diversity

Editorial

Avian Ecology and Diversity, Population Monitoring and Conservation: Introduction to the Special Issue

Huw Lloyd

Ecology and Environment Research Centre, Department of Natural Sciences, Manchester Metropolitan University, Manchester M1 5GD, UK; h.lloyd@mmu.ac.uk

Birds represent one of the most widely recognised and well-studied taxa. In recent years, there have been great advances in both the use of new technologies and analytical techniques for studying bird ecology and in the examination of the evolutionary origins of bird diversity and bird distributions. The field has also witnessed a remarkable rise in the use of citizen science initiatives to study birds, which partly reflects the affinity and passion so many people have for this remarkable group of animals. Sadly, populations of many bird species continue to decline worldwide due to climate change and a multitude of other anthropogenic threats. Despite our recent advances, significant knowledge gaps remain in many aspects of avian ecology and diversity. Thus, to address these issues, in the first volume of this Special Issue in the journal *Diversity* on Avian Ecology and Diversity, we wanted to cast the net far and wide, aiming to extend our knowledge on aspects of avian ecology and diversity at all levels. We were particularly interested in the application of traditional or novel methods to other populations, species, or habitats, and the use of new analytical methods to understand aspects of avian ecology and diversity. Our hope is that, collectively, these papers will represent case studies addressing much broader interests, thereby serving as a key resource for future avian ecology, diversity, and conservation research.

In our first volume, we visit some of the evolutionary origins of avian ecology and diversity, specifically with respect to Charadriiformes. Heingard et al. [1] demonstrate how high-resolution computed tomography (μCT) images of Paleogene fossils can provide fascinating insights into divergence dates and the biogeographic histories of birds. Combining data from skeletal and neural morphology in a phylogenetic context, the authors examine the cranium and the reconstruction of the neural anatomy of the extinct taxa *Scandiavis mikkelseni* to reveal that by the early Eocene, avian brain development had reached a level close to that of modern-day birds. Furthermore, *S. mikkelseni* possessed a novel combination of traits, which could indicate that traits previously proposed to be the result of shifts in shorebird ecology later in their evolutionary history may actually be the result of a much more complex distribution of traits in shorebirds and, possibly, within the highly heterogeneous Gruiformes.

Species distribution modelling has revolutionised the way in which we quantify and visualise species habitat preferences at appropriate scales, identify priority areas for bird conservation, and predict how these attributes may change under different climate and land-use scenarios. There are still numerous threatened bird species, habitats, and ecosystems whose conservation strategies would benefit from such research. Two papers in our first volume use such modelling approaches. In the first of these papers, Latt et al. [2] use SDMs to identify suitable habitats and the key environmental factors that influenced the distribution of suitable habitat areas for the Eastern Sarus Crane (*Antigone antigone sharpie*) populations in the ~82,000 km^2 Ayeyarwady Delta Region in Myanmar, an area widely suspected to be one of the most important areas for the sarus crane in the country. Their models revealed that the lower part of the Ayeyarwady Delta is currently suitable for supporting cranes throughout all seasons and that the species is often found in close

check for updates

Citation: Lloyd, H. Avian Ecology and Diversity, Population Monitoring and Conservation: Introduction to the Special Issue. *Diversity* **2023**, *15*, 520. https://doi.org/10.3390/d15040520

Received: 30 March 2023
Accepted: 30 March 2023
Published: 4 April 2023

proximity to human settlements. However, reduced water levels and perennial water sources during the summer and anthropogenically induced higher water levels during the rainy season are having significant impacts on habitat suitability, while the ongoing drainage of wetlands poses a significant long-term threat to the crane population.

In the second paper, Ottó and Végvári [3] use SDMs to identify some of the key climatic predictors governing the historical distribution of the great bustard (*Otis tarda*) within the Carpathian Basin in Central Europe over the past two centuries. This is one of the most threatened species within the order Otidiformes and is currently classified as vulnerable due to population decline, habitat fragmentation, and range contraction alongside significant persecution through hunting. The authors found that future projections for the species predict a further significant reduction in the core area of the range of the great bustard in the region. However, the lowland areas of the basin remain currently bio-climatically suitable for maintaining the bustard population, and three additional regions might have been historically suitable for the species' survival. Nevertheless, the authors caution that these areas are may not been currently suitable given the uncertainty concerning the spatial availability of suitable habitats.

Density estimates are critical for successful bird conservation initiatives because they can link the number of individuals per unit area of habitat to specific on-the-ground conservation measures such as habitat restoration or the creation of protected areas. Density estimates are also relevant for ranking the degree of threat posed to any bird species since the current IUCN criteria are highly quantitative. Two papers in our Special Issue employ distance-sampling methods to estimate the densities of key bird species. Jameel et al. [4] estimated the densities of several Galliform species in Pakistan's Himalaya and Hindukush ranges and found that three Himalayan valleys (Palas, Jalkot and Kandia) have quite stable populations of these iconic species compared to three other neighbouring valleys. In addition, these authors used SDMs to reveal that major infrastructure development projects, illegal hunting, and deforestation still pose significant threats to these montane Galliform populations. Lopez et al. [5] used distance sampling to estimate the densities of two potential indicator species, namely, Lesson's motmot (*Momotus lessonii*) and the turquoise-browed motmot (*Eumomota superciliosa*), in the moist and dry forest habitats of the Karen Mogensen Wildlife Refuge, a protected area of north-western Costa Rica, which is part of the biological corridor of the Nicoya Peninsula. While the overall density estimates were similar for both species, the authors found a clear difference in motmot abundance along survey routes spanning the transition between moist and dry forest habitats, and it was observed that the two motmot species tended to replace each other within moist forests (where Lesson's motmot is more common) and dry forests (in which the turquoise-browed motmot is more commonly recorded).

Another significant challenge for avian ecologists is to broaden our understanding of how habitat quality and food availability influence populations of both resident and migratory bird species. Many highly fragmented landscape mosaics are dominated by agricultural land-use practices, some of which are of national and global economic importance. However, these may pose significant issues, particularly for migrant species that use them for their wintering grounds, since changes to habitat quality are known to influence their body conditions and, ultimately, survival and reproductive success on their breeding grounds. Oliveira et al. [6] examine the territorial behaviour of overwintering American redstarts (*Setophaga ruticilla*) in non-native monocultures of oil palms in a highly fragmented landscape mosaic dominated by other human-modified land cover in the state of Tabasco, Mexico. Oil palm plantations have undergone rapid expansion in the Neotropics, and this is the first study of its kind to identify and map territorial behaviour for wintering American redstarts in oil palm monocultures, a habitat widely considered to be suboptimal for many bird species.

Molina-Marin et al. [7] assessed the effects of landscapes' structure and configuration on the body conditions of neotropical migrant and resident bird species across an elevational gradient through 26 different survey landscapes obtained by the Department of

Caldas, Colombia. These Andean landscapes showed pronounced variation in the levels of anthropogenic disturbance caused by land-use changes from projects undertaken to establish small holdings shade coffee crops and grasslands for cattle grazing. Furthermore, the body conditions of both migrant and resident bird species were positively linked to landscape connectivity, while the influence of forest patch area was only significant for resident bird species. Therefore, maintaining forest connectivity across these highly heterogeneous landscapes will be a critical component for promoting and developing future bird-friendly agroecosystems.

Quantifying avian diets is essential for the in-depth comprehension of patterns of habitat selection, habitat use, and, ultimately, breeding success. Populations of the same species across different sites may show pronounced variation in their diet due to localised differences in the abundance of prey linked to different environmental characteristics; thus, the findings from a single location may not be representative of the species as a whole. Ientile et al. [8] collected the droppings of adult reed warblers (*Acrocephalus scirpaceus*) mist-netted from four different populations in Italy (one in Moderna in the north-east and three on the island of Sicily off the south-west coast). Combining their mist-netting of adult warblers with sweep-netting surveys of arthropod populations, they reveal that all reed warbler populations in the area predominantly fed on Coleoptera, whilst almost a third of their diet was composed of other miscellaneous taxa. This finding differs from what is known about other European breeding populations, which tend to feed on Diptera (which were also the most commonly captured invertebrates in their sweep net surveys). It appears that populations of reed warblers change and adapt their diets to feed on the most available and palatable arthropods in their local environment.

For some species, considerable long-term population data sets are available, which have been collected over many decades using traditional methods and form the basis for avian population-monitoring schemes. Faced with enormous financial constraints, many conservation managers/practitioners today are confronted by the challenge of how best to assess the trajectory of these threatened populations given the contemporary threats of climate and land-use changes. Berger et al. [9] suggest that to provide new insights into population trends, it is not a matter of collecting the data using new methods/technologies but rather analysing these data in new ways through contemporary forms of analyses. In their highly unique study, they reconstruct region-wide population trends for two sympatric, grassland-obligate gamebird species in the Sandhills region in Nebraska, USA, using a 63-year timeseries of breeding ground counts aggregated from old reports and paper archives. Analysing these data using approaches typical for landscape ecology, they show how historical data can be used to address questions of modern-day conservation, identifying unique, species-specific shifts in gamebird abundance and distribution over time, while also unmasking important aspects of changes in grouse populations.

Citizen science programs have transformed public engagement with avian science. Over the years, these programs have taken numerous forms, providing valuable insights into species distributions, migration ecology, and local-scale patterns of diversity, while also leading to much broader engagement and discussions regarding species identification. There are, however, constraints on the interpretation of these data because citizen science programs vary in the ways in which data are collected, and this is a major challenge for avian ecologists examining broad-scale patterns of avian species richness. Butler et al. [10] take up this challenge and investigate the level of agreement on the identification of broad-scale regions of high avian species richness between different citizen science data sets. They use data from museum collections and five different citizen science programs from across 77 counties within the state of Oklahoma, USA, to determine whether each method can identify the same regions of the state with the highest avian species richness, as well as similar avian communities in each location, and whether these methods exhibit a significant correlation in terms of the number of priority conservation species detected. The authors found that the total number of bird species that were detected by each method (of the 460 species known to occur in the state) varied greatly, from 40% to 94% of this total, and that the number of species recorded by county varied depending upon which method was employed as well as the time of year, with few correlations across the different methods. Thus, the selection of the most appropriate data source and understanding any potential bias should be a key part of our investigations into the broader-scale patterns of avian species richness since some citizen science programs are not explicitly designed to identify regions of high biodiversity.

We are immeasurably grateful to all the authors and collaborators for contributing to our first volume of this Special Issue. Collectively, these papers address not only some of the knowledge gaps and highlight recent advances in avian ecology and diversity but also pinpoint and address some of the new and emerging challenges for avian ecologists.

Conflicts of Interest: The author declares no conflict of interest.

References

1. Heingård, M.; Musser, G.; Hall, S.A.; Clarke, J.A. New Remains of *Scandiavis mikkelseni* Inform Avian Phylogenetic Relationships and Brain Evolution. *Diversity* **2021**, *13*, 651. [CrossRef]
2. Latt, T.N.; Chaiyarat, R.; Choowaew, S.; Thongtip, N.; Stewart, T.N. Habitat Suitability of Eastern Sarus Crane (*Antigone Antigone sharpii*) in Ayeyarwady Delta, the Union of Myanmar. *Diversity* **2022**, *14*, 1076. [CrossRef]
3. Ottó, B.; Végvári, Z. Bioclimatic Preferences of the Great Bustard in a Steppe Region. *Diversity* **2022**, *14*, 1138. [CrossRef]
4. Jameel, M.A.; Nadeem, M.S.; Aslam, S.; Ullah, W.; Ahmad, D.; Awan, M.N.; Masroor, W.; Mahmood, T.; Ullah, R.; Anjum, M.Z.; et al. Impact of Human Imposed Pressure on Pheasants of Western Himalayas, Pakistan: Implication for Monitoring and Conservation. *Diversity* **2022**, *14*, 752. [CrossRef]
5. Lopez, D.; Fonda, F.; Monti, F.; Dal Zotto, M. Density Estimates and Habitat Preferences of Two Sympatric Bird Species as Potential Bioindicators of Tropical Forest Alterations. *Diversity* **2023**, *15*, 208. [CrossRef]
6. Oliveira, S.L.; Flaspohler, D.J.; Wolfe, J.D. Winter Territoriality of the American Redstart in Oil Palm Plantations. *Diversity* **2022**, *14*, 1079. [CrossRef]
7. Molina-Marin, D.A.; Rodas-Rua, J.C.; Lara, C.E.; Rivera-Páez, F.A.; Fontúrbel, F.E.; Castaño-Villa, G.J. Effects of Landscape Configuration on the Body Condition of Migratory and Resident Tropical Birds. *Diversity* **2022**, *14*, 432. [CrossRef]
8. Ientile, R.; Tuliozi, B.; Campobello, D.; Borghi, S.; Sala, L.; Dal Zotto, M.; Massa, B. Analysis of Prey Composition in Eurasian Reed Warblers' *Acrocephalus scirpaceus* Droppings at Four Breeding Sites in Italy. *Diversity* **2022**, *14*, 1134. [CrossRef]
9. Berger, D.J.; Lusk, J.J.; Powell, L.A.; Carroll, J.P. Exploring Old Data with New Tricks: Long-Term Monitoring Indicates Spatial and Temporal Changes in Populations of Sympatric Prairie Grouse in the Nebraska Sandhills. *Diversity* **2023**, *15*, 114. [CrossRef]
10. Butler, C.J.; King, C.; Reinking, D.L. Do Citizen Science Methods Identify Regions of High Avian Biodiversity? *Diversity* **2021**, *13*, 656. [CrossRef]