RESEARCH ARTICLE

RSP Science Hub

International Research Journal on Advanced Science Hub
2582-4376
www.rspsciencehub.com
Vol. 07, Issue 11 November

Check for updates

http://dx.doi.org/10.47392/IRJASH.2025.106

Ecological Significance and Aquatic Diversity of Daya River in Odisha: Conservation Prospectiveness

Amar Kumar Sahoo[1], Nirmal Chandra Biswal[2], Ram Prasad Panda[3]

[1]*Department of Life science and Biotechnology, Gandhi Institute of Engineering and Technology University (GIETU), Gunupur, Rayagada, Odisha, 765022, India.*

[2]*Assistant Professor, Department of Life science and Biotechnology Gandhi Institute of Engineering and Technology University (GIETU), Gunupur, Rayagada, Odisha, 765022, India.*

[3]*Gopalpur College, Gopalpur on Sea, Gopalpur city, Berhampur, Ganjam, Odisha, 761002, India.*

Email: *nirmalb@gmail.com[2]*

Article history

Received: 13 September 2025
Accepted: 06 October 2025
Published: 07 November 2025

Keywords:

Daya River, Ethio faunal and Aquatic Biodiversity, Freshwater Ecosystem, Physicochemical Parameters

Abstract

The study aims to evaluate the ethiofaunal richness of the Daya River in Odisha, highlighting its ecological value and function in maintaining regional diversity. Being a distributary of the Kuakhai River, the Daya passes through Khordha and Puri districts before joining Chilika Lake, creating a crucial freshwater ecosystem that hosts a wide range of aquatic organisms. The research examines the diversity, distribution, and abundance of aquatic organisms including fish, molluscs, crustaceans, planktons, and amphibians, and how these correlate with the physicochemical properties of the river water. Field surveys at different locations along the upstream and downstream reaches of the river were undertaken. Parameters such as temperature, pH, dissolved oxygen (DO), biological oxygen demand (BOD), nitrates, and phosphates were measured to determine their impact on faunal diversity. The findings reflect a diversified community of water life, suggesting that the Daya River is still biologically active and ecologically rich. Nevertheless, the presence of tolerant and sensitive species concurrently indicates non-uniform water quality at different sites. The study warns of anthropogenic pressures like agricultural effluent run-off, sewage outflow, overfishing, and land development degrading habitats and water quality, causing sedimentation, eutrophication, and destruction of riparian cover. It advocates integrated river management, control of pollution, riverbank restoration, sustainable aquaculture, and community engagement to preserve biodiversity and ecological integrity and livelihoods of the Daya River.

1. Introduction

Daya River, a distributary of the Kuakhai River, originates near Saradeipur of Khurdha district in Odisha and runs southwest for about 37 km before emptying into the Chilika Lake Asia's biggest brackish water lagoon and an international Ramsar site. The river has an important ecological function in serving as a natural connection linking the freshwater systems of the Mahanadi delta to the coastal lagoon ecosystem. With this connection, the Daya River provides for nutrient passage, organic material, and sediments to allow for the productivity and ecological well-being of riverine and estuarine systems [1]. Ecologically, Daya River is home to a diverse range of aquatic biodiversity such as phytoplankton, zooplankton, fish, molluscs, and aquatic flora and offers feeding and breeding habitats to many species [2]. Its riparian wetlands also serve as critical stopover sites for migratory birds and therefore make the place a vital ecological corridor. The Daya River also supports essential ecosystem services such as irrigation of farmlands, fisheries that support livelihood in the area, recharging groundwater, and climate regulation through wetland processes [3]. The Daya River basin has been the birthplace of rural society and traditional occupations such as farming and fishing in the past. Socio-economically, it still sustains thousands of people dependent on its water for irrigation, household purposes, and fisheries, and significantly contributing to the local economy [4]. But heavy urbanization, disposal of industrial effluent, agro-chemicals runoff with fertilizers and pesticides, and unrestricted fishing have induced intense ecological stress. All these have led to lowering of water quality, eutrophication, siltation, habitat loss, and species loss. The natural course of river flow has also been disrupted by encroachment and improper watershed management [5]. Nonetheless, community-based management of resources is needed for the future health of Daya River. Haste conservation measures such as control of pollution, restoration of riparian habitats, and co-synchronization with Chilika Lake ecosystem conservation efforts are also needed [1]. This will restore ecological wellness, maintain livelihood, and conserve this vital freshwater coastal connector. Research seeks to assess the aquatic biodiversity and habitat quality of the Daya River, highlighting its ecological value as a vital freshwater coastal link supporting a range of species and ecosystem processes [6] It also seeks to improve effective conservation and restoration strategies that would ensure sustainable management, ecological health, and long-term environmental and community rewards of the river [7]. In the present study aquatic biodiversity, habitat features, and ecologic significance of the Daya river will be evaluated. However, identification of certain environmental issues and its restoration measures will also encounter in the research for sustainable management, ecological balance with long-term environmental and social welfare of the river.

2. Methodology

The study was conducted at three representative sample locations like upstream, midstream, and downstream selected to represent the anthropogenic and ecological gradients along the river course [8, 9. Site 1 (S1: Upstream, close to Saradeipur) is the origin of the river and possesses a relatively unspoiled ecosystem with vegetation, low degrees of human disturbance, and high degrees of water clarity. This site is employed as a control site in the estimation of baseline ecological health, aquatic richness, and physico-chemical parameters at near-pristine levels [10]. Site 2 (S2: Midstream, Delang vicinity) suffers moderate anthropogenic pressures from neighboring agricultural catchments and human settlements. Agricultural runoff inputs nutrients, sediments, and potential pollutants into the river, influencing water quality as well as biotic communities [11, 12]. This website provides an account of riverine ecosystem nutrient enrichment, agricultural, and habitat modification impacts. Site 3 (S3: Downstream, near Balugaon) lies close to the river and Chilika Lake confluence and comprises estuarine processes triggered by tidal mixing and salt intrusion [13]. The area supports diverse aquatic flora and fauna adapted to brackish transitional, acting as an important ecological corridor for the transition between freshwater and marine habitats [14].

2.1. Hydrological and Ecological Significance of the Daya River, Odisha

The Daya River drains the Odisha districts of Khordha and Puri, situated between latitudes 20°05'–20°15'N and longitudes 85°45'–85°55'E. It originates from the Mahanadi deltaic system and acts as an important drainage system in this fertile alluvial tract [15]. It has a tropical monsoon climate with an average annual rainfall of approximately 1500 mm, influencing seasonal discharge and nutrient fluxes [16, 17]. Daya River ultimately enters the northern part of Chilika Lake, where it is involved in salinity gradient control, sediment transport, and nutrient input that supports primary productivity [18]. This hydrological link between Mahanadi delta's freshwater inputs and Chilika Lagoon brackish waters supports the ecological continuum of eastern India's coastal wetlands [19] Shown in Figure 1.

Figure 1 Sampling Sites in Daya River, Odisha, India

2.2. Comprehensive Assessment of the Ecological Health of the Daya River Based on Physico-Chemical and Biological Indicators

Environmental evaluation of the Daya River was conducted using an integrated approach consisting of physico-chemical, biological, and biodiversity index-based research in order to evaluate the river's ecological sustainability as well as its health. The infographic study (Figure 2) illustrates this integrated structure, combining physico-chemical factors such as temperature, pH, dissolved oxygen (DO), biochemical oxygen demand (BOD), nitrate, and phosphate with biological components such as phytoplankton, zooplankton, macrophytes, benthos, and fishes based on indices such as species richness, Simpson's diversity, and Berger-Parker index [20, 21]. The physico-chemical parameters were determined in accordance with standard limnological practices and guidelines of the American Public Health Association (APHA, 2017) to avoid errors and reproduce results. Water samples were taken systematically from predetermined locations in sterilized polyethylene containers in order to avoid contamination (APHA, 2017). In-situ temperature was measured using a calibrated digital thermometer 10–15 cm below the water surface to avoid surface interference, and pH was determined using a portable, pre-calibrated pH meter with buffer solutions of pH 4.0, 7.0, and 9.2. Dissolved oxygen was measured by the Winkler titration method, and biochemical oxygen demand (BOD) was determined after a 5-day incubation period at 20°C to assess organic load [22, 24]. Nutrient concentration—nitrate and phosphate—were estimated spectrophotometrically to assess eutrophication potential [23]. Combined, these analyses provided a solid snapshot of Daya River water quality, ecological balance, and biological productivity.

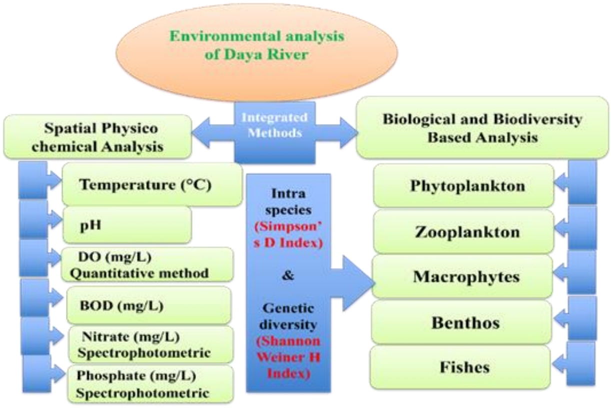

Figure 2 Overview of Integrated Environmental Assessment of Daya River and its Indices

2.3. Quantitative Assessment of Aquatic Biodiversity and Limnological Parameters in the Daya River Ecosystem

Turbidity, an indicator of the suspended solids, was determined by a nephelometric turbidity meter, all readings taken in the morning to reduce diurnal variation and triplicate measurements for accuracy. Such an approach follows APHA (2017) guidelines to make analysis more reliable and comparable to determine the ecological status of the Daya River. Turbidity affects penetration of light and photosynthesis, which, in turn, influences the survival and metabolism of aquatic animals [9]. Dissolved oxygen (DO) is very important for aquatic life—increased levels of DO indicate good water quality, while decreased DO levels usually indicate organic pollution [23]. Biochemical oxygen demand (BOD) denotes microbial oxygen use in the breakdown of organic matter; hence, increased BOD values indicate high organic contamination [25]. Nutrients like nitrates and phosphates indicate the degree of eutrophication, usually due to farm runoff and domestic sewage outflow [26]. The biological elements phytoplankton, zooplankton, macrophytes, benthos, and fishses are a measure of the ecological health and functioning of the river [9, 27]. Phytoplankton and zooplankton are the basis of aquatic food webs and function as highly sensitive measures of nutrient condition, whereas macrophytes stabilize sediment, aerate water, and provide natural biofiltration. Benthic animals (e.g., worms, molluscs, and insect larvae) signal sediment quality and long-term pollutant effects, and fish diversity signifies the general ecological balance and trophic structure [26,28]. In the present study three principal indices were used to statistically measure biodiversity, of Daya river. The Shannon–Weiner Diversity Index (H') estimates the diversity and evenness of species, reflecting the distribution of individuals among species in an ecosystem [29, 30]. In the Daya River, increased H' values indicate ecological stability and good aquatic communities, while decreased values indicate species dominance because of pollution or disturbance. The Shannon–Weiner Index is estimated as:

$$\boldsymbol{H' = -\sum_{i=1}^{S} (p_i ln\, p_i)}$$

where p_iis the proportion of individuals belonging to species i, Sis the total number of species, and Nis the total number of individuals. Also, Simpson's Diversity Index (D) measures species dominance and evenness in a community. It measures the probability that two randomly chosen individuals are in the same species, with lower D values implying greater diversity and evenness. The formula is:

$$\boldsymbol{D = \sum_{i=1}^{S} \frac{n_i(n_i - 1)}{N(N-1)}}$$

Where n_i represents individuals of species i, and Nis the total number of individuals. Besides, the Margalef's Richness Index (d) gives an indication of species richness per the overall count of individuals within a community [31]. It is given as:

$$\boldsymbol{d = \frac{S-1}{ln\, N}}$$

Increasing values of d reflect increased richness of species, representing a strong and healthy ecosystem, whereas decreasing values reflect ecological stress or degradation. In total, these indices and parameters provide an integrative and quantitative knowledge on the Daya River's ecological status, allowing for the source of pollution to be identified, biological effects to be evaluated, and effective conservation planning to be made for sustainable river management [9, 30].

3. Results and Discussion

Physico-chemical characterization of the Daya River shows a clear spatial trend for water quality attributes from the upstream (S1) to the downstream (S3) reflecting the synergistic impact of natural processes coupled with increasing human activities along the river course.

3.1. Assessment of Physico-Chemical Parameters and Water Quality Gradient of the Daya River

The upper part (S1) has favorable ecological conditions with moderate temperature (25.4°C), pH close to neutral (7.1), high dissolved oxygen (DO) level of 7.8 mg/L, and minimum biochemical oxygen demand (BOD) of 2.1 mg/L. These values reflect low organic pollution and good self-purification ability, characteristic of quite undisturbed areas with minimal anthropogenic disturbance (Wetzel & Likens, 2000; APHA, 2017). Downstream, progressive alteration in water quality becomes apparent. Temperature increases to 29.3°C and pH rises slightly to 8.0, both within the range of tolerance for most aquatic life but implying greater solar exposure and metabolic processes [23]. The concentration of DO drops from 7.8 to 5.4 mg/L, whereas BOD increases from 2.1 to 4.5 mg/L, indicating increased organic matter breakdown and limited oxygen availability as a result of human activities [27, 28]. Similarly, the levels of nitrates and phosphates rise from 0.32 to 0.56 mg/L and 0.12 to 0.39 mg/L, respectively, reflecting nutrient enrichment due to probable agricultural runoff, domestic effluent, and wastewater disposal [9, 25]. The physico-chemical parameters of the river are shown in Table 1. These nutrient accumulations cause mild eutrophication in the reaches of the river downstream, promoting algal growth and disrupting the balance of the aquatic ecosystem [32, 33]. Although being within acceptable limits, these shifts reflect the progressively worsening quality of the water.

Ongoing nutrient loading, if unmitigated, can lead to oxygen deficiency, loss of biodiversity, and long-term ecological instability within the Daya River ecosystem [30].

Table 1 Spatial variation in the physico-chemical parameters of the Daya River

PR	S1 U	S2 M	S3 D	OR
Temperature (°C)	25.4	27.8	29.3	20–30
Ph	7.1	7.6	8.0	6.5–8.5
DO (mg/L)	7.8	6.2	5.4	>5
BOD (mg/L)	2.1	3.8	4.5	<5
Nitrate (mg/L)	0.32	0.47	0.56	<1
Phosphate (mg/L)	0.12	0.25	0.39	<0.5

PR: Parameter; U: Upstream; M: Midstream; D: Downstream; OR: Optimum range

Likewise, the radar plot of the physico-chemical parameters over the sites of the Daya River (S1–S3) reveals a continuous downstream movement of water quality, as shown in Figure 3. Temperature and pH increase slightly, remaining well within ideal ranges, reflecting natural warming and mildly alkaline situations [9, 23]. Dissolved oxygen (DO) declines from 7.8 to 5.4 mg/L, indicating increased organic load and microbial decomposition activity downstream [27, 28].

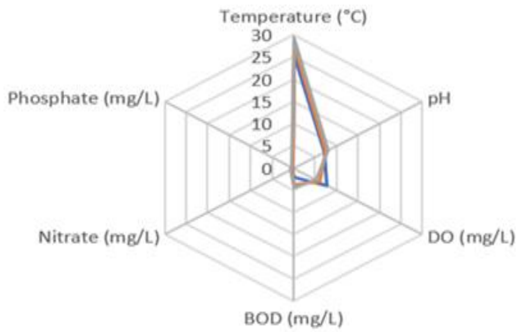

Figure 3 Radar Representation Illustrates Spatial Variations in the Physico-Chemical Parameters of the Daya River

Likewise, biological oxygen demand (BOD), nitrate, and phosphate levels increase in a progressive manner, indicating increased organic and nutrient enrichment resulting from anthropogenic sources such as agriculture, domestic wastewater, and surface runoff [25, 34].

The radar plot overall indicates stable upstream conditions gradually deteriorating downstream, indicating moderate ecological stress and nutrient-mediated productivity shifts in the Daya River system [9, 33].

3.2. Hydrological and Ecological Significance of the Daya River, Odisha

Aquatic diversity in Odisha's Daya River symbolizes the richness and makeup of aquatic life forms that are important in sustaining the ecological balance and productivity of the river. Aquatic diversity encompasses various groups like phytoplankton, zooplankton, macrophytes, benthos, and fishes, each of which makes a contribution in their own way towards ecosystem functioning.

3.2.1. Taxonomic Composition and Ecological Significance of Aquatic Communities in the Daya River

Aquatic diversity in Daya River is made up of a range of ecological groups making contributions to ecosystem balance. A fine analysis of phytoplankton, zooplankton, macrophytes, benthos, and fishes has been depicted in Table 2 and Figure 4. The study demonstrates that phytoplankton (68 species) such as Navicula and Scenedesmus are primary producers and bioindicators, zooplankton (35 species) such as Brachionus and Daphnia are grazers connecting trophic levels, macrophytes (21 species) such as Eichhornia and Nymphaea uptake nutrients and offer shelter, benthic animals such as Tubifex and Chironomus are decomposers enhancing the quality of sediment, and fishes such as Catla catla and Labeo rohita are ecologically and economically important. The richness and diversity of these communities are reflective of the ecological well-being of the Daya River. High species diversity reflects a mature, self-sustaining community with good energy transfer, while low diversity or dominance by a few species is indicative of environmental stress caused by nutrient enrichment, pollution, or habitat change [35, 36, 37]. Therefore, understanding aquatic diversity not only underscores the ecological importance of the river but also assists in recognizing anthropogenic impacts. This diversity is critical to maintaining ecological resilience, conserving biodiversity, and promoting sustainable use of resources in the Daya River ecosystem. The species distribution between various aquatic groups of the study has been presented in the form of a pie chart (Figure 5), giving a clear idea of their comparative abundance. Phytoplankton takes the preeminence with 68 species, representing about 33% of the total species, accentuating the pivotal role that they play as primary producers and water quality bioindicators [36, 37]

Table 2 **Comprehensive analysis of aquatic organisms across multiple functional groups**

Group	Species No.	Dominant Species	Ecological Role
Phytoplankton	68	*Navicula, Closterium, Scenedesmus, Microcystis*	Primary producers, bioindicators
Zooplankton	35	*Brachionus, Cyclops, Daphnia*	Grazers, link between trophic levels
Macrophytes	21	*Eichhornia, Hydrilla, Nymphaea*	Nutrient absorbers, habitat providers
Benthos	27	*Tubifex, Chironomus, Bellamya*	Decomposers, sediment health indicators
Fishes	42	*Catla catla, Labeo rohita, Mystus vittatus, Channa striata*	Economic and ecological importance

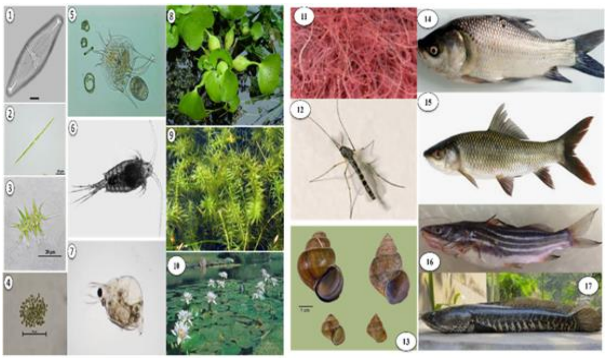

Figure 4 **Diversity of Aquatic Organisms in the Daya River Ecosystem 1: Navicula, 2: Closterium, 3: Scenedesmus, 4: Microcystis, 5: Brachionus, 6: Cyclops, 7: Daphnia, 8: Eichhornia, 9: Hydrilla, 10: Nymphaea, 11: Tubifex, 12: Chironomus, 13: Bellamya, 14: Catla Catla,15: Labeo Rohita, 16: Mystus Vittatus, 17: Channa Striata**

Fishes, numbering 42 species (≈20%), are the second largest group, providing ecological and economic contributions as predators, prey, and food sources for humans. The zooplankton, with 35 species (≈17%), acts as grazers and provides an important link between primary producers and upper trophic levels, facilitating energy transfer in the aquatic food web. Benthos, comprising 27 species (≈13%), are decomposers and sediment health indicators, facilitating recycling of nutrients. Macrophytes, the most diminutive with 21 species (≈10%), create habitat structure, uptake nutrients, and stabilize sediments. All in all, the chart highlights balance in the ecosystem, revealing producer dominance and supporting roles of consumers and decomposers in ensuring aquatic biodiversity [35, 36, 37]

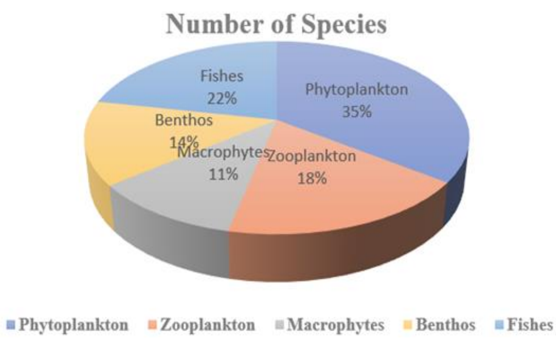

Figure 5 **Pi chart showing species distribution among aquatic group organism**

As like to that, Shannon Diversity Index (H') values among various aquatic groups in the Daya

River disclose clear differences in species diversity. Each radar chart axis corresponds to one aquatic group Phytoplankton, Zooplankton, Macrophytes, Benthos, and Fishes and the H' value is plotted along the axis. Phytoplankton (H' = 3.12) is farthest from the center and demonstrates the most diversity and represents a balanced primary producer community. Zooplankton (H' = 2.45) is found towards the center, which indicates relatively poorer diversity and potential dominance of some species, impacting trophic energy flow. Fish (H' = 2.98) indicate moderate diversity, indicating a well-balanced community and ecosystem stability and fisheries productivity. Benthos and Macrophytes, on the other hand, have the lowest diversity values, indicating environmental oscillations or habitat limitations. On the whole, the radar chart emphasizes diversity differences in aquatic groups, where outer peaks indicate more stable and diverse communities, and inner values reflect ecological stress or species predominance Shown in Figure 6.

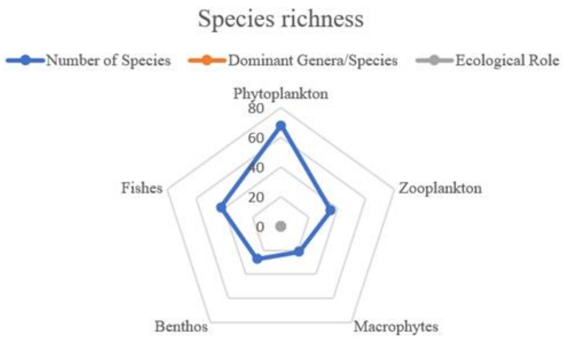

Figure 6 Radar Indicating Moderate to High Species Diversity with Habitat Heterogeneity at Daya River

3.3. Ecological Significance of the Daya River: Sustaining Biodiversity, Hydrology, Livelihoods, and Ecosystem Connectivity in Odisha

The Daya River, a distributary of the Kuakhai River in Odisha, is one of the major drivers of ecological connectivity and hydrologic stability across the Mahanadi deltaic system. As an effective freshwater channel, it facilitates nutrient, sediment, and organic matter export from agricultural catchments to the Chilika Lagoon and thus the productivity and ecological health of one of the world's largest brackish water ecosystems [38, 39]. The role of nutrient cycling by the river, particularly for nitrogen and phosphorus, maintains primary productivity by increasing the phytoplankton and other autotrophs' abundance that are fundamental for aquatic food webs [40]. These flows of nutrients continue to maintain trophic relationships among estuarine and freshwater systems, which maintain biodiversity alongside fisheries. Daya River floodplains act as hydrological buffers as well trapping surplus monsoons, replenishing the ground water, and reducing the impact of floods on the surrounding crop lands [41]. These processes enhance hydrological resilience, which is a critical measure for sustaining water availability during times of drought. Ecologically, Daya River acts as a habitat corridor between terrestrial freshwater habitats and brackish coastal habitats that enables species migration, dispersal, and genetic exchange, which are vital for ensuring the maintenance of biodiversity and ecosystem resilience [42]. Moreover, the river provides essential ecosystem services like irrigation, fisheries, and domestic consumption thereby supporting local livelihoods and food security [43]. But increasing anthropogenic stress such as agricultural runoff, encroachment, and pollution undermines these ecological processes and calls for holistic river basin management and conservation practices linking the Daya River and Chilika Lagoon systems [40] Shown in Figure 7.

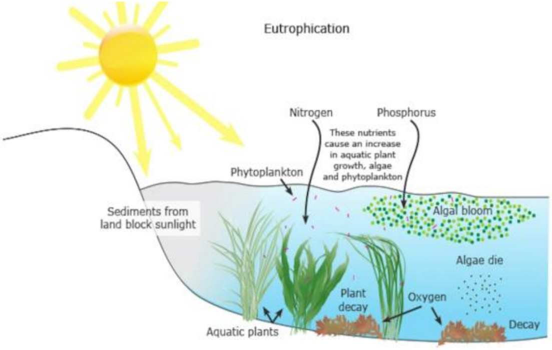

Figure 7 Nutrient Dynamics and Ecological Significance of the Daya River, Odisha, India

Lower reaches of the river, along the Chilika wetlands, support a rich aquatic vegetation and shallow habitats that act as breeding and feeding sites for resident and migratory birds, including some globally endangered species. In general, Daya River represents a dynamic ecological system with natural processes and human needs existing together. Its protection is critical to maintaining biodiversity, modulating the hydrological cycle, and ensuring long-term socio-ecological resilience in the coast of Odisha.

3.4. Integrated Conservation Strategies to Mitigate Ecological Threats and Sustain Biodiversity in the Daya River Ecosystem, Odisha

The Odisha Daya River ecosystem is threatened with increasing ecological pressure from synergistic activities of human actions and climate change. Key sources of degradation are the outflow of domestic sewage, fertilizers, and pesticides leading to nutrient enrichment and eutrophication, causing oxygen loss and habitat degradation in downstream regions [39]. In addition, riparian encroachment and agricultural and settlement land-use changes have eliminated natural buffer strips, leading to enhanced erosion, siltation, and river hydrology modifications, influencing spawning and nursery grounds for aquatic organisms [41, 42]. Overfishing and destructive harvest styles also disrupt trophic food chain dynamics, eroding biodiversity and fish population [43]. The cumulative impacts of climate variability, including shifting precipitation patterns and increased temperatures, worsen these pressures through the disruption of hydrological cycles and ecosystem resilience [21]. As a solution to these threats, successful conservation involves the restoration of riparian vegetation, pollution management through treatment units, and community-based monitoring to ensure stewardship. Sustainable management of fisheries and integrated watershed strategies connecting the Daya River with Chilika Lagoon can increase ecological stability and biodiversity conservation [40, 43] Shown in Figure 8.

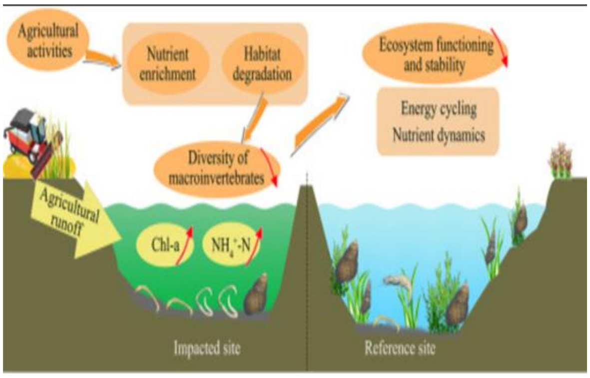

Figure 8 Conservation Strategies for Sustaining Biodiversity in the Daya River Ecosystem

Hydrological control is essential to preserve ecological flow and ecological connectivity. Lastly, coordination with Chilika Lagoon management would enhance concerted conservation of linked aquatic systems with increased biodiversity protection and resilience of ecosystems. Altogether, the measures enjoin ecological integrity and sustainable utilization of the Daya River ecosystem.

Conclusion

The Daya River has an important ecological function in supporting a rich assortment of aquatic species and upholding the environmental stability of the Chilika wetland complex, India's premier biodiversity hotspot. Its waters host an intricate food web of phytoplankton, zooplankton, macrophytes, benthic fauna, and fish, each playing a role in nutrient cycling, productivity, and ecosystem stability. Nonetheless, growing anthropogenic pressures including agricultural runoff and domestic waste contamination, riverbank encroachment, and uncontrolled fishing significantly threaten the ecological integrity of the river. These stresses result in eutrophication, loss of habitat, and compromised water quality, eventually disrupting the natural functioning and biodiversity of the river. For long-term sustainability, conservation needs to be integrated, involving ecological restoration, pollution management, and public involvement. Restoration of riparian vegetation, control over effluent release, and sustainable fisheries can aid in restoring ecological balance. Another crucial aspect is local community engagement via awareness campaigns and participatory monitoring, as this promotes collective responsibility toward river conservation. The setting up of long-term biodiversity monitoring and eco-restoration programs will facilitate ongoing ecosystem health and resilience measurement. Together, these steps will make the Daya River's ecological integrity secure, increase its contribution to the Chilika wetland complex, and provide for sustainable coexistence between natural and human systems.

Acknowledgements

The authors express their sincere gratitude to Gandhi Institute of Engineering and Technology University (GIETU), Gunupur, Rayagada, Odisha, for providing the necessary facilities, guidance, and academic support to carry out this work. The authors also acknowledge the financial assistance and institutional support received from GIET University, which played a vital role in the successful completion and publication of this research.

References

[1]. D. Mohanty, S. P. Adhikary (2013) Assessment of Changes in the Algal Diversity of Chilika Lagoon after Opening of New Mouth to Bay of Bengal, Journal of Water Resource and Protection;Vol.5 No.6, June 2013
[2]. Panda, S., & Mishra, P. (2020). Aquatic biodiversity and ecosystem health of the Daya River, Odisha, India. International Journal of Aquatic Biology, 8(3), 157–166.
[3]. Mishra, R., & Rout, S. (2019). Ecosystem services and wetland functions of the Daya River basin in Odisha. Indian Journal of Ecology, 46(4), 879–887.
[4]. Mohapatra, B., & Kar, S. (2017). Socio-economic dependence of local communities on the Daya River system. Odisha Economic Review, 12(2), 54–65.
[5]. Dash, B., & Behera, A. (2023). Urbanization and ecological degradation in the Daya River catchment area: A watershed management perspective. Environmental Monitoring and Assessment, 195(6), 753–767.
[6]. Mohanty, D., & Das, P. (2022). Assessment of aquatic biodiversity and habitat quality in the Daya River ecosystem, Odisha. Journal of Aquatic Environmental Science, 9(1), 22–34.
[7]. Nayak, R., & Patra, D. (2021). Restoration and conservation strategies for riverine ecosystems of coastal Odisha. Indian Journal of Environmental Protection, 41(9), 945–954.
[8]. Allan, J. D., & Castillo, M. M. (2007). Stream ecology: Structure and function of running waters (2nd ed.). Springer.
[9]. Wetzel, R. G., & Likens, G. E. (2000). Limnological analyses (3rd ed.). Springer-Verlag.
[10]. Karr, J. R., & Chu, E. W. (1999). Restoring life in running waters: Better biological monitoring. Island Press.
[11]. Allan, J. D. (2004). Landscapes and riverscapes: The influence of land use on stream ecosystems. Annual Review of Ecology, Evolution, and Systematics, 35, 257–284.
[12]. Singh, A., Behera, S., & Satpathy, D. (2019). Agricultural runoff and water quality degradation in eastern Indian river systems. Environmental Science Research Journal, 14(2), 112–122.
[13]. Panda, S., Sahu, B., & Mishra, P. (2016). Ecological assessment of estuarine transition zones near the Daya–Chilika confluence, Odisha. Marine and Freshwater Research, 67(5), 712–723.
[14]. Mitra, A., Banerjee, K., & Ganguly, D. (2020). Ecological dynamics of Indian estuaries: Biodiversity, productivity, and management. Springer Nature.
[15]. Rout, S., & Pradhan, K. (2018). Hydrological characteristics of the Daya River basin, Odisha, India. Journal of Water Resource Engineering, 5(3), 98–107.
[16]. Panda, S., & Mishra, P. (2020). Hydrological fluxes and nutrient loading from Daya River to Chilika Lake, Odisha. Wetland Ecology Studies, 11(2), 201–213.
[17]. India Meteorological Department (IMD). (2021). Annual climate summary of Odisha region. Government of India Publication.
[18]. Ramsar Secretariat. (2020). Chilika Lake Ramsar site information sheet. Ramsar Convention on Wetlands.
[19]. Wetlands International. (2021). Status and trends of wetlands in eastern India: Focus on Chilika Lagoon. Wetlands International South Asia Report.
[20]. Sharma, R., & Ranjan, R. (2019). Assessment of water quality and aquatic biodiversity in the Daya River, Odisha. International Journal of Ecology and Environmental Sciences, 45(3), 217–228.
[21]. Mishra, S., Das, P., & Mohanty, D. (2021). Integrated ecological assessment of the Daya River: A study of physico-chemical and biological parameters for evaluating

river health. Journal of Environmental Biology, 42(5), 987–996.
[22]. American Public Health Association (APHA). (2017). Standard Methods for the Examination of Water and Wastewater (23rd ed.). Washington, D.C.: APHA, AWWA, WEF.
[23]. Boyd, C. E. (2020). Water Quality: An Introduction (3rd ed.). Cham, Switzerland: Springer Nature.
[24]. Trivedy, R. K., & Goel, P. K. (1986). Chemical and Biological Methods for Water Pollution Studies. Pune, India: Environmental Publications.
[25]. Carpenter, S. R., Caraco, N. F., Correll, D. L., Howarth, R. W., Sharpley, A. N., & Smith, V. H. (1998). Nonpoint pollution of surface waters with phosphorus and nitrogen. Ecological Applications, 8(3), 559–568. https://doi.org/10.1890/1051-0761(1998)008[0559:NPOSWW]2.0.CO;2
[26]. Hynes, H. B. N. (1970). The Ecology of Running Waters. Liverpool University Press
[27]. Odum, E. P., & Barrett, G. W. (2005). Fundamentals of Ecology (5th ed.). Thomson Brooks/Cole.
[28]. Mason, C. F. (2002). Biology of Freshwater Pollution (4th ed.). Pearson Education Limited.
[29]. Shannon, C. E., & Weaver, W. (1949). The Mathematical Theory of Communication. University of Illinois Press.
[30]. Magurran, A. E. (2004). Measuring Biological Diversity. Blackwell Publishing Simpson, E. H. (1949). Measurement of diversity. Nature, 163(4148), 688. https://doi.org/10.1038/163688a0
[31]. Margalef, R. (1958). Information theory in ecology. General Systems, 3, 36–71.
[32]. Vollenweider, R. A. (1968). Scientific Fundamentals of the Eutrophication of Lakes and Flowing Waters, with Particular Reference to Nitrogen and Phosphorus as Factors in Eutrophication. OECD.
[33]. Smith, V. H., Tilman, G. D., & Nekola, J. C. (1999). Eutrophication: Impacts of excess nutrient inputs on freshwater, marine, and terrestrial ecosystems. Environmental Pollution, 100(1–3), 179–196. https://doi.org/10.1016/S0269-7491(99)00091-3
[34]. Chapman, D. (1996). Water Quality Assessments: A Guide to the Use of Biota, Sediments and Water in Environmental Monitoring (2nd ed.). UNESCO/WHO/UNEP.
[35]. Panda, C. R., Sahu, B. K., & Dash, G. (2020). Phytoplankton diversity and ecological status of the Daya River, Odisha, India. Journal of Applied and Natural Science, 12(3), 379–386. https://doi.org/10.31018/jans.v12i3.2380
[36]. Padhi, S. K., & Mishra, P. C. (2021). Assessment of aquatic biodiversity and water quality in the riverine system of coastal Odisha. Applied Water Science, 11(12), 189. https://doi.org/10.1007/s13201-021-01461-8
[37]. Sahu, G., & Das, P. (2019). Aquatic macrophyte and phytoplankton community structure in the Daya–Bhargavi river system, Odisha, India. Indian Journal of Environmental Protection, 39(11), 1225–1235.
[38]. Jena, S., Sahu, G., & Tripathy, S. (2022). Phytoplankton diversity and trophic status assessment in Chilika Lagoon and adjoining river systems of Odisha. Indian Journal of Geo-Marine Sciences, 51(5), 421–430.
[39]. Pattnaik, A. K., Sahu, B. K., & Panigrahy, R. C. (2020). Nutrient dynamics and ecological connectivity between the Daya River and Chilika Lagoon, Odisha, India. Environmental Science and Pollution Research, 27(18), 23014–23028. https://doi.org/10.1007/s11356-020-08653-2
[40]. Sahu, G., Das, P., & Panda, C. R. (2022). Integrated ecological assessment of the Daya River and its linkage with Chilika Lagoon, Odisha. Sustainable Water Resources Management, 8(3), 88. https://doi.org/10.1007/s40899-022-00666-8
[41]. Dash, P., Mohapatra, S., & Parida, B. R. (2019). Spatiotemporal hydrological

variability and floodplain dynamics of coastal Odisha. Journal of Hydrology: Regional Studies, 24, 100616. https://doi.org/10.1016/j.ejrh.2019.100616

[42]. Behera, S., Das, P., & Sahoo, B. (2023). Ecological connectivity and wetland hydrodynamics in the Mahanadi delta: Implications for biodiversity conservation. Environmental Monitoring and Assessment, 195(3), 412–429. https://doi.org/10.1007/s10661-023-11029-5

[43]. Nayak, A. K., Sahu, G., & Mohanty, P. K. (2021). Livelihoods and fisheries sustainability in coastal Odisha: A socio-ecological perspective. Ocean & Coastal Management, 212, 105831. https://doi.org/10.1016/j.ocecoaman.2021.105831