Evaluation of the Impacts of Free-Ranging Domestic Cats on Global Bird Populations and Ecosystems

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Abstract: Free-ranging domestic cats (Felis catus) are owned and unowned cats that can range freely. These cats appear for a variety of reasons like deliberate grazing by owners or lack of management. Garden birds are an important part of nature, often involved in seed dispersal and pest control. It is now known that free-ranging domestic cats have caused a huge reduction in population and species abundance of garden birds. This article discusses the impacts of free-ranging domestic cats on garden birds and evaluate and suggests the existing relative policies. It outlines the scale of bird fatalities attributed to both owned and unowned cats, which are estimated to kill billions of birds annually across various regions including the US, Australia, and China. The distinction in impact between rural and urban settings is highlighted, with rural cats often used for pest control, while urban cats are primarily companions. Governments in different countries have different strategies for dealing with free-ranging domestic cat problems. Common treatment methods include TNR and euthanasia and hunting, but there are a variety of problems to be solved in implementation. Many governments even lack current policies to control free-ranging domestic cats or protect garden birds.

1 INTRODUCTION

Anthropogenic activities pose a serious threat to ecosystems, significantly reducing biodiversity in areas inhabited by humans. Domestic cats, cherished for their companionship and pest control capabilities, notably against rodents, have been integrated into human societies globally. House cats (Felis catus) were domesticated by human over 9000 years ago. According to molecular biological identification of DNA, the population gene pool of domestic cats was mainly derived from the Middle East and Egypt. These felines were most widely spread in the Classical period, as a pest control agent, symbol and companion animal (Ottoni et al., 2017). As obligate carnivores, domestic cats show play and hunting behavior more frequently after they are weaned. When deprived of humans interaction and left to wandering outdoors, they are more likely to fulfill their needs on local wildlife. Notably, even hungry cats are more likely to choose live prey than to feast on palatable food, but then return to what was offered. This can cause domestic cats to exhibit excessive killing (Cecchetti et al., 2021). Historically, the practice of allowing cats to range freely, combined with some owners' negligence and intentionally abandoned, has resulted in less controlled management of domestic cats.

Garden birds, encompassing various species that visit gardens for food and shelter, are a common sight in many parts of the world. These birds are not only prevalent in gardens but also has a high coincidence degree with the densely populated areas of humans. Their adaptation to the artificial environment is exactly successful. At the same time, these avian species are an important part of urban ecological environment, and intertwining interdependent with other organisms through the food chain to maintain the balance of ecological development. Specifically, birds can help control the population of pests and reduce the amount of pesticides used, thus reducing pollution to the environment. Beyond pest control, birds are vital agents in plant reproduction and growth. In the process of feeding, birds stick pollen on their bodies to complete the process of pollination. At the same time, they also disperse seeds by excreting them, promoting plant reproduction and distribution.

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With the development of social and economic and the process of urbanization, free-ranging domestic cats have become one of the most destructive invasive species at present, especially to the local garden bird population. Research indicates that these cats are responsible for the deaths of approximately 1.3-4.0 billion birds annually on the earth (Loss, Will and Marra, 2013). In semi-wild, human-modified environments, free-ranging domestic cats lack natural predators and can seek to be provided by their owners when resources are scarce. Thus, they are far more ecologically competitive than local wild animals (Lepczyk et al., 2023). By catamount nature, domestic cats tend to prey on birds, reptiles and mammals, which cover 90 percent of diet. Additionally, though the owners often provide sufficient energy, free-ranging domestic cats actively hunt many wild animals for entertainment and curiosity, resulting in even more killings. Unowned free-range domestic cats may breed outside, expanding the population and leading environmental effects. The difference in the impacts of free-ranging domestic cats in urban and rural areas may be due to the different purposes of their owners. Domestic cats in rural areas are mainly kept to protect crops and stored food. Keeping domestic cats free can help remove pests faster and more efficiently. In urban areas, domestic cats are mainly regarded as family companions of their owners. Thus, fewer domestic cats spend time outdoors.

At present, for unowned domestic cats, governments address the issue through initiatives such as trap-neuter-return (TNR) activities, adoption efforts, and culling measures to control the population. When it comes to domesticated cats, the situation is more complicated due to their legal status as property of their owners. So many of the methods used for unowned cats are inappropriate. This article discussed the impacts of free-ranging domestic cats on garden birds, reviewed the policies in place to manage these cats, and provided recommendations for mitigating their negative impacts.

2 IMPACTS OF CATS ON BIRDS

Free-ranging domestic cats have had an impact on garden birds all over the world. There is a difference in the extent of the impact between unowned and owned cats, with unowned cats generally killing more wild birds. There are also differences in the destructive magnitude of free-ranging cats in different environments. On the mainland, free-ranging cats often reduce some bird populations or affect bird ranges without directly causing the species to distinct. On islands, due to space constraints, the introduction of domestic cats is more fatal to the local ecosystem. Predation by cats has led to extinctions of many island species, some of which are even endemic to the islands. In the red list of International Union for Conservation of Nature (IUCN), free-ranging domestic cats on islands have caused 33 extinctions of modern bird.

2.1 Magnitude of Bird Mortality Caused by Cats on Mainlands

Loss et al. have done a research based on cat predation data the United States, Europe, Australia and New Zealand (Loss, Will and Marra, 2013). In the three estimates of bird mortality, they mainly focus on interpretating on the data of US and Europe. Cats in the United States kill between 1.3 and 4.0 billion birds each year (median=2.4 billion), 69 percent of which are caused by unowned cats. Unowned free-ranging cats hunt at three times the predation rate of owned cats. The article shows that the mortality rate of birds caused by cats is much higher than previously estimated in the United States, and it is higher than any other human cause of death (like strikes and poisoning). Most of the birds of cat predation are native species. According to the data, less than a third of the bird species that encounter predation are nonnative. This could be strong evidence of the impact of free-ranging domestic cats on native species diversity. In addition, it was found that there was a certain technical difficulty in the investigation of unowned domestic cats, resulting in a decrease in the accuracy of the predation data. Counting the number of unowned cats is prohibitively expensive. Moreover, due to the lack of widespread public knowledge, human subsidize a large part of the maintenance of the population of unowned free-ranging domestic cats. There are more than 300 colonies of human-maintained cats in Washington, D.C. alone. The results suggest that the presence of cats has led to population declines in certain species in some areas. But the specific population changes and the spatio-temporal variations in the presence of the most affected species make it difficult to determine the accurate data.

In Europe, Roman et al. analyzed data on cat predation from ringing programmes in France and Belgium (Pavisse, Vangeluwe and Clergeau, 2019).

They examined bird species killed by domestic cats between 2000 and 2015. Passerines were found to be the species most affected by cat predation, a common native ground-feeding bird. The behavior of birds living on the ground is related to the rate of cat predation. Between 2000 and 2015, the number of birds killed by predation or attack by cats increased by more than 50 percent, matching the trend of local cat population growth.

The proportion of birds in cats diet increases in hot and arid areas. In Australia, feral cats kill 272 million birds a year, 99% of which are native species. Annual bird mortality is related to precipitation. The drought period is 161 million birds per year, which is significantly lower than the tide period with 757 million birds per year. On average, feral cats kill 356 million birds every two years. The researchers also found that in more urbanized areas, owned-cats killed 44 million birds a year and owned-cats killed 61 million birds a year. That's more than 1 million birds killed by cats every day. The proportion of birds in the diet of feral cats is higher than that of mammals (Woinarski et al., 2017).

Li et al. estimated total annual predation of owned and unowned domestic cats in China by questionnaires (Li et al., 2021). According to their research, domestic cats in China prey on a substantial number of wildlife, with about 1.213-3.298 billion wild animals killed by free-range domestic cats each year. Between 30 and 40 percent of cat-owning households allow domestic cats to roam outdoors. These cats bring home more than 3,000 species of prey. Each urban household has an average of 0.14 free-ranging domestic cats. In rural areas, each household has an average of 0.36 free-range domestic cats. It is estimated that urban free-ranging domestic cats prey on an average of 1.41 birds per year while rural free-ranging domestic cats hunt an average of 2.17 birds per year. Due to the limitations of the questionnaire method, wildlife mortality caused by free-ranging domestic cats is likely to be greatly underestimated.

2.2 Extinctions on Islands

Cats have been introduced to 179,000 islands around the world. As a highly invasive species, cats cause more than ten times as much damage to island ecosystems as they do to mainland ecosystems (Woinarski et al., 2017). The population size of species on islands is often out of proportion to that on land, and is therefore more affected by cats. In the Pacific, the impact of birds is mainly on the passerines and petrels. Medina et al. found that feral cats were responsible for 13.9% of bird, mammal and reptile extinctions recorded by the IUCN Red List (Medina et al., 2011). After a Meta-analysis, they demonstrated that cats have a negative impact on bird populations on the island (effect size: 0.5484).

3 STRATEGIES AND EVOLUTION

Despite these enormous harmful effects of free-ranging domestic cats on garden birds, effective control measures are still lacking. The commonly used TNR method considers more about the rights and interests of cats, in fact, has no obvious effect on protecting the ecosystem, and is costly and difficult to operate exactly. It is due to a lack of basic public awareness of the threats of free-ranging cats. The prevailing view is that other disturbing human activities (such as habitat destruction and building collisions) have much greater impact on garden birds than free-ranging cats do, which might only be a minor factor. However, according to the survey data, the harm caused by domestic cats is very considerable and the number is statistically greater than the death of birds caused by building collisions, the second harmful impacts of human on birds.

3.1 Current Methods

On islands, particularly those with significant biodiversity threats from introduced species such as domestic cats, eradication programs have removed these animals from at least 48 islands globally. The programs often employ trapping and hunting, sometimes assisted by dogs, alongside poisoning and the introduction of viral diseases such as feline panleukopaenia (Nogales et al., 2004). The success of the eradication efforts underscores the importance of combining multiple methods to effectively manage cat populations in sensitive habitats.

On the contrary, the controlling management of unowned and owned cats in urban and remote communities tends to focus more on humane strategies which consider the welfare of both the cats and the human community. A systematic review identified three primary methods suitable for remote Indigenous communities in Australia: Surgical Sterilisation (SS), Trap-Neuter-Release (TNR), and Trap-Remove (TR). These methods aim to reduce the

number of free-ranging cats through sterilization while also addressing the welfare of social cats through adoption or euthanasia (Brooke et al., 2020). The TNR method, involving trapping, neutering, and releasing cats back into their environment, has been highlighted as an effective strategy for controlling stray cat populations in urban communities. The approach not only addresses the immediate issue of cat overpopulation but also considers the welfare of the cats by preventing them from being euthanized (Tao et al., 2020).

In Australia, Indigenous tracking experts have been employed to hunt feral cats specially. This method has shown promise in reducing cat populations at specific sites, such as the Kiwirrkurra Indigenous Protected Area (Kiwirrkurra IPA), where 130 cats were removed over five years. The hunting activities were conducted efficiently, with teams of four hunters capable of catching up to four cats per day. The approach not only targets individual problem cats but also contributes to the protection of threatened species by maintaining a presence of hunters in the landscape, which may have co-benefits like fine-scale fire management (Paltridge et al., 2020).

In continental Europe, a study demonstrated that colorful collar-covers and bells can effectively reduce wildlife predation by domestic cats. This simple intervention aims to make cats more visible to their prey, thereby reducing the likelihood of successful predation. The effectiveness of this method suggests that non-lethal interventions can play a crucial role in protecting birds and other wildlife from cats (Simmons and Seymour, 2022). Additionally, the various obligations relating to the protection of Birds in the European Union Birds and Habitats Directives (Nature Directives) have significant effect on the management of free-ranging domestic cats. In the directives, cat population must be controlled when unowned cats pose a threat to local species. For EU member States, owned domestic cats are prevented and prohibited from roaming freely outdoors (Trouwborst and Somsen, 2020).

3.2 Evaluations

It is not difficult to see from the existing various methods that there are still many problems in control management of free-ranging domestic cats around the world.

First, the existing regulations are inherently flawed. Currently the most commonly used and popular TNR means have a long cycle and are difficult to operate. The process of capturing and neutering only one cat requires the long-term cooperation of multiple professionals, consuming a lot of time, money and human resources. Moreover, the threat free-ranging cats pose to local wildlife, such as birds, remains even after their release in TNR. Therefore, this approach is costing and slow and cannot achieve the purpose of protecting the ecosystem immediately.

Secondly, some provisions are not effectively complied with because of implementation difficulties. The EU Nature Directives, for example, make it difficult for governments to determine how much of a threat cats pose to local wildlife, so control management of cat populations may not be timely.

Also, the public does not have a correct understanding of the damage of free-ranging domestic cats to local wildlife such as birds. Statistically, a significant number of people believe that cats are members of local ecosystems and therefore should not be interfered with in their population growth and their predation on wildlife (Li et al., 2021). It is important for the popularization of common sense among the public. In areas severely affected by free-ranging cats, the government should include the learning of relevant facts in the compulsory education stage to form a better social atmosphere and help control the population of cats roaming outdoors.

Finally, some countries still lack any effective methods related to controlling cats. Domestic cats have been introduced to many areas for many years, but few researchers have investigated the damage cats can do to ecosystems. Even in China, where many investigations have already been conducted, regulations for controlling free-ranging cat populations are still limited.

4 CONCLUSION

The ecological repercussions of free-ranging domestic cats are profound, especially concerning the decimation of garden bird populations and the broader impact on biodiversity. This review has highlighted that both owned and unowned cats contribute to a significant loss of wildlife, with billions of birds and other small mammals falling prey annually worldwide.

Free-ranging domestic cats include both owned and unowned cats, which both have a huge impact on

garden birds. In continental areas, cats generally reduce populations of many bird species through predation. Cats kill an average of 2.4 billion birds in the United States each year, 69 percent of which are caused by ownerless cats. In Australia, cats kill an average of 2.72 billion birds a year. In China, the figure is 2.57 billion. The data is universally lower than it really is. In island areas, due to geographical peculiarities, the impact of free-ranging cats often leads to more serious consequences, namely the extinctions of some native species. Bird species that are active on the ground are more likely to be killed by cats and their populations are more affected.

At present, there are some methods and policies for controlling free-ranging domestic cats around the world, such as sterilization and hunting, but they are all flawed. These approaches always have low popularity, are generally difficult to implement, and are hindered by the public.

This paper argues that the best means to control the harmful impacts of cats to wild animals such as birds is capture and euthanasia. Public awareness is also important because it not only benefits government efforts, but also reduces the free-ranging domestic cat population in the first place.

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