Abstract

Urbanization ranks among the most important processes induced by the human civilization that affects ecological communities at the same time. Birds are the most frequently studied organisms in relation to urbanization. Different birds' species show different abilities to adapt to urban areas, so urbanization works as an environmental filter. As urban environment undergoes extraordinarily high rate of change, the characteristics of the environmental filter are changing rapidly, too. This could influence populations of urban bird species. We can expect that the population change of the species will be related to the time since urbanization; specifically, the early urban colonizers will decline due to alteration of urban environment, while the recent urban colonizers will increase.

I obtained data on population trends from 2000 to 2016 for 95 common urban bird species in 16 European countries. Thanks to the cooperation with local expert ornithologists, I collected the data about the time since urbanization of these species in respective countries and I related these two variables filtering out the influence of 9 other species-specific ecological characteristics. Bird population trends had a statistically significant relation to the time since urbanization: the species that became urbanized earlier declined, while the recently urbanized species increased. This pattern could be caused by changes in the urban environment resulting in, for example, lover breeding and feeding opportunities for the earlier urbanized birds. Underlying drivers may include change in the structure and species composition of the urban greenery, modernization of buildings and transfer of the farming animals and organic waste. Consequently, urban environment becomes "sterile".

To find out whether the population trends of urban birds are specific for cities, or they track the population changes in other habitats, I compared population trends of 52 species between the urban and non-urban habitats using detailed local-level monitoring data collected in the Czech Republic. I found that population trend significantly differed between the focal habitat types in 31 species. Focusing on specific urban vs. non-urban trend combinations, following major patterns were observed: in the case of birds increasing in both habitat types, more species showed larger increases in urban habitat, likely due to explore the new ecological space in cities; in the case of decreasing species, the rate of population decrease was faster in cities, possibly due to reduction of the influx of individuals donating urban population from habitat outside of the city borders. However, many exceptions from these patterns rule exist, e.g., greenfinch (*Chloris chloris*), that is declining faster outside the cities, barn swallow (*Hirundo rustica*) increasing outside the cities and decreasing within the cities, and tree sparrow (*Passer*

montanus) increasing in cities and decreasing outside of them. These results indicate that cities sometimes function as an environment being somewhat independent on their neighborhood, and they could even represent refugia for certain species, especially for the declining farmland (e.g., tree sparrow).

Keywords: urbanization, time since urbanization, population dynamics, ecology of birds, urban birds, urban ecology