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Study of Plankton Diversity in Relation to Fish Production in Wai Lake

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Abstract

Wai Lake has a diverse assemblage of plankton. Phytoplankton population varied from 1.0x101-9.1x103 cell1-1. Chlorophyceae and Bacillriophyceae were co-dominant components. This lake supports a low standing crop of zooplankton (6.1-9.2x10^{-3}ind^{-3}) during the year with pear population being developed after maximum phytoplankton activity. Phytoplankton community (26 species) were far diverse than the zooplankton in the lake. Chlorophycae (39.6%) & Bacillariophycae (30.4%) were the main components of phytoplankton. Cyanophyceae were represented by 30% species. The population structure is quite stable with annual peroration of copepod, Rotifera and Cladocera. Rotifer was the most important components of zooplankton community (10 species). Cladocera plankton was represented by 02 species, 4 species of copepod.

The fish production of the lake on the basis of commercial landing was recorded as 43.1 t during 2021-2022 respectively. Major carps constitute the main fishery of the lake whereas catfishes & minor carps & trash fishes were the smallest components of catch during the year 2021-2022. Fish catch data shown that major carps were contributed more than a catch of weed fishes & minor carps. It appears that most of the energy fixed by the autotrophs (phytoplankton) is utilized by carp fishes particularly Labeo rohita, Catla catla, Cirrihnus mrigala which for about 35% of the total fish population. Composition & abundance of phytoplankton is greatly requested by the zooplankton and Fishes. This paper discusses plankton population in relation to fisheries in the lake.

Keywords: Plankton, Wai Lake, Zooplankton, Phytoplankton

Introduction

Plankton has a universal occurrence in natured water, which constitutes a vital role in the aquatic food chain. Aquatic environment depicts ecological features that leads to the establishment of a very dynamic system in which plankton communities play an important role (Sharma & Sarang, 2004) [9]. Phytoplankton plays a phenomenal role in the biosynthesis of organic material while zooplanktons are important components of secondary production. Thus all plankton provides a link between producers & secondary consumers. They not only provide an estimation of standing crop but also represent more compressive biological index of the environmental conditions.

A scientific study of variations of plankton community provides information about the growth & abundance of fish production & also whether is any scope for introduction of additional species of commercial value in order to utilize the vacant food niches, if any (Mathew;1978) [7]. It is well established that composition & abundance of phytoplankton is greatly requested by the zooplankton. Many studies have suggested an increase in the quantity of phytoplankton would result in an increase in the quantity of zooplankton (Leukowicz; 1974) [6]. On the other hand, some worker have also reported that an inverse relationship between the two groups. Several investigators from all parts of the world have paid attention towards the study on the role of total biomass in fish production.

In present investigation, attempt has been made to evaluate plankton & fish production of a Wai lake, So as to get an understanding of their utilization at different tropic levels in different seasons.

Material and Methods

Study Site

Wai lake is located in central region of India and eastern part of state of Maharashtra. It lies between 78°-38'-27.8''E and 20°04'-52.9'' N. It is 12 km away from Pandharkawada taluka and 143 km away from Nagpur. It is present 3 km away on Nagpur-Hydrabad National highway. The main physical features are, maximum length and catchment area of lake is 6.95 km2, maximum depth 15.70 m, mean depth 8.15m.

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Fig 1: Wai Lake

Weather

According to Metrological department of India, the seasonal feature is a period cool from October to February (Min-max; 7.6-27.7°C), October and March are transition month with variable weather, whereas the remaining three-month (April, May and June) are typically warmer (18-47.6 °C). It hast three well marked season namely rainy, winter and summer with an average rainfall of about 101.00 mm.

Methods

The study was carried out during the year Jan. 2021 to Dec. 2022 for 12 months. Water samples were collected weekly for various physio-chemical analysis as per the procedure described in the slandered methods of water analysis (APHA, 1980 & Trivedi & Goel, 1984) [1, 14].

The present study has been conducted in the limonitic zone of the lake at the two sampling stations. The plankton samples were collected from euphotic zone of the lake using standard filtered through net. The water from different depth is filtered through net. The enumeration of the phytoplankton was done in a bright line haemocytometer (Sharma *et al;* 1982) [8] in this way; the counting even small species was possible. Two slides were counted of each sample & the value were calculated in terms of cells l^{-1}. All the species were counted a single unit whether colonial (e.g. microcystis), single celled (e.g. chlamydomonas) or filamentous (e.g. Melosira).

Results

Annual studies of primary productive have shown that Wai lake is moderately productive. The lake is quite turbid with average euphotic zone.

Species Richness of Plankton:

Phytoplankton community (26 species) were far diverse than the zooplankton in the lake. Chlorophyceae (39.6%) & Bacillariophyceae (30.4%) were the main components of phytoplankton. Cyanophyceae were represented by 30% species. Rotifer was the most important components of zooplankton community (10 species). Cladocera plankton were represented by 02 species, 4 species of copepoda (Table 1)

Table 1: List of plankton of Wai lake

Sr. No.	List of Phytoplankton Community	List of Zooplankton Community
1.	**Chlorophyceae**	**Rotifera**
	i). Spirogyra sp ii). Pediastrum simplex iii). Cosmarium sp iv). Closterium acerosum v). Clorella vulgaris vi). Blue green algae vii). Unidentified green algae viii). Volvex sp.	i). Brachionus angularis ii). Brachionus calyciflorus iii). Cephalodella adriatica iv). Colurella adriatica v). Haraella brahmi vi). Keratella cochearis vii). Filinia longiseta viii). Trichocerca porcellus
2.	**Bacillariophycae**	**Copepoda**
	i). Synedra sp. ii). Fragilaria sp iii). Amphora Ovalis iv). Nitzschia sp v). Epithemia	i). Cyclops sp ii). Diatoms sp iii). Nauplius iv). Encyclops sp
3.		**Cadocera**
		i). Alonella sp ii). Daphania similes

Phytoplankton were the most important components of plankton comprising 94% of the total plankton population. Seasonal variation in the density of phytoplankton & zooplankton population was found. The phytoplankton density ranged from $1.1x10^3$-$9.2x10^3$ $cell^{-1}$ with maximum and minimum season was the least phytoplankton abundance. Like phytoplankton, zooplankton activity was also minimum during winter (1.2-$1.4x10^{-3}$ $indm^{-3}$). Total population in the lake was found to range from a minimum of 1.0x101 units l^{-1} in November to maximum of $9.0x10^3$ units l^{-1} in March.

Fish Yield

The average scale fishing in the lake is done from October to June. Here commercial catch is taken as fish yield. The total catch varied from 31 t (2020-21) to 42.3 t (2021-22) during the last five years.

Table 2: Fish catch & yield in Wai Lake:

Year	Catch(t)	Yeild (Kg/ha)
2018-19	38.1	12.5
2019-20	34.3	11.5
2020-21	31	14.4
2021-22	42.3	15.6
2022-23	54.2	18.3

The fish catch data were categorized into three viz. i) Major carp ii) Minor carp &cat fishes & iii) Weed fishes. Fish catch data shown that major carps were contributed more than a catch of weed fishes & minor carps. The mean percent composition for the year 2021-22 was, major carps (50%), Minor carps & Cat fishes (31.2%), Weed fishes (19.8%).

Discussions

Reduced amount of nutrients reflects the low trophic status of the water bodies (Singh *et al* 1990 b) [10]. Accordingly the total population of plankton in the lake is low. This lake has blooms of the blue green algae, diatoms etc. during some parts of the year & some have a permanent bloom of blue green algae as in south India (Sreenivasan, 1971, Saqunan, 1980) [12, 13]. The dominance of the diatoms is also a characteristic features of clean water (Patrick; 1948).

Low population of phytoplankton result into low standing crop of in zooplankton. The annual zooplankton population in the lake is reported between Cladocera (20%), Rotifera (42%) & Copepoda (21%). Interesting feature is that, this lake has low abundance of Daphnia. The low abundance of Daphania has been attributed the high density of fish. (Dacan & Scheimer; 1987) [2] & high predation pressure (Fernando; 1970 a, b). The high predation pressure also leads to the low specific diversity of zooplankton as evidenced by low value of concentration dominance (Singh & Sharma, 1990 b) [10].

It appears that most of the energy fixed by the autotrophs (phytoplankton) is utilized by carp fishes particularly Labeo rohita, Catla catla, Cirrhinus mrigala which for about 35% of the total fish population. Neverthless there seem to be at least some correspondence between variations of phytoplankton & zooplankton during October coincided with that of phytoplankton March, that seasonality of zooplankton depends on its food. (Mathe 1978, Kannan & Job, 1981) [5].

The average fish yield for five year arrives at 13.7 kg/h. The most dominant fish in this lake is a small clupeiformes (G. chapra) which is purely zooplanktonivore, it utilize most of zooplankton food which lake is suggested that, owing to the unavailability of zooplankton, which constitute the primary food of fish particularly L. Rohita, L. calbasu & Catla catla.

Conclusion

In any aquatic ecosystem biodiversity can affect both directly to fauna and flora and indirectly to human such as food for good health, social relationship, life and freedom of choices, etc. In last decade people interfere with the ecosystem and over-exploitation of natural resources. So that biodiversity is decreases. Losses in biodiversity and change in ecosystem service have adversely affected the well-being. The present study is relevant to fish and phytoplankton biodiversity with relationship to primary productivity of the Lake Wai. This study explains that Wai Lake is rich biodiversity of phytoplankton, fishes and need to conservation in the future.

India is one of the nations with “Mega diversity” for freshwater fish species. India ranks third in Asia and eighth in the world for diversity of freshwater fish. There are many species that can be cultivated. To stop the depletion of freshwater fish resources, illegal fishing practices should be outlawed in this region, and fish farmers should have access to scientific training and facilities in addition to being made aware of fishing practices. Fishing of spawns, larval fish, and immature fish should be strictly avoided, and large-scale loan subsidies could help with high yield fish production. It was further concluded that research could be done to create methods for cultivating fish, safeguarding and conserving biodiversity. If proper conservation measures are not taken, the loss of aquatic Plankton and fish diversity is likely to worsen due to the human population’s rapid growth, increased reliance on aquatic fishery resources, such as water, and the ongoing introduction of exotic species into natural water bodies.

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