Perumchani reservoir of Kanyakumari District, Tamil Nadu and its Physico-chemical attributes.

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Abstract

Water samples from Perumchani reservoir was collected from three sampling sites over a period of 12 months. The Physio-chemical analysis like Turbidity, Transparency, Alkalinity, pH, Biological Oxygen Demand (BOD), Total Nitrogen and Phosphate were carried out in the water samples to find out its impact on the productivity of the reservoir. It was found that the most of the above said parameters were all well within the permissible limit. However PH was more to the acidic side indicating nutritionally poor water in the reservoir but the least polluted water, compared to other reservoirs in the South Western Ghats.

Key words

Physico-chemical parameters, BOD, pH, Alkalinity, Turbidity, Transparency, Total nitrogen and Phosphate

Introduction

Water is the most abundant and familiar chemical component and an absolutely necessity for plant and animal life. It is an universal solvent and one of the most precious commodity required for survival. It is a primary natural resource required for different purpose like agriculture, forest, urbanization and other activities which satisfy human needs. Today water is the most exploited natural resource. Exponential population growth has

resorted in severe constrains upon this life supporting natural resource. Various kinds of natural and man made activity creates water pollution particularly in fresh water system. The main objective of this study was to evaluate the water quality of Perumchani reservoir, which is one of the drinking water source to Nagercoil municipality in Kanyakumari district of Tamil Nadu. The present investigation conducted in Perumchani reservoir is the first of this kind.

Study area

The study area (Perumchani reservoir) is located in the South Western Ghats in Kanyakumari district of Tamil Nadu at 89^0 22' latitude and 77^0 22' east longitude. It is built across Paraliyar river. The water from the reservoir runs into Tamaraparani river and finally into Arabian sea through the Thenkapattanam coast. The water from this dam is taken to Nagarcoil town and near by areas mainly for irrigation but during water scarcity in other dams, this water is also diverted for domestic uses including drinking source. Presently this reservoir has only a very meager miscellaneous fish population. The catchment areas has a few rubber plantations and is least populated.

Methodology

The water samples were collected from the reservoir in sterilized cans. Standard methods suggested by the American Public Health Association (APHA,1981) were followed for determining the Physico-chemical parameters and Biological parameter. Turbidity, Transparency and pH were measured during sampling. Alkalinity, BOD Total Nitrogen and Phosphate were analysed in the laboratory without delay. Primary productivity was analysed using the light and dark method.

Results and Discussion

The annual average for water transparency ranged from 0.93 m to 1.97m (Table 1) with moderately high levels of water transparency during hotter months, and still higher levels during colder months. Monsoons season recorded the lowest transparency levels.

After the monsoon there was an increase in the transparency level in water. Transparency showed negative correlation with turbidity (r = 0.0103) and productivity (r = 0.4275). Transparency levels of water have for reaching effects on all aquatic organisms including their growth and development (Vijayakumar, 1999). According to Sreenivasan, (1968) water transparency level also influences primary productivity of fish food organisms. The overall low transparency level in Perumchani reservoir may be one of the reason for very low productivity thereby fish fauna here showing the negative correlation between transparency and productivity. Summer months exhibited slight high levels of water transparency. This may be due to evaporation of water, rich in nutrients, increase in temptation and development of plankton flora. (Kaushik *et al.,* 1990 and Kant and Raina, 1990: Minakshi Bora *et al*., 2016). While the low transparency recorded during monsoon is due to sand, silt and clay brought into the reservoir. Compared to other reservoirs studied, Perumchani reservoir water showed overall low transparency, this may also be due to rubber coagulants coming into the reservoir water through surface run off from near by rubber plantations. The annual average of turbidity ranged from 4.32 NTU to 5.42 NTU with high turbidity during summer months and post monsoon season. Turbidity showed negative correlation with transparency (r = -0.0107) and productivity (r=-0.6284). Turbidity is recognized as a limiting factor in biological productivity due to hampering of light penetration in a water body thereby affecting the growth of phytoplanktons. High turbidity levels during summer months results from low level of water, decaying vegetation and organic matter, while in the post monsoon season high turbidity results from silt, clay and other suspended particles brought with the reservoir by surface run off (Kaushik and Saksena, 1999). High turbidity affects primary productivity. According to Pandey *et al.,* (1999) suspended particles causing turbidity absorb considerable amount of nutrient elements like phosphate, nitrogen and potassium in their ionic form and make them unavailable for plankton production.

The annual average of alkalinity fluctuated between 15.30 mg/l to 24.80 mg/l (Table 1). The summer months before rains had higher alkalinity levels compared to other months. Positive correlation of this parameter was observed with productivity (r = +0.3275). According to Kaul and Gautam, (2002), alkalinity in natural waters is caused by hydroxide, carbonates, bicarbonates. Alkalinity is not harmful to human beings, still the water supplies with less than 100 mg/l are desirable for domestic use. Water bodies having total alkalinity

greater than 200 mg/l are highly productive (Moyle, 1946). The phytoplankton of a water body is affected by alkalinity (Sarkar and Chowdhury, 1999). The low alkalinity recorded in the water of this reservoir is thereby affecting the productivity of the water body. This observation agrees with Philipose, (1959) who also observed low alkalinity correlated with low productivity. Hence the water in Perumchani reservoir can be categorized as nutritionally poor. However the present observation disagrees with Mair, (1966), according to whom water bodies with 40 ml/g or more alkalinity are considered to be over productive.

Table 1 Values of different parameters analysed in the Perumchani reservoir

Parameters	Mean values *		Correlation with productivity	r value**
	Minimum	Maximum		
Transparency (m)	0.93	1.97	Negative	−0.4275
Turbidity (NTU)	4.32	5.42	Negative	−0.6284
Alkalinity (mg/l)	15.30	24.80	Positive	+0.3275
pH	5.86	6.38	Negative	−0.1127
Total Nitrogen (µ mol/l)	83.42	101.32	Negative	−0.3025
BOD (mg/l)	0.82	1.07	Positive	+0.1187
Phosphate (mg/l)	1.51	2.04	Negative	−0.451

*** Arithmetic Mean of values**

**** r value calculated using Karl Pearson's coefficient**

The overall pH of the reservoir under investigation was more towards the acidic side. The annual average of pH ranged from 5.86 – 6.38 (Table 1). The summer months and post monsoon season also recorded slightly higher values of pH. However the pH of this reservoir was low unlike that recorded from other reservoirs of the South Western Ghats. pH showed negative correlation with productivity (r=-0.112). The pH of an aqueous system is linked with chemical changes, species composition and life processes of the flora and fauna inhabiting them (Pandey *et al.*, 1999). The slight increase in pH during summer and post monsoon accounts from increased photo synthetic activity. The overall low pH is the one of the reason for less algal growth thereby showing negative correlation with productivity. The present observation agrees with Sreenivasan, (1976) who also suggested that low pH decreases productivity of water bodies.

In the present investigation the annual average of total nitrogen ranged from 83.42 μ mol/l to 101.32 μ mol/l (Table 1). It showed a negative correlation with primary productivity (r = -0.3025). Concentration of total nitrogen is very low in this reservoir indicating oligotrophic nature of this reservoir water. A similar trend was also observed by Paul and Varma, (1999). Heavy rains increased the level of this organic nutrient due to inflow of organic waste from catchment areas and river upstream. The negative correlation with primary productivity is due to its utilization by actively a growing phyloplankton in the presence of this nutrient. The very low level of total nitrogen in this reservoir compared to other lentic systems indicated the less polluted nature prevention in this water body.

The Biological Oxygen Demand (BOD) levels in the reservoir water were well within the limits recommended for drinking water. The maximum value of this physico – chemical parameter was 1.0 mg/l recorded during hotter months. Higher BOD levels were also observed in the reservoir water during months before the rains. This parameter showed positive correlation with productivity with r value +0.1187. According to Srivastava, (2002) BOD level of water indicates the fitness of any natural water body for domestic uses, irrigation and pisciculture purposes. The higher BOD level during hotter months is due to

increased bacterial activity affecting the BOD levels. The positive correlation of BOD with productivity cans the explained as an increase due to higher phytoplankton growth. Higher phytoplankton growth results in higher productivity explaining the positive correlation of BOD and productivity. The low BOD level in this reservoir water compared to other reservoirs suggests that this water body is least polluted nature. This work is in agreement with Yannawar, 2013 and Motlagh, 2015.

The summer months recorded higher phosphate levels compared to colder months. With primary productivity phosphate showed negative correlation (r = -0.451). Phosphate in natural waters occurs in very small quantities and is an important nutrient for maintaining fertility of the system. Paul and Verma,(1999) have suggested that phosphate is considered to be one of the limiting nutrient in the primary productivity of lentic systems. The high phosphate level during summer months is due to high wind speed, decrease of water level, increased evaporation and release of nutrients at increased temperature from decomposition of flora (Kant and Raina, 1990 and Kaushik and Saksena, 1999). The negative correlation of phosphate with primary productivity is due to its depletion with increase in productivity. This observation is supported by Dave *et al.*, (1999). The overall low phosphate level of this reservoir water explains the reason for lesser number of fish populations here.

Conclusion

The present ecological investigation is the first of this kind in the Perumchani reservoir. The investigation has found out that the water of this reservoir is nutritionally poor and low in productivity resulting in low fish population. This is mainly due to an acidic pH and very low anthropogenic activity in the catchment areas. However the encroachment by rubber plantations has to be checked to preserve and protect this water body from further pollution for the use of future generations. Steps also has to be taken to increase the nutritional status of the reservoir by desirable means so as to make it available for pisciculture

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