International Journal of Engineering Inventions
e-ISSN: 2278-7461, p-ISSN: 2319-6491
Volume 14, Issue 11 [November 2025] PP: 63-68

Limnological Studies and Fish Diversity of Maroda Tank-2, Bhilai, Durg (C.G.) India

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Abstract
The present study investigates the limnological parameters and fish diversity of Maroda Tank-II, a significant freshwater body located in Bhilai, Chhattisgarh. The aim was to assess the ecological status of the reservoir and its capacity to support aquatic biodiversity, especially ichthyofauna. Seasonal sampling was conducted over a one-year period to capture seasonal variations in water quality and fish population dynamics. Physicochemical parameters including temperature, pH, conductivity, free CO_2, Dissolvedoxygen (DO), alkalinity, hardness, chloride, sulfate and nutrient concentrations (nitrates and phosphates) were measured. The results indicated that water quality remained within acceptable limits for sustaining aquatic life, though slight seasonal fluctuations were observed, especially during the monsoon and summer months. Fish diversity was assessed using standard sampling methods and taxonomic identification. A total of 19 fish species were documented, representing 15 generaand 08 orders. The Cyprinidae family was the mostdominant, followed by Channidaeand Siluridae. Species such as Labeorohita, Cirrhinus mrigala, Channa stritus, and Mystus tengra were commonly encountered. The study concludes that Maroda Tank-2 supports a healthy aquatic ecosystem with considerable fish diversity, influenced by favorable limnological conditions. These findings are crucial for conservation efforts, sustainable fisheries development, and future ecological assessments. Regular monitoring and pollution control measures are recommended to maintain the ecological integrity of this urban freshwater resource.

Keywords: *Cyprinidae**,** Conservation, Limnology, Maroda Tank-2, Dissolved Oxygen.*

Date of Submission: 01-11-2025 Date of acceptance: 08-11-2025

I. Introduction

Freshwater ecosystems play a pivotal role in sustaining biodiversity, regulating hydrological cycles, and supporting local livelihoods [1,2,3,4]. Among these, small freshwater bodies like ponds, lakes, and tanks serve as critical habitats for a variety of aquatic organisms, particularly fish species that are essential to ecological balance and human nutrition [5,6,7]. In India, traditional water bodies often constructed for irrigation or domestic use have evolved into biodiversity hotspots, offering an accessible lens into limnological dynamics and faunal diversity [8,9,10,11,12]. One such important aquatic system is Maroda Tank-2, located in Bhilai, a city in the state of Chhattisgarh known for its industrial significance and evolving urban landscape [13,14]. Maroda Tank-2, although modest in size, holds considerable ecological and socio-economic value [15]. Its waters are utilized not only for household and irrigation purposes but also as a source of subsistence fisheries for the surrounding communities [16, 17]. In recent years, there has been a growing recognition of the importance of documenting and monitoring the limnological parameters of such tank's variables such as water temperature, pH, dissolved oxygen,and nutrient content which directly influence the health and diversity of aquatic life [18,19,20,21]. Fluctuations in species richness and abundance often reflect broader environmental changes, including pollution, eutrophication, and habitat degradation [22,23,24,]. Comprehensive limnological studies, therefore, provide foundational data that not only inform conservation efforts but also support sustainable resource management [27]. Despite its importance, Maroda Tank-2 remains relatively under-explored in terms of scientific study [28]. This research aims to bridge that gap by conducting a systematic limnological assessment in conjunction with an analysis of its ichthyofaunal diversity [29]. Through seasonal sampling, physico-chemical profiling, and species identification, the study seeks to offer a holistic understanding of the tank's ecological status and its capacity to sustain diverse fish populations [30].

Study Area

The present study was conducted on Maroda Tank-2, Bhilai. It is located in between Raipur and Durg cities, somewhere in the middle of present campus of Bhilai Steel Plant. Bhilai lies at 21.21°N 81.38°E in Central India. Elevation of different places ofsteel plant campus ranges from about 295 – 320m above mean sea level. It covers an area of 341 km². According to the 2011 census, Bhilai Nagar Urban Agglomeration had a population of 1,064,222, of which 545,916 are males and 518,306 are females. Bhilai has an average literacy rate of 86.63%, male literacy is 92.22% and, female literacy is 80.71%. Bhilai has several ponds within its area, but the Maroda tank, located at 21^0 09'35" N Lat. and 81^0 22'32" is largest of them. Main role of the pond is that it caters the needs of Bhilai Steel Plant, together with which it is used also for nistar purposes of the surrounding settlements [31].

II. Material And Methods

Physico-chemical characteristics were done by following WHO (2004),USPHS,BIS (2012). In the present study temperature, pH, conductivity, alkalinity, Free carbon Dioxide,DO,Chloride, Hardness as Calcium Carbonate, Sulfate, Total Phosphorus and Nitrate Nitrogen were analyzed during Jan 2023 to October 2023 with the of method IS 3025 [36]. Fishing for the study purpose was carried out with the help of local fisherman by use of Net. Photographs were taken before the preservation. Fishes were identified with the help of book Datta and Shrivastava (1988), Talwar and Jhingran (1999) [32,33].

Fish Diversity

Fishes were collected through fish net in the morning everyday by local fisherman. Daily fish production of the pond is Maroda Tank II. The captured fishes were supplied to local market [34]. Nets with 100 m long and 3-5 m deep with mesh size of 2.5c.m. were used for fish sampling [35].

Table 01: Fish Fauna in study Area

Order	Fish name	Scientist	Local Name	IUCN
Siluriformes	*Rita rita*	*F. Hamilton, 1822*	Khaga	LC
	Ompok pabda	*Bloch, 1794*	Godalae	NT
	Mystus tengra	*Scopoli, 1777*	Singorah	NT
	Mystus seenghala	*F. Hamilton, 1822*	Gulia	LC
Cypriniformes	*Labeo rohita*	*F. Hamilton, 1822*	Rohu	LC
	Cirrhinus reba	*F. Hamilton, 1822*	Raichang	LC
	Cirrhinus mrigala	*F. Hamilton, 1822*	Mrigal	LC
	Labeo angara	*F. Hamilton, 1822*	Gadeli	LC
	Labeo calbasu	*F. Hamilton, 1822*	Kamach	LC
	Osteobrama cotio	*F. Hamilton, 1822*	Chilati	LC
	puntius sarana	*F. Hamilton, 1822*	Kotra	LC
Anabuntiformes	*Channa striatus*	*Bloch, 1793*	Bhunda	LC
	Anabas testudinus	*Bloch, 1792*	Koi	LC
	Chanda nama	*F. Hamilton, 1822*	Channda	LC
Synbranchiformes	*Mastacembelus armatus*	*Lacepède, 1800*	Bami	LC
Beloniformes	*Xenentodon cancila*	*F. Hamilton, 1822*	Sui	LC
Cichliformes	*Tilapia mossambica*	*W. K. H. Peters, 1852*	Talapia	LC
Osteoglossiformes	*NotopterusNotopterus*	*F. Hamilton, 1822*	Chital	LC
Clupeiformes	*Gudusia chapra*	*F. Hamilton, 1822*	Chhuria	LC

Table: 02 Physico - Chemical Parameter on Study Area.

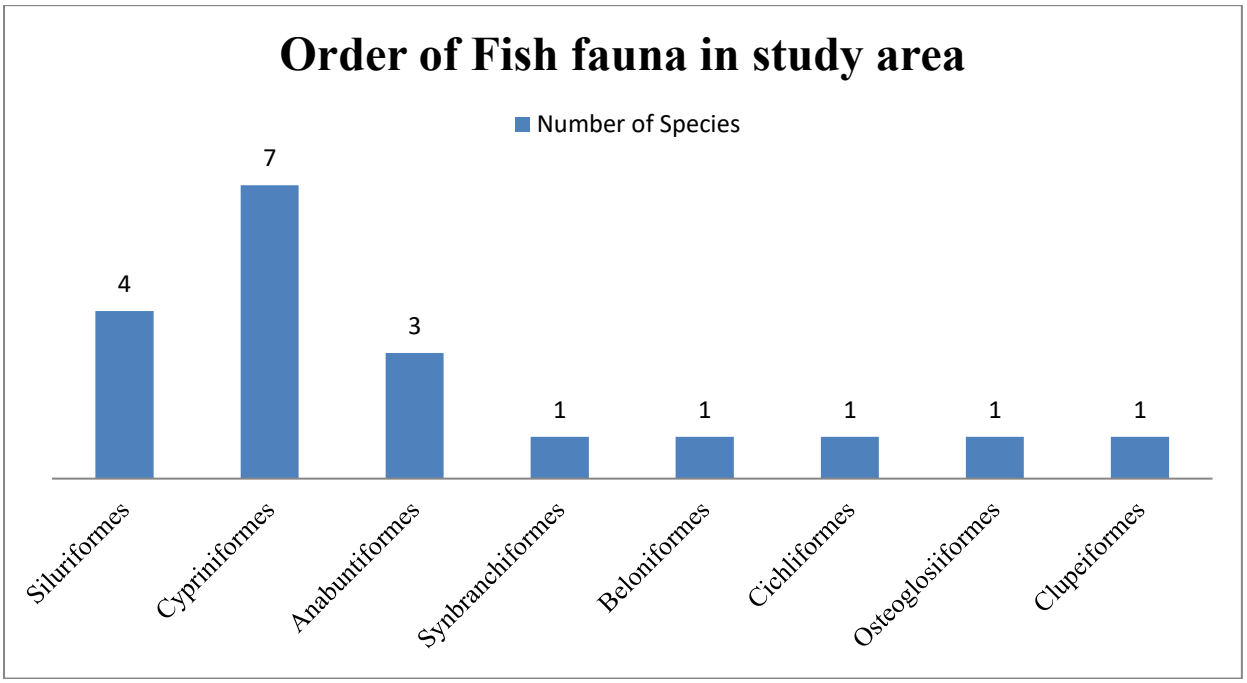
Parameter	Winter	Summer	Monsoon	Mean	WHO	USPHS	BIS
pH	8.23	7.14	7.47	5.56 ± 7.79	6.5-9.2	7.0-8.5	6.5-8.5
Temperature ºC	25	29	26	24.5 ± 26.6	-	-	-
Conductance (µS/cm)	158	145.9	113	180.22 ± 186. 3	150-500	-	-
Total Alkalinity (mg/l)	80	78	64	92.33 ± 94.66	-	-	50-200
Calcium Hardness ($CaCO_3$) (mg/l)	48	50	40	46 ± 49	100-500	200	300
Chloride (mg/l)	5.99	9.49	6.35	8.93 ± 9.49	250	-	-
Nitrate (NO_3) (mg/l)	0.1	0.74	<0.1	0.26 ± 0.31	50	<10	-
Sulphate SO_4 (mg/l)	4.98	3. 21	1.73	2.83 ± 3.96	200-400	250	1000
Dissolved Oxygen (O_2)(mg/l)	7.4	6. 3	6.4	5.5 ± 6.9	4-6	-	6.0
Free Carbon Di Oxide (CO_2)(mg/l)	00	00	1.32	0.40 ± 0.44	<30-35 ppm	-	-
Total Phosphorus(mg/l)	0.05	0.04	0.04	0.01 ± 0.03	-	0.1	-

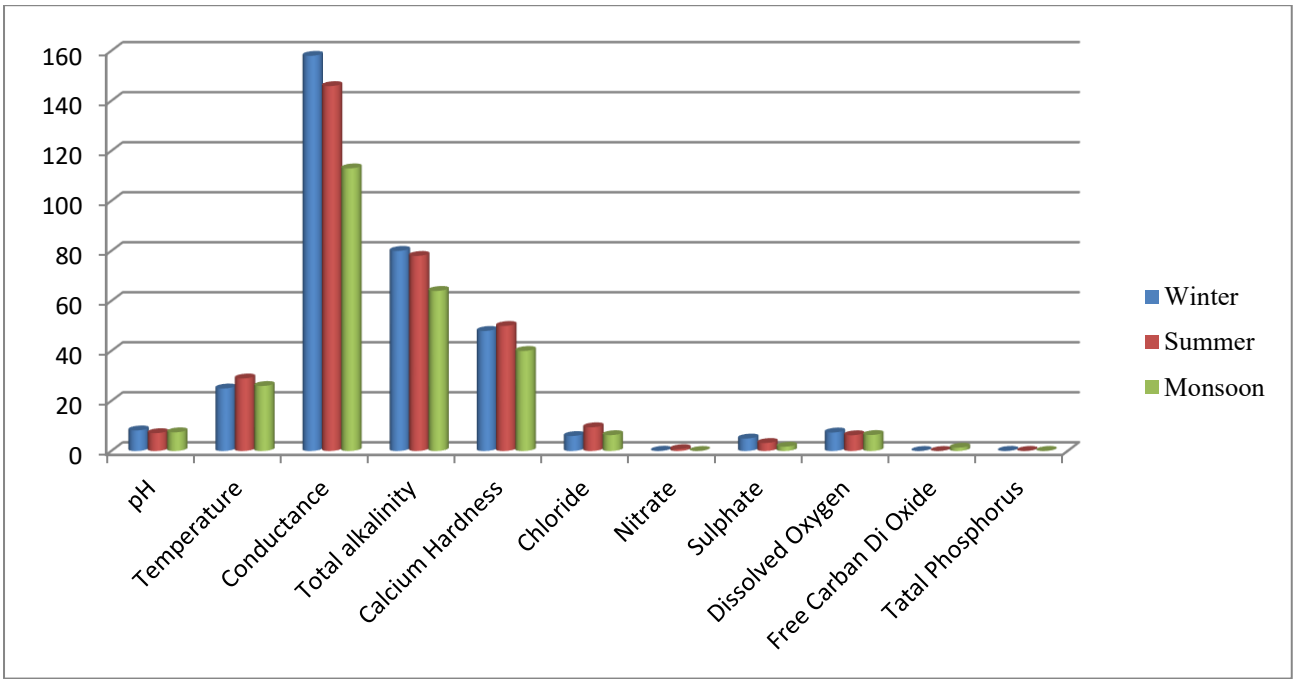
III. Result and Discussion

The limnological parameters of Maroda Tank-2 were systematically studied to assess the water quality and its impact on fish diversity. Key physical and chemical parameters such as temperature, pH, dissolved oxygen (DO),Conductivity, Alkalinity (mg/l), Free co2 (mg/l), Chloride (mg/l), Calcium Hardness (as caco3) (mg/l), Dissolve oxygen, Nitrogen (No3) (mg/l), Total Phosphate (mg/l), Sulfate (mg/l), pH and nutrient concentrations (nitrates and phosphates) were measured monthly over a defined study period [Table 2].Water temperature ranged from 25°C to 29°C, indicating seasonal variation. The pH values were between 7.1 and 8.4, suggesting that the water body was slightly alkaline but within a tolerable range for most freshwater aquatic life. Dissolved oxygen levels varied from6.4 mg/L to 7.4 mg/L, which supports healthy aquatic biodiversity [Table 2]. Lower DO values during the summer months may be attributed to higher temperatures and increased organic decomposition.Nitrate and phosphate levels were found in the ranges of <0.1–7.4 mg/L and 0.04–0.05 mg/L, respectively [Table2] [Graph 1 and Graph2]. These nutrient concentrations, though not alarmingly high, could potentially contribute to eutrophication if unchecked.Overall, the limnological conditions of the tank were found to be within permissible limits for supporting aquatic life, though some parameters indicated early signs of nutrient enrichment.A total of **19 species** from**15 genera**from **08 orders**were identified in Maroda Tank-2. The order Cypriniformes was dominant, represented by genera such as *Osteobrama*, *Labeo*, *Cirrhinus*, and *Puntius*. Other notable orders included Siluriformes(*Mystusseenghala)*,Beloniformes(*Xenentodoncancila)*, Anabuntiformes(*Channa striatus)*and Cichliformes(*Tilapia mossambica),* Osteoglossiformes *(Notopterus notopterus),* Clupeiformes *(Gudusia chapra)*[Table 1 and Plate 1].The presence of both native and economically important fish species suggests that the tank has significant potential for sustainable fishery development. [Table 1 and Plate 1]. Physicochemical data of Maroda tank-2 perfectly aligning with the physicochemical data of Maroda tank-2 (Singh & Sharma, 2022)

This work was also performed by other researchers shows dominancy of cypriniformes order by Sahu *et al.,* (2013) reported 54 species in Kawardha Town of C.G. in India. Cyprinidae family is dominant and contributes 22 species. Patel et al., (2016) reported 61 species in 3 rivers of raigarh district C.G. Cypriniformes were the dominant group representing 43% species. Laxmappa *et al.,* (2015) reported 109 species in River in Mahabubnagar district, Telangana, India where order Cypriniformes were dominant by contributing 61 species. Patel *et al.,* (2016) reported 54 species in river in raigarh district, chhattisgarh, India where Cyprinadae was the largest dominant family contributing 39% species.

However, the occasional capture of fresh water species like Osteoglossiformes*Notopterusnotopterus*concerns about the introduction of non-native fauna, which may pose a threat to the native fish community if not monitored [Table1 and Plate 1].However, any further increase in nutrient load or anthropogenic stress could shift the ecological balance. The limnological conditions and the diversity of fish observed highlight the tank's ecological significance as a productive freshwater ecosystem.





Graph 01: Physico-chemical on study area.

IV. Conclusion

The comprehensive limnological assessment of Maroda Tank-2 indicates that the water body currently maintains conditions favorable for sustaining diverse aquatic life, including several economically and ecologically important fish species. Key physical and chemical parameters remained within permissible limits, although seasonal variations and moderate nutrient enrichment were observed, particularly during the monsoon. The presence of 19 fish species from 15 genera across 8 orders reflects the ecological richness of the tank, with Cypriniformes being dominant. However, early signs of eutrophication, occasional introduction of fresh water species, and overfishing pose potential threats to the ecosystem's stability. Therefore, continuous monitoring, sustainable management practices, and mitigation of human-induced impacts are essential to preserve the tank's ecological integrity and its potential for fisheries development.

References

[1]. Manashree, M. A BRIEF DISCUSSION ON FRESH WATER AND HYDROLOGIC CYCLE. *ENVIRONMENT SCIENCE*, 98.

[2]. Davis, J., O'Grady, A. P., Dale, A., Arthington, A. H., Gell, P. A., Driver, P. D., ... & Specht, A. (2015). When trends intersect: The challenge of protecting freshwater ecosystems under multiple land use and hydrological intensification scenarios. *Science of the Total Environment*, *534*, 65-78.

[3]. McAllister, D. E., Hamilton, A. L., & Harvey, B. (1997). Global freshwater biodiversity: striving for the integrity of freshwater ecosystems. *Sea wind: bulletin of Ocean Voice International; 11 (3)*.

[4]. Dudgeon, D., Arthington, A. H., Gessner, M. O., Kawabata, Z. I., Knowler, D. J., Lévêque, C., ... & Sullivan, C. A. (2006). Freshwater biodiversity: importance, threats, status and conservation challenges. *Biological reviews*, *81*(2), 163-182.

[5]. Brönmark, C., & Hansson, L. A. (2002). Environmental issues in lakes and ponds: current state and perspectives. *Environmental conservation*, *29*(3), 290-307.

[6]. McAllister, D. E., Hamilton, A. L., & Harvey, B. (1997). Global freshwater biodiversity: striving for the integrity of freshwater ecosystems. *Sea wind: bulletin of Ocean Voice International; 11 (3)*.

[7]. Ahmed, S. F., Kumar, P. S., Kabir, M., Zuhara, F. T., Mehjabin, A., Tasannum, N., ... &Mofijur, M. (2022). Threats, challenges and sustainable conservation strategies for freshwater biodiversity. *Environmental Research*, *214*, 113808.

[8]. Mahto, M. K. (2024). Challenges and Opportunities for Water Resources in India: An Exploratory Story of Resilience. *Integrated Management of Water Resources in India: A Computational Approach: Optimizing for Sustainability and Planning*, 59-80.

[9]. Mishra, A. (2030). Pivotal Vulnerability Facets Influencing Static Water Bodies: The Case of Peri-Urban Areas of India.

[10]. Datta, S., Sinha, D., Chaudhary, V., Kar, S., & Singh, A. (2022). Water pollution of wetlands: a global threat to inland, wetland, and aquatic phytodiversity. In *Handbook of research on monitoring and evaluating the ecological health of wetlands* (pp. 27-50). IGI Global Scientific Publishing.

[11]. Acharjee, M. L. (2013). *Diversity of plankton and ichthyofauna in relation to limnochemistry of river Teesta and Relli in the Darjeeling Himalaya of West Bengal* (Doctoral dissertation, University of North Bengal).

[12]. Saccò, M., White, N. E., Harrod, C., Salazar, G., Aguilar, P., Cubillos, C. F., ... & Allentoft, M. E. (2021). Salt to conserve: a review on the ecology and preservation of hypersaline ecosystems. *Biological Reviews*, *96*(6), 2828-2850.

[13]. Höfer, W., &Vicenzotti, V. (2013). Post-industrial landscapes: Evolving concepts. *The routledge companion to landscape studies*, 423-434.

[14]. Gospodini, A. (2006). Portraying, classifying and understanding the emerging landscapes in the post-industrial city. *Cities*, *23*(5), 311-330.

[15]. Kettunen, M., Vihervaara, P., Kinnunen, S., D'Amato, D., Badura, T., Argimon, M., & Ten Brink, P. (2012). *Socio-economic importance of ecosystem services in the Nordic Countries*. Nordic Council of Ministers.

[16]. Clark, B. M., Hauck, M., Harris, J. M., Salo, K., & Russell, E. (2002). Identification of subsistence fishers, fishing areas, resource use and activities along the South African coast. *African Journal of Marine Science*, *24*, 425-437.

[17]. Geheb, K. I. M., & Binns, T. (1997). 'FISHING FARMERS'OR 'FARMING FISHERMEN'? THE QUEST FOR HOUSEHOLD INCOME AND NUTRITIONAL SECURITY ON THE KENYAN SHORES OF LAKE VICTORIA. *African Affairs*, *96*(382), 73-93.

[18]. Mungenge, C. (2017). A study of the limnology and ecology of Mazvikadei Reservoir.

[19]. Saha, A., Parakkandi, J., Vijayakumar Leela, R., Salim, S. M., Panikkar, P., MuttanahalliEregowda, V., ... & Kumar Das, B. (2023). Evaluation of spatio-temporal variations in physico-chemical limnology, trophic status and cyanobacterial diversity of an impacted tropical reservoir, India for its sustainable management. *International Journal of Environmental Analytical Chemistry*, *103*(16), 3988-4003.

[20]. Asa, P. A. O. L. (2025). Evaluation Of Physicochemical Parameters and Phytoplankton Assemblage of Lake Asa, Ilorin, Nigeria. *Animal Research International*, *22*(1), 6023-6039.

[21]. Pandey, C., & Mishra, A. (2024). Assessing The Heavy Metal Contamination On Tissue Of Fish Channa Striata (Bloch) And Its Consequent Impact On Blood Composition From River Kharun, Chhattisgarh (India). *Chhattisgarh (India) Gis Science Journal*, *11*(07), 856-867.

[22]. Pandey, C., Guru, G. S., Thiskey, S., Bhatia, G. S., Ali, M., & Yadav, A. K. (2024). Study Of Diversity and Status of Endemic Ornamental Fish OfShivnath River Mohla-Manpur-Ambagarh Chowki District of Chhattisgarh (India). *Journal of Advanced Zoology*, *45*(6).

[23]. Guru, G. S., & Pandey, C. (2024). Assessment Of Water Quality of Shivnath River and Their Tributaries at Rajnandgaon District and Its Impact on Fish Culture. *International Journal of Creative Research and Thoughts*, *12*(09).

[24]. Guru, G. S., Pandey, C., & Bhatia, G. S. (2024). The Shivnath River: A Critical Analysis of Environmental Stressors and Conservation Needs. *International Journal of Engineering Technology Research & Management*, *8*(11), 14-21.

[25]. Thiske, S., Pandey, C., & Ali, M. (2024). Diversity of Fish Fauna: A Case Study of Rajnandgaon District, Chhattisgarh (India). *Journal Of Novel Research and Innovative Development (ISSN 2984-8687) (2)(4)*.

[26]. Guru, G. S., Pandey, C., Ali, M., *and* Thiske S. (2024). Exploring the Morphological Foundations of Fish Culture: A Review. *International Journal of Science, Architecture, Technology, and Environment,* 01 (05). ISSN 3048-8222, 69-77.

[27]. Barouillet, C., González-Trujillo, J. D., Geist, J., Gíslason, G. M., Grossart, H. P., Irvine, K., ... & Boon, P. J. (2024). Freshwater conservation:

[28]. Al-Nouti, A. F., Fu, M., &Bokde, N. D. (2024). Reservoir operation based machine learning models: comprehensive review for limitations, research gap, and possible future research direction. *Knowledge-Based Engineering and Sciences*, *5*(2), 75-139.

[29]. Parvathy, C. A. (2024). *Limnological study of Thrissur Ponnani kole wetlands with special reference to the ichthyofauna* (Doctoral dissertation, Department of Zoology St. Thomas' College (Autonomous) Thrissur).

[30]. Lianthuamluaia, L., Mishal, P., Panda, D., Sarkar, U. K., Kumar, V., Sandhya, K. M., ... & Ali, Y. (2019). Understanding spatial and temporal patterns of fish diversity and assemblage structure vis-a-vis environmental parameters in a tropical Indian reservoir. *Environmental Science and Pollution Research*, *26*, 9089-9098.

[31]. Rajendran, P., & Smith, H. (2015). Implications of longitude and latitude on the size of solar-powered UAV. *Energy conversion and management*, *98*, 107-114.

[32]. Datta, V. N. (2020). VN Datta. *National Institute of Advanced Studies, Bangalore*, *55*(49), 20.

[33]. Talwar, P. K., &Jhingran, A. G. (1991). *Inland fishes of India and adjacent countries* (Vol. 2). CRC press.

[34]. Murray, F. J., Koddithuwakku, S., & Little, D. C. (2000, February). Fisheries marketing systems in Sri Lanka and their relevance to local reservoir fishery development. In *ACIAR PROCEEDINGS* (pp. 287-308). ACIAR; 1998.

[35]. Rotherham, D., Gray, C. A., Broadhurst, M. K., Johnson, D. D., Barnes, L. M., & Jones, M. V. (2006). Sampling estuarine fish using multi-mesh gill nets: effects of panel length and soak and setting times. *Journal of Experimental Marine Biology and Ecology*, *331*(2), 226-239.

[36]. IS 3025 (PART23): 1986 METIIODSOFSAMPLING AND TEST(PHYSICALANDCHEMICAL). (2000). 100 Department of BIS 2008 UDC628'1/'3:643'319, 01(Part 23).

[37]. Sahu, S. and Datta, S. (2020). Study on Fish Diversity of Kawardha Town, Chhattisgarh, India. *Int.J.Curr.Microbiol.App.Sci,* **9**(9), 2949-2952.

[38]. Patel, G., Chari, M. S., Kumar, S., Bhakta, D., Behera, S., Verma, N.K., Chawan, R.R., Kumar, S, and Ahmad, T. (2016). Fish fauna diversity of mahanadi river in raigarh district, Chhattisgarh. *J. Exp. Zool. India.* **19**(1), 1285-1289.

[39]. Patel, G., Chari, M. S., Kumar, S., Bhakta, D., Behera, S., Verma, N.K., Chawan, R.R., Kumar, S, and Ahmad, T. (2016). Ichthyofaunal Diversity of Three Rivers of Raigarh District, Chhattisgarh. *National Journal of Life Science.***13**(1), 95-99.

[40]. Laxmappa, B., Bakshi, R.R. and Narayana, D.V.S. (2015). Studies on ichthyofaunal diversity of Krishna River in Mahabubnagar district, Telangana, India. *International Journal of Fisheries and Aquatic Studies,* **2***(*5),(99-104)

[41]. Singh, R. & Sharma, P. (2022). Hydrochemical Analysis of Lakes in Central india. *International Journal of Ecology and Development*, 37(1), 55-64.