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DISTRIBUTION OF NUTRIENTS IN THE MAMOM RIVER, KERALA

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Abstract: Seasonal variations of nutrient characteristics of a lotic ecosystem, Mamom River situated in Trivandrum district was studied for a period of one year from June 2008-May 2009. Both surface and bottom water samples were collected from six stations along the river. The range of various parameters were pH 5.2 to 7.6 (surface) 5.2 to 7.4 (bottom) , salinity 0 to 13ppt, temperature 22.6 to 32.5^{0}C (surface) 22.5 to 30.1^{0}C and nutrient parameters namely nitrate 0.1 to 2.4µg/l (surface) 0.08 to 2.2µg/l (bottom), nitrite 0.04µg/l to 0.58 µg/l (surface) 0.02 to 0.55µg/l (bottom), phosphate 0.08 to 1.3µg/l (surface) 0.04 to 1.2µg/l (bottom), silicate 1.0 to 12.6 mg/l (surface), 1.0 to 11.0mg/l (bottom) and sulphate 3.0 to 22.5mg/l (surface), 3.0- 21 mg/l (bottom). Both pH and salinity were recorded maximum during monsoon, but pH minimum during post monsoon. The highest temperature was measured during pre-monsoon and lowest during post monsoon. The nitrate, nitrite and phosphate recorded highest during monsoon and lowest during post monsoon but, distribution of silicate and sulphate maximum during pre-monsoon and minimum during postmonsoon.

Key words: Mamom River, Nutrients, Seasonal variation.

INTRODUCTION

Fresh water resources are most precious to earth: they are the basic ingredient to life. Rivers are natural phenomena, integral component of ecological system and inextricable part of the cultural, social, economic, spiritual lines of the communities concerned. These are highly productive system and the location of critical biogeochemical process. Globally, fresh water has become the fastest depleting natural resource nowadays. River resources of Kerala are under continuous threat of pollution because of the insufficient levels of sewage treatment and diffuse contamination from agricultural and industrial effluents. One of the most harmful effects of human activities on surface waters is nutrient pollution. Nutrients are essential elements and present in the environment in various concentrations. Their presence in the aquatic environment- the water, makes it a valuable resource. A nutrient monitoring network is an important source of information about the nutrient pollution status of rivers. The dynamics and seasonal cycles of the nutrients – nitrate, nitrite, phosphate, silicate and sulphate were controlled most of the biological activities in an aquatic ecosystems, as they are essential for the growth of phytoplankton and inturn for the survival and population fluctuations of other biotic communities.

Mamom River is a small lotic system that originates from the Pandalacode- Kodikkunnu Hills in Kanyakulangara. After meandering mostly through plantations and paddy fields, the river joins the Vamanapuram River at Ayanthikkadavu and finally empties in to the Arabian Sea through the Anchuthengukayal in Thiruvananthapuram district. Mamom River is about 27km long and has an average catchment area of 145 sq.km. The river suffers pollution mainly from the runoff from rubber plantations and the outflow from paddy fields. It is also polluted at various points with domestic wastes and sewage. So far no attempt has been made to study the distribution of nutrients in this river.

MATERIALS AND METHODS

For the present study, six stations were selected from the Mamom River, Kerala— Station 1(Thannirsala), station 2 (Nannattukavu), station 3 (Mathanadu), station 4 (Velavoor), station 5 (Mamom) and station 6 (Ayanthikkadavu) (Fig. 1). Spatial distribution of nutrient studies will certainly provide better scientific basis to understand the ecosystem of Mamom River.

Surface and bottom water samples were collected from six different stations for a period of twelve months during the year 2008-2009. The water samples were collected in different clean bottles as per standard method taken from APHA 2005. The physical parameters such as temperature, pH and salinity and temperature were measured at site itself. Temperature was measured using a high quality Celsius Thermometer, pH using a portable pH meter (Elico, model, Digital pH meter). Salinity was measured using a hand refractometer (ERMA.INC, Tockyo). Nutrients were estimated spectrophotometrically by the procedure adopted from APHA. The investigation period was divided in to three seasons *i.e.,* pre monsoon, monsoon and post monsoon.

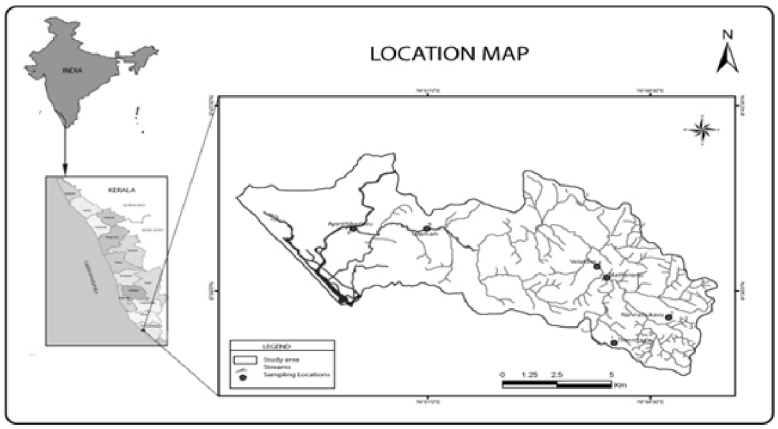

Fig. 1. Location map of sampling sites in Mamom River

RESULTS AND DISCUSSION

Temperature

Temperature is an important water quality parameter and is relatively easy to measure water bodies will naturally shows changes in temperature seasonally. The variations in temperature of Mamom River ranged from 22.6 to 32.5 ^{0}C and bottom water ranged from 22.5 to 30.1^{0}C. During the pre-monsoon period highest temperature was vertical temperature could be due to open nature of the site and due to the hot climate in the pre monsoon (Fig.2). Similar seasonal variations in water temperature was recorded by (Nath and Srivastava, 2001; Shrivastava and Patil, 2002; Saksena *et al*., 2008; Haroon *et al.,* 2010; Namrutha, 2010; Rincy Joseph and Tessy, 2010; Patra *et al.,* 2011; Sukhija, 2010; Sujitha *et al.,*2011). The lowest annual mean value of surface water temperature ranged from (25.63±0.04 mg/l) in station 2 to highest mean value ranged (29.12±0.47mg/l) station 6.The temperature of bottom water showed a lower value ranged from (25.55±0.42mg/l) station 1 to higher value was seen in (28.66±0.43mg/l) at station6.

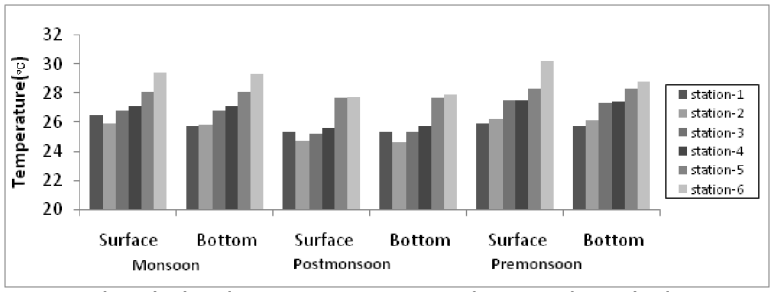

Fig. 2. Seasonal variation in temperature at various stations during 2008-2009

pH

pH is an important parameter for determining the quality of water. pH of the surface water ranged from 5.2 to 7.6 and bottom water ranged from 5.2 to 7.4. The surface and bottom water pH did not showed decisive fluctuations throughout the study period. The pH was highest during monsoon and lowest during post monsoon (Fig.3). Similar conditions of pH were reported by (Bisht, 1993; Gautam *et al*., 2000; Khanna *et al*., 2001; Sankar *et al*., 2002; Anukumar, 2006; Khanna and Matta, 2011; Shraddha, 2011). The lowest annual mean value of surface water pH ranged from (6.52±0.24 mg/l) in station 1 to highest mean value ranged (6.88±0.19mg/l) station 6. The pH of bottom water showed a lower value (6.58±0.23mg/l) station 1 and higher value (6.93±0.23mg/l) was recorded in station 4.

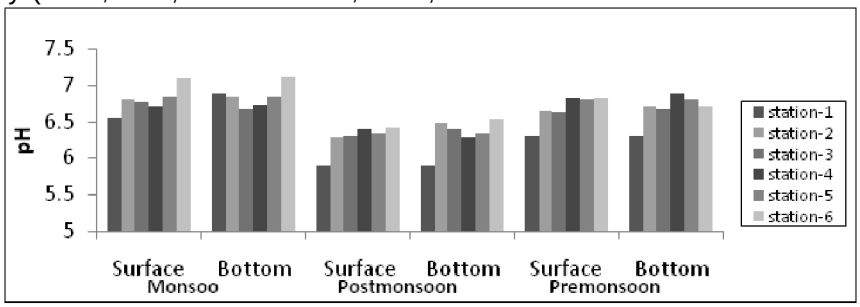

Fig. 3. Seasonal variation in pH at various stations during 2008-2009

Salinity

The surface water concentration of salinity in the river ranges from 0 to 10ppt and that of bottom water ranged from not detected to 13 ppt. The salinity was highest during monsoon seasons and this may due to the sea water intrusion in to the river (Fig.4). Similar findings observed by (CWRDM, 2011; Patra*et al.*,2011). The lowest annual mean value of surface water salinity ranged from (0.42+0.19 mg/l) in station 1 to highest mean value ranged (5.75±0.59mg/l) station 6.The salinity of bottom water showed a lower value ranged from (0.50± 0.29 mg/l) station 1 to higher value (8.92±0.63mg/l) was seen in station 6.

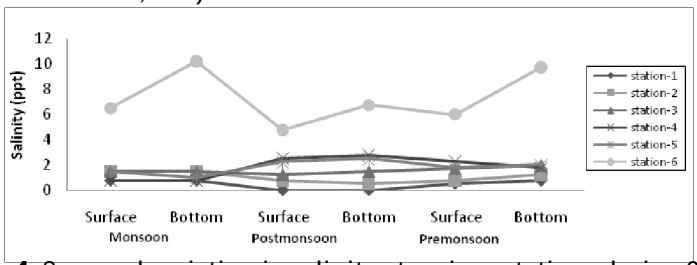

Fig. 4. Seasonal variation in salinity at various stations during 2008-2009

Nitrate

Nitrate is the highly oxidized form of nitrogen and it is essential for plankton growth. The surface water concentration of nitrate-nitrogen in the Mamom River ranged from 0.1 to 2.4 mg/l and bottom water ranged from 0.08 to 2.2mg/l. The concentration of nitrate was highest during monsoon and lowest during post monsoon season (Fig.5). Both the surface and bottom showed similar pattern throughout the study. Nitrate content showed an apparently increasing trend in the downstream. Similar findings were reported in (Ufodike *et al*., 2001; Kennedy and Hains, 2002; Ganai *et al*., 2010; Shraddha *et al*., 2011; Sujitha *et al*., 2011). The high value of nitrate due to the runoff waters from the surrounding area. The lowest annual mean value of surface water nitrate ranged from (0.65 ± 0.13 mg/l) in station 1 to highest mean value ranged (1.05± 0.18mg/l) station 6. The nitrate of bottom water showed a lower value ranged from (0.55+ 0.12mg/l) station 1 to higher value was seen in (1.02±0.18mg/l) station 6.

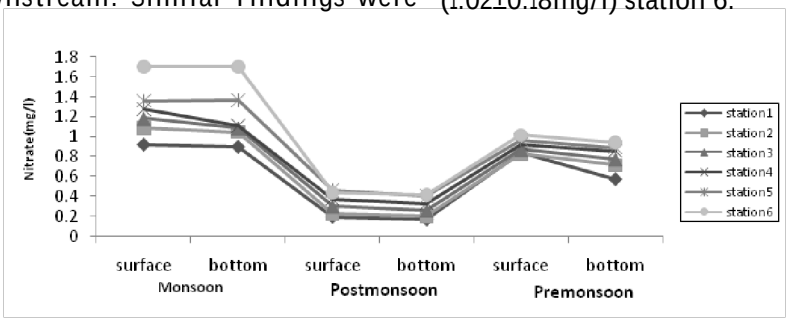

Fig. 5. Seasonal variation in nitrate at various stations during 2008-2009

Nitrite

Nitrite is the partially oxidized form of nitrogen, and it occurs in lower concentration than nitrate in natural waters. The surface water concentration of nitrite-nitrogen in the Mamom River ranged from 0.04 to 0.58mg/l and bottom water ranged from 0.02 to 0.55 mg/l. Nitrite content increased from head stream to lower reaches of Mamom River. The surface and bottom water nitrite concentration showed almost similar. The season wise values recorded maximum during monsoon and minimum during post monsoon (Fig.6). It is due to the influence of terrigenous matter carried by flood waters as well as decomposition activity in the river. Similar findings have been reported by (Mittal and Sengar, 1990;Sarala Devi *et al*., 1991; Babu Jose, 1999; Sheeba, 2001; Sankar*et al*., 2002; Babu*et al*., 2003). In general, increase in downstream the pollution input gives a sufficient indication of the deteriorating quality of water due to entry of waste water in river (Shraddha*et al*., 2011) .The lowest annual mean value of surface water nitrite ranged from (0.22±0.05 mg/l) in station 1 to highest mean value ranged (0.32±0.04mg/l) station 6. The nitrite of bottom water showed a lower value ranged from (0.20±0.05mg/l) station 1 to higher value (0.29± 0.04mg/l) was seen in station 6.

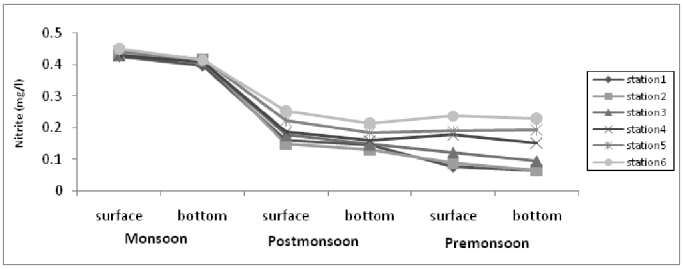

Fig. 6. Seasonal variation in nitrite at various stations during 2008-2009

Phosphate

Phosphorous is one of the most important nutrients of living organism. The concentration of surface water phosphate ranged between 0.08 to 1.3 mg/l and bottom water ranged 0.04 to 1.2 mg/l. Both the surface and bottom water results showed similar pattern throughout the study. Seasonally, the values were highest in monsoon and gradually decrease in post monsoon and pre monsoon (Fig.7). Similar observation is in occurrence of the findings of (Babu*et al*., 2003;Gananie*t al*., 2010;Manimegalaie*t al*., 2010;Namratha, 2010;Rincy Joseph and Tessy, 2010;Sukhija, 2010). The increase in application of fertilizers, use of detergents and domestic sewage greatly contribute to the heavy loading of phosphorous in the water (Shraddha, 2011). The lowest annual mean value of surface water phosphate ranged from (0.36±0.07 mg/l) in station 1 to highest mean value ranged (0.57±0.09mg/l) station 6. The phosphate of bottom water showed a lower value ranged from (0.33±0.09mg/l) station 1 to higher value (0.23±0.09mg/l) seen in station 6.

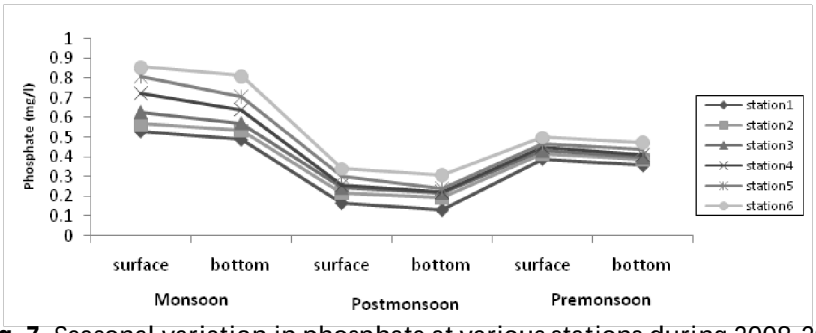

Fig. 7. Seasonal variation in phosphate at various stations during 2008-2009

Silicate

Silicate is present in all natural waters both ionic and colloidal form. The surface water concentration of silicate ranged from 1.0 to 12.6 mg/l and that of bottom water ranged from 1.0 to 11.0 mg/l. Seasonally, the values were maximum during pre-monsoon and minimum during post monsoon (Fig. 8). Similar seasonal fluctuations were reported in (Babu *et al.,* 2003; Subhashini and Saradhamani, 2005; Anukumar, 2006; Saksena *et al.,* 2008; Sujitha *et al.,* 2011; Patra*et al*., 2011). The major source of dissolved silicate in river is the weathering of rocks and minerals in the study area. The lowest annual mean value of surface water silicate ranged from (2.13±0.15 mg/l) in station 3 to highest mean value ranged (7.96±0.71mg/l) station 6. The silicate of bottom water showed a lower value ranged from (2.05±0.14mg/l) station 1 to higher value (7.32±0.59mg/l) seen in station 6.

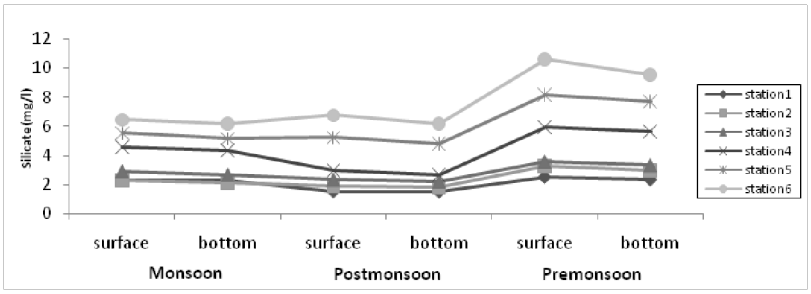

Fig. 8. Seasonal variation in silicate at various stations during 2008-2009

Sulphate

Sulphate occurs naturally in all waters. Domestic sewages and biological oxidation of reduced sulphur species may add sulphate to water. In this study, the surface water sulphate concentration of the river ranged from 3.0 to 22.5 mg/l and that of bottom water ranged from 3.0 to 21.0 mg/l. Seasonally, the values were highest in pre monsoon and decrease in monsoon and post monsoon (Fig.9). Bathing and washing may enhance the sulphate contamination of water bodies. Both the surface and bottom water results showed slight differences throughout the study. Similar findings were reported in (Krishnakumar, 2002; Nirmala and Sobha, 2003; Subhashini and Saradhamani, 2005; CWRDM, 2010; Shraddha *et al*., 2011; Sujitha, 2011). The lowest annual mean value of surface water sulphate ranged from (6.0±0.62 mg/l) in station 3 to highest mean value ranged (18.35±0.76mg/l) station 6. The sulphate of bottom water showed a lower value ranged from (5.0±0.54mg/l) station 1 to higher value (16.33±0.92mg/l) seen in station 6.

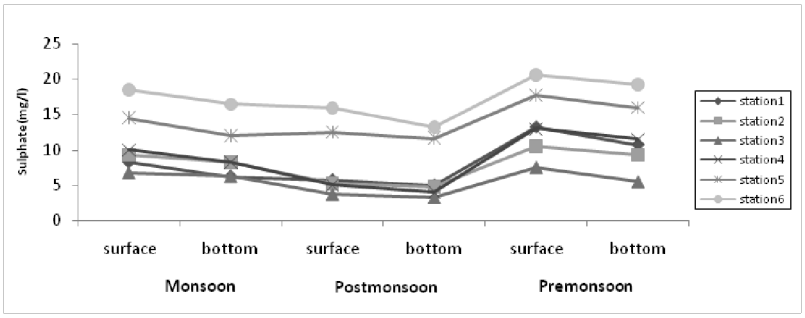

Fig. 9. Seasonal variation in sulphate at various stations during 2008-2009

CONCLUSIONS

This study provides an information data that provides basic data to understand the current status of water quality of the Mamom River. The major sources of pollutants are local anthropogenic activities and agricultural runoff.

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