International Journal of Science and Research (IJSR)
ISSN: 2319-7064
Impact Factor 2024: 7.101

Plankton Diversity in Two Freshwater Ponds of Dahod District, Gujarat, India

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Abstract: ***This study documents the diversity of plankton species in two freshwater ponds—Thala and Parthampur—located in Dahod District, Gujarat, India. Using taxonomic identification methods and microscopy, a total of 36 zooplankton and 32 phytoplankton species were identified. Rotifera and Copepoda dominated the zooplankton groups, while Chlorophyceae and Bacillariophyceae were prominent among phytoplankton. The observed species distribution indicates varying degrees of eutrophication, with Thala Pond showing higher rotifer diversity and Parthampur Pond exhibiting greater copepod prevalence. The findings serve as baseline data for ecological assessments and water quality monitoring in the region.***

Keywords: Zooplankton, Phytoplankton, Rotifera, Copepoda, Ecology

1. Introduction

A pond is a freshwater ecosystem in which the various organisms depend on each other and they play a key role in maintaining regional biodiversity. The term plankton refers to organisms that exhibit a drifting habit and includes all forms of both macro and microscopic life which floats free in water or if motile, are unable to swim against water currents (Koushik Roy et al., 2016). Plankton are divided into phytoplankton and zooplankton. Phytoplankton are free floating unicellular, filamentous and colonial autotrophic forms of aquatic habitat whose movement is more or less dependent on water currents (Millman et al., 2005). This study aims to identify and document the species of plankton present in two freshwater ponds in Dahod District and evaluate their ecological implications

Freshwater communities are extremely sensitive to environmental variables. Creatures living in aquatic environment exist in a delicate ecological balance. This balance has been changed during the last few decades due to the factors such as overfishing, eutrophication and lack of oxygen. Consequently, some zooplankton species are disappearing or available only in small numbers (Caddy 1993; Zaitsev and Alexandrov, 1995).

Zooplankton are a major mode of energy transfer between phytoplankton and fish. These are divided into different groups such as Rotifera, Cladocera, Copepods, Ostracods and Protozoa, including their larval forms (Shashank et.al,2020). Zooplankton have been extensively studied due to their central role in aquatic food webs as they occupy a central position in sustaining the food web components of various aquatic ecosystems.

The study on zooplankton is very useful tool for the assessment of biotic potential and contributes to overall estimation of basic nature and general economic potential of water body (Jalilzadeh et. al, 2007). However, identification and determination of plankton diversity in these areas have not been carried out and data in this regard is sparely.

Phytoplankton constitutes the basis of nutrient cycle of an ecosystem hence play an important role in maintaining equilibrium between living organism and abiotic factor (Wetzel et al.,2001).

Understanding plankton diversity in these ecosystems provides essential insights into aquatic health, pollution levels, and biodiversity, which are critical for environmental monitoring and sustainable water resource management.

2. Materials and Method

Study area: The present study was conducted in the Dahod District of Gujarat, India focusing on two selected freshwater pond Thala and Parthampur.

Selected sites:

1) Thala pond: 22°56'57.1"N 74°04'40.8"E. It has potential of being a suitable place for fishery. The pond is also used for various purposes such as agriculture, bathing of animals, etc.

2) Parthampur pond: 22°59'06.5"N 74°12'11.8"E. Anthropogenic activities such as bathing, washing occurred in and around this pond.

3. Methodology

The samples were collected at fixed time schedules in the morning (7 to 9 AM) and evening (7 to 9 PM) using a plankton net having mesh size 20 and 50 µM. The samples were fixed in 4% formalin. Lugol's solution and Glutaraldehyde stains were used for phytoplankton species and Rose Bengal stain was used for zooplankton species. The samples were allowed to settle down for 24 hours. A drop of the preserved sample was placed on a glass cavity slide and observed under binocular research light microscope which was attached to camera. The image was further evaluated using motic image plus software. The identification of plankton was carried out following Edmonson and Tonapi (1980) and other reference literature.

4. Result and Discussion

The study revealed immense diversity in the species identified as shown in Table 1.

Table 1: Zooplankton diversity

Phylum	Family	Order	Class	Genus and species
Rotifera	Brachionidae	Ploima	Monogononta	*Brachionus forficula*
				Brachionus calyciflorus
				Brachionus diversicornis
				Brachionus rubens
				Brachionus caudatus
				Brachionus isagakinesis
				Brachionus quadridentatus
				Brachionus falcatus
				Brachionus budapestis
				Keratella tropica
				Keratella tecta
				Keratella cochlearis
				Keratella Valga
				Keratella serrulata
				Argonotholea foliacea
	Asplanchnidae			*Asplanchna herriki*
				Asplanchna brightwelli
				Asplanchna pridonta
	Trichocercidae			*Trichocera edmondsoni*
				Trichocera cylindra
	Synchaetidae			*Polyarthra vulgaris*
	Testudinellidae	Flosculariaceae		*Testudinella species*
	Trochosphaeridae			*Filiana longiseta*
				Filiana opoliensis
Arthropoda	Daphniidae	Cladocera	Brachiopoda	*Daphnia magna*
				Daphnia lumholtizi
	Sididae			*Diaphanosoma excisum*
				Diaphanosoma sarsi
	Diaptomidae	Calanoida	Copepoda	*Heliodiaptomus viduss*
				Sinodiaptomus indicus
	Cyclopidae	Cyclopoida		*Thermocyclops hyalinus*
				Thermocyclops decipienes
				Mesocyclops leuckarti
				Nauplius species
				Dicyclops thomasi
	Cypridiidae	Podocopida	Ostracoda	*Eucypris bispinosa*

Table 2: Zooplankton diversity in Thala Pond and Parthampur pond

Sr no.	Name of species	Sampling pond	
		Thala pond	Parthampur pond
1	*Brachionus forficula*	+	-
2	*Brachionus calyciflorus*	+	+
3	*Brachionus diversicornis*	+	+
4	*Brachionus rubens*	+	-
5	*Brachionus caudatus*	+	-
6	*Brachionus isagakinesis*	+	-
7	*Brachionus quadridentatus*	+	-
8	*Brachionus falcatus*	+	-
9	*Brachionus budapestis*	+	-
10	*Keratella tropica*	+	+
11	*Keratella tecta*	+	+

12	*Keratella cochlearis*	+	-
13	*Keratella Valga*	+	-
14	*Keratella serrulata*	+	-
15	*Argonotholea foliacea*	+	-
16	*Asplanchna herriki*	+	-
17	*Asplanchna brightwelli*	+	-
18	*Asplanchna pridonta*	+	-
19	*Trichocera edmondsoni*	+	-
20	*Trichocera cylindra*	+	-
21	*Polyarthra vulgaris*	+	-
22	*Testudinella species*	+	-
23	*Filiana longiseta*	+	+
24	*Filiana opoliensis*	+	+
25	*Daphnia magna*	+	+
26	*Daphnia lumholtizi*	-	+
27	*Diaphanosoma excisum*	-	+
28	*Diaphanosoma sarsi*	-	+
29	*Heliodiaptomus viduss*	+	+
30	*Sinodiaptomus indicus*	-	+
31	*Thermocyclops hyalinus*	+	+
32	*Thermocyclops decipienes*	-	+
33	*Mesocyclops leuckarti*	-	+
34	*Nauplius species*	+	+
35	*Dicyclops thomasi*	-	+
36	*Eucypris bispinosa*	+	-

'+' Present '- 'Absent

A total 36 Zooplankton species were recorded from the two sampling sites which included 24 species of Rotifera, 7 Copepoda, 4 Cladocera, and 1 Ostracoda, individually shown in Table 2. Observations of samples from Thala Pond revealed 29 Genera belonging to 4 groups the highest number of 24 Rotifera species, followed by 3 species of Copepoda, 1 Cladocera species and 1 species identified as Ostracoda. In Parthampur pond, 17 species were found and in the order of species community it differed from Thala Pond which was 7 Copepoda, 6 Rotifera and 4 Cladocera species found. The results suggested that Thala Pond had more plankton diversity than Parthampur pond. In both ponds certain zooplankton species could not be accurately identified.

In the present study, among the Rotifers, the genus Brachionus was found to be more in numbers in Thala Pond, a finding that was also reported by Dharansekarana et.al, (2016). Rotifers are the microscopic, soft bodies, aquatic, multicellular invertebrates which are the indicators of a healthy ecosystem. In the present study the dominance of rotifers was an observation which corroborated with that of several researchers. Crustacean zooplankton Cladocera, Copepod and Ostracoda act as secondary consumers in the aquatic food chain. Cladoceran also known as 'water fleas', are transparent and larger than Rotifers. They serve as food of high nutritional value for secondary consumers. These are found in plenty in ponds and lakes than in Rivers (Ward and Wipple, 1959). Due to their easy culturing, short generation time and clonal reproduction Cladoceran (especially Daphnia) are important model organisms in ecological and evolutionary studies (Forro et al., 2008).

Rotifera is one of the indicator Organisms in the zooplankton groups. The species of *B.calyciflorus* considered to be a good indicator of eutrophication. Among rotifera *B.angularis , B.calcyciflorus, F.longiseta* indicate semi polluted water. the dominance of Brachionus sp and *F. longiseta* in the lake designate eutrophy and are usually recorded in mixotrophic waters. In rotifera, species such as *B. calyciflorus, B.falcatus and Filinia longiseta*. Some species of Cladocera (D.sarsi and C.cornuta), some species of copepoda (*heliodiaptomus viduus*) some species of ostracoda are the pollution tolerant species and also indicate accumulation of organic matter and also reveal that the lake is being eutrophicated and polluted.

In Parthampur pond a high diversity of Copepoda was recorded Copepodan's are important members of the Zooplankton for their role in the trophic dynamics and in energy transfer in the aquatic ecosystems providing food for fishes in fresh water ponds, lakes and playing a major role in fish production (Kamble and Meshram, 2005; Pawar et al., 2003). Copepods are major food organism for small fishes and other crustaceans such as Krill and are known to play a major role in pond ecosystem. They feed on both autotropic and hetero tropic protozoans and metazoans (Turner, 2004). The life history characteristics of copepods are greatly influenced by temperature, food availability and predation (Reid et al., 2010). Ostracoda species were observed in fewer numbers among all other groups in both the ponds. The Ostracods are bivalve structures; they occur in all kinds of freshwater.

Table 3: Phytoplankton Diversity

Sr no.	Group	Genus and Species	Thala pond	Parthampur pond
	Chlorophyceae			
1		*Ankistrodesmus species*	+	+
2		*Closterium species*	+	+
3		*Pediastrum duplex* (Meyen, 1829)	+	-

4		*Pediastrum simplex* (Meyen, 1829)	+	-
5		*Pediastrum tetras*	-	+
6		*Eudorina species*	+	-
7		*Actinastrum hatzschii*	+	+
8		*Scenedesmus dimorphus*	+	-
9		*Scendesmus quadricauda*	+	-
10		*Stigeoclonium species*	-	+
11		*Monoraphidium species*	+	+
	Bacillariophyceae			
12		*Synedra species* (Ehrenberg, 1830)	+	+
13		*Nitzchia species* (Hassal 1845)	+	-
14		*Pleurosigma species*	+	+
15		*Cymbella species (*C.Agardh 1830)	+	+
16		*Navicula species*	+	-
17		*Cyclotella species*	+	+
18		*Frustulia species*	+	-
19		*Pinnularia species* (Ehrenberg, 1843	+	-
20		*Amphipleura species*	+	+
21		*Surirella species*	+	+
22		*Gomphonema species (*Ehrenberg, 1832)	+	-
23		*Craticula species*	-	+
24		*Diadesmis species*	+	-
25		*Aulacoseira granulata*	+	+
	Cyanophyceae			
26		*Cylindrospermum*	+	-
27		*Anabaena*	-	+
28		*Merismopodia*	+	-
29		*Microcystis*	+	+
30		*Anthrospira species*	+	+
	Euglenophyceae			
31		*Phacus species*	-	+
32		*Euglena species*	+	+

'+' Present, '-'Absent

The prepared checklist on 32 species of phytoplankton as observed in the current research from study area. Phytoplankton belong to 14 species to Bacillariophyceae, 11 Chlorophyceae, species to 5 Cyanophyceae, 2 Euglenophyceae. In Thala Pond total 26 Phytoplankton species found as shown in Table 3. In Prathampur Pond species phytoplankton diversity consisting of 13 Bacillariophyceae followed by 9 species of Chlorophyceae, 3 species of Cyanophyceae and 1 Euglenophyceae. In Parthampur pond we observed a total of 19 species. In this pond the species community represented by 8 Bacillariophyceae, 6 Chlorophyceae, Cyanophyceae 3 species and 2 Euglenophyceae. Similar results have been published by Patil (2021).

Many et al., reported the occurrence of *Microcystis* in eutrophic aquatic environment. Similar conditions were observed in both the ponds. In these previous studies of Ratnasabapathy, Gunale and Balakrishan, Jafari and Gunale sanap were found that *scendesmus*, *chalamydomonas*, *Navicula sp*., *Chlorella*, *Nitzchia*, *Ankiostrodesmus* are well flourished into organically polluted water.

Microphotographs of Zooplankton

Fig No.1 *Keratella species*

Fig No.2 *Filiana species*

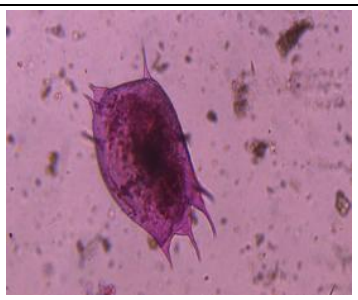

Fig No.3 *Brachionus species*

Fig No.4 *Argonotholca foliacea*

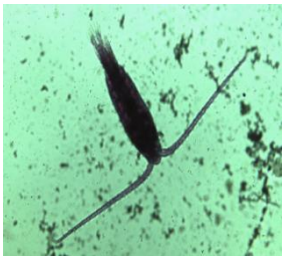

Fig No.5 *Copepoda species*

Fig No.6 *Polyarthra vulgaris*

Microphotographs of Phytoplankton

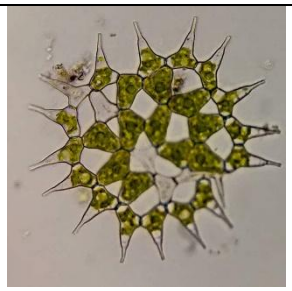

Fig No. 7 *Pediastrum Species*

Fig No. 8 *Scenedesmus Species*

Fig No. 9 *Diatom Species*

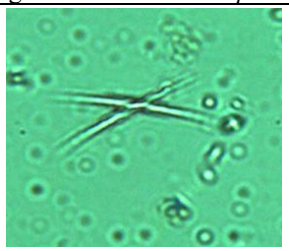

Fig No. 10 *Actinastrum Hantzschii*

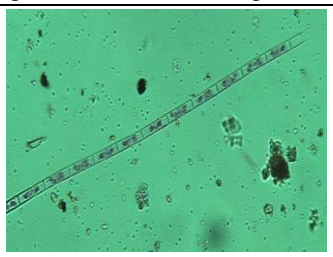

Fig No. 11 *Aulacoseria Granulata*

Fig No. 12 *Monoraphidium Species*

5. Conclusion

The quality of pond is important for regulation of biotic and abiotic factor. This study provides primary data of plankton diversity of two freshwater bodies near Dahod. In Thala Pond, Rotifera group dominate over other group of zooplankton. Many research studies documented that Rotifer presents eutrophic nature of water. In Parthampur pond the Copepoda shows the high diversity. Copepoda dominance may suggest that pond was eutrophicated or oligotrophic in nature. Some species of phytoplankton i.e, *Scenedesmus*, *Navicula sp*., *Nitzchia*, *Ankiostrodesmus* were reported in the Thala freshwater body. Hence, it can be said that the freshwater body is organically polluted. Although this study focused on selected ponds in Dahod, it offers important baseline data for future research on plankton diversity in the region in some selected ponds of Dahod, this will help to get mainly information about plankton diversity which help for further study related to this area.

This study provides foundational data on plankton diversity in two freshwater ecosystems in Dahod District, highlighting the ecological status and degree of eutrophication in both ponds. The dominance of rotifers in Thala and copepods in Parthampur suggests site-specific environmental conditions, possibly influenced by human activities. These findings can aid future ecological studies, water quality assessments, and biodiversity conservation strategies in similar freshwater environments.

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