

## Comparative Study of Physico-Chemical Parameters and Fish Diversity: A Case Study of Ozarkhed and Gangapur Dams, Nashik

**Harshal Gavit**, Zoology Research Centre, PG Department, Faculty of Science, KTHM College Nashik (M.S.) E-mail: harshalgavit2013@gmail.com

**Dhanraj Goswami**, Department Zoology, K.V.N.Naik College, Nashik (M.S.)

### ABSTRACT

The present study investigates the comparative status of physico-chemical water quality parameters and fish diversity in two important freshwater reservoirs of Nashik district, Maharashtra, namely Ozarkhed Dam and Gangapur Dam. Freshwater ecosystems play a vital role in maintaining ecological balance, supporting aquatic biodiversity, and providing water resources for domestic, agricultural, and fishery purposes. The study was conducted to assess the seasonal variation in water quality and its influence on ichthyofaunal diversity in these reservoirs.

Water samples were collected from both dams during three major seasons, namely Monsoon, Post-Monsoon, and Pre-Monsoon, and analyzed for selected physico-chemical parameters such as temperature, pH, dissolved oxygen (DO), biological oxygen demand (BOD), chemical oxygen demand (COD), turbidity, electrical conductivity (EC), total dissolved solids (TDS), total suspended solids (TSS), alkalinity, hardness, chlorides, nitrates, phosphates, sulphates, and ammonia. Simultaneously, fish diversity was assessed through field observations, local fish catch records, fishermen interactions, and taxonomic identification of fish species.

The comparative analysis revealed significant seasonal fluctuations in water quality parameters in both reservoirs. Higher turbidity, nutrient concentration, and suspended solids were recorded during the monsoon season due to runoff and sediment inflow, whereas elevated temperature and dissolved solids were observed during the pre-monsoon season due to evaporation and reduced water volume. Gangapur Dam exhibited comparatively better dissolved oxygen and moderate nutrient levels, favoring richer fish diversity, while Ozarkhed Dam showed slightly higher fluctuations in nutrient load and suspended matter. The fish diversity analysis indicated the presence of economically and ecologically important freshwater fish species belonging to families such as Cyprinidae, Bagridae, Channidae, Siluridae, Cichlidae, and Notopteridae.

The study concludes that water quality strongly influences fish diversity and distribution in freshwater reservoirs. Seasonal monitoring of water quality and ichthyofaunal composition is therefore essential for sustainable fisheries management, aquatic biodiversity conservation, and reservoir ecosystem health.

**Keywords:** Physico-chemical parameters, Fish diversity, Ichthyofauna, Ozarkhed Dam, Gangapur Dam, Water quality, Seasonal variation

## 1. INTRODUCTION

Freshwater ecosystems constitute one of the most valuable natural resources on Earth and are indispensable for ecological sustainability, agricultural productivity, fisheries development, and human welfare. Lakes, reservoirs, ponds, and dams provide critical habitats for a wide variety of aquatic organisms, especially fish, which serve as an important source of food, livelihood, and ecological balance. Among the many factors influencing freshwater biodiversity, water quality plays a central role in determining the survival, growth, reproduction, and distribution of aquatic organisms.

Reservoir ecosystems in India have been increasingly subjected to environmental stress due to urbanization, agricultural runoff, industrial discharges, eutrophication, and climatic variability. Such disturbances affect the physico-chemical nature of water and ultimately influence the composition and abundance of aquatic fauna. Fish, being highly sensitive to changes in water quality, are often considered excellent bioindicators of aquatic ecosystem health.

The Nashik district of Maharashtra is well known for its river systems, reservoirs, and irrigation dams, which support irrigation, drinking water supply, and inland fisheries. Among these, Ozarkhed Dam and Gangapur Dam are two important freshwater bodies with ecological and economic significance. These reservoirs support local fishery activities and provide habitat for a variety of freshwater fish species. However, increasing anthropogenic pressure, changing hydrological patterns, and seasonal variations may affect their water quality and fish diversity.

Physico-chemical characteristics such as temperature, pH, dissolved oxygen, turbidity, alkalinity, conductivity, hardness, and nutrient content directly or indirectly regulate fish diversity by influencing breeding grounds, food availability, metabolic activity, and habitat suitability. Therefore, a comparative assessment of these parameters along with fish diversity provides a more comprehensive understanding of reservoir ecology.

Although several studies have examined water quality or fish diversity independently, integrated studies combining both aspects in the context of Nashik reservoirs remain limited. Hence, the present research attempts to undertake a comparative study of physico-chemical parameters and fish diversity in Ozarkhed and Gangapur Dams to understand the ecological condition of these freshwater bodies and to generate baseline data for future conservation and management planning.

## 2. NEED AND SIGNIFICANCE OF THE STUDY

The present study is important for the following reasons:

1. Reservoirs are major freshwater ecosystems that support fisheries, irrigation, and biodiversity.
2. Water quality directly influences fish diversity, productivity, and survival.
3. Seasonal changes in reservoirs affect physico-chemical balance and aquatic life.
4. Comparative studies help identify ecological differences between freshwater bodies.
5. The study provides baseline scientific data useful for:
  - fishery development,

- biodiversity conservation,
- pollution monitoring,
- water resource management.

This research is therefore highly significant from ecological, environmental, economic, and fisheries management perspectives.

### **3. OBJECTIVES OF THE STUDY**

The study was undertaken with the following objectives:

1. To analyze the physico-chemical parameters of water from Ozarkhed and Gangapur Dams.
2. To compare the seasonal variation in water quality of both reservoirs.
3. To document the fish diversity present in the two dams.
4. To identify the relationship between water quality and fish diversity.
5. To evaluate the ecological health of both reservoirs for sustainable fishery management.
6. To provide scientific suggestions for conservation and monitoring of reservoir ecosystems.

### **4. HYPOTHESES OF THE STUDY**

1. There is no significant difference in the physico-chemical parameters of Ozarkhed and Gangapur Dams.
2. There is no significant difference in fish diversity between Ozarkhed and Gangapur Dams.
3. Seasonal changes do not significantly affect water quality and fish diversity in the selected reservoirs.

### **5. STUDY AREA**

#### **5.1 Ozarkhed Dam**

Ozarkhed Dam is located in Nashik district, Maharashtra, and is one of the important freshwater reservoirs in the region. It serves irrigation and domestic water needs and supports local fishery activities. The reservoir receives inflow from surrounding agricultural and catchment areas, making it susceptible to seasonal runoff and nutrient input.



Figure 1: View of Ozarkhed Dam, Nashik

## 5.2 Gangapur Dam

Gangapur Dam is another major reservoir situated near Nashik city. It is ecologically important and also supports water supply, agriculture, and fishery resources. Owing to its catchment and hydrological conditions, it presents a suitable site for comparative limnological and ichthyofaunal analysis.

Both reservoirs are exposed to seasonal climatic changes such as monsoon rainfall, summer evaporation, and post-monsoon dilution effects, which influence their water quality and aquatic biodiversity.



Figure 2: View of Gangapur Dam, Nashik

## 6. MATERIALS AND METHODS

### 6.1 Research Design

The present study is based on an experimental and comparative field-based research design.

### 6.2 Sampling Period

Water and fish samples were collected systematically throughout the study period covering three distinct seasons: Monsoon, Post-Monsoon, and Pre-Monsoon. Seasonal sampling was carried out to observe variations in physico-chemical parameters and fish diversity, ensuring a comprehensive understanding of temporal changes influencing the aquatic ecosystem of both reservoirs.

### 6.3 Sampling Sites

Selected sampling sites were identified from both Ozarkhed Dam and Gangapur Dam for the present investigation. The sites were chosen on the basis of accessibility, fishing activity, ecological representation, and water spread area. These criteria ensured proper coverage of representative zones for studying water quality and fish diversity.

### 6.4 Collection of Water Samples

Water samples were collected in clean polyethylene bottles from selected locations and transported to the laboratory for analysis.

### **6.5 Physico-Chemical Parameters Studied**

In the present study, important physico-chemical parameters of water were analyzed to assess the ecological condition of Ozarkhed Dam and Gangapur Dam. The selected parameters included water temperature, pH, turbidity, dissolved oxygen (DO), biological oxygen demand (BOD), chemical oxygen demand (COD), electrical conductivity (EC), total dissolved solids (TDS), total suspended solids (TSS), alkalinity, hardness, chlorides, nitrate, phosphate, sulphate, and ammonia. These parameters were chosen because they play a vital role in determining water quality and directly influence aquatic life, especially fish diversity, productivity, metabolic activity, survival, and the overall health of the freshwater ecosystem.

### **6.6 Methods of Analysis**

Standard analytical procedures were used for water quality assessment:

- Temperature – Thermometer / digital meter
- pH – pH meter
- DO – Winkler's method
- BOD – Incubation method
- COD – Dichromate reflux method
- Turbidity – Nephelometric method
- EC/TDS – Conductivity meter
- Nutrients and ions – Standard titration / spectrophotometric methods

### **6.7 Fish Diversity Assessment**

Fish diversity was studied using the following methods:

1. Direct field observations
2. Collection from local fishermen catches
3. Interviews with fishermen
4. Fish market surveys
5. Identification using standard fish taxonomy manuals

### **6.8 Identification of Fish Species**

Collected and observed fish specimens from Ozarkhed Dam and Gangapur Dam were identified up to species level using standard taxonomic procedures. Identification was primarily based on external morphological characteristics such as body shape, fin structure, scale pattern, mouth position, presence or absence of barbels, and body coloration. These features are important for distinguishing freshwater fish species accurately. The identification process was carried out with the help of standard fish taxonomy manuals, field guides, and available scientific literature. Proper

identification of fish species was essential for documenting ichthyofaunal diversity and understanding the relationship between fish distribution and water quality in both reservoirs.

## 7. RESULT AND DISCUSSION

### 7.1 Physico-Chemical Analysis of Ozarkhed and Gangapur Dams

Table 1: Seasonal Physico-Chemical Parameters of Ozarkhed and Gangapur Dams

Parameter	Unit	Ozarkhed Monsoon	Ozarkhed Post- Monsoon	Ozarkhed Pre- Monsoon	Gangapur Monsoon	Gangapur Post- Monsoon	Gangapur Pre- Monsoon
Temperature	°C	25.8	23.9	29.1	26.1	24.2	28.7
pH	-	7.1	7.4	7.8	7.2	7.5	7.9
Turbidity	NTU	38.5	16.2	8.1	34.7	14.8	7.4
DO	mg/L	6.1	7.4	5.3	6.4	7.8	5.7
BOD	mg/L	3.5	2.4	4.6	3.2	2.1	4.2
COD	mg/L	24.3	17.6	21.4	22.5	16.2	20.1
EC	µS/cm	335	382	448	320	370	430
TDS	mg/L	470	535	695	450	520	670
TSS	mg/L	66.4	29.3	18.5	61.8	25.1	17.2
Alkalinity	mg/L	152	164	185	148	160	180
Hardness	mg/L	188	212	248	182	205	240
Chlorides	mg/L	34.2	41.6	53.8	32.8	40.4	50.6
Nitrate	mg/L	6.2	4.1	7.4	5.7	3.8	6.9
Phosphate	mg/L	1.2	1.0	1.3	1.1	0.9	1.2
Sulphate	mg/L	24.5	22.1	26.7	23.8	21.5	25.8
Ammonia	mg/L	0.16	0.11	0.18	0.14	0.10	0.16

### 7.2 Interpretation of Physico-Chemical Parameters

#### Temperature

Water temperature in both dams showed expected seasonal fluctuation. Lower temperatures were observed during the post-monsoon season, whereas higher values were recorded in the pre-monsoon season. This increase in summer temperature may influence fish metabolism, oxygen solubility, and biological activity.

## pH

The pH of both reservoirs remained within a slightly alkaline range, which is generally suitable for freshwater fish species. Gangapur Dam exhibited slightly better pH stability than Ozarkhed Dam, indicating a comparatively balanced aquatic environment.

## Turbidity

Turbidity was highest during the monsoon season in both dams due to sediment inflow, runoff, and suspended matter carried by rainwater. Ozarkhed Dam showed comparatively higher turbidity, suggesting stronger catchment runoff influence.

## Dissolved Oxygen (DO)

Dissolved oxygen levels were found to be higher during the post-monsoon season due to cooler temperatures and dilution effects. Gangapur Dam exhibited slightly higher DO than Ozarkhed Dam, which may support better fish survival and aquatic productivity.

## Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD)

BOD and COD values were comparatively higher during the pre-monsoon season, indicating increased organic load, reduced dilution, and higher decomposition activity. Elevated BOD and COD can adversely affect fish habitat quality.

## Electrical Conductivity (EC), TDS, and TSS

EC and TDS values were higher during the pre-monsoon season, possibly due to evaporation and concentration of dissolved salts. TSS values were highest during the monsoon, due to sediment suspension and runoff. These parameters influence water clarity, fish breeding habitats, and feeding efficiency.

## Nutrients (Nitrate and Phosphate)

Nitrate and phosphate concentrations showed moderate seasonal variation. Increased nutrient concentration may support productivity to some extent but can also lead to eutrophication if excessive.

## Alkalinity, Hardness, and Chlorides

These parameters remained within moderate range in both reservoirs, indicating reasonably suitable conditions for freshwater fish and other aquatic organisms.

## 8. FISH DIVERSITY ANALYSIS

### 8.1 Fish Species Recorded from Ozarkhed and Gangapur Dams

Table 2: Fish Diversity of Ozarkhed and Gangapur Dams

Sr. No.	Common Name	Scientific Name	Family	Ozarkhed Dam	Gangapur Dam
1	Catla	<i>Catla catla</i>	Cyprinidae	Present	Present
2	Rohu	<i>Labeo rohita</i>	Cyprinidae	Present	Present
3	Mrigal	<i>Cirrhinus mrigala</i>	Cyprinidae	Present	Present
4	Common Carp	<i>Cyprinus carpio</i>	Cyprinidae	Present	Present
5	Grass Carp	<i>Ctenopharyngodon idella</i>	Cyprinidae	Present	Present
6	Silver Carp	<i>Hypophthalmichthys molitrix</i>	Cyprinidae	Present	Present
7	Tilapia	<i>Oreochromis mossambicus</i>	Cichlidae	Present	Present
8	Murrel	<i>Channa striata</i>	Channidae	Present	Present
9	Snakehead	<i>Channa punctata</i>	Channidae	Present	Present
10	Magur	<i>Clarias batrachus</i>	Clariidae	Present	Rare
11	Singhi	<i>Heteropneustes fossilis</i>	Heteropneustidae	Present	Rare
12	Wallago	<i>Wallago attu</i>	Siluridae	Rare	Present
13	Mystus	<i>Mystus seenghala</i>	Bagridae	Present	Present
14	Featherback	<i>Notopterus notopterus</i>	Notopteridae	Rare	Present
15	Glass Fish	<i>Parambassis ranga</i>	Ambassidae	Present	Present
16	Puntius	<i>Puntius sophore</i>	Cyprinidae	Present	Present
17	Rasbora	<i>Rasbora daniconius</i>	Cyprinidae	Present	Present
18	Eel	<i>Anguilla bengalensis</i>	Anguillidae	Rare	Rare

### 8.2 Comparative Fish Diversity

The fish diversity survey indicated that both reservoirs support a moderately rich ichthyofaunal composition, dominated by members of the family Cyprinidae. This is common in Indian freshwater ecosystems due to the adaptability and economic importance of carps.

Ozarkhed Dam

Ozarkhed Dam showed the presence of several commercially important and ecologically significant species. However, the diversity appeared comparatively moderate due to seasonal turbidity, suspended solids, and nutrient fluctuations.

### Gangapur Dam

Gangapur Dam recorded relatively better fish diversity and abundance, likely due to more stable water quality, comparatively better dissolved oxygen levels, and moderate habitat conditions. Some species such as *Wallago attu* and *Notopterus notopterus* were more frequently observed here.



Figure 3: Representative Freshwater Fish Diversity

## 9. RELATIONSHIP BETWEEN WATER QUALITY AND FISH DIVERSITY

The study clearly indicates a strong ecological relationship between physico-chemical parameters and fish diversity.

### Influence of Key Parameters on Fish Diversity

1. Dissolved Oxygen (DO): Higher DO supports fish survival, respiration, breeding, and larval development.
2. Temperature: Water temperature regulates metabolism, feeding, growth, and reproductive cycles.
3. pH: Stable pH supports physiological functioning and egg survival.
4. Turbidity: Excess turbidity affects visibility, feeding behavior, spawning grounds, and gill function.

5. BOD and COD: High organic load may reduce oxygen availability and create stress for fish populations.
6. Nutrients (Nitrate and Phosphate): Moderate levels may enhance productivity, but excessive nutrient load can trigger eutrophication and habitat degradation.

Thus, fish diversity was found to be comparatively richer in seasons and sites where water quality was more stable and ecologically favorable.

## **10. DISCUSSION**

The findings of the present study suggest that both Ozarkhed and Gangapur Dams are ecologically important freshwater bodies with significant fishery potential. Seasonal variation strongly influenced the physico-chemical characteristics of both reservoirs. Similar to other Indian reservoir studies, monsoon season increased turbidity and suspended solids, while pre-monsoon season concentrated dissolved solids and nutrients.

Gangapur Dam exhibited relatively favorable conditions in terms of dissolved oxygen and water stability, which may explain the slightly better fish diversity observed there. Ozarkhed Dam, although also supporting substantial fish diversity, showed somewhat greater fluctuation in water quality parameters.

The predominance of carp fishes and other adaptable freshwater species indicates that both reservoirs continue to support inland fishery resources. However, the occurrence of some sensitive or less abundant species only in limited numbers suggests the need for ecological monitoring and conservation measures.

The results also highlight that physico-chemical monitoring should not be treated separately from biodiversity assessment, because both together provide a complete picture of aquatic ecosystem health.

## **11. CONCLUSION**

The present study entitled “Comparative Study of Physico-Chemical Parameters and Fish Diversity: A Case Study of Ozarkhed and Gangapur Dams, Nashik” concludes that both reservoirs are ecologically productive freshwater ecosystems, but they exhibit clear seasonal and comparative variation in water quality and fish diversity.

The analysis of physico-chemical parameters showed that:

- Monsoon season was characterized by high turbidity and suspended solids,
- Post-monsoon season showed relatively improved water quality,
- Pre-monsoon season recorded higher temperature, dissolved solids, and organic concentration.

Both reservoirs supported a diverse assemblage of freshwater fishes, particularly species belonging to the family Cyprinidae, along with catfishes, murrels, tilapia, and featherbacks. However, Gangapur Dam was found to have slightly more favorable ecological conditions for fish diversity due to better oxygen balance and relatively stable water quality.

The study confirms that water quality is a major ecological determinant of fish diversity and distribution. Therefore, regular seasonal monitoring, pollution control, habitat protection, and scientific fishery management are essential for maintaining the ecological health and fisheries potential of these reservoirs.

In conclusion, the present research provides useful baseline information for future limnological, ecological, and fisheries-related studies in Nashik district and contributes to sustainable freshwater biodiversity conservation.

## 12. RECOMMENDATIONS

Based on the findings of the study, the following recommendations are suggested:

1. Regular seasonal monitoring of water quality should be carried out in both dams.
2. Fish diversity should be documented periodically to track biodiversity changes.
3. Agricultural runoff and nutrient inflow should be minimized through catchment management.
4. Excessive fishing and destructive fishing practices should be controlled.
5. Awareness should be created among local fishermen regarding sustainable fishery practices.
6. Reservoir management authorities should implement aquatic biodiversity conservation strategies.
7. Further studies should include:
  - plankton diversity,
  - sediment analysis,
  - heavy metal assessment,
  - fish breeding ecology.

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