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Influence of Spotted Doves' Diet on Their Survival in China Urban Areas

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Abstract. The study of urban birds is not an uncommon occurrence. The total amount of food in cities is higher than in rural wild environments, but bird biodiversity is reduced. As a common bird in many cities in China, the spotted dove's feeding choice may determine its dominant position in the urban ecosystem. In this literature review, from the perspective of the food selection of the spotted dove, through its nesting behaviors, diet, and adaptation to the urban ecosystem, the living situation of the spotted dove in China is described, and the reasons for its adaptation to the urban ecosystem are analyzed. At the same time, some suggestions for improving the biodiversity of urban ecosystem based on the living habits of the spotted doves were also discussed.

Keywords: Spotted dove, Urbanization, bird, foraging behavior

1. Introduction

The study of urban birds is not a new thing. However, due to the differences in geographical, climatic, and human influences in various places, bird species and behaviors will have certain differences. The overall differences between bird communities are large, which makes it necessary to focus on a specific area and species for research and conservation purposes. With the rapid development of urbanization in China in recent years, the habitat of urban birds has changed greatly. The influence of human activities on birds is easy to cause a change in bird behavior, which needs further research. Birds in the city's overall survival is smaller than forests and other ecosystems. Urban bird prosperity is often thought to come from food abundance and lower survival risk. Although the Feral animal, the stray animal in the city, is considered a great threat to birds, many other threats also exist [1, 2]. On the other hand, other studies suggest that the risk is not that high [3]. This may depend on regional differences, and the controversy here deserves further study. Birds have nesting sites in cities, and generally the more urbanized the area, the less predation there is [4].

Meanwhile, food is relatively more abundant in urban areas. There are many cultures that feed birds nuts and seeds. There are birdseed vendors at the seaside and in the parks, and birds in the cities are biologically prolonging their breeding seasons to compensate for their lower survival rate [5]. The increase in breeding seasons may have something to do with global warming [6]. Compared with the more obvious behaviors such as nesting and mating, the study on feeding is relatively less, and more is only the auxiliary condition for nesting and breeding. Therefore, a more comprehensive survey of eating behavior is necessary. This literature review will focus on the spotted dove in China, whose feeding behavior has not been investigated much, but rather in investigation with other birds. About

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the common resident bird spotted dove for further study, is helpful to further studies on birds eating, a better understanding of urban ecological system, and better protect native birds' habitats in the city and explore the urbanization impact on this particular bird physiological, explore the method of improving urban ecological system diversity.

2. Case study of spotted dove(spilopelia chinensis)

2.1. Foraging behavior

Spotted dove (Streptopelia chinensis), It is a common bird whose most distinctive feature is the pearl-shaped spot on its neck. Widely distributed in South Asia [6]. It's been recorded in cities and villages. There are many records in northwest and North China.

Since there is no specific record of spotted doves in China, the analysis is based on the research in Australia. Australia's spotted doves, like those in China, are resident birds with a large population. However, there are differences in wasted food, building structures and vegetation between the two places, which may lead to inaccurate analysis. However, the similarity between urban ecosystems makes the data of Australia have certain reference value as shown in Table 1. In Australia, spotted doves were observed mainly in urban gardens, parks, streets and other places where spotted doves often appeared. These places are also common places in spotted doves in China. This shows some similarity between Australia's spotted doves and China's spotted doves. The Australian records include foraging and foraging and immobility and so on. Within a stable range of food foraging, they spend most of their time pecking and a little time pacing. Only a small part of the observed time is spent eating [7]. Given that the documented breeding period of the spotted dove, it may indicate that the abundance of food within the city reduced the amount of time the doves spent foraging. At the same time, their relatively long periods of vigilance may be an adaptation to human activity. Being vigilant in the face of humans may be their chosen survival strategy in the midst of urbanization.

Table 1. Mean percentage foraging time allocation in 10 species of exotic and native Australasian diurnal land- birds [7].

Species	Sex time of year	Habitat	Mean time foraging (%)
Kaka Nestor meridionalis	w, sp	Forest	43-73*
Crimson Rosella	a (nb)	Forest	45
Platycercus elegans			66
Rifleman Acanthisitta chloris	a, w (nb)	Forest	83
Superb Lyrebird Menura novaehollandiae	All year	Forest	53-58*
Bellbird Anthomis melanura	w, sp, su	Forest	25-60*
Grey Warbler	b	Forest	~79*
Gerygone igata			~41*
Brown Thornbill Acanthiza pusilia	a, w (nb)	Forest	88
Magpie-lark Grallina cyanoleuca	a, w (nb)	Urban parks and street	68
South Island Robin Petroica australis	a, w (nb)	Forest	72-87
Common Myna Acridotheris tristis	sp, su	Urban-rural gradient	75*

A = adult, I = immature; F = female, M = male; a = autumn, w = winter, sp = spring, su = summer; and b = breeding,nb = non-breeding season. *Some values incorporating breeding-season data may overestimate the proportion of daytime spent foraging because, probably like the present Spotted Dove estimate, they refer only to 'off-nest' time. On the other hand, adults rearing nestlings presumably

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need to spend proportionally more time off the nest foraging in order to harvest sufficient food for their young and themselves [7].

2.2. Nesting aspect

Spotted dove usually chooses common materials such as twigs and leaves to nest in spotted dove. Their nest is usually simple, consisting of only dozens of twigs [6]. Usually, they nest in the morning. The spotted dove is a common resident bird in the city. Its nesting site mainly considers safety and food sources. spotted dove has been documented to nest in quieter, secluded high-rise trees to keep their offspring safe. They are also more likely to nest in tall trees and air conditioning platforms near residential areas [8]. This kind of nesting selection close to residential areas may be related to the source of food. In cities, where birds have fewer predators than in the wild, food sources may be an important criterion for choosing a nest site [9]. Spotted dove, a bird that mainly eats plant food in the wild, likes to eat seeds of grasses, legumes, Cruciferae, and other plants, and also eats a small amount of animal food [10]. In cities, rice and beans are less common food, and the more common choices are anthropogenic refuse, seeds from common garden plants, and so on.

2.3. Diet

*2.3.1. In Rural Areas.*Spotted doves are most frequent in autumn, and early spring, mostly in the field, sometimes on the roofs of villages. During the day they mainly walk, forage, chase, fly and do other activities in wheat fields, vegetable fields, wastelands, and lakes. In the cold winter season, most of them live in the trees and rarely move. In the field, the common food is barley, sorghum, and other agricultural crops. An investigation has been taken out from a bothersome capsule and stomach rice rot grain, wheat grain, red bean, wild legume seeds, and other crops. From the bursa and stomach of another turtledove, rice grains, moss grains, wild legume seeds, barley grains, wheat grains, weed seeds, etc [10]. At this time, during the month, the spotted doves often forage in the rape field. This shows that the wide range of feeding habits of the spotted doves helps them adapt to the diverse food environment in the city.

*2.3.2. In Urban Areas.*such as Beijing, the spotted dove mainly feeds near urban forest parks, comprehensive parks, green belts in residential gardens, road shelterbelts, and green belts along rivers. Among the feeding parks, including gymnosperms, angiosperms, evergreen trees, evergreen shrubs, deciduous trees, and other plants, which provide seeds and flowers or flower buds basically half of each station, also provides fruits and berries. Succulent fruit types include fruit drupes, berries, pome, and cones, and a few are dried fruit types such as capsules and samara [11]. As a phytophagy bird, the food supply in the city is abundant for the spotted dove. in the green belts, foodborne plant species are not rich, but the number of its habitats is rich. The possible reasons found are that the green belts have a lot of weeds, and seeds are often a lot of birds like food. it is thought that the lack of medium-sized shrub vegetation types such as helps birds forage for food in the city [8]. Within urban gardens (likely nesting sites of choice for the spotted dove), the lack of medium-sized shrubs, abundant grass, and seeds produced by tall trees are more conducive to the foraging of the pearl-necked turtle. This observation also demonstrates the importance of the understory to the habitat of the spotted dove.

One source of food for urban spotted doves is human-produced kitchen waste. In northern China, about 90 percent of the kitchen waste is plant-based waste [12], which corresponds to the diet of the spotted dove. In the wild, pearl-necked turtle doves eat a diet of beans, rice, and wheat. The quantity of wheat flour products in kitchen waste is very abundant. China's kitchen waste recycling system is not very perfect, so the kitchen waste in the garbage can is a very rich food resource. The food that people wasted was Divided into 16 categories and 48 subclasses as shown in Figure 1: pasta (including flour, steamed bread, cakes, noodles, dumplings, steamed stuffed bun), rice, maize (corn and corn flour), beans, green beans, red beans, soy beans and bean products), coarse grains (such as millet coarse grains), tubers, meat (pork, beef and mutton, poultry), eggs, milk, milk powder and milk/yogurt),

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aquatic products, vegetables, Vegetables and pickles), fruits, snacks (nuts, dried fruits and other snacks), beverages (liquor, beer, wine, and other beverages), edible oils and condiments (salt, soy sauce), vinegar, chicken essence, monosodium glutamate, sesame oil, cooking wine, pepper, sauce, oyster sauce, star anise, onion ginger garlic, and other condiments) [13]. The waste of edible oil and condiment was not quantitatively measured in this study. We defined pasta, rice, maize, beans, coarse grains, tuber, vegetables, fruits, snacks. According to other studies, birds engage in foraging behaviors near dumpsters, such as rummaging and visual searches.

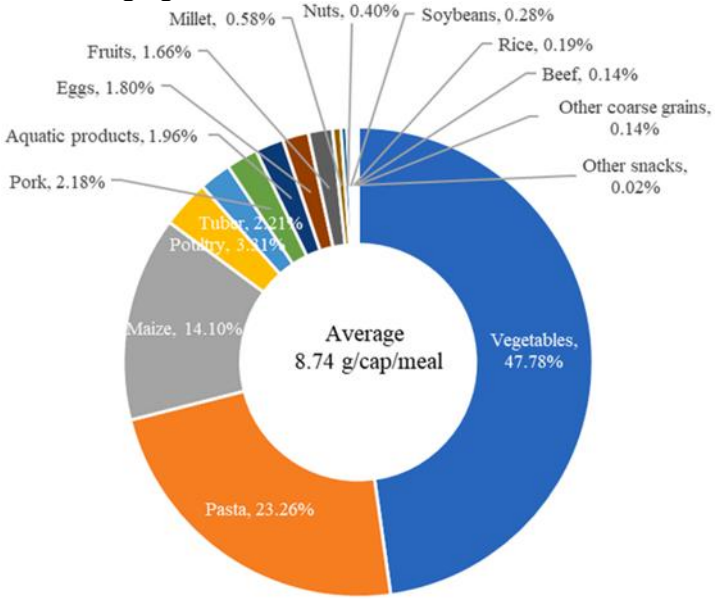

Figure 1. Average food waste and composition in rural households in Shan-dong, China [13].

2.4. Hatching and breeding

In the choice of food and nest, spotted dove in the city is more suitable for human existence. In the neighborhood near human activities, tall trees, and roadside green belts can be seen. However, Spotted Dove would still choose trees on higher floors and air conditioners on the fifth or sixth floors due to other reasons. This may be due to the reasons of keeping away from and guarding against humans while pursuing the maximization of food benefits. Their numerical superiority proves their adaptation to the environment in which they live.

In terms of hatching, Spotted Dove can basically engage in reproductive activities throughout the year. In urban areas, Spotted Dove can reproduce all year round, with male and female mating mostly occurring in spring and autumn, and there is no obvious seasonality between spawning and brooding. Brood can be divided into 3 periods. Pigeon breastfeeding period: the period spotted dove nestling will be sucking pigeon breast in the parent bird's mouth. Transition period: In this period, plant seeds are added to the brood food, but the amount of pigeon milk is reduced compared with the previous stage. Nesting week brood stage: the nestlings go out of the nest and go back to the nest in the evening or perch in the nest to practice flying. There was little difference in the breeding behavior of the spotted dove between seasons [8]. However, in rural areas, spotted doves in the cold winter, mainly inhabiting the bushes, are rarely active [10]. This may indicate that the abundance of food in cities promotes breeding behavior. However, more frequent breeding behavior of birds may lead to physical damage to birds, which may lead to the reduction of life span and quality of life of spotted bird. However, the evidence in this respect is not sufficient and further research is needed. The ability of Spotted Dove in facing new predators in the city may be improved, but there is still no sufficient evidence to prove that Spotted Dove has stronger alertness when facing predators like stray cats and dogs. As an important influencing factor of Spotted Dove in cities, more investigations are needed.

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2.5. Noise influences

According to some researches, the noise in the cities can disturb the interaction between individuals [8]. forced by noises, species that make low-frequency calls may be drowned out by the noise of passing motor vehicles, and thus have to make more frequent call which in turn require more energy expenditure. However, according to previous records in Australia, although individuals' communication in spotted dove is rare, it does not hinder their foraging behavior and breeding behavior. Reproductive courtship behavior of spotted doves is more about physical interactions and chasing, and sound may not be a very important part of it. This may indicate that individuals' communication is not very important, and that beaded turtle doves live in groups that are not affected by noise when food is abundant. The insensitivity of spotted dove to noise may also be the reason for its flourishing in cities.

3. Discussion

Spotted dove has been found in many cities in China, and its adaptation to the urban environment obviously helps its reproduction in various cities. As a phytophagy bird, the urban ecosystem can provide more resources than those who eats insects. It can be the reasons that they are the resident bird in a wide range of cities [14]. However, the data currently available are not very comprehensive, and the differences between regions have not been thoroughly considered. In future studies, more attention should be paid to the differences between different regions. The number of food in the city is very rich, according to a British survey, of birds, there is no significant demand for anthropogenic food, birds have a certain flexibility and ability to choose. At least during the non-breeding period [15].

Another idea is that when a bird's main food source comes from low-quality, large amounts of anthropogenic refuse, it provided by the parent bird to the nestling will provide sufficient food resources for the nestling, but will also reduce the physical health of the nestling. In Spotted Dove, chick rearing mode does not directly provide anthropogenic food to young birds, but feeds them with secretions like pigeon milk and plant seeds. Such breeding characteristics may reduce the effect of anthropogenic refuse on the birds. However, without a more specific comparison of the differences between pigeon milk in Spotted dove in urban areas and rural areas, we could not determine the influence of artificial food on Spotted dove [16].

However, the differences between urban ecosystems are not as significant as those between other ecosystems. When humans create cities, they create similar ecological groups, which in turn promote the emergence of homogeneous bird groups [17]. For example, the spotted dove is widely distributed. Clearly, in order to better protect the ecological diversity of native species in China, China's urban greening, architectural layout, and so on city planning still needs further improvement. Since birds like spotted dove may forage in the city garbage dump, trash can and other places, the government should introduce more perfect requirements on garbage recycling in order to reduce such invasive species. In order to protect the health of such birds in cities, the government could also improve recycling procedures in cities. A view is only for native species to provide a more suitable habitat is still not enough, we can create more niches attracting other species to the urban ecological system, thus reducing the dominance of local invasion of birds, and then create native birds living space [18]. At the same time, without the influence of food resources on birds, many factors in the city may affect the life of urban birds, and the singing behavior of many birds is also worthy of attention. According to one study, artificial light is a good factor in explaining bird density and seasonal similarities. Artificial lighting has altered the nocturnal environment of urbanized habitats, and light pollution may have implications for the physiology, ecology, and evolution of animal populations. Laboratory studies of the effects of artificial light on birds have shown that it alters the birds' biological clocks. A light source acts unconditionally on certain creatures, disorienting them; This may partly explain why birds tend to congregate in bright spots. However, light at night is thought to be the main driver of variation in the timing of daily activities [8]. The song of birds can have many meanings, and there are many differences in the song of different birds, which are worthy of further study. The effects of urbanization are likely to have corresponding effects on many bird behaviors, and the evidence at the

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genetic level is not strong enough to warrant further study. At the same time, without the influence of food resources on birds, many factors in the city may affect the life of urban birds, and the singing behavior of many birds is also worthy of attention. The song of birds can have many meanings, and there are many differences in the song of different birds, which are worthy of further study. The effects of urbanization are likely to have corresponding effects on many bird behaviors, and the evidence at the genetic level is not strong enough to warrant further study.

4. Conclusion

In the case of the spotted dove, it can be seen that the adaptation of spotted doves to the city in nesting, reproduction, and food choices. In general, spotted dove adapted to the urban ecosystem, with a very extensive diet, and was not very vigilant in the face of human influence. As an important part of the urban ecosystem, birds provide us with high research value. At the same time, it is hoped that the factors affecting the survival of birds in Chinese cities can be further studied.

References

[1] Moller A.P., Ibáñez-Álamo J.D., "Escape behaviour of birds provides evidence of predation being involved in urbanization,", Animal Behaviour, Volume 84, Issue 2, 341-348 (2012).

[2] Marina A., John M. M., Eric S., Gordon B., Clare R., Craig Z., "Integrating Humans into Ecology: Opportunities and Challenges for Studying Urban Ecosystems," BioScience, Volume 53, Issue 12, 1169–1179 (2003).

[3] Sorace, A., Laboratory Igiene A., Istituto S. d. S., Viale R. E. 299, 00161 Rome, Italy. Received 14 February 2001, accepted 20 August 2001.

[4] Vincze E., Seress G., Lagisz M., Nakagawa S., Dingemanse N. J., Sprau P., "Does Urbanization Affect Predation of Bird Nests? A Meta-Analysis,", Frontiers in Ecology and Evolution, volume 5, (2017).

[5] Schoech, S.J, and Bowman R., "Variation in the timing of breeding between suburban and wildland Florida scrub-jays: Do physiologic measures reflect different environments?" edited by Marzluff J.M.et al. Avian ecology and conservation in an urbanizing world., 289–306, (2001).

[6] Zhou Y. B., Zhang X., Suo J. Z., Jiang G. H., Hu j. C., and Chen J. "Breeding Ecology and Nest-site Selection of the Spotted doves in Northeastern Sichuan China".

[7] Lill, A., & Geraldene, B. "Do spotted doves need to forage extensively in food-rich urban environments? Australian Field Ornithology,", 33, 121–124, (2016).

[8] Ciach, M., Fröhlich, A. "Habitat type, food resources, noise and light pollution explain the species composition, abundance and stability of a winter bird assemblage in an urban environment," Urban Ecosyst 20, 547–559, (2017).

[9] Zu K. L., Zhang W. H., Hou Y., Li X. Y., Liu W., Li Z. J., "Seasonal dynamics and habitat selection of ruddy shelduck (Tadorna ferruginea) (Anseriformes: Anatidae) in alpine wetland ecosystem of southwest china," in Acta Zoologica Bulgarica, 65, 469-478, (2013).

[10] Anhou Y., Jinsheng M., "A preliminary observation on the ecology of the pearl-necked turtle dove," in Chinese Journal of Zoology, edited by Editorial Board of Chinese Journal of Zoology, pp38-52, (1992).

[11] Jinling S., Zhang Z., Defu H., Minzhong W., Ruihai F., "Studies on Bird-Feed Trees at Green Belts of Beijing Urban Area," in Scientia Silvae Sinicae, 83-89, (2006).

[12] Yunyun L., Ling-en W., Gang L., Shengkui C., "Rural household food waste characteristics and driving factors in China, Resources, Conservation and Recycling." Volume 164, (2021).

[13] Leveau LM., "Urbanization, environmental stabilization and temporal persistence of bird species: a view from Latin America," in PeerJ, (2018).

[14] Yunyun L., Ling-en W., Liua G., "Rural household food waste characteristics and driving factors in China Shengkui Chenga Resources," in Conservation&Recycling, (2021).

DOI: 10.54254/2753-8818/4/20220616

[15] Stofberg, M., Cunningham, S. J., Sumasgutner, P., Amar, A. “Juggling a “junk-food” diet: responses of an urban bird to fluctuating anthropogenic-food availability.” Urban Ecosystems, 22(6), 1019-1026, (2019).
[16] Sauter, A., Bowman, R., Schoech, S. J., Pasinelli, G, “Does optimal foraging theory explain why suburban Florida scrub-jays (Aphelocoma coerulescens) feed their young human-provided food?”, Behavioral Ecology and Sociobiology, 60(4), 465-474, (2006).
[17] Michael L. M., “Urbanization as a major cause of biotic homogenization,” in Biological Conservation, Volume 127, Issue 3, pp. 247-260, (2006).
[18] Eyal S., Susannah B. L., John M. A., Paige S. W., Stanley H. F., Charles H. N. “Invasion, Competition, and Biodiversity Loss in Urban Ecosystems,”, BioScience, Volume 60, Issue 3, 199–208, (2010).