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Recent Trends in Applied Zoology

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Chapter 06

Study of phytoplankton Diversity from Papvinash Lake Latur, in relation to Physico-Chemical Parameters

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Introduction

Numerous unfavorable changes to aquatic habitats have been imposed due to poor management of natural resources and a rapidly increasing population. Urbanisation and substantial industry threaten the majority of the water supply. Novel approaches to the monitoring and evaluation of aquatic ecosystems have emerged as a result of the emergence of new environmental issues.[1, 2]

The interaction of all the physical, chemical, and biological elements that make up an aquatic environment determines its general state or health. Ecosystem protection and restoration depend on knowledge about and comprehension of environmental change.
In order to develop appropriate conservation strategies and restoration techniques for the preservation, management, and sustainable use of natural resources, ecological assessments that take into account all ecosystem components are helpful. [3,4]

The most prevalent element, water, is present everywhere and takes many different shapes and forms. It makes up more than 70% of the earth's surface and may be found in oceans, polar ice caps, clouds, rain, rivers, freshwater aquifers, sea ice, and many other places. [5, 6] All known forms of life depend on water, which also exists in the soil and the air we breathe.

Two-thirds of our bodies are made up of it. In actuality, water makes up between 50% and 90% of the weight of every living thing. [7, 12] Great civilizations have developed in areas with an abundance of water resources, such as along the banks of rivers and significant waterways; [7, 8] Mesopotamia, the alleged birthplace of civilization, was located between two significant rivers. [9, 11] trade that resulted from their convenient accessibility by water. [10]

Water is utilized for many different things in the home, including cleaning, cooking, bathing, industries, navigation, and recreation. Water is constantly flowing through the cycle of evaporation, precipitation, and runoff to the sea on the planet, affecting the climate.

Additional impurities caused by human activity include agricultural pesticides, household and industrial waste, and other less evident toxins. [13, 14]

Freshwater supplies are becoming more and more polluted by sewage, agricultural chemicals, oils, heavy metals, radioactive substances, detergents, and other byproducts of human populations. A global water resources catastrophe is being caused by the world's population explosion and the increasing demand for freshwater. [15]

A growing number of experts agree that, if current trends continue, water scarcity and declining water quality will seriously impede future economic growth, increased food production, and the delivery of essential health and hygiene services to millions of disadvantaged people in developing nations. [16, 17] Although rivers have always provided for the requirements of the living world, humanity has been fully utilising this limited resource. The mishandling of natural resources is the fundamental reason why the world is on the verge of a freshwater crisis. [18, 19,20 ,21]

With varied degrees of scale and intensity, this problem is already noticeable in many parts of the world. According to the World Water Development Report (WWDR, 2003) from UNESCO's World Water Assessment Programme, there would be 30% less water accessible to everyone in the next 20 years.

Currently, there isn't enough freshwater available for even basic hygiene for 40% of the world's population. More than 2.2 million individuals passed away in 2000 from diseases brought on by drinking tainted water or by drought. There is need to analyse small water lakes and plankton which further help for fishes to live in water .so keeping this view into mind present investigation were carried out.

Materials and Methods

All the samples were collected to the laboratory of Department of Zoology and Fishery Science Rajarshi Shahu Mahavidyalaya, (Autonomous) latur .(Latitude and Longitude to decimals 20.0 & 77.0 Latitude and Longitude to degrees minutes seconds 18° 24' 0" N 76° 35' 0" E)

To assess the condition of the water bodies, an integrated investigation of the lakes' physical, chemical, and biological components was conducted. For two months, the monitoring was conducted. Five locations around Papvinash Lake were sampled early in the day. [22, 23,24, 25]

The sampling locations were chosen to represent the water quality at various locations, including the inlets, which are points where the feeder opens into the lake, the centre, which symbolises the lake's overall water quality, and the outlets, which are the locations where the overflow occurs. [26, 27,28, 29]

Grab samples were taken from the surface of each station in the morning in one-litre pre-washed polythene cans to evaluate several physico-chemical characteristics.
From each station, two field replicates were taken. A few rapidly shifting parameters, comprising temperature, [30, 31,32] pH, DO, conductance, alkalinity, hardness, and TDS, were assessed shortly after data collection in the field. The analysis was carried out using NEERI's water and wastewater analysis from 1986 and the APHA's standard procedures from 1985 [33] . In the current study, a number of physical and chemical characteristics, including temperature, pH, conductivity, total dissolved solids, alkalinity, total hardness, and others, were analysed. Sodium, potassium, calcium, magnesium, DO, COD,

Investigation of Plankton

The abundance, species composition, stability, and productivity of the native populations of aquatic organisms are influenced by the physical and chemical properties of water. The collecting, counting, and identification of aquatic species, as well as the processing and interpretation of biological data, are among the biological techniques used to evaluate water quality. Plankton analysis study would be useful for:

• Identifying the cause of turbidity, hues, and the inclusion of taste, flavours, and apparent particles in water.
• The analysis of the chemical findings.
• Figuring out the kind, scope, and biological impacts of pollution.
• Regularly providing information on the condition of an aquatic system.

Qualitative and quantitative evaluation of plankton:

Plankton are evaluated qualitatively and quantitatively by estimating the quantities of each species. This information is used to conduct detailed investigations of phytoplanktonic populations. Individual cells of phytoplankton are defined as filaments, colonies, and phytoplankton as a whole. In order to calculate the average number of cells in a species' colony, the average length of the filament in filamentous algae must be calculated.

Results

Physico-chemical analysis

Sites encompassing the inlets, the middle, and the exits were used to gather samples. Six sampling sites from Papvinash lake and five from Nana Nani lake were chosen for examination of various parameters. In this part, the analyses' findings are provided.

The water body of Nana Nani Lake (table 1) has a relatively unpolluted nature, according to the physicochemical analysis. One metric that fluctuated between 7.67 and 7.61, which is above the tolerance limits, was pH.

Since the sampling was done after the monsoons, the agricultural runoff from the catchment and natural processes may be responsible for the somewhat higher result indicating mild alkalinity. During the investigation, water temperatures ranged from 22.56°C to 23.98°C.

Table 1:– Nana Nani lake Physico- Chemical analysis

Sampling sites					
Parameters	A	B	C	D	E
pH	7.67	7.54	7.60	7.55	7.61
W. Temperature ℃	22.56	22.80	22.98	23.12	23.77
Conductance µS/cm	279.33	268.67	302.53	283.67	274.67
TDS mg/L	154.67	154.00	163.67	156.43	152.43
Transparency cm	120	158	147	157	155
Hardness mg/L	94.40	94.60	90.60	90.00	90.00
DO mg/L	7.30	6.44	5.66	4.56	2.70
Alkalinity (mg/L)	98.07	101.92	109.61	123.07	97.11
COD (mg/L)	9.72	9.72	9.72	9.72	6.48

Electric conductivity measured in the watershed ranged from 279.33 to 302.53 S/cm, indicating lower concentrations of dissolved solids and no significant sources of pollution. Given the water source's usefulness as a supply of drinking water, transparency wasn't all that great. Surprisingly, this supply of drinking water had a pretty high density of algae (an average of 1300 organisms per litre), which decreased its transparency.

The levels of dissolved oxygen in sample points A, B, and C are relatively higher than the desired limits. DO at sampling point E; the reservoir's centre is below the ideal range. Because oxygen is less soluble in water, there may be less turbulence in the centre, which has led to less interaction between the atmosphere and the water surface and a low DO level. Other sample stations' relatively greater oxygen concentrations are caused by enough turbulence being generated in the area.

There is no significant threat to the water quality of this water body, according to the other physico-chemical parameter values, which are all well within the tolerance levels.

The algal population of papvinash lake is divided into five groups (table 2), with one class remaining unclassified due to the study's constraints. Other algal types were dominated by Cyanophyceae

Table 2: Nana Nani Lake – precis of phytoplankton counts and composition

Nana Nani lake						
Total phytoplankton counts						
		Sampling stations				
Sl no	Class	A	B	C	D	E
1	*Cyanophyceae*	18	56	90	102	116
2	*Chlorophyceae*	8	5	7	2	10
3	*Dinophyceae*	6	10	10	4	-
4	*Bacillariophyceae*	-	2	1	-	1
5	Unknown	-	-	-	-	1
Total plankton count per drop		32	73	108	106	128

Conclusions

The Nana Nani Lake is largely unpolluted, according to the thorough analyses of the parameters, which are all well within the tolerance levels, with the exception of the pH values, which show higher alkalinity. [35] The natural causes and agricultural runoff from the basin may be to blame for this. The sewage inflow, on the other hand, has a considerable impact on the limnology of Papvinash Lake and considerably affects the lake's low DO, total hardness, alkalinity, and dissolved solids levels.

The algal population, a significant component of aquatic biota, frequently displays dramatic changes in response to changes in the physico-chemical characteristics of the aquatic environment. Despite maintaining phytoplankton largely dominated by Cyanophyceae members, the discrepancies in the primary phytoplankton assemblage of the lakes reflect their trophic levels.

The high density of phytoplankton, reduced transparency, high hardness, dissolved solids, and alkalinity values are all explained by the high BOD and COD values despite the sewage treatment's efforts to treat it and lower it.

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