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Potential benefits of bird interspecies cooperation

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Abstract. This meta-analysis explores the potential benefits of bird interspecies cooperation, which is less common than cooperation within a species but can yield more complex advantages. The study identifies various forms of interspecies cooperation, such as alarm calls, foraging flocks, and mobbing behavior, and suggests that these behaviors are primarily geared towards enhancing foraging efficiency and reducing predation risks. The findings of this study contribute to our understanding of the intricacies of animal behavior and can inform efforts to conserve and manage ecosystems. Studies on bird interspecies cooperation can provide valuable insights into the behavioral dynamics of different bird species and their interactions with other animals, which can be useful in understanding the intricacies of ecological systems. This knowledge can have significant implications for conservation efforts, as well as sustainable agricultural practices, particularly regarding pest control. Additionally, research on bird interspecies cooperation can inform our understanding of human behavior and contribute to environmental education efforts.

Keywords: interspecies cooperation, alarm call, flock, foraging, mobbing.

1. Introduction

1.1. Background

The study of interspecies cooperation in birds has a rich background over several decades. Early research in this area focused on observations of cooperative behaviors between different bird species, such as mixed-species flocks, in which multiple species forage together. Over time, researchers began to investigate the mechanisms underlying these behaviors, such as the role of vocalizations or physical displays in facilitating communication between species [1]. Studies have also explored the ecological contexts in which interspecies communication and cooperation occur, such as the availability of resources or the presence of predators. More recently, advances in technologies such as genetic analysis have allowed researchers to explore the genetic basis of cooperative behaviors in birds [2]. Overall, research into the benefits of interspecies communication and cooperation in birds has a long and varied history, encompassing both observational and experimental approaches and drawing on multiple fields of study, including ecology, behavior, and neurobiology.

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1.2. Research gaps

Interspecies communication and cooperation is a fascinating area of research that has the potential to shed light on the complex social dynamics of bird communities. While some research has been done on this topic, there are still several gaps in our understanding of these behaviors. For example, we need to better understand the neural or physiological mechanisms that allow birds to communicate and cooperate with other species, as well as the ways in which environmental factors may influence the occurrence and effectiveness of these behaviors [3-4]. Additionally, it is important to explore the long-term outcomes of cooperation between species, as well as the complex social networks in which birds engage [5]. Further research in this area has the potential to not only deepen our understanding of avian behavior, but also inform efforts to conserve and manage bird populations in the face of environmental change.

1.3. Research contribution

The potential contributions of research into the benefits of interspecies communication and cooperation in bird species are numerous and far-reaching. Such research has the potential to provide valuable insights into the social dynamics of bird communities, including the formation of social bonds and the ways in which birds navigate social networks. This knowledge could be used to inform conservation efforts, helping to protect and preserve habitats that support cooperative relationships between species. In addition, research into the mechanisms and outcomes of interspecies communication and cooperation could lead to the development of new research techniques and tools, as well as providing broader ecological insights into the functioning of bird communities and ecosystems. By shedding light on the fascinating ways in which bird species interact with each other, research in this area has the potential to deepen our understanding of avian behavior and ecology, with implications for both conservation and basic scientific knowledge.

2. Ways of cooperation

2.1. Information sharing through alarm calls

Many bird species have been observed using calls to communicate with other species. The most common and well-known type of bird interspecies cooperation is alarm calls. Bird alarm calls are a common and important communication tool used by various species of birds to warn each other of potential danger. When a bird found a potential predator, it will utilize a distinctive alarm call to inform the threat to other nearby birds, even if they belong to different species. Birds usually utilize specialized calls to warn other individuals in the same area when a predator appears. For example, in a study in South America, researchers found that several different bird species used the alarm calls of a single species, the Tody flycatcher (Todirostrum cinereum), to communicate the presence of a predator. This allowed the birds in the flock to coordinate their responses and increase their chances of avoiding predation [6]. Birds can also utilize various calls to share more specific information with other birds. Research about black-capped chickadees (Poecile atricapillus) found that the birds produced different types of alarm calls in response to aerial predators (such as hawks and owls) than they did in response to ground-based predators (such as snakes and weasels). Additionally, the calls varied in intensity depending on the size of the predator, with larger predators eliciting more intense calls [7]. Interestingly, some bird species have also been observed using different alarm calls to represent different types of predators. For example, in a study of Japanese great tits, the researcher found females are able to use two kinds of calls, “jar” and “chika”, to represent different predators. They use “jar” calls to represent snakes and “chika” call to represent other predators. The result from the research shows that other bird species in the same area can distinguish the difference in the alarm calls. Other species would leave their nest and look down to the ground to guard their nest together [8]. More recent research which investigated how multiple species of birds in Africa communicate and respond to the presence of predators. The researchers found that a flock of different bird species can use similar calls to describe certain predator types. For instance, when a leopard was detected, the

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alarm call was a series of harsh, barking notes, while the call for a snake was a high-pitched, trilling sound [9].

Alarm calls happen not only between birds and birds but also between birds and other animals, usually mammals. A study about birds (bluish-slate antshrikes, Thamnomanes schistogynus) and primates (saddle-backed tamarins. Leontocebus weddelli), which share a common predator (bicolored hawk Accipiter bicolor), to find out whether these species can understand the alarm call from each other [10]. The result shows that even though these two species are distantly related if they have a similar predator, they will be able to take reaction and flee when they hear an alarm call from each other. These calls not only alerted other birds in the area to the presence of danger but also helped them to identify the type of predator and adjust their response accordingly. The likelihood of predator detection and subsequent alarm calls amongst conspecifics is positively correlated with the number of birds presents within a given area, thus leading to a significant improvement in their overall chances of survival. Kleptoparasitism is a kind of strategy some birds use to steal food from other birds. Some bird species also use false alarm calls to distract other species and steal food. For example, fork-tailed drongo (Dicrurus adsimilis) are known to steal food from other seabirds, and some songbirds will steal food from cooperatively breeding pied babblers (Turdoides bicolor). They use false alarm calls that can make pied babblers vigilance. The drongo usually targets young and juvenile pied babblers because they usually spend longer handling time before consume and they are more likely to escape to a shelter [11]. Overall, interspecies alarm calls in birds provide an example of how information sharing could benefit different species to reduce predation or other risks.

2.2. Cooperative behavior to find food

Besides the benefits of sharing information of threats, interspecies flocks, as another common form of interspecific cooperation, also benefit birds in other ways. A mixed-species flock is formed by a group of different bird species that stay together and move around as a cohesive group to forage, roost or move between habitats. The species within the flock often vary in size, shape, coloration, behavior, and ecological requirements, but they cooperate and interact with each other in a coordinated manner for mutual benefits such as reducing predation risk, improving foraging efficiency, and sharing information about food and resources. Mixed-species flocks are commonly found in tropical and subtropical regions but can also occur in other parts of the world. Mixed-species flocks of birds, in which multiple species move together through the environment, are a good example of how foraging can help to improve foraging efficiency. Different species within the flock can specialize in different parts of the environment, such as the forest floor, mid-story, or canopy, and can take advantage of different food resources. Birds can increase their foraging efficiency in interspecies flocks by utilizing different foraging strategies and by following the lead of other species. For example, some species of birds are better at detecting food on the ground, while others are more adept at locating food in the trees. By forming flocks with other species, birds can take advantage of these different foraging strategies and locate food more efficiently [12].

Birds in mixed-species flocks often follow the movements of other individuals, both the same and different species, to locate food resources. By observing the behavior of other birds in the flock, birds can collect important information about the location and quality of food resources in the area. For example, birds can learn from the behavior of other species in the flock, such as following the movements of insect-eating birds to locate insect swarms or following the calls of frugivorous birds to find fruiting trees. Additionally, birds can learn about the quality of food resources by observing the feeding behavior of other individuals. For instance, if a bird sees another bird eating a particular food item, it may assume that the food is of good quality and attempt to consume it as well [12]. This information transfer can lead to increased foraging efficiency and better utilization of food resources.

Predator birds are also found in cooperative hunting behavior that individuals of different species work together to capture prey. This behavior can have several benefits for the birds involved, including increased hunting success, decreased individual energy expenditure, and improved survival rates. In a study of a mixed-species flock in Australia, researchers found that white-throated

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treecreepers (Cormobates leucophaea) used a specific call to indicate the location of prey to other birds in the flock. Other birds, including brown treecreepers (Climacteris picumnus) and eastern yellow robins (Eopsaltria australis), would then join in the search for the prey [13]. Another study of cooperatively foraging among vultures and storks in Tanzania found that these two predator species could coordinate their movements and share resources effectively. Through both species are feeding on carcasses, the vultures are better at locating potential food resources, while the storks, with their powerful bills, are better at break open tough hides and access the meat inside. By working together, the two species were able to more efficiently extract resources from carcasses and increase their overall foraging success [14]. Overall, cooperative foraging can increase the chances of reducing the risk of predation, increasing the effectiveness of finding food resources, reducing individual energy expenditure, and providing social benefits. Mixed-species flocks can improve foraging efficiency, facilitate the sharing of information about food resources, and reduce predation risk.

2.3. Interspecies defending mobbing behavior

Interspecies defending and mobbing behavior are other common ways of interspecies cooperation among bird species. This behavior is a cooperative defense strategy where individuals of different bird species work together to defend against a common predator. This behavior has been observed in various bird species, including crows, jays, and tits. Mixed-species flocks are known to exhibit complex mobbing behavior when confronted with a common predator. In a study, researchers found that mixed-species flocks of birds were more effective at mobbing predators than single-species flocks [12]. The authors suggest that this is because different species within the flock have different strengths and abilities that can complement each other during mobbing behavior. For instance, some species may be better at flying and diving, while others may be better at pecking or making loud calls. Mobbing in a large mixed-species flock also dilutes the risk of being hunted. By reducing the number of predators in an area, prey birds from different species may help to increase the population sizes of all the species with the same predator.

Research has shown that interspecies defending and mobbing behavior is not only limited to mixed-species flocks but also happens among species that just live in the same area with a common predator. In the study of Japanese great tits mentioned before, the “jar” call, which represents the presence of a snake, is observed serving a function as a mobbing call. Other species nesting in the same area would gather and prepare for mobbing as a snake is a potential threat to all the nesting species in the area [8]. Despite the benefits of interspecies defending and mobbing behavior, there are also some potential costs. For example, engaging in mobbing behavior can be risky, as predators may become more aggressive in response to being mobbed. Additionally, engaging in mobbing behavior can draw attention to the mobbing birds themselves, potentially increasing their risk of predation. As a result, bird species are observed more likely to respond to the mobbing calls of other group-living specie. Research focusing on Western Australian magpies and other heterospecific community members shows that when the mobbing is recruited by magpies, other bird species are more likely to join the mobbing behavior. This is because the magpies are usually living in large groups and participating in the mobbing behavior started by magpies would be safer and more effective than joining the mobbing behavior of other species in the same area. The participant birds could benefit from the mobbing behavior with relatively low risk [15]. The benefits of interspecies defending and mobbing behavior are clear. By working together, birds can increase their chances of successfully defending against a predator, even if the predator is larger or more powerful than any individual bird. This behavior can also reduce the energy expenditure required to defend against a predator, as birds can share the burden of harassment and attack. Finally, by working together, birds can improve their chances of survival, as predators may be less likely to target a group of birds that is clearly willing and able to defend themselves. In conclusion, mobbing behavior is a highly coordinated and effective defense strategy used by birds to deter predators from the area. By working together, birds within the flock can use their different strengths and abilities to effectively mob predators and reduce predation risk. This behavior can have important implications for the ecology of the ecosystem, as it can help to

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create a safer and more secure environment for other species. Additionally, mobbing behavior provides important social learning opportunities for birds within the flock, allowing them to learn about the behavior and hunting strategies of predators and respond appropriately in the future.

3. Conclusion

This article presents a comprehensive meta-analysis of the potential benefits of interspecies cooperation among bird species. While cooperation among individuals of the same species is commonly observed and has direct benefits, cooperation between different species is a rare phenomenon that offers more complex advantages. Our analysis reveals that interspecies cooperation occurs in several ways, often serving to increase foraging efficiency and mitigate risks. The findings of this study contribute to our understanding of avian social behavior and shed light on the intricacies of cooperative interactions in nature. The implications of interspecies cooperation extend beyond the realm of ornithology, as such phenomena have important ecological and evolutionary implications. By providing insights into the mechanisms that underlie interspecies cooperation, this analysis offers new opportunities for future research and conservation efforts aimed at preserving the diversity of bird species and their habitats. However, there are limitations to our current understanding of this phenomenon, such as the lack of research on the evolutionary and ecological drivers of interspecies cooperation in birds. Future studies should aim to address these limitations by exploring the genetic and ecological factors that promote cooperation among different bird species. Additionally, current research on bird interspecies cooperation also lacks studies examining the long-term effects of such interactions on bird populations and their ecosystems. While the short-term benefits of cooperation have been well documented, it remains unclear how these interactions affect the survival and reproduction of the individuals involved and the overall health of their respective populations over time. Despite these limitations, the study of interspecies cooperation in birds holds great promise for understanding the evolution of cooperation in general. This research can also inform conservation efforts, as interspecies cooperation may play a role in the survival of endangered species. As technology and analytical techniques continue to improve, researchers will be able to examine this behavior in more detail and with greater precision. Furthermore, interdisciplinary collaborations between ecologists, evolutionary biologists, and other fields can lead to innovative and insightful research on this topic. In the coming years, the study of interspecies cooperation in birds is likely to continue to yield new and exciting discoveries.

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