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Qualitative Plankton Diversity of a Fish Culture Pond and a Wild Village Pond of Chhattisgarh, South Central India

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ABSTRACT

A study was carried out in two ponds- Managed fish farm pond (P1) and Unmanaged village pond (P2) in Arang district of Chhattisgarh on qualitative plankton diversity from January to April 2013. A total of seven classes of phytoplankton and three classes of zooplankton were recorded which contained 21 phytoplankton and 19 zooplankton species from both P1 and P2. Out of which 11 species of phytoplankton and 9 species of zooplankton were common at both the pond. P1 alone had 15 species of phytoplankton and 16 species of zooplankton. P2 had 17 species of phytoplankton and 13 species of zooplankton. P1 was richer in zooplankton and P2 was richer in phytoplankton. An inverse relationship was observed between phytoplankton and zooplankton abundance.

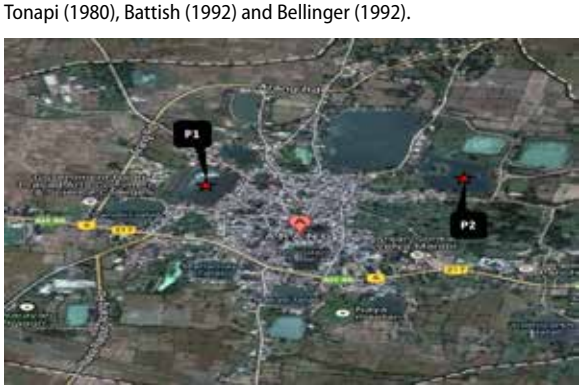
KEYWORDS : Phytoplankton, Zooplankton, Plankton diversity, Managed pond, Unmanaged pond, Rural area.

Introduction

Ponds are relatively shallow bodies of standing water and are generally rich in biodiversity (Williams et al., 2004). The plankton community is comprised of the primary producers or phytoplankton and the secondary producers or zooplankton (Battish, 1992). Phytoplankton is the major primary producers in many aquatic systems and is important food source for other organisms (Gupta & Dey, 2012). Phytoplanktons not only serve as food for aquatic animal, but also play an important role in maintaining the biological balance and quality of water (Benarjee & Narasimha, 2013). Zooplankton constitutes important food item of many fishes. The larva of carps feed mostly on zooplankton (Jhingran, 1985). Zooplankton also plays an important role in the food chain, as they are second in trophic level as primary consumers and also contributes to the next trophic level (Aarti et al., 2013). The pH, dissolved oxygen, alkalinity, hardness, turbidity and the dissolved nutrients are important for the plankton production (Banerjea, 1967).

Materials and Methods

The study was conducted during January 2013 to April 2013 on two ponds viz. - A managed fish farm pond (P1) and an unmanaged village pond (P2) in Arang district of Chhattisgarh. Pond-1 (21°12'03.95"N 81°58'39.65"E) was rectangular in shape with an area of 10000 m2 and was stocked with IMCs for the purpose of composite fish culture practice. Pond-2 (21°11'57.67"N 81°58'49.34"E) was near-circular in outline with an area of 16750 m2 and was being used by villagers for multiple purposes. Plankton samples were collected once in every month between 8:00-10:00 am from 10 randomly selected points of the pond at a depth of 20 cm below the surface (Hossain et al., 2007). Plankton samples for this study were collected with plankton net made of bolting silk cloth no.25 with mesh size: 0.03-0.04mm (APHA, 1995). Phytoplankton samples were preserved in 0.3% Lugol's iodine, while zooplankton samples were preserved in 4% buffered formalin solution and then transported to laboratory for plankton analysis (Lackey, 1938). The identification of plankton species was done with the aid of plankton identification key and monographs by Needham and Needham (1962), Tonapi (1980), Battish (1992) and Bellinger (1992).



Area of study (From Google Earth)

Results

Five classes of phytoplankton (Cyanophyceae, Bacillariophyceae, Zygnemophyceae, Chlorophyceae and Zygnematophyceae) were recorded from P1 and six classes (Cyanophyceae, Bacillariophyceae, Zygnemophyceae, Chlorophyceae, Coleochaetophyceae and Xanthophyceae) were recorded from P2. Fifteen species of phytoplankton (*Nostoc* sp., *Eunotia* sp., *Navicula* sp., *Frustulia* sp., *Rhopalodia* sp., *Synedra* sp., *Fragilaria* sp., *Nitszhia* sp., *Desmidium* sp., *Cosmarium* sp., *Eudorina* sp., *Scenedesmus* sp., *Pediastrum* sp., *Oscillatoria* sp. *and Spirogyra* sp.) were found in P1 and seventeen species (*Microcystis* sp., *Nostoc* sp., *Eunotia* sp., *Navicula* sp., *Amphipleura* sp., *Frustulia* sp., *Stauroneis* sp., *Synedra* sp., *Fragilaria* sp., *Desmidium* sp., *Cosmarium* sp., *Closterium* sp., *Eudorina* sp., *Scenedesmus* sp., *Pediastrum* sp., *Oscillatoria* sp., *Tribonema* sp. *and Coleochaete* sp.) were found in P2 **(Table 1 here).**

Three classes (Crustacea, Branchiopoda and Rotifera) of zooplankton were observed at both P1 and P2. Sixteen species of zooplankton (*Cyclops* sp., *Mesocyclops* sp., *Microcyclops* sp., *Paracyclops* sp., *Macrocyclops* sp., *Bosmina* sp., *Polyphemus* sp., *Pleuroxus* sp., *Ceriodaphnia* sp., *Daphnia* sp., *Monostyla* sp., *Lepadella* sp., *Trichotria* sp., *Branchionus* sp., *Anuraeopsis* sp. *and Keratella* sp.) were recorded from P1 and thirteen species (*Cyclops* sp., *Mesocyclops* sp., *Acanthocyclops* sp., *Microcyclops* sp., *Polyphemus* sp., *Alona* sp., *Pleuroxus* sp., *Ceriodaphnia* sp., *Daphnia* sp., *Macrothrix* sp., *Monostyla* sp., *Trichotria* sp., *Branchionus* sp. *and Anuraeopsis* sp.) were recorded from P2 **(Table 2 and 3 here).**

Table 1: Phytoplankton diversity and distribution of Managed fish culture pond (P1) and Unmanaged village pond (P2) at Arang district of Chhattisgarh during January to April 2013.

Class	Species	Distribution
Cyanophyceae	*Microcystis* sp.	P2 only
	Nostoc sp.	P1 and P2
Bacillariophyceae	*Eunotia* sp.	P1 and P2
	Navicula sp.	P1 and P2
	Amphipleura sp.	P2 only
	Frustulia sp.	P1 and P2
	Stauroneis sp.	P2 only
	Rhopalodia sp.	P1 only
	Synedra sp.	P1 and P2
	Fragilaria sp.	P1 and P2

	Nitszhia sp.	P1 only
Zygnemophyceae	*Desmidium* sp.	P1 and P2
	Cosmarium sp.	P1 and P2
	Closterium sp.	P2 only
Cholorophyceae	*Eudorina* sp.	P1 only
	Scenedesmus sp.	P1 and P2
	Pediastrum sp.	P1 and P2
	Oscillatoria sp.	P1 and P2
Zygnematophyceae	*Spirogyra* sp.	P1 only
Xanthophyceae	*Tribonema* sp.	P2 only
Coleochaetophyceae	*Coleochaete* sp.	P2 only

Table 2: Zooplankton diversity and distribution of Managed fish culture pond (P1) and Unmanaged village pond (P2) at Arang district of Chhattisgarh during January to April 2013.

Class	Species	Distribution
Crustacea	*Cyclops* sp.	P1 and P2
	Mesocyclops sp.	P1 and P2
	Acanthocyclops sp.	P2 only
	Microcyclops sp.	P1 and P2
	Paracyclops sp.	P1 only
	Macrocyclops sp.	P1 only
Branchiopoda	*Bosmina* sp.	P1 only
	Polyphemus sp.	P1 and P2
	Alona sp.	P2 only
	Pleuroxus sp.	P1 only
	Ceriodaphnia sp.	P1 and P2
	Daphnia sp.	P1 and P2
	Macrothrix sp.	P2 only
Rotifera	*Monostyla* sp.	P1 and P2
	Lepadella sp.	P1 only
	Trichotria sp.	P1 and P2
	Branchionus sp.	P1 and P2
	Anuraeopsis sp.	P1 and P2
	Keratella sp.	P1 only

Table 3: Plankton status of P1 and P2.

Pond	No. of Classes found		No. of Species observed	
	Phytoplankton	Zooplankton	Phytoplankton	Zooplankton
P1	5	3	15	16
P2	6	3	17	13

Discussion

For any scientific utilization of water resources plankton study is of primary interest (Jhingran, 1985). Phytoplankton forms the vital source of energy as primary producers and serves as a direct source of food to the other aquatic plants and animals (Battish, 1992). Total twenty-one phytoplankton species were encountered in both the ponds. Among them eleven species were found to be common at both the ponds. Fifteen species were recorded from P1 and seventeen species were recorded from P2. *Spirogyra* sp., *Nitszhia* sp., *Eudorina* sp. and *Rhopalodia* sp. were the species that were recorded only from P1. *Microcystis* sp. *Amphipleura* sp., *Stauroneis* sp., *Closterium* sp., *Tribonema* sp. *and Coleochaete* sp. were the species that were recorded only from P2 (Table 1). They are generally found in organic polluted waters (Palmer 1969, Kumar *et al*., 2012). P2 was found to be richer in phytoplankton and showing eutrophic condition.

Zooplankton are one of the most important biotic components influencing all the functional aspects of an aquatic ecosystem, such as food chains, food webs, energy flow and cycling of matter (Battish, 1992). Total nineteen zooplanktons had been found from P1 and P2. Nine species were common at both the ponds. Sixteen species were recorded from P1 and thirteen species were recorded from P2. *Keratella* sp., *Pleuroxus* sp., *Lepadella* sp., *Paracyclops* sp., *Macrocyclops* sp. and *Bosmina* sp. were the species that were only recorded from P1. *Acanthocyclops* sp., *Alona* sp. and *Macrothrix* sp. were the species that were only recorded from P2 (Table 2). P1 was found to be richer in zooplankton.

Conclusion

An inverse relationship was observed between phytoplankton and zooplankton abundance. The managed fish culture pond which was periodically limed, manured and fertilised showed greater planktonic diversity, with zooplankton being the dominant group. Whereas the unmanaged village pond showed a less diverse and eutrophic condition, with phytoplankton being the dominant group. It implies that a large amount of ecological niches are remaining void and unutilised in village ponds. Whereas all the available ecological niches are being effectively utilised by the stocked fishes and periodically replenished by fertilisation in the managed fish culture pond. Therefore selective stocking with appropriate species at low densities and extensive fish culture practices in the village ponds has ample scope. Adoption and transformation of such village ponds by scientific management practices into semi-intensive fish culture ponds may prove to be an ecologically efficient, financially feasible and socially viable venture.

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REFERENCES

Aarti, D., Sharma, K.K., Sharma, A. & Antal, N. 2013. Zooplankton Diversity and Physico-Chemical Conditions of a Temple Pond in Birpur (J&K, India). International Research Journal of Environment Sciences 2(5): 25-30. | Anand, N. 1998. Indian Freshwater Microalgae. Bishen Singh Mahendra Pal Singh publ., Dehradun, India, pp. 94. | APHA. 1995. Standard Methods for the Examination of Water and waste water.18th edition. American Public Health Association, Washington, DC. | Banerjea, S.M. 1967. Water quality and soil condition of fish ponds in some states of India in relation to fish production. Indian journal of Fisheries 14: 115-144. | Battish, S.K. 1992. Freshwater zooplankton of India. Published by oxford & IBH publishing Co.PVT.LTD. New Delhi. | Bellinger, E.G. 1992. A key to common Algae. The institute of water and environmental management, London. | Benarjee, G. & Narasimha, R. K. 2013. Physico-chemical factors influenced plankton biodiversity and fish abundance- a case study of Nagaram tank of Warangal, Andhra Pradesh. International Journal of Life Sciences Biotechnology and Pharma Research 2(2): 248-260. | Gupta, T. & Dey, M. 2012. Hydro biological Characteristics of Some Semi-intensive fish culture ponds of Lumding town of Nagaon district, Assam. Current World Environment 8:(1). | Hossain, Md. Y., Jasmine, S. & Ibrahim, A.H. 2007. A preliminary observation on water quality and plankton of an earthern fish pond in Bangladesh: Recommendations for future studies. Pak. J. Biol. Sci., 10(6), 868-873. | Jhingran, V.G. 1985 Fish and Fisheries of India. Hindustan Publishing Corporation (India), Delhi. | Kumar, N.K., Solanki, R. & Kumar, J.I. 2012. Spatial variation in phytoplankton diversity in the Sabarmati river at Ahmedabad, Gujarat, India. Annals of Environmental Science 6, 13-28. | Lackey, J.B. 1938. The Manipulation of counting of river plankton and changes in some organisms due to formalin preservation. US Public Health Report 53, 2080-2093pp. | Michael, R.G. & Sharma, B.K. 1988. Indian Cladocera (Crustacea, Branchipoda, Cladocera). Zoological Survey of India, Kolkata, pp. 260. | Needham, J.G. & Needham, P.R. 1962. To guide to the study of freshwater biology. Holden-Day inc. Sanfrancisco costable & Co. Ltd. London. | Palmer, C. M. 1969. A composite rating of algae tolerating organic pollution. Phyco. I5, 78-82. | Tonapi, G.T. 1980. Freshwater animals of India. An ecological approach. Oxford IBH Publishing | Williams, P. & Biggs, M. 2004. Comparative biodiversity of rivers, streams, ditches and ponds in an agricultural landscape. Biological Conservation 115, 329–341.