

Influence of habitat and nest-site quality on the breeding performance of Lanner Falcons *Falco biarmicus*

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Abstract. Site quality may influence breeding performance especially in raptors showing strong territory fidelity as predicted by the site-dependent population regulation hypothesis. Thus, the occupancy of nest-sites is non-random, indicating a preference of certain territories, apparently of higher quality. During four breeding seasons (2003–2006), we recorded the occupancy rate and the number of young fledged from Lanner Falcon *Falco biarmicus feldeggii* nest-sites in eastern Sicily, Italy. Breeding sites with different occupancy rates showed significant differences in environmental attributes, mainly altitude. A generalised linear model revealed a significant effect of the slope of the nest-site on mean fledgling number per successful pair. In addition, the mean slope of the nest territory and the slope of the nest-site are the main predictors for differentiating the cliff selection by Lanners and by much more competitive Peregrine Falcons *Falco peregrinus*. Finally, our results suggest a crucial role of the high quality sites for the population viability. Occupancy rates were positively related to the mean number of young fledged per territorial pair and during the four years of the study period six high quality nest-sites raised 58% of young produced in the whole study area. We suggest that the annual production of young of the high quality territories should be preserved and that evaluation of the effective contribution of the low quality sites for the persistence of a viable population in Sicily should be performed.

Key words: territory quality, occupancy, *Falco biarmicus feldeggii*, Sicily, nest site selection

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Relationships between nest-cavity and mate selection, reproductive performance and fidelity in the Mediterranean endemic Yelkouan Shearwater *Puffinus yelkouan*

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Abstract. Nest and mate choice is important in seabirds, influencing reproductive performance as both nest-site and partner quality varies. The Yelkouan Shearwater *Puffinus yelkouan* nests mainly in pre-existing cavities and to a lesser extent in cavities it excavates. We have monitored breeding colonies of the Yelkouan Shearwater on two islands of the Hyères archipelago, south-east of France, for nine years to analyse nest-cavity and mate selection, to evaluate nest-cavity and mate fidelity, and to investigate their relationships with reproductive performance. Yelkouan Shearwaters selected nest-cavities providing a high degree of concealment and protection. Reproductive performance and fidelity to cavity were highest in deep cavities with a winding tunnel and a steep slope around the entrance. Mating was assortative for bill and tarsus measurements. High rates of return to the same cavity (94.7%) and mate (95.5%) were recorded. Fidelity to nest-cavity was highest when breeding succeeded the previous year (fidelity rate: 97.3% in successful breeders vs. 87.8% in unsuccessful breeders) and was most likely to result in successful breeding the same year (breeding success: 67.5% in faithful breeders vs. 43.8% in movers). The rate of divorce was low (4.5%), did not differ between islands and was not associated with breeding performance. However, breeding success increased by $22.2 \pm 9.9\%$ after mate change following a divorce or the absence of a previous mate. Such high rates of nest-cavity and mate fidelity could indicate a good population status with breeding habitat, food resource and mates of good quality.

Key words: mate choice, mate fidelity, nest fidelity, nest-site choice, Procellariiformes, reproductive performance, sexual size dimorphism

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Nest-site and landscape characteristics affect the distribution of breeding pairs of European Rollers *Coracias garullus* in an agricultural area of southeastern France

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Bouvier J.-C., Muller I., Génard M., Lescourret F., Lavigne C. 2014. Nest-site and landscape characteristics affect the distribution of breeding pairs of European Rollers *Coracias garullus* in an agricultural area of southeastern France. *Acta Ornithol.* 49: 23–32. DOI 10.3161/000164514X682869

Abstract. Understanding factors that drive the choice of breeding habitats for birds is important for species management and conservation. We addressed this question in the case of the European Roller *Coracias garrulus*, an endangered species listed in Annex I of the European Union directive for bird conservation. For secondary hole-nesting birds, such as rollers, the breeding micro- and macrohabitat selection may rely on the location of the nest hole in a tree and its immediate surrounding environment as well as the larger scale foraging habitat. We used both of these criteria to compare the characteristics of Green Woodpecker *Picus viridis* holes that either were or were not occupied by breeding pairs of the European Roller. Our study was carried out in an agricultural landscape of southeastern France where the population of European Roller is trending towards an increase. When compared to unoccupied holes, occupied holes were at a lower height (approx. 6 m above ground) and were preferentially located in dead trees with other holes in close vicinity. Occupied holes were also located in landscapes with lower land use intensity (i.e., higher proportions of meadows, fallow lands, and fewer hedgerows and built areas) than non-occupied holes. Finally, fallow lands and meadows harboured more Orthoptera, an important food resource for rollers, than other land cover categories. Thus, our results highlight the importance of these land covers for the species management and indicate that they may be favourable areas for nest-box provisioning.

Key words: agro-ecosystem, *Coracias garrulus*, conservation, European Roller, habitat selection, nest sites, cavity nesting birds

Spatial distribution and breeding performance of Golden Eagles *Aquila chrysaetos* in Sicily: implications for conservation

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Di Vittorio M., López-López P. 2014. Spatial distribution and breeding performance of Golden Eagles *Aquila chrysaetos* in Sicily: implications for conservation. *Acta Ornithol.* 49: 33–45. DOI 10.3161/000164514X682878

Abstract. Understanding ecological requirements of animals is essential to improve habitat management and conservation strategies for endangered species. However, as most studies on Golden Eagle's habitat preferences and breeding ecology have been conducted in northern latitudes (e.g. USA, Scotland, Scandinavia and the European Alpine region), our knowledge of the species ecology in the Mediterranean basin is more limited. Currently, only 16 pairs still remain in Sicily (southern Italy) and in spite of this delicate status of conservation, there were no previous attempts to analyse ecological requirements of the species in the island. Therefore, we monitored Golden Eagles from 1990 to 2012, analyzed habitat characteristics of breeding territories and quantified habitat relationships with breeding performance. We used a case-control design through Generalized Linear Models to examine ecological descriptors at two different spatial scales: (i) "territory" defined as a plot of 4 km radius centered in the nesting area; and (ii) "landscape" by means of the 10 × 10 km Universal Transversal Mercator (UTM) cells where the species was present or absent. At the territory scale, the presence of Golden Eagle was positively related to the ruggedness of the terrain and to the extension of arable land, and negatively to the extension of forests. At the landscape scale the presence of the species was positively correlated with the range of slope and negatively to the aridity of the surrounding landscape and the extension of forest areas. The Golden Eagle has experienced a strong decline in breeding performance during the last two decades in Sicily, which negatively impacted population dynamics. The best model at the territory scale included the surface of sparsely vegetated areas (i.e. a surrogate of prey availability) as the best predictor of breeding output (i.e. number of young fledged). At the landscape scale, the best predictor of breeding output was the average annual temperature (positive effect) and surface of artificial lands (negative effect). Significant differences in environmental characteristics were found between occupied and unoccupied sampling units and between territories of high and low breeding performance. Our results highlight the importance of maintaining the structure of landscape arising from traditional forms of extensive agriculture in the Mediterranean basin, thereby favouring prey availability, and the importance of limiting human activities and changes in land use in rugged mountainous areas.

Key words: agriculture, *Aquila chrysaetos*, distribution, GIS, habitat heterogeneity, Italy, raptors, spatial analysis, variance partitioning

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Intensity of melanin-based color and risk of predation in the Barn Swallow *Hirundo rustica*

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Galván I., Nielsen J. T., Møller A. P. 2014. Intensity of melanin-based color and risk of predation in the Barn Swallow *Hirundo rustica*. *Acta Ornithol.* 49: 47–56. DOI 10.3161/000164514X682887

Abstract. Predators are supposed to exert strong selection pressures on their prey, especially when phenotypic traits such as secondary sexual characters promote mating success at the expense of costs in terms of natural selection. Signaling theory predicts that individuals of superior phenotypic quality will enjoy an advantage in terms of mating success, but also in terms of natural selection, if such individuals are in prime condition both before and after development of exaggerated secondary sexual characters. We tested this prediction in the Barn Swallow *Hirundo rustica* being preyed upon by the Eurasian Sparrowhawk *Accipiter nisus*, using extensive samples of feathers from prey and non-prey. We measured tail length and coloration of outermost tail feathers in the black area of the proximal and distal part of tail feathers, but also the white spot of the tail feathers. Prey had significantly less dark distal, but not proximal parts of their tails, while there was no difference in coloration of the white spot between prey and non-prey. Prey had significantly paler tail feathers than non-prey, especially among long-tailed individuals. These results suggest that Barn Swallows with long tails that fail to deposit large amounts of melanin in their tail feathers run an elevated risk of predation.

Key words: coloration, ornaments, predation, sexual selection, signals, Sparrowhawk

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A multi-isotope ($\delta^2\text{H}$, $\delta^{13}\text{C}$, $\delta^{15}\text{N}$) approach to establishing migratory connectivity in Palearctic-Afrotropical migrants: An example using Wood Warblers *Phylloscopus sibilatrix*

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Hobson K. A., Van Wilgenburg S. L., Wesołowski T., Maziarz M., Bijlsma R. G., Grendelmeier A., Mallord J. W. 2014. A multi-isotope ($\delta^2\text{H}$, $\delta^{13}\text{C}$, $\delta^{15}\text{N}$) approach to establishing migratory connectivity in Palearctic-Afrotropical migrants: An example using Wood Warblers *Phylloscopus sibilatrix*. *Acta Ornithol.* 49: 57–69. DOI 10.3161/000164514X682896

Abstract. Wood Warblers *Phylloscopus sibilatrix* have declined considerably throughout most of their north and western breeding range in Europe but the causes of this decline are unknown. Declines may be related to factors on the breeding grounds, stopover sites and/or wintering grounds. We used multi-isotope ($\delta^2\text{H}$, $\delta^{13}\text{C}$, $\delta^{15}\text{N}$) measurements of winter-grown feathers of 314 individuals breeding in the Białowieża Forest (E Poland) to infer where they wintered in sub-Saharan Africa over a 4-year period from 2009–2012. We used both aspatial and spatially specific assignment techniques involving a previously developed clustering algorithm related to long-term patterns of precipitation ($\delta^2\text{H}$) and theoretical plant-based isoscapes ($\delta^{13}\text{C}$, $\delta^{15}\text{N}$) for Africa. We determined that our breeding population was consistently assigned to the forested region of the Congo basin. Males were more depleted in ^{13}C and ^2H and more enriched in ^{15}N than females suggesting potential sexual habitat segregation on the wintering grounds. We then similarly examined less extensive samples from Wood Warblers breeding in England, Netherlands, Germany, Switzerland and Karelia (NW Russia), and found a similar assignment to the Congo basin. For all sites, males were isotopically distinct from females suggesting sex-specific habitat segregation on the wintering grounds. Our geospatial assignment model now provides a protocol for testing the hypothesis that declining populations winter more in heavily fragmented forests of west Africa compared to the Congo basin. We encourage this approach for the investigation of migratory connectivity in other sub-Saharan Afrotropical migrants.

Key words: stable isotopes, migratory connectivity, wintering sites, deuterium, carbon-13, nitrogen-15, isoscapes, *Phylloscopus sibilatrix*

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Body size variation of European Storm Petrels *Hydrobates pelagicus* in relation to environmental variables

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Jakubas D., Wojczulanis-Jakubas K., Jensen J-K. 2014. Body size variation of European Storm Petrels *Hydrobates pelagicus* in relation to environmental variables. Acta Ornithol. 49: 71–82. DOI 10.3161/000164514X682904

Abstract. Body size differentiation may have developed in response to environmental gradients. A pattern of large individuals prevailing in colder areas is often observed and is explained by the heat conservation hypothesis (Bergmann's rule). To understand patterns driving body size variation in a pelagic seabird, the European Storm Petrel *Hydrobates pelagicus*, we examined the relationship between wing length, body mass and environmental variables in breeding areas (sea surface temperature, air temperature and wind speed). As this species has been divided into two subspecies: Mediterranean *H. p. melitensis* and Atlantic *H. p. pelagicus*, we performed the analyses at different scales (species, Atlantic subspecies and regional North Atlantic). At the species and subspecies scales, there was a longitudinal increase in wing length from west to east. At the subspecies and regional scale, we found a latitudinal increase in this variable from south to north. This result and the significant increase of wing length with decreasing sea surface and air temperatures are concordant with Bergmann's rule. In addition, body mass at the species and subspecies scales decreased with increasing wind speed, what may have a functional implication (small body mass may increase manoeuvrability over waves in conditions of stronger wind). Both genetic (two subspecies differing in body size) and environmental factors seem to be important forces driving intercolony variation in body size. Our study on sexual size dimorphism (SSD) revealed that in 156 molecularly sexed adults from the Faeroes, wing and tail length, and body mass exhibited female-biased SSD, while head-bill length showed male-biased SSD. The best discriminant function for sexing based on body measurements correctly classified 75% of individuals. Considering low correctness of proposed functions and geographical variation of body size, use of alternative methods (e.g. molecular tools) is recommended for sex discrimination in the European Storm Petrel.

Key words: seabird, body size variation, molecular sexing, sexual size dimorphism, discriminant function analysis

Nest site selection and breeding success in three *Turdus* thrush species coexisting in an urban environment

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Mikula P., Hromada M., Albrecht T., Tryjanowski P. 2014. Nest site selection and breeding success in three *Turdus* thrush species coexisting in an urban environment. *Acta Ornithol.* 49: 83–92. DOI 10.3161/000164514X682913

Abstract. The process of establishing breeding populations of birds in small towns of Central Europe provides a unique opportunity to study them during synurbization *in statu nascendi*. Over the years 2006–2011, we investigated the breeding ecology of three coexisting thrush species *Turdus* spp. in the urban habitats of the town of Bardejov (NE Slovakia). We studied nest distribution, nest predation in relation to nest placement and the breeding success of the Common Blackbird *T. merula*, Fieldfare *T. pilaris* and Song Thrush *T. philomelos*. The study species differed significantly in terms of microhabitat characteristics and vertical spatial distribution, expressed as the nest location height (Blackbird < Song Thrush < Fieldfare), the distance from the town centre (Fieldfare < Song Thrush < Blackbird), the distance from the nest tree to human paths and buildings (Blackbird < Song Thrush < Fieldfare) and the average distance between breeding conspecific pairs (Fieldfare < Blackbird < Song Thrush). We also found significant differences in nesting microhabitats (conifers, deciduous trees and shrubs) usage (breeding in conifers: Song Thrush < Blackbird < Fieldfare). On the other hand, no significant differences were found in breeding success and predation between species. A major factor affecting the predation rate was the distance between nests and the distance to human paths and buildings, and with Fieldfares and Common Blackbirds also the height of trees and the distance to the town centre. Our results suggest that ecological segregation among closely related species can also be common in a changed, urban environment.

Key words: breeding success, coexistence, nest-habitat partitioning, nest site selection, predation, synurbization, urban habitat, thrushes

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Ecology of Aquatic Warblers *Acrocephalus paludicola* in a fall stopover area on the Atlantic coast of France

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Musseau R., Herrmann V., Bénard S., Kerbiriou C., Hérault T., Jiguet F. 2014. Ecology of Aquatic Warblers *Acrocephalus paludicola* in a fall stopover area on the Atlantic coast of France. *Acta Ornithol.* 49: 93–105. DOI 10.3161/000164514X682922

Abstract. The Aquatic Warbler *Acrocephalus paludicola* is the only endangered songbird in continental Europe. This trans-Saharan migratory bird significantly transits along the French Atlantic coastline during post-breeding migration and the right bank of the Gironde estuary has been identified as an important stopover site. We studied the spatial occupancy strategies of stationing individuals during August of three successive years (2010–2012). We characterized habitat use by radio-tracking individuals revealing relatively small foraging ranges (6.6 ± 2.6 ha on average) with only 1 ha actually exploited (core area), and a relatively high habitat fragmentation rate. Capture-mark-recapture analyses assessed the average stopover duration of individuals and body-mass variations during their stopover. The estimated average stopover duration was 6.46 ± 0.46 days (95% confidence interval: 4.4–9.6). Lean birds tended to forage significantly more than stout birds: on average, they gain $2.81 \pm 0.89\%$ of their initial mass each day whereas stout birds only gain $0.12 \pm 0.56\%$. Analyses of droppings characterized the local diet. We noticed that Aquatic Warbler preferentially used partially-flooded or flooded habitats with heterogeneous and rather low vegetation, such as bulrush beds or bulrush beds mixed with reed beds. Orthoptera, Araneae and Hymenoptera represented the largest contributions to the consumed biomass (64.7%, 13.4% and 8.9% respectively). The importance of the fuel deposition rate of lean birds reflects the importance of the estuary as a stopover site for the species. It means that the available resources allow birds to replenish and continue their migration route. However, the sustainability of the site's functionality is questioned because of the evolution of habitats (erosion, rise in water levels and changes in food web).

Key words: stopover duration, diet, habitats, fuel deposition rate, post-breeding migration, radio tracking

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Partial dietary segregation between adult and nestling Bluethroats *Luscinia svecica*

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Abstract. Several studies have suggested dietary segregation between nestling and adult birds resulting from both dietary requirements of offspring and distance to the foraging sites. We examined the diet in terms of composition and dimension, as the weight, habitat and taxonomy of prey in nestling and adult male and female Bluethroats *Luscinia svecica* spp. *cyaneacula* at a recently colonized area in a mosaic of wetland (with sewage water) and terrestrial habitats in south-west Poland. On the basis of faecal samples collected between 2009–2012 from several broods and 94 adults, we found that nestlings had significantly lower diet diversity, consisting of heavier prey items. Comparing the proportion of seven major food types (order of insects/invertebrate class) we showed that the diet composition of adult and nestling Bluethroats differed significantly. The diet of nestlings contained significantly more soft-bodied prey items, namely Diptera and Lepidopteran larvae, and significantly fewer Coleoptera and Hemiptera. Furthermore, since adult showed marked decrease (contrary to young Bluethroats) of diet diversity and number of prey in the progress of the breeding season, hence our entire findings can imply that nestlings are fed in a selective manner receiving more profitable (soft-bodied and terrestrial) prey, and adults adjust their diet consuming less profitable (more chitinized and smaller) prey. This ultimately suggests the partial dietary segregation between nestling and adult birds, both in the term of size (biomass) and composition of prey. The use of a broad spectrum of food items and various prey types, and particularly the low dependence of nestlings on aquatic insects, suggests that Bluethroats have very plastic dietary requirements, which is most likely a factor facilitating the recent population recovery and adaptation to ecotonal zones between moist/wetland and terrestrial habitats with abundant moist soil, in newly settled areas of Europe.

Key words: diet segregation, nestling diet, prey size, spiders, terrestrial prey

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Seed predation on the ground or in the tree? Size-related differences in behavior and ecology of granivorous birds

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Perea R., Venturas M., Gil L. 2014. Seed predation on the ground or in the tree? Size-related differences in behavior and ecology of granivorous birds. *Acta Ornithol.* 49: 119–130. DOI 10.3161/000164514X682940

Abstract. Seed-eating birds may consume seeds in the tree (pre-dispersal predation) as well as on the ground (post-dispersal predation), usually at contrasting microhabitat conditions. We examined the foraging behaviour and contribution to seed predation of a whole assemblage of seed-eating birds (mostly Fringillidae) at both dispersal phases (pre- and post-dispersal) in a wind-dispersed tree, the European White Elm *Ulmus laevis*. We found that most seed predators were tree-feeding birds that prey upon seeds for longer periods in the tree and spend shorter periods in larger flocks foraging on the ground. We also obtained significant differences in predation speed among the seed predator species. The overall number of seeds consumed by birds, as well as the amount of time spent foraging in the tree, increased with increasing feeding heights. Seed availability increases with height, which seems to be the main reason why birds spend more time foraging on higher branches. Birds strongly differed in their perching coefficient (PC, ration of feeding height to distance from crown edge). Small finches such as Serins *Serinus serinus* and Goldfinches *Carduelis carduelis* had a very high value of PC in comparison to large finches such as Greenfinches *Carduelis chloris*, Chaffinches *Fringilla coelebs*, and Hawfinches *Coccothraustes coccothraustes*. In general, finches showed much higher values of PC than non-fringillid species, indicating a greater adaptation to perch and feed on more flexible stems. Birds increased their overall seed predation and the time allocated to foraging on the ground when they were in flocks. Small finches tended to follow larger finches and flock in multispecies groups when foraging on the ground. We suggest that this behaviour increases both feeding efficiency and safety. Further studies should take into account possible differences in behavior of seed-eating birds throughout the dispersal season since it may have important implications for their adaptive behavior to select new niches.

Key words: feeding height, flocking, foraging behaviour, Fringillidae, predation risk, granivorous bird, seed density

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Extra-pair paternity in Varied Tits *Poecile varius*

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Abstract. Extra-pair paternity is of particular interest in socially monogamous species, in which there is a substantial discrepancy between social and genetic mating systems. Varied Tits *Poecile varius* are socially monogamous passerine birds with a distribution in Japan, Korea, and northeast China. We established paternity in all individuals of 40 broods by microsatellite genotyping. Extra-pair paternity occurred in 16 of the 40 broods (40%) and accounted for about 14.7% (37/251) of offspring, higher than the average value (11%) among socially monogamous birds. The relatedness between social partners did not correlate with the percentage of extra-pair offspring in the brood and there was no difference in heterozygosity between maternal half-siblings. As the first such investigation in this species, this study adds to our understanding of their mating system and will be useful for comparative studies of variations in extra-pair paternity rate.

Key words: extra-pair paternity, paternity identification, mating system, *Parus*

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Individual variation in the over-summering areas of immature Short-toed Snake Eagles *Circaetus gallicus*

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Abstract. Satellite tracking is an invaluable tool in the study of bird movements. However, the normally small sample size it involves makes it difficult to obtain data spanning the entire range of migratory behaviour found in particular populations. We recently reported that Spanish immature Short-toed Snake Eagles leave their winter quarters in sub-Saharan Africa to occupy summering areas in northern Africa (north of the Sahara), in contrast to previously reported behaviour of a young French eagle which remained during the summer in the sub-Saharan wintering range. A more recent increase in the sample size of tracked young snake eagles further extends our knowledge of the summering behaviour of this species with one immature reaching the European range but occupying four widely-separated areas during the course of the summer. In the short-term, technology progress may provide the normal use of representative samples to increase accuracy in movement ecology studies.

Key words: delayed maturation, migration, raptor, satellite tracking, summering behaviour

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