

Oral Contributed Papers Abstracts

ORA01: Section: Migration

ORA01-1 The relationship of organ mass to body mass: phenotypic flexibility of 13 organs during long-distance migration

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Long-distance migration can be subdivided into three different phases: pre-migratory period, flight and stopover. The energy demands imposed by migration over great distances are reflected in considerable fluctuations of endogenous resources. Those resources increase during pre-migratory period, are used up during flight and are replenished during stopover. We quantified phenotypic changes in 13 organs of garden warblers (*Sylvia borin*) caught during spring migration in Tanzania within their wintering area, in Ethiopia before crossing the Sahara and in Egypt immediately after the desert flight. Over all, organs increase in mass from Tanzania to Ethiopia, and decrease in mass from Ethiopia to Egypt. During flight across the Sahara mass changes of numerous organs accounts for up to 50% of the respective mass in Ethiopia. The prevailing functional hypothesis for phenotypic flexibility of organs predicts a positive relationship of flight muscle mass to body mass. This is considered to be necessary to meet the differing power requirements for flight due to changing body mass. In addition, changing body mass must be considered to affect other organs besides the flight muscle. Our data show that this hypothesis can only be confirmed for two organs, the leg muscles and the small intestine, in which mass changes are significantly associated with body mass changes during migration. For all other quantified organs, including the flight muscle, alternative hypotheses are needed to explain the changes in organ mass during migration.

ORA01-2 Response of a long-distance migratory bird to the latitudinal photoperiodic gradient

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Birds have evolved responses to daylength – the most predictive source of seasonal information – to time certain stages of their life-cycle. Distributional shifts, however, expose birds to novel photoperiodic conditions which may constrain adaptive changes of the annual cycle. I conducted indoor experiments on the pied flycatcher *Ficedula hypoleuca* to determine how a Palaearctic-African migrant responds to the latitudinal variation in photoperiodic conditions potentially encountered during the non-breeding period. Groups of first-year males were subjected to photoperiodic treatments simulating 5 different wintering latitudes ranging from central Africa to central Europe. The timing of prenuptial moult, spring migratory activity, and testicular growth was determined. First results suggest that birds advance springtime activities with decreasing migration distance. This flexible response along the latitudinal photoperiodic gradient is most likely conserved throughout the phylogeny of passerine species and may have an adaptive value. The underlying response mechanism remains to be determined.

ORA01-3 Nocturnal migration of thrushes (*Turdus* spp.): numbers aloft and wind

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Dependence of nocturnal migration of thrushes (numbers aloft) on the wind conditions in the south-eastern Baltic (Courish Spit) was estimated by the moon-watching method in spring and in autumn during 300 nights.

In spring, when the wind changes from the opposing to the following, the number of thrushes increases up to 10-fold. An increase in numbers (on the average 4,5-fold) takes place already in the last night with the opposing wind. All migration waves (mean duration of a wave 5,3 nights) occurs under the following winds. In spring, up to 91% of all thrushes pass in the nights of migratory waves.

In autumn, the numbers of thrushes also peak under the following winds, and decrease down to 5-fold under the opposing winds. The waves of migration (mean duration 2,2 nights) developed under the following wind conditions or, unlike in spring, with slowing down of the opposing wind velocity. In autumn, about 80% of thrushes pass during the waves of migration. In both seasons, the flight activity of thrushes decreases more than by a factor of 20, or even is completely suppressed under the strong opposing winds.

It is supposed that different dependence of numbers aloft on the wind and spring and in autumn reflects the seasonal difference in the night migration strategies of thrushes. An impact of the ground speed of birds on the moon-watching estimates of their numbers aloft (Migration Traffic Rate) is discussed.

ORA01-4 Irruptions in coal tits *Parus ater*: an experimental study

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Coal tit is a sedentary titmouse, but in some years juvenile move for distances up to 1500 km, mainly towards the W and SW. Next spring, a proportion of birds undergo reverse movements. The causes of development of irruptions and the mechanism of their realization remain unknown. In this study, we have for the first time measured the level of locomotory activity of coal tits kept in captivity during nearly one year. Fifteen nestling coal tits from the population of the Courish Spit on the Baltic were hand-raised in 2001. When self-dependent, they were put in individual registration cages which allowed the birds to hear but not to see each other. All juvenile coal tits showed well-defined periods of elevated activity in autumn and in spring. In autumn, mean daily activity increased since 16 August, peaked on 26 September and declined before 18 November. At its maximum, the activity was twice as high as the initial level. Locomotory activity smoothly increased since January, peaked on 1 April and started to decline before the end of the experiment. The spring activity level was 1.5–2-fold higher than in autumn. In 2002, we measured food caching in 12 hand-raised juvenile coal tits, also from the population of the Courish Spit. Daily means of food caching activity and locomotory activity were significantly inversely related (Spearman's rank correlation $r = -0.176$, 2-tailed $p = 0.034$). Additionally, impact of acoustic communication of coal tits on the dynamics of their locomotory activity during the year is discussed.

ORA01-5 Non-random within colony breeding dispersal in a sand martin colony

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The aim of this study was to analyse the dispersal within one sand martin colony to determine whether birds that nested together in year will breed closer together than expected by chance in the following breeding season. Breeding dispersal was studied in a large sand martin colony, situated in a natural riverside bank along the river Tisza, Hungary, during the 2000–2001 breeding seasons. Regular ringing was performed after the birds completed the egg laying. To examine the level of aggregation in 2001 for birds caught at one section of the colony in 2000, the colony was divided to sections and we calculated the individual distances between each combination of pairs of recaptured bird. Birds were recaptured in similar numbers from the different colony sections, but settlement patterns were different. Ratio of joint breeding of birds recaptured in 2001 from the same 2000 colony section was higher in the case of three sections, where almost half or more birds settled in the same or in the neighbour section of the new colony. Sand martin nesting substrates are changing or renewing annually as early spring floods usually cause the collapse of the river walls used previously for breeding. If there is any prospecting strategy that uses information on breeding success of conspecifics, it may be of adaptive value to link this information to individuals and not to a certain place. This may result in the formation of breeding communities that could disperse together without being attached to a specific colony site.

ORA02: Section: „Sex matters sometimes“

ORA02-1 Cross-fostering of passerine birds to heterospecific hosts in the wild: a study of sexual imprinting and origin of brood parasitism

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Cross-fostering between bird species in the wild makes it possible to quantify fitness consequences of being reared in a different social context but in an environment otherwise natural to the birds. We have cross-fostered chicks between nests of four passerine species, the migratory pied flycatcher *Ficedula hypoleuca*, and three resident species of tits, viz. the larger great tit *Parus major*, the intermediate blue tit *P. caeruleus*, and the smaller coal tit *P. ater*, by adding a single egg to the clutch, or by swapping whole clutches. Survival, and subsequent recruitment and breeding success, were strongly dependent on which species was host and which species was chick. Survival was related to competition from heterospecific nest mates, whereas subsequent social dominance rank, and mating success, were constrained by sexual imprinting on the host species. The results are discussed in relation to sexual imprinting, origin of interspecific brood parasitism, and conservation of endangered birds.

ORA02-2 Do parental quality or extra-pair paternity affect offspring sex ratio in the coal tit (*Parus ater*)?

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Sex allocation theory assumes that parents will distribute resources between male and female offspring dependent on the relative fitness benefits of sons and daughters. Accordingly, brood sex ratio might be adaptively skewed in relation to environmental or parental quality. For instance, females mated to attractive males might maximise their fitness by investing more in sons, since an inheritance of the father's characteristics would be more advantageous to sons than to daughters. Assuming that females engage in extra-pair copulations with males of higher quality than their social mate, sex allocation in extra-pair young should also be biased towards sons. Thus, extra-pair paternity, which is widespread among socially monogamous bird species, might influence offspring sex ratio as well.

For a number of bird species it could be shown that females obviously are capable of manipulating the sex ratio of their progeny in response to different variables. Here we present a study on offspring sex ratio in a coal tit (*Parus ater*) population near Lingen/Emsland (Germany). Based on a sample of almost 2500 nestlings from first and second broods we take a closer look at the following questions: Is brood sex ratio biased towards sons or daughters? Do maternal and/or paternal quality affect brood sex ratio? Does extra-pair paternity influence offspring sex?

ORA02-3 An experimental approach to reveal context-dependence of „good genes“ effects

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Avian extra-pair mating systems offer an excellent model to study female mate choice for genetic benefits, because non-genetic benefits are thought to play a subordinate role. The most straightforward test of „good genes“ hypotheses of female extra-pair mating is the comparison of „naturally cross-fostered“ maternal half-sibs which result from extra-pair paternity. Since these half-sibs share a common rearing environment, paternal genes are expected to be the only source of variance in maternal half-sib performance, and any differences between the two categories of offspring phenotypes can only be attributed to differential paternal genetic contribution.

However, as „good genes“ effects are thought to be small, they may be difficult to demonstrate in natural populations if sampling effort is limited. Furthermore, „good genes“ effects are likely to vary with environmental conditions (giving rise to a paternal genotype by environment effect) and may only be detectable, if conditions are comparatively poor.

In this contribution we report on local recruitment and reproductive performance of maternal half-sibs in the coal tit (*Parus ater*), a species with high levels of extra-pair paternity. In order to assess the significance of the presumed context-dependence of „good genes“ effects, we present data from an experimental approach in which half-sib performance is contrasted after environmental conditions were selectively deteriorated by brood size manipulations.

ORA03: Section: Difficulties of Parenting

ORA03-1 When the caterpillar peak is over: Evidence for a trade-off between brood provision and maintenance in great tit parents during the post-fledging period.

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There is growing evidence that the post-fledging period is a key phase in the reproductive cycle, in which parents experience the rewards or retributions for their decisions on timing of breeding, clutch size and their provisioning performance during the nestling period. However, it is so far unknown how foraging conditions during the post-fledging period affect the parents' decisions (such as provisioning rate and duration) and the chicks' development to independence. We present a first investigation of the post-fledging foraging behaviour of great tit parents and juveniles, providing evidence that post-fledging foraging conditions may be an important factor for reproductive success. First, there is a trade-off in the parents' allocation of energy to the brood and to self-maintenance. The most important result is that the amount of food consumed per unit time by adult tits was constant throughout the season while the provisioning rates varied in response to the chicks' age and to the availability of food. This confirms a general hypothesis from life-history theory that parents should not sacrifice future reproductive potential for a (smaller) benefit in current reproduction. Under energetic constraints tit parents appear to maintain their own body condition and survival prospects while charging their brood with the costs of decreasing food availability.

ORA03-2 To feed or not to feed? – A Trade-off in the post-fledging parental care in the double-brooded barn swallow (*Hirundo rustica*)

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A major part of the fitness-relevant interactions between breeding birds and their environment have so far been attributed to the period from laying to fledging. Recent advances in radio-telemetry now

allow the parental care, the survival and behaviour of juvenile small birds to be investigated for about one month from fledging

In 2000 and 2002 a total of 280 radio-tagged barn swallow fledglings of 67 families were tracked for up to 35 days. We present experimental evidence confirming that there is trade-off between continuing the post-fledging care of first-brood chicks and starting a second clutch early. On one hand, we found that advanced hatching (and thus, fledging) of second broods strongly improved the post-fledging survival of chicks. On the other hand, parents beginning their second clutch early incurred a considerable cost in terms of low survival of first-brood chicks.

We conclude from the experiments that barn swallows adjust the timing of the two broods to maximize the over-all reproductive success. Part of the high survival rate of an early second brood is compensated by a cost in terms of reduced survival of first-brood chicks.

ORA03-3 Does extended parental care compensate for low annual fecundity in tropical *Sylvia* species?

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Previous studies on the differences in life history traits in temperate and tropical birds often disregarded the role of the post-fledging period, mainly due to a lack of knowledge about post fledging periods in tropical species. We studied the post-fledging period of two tropical *Sylvia* species, *Sylvia lugens* and *Sylvia boehmi*, in a two-year breeding biology study in Kenya. The prolonged parental care and presence of the fledglings in their parents' territory enabled us to trace the fate of the fledglings for several months. Our observations document a high survival rate of the young birds at least in the first month of their life. Time to independence from parental feeding was 37.5 days in *S. lugens* and 58.5 days in *S. boehmi*, which is considerably longer than in European *Sylvia* species. Moreover, the comparison of studies of the post-fledging period in European *Sylvia* species to the two African species yielded a high correlation between time to independence and annual fecundity, i. e. the lower the annual fecundity of the species, the longer the period of parental care. As extended parental care can be expected to enhance the survival probability of the fledglings, it can be considered to be a strategy in tropical species to compensate for the low annual fecundity.

ORA03-4 Immunocompetence of male and female blue tit nestlings under different rearing conditions

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In species exhibiting sexual size dimorphism the discrepancy in competitive abilities between sexes due to differences in body size may affect nutritional status of male and female nestlings. This should be particularly pronounced under poor rearing conditions. Nutritional status affects

many physiological functions like immune function, which in turn may influence the prospects of survival. We studied differences in immunocompetence of male and female nestlings under experimentally altered rearing conditions in blue tits (*Parus caeruleus*), a species showing moderate sexual size dimorphism. To enhance competition between nestlings some broods were enlarged by 3 nestlings, while other broods remained unaltered constituting a control group. The immunocompetence was assessed in 12 d old nestlings with a phytohaemagglutinin test, which reflects T-cell mediated immunity. Nestlings from enlarged broods showed lower immune response than nestlings from control broods, and male nestlings were more immunocompetent than female nestlings. However, there was a significant interaction between gender and experimental treatment indicating that immune response of male and female nestlings differed between experimental groups. Female nestlings from control and enlarged broods did not differ in the level of immune response, while male nestlings from enlarged broods raised significantly lower immune response in comparison with the controls. Nestlings from enlarged broods attained lower body mass and had shorter tarsi than control nestlings. Females were smaller than males and the magnitude of sexual size dimorphism was similarly pronounced in both treatments. The data indicates that males possibly prioritize growth at the costs of development of immune function under food shortage.

ORA03-5 Many a little makes a mickle? Body-mass losses of breeding female great tits under stress

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In 1999 and 2000 we run three field experiments to study the reactions of great tits to changes in their environments. Each nest included in the experiments was monitored by automated weighing. These experiments confirmed that harsher conditions decrease female body mass to the benefit of parental activity. In E1 we studied the effect of decreased morning temperature in the incubation period, in E2 we cooled nest-boxes each morning for a week after hatching, in E3 we tried to mimic nest-disturbance in the peak feeding period by a dangerous and stubborn nest-predator of great tits, the great-spotted woodpecker, *Dendrocopus major*. Cooling in both experiments and the presence of nest-predator decreased female body mass due to changed activity. In the incubation period cooling increased on-bout duration and attentiveness in turn it increased mass loss over on-bouts and decreased the average arrival mass of the females during the treatment period. While repeated cooling each morning did not influence significantly the body mass of 7 days old nestlings, their mothers shortened the length but increased the number of their brooding visits, decreased the length of foraging bouts and lost higher amount of body mass over the first week after hatching. In E3 females had lower body mass not only in the treatment period (1 hour) but also several hours after the treatment.

These results may be interpreted in an individual optimisation framework. However, optimisation of body mass does not exclude that repeated, increased mass loss may have fitness cost, through e.g. decreased immunocompetence.

ORA03-6 Body mass change with age in adult common terns (*Sterna hirundo*)

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In common terns body mass is a consistent individual trait which characterises the state of an adult and which is positively related to its long-term reproductive success. In this paper, however, we show that body mass is increasing during the early breeding career of an individual, and we try to separate possible effects of age and experience. The study was conducted in a common tern colony in the harbour area of Wilhelmshaven at the German Wadden Sea coast. Transponders allowed registration of individuals throughout the breeding season and throughout consecutive years by a system of special antennas, combined with electronic balances for recording of individual body mass change within and between years. Individual body mass was measured during three stages of the breeding season: at arrival, during incubation and during chick rearing when mass is lowest in both sexes. Longitudinal analyses of individual data clearly showed, that both parameters, body mass during incubation and chick rearing, increased up to an age of 5 years. Furthermore, a significant lower body mass was found in first time breeders compared to experienced breeders. We assume that increasing experience enables the birds to cope better with the physiological constraints during migration and reproduction. Explaining the general phenomenon of higher body mass in older birds, our results support the constraint hypothesis and refuse the selection hypothesis (Supported by the Deutsche Forschungsgemeinschaft BE 916/5).

ORA04: Section: Species Interactions

ORA04-1 Geographical and density-dependent switches in interactions between *Parus* spp. and *Fringilla* spp. in European bird communities

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Interspecific interactions are assumed to depend on the overlap in the niches in relation to the available resources. Resource levels probably vary substantially both spatially and temporally, which may reflect to species interactions. In this study, our aim was to explore geographical variation in species interactions by examining the density relationship between potential competitors, resident *Parus* spp. and migrant *Fringilla* spp., across a north-to-south geographical gradient in Europe using 108 bird census results. In addition, we performed a meta-analysis of three experimental studies from northern Europe, where *Parus* densities were manipulated and *Fringilla* responses measured. Two scales were used in analyses, firstly, whole Europe and secondly, dividing Europe into the three major forest biomes. We predicted unimodal density association between *Parus* and *Fringilla* densities; low and intermediate *Parus* densities may enhance *Fringilla* densities in breeding habitat selection through a process called heterospecific attraction, whereas high densities promote interspecific competition and avoidance. The results supported our predictions. At the scale of Europe, *Fringilla* densities were unimodally related to *Parus* densities after controlling for the effect of latitude. Also in central Europe the density association was unimodal, whereas in northern

and southern Europe it was linear and positive. The result of the meta-analysis also indicated that increased *Parus* densities enhanced *Fringilla* densities. These results suggest that species interactions may indeed vary in relation to the density of competitor, which may create geographical variation in interactions. In addition to negative, also positive interspecific interactions, should be taken into account in explaining the abundance and distribution of animals.

ORA04-2 Trade-offs and optimal territory location under predation risk

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From prey perspective, avian predators, on one hand, cause a direct risk of mortality on adult birds, and on the other hand, by preying upon nest predators they may provide protection against nest predation. We tested this latter idea by placing artificial ground nests at different distances away from 9 different goshawk nests. These experiments clearly showed a linear decrease in nest survival with distance and support the idea of goshawks providing protection against nest predation. From prey perspective optimal nest location is a trade-off situation where the risk of being predated by a goshawk is weighed against nest predation risks. If direct predation risk is an inverse function of increasing distance (or area) we can predict that optimal territory (and nest) location is at intermediate distance from a hawk's nest; not too close to avoid excessive risk and not too far to still gain protection against nest predation. We tested this idea by studying the rate with which hazel grouse (ground nesting species, important prey for the goshawk) territories were occupied at different distances from the nearest goshawk nest in northern Finland. We found the predicted unimodal pattern in 2001 (goshawk density high, hazel grouse density low) but not in 2002 (goshawk density low, hazel grouse density high). These results suggest that birds are able to assess the predation risk on themselves and on their nests in the landscape and select their nesting sites accordingly.

ORA04-3 Predation risk causing heterogeneity in boreal forests for small passerines

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Predation, due to its influence on survival and fitness, is important in shaping animal behaviour and organisation, but may also have an indirect influence through the existence of predation risk. The landscape, from a prey perspective, is not homogenous but gradients in predation risk exist. This produces a gradient of good and poor habitat, which is determined by predator encounter rates. Encounter rates are expected to be higher closer to predator nests and decrease outwards. This results in a „predation risk landscape“, i.e. environmental heterogeneity, which may affect habitat selection. We test the existence of a predation risk landscape using resident willow tits and migrant pied flycatchers. With willow tits we examined the natural breeding site and success of some 426 nests in relation to 33 avian predator nests over four years. With pied flycatchers we placed nest boxes at different distances from avian predator nests and observed occupation rates and nesting success of all nests and related these variables with distance to predator nest. In general, our results support the existence of a predation risk landscape, however, more for the migrant than the resident bird. In willow

tits the observed effect of the predator nest varied at different scales, while in flycatchers decreased fitness was observed closer to predator nests. The decreased fitness observed when nesting in the vicinity of predator nests has evolutionary consequences for the habitat selection of birds. Thus we emphasise the importance of predation risk related decisions also at the macro-habitat scale.

ORA04-4 Cost of mobbing calls in the breeding pied flycatcher, *Ficedula hypoleuca*

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Since the predation cost of mobbing calls is not known, we investigated whether the vocalizations of the mobbing pied flycatcher, *Ficedula hypoleuca*, a small migratory hole nesting passerine, increase the risk of nest predation. We use mobbing calls of pied flycatchers to examine whether they could lure predators such as the marten, *Martes martes*. The predators may locate their mobbing prey while resting nearby during the day. Martens usually hunt by night. Within 56 areas, from the top of one the nestboxes we played back mobbing sounds of pied flycatchers while blank tapes were played back from the top of the another nestbox. The trials with mobbing calls were carried out 1–2 hours before the sunset. We put pieces of recently abandoned nests of pied flycatchers and a quail, *Coturnix coturnix*, egg into each of the nestboxes. Predation occurred in a quarter of the trials across all experimental areas. Nestboxes with playbacks of mobbing calls were depredated by martens significantly more than nestboxes with blank tapes. The results of the present study indicate that repeated conspicuous mobbing calls together with possible energetic expenditures may carry a significant cost for birds during the breeding season. We suggest that the costs associated with mobbing may prevent the exaggeration of these signals and ensure mobbing honesty. This can make mobbing behaviour a good model for empirical studies and theoretical modelling in the field of evolutionary ecology.

ORA05: Section: Metabolic Rates and Environment

ORA05-1 The physiology-life history nexus in larks: Is parental effort related to environmental aridity?

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We compared physiological, demographic and ecological variables of larks to gain insights into life history variation along an aridity gradient, incorporating phylogenetic relationships in analyses when appropriate. Quantifying field metabolic rate (FMR) and water influx rate (WIR) of parents feeding nestlings as measures of parental effort, we found that parental FMR and WIR were lower by 17–43% and 41–59%, respectively, in larks from arid environments compared with species from mesic areas.

Water and energy requirements of 6–8 day old nestlings were reduced in desert species. Nestling growth rate, clutch size and number of clutches decreased with increasing aridity, and nest predation rates increased with increasing aridity. We combined FMR and WIR of parents and chicks, energy and water accumulated during growth, and brood size to establish energy and water budgets of parent-brood units. Parent-offspring energy budgets were 28% lower in the desert species when taking into account mass differences. Parent-brood units of arid-zone species used 28–52% less water per gram mass than species from mesic areas. These results support the hypothesis that decreasing food and water availability favor lower energy and water requirements of parents and young, reduced growth rates, and smaller clutch sizes with increasing aridity. The decrease in parental effort with increasing aridity might reflect a lower fitness value of a single brood for arid-zone species than for larks from mesic habitats, suggesting that the probability of adult survival is higher in arid than in mesic areas.

ORA05-2 Low levels of energy expenditures in nocturnal continental waders

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Waders are known to have relatively high levels of energy expenditures in temperate climates. But most studies have focused on coastal and wetland species. We do not know whether a low BMR is a genotypic attribute of all charadrii species or is an adaptive response to their expensive way of life in unsheltered and windy habitats. In case of adaptive response, we might expect that species living under milder conditions and/or habitats would show lower energetic rates. We predict that the reduction of heat loss for birds living in sheltered habitat may lead to low energetic rates. Moreover, nocturnal birds could save energy by resting during the day in sheltered habitat and being active at night, when the costs for thermoregulation are higher. We tested these hypotheses in two species of waders that had never been studied earlier: the Eurasian woodcock *Scolopax rusticola* (living in forests and meadows) and the stone-curlew *Burhinus oedipnemus* (living in cultivated plains). Both species have relatively similar body masses and are mostly nocturnal. Basal Metabolic Rate (BMR) and thermoregulation costs were measured at rest in a respirometer chamber, in winter on wild birds for woodcocks, and in summer on captive chicks for stone-curlews. Both species showed low BMR and high plumage isolation compared with coastal waders. Thus, BMR would be an adaptive response to local energetic constraints and not a genotypic attribute of the Charadrii suborder. The causes of low BMR (sheltered habitat vs. nocturnal activity) cannot be determined yet.

ORA05-3 Metabolic adjustments in starlings (*Sturnus vulgaris*) coping with diminishing food reward rates

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To understand, and ultimately predict animal behaviour, it is important to assess the energy budget under a range of potential conditions. We studied the effects of diminishing food resources on the

foraging activity and on the energy budget of starlings, *Sturnus vulgaris*. The birds were living in a closed economy and had to fly between perches, 5 m apart, to earn food. To manipulate mean foraging reward rate, while introducing random variation around the mean, we altered the probability of obtaining a food pellet after one return flight. Total food intake and excreta were measured to obtain individual DME, and corrected for body mass change monitored by perch devices to obtain DEE. The birds experienced a 14:10 hr light cycle and at some nights were kept in a respirometer for indirect calorimetry. Preparatory trials included respirometry by day and night in birds restrained in small cages precluding flight. Eight birds alternately lived in a poor, intermediate and rich environment for 7 days (intermediate) to 17 days (rich and poor) at a time, 4 each beginning at either extreme. Birds in a poor environment flew 4 times as much (i.e. 2.3 h per day) and increased their DEE with a factor 1.4 to peak at 220 kJ/d, equivalent to 3.7 BMR. At the same time body mass, BMR and pectoral muscle size were reduced. Energy expenditure during the 10h night was further reduced by a steeper decrease in metabolic rate by birds under the stringent regime, where BMR was reached earlier during the night. Although under the poor regime birds reduced body mass, BMR expressed on a mass specific basis remained unchanged. Flight costs were derived indirectly from assembling the total energy budget, and estimated at 17.5 W, closely similar to prior direct measurements of short flights in the same system, but greatly in excess of costs of sustained flight. By reducing body mass by 20%, and economising during sleep, the birds achieved savings of 37% in their DEE. There was a clear effect of the starting treatment on body mass: birds that started in the poor environment did not regain mass up to the level of the birds that had started in rich conditions, possibly because their digestive system had not yet recovered after initial reduction.

ORA06: Section: Miscellaneous

ORA06-1 How consistent are the effects of patch size and landscape structure on density and nest success of birds?

The need of replication in time and space.

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An implicit assumption of small-scale field studies is that results from a single area, or short time period can be generalized far more broadly. Failure of this implicit assumption could potentially have detrimental consequences, when management decisions are based on the results of small-scale studies. We explicitly tested whether effects of patch size and landscape features on bird density and nesting success could be generalized across moderate distances (150 km), time periods (4 years), and numbers of species (three grassland passerines). Our results suggest that while some generalizations may hold across these moderate scales, there was also considerable variation in the effects of landscape structure on bird populations across both space and time. Such variation may be present in any system, such as the North American tallgrass prairie ecosystem which we studied.

ORA06-2 Potential impact of global climate change on species richness of long-distance migrants

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For avian communities one could find some cases of changing phenology and range shifts caused by changing climate but only little evidence exists demonstrating that global climate change leads to systematic changes in the structure of bird communities. One would expect warmer winters to lead to declines in long-distance migrants if resident birds benefit from warmer winters and impose increasing competitive pressure on migrants. To study the potential influence of global climate change on long-distance migrants, we correlated the number of all species of land birds, and the number and proportion of long-distance migrants, short-distance migrants, and residents in 595 grid cells across Europe. We used mean temperature of the coldest month, mean spring temperature, and spring precipitation as measures of climatic conditions in winter and during the breeding period. The number and proportion of long-distance migrants decreased with increasing winter temperature, decreasing spring temperature, and increasing spring precipitation. We used this spatial relationship between bird community structure and climate in Europe to make predictions for changes in the bird communities in the Lake Constance region, Central Europe, between two census periods (1980–1981 and 1990–1992). Winter temperature in this region increased significantly between the two censuses, whereas spring temperature and precipitation did not change. As predicted from the models the proportion of long-distance migrants decreased and the number and proportion of short-distance migrants and residents increased between the two censuses. The significant declines of the long-distance migrants in the Lake Constance region are of a magnitude that can be explained by the observed climate change. In further studies we make predictions for other regions within Europe and test the explanatory power of our model but our present results suggest that increasingly warmer winters might possibly have a more severe threat on long-distance migrants than on the other bird groups.

ORA06-3 Postfledging night movements of reed warblers – a telemetry study.

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We studied postfledging period of reed warblers on the Courish spit of Baltic Sea in summer 2002 by telemetry method. Tags were attached to certain local birds, which had been previously ringed as nestlings. Age of marking varied between 25 and 46 days. We traced movements of 21 young birds, which were under control during 24 hours. In an early stage, night activity was realized as flight (age $31,7 \pm 1,5$ days for birds marked before 30 days old, $n = 7$), but we registered changes of signal, which could be related to changes of the bird's body position. At the age of $37,2 \pm 2,8$ ($n = 18$) days range of night movements reached dozens of meters, birds at age of ca. 40 days covered 200–500 meters, spent until 5 minutes in the air, whirling above the ground. However, directions of these movements were chosen at random. On average, first disappearances from the study plot were recorded at the age of $40,6 \pm 2,8$ days ($n = 12$). Of 21 birds traced, 7 returned once, 5 – more than once to the birthplace. Searches of the disappeared birds were done both at night in the moment of

night flight and in the morning. We found 9 displaced birds at distance of 800 – 2000 m in reeds at the nearest lake and meadow drains with sedge. According to our observations, daytime movements of traced birds did not exceed a couple of hundred meters. We suggest that night shuttle movements of young reed warblers between patches of reeds and damp places of meadows concern to dispersal and development of navigational target. Daytime movements reflect feeding activity of birds.

ORA06-4 Diet quality, early development and long-term fitness consequences in captive zebra finches (*Taeniopygia guttata*)

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Diet quality is one of the most important environmental factors during early development of animals. Many aspects of avian reproduction can be influenced by the prevailing diet quality. Life history traits, such as clutch size, egg size, growth rate, developmental time, survival, size and morphology, are among these aspects.

Previously it has been shown that breeding zebra finches is very sensitive to diet quality. In this experiment, we manipulated the diet quality of zebra finches, which was breeding freely in walk-in aviaries. Zebra finches with access to high quality diet showed higher reproductive success compared to zebra finches with access to low quality diet. Nestlings raised on high quality diet showed higher growth rates, fledged at heavier masses and achieved heavier adult masses and larger adult sizes compared to nestlings raised on low quality diet.

The prevailing environment during early development may not only shape the size and morphology of individual birds, but also affect the reproductive abilities later in life. Hence, the diet quality during early development may impose long-term fitness consequences on individual birds. We investigated whether the reproductive performance of adult zebra finches was influenced by the diet quality during their early development. Here, we present the preliminary results of the long-term fitness consequences of diet quality during the early development of zebra finches.

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