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ASSESSMENT OF WAINGANGA RIVER WATER IN SEONI DISTRICT (M.P.), INDIA, WITH SPECIAL REFERENCE TO FISH DIVERSITY

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ABSTRACT



The Wainganga River is an important freshwater ecosystem of Madhya Pradesh and forms part of the Godavari river basin. This proposed study examines the hydrobiological characteristics of selected stretches of the Wainganga River in Seoni district, with special reference to fish diversity and fisheries resources. Assessment of water quality of Wainganga River was carried out for a period of one year from June 2023 to May 2024 from three different stations at Seoni (M.P.). The study focuses on physicochemical parameters such as water temperature, pH, dissolved oxygen (DO), biological oxygen demand (BOD), total dissolved solids (TDS), electrical conductivity, hardness and nutrients. Fish diversity, seasonal distribution and the relationship between water quality and fish communities are also considered. A seasonal, station-wise assessment can provide useful information for sustainable fisheries management and aquatic biodiversity conservation. Numerical results included in the results section are illustrative examples only and must be replaced with actual field and laboratory observations before submission or publication. These attributes were examined and contrasted with the benchmark values suggested by the World Health Organization and the Bureau of Indian Standards. The goal of the current study is to determine the Wainganga River's water quality at Seoni. The findings showed that most of the indicators showed notable seasonal fluctuations; the water was determined to be hard, filthy, and unsuitable for fish, residential, and agricultural growth.

KEYWORDS : *Wainganga River, Hydrobiology, Fish Diversity, Fisheries, Water Quality, Seoni, Madhya Pradesh.*

1. INTRODUCTION

India has a rich nature of heritage and nurtures a unique biodiversity, placing it among the 12 most biodiversity rich countries (Jain et al., 2014). The varied weather, climatic conditions and physico-geographic topographies are the most important factors responsible for rich biodiversity. In many instances, biodiversity has been referred to as “life” or “wilderness”. Capacity of living systems for responding to the changing environmental conditions is affected by the biodiversity of that region and is an essential factor for providing goods and services from ecosystems, nutrient cycles and water. India is among the countries which have rich biodiversity and with reference to freshwater diversity occupies the ninth position.

Rivers are dynamic freshwater ecosystems that support phytoplankton, zooplankton, benthic organisms and fish communities. Their ecological productivity is influenced by physical, chemical and biological characteristics of water and by seasonal changes in flow. Hydrobiological studies help evaluate aquatic ecosystem condition and identify factors that influence fisheries.

The Wainganga is a major tributary within the Godavari river system. It originates in the Seoni region of Madhya Pradesh and flows through parts of Madhya Pradesh and Maharashtra. The river and its associated water bodies support aquatic habitats, agriculture, domestic water use and fishing-related livelihoods. The Seoni stretch is therefore an appropriate area for a focused investigation of water quality and fish resources.

Fish distribution is affected by dissolved oxygen, temperature, pH, nutrients, water velocity, substrate, habitat connectivity, food availability and fishing pressure. A combined assessment of water quality and fish diversity across seasons and sampling stations can help explain local patterns and support evidence-based conservation.

2. OBJECTIVES OF THE STUDY

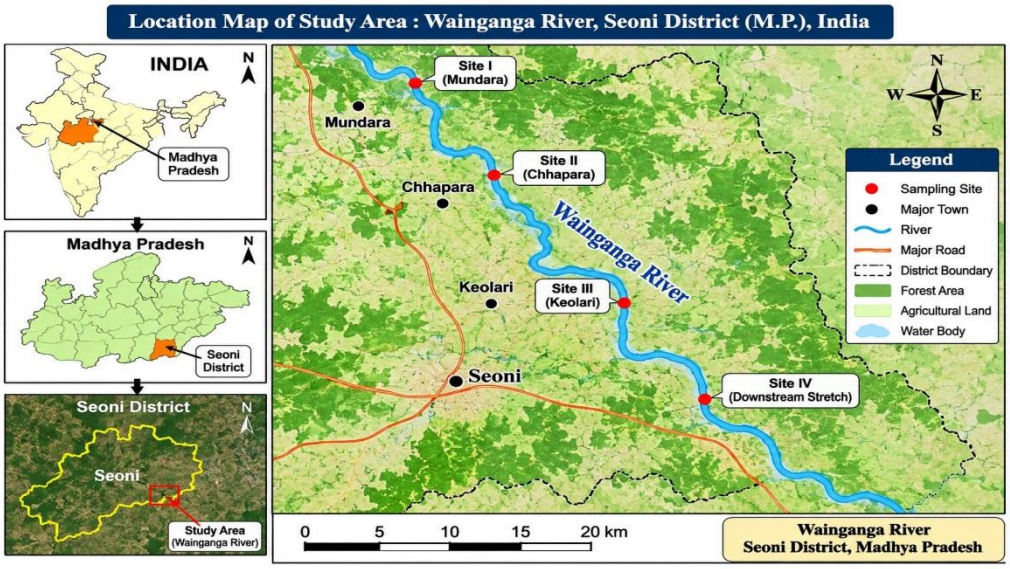
1. To investigate the physicochemical characteristics of Wainganga River water in selected stretches of Seoni district.
2. To assess seasonal variation in important hydrobiological parameters.
3. To document fish species occurring at selected sampling stations.
4. To assess fish diversity, relative abundance and distribution.
5. To examine possible relationships between water quality and fish diversity.
6. To identify potential threats to aquatic biodiversity and fisheries resources.
7. To suggest measures for sustainable fisheries development and river conservation.

3. STUDY AREA

The proposed study area comprises selected stretches of the Wainganga River in Seoni district, Madhya Pradesh, India. Sampling stations may be selected near the river's source region around Mundara, Chhapara, Keolari and a suitable downstream stretch, subject to field reconnaissance and access. The final station coordinates should be recorded using GPS. Seasonal rainfall, river discharge, surrounding land use, settlements and agricultural activities should be documented as contextual variables.

Proposed sampling stations:

- Station I – Mundara region
- Station II – Chhapara
- Station III – Keolari
- Station IV – selected downstream stretch



REVIEW OF LITERATURE:-

The survival of all life depends on rivers, which are delicate freshwater ecosystems. However, it is concerning since the deteriorating water quality in these systems jeopardizes their sustainability. Rivers are strategically significant waterways that supply essential water resources for household, industrial, and agricultural uses worldwide (Sharma *et al*., 2020).

The maintenance of healthy aquatic ecosystem is required for ecological balance and agriculture (Khan *et al.* 2003), which depends on good physico-chemical properties of water. India is gifted with a river system comprising more than 20 major rivers with several tributaries (Kumar *et al*., 2005) and more than 50% of water resources of India are located in various tributaries of these river systems (Lal, 2001).

Wainganga River is one of the key tributaries of the river Godavari. The river rises in the Mahadeo Hills in the Seoni District of Madhya Pradesh. The Wainganga after joining the Wardha River at Chaprala in Gadchiroli district (Maharashtra) is known as the Pranahita River. Wainganga river is polluted due to solid, liquid wastes and sewage disposal which is largely responsible for pollution. Although a large number of workers have studied the hydrobiological parameters and plankton as well as fish diversity of fresh water bodies including Allen (1976), Choudhary (1990), Prakash (2020), Singh and Verma (2016), Kumari *et al.*, (2021), Baghel (2023) Verma and Haque, (2023b), Verma and Prakash (2018, 2020a), Bhagde *et al*., (2020) but till now there is no sufficient baseline data about physicochemical parameters of Wainganga river at Balaghat. Thus, the current study was conducted to investigate the Wainganga River's hydrobiological features in connection to pollution and fishing. The study's goals were to improve the river's hydrobiological state and investigate potential avenues for improved development and management.

4. MATERIALS AND METHODS

4.1 Study period and sampling design

The Wainganga River at Seoni, District- Seoni. The Wainganga River originates in the Mahadeo Hills in Mundara near the village Gopalganj in Seoni District- Seoni (M.P.). This River travels from west to east. The Wainganga River has a length of nearly 569 km and flows through the states of Madhya Pradesh and Maharashtra. The water samples were collected from four different sites in morning between 8.30 and 9.30 a.m. during the period of June 2023 to May 2024. Water was collected using sterile glass stopped bottles and 2L capacity plastic bottle. The estimation of various physico- chemical parameters was done following standard methods described by APHA (2005) , Trivedy and Goel (1986) and Kodarkar (1998).

4.2 Water sampling and analysis

Water samples should be collected in clean, appropriately labelled bottles using standard sampling procedures. Temperature and pH should preferably be measured in situ. Dissolved oxygen, BOD, TDS, electrical conductivity, alkalinity, hardness, nitrate and phosphate should be analysed using standard laboratory methods, with appropriate preservation and quality-control procedures.

4.3 Fish diversity assessment

Fish observations may be obtained through permitted local fishing methods, landing-site surveys, fisher interviews and direct field observations. Sampling effort and gear type should be kept consistent between stations and seasons. Species identification should be verified using standard taxonomic keys and, where possible, expert confirmation and photographic records. Required permissions and ethical practices must be followed.

4.4 Diversity indices

Fish community structure may be evaluated using the Shannon–Wiener diversity index, Simpson's diversity index, Margalef's richness index and Pielou's evenness index. The abundance measure and sampling effort used for each index should be clearly reported.

5. HYDROBIOLOGICAL PARAMETERS

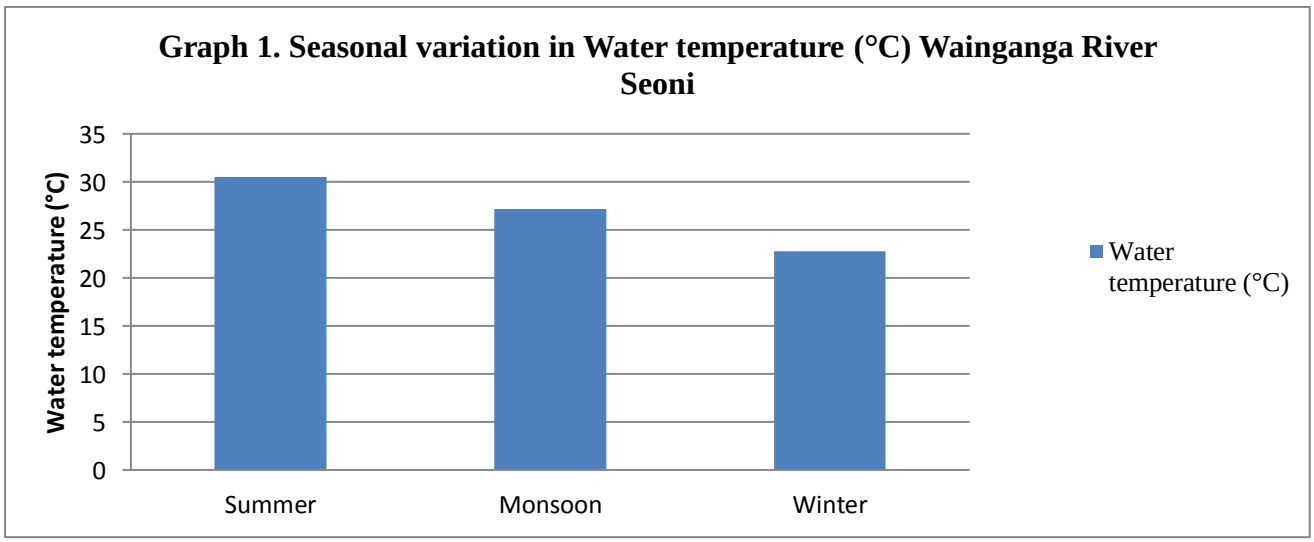
Parameter	Unit	Relevance to Fisheries
Water temperature	°C	Influences metabolism, growth and reproduction.
pH	pH unit	Affects physiological processes and chemical availability.
Dissolved oxygen (DO)	mg/L	Essential for fish respiration and aquatic life.
Biological oxygen demand (BOD)	mg/L	Indicates oxygen demand from biodegradable organic matter.
Total dissolved solids (TDS)	mg/L	Reflects dissolved substances in water.
Electrical conductivity	µS/cm	Indicates ionic content of water.
Total hardness	mg/L as $CaCO_3$	Reflects calcium and magnesium content.
Nitrate and phosphate	mg/L	Nutrients influencing primary productivity and eutrophication.

6. RESULTS AND DISCUSSION

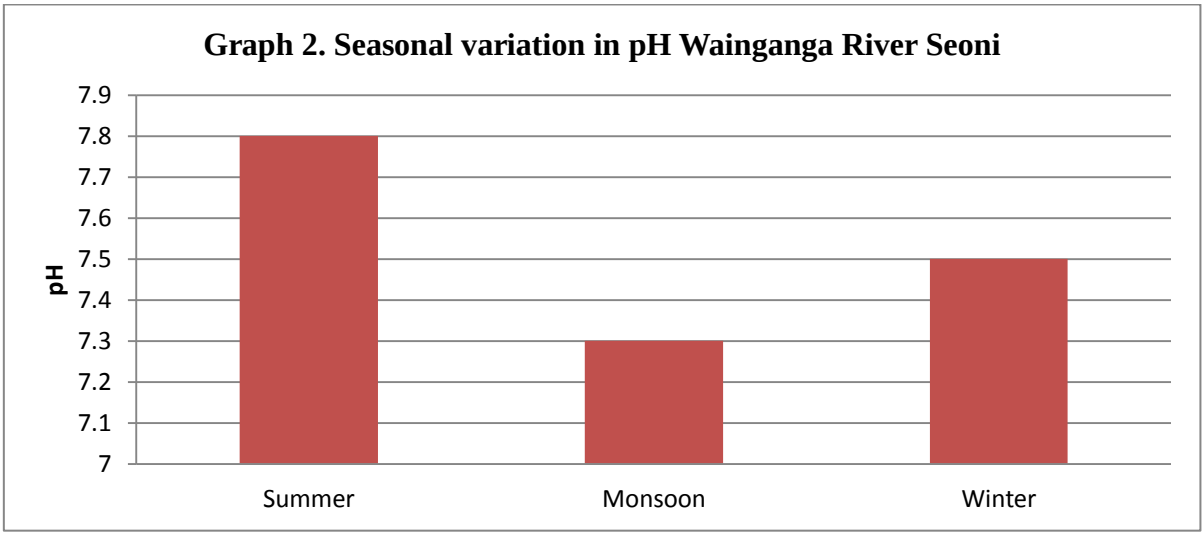
The water quality parameters and their range and mean values for selected sampling sites are presented in Tables 1 and 3 below are illustrative sample data prepared only to demonstrate how results may be presented. They are not verified measurements from the Wainganga River. Replace them with actual field and laboratory data before using this paper as an original research report.

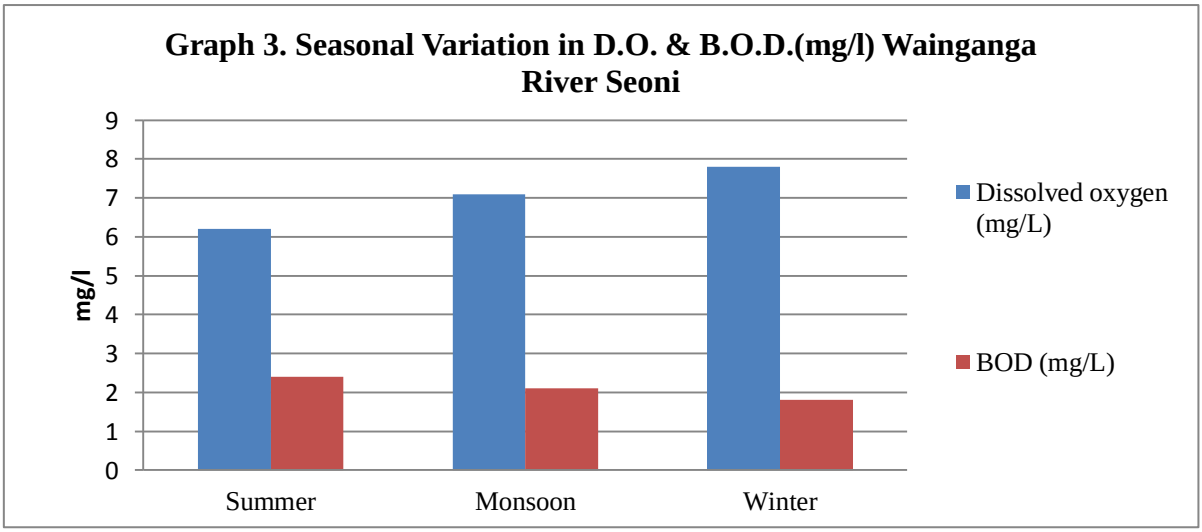
6.1 Seasonal variation in physicochemical parameters

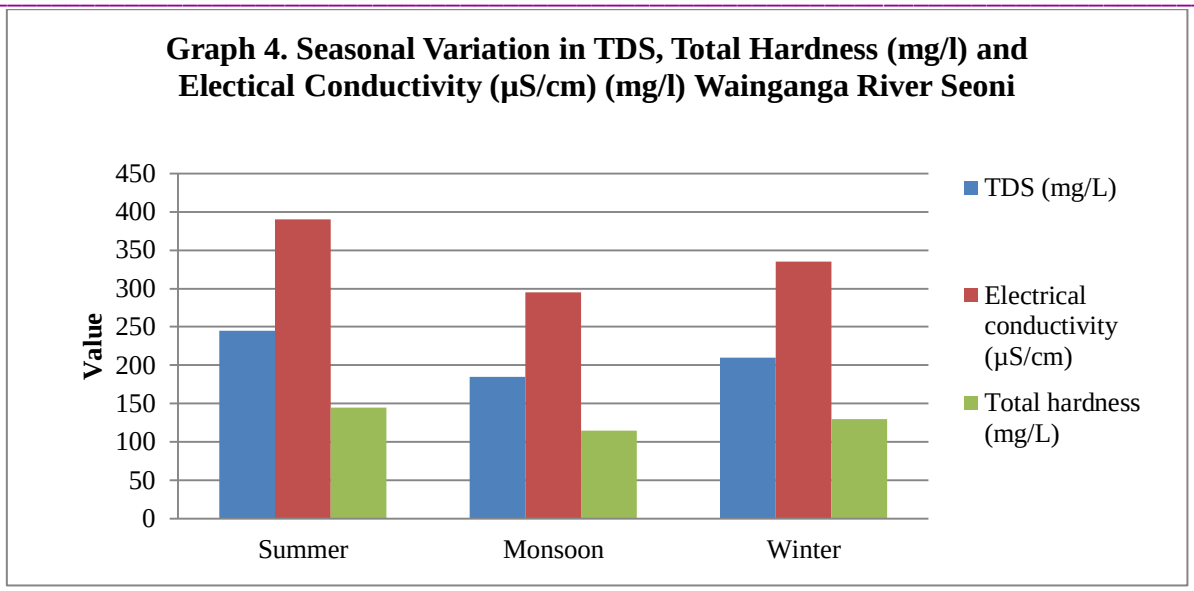
Parameters	Summer	Monsoon	Winter
Water temperature (°C)	30.5	27.2	22.8
pH	7.8	7.3	7.5
Dissolved oxygen (mg/L)	6.2	7.1	7.8
BOD (mg/L)	2.4	2.1	1.8
TDS (mg/L)	245	185	210
Electrical conductivity (µS/cm)	390	295	335
Total hardness (mg/L)	145	115	130
Nitrate (mg/L)	1.2	1.8	1.1
Phosphate (mg/L)	0.12	0.19	0.10

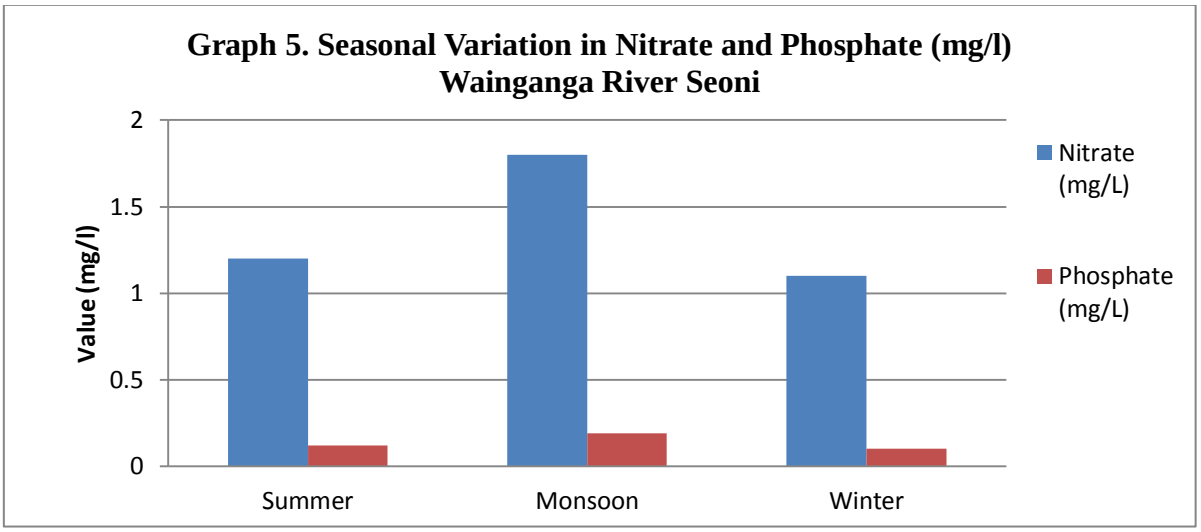


Illustrative results show seasonal variation in the physicochemical characteristics of river water. Temperature is highest during summer (30.5°C) and lowest during winter (22.8°C). The pH range of 7.3–7.8 represents slightly alkaline conditions within this example dataset. Dissolved oxygen is highest in winter (7.8 mg/L) and lowest in summer (6.2 mg/L), a pattern that may be consistent with the effect of temperature on oxygen solubility. BOD ranges from 1.8 to 2.4 mg/L. TDS and electrical conductivity are highest in summer and lowest during monsoon in the illustrative dataset. Such seasonal patterns must be tested against actual measurements and local hydrological conditions.









6.2 Fish diversity

S. No.	Candidate Fish Species	Family	Feeding Habit
1	*Labeo rohita*	Cyprinidae	Column feeder
2	*Catla catla*	Cyprinidae	Surface feeder
3	*Cirrhinus mrigala*	Cyprinidae	Bottom feeder
4	*Channa punctata*	Channidae	Carnivorous
5	*Mystus vittatus*	Bagridae	Omnivorous
6	*Wallago attu*	Siluridae	Carnivorous
7	*Clarias batrachus*	Clariidae	Omnivorous
8	*Puntius sophore*	Cyprinidae	Omnivorous
9	*Rita rita*	Bagridae	Bottom feeder
10	*Amblypharyngodon mola*	Danionidae	Omnivorous

The species listed in Table 2 are candidate freshwater taxa for field identification and are not a confirmed checklist for the selected Seoni sampling stations. Each record should be supported by field evidence, taxonomic verification and the sampling location and date.

6.3 Seasonal fish species richness

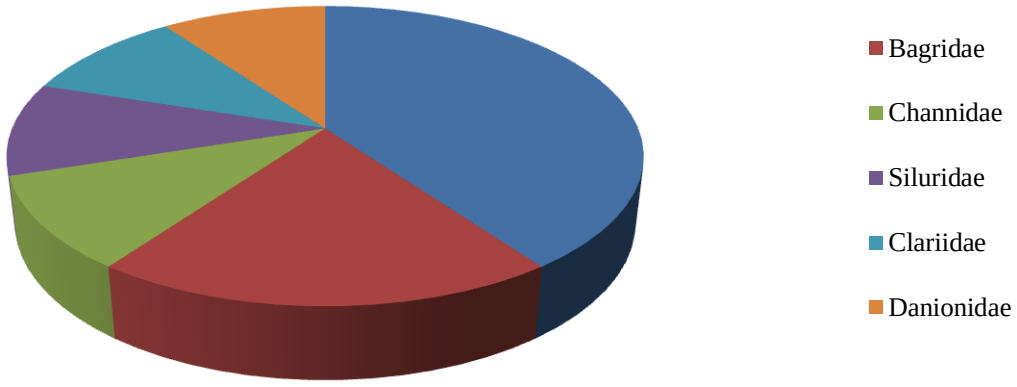
Season	Illustrative number of species	Relative abundance (qualitative)
Summer	8	Moderate
Monsoon	10	High
Winter	9	Moderate to high

In the illustrative example, species richness is highest during monsoon, followed by winter and summer. Increased water volume and habitat connectivity may facilitate movement and expand available habitats during the rainy season. However, observed richness is also affected by sampling effort, gear selectivity, spawning behaviour and fishing activity. Therefore, standardized sampling is essential before drawing conclusions about seasonal abundance.

6.4 Family-wise representation

Family	Illustrative number of species
Cyprinidae	4
Bagridae	2
Channidae	1
Siluridae	1
Clariidae	1
Danionidae	1
Total	10

Graph. 6- Family wise representation number of Fish species in Wainganga River Seoni



The illustrative family-wise distribution contains a higher number of cyprinid candidates. This should not be interpreted as the actual dominance pattern in the study area until all collected specimens have been identified and counted.

6.5 Discussion of major hydrobiological factors

Water temperature and fish diversity

Temperature influences fish metabolism, feeding, growth and reproduction. Higher summer temperatures can reduce oxygen solubility and may increase physiological stress, depending on species and habitat conditions.

pH and aquatic productivity

pH affects fish physiology and the availability of nutrients and other dissolved substances. The illustrative pH values are slightly alkaline, but actual suitability must be assessed using repeated field measurements and relevant ecological standards.

Dissolved oxygen

Dissolved oxygen is essential for fish respiration. Low oxygen may reduce feeding and growth and, under severe conditions, cause fish mortality. Continuous or repeated measurements are useful because oxygen can vary over a 24-hour cycle.

Biological oxygen demand

BOD reflects oxygen consumed during microbial decomposition of biodegradable organic matter. Higher BOD can indicate greater organic loading, but interpretation should consider sampling conditions, laboratory method and other water-quality indicators.

Seasonal fish distribution

Monsoon flows can increase habitat connectivity and provide access to feeding and breeding habitats. Nevertheless, seasonal fish records can also reflect changes in catchability and fishing effort rather than only changes in the fish population.

Fisheries and livelihoods

The river's fish resources can support local livelihoods and food security. Sustainable management should protect breeding habitats, discourage destructive fishing, monitor water quality and involve local fishing communities.

7. MAJOR FINDINGS AND RESEARCH IMPLICATIONS

- Seasonal variation in temperature, dissolved oxygen, nutrients and dissolved solids should be assessed at every sampling station.
- Fish species richness and community composition may vary spatially and seasonally; consistent sampling effort is required for comparison.
- Water-quality measurements should be analysed alongside fish abundance and habitat observations.
- Potential pressures such as domestic wastewater, agricultural runoff, sedimentation and fishing pressure should be documented rather than assumed.
- Long-term monitoring can support conservation planning and sustainable fisheries management.

8. CONCLUSION

The Wainganga River is an important freshwater ecosystem in Seoni district, Madhya Pradesh. A systematic hydrobiological assessment of selected river stretches can improve understanding of seasonal water-quality conditions and their relationship with fish diversity and fisheries resources. Parameters such as temperature, pH, dissolved oxygen, BOD, TDS and nutrients, when combined with verified fish records and biodiversity indices, can provide a sound basis for evaluating ecological conditions. The current investigation's findings show that the water is unfit for household, agricultural, or drinking uses. This river was deemed unsuitable for fish cultivation in its current state. Human activity and unlawful commercial projects in the Wainganga River's basin were the cause of the issue. The river, a natural drain, is turned into a "nallah" (channel) where untreated solid and liquid municipal trash is deposited, severely polluting the priceless aquatic resource. Protection of fish habitats, prevention of pollution, responsible fishing practices and participation of local communities are important for sustaining the river's aquatic biodiversity and fisheries.

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