

6th European Ornithologists' Union Conference 2007
24th–29th August 2007
Vienna, Austria

Edited by R. Hengsberger, H. Hofmann, R. Wagner, and H. Winkler;
Konrad Lorenz Institute for Ethology,
Austrian Academy of Sciences.

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Tim Birkhead

Post-copulatory sexual selection in birds: Sperm and eggs

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Sperm and eggs have a single function: to meet and produce new individuals. It sounds so simple, but the reality is complicated. A number of factors affect the likelihood of sperm and egg meeting and of then producing a viable offspring. A major step forward in our understanding of the way male and female reproductive systems are designed and interact was the discovery of sperm competition, and later cryptic female choice (together referred to as post-copulatory sexual selection – PCSS). Because PCSS is so widespread in birds they provide a particularly exciting system in which to explore both evolutionary and mechanistic aspects of reproduction. In this talk I will discuss the way PCSS has shaped reproductive traits in birds, ranging from behaviour, through anatomy and physiology. One of the most striking patterns is the strong effect of PCSS on male traits (such as testes, phallus, ejaculate and sperm). Female traits (oviducts and ova) by comparison appear to be more highly conserved, but are probably more subtle. However, one striking and not-so-subtle example of female adaptation to post-copulatory sexual selection will be described in detail. Finally, I will discuss the interactions between male and female traits and consider some new methods and new results relating to compatibility between partners and the viability of embryos.

Hanna Kokko

Demography, behaviour and conservation: How Magpie Robins, Guillemots, and virtual birds link it all together

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Behavioural ecologists all too often regard populations as mere convenient sources of experimental individuals, when in reality we should expect population densities to shape and be shaped by individual-level traits such as behaviour. Calls to understand the links between ecology and evolution have been common for decades. Population dynamics, i.e. the demographic changes in populations, arise from life history decisions of individuals and thus are a product of selection, and selection on the other hand can be modified by such dynamical properties of the population as density and stability. It follows that generating predictions and testing them correctly requires considering this ecogenetic feedback loop whenever traits have demographic consequences, mediated via density dependence (or frequency dependence).

Using avian systems to tackle these questions, I will first show two theoretical examples, then followed by two empirical ones. In all cases, population numbers should have a strong influence on what kind of behavioural strategies should evolve in the two sexes, and behaviour on the other hand influences the growth of a species — including an example of an endangered bird.

The first example tackles protandry: What mechanisms can predict the arrival order of individuals of migratory birds? I will show that our earlier understanding of protandry (male-first arrival) can be considered incomplete. The second example considers parenting decisions: give or take some variation, why are sex roles often so much more egalitarian in birds than in mammals?

The third example (the first empirical) shows that competition for breeding sites can shape divorce patterns in common guillemots (*Uria aalge*), and my final example examines the tension between individually optimal traits and population-level performance in a bird that until recently was threatened by immediate extinction: the Seychelles magpie robin *Copsychus sechellarum*.

Yossi Leshem

Migrating birds know no boundaries – from a local to global scale

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Israel's unique location at the junction of three continents has created one of the most important “bottlenecks”, with 500 million birds crossing twice a year during the autumn and spring migrations. The Israeli Air Force (IAF), maneuvering through this same air space, has suffered from numerous aircraft-bird collisions. During three decades, 9 fighter

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planes crashed and 75 aircraft were involved in accidents with damage costing between 1-10 million dollars each, as well as the lives of three pilots. A large proportion of collisions (74 %) involved migrating birds, with soaring birds causing the most significant damage.

Over the last two and a half decades, long-term monitoring of soaring birds has been conducted with a network of ground observers, a motorized-glider, drones and radar stations, reducing collisions by 76 % and saving the IAF 700 million dollars since 1984 (not to mention the lives of pilots and birds). Over the last 12 years since the establishment of the International Center for the Study of Bird Migration at Latrun, an interdisciplinary approach has been developed that combines migration research with flight safety activities, a broad educational network in schools and bird-watching stations for the benefit of people, migrating birds and their habitats.

In a joint research project of the Max Planck Institute in Radolfzell, Germany and the Tel Aviv University in Israel, funded by the German Ministry of the Environment, we tracked 120 migrating White Storks to which satellite transmitters had been attached.

Founded on this joint research, an educational curriculum was developed for 300 schools in Israel, based on an Internet site, www.birds.org.il, which has enabled the online tracking of the migrating birds, as well as including field trips for direct observations.

In addition, during the last decade research data about vultures, pelicans and cranes with satellite transmitters has been entered into the site's database, as well as the data collected from a Russian meteorological radar, MRL-5, which was adapted to track birds and is active during the seven migration months every year.

This scientific-educational project was extended from a local to regional level, funded by US-AID MERC, when Palestinian and Jordanian researchers and schools joined the project between 1998 and 2004. The aim of the project was to use migrating birds as the platform for the furthering of regional co-operation in the Middle East, an area rife with conflict. Later on, with funding by the European Union, we established three tracking stations in Israel, Jordan and the Palestinian Authority along the Great Rift Valley (GRV) in order to develop eco-tourism and bird-watching as well as to nurture connection to the community.

Since 2001 we have advanced an additional regional project encompassing the use of Barn Owls and Common Kestrels as biological pest control in agriculture in the Beit Shean Valley in Israel (27 km south of the Sea of Galilee), on the eastern side of the Jordan River in Jordan and in Jericho in the Palestinian Authority. This project has led to excellent co-operation between all sides involved from the scientific and agricultural aspects.

The success in the Middle East has led us to a new concept, the extension of our activities in the Middle East to the wintering areas of the migrating birds in Africa, with the focus on the GRV. The GRV is one of the unique geological phenomena on earth, stretching from Turkey to Mozambique along 7,200 km. As a result it constitutes a migration route of global importance through which hundreds of millions of migrating birds migrate yearly from Europe-Asia to Africa and back.

Instead of the conventional treatment of each country separately protecting migrating birds and their habitat, a proposal was made to the UNESCO World Heritage Center to declare the entire GRV as one global World Heritage Site as a serial nomination of 22 countries. These countries will together develop policies of research, conservation, education and eco-tourism in a new approach that will expand the conventional approach on a mega scale for the benefit of the migrating birds and their habitat. We believe that this is an ambitious project, and that success of this interdisciplinary proposal will have a significant impact on migration and wintering grounds, emphasizing the leading role of the African countries in this project.

BirdLife International has already expressed their desire to lead this project. UNESCO, UNEP and the UN-Foundation have expressed interest in applying the concept in the GRV.

In my presentation I will show the unique power of birds to connect between countries, even in conflict-ridden regions, while creating an innovative multidisciplinary scientific concept based on education, conflicts in agriculture, eco-tourism, flight safety and nature conservation of birds and their habitats.

Alexandre Roulin

Communication and the maintenance of genetic variation in colour polymorphic birds

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The hypothesis that ornaments can honestly signal quality only if their expression is condition-dependent has dominated the study of the evolution and function of secondary sexual characters. Much less interest has been devoted to the adaptive function of traits for which the expression is under genetic control and of their role in sexual selection processes. In

this context, colour polymorphic species are appropriate because in a same population individuals of the same age and same sex display one of several plumage variants that are genetically inherited and for which the expression is weakly sensitive to the environment and body condition. Despite such traits not being condition-dependent, the degree of colouration often covaries with life history, morphological, physiological and behavioural traits, and thus colour polymorphism may be a criterion in mate choice decisions. However, it remains unclear why non-condition-dependent colour traits can reflect aspects of quality, since covariation between melanism and other phenotypic traits cannot be explained by the handicap principle stating that only high quality individuals can simultaneously invest energy in the development of a colourful ornament and in these other phenotypic traits. Based on a review of genetic and pharmacological studies I generate predictions regarding the signalling function of melanin-based traits. A survey of empirical studies is consistent with these predictions. I finally present a study carried out in the barn owl to demonstrate why predictions based on genetic and pharmacological literature helps understand the evolution, maintenance and adaptive function of melanin-based colour polymorphism.

Irene Tieleman

Physiological dynamics of birds in desert, tropical and temperate environments

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This presentation addresses the puzzle of how birds are adapted to and cope with different, and changing, environmental conditions, including desert, tropical and temperate environments. Birds as a group exhibit wide variation in life histories, with diverse strategies of coping with environmental challenges. Some species are resident year-round and therefore face temporal variation in environmental conditions, while others are migratory and avoid environmental vicissitudes at potentially considerable travel-costs. This diversity can be understood as the result of interactions between adaptation by natural selection, historical evolutionary pathways, and constraints resulting from interacting physiological systems. I will present work on several study systems, including larks, stonechats and shorebirds that highlight different physiological aspects of resident and migratory solutions to cope with environmental variation.

The Lark family (*Alaudidae*) globally encompasses about 90 closely related species that have distinct life history, physiological and behavioural adaptations in different environments. Compared to their temperate zone counterparts, larks from deserts live life at a “slow pace”, with low energy and water turnover (Tieleman *et al.* 2003), low activity, relative small annual reproductive investments, and presumably high survival rates and relatively large investments in self-maintenance (Tieleman *et al.* 2004). These “desert traits” resemble proposed, but poorly substantiated, life history attributes of tropical birds (Tieleman *et al.* 2006). The similarity in demographic attributes of desert and tropical birds presents a puzzle because environmental conditions are vastly different: birds in resource-poor, highly seasonal desert environments seem to have similar traits to birds in tropical environments that are ostensibly resource-rich and environmentally equitable! Two different hypotheses have been put forward to explain the life histories of birds in desert and tropical environments relative to temperate zone species; one based on resource availability, the other on the risk of mortality due to seasonality. I will explore the evidence for these hypotheses, with explicit emphasis on physiological mechanisms related to resource management and resistance against disease.

Seasonal changes in the environment require temporally flexible physiological adjustments of birds. We studied the seasonal adaptations of interconnected physiological systems (immune function, energetics, stress endocrinology) and life cycle events (migration, molt, breeding) in captive stonechats (*Saxicola torquata*) and shorebirds. The wide geographic distribution of stonechats provided the opportunity for an intraspecific study on individuals originating from populations with different annual seasonal patterns. These birds were reared and kept under identical (common garden) conditions at the Max Planck Institute for Ornithology. We included work on resident Kenyan birds that have evolved in a year-round benign equatorial environment, European birds from environments with moderate seasonal variation, and stonechats from Kazakhstan that are subjected to severe seasonality. The environmental seasonality is reflected in the birds’ different internal annual calendars and exemplified by their diverse migratory strategies. The shorebird studies focused on Red Knots (*Calidris canutus*) in captivity and in the wild, thus providing insights into the endogenous and environmental factors influencing seasonal physiological adjustments.

I aim to show how we can study in increasing detail the physiological mechanisms that underlie individual decisions, especially using new tools from ecological immunology (Tieleman *et al.* 2005, Millet *et al.* 2007) and miniature electronics. The resulting insights into the interactions among physiological systems and the environment will help identify where, when and how evolution acts to bring about the global diversity in life histories. This requires a more dynamic view of how animals cope with their environment than hitherto employed. Essential features include the recognition that

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physiological systems within the organism interact and collectively influence the performance of the organism in its environment and that traits are not fixed but flexible over time.

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Symposia

1 Nightlife of diurnal birds

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Description of Symposium: Many migratory bird species change their diurnal activity patterns twice a year: while they generally remain active and feed during the day, nights in spring and fall are often spent on migratory flights. Such a shift in activity time can entail considerable physiological reorganization, for example damped nocturnal melatonin peaks and increased tolerance of sleep deprivation. However, while researchers explore the intriguing specializations of migrants for coping with temporary nocturnal activity, evidence is mounting that nightlife of diurnal birds also occurs in multiple other contexts. Examples include nocturnal song during the breeding season. In some species, such as the nightingale, nocturnal song is employed at particular times of the breeding cycle and in a specific behavioural context. Facultative movements on the winter grounds are thought to sometimes occur at night. New technologies, for instance telemetry studies of free-living birds, have now provided solid evidence that post-fledgling movements and dispersal flights can also take place during the deep night hours. Simultaneously, new and old data from captive birds confirm that seasonally recurring nocturnal restlessness occurs at various times of year in migratory and also non-migratory birds. These findings suggest that diurnal activity patterns of birds are relatively flexible, and that shifts can be rapidly initiated. The purpose of our symposium is to shed light on this under-explored behaviour and encourage further research into the temporal flexibility of birds.

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Hidden movements of Reed Warblers – nocturnal life of diurnal birds

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When we discuss the annual cycles of ‘nocturnal’ migrants, we are referring to their nocturnal behaviour during migration. However, because their daytime activity – such as nest building and feeding their nestlings – during the breeding season is so obvious, we assume that they are diurnal at this time of the year. But are they really diurnal as we assume? If there is any relationship between nocturnal activity and prolonged movements (as occurs during migration), nocturnal activity may occur during other periods of the bird’s life when they make long-distance trips that are not related to migration. There are two kinds of movement fitting this description: i) juvenile dispersal, when birds choose and establish relationships with their future breeding grounds; and ii) breeding dispersal within a breeding season, when birds change their breeding sites after clutch or brood loss. To test our hypothesis that nocturnal activity occurred at these times, we studied Reed Warblers, because this species breeds in a patchy habitat and individuals may have to cover long distances to reach other reedbed patches. Juvenile reed warblers were marked with radio-tags and their movements traced from independence until the beginning of autumn migration. On average, they became nocturnal when 42 days old and all long-distance movements prior to migration were made at night (Mukhin 2004, Mukhin *et al.* 2005). Several pairs of adult Reed Warblers were marked with transmitters and forced to leave their breeding sites by simulating nest predation. Of 9 tracked birds, 6 individuals departed nocturnally: 5 during the first week after nest loss, and the other bird after 40 days. Departure time varied from +2 to +4 hours after sunset (161.6 ± 59.3 min). Also, 2 out of 3 males which were caught at their nests and displaced to remote reedbeds (2, 8.7, 11.5 km away) returned to their nests at night, crossing inhospitable habitats in one or two nocturnal flights. The reasons for this nocturnal behaviour outside the migratory season are discussed.

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Rethinking the significance of nocturnal activity of captive birds

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Observations of the nocturnal activity of captive migrants were an historical milestone in migration research and also stimulated discussion about innate behaviour. Yet, closer inspection of captive birds revealed that nocturnal activity appears in various contexts in both migrant and resident species. For example, in many captive migrants the period of nocturnal restlessness lasts longer than in free-living conspecifics, suggesting that the conditions or environmental factors that regulate the termination of migration are not operating in captivity. During autumn and winter months, nocturnal activity can be triggered in migrants by a reduction in food availability or exposure to a dominant conspecific. Furthermore, individuals of captive resident species that show no proclivity to migrate may exhibit some nocturnal restlessness during migratory seasons. These findings suggest that nocturnal activity displayed by diurnal birds may be more widespread than previously thought. Environmental and/or social conditions may play a role in the expression of this behaviour. Investigations into the specific behavioural components of nocturnal activity suggest that it may represent behaviours that are not necessarily associated with migration. In order to understand the significance of nocturnal activity, we review some of the classical evidence and discuss ideas that have been suggested to explain why nocturnal activity by diurnal species occurs in a wide variety of contexts.

Fusani, Leonida¹

Zugunruhe, food, and melatonin

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A large number of birds are nocturnal migrants, i.e. they migrate mainly at night. In previous studies we have shown that night melatonin levels are lower when birds show migratory restlessness or Zugunruhe. This was first found by comparing blackcaps (*Sylvia atricapilla*) and garden warblers (*Sylvia borin*) in Zugunruhe during the migratory seasons with birds that were not active at night during the sedentary seasons. The same variations in night melatonin levels were found when interruption of Zugunruhe was induced by treating blackcaps with a food regime that simulated a long migratory flight and a refuelling stopover. In autumn, there was a suppression of nocturnal activity and an increase in melatonin in the night following food reintroduction. In spring, the effects were qualitatively similar but their extent depended on the amount of body fat reserves. Because of the latter results, we advanced the hypothesis that body condition and fat reserves at the arrival to the stopover site determines changes in melatonin and Zugunruhe. Recent field experiments with garden warblers at a spring stopover site in the Mediterranean confirmed the latter hypothesis, however the lack of a clear correlation between melatonin and Zugunruhe suggests that these two variables are not causally related but respond to common nutritional factors.

Kunc, Hansjörg P.¹, Amrhein, Valentin², Schmidt, Rouven³, Naguib, Marc⁴

The function of song varies with time of day in the Nightingale (*Luscinia megarhynchos*)

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While seasonal patterns of bird song have been well studied, little is known about whether the function of song varies with time of day. Darwin mentioned the nocturnal song of the nightingale (*Luscinia megarhynchos*) as a striking example of sexual selection, but why such an elaborated form of animal behaviour has evolved is largely unknown. We compared nightingale song at night and dawn between males that were able to attract a female and males that remained unpaired.

We found that nocturnal singing behaviour of male nightingales is strongly correlated with reproductive success: males singing more whistle songs at night were more likely to attract a female. However, we did not find such a difference related to singing at dawn. Moreover, females consistently preferred males as extra-pair fathers that sang more whistle songs than their social mate, and non-cuckolded males sang more whistle songs than cuckolded males. Playback experiments showed that males reduced the proportion of whistle songs during vocal interactions with rival males, suggesting that whistle songs are less important in male-male interactions. Our findings suggest that nocturnal song could have evolved in an inter-sexual context to attract females, whereas dawn song could have evolved in an intra-sexual context directed at other males to announce territory occupancy. Our study emphasizes that time of day can play a critical role in understanding the function of animal signals and the relationship between song and reproductive success.

2 Health of arctic and antarctic populations

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Description of Symposium: Healthy individuals are able to optimize resource use, survival and reproduction. Health of an individual will be under constant attack. Animals have developed immunological, physiological and behavioural strategies to battle these attacks from pathogens, parasites and/or pollution on their health. Ecological immunology is a fast developing field, with beautiful examples of individual and species differences in immune response. Population size and distribution is structured by pathogens, parasites and pollution, whose effect on fitness is often a complex interaction in an evolutionary struggle for survival. Spatial and temporal variation between populations and individuals and knowledge about the battle for health is the main theme of this symposium. Little is known about these aspects in polar bird populations. The Polar Regions are of special interest as these areas are considered to have relatively low levels of pathogens, parasites and pollution. Migratory birds linking temperate regions with the Arctic or Antarctic are potential vectors of diseases as shown by the recent spread of the West Nile Virus, Avian Influenza or Newcastle disease. However, with a changing polar environment due to climate change and pollution, more knowledge is needed on how animals cope with attacks on their health. Such changes have been related to loss of the ice layer and to an increase of temperature of 2.5° C in the last 50 years. Comparisons between the Arctic and the Antarctica will bring detailed knowledge about the dynamics of the host-parasite effects together with the pollutant and UV effects in the avian immune response. This symposium is organized in connection with the international project BIRDHEALTH included in the activities of the International Polar Year.

Barbosa, Andrés¹, Palacios, Maria Jose²

Health of Antarctic birds: A review of their parasites, pathogens and diseases

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The health of some individuals in a population emphasizes the lack of health of the others which suffer the effects of this lack of health and should try to fight the assaults of pathogens or parasites. Healthy individuals are able to optimize resource use, survival and reproduction, so parasites and diseases have recently been considered as selective pressures affecting individual fitness. Because the health of an individual is under constant attack, animals have developed immunological, physiological and behavioural strategies to protect their health. Antarctic birds are not beyond such risks despite polar regions having relatively low levels of pathogens and parasites. However, little attention has been paid to health and its ecological consequences for bird populations. We review the information published about diseases and parasites and its effects on Antarctic birds. The available information is incomplete in terms of host species, parasites or pathogens and geographic regions. Publications about the ecological effects on the populations, including how birds response against pathogens and parasites, are almost absent. It is therefore impossible to establish general patterns of spatial and temporal variation of pathogens and parasites and how such patterns could influence their hosts: more information on this topic is clearly needed. We also discuss some future consequences of climate change and an increase in human activity which could promote the spreading of pathogens and diseases.

Loonen, Maarten J.J.E.¹

Why are we interested in bird health: an Arctic perspective

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Most Arctic breeding birds are migratory, wintering in Europe and migrating to the high north to reproduce. The breeding grounds have the advantage of an exploding food supply, but require an expensive migration and adequate timing. Is migration an escape for predators, parasites and pathogens or are migrating birds vectors for infections, spreading new diseases over large distances? In recent years, avian influenza has put this question into the news as highly relevant for the poultry industry and human health. But what is the birds' perspective? Is their population size or the present geographic and temporal distribution affected by the occurrence of pathogens and parasites? And what is the expected effect of future climate change? In this presentation, I will show examples of transmission of pathogens and parasites from and to the Arctic. Field experiments with pathogens or medicine show the consequences of disease for the infected individuals and immunological techniques allow us to quantify the arms race between pathogen and host within a geographical and a temporal frame.

Hanssen, Sveinn Are¹

Costs of immunity or adaptive life-history decisions, an example from northern Common Eiders

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An induced immune challenge may have two counteracting effects on an individual's reproductive investment. (i) The resource demand may increase to "fuel" the immunological reaction, which in turn may lead to an adaptive decrease in investment in resource-costly activities such as reproduction. On the other hand, (ii) the individual may assume that the immune activity it experiences is indicative of a serious infection. The latter may lead to an adaptive increase in reproductive investment in response to the reduced prospects of survival and future reproduction, so called "terminal investment". In order to measure such life-history related consequences of increased immune activity, one group of incubating female common eiders *Somateria mollissima* was injected with a non-pathogenic antigen (sheep red blood cells, SRBC) while controls were injected with sterile saline. The Eider is a long-lived sea-duck where females, who incubate the eggs and care for young without assistance from the male, engage in facultative anorexia during incubation leading to a large reduction in body mass. Eiders may abandon their young to other females at the cost of reduced young survival. The immune challenge resulted in a larger mass loss, a prolonged incubation period and reduced return rate, demonstrating both short- and long-term costs of immune challenge. Additionally, in response to what may have been interpreted as reduced survival chances in immune challenged females, these females more often tended their own brood after hatching, despite having suffered higher costs during incubation.

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How can we measure 'bird health'?

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As interest in ecological immunity widens, and concerns about the threat of avian flu to human health grow, a range of methods are being developed to investigate the general health of birds. In order to understand better how the health of birds is impacted by the environment in which they live, these methods must encompass both samples collected from the bird itself and samples aimed at quantifying disease challenges present in the environment. This approach requires greater collaboration between ornithologists and researchers in other disciplines, particularly microbial ecologists and epidemiologists. In this talk we will review some methods currently being developed to investigate 'bird health' and the avian disease risk posed by different environments. While traditional methods, such as examination of blood slides to quantify haemoparasitic loads and leukocyte numbers may still prove useful, techniques for measuring immune function

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parameters using whole blood or plasma have increasingly come to the fore. Also, sampling bacterial loads on the surface of birds, in the air, and from soil in conjunction with analyses using molecular techniques (e.g., ribosomal intergenic spacer analysis (RISA) and denaturing gradient gel electrophoresis (DGGE)) will allow a greater appreciation of potential disease threats within the environment. These measures can be combined with quantification of the antibacterial proteins in unhatched eggs and indices of immune function in adult birds to better understand the investments that birds must make to defend themselves from disease.

3 Postcopulatory sexual selection in birds

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Description of Symposium: Ever since the discovery of DNA extra-pair paternity, birds have been one of the most important study systems for investigating the mechanisms involved in postcopulatory sexual selection. Our understanding of the relationship between postcopulatory processes and male and female reproductive behaviour and anatomy is based to a large extent on studies performed in birds. Both experimental and comparative approaches have improved our understanding of the association between the risk and intensity of sperm competition and male reproductive traits such as testis size, ejaculate quality and sperm morphometry and function. In addition, bird studies have enabled us to learn more about the complex processes involved in the coevolution between male and female reproductive biology. We use this symposium to summarize the current state of the art in the study of postcopulatory sexual selection in birds and its implications for other taxonomic groups. We hope to encourage researchers from all fields to think and discuss the future of the study of postcopulatory sexual selection and its potential role in other fields of behavioural ecology and evolutionary biology.

Pizzari, Tommaso¹

Post-copulatory sexual selection in birds, lessons from the chicken

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Post-insemination sexual selection occurs whenever variation in paternity is explained by the competition of the ejaculates of different males over fertilisation (sperm competition) and female biased utilisation of sperm (cryptic female choice). Because the females of several bird species copulate with multiple males, the ejaculates of different partners have a non-zero probability of overlapping within the reproductive tract of a single female, setting the scene for post-insemination sexual selection. The use of poultry techniques in combination with molecular tools is catalysing an interest in the fowl as avian model system of the mechanisms of avian sperm competition and cryptic female choice. In this talk I review recent advances in the field to outline: (i) the main mechanisms of avian sperm competition, (ii) multiple mechanisms of strategic sperm allocation by males, and (iii) mechanisms of cryptic female choice. Post-insemination variation in paternity in birds, appears to be determined by male and female strategies of differential ejaculate expenditure and sperm utilisation and by their complex interactions. A promising future approach to better understand the operation of post-insemination sexual selection in birds would require a two-pronged approach which, on the one hand, investigates behavioural and physiological mechanisms applying poultry techniques and molecular tools to domestic model species such as the fowl, and on the other, tests the functional significance of these mechanisms in wild populations.

Immler, Simone¹, Birkhead, Tim R.²

The evolution of sperm design in birds

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Sperm design varies markedly even between closely related taxonomic groups. Postcopulatory sexual selection, comprising sperm competition and cryptic female choice plays a crucial role in the evolution of sperm design in birds but the nature of this relationship is not fully understood. In passerine birds for example no significant relationship exists between sperm morphometry (i.e. sperm trait dimensions) and the risk of sperm competition when looking at a wide range of species belonging to several families. However, within passerine families the relationship between sperm morphometry and the risk of sperm competition is significant, but may be positive (e.g. in Fringillidae) or negative (e.g. in Sylviidae). There are several possible explanations for these different patterns; one of which is the fact that female reproductive biology plays a crucial role in the evolution of sperm morphometry in passerine birds as well as in other

avian taxa. In passerines, sperm length is known to correlate positively with the length of the sperm storage tubules inside the female reproductive tract. In pheasants, sperm morphometry is independent of the risk of sperm competition, but seems to be influenced by the duration of sperm storage (estimated from clutch size and the spread of laying). The relative importance of sperm competition, female reproductive biology and phylogeny for the evolution of sperm design are discussed.

Lüpold, Stefan¹, Birkhead, Tim R.², Cornwallis, Charlie K.³

Factors affecting sperm form and function in the Feral Fowl

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Spermatozoa are remarkably variable in design at all levels from higher taxa to individual males, but the selecting forces that have brought about this variation are poorly understood. Various comparative studies have shown that (i) the level of sperm competition (the competition between sperm from different males for the same set of ova) is one of the main factors shaping the evolution of sperm design and that (ii) sperm design explains the variation in fertilization success. However, we lack information on these factors at the species level where sperm competition occurs in the first place. In the Feral Fowl (*Gallus domesticus*) as a model species, we are investigating whether sperm competition affects sperm morphology. In this species, sperm competition risk is primarily determined by social status, and social status predicts male fertilization success. However, it is unknown whether sperm competition risk can also explain the variation in sperm morphology. Therefore, we are testing the hypotheses (i) that sperm morphology depends on male social status, (ii) that it explains the variation in sperm swimming performance, a good predictor of male fertilization success, and (iii) that both sperm form and swimming performance are plastic during a male's mating history.

Calhim, Sara¹, Immler, Simone², Birkhead, Tim R.³

Postcopulatory sexual selection decreases inter-male variation in sperm morphology

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The evolutionary role of postcopulatory sexual selection in shaping male reproductive traits, including sperm morphology, is well documented in several taxa. However, previous studies have focused almost exclusively on the influence of sperm competition on variation among species. In this study we tested the hypothesis that intraspecific variation in sperm morphology is driven by the level of postcopulatory sexual selection in passerine birds. Using two proxy measures of sperm competition level, (i) relative testes size and (ii) extrapair paternity level, we found strong evidence that intermale variation in sperm morphology is negatively associated with the degree of postcopulatory sexual selection, independently of phylogeny. Our results show that the role of postcopulatory sexual selection in the evolution of sperm morphology extends to an intraspecific level, reducing the variation towards what might be a species-specific 'optimum' sperm phenotype. This finding suggests that while postcopulatory selection is generally directional (e.g. favouring longer sperm) across avian species, it also acts as a stabilising evolutionary force within species under intense selection, resulting in reduced variation in sperm morphology traits. We discuss some potential evolutionary mechanisms for this pattern.

White, Joel¹, Wagner, Richard H.², Helfenstein, Fabrice³, Hatch, Scott⁴, Danchin, Etienne⁵
Multiple deleterious effects of sperm ageing on reproduction in Kittiwakes

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NB: Speaker will be Etienne Danchin

Sperm ageing is known to be detrimental to reproductive performance. However this apparently general trait has rarely been addressed in an evolutionary context. As it negatively impacts the fitness of individuals, sperm ageing likely constitutes an important selective pressure giving rise to a number of adaptations to avoid its effects. One of the behavioural adaptations suggested is post-copulatory sperm ejection by monogamous female kittiwakes. Our aim was therefore to verify the consequences of sperm ageing in Black-Legged Kittiwakes *Rissa tridactyla*. We experimentally manipulated the age of the sperm fertilising the eggs by using an antipulator ring (or “condom”), fitted on males for a range of durations preceding egg-laying. We found evidence that sperm ageing impacted negatively on four stages of development: fertilisation potential, the rate of embryonic development, embryonic mortality and chick condition at hatching. These effects appear to be the continuum of single phenomenon, whereby the same process of ageing deleteriously affects different aspects of reproduction depending on the degree of damage incurred to the spermatozoa. The marked impact of sperm age on fitness may thus drive post-copulatory sperm ejection by females. Moreover, these results are concordant with those found in a wide range of taxa, underlining the generality of the negative effects of sperm ageing and the potential for a wide array of adaptations.

4 Avian influenza risk assessment: The contribution of ornithology

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Second organizer: **Irene Keller**

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Description of Symposium: Since 2005, H5N1 highly pathogenic avian influenza has infected wild birds and poultry in at least 53 countries in Asia, Europe and Africa. While the spread of the virus through human activities (e.g. poultry trade) has been demonstrated frequently there is still limited understanding of the role of wild birds in the dispersal of highly pathogenic avian influenza viruses. However, most strategies to protect poultry from AI infection are aimed at reducing the risk of contact with wild birds. These measures generally include a ban on free range poultry farming and other regulations which cause both ethical and economic problems and depend on public acceptance. Consequently, there is a rising need for avian influenza risk assessment tools that enable authorities to adjust the measures on a spatial and temporal scale. In many countries, ornithologists are involved in the development of risk assessment tools and help statisticians and veterinarians to make use of large datasets on wild bird movements, spatial bird distribution and bird ecology. This symposium will be open to contributions that use avian influenza outbreak patterns to determine the factors responsible for these outbreaks as well as to presentations of risk assessment tools that are currently being developed.

Fiedler, Wolfgang¹

Avian influenza in wild birds: Brief introduction to our current knowledge

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Waterfowl are the major reservoir for all 16 H- and 9 N-subtypes of low pathogenic avian influenza viruses (LPAIV), including the subtypes H5 and H7, which are a serious economic threat to the poultry industry, and also human influenza viruses H1, H2, H3. LPAIV do not cause any signs of disease in infected wild birds or in poultry. However, LPAIV subtypes H5 and H7 can be introduced into poultry holdings, and with large numbers of highly susceptible animals, the previously stable viruses of low pathogenicity begin to evolve rapidly and may mutate into highly pathogenic avian influenza (HPAI; bird flu) causing up to 100 % mortality in infected birds. Then these HPAIV can be spread by movement of stock, infectious faeces, contaminated water or bird products. Wild birds are usually also blamed for the spread of the disease, but sound supporting data are lacking. In winter 2005/06 HPAI virus Asian lineage H5N1 occurred in wild birds in Europe. Between February and May 2006, 80,066 wild birds were tested within the EU member states, with 589 positive cases of HPAI and 391 detected cases of H5N1. In contrast, European AI cases in winter 2006/07 were largely restricted to poultry holdings. The patterns of occurrence of HPAI outbreaks do not fit convincingly with bird migration. Therefore the risk of transmission of HPAI virus through man (legal and especially illegal trade) appears to be as high as through wild birds. It is still unclear whether a bird infected with HPAI virus H5N1 is able to perform longer flights before or during the virus shedding period (few days) at all. Cases supporting this assumption are largely missing. Within the EU member states between July 2005 and January 2006 39,000 birds (90 % ducks and geese) have been tested and 314 cases of LPAI have been detected, while not a single HPAI case was found. However, as it is still unclear whether the virus may be transported by asymptomatic migratory wild birds it is recommended to monitor the situation carefully.

Keller, Irene¹, Fiedler, Wolfgang², Bachmann, Iris³, Stärk, Katharina⁴, Griot, Christian⁵
Research project Constanze – studying avian influenza in wild birds at Lake Constance

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Lake Constance is an important wintering ground for waterfowl in the Alpine foothills with up to 250,000 individuals observed in mid-winter. Between January and April 2006, highly pathogenic avian influenza H5N1 was detected in 86 wild birds found dead in the area. Against this background, the tri-national research project Constanze was initiated in June 2006. The focus of this project is to investigate several aspects of avian influenza including the epidemiology of infection in wild waterbirds and the risk of virus transmission from waterfowl to poultry. Constanze involves various authorities and research institutes from Switzerland, Germany and Austria and will last until 2009. The occurrence of avian influenza viruses is monitored by testing samples from waterfowl caught in two purpose-built traps or by hand. Additionally, sentinel ducks are kept in each country and regularly tested for avian influenza virus infection via tracheal and cloacal swabs, and antibody monitoring via blood samples. The role of migratory birds in the introduction and spread of H5N1 in the Lake Constance area is investigated by satellite telemetry and the analysis of ring recovery data. The data generated in Constanze will provide the input for models, which aim at assessing the risk of H5N1 introduction from wild birds into poultry.

Clark, Jacquie¹, Atkinson, Phil², Robinson, Rob³, Newson, Stuart⁴, Crick, Humphrey⁵
Understanding bird movements and the threat of AI

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The possibility that migrating wild birds might move Avian Influenza has meant that governments want information on bird movements and distribution to help them assess risk levels. In Britain, we (BTO in conjunction with WWT and Defra) have developed a new recovery mapping technique using statistical methods to both describe and define migration routes. To do this we plot recovery distance against direction and fit a smooth line to the data using GAMS. Different groups of recoveries (migration pathways) are distinguished using turning points. The 'migration pathways' are plotted separately and a smooth line is fitted to them to indicate the timing and direction of movements. Kernel mapping of recoveries is also used to indicate the distribution of populations in different seasons. The maps and data are being brought together in a web tool that can be used to access them. In addition, we have defined priority areas for surveillance for AI using poultry and wild bird abundance from a variety of BTO surveys. These methods provide an extremely valuable way of understanding the possible spread of AI. They can also be applied to other species to help understand the movements and distribution of birds. We are now applying similar methods to Europe-wide data.

Hoye, Bethany¹, Klaassen, Marcel², Munster, Vincent³

Avian Influenza and wild birds: Who, when, where, and some ideas about why

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It is widely accepted that wild birds are the major reservoir for Avian Influenza viruses, and are also likely to play a significant role as vectors for the disease. However, despite intensive surveillance, we still know very little about the role individual wild birds (and their populations) play in the spread of these viruses. Traditionally, phylogenetic studies of the virus have been used to develop spatial and temporal patterns of virus spread, which are in turn compared with migration patterns in order to estimate the degree to which wild birds may be involved. However, this broad scale approach tends to neglect the ecology of the virus, and just as importantly, the ecology of the host. What effect does the virus have on the ecology of the host(s), and what effect does the host have on the virus? From the available IV prevalence data I have attempted to find where most infection is occurring; when; and in whom, in terms of species, and individuals within those species. But the most alarming result of my analyses is why, and it may have very little to do with ecology.

Reinke, Mirjam Isabelle¹, Wink, Michael², Braun, Michael P.³, Sauer-Gürth, Hedwig⁴

Prevalence of Avian Influenza in wild birds of urban environments

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The metropolitan region of the Rhine-Neckar Area including the cities of Mannheim and Heidelberg belongs to the most densely populated area in Baden-Wuerttemberg, making studies on the presence and dispersion of the previously detected avian influenza (AI) in this region especially important. The aim of this project is the analysis of wild birds ("sentinels") that are in close contact with humans in the area of Northern Baden. This especially includes water birds in urban parks or open air baths and also birds that are fed in gardens in winter. These species often come into contact with the migratory birds (e.g. mute swans, gulls, mallards) that are often regarded as major virus vectors. Continuous monitoring of sentinels over a period of two years should serve as an early warning system for AI. Molecular and serological virus diagnostics will be carried out. Former contact with AI can be tested via antibodies in the serum. For positively tested individuals further analysis is needed to detect the exact viral strain. Furthermore it will be investigated if infected birds suffer from additional diseases such as salmonella and blood parasites. The percentage of migratory birds in the urban environment and their origin will be determined via DNA sequencing (mitochondrial DNA) and STR analysis. This project provides both basic knowledge for science and information for the public.

5 Heterogeneity in bird populations, causing biased samples, as a challenge for ecological field studies

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Description of Symposium: The concept of random sampling is a foundation of all empirical sciences; it is the sole guarantee that characteristics measured in a sample are the same, on average, as those in the wider population about which inference is required. In many areas of ecology experiments are difficult or impossible and observational studies are more easily carried out. Furthermore, observational data are widely available and it would be a pity to discard these just because they do not form a random sample. This is particularly the case in field studies, where obtaining a random sample of a population may be hard even in a well-designed experiment. In essence, the samples we observe or catch may often be suspicious in terms of their representativeness. We are convinced that this is something we should: 1) be aware of, 2) test for and 3) correct for, whenever possible. We think that the issue of how to obtain a random sample in field studies, or what to do with a non-random sample, is far from receiving the attention it really deserves. In this symposium, we present contributions that document ways of how to diagnose biased samples and remedies for this. In general, it is our intention to raise the awareness for this important and underestimated issue in the difficult field of animal population analysis.

Kéry, Marc¹, Schmid, Hans², Volet, Bernard³, Zbinden, Niklaus⁴

Trend analyses of avian chance observations in Switzerland: Effort correction using site-occupancy models

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Trends of abundance or occurrence of single species are among the main nation- or even continent-wide indicators of biodiversity. In many countries of the world, well-designed and large-scale surveys are not an option, so the best that can be done is to collate information that is ‘there’ anyway. One big problem with the interpretation of the resulting data is how to correct for variation in observer effort, since typically observers and their activity have greatly increased over the years. In Switzerland, twenty years ago, semi-standardised collection of birdwatchers’ chance observations was introduced. Here, we show how site occupancy models (MacKenzie *et al.*, Ecology, 2002: 2248–2255) can be used to correct for annual variation in observation effort. Furthermore, these models also yield estimates of the components of occupancy change, i.e., of colonisation and extinction probabilities, which may give important hints at where problems lie in declining species. When conducted in a Bayesian context using MCMC, functions of these parameters along with their uncertainties, such as occupancy growth rates, can be obtained easily. These models have considerable potential for monitoring applications such as ours.

van Noordwijk, Arie J.¹

Some animals are more unequal than others

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There are several sources of potential heterogeneity in any set of data collected in natural populations. There are differences among individuals due to sex, age, experience, genotype; there are differences due to properties of their location, e.g. in the case of territories differences due to habitat or the location of the territory; and there are potential observer effects. When a cause for heterogeneity is known, it is possible to correct for it. I will first present a number of examples of heterogeneity due to individual and territory properties and some suggestions of how to analyse these. However, the most intriguing question is how to prevent effects of heterogeneity on our results, when the source of the heterogeneity is not (yet) known. Apart from stratified sampling in which groups to be compared are balanced as much as possible, the use of intra-individual or intra-territory comparison is advocated as a general strategy to isolate the effect of processes to be studied from all other effects.

Ezard, Thomas H.G.¹, Becker, Peter H.², Coulson, Tim³

Changes in bird phenology: The importance of considering age

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There have been numerous reports of changes in bird phenology, which are frequently attributed to environmental change. Age-dependent variation in phenotypic traits, fledgling production and the timing of events in the life cycle is also widespread. Changes in the age-structure of a population could consequently generate changes in phenology, which may be incorrectly attributed to environmental change or micro-evolution. Using long-term individual-based data collected from a breeding colony of common terns (*Sterna hirundo*), the consequences of age-dependent change on population growth rate and estimates of selection are assessed. Prospective and retrospective matrix analysis revealed that different age-classes made different contributions to variation in population growth rate: older age classes consistently produced offspring whereas young adults performed well only in high quality years. A large contribution to population growth rate did not imply a large contribution to its variation. The failure to correct for age generated deceptive estimates of selection on arrival date, arrival mass and laying date in eight out of nine comparisons. In six out of nine comparisons the direction of selection differed between age-corrected and uncorrected estimates. The age-corrected estimates of selection were weak and explained little variation in fitness suggesting that these phenotypes are not under intense selection in this population. These results demonstrate the importance of correcting for age when identifying factors associated with changes in seabird phenology. Improving the accuracy of population and evolutionary predictions demands closer examination of the lives, and deaths, of individuals within populations. Supported by NERC and Deutsche Forschungsgemeinschaft (BE 916/8-2).

Thorup, Kasper¹

The seasonal distribution of migratory birds estimated using ring recoveries

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For long-distance migrating bird species breeding in Europe, the non-breeding distribution is generally rather poorly known. This is especially true for species wintering in Africa, but also for species wintering in other areas with poor observer coverage. Several sources can produce useful information on these distributions, including pure observations, ring recoveries, satellite tracking and to a lesser extent genetic methods and analysis of stable isotopes. Most of the distributional information is based on pure observations that do not provide quantitative information or information on differences among populations, but still, use of observations can be extended with e.g. niche modelling. Ringing recoveries provide a vast database on the occurrence of birds. However, the recovery distributions are heavily biased by regional differences in recovery probabilities. Thus, in many species ringing recoveries allow only qualitative inferences, e.g. for a species that the majority winter south of Sahara with an unknown (small) proportion wintering north of Sahara. Here, I

aim to estimate the recovery probabilities for different areas, thereby allowing for improved estimates of how large proportions of birds are wintering in different areas, e.g. north or south of the Sahara. Assuming survival rate to be constant among species, differences in recovery distributions among species with numbers marked known in species groups allow for such estimates. The analysis is based on country-wide data from Denmark with only annual numbers known (reflecting the general lack of information of birds not later recovered in standard ringing data). For 7 migrants (Redstart, Thrush Nightingale, European Robin, Reed Warbler, Garden Warbler, Blackcap and Pied Flycatcher) estimates of proportions wintering south of the Sahara ranged from zero (European robin) to one (thrush nightingale). Apart from blackcap (0.22), the remaining estimates were in the range 0.64-0.87. Such estimates could for example be used to monitor possible changes in proportions of individuals wintering in these areas resulting from a change in climatic conditions and land use.

6 Ornithology past, present and future

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Description of Symposium: The symposium provides a unique opportunity to witness the development of the entire span of ornithology from the mid 1500s to the present. Fascinating in its own right, the history of ornithology is also a rich source of new ideas. The symposium starts with the emergence of scientific ornithology in the sixteenth century as symbolism, folklore and fantasy are gradually replaced by a more evidence-based ornithology. The second talk focuses on one of the seventeenth-century's main centres of bird study; Italy. At the very hub of the scientific revolution, Italian ornithologists produced not only groundbreaking bird books but what became known as the 'paper museum' – a vast and wonderful documentation of contemporary ornithology that includes some of the finest bird illustrations ever produced. We then move forward to the first keynote talk to explore the modernization of ornithology during the 20th century, where the roles of two towering ornithological intellects, Erwin Stresemann and David Lack are compared. Together but independently, these men brought about a revolution in ornithology, dragging it out of the nineteenth century into mainstream zoology and making it scientifically respectable. The fourth talk continues this theme and examines the role played by amateurs in ornithological science, with particular focus on the tension between David Lack (at the Edward Grey Institute) and the British Trust for Ornithology in the UK in the 1940s and 1950s. The final talk highlights the value of knowing about the history of ornithology. By examining how one particular area of current research developed – mating systems and extra-pair paternity in birds – this second keynote not only brings the history of ornithology right up to date, it demonstrates how a better knowledge of the history of bird study would have facilitated the development of this currently popular area of research.

Charmantier, Isabelle¹

The Beginnings of Ornithology: Bird Symbolism in the 16th and 17th Centuries

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This paper explores the beginning of ornithology. The focus is on the sixteenth and seventeenth centuries and the shift from birds as symbols to birds as objects of scientific study. Since Antiquity, birds have been used to symbolise particular concepts. The crane, for example, was a symbol of vigilance. Two genres of literature appeared for the first time during the sixteenth century: emblem books and natural history works. Emblem books used birds to embody their moral message, while natural history books included emblems as well as fables and myths within their ornithological information. For many naturalists, bird behaviour could be interpreted as moral or immoral. In this sense, emblems and natural history books shared a similar aim: they were meant to help man understand the signs God had placed in nature for man's benefit. They also used the same sources (mainly Aristotle, Pliny, and Aelian) and the same illustrations. The mid-seventeenth century was a watershed in the study of ornithology, with an end of symbolism made most emphatically by John Ray in his *Ornithology* of Francis Willughby (1676). I discuss the causes and consequences of the end of symbolism and the beginning of scientific ornithology.

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A 17th century paper museum

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Italy was at the centre of the scientific revolution. A significant player in this revolution was Cassiano dal Pozzo (1588-1657), patron, scientist and antiquarian whose collection of around 7,000 drawings, and probably as many prints, eventually became part of the British Royal Collection, much of which is still in the Royal Library at Windsor, UK. Cassiano was elected to Europe's first scientific society, the Accademia dei Lincei, of which Galileo was the most famous member. Cassiano and his brother amassed a collection of paintings, a library, a museum of antiquities, animal artefacts and curiosities, and kept a collection of live birds at their palace in Rome. Most notably they created a "museum on paper" or visual encyclopaedia – a collection of illustrations of every branch of knowledge of the man-made and natural worlds. Unlike Aldrovandi's comparable collection of paintings (now in Bologna University Library), much of which was published as woodcuts in books during and after his lifetime, the fact that the greater part of Cassiano's collection was never published meant that the majority of the images remained unknown to later natural history illustrators. The outstanding drawings of birds that formed the models for the etched plates in Giovan Pietro Olina's 'Uccelliera' or 'Aviary' (1622) were an exception and these images had a significant influence on later ornithological illustration. Olina's plates were used in Jonston's *Historia Naturalis de Avibus* (1650), Ray and Willughby's *Ornithologia* (1676) and Buc'hoz's, *Le Traité des Oiseaux de Volière* (1774); Linnaeus also used Olina, especially for birds not seen in Sweden. It is clear that had more of the Paper Museum images been accessible through publications, the course of later 17th and 18th-century natural history illustration might have been different.

Haffer, Jürgen¹

The origin of modern ornithology in Europe

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During the 18th–19th centuries and into the early 20th century, ornithology was deeply subdivided into systematic ornithology and field ornithology (natural history of birds). During the 1920s, Erwin Stresemann (1889–1972) in Berlin, Germany, initiated the integration of both branches into a unified New Avian Biology (Stresemann "revolution") through a change of the editorial policy of the *Journal für Ornithologie* and through the publication of his large volume *Aves* (1927–1934) in the *Handbuch der Zoologie* which became the founding document of modern ornithology in central Europe. It was quickly recognized that the bird is well suited for studies into the problems of functional morphology, physiology, behaviour, and orientation of animals. The Stresemann "revolution" went by unnoticed in Great Britain, where the established editorial policy of *The Ibis* throughout the 1920s–1930s and into the early 1940s was to publish articles based on a traditional definition of science, i.e. fact-gathering rather than answering open questions. Several authors who had published 'biological' studies after 1900 remained on the fringes of British ornithology. One of these authors from the 1930s onwards was David Lack (1910-1973) who, during the early and mid-1940s, was able to introduce the New Avian Biology to the UK against the resistance of the majority of conservatively minded older British ornithologists. As his own contributions to the New Avian Biology, D. Lack added the broad fields of evolutionary ecology and population biology of birds which, under his leadership, became the major research topics of the Edward Grey Institute of Field Ornithology at the University of Oxford.

Greenwood, Jeremy J.D.¹

National collaboration in British ornithology: The first century

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Amateurs have always played a crucial role in scientific ornithology, especially through collaborative investigations. The first systematic survey of bird distributions in the whole of Britain was published in 1865. Thereafter, progress was slow, despite attempts (as elsewhere in Europe) to study migration through collaborative networks. Bird watching became popular as prismatic binoculars became available and collaborative work was promoted by the establishment of the journal *British Birds* in 1907 and the ringing scheme in 1909. Collaborative work by local clubs in the 1920s and the national heronries census of 1928 showed what could be achieved, leading to the foundation of the British Trust for Ornithology in 1933. Long-term studies (apart from ringing) were not established until 1939 (nest-recording) and 1962 (censuses).

The developments were lead almost entirely by amateurs. Professionals have generally been supportive but the Edward Grey Institute, which had originally been linked with the BTO, broke away in the 1940s, mistakenly concluding that the day of the amateur was over.

Birkhead, Tim¹

The sexual infidelity in birds — the history of an idea

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The study of sex has a long and fascinating history. This is especially true for the sexual behaviour and physiology of birds since the domestic fowl proved to be among the most tractable of species. Aristotle studied it and the fowl became a model organism for the study of reproduction during the scientific revolution in the 17th century. The great mystery was how hens could continue to lay fertile eggs in the absence of a cock. Major intellects, including William Harvey in the 1600s, failed to discover the reason, mainly because they failed to embrace the new technology – the microscope. The successive discoveries of spermatozoa, in the late 1700s, avian fertilisation in the early 20th century and sperm storage in the mid 20th century, paved the way for understanding the mechanisms – the ‘how’ of sexual reproduction. Understanding the ‘why’ of reproduction required a different intellectual framework and was provided first by John Ray with his physico-theology in the 17th century, later replaced by Darwin’s concept of natural selection in the 19th century, and further refined by David Lack and others in the 20th century. The fact that the study of sex has been taboo or at least controversial for much of its history, has shaped the way our understanding of avian mating systems developed. Although he knew it wasn’t true, Darwin found it convenient to assume female birds to be sexually monogamous. His Victorian prudery delayed the study of avian mating systems for over a century. The liberating 1960s together with an individual-view of natural selection resulted in a revolution of our understanding of avian mating systems. With hindsight, it may seem remarkable that it should have taken so long to discover what we now know, but I also reveal that had we read the history of ornithology a little more carefully, many of our so-called recent discoveries in this field were already known, just waiting to be brought to light.

7 Dispersal behaviour: causes and consequences

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Second organizer: **Joost Tinbergen**

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Description of Symposium: Dispersal is an important life-history trait, which influences evolutionary processes such as mate choice, local adaptation, the dynamics of populations, and population genetics. A comprehensive understanding of avian dispersal requires not only a characterization of the consequences at the individual and population level (e.g., disruption of local adaptation), but also knowledge about individual behavioural decisions that lead to dispersal and about how these decisions are linked to population characteristics such as breeding density and sex ratio. Individuals' propensity to redistribute themselves over the habitat following specific events in their life history often leads to non-random dispersal. Using a variety of techniques, several types of non-random dispersal have now been documented: dispersal is often sex and age-biased, and is related to an individual's size, body condition, personality traits and genetic background. Although the importance of dispersal has long been recognized, the study of the process of dispersal is still in its infancy. Indeed, dispersal is notoriously difficult to study. Until recently, most studies have concentrated on describing the outcome of dispersal, but the mechanisms behind dispersal decisions have received less attention. The aim of our symposium is to show how recent approaches have contributed to our understanding of dispersal behaviour.

Wikelski, Martin¹

How to study dispersal in songbirds? Advances in tracking individuals over long distances

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Dispersal is arguably one of the most important processes contributing to evolutionary changes in populations. Despite its importance, very little is known about actual dispersal events, the distribution of dispersal events among individuals in a population and the influence dispersal has on population trajectories over evolutionary time. Much of what we know about avian dispersal comes from indirect evidence or from studies on large species (>500 g) that can be tracked with satellite technology. I will review these exciting data but also highlight where information is missing. In particular, small sample sizes of observed dispersal events on large species with necessarily high longevities make generalizations difficult. I will show how modern tracking technologies enable us to potentially study dispersal of small animals over large space and time. In addition, bio-logging of vital physiological parameters allow us to remotely assess the immediate benefits and costs of dispersal, for example in units of energy expenditure or accumulation of allostatic load. I will present data on dispersal in a tropical antbird system and data on migration in various songbirds that highlight the potential of these methodologies.

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Experimental manipulation of sex specific competition: Are dispersal and settlement affected?

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Juvenile dispersal and settlement play a key role in understanding population dynamics, population structure and evolution. A wave of young produced in a breeding season has to find a place to live and a partner to reproduce. In the process of redistribution over the habitat competition plays a prominent role and because both competition and resources are non-uniformly distributed over the habitat frequency dependent effects are expected. We are interested in the effects of competition between and within the sexes. Does the sex ratio of the competitors affect the probability of dispersing? Negative density dependent effects, sex specific or not, play a prominent role in these ideas. A complication is that we do not know how animals judge the quality of the habitat. Individuals may use 'public information' on which to base their dispersal decisions. High density may indicate good resource levels, rather than high levels of competition, and result in a higher tendency to stay in or immigrate into such areas. This may lead, in contrast to the above mentioned negative density dependent effects, to positive density dependent effects on dispersal and settlement. An experimental approach may help to disentangle these opposing effects. In this paper we discuss experimental evidence for the effect of competition on dispersal and/or settlement decisions in birds and present preliminary results of new experiments. We manipulated the sex ratio and the density of fledglings on twelve different plots in a great tit population with the aim of detecting effects of competition on sex specific dispersal and settlement.

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Juvenile Reed Warblers see the world but settle close to home

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Telemetric studies have shown that during the postfledging period practically all Eurasian reed warblers make movements of considerable length and leave their natal site at night (Mukhin *et al.* 2005). Recapture data suggest that the birds may cover up to 44 km (Bulyuk *et al.* 1999) during this period. However, natal dispersal distance is just several kilometres ($1,24 \pm 2,89$ km, $N=48$). This suggests that the functional significance of postfledging movements is more complex than searching for a future breeding area and may be related to the formation of the navigation target for return migration. However, the correct direct comparison of ranges of juvenile and natal dispersal is much hampered by using different estimation methods. It must also be kept in mind that as detection probability declines from the core to the edges of the study plot, average natal dispersal distance is usually underestimated (Hanski and Gilpin 1997, Clobert *et al.* 2001). Therefore we estimated the range of natal dispersal by Eurasian reed warblers by comparing the frequency distribution of natal dispersal distances with a null model which assumed that the distribution of breeding birds within our study area in respect to their natal sites was random. Both males (Wilcoxon matched pairs test, $z=2,69$; $p=0,007$) and females ($z=2,54$; $p=0,011$) bred significantly closer to their natal sites than assumed by the null model. As many as 90 % of birds bred within 4 km from their natal sites. This means that even though we may have underestimated the exact mean natal dispersal distance, the order of magnitude was estimated correctly. Thus, the range of natal dispersal is indeed an order of magnitude smaller than the range of postfledging movements in Eurasian reed warblers.

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Investigating dispersal decisions of Blackbirds hatched on Heligoland Island

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For terrestrial birds hatching on marine islands, dispersal is an all-or-none decision. On the remote island of Heligoland, North Sea, the Eurasian blackbird *Turdus merula* has established a breeding population of over 80 pairs within the last two decades that produces more than 250 viable young per season. Using a combination of colour-ringing, molecular genetic characterisation and trace-element profiling of moulted feathers, we can estimate immigration and emigration rates. Despite vast numbers of migratory and vagrant blackbirds that regularly land on the 1 km² island, genetic immigration appears to be a rare event. Colour-ringing results show that a large proportion of birds hatched on the island recruit in their first year of life, choosing nest sites within a few meters of their natal nest. Yet, an unknown proportion of first-year birds leave the island for good. Long-term tracking of radio-tagged individuals allows us to discriminate dispersal events from local mortality. So far, we have documented 3 cases in which male juvenile blackbirds left the island (of a total of 17 radio-tagged male and 16 female individuals). Two of these birds set out in the same night. It remains to be determined at which proximate level such dispersal decisions are determined and why the majority of birds do not leave the island. Are young and inexperienced blackbirds generally incapable of crossing extensive bodies of water (either physically or psychologically) or has selection acted on individuals with a reduced tendency or capability to disperse? Cross-fostering experiments, introducing genotypes from dispersive mainland populations to the island, may help to distinguish between conditional plasticity and local adaptation causing offspring retention.

Valcu, Mihai¹, Kempenaers, Bart²

Breeding dispersal along a habitat gradient in Blue Tits

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Post-breeding dispersal can have multiple causes mainly connected with mate or site choice. Because mate and site choice can simultaneously determine dispersal, the causes and consequences of dispersal are often difficult to identify. We studied the causes and consequences of dispersal and residency in a Blue Tit population breeding in nest-boxes. To avoid the confounding effect of intra- and inter-annual density fluctuations, dispersal was assessed from the spatial position of territories estimated as Dirichlet tiles. Within-territory nest-box turnover rate between seasons was high for all individuals and the probability of changing the nest-box did not significantly differ between males and females. In contrast, territory change was quasi non-existent among males and occurred in 30 % of females. Settlement following dispersal was driven by habitat quality: dispersers preferentially chose territories with higher clutch size expectancy. Post-breeding dispersal had the same causes and consequences for both widowed and divorced females. Late-laying individuals were more likely to disperse, but no other causes connected with habitat or mate quality seemed to initiate dispersal. Dispersed females raised more fledglings than resident ones, suggesting that dispersal is adaptive. Resident males increased their reproductive success after divorce. The opposite was true for resident females, whose fledging number and fledging success decreased following divorce. Even at relatively small spatial scales and in continuous habitats, dispersal can be driven by habitat quality gradients. We suggest that this is the case only when the scale of habitat heterogeneity exceeds the territory scale.

8 Palearctic migrants threatened by environmental change in the Sahel

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Description of Symposium: More than one-quarter of all European bird species winter in the Sahel region of Africa and it is a crucial staging ground for all trans-Saharan migrants. Recently the Sahel has been subject to major changes through desertification due to decreased rainfall exacerbated by overgrazing and increasing human exploitation, so that Sahelian savanna woodlands are now one of the world's most threatened habitats. Current climate and human population growth models predict that environmental degradation within the region will get much worse over the coming decades. Population declines of several migratory species, such as Sand Martins *Riparia riparia*, Redstarts *Phoenicurus phoenicurus* and Whitethroats *Sylvia communis* have been linked to deteriorating conditions in the Sahel. Despite the clear link between habitat degradation and populations of some Palearctic migrants, there has been almost no research to date based in the Sahel to identify the specific factors that determine the density, distribution and staging of Palearctic migrants. Recently several research initiatives have been set-up to investigate the ecology of Palearctic birds in Africa and this symposium aims to act as a focus for these studies, highlighting the vital importance of the Sahel to European birds and the need for further extensive research within Africa if we are to do anything more than simply document the decline of many of the bird species that breed within Europe.

Salewski, Volker¹

Why is the spring silent – are Palearctic migrant populations limited on their wintering grounds?

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Several decades ago it became clear that many populations of Palearctic breeding birds were declining in numbers. Many of these declines were identified as being caused by environmental toxins (DDT), habitat alteration such as destruction of wetlands, or change in agricultural practices. These factors could, however, not explain why, on a European level, long-distance migrants, i.e. migrants that have their winter quarters in sub-Saharan Africa, are proportionally more subject to declines compared to resident species or short-distance migrants. As early as in the 1970s it was shown that the dramatic drop of numbers of breeding common whitethroats *Sylvia communis* in Europe could be associated with the lack of rainfall in the African Sahel zone, the species' winter quarters. Other similar studies during the following decades found evidence that demographic factors (mortality, breeding success) that then act on the population dynamics of many of long-distance migrants like the purple heron *Ardea purpurea*, white stork *Ciconia ciconia*, sand martin *Riparia riparia*, nightingale *Luscinia luscinia*, sedge warbler *Acrocephalus schoenobaenus*, and willow warbler *Phylloscopus trochilus*, are influenced by conditions experienced in the winter quarters. Adult, but not juvenile, barn swallows *Hirundo rustica* have also been shown to arrive earlier on the breeding grounds in Italy in springs following favourable conditions in the winter quarters which will then probably affect their breeding success. Most of these studies are merely correlative and the underlying mechanisms have not been investigated, although there is additional evidence from the Nearctic-Neotropical migration system, where it has been shown that winter habitat quality is associated with breeding success. These few studies show that there is potentially a large gap in our knowledge of the factors which act on European breeding bird populations, especially those that act in the Sahel region, which is crucial as a wintering and staging ground for the majority of migrating Palearctic species.

Cresswell, Will¹

How are Palearctic migrant populations limited on their wintering grounds in the Sahel?

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More than one-quarter of all European bird species winter in the Sahel region of Africa and it is a crucial staging ground for all trans-Saharan migrants. Recently the Sahel has been subject to major changes through desertification due to decreased rainfall exacerbated by overgrazing and increasing human exploitation, so that Sahelian savanna woodlands are likely to be severely decreasing in both area and quality. Current climate and human population growth models predict that environmental degradation within the region will get much worse over the coming decades. Despite the clear link between habitat degradation and populations of some Palearctic migrants, there has been almost no research to date based in the Sahel to identify the specific factors that determine the density, distribution and staging of Palearctic migrants. What limited research that has been carried out demonstrates that density and diversity of Palearctic migrants depends on the availability of lightly wooded vegetation with a few species of shrub and tree being particularly important, particularly during premigration periods. These important woody species are being removed by grazing and for fuelwood at a high rate, and although Palearctic migrants appear to have some considerable resilience to deforestation, decreases in density have occurred. There have also been recent shifts southward of species more associated with arid regions into the Sahel. There is a clear need for more research within Africa to understand the factors determining the population changes and resilience of Palearctic migrants and resident Afrotropical species within the Sahel: at present we can do little more than simply document the decline of many of the bird species that breed within Europe.

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Ecology and conservation of wintering Montagu's Harriers in the Sahel zone

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In January 2006 and 2007, fieldwork in Niger revealed the preference of wintering Montagu's Harriers *Circus pygargus* for shrubland vegetations over agricultural land. The largest part of the diet consisted of resident grasshoppers, but alternative prey like birds and mantids were also present. Alternative prey abundance in the diet was larger in 2007, when generally less grasshoppers were available than in 2006. The preference for food-rich natural habitats as well as the preference for less-degraded over heavily-degraded habitats indicates the potential threat to the raptors as a result of the disappearance and degradation of shrubland vegetation. Increasing pressure by the growing human population is the most important reason for this threat. There is a clear necessity to expand conservation measures for Montagu's Harriers (a red-listed species in the Netherlands and other European countries) from the breeding to the wintering grounds.

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Variability of the impact of Sahel environment on a stork population

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There is growing evidence that global climate change has a huge influence on a large variety of organisms and ecosystems. However, within the general heading of "global change", there is considerable spatio-temporal heterogeneity. So, how do populations respond to such heterogeneity? This question is of importance in improving our understanding of how the environment and long-term climatic change impact on population dynamics. In Africa, the Sahel represents a key ecosystem for a huge number of Eurasian migrant species. It is also thought to show long-term climatic oscillations which impact human and animal populations. A recent regime shift occurred in 1969, leading to a 30y period of drought in the Sahel. During this period, many studies have reported an impact of the dry climatic regime on migrant species wintering in the sub-Sahara. Since the late 1990s, records indicated that rainfall may have increased, suggesting a change towards less severe conditions. We can therefore ask whether the impact of the environment on

migrants has changed. Using a long-term dataset on a white stork population breeding in western France, we estimated the demographic parameters of the population and the ability of environmental conditions to explain the interannual variability of these vital rates. The main result is that the influence of climate in the Sahel on survival has decreased over the last decade, and is now undetectable. The disappearance of an impact of Sahel rainfall conditions may reflect a progressive shift for the storks from extremely severe towards more favorable conditions for the storks. In terms of population dynamics, we would predict that the consequences may include an increase in the population.

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Whitethroats complete — strategies, phenology and energetics, from the winter quarters to breeding areas and back

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We will give an overview of the life cycle of the Common Whitethroat *Sylvia communis*. Starting with their arrival in an agricultural landscape in Nigeria, we follow the birds over the course of the winter, through Mediterranean stopover sites during spring migration to breeding areas in Scandinavia and back again in autumn. Long-term population changes in the Scandinavian population will be presented, based on ringing data from Ottenby Bird Observatory and data from the Swedish breeding bird census. The main focus will be on studies that we have carried out in Nigeria during several winter seasons. We used a range of methods, including a Constant Effort Site ringing program, radio-tracking of birds, and characterization of preferred habitat parameters. Colour-ringed birds and birds equipped with radio transmitters allowed us to make behavioural observations of individual Common Whitethroats. Many Common Whitethroats were stationary during the winter period, often constricting their movements to a small patch (most often less than 1 ha) of favourable habitat, rich in fruiting bushes. However, hardly any intraspecific and interspecific interactions were recorded. We discuss these findings in relation to issues from migration stopover sites and the long-term changes in population size.

9 Should we feed birds?

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Description of Symposium: The popularity of feeding birds is increasing and every year millions of households provide huge quantities of supplementary food to wild birds. Supplementary feeding can influence many aspects of bird ecology, from reproduction through behaviour to demography and distribution. Although generally perceived as a positive activity, in recent years there are growing concerns over potential negative impacts. Food availability influences the probability of the occurrence of certain species in gardens but we understand little about how supplemental food influences the productivity of birds. Supplementary feeding may have marked effects on multiple breeding parameters (e.g. laying date, clutch size, brood size) and on ultimate measures of reproductive success (e.g. fledging survival and recruitment into the breeding population). Research into such parameters helps us to assess the effects of chronic provisioning of supplementary food on the 'health' of bird populations.

Chamberlain, Dan¹

Do garden birds need people? The effects of a superabundant food supply on the ecology of birds in urbanized environments

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Bird feeding is a very commonplace activity, and it is estimated that 75 % of households in the UK provide food for birds at some time during the year (Cowie & Hinsley 1988. *Bird Study* 35: 163-168.). The amount of energy provided by human-provided food in gardens is likely to far exceed the minimum required for survival in most species that make regular use of this resource (Cannon 2005; PhD Thesis, University of Sheffield). How does this superabundant food source influence the bird communities in urbanized landscapes? In this presentation, I review the differences in several demographic parameters (breeding density, breeding productivity, survival) between populations of common UK bird species in urbanised and semi-natural habitats that arise due to differences in food availability. In particular, I address the question of whether certain species would be able to maintain viable populations in urbanized habitats without the provision of food by humans.

Reynolds, James¹

Food for thought: What does food supplementation tell us about the breeding biology of birds?

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It is estimated that approximately £200-220 million is spent per annum on food supplements for birds in the UK. The comparable figure for the USA is US\$ 3.5 billion representing 450 million kg of seed provisioned per year. Such supplementation by the public is partly encouraged by advice from organisations and from the media who promote chronic feeding in gardens. Do we have empirical evidence to substantiate such advice? In this presentation, I will review what we know currently about the effects of food supplementation on the breeding performance of birds, with special emphasis on the timing and duration of supplementation as well as the nature of the supplement(s). I will examine experimental approaches to supplementation and discuss their relevance to anthropogenic supplementation on broad temporal and spatial scales. My presentation will close with a personal reflection on future directions of supplementation research.

Cresswell, Will¹, MacLeod, Ross²

How supplemental feeding affects body condition in birds

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Starvation risk (predictability of foraging opportunities) determines the amount of fat reserves carried by small birds, but this is traded off against the predation risk that carrying extra mass entails, because fatter birds are less able to escape from pursuing predators. During the winter, for example, reduction in foraging opportunities and increased energy demands result in almost universal weight gain by temperate small birds to minimise starvation risk, but this extra mass is lost as soon as foraging conditions ameliorate, to minimise predation risk. During the day, for example, if foraging is unpredictable, mass is gained early in the day so that starvation risk can be minimised, but when foraging is predictable, mass is gained later in the day so that predation risk can be minimised. Provision of extra food may reduce the unpredictability of foraging opportunities and so result in less mass being put on during the winter, and more mass later in the day. Absolute levels of mass lost by changing foraging predictability will depend, however, on predation risk because of the starvation-predation risk trade-off: where predation risk is very high or low, for example, changing foraging predictability may not affect mass at all. We illustrate these ideas with empirical data of fattening in response to predictability of foraging opportunities (using the winter period as a starvation risk proxy) and predation risk (using sparrowhawk density as a predation risk proxy) from 30 common European small bird species.

Oro, Daniel¹, Martínez-Abraín, Alejandro²

Supplementary feeding of a marine seabird community: Patterns and consequences

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The exploitation of fishing discards by seabirds is a common phenomenon observed in all oceans of the world. Many species enhance their fitness by exploiting such extremely abundant food, which is more predictable in space and time than natural (patchily distributed) prey. Seabirds greatly improve their energy intakes, especially increasing the ratio between energy obtained and energy spent foraging. As a consequence, individuals survive better (especially immatures), produce more chicks, and in general the carrying capacity of the systems increases, allowing populations to increase in size through, for instance, early recruitment and higher fecundity. Nevertheless, discard practices are against sustainable fisheries and policies such as those of the European Union are addressed at reducing the amounts of discards, either by increasing net mesh size or by forcing the industry to land non-marketable fish for purposes other than human consumption (e.g. livestock feed). The application of such policies would dramatically reduce the amounts of food available for birds, both during reproduction and over the winter season and it is therefore a topic of conservation interest. Environmental agencies should be ready to face a new ecological situation where the biology of the birds, including community relationships such as facultative predation of larger species on smaller species, could be much altered. The likely decrease in the carrying capacity would affect not only the most common species, but also some endangered species, probably creating a new conservation challenge for managers. Here we review the evidence accumulated so far on the influence of fishing discards on the marine bird community in the western Mediterranean and foresee possible future conservation problems.

Harrison, Timothy¹, Robb, Gillian²

Supplementary feeding over-winter and during the breeding season: A comparison

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The popularity of feeding birds is increasing and every year millions of households provide huge quantities of supplementary food to wild birds. Despite this, we know very little about the full impacts of such large-scale provisioning. This talk will summarise the findings of two supplementary feeding studies carried out in the UK over recent years. The first is a landscape-scale experiment examining the influence of supplementary feeding over-winter on the reproductive performance of Blue Tits *Cyanistes caeruleus* in Northern Ireland. The second is a study of blue and Great Tits *Parus major* receiving supplementary food during the spring and early summer in the West Midlands, England. Both studies report an advancement of laying date due to food supplementation. In Northern Ireland, feeding was stopped at least six weeks prior to the onset of laying and therefore an advancement of laying date demonstrates a carry-over effect of winter provisioning into the breeding season. Over-winter feeding was also found to increase the fledging success of blue tits. Further to advancing laying date, blue and great tits supplemented during the spring and early summer of 2006 in the West Midlands had shorter incubation periods than un-fed conspecifics. This talk will combine the key findings of these two studies and present results from the 2007 breeding season. The application of these results will be discussed within the context of current trends in garden bird feeding and the likely impacts of garden bird feeding on wild bird populations.

10 Extra-pair paternity: Male or female driven?

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Description of Symposium: Ever since the availability of molecular tools allowed the detection and quantification of offspring sired outside the social pair bond, extra-pair paternity (EPP) in birds has received considerable attention. Behavioural observations in many bird species suggest that females actively seek extra-pair copulations (EPCs), and, with few exceptions, females seem to gain no direct benefits from EPCs. The prevailing view is thus that EPP is mostly driven by females seeking EPCs to obtain indirect genetic benefits in terms of increased offspring fitness via good genes or complementary genes. The aim of this symposium will be to critically evaluate this view and to address uncertainties and complexities of mating systems involving EPCs. Special emphasis will go to the link between the observed mating behaviour of males and females and the outcome in terms of the resulting pattern of EPP, as well as on the evidence (or lack thereof) for genetic benefits of EPP. The symposium will highlight discrepancies between behavioural observations (suggesting that females are actively seeking EPCs) and the studies on benefits for females (often failing to provide evidence for such benefits). We hope to stimulate discussion about the reasons for this discrepancy and about which data are needed to further our understanding of the evolution of EPP.

Friedl, Thomas W. P.¹

Benefits of extra-pair paternity in birds: What is the evidence?

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In this keynote talk I will review the current available evidence for benefits of extra-pair paternity for males and/or females. The most obvious benefit of successful extra-pair copulations for males is an increase in the number of offspring sired at the cost of the cuckolded male. In some cases, however, this benefit might be offset by an increased risk of being cuckolded in the male's own territory. Far less attention has been paid to the possibility that males might increase the quality rather than the quantity of offspring by performing extra-pair copulations with females of higher quality compared to the male's own social mate. Possible benefits of extra-pair fertilizations for females can be classified as material benefits, fertility insurance, and genetic benefits. Conclusive evidence for material benefits in terms of courtship feeding, paternal care, or nest defence provided by the extra-pair male, or access to resources owned by the extra-pair male, is rare. In some species, females seem to seek extra-pair copulations as insurance against infertility (permanent infertility or temporary infertility due to sperm depletion) of their social mate. To date, most available data point to genetic benefits of extra-pair fertilizations for females in terms of increased offspring quality via good or complementary genes. However, surprisingly few studies provide conclusive and unequivocal evidence for such genetic benefits by demonstrating higher fitness of extra-pair young compared to their maternal half-siblings raised in the same brood. In addition, studies which could indeed show a fitness advantage of extra-pair young compared to within-pair young from the same brood sometimes found such differences to be variable in time or context dependent. In conclusion, despite considerable effort there is still a lack of data on the amount and kind of benefits males and/or females obtain by seeking copulations with partners other than their social mate.

Kempenaers, Bart¹

Extra-pair paternity as the outcome of male and female behaviour

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The availability of genetic tools such as microsatellite markers have made it relatively easy to determine the number of extra-pair young in a brood. As a result, we now have a rich database on the occurrence of extra-pair paternity in many populations of a variety of species. However, there is still considerable debate about two questions. (1) Do females benefit from having their young sired by an extra-pair male or by multiple males, and if so, how? (2) How does male and female behaviour lead to the observed patterns of extra-pair paternity? To answer the second question we need detailed behavioural data, which are hard to obtain. Generally, one would expect that males pursue extra-pair copulations without discriminating between females, whenever they can increase the total number of surviving offspring sired within a given season. This implies that there might be a trade-off with other activities, such as mate guarding or brood care. For females, one would expect that the pursuit of extra-pair copulations depends on the opportunities to increase the quality of the offspring, without compromising their number. That means that one can expect that any female might both actively pursue and strongly reject extra-pair copulations, depending on the circumstances, e.g. the potential extra-pair sire, or the presence of her social partner. Here, I will review studies that have attempted to link male and female copulatory behaviour with the outcome in terms of extra-pair paternity. I will argue that there is strong evidence that extra-pair paternity in many bird species is primarily a result of a female strategy. I will then discuss the type of data we need to explain variation in the observed levels of extra-pair paternity in birds.

Peters, Anne¹, Hall, Michelle L.², Kingma, Sjouke Anne³, Delhey, Kaspar⁴

Multiple sexual signals in Purple-Crowned Fairy-Wrens: Conflict or cooperation

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Purple-Crowned Fairy-Wrens, *Malurus coronatus*, belong to the genus *Malurus* which is characterised by the highest known levels of extra-pair paternity and by extreme sexual conflict and sperm competition. Here I present an overview based on data from the literature and our own observations that indicates that *M. coronatus* appears to follow a different strategy. Males have exceptionally small testes and cloacal protuberances. Moreover, we observed that they do not engage in the conspicuous extra-pair sexual displays typical for the genus. Rather pair members maintain exceptionally close contact at all times, engage in conspicuous highly coordinated antiphonal duets and cooperate closely in territorial defense. Nonetheless, striking visual sexual signals are apparent: males, and to much lesser extent females, display colourful seasonal ornamental plumage. Such a combination of traits indicative of strong sexual selection (seasonal sexual dichromatism, phylogeny) as well as indications of reduction in sexual conflict (small reproductive organs, cooperative acoustic signalling) is highly unusual, and I will present first results and our current research aims towards elucidating the role of sexual signalling in this species.

Lifjeld, Jan T.¹, Kleven, Oddmund²

Multiple mating in Tree Swallows

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One striking feature of avian extra-pair mating systems is that they are so diverse. As an implication, we should acknowledge the possibility that no single hypothesis can provide a universal explanation to their evolution. A fruitful approach may be to study a few systems in depth, and try to reveal the evolutionary forces shaping extra-pair mating behaviour in these model species. The extrapair mating system of the tree swallow *Tachycineta bicolor* has been extensively studied over the past 15 years, but still its adaptive significance is obscure. In this paper we review some recent developments in our understanding of this system. Tree swallows are exceptional in the sense that 1) rates of extrapair paternity are among the highest recorded for socially monogamous birds, 2) there are usually several different extra-pair sires per brood, and 3) extra-pair sires are usually not territorial neighbours. All of this point to a female strategy of diversifying the genetic constitution of their offspring. We present some empirical evidence that females enhance the genetic quality of individual offspring by having many different sires in their brood. Female tree swallows seem to actively engage in extra-pair mating, but do not exert any particular mating preferences. The tree swallow system may thus best be explained by the genetic diversity hypothesis, whereby females “hedge their bets” through multiple mating when they have no reliable phenotypic cues to which male would provide the best genes for their offspring. The evolutionary consequence for males in such a system is that their fertilization success will be strongly influenced by their sperm production capacity and sperm competitiveness. This could explain why tree swallows have relatively large testes and high within-pair copulation rates. We will also present some preliminary data on the associations between male fertilization success, copulation frequency and sperm quality.

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Reproductive lifespan and lifetime reproductive performance of within-pair and extra-pair offspring in a socially monogamous passerine, the Coal Tit (*Parus ater*)

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The adaptive significance of female extra-pair mating behaviour in socially monogamous bird species is one of the most contentious issues in behavioural ecology. Why do females of so many species mate extra-pair so frequently? Any truly comprehensive understanding of avian mating systems and sexual selection in birds is impossible without providing a convincing answer to this simple question. In particular the idea that females mate outside the pairbond to obtain good or compatible genes in order to increase offspring genetic quality has received much attention but much less generally accepted support. Comparing fitness of within-pair offspring (WPO) and extra-pair offspring (EPO) is one promising approach to test for genetic benefits of extra-pair matings. If genetic benefits select for extra-pair mating behaviour, EPO are predicted to outperform WPO in terms of viability or reproductive performance. Only a few studies have been able to analyse offspring fitness beyond the nestling stage, because low frequencies of extra-pair paternity or low offspring recapture rates frequently preclude meaningful analyses based on suitable sample sizes. We here report long-term fitness consequences of extra-pair matings in the Coal Tit *Parus ater*, a socially monogamous passerine with a high frequency of extra-pair paternity as well as high local recruitment rates. We have previously shown that local recruitment is affected by paternity in a context-dependent way, while first-year reproductive performance is not. However, even in comparatively short-lived species like the coal tit, reproductive lifespan is potentially very important for variation in lifetime reproductive success. We therefore followed the fate of a few hundred locally recruited individuals with known paternity status (WPO or EPO) from three cohorts to analyse reproductive lifespan (age of an individual when it was last recorded breeding) and lifetime reproductive performance of these individuals in relation to paternity.

11 Edge effect on avian nest predation in Europe

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Description of Symposium: Nest predation is important because the loss of nests and broods is the main cause of reproduction failure in birds, accounting for roughly 30 % of failures. The extension of human land use results in the destruction and fragmentation of original habitats. In the remnant patches the relative ratio of edge habitats increases. The conventional wisdom suggests that nest predation and brood parasitism increase along habitat edges. For example, the continental-scale decline of some Neotropical migrant birds in northeastern America has been attributed in part to increased nest predation and cowbird parasitism near edges. In this symposium we will give an overview of the edge effect on avian nest predation in the highly fragmented European landscape. Our objectives are to answer the following questions: 1. How does the edge effect on nest predation depend on the studied landscape (forested vs. open), habitat type and nest type (real vs. artificial nest)? 2. What is the distance over which an edge effect on nest predation can occur? 3. Is the predation of artificial nests similar to the predation of real nests? 4. How does nest predation (or nest success) depend on factors at different spatial scales?

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Edge effect on avian nest predation in European scale – a meta-analysis

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An important consequence of habitat fragmentation is the increase of edge habitats. Environmental factors are different in the edges from those in the interiors, which causes a change in the distribution of plant and animal species and individuals. This phenomenon is known as the edge effect. Pioneering works on nest predation in forests showed higher nest predation rates at habitat edges than in interiors. We performed a meta-analysis. We made an extensive literature search for European nest predation studies which included raw data on predated and intact nest numbers in relation to the distance from a studied edge (and used only one nest type). After this we carried out a Chi-square test for each experiment, and used the resultant p value and sample size to calculate the effect size of each experiment. We used these to perform a summary meta-analysis and categorical meta-analyses, because studies were separated into ecologically relevant categories. Altogether we included 63 experiments, 10 of real nests and 53 of artificial nests. The summary meta-analysis supported the “edge effect” hypothesis, that is, higher nest predation in the edge than in the interior habitat. Further, edge effects were more pronounced in central Europe than in northern and western Europe. However, this result may be biased due to the habitats studied in the different regions. Marshes had significant edge effects, whereas edge effects were not apparent in forests or fields. Categorising the studies according to nest types (real vs. artificial), no edge effect was found in either category. Edge effects were detected equally in studies that used quail and plasticine eggs. Regarding the diversity of geographic locations, edge types, landscapes, and other variables, our results point to the key role of edge effect in landscape planning. We also showed there is no apparent publication bias in the peer-reviewed literature that we reviewed for our analysis.

Prokop, Pavol¹, Trnka, Alfréd², Batáry, Péter³

Edge effect and avian nest predation in different marsh habitats

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Habitat type and vegetation structure have been recognised as one of the most important variables influencing nest success of birds. Proximity to an edge has also been linked to nest predation rate. Artificial nest studies in marsh habitats found that nests had lower survival at reed edges than in the reed interior. However, predation rates along different reedbed edges showed great variation. One of the reasons could be that vegetation structure is different between reedbeds. To date, no study examining differences in nest predation between reed and reed mace, common habitats of reed warblers, has been carried out. Stems of reed were thinner and taller than stems of reed mace. Differences in vegetation structure may result in different predation rates. To test this, we conducted an experiment with handmade artificial nests resembling the nests of Great Reed Warblers (*Acrocephalus arundinaceus*) in size and appearance containing one fresh Quail (*Coturnix coturnix*) and one plasticine egg. Daily survival rate was significantly lower at the edges than in the interiors in both habitat types, while no edge effect was found at the water edge in either reeds or reed mace. However, other researchers have found an edge effect on nest survival at both edges. We suggest that our results were probably caused by a higher abundance of mammalian predators at the reed-grassland edge. Therefore, more attention should be dedicated to grassland-reed edges.

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Demographic responses by Middle Spotted Woodpeckers to habitat alteration and fragmentation in Spain

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We examined demographic responses by Middle Spotted Woodpeckers to habitat alteration and fragmentation in Spain during seven years (2000-2006). Three types of oak forest management systems determine variations in the forest alteration: i) heavily disturbed young forests; ii) oak dehesas, formed by both old oaks and pasture intercalated; iii) undisturbed mature forests. Dehesas and mature forests were occupied by Woodpeckers, whereas young forests were avoided. No significant differences in territory density, reproductive success (nesting success, clutch size, nestling survival, fledgling number and mass), male pairing success or survival rates (early post-fledging, first-year and adult survival) were found between dehesas and mature forests, suggesting that both forests are suitable habitats for the Middle Spotted Woodpecker. GLMM models showed no significant correlations between habitat patch sizes and the reproductive parameters or Woodpecker survival. However, pairing success was lower in smaller and more isolated patches. Sex ratio at fledging did not differ significantly from parity and was not correlated to patch size. Furthermore, survivorship did not differ between sexes. Therefore, neither female-biased mortality nor male-biased sex ratio at fledging were the mechanisms behind the presence of unpaired territorial males. Low pairing success of birds in isolated patches may be associated to a disruption of connectivity between habitat patches. Alternatively, the presence of unpaired males in small patches with low numbers of territories suggests that females might use the abundance of conspecifics as an indicator of habitat quality when deciding to mate. Conservation measures of Woodpecker populations should consider the improvement of connectivity of the remaining habitat patches (i.e. low disturbed dehesas and mature forests) and the maintenance of large habitat patches with high number of territories to preserve pairing success of males at optimum levels.

Mazgajski, Tomasz¹, Rejt, Lukasz², Zmihorski, Michal³

Lack of edge effect in artificial nest predation on patch and landscape level in Central Poland

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Forest fragmentation leads to increase in the number of patches and their isolation, a decrease in patch size, and an increase in the amount of edge between habitats. As the edge zone could be penetrated by predators coming from the matrix (mostly corvids), the breeding success of ground-nesters could decrease near edges. However, the predators' community composition and density, as well as their penetration of edge habitat, could also be influenced both by the size of the patch and the total forest cover at the landscape level. Therefore patch size and landscape effects on nest predation at edges should also be examined. The study was carried out in 2006 in Central Poland in areas differing in the total amount of forest cover. Data were collected in the agricultural landscape with 6 % and 40 % of forest cover and a number of highly fragmented woodlots. Artificial nests were used resembling those built by thrushes *Turdus spp.* They contained one commercial quail egg, and were placed at three heights: on the ground, on a shrub up to 1.5 m and on saplings and trees at about 3.5 m. The nests were checked after 13-14 days. Edge effects were tested at two different scales depending on the size of the forest. In small patches (up to 20 ha) we compared data from nests placed 0-25 m from edge with nests 75-100 m from the edges. In large forests (>100 ha) we used 4 categories of nest locations (0-25; 75-100; 150-175; 225-250 m from edges). Predation on artificial nests was similar for nests located at various distances from the edges, both for small and large forests. Also predation in edge zones (0-100) was not related to the forest size. However, predation rate was lower in landscape with less forest cover.

Pasinelli, Gilberto¹, Mayer, Christian², Gouskov, Alexandre³, Schiegg, Karin⁴

Small and large wetland fragments are equally suited breeding grounds for a ground-nesting migratory passerine

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Large habitat fragments are generally thought to host more species and to offer more diverse and/or better-quality habitats than small fragments. Yet, the importance of small fragments for population dynamics in general and for reproductive performance in particular is highly controversial. Using an information-theoretic approach, we examined reproductive performance of colour-ringed Reed Buntings *Emberiza schoeniclus* in relation to the size of 18 wetland fragments in northeastern Switzerland over four years. Additionally, we investigated whether reproductive performance was density-dependent. None of five measures of reproductive performance (laying date, nest failure probability, fledgling production per territory, fledgling condition, recruitment probability) was related to wetland fragment size. Regarding fledgling production, however, fragment size interacted with year, indicating that small fragments may be better reproductive grounds in some years than large fragments. Reproductive performance was not density-dependent. Small fragments are thus equally suitable as breeding grounds for the reed bunting as large fragments and should therefore be managed to provide habitat for this habitat specialist. Moreover, large fragments may represent ecological traps in specific years, because a substantial percentage of all breeding pairs in our study area breed in large fragments. Reproductive failure in these fragments – for instance due to the regularly occurring floods – may have a much stronger impact on regional population dynamics than comparable events in small fragments.

12 Radar ornithology – past experiences and future challenges

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Description of symposium: After the Second World War, radar technology became available for ornithological research and suddenly it became possible to study bird migration at long distances, high altitude and during the darkness of the night. During a period of thirty years bird migration was studied extensively using powerful long-range military radars and many new conclusions and hypotheses on this field of research were generated. A very few research groups in Europe and the US have continued radar ornithology during the past 10-20 years using relatively old military tracking and surveillance radar systems. In recent years, the use of short range marine surveillance radars for environmental studies conducted in relation to the many proposed wind farms in Europe and the US, has meant a dramatic renaissance for the discipline of radar ornithology. Unfortunately, these systems have been used repeatedly for the quantification of bird movements without considering all the traps and pitfalls of radar ornithology. The overall aim of this symposium is to assemble as many radar ornithologists as possible to discuss and draw attention to the pros and cons of different radar systems based on past experiences and try to assess the future challenges for scientists dealing with this interesting field of research. Finally, the possibility and feasibility of producing a dedicated bird radar will be discussed!

Liechti, Felix¹, Schmaljohann, Heiko²

Traps and pitfalls in the quantification of bird movements by radar systems

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Quantification of nocturnal bird movements has been an aim of radar ornithology for almost sixty years. Besides the scientific interest, there is an increasing need to quantify bird migration for the assessment of bird collision risk with man-made structures. As in all monitoring methods the quality of the counts depends on detection probability and identification of the detected objects. As in field surveys, these parameters can vary considerably in radar surveys. Detection probability differs not only between radar systems, but is dependent on the size of the bird and its position in relation to the antenna beam. Consequently, the detection probability (surveyed space) depends on the species, the position in the beam and at least in Doppler radars on the flight direction and speed of the bird. In contrast to field observations, identification of the bird's species is rarely possible and even the distinction between birds and non-birds poses a delicate challenge. This probably causes the most critical problems in radar ornithology. All these aspects will be outlined and we will present methods how these problems can be tackled in general and by specific radar systems. The aim is to clarify what kind of information can be taken from which radar system and by which measurement method to achieve an adequate quantification of bird migration.

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Radar ornithology in applied science — avoiding and mitigating impacts from offshore wind farms

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Traditionally, migrating birds have been legislatively protected either in their breeding, staging or wintering areas and the applied scientists have most often used their binoculars for providing the necessary data on bird numbers and distributions. The first radar operators were puzzled over some unidentified flying objects which were named "radar angels" and soon it became apparent that these echoes originated from avian migrants aloft. Suddenly the scientists could study the movement of birds on active migration both during the darkness of the night, over vast distances and at high altitudes. A few research groups continued the study of avian migrants by mainly long-range tracking and surveillance radars over the next decades. A dramatic renaissance for the discipline of radar ornithology came recently with the environmental impact assessments of the many proposed offshore wind farms in Europe and the US. The Danish approach on how to investigate, avoid and mitigate bird-wind farm interactions will be presented and the applicability of both short- and long-range radars into this issue will be outlined. Finally, the possibility and feasibility of producing a dedicated bird radar will be discussed.

Krijgsveld, Karen¹, Dirksen, Sjoerd²

Measuring birds flying over the North Sea using an automated system of horizontal and vertical marine surveillance radar

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Large numbers of migrating birds migrate above the North Sea every spring and autumn, following the Dutch coastline to and from southwestern Europe or crossing the North Sea back and forth to Britain. These birds may be affected by offshore wind farms, in that these may cause collisions, hinder flight paths, or cause disturbance. In this framework, a study commissioned by Northseawind (NUON/Shell), is being carried out in order to establish the effects of an offshore wind farm that is operating 15 km off the Dutch coast at Egmond. To track flight paths of birds, we are using common horizontal and vertical marine surveillance radars. To deal with the inaccessibility of the offshore site and the often harsh conditions at sea, an automated recording system (DeTect Inc., USA) has been installed on these radars. This system allows us to remotely record flight intensities, directions and altitudes continuously, both day and night, year round. Here we discuss the possibilities and limitations of automated versus manual recording of flight patterns. We present data on flight paths and directions of birds and show how automatically recorded tracks relate to manually recorded tracks. We also present data on the vertical distribution of flight activity of birds.

Wendeln, Helmut¹, Liechti, Felix², Hill, Reinhold³, Hüppop, Ommo⁴, Kube, Jan⁵

What do marine ship radars measure? A comparison with tracking radar "Superfledermaus"

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The installation of large scale offshore wind farms in Europe requires extensive environmental investigations. The description of local bird migration intensity forms a major part of these investigations, since negative effects on migrating birds such as barrier effects and collisions are considered to be important. The application of vertically rotating ship radars for the quantification of bird migration is one of the standard methods which have to be applied e.g. in Germany. Many studies have been performed according to these standards, but no verification of data quality has ever been conducted. Bird detection by radar is influenced by brand specific characteristics and radar adjustments. Further, general traps and pitfalls in radar ornithology cannot be addressed by this method. Consequently, quantifications of migration intensity carried out by ship radars are still difficult to judge and comparisons of data obtained with different devices are impossible. In order to address this problem we operated three different vertically rotating ship radars simultaneously to the tracking radar "Superfledermaus". The fast-fixed-beam mode of the tracking radar revealed exact migration rates and was taken as a reference. Generally, the results of the four different radar systems correlated well. However, within the height range of main interest for the environmental investigations (below 200 m), differences were considerable.

Poot, Martin¹, van Belle, Jelmer², van Gasteren, Hans³, Dirksen, Sjoerd⁴

An update on the determination of the detection probability of flying birds by vertical marine surveillance radar

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In the last decade, marine surveillance radars positioned vertically have been used to gather information on numbers of birds aloft during the night. This type of radar is easy in operational use and relatively cheap, and therefore used in many studies in Europe within the framework of estimating potential effects of wind turbines on birds. Herewith especially the study of migration/local movements at low altitudes (<200 m) is most relevant. Information on migration at higher altitudes, however, places migration at low altitudes in a broader perspective and for this reason is often studied as well, although here the detection probability decreases due to limitations of the radar. A unit of measurement of bird flights that is often used in order to compare different studies is Migration Traffic Rate (MTR); this is the number of birds passing per hour per kilometre. In order to arrive at this unit in the first place one has to correct for passages not perpendicular to the radar beam. Furthermore, apart from radar characteristics (power, wave/pulse length), weather conditions (humidity), features of the bird, such as its size, in combination with heading/flight direction, mainly determine whether a bird is detected or not as the reflect ability or radar cross section varies with the position of the bird relative to the radar, with birds that are beamed from the side having the largest radar cross section. This aspect can substantially affect the effective beam shape (both range and width) and therefore recorded fluxes. In this paper, an update in insights is given on the factors limiting the detection probability and what the consequences are for the recorded MTR. This is illustrated by results gathered during different studies performed at various locations in the Netherlands. With this evaluation of the use of vertical surveillance radar for quantifying bird flux, recommendations are given on how to interpret/correct MTRs gathered by vertical marine surveillance radars.

Contributed Orals

CO 1 – Saturday 25th August 2007, Auditory 8

Schmaljohann, Heiko¹, Bruderer, Bruno², Liechti, Felix³

Flying birds do not dehydrate as expected

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Following long-distance flights, migrants have to replenish their energy and water stores. The amount of energy and water used during such crossings depends on the size of the barrier, but is also highly influenced by temperature and wind. Since these meteorological parameters can change with time and space, migrants may adjust their energy and water consumption by choosing the right time and altitude for flying. Wind tunnel experiments, physiological studies of free-flying birds and model simulations have shown that bird's water loss correlates positively with ambient temperature. According to these results, water loss will prevent birds from flying longer than 1-2 hours at high temperatures (> 25°C). In wind tunnel experiments birds refused totally to fly at temperatures above 27°C. High ambient temperature leads to excessive water loss and seems to prevent birds from flying. It was, therefore, suggested that migrants should select flight altitudes with reasonable ambient temperatures to minimize their water consumption. When crossing the Sahara in autumn, air temperature within the lowest 1,000 m was on average > 25°C. In spite of the predicted high water loss more than 60 % of the nocturnal passerine migration occurred at temperatures > 25°C. Flight altitude was not selected to minimize water consumption, but energy; passerines migrated mostly at a height where favourable wind conditions occurred, i.e. within the lowest 1,000m. Considering the water loss estimations of the experiments mentioned above, passerines crossing the desert under such conditions would have lost an unrealistically high amount of water. Since most passerines migrate intermittently across the Sahara, i.e. rest anywhere in the desert during the day, they have no opportunity to replenish their water reserves. Water stress, as proposed by the studies mentioned above, did not seem to occur in birds crossing the Sahara.

Vadász, Csaba¹, Németh, Ákos², Králl, Attila³, Biró, Csaba⁴, Csörgő, Tibor⁵

The seasonal movements of the Moustached Warbler population breeding in the Carpathian Basin

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In this study we investigated the characteristics of the seasonal movements of the Moustached Warbler (*Acrocephalus melanopogon*) population breeding in the Carpathian Basin. The movements were analyzed from 12,388 recovery records belonging to 7,134 individuals ringed between 1975 and 2006. The spring migration was found to be relatively rapid and decidedly asynchronous, showing significant difference in the first arrival dates between males and females. The fastest individual ever recorded covered the distance between the wintering and the breeding areas in 7 days, which indicated the migratory speed to be at least 90 km per day. We found evidence for a directed post-breeding movement type, which, rather interestingly, seems to concentrate the individuals at specific moulting areas. The timing of the autumn migration is heavily influenced by the time of the completion of the full moult of remiges and rectrices executed by both juvenile and adult birds. In the main stage of the moult the birds are virtually flightless, or at least, can be characterized with decreased flight activity due to the raggedness of the wing, which is a rather unique moulting strategy in the order of

Passeriformes in Europe. We tried to find the wintering areas, which have not previously been described, due to the lack of data and ringing activity during the winter period. The results revealed that this population spreads to a wide section of the coasts of the Mediterranean Sea for wintering, with the delta of the Rhone as a possible western limit and with the western coast of the Balkan Peninsula as the eastern limit of the wintering range. At the wintering grounds we found evidence neither for territoriality, nor for decided attachment to a specific wintering site. Instead, the birds seemed to persistently roam. Natal and breeding site fidelity of the male and the female individuals showed a significant difference. A sexual difference may be hypothesized in the wintering area selection.

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Experimental study of seasonal movements of the Long-Tailed Tit *Aegithalos c. caudatus*

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It is well known that in the regular migrants the onset of migration is governed by the endogenous rhythm and to some extent can be controlled by photoperiod. In so-called irruptive species the full picture of the annual cycle regulation has not yet been elucidated. The aim of our research was to reveal the existence or absence of physiologically determined migratory activity in the irruptive species. We analyzed the experimental data on the annual variation of locomotory activity of the Long-tailed Tit. The birds were kept in cages and monitored by a registration system which recorded on-line their coordinates as a function of time. Because of the social nature of the species we kept two individually marked birds in each cage. The original software was used for distinguishing them by colour. The tests were done on two groups of reared Long-tailed Tits hatched in May–early June 2005 in NW Russia. The first group was kept under the natural photoperiod at the latitude 60 N for early broods, the second one – under the natural photoperiod for late broods, with light conditions shifted two months ahead. The third group consisted of birds trapped during autumn passage and served as a control. As a result of our research, two periods of physiologically determined migratory activity, strongly influenced by photoperiodic conditions, have been revealed in the Long-tailed Tit. We found that all experimental birds reared from nestlings showed a distinct rise in their locomotory activity relevant to autumn and spring migration. The birds kept under photoperiod for late broods (shifted two months ahead) started autumn and spring movements at an earlier age and date and had higher rates of activity increase in autumn, in comparison with the birds kept under photoperiod for early broods. The pattern showed by the individuals caught during autumn migration was similar to the ones kept under light conditions for early broods. The study was supported by RFBR 04-04-48998.

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The migratory behaviour of passerines – South vs North

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This study focuses primarily on the influence of wind on the migratory behaviour of small long-distance migrating passerines during the final steps of their migratory journey. Each spring, these birds return from their wintering sites in tropical Africa and often show site-fidelity when returning to breed. Two main predictions were tested: (1) that the long-distance migrating passerines show a preference for travelling in tailwinds, due to their small size and slow airspeed, and (2) that these birds almost fully compensate for wind drift. During late April to early June 2004 nocturnally migrating birds were registered using tracking radar as they passed Lund in south-western Sweden. This work was continued during spring and autumn in 2006 in Lund and in 2007 in Abisko. Results from the Lund 2004 data: Comparisons with ringing data indicate a strong dominance of Willow Warblers (*Phylloscopus trochilus*) among the migrants. Evaluation of the birds' registered wing-beat frequencies also suggests that the selected sample consists of mainly warblers and other species belonging to the group in focus. Analyses showed, contrary to expectation, that fewer birds were recorded in tail-

winds compared to headwinds. Furthermore, the birds' airspeeds were considerably faster than expected. According to the range-energy optimisation theory, airspeed should increase with increasing headwind. Head- and tailwinds seemed, however, to have only a weak influence on airspeed. Time minimisation is proposed to be more important than expected during the later stages of the migratory journey. Passerines passing Abisko (in northernmost Sweden) during spring will overall be closer to their final destinations than birds passing Lund. I aim to present some comparisons of the migratory behaviour of birds sampled in Lund with that of those passing Abisko.

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Eurasian Reed Warblers are able to compensate for longitudinal displacement during spring migration

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The ability of migratory birds to navigate towards their breeding area is supported by a mass of data on site fidelity and displacement experiments. But the mechanisms of long distance navigation have not yet been elucidated. A migrant must use some spatial gradients as coordinates for finding the migratory target. Measuring latitude seems to be a relatively easy task by using the height of polar stars and/or magnetic field inclination and/or intensity, but detecting latitude is a problem. The hypothesis that migrants could use a combination of an internal clock with memory of rotating star patterns has not been supported in planetarium experiments with Indigo Buntings (*Passerina cyanea*), Pied Flycatchers (*Ficedula hypoleuca*) and Blackcaps (*Sylvia atricapilla*). Therefore, it has been suggested that in spring, migrants perform one-coordinate navigation: they may know the latitude, but not longitude, of their migratory destination. To test this hypothesis we captured Eurasian Reed Warblers (*Acrocephalus scirpaceus*) on spring migration on the Baltic coast (55.09 N, 20.52 E) and tested their orientation in Emlen funnels. Significantly oriented individuals were displaced nearly 1000 km to the east (55.42 N, 36.45 E). A total of 27 birds showed a significant orientation vector both before and after displacement. The pooled sample had a mean direction of $A=40 \pm 31$ (mean \pm 95 % confidence interval), $r=0.49$, $N=27$, $p=0.001$. The mean azimuth after displacement was $A=341 \pm 35$, $r=0.45$, $N=27$, $P<0.005$. Thus, even though the 95 % confidence intervals overlap slightly, there seems to be evidence that the birds were able to compensate, in part, for the displacement. In follow-up experiments, we are going to test the hypothesis of the so-called double clock mechanism of longitudinal navigation, which implies the use of temporal desynchronisation of two coupled biological clocks after displacement.

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Homing in Pied Flycatchers (*Ficedula hypoleuca*) studied by radio telemetry

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In summer 2004-2005, 40 male Pied Flycatchers were radio tagged on the Courish Spit on the Baltic Sea when their young were 4-9 days old. Immediately after tagging, the birds were displaced 10 km from their nests and released. During homing, the birds' positions were taken every 20 min by biangulation from sites with known GPS coordinates. For each bird, the trajectory of its movements during homing was known. Time between release and return varied between 1 h 10 min and 118 h 36 min. Weather conditions during release significantly influenced homing duration. Under clear skies the birds returned significantly faster than under cloud cover $>50\%$ (U-test, $z=-2.248$, $p=0.0246$). Two phases of movements can be distinguished. During the first phase, the birds perform undirected movements at the release site. Under overcast a bird may spend up to several days there. During this phase Pied Flycatchers probably determine their position relative to their nest. The second phase is flight from the release site towards the nest. It is usually rapid, but may continue for up to several hours. Apart from the weather, homing speed is influenced by time of the day: the birds

released in the afternoon returned significantly more slowly (Spearman $r=0.37$, $p=0.026$, $N=36$). It is hypothesized that in order to navigate, Pied Flycatchers need to see a significant portion of the sun arc or its morning part.

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Shifting synchrony of irruptive migrants in central Europe

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Many boreal bird species show large, irregular annual variability in their extent of migration and are commonly referred to as irruptive. The cause of such irruptive migration is generally seen in a combination of high population density and food scarcity. However, the mechanisms triggering mass migration are not yet fully understood. Correlations in the numbers of migrants might give indications of the ecological background of irruptive migrations. Therefore, we analysed correlations in the number of migrants between 19 irruptive or potentially irruptive bird species on a mountain pass in the Jura Mountains in northern Switzerland during autumn migration between 1966 and 2005. Furthermore, we described how these correlations change over time. A cluster analysis based on the correlation in the numbers of birds caught per year reveals two main groups. The first group consists of all Finches (except Bullfinch), and the second group contains the Parids, Nuthatch, Great Spotted Woodpecker, Firecrest, Tree Sparrow and the Bullfinch. Blue Tit-Coal Tit and Blue Tit-Great Tit showed constantly high correlations in their numbers over the years while other species pairs showed striking variability in their correlations over time. The results show that the irruptive migration of Great Tit, Blue Tit and Coal Tit might be governed by similar proximate causes. In other bird groups, synchrony of irruptions seem to exist over short periods and dissolve afterwards for unknown reasons.

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Avian migrants adjust spring migration according to the environmental conditions en route

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The onset of migration is assumed to be under endogenous control in long-distance migrants wintering in sub-Saharan Africa. However, recent climate changes seems to have driven earlier arrival on the breeding area over only a few decades indicating phenotypic plasticity in the migratory programme and hence fast adaptation to environmental conditions. We still know little about which climatic factors affect the migrants during the different parts of the migration cycle and whether the patterns seen result from phenotypic plasticity or fast evolutionary change. Using data covering the entire migration period from passage stations located in the Mediterranean and in northern Europe, we show that long-distance migrants have shortened their migration duration through Europe during the last 20 years and adjusted their timing of arrival in northern Europe to the environmental conditions en route through Europe. Conversely, passage in the Mediter-

anean is delayed and the first phase of migration shows later arrival even in years with favourable conditions in northern Africa. Hence, we suggest that the migration schedule is adjusted to the environmental conditions en route, but the onset of migration from the wintering areas is controlled by other factors.

CO 2 – Saturday 25th August 2007, Auditory 7

Aidnik, Alice¹, Goymann, Wolfgang², Schwabl, Ingrid³, Friedl, Thomas W. P.⁴

Plumage colouration, health status and testosterone levels in male Red Bishops (*Euplectes orix*)

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Recent studies have often shown that sexual ornaments are reliable indicators of an individual's quality. According to the immunocompetence handicap hypothesis (ICHH), such ornaments honestly signal quality, as the expression of these ornaments depends on high testosterone levels, which at the same time are assumed to have considerable physiological costs in terms of an impaired immune function. We conducted our study on the Red Bishop (*Euplectes orix*), a polygynous and sexually dimorphic weaverbird occurring in Sub-Saharan Africa, where males compete aggressively with other males for territories in breeding colonies. Males have a striking red and black breeding plumage, which is highly variable among individuals. We measured plumage colouration using a spectrometer and calculated brightness, hue and chroma based on the reflectance data. In addition, we determined testosterone levels as well as individual health status and stress levels (assessed through total leukocyte counts and the heterophile / lymphocyte ratio). Based on these data we want to determine whether there is a relationship between plumage characteristics, testosterone levels and individual health as proposed by the ICHH.

Edler, Ralf¹, Goymann, Wolfgang², Schwabl, Ingrid³, Friedl, Thomas W.P.⁴

An experimental test of the immunocompetence handicap hypothesis in male Red Bishops (*Euplectes orix*)

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According to the immunocompetence handicap hypothesis (ICHH), the hormone testosterone is thought to mediate a trade-off between investment into reproduction such as courtship display or aggressive behaviour and immunological condition. In this study, we tested the ICHH by experimentally increasing testosterone levels in male Red Bishops (*Euplectes orix*) kept in an aviary under semi-natural conditions. The red bishop is a polygynous, sexually dimorphic weaverbird occurring in Sub-Saharan Africa. Male individuals show a striking courtship display to attract females and compete aggressively with other males for nesting sites in breeding colonies. We elevated testosterone levels of breeding males with a subcutaneous injection of testosterone-releasing pellets and compared behaviour, heterophil/lymphocyte

ratio (a common measure for stress in birds) and both innate and acquired immunocompetence (as assessed through a repeated phytohaemagglutinin skin test) of the experimental group to a control group treated with placebos. Males with experimentally elevated testosterone levels were more aggressive and more successful in competing for nesting sites compared to males from the control group. However, they also showed an increased heterophil/lymphocyte ratio, indicating that increased testosterone levels are associated with increased stress levels. In addition, our results implicate that the effect of elevated testosterone levels on the immunocompetence of males differs between innate and acquired components of the immune system.

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Less melanistic breeding males better cope with stressful environment: An experiment with corticosterone

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The trade-off between self-maintenance and reproductive effort is particularly pronounced when resources are limited such as in poor environments. The resolution of this trade-off is mediated by physiological mechanisms including glucocorticoid release which can be induced by environmental perturbation factors. Glucocorticoids help to mobilize stored energy, and redirect behaviour to increased foraging and enhanced restfulness. However, if glucocorticoids remain chronically elevated, negative long-term effects can occur. Here we tested whether the ability to cope with stressful environmental factors varies between individuals. To this end, we manipulated the level of circulating corticosterone in breeding male barn owls to test whether the response varies between individuals. Injection of corticosterone resulted in a moderately elevated level of circulating corticosterone over three days. Corticosterone-implanted males brought less food to the nest than placebo-implanted males which resulted in a reduced nestling growth rate. Males displaying a heritable melanin-based trait to a lower extent were less affected by this experimentally elevated corticosterone level. Among placebo-implanted males feeding rate and the degree of melanism were not correlated. This indicates that a genetically inherited plumage trait signals the ability to cope with stressful environmental factors.

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Coping with stress as an altricial nestling: Short- and long-term effects of moderately elevated corticosterone on development, immunocompetence and survival

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While elevated stress hormones in adults help to survive stressful situations, it is unclear what the costs and benefits of elevated glucocorticoids are in altricial nestlings. Benefits may result from changing energy allocation under restricted food supply and from leading parents to bring more food through more intense begging. Costs may arise from reduced growth and immunocompetence, delayed development and reduced cognitive abilities, resulting in reduced survival. We investigated short and long-term effects of a moderate elevation of corticosterone for some days in the middle of the nestling stage in wild European kestrels. To separate the effect of corticosterone from food deficiency, we used corticosterone implants to manipulate corticosterone levels. Moderately elevated corticosterone levels affected various growth parameters, particularly body mass, but also primary, wing and tarsus growth. Until fledging, the retardation in body mass gain could be compensated. Wing and primary growth rate recovered after corticosterone elevation; wing and primary

length were reduced at fledging, but wing and primary have only two thirds of their final length at this moment, with the opportunity for eventual compensation. Because tarsus growth was completed after the corticosterone elevation, growth retardation could not be compensated; the tarsus was shorter at fledging. In addition to growth, we investigated immunocompetence and behaviour in the nest during and after the corticosterone treatment. Apart from the effects on morphology, we examined other long-term effects after fledging, such as learning to hunt, time until independence and survival.

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Reproduction and modulation of the stress response: Experimental tests in the House Sparrow

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In response to stressors, vertebrates secrete elevated levels of glucocorticoids which enhance survival, but concurrently interfere with reproduction. In two experiments, we tested the idea that individuals may flexibly modulate their stress response with respect to the reproductive value of their brood in free living House Sparrows (*Passer domesticus*). In the first experiment, we increased or decreased clutch size during the nestling period and found that parents tending enlarged clutches responded less strongly to a stressor than parents tending reduced clutches. Within-individual variability in the stress response was also related to the brood size manipulations the birds received in their two consecutive breeding attempts. These results may be interpreted either as the consequence of increased offspring number (enlarged brood had high fitness potential – the brood value hypothesis) or as a consequence of increased parental workload (enlarged broods were energetically demanding for the parents – the workload hypothesis). In the second experiment we aimed to experimentally separate the effects of brood value and workload and to confront the latter two hypotheses. To do so, we captured the male parents from breeding pairs and took them in captivity for 48 h. During the absence of males, mate-removed females made more food deliveries than controls (increased workload) but were unable to fully compensate the lack of their mate, thus their chicks were in worse condition (reduced brood value) than control chicks. After the experimental period, mate-removed females responded more strongly to the standard stress than controls. These results provide experimental support for the brood value hypothesis, i.e. that individuals may actively modulate their stress response (either up- or downwards) with respect to the value of their current reproduction.

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An experimental test of female preference for structural UV crown colour in the blue tit

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Feather colouration in birds can be divided into pigment based (primarily melanins and carotenoids) and structural colours. There is strong experimental evidence that female birds use male pigment based colouration in choosing a mate. The role of structural colours in mate choice has however received much less attention. In this study we experimentally manipulated crown UV reflectance of male blue tits within the natural range to test the hypothesis that females prefer males with higher crown UV reflectance. Blue tits are sexually dichromatic birds with males showing higher UV crown reflectance. This pattern has been linked to sexual selection. In the field crown UV reflectance has been found to positively correlate with female parental investment, male biased sex ratio and female choice. Females were offered two males differing slightly in crown UV reflectance: crown feathers were either slightly UV increased using a light blue marker or slightly UV reduced using a dark blue marker. We recorded the time spent by the female with both males

during three hours. Females did not spend more (or less) time with the males with higher crown UV reflectance. This result calls in question the general belief that structural colour in male blue tits plays a role in sexual selection.

Helfenstein, Fabrice¹, Saladin, Verena², Richner, Heinz³

Females of carotenoid-supplemented males are more faithful and produce higher quality offspring

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Carotenoids are antioxidant molecules that protect DNA and cell membranes from the deleterious effects of free radicals, and regulate immune functions. As they may also serve as pigments in many sexually selected traits, carotenoids convey fitness benefits to male animals both via survival and reproduction. Here, we test the hypothesis that free-living male Great Tits supplemented with carotenoids obtain a greater reproductive success through female investment into the eggs. In each pair, we supplemented males with carotenoids shortly before or just after the laying of the first egg and after clutch completion transferred entire clutches into foster nests. Thus, any effect of the carotenoid treatment of males on offspring quality must be due to female differential investment into the eggs. We found that offspring sired by carotenoid-supplemented males grew bigger and heavier and fledged more successfully. Carotenoid-supplemented males also lost less paternity. Our results highlight the major fitness benefits males accrue from carotenoids and emphasize the selective pressure imposed on males to optimize carotenoid acquisition and utilisation.

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The effect of diet quality on the post-nuptial moult and feather quality of the House Sparrow *Passer domesticus*: Interaction with humoral immune function?

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Moult is one of the most energy and protein demanding activities of birds. The individual branches of the immune system which are competing for resources may therefore be suppressed during moult. Conversely, energy and nutrition deficiency cause, for example, by the activation of the immune system may divert resources from moult, which may result in delayed feather replacement and/or feathers of reduced quality. In this study we compare the progress of post-nuptial moult and the quality of feathers produced between experimental groups of different diet quality and humoral immune activation in House Sparrows *Passer domesticus* kept in aviaries. We also compared the process of moult of aviary birds to that of wild birds. Wild-living House Sparrows moulted faster than aviary birds. In aviary birds, the protein content of the food significantly affected the process of moult, as House Sparrows feeding on food of low-protein content had took longer to moult than the high-protein group. We found no effect of the immunization treatment on moult which supports the low energy and nutritional requirement of humoral immunocompetence in birds. Food quality, but not the activation of humoral immunocompetence, significantly reduced the quality of primaries grown during moult. The protein content of the food had no effect on the primary and secondary humoral immune response against sheep red blood cells by adult male House Sparrows, while the concentration of immunoglobulins dropped only during prolonged malnutrition. It is concluded that the humoral immune system of birds is not strongly limited by protein availability even during periods of intensive nutrition demand like moulting. Our results support the absence of a trade-off between humoral immunocompetence and moult in House Sparrows, which might be related to the low energy and protein need of mounting and maintaining a humoral immune response.

CO 3 – Saturday 25th August 2007, Auditory 6Kovács, Anikó¹, Szent, István², Batáry, Péter³, Báldi, András⁴**Farmland birds of cereal fields in Hungary: Can they survive the iron claw of intensification?***(1) Szent István University, Faculty of Veterinary Sciences, Institute for Zoology, 50. Rottenbiller u., HU-1072 Budapest, Hungary, kovacsanko@freemail.hu**(2) Hungarian Natural History Museum, Ludovika tér 2, H-1083 Budapest, Hungary, batary@nhmus.hu**(3) Animal Ecology Research Group of the Hungarian Academy of Sciences and the Hungarian Natural History Museum, Ludovika tér 2, H-1083 Budapest, Hungary, baldi@nhmus.hu*

Modern agriculture is one of the main anthropogenic threats to biodiversity. The decline of farmland species diversity due to management intensity has been shown in several taxa. Currently, many declining bird species in Western Europe are still abundant in Central and Eastern European countries. Agricultural land covers two-thirds of Hungary's area. Therefore, the conservation of Hungarian agricultural landscapes with relatively high biodiversity is the key to maintaining the unique biota of the Pannon biogeographic region. Our study sites were in Central Hungary, in and around the Kiskunság National Park. In 2005 we chose five farmers and altogether seven land-use intensities. The farmers were asked to complete a questionnaire about the use of organic and artificial fertilisers, and pesticides (herbicides, insecticides and fungicides). In all intensities we chose 3-3 winter cereal fields. As for the Hungarian Common Bird Monitoring, the point count method was used to survey breeding birds. All points were counted twice in the breeding season. Botanical survey was conducted on all fields, in the edge and 50 m further into the field to assess sward structure. Spiders, carabids and bees were collected in the same transects to estimate food resources. The influence of landscape was tested through the percentage of semi-natural habitat, which was estimated in a radius of 500 m around each bird census point. The influence of cultivation and landscape were tested on species richness and abundance with general linear mixed models. From the observed 28 species Skylark (*Alauda arvensis*) 37 %, Yellow Wagtail (*Motacilla flava*) 27 % and Quail (*Coturnix coturnix*) 9 % were the three most abundant. Fertiliser had a significant negative impact on species richness and abundance, which could be the result of less food on the intensively farmed land. Bare soil surface increased the abundance significantly. The abundance of spiders, carabids and bees had no significant effects on birds.

Hahn, Steffen¹, Bauer, Silke², Klaassen, Marcel³**Allochthonous nutrient input into Dutch wetlands by herbivorous waterbirds***(1) The Netherlands Institute of Ecology, Centre for Limnology, POB 1299, NL-3600 BG Maarssen, The Netherlands, s.hahn@nioo.knaw.nl**(2) The Netherlands Institute of Ecology, Centre for Limnology, POB 1299, NL-3600 BG Maarssen, The Netherlands, s.bauer@nioo.knaw.nl**(3) The Netherlands Institute of Ecology, Centre for Limnology, POB 1299, NL-3600 BG Maarssen, The Netherlands, M.Klaassen@nioo.knaw.nl*

Waterbirds are assumed to import large quantities of nutrients to wetlands but quantification of these loadings remains problematic. We developed two general models to calculate such allochthonous nutrient inputs to wetlands considering food intake, foraging behaviour and digestive performance of waterbirds feeding in terrestrial habitats. The models were parameterized with data of seasonally varying N and P contents of potential food and waterbird feces. We applied the models to the case of The Netherlands estimating the contribution of herbivorous waterbirds to annual allochthonous nutrient loading of wetlands. Although the large number of waterbirds in The Netherlands resulted in mean annual N and P inputs of 383 tons and 35 tons, respectively, the corresponding annual per surface area loadings of 1.07 kg N ha⁻¹ and 0.10 kg P ha⁻¹ were relatively low at this large spatial scale. There was a distinct seasonal pattern with peak loadings in January, when bird abundances were highest. Lowest inputs were in August, when bird abundance and nutrient content in food was low and birds fed less in terrestrial habitats. Three quarter of all nutrient input was contributed by only four species: white-fronted goose, greylag goose, wigeon and barnacle goose. Locally, allochthonous nutrient inputs by herbivorous waterbirds may be of considerable concern. We provide general and easy to use calculation methods allowing the estimation of these inputs. The method is applicable for a range of waterbird species and can be adjusted to include a variety of potential diets and feeding behaviours, which may assist in management actions in case the calculated nutrient inputs indicate harmful levels for the focal wetland.

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Why do birds prefer organic wheat seeds?

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Organic farming has been shown to benefit farmland bird diversity, but the mechanisms behind this remain unclear. Studies have yet to consider the possibility of a direct influence of conventionally-grown foods on birds. A range of mammals and birds have been shown to prefer organic to conventionally grown foodstuffs when given the choice. We tested whether this preference extends to the wild situation by measuring consumption of organic and conventionally grown wheat seed from feeders in NE England gardens over two weeks during winter. Birds consumed significantly more organic seed than conventional seed during the second half of our experiment ($p < 0.01$). Biochemical analyses of the seed showed levels of protein and nitrogen, growth regulator chlorocholine chlormequat (CCC) residue and the mycotoxin DON to be significantly lower in the organic seed, while levels of phytic acid were significantly higher. Previous work suggests the lower levels of CCC in organic wheat is most likely to explain the observed preference. Further work will investigate this choice further, initially with a similar study carried out over a longer time period. We also plan to investigate possible physiological effects of a conventional diet, in particular the effect of CCC, on fertility parameters and survival in birds.

Gillings, Simon¹

The effects of landscape diversity and scale on species richness: Implications for atlas surveys

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The diversity and scale of variation in landscape and habitat features may influence species richness. Moreover, the effectiveness of surveys aiming to assess this species richness may be influenced by these same factors. Here I use data from a volunteer-based survey of wintering birds to assess the linkages between field effort (time per location versus number of locations), landscape metrics and survey effectiveness.

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Trends and indicators for breeding birds along UK waterways

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The British Trust for Ornithology has operated a volunteer census programme for breeding waterbirds along the UK's rivers and canals since 1974. Major trends detected include increases in introduced waterfowl, including Canada Goose *Branta canadensis*, Greylag Goose *Anser anser* and domesticated Mallard *Anas platyrhynchos*. In contrast, population decreases among meadow birds such as Redshank *Tringa totanus*, Snipe *Gallinago gallinago* and Yellow Wagtail *Motacilla flava* have sparked conservation concern in the UK and elsewhere. The EC Water Framework Directive, in force since 2000, promotes a new, integrated approach to the protection, improvement and sustainable use of Europe's rivers, lakes, estuaries, coastal waters and groundwater. Although birds are not mentioned specifically in the WFD, the existing programme for monitoring birds along waterways provides scope for using bird data as an overview of sustainable human use of these environments. A set of multi-species bird population indicators for the UK's waterways is currently in development. Because such indicators would comprise data generated by BTO volunteers, they would be a highly cost-effective way for statutory bodies to monitor the sustainable use of the waterway environment. Some indica-

tors could be designed to relate directly to policy issues such as water abstraction and habitat management. We give examples of possible indicators and explore data filters, weighting and smoothing as options for their construction.

Ucarli, Yasin¹

The role and importance of wildlife species in the forest management: A case study from the Northeastern Turkey

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The conservation of forest biodiversity is one of the fundamental matters in sustainable forest management. Because forests support approximately 65 percent of the world's terrestrial taxa, forests are one of the most crucial habitats for biodiversity, which is under threat mainly because of habitat degradation, fragmentation and loss, overexploitation of natural resources and pollution. During the study period, wildlife species, focal species, main threats and crucial habitats for wildlife species were determined. 34 mammals, 174 birds, 14 freshwater fish, 10 reptiles and 7 amphibian species were identified using direct and indirect observations including different tracks and signs in a total 95 field trips from April 2005 to June 2006 in the Ardahan Yalnzçam forest, one of the BTC Environmental Investment Project areas, located in northeastern Turkey and Caucasus hotspots. Golden Eagle (*Aquila chrysaetos*), Lesser Spotted Eagle (*Aquila pomarina*), Black Vulture (*Aegypius monachus*), Griffon Vulture (*Gyps fulvus*), Lammergeier (*Gypaetus barbatus*), Brown Bear (*Ursus arctos*), Lynx (*Lynx lynx*), Wolf (*Canis lupus*), Wild Boar (*Sus scrofa*), Roe Deer (*Capreolus capreolus*), Otter (*Lutra lutra*) and Brown Trout (*Salmo trutta macrostigma*) were identified as focal species by using both criteria from studies of single species and from field monitoring. Clearance of native vegetation, overharvesting of timber, illegal logging, fuel-wood harvesting, overgrazing, road construction and maintenance, unplanned recreation activities, pest control in farmlands, illegal collecting/harvesting, overhunting, overfishing and pollution of rivers and wetlands were the main threats to biodiversity. The main conservation action, especially for wildlife species under forest management, was the determination of crucial areas for wildlife species, buffer areas, biodiversity monitoring areas and linkage areas.

Lebedeva, Natalia¹

Birds as bioindicators of long-term changes in the Azov Sea ecosystem

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In the recent past, the ecosystem of the Azov Sea was one of the most highly productive in Europe. Since the second half of the 20th century, disastrous changes in this ecosystem have begun, related to both natural and anthropogenic change: these changes include over-fishing coinciding with periods of changing salinity, the introduction of exotic species, contamination, including fallout of Chernobyl's radionuclides, and the deposit of industrial waste in the Azov Sea. We investigated various aspects of the biology and ecology of fish-eating birds to reveal the effect of these negative factors. Food composition and the accumulation of heavy metals and radionuclides by fish-eating birds were also studied. The southern sub-species of the Cormorant (*Phalacrocorax carbo sinensis*), a widely spread species, was chosen for study. The Cormorant is a breeding, migratory, and, in the southern parts of the area, resident species. The Herring Gull was the second fish-eating species studied. Colonies on the islands in Taganrog Bay of the Sea of Azov were studied. There was a tendency for the diet of Cormorants to change with the structure of the fish community. The concentration of heavy metals was determined in the content and shell of eggs, excrement and tissues of the Cormorant, bones of other bird species, bottom sediments, macrophytes and five species of fish. The occurrence of metals is generally similar in fishes and young Cormorants, although the concentration of Ni in fishes was much higher than in birds, and Cu and Pb occurred at higher concentrations in birds than in fishes. Birds selectively accumulated Zn and Cu. The levels of Cs-137, Sr-90 and Pu-239 and 240 testify to weak radioactive contamination of the tissues of fishes and cormorants. However contamination of the environment within big colonies occurs through the accumulation of Sr-90 and Pu-239,240 in guano. Thus, fish-eating birds can be good bioindicators of long-term changes in marine ecosystems.

CO 4 – Saturday 25th August 2007, Auditory 5

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Climate and seed masting affect Dormice populations and create a trap for the hole nesting bird community

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Global climate change has been shown to cause variable shifts in phenology in a variety of animals. Here we examined how rising annual spring temperatures affected the interactions between seed masting, cavity nesting birds and the dormice using a long-term data (1980-2005) from the eastern Czech Republic. We show that climate change caused unequal shifts in phenology of two cavity-breeding groups: dormice and birds. Until recently, they had distinct temporal patterns of cavity use. However, rising spring temperatures have progressively advanced the termination of hibernation for the edible dormouse *Glis glis*, a common bird predator, leading to an overlap in use of nesting boxes between dormice and birds. In contrast, only the collared flycatcher *Ficedula albicollis*, of the four cavity-nesting bird species, has advanced its breeding dates in response to rising temperatures. At the same time, favourable weather conditions coupled with good seed masting years have led to a substantial rise in dormice numbers. An increase in dormice populations caused an increase in nest losses from less than 3 % to about 20 % (up to 70 % in flycatchers in seed masting years). The increasing dormice abundance was the main factor causing high brood losses in birds, while the animal phenology had a variable effect on different bird species. This study illustrates how climate might affect organisms at various trophic levels with often unexpected outcomes. Limited evidence from other study organisms suggests that species most at risk are those at different trophic levels that do not shift at the same rate or in the same direction as their food resources, predators, or competitors.

Mönkkönen, Mikko¹, Kananoja, Tiina², Ylönen, Hannu³

Nest site selection and reproductive strategies in response to experimentally manipulated predation risk

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The environment is spatially heterogeneous for most organisms, and they hence benefit from non-random settlement, i.e. habitat choice. In addition to resources, mortality factors are important determinants of environmental quality. To maximize fitness individuals should select sites where the risk of predation is low. If only high risk sites are available, individuals should alter their reproductive strategies compared to low risk sites. We conducted experiments at two spatial scales. First, we tested if cavity nesting birds are able to detect the presence of mammalian predators and select safer nest sites by providing nest boxes for breeding birds in triplets: water treatment (control), least weasel treatment (high risk) and vinegar treatment (odor control) boxes. This experiment showed that Pied Flycatchers *Ficedula hypoleuca*, but not titmice *Parus spp.*, avoided selecting nest boxes with signs of least weasel visits. Second, we created four high and four low risk areas (5-10 ha) each with 6 nest boxes either with clear signs of least weasel visits (high risk areas) or without any sign of predator presence (low risk areas). This experiment showed that Pied Flycatchers, but not titmice, tended to invest more in reproduction in high risk areas than in low risk areas. Pied Flycatchers tended to start nesting earlier and lay heavier clutches in high risk areas. Fledgling mass was higher in high risk than in low risk areas. We conclude that Pied Flycatchers are able to detect relative predation risks when selecting nesting sites (first experiment), but if selecting among low and high risk nest boxes is not possible (second experiment) flycatchers invest more in rapid development of their offspring to minimize nest predation risks.

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A snack or a main menu — does size of nuptial gifts matter for male Lesser Grey Shrikes?

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Nuptial gifts are common in many animal taxa including birds. Female birds especially of raptor species receive food in return for copulations. If the nuptial gift is food, one can assume that female willingness to copulate is affected by their state of hunger. Consequently male should optimize nuptial gift size to get as many copulations as possible which means that food should be big enough to get a copulation as reward but not so big that the female becomes satiated. We investigated the role of nuptial gifts (i) for copulation behavior and (ii) the size and type of nuptial gifts for female willingness to accept copulations in Lesser Grey Shrikes *Lanius minor*. Our results show that in years with cockchafer outbreaks plenty of food is available during the mating period. We found (i) that feeding the female is linked to copulation events, (ii) a significant lower copulation frequency in cockchafer compared to non-cockchafer years, (iii) nuptial gift size varying between cockchafer and non-cockchafer years and, (iv) nuptial gifts being smaller food items than what is normally eaten by male or female shrikes.

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The significance of post-fledging mass growth for survival until recruitment in Common Terns (*Sterna hirundo*)

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While pre-fledging development in birds is relatively well studied and understood, knowledge about post-fledging growth is limited, mostly due to methodological restrictions. As the process of growth, however, is not yet complete at fledging the post-fledging period can have major consequences for survival of young. We studied Common Terns using a novel transponder-based detection system at Banter See colony in Northern Germany, which includes automatic balances. This enabled us to investigate body mass growth of juveniles during this frequently neglected period, and its consequences for survival after fledging until return and recruitment into the natal colony. We analysed data from two contrasting breeding seasons, 2000 and 2001, in order to determine inter-year and inter-sex variation of post-fledging parameters, such as the period a juvenile is still present at colony surroundings, its last mass record and date of last record. We found that the last recorded post-fledging mass was the only significant parameter influencing survival probability. No significant influence of year and sex on survival was detected. Individuals of the cohort 2000, which had left the colony area on average 5 g lighter than those reared under the more favourable conditions in 2001, did not exhibit lower return probability. Our results suggest that last post-fledging mass is a more relevant parameter predicting survival than fledging mass, especially in species with pro-longed parental care post-fledging. This study was supported by the Deutsche Forschungsgemeinschaft (BE 916/5 and 8).

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The influence of ambient temperature on resting metabolic rate in Pied Flycatcher (*Ficedula hypoleuca*) fledglings

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We measured resting metabolic rate (RMR) of Pied Flycatcher fledglings in the Moscow region in 2000-2005 years (953 chicks from 362 broods). Ambient temperature (T_a) was calculated as daily average temperature during a week before RMR measurement. We tried to estimate the effects of T_a on the fledgling's night time RMR. This relationship was positive overall, but several factors influenced it including the age of the male parent, brood size and the chick's sex. The relation between RMR and T_a was most pronounced in offspring of young (1 year old) males from small broods (<6 fledglings). The age of the female had no effect on this relationship. On average, RMR of offspring of old males (≥ 2 years old) tended to be higher than that of young ones, and the RMR of chicks in small broods was higher than that in large broods. The results suggest that chicks of low quality parents need additional favourable conditions to be able to switch to a costly energetic regime.

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Timing of reproduction: Genetic variation in the mechanism underlying phenotypic plasticity

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Climate change has led to mistimed reproduction in Great Tits (*Parus major*); the birds are laying too late to take full advantage of the temporal peak in their caterpillar prey to feed their nestlings. As a result, the reaction norm of laying date versus temperature is now under directional selection: the birds should lay earlier at any given temperature. A prerequisite for a response to this selection is that there is genetic variation in the reaction norm. A major complication is that egg laying is the end product of a whole cascade of processes: onset and rate of gonadal growth, start of follicle development, and so on, and that each of these processes may differ in their temperature or photoperiodic sensitivity. To study the genetic variation in the mechanism underlying phenotypic plasticity (the response mechanism), we kept Great Tits in climatized aviaries and recorded their laying dates. These birds are the offspring of wild great tits (from each pair a number of siblings are used) for which we have the breeding value for timing of reproduction, i.e. whether they are genetically early or late. Throughout the experiment (December–May) we measured gonadal development and recorded laying dates and dates of the termination of reproduction and onset of moult. There were no differences in laying date between the genetically early and late birds nor was there an effect of temperature on laying date. However, the temperature treatment did have an effect on the termination of reproduction: animals in the warm treatment stopped producing replacement clutches earlier. A better causal understanding of the effects of temperature on reproduction will help us to predict the response to selection due to climate change of Great Tits and to assess whether the current mistiming will be restored.

Gwinner, Helga¹, Yohannes, Elizabeth²

Starling nestlings benefit from herbs incorporated into the nests by their fathers

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Male European Starlings (*Sturnus vulgaris*), a hole nesting species, intermingle fresh herbs, preferably species rich in volatiles, into their otherwise dry nest-material. We investigated this behaviour in a field study in a starling nest box colony in Southern Bavaria. We considered several hypothesis accounting for the use of green nest material: 1. insecticide or bactericide compounds of the herbs may control nest dwelling parasites or the germ load of the nestlings; 2. herbal substances may improve the nestlings condition directly; 3. herbs may effect nest temperature either directly or by influenc-

ing the behaviour of the incubating female; 4. females may vary the investment into their eggs according to the males' effort in herb provision. In a field study we found that nest herbs did not reduce nest ectoparasites but reduced bacteria in starling nests. Herbs stimulated elements of the immune system relevant for parasite defence and had a positive effect on the nestlings' body mass and the return rate of the yearlings. Green nest material also had an influence on yolk hormones and the female's incubation behaviour. The effect of nest herbs is multifaceted and nestlings may benefit in various ways from their father's herbal gift.

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Lying without blushing? – An experimental study on the begging behaviour of Wilson's Storm Petrel chicks

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In long-lived seabirds life history theory predicts a trade-off between investment in current and future reproduction. The parents can either feed their current offspring or invest in their own body condition, which increases the survival prospects to the next potential reproductive period. Therefore the adults have to balance their allocation of limited food resources carefully between increased provisioning of undernourished chicks and reduced food delivery to well-fed nestlings. Solicitation behaviour by the chick can give the adults useful cues about the current state of their offspring and thus facilitates the assessment of the amount of food to deliver to the chick, if the information provided is honest. We addressed this question in a supplementary feeding experiment to a model organism, the Wilson's Storm-Petrel *Oceanites oceanicus*, on King-George-Island (South Shetland Islands, Antarctic). The initial results indicate that the parents adjust the amount of provided food to the intensity of the chick's begging behaviour. Conversely, there is evidence that after receiving food, either from a parent or by supplementation, begging becomes more intensive. Only changes in the call rate between controls and supplemented chicks are in line with initial expectations that begging intensity would decline after food provisioning. The project was partly supported by the German Research Foundation (DFG PE 454) and the Federal Ministry of Education and Research (DLR).

CO 5 – Saturday 25th August 2007, Auditory 4

Zehtindjiev, Pavel¹, Ilieva, Mihaela², Hansson, Bengt³, Bensch, Staffan⁴

Connectivity in Paddyfield Warbler (*Acrocephalus agricola* Jerd.) – orientation behavior, avian malaria and genetic variability of the population

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According to our results, European Paddyfield Warblers still follow the route of their historical breeding range expansion during their seasonal migrations. The Bulgarian population circumvents the Black Sea in autumn. The migratory program in adult and first year birds includes changes from NNE to SE in direction with the progress of the autumn season. The switch is not gradual. Population sizes vary considerably across the breeding range. In order to investigate whether the specific orientation behaviour of Bulgarian birds correlates with the population structure of the species we analyzed the genetic variability and the prevalence of malaria parasites using samples from three localities in the breeding range. A portion of the mitochondrial control region (456 bp) was sequenced in 104 Paddyfield Warblers sampled in 3 breeding populations in Bulgaria, Russia and Kazakhstan. There was little evidence of divergence between Bulgarian and Russian populations (Fst: -0.0024) whereas the samples from Kazakhstan differed significantly from the European breeding populations (Fst: 0.033 Russian/Kazakhstan and 0.046 Bulgarian/Kazakhstan). The degree of microsatellite differentiation was weaker than was the case for the mtDNA data, which may be explained by differences in effective long-term population size and/or in the mutation-drift equilibrium for these two types of markers. The overall prevalence of

haemosporidian parasites was 28 %. The most common haemosporidian infection in the breeding Bulgarian population was a new lineage of Haemoproteus described for the first time in the present study. Parasites of the genus *Plasmodium* were present only in Russian and Bulgarian birds. One lineage was found only in birds breeding in Kazakhstan or at the border region with Russia. The lack of Plasmodium infections in the Kazakhstan population and abundance of these parasites in Russian and Bulgarian birds indicate different wintering sites and migratory routes of the populations.

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Differences in size and condition of House Sparrows along an urbanization gradient

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Urbanized habitats differ from natural ones in several ecological features, including climate, food availability, strength of predation and competition. Although the effects of urbanization on avian community composition and population densities are well known, there is much less information about how the individual birds are affected by these human-generated habitat differences. In this study we investigated the relationships between the morphological characteristics and the degree of habitat urbanization in House Sparrows (*Passer domesticus*). We collected data for 1,100 non-breeding adult individuals in Hungary between 1997-2006, from seven sites including city centres, suburban areas and farmlands. We found that the body mass, tarsus length, and body condition of sparrows differed significantly among the sites, and birds in more urbanized habitats were generally smaller and in worse condition than birds in more rural habitats. A composite measure of habitat urbanization (based on building density, road density, and vegetation cover) explained more than 80 % of the variance in the studied traits. The difference in body mass between urban and rural sparrows remained significant when birds from these populations were kept in aviaries for several weeks under identical conditions. In food provisioning field experiments, we found no difference between urban and rural sites in the amount of seed consumed by resident sparrows, suggesting little difference in the strength of intra-specific competition for winter food among adult birds. It is therefore unlikely that the marked differences in body size and condition between habitats are the consequences of the differences in food supply available for adults. We discuss other mechanisms, including food quality of nestlings, and selection by differential climatic and predation conditions, that may account for the changes along the urbanization gradient.

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Spatial sub-division of breeding populations of a passerine bird due to migratory connectivity

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Ecological populations of animals are usually continuous, with no clear delimitation, although different populations may be partly differentiated from each other due to restricted movement. Migratory bird species disperse further than residents, but also migrate thousands of kilometers from breeding to wintering grounds, making them unlikely candidates for strong population differentiation. However, migratory connectivity resulting from non-random connection between specific breeding and wintering grounds may cause differentiation if the fitness benefits of individuals arising from such

fidelity to specific breeding and wintering grounds exceed the costs of freely mixing among populations. Here we use a combination of six different methods to delineate population boundaries in a migratory passerine bird, the sand martin *Riparia riparia*, wintering in sub-Saharan Africa. Using long-term capture-mark-recapture data from a study area of 300 km² in Eastern Hungary for a period of 12 years we identified three populations that differed in terms of temporal patterns of (1) composition of trace elements of feathers moulted in the African winter quarters, (2) juvenile and adult survival, (3) juvenile and adult transition rates among populations, (4) population size, (5) spring arrival from the winter quarters, and (6) variation in wing length. These findings suggest that different populations of sand martins show a high degree of site fidelity to specific breeding and wintering grounds, providing evidence of strong migratory connectivity.

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Population differentiation in the Siskin *Carduelis spinus* in Europe: Evidence from postjuvenile moult extent

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The Siskin *Carduelis spinus* is a monotypic species. The species is generally considered to be a wandering and migratory flocking bird in all parts of its European range, and the absence of morphological intraspecific differentiation can be explained by its nomadism and current gene flow between different groups. However, some populations may be resident. We studied the postjuvenile moult to investigate population differentiation in this species in Europe. It is known that some siskins in Switzerland renew a few central primaries and all tail feathers and tertials in postjuvenile moult (Winkler, Jenni 1987; Jenni, Winkler 1994). In 2000 (non-invasive year), we investigated 38 birds netted at the Col de Bretolet. The presence of renewed tertials, secondaries, primaries and rectrices was recorded in 21, 1, 4 and 19 birds respectively. Among thousands of birds caught at the Ladoga Ornithological Station (NW Russia) only a few birds had changed some tertials and rectrices (as a rule in the years with high numbers during autumn migration). Moult of primaries and secondaries has never been recorded. Moult is under photoperiodic control and depends on the age at the onset of moult. Under experimental conditions, NW Russian birds that started to moult at the maximum age have never changed their primaries and secondaries. The moult extent of wing and tail feather tracts in NW Russia is significantly different from that found in Switzerland. Birds from the central European population (if they are migratory) never reach NW Russia. Data on changing numbers of siskins with different extent of moult in autumn and the following spring in Switzerland and NW Russia also confirms the existence of different populations distributed in these two regions of Europe. The following questions remain to be investigated: where the geographical border between these populations is and if there are genetic differences between them.

Duriez, Olivier¹, Saether, Stein A.², Ens, Bruno³, Choquet, Rémi⁴

Consequences of a major habitat change on survival and distribution of wintering Oystercatchers

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Habitat loss is one of the major threats to bird populations. Oystercatchers are long-lived shorebirds, faithful to their wintering area, and are particularly sensitive to changes in tidal regime that can reduce their access to low-tide feeding grounds. The Netherlands host about 30 % of the European wintering population, with a significant proportion in the Delta area. However the Dutch population has declined by 40 % since 1980. We investigate the effect of a major habitat change (loss of a third of the tidal area after the closure of one main branch of the Delta in 1986) on the survival and distribution of birds wintering in the area. Before the closure, an unprecedented number of Oystercatchers was caught and

marked, which allowed us to use a new parameterization for multistate capture-recapture models to estimate simultaneously survival and movement rates (mixing live recaptures and dead recoveries). We looked both at a local scale (Delta) and at the continental European scale and we tested the additional effect of winter severity and food abundance, as well as the origin and the age of the birds. We hypothesized that birds affected by the habitat loss would show an increased propensity to move and reduced survival in the years immediately following the habitat loss. We tested how long the impact on the birds persisted.

Leech, Dave¹, Newson, Stuart²

Potential impact of Grey Squirrel *Sciurus carolinensis* on woodland bird populations in England

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The Grey Squirrel (*Sciurus carolinensis*), a North American rodent that is known to predate the nests of birds, was introduced to England at various sites between the late 19th and mid 20th Century, and the population has subsequently increased significantly in both range and size. In contrast, several woodland bird species have declined markedly in abundance over the last 40 years. The causes of these declines currently remain unclear but, given the timing, it has been suggested that increased predation pressure from Grey Squirrels may have played a part. We have used a novel approach to analyse extensive national datasets collected by participants in the BTO/JNCC/RSPB Breeding Bird Survey (BBS) and the BTO Nest Record Scheme (NRS) to investigate the relationships between Grey Squirrel abundance and the population trends and productivity of a range of bird species.

CO 6– Tuesday 28th August 2007, Auditory 8

Räß, Michael¹

Bringing flocks into the wind tunnel: Physiological and behavioural correlates of single versus grouped flight in European Starlings

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Increased efficiency to avoid predation and find prey and mates is considered as the main factor driving the formation of social groups. Birds flying in a group may have an additional advantage: aerodynamic theory predicts that they should be able to save flight costs by adopting specific positions in relation to their flock members. However, the spatial precision necessary to exploit the group members may be attainable only in the two-dimensional flight formations usually adopted by large birds, but not in the three-dimensional flocks observed in smaller birds. Correspondingly, empirical support for decreased energetic requirements in bird flocks has so far come only from studies on ducks, geese, and pelicans. European starlings are small passerines that are gregarious throughout the year. Flocks of several thousand individuals can be observed in autumn and winter. We trained starlings to fly in a wind tunnel for up to six hours. During flight, we continuously recorded their heart rates and spatial positions in the flight chamber. In addition, we measured glucocorticoid levels before and after three hours of flight. We compared these parameters in starlings flying either singly or together with two to three flock members, to assess the effects of group size on flight performance and flight efficiency in the wind tunnel setting.

Jorge, Paulo¹, Estrela, Alice²

The navigational function of flocks. Compromise vs. Leadership

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When travelling in groups, the way that individuals negotiate their routes is a fundamental issue in avian navigation. Two systems have been proposed, the “many wrongs” hypothesis claims that individuals average their preferred direction, leading to a compromise in route choice. Alternatively, in the leadership hypothesis, one or a small subset leads the group. A strong argument against there being a leader is that the average directional error decreases with group size, because errors are on both sides of the ideal direction. This would have as a consequence that, unless leaders have very different and superior information, their accuracy will be less than the average accuracy of the group. In homing pigeons although some researches have found no orientation function to flocking, others have concluded that flocks fly faster or more accurately than solitary birds. In the present study we are investigating the role of small flocks in improving the navigational performances of their own individuals when alone. Also we are trying to analyze what strategy individuals adopt during the returning flight (Leadership vs. Compromise). Results suggest that in groups of the same age and experience there is no evidence of a leader. Nevertheless, when leaders are identified those are consistently the birds having the median homing performances of the flock. Flocks appear to incidentally favour the less informed birds by improving their homing performances, while the best individuals do not benefit. In flocks with individuals of different ages, there are no specific leaders at the beginning, but at arrival leaders are always the oldest birds of the flocks. In conclusion the “many wrongs” hypothesis appears to be the generally adopted system during the returning flight. However, when birds in the flock vary in age there is an initial phase where the “many wrongs” hypothesis is adopted, but then a change occurs to a leadership system where the oldest bird assumes the control of the flock.

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Differential migration of Spoonbills: highest survival at intermediate migration distances

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Differential migration can be defined as intraspecific variation in migration distance and is a widespread phenomenon among birds. A number of theories have been proposed to explain differential migration. These theories differ in their predictions about winter distribution in relation to age and sex, and about the relationship between migration distance, survival and reproductive success. This study will test these predictions in the Spoonbill *Platalea leucorodia*. The Dutch spoonbill population shows great variation in migration distance, with birds overwintering in coastal areas between France (500 km) and Senegal (4500 km). The effort of many voluntary ring-readers over the relatively limited number of wintering area has revealed the wintering areas – and thus migration distance – of many Dutch spoonbills. This study investigates at an individual level whether migration distance changes with age and whether the sexes differ in the distance they migrate. Second, annual survival of birds with different migration distances will be compared using the program MARK. Adults were found to migrate further than juveniles, and females further than males. Survival was found to be quadratically related to migration distance, with highest survival probability for individuals with an intermediate migration distance. These results are contradictory to existing theories. A new theory will be discussed in addition to future directions of research.

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Determinants and consequences of variation in arrival date in the Pied Flycatcher (*Ficedula hypoleuca*)

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A potential constraint on the speed of adaptive change in timing of breeding of migratory birds may be the rate of change in the timing of spring arrival. It has been suggested that the use of day length for initiating moult and migration, lack of phenotypic plasticity, and differences in the rate and direction of changes along the migration route could hamper the immediate response of migration phenology to selection for earlier arrival. This hypothesis has not yet been tested, because we currently lack reliable empirical data that could be used to identify the determinants of variation in arrival date. We studied individual arrival from 2002 through 2007 in the Hoge Veluwe National Park in the Netherlands. Based on spring arrival of more than 300 individuals, we investigated the influence of caterpillar phenology, local weather and conditions on route on individual variation in arrival date, mating propensity and timing of egg-laying. Moreover, we determined among-year repeatability and family effects in these traits. The study period included the earliest and one of the latest springs on record allowing us to assess individual adjustment to among-year variation in environmental conditions. We discuss the results in the light of the expected global increase in temperature on the breeding grounds and give an evaluation of the factors facilitating or preventing adaptation of the timing of migration and reproduction in this species to rapid changes in climate.

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Orientation programme of first-year Pied Flycatchers *Ficedula hypoleuca* from Siberia implies an innate detour around Central Asia

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Field studies suggest that in autumn, passerine Siberian-African migrants make a detour around Central Asia and fly north of the Caspian Sea. We tested whether it results from their innate spatiotemporal programme. We hand-raised Pied Flycatchers (*Ficedula hypoleuca*) from Europe and from western Siberia in captivity and studied their migratory orientation by testing in Emlen funnels. The birds were kept outdoors in the local natural magnetic field. Siberian birds showed a purely westerly orientation in mid August–mid September (269, $N=20$, $r=0.58$, $p<0.001$). It was not significantly different from directions shown by Baltic birds in 2005 (245, $N=23$, $r=0.64$, $p<0.001$; Mardia-Watson-Wheeler test: $W=5.22$, $P=0.074$) and in August 2006 (252, $N=28$, $r=0.61$, $p<0.001$; MWW test: $W=1.95$, $P=0.378$). When the Baltic birds changed their orientation in September 2006 as compared with August, the new direction (212, $N=24$, $r=0.52$, $p=0.001$) differed from the one shown in Siberia (MWW test: $W=11.35$, $p=0.003$). These data suggest that juvenile Siberian Pied Flycatchers indeed have an innate spatiotemporal programme that brings them to Europe before migration to West African winter quarters. Siberian Pied Flycatchers displaced to the Baltic area as nestlings, raised and tested there showed no significant second-order orientation vector in August ($r=0.19$, $N=18$, $p=0.51$); in September their mean orientation direction was 202 ($N=18$, $r=0.87$, $p<0.001$). It differed significantly from the direction shown by their conspecifics in Siberia in August–mid September (MWW test: $W=16.86$; $p<0.001$; 95 % confidence intervals did not overlap). A possible expla-

nation is that the displaced birds detected displacement on the basis of the innate knowledge of some signposts. They may have 'skipped' the section of the route from Siberia to Europe and 'switched on' their migratory programme when in Europe, already towards the SSW. The study was supported by RFBR grant no. 05-04-49693 to C.V.B. and by Russian Science Support Foundation to N.C.

CO 7 – Tuesday 28th August 2007, Auditory 7

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Individual consistency of exploratory behaviour of Starlings (*Sturnus vulgaris*) on Fair Isle: Repeatability and the relationship to ranging behaviour

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Recent studies have shown individual differences in behaviour that are consistent and correlated across contexts in many species. Although such behavioural syndromes or 'animal personalities' may be interesting in themselves, analysis of their relevance in an ecological context is vital because they are expected to constrain behavioural flexibility. We show that individual exploratory behaviour of wild starlings (*Sturnus vulgaris*) as measured in behavioural assays is repeatable. Similar consistent differences in exploratory behaviour have been used in e.g. Great Tits (*Parus major*) as a measure of behavioural syndromes or personality. Secondly, we show that movement distances in the wild were negatively correlated to exploratory behaviour as measured in the assays, suggesting that more explorative individuals range less far in the wild. Earlier studies on other species have shown the opposite pattern. We discuss these contradictory results in the context of existing hypotheses on the relationship between exploratory behaviour as measured in behavioural assays and ranging behaviour in the wild.

Rössler, Martin¹

Fatal bird strikes on glass panes: Experimental approach to making invisible risks visible

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Lethal collisions with glass buildings in bird habitats cause considerable loss of birds. Collisions take place irrespective of the sex, age and species of bird. To reduce the risk of collisions there is an urgent need for clear instructions on how to furnish glass panes. Raptor silhouettes applied to glass have proven to be inefficient and alternatives have yet to be found. Special coatings giving ultraviolet (UV) absorption and reflection have not yet given promising results. This may be a consequence of a misinterpretation of physiological findings: UV plays an important part as an attractant in sexual selection as well as in searching for prey. But to alert flying birds to a danger the mechanisms to be stimulated must relate to movement perception. There is evidence that short wavelengths do not contribute to fast achromatic mechanisms in the bird's visual perception. With this rationale we tested white, black and semitransparent colourless markings. We shall present the results of 3,025 choice experiments over a period of three years (2004-2006). The experiments were conducted in a dark 9m flight tunnel based on a pivot. The tunnel was equipped with two mirrors and followed the angle of sunlight to provide parallel illumination of the tested glass panes. The test birds were wild birds caught for banding at the Biological Station Hohenau-Ringelsdorf, Austria. Each bird was forced to undertake a single experimental flight, which was documented and analysed by video. Safety was provided by a mist net in front of the experimental panes. We analysed the perception of different markings under different light conditions. Our results show that: 1) coverage is less important than the shape of the marking; 2) vertical stripes are more efficient than horizontal stripes; 3) white and black do not show specific efficiency for different light; and 4) the intensity of background light is a crucial factor that may reduce the efficiency at dim light.

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Hormonal partner compatibility in Geese: mechanisms and functions

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Testosterone (T) regulates and responds to sexual behaviour in male and female vertebrates. At least in males from monogamous fish and bird species T is more responsive to agonistic interactions than in polygynous species. The interaction between mating strategies, reproductive output and T is probably insufficiently investigated if the focus is on only one member of the pair (the male), particularly with regard to biparental reproductive effort. Therefore, we used a dyadic measure of hormonal partner compatibility, the 'within-pair testosterone co-variation' (TC). In the monogamous Greylag Goose (*Anser anser*), pairs with a higher degree of TC produced more fledged offspring per year than less synchronized pairs. Moreover, TC seemed to be related with mate choice during pair formation rather than developing with pairbond duration. Also in the polygynous and biparental Domestic Geese (*A. domesticus*) we observed the full range from non-synchronized to a high degree of TC when kept as pairs. Thus, biparental care is indeed a major variable of TC. The mate choice effect also became clear from the experiments with domestic geese: more TC pairs occurred among the 'preferred partner group' than among randomly assigned partners. Finally we tested the effect of induced social instability on established TC. TC-patterns were predicted to remain robust when the same pairs were kept as one large group. The domestication effect (i.e., intensive egg production over prolonged periods) was reflected in smaller TC rates in pairs with females that additionally never initiated incubation. We suggest dyadic TC as a relevant measure of pairbond quality in birds with biparental care. As a next step tests in further species including other vertebrate taxa are needed and in progress. Funded by FWF R30-B03.

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A role for corticosterone and nutritional stress in the fledging of White Stork (*Ciconia ciconia*) chicks

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Elevated plasma levels of corticosterone (CORT) help birds to overcome stress by increasing the mobilization of energy stores and promoting food searching activity. In several avian species, endogenously elevated CORT levels are believed to facilitate the critical fledging stage. Although nutritional deficit is common at the end of the nestling period, the interrelations between activity, CORT and nutritional status in pre-fledging chicks have never been investigated. Moreover, as chronically elevated CORT results in growth impairment and depletion of muscular protein, the condition and hatching rank of chicks may affect the endocrine responsiveness to stress. We examined the dynamics of activity (wing-flapping) levels and CORT together with nutritional status (parental feeding rates, body mass: BM, plasma levels of free fatty acids: FFA and uric acid: UA) and growth (wingchord: WC) in 9 White Stork chicks (3 broods) during the month preceding fledging. A sharp decrease in parental feeding rate, BM and WC growth characterized the three weeks preceding fledging. BM loss was inversely and positively related to UA (exogenous protein catabolism) and FFA (fat store mobilization), respectively, indicating that reduced provisioning caused a disruption of energy homeostasis in chicks. A 4-fold increase in CORT started 12 days before fledging, CORT being inversely and positively related to body condition and activity levels, respectively. Nest departure occurred sooner after the onset of CORT elevation when the elevation was steeper. Our data show that a nutritional stress-induced CORT elevation promotes muscular exercises and fledging in White storks. In smaller chicks, higher growth rates and extended periods at nest, concomitant to slower CORT elevations, resulted in the within-brood standardization of WC lengths at fledging. Thus, chicks were capable of blunting the CORT elevation in response to a chronic nutritional stress if the required size for appropriate behaviour had not been met.

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The capacity to use objects as means in non-tool using keas

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Although wild keas, *Nestor notabilis*, are well known for their extensive play with objects, they are not known to use objects as means for foraging in the field. Here, we report about the amazing capacity of keas to do so spontaneously in the lab, which contradicts our investigations in field. This gives rise to questions concerning the interrelation between tool use as innovation and factors like development, environmental conditions, sensorimotor intelligence and behavioural flexibility. In Darwin finches and New Caledonian crows that probe holes with sticks for larvae of invertebrates, ontogenetic studies showed a remarkable consistency in the time course in which tool use develops. Furthermore it was found, that adult Darwin finches from non-tool using populations fail to probe holes with objects, while their offspring readily develops the skill. From the point of cognitive development, a relevant skill for such tool use is to insert small objects into holes outside of a food context - that is to explore spatial relationships between objects. Non-tool using kakarikis failed to do so in an ontogenetic study, while immature keas but not adult ones did so in our lab. However, most adult keas inserted objects in holes and used them as a means to obtain food although all of them were naïve to the experimental situation. Control conditions indicated, that the birds also intended to insert objects. Thus, there is considerable variation between species in flexibility to use tools. Furthermore, tool use should not be considered as being only a maturational process occurring in an appropriate environment or as the effect of mere trial-and-error learning. Rather, cognitive skills have some impact at least in species with well developed sensorimotor intelligence.

CO 8– Tuesday 28th August 2007, Auditory 6

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Lapwing nest protection from predation and agriculture to improve nest and chick survival in Swiss farmland

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Switzerland had up to 1000 Lapwing pairs in 1975. Currently, there are some 200. The crash was mainly due to a poor productivity of 0.2-0.4 fledglings/pair/year. To achieve a fledging rate above 0.7 required for population stability, a Recovery Programme was initiated to test measures to support a small population in central Switzerland. In 2004-2006 all nests were marked and spared during agricultural activities by the farmers. As a result of well-established cooperation with local farmers, not a single nest was destroyed by agricultural activities. Nests were in arable crops (81 %) or meadows (19 %), accounting for 53 % and 47 % of farmland, respectively. In 2005 and 2006, but not in 2004, most nests were protected from ground predators by surrounding entire fields rather than individual clutches with electric-fences like those used in sheep farming. While 95 % of clutches within fences hatched successfully, 61 % of unprotected nests were predated. In 2006, radio-tagged chicks were followed. They had no difficulty in traversing the fences. Predation occurred mostly at night (73 %) and outside the fences (87 %). Of 46 chicks predated at night, only one was taken inside an electric-fence. Daytime predation played a minor role (27 % of all chick predation) and occurred at the same rate inside and outside the fence. Until mid-June, Lapwing families foraged in sugar beet (41 %), potatoes (21 %) and maize (7 %), accounting for 33 % of the farmed area. 31 % were in meadows, covering 53 %. Families then shifted to meadows (66 %), which were preferred after mowing. Winter wheat accounted for 14 % of the area and was not used for foraging or nesting. It grew very densely and was already above the height tolerated by Lapwings (i.e. >20 cm) in May. Reproductive success in 2005 was some 0.8 fledging young per pair per year. In 2006, however, it dropped to 0.25 due to heavy chick predation. This suggests that a high hatching success due to nest protection does not guarantee an adequate breeding success in years of heavy predation.

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Conservation measures for the Whinchat *Saxicola rubetra* in Switzerland: Struggle between effect and politics

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The Whinchat, a characteristic meadow bird, has been declining on Swiss grasslands in the past 30 years. It has disappeared from the lowlands and there is also evidence for negative trends in the strongholds at higher elevations. Species Recovery Programmes, which are developed, tested and implemented in Whinchat hotspots, are therefore urgent. Habitat changes are the main reason for the decline in breeding populations. In many farmland areas, grasslands no longer meet the species' requirements. There is, for example, a lack of nest sites safe from destruction by mowing machines (Müller *et al.* 2005, *J. Ornithol.*). Moreover, shifts in the plant species composition of meadows and the advanced mowing date have clearly detrimental effects on farmland insects, the major prey of Whinchats (Britschgi *et al.* 2006, *Cons. Biol.*). We discuss the prospects of stopping or even reversing these negative effects in (subalpine) farming and ask which of the measures beneficial to Whinchats are acceptable to farmers. Based on the habitat requirements of the Whinchat and on feasible preconditions set by agriculture we propose measures to the benefit of the Whinchat in meadows, pastures and wetlands. The following measures and farming practices proposed for implementation are tested for their acceptance by farmers and their efficiency for Whinchat conservation: small meadow plots or strips with a postponed mowing date; unfarmed plots on pastures, protected by fencing; nest protection from farming; meadow-bird friendly farming on a large scale; rotational pasturing; increasing the availability of perches for foraging Whinchats; specific conservation measures in wetlands. Meadowbird-friendly farming is adequate to maintain populations of a viable size, although it is difficult to implement. Nest protection is justified to save small numbers near a critical population size, although it is elaborate and time consuming.

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Distribution and movements of the Western pannonic Great Bustard (*Otis tarda*) population: Influence on the cross-border conservation

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During the 20th century the size of the Western Pannonic Great Bustard population decreased from more than 3,000 individuals to about 120 individuals by 1995. This population occurs in parts of Austria, the Czech Republic, Hungary and Slovakia. It is practically isolated from all other populations in Central Europe. Areas of occurrence, movements and population trends are described for a 12-year period (1995/1996–2006/2007). During this period the winter numbers increased from 129 to 315 individuals. As a consequence of this, the number of occurrence in less frequented places, as well as the home range, has grown. Detailed records of distribution and flight movements have been collected since 2002 and the results show that there are seasonal differences in the distribution of the Great Bustards amongst the four countries. Numerous conservation measures have been implemented in Austria, Hungary and Slovakia for the protection and management of their Great Bustard populations. Habitat management according to the needs of the species started in the first half of the 1990s, initially in Austria and Hungary, where more than 90 % of the whole West Pannonic population occurred. This made it necessary to extend the bustard-friendly habitat management to new areas. The most important measures are large protected areas with agri-environment measures for bustards which are complemented with extensive site surveillance on all Great Bustard areas. Although this steppe bird flies only rarely, within the cross-border monitoring in the border triangle Austria, Hungary and Slovakia more than 1,300 flights were observed and nearly 20 % of them

were transboundary flights. This shows the importance of extensive measures to be taken for the management of all breeding areas and key migration and wintering sites of the Western Pannonic Great Bustard population.

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Quantifying the decline of the Corncrake in Europe by the use of ringing data

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Declines of the Corncrake population in Europe had already started at the end of 19th century, but until the 1990s the decline was not monitored quantitatively in most European countries. We analyze Corncrake numbers ringed by 15 Ringing schemes in Europe during the period of 1925–1995. Analyses of ringed adults and pulli were carried out separately. Ringing data can be used for population trend analyses, provided that the ringing of a bird is random event: a higher population will then result in higher numbers of birds being ringed. We assume that ringing of Corncrake pulli has occurred randomly, as would be the case if ringers ring pulli that have been accidentally. The number of ringed Corncrakes was calibrated using 1,000 ringed birds from the same ringing scheme and year, and on the number of active ringers for the ringing scheme and year. Number of ringed Corncrakes, however might be affected by ringer behaviour as well. Therefore we analyzed the numbers of other ringed birds which could be ringed in similar habitats in Latvia: Common Whitethroat, Eurasian Linnet, Eurasian Skylark, Meadow Pipit, Whinchat and Yellow Wagtail. Yellow Wagtails are found in the most similar habitats to Corncrakes, and their numbers have not changed in Latvia over the 20th century. The estimated index of ringed Corncrakes in 8 countries (except Latvia) combined has fallen from about 1.6 in 1930 to about 0.1 in 1990. In Latvia the number of ringed Corncrakes declined significantly between 1925 and 1995, while the number of ringed Yellow Wagtails has remained stationary. The population size of Corncrakes has increased in Latvia since 1996 and is estimated to have been 48,000–58,000 calling males in 2006.

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Contribution to the bio-ecology of Grey-necked Picathartes, *Picathartes oreas*

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The ground-dwelling Grey-Necked Picathartes, classified as “Vulnerable” by IUCN and BirdLife International, lives within the Mbam-minkom mountain forest of southern Cameroon. Over the past three years we have been investigating the population status and habitat requirements of this enigmatic bird. Methods involve belt transects for vegetation surveys, ground truthing, quadrat sampling, pitfall and malaise trapping for assessment of potential food supply, radio-tracking to determine home range, observations from hideouts to determine feeding ecology, monitoring, and involvement of adjacent communities to raise awareness and promote its conservation. 90 breeding and 24 potential breeding sites have been mapped with the population estimated at 70 mature individuals. Closed canopy intact vegetation is needed for at least 200 m around breeding sites to provide a hideout and foraging area for this shy bird that feeds on invertebrates (mostly insects) and some vertebrates such as small frogs and lizards. Slash and burn agriculture and illegal timber exploitation remain its major threat. Sensitization is ongoing to develop management plans for site protection as a community sanctuary.

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Recovery of Mediterranean forest bird assemblages after undergrowth clearing

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The increased use of mechanical clearing in Mediterranean forests to reduce fire risks has consequences on bird communities that are poorly known. To address this issue, we studied forest birds in parcels with different undergrowth age (1-70 years), estimating how the assemblage changes over time after clearing. The study was carried out in a cork oak *Quercus suber* forest landscape in southern Portugal, where birds were counted in 48 100-m radius plots in the breeding (April and June 2005) and wintering (December 2005 and January 2006) seasons. Assemblage attributes were related to habitat variables describing the composition, structure and age of the woody vegetation, using principal components regression. Following clearing, the undergrowth vegetation increased progressively over time in cover and structural complexity. This was associated with increasing abundance and species richness of breeding and wintering birds. In spring, this effect was particularly strong for insectivorous species and for species associated with shrubland habitats, with strong increases in the abundance of species such as Robin *Erithacus rubecula*, Long-Tailed Tit *Aegithalos caudatus*, Jay *Garrulus glandarius*, Blackcap *Sylvia atricapilla*, Dartford Warbler *Sylvia undata*, and Wren *Troglodytes troglodytes*. In winter the effect of undergrowth age was strongest for frugivorous species and species associated with shrubland and tree canopy habitats, with major increases in the abundance of Blackbirds *Turdus merula*, Robins, Firecrests *Regulus ignicapillus*, Blackcaps, Sardinian Warblers *Sylvia melanocephala* and Song Thrushes *Turdus philomelos*. Winter results appeared shaped to a large extent by the abundance of strawberry tree *Arbutus unedo* fruits in older stands. To minimize the strong and enduring negative effects of undergrowth clearing on Mediterranean forest birds, fuel management schemes should recognize the need to preserve forest patches with well-developed and old (>30 years) undergrowth.

CO 9 – Tuesday 28th August 2007, Auditory 5

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Niche partitioning, resource use and foraging behaviour of birds in the canopy of a temperate alluvial forest

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In this study we analysed and compared patterns of resource use in birds by observing their foraging behaviour from a crane in the canopy of a temperate alluvial forest patch. We selected 12 bird species, documented their foraging behaviour and addressed seasonal changes in feeding activity during the vegetation period in spring including preferences and average staying time in two selected tree species, *Acer pseudoplatanus* and *Quercus robur*. In addition, we documented utilization of different tree strata and preferred foraging techniques and identified several ecological characteristics that influence resource partitioning in birds. All of the selected bird species revealed high variability in foraging behaviour including tree preferences, feeding techniques, and stratification. Most birds preferred oak trees. This preference was probably associated with higher food abundance and a varied set of substrates on which prey could be readily detected and captured. We classified the birds into two functional guilds defined by their main foraging technique. With the exception of *Ficedula hypoleuca*, all birds searched for food at short distances (0.1-0.5 m). As gleaners, they took food mainly from the substrate. *Ficedula hypoleuca*, in contrast, foraged by aerial-gleaning and searched over longer distances (0.75-5 m).

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Prediction of bird-day carrying capacity on a staging site: A test of depletion models

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The carrying capacity of a site for migratory water birds, expressed in bird-days, can be of particular conservation value. Several attempts have been made to model this carrying capacity using depletion models, in which the distribution of birds is fully determined by exploitative competition. In the tests of depletion models carried out so far, no alternative models were compared; rather, one specific model was tested. We tested whether bird-days were more in accordance with birds depleting the food resource (a1) until a critical food density which just enabled survival or (a2) until an optimal food density which renders the site as profitable as an alternative site; and birds (b1) satisfying their daily requirements or (b2) maximizing daily intake. We studied Bewick's Swans *Cygnus columbianus bewickii*, feeding on below-ground tubers of fennel pondweed *Potamogeton pectinatus*, in one part of an autumn staging site between 1995 and 2005. We measured tuber biomass densities around September, November and March, and counted swans daily during their stopover in October. The best fit between observed and predicted bird-days was obtained by assuming that the swans were maximizing their daily intake and depleting the tubers until an optimal biomass density. The fit improved after accounting for a small part of the initial tuber biomass being out of reach of the swans. Interestingly, this unaccessible part has slowly increased over the years, because of deeper burial of tubers by the plant. Our results suggests that the applicable model to calculate carrying capacity may depend strongly on whether birds use a site to stopover or to winter, because it determines whether the birds are more likely to use a threshold or optimal food density, and to behave as energy maximizers or satisficers.

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Causes and consequences of a lower foraging efficiency of juvenile Bewick's Swans

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The carrying capacity, i.e. the number of animals that can be supported by a site, largely depends on how much food there is available. In order to estimate carrying capacity, the resource harvesting efficiency of foragers must be known. Many carrying capacity models use an 'average' animal, consuming food at one particular rate. However, it has been shown with several bird species that there are marked differences in efficiency between adult and young animals, with the latter group reaching significantly lower instantaneous intake rates. This phenomenon does not only affect the juveniles themselves. In animal species where families stay together, parents might adjust their behaviour to their offspring. On the one hand, families might try to monopolize the best feeding places in the environment to compensate for the lower efficiency of the young. On the other hand, families might give up foraging at food densities that are still profitable for adults but not for juveniles. Therefore, the role of juvenile intake rates cannot be ignored while determining the carrying capacity of a habitat. The main goals of our study were to compare the instantaneous intake rate of first-winter Bewick's Swans with that of adults in an experiment and subsequently investigate, using field data, whether this could lead to different spatial distributions at a staging site in the Netherlands. We found that first-winter Bewick's Swans achieve a lower intake rate than adults under the same experimental circumstances. However, no behavioural aspect could explain the difference. Among the measured physical variables weight and width of foot-web showed a significant correlation with instantaneous intake rate. The field observations revealed that young birds tended to select foraging sites with high human disturbance but fewer conspecific competitors. We propose a causal link between the lower feeding rate of young birds and their preference for lower intraspecific competition.

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Basal metabolic rate as an indicator of mating cost in Pied Flycatcher males

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We investigated the energetic cost of advertising behaviour (AB) of free-living Pied Flycatcher males occupying nest-boxes in the pre-breeding period. AB of bachelor males was recorded by metronomic timekeeping and their basal metabolic rate (BMR) was measured at night time. Males differed in the ratio of time spent on singing and flight activities. This ratio was influenced by male colour type and habitat fragmentation. The rates of singing and flights were negatively related. Mass specific BMR was positively related to daily energetic cost of AB which was mainly influenced by time spent on such expensive activities as flights. At the same time, BMR was negatively related to song rate. The results suggest that the use of an expensive advertising strategy is accompanied by the need for an increased BMR in this species.

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Nest parasitism and its effect on production in Ducks

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Intraspecific and interspecific nest parasitism is common in ducks. We examined this phenomenon in Common Pochards (*Aythya ferina*) and Tufted Ducks (*A. fuligula*). The long-term study was carried out at Krotovaya Lyaga Lake, Western Siberia (53°72' N; 78°02' E). We used traditional methods of identifying eggs from different females: dissimilarity in colour, size, shape, or in stage of development; eggs with live embryos after hatching; a clutch size >15 eggs; a rate of egg deposition of >1/day. During the 30-year period, 0.31.0 % of Tufted Duck nests and 11.1–52.2 % of Common Pochard nests were parasitized each year. An increase in the proportion of joint nests with increasing nest numbers was only found in Tufted Ducks ($r=0.48$, $p<0.05$), but the proportion of joint nests increased significantly in years with late nest initiation only in Common Pochards ($r=0.37$, $p<0.05$). The negative consequences of parasitism were due to nest abandonment, damaged eggs, and eggs laid after the start of incubation or outside nests. Egg failure rates in joint nests varied from 2.5 % to 22.1 % in Common Pochards; and from 0 % to 15.9 % in Tufted Ducks, reaching its peak when Tufted Duck nests were concentrated in Common Tern colonies. The hatchability of eggs laid in joint nests was below the hatchability of eggs laid in normal nests with the same numbers of eggs. Nest parasitism had significant negative effects on the potential population productivity.

CO 10 – Tuesday 28th August 2007, Auditory 4

Tóth, Zoltán¹, Bókony, Veronika², Lendvai, Ádám Z.³, Szabó, Krisztián⁴, Liker, András⁵

Effect of relatedness on social foraging tactic use in House Sparrows

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Genetic relatedness is known to play an important role in shaping reproductive behaviours (e.g. cooperative breeding) in birds, but there is much less information about the behavioural consequences of kinship between flock mates in the non-reproductive period. We investigated the effect of relatedness on the use of social foraging tactics (“finding” and “joining”), in two mixed-sex captive flocks of House Sparrows (*Passer domesticus*). We determined relatedness between individuals in two different ways. First, we knew family-relationships among 23 individuals from pedigrees (siblings and parent-offspring dyads). Second, we determined all pair-wise relatedness coefficients for both flocks by genotyping individuals at 7 highly polymorphic microsatellite loci. Using both types of relationships, we tested whether kinship affected the type, frequency and efficiency of joining behaviour (i.e. feeding from a food patch found by a flock mate). We recorded the number and type of each tactic (finding, aggressive joining, non-aggressive joining) the birds used to get food on a feeding board containing patches of seed, the number of pecking (to estimate feeding efficiency), and the number of aggressive interactions during feedings. We found that males tended to avoid their relatives when using the joining tactic, significantly so in the case of aggressive joining. The number of pecking also decreased when males joined kin. Females did not show differences in their tactic use against related and unrelated birds. Although higher-ranking individuals used aggressive joining tactic significantly more often in general, the birds’ rank in the dominance hierarchy had no effect on their strategy use against kin. Our results indicate that kinship may have an effect on social foraging tactic use in House Sparrow flocks as predicted by kin-selection theory, i.e. sparrows exploit the food-finding efforts of their kin less often by aggressive joining than that of non-kin.

Helfer, Gisela¹, Brandstaetter, Roland²

Clocks here, clocks there, clocks everywhere: The molecular clockwork sparrow

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Birds are equipped with a complex circadian pacemaking system that regulates rhythmicity of physiology and behaviour. As with all organisms, transcriptional and translational feedback-loops of particular genes, so-called “clock genes”, represent the basic molecular mechanism of rhythm generation in birds. To investigate whether clock gene expression is an exclusive property of well-characterised circadian oscillators, including the retina, the pineal gland, and the hypothalamus of songbirds, we cloned partial cDNA sequences of six mammalian clock gene homologous (*pBmal1*, *pClock*, *pPer2*, *pPer3*, *pCry1* and *pCry2*) and a novel avian clock gene (*pCry4*). Expression patterns were analysed in central (retina, pineal gland and brain, dissected into telencephalon, diencephalon, cerebellum, and tectum opticum) and peripheral tissues (muscle, heart, liver, lung, spleen, kidney, and gastro-intestinal tract) by semi-quantitative RT-PCR and RNase Protection Assay of total RNA extracted from adult male House Sparrows. Levels of clock gene mRNA varied considerably between genes and time points showing pronounced rhythmicity in all parts of the brain and peripheral tissues. Phasing of the various House Sparrow clock genes when compared to each other as well as in relation to the light/dark cycle indicate that the circadian control mechanisms are highly distinct between avian and mammalian model systems, both at the molecular as well as at the whole-organism level. The present results demonstrate that molecular oscillations are not only

present in specialised central nervous structures, but also other parts of the brain and a variety of peripheral tissues illustrating the high complexity of the avian circadian system as a whole.

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The mitochondrial clock strikes again — calibrations based on sequence data of Titmice and Kinglets (*Parus, Regulus*)

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The ongoing debate on the reliability of avian molecular clocks is actually based on only a small number of calibrations carried out under different assumptions with respect to the inference of calibration points or to substitution model settings. According to these studies, a frequently adopted estimate for the substitution rate of the avian cytochrome b ranges at roughly 2 % sequence divergence between lineages per million years. Calibrations for other mitochondrial or nuclear genes are scarce to date. We present mitochondrial clock calibrations for cytb and the control region in two passerine genera, Titmice and Kinglets (*Parus, Regulus*). Maximum and minimum time constraints for one up to six calibration nodes of ML and NJ trees were inferred from age estimates for several paleogeographic events, such as volcanic ages of the Canary Islands and the Azores. Mean and local rate estimates were then assessed in a non-parametric approach using r8s 1.70. Overall rate variation is high in both genes and encompasses the 2 % value in a 95 % CI for cytb data. At an average, model-corrected sequence data yielded higher rate estimates than uncorrected data. An increase of gamma shape parameter goes along with a significant decrease of rate and partly divergence time estimates, too. Regardless of the impact of model settings, local rates differ significantly between taxonomic levels with lowest estimates for haplotype lineages and higher local rates for deeply split clades. At the population/subspecies level mean sequence divergence between lineages matches the 2 % rule best for most cytochrome b datasets (1.5-1.9 % per my) with maximum local rates in island populations (*Canarian P. teneriffae* complex: up to 3.9 % per my; Goldcrests from the Azores). Relaxation of time constraints assigned to distinct calibration nodes yielded deviating results for divergence time estimates, e.g. a more recent split of North African/Canarian taxa from their European counterparts.

Töpfer, Till¹

A comparative phylogeny of the genus *Pyrrhula*: Patterns and concepts

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During the last decade bird taxonomy has been subject to extensive changes. Moreover, the criteria for delimitating taxonomic categories are challenged by new methods of examination and analysis. Computer programs used to resolve phylogenetic relationships are mainly based on cladistic principles, making it difficult to harmonise these results with the classical understanding of adaptive radiations (e.g. criterion of paraphyly) and the Biological Species Concept (BSC). So there is a great need to crosscheck the results of modern phylogenetic research against their conceptual background. The *Pyrrhula* Bullfinches, showing distinguished characters of an evolutionary unity, offer a unique opportunity to examine the consequences of the different methodologies (i.e. possibly incongruent differentiation patterns) on the reconstruction of phylogenies. Resulting from a multi-methodological approach, the findings of morphological and molecular genetic examinations presented here are confronted with each other. It is discussed to what extent they are usable to resolve the degree of relatedness in these birds. Furthermore, the influence of environmentally induced character modifications (cf. eco-geographic rules) on phylogenetic groupings will be analysed. The results will be analysed with respect to their implications for conceptual and methodological fundamentals in zoology. As a conclusion, a proposal for a modern phylogenetic and taxonomic treatment of the genus *Pyrrhula* will be made.

Kulemeyer, Christoph¹, Asbahr, Kolja², Bairlein, Franz³

3D methods in ecomorphology

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Foraging behaviour in birds co-varies with bill morphology. Traditional methods focus on single character measurements of bill-shape variation such as bill length, bill width and bill height which is often analyzed by multivariate analysis to reduce covariation. However, these data cannot reveal the "true" shape of the bill such as the curvature. Therefore, we introduced a 3-dimensional approach using computed tomography (CT) and 3D-reconstruction. We applied the study to the bill shapes of corvids. 3D-data were obtained from corvid skulls using geometric morphometrics basing upon CT scans and the 3D-coordinates of biologically definable "landmarks" and the geometric information about their relative positions. Variation in bill shape between species is discussed with respect to foraging behaviour and habitat associations.

Poster Presentations

Subject 1 Behavioural ecology

1. Bán, Miklós¹, Barta, Zoltan², Moskat, Csaba³, Takasu, Fugo⁴, Munoz, Roman⁵, Nakamura, Hiroshi⁶

A comparison of egg shape in Cuckoos and their hosts

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The brood parasitic Common Cuckoo *Cuculus canorus* shows adaptations to hosts in several ways. One of the most important is the adaptation in their egg appearance to host eggs, including different components, like colour, markings, size and shape. Previous studies evaluated the role of most of these components in host-brood parasite relationships, but egg shape is often neglected from these evaluations. The evolutionary adaptation by cuckoos to their hosts' egg shape may have two functions: (i) optimal egg shape can be important in incubation, and (ii) if cuckoo eggs are similar to host eggs the chance of their acceptance by hosts can be higher. In order to investigate these functions we compared cuckoo and host egg characteristics related to 5 host species (*Acrocephalus arundinaceus*, *A. palustris*, *Erithacus rubecula*, *Lanius bucephalus*, and *Emberiza spodocephala*) from two different geographical areas (Hungary and Japan). Although these host populations showed significant differences in egg shape, cuckoo eggs proved to be not significantly different, neither between geographical areas nor within areas. We conclude that cuckoo eggs did not show a high level of adaptation to host eggs in shape. We explain this result as cuckoos try to keep their ability to change host, which could be more difficult when the shape of their eggs are highly specialised. Additionally, several hosts seem to be less sensitive to egg-shape, so egg shape cannot be regarded as an important and necessary component of mimicry.

2. Biard, Clotilde¹, Møller, Anders Pape², Hoi, Herbert³

Maternal effects, breeding density and female egg allocation strategies in the House Sparrow

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Social competition affects the rate or the intensity of intraspecific interactions. Despite such interactions individuals of many species still prefer to live in social circumstances. This raises the possibility that the costs of social competition are traded against the benefits of sociality. If individuals of different phenotypic quality differ in their ability to cope with stressful social situations, we might expect them to be non-randomly distributed across social environments. This potential variation in individual or environmental quality with colony site might be reflected in differences in reproductive success. However, whether density itself could functionally influence the behaviour and breeding success of

birds is not known. House Sparrows *Passer domesticus* prefer to breed in colonies composed of five nest boxes over colonies with three or ten nest boxes. In this experiment, using nest box arrangements in aviaries, we intended to test whether breeding density affects phenology and breeding success. We found that a lower proportion of birds initiated a breeding attempt in the lower density situation and that the time taken to initiate nest building and then laying was lower in the medium and high density situation. However, there was no difference in clutch size across breeding densities. This therefore suggests that colony size in itself may influence breeding behaviour, independently of individual quality and environmental effects.

3. Buczma, Anna¹, Goc, Michal², Szewczyk, Lukasz³

Breeding losses of the Great Cormorant *Phalacrocorax carbo sinensis* and Grey Heron *Ardea cinerea* in a colony at Katy Rybackie (N. Poland) - variation among colony sections

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The study was conducted in the largest European Cormorant breeding colony (11,637 pairs) at Katy Rybackie (northern Poland). Data were collected in four study plots including 255-441 nests. Three of the plots differed in age (time of first inhabitation), and the fourth was chosen because Cormorants nest there together with Grey Herons (62 nests). The study area was visited every week from 27th April -9th August 2006 (altogether 20 controls). During every control the number of occupied nests was recorded and eggshells collected. Chicks that had fallen from their nests were aged, noted and marked with a numbered plastic strip and left in situ. Cormorants in the oldest part of the colony hatched earliest. The highest egg losses (number of unhatched eggs found/per nest) in Cormorants was found in the mixed part of the colony. Herons (in this plot) had similar egg losses as Cormorants in the other parts of the colony. On the other hand, the number of dead chicks per nest we observed for Grey Herons was higher than in Cormorants in each of four plots. Among cormorants, the highest nestlings losses were found in one of the "younger" parts of the colony.

4. Cucco, Marco¹, Guasco, Beatrice², Leboucher, Gerard³, Malacarne, Giorgio⁴, Tanvez, Aurelie⁵

Effects of prenatal yolk testosterone on growth and immune condition of Grey Partridge chicks

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Maternal hormones represent an important way by which mothers may adjust offspring fitness. The egg yolks of many bird species contain substantial concentrations of androgens deposited by the laying female. Beneficial effects of in-ovo testosterone (T) injection on chick traits (growth, behaviour, immunocompetence, body condition) have been reported both in altricial and precocial species. However, other studies have evidenced null or negative effects of T on growth and/or immunocompetence. We have experimentally injected Grey Partridge *Perdix perdix* eggs with different concentrations of T, and measured growth and immune reactions in chicks aged 10, 21 and 90 days. Interestingly, a

supraphysiological high dose of T negatively affected chick growth and immune condition (measured by PHA reaction), but a low concentration of T (physiological dose) had a beneficial effect on growth and immune condition in chicks 10 days old. The beneficial effects on growth and immune competence disappeared in older chicks. Preliminary results suggest that partridge chicks exposed to increased egg T were more active than controls after hatching. The higher activity seems to be related to the temporary increase in growth and to the better immune condition, even if chicks were not involved in competition for food because they were provisioned with food ad libitum. Since the beneficial temporary effect was lost with time, it is difficult to assess its long term adaptive value, as well as the physiological mechanisms involved. Our results are discussed in the light of the contrasting literature on the evolutionary significance of androgen accumulation in bird eggs and its tradeoffs. Our current research is focused on the environmental and social factors (male dominance, male colour, female preference) that could influence, in the laying female, a change in hormone allocation within the clutch.

5. Darolova, Alzbeta¹, Kristofik, Jan², Hoi, Herbert³

Extreme sex ratio variation, hatching order and developmental differences in nestling Bearded Tits *Panurus biarmicus*

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Deviation from an equal sex ratio has been observed in several avian species and there is now descriptive as well as experimental evidence that females are able to modify the sex of their offspring within a brood. Less attention has been paid to consequences of sex ratio manipulation and sex-specific differences e.g. in competitive disparities between male and female siblings and parental tactics to compensate for such competitive differences. In this study we examine within-brood sex ratio variation in the socially monogamous Bearded Tit *Panurus biarmicus* in relation to season, brood size and hatching order and examine differences in chick development in relation to sex and hatching order. Mean brood size was 5.4 ± 0.5 . The population sex ratio was almost equal ($p=0.52$ for females). However, our results revealed a significant bias in within-brood sex ratio, with 42 % of all nests containing single sex broods. We found not only male- but also female-biased nests and a seasonal variation, with more female offspring at the beginning and the end of the breeding season. Male nestlings seem to develop much quicker than female nestlings but females frequently hatch earlier and have a higher initial weight. In this way mothers seem to promote daughters to compensate for their slower growth.

6. Griggio, Matteo¹, Hoi, Herbert², Pilastro, Andrea³

Are your feathers clean? Preening mediates female choice for a UV signal

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Elaborate or colourful feathers are important traits in female mate choice in birds but little attention has been given to potential costs of maintaining these traits in good condition with preening behaviour. Preening requires time which may result in a temporal trade-off between investment in preening and other important activities. Despite this, preening behaviour is one aspect of self maintenance behaviour which has not attracted many investigations. We investigated how dirtiness can influence plumage reflectance and whether there is a female preference for plumage cleanness in Budgerigars (*Melopsittacus undulatus*). To achieve this, we compared the spectral colour of birds that could normally preen their plumage and individuals that were prevented from preening. Subsequently, we measured females' preference for preened and unpreened males using a two-choice test. In a second experiment we allowed females to choose between an unpreened male and a male smeared with UV-absorbing sunblock chemicals (UV-blocked male). The proportion of time in which females stayed near preened males was statistically higher than for unpreened males, however, females

spent similar amounts of time with unpreened males and UV-blocked males. These results are consistent with the idea that female Budgerigars are able to discriminate between preened and unpreened males, and that UV colours, mediated by preening, are special signals conveying information about a bird's current condition. In conclusion, feathers colours are not static signals but are more plastic traits than considered in the past.

7. Hoi, Herbert¹, Krištofik, Jan², Darolova, Alzbeta³

Sex ratio adaptation in relation to male and female quality

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Sex allocation theory predicts that females should modify their brood sex ratio in response to differential benefits when increasing maternal investment into sons or daughters. Differential allocation into either sex should occur i.e. in direct relation to maternal condition or in relation to attractiveness or quality of their mate or extra-pair mates. In this study we examine whether individual quality or attractiveness affects offspring sex ratio and growth rate of the socially monogamous Bearded Tit *Panurus biarmicus*. We found female intrinsic quality to influence the proportion of sons produced per brood. However male quality, condition or attractiveness had no significant effect on sex ratio. Also sex ratio of extra-pair chicks did not vary from an equal distribution. Neither female nor male quality did affect offspring growth but extra-pair paternity nestlings developed significantly better than their putative siblings.

8. Kulcsár, Anna¹, Bókony, Veronika², Liker, András³, Tóth, Zoltán⁴

Plumage ornaments and papillomavirus infection at moult in House Sparrows

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Condition-dependent ornaments may signal various aspects of individual quality, including resistance to parasites. Although previous studies indicated that different types of plumage colouration may reveal different kinds of parasitism, a relatively small number of avian and parasite taxa were examined. Here we investigated whether the expression of plumage colour ornaments in male House Sparrows *Passer domesticus* is related to infection by papillomavirus during moult. We captured sparrows in 2004-2006 in a Hungarian population with high prevalence (12-30 %) of cutaneous papilloma symptoms in the moulting period. This infection is sub-lethal, and is not expressed in the breeding season when mate choice occurs. During their first moult, we assessed the infection state of the birds based on wart-like lesions on their bare parts (mainly legs) that are caused by avian papillomavirus. Upon captures after moult, we measured two sexually dimorphic plumage ornaments that are known to have sexual/social signalling functions in male sparrows: the size of the black (melanin-based) bib and the conspicuousness (achromatic brightness) of the white wingbar. We found that males with papillomatous symptoms developed smaller bibs and less bright wingbars than did healthy males. This suggests that bib size and wingbar conspicuousness may signal resistance to papillomavirus infection or to the manifestation of papillomatosis in male House Sparrows. To our knowledge, this study is the first to investigate the relationship of a viral infection with melanin-based and structural white colouration. The fact that both ornaments were similarly affected, coupled with the knowledge that several other stressors also influence both the bib and the wingbar, supports the recent view that sexual signals need not be specifically linked to different aspects of quality, but rather may be selected to reflect individual condition in a broader sense.

9. Lakatos, András¹, Fozo, Rita,² Hegyi, Gergely³, Török, János⁴

Constraints on differential allocation: Great Tit egg quality in a bad year

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Previous research has shown that plumage colour signals are important determinants of an individual's fitness, including prenatal maternal investment in offspring. The female can influence the future of young by transferring macronutrients (lipids, proteins), but also different biologically active molecules (e.g. steroids, carotenoids, vitamins) to the eggs. However, maternal investment in eggs also has costs, so females adjust egg composition to their individual quality, as well as quality of the environment and the partner male. Egg composition therefore results from both proximate constraints and adaptive strategies. We examined the potential predictors of primary reproductive investment in the great tit in a breeding season with unfavourable weather conditions. Egg attributes measured included clutch size, egg volume, yolk mass and yolk colour (a measure of carotenoid content). Explanatory variables we used were female and male morphology, and three potential visual signals (breast stripe size, and the spectral attributes of the yellow breast and the black crown). Female mass and yolk mass were positively related. Moreover, we found three contradictory allocation patterns in relation to male colour. Females deposited more carotenoids, but laid fewer eggs when paired to males with darker crowns. Conversely, more eggs with fewer carotenoids were laid for males with yellower breasts. Finally, females laid more eggs, but with smaller yolks, when mated to males with stronger crown ultraviolet reflectance. These patterns suggest that trade-offs in adverse environmental conditions may severely limit allocation decisions, and comprehensive studies are needed to better understand primary reproductive investment in natural bird populations.

10. Limmer, Bente¹, Becker, Peter H.²

Influence of parental experience and age on foraging efficiency and chick growth rate in Common Terns (*Sterna hirundo*)

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The breeding cycle is a period of high energetic cost in a bird's life. As shown in several species reproductive effort increases with parental age and with experience. Several hypotheses have been proposed to explain these findings: reproductive effort should increase with age, because of the decrease of the residual reproductive value ("Restraint hypothesis" or "Residual reproductive value hypothesis") or because individuals improve skills ("Constraint hypothesis"). During 2003 and 2004, we studied individual variation in the performance of parental care of common tern *Sterna hirundo* in a colony in Wilhelmshaven at the German Wadden Sea coast. We examined food quality, foraging effort, foraging success, feeding rate as well as nestling growth rate of first time and experienced breeders of known sex. Transponders allowed registration of individuals throughout the breeding season and throughout consecutive years by a system of special antennas. Sex, age and reproductive history of each individual was known. From some individuals it was possible to deal with longitudinal data sets. Our data show that there is an individual increase in food quality and quantity between first time breeders (recruits) and experienced breeders: experienced breeders catch larger fishes of higher energy content and feeding more often and more unerringly their chicks than recruits. Consequently chicks of inexperienced adults grew more slowly than those of experienced birds. We assume that with increasing experience and skill, birds are able to forage more efficiently and thus cope better with the physiological constraints of reproduction. Our

results support the constraint hypothesis, but further analyses concerning other years are still in progress. This study was supported by the Deutsche Forschungsgemeinschaft (BE 916/5).

11. Marques, Paulo¹

Parental care in the Spanish Sparrow (*Passer hispaniolensis*): Provisioning strategy

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Parental care is an important component of the overall species' life history, with a strong impact on breeding success and survival of individuals. Especially interesting is the difference that each sex commits to a given reproductive effort. In this study I focus on the differences in parental care between males and females and its impact on the patterns of parental care in the Spanish Sparrow (*Passer hispaniolensis*). 33 unmanipulated nests were observed for approximately two hours to characterize the adults' behaviour during incubation and 43 nests for nestling growth, all in 2000 and 2001. This study reports the occurrence of facultative male mate desertion that resulted in two different patterns of parental care, bi-parental care and female uni-parental care. Male desertion happened soon after the end of the laying phase or at the beginning of incubation. With this desertion timing, males ensured both egg fertilisation and a minimal parental investment. The estimated male desertion rate varied greatly between years. Overall the deserted and bi-parental nests did not differ significantly in the breeding parameters, although deserted nests presented slightly lower values. The comparison between uni-parental and bi-parental care nests revealed some behavioural differences for each nest type that resulted in differences in care provided. Deserted nests presented less brooding care during incubation but similar feeding effort per nestling at age 5 days. Single females presented higher parental care when compared with paired females, both during incubation and nestling growth. This extra-effort to compensate male absence partially reduces the impact of the male desertion in the current reproduction. These results suggest that female fitness might be affected by desertion. However, several factors should be considered before drawing conclusions about the difference in sex fitness pay-off of desertion, namely the cost of defending the nest area or the cost of nest construction.

12. Moskat, Csaba¹, Hauber, Mark²

Great Reed Warblers recognise more parasite eggs than they reject

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The brood parasitic Common Cuckoo *Cuculus canorus* lays eggs in the nests of small passerines. The young nestling cuckoo evicts all eggs and nestlings from the nests, critically reducing the hosts' reproductive success. The Great Reed Warbler *Acrocephalus arundinaceus*, a host of this cuckoo species, rejects ca. 1/3 of parasitic eggs but accepts the rest and pays the high costs of cuckoo parasitism. We studied the cognitive basis of hosts' egg rejection behaviours to explore this seemingly maladaptive variation in hosts' antiparasite defence. Our observations and experiments revealed differences in the intensity of egg rejection behaviour within one-day periods just before and during hosts' egg-laying periods. In naturally parasitized nests, hosts rejected ca. 28 % of the cuckoo eggs from empty nests just before own egg-laying started. When cuckoos swapped the first host egg with the parasitic egg, rejection increased to 75 %. In later stages, when one or more of the hosts' own eggs remained in the nest just after cuckoos laid their eggs, hosts' rejection decreased to 37.5 %. We also revealed a similar direction in the change of egg rejection rates if we experimentally parasitized nests by foreign conspecific eggs: when nests contained one or two host eggs, the rejection rate of these highly mimetic foreign eggs decreased from 35 % to 0 %. We found mistakes in hosts' egg rejection mostly in the last stage of laying, when nests contained 5 or 6 eggs. Both natural parasitism with real cuckoo eggs and experimental parasitism with foreign conspecific eggs pointed to a cognitive process of egg discrimination through several shifts in hosts' optimal acceptance thresholds of foreign eggs. Our results support the view that Great Reed Warblers recognize more eggs than they reject. We conclude that the experience of hosts of inspecting and learning about the appearances of their own eggs seems to be an important, but usually neglected factor in egg discrimination.

13. Pechacek, Peter¹, Czeszczewik, Dorota², Walankiewicz, Wieslaw³

Does the habitat matter? Phenotypic differentiation in a Woodpecker species associated with conifers

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We investigated the evolution of phenotypic differentiation in Eurasian Three-Toed Woodpeckers *Picoides tridactylus* – a species closely associated with coniferous forests dominated by spruce. We tested if the Three-Toed Woodpecker can adjust its foraging ecology to non-conifers. We recorded behavioural patterns during foraging bouts and measured characteristics of trees used for foraging, and those randomly available at foraging sites. Our sample contained observations of 30 colour-banded *P. t. alpinus* from the spruce-dominated habitat in Berchtesgaden National Park, Germany, and on at least 23 unmarked *P. t. tridactylus* from the mixed deciduous forest in Białowieża National Park, Poland. Woodpeckers preferred spruce snags with > 30 cm DBH (diameter at breast height) for foraging, and avoided logs and live trees. Both sexes spent more time foraging on trunks than branches. However, males spent less time foraging on branches than females and tended also to forage longer in the lower third of the trees than in the upper third. Differences found between foraging behavior of the two studied populations were only minor. Evolution of a broader foraging niche, and thus a phenotypic differentiation in the Eurasian Three-Toed Woodpecker may be prevented by the presence of a rich and abundant Woodpecker guild in habitats dominated by deciduous trees. Due to narrow specialization and lacking adaptability to changing environmental conditions, the Eurasian Three-Toed Woodpecker may likely be negatively influenced by the predicted retreat of spruce in relation to global warming.

14. Rowiński, Patryk¹, Wesołowski, Tomasz², Rutkowski, Robert³

Extra-pair paternity in Blue Tits in a primeval forest – preliminary results

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In 2005-2006 we investigated extra pair paternity (EPP) rates in a Blue Tit *Cyanistes caeruleus* population in a primeval forest in Białowieża National Park (East Poland). Each year we collected data on breeding parameters on ca. 30 families of individual marked birds breeding in natural holes in two study plots (100 ha). For molecular analysis we sampled tail feathers from all nestlings and both parents. To determine EPP we used four polymorphic markers. In spite of very low relative breeding densities (2-3 pairs per 10 ha) in 2005 we found over 30 % of nests with EPP and 8 % of young were extra pair. Finally, we'll show two years of EPP data of 60 Blue Tit families and examine the frequency of EPP in relation to nest density, male and female age, and other breeding parameters.

15. Surmacki, Adrian¹, Nowakowski, Jaroslaw K.²

Soil and preen waxes influence the expression of carotenoid-based plumage colouration

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The signalling function of carotenoid-based plumage is mainly determined by the concentration of pigments in feathers. For this reason, most studies of the proximate control of colouration focus on processes during and preceding the moult. In Great Tits *Parus major*, past research demonstrates that carotenoid-based plumage colouration honestly indicates male quality and thus may be a sexually selected signal. In this study, we investigated how dirt and preen oil influence the colouration of carotenoid-based feathers in the Great Tit. We collected six feathers from each individual bird; three feathers served as controls while the remaining three feathers were washed with a chloroform/methanol mixture to remove soil and preen waxes. We assessed plumage colouration using digital photography. This cleaning procedure slightly enhanced ornamentation; the experimentally cleaned feathers expressed hues shifted towards shorter wavelengths and expressed brighter overall colouration than control feathers. This is the first experimental study conducted on wild birds demonstrating that, in addition to pigment concentration, the presence of preen waxes and soils on feathers may contribute to variation in colouration.

16. Weidinger, Karel¹

Video identification of predators and fates of passerine nests

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Nest success has been documented for many bird species, and predation is recognized as the main cause of failure in open-nesting songbirds. Determining nest fate and soundly interpreting survival rates is contingent on identifying local nest predators. I documented the fate of 270 nests of 13 species (mainly Blackcap, Song Thrush, Blackbird, Yellowhammer and Chaffinch) in fragmented deciduous woodlands in the Czech Republic in 2002-2006. I used mini-video cameras with IR illumination connected to a time-lapse VCR. In all, I videotaped 20-22 species of predators at 177 nests. The number of documented predator species increased linearly with the cumulative number of videotaped predation events while the proportion of the two dominant species remained stable once the number of videotaped predations reached about 50. The most important predators were Pine/Stone Marten (37%), Jay (29%), Common Buzzard (7%) and Great Spotted Woodpecker (7%); about 3% of nests were attacked by more than one predator species. Mammals accounted for 47% of total predation; no predation by small rodents was recorded. About 34% of depredated nest was robbed during the night; mammals accounted for 95% and 23% of nocturnal and diurnal predation, respectively. Nests depredated by Martens and Jays did not differ in nest site characteristics. Nests of small (warbler-sized) species were robbed by all predators (Martens 33%, Jays 39%) while nests of thrushes were only rarely robbed by Jays (Martens 56%, Jays 4%). Martens always consumed nest contents all at once; Jays returned to the nest repeatedly during 1-4 days. Predation was frequent on old nestlings; fledging was initiated by predator attack (partial predation) in about 20% of "successful" nests. Parental nest defence was documented in most monitored species and towards all predator categories. Predator species/category could not be determined from the appearance of the depredated nest. (Supported by: GACR 206/04/1081 and MSM 6198959212)

Subject 2 Behaviour

17. Barske, Julia¹, Belloni, Virginia², Fusani, Leonida³

The influence of intersexual selection on behavioural aspects of the courtship display of *Manacus vitellinus*

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The Golden collared Manakin *Manacus vitellinus* is a passerine species of the Neotropics with a lek mating system. During a 7-month long breeding season, male manakins aggregate in leks of up to 12 individuals, and each male clears a small 'court' on the forest floor where he spends several hours per day performing his displays either with or without a female being present. The acrobatic courtship displays of male manakins are composed of two main behavioural patterns: the jumps between the saplings that delimit the court, and the emission of mechanical sounds produced by wings. The skewed male mating success typical of lek species and described also for *Manacus* argues for strong and convergent

choice by females for certain male or site characteristics. A combined action of male-male competition and female choice may play an important role in influencing individual reproductive success. Previous studies demonstrated the importance of the morphological features of the male in female choice. Recently, we found that several elements of the snap-jump display differ significantly among males. Here we investigated how behavioural features of the Manakin snap-jump display are involved in sexual selection. In this species courtship success, i.e. the frequency of female visits to a male's court, is highly correlated to mating success. We recorded the behaviour of males in four different leks during a three month (Feb-May) field project in the forest of Panama. We used a high speed camera to record the courtship displays. We found that several aspects of male displays were correlated with courtship and mating success, suggesting that these traits are under intersexual selection.

18. Gwinner, Helga¹, Berger, Silke²

What cues do male Starlings use to select green nest material?

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Male European starlings incorporate fresh volatile herbs into their nests. This behaviour is related to courtship but also benefits the nestlings. We tested in aviary experiments whether males select aromatic plants using olfaction and whether they depend on experience with nest odours they encountered as nestlings or not. We scented nests of wild starlings with milfoil, a preferred nest plant of the starlings and other control nests with vanilla. Fledglings from both nest types were hand raised and tested the following year in dyadic choice experiments for their odour preference. Males from both milfoil- and vanilla-treated nests preferred milfoil scent when they had the choice between milfoil- versus vanilla-scented or versus unscented leaves. However, when they had to choose between vanilla scent and no scent, males from vanilla nests chose vanilla but males from milfoil nests without vanilla experience did not discriminate. Because naïve males instantly recognized and preferred milfoil odour and because they discriminated between leaves of the same plant species looking the same but scented with different odours, we conclude that starlings use olfactory cues to select green nest material following an olfactory pattern designed prior to birth which may be supplemented by learning early in ontogeny.

19. Honza, Marcel¹, Pozgayova, Milica², Procházka, Petr³, Tkadlec, Emil⁴

Responses of Blackcaps towards repeated brood parasitism

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The Blackcap *Sylvia atricapilla* is a strong rejector of alien eggs, which is suggested to be the reason why it is currently only rarely parasitized by the Common Cuckoo *Cuculus canorus*. In this small passerine, mates alternate in clutch incubation and both are also capable of egg-rejection. However, whether the individuals are consistent in their reactions towards repeated brood parasitism, is little understood. To evaluate this, we experimentally parasitized and continuously videotaped Blackcap nests in two consecutive trials. The most common response in both trials was rejection of a foreign egg, which was either ejected (94.5 %) or deserted (4.1 %), and in one case (1.4 %) accepted. The general method of ejection was egg-puncturing. In the majority of trials birds removed an egg from the nest by holding it in their mandibles. Nevertheless, in 9.8 % of filmed ejections, already punctured eggs stuck to the abdominal feathers of the incubating bird and was carried out of the nest. Females were responsible for the great majority of ejections and their response time was significantly shorter than that of males. This may be explained by their greater time incubating. In 19 experiments, Blackcaps exhibited consistency in the sex responsible for egg ejection over the two trials; but in five (20.8 %) instances individuals changed their behaviour. In ejections made by the same bird, the response was significantly quicker in the second trial, which implies the presence of certain learning abilities. Our results indicate that although both mates are

able to recognize and reject an introduced egg, the likelihood of becoming an egg-rejector depends on the individual's share in parental care. Furthermore, this currently almost abandoned Common Cuckoo host is quite consistent in its responses towards parasitic eggs when parasitized repeatedly within one breeding attempt (A600930605; 524/05/H536).

20. Polačiková, Lenka¹, Procházka, Petr², Stokke, Bård G.³, Honza, Marcel⁴, Moksnes, Arne⁵, Røskoft, Eivin⁶

Egg spottiness as a possible individual signature for egg recognition in the Song Thrush

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Colour and speckling of avian eggshells are important characteristics in egg recognition behaviour. In this study, we tested whether the blunt egg pole in Song Thrushes *Turdus philomelos* presents an essential cue for egg recognition. We hypothesized that the spotting pattern concentrated at this egg part, which is the most visible in the nest, could have evolved as an individual signature, facilitating alien egg recognition. To test this hypothesis, we examined rejection behaviour against four types of model eggs: artificial blue eggs, conspecific eggs painted blue either at the blunt or sharp pole, and unpainted conspecific eggs. Since song thrushes lay blue eggs with variable speckling (small black spots) predominant on the blunt pole, we predicted that the model eggs with no spotting on this egg part should be rejected. The spottiness of both whole eggs and their parts was assessed from photographs by human subjects and image software analyses. Moreover, background colouration of experimental eggs was measured by a reflectance spectrophotometer. As predicted, both model egg types with no spot cover at their blunt egg parts were significantly more rejected than eggs with spots on the blunt pole. Moreover, both human and image software assessments revealed that the probability of egg rejection increased with increasing spot density of host eggs and contrast between host and alien eggs, both at the blunt pole. Furthermore, the blunt poles had a higher density of spots compared to the sharp poles, which were wider and less circular. Additionally, the spectrophotometric method showed that blunt poles of song thrush eggs were significantly darker in background colour than sharp poles. Our study points to the role of blunt egg poles as an important cue for egg recognition, suggesting that spotting pattern in this part of the egg may represent an individual's signature. The study was supported by project no. 524105/H536 and the MU rector's programme no. 20061431C0010.

21. Pozgayova, Milica¹, Honza, Marcel², Procházka, Petr³

Increased male nest attendance in the Great Reed Warbler after a visit of the Common Cuckoo

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Nest guarding against intruders plays an important role in nest defence. Encounters with intruders may increase nest attendance and vice versa, increased attendance may cause quicker spotting of intruders. Moreover, the sight of a brood parasite may put hosts on alert and lead to increased egg rejection. The Great Reed Warbler *Acrocephalus arundinaceus* is a major Common Cuckoo *Cuculus canorus* host and an intermediate rejector of its eggs. Furthermore, it belongs to the most aggressive species, strongly responding especially to the Cuckoo dummy. Host female is supposed to be responsible for egg rejection, because she incubates the clutch. Nevertheless, male either feeds its mate while she is sitting or guards the nest when she is away. Because of detrimental impact of brood parasitism on host fitness, increased nest attendance and clutch inspection should be adaptive for both parents. To test this, we filmed behaviour of hosts before and after their encounter with an intruder. In the experimental group of nests, we presented a Cuckoo dummy, in the control group only a human approached the nest. Females did not change their nest attendance after the visit of either nest intruder. However, they significantly increased time spent by checking nest contents both after the Cuckoo presentation and human visit. On the contrary, males significantly increased time spent nest guarding only after the Cuckoo presentation, however, they did not change time spent by clutch inspection. Our findings indicate that clutch inspection in females is apparently a nonspecific response. Nevertheless, increased nest guarding in males seems to be a specific response to the Cuckoo, suggesting that also males might be engaged in egg rejection (A600930605; 524/05/H536).

22. Scriba, Madeleine¹, Goymann, Wolfgang²

Hormonal patterns during territorial challenges in European Robins *Erithacus rubecula*

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The Challenge Hypothesis (CH; Wingfield et al., 1990) predicts that circulating testosterone increases when socially monogamous male birds are challenged during breeding. The hormonal response may help to maintain the persistence of aggressive behaviours. The CH has been confirmed in large-scale interspecific comparisons of seasonal hormone profiles. However, experimental tests of the CH are still scarce and the results equivocal. We tested the predictions of the CH in European Robins. First, we investigated the behavioural and hormonal reaction of free-living European Robins during simulated territorial intrusions (STIs). Second, we compared the reactions of robins to STIs with stuffed and live decoys to see whether these stimuli are perceived in similar ways. We conducted STIs by placing a stuffed or live decoy in a territory, played-back robin song and recorded the behaviour for at least 10 min., after which the focal bird was caught. Controls were caught within 10 min. Blood samples were taken immediately and hormone concentrations measured by radioimmunoassays. Although testosterone may have an impact on aggression, European Robins do not respond to STIs with an increase in testosterone. Possibly, certain levels of testosterone may be required to initiate territorial aggression and not for its maintenance. Males challenged with a stuffed decoy had significantly higher corticosterone levels than males challenged with a live decoy, although the androgen levels did not differ. The differential corticosterone response of robins to stuffed and live decoys suggests that stuffed decoys may be perceived as more threatening than live decoys.

23. Zamfirescu, Stefan¹, Ion, Constantin²

Aspects concerning songs of Reed Warblers *Acrocephalus scirpaceus* from Eastern Romania

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The bioacoustics analysis of Reed Warbler song would allow the recognition of its role and the species recognition. We examined the structure of Reed Warbler song in reed-beds of Eastern Romania. Reed Warbler song in the reproduction period shows a considerable varied structure. In the studied area, the songs comprise five different types of units. The average song duration is higher than other warblers: 4.135556 ± 2.002135 . The average number of units per song is 11.33 ± 4.846268 , while the average number of distinct units per song is 3.11 ± 0.600895 . The pause between units is also discussed. There is a positive correlation between the song duration and the number of units per song. The amplitude

peak corresponds to the 3 KHz frequency and decreases at frequencies higher than 4 kHz. The complexity of song is associated with more active behaviours in the periods of territory establishment, finding a partner and breeding. The significance of using different units of songs is also discussed.

Subject 3 Migration and orientation

24. Adamska, Karolina¹

Axial behaviour and reversed headings observed in orientation cages

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Reversed migration is a phenomenon quite often observed in bird migration. It is well documented by both direct field observations and results of tests in orientation cages. During this analysis I also found that directional preferences of birds tested in orientation cages during autumn migration often pointed to the northern directions, opposite to standard migration direction characteristic for this season. Such behaviour was observed during autumn migration at Bukowo-Kopań Station (Polish Baltic coast) in case of birds tested in the Busse's cage. During 11 years of studies – 2,967 Robins (*Erithacus rubecula*) were tested; the average proportion of northern headings was 54 %. In this case, these headings were mainly concentrated along the axes, which contain directions correct for the season. Moreover, the rate of backward headings on the NE-SW axis was high – 61 %, while along the NW-SE axis it was 45 %. Distribution of mode values, the most frequently observed data, defined for the distribution of headings for all studied seasons, indicated axial behaviour of tested birds. These results could be supported by the axial hypothesis, i.e. that birds have genetically encoded migration direction axiality – directed towards breeding and wintering grounds. If we assumed this hypothesis and add 180° to all northern directions we obtain directions which are strongly supported by ringing recovery data and proposed migratory routes.

25. Bulyuk, Victor¹

Factors affecting departure decisions of European Robins after short and long stopovers during autumn migration

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A significant part of species-specific migration strategies of passerines is the relationship between stopover duration and the bird's temporal and spatial position in respect to its endogenous schedule, fuel deposition rate (FDR), actual physiological state (fuel reserves), and certain weather variables. In order to investigate the impact of FDR, departure fuel load and weather on the decision of robins to depart or remain in a resting area, I analysed the data on 74 first-autumn individuals captured after their stopover arrival on the Courish Spit in standard mist nets and recaptured at take-off in high mist nets in 1997-2003. Stopover duration varied from 1-11 days (on average 3.3 ± 2.7 days, median 3.1 days). It was positively related to departure fuel load and unrelated to FDR. European Robins that stopped for >1 day ($N=47$) took off after a wide variety of weather conditions. Departure decisions by these birds might be controlled by their fuel stores and/or endogenous spatiotemporal programme. Unlike these birds, robins that stopped over for just 1 day ($N=27$) significantly more often arrived and departed with waves of migration, on average under much more favourable weather conditions. Departure fuel load of these birds was negatively related to the degree of wind assistance. The data support the hypothesis that individual birds may fly during several nights in succession after several days of stopover, given sufficient fuel stores and good weather, primarily wind assistance. The series of two or several nocturnal flight bouts finishes when the weather becomes adverse and/or fuel stores are used up. This migration strategy may be adaptive in unpredictable and often changing weather conditions. It allows the birds to migrate under opposing winds that are frequent in autumn and make the most of improved weather, in spite of sometimes moderate fuel stores. This study was supported by a grant from RFBR (grant no 04-04-49161).

26. Coiffait, Lisette¹, Bevan, Richard², Newton, Jason³, Redfern, Chris⁴, Wolff, Kirsten⁵
Understanding migratory movements of the Blackbird *Turdus merula*: Insights from old and new techniques

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The ability to link geographic regions used by migratory species throughout the annual cycle forms the basis of our understanding of the ecology and evolution of migration. Blackbirds *Turdus merula* are partial migrants, and during the autumn, the resident UK & Irish population is increased by a huge influx of migrants. The reasons underlying variation in migratory behaviour between individuals from partially migrant populations remain unclear; an inability to determine breeding origins of wintering individuals confounds our ability to identify patterns of migration. Ringing data from the UK suggest a tendency for migrant Blackbirds to have longer wings than residents. Wing length may thus be a useful indicator of the migratory status and origin of individuals caught in the winter. Newer techniques, such as stable isotope and DNA analyses, can also provide clues about the origins of migratory birds. Most research in the use of stable isotopes as a means of tracking migratory birds has been undertaken in the Americas, and their utility for European species is yet to be established. Data from Blackbirds caught between 1996 and 2005 in the UK & Ireland were used to describe seasonal changes in mean wing length. In addition, stable isotopes of carbon, nitrogen and hydrogen were sampled from feathers of European-breeding, and UK-wintering Blackbird populations. Mean wing length of all age/sex groups was found to be highest during the autumn migration period. Although there was some evidence for geographical trends in stable isotope ratios of feathers, the relationship was not straightforward. However, there was a highly significant correlation between wing length and feather hydrogen and nitrogen ratios. These initial findings indicate that combining different approaches is more useful than a single technique used in isolation. These data are being combined with genetic markers to further elucidate patterns of migration and population connectivity in this species.

27. Erciyas, Kiraz, Gursoy, Arzu, Ozcam, Pinar, Ozsemir, Arif Cemal, Baris, Yakup Sancar

Body mass and fat score changes in recaptured birds during the autumn migration in Cernek Ringing Station, Turkey

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The fat level and the body mass of recaptured birds that have been caught during the field work of Cernek Ringing Station are presented in this study. Data collected during the autumns of 2003-2005 were analysed to compare species of different migratory and feeding habits. A total of 388 recaptures from *Sylvia atricapilla*, *S. borin*, *Acrocephalus scirpaceus*, *A. palustris* and *Cettia cetti* were mist-netted and handled according to the South-East European Bird

Migration Network (SEEN) standards. The mean weight increase of *A. scirpaceus* and *A. palustris* and those of *S. atricapilla* and *S. borin* were similar within genus but higher in *Sylvia* compared to *Acrocephalus*. The recapture rate was the highest in *C. cetti* but the mean weight increase was the lowest. In *C. cetti* among 60 retraps, 9 birds increased their fat scores while the rest stayed the same or lost fat while the other species gained fat significantly. The stopover duration differed among species. Obtained results indicate that the birds use Cernek location as fuelling stations during the autumn migration and the rate of fat level and body mass increase differs according to feeding and migrating habits.

28. Filar, Monika¹

Age-fat related relationships in directional preferences and reverse directions in the Chiffchaff *Phylloscopus collybita* migratory orientation

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The migrating Chiffchaff's directional preferences were studied according to the results of orientation tests at Carpatia Ringing Station that is a member of the SEEN (SE European Bird Migration Network) in years 2000-2005. The ringing station is located in the Valley of Beskidy Mountains in southeastern Poland. In total, 535 Chiffchaffs were tested with the Busse orientation cage. The results showed that directional preferences of adult and immature birds were very similar. It was also observed that tested individuals of different ages (adult or immature) and fat store classes (lower fat deposit: 0-1; higher fat deposit 2-3) showed a high proportion of "reverse" directions, which moreover was higher along the NE-SW migration axis. In adult and immature birds, the proportion of reversed directions was similar (respectively 67 % and 63 %). While in both age groups divided according to fat-score classes, some differentiation was observed. In both age groups, individuals with lower fat deposit showed more directions opposite to their standard autumn migration direction. Adult Chiffchaffs with lower fat deposits indicated as much reverse directions as 73 %, compared with 59 % for adult birds with higher fat deposits. It could suggest that birds with low fat deposits might rather search for appropriate stop-over sites, prefer to go back and restore their fat reserves before crossing the Carpathian Mountains.

29. Fuchs, Roman¹, Winkler, Hans², Helm, Barbara³, Bernroider, Gustav⁴

Specific brain adaptations correlating with avian seasonal migration

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Selection and adaptation processes may trigger changes in the sizes of localized functional systems in the brain that correlate with certain behavioural abilities. For a recent critical review on this challenging question refer to Healy & Rowe, 2007. Within this context, seasonal long distance migratory behaviour in birds has been at the center of attention for more than a decade. In the view of an innovation and flexibility hypothesis regarding the correlation of brain size and ecological factors, it has been suggested that long-distance avian migrants tend to have smaller forebrains (Winkler *et al*, 2004). Because brain tissue is metabolically expensive, these findings were discussed within the framework of energetic constraints during migration and innovation costs in non-migratory birds. In the mammalian brain, selection for behavioural abilities results in the coordinated enlargement of the entire, non-olfactory forebrain, in particular the neocortex (Finlay *et al*, 1995). In the avian brain, relative size changes in neuronal compartments and their behavioural correlations remain largely unknown. In the present work we present a detailed anatomical study employing statistical form analysis to explore volumetric changes in neural structures and their correlations to migratory behaviour in different passeriform species. The results can shed light on the question of a possible trade-off between metabolic cost and selection for behavioural adaptations in the avian brain. References: Finlay, B.L. & R.B. Darlington (1995) Linked regularities in the development and evolution of mammalian brains, *Science*, 268, 1578-1584. Healy, S.D. & C. Rowe. (2007) A critique of comparative studies of brain size. *Proc.R.Soc.B.* 274, 453-464. Winkler, H., Leisler B. & Bernroider G. (2004) Ecological constraints on the evolution of avian brains. *J. Ornithol* 145, 238-244.

30. Gyimóthy, Zsuzsa¹, Gyurácz, József², Bank, László³, Farkas, Roland⁴, Németh, Ákos⁵, Csörgő, Tibor⁶

Autumn migration of Robins *Erithacus rubecula* in Hungary

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The autumn migration of the Robin was studied using data of birds captured between the 13th of August and the 27th of October 2004 at the Izsák and Ócsa (Central Hungary), Sumony (Southern Hungary), Szalonna (Northern Hungary) and Tömörd (Western Hungary) bird ringing stations of Actio Hungarica. The vegetation of the studied areas varies from forest to reed bed. During this period, 3,671 individuals (596 adults and 3,075 juveniles) were captured and 599 were recaptured (68 adults and 485 juveniles) at the five study sites. The migration patterns of the Robin populations were analyzed based on daily captures of ringed birds. The dynamics of migration and morphometrical characteristics (body mass, fat, wing-length) of migratory populations were compared between the five study areas. The median dates of the autumn migration are generally in the last week of September. The migration begins earliest in Szalonna and latest in Izsák. The recapture rate was the biggest (22.0 %) in Sumony and the smallest in Izsák. The mean minimum stopover time of recaptured birds was the longest (8.9 ± 10.6 days) in Szalonna and it was 3-6 days long at the other sites. The mean of the stored fat of the ringed birds in September and October was the smallest in Szalonna, whereas the increase of body mass and fat of the recaptured birds was the biggest here. The five sites have different qualities from the point of view of the Robins' habitat preferences. Some of them also serve as a breeding place – on a different level though – while others have a role only periodically during the migration of this species. Comparing the five different study sites we found three significant differences in the wing-length average of the ringed birds. The wing-length of the Hungarian breeding population is uniform. In our study sites, birds of different origin with varying wing morphology pass through in a different ratio. This fact can cause the differences appearing in wing-length.

31. Keşaplı Can, Ozge¹, Keşaplı Didrickson, Özgür², Didrickson, Jno³

Ringing results of Akyatan Station (Southeast Turkey) in 2003-2005

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Akyatan Station (36°36'N; 35°17'E) is situated on the coast of the biggest lagoon of the Çukurova Delta on the southeastern Mediterranean coast of Turkey. Between the lagoon and the sea there lies an extensive area of dunes covered by a man-made forest formed mainly by Acacia, Eucalyptus and Pinus. Bird ringing in Akyatan started with a pilot study in the spring of 2003 and continued for five consecutive seasons. Birds were captured with mist nets without any lure mechanism and the nets were open throughout the day. All birds were ringed, aged and sexed when possible, weighed, measured and fat-scored. In total, approximately 6,200 birds of 94 species have been ringed. The percentage of retrapped birds was low (5-7 %) compared to some other ringing stations in Turkey. In a 2003 pilot study (04-15 April) 494 birds of 38 species were ringed. The ringing totals for the following seasons were 1,546 for autumn 2003 (08.09-05.10), 2,066 for spring 2004 (20.03-29.04), 1,776 for autumn 2004 (06.09-01.10) and 1,266 for spring 2005

(07.03–25.04). During spring, *Sylvia atricapilla* (1134), *S. curruca* (347) and *Phylloscopus colybita* (277) dominate the catch while in autumn the dominant species were *S. borin* (736), *S. atricapilla* (639) and *P. trochilus* (220). Several species that are rare passage migrants were also caught, including *Oenanthe cyriaca*, *Hippolais icterina* and *Crex crex*. In autumn 2003, *Acrocephalus dumetorum* and in spring 2005 *S. Melanothorax* were captured, constituting the 4th and 5th records of these species in Turkey. Also high numbers for species like *Lanius nubicus* (156) and *Alcedo atthis* (166) point to the importance of Akyatan for bird migration. In spring 2004, a *L. collurio* ringed in autumn 2003 was recovered in South Africa, while in autumn 2004 a ringed *S. borin* was recovered in Syria only a couple months later. In autumn 2003 an *A. atthis* ringed in Cernek Station (N. Turkey) was recovered only three days after being ringed, while in spring 2004 another *A. atthis* was controlled in Hatay (S. Turkey) only two days after it was ringed.

**32. Keşaplı Didrickson, Özgür¹, Didrickson, Jno², Bilgin, C. Can³, Busse, Przemyslaw⁴
Body mass, fat load and stopover of Willow Warblers during autumn migration at Kuşçenneti National Park, Northwestern Turkey**

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The Willow Warbler *Phylloscopus trochilus* is a long distance migrant whose stopover ecology during autumn migration before crossing the Mediterranean and the Sahara is scarcely known. In autumn 2002 and 2003 we studied autumn migration dynamics of Willow Warblers at Kuşçenneti National Park (40.23 N, 28.04 E) near Lake Manyas in Northwestern Turkey. Birds were mist-netted, ringed, measured, weighed and fat-scored from the end of August in 2002 to mid-September in 2003 and to the end of October in both years. The number of ringed and retrapped individuals were 543 and 930 for 2002 and 2003, respectively. Highest numbers were recorded in the beginning of October in 2002, and in the last third of September in 2003. Two separate peaks with two weeks' time difference were discernable, at least in 2003, and correlating with data from another station. For 2002 and 2003 respectively, the fat score values (mean \pm SE) are 4.63 ± 0.06 and 3.84 ± 0.05 , and body mass 11.38 ± 0.07 and 10.37 ± 0.05 grams for birds captured the first time. Fat scores of birds captured in 2003 show a bimodal distribution with peaks of T2 and T5, indicating populations or age classes with different migratory strategies. The later arriving birds are also slightly heavier. Retraps constitute 9.2-12.2 % of birds captured. In both years, minimum stopover length ranged from 1 to 16 days with a median of 5 days. The majority of the birds stopping over put on significant fat in both years. Retrapped birds continued to put on weight for the first two weeks of their stay. Our results suggest that Kuşçenneti National Park could be a crucial stopover and refuelling site especially for autumn migration before two important ecological barriers, the Mediterranean Sea and possibly the Sahara, for several Willow Warbler populations.

33. Mateos, Maria¹, Arroyo, Gonzalo M.², De La Cruz, Andres³, Cuenca, David⁴, Barrios, Luis⁵

Modelling migrating seabird detection using A S-band radar

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A surveillance radar was operated in a hot spot of migration in Europe: the Straits of Gibraltar, in spring and autumn 2006. The aim was to test the capacity of the radar to detect seabirds migrating across the Straits. The radar operator had to detect on the radar screen the seabirds which have been seen by a visual observer, both of them connected by radio. We conducted a total of 92 hours of simultaneous counts. 3,476 seabird flocks were visually observed from the coast. Only 1,228 of them were detected on the radar screen, resulting in 35.3 % detection. This percentage was higher in autumn (1,016 of 2619 (38.8 %)) than in spring (212 of 857 (24.5 %)). Both in spring and autumn the more frequently detected species were Northern Gannets, Cory's and Balearic Shearwaters, Puffins, Razorbills and the Great Skua. These species were also the most abundant through the area. We related radar seabirds detection to 21 explanatory variables (temporal, meteorological, behavioural and technical variables), using generalized linear interactive models (GLIM v. 3.77). The main factors explaining the detection of species were wind speed and flock sizes.

34. Miholcsa, Tamás¹, Csörgő, Tibor²

The role of Moulting in the change of timing of autumn migration caused by global warming

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Many studies show that all types of migratory birds arrive and breed earlier in the spring, due to earlier and warmer springs in the last decades. These trends in the changes of spring arrival are uniform for all migratory species because for successful breeding it is important to occupy territories as early as possible. It is harder to interpret the changes in the case of long-distance migrants, because in their case the connection between the external conditions and the timing of migration is not so strong as in the case of other migration types. In contrast with the spring migration, in the autumn migration the birds optimize many factors to survive rather than reproduce. Therefore the changes in the timing of autumn migration are less studied and understood. Our research was done on six Trans-sahara migrant *Acrocephalus* and *Locustella* species caught in Ócsa, Hungary between 1987-2004. Cumulative diagrams of the migration have been constructed for adults and juveniles for every year and the dates of the 50 % and 90 % catching values have been established. These data have been represented in the function of years and the average temperatures of August. On these distributions linear regressions have been made and their parameters have been studied. The related species react to climate change in different degrees and directions. Although the study period is not too long, we have found some significant changes in the timing of migration and correlations with temperature. The migrating strategies of the species are very complex, so it is difficult to give a uniform explanation for the changes. Because of its high energy and time demand, post-juvenile or post-breeding moulting seems to be the key-factor. The moulting strategies of the species determine the direction and intensity of these changes. Intra-specific differences in moulting strategies result in different trends between age-classes in the timing of autumn departure.

35. Ozarowska, Agnieszka¹, Busse, Przemyslaw², Mus, Krzysztof³

Multimodal behaviour of migrants tested in orientation cages

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Orientation cage tests are commonly used in studies on orientation and navigation mechanisms of bird migration, whereas this method is rarely applied in studies on migratory directions. In 1995 when Busse proposed a new field technique for testing migrants in the orientation cage, he had already mentioned some preliminary results on a differentiated model of directional behaviour of tested birds. Currently, sets of data collected with this method have

become numerous enough to enable to us to analyse models of behaviour of individuals tested in the orientation cages in detail. The analyses included tests on the most numerous species caught in both migration seasons at different locations on migration flyways, thus some aspects of species/site specific characteristics could be discussed. Moreover, comparisons of tested bird behaviour in two types of orientation cages – the Emlen funnel and the Busse flat cage, were also conducted. Analysis of orientation tests' results in two spring migration seasons ($N=849$) at the International Birding and Research Center ($29^{\circ}33'N$, $34^{\circ}57'E$) in Eilat, Israel and nine years of study during autumn migration ($N=2,734$) at the Operation Baltic station, Bukowo, Poland ($54^{\circ}28'N$, $16^{\circ}25'E$) showed that multimodal behaviour of birds tested in orientation cages is a rule and common phenomenon despite the migration season, geographical location of ringing station or analysed species. The most common patterns of bird behaviour are uni- and bimodal, while tri-modal is observed more rarely. Tests in two types of orientation cages – the Emlen funnel and the Busse flat cages (Eilat; autumn migration 2002) also showed similar results. To conclude, it can be stated that multimodal behaviour of migrants tested in orientation cages is a common phenomenon influenced most probably by species migration strategy resulting from both external (like migration season, range, routes incl. local topographical conditions) and internal factors (like genetically encoded “migration” programme).

**36. Ozsemir, Arif Cemal¹, GURSOY, Arzu², ERCIYAS, Kiraz³, OZCAM, Pinar⁴, Baris, Sancar⁵
Autumn migration dynamics of *Sylvia* Species in the Kizilirmak Delta Cernek Ringing Station**

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This study was carried out to determine autumn migration dynamics of *Sylvia borin*, *S. atricapilla*, *S. communis*, *S. curruca*, *S. melanocephala* and *S. nisoria* between years 2002-2005 in the Kızılırmak Delta, Samsun. *S. melanocephala* was resident and the other *Sylvia* species were migrants. *S. atricapilla* and *S. curruca* were caught during the whole autumn ringing activity. *S. borin*, *S. communis* and *S. nisoria* started and ended their migration early. Between the beginning of ringing on 15 August and 30 September, 95.4 % of *S. borin*, 98.6 % of *S. communis* and 100.0 % of *S. nisoria* were captured. Daily catching numbers of *Sylvia* species were affected by daily average air pressure, average wind and rain but these effects did not alter the migration phenology. A fat score of two was common for the trapped *Sylvia* species. This low fat score level can be explained by the fact that most of the trapped birds were immatures with suboptimal foraging and competition skills. Especially for *S. borin* and *S. atricapilla* the high proportion of young individuals cannot be explained by breeding success alone.

Subject 4 Foraging and energetics

37. Angelier, Frédéric¹, Bost, Charles-André², GIRAUDEAU, Mathieu³, Lendvai, Ádám Z.⁴, Chastel, Olivier⁵

Corticosterone and foraging effort in a diving seabird: The Adélie Penguin *Pygoscelis adeliae*

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Because endocrine mechanisms are thought to mediate physiological and behavioural responses to intrinsic or extrinsic stimuli, they are especially interesting for understanding how animals adapt their foraging decisions to energetic demands of reproduction. Thus, the hormone corticosterone deserves specific attention because of its major connections to metabolism, food intake and locomotor activities. We examined the relationships between baseline corticosterone levels and foraging behavior and foraging success in a diving seabird, the Adélie Penguin *Pygoscelis adeliae*. Data were obtained from free-ranging penguins during the brooding period (Adélie Land, Antarctica) by using satellite transmitters and time-depth-recorders. The birds were weighed and blood sampled before and after a foraging trip (pre-trip and post-trip corticosterone levels, respectively). Penguins with elevated pre-trip corticosterone levels spent less time at sea and stayed closer to the colony than penguins with low pre-trip corticosterone levels. These short trips were associated with a higher foraging effort in terms of diving activity and a lower foraging success than long trips. This therefore suggests that penguins with elevated pre-trip corticosterone levels maximized the rate of energy delivery to the chicks at the expense of their body reserves. Moreover, corticosterone levels decreased during a foraging trip. This decrease might either result from the restoration of body reserves during the foraging trip or from a break in activity at the end of the foraging trip. This study demonstrates for the first time in a diving predator the close relationships linking foraging behavior and baseline corticosterone levels. We suggest that slight elevations in pre-trip corticosterone levels might play a major role in breeding effort by facilitating foraging activity in breeding seabirds.

38. Ivankina, Elena V.¹, Kerimov, Anvar B.², Bushuev, Andrei V.³

The influence of social factors and ambient temperature on sexual asymmetry in energetics of Great Tits

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Great Tit males and females clearly differ in body size and social positions in wintering groups. We attempted to find out if short time changes in ambient temperature (T_a) modify the effect of social factors on energetics of males and females. Yearling Great Tits were randomly joined in heterosexual pairs and kept in outdoor aviaries from the beginning of the winter season to July (Moscow region, 2002-2007, $N=260$). We used one- and two-room aviaries which modeled two gradations of density factor and environment heterogeneity. The food was provided ad libitum. Among tits living in one-room aviaries, the winter basal metabolic rate (BMR) was higher in females than in males. This relation was not pronounced in pairs occupying two-room aviaries. BMR of females was negatively influenced by ambient temperatures during the entire winter period. In males, similar temperature dependence of BMR occurred only in the beginning of winter. The energetic difference between males and females reached maximum in mid-winter (on average, the coldest period in the study area) in pairs staying in one-room aviaries. The superiority of females in BMR was minimal in both types of aviaries in the years of an anomalously warm winter (2006-2007). The results suggest that under conditions of intensive social competition, low temperatures may act as a factor markedly increasing sexual asymmetry in maintaining energetic costs.

Subject 5 Community and Landscape ecology

39. Amann, Laurent¹, Gajdon, Gyula K.², Huber, Ludwig³

Kea attend more to visual features of novel food sites than to their absolute position

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We have considerable knowledge about the bird's complex management of food caches. But little is known about how birds organize their foraging behaviour after finding food at a novel site. Here, we investigated whether Kea, *Nestor notabilis*, pay more attention to feature aspects of a novel food site than to its spatial position. We offered a piece of bark and a wooden board eighty cm apart from each other. For some birds the bark had been baited in two trials, for others the wooden board. In the third trial, the previously rewarded cover was in a new position and the non-rewarded cover at the position food had been provided before. In this test trial, six of nine keas checked the type of cover that had been rewarded previously. Five of these six birds still preferred to check the feature-matching cover when tested after additional five training trials. However, when a cover of the rewarded type was in the new position as well as in the position of previous reward, all birds checked the cover in the previously rewarded position. This shows that Kea are able to remember spatial positions of food but prefer sites with matching feature of covers.

40. Böhm, Stefan M.¹, Wells, Konstans², Pfeiffer, Simone³, Kalko, Elisabeth K.V.⁴

Integrating birds in functional biodiversity research: A large-scale experiment across land use gradients in Germany

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Birds comprise large-ranging and mobile species that actively move in the landscape and thus may link habitats and ecosystems with different land use patterns. Their assemblage diversity and activity patterns in a landscape matrix are largely driven by habitat qualities across land use types and in turn, determine their functional impact on local habitat patches with different properties. Within the large-scale DFG-project of the "Exploratories for functional biodiversity research" we aim at investigating the impact of land use gradients in German forest and grassland landscapes on local bird assemblages and the activity and resource use of selected species under different diversity scenarios. Our main focus is on the impact of local resource availability on bird assemblages via different plant and arthropod diversity across land use gradients. In particular, we are interested in the functional impacts of birds by their local resource use and activity patterns. Our diversity assessment and experiments consist of a monitoring program (point counts) and geo-referencing of observational data in the field including bird nesting sites and hollow trees in each exploratory. Furthermore, we measure body condition, biometry, and stomach content and collect tissue samples of birds trapped with mist-netting in selected areas to assess the impact of different habitat types and land use gradients on resource use and niche partitioning of birds. Experimental approaches will include bird recordings in tree crowns and identification of arboreal arthropods via netting and canopy fogging as well as assessment of leaf damage in the canopy before and after enclosure of birds in order to identify their role in controlling phytophagous arthropods. Overall, our studies combine monitoring programs and experimental approaches to integrate the influence of landscape patterns and habitat characteristics on habitat and resource use of birds in avian biodiversity research.

41. Brunner, Patrick¹, Pasinelli, Gilberto²

Discovery of a new singing style in Reed Buntings *Emberiza schoeniclus*

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Earlier studies have suggested that male Reed Buntings generally use two singing styles, referred to as rapid singing style (rss) and slow singing style (sss). The terms rapid and slow refer to the intervals between the first two syllables within a song (hereafter, intrasong interval) and to the interval between two songs (intersong interval). In sss the intrasong intervals are longer and the intersong intervals shorter than in the rss. The use of these singing styles changes both seasonally and in relation to social and environmental circumstances: on the one hand, rss is sung by unpaired males early in the breeding season, whereas paired males (later in the season) only sing sss. On the other hand, paired males, which lost their mate, stop singing sss and switch back to rss. During a study on the effectiveness of the two singing styles in relation to the territorial defence, song recording data of ten male Reed Buntings from two study sites in Switzerland were collected during March until July 2006. Here, we present evidence that male Reed Buntings regularly sing a so far unknown, third singing style, which we call intermediate singing style (iss). Iss mainly differs from rss and sss by having a longer intrasong interval than rss and a shorter intersong interval than sss. Iss was only sung by paired males mainly after sunrise, unlike sss, which also was sung by paired males but mainly before sunrise.

42. Cook, Aonghais¹, Rhymer, Caroline²

An assessment of Gull roost site location, implications for bird strike risk

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Around the world, Gulls (*Larus spp.*) account for the majority of strikes on civilian as well as military aircraft. Approximately 463,000 pairs breed at high densities on coasts, marshes and inland waters around the United Kingdom. Over-wintering Scandinavian birds boost the population to around 4 million. These birds form nocturnal roosts around the coast and inland, on lakes or reservoirs, traveling up to 50 km to feeding areas. Large numbers are recorded at landfill sites, with frequent flights to and from the roosts. Between 1990 and 2006, RAF fixed wing and rotary aircraft reported 3,900 bird strikes within UK low flying areas. These bird strikes cost the RAF in the region of US\$ 23.3 million per annum, excluding the cost of lost aircraft. Whilst many of the species involved remain unidentified, 755 were known to be due to gulls. Bird strikes involving gull species are of particular concern due to their large body mass and tendency to flock. To assess bird strike risk it is necessary to understand how gull species interact with the landscape. A combined GIS and spatial modelling approach was used to examine roost site selection in relation to habitat and proximity to landfills. Associated daily flight movements were compared to observed bird strikes to investigate bird strike patterns in both time and space. This led to a more accurate assessment of bird strike risk levels. The implications of these results are discussed in terms of bird avoidance modelling and landfill site planning.

43. Croitoru, Maria-Magdalena¹, Puica, Alexandru², Paduraru, Ioana Daniela³, Gache, Carmen⁴

Ecological aspects regarding the avifauna of periurban ecosystems in Iassy City, Romania

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Our ornithological researches were done in three periurban ecosystems near Iassy City (north-eastern Romania), during the years 2006 and 2007. There are three forest plantations: Ciric, Galata and Cetatuaia, with a total area of about 482 hectares. The age of these forests is about 60 years and the habitats are homogenous enough. In the Ciric area, there

exist two dam lakes, but the reed covering only a small surface on the edge of the aquatic areas. Bird studies were done before only in the Ciric area (Gache, 2004) and some references in other general study regarding the urban avifauna in the Iassy City area (Butnaru, 2005). Despite the high level of human pressure, we identified 72 bird species in these study stations. From these, 44 were breeding species and we considered another 4 species to likely be breeding – the habitats are favourable for birds' resting, breeding and feeding, especially in the Ciric area. The biggest bird fauna diversity was found in the Ciric forest-park despite its character of a recreation place for the Iassy City's inhabitants. In Galata and Cetatuaia forest plantations we found 40 bird species for each study station. The human pressure was not so high, but the habitats' diversity is lower and also the sizes are smaller than in the Ciric area. Like argument to increase the conservation status of these areas, we are using the presence of 21 protected species (Berna Convention, Romanian Protected Areas Law). We analysed the influence of the different human activities on the birds' diversity, focusing on habitat degradation. The present study will give scientific support in order to prepare an ecological education project involving the local community, especially the nearest sites' inhabitants and the children from the nearest schools.

44. Erdos, Sarolta¹, Báldi, András², Batáry, Péter³, Kovács, Anikó⁴

Distribution of breeding passerines in arable and grassland fields in a southern Hungarian farmland

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Agriculture intensification has led to the widespread decline of farmland birds across Western Europe. In contrast, agriculture in Central and Eastern Europe, including Hungary, is less intensive than in Western Europe. However, the new EU membership, and ongoing changes in agriculture may have adverse effects on bird populations. The aims of our study were to examine the habitat preference of birds in a Hungarian agricultural landscape, south of Lake Balaton. Birds were censused twice in the spring of 2006 by point census technique. Altogether we censused birds on 105 points in extensive (22 points) and intensive (10) grasslands and extensive (25) and intensive (48) arable fields. We analysed assemblage composition by Discriminant Function Analyses. Our results show that bird assemblages are different between grasslands and arable fields. The extensive and intensive grasslands also differed, but the extensive and intensive arable fields largely overlapped. Additionally, 180 nest boxes were placed at the edges of the extensive and intensive pastures and arable fields. Two species occupied the nest boxes, the Tree Sparrow *Passer montanus* and the Great Tit *Parus major*. The farmland species (Tree Sparrow) preferred the extensive pasture, while no preference was found for the generalist forest species (Great Tit). Grasslands are characteristic habitats of Hungary, covering 12 % of the country and our results attract attention that grassland may be more sensible for the agriculture than arable fields. Although Hungarian agriculture is less intensive than in Western Europe, our study showed that intensification of agriculture may have several negative affects on the bird populations. We suggest that further information is needed on the habitat preferences of farmland bird species to effectively guide their protection on farmland in Hungary.

45. Gache, Carmen¹

Birds' fauna diversity in some urban parks in Iassy City, Romania

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Ornithological researches in the urban perimeter are just recent in Romania; there exists just few available data on this topic and only on some focused areas (especially, botanical gardens). In Iassy City, Romania also, we found only three studies done before 2004, all of them regarding the birds' fauna from the Botanical Garden perimeter. A preliminary study was published in 2005 about the birds' presence in parts of the urban and peripheral green spaces. The present study gives information on the birds' diversity in four parks and gardens from Iassy City, situated on the western side of the Copou Hill. These green urban sites cover, together, 120 ha but are different by size, vegetation, position from the

main street and the human disturbance level. We identified 108 birds species in these sites, 63 species certainly and 10 species probably breeding or irregular probably breeding species in one park, at least. We recorded 15 common breeding species for all four studied parks and gardens. We are presenting the main factors that influence the quality of birds' fauna and the populations of breeding birds species for each of the study sites (the parks' surface, habitat diversity, available food for birds, the human activities and the level of the human presence in the area). The biggest diversity of the birds' fauna was recorded in the Botanical Garden perimeter (107 species) but this comprises nearly 100 ha, very different habitats, including a small dam lake with reedbeds, and has a special status regarding the public presence and specifically human activities. We present an analysis of the synanthropisation behaviour of some birds species using the synanthropic index. By the means of factorial analysis we notice the high degree of interdependence between the fauna diversity, bird density and environmental factors.

46. Godinho, Carlos¹, Rabaça, João Eduardo²

Riparian habitats of southern Portugal: How important are they to breeding summer visitors? Effects of stream edge and stream bed variables

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Riparian areas are among the most complex, dynamic and species-rich ecosystems in terrestrial biomes. They provide habitat for a large number of plant and animal species and bird species-richness tends to be higher in these habitats compared with adjacent areas. These ecosystems are critical in maintaining high biodiversity worldwide. Nevertheless, these habitats have been severely degraded by anthropogenic activities, thus affecting their multi-use on several ecological grounds. Riparian areas not only meet habitat requirements for several organisms but can also act as critical dispersion corridors and/or stopover sites during bird migration. This study is focused on Summer Visitors passerines breeding in riparian habitats of the River Guadiana basin (Southeast Portugal). Our goal was to examine the effects of riverbed and riverside habitat features (e.g canopy height, percent canopy cover, percent understory cover, riverbed width, vegetation dominant species) on the occurrence of breeding bird species. From 1999 to 2001 we surveyed 11 watercourses belonging to the Portuguese River Guadiana basin. Field work lasted from April to early July and a total of 180 sampling points with a counting period of 10min were conducted. For data analysis we used 14 passerine species of Summer Visitors and 30 environmental variables. The canonical correspondence analysis (CCA) results indicate that 41.59 % is explained by the two variables data sets. The species with highest percentage of explanatory power were the Great Reed Warbler (54.47 %), Golden Oriole (48.26 %) and Melodious Warbler (45.73 %). The proportion of variance explained by stream-edge and stream-bed as result of the partial CCA indicate that stream-bed explains 12.14 % of variation and stream-edge 24.06 %. The combination of both variable groups is responsible for 5.39 % of the variation. The results suggest that riparian habitats represent an important role in the breeding summer visitors principally due to stream-edge vegetation.

47. Ion, Constantin¹, Zamfirescu, Stefan², Zamfirescu, Oana³

Aquatic passerine communities from wetlands in Eastern Romania

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The aim of this study was to describe the similarity of the aquatic passerines in regard to their habitat preference. During the breeding periods, from 2001 to 2006, we investigated 7 communities of aquatic passerines, identifying 8 species: *Locustella luscinioides*, *Locustella fluviatilis*, *Acrocephalus schoenobaenus*, *Acrocephalus scirpaceus*, *Acrocephalus arundinaceus*, *Panurus biarmicus*, *Remiz pendulinus* and *Emberiza schoeniculus*. Based on the average density of the species in each studied community, we estimated the similarity among the species and their preference for certain habitats. Thus, the identified aquatic passerines fell into two groups. The first group included the species: *Emberiza schoeniculus*, *Remiz pendulinus* and *Acrocephalus scirpaceus* as most similar, together with *Panurus biarmicus* and

Acrocephalus arundinaceus. The second group contained the species *Locustella luscinioides*, *Locustella fluviatilis* and *Acrocephalus schoenobaenus*. The first group consisted of species with high densities, which use different habitat resources, whereas the second one comprises species with low densities that usually compete with the species of the first group for resources. This research links the diversity of the habitat resources with the diversity of the aquatic passerines, an important fact for the conservation of aquatic ecosystems.

48. Reino, Luis¹, Beja, Pedro², Osborne, Patrick E.³, Morgado, Rui⁴, Fabião, António D.⁵
Effects of farmland afforestation on the conservation of Mediterranean grassland birds: The role of forest edges

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Afforestation of agricultural open habitats such as dry cereal croplands and other grassland areas has become an important conservation issue in both Europe and North America in the last decade. This study evaluates the potential influence of afforestation on the distribution of grassland breeding birds in the extensive agricultural landscapes of Southern Portugal. In the last 16 years ongoing afforestation has tripled forest cover. We selected a total of 52 forest patches (of three types: eucalyptus, pinewoods and oakwoods) with surrounding fallow land. Censuses were conducted using a transect-point count method, starting at the border of each forest stand on distance and progressing into the fallow area with point counts located at 100, 200 and 300 m distance. Preliminary results show that some species show a negative response to edge effects (e.g. Calandra Lark and Short-Toed Lark), i.e., being significantly more abundant further away from the forest edge. Others denote a positive response to edge effects like Galerida Larks and Stonechats. Results suggest that the afforestation process can affect negatively some grassland species, not only by directly destroying their habitat but also by reducing habitat suitability in the forest patch vicinity (edge effects). Moreover, the results also suggest that for some species other features associated with the forest patch and landscape context may contribute to the effective reduction of certain grassland bird populations in the surrounding of forest plantations. Simulation results also show that an increase of 25 % in forest area could affect bird distribution on about 70 % of whole area.

49. Wysocki, Dariusz¹

Within-species adoption in an urban population of the European Blackbird in Szczecin (NW Poland) in 2002-2006

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In the years 2002-2006 at least 36 cases of within-species adoption in an urban population of the European Blackbird *Turdus merula* were observed in the city park of Szczecin (NW Poland). From March 1st through the termination of the last breeding event, for 4-6 hours daily, 1-3 persons observed the behaviour of colour-ringed birds. All cases of adoption concerned fledglings aged 14-40 days (there were no adoption of nestlings). In the early broods (the first egg was laid in March and April), 14 % of broods contained at least one adopted fledgling, 48 % in the middle one (the first eggs were laid in May), and 18 % in late ones (the first eggs were laid in June and July); $\chi^2=18.35$; $df=5$; $p 0.002$. Among the larger broods (3-5 fledglings) adoptions were more common than in the smaller ones (1-2 fledglings) – 20 % versus 10 %

($\chi^2=4.02$; $df=1$; $p<0.045$). There were no age differences between parents of adopted fledglings and parents feeding their fledglings themselves.

Subject 6 Population and Individual ecology

50. Baltag, Emanuel¹, Ion, Constantin²

Ecological aspects of birds of prey breeding in Eastern Romania

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The study was conducted between 2005-2007 in Eastern Romania in the Basin of the Prut River, which constituted a veritable "tower" of Danube Delta Biosphere Reservation. We inventoried during breeding four species of birds of prey (*Buteo buteo*, *Accipiter gentilis*, *Accipiter nissus* and *Falco tinnunculus*) and five species with unsure status: *Haliaeetus albicilla*, *Milvus migrans*, *Pandion haliaetus*, *Falco vespertinus* and *Falco subbuteo*. The habitats where the birds of prey breed are predominately forests situated on the sides of the hills at the edge of the open fields, with trees and shrubs, compact bushes or clusters of trees near roads, railways and villages. We suppose that is possible for the very rare species, the White Tailed Eagle (*Haliaeetus albicilla*), the Osprey (*Pandion haliaetus*) and the Black Kite (*Milvus migrans*) to breed in the stands of white poplar from Prut River. The presence of birds of prey is possible because the existence of a high biomass of locusts, frogs, lizards, passerines but in particularly of rodents, from which the European Souselik represents the favourite food for birds of prey. The preference for some types of habitats during the breeding period, the techniques for hunting and the future conservations status in Romania are also discussed.

51. Batáry, Péter¹, Báldi, András²

The effect of nest predation on the survival of real and artificial Great Reed Warbler's nests

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From the nature conservation perspective it is important to study the reproduction of marshland birds because the populations of these species are declining in Western Europe. Nest predation is the most important cause of nesting failure of marshland birds, which is often studied using artificial or dummy nests, however little effort has been made to perform comparative studies of real and dummy nests. We studied the breeding phenology of the Great Reed Warbler and compared the survival of real nests with artificial nests in May 2002 at Lake Velence, Hungary. Each artificial nest resembled Great Reed Warbler nests and contained one plasticine and one Quail egg. An additional experiment was completed during the late breeding season in July, when we used the abandoned Great Reed Warbler nests with Quail and plasticine eggs and compared their survival rates with those of artificial nests. Furthermore, we tested the effects of vegetation structure (reed-density, -height and -thickness) and the effect of other nest site characteristics (distance from the water's edge, water depth) on the success of nests. Great Reed Warblers laid 4.88 ± 0.074 eggs and fledged 1.72 ± 0.194 nestlings. The successful warbler broods were started a week earlier than the not successful ones. Nest survival of artificial nests was lower compared to both the real Great Reed Warbler nests and to the abandoned Great Reed Warbler nests with Quail and plasticine eggs. The nest cover (reed density and height) significantly increased the survival of both real and artificial nests, but only during the middle of the breeding season, in May. Finally, we conclude that dummy nests are suitable instruments for comparing nest predation pressure in different habitats or seasons, although artificial nests generally measure higher nest predation rates.

52. Goc, Michal¹, Grochowska, Angelika², Malinga, Michal³, Matuszak, Magdalena⁴, Kosecka, Justyna⁵

Sex ratio among Great Cormorant hatchlings estimated with a molecular method with remains of allantochorion as source of genetic material

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Bias in sex structure of broods was observed in some bird species especially in those that are sexually dimorphic in size. It has been proved that environmental as well as internal factors may affect such non-equal sex structure. The aim of the project was to identify the overall sex ratio of Great Cormorants *Phalacrocorax carbo sinensis* hatchlings using the original method. We use the remains of embryonic membrane – allantochorion isolated from post-hatching eggshells as a source of genetic material, further used for molecular sexing. Great Cormorants remove from nests most of post hatching eggshells. We collected them weekly on the study area in the largest European breeding colony at Vistula Spit (N. Poland), during breeding seasons starting from 2005. It allowed us to estimate timing of breeding. The material was divided into sub-classes according to timing of hatching. Then representative samples were sexed by PCR method (Griffiths *et al.*, 1996).

53. Grochowska, Angelika¹, Goc, Michal², Malinga, Michal³, Stepniewski, Pawel⁴

Does breeding disturbance in a Great Cormorant colony bias the primary sex ratio of the broods in the following season?

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Bias in sex structure of broods was observed in many bird species, especially in those with sexual dimorphism in size. Both environmental and internal factors may affect such non-equal sex structure. Recently, most papers deal with the brood (post-hatching) sex ratio, but data about primary sex ratio (pre-hatching) are still scarce. The material was collected in a small, external part of the largest European breeding colony at Vistula Spit (N. Poland). Since 2005, measurements have been taken aimed at stopping the expansion of the colony in a particular direction. Two methods of reducing breeding success were used: in some nests eggs were oiled (100 clutches in 2005 and 111 in 2006) and in others they were replaced with infertile hen eggs (59 and 58 clutches respectively). Cormorant embryos from removed eggs were sexed using the molecular method (Griffiths *et al.* 1996). Their age (in days of incubation) and order in the clutch was estimated. The aim of the study was to check whether there is any bias in primary sex ratio within the broods before the experiment (first season) and if locally reduced breeding success in one year affects that ratio in next season. In 2005, there were 81 females and 93 males in the sample of 174 eggs, and the proportion did not differ significantly from equal. In the second season the ratio was biased toward females (85 versus 58 males). This difference is significant and can provide a relationship with breeding success in the previous season. Relationships within the broods will be also analyzed and discussed.

54. Hegemann, Arne¹, Tieleman, Irene²

In search of bottlenecks in the annual cycle of Skylarks *Alauda arvensis*

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The Skylark is still a numerous and widespread species in almost all Europe, but the populations are rapidly declining. There is increasing evidence that with a changing agriculture their breeding success is not sufficient anymore. However, we know little about changes in adult mortality. In fact, we do not know how mortality is distributed over the year and if some periods can be considered bottlenecks in the annual cycle. Monitoring mortality over time is difficult. A measurable proxy for mortality however is body condition. Historically the body condition of a bird was determined as the weight corrected for the body size and a too low body weight was thought to be equal to a bad body condition and vice versa. But more than just body weight forms body condition other factors are the immune system, the endocrine system and the energy/water balance from the physiological body condition. But still little is known about the variation of these physiological variables throughout the annual cycle and the variation among individuals. Furthermore, we do not know how the physiological variables related to body condition influence the life history of a bird and where trade-offs either within these physiological systems or between these systems and life history traits occur. This project investigates seasonal patterns of physiological systems related to body condition and links them with life history parameters in a Skylark population in order to detect bottlenecks. We will present the first results of this project.

55. Kania, Wojciech¹

Ringling schedules as a source of data on breeding biology changes over decades: examples in Starlings *Sturnus vulgaris* and Great Tits *Parus major*

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A spatio-temporal analysis of some life history traits can be carried out on ringling schedule data. This is particularly the case in species in which nestlings are ringed each year in great numbers by numerous ringers in different areas through several decades. A few examples of such analyses based on data collected by Polish ringers in 1931-2005 will be presented for two hole nesters. Ringling dates alone will be applied to follow the breeding time changes in the last 75 years. A more precise analysis will be made for the last 20 years using hatching dates calculated from ringling dates and nestling age, estimated by means of the probability conversion tables from wing length or feather development stage. Also the examples of spatio-temporal diversification in the brood size will be shown.

56. Kosmalski, Wojciech¹, Goc, Michal²

Breeding phenology in Great Cormorants *Phalacrocorax carbo sinensis* at Katy Rybackie colony (N. Poland): Difference in synchronization

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The largest European colony of Great Cormorants, with 11,500 pairs, is located at Katy Rybackie (Vistula Spit) where breeding effects were investigated in 2003 and 2004. Data were collected on two study plots located in distant parts of the colony and differed in age (year of first inhabitation). Both plots had similar numbers of occupied trees but the number of nests was higher on younger ones. Each year birds started to occupy nests earlier in the older part. Nevertheless, in 2003 the long winter resulted in synchronization of breeding, thus the peak of hatching took place in the same week on both plots. The number of chicks observed in nests was 1 to 5, mostly 2 or 3. Number of chicks fledged per nest was related to timing of breeding. Early breeders reared more chicks to fledging than those which bred later and the mean number ranged from 0.5 to 2.8 chicks per nest.

57. Mikulic, Kresimir¹, Cikovic, Davor²

Habitat preference and population characteristics of the Grey Wagtail (*Motacilla cinerea tunstall*) in the Nature Park Medvednica, Croatia

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During April 2005 all breeding pairs of Grey Wagtails were counted and registered on 16 major streams in the Medvednica Nature Park. The method included waterway survey and noting down all breeding pairs on topographic maps (1:25,000). Altitude, slope and length of the reaches surveyed were also calculated from the maps. Supplementary habitat research was carried out at 20 locations with breeding pairs and at 20 locations without Grey Wagtails. The purposes of this research were to measure waterway dimensions, estimate the density and cover of the riparian vegetation and estimate human impact on these locations. In the Medvednica Nature Park, 75 pairs of Grey Wagtail bred on 16 streams with an average density of 7.6 pairs per 10 km, which is positively correlated with stream slope. There was a difference in the density and cover of the riparian vegetation between the breeding locations and those without Grey Wagtails. Differences were also recorded in relation to human impact at these locations, being higher at the breeding sites.

58. Nevoux, Marie¹, Forcada, Jaume², Barbraud, Christophe³, Phillips, Richard⁴, Weimerskirch, Henri⁵

The demographic response of two Albatross populations to environmental variability

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It has been widely demonstrated that environmental fluctuations have some strong repercussions on populations. The amplitude as well as the predictability of the resources in the environment may contribute to local adaptations. In term of population dynamics, the impact of such perturbation was supposed to be balanced between different demographic traits in order to maximise population growth rate. The traits most strongly related to fitness should be those that are most preserved against external forces. According to the demographic strategy, the nature of the response may differ between species and populations. The aim of this study was to compare the demographic response of two Black-Browed Albatross *Thalassarche melanophris* populations from the Kerguelen Archipelago and South Georgia to environmental fluctuations. They inhabit different regions characterised by highly contrasted ecosystems. In addition, previous findings suggested differences in the life histories of these populations, the one from South Georgia presenting an even more long-lived strategy. Using long-term capture mark recapture data, we consider whether it is possible to obtain different responses to environmental variability, as predicted by their respective demographic strategy, and what could be the consequences on the population dynamics.

59. Preiszner, Bálint¹, Csörgő, Tibor²

Effects of fragmentation on passerine habitat use

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Habitat fragmentation is currently a major nature conservation issue. In the case of wetlands this problem usually commences at a small scale. Bird species indicate this process differently, depending on their microhabitat preferences. This study was carried out at the most fragmented, mosaical part of the Ócsa Landscape Protection Area (Duna-Ipoly National Park, Hungary) in years 2002-2006. The three most characteristic Passerine species of the area were involved in our work: Reed Warblers *Acrocephalus scirpaceus*, Marsh Warblers *Acrocephalus palustris*, and Blackcaps *Sylvia atricapilla*. Birds were captured in different, representative vegetation types with 51 mist nets, 12 m long each. Net-sites were located with GPS, so each bird's capture spot is known with 12 m accuracy. Distributions were compared among the species, within the species between separated periods (breeding season, post-breeding period) and between ages (adults, juveniles) in the post-breeding period. Recapture data were also processed with GIS (Geographical Information System) software, which let us calculate the different mean home range sizes in the different life periods of the studied species. Habitat choice is confirmed to be a small scale decision despite the diverse distribution patterns and home range sizes. Species vary in the rate of preference change between the detached periods; however there was no significant difference between the age classes of a species. Small changes in the vegetation's structure were enough to change the spatial distribution of the species, although species' reactions to these changes differed. Certain species might be threatened by fragmentation, and others might benefit from it, so small scale fragmentation could be indeed an important factor in habitat quality. After collecting these kinds of data for all species, it could be applied in steady state surveys, processing species or area protection plans, and in monitoring activities.

60. Puchala, Peter,¹ Sobeková, Karolína², Országhová, Zlatica³

North Atlantic oscillation and Tree Sparrow breeding: How are they related in Central Europe?

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Many studies have shown the impact of weather and climate changes on population biology of different bird species over last decades. Climate changes can affect different parts of annual cycle of birds including laying onset, duration of breeding period and breeding parameters (clutch size, number of hatchlings, and number of fledglings) as well. One of the large-scale climatic phenomena the North Atlantic Oscillation (NAO) affects temperature and amount of rainfalls throughout the Europe. Our study is focused to reveal the relationship between NAO index, local weather variables (mean month temperature and precipitation) and breeding parameters (initiation of clutch, clutch size, fledging success) of the Tree Sparrows nesting in nestboxes. Population of this species was studied continuously in south-western Slovakia from 1996 till 2006. Study area was situated in National Nature Reserve Šúr near Bratislava in two sites (Alder Fen wood and edge of termophilous Oak wood). Data from 11 years of study show that during years with lower values of winter NAO index (December–March) tend sparrows to start egg laying later, which is connected with long period of cold weather during March and April as well. Clutch size didn't vary systematically over the studied period. Inter-annual variance in hatching and fledging success tend to be influenced by local weather variables. (This study was supported by Scientific grant agency of Slovak republic, grant VEGA 1/2369/05.)

61. Roth, Tobias¹, Schmidt, Rouven², Sprau, Philipp³, Kunc, Hansjörg⁴, Naguib, Marc⁵, Amrhein, Valentin⁶

Territory settlement of the Nightingale *Luscinia megarhynchos*

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Territory quality often predicts breeding success, and individuals are assumed to carefully investigate available territories. It has been shown that prospecting for breeding territories and selecting the best territory available can lead to a non-random settlement. As individuals may prefer some territories to others, territory occupancy might be used as a reasonable surrogate of territory quality. In previous studies, non-random settlement is assumed if the observed pattern of territory occupancy differs from a Poisson pattern expected if territories are occupied at random. However, non-random territory settlement may also be explained by territory fidelity of some individuals breeding in the same territory as in a previous breeding season and all other individuals (e.g., yearling birds) settling at random. In this case, no prospecting of breeding site would occur, and territory occupancy may not be used as a surrogate for territory quality. We are simulating territory settlement using three different parameters: proportion of males that return to the same territory as in the previous breeding season (territory fidelity), and probability of settling of a new individual in previously occupied and previously non-occupied territories, respectively. We are using data of a long-term research project on Nightingales in which territory settlement and pairing status of birds were investigated in 59 territories during a study period of 10 years (1998-2007).

62. Svoboda, Aleš¹, Pavel, Václav²

Nesting success of the Meadow Pipit in arctic-alpine habitat: An artificial nest experiment

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Artificial birds' nests are often used to test various ecological and behavioural hypotheses. Frequently, it is also used for identification of nest predators and for estimating nesting success. An artificial nest experiment was carried out to complete knowledge about nest predation of ground-nesting passerines breeding in arctic-alpine tundra of the Giant Mts. (Czech Republic) in 2004-2006. The study species was the Meadow Pipit *Anthus pratensis*, a passerine that lays four eggs in average; one breeding cycle takes 30 days (4 days of laying, 13 days of incubation and 13 days of fledging) in this area. We focused on the identification of major nest predators and on the applicability of artificial nests for nesting success estimation of active nests. The study was carried out on active (natural) and on artificial nests (non-active meadow pipit nests baited with two meadow pipit or House Sparrow *Passer montanus* eggs and with two plasticine eggs exposed for 15 days). The artificial nests were monitored by automatic cameras to determine nest fate, date of potential nest-loss and to identify predators. The active nests were monitored by time-lapse video recorders and temperature data loggers. The results show that nocturnal nest predation by small mammals predominate in the study area and studied species. Predation on artificial nests corresponds to the predation on active meadow pipit's nests during the egg-laying

and the incubation period. This design of artificial nests seems to be a useful tool for estimating nest predation in ground-nesting passerines in arctic-alpine tundra.

63. Wesolowski, Tomasz¹, Rowiński, Patryk²

Natural nest sites of Blue Tits *Cyanistes caeruleus* in a primeval forest

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Patterns of nest-site utilisation by Blue Tits in the Białowieża National Park (E. Poland) are described. Distribution of over 600 breeding holes is analysed in relation to tree species, tree size, tree condition, part of tree, height above the ground, as well as hole origin and exposure.

Subject 7 Conservation

64. Báldi, András¹

Long-term changes of passerine bird populations in the Kis-Balaton wetland, W-Hungary

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Wetlands are among the most valuable bird habitats in Europe. The 14,000 ha Kis-Balaton wetland in Western-Hungary is a Ramsar site, due to its rich birdlife. Mainly dense reed- and sedgebeds, with scattered bushes, trees and some other vegetation types covered the study part of the wetland (Lake Fenéki). Due to the eutrophication of Lake Balaton, the main touristic area of Hungary, it was decided that the water of the main inflow river should flow through the study area for natural water cleaning. It resulted in ca 40 cm water level increase in the study area in 1992. As a consequence, the sedge layer disappeared from the reed beds, which became rather open; almost all sedge beds were converted to open water, and bushes and trees died out, except a few along dikes and on islands. Line transect censuses of breeding passerines were conducted on a 13 km long route along dikes in Lake Fenéki. Birds were censused in April and May from 1989 to 2007. Reed passerines showed species-specific responses to vegetation changes. The population of the Great Reed Warbler (*Acrocephalus arundinaceus*) sharply increased, the Sedge Warbler (*A. schoenobaenus*) sharply decreased, while the Reed Warbler (*A. scirpaceus*) remained rather stable. These changes can be attributed to the vegetation changes (e.g. opening of reed beds, disappearance of bushes) and habitat selection of the species. Reasons for the slight decrease of Reed Buntings (*Emberiza schoeniclus*), and the sharp decline then increase of Savi's Warbler *Locustella luscinioides* are less clear. It seems that the water level increase had significant effects on the composition of breeding passerine bird assemblages via vegetation changes.

65. Beissmann, Helmut¹, Zink, Richard²

Modeling habitat quality for Bearded Vultures (*Gypaetus barbatus*)

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20 years after the alpine reintroduction of Bearded Vultures accompanied by an International Monitoring Program we analyzed their current habitat preferences and quality in Austria. The study is based on observational data and about 70 ecogeographical variables including food availability, land cover, digital elevation model, etc. and aims at the protection of potential breeding grounds.

66. Bieringer, Georg¹, Kollar, Hans Peter², Pollheimer, Martin³

Effects of roads and traffic noise on breeding birds in open arable land

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The effects of distance from roads and of traffic noise on breeding birds were assessed in three study areas in eastern and northern Austria. In these study areas, a total of 100 randomly selected plots, each of 4 ha in size, were considered. To account for possible biases, the assignment of plots to different observers was randomized, as well as the allotment of plots to be surveyed on weekends and weekdays respectively, and the sequence in which the plots were visited. For each study plot, habitat variables determining breeding bird densities were assessed, such as habitat structure, land use and exposure to human activity. Traffic noise was calculated by the standard computation model used in road planning in Austria. A multivariate analysis was applied to sort out the variables accounting for breeding bird density. Out of 16 species only the Skylark *Alauda arvensis* showed a consistent road avoidance which could not be explained by other variables. In all study areas distance from roads was a better predictor for Skylark abundance than calculated traffic noise or distance from main roads. We thus conclude that either masking of acoustic communication by traffic noise is not (as often assumed) the factor mainly responsible for road avoidance by Skylarks or the calculation of traffic noise does not reflect the characteristics of noise relevant to Skylarks. In any case we suggest that in nature conservation and road planning the use of effect distances should be preferred over the use of critical noise loads.

67. Dumbovic Ruzic, Vlatka¹, Kralj, Jelena², Cikovic, Davor³

Birds and forest management in Papuk Nature Park – the time for change

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Papuk Nature Park (PNP) is situated in continental Croatia, representing “island”, hilly and forested area in a lowland, agricultural region. The PNP area (336 km²) is covered with beech forests with sessile oak forests in the lower and mixed beech-fir forest in the highest parts of the area (up to 954 m a.s.l.). Comparisons are made between six types of forest stands of different ages, management intensity and tree species dominance. Point-count bird census techniques were carried out on 56 points distributed in different forest stands. Woodpecker densities were estimated using playback techniques. The circular plot method was used for estimation of habitat parameters. Densities were calculated for 34 forest bird species, giving an average total density of 628.77 ± 47.27 pairs/km². Only one type of bird community was identified (Morisita's index > 0.5). Obvious differences in species' richness and bird densities among forest stands of different age and management intensity were found. Bird density and species diversity increased with the age of the stands of the same forest type. Density was the highest in middle-aged sessile oak forests, while species diversity was the highest in old, unmanaged beech forests. Three species (Goldcrest, Firecrest and Nutcracker) were observed only in beech-fir forest indicating, along with the presence of White-Backed Woodpeckers (WBW), an isolated mountain bird community. WBW was observed only in beech-fir and old beech forest stands where the amount of dead wood exceeded 30 m³/ha. The densities of hole-nesters increased with the age of forest stands. Clear-felling and removal of dead wood are the main threats to birds in PNP. The selection cutting system or group harvesting should become forest management practice, preserving at least 30 m³/ha of dead wood in all forest stands. Key words: breeding bird community, species richness, dead wood, forest management.

68. Gillings, Simon¹

How many Golden Plovers *Pluvialis apricaria* does Europe host on passage and in winter?

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Golden Plovers occupy many European countries during autumn passage and in winter. Many countries now have some form of monitoring. In October 2003 several countries achieved a coordinated count and there are plans for a more extensive coordinated count in October 2008 for which counters are needed. See Projects at www.waderstudygroup.org for more details.

69. Goławski, Artur¹

Factors influencing nest box occupation by Barn Owls and Jackdaws

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The Barn Owl is a species that is decreasing in numbers in many parts of Europe. Many breeding pairs of this species occupy church buildings in Poland. As a result of the losses of available breeding places in such sites (mainly because of reconstruction), the numbers of this owl have decreased. The aim of this research was to protect the Barn Owl by restoring breeding sites in church buildings. This project to protect the Barn Owl was carried out in central-eastern Poland in 2000-2003. Nest boxes ($N=98$) for this species were mounted in church attics and towers. The nest boxes were occupied by Barn Owls (38 % of all boxes), Jackdaws (14 %), Domestic Doves (7 %), Tawny Owls (1 %) and Black Redstarts (1 %). The Barn Owls preferred nest boxes in buildings where this species had been recorded before nest box provision. The site of the nest box (close to or distant from the inlet opening) and previous occupation of the building by Jackdaws did not influence occupation by Barn Owls. However, Jackdaws preferred nest boxes mounted close to the inlet openings in the walls, but no other factors were found. To protect Barn Owls in church buildings, an inlet tunnel to the box is needed to prevent access to the box by other bird species, especially the Jackdaw.

70. Kalisińska, Elżbieta¹, Lisowski, Piotr²

Trace metals in the bodies of selected diurnal and nocturnal Raptors in Poland

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In the years 2001-2006, biological material (bone, liver and breast muscle) was collected from 10 species (13 individuals) of diurnal (Falconiformes: *Falco peregrinus*, *F. subbuteo*, *F. tinnunculus*, *Accipiter nisus*, *A. gentilis*, *Buteo buteo*, *Haliaeetus albicilla*, *Pandion haliaetus*, and *Gyps fulvus*) and nocturnal raptors (Strigiformes: *Bubo bubo* and *Strix aluco*). All these species are a globally threatened (LC) and have been listed on the IUCN Red List (Birdlife International 2006); some of the birds are also threatened locally in Poland (*Falco peregrinus* CR, *Haliaeetus albicilla* LC, *Pandion haliaetus* VU, *Bubo bubo* NT, *Gyps fulvus* EXP, according to Głowacinski 2001). Concentrations of essential (Mn, Ni, V) and non-essential metals (Pb and Cd) were determined by means of inductively coupled argon plasma atomic emission spectrometry (ICP-AES), according to the methods described by Kalisinska *et al.* (2004). The concentrations of the elements were converted to 1 g of dry weight. Those of Mn, Ni, V, Pb, and Cd ranged as follows: 0.28-22.49, 0.027-0.689, 0.90-1.444, 0.05-4.47, ND-1.638 mg/kg, respectively. The highest levels of Mn and Cd were recorded in the liver (l), followed by bone (b), muscle (m); V and Pb: $b > l > m$; Ni: $m > b > l$. It is not likely that any of the concentrations measured approached the threshold of the sublethal or lethal value. This report is one of very few publications on trace elements found in these birds in Poland. *Haliaeetus albicilla* is an exception, as a number of more comprehensive papers have been published in this area (Falandysz 1984; Falandysz *et al.* 1988, 2001; Kalisinska *et al.* 2006). References Falandysz J. *et al.* Environ Cons 1984, 13:69-70 Falandysz J. *et al.* Marine Pollut Bull 1988, 19:521-526 Falandysz J. *et al.* Marine Pollut Bull 2001, 42:1190-1193 Głowacinski Z. (red.) Polish Red Book. Vertebrate. PWRiL, Warszawa 2001 Kalisinska E. *et al.* Sci Total Environ 2004, 320:145-161 Kalisinska E. *et al.* Pol J Environ Stud 2006, 15:727-737.

71. Kasprzykowski, Zbigniew¹, Polak, Marcin²

Nest site of the Great Bittern *Botaurus stellaris* in fishponds: Case study management

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The Great Bittern is a rare and vulnerable bird species because of declining areas of reed beds – its most important type of habitat. In Poland, the Great Bittern is a widespread but very scarce breeder. In lowland regions without natural lakes this species occupies fishponds. The aim of our study was to characterize the nesting places in commercial carp farms. Habitat structures around 38 nests were described. Usually the nests were situated in reed beds, rarely in rushes of Narrow-Leaved Cattail and Sedges. We also measured the width of continuous reed belt, the distance from a nest to the dike and open water pool, water depth and the numbers, heights and diameters of new and old reed stems near the nest. In this way we determined the range and minimum habitat requirements. Our results could be the basis for planning effective methods for protecting this species in such types of artificial wetlands. We conclude that extensive management and the maintenance of suitable patches of reedbeds are crucial to conservation of the Great Bittern in fishponds.

72. Kohl, Ingrid¹, Plutzer, Christoph²

A habitat suitability model as a support for the survey of the Redspotted Bluethroat *Luscinia svecica svecica* in Central Europe

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The Redspotted Bluethroat has is continuously distributed over Northern Scandinavia, Northern Siberia and a small part of Alaska. Since the mid-Seventies some small isolated populations were found in Central European mountain ranges (The Alps, Giant Mountains and Carpathian Mountains) but it is likely that more, undiscovered populations exist. The Red List of endangered species of Austria demands the protection of all breeding areas (wet areas in alpine regions), the survey of unknown breeding areas, the estimation of population size and monitoring. To close information gaps and to aid further field surveys, we developed a spatially explicit habitat suitability model for the Redspotted Bluethroat in Central European mountain ranges to identify potential breeding areas. For this subspecies it is the first habitat model of this extent. A parallel intensified survey in the breeding seasons 2007 and 2008 will enlarge the knowledge about distribution and habitat requirements and enable us to test and improve the quality of the habitat model. These insights will provide basic information for decision making to protect alpine habitats as well as the populations, e.g. with the declaration of protected areas. Winter tourism and bluethroats share the same preferences for areas leading to conflicts between tourism and nature conservation. Winter tourism leads to an irreversible loss of valuable habitat in these alpine regions and hence is a constant danger for some populations. Flagship species like the Redspotted Bluethroat, which was declared as the bird of Austria by the European Union, can help to protect these endangered habitats.

73. Mitrus, Cezary¹, Beata, Jarkiewicz²

What does the Red-breasted Flycatcher *Ficedula parva* need for breeding?

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The Red-Breasted Flycatcher is a migratory bird species that breeds in forests in Europe and over-winters in the Indian sub-continent. It is a widespread species, but in many countries in Western Europe is very rare. The goal of my study was to investigate the requirements of the Red-Breasted Flycatcher for breeding. From 2000, I studied this species in the Białowieża, a National Park, where it is a regular breeder and the population is relatively large and stable. I described 52 territories and 166 nests sites. Fourteen tree species were identified in the territories of Red-Breasted Flycatchers. Of the live trees, the most numerous species were the Hornbeam *Carpinus betulus* and Small-Leaved Lime *Tilia cordata* with the Norway Spruce *Picea abies* comprising the dominant snag (standing dead tree) species. Snags constituted 20.2 % of tree stands. The mean density of live trees was 410 ± 123.8 indiv/ha and the density of snags 4.2 ± 22.5 indiv/ha. Red-Breasted Flycatchers used various hollows as nest sites in eight tree species. Most nests were

built in Hornbeams (51.2 %) and Limes (24.1 %). Almost 35 % of nests were situated in dead standing trees. Based on my data, I recommend for the Red-Breasted Flycatcher's protection that tree species diversity be maintained within stands and that old, dead standing trees are not removed.

74. Muller, Johanna Walie¹, Gache, Carmen²

A new Important Bird Area in the Inferior Valley of Siret River, Romania

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Until now, there were no designed Important Bird Areas in the Inferior Valley of Siret River and there were no proper scientific data on birds' presence. Beginning from July 2005, we started the first regular study focused on the avifauna diversity in this area, identifying one IBA in the Talabasca swamp perimeter. Our results permitted, also, to include this perimeter in the Romanian Natura 2000 Network, like part of one Special Protected Area (SPA) from the Siret River basin. This swamp covers about 139 hectares; the reedbeds and other paludous vegetation represent near 40 % from the whole surface. On the southern swampy areas' limit is present a meadow humid forest along the Siret River's left side. Starting from 1994, the Talabasca Swamp has had protected natural area status in order to preserve the steppe flora and fauna, with some transition elements to the plain forest habitat, but, also, with characteristic wetland influences. There is one stakeholder that is managing the protected areas, working to develop an ecological management plan for it. The birds find here an enough quiet place for resting and reproductive season, with favourable breeding habitats and a great variety of available food resources. Our birds' fauna list, that we consider preliminary, include 90 species, part of them listed in the Annexe 1 of the Birds' Directive. Among the breeding species we mention: *Platalea leucorodia*, *Nycticorax nycticorax*, *Cygnus olor*, *Aythya nyroca* and one colony of Terns (*Sterna sp.*) and *Chlidonias sp.*, between which we notice the breeding presence of the White-Winged Black Tern (*Chlidonias leucopterus*), which is very rare in this part of Romania. There are present two rare species breeding in Romania: *Tadorna tadorna*, present with two pairs and *Recurvirostra avosetta*, with four pairs. We encountered groups of pelicans (*Pelecanus onocrotalus*) that arrived to forage. We also analysed the impact of different human activities on the birds' fauna.

75. Nemeth, Erwin¹, Dvorak, Michael²

How age and structure of reeds affects abundance and distribution of bird species: implications for the conservation and management of large reed beds at Lake Neusiedl, Austria

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The large reed beds of Lake Neusiedl (180 km²) on the eastern border of Austria are home to populations of bird species that are important on an international level. The reed beds vary considerable in their age and there are areas that are more than 20 years old. Harvesting of Reeds (*Phragmites australis*) includes cutting and the more or less uncontrolled burning of reeds to improve the yield of the next year. Here we compare bird abundances of small passerines and rails in 20 year old reed stands with areas that were burned three years before. Together with results from a long-term monitoring of reed birds we show a differential influence of age and structure of reed stands on species abundance and distribution. The highest species diversity is supported by middle-aged reed stands. Current reed harvesting practices lead to a dichotomy of very young and old, already degenerating reed areas. Therefore, we suggest a change in reed utilization to achieve a balanced distribution of different age groups of *Phragmites*.

76. Pazderová, Alena¹, Vorisek, Petr², Gregory, Richard³, Van Strien, Arco⁴, Gmelig Meyling, Adriaan⁵

Population trends of European common birds, 2007 update

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We present an enlarged set of population trends and indices of 124 common bird species in Europe, which have been produced by the Pan-European Common Bird Monitoring scheme (PECBMS) in 2007. The trends and indices presented cover the period 1980-2005. Trend information was derived from annually operated national breeding bird surveys spanning different periods from 20 European countries, obtained through the Pan-European Common Bird Monitoring scheme. A software package named TRIM (which allows for missing counts in the time series and yields unbiased yearly indices and standard errors using Poisson regression) was used to calculate national species' indices and then to combine these into supranational indices for species, weighted by estimates of national population sizes. Within the group of all 124 common European bird species we selected 28 forest species and 33 farmland species. The multi-species indices (indicators) show that on average common farmland birds have declined sharply and common forest birds have declined moderately. All common birds together (farmland, forest and generalist species and species specialised to other habitats) have fallen by some 15 %. This is caused mainly by the decrease of farmland birds, which confirms the previous trend found in the last update in 2005. Thanks to the record-breaking amount of data supplied by coordinators of national monitoring schemes, we can present information on species previously not covered by PECBMS. For instance, House Sparrows *Passer domesticus* have declined continuously in North and West Europe, as well as in Central and East Europe, where it appears to have stabilised since the beginning of 1990s, while it was rather stable in South Europe. Other species trends and their potential drivers will be described and discussed. Wild Bird Indicator based on PECBMS outputs has been accepted as EU Structural Indicator and Indicators of Sustainable Development.

77. Pollheimer, Jürgen¹, Pollheimer, Martin²

Numbers and trends of the last Austrian Ortolan Bunting population

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In most parts of its central European breeding range the Ortolan Bunting inhabits open farmland with sparse trees and a high diversity of crops. Since the 1970s, western and central European populations have declined severely. In Austria, the formerly widespread species within three decades lost major parts of its breeding range, resulting in just one remaining population in western Austria (Northern Tyrol) in the late 1990s. As in other countries, changes in land use (amalgamation of fields, reduced crop diversity), loss of structures (e.g. sparse trees) and pressure through road development and increasing traffic were identified as factors causing the decline. Since the beginning of the Austrian Breeding Bird Monitoring in 1998, we have been surveying the last remaining Austrian population of the Ortolan Bunting in a largely traditionally managed area in the upper valley of the River Inn (Northern Tyrol, Austria). Small plot areas, high diversity of land use and habitat structures are characteristics of the area. Abundance of the Ortolan Bunting was synchronously determined by different methods in every season using rationalized territory mapping (3-4 counts per season) and point counts (open distance, no distance belts). Land use was noted for every plot in the study area, as well were relevant structures (hedges, trees, haystacks, poles and ditches). Presence and abundance of the species were related to mean plot size, crop type and diversity and presence / absence of single structures.

78. Pollheimer, Martin¹, Oberwalder, Jörg², Pollheimer, Jürgen³

Land use and grassland birds in an alpine Austrian valley

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European cultural landscapes are under increasing pressure of human activities since the beginning of the 20th century. Breeding birds in these habitats are among the most threatened species in Europe. Causes are direct habitat destruction and progressive habitat degradation through intensification of land use and loss of key structures and marginal habitats. In detail, the most important effects result from drainage, consolidation of farmland, "landscape simplification", increasing mechanised land use, enlargement of cultivation units, higher donation of fertilizer and biocides, earlier and more frequent mowing and turning grassland into arable land. As in the Alps, only a small part of the land area matches the characteristics of human land use, the valleys face a rising pressure through growing settlements, infrastructure and industry. Inner-alpine populations of endangered bird species are therefore in an especially critical status. Between 1996 and 2005 we surveyed the breeding bird community in a partly traditionally managed area in the inner-alpine valley of the River Enns (Styria, Austria). Relics of wet grassland, reeds, small wetlands and fragments of riverine forests and bogs inhabit nationally important populations of e.g. Corncrake, Whinchat, Grasshopper Warbler and Scarlet Rosefinch. Abundance of all breeding bird species was determined by means of a rationalized territory mapping. Finally we used geographic information systems and multivariate statistics to relate habitat characteristics and land use intensity to presence and abundance of the grassland species mentioned above.

79. van Noordwijk, Arie J.¹

Using multi-state models to optimise ringing effort after the successful reintroduction of the Stork in the Netherlands

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In the 1970's, the Stork *Ciconia ciconia* became almost extinct in the Netherlands. A reintroduction programme has been quite successful and this led to the question how many Storks should be ringed in order to allow monitoring of the population with reduced ringing effort. For 6,500 ringed Storks almost 18,350 reports are available, including 1,100 recoveries of dead birds. A strong heterogeneity in observation probabilities is a major problem in these data. However, a multi-state model with breeding close to or far from a Stork-station as well as a hidden state allows for a parsimonious modelling of the data. The implications of reducing the ringing effort were investigated by calculating survival estimates for various subsets of the data. Whereas random subsets behave as expected from the estimated standard errors in the total dataset, subsets based on geographic region or on blocks of 25 subsequent rings show much more heterogeneity in the results. Thus the question of which Storks are to be ringed becomes more important than the question of how many should be ringed. Given that over the next decades the state of Stork populations will be used as an indicator of the success of habitat restoration programmes, the conclusion of this study was that at least 100 Storks should be ringed every year in each of the three habitat types where the Stork occurs. It goes without saying that these estimates are based on current practices and that maintaining the integration of ringing effort and observation schedules is crucial. The longevity of Storks also makes it essential to maintain the same design for long periods.

80. Zink, Richard¹

Web-based monitoring system for widely ranging birds. A case study in the Bearded Vulture (*Gypaetus barbatus*)

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Until becoming mature Bearded Vultures explored areas of several ten thousands of square kilometers and even territorial breeding pairs use up to 7500 km² (Brown 1983). Monitoring them is only successful at an international level. Our aim was to develop a monitoring system based on common data standards avoiding problems caused by different languages.

Subject 8 Population genetics

81. Kapun, Martin¹

The genetic structure of Slovakian Bee-eaters (*Merops apiaster*): Microsatellite differentiation between individuals and colonies

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A highly restricted availability of nesting sites such as found in European Bee-eaters (*Merops apiaster*) may represent a major factor for the evolution of colony breeding. Spatially distinct colonies with breeding pairs characterized by high site fidelity should promote genetic differentiation. The species is limited to arid environments, where it digs breeding holes in sandy cliffs. European Bee-eaters are long-distance migrants. While western European populations migrate along the western coastline of Africa to their wintering areas, Eastern European and Asian populations migrate over the Sinai Peninsula towards their wintering grounds in the eastern part of Africa. The aim of this study was to estimate the degree of genetic substructure among 165 individuals from seven Bee-eater colonies from Slovakia and one colony from Spain. Five microsatellite loci were used for assigning all individual birds to a colony and to quantify genetic similarity between the colonies. θ_{ST} , R_{ST} and five genetic distance coefficients provided similar results indicating very little differentiation between most of the Slovakian colonies except for one nesting site. The Spanish nesting site showed a pronounced genetic differentiation compared to all Slovakian colonies indicating a possible genetic isolation between Western and Eastern Bee-eater colonies. Slovakian Bee-eaters appear to have a high dispersal rate probably caused by destruction of nesting sites through erosion and vegetation growth and to avoid a high inbreeding caused by small colony sizes.

82. Procházka, Petr¹, Bellinvia, Erica², Fainová, Drahomíra³, Elhalah, Anwar⁴, Alomari, Khaldoun⁵

Resurgence of a bottlenecked Reed Warbler population in the Azraq Oasis, Jordan

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In a population bottleneck, where the population suddenly contracts to a small size, genetic drift can result in sudden and dramatic changes in allele frequencies that occur independently of selection. In such instances, many beneficial adaptations may be eliminated even if the population later increases. Extensive groundwater extraction from the Azraq Oasis led to a considerable deterioration of the unique wetland ecosystem during the 1980s and most of the aquatic vegetation died off in the early 1990s. At that time, numbers of local Reed Warblers *Acrocephalus scirpaceus* dramatically dropped to almost zero. The numbers slightly increased again after wetland restoration efforts were begun. To infer possible consequences of the population collapse on genetic diversity, we genotyped 40 local breeders at ten polymorphic microsatellite loci. Fifteen years after the crash, the Azraq population showed no evidence of past genetic bottlenecks. The absence of reduced genetic diversity suggests that the population has largely benefited from gene flow. Although the oasis is widely isolated in the Syrian Desert, immigration of new birds may have been facilitated by the fact that the site constitutes an important spring stopover for the species. Supported by GAAV (KJB600930508).

Subject 9 Systematics, biogeography and paleontology

83. Arnaiz-Villena, Antonio¹, Ruiz-del-Valle, Valentin², Moscoso, Juan³, Reguera, Raquel⁴, Zamora, Jorge⁵

mtDNA Phylogeography of North American *Carduelis Pinus* Group of Birds

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The mitochondrial cytochrome b gene was analysed for the first time in *Carduelis dominicensis* (Antillean Siskin), *Carduelis atriceps* (Black-Capped Siskin) and *Carduelis pinus perpelexus* (Pine Siskin perplexus) species and also in the related *C. pinus pinus* (Pine Siskin). These four species will be defined as the *C. pinus* monophyletic group (see below). The genes have been sequenced and phylogenetically studied together with the majority of world-wide *Carduelis* species. Lineages which have given rise to the extant *Carduelis* studied species seem to have initially diverged in the Pliocene epoch which has also played a role in the diversification of the present-day Black-Capped Siskin, Pine Siskin and Pine Siskin perplexus. The Antillean Siskin shows an ancestrally older origin, in the Pliocene epoch within the Pine Siskin *Carduelis* cluster. No phylogenetic mtDNA molecular differences were found among Pine Siskin specimens from different latitude populations across North America. A bottleneck expansion from a glacial refuge of the present day Pine Siskin and the subsequent genetic drift could be the result of its lack of phylogeographic structure according to mtDNA. Black-Capped Siskin and Pine Siskin seem to be the most recent North American *Carduelis* species. The Antillean Siskin phylogeographic pattern is still unclear, and its morphology is atypical within the genus *Carduelis*, probably due to the lack of disappeared ancestors or its convergent evolution due to isolation in island highlands. The Pine Siskin perplexus seems a sister species or subspecies of the Black-Capped Siskin.

84. Arnaiz-Villena, Antonio¹, Zamora, Jorge², Moscoso, Juan³, Ruiz-del-Valle, Valentin⁴, Serrano-Vela, Juan Ignacio⁵

Citрил Finch belongs to Genus *Carduelis* by conjoint molecular canaries and goldfinches phylogenies

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Conjoint mitochondrial phylogenetic trees for Canaries *Serinus* spp. and Goldfinches *Carduelis* spp. show several specific polytomies. Canaries and goldfinches seem to form a phylogenetic group separated from other Carduelini tribe radiations. The present study conjointly analyses for the first time the phylogenetic relationships among Canaries (genus *Serinus*) and Goldfinches (genus *Carduelis*), and others, and the particular case of Citрил Finch (*Serinus citrinella*) which has been included by different authors either in the canaries or in the goldfinches group. Also, two new species: *Serinus totta* and *Serinus syriacus* have been newly DNA sequenced and studied. The Eurasian, African and American Canary

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and Siskin-Goldfinch species living ranges were surveyed. Also, island (Corsica and Sardinia) and continental (Madrid, Alps and Pyrenees) Citril Finch individuals were analysed. The mitochondrial cytochrome b (mt cyt b) DNA gene was sequenced. Parsimony and genetic distance based methodologies were used for dendrogram construction. Enforced constraints were used to test the inclusion of Citril Finches within either the *Serinus* or *Carduelis* groups. Canaries and Goldfinches may or may not be different genetic radiations with different evolutionary pathways. However it is confirmed that canaries are the closest Fringillidae family relatives to Goldfinches. Also, each of these groups shows monophyletic and non-monophyletic supported subgroups as indicated by bootstrap values. The Citril Finch is definitively included within the genus *Carduelis*. This is supported by cladistic, and distance-based phylogenetic molecular analyses; it was also postulated by Bernis in 1954 based on phenetics. Citril Finch island individuals seem to be more ancient than those extant on the continent. Genus *Loxia* (Crossbills) is included within genus *Carduelis*. *Serinus totta* seems to cluster with the small African Canaries clade and *Serinus syriacus* is included within the *Serinus pusillus*/*Serinus alario* subgroup.

85. Braun, Michael P.¹, Wink, Michael²

Molecular phylogeny of Parrots (Aves: Psittaciformes)

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Parrots are among the best known birds, having been kept as pets for over 2000 years. Inside this well-defined avian order many species are well-studied, but the phylogenetic relationships require a deeper examination. Using mitochondrial (cytb) and nuclear markers (rag-1), we present a phylogenetic tree including the main taxa of this group. We place special emphasis on parrots of the Wallacea region as well as Neotropical taxa. Some of the former subspecies could now be regarded as full species due to genetic isolation.

86. Pavel, Václav¹, Chutny, Bohumir², Turcokova, Lucia³

Subspecific differentiation in Bluethroats *Luscinia svecica*: phenotypic variability of two European subspecies

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The Bluethroat is a widespread migratory Eurasian passerine bird, ranging from arctic and mountain to steppe habitats at middle latitudes. It is a polytypic species, with about ten colour morphs defined by the colouration of the throat (combination of the red, white or no spot on the blue patch), currently recognized as subspecies. Two bluethroat subspecies occur in the Czech Republic. *L. s. cyanecula* males have a white spot on the blue throat and numerous breed in shrub and reed vegetation of the lowland wetlands in throughout the country; *L. s. svecica* males have a red throat spot and several pairs breed only in the mountain range Krkonoše (northern Czech Republic). Here we present data on body size and plumage ornamentation for both Czech subspecies and also for several Scandinavian populations of Bluethroats. Our data support "Scandinavian hypothesis" about the ancestry of the Krkonoše population of *L. s. svecica*. The detailed study of this population has revealed a small fraction of males with a white throat spot, different ornamentation patterns and smaller body size (uniform to *L. s. cyanecula*) that introgress into the dominant population. This is a first record of hybridization of Bluethroat subspecies in Central Europe.

87. Woog, Friederike¹, Wink, Michael², Rastegar-Pouyani, Eskandar³, Helm, Barbara⁴

Taxonomic position of the Madagascar Stonechat *Saxicola torquatus sibilla* revealed by nucleotide sequence data of mitochondrial cytochrome b and ND2

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Recent studies of palaeotropic Stonechats (genus *Saxicola*) provide evidence that these are geographically more distinct than originally suspected: European, Siberian and African Stonechats form monophyletic groups which are considered distinct species by some authors. For example, the two allospecies *S. t. rubicola* and *S. t. maurus* are genetically clearly differentiated as based on nucleotide sequences of mitochondrial DNA. For at least 12 African subspecies, species status is still being debated, paralleling the situation within the European stonechat group. However, data are still scarce. Here, we present data on differentiation among African stonechats, *Saxicola torquatus*. Nucleotide sequences of mitochondrial cytochrome b and ND2 genes indicate that stonechats from Madagascar, *Saxicola t. sibilla* form a distinct clade. They constitute a monophyletic group with stonechats from mainland eastern Africa *Saxicola t. axillaris* and La Réunion *Saxicola tectes*. Genetic distances suggest that the Madagascar Stonechat may be considered a species in its own right, *Saxicola sibilla* (Linnaeus 1766). In larger perspective, a more complete phylogenetic picture of stonechats could inspire evolutionary scenarios of stonechat radiation.

Subject 10 Evolutionary biology

88. Arnaiz-Villena, Antonio¹, Ruiz-del-Valle, Valentin², Westerdahl, Helena³, Moscoso, Juan⁴, Serrano-Vela, Juan Ignacio⁵

Major Histocompatibility Complex class I genes evolution in *Serinus canaria* from Canary Islands is different from that of Asian and African continental *Serinus* species

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The radiation of canaries (genus *Serinus*) occurred in Africa and Eurasia during the Miocene Epoch (9 million years ago), according to Maximum Parsimony (MP), Neighbor-Joining (NJ), Maximum Likelihood (ML) and Bayesian methodologies. *Serinus canaria* (Wild Canary) and *Serinus serinus* (European Serin) form together one of the several polytomies within the genus *Serinus* phylogenetic trees. In a relatively late period, a wild ancestor of *Serinus canaria* invaded the Canary Islands. These birds are the origin of all existing cage canaries, including the first genetically engineered animal: the red canary. The analysis of the Major Histocompatibility Complex (MHC) molecules in the islander species *Serinus canaria* shows that MHC evolution in the islands is different and faster to that of the continental species, i.e. *Serinus thibetanus* (Asia) and *Serinus mozambicus* (Africa), particularly in the peptide binding region (PBR), but also in the rest of the molecule. These data support the hypothesis that oceanic islands may be evolutionary reservoirs and not evolutionary dead ends.

89. Delhey, Kaspar¹, Peters, Anne²

Are sexually selected traits more variable? The case of bird colours

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It is generally accepted that variation in sexually selected traits should be greater than that in comparable naturally selected traits. However, supporting evidence is limited to metric traits. Particularly ill studied in this regard is variability in colouration, although colours constitute currently some of the best examples of sexually selected traits, especially in fishes and birds. This omission is certainly partly due to computational difficulties since colours are often quantified using arbitrary scales and thus their variance does not scale with the mean. Here we quantify the degree of discriminable variation in bright and drab colour patches in six common European passerine birds by combining reflectance spectrometry with newly developed models of avian colour vision. First we calculated standardized cone quantum catches for reflectance spectra and plotted these in the tetrahedral avian visual space. We calculated the discriminability between each individual point in this space and the average for that plumage patch and used the average difference in discriminability for a plumage patch as a measure of its variability. Our main findings were: (a) for all studied species we found considerable differences in colour variability between patches but provided only mixed support for the prediction that more sexually dimorphic colour patches should be more variable than monomorphic ones. Additionally, (b) males and females did not show consistent differences in variability across species. Nonetheless, (c) those coloured patches for which there was published information that they function as a sexual signal showed higher levels of variability than the others.

90. Gonzalez, Javier¹, Düttmann, Heinz², Wink, Michael³

Molecular phylogeny and hybridization in Anseriformes: Do Anseriformes follow Haldane's rule?

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Anseriformes are one of the best studied groups of birds. Several species are closely related and therefore they are prone to hybridization. Using a molecular phylogenetic approach, we analyzed the phylogenetic hybridization pattern in 120 species of Anseriformes. The phylogenetic relationships used in this study are based on nucleotide sequences of two mitochondrial genes: cytb and nd2. Our concatenated data set consists of about 2,000 base pairs. Maximum Likelihood and Bayesian Inference algorithms were used to reconstruct phylogenetic trees and calculate genetic distances between different lineages. Subsequently, Maximum Parsimony was used as a criterion to trace the evolution of hybridization as a character. Furthermore, we performed statistical tests of correlation, K-S tests and non-parametric tests in order to assess the following hypotheses: 1) reproductive isolation increases with the phylogenetic distance between hybridizing species; 2) sympatry increases the levels of hybridization and higher reproductive isolation is found to be present in allopatric species; 3) the hybridization pattern in Anseriformes follows Haldane's rule. Finally, we discuss how our conclusions could be affected by potential biases such as differential detectability of males and females, hybrid sex ratio and the effects of phylogeny.

91. Kingma, Sjouke Anne¹, Hall, Michelle L.², Peters, Anne³

Nuptial plumage acquisition in Fairy-Wrens: Is the Purple-Crowned Fairy-Wren an exception?

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As feather moult is a costly process in birds, timing, duration and intensity of prenuptial moult might be of major importance for the signaling function of a plumage trait. Previously, it has been shown that the prenuptial moult in superb Fairy-Wrens plays a role in (extra-pair) mate-choice. It probably does so, because older males and those in better condition are able to overcome the costs of earlier acquisition and longer maintenance of nuptial plumage. We briefly review the moult-profiles of sexually and seasonally dimorphic feathers of males of the nine Australian Fairy-Wren species and show a large variation in moult-profile in most species, probably related to sexual selection. This survey also indicates that this pattern may not apply for Purple-Crowned Fairy-Wrens *Malurus coronatus*. Therefore, we investigated the prenuptial moult of male Purple-Crowned Fairy-Wrens in relation to individual condition and timing of breeding in a field study in Western Australia. We found a relatively low temporal variation in acquisition of nuptial plumage in combination with the lack of correlation between moult parameters and body condition. This suggests that in Purple-Crowned Fairy-Wrens, timing of moult might not act as a sexual signal of quality.

92. Laskemoen, Terje¹, Kleven, Oddmund², Fossoy, Frode³, Robertson, Raleigh J.⁴, Lifjeld, Jan T.⁵

High repeatability of sperm morphometry and motility between ejaculates in a free living passerine, the North American Barn Swallow

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Information on repeatability in sperm morphometry and sperm motility among ejaculates in free living animals is scarce. Sperm size varies enormously among species, and causes and patterns of this variation is the subject of considerable research. Additionally, sperm motility has been shown as a very important quality trait in means of fertilization success in several species. Hence, a prerequisite for interpreting sperm motility as a quality trait is that it is repeatable. In the present study, we report that both sperm morphometry and motility are highly repeatable between ejaculates in the North American Barn Swallow *Hirundo rustica erythrogaster* (morphometry: all $r > 0.70$; motility: all $r > 0.51$). Males were caught and sampled for sperm on two different days in four colonies in the vicinity of the Queens' University Biological Station, Ontario, Canada during the breeding season of 2006. The time span between ejaculates ranged from 2–46 days, and time between ejaculates did not influence change in sperm morphometry or motility. We found no relationship between morphometric traits and motility. Our study demonstrates that both sperm morphometry and motility is repeatable between ejaculates from the same male in a free living passerine. This implies that sperm motility can be interpreted as a quality trait in this species, and provide a scope for future research on possible relationships between motility and fertilization success. Additionally, relationship between various morphometric sperm traits and fertilization success deserves further investigation.

93. Leisler, Bernd¹, Steinheimer, Frank², Winkler, Hans³

Convergence in suboscine and oscine Reed Dwelling birds

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Many researchers have marveled at the convergence between certain South American suboscines and unrelated birds on other continents. Especially the Ovenbirds (Furnariidae) produced species that are astonishingly similar to certain Old World birds. We analyse for the first time quantitatively such possible convergence in birds that inhabit reeds which form extreme habitats found on all continents. In addition to the general hypothesis that these habitats produce overall similarities, we tested the specific hypothesis that convergence affects characters related to bipedal locomotion only, because reeds pose the most stringent demands in this respect. We found that reed dwellers in the families Acrocephalidae, Furnariidae, and Tyrannidae indeed are similar overall. The evolutionary road to reed dwelling, however, is different in these groups. All groups developed parallel hindlimb characteristics suitable for vertical clinging. The necessary morphological changes were most pronounced in the Ovenbirds and Warblers, and least in the Tyrannids. The cluttered reed habitats led to smaller wings in reed-dwellers of all three families. The necessary changes were most significant for the tyrannids and furnariids, and least in the Old World Warblers. Bills of reed-dwelling birds are adapted for gleaning and probing, what required the most massive changes in the New World flycatchers. Our results show that extreme habitats generate selective demands that affect several functional complexes at the same time, thus generating conspicuous overall similarities. However, the necessary changes vary depending on the evolutionary starting point.

94. Valenzova, Zdenka¹, Fuchs, Roman², Zrzavy, Jan³

Evolution of plumage colouration and ornaments in Gamebirds (Galliformes)

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Variation in the extent of sexual plumage dimorphism and other sexually selected traits in Galliformes is traditionally attributed to differences in social mating system (conspicuousness), though there might be some other causes (physiological constraints and predation selection pressure to be drab) in play. However, the phylogenetic relationship might be crucial. I examined plumage dimorphism by setting up a matter of sexual selected traits in species of 75 genera and I carried out a phylogenetic analysis. A supertree was constructed by combining molecular and morphological traits. Concerning the evaluation of ornaments/colouration, each relevant body region was described in several characteristics (pigment, colour, overall darkness, type of spots, qualities of special structures). In the genus *Lophura* (11 species), were found following connections between traits, sex and phylogenetic relationships: (1) some traits are the same in both sex (colour of wattles and legs), (2) even females may have a conspicuous trait which is slightly different (equally or less bright) from the relevant one in males (spotty ornaments on breast and wings which apparently do not serve as antipredatory distraction), (3) metallic hues, which are typically considered as “male” traits, were found even in females of one species (*L. erythrophthalma*). The rate of derivation in this feature is fragile. Changes of plumage and ornaments in other genera are being elaborated. The relations between sexually selected traits and (1) speed of phylogeny, (2) environmental conditions and (3) biogeography are being discussed.

95. Winkler, Hans¹, Leisler, Bernd²

What turns Reed Warblers into Island Warblers?

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The 'island rule' and its variants hold that the bills and the body size of small birds tend to increase on islands (Clegg & Owens 2002). This has been explained with increased generalism and niche expansion (Scott *et al.* 2003). In this poster we analyse the morphology of *Acrocephalus warblers*, a genus in which more than 40 % of the species live on oceanic islands, and show that even more important changes take place in other functional complexes when birds evolve on islands. We analysed body mass and external characters relating to hindlimb, the flight apparatus and the bill of 15 insular and 9 continental species. We did not find a general trend to increased body size and thus no support for the 'island rule'. Wings are generally short and weak as a consequence of constraints on dispersal and probably on energy expenditure. The forced change from reeds to arboreal habitats allows legs to grow thick and strong. Bills get larger in some species, but not necessarily for the reasons proposed in the literature. Islands have very individual histories and little in common, therefore morphological changes have to be assessed case by case. We suggest that selective demands common to most islands are mainly related to constraints on movements and the low chance that new arrivals will find the specific resources they may require.

96. Zielinska, Monika¹, Dubiec, Anna², Zielinski, Piotr³

Parental quality and sex allocation patterns in the House Martin

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According to sex allocation theory, females should adjust the sex ratio of their offspring and bias it towards the sex with the greater rate of reproductive returns. This bias may be driven by various factors including parental characteristics and environmental cues. Sex ratio allocation was studied in the House Martin in northern Poland during two breeding seasons. In this species, males show higher reproductive potential due to engaging in extra-pair copulations. Consequently, high quality sons are expected to have higher reproductive value than high quality daughters. We predicted that clutch sex ratio should be biased towards sons when produced by high quality females and/or by females mated to high quality males. The quality of parents was assessed by body mass, tarsus length, wing length and the length and pigmentation of white rump patch. None of the parental characteristics was associated with the primary sex ratio except for female wing length. Females with short wings produced more sons than females with long wings. This may suggest that in the House Martin females do not respond to the cues of the social mate quality, but rather skew the brood sex ratio in relation to their own quality.

Subject 11 Morphology, ecomorphology

97. Bušs, Agnis¹, Keišs, Oskars²

Is identification of passerine bird species possible by examining microstructure of the egg shell?

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We explored methods to identify species by examining the microstructure of the egg shell. Our objective was to find a tool for species identification from egg shell remains in cavities as well as to prove the identity of an *Acrocephalus*

paludicola clutch deposited at the collection of the Museum of Zoology, University of Latvia. Trials included eggs of various species of the genera *Acanthis*, *Acrocephalus*, *Ficedula*, *Parus* and *Passer*. Egg shells were examined in the light microscope by 200 increase. Before examination, shells were washed in a 5 % solution of NaOH. Differences in the inner surface of the eggshell, conic layer basal caps (mammillae), were detected in different bird species, e.g. *Passer montanus* was significantly different from another *Passer* species, but *Acrocephalus paludicola* was not significantly different from *Acrocephalus achoenobaenus*. Developing of the identification key of passerine species requires studies of more eggs and more species.

98. Eck, Siegfried¹ †, Fiebig, Jürgen², Fiedler, Wolfgang³, Heynen, Iris⁴, Hoff, Nils⁵, Nicolai, Bernd⁶, Töpfer, Till⁷, van den Elzen, Renate⁸, Winkler, Raffael⁹, Woog, Friederike¹⁰

Measuring birds

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Developed by a team of bird ringers and museum ornithologists, this publication is the first comprehensive presentation of a large number of different measurements that can be taken on birds: with the aid of detailed illustrations this handy volume offers concise instructions and recommendations on how to measure birds. Problems with particular measurement techniques are discussed, as are accuracy, reliability and comparability of measurements, the numbering of flight-feathers, skull ossification, measuring tools and weight. A comprehensive list of references rounds off this useful book. Printed on durable water-resistant plastic and with an innovative binding, this manual has been explicitly designed for use in the field and for taxidermy. An absolute must for bird ringers, museum curators, taxidermists and everyone concerned with morphometry. To be published by the end of 2007. A publication by the DO-G working group "Ornithological Collections". To be informed about date of publication, subscription rates, etc., please send an email to measuring.birds@web.de

99. Ginter, Malgorzata¹, Kaszuba, Michal²

Sexual dimorphism in Robins (*Erithacus rubecula*) migrating through the Polish Baltic Coast

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119 dead Robins found in years 2001-2006 were sexed by gonadal inspection and 189 individuals caught in 2006 and sexed by molecular techniques were used in this analysis. Feathers from some dead birds were also used in genetic analysis and repeatability of sexing by these two methods was checked. Linear measurements were taken (wing length, tail length, wing formula, bill length, total head length, tarsus length) and amount of greyness on head and flanks was determined. Based on wing formula measurements, the pointedness and asymmetry indexes were calculated. The aim of this study was to analyse and recommend measurements which could be the best criteria for sexing Robins. Percentage distribution of different measurements in both sex groups was presented and averages of all measurements between sexes were compared. Next, conceptual models to explore the possibility of sex determination according to a combination of different measurements were analysed by the GLM method. The analysis was done for both age groups jointly as well as only for immatures, as well as for birds sexed with both methods and by each method separately. The results showed that wing, tail and total head length differed significantly between analysed sex groups ($p < 0.001$). It was also found that in live birds (sexed genetically), wing formula differed significantly between sexes. Therefore, we recommend wing length as a decisive criterion in sexing migrating Robins. However one has to keep in mind that the total head length factor enlarges the probability of proper sex determination. In Fennoscandian Robins, differences between sexes refer to wing and tarsus length. Similarly in Robins migrating through the Polish Baltic coast, wing length seems to be a proper decisive criterion in sexing birds, but as tarsus length did not differ between analysed sex groups, we rather recommend total head length as a better, supporting criterion.

100. Kulemeyer, Christoph¹, Asbahr, Kolja², Ingmar, Vogel,³ Bairlein, Franz⁴

Functional traits in the predator avoidance of Corvids

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Predation is thought to be a strong selective force on the morphology and behaviour of birds. Predator avoidance can be separated into the ability to detect approaching predators and the ability to escape. As behaviour and morphology covary, predator detection is dependent on visual acuity and visual fields. Thus, birds with higher visual acuity and wider visual fields are thought to have a greater ability to detect predators. However, escape from a predator is dependent on take-off ability, flight speed and aerial maneuverability. Take-off ability, maneuverability and flight speed are greater in birds with rounded wings. Furthermore, take-off ability is also facilitated by longer hind limbs, allowing a bird to flap with a greater amplitude when taking off from the ground. We studied anti-predator related traits of six corvids, the Common Raven, Hooded Crow, Rook, Jackdaw, Black-billed Magpie and Eurasian Jay. We introduced a simple method to investigate visual fields from skull measurements as visual fields are a function of orbit convergence. In addition, we investigated visual acuity, wingtip-shape, hind limb composition and relative leg-length. Our results indicate that Black-billed Magpies and Eurasian Jays have small visual fields and visual acuity but have a strong ability to take off from the ground through rounded wings and relatively long legs to compensate late predator detection. In contrast, the Common Raven, Rook and Hooded Crow have a wide visual field, a high visual acuity and a weak take-off ability through pointed wings and short legs. Exceptional is the Jackdaw with a narrow visual field and a weak take-off ability. These abilities and limitations in predator detection, escape and respective habitat associations are discussed.

Subject 12 Other subjects

101. Indykiewicz, Piotr¹

H5N1 virus in Mute Swans *Cygnus olor* wintering in 2006 in Bydgoszcz (Poland) and number fluctuations, age structure and reasons of swan mortality in 1997-2007

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Bydgoszcz (53°07'N, 18°00'E) is one of the biggest cities in Poland. The area of 174.6 km² is inhabited by a population of 366,000. The longitudinal axis of the city is formed by the Brda River, which flows into the Vistula River, near the eastern city boundary, and in the west it is linked to the Noteć River by the Bydgoszcz Channel. Between 8th March and 6th April 2006, in three separate locations within the city, the presence of the virulent avian flu of the H5N1 type was found in 19 dead Mute Swans *Cygnus olor*. Individuals with confirmed infection by the H5N1 virus belonged to the flock over-wintering in the city. During winter 2006, this flock comprised of 554 swans, including 345 adults. It should be emphasised that Bydgoszcz, for many years has been supporting large numbers of swans in winter due to feeding by the local residents as well as favourable conditions for habitation. During six consecutive winters between 1998/99 and 2004/05 in the Bydgoszcz-wintering flock, 90 swans were found dead (17, 19, 13, 15, 4 and 10, 12 individuals, respectively), which constituted 1.2–5.0 % of the flock). In January and February 2006, when temperatures lowered to 27° C, in which a total of 45 swans died (8.1 % of the wintering flock). During 1998-2004, among 61 dead swans: 42.6 % died due to hypothermia, 16.4 % due to difficulties in feeding or diseases caused by swallowing indigestible materials. Moreover, 14.8 % of birds were killed by humans, and 9.9 % died of extensive injuries (multiple open fractures) of wings and legs. On the basis of ringing recoveries from 173 swans, it was found that 93 birds were young, spending their first winter in Bydgoszcz. During the stated period the proportion of the immatures in winter assemblages varied from 14.2 % to 25.9 %. At the wintering site in Bydgoszcz there appeared adult swans ringed as chicks at breeding locations in the Barycz river valley, near Cze, Stochowa, in the Wielkopolska region, in Gdańsk and near Troki, Lithuania.

102. Matson, Kevin¹, Horrocks, Nicholas², Scheuerlein, Alexander³

Haptoglobin: A marker of health and immune status in wild birds

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With interest in ecological immunology and wildlife health continuing to grow, assembling a diverse toolkit that includes a range of relevant measures suitable for both the intra- and inter-specific comparisons becomes increasingly important. Inflammation serves to defend against infection, and markers of inflammation can provide critical insight on health and immune status. Inflammatory responses (also known as acute phase responses) induce a suite of behavioural and physiological changes, including changes in circulating concentrations of acute phase proteins (APPs). Within populations of wild birds, quantification of APPs can be used as an index of current infection status; among species, quantification of APPs can be used to estimate investment in innate immunity, even when repeated measures within individuals are logistically impossible. Haptoglobin (Hp) and haptoglobin-like proteins are APPs found in a wide range of taxa including birds. Hp complexes and removes haeme, thereby preventing the haeme from serving as a nutrient for pathogens and from initiating deleterious oxidation reactions. Concentrations of Hp increase with inflammation resulting from infection or trauma, but low levels are constitutively present in healthy birds. We measured Hp concentrations in plasma samples from a phylogenetically diverse array of birds (>75 species). Hp concentrations were quantified using a commercially available kit to perform a relatively high-throughput assay, which is independent of species-specific reagents. We found a highly significant effect of species on Hp concentration. Additionally, we found a significant effect of location when comparing phylogenetically-matched species pairs.

103. Vas, Zoltán¹, Csörgő, Tibor², Møller, Anders Pape³, Rózsa, Lajos⁴

Frequency distribution patterns and origin of the feather holes in the Barn Swallow *Hirundo rustica*

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Fifteen years ago, characteristic feather holes were found on the retrices, primaries and secondaries of the Barn Swallow *Hirundo rustica*. Based on a positive correlation between hole numbers and the intensity of infestation, it was suggested that the holes were feeding traces of *Machaerilaemus malleus*. Since then, a number of influential papers have been published on this assumption. However, the origin of feather holes has never been tested accurately. We found the following reasons to question whether or not *M. malleus* could be the causative agent of these symptoms. According to published data based on traditional collection methods, *M. malleus* appears to be a very rare species in Europe whereas feather holes are highly prevalent. Similar feather holes were also described from birds that are not known to host any *Machaerilaemus* lice. *M. malleus* is a large-bodied and oval-shaped Amblyceran, apparently not adapted to stay on the vane (aerodynamic surface) of major tail and wing feathers. We found that the shape of frequency distributions of feather holes and differences between frequency distribution patterns of migratory and breeding populations, sexes and ages corresponds to the idea that it reflects intensity of infection by a contagious pathogen. Collections with fumigants revealed that *M. malleus* is a rare species indeed; and *Brueelia domestica* is much more prevalent in Barn Swallows than indicated in the literature. The presence or absence of feather holes on small-bodied passerines fits well to the known occurrence of *Brueelia* spp. We conclude that it was most probably right to claim that feather holes are traces of louse feeding. On the other hand, we propose that the lice were probably misidentified; holes are most likely to be feeding traces of *Brueelia domestica* in Barn Swallows and other *Brueelia* spp. in other small passerines.

Journals Discussion

Any Questions? (A Panel Discussion)

At the Strasbourg EOU conference a group of us spent one coffee break discussing problems that are faced – particularly by first-time authors – in getting ornithological papers published in journals. We decided that it would be nice to do something about this at the EOU conference in Vienna, but what to do? A lecture seemed a rather dry affair, it might not cover the questions that people really wanted answered, and, perhaps most importantly, different journal editors have different opinions on many matters, so a lecture by just one of them would present a narrow view. We therefore hit on the idea of a panel discussion modelled on a long-running British radio program called *Any Questions?* The format consists of a panel of four people, chosen to represent a range of views, who answer (pre-screened) questions from the audience. The answers are fairly short, and sometimes the chair will ask for a comment on the answer from the questioner or allow them to ask a subsidiary question, or take a ‘straw poll’ of the opinions of the audience.

The questions can range from the serious to the humorous, and for the Journals *Any Questions?* might include questions like ...

- **How should I choose a journal to send my paper to?**
- **What single piece of advice would you give to maximize the chance of my paper being accepted?**
- **I’m not a native English speaker: how much difference does it make to the chance of acceptance if my paper is written in poor English?**
- **If I am asked to revise my paper, do I have to follow all the referees’ recommendations?**
- **Should I choose an ‘open access’ journal?**
- **Is it worth challenging a ‘reject’ decision?**
- **What’s the best way to annoy an editor?**
- **Do editors enjoy rejecting papers?**

Questions will be pre-screened and can be submitted during the early part of the conference.

The panel will be:

- **Will Cresswell** (University of St Andrews, UK): Will is currently an editor of **Behavioral Ecology**, an academic editor for **PLoS One**, on the Editorial Boards of **Bird Study** and **British Birds** and has been an associate editor for **Ibis**. He has refereed extensively for a lot of the specific and general journals that an ornithologist might submit to, at all impact factor levels. He has refereed on average 29 papers a year for the last 7 years, and in one year, when this exceeded 50, decided it was better to cut his losses and officially become an Editor. He now referees or edits about 70 papers a year, which is probably far too much, but somebody has to do it... He is also an author, with a large enough sample size of submissions to begin to draw some conclusions about the good, bad and the ugly sides of peer review and the scientific publication process.

- **Barbara Helm** (Max Planck Institute for Ornithology, Germany): Barbara is a science editor of *Journal of Avian Biology*. Being relatively new to the job, she's full of enthusiasm for improving the way that manuscripts are handled. She's particularly interested in perfecting the identification of excellent scientific contributions, and in the ways this process is hindered, for example by differences in the scientific culture and experience of authors.
- **Joost Tinbergen** (Animal Ecology Group, University of Groningen, NL): Joost has experience in writing and refereeing papers for journals ranging from ornithological ones like *Ardea* and *Bird Study* to more general ecological ones like the *Journal of Animal Ecology*, *Behavioral Ecology* and the *Proceedings of the Royal Society B*. He believes that the communication between author and reviewer is essential in the process of refereeing, and hopes that the discussion will raise ideas as to how first time authors can be helped during this process.

Roundtable

Organizer: **Przemyslaw Busse**

What we can achieve by working within bird migration networks

Introduction: The study of bird migration must be a co-operative activity. This is because bird migration occurs on a continental scale, so it is impossible to draw conclusions for any species by working at a single field station or within a single country. It makes no sense to work locally on bird migration strategies, differentiation of stop-over biology, or the protection of migrants or habitat management at bottleneck areas (because we must first know their location).

We hope to encourage people working in this field to more greater cooperation, both in making observations and exploring and developing existing databases. The meeting will demonstrate that the whole Mediterranean area of bird migration is covered, or in a process of being covered, by networks that have the same general goals but have developed at least partly independently and would therefore benefit from greater uniformity in methodology and organization in the future. We will discuss the basis for developing more compatible work and for the efficient creation of bird migration databases. Our overall goal is to increase the efficiency with which bird migration is studied either within Europe or anywhere within the European-African bird migration system area.

In this Round Table Discussion we will present how more extensive bird migration study networks currently function in Europe and discuss perspectives for co-ordination of their work. There are two such networks currently running (SEEN–SE European Bird Migration Network and the Small Islands Project), while a third one (Spanish Network) is being organized. Altogether they cover the whole Mediterranean area and oversee the European-African bird migration system.

There will therefore be **three introductory presentations** by:

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The points that will be presented and could be discussed are:

- What ideas underly the organization of the network? (Why the network was born? How did it develop?)
- What field methods are standardly used? (To what extent are they are compatible between networks, and what are differences? What data handling methods are used and how is the network organized?)

We hope that we will reach some conclusions on the following questions:

- (1) Is it reasonable to start discussions about more unified networks with more standardized ways of working?
- (2) Are there any special methodological points that need to be discussed?
- (3) Are there any organizational needs to prepare bird migration students for active participation in wider European projects (e.g. in European Space Agency *System of Systems* Project)?

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