



Assessment of freshwater zooplankton diversity in Aranmanai pond, Sivagangai district, Tamilnadu, India

Chandran G¹, K Umamaheswari², G Rajkumar¹, S Krishnamoorthy^{3*}

¹ Department of Zoology, Yadava College (Co-Education), Madurai, Tamil Nadu, India

² Department of Zoology, Govt Arts College for Women, Sivagangai, Tamil Nadu, India

³ Department of Zoology, Vivekananda College, Tiruvedakam West, Madurai, Tamil Nadu, India

Abstract

The aquatic ecosystem is a vital ecosystem in the world, occupying a significant area. The animals residing in this ecosystem are constantly affected by the continuous changes in the aquatic environment. Zooplanktons are naturally found in all freshwater tropical wetlands and are widely distributed. The diversity and distribution of zooplankton in the aquatic ecosystem primarily depend on the physico-chemical properties of water. These organisms are considered ecologically important and play a crucial role in energy transmission. This investigation focused on the diversity of planktons in the aranmanai pond system, located in Sivagangai District. The study was conducted over a period of six months, from November 2021 to April 2022. The aim was to examine the relationship between various categories of zooplankton diversity and water quality parameters. A total of 15 species were identified, belonging to the subclasses of Cladocera, Copepoda, Rotifera, and Protozoa. Among these zooplanktons, Copepoda was found to be the dominant species. Based on the findings of this study, it is recommended that the pond be monitored by the local community and that all anthropogenic activities be regulated. This should be a top priority in environmental management policies to ensure the sustainability of the pond's aquatic resources.

Keywords: Zooplankton diversity, water quality parameters, pond system

Introduction

Ponds are typically small, shallow bodies of water that play a significant role in providing water for various purposes such as domestic, industrial, and agricultural uses. Understanding the ecology of pond water is crucial for conducting systematic studies. The study of plankton is particularly valuable for assessing water quality and contributes to learning (Pawar *et al* 2006) [5]. In India, ponds are an integral part of human settlements, with almost every village having at least one pond. These ponds serve multiple purposes, including bathing, washing clothes and animals, and conducting religious rituals. Unfortunately, due to negligence, disregard for the environment, lack of ecological education, pollution, and the discharge of local waste, these aquatic bodies are deteriorating over time. Over the past few decades, many researchers have focused on studying the hydrobiological profiles of various water bodies such as ponds, reservoirs, and lakes, aiming to assess water quality (Shastri and Pendse, 2001 [6]; Singh, 2000 [7]; Azizul Islam *et al.*, 2001 [3]; Thakur *et al.*, 2003) [8]. The available information on the condition of lentic water bodies in the Indian subcontinent indicates a general decline in water quality (Chandrashkhar and Jafer, 1998). This study aims to evaluate the diversity and distribution of zooplankton in the pond system.

Materials and methods

1. Study Area

The research area was situated in the city of Sivagangai. A field survey was conducted for a duration of six months,

Starting from November 2021 and ending in April 2022. The sampling process took place in the morning hours, specifically between 9:00 and 10:00 AM. The selected sites were located in the urban area, characterized by a significant amount of vegetation. These sites were surrounded by residential areas and featured well-maintained gardens and open fields. In order to conduct physico-chemical examinations, water samples were collected in 1-liter plastic bottles using plankton nylon nets. These samples were then preserved on-site in a 5% solution of formaldehyde. The identification and enumeration of zooplankton were carried out using a binocular light microscope.

Table 1: Seasonal variation of Physico-chemical parameters of pond system

Parameters	Premonsoon (February-April)	Post monsoon (November-January)
Air Temp	30	27
Water Temp	27	25
p ^H	9.2	8.4
TDS	42.2	48.1
DO	9.3	8.5
BOD	2.8	4.2
CO ₂	3.9	2.7
Chloride	42.67	23.08
Calcium	12.56	9.06
T.Hardness	56.3	12.0
T.acidity	19.1	13.4

Note: all the parameters are in Mg/L except pH, temperature (°C)

Table 2: Distribution and abundance of planktons of pond system

Cladocera	Total number individuals
<i>Alona pulchella</i>	12
<i>Daphnia carinata</i>	14
<i>Diaphanosoma excisum</i>	09
<i>Moina carinata</i>	11
<i>Ceriodaphnia cornuta</i>	08
Copepoda	
<i>Heliodyptomus</i> sp.	32
<i>Naupliar larve</i>	13
<i>Neodyptomus stregilipes</i>	12
Rotifera	
<i>Brachionus falcatus</i>	28
<i>Brachionus quadridentatus</i>	22
<i>Lepadella ovalis</i>	08
Protozoa	
<i>Arcella</i> sp.	12
<i>Diffusia</i> sp.	04
<i>Paramecium</i> sp.	07
<i>Vorticella</i> sp.	11
Total no. of individuals	203

Results and discussion

1. Physico - Chemical properties

The physicochemical characteristics of the pond are summarized in Tables 1 and 2. The air temperature ranges from 30.0 to 27.0, while the water temperature ranges from 30.0 to 27.0. Interestingly, the mean water temperature is observed to be lower than the air temperature, which can be attributed to the ponds receiving less heating. The pH values (ranging from 9.2 to 8.1) did not exhibit a definite seasonal pattern, with the highest value recorded in February and the lowest in November. This could be due to the turbidity of the water, which reduces the photosynthetic activity of algae, leading to the accumulation of CO₂ and subsequently lowering the pH (Adibisi, 1980)^[1].

Dissolved Oxygen (DO) is an important indicator of water quality as it reflects the physical, chemical, and biological activities in a water body. It also affects the solubility and availability of nutrients, thus influencing the productivity of aquatic ecosystems (Wetzel, 1983)^[9]. In this study, the DO values were consistently above 8.0 mg/l, indicating that the pond system is optimal for supporting aquatic life. The low values of Biological Oxygen Demand (BOD) suggest a low presence of biodegradable materials and the absence of non-biodegradable substances.

The chloride content in the water ranged from 42.67 to 23.08 mg/l, indicating that the water is suitable for irrigation purposes. The decrease in chloride content during the winter season may be attributed to the absence of dilution effects. The variation in sulphate content in the ponds could be due to variable organic inputs.

Furthermore, the total hardness (measured in mg/l CaCO₃) and total alkalinity were found to be low, ranging from 52.10 to 12.0 mg/l, respectively. Such water bodies can be considered as soft.

2. Zooplankton Diversity

The diversity, relative abundance, and dominance of the zooplankton community in the Aranmanai pond were investigated from November 2021 to April 2022. A total of 15 zooplankton taxa belonging to four groups (Copepoda, Cladocera, Rotifera, and Protozoa) were identified and quantified in two seasons, as shown in Table 2. The percentages of these taxa were 54%, 57%, 58%, and 34%

respectively, with the highest number of zooplankton taxa observed during the pre-monsoon season and the lowest during the post-monsoon season. The variation in population among different zooplankton groups throughout the year can be attributed to the availability of food and their preference to avoid competition (Singh, 2000)^[7]. Welch (1952) noted that smaller water bodies tend to respond more quickly to changes in atmospheric temperature. The pH of the water body was found to be alkaline, ranging from 7.2 to 8.0. This pH range is favorable for the growth of aquatic organisms (Lendhe and Yeragi, 2004). Bell (1971) stated that a pH range of 6.5 to 9.0 provides adequate protection for the life of freshwater organisms.

Conclusion

An inverse correlation was observed in the abundance of zooplankton. The managed fish culture pond, which underwent periodic liming, manuring, and fertilization, exhibited a higher presence of zooplankton as the dominant group. On the other hand, the unmanaged village pond displayed a less diverse and eutrophic state, with zooplankton as the dominant group. This suggests that there are numerous untapped and unused ecological niches in village ponds. In contrast, the managed fish culture pond effectively utilizes all available ecological niches through selective stocking of appropriate species at low densities and regular replenishment through fertilization. Therefore, there is significant potential for the adoption and transformation of village ponds into semi-intensive fish culture ponds through scientific management practices. This approach could prove to be ecologically efficient, financially feasible, and socially viable.

References

- Adibisi AA. The physicochemical hydrology of tropical seasonal upper Ogun River. *Hydrobiologia*,1980:79:157-65.
- APHA, Standard methods for the examination of water and wastewater. 19th ed. New York: American Public Health Association, 1995, 1143.
- Azizul Islam M, Choudry AN, Zaman M. Limnology of fish ponds in Rajshahi, Bangladesh. *Ecol Envir Conserve*,2001:7:1-7.
- Chandrasekhar SV, Muhammed Jafer P. Limnological studies of a temple pond in Kerala. *Environ Ecol*,1998:16:463-367.
- Pawar SK, Pulle JS, Shendge KM. The study on phytoplankton of Pethwadaj Dam, Taluka Kandhar, District-Nanded, Maharashtra. *J Aqua Biol*,2006:21:1-6.
- Shastri Y, Pendse DC. Hydrobiological study of Dehikhuta reservoir. *J Environ Biol*,2001:22:67-70.
- Singh DN. Seasonal variation of zooplankton in a tropical lake. *Geobios*,2000:27:9-100.
- Thakur TS, Bhuyan K, Burva R. *Indian J Env Ecoplan*,2003:7(1):83-86.
- Wetzel RG. *Limnology*. 2nd ed. Saunders Coll Publ, 1983, 767.