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Study on seasonal variation of Dissolved Oxygen (DO) and its impact on zooplankton density in a fishery pond in Birbhum District, West Bengal, India

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Abstract
The present investigation was carried out month wise at different sites of a fishery pond in Birbhum district, West Bengal for a period of 10 months from September 2022 to May 2023. High dissolved oxygen (DO) was found during late winter months due to efficient photosynthetic activity of rich phytoplankton in water that support greater density of zooplankton. The minimum DO level was found due to evaporation as temperature increases during summer months and hence zooplankton density decreases. Dissolved oxygen varies from 4.70 to 16.20 mg/L. during the study period. Highest DO was found in February, 2023 and lowest during August, 2022. Highest density of zooplankton was found in the month February, 2023 and lowest in August, 2023. There is strong correlation between dissolved oxygen content in pond water and the zooplankton density with Spearman's correlation coefficient value 0.9587(close to 1.0).

Keywords: Fishery pond, dissolved oxygen, zooplankton density, correlation

1. Introduction
Fresh water ponds are found throughout the world having great diversity in morphometric parameters, physical and chemical properties of water and limnobiological characteristics. The high variability of abiotic factors, and the often comparably variable composition of the fauna, appears particularly important. Birbhum district of West Bengal is rich in fresh water ponds of different sizes of both perennial and seasonal type [1]. Many of rural area ponds provide a good earning for living of large number of families from fishery practice. The physical and chemical parameter analysis and impact of their fluctuation have been investigated by many workers and these findings must be reached to the farmers so that they can be aware and follow a best process of management to avoid the negative impacts. Dissolved oxygen content of fishery pond is a good indicator of healthy production of fish. Higher Dissolved Oxygen (DO) favour growth of zooplankton, fishes and other aquatic animals [2, 3]. Zooplankton consume phytoplankton and an important member of aquatic food chains as they are consumed by young fishes. Investigation of many authors establish the fact that zooplankton density is largely affected by fluctuation of different physic-chemical parameters [4, 5, 6, 7]. Dissolved oxygen content in pond and lake water varies throughout the year [8, 9]. It plays vital role in zooplankton growth [10, 11, 12]. Several studies have explored the relationship between phytoplankton and dissolved oxygen levels in freshwater bodies such as lakes, rivers, and reservoirs [13]. Seasonal variations, nutrient enrichment, and anthropogenic activities can alter phytoplankton dynamics that leads to fluctuations in DO levels [14]. The higher the phytoplankton growth, concentration of dissolved oxygen is higher and the better is the water quality [15]. Oxygen is removed from the water by respiration and decomposition of organic matter, domestic sewage and water evaporation reduces dissolved oxygen [16]. When sewage enters ponds, microorganisms begin to decompose the organic materials and oxygen is consumed. When the dissolved oxygen levels drop too low, many aquatic species perish [17]. The present work has been carried out in a rural fishery pond near Suri, Birbhum to study the dissolved oxygen and its impact on zooplankton density.

2. Materials and Methods

2.1 Study site

A rural pond used by fisherman to culture fishes mainly Indian major carps (IMC) and exotic carps like silver carp and common carp. The pond is located at 23°54'52"N latitude and 87°31'53"E longitude eastward of Suri Town. The size is around 2.4 hectare and is a perennial pond. Its water Its water is also utilized for agricultural purpose. Rain water fills the pond.

2.2 Water sample collection and DO measurement

The water sample was collected in polyethylene bottles of one litre capacity during in the morning from three sites. These samples were transported to laboratory for measurement of dissolved oxygen content. Sample was collected between 12th to 15th day of each month from August,2022 to May, 2023. DO was measured by Wrinkler's iodometric method in mg/L unit.

2.3 Zooplankton sample collection and counting

On the same day of water from surface was collected in polyethylene bottles of one litre capacity during in the morning in each month from three sites for counting of zooplankton. The water is strained in 350 micron mesh size plankton strainer cloth leaving one tenth volume of water or one deciliter (dL). Then they are counted in Sedgwick-Rafter counting slide under light microscope at 10X power of objective lens. Count was presented in count/litre unit.

3. Results and Discussion

3.1 Dissolved oxygen content

Month wise dissolved oxygen measured in laboratory and zooplankton density are presented in Table1. The range of dissolved oxygen content was found 4.70 mg/L to 16.20 mg/L with mean value 9.93 and SD 3.675. Highest dissolved oxygen (16.20 mg/L) was found in February month, the late winter season and lowest was found in August month (4.70 mg/L) or onset of monsoon. Dissolved oxygen is one of the important parameters in water quality assessment and reflects the physical and biological processes prevailing in waters. Some authors have reported that relatively higher values of dissolved oxygen might be due to increased solubility of oxygen at low temperature. Kulkarni (2016) [9] found that there exists an inverse relation between dissolved oxygen and temperature. In summer with the increase in water temperature there was reduction in dissolved oxygen; whereas in winter months due to decrease in temperature the level of dissolved oxygen increased. The decrease in oxygen may be the result of the high load of organic substances in the drainage inflow of domestic sewage [16]. The primary production and input of degradable organic substances create a demand for oxygen.

3.2 Zooplankton density

Zooplankton density range found was 564 count/L to 1024 count/L with mean value 817.8 and SD 137.528. Highest density (1024 count/L) was found in February month and lowest (564 count/L) in August month.

Table 1: Month wise dissolve oxygen content, zooplankton density and their correlation

Month	Dissolved O_2 (mg/L)	Zooplankton density (Count/L)	Pearson's correlation co-efficient (R)
August,2022	4.7	564	0.9587 (Strong positive correlation)
September,2022	4.9	648	
October,2022	5.8	756	
November,2022	9.6	790	
December,2022	10.8	836	
January,2023	12.7	924	
February,2023	16.20	1024	
March,2023	13.9	996	
April,2023	11.2	872	
May,2023	9.5	768	
Mean Value	9.93	817.8	
SD	3.675	137.528	

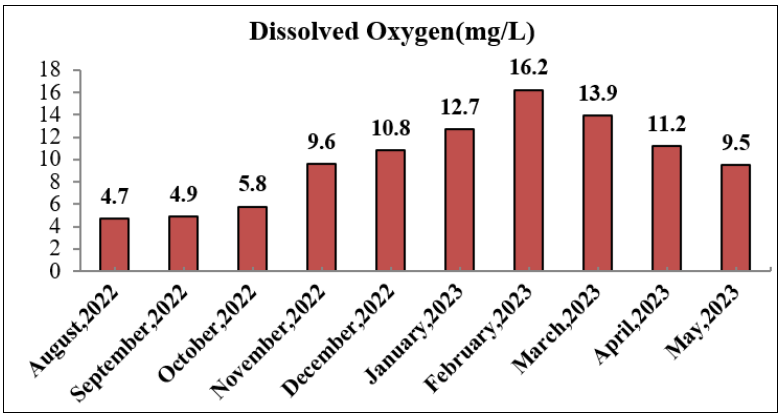

Fig 1: Month-wise dissolved oxygen content (mg/L)

3.3 Impact of dissolved oxygen content on zooplankton density

Zooplankton density is dependent upon different physicochemical factors of water as described by different authors. In the present study there is found strong correlation between dissolved oxygen content. Value of Pearson's correlation (R) is found 0.9587 which is close to 1.0 (Table 1)

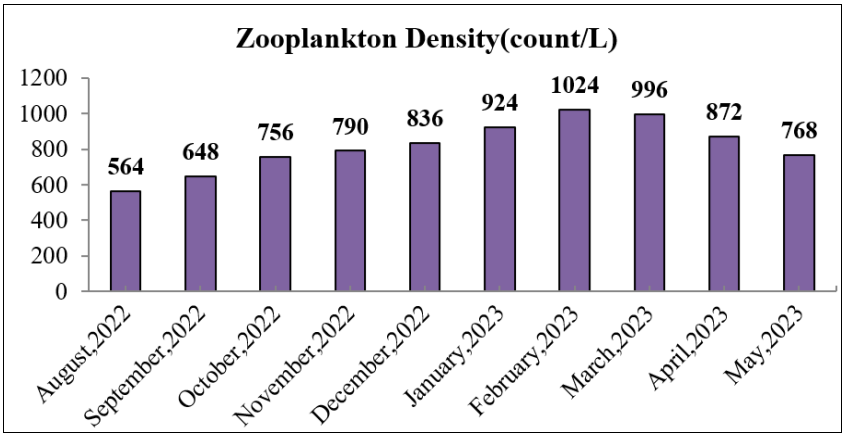

Fig 2: Month-wise zooplankton density (count/L)

3.4 Management strategies to maintain a desirable Dissolved Oxygen (DO) content

Aeration: Use aerators or fountains to maintain oxygen levels, especially during summer.

Monitoring: Regularly measure DO levels, particularly during critical periods (e.g., early morning in summer).

Nutrient control: Limit nutrient inputs to prevent excessive algal growth that ultimately leading to eutrophication

Stocking density: Avoid overstocking fish to reduce oxygen demand.

Vegetation management: Maintain a balance of aquatic plants to support oxygen production without overgrowth.

4. Conclusion

There is a clear finding from the study that dissolved oxygen content of the fishery pond changes in every month. There are different factors responsible for the change including photosynthetic efficiency by phytoplanktons, temperature, dissolved solids, presence of organic sediments and waste water admixing, stocking density of cultured fishes etc. It affects growth and multiplication of zooplankton either in preferable level or decreasing rate. Whatever the effect aquatic food chain is disturbed that influence fishery output.

5. References

1. Fisheries Booklet 2023. Birbhum District Fishery Department. Available from: https://birbhum.gov.in/fisheries/
2. Boyd CE, Hanson T. Dissolved-oxygen concentration in pond aquaculture. Glob Aquac Advocate. 2010;13(1):40-41.
3. Ali B, Anuska, Mishra A. Effects of dissolved oxygen concentration on freshwater fish: A review. Int J Fish Aquat Stud. 2022;10(4):113-127.
4. Gupta RK, Nayak SR. Seasonal variations in zooplankton diversity and its relationship with physicochemical parameters in a freshwater lake of Karnataka, India. J Environ Biol. 2016;37(4):641-647.
5. Kumar A, Prasad R. Impact of physicochemical parameters on zooplankton diversity in a freshwater reservoir of Jharkhand, India. J Aquat Biol Fish. 2017;5(2):45-52.
6. Nair P, Kumar S. Seasonal variations in zooplankton abundance and its correlation with physicochemical parameters in a freshwater lake of Kerala, India. J Aquat Res Mar Sci. 2017;8(1):34-42.
7. Patel M, Desai R. Seasonal dynamics of zooplankton in relation to physicochemical parameters in a freshwater lake of Gujarat, India. Int J Sci Res Environ Sci. 2018;6(4):89-95.
8. Chang WY, Ouyang H. Dynamics of dissolved oxygen and vertical circulation in fish ponds. Aquaculture. 1988;74(3-4):263-276.
9. Kulkarni SJ. A review on research and studies on dissolved oxygen and its affecting parameters. Int J Res Rev. 2016;3(8):18-22.
10. Chakraborty D, Sen S. Zooplankton community structure and its relationship with dissolved oxygen in a freshwater lake of West Bengal, India. J Limnol Freshw Fish Res. 2019;5(2):67-74.
11. Sharma BK, Lyngdoh M. Impact of water quality on zooplankton population in freshwater ponds of Cachar District, Assam, India. J Environ Biol. 2018;39(5):789-795.
12. Sharma S, Sharma P. Seasonal dynamics of zooplankton population in relation to physicochemical parameters of a freshwater lake in Udaipur, Rajasthan. Int J Sci Res. 2017;6(8):45-48.
13. Smith DW, Piedrahita RH. The relation between phytoplankton and dissolved oxygen in fish ponds. Aquaculture. 1988;68(3):249-265.
14. Sharma RC, Singh N. Phytoplankton diversity and water quality assessment of a freshwater lake in Uttarakhand, India. J Environ Biol. 2010;31(5):721-724.
15. Deshmukh A, Ambore NE. Seasonal variation of phytoplankton and its relation to dissolved oxygen in a freshwater reservoir. J Ecophysiol Occup Health. 2006;6(3-4):155-160.
16. Hussain J, Hussain I, Sharma KC, Arif M. Impact of domestic wastewater on Gandhi Sagar lake, Bhilwara, Rajasthan, India. Ecol Env Cons. 2004;10(3):363-367.
17. Pani S, Mishra SR. Seasonal variation of water quality parameters in freshwater ponds of Cuttack, Odisha, India. Int J Fish Aquat Stud. 2017;5(4):1-5.