the size of the area that should be offset by estimating the forest areas that had been destroyed during the construction of the Hushan Reservoir. In the forest ecosystem approach, we quantified the habitat status near the Reservoir by calculating the percentage of broad-leaf forest cover, largest forest patch index and the mean nearest distance to other broad-leaf patches using GIS and the moving window method. In the target species approach, we modeled the occurrence of fairy pitta within the study areas based on previous studies on its habitat requirements at landscape-level using the Maximum Entropy Modeling method. Finally, the suggested restoration sites and their priorities were delineated by combining the results of the two approaches we have adopted.



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Bird sensitivity to forest fragmentation in the upper Paraná River, Brazil

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This study compares bird sensitivity to forest fragmentation in two contiguous but distinct landscapes of the Upper Paraná River Floodplain region, states of Paraná (PR) and Mato Grosso do Sul (MS), Brazil. One landscape (PR) has less permeability than the other (MS) on the opposite shore. The Paraná River is the boundary between Atlantic Forest (ATL; margin PR) and Central South America (CSA; margin MS) zoogeographic zones. Several bird species occur in both landscapes being expected differences in their sensitivity due to landscapes permeability and biogeographic association. Point counts were used to obtain abundance of birds in two small and two large forest remnants in each landscape. Species recorded only or with greater abundance in large remnants were considered sensitive. 69 and 78 bird species were recorded at PR and MS respectively. greater proportion of bird species was sensitive in PR (53%) than in MS (27%). 30% of species found in both landscapes showed different sensitivities. Species related only to ATL had greater proportion of sensitive species in both landscapes. However, all species related only to CSA recorded at MS and 50% of species related to this zone recorded at PR were not sensitive. So, different tendencies of sensitivity in the analyzed bird species could be explained, mostly, by the association to a biogeographical zone. We also suggest that there are variations in the sensitivity levels to forest fragmentation due to the localization of the fragmented landscape in the geographical distribution of the species. Therefore, beside differences in landscape permeability, other factors could contribute to tendencies to forest fragmentation.



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Seasonal variation in abundance and habitat use of foraging shorebirds in Baía de Todos os Santos, northeastern Brazil

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We present the first description of the seasonal variation in abundance and distribution of foraging shorebirds in relation to environmental factors in Baía de Todos os Santos (12°44'S, 38°44'W), Brazil. The study was done in an intertidal area of 280 ha, inserted in a complex of mudflats, sandy beaches, channels and mangroves, intensively used by foraging shorebirds. Counts were carried out weekly, within two hours from the time of low tide, from January to December 2007. We recorded all shorebirds on 11 adjacent sectors, using GPS positions and landmarks, and expressed their abundance as birds per ha. The density of shellfish collectors in each sector was used as a proxy for human disturbance. Cores of sediment (10x10x10cm) were sampled in each sector and used to estimate invertebrate prey abundance. Sediments were classified on a scale with 5 levels of increasing particle size. Using GIS we also calculated the area of mangrove around each sector and measured its distance to main channels and high-tide roosts. Associations between bird species and environmental factors were explored using a canonical correspondence analysis, which indicated that the foraging bird assemblage could be divided into five main groups. The most important environmental factors driving bird distribution and abundance on the intertidal flats were: invertebrate abundance, type of sediment and area of mangrove cover. The analyses of seasonal abundance revealed that five species were residents and 10 were Neartic migrants. Greater densities were found in March and October, during the migration period, indicating that this bay is a stopover for animals that use southern non-reproductive sites. Our findings imply that maintenance of the diversity of intertidal habitats in this bay is crucial to satisfy the particular habitat requirements of the resident and migrant shorebirds.



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Distribution of birds on an agricultural mosaic: ecological niche modelling as a predictive tool

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The process of landscape change with habitat fragmentation and loss has dramatically influenced the biodiversity. The understanding of species distribution patterns in human-dominated landscapes could provide useful information for management and conservation actions. This study aimed to analyze bird species distribution on a highly fragmented agricultural mosaic (Corumbataí river basin, 170,000 ha), in southeastern Brazil, by the ecological niche modeling. Species were surveyed in 95 random points by unlimited radius point counts between April to September 2006. 39 bird species (33% forest dependent, 36% open habitat, 31% habitat generalist) and seven environmental variables (land cover, landscape diversity, forest distance, water distance, elevation, slope, aspect) were modeled in Maxent with 20-m spatial resolution. Thresholds of the minimum training presence were used to reveal the suitable areas for species occurrences. Models were evaluated by the AUC value and by the proportional binomial test. Most models were considered satisfactory (AUC > 0.75), but only 38.46% of models were statistically significant ($p < 0.05$). Forest bird species presented the best statistical and biological models. Environmental heterogeneity of the landscape reduced the model performance for widely distributed habitat generalist species. Results suggest a reduced environmental suitability of this agricultural landscape for most forest-dependent bird species. Ecological niche modelling proved to be a useful tool in predicting the environmental suitability for bird species in a finer spatial resolution. (FAPESP Procs. Nos. 2005/00405-4, 2008/03500-6).



Bird communities in lowland Atlantic forest fragments in Rio Grande do Sul and Santa Catarina States, Brazil

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The Atlantic forest is the biome that has lost the greatest extent of its original area in Brazil. Today, only 8% of the original cover remains. Today, lowland Atlantic forest fragments are almost gone in southern Brazil. The main objective of this work is to evaluate the bird communities in lowland Atlantic forest fragments in northeastern Rio Grande do Sul State and southeastern Santa Catarina State. Ten fragments that have areas ranging from 4.6 ha to 169.8 ha were sampled using the point count method from December 2008 to March 2009. Counts lasted 15 minutes with unlimited radius. One count was carried out in areas smaller than 10 ha and was repeated three times. In the larger areas, four counts were carried out once each. Linear Regression was used to evaluate the effects of area (log transformed) in the richness, abundance and composition of birds. During the counts, 81 bird species were found. Species richness ranged from 18 to 44 in the fragments and there was significant difference in the species richness with the increase of area. The mean contact number was similar among areas. In Rio Grande do Sul, species in the vulnerable category were more often found in large areas. The categories endangered and critically endangered were similar. In relation to feeding habits, invertivore and omnivore species were more found in large areas. There was not significant difference to the frugivore, granivore and nectarivore species.



Species richness and diversity of understorey birds in Atlantic forest remnants of Minas Gerais State, Brazil

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Fragmentation of the Atlantic Forest has led to the formation of very small remnants in southeaster Brazil leading to declining biodiversity. Here, conducted in different years, we banded understorey birds in three forest fragments in the SE Minas Gerais State, two being seasonal semi-deciduous, covering 56 ha (F1) and 277 ha (F2), and a third covering 90 ha of rain forest (F3). Based on banded birds, we compared species richness and diversity of the three areas with those in F4, two 100-ha plots of seasonal semi-deciduous forest in an area of around 36,000 ha in the Rio Doce State Park. The Park is situated in eastern Minas Gerais State, a well conserved area and useful as a reference for impacted areas. In F1, there were 420 individual captures; in F2, 217; in F3, 553; and in F4, 108. Rarefaction curves revealed that the F4 consistently possessed greater richness of species than F1 and F2, but not in relation to F3. On the contrary, permutation tests revealed that there were no differences in the Simpson diversity indexes, indicating similar dominance levels. Areas F3 and F4 are the best conserved, where the presence of more demanding species seems to favor richness. F1 is secondary forest in an advanced stage of regeneration, constituted mainly of bird species that are generalist in terms of habitat. Area F2, despite being a biological reserve, suffers anthropic impacts, as a consequence of the advance of urbanization on the perimeter.



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Network analyses of bird and plant assemblages of Socorro Island as a tool to evaluate the impact of an introduced herbivore, explore community resilience and prevent extinctions

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Network analyses on bird- plant assemblages on Socorro Island, pondered by their relative abundance (preserved and overgrazed *Croton* scrub and montane forest) indicate that bird-plant networks are simple with only one compartment. Assemblages in *Croton* scrub have few species and did not show significant nestedness. Montane forest assemblages have more species and showed significant nestedness suggesting a strong mutualism between fruiting trees and frugivorous birds. Our results suggest that on Socorro Island, ecological specialization is context-dependent. In *Croton* scrub *Parula graysoni*, the most abundant and widespread bird on the island was the least specialized. However, in montane forest, *Mimus graysoni* was among the least specialized. This result is counterintuitive but could be explained by the fact that the majority of woody plant species in montane forests offer food resources for this species. Moreover, this finding suggests that montane forests on Socorro Island are the result of an intimate mutualism with birds. Plant and bird assemblages in *Croton* scrub showed the greatest differences caused by sheep overgrazing. By comparing network similitude between assemblages it was possible to detect species with a similar set of interactions - they constitute redundant elements that allow ecosystem resilience. By looking at extinct birds, lost critical interactions can be detected to help us unveil factors leading to their extinction.



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Why are birds and other taxa more abundant on organic farms? A meta-analysis

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Agriculture is currently the largest threat to biodiversity of birds globally and is likely to be a major threat to other taxa. Thus understanding how to integrate farming and wildlife together successfully is a major goal for conservation ecologists. Organic farming is one method that increases biodiversity relative to conventional methods of agriculture. Many studies have compared biodiversity on organic and conventional farms or focussed on individual components of organic farms (e.g. on the effects of spraying or non-cropped habitats on biodiversity). Recent reviews have concluded that there is more biodiversity on organic than conventional farms, however, they could identify which features of organic farming are of particular benefit to biodiversity. We present the findings of a meta-analysis which has disaggregated the effects of different components part of organic farming, thereby identifying which of those components are most responsible for the observed increases in biodiversity (birds, mammals, invertebrates and plants).



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Avian diversity in an exotic eucalyptus tree plantation: effects of proximity to native forest

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Agroecosystems are gaining importance in ecological research for their potential conservation value in a world dominated by human-modified landscapes. Studies relating specific features of this complex array of land cover and its capacity to maintain biodiversity enable us to improve our efforts towards a more sustainable agriculture. In southeastern Brazil major changes in the type of land use are occurring, since different cultures are being replaced by sugar cane crops or exotic tree plantations. We analyzed the influence of the distance from the nearest native forest fragment on avian richness, composition and abundance detected in an eucalyptus plantation of 2224 hectares. Distances varied between 66 and 1775 meters and no significant correlation was found between avian parameters and distance from forest fragments. There was also no effect when bird species were grouped by their sensitivity to habitat fragmentation. These results may indicate that distance alone does not play a significant role on increasing the alpha diversity of the silvicultural plots, at least at the geographic scale of this study. The importance of natural forest fragments to the study region, however, is not being questioned; they contribute greatly for its beta diversity. This project is financed by Fapesp (Proc. No. 06/60954-4 and 09/52684-5).



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Comparison between point-count and transect bird census techniques in the Southern Pantanal, Mato Grosso do Sul, Brazil

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In bird surveys, the methodology varies depending on the type of vegetation and accessibility of the area. However, the vegetation of the Pantanal is defined as a mosaic of forest and open areas and its accessibility varies according to topography. Thus it is necessary to test the sampling methods in terms of richness and abundance to improve further studies in this biome. Therefore, we performed a bird survey using both point-count and transect census techniques in two different habitats in the Pantanal (gallery forest and thecoma savanna). The study was conducted in August 2009 at sunrise and two hours before sunset, including 50 meters in diameter in both census and 20 hours of observation per method. The transect was performed for two hours, an average of 1460 meters per hour, covering 292 km². Seven points were considered in the point-count method, covering approximately 55 km² of sampled area. During the transect methodology, a total of 148 species were recorded, belonging to 20 orders, 44 families and an abundance of 1155 contacts. Concerning the point-count method, we recorded 122 species belonging to 16 orders, 39 families and 932 contacts. For both methods, Tyrannidae was the most representative family, followed by Emberezidae. Considering only the species sampled in each method, 52 species were recorded at the transect, and only 26 in the point-count. The transect method was superior (qualitative and quantitatively) due to this methodology covers the sample area larger than four times in relation to the point-count method, which consequently increases the richness and abundance. However the point-count method provides more richness and abundance per area, it also provides more replicas, which can be advantageous in some studies, mainly for statistical approaches. In conclusion, both methodologies show advantages and disadvantages and the choice of one method must depend on the physiognomic characteristics of the study area and especially the goal of The study.



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Bird species richness, similarity and turnover in the Cerrado Region: are non core areas irrelevant?

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Planning conservation strategies for regional avifaunas need information of its richness and spatial distribution. Published accounts on the Cerrado Region avifauna have overlooked non core sites. In this region, where habitat destruction occurs at a greater rate than Amazonian forest, we made an analysis of available bird inventories considering not only core, but also peripheral areas. The aim of our study was to compare species richness, composition and similarity between core and non core areas considering 30 sites: 19 from core area and 11 from Amazonian and Atlantic forests cerrado enclaves. 791 species were reported in all sites, more than 90% of the 860 species listed for the Cerrado Region. Our analysis revealed a high intersite heterogeneity: a large portion of the species - 342 (71.1% of them forest birds) was recorded in only 1-3 sites, whereas 90 species (51.1% of them savanna birds,) occurred in 27-30 sites. Core and non core areas harboured respectively 661 and 604 species, including 187 and 130 exclusive species. Cluster analysis using five binary coefficients and bird species presence-absence as the variables revealed consistently four large avifauna groups: Amazonian Forest influence (5 sites), South Atlantic Forest influence (4), central and southeast Brazil (10), central and north Brazil (8). Cluster analyses using just savanna inhabiting birds showed more similar avifaunas (e.g., Sorensen index, mean 0.621 ± 0.113 SD, $n = 435$) than all birds (0.539 ± 0.109 , $n = 435$); Wilcoxon, $z = 17.92$, $p < 0.0001$. Peripheral cerrado areas deserve more attention for conservation, harbouring a diverse avifauna under contact with other biomes and at high risk of destruction.



Distribution and conservation status of birds of prey (Falconiformes) in Fizes Basin (NW Romania)

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Fizes Basin, is extending on a surface of about 56171.74 ha (16 % forest, insular distributed and with low connectivity between them) (David A, 2008) it became part of Nature 2000 Network as SPA (Special Protected Area) and include three of the most important ornithological natural reserves of Transilvania (Pike Lake, Legii Valley, Sic Reed wetlands). Until the mid-XIX century, in Fizes Basin, species like: *Gyps fulvus*, *Aegypius monachus*, *Aquila heliaca*, *Milvus milvus*, *M. migrans*, *Falco peregrinus*, *F. vespertinus* were nesting (Catuneanu et al., 1971), but nowadays they are extinct. The study we made in Fizes Basin lead to the identification of 12 birds of prey species: *Accipiter gentiles*, *A. nisus*, *Buteo buteo*, *B. lagopus*, *Circus cyaneus*, *C. aeruginosus*, *C. pygargus*, *Circaetus gallicus*, *Falco tinnunculus*, *F. columbarius*, *F. subbuteo*, *Pernis apivorus*. This number is 40% from the total of 30 Falconiformes species present in Romania and 31% from the total of 39 Falconiformes species in Europe. Distribution, niche superposition, habitat use and phenological succession of all species nesting here had been studied. The strong environmental stress determine the majority of the nesting pairs found here to belong to species with greater plasticity regarding ecological necessities (*Buteo buteo*, *Circus aeruginosus* and *Falco tinnunculus*). The study carry to the conclusion that the structure of falconiformes populations from Fizes Basin suffered in the past few years large changes due to the antropic impact (the forest loss or fragmentation, agriculture intensification and traditional sheep grazing disappearance). We also presented a program of public awareness, with local population.



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Protection of seabird colonies in São Paulo State, Brazil: establishing new Marine Protected Areas

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The coastal area of São Paulo State encompasses 2.119.000 hectares containing 140 islets and islands. Twenty one of these areas are used for breeding by five resident seabird species: magnificent frigatebird *Fregata magnificens*, brown booby *Sula leucogaster*, royal tern *Thalasseus maximus*, cayenne tern *T. sandvicensis eurygnatha* and South American tern *Sterna hirundinacea*. However, nine of these breeding sites are not fully protected yet. In 2008, the government of São Paulo State established new protected areas of the marine environment covering an area of 1.123.107,68 hectares and including almost all islands along the state coast, which were mainly classified under the category of “sustainable development”. Nevertheless, some of the breeding sites were classified under the status of “special management area for protection of biodiversity”, a category that does not have effective legal protection. Even though there are 40 islands classified as National Ecological Stations and State Parks, those nine breeding sites still remain without legal protection, despite their importance for breeding of vulnerable species such as Royal tern and South American tern. Therefore, there is a urgent need for the establishment of wildlife refuges at Laje da Conceição Island (Itanhaém), Itaçuce and Apara Islands (São Sebastião), Alcatrazes Archipelago (São Sebastião), Queimada Grande Island (Itanhaém) and Figueira Sul Island (Cananéia) in order to protect these seabird colonies. Additionally, other coastal and mangrove areas (e.g Cubatão-Santos, Taniguá in Peruíbe and lake areas of the south of the state) used for foraging, landing and stopover of these marine birds and shorebirds species should also be fully protected.



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Richness and frequency of bird communities of the wetland of Santa Genebra Reserve, Campinas, SP

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At present, the fragmentation of the forest in the Atlantic Forest is causing a direct impact in the bird community. Thus, it is essential that preservation actions are taken to minimize the pressures of the negative environment. Thus, faunal surveying are extremely important to evaluate the biodiversity, which will help the monitoring of these species. Through this monitoring, it is possible to structure specific plans that decrease the problem of the loss of the habitat. In between August 2008 to August 2009, were performed weekly visits to find out the richness and the frequency of the bird community present in the wetland adjacent to the Santa Genebra reserve in Campinas, São Paulo. Data about these subjects has never been deeply investigated, leaving a gap on the make up of the paludicola and aquatic bird communities present in the reserve. A total of 312 hr of field work was carried out, using visual and aural contacts. During this period, 83 bird species in 15 orders and 36 families were identified. The most frequent families were: Jacanidae, Rallidae, Furnaridae and Passeridae. The Ardeidae, Alcedinidae, Falconidae, Emberizidae, Hirundinidae, Tyrannidae, Picidae and Ramphastidae families, occurred practically all year along. In the Ciconiiformes order was registered 7 new species: *Ardea alba*, *Ardea cocoi*, *Egretta thula*, *Mycteria Americana*, *Nycticorax nycticorax*, *Platalea ajaja* and *Tigrisoma lineatum*, in the Gruiformes two new were registered: *Aramus guarauna* and *Laterallus melanophaius*, adding up to 9 new species to the known richness of the Santa Genebra Reserve birds.



Restoration and management of Baltic coastal meadows for birds

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Boreal Baltic coastal meadows are among the most threatened habitats in Europe, designated as priority habitat type according to EU habitat directive. Coastal grasslands are semi-natural habitats, conservation of which is dependent on traditional extensive agricultural activities. Some of the coastal meadows have a history of more than one thousand years of continuous grazing or mowing and have never been fertilised. Baltic coastal meadows are valuable e.g. as the breeding sites for Southern dunlin (*Calidris alpina schinzii*), ruff (*Philomachus pugnax*), black-tailed godwit (*Limosa limosa*), avocet (*Recurvirostra avosetta*) and an endangered amphibian, natterjack toad (*Bufo calamita*). Lesser white-fronted goose (*Anser erythropus*) uses coastal grasslands as stop-over sites. Within the last sixty years management has ceased on many semi-natural grasslands due to non-profitability. This has resulted in extensive loss of the habitat, followed by the decline of populations of breeding waders and other meadowbirds. Recently the EU and national agri-environmental subsidies have partly succeeded in reversing the decrease of semi-natural grassland areas around the Baltic. Several LIFE-Nature projects and other conservation activities have contributed to restoration of coastal meadows. Besides just recovering management on coastal areas, more attention should be paid on meeting specific habitat needs of endangered species, like suitable grazing intensity, timing of grazing season, restoration of wet depressions etc. Sound and feasible subsidy schemes and site-specific guidelines can be appropriate tools when managing semi-natural habitats for biodiversity.



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Modularity of a seed dispersal network formed by bats and birds

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Seed dispersal is an essential process for plant population and community dynamics. About 90% of the woody plants in tropical forests depend on seed dispersal by animals. It has been suggested, but not tested, that seed dispersal networks are formed by mutualistic modules, i.e. subgroups formed by closely related species that interact with a similar subset of partners. Until now all studies focused only at one vector at a time, leaving all other animal groups aside, and so some conclusions may not apply to whole ecosystem services. We studied a seed dispersal network from northeastern Brazil where the main vectors (responsible for 80% of the seed rain in some localities) are included: bats and birds. We (i) assessed the modularity of the whole network, and (ii) tested the overlap between bird and bats in their services. The degree of modularity was significantly greater than that of random networks ($M = 0.16$, $p = 0.009$). There were three modules: one comprising only birds, and two by bats only, and so there was low diet overlap between the two vectors. Birds dispersed a high richness of plant species, but with a low intensity in interactions, and bats showed the opposite pattern. The modularity observed for the whole network was intermediate, considering values observed in seed dispersal networks formed by a single vector. Our results are consistent with the hypothesis of mutualistic modules, and reinforce the notion that ecosystem services are indeed formed by a mosaic of subservices. This finding has important implications for conservation, as plans targeted at forest restoration have to take into account the different properties of the parts of an ecosystem service.



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Vertical zonation and community structure in an altitudinal gradient in the region of Itatiaia National Park, Southeastern Brazil

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The altitudinal range (from 400 m to 2400 m altitude) found in the Itatiaia National Park, Rio de Janeiro, Brazil, provides several environments, and in this study we analyzed life zones in order to understand the community structure of birds within each elevational zone, and possible similarities or differences between the north and south sides of the mountain. The gradient can be divided into five life zones on the south and three on the north. The life zones were grouped in bands - Hot Zone (400 to 700 m), intermediate tropical zone (701 to 1,100 m), tropical zone (1,101 to 1,700 m), mid-temperate zone (1,701 to 2,000 m) and temperate zone (2,001 to 2,400 m). From 1984 to 1999, we sampled 25 points by mist netting, and 3,494 birds of 186 species were identified, which is 32 families. The most well-represented family was Tyrannidae (36 species on the south and 13 on the north), and the most frequent species was *Chiroxiphia caudata* ($n = 186$ captures). The areas having the greatest number of species were the intermediate ones, the Intermediate Tropical Zone ($n = 104$) on the north and the Tropical Zone ($n = 68$) on the south. According to the cluster analysis, the most similar zones in bird fauna were the intermediate-tropical and tropical on the south, and the tropical and intermediate on the north. Similar altitudes in opposite sides had similar composition of avifauna. For five feeding guilds, frugivorous, granivorous, insectivorous, omnivorous and nectarivorous, significant statistical differences were detected when comparing the tropical intermediate and temperate zones in the south and the tropical intermediate temperate in the north.



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Importance of connectivity for the conservation of birds

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Forest fragmentation alters the local and regional patterns of biodiversity through loss of single microhabitat, habitat isolation and changes in dispersal and migration patterns. Its deleterious effect on birds is felt mainly on the groups with more specific ecological requirements. The relationship of these groups with greater sensitivity to fragmentation, the size of those respective area needed to live and play their ecological function are directly proportional. However the preservation of large contiguous areas isn't feasible in many regions, mainly due to the massive cattle farming. A study conducted in the upper Paraná River floodplain, Paraná, Brazil, evaluated the importance of two small riparian forests in maintaining the regional diversity of birds. These forests, with respectively 4.5 and 10 hectares, are connected to larger fragments of riparian corridors, showed a great ability to maintain high species wealth (128 and 145 species respectively). In addition birds very sensitive to fragmentation as *Campylorhamphus trochilirostris*, *Hylocryptus rectirostris*, *Pteroglossus castanotis*, *Ara chloropterus*, *Xiphorhynchus fuscus* and *Hypoedaleus guttatus* could be found in the areas and the first three of them, being frequently contacted. Thus it is concluded that the short distance between fragments and the physical linkage through corridors allow the maintenance of a large number of species and species with greater requirement of habitat, even in small fragments, because individuals are capable of using different fragments nearby or do occasional longer movements, maintaining marginal populations by rescue effects or re-colonization.



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Abundance of terrestrial endemic birds of Fernando de Noronha Archipelago (Brazil)

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This study assessed and compared the abundance of the terrestrial endemic birds in *Fernando de Noronha* (FN) Archipelago (NE Brazil). *Elaenia ridleyana* (Noronha Elaenia) and *Vireo gracilirostris* (Noronha Vireo) are considered globally vulnerable and near threatened (respectively), however they are still poorly studied. FN is a volcanic archipelago with 21 islands, and at the larger island occur five species of terrestrial birds (non marine) including *E. ridleyana*, *V. gracilirostris*, *Zenaida auriculata* (eared dove), *Passer domesticus* (house sparrow), and *Bubulcus ibis* (cattle egret). In September and October 2005 and 2006, we estimated the abundance of these terrestrial species by 159 point counts (5 min, 25m radio) between 5:00 and 9:00 h. The points were classified by vegetation covering and human modified areas. We registered 2,559 birds, including 284 *E. ridleyana* (mean = 1.8, standard deviation = 1.8); 610 *V. gracilirostris* (3.8, 4.2); 1,199 *Z. auriculata* (7.5, 10.3); 280 *P. domesticus* (0.05, 0.4); and 186 *B. ibis* (1.2, 5.9). We found frequencies of 63% *E. ridleyana*; 88.7% *V. gracilirostris*; 89% *Z. auriculata*; 24% *P. domesticus*; and 23% *B. ibis*. We registered greater abundance of *E. ridleyana* and *V. gracilirostris* ($p < 0.001$) in sites predominating vegetation. *Z. auriculata* were more abundant in open habitats and human modified areas ($p < 0.01$), and *P. domesticus* and *B. ibis* were aggregated in antropogenic sites. These findings suggest preference for specific sites, and show a possible human interference in abundance of endemic endangered birds. This study was continued in 2009 and detailed conclusions will be published soon.



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Habitat use of four sympatric species of *Drymophila* antbirds

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We investigated the habitat use of four *Drymophila* species at two sympatric localities in Brazilian Atlantic Forest, using the point count technique combined with playback method at montane forest trails (1100 m up to 2100 m above sea level). At each sample point, located at intervals of 50m of elevation, we used a circular sample-plot to quantify ten habitat variables, including elevation. The relationships between the presence of each species and habitat variables were examined using logistic regression. We also evaluated the importance of bamboo as foraging substrate and the differential use of three bamboo genera with chi-square tests. The presence of each species was related to different habitat features: *D. ferruginea* thrives where *Guadua* bamboos and trees reach high densities; *D. genei* were recorded at higher altitudes, with high abundance of *Chusquea* bamboos and dense herbaceous/arbustive vegetation. *D. rubricollis* and *D. ochropyga* were related with none studied factors but altitude (both prefer lower elevations). All species but *D. genei* preferentially selected bamboo as substrate for foraging but differed in the use of bamboo genera. Only *D. rubricollis* foraged in the three bamboo genera sampled (*Chusquea*, *Guadua* and *Merostachys*) but showed a significant preference for *Chusquea* and *Merostachys* when compared to *Guadua* and non-bamboo plants. *D. ochropyga* foraged in *Chusquea*, *Guadua* and in non-bamboo plants but showed no difference among them. Both *D. genei* and *D. ferruginea* foraged only in one bamboo genus; *D. genei* foraged equally in *Chusquea* and in non-bamboo substrates and *D. ferruginea* foraged preferentially in *Guadua*. The results showed that the birds segregated each other both spatially (at different elevations) and through differential habitat use.



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Fire influence on the structure of bird mixed-species flocks in a grassland physiognomy of Cerrado

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The Cerrado vegetation province, considered a threatened world hotspot of diversity, can support wild fires periodically. Despite being fire-adapted, the frequency of criminal fires may change ecological patterns and processes, and also prejudice its intrinsic resilience. We aimed to verify the influence of fire on the structure of mixed-species flocks of birds in a grassland area of Cerrado ("campo sujo"), before and after a fire event occurred on July, 2009, and lasted about two days. The burnt area is approximately 300ha, around 13% of Itirapina Ecological Station, São Paulo state, Brazil. We gathered data at three times with respect to the fire: T1 (25-30 days before the fire), T2 (25-30 days after) and T3 (50-55 days after). We sampled $n = 36$ bird mixed-flocks, 12 per period. Twenty-four species formed flocks: 23 during T1 campaign, 15 and 21 species in T2 and T3 respectively. We used species abundance data of each period to compare, through t -test, the Shannon index of diversity. There were no significant differences only between T1 and T3. The Friedman test indicates changes in abundance patterns, although the occurrence frequency of species in mixed-flocks was not influenced by the fire (Kruskal-Wallis test). One species was responsible for 13.85% of variance in mixed-flocks, and 11 species explained 84% (PCA). Seven birds play a role as nuclear species. Five species surveyed in this study are threatened, and four are endemic to Cerrado. This study suggests that fire can affect some mixed-flocks patterns, due to the sensitivity of some species, but the recovery of these patterns can be rapid



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Funding Bird Conservation Projects through the Neotropical Migratory Bird Conservation Act

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In 2000, the congress of the USA passed the Neotropical Migratory Bird Conservation Act to help protect migratory birds that breed in or migrate through the USA and Canada and spend the non-breeding season in Latin America and the Caribbean. The U.S. Fish and Wildlife Service manages a grants program to implement the terms of this legislation. The Act establishes a competitive, matching grants program that supports public-private partnerships carrying out projects in the USA, Canada, Latin America, and the Caribbean that promote the long-term conservation of Nearctic-Neotropical migratory birds and their habitats. Recent appropriations have been \$4 million in 2004-2007 and \$4-5 million in 2008-2010. A number of conservation groups are working to increase this amount substantially over the next few years. At least 75% of these funds are to be used to support projects outside the USA. Between 2002 and 2009, the program supported 296 projects, coordinated by partners in 48 USA states/territories and 36 countries throughout the Western Hemisphere. More than \$30 million from NMBCA grants have leveraged about \$134 million in matching contributions. Projects involving habitat conservation have affected about 1.9 million acres of bird habitat. In addition to habitat conservation, grants provided through NMBCA support research and monitoring, law enforcement, and outreach and education. Examples of successful projects from South America will be used to show how both Nearctic-Neotropical migrants and resident species south of the USA can benefit from this program. Details are available at <http://www.fws.gov/birdhabitat/Grants/NMBCA>.



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Habitat characterization of the military macaw (*Ara militaris*), in México

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In the past 200 years, development of civilization led to the transformation of large natural areas in anthropogenic landscapes, affecting the functioning of natural ecosystems. The military macaw populations are fragmented, mainly due to habitat lost. The habitat has a clear influence on the survival of animal populations, as these have certain preferences for habitat characteristics. This selection depends on the breeding and feeding requirements of the species. The objective of this study was to determine the structural features of the green macaw habitat in eight distribution sites throughout Mexico. In six distribution sites green macaw, the vegetation used can be classified as tropical forest deciduous and on two sites it is a tropical semi-deciduous forest. The Shannon diversity index showed bigger plant diversity in Guerrero (2,983), while the smaller diversity was found in Nayarit (1,987). The most abundant plant species in Sonora, Sinaloa and Nayarit were *Brosimum alicastrum* and *Hura polyandra*. In the localities of Guerrero and Oaxaca, the most abundant plant species were *Mimosa luisiana*, *Cytocarpa procera* and *Bursera aptera*. In eight sites trees with DAP of 2 cm to 65 cm. The eight sites are used by the Military macaw as feeding and breeding sites.



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Bird responses to food abundance across an elevation gradient: implications for climate change

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Food abundance, which is often influenced by climate, is thought to be a major driver of annual fecundity and recruitment in migratory songbirds within northeastern North America. Therefore, knowing how climate affects bird food abundance is critical for understanding population dynamics, regulation and the effects of impending climate change. Long term monitoring of insect abundance across the climate gradient associated with 600 m of elevation within the Hubbard Brook Experimental Forest, NH, USA reveals significantly greater food abundance for birds in the cooler climates at upper elevations within northern hardwoods forest. Indeed, biomass of caterpillars and spiders is double that at low elevation and biomass of flying insects is triple that at low elevation. Bird abundance is greater in the cooler upper elevation environments in some but not all years, thus frequently showing a lack of congruence with the strong patterns in food abundance across the elevation gradient. We hypothesize that environmental variability, primarily in spring weather during settlement, and the spatial patterns of annual recruitment and site fidelity preclude close matching of bird density with food availability. We project that the consequences of climate-induced changes in site fidelity and in food supply will only further disrupt any matching between the spatial distribution of birds and the abundance of their foods. Such changes will likely reduce bird population densities and erode resilience of migratory bird populations to disturbance.



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Effects of forestry management on the composition and abundance of understory bird communities in the "Distrito Florestal Sustentável" of the BR 163 highway

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Species of birds of the forest understory are among the most vulnerable to the effects of the timber exploitation. We sampled understory bird communities of the "Distrito Florestal Sustentável" of the BR 163 highway, a 19 million ha. mosaic of 14 conservation units including some devoted to timber exploitation. Field work took place between October 2008 and September of 2009 at 13 sites in the following conservation units: FLONAs Tapajós (Km 83 and Km 117), Itaituba II and Trairão (Cupari and Vicinal of Cacau), RESEXs Riozinho do Anfrísio, PARNA Amazônia, and localities Retiro, MAFLOPS, Fortaleza, APROESTE, Rabelo and Burandir. At each site, we evaluated species richness, composition, and abundance of local communities with 3 lines of 10 mist-nets each, separated from each other by 1 km along a 3 km long transect. During the entire study, we accumulated a sampling effort of 4002 net / hours and captured 501 individuals belonging to 92 species. The sites with greater richness were FLONA Trairão (Cupari) with 34 species, followed by FLONA Itaituba II (30 species), Fortaleza, and FLONA Trairão (24 species each) and PARNA Amazônia (23 species). The average species richness of the remaining 8 areas was 18.4, varying between 13 and 21 species. Mixed species flock insectivores were the most frequent ecological group captured at all sites (26% of all captures), indicating that in spite of significant differences in vegetation structure among sites due to distinct logging practices, this disturbance-sensitive group has not been adversely affected along the BR 163 highway. Probably, local landscape conditions favoring the colonization of disturbed areas by populations from less disturbed sites might explain this pattern.



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Spatiotemporal variation in diet-niche overlap of frugivorous birds in a subtropical montane forest

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Analyses of niche overlap can provide insights on processes affecting interspecific relationships in a community. Usually, niche overlap is assumed to be inversely related to competition intensity for resources. Resource scarcity would lead to a low niche overlap by increasing interspecific competition. Resource availability and its spatiotemporal variation are often ignored, however, and alternative explanations are overridden. We studied spatiotemporal variation in diet-niche overlap of frugivorous birds in a subtropical montane forest in NW Argentina. Six sites in four altitudinal strata were monitored during the main fruit period. One of those was bi-monthly visited for a year. Pianka's index was calculated including fruit availability data and compared against null models. Geographically, diets always overlapped more than expected by chance. Sites with more bird species had lower overlap levels, which would be related to specialization in few preferred fruit species rather than to competition, since fruit density and diversity in these sites were the greatest. Temporally, diets overlapped less than expected by chance only in the month with fruit scarcity, which would have increased the interspecific competition. Remaining months showed greater overlap than expected by chance, but months with the greatest fruit abundance had the lowest absolute overlap indices. Thus, low overlap levels were reached in fruit scarcity periods by increasing interspecific competition, but also in resource abundance periods by consumption of preferred fruits. Hence, resource availability data were useful to distinguish two processes causing the same pattern.



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Quantifying avian nest survival along an urbanization gradient using citizen and scientist generated data

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Despite the increasing pace of urbanization little is known about the factors that limit bird populations (i.e., population-level processes) within the urban/suburban land-use matrix. Here, we report rates of nest survival within the matrix of an urban land-use gradient in the greater Washington, DC area for five common songbirds using data collected by scientists and citizens as part of a project called *Neighborhood Nestwatch*. Using program MARK, we modeled the effects of species, urbanization at multiple spatial scales (canopy cover and impervious surface) and observer (citizen vs. scientist) on nest survival of four open-cup and one cavity nesting species. In addition, artificial nests were used to determine relative impacts of specific predators along the land-use gradient. Our results suggest that predation on nests within the land-use matrix declines with urbanization but that there are species-specific differences. Moreover, variation in nest survival among species was best explained by urbanization metrics measured at larger “neighborhood” spatial scales (e.g., 1000m). Trends were supported by data from artificial nests and suggest that variable predator communities (avian vs. mammalian) are one possible mechanism to explain differential nest survival. In addition, we assessed the quality of citizen science data and show that citizens had no negative effect on nest survival and provided estimates of nest survival comparable to Smithsonian biologists. Although birds nesting within the urban matrix experienced greater nest survival, individuals also faced a multitude of other challenges such as contaminants and invasive species, all of which could reduce adult survival.



Bird diversity in a coastal area in Rio Grande do Sul, southern Brazil

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The northern coast of the state of Rio Grande do Sul, southern Brazil, has been experiencing an increasing process of urbanization in the last 30 years, with significant losses of natural areas. The bird communities of these areas are poorly known, and their habitat are being destroyed. Only a few fragments preserve the original vegetation in the northern coast of Rio Grande do Sul. The aim of this study was to make a qualitative bird inventory in one of these fragments. The site studied is located in the municipality of Capão da Canoa (29°42'00"S; 49°58'42"W), and has an area of 138 ha covered with the original habitats of the region (sandy beach, primary dunes, psammophilous fields and restinga forest). A total of 24 surveys were conducted between June 2008 and June 2009. In each survey, birds were recorded by visual observation or vocalization in six parallel transects perpendicular to the coast. The composition of each habitat was compared using the Jaccard Index. At present, 111 species were recorded. Estimated richness (Abundance Cover Estimator, EstimateS 8.0) indicated that 125 species may occur in the area. The observed richness is greater than that recorded in similar coastal areas located in northern sites in Brazil, like Pontal do Sul, Paraná (25°S; 64 sp.), and Jurubatiba National Park, Rio de Janeiro (22°S; 96 sp.). Considering frequency and seasonality, 23% of the recorded species were considered resident, 20 probable resident, 10 seasonal and 47 sporadic. The species richness was greater on psammophilous grasslands (75 sp.) than in the restinga forest (46 sp.), sandy beach (30 sp.), and primary dunes (25 sp.). The dunes and the grasslands were the most similar habitats, while the sandy beach was the most dissimilar habitat. The studied fragment, although located in an urban matrix, still preserves a significant richness and possibly still includes the original bird composition of the region.



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Identification of stopover places for Charadriidae and Scolopacidae and temporal fluctuations of abundance in the coast of Venezuela

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Due to geographic location in northern South America, Venezuela is used as a stopover for 29 species of migratory birds in the families Charadriidae and Scolopacidae. Although the winter headquarters and the reproductive places are well known, information available on the stopover places used during the migratory journeys is scarce in the Neotropics. We evaluated the relevance of the north coast of Venezuela for Charadriidae and Scolopacidae at two extreme locations: Margarita Island (MI), in the east (8 localities), and Falcón State (FS) in the west (4 localities), distant each other 450 km. Between 2006 and 2009 we did at least 2 annual censuses (February and July) and more occasionally also in October and March, counting the shorebirds and plovers present in coastal lagoons. In terms of richness and abundance, we consider 4 localities important for the migratory birds in MI and 4 in FS. Richness was greatest in FS (24 species), in August, and lower in MI (12-15 species), with maxima in October. Abundance was greatest in October (about 3500 ind) and minima in July in MI, but in FS the maxima was in March (about 12000 ind), decreasing in May and August. In both regions the more common species were *Calidris* spp (*C. mauri* and *C. pusilla*) and *Tringa* spp (*T. flavipes* and *T. melanoleuca*). There were important interannual fluctuations in the presence of certain species in different months, the abundance, and the use of local lagoons. Our results show the importance of both regions for stopover for migratory birds. Also, instability of these ecosystems makes it more relevant to protect the system of nearby lagoons, instead of isolated ones.



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Altitudinal distribution of birds in Serra do Mar state park, São Paulo, Brazil

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There are few studies about altitudinal distribution of birds in Atlantic Forest. We selected eight points from 30 to 800 m asl at Serra do Mar State Park, Curucutu, in São Paulo, Brazil (23°59' S, 46°44' W). The localities surveyed in this study were chosen in order to select the main vegetational types represented in the area (dense rain forest, cloud forest and cloud fields also called natural fields). Each point was visited in 3 consecutive days per season during the last 30 months of research with 150 days of fieldwork. Each point was sampled by fixed ratio point counts and with 20 mist nets disposed in line (19,600 hours/net). As result we captured 2,213 birds of 151 species and also had 504 individuals recaptured; 2,078 of these birds were marked with metallic bird bands of the CEMAVE/ICMBio. Individuals from 5 species were recaptured in distinct elevations with an altitudinal range of 400 m from the point where they were first caught. We also notice that the bird community varies in different altitudinal levels. At 30 m asl 212 species were recorded, at 400 m there were 166 species and at 800 m, 231 species. A total of 323 species were registered at Curucutu being one of the most diverse and well known localities in eastern Brazil with several endemic and/or threatened species, including: *Aburria jacutinga*, *Touit melanonotus*, *Leucopternis lacernulatus*, *Glaucidium minutissimum*, *Carpornis melanocephalus*, *Lanisoma elegans*, *Myrmotherula minor*, *Platyrrhynchus leucoryphus*, *Sporophila frontalis* and *Sporophila angolensis*.



Patchy distribution and habitat occupancy of Worthen's sparrow (*Spizella wortheni*) in the Mexican Plateau

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Species distribution pattern is influenced by distribution and arrangement of its habitat across the landscape. Spatial structure hence is an important factor affecting regional distribution pattern of bird species. Process within landscape like fragmentation, potentially modified bird distribution and alter individuals flow between populations. Macro-scale studies allow us to assess, at regional level, the potential factors that influence or delimit the geographic bird distribution, also help us to infer anthropological or natural barriers acting on it. Using spatial analysis we obtain the distribution pattern and habitat occupancy of Worthen's sparrow (*Spizella wortheni*) an endemic species from northeastern Mexico and recognized as a threatened species in the IUCN red list. We visited once in the breeding season of 2006, the historical distribution sites of Worthen's sparrow; we also monitored during five years (2003-2008), in winter and in the breeding season, the actual distribution sites and search for the species across the Central Mexican Plateau. We could not confirm the presence of Worthen's sparrow in its historical distribution sites, but we found a highly patchy distribution across north-east portion of the Mexican Plateau, following the isolated pattern distribution of the remaining suitable habitat, which include low shrub patches with creosote bush, bushy juniper patches or tar bush. Human activities, like farming, near its habitat indicate that modification of vegetation in the north-east portion of the Mexican Plateau, modified the spatial distribution of suitable habitat influencing the geographic distribution of *Spizella wortheni*.



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Effects of insularization on the occurrence of understory frugivorous, omnivorous and insectivorous tree and ground birds in the Central Amazon

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Construction and maintenance of hydroelectric plants generates severe environmental impacts. The Amazon Basin is considered the region's largest hydroelectric potential in Brazil, where it is running on expanding the number of dams for energy purposes. The formation of these reservoirs can isolate islands of native habitat with different configurations in dependence on regional topographic features. Deleterious effects of forest fragmentation on bird communities have been observed in studies in Neotropical rain forests and in some cases the community is partially restored depending on the state of the vegetation succession of surrounding areas to the fragments. We studied the effects of insularization at Balbina Hydroelectric Plant lake, Central Amazon, on understory frugivorous, omnivorous and insectivorous ground and trunk birds, through point count censuses and play backs. We sampled 175 points distributed in 42 transects located on 27 islands with areas between 4.7 and 1.855 ha, and three areas of continuous forest adjacent to the lake. Analysis of occupation based on the presence and absence of species showed a general downward trend of richness and abundance for the species in direct relation to the size and isolation of the islands surveyed, even among species with high dispersal abilities (e.g. Picidae and Dendrocolaptidae). There are also constraints for the distribution of occurrences of some species (e.g. *Hylexetastes perrotii* and *Neopelma chrysocephalum*) on the bygone landscape, mainly related to the original course of the Uatumã River and species (e.g. soil insectivores) whose occurrence is correlated to the distance between islands sampled areas of continuous forest on the banks of the reservoir. This is a pioneering work assessing the effect of islands in reservoirs of hydroelectric power plants, showing notorious consequences of landscape change in the region and the importance of assessing the unique geographical features of the region.



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A year long survey for aquatic birds in a coastal lagoon at northern, Rio de Janeiro, Brazil

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Coastal Brazilian wetlands have been largely destroyed or transformed by human occupation. The conservation unit of Lagoa da Ribeira, located in the northern Rio de Janeiro State, at Quissamã, is a 5km² wetland, surrounded by periodically flooded fields and *restinga* vegetation. This area has been poorly studied regarding aquatic birds. The present work is part of a long term monitoring study of aquatic birds along the coast of Rio de Janeiro. Monthly surveys were conducted from August 2008 to July 2009, resulting in 176 hours of field observations. Relative abundance was estimated considering the greatest counting of individuals present on an imaginary 300m circle. We recorded 45 families and 165 species of birds. 78 species are considered common, 41 uncommon and 46 occasional in the area. The most abundant species included: *Dendrocygna viduata*, *Dendrocygna autumnalis*, *Jacana jacana*, *Gallinula chloropus*, *Porphyrio martinica* and *Anas bahamensis*, with mean monthly counting of 122, 53, 53, 52, 38 and 23 individuals/circle, respectively. Species richness did not show difference among wet and dry seasons. Abundance in the 2009 dry season was greater for ducks, *Jacana jacana* and *Rostrhamus sociabilis*. Lagoa da Ribeira has evidenced its conservation importance as an important habitat for *Dendrocygna autumnalis*, *D. bicolor*, *Himantopus melanurus*, *Ciconia maguari*, *Sporophila collaris* and *Theristicus caudatus*. Considering the richness and abundance of migratory and endangered species for coastal Rio de Janeiro, the Lagoa da Ribeira should be assigned as a priority area for aquatic bird conservation in southeast Brazil. We also would like to call the attention for the importance of a long term monitoring program of birds as a tool for the implementation of an effective management in the region.



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Seasonal variation in bird species composition and abundance in a Sudan savanna biome

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In tropical Africa, bird species composition is known to be highly influenced by the wet and dry seasons respectively. This survey was carried out in Yankari Game Reserve, from 2007 to 2009 to determine the variation of bird species composition and abundance within two habitat types- the gallery forest and the savanna woodland habitat types. The result shows considerable variation in species composition and abundance between the two habitat types (Gallery N = 131, mean = 9.31 +1.35, savanna N = 192, mean = 16.47 + 12.85, p = 0.045) as well as variation between the wet and the dry seasons (Gallery N = 542, 2.17 + 0.12, savanna N = 755, 2.69 + 0.15, p = 0.001). The total number of species recorded in the gallery forest during the wet season (June - September) was 125, whereas 130 species was recorded during the dry season (November - April). In the savanna woodland habitat 194 species was recorded during the dry season and 135 species was recorded during the wet season. The total number of birds recorded in the two habitat types were 1,219 for the gallery forest and 3,162 for the savanna woodland.



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Forest bird response to naturalness in Mediterranean forest ecosystems: structure or floristics?

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Threshold detection in forest birds' response to habitat alteration is a powerful tool to quantify their requirements and develop conservation targets. This approach can be used with several response parameters, such as presence-absence, abundance, or fitness. This study aimed to test for threshold assessed in the occurrence of 31 forest bird species along a gradient in forest naturalness obtained using principal component analysis (PCA) on vegetation variables. The results of logistic regression combined with receiver-operating characteristic (ROC) analysis showed that 23 species had a significant ($p < 0.05$) response to forest naturalness, with 13 negative and 10 positive responses. Among these, five species had the best models, based on the area under the ROC curve (AUC): *Picus vaillantii*, *Dendrocopos major*, *Parus major*, *Certhia brachydactyla* and *Ficedula speculgera*. Combining the thresholds of the five most sensitive species, a high probability of presence (> 0.9) requires 700 stems/ha of large-diameter trees (DBH > 30 cm), 130 stems/ha of snags, and 85% canopy closure. However, these values should be taken with caution because they do not account for tree species composition: cork oak *Quercus suber* or zeen oak *Quercus fagenia* and nesting requirements may be greater than those based on mere presence. Hence, we will refine these models using abundance and fitness as response variables, and by accounting for tree species composition.



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Bird Assemblages in two types of forests in the floodplain of the lower Parana River (Argentina)

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The Parana River system is the second largest in South America. In the Lower Parana River, the landscape is primarily made up of two types of forests: "Albardón" and "Barranca". The goal of the present study was to describe and compare the bird assemblages of both forest types in terms of species composition and structure, based on points counts conducted from March 2006 until March 2007. A total of 76 species was recorded. Seasonal variation in species richness followed a similar pattern in both forests: greatest in spring and lowest in winter. Seasonal variation in species richness in both types of forests reflected, at least in part, the arrival and departure of migrant species. Family composition generally was similar in both forests. Differences between the forests were more evident at the species level as demonstrated by indicator-species analysis. Much of the difference in species composition between forest types was related to the presence or absence of species associated with aquatic habitats. Guild composition was very similar in both forests, differing primarily in the relative importance of species associated with aquatic habitats or more open areas, more than with respect to the diet or substrate. Foliage-gleaning insectivores were represented by the most species in both forests, followed by gleaning insectivore-frugivores. Most guilds appeared to show marked seasonal variation in abundance but patterns of variation generally differed between the two habitats. In this study, composition of bird assemblages found in two different forest types largely was determined by the presence or absence of species associated with aquatic habitats and open areas.



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Frugivory by birds on *Trema micrantha* (L.) Blume (Ulmaceae) in southern Brazil

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Trema micrantha (L.) Blume (Ulmaceae) is a wide spread Neotropical pioneer tree and in accordance with the ornithochoic syndrome, essential to the restoration of degraded areas. It presents a cycle of about fifteen years, being replaced by other tree species subsequently. The aim of this work was to identify birds that eat fruits and are potentially responsible for the seed dispersal of *T. micrantha*. The study occurred at the Horto Botânico Irmão Teodoro Luis (31°47'48"S; 52°15'45"W), a fragment of *Restinga* forest in southern Brazil. Focal observations were performed during 4h after sunrise and 4h prior to sunset, in February, April and May, 2009, in a total of 48h. During this study, 21 bird species were recorded, including Columbidae, Picidae, Emberizidae, Thraupidae, Turdidae, Tyrannidae and Coerebidae. The birds stayed at the plant for 112.5 ± 62.4 s on average, and ate 1316 fruits in 207 visits. *Pitangus sulphuratus* was the main forager (removed 32% of the fruits in 44 visits), followed by *Turdus rufiventris* (16% in 25 visits) and *Thraupis sayaca* (13% in 39 visits). Although *T. sayaca* was a more common visitor than *T. rufiventris*, its consumed fewer fruits (4.5 ± 3.0 vs. 8.5 ± 4.5 fruits respectively). Since *T. micrantha* produces small single seeded fruits, the birds swallowed it whole, except *Coryphospingus cucullatus*, which was observed mandibulating it. As described previously, during this study the ripening of fruits in different *T. micrantha* individuals was not synchronic, being important to the diet of the local avifauna by offering resources throughout the year, even to migratory species such as *Tyrannus savana*, *T. melancholicus* and *Myiodynastes maculatus*.



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Bird communities in natural and planted forests in Southern Brazil

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Conversion of natural by planted forest has been a common practice in several countries, and it is point to concern, due to the threat to bird diversity. The present study was conducted in Mixed Ombrophilous Forest (FN) and in planted forests of *Araucaria angustifolia* (FA) and *Pinus elliottii* (FP), southern Brazil, where the bird communities were evaluated considering the dependence of the natural forest, feeding categories, foraging stratum. The fixed 100 m radius point-counts method was used. The following numbers of points were established in each area: 18 in FN, 12 in FA and 12 in FP. A total of 114 bird species were recorded in all areas, being 93 in FN, 87 in FA and 81 in FP. The repeated measures ANOVA, with LSD post hoc tests, presented greater mean species richness of forest-dependents in FN and FA than in FP. Richness of insectivorous birds was greater in FN and FA, while in frugivores was greater in FN, in seed-eaters was greater in FP, and in generalist did not present significant differences in the studied areas. greater numbers of canopy species were recorded in FN and FA, when no significant differences were observed for understory bird species. Two vulnerable species (*Procnias nudicollis* and *Dryocopus lineatus*) were recorded in FN and FA. Data suggest that FP is less attractive for certain bird species, as threatened species, forest-dependents and for those with specialized feeding habits. G.H.Volpato supported by CAPES (doctoral scholarship).



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Is agricultural intensification leading to a spatial separation of resources for the declining house sparrow in southern Sweden?

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Agricultural intensification, e.g. loss of habitat heterogeneity and farming specialization, is today commonly accepted as the cause of the dramatic farmland bird species decline that has occurred in NW Europe during the last decades. The house sparrow, *Passer domesticus*, is a farmland species that has declined by more than 50 % in Sweden since 1975. Since 2008 we are studying a set of house sparrow populations in the farmland of southern Sweden to determine the effect of loss of habitat heterogeneity on the population decline. Our first studies indicated that the strength of population limitation differs in landscapes with different heterogeneity of farmland use. We found a positive relationship between house sparrow occurrence and landscapes with heterogeneous mixed farming compared to more homogeneous landscapes with either mainly crop production or animal husbandry. In an ongoing study we want to test if the food limiting factors in these different landscapes differ as a result of resource separation through farming specialization. We use behavioral indicators of habitat quality, giving up densities (GUD) at artificial food patches, to estimate food availability for house sparrows on the farmsteads during both summer and winter. If the house sparrows are suffering from a spatial and temporal resource separation we expect to find differences in GUDs between landscapes and between seasons. Identification of population limiting factors is important for future conservation work. If population limitations depend on habitat heterogeneity, conservation work needs to be regionally adapted for more efficient measures. We will report results from both previous and ongoing field season.



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Raptor diversity in grassland landscapes in southern Brazil and Uruguay

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The grassland landscapes in southern Brazil and Uruguay (called Campos) may be divided into two disconnected regions, each one in a different ecoregion, roughly delimited by the southern borders of the Brazilian Southern Plateau. The grasslands are the dominant habitat on the Uruguayan Savannas ecoregion (US) while on the northern portion, along the Araucaria moist forest ecoregion (AF), the grasslands comprise fragments inside a forested matrix. Patterns of distribution and even occurrence of the raptors along and between these regions are unknown, despite their ecological importance on ecosystem. During fall/winter season on 2009, roadside surveys were conducted in 11 selected areas (four transects/area). At each transect, raptors (Falconiformes only) were surveyed in ten 30min-point counts (5km apart from each other), totaling 5 hours of survey/transect. A total of 1776 individuals (20 species) were recorded. Species richness decreased from northeast to southwest surveyed areas. The relative abundance (RA) differed between areas ($p = 0.02$) and between ecoregions (US = 7 ind/h; BA = 12.7 ind/h; $p < 0.1$). All but two US areas had similar raptor composition (Correspondence analyses). These have dominance of open habitats (grasslands, crop fields) and high abundance of *Rupornis magnirostris*, *F. sparverius* and *Heterospizias meridionalis*. On the other hand, forested habitats were predominant in three areas and crop fields in one. High abundance of *Milvago chimachima* and *M. chimango* was found on those areas. Results suggest that raptors taxocenoses differ between two ecoregions. Historical distributions and landscapes characteristics also could have influence on taxocenoses composition.



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Effects of forest degradation and fragmentation on Neotropical-Nearctic migrants in the Andes

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Understanding how anthropogenic disturbance and fragmentation affect the suitability of wintering grounds remains a key issue in the ecology and conservation of migratory birds. A failure to study patterns across broad spatial scales, coupled with inconsistent methodology, continues to limit this understanding. In this study, we examined the extent to which species richness and abundance of Neotropical-Nearctic migratory birds were related to local and landscape-scale forest degradation and fragmentation throughout the Northern and Central Andes. From 2007-2009, we conducted systematic avian surveys at 135 1 km² pixels distributed from Venezuela to Peru based on a stratified-random design. Twenty-six species of Neotropical-Nearctic migrants were detected, including species of conservation concern such as cerulean (*Dendroica cerulea*) and golden-winged warbler (*Vermivora chrysoptera*). Richness and abundance decreased with habitat degradation, and migrants were virtually absent from sites with low levels of tree cover and limited structural complexity of forests. At the same time, migrants were flexible in their habitat choice, inhabiting both secondary forests and agroforestry systems. Although migrants appeared to be relatively unaffected by intermediate levels of fragmentation, they avoided areas with extensive deforestation. Interestingly, nearly 80% of detected migrants joined mixed-species flocks, which also were sensitive to habitat degradation. Thus, our study suggests that continued landscape transformation in the Andes affects Neotropical-Nearctic migrants not only directly, via local and landscape changes in habitat, but also indirectly through affecting the presence and stability of social systems such as mixed-species flocks. Implications of these findings in the light of a broader migratory bird conservation approach are discussed.



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SA03 Evolutionary Biology



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First reported use of radio-telemetry to locate cryptic nests of Neotropical passerines

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Recent years have seen a renaissance in studies of Neotropical birds and an increase in the rate of discovery of nests previously unknown to science. Despite this positive trend, nests of some 15% of Neotropical passerines remain undiscovered and our understanding of intraspecific variation in nest architecture for many tropical species remains unsatisfactory. These data deficiencies are most apparent among taxa known or implied to nest in subterranean or tree cavities. Furthermore, the fact that most nest burrows being reported are located in vertical walls of road embankments and riverbanks indicates a potential human observational bias. We developed a novel methodology utilizing radio-telemetry in conjunction with GPS tracking to locate nests of cavity and burrow nesting passerines that are challenging to find in traditional nest searches. The fieldwork was conducted in Suriname and Ecuador in a seasonal forest habitats. Potential target species were mist-netted and screened for the presence of a well-developed, vascularized brood patch, taken as the evidence of breeding. Birds with a brood patch were equipped with small radio-transmitters (Advanced Telemetry Systems, 0.2-0.3 g) and followed for the subsequent 1-3 days. Our study resulted in the discovery of nests away from roads and rivers, sometimes in microhabitats previously unreported for a given species. The poster will illustrate some of the novel nest sites we discovered and the methodology that we have developed.



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Characterization of major histocompatibility complex (MHC) class I genes in the long-distance migrant red knot (*Calidris canutus*)

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Major histocompatibility complex (MHC) genes code for receptors on cell surfaces which allow the presentation of antigens to immune cells and the initiation of the immune response. Variability in this gene complex may indicate relative preparedness to recognize and respond to pathogens which has increased interest in the study of MHC genes. The MHC encompasses two main subgroups of immunologically active molecules. Class I molecules are expressed on all nucleated cells and are associated with defence against intracellular pathogens. Class II molecules are expressed on specialist cells of the immune system and are associated with defence against extracellular pathogens. Most studies of MHC in non-model avian species have focused on MHCII. However the importance of MHCI for defence against intracellular threats such as viruses, as well as possible interactions between class I and II subgroups in wild animals facing multiple infections remain to be studied. We isolate MHCI genes in red knots (*Calidris canutus*) using a PCR-based approach combining primer-walking on genomic DNA, direct sequencing, and molecular cloning, to characterize MHCI loci and to verify their expression in a cDNA library from the spleen. We also look for evidence of positive selection at these loci and compare characteristic structural features knot MHCI genes to those of other bird species. Red knots represent a group of highly migratory birds whose flyways span the globe. In future, information on the genetic basis of aspects of their immune system can be coupled with functional assays of immunity and pathogen screening to provide a clearer picture of how migratory birds stay healthy.



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Maternal and environmental effects on oxidative stress in the great tit (*Parus major*)

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Oxidative stress results from an imbalance between damaging pro-oxidantia and neutralizing antioxidantia. Because both compounds are affected by exposure to parasites and oxidative stress as well as parasites are believed to have far-reaching consequences for life-history trade-offs, parasite-induced maternal investment can be expected to result in modified oxidative stress levels in offspring. In line with this prediction, body condition and survival in great tit (*Parus major*) nestlings were earlier shown to improve following an induced maternal response to parasites, possibly mediated by changes in oxidative stress levels. To experimentally confirm if, and to what extent, maternal exposure to parasites affects oxidative stress levels in offspring, we combined an ectoparasite treatment of great tit nests prior to egg-laying with a cross-foster experiment between half broods of infested and uninfested nests. Based on values of plasma antioxidant barrier and plasma pro-oxidative status in nestlings, we discuss developmental and fitness effects of direct and maternal-mediated exposure to parasites in male and female offspring.



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What mechanism for the control of clutch size in the first birds?

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In birds, different mechanisms have been evolved to control clutch size. This was first hinted at by the fact that, in species known as indeterminate layers, females will lay a greater clutch if eggs are removed from the nest during laying. To date, seven mechanisms have been identified, depending on the nature of signals relied upon by the female to halt the process of egg formation. Signals can be exogenous (indeterminate layers) or endogenous (determinate layers), or a combination of both (semideterminate layers) and, while exogenous signals reach the brain either through tactile, visual or thermal stimulation, endogenous signals are generated by genes. This evolutionary diversification raised the question of knowing what mechanism was used to control clutch size in the earliest birds. In this paper, two lines of evidence are presented which support the thesis that basal birds were indeterminate layers. First, indeterminate laying has been shown to occur in all ratite families. Ratites are the earliest known offshoot in the evolution of modern birds. Second, fossilized remains of the nest, eggs and adults from non-avian theropods have revealed that most bird-like traits associated with indeterminate egg laying were already evolved by this group of dinosaurs. Non-flying theropods are generally thought to be the stock from which modern birds have sprung. The possibility that basal birds relied upon tactile stimulation from eggs present in the nest to cease laying is discussed.



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Dressing in two black suits - Cryptic sexual dichromatism in the black bulbul (*Hypsipetes leucocephalus nigerrimus*)

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Sexual dichromatism is important to develop capability of sex discrimination, assessments of individual quality and attractiveness in birds. Although it had been revealed in several recent studies, cryptic sexual dichromatism in birds with monotonic melatonin-based plumage coloration has not been explored yet. In this study, we investigated the sexual differentiation of plumage coloration between fourteen males and eleven females of the black bulbul (*Hypsipetes leucocephalus nigerrimus*), which is covered entirely by black plumage. For each individual, the reflectance between 300 to 700 nm of eight body regions was measured by a spectrometer. We calculated the total brightness and UV chroma of each region for both sexes. We found that male plumage showed greater UV chroma than that of females at forehead, tail, remige and scapular; we also discovered that the reflectance spectrums of male plumage was also differed from that of females ($t_{1,23} = -5.283$, $p < 0.001$). Because the melanin-based plumage could be associated with individual quality or their social dominance, the cryptic sexual dichromatism of black bulbuls we discovered might potentially serve as an important visual cue for females to assess male quality during mate choice.



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Photoperiodism is a conserved regulatory mechanism for important life history stages of birds: a case study of Indian birds

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We have compared data from light-response studies done at 27°N, 81°E on four bird species, including two migrants, the black-headed bunting (*Emberiza melanocephala*) and redheaded bunting (*Emberiza bruniceps*), and two non-migrants, the Indian weaver bird (*Ploceus philippinus*) and house sparrow (*Passer domesticus*). They are photosensitive species: long days are stimulatory, short days are non-stimulatory, and post-reproductive gonadal regression occurs even though birds are subjected to stimulatory long day lengths. A circadian photosensitive rhythm measures day length with slight variation in characteristics among species. Further, critical day length appears species and response specific. In migratory birds, stimulation of body fattening follows the pattern of testicular growth and development, but these two photoperiodic events are dissociated. Hence, photoperiodism in birds is conservation of environmental control mechanisms for long-term life events evolved over a long period of time, as an adaptive strategy ensuring such events to happen at the most suited time of the year. Difference in photoperiodic responses among different species and among populations of the same species inhabiting different latitudes, as reflected by results from our various studies when compared with studies on temperate populations, could suggest specific adaptations of the photoperiodic species at the given latitude.



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Experimental evidence for state-dependent nest weight in the blue tit (*Cyanistes caeruleus*)

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Parental investment in reproduction is generally limited by food availability, and so avian life-history research has traditionally focused on the brood rearing phase, when food requirements are greatest. Only relatively recently has the focus extended to the incubation phase, and even more recently to the nest-building phase, where observational and comparative evidence suggest that avian nest building is an energetically expensive and time-consuming activity. We aimed to experimentally test the limitations on this cost in a hole-breeding passerine, the blue tit (*Cyanistes caeruleus*), by providing supplementary food to experimental pairs during the nest building period. In comparison with control females, that did not receive supplementary food, experimental females constructed heavier nests, with greater amounts of moss base but similar amounts of cup lining, despite their being no differences in the time taken to build the nest. This study provides empirical support for the hypothesis that avian nest building is a costly behaviour, limited by food availability.



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Using song playback to assess population status in the endangered Western whipbird *Psophodes nigrogularis*: implications for conservation management

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The song of the Western whipbird, *Psophodes nigrogularis*, varies considerably across the four subspecies found in South Australia and Western Australia, which is hardly surprising given their geographical separation. In this study, we aimed to ascertain the variability of the songs in each population and test whether the songs function as isolating mechanisms that would prevent interbreeding between the subpopulations. We used bioacoustic analysis and playback experiments to find evidence for reproductive isolation across populations. Bioacoustic analysis of their songs showed differences in low frequency and a different response to playback from different populations. We quantified vegetation density, collected ambient noise measurements and conducted sound transmission experiments to determine whether these environmental factors correlate with the low frequency differences across the populations. The environmental factors predicted some of the variation in song characteristics with lower frequency song in areas with high vegetation density. Therefore, birds can potentially recognise differences in the geographic origin of the singer perhaps because of differences in surrounding vegetation. Our research will elucidate the biology of the largely unknown Western whipbird and provide evidence for assessment of the number of species across allopatric populations, both of which are essential for effective management and future protection.



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Breeding biology and life history traits of an Australasian tropical granivore, the crimson finch (*Neochmia phaeton*)

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We present detailed breeding biology and life history data for an Australasian tropical granivore, the crimson finch *Neochmia phaeton* collected over three breeding seasons at Mornington Wildlife Sanctuary in north-western Australia. Crimson finches were socially monogamous and divorce was rare (2.9%, $n = 173$ pair years). The breeding season averaged 3.7 months in duration and corresponded to the wet season. Annual adult survival was 72% but with high annual variation. They were riparian specialists with 98% of nests ($n = 870$) found in *Pandanus aquaticus* and 99.6% of nests ($n = 841$) within 20 meters of the center of a creek. Males built the nests and both sexes incubated the eggs and brooded and provisioned the offspring. Clutch size was 5.08 ± 1.03 ($n = 227$, range 1-7) and pairs initiated 2.39 ± 0.96 clutches ($n = 77$, range 1-5) per year. Reproductive success was low, in part because of high nest predation (60%), with only 27% of clutches resulting in at least one fledgling ($n = 389$). Tropical/southern hemisphere birds are thought to differ from their northern counterparts in having a greater nest predation rate and greater annual survival, which may select for their typically small (i.e. 2 eggs) clutch sizes. Crimson finches, however, have large clutches. We suggest that other factors may influence clutch size and that exploring life histories that differ from the norm may be particularly helpful in understanding latitudinal differences in these strategies.



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Life-history evolution in Australian and New Zealand songbirds: phylogeny, allometry, and environment

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Factors shaping life-history evolution and their relative contribution have been of considerable interest to ecologists and evolutionary biologists for decades. Phylogenetic relationships and various environmental factors have been demonstrated to influence direction and patterns of life-history evolution. However, our understanding of life-history evolution in birds has been hampered by focus on northern temperate birds and a narrow suite of traits. To overcome these difficulties, we collected a large dataset of life-history and developmental traits, together with environmental factors, in Australian and New Zealand songbirds based on a comprehensive literature search. Australia and New Zealand provide an ideal model system, because they comprise an ancient radiation of Corvoid songbird lineages and are the only area on Southern Hemisphere where large datasets are available. We collected data on clutch size, nestling growth and development, sociality, nest predation, temperature, and seasonality from populations ranging from tropics to southern temperate regions. In our contribution, we will 1) provide a comprehensive overview of life-history patterns in Southern Hemisphere songbirds by analyzing the largest dataset collated to date, including effects of unique phylogenetic history, 2) test alternative hypotheses about life-history evolution (seasonality, nest predation etc.), and 3) provide comparisons to large databases on northern temperate songbirds collected previously (North America, Europe).



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Genetic population structure predicts vocal variation in a parrot

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Culturally transmitted signals, such as avian vocalizations in species that display vocal learning (i.e. songbirds, parrots, hummingbirds), could potentially act as a rapidly evolving isolating mechanism between populations. We studied geographic variation in the contact calls of the crimson rosella complex (*P. elegans*), in relation to their genetics. This Australian parrot species has striking variation in plumage coloration, vocalizations and genotype. Recent work in our study area observed a mismatch between plumage coloration and corresponding mtDNA haplotypes with genetic population structure observed with microsatellites. Our study provides the first test of whether vocal variation is in concordance with established neutral genetic variation observed with microsatellite analysis in a parrot. We recorded contact calls in populations along a river, allowing us to analyse covariation between vocal divergence and genotype across a transect. A large part of the variation present in three out of five acoustic variables (fundamental frequency, mean frequency modulation and the location of the peak frequency in the call) was explained by the microsatellite clusters. Call properties differed significantly with geographic distance between recording sites, but the acoustic variables displayed most variation in the area where the microsatellite clusters meet. We will discuss these results and the results of related playback experiments with respect to the phylogenetic background of this species and what effect vocal variation can have on maintaining the exceptional phenotypic and genotypic diversity present in this species.



Testosterone, health and wing ornamentation in wild common gulls

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The idea, that androgens may play a crucial role in the mechanisms of honest signalling has erected a vivid discussion during recent years. Namely, it has been suggested, that one of the main costs of testosterone-dependent sexual ornaments could be the damage that may result from oxidative stress. Such situation may arise if antioxidative defences of an organism are overwhelmed by the increased production of free radicals, which is the side effect of testosterone-induced increase in metabolism. In this study, we test whether testosterone levels are associated with individual ability to maintain redox balance in the wild population of common gulls (*Larus canus*) during breeding season. We test whether variation in individual testosterone levels results in concurring variation in the indices of individual ability of maintaining oxidative balance (lipid peroxidation, total oxidative status, total antioxidant capacity), levels of pro ndash and antioxidants (respectively homocysteine and uric acid, glutathione and carotenoid levels) and general hematological condition indices (nitric oxide, protein and triglyceride levels) and reproductive parameters (laying date, egg size and hatching success). We also test whether these indices are associated with the expression of ornamental wing tip pattern in these birds. Bigger white spots on black wing tips has been previously shown to reflect greater individual survival prospects and lower divorce rate in common gulls and to be characteristic to birds in their superior reproductive stage of life.



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Testing genetic bottleneck in populations of *Larus dominicanus* (Laridae)

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Larus dominicanus (kelp gull) is widely distributed in the Southern Hemisphere. Its generalist habits have been considered the main cause of its population growth, what has been harmful to coastal communities. Recent studies show that *L. dominicanus* presents low genetic variability in mtDNA. It is important to understand the history of this species for future management plans. Species which suffered bottlenecks have reduced genetic variability and an excess of heterozygosity. This study aims to examine whether the low genetic variability of *L. dominicanus* is associated with bottleneck. We sampled individuals from nine islands of the Brazilian coast and one of the Antarctic Peninsula. We used eight microsatellites and adopt the Two-Phase Model (TPM), varying two parameters: the proportion of single step mutations and the variance in the number of repetitions in each mutational step. One Brazilian coast population had significant excess of heterozygosity for all parameters combinations, indicating a probably recent bottleneck. Two populations from the Brazilian coast and the one from the Antarctic Peninsula presented significant excess heterozygosity for parameters very close to those recommended for microsatellites, so it is possible that these populations have experienced bottleneck. Since not all populations of the Brazilian coast had signs of bottleneck, the species unlikely has undergone bottleneck before or at the beginning of the Brazilian coast occupation. It is possible that bottlenecks have occurred in some populations, perhaps related to effects founders. These data are consistent with simulation studies with mitochondrial and nuclear markers, which showed that the bottleneck hypothesis does not explain the current scenario for *L. dominicanus*.



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Molecular characterization of MHC II class B in red-knots

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The high variability of MHC genes and their role in immune recognition makes them relevant to several aspects of ecology and evolution of organisms. Red knots (*Calidris canutus*) comprise six subspecies that undertake marathon annual migrations up to 15,000 km between high arctic breeding grounds and marine wintering environments. The parasite hypothesis of shorebird migration predicts that restriction of species to these parasite-poor environments reflects their susceptibility to parasites and pathogens, and thus they have to migrate great distances to find such habitats. As red knots passed through a population bottleneck during the last glacial maximum, they might have low immunocompetence due to genetic impoverishment. To test this hypothesis we characterized MHC IIB genes using a primer walking technique and direct sequencing of three loci. We designed locus-specific primers to screen the allelic variability in exon 2, which includes the peptide-binding region for detection of extracellular pathogens. Two of the loci were found in a cDNA library, suggesting that they are expressed. Single locus assays showed that red knots have surprisingly high allelic diversity in MHC IIB genes, and sites in exon 2 of two loci are under positive selection. This suggests that host-pathogen interactions play an important role in red knot population dynamics, and MHC diversity is probably maintained by balancing selection.



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The plumage coloration of the pied flycatcher (*Ficedula hypoleuca*) does not confirm the reinforcement hypothesis in the eastern part of the range

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Pied flycatcher males have different types of breeding plumage color (morphs), varying from bright black-and-white variants to very pale, female-like ones. The relative abundance of morphs differs between populations and it was suggested that the pattern of distribution of pale and dark-colored males in Western Europe may be a result of reinforcement in the sympatry zone with the collared flycatcher (*F. albicollis*). The theory of reinforcement predicts that in the sympatric zone of two sibling species we shall observe divergence in traits between two species to avoid hybridization, if hybrids have lower fitness, than the parental species. Indeed, in Central Europe, where the range of the pied flycatcher overlaps with the areal of the bright-colored collared flycatcher, pale morphs are more common, compared to neighboring allopatric zones. We checked this hypothesis analyzing literature and our own data on morph abundance in 8 populations in Eastern Europe and Asia (2 sympatric and 6 allopatric, overall 6971 males). In areas of study males were caught and their morphs were defined during the breeding season. Additionally we described morphs' ratio in 12 zoological museum collections of the pied flycatcher (424 males). According to our data, the reinforcement hypothesis cannot explain the distribution of pale and dark morphs among pied flycatcher populations. The ratio of morphs in sympatric populations does not differ from neighboring allopatric sites. Moreover, we have shown that in allopatric populations the percentage of dark morphs increases to the north while the percentage of pale males increases to the east.



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Human activity caused rapid ecological speciation of crows in the western Pacific islands

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Environmental modification resulting from human activity has led to the extinction of many organisms on islands; it may also have caused other island organisms to speciate. We found that "human-caused speciation" is in progress among crows on islands in the Yaeyama archipelago in the western Pacific Ocean. The Yaeyama archipelago consists of forest-covered islands and highly cultivated islands. Populations on these two types of island are not reciprocally monophyletic in the mitochondrial control region, suggesting very close relationships. Despite this, there is a consistent behavioral difference between them: the crows on the forest-covered islands seldom or never exploit the few cultivated lands on these islands, whereas the crows on the highly cultivated islands frequently forage on the ground in cultivated areas. When feeding in cultivated fields, the latter crows often exhibit probing behavior, which is characterized by using a bill to probe below the surface of the ground. Natural selection is expected to favor a longer bill and more sidewise oriented orbits for birds that frequently probe. Examination of skulls reveals that the crows on the highly cultivated islands have already evolved such morphological characteristics. Agriculture in the Yaeyama archipelago began in the twelfth century, and so the findings presented here strongly suggest that the crows in this archipelago rapidly changed their behavior and morphology and adapted to a new ecological space made by humans within the past 900 years.



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SA04 Macroecology



Influence of macroecological factors in frugivory by Tyrannidae along *Araucaria* forest distribution

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Broad scale patterns of species distribution have been focus of many studies. The mechanisms of origin and maintenance of those patterns are usually current climate and habitat heterogeneity. This work aimed to verify if the frugivory in Tyrannidae vary along a latitudinal gradient in the *Araucaria* forest and which are the main factor related with this variation. We evaluated the influence of geographical (latitude, longitude, altitude), environmental (annual mean temperature, temperature seasonality, annual mean rainfall and rainfall seasonality) and biotic factors (proportion of zoochorous species of wood plants) upon the distribution of frugivory in Tyrannidae. We used range maps of Nature Serve database to evaluate Tyrannidae composition in 20 sampling units. Our sampling units consisted of 15'x15'cells distributed along *Araucaria* forest geographical range. For each sampling unit we obtained the composition of Tyrannidae species that use forest and/or edges and, after this, we classified each species on their feeding habits (fruit consumer or not). We calculated the proportion of frugivores for each sampling unit. To evaluate if frugivory in Tyrannidae presents a latitudinal tendency we performed a linear regression. In order to answer which factor explains better the variation in frugivore proportion we did a multiple regression with geographical, environmental and biotic factors. We found a positive association between proportion of frugivory and latitude ($P < 0.001$) and this pattern were mostly explained by rainfall seasonality ($P < 0.001$). The importance of rainfall seasonality could be explained by the major resource availability (fleshy fruits) in sites where the dry period is less intense (lower variation in water availability).



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Analysis of the abundance-range-size relationship in Trans-Mexican Volcanic Belt bird communities

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Macroecology studies species general distributional and ecological patterns, considering major geographical and temporal scales. In different macroecological studies analyzing the relationship between relative abundances and species's range-sizes it has been found a trend towards a positive correlation between them. This study examined the relationship between the range size of several species of Mexican birds from mountainous habitats, and their estimated population values and relative abundances locally along the Trans-mexican Volcanic Belt using two different species concepts. In our study, we found that the relationship between range-size and population parameters was overall positive, whereas the correlation was negative between range and local relative abundances using both biological and phylogenetic species approaches. Nevertheless, for this particular assembly the results are not affected significantly by the species concept used. The resulting correlations can be explained by relying on various different scenarios, such as the ecological optimum and minimum requirements, resource availability, habitat selection and metapopulation dynamics.



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SA05 Migration and Orientation



Campos do Jordão 2010 25th International Ornithological Congress 22-28 August 2010 (www.i-o-c.org)

Juvenile and adult osprey (*Pandion haliaetus*) migration between North and South America: routes, timing, and mortality

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Between 1998 and 2009 we deployed satellite platform telemetry transmitters on 36 juvenile Ospreys in Minnesota (n = 7) and in the eastern U.S. (n = 29). The movements of these juveniles on their first and subsequent migrations are compared to data from 57 adults tagged primarily before the current study. All but 4 juveniles initiated migration, and 28 of the remaining 32 young made it at least to the Caribbean or South America. First-year mortality of young tagged through 2008 was 66%. Mortality through 2 yrs for this cohort will be 79% or 83% (1 bird pending). Juvenile ospreys either migrated directly from their natal areas, with or without exploratory excursions prior to migration, or after having dispersed from their natal territories to staging areas, where they settled for as long as two months. Most young started migration in early Sept.; two did not start south until Nov. Once settled on wintering areas, young often make looping exploratory excursions of hundreds of km, navigating back to favored spots from novel directions. Fall migration routes differed dramatically between adults and juveniles: 6 juveniles from southeastern New England crossed 1,800 - 2,400 km of open Atlantic Ocean, making landfall in the Bahamas or Cuba before moving south through the Caribbean. No adults made this long, overwater crossing. Most young reached the eastern end of Hispaniola before turning south. Most adults took a shorter route from central Hispaniola to South America. We believe the more conservative routes taken by adults are related to learning a different route on their return north, rather than selection on young taking more dangerous routes on their first migration.



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Spring locomotory activity in migratory and "sedentary" goldcrests (*Regulus regulus*)

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Certain bird populations may be characterized as partially migrating: some individuals migrate and others do not. The population of the goldcrest in the northern Europe is believed to present such an example. The goldcrest is a tiny bird with body mass from 4,5 to 7 g. Being one of the most numerous migrants trapped at ringing stations in some years in autumn, it is found in our study area (NW Russia, near St.Petersburg) all year round. However, for the goldcrest the population studies based on ringing are lacking, because outside the migration period this species is very difficult to trap and follow. The idea of the present study was to compare the body mass and fat changes, diurnal and nocturnal locomotory activity during winter and spring months in migratory and "sedentary" goldcrests. Migratory birds were trapped during autumn passage in NW Russia at the Ladoga Ornithological station. Individuals from "sedentary" part of population were trapped near St.Petersburg during early winter after the migration of the species had already finished. The activity was studied using videorecording system connected to the computer. It was possible to observe the behaviour of the caged bird and record the length and timing of different types of activity (hopping, wing whirring, slow moving) on-line. Surprisingly, we revealed that all goldcrests from presumably sedentary part of population trapped in winter, as well as individuals trapped on migration, showed nocturnal restlessness and fattening corresponding to spring migration (from late February to late April). The body mass and fat changes also indicated that "sedentary" birds migrated. Our results suggest that the concept about the goldcrest being a partial migrant should be revised at least for the region studied. Probably this is the case when individuals of northern origin winter in the breeding range of southern population. The study was supported by RFBR grant 09-04-01087a.



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Mesic movers and xeric squatters: dual migration strategies in painted buntings (*Passerina ciris*)

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Evidence from banding efforts and museum collections indicates that painted buntings breeding in the South Central and Southwestern US molt on the wintering grounds in Mexico and Central America or on separate molting grounds after they leave the breeding area. In 2006, we examined stable isotopes of hydrogen and carbon in the feathers of painted buntings from a single population in Oklahoma. To our surprise, these birds evinced two distinct molt-migration strategies. Some birds were 'mesic movers' that consumed primarily C3 carbon sources and underwent significant geographical movement during molt. Others were 'xeric squatters' that consumed mostly C4 carbon and remained stationary during molt. Divergent molt-migration strategies within a single population are rare, probably because the combined effects of gene flow and competition limit intraspecific variation in migration behavior, so dual migratory strategies in painted buntings begs explanation. The existence of genetically distinct behavioral morphs, carryover effects within the annual cycle, and condition-dependent migration are all possible implications of our findings. Efforts to more clearly define the differences between mesic movers and xeric squatters are already underway and include broad sampling of feathers from birds captured in the US and Mexico and development of tiny (0.65 g) archival geolocation tags for mapping individual migration routes. We will describe our latest findings and relate our efforts to discover what factors (environmental or genetic) determine migration strategies in painted buntings.



Competition as a determinant of migration strategy – a case study with *Phylloscopus* leaf warblers

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Inter-specific relations may influence migration strategy. Willow warbler *Phylloscopus trochilus* and chiffchaff *Phylloscopus collybita* are closely related species, exhibiting similarities in their morphological and ecological requirements. The aim of these studies was to propose a model of reciprocal-dependent migration strategy. Long term data (35 years) from bird ringing stations and direct behavioural observation of migrants were used. The migration of willow warbler during early autumn was extended in time and did not depend on the number of migrating individuals. Migration of chiffchaff took place later in the season and the duration of the migration period varied in inverse proportion to the number of migrating individuals. Migration dynamics of both species were closely connected - the beginning of chiffchaff migration depended on the end of the willow warbler migration. Relation between both species migration is confirmed by direct observations of habitat use and preferences of birds in their stopover site. Willow warbler used optimal habitats (thin branches with leaves). However, chiffchaff showed shift in habitat use during migration. In first period of autumn migration, while willow warbler occupied optimal habitats, chiffchaff used sub-optimal and marginal habitats (thick and leafless branches). When willow warbler finished its migration, chiffchaff started to use optimal habitats, previously occupied by competitor. A suggested model of reciprocal-dependent migration explains the migration strategy of closely related species. Inter- and intra-specific competition could play a significant role in the evolution of migration strategies.



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Fall migration and population estimate of white-backed stilt (*Himantopus melanurus* Vieillot 1817) in non-reproductive period in Rio Grande do Sul, Brazil

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The white-backed stilt is common in wetlands of Rio Grande do Sul state. In this study we sought to (a) additional information on the temporal fluctuations (annual, seasonal and daily) on the shores of the sea (b) estimate the population size of species, (c) investigate the possible relationship of density with climatic variables that influence the configuration of habitats, and (d) assess whether the urban landscape of large coastal cities influence the distribution and density of species in Rio Grande do Sul coast. During the years 2002, 2003, 2006, 2007 and 2008-2009 censuses were conducted monthly on the beaches of the state. The density of white-backed stilt increase in months with low rainfall (March-July) on the coast of Rio Grande do Sul, Brazil, during their non-reproductive period. It was estimated that each year around 10.000 individuals migrate to the coastal areas to seeking refuge and food. There's no variation in the number of individuals between years, spatially or directly related to air temperature. These individuals return to wetlands and lagoons in the rainy months (August to February). They need interdependent habitats showing that the species is an important tool for management actions wetlands. Rio Grande do Sul, Brazil.



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Stopover ecology of golden plovers (*Pluvialis apricaria*) in an intensively farmed landscape

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Agricultural intensification has caused severe declines in many bird populations using farmland landscapes during breeding or winter. However, relatively little is known about the effects of intensive agriculture on birds during migration. In an intensively farmed area in Southern Sweden, we investigated the autumn stopover ecology of Eurasian golden plovers, a species listed in the EU Birds Directive and one of few waders using this habitat during migration. The birds preferred large arable fields with no or low vegetation and long distances to potential predator shelters both for day-time roosting and night-time foraging. In contrast to most previous studies, grasslands were used less than expected from availability at daytime. We also show that the observed daily movements between coastal roosting areas and nocturnal foraging fields further inland were best explained by spatial and temporal variation in food availability. Finally, we used key ecological variables (length of stay, fuel deposition and moult) as fitness proxies to evaluate how the birds manage in arable farmland. Clearly, the behaviour of golden plovers in terms of daily routines and habitat choice differs between birds that use arable landscapes and birds using predominantly grassland areas. Although this may be an adaptation to different (poorer?) conditions in arable farmland, the long stopover duration as well as the fact that the birds moult in the area and store substantial fuel loads suggest that golden plovers do well in intensively farmed arable areas.



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Are trans-Saharan migrants constrained by the increasing head winds of climate change?

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How increasing temperatures are changing the timing of avian migration world wide through long-termed ringing studies has been studied. It is predicted that climate change will also affect the wind speeds, and thus, it is the aim of this study to assess the impacts from such changes on the avian migration pattern. In autumn millions of trans-Saharan migrants are leaving Northern Europe on a south-westerly heading for their winter quarters in Africa, and thus, many will face the dominating south-westerly head winds over Europe. A combination of radar data on migrating songbirds and long-term wind data for Europe will be used to assess whether trans-Saharan migrants are constrained by the increasing head wind of climate change and whether this could have an impact, conservation-wise, on these populations.



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Effect of a tornado on bird use of forest understory in an old-growth research natural area in temperate floodplain forest

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We measured bird use of understory of Overcup Oak Research Natural Area on Delta National Forest, Sharkey County, Mississippi, USA, in September 2009 using mist nets. We compared the use by birds of the portion of that Research Natural Area (RNA) that had been heavily impacted by a tornado (EF2, 190 kph winds) on 3 March 2008 with the part of the Research Natural Area not so impacted. We used a random sampling design to locate an equal number of mist nets in each portion of the Research Natural Area. We used the Redgum Research Natural Area, located 1.6 km away, as a control area away from the tornado, and in a different forest type as a control area and located an equal sampling effort there. Results indicated that bird use of the less flood-prone Redgum Research Natural Area forest was greater than that within the more flood-prone Overcup Oak Research Natural Area. Within the Overcup Oak Research Natural Area, bird use of the understory in the area affected by the tornado was significantly greater than that in the area unaffected by the tornado. We infer that this greater use reflected the larger amount of woody debris on the ground in the tornado damaged portion of the tract, as well as the increase in herbaceous vegetation that resulted from the opening of the canopy caused by the storm. Although we conducted our sampling during the height of fall migration, the number of actual migrating birds, rather than of resident species or of breeding individuals of migratory species, was very low in both Research Natural Areas.



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Optimal flight theory and the effect of flight duration on mass-specific metabolic rates

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The theory of optimal flight states that a bird traveling a long distance to reach a specific destination will fly at a velocity that will minimize its energy use per unit distance, but a bird flying with no set destination will fly at a velocity that will minimize its energy use per unit time. To test this theory we undertook a reanalysis of three previous studies as well as our own previously unpublished data. We chose to work with homing and tipler pigeons because of their different flight characteristics. Homing pigeons are bred and trained to travel long distances to a defined destination. By contrast, tipler pigeons are bred to fly in circles above a loft for long periods of time. Because of difficulties in measuring and comparing flight speeds, especially of circling tipler pigeons, we used metabolic rates as an analogue for flight speed. We predicted that tipler pigeons circling for longer periods will have lower mass-specific metabolic rates than tipler pigeons circling for shorter periods of time, since the incentive will be greater to minimize energy expenditure for longer flights. We also predicted that homing pigeons flying to a specific destination will have greater mass-specific metabolic rates than circling tipler pigeons, since they will be flying closer to V_{mR} while tipler pigeons will be flying closer to V_{mp} . We used the doubly labeled water method to measure flight metabolic rates and compared our results with previously published results. Our results confirm these predictions and support optimal flight theory. Tipler pigeons flying for shorter periods of time had significantly greater mass-specific metabolic rates while Tipler pigeons consistently had lower mass-specific metabolic rates than homing pigeons flying for a similar length of time.



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Into thin air: the migratory flight of the bar-headed goose (*Anser indicus*)

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Although flight is a particularly costly form of transport, it permits birds to cover huge distances in relatively short periods of time, travelling between wintering habitats and seasonally favourable high latitude breeding areas. During their migrations, different species of birds may travel over demanding geophysical barriers, such as mountain ranges, deserts and vast expanses of ocean, which may incur great metabolic costs. Bar-headed geese (*Anser indicus*) make one of the highest migrations in the world, travelling across the Himalayan mountain range (mean altitude 5,000m) between breeding areas as far North as Mongolia and wintering areas as far south as India. However, despite their many adaptations for coping with high altitude, current models predict that larger birds such as bar-headed geese (2-3kg in body weight) should have only a marginal capacity to sustain climbing flight at sea level, while, at altitude, climbing flight should become even more challenging. In addition, above the Himalaya the air becomes progressively less dense with altitude, (providing less lift), and the partial pressure of oxygen at the top of Mount Everest decreases to a third that at sea level. We deployed satellite Argos-GPS transmitters on bar-headed geese in Mongolia and India to track the migration of bar-headed geese as they pass over the mountains and describe their maximal altitudes and flight performance as they traverse the eastern Himalaya. We contextualise bar-headed geese migration and their observed climbing flights with those of other avian species, estimate the power required for such flights, and suggest how these climbs might have been achieved.



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The importance of carry-over effect in Icelandic whooper swans

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Populations consist of individuals; hence understanding what drives variation in individual fitness is clearly vital to elucidating the mechanisms that drive population level processes. Quantifying this variation is particularly challenging for migratory animals, as different stages of the annual cycle are geographically isolated. Among migratory birds, much of the variation in individual fitness is likely to be a function of decisions made during migration, particularly in relation to timing of migration and site choice. From a conservation standpoint, a better understanding of this variation would enable us to identify the points or sites in the annual cycle where population regulation occurs and hence better target management interventions. Until recently choices made by individuals at different points in the annual cycle have been considered in isolation. A growing body of evidence however suggests that conditions in one season can be “carried-over” into subsequent seasons. For example, winter habitat selection is likely to have a strong effect on pre-migratory body condition, which in turn will influence both the timing of migration and breeding site selection. The Icelandic population of whooper swans (*Cygnus Cygnus*) has been the subject of an intensive marking and resighting program, at all stages of the annual cycle, for the past 30 years. The assembled resighting database consisting of over 180,000 resightings of around 9000 individuals is a unique resource to examine the importance of carry-over effects on a suite of life history parameters in this population. Here we utilise a range of existing and novel analytical techniques to examine how different wintering strategies affect individual fitness and survival, and ultimately population dynamics.



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Satellite telemetry of the white stork (*Ciconia ciconia*) - selected migratory routes

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From 1990 the ornithological station Loburg has been involved with satellite telemetry research of the white stork in cooperation with the Max Planck institute for ornithology in Radolfzell. This research has opened up entirely new possibilities of protecting birds along their migratory routes. The central part of the poster is dedicated to the female white stork “little princess” (German: Prinzesschen), who received the ring no. KA 0749 of the Ornithological Station Hiddensee and a satellite transmitter at our station in Loburg in 1994, enabling us to monitor and record her extraordinary migration performance in the following years. Her migratory route had a length of roughly 11.000 km crossing 22 countries until her arrival in South Africa. A large part of her migration was also tracked by following her in land vehicles and aircraft resulting in unique film documentaries and camera pictures (German TV channels: ZDF, MDR, ARD). In 1994 the Federal Republic of Germany published a special stamp in her honour. Further satellite telemetry studies with the white stork were made possible by LOTTO Sachsen’s financial support for the ornithological station in Loburg. This sponsoring has allowed us to seamlessly continue two decades of uninterrupted research. The aim of this last project is to learn more about potential changes of stork migration influenced by climate change. In the year 2008/2009 satellite transmitters were attached to four different white storks: Albert von Lotto, Petho, Leopold and Louis Henri. On the poster there are map figures of several migratory routes across Europe, Asia and Africa of these four storks including a discussion of the routes.



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Traveling light and fast in stochastic environments

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Long-distance migrants depend on (a chain of) staging sites where energy stores can be accumulated. How often birds should stop and how much fuel they should carry has been the focus of many studies. For example, time-minimizers should skip stopover sites with low or unpredictable food supplies, and departure fuel loads should enable birds to reach their next destination. Yet, carrying more fuel than required may bring energy (transport) and time (storage) costs and greater predation risk. The Afro-Siberian red knot *Calidris canutus canutus* migrates from West Africa to central Siberia in two long-distance flights via the key staging site in the German Wadden Sea. An annually varying number also stops at the central French Atlantic coast. We studied red knots on northward migration, a period when they seem to be extremely time stressed. Despite stochastic wind conditions between Africa and Europe red knots prefer to travel comparatively light. Hence, in years with unfavorable winds, they must make an emergency stop in France, which may have additional time costs. We studied food resources for four years and found that the French sites provide more predictable and better conditions to fuel than the Wadden Sea. Despite the good food, in most years most red knots skip France. Yet, they all visit the Wadden Sea, where fueling conditions deteriorated in the course of the study. What fitness consequences may result from the deteriorated fueling conditions or the time costs of an additional stop? Why do knots not store more fuel in Africa to be independent from unfavorable winds?



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Shorebirds in the southern Brazilian marine environment: increasing or decreasing the Neartic populations?

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In the southern of Brazil the birds find ecological resources necessary for its survival and fitness among stages of their migratory cycles. But many factors can influence the seasonal and spatial distribution of these populations, such as changes on the availability of resources due to human disturbance, climate change and the natural variation in the habitats conditions. This study aimed to (1) reveal the composition of Neartic shorebirds and (2) test the hypothesis of a possible population decline over the years studied on the coast of Rio Grande do Sul, Brazil. The study area is between 29°S and 30°S, where they covered 80 km per month in the years 2002, 2003, 2006, 2007, 2008 and 2009. We recorded 15 species of Neartic birds on the beaches. Six species were observed sporadically and 9 are often found. The most abundant were: *Calidris alba* (flocks of up to 8.000), *C. fuscicollis*, *C. canutus*, *Pluvialis* spp. and *Tringa* spp. The total abundance did not vary between years ($p = 0.83$), but some species were recorded less, (e.g. *C. canutus*, *P. squatarola* and *T. melanoleuca*). We observed that some species are arriving in these stanging areas earlier and some individuals are staying in place, waiting until the next breeding season. Effective bird conservation is not possible without monitoring information to tell us how population levels are changing, and ideally, providing pointers as to why these changes are taking place. The monitoring of bird populations has the added advantage that birds can act as valuable barometers or indicators of the general health of the countryside.



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Nocturnal passerine migrants tested with radiotransmitters and Emlen funnels at The Faroe Islands in the NE Atlantic Ocean

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Traditionally the migratory orientation in nocturnal passerines has been inferred from behaviour in Emlen funnels. With the emergence of small radiotransmitters it has now become possible also to investigate free-flying orientation in small nocturnal migrants in the wild. We compared the orientation of three passerine warblers (*Sylvia atricapilla*, *S. borin*, *Phylloscopus trochilus*) in Emlen funnels and in a free-flying condition using radiotransmitter at the southern tip of The Faroe Islands. Songbirds equipped with radiotransmitters could be tracked up to about 30 km. In most cases, the flight direction of radio-tagged birds stabilised a while after takeoff, and this appeared to indicate the onset of a migration episode. The results from the two techniques corresponded only to some extent. Differences were partly caused by abnormal behaviour by birds after release from cage and a preference to stopover for longer periods in some individuals.



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Why birds migrate?

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This bibliographic review gives a general overview on the currently published studies about bird migration. The cause for bird migration cannot be answered straightforwardly. The application of scientific reductionism saying that migration is an adaptation to life in seasonal environments is not enough to explain this extraordinary phenomenon. The reasons are complex and not fully understood. An amazing aspect of bird migration is that the route, location and perhaps even the techniques are designed into their brains. The review of current literature was undertaken with the aim of gaining knowledge that could serve as a guide and stimulus to deepen the study of bird migration. It would be misleading to divide bird species neatly into migratory and sedentary. Both types of behaviour can be found in a single species or even in a single population. Migration itself is not a trait in its own right, but an attribute made up of several components.



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Flying strategies of inexperienced young pigeons

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To study the behaviour of young pigeons during the phase of map learning, routes of young, inexperienced pigeons released at four sites up to 13.5 km from the loft were recorded with GPS-based tracking devices. While the flights of the young pigeons at first glance seem to be somewhat erratic, they are apparently limited to either the northern or southern semicircle. The activity seems to be centered around the release site to which pigeons often returned after excursions in the various directions. The length of the routes often exceeds the distance release site - loft more than five times, while at the same time the tracks seldom cross a circle around the release site through the loft that appears to form some kind of virtual border. The additional length of tracks do not only result from the young pigeons circling above areas close to the release site, but also from extended flying near this virtual border. Together, these observations suggest that young pigeons when gaining experience to improve their still rudimentary map limit their flights to specific area, applying strategies that do not only tolerate some navigational errors, but also allows extended exploration while mimimizing the danger of getting lost.



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Banding and monitoring programs of magellanic penguins on the Brazilian coast in 2008

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Regarding banding procedures, in contrast to other seabirds, it is not feasible to use leg bands on penguins due to their joints. In this case, caution in band design is needed considering evidences that flipper bands may adversely affect some species, especially aluminum bands. Flipper banding is cheap, allows monitoring of a greater number of animals, enables identification to be made from a distance and has been largely used on penguins since the 1950s. In Brazil, data regarding the number of magellanic penguins (*Spheniscus magellanicus*) banded each year, or its recovery, have not yet been extensively discussed. A governmental institution, the National Center for Bird Conservation Research – CEMAVE, controls banding activities in Brazil. Each year thousands of magellanic penguins migrate along the Atlantic coast of South America and some are found ashore along the Brazilian coast. Most animals are juveniles with high degrees of parasitism and low body weight. Some may be oiled. During the migrating season in 2008, a greater number of magellanic penguins were seen on a wide extension of the Brazilian coast. Hundreds of birds recorded were not only debilitated but also oiled, especially in Santa Catarina State. Rehabilitators have cleaned and cared for these weak and oiled birds, although hundreds were found already dead. In 2008, seven Brazilian institutions have banded magellanic penguins, totalizing 708 animals rehabilitated and released. Of these, 518 penguins were released with official stainless steel bands provided by CEMAVE. Other institutions released 91 birds with alternative rings (IA# n = 72 and GREMAR# n = 19). This study shows that a cooperative effort has been undertaken by Brazilian organizations in order to establish standards for penguin rehabilitation, release and monitoring. IFAW & IBRRC's initiatives' were crucial to help integrate rehabilitation centers, besides CEMAVE's support to researchers and banding projects.



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Long-term banding data from a RAMSAR site in southern Brazil

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In Brazil, one of the most important areas for migratory bird species is the Lagoa do Peixe National Park, a protected area officially created in 1986, because of its relevance to these birds, demonstrated by the study developed at that time by the Wild Birds National Conservation and Research Center - CEMAVE, a governmental institution, linked to the Ministry of Environment / ICMBio, which controls ringing data activities in this country. This protected area, located in the state of Rio Grande do Sul, includes coastal habitats like salty and freshwater lagoons, associated wetlands, dunes, beaches and sea. Such habitat diversity associated with the high productivity of the lagoon is very attractive to both resident and migratory bird species, whose come for this area in search of temporary better food supply conditions compared to the north winter. For this reason, this area became a RAMSAR site in 1993. In this study, we analyzed banding data registered in this site by the CEMAVE staff through 21 years, not sequenced, since 1984 to 2008, totalizing 24 expeditions, 21 of them carried during the Brazilian autumn (march/june). In each field mission it was used at least 30 mist-nets, opened from dusk to dawn, during 10 nights. Every captured bird had the morphometrical parameters registered, were banded and released. A total of 10,677 birds were captured, comprising 50 species from 18 families grouped in 8 orders, being the richest one the Charadriiformes, with 33 species. The most captured species were the common tern *Sterna hirundo* (3,264) and the red-knot *Calidris canutus* (2,675). During the study a total of 535 rings were recovered, being 381 from North America. These results points out to the great importance of this site and to the importance on continuing this long term-studies.



Conditioning on magnetic field shift with food as reward in the ruby-throated hummingbird (*Archilochus colubris*)

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Conditioning experiments using magneto-perception have been few and with ambiguous results. A possible explanation is that perception and use of magnetic fields may be context dependent, the sensors or the neural information treatment mechanisms normally being turned off and activated only when needed. It is not yet known whether hummingbirds use magnetic cues during migration, being small for traditional orientation funnels. We used ruby-throated hummingbirds during south-bound migration at Fort Morgan, Alabama, to find (1) if they could perceive a magnetic field shift, and (2) if they could be conditioned on such a field shift. Two feeders, one with sugar solution and the other with water, were placed in the centre of two 1x1x1 m cages with magnetic coils, which were put close to each other in an open area where individual birds could be followed closely. The birds could reach the feeders only from the sides where the shifted field penetrated out of the coil cage. The field was shifted 110 degrees off north for the sugar feeder. Fifty cm outside the cage the shift was still 80 degrees so the birds were potentially able to discriminate between the two cages well before entering one of them. During training, the feeders were changed between the two coils. When the focal bird seemed to have learned to choose the sugar feeder irrespective of the location of it, and presumably was trained on the shifted field, we presented water in both feeders, and shifted the field again, recording which feeder was first visited. Due to many disturbances, rapid turn-over of individuals and fights between them, only nine acceptable results could be obtained (i.e. with the same undisturbed individual present sufficiently long): in eight of the nine tests, the bird made the right choice. Although this is not significantly different from a random result, it suggests that ruby-throated hummingbirds can perceive magnetic field shifts and, possibly, can use magneto-perception in learning.



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SA06 Morphology, Ecomorphology, Evo-devo and Development



Photos and rulers: what works better a camera or a paquimeter?

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As bill size and shape are a key role on feeding abilities, it may give clues on a species's feeding behavior. Most bill measurements are still done with a paquimeter, usually without repeated measurements. Here we test a morphometrical methodology based on photography. We used three specimens of *Amazona aestiva* and three of *Amazona amazonica*. We made three non-sequential paquimeter and photographs measurements on bill size (BS), bill gap (BG) and bill width (BW). Photographs were taken 1.5m away (6mp resolution). We used a 3 cm steel bar (0.001mm precision) as a photograph scale resulting on a 0.05mm precision. Alignments were carefully done in order to avoid errors. We informed the scale (steel bar size) to J-image software and mouse measured the bill. We examined differences between the methodologies within each measurement with Kruskal-Wallis. To detect accuracy differences between the methods we used a pairwise sign test between the coefficient of variation (CV). We found no difference between paquimeter and photograph measurements. However, differences on CV indicates that BG measurements were more accurate for photography ($p < 0.05$), probably due to difficulties to position the paquimeter properly. Pictures don't have this limitation however, as measurements are done with a virtual ruler. BW photography measures were extremely difficult, as it was really hard to find the proper focus distance of the widest part of the bill. BS was properly measured either way. Digital photography also gives the possibility of shape measurements, and to make measurements quite after a trip to a museum. The methodology may therefore be used on future work, except for width bill measures.



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Comparative anatomy of the syrinx in the Bucconidae

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The Bucconidae includes 35 species in 12 genera. Given that the syrinx is morphologically very variable, and has been an important source of characters at different taxonomic levels, we made a comparative analysis of this organ in 21 specimens of the Bucconidae belonging to 8 species (*Monasa morphoeus*, *M. nigrifrons*, *Chelidoptera tenebrosa*, *Malacoptila rufa*, *M. striata*, *M. rufa*, *Bucco tamatia* and *Notharcus ordii*). Our aim was to detect variable characters that could be useful in taxonomic studies. The syrinxes were studied using a stereomicroscope after being clarified and coloured with Alcian blue and Alizarine red. The skeletal elements termed A are those that are more cranial, more robust and more calcified; the elements termed B are the more caudal, slender and cartilaginous. The more cranial elements A are complete whereas the most caudal, which support a bifurcation of the trachea into the bronchi, are incomplete ventrally and/or dorsally, and this aspect was very variable in the specimens studied. The complete, more caudal elements A and the ventrally/dorsally incomplete are fused (forming the tympanum). Caudally to the tympanum follow the B elements, becoming divided and medially incomplete, and they support the bronchi. The tracheolateral muscle originates in the glottis, extends laterally to the trachea and it inserts ventrally or laterally on the complete caudal elements A; the sternotracheal muscle originates at the sternum and inserts laterally on the trachea close to the syrinx. The point of insertion of these muscles, and also their proportions and position in relation to the trachea, were variable in the taxa studied. Funds: CNPq, CAPES.



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Morphometric differences in two populations of Malvinas skua *Stercorarius antarcticus*

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Skuas are birds characterized by presenting a high fidelity to the pair and the breeding site, for this reason it is probable that far away populations of the same species present some degree of differentiation on their morphological characteristics. The discriminant function analysis (DFA) is a useful technique to differentiate individuals of different species and sexes from their morphological measures. In this case it was applied with the aim of developing functions which would enable us to differentiate the individuals of two different populations. We worked on Malvinas skua, *Stercorarius antarcticus antarcticus*, from the populations of Malvinas Islands and Argentinean Patagonian coast. Measures of culmen, bill height and width, tarsus and wing chord were used, from alive and museum individuals of both populations. Only the bill height and width measures presented significant differences between populations, because of that they were the ones used in a DFA. This analysis generated a function which let us assign correctly the origin population with a 90 % of certainty. Despite the small number of the sample, this study highlights the occurrence of some morphological differentiation between individuals of two populations of the same subspecies, possibly originated by the isolation between both. Also, it gives a tool that could be applied to the determination of the breeding site of individuals found in other areas of their distribution.



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Ecological segregation based on the morphology and diet of the understory insectivorous birds on the Deciduous Seasonal Forest, GO, Brazil: testing the Hypothesis of Limiting Similarity

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Communities structured by competitive interactions should provide a limit of similarity in the use of resources that can ensure the coexistence of species (MacArthur & Levins, 1967). In this context, the objectives of this study are: (1) determine how the insectivorous birds, residents of the understorey in deciduous forest, share resources, or as segregated in relation to diet and (2) test the hypothesis of limiting similarity, the guild addressed through the use of null models. Individuals were captured with mist nets and were taken with a digital caliper morphometrics. For the analysis of species in relation to diet, a Principal Components Analysis (PCA) and Cluster Analysis based on Euclidean distance of the farthest neighbor. In morphological space, the ordering of the species was based mainly on measurements of beak, body size. The analysis separated species with larger body size (total length) and longer beak at one end in the morphological space. In extreme were separated, still, species with beak thinner *Galbula ruficauda*, the nozzle thicker and wider, *Taraba major* and *Nonnula rubecula*. In contrast morphological space were observed smaller species. In an intermediate space in the ordination axes formed a group with intermediate body size and beak. In two diet analysis of ordination, was formed three groups: (1) formed by *Taraba major*, more foreign species, *Basileuterus hypoleucus* and *Furnarius rufus*, with high rates of food ants, (2) formed by *Myiobius atricaudus*, *M. barbatus* and *Galbula ruficauda*, with high proportions of Hymenoptera other than Formicidae in their diets, this group is composed exclusively of species that catch the insects in flight by air maneuvers and (3) with the remaining larger group of species with high rates of food Coleoptera. The index of overlap in relation to body measures, observed was approximately 0.18, value greater than the average of the index dummy (0.08), though the overlap values obtained are not significantly different from expected values in random communities. Probably, the community of insectivorous not show a structure based on segregation by resource competition.



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Protandrous migration and variation in morphological characters in *Emberiza* buntings at an East Asian stopover site

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The effects of timing of the breeding migration on reproductive success differ between the sexes, so various sex-differential tactics for migration timing have evolved in many migratory avian groups. Various hypotheses have been proposed to explain differential migration to breeding or wintering grounds, and inter- and intrasexual size differences are often enumerated as one of the proximate mechanisms. We investigated 1) arrival patterns in the spring by individuals of each sex, 2) sexual size dimorphism and related morphological variables, 3) the relationship between size variation and arrival date in five bunting species that pass through the East Asian migratory flyway from 2006 to 2008. In all five species, males migrated before females, and significant sexual dimorphism was observed. Several morphological characters, including total length, tail length, and wing length contributed to the size variations, and bigger males arrived earlier whereas there was no relationship between arrival date and size in females. Our study confirmed that East Asian buntings display a discriminated protandrous migration pattern at the stopover site as well as in the breeding ground, which is consistent with the view that large size in the chosen sex is favored due to its association with early arrival thus preoccupy resources and enhance mating success.



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Carbonic anhydrase and calcium mobilization from the avian eggshell during embryonic development

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The avian eggshell contributes to successful embryogenesis by acting as the major source of calcium. It has been suggested, moreover, that birds have evolved eggshells with different structures adapted to cope with different calcium requirements imposed by different growth rates and modes of development. Yet the mechanism of calcium removal from the avian eggshell by the embryo remains unknown. Using enzyme histochemistry, we here test an old hypothesis stating that calcium is released from the eggshell by means of acidification by the action of carbonic anhydrase (CA) in the extra-embryonic chorio-allantoic membrane (CAM). This enzyme catalyses the reversible reaction $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{H} + \text{HCO}_3$ and is known to take significant part in acid-base regulation in the body. We examined CAMs from two bird species, *Coturnix japonica* and *Sturnus vulgaris*, with very different growth rates and modes of development. The CAMs were examined for CA activity at the later stages of embryonic development. However, in all CAMs examined, staining for CA was absent, leading us to the conclusion that existing hypothesis about a link between CA and embryonic calcium mobilization from the avian eggshell is at present premature.



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Molt and tail length of the long tail sylph (*Agelaiocercus kingi*)

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The long tail sylph (*Agelaiocercus kingi*) is a highly dimorphic hummingbird; the male having extremely long outer tail feather, compared with the female. We examined the molt period and recorded the tail length of its two Venezuelan subspecies: *A. k. caudata* from south-western Venezuela (museum specimen), and *A. k. margaritae* from the coastal mountain range (birds mist-netted in Portachuelo Pass -Henri Pittier National Park, Aragua state-). We recorded whether birds were molting tail, wing and body feathers, in 89 males and 17 females of *A. k. caudata*, and in 339 males and 205 females of *A. k. margaritae*. *A. k. caudata* molted between June and September, and *A. k. margaritae* between September and November. In both subspecies the frequency distribution of tail length was bimodal, including short-tailed birds (76.9 ± 0.8 mm average length for 51 adults males of *A. k. caudata* and 87.2 ± 9.4 mm for 46 adult males of *A. k. margaritae*) and long-tailed birds (132.7 ± 1.8 mm average length for 39 males of *A. k. caudata*; and 118.2 ± 8.8 mm for 69 adults males of *A. k. margaritae*). Short-tailed males are likely younger than long-tailed, but within each sub-group, there is a variability, not likely explain by age.



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Abnormally billed ashy-headed greenlet (*Hylophilus pectoralis*) in an Amazonian savanna

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Many occurrences of bill abnormalities have been registered for captive birds. However, registers of bill deformations on birds in the wild are less common. Bill abnormality may be caused by bill injury, mutation or teratogeny. We captured an adult ashy-headed greenlet (*Hylophilus pectoralis*) with an abnormal bill on September 1st 2009, during a bird survey made with 36 mm mist nets in an Amazonian savanna, located in a peninsula on the right bank of the Tapajós River. The upper portion of the bill was curved to the right, while the lower mandible was slightly curved to the left. We did not observe the bird's feeding behaviour. Its bite was much weaker than what we have noticed for its conspecifics. The bird showed no other signs of abnormalities. Since there were no signs of weariness due starvation, we believe the bird was adapted to its handicap. The ashy-headed greenlet is known as an insectivore that forages on tree trunks, but has also been registered feeding on fruits. This adjustable feeding behaviour may facilitate the bird's survival. The survival of abnormally billed individuals due to their own and to conspecifics' behavioural adaptation has been registered in the wild.



Functional morphology of the neck in the Ardeidae

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Birds of the heron family are able to extend and retract the neck in a very rapid movement so that they are able to lunge with the beak like a harpoon. According to the literature, this movement is facilitated by a special articulation between the 6th and 7th cervical vertebrae. In all Ardeidae the articulations C5-C6, C6-C7 and C7-C8 are principally responsible for the marked retraction of the neck (dorsiflexion), with the most important being the articulation C6-C7. In the vertebrae C3 to C6 the articulations of the prezygapophyses are angled dorsocranially, whilst C7 to C10 are directed dorsocaudally. Nevertheless, there are details of the cervical vertebrae among the species of this family. In the genus *Ardea* (*A. cocoi*, *A. cinerea*, *A. herodias* and *A. purpurea*) and in the Botaurinae (*Botaurus* and *Ixobrychus*) the vertebra C5 shows a caudal expansion of the articulations of the postzygapophyses that is not present in the other species of the family. Only in *Tigrisoma*, *Agamia*, *Pilherodius*, *Botaurus* and *Ixobrychus* the vertebra C6 has a very high spiny process. The cranial extreme of *processus costalis* of the vertebra C7 are more expanded cranially in *Agamia* and *Tigrisoma* than in the other ardeids. These features comprise some of the differences between species of the Ardeidae that function to provide the moment of force needed to extend the cervical column so as to lunge with the beak like a harpoon. Darters (Pelecaniformes: Anhingidae) also realize this type of neck movement but whereas in the Ardeidae the cervical vertebrae C6, C7 and C8 articulate in the form of a "U", in maximum dorsal flexion, the darters articulate in the form of an inverted "U", that is with maximum ventral flexion. Funds: CNPq, CAPES.



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SA07 Nutrition, Energetics and Foraging



Campos do Jordão 2010 25th International Ornithological Congress 22-28 August 2010 (www.i-o-c.org)

Availability peak of caloric fruits coincides with energy-demanding seasons for resident and non-breeding birds in Restinga, an associated ecosystem of the Atlantic forest, Brazil

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We evaluated temporal variation and quality of food resources available to birds especially in two energy-demanding seasons: one when there is a peak of molting residents and another when non-breeding individuals are the bulk of biomass of captured birds. Birds were captured and observed, as well as fruits counted and collected, in two restinga sites for two years at Restinga de Jurubatiba National Park, Rio de Janeiro. Molting resident birds (biomass of captured birds mostly represented by *Mimus gilvus*) may rely basically on the regularly produced *Clusia hilariana* and *Erythroxylum* spp. fruits as lipid-sources, while non-breeders (mostly *Turdus amaurochalinus*) count on *Ocotea notata* fruits (also rich in lipids) during their passage by the study site. We found that fruits with sugars, lipids or proteins were available throughout the whole period, but a more intense seasonal variation was observed for those plant species. The birds studied are highly frugivorous and are known to be potential seed dispersers of these plant species, which are important components of restinga plant community structure. Funding: CAPES, CNPq, PELDsite-5.



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Metal contamination in common terns: status, trends, and vulnerability to contaminants from fish

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In many places in the hemisphere common terns are used as bioindicators of environmental contamination. We have measured cadmium, lead, and mercury in the eggs and feathers of common terns for over 35 years in coastal New Jersey. While levels of cadmium and lead and common tern eggs have declined, the levels of mercury have remained relatively constant. The levels of contaminants in the feathers of young birds can serve as an indicator of local exposure, and suggest that the levels of metals, especially mercury, are acquired from local exposures. The levels of mercury in the prey fish of common terns from Barnegat Bay indicate that there is yearly and seasonal variation in mercury, lead and cadmium levels that partly reflect size relationship. Further, there is some indication that the terns bring back prey fish from the estuaries that have greater levels of mercury than those in prey fish caught by seines or other collection methods. This suggests that prey fish with greater contaminant levels may be easier to catch, and pose a greater risk to nesting terns.



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Diet composition of *Athene cunicularia* and its influence upon individual quality

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Food availability in a territory may affect survivorship and reproduction of animals. Individual condition and number and quality of young, as well as mating systems are affected by the amount and quality of food ingested by an individual. The burrowing owl (*Athene cunicularia*) is an excellent species to test the effect of food intake on a variety of factors influencing an animal's life, since it is easy to find regurgitated pellets around their nests. We monitored 21 territories of *A. cunicularia* and collected pellets weekly. We subsequently separated food remains from the pellets and identified prey items to the lowest possible taxonomic level. A total of 96.8% of the diet of *A. cunicularia* was composed of invertebrates, most of them (67.1%) Coleoptera, followed by Isoptera (25.3%). Rodents were the most common vertebrates, although they amounted to only 3.1% of the diet. There was a positive and significant relationship between weight of the birds and the richness of prey items (no. of taxa) found in the pellets. In general, the diet composition we found is in agreement with other studies, except for the high presence of Isoptera. Our data suggest that individual condition of nesting birds may reflect the richness of prey found in territories, and this habitat variable may affect important features of survivorship and reproduction in this species.



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Frugivory by birds in *Copaifera langsdorffii* Desf. (Caesalpiniaceae) in a rocky savanna in the Parque Estadual da Serra Azul, Mato Grosso, Brazil

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Several bird attributes affect their efficiency as dispersers. In order to infer about the potential of each species to act as seed dispersers of *Copaifera langsdorffii*, this study was carried out in a rocky savanna area in the Parque Estadual da Serra Azul (15°52'S, 51°16'W), Mato Grosso, Brazil. Fruits eaten were noted by focal-individual observations, which included frequency of visits, fruit taking behavior, consumption tax, and feeding behaviors. In eight hours of observations (September 2009), 49 visits were recorded and eleven species were observed consuming fruits of *C. langsdorffii*, such as blond-crested woodpecker, streaked flycatcher, boat-billed flycatcher, masked Tityra, white-naped jay, pale-breasted thrush, creamy-bellied thrush, chalk-browed mockingbird, hooded tanager, Sayaca tanager, and burnished-buff tanager. From these, only the tanagers and the white-napped jay were not considered potential seed dispersers, since they all dropped seeds under the parent tree. All other species swallowed the whole diaspore. In total, 219 fruits were removed and the main seed consumer was the non-disperser white-napped jay (31.5%). The main seed potential disperser, however, as well as the most frequent visitor, was the pale-breasted thrush, which removed 22% of the diaspores and had frequency visit tax of 0.032. The main technique used on fruit removal was picking (57.5%), followed by reaching (31.5%), hovering (6.4), and hanging (4.1%). The large number of species recorded as potential seed dispersers of *C. langsdorffii*, being most of them very abundant in Brazilian savanna areas, may guarantee seed dispersal of this plant and regenerate disturbed areas.



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Foraging ecology of an inshore seabird: how can the smallest penguin *Eudyptula minor* help to answer big questions in a changing world?

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Seabirds use two different ecosystems in their life cycle; they must breed on land but rely totally on the ocean for their food supply. However, there is disproportionately less information available on their marine life cycles. Only quite recently, thanks to new techniques, the marine life of seabirds has been revealed. Seabirds, penguins in particular, can be good indicators of the health of marine systems, so the need for long-term datasets on their foraging behaviour is growing, in particular to monitor or predict the impact of climatic changes in the oceans. Most studies on their foraging strategy are biased towards species using pelagic habitats with relatively less information on those using inshore. Strategies used by pelagic seabirds may not be the same than those of inshore species, which spend their lives in a much smaller area, may not migrate and may be more sensitive to changes at local rather than large scales. Here, we will summarise the results of a long-term study of the foraging ecology of the smallest penguin *Eudyptula minor* by examining its diet (using conventional and isotopic methods), diving behaviour and foraging plasticity. Parents can decrease food provisioning, increase diving effort and simplify their trophic breadth in response to years of low breeding success. Further, we have been able to detect penguins fishing up the food web after a massive mortality of a key lower trophic-level prey and discovered that foraging success decreases when thermoclines are absent in the penguin's foraging zone - an event that could become more frequent due to climate change.



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Birds at winter-flowering *Aloe ferox* in South Africa: a nectar source in a season of scarcity

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During the two-month winter flowering period, dense stands of *Aloe ferox* produce large volumes of relatively dilute nectar (12.5% sugar content). This plant is thus predicted to attract primarily opportunistic nectar-feeding birds to serve as its pollinators, rather than specialist nectarivores such as sunbirds, which should favour more concentrated nectar sources. Studies of *Aloe marlothii* in northern South Africa by other researchers supported these expectations. However, in the Eastern Cape region flowering aloes attract many sunbirds. For three years we have used monthly point counts and constant-effort mist-net captures at an extensive patch of *Aloe ferox* to monitor the species diversity and abundance of birds before, during and after the flowering season. Malachite sunbirds *Nectarinia famosa* are present only during the aloe flowering period, and are often the most abundant species. Ringing has shown that individual malachite sunbirds visit different aloe patches, and also return to the same sites in subsequent years. By contrast the amethyst sunbird *Nectarinia amethystina*, a common species in the region, has not been recorded feeding at aloes. While bird species composition changes, there is no significant increase in total species diversity during the flowering period but the numerical abundance of birds increases hugely at this time. Examining captured birds for pollen has shown that there are no significant pollen residues on 90% of the malachite sunbirds, whereas > 50% of the occasional nectar feeders such as weavers (*Ploceus* spp.) and streaky-headed seedeaters *Crithagra gularis* were heavily coated with pollen. Both specialist and occasional nectarivores exploit this food source, but specialists are nectar robbers, while the occasional nectar feeders pollinate the plants.



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Diet of the Brazilian tanager (*Ramphocelus bresilius*) in a natural reserve in Rio de Janeiro, Brazil

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The Natural City Park Chico Mendes is located in the city of Rio de Janeiro. The vegetation is of dry and muddy restinga. The objective of this study was to know the diet of the Brazilian tanager (*Ramphocelus bresilius*) in the Park. Individuals of Brazilian tanager were captured with mist-nets being administered a solution of tartar emetic resulting in 41 induced regurgitation and some feces samples. After the bird have regurgitated the identification of the vegetable and animal items was accomplished using a stereo microscope. Vegetable and animal items were found together in 58% of the samples, but only vegetable (34%) or animal (8%) items were also found in the samples. Eight vegetable species were identified in the sample, but three seeds were not identified, being categorized in morfotypes. *Ficus* sp. was the species of the most seeds encountered in the samples (42%). The Coleoptera was the main order amongst the animal items consumed (54.2%). Through the induced regurgitation and feces samples analysis of the tanager, it is concluded that the species is mainly non-specialized frugivorous, with its diet constituted by small fruits with large number of seeds. The vegetable species *Ficus* sp. was an important food resource for the Brazilian tanager, being consumed during most of the year.



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An alternative technique to estimate prey consumption in the king penguin and other diving birds

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Seabirds such as penguins play a central role in marine food webs, and it is important to determine how much and when they forage. Several methods have been employed to measure prey ingestion events, each with advantages and disadvantages: probes measuring temperature drops in the oesophagus (OesoDrop), Hall sensors recording beak opening events (BeakOp), depth-recorders identifying undulations in the dive profile (Wiggles) and accelerometers measuring changes in wing stroke frequency (WingF). We employed these 4 different techniques simultaneously to evaluate estimates of prey consumption in free-ranging king penguins (*Aptenodytes patagonicus*). BeakOp, the most accurate technique, served as standard against we compared the 3 other techniques. They all detected prey capture events less reliable than BeakOp. When capture frequency was high, OesoDrop tended to underestimate number of ingestions. In contrast, Wiggles can highly overestimate the number of ingestions during some dives. While BeakOp is the most reliable method to investigate prey capture in king penguins, such sensors are technically difficult to attach without impairing movements/behaviour at sea. We show that a combination of depth and acceleration records detects prey capture very accurate and, at the same time, instrumentation is easy and less disturbing to the animal. We discuss this technique for monitoring feeding success at high temporal resolution in a large range of fish and krill eating seabirds.



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Little Auks' feeding grounds under different oceanographic conditions

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The structure of Arctic ecosystems appears to be simple, with relatively small number of components occurring in enormous populations. Eliminating even one of the key species such as little auks (*Alle alle*, LA), may have cascading effects and cause reconstruction of whole ecosystems. LAs are the most numerous planktivorous seabirds in the Arctic, inhabiting the west coast of the Spitsbergen. Their breeding successes depend on available food resources influenced by unstable arctic environmental conditions. In the years with stronger influx of Atlantic waters, the proportions of the preferred energy-rich arctic copepod *Calanus glacialis* in zooplankton on the Spitsbergen shelf systematically decline in contrast to less caloric Atlantic *C. finmarchicus*. So far only a fragmentary knowledge on zooplankton distribution on the LAs' feeding ground obtained with single plankton nets was accessible. Improved methods (replicate samples, vertical stratification, Laser Optical Plankton Counter (LOPC)) provide novel, much broaden information of LAs feeding conditions on West Spitsbergen Shelf. Moreover the LOPC has the potential to determine and locate the optimal foraging areas for LAs through generating 3D maps of zooplankton distribution in different size categories. The previous results have demonstrated that the Hornsund region where the Arctic current influence is stronger, clearly offers better feeding conditions for the LAs (the ratio of *C. glacialis* to *C. finmarchicus* 1:1) than the Atlantic influenced warmer north region (*C. glacialis*: *C. finmarchicus* 1:14). We compare LAs' zooplankton prey structure and abundance in different areas of Spitsbergen shelf presenting results basing on both traditional methods (2007, 2008) and advanced technology with vertical and horizontal complete investigation (2009).



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Predation of *Platyrrhinus lineatus* (E. Geoffroy, 1810) (Mammalia: Chiroptera) by *Cyanocorax chrysops* (Vieillot, 1818) (Aves, Passeriformes)

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The predation of vertebrates by birds, including bats, is very common in some families (Accipitridae, Falconidae, Tytonidae, Strigidae), constituting the main diet of them. For other families (except those that feed themselves strictly on the consumption of fish) it becomes occasional and sometimes a matter of opportunity. Here we registered the predation of a kind of bat (*Platyrrhinus lineatus*) by a Neotropical bird, plush crested-jay (*Cyanocorax chrysops*). In the neotropic the species concerning to the *Cyanocorax* genera present mixed diets, by this way, it was already registered food items that varied from anthropods and fruits to unsuccessful attacks to *Turdus leucomelas*, *Pitangus sulphuratus* and in this present study a kind of bat. On July 26th, 2009, near 11:00 AM, it was registered an undetermined sex individual *Cyanocorax chrysops* carrying in the beak a sample of *Platyrrhinus lineatus*. After crossing approximately 30m in an open orchard area, the bird landed on an unidentified tree 5m high (approximately); then, held the *Platyrrhinus lineatus* with the feet and pecked strongly it in the head, for 5 minutes, till dilacerate it. This record occurred during the execution of the mastering project - OFJ - Animal Biology Program - UNESP - São José do Rio Preto, in the Jacarezinho Farm (20°59'44"S, 50°51'22"W) (Valparaiso - São Paulo). The prey species identification proceeded by visual observation, considering the bat size and its external morphology, especially by the presence of the white dorsal bright stripe. Probably, the adopted *Platyrrhinus lineatus* behavior, of living together or in pairs on the canopies of trees, turned the capture by the ornith easier. This record highlights another feed item in the *Cyanocorax chrysops* diet and underlines the necessity of additional studies relating to birds diet in the neotropic, even though those ones are more noticeable. Funding Agencies: FAPESP, CNPq.



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Miniature GPS and temperature loggers as a tool of studying foraging range, flight patterns and daily time budget of little auks (*Alle alle*)

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Dramatic changes in climatic and oceanographic conditions in high Arctic influence largely zooplankton communities and availability of food resources for planktivores such as Little Auk (LA) which is the most numerous colonial seabird and a keystone species in many Arctic ecosystems. Increasing influx of warm Atlantic currents replacing Arctic waters with preferred by LA energy-rich calanoid plankters, forces breeding birds partly to change their diets, feeding behaviour and probably the range of foraging flights. To study the latter questions we used 4.7g (including battery) miniature GPS devices and 1g miniature temperature loggers which were attached to birds and checked every 2-5 days. The study was performed in July-August in Magdalenefjorden (NW Spitsbergen) in large LA breeding colony. We obtained 2930 hours of temperature records taken every 60 seconds from 18 birds and 111 GPS fixes from 2 birds equipped with devices. The results show that the range of foraging flights reached at least 130 km and total distance covered during single flight was 250-300 km. Usually the flights to feeding grounds characterised with many stopovers in contrast to flights back to colony. Basing on temperature loggers records, during the chick-feeding period parent birds spent on average 38.3% of their time feeding, 21.8% flying and 39.9% staying in the colony. Some constraints of the method are related with stress and extra loading of the parent birds, which could result in disturbance in their behaviour, chick feeding frequency, and consequently, delayed chick development.



Ecological and behavioural response of little auk (*Alle alle*) to climate change in the high-Arctic

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Since breeding ecology of animals feeding in the sea often reflect conditions in marine ecosystems seabirds are considered as sensitive indicators of oceanographic changes. Little auk is planktivorous colonial seabird breeding in high Arctic. This region is currently undergoing a dramatic climate change. Studies performed in large colonies in Spitsbergen show that little auks respond to climate changes in different ways, modifying timing of breeding, diet composition and parental efforts. Birds from Hornsund colony advanced breeding over the period 1963-2008 as their nests are now available earlier due to advanced spring snow melting. To cover their extremely high energetic demands little auks focus on energy-rich copepod *Calanus glacialis* associated with cold Arctic waters. This prey, due to climate changes, is replaced by less profitable *C. finmarchicus* carried by warm Atlantic currents. Studies performed in seasons and areas of Spitsbergen differing in predominance of water masses (cold Arctic vs. warm Atlantic) and ice conditions demonstrated flexibility of the little auk time and energy budget. Energetically less valuable food delivered to chicks in years/areas with greater influx of warm waters were compensated by greater rate of food provisioning. Parents also spent more time foraging. This indicates that little auks in warmer seasons/areas are forced to spend more time on searching for preferred food in suboptimal conditions and/or to fly to distant foraging grounds where preferred prey is still abundant. This suggests that little auks may be negatively impacted by expected further climate warming in Arctic.



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Can the foraging behaviour of shorebirds explain their decline in the Murray Estuary, South Australia?

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The Coorong National Park, South Australia, includes the estuary of the Murray River, the largest river in Australia, which has been blocked with barrages since the 1940's. It is an important over-wintering site for migratory shorebirds, however its importance has declined as the system has been under extreme environmental constraints following reduced water flows over the barrages into the estuary. This has led to the closure of the Murray mouth with a concomitant rise in salinity and decline in the health of the Coorong. The mouth closure has reduced tidal movements, which, together with rising salinity levels, have reduced the benthic fauna and hence the food available for shorebirds. Of the 20 shorebird species found in the National Park we have focused on five: red-necked stint (*Calidris ruficollis*); sharp-tailed sandpiper (*C. acuminator*); curlew sandpiper (*C. ferruginea*); bar-tailed godwit (*Limosa lapponica*); and black-tailed godwit (*L. limosa*). We studied their foraging behaviour and the availability of suitable benthic food in the mudflats they utilised during the 2006-2007 and 2007-2008 over wintering periods. By analyses of video we quantified foraging techniques, intake rates, time spent foraging, and energy expenditures. We recorded the food availability on the mudflats by benthic sampling to show the depth at which prey items are found in relation to the bill length of the five focal species. The foraging behaviour and food availability indicate why some species of shorebirds have declined while others have remained relatively stable.



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Wintering diet of the North African houbara bustard: inferences on the species foraging strategy

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The North African houbara bustard (*Chlamydotis undulata*) is described as omnivorous and opportunistic; its diet reflecting local abundances of plants and invertebrates. However comprehensive studies based on both plant and animal material are lacking to confirm or invalidate this postulate. The species wintering diet was studied to the taxonomic level using 42 adult stomach contents, collected in 2004, 2006 and 2007, within two areas. Taxa were identified to the species or genera using a herbarium, a plant epidermis reference collection, an invertebrate reference collection, and an invertebrates' fragments reference collection. We analysed the variation of diet according to sex, areas and years. The wintering diet was mainly composed of plant material ($66\% \pm 25$). The relative proportion of plants and invertebrates did not differ between sexes, nor year or area. Plant and invertebrate assemblages differed between years and areas but not between sexes, suggesting that both sexes forage in similar habitats and that their diet reflects spatial and temporal variations of plant and invertebrate availability. Analyses on taxa occurrence, relative abundance and their distribution between samples highlighted that while houbaras ingested a high diversity of plants, they favoured 5 families and selected mostly basal green leaves. Within invertebrates, houbaras favoured 3 Coleopteran families and one genera among the Formicidae, which all presented differences in morphology and ecology. This first study on the African houbara bustard diet emphasized the opportunism of the species in winter, but also underlined its ability to select specific plant organs and particular invertebrate taxa, providing novel inferences on its foraging strategy



Nutrient content and morphological features of alien fruits consumed by dusky-legged guan (*Penelope obscura obscura*) in the lower delta of the Parana River

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Dusky-legged guan (*Penelope obscura obscura*), a threatened species in Argentina, is the southernmost member of the Cracid Family and the Delta of the Paraná River is its distribution boundary. This eco-region has been modified by human activities since the middle of the XIX Century, having a strong impact on the original habitat of this guan species. At present, the guan diet is composed mainly of alien fruits. We compared physical properties and lipids, carbohydrates, proteins, water and minerals contents of alien fruit in each season: *Phytolacca Americana* (PA), *Ligustrum lucidum* (LL), *Ligustrum sinense* (LS), *Rubus* sp. (RS), *Morus nigra* (MN), and *M. alba* (MA). All these fruits have red, purple or black colours and the size of fleshy fruits were in average width and length between (0.42 x 0.42 mm to 1.90 x 1.20 mm). Their water content varied between 11% for LS and 90% for RS. Concentrations of sugar were greater in fruits eaten in spring and summer than the fruits eaten in fall and winter. The averages for fall-winter were ($7.86 \pm 8.73\%$ to $35.02 \pm 11.9\%$); for spring-summer ($96 \pm 3.13\%$ to $44.65 \pm 5.89\%$). The averages content of lipids was of $8.37 \pm 3.17\%$ spring-summer to 8.64 ± 3.83 for fall-winter. The average content of proteins was $0.4 \pm 0.01\%$ for fall-winter and $2.75 \pm 0.77 \%$ for spring-summer. The energy value of fruits varied from 1.74 to 2.17 Kcal/mg in fall and winter and from 2.44 to 2.38 Kcal/mg for spring and summer, respectively. We consider that determination of nutritional contents of the consumed alien fruits by dusky-legged guan, not only contribute with basic data on the nutritional quality of this kind of food for this species but also with information which could be a useful tool for identifying key food resources and habitat types for the conservation of this and another bird species in this ecoregion.



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Relation between fruitification, size of the fruit and fruit predation of *Qualea grandiflora* (Vochysiaceae) for Psittacidae

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The frugivorous/granivorous animals play basic a role in the animal-plant relation, overcoat as for reproductive success of the explored plants. In the general, the green seeds of the species of the *Qualea* sort are a great alimentary resource for the Psittacidae. This work aims at compare the tax of predation of fruits of *Q. grandiflora* with the tax of fruitification and the average size of the fruits of each tree showed in a field-closed area. During the period of fruitification of the *Q. grandiflora* in 2008 had been marked 50 trees, that had been marked and were distributed in the campo-cerrado of the Sta. Maria Farm the west of the of Três Lagoas city. The marked trees had their fruit estimate recorded in the beginning of the fruitification period and later, biweekly samplings were performed to estimate the quantity of pregiven fruit, their size and the number of Psittacidae fed by them and their species. The results show a strong correlation (r Pearson = 0.999) between the fruitification tax and the predation tax, although there is not a significant correlation between the predation and the average size of the fruits (r Pearson = -0.3035). This demonstrates that, the density of the fruits in the trees of *Q. grandiflora* has great effect on the predation tax. However, this does not happen when we compare the tax of predation with the average size of each tree. This way, potentially these animals adopt as a forrageament strategy, a massive predation in trees focus which show a greater fruitification. Finally, this work demonstrates the necessity of bigger studies that they search to know the standards of coexistence between animals and plants and the details of these relations in the open pasture and degraded environments.



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Use and selection of sap trees by white fronted woodpecker, *Melanerpes cactorum*, in the Semiarid Chaco, Argentina

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Melanerpes cactorum drills holes on different species of trees and feeds on the exuded sap, mainly in times of low resource availability. Sap is a major constituent of its diet, 79% and 42% of the foraging records respectively during winter and spring were on sap. We investigated the factors that determine the selection of sap trees by *M. cactorum* during 2008 and 2009. To investigate if *M. cactorum* selected tree species based on their availability in the environment or on tree species-specific attributes, we measured the plant density and structural and morphological attributes of 8 used sap-species trees and 9 unused species. Also, we estimated sap flow and sap-sugar concentration of each tree species. *M. cactorum* selected some trees species (mostly *Prosopis ruscifolia*), while most other species were consumed in smaller quantities respect to their availability (e.g. *Bulnesia sarmiento*) or were not consumed (eg *Ruprechtia triflora*). Relationships between frequency of consumption and structural attributes, bark morphology, sap-flow volume and sugar concentration explained a smaller fraction of species selection for sap consumption. We suggest that harmful secondary chemicals could play a role in the tree selection. In addition, morphological and chemical attributes of the selected sap trees were evaluated at the intraspecific level. Sap flow and sugar concentration were greater in the individual trees consumed, especially in the most consumed species. Overall, our findings suggest that chemical cues, more than the bark morphology, promote selection of sap trees.



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Effects of color and distribution of artificial fruits in rates of consumption by birds in a State Park, Parana, Brazil

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Understanding how dispersion of seeds works is a major process in vegetal ecology. The participation of birds in the consumption and dissemination of these propagules is of great importance. Studies produced with artificial fruits are an alternative for testing in the natural environment the preferred conditions for consumption of fruits by these animals. The objectives of this experiment were to evaluate whether there are differences in the fruit consumption rates by birds in relation to; fruit coloration; aggregation and distribution of fruits and environment (edge and interior of forest small fragment). The results showed a total of 13.56% of consumption, 79.91% of which by birds. The signs left by birds were found in four patterns. There were differences during the study phases; the first one had a greater exploration. The results of environments on this experiment showed that the studied area seems to suffer from fragmentation effects, it shows that in small areas there are not differences between fruit exploration in different environments. The exams for kinds of treatment (color/grouping) were significant for the first phase only. Data on the variety related to distinction of exploration in grouping patterns, was found only for red fruits, explored in greater number when grouped together. The variety of exploration of artificial fruits by birds corroborated with the hypothesis which predicted the difference of exploration according to their colors. The maintenance of the natural succession processes and the conservation of bigger areas, with more structural quality are of great importance for the reduction impacts on the natural interactions between birds and plants.



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Avian frugivory in rock savanna at the Parque Estadual da Serra Azul, Mato Grosso, Brazil

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To identify frugivorous birds and their potential role as seed dispersers and fruit morphology, this study was carried out from May to September 2009 in the Parque Estadual da Serra Azul (15°52'S e 51°16'W), Mato Grosso, Brazil. Fruits eaten were noted by focal observations. Seventeen bird species were recorded consuming fruits of three plant species: *Copaifera langsdorffii* Desf. (Caesalpiniaceae), *Curatella americana* L. (Dilleniaceae) and *Davilla elliptica* St. Hil (Dilleniaceae). Only sayaca tanager and burnished-buff tanager consumed fruits of all plants, but they were considered potential seed dispersers only in *C. americana*. From the eight bird species that consumed fruits of *D. elliptica*, only streaked flycatcher swallowed the whole diaspore; the others dropped the seeds under the parent tree. In *C. langsdorffii* we recorded eleven bird species foraging, and 73% were considered as potential seed dispersers by swallowing the whole diaspore, having short visits (on average two minutes), and dropping seeds far from the parental plants. In all plants the main fruit taking behavior used was reaching, followed by picking and hovering, the last one being employed mainly by the flycatchers. The most effective seed dispersers of rocky savanna plants were generalist birds, which had a high visiting rate, high fruit consumption rate, and spent short periods on the plants. Fruits were classified as dry dehiscent and the diaspore (aril plus seed) averaged 5.0 ± 0.3 mm length by 3.2 ± 0.2 mm width. All fruits present black seeds and are covered by an aril that vary in color from orange (*C. langsdorffii* and *C. americana*) to white (*D. elliptica*). Support: FAPEMAT.



Dispersion for ornithochory in *Ocotea bicolor* (Lauraceae), Mantiqueira Range, Brazil

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There is a lack of information related to the identification of dispersive agents. The aim of this study was to identify and characterize the dispersive agents of *Ocotea bicolor* Vattimo-Gil, in a 1.400 meter elevation area of a Tropical Rain Forest. The fruit of *O. bicolor* presents yellowish receptacle and measures approximately 10 mm. Six species of birds were observed feeding on the fruits of *O. bicolor* including three large fruit-eating; red-ruffed fruitcrow (*Pyroderus scutatus*), rusty-margined guan (*Penelope superciliaris*) and red-breasted toucan (*Ramphastos dicolorus*); and three medium omnivorous species; great kiskadee (*Pitangus sulphuratus*), creamy-bellied thrush (*Turdus amaurochalinus*) and pale-breasted thrush (*T. leucomelas*). All species observed removed the fruit without removing the receptacle from the tree. Both species of thrush, great kiskadee and red-ruffed fruitcrow were observed capturing the fruit while flying and when finding an appropriate branch, they handled and swallowed the entire fruit. Rusty-margined guan and red-breasted toucan picked the fruits, moving along the branches of the tree crown. The seeds in excrements of rusty-margined guan could be found in a range of 10 meters from the mother plant. The toucan regurgitated the seeds while performing its feathers maintenance on the tree. All species ingested the entire fruits. This feeding behaviour causes dispersion of seeds, through defecation and regurgitation, far from the mother plant. These findings suggest that the dispersion may be occurring in different levels of efficiency. The individuals of *O. bicolor* observed in this study were marked to produce seedling, aiming the conservation of large fruit-eating birds.



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Trophic ecology of birds: investigation on the use of stable isotopes by a scientometric analysis

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Ecologists have been intensified studies in energy flow in food webs with stable isotope analysis (SIA), investigating energy sources and trophic position of invertebrates and vertebrates. The goal of this work was to evaluate quantitatively the use of SIA on trophic ecology of birds' studies. For that, it was realized a scientometric analysis on ISI Web of Science, between 1945 and 2009, using the keywords: food web* bird* stable isotope. Were analyzed these factors: document type, journal in which the document was published; publication year, which tissue was utilized, which environment the study were done. Among the 82 articles recorded, we noticed no one publications before 1991, and until 2004, the publications number didn't exceed 5 per year. From 2004, occurred an increased in the number of publications, varying from 6 to 15. This increase is an indicative of the tool's use enlargement, which has been common used by ornithologists that publish almost exclusively in English (99%). The works were published mainly in article format (85%). Of a total of 43 journals identified, highlights the Marine Ecology-Progress Series (11), Oecologia (7) and Canadian Journal of Zoology-*Revue Canadienne de Zoologie* (5). Considering the total article number in which were possible to identify the environmental studied, 65% were marine, 18% freshwater and 17% terrestrial. These results indicate that the most part of works with SIA, in trophic ecology of birds, are concentrated in marine species. The feathers were more frequently used in analysis (46%), beyond combinations with more than one tissue. The use of feathers don't demand animal sacrifice, this can explain its greater use. USA (42%), Canada (31%) and Scotland (12%) were the countries that highlighted in this kind of research. In Brazil, works with SIA weren't identified on the data base investigated, what permit to conclude that this tool has not been used in ecological studies of Brazilian avifauna.



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Feeding ecology and local abundance of blue-fronted Amazon (*Amazona aestiva*) in a habitat mosaic in the Pantanal of Miranda, Mato Grosso do Sul, Brazil

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The use of the feeding resources by the blue-fronted Amazon (*Amazona aestiva*) in a habitat mosaic in the Pantanal, Brazil, was analyzed. The studied habitats included riparian and dry forest, flooded plain and exotic pasture. From Jul 2005 to Dec 2007 a permanent trail in each environment was travelled monthly (total of 38 sampling spots), and the local abundance of blue-fronted Amazon, their feeding activities, and availability of food resources (phenology of 190 trees) along the trails were recorded. The availability of food resources (flowers and fruits) showed high seasonal variation, being the least production observed in the middle of the rainy season (Nov-Dec), indicating that this is a critic period due the lack of food, and the greatest production observed between the end of the dry season and beginning of the rainy season (Jul-Oct). We registered 1,349 parrots in feeding activities, consuming flower, pulp, leaves, and particularly seeds of 48 vegetal species, from 25 families. The fruits that predominated in the diet were from Anacardiaceae, Bignoniaceae, and Fabaceae families. At the studied site, the blue-fronted Amazon was a generalist in relation to the use of food resources, according to the special and temporal erratic availability. The positive correlations among the Levins' breadth index food niche and the abundance of food resources, the number of vegetable species consumed, and the diversity of food resources (Simpson's index) indicate the large flexibility of the blue-fronted Amazon's diet in response to the intensity and variety of the food resources in a mosaic environment.



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High delta¹⁵N stable isotope values in the forest ecosystem affected by cormorants in the Katy Rybackie colony (N. Poland)

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Bi-environmental colonial waterbirds that feed in the water and breed on land are one of the most important vectors transporting organic matter from aquatic to terrestrial ecosystems. Cormorants (*Phalacrocorax carbo sinensis*) establish their colonies usually in the forest close to water bodies. Katy Rybackie colony is the largest breeding colony of that species in the world (c. 11000 pairs). Depending on the season and weather conditions birds feed in the Vistula Lagoon or Gdansk Bay (Baltic Sea). In the colony area they deposit large amounts of excreta that dramatically change chemical composition of the soil and consequently affect considerably vegetation. We measured and compared contents of delta¹⁵N in the samples of soil, plants and pine wood collected in the colony and in the control, unoccupied area. Wood samples were taken from young parts of trunks growing during the last 20 years of high pressure of cormorants on the area, and from c. 50 years old inner parts of the pine's trunk that had been growing prior to cormorants' appearance. Significantly greater values of delta¹⁵N isotopic signatures of plants and soil were found in the cormorant colony comparing to the control area. Samples of young wood tissue collected from pines growing in the colony also showed greater delta¹⁵N rates than those from the older tissues and trees growing outside the colony. delta¹⁵N analysis can be used as a measure of spatial range of the cormorants' impact on soil and plants in the forest ecosystem as well as an important tool of dating the colonies.



Climate evaluation on the nectar sugar composition from *Malvaviscus arboreus* visited by nectar feeding birds in the southeast mountainous region from Brazil

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The aim of this study was to evaluate the nectar sugar composition according to climate zones concomitantly with the pollinator necessity. Nectar samples from *Malvaviscus arboreus*, an exotic species widely in the Southeast mountainous region from Brazil were collected according to Köppen, Af (0m), Cwa (500m) and Cwb (1000 and 1800m). The sampling period was from May to August. The sugars as sucrose, fructose and glucose in the samples were analyzed by high performance liquid chromatography using a Refractive index detector and Biorad Aminex HPX-87H column (300 x 7.8 mm) at 45°C, 0.005 M H₂SO₄ as eluent, at 0.6 mL.min⁻¹ flow rate and 20 µL injection volume. During the sampling period, it was observed that the *M. arboreus* flowers were visited by the following 11 hummingbird species: *Phaetornis ruber*, *Hylocharis cyanus* and *Aphantochroa cirrochloris* in the altitude of 0m asl; *P. eurinome* and *Amazilia lactea* in the altitude of 0m and 500m asl; *Thalurania glaucopis* in the altitude 500 and 1000m asl; *Eupetomea macroura* in the altitude 0m, 500m and 1000m asl; *P. pretrei*, *Florisuga fusca* in the altitude 1000m asl; and *Clytolaema rubricauda* and *Heliostyris auritus* in the altitude 1000m and 1800m asl. The lowest sugar concentration was obtained in the altitude at the sea level and the more energetic nectar, which corresponded to the ones of the greatest sugar concentration, was found in the cold climate related to the intermediated altitudes. However, further studies are needed to clarify potential disruptions in plant-pollinator as a result of climate change.



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Frugivory by birds in *Trema micrantha* (Ulmaceae) in the Parque Ecológico Monsenhor Emílio José Salim, in Campinas-SP, Brazil

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The process of frugivory can benefit both the dispersion of the plant, since the seeds can be transported longer distances from the parent plant, and birds, which obtains energy and nutrients by consuming the flesh of the fruit. Many plants have characteristics that favor the ornithocoric dispersion, and *Trema micrantha* is one of them. Thus, the objective of this study was to identify the species of birds that feed on the fruits of *T. micrantha* in a fragment of semideciduous forest and evaluate the importance of each species in the processes of seed dispersal. The study was conducted in Parque Ecológico Monsenhor Emílio José Salim, in Campinas, São Paulo. Data were collected between March and August 2008, with focal observations in two individuals of *T. micrantha*, from 6:00am to 6:00pm, totaling 72 hours of observation. For each bird-plant interaction was registered visitor species, the number of individuals, the number of fruits consumed, time spent in the plant and employee behavior in fruit collection. We recorded 486 visits of 35 bird species, distributed in 14 families, of these, 23 species were observed eating the fruits. The visits lasted an average of 165s and were consumed on average 7.35 fruits/visit. The main potential seed dispersers were *Pitangus sulphuratus* (15%), *Colaptes campestris* (15%), *Thraupis sayaca* (7%) and *Turdus amaurochalinus* (7%). Although the majority of potential dispersers of *Trema micrantha* were generalists, they are common and frequent, even in disturbed areas, and showed a high frequency of visits, high rates of consumption and stayed for short periods of time on the plants, which can help the efficiency of dispersal, even in degraded environments.



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Terrestrial ecosystem enrichment with marine-derived ^{13}C and ^{15}N by planktivorous and piscivorous seabirds in the Arctic

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The consequences of climate change is reorganization of the structure and functioning of the ecosystems. Such phenomena are easily observed in polar regions where increasing inflow of warmer Atlantic waters into the Arctic shelf carries zooplankton consisting of much smaller taxa, pushing out indigenous communities. This can cause long-term effects on the food availability for the consumers of higher trophic levels. Such trend in a longer perspective will facilitate plankton-eating fish populations and afterwards - fish-eating seabirds while feeding conditions for planktivorous seabirds will get worse. Large seabird colonies in the Arctic play a very important role in creating and sustaining tundra so changes in avifauna composition may generate changes in development and functioning of different types of ornithogenic tundra supplied by seabirds of a different diet. We used proportions of stable isotopes ^{13}C and ^{15}N to assess the extent of terrestrial ecosystem enrichment with organic matter transported from sea to land by colonial seabirds in Hornsund, SW Spitsbergen. We compared an isotopic signal of successive food web links i.e. seabirds' tissues, their food items and faeces, as well as soil invertebrates, plants, herbivores' and predators' tissues collected in the vicinity of two big seabird colonies: plankton-eating little auks and fish-eating Brünnich's guillemots and kittiwakes. Differences in nitrogen and carbon isotopic composition of analyzed material let us to verify the hypothesis of different impact of planktivores and piscivores on tundra plant and animal communities.



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SA08 Physiology, and Cell and Molecular Biology



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Haemoglobin concentration of nestling blue tits (*Cyanistes caeruleus*) and great tits (*Parus major*) in relation to variation in food availability

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Good food supply during the nestling stage of altricial birds positively influences their physiological condition at fledging. The trophic base of insectivorous birds living in seasonal environments of temperate zones is variable among habitats and years, which should be reflected in the respective inter-habitat and inter-year variation in physiological parameters. In this paper we treat blood haemoglobin concentration as an index of physiological condition of nestling blue and great tits. The study was conducted in 2003-2009 in two contrasting habitats: an optimal deciduous woodland and a suboptimal urban parkland. In 2003, the year of the greatest abundance of tree canopy caterpillars as basic food of chicks, the level of haemoglobin was high, on average 138 g/l and 140 g/l in the woodland and 127 g/l and 122 g/l in the parkland, for the great tit and the blue tit nestlings, respectively. In the following years the concentration of haemoglobin in nestlings quite strictly reflected inter-year and inter-habitat differences in the abundance of caterpillars. The response of nestling haemoglobin concentration to caterpillar availability was weaker in the great tit than in the blue tit, which suggests that the former is a more versatile species, able to use some alternative food sources to compensate for poor supply of caterpillars. The study was supported by the Polish Ministry of Science (no. N N304 045136).



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Analysis of the sensitivity of the photoperiodic response system in a subtropical starling species, the brahminy myna, *Sturnus pagodarum*

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Experiments were performed on photosensitive male brahminy myna to investigate the effects of light intensity and wavelength on photoperiodic induction of testicular growth -regression cycle in the brahminy myna. The first experiment compared the effects of complete (13L: 11D) and a skeleton (6L:6D:1L:11D) photoperiods at ~700 lux intensity. The second experiment investigated the relative inductive effects of 1-h light pulse in a skeleton photoperiod 6L: 6D: 1L:11D at 2-, 10-, 50- or 100-lux intensity of white, green (~528 nm) and red (~654 nm) light. The third experiment compared the response to 13L:11D at 50-, 100-, 500- and 1000- lux intensities. We also examined phase-dependent effects of light wavelengths on the photoperiodic clock using 50± 2-lux intensity at 500 nm (green) or 650 nm (red) in a skeleton paradigm (6L:6D:1L:11D); both light periods were applied in same or different colors (wavelengths). The results indicate that the intensity and wavelength of light play an important role in photoperiodic induction of seasonal responses in the brahminy myna, and suggest that photoperiodic response system in myna can discriminate between different light spectra and intensities and use for timing its daily and seasonal activities.



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Endogenous periodicity in gonadal cycle and associated responses in the spotted munia (*Lonchura punctulata*) held under constant illumination

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Most, if not all birds are seasonal breeders. The precision with which the reproduction is timed to occur during the most favourable season of the year is believed to be mediated by an endogenous seasonal clock. Whereas the circadian clock has been characterized in a number of bird species, the existence of the seasonal (circannual) clock is debated. Herewith, we report the results from a long term study on a tropical (subtropical) species carried out under constant conditions of light and temperature. A group of male and female spotted munia (*Lonchura punctulata*) was kept on constant light (LL) and temperature as follows: group 1- ~22 lux, 18±2°C; group 2- ~90 lux, 18±2°C. We recorded the pattern in body and primary feathers molt and the changes in body mass, bill and plumage coloration, and gonadal size every two or four (only gonadal size) weeks over a period of 20 to 24 months. The data reveal multiple (2 to 3 cycle) cyclicity in all parameters during the course of the experiment, albeit with individual differences. There also appears to be a difference in the response to LL at two different intensities. It is suggested that an endogenous seasonal clock with sensitivity to light regulates seasonality in the spotted munia. Supported by DST-IRHPA Center for Excellence grant.



Photoperiod-induced changes in cloacal gland development in male Japanese quail classified at 11 days of age according to their preference to remain in close proximity to conspecifics

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This study evaluates the relationship between early social responses and photo-induced reproductive changes and the timing of photorefractoriness. Male birds were classified considering two criteria i) at 11 days of age, according to whether they were found in close proximity to a high (12 chicks, HD) or low (3 chicks, LD) density of confined conspecifics; ii) at 16 weeks of age according to their reproductive performance following 5 weeks of photoinhibition: birds that showed a reduction in the cloacal gland volume (CG) to $< 1000\text{mm}^3$ and no foam production (FP) were termed high photo-sensitive (HPS); the remaining males were termed low photo-sensitive (LPS). Quail were photostimulated (long days; 16L:8D) from 4 to 11 and 23 to 28 weeks of age and photoinhibited (short days; 8L:16D) from 12 to 22 weeks of age. CG and FP were measured weekly. As expected, CG development and FP increased significantly from 4 to 11 weeks of age. According to the photo-response classification criteria, highly significant differences in CG measurements were detected between HPS and LPS quail after 2 weeks of photo-inhibition. Both HD and LD categorized groups presented a similar number of individuals with either HPS or LPS CG response patterns. However, while LPS-HD and LPS-LD quail showed similar and greater CG volumes, the HPS-LD males compared to their HPS-HD counterparts showed an accelerated (5 weeks advanced) CG volumen spontaneous recovery. After 4 weeks of relighting, all groups showed similar maximum CG developments. The results indicate that gonadal photorefractorines in short daylength season interact with the quail's early social grouping strategy.



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Ecophysiology of circannual clock in birds

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The concept of circannual rhythms has gained wide acceptance. But their physiology and mode of synchronisation remain to be understood. Reproductive cycle of tropical spotted munia, *Lonchura punctulata*, is governed by an endogenous circannual rhythm with a periodicity of approximately 10 months (in continuous illumination or dark). A segment of the photo cycle prior to vernal equinox was shown to synchronize the circannual rhythm of reproduction (and associated molt and fattening) in this bird in nature as well as in artificial conditions through daily increments in light (and not absolute duration of day length). Since this strategy was experimentally demonstrated to be used equally by southern and northern populations of *Lonchura* it may well be a universal phenomenon. The process of synchronization appears to involve a phase delay and hence a gonado-inhibitory rather than the conventional gonado-stimulatory response to increasing day length. Considering the anti gonadal effect of thyroid hormones in this bird, an attempt was also made to study their involvement in the process of synchronization. Results clearly showed that a brief 15 day exposure in winter to physiological doses of thyroxine synchronised the free running cycle of birds held in LL with the monsoon period through a phase delay. Apparently entrainment either by daily increments of light or by T4 involves a temporary check on gonadotrophin secretion and the neural locus of action for both may be same/ associated.



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DNA extraction from feathers and egg shell of the Restinga antwren (Passeriformes: Thamnophilidae), applied to sex determination

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Molecular studies in birds are conducted mainly by blood sampling. This collecting blood is not always possible due to sampling difficulties and/or *stress* caused by manipulation of individuals, particularly those sensitive and/or endangered, as the Restinga antwren, endemic to restinga. We quantified and tested the quality of DNA extracted from feathers of three Restinga antwrens, using adult feathers and one egg shell. For DNA extraction, feathers were cut at 5mm from the base and incubated at 37°C for five days in a digestion solution, with a daily addition of proteinase K (10mg/mL). The extraction followed the phenol/chloroform technique. We used samples of a single feather, two feathers and a small portion of the inner egg shell membrane. The concentration of DNA was 17ng/ul, 1,27ng/ul and 24 ng/ul, respectively. DNA quality was tested by performing the molecular sexing technique, using the P2 and P8 primers, which amplify regions of the genes CHD-Z/CHD-W in birds. The PCR profile consisted of one cycle at 95°C for 5min, followed by 40 cycles at 95°C for 30s, 45°C for 30s, and 72°C for 30s, and a final extension cycle at 72°C for 5 min. PCR products were separated by electrophoresis in a 6% acrylamide gels. The result allowed sex determination through a less invasive technique than blood collection. Additionally, DNA extraction from egg shells may be useful for behavioral and population studies with species that have high nestling predation rate, which occur in open areas such as restingas. Funding: CIBrasil, SaveBrasil, CNPq.



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The influence of acute stress on glucose and protein utilization of a desert songbird

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An often cited adaptive value of the avian stress response is the mobilization of energy stores to enable behavior aimed at increasing chances of survival. This mobilized energy is thought to come mainly in the form of glucose. However, this conclusion in birds is largely based on studies on captive European Starlings and no data are available for free-ranging birds. Studies in migratory birds also suggest that elevated plasma corticosterone, the primary stress hormone in birds, promotes protein utilization to enhance metabolic processes. Yet little data is available on the effect of acute stress on protein catabolism in wild birds. We investigated acute stress-induced changes in plasma glucose and uric acid, the end-product of protein catabolism, in free-ranging Abert's towhees, *Pipilo aberti*. We predicted that acute stress would not elicit hyperglycemia but protein catabolism would be enhanced leading to increased plasma uric acid concentrations. Consistent with studies of other captive birds, 60 minutes of handling and restraint did not induce hyperglycemia. However, acute stress resulted in a 43% decrease in plasma uric acid, indicative of decreased protein catabolism. Thus, the primary energy source mobilized in response to acute stress in birds may not be glucose or protein. Ongoing studies are aimed at determining whether acute stress promotes free fatty acid utilization.



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Stress and energy: corticosterone and body condition interact to facilitate urban colonization by a desert bird

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The concepts of stress and energy are inextricably linked in that responding to stress requires energy, but changes in energetic status can influence the stress response. This interaction is particularly important for birds attempting to occupy changing habitats, as these birds must locate food while coping with novel and potentially adverse environmental stressors. Curve-billed thrashers, *Toxostoma curvirostre*, are Sonoran Desert specialists that increasingly inhabit rapidly expanding cities of the Southwestern US. During the hot and dry breeding season, desert birds including thrashers decrease their corticosterone secretion in response to acute stress whereas urban birds maintain a consistent stress response year-round. We tested the hypothesis that the lessened corticosterone secretion of urban thrashers following stress is related to increased and predictable access to food. Urban thrashers are in better body condition than desert conspecifics, as reflected in greater plasma triglyceride levels, indicative of greater lipid deposition. In response to acute stress, desert but not urban thrashers decrease plasma triglycerides and free glycerol, the latter indicative of lipid catabolism. However, plasma b-OH-butyrate (a ketone) is greater in urban than desert birds, suggesting increased fatty acid oxidation. Thus, desert thrashers may rely on endogenous lipid reserves to generate energy during stress to a greater extent than urban birds. Studies manipulating food availability in captive and free-ranging thrashers provide further insight into how access to this resource can impact the stress response.



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Male ornament size predicts the inhibitory effect of testosterone on macrophage phagocytosis in the spotless starling (*Sturnus unicolor*)

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The immunocompetence handicap hypothesis (ICHH) proposes that the expression of exaggerated male ornaments is immunologically costly, and that androgen-induced immunosuppression is the physiological mechanism that causes the correlation between ornament expression and male quality. Numerous tests of this hypothesis have been conducted on the humoral and cell-mediated components of immunity, with mixed results. However, no study so far has addressed whether macrophage phagocytosis, a basic and fundamental mechanism of the immune system, plays a role in the ICCH. In this study we tested whether male ornament size is a predictor of *in-vitro* macrophage phagocytosis in spotless starlings (*Sturnus unicolor*). We found that a moderate physiological concentration of testosterone (T) induced strong phagocytic inhibition. This inhibition was larger for old than for young birds. We found no significant relationship between ornament size and phagocytic activity in basal conditions. Contrary to expectations, T-mediated phagocytic inhibition was strongly and positively related to ornament size. Furthermore, males with greater T concentrations suffered increased T-mediated phagocytic inhibition. Our results provide partial support to the ICCH, and suggest that males with exaggerated ornaments and high T concentrations may counteract the inhibitory action of testosterone by some compensatory mechanism. Possible candidates include the presence of immunoenhancing substances, such as melatonin or antioxidants.



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The thermal properties of birds nests

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Birds nests have evolved into many shapes and sizes, but all are designed for the same general function: to protect the eggs and hatchlings and help moderate their microenvironment. In addition to attenuating changes in egg temperature, well-insulated nests also conserve the energy reserves of the parent at low ambient temperatures. Such energy savings have the ability to influence the lifetime reproductive success of an individual. Nest insulation is therefore important and may be related to the size of the parent and the incubation climate. This study measures thermal conductance through the nests of over 35 species of Australian birds, with the data analysed allometrically according to parental body mass. Scaling of nest dimensions (internal diameter, depth, surface area and nest mass), indicates that nest size is directly related to bird size. However, nest insulation scales with parental mass to the power of $-1/4$. This is much less than the $-2/3$ expected if insulation scaled with metabolic rate, indicating that larger nests are relatively better insulated than smaller ones. This is reflected in an increase in surface-specific insulation and an increase in nest wall thickness. Material conductivity is independent of parent mass. The design and construction of birds nests is therefore influenced mainly by structural support of the parents and offspring and insulation is of minor importance.



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Heart rate, body temperature and metabolism in the wood pigeon (*Columba palumbus*) and the common buzzard (*Buteo buteo*)

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The correlated physiological parameters heart rate, body temperature and metabolism are key factors for ecological adaptations in animals. For comparative studies the diurnal cycle of those parameters was investigated in a granivorous and a strictly carnivorous bird with similar distribution in Europe. The wood pigeon (*Columba palumbus*) and the common buzzard (*Buteo buteo*) were chosen since both are the most common and most widespread representatives of their respective families but almost no physiological data have been recorded so far. Miniaturized telemetry devices were implanted into the body cavity to record ECG and body temperature simultaneously while metabolism was measured through indirect calorimetry. Using altered ambient temperatures (0 °C to +40 °C) this study involved seven Wood Pigeons over a study period of 99 days and five common buzzards over 121 days. In addition body temperature was recorded continuously in two wood pigeons (88 days) and in four common buzzards (110 days) by using temperature data loggers. For a part of this research M. Helb obtained an Erwin-Stresemann-grant from the Deutsche Ornithologen-Gesellschaft (DO-G).



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Cost of moult and its timing in the annual cycle: insights from an opportunistic breeding arid-zone species

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The majority of bird species schedule molt to avoid overlap with other energetically demanding events; potentially due to trade-offs between fecundity, survival, and future reproduction. Empirical studies reveal that the smallest birds, with the greatest mass-specific basal metabolic rates (BMR), have the greatest molt costs per gram of feathers produced. However, many small passerines, including white-plumed honeyeaters (WPHE; *Lichenostomus penicillatus*), breed in response to resource availability at any time of year, and do so without interrupting their annual molt. We examined the energetic cost of the natural molt period in wild-caught WPHE held in captivity. We also measured the energetic cost of feather replacement by forcing a second group of WPHEs to replace an additional 25% of their plumage at the start of their natural molt period. Energetic expenditure during natural molt was close to values reported for similar-sized birds from predictable north-temperate environments, indicating that a strong relationship exists between molt cost and mass-specific metabolic rate, regardless of life-history. The protracted molt of WPHE did not reduce daily molt costs, and maximum increases in BMR during the molt period are some of the greatest yet reported. Yet, despite these considerable energetic costs, molt is regularly observed outside periods of peak food availability in opportunistic breeders of the arid zone. Given the capacity of such birds to molt and breed simultaneously, it would therefore appear that the energetic cost of feather replacement is not a primary determinant of the scheduling of molt in the annual cycle, and molt and breeding may be independently timed to coincide with a range of environmental conditions.



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Avian circadian biology: hypothalamic input and output mechanisms

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Circadian rhythms are generated endogenously, but can be entrained by external cues, e.g. light. True circadian rhythms persist when the external cues are removed, for a period of about 24h. Circadian rhythmicity regulates the production of hormones (e.g. melatonin), the organisms' physiology (homeostasis, brain activity, sleep-wake pattern, and cell regeneration) and behaviour (feeding, migration, breeding, etc.) via light-dark entrainment of the day-night cycles. The avian circadian system is more complex than the mammalian system; has the capacity to obtain environmental photic information from the retina, pineal gland, deep encephalic photoreceptors, all of these oscillators have the ability to interact (mutual inhibition) with one another to produce a stable circadian rhythmicity. This study looks at the two input mechanisms and the output mechanisms of the avian hypothalamic oscillator. The inputs are light input during the day and hormone melatonin secreted during the night. Both these inputs can entrain the circadian rhythms to the external environment. The output from the hypothalamic oscillator are neurotransmitters/peptides and hormones, such as arginine-vasotocin, somatostatin, serotonin, vasoactive intestinal peptide, amongst others.



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Natural variation in stress response influences post-stress parental effort in male house sparrows

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Resource allocation between current and future reproduction is thought to be mediated by the steroid hormone, corticosterone (CORT) in birds, but the causal relationship between naturally occurring CORT levels and parental behaviour is rarely studied. We observed the chick provisioning behaviour (feeding rate) of male house sparrows (*Passer domesticus*) both before and after they were subjected to a standard capture-handling stress. We investigated the relationships between CORT levels, pre- and post-stress feeding rate, while we statistically controlled for a number of other variables using a multivariate regression method, the path analysis. We found that male's baseline feeding rate predicted the body mass of the nestlings, indicating that male parental care is directly linked to fitness. CORT levels were not explained by baseline feeding rate, but both baseline and stress-induced CORT levels had a negative influence on the males' post-stress feeding behaviour. Moreover, males with large bib size had a stronger stress response and lower post-stress feeding rate than small bibbed males. These results indicate parental effort may be regulated in a complex manner, with CORT mediating the life-history trade-off between current reproduction and survival. However, different resolutions of this trade-off were apparent only following the stress, therefore the ability to modulate the stress response and maintain parental care in stressful situations may be important in life-history evolution.



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Physiological and biochemical aspects of the avian uropygial gland

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The uropygial gland exhibits a striking morphological diversity in size, shape and presence/absence of tufts of feathers. It was shown that acidic mucins, neutral lipids, glycolipids and phospholipids are normal components of secretion. We discuss different aspects of the uropygial gland of birds. Several morphological and physiological aspects of the gland were studied on rock pigeon *Columba livia*. The amount of the uropygial gland secretion, its lipid content and fatty acids profile were determined. The extracted lipid mixture contained of C14 to C20 fatty acids, mostly unsaturated; the saturated fatty acids were mainly 14:0, 16:0 and 18:0. No correlation was found between the size of the gland and the aquatic/terrestrial nature of the species. Ablation of the gland did not affect survival, body weight, feeding rate and serum cholesterol, total lipids or calcium levels after 32-120 days. The possible role of the gland in the protection against lipophilic compounds was discussed. The function of the gland is still a subject of controversy. It is accepted that its secretion confers water-repellent properties on the feather coat and maintain the suppleness of the feathers. Other physiological roles of the gland secretion may be associated with pheromone production, control of plumage hygiene, thermal insulation and defence against predators. Concerning the endocrine regulation of the uropygial function, there is scarce information presenting evidence for steroid regulated mechanisms.



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Age- and sex-specific immunological status in the zebra finch (*Taeniopygia guttata*)

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Aging is defined as an inevitable physiological senescence in the form of progressive deterioration of body structures and functions. The immune system, which protects the organisms against parasites and diseases, is no exception. Immunosenescence is therefore thought to increase the susceptibility to infection and risk of autoimmune diseases and cancer, further leading to greater morbidity and mortality rates. However, little is known about avian immunosenescence and whether the different components of the immune system are affected equally, also in regard to sex. In this context, we assessed the three components of the immune system in a laboratory population of female and male zebra finches (*Taeniopygia guttata*) of three age groups (2.5 months, 2.5 years and 5 years). The acquired cell-mediated immunity was quantified through PHA response, the acquired humoral immunity via the amount of immunoglobulin levels and the innate immunity was measured as bacterial killing capacity. Cellular immunity followed a bell-shaped pattern with age, with males showing stronger response than females. In contrast, humoral immunity followed a linear increase with age, independently of sex. Finally, for innate immunity an age difference was only present between old and young males, with young ones having greater bacterial killing capacity than old ones, while sexes only differed in the mid-age group with females being superior. These contrasting results indicate that investment in the different arms of the immune system changes with age and sex, and they also reflect the enormous complexity of the immune system. High investment in one part of the immune system may provoke a reduced investment in another, and as developmental constraints and trade-offs in energy allocation may differ between the age groups, this may result in the intricate results we found in the zebra finch.



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Molecular control of retinoid signaling in the avian song system

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Vitamin A is an important nutrient that is metabolized to retinoic acid, and is an important neuromodulator in the brain. In zebra finches (*Taeneopygia guttata*) retinoid signaling is indicated in the song system by the presence of the terminal enzyme in the synthesis pathway, retinaldehyde dehydrogenase 2 (*RaldH2*). In adults *RaldH2* is highly expressed in song nuclei HVC and IMAN but not area X, and perturbation of retinoid signaling disrupts the maturation of adult song. Because too much or too little retinoic acid is known to cause learning deficits, retinoid levels are thought to be tightly controlled. Here we provide a comprehensive description of the zebra finch brain distribution of genes known to be involved in retinoid metabolism, including the song system. We made DIG-labeled riboprobes from the ESTIMA neurogenomics library for the synthetic enzymes retinol dehydrogenase (*RDH 10 & 14*), and Short-chain dehydrogenase/reductase (*retSDR*), as well as plasma and cellular retinol binding proteins, cellular retinoic acid binding proteins, and degradation enzymes. Many genes, such as *RDH*, are uniformly expressed at high levels throughout the brain, including the song system nuclei. Others show more restricted expression patterns that may be related to more specific roles of retinoic acid in the song system. *RaldH2* is well described and is expressed in X-projecting cells of song nucleus HVC, but not area X. *retSDR* is expressed throughout much of the telencephalon, but is reduced in HVC, IMAN and area X. This enzyme converts retinaldehyde to retinol, thus removes the substrate available for retinoic acid synthesis. Thus, *retSDR* may function to oppose the effects of *RaldH2*. These results are consistent with the notion that retinoid levels are under tight control in the avian song system. Furthermore, our data suggest that retinoic acid levels are also regulated in brain regions that are not necessarily indicated by the presence of *RaldH2* expression, such as area X.



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How the immune function during breeding relates to annual survival in birds

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Birds of all ages need to protect themselves against a variety of pathogenic influences. The avian immune system consists of different defensive factors which together act as a protective barrier against these pathogenic influences. We explore if and how the combination and activity of different, but cooperating immune parameters during the breeding season is associated with the survival of birds to the next year. We monitored a breeding population of skylarks (*Alauda arvensis*) in the Netherlands, during a period of four consecutive breeding seasons. We took blood samples of nestlings and adults in the field and provided all birds in the population with individual color ring combinations. This enabled individual recognition and monitoring. Both young and adult skylarks show high site fidelity. We therefore took re-sightings during the following breeding season as a measure of survival. We analyzed the plasma samples to determine several immune parameters, including haemagglutination by natural antibodies, haemolysis by complement and the acute phase protein haptoglobin. We also performed white blood cell counts for all individual birds. We will analyse and present the associations between these immune parameters and the survival of birds to the following year.



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Glucocorticoid stress physiology: repeatability and relationship to fitness in the Florida scrub-jay

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Measurement of glucocorticoid levels is a common method used to assess the physiological condition of an animal, as well as the ways in which an individual may cope with environmental perturbations. We examined the repeatability of baseline and stress-induced corticosterone levels in young Florida scrub-jays, as well as the relationship between corticosterone levels and survival. Over the course of three years of study, each individual in our study population was tracked from the nestling phase through the course of its lifetime. Baseline corticosterone samples were obtained from 11-day old nestlings. If these individuals survived to reach nutritional independence (~2.5 mo), one year of age, or two years of age, we used a capture and handling protocol to measure baseline and stress-induced corticosterone levels. Nestling baseline corticosterone levels were negatively correlated with both baseline corticosterone at one year of age and the initial rate of corticosterone increase (0-5 min post-capture) at one year of age. Additionally, nestling corticosterone was negatively correlated with integrated corticosterone at one year of age, although this trend did not reach statistical significance ($p = 0.09$). Nestlings with high corticosterone levels in one cohort were less likely to survive to nutritional independence than nestlings with low corticosterone levels. In addition, individuals with high baseline corticosterone levels at nutritional independence were, in one cohort, less likely to survive to the age of two years. The results of this study indicate that some measures of stress physiology are correlated within individuals in this species. In addition, this study provides exciting evidence of a link between stress physiology and fitness in a free-living bird.



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Effects of captivity on hematological condition indices in greenfinches

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Ecophysiological research aiming at explaining the causes and consequences of variation in individual condition, health state and allostasis is traditionally performed on captive animals under controlled laboratory conditions. The question about how captivity *per se* affects studied parameters is therefore of central importance for generalizing the information gained from such studies. We addressed this question by comparing various indices of physiological condition of wintering greenfinches sampled in the wild and kept in captivity for different time periods. Bringing wild greenfinches into captivity did not result in systematic alteration in most of the physiological parameters studied. Captive birds had consistently lower plasma carotenoid and uric acid levels and greater levels of nitric oxide production than wild-ones. Captive birds had no measurable levels of Total Oxidant Status (TOS) unlike wild greenfinches. Variation in differential leukocyte counts did not reveal any signs of elevated stress of birds kept in captivity. These results indicate that for a number of physiological parameters, information obtained from captive animals can be generalized to natural situation. Variances in traits most closely related to physical exercise capacity (body mass and hematocrit) were much lower in the wild than in captivity. This suggests that under harsh environmental conditions experienced by wild birds (i.e., predation threat, scarce resources) traits such as hematocrit and body mass are fine-tuned by physiological trade-offs.



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Role of pineal in regulation of circadian activity in migratory blackheaded bunting (*Emberiza melanocephala*) and non-migratory Indian weaver bird (*Ploceus philippinus*)

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We report the results from three experiments done to demonstrate the role of pineal in regulation circadian activity in two bird species. In the experiment 1, a group (n = 8-9) of intact and pinealectomized (pinx) buntings, were first exposed to 12.5L:11.5D and then released into dim constant light (LLdim). The absence of pineal delayed the development of night activity (Zuguruhe) and pinx birds became arrhythmic under LLdim. In the experiment 2, buntings (n = 5) were exposed to 12.5L:11.5D, and after Zugunruhe appeared, they were subjected to 6 h advance and delay light phase shifts. Thereafter, birds were pinealectomised and identical phase shift protocol was repeated. The amplitude of Zugunruhe was reduced in pinx but not the resynchronization time to new light cycle. In the last experiment, which was similar to the experiment 2, pinx and intact Indian Weaver birds were first exposed to 12L:12D, and then were subjected to 6 h phase shifts. There was a difference in daily distribution of the activity but not in the resynchronization times between pinx and intact birds. It is suggested that pineal contributes to the timekeeping circuitry in these bird species. Supported by DST-IRHPA Center for Excellence grant.



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Can the oxidative stress theory of aging explain differences in longevity between galliformes and psittaciformes?

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Birds have basal metabolic rates (BMR) that are on average 1.5-fold greater than those of similar-sized mammals. According to the rate of living theory, birds would be expected to live only two-thirds as long as similar-sized mammals, yet birds live up to four-times longer. Differences in maximum lifespan can be also found within the class aves, e.g. between galliformes (chickens and quails) and psittaciformes (parrots) with parrots living up to 6-fold longer. A modification of the oxidative stress theory of aging, which suggests explanations for the observed differences in longevity, emphasizes three major components: (1) Mitochondria produce reactive oxygen species (ROS) as a normal by-product of respiration, which damage DNA, proteins, and lipids, which, in turn, causes aging and eventually death. (2) Animals have antioxidants and repair mechanisms that protect against ROS damage. (3) Membrane polyunsaturated fats exposed to ROS form lipoxidation products that are highly reactive and produce further cellular damage. Interspecific differences in membrane fatty acid composition can therefore influence the potential extent of damage. To determine whether any of these processes account for the longevity differences between short-living galliformes and long-living psittaciformes, we have undertaken a multi-species comparison, measuring mitochondrial ROS production, intermediate and end products of ROS damage, antioxidants, and membrane fatty acid composition. While mitochondrial ROS production, products of ROS damage and antioxidants could not explain the observed differences in longevity, membrane fatty acid composition tended to have a lower susceptibility to peroxidation in the longer-living species. These results suggest that the oxidative stress theory of aging is not a universal explanation for differences in longevity between species and that other explanations must be considered.



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Long or short histories of tourism visitation differentially affect hormonal but not behavioral response to visitation in magellanic penguins

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The amazing popularity of penguins makes them popular for ecotourism visitation. The effects of this visitation have been studied in many species of penguin. Here we examine how magellanic penguins (*Spheniscus magellanicus*) in two colonies with different histories of tourist visitation compare in responses to disturbances. Punta Tombo, on the coast of South central Chubut, Argentina, has a 30+ year history of tourist visitation and over 150,000 people visit this colony each year. In contrast, San Lorenzo, located on the Valdes Peninsula of Argentina, 300 km north of Punta Tombo, has been open to tourists for 9 years, and only 10,000 people visiting annually. For adult penguins in both colonies, behavioral habituation – i.e., lack of any overt aggressive behavior – is apparent in penguins living in tourist areas, as opposed to penguins in non-disturbed areas of the colony. In contrast, there is a significant difference in the glucocorticoid response to acute stress in the two colonies. Tourist-exposed penguins in Tombo have reduced adrenal functionality when captured and held (as compared to undisturbed birds) whereas penguins in new-disturbed San Lorenzo show no differences in acute responses between visited and non-visited birds. In addition, newly hatched chicks in the long-disturbed Tombo colony show an adult-like stress response immediately after hatch. This is unexpected in semi-altricial chicks that usually have a reduced stress response immediately after hatch. In contrast, newly-hatched chicks at San Lorenzo show no increased expression of the stress response immediately after hatch. The significance of these findings for both adult and chick magellanic penguins will be discussed in context of long-term conservational strategies.



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SA09 Population and Individual Ecology



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Non-breeding biology of the whinchat, *Saxicola rubetra*, in Nigeria

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We present the results of a study conducted on the non-breeding ecology of the whinchat, *Saxicola rubetra*, in one of its African wintering grounds in Central Nigeria. The core study site was at Gwafan, an open scrubland habitat located 10 Km east of the city of Jos. The density of whinchats at various sites in Jos was estimated using line transect surveys. Time budget observations described the daily activities of colour banded whinchats, including six birds fitted with radio-transmitters. Overall density in the Jos area was estimated at 0.21 individuals/ha, but density at Gwafan was 0.58 individuals/ha indicating that this contained preferred habitat. Whinchats spent 80% of their time perching, 11% foraging, 7% preening and 2% flying. The main method of catching insects was a swoop to the ground. There was no significant change in foraging, perching, preening or flying time from the time the study started in February to the time it ended in April. GPS positions of individuals showed that all birds held clearly demarcated territories and defended this area against Whinchats in neighbouring territories. Aggressive interactions were also recorded between the whinchats and other bird species. Three birds colour-ringed in 2006 returned to the study site in 2007 and one occupied almost the same territory in 2007 as held in 2006 indicating site fidelity.



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Relaying in common terns: consequences for fitness and demography

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Laying additional eggs is known to be costly for the female in terms of condition and fitness, via reduced reproductive success or survival. On the other hand replacement clutches may increase the annual reproductive output of individuals and population. Whether lifetime reproductive success and survival are affected by reneesting is unknown. Relaying common terns *Sterna hirundo* have shown to be high quality individuals. In an individual-based long-term study (1992-2008) I investigated common terns marked with transponders, breeding at the colony site "Banter See" on the German North Sea coast. This approach allowed of studying short and long-term consequences of relaying for the population as well as for the individual. Reneesting probability increased with earliness in laying the first clutch and with age. 9 % of the clutches were replacements, which produced 4 % of all fledglings. In most years relaying birds were able to increase their reproductive output compared to their failed first clutch. In 5 of 8 years characterized by greater relaying activity, breeding success of replacement clutches was similar or even greater than that of first clutches. Return- and recruitment-rates of subadults originating from first and replacement clutches did not differ. The overall proportion of natal recruits coming from replacement clutches was only 3 %. On the individual level, strong heterogeneity was obvious: About one third of breeders did relay at least once in life. In those individuals 25% of the clutches produced during life was due to relaying, and 9% of fledglings stemmed from replacement clutches. Relaying individuals had greater lifespan and lifetime reproductive success compared to birds without replacement clutches. In conclusion demographic effects of the reproductive output from relaying seem to be minor. Fitness of individuals, however, can be improved by the investment of parents into replacement clutches.



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Reproductive success of blue-fronted parrot (*Amazona aestiva*) in the Chaco region of Argentina

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The blue-fronted parrot (*Amazona aestiva*) is a widely distributed Neotropical parrot and one of the most captured parrots in nature to supply the illegal trade of wild animals. In addition, recent increase in deforestation and selective logging are reducing the number of cavities for blue-fronted parrots in breeding, non-protected areas. The aim of this study was to determine the main factors that affect the reproductive success this species and provide information for modeling the impact that harvest and habitat destruction could have on their populations. During five consecutive years we monitored 159 nesting attempts in the Chaco region of Argentina. Predation accounted for approximately 50% of nest failures. Other causes of nest failures were nest abandonment after the death of all chicks (23%) or flooding of the nest cavity (11%). Daily survival rates increased with age of the nest and decreased with time of breeding. Considering that the length of the nesting cycle was 85 days, the cumulative probability of nest survival was 0.4. On average, clutch size was 3.7 eggs and hatching success and chick survival were 73% and 81%, respectively. Brood reduction was relatively uncommon and restricted to the first week after hatching. We did not observe re-nesting attempts after nest failure, but at least 63% of females whose nests failed re-nested the following year. Considering the proportion of nests that were successful and the number of chicks fledged per successful nests, the number of young produced per nesting attempt was approximately 0.9. Approximately 94% of the young survived until the age of one month. These results indicate that recruitment in protected areas is appropriate for sustaining blue-fronted parrot populations.



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Habitat use and temporal distribution of Mato Grosso antbird (*Cercomacra melanaria*) in the Pantanal of Poconé, Mato Grosso, Brazil

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The choice of habitat indicates a selection process, where the behavioural responses lead the individual to distinguish and select a particular environment. The environmental factors of this area influence the individual life history. The objectives of this research were to determine attributes of habitat use and temporal distribution of Mato Grosso antbird in Pirizal region - Pantanal of Poconé. Mato Grosso antbird is an insectivorous bird and inhabits understory in forests often near water bodies in the Brazilian Pantanal, Guaporé and Bolivian Chaco. We use data capture and recapture, and to demarcate tapping points (ten to Carvoal, 12 to Cordilheira and Cambarazal and 11 to Landi), 150 meters distant from each other. Each point was sampled for a period of ten minutes. These observations were made with the aid of binoculars (8x42 mm). The results of the observations indicate a preference for the environment called Cambarazal, where it was recorded 327 times of 353 totals. The use of this vegetation type occurs from the territory defence to build nests. The species was found throughout the year in the study area, except the month of February. The species showed a clear preference for Cambarazal, and show a clear change in its special distribution during the flooding at Pantanal. Such information serves as basis for possible plans for the conservation of this species and its life's area.



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Environmental drivers of laying date in Florida scrub-jays (*Aphelocoma coerulescens*)

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Variation in annual reproductive success often is linked to environmental variables, such as weather, food, and predation pressure. In the Florida scrub-jay reproductive success is linked to timing, with early egg-laying seasons predictive of greater success. We investigated environmental parameters and timing of laying over 30 breeding seasons, emphasizing biologically reasonable hypotheses. We assume that an increase in the quality or quantity of resources leads to earlier laying. Hypotheses included: 1) Weather could affect acorn mast, with poor mast delaying breeding. 2) Dry warm winter weather increases survival of orthopterans resulting in increased winter and spring food. 3) Wet autumns and balmy winters might maintain lizard and frog abundance. 4) Cold winters may increase energy needs while limiting resource availability thus reducing body condition and delaying breeding. 5) Cold wet fronts at the onset of breeding may delay nest building and laying. 6) Inexperienced pairs breed late, and high mortality the previous year increases the number of new pairs and delays the breeding season. 7) The Southern Oscillation cycle can drive Florida's weather: La Niña causes warmer drier winters and El Niño causes cooler wetter winters; therefore, SOI could affect laying date. The most informative model, included previous-year breeder mortality, cold winters, and SOI, explained 44% of the annual variation in timing of laying. We discuss the relationship between weather, breeder mortality and the role of epidemics, and analyse the direct and indirect linkages through which they influence timing of breeding.



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Climate change, timing of breeding and nestling diet: An analysis of seasonal and geographic variation of diets and its fitness consequences in pied flycatchers (*Ficedula hypoleuca*)

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One important effect of climate change is that mismatches can arise between the timing of breeding and the timing of food availability. This likely reduces reproductive success and might subsequently lead to population declines. However, habitats differ in their seasonality and food availability and it is unclear how those components determine breeding success. Climate change might render certain habitats with a high seasonality in food supply unsuitable for breeding if birds fail to advance sufficiently. We analyse nestling diet of pied flycatchers collected at different geographic locations across Europe and investigate dietary features between populations like seasonal changes and composition of food. Together with nestling fitness parameters we try to reveal factors explaining the variation in breeding success. Populations in areas of strong climate warming might show stronger seasonal declines of the preferred food in their diet than populations which recently experienced only little climatic changes. One important adaptation to climate change is dispersal to a northern breeding area to restore synchrony with the food peak. These dispersers will be confronted with large differences in food composition in addition to changes in other environmental factors. Knowledge about the geographic variation in diets will therefore be important for making predictions about whether northward dispersal is a valid option to adjust to ongoing climate change.



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Migratory ecology of yellow rails (*Coturnicops noveboracensis*) in Oklahoma

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Yellow rails (*Coturnicops noveboracensis*) are marsh-dwelling nocturnal birds that breed in the northern US and Canada and winter along the coast from Texas to North Carolina. Recently, it was discovered that they pass through southeastern Oklahoma in small numbers during fall migration, with a few records into December and a single record in January. We hypothesized that these birds may overwinter in southeastern Oklahoma. We made seven trips (three in November 2008 and one per month from December 2008 through March 2009) to Red Slough Wildlife Management Area in McCurtain County (Oklahoma) to catch and band yellow rails. We also removed the outer two rectrices for stable isotope analysis using deuterium. A total of 25 yellow rails were banded and birds were observed during each month. The rails were encountered in areas dominated by *Sporobolus* spp. averaging 44 cm in height, in areas with 4 cm or less of standing water. The stable isotope analysis suggested that these birds came from the western part of their breeding range in Canada. Yellow rails appear to overwinter in small numbers in McCurtain County, approximately 300 km north of the Gulf Coast. It is unclear whether this is a recent winter range expansion or whether these birds have historically wintered here, but observers should be alert for this species at other inland locations in the southeastern US.



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Habitat selection by the critically endangered cone-billed tanager (*Conothraupis mesoleuca*)

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The cone-billed tanager is one of the rarest and poorly known birds in the world. It is considered critically endangered by the IUCN, since both its range and population size are considered to be small. Nevertheless, the lack of knowledge on the species biology and behaviour precludes detailed assessments of its conservation status. For instance, information about the habitat requirements of the species is necessary to identify areas of potential habitat and accurately estimate its population size and range. In this study I tested the null hypothesis that the cone-billed tanager does not select specific habitat types, i.e., that it uses habitats as they are available. Playback trials ($n = 146$) were carried out at random in places (sampling points) accessible by boat, car or trail. During trials I broadcasted a male loudsong for 5 minutes followed by 5 minutes of silence. Then I noted: presence or absence of the species, the habitat type (cerrado savanna, flooded forest, gallery forest, or flooded grassland), and coordinates. Minimum distance between sampling points was 750 m. To test the null hypothesis I performed a randomized chi square test (1000 randomizations) to compare used vs. available habitat. The species used flooded habitats more than expected by chance, thus such habitats appear to be preferred by the species, whereas Cerrado savanna and riparian forest appear to be avoided. Also, the species was found in only 10% of the sampling points, suggesting low population size. Selection of flooded habitats may account for the rarity of the species, since these habitats are not common in the region. If the species is dependent on such rare habitats, habitat loss would be the main threat to the species.



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Evaluation of variations in egg size and egg weight related to fisheries discards during three breeding seasons of kelp gulls (*Larus dominicanus*) in the archipelago of currais, Parana state, Brazil

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The kelp gull, *Larus dominicanus*, is a generalist seabird that is widely distributed in the Southern Hemisphere. In some parts of the species' range, over recent decades, its populations are increasing due to food from fisheries discards. In Brazil, data on the reproduction of kelp gulls are relatively scarce, and thus, our study reports on information on a breeding colony of kelp gulls in the Archipelago of Currais (25° 44'S, 48° 22'W) in Paraná State, southern Brazil. The data were collected during the breeding season of kelp gulls in 1999, 2006 and 2009 in order to measure eggs. Eggs were weighed and measured with spring scales and vernier calipers. Twenty-nine eggs were measured and weighed in 1999. In 2006, sixty-seven eggs were measured and weighed. In 2009, forty-nine eggs were measured and weighed. Mean values of weight, width and length observed over these three years were respectively 87.03 ± 0.67 , 49.20 ± 0.13 and 71.34 ± 0.25 . Comparing the averages of width and length we observed significant difference between these years. Greater averages of width were observed in 1999 (49.86 ± 0.20) and greater averages of length were observed in 2009 (72.40 ± 0.43). In relation to weight, 2006 presented the smaller mean values (84.76 ± 1.09), that was significantly different ($p < 0.05$) to means observed in 1999 and 2009. In 2006, for the first time, the trawl fishing moratorium coincided partially with the breeding season of gulls. During the moratorium, fewer discards were produced, thus reducing the amount of food available to gulls. This could explain the smaller weight of eggs.



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Asymmetric competition between Chinese sparrowhawks (*Accipiter soloensis*) and egrets in rice paddies

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The Chinese sparrowhawk (*Accipiter soloensis*) has been largely regarded as a specialist predator that feeds on amphibians, especially on frogs throughout its breeding seasons, and egrets also use frogs as important food resources in rice paddies of Korea. Although the sparrowhawks and egrets (genus *Egretta*) are distantly-related avian taxa, the recent global and local decline in amphibians may have resulted in reduction of available food resources for both sparrowhawks and egrets. From 2004 to 2006, we monitored diets of two avian taxa to recognize diet overlap and possible resource competition in central parts of Korea. During the early and middle breeding stages of the sparrowhawk, both birds generally foraged on frogs in rice fields and demonstrated a high level of diet overlap. In the late breeding stage when the density of frogs was lowered, however, the sparrowhawk changed main diets from amphibians to insects while wading egrets still foraged on frogs in rice paddies. This result suggests that asymmetric competition may occur between sparrowhawks and egrets in rice paddies when the availability of frogs is limited. Interactions between two distinct avian taxa with a similar food niche are closely related to the conservation of raptors in rice paddy ecosystems with declining amphibian populations.



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Effects of nest environment on stable isotope composition of blood and feathers in tree swallows (*Tachycineta bicolor*) and American kestrels (*Falco sparverius*)

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Stable hydrogen (D), nitrogen (N-15) and carbon (C-13) isotopes are increasingly applied in avian ecological studies to reveal broad movement patterns and trophic interactions. However, such applications would benefit from thorough evaluations of factors that affect natural variation in tissue-isotope measurements. Thus, we conducted cross-fostering experiments with tree swallows (at 2 widely-separated sites) and American kestrels (1 site), by swapping newly-hatched birds (<4 days old) among nest box types built from natural (swallows at 1 site) or standard materials (both species) and collecting blood and feathers from nestlings just prior to fledging. Mixed (hierarchical) modelling results indicated that isotope measurements were not strongly related to either nest box type or natal nest (i.e., source family) effects. Rather, most variation in tissue-isotope composition was related to effects of rearing environment, perhaps indicative of differences in nest and parental quality or foraging and provisioning tactics of parents. Finally, average differences between D in blood and feathers were similar for swallows from the two sites (27permil and 32permil), but differences recorded in swallows were ~40% less than those observed in kestrels (50permil). Strong *species-specific* patterns in blood-feather differences were not observed for N-15 and C-13 isotopes; divergent D results may be related to differences in nests, diet composition, or physiological processes affecting hydrogen assimilation during growth and feather synthesis.



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The cipo canastero *Asthenes luizae* nest on endemic plant species of Espinhaço Range

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Cipo canastero *Asthenes luizae* is an endemic ovenbird to *campos rupestres* areas of southern Espinhaço Range, Minas Gerais state, Brazil. Globally threatened in the Vulnerable category, some of the conservation measures proposed for this species include studies of its breeding biology. There are only few works with nesting data for *A. luizae*, all pointing out to the Velloziaceae *Vellozia nivea* as the plant species supporting the nests. In 2009, we search for nests in the highlands of Serra do Cipó, Santana do Riacho municipality. We found 23 nests supported by 10 different plant species. Most nests (six) were in *Coccoloba acrostichoides* (Polygonaceae), one of those also in *Achyrocline satureioides* (Asteraceae). *Apochloa molinioides* (Poaceae) hold up five nests, being one also in a non identified dry shrub. *V. nivea* support four nests, one hold by two individuals of this species. *Vellozia* cf. *compacta* and *Encholirium subsecundum* (Bromeliaceae) support two nests each. The remaining nests are in *Vellozia* cf. *epidendroides*, *Vochysia* sp. (Vochysiaceae), *Apochloa euprepes* (Poaceae) and in an unidentified grass (Poaceae), all with one nest each. Almost all of those plant species also are endemic to Espinhaço Range. Many factors can be related to the choice of the support plant for nesting, like the surrounding area and plant architecture. This choice can influence nest success rates and habitat use patterns, making the study of species of plants that support nests very important in breeding biology and habitat studies of bird species, specially the threatened ones, like *Asthenes luizae*.



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Movement patterns of granivorous birds in relation to seed abundance in the central Monte desert, Argentina

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In the central Monte desert, grass seeds constitute 80% of granivorous birds' diet. This strong dependence may have important effects on the dynamics of these birds, which may vary with their ecological strategies. We seasonally mist-netted birds at Ñacuñán Reserve and estimated grass seed production during 2005-2009. We found a continuous range of movement patterns in four granivorous populations. We relocated 40.4% of the many-colored Chaco finch (MCCF) individuals, and observed lower values for the ringed warbling finch (RWF: 18.5%), the resident population of the rufous-collared sparrow (RCS: 12.2%) and the migratory population of the RCS (mRCS: 2.6%). Seed production showed low year-to-year variation in 2005-2008 (CV: 15.2%; Mean: 13340 seeds/m²) but dramatically decreased during 2009 (494 seeds/m²). Although fluctuations in the number of captures during winter in 2005-2008 for the most sedentary species was also low (CV: 7.1%, Mean: 0.011 captures/net-hour) we found high variation for RWF (CV: 58.7%, Mean: 0.030 captures/net-hour), RCS (CV: 50.2%, Mean: 0.071 captures/net-hour) and mRCS (CV: 59.9%, Mean: 0.032 captures/net-hour). Notwithstanding, these populations had a marked decrease in their capture number during 2009 (captures/net-hour were zero, 0.003, 0.012 and zero for MCCF, RWF, RCS and mRCS, respectively). Our results suggest that highly sedentary birds have a close relationship with local resources and low fluctuations in their local abundance. Less sedentary and wandering birds abundances may be restricted by resource variations at broader scales in space and time, as is usually observed in arid regions. However, in years of extremely low seed abundance birds could be equally affected - independently of their movement pattern.



The rise and fall of local populations of ortolan buntings: importance of movements of adult males

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Changes in population size of local populations of birds have usually been interpreted in relation to adult return rate and recruitment of young individuals after natal dispersal. Little is known about the importance of redistribution of adult individuals through breeding dispersal. The small Norwegian population of ortolan buntings (*Emberiza hortulana*) has a patchy distribution with about 30 long-term local populations. During a period of general population decline (29% decrease over 7 years), the population trends of local populations (measured as number of males recorded) were highly variable, with some even increasing four-fold. Comparisons of demographic parameters showed that adult immigration rate (i.e. breeding dispersal of males) explained both yearly changes in male population size and population trends over the whole study period better than adult return rate or adult emigration rate, or a measure of recruitment of young males. Adult immigration rates and recruitment rates were correlated, suggesting that both young and adult males find the same places attractive. In the study area, adult sex ratio was strongly male-biased, and immigration rate was greater when sex ratio was less skewed. In addition, less skewed sex ratio was related to greater adult return rate and lower emigration rate. We found no relationships between measures of breeding success and population change. We suggest that conspecific attraction may explain the observed patterns. Some local populations may act as hot-spots attracting adult males from other populations. Thus, local population changes need not reflect overall population growth rate, but may be a consequence of redistribution of adult birds.



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Temporal and spatial connectivity in the partially migratory oystercatcher: carry-over effects of habitat quality and weather conditions as evidenced by seasonal survival

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As a consequence of migratory connectivity, events happening at one season can affect life-history traits of birds at subsequent season through carry-over effects. The Eurasian oystercatcher *Haematopus ostralegus* spends the winter along the coasts of Europe. In summer, a resident population breeds at these shores while a migrant population breeds inland or further north. We studied if survival rates 1) differed between populations; 2) differed between seasons and fluctuated with local conditions; and 3) were affected by changes in wintering habitats (closure of the Oosterschelde in the Dutch Delta, reduction in food stocks in the Wadden Sea)? We used all ringing-recovery datasets from 1975 to 2000 from all continental European countries to estimate winter and summer survival rates. During periods with mild winters, adults of both populations exhibited lower survival rates in summer than in winter. Severe winters affected survival rates of migrants and residents similarly. In most years, the decline in survival observed during severe winters was followed by a decline in the subsequent summer, indicating a short-term carry-over effect. After the closure of the Oosterschelde a decline in survival was measured in winter for young birds and in summer for migrant adults, that mostly use that area in winter. Resident adults were affected in winter by the reduction in food stocks in the Wadden Sea. Thus, wintering habitat changes induced long-term (>10 years) carry-over effects in both winter and summer, depending on age and migratory status. Moreover, after habitat changes, the effects of severe winters were amplified.



An engineering model approach to assessing the cumulative impact of human activities on wintering shorebirds: do we need variation between individuals?

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According to the web of science, the oystercatcher is the best studied shorebird in the world. It is common in the Wadden Sea and Dutch Delta area, though rapidly declining. We developed a simulation model that describes the energetic requirements of the birds in combination with low tide foraging on the mudflats. The ratio between actual food intake (the required amount) and the potential food intake is the "workload" of the birds. And the average workload for December, January and February is termed the stress index for a particular winter. Due to simplifications, like grid cells having a uniform prey density, the model birds have an easier life than real birds and the stress index has to be calibrated. Data on the death rate in winter and on changes in the number of wintering birds suggest a critical stress index of about 0.5. This figure hides all the details of the real foraging process of different individuals in a heterogeneous environment. By calculating (in the model) the number of birds for which the stress index reaches its critical value, we can estimate the carrying capacity of the area. Estimated carrying capacities conform well to the number of oystercatchers wintering in different areas, despite the fact that our model does not include variation between individuals. We subsequently applied our model to scenario studies with and without habitat loss, shellfish fishery, soil subsidence and sea level rise. It turns out that carrying capacity of wintering birds is primarily determined by the extent of shellfish beds high in the intertidal zone. We hope to test this prediction studying oystercatchers administered with newly-developed high frequency GPS-transmitters.



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Haemoparasitism in *Turdus albicollis* (Muscicapidae) and *Trichothraupis melanops* (Thraupidae) in Atlantic forest at Ilha Grande, RJ, Brazil

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Birds have a large range of parasites using their blood stream to complete part of their life cycles. The purpose of this work is to analyze some aspects of the bird-parasite interaction in *Turdus albicollis* and *Trichothraupis melanops*, representative parasited families in Atlantic forest and frequently captured on the study site. The study was made in the Atlantic forest at Ilha Grande, Rio de Janeiro. Birds were captured from Aug/2007 to Sep/2009, banded, weighted and released after blood sample taken. Blood was used to make blood smears (fixed in 100% ethanol and stained with MGG) and molecular sex determination of *T. albicollis* that does not have apparent sexual dimorphism. A total of 35 samples of *T. albicollis* (16 birds had their sex molecularly determined, 11 9794 and 5 9792) and 17 to *T. melanops* (12 9794 and 5 9792) was taken. Only microfilaria was detected on both species with morphological differences between them. The overall prevalence in *T. albicollis* was 48.5%, being greater in females (50%) then in males (36.5%). The overall prevalence in *T. melanops* was 53%, being greater in males (66.5%) then in females (20%). Another work on the Atlantic forest found prevalence of 12% and 0.6% for *T. albicollis* and *T. melanops*, respectively, which are much smaller than what was found in our study. It could be due to physiological differences between populations and/or vectors distribution, whereas the differences between genders can be due to physiology and/or behavioral responses. The parasitism did not affect the body mass of the parasitized individuals of both species. Funding: UERJ/SR-2/CEADS, CNPq.



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First data on the breeding biology of the tawny-bellied seedeater (*Sporophila hypoxantha*) in south Brazilian high altitude grasslands

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The life history of several seedeaters (*Sporophila* spp.) is virtually unknown. Since 2007, we have studied the basic biology of seedeaters in upland grasslands located in the south of Brazil. Aspects related to breeding biology of the tawny-bellied seedeater (*Sporophila hypoxantha*), a typical member of the “capuchinos” group, were evaluated in a migratory population by means of nest monitoring ($n = 42$) and observation of parental behavior. Territorial males defend an area of 0.21 ± 0.082 ha ($n = 6$) on average and present agonistic behavior for long periods of the day. The vegetation on nest sites is characterized by a dense middle stratum composed mainly by shrubs (Asteraceae) and grass clumps. The nest, in shape of a small cup, is built quickly (in four to six days) by only females on small shrubs (e.g. *Vernonia chamaedrys* and *Eupatorium gaudichaudianum*) less than 45 cm above the ground. The clutch size is two (88%) or three eggs, which measure $16.2 \pm 0.72 \times 11.9 \pm 0.23$ mm ($n = 6$), and the incubation (held by the female) lasts 11-12 days. Until about five days of age chicks are fed only by females. Males help from there on and during the fledging stage. Nestlings leave the nest with nine days of age. Preliminary measures from 33 nests indicate a reproductive success of 45% (31% by Mayfield method) with predation as the main cause of failure, affecting 28% of the nests, followed by abandonment (18%), cattle trampling (3%), fire (3%) and infestation by *Philornis* fly larvae (3%). This is the first assessment of the reproductive success for the species. The basic reproductive patterns of the species in the study area are very similar to that found in Formosa region (Argentina), where its natural history is better known. More data will be collected in the next breeding seasons so that several aspects of the life history of this poorly known species can be best understood.



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Home range of a mountaintop endemic of eastern Brazil pale-throated serra-finch (*Embernagra longicauda*)

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The pale-throated serra-finch (*Embernagra longicauda*) is an endemic bird restricted to the mountaintops of eastern Brazil, occurring in the interior of Bahia and Minas Gerais state, mainly above 900 m. We followed a population of this species from February 2007 to May 2008 in an 134 ha area in Serra do Cipó National Park. We marked twenty-one birds with colored leg bands and identified 17 pairs inhabiting the entire area during the study period. Locations of color-banded individuals were recorded using a GPS unit. For two pairs of two adjacent pairs we got a stable point accumulation curves for the home ranges generated by means of Bootstrap from MPC 100%. The average home range size obtained by using the 95% Kernel for these four pairs was 3.66 ± 0.65 ha and 2.80 ± 0.45 ha according to the MPC 100%. Distance between the centers of areas was estimated using the centers of activity generated by the construction of the 95% Ellipse and was found to be an average of 150.53 m. The overlapping area between Kernel 95% was $15.3\% \pm 5.9\%$, and between the core areas (Kernel 50%) was $11.5\% \pm 0.7$ for two pairs, and nonexistent for another two pairs. We observed that this species have site fidelity, monogamous habits, and territory defence along all the year. There are few available data about home range of other Neotropical grassland birds, but seems that *E. longicauda* have a smaller home range size even compared to small species. The existence of allometric relationships between home-range size and body mass was not found as expected from predictive theory. The study of space use of mountaintop restrict species have a great importance despite its vulnerability to the nowadays climatic changes.



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Predation threat by golden eagle *Aquila chrysaetos* restrict the breeding distribution of rough-legged buzzard *Buteo lagopus*

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A “natural experiment” – the re-colonisation by golden eagles of the Dovrefjell area in central Norway after the protection of eagles in 1968 resulted in the systematic abandonment of rough-legged buzzard breeding sites as the number of golden eagle pairs increased. The evidence is only circumstantial; the mechanism could be a) competition for food, b) competition for nest sites or c) predation by golden eagle. The diet overlap between the two species was small. The food niche breadth of the golden eagle was 0.59 and it was 0.05 for the rough-legged buzzard. Competition for nest sites does not seem to be a likely explanation for the restriction in distribution of the rough-legged buzzard as suitable nest sites are usually abundant for this species. The most likely explanation is therefore the predation threat by golden eagles. Rough-legged buzzard nests in the study area (n = 58) were classified according to reproduction status and if they were inside or outside the tolerance border of a golden eagle territory. There was a significantly greater proportion of non-occupied rough-legged buzzard nests inside the tolerance border of golden eagle territories than outside.



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Breeding biology and conservation of the bearded tachuri (*Polystictus pectoralis*) and sharp-tailed tyrant (*Culicivora caudacuta*) in high-altitude wet and grasslands in southern Brazil

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Studies on breeding biology of the bearded tachuri (BT) and sharp-tailed tyrant (ST), both under threat grassland flycatchers, are being developed in two areas in Northeast of Rio Grande do Sul (RS) and Southeast Santa Catarina (SC). The study areas include (1) a high altitude wetland in a plain terrain and (2) grasslands steep slopes which follow Lava-Tudo River. Both species were unknown for these areas until 2007, when BT was first registered for SC state and ST for Campos de Cima da Serra (CCS) region. Between 2007/2008 and 2008/2009 reproductive seasons 18 field expeditions were conducted in these areas (142 effort hours for these species). In five BT's nests found only one (20%) has its success confirmed. The other four were predated or abandoned. Thirteen ST's nests were found. They had mainly three eggs and the mean of incubation time was 15 days. Five nests (38%) had their success confirmed, with two or three fledglings. Predation and abandonment were the main cause of the other eight nests failure (62%). Field observations demonstrated that both male and female ST build the nest and take care of the nestlings. These preliminary results show the importance of the study areas in the conservation of these two rare birds with almost unknown biology. A greater effort will be done in the 2009/2010 reproductive season (October to February) and in successively years aiming to increase data collection on the reproductive biology of these two species. A long-term field monitoring can also be useful to identify and propose conservation areas not only for these species, but also for other grassland birds associated in the same habitats as some threatened seedeaters (*Sporophila* spp.).



Factors influencing nest survival rates in the stripe-tailed yellow-finch (*Sicalis citrina*) breeding in old mining pits

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Predation is the major cause of nest loss in birds and is thought to be of greater importance in the neotropics compared to temperate zones. Here we estimate nest success and test the influence of several factors on the stripe-tailed yellow-finch *Sicalis citrina* nest survival rates: (a) variation across the breeding season, (b) edge effect, (c) nest age, (d) nest height, (e) nest substrate (plant used), (f) nest size and (g) observer effect. We searched and monitored nests in old mining pits at Brasília National Park, central Brazilian cerrado, from January to May 2007. We found 99 nests and determined the fate of 73 of them. Predation was the main cause of nest failure ($n = 48$, 66%), while six nests were abandoned (8%) and 19 nests produced young (26%). Mayfield's daily survival rates and nest success were 0.94 and 21%, respectively. From the 73 nests we determined fate only 59 were suitable for nest survival modelling in program MARK. Nest height and nest substrate were correlated, so we only used nest substrate. The best candidate model included a linear trend across the breeding season and nest age covariate (95% CL: 0.003, 0.032; -0.126, -0.023, respectively). The best model also included nest substrate, however the confidence limit for this covariate included zero. Nests placed on the most common plant tended to have greater survival probability. Using MARK we found that daily survival rates increased linearly towards the end of the breeding season, as nests become less abundant, and decreased as nests age, probably as a function of increased nest attentiveness. Edge effect, nest size and observer effect showed little effect on daily survival rates.



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Seasonal effects of nest parasites on nestling tree swallows (*Tachycineta bicolor*)

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Quality and survival of nestlings in many avian species declines over the breeding season but mechanisms producing these patterns remain uncertain. Disease emergence generally increases with rising temperatures in temperate systems and parasite populations of avian species often increase during the breeding season. Thus, late-hatched offspring may face greater disease challenges, or have lessened capacity to cope with such challenges, than early-hatched counterparts. We experimentally investigated the seasonal effects of nest parasites on quality and glucocorticoid hormone of nestling tree swallows on two study areas in Canada. Nest parasite abundance was successfully reduced using five insecticide treatments during the nestling period, but we did not detect a seasonal decline in any measure of nestling quality in either control or treated nests. Furthermore, nestling mass at fledging, and growth rates of mass, primary feather and head-bill were unaffected by parasite removal. Nestlings from treatment and control groups survived at similar rates. A measure of immunological responsiveness, via phytohemagglutinin test, was also not different between control and treated nestlings. However, nestlings in fumigated nests had significantly lower levels of corticosterone in feathers than did control nestlings. Results indicate that nestlings adjusted their energetic resources, measured by corticosterone levels, in response to decreased parasite abundance. Because no measure of nestling quality changed seasonally, it was impossible to address whether parasite infestation is a mechanism driving seasonal decline in nestling quality. The significant decrease in corticosterone levels in fumigated nests when considered with the lack of difference in nestling quality indicates that either, parents compensated for larger metabolic costs to parasitized nestlings, or that nestlings compensated for nest parasite infestation with no consequence to their quality and survival.



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Resiliency of understorey insectivorous birds to edge effect in a fragmented tropical rainforest

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Edge effect has great impacts on the persistence of understorey insectivorous bird species in isolated forests. We examined the abundance insectivorous birds along the edge-interior gradient in an isolated lowland tropical rainforest in Peninsular Malaysia. The study was conducted between May 2007 and April 2008 using Distance Sampling Point Count method. Results showed that the most striking changes on the understorey bird community (i.e. relative abundance, density, diversity, and composition) occurred within 25 m to 400 m of the forest edge to the interior. The association between the birds and the micro-environmental factors separated two completely different groups of birds: (1) forest interior-specialist species such as the short-tailed babbler and black-caped babbler which used the forest interior habitats discriminately and tended to avoid the microclimatic fluctuations close to the edge; and (2) forest edge-specialist species such as the yellow-vented bulbul and cream-vented bulbul which preferentially used the edge. In terms of feeding guilds, interior-specialist guilds such as terrestrial insectivores and sallying insectivores and the edge-specialist guilds such as arboreal foliage gleaning insectivores and terrestrial insectivores-frugivores were separated based on their sensitivity to the edge effects. The environmental conditions, vegetation structure and composition along the edge-interior gradient resulted in different responses of the understorey birds. The forest edge-specialist species were associated with the high light intensity and shrub cover, and they could be the best indicators of the edge habitat condition. The forest interior-specialist species were associated with high relative humidity and leaf litter cover and thus, could be the best indicators of the forest interior habitat condition.



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Breeding biology of the marsh seedeater (*Sporophila palustris*) in southern Brazil

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The breeding biology of *Sporophila palustris* - a globally threatened seedeater that breeds in Uruguay, northeastern Argentina and southern Brazil - is poorly-known. Between December 2008 and January 2009 we conducted six expeditions to wetlands of Mato Grande Biological Reserve (southern Rio Grande do Sul, Brazil) in order to study the species' breeding habits. We realized focal observations on three breeding pairs. Breeding events occurred in wet grasslands covered with seeding grasses and sedges on the border of deep marshes. Nests ($n = 2$) were deep cups constructed of fine grass panicles attached by their sides to forbs. Nests had an average external diameter of 5.7 cm, internal diameter of 4.1 cm, height of 5.3 cm, depth of 4.5 cm, and were built 21-28 cm from the ground. Clutch size was two eggs ($n = 2$ nests). Eggs were 1.73 cm long, 1.26 cm wide and weighed 1.5 g ($n = 2$). The tasks of nest building and egg incubation were performed solely by females. Eggs were incubated on average for 23.1 ± 16.9 min ($n = 12$ incubation bouts on one nest). Both sexes were responsible for feeding nestlings and fledglings. All observed food items consisted of small grass seeds collected at an average distance of 46.5 ± 27.7 m from the nest ($n = 80$ searches). Estimated fledging success was 50% ($n = 2$ nests). Breeding of this species in the reserve could be related to the availability of adequate herbaceous vegetation structure and food resources, a probable consequence of the limited presence of cattle in the grassland.



Habitat selection by collared crescentchest (*Melanopareia torquata*, Melanopareidae), sharp-tailed tyrant (*Culicivora caudacuta*) and cock-tailed tyrant (*Alectrurus tricolor*) (Tyrannidae) in Estação Ecológica de Itirapina, state of São Paulo, Brazil

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The goal of the present study was to verify the habitat selection of an endemic cerrado bird, Collared crescentchest (*Melanopareia torquata*), and two threatened tyrannids, sharp-tailed tyrant (*Culicivora caudacuta*) and cock-tailed tyrant (*Alectrurus tricolor*). The study was developed in a Cerrado area of 2720 ha, in the Estação Ecológica de Itirapina (EEI) and A USP, an adjacent area, during the reproductive period (October to December of 2006 and 2007). Macrohabitat and microhabitat selection was analyzed through use-availability and logistic regression models selected by Akaike Information Criterion (AIC), respectively. *Melanopareia torquata* selected only “campo cerrado” areas while the tyrannids occurred mainly in grasslands. In A USP, area with intense cattle grazing, these species were not reported. The best model selected to explain *M. torquata* presence was high density of tall shrubs (> 1 m) and native grasses. The importance of these variables to *M. torquata* is evident during its vocalizations on high shrubs, and its foraging, and reproduction in lower stratum. The native grasses selection could indicate a negative relation to alien grasses, because of the competition among them. The low density of the palm, *Attalea geraensis*, and trees was the most relevant model for *C. caudacuta* and *A. tricolor*. Other model selected for *C. caudacuta* was short shrubs (< 1 m), and lesser exposed ground associated with a low density of *A. geraensis*. *Melanopareia torquata* management’s could be made with removal of alien grasses and cattle. We suggest for the tyrannids preserving grasslands dominated with native grasses, including short shrubs.



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Arctic shorebird demographic network: understanding the mechanisms behind shorebird declines

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There is growing evidence that many shorebird populations may be declining in North America. Reasons for these declines are unknown. Demographic studies on the breeding grounds provide an opportunity to measure a variety of parameters that influence population growth (e.g., reproductive effort and performance, age of first breeding, adult survival). Here we introduce a new initiative called the “Arctic Shorebird Demographic Network” (ASDN) whose goal is to gather information on potential mechanisms behind shorebird declines that can be measured on the breeding grounds. This approach compliments the Arctic PRISM that estimates population size and trends of shorebirds. We discuss the practical and statistical problems associated with selecting study sites and species, and parameters to monitor. We also describe methods developed during a 7-year intensive breeding ecology study at Barrow, Alaska, that optimize ways to record data for the thousands of nests to be located and birds that will be banded. The ASDN also will allow the collection of samples from a large number of birds (or eggs) across a large geographic area, enabling assessments of contaminants, genetic subdivision, migratory connectivity, and other areas of interest.



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Territory size and breeding density of Chinese sparrowhawks (*Accipiter soloensis*) in Korea

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The Chinese sparrowhawk (*Accipiter soloensis*) is the most common breeding raptor in Korea and mainly breeds on forest edges with various types of wetlands such as rice paddies. To estimate the territory sizes and breeding density, sparrowhawk nests were searched and monitored in two study areas of central Korea from May to September 2005. Based on 100% minimum convex polygon (MCP) methods studied in Musu-ri, breeding Chinese sparrowhawks occupied 3.62 ± 0.55 ha. According to a previous study in 1974, eight pairs of the sparrowhawk bred at the Gwangneung Forest in Gyeonggi Province, but only four active nests were found at the same study site in 2005. However, the breeding densities of the sparrowhawk in the study areas were ranged from 1.33 to 2.00 pairs/km², or possibly up to 2.57 pairs/km² in 2005. This result suggests that the Chinese sparrowhawk is the most common and widely distributed raptor of high breeding density in Korea, but some local populations seem to be significantly declining (50-75% drop) over the last 30 years. This local decline was probably caused by habitat loss, particularly by local reduction of rice paddies (30-76% drop). Although Chinese sparrowhawk numbers on autumn migration are well monitored in many Asian countries, a corresponding system of monitoring efforts in its breeding ranges is needed to estimate its overall population trends.



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Avian malaria infection in nestlings of the bull-headed shrike (*Lanius bucephalus*): effects of mosquito abundance and brooding behavior

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The degree of host-vector contact is considered one of the most important factors of vector-borne disease transmission. Parental brooding for the night is thought to be efficiency to avoid biting by nocturnal mosquitoes for nestlings in open-cup nests. We investigated relationship of prevalence of avian malaria parasite for nestlings, vector mosquito abundance, and parental brooding for the night during the nestling period in bull-headed shrikes on Minami-daito Island, Japan. *Plasmodium* spp. were detected by microscopical examination from 11.9% of ge11-days-old nestlings (n = 84) from 2004-06. The appearance of infected broods that included at least one nestling detected avian malaria parasite increased significantly with progression of breeding season. However, abundance of nocturnal *Culex* mosquitoes harbored *Plasmodium* spp. would tend to decrease in the late breeding season than early breeding season by mosquito sampling using CDC-like battery-operated traps and detecting the partial mtDNA *cyt b* genes by nested-PCR. Temperature loggers revealed that the frequencies of parental brooding for the nights decreased with the progression of breeding season and ambient temperature. We therefore suggested that avian malaria infection risk of nestlings seasonally increase despite low density of vectors because the degrees of nestling-vector contact would increase through reduction in the frequencies of parental brooding for the nights.



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Habitat selection of the Restinga antwren, *Formicivora littoralis* (Thamnophilidae) in a coastal fragment of Rio de Janeiro State, Southeastern Brazil

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The Restinga antwren is considered the only endemic bird of the *restingas* of southeastern Brazil. It is currently categorized as critically endangered due to the continuous and accelerated loss of its highly restricted habitat. It is known only to the central coastal region of Rio de Janeiro State. In order to define the space use of the species at the Núcleo Experimental de Iguaba Grande (campus of Federal Fluminense University), we sampled (December 2008 to September 2009), six transects (300 m each) perpendicular to the margin of Araruama lagoon, including *restinga* vegetation (initial segment) and dry forest (more internally). Our sampling consisted on transects to obtain visual and auditory records, spontaneously and using playback. In addition, we measured vegetation variables: canopy coverage, canopy height, number of layers, foliage density and presence of cacti and bromeliads. We conducted 132 transects (total 60 h), totaling 38 contacts with Restinga antwren. Thirty-two (84%) of these records were up to 100 m away from the lagoon's margin, where *restinga* vegetation prevails. The main vegetation variables statistically associated with the number of records of Restinga antwren were foliage density (positively) and canopy height (negatively). These agree with the typical habitat known for the species, i.e., dense scrubby vegetation. The species used mostly (but not exclusively) *restinga* habitat, also occupying the adjacent dry forest (*savana estépica*).



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Analysing the feeding trips of breeding oystercatchers (*Haematopus ostralegus*) leaving their territory using newly developed GPS-loggers

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The population of oystercatchers, *Haematopus ostralegus*, breeding on the island of Schiermonnikoog in the Dutch Wadden Sea, has been studied intensively since 1983. Territories differ markedly in quality, depending on distance between breeding and feeding area. Both male and female spend much effort in territory defence. During the breeding season of 2008 oystercatchers breeding in high quality territories were equipped with new solar powered GPS-loggers, developed by the University of Amsterdam, which are light enough (i.e. 12 gram) to be used on oystercatchers. These loggers can record the position of the bird with a high frequency up to once every three seconds. This allowed us to track the birds when they were outside their territory, both day and night. We made a distinction between day and night and between egg and chick phase. Since the predation risk on eggs and chicks is lower during the night, we expected the birds to make more trips during the night. The studied birds did not make more trips during night-time, but the duration of the trips were longer. For only one bird the frequency of trips changed during the breeding season. When the bird had young, it made more trips during daytime. Our preliminary study shows the great potential of these flexible high frequency GPS-loggers for detailed studies on the feeding ecology and social behaviour of birds no smaller than Oystercatchers.



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Effect of the floral neighborhood and foraging strategy on the breeding success of two species of *Salvia* in western Mexico

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There is a close relationship between pollination success and several floral and morphological features of plants. For example the position of pollen in hummingbirds' bodies can reduce pollen mixtures that produce lower seed production. This mixture can also be avoided by flowering isolated from other plants that compete for pollinator services. The purpose of this work was to document the effect of neighborhood and floral morphology over seed set in *Salvia mexicana* and *S. iodantha*, plants that bloom synchronically in western Mexico. We measure foraging strategy, visitation rate, and pollen loads of hummingbirds visiting the different flower patches (isolated species vs. mixtures). We recorded 3193 visits from 5 hummingbird species in *Salvia mexicana* monospecific flowering patches, while 2482 visits of 6 hummingbirds in mixed patches. In *S. iodantha* monospecific patches a total of 2854 visits of 6 hummingbird species were registered while mixed patches received 5471 visits of 8 hummingbird species. Both species shared many of the visitors. Pollen was placed in different places in the visitors' bodies as revealed by experimental visitation to fluorescent marked flowers of both species by the main visitors. Visitors differed in pollen frequency registered in the 200 pollen loads analyzed. Floral morphology along with foraging strategies can account for most of the pollen separation and aloud synchronically flowering and visitor sharing in this two plant species.



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The effect of arthropod and fruit abundance on breeding parameters of a neotropical savanna tanager (*Neothraupis fasciata*)

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Food resources are ecological factors that can affect life history characteristics, population sizes and community structure. The high energetic demand that birds face during the reproductive period forces them to breed during periods of high food abundance. However, little is still known about the effect of resource abundance and reproductive parameters of tropical birds. We evaluated the effect of food resources abundance (arthropods and fruits) on the reproductive parameters (clutch size, egg volume and date that eggs were laid) of the white-banded tanager *Neothraupis fasciata*, in the savanna (cerrado) of central Brazil. We did not find a correlation of clutch size or egg volume with arthropod and fruit abundance. The date that eggs were laid, first half of September, was strongly correlated with an increase in both arthropod and fruit abundance. However, the correlation with arthropods was stronger than the correlation with fruits. Fruits are sources of water, minerals and sugar, whereas arthropods have are rich in lipids and proteins, substances important for the production of organic tissues, for the production and development of eggs and nestlings. The determination of clutch size and egg volume is probably related to physiological or genetic characteristics poorly related to resource abundance.



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Breeding biology of yellow-crowned night heron, *Nyctanassa violacea*, at a mangrove area on south of Brazil

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The breeding biology of the yellow-crowned-night-heron was studied during three breeding seasons, during 2005 to 2008, in a mangrove site, at coast of Paraná State, south of Brazil. A total of 84 nests were monitored and 65.5% became active; 63.3% in the first breeding season, 66.7% in the second and 66.7% in the third, what gave an estimated breeding population of 38, 32 and 40 individuals respectively. The breeding activity started on August and lasted until March, with peaks on September and November. Clutch size varied from two to five eggs, with a mean of $2.8 (\pm 0.64)$ eggs per nest. The length and width (mm) averages of the eggs in the three breeding seasons were $51.56 (\pm 1.54) \times 37.47 (\pm 1.98)$. There were more losses during the incubation period than any other to all breeding seasons. The greater breeding success was registered in the first breeding season (1.33 fledged/nest); and the lowest breeding success was registered in the second breeding season (0.35 fledged/nest). The breeding population size was relatively stable during the study, probably regulated by extrinsic factors such as reduction of local mangrove area. The breeding activity peak as well as the clutch size may be related to factors as food availability and weather condition. Predation and bad weather conditions may be the most important causes of egg disappearance. In order to maintain the local population, the park area must be preserved.



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Does supplementary feeding enhance the breeding performance of birds? Lessons from a protracted study in the UK

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The general public in the UK has been encouraged by conservation organisations to provide supplementary food for birds in their gardens throughout the year. Furthermore, supplementary feeding is used as an important tool in the recovery of populations of threatened species. However, empirical data are lacking to support protracted, intensive supplementary feeding, especially during the breeding season. In this study, we provided peanut cake and live food in the spring and early summer to birds breeding in nestboxes at a mixed woodland site. As in other studies, we found significant effects of supplementary feeding on breeding phenology; laying and hatching dates were advanced. However, we also found some significant, and unexpected, negative influences on breeding outputs. These included reduced clutch and brood sizes, and depressed fledging success. However, we detected an increase in “apparent survival” in the autumn. Taken collectively, these findings have informed ongoing work that is focussing on the behavioural, energetic, genetic and nutritional impacts of supplementary feeding on our study population. These findings should facilitate predictions of the influences of the widespread feeding of birds in urban areas. Furthermore, they should also caution against using food supplementation as a conservation tool to “rescue” populations of threatened species without first appreciating the full effects of a supplementary feeding programme at different spatial and temporal scales.



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The effect of changes in soil moisture on the reproductive success of the starling (*Sturnus vulgaris*)

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Over the past 25 years, many UK lowland farmland bird species have undergone breeding population declines. Included among these are starling *Sturnus vulgaris*, song thrush *Turdus philomelos*, redshank *Tringa totanus*, lapwing *Vanellus vanellus* and snipe *Gallinago gallinago* all of which feed predominantly by probing the soil for invertebrate prey. Soil moisture levels are one of the main factors determining access to and abundance of suitable prey items in the top soil layer and penetration resistance (maximum force required to probe the soil). Under dry soil conditions, prey availability is reduced as earthworms descend deeper into the soil, invertebrate larvae desiccate and soil penetrability decreases. Moist surface soils have greater penetrability and support larger densities of soil invertebrates than dry surface soils. However, prolonged water-logging can result in invertebrate prey that are accessible but at low abundance due to reduced populations. Using the starling as a model species, data from a 4 year study of nest box provisioning and fledgling survival was used to quantify the relationship between soil moisture, diet and reproductive success. The results of this study will be presented along with environmental management options, informed by these results.



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Modelling the occurrence and abundance of a colonial species, the Arctic tern (*Sterna paradisaea*) on the Finnish coast

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Knowledge of the habitat requirements and suitable breeding areas of sea birds is crucial for their management and conservation. However, there are still few studies that have modelled the breeding distribution and abundance of colonial sea birds. In this study, we created predictive distribution models for a colonial species, the Arctic tern *Sterna paradisaea*, using 14 environmental variables calculated for 525 islands in the Archipelago Sea in SW Finland. We modelled the occurrence (presence-absence) using generalised additive models (GAMs) and abundance (pair numbers/colony size) using hurdle models fitted with GAM. We tested for spatial autocorrelation in model residuals and evaluated the models on independent data. Critical factors influencing the occurrence of the Arctic Tern were the proportions of boulder or gravel and forest of island area, as well as island maximum elevation and area, such that the species seemed to prefer large and low islands with sparse vegetation. Abundance was influenced by the proportions of boulder or gravel and bare rock of island area, as well as exposure and island area. To some extent, different factors influenced the occurrence and the abundance. The evaluation results of the models were good, with an AUC value of 0.91 for the most accurate presence-absence model and a Pearson's correlation coefficient of 0.60 for the most accurate hurdle model. The predictive ability of the models increased when we removed islands with single or few breeding pairs from the data set. Although the hurdle models did not produce accurate pair number estimates, they indicated which islands are suitable for larger colonies. Abundance is a crucial factor for colonial species. This modelling technique can therefore be of great value for the conservation and management of the Arctic Tern and similar colonial species.



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Estimating population size of *Phaeton lepturus* in Fernando de Noronha Archipelago (Northeast Brazil)

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This study reports the estimated population size of the white-tailed tropicbird (*Phaeton lepturus*) by boat transects and bird counting around the *Fernando de Noronha* (FN) Archipelago, Northeast Brazil. Despite its large tropical range, *P. lepturus* occur in few localities in the Brazilian territory, breeding only in FN. For this reason, it is considered as endangered species in the country. FN is a volcanic archipelago with 21 islands; breeding sites for two species of *Phaethon* (*P. lepturus* and *P. aethereus*). The population census of *P. lepturus* were made during 19 to 30 October 2009 by counting the birds in two boat trips around the islands, and in other 10 sites were we registered their occurrence. These boat transects were accomplished between 6:00 and 12:00 h, and were divided by 29 (1km) sectors. No *P. aethereus* were observed in the expedition. We observed 57 and 68 individuals of *P. lepturus* in the two boat trips. We found 72% of sectors around the islands with their presence. We observed no aggregations of individuals, and most of them in pairs. We also measured and banded 24 individuals in Chapéu island. Including the individuals counted in the other 10 independent sites (sampled separately) and other 25 nests (about 50 breeding individuals), we conclude about 150 individuals of *P. lepturus* occurring in FN Archipelago in this period. Published data reports about two times this population size. Therefore, it is important to consider migration of individuals in other seasons. We emphasize the need of continued studies addressing detailed annual samplings in these sites.



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Breeding biology of black-bellied seedeater (*Sporophila melanogaster*) in south of Planalto Meridional Brasileiro

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Black-bellied seedeater (*Sporophila melanogaster*) is a small migratory bird that breeds only in grasslands of Atlantic Forest Biome. Although, it is currently threatened in Brazil its nest and eggs have not been even described. Thus, due to the lack of information about their basic biology, we studied aspects concerning mainly the breeding biology of the species. By monitoring 32 nests during the breeding season of 2007/2008 and 2008/2009, we collected information in three distinct areas in the south of Planalto Meridional Brasileiro. Pairs established territories in boggy portions which were characterized by plants such as *Sphagnum* sp., *Paspalum* spp., *Andropogon* spp. and *Eryngium pandanifolium* (the latter with heights between 1.2 and 1.7 m). The nests were built in bushes only by the female at about 32 cm (n = 23) above the ground. Nests were classified as low cup/fork, being built in three or four days exclusively by the female. Most nests (85.7%, n = 21) had two eggs but three eggs were also found (n = 3). The eggs were white with small purple spots and measured 17 x 12 mm. Incubation was performed by the female and lasted 12 days (n = 20) in average. The nestlings left the nest in 11 days (n = 21) after hatching. Females were responsible for feeding them the first five days of life, being assisted by the male after this period. We found a reproductive success of 37.57% (n = 29). This rate is in agreement with other species studies from open areas of Brazil Central. The main causes of the failure of the nests were related to natural predators (58.3%). Data collection will continue to elucidate the breeding biology of *S. melanogaster*.



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Age of first breeding and population dynamics in tawny (*Strix aluco*) and Ural owls (*Strix uralensis*) in Finland

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Tawny and Ural owls breed in nest boxes in forested areas in Finland. For both species, the proportion of owls breeding increases with age from one to five years of age; the larger Ural owl generally breeds at a later age than the tawny owl. The proportion of birds breeding at each age varies dramatically among years, in relation to the ~3-year cycle of prey abundance--when few voles are present, relatively fewer young birds breed. Understanding the costs and benefits to individuals that breed at an early age, both in years of high and low vole abundance, can provide insight into the selective pressures that favour delayed breeding. Are individuals that breed at an early age less able to survive or breed in subsequent years, and how does this affect population dynamics? To address these questions, we analysed large (>35,000 birds), long-term (>40-year) mark-recapture and recovery data sets available for both species from Finland. We developed multi-state models to estimate age-specific breeding probabilities and to determine whether the probability of surviving or breeding in one year depends on the probability of breeding in the previous year for both young and older birds. Because non-breeders are unobservable, unless they are recovered dead, we used information on the proportion of occupied nest boxes where adult owls are captured, to help make the models identifiable. We used random effects models implemented in a hierarchical Bayesian framework to cope with the extremely large numbers of parameters required to model age and time-specific variation in all parameters over a 40-year period.



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Neotropical Birds Online: a new, comprehensive resource for information on the birds of Central and South America and of the Caribbean

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Neotropical Birds Online (<http://neotropical.birds.cornell.edu/portal/home>) is an authoritative, comprehensive resource for life histories of Neotropical birds. The scope is all bird species that occur regularly from Mexico and the Caribbean south to southernmost South America. A standard set of topics are covered in each online account, including nesting biology, diet, foraging behavior, distribution, habitat, conservation status, appearance and identification, and priorities for future research. Online, authors can revise their species accounts to keep pace with new research, and can add rich media such as photographs, sound recordings and video. This is a collaborative project. Not only will it be useful to researchers, birders, and managers who are interested in birds of the neotropics, but it will be *created* by that same community of specialists. The accounts are developed within a moderated wiki environment where web pages for every species are designed to enable anyone with information to access, contribute, or modify content. Contributions are solicited in the form of authored species accounts, or authored chapters within a species account; we also welcome contributions in the form of photographs or videos of Neotropical birds that can be posted to the site; contributions of audio recordings; or assistance with translating our materials into all three of the main languages in the region (Portuguese, Spanish, and English). Everyone with an interest in Neotropical birds has a role to play.



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Ecological and genetical characteristics of Eurasian skylark populations at mountain habitats in Japan

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There are three subspecies of the Eurasian skylark, *Alauda arvensis*, in Japan. Both of *A. a. pekinensis* and *A. a. lonnbergi* are considered winter visitors. *A. a. japonica* breeds in Hokkaido as a migrant and in other regions as a resident. The breeding habitats are open grassland at lowlands such as cultivated fields, meadows, dry riverbed, and sandy coasts, in general. Recently, we found some skylarks in small populations at the alpine habitats of the Daisetsu mountains (ca. 2,000 m A.L.S.) in Hokkaido, and one brood was confirmed each in 2008 and 2009. Breeding populations of skylarks were also confirmed at the subalpine zone of Mt. Fuji in Honshu (ca.1800-2100m A.L.S.) and at the top of some mountains with summit phenomena in Hokkaido. These breeding habitats were alpine crest areas, turf-banked terraces and lava clast areas, with poor vegetations. To clarify the genetical characteristics of breeding populations of the skylarks at mountain habitats, we analyzed nuclear DNA microsatellite regions using DNA samples from mountain and lowland populations. Analyses for 34 DNA samples with four markers were conducted and 4, 7, 8, and 12 alleles were identified for each marker, but clear differences in allelic frequencies were not found between mountain and lowland sites. In the presentation, the characteristics of skylark populations breeding at mountains and the relationship between lowland and mountain habitat populations will be considered through comparisons of breeding traits with both populations, and genetic analyses with additional DNA samples and markers.



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The military macaw at the Biosphere Reserve of Tehuacán-Cuicatlán: a medium-term study in Mexico

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The military macaw (*Ara militaris*) is an endangered species that inhabits oak and deciduous forests in Mexico and South America. Pet trade and habitat lost are the principal causes of their population decrement. One of the largest populations in México (80 to 100 individuals) is at the The Sabino Canyon at the Biosphere Reserve of Tehuacán Cuicatlán, where the macaw uses the natural holes of the cliff walls as nests. We present medium-term results of our study with this species; our analyses with data since 2004 shows a considerable variation in bird abundance among years. Our study implicates flying directions, potential and real use of nest availability, reproductive success, behavior, use of plant resources and searching of other sites visited by the Macaw on the reserve. Those results, together with the work of the community of Santa María Tecomavaca, makes to the Sabino Canyon, a perfect site to implement a conservation and management program.



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Mycoplasma as a limiting factor in the recovery of magellanic penguins, *Spheniscus magellanicus* (Forster, 1870)

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The magellanic penguin is the most known species in Brazil, found in several beaches of Brazilian coast. When those birds arrive, they are very weak, due to the exhausting trip and, in which, they are exposed to environmental factors such as pollution, exhibiting signs of petroleum intoxication, malnutrition, dehydration and low immunity. In 2005, a new *Mycoplasma* species was described in a penguin of the same genus with respiratory disease. The objective of this study was to investigate the presence of microorganisms of the genus *Mycoplasma* in magellanic penguins found in Rio de Janeiro state beaches, and assisted by the Zoonit Foundation, Niterói-Rio de Janeiro, Brazil. Oropharynx swab samples from 20 penguins were collected. These specimens were diluted, streaked on Frey's solid and liquid media and incubated at 37°C. Isolates from growth positive samples were submitted to pcr. A total of 20% of the specimens were positive for *Mycoplasma* spp. For the first time, *Mycoplasma* spp. was identified in magellanic penguins captured in Rio de Janeiro state, Brazil. This finding emphasizes the importance of investigating the capacity of development of disease in penguins by mycoplasmas. If that is the case, one should expect that mycoplasmas associated with predisposing factors would limit the recovery of these birds as well as interfere with management and preservation of this species.



Do slate-throated whitestart *Myioborus miniatus* and spectacled whitestart *M. melanocephalus* compete in sympatric zone?

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Slate-throated whitestart and spectacled whitestart are similar and highly specialized species that both perform the “flush-pursuit” technique of foraging. Both species occur on the slopes of the Andes, but slate-throated whitestart occupy lower elevations (800-2400 m a.s.l.) whereas spectacled whitestart higher ones (2000-4000 m a.s.l.). Within the narrow sympatric zone both species occur side by side. The research was carried out in 2008-09 at Yanayacu Biological Station, at 2100 m a.s.l. (Napo Prov., Ecuador), in mostly undisturbed montane cloud forest interspersed with small overgrown pastures. The density of slate-throated whitestarts on a 3 km long transect was three times larger than those of spectacled whitestarts. We found that habitat selection of the two species differ considerably. Slate-throated whitestart prefers high tree stands where they live in the canopy. Spectacled whitestart occurs mainly in lower vegetation up to 5 m, in predominately bushy areas with only scattered higher trees. The average foraging height for slate-throated whitestart is significantly higher than in spectacled whitestart. Slate-throated whitestart flush insects by spreading their tail significantly more often than spectacled whitestart. We have never noticed any aggressive encounters between both species, and some breeding territories overlap. Therefore, we have not found any sign of competition between them. It seems they have not changed their habits and niches in the sympatric zone and spectacled whitestart is adapted to lower vegetation, which is typical for higher elevations, whereas slate-throated whitestart to higher vegetation at lower elevations.



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Climatic influences on the Norwegian willow warbler *Phylloscopus trochilus* population

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In Norway the willow warbler breeds during the summer and thereafter migrates to south of Sahel in Africa. A breeding population of the willow warbler has been monitored in a subalpine birch forest (800-880 m a.s.l.) plot of 24 ha in Budalen (62°45'N, 10°30'E) since 1967. The population (P) declined during the first twenty years. However, lately it has shown some improvement. According to local climatic measurements there are no significant trends for temperature and precipitation during the breeding season in our study area; and neither any good correlations between P and the mean temperatures and amount of precipitation during May, June and July. The only exception is a slightly significant positive relation between P and the mean temperatures in June the actual and previous breeding season ($r = .311$ and $.365$, respectively, $p < .05$ for both). Therefore, the climatic conditions on the breeding ground are barely the main cause for the variation of P. But what about the climatic conditions during the migration and wintering phases? For answering this we can apply the North Atlantic Oscillation index (NAO) and the Sahel rainfall index. The correlations between these parameters for the previous years and P become highly significant; that for the annual NAO and winter NAO become $-.507$ and $-.537$ ($p < .001$ for both), and those for the Sahel index previous springs, and the spring before that again, become $.402$ and 0.441 respectively ($p < .01$ for both), and for the corresponding fall indexes $.318$ and $.494$ ($p < .05$ and $.001$, respectively). Our findings indicates that the population size of the Willow Warbler is significantly driven by climatic events in the migrating and wintering areas, and only slightly influenced by the varying weather conditions on the breeding grounds.



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Differences in nest cavity selection between sympatric populations of similar sized scops owl species (*Otus elegans* and *Otus semitorques*)

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Two scops owl species with similar size sympatrically occur in forests of Okinawa Island: the elegant scops owl (*Otus elegans*) and the Japanese scops owl (*Otus semitorques*). We investigated the nest cavity selection of these two scops owl species in a habitat where they sympatrically occur, and discuss possible mechanisms of coexistence from the aspect of nest cavity selection. Nest cavity characteristics were observed for the two species in natural conditions and the nest cavity selection was experimentally analyzed using nest boxes of which size (large and small) and installation heights (low, middle and high) were categorized. Japanese scops owls used large tree cavities in natural conditions and used only larger nest boxes in the field experiment. In contrast elegant scops owls used small tree cavities (Okinawan-woodpecker's old nests) in natural conditions, while in experiment, they used both small and large nest boxes, for which selection indices indicated neutral selection. These results suggested that the existence of Japanese scops owl restricted opportunities of large tree cavity utilization in the elegant scops owl in natural conditions. The nesting season of the Japanese scops owls was earlier (about 1 month) than that of elegant scops owls and the nesting period of both species were similarly about 60 days. Thus Japanese scops owls have an advantage for nest cavity selection. When elegant scops owls start nesting, large tree cavities would already occupied by Japanese scops owls. Elegant scops owl may soften the interference by the Japanese scops owls by using nest cavities which are seldom used by Japanese scops owls.



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How much does weather influence the breeding of golden eagle (*Aquila crysaetos*) and lesser spotted eagle (*Aquila pomarina*) populations in the lowlands of northeastern Europe? An example from Estonia

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The golden eagle and the lesser spotted eagle are two raptor species that coexist in lowland regions of northeastern Europe but occupy different ecological niches. Although both species are forest-dwelling here, golden eagle breeds in marshland while lesser spotted eagle occupies mosaic forest-grassland landscape. In the current study we use 17-year monitoring data from Estonia to analyse how much do weather conditions and how much do other factors, such as food resources, set potential limits to populations of the two eagle species. Breeding frequency, breeding success and productivity of both species fluctuated significantly. These changes were cyclic, synchronous and highly correlated – lesser spotted eagle productivity peak was one year ahead of the peak in the golden eagle. This suggests that the two species with completely different ecological niches are similarly affected, lesser spotted eagle directly and golden eagle indirectly, mainly by rodent abundance. However, also weather conditions affected productivity, most strongly during the prelaying period of each species. As the timing of breeding is different, weather seems to have rather weak effect to the synchrony of productivity fluctuations and its importance remains lower than the effect of the food conditions.



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Study of birds occupying mangrove in formation

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Much of the mangrove avifauna is typical, but not exclusive. Yet this environment has an essential role in feeding, nesting and resting of this and other groups. With the implementation of the South Expressway Hydraulic Landfill in Florianópolis, Brazil, a place conducive to the establishment of mangroves has been created. Typical mangrove tree species introduced by a study in this environment in 1998 with more specimens brought in by Pirajubaé mangrove tidal allowed the formation of a new ecosystem in this region. This event proved an opportunity to observe bird populations at a new space. This work raised the populations present in this biogeocenosis during the spring. Spring has the greatest abundance and diversity of birds in southern Brazil, being the period of breeding and migration of many species. It was performed 71.5 hours of daytime punctually observation in 11 locations spaced in the study area. With the aid of binoculars, cameras and field guides. It was also made descriptions, photographs, movies and vocalizations' recordings for identification. There was an increase in relation to previous works. It was evidenced species like American oystercatcher (*Haematopus palliatus* Temminck, 1820), the white-backed stilt (*Himantopus melanurus* Vieillot, 1817), the Neotropic cormorant (*Phalacrocorax brasilianus* Gmelin, 1789) and the cocoi heron (*Ardea cocoi* Linnaeus, 1766), in addition to other typical species already observed in other studies, like the southern lapwing (*Vanellus chilensis* Molina, 1782) and the kelp gull (*Larus dominicanus* Lichtenstein, 1823). This final result demonstrates the environment capacity of regeneration and adaptation about some urban sprawl and also shows birds' response to the birth of an ecosystem essential to their lives.



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Why birds outnumbered mammals in cavities of the primeval stands of the Bialowieza Forest?

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We compared numbers of secondary cavity nesting birds and mammals using the same cavities in oldgrowth lime-oak-hornbeam stands of the Bialowieza National Park (eastern Poland). In some years within this habitat birds (titmice *Paridae*, flycatchers *Ficedula*) are outnumbered by some rodent species (especially by yellow-necked mouse *Apodemus flavicollis*). Rodents fluctuated much in their densities through years of the investigation while bird densities were much more stable. Fledgling's production was affected much by brood predation caused by rodents. Then, next-year birds' breeding densities were affected by low production in previous year. We explain this by use of different food resources. Birds have much more stable food resources (mainly insects) than rodents which depend on seed production of oak, hornbeam and other tree species (pulsed resources).



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The balance of provisioning effort : Do increased food resources affect the contribution of parents during brood rearing?

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The rate at which nestlings are provisioned by their parents has long been used to investigate the relationship between resource availability and parental investment in offspring. Recent technological developments now allow detailed examination of the balance of investment between parents within a pair, leading to the potential to model parental life history decisions within the framework of game theory. Most experimental studies of brood rearing investment have focussed on increasing the costs of provisioning through handicapping or removing one partner. In this study we investigated the effects of decreasing the costs of chick provisioning using food supplementation and report the effects of this supplementation on the balance of provisioning rates between parents. We attached Passive Integrated Transponder (PIT) tags to both individuals of breeding pairs of birds to identify each individual as they entered the nestbox and determine their brood provisioning rates over 24 hour periods. The study was conducted in our well-established food supplementation system involving great tits (*Parus major*) and blue tits (*Cyanistes caeruleus*) at a woodland study site. We have found that food supplementation has a significant effect on the balance of provisioning rates between parents. Our findings show that increased food availability can alter the cost to parental birds of the reproductive event and that this affects the balance of work between the provisioning partners.



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Natal environment and host dispersal as drivers of avian malaria infection in a wild bird population

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All organisms are subject to parasite infection, and the influence of infectious disease is gaining an increasing role in our understanding of the ecology of wild populations. Here, we examine the importance of the natal environment, individual quality and host dispersal as drivers of individual variation in avian malaria infection, in a nestbox population of approximately 300 pairs of individually marked blue tits *Cyanistes caeruleus*, studied over nine years. Avian malaria infection in this population shows marked spatial at a small geographical scale (385Ha) and considerable temporal variation within and between years. Although the diversity and widespread occurrence of avian malaria make for an ideal study system in which to study a range of evolutionary and ecological questions, relatively few studies have considered the dynamics of this disease at the population level. Infections were diagnosed using PCR based techniques, and a GIS approach was used to integrate these data with measurements of host dispersal and survival from a network of automated data loggers. The local natal risk of malaria infection for nestlings has consequences for subsequent infection as an adult, acting in concert with host dispersal. We also examine the importance of the natal risk of malaria infection for the survival of blue tits, using capture-recapture statistical techniques.



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SA10 Population Genetics and Phylogeography



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Genetic diversity of four rock firefinch (*Lagonosticta sanguinodorsalis*) subpopulations on the Jos Plateau, central Nigeria

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Small populations are prone to loss of genetic diversity due to genetic drift, which may result in the increase in the frequency of rare deleterious recessive alleles. This leads to reduction in fitness as a result of inbreeding depression. The rock firefinch is a firefinch with small patchy populations scattered within the Jos Plateau. Being a species with pockets of small subpopulations, the rock firefinch may be experiencing loss of genetic diversity within the various small subpopulations. We determined the genetic diversity of four subpopulations of the rock firefinch on the Jos Plateau. Distances between these four subpopulations ranged from 35 - 120km. We compared genetic diversity between individuals within each subpopulation and between subpopulations using 10 microsatellite loci. We present the level of genetic diversity in each population and discuss the genetic relationship between the subpopulations as well as the implication of the level of genetic diversity on the general population of the rock firefinch. This has important implication for their conservation.



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VNTR polymorphism in serotonin transporter gene detected in birds and its relation to behavioral traits

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To elucidate the relationship between genetic polymorphism and behavioral traits, numerous efforts have been made mainly in the field of human aetiology. In this study we focused on a variety of chicken purebred lines on the basis of whether they exhibited polymorphism in two Variable Number of Tandem Repeat (VNTR) regions of serotonin transporter gene (*5-HTT*) known as one of key neuro-transmitter related genes. First we isolated two distinct VNTR sequences in intron regions of *5-HTT* from the chicken genome database and designed novel primer sets in flanking sites of VNTR sequences. Genotyping using various avian specimens revealed that 11 out of 12 chicken purebredlines including the red jungle fowl (*Gallus gallus*) showed polymorphism in the intron 2 VNTR, as well as the intron 10 VNTR, indicating highly polymorphic patterns in all chicken purebredlines tested. According to the sequences of each VNTR, we found that the intron 2 VNTR was composed of 16 to 22 bp repeat units and repetitive numbers ranged from two to five, whereas the intron 10 VNTR had 18 to 19 bp units repeated 12 to 17 times. Allele frequencies at both VNTR loci were clearly skewed according to chicken purebredlines and some alleles were prominent in one line but absent in the other lines. Contrary to the high polymorphisms at two VNTR loci detected in chickens, these alleles were completely fixed in the Japanese quail (*Coturnix japonica*), the ring-necked pheasant (*Phasianus colchicus*), and the toco toucan (*Ramphastos toco*). Based on the combination of *5-HTT* genotypes (i.e. haplotypes) we identified, further work is underway to elucidate the relationship between VNTR haplotypes of *5-HTT* and behavioral traits in chickens such as “aggressive” behavior toward flock.



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Chromosome homology between the scarlet ibis (*Eudocimus ruber*) and the domestic chicken (*Gallus gallus*)

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Recent advances in fluorescence *in situ* hybridization (FISH) using probes specific for entire chromosomes or chromosome segments can provide a cytogenetic map of homologies that can be used for comparisons in phylogenetic studies or genome reorganization analyses. These maps are common for Mammals, but only a few species of birds had their maps built, usually using *Gallus gallus* karyotype as reference. One of the orders with a greater chromosomal variation is Ciconiiformes, with diploid numbers ranging from 56 to 78. Nevertheless, no species of this group has been studied by FISH. We analyzed the karyotype of *Eudocimus ruber* using whole chromosome probes derived by *G. gallus* (GGA 1-10). Chromosome preparations were obtained from cultured biopsies from a female. We found a $2n = 72$, with 14 pairs of macrochromosomes and 21 microchromosomes. The Z was submetacentric and the W metacentric. Whole chromosome probes hybridizations indicated the maintenance of most syntenic groups of *Gallus* in *E. ruber*, which painted only one chromosome or chromosome segment per haploid set. GGA3 and GGA4 hybridized onto two distinct chromosomes of *E. ruber* each. The hybridization of some probes onto chromosome arms suggests the occurrence of events of fusion, such as in pair 2, which had each arm hybridized by a different probe (GGA7 or GGA8). Considering that *Gallus* show a genomic organization similar to the putative avian karyotype, these results confirm the occurrence of fusion and fission events even in birds with bimodal karyotypes, such as *E. ruber*.



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Molecular systematics of the complex *Synallaxis ruficapilla*/*S. whitneyi* (Passeriformes, Furnariidae): a possible contact zone revealed

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Synallaxis ruficapilla (rufous-capped spinetail), *S. whitneyi* (Bahia spinetail) and *S. infuscata* (Pinto's spinetail) form a species complex that occurs in the Atlantic forest. We analyzed the genetic variation of *S. ruficapilla* and *S. whitneyi* along their geographic range. We sequenced 1003 bp of the mitochondrial cytochrome b from 45 specimens collected in the Brazilian states of Bahia (BA), Minas Gerais (MG), Rio de Janeiro, São Paulo, Espírito Santo, Paraná, and Santa Catarina. We observed 28 haplotypes and mean nucleotide diversity (π) of 0.0078 (sd. 0.00188). Phylogenetic analyses (neighbor-joining and Bayesian inference) and median-joining network revealed the existence of three clades: (1) samples of *S. ruficapilla* from all over its described range; (2) *S. whitneyi* individuals (two samples from the valley of Jequitinhonha river in Minas Gerais and Boa Nova-BA) and one *S. ruficapilla* from Poté (Minas Gerais); and (3) one unexpected clade with two samples from Poté (Minas Gerais) and one from José Gonçalves de Minas (Minas Gerais), whose morphologies are similar to *S. ruficapilla*. High genetic divergences between pairs of clades were observed (1-2 = 0.032; 1-3 = 0.022; 2-3 = 0.033). Due to sample size, summary statistics were obtained only for clade 1. No genetic structure and reduced π of 0.00246 (sd. 0.00029) were observed in clade 1. Neutrality tests revealed recent demographic expansion in clade 1 ($D = -2.1297^*$, $F_s = -20.0711^{**}$, $R_2 = 0.0383^{**}$). It was very interesting to observe that in Poté (Minas Gerais), haplotypes belonging to all three clades occur in sympatry. This may be a contact zone between lineages, but the extension of the distributions of these lineages still needs to be investigated in detail. Funds: FAPESP, CNPq, and CAPES.



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Molecular phylogeny of parrots (Psittaciformes)

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We present a broad molecular phylogeny of parrots using two genetic markers, 1 mitochondrial (cytb) and 1 nuclear (RAG-1). Results will be discussed in context of morphological and biogeographical data. We are presenting the relationships between all major taxonomic groups: Cacatuidae; Loriinae; Psittacinae: Psittichadini, Nestorini, Strigopini, Micropsittini, Cyclopsittacini, Platycerini, Psittaculini, Arini.



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Population structure and gene flow of an endemic and endangered bird species, the Worthen's sparrow (*Spizella wortheni*), in a fragmented Mexican landscape

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Evolutionary processes are affected by gene flow within and between subpopulations. Bird populations living in or close to intensive farmland areas show low levels of diversity and their population sizes are declining, these facts could be yielding a low exchange of individuals between fragmented habitats resulting in the deterioration of genetic variation. The Worthen's sparrow, *Spizella wortheni*, is an endemic species from northeastern Mexico that is affected by habitat modification and now is recognized as a threatened species in the IUCN red list. We assessed genetic diversity, population structure, and gene flow of the Worthen's sparrow between different localities distributed in three states of northeastern Mexico. Four cross-species microsatellite markers and five newly developed species-specific microsatellite markers were used. We found a low level of genetic differentiation between the sampled populations, heterozygosity deficiency and a considerable amount of inbreeding. Individuals assignment test yielded a maximum number of four population clusters, one of them showed significant genetic differences. The two smallest clusters were located in the center of the study area, where there is strong agricultural activity. These clusters exchange genes with individuals from the northern and southern populations as indicated by considerable gene flow. Our data suggest that the central subpopulations became fragmented due to the farming in this region, but that there is still genetic exchange to the larger subpopulations.



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Microsatellite loci amplification in four species of Neotropical passerines using heterologous primers: developing tools for reintroduction of illegal captured birds

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Illegal trade is one of the main threats to Neotropical birds. Thousand birds are annually seized by the environment agencies and some of them are potentially able to come back to nature. However, reintroduction efforts must be considered with caution because most of captured birds are from unknown origin and genetic impacts can be brought to the wild populations if they were embedded in different genetic population. Microsatellites are molecular markers that have been widely used in population genetics and conservation assessment studies, and also can be helpful to identify the origin of captured birds. However, the development of these markers for a particular species is complex and costly, and the use of heterologous primers has been an efficient strategy for using these markers in population studies. Here, we evaluated the application of 16 primer pairs developed for *Neothraupis fasciata* (Emberizidae) to amplify similar microsatellite sized products in four songbirds species commonly seized by Brazilian environment official agencies: *Sporophila angolensis*, *Sicalis flaveola* (Emberizidae), *Gnorimopsar chopi* (Icteridae) and *Turdus rufiventris* (Muscicapidae). PCR reactions were performed using DNA sample of one individual from each species and three annealing temperatures: 50, 53 and 56°C. The amplification products were scored in 6% polyacrilamide gel. Primer pairs that amplified unique PCR fragments with similar size than those observed in *N. fasciata* were considered as successful cross-species amplification. *S. angolensis* and *G. chopi* presented more successful cross-species amplification, with 12 and 11 loci, respectively, than the remaining two species, seven in *S. flaveola* and three in *T. rufiventris*. These results indicate that some of these loci can be used for genetic studies in these passerines and in efforts to reintroduction the illegal captured birds to their original populations.



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Phylogeographic patterns and genetic diversity of *Polystictus superciliaris* (Passeriformes: Tyrannidae) in Minas Gerais State

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The grey-backed tachuri, *Polystictus superciliaris*, belongs to the Tyrannidae family a strain suboscines passerine that is classified as Near-threatened by IUCN. The species is endemic to the shrubby and rocky grasslands on top mountains of eastern Brazil, between 1000 and 1600ms above sea level. The study aims to characterize the distribution of genetic variability in space and time. We analyzed 29 individuals from 10 geographic locations by sequencing of 1266 bp of mtDNA (586 bp/COI gene and 682 bp/ND2). For the analysis of data we have used the software Phred-Phrap-Consed, MEGA 4, DnaSP, ARLEQUIN, NETWORK and GENELAND. We found 13 haplotypes, and the nucleotide diversity estimated was 0.002 and haplotype diversity was 0.796. The high haplotype diversity is due to the large presence of unique characters to some individuals. The construction of a haplotype network with the Median-Joining algorithm revealed a star-shaped topology, suggesting population expansion and recent diversification. This finding is supported by the negative and significant value (-1.85) obtained with the Tajima's D test. Genetic landscape analysis revealed the presence of two populations that we named: CSN (mountains between Serra do Cipó and the mountains of northern Minas Gerais) and QF (mountains of passage known as the Iron Quadrangle). The AMOVA using this geographic division has shown moderate but significant population structure ($f_{ST} = 0.13$, $p = 0.002$). The results evidence the occurrence of a recent population expansion in the species, and also a significant structuration despite the small sample size. It also marks a north-south division in the species distribution which occupies areas with different vegetation types of ferruginous outcrops and limestone.



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Genetic variability of Papua and Adelie penguins in Antarctic Peninsula, King George Island

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Penguins are adapted to live in extreme environments, but they can be highly sensitive to climate changes. The ice shelves in Antarctic continent have melting and creating new breeding areas to species that breed on ice-free, such as Adelie (*Pygoscelis adeliae*) and gentoo penguin (*P. papua*). Thus, it is expected that these species expand their range with global warming. In this sense, studies that access the evolutionary history and the current genetic variability are fundamental to conservation and monitoring the global warming effects on the species. This study aims to investigate the genetic variability of Adelie and gentoo penguins from Antarctic Peninsula. We analyzed the Dloop region of mtDNA (~500bp) from 25 individuals of gentoo and 38 adelie. Our outcome showed high levels of genetic diversity from both species ($h_{dpapua} = 0.98$, $h_{dadeliae} = 1.00$; $P_{ipapua} = 0.0188$ $P_{iadeliae} = 0.0112$). We estimated the effective population size based on mtDNA theta values and found 130 individuals to Adelie and 506 to gentoo. Signs of significant population expansion were found exclusively to Adelie penguins showed expansion (Tajima $D' = -2.034$ and Fu & Li = -2.59). These results are consistent with the information that Adelie penguins may have recently expanded their populations as a result to the global warming. However the gentoo penguin did not show any sign of expansion due to the large effective size. In this sense we suggest that Adelie penguins are important bio-indicators of climate change in the Antarctic marine environments.



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Patterns of genetic differentiation in phenotypically divergent populations of red-winged blackbird (*Agelaius phoeniceus*)

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Populations of red-winged blackbird (*Agelaius phoeniceus*) in California (USA) and central Mexico are strongly differentiated from adjacent populations both in plumage (male epaulet color and female breast pattern) and in song characteristics. Historically, these populations have been considered a separate species (*Agelaius gubernator*, the bicolored blackbird), but discovery of extensive hybrid zones between them and adjacent “typical” redwings led to their synonymy. Male plumage traits have been shown experimentally to affect male-male competition and female choice, and their variation and its potential impact on patterns of genetic differentiation is of particular interest. Using 10 polymorphic microsatellite loci and mtDNA sequences, we estimated the degree of genetic differentiation among populations of both morphologies. We found evidence of substantial population differentiation both within and between these forms. We interpret these results in light of patterns of phenotypic differentiation, and evaluate hypotheses for the origin of the disjunct distribution of bicolored forms.



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Morphological and molecular data confirm cryptic endemism of the wedge-billed woodcreeper (*Glyphorynchus spirurus*) in the Madeira River basin, Amazonia, Brazil

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Studies focusing on the geographic distribution of Amazonian species have shown that many taxa are separated by major rivers, and that those delimit areas of endemism. Recent morphological and genetic studies have suggested that smaller rivers such as the Aripuanã and Jiparaná can also bound diagnostic populations of primates and birds. We investigated the levels of genetic differentiation of the wedge-billed woodcreeper *Glyphorynchus spirurus* (Dendrocolaptidae) across the Madeira River and two of its right-bank tributaries, the Aripuanã and Jiparaná rivers. We reconstructed molecular phylogenies using sequences of the mitochondrial cytochrome b gene (about 950 pb) and inferred the hierarchical relationships among haplotypes and sampling regions. The degree of concordance between phylogeny and genetic distances, in addition to patterns of geographical distribution of clades, allowed us to make historical inferences. We measured six morphological traits of all birds sequenced and specimens available in bird collections. Bayesian inference and maximum parsimony analyses revealed four clades and high levels of genetic differentiation (3.5 to 5%) on opposite banks of the three rivers sampled. In contrast, no significant differences across rivers were found in morphological characters. Genetic structure and absence of morphological differentiation across river banks highlight cryptic endemism in one of the most threatened region of the Brazilian Amazon. Thus, instead of a single species, *Glyphorynchus spirurus* may represent a species complex with yet unknown cryptic species.



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Phylogeography and synchronous diversification of the *Corvus* corvids of the world

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The genus *Corvus* with its approximately 40 species is found world wide except in South America. The greatest diversity is found in Australasia and SE Asian islands. Ten species (25%) are coloured black and white/grey, the rest are completely black. We investigated the phylogeny of the genus *Corvus* employing DNA sequences of the mitochondrial control region. The study was based mainly on museum material allowing the analysis of more than 30 species. Inclusion of sequences of other corvid genera as available in GenBank confirmed the monophyly of the genus *Corvus*. Within the *Corvus* clade several distinct subclades can be distinguished. Some contain only single species or species pairs (e.g., *C. monedula* + *C. dauricus*; *C. frugilegus*; *C. palmarum*) while other clades are composed of many species (e.g., the Holarctic and African clade or the SE and E Asian clade). In general, the composition of the clades reflects geographic contiguousness. The basal relationships among clades remain unresolved with this marker sequence. It is remarkable that each clade contains black as well as white/grey coloured representatives. None of the latter are found in N America, whereas almost all African species south of the Sahara show black-white pattern. The most parsimonious explanation for the distribution of plumage colour in the phylogenetic tree is that the pale markings evolved at least five times independently. The assumption that the white/grey colour pattern - which is found also in other genera of the family Corvidae, e.g., *Pica* - is the plesiomorphic state, is less likely.



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Estrildinae finches (Aves, Passeriformes) from Africa, South Asia and Australia: a molecular phylogeographic study

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Estrildid finches are distributed throughout Africa, South Asia, Australia and Indian and Pacific Ocean islands. Specific phylogenetic questions have been clarified in this study by analyses of 64 species of estrildids through cytochrome b DNA sequencing and Bayesian Inference. Our results support that estrildids are a monophyletic group with polytomies that may have started evolving by Middle Miocene Epoch (about 16.5 million years ago). This date is coincidental with the Fringillinae finches' radiation starting time and also with the largest Himalayan and Tibetan Plateau uplift. The most basal estrildid clade comprises African, Indian and Australian birds, suggesting that the whole estrildids radiation might have originated around India. It is shown that: 1) Gouldian finch (*Chloebia / Erythrura gouldiae*) is definitively included within genus *Erythrura*, 2) the oldest Estrildinae evolutive radiation group seems to be the African silverbill (*Lonchura cantans*), together with Indian silverbill (*Lonchura malabarica*), and the phenetically distinct diamond firetail (*Stagonopleura guttata*) from Australia, 3) the Java sparrow (*Padda / Lonchura oryzivora*) is a *Lonchura* species, 4) African munias (*Spermestes*) form a distinct phylogenetic cluster (within genus *Lonchura*) with respect to Asian and Australian munias. Ref: Estrildinae finches from Africa, South Asia and Australia: a molecular phylogeographic study. Open Ornithology Journal 2:29-36 (2008).



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New data on the interrelations between western (*Phylloscopus trochiloides viridanus*) and eastern (*Ph. tr. plumbeitarsus*) greenish warbler in the south of Siberia

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The relations between the western and eastern greenish warblers in a zone of their sympatry in Altai-Sayan region for a long time was an example of a ring species (Mayr, 1944). The assumption of such possibility has been put forward by Ticehurst in 1938. He did not manage to find out in accessible World collections any hybrids specimens between *viridanus* and *plumbeitarsus*. In 1990-2009 we have investigated some areas of the overlap zone of the two forms in the south of Siberia. *P. plumbeitarsus* breeds in deciduous and mixed coniferous forests, while *viridanus* leaves in mixed taiga forests up to subalpine zones. In some habitats in Transbaikalia, East Sayan and Middle Yenisei two forms breed in the same habitats, territories of some pairs border with each other. About 10% of greenish warblers from our sample (n = 65) had morphological characters intermediate between *viridanus* and *plumbeitarsus*. Some intermediate specimens we have recovered also in the museum collections. The songs of *viridanus* and *plumbeitarsus* show great variability but sonographic analysis reveals that singing of some individuals from the zone of sympatry has intermediate characters according to the form of elements and the frequency range. Playback experiments show clear response of many *viridanus* and *plumbeitarsus* to the non-conspecific song. Thus our data are not suggest the widely accepted view on the greenish warbler complex as a ring species (Irwin, 2001, 2008). It is not excluded, that in the zone of sympatry in Altai-Sayan region and north-western Mongolia a substantial hybridization of the two taxa takes place.



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Genetic diversity of the Azores bullfinch *Pyrrhula murina*

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The Azores bullfinch *Pyrrhula murina* is one of the most threatened passerine species and is critically endangered. It is confined to a small area in the largest island of the Azores archipelago, in the North Atlantic Ocean. After sampling thoroughly the small population, we estimated genetic variability using several mitochondrial and nuclear markers. We found low nucleotide diversity, which is consistent with the historical bottleneck that was observed in the last century. Divergence time from continental populations is shown to validate previous findings. The use of a set of microsatellites markers shows that despite recent increases in the population abundance, genetic diversity is still very low.



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Phylogeography of *Sittasomus griseicapillus* (Aves: Furnariidae)

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We obtained the genetic structure of olivaceous woodcreeper (*Sittasomus griseicapillus*) to understand the phylogenetic relationships among the populations from Mexico and Central America (Mesoamerica area). We sequenced mtDNA, specifically ND2 gene for 100 individuals in 35 populations approximately. *S. griseicapillus* complex is distributed in major part in montane forests (principally the cloud forests "patches") and tropical lowland forests that ranges from Mexico to South America. The complex presents some geographic variation in pattern color, size and vocalization from north to south gradually. According to this some studies divided in at least 5 major groups and 15 subspecies. In Mexico are reported three subspecies (*jaliscensis*, *sylvioides* and *gracileus*) all of those is included in the major group of *griseus*. We constructed maximum Parsimony, maximum likelihood and Bayesian inference trees and we performed nested clades analysis. A preliminary result indicated that only haplotypes from the North Sierra Madre Oriental in Mexico have minimum differences, all of the rest of populations from Mexico and Central America (*sylvioides*) are genetically similar.



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Detecting patterns and intensity of sexual selection in lekking manakins (Pipridae) with population genetics

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Members of the manakin family have evolved lek mating systems with highly diverse characteristics. These include size, density, and a diverse repertoire of sound and visual displays employed by advertising males to attract females. Understanding the evolution of these lek systems requires a knowledge of their mechanics and the underlying intensity of sexual selection. However, measuring sexual selection using observational or genetic parentage analyses is challenging. Here, we take a novel population genetics approach to estimating the degree of sexual selection in manakin populations to help elucidate the underlying mechanics and evolution of their enigmatic mating systems. Population genetics theory predicts that an increase in the variance of reproductive success between males and females of birds are expected to have differential impacts on the level of genetic diversity in Z (sex) chromosomes versus autosomes. This is the result of an unequal distribution of Z chromosomes between the sexes (a majority residing in ZZ males) versus a more uniform distribution of autosomes. We tested this hypothesis by estimating Z and autosomal relative levels of genetic diversity in a 10 species sample that includes both species of manakins and putative monogamous species from closely related families. To obtain estimates of genetic diversity we sequenced 10 Z linked and 10 autosomal loci. This study is relevant for elucidating the evolution and mechanics of manakin lek, and also has implications for understanding the effect of sexual selection on genomes.



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Noninvasive tissue sampling for genetic analysis in *Mergus octosetaceus*: a critically endangered bird species from Brazil

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Genetic analysis is an important tool for conservation studies. Noninvasive sampling for DNA analysis is often appropriated for protected, vulnerable or endangered species. The Brazilian Merganser, *Mergus octosetaceus*, is a critically endangered bird species. In Brazil, there are confirmed registers of its occurrence on São Francisco, Tocantins, Paraná and Rio Doce rivers, being Serra da Canastra population, in Minas Gerais state, the most significant. There are isolated registers for Paraguai and Argentina. It is estimated that there are less than 250 free individuals and little is known about its biology and ecology. Here we demonstrate the usefulness of noninvasive sampling to investigate both the investment of the male and female in nest building and the sex of the nestlings. Feathers and two eggshells were collected from one nest. DNA extraction was performed with Chelex and DNAzol methods. CHD-Z and CHD-W introns were amplified through polymerase chain reaction (PCR) using P2 and P8 primers. The amplified fragments were separated in a 12% acrylamide gel stained with silver nitrate. All feathers samples presented two bands on the acrylamide gel, suggesting that the female is the main responsible for covering the nest with its own feathers. The PCR products from eggshell samples showed male and female pattern respectively. These results indicate that noninvasive sampling is useful for behavioral studies and for molecular sexing of rare and sensitive endangered birds.



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Molecular and bioacoustic differentiation among European coal tit (*Periparus ater*) populations

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Knowing that Scandinavian and Southern European populations of the coal tit (*Periparus ater*) belong to separate mitochondrial lineages we aim to reconstruct a phylogeography for European and Mediterranean populations of this species. An approximately 600 bp long fragment of the non-coding control region was chosen as genetic marker. Particular interest lies on island populations like the morphologically distinct subspecies *cypristes* from Cyprus and *sardus* from Corsica and Sardinia. A second main target is to localize the postulated zone of secondary contact between populations from the North Palearctic nominate *ater* group and the S and C European *abietum* group. The degree of gene flow among continental and island populations, haplotype distributions and evidence of potential Pleistocene refuges and post-Pleistocene population expansion are inferred from the sequence data set. In a flanking bioacoustic analysis territorial songs from all study populations are compared. Playback experiments with island dialect song types are carried out in C European populations in order to test a postulated pre-mating barrier of songs. The project is funded by Staatliches Ministerium für Wissenschaft und Kunst Sachsen, Germany.



Genetic structure in the *Pteroglossus azara* (Ramphastidae) species complex across the Japurá river in northwestern Amazonia

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Understanding population structure within the vast Amazon basin is essential to define areas of endemism (AOEs), identify divergent intraspecific units for conservation, and to study the evolutionary processes affecting diversity in the region. In Amazonia, patterns of population structure of avian taxa are particularly interesting across major geological barriers, such as rivers. In this study, we investigate the population genetics structure of the *Pteroglossus azara* (Ramphastidae) species complex across the Japurá river, one of the major tributaries of the upper Amazon. The taxa of this group are distributed in western Amazonia, both north (*P. a. azara*) and south (*P. a. flavirostris* and *P. a. mariae*) of the Japurá river, with the two latter taxa separated by the upper Amazon. We analyzed DNA sequences of 18 individuals of all of the *Pteroglossus azara* (Ramphastidae) species complex distributed throughout western Amazonia and assess population structure using an Analysis of Molecular Variance (AMOVA). Contrary to one of the currently recognized species limits in the complex, we found that there was significant geographic structure across the Japurá river (between *P. a. azara* and the remaining taxa), but not across the upper Amazon (between *P. a. flavirostris* and *P. a. mariae*). We found no significant correlation between genetic and geographic distances among the different individuals sequenced ($P = 0.083$). Thus, geographic distance alone cannot explain the genetic differentiation in this group. Thus, genetic data characterize the taxa found on either bank of the Japurá river as diverging and independent evolutionary units, whereas the taxa found on either side of the upper Amazon are not.



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Demographic history and phylogeography of *Chiroxiphia caudata* (Pipridae: Aves)

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The swallow-tailed manakin (*Chiroxiphia caudata*) is a lek breeding endemic bird from the Atlantic forest. *C. caudata* lives in understory in the forests and is sensitive to forest fragmentation. In this study we analyzed the genetic structure and demographic history of this manakin. We sequenced 1019 bp of the mitochondrial ND2 gene from 37 specimens collected in the Brazilian states of Paraná, São Paulo, Rio de Janeiro, Espírito Santo and Minas Gerais. We observed 16 haplotypes and nucleotide diversity of 0.00483 (sd. 0.00053). The phylogenetic reconstruction (in MEGA 4) by neighbor-joining using the Kimura 2 parameter model indicated no population genetic structure. Neutrality tests (in DnaSPv5) revealed recent demographic expansion. The lack of genetic structure observed in this species was observed in other taxa that occur in the Atlantic forest. This pattern may be explained by a bottleneck followed by a more recent demographic expansion. These observations may be related to the climatic changes that occurred in the Atlantic forest during the Pleistocene. Funds: FAPESP, CNPq, and CAPES.



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Diverse patterns of bird speciation in the Japanese archipelago suggested by DNA barcodes

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DNA barcoding has a strong track record for identifying species in varied taxonomic groups. Leading study of COI barcodes for 260 species of North American birds clearly shows that average COI sequences differences between closely related species were far greater than differences within species. 96% of all species present within 2% intra-specific genetic differences means that general boundaries between intra-inter species can be drawn by 2% sequence divergence. Of course, there are exceptions such as deep divergence within a species or little genetic differences between related species. The former cases have the possibility of discovering new cryptic species and the latter will give good opportunity to study for avian rapid speciation. Here we provide a comprehensive DNA barcode analysis for approximately 500 bird species, the breeding, pelagic and migrant species in and around Japan. It is suggested that species identification of Japanese birds through DNA barcode were mostly effective. In this presentation, we focus on the “exceptional” cases of genetic boundaries between intra and inter species which shed the light on the investigating the evolution of Japanese birds. Examples of closely related species with less than 2% divergence are as follows: four species of *Turdus pallidus* superspecies (brown thrush *T. chrysolaus*, Izu Island thrush *T. celanops*, pale thrush *T. pallidus*, and eye-browed thrush *T. obscurus*), and Middendorff's grasshopper warbler *Locustella ochotensis* and Taczanowski's grasshopper warbler *L. pleskei*. Examples of species with larger than 2% intra-specific genetic variations are as follows: arctic warbler *Phylloscopus borealis* and Eurasian jay *Garrulus glandarius*.



**Acoustic and genetical differentiation in a wide zone of hybridization
between Siberian and east-European chiffchaffs
(*Phylloscopus [collybita] tristis*, *Ph. c. abietinus*)**

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Wide zones of sympatry between closely related species attract the attention of researchers because of expected hybridization. One of these examples is the zone of sympatry between Siberian (*Phylloscopus [collybita] tristis*) and east-European (*Ph. c. abietinus*) chiffchaffs. The hybridization between these two forms was proved on Southern Ural (genetic introgression level reaches 34.7%) (Marova *et al.* 2009). The goal of present study is to test the hypothesis of presence of hybridization in the most north-western area of the sympatry zone in Archangelsk region (Belomor-Kuloy Plato). Our study is also devoted to the comparison characteristics of the two populations. Two chiffchaff forms have slight morphological differences but their songs are clearly different. Presence of mixed songs in the population is a sign of possible hybridization; however it does not prove it. To confirm the hybridization we estimate morphological (a presence of yellow hue in the coloration, tail index), acoustic (discriminant analysis of songs) and genetic (variability of the cytochrome b gene) features. This analysis confirms the presence of hybridization in Archangelsk region, as numerous individuals show a mixture of features of the two sub-species. In the Southern Ural region it was possible to draw an approximate boundary between the distribution of the two forms - Zilmerdak ridge. To the east of it the number of Siberian chiffchaff increases and hybridization takes place. In Arkhangelsk region the abundance and spatial distribution of individuals with pure features makes it impossible to draw a clear boundary. Our data support that the zone of hybridization between Siberian and east-European chiffchaffs extends for over 1500.



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Genetics of Brazilian populations of cattle egret, *Bubulcus ibis*

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Cattle egret is a species that nowadays inhabits the American continent, whilst its original range is in central Africa. American populations have been showing a pattern of constant population growth and range expansion. This study aims to determine the distribution of genetic diversity of Brazilian populations to answer important questions related to its invasive history, as well as assist the comprehension of colonization of this country. The approach includes use of two types of molecular markers: mitochondrial DNA sequences and microsatellite *loci*, and 10 populations distributed from the possible entrance in the continent (Guianas/Suriname) until the extreme south of the west coast will be sampled. Intra and inter-population genetic diversity will be evaluated by sequences from three regions of mitochondrial DNA (domains I and III of control region and ND2 gene) and at least 8 microsatellite *loci*. We isolated 26 microsatellite *loci* for the species, and 15 pairs of primers were developed to verify polymorphism levels. As an initial analysis, a sequence of 508 bp of domain I was determined for 34 individuals from populations of three regions - Amazonas (N = 7), São Paulo (N = 11) and Rio Grande do Sul (N = 16), and 11 haplotypes were found. Haplotypic and nucleotidic diversity for the regions were of 0.90 ± 0.10 and 0.0083 ± 0.0053 for Amapá, 0.91 ± 0.06 and 0.0059 ± 0.0038 for São Paulo, and 0.86 ± 0.06 and 0.0061 ± 0.0037 for Rio Grande do Sul. Non significant differences between these values were detected by statistic tests. The haplotypic network did not show a strong evidence of population structure and the haplotype pointed as the possible ancestral occurred in Rio Grande do Sul.



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Genetic variability estimated by heterologous amplification of microsatellite loci in a Brazilian population of white-faced ibis (*Plegadis chihi*)

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Data on population genetics of waterbirds' species of the family Threskiornithidae are underrepresented in the literature. The white-faced ibis (*Plegadis chihi* Vieillot 1817) breeds in dense colonies in wetlands in southern Brazil. We estimated genetic variability using heterologous microsatellite markers in one breeding colony of this species located in Alvorada city, Rio Grande do Sul state (RS). Genomic DNA extracted from 82 nestlings' growing feathers was used to test 22 microsatellite *loci* developed for species that belong to Threskiornithidae family: scarlet ibis (4), roseate spoonbill (4), crested ibis (1), and for species that belong to other families within the order Ciconiiformes: wood stork (9) and great blue heron (2). Heterologous amplification was successful in 10 *loci*, and five of these proved to be polymorphic in the White-faced Ibis: three described for scarlet ibis, one for roseate spoonbill and one for crested ibis. None of the *loci* described for species from other families than Threskiornithidae show polymorphism. The number of alleles in white-faced ibis population ranged between four and 12, a level of diversity lower than that in the original species (3 to 17 alleles). Average observed heterozygosity (H_o) was 0.46 and average expected heterozygosity (H_e) was 0.59. According to phylogenetic relationships, the crested ibis is closer to the white-faced ibis than to the roseate spoonbill and the scarlet ibis. In agreement with this, our results showed that the probability to find polymorphism in the white-faced ibis using heterologous primers was greatest using primers described for the crested ibis.



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Characterization of the karyotype of *Heterospizias meridionalis* (Falconiformes, Accipitridae) by classical and molecular cytogenetics

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Comparative molecular cytogenetic analysis by fluorescence *in situ* hybridization (FISH) reveals major chromosomal changes that have reorganized genomes. We characterized the karyotype of the savanna hawk (*Heterospizias meridionalis*) by means of classical and molecular cytogenetics. Metaphase chromosomes obtained from fibroblast culture were analyzed by conventional staining, C-banding, and hybridization with whole chromosome probes derived from *Gallus gallus* (GGA) macrochromosomes 1-10, DNAr and telomeric probes. We found $2n = 66$. Heterochromatic blocks were found in the centromeric region of a few pairs. A pair of small chromosomes was almost completely C-positive. FISH experiments showed that GGA1, GGA2, GGA3, GGA4 and GGA5 hybridized onto two to five pairs in the karyotype of the savanna hawk each, revealing the occurrence of fissions. GGA6 to GGA10 hybridized onto whole arm of one pair each, confirming the maintenance of these syntenic groups and occurrence of fusion/translocation events. DNAr probes hybridized onto the short arm of pair 7, coinciding with the secondary constriction found in this region. Signals of telomeric probes were found not only on the terminal region of all chromosome arms, but also on intercalary regions of three distinct pairs, reinforcing the occurrence of fusion events. These results indicate fissions of large chromosomes and fusions of smaller segments and microchromosomes as the main events involved in the derivation of this karyotype starting from a putative ancestral karyotype similar to *Gallus*.



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Genetic differentiation between and within the greater (*Aquila clanga*) and the lesser spotted eagle (*A. pomarina*)

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The greater spotted eagle and the lesser spotted eagle are two threatened Eurasian raptor species. Genetic studies, using a number on autosomal, Z-linked and mitochondrial markers sequenced in historical and contemporary samples across the ranges, have revealed the history and future prospects of the two sister species. Although the two species are well differentiated, there exists an extensive gene flow between the species. However, this gene flow is reduced and asymmetrical in sex-linked genes, in both Z-chromosomal and mitochondrial DNA. There are unexpected differences in genetic diversity and population structure in the two species, most probably because of different glacial and postglacial history.



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Comparative bird phylogeography of the Tres Marías islands, Mexico

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Continental islands are useful models to investigate genetic differentiation and speciation events. For co-distributed taxa with continental and island populations, there could be different hypotheses accounting for their distributions. One is island vicariance, indicating a single splitting event caused population differentiation. The alternative is overwater dispersal, in which multiple splitting events would be observed. We tested these hypotheses using two bird species from Mexican Pacific Ocean islands and mitochondrial genes. The streaked-backed oriole (*Icterus pustulatus*) had a single mutation in Control Region between islands and continent. In contrast, the happy wren (*Thryothorus felix*) had four mutational steps in the ND2 gene. This could be product of either two independent splitting events or different mutation and sorting rates in different genes and taxa. We constructed a hierarchical approximate Bayesian computation analysis to distinguish between number of events and gene-taxa biases. The posterior distribution of hypervariables from assorted population models indicated bird data are more consistent with the multiple splitting events hypothesis. Our analyses suggest that islands in Mesoamerica have a complex biogeographic history. These results also suggest statistical phylogeographic methods could be used to disentangle even simple-looking speciation events.



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Demographic history of an endemic species, Elliot's laughing thrush (*Garrulax elliotii*) revealed the complexity evolution history of the Hengduan mountains

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Pleistocene climate fluctuations shaped the patterns of genetic diversity observed in extant species. In contrast to Europe and North America where the effects of glacial cycles on genetic diversity have been well studied, the genetic legacy of the Pleistocene for the Hengduan mountains area, a region of topographical complexity and presumably milder historical climate, remains poorly understood. Here we analyzed the demographic history of an endemic species to the Hengduan mountains, Elliot's laughing thrush (*Garrulax elliotii*) by four mitochondrial DNA fragments. Our result revealed that this species harbours two geographically incompletely-separated north and south lineages. Coalescent analyses support late Pleistocene divergence (0.227, 0.08-0.61). The demographic histories of two lineages consistently showed continuous population growth since the penultimate glacial period (about 170 000 years ago). The low altitude south parts were identified as the glacial refugia of south lineage, whereas the east regions were identified as refugia for north lineage. These results are at odds with the single semi-continuous refugium appeared in avian species of neighboring regions (the Tibetan plateau). The vegetation heterogeneity, topographic complexity combined with glacial-induced ecogeographic isolation may have generated distinct niches for different populations, thus promoted the divergence in these complex habitats. Intermittent gene flow between two refugia might have resulted in mixing of mitochondrial lineages with different origins and effectively scramble traces of genetic partitions formed during separated refugia.



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Phylogeny and variation within the complex *Hylocharis leucotis* (Aves: Trochilidae) using mitochondrial (ND2, ND4) and nuclear (AK1) fragments of DNA

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The white-eared hummingbird (*Hylocharis leucotis*) inhabits oaks-pine and pine-evergreen forests, at 1200-3500 m. In this species are recognized three subspecies: *H. l. borealis* (N Mexico, rarely to SW USA), *H. l. leucotis* (highlands of C & S Mexico to Guatemala) and *H. l. pygmaea* (highlands of El Salvador, Honduras and Nicaragua). The base of the geographical variation of these groups has been described by some authors taking the differences in morphological characteristics, color or size. A phylogeographic study with two mitochondrial genes (ND2, ND4) and a nuclear gene (AK1) are going to be conducted for this species with approximately 150 tissue samples from 60 different localities along its distributional range. The main goal of this project is to fundament the existence of more than one evolutive lineage in the species.



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SA11 Species and Populations Conservation



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Birds of State Park Mãe Bonifácia

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The city of Cuiaba has 3538.167 km², about 16 protected areas occur in this region. This study aimed to survey the avifauna State Park Mãe Bonifácia - PEMB, which has an area of 77.1609 hectares and is located in the northern region of Cuiabá. The birds were recorded by direct observation using binoculars 8x40 and 7x35, and by vocalization, from March to October 2009. The methods used for the surveys were the census-dots and census per scan. Five points were established to accommodate the different vegetation types found in PEMB, and consequently to obtain a more comprehensive sampling. The frequency of occurrence and the similarity index among the different areas were evaluated. We recorded 77 species of birds distributed in 34 families. According to the frequency index nine species of birds are residents (*Pitangus sulphuratus*, *Thraupis sayaca*, *Coereba flaveola*, *Thryothorus leucotis*, *Turdus rufiventris*, *Thamnophilus doliatus*, *Saltator coerulescens*, *Amazilia fimbriata*, *Furnarius rufus*), 38 residents likely representing 69.33 % of bird species recorded for the PEMB. The following species were found nesting in PEMB: *Pitangus sulphuratus*, *Coereba flaveola*, *Thryothorus leucotis*, *Turdus rufiventris*, *Furnarius rufus*, *Phacellodomus rufifrons*, *Phacellodomus ruber*, *Tachornis squamata*, *Campylorhynchus turdinus*, *Trogon curucui*, *Picummnus albosquamatus*, *Icterus jamacaii*. These data show the role of the Park as maintainer of birds in the urban area of Cuiaba. Financial support: LEAA/UFMT



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Nest site selection of endangered Saunders' gull in northeastern China

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Saunders's gull (*Larus saundersi*) is a Vulnerable species in the IUCN Red List. Its estimated world population is 7100-9600 birds. It breeds in salt marshes around the Bo Hai and Yellow Sea in northeastern China and South Korea. It passes the winter in southern China, Japan, South Korea, Taiwan, etc. About 2000 birds pass the winter in western Japan. We conducted a survey for nest site selection in the Liaoning Shuangtai-hekou National Nature Reserve in China in late June, 2005. It is the world's largest breeding site, and we recorded about 4700 adult birds in the colony. However, since around 1995, the almost entire coastline of the reserve has been lined with embankments, and the gull population was breeding around shrimp culture ponds. Their nests were mainly made from branches of *Suaeda* spp. on bare ground. The distance between nearest neighboring nests was 10.6 ± 15.2 m (mean \pm S.D.). Logistic regression analysis showed that vegetation height and distance to the waterside were important in determining nesting site, although correlations were low overall. The preferred breeding habitat appears to be where patches of *Suaeda* spp. occur in the salt marsh near the waterside or waterways. For conservation of Saunders' gull, ongoing financial compensation to the shrimp farmers and management of water level of the shrimp ponds are of primary importance in the short term, and more attentive management of the existing permanent reserve and man-made islands to facilitate gull breeding would be useful. In the long term, preservation of the natural salt marsh outside the embankment and also of the natural coastline is required.



First record of *Nyctibius leucopterus* in Southeastern Brazil, with notes on its distribution and conservation in the Atlantic Forest

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The white-winged potoo (*Nyctibius leucopterus*) is one of the most enigmatic and poorly known species of all Neotropical birds. Since its description, it remained unknown in life for almost two centuries, being rediscovered in the last decades. On 4 July 2009, during fieldwork at the Sooretama Biological Reserve, Espírito Santo State (19°03'S, 40°08'W), we searched for *Nyctibius leucopterus* performing playbacks of the song of the Amazonian population. Around 7:00pm, we heard and recorded its typical call notes emitted in response to our playbacks, a short call note *bweep* given in flight or perched. After our constant playbacks, the bird sang its distinctive voice, which consists of a long, descendent whistle *feeeeeeeooooooooo*. This record is the fourth locality for the species in the Atlantic forest, the first for Southeastern Brazil and a southwards range extension of ca. 320 km. To make out its vocal repertoire and habitat preferences is clearly the main way to record this elusive species, and the nutrient-poor, sandier soil observed in Sooretama appears to be an important factor for its occurrence in the Atlantic forest. If it is confirmed that the bird is able to occur throughout the Sooretama-Linhares complex (with ca. 50,000 ha), it will represent the most part of its distribution in area size, being roughly twice the size of all fragments where the species occur in Bahia. In addition, following the description of the Amazonian bird as a new taxon as suggested in the literature, the Atlantic Forest form will be restricted, according to the current knowledge, to fragments in Bahia and Espírito Santo, and thus critically endangered.



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Monitored release of Lear's macaw back to the wild (*Anodorhynchus leari*, Aves: Psittacidae) in Bahia, Brazil

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Releasing captive species is an important tool for populations and species management. This work aims to explore techniques and evaluate the rehabilitation process and release of two captive indigo macaws using radio-tracking techniques as tool for monitoring releasing success and obtaining technical background for future efforts regarding strategies for its management and conservation. These specimens were rescued from the field and then exposed to a pre-release training protocol. One macaw had the transmitter applied to the tail (*tail mount*) and the other to the neck (radio-collar). The reception system used was a unidirectional reception YAGI type antenna and a radio-receptor Rx-81 model. This monitored macaw presented a highly social behavior during the first days after release, flying with wild flocks and coming back to the enclosure afterwards. Flights were gradually becoming longer and to further distances. At the 10th day of post-release monitoring was registered at a 7 km distance from the enclosure area. The monitoring process was performed during 34 days, after this period the bird was monitored only by binoculars and telescope, confirming the releasing success. It is very important to realize the peculiarities of this species and limitations associated with the methods. Therefore, we consider the radio-telemetry a viable and economical option due to the excellent results that it can provide. Considering the conservation status of *A. leari* and the permanent threat of illegal capture for animal trade, it is important to test and evaluate actions that replace captive birds back to the wild.



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Description of the remote nests of the indigo macaw *Anodorhynchus leari* at the Canudos Biological Station, semi-arid of Bahia, Brazil

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The indigo macaw *Anodorhynchus leari* is known to roost and nest in natural cavities on cliff walls, mainly those formed during the deposition and erosion of the Mesozoic sandstone basin in Canudos, Bahia state, Brazil. We studied 10 nest cavities at the Canudos Biological Station, accessed through vertical descent (rappel), throughout the reproductive seasons of 2008-09, and collected spatial and climatic measurements. All cavities were found in heights over 30 m, and 50% had their openings facing west. The egg chamber (the section of the cavity where the nest is located) is connected to the cavity entrance by a single (50%) or bi-forked (20%) tunnel, or through a series of galleries (30%). The internal height, width, and total length varied, respectively, between 27-122 cm, 33-181 cm, and 570-1800 cm. The horizontal distance from the entrance to the egg chamber varied between 250-1380 cm, and the internal cavity space (volume) varied from 55.8-1998.2 cm³. In 40% of the cavities, the egg chamber was not situated at the end of the tunnel, and at their final stage of development, chicks could be found wandering throughout its length. Mean humidity at the egg chamber was 55.8%, and mean temperature at the nest was 29.20 C. In 80% of the nests the temperature was lower than outside the cavity, up to 3.220 C. This information will serve as reference for the efforts of reproduction in captivity and location of new nests of this critically endangered species.



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New records of Brazilian merganser (*Mergus octosetaceus*) at Serra Geral do Tocantins Ecological Station, Brazil

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Brazilian merganser is one of the most rare and threatened birds of Neotropical region, being considered as critically endangered. Actually in Brazil, it is found only at Minas Gerais, Goiás and Tocantins States. In the latter its occurrence was confirmed from 2002 at Novo River, along Jalapão State Park border area, where three reproductive pairs were identified. On 11-12 October 2009, an 60 km expedition traveled, by the first time, across the Novo River inside the Serra Geral Ecological Station, Tocantins State. Eight Brazilian merganser were recorded, three pairs and two solitary individuals. Together with the known Brazilian merganser pairs at Jalapão State Park area, the new records increased to six the number of pairs along the Novo River in the 115 km prospected interval. All together we can consider that only the three pairs inhabiting the Ecological Station area are effectively protect, since the Novo River interval is fully inserted on this protected area. Therefore, conservation efforts in order to fully protect Brazilian merganser population at Novo River are urgently needed and include changes in the Jalapão State Park limits in order to incorporate both margins of the river, immediately define tourism guidelines to rafting and camping activities at both margins of Novo River.



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Population active in reproduction and population assessment of Lear macaw (*Anodorhynchus leari*, Psittacidae) in Bahia, Brazil

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Lear's macaw (*Anodorhynchus leari*) is an endemic and threatened species which breeds in cavities found in sandstone cliffs in only two sites in Bahia State, Brazil. This study had the aims of estimate the number of breeding pairs at these two sites and the increment of the population during three breeding seasons. Observations of breeding pairs, fledging birds and bird counts were made with the aim of binocular and scopes from strategical points, avoiding double countings. In average, each pair raised on young/nest/year, which left the nests in meddle of April. During three breeding seasons 242 nests were studied (67 in 2004-5; 63 in 2005-6; 112 in 2008-9). The number of breeding pairs raised from 134 in 2004 to 22412288in 2009 and at least 288 new individuals were added to the population in these three breeding seasons, with average sighting of nestlings of 1 chicken per pair. We estimate the total population of Lear's macaw in a minimum of 1,000 birds, a significant increase of 150% since the counts started in 2003, when 400 individuals were found. Continuous monitoring and educational programs, and protection of the key areas are essential to the protection of this species.



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Radio-telemetries tracking of adult harpy eagle (*Harpia harpyja*) released in nature in Atlantic Rain Forest, in Bahia State

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Actually, the harpy eagle is almost restricted to the Amazon forest, with a few pairs in the Cerrado and Atlantic Rain Forest. Captured in 1997 by farmers, an adult female harpy eagle, was transferred by IBAMA to RPPN Estação Veracel in Porto Seguro, Bahia State, and remained for 13yrs in a 30m long enclosure. In the last two years, with the Atlantic Rain Forest Harpy Eagle Project, went through a rehabilitation process and visual isolation, realized by SOS Falconiformes and ABFPAR, with the Harpy Eagle Conservation Program - INPA, to be released in 2009. On August 18, the bird was released in the Veracel High Value Conservation Forest witch borders of the Pau Brasil National Park (11.580 ha area), carrying on its back two transmitters, a satellite PTT/GPS Microwave and a conventional VHF Biotrack to be tracked daily in the first 15 days, and weekly after this. Three days after release, the female fed for the first time, she was eating a sloth (*Bradypus variegatus*). At the 12th day, she crossed the National Park border, and a second fed was assumed by the 13th when she moved 370 meters in three days. During the daily VHF monitoring, the bird moved 10.5 km; on the feeding period, the average daily displacement was 230 m and on the others days it was 945 m. In the third week, the bird was 500 m from the point of 15th day, and tracked by satellite by 60th days at 3.7km from release. The bird is being tracked monthly by the INPE satellites, for the next three years. Funding: RPPN Estação Veracel; ICMBio/PARNA do Pau Brasil; CNPq grant; INPA.



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Captive breeding and release diminishes genetic diversity in the brown teal (*Anas chlorotis*), an endangered New Zealand duck

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Genetic diversity in the captive breeding and release programme for the endangered New Zealand brown teal or pateke (*Anas chlorotis*) was examined by comparing mitochondrial DNA (mtDNA) sequences and DNA microsatellite diversity in the 2 remaining wild populations on Great Barrier Is. and in Northland, the population of birds in captivity throughout New Zealand, and 4 new populations established by released captive offspring. DNA was isolated from feather samples. The larger (ca. 600) wild population on Great Barrier Is. had 2 mtDNA haplotypes, one very rare, which itself may indicate an historic bottleneck. The captive population was founded exclusively from Great Barrier Is.; it and all new populations contained only the common Great Barrier Is. haplotype. In contrast, the smaller (~300) wild population from Northland contained 11 mtDNA haplotypes including the common Great Barrier Is. haplotype, the latter possibly introduced by captive-sourced releases 18-20 years ago. Microsatellite allelic richness was greatest in wild populations and reduced in captive and new populations in direct relation to their number of founders. We conclude that captive and new populations lack genetic variation that is naturally found in wild populations and hence require immediate genetic enrichment directly or indirectly from the smaller wild population, and that long-term goals of the brown teal recovery programme in New Zealand could benefit from assiduous and persistent genetic management and monitoring.



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Conservation status of hawk-eagles in Minas Gerais State, Southeastern Brazil

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Hawk-eagles are represented in the Neotropics by three species, *Spizaetus melanoleucus*, *S. ornatus* e *S. tyrannus*, which face conservation issues along all its eastern range in Brazil. In Minas Gerais State red list all three species are considered endangered. According to bibliography and random surveys, the black-and-white hawk-eagle (*S. melanoleucus*) presented 12 historic and recent records in the State. Two were confirmed as breeding areas, Rio Doce State Park and RPPN Feliciano M Abdala. RDSP holds the most significant population of the species in the State, estimated in 8.4 pairs, not including *surplus birds*, throughout repeated point counts and records of pairs on 12 plots of known size. We recorded the ornate hawk-eagle (*S. ornatus*) at 13 localities and confirmed two as breeding areas. We estimated 6.7 pairs for RDSP and 2 for Araguari river basin, again not considering *surplus birds*. The black hawk-eagle (*S. tyrannus*) was seen 13 times, one breeding area confirmed. The BWHE had two nests located on tertiary branches at tall emergent trees (>35m) in contiguous forest tracts. The OHE had both nests located on secondary branches of two tall emergent trees (>25m) at fragmented areas. The BHE's nest was on top of a tree (15-20m), at a small forest patch of early secondary growth vegetation at a fragmented region. Search, monitoring, protection of breeding sites and logging control, are essential for hawk-eagles conservation in Minas Gerais. Hunting and persecution showed up as secondary threats, being environmental education also required.



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Nest-site selection by the slender-billed conure (*Enicognathus leptorhynchus*) in an agricultural matrix in Southern Chile

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Determining if a species uses habitat in a preferential way is the first step towards resolution of many ecological conflicts. Scattered trees are an important characteristic of agricultural landscapes globally. The slender-billed conure is a Chilean endemic psittacid that uses cavities for its reproduction in these landscapes. The aim of this study was to investigate the necessary requirements for nesting by this species in scattered trees in southern Chile at multiple spatial scales. The study design was based on variables measured for nest trees and their surroundings compared with control trees and surroundings using multiple logistic regressions. Akaike's Information Criterion was used for selecting the most parsimonious models explaining the presence of nests. Three different scales were used: 1) individual tree, 2) nest tree immediate surroundings (30 m radius) and, 3) nest tree surroundings (50 m radius). Variables selected for nesting across all scales were positively related to probability of finding suitable cavities. Although the number of cavities per tree was the best predictor, this variable by itself does not reflect suitability of any particular cavity for nesting, as many cavities did not have adequate dimensions. Variables related to tree health and degree of decay are associated with increasing probabilities of finding suitable nesting cavities and were positively related with the chance of a nest being occupied by the species. The results demonstrated that for an effective management, besides the characteristics of the nest trees, their surroundings must be considered. Our results are in accordance with the increasing evidence of the importance of maintaining scattered trees for the persistence of many species.



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Mitochondrial DNA sequence data help to elucidate the ancestry and genetic differentiation of South American savanna birds

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Certain patterns of species sharing between isolated regions can be interpreted as evidence for past geographic connections between these regions. Three recent Yale Peabody Museum surveys of Sipaliwini savanna, an Amazonian savanna enclave along the Suriname-Brazil border, have discovered that in Sipaliwini, forest birds are a subset of the Guiana Shield avifauna, while open-habitat species are shared predominantly with the Brazilian Cerrado. The observed pattern of species sharing between Sipaliwini and the Cerrado implies that there were once connections between South America current islands of savanna. Voucher tissue specimens collected by the YPM expeditions provide the unique opportunity to test this species-sharing hypothesis with genetics. We selected eight grassland target species based on their occurrence in representative savanna habitats throughout South America, including other Amazonian savanna enclaves, and the large savanna complexes of the Llanos and Cerrado: *Ammodramus humeralis*, *Chordeiles pusillus*, *Emberizoides herbicola*, *Neopelma pallescens*, *Sturnella magna*, *Tyrannus albogularis*, and *Polytmus guainumbi*. Using tissues from the Peabody's collection and from partner institutions, portions of control region and ND2 sequences were successfully amplified with customized primers and analyzed within a statistical framework. This will allow us to evaluate the intraspecific species relationships between Sipaliwini and other savannas, in addition to further illuminating the history of the South American landscape. The poster will report the results of our genetic study, which we expect to support the hypothesis that the Sipaliwini savanna was once connected to the Cerrado, likely via a coastal corridor.



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Shrinking towards extinction: potential habitat distribution and status of the endangered Pfrimer's parakeet

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Species' distribution models are powerful tools that have become widely used in many conservation applications ranging from predictions of new species' occurrence to possible impacts of climate change. These predictions can be refined when model results are combined with land cover maps generated from remote sensing data to produce estimates of the species current distribution. In this study, we modelled the distribution of the Cerrado endemic and IUCN threatened Pfrimer's parakeet (*Pyrrhura pfrimeri*) using MAXENT. The model predicted potential occurrence of Pfrimer's parakeet among three large regions in central Brazil. The most conservative threshold suggested a total distribution area of at least 40,300 km². We tested our model carrying out field surveys in each predicted area but found the Pfrimer's parakeet was associated with only one of the three regions previously predicted: the dry forests of the Parana River Basin. A subsequent spatiotemporal analysis of land cover changes for that region was carried out using satellite images taken between 1977 and 2008. Our results revealed a reduction of more than 66% of dry forest extent over 31 years. Moreover, the species is currently restricted to several fragmented areas totaling less than 5,000 km², which is about 12% of the area originally predicted for occurrence. Thus, measures for protection of the species' habitat within the range of the Parana River Basin are imperative to secure the species' immediate future.



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Survival estimates of two high-Andean *Polylepis* bird specialists (*L. yanacensis* and *O. fraseri*)

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Optimal habitats are usually characterized by greater survival rates than suboptimal ones. Therefore, the quality of large and small fragments in addition to affect abundance may as well affect survival probabilities. In the high-Andes, *Polylepis* forest remnants are mostly medium to small sized fragments, with varying degradation conditions and largely isolated from one another. Two *Polylepis* forest specialists' birds, *Oreomanes fraseri* and *Leptasthenura yanacensis* have shown to be strongly linked to the interior part of forests fragments, avoiding edges and therefore only using a percentage of the total area in small fragments. Moreover a strong fragment size effect with lower abundances in small fragments was found. We captured and recaptured both species for six years to evaluate survival and we predicted that since small fragments presented lower food (arthropod) abundance and a smaller amount of mature *Polylepis* trees, *O. fraseri*, the most specialized species would be prone to a greater fragment size effect on survival. Survival probabilities between consecutive mist netting sessions were estimated using standard statistical techniques for modeling capture-recapture data. Our data demonstrated that survival of *L. yanacensis* was variable from year to year and that these variances were more important to its survival than differences between small and large fragments. However, survival estimates for the most specialized species, *O. fraseri* showed that season and fragment size had an effect with lower survival in the dry season and in smaller fragments. Annual survival estimate for *L. yanacensis* was 0.40 and for *O. fraseri* was 0.43.



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Population expansion of the endangered scarlet ibis (*Eudocimus ruber*) in the southeast of Brazil

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The scarlet ibis *Eudocimus ruber* (Ciconiiformes) is an aquatic bird inhabiting coastal and mangrove areas. It presents a unique bright red coloration which is due to the presence of the pigment canthaxanthin in its major prey item, crustaceans. In Brazil, there are two populations with a disjointed distribution: one in the north-northeast region (between Amapá and Ceará states) and the other in the south-southeast region (between Rio de Janeiro and Santa Catarina states). The population size of this species has declined as a consequence of egg poaching and hunting and this bird became almost extinct in the southeast of Brazil during the second half of 20th century. Since then, very few scarlet ibis were recorded in Rio de Janeiro (1979 and 1985), at Baía de Antonina, in Paraná state in 1977 and in São Vicente, São Paulo state in 1961. In 1984, one breeding colony of 100 specimens of this species was discovered in mangroves of Cubatão-Santos (São Paulo State) and this population was estimated in 600 individuals during the 90'. In 1998, the birds abandoned this area after starting nest preparation and since then reproduction has no longer occurred there. In lagoons and mangrove habitats southeast of Cubatão-Santos only a few vagrant birds were observed until 2003, when 20 breeding pairs were observed in the northeast of Ilha Comprida. Since then, this area has been monitored by the project "Aves do Lagamar" and the population size has reached 2000 specimens in 2008 revealing that this species has become successfully established in this area and that the population is expanding. Currently, the scarlet ibis is listed as endangered on the official list of the endangered animals of São Paulo State. In order to guarantee the protection of this endangered species, we propose the establishment of a wildlife refuge in Ilha Comprida and also in the neighboring area of Iguape, where the scarlet ibis is frequently seen feeding.



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Use of secondary forests by understory birds in a fragmented landscape in Central Amazonia

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Some authors believe that the Amazon may be experiencing a massive process of species extinction due to forests destruction. However, the deforestation is accompanied by the expansion of secondary forests (capoeira) that establishes in abandoned areas. According to the forecasts, the trend is an increase in secondary forests cover, resulting in a mosaic of continuous forest and fragments separated by an array of capoeira. In this scenario, the prediction of a massive extinction could be overestimated if many forest species could survive in the second forests. To assess the importance of the capoeira for the understory birds we sampled a capoeira in regeneration for 20 years and an adjacent continuous forest of a fragmented landscape in the area of biological dynamics of forest fragments Project - BDFFP in Manaus, AM, Brazil. For sampling we conducted 24 mist next per day, six days a month for 8 months. A total of 61 species were captured in the continuous forest and 45 in the capoeira. The recaptures rates and apparent survival of the species suggest that some forest species, such as *Pithys albifrons*, *Gimnopathys rufigula*, *Willisornis poecilinotus*, *Dixiphia pipra* and *Thamnomanes caesius* inhabit the capoeiras. However, some forest species such as *Deconychura stictolaema*, *Hylexetastes Perotti*, *Cyphorhinus aradus*, *Sclerurus rufigula*, *Hylophilus ocraceiceps* and *Schiffornis turdina* do not seem to be adapted to the capoeiras environment and its occurrence are restricted to continuous forest environments. The secondary forest may attenuate the process of extinction. Nevertheless, the large number of species found only in continuous forest can suffer drastic reductions in their populations if the current state of deforestation in the region continues.



Density estimate and defended territory for the white-necked hawk (*Leucopternis lacernulatus*) at an Atlantic Rainforest fragment, east of Minas Gerais

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Studies over density and territorial behaviour in birds of prey are important to management proposals for reserves (Hulbert et al 1996). The endemic white-necked hawk (*Leucopternis lacernulatus*) is unknown regarding these aspects of its natural history. For such, 1-4 point counts (2.5 km radius; apart $X = 831 \pm 514$ m), considered located at a single plot, were used at 12 plots (apart $X = 5.3 \pm 2.2$) in the Parque Estadual do Rio Doce (360km²), Minas Gerais state. Ten hills and 23 emergent trees were used. The view angle varied from 120 to 360 ($X = 2600 \pm 64$). The spot mapping was accomplished between 07:30 and 12:00 and involved 126 visits from July 2006 to January 2009, totaling up 567 hours of observation and 67 records of the species between 07:45 and 08:00 (IC 95%). According to records ($N = 38$) of aerial displays (1.3 ± 0.9 loops per minute), and records of pairs ($N = 26$) or individuals during the breeding season (*fledgling* documented), routes used by the birds during flight ($X = 41 \pm 25$ minutes) were mapped using topography and vegetation cover maps (Hirsch 2003; IBGE 2003) of PERD. Five polygons of defended territory were created. Compass was used for measurements of distance estimate along with GPS coordinates of known points in the landscape and transects, and accrued through digital map software. According to the presence of displaying birds on the 12 plots (21400ha) and aggressive behavioral records ($N = 8$) of neighboring pairs (3-4 indiv.), ten territories were defended, totaling up an estimate of 10-18 pairs of the species, not including *surplus* birds. The mapped area of the polygons was calculated in 322-516 ha ($X = 394$ ha ± 66).



Abundance, elevational distribution and diet of the gray-winged cotinga (*Tijuca condita*) at Serra dos Órgãos National Park, Rio de Janeiro, Brazil

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The gray-winged cotinga, an endemic and vulnerable Atlantic Forest bird, can be considered as one of the least known Brazilian birds. To gather basic data about its biology and ecology, we have established a research program on it at Serra dos Órgãos National Park. Here we present data gathered during the first 10 months of study. Censuses were conducted at 56 sample points located at intervals of 100 m along montane trails from January to October 2009. At each sample point we played a pre-recorded voice of *T. condita* and counted the number of individuals subsequently detected by sight and auditory records. We estimated relative abundances by unlimited distance point-counts and expressed abundance by the index of point abundance (IPA). We recorded *T. condita* from 1560 m to 2105 m a.s.l., at patches of high-montane and cloud forest but it was more abundant between 1800 m and 1990 m a.s.l. In September and October we noted a decrease of IPA at the highest points (above 1900 m elevation) and an increase of this index at lower elevations (from 1700 m to 1890 m). In these months we got the lowest elevation records of *T. condita* at the study site (contacts at 1560 m, 1590 m and 1650 m). More records, obtained in different months, will be necessary to know if there is a regular vertical migration or if only some individuals wander to lower altitudes. We recorded *T. condita* feeding on 38 fruits of nine different morphospecies, on flower buds of Melastomataceae (n = 2), on a stick insect (Phasmidae) and on a caterpillar. Three foraging patterns were observed: stalling (n = 3), hanging (n = 1) and picking (n = 34).



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Preliminary data on the breeding biology of the black hawk-eagle (*Spizaetus tyrannus*) southeastern Brazil

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The black hawk-eagle (*Spizaetus tyrannus*), a medium sized eagle that inhabits the canopy from different types of Neotropical forests, including fragmented and secondary-growth forest areas. The species` nesting was studied in Guatemala. On 2nd august 2009 a nest of the BHE was found at a small forested patch in the Caranaíba municipality, Minas Gerais state. The region is characterized by fragmented areas of early and late secondary-growth with forested hills up to 800 m. It was located above the tree canopy of an Angico tree (Mimosoidae) with 15-20 meters in height and 140 cm of CAP. The nest of sticks was entangling within lianas and parasitic herbs, being sustained by one tree branch below. The prey deliver (N = 6) and visits (N = 8) by the male, behavior of adults at the nest, and nestling development, were weekly followed, totaling up 54 hrs of observation from a blind at an adjacent tree, less than 100 m from the nest. The all white nestling was first recorded on September 12th. On the October 10th the nestling was observed eating by himself in the nest. The fledgling left the nest on early November. Only the male brought prey to the nest from the incubation period until the young fledged. The female was observed feeding and protecting the nestling from the sunlight. After the sixth week, for the first time, the female was most seen out of the nest in trees close by the nest. Both female and young presented interespecific reactions, including loud calls, towards vulture and raptor species gliding near and above the nest. Identified prey included a bare-tailed woolly opossum (*Caluromys philander*) and a rodent.



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The home range and habitat use of dunlin (*Calidris alpina*) in wintering and pre-migration periods in Chongming Dongtan, Shanghai, China

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Dunlin (*Calidris alpina*) is one of the best studied calidrid sandpipers in the world and is also one of the most abundant shorebirds in the Northern Hemisphere, including the East Asian-Australasian Flyway (hereafter EAAF). However, relatively little research has been done on this species along the EAAF. In the winter of 2006-2007, we employed 45 radio transmitters to study the home range and habitat use of dunlin in Chongming Dongtan during the mid-winter (early December to mid January), late-winter (late January to mid March) and spring period (late March to early May). Preliminary analysis indicated no significant difference in the home ranges (95% MCP) between tracking periods and age-groups. The mean home ranges calculated in this study were 10-20 times smaller than that in western Oregon, which focused on another dunlin subspecies. The intertidal mudflat was used extensively by dunlin throughout the study periods while the aquacultural ponds were used mostly in the mid-winter but not later periods. There seemed to be some movements of dunlin out of the study area in all the three different periods. Our results suggested that the natural intertidal mudflat in Chongming Dongtan is an important wintering and refueling habitat for dunlin while aquacultural pond is less important in comparison.



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Study of arboreal species used as feeding sources by birds in the city of São Paulo

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Great amount of fruits and seeds of arboreal species is used as feeding sources for the fauna, especially birds. The culture of these species makes possible the preservation of wild fauna in town, by offering food, rest and places to nidificate. The objective of this work is to present a list of native arboreal species of the City of São Paulo with potential to attracting wild fauna, with approach in birds, based in remarks of field made by the technicians of the Biology Sector of the Division of Fauna of the City Hall in São Paulo, and information of literature, aiming to subsidize plantation in green areas of the city. The bibliographical review was made consulting scientific documents and books. The field observations had been carried through in municipal parks and green areas of the City of São Paulo between 1993 and 2009, at morning (from 6:00 to 10:00 a.m.), with the aid of binoculars 8x40. Random comments had been enclosed also. Flowery branches of the plants had been sent for identification for the Municipal Herbarium. The choice of the arboreal species of the list was based on observation of the consumption of resources as leaves, nectar, fruits and seeds, as well as in the morphologic characteristics of the fruits and seeds. One hundred and fourteen arboreal species had been enrolled and in the table are reported the botanical family, scientific name, popular name, animal species that feeding on the plants according to literature, consumed part of the plant, and data on the direct comment, as animal species and studied area. Many attractive species for birds are for other animals, which play the role as seed dispersers.



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Distribution and winter ecology of cerulean warbler in the Andes: new insights

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Recent population declines have prompted the International Union for the Conservation of Nature to list cerulean warbler (*Dendroica cerulea*: Parulidae) as a Vulnerable species. In response, members of El Grupo Ceruleo, a subcommittee of the Cerulean Warbler Technical Group that addresses wintering ground issues faced by the species, developed a predictive model of wintering habitat for cerulean warblers throughout the northern and central Andes. From 2006-2010, we conducted systematic avian surveys at 135 1-km² pixels distributed in Venezuela, Colombia, Ecuador and Peru based on a stratified-random design as part of efforts to validate this winter habitat model. In this presentation, we overview recent analyses about the suitability of the habitat model to predict wintering range as well as share new insights into the distribution and wintering ecology of cerulean warblers. First, across the entire surveyed area, cerulean warblers were detected in 24 pixels (17.8% naïve presence). The species was recorded in both western and eastern slopes of the Andes as well as in isolated geographic ranges. Second, wintering ceruleans occupied a broader altitudinal range and utilized a wider variety of habitat types than expected, including different successional stages and agroforestry systems, but it was absent from habitats without a tree component. Third, the species showed a strong association with mixed species flocks mostly composed of resident species, including birds of conservation concern. Areas with high levels of presence of the species were detected throughout its wintering range. Collectively, these findings have important implications for conservation efforts of the cerulean warbler and resident species of conservation concern in the Andes.



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Effects of forest management on woodpeckers abundance in Bialowieza Forest, Poland

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Many woodpecker species are known as responsive on dead wood removal. In 1999-2001 and 2007-2009 woodpeckers and dead wood abundance were studied in coniferous stands of the Bialowieza Forest (NE Poland). Transects (3.9-6 km long) were appointed in three zones: 1) primeval, unmanaged stands, 2) partially managed, 3) standard managed. Both, woodpecker indices as well as dead wood abundance were the greatest in primeval zone, while the lowest in standard managed zone. However the greatest number of woodpecker species (6) was in partially managed zone. On average the density of all species in 2007-2009 increased on all transects, compare to 1999-2001, mainly due to increase in number of the most common species (*Dendrocopos major*). However density of other species decreased in later period only within managed zone due to decreasing of dead wood resources and rejuvenated of the tree stands. In partially managed zone abundance of dead wood increased from the earlier to the later period due to outbreak of the spruce bark beetle *Ips typographus*, and suspension of dead spruces *Picea abies* removal by forester service. It is a good example of the positive effect of intense management suspension on woodpecker community.



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Search for the critically endangered Stresemann's bristlefront (*Merulaxis stresemanni*) (Passeriformes: Rhinocryptidae) in the eastern Brazil

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The Stresemann's bristlefront (*Merulaxis stresemanni*) is a critically endangered rhinocryptid endemic to the Atlantic Forest of Minas Gerais and Bahia, Brazil. After 50 years of its description it was discovered in 1995 near Una, Bahia, but since then no records there have been done. The species was found (2004) in a forest tract between Bandeira / Macarani counties (Minas Gerais/Bahia states), in a roughly 3,000 ha pristine forest tract suffering from fires, hunting, selective logging and slash-and-burn agriculture. Part of the area has been purchased to try to protect the only known population of *M. stresemanni*. Samplings begun on the Jequintonhonha and Pardo rivers watersheds since July 2009, to study its natural history and to estimate its abundance and detailed range. Until now two other individuals (female) have been found in the Macarani/Bandeira area, adding to five the number of known live individuals in the area. We already discovered that females can be distinguished also by their voices. If Stresemann's bristlefront proves to be widespread in the region there is hope that it can be still preserved. However, if it proves to be restricted to the Bandeira/Macarani area, Ornithology will be facing one of its major conservation challenges.



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Habitat selection by spruce grouse in a fragmented habitat: influences of habitat deterioration and isolation

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Influences of habitat loss and fragmentation on avian distribution and fitness fall in two main categories: habitat deterioration and isolation. Both of these categories have been documented by empirical studies of forest birds. Determining whether habitat deterioration or isolation is the main process is key to effective conservation, because solutions to stop or reverse these processes differ greatly. Spruce grouse (*Falci pennis canadensis*) is common throughout Canadian boreal forests, but scarce at the southern limit of its range, where conifer habitat is often patchy. To answer concerns about the long term viability of the species in southern Québec, Canada, we conducted a radio-telemetry study as well as call-response surveys to determine whether this species distribution is mostly influenced by habitat quality or isolation. Call-response surveys indicate that spruce grouse male abundance is greater in large patches of spruce-dominated stands, especially adjacent to bogs. Preliminary analyses suggest that reproductive output is mostly determined by local, as opposed to landscape, factors, such as proximity to forest edges induced by forestry. Thus, spruce grouse distribution in our study area appears to result both from habitat degradation and isolation. Our poster will present results from a field experiment to be conducted in autumn 2009 and winter 2010, in which radio-tagged individuals will be translocated ca. 20 km and released into unoccupied contiguous and isolated patches of forest to further investigate the relative roles of habitat degradation and isolation.



Birds of the Redbog (NE Poland) - the case of chances and threats of biodiversity

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Redbog (Czerwone Bagno) is the oldest nature reserve in Poland. Nowadays as a part of Biebrza NP it's a strict protected zone. Study area (37 km²) included old marshy pine forest, surrounded by marshy birch forests, bushes and mostly abandoned, overgrowing sedge meadows. The main processes effecting on bird populations are: drop of water level, rapid tree and bush succession in open marshes, maturation of birch woods and disintegration some oldest parts of pine forests. In years 2007-2009 we studied number and distribution of rare birds on whole area and composition of bird communities on 4 study plots (with use of cartographic method). We observed 133 bird species (87 breeding). The most valuable (> 1% national population) are: spotted eagle (1-2 pairs), eagle owl (3 p.) and white-backed woodpecker (12-14 p.). There is also small population of aquatic warbler (25 males) - the globally endangered species. Bird communities characterize by general low densities (< 40 pairs/10 ha) and specific species composition, for example low density of thrushes *Turdus* spp. Habitat changes influenced on birds species in different ways. In comparison with accessible data from the second half of 20-th century, we revealed increase of white-backed woodpecker and common crane, whereas golden eagle, hen harrier and bluethroat ceased breed. Should we interfere in this situation? How to help the most endangered species? We propose some activities to improve habitat conditions for species related to open marshes.



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Genetic variation in a population of *Dendrocincla turdina* (Dendrocolaptidae, Aves) from Caraguatatuba, SP, Brazil

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The remaining Atlantic Forest is highly fragmented, representing 7.5% of the native formation. It holds 75.6% of endemic and vulnerable birds from Brazil, being an international biodiversity hotspot. It is well known that *Dendrocincla turdina* (Dendrocolaptidae) has reduced ability to survive in fragmented and depleted areas. It has been considered critically endangered in the Rio Grande do Sul State and already extinct in Viçosa (Minas Gerais State) due to its ecological specialization. Considering the Atlantic Forest's critical situation, studies on genetic variability could be helpful to conservation proposes of this bird species. Our aim was to isolate specific microsatellite loci, once there was no one in the literature, in order to analyze the plain-winged woodcreeper population genetic variation from Caraguatatuba, an Atlantic forest area in the São Paulo State. We identified microsatellite loci from an enriched partial genomic library and, therefore, we characterized 27 individuals from the Caraguatatuba population using ten polymorphic loci. For all ten loci, there was no evidence of Hardy-Weinberg deviations or linkage disequilibrium. The range number of alleles was 2 to 16 and the average expected heterozygosity was 0.34 ± 0.25 , which are similar to other birds. There was no evidence of inbreeding ($F_{is} = 0.01$, $p = 0.38$). An extensive analysis using these microsatellites in different *D. turdina* populations could identify the whole genetic diversity and putative population structuring among them, producing reliable data for conservation and management programs that can contribute to maintain the genetic variability of birds in the Atlantic forest. Financial support: CNPq



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Case analysis of the birds retentions registered by the Associação Mata Ciliar, Jundiaí, SP

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With the advance of the human beings populations in areas previously covered for vegetation, the native birds had to adapt themselves to these changes, in this way, the occurrence of accidents with these animals are increasing to each year. Because of this anthropic action, the apprehensions of birds and the illegal trade have also increased considerably. The objective of this study was to analyze the main causes of retention based in data of entrance and exit of animals from the Associação Mata Ciliar. The analysis of these data would be made through the reading of forms of retention and destination in the period of July of 2008 to June of 2009. With these data, a detailed analysis of the main causes of retention of birds by AMC could be made, the analysis of the destination of these animals, knowing the number of releases, of death and still the animals that remain in the AMC because of the impossibility to be reintroduced. As results were registered 748 birds retentions in the study period, of 95 different species, and from these 472 was coming from apprehensions, the most frequent cause of retention. About all the cases, 433 resulted in the animal release and 219 in death. The majority of the cases were registered at Jundiaí city, and the Polícia Militar Ambiental was responsible for a great number of apprehensions. Through the obtained data, it is possible to realize that the wild animal traffic was the main retention cause, but also is important to highlight the accidents occurred near Associação Mata Ciliar.



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Where do the birds seized from the illegal trade come from? An approach with molecular markers

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The illegal wildlife trade is one of the greatest threats for Brazilian wildlife, especially birds. Many individuals are taken from wild populations and transported for sale in local fairs far from their origins. Here we propose a contribution from the academy to the establishment of Wildlife Forensics capabilities in Brazil. Working with 4 bird species exploited by the illegal trade - *Paroaria dominicana*, *Sporophila frontalis*, *Cyanoloxia brissonii* and *Saltator similis* - we are developing primers to amplify anonymous polymorphic nuclear *loci*, performing population differentiation analyses, constructing a reference blood bank for most of the distributions of these species, and carrying out assignment tests to infer the origins of the trafficked birds. We developed genomic libraries for each species, resulting in 56 pairs of primers which were amplified in gradient PCRs and are undergoing tests of polymorphism. At this point we have tested two sets of primers in the four species and they were polymorphic. This approach will help us to add critical information for reintroduction efforts, pinpoint most exploited regions, and work with different Police divisions to develop regional educational and enforcement plans. We will have the tools for the assignment tests ready for use for these species in upcoming police raids. In the meantime, we are collecting blood samples of as many individuals as we can, from the natural populations and from the seized individuals, working with the environmental authorities and the Civil Police. The next challenge will be to work with the Justice system so this kind of scientific evidence can be accepted during the legal process. Funds FAPESP and CAPES.



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Seroprevalence of *Mycoplasma synoviae*, *Salmonella pullorum* and hemoparasites in an Alagoas curassow (*Pauxi mitu*) population in Brazil

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The family Cracidae, the curassows, guans, and chachalacas, is found exclusively in the Americas. Of the 50 currently accepted species of cracids, 22 occur in Brazil and seven taxa are considered threatened. The Alagoas curassow (*Pauxi mitu*) is considered extinct in the wild, with only ~ 120 individuals surviving in captivity. Conservation of this species depends on captive breeding with future restoration of population in nature. However, the release of animals in nature after being in captivity for a while implies the risk of disease transmission. The reintroduced animal may act as the vector for the introduction of a pathogen in an area previously free of this agent. Among the diseases that can affect wild galliforms there are the mycoplasmosis, salmonellosis and hemoparasitosis. The objective of this study was to evaluate the presence of antibodies against *Mycoplasma synoviae*, *Salmonella pullorum* and hemoparasites. In two breeding farms in southeastern Brazil, blood samples were collected from the brachial vein of 121 curassows (*P. mitu*), all known population of this species. The serum was evaluated by agglutination tests with commercial antigens (Biovet[®]) related to each of the agents listed. Similar parts of antigen and serum were added; the solution was mixed and after two minutes the presence or not of clots, was verified, indicating the antigen-antibody formation. Serum positive and negative controls were tested simultaneously. For the hemoparasite investigation, blood smears were performed and analyzed in the microscope. The birds were negative in all exams. Even though results were negative, more studies with potentially pathogenic agents for cracids should be performed, since little information about health in the curassow can be found in the literature. Those studies will contribute to future programs of *ex situ* conservation and reintroduction of these threatened species.



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Can microphones and recorders help expand coverage of the Breeding Bird Survey?

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The Breeding Bird Survey (BBS) is the most important survey for monitoring the status of breeding landbirds in the USA and Canada, but coverage in Canada is currently limited largely to the south. Suitable road networks exist in many areas to expand coverage farther north, but there are insufficient skilled birders in most of these areas to run routes. We evaluated the feasibility of using microphones and digital recorders to record species on BBS routes for later identification by experts, by recording and analysing 20 stops on each of 4 routes in Ontario and Quebec. On all 4 routes, more species per stop were identified on the recordings than were reported by the field observers. Overall, more species were detected on recordings and overlooked in the field (8) than the converse (3); furthermore, the 3 species not detected on the recordings are species that regularly vocalize. This suggests that comparable information could be obtained through analysing recordings than with field observers. However, individual skilled birders listening to recordings differed considerably in the number and selection of species detected; intensive analysis methods with multiple observers and computer spectrograms are needed to obtain relatively complete species lists. In a separate experiment, we found that different recording equipment also affected numbers of species detected, though much less than observer effects. We conclude that recording equipment could potentially be used to expand coverage, but further developments are required to identify efficient analysis methods, and careful calibration will be required to prevent bias due to changes in equipment over time.



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Specific prey selection of Japanese golden eagle *Aquila chrysaetos japonica* inhabiting deciduous broadleaf forest

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Golden eagles typically inhabit open habitat. However, a subspecies of the golden eagle, Japanese golden eagle, is found in deciduous broadleaf forest. Seasonal changes in canopy structure derived from leaf-phenology of deciduous broad-leaved forest may exert a large influence on the prey selection of the Japanese golden eagle, which might in turn affect the breeding success of this subspecies. In this study, to evaluate the effects of leaf-phenology on reproduction of Japanese golden eagle, we first predicted potential distributions of both eagle foraging and preferred habitat of prey before and after leafing, respectively. Then we investigated the effects of the switching of prey animals caused by leafing on growth of nestlings. Before leafing, a potentially usable habitat of eagle was identified within the home range of a target pair, as well as that of hare. As the results, a usable habitat distribution of eagle considerably overlapped with a preferable habitat distribution of hare. On the other hands, after leafing a potentially usable habitats of eagle were remarkably decreased and did not entirely overlap with those of hare within the eagle's home range, which intimates that eagle cannot capture hare after leafing and need to switch to alternative prey animals. A video-camera analysis showed that before leafing, the parent eagles fed hare to nestlings more frequently, but after leafing, a main feeding prey delivered by the parent eagles was switched from hare to snake. The total amount of feeding of each pair was rapidly decreased after switching of prey animals and thereby total body length of chick with prey switching was smaller than that of chick without prey. These results suggested that prey selection of Japanese golden eagle was strongly affected by leaf-phenology of deciduous broad-leaved forest and prey switching which may restrain the growth of nestling occurred before and after leafing.



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***Eucalyptus* plantation and bird conservation**

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Today, planted forests exceed 70 million ha in the tropics, 50% of which comprise *Eucalyptus*. Understanding how the species behave in this situation is a need to the biological conservation. This work investigated the avifauna at Barra do Moeda farm, Fibria Company (51°47'W, 20°59'S), in the state of Mato Grosso do Sul (Brazil), where there are eucalyptus plantations for pulp production in areas of savanna. The avifauna was sampled with point counts, 40 in the plantation and 40 in fragments of forest savanna in three phases between August 2008 and March 2009, 10 min/point/campaign. The species were characterized in forest-dependence categories. A total of 120 species were recorded (Index of Abundance Point, IAP = 11.7) in the cerradão. These numbers are significantly greater than in the plantations, where 61 (IAP = 4.5) species were registered. The Sorensen Index was 68%. In the fragments it was recorded 45 dependent (IAP = 4.8), 47 semi-dependent (IAP = 5.4) and 28 independent (IAP = 1.4) forest species. However, in the plantation it was recorded 17 dependents (IAP = 1.2), 27 semi-dependents (IAP = 2.7) and 17 independents (IAP = 0.6) forest species. Regression models showed that understory density influenced positively on the total richness and abundance and on the dependent forest richness and abundance. The distance between the plantation point counts and the fragments did not affect the avifauna. Specialist species like bark-foraging insectivores and large frugivores were absent in the plantations. However, hummingbirds and tyrant-flycatchers can occupy this habitat for foraging. *Eucalyptus* plantations can maintain some bird diversity and the presence of understory can improve the permeability of this matrix.



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Multiple effects of oiling on birds: current knowledge and future research directions

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During oil spills thousands of seabirds suffering from hypothermia, cachexia and from the toxicological effects of petroleum arrive in care centres. Only few of them are finally released in the wild, and the causes of rehabilitation failures remain poorly understood. In this presentation, we overviewed the current knowledge concerning the consequences of oil-covering on seabirds. The toxicological effects are numerous, and can be different depending on oil types and bird species. However, most studies report a haemolytic anaemia followed by lesions of haemosiderosis. Immunodepression might occur widely and explain the importance of nosocomial infections from aspergillosis to wound infections. Stress of oil-covering, handling and captivity may worsen the immunodepression and the loss of appetite. Gaining mass is indeed a difficult challenge for these birds, as the adverse effects of starvation to those of toxicity and stress are added. Recent studies demonstrated that post-release survival rates after a cleaning can be good and that the released birds may survive to reproduce. Consequently, research efforts should be done to improve care, which means to understand the interactions of toxicity, starvation and stress at different levels. The final goal is to increase the percentage of birds released in the natural environment to contribute to the preservation of populations.



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Mortality of hyacinth macaws *Anodorhynchus hyacinthinus* (Aves, Psittacidae) nestlings in Miranda Pantanal, Mato Grosso do Sul, Brazil

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Population growth is influenced by intrinsic and extrinsic factors that act on survival rates. This study examined mortality of hyacinth macaw nestlings in Miranda Pantanal, Mato Grosso do Sul, over 10 years (1997 - 2007). A total of 489 nests were monitored, 64% (n = 316) had 1.5 nestlings per pair. Half of the nests (n = 158) had nestlings with partial or total mortality and this represented a nestlings mortality rate of 37% (n = 183), and the lost hatchling size average was 1.2 ± 0.4 . Death was the principal cause of nestlings loss (62%, n = 114, t = 3.5, df = 9, p = 0.006) and usually occurred in hatchlings. Predation was the second loss factor of chicks and was due to insects, birds and mammals. The causes of chick death include starvation, low temperature, disease or ectoparasites, flooded nests, broken branch or fallen tree. We observed ants (*Solenopsis* sp.) and birds (*Ramphastos toco*, *Micrastur semitorquatus* and *Pulsatrix perspicillata*) preying on hatchlings and we suspect that *Bubo virginianus* and *Eira barbara* are also predators. Asynchronous hatching, food availability, ecological relationships and environmental climate changes are discussed to establish future management and conservation of *A. hyacinthinus*.



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Breeding biology of the endangered Blakiston's fish owl (*Ketupa blakistoni*) in Japan

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Although until the 1950s Blakiston's fish owl was formerly widespread throughout Hokkaido, the northern-most main island of Japan, it now occurs only in very restricted areas and has a population estimated at no more than 35 breeding pairs. The primary cause of population decline in Japan is thought to be the loss of suitable habitat and a reduction in the availability of their prey (fish). Since 1986, the government has organized Blakiston's fish owl conservation programs and has supplied fish to the owls by means of artificially stocked ponds in some habitats. I have been carrying out a long-term study of the life history of Blakiston's fish owl since 1987, based on continuous observation of marked individuals of a single family. This revealed their reproductive ecology to assist with recovery of this endangered species. Breeding attempts were observed in all the years between 1987 and 2007, but some of the clutches did not hatch in ten out of twenty-one years. Clutch size was two (10 of 19 years) or one (9 of 19 years). Incubation was performed entirely by females for 33-38 days before hatching. During the nestling period, parents brought 50.3 kg of food to raise one offspring from hatching to fledging. The majority of the prey mass (94%) was from the stocked fishery. Fifteen of sixteen nestlings, hatched from 1989 to 2007 fledged successfully at 48-60 days of old. Extremely high breeding attempt rates (100%) and high fledging success (94%) must be supported with their stable and plentiful food supply by artificially feeding.



Bird extinctions at Tucuruí dam, eastern Amazon, Brazil

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The construction of large reservoirs for hydropower generation is one of the most dramatic anthropogenic impacts on the biodiversity. The UHE Tucuruí, on the Tocantins River in the state of Pará, is the largest Amazon dam and flooded an area of 2875 km² after its completion in 1984. We used quantitative censuses from 2005 to 2007 and a list of previously collected specimens to assess changes in bird community. We recorded 481 bird species. Eighty species with confirmed occurrence by specimens collected before 1984 were not recorded. At least 71 of these were resident and can be considered locally extinct. Analysis of ecology of these species indicate that 90% are restrict to forest habitats (28 in *terra firme* forest, 13 in alluvial forest, 24 in both types of forest), 73% have some dependence level of riverine habitats, 30% are restrict to riverine habitats, three are rheophilic (*Nyctprogne leucopyga*, *Atticora fasciata* and *Atticora melanoleuca*), and 70% are insectivorous. This first assessment of bird community change at Tucuruí is a conservative estimate, because we analyzed only presence/absence data, but it highlights the need to intensify study of the mechanisms and consequences of biological diversity change in the hydroelectric impoundment areas, the necessity of quantitative samples before the construction and long term monitoring to a consistent analysis of the temporal changes in the pattern of extinction. From the total of 13 species in the Brazilian List of Threatened Fauna with occurrence confirmed, only two were not recorded by our studies: *Crax fasciolata pinima* and *Phlegopsis nigromaculata paraensis*. Therefore, Tucuruí is an important area for management and conservation of these vulnerable species.



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Nests, vocalizations, and habitat use of the endangered Cochabamba mountain-finch (*Compsospiza garleppi*)

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The Cochabamba mountain-finch (*Compsospiza garleppi*) is an endangered resident of the semihumid shrublands in the high Andes of Bolivia, with a range restricted to a few high valleys above 3200 m.s.n.m. We examined the breeding behaviour, feeding ecology, habitat requirements, and vocalizations of the Cochabamba mountain-finch from November 2006 to April 2007. We observed 10 nests of eight pairs, with nests found in a variety of small woody shrubs as well as bunchgrass and a ground bromeliad. Our observations suggest that the Cochabamba mountain-finch is not a *Polylepis* specialist as previously thought, and uses a variety of native shrubs often associated with *Polylepis* woodlands for foraging and nesting. Pairs inhabited modified habitats where native vegetation and woodland edge persisted, but were not observed in closed canopy woodlands. Cochabamba mountain-finch frequently foraged on the edges of potato fields and, at least occasionally, consumed parts of unearthed tubers. We recorded two previously unknown song types and three types of calls. We recommend that habitat restoration projects should focus on maintaining a diversity of native shrubs rather than only *Polylepis* trees.



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Survey and breeding notes on the yellow-headed parrot (*Amazona oratrix*) population on the Tres Marias Island Archipelago, Nayarit, Mexico

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The yellow-headed parrot is recognized by the Mexican Government as a threatened species and the 2009 IUCN Red List category as an endangered species. Very little is known about the biology and conservation status of this isolated population. The Cornell Lab of Ornithology, the Institute of Ecology-UNAM and the National Institute of Ecology-SEMARNAT conducted a series of surveys in 2007/2008 in the Tres Marias Island Archipelago to assess the status and document the natural history of the yellow-headed parrot on three of the four islands. The parrot continues to occur in very low numbers on Maria Madre (60 birds), Maria Cleofas (10 birds) and San Juanito (4 birds) islands. Even though the species has been protected since 1994 under Mexican Federal law its habitat, the Tres Marias Islands Archipelago, has been protected recently in 2000 as a Biosphere Reserve by the Mexican government and although no wild psittacine can be traded in the entire country since 2008, the illegal live harvesting of wild adult and young birds continues as well as habitat loss and degradation. Development of our understanding of the breeding biology and demography of this species in the Tres Marias Island Archipelago is necessary, as is the need to conduct a census every other year. From results obtained, the conservation status of the yellow-headed parrot population in the Tres Marias Island Archipelago, currently listed as Endangered should be upgraded to Critically Endangered and further conservation strategies are needed to protect this population in rapid decline.



Campos do Jordão 2010 25th International Ornithological Congress 22-28 August 2010 (www.i-o-c.org)

Flagship Amami jay and the utility of its ecological study for unique island biodiversity conservation

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The endemic Amami jay (*Garrulus lidthi*) was recovered from the endangered to a common status in 2008, by the Ministry of the Environment, Japan, mainly because of forest habitat recovery and successful alien predator (*Herpestes javanicus*) control. Amami Islands with many endangered and endemic species locate at the northeastern corner of the Oriental region. The authors are studying this species as a model and indicator species of the forest ecosystem. An ever green oak tree, *Castanopsis sieboldii*, is keystone species, and its acorn production and masting ecology is one of the most important factors regulating the ecosystem dynamics, as much as the typhoons, human activities, and alien predators. Breeding success of the jay is dependent on the acorn production of the previous autumn. They caches acorns of both *C. sieboldii* and *Quercus glauca* in rich crop years, or depend even on farm land or farmers' stocks on poor years. The jay is a communal breeder, and it was suggested with nest box observation that their conflict among individuals in the flock also depend on the acorn production sequence, in relation to the previous breeding performances. At a secondary forest without good nest sites, say the shortage of predator defensive cavities, the breeding success became low after the two year famine in 2005 and 2006, then egg looses were observed after rich years in 2007 and 2008. The jay is an indicator and / or a flagship species at that unique island ecosystem, and also for the conservation of the whole forest and marine ecosystems. It will discuss this in the framework of D. Simberloff (1998) on keystone, flagship and umbrella species with the idea of ecosystem management, referring a decade experience.



Campos do Jordão 2010 25th International Ornithological Congress 22-28 August 2010 (www.i-o-c.org)

Ecology and conservation of the Arabian bustard *Ardeotis arabs* in Yemen

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The Arabian bustard *Ardeotis arabs* inhabits arid environments across the Sahelo-Sudanese belt from Senegambia to Eritrea, with a range extension on the Tehama plain on the south-western side of the Arabian Peninsula. Both its ecology and the status of its populations have received little attention to date. Despite scattered reports suggesting important decreases due to hunting and habitat loss all over the range, this species is not listed as vulnerable on the IUCN red list. Historically, the species was found all along the Red Sea coast from Jeddah in Saudi Arabia to Aden in Yemen, but has by now probably already been extirpated from Saudi Arabia. Our surveys conducted in Yemen from 2005 to 2009 suggest that population as well as the size of the current distribution range are only a fraction of historical figures. Our focal population, composed of about 30 individuals, mainly inhabits fields of sorghum and pearled millet, traditionally cultivated and highly dependent on summer monsoon rainfalls. We also report low breeding success in our study area, and heavy poaching, illegal trading, change in agricultural practices and habitat loss throughout the region. Data from two males and five females tagged with GPS satellite transmitters and followed for up to 3 years reveal a sedentary habit with small annual home range. Being geographically and probably genetically isolated from the African populations, the Tehama Arabian Bustard is clearly at a high risk of imminent extinction. We discuss urgent conservation measures and research priorities.



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Search coverage for ivory-billed woodpecker (*Campephilus principalis*) in the southeastern U.S.A. during 2004-2009

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The ivory-billed woodpecker is a critically endangered species originally found in the southeastern United States and Cuba. Sightings and video documentation of one ivory-billed woodpecker in 2004 and 2005 in eastern Arkansas, although not universally accepted, sparked the formation of a U.S. Fish and Wildlife Recovery Team for this species. Unconfirmed reports of ivory-billed woodpeckers and existence of potential habitat outside Arkansas motivated searches throughout the historical U.S. range of the species. We report on the search methods and areas searched during 2004-09 in ten states and present an analysis of the efficacy of the search coverage. It is improbable a population of ivory-billed woodpeckers exists in eastern Arkansas, and we have not found conclusive evidence for the presence of the species elsewhere. Nevertheless, we have identified areas with suitable habitat where search coverage cannot rule out presence of small numbers of individuals. Risk of shooting has declined since the early 20th century, and habitat conditions have improved in several areas in recent decades. Declaring the ivory-billed woodpecker extinct is still premature.



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Impacts of global warming on the health of house sparrow population (*Passer domesticus*) in urban environments

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Climate change is a global threat to human health and ecosystems. The increase in temperature between 1.4 and 5.8 °C in the next 100 years may influence the conservation of biodiversity, the incidence of diseases vectors and changes in the life cycle of many animals and plants. The increase of disease such as avian malaria is a reality in this future scenario and it may affect the dynamics of bird populations. We used populations of house sparrow (*Passer domesticus*) as objects of study to estimate the possible impacts that global warming may have on the health of the species, comparing parasitological data and health of birds in a tropical environment (Brazil) and a temperate environment (Portugal). The specific objectives of this research were: investigate and quantify the presence of vectors of hemoparasites in temperate and tropical environments; determine the prevalence of hemoparasite sparrows in both environments; analyze the clinical state of these birds through analysis of hematological parameters and correlate the presence of hemoparasites with the health birds. Two areas were selected for this study: the metropolitan region of Belo Horizonte, Minas Gerais, Brazil, and the city of Coimbra, Portugal. The birds were captured with mist-nets, 12 m x 2.5 m with 35 mm of mesh. Diagnosis of avian malaria and blood parameters were achieved through use of molecular (PCR) and microscopic blood smear. Light traps were used to capture insects and identify the local vectors. Preliminary results show a significantly greater incidence in *Plasmodium* sp., in the Brazilian sparrows than in the Portuguese sparrows associated with a 3°C difference in mean summer temperature. We intend to use this study as a multidisciplinary tool to support future management actions for the conservation of tropical and temperate birds species.



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Monitoring *Calidris canutus rufa* in southern Brazil, data from 2006 to 2009

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The oceanic beaches of southern Brazil are known as important refuge to different species of birds, resident and migratory, because of food availability and safety. Among migratory species that frequent the beaches of the state of the Rio Grande do Sul is the *Calidris canutus rufa*, a long-distance migrant that migrates from the Canadian Arctic to Tierra del Fuego. According to the literature this species has suffered a decline of 40% of its population in the years 2000 and 2001 caused by the overfishing of the horseshoe crab, *Limulus polyphemus*. To monitor the passage of species from southern Brazil, we counted birds between October 2006 and July 2009, along 176 km, between the Tramandaí and Mostardas beaches. In total 2659 individuals of *C. c. rufa* were registered. Of these 92 were banded. Peak crossing the coast of Rio Grande do Sul were recorded in August and October when the birds migrate to Tierra del Fuego, and April when they return to Arctic. 28 ringed birds were recorded in Río Grande, Tierra del Fuego, Argentina, 18 in Delaware Bay, USA, 14 in New Jersey, USA, 11 in Bahía Lomas, Tierra del Fuego, Chile, ten in others localities in USA, eight in others localities in Argentina, two in San Antonio Oeste, Argentina and one in Mingan Archipelago, Quebec, Canada. Most individuals reported in August 2008 were young birds, born in the same year in the Arctic, fact also recorded later in Argentina, in San Antonio Oeste. This record was considered extremely important for the recovery of the species because a long time young birds had not been successful in arriving in Patagonia Argentina.



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Post-mining vegetation provides feeding habitat for threatened black-cockatoos within six years

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The time required for restored habitat to provide feeding resources is an important issue in the jarrah forest of south-western Australia, where several mining operations clear and then restore habitat for three nationally-threatened black-cockatoos: Carnaby's black-cockatoos *Calyptorhynchus latirostris* (CBC), Baudin's black-cockatoos *C. baudinii* (BBC), and the forest red-tailed black-cockatoos *C. banksii naso* (FRTBC). We are examining the restoration of black-cockatoo feeding habitat at a gold mine using behavioural observations, and sampling of vegetation and feeding residues within mining areas rehabilitated between 1998-2002 (i.e. 6dash10 years old), with the aim of identifying protocols that restore important foods quickly. So far, we have found that cockatoo-feeding in rehabilitated areas varies by species, and according to successional stage, species composition and structure of revegetation. From November 2007-September 2009, we observed CBC and BBC feeding in 15 of the 24 rehabilitation areas ($n = 34$ sightings). FRTBC were only observed feeding in revegetation with uncleared forest areas immediately adjacent, suggesting that some factor such as perceived predation risk may limit their use of rehabilitation areas. However, all three species fed in rehabilitation areas of all ages. CBC feed on proteaceous shrubs (*Banksia* and *Hakea* spp.), while BBC and FRTBC feed on a eucalypt (marri; *Corymbia calophylla*). In the winter 2009 sampling, we observed CBC feeding residues in 53 of 90 (58.9%) 10m \times 10m plots, BBC in 27 plots (30%), and FRTBC in 6 plots (6.7%). These findings indicate that some feeding habitat can be restored within six years of establishment. Further study will characterise predictor variables for feeding activity within rehabilitation areas to guide rehabilitation prescriptions.



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Artificial egg incubation as a management strategy of wild birds

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A reduction in egg exposition is a management strategy to reduce high nest predation rates of nests and increase their success. We evaluated the efficiency of several management methods to increase nesting success of *Elaenia chiriquensis* (Tyrannidae) through a reduction in egg exposure to predation. We conducted the study in a reserve in cerrado (savanna-like habitat) in central Brazil. We searched, manipulated and monitored *E. chiriquensis* nests with daily and every three-day monitoring schedules. Natural eggs were incubated in the laboratory while artificial eggs were placed in their nests. Artificial eggs were placed in the nests after predation to avoid abandonment. Nestlings were returned to their original or foster nest after hatching. *Elaenia chiriquensis* accepted artificial eggs and continued normal nesting behaviors. As expected, egg success was greater for artificially incubated eggs. Daily nest monitoring proved to be more efficient to keep nests active after predation, allowing nestlings to be returned to their nests of origin. Nest abandonment by the female was less with daily monitoring and replacement of predated eggs. Every effort should be made to avoid egg or nestling loss due to manipulation, including high temperatures during transport, breakage during transport and egg marking. Recently born nestlings require careful thermoregulation, feeding and handling. This management technique proved to be efficient to increase eggs success if made with extreme care and has a potential to be used to help increase the nesting success of endangered species.



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Distribution and habitat of an endangered Atlantic Forest endemic, the Kaempfer tody-tyrant (*Hemitriccus kaempferi*) (Tyrannidae)

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Kaempfer's tody-tyrant (*Hemitriccus kaempferi*) was described and then remained unknown in nature for 33 years, until it was rediscovered at the type locality of Salto Piraí (municipality of Joinville). There have been only nine occurrence records of the species. The present study involves an ongoing effort to search for the species in the states of Paraná (PR) and Santa Catarina (SC) in seven forest formations and altitudes between 0 - 300 m. with playback use. The species was recorded in 42 of 168 visited locations, with the northernmost being the municipality of Guaratuba (PR) and the southernmost in the municipality of Tijucas (SC). We have not confirmed previous records north of Guaratuba. The species was most common in flooded and alluvial lowland forests, in altitudes between 0 - 50 m. The current records do not agree with its classification as a "critically endangered" species, but its area of occupancy suggests its placement into "endangered" category. The main threats to the species are habitat conversion in rice fields, pastures and banana plantations, human occupation, sand extraction, and others, all of which are isolating *H. kaempferi* populations due forest fragmentation. The only protected areas where the species occurs are two unimplemented parks (Parque Municipal Natural da Lagoa do Parado and Parque Estadual do Boguaçu) and a private reserve (Reserva Bicudinho-do-brejo) at Guaratuba and the RPPN Volta Velha in Itapoá, SC, which should be considered as key areas for its conservation.



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Behavioral responses of captive-born greater rheas reintroduced into the wild in central Argentina

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To evaluate the efficiency of translocation of captive-born greater rheas, 13 adults were released into two wild populations of central Argentina. One population was at a semi-natural grassland (average density: 4.08 ± 0.36 rheas/km²) where 3 males and 2 females were released. The other was in an agroecosystem (average density: 0.34 ± 0.04 rheas/km²) where 4 females and 4 males were released. The animals were tagged with radio transmitters and a hard-release protocol was followed. We monitored the rheas for at least 16 days post-release, registering their behavior, home range and survival. Only one rhea was injured during transportation and died shortly after release. Home range (95% Minimum Convex Polygon) did not differ between environments (grassland: 7 ± 2.2 km² and agroecosystem: 8 ± 1.3 km²). Individuals moved less during the first monitored week (3 km²) than during the last (5 km²). In the grasslands, 80% of translocated rheas joined wild groups 10 to 20 days after release, while in the agroecosystem only 38% of individuals joined. In the latter, we observed that females incorporated into wild groups more rapidly than males, perhaps because of the aggressive behavior exhibited by males. The released rheas showed attraction to humans. In the agroecosystem two individuals were predated by *Felis concolor*, and in the grassland one died due to gizzard impaction. Rheas showed no difference in spatial behaviour across environments, although those released in the agroecosystem seem to be less prone to integrate wildlife groups and to be more susceptible to predation. These results indicate that translocation of rheas raised in captivity can be an effective management strategy for conservation. However, antipredator training against both natural predators and human may be necessary under some circumstances, to ensure survival of released rheas over time.



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Genetic diversity and population structure of the endangered yellow cardinal *Gubernatrix cristata* and implications for its conservation

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Gubernatrix cristata is a typical species of “Campos” grasslands and its biology is practically unknown. The main objective of Yellow Cardinal Project is to determine the status of *Gubernatrix cristata* populations throughout their range in relation to population structure, gene flow and strategies for their conservation. Microsatellites are repetitive DNA sequences present in the genome of eukaryotes. The characteristics displayed by these loci allow its use in a wide variety of studies such as the genetic variability of individuals among species and populations, the genetic structure of populations and in phylogenetics, phylogeographical and conservation studies. We carried out field trips to Brazil (RS State), Uruguay and Argentina. Tissue samples (blood and feathers) were collected from all specimens. We create a microsatellite enriched library from the extracted DNA. We found 10 microsatellite loci with 59 valid alleles. The expected heterozygosity (HE) and observed (HO) ranged respectively from 0.126 to 0.893 and from 0.130 to 0.930, with averages of 0.6824 and 0.1144 + 0.7132 + 0.0272. Such high values of heterozygosity observed may indicate that the species suffered no bottleneck, although this should be viewed with caution, both by the low sample size depending on the rarity of the species in the wild as the low quality of many of these DNA samples as a function of the material collected. For the mitochondrial DNA we used ND2 and ATPase 8 genes. We found 5 haplotypes that seem to have no population structure. In terms of ex situ conservation the data support the conclusion that we can create a captive breeding program with a high likelihood of success, since it does not have low genetic diversity as shown by the observed heterozygosity.



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Breeding aspects of *Ramphastos toco* (Aves: Ramphastidae) in Pantanal wetlands, Midwest of Brazil

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Although common, widespread and very conspicuous, relatively little data exists on toco toucan (*Ramphastos toco*) reproductive biology. This study reports data on breeding seasonality, egg characteristics, incubation and nestling development. All nests were found in the sub-region of Miranda, Mato Grosso do Sul, Brazil. Twenty one active nests were monitored at 1-5 days intervals during the 2008 breeding season. Eggs were dull white and with a large number of visible pores; the length and width averaged 3.11 ± 0.12 cm and 4.21 ± 0.19 cm (mean \pm SE) ($n = 64$), respectively. The average fresh egg weight was 21.65 ± 1.75 g ($n = 25$), and during incubation the average weight loss was 0.1221 g/day ($n = 4$). At hatching, the egg shell weighed 2.6 g ($n = 1$). Clutch size ranged from one to four eggs, with an average of 3.5 ± 0.7 eggs ($n = 26$), and were laid on consecutive days ($n = 7$). Incubation started with the first egg and lasted 17.26 ± 0.49 days ($n = 23$); the nestling period lasted 42.22 ± 1.01 days ($n = 27$). Multiple attempts of breeding were observed when reproduction failed the first time. Breeding season started in the beginning of October until mid February, matching with the breeding season of most Passeriformes in Brazil and with the wet season in Pantanal.



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Geographical isolation, genetic structure and conservation of Japanese rock ptarmigan

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Japanese rock ptarmigan *Lagopus mutus japonicus* is the southernmost sub-species of rock ptarmigan. Its habitat is the alpine zone of central Honshu, Japan. The ptarmigan is relic population after the ice age and isolated on the mountain tops. Thirty years ago, the total population size was estimated to be about 3,000 birds. Population size has been recently declining, and an estimated 1,700 birds exist. The ptarmigan population is separated into 5 groups by mountains (Mt. Hiuchi, North Alps, Mt. Norikura, Mt. Ontake and South Alps). A total of 240 blood samples were collected from each mountain group and their mtDNA were analyzed. Based on the haplotype analysis, it was clear that the ptarmigan populations is divided into two main groups (North Alps and its surrounding mountains population, and South Alps population) and isolation among mountain groups continues since the last ice age (about 20,000 years ago). Comparative study of the ptarmigans among different populations by individual marking were done on four study areas respectively located in the North Alps, Mt. Norikura, Mt. Hiuchi and South Alps. It was suggested that some ecological differences in population barometers and morphological differences are arising in populations of the Japanese rock ptarmigan. The ptarmigan is confronting some troubles; decreased numbers in some mountains and fragmentation; invasion in their alpine zone range by Sika Deer and Japanese Macaques; a recent increase in predators, and global warming.



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Minimum viable population of Mato Grosso antbird in the Pantanal of Poconé, Mato Grosso, Brazil

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Minimum viable population (MVP) estimates the minimum number of individuals that a population needs to persist in a period of time. The population size is determinant to persistence of a variety of animal species, as the small populations are more susceptible to random environmental pressures than large populations. Mato Grosso antbird is the only bird endemic species in the region of the Pantanal, considered globally important, vulnerable and high-priority to conservation on a regional scale. The aim of this study was to determine the minimum viable population size of Mato Grosso antbird. The simulations were performed using the program VORTEX (version 9.95), which is a computer program to simulate population models generated based on the individual. The populations were modeled by the initial sizes 1250, 625, 312, 156, 100 and 50 individuals, when we considered the presence of one and two disaster. These scenarios were created to determine the minimum population size necessary to maintain a viable population in the presence of fire and drought. With the presence of a disaster, the MVP was 100 individuals. Considering two disasters, the MVP increased to 150 individuals. The parameter "reproducing females" was the factor with the greatest ability to influence the persistence of the population, and the parameter "rate of mortality" the second most important. These two parameters used as disasters have shown influence on the population. Still variations found in MVP size, 156 individuals were considered the best value to be used in decision making for conservation of this species.



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Population status of birds in the Murici Ecological Station, Alagoas, Brazil

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The Atlantic forests in Pernambuco, northeastern Brazil, are considered one of the most critical areas for bird conservation in the world. The "Bananeiras" forest fragment, at Murici Ecological Station, is an extremely important site in this region, being the type-locality for four restricted-range species (*Philydor novaesi*, *Myrmotherula snowi*, *Terenura sicki* and *Phylloscartes ceciliae*) and with another 30 species of the official Brazilian Red List. In this study we conducted a survey in this forest remnant, in April and December 2007, using point-count method and understory mist-nets. We have already recorded a total of 127 species, including those detected in gaps between sample units, with 28 endangered taxa belonging to the Brazilian or the IUCN Red list. We detected 88 species on the 40 point-counts sampled and captured 29 species (138 individuals) throughout 1200 net-hours. The most common species were *Chiroxiphia pareola* (Frequency Index = 0.75), *Herpsilochmus rufimarginatus* (FI = 0.62), *Ramphocaenus melanurus* (FI = 0.45). The most captured species were *Pyriglena leuconota* (n = 22), *Conopophaga melanops nigrifrons* (n = 21), *Xiphorhynchus fuscus atlanticus*, *Myrmeciza ruficauda* and *C. pareola* (n = 10, each). *T. sicki* and *P. ceciliae* were detected just once on point-counts, and *M. snowi* and *P. novaesi* were rarely sighted during gaps in sampling. Our preliminary results indicate that some taxa included in red lists are locally abundant, however point out to the low abundance of others and their fragile conservation status. Such information is important for conservation measures, as a more accurate assessment on species updating of threat category.



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DNA-based sex identification of magellanic penguins (*Spheniscus magellanicus*) stranded on the coast of Rio Grande do Sul, Brazil: preliminary results

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The magellanic penguin is one of four species of *Spheniscus*, all of which live in temperate and tropical climates and are morphologically similar. *Spheniscus magellanicus* occurs along the southernmost coast of South America in the Pacific and Atlantic oceans. It nests in colonies in Argentina, Chile, and the Falkland Islands, and migrates to the low latitudes of South America. Mortality during these migrations is high; an estimated 19,000 magellanic penguin carcasses are stranded on the coast of the state of Rio Grande do Sul, Brazil, each year, mainly from September through December. The general objective of this study was to test for sexual bias in the mortality of *S. magellanicus* on this coast. Two sampling areas, each 40 km long on the south and north coasts of the state are being monitored monthly from September through December, to collect tissue from the stranded penguin carcasses. Because of the slight sexual dimorphism of this species, a molecular procedure for sex determination is applied through PCR amplification of the CHD (chromo-helicase-DNA-binding) gene region. To date, we have collected 79 specimens in the north and 18 in the south (from the September and October expeditions). All 6 specimens analyzed so far were females. The final results will be compared to those from other studies, generating important information for future management strategies for this species, some of whose populations are rapidly declining.



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Movements and risk assessments of juvenile white-tailed eagles (*Haliaeetus albicilla*) at Smøla wind-farm in Norway determined by satellite telemetry

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Movements of juvenile white-tailed eagles have been studied at the island of Smøla, Western Norway since 2003 in an EIA study in connection with the establishment of a wind-farm at the site. The breeding population was monitored closely since 1996. Smøla had one of the densest breeding populations known of the white-tailed eagle prior to the construction of the wind-farm, with approximately 65 occupied territories. In a post-construction study, 50 fledglings were satellite-tagged 2003-2009. From August 2005 (when searches for dead birds started) to October 2009, four of these were killed by collisions with turbines, out of a total kill of 27 white-tailed eagles, involving 14 adults, six immatures and seven juveniles. Two of satellite-tagged juveniles were killed in their first autumn, while two more were killed during the following spring. Both sexes stayed within the Smøla area during their first winter, involving collision risk with the turbines. Both sexes moved away during spring in their second year (March-April). Females dispersed further than males, often more than 800 km during summer, generally to the north. There was a return movement to the natal area during the second autumn, involving further risk of turbine mortality. The same pattern repeated itself in the third and fourth year for females, while the males showed more philopatry. The findings are discussed within the context of risk assessment and population viability. Studies are currently being expanded with the use of a bird radar to refine risk assessments, and DNA techniques to measure population turnover and estimate possible long-term impacts on the population.



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Habitat associations of the rufous-legged owl (*Strix rufipes*) in northern Andean Patagonia

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The rufous-legged owl (*Strix rufipes*) is a medium-sized owl endemic to the Austral temperate forests of Argentina and Chile. It is classified as Vulnerable in these countries, where it is also considered of sanitary importance because its distribution overlaps that of the long-tailed rat (*Oligoryzomys longicaudatus*), reservoir of the Andes hantavirus that is an endemic disease in the local human population. Reports on diet indicate that rufous-legged owls are important predators of the rat. Despite being relevant for human health, little is known about their habitat associations and limitations. We conducted acoustic lure surveys of rufous-legged owls on stations placed every 1-km along roads in forested habitats in northern Andean Patagonia. Our objective was to determine if owls were associated with particular forest types and fragmentation scenarios. We detected owls at 289 of 424 (68%) stations. Preliminary analyses indicate that owls were significantly more abundant in wild and rural forest landscapes than in urban and suburban forested areas and in low forests or scrubland compared to tall forests (either conifer or broadleaved). The latter was surprising since this species was considered as dependent on old-growth tall forest, similar to *S. occidentalis* from the Northern Hemisphere. Currently, we conduct research at smaller scales, such as habitat use of territorial pairs, which will help explain the occupancy patterns found at landscape scales.



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Bananal Island birds: species richness, endemism, threatened species and ornithological sample effort

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Bananal Island, the largest fluvial island of the world, is located in the Araguaia River flood plain. The Ramsar site title associated with its transitional character, placed in between the Amazon and Cerrado biome, assemble to the Bananal Island a great ornithological biodiversity sanctuary, which had never being grouped. Though, by consulting national and international ornithological collections, scientific articles, historical documents and field work, we elaborated a compilation list of occurring birds on Bananal Island, highlighting: i) species richness, ii) Brazilian, Amazon and Cerrado endemism, iii) threatened species (IUCN e MMA-BR) and iv) ornithological regional sample effort until today. Bird richness on Bananal Island was 357 species, of those 266 belonged to documented and 93 of no documented registers. The compilation list revealed 26 Amazon endemic, 6 Cerrado endemic, 10 Brazilian endemic species and 5 species threatened or extinction. Documented registers of white-shouldered antshrike *Thamnophilus aethiops* and red-shouldered tanager *Tachyphonus phoenicius*, Amazon endemics, are considered the first in the state of Tocantins. Chestnut-bellied guan *Penelope ochrogaster*, Bananal antbird *Cercomacra ferdinandi*, Araguaia spinetail *Synallaxis simoni* and crimson-fronted cardinal *Paroaria baeri* are the main Brazilian endemism and Cerrado biome found on Bananal Island. The first three species together with hyacinth macaw *Anodorhynchus hyacinthinus* and crowned eagle *Harpyhaliaetus coronatus* are five threatened species of the region. Recent bird inventories greater than 400 species on the Bananal island proximities, carried out by the authors, indicate a subestimate, which is due to the reduced ornithological sample effort realized inside of Bananal Island: Emile Snethlage in 1927; Andre Pesce in 1953; Machris Expedition in 1956; José Hidasí in 1963; Dante Teixeira in 1980; MMA in 1981 and TD and RTP in between 2005 e 2009; suggests the need of new bird inventories on Bananal Island.



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Population genetic structure of the red-and-green macaw (*Ara chloropterus*): implications for conservation

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We present data on the population genetic structure of the widely distributed Neotropical red-and-green macaw (*Ara chloropterus*). We analyzed 63 individuals from six regions within Brazil (Mato Grosso do Sul, Mato Grosso, Pará, Piauí, and Rondônia) and Peru. Seven polymorphic microsatellite loci were analyzed and presented no deviation from the expected Hardy-Weinberg equilibrium. F_{ST} values did not reveal differentiation between Perú and all the other groups, between Pará and Mato Grosso, and between Pará and Rondônia. However, the remaining pairwise comparisons showed moderate population differentiation. Additionally, the mitochondrial control region (967 bp from 61 individuals) was sequenced, and we observed 79 polymorphic sites and 38 haplotypes. Haplotype diversity (h) was 0.979 and nucleotide diversity (960), 0.016. The comparison of these indexes from the control region with data from other macaw species indicated relative high genetic variability in the red-and-green macaw. The haplotype network did not reveal any geographic structure. The apparently contradictory results from the two markers could be related to the faster evolutionary rate of microsatellites or greater levels of female dispersion. Funds: FAPESP, CNPq, and CAPES.



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Monitoring outcome of translocated birds in the São Paulo metropolitan region

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Translocations using technical criteria can be a viable alternative for the destination of countless birds rescued from the traffic of wild animals. Since 2004 the Fauna Division actively monitors birds translocated to the following localities: Bororé EPA (23°81'S 46°64'W São Paulo City), Capivari-Monos EPA (23°58'S 47°00'W São Paulo City), and Juquitiba (23°50'S 47°00'W São Paulo city metropolitan region). During quarantine the birds received a 3-day sulphaquinoxaline treatment at a daily dose of 2 g/L, and their feces were examined for parasites. Trial testing included clinical and behavioral examinations. Individuals were identified with metal bands. The birds were soft released, after a 15-day adaptation period. Food was supplied continuously. The sampling effort comprised 12h/mo/area and was done with mist net captures at fixed points, direct observations, direct search, listening, play back, and trapping. From 2004 to 2009, a total of 593 birds were translocated: 256 *Sporophila frontalis*, 204 *Saltator similis*, 64 *Sporophila caerulescens*, 5 *Turdus albicollis*, 18 *Tachyphonus coronatus*, 9 *Thraupis ornata*, 36 *Ramphastos dicolorus* and 1 *Rosthramus sociabilis*. Recovery rate was of 2%. Monitoring by direct observation, search, listening and play back resulted in 27 encounter events of 4 different species, without individual discrimination. The use of mist nets in fixed points did not proved effective monitoring *S. frontalis*. Active monitoring with different techniques has proved to be the best way to evaluate the translocations results. Settlement and territory defence, reproductive success, anti-predatory behavior, home range and death were also registered.



A predictive modelling approach to understand the breeding habitat of an endangered endemic tropical seabird: the Barau's petrel (*Pterodroma barau*) at Réunion Island (Indian Ocean)

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The conservation of threatened species requires a detailed understanding of their basic biology, distribution and habitat use. The Barau's petrel (*Pterodroma barau*) is an endangered gadfly petrel endemic to Reunion Island, which nests in burrows at more than 2200 m above sea level in very remote areas. Although locally abundant, this species is one of the less known seabirds in the world. To improve our knowledge on the breeding habitat of this species, we examined the habitat selection of this species when breeding in order to identify its ecological needs during this crucial phase of its life cycle and to investigate the interactions between nesting habitat and breeding success. Nesting habitats were studied at three spatial scales: a) the upper parts of Réunion Island, b) the breeding colonies and c) the nesting burrows. Generalised Linear Models of burrow abundance using topographic data collected in the field were used to understand habitat selection. Our results show that Barau's petrels breed between 2 400 and 2 700 m above sea level, on cliff and ridge with a steeper slopes. At the scale of the colony, stable substrate (volcanic flow) enables the development of a perennial plant cover, which itself led to the formation of deep humus where birds can dig their burrows. At the opposite, unstable substrate (rock slide) leads to a regeneration of vegetation and a modification of the substrate limiting the humus accumulation. These differences lead to differences in burrow density and breeding success. Using habitat selection criteria, we also developed a predictive model of habitat selection to map all potential habitats for this species. This map will be a powerful tool to design adaptive conservation actions in the future in the core area of the National Park of Réunion Island.



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Genetic variability of Spix's (*Cyanopsitta spixii*) and Lear's macaws (*Anodorhynchus leari*): implications for their captive international breeding programs and their conservation

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We present genetic data on two mostly endangered parrot species in Brazil: Spix's macaw (*Cyanopsitta spixii*, extinct in the wild) and Lear's macaw (*Anodorhynchus leari*, endangered). Captive international breeding programs for both species are coordinated by the Brazilian wildlife authority. These programs are part of a conservation strategy of both species, being especially relevant for the Spix's macaw. We used nuclear (microsatellite) and mitochondrial (cytochrome b, control region, and ATPase 8) markers to estimate the pairwise genetic similarity between 67 Spix's and 40 Lear's macaws. Fourteen pairs of heterologous microsatellite primers were tested, out of which eleven generated amplification products, but only four loci showed to be polymorphic and presented no deviations from Hardy-Weinberg proportions. The mitochondrial sequences did not show significant levels of variation between individuals. Despite the general low degree of genetic variability detected in this group of birds, indices of similarity could be calculated between all pairs of individuals for each species, based on microsatellite data. As expected, the average genetic similarity between first degree relatives of *C. spixii* was significantly greater than the one observed between unrelated individuals. Our similarity data, together with other parameters, was used to recommend the best breeding pairs, in an attempt to minimize inbreeding and to maximize heterozygosity and genetic diversity the two species. Financial support: FAPESP, CNPq, CAPES.



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The golden-spangled piculet *Picumnus exilis* (Picidae): a case of underestimated diversity and its effects in biogeography and conservation

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The genus *Picumnus* comprises about 30 species of small woodpeckers distributed mainly from Panama to southern Brazil and northern Argentina. In the twentieth century a considerable number of taxa of this genus were described and most of them were assigned to subspecies level. Most of these assignments were made without complete plumage variation studies that were based on only one or few specimens. The few taxonomic reviews that were conducted in the last 50 years found large numbers of polytypic taxa forming several species complexes. We studied the widespread and polytypic golden-spangled piculet *Picumnus exilis*, found from Venezuela and eastern Colombia to northeastern Brazil. Plumage and morphometric characters were analyzed in specimens, including types of all nominal taxa, deposited in the main collections of the world. Four distinct evolutionary unities were identified and one of them, *Picumnus pernambucensis* (Zimmer 1947), is found on a small and narrow Atlantic Forest area to the north of the São Francisco river which is part of the so called Pernambuco Center of Endemism. This species must have its conservation status re-evaluated and should be considered as Vulnerable due to its small area of occurrence, which is severely fragmented and altered. These findings are an example of how taxonomic studies can and should be taken under consideration for assumptions and studies focusing on species conservation.



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Survival and breeding productivity of captive-reared Puerto Rican parrots released in the moist karst region of northcentral Puerto Rico

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We report first year survival and breeding productivity for captive-reared Puerto Rican parrots (*Amazona vittata*), a critically endangered species, released in 2006, 2007 and 2008 in the Rio Abajo Forest in northcentral Puerto Rico. Because of the vulnerability to extinction from natural and climatic threats, the establishment of a second wild population is a critical and essential element to ensure a successful recovery of this species. After extensive prerelease training, a total of 63 parrots (35 males; 28 females) ranging in age from 1-6 years old were released, all at the same release site. Survival of each successive release group increased over the years. The first-year survival was estimated at 0.46-0.50 in 2006, 0.50-0.70 in 2007 and 0.83-0.88 in 2008. Most (77%) documented mortalities were due to raptor predation. First breeding attempt occurred just two months after the first release. Four chicks were produced by the reintroduced population between 2007 and 2009. Fertility during this period was 48% (14 of 29 eggs). Social interactions promoted during prerelease training were important to post release survival, adaptation and breeding productivity of captive-reared parrots. Apparently, increased flock size year to year was an important factor in initial survival of parrots released in 2007 and 2008. The addition of each release group and presence of survivors from previous groups may allow for a more efficient foraging and vigilance of parrots. Also, post release supplemental feeding has played an important role in increasing initial survival and promoting the establishment of a resident flock near the release site that may facilitate the acclimation of future released parrots.



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Endemic and endangered birds of Pernambuco Centre - the critical situation to the biodiversity in Northeastern Brazil

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The Atlantic Forest in Northeastern Brazil is an important area of endemism for birds and plants and is called the Pernambuco Centre. Several conservation efforts are taking place here to save the 27 species of endemic birds (excluding *Pauxi mitu*, now extinct in the wild) still living in these forests. Despite that this region comprises only 4% of the remaining Brazilian Atlantic forest, two thirds (440 species) of all birds species typical of this ecosystem can be found in Pernambuco centre. During the last 20 years five new species of birds were described for this region, namely: *Philydor novaesi*, *Terenura sicki*, *Myrmotherula snowi*, *Phylloscartes ceciliae* and *Glaucidium mooreorum*. Some of them are found in only 3-4 locations. To avoid the extinction of these species, seven management plans were created to define crucial conservation initiatives for the five new species and two more threatened endemic birds, *Synallaxis infuscata* and *Tangara fastuosa*. Fragmentation combined with the large number of endemic species makes the Pernambuco centre the hottest of the hotspots for conservation efforts. Local NGOs have been trying to involve the people together with local government in the protection of these species. Forest restoration, incentives to creation of private reserves and management plans are the main efforts to avoid the extinction of dozens of species in this area. If more decisive conservation efforts are not implemented in this region, extinction will be unavoidable for several species unique to this area of the Brazilian Atlantic forest.



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Preliminary aspects of the installation of artificial nests for the conservation of *Ramphastos toco* and *Amazona aestiva* in the region of São Carlos, SP, Brazil

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In the region of São Carlos small important fragments of native forest remain in which populations of *Ramphastos toco* and *Amazona aestiva* are commonly observed. The great challenge of these species is to find suitable sites for nesting. The Nests Project was developed to increase the supply of suitable sites for nesting and provide an increase in population of these birds. The manufacture of nests is fully handmade and use adapted measures of other similar projects. The wood used is *Pinus caribaea*, because it is cheaper and easier to handle. The artificial nests are installed at individual farms with permission and support of the owners. The installation locations are chosen by addressing the following aspects: hard-reaching area, with large areas of native forest, away from urban areas and where there is a record of individuals of these species. Nests are installed eight meters high in the trees, and preferably in palm trees (*Acrocomia aculeata*), which are very common in this region and often chosen, after dying, by the two species for nesting. The nests installed are being constantly monitored by the staff and owners of the areas. The first positive aspect is the cooperation of owners and residents of the chosen areas, providing the project with an educational character in the environmental area. The project is still in its early stage but we hope to show positive results as soon as possible.



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Conservation vulnerability assessment of North American landbirds: partners in flight tri-national vision

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Assessment of conservation vulnerability across 882 native landbird species that breed in Canada, USA, and Mexico identified 147 species in need of immediate conservation action to prevent extinction or extirpation from North America. For 60 species at greatest risk, high or severe threats are exacerbated by small global populations and limited distributions. Most are Mexican endemics and are concentrated in tropical dry and highland forests. An additional 44 Meso-American forest species and 24 widespread South American species are at the northern limit of their distribution in southern Mexico, where populations are highly threatened. The remaining 19 species with high threats and declining populations are widely distributed in temperate and boreal forests, grasslands, and aridlands. In addition to species of immediate concern, PIF identified 42 common species with steeply declining populations and 59 species with at least 25% of their population shared by all three countries. The most critical conservation actions to prevent loss of diversity and avian abundance include (1) increased support for a network of protected areas in Mexico, linked to forest reserves throughout Central and South America; (2) implementing endangered species recovery plans in each country; and (3) community-based conservation and land-use policies that promote sustainable agriculture, forestry, and energy development, and limit urban sprawl. PIF seeks to expand its vision for bird conservation throughout the Western Hemisphere.



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Population monitoring of hyacinth macaw, *Anodorhynchus hyacinthinus* (Psittacidae), in the Pantanal of Barão de Melgaço, Mato Grosso, Brazil

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Here we monitor the population of the hyacinth macaw, *Anodorhynchus hyacinthinus*, in a roosting area at the Fazenda São Francisco, Pantanal of Barão de Melgaço. The field survey consisted was 22 expeditions of 4 to 5 days, from 2001 to 2009. The roost was an island (*capão*) of cerrado vegetation, mainly palms *Acrocomia aculeata* and the individuals count was made by 6-8 people placed in the north, south, east and west of the *capão*. The roost had an average of 226 ± 71 hyacinth macaws, the largest group was observed in February of 2005 with 341 macaws and the smaller group was on September of 2009, with 99 individuals. Hyacinth macaws come to roost around 16h30 to 17h. The duration of the hyacinth macaws arrival in the roost area ranged from 25 to 140 minutes, the average was 60 minutes. The arrival time and the duration of this event varied with the season. Hyacinth macaw took longer to arrive and come later to the roost in the summer, which is the raining period in the Pantanal and lower food availability. The number of hyacinth macaws varied over the years, increasing from September 2002 to February 2005, after that showed a slight decline. Fluctuation of this roosting group over the years and during the breeding season, and also the importance of these sites as a bird communication centre will be discussed. This macaw concentration reinforces the need for long term studies as well as the preservation of this area, for hyacinth macaws and other parrots, as some species of the genus *Amazona*.



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Reintroduction of island scrub-jays (*Aphelocoma insularis*) to Santa Rosa Island, California: an opportunity for proactive species management and the restoration of an insular ecosystem

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Aphelocoma insularis currently exists only on Santa Cruz Island, part of Channel Islands National Park (CINP) in California, USA. Surveys conducted in 2008-09 indicate a total population size < 3000, making *A. insularis* one of the rarest North American bird species. Emerging threats like disease and climate change underscore the need for a robust conservation plan. Here, we present a framework for the reintroduction of *A. insularis* to nearby Santa Rosa Island (SRI) in CINP. Recent evidence indicates that this species existed on SRI into the late 1800s and was likely extirpated by widespread destruction of vegetation by sheep. All sheep have since been removed, and some vegetation recovery has occurred over the past several decades. However, the hundreds of non-native deer (*Odocoileus hemionus*) and elk (*Cervus elaphus*) prevent extensive regeneration of scrub and oak chaparral habitat. These ungulates will be removed in 2011, and native plant and animal communities will slowly recover. The regeneration of SRI would be hastened by *A. insularis*, which through their acorn and seed caching behavior are important ecosystem engineers. Expanding the range of *A. insularis* to again include SRI would also increase population size and hence species viability. Based on a hierarchical model for predicting habitat-specific abundance of *A. insularis*, we estimate that SRI could support a small but viable population of jays now, and a population of several thousand when native vegetation has fully recovered.



Conservation value of National Forests in the Amazon for harpy eagle (*Harpia harpyja*) in Brazil

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The National Action Plan for the Conservation of Birds of Prey-PANCAR, published in 2008 by the Chico Mendes Inst. for Biodiversity Conservation-ICMBio, includes conservation of the harpy eagle in Brazil. We describe nests of harpy in national forests at Amazon, providing support to decision makers in the reconsideration of the management plans, and report the importance of conservation areas in the preservation of species. In three National Forests (Flona) of Amazon we mapped four active nests of harpy eagle, one in the Tapajós Flona-PA (55°30'W, 2°30'S), two in the Carajás Flona-PA (50°19'49"W, 6°00'S) and one in the Purus Flona-AM (68°4'21"W, 8°1'S), of 545,000, 411,948 and 256,000 ha respectively. The harpy, until 2003 was considered as threatened with extinction, and currently considered as "near threatened." These birds, build their nests in emergent commercial trees and therefore depend on ecologically structured forests for their reproductive success. The multiple activities in national forests in the Amazon are a challenge that aims to ensure the sustainable use of natural resources and preserving biodiversity. The mapping of these nests favors knowledge about the species and can (re)direct the zoning and management of these areas in order to protect them. In this context the ecological research of certain species can act as a tool to support the areas. Funding: ICMBio, Vale, CNPq, FAPEAM.



Nests characteristics of hyacinth macaw (*Anodorhynchus hyacinthinus*) in the Pantanal of Barão de Melgaço, Mato Grosso, Brazil

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The hyacinth macaw (*Anodorhynchus hyacinthinus*) is a social, conspicuous and resident species that live in family groups and show some fidelity to nesting sites. The objective of this research was to describe the hyacinth macaw nests characteristics in the Pantanal of Barão de Melgaço, MT, in three different years: 2005, 2007 and 2008. Nests were accessed with climbing equipments and were registered just if there were eggs or chicks. A total of 63 cavities were inspected and 13 were registered, measured and mapped. The tree height average with nests was 16.12m, while the nest height average was 9.47m. The largest diameter of the nest opening ranged from 16 to 60cm and the smallest ranged from 10 to 33cm. The nests interior showed a lateral depth from 42 to 60cm and the vertical depth varied both down and upwards, 0 to 26 cm and 0.84m to 1m or more, respectively. Most nests, 69.3% (n = 09), originated from branch break and the others by other agents such as fungi, bacteria or birds of the family Picidae. The nest-trees DBH average was 93.5cm and 100% of nests were found in *Sterculia apetala*. The nests were more common in the forest interior, 77% (N = 10), than in forest edge, 23% (N = 3). Considering factors such as deforestation, fires, competition with other species by cavities and other causes, it is important to extend these studies to support management actions for the species conservation in their natural habitat.



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Monitoring and management of nests of the red-tailed parrot (*Amazona brasiliensis*) species in the state of Paraná, in southern Brazil

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The red-tailed parrot, *Amazona brasiliensis* is endemic to the Atlantic Forest in southern Brazil. It is an endangered species due to the fragmentation of its habitat and the capture and illegal trafficking of chicks. The estimated population is approximately 6,670 individuals. This work looks at the breeding period of the red-tailed parrot at one of the main breeding sites for the species on the northern coast of Paraná, the state that is home to 75% of the total population. The study was carried out from September of 2008 to February of 2009. The objective was to record the breeding success rate and the population increase of the red-tailed parrot by installing and monitoring artificial nest boxes. 80 artificial nest boxes were monitored, 40 were made of wood and 40 were made of PVC (plastic pipes). Of the 49 nest boxes that were occupied, 26 were made of wood and 23 were made of PVC, with the total birth of 79 chicks. During this period, the number of available artificial nest boxes doubled while the number of natural nests decreased at this breeding site. Of the 25 natural nests monitored, 10 were damaged from falling and/or rotting and two were occupied by other birds. There were some advantages found with the PVC nest boxes like the ease of installation, greater durability and the fact that they were not occupied by exotic bees. However, a greater number of parasites were found on the chicks born in nest boxes made of PVC, and there was an increase in the number of eggs abandoned by pairs. The results demonstrate the importance and efficiency of the artificial nest boxes as a conservation strategy for the red-tailed parrot in nature, since it has contributed to the population increase in the region.



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Avifauna from Boqueirão da Onça region, São Francisco River Basin, Bahia, Brazil

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The region of *Boqueirão da Onça* is part of the São Francisco River Basin and it is located among the municipalities of Sento Sé, Campo Formoso and Umburanas, in the extreme northwest of the State of Bahia. The predominant vegetation is the caatinga, whereas in the upper parts there are also savanna and rocky field patches (*campos rupestres*), which can still be found protected due to the difficulty in accessing the area. There is a proposal to create a National Park in the region, which is in process in the Brazilian government. In May and August 2009, the CEMAVE, with collaborators from northeastern non-governmental organizations and educational and research institutions, conducted two expeditions, performing captures with mist nets, accomplishing an effort of 3600 hours/net. Active researches in the surrounding areas were also conducted in an attempt to register species less conspicuous. The main purpose was to carry out a survey of the local bird diversity in the region. As a result, it was registered 235 species belonging to 72 families, and the registration of endemic and endangered species listed in IUCN (2009) and MMA (2003). We emphasize the presence of *Gyalophylax hellmayri* and *Megaxenops parnaguae* as endemic species of the Caatinga Biome, as well as some globally threatened species such as *Penelope jacucaca*, *Anodorhynchus leari*, *Augastes lumachella*, *Xiphocolaptes falcirostris* and *Sporagra yarrellii*. Given the environments found in the region, it is believed that the near threatened *Knipolegus franciscanus* may be found. These findings reinforce the need and urgency in the creation of the national park.



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Documented case of hybridization in nature, outside the original distribution area, of two species of psittaciforms: *Ara ararauna* x *Ara chloropterus*

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A hybrid birth from the crossing between an *Ara ararauna* female with an *Ara chloropterus* male was observed and its growth until adulthood was documented in the region of Ribeirão Bonito, state of São Paulo, Brazil. This region is not within the original distribution of the two species, and only small groups are occasionally seen. The Nests Project found this hybrid macaw during the installation of artificial nests in the region. This bird has been constantly observed, as well as the repeated crossing of its parents. The hybrid macaw shows differentiated colors, mixing colors of the two species, providing a unique standard. The hybrid macaw feeds similar to its parents, but it no longer sticks to the same group. The Nests Project is monitoring the behavior of this hybrid and its parents on farms in the region where they are sighted. Such monitoring occurs in constant contact with the owners and residents of the areas. Interviews with residents have provided important help in this monitoring. There are some accounts of a hybrid exemplary originated from the crossing of *Ara ararauna* with *Ara chloropterus* only in captivity, under the name harlequin hybrid macaw. However, there are no accounts of other cases in nature.



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Bird assemblage in a Brazilian Atlantic forest area based on mist-netting data: a comparison of elevated versus ground-level nets

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Mist nets may be opened at different heights in forest, but they are seldom used over 3 m above ground. Sampling with two methods, we compared composition, relative abundance of species and trophic structure of the bird assemblage at Ilha Grande, Southeastern Brazil. We mist-netted using two different methods at the same study area (with 290 birds standardization): conventional ground-based nets (0-2.4 m height range) and elevated nets (0-17 m) with an adjustable-height system, modified from Humphrey *et al.* (1968). We found significant difference between the assemblages sampled with the two methods. We captured 44 species with elevated net and 30 species with ground-based nets, from which only three were exclusive. Among species whose capture frequencies could be compared between both methods, approximately 20% differed significantly (chi-squared test, $p < 0.05$), consisting mainly of species of Suboscines passerines. Among trophic guilds, insectivores were significantly more abundant in the ground-level nets, whereas frugivores and nectarivores were more frequently captured in the elevated nets. Our study reinforces that different sampling methodologies used at the same locality may result in extremely distinct diagnosis of avifauna, both in qualitative and quantitative terms. With the use of ground-level nets we recorded less than 2/3 of the richness of the captured species when we sampled different forest strata. Additionally, ground-level nets tended to under or overestimate the relative abundance of at least 1/4 of captured species, favouring insectivorous. Therefore, dissemination of capture studies including elevated mist nets is a feasible and necessary way to more accurately represent the bird fauna in Atlantic forest. Funding: CAPES, CNPq, SR-2/CEADS.



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Bird bycatch in coastal gillnets in Estonian (NE Baltic Sea) waters

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Seabird mortality in fishing gears is globally recognized conservation issue, which is believed being responsible for declines of a lot of bird populations. Marine waters of the north-eastern Baltic Sea are favoured by numerous diving birds: sea ducks, divers, grebes, and alcids. Bird abundance increases especially during the cold-water periods, when species nesting in high northern latitudes shift southwards and aggregate in coastal waters and shallow offshore banks of the Baltic Sea. However, not only birds are abundant in the seas of northern Europe - commercial fisheries operate extensively within the region, and gillnetting is fishery type predominately concentrated in coastal areas. The present study summarizes bird by-catch data collected in Estonia in 2005 - 2010 using the framework of contracted commercial fishermen, and relates this also to the commercial fisheries effort, which enables to estimate total mortalities. Most endangered species, areas and seasons are highlighted.



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Seasonal variation in behavioral and physiological response in magellanic penguins

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Ecotourism has expanded greatly over the last two decades in Patagonia, Argentina. While ecotourism is economically important, there is the potential for significant negative effects of tourist visitation to wildlife. We initially studied the effect of tourist visits on magellanic penguins (*Spheniscus magellanicus*) in San Lorenzo colony, located in Peninsula Valdés, Chubut, Argentina by measuring both a behavior response (distance until initiation of the defensives “head turns”) as well as a physiological response (glucocorticoid stress-hormone response to capture and restraint) in both tourist-visited and non-visited female penguins during the incubation period. We found that while behavioral responses (distance at which started doing head turns) were less severe in tourist-visited penguins, the glucocorticoid stress response was the same. Thus, behavioral habituation to visitation was present, whereas there would not be physiological habituation to disturbance. To examine the potential seasonal effects on stress, we then measured behavioral and hormone response in non-disturbed female penguins in three additional periods (early chicks, late chicks and molt). Behavioral responses in undisturbed females did not vary throughout the season. However, we found that stress hormone levels differed, being greatest during “early chick” and most reduced during molt. Thus, it appears that physiological responses of penguins are dependent on season, which may have particular pertinence for penguins being visited by tourists.



Seed dispersal effectiveness by birds on the palm *Euterpe edulis* in a highland Atlantic Forest of Brazil

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Euterpe edulis has a wide distribution throughout the Atlantic Rainforest. Populations of this keystone palm represent important renewable natural resources, they bear large fruit crops during periods of fruit scarcity, palms produce 1-5 infructescences bearing on average over 3000 fruits each, which are eaten by a variety of animals as toucans, thrushes, large cotingas, and guans (it's major seed dispersers). Disastrously *E. edulis* has been exploited in a predatory pattern over decades what was resulting on its disappearance from many areas. The aim of this work was to determine the most important dispersers for *E. edulis* in forest area. For this we quantified effectiveness (def) by recording data for abundance, visitation rate, feeding behavior for the achievement of the quantity component (qtc) and seed retention time, germinability and germination rate for the quality component (qlc). We registered 18 species visiting *E. edulis* fruits during 288h of focal observation, the main dispersers (swallowed, carried or regurgitated) were *Ramphastos dicolorus* (53), *Penelope obscura* (57), *Selenidera maculirostris* (66), *Carpornis cucullata* (81), *Ramphastos vitellinus* (82) and *Turdus albicollis* (138). Finally the species with the greater values of effectiveness (def = qtc x qlc) were *P. obscura* (qtc = 1.28, qlc = 3.58, ef = 4.59), *R. dicolorus* (qtc = 1.06, qlc = 1.12, ef = 1.19) and *R. vitellinus* (qtc = 1.64, qlc = 3.14, ef = 5.13). These 3 species were considered the most important dispersers due to the fact that these birds not only visited and dispersed *E. edulis* fruits but also strongly influenced processes extremely important for the survival of palm seedlings, such as retention time, germinability and germination rate which are essential patterns for seedling establishment.



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International collaboration to model and survey *Vermivora chrysoptera* during the non-breeding season

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U.S. breeding populations of golden-winged warbler (*Vermivora chrysoptera*) have declined to one-fourth of levels 40 years ago. Clarifying non-breeding season threats in Central and northern South America is essential for effective conservation across the full life cycle of this Neotropical/Nearctic migrant. Using historical specimen and sight records in MAXENT, Alianza Alas Doradas modelled potential distribution. To validate the model, the Alianza team selected 34 100-km² blocks in Colombia, Panama, Costa Rica, and Nicaragua where probability of occurrence was ≥ 0.8 and used a standardized survey protocol with passive listening and playback at 10 point counts per day. During the 2008-09 non-breeding season, 919 censuses at 350 point counts yielded 194 new golden-wing records with 58.3% in secondary forest, 21.3% in primary forest, and 19.4% in agroecosystems. Secondary forest, wooded pastures, and early seral forest patches were used more frequently than expected. Finer habitat measurements indicated association with larger bodies of water and greater presence of vines, epiphytes, and dry leaves. A revised MAXENT model incorporating new survey records refined survey site selection for the 2009-2010 season in the same countries plus Venezuela. Estimates of connectivity between breeding and non-breeding populations using stable isotope analysis of feathers will serve to mobilize partner conservation support. This project provides an exemplary model for connecting researchers from seven different countries using a standardized protocol to provide science foundations for a full life cycle conservation strategy.



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Distribution and present status of the black stork (*Ciconia nigra*) in central Poland

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In Poland the black stork is a rare species inhabiting forests mainly in eastern and northern part of the country. After a serious decline in the 20th century the population of black stork in central Poland increased from merely three breeding pairs in 1940s to 68 in 2008. The greatest increase in the number of breeding pairs in central Poland was recorded in 1970s. The density of the black stork was 0.37 pairs per 100 km² of the total study area (18219 km²), 1.8 pairs per 100 km² of forested area and 3.8 pairs per 100 km² of forests older than 60 years. The nests were evenly distributed in the area studied and the mean inter-nests distance was 11.4 km. The number of fledged young per successful nest varied, mainly due to feeding conditions in the spring, from 2.1 in 2002 to 3.1 in 2006. Although forests cover only 21% of central Poland, the population of the black stork is still increasing. The establishment of a net of small forest reserves protecting old-growth stands in damp habitats proved to be the most effective conservation action for the black stork (studies supported in 2008-2009 by the science grant NN304323135).



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SA012 Systematics, Biogeography and Paleontology



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Spatial consistencies and temporal inconsistencies in Amazonian biogeography as revealed by comparative phylogeographic data on 21 lineages of birds

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Comparative phylogeography provides a framework for studying diversification processes by using co-distributed species as statistical replicates. We evaluated levels of spatial and temporal concordance in phylogeographic patterns of 21 monophyletic lineages of birds endemic to the Amazon basin. Molecular datasets included a dense-taxon sampling regime within each lineage and sequences of several mtDNA protein coding genes. Bayesian gene trees were reconstructed from the concatenated gene sequences. We also performed a Bayesian relaxed-clock analysis to assess lineage divergence times. Three main spatial patterns of diversification were observed: in twelve (~57%) of the gene trees analyzed, the first diversification event corresponded to the isolation of the Guyanan shield endemic from all remaining lineages; in five lineages (~24%), the first split isolated clades separated by the Amazon river, and in four (~19%) it isolated Brazilian shield endemics. These results point to common barriers corresponding to the current positions of the Negro, Madeira, and Amazon rivers, with the oldest split within each lineage always corresponding to the position of one of those rivers. For all lineages distributed on the Brazilian shield, splits always followed the same order across the following rivers: Tapajós, Tocantins, and Xingu. Although all lineages diversified during the Plio-Pleistocene, inconsistencies were found among the timing of spatially analogous splitting events across several lineages, and are probably related to differences in natural history. Nevertheless, the common diversification patterns found underscore the importance of the Amazonian shields as main areas of diversification, with the sedimentary basin being occupied later in time, and of the development of the transcontinental Amazon river basin as a major event promoting recent cladogenesis among lineages of Amazonian birds.



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Phylogenetic relationships of the wing-banded antbird *Myrmornis torquata* to the tracheophone families based on comparative morphology (Passeriformes: Furnarioidea)

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Before the split of Formicariidae (l. s.), *M. torquata* was associated sometimes to “ground” antbirds, sometimes to “typical” antbirds, although more often placed between these two informal groups, as an “intermediate form.” Following that split, *M. torquata* was subjectively associated with the Thamnophilidae based on vocal and nest similarities. Although this hypothesis has been corroborated by molecular phylogenies, *Myrmornis* has not been the subject of a deeper anatomical study, and no phylogeny based on morphological characters has ever resolved its systematic affinities. We undertook a cladistic analysis of 12 terminal taxa, including *M. torquata* and other species representing all the Furnarioidea families (except Melanopareidae and Scleruridae). Two species of Pipridae (Tyrannoidea) were defined as the outgroup, used to root the trees. Sixty osteological and syringeal characters were subjected to a parsimony analysis using the branch-and-bound algorithm of PAUP 4.0b10. Our results support the view that *M. torquata* belongs to Thamnophilidae, by sharing with taxa in this family three synapomorphies in all the seven most-parsimonious trees obtained. Two of these synapomorphies are syringeal features exclusive to the family: presence of calcified processes on the supporting elements of the syrinx associated with the origin of *Musculus vocalis ventralis* and division of *M. sternotrachealis* into two *fasciculi* near its insertion on the syrinx. The other synapomorphy is a homoplastic osteological feature, independently present in Rhinocryptidae which is a partially overlapping of the *Foramen orbitonasale mediale* by the *Os ectethmoidale*.



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Comparative molecular and vocal variation among cis-Andean taxa of the long-tailed woodcreeper *Deconychura longicauda* (Dendrocolaptidae)

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The polytypic long-tailed woodcreeper *Deconychura longicauda* includes seven taxa currently regarded as subspecies. Three main vocal patterns have been recognized in this species: one involving all trans-Andean taxa (*dariensis*, *minor*, and *typica*), a second found exclusively in the nominate form, endemic to the Guyanan shield in northeastern Amazonia, and a third shared by all the remaining Amazonian taxa (*connectens*, *pallida*, and *zimmeri*). Since vocal characters have proven important in determining interspecific limits in suboscine passerines, we sought to evaluate whether vocal and molecular variations are consistent with each other among cis-Andean taxa of *D. longicauda*, known previously to represent a monophyletic group where most of the vocal variation is contained. Preliminary analyses carried out with the Raven 1.3 software based on 21 loudsong recordings indicated strong consistency with a maximum-likelihood molecular phylogeny based on ca. 1,000 bp of the mtDNA genes ND2 and cytb for 25 individuals covering all cis-Andean taxa. Four main clades were recovered by the molecular analysis, each corresponding to a vocally diagnosable group. Populations from the Guyanan shield (*longicauda*) are basal and also the most vocally divergent among all cis-Andean taxa. Among the remaining cis-Andean populations, those found east of the Madeira river (*zimmeri*) were basal, whereas those bound by the upper Amazon and Madeira rivers (to which both names *connectens* and *pallida* apply) and by the upper Amazon and Negro rivers are sister clades; even though those three latter clades are vocally reciprocally diagnosable, *zimmeri* is the most divergent one, mirroring the molecular data. Thus, the combination of both molecular and vocal characters indicates that at least four main evolutionary units corresponding with distinct phylogenetic and biological species exist in the cis-Andean *D. longicauda*.



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Multi-character taxonomic review of the Amazonian barred woodcreeper *Dendrocolaptes certhia* (Dendrocolaptidae)

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Morphological variation among taxa of the polytypic species *Dendrocolaptes certhia* (Dendrocolaptidae) has been examined in several studies, but consistent diagnosis for each is still lacking. We carried out a multi-character taxonomic review of *D. certhia* based on a combination of plumage, molecular and morphometric data. Morphological analyses were based on 194 specimens and molecular phylogenies were inferred based on 1213 bp of the mitochondrial DNA genes 16S, ND2, and Cyt-b belonging to 28 specimens, including an outgroup (*D. picumnus*). Validity of the taxon *D. medius* (occurring in the Belém area of endemism and northeastern Brazil) is particularly important, because it is endangered in Brazil. Plumage and, to a lesser extent, morphometric characters agreed with the molecular analysis in recognizing seven main reciprocally diagnosable lineages in the polytypic *D. certhia*, each inhabiting one of the main Amazonian interfluvia. Since they are readily diagnosable from each other by a combination of plumage and molecular characters, they can be ranked as full species status under the General Lineage Species Concept. This change in the taxonomic ranking of the taxa currently listed as subspecies of *D. certhia* underscores the importance of taxonomic studies in uncovering the true diversity of the Amazonian biota, and also emphasizes the urgent need of designing effective conservation strategies for *D. medius*, whose populations in northeastern Brazil have not been found in recent field surveys.



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Historical biogeography and radiation (distribution) of Neotropical parrots (genus *Amazona*)

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The Neotropical genus *Amazona* comprises 31 described species, of which 18 are on the IUCN list of endangered species. To understand the history of the genus and the current distribution of species, we tested the likely sources of radiation by comparing the phylogeny recently proposed and current distribution of genus in zoogeographical regions. Twenty seven species were used for cluster analysis of these regions through software Winclada. A dichotomy separates two groups, one which has its origins in northwestern South America and the other from the Amazon Basin. It is inferred that *A. albifrons* is a basal phylogenetic branch that spread from toward Central America from northwestern South America and resulting in species of the Greater Antilles: *A. agilis*, *A. collaria*, *A. leucocephala*, *A. ventralis* and *A. vittata*. The second group had a large radiation, from the Lesser Antilles, the Brazilian *cerrado*, Atlantic Forest and Yungas. *Amazona guildingii* and *A. imperialis* occur on islands, but share *A. amazonica* (from the Amazon) and *A. brasiliensis* (from Atlantic Forests) as common ancestors. Another clade has an Amazon ancestor from which *A. farinosa* and *A. rhodocorytha* are derived, and is the most basal branch and predecessor of the monophyletic "yellow-headed" parrots. Thus, related species are close geographically. However, those with small distribution or that live only on islands may be geographically separated, but still genetically close to those with widespread distributions.



Molecular phylogenetics and chronology of an Amazonian endemic diversification: the genus *Phlegopsis* (Thamnophilidae)

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Phylogenetic studies focusing on endemic lineages are fundamental for reconstructing the diversification histories of particular areas. With 2861 bp of mtDNA protein coding genes (COI, ND2, cytb) and a nuclear intron (BFib 7) from 52 individuals belonging to all three species of the Amazonian endemic genus *Phlegopsis*, including *P. borbae* (5 samples), *P. erythroptera* (15 samples), and *P. nigromaculata* (32 samples) we examined this lineage. Maximum-likelihood trees were reconstructed from the concatenated gene sequences, while the mtDNA dataset was used alone in Bayesian relaxed-clock analysis to assess lineage divergence times based on an average substitution rate of $\lambda = 2.1\%$. All trees obtained were consistent in separating first *P. erythroptera* from *P. borbae* and *P. nigromaculata*, with this initial split dated to 4.273 Mya (± 0.03472). The subsequent split between *P. borbae* and *P. nigromaculata* took place around 2.646 Mya (± 0.02533). Within the most widespread *P. nigromaculata*, splits took place in chronological order across the following main tributaries of the Amazon river: Tapajós (1.531 ± 0.01467 Mya), and Tocantins and Xingu (1.316 ± 0.01531 Mya). Reconstruction of the evolution of ancestral geographic ranges in *Phlegopsis* under a maximum-likelihood approach indicated that three distinct dispersal episodes likely account for the current sympatry between *P. erythroptera* and *P. nigromaculata* and between the latter species and *P. borbae* at different sectors of the Amazon. On the other hand, major splits were correlated with the formation of the Amazon river and its major tributaries during the Plio-Pleistocene.



Multi-character taxonomic review of the spotted antpitta *Hylopezus macularius* (Grallariidae)

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A systematic revision of the polytypic spotted antpitta (*Hylopezus macularius*, Grallariidae) based on morphometric, plumage, vocal, and molecular characters are presented. Morphological and vocal analyses were based, respectively, on 49 specimens and 104 recordings. Molecular phylogenies were inferred based on 1,370 bp of the mitochondrial DNA genes 16S, ND2, and *cyt b* belonging to 26 specimens, including several outgroups. Our results revealed the existence of an undescribed taxon endemic to the Madeira - Xingu interfluvium, cryptically similar in morphology to *paraensis*, but vocally and genetically readily distinguished from the latter and any other taxon grouped under *H. macularius*. Resultant molecular trees strongly supported reciprocal monophyly in four main lineages of the spotted antpitta, three from already named taxa (*dilutus*, *macularius*, and *paraensis*), and one unnamed taxon. We show that those four taxa are also mutually diagnosed by a combination of both vocal and morphological features, and therefore recommend treating them as separate species. Dating of the molecular trees indicated that splits among species of the spotted antpitta complex took place between 2.92 and 0.78 mya, with the older splits concentrated in northwestern Amazonia (across the Negro and upper Amazon rivers) and the most recent ones in the southeastern part of the basin (across the Xingu river).



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Is the mid-domain effect responsible for altitudinal distribution of Atlantic forest birds?

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The mid-domain effect (MDE) is a null model that suggests simple spatial boundaries in altitudinal gradients (base and top of mountains) and predicts a unimodal diversity curve with maximum richness at the mid-point of the mountain. It also predicts a strong, positive association between predicted richness based on Monte Carlo simulations and empirical richness. To test whether the MDE accounts for altitudinal distribution of Atlantic forest birds in Serra do Mar, we conducted Point Counts along one route at Boracéia Biological Station (23°38'S, 45°52'W), in the state of São Paulo, Brazil. Along this 800 m altitudinal gradient, we established nine 100 m altitudinal belts each with three points at least 200 m apart. To avoid spatial pseudo-replication along the route we randomly selected between right or left and a short distance within 0 – 50 m in which points were selected from the main transect line before establishing the first Point Count. Point Counts lasted for 10 min and were sampled on three days from October 2008 – February 2009. Sample effort was not exhaustive so we estimated richness for each altitudinal belt using the MMMean statistics as well as compared our richness data with null model prediction based on 50,000 Monte Carlo simulations sampled without replacement from empirical range sizes. We recorded 104 species along the altitudinal gradient and only the estimated number of species had a peak in richness around 400 and 700 m. Linear regression between species richness and MDE was not significant ($P = 0.900$). Although the MDE seems to be important elsewhere in determining a few cases of bird altitudinal distribution, MDE was not supported here. Other spatial constraints need testing, such as area, as well as biological variables should also be taken into account to determine altitudinal distribution of Atlantic forest birds.



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Areas of endemism for Brazilian Amazonian birds

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One of the most surprising and spectacular features of Amazonian bird distributions is that many species occupy only small subregions of the entire, seemingly uniform, expanse of rainforest, and that the boundaries of these subregions are shared by numerous restricted-range taxa in what have long been recognized as distinct areas of endemism. Over the last several decades, the importance of the major Amazonian interfluves as areas of endemism has become solidly established. Recently, however, smaller areas within some of these interfluves have also been detected. Furthermore, the distributions of species associated with riverine habitats should not necessarily conform to interfluves and, in fact, show distinct geographic patterns. Other environments as well, especially montane and savanna, show yet again different patterns of endemism in their resident species. The interplay between habitat and geography leads to a more complex view of areas of avian endemism, summarized in the map presented. With respect to river barriers, it is likely that sharp divisions break down near headwaters regions, usually outside of Brazil. Thus, what appear to be clear patterns of endemism here may not be reflected in other countries, and further studies of Amazonian bird distributions, integrated across countries throughout Amazonia, are recommended. This classification is directly applicable to conservation initiatives and land management, allowing quantitative analyses of habitat destruction within distinct areas of endemism. It should also stimulate the search for undescribed (cryptic) avian diversity in these areas, as well as studies of historical biogeography and speciation processes, and tests of applicability to non-bird taxa.



Phylogeny of the potoos (Caprimulgiformes: Nyctibiidae) inferred from osteological characters

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The family Nyctibiidae (potoos) comprises seven extant species, all currently classified within a single genus, *Nyctibius* Vieillot, 1816. They are secretive nocturnal birds, distributed throughout tropical America and are among the most poorly known of all birds. A phylogeny of all but one species of Nyctibiidae was estimated on the basis of 21 osteological characters from the skull and mandible, using nightjars and allies (Caprimulgidae) were used as outgroup. The monophyly of the family was strongly supported, with bootstrap support of 100% and Bremer Index of 11. PAUP analysis resulted in a single most parsimonious tree with a length of 24, and the ingroup topology was (*N. bracteatus* (*N. leucopterus* ((*N. griseus*, *N. jamaicensis*) (*N. aethereus*, *N. grandis*))). The first cladogenesis within Nyctibiidae splitting the others potoos from *N. bracteatus* is obtained by five apomorphies, and the second cladogenesis event splitted *N. leucopterus* from other species by four synapomorphies. Only two and one apomorphies are attributed to the groups (*N. aethereus*, *N. grandis*) and (*N. jamaicensis*, *N. griseus*), respectively. These results corroborate to some extent the phylogeny developed by molecular data. Although included in a single genus, these species show a noteworthy variation in the cranial osteology, following the extremely high levels of genetic divergence demonstrated in the literature. Thus, the currently recognized taxonomy of the family, in which the seven species are included in a single genus, must be reviewed.



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Geographic variation in the *Megascops watsonii* species complex (Strigidae)

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The *Megascops watsonii* species complex occurs throughout the Amazon basin, and is divided into two species, whose distributions are bounded by the Amazon river: *Megascops watsonii* (northern bank) and *M. usta* (southern bank). Both species are diagnosed by subtle plumage characters, and obvious vocal differences; in the case of *M. usta* songs are quite variable between populations. In this study, we analyzed skins and recordings of *M. watsonii* / *usta* to document geographic variation in this complex. Morphological and vocal characters were studied based on specimens and tape-recordings deposited in different institutions and databases, covering most of the complex's distribution. No differences were found in the morphological measurements between *M. watsonii* and *M. usta*. In *M. usta*, individuals east of the Madeira river have significantly faster songs than individuals from the west, and (ca. 6 notes/sec versus ca. 2 notes/sec), thus sound more like *M. watsonii* (ca. 8 notes/sec) than populations of *M. usta* distributed east of the Madeira. Furthermore, individuals from northern Mato Grosso (Teles-Pires River) and southeastern Amazonia have yet different songs, with ca. 3 notes/sec. Vocal characters not only warrant the treatment of *M. watsonii* and *M. usta* as separate species, but also indicate that *M. usta* can be split into at least three separate species. Molecular analyses are currently being conducted to provide a phylogeny for the different taxa of the *M. watsonii* / *usta* complex, and thus better understand both vocal and morphological variation in the taxa involved.



A morphological phylogeny of parrots (Aves: Psittaciformes) based on syringeal and osteological characters

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We propose phylogenetic relationships among Psittaciformes, based on morphological characters, using parsimony for analysis of data. Samples comprised 215 syringes and 208 skeletons, belonging to 91 species from 43 genera. The specimens were organized in 53 terminal taxa. Eleven specimens were not studied for either the syrinx or skeleton and are regarded as incomplete terminals for processing with missing data. A total of 101 characters (62 from syrinx and 49 from skeleton) were coded, and these characters were used in repeated analyses, with variously added incomplete samples, to construct phylogenies. For each main analysis using ordered multi-state characters, we ran an additional analysis with all characters unordered so as to verify the influence of ordering on the topologies. The resulting phylogenies were compared with those in the literature and many congruencies were found. The choice of ordering affected some components more than others, and additional analyses generated phylogenies less in accord with those in the literature. The sampled characters contain various homoplasies but the fact that our resolved phylogenies are strongly congruent with previous phylogenies reinforces the importance of morphological characters in phylogenetic studies of the Psittaciformes. Based on these results, we recommend the following changes in the systematics of the Psittaciformes: (a) recognition of two families in the Order: Nestoridae (*Nestor*, *Strigops*) and Psittacidae (remaining Psittaciformes); (b) inclusion of *A. xanthops* in the genus *Graydidascalus*; (c) inclusion of *N. nenday* in the genus *Aratinga*. Funds: CAPES, CNPq.



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Neogene biogeography of babblers

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During recent years the phylogeny of babblers has been largely resolved, and five main clades have been identified. Four clades contain most of the traditional Timaliidae + Zosteropidae and one clade is assigned as Sylviidae. Based on densely sampled multi-locus phylogenies of two of the Timaliidae subclades, Leiothrichinae (laughing thrushes, song babblers and “Turdoidea” ground babblers) and Pellorneinae (e.g. wren- and jungle babblers), the historical biogeography is reconstructed for these two sister clades. We focus on the early radiations during late Oligocene and early Miocene, and the following Miocene and Pliocene history. Here, we find intriguing patterns of evolution in terms of vicariance vs. dispersal events, as well as examples of congruent/parallel evolution, and we evaluate the impact of historical climate changes on timaliid evolutionary history. Both large scale patterns such as African – Eurasian interactions, and more detailed biogeographical patterns such as circumstances of the multiple historical colonisations of the Sunda region are investigated. The phylogenies are mainly based on DNA sequences from old museum study skins (appr. 1850 – onwards), which provides an unparalleled source of scientific material. Today, the majority of all traditional and potential babbler genera have been included in molecular studies, and a great number of genera have been shown to be paraphyletic.



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Using species distribution modeling to identify occurrences of pearly parakeet (*Pyrrhura lepida*) in the Brazilian Amazon: support for species taxonomic studies and conservation

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The Amazon region is the largest and most diverse tropical rainforest in the world. Its area covers around 6 million km² in nine different countries. Though subject of many studies, regional biodiversity is still poorly studied, especially with respect to phylogeny, species richness and species distribution. There are areas of the forest that have never been visited by scientists, many specimens yet to be described and a large number of species presenting taxonomic uncertainties. *Pyrrhura lepida* is a threatened and polytypic species endemic to the Amazon that has significant uncertainties in its taxonomic history due to its similarities with *Pyrrhura perlata*. Consequently, these taxa have been frequently misidentified confounding the results of studies of each species. One of the major questions arising from this frequent misidentification is the actual distribution of each species. Applying an ecological niche model based technique combining remote sensing, climate, and species occurrence data we aimed to indentify the most suitable areas for the *P. lepida* in order to guide field expeditions to search for known and unknown populations of the species. These expeditions are collecting genetic and morphological data to clarify phylogenetic and taxonomic questions for the group. During the expeditions we found new populations of *P. lepida anerythra*, which distribution was unclear until recently. This finding made an invaluable contribution for the ongoing taxonomic study of the group. Additionally, with validated taxonomy and maps of their current distribution we will be able to define strategies for these species conservation.



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Biogeography and sexual selection, a phylogenetic comparison between bowerbirds and birds-of-paradise

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The decorated bowers built by male bowerbirds (Ptilonorhynchidae) and the highly elongated and elaborate feathers in male birds-of-paradise (Paradisaeidae) are among the most well-known examples of sexually selected traits in birds. It has been suggested that sexual selection could generate a rapid change in sexual selected traits and be a powerful force in speciation, but this is not supported by published data on birds-of-paradise. Here I present a species level phylogeny of the bowerbirds. The phylogeny is used to study the evolution of sexually selected trait in bowerbirds, and to compare these results with the situation in birds-of-paradise. As bowerbirds and birds-of-paradise show similar and complex biogeographical patterns, where most species and subspecies are locally and disjunctly distributed on New Guinea and Australia, the biogeographical history of these two families are also compared.



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The Central American land bridge as an engine of diversification in New World doves

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The closure of the Central American land bridge connection between North and South America 3.5 million years ago was a major biogeographic event that allowed considerable interchange of the previously isolated faunas of these continents. However, the role that this connection may have played in diversification of North and South American faunas is less well understood. With the potential of repeated rare dispersal followed by isolation, the formation of this connection may have been an engine generating diversity. We tested this hypothesis using a molecular phylogeny for mid-sized New World doves that was dated using internal calibration points for endemic island taxa with known ages. This tree was well supported and recovered monophyly of the genera *Leptotila* and *Zenaida*, but the quail-doves (*Geotrygon*) were paraphyletic, falling in three separate lineages. This tree indicated at least eight dispersal driven divergence events between North and South America, with the majority being from South to North America. All of these events occurred at the time of or after the formation of the Central American land bridge, indicating that this land connection played a role in facilitating dispersal of doves between continents.



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Occurrence and seasonality patterns of *Thalassarche chlororhynchos* and *Thalassarche melanophris* on the coast of Rio de Janeiro, Brazil

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The genus *Thalassarche* comprises 9 species of albatrosses. Four occur on the Brazilian coast, including *Thalassarche chlororhynchos* and *T. melanophris*. Both are considered threatened nationally and internationally. Information on their distribution and migratory pathways is crucial for conservation. The aim of this study is to provide new information on occurrence and seasonality patterns of *T. chlororhynchos* and *T. melanophris* on the coast of Rio de Janeiro State. From November 2008 to October 2009, beach monitoring surveys were conducted for recording carcasses along a 46 km sandy beach between Saquarema (22°56'14"S, 42°28'25"W) and Arraial do Cabo (22°58'15"S, 42°1'59"W). Approximately 800 km was patrolled and 202 carcasses were recovered. In addition, offshore seabirds censuses were conducted in Campos Basin from 15-20 May 2009. 24 *T. chlororhynchos* carcasses were recovered, representing the third most abundant beached seabird. Records were between early May and early October, with peaks in June and August. 70% were juveniles. During the censuses, 147 *T. chlororhynchos* were sighted. Only 3 carcasses of *T. melanophris* were found, all juveniles, in June, July and August; none was sighted during the offshore survey. The greater abundance of *T. chlororhynchos* could be explained by its preference for warmer waters. In addition, our data indicates the regular use of coastal Rio de Janeiro by *T. chlororhynchos*, which has important conservation implications for the species.



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Phylogenetic relationships of Thamnophilidae of the Atlantic Rainforest

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Previous studies on the molecular phylogeny of the Neotropical family Thamnophilidae have focused almost exclusively on species from Amazonia. In the present study, we inferred the phylogenetic relationships of a set of Atlantic Forest endemic genera and taxa based on three mitochondrial genes: cytochrome B (cytB) (446bp), ND2 (491bp) and ND3 (279bp). These sequences were combined with previous data from other taxa available in GenBank. DNA substitution models were chosen using jModelTest and analyses were performed using maximum likelihood and Bayesian inference. Results indicate considerable genetic divergence between the Amazonian *Myrmotherula axillaris axillaris* and Atlantic Forest *M. a. luctuosa* (uncorrected p distance 0.04 for cytB, 0.05 for ND2 and 0.04 for ND3). This suggests the possible species status for the latter, since it also has morphological and vocal differences from *M. a. axillaris*. Data from cytB alone and from ND2 and ND3 analyzed together suggest that *Myrmotherula gularis* does not belong to this genus, always being far from *M. brachyura* (type for the genus) and in a clade containing *Cymbilaimus*, *Dichrozona*, *Batara*, *Hypoedaleus*, *Frederickena*, and *Mackenziana*. This suggests that *Rhopias* (Cabanis and Heine, 1860) may be revalidated, being another genus endemic in the Atlantic Forest. Parsimony reconstructions of the biomes occupied by the Thamnophilidae taxa shows that the Atlantic Forest was colonized at least by eleven different lineages, with two possible reversions from the Atlantic rainforest to the Amazon.



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Scientific potential of the paleornithology collection of the Laboratório de Paleontologia do Museu de Ciências Naturais da PUC Minas

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Fossil bird bones are not uncommon in many geological deposits, despite their apparent fragility, and are good indicators of environmental changes that may have occurred, and obviously contribute to the understanding of their natural history. In recent years, several studies carried out by Castor Cartelle from Laboratório de Paleontologia da PUC Minas and colleagues, included the discovery of fossils in caves in Bahia (Brazil), with mostly mammals of the Pleistocene megafauna. However, much material remains to be studied, as in the case of fossil birds. From this paleo-ornithological material at the Laboratório de Paleontologia do Museu de Ciências Naturais da PUC Minas, relevant work has been produced. For example, the description of *Wingegyps cartellei* (Alvarenga and Olson, 2004) and a review of the biogeography of species of macaws (Psittaciformes, Psittacidae) *Anodorynchus glaucus* and *Anodorynchus leari* (Alvarenga, 2007), among others. The paleo-ornithological collection currently has more than 2.000 pieces among Tibiotarsus, sternum, metatarsals, coracoids, femora, ulna, radius and synsacrum mostly well preserved and not studied, from various locations in Brazil. This collection has a great scientific potential and actually is undergoing revision and reorganization, and will be available by the end of 2010.



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Two sharp transition zones between *Xiphorhynchus guttatus* subspecies in the upper R o Orinoco basin of southern Venezuela

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Xiphorhynchus guttatus occurs primarily in the Amazon and Orinoco river basins, but with populations that occur in central Brazil and the Atlantic forest. Aleixo (2002) recommended, on the basis of mtDNA evidence, the elevation of some Amazonian populations to a full species, *X. guttatoides*. Sequence divergence was indeed high between *X. g. polystictus* and *X. g. guttatoides*, the two subspecies that occur in Venezuela, but Aleixo's samples were from geographically distant Brazilian locations in Amap  and Amazonas. We document two zones of phenotype transition with limited overlap along a roughly 500 km transect on the upper reaches of the Orinoco and Ventuari rivers in southern Venezuela. On both rivers, we found transitions from *X. g. polystictus* in the north to *X. g. guttatoides* in the south that appear to be little influenced by the rivers. Song-type changes from one taxon into the other with little or no intermediacy despite no obvious geographic barrier. By contrast, birds in both transition zones show signs of morphological introgression, with bill coloration intermediate in some birds, and overall size varying clinally from smaller in the north to larger in the south. Preliminary genetic analyses in an mtDNA marker (ND2) revealed an approximately 5% divergence between these two populations, even in the zones of geographic overlap. We plan to expand on our genetic analyses to better assess the degree of hybridization in these zones. Limited data suggest that the breeding seasons of these taxa may differ, with *X. g. polystictus* singing and in breeding condition during the late dry season, when nearby populations of *X. g. guttatoides* were apparently not breeding.



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Osteology of the New World nine-primaried Oscines – inferring relationships in a very diverse group of passerines

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The New World nine-primaried Oscines are a very diverse group of passerines, including the families Fringillidae, Emberizidae, Thraupidae, Parulidae, Cardinalidae, and Icteridae. Despite this diversity, both anatomical and molecular studies indicate that the group is monophyletic. Recent molecular studies have challenged traditional relationships within this group, but there have been no recent studies taking anatomical characters into account in cladistic approaches. Our objective was to find and describe characters from skeletons of members of the Fringillidae, Emberizidae, Thraupidae and Cardinalidae for a future phylogenetic analysis of this group. The post-orbital process is present in variable sizes in most species, but absent in *Dacnis* and *Coereba*. The orbito-nasal foramen is either slit-like (most species) or oval (e. g. *Tachyphonus coronatus* and *Schistoclamys ruficapillus*), while the lacrimal is absent in most species, it is present only in *S. ruficapillus*, *Ramphocelus bresilius*, *Tangara cayana* and in the three species of *Thraupis* studied. The palatine process of the premaxilla is fused to the maxillary process of the palatine in most species, being partially free only in *Tersina* and *Piranga flava*. The *pars lateralis* of the palatine bone is vestigial in *Tersina* and *R. bresilius*, being more developed in the other species. The rostro-medial process of the palatine is absent in *Euphonia pectoralis*, *E. violacea* and *Zonotrichia capensis* while the *spina interna* of the sternum is absent in most species, being present in *Tersina*, *Chlorophanes*, *Cyanerpes cyaneus*, *Coryphospingus pileatus*, *Paroaria dominicana* and *Tachyphonus coronatus*. The *tricipital fossa* of the humerus presents pneumatic foramens only in *R. bresilius*, *Thraupis palmarum*, *Tachyphonus coronatus* and *Saltator similis*. The variation found in the characters shows no agreement with proposed family boundaries, and more taxa need to be included to perform a more complete phylogenetic analysis.



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Cranial osteology of the black-collared hawk (*Busarellus nigricollis*, Accipitridae) and the non-monophyly of traditional buteonine hawks

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The black-collared hawk is a piscivorous accipitrid usually found near rivers, lakes, mangroves and other aquatic habitats in the Neotropical region. Placed in the monotypic genus *Busarellus*, this species has been considered to be closely related to the buteonine hawks, particularly with the genus *Buteogallus*. Despite this phylogenetic attribution, we were impressed by the striking cranial morphology of the black-collared hawk when compared to other buteonine taxa. Such characters include a lacrimal bone with a short orbital process, the zygomatic process longer than the suprêmeatic, the *foramen magnum* directed caudally, a relatively inconspicuous *proeminentia cerebellaris*, a *crista nuchalis transversa* with an inverted U-shape, and the *quadrato-quadratojugal* articulation posterior to the postorbital process. To test the monophyly of the buteonine hawks, a phylogenetic analysis of 59 cranial characters from 37 accipitrid taxa, including the majority of the buteonine hawk genera, was conducted. Results suggest that *Busarellus nigricollis* does not belong to the buteonine assemblage since it appeared within the sister group of the Buteoninae that also included the non-buteonine genera *Haliaeetus*, *Spizaetus* and *Aquila*. After character optimization, the skull features of *Busarellus nigricollis* revealed a great number of autapomorphies (including all the characters cited above) that are not shared with any of the buteonine taxa sampled. In this context, this study shows that the reinterpretation of osteological characters can provide important insights into the systematics of this group. Financial support: CNPq.



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Systematics and biogeography of Chloropseidae and Irenidae

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We present the first molecular phylogeny for the bird families Chloropseidae (leafbirds) and Irenidae (fairy-bluebirds) based on nuclear and mitochondrial DNA data. Dense taxon sampling was obtained by using DNA extractions from old museum skins. The study confirms the relationship between the two groups and their placement near the base of the large Passeroidea radiation. Relationships within the two families have so far been based on morphological variation only and many uncertainties still surround the classification and taxonomic ranking of many populations. In the present study representatives of all distinct populations will be included in order to obtain a well supported phylogeny and a better interpretation of species limits, the diversification history and biogeographic patterns. These patterns are interpreted in relation to the complex plate tectonics of southeast Asia, with particular attention to the colonization of the Philippine archipelago. Many taxa of fairy-bluebirds and leafbirds have declined significantly because of trapping for the cage-bird market, and the classification based on molecular phylogenetic relationships may improve the basis for revision of the conservation status of these birds. The project is part of a broader, collaborative project covering the largest avian radiation, the Passeriformes.



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Chromatic polymorphism in *Lathrotriccus euleri* (Cabanis, 1868) (Aves, Passeriformes)

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Euler's flycatcher, *Lathrotriccus euleri*, (Tyrannidae) has a dark grayish brown color, lighter belly, whitish jaw and black maxilla. Its mouth lining and tongue color distinguishes two morphological types, orange or pinkish, even in sympatric individuals. This pattern and the fact that mouth lining and tongue has been know to be highly conservative in Tyrannidae, suggests that two cryptic species or a undescribed polymorphism could be involved. The present study describes external morphology of live and museum specimens, as well as calls and molecular variations of *L. euleri* in Minas Gerais, southeastern Brazil. These descriptions were used to examine whether this variation is individual, within the group, or as an interespecific variation. These data were analyzed with a t-test and a principal component analysis, to verify their relationship with the mouth lining and tongue color. Data were collected mainly in fragments of semideciduous Atlantic Forest in Viçosa county (20° 48' S, 42° 51' W). *Lathrotriccus euleri* showed little variation in plumage color and no significant difference in measures among specimens with different mouth lining and tongue colors. Calls also did not show significant variation between the two morphological types of *L. euleri*. DNA analysis using the RAPD-PCR technique has not allowed to separate the two morphological types of *L. euleri* in different groups. Only one specimen, from Santa Maria do Salto, in northeastern Minas Gerais, with mouth lining and tongue, both orange, showed a molecular pattern distinct from the others. According to these results, *L. euleri* has color polymorphism, presenting two morphs for mouth lining and tongue color, one pinkish and other orange, not due to sexual differences.



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The systematic position of *Calyptura cristata* revealed by sequence data from multiple genes

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The kinglet calyptura (*Calyptura cristata*) is one of the most enigmatic bird species in South America. It is known only from specimens collected in the 19th century and two recent sightings, and its ecology and behaviour are almost completely unknown. Due to the lack of data on its ecology and to its unique appearance, the systematic position of *Calyptura* has remained obscure. Traditionally, it was placed in Cotingidae, but there loosely associated with genera that are now known to fall outside that family. A relationship with *Piprites* has also been proposed, based mainly on vague similarities in external appearance and assumed similarities in behaviour. *C. cristata* is reasonably well represented in museum collections and with improved extraction and PCR techniques it is often feasible to obtain good quality sequence data from study skins dating from the early 19th century. In an attempt to clarify its systematic position, we sequenced multiple genes for *C. cristata* and incorporated this into a comprehensive dataset of Tyrannides. Our data show that *C. cristata* is a deep branch in the tyrannid phylogenetic tree, most closely related to *Platyrinchus*, *Neopipo* and *Tachuris*, all early offshoots from the branch leading to the tody-tyrants and flatbills (Rhynchocyclidae).



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Systematic and biogeography of the genus *Conopophaga* (Aves: Passeriformes)

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Here we examine the historical processes of diversification of genus *Conopophaga* in South America. Two mitochondrial DNA sequence matrixes were used to perform the phylogenetic analyses. The first one comprising 2270 characters (941 bp of ND2, 343 bp of ND3 and 986 bp of cytochrome b - *cytb*) and the second one comprising 878 characters (461 bp of ND2 and 417 bp of *cytb*). The results showed that the genus *Conopophaga* is monophyletic, and after the divergence of *C. melanogaster* and *C. melanops*, a rapid diversification occurred. This diversification resulted in two groups: (1) Amazonian species, with the ancestral black jaw and (2) a group with white jaws that is found in both the Amazon and the Atlantic forest. Within the last group, subspecies *C. l. cearae* did not group with other *C. lineata* individuals suggesting that this species is not monophyletic. Moreover, the distribution pattern of species presenting white jaws indicates a possible past connection between the east of the Amazon and the Atlantic forest. Finally, the occurrence of vicariant events, such as geological disjunctions and climatic oscillations, may have influenced the diversification of this genus. Dispersion events and/or selection should also be considered for the understanding of the biogeographic history of this and other groups in South America. Funds: FAPESP, CNPq, and CAPES.



Phylogenetics analysis inferred from morphology and osteological contributions to the systematics of turacos (Musophagidae)

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The turacos are afrotropical plant-eaters birds and comprise six genera and 23 species in three subfamilies. Phylogenetic approaches within turacos have been investigated with molecular, vocal and morphological data but none based on osteological characters. In this study we performed a cladistic analysis with all turaco species on the basis of 51 osteological characters and including another 34 plumage characters from the literature. The analysis resulted in four equally parsimonious trees (172 steps) and the ambiguous relationships are concentrated only among *Tauraco* species. The turacos are divided into two distinct groups: 1) (*Corythaixoides*, *Crinifer*) (9 synapomorphies, bootstrap of 67% and bremer of 7) and 2) (*Corythaeola* (*Musophaga* (*Tauraco*, *Ruwenzorornis*))) (11, 77%, 10). These subfamilies arrangements (Criniferinae, Corythaeolinae and Musophaginae) are in agreement with others phylogenies. *Tauraco* and *Ruwenzorornis* are close related (seven, 86%, 6), in contrast with molecular data where *Tauraco* is closely related to *Musophaga*. Although the most taxa have their validity (sensu Turner 1997) confirmed, the *Tauraco porphyreolophus* is more closely related to *Ruwenzorornis* than to others *Tauraco*. *Gallirex porphyreolophus* (Vigors, 1831) is a valid taxon, in agreement with molecular and morphological studies. In conclusion, the osteological data do not dramatically change the turacos phylogeny, but the resolution is better when they are included. This to lead us to affirm that the phylogeny of turacos is stabilized, except for the position of *Tauraco* and the relationships among some species within this genus.



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Insights into the phylogeny of the family Threskiornithidae

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The Family Threskiornithidae is traditionally divided into two subfamilies: Plataleinae and Threskiornithinae. Here we test monophyly of this family and its subfamilies. DNA samples were obtained for three species of Threskiornithidae (*Platalea ajaja*, *Plegadis chihi*, and *Eudocimus ruber*) and two outgroups: *Ardea alba* and *Mycteria americana*. We sequenced the 16S rRNA gene (16S, 600 bp) and the intron 7 of beta-fibrinogen (FIB7, 1000 bp). Sequences from other species of the family were obtained in GenBank: six sequences of 16S and three of FIB7. Phylogenetic trees were constructed by various inference methods. Family Threskiornithidae formed a monophyletic group strongly supported. Trees based on 16S support weakly the monophyly of Plataleinae, and Threskiornithinae formed a paraphyletic group. Surprisingly, Plataleinae was placed close to *Geronticus eremita* and to *Threskiornis aethiopicus* with good support, and *E. ruber* has a long branch in a basal position. Trees based on FIB7 showed two strongly supported groups: one comprising *P. ajaja* and *P. chihi* and the other comprises *E. ruber*, *E. albus*, *Theristicus caudatus*, and *T. caerulescens*; Threskiornithinae clearly is a polyphyletic group. Family Threskiornithidae is widely accepted as a natural group being corroborated by this study. However, current classification in two subfamilies should be evaluated. Morphological studies disagree on the monophyly of these subfamilies, which sometimes were placed as separate families while other studies found Threskiornithinae as a paraphyletic group. Increased sampling of genera and species will give us a better insight into the evolutionary relationships within this group. CAPES – FAPESP.



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Taxonomy and geographic variation of the versicoloured emerald (*Agyrtria versicolor* Vieillot, 1818) (Aves: Trochilidae)

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Taxonomic discussions about *Agyrtria versicolor* date from its discovery, and continued as new taxa of the group were described. As many as 12 taxa have been involved in discussions concerning its nomenclature, diagnosis and specific and subspecific status. Although a general consensus has been achieved, its practical applicability still remains limited. The present study reviewed the taxonomy of *A. versicolor*. Skin (n = 520) analysis focused on plumage characters and lengths of the wing, exposed culmen and of the central pair of the rectrices. Complementary field work, including sampling of specimens and vocalization recordings in southeastern Brazil, enabled us to examine morphotypes usually referred to as intermediates, as well differences regarding sex and ontogeny. Our analysis suggests that five taxa are valid species and encompass all variation: *Agyrtria versicolor* (Vieillot, 1818), *Agyrtria brevirostris* (Lesson, 1829), *Agyrtria millerii* (Bourcier, 1847), *Agyrtria chionopectus* (Gould, 1859) and *Agyrtria rondonie* (Ruschi, 1982). Therefore, in view of the well established existence of sympatric taxa in southeastern Brazil and the concordance of Lesson's description of *Ornimya brevirostris* (1829) with the second taxa of the southeast, we agree with Hartert's suggestion (1900) of an erroneous type locality for *A. brevirostris* (Guiane), in which the correct type locality would actually be southeastern Brazil, thus validating both priorities of Lesson (1829) and Gould (1859) on *Agyrtria brevirostris* and *Agyrtia chionopectus*, respectively.



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A recent arrival to the Galápagos Islands: colonization history of *Myiarchus magnirostris*

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The Galápagos Islands have never been connected to any continental land masses and understanding the population structure of species that live there and their affinity with closely related continental counterparts can elucidate the colonization history and diversification in the Galápagos. We analysed the phylogenetic placement of *M. magnirostris* within the genus *Myiarchus* by using the genes ND2 and CytB (1970bp) to compare 16 species out of the 22 that this genus comprises. We also analysed the variability in CytB sequences from 154 *M. magnirostris* individuals captured in seven islands from Galápagos. Our phylogenetic analyses recovered the two main *Myiarchus* clades that had been previously described by other genetic, morphological, and vocal analyses. *M. magnirostris* is monophyletic and belongs to a clade that comprises 2 lineages: one with *M. magnirostris* and *M. tyrannulus* from Mexico and Central America, and another with *M. nugarator* (San Vincent & Grenada) and *M. tyrannulus* from South America. This shows that the species currently defined as *M. tyrannulus* is paraphyletic. The genetic divergence between *M. magnirostris* and *M. tyrannulus* from Central America is 0.0156, allowing us to estimate that these two groups have been separated for around 750,000 years. This is a relatively recent arrival time to the Galápagos by their common ancestor. Regarding *M. magnirostris* only, total nucleotide and haplotype diversity were very low ($P_i = 0.0009$ and $h = 0.4913$). One single DNA haplotype was found to be the most common in all islands and a few haplotypes, not very divergent from this one, are rare and specific to each island. Our results suggest that *M. magnirostris* had a single colonization event and a recent population expansion in the Galápagos archipelago.



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Evolutionary stability of diversity patterns in African estrildid finches (Estrildidae)

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Ecological niche models have been used in a wide area of application, e.g. to predict the potential distribution of invasive species or to identify species' past or future potential distributions. In this study, we used Maxent to estimate the potential distribution of a species group for current and past diversity patterns of 61 species of African estrildid finches. Analyses were computed to predict the potential distribution under current conditions; models were then projected onto two past climatic scenarios (CCSM, MIROC) representing the Last Glacial Maximum. Overlay of the resulting models was conducted under unlimited and limited dispersal assumptions, followed by a comparison with expert maps. Our results suggest similar current distribution patterns obtained by Maxent estimations and expert maps. Both pleistocene scenarios showed similar patterns. For limited dispersal we suppose only slight shifts of diversity hotspots, but under unlimited dispersal conditions hotspots were less concentrated with additional diversity centres mainly in western Africa. Diversity hotspots of forest species under MIROC conditions were consistent with suggested forest refugias. savanna species were more widely distributed during the drier conditions of the pleistocene. Our models suggest that current African estrildid finch diversity patterns have changed at least slightly since the pleistocene. However, we emphasize the importance of different climatic scenarios as well as supposed dispersal of organisms influencing results on a broad scale.



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Molecular and bioacoustic differentiation of Taiwan endemic passerines

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The Island of Taiwan has 17 endemic species and 60 endemic subspecies. We investigated the phylogenetic relationships of five passerine endemics inhabiting the Central Mountain Range. Phylogenies were inferred from mitochondrial and nuclear gene sequences and partly from flanking bioacoustic analysis, too. A relaxed molecular clock was applied to the sequence data in order to estimate time intervals for passerine invasions to Taiwan. Closest relatives of all Taiwan endemics investigated were found in the Sino-Himalayan region. Even the Taiwan firecrest, *Regulus goodfellowi*, resulted as the sister species of the Eurasian goldcrest assemblage (*R. regulus*). These genetic results are strongly supported by discriminant and cluster analysis of song parameters. Similarly high genetic divergence of Taiwan populations from their continental relatives was found in two finch species: the grey-headed bullfinch (*Pyrrhula erythaca*) and the vinaceous rosefinch (*Carpodacus vinaceus*). Two other passerine species showed no particular phylogeographic structure with respect to the populations from Taiwan: brown bullfinch (*Pyrrhula nipalensis*) and coal tit (*Parus ater*) are probably among the youngest descendants from continental Chinese populations that invaded Taiwan during the late Pleistocene era. This project was substantially funded by the German Ornithologists Society (DO-G) and the Gesellschaft für Tropenornithologie (GTO).



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A species-level phylogeny of the nightjars (Caprimulgidae)

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The nightjars are the most diverse family of the Caprimulgiformes with over 80 recognized species in 15 genera and high intraspecific diversity for a number of widespread species. Previous work suggests geographic structure within the species-level phylogeny as well as paraphyly of certain genera. We present a phylo-species level molecular phylogeny of the nightjar family, with emphasis on New World species that includes most North, Central and South American nightjar species and their subspecies as well as representatives from a monophyletic Old World clade and from the more basal Old World genus *Eurostopodus*. Our results support that there is clear geographic structure within the family, with continental nightjar faunas being separated into major monophyletic clades. Our results also have implications for the current taxonomy as we support the paraphyly of the speciose genus *Caprimulgus*, which is found in a number of large clades on the tree.



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Taxonomy, biogeography and conservation of the pearly parakeet (*Pyrrhura lepida*: Psittacidae)

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The pearly parakeet (*Pyrrhura lepida*) is found in southeastern Amazonia, where it inhabits *terra firme* forest. This poorly known species, which is also rare in scientific collections, is currently accepted to comprise three taxa: *P. l. lepida*, *P. l. coerulescens*, and *P. l. anerythra*. The present study aimed to review the validity of those taxa based on morphological and morphometric characters, and determine their distribution. We analyzed 96 specimens, including the types of all nominal species involved. Our data showed that the purported diagnostic characters of *P. l. coerulescens* are within the individual variation found in the nominate taxon and therefore that name must be considered a synonym of *P. l. lepida*. On the other hand, *P. l. anerythra* has consistent diagnostic characters and must be considered a valid species. This latter taxon differs from its closely related taxa by the green underwing coverts and the dark red spot on the belly. Morphology showed a trend of greater values of wing and culmen length for *P. anerythra* compared to those of *P. lepida*, although there is some overlap. Both taxa are endemic to the Amazon basin, with *P. anerythra* restricted to the Xingu-Tocantins interfluvium, whereas *P. lepida* occurs from the right bank of the Tocantins river eastward to west Maranhão. Given that about 70% of the range of *P. lepida* has been deforested, this species should be considered as threatened.



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Predicting the potential distribution of the invasive common waxbill *Estrilda astrild* (Passeriformes: Estrildidae)

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Globalization has led to an increased spread of non-indigenous species. Alien invasive species can have a major impact on many aspects of ecological systems. Therefore, the ability to predict areas potentially suitable for the alien species which are hence at high risk has become a core task for successful management. The common waxbill *Estrilda astrild* is a widespread African species, originally endemic to areas south of the Sahara with some distributional gaps in rainforests and some arid regions. Common waxbills have been successfully introduced to many parts of the world, e.g. the Iberian peninsula, Brazil, and various tropical islands. Herein, we used MAXENT to assess its current potential distribution based on species records compiled from various sources (e.g. GBIF, literature data, specimens held at the ZFMK collection). MAXENT models were computed separately for the species' native range and both native and invasive range. Subsequently, the models were projected onto a future climatic scenario for the year 2100 (CCM3). The models identified the species known range as well as some regions that seem climatically well suited where the common waxbill is not recorded yet. Assuming CCM3 conditions, the models suggest poleward range shifts. However, its potential distribution within its tropical native and invasive ranges appears to be more complex. General trends are more difficult to underline. Although the results of both separate analyses showed general similarities, many differences have become obvious. Therefore, we call for care when selecting species records for modelling purposes.



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Taxonomy of the *Momotus momota* complex of northern South America and adjacent areas

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The revision of the genus *Momotus* by Chapman divided this genus into seven species, but Peters in 1945 reduced this to two: the rufous-crowned *mexicanus* and the highly variable *momota*, all taxa of which have blue crowns or diadems. Recent work in South America indicated that this complex might include at least two species, but there had been little agreement regarding which and how many taxa should be recognized. I examined over 500 specimens of ten taxa of this group and used 14 characters of plumage pattern and five morphological variables, as well as measurements of sonograms of the hooting primary song of all taxa, employing ANOVA, discriminant and principal component analyses to resolve this question. My criteria for recognizing species were diagnosability and the likelihood that the differences found would contribute to reproductive isolation, since most taxa are allopatric. I also compared my results with a recent phylogeographic analysis by Witt of the motmots. I conclude that five species-level taxa of *Momotus momota* may be recognized within the area studied: *lessonii* of southern Central America, *subrufescens* of transandean South America, *momota* of cisandean South America, *aequatorialis* of the Andes and *bahamensis* of Trinidad-Tobago. My analysis is essentially a return to the classification of Chapman, save that the transandean *argenticinctus* belongs with *subrufescens* and not *momota*, in agreement with Witt's phylogeographic study. Several named subspecies of *subrufescens* were also synonymized as undiagnosable.



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Alpha taxonomy of *Synallaxis stictothorax* Sclater, 1859 (Aves: Furnariidae)

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Synallaxis stictothorax Sclater, 1859 comprises three subspecies, the nominal (Guayaquil, Ecuador), *S. s. maculata* Lawrence, 1872 (Tumbez, Peru) and *S. s. chinchipensis* Chapman, 1925 (Chinchipe river, Peru). One of the greatest problems regarding the understanding of this group is the few specimens available in natural history museums. Ridgely and Tudor (1994) regard *S. s. stictothorax* and *S. s. chinchipensis* as independent species based on different plumage patterns. This treatment was followed by Ridgely and Greenfield (2001) and rejected by Remsen (2003) who opted for maintaining them in the same species due to lack of published strong evidence supporting their separation. Our purpose here is to provide a review of the taxonomy of *S. stictothorax* based on vocalization and morphology. We have analyzed 50 specimens and 20 vocalizations of this species group, including the types and their original descriptions. Two taxa presented good morphological characters proving to be valid species: *S. stictothorax* and *S. chinchipensis*. Among the diagnostic characters that support the independence of these two species, two are notably conspicuous: (1) the front color of *S. chinchipensis* is chestnut while this region is striated white in *S. stictothorax*; (2) the superciliary stripe is also chestnut in *S. chinchipensis* and white in *S. stictothorax*. Both species are also diagnosable by morphometry, as there is no overlap among measurements. *Synallaxis chinchipensis* is always larger than *S. stictothorax* in bill and tail lengths. Our analysis has also shown that *S. s. maculata* is based on specimens that represent a polymorphism included in the overall variation of *S. stictothorax* and thus it must be considered as its synonym.



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Insular group variation in the male territorial hooting call of the elegant scops owl (*Otus elegans*) in the Ryukyu archipelago, Minami-daito, and Ranyu Islands

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The elegant scops owl *Otus elegans* is divided into four subspecies in east Asia. The nominate race *elegans* has the widest distribution, over 900 km, however a wide oceanic trench (270 km) separated the area into two island groups. Two endemic populations on oceanic islands, Minami-daito Island in Japan and Ranyu Island in Taiwan are identified as subspecies, *iterpositus* and *boterensis*, respectively. It is predicted that the later two populations are strongly isolated from the other populations. To discriminate among the male territorial call of subspecies, calls of 718 individuals were recorded from 22 islands during breeding seasons in 2004-08. Songs were compared among island populations in two levels of analysis: a typological analysis of call morphology (element, syllable, and call types) and a spectral analysis of four acoustic characteristics of calls (frequency, time duration of elements, time interval of calls). The typological analysis revealed that all the islands have a basic syllable type in common. Complication and transmutation of elements occurred in a fraction of some individuals on each island. There was also a latitudinal cline of the number of syllables. Nonmetric multidimensional scaling was employed in the spectral analysis. Call of the subspecies *interpositus* was predictably unique among subspecies. Call of the nominate race *elegans* was clearly divided into two, northern and southern island groups. It was inferred that the vicariance resulted in the difference of call. Contrary to my prediction, call of the subspecies *boterensis* was just included into the southern group. Classification of the subspecies should be reviewed according to the acoustic viewpoint.



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New Zealand's avian archipelago; do ecogeographical rules apply?

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Changes in body size are widely perceived to be common aspects of the island evolutionary syndrome. The island rule suggests that smaller species evolving to become larger, and larger species evolving to become smaller. This rule has been the subject of considerable research in recent years, but its validity and widespread applicability are not universally accepted. In birds it was originally thought that the class did not conform to the rule, more recent studies have suggested they might. Related to the island rule is Bergmann's rule, which states that species increase in size with increasing latitude. We examined the patterns of size changes in birds in the New Zealand archipelago, where a number of species occupy islands spanning a wide range of sizes, degrees of isolation and latitude, allowing us to search for the effects of both rules. Measurements were taken from study skins in museum collections with known collection localities. Four commonly used measurements of body size were collected, with weight at time of collection being recorded where available. Ten species or closely related superspecies found both on the two main islands and a number of offshore islands were used.



Spatial and temporal patterns in Atlantic Forest bird evolution

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An increasing number of studies examine diversification of Atlantic Forest (AF) birds. We present a synthesis of sample studies based on mtDNA and nuclear sequences from co-distributed forest birds: *S. scansor* (SS), *A. leucophthalmus* (AL), *X. fuscus* (XF), *S. virescens* (SV), *C. lineata* (CL) and *C. melanops* (CM). The estimates of divergence time between those species and their sister taxa (Amazonian/Andean taxa) suggest that the origin of the AF lineages took place during Late Pliocene/Early Pleistocene. From the six studied species, only four showed clear phylogeographic structure (SS, XF, CL, CM). Comparisons among the structured species show a high congruence in intraspecific lineages distribution. Three main phylogeographic breaks were identified: Paraíba do Sul headwater region; Doce and Rio São Francisco rivers. The estimates of divergence time suggest that intraspecific diversification, in all species, took place during Pleistocene. The tree topologies that represent the relationships among lineages from south of S. Francisco river, in contrast, are not congruent. Results from demographic analyses points out the distinct demographic histories among AF regions. All studied species showed deep changes in effective population size in lineages from southern region. On the other hand, the lineages from central AF remained more stable through the recent time. The northern lineages of SS and XF had signals of recent bottlenecks. Non-structured species (AL, SV) also had clear signatures of recent population expansion. The time since expansion was dated to Late Pleistocene for all lineages, including for non-structured species. Our results strongly suggest that the Pleistocene climatic changes had a deep influence in the evolution of AF birds, shaping the actual distribution of intraspecific lineages, as well as the geographic patterns of genetic structure level and diversity.



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SA 13 Other Subjects



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Malaria prevalence on birds from natural/undisturbed and urban/disturbed areas of Central Brazil

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Environmental changes are considered to be one of the main forces responsible for stress on biological systems and organisms and have been linked to the increased prevalence of several infectious diseases. In the present study we compared malaria prevalence in wild birds from two protected/undisturbed areas (Cantão and Lajeado State Parks) and one urban/disturbed area (city of Palmas, Tocantins). Blood smears from 398 birds of 25 families and 95 species, were microscopically screened, 111 from Lajeado, 174 from Cantão and 113 from Palmas urban area. We found a significant greater prevalence on birds from Palmas/disturbed urban area ($n = 47$, 41.59%) in relation to Cantão ($n = 39$, 22%, $\chi^2 = 11.1$, $p = 0.0009$) and Lajeado ($n = 22$, 20%, $\chi^2 = 11.5$, $p = 0.0007$) State Parks/undisturbed areas. None of the species caught in Palmas were considered urban dependent or semi dependent (synanthropic), making us believe that the greater prevalence found on Palmas urban area birds could be direct or indirect related to landscape transformations. Indeed, Palmas, the youngest country state capital, built 20 years ago, has one of the Brazilians greatest growth rate, creating a scenery were natural areas are being rapidly transformed on semi-urbanized and finally urbanized areas. Knowing that urbanization promotes significant changes in the whole biota, favoring generalist species and homogenizing the communities, it is too early to make conclusions and relate our results to stress, vectors or a combination of factors. Nevertheless, we reported by the first time that blood parasites are negatively affecting wild bird communities in urbanized landscapes.



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Avifauna from the São Francisco River Basin

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The São Francisco River Basin (SFRB) includes 8% of Brazil's surface area and drains areas in the states of Minas Gerais, Goiás, Bahia, Pernambuco, Alagoas, Sergipe and part of the Federal District. The São Francisco river is 2,863 km long, starting at the Serra da Canastra in Minas Gerais and flowing northwards until it reaches the Atlantic ocean between the states of Alagoas and Sergipe. The SFRB comprises the biomes Cerrado (savanna), Atlantic Forest and Caatinga (semi-arid forests), these complex vegetation types result in a rich avifauna, including endemic species from each biome as well as its river basin, such as the Minas Gerais tyrannulet *Phylloscartes roquettei* and the Bahian nighthawk *Nyctiprogne vielliardi*. Based on museum specimens, field work and literature a total of 559 species were found to occur in the SFRB. This number is ~30% of the Brazilian avifauna, including the main area of distribution of a number of threatened species, such as the Lear's macaw *Anodorhynchus leari* and the Brazilian merganser, *Mergus octosetaceus*. Despite the large number of species, our knowledge is still insufficient. Few localities in the basin present bird lists with more than 100 species, a minimum number that could give us any accurate information regarding the bird diversity of the area. This low number of localities with adequate bird lists is critical for understanding possible sustainable use. Also, the SFRB is under extreme pressure for land use and management which will lead to drastic alteration of its flora and fauna.



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Movement ecology of a unique avian frugivore, the oilbird

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We studied movement patterns and foraging and roosting sites of oilbirds (*Steatornis caripensis*) in eastern Venezuela by means of newly developed GPS/acceleration loggers with remote UHF readout. We attached loggers to 12 birds in October 2007 and to 29 in August 2008 at the “Caripe Cave”, towards the end of their chick rearing period. Oilbirds are unique avian frugivores; they sally for fruit at night and during the day are reputed to roost in deep caves only. In 2007 loggers were programmed at 600 - 900s intervals between GPS fixes allowing for up to four nights recording. In 2008 they were programmed at 6h intervals once a week, allowing for up to seven months recording. On the short term we found that on average, oilbirds spend only every 3rd day in a cave, individuals spent most days sitting quietly in trees in the rainforest where they regurgitate seeds. Roosting trees were 32.0 ± 5.4 km away from caves and 10.0 ± 4.6 km away from foraging sites. On the longer term we found that the foraging range of oilbirds expanded during the non-breeding season, likely in relation to the shortage of fruit of Lauraceae in the vicinity of the Caripe Cave. Using GPS/accelerometers, which allowed for remote monitoring of the behaviour of oilbirds, we elucidated previously unknown aspects of this species' life history. We conclude that oilbirds are perhaps the most important long-distance avian seed disperser in Neotropical forests.



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Mission impossible? Flying over Everest

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Bar-headed geese (*Anser indicus*) breed in the high plateaus of central Asia. Up to half of the population overwinters in India and so traverses the Himalayas during its migrations. Most passes through the Himalayas are over 5000 m above sea level, where atmospheric pressure and partial pressure of oxygen are about half those at sea level. However, bar-headed geese have been tracked reaching altitudes of almost 9000 m, where partial pressure of oxygen is only one third that at sea-level. Rate of oxygen consumption of bar-headed geese during forward flapping flight at sea level is about 12 times the night-time resting value. In humans, maximum rate of oxygen consumption, and thus maximum sustained work rate, at an altitude of 5000 m are about 65% those at sea level. How then do bar-headed geese manage to migrate at such altitudes? A number of physiological and morphological adaptations have been identified and an important adaptation is that the haemoglobin of bar-headed geese has a greater affinity for oxygen than those of lowland geese and ducks. Captive bar-headed geese can run at a simulated altitude of 9000 m, but their rate of oxygen consumption does not increase above the pre-exercise level and so the exercise cannot be sustained. There is evidence that barnacle geese can slope soar, so it is feasible that bar-headed geese can use updrafts to give them lift as they pass over the highest peaks of the Himalayas, thus reducing their metabolic requirements quite considerably. An international team is currently investigating this possibility.



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Raptors as biological pest controllers in agricultural fields from a local to regional project

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Since 1983, barn owls (*Tyto alba*) and later Eurasian kestrels (*Falco tinnunculus*) have been used in agriculture in Israel as biological pest control for rodents. Unlike most projects, nest boxes were added in large densities (typically 200-400 m between nest boxes) and more than 95% of the nest boxes were added by farmers strictly for pest control of rodents. A national project was established to improve the use of raptors as pest controllers and to decrease pesticide use. 1,700 nest boxes and rodent populations were monitored during the 2007-2009 breeding seasons and farmers were visited to increase public awareness of secondary poisoning and proper nest box positioning. Yearly occupation of nest boxes was 32%, with nest box occupation ranging from 14% to 48% in the seven regions. Mean number of fledglings (2577 banded) per nest box was 4.3 during the three years. Occupation of nest boxes in the region was positively correlated with rodent numbers from trapping and long-eared owl diet but not with the barn owl diet. Since the success of the project in Israel, a regional cooperation using barn owls was established between Israel, Jordan and Palestinian Authority. Since the establishment of the project, rodenticide use has decreased by farmers, which will benefit both migrating and resident birds.



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Effects of organophosphate avicides for control of the red-billed quelea on cholinesterase levels in the blood of target and non-target birds

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The red-billed quelea *Quelea quelea* is a pest of small grain cereals in sub-Saharan Africa. The birds nest and roost colonially, providing targets that are controlled with organophosphate (OP) avicides or explosives, which may affect non-target birds. As blood cholinesterases are depressed by OPs, we analysed erythrocyte cholinesterase (acetylcholinesterase, AChE) and plasma cholinesterase (butyrylcholinesterase, BChE) levels in the blood of birds caught before and after spraying with fenthion to assess non-target morbidity. Amongst targets in breeding colonies, significant reductions in both enzymes were detected in nestlings (52% in AChE, 54% in BChE), juveniles (68, 80), adult females (50, 63) and adult males (62, 77) of *Q. q. lathamii* in Botswana and nestlings (20, 30), adult females (83, 84) and adult males (81, 83) of *Q. q. aethiopica* in Tanzania; the latter subspecies had greater levels for pre-control values than did *lathamii*. Nests may be protective as the reductions in enzymes of nestlings were lower than in free-flying birds. Amongst non-target birds, reductions of up to 90% were found for both enzymes in Afrotropical species and migrants from the Palaearctic such as red-backed shrike *Lanius collurio* and whitethroat *Sylvia communis*. Reductions were generally greater in BChE than AChE.



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Hummingbird (Trochilidae) pollen vectors and the pollination systems of *Prepusa montana* (Mart.) (Gentianaceae) in an area of campo rupestre vegetation in the Chapada Diamantina, Bahia State, Brazil

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Hummingbird pollen vectors for *Prepusa montana* were investigated in an area of campo rupestre vegetation in the Chapada Diamantina, Bahia, Brazil, from June to August 2006 and from April to July 2007. Hummingbird visits flowers were recorded from 06:00 to 18:00 h (totaling 240 hours), registering the frequencies and types of visits (legitimate or pillaging), foraging behavior ("trapliner" or "territorial"), and aggressive interactions. Corolla length and width and nectar concentrations were measured, and floral biology was noted. Pollination experiments were performed for spontaneous self-pollination, geitonogamy, and xenogamy. Nine species of hummingbirds were observed legitimately visiting *P. montana* flowers and making contact with their reproductive organs. *P. montana* flowers are hermaphroditic, protandric, and remain open for eight days. Seed production by spontaneous self-pollination was low ($n = 440$) and no differences were observed between geitonogamy and xenogamy ($P > 0.05$), both showing high levels of seed production (1,087 and 1,134). The territorial behavior of the Trochilinae (visiting many flowers during the entire day), and the placement of the reproductive organs of *P. montana* both facilitated cross pollination by these birds. Protandry in these flowers reduces spontaneous self-pollination as it lessens the probability of contact between the pollen and the receptive stigma of the same flower. *P. montana* is self-compatible, but dichogamy reduces spontaneous delayed self-pollination and it depends on hummingbirds for effective pollen transfer.



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Phenology of food plants used by the military macaws in Central Mexico

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Tropical dry forests have a marked seasonality in leaf, flower and fruit production. Several studies have shown that seasonal migration of parrots are common and can be correlated with spatial changes in food availability. We evaluated the seasonal variation in the abundance of flowers, fruits and leaves in two types of vegetation used by military macaws in the Biosphere Reserve Tehuacán-Cuicatlán, Mexico. In each site we noted monthly phenological changes. We followed 24 plant species in tropical dry forest of Santa Maria Tecomavaca, 25 in tropical dry forest and 13 in the contiguous oak forest at San Juan Coyula. The species used by macaws to feed in the tropical dry forest had a marked seasonality. Tropical dry forests provided feeding resources during the dry season, and when resources became scarce the military macaws moved to places where feeding resources are more abundant.



Variation in eggshell thickness of the brown booby (*Sula leucogaster*) along the Brazilian coast

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Eggshell thickness alterations have been widely studied in the past and reported as a consequence of persistent organochlorinated pollutants (POP) contamination, responsible for reduced reproductive success. But, as mentioned in some studies, one need be careful before attributing eggshell measurements to POP concentrations. In this study brown booby eggs were collected along the Brazilian coast. The São Pedro and São Paulo archipelago is 1,010 km from the city of Natal in northeastern Brazil. The archipelago of Abrolhos is 70 km away from Bahia. And the archipelago of Cagarras is 4 km from the city of Rio de Janeiro. The eggshells from São Pedro and São Paulo are the heaviest and thickest (7489.55 mg and 0.54 mm) among the eggs analyzed and their POP concentration (0.0495 ug.g⁻¹ of PCB and 0.0147 ug.g⁻¹ of DDT) is the lowest. If we compare this data to the Cagarra's data, with a much greater POP concentration (8.4039 ug.g⁻¹ of PCB and 1.8440 ug.g⁻¹ of DDT) and lighter and thinner eggshells (5106.39 mg and 0.42 mm), we are induced to conclude that the POP contamination is causing eggshell alteration. But the Abrolhos eggs also have a very low concentration of those pollutants (0.1872 ug.g⁻¹ of PCB and 0.0382 ug.g⁻¹ of DDT) with eggshells as light and thin as the Cagarras' eggs (5558.13 mg and 0.45 mm). This difference in the eggshells measurements can be explained by the geographical isolation imposed at São Pedro and São Paulo.



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Avifaunal inventory of the Floresta Nacional do Pau-Rosa, Maués, State of Amazonas, Brazil

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The Tapajós area of endemism, bound by the Tapajós and Madeira rivers, is one of the least ornithologically explored regions in Amazonian Brazil. There have been few ornithological studies in this part of the basin, and we present the results of an avifaunal inventory carried out at Floresta Nacional (Flona) do Pau-Rosa, a conservation unit in the municipality of Maues, Amazonas State. Field work took place between 16 February and 6 March 2009 and sampled six different sites in the conservation unit. We used primarily mist-net and point-count censuses, augmented by casual observations. We censused birds primarily in terra firme forest, but also in a small patch of campina and in igapó forest. We recorded 269 bird species, from a pool of more than 600 expected in the region. We found three endemic species in the Tapajós area of endemism (*Capito brunneipectus*, *Rhegmatorhina berlepschi*, and *Skutchia borbae*). Other important records involved *Aratinga pertinax*, previously known only from only a single record for the whole interfluvium, and *Conopias parvus*, known from a few sites south of the Amazonas river. In 720 net-hours, we captured 132 individuals in 54 species, with the most frequently captured being *Glyphorhynchus spirurus*, *Willisornis poecilinotus*, *Thamnomanes saturninus*, *Dendrocincla merula*, and *Pipra rubrocapilla*. In 19 hours of point-counts, 1009 individuals of 139 species were recorded, with *Cercomacra cinerascens*, *Lipaugus vociferans*, *Brotogeris chrysopterus* and *Pyrrhura perlata* being the most abundant. Given the preliminary nature of the study, the number of species recorded was considered satisfactory, but more expeditions will increase considerably the list of species known for Flona Maues.



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Consequences of breeding and molt overlap on body condition for Neotropical mountain birds

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It is commonly acknowledged that costly events in the life cycle of organisms, which demand energy and resources, are separated in time. However, recent data suggests that overlapping of such events may be more common than previously suspected. Birds from Neotropical cloud mountain forests were surveyed to assess their reproductive and molting conditions during 13 consecutive months during 1999-2000 and two months during 2008. All individuals were examined for reproductive state by unilateral laparotomy, determining active gonadal enlargement and generating a gonadal index for each species. Molt was scored in flight feathers following the BTO method with modifications into a state of plumage index (EMA). Overlap of both events was found for more than 70% of individuals showing a gonadal index >0.6 in both females and males. Also, the overlap was restricted to individuals with advanced and heavy molt in flight feathers, having 3-4 wing and 2-3 tail feathers molting at different stages. All individuals showing overlap had lower furcular fat scores, presented more ectoparasites, and had less body weight than individuals in either of the stages or in none of them. Species with lower mobility presented the least decrement in body weight when compared to highly mobile species. Differences could also be related to local resource availability and weather conditions. Overlapping of both events presents a great challenge for each individual, in which initial body condition and its change over time is a constraint they must overcome. Detailed energetic and behavioral measurements are being studied to determine costs and their possible effects when both events overlap.



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The avifauna of the coffee-producing region of Colombia: promoting bird conservation in a rural landscape

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A global challenge for bird conservation is to monitor avian communities and to identify conservation tools in rural landscapes with increasing deforestation. We present the results of the studies conducted by Cenicafé, the research branch of the association of Colombian coffee growers, on birds in coffee-producing regions of Colombia. Coffee is the main agricultural crop at elevations that range from about 1000 to 2000 m. Using a diversity of sampling methods to answer several different research questions in more than 69 localities, we have already registered 504 bird species, which is close to 26% of the total for Colombia, and 60% for the entire Andean region. This includes 30 boreal migrants, 35 endemic or almost endemic species, and 26 in the red list. We have found that shade production systems make a significant contribution to regional bird diversity, and harbour many forest and migratory species; but the value of the shade depends on its composition, structure, and regional context; that forest remnants provide habitat for many specialists, and the most vulnerable species; and that many species have become locally extinct. To promote bird conservation in this landscape, we propose several tools to be applied at the farm or regional scales: conservation of forest fragments; use of heterogeneous and complex shade systems; increases in connectivity with life fences, forest corridors, and shade coffee plots; adoption of environmental certification models to coffee production; and adoption of environmentally sound agricultural practices. We also found that participatory research programs can be an effective way to promote cultural changes towards bird conservation among rural communities.



Delayed plumage maturation in the tawny-bellied Seedeater (*Sporophila hypoxantha*)

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Differences in avian and human visual systems sometimes conceal plumage color differences to the human eye that are perceived by birds. The tawny-bellied seedeater (*Sporophila hypoxantha*) is sexually monogamous and dichromatic species, but it is virtually impossible for the human eye to distinguish between females and juveniles. We analyzed plumage maturation in this species using reflectance spectrometry. We captured 52 individuals at Formosa Province, Argentina, and maintained them in captivity until they completed the first post-reproductive molt. We analyzed plumage coloration in three groups: adult males, females and juvenile males. All individual were sexed genetically. We took measurements on four body parts (throat, breast, belly and crown) and calculated four spectra variables (brightness, UV-blue chroma, green chroma and red chroma). Spectrometrical analyses confirmed color differences observed between adult male and female plumage, and unveiled color differences between the plumage of females and juvenile males. Juvenile males also differed from adult males throughout the first year, but this difference disappeared in after one-year old individuals in almost every measured body region, except for crown plumage, where they still differed from adult males in all variables except in brightness. Our results indicate that tawny-bellied seedeaters have delayed plumage maturation and during the first breeding season one-year old males differ from older ones. Whether females are capable to distinguish these plumage color differences and choose males accordingly still deserves further research.



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Extreme flexibility in reproductive behavior: tests of alternative mating hypotheses

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Mating behavior is often viewed as a static characteristic of populations. Classification of a population's mating "system" implies that individuals express similar patterns of reproductive behavior and experience similar ecological or social circumstances. Recent observations suggest that behavior may be flexible at the level of the individual, yet few hypotheses explain the origin and maintenance of individual flexibility in the context of reproduction. We used ecological, social and genetic data collected during 2000-2003 from 358 radio-tagged, mature northern bobwhites (*Colinus virginianus*) and 841 bobwhite offspring to test the hypothesis that individual, reproductive behavior is flexible. We observed nine, distinct, social-genetic mating patterns in the population within- and across-years; observations consistent with flexible individuals. We conducted comparisons between our data and predictions generated from alternative mating hypotheses, including the: polygyny threshold hypothesis (Orians 1969), Emlen and Oring (1977) model, intra-sexual aggression hypotheses (Wittenberger and Tilson 1980), female constraint hypothesis (Gowaty 1996), and switchpoint theorem (Gowaty and Hubbell 2009). We discuss our observation of apparent reproductive flexibility in light of these classic and contemporary hypotheses.



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Élio Gouvêa bird collection from Museu da Fauna e da Flora of Itatiaia National Park: research and diffusion

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Itatiaia National Park (INP) in southeastern Brazil, in the Serra da Mantiqueira (22°45' S, 44°15' W) has a total area of ~30,000 ha of predominantly Atlantic Forest at elevations ranging from 600 to 2791m. Since the beginning of the last century, INP has attracted special attention because of its fauna, especially the birds. The avifauna of INP was previously studied by several authors, such as Olivério Pinto (1954), and more recently by Lima & Rennó (2009), who recorded a total of 352 species. Élio Gouvêa, an employee of INP, developed various studies and collections on the local biodiversity and also contributed to the creation of the Museu da Fauna e da Flora. Élio Gouvêa bird collection amounts to 936 specimens belonging to 260 species of several families. His collection was recently (2007) donated to the Museu Nacional (MN), Rio de Janeiro, where the specimens are being cataloged, correctly identified, labeled and restoration. The goal of this study is to make public the existence and importance of this collection through a catalog with general information on this material. Some birds of this collection are particularly interesting for different reasons: taxa rarely found even in the larger collections (*e.g. Nyctibius aethereus*); taxonomic problematic taxa occurring in sympatry (*e.g. Trogon s. sarrucura* and *T. s. aurantius*) and unexpected records for INP (*e.g. Aramidés mangle*). This project stresses the importance of this collection for future taxonomic and conservation studies and may provide a base for comparison with recent surveys.



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Detection of *Helicobacter* genus in feces and digestive tracts of wild birds in Venezuela

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The genus *Helicobacter* comprises 38 species and most of these species have mammal hosts. Only five *Helicobacter* species (*H. pullorum*, *H. pametesis*, *H. canadensis*, *H. anseris* and *H. brantae*) use birds as natural reservoirs and two of them (*H. pullorum* and *H. canadensis*) has been associated with enteritis and hepatic disease in humans, suggesting that birds are a vector for transmission of *Helicobacter*. Nevertheless, only a few studies reported *Helicobacter* infection in wild birds. The aim of our study was to determine the presence of *Helicobacter* sp. in wild birds from Venezuela. *Helicobacter* sp. was assessed by PCR in feces and digestive tract samples. A total of 77 fecal samples from four species of wild birds and samples of stomach (proventriculus and gizzard) and intestines from 37 wild birds (23 species) were collected. *Helicobacter* sp. was detected in 13 of 77 fecal DNA (17%) and in 3 of 37 intestine samples DNA (8%). Doves (2 species) and thrushes (2 species), both groups present in human settlements and cities, are the birds with more proportions of *Helicobacter* infections. These results confirm that wild birds may serve as reservoirs of *Helicobacter* species in nature and highlight the need of further studies to assess if these *Helicobacter* species may pose a risk to humans.



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Antipredator responses of birds to playbacks vary with predator foraging habit, prey family and foraging site

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Predation is an important selective force in many animal populations since imprecise predator recognition generates fitness costs. Studies that evaluate anti-predator responses focus on behavioral tactics, such as vigilance, alarm calling and mobbing or test if birds are sensitive to more detailed differences between variously sized (small, intermediate, large) raptor species. We designed playback experiments and used recordings of three local predator species (*Rosthramus sociabilis*, *Falco femoralis*, and *Heterospizias meridionalis*) to determine whether (1) prey recognize the calls of three predators with different foraging tactics, (2) the response vary with prey family and (3) foraging site. *Rosthramus sociabilis* was chosen as a control since it feeds exclusively on mollusks. We found significant difference in prey response to different predators. Responses to predator playback were related to prey foraging substrate and family. Precise identification of predators will confer substantial selective advantages to animals that serve as food to others. Prey should evolve adaptations to maximize the chances of escaping a predator attack, leading to a co-evolved predator-prey race in which preys should have variable antipredator responses. Species also differ in their perception of risk due to vegetative cover. Field studies have revealed that predation risk varies within tree and is greater for birds that use the outer parts of branches in the lower canopy and the uppermost parts of young trees. Predators may influence many terrestrial vertebrate communities via prey responses to vegetative cover and foraging tactics.



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Seabird seed dispersal by attachment to feathers in the oceanic Bonin Islands, Japan

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The Bonin Islands are oceanic islands in northwestern Pacific and have suffered from alien species introductions, similar to other Pacific islands. The range expansion of introduced plants has become a serious threat to the conservation of native ecosystems. Frugivorous land birds are well-known as seed dispersal agents of alien plants and have received attention. On the other hand, not enough attention has been given to birds that disperse seeds by the adherence of seeds and fruits to their feathers, although it has been recognized as one major way of seed dispersal. Seabirds are suggested to be important vectors of introduced plants in this manner, because they frequently breed at disturbed open habitats keeping various introduced herbs and have the ability to migrate extensively. Thus, we examined the frequency of seed dispersal by attachment to feathers of major breeding seabirds on the islands; the brown booby *Sula leucogaster*, the black-footed albatross *Phoebastria nigripes*, the Bulwer's petrel *Bulweria bulwerii* and the wedge-tailed shearwater *Puffinus pacificus*, and estimated the possibility of successful transport.



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Comparison of EROD enzyme activity and oxidative stress biomarkers in different passerine species

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Interspecific differences in animal defence mechanisms against toxic substances are poorly understood. EROD enzyme is a member of mixed function oxidases, which are important in defending against toxic chemicals. Interspecific variation in EROD activity is common, thus being a useful biomarker in comparative studies of different species exposed to pollutions. Little is known about the interspecific differences in antioxidant status related to different feeding habits. Our aim was to compare enzyme activities among passerine species to see if there is variation in EROD activity and oxidative stress levels in relation to their diet and year cycle. Our results showed that migratory insectivores had greater EROD activity than granivores. We hypothesize that the normal diet of migratory insectivores contains a wider range of natural toxins, which may have affected the evolution of MFO system and enzyme activities. On the other hand, narrower and less natural toxins containing diet might explain why the efficiency of detoxification system remains lower in granivores. Oxidative stress levels were further measured by using glutathione and antioxidant enzymes as biomarkers. Insectivores seemed to have lower enzyme activities compared to granivores and diet seemed to affect glutathione metabolism more than migration status. Phylogenetic relationships may also explain the similarity of the species in their metabolism. Based on our results, species-specific variation in EROD enzyme activity and oxidative stress levels could be used to identify species that can be used as most sensitive indicators of environmental pollution.



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Shorebirds in southern Brazil: a long term monitoring

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The results of a long term monitoring carried out for 10 years, from 1999 to 2009, in a beach of Paraná, in southern Brazil, are presented. The beach segment monitored has nine kilometers and 100 m width and part of it receives an elevated number of tourists during Summer, from December to March. The sampling walks were monthly performed when the presence and quantity of birds were noted. A total of 52 species were recorded using the intertidal region, among them 14 showed strong association with the area, e.g. sandpipers and plovers; 18 were considered partially dependent like gulls and 20 represent only an extension of distribution. In a general description 24 birds were recorded by kilometer, whereas it was 67% greater in the sector without strong antropic influence. The gull *Larus dominicanus* was dominant representing 54.88% of all contacts, with an expressive change during summer when the species represented 74.7%. Additional species with high frequency and relative abundance were: *Vanellus chilensis* and *Charadrius collaris*, recorded in more than 95% of our sampling trips with 12.08% e 5.19% when compared to the total number of contacts. An expressive reduction of *C. collaris*, in presence and in numbers, was recorded, with only 20% of initial registers. Beach environments are important areas for many bird species and in the last decades also for humans, and so it is urgent that anthropic impacts on these systems be minimized.



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Song variation in a disjunct population of dusky flycatchers (*Empidonax oberholseri*)

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Geographic variation in the learned songs of oscine passerine birds (Suborder Passeri) is well-studied. In contrast, we know little about intra-specific variation in the innate songs of suboscine passerines (Suborder Tyranni). Song differences between disjunct or widely-separated populations of suboscines are interpreted as evidence of genetic differentiation, frequently at the specific level. However, because detailed studies of intraspecific variation in suboscine songs are almost non-existent, such differences may reflect the extremes in patterns of clinal variation. The coniferous forests of the Cypress Hills plateau of SE Alberta, Canada, support disjunct populations of several montane bird species which are separated from their primary ranges in the Rocky Mountains by 250 km of unsuitable grassland habitat. These populations may have been isolated soon after the end of the Wisconsin glaciation, almost 10,000 years ago. Songs of several oscine passerines in the Cypress Hills are recognizably distinct from those of conspecifics in the Rocky Mountains. We compared songs of the suboscine dusky flycatcher population in the Cypress Hills with those of two populations in the Rocky Mountains using spectral cross-correlation and multivariate analysis of song characteristics. We were unable to differentiate songs of birds from the disjunct population from those in the main range of the species. We consider alternative explanations for this finding.



Arthropods associated with nests of blue-fronted-parrots (*Amazona aestiva*) in the Pantanal de Miranda, Mato Grosso do Sul

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Blue-fronted-parrots (*Amazona aestiva*) are widespread in South America (northeastern and midwestern Brazil, eastern Bolivia, northern Argentina and southern Paraguay). Blue-fronted-parrots use secondary cavities in mature trees (25 tree species in 16 families), of varying sizes. Inside the cavity, nests include a substrate of leaves and wood shavings by the parrots. Here, we examined arthropods associated with blue-fronted parrot nests. The nests were in the Pantanal of Miranda, state of Mato Grosso do Sul, Brazil and were monitored between August and November 2005 to 2008. The substrate of the nest was collected when a nest ceased to be in use (either to failure or success). Substrates were isolated and taken to the laboratory, where the associated arthropods were removed and placed in 70% alcohol. Immature and adult hexapoda and chelicerata were found. Orders included Coleoptera (45%), Diptera (37%), Hemiptera (5%), Hymenoptera (15%), Orthoptera (12%), Psocoptera (5%), Collembola (3%), and Isoptera (2%). Chelicerata included Acari (20%) and Pseudoscorpionida (5%).



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Interaction between buff-necked ibises and towers for high voltage transmission lines in Brazil

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The buff-necked ibis *Theristicus caudatus* is typical of open, dry landscapes in South America. Between August 2005 and December 2007 we monitored populations along electrical transmission lines in central Brazil. These birds use the transmission facilities for roosting and nesting, and are often responsible for energy interruptions, with consequent high costs for repair paid by the utility companies. The objective of this study was to evaluate the forms of interaction of ibises with the towers. We considered habitat, and behavioral and reproductive variables for this species along the transmission lines. We examined 535 towers, 21% of which were occupied by ibises. Of the evaluated towers 74% were in disturbed areas and 26% in natural areas. There was a statistical association between tower design and habitat, with respect to occupation by buff-necked ibises, with a preference for SB towers within disturbed landscapes. No significant difference in occupation was found between towers in natural versus disturbed areas. Clutch size for the 49 nests found varied between one ($n = 2$), two ($n = 22$) and three ($n = 18$) eggs, with a mean of 2.21 eggs per nest. Egg laying occurred from April to December. Knowledge of ecological, behavioral and reproductive traits is essential to understand the use of high voltage transmission towers by buff-necked ibises. Such information will allow the development of mitigation measures to avoid interruption in energy supply and negative impact on the species.



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The use of automated recording devices for forest bird monitoring in Bruce Peninsula National Park

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Effectiveness of forest bird monitoring over large forested areas presents many challenges, such as consistency with bird identification, timing, and weather. Surveys in northern and central Ontario are often conducted by seasonal personnel whose birdsong identification skills vary considerably. The use of automated recording devices in bird monitoring is not new, but improvements in technology in the last decade or so have led to greater reliability of the devices, and better recording quality. In 2009, Bruce Peninsula National Park used ten Song Meters by Wildlife Acoustics® to monitor forest birds in this 15,000 ha national park located in the Great Lakes region of Ontario, Canada. A total of 40 stations (8 routes) were surveyed twice between 30 May and 15 July. Four routes were in coniferous, and four in deciduous forest. Five Song Meter units, positioned at least 200 m apart, and at least 200 m away from the forest edge or a major road, were deployed along each route. This was done to make our data consistent with Forest Bird Monitoring Protocols (stations 200 m apart, 2 visits per year). The units were programmed to record four times a day: 04:30, 05:30, 06:30, and 07:30 hrs. Each recording was 10 min long. At a time when Song Meters were deployed, two routes (10 stations) were additionally surveyed by an experienced birdwatcher. Each recording was analysed by ear, and with the help of Song Scope software (Wildlife Acoustics®). The results suggest that the use of Song Meters (or similar devices) is a more cost-effective and efficient way to monitor forest birds. Recordings could be stored and reanalysed if necessary.



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The effect of highly pathogenic Avian Influenza (H5N1) on a flock of mute swans (*Cygnus olor*)

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The population of mute swans which breed colonially at Abbotsbury Dorset, England has been studied for 40 years. In winter there may be about 1,000 birds present. The large majority of the birds have been raised in the colony and ringed as cygnets. Hence they are marked and of known age. A smaller proportion are immigrants and most of these will eventually depart again. Because of concerns that the virulent subtype of Avian Influenza, H5N1, might be brought into Britain by waterfowl, Government Agencies were checking dead birds for H5N1. In early January 2008 dead Mute Swans, submitted for testing from Abbotsbury, tested positive for H5N1. Contrary to some expectations, mortality during the 2007/08 winter was low. Only nine birds of the birds which died during winter tested positive for the virus. All were young birds, suggesting that the older birds had developed some form of resistance to the virus. Blood samples taken in 2008, together with others taken for a different study in 2006 and 2007 were tested for antibodies to a range of subtypes of Avian Influenza, using an AI specific ELISA followed by subtype-specific HI assays. More than 90% of the birds tested had antibodies to one or more subtypes of avian influenza. The implications of this are discussed.



***Plasmodium* sp. parasitism in Central-Brazilian birds**

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Blood parasites exert an important role in several biological and ecological aspects of bird life. Relatively little is known about blood parasites of wild birds from Brazil, a country of particular interest because of its avian diversity. We used, for the first time, molecular techniques (nested PCR) to identify *Plasmodium* sp. and compare its prevalence in different Cerrado vegetation physiognomies and bird habitat preference in the state of Tocantins, Brazil. We found that 39% of 480 bird samples and 63% of 102 species were infected with *Plasmodium* sp. This is among the greatest prevalence rates reported in Neotropical birds. Also prevalence in different bird species were the greatest reported for Brazilian birds: pale-breasted thrush, *Turdus leucomelas* (n = 15, 93%), yellow-rumped cacique, *Cacicus cela* (n = 9, 89%), red-eyed vireo, *Vireo olivaceus* (n = 10, 90%). Although *Plasmodium* sp. prevalence were greater on riverine forest birds (n = 67, 47%), in relation to cerrado *sensu stricto* (n = 50, 35%) and secondary cerrado (n = 59, 33%), while habitats had similar prevalence rates ($\chi^2 = 3.39$, gl = 2, p = 0.1830). Forest birds that use open habitats had greater rates as well ($\chi^2 = 6.834$, gl = 3, p = 0.07). The overall and individual high *Plasmodium* sp. prevalence found in Cerrado birds is an important first step to better understand whether high prevalence is natural or is being caused by changing land use patterns in the Cerrado.



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Biologically active compounds discovered in *Cinnamomum glaucescens*, the hornbill dispersed plant in a moist evergreen forest of Khao Yai National Park

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Cinnamomum is a genus of evergreen tree and shrubs in the family Lauraceae. There are more than 300 species in this genus found in tropical and subtropical North, Central and South America and Asia. *Cinnamomum glaucescens* is a very large tree among the 84 species of hornbill food plants. It is important not only for providing food but also being a nest tree. Large cavities in these trees are commonly used by hornbills for nesting. Interaction between hornbills and *Cinnamomum glaucescens* fruiting is synchronized with hornbill flocking period, July to September. Except the hornbills, few frugivores are observed feeding on the fruit of this species. Squirrels were observed to eat young seeds. Therefore, hornbills seem to be a competent seed disperser in sustaining this species in a moist evergreen forest of Khao Yai. Wood of *Cinnamomum glaucescens* has strong aroma, therefore plants of genus *Cinnamomum* have been extensively investigated for aromatic oils from leaves and barks, while the other chemical constituents are limited. In this study, chemical compositions of crude extracts from barks and fruits of *Cinnamomum glaucescens* were investigated and structure elucidations were characterized by spectroscopic data. We discovered *trans*-ferulates (1) *trans*-sinapaldehyde (2) and 3-(3,4-methylenedioxyphenyl)1,2-propanediol (3) in addition to their aroma constituents from barks, phenylpropanoids (4-6). Importantly, two biologically active tetrahydrofuran lignans were obtained as major components from the fruits. (+)-Epieudesmin (7) exhibited antifungal activity against basidiomycetes and (+)-phillygennin (8) showed antitumor activity.



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Detection of *Chlamydophila psittaci* in colonial seabirds of São Paulo State, Brazil

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There are ninety species of seabirds along the coast of Brazil including migratory visitors and species that breed along the coast and rivers inside the continent. Several diseases can affect these seabirds, among them chlamydiosis, caused by the bacteria *Chlamydophila psittaci*, has been detected in 467 species of birds. In seabirds, this pathogen can be found in penguins, seagulls, terns and skimmers. In Brazil, few studies have addressed the occurrence of *C. psittaci* in wild birds and their main focus was psittacine birds. In the present study, we tested for the presence of *C. psittaci* through nested PCR in seabirds from five localities in São Paulo State: Laje de Santos Island, Terminal Petrobrás, Itaçucê Island, Alcatrazes Archipelago and Laje da Conceição Island. Cloacal and pharyngeal swabs were collected from 93 birds belonging to five species: magnificent frigatebird (*Fregata magnificens*, n = 24), brown boobies (*Sula leucogaster*, n = 3), South American tern (*Sterna hirundinacea*, n = 53), royal tern (*Thalasseus maximus*, n = 12) and Cayenne tern (*T. sandvicensis eurygnatha*, n = 1). Twelve birds (12.9%) were positive for *C. psittaci*, all of them were *S. hirundinacea*. These positive birds were found in Laje de Santos (2/7), Terminal BR (1/4), and Itaçucê Island (9/26). The mechanism of transmission is particularly interesting to be studied in these birds, since they remain in large groups for long periods of time contributing for the pathogen dissemination. The ecological and epidemiological effects of *Chlamydophila* infection in wild populations of seabirds are still unknown and need further investigation. Support: Fapesp, CNPq.



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The plumbeous seedeater (*Sporophila plumbea*) of upland grasslands from southern Brazil: is it a new species?

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The plumbeous seedeater (nominal form) inhabits savannas with tall grasses and is widely distributed from south of Amazon to south Brazil. It presents a black bill (BB), easily recognized in the field, but yellow bill (YB) individuals have also been mentioned in the literature. In 2005, after 35 years from the first collected individuals from Rio Grande do Sul (RS) by P. Schwartz and W. Belton, we found YB breeding population and immediately started to study its biology in the southernmost states of Brazil, RS and Santa Catarina (SC). Our four years of experience with YB in field and the accumulated experience in field and with skins of BB allowed us to observe that YB are morphologically different from BB. Could be that differences due to another case of cryptic species of plumbeous seedeater? Based on skins and captured live individuals we compared adult males BB (n = 49) and YB (n = 41) regarding their plumage and soft parts coloration, body morphology, vocalizations, as well as habitat use and geographic distribution. We found that YB are larger than BB (Student's *t* test, $P < 0,001$) in all body variables measured, including: bill length, culmen, bill height, bill width, wing size, tail length and body mass). All YB adult males had bill full bright-yellow and the white malar stripe, chin and subocular spot (typical of BB) were mainly absent. Calls present differences in shape, frequency and duration of some notes and exclusive notes were also found in both YB and BB repertoires. YB is a migratory and rare parapatric population that breeds in specific grassland habitats in the highlands of northeastern RS throughout north Paraná, occurring near BB only in the extreme north part of its breeding distribution range. Strong evidences suggest that YB and BB have different evolutive trajectories. However, to examine how they differ, we are now searching for genetic evidence.



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Incidence of *Giardia* spp. and *Eimeria* spp. on the avifauna of Distrito Federal/Brazil evaluated by molecular diagnosis

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Giardia and *Eimeria* are genera of intestinal protozoa that commonly infect birds, causing intestinal lesions of variable extent and severity. Molecular diagnosis has been showed to be more efficient than the classical methods to detect the presence of these parasites in the feces samples. However, there are only a few data concerning the presence of these parasites in wild bird populations. Here, we identified the incidence of *Giardia* spp. and *Eimeria* spp. in the avifauna of Distrito Federal (DF), Brazil, by molecular diagnosis. Feces samples were collected from 77 birds (26 species of 19 families) captured using mist nests installed in two conservation units: ESECAE and Recor/IBGE. The DNA was extracted using the QIAamp DNA stool kit and the diagnostic test was based in the PCR amplification of 163 bp fragment of the heat shock protein gene for *Giardia* and 250 bp of the cytochrome c oxidase subunit I mitochondrial gene for *Eimeria*. The PCR amplifications were visualized in 1.5% agarose gel stained with ethidium bromide. All birds were screened for *Eimeria* while only 31 birds were screened for *Giardia*. Of the feces samples screened for *Eimeria*, 72 (93.5%) were positive, while 29 (93.5%) were positive for *Giardia*. We detected double infection by both parasites in 31 birds. These results showed elevated incidence of *Giardia* and *Eimeria* with wide spectrum of occurrence in the avifauna of DF. The causes of this elevated incidence should be better investigated, in both to help in the sanitary control of the human population, in the case of *Giardia*, and to assess the possible factors that are influencing the dissemination of these parasites in the studied populations.



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Parental effort and hormones: do prolactin and corticosterone levels differ between first and replacement clutches in common terns?

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Additional costs of producing a replacement clutch may negatively affect lifespan and lifetime reproductive success. Therefore, the investment in a replacement clutch is often comparatively low. Prolactin and corticosterone are two hormones involved in breeding decisions and related to the current state of the bird. We investigated if they differ between first and replacement clutches of common terns (*Sterna hirundo*). Therefore, we sampled individual breeders at mid-incubation of their first and replacement clutch. Blood samples were taken via blood sucking bugs (*Dipetalogaster maximus*), a method without stress for the bird. Hormone baseline levels were compared between the two breeding attempts and related to sex, breeding experience and hatching success. We found a correlation of hormones and hatching success neither in the first nor in the replacement clutch. Prolactin showed a clear decrease in the second clutch, which was most pronounced in males and inexperienced breeders. However, corticosterone showed no change and β -hydroxy-butyrate, a signal of the current state of a bird, a slight increase. Low prolactin levels may reduce parental effort during care of replacement clutches. Especially the duties of the father may be impaired whose effort is important in courtship, incubation as well as chick rearing.



Effects of an increase in predation risk on stress and reproduction in female mallards

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Predators usually induce stressful reactions among their preys, that results in the release of corticosterone (CORT). Although this mechanism is advantageous for triggering immediate survival, a chronic stress may have dramatic effects, especially on reproduction. This study aimed to determine how female mallards respond to the stress induced by high predation risks during the wintering season and how future reproduction is affected. Two groups (G1, G2) of 7 mallard pairs maintained in outdoor aviaries were intensively disturbed (2×20 and 4×20 min.day⁻¹) during 4 one-week sessions. Plasma levels of CORT and prolactin (PROL) were measured before and after disturbance sessions and compared to values of an undisturbed control group (CG). PROL was also determined after hatching. Overall, [CORT] was lower in G2 than in CG and also lower after disturbance than before in G1 and G2. Before reproduction, [PROL] increased after treatment only in G1. During brood care, [PROL] was similar in the 3 groups. Although the total number of ducklings was lower in G2, mean brood size of successful females and hen-brood behaviour pattern did not differ between the 3 groups. To conclude, G1 females which exhibited a short-term increase of [PROL] would be subject to an acute stress. Conversely, G2 birds rather experienced a chronic stress by keeping low [CORT] likely to minimize deleterious effects of stress. Chronic stress only seemed to affect low quality females that did not reproduce. However, high quality females appeared to succeed in coping with predation risks by limiting the adverse effects on recruitment.



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Birds visiting flowers in an Atlantic rainforest site: sazonality, vertical distribution and interactions

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Birds are a very important component for plant reproduction in tropical ecosystems, and hummingbirds are among the most important vertebrate pollinators in the Neotropics. Other flower-visiting birds are less specialized for nectarivory, although nectar may be a very important component of the diet of some groups of birds. In a two year study in the Atlantic rainforest in southeastern Brazil, bird activities were recorded along the year and in relation to vertical stratification every month, during sightings along line transects samplings, while accessing canopy with climbing equipment and during focal observations. Nectar accumulated volume and sugar concentration of plant species visited by birds were measured from bagged flowers at the end of the morning. Thirteen hummingbird species were recorded at the study site besides nine species of perching birds. Hummingbirds were observed visiting flowers in all forest strata, while perching birds were only recorded visiting flowers in the canopy, even during the rainy summer. Birds visited flowers with a wide range of nectar features. Bird-flower network was nested-like and no difference between hummingbirds and perching birds could be seen in a cluster analysis, which means that core species in this punctual network were generalists and that both groups of birds were using similar resources. Hummingbirds were the most important pollinators of the majority of the ornithophilous species in the area but perching birds were also important to few species that do depend solely on them as pollinators in the canopy and in different seasons.



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Cortisol and corticosterone binding sites in plasma, liver, immune organs and brain of developing zebra finches

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Glucocorticoids (GCs) affect the development of the immune and nervous systems. To do so, GCs bind to intracellular receptors (mineralocorticoid receptors (MR) and glucocorticoid receptors (GR)) or membrane-associated corticosteroid receptors (mCR). Two well-known GCs are corticosterone and cortisol. Although corticosterone is the primary GC in zebra finch plasma, cortisol is the primary GC in zebra finch immune organs and is also present in the brain and plasma during development. Here, we characterized binding sites for corticosterone and cortisol in plasma, liver, immune organs, and brain of juvenile zebra finches. Both intracellular and membrane-associated receptors were examined in tissues. For intracellular receptors, there were MR-like and GR-like binding sites, and intracellular receptors differentially bound corticosterone and cortisol in a tissue-specific manner. For mCR, we found little evidence for a mCR in immune organs, but this could be due to the small size of immune organs. Interestingly, cortisol, but not corticosterone, showed a low amount of specific binding to bursa of Fabricius membranes. For neural membranes, corticosterone bound one site with low affinity and a high B_{max} . In contrast, cortisol bound one site with high affinity but a lower B_{max} . Our results suggest that both intracellular and membrane-associated receptors differentially bind corticosterone and cortisol, suggesting that these two GCs could have different effects on gene transcription or intracellular signaling pathways and that they may have different roles during development.



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Towards developing a Global Wild Bird Index

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The Global Wild Bird Index (WBI) will measure population trends of a representative suite of wild birds to act as a barometer of the general health of the environment. The methodology for producing WBIs is well developed; European WBIs have already been produced and are being used to measure progress towards the EU's aim of halting biodiversity loss by 2010. WBIs have recently been published for the United States and an indicator initiative has begun in Australia. The WBI measures biodiversity change in a similar fashion to the LPI, the main difference being that the WBI only incorporates trend data from formally designed surveys to deliver scientifically robust and representative indicators. As a result, data coverage is currently patchy and the WBI is not presently applicable at a global scale. This project will develop WBIs from national population monitoring schemes. Where such schemes already exist, it will coordinate and facilitate the collation of species' indices. Where there are no schemes, it will provide tools and support to implement similar data collation and synthesis in a representative set of countries across regions. A key tool will be the web-based Worldbirds, which will support the collation of data from bird surveys. The project is already supporting the establishment of several new bird-monitoring schemes in Africa (e.g. Botswana, Uganda, Rwanda) to extend the scope of the WBI project. Assistance and encouragement is being provided to other countries and information on bird monitoring programmes is being gathered from across the globe. Since contributing data are generated at the local level, WBIs are scalable and can be aggregated or disaggregated at the global, regional and national (sub-national) level, or by habitat, guild, or aspects of species ecology.



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Does parasitic infection affect reproductive success and survival in purple martins?

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Parasite resistance is an important mechanism for sexual selection because parasite infection is expected to have an important impact on survival and reproductive success and thus should influence social and extra-pair mate choice. This study quantified *Haemoproteus* infection in purple martins (*Progne subis*) and tested the prediction that birds exhibiting greater loads of *Haemoproteus* have reduced annual survival probability and lower reproductive success. This study used mark-recapture, nest monitoring and blood sampling of dozens of purple martins from two colonies in northwestern Pennsylvania, U.S.A. over a four year period (2006-2009). Infection loads of *Haemoproteus prognei* were determined using quantitative real-time PCR; this highly sensitive method is more accurate at detecting infection than microscopy. Results from one colony (2006-2007) indicate that female reproductive success does not differ significantly between infected and uninfected birds, even after controlling for age class. As part of a collaborative study investigating the role of parasites in sexual selection, these data will be combined with paternity data to determine if females improve their offspring fitness through extra-pair mating.



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Environmental regulation of GnRH1 plasticity in European starlings (*Sturnus vulgaris*)

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The annual change in daylength allows temperate zone animals to predict, and reproductively prepare for ambient changes which would otherwise be detrimental to the survival of the offspring. The GnRH1 system in avian species exhibits profound variation in hypothalamic content that is dependent on photoperiod experience. The variation in GnRH1 protein could arise from a number of mechanisms, including changes in *GNRH1* mRNA expression. We will present data demonstrating that *GNRH1* mRNA expression increases when starlings are transferred from short daylengths to long daylengths. *GNRH1* mRNA expression subsequently declines after exposure to long daylengths for approximately five weeks. Thus, the onset of photorefractoriness is associated with a decrease in *GNRH1* mRNA expression. We found that photorefractory starlings transferred to short daylengths for 10 days resulted in a rapid increase in *GNRH1* mRNA density and after 30 days resulted in a substantial increase in *GNRH1* cells in the preoptic area (POA). Additionally, particular subregions of *GNRH1* cells within the medial-intermediate, medial-caudal, and lateral-intermediate preoptic area exhibit greater variation in expression, suggesting localized anatomical effects of photoperiod. In support of localized effects of environmental cues, we found significantly more rostral and intermediate POA GnRH1 immunoreactive cells in male starlings housed with females compared to starlings housed alone. The data suggest that the GnRH1 system is highly dynamic, susceptible to changes in photoperiod and social context, and exhibit mark plasticity in anatomically distinct regions.



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Inquiline birds of *Furnarius rufus* (Gmelin, 1788) [Aves: Furnariidae], the true hosts of *Acanthocrios furnarii* (Cordero & Vogelsang, 1928) (Hemiptera: Cimicidae)

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The nest of *F. rufus* is an inverted U-shaped mud structure, with a wall separating the breeding chamber from the outside. In general each pair builds one nest per year. Some nests remain in the field more than a year, and more rarely for more than 8 years. Nests are widely used by other vertebrate and invertebrate inquilines. *F. rufus* is the bird that had the greater amount of bird species (25) comprising 289 cases of inquilinism recorded in Argentina. A total of 120 nests of *F. rufus* were sampled in Argentina (Chaco, Córdoba, Santa Fe, San Luis, La Pampa, and Buenos Aires). The most abundant species were two hematophagous insects, *Philornis* sp. [Diptera: Muscidae], parasite on the nestlings of *F. rufus*, and *Acanthocrios furnarii* [Hemiptera: Cimicidae], parasite on the inquiline birds. Of 21 nests infested with *A. furnarii*, 14 (67 %) were occupied by *Sicalis flaveola*, 1 (5 %) by *Passer domesticus* and *S. flaveola*, 3 (14 %) by *P. domesticus*, 2 (10 %) by *Troglodytes aedon*, and 1 (5 %) by an inquiline bird not identified. *A. furnarii* was never found in a nest used by *F. rufus*. As each nest is used by *F. rufus* for one clutch or consecutive clutches in the same breeding period, this bird is never affected by *A. furnarii*. All previous mentions of *F. rufus* as the host of *A. furnarii* were erroneous because the species of birds using the nests were unknown.



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The first results of color-ring marking of actites dunlin (*Calidris alpina actites*) at the breeding area in the north-eastern of Sakhalin Island

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The Actites dunlin is the most southern subspecies of dunlin having a narrow range and small population. It is in the Red Book of Russia. It nested near shallow sea bays in the north-east of Sakhalin. Rings and color flags (yellow top, white bottom) were first banded 192 birds in the vicinity of Chaivo Bay: 20 in 2007; 59 in 2008; and 113 in 2009. At least 5 marked birds returned to Chaivo Bay area in 2009, three of which were caught again at their nests with the nestlings. Adult male and female banded in 2008 made new nests in 122 and 104 meters away from the previous years' nest locations. Nestling banded in 2008 was found as breeder within 300 meters from the banding place. Two young birds banded of hatching in the end of June, 2007, were seen on the Sakhalin Island 33 and 57 days later in 30 and 45 km southward from the breeding area. A photo of a young bird in winter plumage was taken by a birdwatcher in Shanghai on the 3rd of October, 2008. Additionally on the 12th of July, 2009, an adult female marked with Chinese color flags, was found with the brood in the Chaivo Bay area. Those were the first records of the subspecies away from the breeding area. Size of the nesting place of dunlins in the Chaivo Bay is 8 - 10 km². The population of the birds in diffuse colonies stayed at the level of no less than 10 pairs per 1 km². Shortest distance between nearest nests in the centre of colonies consisted near 80 to 200 meters. In the first days of nestling life both males and females stayed with them, and birds of neighbouring pairs always participated in protecting nests and brood of their neighbours in case of danger.



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The influence of microbial processes on the infection rate and viability of passerine eggs

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Along with food supply and predation risk, environmental conditions acting on events early in the reproductive cycle could constrain the evolution of life-history traits such as clutch size and hatching patterns. The viability of freshly laid avian eggs declines over time when eggs are exposed to ambient conditions: a decline in egg viability often begins after several days of preincubation exposure, increases with duration of exposure, and occurs faster in tropical than in temperate ecosystems, although few in situ experiments on wild species have been conducted. We measured microbial loads on egg shells, the incidence of microbial penetration of egg contents, and changes in the viability of wild passerine eggs (*Sialia mexicanus*, *Tachycineta bicolor*, *Tachycineta thalassina*) experimentally exposed to ambient conditions in situ in a Mediterranean climate in northern California. Initial microbial loads on eggshells were generally low at our study site (~10 CFU/egg). Eggshell microbial loads did not increase with exposure to ambient conditions, were not reduced by twice-daily disinfection, and were unaffected by parental incubation. The rate of microbial penetration into egg contents was low (2.9% in albumen, 7.9% in yolk) and unaffected by duration of exposure or alcohol disinfection of the eggshell. Egg viability declined very gradually but significantly with exposure duration ($p < 0.001$) and the rate of decline differed among species. We found little evidence that temperature or microbial mechanisms of egg viability decline were important. Delaying the onset of incubation until the penultimate or last egg of the clutch may maintain hatching synchrony without a large trade-off in egg viability at our temperate-zone study site.



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Ecological isolation in congeneric sympatric cormorants (*Phalacrocorax* spp.) in and around Aligarh

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Two congeneric species of cormorants, the large cormorant *Phalacrocorax carbo* and little cormorant *P. niger*, are commonly found together in wetlands of northern India. Niche partitioning measures adopted by the species over differential use of space, food and time allow competition and not exclusion. A survey was conducted in cormorant habitats including the Keoladeo Ghana National Park and intensive ecological data was collected at the Sheikha Lake of Aligarh pertaining to the time and activity pattern of cormorants. Time or activity budget is a quantitative description and are important in understanding the evolution of avian reproductive and foraging behavior. Individuals of both species were observed through focal animal sampling for their daily cycles that included 13 behavioral categories. Data on activities in different seasons and over a day was pooled and analyzed by performing one-way ANOVA, Mann-Whitney U test and post hoc Tukey's tests. It was found that the most frequent category for Little cormorant was resting followed by foraging and loafing while for the Large cormorant these happened to be resting followed by foraging and preening. Further results suggest the proportions of time allocated by the two species to the different non-breeding activities under observation varied significantly. This difference was confirmed over seasonal changes as well as variations in sunlight in a single day over a gradient responsible for conspicuously altering the bird's activity pattern. The paper concludes that as in other congeneric sympatric species of birds, natural selection has incurred a mechanism of niche separation among sympatric cormorants through varying activity patterns allowing successful coexistence.



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Round Table Discussion



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International priorities for research and conservation of threatened Atlantic forest birds

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The setting of the 2010 IOC is the Atlantic forest: one of the top global priorities for the conservation of birds. The Atlantic forest extends along the southeast coast of Brazil, through northeastern Argentina to Paraguay, and harbours nearly 950 species of birds, over 150 of them endemic to the region. Since European colonization, some 90% of the Atlantic forest has been replaced by agriculture, pasture, urban areas and plantation forestry with exotic trees. Remaining forest is fragmented, degraded by logging, and often subject to heavy hunting pressure. As a result, 55 bird species endemic to the Atlantic forest are globally threatened. Many of these species are shared among the three Atlantic forest countries, yet a lack of information about their abundance, natural history, taxonomy, migration, ecology and threats in different parts of the Atlantic forest has made it difficult to define precise conservation objectives. Some of these species are habitat specialists in parts of their range, some are longitudinal or altitudinal migrants, and some suffer from trafficking across international borders. We aim to bring together ornithologists working in the Atlantic forest to discuss priority species and areas for action at an international level, identify key gaps in current knowledge of threatened species, and increase collaboration among ornithologists in the three Atlantic forest countries. We will generate recommendations for research and action aimed at conserving threatened Atlantic forest birds throughout their ranges.



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Large scale avian distribution mapping: the pros and cons of exhaustive atlasing and spatial interpolation of point data

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Avian distribution maps are invaluable for applied and theoretical ornithology. Increasingly there is a need for maps covering large geographic areas, to model current and future ranges and for prioritising areas for conservation or development. Distribution maps are normally produced from data collected through two approaches. Firstly, atlases characterised by periodic intensive and complete coverage of geographic areas. Secondly, annual monitoring schemes, characterised by large-scale surveying of a sample of representative sites, can generate maps using interpolation algorithms. The end products may appear superficially similar but depending on the end use of the maps the strengths and weaknesses of these two approaches may differ. Topics for discussion include: 1. completeness of species coverage; 2. completeness of spatial coverage; 3. statistical limitations and representation of error; 4. limitations of uses, perceptions and acceptance. The discussion will aim to conclude with a clearer idea of the situations and uses that each method is best suited to.



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Beyond the Parrot Action Plan: challenges and priorities for the research and conservation of Psittaciformes

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Psittaciformes is one of the most endangered orders of birds. The Parrot Action Plan (2000-04) classified 29% of parrot species worldwide at some risk of extinction. This situation is even worse in the Neotropics, where 34% of the species are at risk of extinction. The principal sources of threat are collection of birds for the pet trade, habitat loss and degradation; introduction of exotic species, persecution and hunting may also play a role in the endangerment of some species. At present, there is a dangerous lack of breeding biology data available for 87% of parrot species. These data are urgently needed both for the identification of specific threats and the formulation of regional conservation measures. Furthermore, there are often political and regulatory barriers to research that discourage progressive and proactive conservation actions. This Round Table Discussion will focus on: 1) establishing research needs and priorities for the decade 2010-20, with particular attention to regional conservation strategies, 2) identifying barriers to effective research and conservation of parrots, 3) the possible creation of a Research Coordination Committee on Psittaciformes under the auspices of the International Ornithologists' Union (IOU).



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Is a forest road a barrier for the Vulnerable Cabot's tragopan *Tragopan Caboti* in Wuyishan, Jiangxi, China? How about in future?

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Cabot's tragopan *Tragopan caboti* is categorized as Vulnerable on the IUCN Red List, listed on Appendix I of CITES and is endemic to China. Habitat loss and fragmentation are believed to be the main causes of decreases in abundance of the species. Wuyishan National Natural Reserve supports a relatively stable population of the tragopan but is bisected by a clay road through the core area. This study used direct observation and radio telemetry to investigate the impact of the road on the species. The research was undertaken during March–June 2006 and March–September 2007, which covered the breeding season of Cabot's tragopan and the rainy season of each year. We found that weather was the most important factor affecting the number of individuals actually seen on the road, and the volume of traffic was the main factor affecting the behaviour of individuals, especially at dusk. The road does not appear to be a barrier for Cabot's tragopan. Management of vehicular traffic on the road to Wuyi Mountains ensures that all vehicles pass through the habitat of the species without stopping and thus there is little human disturbance. It has been proposed that the surface of the clay road be replaced with a bituminous macadam surface. This could potentially reduce the availability of grit for Cabot's tragopan but small ditches either side of the road could fulfill this function. Upgrading of the road could result in increased traffic and therefore careful traffic management needs to be maintained to ensure the impacts of the road are minimized.



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Geographic variation in avian life-histories: conceptual and technical advances, challenges and solutions

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The objective of this Round Table session is to explore conceptual and technical aspects of testing hypotheses about factors driving geographic variation in avian life-histories. Generally, we will consider how persistent fundamental questions in avian biology may be addressed by applications of e.g., historical population genetics, functional genomics, climatic species distribution models, electronics, and stable isotope assays to understand the origins and maintenance of patterns of variation in life history traits and to link them with dispersal and migratory movements and historical and current climate change. We plan to invite leading experts attending the IOC to join us in this discussion. They will be asked to briefly review how rapidly evolving technologies may be used to reveal new patterns and processes affecting birds, to explain the impediments that currently limit the full power of these techniques and, hence, describe the kinds of developments or experiments needed to surmount these obstacles. Short presentations (5-10 min) by 4 speakers will be followed by wide-ranging discussions facilitated by the organisers. This will produce a productive setting to discuss collaborations needed to properly test for latitudinal variation in clutch size - or other general patterns of reproductive effort versus survival trade-offs - as well as to evaluate broad issues like climate change impacts in migratory birds. Our goal is to create synergy, by catalysing new linkages among researchers with similar interests in different systems and help them to connect with others who may have innovative ways or ideas for answering these long-standing questions in avian evolution and ecology.



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Frontiers in urban ecology: moving from pattern to process

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Urban development is the fastest growing global land-use, with the resultant towns and cities exhibiting highly divergent ecologies from the rural areas which they replace. Biologists have largely focussed on describing ecological and evolutionary patterns along rural-urban gradients and within urban systems. How these patterns are influenced by the complex multiple socio-economic and bio-physical factors that influence urban areas has received much less attention. However, a sound understanding of avian urban ecology, especially how it is influenced by coupled human-natural systems, is essential to improving biodiversity conservation, sustainable development, and environmental justice. This is increasingly realised by biologists, but in many regions conservationists and associated policy makers appear largely to ignore urban areas and instead focus on more natural environments. In this roundtable discussion, we will focus our dialogue on three questions: (1) What are the emerging issues and priority areas for urban ecological and evolutionary studies, and how are these linked with the coupling of human-natural systems?, (2) What major efforts are currently underway that address these key topics?, and (3) How can we better integrate research and outreach efforts in ways that promote use of our growing body of scientific knowledge in the decision-making arena?



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Bad practice in field biology - what should be done?

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Rigorous science reporting requires: 1) full descriptions of methods permitting exact replication of research; 2) careful documentation of observations/experiments; 3) critical assessment of bias in the data; 4) evaluation of how representative our data sets are for a wider set of conditions; and 5) giving credit to the earlier work. These conditions are often not met in the current publications, methods are frequently underreported, data are replaced by test statistics, relevant references to older literature are lacking. The tendency to sloppy reporting is strongly increasing, what threatens status of field biology as a legitimate science. The aim of this RTD is 1) to diagnose factors leading to lowering of the reporting standards, 2) to discuss possible remedies, and 3) if consensus could be achieved, to agree upon a minimum standards of presentation to be required by ornithological journals. All people concerned with the current bad situation are invited to attend. However, the editors and members of editorial boards of the ornithological journals are specially welcome, as they are critical figures, first of all responsible for keeping scientific integrity and quality of reporting.



Workshop: Linking banders and bird Conservation across the Hemisphere

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Through the Western Hemisphere Bird Banding Network (WHBBN), many national program coordinators have been working to enhance international collaboration. Several Latin American and Caribbean countries and organizations are in the process of developing or have expressed interest in developing national banding schemes and coordination at this time provides an opportunity to create strong future partnerships. Previous WHBBN workshops have produced an action plan, a webpage for reporting captures, a communications list serve, supported development of new banding centers, and provided opportunities to share expertise. Many challenges remain and WHBBN is interested in addressing issues regarding capacity building, permits, data management and sharing, standardized metadata and data collection, bander ethics, encounter/recovery reporting, and communication among countries. During this workshop, WHBBN will address all these aspects and aims to update the WHBBN action plan, identify specific actions to be implemented within the next years, and address future directions for the network. This workshop will demonstrate how coordinated banding programs and shared banding expertise can support the stewardship of western hemisphere migratory birds and express the usefulness of collaborative banding efforts. This meeting will benefit from experiences derived from networks of banding centers world-wide, as gathered also through the IOC Research Coordination Committee on Bird Marking. Within a climate change scenario it is urgent to build up the potential for global monitoring approaches based on shared protocols for bird conservation and demographic monitoring. Analyses of connectivity across continents and CMR data sets will positively contribute to scientifically sound conservation policies. WHBBN Meeting Proposed Program (preliminar): we propose that this meeting has a one day program, with the participation of the banding centers from several countries, especially from Americas. We will discuss many bird banding aspects, to be defined, including: 1) Capacity building. How we can join efforts (training, organizational support and partnerships) an offer training courses, support new banding programs, transfer materials across the hemisphere? 2) Encounter/recovery reporting. How can we facilitate recovery reporting so that all banders have access to their recovery reports and reporters have access to banding records? 3) Permit issues. What is the process to obtain a banding permit in each country of the America? 4) Data management and sharing. What data should banding schemes share? How can data be shared? 5) Bands and marking Issues. Standards, supply, country code, distribution. 6) Mechanisms for Communication. Web page development and list serve advances. 7) Bander ethics and bird safety. A code of ethics reviewed for the WHBBN. 8) Banding and Encounter Data: coordination, management and sharing across the Hemisphere [LandBird Monitoring Network - C.J Ralph – Redwood Sciences Laboratory]. 8) Bird Banding in Western Hemisphere recent developments and future directions. 9) A brief introduction by country representatives: **Brazil**, Raquel Lacerda, CEMAVE; **Chile**, Francisco Chavez, Servicio Agrícola y Ganadero; **Costa Rica**, Pablo Elizondo, PiF/InBio; **Peru**, Evelyn Tavera, Fundación Corbidi.



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Lunchtime Talk

Using birds as peacemakers in conflict area

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The unique location of the Middle East, in a junction of three continents, Asia, Europe and Africa, makes it a global bottleneck for bird migration. One billion birds migrate over the region annually. On the other hand, the geopolitical status of the region since ancient times suffered conflicts and wars. The three authors and other colleagues developed a multidisciplinary concept to get the people from the three nations to join forces on resident and migrating bird studies under the title "Migrating Birds Know No Boundaries". A migration stork project in cooperation with Max Plank Institute, Radolfzell, Germany using satellite transmitters to follow 120 storks as well as developing a network of ringing stations in the three countries, and following the migration with a network of ground observers. We developed three websites in which the students in about 500 schools followed the migration online. Part of the educational studies was to go out in the field to enjoy migration and in many cases the students met each other and became friends. Another regional project, is operating since 2002 with Israeli, Palestinian, Jordanian farmers, using barn owls and kestrels as pest controllers of rodents in agriculture fields. A total of 1900 nesting boxes were mounted in the region.