



# International Journal of Fisheries and Aquatic Studies

E-ISSN: 2347-5129

P-ISSN: 2394-0506

(ICV-Poland) Impact Value: 76.37

(GIF) Impact Factor: 0.549

IJFAS 2023; 11(2): 96-100

© 2023 IJFAS

[www.fisheriesjournal.com](http://www.fisheriesjournal.com)

Received: 05-12-2022

Accepted: 09-01-2023

**Rishabh Shukla**

Department of Zoology and  
Applied Aquaculture,  
Barkatullah University, Bhopal,  
Madhya Pradesh, India

**Abhilasha Bhawsar**

Department of Environmental  
Sciences and Limnology,  
Barkatullah University, Bhopal,  
Madhya Pradesh, India

**Praveen Tamot**

Government MLB College,  
Bhopal, Madhya Pradesh, India

**Sneha Sharma**

Department of Environmental  
Sciences and Limnology,  
Barkatullah University, Bhopal,  
Madhya Pradesh, India

**Corresponding Author:**

**Abhilasha Bhawsar**

Department of Environmental  
Sciences and Limnology,  
Barkatullah University, Bhopal,  
Madhya Pradesh, India

## Assessment of fish biodiversity in relation to physico-chemical characteristics of Kolar River, Madhya Pradesh, India

**Rishabh Shukla, Abhilasha Bhawsar, Praveen Tamot and Sneha Sharma**

**DOI:** <https://doi.org/10.22271/fish.2023.v11.i2b.2793>

### Abstract

The present study was conducted on the Kolar River, a tributary of the Narmada River. The fish diversity of the Kolar River in the Sehore district of Madhya Pradesh, Central India, is represented in this view. It was investigated from February 2021 to June 2022. The Kolar River is a vital source of water for the people who live in nearby villages, primarily for domestic use. In the community, fishing for a living and food is a common practise. The study's goal was to investigate the Kolar River's water quality and fish fauna. During the investigation, six sampling stations were chosen for the collection of data: Near reservoir, Lawakhadi, Veerpur, Near old bridge, Dana baba temple, Amdoh, and Jholiyapur.

The study discovered 25 fish species from eight orders (Cypriniformes, Siluriformes, Perciformes, Osteoglossiformes, Synbranchiformes, Clupeiformes, and Beloniformes). Cypriniformes are the dominant order of fishes in this area (Kolar), with the highest number of ten species recorded. The recorded fishes were found to be widely distributed and abundant in the river.

**Keywords:** Fish biodiversity, Kolar River, physicochemical parameters, species diversity index

### 1. Introduction

Rivers play an important role in aquatic organisms' lives. The most productive source of fish culture is water. A sufficient amount of dissolved oxygen, food, suitable breeding sites, and specific characteristics such as pH and water temperature are required for fish survival. Lavudya and Pathak (2002) [30]. India has two biodiversity hotspots, the Western Ghats and the Eastern Himalayas, making it one of the world's 12-mega biodiversity countries. In terms of biodiversity, India ranks ninth in the world. 2017 (Kumar and Uchchariya) (Kumar and Uchchariya).

The recent study was carried out to investigate the fish diversity of the Kolar River in India's Sehore District (M.P.). The Kolar River is a well-known river in Madhya Pradesh, and it is a major tributary of the renowned Narmada River. The study's aim was to provide current data on fish diversity and physicochemical parameters of this river to help with a better understanding of fish diversity and to serve as a tool for conservation planning of aquatic environments in this region. This is the first study in this field, and several indigenous, commercially important, and economically valuable fish have been discovered.

(Namdeo and Singh 2021) [3]. Some studies were conducted on the Study on Species Diversity and Assemblage of Fish Fauna of Jamner River: A Tributary of the Narmada River (Vishwakarma and Vyas, 2014) [4]. The fish fauna of the Bharathapuzha River in Kerala (Biju Kumar & Sushama, 1999) [5] and the Barna Stream Network in the Narmada basin (Central India) were also studied (Vishwakarma *et al.*, 2014) [4].

### 2. Material and Method

#### 2.1 Study Area

The current investigation was carried out on the Kolar River in the Madhya Pradesh district of Sehore. It is one of the most important Narmada River tributaries, located 35 kilometres southwest of Bhopal at 21°14'N and 79°10'E. The Kolar River runs for 101 kilometres. The Kolar River rises in Madhya Pradesh's Sehore district's Vindhya Range and flows south-west to meet the Narmada River near Nasrullah Ganj

**Table 1:** Showing geographical locations of different Stations at Kolar River

S. No.	Sampling sites	Station name	Latitude and longitude
I	K-1	Near Reservoir	22°57'36.84" N 77°20'52.30"E
II	K-2	Lawakhadi	22°58'30.9" N 77°21'38.4"E
III	K-3	Near old bridge	22°59'7.07" N 77°22'10.3"E
IV	K-4	Dana baba temple	22°57'56" N 77°20'34"E
V	K-5	Amdoh	22°51'46.5" N 77°24'34"E
VI	K-6	Jholiyapur	22°51'7.35" N 77°23'48"E

## 2.2 Physiochemical analysis

The current Kolar River study was carried out from 2020 to 2022 to investigate the river's water quality. Water samples were collected from six different locations during four different seasons: winter, summer, monsoon, and post-monsoon. The values of parameters such as air temperature, water temperature, pH, TDS, dissolved oxygen, conductivity, total alkalinity, chloride, total hardness, calcium hardness, nitrate, and orthophosphate were calculated using standard methods such as APHA (2005) [7] and Adoni *et al.*, (1985) [6].

## 2.3 Collection of fishes

With the assistance of local fishermen, fish were collected from the Kolar River on a seasonal basis using a variety of active and passive gears such as cast nets and gill nets. After gathering information about the source of the fish, fish samples were collected from nearby local fish markets. Jayaram (1999) [8], Talwar (1991) [9], and Jhingran (1991) [9] provided standard keys for identifying the fishes (1999).

## 2.4 Fish Diversity Analysis

The fish assemblage structure was estimated for each type of habitat and it included: the Simpson index (1-D), Shannon diversity index (H'), Pielou's evenness index (J) and Margalef's species richness (S):

Simpson index is based on the following formula:

$$D = 1 - \sum ni(n-1)/N(N-1) \text{ (Simpson, 1949) } [26]$$

Where  $ni$  = is the number of individuals of taxon I, and  $N$  = is the total number of individuals.

The Shannon diversity index is based on the formula:

$$H = -\sum[(pi) \times \ln(pi)] \text{ (Shannon and Wiener, 1949) } [27].$$

Where,  $pi = n/N$ ,  $H$  = the diversity index,  $ni$  = the relative abundance ( $S/N$ ),  $S$  = the number of individuals for each species, and the  $N$  = total number of individuals.

Evenness index (J) is based on the following formula:

$$i / \ln((s-1) / \ln(n)) \text{ (Pielou's, 1966) } [28].$$

Where,  $i$  = is the Shannon-Wiener's diversity index, the  $n$  = total number of individuals, and  $S$  = is the number of different species in the sample.

Species richness (S) is based on the following formula:

$$D = (S - 1) / \log(n) \text{ (Margalef, 1968) } [29] \text{ Where } D =$$

Margalef's richness index,  $S$  = Number of different species in the sample, and  $N$  = Total number of individual species in the sample.

## 3. Result and Discussion

The data collected from sampling stations during the study period was used to estimate the fish diversity in the Kolar River. In the Kolar River, 25 fish species from 7 orders and 11 families were collected. According to the composition of species and their percent under various orders, 15 species are available under Cypriniformes (63%), 4 species under Osteoglossiformes (17%), 2 species under Clupeiformes (8%), and 1 species each under Beloniformes, Synbranchiformes, Perciformes, and Siluriformes (4%). During the current study, the following fish orders predominated: Cypriniformes (63%) > Osteoglossiformes (17%) > Clupeiformes (8%) > Beloniformes, = Synbranchiformes = Perciformes = Siluriformes (4%).

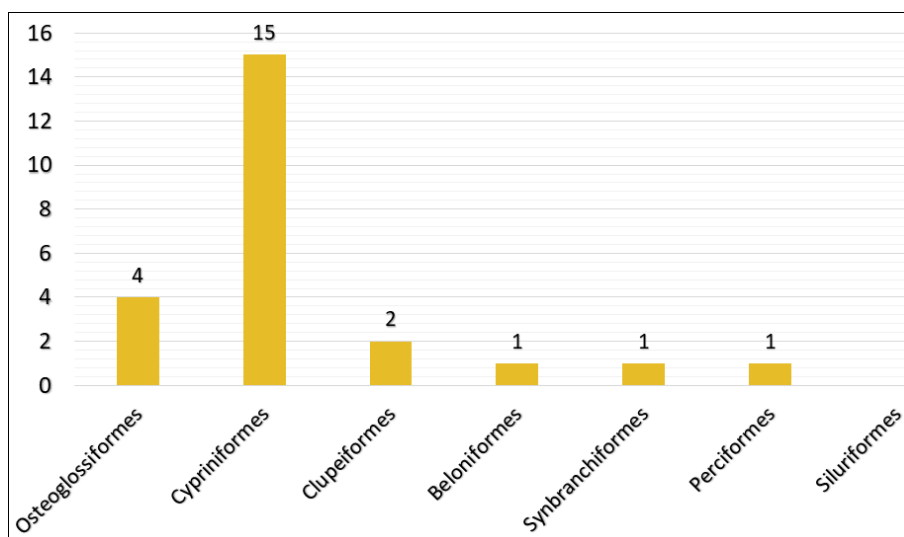
However, Lodhi *et al.*, 2020 [11] discovered a similar result while researching the fish diversity of Atal Sagar Dam in Shivpuri district, Madhya Pradesh, India. According to the research, the fish fauna of Atal Sagar Dam consists of 22 species from 6 orders and 11 families. The Cypriniformes order has the most species, with ten, followed by the Siluriformes with five, Perciformes with four, Osteoglossiformes with one, Beloniformes with one, and Synbranchiformes with one. Vishwakarma *et al.* (2014) [4] worked on the Narmada basin's Barna Stream Network. The findings of this study reveal the presence of 33 fish species from 5 orders, 9 families, and 21 genera. The order Cypriniformes was discovered to be dominant (24 species), followed by Perciformes and Ophiocephaliformes (3 species each), and Mastacembeliformes (2 species) and Beloniformes (1 species), which is almost similar to the results of the present study.

**Table 2:** Order-wise fish distribution of fishes of Kolar River (MP)

S. No.	Order name	Number of fishes
1.	Osteoglossiformes	4
2.	Cypriniformes	15
3.	Clupeiformes	2
4.	Beloniformes	1
5.	Synbranchiformes	1
6.	Perciformes	1
7.	Siluriformes	1

## 3.1 Statistical analysis

During the study, various indices were used to assess the diversity of the Kolar River. The Shannon diversity index ranged between 2.22 and 3.345. Station-4 (3.345) had the highest value during the summer and Station-II (2.22) had the lowest value during the winter; however, the Simpson index values ranged from 0.8 to 0.96. Station-6 (0.96) had the highest value during the post-monsoon season, while Station-1 (0.8) had the lowest during the winter. Margalef's richness index ranged from 2.246 to 5.796. Station-4 (5.796) had the highest summer value and Station-2 (2.246) had the lowest winter value.



**Fig 1:** Fish distribution at Kolar River

### 3.2 Physicochemical properties at Kolar River

During the present study following results were attained for the physicochemical properties of the Kolar River. The detailed structure of physicochemical variation is given in Table 2.

#### 3.2.1 Temperature

During the study period, the air temperature ranged from 21 °C to 42.5 °C. The highest atmospheric temperature was recorded at Station - 6 during the summer, and the lowest temperature was recorded at Station - 5 during the winter. The water temperature was measured between 19 °C to 32.7 °C. The highest recorded water temperature was 32.7 °C in the post-monsoon at Station, and the lowest recorded water temperature was 19 °C in the winter at Station - 6. In general, surface water temperature fluctuations appear to follow atmospheric temperature (Golterman, 1975; Hutchinson, 1976; Sharma *et al.*, 2011) <sup>[12-14]</sup>.

#### 3.2.2 pH

During the current study, the pH of the water ranged from 7.2 to 9.15. The maximum pH value was 9.15 in the winter at Station - 5 and the minimum pH value was 7.2 in the post-monsoon at Station - 1. Similar results were obtained in the Narmada River in Madhya Pradesh (Sharma *et al.*, 2011) <sup>[14]</sup> and the Yamuna River in Uttar Pradesh (Kumar *et al.*, 2011) <sup>[15]</sup>.

#### 3.2.3 Total dissolved solids

Total dissolved solids in water ranged from 120 to 314 ppm during the current study. The maximum TDS value was 314 ppm in the summer at Station -6, and the minimum TDS value was 120 ppm in the post-monsoon at Station -1. Similar findings with 256-500 ppm in the Ganga River, Kanpur (Trivedi *et al.*, 2009) <sup>[16]</sup> and 255-540 ppm in the Ganga River, Kanpur (Thareja *et al.*, 2011) <sup>[17]</sup> support the current findings.

#### 3.2.4 Electrical Conductivity

Water conductivity ranged from 129 mg/l to 400 mg/l in this study. The maximum conductivity at Station - 2 was 400 mg/l in the summer, and the minimum was 129 mg/l in the post-monsoon at Station - 4. Some researchers discovered electrical conductivity values of 272- 462 mhos in the Narmada River, 340-734 mg/l in the Yamuna River in Uttar

Pradesh (Kumar *et al.*, 2011a) <sup>[15]</sup>, and 380-570s/cm in the Narmada River in Madhya Pradesh (Bashir *et al.*, 2015) <sup>[18]</sup>.

#### 3.2.5 Chloride

The chloride concentration was varied from 6 mg/l to 71 mg/l during the current study. The highest value of chloride in water was recorded at Station - 6 in the summer, and the lowest value was recorded at Station - 5 in the winter. A similar range of chloride was recorded in the Cauvery River, Tamilnadu (Kalavathy *et al.*, 2011) <sup>[19]</sup>; 29.61-66.68 mg/l in the Barna stream Narmada River basin, Madhya Pradesh (Bhawsar and Vyas, 2014) <sup>[20]</sup>; and 18-32 mg/l in the Yamuna River, Uttar Pradesh (Kumar *et al.*, 2011) <sup>[15]</sup>.

#### 3.2.6 Total alkalinity

During the current study, the total alkalinity in water ranged from 72 mg/l to 239 mg/l. The maximum value of total alkalinity in water was recorded 239 mg/l at Station - 3 during the monsoon, and the minimum value of total alkalinity in water was recorded 72 mg/l at Station - 4 after the monsoon. Some researchers have found a similar range of total alkalinity in the Yamuna River, Uttar Pradesh (Kumar *et al.*, 2011) <sup>[15]</sup> and the Ram Ganga River, Uttar Pradesh (Chandra *et al.*, 2011) <sup>[21]</sup>, which supports the current values.

#### 3.2.7 Calcium hardness

The calcium hardness value ranged from 25.2 mg/l to 294 mg/l. The highest calcium value was recorded at Station - 4 during the monsoon, and the lowest value was recorded at Station - 2 during the winter. The range of calcium hardness was also discovered to be 330 - 396 mg/l in the Narmada River (Sharma *et al.*, 2011) <sup>[14]</sup> and 212.1 - 289.8 in the Narmada River (Bashir *et al.*, 2015) <sup>[18]</sup>.

#### 3.2.8 Total hardness

The total hardness of the water in this study ranged from 70 mg/l to 276 mg/l. The maximum total hardness was 276 mg/l during the monsoon at Station -5, and the minimum was 70 mg/l during the post-monsoon at Station -4. The total hardness value in Ganga River, Kanpur was 106-246 mg/l (Thareja *et al.*, 2011) <sup>[17]</sup>; 182.1-300 mg/l in Ram Ganga River, Uttar Pradesh (Chandra *et al.*, 2011) <sup>[21]</sup>; and 148.66-236 mg/l in Barna stream Narmada River basin, Madhya Pradesh (Bhawsar and Vyas, 2014) <sup>[20]</sup>, which supports the current findings.



### 3.2.9 Nitrate

During the current study, the nitrate concentration in the water ranged from 0.107 mg<sup>l</sup>-1 to 1.702 mg<sup>l</sup>-1. The maximum nitrate concentration was 1.702 mg<sup>l</sup>-1 at Station - 5 during the monsoon, and the lowest concentration was 0.107 mg<sup>l</sup>-1 at Station - 6 during the winter. Some researchers found nitrate levels ranging from 0.008 to 0.024 mg<sup>l</sup>-1 in the Chambal River (Saksena *et al.*, 2008) [22] and 1.38 to 2.6 mg<sup>l</sup>-1 in the Ganga River in Varanasi (Mishra *et al.*, 2009) [23].

### 3.2.10 Orthophosphate

During the present investigation, the orthophosphate in the water ranged from 0.121 mg<sup>l</sup>-1 to 1.360 mg<sup>l</sup>-1. The maximum value of orthophosphate was 1.360 mg<sup>l</sup>-1 at the Station - 1 in the post-monsoon and the minimum value was 0.121 mg<sup>l</sup>-1 in the winter at Station - 3. The concentration of Phosphate in the Narmada River water sample was found to be in the range of 0.16-0.28 mg<sup>l</sup>-1 (Sharma *et al.*, 2011) [14].

**Table 3:** Showing physicochemical parameters at Kolar River

S. No.	Parameters	Min value	Max value	Mean	Median	Mode	STD
1.	AT	21	42.5	28.52917	29.3	36	6.561845
2.	WT	19	32.7	24.05833	24.4	22	5.220188
3.	pH	7.2	9.15	7.845833	8	8.3	0.509031
4.	TDS	120	314	161.0417	162	168	20.55
5.	EC	129	400	229.6667	235.5	240	49.31502
6.	TA	72	239	124.9583	104	82	53.0967
7.	DO	6	10	7.9125	7.85	6.4	1.042702
8.	CL	6	71	25.55	23	23	12.57257
9.	Ca H	25.2	294	116.9042	99.5	295.3	70.23447
10.	TH	70	276	128.75	105	90	61.82742
11.	No3	0.107	1.702	0.667917	0.3875	0.2345	0.597922
12.	Po4	0.121	1.360	0.803708	0.6415	0.5439	0.505272

## 4. Conclusion

The work concluded with future strategies for the development of fish diversity in the Kolar River at Sehore (M.P.) India. Recent data on the fish diversity of the Kolar River aims to contribute to a better understanding of the fish diversity planning of aquatic environments in this region. According to the current study, the Kolar River has a diverse fish fauna with a large number of fish species, and their production in the river may be related to the suitable ecology of the water body, which provides a good breeding ground for fish. This also implies that the river's water parameters are within acceptable limits for fish and fisheries practises (according to WHO and BIS standards). The current study found 25 fish species from 7 orders, 15 families, and 24 genera. The species collected were mostly from the order Cypriniformes. Recent data on the fish diversity of the Kolar River, with the goal of improving understanding of fish diversity planning in this region's aquatic environments.

## 5. Abbreviations

APHA, American Public Health Association; AT, air temperature; WT, water temperature; pH, hydrogen ion concentration; DO, dissolved oxygen; EC, electrical conductivity TDS, total dissolve solid; TA, total alkalinity; CL, chloride; NO<sub>3</sub>, nitrate; PO<sub>4</sub>, orthophosphate; TH, total hardness; CaH, calcium hardness; TA, total alkalinity STD, standard deviation, and pH hydrogen ion concentration.

## 6. References

1. Pathak, Lavudya. Diversity of freshwater fish in Narmada

- River, Madhya Pradesh. Journal of Entomology and Zoology Studies. 2021;9(2):704-709.
2. Kumar DS, Rakhi Uchchariya R. A study of ichthyofauna of Pagara Dam of Morena district, Madhya Pradesh. Indian J Sci. Res. 2017;7(2):51-57.
3. Namdeo AK, Singh BS. Fish diversity of Narmada River at Chandan Ghat in Dindori District (M.P.). International Journal of Advanced Academic Studies. 2021;3(3):275-278.
4. Vishwakarma K, Mir A, Bhawsar A, Vyas V. Assessment of Fish assemblage and distribution in Barna Stream Network in Narmada basin (Central India). International Journal of Advanced Research. 2014;2(1):888-897.
5. Bijukumar A, Sushama S. The Fish fauna of Bharathapuzha River, Kerala. Journal Bombay National Historical Society. 1999;98(3):464-468.
6. Adoni AD, Joshi G, Ghosh K, Chourasia SK, Vaishya AK, Yadav M, *et al.* Workbook on Limnology. Pratibha publication, Sagar, M.P., India; c1985. p. 1-216.
7. APHA; American Public Health Association Standard methods for the examination of water and waste water. 21<sup>st</sup> ed., American Public Health Association/American Water Works Association/Water Environment Federation, Washington, DC; c2005.
8. Jayaram KC. The fresh water fishes of India, region. Narendra Publication House. Delhi 110006 (India); c1999.
9. Talwar PK, Jhingran VG. Inland Fishes of India and adjacent countries. Oxford and IBH Publishing House. 1991;2:1158.
10. Jhingram VJ. Fish and Fisheries of India, Hindustan Publishing Corporation (India), Delhi; c1991.
11. Lodhi RK, Singh Y, Gurjwar RK, Rao RJ. Fish diversity of Atal Sagar Dam in Shivpuri district, Madhya Pradesh, India. International Journal of Fisheries and Aquatic. 2020;5(4):46-49.
12. Golterman HL. Chemistry. In: Whitton BA (ed) River Ecology. University of California Press, Berkeley, CA; c1975.
13. Hutchinson GE. A treatise on Limnology. Vol.2 Introduction to Lake Biology and the Limnoplankton. Wiley, New York; c1976.
14. Sharma S, Vishwakarma R, Dixit S, Jain P. Evaluation of water quality of Narmada River with reference to physicochemical parameters at Hoshangabad city, MP, India. Res.J.Chem.Sci. 2011;1(3):40-48.
15. Kumar V, Arya S, Dhaka A, Meenakshi, Chanchal. A study on physico-chemical characteristics of Yamuna River around Hamirpur (UP), Bundelkhand region central India. International Multidisciplinary Research Journal. 2011;1(5):14-16.
16. Trivedi P, Bajpai A, Thareja S. Evaluation of water quality evaluation of water quality: physico- chemical characteristics of Ganga River at Kanpur by using correlation study. Nature and Science. 2009;1(6):91-94
17. Thareja S, Choudhury S, Trivedi P. Assessment of water quality of Ganga River in Kanpur by using principal components analysis. Advances in Applied Science Research. 2011;2(5):84-91.
18. Bashir T, Kumar A, Vyas V. Assessment of various ecological parameters of Bhagner stream- A tributary of River Narmada in the central zone, India. International Journal of Research in Natural and Applied Science.

- 2015;5(1):1-6.
19. Kalavathy S, Sharma TR, Kumar SPP. Water quality index of River Cauvery in Tiruchirappalli district, Tamilnadu. Arch. Environ. Sci. 2011;5:55-61.
  20. Bhawsar A, Vyas V. Estimation of water quality index in barna stream network of Narmada River basin. International Journal of Current Research. 2014;6(09):8600-8604.
  21. Chandra R, Gupta M, Pandey A. Monitoring of river Ram Ganga: physico chemical characteristics at Bareilly. Recent Research in Science and Technology. 2011;3(6):16-18.
  22. Saksena DN, Garg RK, Rao RJ. Water quality and pollution status of Chambal River in National Chambal sanctuary, Madhya Pradesh. Journal of Environmental Biology. 2008;29(5):701-710.
  23. Mishra A, Mukherjee A, Tripathi BD. Seasonal and temporal variations in physicochemical and bacteriological characteristics of river Ganga in Varanasi. Int. J Environ. Res. 2009;3(3):395-402.
  24. World Health Organization. Guidelines for drinkingwater quality. 2<sup>nd</sup> ed; c1997, 3. [https://www.who.int/water\\_sanitation\\_health/dwq/gdwqvol32ed.pdf](https://www.who.int/water_sanitation_health/dwq/gdwqvol32ed.pdf)
  25. Indian Standard Drinking Water Specification IS: 10500, Second Revision; c2012.
  26. Simpson EH. Measurement of diversity. nature. 1949 Apr 30;163(4148):688-.
  27. Wiener CS. The Mathematical Theory of Communication: Unknown Distance Function. Urbana, IL: Illinois Press; c1949.
  28. Pielou EC. Shannon's formula as a measure of specific diversity: its use and misuse. The American Naturalist. 1966 Sep 1;100(914):463-5.
  29. Margalef, Ramon. Perspectives in ecological theory; c1968.
  30. Uribe CL, Schweikhart SB, Pathak DS, Marsh GB, Fraley RR. Perceived barriers to medical-error reporting: an exploratory investigation. Journal of Healthcare Management. 2002 Jul 1;47(4):263.