

Explore the Impacts and Alterations of Urban Environments on Bird Populations

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Abstract: The accelerating process of urbanization has had an impact on the living environment of birds and other wildlife; hence, many wild animals and plants have been forced to become urban settler. Birds, as an important indicator of the ecosystem, and analyzing the impacts and changes of the urban environment on bird populations can enable researchers to better understand the state of the ecosystem. Therefore, the purpose of this paper is to explore the effects of urban environments on bird populations and summarize how urbanization has changed the bird's survival in various aspects. The paper finds that disturbances in urban environments cause birds to develop corresponding adaptive changes through behavioral changes to avoid the effects of environmental disturbances; meanwhile, urban birds also use some features of urban environments to reduce the consumption of their survival. The analysis in this paper briefly summarizes the impact of urbanization on the survival of birds in various aspects.

Keywords: Birds, Urbanization, Reproduction, Behavior

1. Introduction

As modern urbanization continues, the proportion of the natural environment is decreasing, and human activities are inevitably affecting the natural environment and ecosystem. Urbanization means the expansion of urban land and the rise of population, as of 2024, the population living in urban area is 55% of the total population [1]. Cities have gradually become the mainstay of human development, and correspondingly, with the expansion of urban areas and the occupation of natural resources, the natural environment has been degraded, the reduction in the living space for wildlife appear correspondingly. Birds, as an important part of both urban and natural ecosystems, are sensitive to habitat changes, widely distributed, and characterized by high species diversity, is an important indicator for studying ecological changes. It is crucial to the protection of natural resources; the development of society relies on the balance between the nature and the cities. Therefore, by studying the survival status of urban populations of birds and comparing the behavioral and physiological differences between urban and natural populations, we can better understand the status of the urban environment, and thus build a balanced and sustainable modern society.

Research on the adaptation of bird populations in urban areas has attracted the attention of researchers in various fields of ecology and zoology. Scholars in different fields have been studying the behavioral and physiological changes of bird populations in urban areas and summarizing the adaptations of birds in urban areas, it has been widely noticed whether the breeding behavior of birds is affected by various characteristics of urban environment. A research team from Tehran University

summarized the factors affecting birds' nesting location choices in cities by studying the characteristics and patterns of Laughing Dove (*Spilopelia senegalensis*) on nesting sites in urban environments in Iran [2]. A research team from Qufu, China pointed out the behavioral adaptations of the Black crowned night heron (*Nycticorax nycticorax*) to urbanization by combining the degree of urbanization and the height of nesting [3]. Aspects of the urban environment not only change bird populations behaviorally but are also critical to the change of physiological changes in bird populations, among which the effects of urban nighttime light on bird endocrinology have received attention, such as the researchers from Minzu University of China who addressed the relationship between metabolic capacity and nighttime light in the Australian Zebra Finch (*Taeniopygia castanotis*) [4].

This article summarizes the survival of bird populations in urban environments by interpreting existing research results, and discusses how to promote the balanced development of urban environments through urban wildlife research. The article will begin with an analysis of the environmental characteristics of cities as habitats, followed by a summary of changes in bird populations in response to factors in cities.

2. Environmental characterization

2.1. Bird habitat characteristics

Birds' choices of habitat is influenced by various factors. These factors include food resources, breeding conditions and safety. Generally, habitats have sufficient food reserves and suitable water distribution. Different species of birds have different habitat requirements, including wading birds and swimming birds, such as black crowned night herons and egrets among wading birds and mallards and swans among swimming birds. Some members of the Pelecaniformes and the Anseriformes prefer water-rich environments for feeding and breeding. Arboreal birds require a certain number of trees in their habitat for nesting.

However, these needs usually cannot be fully met in urban environments, where facilities are designed for human activities, and bird populations with strong adaptive capacity can gain a greater advantage in urban environments. At the same time, strong adaptive capacity also means that dominant urban populations do not usually have physiological traits that are specialized for one environment. In urban environments, the areas that can satisfy the habitat needs of birds are mainly concentrated in green lands, such as parks and greenery, which are richer in natural resources than other facilities and areas in the city, and are more suitable for the survival of birds.

2.2. The current state of urban environments

Urban ecosystems are characterized by the fact that cities are built and designed based on the needs of human activities. The survival of wildlife in urban environments are usually involved in variety of disturbances. Studies have shown that urban environments are characterized by many disturbances and patchy distribution of suitable habitats; urban climates act differently from natural environments, with the urban heat island effect, where temperatures are usually higher than in the external environment; and low diversity of plant and animal species in urban areas, resulting in monocultures and low vegetation cover [5]. The disturbances caused by human activities are mainly in the form of noise, pollution and light, etc. generated by human behavior and man-made structures.

3. Influence of urbanization on birds

In urban environments, birds need to face different disturbances that in their natural habitat. Urban disturbances are caused by human impacts: transportation systems, modern buildings, etc. The

reduction of natural habitats due to urbanization caused birds populations tend to have more concentrated distribution on certain preparable regions, parks, etc. For some species that are able to adapt to human-made structures, it is feasible for them to choose to nest in modern building, using unnatural materials that can be found in the city, but such choices may possibly crate problems of conflict with human, and in terms of health and hygiene, the overlap between birds and human settlements can hurt both birds and human's health. Often, urban environments produce disturbances to a greater extent than natural environments, an example of this is the impact of noise from urban areas, noise form transportation systems and human activities can affect the daily activities of birds, which rely on song to communicate information, noise has the potential to interfere with the proper transmission of acoustic information. meanwhile, human activities themselves can interfere with birds' search for food, choosing the correct response to potential harm, and discerning whether an object approaching is dangerous. Birds will tend to avoid these factors in the city, thus choosing urban green spaces closer to the natural environment as a place to live, these parks and green spaces in the city had scattered distribution, in the limited area, forming the urban environment habitat appearing patchy and fragmented characteristics. The distribution of birds in urban green space is related to the size of the green space, usually the larger the area, the greater diversity of species; the deeper the degree of urbanization, the lower the diversity.

The impact of urbanization on the distribution of birds is mainly reflected in the reduction of suitable habitats caused by urbanization, which affects the survival status of bird populations. Inside the city, bird populations mainly live in urban green spaces, which are limited in size and resources abundance, and are separated by other facilities and buildings, all of which constrain the diversity of urban bird populations. At the same time, there are some dominant species, some of which are better able to adapt to changes in the cities and thus have an advantage in such environment, mainly in terms of being able to carry out their activities more efficiently.

4. Adaptation of birds

Birds adaption to urban environments by changes in physiological and behavioral states. For example, birds adapt to the effects of noise in urban environments by altering their song patterns, e.g., urban birds shorten the duration of a single call to ensure that the transmission of a message is less likely to be interrupted [6], and by altering the frequency of the call to avoid noise interfering with the transmission of sound [7]. For example, some urban bird populations call louder or for shorter durations than those in natural environments to ensure that messages are adequately transmitted in noisy urban environments. The timing of calls may also vary in response of the noise at different times of the day in the city. Meanwhile, birds show the ability to learn and adapt to the rapid changes in urban environments.

In terms of reproduction, bird populations in urban environments choose locations that are better protected from disturbances, and tend to nest higher compare to location choices in natural environments. In addition, urban birds are thought to be more receptive to new nesting materials and choose man-made structures for nesting locations [8]. A study on nesting materials of birds in urban areas of Pakistan showed that the proportion of man-made materials used by birds for nesting increased along with degree of urbanization, such as the usage of metals, plastics, etc. for building and supporting nest structures [9]. The fact that urban bird populations choose materials that are more readily available implies that urban bird populations are capable of learning and are more receptive to new things. Urban bird populations show physiologically higher tolerance to human behavior, which leads to shorter flighting distances.

This paragraph uses the black-crowned night herons (*Nycticorax nycticorax*) as an example to illustrate the adaptive behavior made by urban populations in terms of breeding behavior. Behaviorally choice of nesting locations during the breeding season, with the species populations

choosing to nest at higher sites in highly urbanized areas than in natural environments, coinciding with a general pattern of disturbance, the specie population in urban areas had shorter flight distances than those in less urbanized areas, suggesting that night heron populations have adapted to the changes brought by urbanization in terms of behavior. In the selection of nesting materials, populations in urban environments choose materials differently from those in their natural habitats,

Bird populations in urban environments show higher densities than in rural and natural environments due to differences in food and other resources available in urban areas as well as the climate. This difference in density is partly due to the fragmented and dispersed distribution of preferable habitat as one of urban environment characteristics, which caused the phenomenon of high density and low diversity due to the tendency of birds to live in these environments; additionally, it has been suggested that urban environments have richer food reserves than low urbanized areas [9]. Meanwhile the long-term changes of organization on bird populations are not only reflecting the response of birds to disturbances, based on some of the characteristics of urban environments, birds may transform these characteristics into favorable factors for the survival of the populations by changing their behavioral patterns. Studies have shown that urbanization provides an advantage for birds during winter in cities by altering the climate, such as an increase in temperatures due to the urban heat island effect, and by increasing available resources: more food reserves and relatively fewer predators, which transforms some migratory species into resident populations [10]. A study of the migratory behavior of urban and forest populations of the European blackbird (*Turdus merula*) found that urban populations are gradually preferring to stay in urban environments as breeding grounds for the winter, based on the urban resources that facilitate wintering and early reproduction [11].

By studying the survival of birds in the city, it can give us a better understanding of the health and status of the urban environment and help us build a sustainable and eco-friendly city.

5. Suggestions

The impact of urbanization on all types of wildlife, including birds, cannot be ignored, and it is vital to balance urban development with the protection of the natural environment. This not only means protecting existing natural habitats but also requires consideration of the survival of birds in cities. With regard to the survival of urban populations of birds, it is undeniable that cities are not the best option for bird survival. In the process of urban development and planning, although the principle of human-centeredness should be adhered to, it is necessary to take into account the survival of birds and other plants and animals in the construction. For the survival of birds, urban planning can add more greenery, expand the area of parks and other facilities in line with the conditions of survival of birds, and as far as possible to maintain the stability of species diversity within the urban environment. This protection of birds can ultimately have a positive impact on the overall development of the city and provide a better experience for people living in the city.

6. Conclusion

This paper summarizes previous studies and reports on urbanization and bird survival to provide as comprehensive an understanding as possible of the current status of urban survival of birds. This paper finds that bird populations survive in urban environments and are affected by various aspects of urbanization. Urban environments are characterized by a variety of disturbances not found in natural habitats, and birds adapt to urbanization through behavioral and physiological changes, such as noise and human activities. Urbanization not only interferes with the survival of birds, but also some features of urban environments change the survival conditions of birds. Climate change caused by factors of cities is gradually altering the migration and breeding behaviors of migratory birds, and

is gradually forming urban populations that are different from their natural environment populations. This paper summarizes the results of current research on the survival of birds. More attention can be paid to the urban survival of birds and how to strengthen their ability to survive in cities and how to enhance the inclusiveness of urban environments.

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