



ISSN Print: 2394-7500  
ISSN Online: 2394-5869  
Impact Factor (RJIF): 8.4  
IJAR 2024; 10(9): 205-209  
[www.allresearchjournal.com](http://www.allresearchjournal.com)  
Received: 24-07-2024  
Accepted: 29-08-2024

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## Assessing aquatic avifaunal diversity and its impact on invertebrate fish population in Komati Cheruvu, Siddipet, Telangana

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### Abstract

This investigates the diversity of aquatic avifauna in Komati Cheruvu, Siddipet, and its potential impacts on invertebrate fish population, focusing on the interplay between water quality, avifaunal activity, and ecosystem health. From February 2024 to August 2024, a total of 12 birds' species were identified, representing a range of ecological niches and feeding habits. These species include *Ardea alba*, (Great Egret), *Cygnus atratus* (Black Swan), *Threskiornis melanocephalus* (Black-headed ibis), and members of the Alcedinidae family (Kingfisher), among others. Each species role in the aquatic food web was analyzed, particularly their feeding patterns, which influence the abundance and diversity of invertebrate populations.

The study highlights how piscivorous species, such as the kingfisher and cormorant, exert direct pressure on fish populations, while other species, like the black headed ibis and painted stork, contribute to ecological balance by feeding on invertebrates thus indirectly supporting fish populations. Observations suggest that variations in bird activity, particularly in foraging behavior, are linked to seasonal changes, water level fluctuations, and habitat quality. The presence of invasive bird species, such as the black swan, poses questions about their long term ecological impact on native species and water quality.

Water damage from avian activities was noted in areas of high bird concentration, where sediment disruption and nutrient input were higher, potentially leading to eutrophication and degraded water quality. This in turn affects invertebrate communities, which are crucial for fish diets, leading to cascading effects on fish diversity and abundance.

**Keywords:** Komati Cheruvu, avifaunal diversity, Telangana

### Introduction

Birds are amazing creatures on this planet earth represent diverse group of vertebrates, found in various types of ecosystems to lead normal survival. However, few bird species require aquatic habitats to attend various activities during their survival. Inland aquatic habitats include fresh water ponds, lakes, rivers, marshy areas and wetlands have provided suitable habitat for local and migratory aquatic avifauna. However, inland aquatic habitats are prone to various anthropogenic activities such as clearance. Conversion and degradation, encroachment and sewage pollution, hunting for food, wild birds, wild birds trade etc. All these activities have pushed several inland lakes/ponds to endangered state in recent years. Since, avifauna of India represents 64% global avian diversity. Among them, many bird's species are depended on inland water habitats. According to the Ramsar convention of the IUCN at Iran in 1981.

The bird's assemblages are affected by various factors like the food availability, the size and the abiotic changes in the wetlands. Not only the birds but all the organisms, belonging to the plant and animal communities, are affected by the physical characteristics of the environment. In a wetland ecosystem these biotic factors are mostly dependent on the season and hydrology. Aquatic avifaunal diversity refers to the variety of bird species that inhabit aquatic environments such as lakes, wetlands, estuaries and oceans. This diversity includes a wide range of birds adapted to living in or near water, each with unique behaviors, dietary preferences and physical adaptations.



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#### **Traits of aquatic avifaunal diversity on invertebrate communities**

Birds are a large nutrient vector from marine to terrestrial environments where the increased nutrient input typically results in greater primary production and enhanced microbial activity. Associated invertebrate populations however, show large response variability to bird nutrient subsidies. Birds with a mixed diet increased Coleoptera populations the most. Invertebrate responses to bird presence were largest in Polar Regions but variation remained high. Not all species within communities responded to bird presence, indicating that nutrient limitation is species-specific or ecosystem are affected in different ways by birds. External nutrient imports are an important source for those habitats where abiotic conditions constrain internal nutrient cycling, weathering and biological fixation. Particularly deserts and Polar Regions can greatly benefit from external nutrient sources. Animal can act as an important transfer route of nutrients between biomes.

Invertebrate communities consist of several trophic feeding groups and may therefore, not respond consistently to changes in primary production and resource quality resulting from bird derived nutrients. Detritivores and primary consumers may benefit more than higher trophic levels from increased primary production. However, saprophagous and detritivore beetle abundance increased in response to the presence of birds while the abundance of herbivorous and predatory beetles declined on islands in southern Sweden.

Aquatic birds can have significant impacts on invertebrate and fish populations in various aquatic ecosystem. Their influence can be both direct, through predation, and indirect, by altering the habitat or the behavior of prey species. Here's a breakdown of their impact:

### **1. Direct Predation**

**Invertebrate:** Many aquatic birds, such as ducks, wading birds, and shorebirds, feed on invertebrates like insects, crustaceans, mollusks, and worms. By preying on these invertebrates, birds can reduce their populations, sometimes significantly altering the balance within the ecosystem.

**Fish:** Piscivorous (fish farming) birds, like herons, kingfishers, and cormorants, prey directly on fish. This can lead to reductions in fish populations, particularly in smaller or enclosed bodies of water where fish can't easily escape predation.

### **2. Indirect Predation**

**Prey behavior:** The presence of aquatic birds can change the behaviour of invertebrates and fish, making them more cautious and leading to changes in their feeding, reproduction, and movement patterns. This can affect their growth and survival rates.

#### **Impact on ecosystem dynamics and nutrient cycle**

Birds that rely on these habitats interact with invertebrates in complex ways, influencing their populations and consequently the broader ecosystem. Predation is a primary mechanism through which aquatic birds regulate invertebrate populations. Beyond predation, birds contribute to nutrient cycling through guano deposition, which enriches aquatic environments and enhances the growth of primary producers like algae. This nutrient input can indirectly affect invertebrate populations by altering food availability and habitat conditions. Additionally, birds act as energy transfer agents between aquatic and terrestrial ecosystem, further influencing invertebrate communities. Habitat modification is another significant impact as bird nesting and roosting activities can alter vegetation, substrate composition, and nutrient content in aquatic ecosystem, thereby affecting invertebrate habitats.

#### **Ecological cascades and long-term impacts:**

The feeding habits of aquatic birds can have profound effects on biodiversity. By selectively preying on certain invertebrates or fish, these birds can either enhance or reduce species diversity. Often, their targeted feeding helps maintain ecological balance by preventing any one species from becoming overly dominant, thus supporting a richer variety of species within the ecosystem.

Birds contribute significantly to nutrient redistribution within ecosystem, often transporting nutrient between different areas. As they feed in one location and roost in another, their nutrient rich droppings can enhance soil or water fertility, boosting plant growth and overall ecosystem productivity.

#### **Human wild life conflicts and conservation implications:**

Aquaculture and fisheries often face conflicts with such as cormorants and herons, which prey on farmed and wild fish, respectively. This predation can lead to significant economic losses for fish farmers and competition with human fisheries, particularly in regions where fish are vital for food security or economic stability. To mitigate these conflicts, various deterrence strategies, such as netting and scare tactics, are employed. On the conservation front, the presence of aquatic birds is a strong indicator of a healthy

ecosystem, making their protection essential for maintaining ecological balance.

**Material and methods**

The study area was confined to a limit part of the lakes, Komati cheruvu, Siddipet, about 4 sq. km and observations were conducted in this area at weekly intervals between February 2024 to august 2024. The field notes on major bird fauna were mainly taken during forenoon between 6 am to 8 pm by using a digital camera.

Identified data for this study for this study from peer reviewed literature searches from online libraries such as web of science, google scholar and vu library resources using multiple searches including the following search strings: bird, invertebrate, nutrient, guano and various derivative terms such as seabird, beetle, ornithogenic, allochthonous, cormorant, springtail, arthropod. I also screened cited references in papers and reviews to identify additional studies.

**Bird analysis and data collection**

Bird surveys have been performed all throughout the study region so as to establish a scientific basis of the species from February 2024 to august 2024 covering the broad regional periods of pre-monsoon, monsoon, post-monsoon. The bird counts were made during the morning between 06:00 am to 11:00 hrs. Including both low and high tides as this as this is the best time when most of the birds are active. To standardize response variables across studies we quantified the effect size of bird derived nutrients compared to control using the following formula.

O – E/E



**Far- Reaching consequences for aquatic ecosystems**

The decline in aquatic avifaunal diversity from the past to the present has led to significant disruption in aquatic ecosystem, with particularly detrimental effects on invertebrate populations. The reduction in bird’s species diversity and population sizes has alters predator prey dynamics, making invertebrates more susceptible to environment changes, pollution, and invasive species. These changes have far-reaching consequences, understanding the health and stability of aquatic ecosystem.

**Results & Discussion**

The diversity of aquatic birds and analyse their interactions with the invertebrate and fish populations within a 4 sq. km area. The presence of aquatic bird species is a key indicator of the health and stability of the ecosystem. The identified bird species provide insights into the richness of biodiversity and the balance of prey predator relationships in this habitat.

**Identified Species**

1. *Ardea Alba* (Great Egret)
2. *Cygnus Atratus* (Black Swan)
3. *Threskiornis Melanocephalus* (Black-headed Ibis)
4. Alcedinidae (Kingfisher family)
5. *Dendrocygna Javanica* (Lesser Whistling Duck)
6. *Ardeola Grayii* (Indian Pond Heron)
7. *Anas Poecilorhyncha* (Indian Spot-billed Duck)
8. *Mycteria Leucocephala* (Painted Stork)
9. *Porphyrio Porphyrio* (Purple Swamphen)
10. *Anas Platyrrhynchos* (Mallard)
11. *Microcarbo Niger* (Little Cormorant)
12. *Himantopus Himantopus* (Black-winged Stilt)



**Great Egret**



**Black Swan**



**Kingfisher**



**Indian Pond Heron**



**Indian spot-billed duck**



**Painted Stork**



**Mallard**

### **Bird's habitats and feeding behaviours**

These bird species were observed across various microhabitats within the lake, including shallow wetlands, open water, and densely vegetated areas. Their feeding behaviours were diverse:

- **Piscivores:** (Fish-eating species like *Microcarbo Niger*, Alcedinidae) played a critical role in controlling fish populations.
- **Omnivores:** (such as *Anas poecilorhyncha*, *Dendrocygna javanica*) fed on both fish and invertebrates, helping to regulate multiple trophic levels.
- **Insectivores** (such as *Threskiornis melanocephalus*) fed on aquatic insects and other invertebrates, playing a crucial role in managing invertebrate populations.

### **Impact on invertebrate and fish populations**

The presence of these bird species has significant ecological implications for the invertebrate and fish populations within Komati cheruvu. Predatory species, such as Alcedinidae (kingfishers) and *Microcarbo Niger* (cormorants), exert control over fish and invertebrate population, helping to maintain a balance within the aquatic ecosystem. The varied feeding habits of these birds, ranging from piscivory (fish-eating) to insectivory, contribute to the regulation of prey populations, which in turn supports the overall health of the ecosystem.



### **Discussion**

Aquatic birds, as apex predators or significant links in the food chain, play a crucial role in regulating the populations

of both invertebrates and fish. The presence of 12 different bird species in the 4 sq. km study area suggests a diverse and well-functioning food web. Each bird species occupies a specific ecological niche, meaning they have particular feeding habits, preferences for certain types of prey, and roles in the ecosystem.

Invertebrates in turn are key components of the food web, serving as a primary food source for many fish species. A healthy invertebrate population supports a robust fish population, which then sustains the bird population. The abundance and diversity of invertebrates are closely linked to water quality and habitat conditions, which are influenced by both natural process and human activities.

The interactions between aquatic birds, invertebrates and fish populations in Komati Cheruvu form a complex and interdependent web of life. These interactions ensure that the ecosystem remains balanced with each species playing a specific role in maintaining the stability and health of the environment. The diversity of bird species observed in the study reflects as well functioning ecosystem, where the intricate relationships between and ecological integrity of Komati Cheruvu.



### **Impact on invertebrates and fish populations**

Aquatic birds play a crucial role in shaping the dynamics of invertebrate and fish populations in Komati cheruvu. Their predation directly influences the abundance and distribution of these organisms, contributing to the overall balance and health of the ecosystem.

In addition to piscivores, other bird species in the area may specialize in feeding on invertebrates, such as aquatic insects, crustaceans, and molluscs. These invertebrates are foundational to the aquatic food web, serving as primary or secondary consumers. Birds that feed on invertebrates help regulate their populations, ensuring that these organisms do not proliferate to the point where they deplete resources like algae or detritus, which are vital for maintaining water quality and overall ecosystem function.

However, the ecosystem can become destabilized if bird populations decline significantly. Factors such as habitat loss, pollution, climate change, and human disturbance can lead to reductions in bird numbers. For example, pollution can degrade water quality, making it less suitable for both bird's numbers. For example, pollution can degrade water quality, making it less suitable for both birds and their prey. Habitat loss, such as the destruction of nesting sites or feeding grounds, can reduce the availability of essential resources for birds, leading to a decline in their populations.

### Effects on aquatic birds

Aquatic birds in Komati cheruvu rely heavily on the availability of healthy fish and invertebrate populations to meet their dietary needs. The health and abundance of these prey population directly influence the well-being, behaviour and reproductive success of the bird species in the area. Several factors, including fluctuations in prey availability environmental changes and human activities, can significantly impact these birds.



### Conclusion

The study conducted in Komati Cheruvu, Siddipet, reveals a diverse assemblage of 12 bird species, all classified under the same kingdom, phylum, and class. This diversity reflects the richness of the aquatic ecosystem and its ability to support a variety of avifaunal species. The interactions between these birds and the invertebrate fish populations they prey upon highlight the delicate balance within the ecosystem. Predatory bird species play a crucial role in regulating invertebrate and fish populations, ensuring ecological stability and preventing overpopulation of certain species.

The findings underscore the importance of preserving the natural habitats in Komati Cheruvu, as they are vital for sustaining both avifaunal diversity and the broader ecological health of the area. Conservation efforts should focus on maintaining the quality of these aquatic and semi-aquatic environments, which are essential for supporting a wide range of species and ensuring the long-term sustainability of the ecosystem. By protecting these habitats, we can safeguard the intricate web of life that thrives within Komati Cheruvu and contribute to the overall biodiversity of the region.

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