IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 1, December 2025
Impact Factor: 7.67

Assessment of Faunal Diversity, Habitat Characteristics and Environmental Drivers in the Garbardi (Suki Dam) Reservoir Ecosystem

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Abstract: *Reservoir ecosystems are variable aquatic habitats with a variety of fish, aquatic invertebrate, amphibian, reptile, bird and terrestrial species. Seasonal hydrology, water quality, habitat structure, vegetation and anthropogenic activities affect their biodiversity. The present study is designed to evaluate the diversity of fauna, habitat characteristics and environmental factors affecting the faunal diversity in Garbardi (Suki Dam) reservoir ecosystem and its surrounding habitat of Jalgaon district of Maharashtra, India. Representative aquatic, littoral, riparian, agricultural, forest-edge and terrestrial habitats will be included in the study. Standardised field surveys will be carried out that will record fish, aquatic fauna, amphibians, reptiles, birds and mammals. Environmental parameters such as temperature, pH, dissolved oxygen, electrical conductivity, turbidity, transparency, nutrients, water depth and vegetation characteristics will be measured. Relationships between faunal communities and environmental variables will be explored through the use of diversity indices, correlation analysis and multivariate statistical techniques. The research will contribute to the ecological monitoring, baseline data on biodiversity, and habitat conservation and sustainable fisheries management/biodiversity-oriented planning of the Garbardi-Suki Dam ecosystem.*

Keywords: *Faunal diversity; Suki Dam; Garbardi; reservoir ecosystem; habitat characteristics; biodiversity; environmental drivers; aquatic fauna; riparian habitat; Maharashtra.*

I. INTRODUCTION

Freshwater reservoirs are a socio-ecological system in which aquatic, riparian and terrestrial systems are interdependent and interdependent in space and time. Reservoirs are also human-made ecosystems, and can also have a high level of biodiversity, providing feeding, breeding, shelter and movement for fish, aquatic invertebrates, amphibians, reptiles, birds and mammals. Water-level fluctuations, hydrology, physicochemical properties, vegetation, habitat structure and land use in the surrounding area affect their ecological conditions.

Aquatic productivity and faunal distribution is greatly influenced by environmental variables like water temperature, pH, dissolved oxygen, electrical conductivity, transparency, nutrient availability and depth. Likewise, shoreline vegetation, substrate, aquatic macrophytes/ripsarian habitats all add habitat complexity and resources for a variety of organisms. Thus, fish production should not be the only factor considered when assessing reservoir biodiversity but rather all faunal components including aquatic, semi-aquatic, and terrestrial groups.

Garbardi (Suki Dam) reservoir is an important landscape for such an assessment in the Raver region of Jalgaon district, Maharashtra. The reservoir is located on the river Suki and is mainly connected to irrigation. Wilderness surrounding landscape includes riparian, agricultural, forest edge and wildlife habitats of the Pal Wildlife Range and the surrounding Yawal Wildlife Sanctuary landscape.

Integrated information on faunal diversity, habitat characteristics and environmental drivers in the Garbardi–Suki Dam ecosystem is still very limited, although ecologically important. The present study is thus intended to document faunal diversity and to assess the effects of these habitat and environmental factors on species distribution and to provide

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baseline data for biodiversity conservation, ecological monitoring and sustainable reservoir management throughout the study area.

II. OBJECTIVES

Specific objectives are:

- To create a record of the faunal diversity of the Garbardi (Suki Dam) reservoir ecosystem.
- To measure diversity of fish, aquatic invertebrate, amphibian, reptile, bird and terrestrial mammal.
- To describe the major aquatic, riparian and adjacent terrestrial ecosystems.
- To compare faunal composition and abundance of different seasons.
- To evaluate some of the physicochemical properties of reservoir water.
- To explore faunal diversity - habitat characteristics.

III. RESEARCH QUESTIONS

The following questions will be explored in the investigation:

- What are the taxonomic composition and diversity of fauna in the Garbardi–Suki Dam ecosystem?
- Are there any differences in faunal diversity between reservoir, riparian, forest-edge, agricultural and surrounding habitat?
- How variable is the faunal composition over time (season)?
- What are the predominant physicochemical and habitat factors most closely related to faunal abundance and distribution?
- What are the comparatively more species rich and conservation value reservoir zones and surrounding habitats?

IV. REVIEW OF LITERATURE

Wanjari et al., (2025) studied temporal and spatial diversity of fishes in Gosikhurd Reservoir, Maharashtra. Forty-seven fish species were recorded and significant seasonality in diversity was observed. The canonical correspondence analysis revealed that temperature, chlorophyll a, pH, alkalinity and dissolved oxygen were significant factors in fish distribution. The study emphasized the need for systematic seasonal monitoring and base line biodiversity inventories to guide the conservation and management of reservoirs.[1]

Shrivastava and Das (2025) examined the diversity of fish and physicochemical parameters of Ghunghutta Reservoir, Chhattisgarh. Nineteen fish species were found and Cyprinidae was the most dominant of these. The study indicated some seasonal variations in water quality such as higher turbidity and phosphate during the monsoon period and some possible signs of organic pollution and progressive eutrophication. Their results show how important it is to consider fish diversity in combination with the physicochemical conditions of a reservoir ecosystem.[2]

Choudhary et al., (2025) examined the microbiological pollution and related ecological threats in Godavari River system. Their study showed microplastics in water, sediment and fish and that water from dams and reservoirs was more likely to contain micro plastics than other water sources. The results underscore the importance of examining

[1] Wanjari, R. N., Shah, T. H., Telvekar, P. A., Bhat, F. A., Somasundharam, I., et al. (2025). Exploring temporal and spatial patterns of fish diversity in a tropical reservoir in relation to environmental parameters. *Heliyon, 11*(14), e43826. https://doi.org/10.1016/j.heliyon.2025.e43826

[2] Shrivastava, P., & Das, R. (2025). Diversity of fish species and physico-chemical assessment of Ghunghutta Reservoir, Chhattisgarh, India. *Uttar Pradesh Journal of Zoology, 46*(11), 229–236.https://doi.org/10.56557/upjoz/2025/v46i115022

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emerging pollutants and anthropogenic influences in the ecological condition assessment of reservoir-associated freshwater systems.[3]

Alam et al. (2023) studied the ecological characteristics, fish diversity, assemblage pattern and feeding guilds of Rihand Reservoir, India. They worked on spatial and temporal variation of fish communities and analyzed the impact of environmental parameters using ecological and GIS approaches. The research showed the potential of the combination of biological observations, environmental and spatial data in order to manage large subtropical reservoirs sustainably.[4]

Majhi et al. (2022) explored fish assemblage and relationship of water quality in the interface of river and reservoir in Central India. They found that the environmental factors had a different impact on the various feeding guilds; conductivity and total dissolved solids were correlated with abundance of fish while temperature, alkalinity, chlorophyll and nitrate were correlated with the abundance of omnivorous fish. Some changes in native species distribution were also reported, and the importance of river-reservoir transition areas for conservation and fisheries managers was noted.[5]

V. MATERIALS AND METHODS

5.1 Study Area

The study will be done in and around the Garbardi (Suki Dam) reservoir in the Raver area of Jalgaon district, Maharashtra, India. The Suki River and Satpura landscape are associated with the reservoir. The dam records are available and show that Suki Dam is an earthfill dam built on the Suki River and the Garbardi area is linked to the Pal Wildlife Range of Yawal Wildlife Sanctuary.

The study landscape should be broken down into ecologically relevant sampling units, and not into a homogeneous reservoir.

5.2 Habitat Stratification

The study area will be divided into the following broad habitat categories:

A. Aquatic habitats

Inlet/riverine zone
Transitional zone
Littoral zone
Open-water/lacustrine zone
Dam/reservoir outlet area
Shallow-water areas

[3] Choudhary, A., George, L., Mandal, A., Biswas, A., Ganie, Z. A., & Darbha, G. K. (2025). Assessment of microplastics and associated ecological risk in the longest river (Godavari) of peninsular India: A comprehensive source-to-sink analysis in water, sediment and fish. *Marine Pollution Bulletin, 212*, 117560.https://doi.org/10.1016/j.marpolbul.2025.117560

[4] Alam, A., Kumar, J., Sarkar, U. K., Jha, D. N., Sahu, S. K., Das, S. C. S., Srivastava, S. K., Kumar, V., & Das, B. K. (2023). Linking ecological characteristics with fish diversity, assemblage patterns and feeding guilds, and GIS applications along the temporal and spatial gradients in a large subtropical reservoir, India, for sustainable management. *Journal of Water & Climate Change, 15*(2), 607–627. https://doi.org/10.2166/wcc.2023.513

[5] Majhi, P., Gogoi, P., Lianthuamluaia, L., Jana, C., Tayung, T., Kumari, S., Sarkar, U. K., & Das, B. K. (2023). Assessing spatio-temporal dynamics of phytoplankton assemblage and ecohydrological interaction in a community managed reservoir using GIS for sustainable fisheries management. *Ecohydrology & Hydrobiology, 23*(1), 109–126. https://doi.org/10.1016/j.ecohyd.2022.11.002

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B. Riparian habitats

Shoreline vegetation
Emergent macrophyte zones
Marshy areas
Inadequate elevation control and protection of mudflats and exposed shorelines.
Rocks on or in the shoreline, or sand bars located at the shoreline

C. Terrestrial habitats

Forest habitat
Forest edge
Scrubland
Agricultural fields
Grassland/open land
Human-influenced areas
This stratification will provide the opportunity for comparison of biodiversity along environmental gradients.

VI. SAMPLING DESIGN

There are four major seasonal periods that can be considered:
Summer/pre-monsoon
Monsoon
Post-monsoon
Winter
Field availability, or local conditions, should determine the number of representative sampling stations to be located within each major habitat category, at a minimum of three sampling stations per category.[6]
Multiple sampling will enable measurement of spatial variation and temporal variation.

Result

Table 1: Proposed Sampling Stations for Bar-Graph Representation

Habitat Category	Sampling Habitat	Proposed No. of Stations
Aquatic	Inlet/Riverine Zone	3
	Transitional Zone	3
	Littoral Zone	3
	Open-water/Lacustrine Zone	3
	Dam/Reservoir Outlet	3
	Shallow-water Areas	3
Riparian	Shoreline Vegetation	3
	Emergent Macrophyte Zone	3
	Marshy Areas	3
	Mudflat/Exposed Shoreline	3
	Rocky/Sandy Shoreline	3
Terrestrial	Forest Habitat	3
	Forest Edge	3

[6] American Public Health Association, American Water Works Association, & Water Environment Federation. (2023). *Standard methods for the examination of water and wastewater* (24th ed.). APHA Press.

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	Scrubland	3
	Agricultural Fields	3
	Grassland/Open Land	3
	Human-influenced Areas	3
Total	17 habitat types	51 stations

Interpretation

Table 1 shows proposed distribution of sampling stations by habitat categories of the Garbardi reservoir (Suki Dam) ecosystem. There are 51 sampling stations, representing 17 habitat types with three stations for each habitat to give a balanced spatial representation. The six habitat types in the aquatic category account for 18 stations, including inlet, transitional, littoral, open-water, outlet and shallow-water habitats. The riparian category includes five habitat types with a total of 15 stations, related to shoreline vegetation, macrophyte, marshy, mudflat and rocky and sandy habitats. Terrestrial (forest, forest-edge, scrubland, agricultural, grassland and human-influenced) accounts for 18 stations and six habitat types. This layered structure ensures that there is a similar effort in sampling habitats and allows the evaluation of the spatial and seasonal variations in faunal diversity, habitat features and environmental conditions.[7]

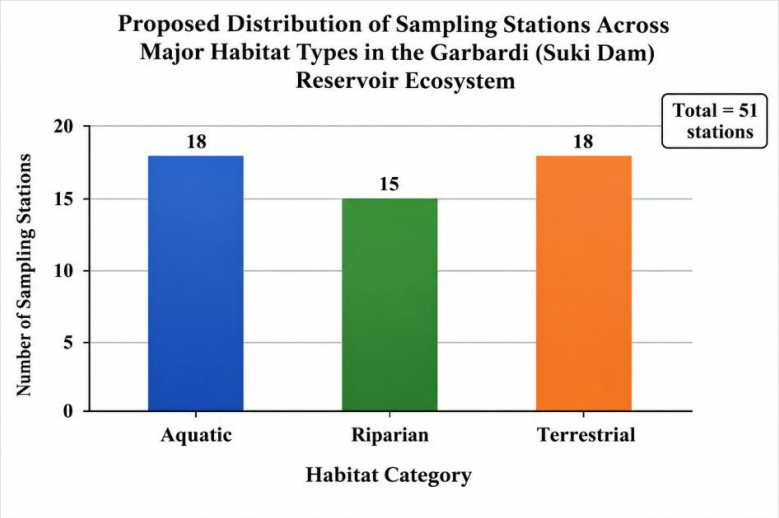

Figure 1: Proposed Sampling Stations for Bar-Graph Representation

VI. FAUNAL SURVEY METHODS

7.1 Fish Diversity

Systematic surveys will be carried out to cover representative habitat types and sampling stations in the reservoir to assess fish diversity. Where legally and ethically allowed, standardised fishing methods will be used, such as cast nets, drag nets and other suitable nets for fishing. Further data will be gained from direct observations made in shallow littoral zones, local fish landings and photo documentation. The local fishers can be consulted as additional sources of information for the identification of commonly occurring species and occurrence of the season. Comparability among stations and seasons will be achieved through standardizing sampling effort, duration, and the type of sampling gear used as well as sampling area. Fish will be released preferably in the field where they were captured, after being

[7] Andrabi, S., Bakhtiyar, Y., Yousuf, T., Akhtar, M., & Nissar, S. (2024). Water quality assessment in relation to fish assemblage using multivariate analysis in Manasbal Lake, Kashmir. *Water Science, 38*, 92–108. https://doi.org/10.1080/23570008.2023.2300850

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identified with the right keys. Only voucher specimens will be collected when necessary for taxonomic confirmation and when there are available permissions. Species richness, abundance and diversity indices will then be computed.[8]

7.2 Aquatic Invertebrates

Representative littoral, shallow and benthic habitats of the Garbardi (Suki Dam) reservoir will be sampled to assess aquatic invertebrate diversity. Hand nets will be used as standard type nets and aquatic insect nets or appropriate benthic sampling devices will be used as per substrate and habitat conditions. Microhabitats sampled will include shallow shoreline areas, submerged vegetation, sediments, stones, woody material. The main taxonomic groups that will be taken into account will be Mollusca, Odonata larvae, Ephemeroptera, Hemiptera, Coleoptera, Diptera larvae, Crustacea and other identifiable macro-invertebrates. Samples will be sorted and preserved (if required) and identified with standard taxonomic references. Species richness, abundance and relative abundance will be compared amongst habitats and season. Aquatic macroinvertebrates will also be used as an ecological indicator as changes in their community structure will give data on water quality, habitat condition, organic enrichment and environmental disturbance.[9]

7.3 Amphibians and Reptiles

Diversity of amphibians and reptiles will be documented via systematic visual encounter surveys, shoreline searches, standardized transects and nocturnal observations. Surveys will be undertaken in suitable season and weather, especially in and around wetlands, shallow water, riparian vegetation, and other suitable breeding, feeding and shelter habitats. Calls from amphibians will also be recorded to ensure species identification for species which might not be seen during visual surveying. The rocks, fallen logs, leaf litter, vegetation, muddy margins and crevices where reptiles and amphibians may be found will be looked at in particular. Photographic evidence will be used to support all observations wherever possible and taxonomic references will be used to identify species. Information including species, number of individuals, habitat, time and location will be recorded. The data to be generated will be used to assess species richness and relative occurrence, habitat associations and seasonal variation of amphibian and reptile communities.[10]

7.4 Avifaunal Diversity

Fixed-radius point counting and line transect surveys of avifauna will be conducted in reservoir, riparian, agricultural, forest edge and surrounding terrestrial habitats. Surveys will take place preferably when birds are active such as in the morning and late afternoon. The species name, number of individuals, type of habitat, activity, feeding behaviour, breeding evidence and time of observation will be noted for each observation. GPS-equipped devices can also be used to collect geographic coordinates to aid spatial analysis of bird distribution. Special focus will be given to aquatic and wetland associated birds as feeding, resting and nesting areas on the shorelines of the reservoirs, shallow water areas and exposed mudflats may be important. The seasonal observations will be repeated to detect resident, seasonal and

[8] Devi, A., Balasubramanian, A., Neeraja, T., Ramalingaiah, D., & Jesintha, N. (2024). An annotated checklist of fish faunal diversity of Sathiyamoorthy Sagar Reservoir, Tamil Nadu, India. *Uttar Pradesh Journal of Zoology, 45*(14), 332–339. https://doi.org/10.56557/upjoz/2024/v45i144210

[9] Lalitha, H. M. (2024). A review on fish diversity of freshwater ecosystems in India. *International Journal of Fisheries and Aquatic Studies, 12*(6), 103–106. https://doi.org/10.22271/fish.2024.v12.i6b.3001

[10] IUCN. (2025). *The IUCN Red List of threatened species* (Version 2025-2). International Union for Conservation of Nature. https://www.iucnredlist.org/

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migratory species. Bird diversity will then be assessed based on species richness, relative abundance, Shannon–Wiener diversity and evenness indices.[11]

7.5 Terrestrial Mammals

A diverse array of direct and indirect field observations will be conducted in the forest, forest-edge, scrubland, agricultural and riparian habitats around the reservoir to measure terrestrial mammal diversity. Direct observations (sightings) will be recorded using line transects, as will be other indirect observations, including burrows, resting sites, feeding marks, scat and characteristic calls. Camera traps can be placed at points of interest such as wildlife trails, water access points and frequented areas for mammals. Species, number of individuals, habitat type, date, time and geographic location (where available) will be included with each observation. Photos will be taken to ensure accurate evidence of indirect evidence. A series of seasonal surveys will aid in determining species occurrence and habitat use. The information created will be utilized to estimate species richness, relative occurrence of terrestrial mammals and habitat association in the Garbardi–Suki Dam landscape.[12]

VIII. WATER-QUALITY ASSESSMENT

Seasonal samples will be taken at certain water stations within the reservoir.
The following physicochemical variables are suggested:

Parameter	Unit/Method
Water temperature	°C
pH	pH units
Dissolved oxygen	mg/L
Electrical conductivity	µS/cm
Total dissolved solids	mg/L
Turbidity	NTU
Transparency	Cm
Total alkalinity	mg/L
Total hardness	mg/L
Nitrate	mg/L
Phosphate	mg/L
Ammonia	mg/L
Chloride	mg/L
Water depth	M

Field and lab analyses should be run using standard methods, as described in APHA protocols when applicable.

IX. VEGETATION ASSESSMENT

Vegetation will be assessed in the aquatic, riparian and adjacent terrestrial habitats that comprise the Garbardi (Suki Dam) reservoir ecosystem. The structure of vegetation is a significant ecological feature since it supplies food, shelter, nesting and breeding areas as well as corridors for various faunal groups to move. Species diversity, tree density, shrub density, herbaceous cover, aquatic macrophyte diversity and canopy cover will be recorded in the field. The presence

[11] Lalitha, H. M. (2024). A review on fish diversity of freshwater ecosystems in India. *International Journal of Fisheries and Aquatic Studies, 12*(6), 103–106. https://doi.org/10.22271/fish.2024.v12.i6b.3001

[12] Markad, G., More, R., Kakade, V., & Sarwade, J. (2025). Assessing fish diversity in the Ujani reservoir: An updated overview after one decade. *Journal of Threatened Taxa, 17*(10), 27705–27719. https://doi.org/10.11609/jott.9673.17.10.27705-27719

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ISSN: 2581-9429 Volume 5, Issue 1, December 2025 Impact Factor: 7.67

and spread of any invasive plant species will also be recorded. At sampling stations, the extent of vegetation disturbance (removal, trampling, habitat degradation) will be evaluated. Vegetation characteristics will subsequently be compared with faunal diversity to determine relationships between habitat structure and the distribution of birds, amphibians, reptiles and terrestrial mammals.[13]

X. ANTHROPOGENIC DISTURBANCE ASSESSMENT

The anthropogenic disturbance will be evaluated at each sampling station in order to measure the impact of humans on the Garbardi (Suki Dam) reservoir ecosystem. Intensity of fishing, agricultural run-off, livestock access, domestic waste, plastics, removal of shoreline vegetation, disturbance of soil/sand, tourism, boating, road disturbance, noise and settlement expansion will be documented through field observations. Invasive species that are linked to human activities will also be documented. Intensity and spatial extent of each disturbance factor can be assigned a standardized score. Then a single Anthropogenic Disturbance Index will be determined for each sampling location. This index will be compared with faunal diversity and habitat characteristics to look for faunal/ habitat/human pressure relationships.[14]

XI. DISCUSSION

The ecological importance of the Garbardi–Suki Dam ecosystem must be understood in the context of the interactions among habitat heterogeneity, hydrology, water quality and adjacent land use. Reservoirs are not a homogenous water body. Gradients in depth, flow, substrate, and vegetation, oxygen and nutrient conditions occur as the riverine or inlet conditions change into shallow littoral and deeper open-water conditions. These gradients can create variation in the species composition and abundance.

Whereas the expected importance of dissolved oxygen is especially relevant because aquatic organisms are directly impacted by the presence of oxygen, and indirectly by the absence of it, affecting decomposition and nutrient cycling. Likewise, metabolic rates, feeding activity, and reproduction and habitat suitability are affected by temperature. The ionic composition and mineral characteristics of reservoir water can be determined from the conductivity, and can be used to determine its alkalinity and hardness.[15]

Nutrient concentrations also are important because high levels of nutrients can lead to increased primary production and changes in aquatic community structure. Studying the phytoplankton of Indian reservoirs has shown that there is a good correlation between the nutrient variables and community composition.

Structure of the habitat is also important. Shoreline and submerged plants, woody debris, shallow and heterogeneous substrates provide refuge and feeding habitat for fish and aquatic invertebrates and potentially support amphibians, reptiles and birds. Therefore, even if basic water quality parameters are within acceptable ranges, degradation of shoreline habitat may result in a loss of biodiversity.

Forest and wildlife habitat surrounds the reservoir, which could enhance the ecological value of the reservoir due to the continuity of the aquatic system with the surrounding terrestrial habitat. The reservoir may be used for drinking and feeding by birds and mammals, and aquatic and terrestrial habitat may be utilized throughout the life cycle by amphibians and reptiles.

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[13] Panikkar, P., Khan, F., Ramya, V. L., Saha, A., Vijaykumar, M. E., Sarkar, U. K., Jesna, P. K., & Das, B. K. (2024). Assessment of plankton diversity and physico-chemical characteristics for sustainable fish production in a tropical reservoir in South India. *Indian Journal of Fisheries, 71*(3). https://doi.org/10.21077/ijf.2024.71.3.147246-05

[14] Shaikh, A., & Bansode, S. (2024). Evaluating the diversity and conservation status of fishes in Ujani Dam, Solapur District, Maharashtra, India. *International Journal of Fisheries and Aquatic Studies, 12*(5), 142–149. https://doi.org/10.22271/fish.2024.v12.i5b.2977

[15] Sutar, V. B., Kulkarni, A. S., Markad, A. T., Meshre, S. D., & Bansode, V. V. (2024). Fish biodiversity assessment of Tawarja Reservoir, Latur (Maharashtra): A case study. *Archives of Current Research International, 24*(4), 127–134. https://doi.org/10.9734/acri/2024/v24i4668

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Meanwhile, human activities in the reservoir might create ecological stressors. Habitat quality may be impacted by fishing, agriculture, shoreline modification, and waste disposal activities as well as livestock activity. Sustainable reservoir management thus needs to take into account not only biodiversity conservation but also local livelihood needs.

The recent studies on Indian reservoirs have highlighted the importance of ecosystem-based management of reservoirs instead of merely concentrating on fish production. The Garbardi–Suki Dam study could be used for this by combining the two disciplines of biological monitoring and environmental assessment.

12. Conclusion

The Garbardi (Suki Dam) reservoir ecosystem is a complex aquatic-terrestrial interface that also has potential importance for fish, aquatic invertebrates, amphibians, reptiles, birds and terrestrial mammals. The ecological condition is anticipated to be associated with the interplay of water quality, seasonal hydrology, habitat complexity, vegetation structure, anthropogenic pressures.

The proposed study has a comprehensive plan for systematic faunal surveys, habitat assessment, physicochemical monitoring, and multivariate statistics to evaluate these interactions. The study considers the importance of connectivity, between aquatic, riparian, forest and agricultural habitats, rather than considering the reservoir as an isolated water body.

The analysis and development of a site-specific biodiversity baseline and identification of the environmental drivers related to faunal distribution are the main results of the scientific investigation. This can help inform ecological monitoring, conservation, sustainable fisheries management and landscape planning for Garbardi – Suki Dam.

The study is significant as the Suki dam/Garbardi area is linked to Pal Wildlife Range and the wider Yawal Wildlife Sanctuary landscape. The existing management documentation notes the ecological and eco-tourism value of the reservoir area, which further justifies the systematic assessment of biodiversity and management that is environmentally sensitive.

In general, an integrated approach to aquatic and terrestrial biodiversity assessment can help identify a scientific basis for the preservation of ecological integrity and the achievement of livelihood, fisheries and conservation goals that are compatible.

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