PREFACE

Birds are a commonly acknowledged indicator of biodiversity. This book presents an indigenous perspective on the effects of traditional activities on birds. Moreover, birds are among the main components for plant reproduction in tropical ecosystems, hummingbirds being the most important vertebrate pollinators in the Neotropics. This book puts together different approaches and perspectives to study bird-flower interaction networks, reinforcing the idea of communities displaying high connectedness. In addition, data on the number of occupied territories and breeding frequency (active nests) of nine species of vole-eating birds of prey in Finland are examined, using generalized linear models. It was expected that the effects of global warming on various vole-eating birds of prey at high latitudes were both positive and negative, in particular due to mild winters. Thus, because temperature affects the distribution limits of many organisms, global warming may provoke an advance of distribution ranges polewards. The authors also discuss whether European birds have advanced their distribution ranges mainly northwards in response to climatic warming. Furthermore, fossil footprints provide important evidence regarding the morphology, behavior, distribution, and ecology of ancient animals. For the first time, the entire avian track record is reviewed, including its specialized ichnotaxonomy, from the Mesozoic through the Holocene. How the evidence impacts the understanding of avian evolution and ecology is discussed as well.

Chapter 1 - Fossil footprints provide important evidence regarding the morphology, behavior, distribution, and ecology of ancient animals. In recent years, the ichnological record (pertaining to fossils other than skeletal or body parts, most familiarly and commonly tracks) of major tetrapod clades has been studied intensively. The body fossil record amply demonstrates that the origin of birds lies within the theropod dinosaur lineage (making birds extant dinosaurs, in an evolutionary sense), but the ichnological record contributes much valuable information concerning behavioral shifts during both this evolutionary transition and the early diversification of birds. Here, for the first time, we review the entire avian track record, including its specialized ichnotaxonomy, from the Mesozoic (the "Age of Reptiles," 250-65 million years ago) and Cenozoic (the "Age of Mammals and Birds," 65 million years ago through the present, including the Holocene) and consider how the evidence impacts the understanding of avian evolution and ecology.

Growing evidence from both the skeletal and track records indicates that the initial avian taxonomic, morphological, and ecological radiations took place around the Jurassic-Cretaceous boundary (about 145 million years ago). Tracks similar to, and in some cases indistinguishable from, those made by modern shorebirds (Charadriiformes), small ducks (Anseriformes), small herons (Ciconiidae), and even roadrunners (Cuculiformes) appeared, and were even regionally abundant only 15-20 million years thereafter. In contrast, the oldest body fossil records of anseriforms and possibly charadriiforms occur very close to the end of the Cretaceous (roughly 70 million years ago), and later still for ciconiiforms and cuculiforms. This strongly implies that the early track makers were members of extinct, early avian lineages with which later taxa converged in foot morphology. Feeding traces associated with some of these tracks demonstrate that behaviors reminiscent of extant herons and spoonbills had also evolved by this time. However, despite significant skeletal and footprint finds, there is little correspondence between the records — few footprints match the feet of birds represented by skeletal remains. In short, the familiar morphologies and behaviors of many modern birds actually evolved convergently with many of their extinct, Mesozoic relatives. Footprints thus have the dual benefits of providing an important, and unexpected, complementary record of early avian morphological and ecological diversity while highlighting the importance of morphological and behavioral convergence.

Although the skeletal record suggests an avian taxonomic shift at the "dinosaur-killing" Cretaceous-Paleogene (K-P_g) boundary extinction event, the track record provides insufficient evidence to support or refute such a shift because the dominance of shorebird-like tracks continues uninterrupted from Mesozoic to Cenozoic. Early Paleogene tracks provide evidence of large, *Diatryma*- or *Gastornis*-like, ground dwelling birds in addition to typical shorebirds and waterbirds like the Eocene anseriform *Presbyornis*. Neogene tracks include those of a few large ratites and a turkey-like species; Holocene tracks include those of several species of moa. Unlike its Mesozoic counterpart, the Cenozoic avian body fossil and ichnological records correspond much more closely.

Tracks of perching birds, raptors, and other groups that do not habitually frequent wet shorelines — the most suitable environment for track preservation — are rare. Indeed, the avian track record is dominated by the footprints of shorebirds, with a minor component attributable to large flightless and cursorial forms. Nevertheless, the body of literature on fossil bird tracks is still relatively small (~200 reports), describing about 6 ichnofamilies, comprising about 38 named ichnogenera and 65 ichnospecies.

Chapter 2 - Herons are one of the best represented families in the floodplain of the Paraná River. The fact that interspecific competition constitutes the most significant factor in resources distribution is a prevailing idea in the ecological theory. According to recent studies, even though competition is important, the modeling of the community's structure results from the combined action of other factors which operate independently from the interspecific interaction. The distribution of resources is closely related to the ecological niche concept, this being the quantitative description of the organic unit requirements. It is hypothesized in our work that the studied species: *Ardea cocoi* (White-necked Heron), *Butotides striatus* (Striated Heron), *Bubulcus ibis* (Cattle Egret), *Ardea_alba (*Great Egret), *Egretta thula* (Snowy Egret), Syrigma sibilatrix (Whistling Heron), *Nycticorax nycticorax* (Black-crowned Night Heron), *Tigrisoma lineatum* (Fasciated Tiger-Heron) and *Ixobrychus involucris* (Stripe-backed Bittern), despite of the observed sympatry, have developed adaptative mechanisms of ecological segregation. This allows these species to use the resources in such a way that their diet composition (trophic sub niche) and other parameters of their ecological requirements (temporal sub niche and spatial sub niche) are differentiated. The index of relative importance was applied to calculate the contribution of each food category to the diet of each species. The trophic overlapping of the alimentary spectra, accumulated trophic diversity, alimentary efficiency, dietary selectivity, trophic spread of the niche, spatial sub niche and habitat preference were estimated. As regards trophic spectrum, even though fishes were found to be the basic diet for all four species and insects the second food category, slight differences exist between them which would establish mechanisms at the catches level. This is reinforced by the low overlapping values obtained and the lack of significance in the selectivity values. Variations concerning temporal and spatial sub niches were also obtained. Summarizing, the coexistence is mainly based on the differential utilization of the resources as basic isolation mechanisms and less subtly on space and time. Without leaving aside the usefulness of further research, we think these results provide valuable data for the understanding of the Paraná complex system dynamics.

Chapter 3 - We examined long-term (1986–2008) data on the number of occupied territories and breeding frequency (active nests) of nine species of vole-eating birds of prey in southernmost Finland, using generalized linear models. Explaining variables included wintertime and monthly large-scale climatic conditions indicated by North Atlantic Oscillation (NAO), mean winter and monthly mean ambient temperature and depth of snow cover at five local weather stations, as well as indices of autumn and spring abundance of voles at three localities within or near to the study area. The birds of prey included six site-tenacious species, of which four (*Bubo bubo, Glaucidium passerinum, Strix aluco, Strix uralensis*) were mainly sedentary and two (*Circus aeruginosus, Buteo buteo*) migratory ones, and three more or less nomadic species (*Falco tinnunculus, Asio otus, Aegolius funereus*). We expected that climatic effects were expressed in the numbers and breeding performance of birds of prey largely via their effects on highly fluctuating vole populations. In accordance with earlier findings, numbers and breeding of vole-eaters were largely governed by the abundance of small voles, confirming the suitability of our data to the present purpose. Large-scale climatic phenomena, indicating mild winter conditions, presented a nearly significant positive influence on the numbers and breeding frequency of southerly distributed site-tenacious species (*Buteo buteo, Bubo bubo, Strix aluco).* The combined effect of vole abundance and local mean winter temperature was negative both in sedentary *Strix aluco* and nomadic *Falco tinnunculus.* High temperatures in the beginning and at the end of winter showed positive associations. Thick snow cover combined with vole abundance showed positive associations with numbers and breeding frequency of various kinds of vole-eating birds of prey. The results followed largely our expectations though the link via vole abundance was inadequately demonstrated. Our results suggest that the effects of global warming on various vole-eating birds of prey at high latitudes were both positive and negative, in particular due to mild winters. This would lead to changes in local populations and distribution ranges of species. Due to their flexible moving habits, nomadic species might be less seriously affected than site-tenacious ones that are more dependent on local resources, such as nest sites. From a local point of view and during a short period of time, however, the impact seemed to be more pronounced on nomadic species due to their sudden and drastic shifts.

Chapter 4 - It has been difficult to integrate indigenous knowledge into conservation planning. Although indigenous naturalists have accumulated generations of observations concerning their environments, stereotypes concerning their relationship to nature have frustrated attempts to involve indigenous societies in conservation. However, unencumbered by western philosophy, indigenous naturalists have been developing a dynamic view of nature that incorporates connectedness, disturbance and recovery as a normal course of events in the natural world. This non-linear view of nature has only recently emerged as scientific consensus. In this article, I argue that communication between conservationists and indigenous people can be facilitated by using indigenous knowledge of birds to identify the impacts of tradition on biodiversity. Birds are a commonly acknowledged indicator of biodiversity. Because indigenous people have a long-range perspective on the effects of human activity on avian diversity, they can provide a perspective vital to conservation planning. Drawing on ethno-ecological fieldwork with the Hewa of Papua New Guinea, this paper presents an indigenous perspective on the effects of traditional activities on birds. The Hewa describe their traditions as shaping the environment by creating a mosaic of habitats of varying diversity. I argue that the while the current lifestyle of the Hewa may not necessarily be a template for future sustainability, the Hewa view of the natural world provides insights into the potential of indigenous people to conserve their resources.

Chapter 5 - Because temperature affects the distribution limits of many organisms, global warming may provoke an advance of distribution ranges polewards. This work examines whether European birds have advanced their distribution ranges mainly northwards from 1950 to 1993 in response to climatic warming. Bird species were separated into different categories according to their distribution. The findings show that European birds advanced their distribution ranges northward more than southward. Only northernmost species showed the contrary pattern, probably because their northward expansion was constrained by the Arctic Sea. Birds from the central Europe advanced their distribution ranges primarily northward, strongly suggesting that the change in distribution was occasioned by climate warming, as a change due to other causes predicts equal frequency of species advancing southwards and northwards.

Chapter 6 - Birds are among the main components for plant reproduction in tropical ecosystems, with hummingbirds being the most important vertebrate pollinators in the Neotropics. Flower-visiting birds of another groups (the perching birds) are often considered as parasites of the flower-hummingbird relationships. These birds do not present a high degree of specialization for nectarivory, although nectar should be a very important component of the diet of some groups. Birds usually also visit non-ornithophilous flowers, as they look for resources in flowers adapted to pollination by other animals as well. However, very few studies have focused on non-ornithophilous flowers, which means looking at the whole group of species visited by birds, from the bird's point of view— the *resource approach*. While visiting non-ornithophilous flowers, birds (usually hummingbirds) may act merely like robbers, thieves or even co-pollinators. Therefore, when the aim of the study is pollination, one should not only look for ornithophilous flowers, but also for other possible bird pollinated species, from the flower's point of view—the *pollination approach*. Studies focusing on this last approach are even scarcer at the community level. It is important to realize that the set of *ornithophilous species* are inside the wider set of *pollinated species* by birds, and this one is contained inside the set of *visited species* by birds. Studies that only pick up ornithophilous species from a community are not focussing on pollinated species by birds, but rather on a subset of that. Another problem of point of view is that most studies in the Neotropics are ground based, which may reduce sampling of canopy species information. Observation positions within the canopy greatly enhance this kind of study and should be used more often. As flowers pollinated by perching birds may be more common in the canopies of Neotropical forests, perching bird flowers and their visitors and pollinators are underestimated in communities sampled only from the ground, which means that the majority of the studies on bird-flower interactions in Neotropical forests present good lists of bird and plant species, but very incomplete interaction networks. After putting together these different approaches to study the bird-flower interaction network, we could maybe build—with the help of other animal-flower networks—a picture of a combined model of nested compartments to the whole community, connecting all animal-flower networks by interactions of co-pollination or just visits, reinforcing the idea of communities displaying high connectance.

Chapter 7 – The Beginning of Radar Ornithology: Eric Eastwood (March 12, 1910–October 6, 1981) was one of the first to use radar to study the movement of birds, and many of his studies and those of other pioneers are summarized in his book, *Radar Ornithology* published in 1967. He was elected as Fellow of the Royal Society 1968. In the *Biographical Memoirs of Fellows of the Royal Society,* Vol. 29 (November 1983), p. 177–195, F.E. Jones said the following about Eric Eastwood: "An observation that was to prove of great interest to Eastwood in later years was made by operators at a very early CHL type radar station installed at Happisburgh, on the Norfolk coast. Some echoes were positively identified as coming from a flock of geese crossing the sea. This observation, made in 1940, was the first record of the flight of birds being followed by radar and it led to extensive investigations by Eastwood in later years and to the publication of a book on the subject (Eastwood, 1967)." The CHL (Chain Home Low) radar system was developed to counter the low-level air defense threat to the United Kingdom in 1939.