Chapter 15
Bird Diversity Improves the Well-Being of City Residents

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Abstract Humans are increasingly becoming urbanized. Because a number of bird species readily live in urban areas and birds are relatively easily observed, birds are becoming the largest everyday encounter with wild fauna people will have, globally. Despite, few studies have been made on how visual (or acoustic) bird encounter affects humans. The few existing studies show that birds provide humans with increased self-evaluated well-being when seeing and hearing them. These values provided by birds can be recognized as a cultural ecosystems service.

Here we review extant literature to consider why certain species fascinate humans more than others, and some can increase well-being and provide ecosystem services, while others offer disservices through unappealing characteristics. We particularly highlight indications of links between species diversity and well-being. Finally, we discuss possible reasons for variations in our responses to birds and birdsong associated with age, gender, childhood, contact with nature, and the biophilia theory.

If interaction with birds truly increases quality of life, then this value should be considered in the planning of sustainable cities. Both conservation and proper management of existing urban green areas are needed to increase possibilities to encounter many bird species.

Keywords Biodiversity • Green space • Passerines • Songbirds • Urban soundscape • Urban woodland

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15.1 Introduction

Humans have become increasingly distanced from nature, both physically and emotionally, as the global population has shifted to urban areas. Although numerous animal species have adapted to urban life, birds are the wild fauna that people most commonly encounter, apart from substantially smaller taxa such as insects, in their everyday life (US Department of the Interior et al. 2011). Birds are active during daytime, easy to spot by sight or hear through birdsong, and have little fear of humans. Nevertheless, most previous research concerning urban bird fauna has focused on aspects related to their ecology, urban adaptations, and evolutionary processes, while the visual and acoustic effects of bird encounters on our well-being have generally received little attention. However, interest has emerged recently in birds' potential cultural values for humans, particularly in cities (Fuller et al. 2007; Bjerke and Østdahl 2004; Luck et al. 2011; Clucas and Marzluff 2014; Hedblom et al. 2014; Shwartz et al. 2014; Belaire et al. 2015).

It is not surprising that the potential cultural values of birds are being recognized in the urban environment. Bird density is higher in cities than other landscapes; hence there are higher frequencies of encounters between birds and urban residents (Marzluff 2001; McKinney 2002; Shochat 2004). Furthermore, bird sighting is easier in cities because birds have changed their behavior as they have adapted to urban environments, becoming less sensitive to humans (Jerzak 2001; Randler 2008 but see; Valcarcel and Fernández-Juricic 2009). Cities can also host a surprisingly high diversity of bird species (Lepczyk et al. 2016), especially in suburbs and natural remnants (Blair 2001; Hedblom and Söderström 2010). Additionally, humans can increase frequencies of interactions with birds by providing food and nest boxes (Lepczyk et al. 2012; Fuller et al. 2012).

The Millennium Ecosystem Assessment (MEA 2005) provides a potentially useful conceptual framework of cultural ecosystem services (consisting of spiritual, aesthetic, and cultural heritage and identity and inspirational, recreational, and educational values) for assessing birds' cultural values or immaterial services. Encounters between birds and humans can certainly have value in these respects, as several studies have shown that contact with nature reduces stress (Kaplan 1995; Grahn and Stigsdotter 2003; Hartig et al. 1991; Mitchell and Popham 2008; Tamosiunas et al. 2014; Alcock et al. 2014) and that certain habitats, such as woodland parks, have stronger stress-reducing effects than others, such as urban parks (Tyrväinen et al. 2014). Thus, as bird frequencies are strongly linked to urban greenery and wetlands, their sightings and sounds may be linked to the reported increases in well-being and/or reductions in stress associated with experience of nature.

The reasons why humans perceive birds in certain ways are complex. These perceptions seem to be influenced by cultural presentations in stories and film, as well as by individuals' gender, age, experiences of nature during childhood, and knowledge of ecology (Bjerke and Østdahl 2004; Cooper and Smith 2010; Shwartz et al. 2014; Belaire et al. 2015). Another explanation is offered by the biophilia

hypothesis that humans generally have a deep affiliation to other life forms (Wilson 1984). Moreover, it has been suggested that birdsongs and music share underlying biological mechanisms (Earp and Maney 2012). The perception of birdsong is also linked to human maturity, as older people seem to appreciate birdsongs more than younger people. Furthermore, gender seems to influence our perceptions of certain species (e.g., Bjerke and Østdahl 2004).

There also appear to be associations between knowledge of birds, our perceptions of them, and the attention paid to them. For instance, people who recognize more species also generally pay more attention to them, e.g., by providing food and nest boxes, and thus have more interaction with them. A further complication is that cities have limited urban green areas, so people who live close to them or have large gardens will have most contact with birds and nature generally on a daily basis. Thus, distances between people's residences and green spaces may be more important than knowledge of birds per se. Hence, the mechanisms involved in human appreciation of certain birds and birdsong are complex and far from well understood.

Here we review and discuss research on this transdisciplinary topic, most of which has focused on urban environments. We consider the few published studies on why some species affect humans more than others and apply results from a case study concerning birdsong combinations to address responses to perceiving multiple species. We then address findings regarding effects of age, gender, knowledge, and childhood memories on human perceptions of urban birds, mechanisms that may account for our perceptions of birds, and their links to the biophilia theory. Finally, we present reasons for taking these values into consideration for urban planning.

15.2 What Cultural Ecosystem Services Can Birds Offer?

The very meaning of an ecosystem services is to put a value on something that benefits humans, in our case the perception of urban birds. The MEA (2005) definition of cultural ecosystem services relates to words such as *appreciation*, *well-being*, *restorative perceptions*, *education*, *and spiritual enrichment* and differs from the interpretation of words used in the scientific literature of urban birds and cultural ecosystem services. Few studies explicitly use the framework of cultural ecosystem service to describe their frame of reference, although they do highlight topics raised by MEA (2005). This means that there are broader definitions of the cultural ecosystem service concept than the Millennium Ecosystem Assessment (2005) defines.

For example, it is difficult to allocate studies in urban areas using the term "spiritual values," although it is most likely that people experience specific environmental (i.e., biophysical and social) features as spiritual in the natural settings (Fredrickson and Anderson 1999), such as birds.

The concept of "inspiration" has been investigated by Plambech and Konijnendijk van den Bosch (2015), who mentioned birdsong as one of many natural factors that can inspire creative thinking. Measuring potentially relevant variables such as a bird's visual aesthetic appeal is far from straightforward (Belaire et al. 2015). Hence, many studies rely on self-evaluated estimations of effects of considered variables on people's well-being or other responses, but physiological variables such as saliva cortisol levels may provide more robust estimates of stress reductions and other important responses.

Ulrich et al. (1991) found that people exposed to natural settings (vaguely defined as areas free of people with trees, a light breeze, and birds) rather than various urban environments use lower levels of painkillers. Thus, even if a value of perceiving birds is obtained in some way, it must be interpreted in the context of pertinent background variables that relate to the ratings (e.g., which species is rated against which) or local cultures or similar. We begin by reviewing the existing literature concerning human perceptions of birds, especially those in cities.

15.2.1 Humans' Perceptions of Birds

The book *Birds and People* by Cocker and Tipling (2013) highlights cultural interactions between birds and people throughout history, providing insights into why humans appreciate certain birds and disapprove of others. Humans particularly seem to appreciate species that are visually spectacular and have distinguishing characteristics regarded as attractive. Prime examples are hummingbirds, which seem to be highly popular due to their extremely small sizes, bright colors, ability to hover, and ease of spotting (especially when a feeder is provided). Furthermore, as nectar feeders they do not adversely affect any vital human activities (such as farming or garden plants) or threaten to kill or injure other animals. General features of birds that promote popularity seem to include attractive plumage and a non-provocative character, according to Bjerke and Østdahl (2004). These authors also note that small species with nice songs are highly appreciated and seem to be associated with spring, summer, and organic growth (see also Ratcliffe 2015, p. 136), at least in temperate areas since spring and summer are not as well defined in the tropics.

However, various other factors also affect bird popularity, as not all birds with spectacular size are popular. For example, the marabou stork *Leptoptilos javanicus*, which breeds in urban areas, is rather spectacular but has, according to Cocker and Tipling (2013), a reputation for being one of the world's ugliest birds. Furthermore, not all birds that are easy to spot in the garden are popular, for example, the red-faced mousebird *Urocolius indicus* is poisoned, or even shot on sight, due to its inclination for the fruits and flowers of suburban gardens in southern Africa (Cocker and Tipling 2013).

Disservices of birds are surprisingly pronounced in the urban bird literature. Belaire et al. (2015) argue that people remember experiences with negatively

perceived bird species more clearly than experiences with positively perceived species. Accordingly, numerous studies highlight negative perceptions. Notably, Clergeau et al. (2001) found negative attitudes toward various bird species in French urban environments, for example, herring gull *Larus* spp., European starling *Sturnus vulgaris*, house sparrow *Passer domesticus*, and rock dove *Columba livia*. Similarly, Belaire et al. (2015) found that urban residents in the Chicago area not only had negative perceptions of the house sparrow, common grackle *Quiscalus quiscula*, and blue jay *Cyanocitta cristata* but also, surprisingly, mentioned no positive qualities of these birds. According to Belaire et al. (2015), these three species had negative associations due to not being "pleasant to the eye" or not having "spiritual values." Belaire et al. (2015) further argue that these negative experiences were not seen as a major problem, but rather were exaggerated and did not reflect the birds' real characteristics and/or people's true responses. Clergeau et al. (2001) reached a similar conclusion, as people interviewed in Paris had negative perceptions of some species, but 69–74 % of the interviewees found pleasure in the presence of birds.

Although numerous negative associations and experiences with birds are described in the literature, there *are* positive attitudes toward many bird species in urban areas. Some species are positively perceived in gardens, such as hummingbirds, robins, cardinals, and blue jays (Dawson et al. 1978), while other species, such as blackbirds, starlings, and ducks/geese, are positively perceived when not in the immediate garden (Brown et al. 1979). A study in Norway found that "small birds" and "ducks" were among the most highly rated urban animals (Bjerke and Østdahl 2004), indicating that species do not need to be visually vibrant to attract people. Furthermore, most birds are heard rather than seen, and natural sounds of the wind, water, and birdsongs are known to have restorative effects on humans (Ratcliffe et al. 2013). Additionally, natural sounds mostly have been compared with less attractive sounds from, e.g., noisy traffic (Viollon et al. 2002), and it is perhaps not very surprising that people prefer birdsong prior to traffic. However, most studies that highlight the positive influences of birdsongs mention only "twittering birds" or "birdsong" as the sound used, rather than a song of a specific species (e.g., Viollon et al. 2002; Annerstedt et al. 2013). This is somewhat surprising, since birdsongs vary greatly between species.

In the cited study by Ratcliffe et al. (2013), 20 British adults were played tape recordings of natural sounds, and birdsong was rated most frequently (by 35 % of the participants) as having the best potential for reducing human stress, followed by sounds of water (24 %), non-avian animals (18 %), elements (e.g., soft wind and rain 12 %), and other sounds such as interaction with nature and silence (11 %). Ratcliffe (2015) built on these findings in her doctoral thesis by proposing that certain birdsongs have higher "restorative perception," described as the potential to reduce stress, than others. Her respondents also ranked the songs of 50 common bird species from the UK and Australia according to their aesthetic value and self-perceived restorative potential. The Australian species were included to provide novel bird sounds to British respondents. Respondents were asked to listen to a birdsong and imagine how it would help them recover from certain stressful

scenarios, such as having an argument with a friend and feeling very stressed afterward. The results indicated that smooth or consonant sounds were considered more pleasant than rough sounds. However, she found no connection between either the pitch of a birdsong and its appeal to humans or the pitch and arousal. Pitch is defined as the perceived highness or lowness of a sound and is related to frequency (the number of sound waves per unit time). Thorpe (1961) found that low-frequency sounds were negatively associated with larger birds such as crows, jays, magpies, and owls, while high-pitched bird sounds were associated with positive values for humans. Similarly, Björk (1985) found that unpleasant sounds had low frequencies. Thus, low frequencies could be perceived as unpleasant because they are associated with large, potentially aggressive birds. On the other hand, high frequencies could have positive associations and may have higher restorative potential.

When qualitative aspects, such as *association* and *memories*, of the 50 bird species were ranked, the species with the highest scores were found to be abundant in urban areas, gardens, and even indoor environments (Ratcliffe 2015). For example, the three highest-ranked species, on a scale from 0 to 6, were dunnock (*Prunella modularis*; score 5.26), greenfinch (*Carduelis chloris*; score 5.23), and blackbird (*Turdus merula*; score 5.06), all of which are common in British gardens. In contrast, the three least appreciated were Australian raven (*Corvus coronoides*; score 1.65), red wattlebird (*Anthochaera carunculata*; score 1.50), and silver gull (*Chroicocephalus novaehollandiae*; score 1.50) (Ratcliffe 2015, p. 128). These results show that the perception of a species is strongly influenced by memories and associations of rather ordinary birds in the everyday surroundings.

15.2.2 Birds as Representatives of the Natural World in Urban Settings

There has been concern that residence in urban areas causes people to distance themselves from and lose an understanding of nature (Myer and Franz 2004; Miller 2005), particularly as a large and increasing fraction of the global population experiences childhood in urban areas with decreasing natural spaces. Hence, many people will have their first, and maybe only, interaction with nature in cities. Accordingly, several studies have shown that urban residents have limited knowledge about the birds that inhabit their cities (Dallimer et al. 2012; Shwartz et al. 2014).

A nationwide study in Denmark found that almost half of the respondents were motivated to visit parks and green spaces due to the presence of fauna and flora (Schipperijn et al. 2010). A similar survey in Paris noted that people visited the gardens to interact with nature (Shwartz et al. 2014). However, Miller (2005) argues that conservationists have failed to convey the importance, wonder, and relevance of biodiversity to the general public, tending to "preach" to those already engaged,

rather than reaching the unconverted and leaving the public with a feeling of helplessness about species extinction and habitat conservation. Miller (2005) further argues that if people could experience meaningful connections with nature close to where they work or live, then the connection between humans and the natural world would improve. This is consistent with suggestions by Belaire et al. (2015) that birds could connect urban residents, land managers, and environmental policymakers regarding the enhancement of ecosystem services. Similarly, Fuller et al. (2012) argue that feeding birds in public gardens could improve the engagement between humans and nature, leading to positive effects on quality of life. Efforts in this area could have large effects as, for example, 43 % of Arizona's population and 66 % of Michigan's population feed birds (Lepczyk et al. 2012). Furthermore, 200 million GBP (US $390 million) is spent annually in the UK and $3.5 billion in the USA (Fuller et al. 2012) on bird food. Clearly, feeding birds is a popular way for people to connect with nature. Birds *can* awaken an interest in the natural world and motivate people to learn how to appreciate it.

15.3 Perception of Bird Biodiversity

There is increasing evidence that a combination of bird species may be perceived more positively than the presence of a single species (e.g., Fuller et al. 2007; Luck et al. 2011; Hedblom et al. 2014). However, this conclusion is controversial as some studies have found that higher diversity increases well-being, while others identify perceived diversity to be more important than actual diversity (e.g., Dallimer et al. 2012; Belaire et al. 2015). We consider associations between diversity and perceptions in more detail in the following section, which begins by presenting findings from case studies of human responses to various birdsong combinations.

15.3.1 Case Study of Responses to Birdsong Diversity

In a preference experiment conducted in Sweden, 44 environmental science students were asked to rate various combinations of birdsongs (Fig. 15.1). The hypothesis was that species richness would be positively correlated with the ratings, based partly on results of a survey by Fuller et al. (2007) of perceptions of users of public urban green spaces in Sheffield, UK (including findings of a significant positive relation between bird species richness and psychological benefits, defined as *continuity with past and present*). The preference study was subsequently followed up in another study with fewer birdsong combinations but more participants (Hedblom et al. 2014).

Birdsongs were played for 45 s on loudspeakers in a lecture room, and then the participants were asked to rate their appeal on a scale of −7 to 7, with negative and positive numbers reflecting negative and positive associations, respectively. Songs

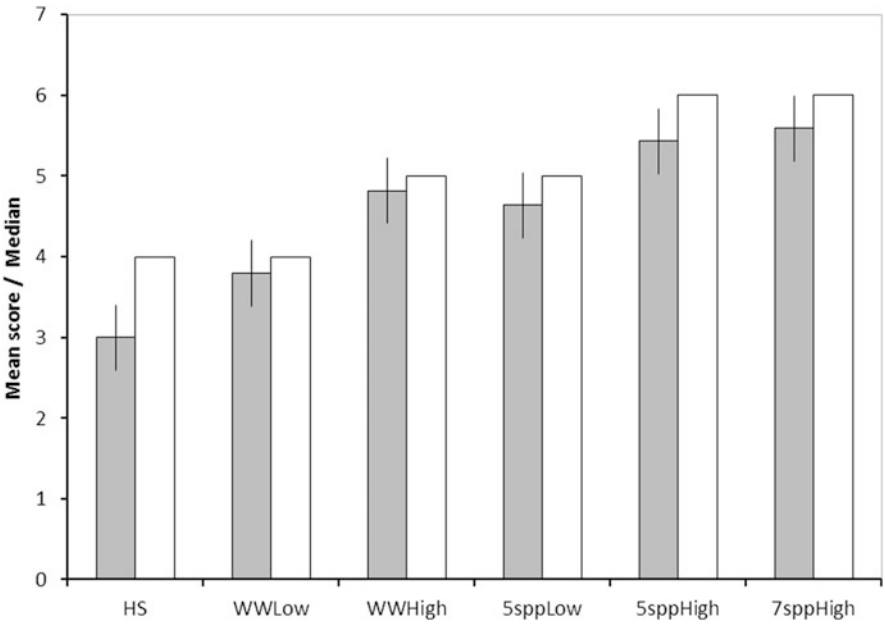

Fig. 15.1 Ratings of birdsongs of individual species and combinations of species with varying strophes. The *gray* and *white bars* indicate mean and median ratings, respectively. HS = house sparrow, WWLow = willow warbler with few (low abundance) strophes, WWHigh = willow warbler with many (high abundance) strophes; 5sspLow = five species with few (low abundance) strophes; 5sspHigh = the same five species with many (high abundance) strophes; and 7sspHigh = seven species with many (high abundance) strophes

could also be given a neutral score of 0. The effect of bird diversity was tested by playing songs of both individual species of birds and combination of species. The effect of bird abundance was tested by playing birdsongs with varying numbers of strophes (discrete birdsongs). For example, respondents were exposed to two willow warbler (*Phylloscopus trochilus*) sounds, one with 8 strophes and the other with 23 strophes. The combinations, played in random order, were house sparrow (33 strophes); willow warbler (8 strophes); willow warbler (23 strophes); five species, including chaffinch *Fringilla coelebs*, blue tit *Cyanistes caeruleus*, great tit *Parus major*, and European robin *Erithacus rubecula* (eight strophes); the same five species (16 strophes); and seven species (the previous five plus common blackbird and great spotted woodpecker *Dendrocopos major*, 26 strophes).

All of the species included in the study are common in suburban woodlands of southwestern Sweden (Hedblom and Söderström 2010; Heyman 2010), except the house sparrow, which mainly breeds in urban habitats such as hedges. A panel of three experienced field biologists reviewed the birdsong combinations before they were played to participants to ensure that they represented sounds that may be heard in a natural setting.

Table 15.1 Mean ratings for birdsong combinations and results of pair-wise comparisons of the ratings by a nonparametric Friedman two-way ANOVA test (overall results; chi-square = 68.423, df = 5, $P < 0.001$)

3.00	3.80	4.82	4.64	5.43	5.59	Mean score
HS	WWLow	WWHigh	5sppLow	5sppHigh	7sppHigh	
	1.000	**0.003**	**0.029**	**<0.001**	**<0.001**	HS
		0.055	0.34	**<0.001**	**<0.001**	WWLow
			1.000	1.000	0.214	WWHigh
				0.271	**0.031**	5ssLow
					1.000	5sppHigh
						7sppHigh

For meanings of abbreviations, see the legend of Fig. 15.1
Bold values indicate significance of $P < 0.05$

As hypothesized, both density and diversity of species were positively correlated to the songs' ratings (Fig. 15.1). The house sparrow song was rated significantly lower than all of the others (Table 15.1), while the combination including songs of seven species was most highly rated and significantly more highly rated than songs of the house sparrow, willow warbler (low abundance), and five species (low abundance). The score of the second most highly rated combination (five species, high abundance) differed significantly from scores for the house sparrow and willow warbler (low abundance) songs, but not from the willow warbler (high abundance) song. Interestingly, there was little difference between ratings for the birdsong with contributions from seven species and the willow warbler song with large numbers of strophes. This suggests that not only the *number of species* but also *bird abundance* affected the respondents' ratings of sounds, i.e., the respondents rated songs of multiple birds highly, irrespective of the number of species. In another study (Hedblom et al. 2014), three birdsong combinations, all with high abundance, in combination with photos of three different urban settings, were used. The ratings of the urban settings increased when birds were singing and were highest when multiple species were singing.

15.3.2 What Affects Perceptions of Diversity?

The results described above did not clearly demonstrate whether the appeal of multiple birds' songs was based more on bird diversity or abundance. Ratcliffe (2015) dissected the soundscape of birds into "intensity (dB) or loudness," "pitch or frequency," "roughness versus smoothness," and "aesthetic properties," but did not consider abundance, measured as the number of strophes per unit time, as a potential factor in birdsong perception. Diversity was briefly discussed as being linked to positive environmental perception, but her research concentrated more on how complex bird sounds are perceived as "more pleasant" and "more fascinating" than simple ones (Ratcliffe 2015, p. 115).

The perception of diversity is clearly a complex phenomenon, and various studies have provided conflicting indications of influential factors' effects, but deviations between actual and perceived diversity could be related to the visibility of organisms. For example, the previously cited survey of users of public green spaces in Sheffield, UK, found that their perceived biodiversity of plants was strongly correlated with actual plant biodiversity, whereas perceived and actual biodiversity differed for more "cryptic" birds (Fuller et al. 2007). Shwartz et al. (2014) also found that participants in the previously mentioned study in Paris, France, preferred flower diversity to that of birds or trees

An important issue that has not yet been addressed is the relationship (if any) between species diversity and human well-being. Dallimer et al. (2012) did not find a consistent positive relationship between well-being of human visitors of urban green spaces and actual species richness. On the contrary, they found that as plant species richness increased, well-being tended to decrease and concluded that people in urban environments have a limited capacity to accurately gauge the diversity of natural environments. Thus, well-being may be positively related to perceptions of species richness rather than actual richness. Results of an intervention in the previously cited study by Shwartz et al. (2014) support this hypothesis. The bird diversity in Parisian public gardens was actively increased by adding nest boxes, and the actual bird diversity increased by 26 %, with an average of 3.2 new species per garden. Visitors, who were not aware of the experiment, were questioned about their biodiversity perception and sensitivity to biodiversity before and after the increase. The results showed that there was no correlation between perceived and actual diversity. The visitors claimed that biodiversity was linked to their perception of well-being, but they did not notice that the biodiversity of birds had increased during the experiment. In accordance with Dallimer et al. (2012), Shwartz et al. (2014) concluded that city dwellers generally have poor knowledge of birds and cannot distinguish species. Similarly, results of a study in Rennes, France, showed that people in urban areas, where bird abundance is high and diversity is low, rarely perceive birds (Clergeau et al. 2001). On the other hand, a clear majority of people living in suburbs, where abundance is lower but diversity is higher, do perceive them.

Humans use all five senses when perceiving biodiversity. However, Viollon et al. (2002) argue that visual and acoustic stimuli are interdependent. Accordingly, in a study by Benfield et al. (2010) in which participants were played various sounds while viewing scenes of national parks, anthropogenic sounds, such as air or ground traffic, seemed to disrupt the experience, but the natural sounds of birds and foliage rustling in the wind had no negative effects on perceptions of the landscapes. In addition, three of the song combinations from the abovementioned case study (Sect. 15.3.1) were used in another experiment, which involved showing photos of urban settings (pictures of multifamily housing units surrounded by varying amounts of greenery) with or without birdsongs (Hedblom et al. 2014). The results showed that all of the urban settings were rated more highly when birdsongs were heard, even if it was only the chattering of house sparrows. Ratings were further increased by increases in species richness, indicating that diversity of birdsongs enhances people's appreciations of urban landscapes. Arguably, perception also

depends on attention and interest, i.e., people with a keen interest in, and knowledge of, birds will spot them more often.

To summarize, an increase in the diversity of birds, both seen and heard, seems to increase self-reported well-being and ratings of urban settings. However, these conclusions are tentative because they are based on results of only a few studies. Furthermore, an increase in the diversity of even a rather species-poor environment does not necessarily increase its attractiveness or the well-being of people present in it. Additional studies are also needed to determine whether humans are more appreciative of songs by numerous birds or a high diversity of birds. Thus, differentiation of perceived and actual bird biodiversity seems to be more complex than previously thought. It is possible that there is a limit to the number of species that people can perceive and that this limit is lowest for people who live in cities due to a lack of taxonomic knowledge.

Background variables could also account for some of the variation in the perception of diversity (see Sect. 15.4). On the other hand, some of the deviations in findings regarding perceptions of biodiversity could be due to flaws in experimental design (as indicated by Shwartz et al. 2014), such as basing studies on self-reported measures of well-being, as argued by Hough (2014). Hough (2014) further argues that the direct relationship between actual biodiversity and health presented in literature needs further research. However, there are now several lines of evidence indicating a relationship between contact with nature and human health (Hartig et al. 2014).

15.4 Specific Characteristics Affect How Humans Perceive Birds

Demographic factors, including gender, age, knowledge, and education, as well as where a person grew up (e.g., in a rural or urban environment), have demonstrated links to individuals' connection to nature (see, e.g., Dawson et al. 1978; Bjerke and Østdahl 2004; Shwartz et al. 2014; Belaire et al. 2015). The relationships between demographic factors and connection to urban birds have been less intensively studied. However, distances to and the availability of urban natural green areas (or waters) seem to be important factors in the perception of birds, and they are also strongly related to socioeconomic factors.

15.4.1 Age Affects Perceptions of Birds

Generally, older people have more positive perceptions of urban birds than younger age groups (e.g., Shwartz et al. 2014; Belaire et al. 2015) and are willing to spend more money on feeding birds (Clucas et al. 2014). Bjerke and Østdahl (2004)

confirmed that older Norwegians more highly rated "small birds," "seagulls," and "magpies." However, ratings for "birds of prey" declined with respondents' age. Shwartz et al. (2014) also found that older men in France tended to give higher, and more realistic, estimates of true bird biodiversity than younger men. Very few studies have addressed the relation between children and birds but (Bjerke and Østdahl 2004) found that Norwegian children's favorite bird species were swans.

15.4.2 Gender as a Factor of Bird Perception

Previous research has shown that gender affects people's views of green spaces and their opinions about spaces' ideal purposes (Cohen et al. 2007; Kaczynski et al. 2009; Schipperijn et al. 2010; Tyrväinen et al. 2007). The differences between genders are also reflected in the perception of birds. In Norwegian cities, Bjerke and Østdahl (2004) found that women had significantly higher preferences for seagulls, magpies, and crows than men, who preferred birds of prey. Furthermore, women tended to rate popular taxa (such as small birds) higher than men and less popular taxa (rats, mosquitoes, and mice) lower than men. Cooper and Smith (2010) found that men and women also had different objectives for bird-related recreation. Women were motivated by altruistic factors, such as helping birds, teaching children, or assisting scientific endeavors. Men, on the other hand, were more focused on activities linked to achievements, such as bird watching. Women were also more likely to get involved in activities related to nest boxes and bird feeding (Cooper and Smith 2010). Gender-related differences have also been seen in younger age groups, as Zhang et al. (2014) found that 9–10-year-old girls in China showed more willingness to conserve species than boys of the same age. This is consistent with indications that gender may operate as a "critical filter," through which personal goals and aspirations are managed (Fivush et al. 2012), and that women are more concerned about future generations and environmental issues than men (Jackson 1993; Knez et al. 2013). Emotional differences based on gender have been detected across several cultures, indicating that women are generally more emotionally intense and expressive than men (Timmers et al. 2003). Additionally, environmental psychology research has shown that differences in age and gender affect how we perceive environmental stimuli, such as light (Knez and Kers 2000), which is perceived both consciously and unconsciously in the brain (Knez 2014a).

A Danish study (Schipperijn et al. 2010) also suggested that the motivation for visiting urban green areas could be influenced by age *and* gender. In the study, people over 65 reported stress reduction as the most important reason to visit an urban green area. Younger people reported their main reason to be enjoying the weather and getting fresh air, followed by stress reduction. In addition, the study revealed a clear gender bias in the stress comparison, whereas 71 % of young women found stress reduction most important, compared to 52 % of the young men (Schipperijn et al. 2010).

15.4.3 Experiences of Nature and Education Affect Perception of Birds

Experiences with wildlife in early years have been argued to increase the understanding of nature later in life (e.g., Thompson et al. 2008; Zhang et al. 2014). This viewpoint was confirmed to some extent by Shwartz et al. (2014) as respondents who had spent a large part of their childhood in green environments scored higher on a measure of bird biodiversity perception than those who had spent their childhood further away from nature. Another study showed that growing up in a village in Tanzania created strong connections to birds and their songs (Sanga 2006). However, the relation between early nature experiences and a connection to the environment was found to be weak among Chinese respondents surveyed by Zhang et al. (2014), possibly due to children in both rural and urban areas lacking opportunities to interact with nature. Nevertheless, most (62 %) of the urban Chinese parents wished that their children could experience green spaces elsewhere than in urban areas. In Sweden, Giusti et al. (2014) found that children who were exposed to nature in preschools were more empathetic and concerned for nonhuman life forms, and more cognitively aware of human-nature interdependence, than children who had received minimal exposure.

15.4.4 Distance to Urban Greenery Affects the Perception of Birds

Several studies have shown that distances between people's homes and urban green areas influence their knowledge of nature. Notably, Clergeau et al. (2001) found that sociological differences along the urban-rural gradient in Paris seemed to affect people's perception of birds. Few residents of central urban areas, with the least greenery, fed birds, read about birds, and knew when birds arrived in spring or even about their annual cycles. In contrast, attitudes of people in suburbs with more greenery were closer to those of rural residents, and they often responded that watching birds was a source of personal pleasure. Interestingly, 11 bird species were identified in the central urban area, 19 in the adjoining suburbs, 11 in distant suburbs, and 23 in the rural sector (Clergeau et al. 2001). Thus, access to greenery seems more important than a high diversity of birds for sparking a person's interest in birds and their ecology.

Wealth seems to be another factor affecting bird perception, as wealthier neighborhoods typically have more greenery and better access to natural areas than poor neighborhoods (Melles 2005; Hough 2014; Sander and Zhao 2015). In Chicago, Davis et al. (2012) showed that low- to mid-income Hispanic residents lived further away from both open spaces and lakes, in areas with less tree canopy cover and bird biodiversity than residents with higher incomes. There was also a significant difference between wealthy and poor neighborhoods in the distance from Lake

Michigan. However, areas largely populated by low-income African Americans did not significantly differ from higher-income areas in terms of proximity to open space, tree canopy cover, or bird biodiversity. It might not always be clear what the cause is and what is the effect since it also might be that people with large interest in, e.g., bird watching, tend to settle in greener areas or manage gardens in a way that attract birds and increase bird abundance.

Clucas et al. (2014) noted that the demographic variable of income did not affect the money spent on feeding birds or its frequency in either Berlin or Seattle, but there were differences between the cities, as residents of Berlin in high income brackets spent more money on bird food, and participated in more bird-related activities, than corresponding residents of Seattle.

Demographic factors (age, income, etc.), urban green cover, and bird species richness all have complex interactive effects (Luck et al. 2011). Luck et al. (2011) showed that an increase in species richness improved residents' satisfaction with where they live. However, the strongest factors associated with well-being were greenery cover and the level of urbanization (Luck et al. 2011). This indicates that the relative proportion of green spaces in urban development may be more valuable for residents' well-being than, e.g., bird species richness.

15.4.5 Mechanisms Behind the Perception of Birds

Other important questions, which we can only currently speculate about, regard the mechanisms responsible for our perceptions of birds generally, specifically urban birds. Similarities in neural pathways involved in vocal learning in humans and birds may be involved (Bolhuis et al. 2010) and/or the similarity of birdsongs to music and/or evolutionary processes that have shaped our perceptions of the natural world (Earp and Maney 2012).

The ways humans learn to speak and birds learn to sing are surprisingly similar (Bolhuis et al. 2010). The neural pathways involved are far more similar than previously thought, and birds and humans even share a protein that is relevant for speech (Bolhuis et al. 2010). There is also an increasing evidence of parallel evolution of human language and birdsong (Balter 2010; Earp and Maney 2012), suggesting that convergence may have facilitated human perception, and appreciation, of avian vocal information. However, it is more likely that birdsongs inspired humans to sing (Sanga 2006), and some researchers have suggested that the first humans used songs rather than speech to communicate (Wallin et al. 2000). Several evolutionary psychologists have argued that humans "are emotionally moved by music" (Johns-Laird and Oatley 2010, p. 104). Thus, if we hypothesize that music is in some sense similar to birdsongs, then birdsong, as a form of music, may be an emotional stimulus. In this manner, we could connect research focusing on birdsongs to the field of emotional psychology, which has shown that our emotional responses increase with age (Magai 2001) and that emotions can be related to physical places, such as urban green spaces (Knez 2006, 2014b).

Human responses to birdsongs are not always positive, but can also be negative. These negative experiences may consist of heightened awareness of potential danger and an uncomfortable feeling. Ratcliffe (2015) recalled a respondent who associated a magpie (*Pica pica*) call as non-restorative due to its aggressive character. The respondent said, "... it's probably being aggressive to something else, and therefore that's a stressful sound...." Such responses raise intriguing questions about the validity of the interpretations of birds' calls and the mechanisms involved. Marler (2000) highlighted interesting examples of monkeys reacting differently to two negative stimuli. When monkeys heard an eagle call, they searched the sky and ran into bushes, whereas a leopard call caused the monkeys to leap into the tree canopy (where leopards cannot reach them). It is possible that an ancestor of modern humans may have linked certain bird alarm calls to impending danger. In accordance with this hypothesis, Krause (one of the world's best known recorders of natural sounds) describes pygmies in Africa relating certain sounds, including bird sounds, to food and potential danger (Krause 2014, p. 104). Furthermore, the absence of sound in an environment may also indicate danger. Björk et al. (2008) noted that quietness and serenity are desirable characteristics of natural environments, but total silence, or excessive suppression of natural sound, induces discomfort. Similarly, Kjellgren and Buhrkall (2010) found that if people were presented with visual stimuli of nature without sound, in videos, they missed the "smells and sounds" of nature and described it as being "too quiet." Thus, humans can react to various bird sounds in different ways and can also experience certain emotions when there is an absence of natural sounds. It is possible that our ancestors used bird sounds, such as the alarm calls of eagles, as indicators of potential threats, and for this reason, we perceive alarm calls as unpleasant sounds. On the other hand, the birdsongs of a certain habitat may indicate that there are no major threats present, and as they convey safety, we have positive perceptions of these sounds.

Another factor that may be highly relevant is "biophilia," defined as "love of life or living systems," in conjunction with a hypothesis by Wilson (1984) that humans have an intrinsic affiliation to other life forms, possibly as a result of our shared biological evolution. The hypothesis is supported by the altruistic responses adult mammals often show toward baby mammals of other species, which increase the survival rate of all mammals. Biophilia could explain why interactions between humans and certain bird species in urban settings evoke positive feelings. The mechanisms behind our positive perception of birdsongs are complex and seem to be influenced by our evolutionary history, but further research is needed to elucidate the processes involved.

15.5 Discussion

Overall, it seems that birds do provide humans with services of nonmonetary value, such as increased well-being and stress reduction. However, some species are valued more than others, depending on how we perceive them, as shown, for instance, by Ratcliffe (2015). The variations in perceptions of different species are not surprising, because characteristics such as the vibrancy of plumage also vary widely among species. Part of the perception and appreciation of birds, and their songs, may be due to a shared human fascination with nature. However, other factors that influence perception are based on demographic factors, such as gender and age. It has been predicted that 66 % of the human population will live in cities by 2050 (UN 2014). Thus, most children in the future will have their first encounter, and memory, of nature in an urban environment. Children in poorer neighborhoods will be less likely to encounter birds during childhood, partly because there will be less green spaces near their homes than in wealthier neighborhoods. This limited interaction with nature may cause the children to show less engagement with, understanding of, and empathy for nature as adults. Hence, future generations may be less willing to conserve nature (Melles 2005), and as a result of expected reductions in urban greenery, they will have fewer possibilities to enjoy the aesthetic values provided by urban birds.

Extant literature shows that not only visual encounters with birds in urban areas but also exposure to birdsongs can create positive memories and potentially reduce stress. The positive response is stronger when many species are heard. However, it is becoming increasingly difficult to hear birdsongs without background urban noises, even early in the morning or in remote suburbs. Payne (2013) observed that rural soundscapes had higher restorative potential than those of urban parks and other urban settings. However, it has been noticed that urban birds have raised the pitches of their songs, presumably through adaptive responses that allow them to compete acoustically with the high levels of urban background noise (Halfwerk et al. 2011). This evolution of birdsongs in urban environments raises intriguing research questions, such as whether the changes in pitch will affect humans' perceptions of species.

Knowledge of people's perceptions of birds may be highly valuable for managing bird populations in manners that improve our well-being. For example, urban forests could be managed to have a lower density of trees, allowing people to move through the area more freely, yet maintaining the same amount of bird species (Heyman et al. 2016). Moreover, certain species have negative perceptions but are still popular as part of the species richness of natural areas. For example, there have been many complaints about Canada geese *Branta canadensis* in both the USA and Sweden (Coluccy et al. 2001), but only 9 % of respondent to a survey in the USA agreed with the statement that there should be fewer geese in an area.

Research that has focused on the cultural services that birds can offer seems to be rooted in urban ecology. This is interesting, since it has been argued that urban ecology merely applies other theories to urban habitats. This highly

transdisciplinary field that integrates human psychology and ecology has been dominated mainly by social scientists (see also Keniger et al. 2013). However, ecologists now have the opportunity to make major contributions through investigation of bird species' characteristics, combinations, and behaviors linked to human perceptions.

The planning and management of urban green areas is a highly complex process. Birds are constantly losing potential habitats in cities, even with strong conservation efforts. Infrastructure and housing are the primary concerns in city planning, so the conservation of urban nature and birds receives less attention. However, functional green spaces may attract more interest as results continue to show that interactions with birds improve the health of city residents. Although the research area of cultural ecosystem services provided by birds is rather new, it may provide interesting insights into the environments where most of the human population lives, our cities.

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