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# A Comparative Study of Zooplankton with Water Quality Parameters of Three Different Freshwater Ecosystems of Tirunelveli and Tuticorin Districts

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**Abstract**

This study evaluated zooplankton diversity and water quality in three freshwater ecosystems: Pillaiyarkulam Pond (Tirunelveli), Seydunganallur Canal, and Srivaikundam Well (Tuticorin) during January–March 2025. Zooplankton communities comprising Rotifers, Cladocerans, and Copepods were assessed in relation to physicochemical parameters. Diversity was comparatively higher during summer, associated with favorable environmental conditions, while variations occurred across sites due to differences in water quality and human activities. Pillaiyarkulam Pond supported greater zooplankton abundance, whereas the canal showed moderate diversity under fluctuating conditions. The well exhibited lower abundance and relatively stable water quality. Overall, zooplankton diversity reflected differences in environmental conditions and provided useful indicators of freshwater ecosystem quality.

## 1. Introduction

Freshwater ecosystems support diverse aquatic organisms and provide important ecological functions (Dudgeon *et al.,* 2006). Zooplankton are an important component of freshwater ecosystems and occupy a central position in aquatic food webs (Muñoz-Colmenares *et al.,* 2021). Major freshwater zooplankton groups include Rotifera, Cladocera and Copepoda, which contribute to energy transfer within aquatic food webs (Manickam *et al.,* 2018). Zooplankton communities are sensitive to environmental fluctuations and can respond rapidly to changes in their surrounding aquatic conditions (Goździejewska *et al.,* 2024). Changes in temperature can influence zooplankton abundance, diversity and seasonal distribution (Manickam *et al.,* 2018). Physicochemical conditions of freshwater ecosystems can therefore influence the composition and abundance of zooplankton communities (Mayavan *et al.,* 2017). Zooplankton abundance and composition are also influenced by physicochemical factors such as temperature, pH, dissolved oxygen and nutrient conditions in freshwater ponds (Santha Kumari, 2025). Zooplankton diversity can provide useful information about changes occurring in freshwater ecosystems (Sinha & Singh, 2016). Recent research has demonstrated that zooplankton communities can be used as indicators of environmental pressures affecting freshwater ecosystems (Goździejewska *et al.,* 2024). Zooplankton species have also been investigated as indicators of trophic status and ecological condition in freshwater reservoirs (Muñoz-Colmenares *et al.,* 2021).

Water-quality changes can alter zooplankton community structure and the relative abundance of different species (Mayavan *et al.,* 2017). Environmental factors such as temperature, nutrient conditions and other physicochemical characteristics can influence zooplankton distribution in freshwater habitats (Sangeetha *et al.,* 2024). Seasonal changes can also produce variations in zooplankton abundance and species diversity within the same water body (Rahim *et al.,* 2022). Anthropogenic activities and changes in land use can modify freshwater environmental conditions and subsequently affect zooplankton communities (Goździejewska *et al.,* 2024). Studies have shown that intensified agricultural and urban pressures can reduce zooplankton abundance, taxonomic richness and ecosystem functionality (Dhanapathi, M.V.S.S.S. (2000). The use of zooplankton diversity together with physicochemical parameters can therefore provide a broader understanding of freshwater ecosystem conditions (Santha Kumari, 2025).

Diversity indices such as species diversity, richness and evenness are useful for describing differences in aquatic communities (Manickam *et al.,* 2018). Therefore, studying zooplankton diversity in different freshwater habitats can help identify variations in biological community structure and environmental conditions (Sinha & Singh, 2016). The present study focuses on zooplankton diversity in Pillaiyarkulam Pond, Seydunganallur Canal

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and Srivaikundam Well, with emphasis on their abundance, diversity and relationship with water-quality conditions.

## 2. Materials and Methods

### 2.1Study Area

The study was conducted in three selected freshwater ecosystems representing different types of water bodies: Pillaiyarkulam Pond, Seydunganallur Canal, and Srivaikundam Well. These three stations were selected to assess zooplankton diversity and its relationship with water quality parameters.

### 2.2 Sample Stations

Three sampling stations were selected for the present investigation:

1. Pillaiyarkulam Pond – Tirunelveli
2. Seydunganallur Canal – Tuticorin
3. Srivaikundam Well – Tuticorin

EXPERIMENTAL PONDS


**Plate: 1 Pillaiyarkulam Pond**


**Plate: 2 Seydunganallur Canal**

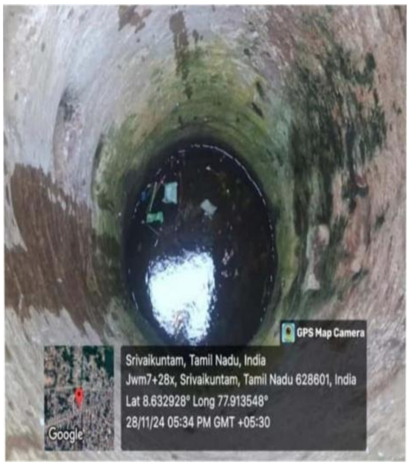



**Plate: 3 Srivaikundam Well**

Water samples were collected separately from each selected station for zooplankton analysis and water quality assessment.

### 2.3 Collection of Water Samples

Water samples were collected directly from the selected sampling stations using a plankton net made of nylon mesh. Sampling was carried out during the early morning hours, approximately between 6:30 a.m. and 8:00 a.m. The collected samples were transferred into suitable sample bottles for further examination.

### 2.4 Sampling Period

The samples were collected during the period from December 2024 to March 2025. Sampling was conducted during the morning hours to obtain representative zooplankton samples from the selected freshwater ecosystems.

### 2.5 Collection and Isolation of Zooplankton

Water samples from the three stations were collected separately at random using a nylon-mesh plankton net. The collected samples were subsequently filtered using a filtering stand fitted with different mesh sizes of 30 µm, 50 µm, 100 µm, and 160 µm. This filtration process was used for the isolation and collection of planktonic organisms.

### 2.6 Plankton Net

Plankton nets were used for the collection of zooplankton because they allow a relatively large volume of water to be filtered and are suitable for both qualitative and quantitative studies. Plankton nets are available in different sizes and types. The document describes open nets, which are mainly used for horizontal and oblique hauls, and closed nets with messengers, which can be used for collecting samples from specific depths.

### 2.7 Identification and Enumeration of Zooplankton

The collected plankton samples were examined for the occurrence and abundance of zooplankton. The major zooplankton groups recorded in the study included Cladocerans, Copepods, and Rotifers. The numerical data obtained from the samples were used for subsequent diversity analysis.

### 2.8 Physicochemical Analysis of Water

The selected water samples were examined for important physicochemical characteristics to evaluate the water quality of the three sampling stations. The parameters considered in the project included temperature, pH, dissolved oxygen, salinity, and chlorinity. Dissolved oxygen was determined using the Winkler's Hydrometric Method.

### 2.9 Estimation of Dissolved Oxygen

Dissolved oxygen in the water samples was determined using Winkler's Hydrometric Method. The materials used included a pipette, burette, conical flask, measuring jar, narrow-mouth sample bottles, and porcelain tile.

The reagents mentioned in the project were:

- 48% manganese sulphate
- Alkaline iodide solution
- 0.025 N sodium thiosulphate solution
- Sulphuric acid
- 1% starch solution

The method is based on the reaction of dissolved oxygen with manganese compounds followed by iodine liberation and titration with sodium thiosulphate.

### 2.10 Diversity Indices

The numerical data obtained from the zooplankton samples were analyzed using different ecological diversity indices. The project used the following indices:

### A. Shannon's Diversity Index

Shannon's index was used to estimate the diversity of zooplankton communities based on the relative abundance of the organisms.

$$H' = -\Sigma\, p_i \ln p_i$$

where pi represents the relative abundance of each group of organisms.

### B. Margalef's Richness Index

Margalef's index was used to determine the species richness of the zooplankton community.

$$D = (S - 1) / \ln N$$

where S represents the number of species and N represents the total number of individuals.

### C. Pielou's Evenness Index

Pielou's index was used to determine the evenness of distribution of zooplankton species within the samples.

$$J' = H' / H'_{max}$$

where H′ is the Shannon diversity index and H′max represents the maximum possible value of the Shannon index.

### 2.11 Data Analysis

The zooplankton abundance data and physicochemical parameters obtained from the three sampling stations were compared to understand differences in zooplankton diversity among the pond, canal, and well. The calculated diversity indices were used to assess the richness, diversity, and evenness of zooplankton communities in the selected freshwater ecosystems.

## 3. Results

The present study assessed the zooplankton diversity, abundance and physicochemical characteristics of Pillaiyarkulam Pond, Seydunganallur Canal and Srivaikundam Well during January–March 2025. The zooplankton community mainly comprised Copepoda, Cladocera and Rotifera, along with different developmental stages of mosquito larvae. Variations in zooplankton abundance and physicochemical characteristics were observed among the three freshwater habitats and across the sampling months.

### 3.1 Physico-chemical Characteristics of the Study Sites

#### 3.1.1 Physico-chemical Parameters of Pillaiyarkulam Pond

The physicochemical parameters recorded from Pillaiyarkulam Pond during January–March 2025 are presented in **Table 1.**

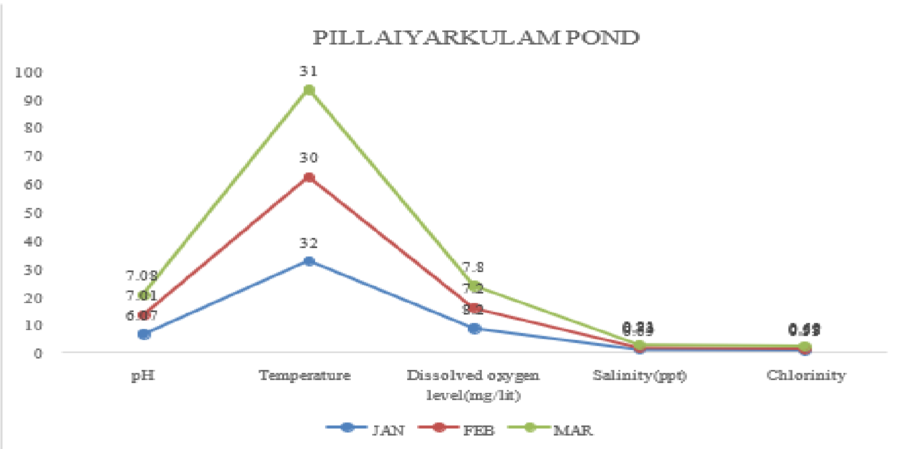
**Table 1. Physico-chemical parameters of Pillaiyarkulam Pond during January–March 2025**

| S. No. | Parameter | January | February | March |
|---|---|---|---|---|
| 1 | pH | 6.07 | 7.01 | 7.08 |
| 2 | Temperature (°C) | 32 | 30 | 31 |
| 3 | Dissolved Oxygen (mg/L) | 8.2 | 7.2 | 7.8 |
| 4 | Salinity (ppt) | 0.69 | 0.73 | 0.81 |
| 5 | Chlorinity | 0.53 | 0.58 | 0.69 |

The pH of the pond increased from 6.07 in January to 7.01 in February and 7.08 in March, indicating a gradual shift from slightly acidic towards neutral and slightly alkaline conditions. The temperature decreased from 32°C in January to 30°C in February and increased slightly to 31°C in March.

Dissolved oxygen decreased from 8.2 mg/L in January to 7.2 mg/L in February, followed by an increase to 7.8 mg/L in March. Salinity showed a gradual increase from 0.69 ppt in January to 0.81 ppt in March. Similarly, chlorinity increased from 0.53 to 0.69 during the study period. These variations indicate moderate temporal changes in the physicochemical characteristics of the pond.

**Figure 1. Physico-chemical parameters of Pillaiyarkulam Pond during January–March 2025.**




**3.1.2 Physico-chemical Parameters of Srivaikundam Well**

The physicochemical parameters recorded from Srivaikundam Well during January–

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March 2025 are presented in **Table 2**.

**Table 2. Physico-chemical parameters of Srivaikundam Well during January–March 2025**

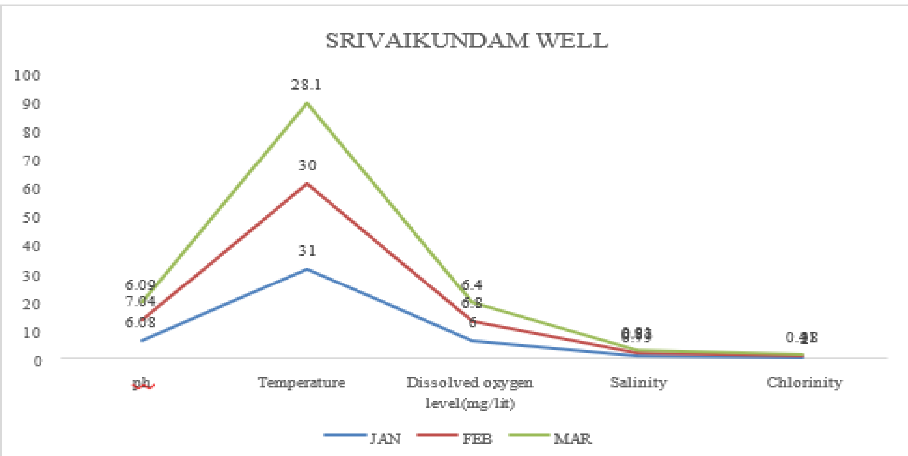
| S. No. | Parameter | January | February | March |
|---|---|---|---|---|
| 1 | pH | 6.08 | 7.04 | 6.09 |
| 2 | Temperature (°C) | 31 | 30 | 28.1 |
| 3 | Dissolved Oxygen (mg/L) | 6.0 | 6.8 | 6.4 |
| 4 | Salinity (ppt) | 0.79 | 0.87 | 0.81 |
| 5 | Chlorinity | 0.28 | 0.38 | 0.41 |

The pH of the well water increased from 6.08 in January to 7.04 in February, followed by a decrease to 6.09 in March, indicating temporal fluctuations between slightly acidic and near-neutral conditions. Temperature showed a gradual decrease from 31°C in January to 30°C in February and 28.1°C in March.

Dissolved oxygen increased from 6.0 mg/L in January to 6.8 mg/L in February and subsequently decreased slightly to 6.4 mg/L in March. Salinity increased from 0.79 ppt in January to 0.87 ppt in February and declined slightly to 0.81 ppt in March. Chlorinity showed a gradual increase from 0.28 in January to 0.41 in March.

Overall, the well exhibited relatively moderate temporal variations in physicochemical conditions during the study period.

**Figure 2. Physico-chemical parameters of Srivaikundam Well during January–March 2025**



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### 3.1.3 Physico-chemical Parameters of Seydunganallur Canal

The physicochemical parameters recorded from Seydunganallur Canal during January–March 2025 are presented in **Table 3**.

**Table 3. Physico-chemical parameters of Seydunganallur Canal during January–March 2025**

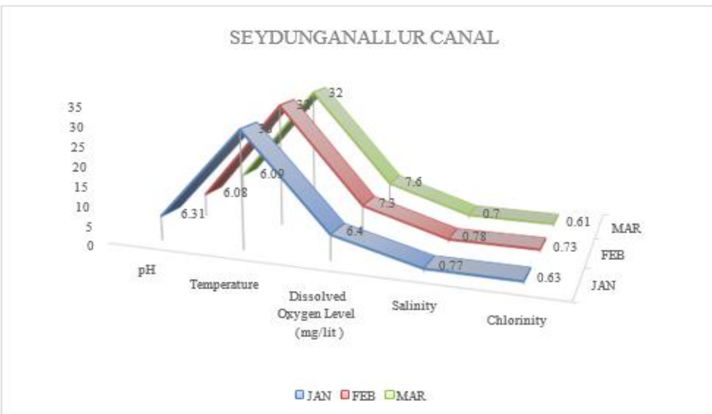
| S. No. | Parameter | January | February | March |
|---|---|---|---|---|
| 1 | pH | 6.31 | 6.08 | 6.09 |
| 2 | Temperature (°C) | 30 | 32 | 32 |
| 3 | Dissolved Oxygen (mg/L) | 6.4 | 7.3 | 7.6 |
| 4 | Salinity (ppt) | 0.77 | 0.78 | 0.70 |
| 5 | Chlorinity | 0.63 | 0.73 | 0.61 |

The pH of Seydunganallur Canal decreased from 6.31 in January to 6.08 in February and remained nearly stable at 6.09 in March, indicating mildly acidic conditions throughout the study period. Temperature increased from 30°C in January to 32°C in February and remained at 32°C in March.

Dissolved oxygen showed a progressive increase from 6.4 mg/L in January to 7.3 mg/L in February and 7.6 mg/L in March. Salinity increased slightly from 0.77 ppt in January to 0.78 ppt in February, followed by a decrease to 0.70 ppt in March. Chlorinity increased from 0.63 in January to 0.73 in February and decreased to 0.61 in March.

These results indicate that Seydunganallur Canal experienced moderate temporal fluctuations in physicochemical characteristics, particularly in pH, dissolved oxygen, salinity and chlorinity.

**Figure 3. Physico-chemical parameters of Seydunganallur Canal during January–March 2025**



### 3.2 Zooplankton Composition and Abundance

The zooplankton community recorded from the three freshwater habitats consisted predominantly of Copepoda, Cladocera and Rotifera. Variations in abundance were observed between sampling months and among the study sites.

#### 3.2.1 Copepoda

Copepods constituted an important component of the zooplankton community. Among the recorded copepod taxa, Calanus showed the highest total count of 33 individuals, while Nauplius larvae recorded a total count of 29 individuals. Calanus showed relatively higher abundance during January and remained present during February and March.

Nauplius larvae also occurred throughout the study period, with relatively higher occurrence during February. Other copepod taxa, including Cyclops strennus, Paracyclops fimbriatus, Corycaeus and Diaptomus, showed moderate variations in abundance.

Overall, copepods showed comparatively higher abundance during January, with Calanus contributing substantially to the observed community.

#### 3.2.2 Cladocera

The cladoceran community included Daphnia magna, Daphnia pulex, Moina and Bosmina. Among the recorded taxa, Daphnia species showed relatively higher abundance.

Daphnia magna showed an increase during February and remained comparatively abundant during March. Daphnia pulex also showed a consistent occurrence during the study period. Moina and Bosmina were recorded at moderate densities.

The relatively higher abundance of cladocerans during February indicates a temporal increase in this group during the study period.

#### 3.2.3 Rotifera

Rotifers showed a comparatively scattered distribution across the sampling months. The major recorded taxa included Brachionus angularis, Brachionus falcatus and Brachionus mirabilis.

Among these, Brachionus angularis showed comparatively higher abundance during February, whereas Brachionus mirabilis remained relatively stable with a slight reduction during March. Euglena and Phacus were also recorded consistently but at comparatively lower abundance.

#### 3.2.4 Mosquito Larval Stages

Different developmental stages of mosquito larvae were recorded during the study period. The larval stages showed comparatively lower abundance than the major zooplankton groups. The first and second instar stages were recorded at relatively lower densities, whereas the fourth instar and pupal stages showed comparatively higher counts. The fourth instar stage recorded 10 individuals, while the pupal stage recorded 13 individuals.

### 3.3 Monthly Variation in Zooplankton Density

The monthly distribution of zooplankton showed noticeable temporal variation.

January showed comparatively higher density among several copepod taxa, particularly Calanus and Nauplius larvae. This indicates that copepods contributed substantially to the zooplankton community during the initial sampling month.

During February, an increase in cladocerans and rotifers was observed. Daphnia magna and Brachionus species contributed considerably to the zooplankton assemblage during this month.

In March, some taxa showed continued occurrence or moderate recovery, although the overall abundance varied among the taxonomic groups. Cladocerans, particularly Daphnia species, continued to remain relatively abundant.

Thus, the results indicate that January was characterized by comparatively higher copepod abundance, whereas February showed greater representation of cladocerans and rotifers.

### 3.4 Dominant and Less Abundant Taxa

Among the recorded zooplankton, Daphnia magna was reported as one of the most abundant cladocerans, followed by Bosmina sp. and Moina sp. Among copepods, Diaptomus sp. and Cyclops vernalis showed comparatively higher densities.

The recorded high-density taxa included:

1. Daphnia magna – 20 individuals
2. Bosmina sp. – 16 individuals
3. Moina sp. – 15 individuals
4. Diaptomus sp. – 15 individuals
5. Cyclops vernalis – 14 individuals

Among the lower-density taxa, Brachionus quadridentatus recorded 9 individuals. The second and fourth instar mosquito larval stages recorded relatively low values in the respective dataset.

### 3.5 Diversity Indices

The diversity indices showed variations among the three sampling sites. Shannon diversity values ranged from 2.3432–2.8764 in Seydunganallur Canal, 2.8853–2.9561 in Pillaiyarkulam Pond and 2.8997–2.9113 in Srivaikundam Well.

The variation in Shannon diversity indicates differences in species richness and distribution among the sampling habitats. Simpson's index also showed variation among the sites, indicating differences in community structure and dominance.

Overall, the diversity results demonstrate spatial variation in zooplankton communities among the pond, canal and well ecosystems.

From the above result findings demonstrate that the three freshwater habitats differed in both physicochemical characteristics and zooplankton composition. Pillaiyarkulam Pond showed relatively higher zooplankton abundance and a gradual increase in pH, salinity and chlorinity during the study period. Srivaikundam Well showed comparatively stable physicochemical conditions with a decreasing temperature trend and moderate variation in pH, dissolved oxygen and salinity. Seydunganallur Canal exhibited greater temporal variation, particularly in temperature, dissolved oxygen, salinity and chlorinity.

The zooplankton community was dominated by Copepoda, Cladocera and Rotifera, with copepods showing comparatively higher abundance during January and cladocerans and rotifers showing increased representation during February. The observed variations in zooplankton abundance and diversity demonstrate temporal and spatial differences among the three freshwater habitats.

## 4. **Discussion**

The physicochemical characteristics of Pillaiyarkulam Pond were analysed during January to March 2025 to understand the environmental conditions associated with zooplankton diversity. (Aravinth *et al.,* 2023) The parameters considered in the present study were water temperature, pH, dissolved oxygen, salinity and chlorinity. (Manickam *et al.,* 2018) All these parameters showed variations during the study period. (Aravinth *et al.,* 2023) Such physicochemical variations can influence the abundance, distribution, growth and diversity of zooplankton because planktonic organisms respond to changes in their surrounding aquatic environment. (Dhanasekaran *et al.,* 2017) Previous studies have also reported relationships between physicochemical conditions and zooplankton biodiversity and community structure. (Manickam *et al.,* 2018; Aravinth *et al.,* 2023) The water temperature of Pillaiyarkulam Pond ranged from 30°C to 32°C during the study period.The highest temperature of 32°C was recorded in January, while the lowest temperature of 30°C was recorded in February, followed by a slight increase to 31°C in March.The variation in temperature may be related to differences in solar radiation, atmospheric temperature and seasonal weather conditions. (Manickam *et al.,* 2018) Water temperature is an important ecological factor affecting aquatic organisms and plankton communities. (Aravinth *et al.,* 2023) Changes in temperature can influence zooplankton abundance and species distribution. (Manickam *et al.,* 2018)

The relatively high temperature recorded in January may have influenced metabolic and biological processes in the pond. (Manickam *et al.,* 2018) The reduction in temperature during February may have resulted from temporary changes in atmospheric and seasonal conditions. (Manickam *et al.,* 2018) The slight increase during March may be related to increased solar heating. (Manickam *et al.,* 2018) Temperature can also influence dissolved oxygen conditions in aquatic ecosystems. (Aravinth *et al.,* 2023) Therefore, temperature may influence zooplankton both directly through environmental conditions and indirectly through other water-quality parameters. (Dhanasekaran *et al.,* 2017) The pH of Pillaiyarkulam Pond showed a clear increasing trend during the study period.The pH was 6.07 in January, increased to 7.01 in February and reached 7.08 in March.The January value indicates slightly acidic water, whereas the values recorded during February and March were close to neutral.Changes in pH can occur due to variations in photosynthetic activity, respiration and carbon dioxide concentration. (Aravinth *et al.,* 2023) pH is an important environmental parameter that can affect zooplankton abundance and diversity. (Dhanasekaran *et al.,* 2017) The increase in pH from 6.07 in January to 7.08 in March may indicate changes in the balance between photosynthesis, respiration and decomposition within the pond. (Aravinth *et al.,* 2023) The nearly neutral pH observed during February and March may have provided suitable conditions for freshwater zooplankton. (Dhanasekaran *et al.,* 2017) Changes in pH can also influence the biological processes occurring within freshwater ecosystems. (Aravinth *et al.,* 2023) Dissolved oxygen showed monthly variation during the study period.The highest value of 8.2 mg/L was recorded in January, followed by a decrease to 7.2 mg/L in February and a slight increase to

7.8 mg/L in March. Dissolved oxygen is an important hydrographical parameter associated with plankton diversity. (Aravinth *et al.,* 2023) The reduction observed in February may be associated with changes in biological oxygen consumption and decomposition processes. (Aravinth *et al.,* 2023) The subsequent increase in March may be associated with changes in biological activity and oxygen production. (Aravinth *et al.,* 2023) The dissolved oxygen concentration of 7.2–8.2 mg/L observed in Pillaiyarkulam indicates good oxygen availability during the study period.Adequate dissolved oxygen can support the biological activities of aquatic organisms. (Dhanasekaran *et al.,* 2017) Dissolved oxygen has been reported as one of the physicochemical parameters associated with zooplankton distribution and abundance. (Dhanasekaran *et al.,* 2017) Salinity showed a gradual increase from 0.69 ppt in January to 0.73 ppt in February and 0.81 ppt in March.The increasing trend may be associated with evaporation, concentration of dissolved salts or changes in freshwater input. (Manickam *et al.,* 2018). Salinity is an important environmental factor affecting the distribution and abundance of zooplankton. (Dhanasekaran *et al.,* 2017)

Different zooplankton groups may respond differently to changes in salinity. (Manickam *et al.,* 2018) . Although salinity increased gradually, the recorded values remained relatively low throughout the study period.Such low salinity conditions are consistent with freshwater conditions. (Manickam *et al.,* 2018). Seasonal changes in physicochemical characteristics can contribute to changes in zooplankton biodiversity and abundance. (Dhanasekaran *et al.,* 2017; Manickam *et al.,* 2018). Chlorinity also showed a progressive increase during the study period.The values increased from 0.53 in January to 0.58 in February and 0.694 in March.

The increasing pattern was similar to that observed for salinity, suggesting a gradual change in dissolved ionic constituents. Chloride has been investigated as one of the hydrochemical variables associated with plankton diversity in freshwater ecosystems. (Aravinth *et al.,* 2023)

The increase in chlorinity together with the increase in salinity may indicate concentration of dissolved ions during the study period. However, the present study did not separately measure evaporation, groundwater contribution or mineral inputs. Therefore, these factors should be considered only as possible explanations for the observed increase. Hydrochemical characteristics can influence plankton communities together with temperature, pH and dissolved oxygen. (Aravinth *et al.,* 2023) .The zooplankton community recorded in Pillaiyarkulam Pond included organisms such as Brachionus, Cyclopodia and Calanus.

Cyclopodia showed an abundance of 11 individuals, while Calanus recorded an abundance of 31 individuals in the pond.The occurrence of different zooplankton groups indicates that the pond supported different planktonic organisms during the study period. (Manickam *et al.,* 2018) . Rotifers and copepods are important components of freshwater zooplankton communities. (Manickam *et al.,* 2018). Their abundance and distribution can vary according to environmental conditions. (Dhanasekaran *et al.,* 2017). The occurrence of Brachionus in the present study is consistent with previous freshwater zooplankton investigations. (Manickam *et al.,* 2018). The presence of different zooplankton groups in Pillaiyarkulam suggests that the environmental conditions were capable of supporting a zooplankton community during the study period.

(Dhanasekaran *et al.,* 2017; Aravinth *et al.,* 2023). Overall, the zooplankton community in Pillaiyarkulam Pond may have been influenced by the combined effects of temperature, pH, dissolved oxygen, salinity and chlorinity rather than by a single environmental factor. (Dhanasekaran *et al.,* 2017; Aravinth *et al.,* 2023).

## 5. Summary

The present study compared zooplankton diversity and water-quality characteristics of three freshwater ecosystems—Pillaiyarkulam Pond, Seydunganallur Canal and Srivaikundam Well—during January–March 2025. The zooplankton community was mainly represented by Copepoda, Cladocera and Rotifera, with noticeable monthly and site-wise variations. Pillaiyarkulam Pond showed comparatively higher zooplankton abundance, while Srivaikundam Well exhibited relatively stable physicochemical conditions. Seydunganallur Canal showed greater temporal fluctuations in several water-quality parameters. The observed differences in zooplankton composition and diversity were associated with variations in temperature, pH, dissolved oxygen, salinity and chlorinity. Shannon diversity values also demonstrated spatial differences among the three habitats.

## Short Summary

The present study compared zooplankton diversity and water-quality characteristics of three freshwater ecosystems—Pillaiyarkulam Pond, Seydunganallur Canal and Srivaikundam Well—during January–March 2025. The zooplankton community was mainly represented by **Copepoda, Cladocera, and Rotifera**, with noticeable monthly and site-wise variations. Pillaiyarkulam Pond showed comparatively higher zooplankton abundance, while Srivaikundam Well exhibited relatively stable physicochemical conditions. Seydunganallur Canal showed greater temporal fluctuations in several water-quality parameters. The observed differences in zooplankton composition and diversity were associated with variations in temperature, pH, dissolved oxygen, salinity and chlorinity. Shannon diversity values also demonstrated spatial differences among the three habitats.

## 6.Conclusion

The study demonstrates that the three freshwater ecosystems differed in both physicochemical characteristics and zooplankton community structure. Pillaiyarkulam Pond supported relatively higher zooplankton abundance, whereas Srivaikundam Well showed comparatively stable environmental conditions and Seydunganallur Canal exhibited greater temporal variation. Copepods were more prominent during January, while cladocerans and rotifers increased during February. The findings indicate that zooplankton composition and diversity respond to changes in environmental conditions and can therefore provide useful information for assessing the ecological condition of freshwater ecosystems.

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