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Research Article

LIMNOLOGICAL STUDIES AND ANALYSIS OF WET SOIL LAND AND POND WATER AROUND MUKKUDI VILLAGE OF SIVAGANGAI DISTRICT, TAMILNADU, INDIA

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ABSTRACT
The physico-chemical state of water plays a vital role in the ecosystem of wetlands. The different physicochemical parameters of mukkudi village water were studied from January 2021 to December 2021 to discover its impact on the planktonic population, fish farming and agriculture. The authors recorded water temperature ranges of 29 to 37°C, transparency ranges of 28.4 to 37.8 cm, dissolved oxygen ranges of 7.9 to 9.1 ppm, free carbon 12.8 to 14.7 ppm, pH ranges of 6.7-7.5, total alkalinity ranges of 178 to 205 ppm, total solids are 97 to 109 ppm, nitrates between 1.01 and 1.12 ppm and phosphates between 0.88 and 0.99 ppm. More than 20 species of phytoplankton and zooplankton have also been identified. A bimodal pattern of seasonal variation in plankton was observed with a primary peak between June and August and a secondary peak as on December 2021.

Keywords: Physio-Chemical Parameters, Mukkudi Village, Phytoplankton, Agricultural lands.

1. INTRODUCTION
The wet soil lands are described as lands for transitional among terrestrial and aquatic eco system, in which the water label is normally at or close to the floor or the land is protected through shallow water. These lands are very efficient ecosystems, which assist with inside the law of organic cycles, protection of water quality, nutrient motion and assist for meals chains. The wet soil lands are regions in which water is the number one thing controlling the surroundings and the related vegetation and animal life [1]. These lands are important components of river basins and perform many valuable functions for the environment and for society. The water resource is used for various purposes such as domestic use, agriculture and fish farming, etc. of the local community (rural societies). The wet soil lands are now declining rapidly due to urbanization and industrialization in and around the selected areas of Sivagangai district. Due to urbanization and human pressure, most wet and dry soil lands experience a greater degree of accumulation of biologically active nutrients. Limnological characteristics relate to agriculture and fish farming [2]. Review of literature discovered that many research people did researches on earth science and being diversity of various water bodies [3-5]. In future, there will be a threat of contamination of water from the surface runoff of much usage fertilizers, pesticides and other chemical contaminated substances. Water quality is powerfully influenced by feed inputs, and ponds with high feeding rates often have additional severe issues with low dissolved gas concentrations and excessive concentrations of ammonia and group in ponds with low or moderate feeding rates [6, 7]. The natural aquatic resources are inflicting significant and varied pollution in aquatic atmosphere resulting in water quality and depletion of aquatic biota. Ponds are one of the crucial water sources used on this area. On the opposite hand, additionally they offer a habitat for invertebrates, fishes and aquatic birds [8-10]. In water aquaculture, the same old of water is one most of the predominant crucial factors. It looks at of physico-chemical parameters enables to increase techniques to screen water pleasant parameters and to put in force schemes to hold water pleasant. The physico-chemical characters of the wet soil land and pond water is accustomed assess the ecological nature of

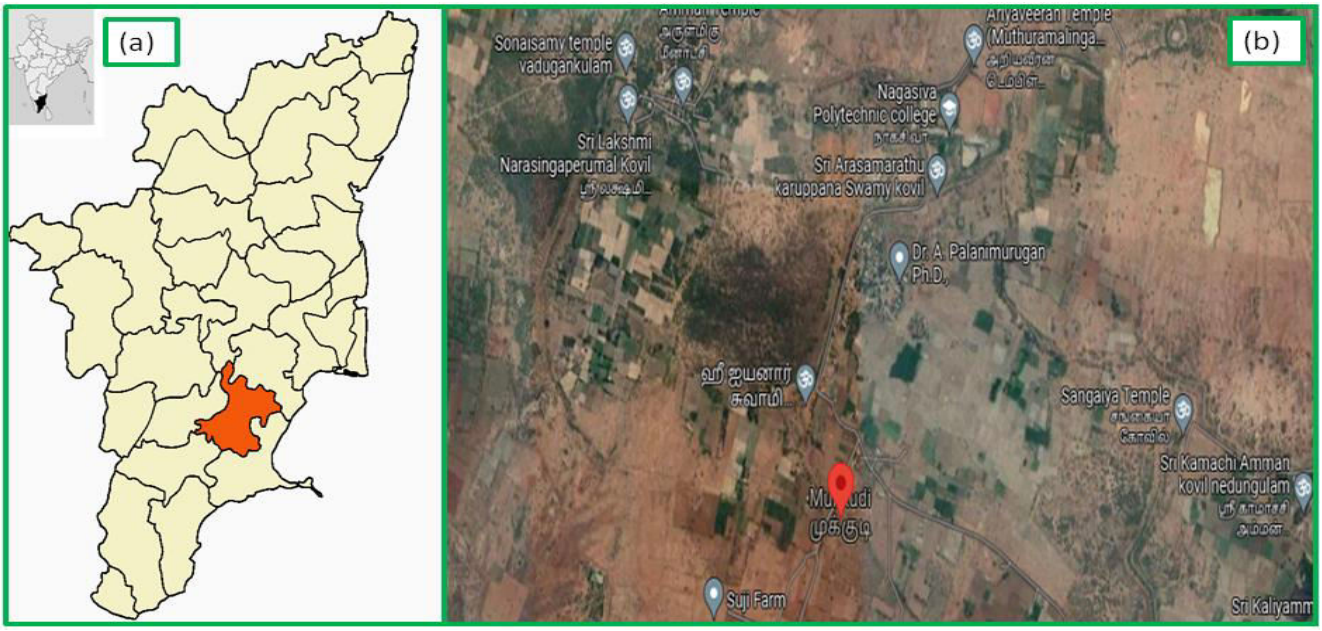
the wet soil lands and collected pond waters [11-13]. But so far there is not enough baseline data on limnological parameters of Mukkudi village wet soil land, so the authors have undertaken to study limnological characteristics in relation to fishing culture and agricultural purposes.

2. MATERIAL AND METHODS

2.1. Area of study around Mukkudi village

The wet soil land explored is located in the village of Mukkudi in the Sivagangai district of Tamilnadu. Mukkudi is located about 21 km from Madurai Corporation (main southern temple city) and about 450 km from Chennai (main city of Tamilnadu).

Its nearest station is Silaiman and Thiruppuvanam (Madurai and Sivagangai districts). It is located at the latitude of 9.7653 ° N, 78.1660 ° E in Figure 1 (a) and (b). The total area of Mukkudi village is 946.75 hectares and the maximum water depth in the pond is 10-15 feet during monsoon (July August) and minimum 1-5 feet in summer (May-June). Water supply sources for the irrigation tank, pond and well are surrounding rainwater environments and small drainage waters from neighboring rivers. The Mukkudi village is somewhat enriched with many form of vegetation like rice, sugar cane, ground nut, onion, chilli, cotton, and so on. The water (from lake and well) of Mukkudi village is employed chiefly for agricultural purposes. The margin of the Mukkudi village is heavily concerned by tree Niloica, Aracaceae and also the organic deposition causes alleviation of the Mukkudi village.



Located at the latitude of 9.7653 ° N, 78.1660 ° E in (a) Sivagangai district and (b) Google searched satellite view site of Mukkudi village.

Fig. 1: The map image of selected village (Mukkudi)

2.2. Water sampling

Water samples were taken every two weeks from five different sites in capped plastic bottles, temperature, dissolved oxygen, free carbon dioxide and pH were recorded on site using a water quality analysis kit. Analysis of total alkalinity, total hardness, nitrates and phosphates was performed in the field as well as in the laboratory according to standard methods (APHA 2005 Manual). In biological parameters, plankton productivity was measured using the Sedgewick Rafter plankton counting cell and the amounts are here expressed in units per liter of pond water. Plankton was identified using a book titled "A Guide to the Study of Freshwater Biology" (1962) and other standard procedure from publications [14].

3. RESULTS AND DISCUSSION

3.1. Physico-chemical properties of collected water samples

The careful results of the physico-chemical attributes of the collected water samples are conferred in Table 1. The elaborated results obtained (Fig. 2) in parameter wise that are mentioned exploitation given sections.

Table 1: Physico-chemical studies of samples around mukkudi village by every month variations

S. No.	Months	pH	TH (ppm)	NO_3^- (ppm)	PO_4^{3-} (ppm)	Trans. (cm)	DO (ppm)	FCO_2 (ppm)	Total Alkalinity (ppm)	Temp. (^{0}C)	Temp. (^{0}F)
1	Jan	7.5	109	1.13	0.99	37.8	8.9	14.5	200	29	84.2
2	Feb	7.3	106	1.1	0.96	34.5	8.6	13.9	193	32	89.6
3	Mar	7.4	107	1.12	0.98	29.8	8.2	13.3	184	37	98.6
4	Apr	7.2	104	1.09	0.95	27.9	7.9	12.8	178	37	98.6
5	May	7.3	106	1.1	0.96	32.5	8.5	13.8	191	36	96.8
6	Jun	6.8	99	1.02	0.89	28.4	8.2	13.3	184	35	95
7	Jul	6.7	97	1.01	0.88	32.7	9.1	14.7	205	37	98.6
8	Aug	6.9	100	1.04	0.91	35.6	8.7	14.1	196	36	96.8
9	Sep	6.8	99	1.02	0.89	33.8	8.8	14.3	198	37	98.6
10	Oct	6.7	97	1.01	0.88	36.5	8.3	13.4	187	31	87.8
11	Nov	6.7	97	1.01	0.88	34.7	8.5	13.8	191	29	84.2
12	Dec	7.1	103	1.07	0.94	32.9	8.2	13.3	184	33	91.4

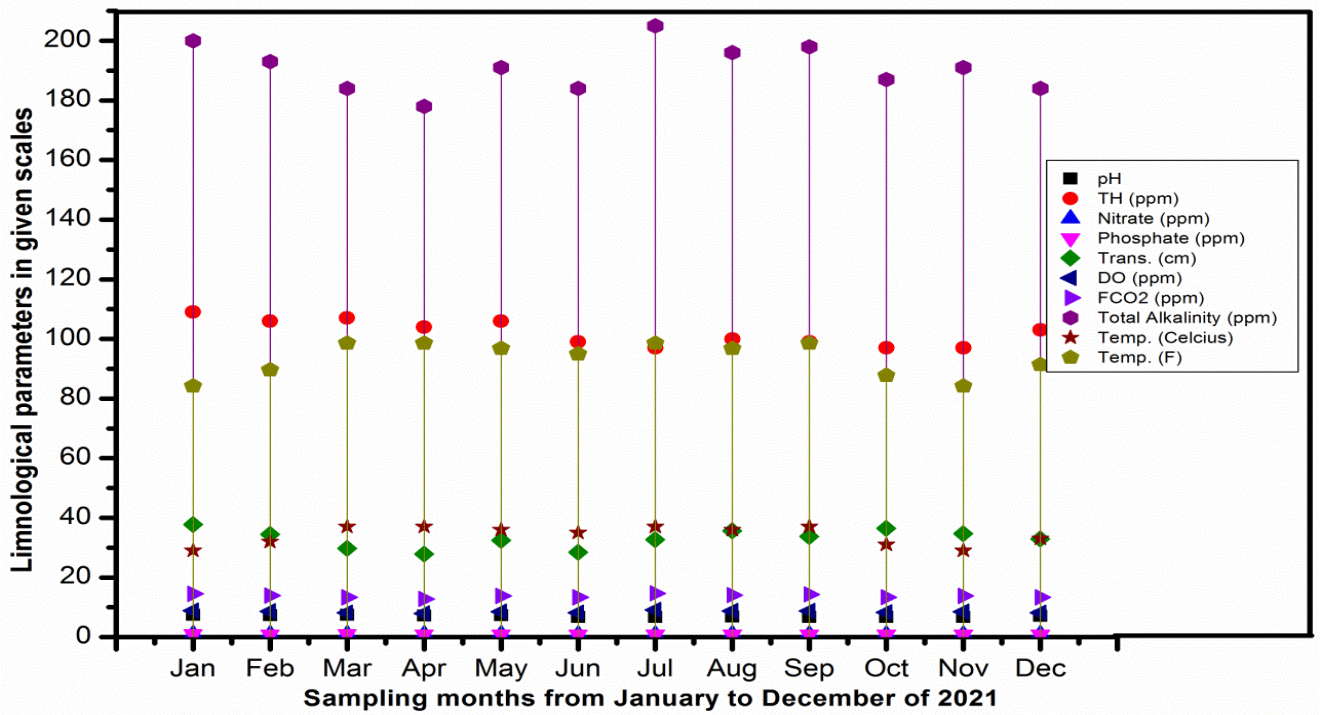


Fig. 2: Physico-chemical studies of water bodies variations around mukkudi village by every month variations

3.1.1. pH of water samples

pH is used to measure as strength of acidity or alkalinity (ranging from 0-14) on a scale. The pH is an indicator of overall environmental condition of the aquatic system. The pH of water samples ranged from 6.7 to 7.5. During summer, rainy season and other climatic situations, pH may be attributed to productive capacity of the water samples from selected sites. Aquatic life felt comfortable and suitability when alkaline nature of water.

3.1.2. Temperature of water samples

The physiological activities of aquatic organisms by water temperature are influenced and it was observed that water temperature is influenced by aerated temperature. The water temperature of ranged from 29-37°C (84.2-98.6 F) during January to December, 2021. In the present study, maximum temperature was recorded during summer followed by rainy season whereas the minimum temperature during winter. The range of water temperature is suitable for culture of

Indian major carps and exotic carps. Monthly variations noted in water temperature is a consequence of fluctuations in ambient temperature as the selected samples represent smaller body of water in comparison to lakes and river and more quickly react to changes in atmospheric temperature [15].

3.1.3. Transparency of water samples

The average depth at which disc disappears and reappears from open surface of water is called transparency of water and it is inversely proportional to the turbidity of water. It controls the energy relationship at different trophic levels in food chain and the water transparency ranged from 27.9-37.8 cm. Lower transparency observed during summer may be due to high planktonic population and the highest transparency was noted during winter, moderate in rainy and minimum in summer. Similarly maximum transparency recorded during winter which could attributed to sedimentation of suspended matter as orated earlier [16].

3.1.4. Analysis of Dissolved Oxygen

Dissolved oxygen of any water body is an important parameter because it serves as indicator of the physical, chemical and biological activities of that water body. The DO ranges of selected samples ranged between 7.9 and 9.1 ppm. The highest dissolved oxygen was recorded during winter months may be attributed to high photosynthetic activity during these months. Oxygen is more soluble in cold water and stated that the highest dissolved oxygen in winter due to low atmospheric temperature and minimum dissolved oxygen in summer may be due to high metabolic rate of organisms. The oxygen depletion in rainy season was to the low respiratory activity or photosynthetic of heterotrophic organisms and also probably due to the combined effects of temperature and photosynthetic activity and the biological oxidation of organic matter. The concentration of dissolved oxygen which is above 5.0ppm, showed that the wetland is very much productive for various organisms [17].

3.1.5. Identification of Free Carbon dioxide

The free carbon dioxide in a water body is generally derived from the atmospheric sources, decomposition of organic matter by saprophytes and biotic respiration. In this study, the CO_2 (free) was ranged between 12.8 and 14.7 ppm. The concentration of FCO_2 in the selected samples was maximum during rainy months and minimum during winter months. The appearance of high concentration of free carbon dioxide during monsoon months could probably be associated with active decomposition of organic matter. The present research finding is almost similar to that of previously published research work [18].

3.1.6. Nitrate ion [NO_3^-] in water samples

Nitrate is the most chemically stable available form of nitrogen and its high concentration is responsible for algal blooms in water body. Surface runoff, decayed vegetations and animal matter are the main sources of nitrates in water body. The nitrate contents of the water ranged between 1.01-1.13 ppm and the maximum concentration was observed in the post monsoon seasons [19].

3.1.7. Phosphate ion [PO_4^{3-}] in water body

Phosphate ion is considered as the critical nutrient substance in the maintenance of pond productivity. It is essential for the growth of organisms and a nutrient that limits the primary productivity of the water body. In this study, the phosphate ion content was ranged between 0.88-0.99 ppm and the minimum contents were observed during winter seasons and maximum contents during the months of summer. Low and high phosphate contents during winter and summer or post monsoon months may be due to low decomposition of organic matters during summer season [20].

3.1.8. Total Alkalinity

The total alkalinity of selected samples is directly related to the productivity of water bodies and it regulates pH and free carbon dioxide of the water bodies. The presence of carbonates and bicarbonates from most of natural water are responsible for alkalinity. The total alkalinity ranged between 178 and 205 ppm indicated that the water of the samples is in rich nutrient and high productive. The maximum alkalinity was in rainy season and minimum during winter season [21].

3.1.9. Total Hardness

The sum of calcium and magnesium carbonate concentrations in water are known as total hardness and it is an index of fertility for aquatic ecosystem. Many researchers suggested 40 ppm of hardness as a natural separation point between soft and hard waters. The total hardness ranged between 76-123 ppm indicated that water of the samples is suitable for fish culture. The highest and lowest hardness was noticed in winter and rainy months [22].

3.2. Biological studies of water bodies

In the present investigation, twenty five species of phytoplankton were found. Among them, two species belong to Euglenophyceae (*Euglena* and *Phacus*), seven to Cyanophyceae (*Anabaena, Spirulina, Microcystis, Raphidiopsis, Merismopedia, Cloecapsa,* and *Oscillatoria*), eight to Bacillariophyceae (*Fragillaria, Synedra, Cyclotella, Navicula, Melosira, Cymbella, Nitzschia* and *Pinnularia)* and eight belongs to Chlorophyceae (*Pediastrum, Ankistrodesmus, Coelastrum, Scenedesmus, Botryococus, Colosterum, Crucigenia* and *Chlorella*). Apart from these, twenty four species of zooplankton were also perceived. Of these, two Ciliates (*Paramecium* and *Vorticella*), five belongs to Copepods (*Cyclops, Mesocyclops, Diaptomus, Heleodiaptomus* and *Nauplius* larva), eight species belong to Rotifers (*Brachinous, Keratella, Notomate, Notholca, Rotaria, Asplanchna, Polyarthra* and *Lecane*) and nine species belongs to Cladocerans (*Diaphnosoma, Ceriodaphnia, Daphnia, Simocephalus, Chydorus, Bosmina, Bosminopsis, Sida* and *Macrothrix*). Presence of these species was reported in fresh water bodies of eastern part of India (Uttar Pradesh). Presence of 25 and 24 species of phytoplankton and zooplankton respectively showed that the available place is rich in planktonic diversity. The annual periodicity of phytoplankton that shows increses and decrease is given in fig. 3.

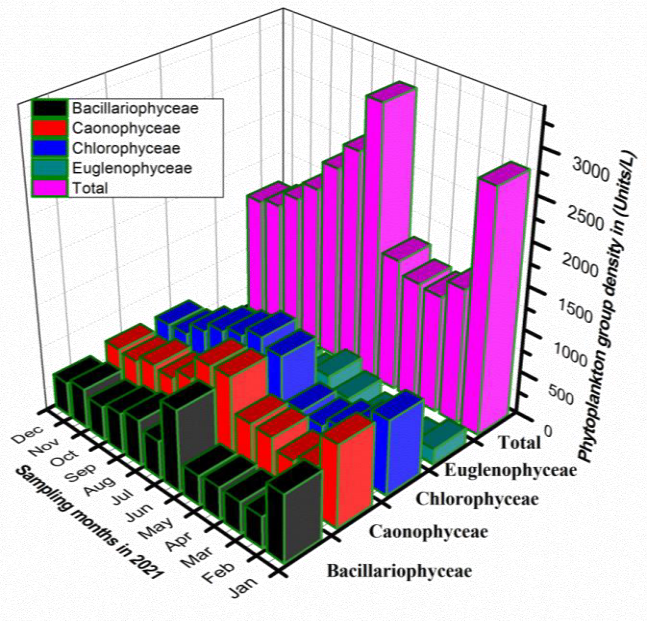


Fig. 3: Monthly fluctuations in Phytoplankton group density (Units/L) in water bodies

In the present study, the maximum density of phytoplankton was recorded in July 2021 and minimum in the month of April 2021. The annual productivity of zooplankton shows that Rotifers dominated and constituted as seen in fig. 4. The maximum density of zooplankton was recorded in July 2021 and minimum in December 2021. The similar observations were made by various researchers [23-26].

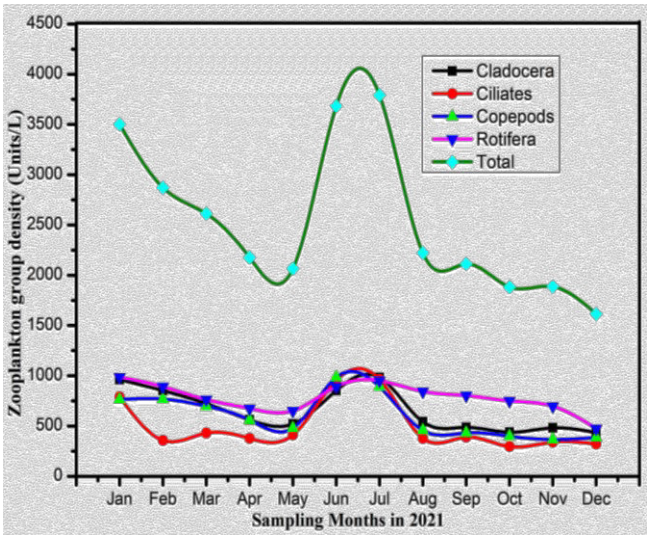


Fig. 4: Monthly fluctuations in Plankton Population in water bodies [Zooplankton group density (Units/L)]

The plankton density in the Mukkudi village showed that highly productive. In the present study, bimodal pattern of seasonal variation of plankton was observed with a primary peak in the month of July 2021 and secondary peak in January 2021. Similar pattern of plankton distribution were reported in the fresh water bodies of Uttar Pradesh (Eastern India).

4. CONCLUSION

This study concluded that in spite of favorable physico-chemical and biological stipulation of water, potential fish yield is not being realized and its productivity can be augmented to a vast coverage if scientifically managed. It can also be realized optimally by stocking of fast growing Indian major carps and exotic carp about 1000-1500 fingerlings/ha to utilize the rich resources in plankton.

Conflict of interest
None declared

Source of funding
None declared

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