ORIGINAL RESEARCH PAPER

Volume - 13 | Issue - 09 | September - 2024 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

SEASONAL VARIATION THE DIVERSITY OF PLANKTONS ON MANJALAR RESERVOIR IN WESTERN GHATS TAMIL NADAU, INDIA

Zoology

M. Sudhanthiralingammal* Research Scholar, Department Of Environmental Studies, School Of Energy, Environment & Natural Resources, Madurai Kamaraj University, Madurai, Tamil Nadu, India. *Corresponding Author

Dr. S. Kannan Chairperson , Professor And Head, Department Of Environmental Studies, School Of Energy, Environment & Natural Resources, Madurai Kamaraj University, Madurai, Tamil Nadu, India.

M. Mathar Fathima Research Scholar, Department Of Environmental Studies, School Of Energy, Environment & Natural Resources, Madurai Kamaraj University, Madurai, Tamil Nadu, India

ABSTRACT

The plankton constitutes the basic food sources of any aquatic ecosystem, which supports fish and other aquatic animals. The productivity of an aquatic environment is directly correlated with diversity of planktons. The status of health of any aquatic ecosystem of planktons. Both phytoplankton and zooplankton are used to as indicators of water quality. They occupy an intermediate link between phytoplankton and fish. Zooplankton diversity the most important ecological parameters in water quality. Zooplankton are considered to be the most important primary consumer of the aquatic ecosystem. In the present study was aimed to Seasonal variation the diversity of Planktons on Manjalar Reservoir on Western Ghats, in Tamil Nadau. Water sample were collected at surface water sample at an fort-night interval in the month January 2021-December 2021 is an attempt to estimate the diversity indices of Phytoplankton's and Zooplanktons and to find out the richness, evenness, of the freshwater aquatic body. Collection of the planktons samples and their quantitative and qualitative analysis was done following the standard methods (Trivedi and Goel., 1992, APHA, 2005).

KEYWORDS

Planktons, Phytoplankton's, Zooplankton's, Manjalar Reservoir, Western Ghats.

INTRODUCTION:

An essential component of human life is water. According to Balsane et al., (2014), it is vital to the lives of all living things on Earth. For all living things on Earth, the ecosystem of fresh water is regarded as one of its many vital natural resources. There are numerous freshwater environments, such as lakes, reservoirs, ponds, and rivers. The freshwater habitats' water quality offers valuable insights into the resources that are now available, as it is influenced by both biological characteristics and physico-chemical parameters. The efficiency on plankton and the overall production of aquaculture products are significantly influenced by the physical, chemical, and biological properties of the water.

The term “plankton” refers to those minute aquatic forms that are non-motile or insufficiently motile to overcome transport by currents and live suspended in open or pelagic water. The planktonic plants are called phytoplankton, and the planktonic animals are called zooplankton (Kushwaha and Agrahari, 2014).

Plankton constitutes the basic food source of any aquatic ecosystem, which supports fish and other aquatic animals. Phytoplankton, being the primary producer, occupies the first position in an aquatic grazing food chain, and the fate of productivity largely depends on it. Moreover, phytoplankton acts as a primary food organism in pond aquatic ecosystems. Phytoplankton is the base of aquatic food webs, and energy production is linked to phytoplankton primary production. The diversity, distribution, abundance of plankton, and variation according to abiotic factors afford information on energy turnover in the aquatic ecosystem (Forsberg, 1982). Damodharan et al., (2010) The phytoplankton in a reservoir is an important biological indicator of the water quality of the reservoir ecosystem (Patil et al., 2013). Phytoplankton, which include blue-green algae, green algae, diatoms, desmids, and euglenoids, are important among aquatic flora.

They are ecologically significant as they form the basic link in the food chain of all aquatic flora (Ravikumar et al., 2006). Its energy is transferred to secondary producers through the food chain (Ananthan et al., 2016). Phytoplankton are good indicators of water quality; they are quick to respond to environmental changes (Maybeck M. et al., 1996; Ashok et al., 2001). The zooplankton are one of the most important ecological parameters in water quality assessment. Zooplankton are microscopic, free-floating organisms that occur in all natural water bodies. Planktons, being the primary producers, occupy the first position in the aquatic grazing food chain, and plankton is a primary food organism in reservoir aquatic ecosystems. They are a major form of energy source between phytoplankton (plant plankton), zooplankton (animal plankton), and other aquatic animals (Dadhick and Saxena 1999). These zooplankton are well known to act as biological indicators of any natural aquatic body (Ahamed et al., 2011). They are used as indicator organisms for physical, chemical, and biological processes in the aquatic ecosystem.

The zooplankton is a fundamental character within the significance of an aquatic ecosystem and plays a key function in energy transfer. Zooplankton are microscopic, free-floating organisms that occur in all natural water bodies. The freshwater zooplankton comprises protozoa, rotifera, cladocera, copepoda, ostracoda, microscopic crustaceans, and micro invertebrates. Zooplankton plays an integral role, may serve as bio-indicators, and is a well-suited too zooplankton are an economically and ecologically important group of aquatic organisms. Their ecological processes influence fisheries, oceanography, and climate. They play an important role in the food web by linking the primary producers and higher trophic levels (Deivanai et al., 2004). They have different types of life histories influenced by seasonal variations of biotic factors, feeding ecology, and predation pressure. for understanding water pollution status (Contreras et al., 2009).

Zooplankton are widely accepted as very important organisms for fish feeding and nutrition. So, successful aquaculture management depends to a large extent on the species diversity and abundance of zooplankton in an aquatic body (Ghosh and Biswas, 2015; Shama, 2020). In addition to locating food and avoiding predators, zooplankton may benefit from changes in their bioenergetics, which result from metabolic rates that differ on either side of the thermocline (Kumar et al., 2011) in stratified waters. The quality of water, especially in eutrophic waters, is essentially determined by the quantity of algae. Drinking water supplies, recreational activities, and fisheries can be impaired by high phytoplankton biomass.

Plankton communities and analysis of phytoplankton and zooplankton with diversity indices like Shannon-Wiener and Simpson diversity index, species richness and evenness, structure, and composition trends with total abundance of various plankton are essential to assess the water quality and aquatic health for proper management of reservoirs (Dipankar Ghosh and Jayanta Kumar Biswas, 2014). A number of studies have been carried out on the condition of ecology and freshwater bodies in various parts of India (Smitha et al., 2007). So the present study was undertaken to investigate the phytoplankton and zooplankton diversity in Manjalar reservoir through the months of January 2021 to December 2021 in order to assess the plankton diversity of the reservoir.

Study area

Manjalar Reservoir

The fresh water will be selected in the Manjalar Reservoir for this study. Manjalar reservoir built in 1967 for irrigation purpose. It originates from Palani hills and joins the Vaigai river.Having small broken in to a number of regulates like Mulliur,Varattar, Iruttar and Maruthanadhi. The reservoir type is earthen surrounded by mango farms and has been constructed for irrigation purposes. The reservoir is mainly culture as a tilapia fishery. In the present study was aimed to Seasonal variation the diversity of Planktons on Manjalar Reservoir on Western Ghats, in Tamil Nadau.

Methodology

The surface water samples were collected from Manjalar reservoir in every month of fortnight samples during the month January 2021 to December 2021 in the morning 8.00 to 10.00 A.M, in four different sampling sites. For collection and filtered the surface water samples using plankton net bolting silk with mesh size 35um fitted to aluminium frame. By adding 1ml of 4 % formalin, was added to it for further qualitative and quantitative studies for quantitative estimation of plankton, 1ml well mixed sample was taken on Sedgwick Rafter cell for plankton counting chamber for species enumeration (each sample having replicates of the concentrate) which were examined under the binocular microscope using the scanning, low-power and high-power objectives at 100-200x, 100-400x magnifications. (Needham et al.,1962) and Tonapi (1980). The composite species were identified with the aid of keys, descriptions and illustrations such as Durand and Léveque (1980) and APHA, 2005). The different organisms identified were classified into different families and species and their frequencies were noted. (Edmonson 1963., Battish et al.,1992).

CALCULATION:

- No. of planktons' ml = $\dfrac{\text{Number of organisms counted}}{\text{Number of replicates taken}}$

No. of planktons/ml = $\dfrac{\text{Number of organisms in all the strips x 1000}}{\text{l x b x d of each strip x number of strips counted.}}$

(L- Length, b- breath, d- depth).

Plankton Classification

- Pico plankton(0.2 –2 µm) Nano plankton 2 - 20 µm Bacterio-plankton, Myco-plankton, Phytoplankton, Protozooplankton.
- Micro plankton 20 - 200 µm Myco-plankton, Phytoplankton, Protozooplankton, Metazooplankton
- Meso plankton 0.2 – 2 mm Phytoplankton, Protozooplankton, Metazooplankton, Small hydro medusae, ctenophores.
- Macro plankton 2mm -20 cm Phytoplankton, Protozooplankton, Metazooplankton, Larger specimens of hydromedusae, mysids, amphipods.
- Mega plankton 20- 200 cm Metazooplankton Jellyfish , siphonophores, scyphozoan.

Phytoplankton's Classification:

S.No	Phytoplankton's	Kingdom	Phylum	Class	Order	Family	Genus
1	**Volvex Globator**	Plantae	Chlorophyta	Chlorophycea	Chlamydomonodales	Volvocaceae	*V*
2	**Chlorella**	Protista	Chlorophyta	Trebouxiophyceae	Chlorellales	Chlorellacea	Chorella M.Beijerinck,1890
3	**Nostoc**	Monera	Cyanobacteria	Cyanophyceae	Nostocales	Nostocaceae	Nostoc Vaucher, 1888
4	**Spirogyra**	Protista	Chlorophyta	Zygnematophyceae	Zygnematales	Zygnemataceae	Spirogyra C.G Nees, 1820
5	**Navicula oblongata**	Chromista	Gyrista	Bacillariophyceae	Naviculaes	Naviculeae	Navicula oblongata Bory de Saint-Vincent 1822.
6	**Anabaena**	Monera	Cyanobacteria	CYanophyceae	Nostocales	Nostocaceae	**Anabaena Beryde Saint vient -1886)**
7	Ocillatoria Princeps	Bacteria	Cyanobacteria	Cyanophyceae	Osiciiatoriales	Oscillatoriaceae	**Oscillatoria Princeps**
8	Diatom	Protista	Chrysophyta	Bacillariophyceae			Diatom (Dangeard, 1993)
9	Dinoflagellata	Chromista	Myzozoa	Dinoflagellata		Gymnodiniaceae	Dinoflagellata (Butschli 1885)
10	Microcystis aeruginosa		Cyanobacteria	Cyanophyceae	Chroococcales	Microcystaceae	Microcystis aeruginosa (Kutzing, 1833)
11	Spirulana	Bacteria	Cyanobacteria	Cyanophyceae	Spirulinales	Spiruliaceae	Spirulina

Zooplanktons classifications:

S.No	Zooplankton's	Kingdom	Phylum	Class	Order	Family	Genus
1	**Daphnia**	Animalia	Arthropoda	Branchipoda	Anomopoda	Dphniidea	Daphnia (Muller,1785)
2	**Cypris**	Animalia	Arthropoda	Ostracoda	Podocopida	Cyprididae	Cypris
3	**Paramecium**	Chromista	Ciliophora	Oligohymenophorea	Peniculida	Paramociiidae	Paramecium (Muller,1773)
4	**Copepods**	Animalia	Arthropoda	Copepoda	Calanoida	Canthocamptidae	Copepoda (H.Milne Edwards ,1840)
5	**Cyclops**	Animalia	Arthropoda	Copepoda	Cyclopoidae	Cyclopoidae	Cyclops (O.F. Muller ,1785)
6	**Branchionus Calyciforus**	Animalia	Rotifera	Monogonota	Ploima	Branchionidae	Branchionus (Palls, 1766).
7	**Rotifera Pulchritia dorsicornuta**	Animalia	Rotifera	Platyzoa			Rotifera Pulchritia dorsicornuta
8	**Mysis relicta**	Animalia	Arthropoda	Malacostroca	Mysida	Mysidae	Mysis relicta (Loven, 1862)
9	**Macrothrix**	Animalia	Arthropoda	Branchiopoda	Anomopoda	Macrothricidae	Macrothrix (Baird, 1843)
10	**Nauplius**	Animalia	Arthropod				
11	**Monia**	Animalia	Mollusca	Bivalvia	Pectinida	Anomiidae	Monia (Gray, 1850)

Statistical analysis:

Population of plankton were recorded and its diversity indices was studied with help of statistical tool Shannon Wiener Diversity Index. In the present study **Brandon Shamp (2011)** modified method of Shannon Wiener Diversity Index was followed and determined.

Months	**Phytoplankton Diversity**	**Site-I**	**Site-II**	**Site-III**	**Site-IV**
January	Shannon	-9.32663	-11.3988	-0.50407739	-4.545177
	Evenness	-5.20473785	-5.857844	0.7273015	-3.27865206
February	Shannon	-5.238324625	-14.60259	-4.744604	-7.0419
	Evenness	-3.77865275	-7.50424737	-3.422509222	-4.387665099
March	Shannon	-9.750557	-6.154042	-2.2958336866	0.386294361
	Evenness	-5.441890902	-3.823721075	-2.089758428	-0.557305104
April	Shannon	-16.61636159	-17.405536695	-16.79981166	-12.86294361
	Evenness	-7.99078082	-8.370291982	-8.079001655	-6.610245906
May	Shannon	-20.24245544	-25.59747002	-13.32633618	-12.86294361
	Evenness	-9.212738494	-11.11683998	-6.848382597	-6.610245906
June	Shannon	-10.23081306	-14.46973885	-9.982313714	-4.545177444
	Evenness	-5.709926982	-7.435975379	-5.57123682	-3.278653333
July	Shannon	-16.50518553	-17.30950877	-16.32206846	**-2.465735903**
	Evenness	-7.937476576	-8.324114153	-7.84925574	**-2.244410131**
August	Shannon	-10.090354489	-7.811422534	-0.386294361	-----
	Evenness	-4.8524337	-4.853509445	-0.557304959	------
September	Shannon	-20.16131556	22.90566665	-7.265650166	-2.295836866
	Evenness	-9.175810143	-9.947804565	-4.514402025	-2.089761322
October	Shannon	-16.7932006	-19.46446938	-10.09035489	-2.465735903
	Evenness	-8.075820629	-9.360429086	-5.631535765	-2.244410131
November	Shannon	-13.39200322	-20.57780536	-5.068425588	-4.780743516
	Evenness	-6.883257127	-9.36536282	-3.656097183	-3.448578379
December	Shannon	-7.501216237	-17.28601331	-2.988984047	-4.704199055
	Evenness	-4.660767446	-8.312815225	-2.720691242	-3.393363208

Zooplankton's Diversity:

Months	Phytoplankton Diversity	Site-I	Site-II	Site-III	Site-IV
January	Shannon	-9.921635734	-16.46001358	-15.639097167	-16.486101819
	Evenness	-5.537370337	-7.915591577	-16390592	.62137104
February	Shannon	-13.31451822	-19.83699033	-12.86294361	-7.047189562
	Evenness	-6.842309015	-9.028201632	-6.61132961	-4.378664827
March	Shannon	-10.10390592	-23.26015132	-2.295836866	-4.545177444
	Evenness	-5.63909874	-10.10175537	-2.089760771	-3.278652482
April	Shannon	-19.59482896	-17.39745692	-10.10390592	-0.386294361
	Evenness	-8.917990981	-8.366408273	-5.639097621	-0.557304985
May	Shannon	-24.21117566	-18.59957991	-10.26999579	-10.09035489
	Evenness	-10.51477999	-8.944507232	-5.731793783	-5.631534287
June	Shannon	-10.04292184	-13.57499804	-2.442019376	-4.545177444
	Evenness	-5.605061398	-6.977313287	-2.222821826	-3.278652482
July	Shannon	-19.2878006	-13.57499804	-4.704199055	-4.545177444
	Evenness	-8.777336765	-6.976168987	-3.393362327	-3.278865248 2
August	Shannon	-16.10005342	-16.46001346	-9.982313714	-2.295836866
	Evenness	-7.742720281	-7.91559333	-5.571235359	-2.089760771
September	Shannon	-19.79441542	-16.79981166	-15.88464944	-2.295836866
	Evenness	-9.008826693	-8.079001663	-7.638901657	-2.089760771
October	Shannon	-14. 007665665	-13.5500843	-13.03865411	-7.047189562
	Evenness	-7.198516162	-6.963365857	-6.700548538	-4.378665072
November	Shannon	-16.64672273	-24.96833869	-5.238324625	-7.630938457
	Evenness	-8.005381442	-12.29810814	-3.778652483	-4.741368654
December	Shannon	-16.34223055	-20.75797977	-10.61478291	-12.86294361
	Evenness	-7.858951656	-9.447363728	-5.924223138	-6.610245396

CONCLUSION

Plankton were collected from the surface water sample at sampling sites I, II, II and IV. The maximum phytoplankton's was observed during the month of May (S-I & II) Shannon -20.24245544, -25.59747002, and Evenness -9.212738494, -11.11683998. The minimum was August (S-III & S-IV) Shannon -0.386294361, Evenness -0.557304959, (S- IV) Shannon –0.00 and Evenness -0.00, recorded during 2021. The maximum Zooplankton's Diversity was observed during the month of May (S-I) Shannon -24.21117566 and Eveness -10.51477999 (S-II) -18.59957991 and Evenness -8.944507232 and November (S-II &S-I) -24.96833869 -12.29810814, and (S-I) Shannon 16.64672273, Evenness -8.005381442 and minimum was (S-IV) April Shannon -0.386294361, Evenness -0.557304985 and August (S-IV) Shannon -2.29583686, Evenness-2.089760771.

Similar type of observation has been found on River Seeta (Ramesh and Sophia 2013; Pandit et al., (2020). The phytoplankton are responsible for a percentage of all primary production in any given water body. The zooplankton, fish and other organisms in turn graze upon the Phytoplankton's. Hence, it is Manjalar reservoir such the plankton can be good indicators of water quality.

Conflicts of interest: The authors stated that no conflicts of interest.

REFERENCES:

1. Rahman S, Hussain MA. A study on the abundance of zooplankton of a culture and a non-culture pond of the Rajshahi University campus. Univ J Zool Rajshahi Univ. 2008; 27:35-41.
2. Ahamad V., Parveen S.., Khan A.A., ET et al ., (2011) Zooplankton population in relation to physico-chemical factors of the sewage fed pond of Aligrah (U.P). Biol. Medic., 3;336-341.
3. American Public Health Association (APHA), American Water Work Association (AWWA) and Water Pollution Control Federation (WPCF) (2005): Standard methods for the examination of water and waste water. 21st ed. APHA, Washington D. C., 1195pp.
4. APHA (2005): Standard Methods for the Examination of Water and Wastewater. 21st Edn. APHA, AWWA, WPCF, Washington DC, USA.
5. Battish SK, Kumari P. Effect of physico-chemical factors on the seasonal abundance of cladocera in typical pond at village of Raqba, Ludhiana. Ecology. 1986;13(1):146–151.
6. Contreras, J.J.; Sharma, S.S.; Merino-Ibarra, M, and Nandini, S. (2009): Seasonal changes in the rotifer (Rotifera) diversity from a tropical high altitude reservoir Valle de bravo, Mexico. Journal of Environmental Biology. 30: 191-195.
7. Dadhick, N. and Saxena, M. M. (1999): Zooplankton as indicators of trophical status of some desert waters near Bikaner. Journal of Environmental Pollution. 6: 251-254.
8. Damotharan, N., Vengadesh Perumal., Arumugam, M., Perumal, P., Vijayalakshmi, S., and Balasubramanian, T., 2010. Studies on zooplankton ecology from Kodiakkarai (Point Calimere) Coastal waters (South east coast of India). Res. J Biol. Sci.., 5(2): 187-198.
9. Dipankar Ghosh, and Biswas J.K., 2014. Zooplankton Diversity Indices: Assessment of an Ox-Bow Lake Ecosystem for Sustainable Management in West Bengal. International Journal of Advanced Biotechnology and Research, 6(1): 37-43.
10. Durand, J. R. et Leveque, C. (1980): Flora et faune aquatiques de L´Afrique . Sahelo-Soudanienne Tomme 1 Paris. 189pp.
11. Edmondson, M.T. (1965): Reproductive ratesof planktonic rotifers related to food, temperature in nature. Ecol. 5: 61-68

12. Ghosh D and Biswas J.K. (2015). Zooplankton Diversity Indices; Assessment of an Ox-Bow Lake Ecosystem for Sustainable Management in West Bengal. Internat. J. Adv. Biotech. Res., 16 (1); 37-43.
13. Kumar et al., (2012) have attempted to study the two high altitude Himalayan ponds situated near the Badrinath temple, Uttarakhand (India).
14. Manickam N, Bhavan PS, Santhanam P. (2015) Physico- chemical characteristics of Lake Ecosystem. Lap Lambert Academic Publishing. ISBN-13, b.
15. Misra SM (2001) Assessment of trophic status by using Nygaard index with reference to Bhoi wetland. Poll. Res.20.
16. Needham J.G. and Needham P.R., 1962. A guide to study freshwater biology. Holden Bay, San Fransisco, U.S.A. 83pp.
17. Pandi, D.N., Kumari, P. and Sharma, S.K. (2020). Ecology and diversity of zooplankton of the river Ganga at Bihar India in Relation to Water Quality. Current World Environment, 15 (2); 305-313. DOI: http; //dx.doi.org/10.12944/ CWE.15.2.18.
18. Patil J.V., Ekhande A.P and Padate G.S. (2013): Water quality monitoring–study of seasonal variation of diatoms and their correlation with physico-chemical parameters of Lotus lake Toranmal (M.S.), India. Apllied Science Research. 5(1): 172-176.
19. Ramesha M.M.and Sophia S. (2013). Species composition and diversity of plankton in River Seta at Seetanadi, the Western Ghats, India, Advanced Bio Tech., 12 (8); 20-27.
20. Ravikumar M., Manjappa S., Kiran B.R., Puttaiah E.T and Patel A.N. (2006): Physico-chemical characterization of Neelgunda Tank near Harpanahalli, Devanagere, Ind. J. Env. Prot. 26(2): 125-128.
21. Sharma, R.C. (2020). Habitat ecology and diversity of freshwater zooplankton of Uttarakhand Himalaya, India. Biodiversity Int. J., 4 (5); 188-196. DOI; 10.15406/ bij. 2020.04.00184.
22. Tonapi, G.T. (1980): Fresh water animals of India (An ecological Approach). Oxford & IBH Publishing Co. New Delhi. 341.
23. Ananthan G, Sampathkumar P, Soundrarajan P. (2016). Verampattinum coast of Pondichery. Int J of Aqua Biolo 19:67-72.
24. Maybeck M, Kuusisto E, Makila A, Malkki E (1996). Water quality monitory. Int J Bartram & R balance, London, UK.
25. Ashok SD (2001). Hydrological studies of a fresh water reservoir Nipani from Belgam District.
26. Brandon and Shamp, (2011). Shannon- Wiener Diversity Index. In Excel. Demmonstration of how to calculate the Shannon –Wiener Diversity Index in Microsoft Excel.
27. Smitha P.G., K. Byrappa and S.N. Ramaswamy;(2007). Physico-chemical characteristics of water samples of bantwal Taluk, South –estern Karnataka, India. J. Environ. Biol., 28 591-595.
28. Kushwaha and Agrahari (2014). Recorded the effect of domestic sewage on zooplankton population in River Rapti at Gorakhpur (U.P), India.