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Comparative study on plankton diversity of ponds (culture and non-culture) ecosystem in Prayagraj, Uttar Pradesh: a note

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Abstract

Diversity of plankton is an excellent biological indicator of an environment's health. Four water bodies were selected for the present study. The first two ponds are non-culture fish ponds while third and fourth is fish culture pond at Prayagraj, Uttar Pradesh. The water samples was collected during May 2023 between 8:00 to 1:00 AM .Samples collected 1000 ml water in one liter of plastic bottles at selected location and preserved them with 2-3 ml Lugol's solution. A total of 69 species belonging to Bacillariophyta, Chlorophyta, Cryptophyta, Cyanobacteria, Euglenozoa, Myzozoa, and Rotifera were observed in the present study. The maximum number of genera of phytoplankton was recorded in Chlorophyta (22 genera) followed by Bacillariophyta (20 genera), Cyanobacteria (15 genera), Euglenoza (8 genera), Cryptophyta (2 genera) and Myzozoa (1genera). Only one group (Rotifera) was recorded under Zooplankton. Culture ponds showed more diversity compared to non-culture ponds in the present study.

Keyword: Plankton, phytoplankton, Zooplankton, pond, Prayagraj

Introduction

Plankton communities (Example phytoplankton and zooplankton) are one of the major indicators of biotic communities for freshwater aquatic ecosystems. The stagnant/lentic ecosystem is inland freshwater bodies (examples ponds, lakes, tanks, pools, puddles, swamps) which have a key responsibility in supplying resources and habitats to aquatic and terrestrial animals (Williams *et al.* 2004, Scheffer *et al.* 2006, Martins *et al.* 2020, Kumar *et al.* 2022). Plankton is susceptible to water pollution (Zelalem 2015, Kumar *et al.* 2015, 2020). Plankton are classified on the basis of size such as macroplankton (200-2000 µm), microplankton (20-200 µm), nanoplankton (2-20 µm), picoplankton (0.2-2 µm) and femtoplankton (0.02-0.2 µm) (Tucker and Lloyd 1984) Planktons form the primary food or basic food for herbivorous as well as omnivorous fishes with reference of Indian Major carps (IMC) from the riverine ecosystem (Alam *et al.* 2015, Dwivedi *et al.* 2019, Dwivedi & Mishra 2023) and also provide the food for zooplankton (Islam *et al.* 2020, 2022).

Plankton populations are influenced by factors such as nutrient availability, temperature, sunlight, and water currents. They form an essential component of ecosystems, contributing to global biodiversity, carbon cycling, and the overall health of the oceans. In ponds, similar to the ocean, plankton also exist, although the specific composition and abundance may vary. Ponds typically support a different set of organisms compared to the open ocean due to differences in size, nutrient availability, and environmental conditions. Ponds also provide habitat for the early life stages of many aquatic insects, such as mosquitoes, midges, dragonflies, and damselflies. The larvae of these insects are often considered part of the plankton community. They live in the water column, feeding on smaller organisms and detritus until they mature and undergo metamorphosis (Cottenie *et al.* 2001, Céréghino *et al.* 2008, Hoverman & Johnson 2012).

Ponds were recently determined to help extra species, in addition to extra remarkable, rare, and threatened species in comparison to streams, rivers, reservoirs and lakes (Mohanty *et al.* 2011, Gebre *et al.* 2016, Dwivedi *et al.* 2004, Jha *et al.* 2015). There are two types of water bodies, natural and manmade. These may be permanent and temporary (Biggs *et. al.* 2005). The ponds are formed by digging a large hole

into the ground and filling and keeping it with water. Commonly the water of springs and streams falls into these ponds. Ponds are generally landlocked and there is no discharge of water. Because of this, they are supposed to be independent ecosystems. These ecosystems contain a huge variety of plankton (Sondergaard *et al*. 2005).

Pollution, particularly from industrial discharge or chemical contamination, domestic and sewage can alter the species composition of plankton. Some species may be more tolerant of pollution, while others may be more sensitive and decline in abundance. Shifts in the dominance of certain plankton species can signal changes in water quality and pollution levels. The purpose of present research work is to determine the diversity of various planktonic species from rearing and non-rearing fish ponds in summer season (lowest water depth in ponds due to higher temperature, low availability of water, maximum seepage, multiple use of water (example agriculture and cattle farming) at Prayagraj, Uttar Pradesh.

Materials and methods

There were four water bodies selected for the present study the first two ponds are non-culture fish ponds while third and fourth is fish culture pond. All water bodies are situated within the Prayagraj.

Pond-1: The first pond (P-1) is located nearby Andawa on the roadside of town. This pond is a non-culture fish pond. The source of water in this pond is precipitation water. Pond mainly used by mlocal people for domestic, commercial and irrigation purposes. This pond is free from sewage water effluents.

Pond-2: The second pond (P-2) is located nearby Jhusi, Shri Ram Chandra Mission Heartfulness Meditation Center on the roadside of town. This pond is also a non-cultural fish pond. The source of water in this pond is precipitation water. Pond mainly used by local people for domestic, commercial and irrigation purposes. This pond is also free from sewage water.

Pond-3: The third pond (P-3) is located nearby Jhuthi Tali, Kotwa, near Nehru Gram Bharati (Deemed to be University) Campus the road side. This pond is culture fish pond (Indian major carp and *Cyprinus carpio*). The source of water in this pond is rainwater and domestic. This pond is also free from sewage water.

Pond-4: Fourth pond (P-4) is CIFRI pond in Prayagraj. This pond is also used for rearing of fish fingerlings namely *Gibelion catla, Labeo rohita, Cirrhinus mrigala* (Indian major carp) for the purpose of river ranching. The source of water in this pond is rain, groundwater and supply water.

Sample Collection

We collected 1000 ml water samples in one liter of plastic bottles at selected location during 8:00 to 1:00 AM and preserved them with 2-3 ml Lugol's. The preserved samples were brought to the laboratory. The samples were stored in the dark place at room temperature for 24-48 hours. A Siphoning procedure was followed to obtain 50 to 100 ml concentrates.

Sample Analysis

The concentrated sample of 5 microliters (v1) was examined under a trinocular microscope and counted all the plankton species (n).

Density (unit/litre) = (n/v1) x concentrated volume.

Diversity indices

During the study period, diversity indices were used to determine species composition and abundance.

Simpson's index (D)

Simpson's Diversity Index is a measure of diversity which considers the number of species present and the relative abundance of each species. As species richness and evenness increase, so does diversity increases.

$$D = 1 - \left(\frac{\Sigma\, n(n-1)}{N(N-1)} \right)$$

n = total number of organisms of a particular species

N = the total number of organisms of all species

The value of D ranges between 0 and 1. With this index, 1 represents infinite diversity and 0,

no diversity.

Shannon index or Shannon-Weiner index (H′)

The Shannon Diversity Index (sometimes called the Shannon-Wiener Index) is a way to measure the diversity of species in a community.

Denoted as H, this index is calculated as:

$$H = -\Sigma pi * \ln(pi)$$

where:
Σ: A Greek symbol that means "sum"
ln: Natural log
pi: The proportion of the entire community made up of species i

The higher the value of H, the higher the diversity of species in a particular community. The lower the value of H, the lower the diversity. A value of H = 0 indicates a community that only has one species.

Result and discussion

A total of 69 species belonging to Bacillariophyta, Chlorophyta, Cryptophyta, Cyanobacteria, Euglenozoa, Myzozoa, and Rotifera were recorded in the present study under phytoplankton and zooplankton communities (Table 1). The maximum number of genera recorded in Chlorophyta (22 genera) followed by Bacillariophyta (20 genera), Cyanobacteria (15 genera), Euglenoza (8 genera), Cryptophyta (2 genera) and Myzozoa (1genera) (Fig. 1). Only one group (Rotifera) and 1 genera was recorded under zooplankton communities (Fig. 1).

Plankton density (U/l)

Density of plankton groups varied from one sampling station to another (Table 2). The highest density was recorded under Cyanobacteria (144000 to 10850000 unit/l) followed by Bacillariophyta (36000 to 1000000 unit/l), Chlorophyta (18000 to 435000 unit/l), Cryptophyta (0 to 750000 unit/l), Euglenozoa (0 to 750000 unit/l), Myzozoa (0 to 50000 unit/l). One group of zooplankton Rotifera was recorded lowest density (0 to 50000 unit/l).

Species richness from CIFRI Pond

A total of 39 plankton species belonging to Chlorophyta (17 genera), Bacillariophyta (9 genera), Cryptophyta (1 genera), Cyanobacteria (10 genera), Euglenozoa (1genera) and Myzozoa (1genera) were recorded in CIFRI pond (Fig. 2). This pond is used for rearing of Indian Major Carp (IMC) fingerlings. The different groups are present in this pond. The dominant genera were belonged to Chlorophyta followed by Bacillariophyta and Cyanobacteria.

Plankton density (unit/l)

Plankton density ranged from (0 to 8000000 unit/1) in CIFRI pond. The highest density recorded under Cyanobacteria (557000 unit/l) followed by Chlorophyta (2487000 unit/l) and Bacillariophyta (536000 unit/l) in CIFRI pond. Euglenozoa (125000 unit/l) Myzozoa (67000 unit/l) and Cryptophyta (125000 unit/l) were present in lower abundance in CIFRI pond.

Species richness from Andawa Pond-1

A total of 14 plankton genera belonging to Bacillariophyta (8 genera), Chlorophyta (3 genera), Myzozoa (1 genera), Cynobacteria (2 genera) were recorded in Andawa Pond-1 (Fig. 3). The dominant genera were belonged to Bacillariophyta followed by Chlorophyta and Cyanobacteria.

Plankton density (unit/l)

Plankton density ranged from (0 to10980009 unit/l) in Andawa pond 1). The highest density recorded under Bacillariophyta (54000 unit/l) followed by Chlorophyta (36000 unit/l) and Cyanobacteria (126000 unit/l) in Andawa pond 1. Myzozoa (72000 unit/l) were present in lower abundance in Andawa pond 1.

Species richness from Andawa Pond-2

A total of 15 species to Cyanobacteria (5 genera), Chlorophyta (4 genera), Bacillariophyta (3 genera) were recorded in Andawa Pond-2 (Fig. 4). The different

groups are present in this pond. Myzozoa (1 genera), Euglenozoa (1 genera) and Cryptophyta (1 genera) were recorded Andawa pond 2. The dominant genera belonged to Cyanobacteria followed by Euglenozoa and Myzozoa.

Plankton density (unit/l)

Plankton density ranged from (0 to 681000 unit/l) in Andawa pond 2). The highest density recorded under Cyanobacteria (4395000 unit/l) followed by Bacillariophyta (123000 unit/l) and Chlorophyta (51000 unit/l), Euglenozoa (31500 unit/l), Cryptophyta (18000 unit/l) and Myzozoa (18000 unit/l) in Andawa pond-2.

Species richness in Jhuti tali Kotwa Pond-3

A total of 38 plankton species belonging to Chlorophyta (10 genera), Barillariophyta (9 genera), Euglenozoa (8 genera), Cyanobacteria (7 genera), Cryptophyta (2 genera) and Myzozoa (1 genera), Rotifera (1 genera) were recorded in Jhuti Tali Kotwa pond (Fig 5). The dominant genera were belonged to Chlorophyta followed by Barillariophyta, Euglenozoa, Cyanobacteria, Cryptophyta,Myzozoa and Rotifera.

Plankton density (unit/l)

Plankton density ranged from (0 to 4799000 unit/l) in Jhuti tali Kotwa pond. The highest density recorded under Cyanobacteria (3094000 unit/l) followed by Euglenozoa (456000 unit/l) and Cryptophyta (429000 unit/l) in Jhuti tali Kotwa pond. Chlorophyta(401000 unit/l), Bacillariophyta (376000 unit/l) in Jhuti Tali Kotwa pond. Myzozoa (18000 unit/l) and Rotifera (25000 unit/l) were present in lower abundance in Jhuti tali Kotwa pond.

Diversity indices Simpson's index

Simpson's index ranged from 0.6014 to 0.9309 during the present study period. The minimum and maximum values were recorded in CIFRI pond due to sampling days (Table 3).

Shanon index or Shanon-Weiner index (H′)

Shanon index H was varied from 1.594 to 2.932 in which minimum value recorded in Andawa pond 2 while maximum value observed in CIFRI pond (Table 3).

A total of 69 species recorded during the study period revealed rich diversity of plankton. However, study sites were dominated by different groups of plankton in different sites. Overall Bacillariophyta was the dominant species recorded. Regarding abundance, Cyanobacteria was highly abundant followed by Bacillariophyta, Chlorophyta, Cryptophyta, Euglenozoa indicating organic pollution (Paramasivam & Srinivasan 1981). Pollution, particularly from industrial discharge or chemical contamination, domestic and sewage can alter the species composition of plankton (Rajgopal *et al.* 2010).

Chlorophyta was the dominant species in the CIFRI pond followed by Cyanobacteria and Bacillariophyta. However, Cyanobacteria was found to be in high abundance followed by Chlorophyta and Bacillariophyta indicating deterioration of water quality (Paramasivam and Srinivasan, 1981). Cyanobacteria are considered to be toxic algae and release toxic in water which is detrimental to aquatic life. Recently, fish mortality was also recorded in CIFRI pond due to algal bloom of filamentous Cyanobacteria and Chlorophyta.

Bacillariophyta was the dominant species in Andawa 1 pond and abundance was also high in Bacillariophyta groups followed by Chlorophyta and Cyanobacteria indicating relatively less pollution (Sabir and Fakhruddin, 2007). The water of this sampling site may be considered to be safe for aquatic life based onthe presence of Bacillariophyta as a dominant species. Cyanobacteria was the dominant species in Andawa 2 pond. Cyanobacteria was highly abundant followed by Chlorophyta and Bacillariophyta. The dominance of Cyanobacteria is considered to be high organic pollution in aquatic environments (Paramasivam & Srinivasan 1981).

Chlorophyta was the dominant

species in the Jhuti tali kotwa pond followed by Bacillariophyta, Euglenozoa and Cyanobacteria, however, Cyanobacteria was highly abundant followed by Euglenozoa. The presence of Cyanobacteria and Euglenozoa indicates high organic pollution in this pond (Alekesandar *et al.* 2007).

The highest diversity in the CIFRI pond indicates a well-managed water body among others, However, diversity was found to be good in other water bodies also. Cyanobacteria, Euglenozoa, and Cryptophyta were tolerated in high organic pollution water bodies. High temperature during summer is favourable for the growth of Cyanobacteria and it was also supported by Bomchul *et al.* (2001) and Aleksandar *et al.* (2007).

Conclusion

It may be concluded that the culture ponds showed more diversity compared to non-culture pond in the present study.

References

Alam, A., N. K. Chadha, K. D. Joshi, S. K. Chakraborty, P. B. Sawant, T. Kumar, K. Srivastava, S. C. S. Das & A. P. Sharma (2015). Food and feeding ecology of the nonnative Nile tilapia *Oreochromis niloticus* (Linnaeus, 1758) in the River Yamuna, India. *Proceedings of the National Academy of Sciences India Section B - Biological Sciences*, **85(1):** 167–174.

Céréghino, R., J. Biggs, B. Oertl0i & S. Declerck 2008. The ecology of European ponds: Defining the characteristics of a neglected freshwater habitat. *Hydrobiologia*, **597:** 1–6.

Cottenie, K., N. Nuytten, E. Michels & L. De Meester 2001. Zooplankton community structure and environmental conditions in a set of interconnected ponds. *Hydrobiologia*, **442:** 339–350.

Dwivedi, A. C., A. S. Mishra, P. Mayank & A. Tiwari (2016). Persistence and structure of the fish assemblage from the Ganga river (Kanpur to Varanasi section), India. *Journal of Geography and Natural Disasters*, **6:** 159. **Doi:** 10.4172/2167-0587.1000159.

Dwivedi, A. C., N. P. Tewari & K. R. Singh (2004). Present structure of capture and culture fishery of the Faizabad District (U.P.). *Bioved*, **15(1, 2):** 95-98.

Dwivedi, A.C. & N. Mishra (2023). Health of stock of commercially exploited non native fish species, *Cyprinus carpio* (Linnaeus, 1758) from the tributary of the Ganga River, Central India. *Geology, Earth and Marine Sciences*, **5(1):** 1-3, **DOI:** 10.31038/GEMS.2023514.

Gebre, T., M. Dessie, S. Hagos, M. Getachew, M. Sinshaw, *et al.* (2016). An Assessment of Risks and Opportunities Related to Ecosystem Services, in the case of Mekelle city. *J. Ecosyst. Ecogr.*, **6:** 217.

Hoverman, J.T. & P.T.J. Johnson 2012. Ponds and Lakes: a Journey Through the Life Aquatic. *Nat. Educ. Knowl.*, **3:** 17.

Islam, M.S., M.A. Azadi, M. Nasiruddin & M.S. Islam (2020). Diversity of phytoplankton and its relationship with physicochemical parameters of three ponds in Chittagong University campus, Bangladesh. *IOSR J Environ. Sci. Toxicol. Food Technol.*, **14(6):** 46-52.

Islam S, Azadi MA, Nasiruddin M, Sarker MM (2022) Plankton Species Composition, Abundance and Diversity Indices in Three Ponds of Chittagong University Campus, Bangladesh. *Fish Aqua J.*, **14:** 321.

Jha, D. N., K. D. Joshi, A. C. Dwivedi, P. Mayank, M. Kumar & A. Tiwari (2015). Assessment of fish production potential of Chitrakoot district, Uttar Pradesh. *Journal of the Kalash Science*, **3(3, Special Volume):** 7-10.

Kumar, J., G. Deshmukhe & S.K. Chakraborty (2015). Influence of hydrological parameter on phytoplankton diversity, abundance and productivity of Vasai creek, Mumbai, India. *J. Kalash Sci.*, **3:** 11–21.

Kumar, J., A. Alam, U. K. Sarkar, B. K. Das, V. Kumar, ·S. K. Srivastava (2020). Assessing the phytoplankton community and diversity in relation to physico-chemical parameters in a tropical reservoir of the River Ganga basin, India. *Sustainable Water Resources Management*, **6:** 110. doi.org/10.1007/s40899-020-00470-z.

Kumar, J., A. Alam, D. N. Jha, P. Gogoi, S. Borah & B. K. Das (2022). Impact of barrages on assemblage pattern of phytoplankton in tropical river Ganga, India. *Environ. Monit. Assess.*, 194: 804. doi.org/10.1007/s10661-022-10484-z.

Martins, F.S., A. Moutinho, J. Espinha Marques, N. Formigo & S.C. Antunes (2020). Plankton characterization of alpine ponds: a case of study for the assessment of water quality in Serra da Estrela (Portugal). *Ann. Limnol. - Int. J. Lim*., **56:** 4. doi.org/10.1051/limn/2020001.

Mohanty, S., P.K. Choudhury, A. Dash, M. Samanta & N.K. Maiti (2011) Genotypic and phenotypic diversity of *Bacillus* spp. isolated from freshwater ecosystems. *J. Aquac. Res. Development*, **2:** 112.

Paramasivam, M. & A. Srinivasan (1981). Changes in algal flora due to pollution in Cauvery river. *Indian J. Environ. Hlth.*, **23:** 222-238.

Rajgopal, T.A., A. Thangamani & G. Archuran 2010. Comparison of physico-chemical parameters and phytoplankton species diversity of two perennial ponds in Sattur area, Tamil Nadu. *J. Environ. Biol.*, **31:** 787-794.

Sabir, B. M. & A. A. Fakhruddin (2007). The effect of the flood cycle on the diversity and composition of the phytoplankton community of a seasonally flooded Ramsar wetlands in Bangladesh. *Wetlands Ecol. Manage.*, **15:** 81-93.

Scheffer, M., G.J. Van Geest, K. Zimmer, *et al.* 2006. Small habitat size and isolation can promote species richness: Second-order effects on biodiversity in shallow lakes and ponds. *Oikos*, **112:** 227-231.

Williams, P., M. Whitfield, J. Biggs, *et al.* (2004). Comparative biodiversity of rivers, streams, ditches and ponds in an agricultural landscape in Southern England. *Biol. Conserv*., **115:** 329–341.

Zelalem, D. 2015. Photosynthetic productivity and biomass of phytoplankton, in Lake Kuriftu, Ormia Region, Ethiopia. *Int. J. Fish. Aquac*., **6(5):** 71–80.

Table 1 Plankton species recorded during study period from the different ponds (culture and non-culture) at Prayagraj, Uttar Pradesh

Ponds	CIFRI	Andawa 1	Andawa 2	Jhuthi Tali Kotwa	Andawa 2	CIFRI	Jhuthi Tali Kotwa
Dates	09.052023	10.05.2023	10.05.2023	16.05.2023	20.05.2023	22.05.2023	20.05.2023
Plankton species							
Bacillariophyta							
Achnanthidium sp.	0	0	0	18000	0	0	0
Anomoconeis spaeraphora	0	0	0	36000	0	0	0
Aulacoseira granulate	0	0	42000	54000	0	0	0
Cocconeis sp.	12000	126000	0	36000	0	0	0
Cyclotella sp.	0	0	0	0	0	600000	0
Cymbella sp.	0	180000	0	0	0	0	0
Diadesmis sp.	0	0	0	18000	0	0	0
Diatoma sp.	0	54000	0	0	0	0	0
Diatoma vulgaris	0	0	0	0	0	0	50000
Fragilaria sp.	0	0	0	0	0	150000	0
Navicula sp.	12000	90000	168000	72000	18000	150000	200000
Neidium sp.	12000	0	0	0	0	0	0
Nitzschia sp.	12000	0	0	0	0	50000	0
Pinnuleria sp.	12000	54000	0	0	0	0	0
Stauroneis sp.	0	0	0	0	0	0	100000
Ulnaria acus	0	18000	0	0	0	0	0
Ulnaria acus	0	0	0	0	0	50000	0

Trybilionella sp.	12000	0	0	0	0	0	0
Diploneis sp.	0	18000	0	0	0	0	0
Gomphonema sp.	0	72000	0	18000	18000	0	150000
Chlorophyta							
Akistrodesmus sp.	12000	0	0	18000	0	100000	50000
Chlamydomonas sp.	48000	180000	0	18000	0	0	0
Chorella sp.	168000	0	21000	0	0	350000	0
Coelastrum sp.	0	144000	0	0	0	0	0
Cracigenia fenestrata	0	0	0	0	0	150000	0
Crucigenia sp.	12000	0	0	0	0	0	0
Desmodesmus sp.	48000	0	0	54000	0	1250000	0
Golenkinia sp.	0	0	0	0	0	500000	0
Kirchneriella sp.	36000	0	42000	0	0	200000	0
Monoraphidium contortum	48000	36000	21000	36000	0	0	150000
Monoraphidium irregulare	36000	0	0	0	0	0	0
Oocystis sp.	0	0	0	0	0	150000	200000
Pediastrum tetras	0	0	0	0	0	0	50000
Desmodesmus armatus	0	0	0	0	0	400000	0
Desmodesmus communis	36000	0	0	0	0	0	0
Scenedesmus quadricauda	0	0	0	18000	0	0	0
Scenedesmus sp.	60000	0	0	54000	0	0	100000
Desmodesmus opoliensis	0	0	0	0	0	1250000	0
Selenastrum sp.	36000	36000	0	0	18000	0	0
Tetradesmus obliquus	84000	0	0	0	0	0	0
Tetraedron sp.	0	0	0	36000	0	0	0
Verrucodesmus verrucosus	0	0	0	18000	0	0	0
Cryptophyta							
Cryptomonas sp.	0	0	0	0	0	0	600000
Rhodomonas sp.	0	0	0	108000	36000	100000	150000
Cyanobacteria							
Anabaena sp.	0	0	63000	18000	0	0	0
Aphanocapsa sp.	120000	0	0	36000	0	100000	150000
Aphanothece sp.	24000	36000	0	0	0	0	0
Chroococcus sp.	36000	0	0	180000	0	0	5000000
Dolichospermum planctonicum	0	0	0	252000	0	0	0
Dolichospermum sp.	0	0	588000	234000	54000	150000	250000
Lyngbya sp.	12000	0	0	0	0	0	0
Merismopedia sp.	0	0	0	0	0	500000	0
Microcystis sp.	12000	0	0	0	0	10000000	0
Nostoc sp.	36000	0	0	0	0	0	50000
Oscillatoria sp.	0	0	0	18000	0	0	0
Phormidium inundatum	0	0	0	0	90000	0	0
Phormidium sp.	60000	90000	21000	0	0	0	0
Pseudanabaena sp.	0	0	63000	0	0	0	0
Spirulina sp.	0	0	0	0	0	100000	0

Euglenozoa							
Euglena sp.	0	0	0	36000	0	0	400000
Euglena gracilis	0	0	0	0	0	0	200000
E. tubacarter	0	0	63000	36000	0	250000	0
Euglena sp.	0	0	0	18000	0	0	0
Lepocinclis ovum	0	0	0	54000	0	0	0
Phacus sp.	0	0	0	18000	0	0	50000
Strombomonas sp.	0	0	0	0	0	0	50000
Trachelomonas sp.	0	0	0	0	0	0	50000
Myzozoa							
Peridinium sp.	84000	72000	0	36000	36000	50000	0
Rotifera							
Brachinonus plicatilis	0	0	0	0	0	0	50000

Table 2 Density of plankton groups recorded during study period

Plankton groups	**Minimum density (unit/l)**	**Maximum density (unit/l)**
Bacillariophyta	36000	1000000
Chlorophyta	18000	4350000
Cryptophyta	0	750000
Cyanobacteria	144000	10850000
Euglenozoa	0	750000
Myzozoa	0	50000
Rotifera	0	50000

Table 3 Diversity indices recorded during study period

	CIFRI pond	Andawa 1	Andawa 2	Jhuti Ttali Kotwa	Andawa 2	CIFRI pond	Jhuti Tali Kotwa
Simpson_1- D	0.9309	0.9049	0.6723	0.9194	0.8	0.6207	0.6014
Shannon_H	2.932	2.5	1.594	2.898	1.767	1.702	1.68

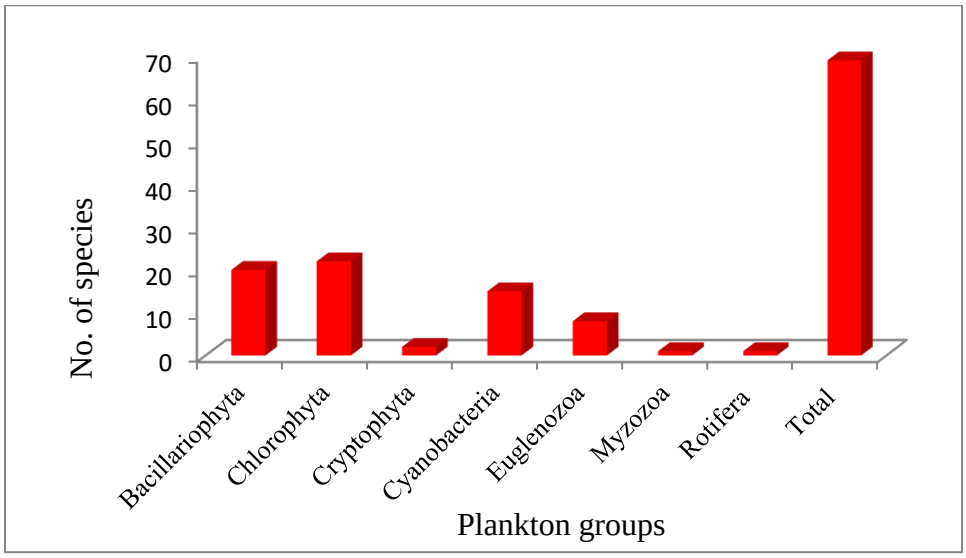

Fig.1 Plankton groups were recorded in the sampling period in all ponds

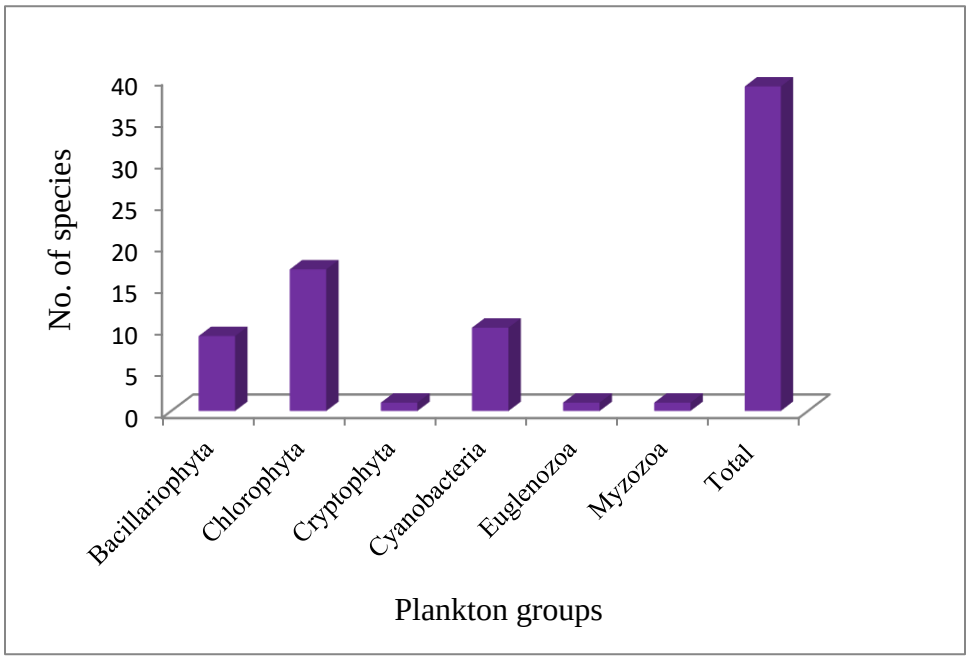

Fig. 2 Species richness of plankton recorded in CIFRI Pond

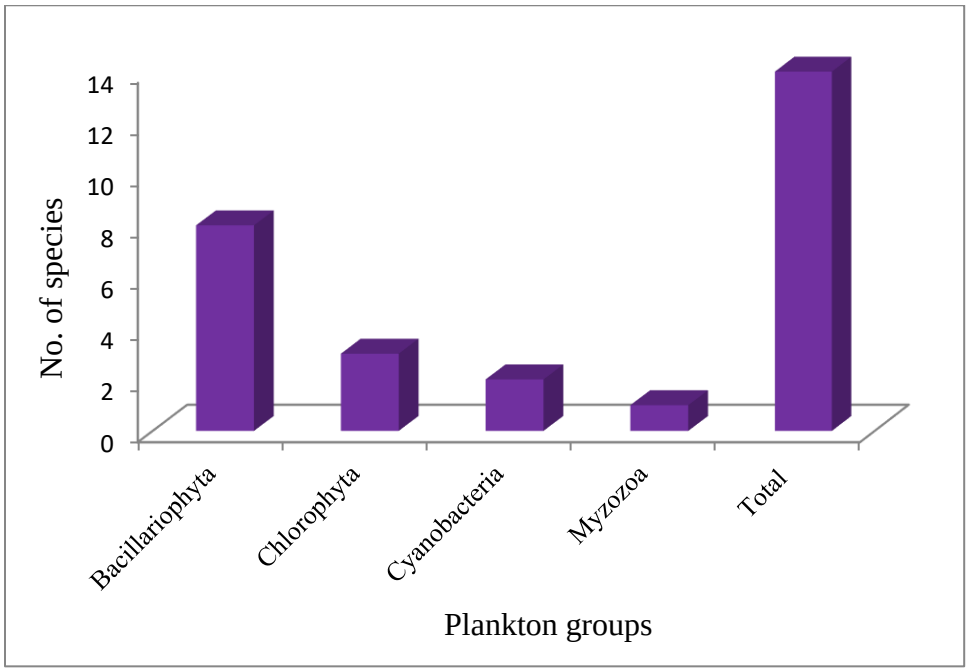

Fig. 3 Species richness of plankton recorded in Andawa pond 1.

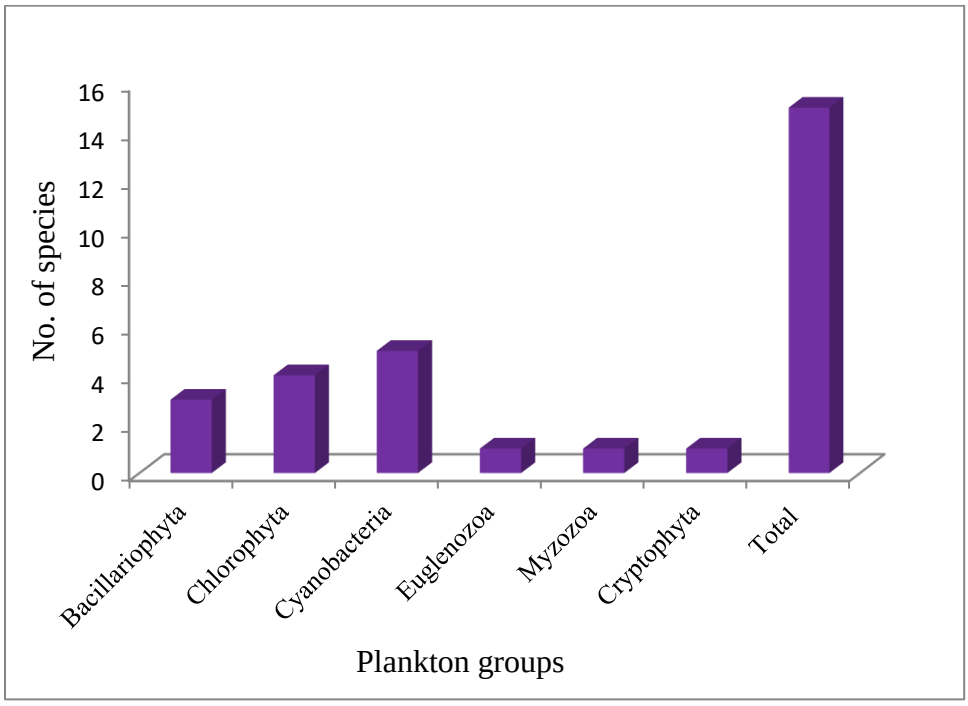

Fig. 4 Species richness of plankton recorded in Andawa pond 2

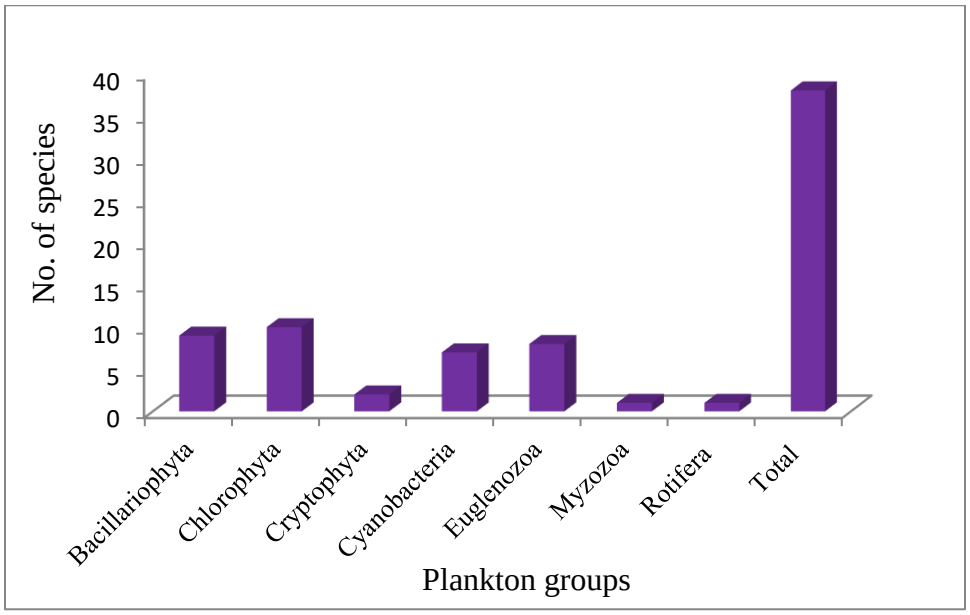

Fig. 5 Species richness of plankton recorded in Jhuti Tali Kotwa Pond.