Sex at second sight. Pitfalls of sexing Water Rails *Rallus aquaticus* and Spotted Crakes *Porzana porzana* using morphology and molecular techniques

Alexander EILERS, Angela SCHMITZ ORNÉS & Martin HAASE

Vogelwarte Hiddensee, Zoological Institute and Museum, Ernst Moritz Arndt University of Greifswald, Soldmannstraße 23, 17489 Greifswald, GERMANY, email: alexandereilers@uni-greifswald.de


Abstract. Based on plumage traits it is impossible to reliably identify the sex of Water Rail *Rallus aquaticus* and Spotted Crake *Porzana porzana*. In order to analyze their sexual size dimorphism we collected morphometric data and, for genetic control, feather pins as DNA source of 71 adult Water Rails and 31 Spotted Crakes during the breeding season 2008–2009. We determined the sex of each individual using PCR based molecular techniques taking into account the length polymorphism of the sex linked CHD1Z allele encountered in Water Rails. The polymorphism of this sex marker may have caused erroneous conclusions in previous studies using different approaches. In the present case, unawareness of the polymorphism would have lead to the misclassification of 50.8% of the individuals, which would result in problems with morphological comparison of the sexes. In general, males of both species were significantly larger than females. However, single measurements partly showed a high overlap of the sexes. Conducting a stepwise discriminant function analysis revealed bill, maximum wing chord and tarsus length as best discriminants for Water Rail. The resultant discriminant function, which allows assigning an individual to one of the sexes with a specific accuracy by its body measurements, correctly classified 98.6%. In Spotted Crakes the analysis included tarsus and wing length into the model and assigned the sex with an accuracy of 100%. The discriminant functions thus represent a simple and cost efficient way to determine the sex of these rallids for field ornithologists.

Key words: Rallidae, molecular sexing, sexual dimorphism, heterozygosity, morphology, discriminant function analysis

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INTRODUCTION

Sexual dimorphism is common and widespread in animals and describes inter-sexual differences in the morphology of a species. Sexual dimorphism plays a significant role in mating systems and in life history (Fairbairn et al. 2007). In birds, these differences can be expressed in plumage coloration and in body size. Sexual size dimorphism (SSD) varies between species and with some exceptions (reversed SSD) male birds are larger than females (Andersson 1994). In monomorphic bird species, sex identification using plumage traits or other indicators like e.g. brood patches is often difficult or impossible (Svensson 1992, Winkler & Jenni 2007). For that reason molecular sexing methods based on a conserved part on avian sex chromosomes, an intron of the ‘Chromo-Helicase-DNA Binding Protein’ (CHD gene, Ellegren 1996), became more prevalent during the last years due to reliable and affordable tests. In general, the established tests (Griffiths et al. 1998, Kahn et al. 1998, Fridolfsson & Ellegren 1999) are considered exact and reliable under certain conditions (Jensen et al. 2003, dos Remedios et al. 2010). On the other hand, comparative studies of different molecular sexing methods revealed inaccuracies (Lee & Griffiths 2003, Robertson & Gemmell 2006, Ong & Vellayan 2008).

Recently, several bird species were reported to be heterozygous at the CHD-Z locus (Dawson et al. 2002, Lee et al. 2002, Schroeder et al. 2008, Casey et al. 2009). The above mentioned sexing tests expect to amplify fragments of the same length from each chromosome (ZZ) in males and fragments of different length in females (ZW) resulting in a single or double band, respectively, on agarose gels. The consequence of the CHD-Z heterozygosity is that males may be mistaken for females. If this polymorphism is neglected the
Hunger is not the only determinant of nestling begging behavior and parental feeding in the Black-billed Magpie *Pica pica*

Sang-Im LEE1,2, Jin CHOI3,4 & Jae Chun CHOE3,*

1Institute of Advanced Machinery and Design, Seoul National University, Seoul 151–742, KOREA  
2Laboratory of Behavioral Ecology and Evolution, Department of Biological Sciences, Seoul National University, Seoul 151–742, KOREA  
3Laboratory of Behavior and Ecology, Division of EcoScience, Ewha Womans University, Seoul 120–750, KOREA  
4Current address: Department of Theriogenology and Biotechnology, College of Veterinary Medicine, Seoul National University, Seoul 151–742, KOREA  
*Corresponding author, e-mail: jaechoe@ewha.ac.kr


Abstract. Nestlings can employ a combination of tactics to obtain provisioning from the parents. In this observational study, we examined whether nestling begging behavior reflects hunger level and how parents respond to nestling begging in the Black-billed Magpie *Pica pica* by putting small video-cameras in six Magpie nests. Our results revealed a strong effect of nestling begging behavior on parental feeding. Begging earlier than others and stretching the neck towards the parent was important in inducing parental provisioning regardless of age of the nestlings. Being closer to the nest entrance slightly increased the chance of being fed, but did not influence parental feeding priority. The number of nestling begging events increased with the time interval since the last feeding, which indicates that begging frequency reflects the hunger level of the brood. However, in contrast to what can be predicted when begging behavior reflects hunger levels of nestlings, nestlings increased their begging level when parents provided more feedings in the previous visits and vocalized begging negatively affected the probability and the order of being fed by the parent. In addition, sensitivity in begging behavior and parental feeding decisions depended on nestlings’ age, which suggests a possibility that parental feeding decisions change with growth stages of nestlings. Our results imply that begging behavior and food allocation in Magpies does not solely determined by the hunger level of nestlings.

Key words: nestling begging, parental feeding, signal of hunger, Black-billed Magpie

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INTRODUCTION

Parental provisioning at the early stage of offspring development can enhance the fitness of offspring, and by extension, parents. In altricial birds, where offspring depend on parental provisioning, nestlings use combinations of tactics to obtain more provisioning effort from the parents: increasing the frequency and intensity of begging (Whittingham et al. 2003), securing better positions in the nest (Kölliker et al. 1998, Kölliker & Richner 2004, Porkert & Spinka 2006), using vocalization while gaping (Price 1998, Glassey & Forbes 2002), and stretching necks towards the parents while gaping (Glassey & Forbes 2002). These features of nestling begging behavior are an outcome of complex dynamics of parent-offspring conflict over the provisioning and allocation of resources (e.g. Mock & Parker 1997 and Wright & Leonard 2002 for reviews, Rodríguez-Gironés et al. 1996 and Hinde et al. 2010 for modeling effort).

There has been considerable interest in the question of honesty of nestlings’ begging signals and the effect of begging calls on food allocation by parents (Godfray 1995, Cotton et al. 1996, Leonard & Horn 1996, Krebs et al. 1999; see Mock et al. 2011 for a review). Parent-offspring conflict theory predicts that nestlings are selected to beg more food from its parent than the latter is selected to give (Clutton-Brock 1991), and thus nestlings are prone to employ exaggerated begging displays with high intensity (e.g. Smith & Montgomerie 1991, Kölliker et al. 1998, Neuen-schwander et al. 2003). Despite this possibility,
Breeding biology of Rock Sparrows *Petronia petronia* in the Tibetan plateau, with special reference to life history variation across altitudes

Shaobin Li & Xin Lu

Department of Zoology, College of Life Sciences, Wuhan University, Wuhan, CHINA 430072, e-mail: luxinwh@gmail.com


Abstract. The Rock Sparrow *Petronia petronia* has been well studied with respect to reproductive biology at low-altitude in Europe, but not at high altitudes. This study presents the information on a Rock Sparrow population breeding in an alpine meadow at 3400 m altitude and compares the life history traits with their lower-altitude counterparts studied in Europe. The birds are resident all year round in this area. Nests of Rock Sparrows tended to cluster and were mainly located in abandoned burrows of the Ground Tit *Parus humilis*. Pairs were monogamous and territorial behaviors were absent, which differed from European populations, where Rock Sparrows show a series of mating systems and display strong territoriality around the nest site. Egg-laying took place between late May and late June, with every pair making a single nesting attempt. Clutch size averaged 5.1 ± 0.9, incubation undertaken by female only lasted 12.7 ± 0.8 days, and young in the nest were fed by both parents for 19.9 ± 0.7 days. Breeding success, measured as the proportion of nests with at least one fledgling, was 89%. Compared to their lower-altitude populations studied in Europe, the high-altitude Rock Sparrows start breeding later, experience a shorter breeding season, produce fewer but bigger eggs, and have a longer nestling period. Such a life history strategy that allows birds to allocate more energy into individual offspring should be adaptive to the harsh high-altitude conditions.

Key words: altitudinal gradient, life history, *Petronia petronia*, reproduction, Tibetan plateau

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INTRODUCTION

Life history theory predicts that birds breeding at high altitudes should invest more energy into individual offspring to increase their chances to survive in harsh conditions (Roff 2002). High altitudes mean adverse environments to many organisms. A number of studies have detected that high-altitude birds tend to produce fewer broods, smaller clutches of bigger eggs than birds at low altitudes (Badyaev 1997, Lu 2005, Lu et al. 2008, 2009, 2010, 2011). Compared to their low-altitude counterparts, high-altitude birds often have longer nestling period, which is an indication of increased parental investment (Badyaev & Ghalambor 2001).

The Rock Sparrow *Petronia petronia* is found from southern Europe through northwestern Africa to the centre of Asia (Zheng 2002). This species is non-migrant in most areas of its range and inhabits various environments, including grasslands, open woodlands, rocky mountains and human settlements (Cramp & Perrins 1994, del Hoyo et al. 2009). Breeding ecology of the Rock Sparrow has been well studied at low altitudes in Europe (Debru 1958, 1961, Muntaner et al. 1983, Cramp & Perrins 1994, Mingozzi et al. 1994, Tavecchia et al. 2002, Griggio et al. 2003). The species breeds solitarily or in colonies from a few to hundreds of pairs, and mainly places nests in crevices, rock cracks, or unoccupied burrows of other species (Cramp & Perrins 1994, del Hoyo et al. 2009). The birds are sexually monomorphic in plumage pattern. Both sexes have a yellow breast patch (a carotenoid-based trait), which distinguishes them from other similar passerine species. They exhibit complex social mating systems, from monogamy to polygamy, and brood desertion occurs in both sexes (Griggio et al. 2003, Griggio & Pilstro 2007).

However, natural history of Rock Sparrows living at high altitudes is poorly known. Here, we report on breeding data collected from an Asian population, situated at 3400 m altitude in
Foraging patterns reveal niche separation in tropical insectivorous birds

Mohammad S. Mansor & Shahrul A. Mohd Sah

School of Biological Sciences, University Sains Malaysia, 11800 Pulau Pinang, MALAYSIA, e-mail: msafulmansor@gmail.com


Abstract. The study examines the uses of attack maneuvers and foraging substrates by ten insectivorous passerine birds to explain how these trophically similar species can coexist in the same habitat, a central question in ecology. Information on the foraging height, attack maneuvers, substrate and foliage density was collected independently for each foraging bird. Sallying was the most frequently used attack maneuver, and leaves were the most frequently used substrate. Statistical analyses showed that the variation in the foraging data was significantly influenced by foraging height, followed by attack maneuver, substrate, and lastly foliage density. The foraging height, the parameters of the attack maneuvers and substrate effectively divided the birds into three foraging guilds: (1) 'High-sally insectivores' — birds that foraged in higher strata using sallying tactics, namely Arctic Warbler Phylloscopus borealis, Black-naped Monarch Hypothymis azurea, Asian Paradise-flycatcher Terpsiphone paradisi and Asian Brown Flycatcher Muscicapa dau urica; (2) 'High-foliage insectivores' — birds that foraged in higher strata using glean-stretch-hang tactics, namely White-bellied Erpornis Erpornis zantholeuca, Green Iora Aegithina virensina, and Pin-striped Tit-babbler Macronous gularis; and (3) 'Understory insectivores' — birds that foraged in lower strata, namely Abbott's Babbler Malacocincla abbotti, Chestnut-winged Babbler Stachyris erythroptera, and Rufescent Prinia Prinia rufescens. Except for Asian Paradise-flycatcher and Asian Brown Flycatcher, no other two species used similar foraging heights, substrates and attack maneuvers at the same time. However, the use of foliage density differed significantly between these two species. Therefore this parameter should also be taken into consideration in analysis of foraging niche in tropical birds.

Key words: behaviour, feeding ecology, insectivores, limestone habitats, tropical forest

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INTRODUCTION

The loss of tropical forests represents one of the greatest threats to the global bird diversity (Niester et al. 2004). Removal of some microhabitat components, such as curled leaves, dead trees and ant swarms, owing to forest destruction may affect insectivorous birds, particularly their foraging patterns (Ford et al. 2001). Studies of foraging ecology provide an understanding of the ways in which ecologically different species partition their resources in a habitat and may reveal how guilds of forest birds respond to disturbance. Resource partitioning reduces the competition rates by decreasing the amount of niche overlaps between the competitor species (Wiens 1989) and thus allows for the existence of the great species diversity. This niche partitioning allows them to coexist in the same geographical area (Kwok 2009).

Generally, insectivorous birds have high habitat specificity and are more confined to the forest interior than other avian feeding guilds, especially in the tropical forest (Canaday 1996). In addition, insectivorous birds are more specialized (Snow 1976) and sensitive to microclimate changes (Karr & Freemark 1983). Unlike fruits, flowers and seeds, insects actively avoid the birds and, as a result, insectivorous birds have developed numerous specialized niches and seek prey on preferred microhabitats (Sekercioglu et al. 2002). The use of foraging substrate and the attack manoeuvres may be different by trophically similar, specialized species (Holmes & Robinson 1988).

The foraging ecology of birds has been intensively studied since the beginning of 1980s (Robinson & Holmes 1982). However, the knowledge on the foraging ecology of tropical birds is incomplete, particularly in the Southeast Asia. Tropical birds vary in size and are easy to detect owing to their often loud vocals and distinctive colours. The babblers (Timaliidae), crows (Corvidae), flycatchers (Muscicapidae), woodpeckers (Picidae), and trogons (Trogonidae) are the keys of Malaysian insectivorous birds (Yong et al. 2011). Perch
Local and landscape-level factors affecting the density and distribution of the Feral Pigeon *Columba livia* var. *domestica* in an urban environment

Katarzyna Przybylska1, Andżelika Haidt1, Łukasz Myczko3, Anna Ekner-Grzyb2, Zuzanna M. Rosin3, Zbigniew Kwieciński1,4, Piotr Tryjanowski1, Joanna Suchodolska1, Viktoria Takacs1, Łukasz Jankowiak2, Marcin Tobólk1, Oskar Wasielewski1, Agnieszka Graclik1, Agata J. Krawczyk5, Adam Kasprzak1, Przemysław Szajkowski6,7, Przemysław Wylegala8, Anna W. Malecha1, Tadeusz Mizera1 & Piotr Skórka9

1Institute of Zoology, Poznań University of Life Sciences, Wojska Polskiego 71 C, 60–625 Poznań, POLAND
2Dept. of Behavioural Ecology, Faculty of Biology, Adam Mickiewicz University, Umultowska 89, 61–614 Poznań, POLAND
3Dept. of Cell Biology, Faculty of Biology, Adam Mickiewicz University, Umultowska 89, 61–614 Poznań, POLAND
4Zoological Garden, Browarna 25, 61–063 Poznań, POLAND
5Dept. of Systematic Zoology, Faculty of Biology, Adam Mickiewicz University, Umultowska 89, 61–614, Poznań, POLAND
6Division of Rural Tourism, Poznań University of Life Sciences, Witosy 45/114B, 61–693 Poznań, POLAND
7Dept. of Animal Physiology and Biochemistry, Poznań University of Life Sciences, Wolsztyńska 35, 60–637 Poznań, POLAND
8Polish Society for Nature Conservation Salamandra, Stolarska 7/3, 60–788 Poznań, POLAND
9Institute of Environmental Sciences, Jagiellonian University, Gronostajowa 7, 30–387 Kraków, POLAND

*Corresponding author: skorasp@poczta.onet.pl*


Abstract. Urbanization is the most dynamic phenomenon worldwide and many species colonize urban environment. Some of these species became so abundant in towns and cities that they are regarded pests, are human health hazard, causes damage to buildings and affect other urban species. Therefore, it is important to understand how such successful colonizers utilize urban environment and which factors affects their population densities. One of such species is the most common urban pest bird in the world, the Feral Pigeon *Columba livia* var. *domestica*. The aim of this study was to investigate how local food resources and the composition of the urban landscape affects densities of Feral Pigeon in the city of Poznań (Western Poland). Three counts were made in summer 2010 in 60 0.5 km x 0.5 km plots (25 ha) distributed randomly across residential areas in the city. The density of pigeons showed significant spatial autocorrelation, both positive and negative one. The density of pigeons was highest in plots with more tall buildings (over four floors), a large number of human-related food resources, schools, and a high proportion of green space. The density of pigeons was lower in plots with a higher density of streets and located further from the city centre. The solution to the pigeon problem appears to be plan residential areas with low-rise buildings. To control the number of pigeons in urban areas, we suggest preventing access to local food resources by using litter-bins that are inaccessible to animals. The public should also be educated to behave appropriately towards pigeons and refrain from feeding them intentionally.

Key words: urban ecosystems, pest, landscape ecology, residential areas, spatial autocorrelation

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INTRODUCTION

Towns and cities are nowadays the most quickly developing areas in the world and they have profound effect on wildlife (Tomiałojć 1976, Marzluff et al. 2001, Lin et al. 2008, Evans et al. 2010). In urban landscapes, the presence of animals is limited by the availability of habitats, human disturbance, collisions with vehicles, predation and behavioural shyness (Górski & Antczak 1999, Fernández-Juricic & Jokimäki 2001, Randler 2003, Chace & Walsh 2006, Ditchkoff et al. 2006, Wang et al. 2009). Although many organisms colonized towns and cities there are some species which are so abundant there, that they have strong direct impact not only on other species but also on humans. Due to their noise, the possible transmission of disease, accumulation of excrement or
Major roads have a negative impact on the Tawny Owl *Strix aluco* and the Little Owl *Athene noctua* populations

Clara C. Silva1, Rui Lourenço2,3*, Sérgio Godinho1, Edgar Gomes1, Helena Sabino-Marques1, Denis Medinās1,3, Vânia Neves1, Carmo Silva1, João E. Rabaça2,3 & António Mira1,3

1Conservation Biology Unit, Department of Biology, University of Évora, 7002–554 Évora, PORTUGAL
2LabOr — Laboratory of Ornithology, Department of Biology, University of Évora, 7002–554 Évora, PORTUGAL
3Mediterranean Ecosystems and Landscapes Research Group, Institute of Mediterranean Agrarian and Environmental Sciences, University of Évora, 7002–554 Évora, PORTUGAL

*Corresponding author, e-mail: ruiazendalourenco@gmail.com


**Abstract.** The increasing road networks threaten ecosystems by direct effects such as increased mortality due to collision with vehicles and by various indirect effects leading to road avoidance. We censused Tawny Owls *Strix aluco* and Little Owls *Athene noctua* in 2005, 2007 and 2009 in a rural landscape in Southern Portugal in order to study the effects of roads and habitat characteristics on Tawny Owl density and Little Owl presence. The presence of both owl species in the 70 census locations was coherent among years. Our results showed that Tawny Owl density near major roads was lower, with the negative effects extending possibly up to 2 km. The probability of Little Owl presence was also negatively affected by the proximity to major roads. The negative effects of roads were significant even considering habitat preferences and spatial autocorrelation, which had the most marked effect on the density or presence of both owls. The reduced occupancy by Tawny Owls and Little Owls of habitats near major roads may be caused by several factors, including increased mortality, disturbance caused by high traffic density, and increased fragmentation. Traffic noise in particular may affect intra-specific communication and hunting efficiency. Consequently, habitat near roads may represent lower-quality territories for owls.

**Key words:** *Athene noctua*, *Strix aluco*, Mediterranean landscape, road mortality, traffic noise

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**INTRODUCTION**

The vast and continuously increasing road networks of modern societies have been revealing huge detrimental effects on natural patterns and processes of landscapes, which often operate in a synergistic way, ultimately leading to the destruction of wildlife habitats in a broad sense (Forman & Alexander 1998, Spellerberg 1998, Trombulak & Frissell 2000). Vehicle-caused mortality of wildlife is one of the most visible direct negative effects of roads, being the main cause of non-natural mortality for millions of birds every year (Erritzoe et al. 2003, Kociolek et al. 2011). Rare and endangered species can be particularly sensitive, since road mortality rates sometimes exceed population input from reproduction and immigration (Forman & Alexander 1998, Trombulak & Frissell 2000). But it has been assumed that some indirect effects of roads may have a greater effect on population persistence than vehicle-caused mortality (Forman & Alexander 1998, Reijnen & Foppen 2006). Major roads, characterized by high traffic, are mostly responsible for pronounced habitat fragmentation, creating a barrier effect capable of isolating wildlife populations into smaller metapopulations, and reducing connectivity (Forman & Alexander 1998, Lodé 2000). The consequent lower rates of genetic interchange among populations can cause the decrease of genetic diversity and other demographic problems that in many cases reduce ecosystem biodiversity and integrity (Forman & Alexander 1998, Trombulak & Frissell 2000, Holderegger & Di Giulio 2010).
Ground nest depredation by European Black-billed Magpies *Pica pica*: an experimental study with artificial nests

Petr Suvorov, Jana Svobodová, Martina Koubová & Lucie Dohnalová

Department of Ecology, Faculty of Environmental Science, Czech University of Life Sciences, Kamýcká 129, 165 21 Prague 6, CZECH REPUBLIC, e-mail: svobodovajana@fzp.czu.cz


Abstract. Nest characteristics can significantly affect specific behaviour of predators during nest depredation, such as relating to nest searching, manipulating and eating eggs. However, the effect of egg size and coloration on behaviour of avian predators rarely has been quantified. Since the European Black-billed Magpie *Pica pica* is regarded as an important nest predator in suburban areas, we studied the effect of different types of artificial ground nests — baited with chicken and quail eggs — on predation probability by magpie. In addition, to compare temporal changes in magpie predation, experimental clutches were installed at 39 active magpie nests in two breeding stages: incubation stage and stage of nestling feeding. In our experiment, magpies detected almost all artificial nests at both breeding stages. However in contrast to our prediction, nests were preferentially depredated at the first stage. This probably was due to the change of magpie foraging preference to invertebrates as a main food of nestlings. Furthermore, we found that predation rate did not differ between real and wax eggs, suggesting that magpies are not able to discriminate between them. Whereas quail eggs were carried away, chicken eggs were consumed in the nest where remnants of egg shell and egg content were left. Obviously, the possibility to immediately carry the egg away increases food attractiveness for magpies. Therefore, we conclude that chicken eggs are more suitable for identification of middle-sized avian predators than quail eggs.

Key words: artificial nest, bird predator, predator-generalist, suburban area

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INTRODUCTION

In Europe, corvids comprise an important group of nest predators in anthropogenic landscapes (Jokimäki & Huhta 2000, Albrecht 2004). Their densities usually increase near human settlements due to such additional food resources as garbage, waste materials or animal cadavers along roads (Jerzak 2001, Anton & Atanasova 2002, Marzluff & Neatherlin 2006). Although many studies have suggested that corvids negatively impact on bird populations in urban areas (e.g. Möller 1988, Groom 1993, Roos 2002, Šálek 2004), no direct link has been shown between the dynamics of corvid populations and the rate of nest predation (Gooch et al. 1991). This is probably due to the fact that most studies have failed to reliably determine species of nest predators. Therefore, they have not been able to evaluate the effect of particular species on nest predation (Danielson et al. 1997, Maier & DeGraaf 2000, Šálek 2004, Thompson & Burhans 2004). Moreover, if predators completely remove particular eggs or whole clutches without leaving evidence of predation events (i.e. egg remains, predator’s footprints, hair and feathers), a possibility of reliable estimation of total predation risk is precluded. In the case of crows, for instance, it has been found that they are able to remove up to 75% of both natural and artificial eggs while leaving no traces (Fjeld & Sonerud 1984, Schaefer 2004). Though such behaviour has been recorded in many other species (Maier & DeGraaf 2000, Rangen et al. 2000, Mazgajski & Rejt 2005, Weidinger 2010), it has not been quantified in particular predators.

Artificial nests are frequently used in various types of studies (e.g. behavioural, Olsen & Schmidt 2004; landscape, Andrén & Angelstam 1988, Yahner & Mahan 1996, Davison & Bollinger 2000), even though some researchers have doubts about their applicability, mainly due to their insufficiency in simulating predation rate on natural
Reproduction and population dynamics of Hawfinches *Coccothraustes coccothraustes* in the primeval forest of Białowieża National Park (NE Poland)

Ludwik TOMIAŁOJĆ

Natural History Museum of Wrocław University, Sienkiewicza 21, 50–335 Wrocław, POLAND, e-mail: tomilu@biol.uni.wroc.pl


Abstract. The breeding performance of Hawfinches was studied during seven years (1991–98, except 1995) under conditions of an extensive close-to-pristine oak-lime-hornbeam forest in the Białowieża National Park, eastern Poland. Two 30–31.5 ha plots were regularly checked each year to find most nests present, usually observed since the period of their construction. Mean clutch size (5.27 ± 0.66, for best year — 5.5) finally produced small family size, owing to a partial loss, fledging and post-fledging mortality. Average breeding losses calculated traditional way were 72.8% (n = 202), mostly due to egg robbing, then predation on nestlings (three times less frequent), and, sporadically, adverse weather conditions at the moment of fledging. Nesting success (5.9–35.7%, 27.2% on average), strongly varying between years, is lower than in most Hawfinch populations from other (anthropogenic) habitats, being one of the lowest among temperate Passerines. In spite of low production of young the species remains numerous across deciduous stands of the Białowieża Forest, with its numbers even increasing since the 1980s. This large and dense population living in an apparently optimal habitat may, sporadically, be supported by influxes from other (anthropogenic?) sites.

Key words: Hawfinch, reproduction, nest mortality, population changes, pristine forest, Białowieża National Park

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INTRODUCTION

Extensive and very natural in its core parts, Białowieża Forest serves as a reference point for several biological field studies carried out elsewhere in equivalent but usually much more transformed secondary woods of Europe (Faliński 1986, Jędrzejewska & Jędrzejewski 1998, Tomiałojć & Wesołowski 2005). For this reason a continuous team work on forest birds, their communities and population dynamics of selected species, has been going on in the Białowieża National Park (BNP) since 1975 (Tomiałojć et al. 1984, Wesołowski & Tomiałojć 1997 and more recent papers).

In addition to some model bird species, also the Hawfinch *Coccothraustes coccothraustes* has been selected for more detailed research, as one of common forest birds widespread across Europe. Yet, in spite of massive amount of data accumulated in the European handbooks (Cramp & Perrins 1994, Glutz von Blotzheim & Bauer 1997), it still remains a rather poorly known species (Mountfort 1957, Bijlsma 1979, 1998, Krüger 1982, Kwiatkowska & Mroczkiewicz 1995, Knysh 1998).

The Hawfinch is a monogamous species breeding across the whole European plain. It has been shown (Glutz von Blotzheim & Bauer 1997, Tomiałojć 2005) that the Białowieża oak-lime-hornbeam stands constitute its near-pristine and apparently optimal (consistently densely populated) breeding habitat. These stands are rather unlike the fragmented, managed woodlands or parklands elsewhere, where earlier Hawfinch studies were carried out. Breeding conditions in the BNP can be briefly characterised by the following set of features: i) continuous, mainly deciduous woodland, populated by the Hawfinches even deep in its interior (Tomiałojć et al. 1984), ii) Hawfinch nesting is restricted to high canopy layers of the oldgrowth (Tomiałojć 2005), iii) during the breeding season the species relies mostly on the forest-interior food resources, and results from the studies in the habitats that were planted, fragmented or otherwise transformed by humans, either in Great Britain, the Netherlands, or in Germany, Poland and Ukraine (Mountfort 1957, Bijlsma 1979, 1998, Krüger 1982, Kwiatkowska & Mroczkiewicz 1995, Knysh 1998).

Reproduction and population dynamics of Hawfinches *Coccothraustes coccothraustes* in the primeval forest of Białowieża National Park (NE Poland)
Winter night inspections of nest boxes affect their occupancy and reuse for roosting by cavity nesting birds

Zdeněk Tyllér¹, Martin Paclík² & Vladimír Reměš¹

¹Department of Zoology and Laboratory of Ornithology, Faculty of Science, Palacký University, tř. Svobody 26, 771 46 Olomouc, CZECH REPUBLIC, e-mail: zdenek.tyller@centrum.cz
²Department of Biology, Faculty of Education, Palacký University, Purkrabská 2, 779 00 Olomouc, CZECH REPUBLIC


Abstract. Overwintering strategies are important for the survival of resident birds in temperate climates and among the most important are adjustments in roosting behaviour. In cavity roosting birds, previous studies have frequently used contact checks of man-made nest boxes to quantify roost-site occupancy. However, there is a concern that occupancy rate estimated by this method may be biased due to procedural disturbance. In this study, we quantified this potential bias by examining the winter time occupancy of 182 nest boxes in a floodplain forest in the Czech Republic. Nest boxes were checked three times a month from November to February 2007–2010 by three methods with decreasing level of potential disturbance. We obtained 1319 records of roosting birds of three species, with 94% being Great Tits, Parus major. We found a considerable decline in nest box occupancy throughout the winter when using the contact method (capture and handling of the bird), whilst occupancy rates remained constant when using the two non-contact methods (visual inspection of the opened nest box; the inspection by Infra red light mini camera passed through the entrance). The contact method was also associated with lower reuse rate of individual nest boxes. In conclusion, the commonly used direct night checks of nest boxes caused a disturbance to roosting birds and thus can lead to biased conclusions when studying winter time roosting behaviour in birds. More generally, this study demonstrates that using nest boxes may introduce bias in studies conducted during the non-breeding season, similarly as has been demonstrated for studies conducted in the breeding season.

Key words: nest box, handling, mini-camera, Great Tit, Parus major, roosting, methods, hole nesting birds

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INTRODUCTION

Winter is a critical period for the survival of animals living at high latitudes. In particular, birds encounter here the multiple pressures of low food abundance, low temperatures and prolonged night time fasting, which imposes considerable requirements for efficient energy management (Moore 1945, Pravosudov & Grubb 1997, Carey & Dawson 1999, Broggi et al. 2004). Increased fat reserves (Lehikoinen 1987, Houston & McNamara 1993, Polo et al. 2007), switching to more energetic food or making food storages (Gibb 1960, Nilsson et al. 1993, Pravosudov & Grubb 1997), and/or flocking when foraging (Suhonen et al. 1993, Lima et al. 1999, Krams 2002). Energy expenditure may be reduced by hibernation (known in the Common Poorwill Phalaenoptilus nuttallii; Jaeger 1949, Withers 1977), night time hypothermia (Mayer et al. 1982, Reinersen & Haftrøn 1986, Cooper & Gessaman 2005), and/or selection of a suitable roost (Moore 1945, Webb & Rogers 1988, Cooper 1999), sometimes combined with grouping within a roost (Knorr 1957, McGovan et al. 2006).

Although open roosts (e.g., in vegetation) are more frequent in birds (Moore 1945, Walsberg 1986, Webb & Rogers 1988), closed ones, especially tree

availability may be increased by seasonal acclimatization (Dawson & Smith 1986, Carey & Dawson 1999, Broggi et al. 2004), increased fat reserves (Lehikoinen 1987, Houston & McNamara 1993, Polo et al. 2007), switching to more energetic food or making food storages (Gibb 1960, Nilsson et al. 1993, Pravosudov & Grubb 1997), and/or flocking when foraging (Suhonen et al. 1993, Lima et al. 1999, Krams 2002). Energy expenditure may be reduced by hibernation (known in the Common Poorwill Phalaenoptilus nuttallii; Jaeger 1949, Withers 1977), night time hypothermia (Mayer et al. 1982, Reinersen & Haftrøn 1986, Cooper & Gessaman 2005), and/or selection of a suitable roost (Moore 1945, Webb & Rogers 1988, Cooper 1999), sometimes combined with grouping within a roost (Knorr 1957, McGovan et al. 2006).

Although open roosts (e.g., in vegetation) are more frequent in birds (Moore 1945, Walsberg 1986, Webb & Rogers 1988), closed ones, especially tree
The weekend bias in recording rare birds: mechanisms and consequences

Michał ŻMIHORSKI1, Tim H. SPARKS2 & Piotr TRYJANOWSKI2*

1Museum and Institute of Zoology, Polish Academy of Sciences, Wilcza 64, 00–679 Warsaw, POLAND
2Institute of Zoology, Poznań University of Life Sciences, Wojska Polskiego 71 C, 60–625 Poznań, POLAND
*Corresponding author, e-mail: piotr.tryjanowski@gmail.com


Abstract. The creation of species lists is a quick and relatively cheap method to evaluate the biodiversity value of some sites and as such they are used in various conservation actions. Species lists typically focus on recording rare and endangered species, usually by volunteers who watch birds during their free time, which may lead to an uneven distribution of observations during the week. We examine whether and to what extent a weekend bias exists in the recording by volunteers of rare bird species. We used a database summarizing 1679 records throughout Poland of 154 rare bird species represented by 2433 individual birds. The proportion of individual birds recorded during weekends was significantly higher than expected by chance. The proportion of records of rare birds that were made during weekends varied from 32.4% in July to 54.9% in November and the weekend bias was lowest during the summer holidays (i.e. July and August). Species varied in their weekend bias, however species size and conspicuousness scores did not explain species-specific weekend bias. Species richness as a function of sampled individuals did not differ between weekends and weekdays. We suggest that potential biases caused by increased weekend recording need to be considered when comparing abundances based on lists from different sites or seasons, e.g. in studies on the effect of weather on birds. Our results suggest that the weekend effect is not qualitative but only reflects changes in sampling effort across the week and therefore records from weekends and weekdays are comparable in term of species composition.

Key words: biodiversity inventories, detectability, holidays, migration, rarities, social effect, vagrants, volunteers

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INTRODUCTION

The creation of species lists is a widely used method for the evaluation of the biodiversity value of some sites and, therefore, it is often used in various conservation actions, for example prioritizing areas for protection (Droege et al. 1998, Roberts et al. 2007, Keil & Hawkins 2009). Despite the fact that the general species richness pattern is mainly composed of common species these analyses focus, in particular, on recording rare and endangered species. However, assessing the distribution and abundance of rare species is a difficult task because of the low probability of finding specimens in random samples, whereas nonrandom sampling may lead to statistical problems (Gaston 1994). This is because in the case of rare species, such as birds, coleopteran beetles, butterflies and others (Gaston 1994), a lot of data is collected by volunteers. It is well known that volunteers are potentially a huge scientific resource in the creation of animal species lists of a particular site and subsequent ecological modelling (e.g. van Strien et al. 2010) but the reliability of data collected in this way should be treated with caution and differences in the performance of volunteers and professionals should be taken into account (Foster-Smith & Evans 2003, Greenwood 2007, Miller-Rushing et al. 2008). Nevertheless, data collected by volunteers are widely used because they are obviously cheaper, and national and international programmes for conservation of biological diversity are seriously under-funded (e.g. Foster-Smith & Evans 2003, Chen 2007). Moreover, in some types of studies, especially atlas and monitoring studies, good quality data collected by relatively numerous and geographically widespread volunteers are crucial to the analysis (see review in Greenwood 2007).
Piracy at the nest: factors driving kleptoparasitic behaviour of Common Tern *Sterna hirundo* chicks

Stephen Oswald¹*, Jennifer Arnold¹, Jeremy Hatch² & Ian Nisbet³

¹Division of Science, Penn State University, Berks Campus, Reading PA 19610, USA
²Department of Biology, University of Massachusetts / Boston, 100 Morrissey Boulevard, Boston, MA 02125, USA
³I. C. T. Nisbet & Company, 150 Alder Lane, North Falmouth, MA 02556, USA

*Corresponding author, e-mail: steve.oswald@psu.edu


Abstract. Stealing of provisioned food items by adult conspecifics (intraspecific kleptoparasitism or piracy) is common among birds, can reduce breeding success and may be one disadvantage of colonial breeding. Theft by chicks from neighbouring broods has rarely been quantified but may have similar reproductive consequences and the factors that influence it require further study. We took advantage of unusually diverse weather during the critical early stages of growth to elucidate the factors driving kleptoparasitic behavior of Common Tern *Sterna hirundo* chicks. Kleptoparasitism was restricted to misty days when large chicks were fed much smaller fish than on other days, inducing them to steal from neighbouring broods with young chicks. Our study indicates that kleptoparasitism by chicks could be a way to overcome shortfalls in parental provisioning, and may be a net cost of colonial breeding. Our results both provide evidence of a potential mechanism behind food-stealing by chicks and suggest hypotheses for future testing.

Key words: intraspecific kleptoparasitism, chick kleptoparasitism, Common Tern, seabird ecology, food provisioning, weather

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Kleptoparasitism (piracy or food-stealing) is commonly observed in birds (Morand-Ferron et al. 2007) and is particularly prevalent in raptors (Brockmann & Barnard 1979) and colonial seabirds (Furness 1987). Although many published studies focus on interspecific kleptoparasitism, the costs and benefits may be analogous for food-stealing by conspecifics (Brockmann & Barnard 1979). This intraspecific kleptoparasitism by adult or subadult birds has been regularly reported, both as opportunistic behaviour and obligate foraging strategy (Brockmann & Barnard 1979, Furness 1987). In fact, one possible disadvantage of colonial nesting is an increased frequency of intraspecific interactions (Coulson 2001), including aggression and kleptoparasitism (e.g. Ramos 2003, Oswald et al. 2005).

Food-stealing by chicks is much less commonly reported but has been noted with sufficient frequency in waterbird species, including the Common Tern *Sterna hirundo*, to suggest it may have some adaptive significance (Elston et al. 1978, Nisbet et al. 1978, Elston & Southern 1983, Fetterolf 1983, Dulude et al. 1987, Burger & Gochfeld 1991, Ludwigs 1998, Sudmann 1998, Buckley & Buckley 2002, Muller & Storer 2002, Ramos 2003, Arnold et al. 2004, Becker & Ludwigs 2004, Oswald et al. 2005, Jakubas 2009). Unfortunately, only five of these studies separated incidences of chick-initiated kleptoparasitism from those initiated by adults (Nisbet et al. 1978, Fetterolf 1983, Sudmann 1998, Oswald et al. 2005, Jakubas 2009). These papers suggest that food-stealing by chicks can have reproductive consequences but the evidence is currently insufficient to identify more general explanations of its proximate causes. Nisbet et al. (1978) reported that the older chick from a food-stressed brood survived