



Population study of Phytoplankton in Kullursandhai reservoir with relation to Atmospheric temperature by applying Geographical Information System (GIS).

Dr. K.Nagarajan^{1*} and Dr.S.Kannan¹

¹Associate Professor, PG and Research Department of Zoology, VHNSN College (Autonomous), Virudhunagar

²Associate Professor, Dept. of Environmental Studies, School of Energy, Madurai Kamaraj University, Madurai

Abstract

GIS software application on the physical factor Atmospheric temperature in the four different sampling sites of Kullursandhai reservoir revealed low temperature in the southern part during the Monsoon season, medium in the middle part of the during the Post-monsoon season and higher Atmospheric temperature was experienced during the pre-monsoon and Summer in the sampling site -IV. Diversity indices of phytoplankton was 2.21 in the summer and lowest of 2.01 during the Pre-monsoon season. Therefore it was investigated by GIS that the high temperature in the Summer season at sampling site – IV is the apt season favouring the mass diversity of the phytoplankton population in Kullursandhai reservoir.

Keywords : Geographical Information System (GIS), Atmospheric temperature
Kullursandhai reservoir, Season, Diversity indices, Phytoplankton.

Introduction

Fresh water ecosystem is a unique water resource for fish production and reservoirs are man made water body formed for the purpose of Pisciculture (Wetzel 1985). Globally 97% of water is salty and 2.8% is present as fresh water. Quality of water in an ecosystem provides a significant function about the available resources for supporting life in an ecosystem. Strata of the water body depends upon the Atmospheric temperature disturbances and seasonal changes leading to the fluctuations in the biological characteristics (Barrow 1981; Sreenivasan 1993; Sivanappan 2001). In the water medium Phytoplankton plays an important role in the food chain as a second trophic level (Quasim 1980). Temperature influence in the water reservoir the plankton can be expressed and visualized by using Geographical Information System. GIS is a tool of prime importance in the ecological investigation which

can be effectively done by an organized collection of computer software described in such a way to capture, store, update, manipulate and display all forms of geographical information system including the ecological database (Ashalatha & Raghavasamy 2000). In the present study GIS is used in a better manner to assess the qualitative distribution patterns of temperature parameter. Ecologically sensitive areas with reference to topography and hydrological regimes need to be identified and networked in the context of species diversity (Pileou 1979). Hence GIS visual pictorisation of Atmospheric temperature was correlated with the plankton population in Kullursandhai dam. In a water body is an exclusive tool for fishing practice. Therefore an attempt was made during the year 2012-2013 to measure the Atmospheric temperature and assess the phytoplankton population by interpolating the result with GIS. This study reveals and enlightened the precise area in the Kullursadhai reservoir for the presence of predominant phytoplankton population as a step to improve the fishing practice.

Study Area

During the year 1979 Across the flow of Kowsiga river a Kullursandhai reservoir was constructed. Location of this reservoir is five kilometers away from the Virudhunagar town directed towards eastern side of the Tamil Nadu state. Reservoir is situated at an altitude of 84 metre from the sea level and extending from 9 degree 32 inch of North latitude to 77 degree 58 inch of East longitude. Total catchment area of Kullursandhai reservoir is 2,78.64 Square km with full water capacity of 3,596 Cubic Metric Feet during the rainy season. Kullursandhai dam is exclusively used for irrigation and fishing purpose. Study area is divided into Four sampling sites from South the entry of house hold waste water (Sampling site – I), East the region with anthropogenic activity (Sampling site-II), North part of the reservoir dumped with washer man activity (Sampling site-III) and Western side of the reservoir a high elevated part from where the heavy water inflow was noticed (Sampling site-IV).

Materials and Methods

Atmospheric temperature was recorded with the help of Digital thermometer on every fortnight of a month from January to December during the year 2012-2013 in four different sampling sites. Average reading was taken summing up the months together for seasonal analysis. January to March as Post- monsoon season, from April to June as Summer season,

from July to September as Pre-monsoon season and from October to December as Monsoon season.

Simultaneously Phytoplankton were collected by using Bolting silk plankton net having a mesh size of 30 μ fitted to aluminium frame. 10 litres of water was poured through this plankton net and filtrate was collected. Filtrate was immediately carried to VHNSN College laboratory and made up to 100 ml. Samples were centrifuged at 1000 rpm for 5 minutes. Supernatant was collected in order to remove the sediment debris. One ml was taken in a clean glass slide and counted in the Sedgewick Rafter Counter cell. Volume of plankton was recorded as biovolume and expressed as ml/l. Phytoplanktons were identified with the help of Needham *et al* (1962) and Tonapi (1980).

Statistical analysis

Population of phytoplankton were recorded and its diversity indices was studied with the help of statistical tool Shanon Wiener Diversity Index. In the present study Brandon Shamp (2011) modified method of Shanon-Wiener Diversity Index was followed and determined. Diversity indices of Phytoplankton was compared with the Atmospheric temperature and the value was interpolated with the GIS tool. GIS software package was applied to correlate and interpolate the observed seasonal Atmospheric temperature with the map image of Kullursandhai reservoir.

Results

Atmospheric temperature recorded in four different sampling sites in Kullursandhai reservoir during the year 2012 – 2013 was represented in the form of graph (Fig - I). Variations in the Atmospheric temperature values among the first and second year were tested using ANOVA and there were found to be no significant different between the four different sampling sites since P value is greater than 0.05 (P value 0.08). Lowest temperature of 23⁰C was recorded in the sampling site – I during the month of December, 2012 and highest degree of 40.1⁰C was recorded in the sampling site – III during the month of July, 2012. Graph (a) reveals that the fluctuation in the Atmospheric temperature in Kullursandhai reservoir is constant but in the graph (b), in site – III during the month of July it raised to 40⁰C, in the graph (c) it behaved similar to that of the site – III and in the site – IV the Atmospheric temperature declines sharply to 24⁰C in the graph (d). Average value for Atmospheric temperature is 30.4⁰C.

Season wise variations of Atmospheric temperature were recorded in the Kullursandhai reservoir is given in the (Fig - II) graph e and f for the year 2012-2013. Gradual increase in

the value was noted in all the sampling sites from the Post monsoon season to Pre-monsoon season. Since the P value is 0.03 on ANOVA analysis showed that P value is smaller than 0.05 there is significant difference exist between the different seasons for Atmospheric temperature. In the year 2013, there was a sharp rise in the parameter value from the Post-monsoon season to Summer and thereafter there was gradual lowering of the temperature was noted.

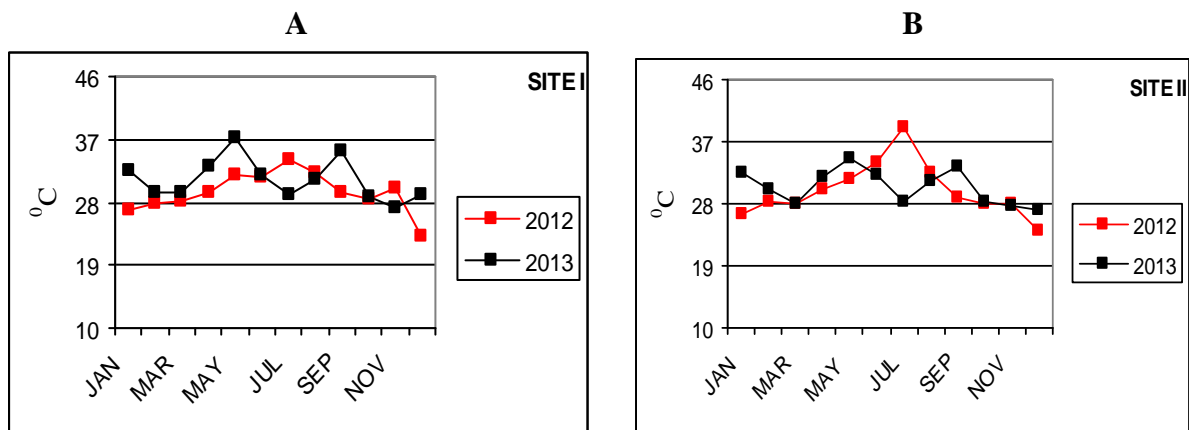
GIS map A indicates the view of the Kullursandhai reservoir image in pictorial visualization on which lower half of the reservoir that is southern part the Atmospheric temperature value is BELOW the average value and upper half of the reservoir that is northern part the Atmospheric temperature is ABOVE average. In map B during the monsoon season the lower part of the Kullursandhai reservoir experienced low level of Atmospheric temperature during the Post-monsoon season, in the middle part of the reservoir Atmospheric temperature was in medium level and in the Summer season the Atmospheric temperature value was recorded high particularly in the sampling site – IV. Diversity indices of Phytoplankton from the Fig - III reveals that the maximum index value of 2.21 was calculated during the Summer season both in the year 2012 and 2013. From the Fig- Lowest index value of 2.01 and 2.05 was calculated during the Pre-monsoon in the year 2012 and 2013 respectively.

Table – 1. Value of Atmospheric Temperature in different sites of Kullursandhai dam with relation to various climatic seasons.

	Sampling site –I	Sampling site -II	Sampling site -III	Sampling site –IV
Post-monsoon	27 ± 0.18	28 ± 0.16	30 ± 0.26	29 ± 0.22
Summer	30 ± 0.21	31 ± 0.29	31 ± 0.26	30 ± 0.29
Pre-monsoon	31 ± 0.32	30 ± 0.26	32 ± 0.19	31 ± 0.24
Monsoon	25 ± 0.21	24 ± 0.19	24 ± 0.20	25 ± 0.11

Mean ± SD of triplicate value

Fig: I. Atmospheric Temperature in Kullursandhai Reservoir



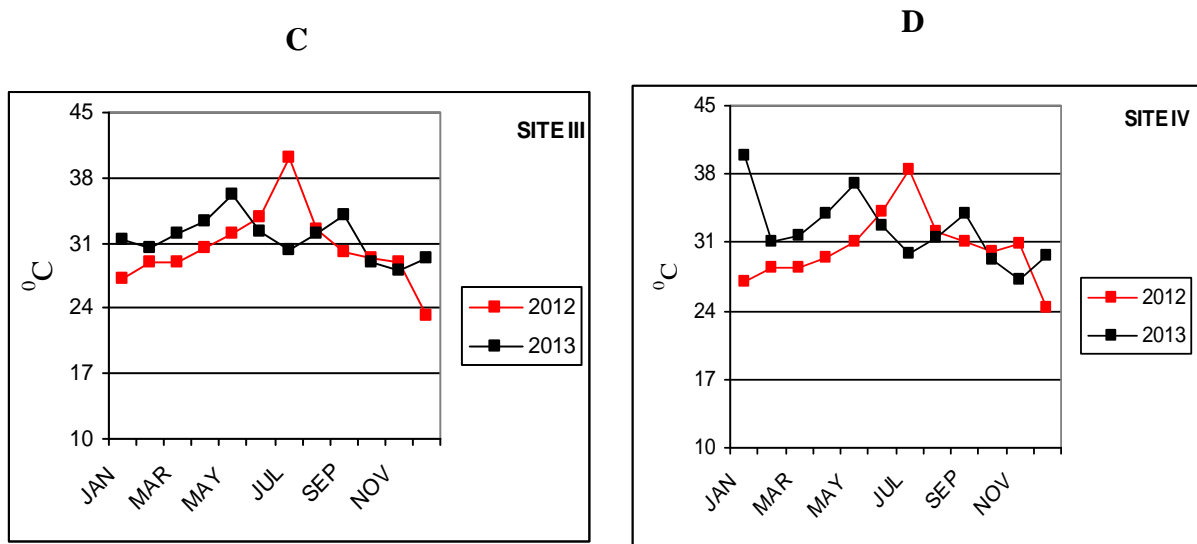
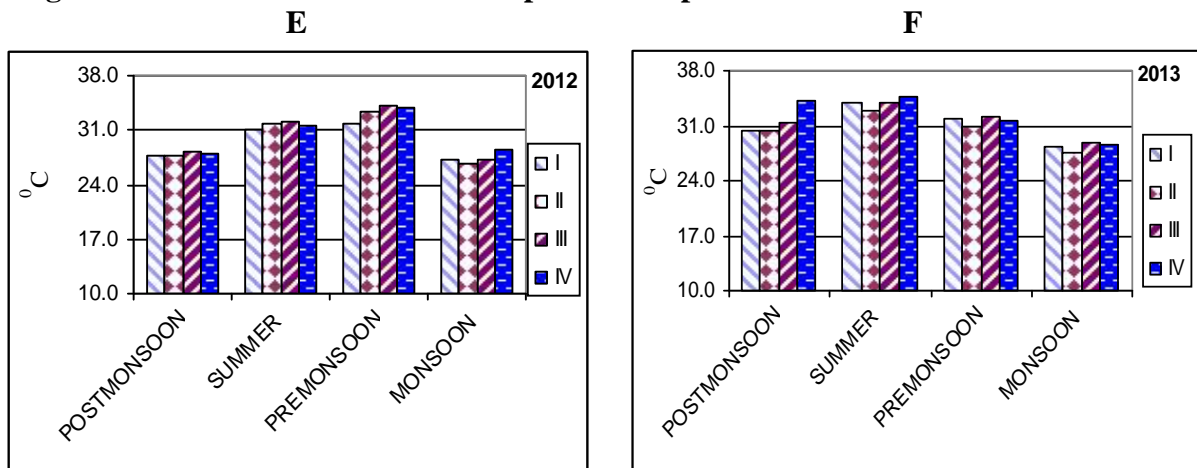


Fig: II. Seasonal Variations of Atmospheric Temperature in Kullursandhai Reservoir



GIS. Map. A. Map showing the ABOVE & BELOW average value of Atmospheric Temperature for the year 2012-2013.

B. Map showing the Atmospheric Temperature status in four sampling sites of Kullursandhai reservoir to different seasons.

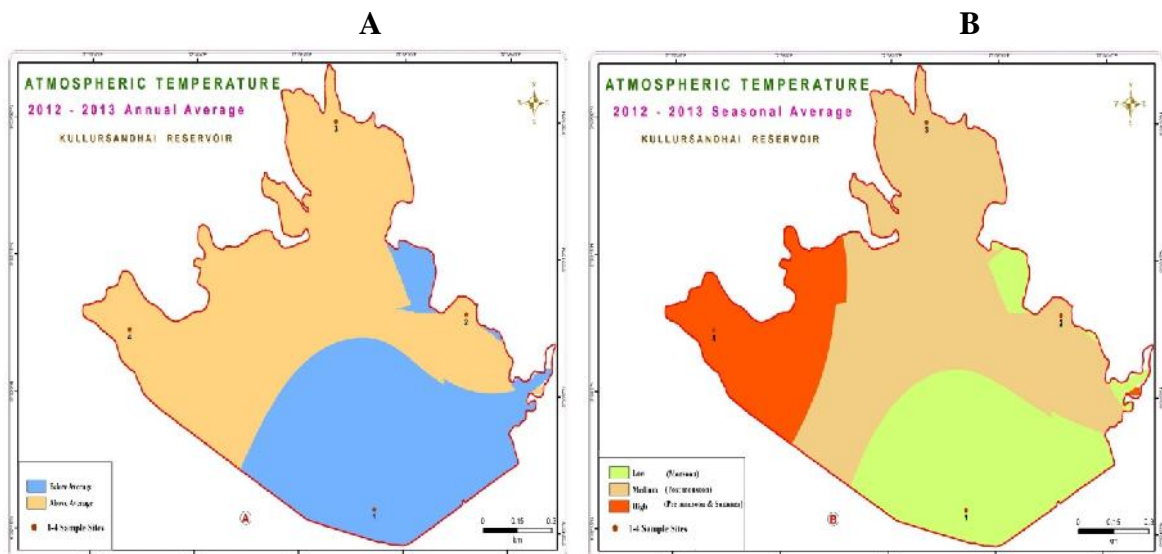
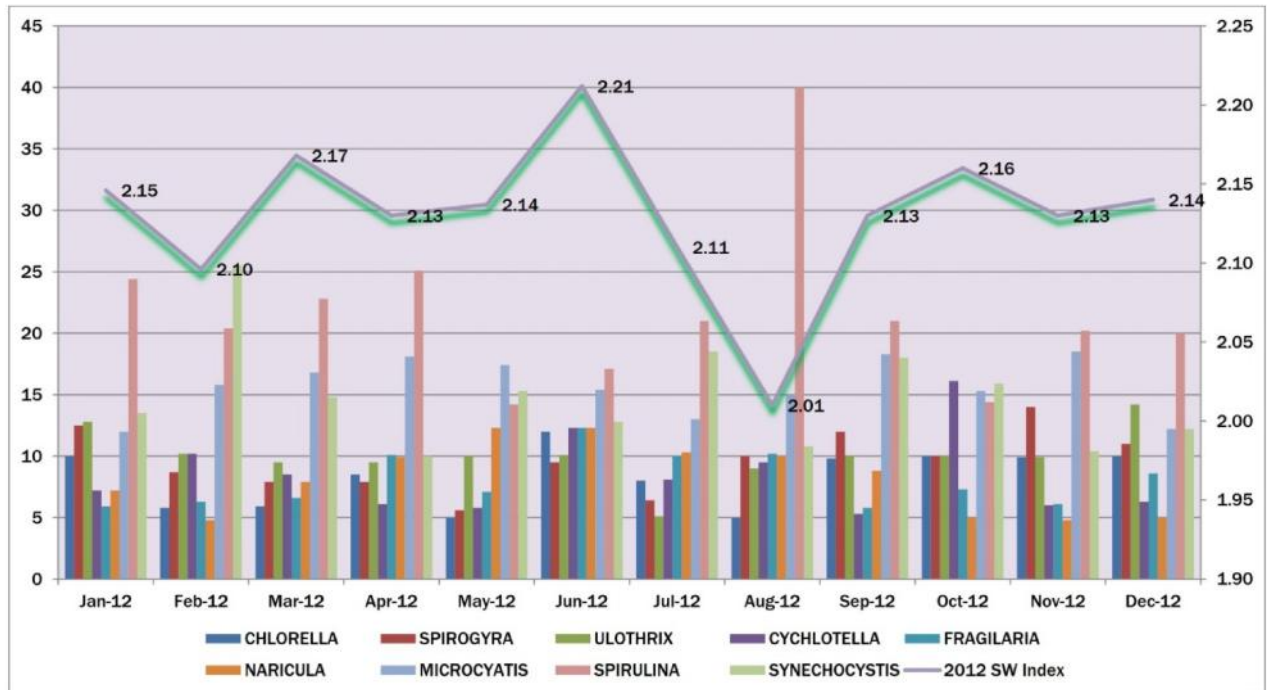


Fig: III Performance occurrence of Phytoplankton in Kullursadnhai Reservoir during 2012 - 2013



Discussion

Atmospheric temperature is of great importance for understanding the growth and population study of organism in an aquatic system (Lloyd 1992). Atmospheric temperature during the month of October – December may be due to the start of the North – East monsoon which brings the rain to this part (Rao *et al* 2003). Similar trend of low temperature of 30.90C was studied by Vijay Kumar *et al* (1999). During the Pre-monsoon season and Monsoon season, high Atmospheric temperature as revealed from the GIS map may be the causative factor for the lowest phytoplankton population as studied from the Diversity indices graph. Plankton population was maintained at constant number throughout the season is due to the large amount of incoming rain water into the Kullursandhai reservoir. Aquatic medium of this reservoir is greenish in colour appearance is the possible reason for the consistency in the phytoplankton population. It was evident from the map.1.B with seasonal variations the phytoplankton population density is almost stable in number exclusively during the Pre-monsoon season and Summer season.

Conclusion

Population density and Diversity indices of Phytoplankton was stable and constant during the Pre-monsoon season and Summer season in the sampling site – IV in Kullursandhai reservoir with high Atmospheric temperature value.

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