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Popular Article

# Nagi and Nakti Twin Bird Sanctuaries: Conservation Challenges and the Sustainability Needs of Two Ecologically Important Ramsar Wetlands of Bihar, India

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***Abstract***

The Nagi and Nakti Bird Sanctuaries in Bihar, India, are Ramsar-designated wetlands of international importance. Originally built as irrigation reservoirs, these man-made ecosystems now support rich biodiversity, including over 136 bird species, 30 fish species, diverse plankton communities, and submerged macrophytes. However, these sanctuaries face critical conservation challenges such as habitat degradation, invasive species, and climate change. This article highlights the ecological significance of the sanctuaries, documents biodiversity patterns, and assesses threats. It emphasizes the urgency of integrated management strategies, habitat restoration, and community involvement to ensure long-term sustainability of these vital ecosystems and their role in avian and aquatic conservation.

## Introduction

Nestled in the heart of Bihar's Jamui district, the Nagi and Nakti Bird Sanctuaries are two significant wetland ecosystems. Initially constructed for irrigation in the 1950s and 1980s, these man-made reservoirs have become vital habitats for migratory birds. Their aquatic vegetation and food abundance transformed them into essential avian sanctuaries. Recognized as sanctuaries in 1984 and 1987, they were officially notified under the Wildlife (Protection) Act, 1972, in 2009. In 2004, the sites were designated as an International Biodiversity Area and Key Biodiversity Area.

The sanctuaries span 332 ha (Nagi) and 791 ha (Nakti), surrounded by hillocks and agricultural lands. Fed by seasonal rivers and rainwater, they support over 136 bird species. Notably, the Bar-headed Goose (Anser indicus) is prominently found here. The Asiatic Waterbird Census 2023 recorded 7,844 birds at Nakti and 6,938 at Nagi. On June 5, 2024, they became India's 81st and 82nd Ramsar sites, emphasizing their global importance.

Despite their ecological and economic value, these sanctuaries face challenges like habitat degradation, invasive species, and water quality decline. This article explores their biodiversity, conservation challenges, and strategies for long-term sustainability.

**Fig. 1: Nagi Bird sanctuary**

**Fig. 2: Nakti Bird sanctuary with cattle grazing in peripheral region**

**The Ecological Diversity and Resources of Nagi and Nakti Wetlands**

Nagi and Nakti wetlands serve as a sanctuary for a rich array of biodiversity. Their interconnected ecosystems sustain a diverse range of flora and fauna, making them crucial for conservation efforts.

***1. Avian Fauna: The Jewel of the Wetlands***

These sanctuaries are key habitats for over 136 migratory and resident bird species. Migrants from Eurasia, Central Asia, and Russia depend on these wetlands for food, rest, and breeding. Species like the Bar-headed Goose, Northern Pintail, and Common Teal are regularly observed. Climate change and habitat degradation are disrupting migratory patterns and food availability, emphasizing the need for robust conservation.

***2. Seasonal Dynamics of Planktonic Communities***

Planktonic organisms play a crucial role in aquatic ecosystems, responding rapidly to environmental fluctuations and anthropogenic disturbances, making them effective bioindicators of water quality and ecosystem health. In our study, seasonal variations in phytoplankton and zooplankton communities were assessed in Nagi and Nakti Bird Sanctuaries. During the Dry season, phytoplankton diversity and abundance were significantly higher, with 53 species recorded and cell densities reaching 118,900±4,768 cells/L in Nagi and 64,500±16,450 cells/L in Nakti. In contrast, during the Wet season, phytoplankton abundance decreased to 12,315±268 cells/L and 17,043±3,450 cells/L in Nagi and Nakti, respectively. Cyanophyceae, particularly Microcystis sp., dominated the phytoplankton community, indicating a higher organic load, possibly associated with bird roosting activities from December to January. Zooplankton communities also exhibited seasonal variability, with 28 species identified, including 20 rotifer genera, where *Brachionus*, *Lecane*, and *Keratella tropica* were dominant in Nagi Bird Sanctuary. In Nakti, 16 species were recorded, with larger taxa such as Cladocera and Copepoda being more prevalent. Mean zooplankton abundance in the Wet season was 627±123 individuals/L in Nagi and 525±202 individuals/L in Nakti, increasing significantly in the Dry season to 876±243 individuals/L and 1,489±235 individuals/L, respectively. These findings suggest that seasonal changes, coupled with ecological interactions, strongly influence planktonic community structure, with potential implications for the trophic dynamics and water quality of these wetland ecosystems.

**3. *Fish Diversity: The Aquatic Lifeline***

The Nagi and Nakti wetlands are critical aquatic ecosystems that support a good number of fish species, playing a vital role in maintaining ecological balance and sustaining local fisheries. A total of 30 fish species have been recorded in these wetlands (Fig 3), with Cypriniformes being the most dominant group (55%), followed by Anabantiformes (17%) and Perciformes (14%). Native species such as *Amblypharyngodon mola*, *Cirrhinus mrigala*, *Puntius sophore*, and *Channa striata* contribute significantly to the stability of the wetland ecosystem by maintaining trophic interactions and supporting fisheries.

Historical records indicate a higher fish diversity, with 36 species documented in 2018 (http://rsis.ramsar.org). *Wallago attu* was previously a dominant species; however, recent studies have failed to observe its presence, suggesting a decline or possible local extinction. One of the significant ecological disturbances impacting fish populations in the Nagi and Nakti wetlands is the introduction of non-native species, particularly Tilapia (*Oreochromis spp*). Known for its high reproductive capacity and adaptability, Tilapia has outcompeted native fish species for food and habitat, leading to a decline in indigenous populations and disrupting the natural food web. The Nile Tilapia (*O. niloticus*), in particular, has established a breeding population in both reservoirs, as evidenced by the abundance of juvenile individuals. Pathway analysis suggests that the introduction of this exotic species was initially intended by authorities to supplement food availability for migratory birds. However, the species has since become established within the reservoir ecosystems, presenting ongoing ecological challenges.


**Figure 3: Fish species diversity of Nagi and Nakti Bird Sanctuary**

***4. Macro-invertebrates and Aquatic Plants: Indicators of Wetland Health***

Recent observations in



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the Nagi and Nakti wetlands indicate a decline in macrophyte diversity from 14 to nine species. However, during the wet season, macrophyte proliferation increased, potentially reducing plankton abundance. 90% of submerged macrophyte, which supports variety of insects and mollusks and thereby birds These plants, vital for migratory birds, provide food and habitat. Submerged species such as *Potamogeton nodosus, Potamogeton wrightii,* and *Potamogeton natans* dominated, covering over 70% of the wetland. *P. nodosus*, known for its dense seed heads, supports bird populations (Fig 4). In winter, macrophyte coverage declined, likely due to bird foraging. Additionally, nutrient enrichment from agricultural runoff has led to algal overgrowth, impacting aquatic flora. These findings highlight the need for sustainable wetland management to preserve ecosystem balance.

**Figure 4: *Potamogeton nodosus* exotic weed dominant in Nakti Bird sanctuary**

Seasonal variations significantly influence benthic communities in the Nagi and Nakti wetlands. During winter, macro-benthos were sparse, whereas their abundance peaked in the dry season. A total of eight species were recorded, with *Bellamya dissimilis* and *Bellamya bengalensis* being the most dominant (Fig. 5). In Nagi Bird Sanctuary, the highest density was observed in the dry season (363 ± 21 ind./m²), followed by the wet season (165 ± 13 ind./m²). Similarly, Nakti Bird Sanctuary recorded higher macro-benthos density in the dry season (211 ± 7.7 ind./m²) than in the wet season (43 ± 4.2 ind./m²). These fluctuations highlight the dynamic response of benthic fauna to seasonal changes, impacting nutrient cycling and ecosystem stability.

**Figure 5: Abundance of molluscs in peripheral region of Nagi Bird sanctuary**

### *5. Water Quality: The Lifeline of the Ecosystem*

Water quality plays a crucial role in shaping the biodiversity and productivity of the Nagi and Nakti wetlands, with seasonal fluctuations in physico-chemical parameters influencing aquatic life. Dissolved oxygen levels (5.2-8.8 mg/L) indicate a supportive environment for fish and other organisms, while the wetlands' alkaline nature (pH 7.05-9.17) fosters aquatic biodiversity. Water transparency varies between the two wetlands, with Nakti exhibiting greater clarity (201-336 cm) during the dry season compared to Nagi (152-199 cm), affecting light penetration and photosynthetic activity. Nutrient levels are higher in Nagi, with increased nitrate and phosphorus concentrations attributed to bird activity and agricultural runoff, leading to organic enrichment Table 1. Additionally, Nagi's substrate contains higher organic carbon (up to 3.76%), supporting a diverse benthic community.

These factors collectively influence the ecological dynamics of the wetlands, highlighting the need for continuous monitoring and conservation efforts.

**Table 1: Water quality parameter assessed during the wet (July) and dry season (February)**

| | Nagi Bird sanctuary | | Nakti Bird Sanctuary | |
|---|---|---|---|---|
| **Water quality** | Wet Season | Dry Season | Wet Season | Dry Season |
| **Depth (m)** | 1.5-10.4 | 1.87-7.37 | 1.9-7.9 | 1.96-6.12 |
| **Transparency (cm)** | 210-230 | 152-199 | 165-180 | 201-336 |
| **Temp Water (ºC)** | 31.8-32.4 | 20.7-21.5 | 32.6-33.8 | 20.1-20.8 |
| **pH** | 8.95-9.17 | 7.05-7.7 | 7.7-8.5 | 7.26-7.85 |
| **Specific conductivity (µS/cm)** | 210-226 | 242-248 | 233-238 | 271-276 |
| **Dissolved Oxygen (ppm)** | 7.2-8.8 | 8.5-8.7 | 6.6-8.1 | 5.2-7.2 |
| **FreeCO2 (ppm)** | Nil | Nil | Nil | Nil |
| **TDS (ppm)** | 149-154 | 170-191 | 165-169 | 191-195 |
| **Chloride (ppm)** | 20-22 | 42-56 | 20-22 | 54-60 |
| **Salinity(ppt)** | 0.09-0.1 | 0.112-0.127 | 0.106-0.108 | 0.127-0.136 |
| **Total Alkalinity (ppm)** | 88-94 | 108-112 | 100-108 | 132-136 |
| **Total hardness (ppm)** | 68-72 | 88-104 | 68-80 | 96-104 |
| **Ca ++ (ppm)** | 11.2-14.4 | 19.2-20.8 | 12.8-14.4 | 17.6-20.8 |
| **Mg ++(ppm)** | 7.8-10.7 | 9.7-13.1 | 8.8-10.7 | 10.7-13.6 |
| **Nitrate-N (ppm)** | 0.27-0.4 | 0.21-0.28 | 0.32-0.43 | 0.2-0.46 |
| **Silicate-Si(ppm)** | 10.2-12.7 | 0.61-4.27 | 8.4-12.1 | 1.72-3.77 |
| **Total Phosphorus(ppm)** | 0.09-0.33 | 0.16-0.92 | 0.06-0.11 | 0.11-0.34 |

**Conservation Threats Facing by Nagi and Nakti**

**1. Habitat degradation and anthropogenic pressure**

Human dependency on wetland resources—water extraction, livestock grazing, and illegal fishing—degrades habitats. Regulatory enforcement is essential.

**2. Water management conflicts**

Management conflicts arise between irrigation priorities and conservation goals. Periodic water diversion alters hydrology and food availability for birds.

**3. Vanishing Natives: The Decline of Fish Diversity and the Rise of Invasive Species**

Fish diversity in the sanctuaries has declined from 36 to 30 species, likely due to habitat changes and the introduction of exotic species like Tilapia. Tilapia may outcompete native fish, disrupt the food chain, and pose risks to wildlife, including migratory birds and gharials, by accumulating toxins and carrying pathogens (Pandiyan et al. 2022). To restore biodiversity, controlled stocking of native species—especially small indigenous fish—and sustainable management are essential. Further references are provided separately.

**4. Pollution and nutrient Load**

Agricultural runoff may carry pesticides and fertilizers increases nutrient loading in the reservoirs, which may lead to eutrophication. This results in excessive algal growth for short period, depleting oxygen levels and negatively impacting aquatic life. Managing agricultural practices around the sanctuaries is essential to maintain water quality and ecological health.

**5. Climate change and its impact**

Climate change poses an emerging threat to the sanctuaries, influencing water availability, temperature fluctuations, and migratory bird patterns. Changes in monsoon patterns could lead to water shortages, affecting both irrigation and wetland sustainability (Kumar et al., 2025). Monitoring climatic trends and implementing adaptive management strategies are crucial for long-term conservation.

**Present conservation efforts and the need for greater attention**

On June 5, 2024, Nagi and Nakti Bird Sanctuaries were officially designated as Ramsar sites, joining India's growing list of wetlands of international importance. This recognition highlights their ecological value and underscores the need for stronger conservation efforts. However, their inclusion in the Ramsar list must be followed by effective management interventions to address existing threats.

**1. Strengthening protected area management**

Ensuring the ecological integrity of these wetlands requires stricter enforcement of conservation laws, habitat restoration initiatives, and integrated wetland management plans.

Collaborative efforts between the forest department, irrigation authorities, and local communities can lead to more effective governance.

**2. Community involvement in conservation**

Local communities play a vital role in wetland conservation. Establishing eco-tourism initiatives, sustainable fishing practices, and alternative livelihood programs can reduce pressure on wetland resources while providing economic benefits to local populations.

**3. Indigenous fish restoration and Habitat enhancement**

Reintroducing native fish species, controlling invasive species, and implementing sustainable recruitment practices can restore aquatic biodiversity. Habitat restoration projects, such as replanting native vegetation and improving water quality, will enhance ecological resilience.

**4. Scientific research and monitoring**

Regular ecological assessments, water quality monitoring, and bird population studies are essential to track environmental changes and inform conservation strategies. Establishing research partnerships with universities and conservation organizations can enhance scientific understanding and adaptive management.

**Conclusion**

The Nagi and Nakti Bird Sanctuaries, once irrigation reservoirs, have become vital wetlands of international importance. However, their sustainability is under threat from habitat degradation, water conflicts, and climate change. The wetlands rely on a delicate balance among macrophytes, macro-invertebrates, fish, and birds. Submerged macrophytes like *Potamogeton nodosus*, *P. wrightii*, and *P. natans* support fish and provide crucial breeding and foraging habitats for migratory birds, especially during winter. Macro-invertebrates such as *Bellamya dissimilis* and *B. bengalensis* aid in nutrient cycling and serve as essential bird food. With about 30 native fish species, including *Amblypharyngodon mola*, *Cirrhinus mrigala*, *Channa striata*, and *Puntius sophore*, the sanctuaries maintain ecological stability and bird sustenance. Protecting this interlinked system calls for sustainable conservation strategies focused on habitat preservation, effective wetland management, and community engagement—positioning Nagi and Nakti as a model for wetland conservation in India.

**Suggested readings**

https://rsis.ramsar.org/RISapp/files/3851834/documents/IN2545_mgt240529.pdf

BirdLife International (2025). Site factsheet: Nagi Dam and Nakti Dam Bird Sanctuary. Downloaded from https://datazone.birdlife.org/site/factsheet/nagi-dam-and-nakti-dam-bird-sanctuary on 13/03/2025

Pandiyan, J., Poiyamozhi, A., Mahboob, S., Al-Ghanim, K. A., Al-Misned, F., Ahmed, Z., Manzoor, I., & Govindarajan, M. (2022). Assessment of the Toxic Effects of Heavy Metals on Waterbirds and Their Prey Species in Freshwater Habitats. *Toxics*, *10*(11), 641. https://doi.org/10.3390/toxics10110641.

Kumar, A., Thangavel, M. Unravelling the dynamics of rainfall patterns in Bihar, India: A comprehensive spatiotemporal analysis. *Environ Sci Pollut Res* (2025). https://doi.org/10.1007/s11356-025-36243-4