Uttar Pradesh Journal of Zoology

Volume 45, Issue 15, Page 18-24, 2024; Article no.UPJOZ.3740
ISSN: 0256-971X (P)

Evaluation of Importance of Birds from Non-Tidal Wetlands: A Review

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Author's contribution

The sole author designed, analyzed, interpreted and prepared the manuscript.

Article Information

DOI: https://doi.org/10.56557/upjoz/2024/v45i154217

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://prh.mbimph.com/review-history/3740

Review Article

Received: 30/04/2024
Accepted: 02/07/2024
Published: 05/07/2024

ABSTRACT

Wetlands are the lands transitional between terrestrial and aquatic eco-systems where the water is usually at or near the surface or the land is covered by shallow water. They are most productive, valuable, and provide a wide range of goods and services. Wetland birds rely on waterways for survival and each bird species has its own requirements for food, shelter and breeding sites. Monitoring of wetland birds is an engaging activity that provides researchers with an insight into the functioning and health of wetlands. Despite the high value of services derived from wetlands, they have been systematically drained and filled to support agriculture, urban expansion, and other developments. Agriculture, climate change, draining, dredging, introduced species, pollution, salinization, and urbanization are the major threats to wetlands. In light of these observations, the aim of this review is to update recent information from the available literature relating with the ecosystem services provided by birds from non-tidal wetlands.

Keywords: Wetlands; ecosystem services; birds; freshwater; conservation.

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Cite as: *Lubal, M. J. (2024). Evaluation of Importance of Birds from Non-Tidal Wetlands: A Review . UTTAR PRADESH JOURNAL OF ZOOLOGY, 45(15), 18–24. https://doi.org/10.56557/upjoz/2024/v45i154217*

1. INTRODUCTION

According to Ramsar Convention on Wetlands and World Tourism Organization [1], "wetlands are the areas where water is static or flowing, including areas of marine water the depth of which at low tide does not exceed six metres". "Wetlands is the land that is saturated with water long enough to promote wetland or aquatic processes as indicated by poorly drained soils, hydrophytic vegetation, and various kinds of biological activity adapted to wet environments" [2,3]. "They are ecologically sensitive and adaptive systems, and exhibit enormous diversity" [4,5].

"Worldwide, the wetland ecosystems ranges from 917 million hectares (m ha) to more than 1275 m ha with an estimated economic value of about US$15 trillion per year" [6,7]. "Wetlands are categorized into marine (coastal wetlands), estuarine (including deltas, tidal marshes, and mangrove swamps), lacustarine (lakes), riverine (along rivers and streams), and palustarine (marshy: marshes, swamps and bogs) based on their hydrological, ecological and geological characteristics" [8].

Mathialagan et al [9] pointed that, "most of the natural water bodies such as rivers, lakes, coastal lagoons, mangroves, peat land, coral reefs and man-made wetlands like ponds, farm ponds, irrigated fields, sacred groves, salt pans, reservoirs, gravel pits, sewage farms and canals constitute the wetland ecosystem". "Wetlands support large biological diversity and also provide a wide array of ecosystem goods and services such as food, medicines, nutrient cycling, etc" [10,11].

Sale and Morass [12] stated that, increased salinity will reduce the extent of freshwater wetlands and the abundance of freshwater dependent plants, invertebrates, along with fish and waterbirds. Continued persistence of these components in the system will depend on available habitat up-stream and the ability to maintain freshwater inflows to the fringing wetlands [13].

Government of South Australia [14] stated that, "wetland birds are the most mobile animals, and some of them migrating around the world seeking conditions suitable for breeding or visiting when conditions at home are unfavourable" [15]. "Waterbirds use many kinds of wetlands, including swamps, lagoons, mudflats, estuaries, bays and open beaches, freshwater and saltwater lakes, rivers, floodplain wetlands and dams" [16]. "Birds prefer the wetlands mainly for feeding, breeding and as a place to refuel and rest during migrations" [17].

"India supports diverse and unique wetland habitats. Natural wetlands in India consist of the Himalayan lakes, wetlands situated in the flood plains of the river systems, saline and temporary wetlands, coastal wetlands, and marine wetlands" [18]. "Indian wetlands also cover the large number of man-made wetlands which sustain the faunal and floral diversity. In India, out of the total area under wetlands, inland wetland accounts for 69%, coastal wetlands 27%, and other wetlands 4%" [19, 20,21,22].

According to Bryce et al [23], "birds occupy an extremely diverse range of niches within riparian systems and are sensitive indicators of environmental conditions". "They are important for ecological functioning of the environment, as indicators of pollution, seed dispersal, scavenging and as predators of insect pests" [24]. As birds are among the best monitors of environmental changes, they have been used to evaluate the environment as "bio-monitors" [25].

As recorded by Inskipp et al [26], "birds face threat from illegal trade, water poisoning, over fishing, food scarcity, over grazing and use of pesticides, pollution from households and industrial discharges and agricultural run-off, and degradation of the habitat" [27]. "The illiterate and poor people generally lack the awareness on the importance and conservations of birds" [28].

"Species diversity and abundance are equally key factors for improving the ecosystem. Assessment of bird communities has become a useful tool in biodiversity conservation and finding measures for the conservation of high human pressure areas" [29,30]. "However, monitoring the abundance of bird species provides useful information, widely used in bird conservation and management of threatened and endangered species. Moreover, seasonal bird monitoring is equally important to finding dynamic bird movement in specific habitats" [31]. According to Millennium Ecosystem Assessment (MEA) [32], "ecosystem services are the ecosystem resources and processes that have a benefit to human society". "Wetland birds are the most important wetland icons and include a large group of species who play a crucial role in many food webs of aquatic ecosystem and they are known as good 'bio-indicators' as they are very sensitive to minor environmental changes" [33].

Datta and Pandey [34] reported that, “birds can serve as bio-indicators of occupied regions and provide information about the general habitat quality”. “Bird population trends can reveal information about the health of the ecosystem when birds depend on the habitat's functioning in particular ways. Wetland birds are the most active component of wetland ecosystems” [35]. “By observing changes in community composition and diversity that directly reflect changes in wetland ecosystems, they serve as an objective biological indicator of changes in the wetland environment” [36].

Amat and Green [37] noted that, “wetland birds are shown to track environmental variations, at short (months) and long (years) temporal scales, and at both species and community levels”. “Many species are top predators and several contaminants often accumulate along the trophic chain, such species may be used as indicators of changes occurring at lower trophic levels” [38]. Waterbirds either themselves or their prey are exploited by humans (e.g. hunting and fisheries), so that hunting bags of waterbirds may be indicative of productivity in nesting areas or breeding parameters of birds may inform on fish stocks [39,40].

The aim of this review is to update recent information from the available literature relating with ‘Ecosystem services provided by birds from non-tidal wetlands’ with respect to cultural services, provisioning services, supporting services, and regulating services.

2. LITERATURE SEARCH METHODS

This review was carried out by collecting information on relevant research findings with the help of Internet search engines like Google, Google Scholar, PubMed, ScienceDirect, and ResearchGate and other published articles, reports, and monographs. A total of 39 published articles have been reviewed and the related information was gathered for this current study with respect to ecosystem services provided by birds of non-tidal wetlands from Indian region and from other countries.

3. ECOSYSTEM SERVICES PROVIDED BY BIRDS FROM FRESHWATER WETLANDS

Mathialagan et al [9] described that “birds acts as predators, pollinators, scavengers, seed dispersers, pests, predators, nutrient cycling, ecosystem engineers, and provide many other services. The services birds provide are ecologically and economically important, but are not adequately appreciated due to insufficient information”.

Green and Elmberg [41] reported that, “ecosystem services provided by freshwater wetland birds are generally divided into four categories such as supporting services (seed dispersal or nutrient cycling), regulating services (pest control), provisioning services (resources exploited for food, clothing or other uses), and cultural services (recreational value or spiritual value of birds)” [35].

According to Boere et al [38], “inland wetland is located in the riparian zone where rivers, streams, lakes and ponds are the main water body for the habitat”. “They are more productive with high diversity of species than coastal wetlands due to the less tidal action and tolerable salinity” [36].

3.1 Cultural Services

- **Seed Dispersing Agents**

Mathialagan et al [9] reported that, “wetland birds disseminate the seeds of many trees and plants that are of immediate use to humans for medicine, food, timber, or other purposes. Birds feeding exclusively on fruits spread seeds over a much greater distance. Therefore, birds are important dispersers of plant seeds, and promote and maintain the biodiversity and community structure”. “They disperse the seeds of trees, shrubs, herbaceous plants, and contribute to reforestation in deforested areas. Birds also promote the forest growth and provide a number of other services that primarily benefit humans” [33].

- **Scavengers**

Green and Elmberg [41] stated that, “wetland birds scavenge on waste and thus help to prevent disease outbreaks that can occur when animal carcasses accumulate”. “They also play an important role in foraging, nutrient cycling, waste removal, and disease regulation. Thus the value of birds to people is very high and underscores the immediate importance of a healthy avifauna to human and ecosystem benefits” [9].

- **Research and Education**

According to Djerboua et al [35], bird watching helps to hone observational skills. It enhances

student ability to notice details and make accurate observations in various subjects. Also study of birds fosters a better awareness of the interconnectivity of living organisms by offering a practical understanding of biology, ecology, and environmental science. Describing bird species and their behaviours through writing or verbal communication enhances language skills. It encourages precise expression. Bird watching nurtures a sense of connection with nature. It helps reducing stress and promoting overall well-being.

Research on wetland birds with respect to their behaviour during feeding, roosting, mating, migration, and competition for habitat sharing will add innovation in the knowledge of wetland ornithology. Birds are also often used in basic biological research to understand how their bodies function, such as how air flows through their respiratory system during flight, communications and cognitive studies, and toxicology [41].

- **Other services**

From the ancient days, wetland birds were used an object for art, bird watching, conservation flagships, ecotourism, recreational hunting, and recreational value or spiritual value [9]. “Studies on wetland bird’s physiology can provide information to detect stressors and to predict possible negative effects on populations” [37]. “Waterbirds such as ducks, geese, swans, flamingoes and other waterbirds are used as flagships of conservation. Swans, flamingos and ibises are also important for cultural services and are reflected in history for artistic and religious importance” [41].

3.2 Provisioning Services

Mathialagan et al [9] stated that, “wetland birds are an essential part of the food web and play an important role in human life as a food source. They serve as an essential provisioning of meat, feathers, eggs, etc. for both indigenous and westernized people”. “Birds of the families such as Anatidae, Rallidae, shorebirds and other waterbirds are harvested for human consumption world over, mainly by indigenous people as a major part of the diet” [41].

3.3 Supporting Services

- **Bio-Indicators**

Wetland birds act as bio-indicators and are important in assessing the ecosystem quality and habitats. They indicate the changes in ecosystems, maintain the biodiversity, and acts as an ecological tool for assessment of different habitats. Of the wetland birds, waterfowl are used as bio-indicators of wetland conditions at both local and regional scales. They are sensitive to pollution and are indicators of human health risks from pollution [9].

- **Pollinators**

Green and Elmberg [41] noted that, along with bees and insects, wetland birds also play a major role in pollination and seed dispersion. Birds such as black drongo, mynas, crows, thrushes, rose-ringed parakeets, etc can pollinate the flowers. Thus wetland birds act as pollinators and have tremendous positive impacts on the ecosystem by maintaining biodiversity through pollination behaviours.

- **Nutrient cycling**

Mathialagan et al [9] reported that, droppings of wetland birds is a good source of potassium, nitrogen, phosphate, other nutrients, and also act as source of nitrogen in agriculture. This increases the soil fertility by transfer of nutrients. The transfer of nutrients and the formation of soils are important services provided by wetland birds in an ecosystem.

3.4 Regulating Services

- **Predator/Pest controlling agents**

Birds such as eagles, hawks, owls, kites, and buzzards are strong predators and can attack the insects, rodents, snails, grasshoppers, reptiles, turtles, and worms. Example: Cattle egret (*Bubulcus ibis*) is a well-known predator of the grasshoppers in the paddy fields. These birds reduce the number of crop pests by decreasing the damage to the crop and help the farmers in increasing the crop yield. This will also reduce the application of chemical pesticides and helps to maintain health natural ecosystem. Aquatic birds such as herons, egrets, storks, ducks, and many other waterbirds have significant control over the insect populations [9].

- **Ecosystem balance**

According to Green and Elmberg [41], wetland birds also act as ecosystem engineers. Birds like swans and flamingos do the bioturbation while feeding and can radically change the distribution

of sediments. Birds also increase the stability of sediments and produce carbohydrates that induce sediment cohesion.

4. CONCLUSION

Results of this study indicate that, wetland birds provide many important ecosystem services. Conserving and maintaining healthy bird populations and their habitats would preserve diverse ecosystem services by benefiting many living species and human welfare. Detailed studies on conservation, restoration and management of habitat of wetland birds required. Therefore, there is an urgent need to quantify the economic value of the ecosystem services provided by the wetland birds.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

COMPETING INTERESTS

Author has declared that no competing interests exist.

REFERENCES

1. Ramsar Convention on Wetlands and World Tourism Organization (WTO). Destination Wetlands: Supporting Sustainable Tourism. The Secretariat of the Convention on Wetlands and World Tourism Organization, Gland and Madrid; 2012.
2. Maynard Laurie, Douglas Wilcox. Coastal Wetlands. State of the Lakes Ecosystem Conference 1996 Background Paper. 1997:115.
   ISBN 0-662-26032-5 EPA 905-R-97-015b Cat. No. En40-11/35-2-1997E.
3. Bhati Rinku A. An investigation of water quality, floral and faunal diversity, and microbial quality at Pariej Lake. Dissertation submitted to Sardar Patel University, Vallabh Vidyanagar For the partial Fulfilment of the degree of Master of Science Zoology. 2018:88.
4. Clarkson BR, Ausseil AE, Gerbeaux P. Wetland ecosystem services. In: Dymond, J. R., ed. Ecosystem services in New Zealand – conditions and trends. Manaaki Whenua Press, Lincoln, New Zealand. 2013;192-202.
5. Alam Mohammad Zahangeer. Status of Biodiversity at Wetland Ecosystem of Mohangonj Upazila in Netrakona District. Advances in Ecology. 2014;642450:8
   Available:http://dx.doi.org/10.1155/2014/642450.
6. Ten Brink P, Badura T, Farmer A, Russi D. The economics of ecosystem and biodiversity for water and wetlands: A Briefing Note. Institute for European Environmental Policy, London; 2012.
7. MacKenzie Richard, Matthew Warren. Topic B4: Wetlands and Ecosystem Services. PPT. In: SWAMP toolbox: Theme B, Section B4. 2015:53.
8. Cowardin LM, Carter V, Golet FC, LaRoe ET. Classification of Wetlands and Deepwater Habitats of the United States. U. S. Department of the Interior, Fish and Wildlife Service, Washington, DC; 1979.
9. Mariyappan Mathialagan, Meena Rajendran, Sarathkumar Velu, Alfred Daniel Johnson, G K Dinesh, Kumaravel Solaimuthu, Maheshwaran Kaliyappan, Mangayarkarsi Sankar. Ecological Role and Ecosystem Services of Birds: A Review. Int. J. Environ. Clim. Change. 2023;13(6):76-87.
   DOI: 10.9734/ijecc/2023/v13i61800.
10. Campbell D. Wetlands. Encyclopedia of the World's Biomes. 2020:99–113.
    Available:https://doi.org/10.1016/b978-0-12-409548-9.11810-x.
11. Vencatesan Jayshree, Anjana Vencatesan, Seetha Gopalakrishnan, Keerthika C, Sudarmathi S. Cultural Significance of Indian Wetlands. Ministry of Environment, Forest and Climate Change, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. 2023:82.
12. Sale Common, Macleod Morass. Freshwater Wetlands. CSIRO Factsheet. 2023:03.
13. Chandra K, Bharti D, Kumar S, Raghunathan C, Gupta D, Alfred J R B, Chowdhury B R. Faunal Diversity in Ramsar Wetlands of India, Jointly Published by the Director, Zoological Survey of India and Wetland Division, Ministry of Environment, Forest and Climate Change, Government of India. 2021:1-292.
14. Government of South Australia. South East of South Australia Wetland Birds Identification Guide. South East Natural

Resources Management Board, Mount Gambier Office, 9 Wehl Street South Mount Gambier. 2005;5290:11.
15. Gopal Brij. Guidelines for Rapid Assessment of Biodiversity and Ecosystem Services of Wetlands, Version 1.0. Asia-Pacific Network for Global Change Research (APN-GCR), Kobe, Japan, and National Institute of Ecology, New Delhi. 2015:134.
16. Bijlsma Rob G, Maarten Platteeuw, Mennobart R van Eerden. Wetlands and birds: expected and unexpected changes in the birdscape. ARDEA. 2010;98(3):259-263.
17. Vest Josh L, David A Haukos, Neal D Niemuth, Casey M Setash, James H Gammonley, James H Devries, David K Dahlgren. Chapter 13 Waterfowl and Wetland Birds. In, L B McNew et al. (eds.), Rangeland Wildlife Ecology and Conservation. 2023:417-469.
Available:https://doi.org/10.1007/978-3-031-34037-6_13,
18. Meena Ashvin Kumar, Chothmal Sharma. Chapter – 8 Wetlands in India: Ecosystem Benefits, Threats and Management Strategies. 2019:115-131.
19. Noble David, Mark Everard, Andrew Joys. Development of wild bird indicators for freshwater wetlands and waterways: Provisional indicators. BTO Research Report No. 498. Joint Bto Research Report / Environment Agency Report May 2008. British Trust for Ornithology. 2008:43
ISBN No. 978-1-906204-35-8.
20. Manzoor Javid, Manoj Sharma, Irfan Rashid Sofi, Mufida Fayaz, Musadiq Hussain Bhat. Chapter 4 Status of Indian Wetlands with Special Reference to Pesticides and Their Impact. IGI Global. 2018:64-83.
DOI: 10.4018/978-1-5225-6111-8.ch004.
21. Gomez-Sapiens MM, Soto-Montoya E, Hinojosa-Huerta O. Shorebird abundance and species diversity in natural intertidal and non-tidal anthropogenic wetlands of the Colorado River Delta, Mexico. Ecological engineering. 2013;59:74-83
22. Beauchard O, Jacobs S, Ysebaert T, Meire P. Avian response to tidal freshwater habitat creation by controlled reduced tide system. Estuarine, Coastal and Shelf Science. 2013;131:12-23.
23. Bryce SA, Hughes RM, Kuffmann PR. Development of bird integrity index: Using bird assemblages as indicators of riparian condition. Environmental Management. 2002;30(2):294-310.
24. Green Andy J, Merel Soons, Anne-Laure Brochet, Erik Kleyheeg. Chapter six Dispersal of Plants by Waterbirds. In: Why Birds Matter. Avian Ecological Function and Ecosystem Services. Eds. C. H. Sekercioglu, D. G. Wenny, C. J. Whelan. University of Chicago Press. 2016:147-195.
ISBN: 9780226382630,
25. Pandiyan J, Naresh B, Nagarajan R. Temporal variations of shorebirds and benthic community, traditional saltpans of east coast of Southern India. J. Pure Appl. Zool. 2014;2(1):14-25.
26. Inskipp C, Baral HS, Phuyal S, Bhatt TR, Khatiwada M, Inskipp T, Khatiwada A, Gurung S, Singh P B, Murray L, Poudyal L, Amin R. The status of Nepal's Birds: The national red list series. Zoological Society of London, UK; 2016.
27. Jethva Bharatkumar, Chittaranjan Dave, Kiran Ahir, Dishant Parasharya, Mayurdan Gadhvi, Kangkan Jyoti Sharma. Faunal Biodiversity Survey for Baseline Assessment of Gosabara Wetland Complex in Gujarat. CMPA Technical Series No. 34. Indo-German Biodiversity Programme, GIZ-India, New Delhi. 2017: 114.
28. Kanchan Parajuli. Diversity and Relative Abundance of Avian fauna of Karra River, Hetauda, Makwanpur, Nepal. A Dissertation submitted for the award of the Degree of Master of Science in Zoology with special paper Ecology and Environment Submitted to Central Department of Zoology, Institute of Science and Technology, Tribhuvan University, Kirtipur, Kathmandu, Nepal. 2016;67.
29. Pawar PR. Species diversity of birds in mangroves of Uran (Raigad), Navi Mumbai, Maharashtra, West coast of India. Journal of Experimental Sciences. 2011;2 (10):73-77.
30. Kiros S, B Afework, K Legese. A preliminary study on bird diversity and abundance from Wabe fragmented forests around Gubre subcity and Wolkite town, Southwestern Ethiopia, International Journal of Avian & Wildlife Biology. 2018; 3(4):333–340.
31. Haider Muhammad Zeshan, Shakeel Ahmed, Nuzhat Sial, Gulnaz Afzal, Ayesha Riaz, Akhtar Rasool Asif, Tahir Mehmood,

Abdul Rasheed, Sayyed Aun Muhammad, Hafiz Ishfaq Ahmad. Avian Diversity and Abundance of Taunsa Barrage Ramsar Site in Punjab, Pakistan. Journal of Zoological Systematics and Evolutionary Research. 2022;4736195:14.
Available:https://doi.org/10.1155/2022/4736195.

32. Millennium Ecosystem Assessment (MEA). Ecosystems and Human Well-Being: Synthesis. Island Press, Washington, DC; 2005.
33. Djerboua S, Djerdali S, Guerrero-Casado J, Bachir A S, Guendouz A. Water Birds as Indicators of Ecological Conditions in a Ramsar Wetland (Sebkhet Bazer, East of Algeria). Agricultural Science Digest. 2022; 42(3):341-350.
DOI: 10.18805/ag.D-334
34. Datta Piyali, Sneha Pandey. Systematic Review of Ecological and Ethological Studies on Water Birds. International Journal of Early Childhood Special Education (INT-JECSE). 2022;14(8): 2533-2539.
DOI:10.48047/intjecse/V14I8.353
35. Kuijken E. A short history of waterbird conservation. Waterbirds around the world. Eds. G. C. Boere CA. Galbraith DA. Stroud. The Stationery Office, Edinburgh, UK. 2006:52-59.
36. Rahman Faid, Ahmad Ismail. Waterbirds: An Important Bio-Indicator of Ecosystem. Pertanika J. Sch. Res. Rev. 2018;4(1):81-90.
37. Amat Juan A, Andy J Green. Waterbirds as Bio-indicators of Environmental Conditions. C. Hurford et al. (eds.), Conservation Monitoring in Freshwater Habitats. 2015:1-8.
38. Boere GC, Galbraith CA, Stroud DA. (eds). Waterbirds around the world. The Stationery Office, Edinburgh, UK. 2006; 960.
ISBN 0 11 497333 4.
39. Daniel Wenny G, Travis L Devault, Matthew D Johnson, Dave Kelly, Cagan H Sekercioglu, Diana F Tomback, Christopher J Whelan. The Need to Quantify Ecosystem Services Provided by Birds. The Auk. 2011;128(1):1-14.
Available:http://www.bioone.org/doi/full/10.1525/auk.2011.10248
40. Ogden JC, et al. Waterbirds as indicators of ecosystem health in the coastal marine habitats of southern Florida: Selection and justification for a suite of indicator species. Ecol. Indicat. 2014;
Available:http://dx.doi.org/10.1016/j.ecolind.2014.03.007
41. Green Andy J, Johan Elmberg. Ecosystem services provided by waterbirds. Biol. Rev. 2023;89: 105–122.
DOI: 10.1111/brv.12045

Peer-review history:
The peer review history for this paper can be accessed here:
https://prh.mbimph.com/review-history/3740