Uttar Pradesh J. Zool. 32(1) : 105-109, 2012 ISSN 0256-971X

ENVIRONMENTAL IMPACT ON THE HYDROGRAPHICAL FEATURES OF THEKKUMBHAGAM CREEK OF ASHTAMUDI ESTUARY

DIVYA S. RAJAN, R. BINDHU AND S. SHIBU
PG & RESEARCH DEPARTMENT OF ZOOLOGY,
SREE NARAYANA COLLEGE, KOLLAM-691 001, INDIA
(e-mail : divyashyju2010@gmail.com)

Thekkumbhagam is an island situated beyond the palm trees and shining waters of the enchantingly beautiful Ashtamudi estuary of Kerala, India. Nowadays signs of decline in fish availability and dwindling of the fragile lake zone has been noticed due to the deposition of large quantities of untreated sewage, human excreta, oil spills, industries waste, retting yards as well as from eco-tourism. As a result *Etroplus suratensis* and *mullet*, the traditional resources of this area have disappeared while comparing with the previous yield resulting in the migration of the fishermen to other lakes. The present study was carried out to find out the changes of physiochemical characters of Thekkumbhagam creek that provides an insight into the need for conservation of the island.

Key words : Thekkumbhagam creek, Ashtamudi estuary, dissolved oxygen, pH, salinity, carbon dioxide, nitrite, phosphate and silicate.

INTRODUCTION

The total life of the world depends on water and hence the hydrological study is very much essential to understand the relationship between its different tropic levels and food webs. The environmental conditions such as topography, water movement, salinity, oxygen, temperature and nutrients characterising particular water mass also determines the composition of its biota (Karande,1991). Estuaries host the complex mix of bio-geo chemical processes that can vary temporarily and spatially within the system and often act as opposing or competing influence on nutrient distribution (Badarudeen *et al.*, 1996).

Thekkumbhagam is a traditional village of about 20 sq km area fully surrounded by the Ashtamudi lake and this island is now connected with bridges, one from south at Neendakara and one to the north at Thevalakkara. Ashtamudi estuary in Kerala is designated as the "Wetland of international importance" and is located between latitude 8° 53′- 9° 21′ N and longitude 76° 3′ - 76° 41′ E. It is a palm shaped extensive water body with eight (ashta) prominent arms (mudi = locks of hair) adjoining the Kollam town. This estuary is one of the foremost centres of marine fish production and landings along the Kerala cost (Thressiamma & Nair, 1980) and receives much attention due to its rich and varied fishery resources and an annual production of 23000 tons of fish (Kurup & Thomas, 2001).

At present Thekkumbhagam creek is facing many threats *viz.* pollution, over-fishing, sand mining, bank erosion, loss of mangroves, retting and oil spills. So hydrographical studies are essential for a scientific study to solve the problem of depletion of water.

MATERIALS AND METHODS

Water samples were collected from the site of Thekkumbhagam creek during the period of June 2008 to May 2009. Water and atmospheric temperature was measured by

using an accurate centigrade thermometer. The hydrogen ion concentration (pH) of the water sample was estimated by using a portable pH meter. The dissolved oxygen in the samples were analyzed in the laboratory using the modified Winkler's method (APHA, 1985). The free carbon dioxide in the water samples was estimated by titration using NAOH and phenolphthalein indicator. For the estimation of micro nutrients, water samples were collected in polythene bottles and stored in refrigerator until the time of analysis. Inorganic phosphate, nitrate and silicate contents of the water samples were estimated by following the method given by Strickland & Parson (1968) with modification given by Grashoff & Koroloff (1983). Salinity of the water samples was estimated by titration using silver nitrate solution and potassium dichromate indicator (Strickland & Parson, 1968).

RESULTS AND DISCUSSION

The temperature variation is one of the factors in the coastal and estuarine system, which may influence the physico-chemical characteristics and also influences the distribution and abundance of flora and fauna. Surface and bottom water temperature recorded a minimum during post monsoon and maximum during pre-monsoon. Lower temperature in the month of November due to cloudy sky and rainfall brought down the temperature to minimum (Kannan, 1996).Similar observations have been reported by Sreenivasan (1998) from Vellar estuary.

Dissolved oxygen concentration varies according to many factors; the main factors are due to photosynthesis and respiration by plants and animals in water. In the present study minimum dissolved oxygen was recorded during pre monsoon and maximum during post monsoon. It was observed that the amounts of dissolved oxygen during different month have shown minimum quantity in lower reaches when compared to upper reaches. This is because of the oxygen consumed more by aquatic animals due to effluent stresses. Federal water pollution control administration of USA has recommended 4mg/l dissolved oxygen as optimum for coastal estuarine water, where as dissolved oxygen less than 2.5mg/l as discovered to be hypoxic condition. (Laponite & Clark, 1992). The lower dissolved oxygen in estuarine sites may be attribute to the low solubility of oxygen in saline water and supports with the earlier studies conducted by (Sankaranarayanan & Panampunnayil, 1979). The distribution of dissolved oxygen is found to be greatly related to salinity and has an inverse relation with it.

Respiratory activity of aquatic organisms and process of decomposition are important sources of carbon dioxide in water bodies. Present study shows a minimum value of carbon dioxide during monsoon and a maximum during pre monsoon. It showed inverse relation with oxygen. Similar findings were also made by (Laxminarayan, 1965).

Salinity is considered as the most outstanding chemical property of the estuarine water. Surface salinity values were found to be lower than that of bottom in the sites indicating the prevalence of density stratification within the estuary. The difference in the surface and bottom salinity can also be due to the out flowing riverine water giving a two layered structure. Similar results were reported by Nasnolkar *et al.* (1996). A slight change in salinity will reflect other physical, chemical and biological factors. (Dehadri, 1970).In the present study there is a sharp decline of salinity in post monsoon and highest value in pre monsoon. Variation in salinity agrees with the observations of (Nair & Azis. 1987). The prevalence of wide salinity ranges is a characteristic feature of the back

MAP OF ASHTAMUDI LAKE
Kizhakkekallada
Thevalakkara
Palmana
Chavara
Perayam
Perinad
Kilikolloor
N
Kollam
Sakthikulangara
Thekkumbhagam
Neendakara
Thrakkadavur

waters. pH is considered as an important chemical parameter in water bodies since most of the aquatic organisms are adapted to an average pH and do not with stand abrupt changes .Minimum pH was observed during monsoon and maximum during post monsoon. According to Levinton (1982) carbon dioxide produced by decomposition and respiration can decrease pH of marine waters to 7.5 and photosynthesis can raise to 9.

In the present study phosphate phosphorous was maximum during monsoon and minimum during pre-monsoon. Similar observations were observed by Rajasekhar *et al.* (2007) from minor reservoir Nadergut. Phosphate is the key nutrient in the productivity of water in reservoir.

Determination of nitrite plus nitrate in surface water gives a general indication of the nutrient status and level of organic pollution. The higher concentration of nitrite and seasonal variation could be attributed due to variation in phytoplankton, excretion and oxidation of ammonia and reduction of nitrite. (Kannan,1996).The low contents of nitrites during the months of April to May was due to less fresh water input, higher salinity, higher pH and also uptake by phytoplankton. The same was recorded by (Chandran, 1982) from Vellar estuary. Nitrite values were maximum during monsoon and minimum during pre monsoon months. This agrees with the observations of Rajasekhar *et al.* (2007).

The availability of silicate silicon is one of the important factors that can regulate the species composition of phytoplankton assembly (Egge & Aksinses, 1992). The values of silicate silicon during the present study recorded minimum during monsoon and maximum during pre monsoon. Usually higher values of dissolved silicates stimulate the growth of diatom, one of the common groups of phytoplankton.

It is concluded from the present study that several anthropogenic influences like influx of domestic sewage, municipal sewage, industries ,oil spill from thousands of fishing -boats, retting yards, improper sanitation facilities of the port, the thrown out waste during the boating of tourist as a recreational activity of tourist centers contributed to ecological degradations. These ecological degradation led to the shrinking of the lake area from 54sq km to 34sq km. For the sustainability of estuaries, water quality management needs special attention by phasing out the pollution sources, management of urban wastes, encouraging mangrove afforestation, stopping of estuary reclamation, upgrading port facilities, phase out the discharge of waste pith into the water. Since the shores of Ashtamudi estuary are home to nearly one million people and an equally important species of birds and animals. Any decision made concerning the estuary's resources and its sustainable management will be significantly affecting the future.

ACKNOWLEDGEMENT

The authors are thankful to the Principal, Sree Narayana College, Kollam for the facilities provided.

REFERENCES

APHA. 1985. *Standard Methods for Examination of water and waste water.* American Public Health Association, Washington.D.C.

BADARUDEEN, A, DAMODARAN, K.T & SAJAN, K.1996.Texture and geochemistry of the sediments of a tropical mangrove ecosystem, southwest coast of India. *Environ. Geol.* **27** : 164-169.

CHANDRAN, R. 1982. Hydrobiological studies in the gradient zone of the Vellar estuary. *Ph.D .Thesis, Annamalai University, Guntur, India.* pp.195.

DEHADRI, P.V. 1970.Changes in the environmental features of the Zuari and Mondovi estuaries in relation to tides. *Proc. Indian. Acad. Sci.* B**72** : 68-80.

EGGE, J.K & AKSENSUS, D.L.1992. Silicates as regulating nutrients in phytoplankton competition. *Marine Ecological Progress Series.* **83** : 281-289.

KARANDE, A.A. 1991. Use of epifaunal communities in pollution monitoring. *J. Environ. Biol.* : 191-200.

KOROLEFF, F., GRASSHOFF, K., EHRDARDT, M. & KREMLING, K. 1983. Determination of phosphorous in methods of sea water analysis. *Verlag, Chemic. Gmp. Weinheim.* pp. 419.

KURUP, B.M & THOMAS, K.V, 2001. Fishery resources of the Ashtamudi estuary. Technical report No.**14**, ASR Ltd. Marine and Freshwater Consultants Hamilton, New Zealand and Centre for Earth Sciences Studies, TVM, India.

LAPONITE, B.E & CLARK, M.W.1992. Nutrient inputs from the water shed and coastal eutrophication in Florida. *Keys.Estuaries.***15** : 465-476.

LAXMINARAYAN, J.S.S. 1965. Studies on phytoplankton of the river Ganga, Varanasi, India, Part1-**4**, *Hydrobiologia.* 119-175.

LEVINTON, J.S.1982. *Marine Ecology* .Prentis-Hall Inc Englewood, Cliffs, New Jersey.

NAIR, N.B & AZIS, P.K.A.1987. Hydrobiology of the Ashtamudi estuary, a tropical back water system in Kerala (Nair, N.B. Ed.). In : Proc. Matl. Sem .Estuarine Management, Trivandrum. pp. 268-280

NASNOLKAR, C.M., SHIRODHKAR, P.V. & SINGBAL, S.V.S. 1996. In : *Mar. Sci.* **25** : 120-124.

RAJASHEKHAR, A.V., LINGIAH, M.S., SATYANARAYANA, RAO. & RAVI SHANKAR. 2002. The studies on water quality parameter of a minor reservoir Nadergut.*J. Aqua.Biol.* **22**(1) : 118-122.

SANKARANARAYANAN, V.S & PANAMPUNNAYIL, V.S. 1979. Studies on organic carbon, nitrogen and phosphorous in sediments of Cochin backwaters. *Indian Journal of Marine Sciences.* **8** : 27-30.

SREENIVASAN, R. 1998. Spectral reflectance properties of the Vellar estuarine environment, south east coast of India. *M. Phil. Thesis, Annamalai University, Guntur, India.* pp 35.

STRICKLAND, J.D.H & PARSON, P.R. 1968. A practical handbook of sea water analysis. *Bull. Fish. Ref. Bd. Canada.* pp. 311.

THRESSIAMA, M & NAIR, N.B.1980.Phytoplankton of the Ashtamudi estuary, Kerala. *Indian Journal of Marine Sciences.* **9** : 253-257.