International Journal of Entomology Research
www.entomologyjournals.com
ISSN: 2455-4758
Received: 14-04-2024, Accepted: 07-05-2024, Published: 30-05-2024
Volume 9, Issue 5, 2024, Page No. 85-90

Distribution and abundance of Ichthyofaunal diversity in Vanivilasa Sagara reservoir of Chitradurga, Karnataka

Keerthi P[1], Ashashree H M[2]
[1] Research Scholar, Department of Zoology, Sahyadri Science College, Kuvempu University, Shivamogga, Karnataka, India
[2] Associate Professor, Department of Zoology, Sahyadri Science College, Kuvempu University, Shivamogga, Karnataka, India

Abstract
Fish nutrients are essential for human health and national economies. The study was conducted from April 2022 to March 2023 by examining fish diversity in the Vanivilasa Sagara reservoir in Chitradurga district, Karnataka. This study demonstrated that this reservoir supports 25 species of fishes belonging to 12 families and 21 genera. Among them, Cyprinidae is the most predominant group with 11 species, followed by, Channidae, Siluridae, and Ambassidae with 02 species each and rest of the families *viz*., Cichlidae, Gobiidae, Notopteridae, Belonidae, Clariidae, Bagridae, Mastacembelidae and Heteropneustidae each with 01 species respectively. Biodiversity status and significance of fishes are discussed in this article. Therefore, to properly manage and utilize this fish abundance, sustainable measures must be taken to fish health in this reservoir.

Keywords: Ichthyo fauna, Vanivilasa Sagara reservoir, Economic Importance, Chitradurga.

Introduction
Not only the fish essential indicators of surroundings health and species richness, but through consumption of plankton and small animals, fish ensure the stability of the food chain and the process of eating and being eaten by the organisms may be disrupted by contamination of water structures. In addition, there are various threats to fish variety, together with the construction of dams that prevent spawning migration, the advent of invasive species, and overfishing (Ramanjaneya and Ganesh, 2016) [23].

Humans, who first appeared on Earth during the early Pleistocene era about 2 to 3 million years ago, needed water to survive. In recent years, the population has been increasing rapidly and lot of demand for the agricultural and industrial areas (Abhishek Giri and Shriparna Saxena, 2017) [2].

Among living organisms, fish are the most well-known type of aquatic organism and the only food source obtained from natural populations. Additionally, fish live at or near the top of the food chain and serve as indicators of a balanced aquatic ecosystem. Fish diversity includes species richness and phylogenetic diversity (Gorman and Karr, 1978) [10].

Reservoirs are used for various purposes and are located between wetland and wetland ecosystems. This country has an area of 3.15 million hectares under the reservoir (Ayyappan, 2011) [4]. Reservoirs act as ecotones that transition between different habitats, exhibiting characteristics of both aquatic and terrestrial ecosystems. These habitats are home to a wide variety of plants and animals, making them highly productive ecosystems similar to rainforests in terrestrial ecosystems. Reservoirs are influencing the chemical composition and mass transport of river systems. The physico-chemical properties of water play an important role in supporting fish diversity in freshwater ecosystems (Harris, 1995) [12].

There is a lack of proper scientific studies on fish diversity in the reservoirs of our state and very little information is available for small reservoirs like the Cauvery river (Jayaram *et al*. (1982) [15], Markonhalli reservoir (Anon, 1988), Hemavati reservoir (Manjappa, 1999) [17], and Bhadra reservoir (Venkateswarlu *et al*., 2002; Thirumala *et al*.,2011) [29]. A step in this direction has been taken to study the diversity of fishes in the Vanivilasa Sagara reservoir and assess the various values they have. This serves as baseline information for assessing fisheries development and biodiversity conservation.

No work has been done on fish diversity in the Vanivilasa Sagara Reservoir. Hence, present investigation has been under taken to study in order to describe the fish assemblage. There is a need to understand the ichthyofaunal variety and distribution of this area.

Materials and Methods
Study Area
Vanivilasa Sagara Reservoir (Fig 1), is known as Marikanive is located at Marikanive village, Hiriyur Taluk, Chitradurga District, Karnataka. It is the oldest dam in the state (1907). The dam was built by the Mysore Maharaja's during the pre-independence period across the river Vedavati. The dam is an exquisite piece of architecture, an engineering marvel for that time, and provides water to many of surrounding cities, towns and villages which are largely dry lands of the Deccan area of central Karnataka. It is 621.0 meters in height and 405.40 meters (1330 feet) long with an area of 8640 hectares. The dam has longitude of 75^0 01^I 00" E and latitude of 13^0 20^I 00" N. 30 TMC is the gross storage capacity, live storage capacity is 28.13TMC and 1.87TMC is the dead storage capacity of this reservoir.

Fig 1: A view of Vanivilasa sagara reservoir, Chitradurga

Sampling methods and data collection

Fish samples were collected monthly from the Vanivilasa Sagara Reservoir and will be brought to the laboratory for analysis. For fish sample collection different mesh sized gill net will be used at selected sampling stations in the reservoir. After collection, fishes will be examined; number will be counted and release to the system. Fish specimens were preserved in 5% formaldehyde for laboratory analysis.

Fish catch analysis

The fish samples will be collected during experimental fishing using different mesh sized gill net and the identification of fish will be done based on fresh or preserved specimens, according to FAO identification sheets (Fisher and Bianchi, 1984), ITIS (Integrated Taxonomic Information System) standard report (http://www.itis.gov/), Fish Base (Froese and Pauly, 2007) [9], Day (1889) [7], Talwar and Jhingran (1991) [26] and other books/monographs.

Biodiversity Indices

The fish data is used for the calculation of Shannon-Weiner, Margalef and Pielou's Evenness indices. Since individual size of fish species differ greatly, the indices will be expressed in terms of biomass and not in terms of number of individuals. Hill's abundance will be used to examine the variation in the number of dominant species. Species richness will be calculated by Margalef's index. All the diversity indices will be done by using the PRIMER V.7 analytical package developed by Plymouth Marine Laboratory, U.K. (Clarke and Gorley, 2006) [6] and Bio Diversity statistics analysis was done according to standard softwares (McAleece *et al.*, 1997) [19].

Results and Discussion

Results are depicted in Tables 1-3 and Fig s 2 to 5. In the current study, 25 species of fishes belonged to 21 genera and 12 families were recorded. Cyprinidae was the most dominant with 11 species preceded by, Channidae, Siluridae, and Ambassidae with 02 species and others *viz*., Cichlidae, Gobiidae, Notopteridae, Belonidae, Clariidae, Bagridae, Mastacembelidae and Heteropneustidae each with 01 species respectively.

The biodiversity status (IUCN, 1994) and abundance of fishes in Vanivilasa sagara reservoir is depicted in Fig 2 and 3. Nonetheless, Table 3 shows the economic importance of fishes.

Mawhoob Noman Alkadashi *et al*. (2010) and Shivashankar and Venkataramana (2012) [24] have opined that dissolved oxygen is influencing fish distribution. Our results are consistent with the views of the researchers mentioned above.

Channa and *Heteropneustes* fishes have high market value. However, P*untius* and *Systomus* species have ornamental value and are used as decorative purposes due to their size and bright colors. Commercial fishes exist, but are not sufficient to make commercial fishing economically viable. *Hyporampus limbatus* is rarely found in the studied reservoir.

Thirumala *et al*. (2011) [29] recorded 33 fish varieties in Bhadra reservoir of Karnataka, Narasimha Ramulu and Benarjee (2013) [21] have recorded 30 species of ichthyofauna of Nagaram tank in Warangal (Andhra Pradesh).

In Kudligere tank of Bhadravathi taluk Thirumala and Kiran (2016) [28] have reported 18 species of fishes. Sanchez-Botero *et al.* (2014) [25] reported that the fishes belonging to 9 species, representing 7 families and 4 orders from Santo Anastacio reservoir, Brazil. Thirumala and Kiran (2017) [27] have reported thirteen ichthyofauna in Gowdanakere tank and they opined that Cyprinidae was predominant.

Fishing of the immature fish should be avoided. The species richness, abundance and biodiversity indices in all the three sites are shown in Table 2. The highest abundance and richness is recorded in Site 1. The Shannon-Weiner and Margalef indices shows highest in Site 1. Simpson's index of Diversity (1-D) is highest at site 1 (0.92). The Pielou evenness value was highest in site 2.

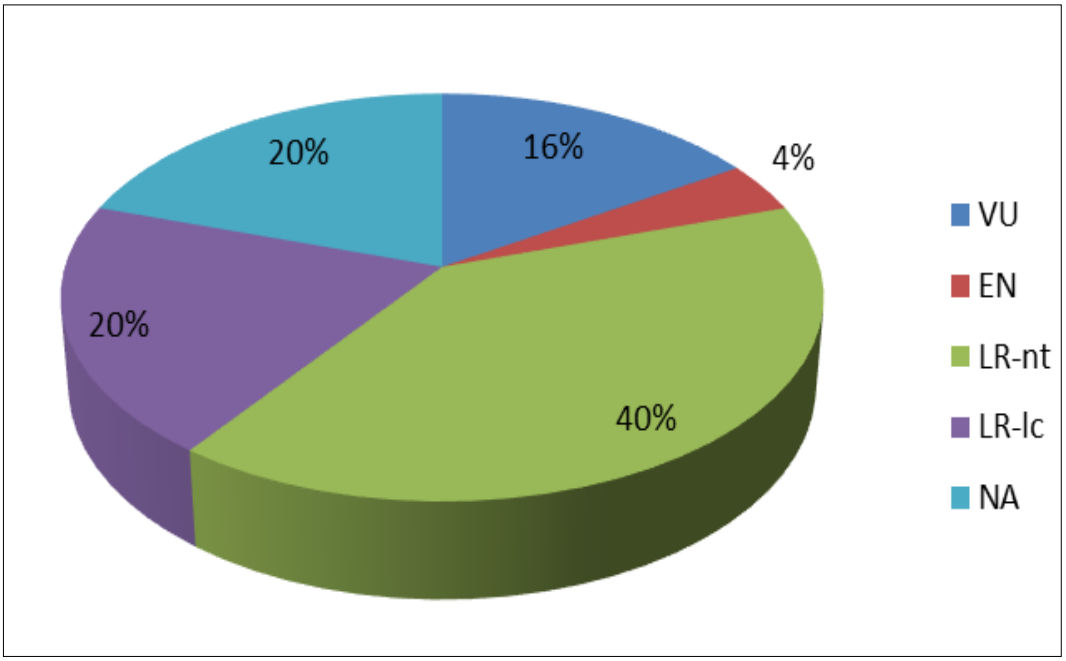


Fig 2: Biodiversity status (IUCN, 1994) of fishes in Vanivilasa Sagara Reservoir of Chitradurga district, Karnataka

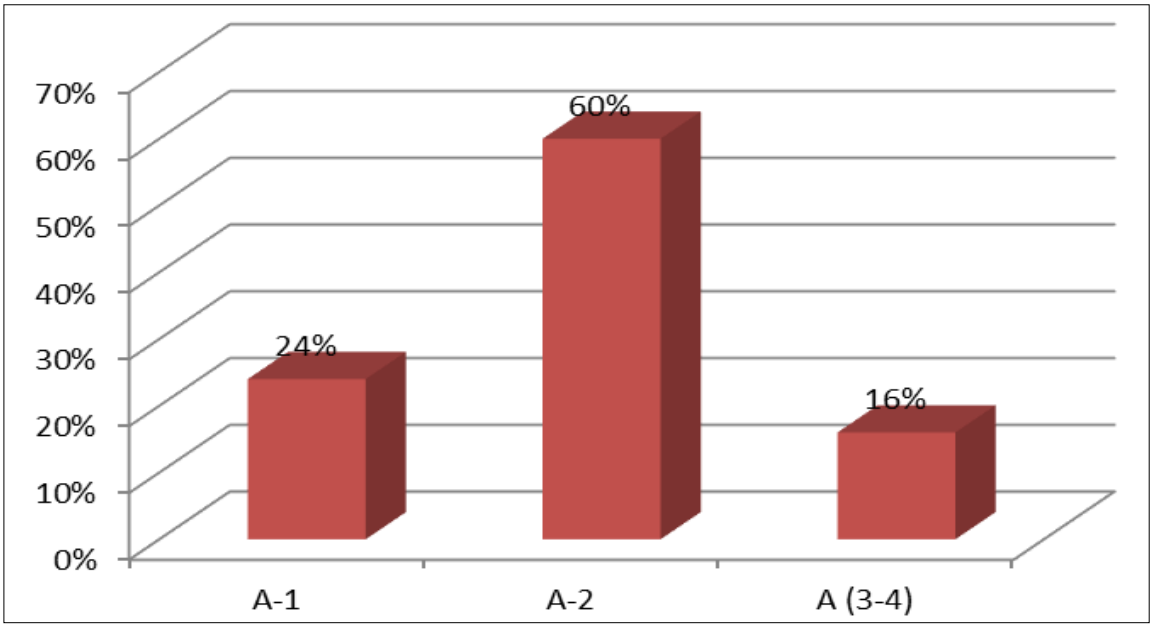
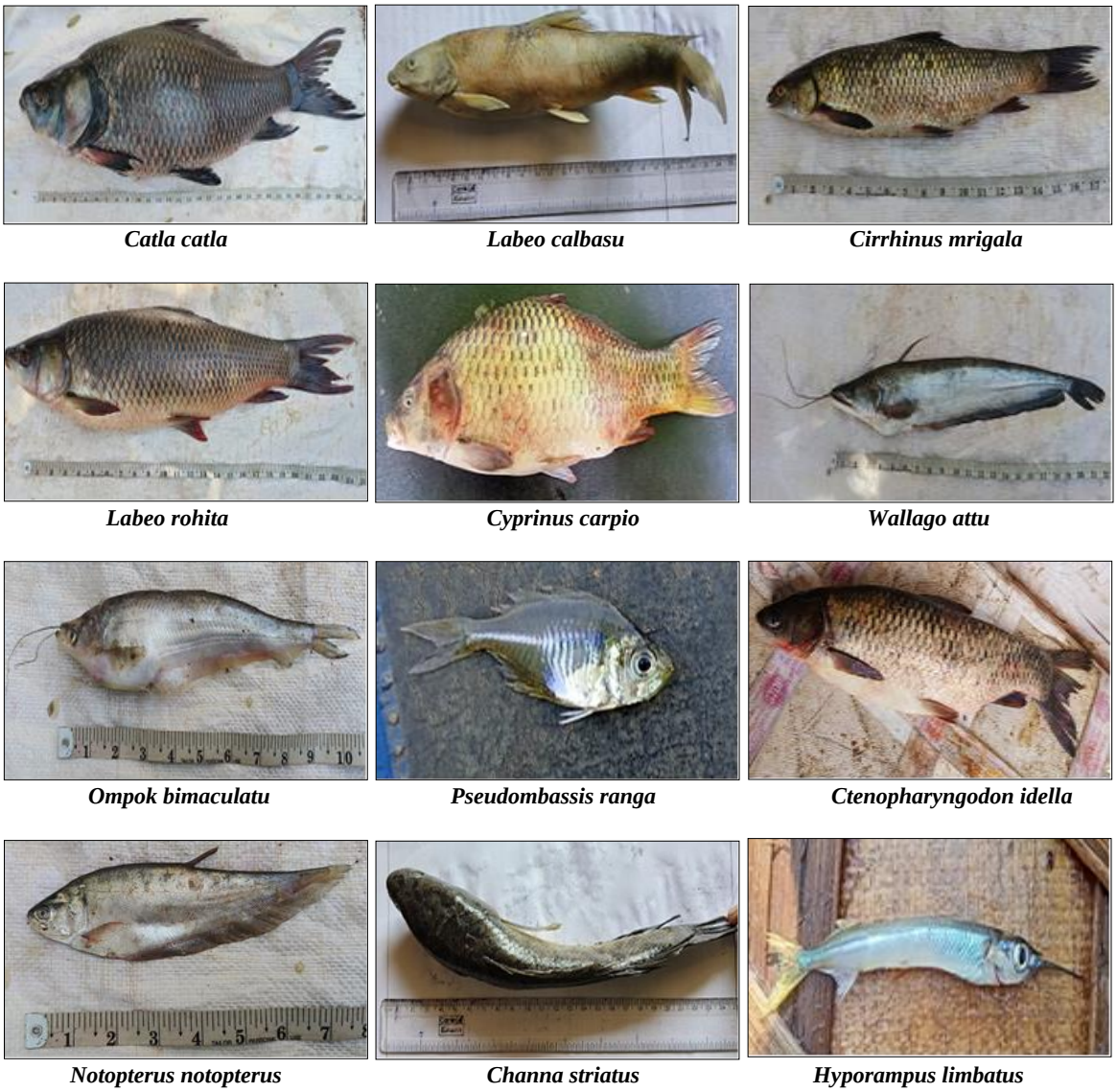


Fig 3: Percentage abundance of fishes in Vanivilasa Sagara Reservoir of Chitradurga district, Karnataka



Catla catla ***Labeo calbasu*** ***Cirrhinus mrigala***

Labeo rohita ***Cyprinus carpio*** ***Wallago attu***

Ompok bimaculatu ***Pseudombassis ranga*** ***Ctenopharyngodon idella***

Notopterus notopterus ***Channa striatus*** ***Hyporampus limbatus***

Fig 4: Ichthyofaunal diversity in Vanivilasa sagara reservoir

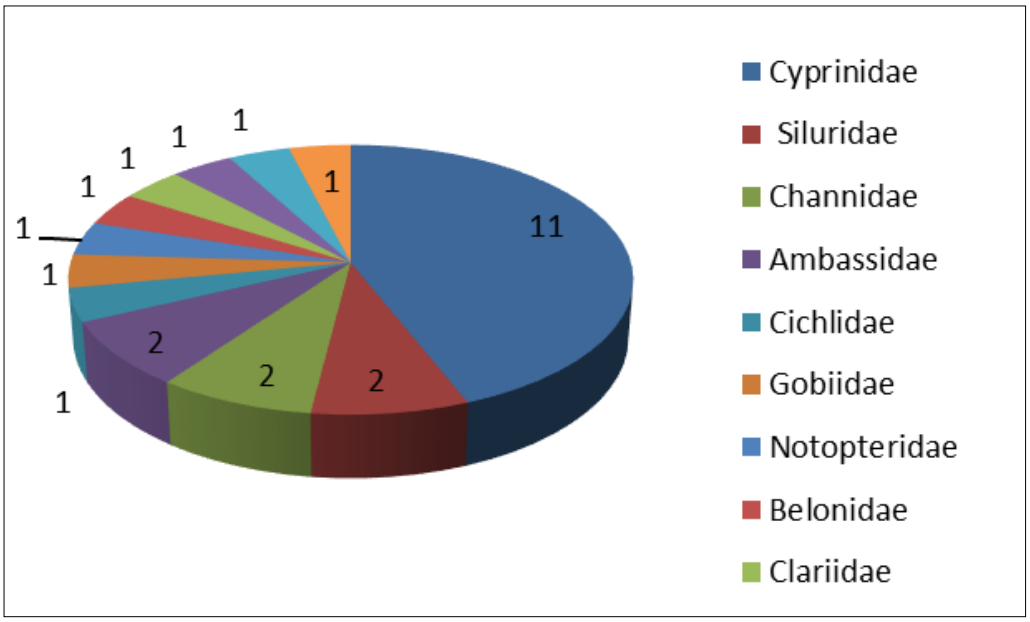


Fig 5: Family wise occurrence of fishes in Vanivilas sagara reservoir

Table 1: Monthly and family wise occurrence of fishes in Vanivilasa sagara reservoir of Chitradurga

Species	Family	Apr. 2022	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.2023	Feb.	Mar.
Catla catla	Cyprinidae	1	3	3	5	1	0	1	1	1	1	1	1
Labeo rohita	Cyprinidae	1	2	8	10	2	1	1	2	1	0	1	1
Cirrhinus mrigala	Cyprinidae	2	10	12	20	3	4	2	3	2	3	2	2
Wallago attu	Siluridae	0	0	0	0	1	6	10	2	0	0	0	0
Ompok bimaculatus	Siluridae	0	0	0	2	1	6	9	2	0	0	0	0
Notopterus notopterus	Notopteridae	1	2	5	4	2	50	60	0	1	0	0	1
Channa marulius	Channidae	0	0	0	0	0	0	0	0	15	1	0	1
Oreochromis mossambicus	Cichlidae	2	4	5	3	2	2	2	1	4	2	2	2
Mystus cavasius	Bagridae	0	0	0	0	0	100	180	158	175	86	1	0
Mastacembellus armatus	Mastacembelidae	0	1	3	02	2	20	28	20	3	2	2	1
Ctenopharyngodon idella	Cyprinidae	1	2	1	2	0	1	0	1	1	2	0	1
Xenentodon cancila	Belonidae	2	3	1	1	2	3	2	1	1	1	0	2
Pseudombassis ranga	Ambassidae	1	0	1	1	1	2	1	4	1	1	0	0
Channa striatus	Channidae	1	2	0	1	3	2	4	0	1	6	1	0
Cirrhinus reba	Cyprinidae	22	2	25	2	1	1	2	7	4	5	7	42
Cyprinus carpio	Cyprinidae	1	1	4	1	1	2	1	0	3	1	2	1
Labeo calbas	Cyprinidae	5	8	2	1	3	8	5	4	2	3	6	2
Heteropneustes fossilis	Heteropneustidae	1	0	0	0	0	2	3	0	0	0	0	0
Puntius sophore	Cyprinidae	22	34	6	1	2	2	1	1	2	0	0	13
Cirrhinus fulungee	Cyprinidae	1	2	3	2	2	4	2	1	0	0	2	1
Glossogobius giuris	Gobiidae	1	2	3	3	4	2	2	1	0	1	2	1
Clarias batrachus	Clariidae	1	2	3	1	0	1	0	2	4	1	3	0
Labeo fimbriatus	Cyprinidae	0	0	0	0	0	0	0	0	4	2	0	0
Chnda nama	Ambassidae	8	20	1	7	2	3	14	12	9	3	17	5
Systomus sarana	Cyprinidae	0	0	2	0	1	0	0	0	0	1	0	0

Table 2: Fish diversity indices for Vanivilasa Sagara reservoir of Chitradurga district

Diversity indices	Site 1	Site 2	Site 3
Species Richness	25	22	23
Shannon-Weiner Index	2.9	2.7	2.8
Simpson index of Diversity	0.92	0.85	0.88
Pielou Evenness	0.80	0.90	0.86
Margalef Index of species richness	2.3	1.9	2.1

Physico-Chemical Characteristics

Temperature

It was observed that the water temperature was minimum in winter and maximum during summer in all the 3 collection sites. The highest water temperature was 30.2 degrees in May 2023 at the dam site and the minimum water temperature was 24.4 at the Inlet of the Reservoir. The temperature of the water collected from 3 different sites ranges from 24.4 to 30.2.

It is reported that pure water has a pH of 7, making it neutral. Water that has a pH of below 7.0 is classified as acidic, whereas water that has a pH of higher than 7.0 is classified as basic or alkaline. During our study, the pH ranged from 6.6-8.4 at the outlet 6.2-8.4 at the inlet, and 6.6-8.2 at the dam site of the reservoir. Minimum pH was observed in the inlet of the reservoir in Feb 2022 and maximum pH was observed in April 2023 at the outlet of the reservoir. There was no noteworthy difference in pH,

which was in accordance with the previous studies (Indur, 2019 [13]; Kishore and Gujjar; Abhilash & Mahadevaswamy, 2021 [1]; Yogitha Babu *et al*.,2018 [5] and Murthuzasab *et al*., 2010) [20].

The highest DO was recorded in the Outlet of the Reservoir i.e. 8.5. Similar results were reported by Indur 2019 [13] and Kishore and Gujjar in their respective studies but in contrast, the studies by Abhilash & Mahadevaswamy, (2021) [1]; Yogitha S Babu *et al*.2018 [5] and Murthuzasab *et al*. (2010) [20] reported highest level in summer. In all three dam sites highest free CO_2 was recorded 1.0 to 3.3 mg/l. a study by Murthuzasab *et al*., (2010) [20] reported free CO_2 range from 4.4 to 39.6 mg/L.

Our study reported total hardness from 113.8 to 125.8 at the outlet of the reservoir, 111.6 to 125.3 at the inlet of the reservoir, and 115.3 to 127.3 at the dam site. Our results are similar to the study conducted by another researcher in different reservoirs in Karnataka. (Gujjar and Kiran, 2017 [11]; Yogitha Babu *et al*. 2018) [5]. Based on hardness measurements Kannan (1991) [16] classified water into three groups: "mild (0–60 mg/L), moderately hard (61–120 mg/L), hard (121–160 mg/L), and very hard (more than 180 mg/L) (Prabhu and Gowda, 2019) [22]. Our study results showed that Vanivilasa Sagara reservoir water is moderately hard.

The maximum alkalinity values were recorded during the summer season, while lower values were observed in the monsoon season. The highest values (230.0mg/L) are recorded from the water sample at the outlet of the reservoir. Level of alkalinity level was ranged from 208 mg/L to 230 mg/L. This is similar tothe findings of Yogitha Babu *et al*. (2018) [5] in Bangalore Lake.

The electric conductivity of Vanivilasa Sagara Reservoir ranges from 280-420 at the Outlet of the Reservoir, 285-410 at the Inlet of the Reservoir, and 285-442 at the Dam site. Electric conductivity was highest in the summer season and low in winter. Seasonal changes in conductivity, particularly in lakes with minimal water inflow, are mostly caused by temperature and evaporation (Abhilash & Mahadevaswamy, 2021) [1]. Transparency of water collected from different study sites of Vanivilasa Sagara Reservoir ranged from 60-170 at the Outlet of the Reservoir, 69-180 at the Inlet of the Reservoir, and 65-150 at the Dam site.

Conclusion

As a result of this observation, 25 species of freshwater ichthyofauna were confirmed in the Vanivilasa Sagara reservoir in Chitradurga. This ichthyofauna appears to indicate a low number inhabiting in this water body, and sustainable strategies for discovering and conserving additional fish communities in this reservoir are detailed. Observation of physic-chemical parameters of Vanivilasa Sagara reservoir revealed that most of the water parameters were below the permissible limits. This water body is home to several ornamental fishes as well as economically important fishes that can be farmed. Conservation measures require restrict fishing in breeding season and identifying illegal fishing.

References

1. Abhilash HR, Mahadevaswamy M. Assessment of water quality parameters and aquatic insect assemblages in Dalvoy Lake, Mysore district, Karnataka, India. Curr World Environ,2021:16(2):514-29.
2. Giri A, Saxena S. Study of fish diversity of Shahpura lake, Bhopal, India. World J Pharm Pharm Sci,2017:6(7):1064-72.
3. Anon. Australian herring. Fisheries Department of Western Australia. Fishing WA,1988:3:4.
4. Ayyappan S. Hand book of Fisheries and Aquaculture. Directorate of Knowledge Management in Agriculture. Indian Council of Agricultural Research (ICAR),2011:988-95.
5. Babu Y, Mohan MR. A study on physico-chemical parameters of errarajan lake of Bangalore rural. Int J Sci Res,2018:7(2):401-2.
6. Clarke KR, Gorley RN. Primer v5 User manual/tutorial. PRIMER-E, Plymouth UK, 2006, 9.
7. Day F. The Fauna of British India, including Ceylon and Burma: (Fishes). W.T. Blanford publications, 1889.
8. Fischer W, Bianchi G. FAO Species Identification Sheets for Fishery Purposes: Western Indian Ocean (Fishing Area 57). Food and Agriculture Organization of the United Nations, Rome, Italy, 1984.
9. Froese R, Pauly D. Fish Base, World Wide Web Electronic Publication, 2007. Available from: http://www.fishbase.org/search.php.
10. Gorman OT, Karr JR. Habitat Structure and Stream Fish Communities. Ecology,1978:59:507-15. Available from: http://dx.doi.org/10.2307/1936581.
11. Gujjar KN, Kiran BR. Assessment of Physico-Chemical Parameters of Hiremagalur Pond Water in Chikmagalur, Karnataka. Int J Multidiscip Res Mod Educ,2017:3(1):350-4.
12. Harris JH. The use of fish in ecological assessments. Aust J Ecol,1995:20:65-80.
13. Indur B. Studies on the physico-chemical parameters of Mailapur reservoir at Yadigr District, Karnataka State. Int J Res Advent Technol,2019:7(2):315-21.
14. International Union for Conservation of Nature and Natural Resources (IUCN). Red list of threatened animals. Gland, Switzerland and Cambridge, UK: IUCN, 1994.
15. Jayaram KC, Venkateshwarlu T, Raghunathan WB. A Survey of the Cauvery river system with major account of its fish fauna. Rec Zool Surv India,1982:36.
16. Kannan K. Fundamentals of Environmental Pollution. New Delhi: S. Chand and Company Ltd., 1991.
17. Manjappa K. Fish and Fisheries of Hemavathi river, Karnataka. The IVth Indian Fisheries Forum Proceedings,1999 Nov 24-28: Kochi. p. 389-91.
18. Alkadasi MN, Puttaiah ET, Shahnawaz A. Fish fauna of Lakkavalli Lake, Karnataka with respect to environmental variables. Curr Biotica,2010:4(1):103-10.
19. Mcaleece N, Gage JDG, Lambshead PJ, Paterson GLJ. Biodiversity Professional statistics analysis software,1997. Available from: http://www.sams.ac.uk/peter-lamont/biodiversity-pro.
20. Murthuzasab MR, Rajashekhar M, Vijaykumar K, Haliked NS. Seasonal variation in physico-chemical parameters of Hirahalla Reservoir, Koppal District Karnataka. Int J Syst Biol,2010:2(2):16.
21. Ramulu KN, Benarjee G. Fish species diversity of Nagaram tank of Warangal, Andhra Pradesh. IOSR J Environ Sci Toxicol Food Technol,2013:3(4):14-8.

22. Prabhu CM, Gowda KK. Seasonal Variations in Physico-Chemical Characteristics of Devarabelakere Reservoir in Karnataka, India and Its Suitability for Irrigation, 2019.
23. Ramanjaneya, Ganesh CB. Fish faunal diversity in Tungabhadra Reservoir, Hosapete, Ballari District, Karnataka. Int J Res Fish Aquac,2016:6(2):21-5.
24. Shivashankar P, Venkataramana GV. Ichthyo diversity status with relation to water quality of Bhadra River, Western Ghats, Shimoga District, Karnataka. Ann Biol Res,2012:3(10):4893-903.
25. Sanchez-Botero JI, Reis VC, Chaves FD, Garcez DS. Fish Assemblage of the Santo Anastacio reservoir (Ceara State, Brazil). Bol Inst Pesca Sao Paulo,2014:40(1):1-15.
26. Talwar PK, Jhingran AG. Inland fishes of India and adjacent countries. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd., 1991,1158 p.
27. Thirumala S, Kiran BR. Fish diversity in Gowdanakere tank of Bhadravathi taluk, Karnataka. Int J Multidiscip Res Mod Educ,2017:3(1):355-8.
28. Thirumala S, Kiran BR. Fish diversity and abundance in Kudligere tank of Bhadravathi Taluk, Karnataka with special note on their Biodiversity status. Int J Res,2016:3(18):1637-45.
29. Thirumala S, Kiran BR, Kantaraj GS. Fish diversity in relation to physico-chemical characteristics of Bhadra reservoir of Karnataka, India. Adv Appl Sci Res,2011:2(5):34-47.
30. Venkateshwarlu M, Shanmugham MS, Mallikarjun HR. The Fish fauna of Bhadra Reservoir, Western Ghats. J Aqua Bio,2002:17(1):9.