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Hydrobiological Studies On Selected Water Bodies Located At Various Altitudes In Southern Tamil Nadu

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Abstract:

The study looks at the hydrobiological properties of selected water bodies at different altitudes in Southern Tamil Nadu particularly focus on water quality, biodiversity and ecosystem health. The study seeks to evaluate the physical, chemical and biological properties of four freshwater ecosystems: Suthamalli Dam, Thenkarai Pond, Manjalar Dam, and Shanmuganathi Reservoir. These locations serve as crucial for irrigation and drinking water, but they are under threat from environmental factors such as Climate change, agricultural runoff, industrial pollution and anthropogenic activities which leads to eutrophication of the waterbodies. This study assesses phytoplankton, zooplankton and fish species composition, nutritional content, and heavy metal concentrations using field sampling and laboratory analysis. Statistical modelling and Geographic Information System (GIS) approaches reveal regional trends in water quality and biodiversity. The findings provide valuable insights and significant data into the impact of environmental changes on aquatic ecosystem health in Southern Tamil Nadu the conservation and sustainable management of these ecosystems. This research also supports local environmental management authorities in preserving aquatic biodiversity in the ecologically sensitive Western Ghats region.

Key Words: Hydrobiology, Water quality, Biodiversity, Altitudinal variation, Western Ghats, Tamil Nadu

INTRODUCTION:

The study of organisms living in water and its processes are known as hydrobiology. Water is essential to all of the life and it exists in protoplasm of all the alive organisms and its components. Earth comprises approximately 70.8% of water covered area and remaining as a land area. Water performs a variety of tasks, ranging from serving as a solvent to transport media for most compounds found in an organism. Many organisms rely on water at various phases of their lives and use it as a habitat for their survival. In nature, Water in hydrological cycle present in various forms or states as precipitation, transpiration, runoff, evaporation and condensation. According to the scientific study, precipitation covers 1,05,000 km^3 of land every year of which one third runoff and empties into the ocean through rivers and rivulets and remaining two thirds of the water are lost through evapo-transpiration, which releases them into the atmosphere annually. Recently, anthropogenic activity such as population explosion, industrialization, modernization, agricultural waste water runoff containing pesticidal residues have resulted in highly contaminated the existing water bodies with numerous minacious contaminants (Simpi *et al*., 2021).

Aquatic ecosystem health depends mostly on the physical and chemical parameters of the water as well as biological diversity (Kaushik and Saxena, 1995). Changes in physico-chemical parameters promote an associated change in the relative composition and abundance of the organisms in the water (Adeyemi *et al*., 2009).The waterbodies having planktons are found as microscopic one that are considered as essential components of the aquatic food chains and food web and greatly contribute to the productivity of aquatic ecosystems. Phytoplankton makes a considerable contribution to productivity of aquatic ecosystem, which acts as a reliable gauge of water quality. Similarly, zooplankton also functioning at the second tropic level and play a significant role in the nutrient recycling, energy transfer making them one of the most influential and functional elements of a healthy ecosystem. Zooplanktons undergo transition of dead, decayed detritus matters into edible forms of food (Koli *et al*., 2012).

Fishes in waterbodies are found most abundantly and diversified group of a vertebrates and dominate the waterbodies around the globe due to a remarkable array of its morphological, physiological and behavioral adaptations. Diversity of fish fauna is reflected in the large number of living species estimated as 35,672 fishes (Fricke *et al*., 2020), In India, an estimation reveals that 3,709 fish species were found, of which 1,039 are freshwater ones. Over 60.3% of India's major freshwater fish species are native to the country, with the Western Ghats having the highest endemism (Gopi *et al.*, 2017). Recently Kannan *et al.*, (2020) reported Fifty five species in streams and rivers of Kalakad-Mundanthurai Tiger Reserve (KMTR), Tamil Nadu. The Western Ghats of India are considered one of the 25 global biodiversity hotspots because of their concentration of endemism (Myers *et al*., 2000).

The current studies have planned to explore the freshwater fish diversity, phytoplankton, zooplankton composition and its distribution from the selected four waterbodies existing in Southern part of Tamil Nadu. Hence, the study was planned with the following objectives for long-term monitoring and better management of the conservation of freshwater ecosystems at various altitudinal locations in the Southern Western Ghats of India.

OBJECTIVES OF THE STUDY:

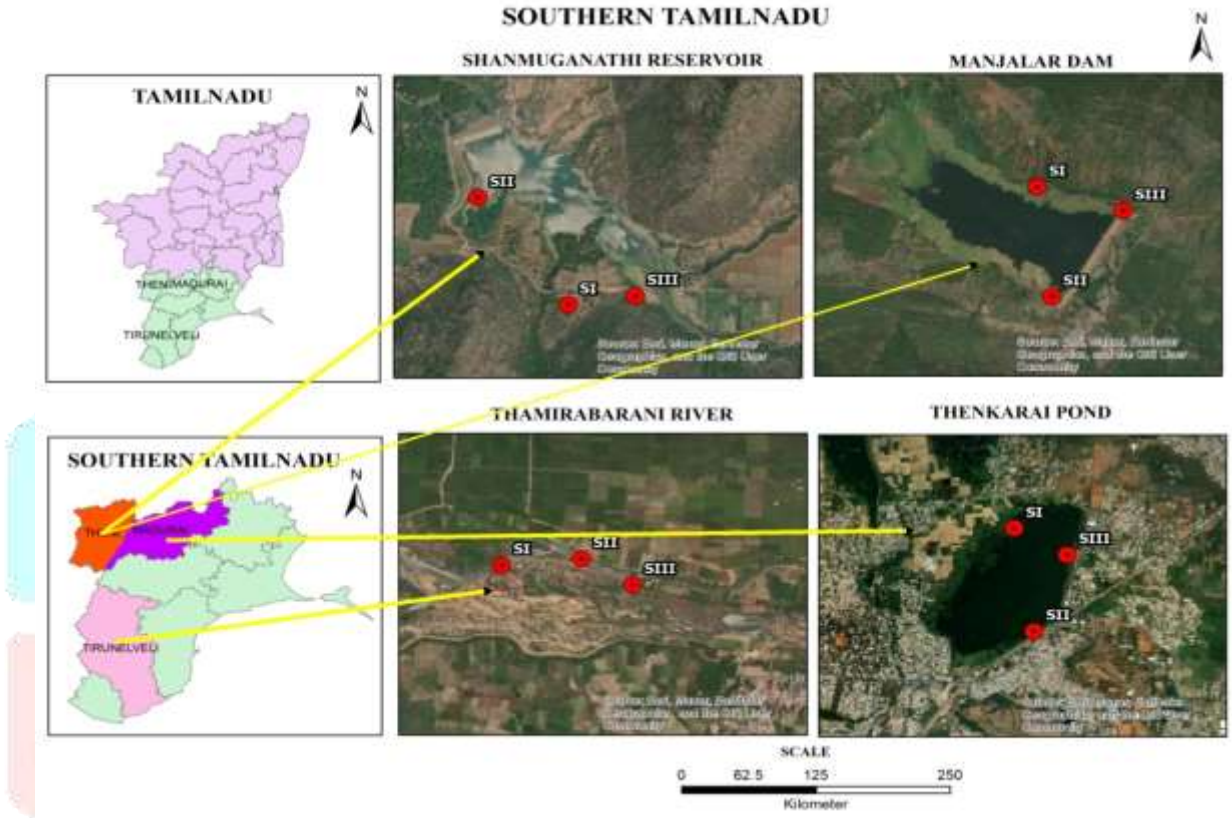
The main objectives of the study involves the following,

- To analyze the Physico-Chemical and Nutrient parameters of water samples collected from selected waterbodies using standard procedures.
- To analyse the concentrations of heavy metals in collected water samples.
- To study the phytoplankton and zooplankton species composition together with its role on the fishery productivity.
- To explore the taxonomic diversity and large-scale distribution patterns of freshwater fishes from selected study area.
- To visualize existing status of waterbodies and their various characteristic features using statistical modeling and GIS techniques.

MATERIALS AND METHODS:

Study area:

At present, due to anthropogenic activities and overexploitation the freshwater faunal groups found in the Western Ghats region going to threatened categories. Hence, the current investigations have planned to conserve the freshwater ecosystem at different altitudes in selected waterbodies such as Suthamalli Dam (37 msl), Thenkarai Pond (136 msl), Manjalar Dam (311 msl) and Shanmuganathi Reservoir (419msl). Based on the available scientific study reports showed that there is not much record of flora and fauna diversity analysis and comparison in accordance with existing physico-chemical, nutrient characteristic features.



(Fig 1: Map showing the study localities of selected waterbodies)

Suthamalli reservoir is located on the bank of Thamirabarani River and it was built in 1877 for irrigation purpose. Thamirabarani river originates from the Agasthiyar/koodam peak of Pothigai hills of the Western Ghats and to the south of Pabanasam. It flows through Tirunelveli and Thoothukudi district of Southern India and joins the Gulf of Mannar. Suthamalli reservoir is found in 47m above from the sea level. Latitude and longitude of this dam is 11°03'53"N and 79°13'35"E, the total agricultural area is 2559.69 hectares.

Thenkarai Pond is situated near Thirupparankundram in the district of Madurai and the pond locates 136m altitudes from sea level. Latitude and longitude of this dam is 9°53'25"N, 78°04'15"E. The paddy and plantain fields there provide food for the locals that live close to the pond. Thenkarai Pond's catchment area covers around 93.9 hectares (Mani *et al*., 2021).

Manjalar dam has been constructed across Manjalar River and its originating vaigai sub basin. The dam is located in Theni district and it was built for irrigation purpose in the year of 1967. The dam is a small reservoir that serves the Madurai district's water needs. The reservoir primarily acts as a tilapia breeding ground. The area accounts for more than 80% of Tamil Nadu's fishery production. The dam is 1043 meters long and 28.33 meters high and Latitude and longitude of this dam is 9°43'43"N, 77°21'25"E.

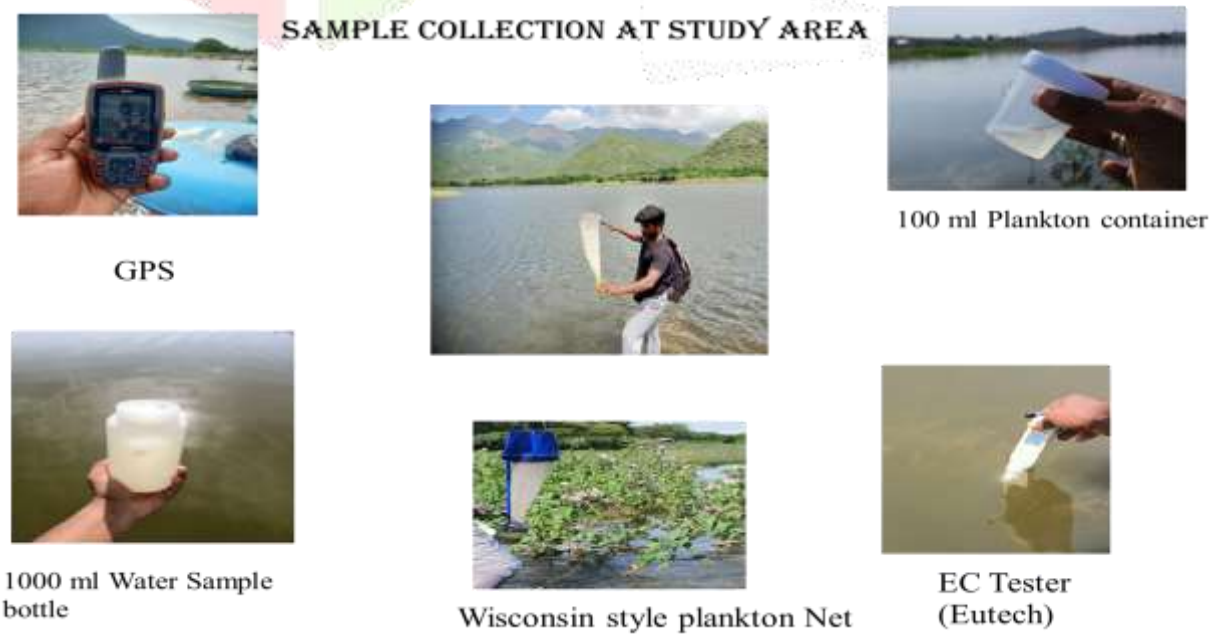
The Shanmuganathi Dam spans the Shanmugha River at Rayapanpatty in Tamil Nadu's Theni district in southern India. It supplies water for irrigation on dry plains in the Theni district, including Pusarikoundan Patti, Appi Patti, Sukkangal Patti, Vellaiammalpuram, Odai Patti, and Sepalakottai. This dam is more scenic and located at 2 kilometres from Anaipatty village and 4 kilometres from Rayapanpatty village, both of which are close to Uthamapalayam, at the foot of the Meghamalai mountain range. The Meghamalai Hills provide a picturesque background for the dam's location. Latitude and longitude of the dam is 9°43'38"N, 77°21'35"E.

Methods adopted for the analysis:

The collected water samples will be analyzed for a number of physico-chemical parameters. Protocols are based on the standard methods for the examination of water and wastewater (APHA, 2012 and Trivedy *et al.*, 1998). The surface water temperature of the waterbodies measured at one metre depth. Electrical conductivity, pH, and total dissolved solids are recorded in the field with the help of digital electronic testers (Eutech). Dissolved oxygen content will be estimated through Winkler's methods.

An analysis of the spatial distribution of heavy metal contents in water can be estimated using a geographic information system (GIS). The quantitative determination of phytoplankton and zooplankton species and their composition in the fishing grounds can be determined by the Sedgwick rafter cell method. The qualitative zooplankton species will be examined under a light microscope and identification can be made using standard literature and manuals (Battish, S K., 1922; Edmondson, W. T, 1959; Altaff, K., 2004 & Sharma, S., & Sharma, B. K., 2008). Recording of the native/ endemic/ endangered fish species can be valued using standard taxonomic keys (Talwar P.K., Jhingran A. G., 1991 & Jayaram, K.C., 2010).

` At the outset of sampling, the habitats of the areas sampled were noted. GPS readings were taken for each survey locality. The faunal samples were collected using a cast net, hand net, Watermark Wisconsin-style and handmade plankton net, etc. Fish were fixed with a 10% formaldehyde solution and then preserved in 70% ethyl alcohol. Fresh fish specimens were preserved in 100% ethyl alcohol for DNA analyses as well as Plankton samples were preserved with 5 % formaldehyde solution. All the samples should be labelled with details like group name, locality, collector, collection date, station number and number of examples. The collected specimens will be brought to the laboratory for further analysis.



(Fig 2: Materials for the sample collection)

SIGNIFICANCE OF THE STUDY

The selected four water bodies are mainly constructed for irrigation and drinking purpose. One of the major problems facing freshwater bodies are undergo the state of eutrophication due to anthropogenic activities - allochthonous nutrient input particularly phosphorous and nitrogen and alteration of physicochemical parameters. The physico-chemical characteristics of water quality affected by rainfall, temperature, availability of light. The chemical parameters such as temperature, pH, Dissolved oxygen, organic and inorganic constituents play an important role in determining the nature and pattern of fluctuations of population densities in an aquatic ecosystem. Results of the current investigation are highly useful for faunal assessment to the Department of Forest and wildlife and the Water Resources Organization, Public Works Department Government of Tamil Nadu for their maintenance of qualities of concern water bodies as the point of conservation.

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