

Evaluation of Physico-chemical parameters in relation to fish production of Bhima River, M.S., India

S.B. Patil

Department of Fishery Science, Arts, Science and Commerce College, Naldurg,
Dist.-Osmanabad 413 602, MS, India

(Received 6 May, 2023; Accepted 8 July, 2023)

ABSTRACT

Water bodies are considered as the most productive ecosystem as they constitute huge floral as well faunal diversities. Water quality is determined by various physico-chemical and biological factors, as they directly or indirectly affect its quality and consequently its suitability for the distribution and production of fish and other aquatic animals. The productivity of fishes depends on various physico-chemical parameters as temperature, pH, electrical conductivity (EC), dissolved oxygen (DO), biochemical oxygen demand (BOD), chemical oxygen demand (COD), total alkalinity (TA) and total hardness (TH). This work intends to assess the water quality and relate it to the fish production.

Key words: Biochemical oxygen demand, Dissolved oxygen, Physico-chemical parameters

Introduction

Water is a renewable natural resource that is essential to all life supporting systems on the planet. Due to over exploitation and pollution, freshwater has become a scarce resource. The maintenance of healthy aquatic ecosystem is dependent on the physico-chemical properties and biological diversity (Abubakar, 2006). The physico-chemical conditions have a significant impact on the living environment of fish and fish farming (Bronmark, 2005). Physico-chemical changes in aquatic systems cause changes in the relative composition and amount of species that survive in the water, making them more valuable as a monitoring tool for aquatic ecosystem. Aquatic quality is defined by the chemical, physical and biological components of water (Ejsmont-Karabin, 2013).

Deterioration in water quality can result in fish

being stressed and vulnerable to disease (Farshad, 2012). These physico-chemical conditions have a very significant impact on the living environment of fish and therefore on fish farming activity. Fish is an inexpensive source of protein and an important cash crop. Water is the physical support in which they carry out their life functions (Haberman, 1998). Bhima river provide feeding and spawning grounds for aquatic ecosystem, fishes, especially *Tilapia mozambica*.

This work evaluate the physico-chemical parameters like temperature, pH, electrical conductivity (EC), total dissolved solids (TDS), dissolved oxygen(DO), biochemical oxygen demand(BOD), chemical oxygen demand (COD), total alkalinity (TA), chlorides(Cl⁻), calcium (Ca²⁺), magnesium (Mg²⁺) and total hardness (TH) and relate it to the fish production of the Bhima river water.

Materials and Methods

The study area

Bhima river is the major river in western india and south india. Bhima river is situated at Northern latitude 17° 57.6408' and Eastern longitude 75° 1.5963'. The Bhima river has become a place for fish and other aquatic organism's growth. Fishery is primary source of income for the local fisherman.

Water sampling

Sampling station was selected within the study area, near to industrial zone Kumbhargaoon. Water sample was collected from sampling station during wet season, winter season and summer season during the year 2021-2022. Water sample was collected in a sterilized 1 liter polythene bottles. The collected sample was brought to the laboratory immediately for further analysis.

Results and Discussion

Results on the regime of seasonal mean variation of physico-chemical parameters of Bhima river are shown in Table 1.

The major aim of the study was to assess the physico-chemical parameters of Bhima river water and its relation to fish production and understand the water quality. The analysis has been specified for twelve parameters. Surface water temperature is one of the most important and changeable environmental factor. Highest water temperature was recorded in summer season 29.5 °C and lowest 23.5 °C in the winter season. Rise in temperature speeds up

the biological and chemical reactions (ICAR; and Jakar, 2013).

pH measures the concentration of hydrogen ions in water and assess the severity of acidity and alkalinity. High rate of photosynthesis in water bodies increases pH values, as in summer season higher pH 8.29 and lower 7.20 in the rainy season was recorded (Kiran, 2010). The alkaline pH provides the growth to natural food organisms and increases the productivity of fish (Kulkarni, 2000).

Electrical conductance (EC) is the property caused by ions. The maximum electrical conductivity was seen in summer season 216.9 µs/cm and 109.5 µs/cm in the rainy season. This shows a positive correlation between conductivity and temperature (Kumar Bankar, 2017).

Total dissolved solids (TDS) are an indication of the degree of the dissolved substances as metal ions in the water. The study has revealed maximum 1660 mg/l in winter season and 850.4 mg/l in the summer season. Water with high amount of dissolved solids may lead to scaling in boilers, corrosions and degradation of products (Kumar, 2006).

Dissolved oxygen (DO) shows the ability of water to purify itself through biochemical processes. During rainy season, dissolved oxygen was recorded higher as 9.05 mg/l and lowest 6.80 mg/l in the summer season. This increase was due to increased mixing of water with atmospheric air (Manickam, 2015). BOD level was observed highest 6.20 mg/l in the summer season and 4.85 mg/l in the winter season. BOD level between 3.0- 6.0 mg/l has been reported as optimal for normal activities of fish. Similar correlation was found for Chemical oxygen demand (COD) as 8.92 mg/l in the summer season

Table 1. Seasonal mean variation in physico-chemical parameters of water sample

Sr. No.	Parameters	Rainy Season	Winter Season	Summer Season
1	Temperature	24.5	23.5	29.5
2	pH	7.20	7.83	8.29
3	Electrical conductivity	109.5	160.2	216.9
4	Total dissolved solids	1350	1660	850.4
5	Dissolved oxygen	9.05	7.59	6.80
6	Biological oxygen demand	5.38	4.85	6.20
7	Chemical oxygen demand	7.16	6.80	8.92
8	Total alkalinity	123.3	144.9	166.5
9	Chloride (Cl ⁻)	192.7	281.6	306.5
10	Calcium(Ca ²⁺)	105	192.5	175.3
11	Magnesium (Mg ²⁺)	77	112.4	129.4
12	Total hardness (TH)	108	230.8	275.5

Temperature in °C, EC in µs/cm, All other units in mg/l

and 6.80 mg/l in the winter season. This decrease was due to decomposition of organic matter (Perga, 2021).

Total alkalinity (TA) is due to presence of the carbonate, bicarbonates and hydroxides. Highest value of alkalinity was recorded in the summer season as 166.5 mg/l and lowest 123.3 mg/l in the rainy season. This was due to higher photosynthetic rate.

The Chloride (Cl⁻) content was found to be high during summer season 306.5 mg/l and low 192.7 mg/l in the rainy season. High chloride indicates pollution from domestic sewage and industrial effluents. Chloride content above 250 mg/cm³ makes water salty (Piska, 2000).

Calcium (Ca²⁺) is an essential element for the fish. Calcium has an important role in the biological processes of fish. The result has revealed that the highest 192.5 mg/l calcium content was recorded in the winter season and lowest 105 mg/l calcium content during rainy season.

Magnesium (Mg²⁺) is essential for the fish growth. Summer season has recorded the highest level of magnesium level as 129.4 mg/l and 77 mg/l in the rainy season. Highest value in the summer might be due to higher decomposition rate of organic matter (Pulle, 2001).

Total hardness (TH) depends upon salts of calcium and magnesium ions in water. It is an index of fertility of the aquatic ecosystem. The highest hardness was noticed in the summer season 275.5 mg/l and lowest 108 mg/l in the rainy season. The increase of hardness in summer was due to decrease in water level and increase in the rate of evaporation (Ventaktesharaju, 2010). The concentration of total hardness was found beyond the permissible limit.

Acknowledgement

Author is thankful to the Management Balaghat Shikshan Sanstha, for providing necessary facilities. Author is also thankful to the Principal Dr. Sanjay Korekar, Arts, Science and Commerce College, Naldurg Dist. Osmanabad.

Conclusion

The present study was conducted to analyze the physico-chemical parameters. It is evident from the present findings that physico-chemical properties of water play a key role in fish food as well as fish production. On the basis of the results obtained indi-

cated that the parameters like pH, dissolved oxygen, biochemical oxygen demand, chemical oxygen demand, total alkalinity, total hardness are well within the permissible limits compared with the water standards. As dissolved oxygen is the most important parameter for the fish production. The study has revealed that dissolved oxygen in the range of 5-10 mg/l is optimum for the production of fish. Biological oxygen demand level is well within the optimum range which is favorable for the fish growth as well production. Findings of the study indicate that most of physico-chemical parameters are within the recommended values. The water of the Bhima river is suitable to support fish production and other aquatic ecosystem. This study showed that fish production is dependent on the quality and management of water characteristics.

References

- Abubakar, K.A., Haruna, A.B. and Ladu, B.M.B. 2006. An assessment of physico-chemical parameters and productivity status of lake Geriyo, Yola, Adamawa State Nigeria. *African Journal of Environmental Science and Technology*. 2 (7): 185-196.
- Bronmark, C. and Hansson, L.A. 2005. The biology of lakes and ponds, Oxford .University Press Oxford. 245-246.
- Ejsmont-Karabin, J. and Karabin, A. 2013. The suitability of zooplankton as lake ecosystem indicators, Crustacean trophic state index. *Polish. J. Ecol.* 61(3) : 561-573.
- Farshad, H. and Venkataramana, G.V. 2012. Impact of physico-chemical parameters of water on Zooplankton Diversity in Nanjangud Industrial Area, India. *Int. Res. J. Environ. Sci.* 1 (4): 37-42.
- Haberman, J. 1998. Zooplankton of Lake Vortsjarv. *Limnologica*. 28(1) : 235-251.
- ICAR, Indian Council of Agricultural Research. Handbook of Fisheries and Aquaculture.
- Jakar, P. 2013. Role of phytoplankton and zooplankton as health indicators of Aquatic ecosystem: A Review. *Int. J. Innov. Res. Stud.* 2(12): 489-500.
- Kiran, B.R. 2010. Physico-chemical characteristics of fish ponds of Bhadra, Karnataka. *RJCABP*. 3: 671-676.
- Kulkarni, J.R. and Shrivastava, V.S. 2000. Physical and chemical investigative for the assessment of pollution in and around industrial area. *Indian J. Env. Prof.* 20(4): 252-256.
- Kumar Bankar, S. and Tiwari, A.K. 2017. Studies on zooplankton diversity in Barchar Dam, Sidhi (M.P.). *Int. J. Fauna Biol. Stud.* 4(1) : 116-118.
- Kumar, K. and Kapoor K. 2006. Water quality monitoring in respect to physico-chemical characteristics of

- tropical lake of Udaipur city of Rajasthan. *Indian J. Environ and Ecoplan.* 12(3) : 775-782.
- Manickam, N., Bhavan, P.S., Santham, P., Murlisankar, T., Srinivasan, V. and Radhakrishnan S. 2015. Biodiversity of freshwater zooplankton and Physico-chemical parameters of Barur lake, Krishnagiri District, Tamilnadu, India. *Malaya J. Bio. Sci.* 2(1) : 1-12.
- Perga, M.E., Syarki, M. and Spangenberg, J.E. 2021. Fasting or feeding: A Planktonic food web under lake ice, *Freshw Biol.* 66(3): 570-581.
- Piska, R.S. 2000. Concepts of Aquaculture, *Lahari Publications*, Hyderabad India. 136-137.
- Pulle, J.S. and Khan, A.M. 2001. Seasonal variation in primary production in Isapur Dam. *J. Aqua. Biol.* 16(1): 19-33.
- Ventaktesharaju, K., Ravikumar, P., Somashekar, P.K. and Prakash, K.L. 2010. Physico-chemical and bacteriological investigation on the river Cauvery of Kollegal stretch in Karnataka University. *Journal of Science, Engineering and Technology.* 6(1): 50-59.
-