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Original Research Paper

A Study on Bhitarkanika Mangrove Forest: A Sensitive Fragile Ecosystem

Lakshman Nayak, Durga Prasad Behera, Rupanita Mohapatra and Digambar Swain
Deptt. of Marine Sciences, Berhampur University, Bhanja Bihar, Berhampur-760 007, Orissa

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ABSTRACT

Out of 110 species of mangroves, identified on the globe, 63 species are found in Bhitarkanika. The mangroves support marine life of 60 genera and 64 species of microfauna, 34 genera and 55 species of meiofauna, 19 species of amphibians, 42 species of reptiles including the rare and endangered sea turtle, more than 200 species of birds, 60 species of mammals, and 6 species of marine mammals. Three hundred species of fishes and 229 species of crustaceans also inhabit this sanctuary. The wild animals such as leopard, cat, fishing cat, jungle cat, hyena, wild boar, spotted dear, sambar, porcupine, python, dolphin, king cobra, salt water crocodiles, water monitor lizard, terrapins, common mongooses, Indian field mouse, and Indian mole rat are living in this sanctuary. The water temperature of the sanctuary varied from 25°C to 32°C, and air temperature from 28°C to 36°C. The pH value ranged from 6.98 to 8.7. Salinity fluctuated from 9 ppt to 33.8 ppt. The dissolved oxygen ranged from 2.325 mg/L to 7.250 mg/L, carbonate alkalinity from 25 mg/L to 60 mg/L, and bicarbonate alkalinity from 65 mg/L to 120 mg/L.

INTRODUCTION

Mangroves are the tidal forests of coastal wetlands, existing in the intertidal zones of sheltered shores, estuaries, tidal creeks, backwaters, lagoons, marshes and mud-flats of the tropical and sub-tropical regions of the world. The Bhitarkanika mangrove forest is the second largest mangrove forest in India. Mangroves of Bramhani and Baitarani delta of Kendrapara district have been declared as Bhitarkanika Wildlife Sanctuary in April 1975 covering an area of 672 sq km. The core area of the sanctuary has been declared as Bhitarkanika National Park in September 1998 covering an area of 145 sq km. Bordering the Bhitarkanika Sanctuary/National Park, an area of 1453 sq km has been declared as Gahiramatha Marine Wildlife Sanctuary in September 1997. Bhitarkanika is endowed with very complex sub-ecosystem of freshwater, marine and terrestrial, which is intricately mixed with each other. Mangrove swamps are one of the richest and most productive areas, which form the base of the food chains in sea and coastal waters. The mangroves, wetlands and coral reefs, which are fragile ecosystems, face threat due to various anthropogenic activities. Their over exploitation will certainly hamper the existence of many communities of plants and animals in this fragile ecosystem. The mangrove ecosystem plays a vital role in contributing to the food web, in general, and detritus food chain in particular, supporting rich estuarine and adjacent marine fisheries (Chadha & Kar 1999). The mangroves play a significant role in protecting the hinterland against cyclones and the ingress of seawater during tidal surge. Mangroves stabilize coastal landmass against sea erosion. Mangrove forests act as a buffer against any natural disasters. Depending on the recommendations of National Committees on Wetlands, Mangroves and Coral Reefs, 24 wetlands, 33 mangroves and four coral reefs in the country have been identified for conservation and management by the Ministry for conservation and management (Mandal & Rastogi 2004).

Several workers have done work on distribution of mangroves in India (Sidhu 1963, Nayak 2006). Some work has been done on the floral characteristics of Bhitarkanika by Banerjee & Das (1972), Mishra & Panigrahy (1978), Pattnaik & Choudhury (1989) and Banarjee & Rao (1990). Little work has been carried out on the hydrographical features of Mahanadi estuary by Upadhyay (1988) and Raju et al. (2000). No work has been done on the hydrological characteristics of Bhitarkanika mangrove forest, therefore, the present work has been undertaken to study the hydrological parameters of Bhitarkanika.

MATERIALS AND METHODS

Bhitarkanika sanctuary, one of the spectacular sanctuaries, lies between 20°4' and 20°8' N latitude and 86°45' and 87°5' E longitude covering an area of about 650 sq km of which about 150 sq km is under mangrove forest. The study was carried out during January 2006 to December 2007. The monthly water samples were collected from three different stations. The samples for hydrological parameters such as temperature, pH, salinity, dissolved oxygen and alkalinity were collected regularly. The air and water temperature were recorded using a mercury thermometer (± 0.1°C). The water samples were brought to the laboratory and analysed for pH, salinity, dissolved oxygen and alkalinity following the standard methods (APHA 1995). Station-1 was chosen at Nalitapatia, which is located near to Dhamara river. Station-2 is Dangmal, located between Nalitapatia and Bhitarkanika estuary. Station-3 was chosen at Bhitarkanika estuary, which is towards the sea and the hydrological parameters are highly fluctuative.

RESULTS AND DISCUSSION

The hydrological data, collected from the three stations of Bhitarkanika, are presented in Tables 1, 2 and 3. The temperature was highest at 36°C during May and lowest temperature at 28.1°C in the month of December. In station-2, the highest water temperature was 32°C during April, and lowest 25.1°C during the month of December. The highest atmospheric temperature was 36°C during April, and lowest 28.5°C during January. In station-3, the highest atmospheric temperature was observed during the month of May at 35°C, and the lowest during the month of January at 27°C. The highest and lowest water temperatures in this station were observed to be 32°C and 25°C in the month of May and December respectively. There has been gradual decrease in the temperature from station-1 to station-3 towards the downstream along the river system. The findings are in general agreement with the Upadhyay (1988) and Raju et al. (2000).

The highest pH value of 8.70 was in the month of December, and lowest of 7.00 during the month of June at station-1. In station-2, the highest pH was observed during the month of November being 8.4, and the lowest during the month of July being 8.0. Similarly, at station-3, the highest pH value was observed during the month of December at 8.5, and the lowest during the month of June at 6.98. The higher value of pH may be due to influence of seawater penetration. The lower value of pH was quite low during monsoon period, which may be due to the influence of freshwater influx and decomposition of organic matter carried out by the flood water into the riverine system (Raju et al. 2000, Shriadah 2000).

Seasonal and regional fluctuation in salinity was observed at all the stations. The salinity values increased both in post-monsoon and pre-monsoon months. The highest value of salinity was observed in the month of May at 33.8 ppt, and lowest in the month of July (10 ppt) at station-1. In station-2 the lowest salinity value was observed during the month of July (9 ppt), and highest in

Table 1: Monthly average value of hydrological parameters of Bhitarakanika during January 2006 to December 2007 at station-1.

Month	Temperature(°C)		pH	Salinity (ppt)	Dissolved oxygen (mL/L)	Alkalinity (mg/L)	
	Air	Water				CO_3	HCO_3
January	28.1	26.0	8.20	31.40	6.355	40	100
February	30.5	27.0	7.92	29.30	6.532	25	090
March	32.8	28.0	8.50	30.80	6.500	30	085
April	35.7	29.2	7.05	23.00	7.012	45	090
May	36.0	32.0	7.02	33.80	5.268	35	075
June	34.8	29.7	7.00	15.00	5.360	45	105
July	33.7	29.2	8.00	10.00	6.330	40	110
August	32.5	29.0	7.60	19.00	2.580	25	075
September	32.1	28.7	7.20	17.00	6.130	35	080
October	31.8	28.2	7.05	28.00	7.160	40	100
November	31.0	27.0	7.80	26.00	7.210	30	090
December	30.5	25.3	8.70	30.00	7.250	40	085

Table 2: Monthly average value of hydrological parameters of Bhitarakanika during January 2006 to December 2007 at station-2.

Month	Temperature(°C)		pH	Salinity (ppt)	Dissolved Oxygen (ml/L)	Alkalinity (mg/L)	
	Air	Water				CO_3	HCO_3
January	28.5	26.0	8.30	31.00	5.525	35	105
February	29.7	28.0	8.10	28.00	5.120	30	080
March	32.0	29.0	8.20	31.00	4.140	25	070
April	36.0	32.0	8.17	32.00	5.585	35	085
May	35.8	31.0	8.20	18.00	5.023	30	080
June	34.2	30.0	8.12	16.00	3.792	30	070
July	33.0	29.2	8.00	09.00	3.315	45	090
August	32.5	27.0	8.20	23.00	2.325	25	070
September	32.2	29.0	8.30	27.00	2.790	30	085
October	31.8	28.5	8.31	25.00	4.682	40	060
November	31.2	27.0	8.40	28.00	5.104	30	090
December	30.0	25.1	8.30	29.00	6.788	35	110

month of April (32 ppt). Similarly, the higher and lower values of salinity were observed in the month of April and July respectively being 32 ppt and 10 ppt at Station-3. The salinity of the estuary did not go usually above 33.8 ppt or below 9 ppt although during the monsoon season there is fresh-water influx into the estuary. The high salinity values may be due to high evaporation and low intensity of river run off into the estuarine system. In the present study, the annual variation of salinity was 9 ppt to 33.8 ppt. Salinity values were maximum during peak summer month at all the stations. However, drastic reduction of salinity was noticed during the monsoon period, which is in conformity with the observations of Achuthankutty (1987) from the estuary of Goa.

The dissolved oxygen concentration showed a wide range of variation throughout the year. In the month of December the dissolved oxygen concentration was very high being 7.25 mL/L, and minimum (2.58 mL/L) in the month of August in station-1. In station-2, the dissolved oxygen concentration was highest at 6.788 mL/L in December, and lowest at 2.325 mL/L in August.

Table 3: Monthly average value of hydrological parameters of Bhitarakanika during January 2006 to December 2007 at station-3.

Month	Temperature(°C)		pH	Salinity (ppt)	Dissolved Oxygen (ml/L)	Alkalinity (mg/L)	
	Air	Water				CO_3	HCO_3
January	27.0	25.2	8.20	28.00	6.296	45	110
February	29.5	27.0	8.30	29.00	6.564	35	105
March	31.8	29.0	8.02	30.00	5.255	25	080
April	34.5	31.0	8.13	32.00	5.012	35	075
May	35.0	32.0	8.15	28.00	5.181	38	085
June	33.0	29.0	6.98	27.50	5.190	40	090
July	32.5	29.5	8.00	10.00	5.182	35	075
August	32.2	29.6	7.16	12.00	5.162	30	085
September	32.0	28.2	7.26	16.00	5.590	25	075
October	31.5	28.0	7.80	20.00	6.280	45	085
November	31.0	27.0	8.40	22.00	7.091	50	110
December	30.0	25.0	8.50	25.00	7.210	60	120

Likewise, the maximum and minimum values were observed during December and August respectively at station-3, being 7.21 mL/L and 5.162 mL/L. Comparatively, high dissolved oxygen values were associated with high pH values along the estuarine system during post-monsoon period. Low values of dissolved oxygen correspond to monsoon period, which may be due to biodegradation of organic matter in the water column (Raju et al. 2000).

Alkalinity generally determines the magnitude of diel fluctuation of pH of water. Water with low alkalinity (less then 15 mg/L) results in wide fluctuation in pH from 7.5 at dawn to 10 or even higher in afternoon. Alkalinity value was generally higher at all the stations. The highest value was observed in the month of December, and lowest in the month of April. The bicarbonate alkalinity varied from station to station. Bicarbonate alkalinity was more in the month of June and July, which may be due to high influx of freshwater and high pH in estuarine system of Bhitarkanika. This observation is in conformity with the observation of Nayak & Behera (2004) from Chilika lagoon. The pH showed direct relationship with total alkalinity. Such relationship was observed from Attigre tank of Kolhapur district, Maharashtra by Hujare (2008).

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