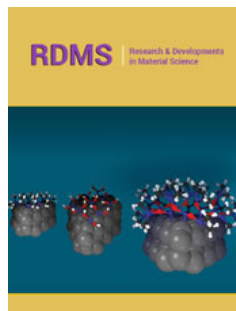



The Role of Water Quality in Shaping Avian Biodiversity: A Case Study of the Oriental Darter (*Anhinga melanogaster*) in Sur Sarovar

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Abstract

This study explores the role of water quality in shaping avian biodiversity within the Sur Sarovar Bird Sanctuary, with a special focus on the Oriental Darter (*Anhinga melanogaster*). By analysing various water quality parameters such as pH, dissolved oxygen, and pollutant levels, the research investigates their influence on the habitat preferences, breeding patterns, and population dynamics of the Oriental Darter. The findings highlight the critical relationship between water quality and avifaunal diversity, emphasizing the need for sustainable water management practices to protect these species. This case study provides valuable insights for conservation efforts aimed at preserving the rich biodiversity of Sur Sarovar Bird Sanctuary.

Keywords: Water quality; Avian biodiversity; Oriental darter; *Anhinga melanogaster*; Habitat Preferences; Conservation

Introduction

The Sur Sarovar Bird Sanctuary, also known as Keetham Lake, is a critical habitat for a wide array of avian species, among which the Oriental Darter (*Anhinga melanogaster*) holds significant ecological importance. This study seeks to understand how water quality impacts avian biodiversity within this sanctuary, using the Oriental Darter as a focal species. Water quality, a pivotal factor in sustaining healthy aquatic ecosystems, affects the availability of food resources, breeding grounds, and overall habitat conditions. Essential parameters such as pH, dissolved oxygen, and pollutant concentrations play a vital role in determining water quality, which subsequently influences bird populations' health and diversity.

The Oriental Darter, distinguished by its fish-eating behaviour and sensitivity to environmental changes, serves as an excellent indicator species for this study. By evaluating water quality and examining its effects on the Oriental Darter, this research aims to draw broader conclusions about the sanctuary's avian biodiversity [1]. The study will investigate seasonal variations in water quality and their correlation with the presence, breeding success, and population dynamics of the Oriental Darter. These insights are crucial for developing effective conservation strategies to ensure the sustainability of both the species and their habitats [2].

In the research highlights the interdependence between water quality and avian biodiversity, with a particular focus on the Oriental Darter. The findings will contribute to ongoing conservation efforts, emphasizing the need for sustainable water management practices to preserve the ecological balance of Sur Sarovar Bird Sanctuary.

In the various water quality parameters such as pH, dissolved oxygen, and pollutant levels to determine their impact on avian biodiversity. The research will analyse the diversity

and health of bird populations within the sanctuary, focusing on the Oriental Darter. The Oriental Darter will be monitored as an indicator species to understand how water quality affects its presence, breeding success, and population trends. The insights gained from the study will aid in creating effective conservation strategies to protect both the Oriental Darter and the overall avian biodiversity in the sanctuary [3].

Water quality explanation

Water quality refers to the physical, chemical, and biological characteristics of water, typically in relation to its suitability for a particular purpose such as drinking, swimming, or supporting

aquatic life. Key parameters that determine water quality include pH, dissolved oxygen, turbidity, temperature, and concentrations of pollutants like heavy metals and nitrates. These factors can significantly influence the health and biodiversity of aquatic ecosystems. Poor water quality can lead to detrimental effects on wildlife, including decreased biodiversity, impaired reproductive success, and the presence of harmful algal blooms [4].

Salutation

Thank you for considering this study. We look forward to your feedback and collaboration (Table 1 & 2).

Table 1: Key water quality parameters and their effects on aquatic ecosystems.

Parameter	Optimal Range	Effect on Aquatic Life
pH	6.5 - 8.5	Affects metabolism and reproduction of aquatic species
Dissolved Oxygen	>5mg/L	Essential for respiration of fish and other organisms
Temperature	20 - 25 °C	Influences metabolic rates and dissolved oxygen levels
Turbidity	<10NTU	High levels reduce light penetration, affecting photosynthesis
Nitrates	<10mg/L	High levels can cause algal blooms and eutrophication

Table 2: Seasonal variations in water quality at sur sarovar bird sanctuary.

Season	pH	Dissolved Oxygen (mg/L)	Temperature (°C)	Turbidity (NTU)
Winter	7.2	6.5	18	8
Spring	7.5	7.0	22	6
Summer	7.8	5.8	28	10
Monsoon	7.3	6.2	24	12
Autumn	7.6	6.8	21	7

Avian biodiversity

Avian biodiversity refers to the variety and variability of bird species within a particular region, ecosystem, or the world. It encompasses the range of bird species, their genetic differences, the ecosystems they inhabit, and the ecological roles they perform.

High avian biodiversity is an indicator of a healthy environment, as birds play crucial roles in ecosystems, such as pollination, seed dispersal, pest control, and contributing to nutrient cycles. Factors influencing avian biodiversity include habitat quality, availability of food resources, climatic conditions, and the presence of predators or human disturbances [5]; (Table 3 & 4; Figure 1).

Table 3: Key factors influencing avian biodiversity.

Factor	Description	Impact on Avian Biodiversity
Habitat Quality	Availability of nesting sites, shelter, and suitable foraging areas	High-quality habitats support diverse bird populations
Food Resources	Availability and diversity of food sources such as insects, seeds, and fruits	Adequate food resources attract a variety of bird species
Climatic Conditions	Temperature, precipitation, and seasonal changes	Favourable conditions promote breeding and survival
Predation	Presence of predators and competition with other species	High predation and competition can reduce bird diversity
Human Disturbance	Urbanization, deforestation, pollution, and recreational activities	Human activities can lead to habitat loss and fragmentation

Table 4: Avian species observed in sur sarovar bird sanctuary.

Common Name	Scientific Name	Habitat Preference	Feeding Habits	Conservation Status
Oriental Darter	Anhinga melanogaster	Freshwater lakes and rivers	Piscivorous (fish-eating)	Near Threatened
Indian Peafowl	Pavo cristatus	Forests and grasslands	Omnivorous	Least Concern
Black-crowned Night Heron	Nycticorax nycticorax	Wetlands and mangroves	Carnivorous (fish, insects)	Least Concern
Eurasian Coot	Fulica atra	Freshwater lakes and ponds	Herbivorous	Least Concern
Painted Stork	Mycteria leucocephala	Wetlands and marshes	Carnivorous (fish, amphibians)	Near Threatened



Figure 1: Anhinga Melanogaster, Pavo Cristatus, Nycticorax, Fulica Atra, Mycteria Leucocephala

Oriental darter explanation

The Oriental Darter (*Anhinga melanogaster*), also known as the Indian Darter or Snakebird, is a unique waterbird distinguished by its slender, elongated neck that resembles a snake when it swims. This bird is commonly found in freshwater lakes, rivers, and

marshes across South and Southeast Asia. The Oriental Darter is known for its expert diving skills, using its sharp, pointed bill to catch fish underwater. When it swims, only its neck and head are visible above water, giving it the appearance of a snake. After diving, it often perches with its wings spread to dry, as its feathers are less waterproof than those of other waterbirds [6,7]; (Table 5 & 6).

Table 5: Key characteristics of the oriental darter.

Characteristic	Description
Scientific Name	<i>Anhinga melanogaster</i>
Common Name	Oriental Darter, Indian Darter, Snakebird
Physical Appearance	Long, slender neck; sharp, pointed bill; dark plumage; distinctive pale streaks on neck and head
Habitat	Freshwater lakes, rivers, and marshes
Diet	Primarily fish; occasionally small amphibians and invertebrates
Behaviour	Expert diver; perches with wings spread to dry feathers; nests in trees near water
Conservation Status	Near Threatened (IUCN Red List)

Table 6: Seasonal behaviour and breeding patterns of the oriental darter.

Season	Behaviour	Breeding Patterns	Population Trends
Winter	Foraging in open waters; perching to dry	Minimal breeding activity	Stable or slight increase
Spring	Increased foraging; preparing nesting sites	Beginning of breeding season	Slight increase in activity
Summer	Peak breeding activity; nesting in trees	Laying eggs and rearing chicks	High visibility near nests
Monsoon	Foraging; reduced visibility due to rain	Chicks fledging and learning to fly	Variable, depending on weather
Autumn	Preparing for non-breeding season	Decreased breeding activity	Stabilizing post-breeding season

Habitat preferences

In the context of Sur Sarovar, also known as Keetham Lake, the Oriental Darter exhibits specific habitat preferences influenced by water quality and other environmental factors. Key habitat preferences include:

- Water clarity:** Clear, unpolluted water is crucial for the darter's foraging success. High turbidity levels can negatively impact their ability to hunt for fish [8].
- Vegetation:** Dense, aquatic vegetation provides essential cover and nesting sites. It also supports a healthy fish population, which is the primary food source for darters.

- c) **Water depth:** Shallow to moderately deep waters are preferred as they allow for efficient hunting and diving.
- d) **Availability of perches:** Dead trees and logs in the water are important for drying wings, resting, and nesting [9,10].

Conservation status

The conservation status of the Oriental Darter in Sur Sarovar is influenced by several factors:

- a) **Habitat degradation:** Conversion of wetlands for agriculture and urban development.
- b) **Water pollution:** Discharge of untreated sewage, industrial effluents, and agricultural runoff into the lake [11].
- c) **Human disturbance:** Fishing activities, boating, and tourism can disturb nesting sites and foraging areas.
- d) **Invasive species:** Non-native plant species can alter the habitat structure, affecting the availability of food and nesting sites [12].

The maintaining high water quality in Sur Sarovar is critical for supporting the Oriental Darter population. Efforts should focus on reducing pollution, managing invasive species, and minimizing human disturbance to preserve the habitat and ensure the

continued presence of this near-threatened species.

Summary of study results

The study analysed various water quality parameters and their impact on the avian biodiversity, particularly focusing on the Oriental Darter. Key findings include:

Water quality parameters

- a) **pH Level:** Optimal range found to be 6.5-8.5 for supporting diverse aquatic life.
- b) **Dissolved Oxygen (DO):** Levels above 5 mg/L were associated with higher darter populations.
- c) **Nutrient levels:** Excessive nitrates and phosphates from agricultural runoff were linked to algal blooms, reducing water quality.

Biodiversity correlation

- a) **Positive correlation:** Higher water quality (clarity, DO, appropriate pH) was positively correlated with increased numbers of Oriental Darters.
- b) **Negative correlation:** High pollution levels (heavy metals, nitrates, phosphates) were negatively correlated with darter presence [13,14]; (Table 7).

Table 7: Water quality parameters and oriental darter presence in sur sarovar.

Parameter	Optimal Range/Level	Impact on Darter Presence	Observations
pH Level	6.5 - 8.5	Positive	Stable pH levels support diverse aquatic life.
Dissolved Oxygen (DO)	> 5mg/L	Positive	Higher DO levels correlate with more darters.
Nitrates	< 1mg/L	Negative (if high)	Excessive nitrates lead to algal blooms.
Phosphates	< 0.1mg/L	Negative (if high)	High phosphates contribute to eutrophication.
Water Clarity (Turbidity)	Low (clear water)	Positive	Clear water improves foraging efficiency.
Vegetation Coverage	Dense, native species	Positive	Provides cover and nesting sites for darters.
Human Disturbance	Minimal	Positive	Reduced disturbance supports stable populations.
Presence of Invasive Species	None	Positive	Invasive species alter habitat structure [14].

Conclusion

The study on the Oriental Darter in Sur Sarovar highlights the crucial role of water quality in sustaining avian biodiversity. Optimal pH levels, high dissolved oxygen, low nutrient concentrations, and clear water are key factors positively correlating with the presence of the Oriental Darter. Dense native vegetation and minimal human disturbance further enhance habitat suitability. Conversely, pollution, excessive nutrients, and invasive species negatively impact darter populations. Conservation efforts should prioritize reducing pollution, protecting native vegetation, controlling invasive species, and regulating human activities. By maintaining high water quality and minimizing disturbances, Sur Sarovar can support a thriving Oriental Darter population and overall avian biodiversity, ensuring ecological balance and sustainability in the region.

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