Ecological Study of Shambavi Estuary, Karnataka

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Abstract

Studies were carried out on the ecological characteristics like physico-chemical parameters (pH, temperature, total suspended solids, total dissolved solids, total solids, biological oxygen demand, salinity and phosphate) and biological parameters (fauna and flora) of Shambavi estuary, Mulki, Dakshina Kannada District, Karnataka for six months i.e. from January to June, 2009. The air temperature ranged from 29±0.01 ^{o}C to 32±0.0 ^{o}C and the water temperature ranged from 30^{o}C±0.0 to 35±0.0 ^{o}C. The level of pH was more or less neutral. BOD value was in between 108±1.14 mg/l and 288±1.22 mg/l, salinity varied from 32±0.0 ppt to 35±0.24 ppt. The level of total solids, total dissolved solids and total suspended solids recorded were ranged from 52±0.0 mg/l to 60±1.31 mg/l, 44±0.41 mg/l to 60±1.63 mg/l, 4.0±0.0 mg/l to 16±0.0 mg/l respectively. The level of phosphate ranged from 0.01±0.0 mg/l to 0.10± mg/l. This study revealed that there is a mild fluctuation in the physico-chemical and biological parameters of water. When this data is compared to the data of 2012, there is a drastic change (decreased) in the value of salinity in the month of June. Some of the plankton species identified during the study were *Anabaena* sp., *Oscillatoria* sp., *Closterium* sp., *Pinnularia* sp., *Navicula* sp., *Chaetoceros* sp. A positive correlation was observed between salinity and Bacillariophyceae members and a negative correlation was observed between salinity and Chlorophyceae members. The more abundant mangrove plants observed were *Rhizophora* sp. and *Avicennia* sp. The crabs identified were *Ocypoda* sp., *Thalamita* sp., *Gelasimus* sp. and *Sesarma* sp. A species of prawn i.e. *Penaeus* sp. were observed. The fishes occurring in the study area include *Glossogobius* sp., *Ambassis* sp. and *Mugil cephalus*. Gastropods identified were *Cerithidia* sp. and *Neritina* sp. The birds identified around the site include Egrets, Herons, Kingfisher and Brahminy Kite.

KEYWORDS: Ecology, mangrove, fauna, flora, BOD, solids, pH

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1. Introduction

An estuary is a partially enclosed body of water formed by the mixing of freshwater from rivers and streams with the seawater. These are fragile ecosystems with unique physical, chemical and biological features and are influenced largely by the annual cycles of land run off from freshwater inputs influenced by human activities and tidal cycles. Estuarine areas are transitory places where the landscape changes from land to sea, and the water quality from fresh to salty. They form a link between the land, freshwater and seawater. Estuaries are very dynamic and productive, supporting unique but diverse fauna and flora. Although influenced by the tides, estuaries are protected from the ocean waves, winds, and storms by reefs, barrier islands, and land, mud, or sand that define an estuary's seaward boundary. Estuarine environments are among the most productive ecosystems on earth, creating

renewable organic matter. Diverse habitats that are found in and around estuaries can be grouped as: shallow open waters, freshwater and salt marshes, sandy beaches, mud and sand flats, rocky shores, mangrove forests, river deltas, tidal ponds and sea grass beds (Madhyastha *et al*., 2000). The adapted vegetation found in estuary are mangroves which possess varied structural modifications like vivipary, pneumatophores to overcome the saline and water logged conditions and grow along the seas as they cannot compete successfully with freshwater flora (Rutzler and Feller, 1996).

India has a coastal belt of 5686 kms, receiving an enormous amount of fresh water from many rivers all along the stretch from east to west. According to an estimate, the estuaries and backwaters of India occupy 2.6 million hectares of water spread area, of which Karnataka occupies about 0.1 million hectares (Jhingran, *et al.,* 1972). Karnataka coastline extends over a length of 320 km with numerous river mouths, lagoons, bays, creeks and long beaches (Purushottama *et al*., 2014). Fourteen rivers drain their waters into the coastal waters of Karnataka. The shoreline of Dakshina Kannada district ranging about 141 km and has 6 estuarine mouths with several rivers flowing from the Western Ghat region. Karnataka State has three coastal districts – Uttara Kannada, Udupi and Dakshina Kannada. All these districts harbour mangroves and the important estuaries are Nethravathy, Mulki and Gangolli estuary. For the present study, a typical estuary at Bappanadu village near Mulki was taken up.

2. Materials and Methods

Shambavi estuary is situated at about 30 km north of Mangalore (13^{o} 5' 60 N and 74^{o} 47' 60 E). It is more dynamic in nature and become almost fresh during south-west monsoon (June to September) period due to the influx of fresh water through riverine flow. During post-monsoon (October to January) period, estuarine water is moderately saline while in the pre-monsoon season (February to May), it is almost similar to seawater due to reduced freshwater influx. It takes its origin from the foot of western Ghat and flowing westwards. It opens into the Arabian Sea at Mulki but before reaching the Sea, the river forms an estuary. Surface water samples were collected once for a month from January to June, 2009 and analysed for physico-chemical parameters like total solids (TS), total suspended solids (TSS), total dissolved solids (TDS), biological oxygen demand (BOD), salinity, phosphates and silicates according to the procedure given by APHA (1995).

3. Results

The variations in pH and phosphate levels in estuarine water are presented in Fig.1, variations in water temperature, air temperature and salinity are depicted in Fig. 2 and variations in TS, TDS and TSS are showed in Fig. 3. Similarly the variations in pH, water temperature and salinity in 2009 and 2012 are presented in Fig. 4, 5 and 6 respectively.

4. Discussion

The physical, chemical, and biological aspects of the estuaries are being monitored over a decade (Madhyastha *et al*., 1990). Studies show that Malpe and Gangolli estuaries are very productive at primary and secondary levels and also at benthic productivity level. Gangolli estuary has a water spread of 50 ha with adjoining mangrove vegetation of high fertility compared to Malpe zone. The district faces severe monsoon during June-September. Purushottama *et al*. (2014) also studied the

seasonal abundance of commercially important finfish and shellfish seed resources in Shambavi Estuary, Mulki, Karnataka.

4.1 Physico-chemical parameters:

pH

pH is the negative logarithm of hydrogen ion concentration. It remained more or less neutral. The values obtained are normal and indicate that the area is not affected by pollution source nearby. In the year 2012, it was found to vary from 7.20 (post-monsoon) to 8.29 (monsoon).

Temperature

Mangrove vegetation commonly occurs along tropical shores and thrives along coasts where average water temperature does not exceed 23^{o}C (Rutzler and Feller, 1996). Dakshina Kannada district having tropical climate support mangrove vegetation and the lowest water temperature recorded in the site was 29±1.0 ^{o}C.

TSS, TDS and TS

The amount of TDS indicates the organic content of the aquatic system. The increase in TDS may be due to the formation of complex chemical substances in the water sample. TDS values were recorded high compare to TSS. TS values were obtained by the addition of both TDS and TSS. The values were within the normal range which implies that the water body is not polluted.

BOD

The BOD values were decreased from January to June. Decreased BOD implies that there is growth of algae or micro-organisms in the water. It also due to increased aeration in the water sample. The increase of BOD values could be due to the reduced growth of algal cells and reduced photosynthetic activity.

Salinity

The salinity influences the physical factors of environment. It showed more or less constant values (between 32±1.14 ppt and 35±0.2 ppt). In summer, salinity showed slight higher values than rainy season may be due to dilution of water. Similar trend was also observed in 2012 by Purushottama *et al*. (2014) in the same area. It was as low as 0.05 ppt in the monsoon season and as high as 35 ppt in the pre-monsoon season.

Phosphate

Phosphate is an essential nutrient required for phytoplankton to grow in water. It was ranged from 0.02±0.0 mg/l to 0.09±0.01 mg/l. Lower values indicate higher number of micro-organisms and vice-versa. In monsoon periods, due to their mobilization from the land, drainage and fertilizers from the catchment area, phosphate level is high and after monsoon, their values decreased, probably due to higher biotic activities. The high levels of productivity linked with these environments are due to the input of nutrients by rivers and the effective recycling between sediment and water mass. The prevailing tidal action results in a rapid circulation of nutrients that might help in removal of nutrients at a rapid rate.

4.2 Biological parameters

Fluctuation of physico-chemical parameters on annual, seasonal or short term intervals is well known and the aquatic community inhabiting this environment adapt to those changes (Horn and Allen, 1981). An environmental basis for species association, in any aquatic system, is constituted by a number of variables right from physical parameters, hydrological features, the plankton, the availability of nutrients and the food materials. The most important variables which are reported to influence

the abundance of organisms in estuarine environment are temperature, salinity, dissolved oxygen and pH (Pushparajan *et al*., 2012).

Flora

A study on plankton recorded three groups: Cyanophyceae, Chlorophyceae and Bacillariophyeae. Some of the species identified during the study were *Anabaena* sp., *Oscillatoria* sp. (Cyanophyceae members), *Closterium* sp., *Cosmarium* sp. (Chlorophyceae members), *Pinnularia* sp., *Navicula* sp., *Chaetoceros* sp. (Bacillariophyceae members). A positive correlation was observed between salinity and Bacillariophyceae members and a negative correlation was observed between salinity and Chlorophyceae members.

The mangrove vegetation was observed as patches along the banks of the river. The more abundant plants were *Rhizophora* sp., *Acanthus* sp. and *Avicennia* sp. The *Rhizophora* sp. extending stilt roots into deeper water and exhibit vivipary. These mangroves provide niche for birds and also support the local human population in providing food, fodder and fuel wood (Madhyastha *et al*., 2000).

Fauna

The mangrove environment supports a large number of molluscs, worms, crabs, shrimps and fish. The crabs identified were *Ocypoda* sp., *Thalamita* sp., *Gelasimus* sp. and *Sesarma* sp. A species of prawn i.e. *Penaeus* sp. were observed. Manja Naik *et al*., (2009) also reported the abundance of *P. monodon* seed during pre-monsoon season in the Mulki estuary. Mohan (1984) while presenting the hydrobiological characters of the surf waters of Calicut reported the peak period of occurrence of post-larvae of P. monodon as September-December. The fishes occurring in the study area include *Glossogobius* sp., *Ambassis* sp. and *Mugil cephalus*. According to Purushottama *et al*., (2014), *Mugil* spp. were available throughout the year and the seeds of *Mugil* spp. were predominant in the samples throughout the survey period. Gastropods identified were *Cerithidia* sp. and *Neritina* sp. The birds identified around the site include Egrets, Herons, Kingfisher and Brahminy Kite.

From the results, it was seen that the site under the study was not being affected by any major pollution source such as sewage, fertilizers etc. The area is a good nursing ground for fishes and prawns and supports other species like crabs, molluscs, gastropods and birds. The mangrove vegetation can be efficiently used for fisheries and they also serve in soil conservation.

Acknowledgment

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Fig. 1: Variations in pH and Phosphate levels

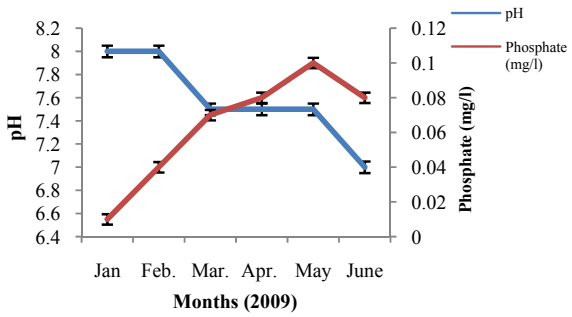

Fig. 2: Variaions in Water Temperature ('C), Air Temperature ('C) and Salinity (ppt)

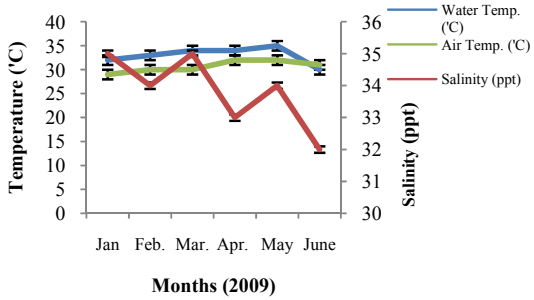

Fig. 3: Variations in TS (mg/l), TDS (mg/l) and TSS (mg/l)

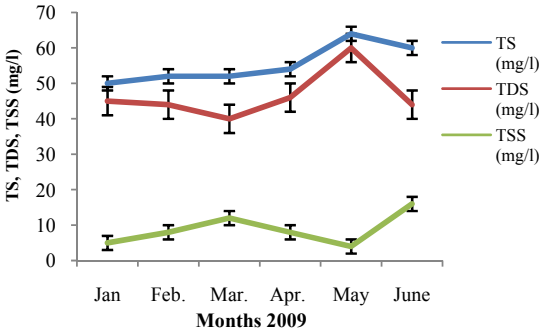

Fig. 4: Variation in pH in 2009 and 2011

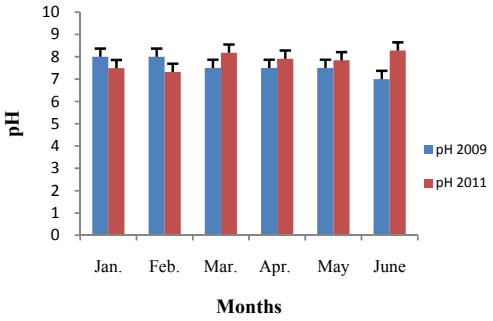

Fig. 5: Variation in Water Temp. in 2009 and 2011

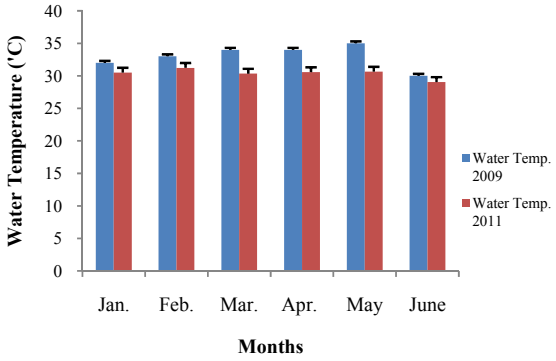

Fig. 6: Variation in Salinity in 2009 and 2011