IMPACT OF AQUATIC POLLUTION ON THE POPULATION DYNAMICS OF ROTIFERS AND PRIMARY PRODUCTION IN THE LENTIC ECOSYSTEMS

Environmental Science

Dr. Padmanabha. B — Associate Professor & Head Post-graduate Department of Applied Zoology, Maharani's Science College for Women, J.L.B. Road, Mysore- 570005, Karnataka, India

ABSTRACT

Objective: is to study the impact of aquatic pollution on the population dynamics of rotifers and primary production in the lentic ecosystems.

Materials and methods: In this study, the Water Quality Index (WQI), population dynamics of Rotifers and estimation of primary production in the three lakes (Kamana, Mandakally lake and Dalavai lake) of Mysore city carried out for two years (2015-17).

Results and discussion: The results showed that, the Dalavai lake documented highest WQI or pollution load, Species Dominance Index and Community Respiration but lowest Species Diversity Index, Gross Primary Production and Net Primary Production. Kamana lake recorded lowest WQI or pollution load, Species Dominance Index and Community Respiration but highest Species Diversity Index, Gross Primary Production and Net Primary Production.

Conclusion: The comparative analysis of these results suggest that, increase in the Water Quality Index or Pollution load, increases species dominance and community respiration but decreases species diversity, Gross and Net primary production in the lentic ecosystem.

KEYWORDS

Rotifers, Water Quality Index, Primary production, Species diversity, Species dominance, Community Respiration.

INTRODUCTION Water is the most exploited natural resource by anthropogenic activities. Domestic sewage, corporate sewage, agricultural runoff, industrial effluents etc. are dumped in to the aquatic ecosystems. The limited sources of lentic ecosystems are polluted by these pollutants. The aquatic pollution leads to the spreading of water borne diseases, deplete the quality and quantity of fish production, damage the agricultural land and also limit the availability of potable water. If same rate of aquatic pollution take place, then it would become difficult to get safe and clean water to drink in the near future. To bring awareness and give suggestions among us we have to and should take studies on the impact of aquatic pollution on aquatic animals. Definitely, aquatic pollution provides significant impact on the population dynamics of aquatic flora and fauna. To provide evidence to this, here is an attempt, in which water quality of lentic ecosystem is assessed, diversity and density study of Rotifers is carried out, primary production of the lentic ecosystem is estimated to show a relationship between water quality, population dynamics of Rotifers and primary productivity. Few water quality parameters are summed up as Water Quality Index (WQI). Rotifers are the microscopic, aquatic, multicellular invertebrates which are the indicators of aquatic health.

In pollution stressed aquatic environments, change in the community structure is reflected in the diversity patterns of the component species. These changes can be quantified numerically as diversity indices, which are useful in water quality monitoring. Various indices are now extensively used in measuring stress on plants and animals due to overexploitation and pollution [1,2,3,4,5,6,7,8,9]. Pollution load decreases the primary productivity of an aquatic body [10]. In the present study an attempt is being made to evaluate the impact of pollution level on the population dynamics of Rotifers and primary productivity in the lentic ecosystem.

MATERIALS AND METHODS

Three lakes namely Kamana, Mandakally and Dalavai lakes in the Mysore city are selected for this study. The water samples are collected (2015-17) and analyzed for different hydrographical parameters[11]. The water quality parameters are expressed in a single numerical value, known as Water Quality Index (WQI). For the computation of WQI = $\sum$ qiwi formula is being used [3,7,8,12,13,14]. The zooplankton samples are collected, preserved and analyzed for abundance and diversity studies [15,16,17]. Different ecological indices such as diversity index, dominance index [18,19,20] are quantified. Primary productivity (Gross and Net) and community respiration of lentic ecosystems are estimated [10].

RESULTS AND DISCUSSION

1. **Water Quality Index (WQI):** This is defined as "a rating reflecting the composite influence of different water quality parameters, on the overall quality of water" [21]. WQI is a single number (like a grade) that expresses the overall water quality at a certain location based on several water quality parameters. Kamana lake recorded lowest WQI (0.95) followed by Mandakally lake (1.17) and highest in the Dalavai lake (1.45) (table 2). Higher WQI reflects higher level of aquatic pollution [3,22].

2. **Shannon - Weaver Index of species diversity (SWI) (H):** The SWI recorded highest in Kamana (2.5) followed by Mandakally (1.90) and lowest in the Dalavai lake (0.92) (table 1). Diversity tends to be higher in communities in stable environments than disturbed conditions [23]. As per the species diversity scale (H>3 =clean water, H = 1-3 – moderately polluted and if H<1 – heavily polluted) [24], Kamana and Mandakally lakes are moderately polluted but Dalavai lake is heavily polluted.

3. **Simpson Dominance Index (SDI) (λ):** Dalavai lake recorded highest SDI (1.10) followed by Mandakally (0.9) lakes and lowest in the Kamana lake (0.6) (table 1). Increase in the SDI indicates increase in the pollution load. Some species of Rotifers are sensitive or intolerant due to increased pollution and eliminated but few species have increased tolerance for adverse conditions [2,3,7].

4. **Primary Productivity (Gross & Net) and Community Respiration (CR):** The Gross Primary Productivity (GPP)(1.25gC/m^3/hr) and Net Primary Productivity (NPP) (1.05gC/m^3/hr) are highest in Kamana lake but Community Respiration (CR) (0.20gC/m^3/hr) is lowest. The Dalavai lake recorded lowest GPP (0.80gC/m^3/hr) and NPP (0.42 gC/m^3/hr) but highest CR (0.38gC/m^3/hr). These results indicate that Dalavai lake is having higher pollution than other two lakes and Kamana lake has lowest pollution. Pollution of water leads to a reduction in primary productivity. Pollution also affects the production (P)/Respiration (R) ratio, a proper level of which is very essential for the sustenance of the system. In a non-polluted water, the P usually exceeds R, but in organically polluted systems R exceeds P and no organic material is left available for the bioactivity of the system leading to system's impairment [10,11,23,25].

CONCLUSION

In conclusion, increase in the pollution; increases WQI, species dominance and community respiration but decreases species diversity, Gross and net primary productivity of a lentic ecosystem (Graph 1).

Table1: Water Quality Index and other ecological indices of Rotifers

	Kamana lake	Mandakally lake	Dalavai lake
Water Quality Index	0.95	1.17	1.45
Species Diversity Index	2.5	1.90	0.92
Species Dominance Index	0.6	0.9	1.10
Gross Primary Productivity	1.25	1.06	0.80
Net Primary Productivity	1.05	0.74	0.42
Community Respiration	0.20	0.32	0.38
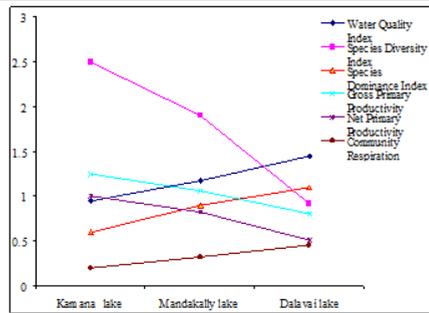
Graph 1: Relationship between WQI, GPP,NPP, CR and population parameters of Rotifers.

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