

Chapter 1

Urban Bird Research in a Global Perspective

Marcus Hedblom and Enrique Murgui

Abstract More than half of the world's human population lives in cities in which birds constitute the major, or only, contact people have with wildlife. The vast amount of predicted urbanization in the coming years will, however, consume habitats and reduce the possibilities for birds to thrive in cities and thus also reduce people's potential to detect birds. The scientific literature is presently dominated by studies from Europe and North America although the largest occurring urbanization processes occur in South East Asia and Africa. Further, these understudied continents, together with South America, harbor some of the most important areas of urban bird biodiversity and are thus of special importance to study. The last 15 years of urban bird ecology research have been exponential and now enables amalgamations and reviews of research. Here, in this volume, we try to overview these present findings in urban bird research from all continents. We illustrate this by over-viewing patterns and processes, spatial and temporal scales and methodological approaches, pollution effects on birds, bird's effects on human well-being, and how urban habitats are conserved and managed for birds. The patterns of how urban birds are affected by urbanization processes are similar globally, with decreasing habitats and change of habitat qualities and pollution effects. However, increasing number of areas for urban bird conservation are being recognized and habitats managed to provide urban bird populations are increasing. In a global perspective, cities do still provide habitats to allow a diverse bird fauna.

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Birds have fascinated and attracted humans throughout history by their colorful appearance, flight, and song (Cocker and Tipling 2013). However, they have also

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shown to be considered disturbing because of their noise, feces, and high population densities. Nevertheless, in the era of urbanization, where more than half of the world's population lives in cities (UN 2015), birds are probably the main everyday experience of wildlife for people globally (US Department of the Interior et al. 2011). Children of today will spend a major part of their lives in cities. Thus, to pick up a small bird in one's hand or to hear a bird sing on the way to work are valuable experiences and important links to nature for city dwellers. These experiences may also promote a deeper understanding of other habitats outside the urban fringes (Myer and Franz 2004; Miller 2005). City planners do not generally focus on urban nature or birds when planning, but instead concentrate on housing, roads, and industry, which continue to consume habitats. However, cities *can* be planned to permit birds to thrive and thus increase the potential for positive experiences of birds and nature. Cities harbor unique habitats that allow the presence of red-listed species, endemic species, and a large diversity of birds (Aronson et al. 2014). However, conservation of areas for birds in cities not only needs effective dialogue between nature conservationists, ornithologists, city planners, and decision makers but also requires an understanding of what makes birds flourish in cities and what makes them avoid cities or perish there. Thus, conservation of birds in cities needs knowledge of their ecology.

Urban bird ecology has transformed from a rather diffuse topic on the periphery of traditional ecology, conducted in more “natural” habitats, to an established research field in its own right. This is illustrated by the increasing number of publications and books on urban bird ecology (Dinetti and Fraissinet 2001; Marzluff et al. 2001; Kelcey and Rheinwald 2005; Lepczyk and Warren 2012; Gill and Brumm 2014; see also Fig. 1), and a large and growing number of papers (see Warren and Lepczyk 2012), reviews on the subject (e.g., Chace and Walsh

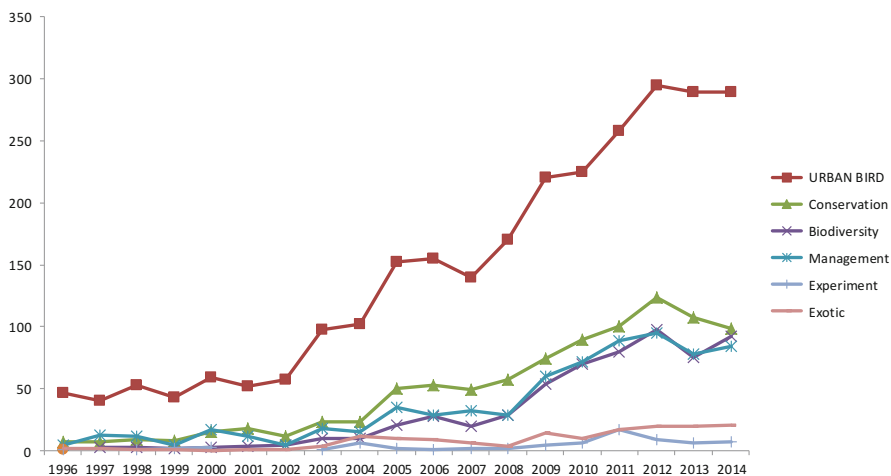


Fig. 1 Articles published in the ISI Web of Knowledge from 1996 to 2014 using the search terms “urban” and “bird” and distinguished by topic

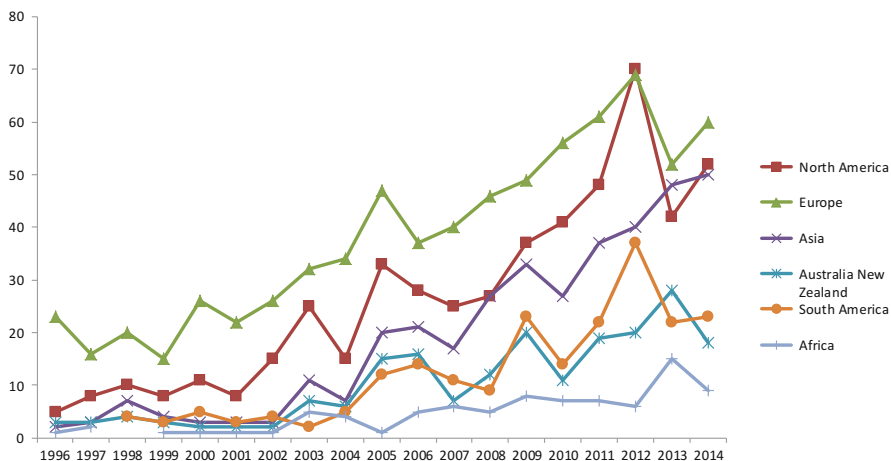


Fig. 2 Articles published in the ISI Web of Knowledge from 1996 to 2014 using the search terms “urban” and “bird” and distinguished by continent

2006), popular science books (Marzluff 2014), and books on urban birdwatching (e.g., Milne 2006; Lindo 2015).

Current literature is dominated by studies from the northern hemisphere (Europe and USA) and Australia, although some of the biggest urbanization processes are presently occurring in Southeast Asia, Africa, and South America. This is a *major* bias in the research field of urban bird ecology (Warren and Lepczyk 2012; see also Fig. 2).

It is thus important to highlight these other parts of the world and their cities because many are presently expanding in tropical areas or in areas with high endemism, which makes mapping of species and ecological knowledge for potential conservation urgent. In this volume, we approach urban ecology from a global perspective, including all continents except Antarctica.

Previous studies concerning ecological theories and patterns for cities have been rather scattered, but the current high number of publications on urban birds allows review and amalgamation of results. This volume presents numerous topics, such as species abundance in cities, adaptation, effects of temporal and spatial scales, and how birds are affected by anthropogenic factors such as different types of pollution. Because cities are diverse in size, location, and types of habitat (urban greenery and water) yet fall under the same umbrella of urbanization, these reviews can reveal potential patterns of effects on urban bird fauna globally. Present knowledge of urban birds is varied, where some nations lack basic knowledge of existing bird species abundance in their cities and others have monitored birds for years, allowing sophisticated research on the mechanisms behind, for example, urban adaptation or abundance.

Conservation in cities is challenging and maybe more so than in non-urban landscapes because the value of birds and nature in general is set against property values and an ever-increasing need for infrastructure. Seemingly, once nature is

transferred into infrastructure it is to a large extent irreversible; very few roads, houses, and squares are returned to nature-like conditions. Furthermore, many cities are located in global urban biodiversity hotspots (Cincotta et al. 2000) that, in the coming years, will have a large impact on urban surroundings (Seto et al. 2012).

Urban areas are predicted to increase threefold by 2050, reaching a global cover of 3,180,000 km² (Angel et al. 2012) and thus becoming landscapes themselves. Therefore, there is an urgent need to discuss how these urban conglomerations, covering large landscapes, can also promote conservation of bird species. In China alone the present number of people in cities is 758 million and will increase by an additional 292 million by the year 2050. However, the highest percentage increase in urban populations is expected in Africa, where it is predicted that the rate of increase in urban land cover will be 590% above 2000 levels by 2030 (Seto et al. 2012).

The first section of this volume *General patterns and processes* (Chaps. 2–7) reveals global and large spatial scale patterns of abundance, evolution, and adaptation to cities by urban bird species. Lepczyk et al. (Chap. 2) show that the general portrait of urban areas as species-poor, with a dominance of omnivorous and granivorous species, does not reflect reality. By comparing cities globally they illustrate that the most common families are Accipitridae, Anatidae, and Scolopacidae. Although the diversity of birds in cities is relatively high from a global perspective (Aronson et al. 2014), 31 of the world's most invasive species are found in cities (Lepczyk et al. Chap. 2). Belloq et al. (Chap. 3) narrow the global perspective to a 1400-km gradient of South America and reveal that, although less urbanized than many other regions of the world, the urbanization process affects birds in similar patterns as elsewhere. The size of city had a threshold effect on species composition, with no effect in cities of less than 7000 inhabitants. According to Belloq et al., this contradicts previous European studies in that bird species richness declined with increasing latitude in rural areas.

China is going through the biggest urbanization process ever seen in history, according to the number of people moving from rural to urban areas. Chen and Wang review for the first time existing studies on urban birds in China (Chap. 4). They show that cities close to each other have similar bird species (indicating similar vegetation) but also that cities in different biogeographic regions have similar species, indicating a potential homogenization process. Some bird species apparently become more successful in urban areas than others. There is no single explanation for this but instead the research fields of bird adaptation (evolutionary processes) and adjustment (plasticity in existing populations) to urban areas have multiple alternative hypothesis rather than pointing in one direction. In this volume, three chapters (Chaps. 5–7) approach this issue from different angles using some common denominators. Sol et al. (Chap. 5) highlight the paradox that exotic species (non-native) have had little opportunity to adapt to the novel environment of cities but are still able to proliferate there (and even become more abundant than many native species). Sol (Chap. 5) proposes that exotic species occupy novel ecological niches that most native species are unable to use and that exotic species possess the necessary adaptations to invade these niches. Garcia et al. (Chap. 6) further argue

that possession of phenotypic plasticity or behavioral plasticity is one of the major differences between rural and urban bird species. They argue that some species can keep pace in adapting to ever-changing urban areas (e.g., as house sparrows have done) whereas other urban species cannot maintain these rapid changes and are forced to leave the urban environment. This is partly confirmed by Miranda (Chap. 7), who states that further research is needed, especially in southern regions in areas with recent urbanization. Miranda (Chap. 7) has added yet another aspect to urban adaptation by comparing plasticity and microevolutionary changes in behavior in urban species. Both Miranda (Chap. 7) and Garcia et al. (Chap. 6) suggest that genetic and environmental components should be separated to understand the role of evolutionary changes versus phenotypic plasticity in future studies.

The urbanization process affects available habitats for birds in cities globally through densification, where urban green habitats are reduced, and through fragmentation of habitats by expansion of cities into the peri-urban surroundings (often referred to as sprawl). How these processes affect birds is linked to two fundamental factors of ecology: scale and time. The section *Spatial and temporal scale and methodological approaches* (Chaps. 8–11) discusses methods used to investigate these effects.

The issue of scale is raised directly and indirectly in many of the chapters in this volume, but Litteral and Shochat (Chap. 8) specifically discuss and review landscape scale factors and their influence on the shaping of urban bird communities. The importance of long-term ecological studies is well recognized but there are few studies of urban bird ecology in general and almost none outside North America and Europe. Fidino and Magle (Chap. 9) review long-term urban bird research and show that most urban bird studies only span one or two years and that very few studies date back longer than 30 years. Fidino and Magle (Chap. 9) emphasize that the potential for long-term studies is infinite but describe some challenges in sampling and in ensuring standard protocols. They also suggest alternative sources of data for dating back in time, such as newspaper articles and museum collections. Van Heezik and Seddon (Chap. 10) review the methodology of bird counts, which complements the findings of Fidino and Magle (Chap. 9) concerning shortcomings in methodologies. They provide a framework for estimating bird abundance in cities and discuss the strengths and weakness of different approaches relating to an urban context. Luniak (Chap. 11) reviews the ornithological atlases currently existing in Europe. The urban atlases highlighted in the chapter by Luniak could also contribute to dating back in time.

Some birds respond rapidly to changes in the physical environment by management changes in habitat, but also respond to other types of anthropogenic effects such as pollution. In the section *Anthropogenic factors* (Chaps. 12–15), the indirect and direct effects of humans on birds are reviewed and also the “opposite” effect of birds on human well-being. It is possible to use birds as indicators of a healthy human environment; therefore, investigation of their general condition, breeding success, and uptake of anthropogenic pollutants can give an indication of conditions for human well-being. Kekkonen (Chap. 12) reviews the effects of heavy metals and organic pollutants on urban bird populations. It is largely a dystopic picture,

illustrating that, despite the many restrictions already in force to discourage harmful substances, many heavy metals and persistent organic pollutants will remain in the urban environment for a very long time. These pollutants have direct physiological effects on urban birds and also indirect effects such as decreased food availability. Another pollutant, quite unique for urban habitats, is night light. Dominoni (Chap. 13) reviews this topic, revealing that light directly affects mortality by causing collisions against lit towers but also changes the daily and seasonal biology of species. Dominoni used light loggers (miniature loggers glued onto the back of blackbirds) to reveal their exposure to artificial night light in the field. He further extended this work to experiments in cages, revealing that increased exposure to night light affects reproductive physiology. Tomiałoć (Chap. 14) overviews the effects of human intervention on urban bird species in cases where exotic birds escaped from captivity and later became part of the urban bird fauna. He reveals a long history of human interference with tame and wild birds in Europe. Hedblom et al. (Chap. 15) review the new and highly transdisciplinary field of cultural ecosystem services, which concerns the cultural value that birds provide humans through positive experiences by increasing well-being and potentially reducing stress for urban residents.

Humans affect the existing habitats of birds by transforming the landscape through infrastructure but also by replacing natural habitats with other more human-related, non-indigenous habitats. The section *Urban bird habitats: conservation and management* (Chaps. 16–23) reviews different urban habitats and their prerequisites and discusses their influence on bird abundance, conservation, and management. Symes et al. (Chap. 16) investigate a region in South Africa where urbanization changed the prerequisites of bird fauna dramatically from a savanna–grassland ecosystem to a woody habitat through bush encroachment and planting of exotic and native trees. These changes transformed the previous original grassland bird fauna to a more exotic and wood-dependent fauna. In Australia, similar to South Africa, the landscape has been transformed from native trees that let through half of the incident light into dense crowned European forests, which changed the prerequisites for native urban bird fauna (Daniels and Kirkpatrick; Chap. 17). Daniels and Kirkpatrick reveal that it is the beta diversity in exurban habitats that provides opportunities both for native and exotic species. In both South Africa and Australia these major changes occurred over less than 200 years. Goddard et al. (Chap. 18) deepen our knowledge of residential gardens, which are a rather unstudied urban habitat although covering substantially large areas of cities. They emphasize that this habitat offers considerable opportunities for bird conservation and that, in contrast to urban planning that is often top-down, private urban gardens can be managed through personal initiative and designed to enhance bird populations. Meffert (Chap. 19) describes the state of knowledge of birds in the rarely examined and unique habitat of wastelands. This habitat, which only exists in cities, has important value for endangered species.

Gleditsch (Chap. 20) illustrates the positive and negative, indirect and direct effects of exotic plants on urban birds. Furthermore, Sorace and Gustin (Chap. 21) compare parks with surrounding urban areas as habitats for species requiring

conservation, revealing potential homogenization effects. Herrando' et al. (Chap. 22) take a step further towards provision of an indicator for monitoring programs by relating urban green infrastructure to current data on bird abundance. The indicator is based on species response to green infrastructure at the population level. Through this indicator it is possible to track temporal changes in bird populations linked to an increase or decrease in urban green areas. Despite increasing attention to practical suggestions for conservation (often at the end of papers summarizing the need for change), few examples of true implementation are found. Heyman et al. (Chap. 23) put theory into practice with their large-scale experiment on managing urban woodlands to both optimize urban bird species richness and create woodlands that are recreational friendly for humans. They also review how management affects urban bird populations.

To summarize, this volume opens up questions concerning urban ecology and conservation. In the final chapter, we try to reveal some of the shortcomings of current research and implementation and indicate future needs (Chap. 24; Murgui and Hedblom).

The conclusion, in short, is that the effects of urbanization on urban birds are similar worldwide, where existing habitats are reduced in size (or totally removed), natural habitats are turned into more human-influenced habitats such as parks and lawns, green areas are managed to suit human purposes such as leisure and safety, and different pollutants are constantly added. Despite this seemingly large number of negative influences on urban birds, cities globally still *do* provide habitats that allow a diverse and flourishing bird fauna (Aronson et al. 2014), although it is necessary to take action to enable birds to thrive in cities. Hopefully, increased global awareness of the present situation of urban birds illustrated by this volume will add to overall knowledge and have an effect on future decisions in city planning. We believe that providing urban bird habitats in cities, such as urban greenery and open waters, not only creates healthy and diverse bird populations but also provides cities that are attractive and healthy for humans.

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