FB PO 28

INFLUENCE OF SELECTED ANTHROPOGENIC IMPACTS ON ECOLOGY OF VEMBANAD LAKE

*Prema, D., Shelton Padua, Kripa, V., Jeyabaskaran, R., Abhilash, K. S., Lavanya Ratheesh, Jyosthna, J. B., Shylaja, G., Ranith , R., Vysakhan, P ., Seban John and Vineetha Valsalan

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE, KOCHI

Key words : Vembanad Lake, Anthropogenic impacts, Water quality index, Coastal ecology, Spatial mapping, Environment management plan

*premadicar@gmail.com

INTRODUCTION

Wetlands are integral part of river basins or extension of sea and are considered as very productive ecosystems. The Vembanad Lake (VL) , one of the massive coastal wetland ecosystem, located in the south-west coast of India is an Ecologically sensitive zone. This Ramsar site is an indispensable habitat for many biologically and economically important resident and migratory aquatic fauna. Today wetlands are under serious threats due to urbanization, climate change, introduction of new species, salinization, dumping of sewage and toxic chemicals by the industries, construction activities, various agricultural practices, dredging activities, retting activities and tourism etc. and the VL is no exception. Recent studies showed that the VL underwent many alterations viz. changes in community structure (Walmiki *et al*., 2016), shrinkage in area (Nair and Babu, 2016) variation in water quality (Prema *et al*., 2014), nutrient dynamics (Sujatha *et al*., 2009), nonpoint source pollution (Paul *et al*., 2014) and many more. The anthropogenic threats encountered in VL were narrated by Sujatha *et al*., (2009). Environmental degradation in VL occurs by the irresponsible usage and also by the insensible disposal / discharge of pollutants into the water bodies. It is essential to make an evaluation of the health status of VL to evolve methods for its renovation, based on which, micro-level environmental management plans can be prepared to abate stress and sustain ecosystem health.

OBJECTIVES

- To assess ecosystem health of VL, in selected locations, based on water quality index and phytoplankton as major indicators during pre-monsoon as impacted by selected anthropogenic activities
- Spatial mapping of VL based on water quality index and phytoplankton abundance
- Suggestion of suitable environment management plans based on the results of assessment and mapping

MATERIALS AND METHODS

SAMPLING LOCATIONS

The present investigation was carried out at selected locations of VL (Fig 1). The sites were selected based on selected anthropogenic activities.

- Effluent discharges from industries : Eloor.
- Tourism : Kumarakom.
- Effluent discharge from sea food processing plants and shrimp peeling sheds : Aroor.
- Reference station :Panangad

Fig 1. Sampling Locations

METHODOLOGY

Standard methods of sampling and analysis for water quality were adopted with precision and accuracy during pre-monsoon period (Dec2016- April17). Water quality index (WQI) was calculated as per the USEPA (2006) method. Phytoplankton samples were collected from surface water using a conical net of mesh size 20 micron. Quantitative analysis of phytoplankton samples in the laboratory was done by Sedgwick-Rafter counting chamber under a compound microscope. The statistical analysis for diversity indices was done using the software PRIMER 6. The analysed data sets were plotted using GIS software ArcGIS 10.0 , QGIS 2.18.14 and R 3.4.2.

RESULTS AND DISCUSSION

Assessment of ecosystem health of V L, was done in selected locations, based on water quality index and phytoplankton. The water quality was indexed, using USEPA grading of selected environmental indicators (Table 1).

Table 1. Range of selected environmental indicators for water quality indexing

Ranking	Grade colour	DO, mg l^{-1}	Chl a, µg l^{-1}	DIP, mg l^{-1}	DIN, mg l^{-1}
Good		> 5	> 20	<0.01	<0.1
Fair		2-5	5-20	0.01-0.05	0.1-0.5
Poor		< 2	<5	>0.05	>0.5

Aroor area impacted by sea food processing plants & shrimp peeling sheds and Eloor area impacted by industrial effluents were having water quality index, as “POOR” (Fig. 2). Kumarakom area where there are tourism activities and a control region (Panangad) were having fair water quality. Corresponding phytoplankton and species abundance in selected locations of VL are shown in Figs. 3, 4 and 5.

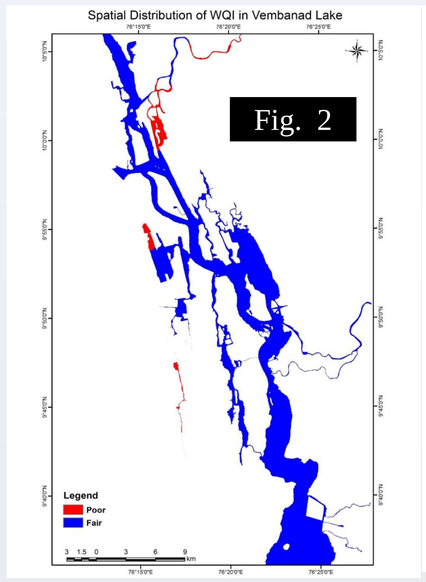


Fig. 2

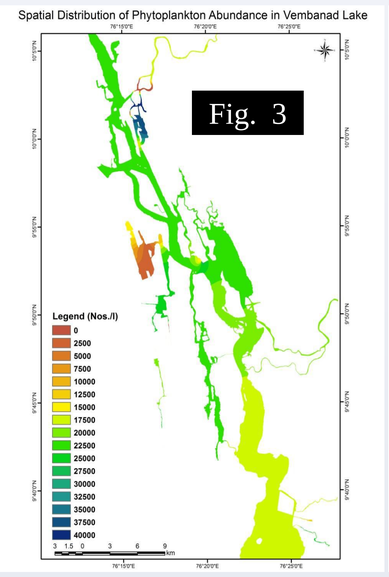


Fig. 3

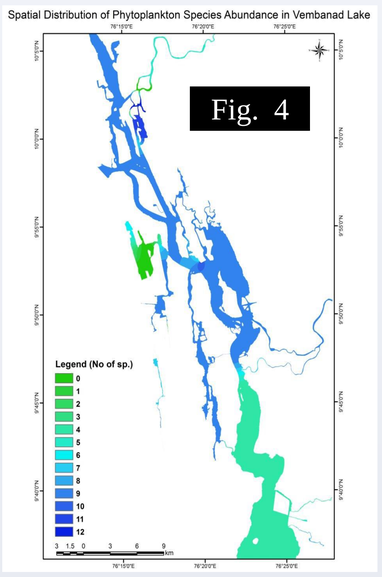
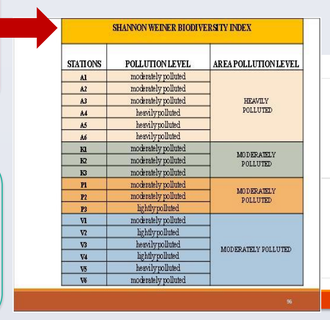


Fig. 4

The phytoplankton diversity index of the locations with interpretation of pollution level



SHANNON WEINER BIODIVERSITY INDEX

STATIONS	POLLUTION LEVEL	AREA POLLUTION LEVEL
A1	moderately polluted	HEAVILY POLLUTED
A2	moderately polluted	
A3	moderately polluted	
A4	heavily polluted	
A5	heavily polluted	
A6	heavily polluted	
K1	moderately polluted	MODERATELY POLLUTED
K2	moderately polluted	
K3	moderately polluted	
P1	moderately polluted	MODERATELY POLLUTED
P2	moderately polluted	
P3	lightly polluted	
V1	moderately polluted	MODERATELY POLLUTED
V2	lightly polluted	
V3	heavily polluted	
V4	lightly polluted	
V5	heavily polluted	
V6	moderately polluted	

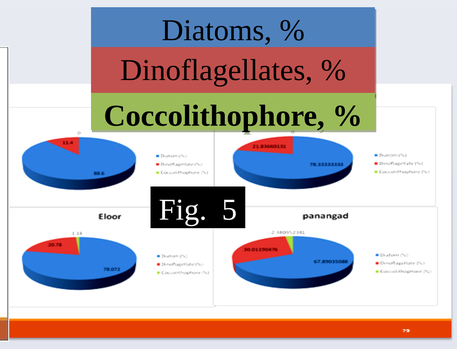


Fig. 5

- Results indicate VL ecosystem deterioration and ecological imbalance.
- Needs immediate intervention to stop further damage

ENVIRONMENT MANAGEMENT PLAN

- ✓ Action must be taken to provide and / or improve sewage treatment at Aroor
- ✓ Proper collection and processing facilities for biodegradable wastes must be provided here.
- ✓ Awareness campaigns on waste disposal must be conducted.
- ✓ In Eloor, measures should be initiated for effluent treatment plants, effluent monitoring, proper disposal of effluents
- ✓ Possible bioremediation measures also must be attempted here.
- ✓ In Kumarakom, house boats should have appropriate means for collection, treatment and disposal of wastes generated during house boat usage / journey
- ✓ There should be proper mechanism for collection, treatment and disposal of domestic wastes, plastic and other wastes in this area.

REFERENCES

Nair, P.K and Babu, SDS. 2016. Spatial Shrinkage of Vembanad Lake, South West India during 1973 -2015 using NDWI and MNDWI. *International Journal of Science and Research*. 5 (7), 319-7064.

Paul,K., Alias, BM and Varghese, S. 2014. Spatial Distribution of Non-point Source Pollution in Vembanad Lake. *International Journal of Innovative Research in Science & Engineering*. ISSN (Online) 2347-3207

Prema, D., Jeyabaskaran, R ., Kaladharan, P ., Khambadkar, L R., Anilkumar, PS., Nandakumar, A ., Valsala, KK and Kripa, V. 2014. Water quality indexing of coastal waters off Cochin. .*Marine Fisheries Information Service; Technical and Extension Series* (219). pp. 15-16

Sujatha CH, Benny N, Raveendran R, Fanimol CL and Samantha NK. 2009.Nutrient dynamics in the two lakes of Kerala, India. *Indian J Mar Sci*. 38:451-456.

Walmiki, N., Sharma, D and Kubal, P. 2016. Aquatic Diversity with Reference to Phytoplankt Benthos in Lake Vembanad, Kottayam, Kerala, India. Research Journal of Marine Sciences. 4 (3): 1-10. E-ISSN 2321–1296

ACKNOWLEDGEMENT

Authors are grateful to Dr. A. Gopalakrishnan, Director, CMFRI for providing support for the investigation. Thanks are also due to Dr. V. Kripa, Head, FEMD, CMFRI for making available the Divisional Manpower and Facilities for the the study.