Research Paper Geology

Physico-Chemical Parameters for Coastal Water of Pulicat Lagoon, South East Coast of India

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ABSTRACT

Changes in lagoon characteristics of Physic (o)-chemical parameters like pH, temperature and electrical conductance (Ec) and chemical parameters like Dissolved oxygen (DO), Organic matter and Silica provides valuable information on the quality of the water in the lagoon. The study area is located in the major portion in Nellore district of Andhra Pradesh and remaining part is on Tiruvallur district of Tamil Nadu. A total of 41 water samples were collected during July, 2011 and analyzed for physico-chemical parameters (pH, bottom water temperature, air temperature, EC, Salinity, Dissolved Oxygen, Organic matter and Silica). Statistical analysis like Pearson Correlation matrix and Factor loadings were performed to the data set to know the relationship among the studied parameters.

KEYWORDS Lagoon, Physical factors, Pulicat lagoon,Southeast coast of India, Electrical Conductance, Anthropogenic pollution, ecological factors

INTRODUCTION :

The southeast coast of India has been receiving industrial, agricultural and aquaculture effluents and causing environmental pollution in the Bay of Bengal and surrounding coastal water bodies. The present study area i.e. Pulicat lagoon is located along the south Andhra coast receives lot of aqua and agricultural effluents and thus provides an ideal site for pollution studies. Recently, morphological abnormalities are increasingly taken into consideration (Geslin, 1999) for determining environmental pollution. The increased usage of pesticides and fertilizers in both agriculture and aquaculture sectors along the coastal tracts east coast has been additionally responsible for increased effluent discharge into coastal water bodies of Uppateru, Arani and Kalangi rivers causing immense stress on eco system in and around the Pulicat lagoon.

STUDY AREA :

The study area i.e. Pulicat lake is located in the Survey of India toposheets nos: 66 B/2, 66 B/3, 66 C/2 respectively at the scale of 1: 50,000. The lake lies between longitudes 80o 02' – 80o 20' E and latitudes 13o22'-13o 45' N. The total area of the lake is about 250 Km^2. The Pulicat Lake is a small brackish water basin and is particularly attractive for studying the interaction between hydrography and the underlying sediment cover because of its proximity to the Bay of Bengal. The important ephemeral rivers that join the lake include Arani and Kalangi. Enormous quantities of fresh water influx along with sediment loads are discharged into the study area during monsoon. The alluvium of these rivers is essentially composed of sand, silt and clay in varying proportions and is restricted to very narrow strips in the banks of the river and tributaries. They are usually pale gray and occasionally dark brown and resulted due to admixture with laterities which derived from laterite deposits cropping out in a large area of coastal lands. The study area a tropical sub humid type of climate with an annual mean temperature of 25^{0}C. Usually summers are long and hot shooting mercury from 33°C to 45^{0}C, winters are short and mild with temperature range of 24°c to 29°c.

METHODOLOGY:

In this work, 41 water samples collect from Pulicat Lagoon, Nellore district and Tiruvallur district of Tamil Nadu,Southeast coast of India were collected using shallow water sampler and Phisico-chemical properties were determined . The positions of the sampling stations were accurately located by using a hand held Global Positioning System(GPS) (Table.1) (Sundara Raja Reddy et al., 2012 ; Sreenivasulu et al. 2015). The lagoon water samples were collected at 1.5 meter below water surface through a water sampler and transferred in polyethylene bottles, which were already cleaned by soaking in 5 M HCl for more than three days and washing with distilled-deionized water thoroughly before use. The atmospheric temperature and water temperature was measured using thermometer on the spot and recorded (Velsamy et al. 2013). Salinity was measured using Atago refractometer (Arumugam and Sugirtha, 2014). Pye Unicam model 292 meter, (after standardization with buffer solution at pH4.0, 7.0 and 9.0) was used for pH and electrical conductivity determination (Ibrahim et al. 2009). Dissolved Oxygen, organic matter and silica were measured using standard laboratory methods (APHA, 1995).

1. pH : The pH changes in the water are governed by the amount of free carbon die oxide , carbonates and bicarbonate. All sampling locations having the almost same pH values. Almost neutral pH is observed in all the locations throughout the sampling events. Boyd and Lichtkoppler(1979) reported pH range of 6.09 - 8.45 (Table.1)as being ideal for supporting aquatic life including fish. According to Umavathi et al. (2007) pH range between 5 and 8.5 is best for plankton growth. In this study the pH ranged between 7.9 and 7.9 obtained from sampling station 9 , respectively with overall mean value of 7.62. The results show that the water from all locations were moderately alkaline and within thepermissible limit (pH 6.5-8.5) for plankton growth.

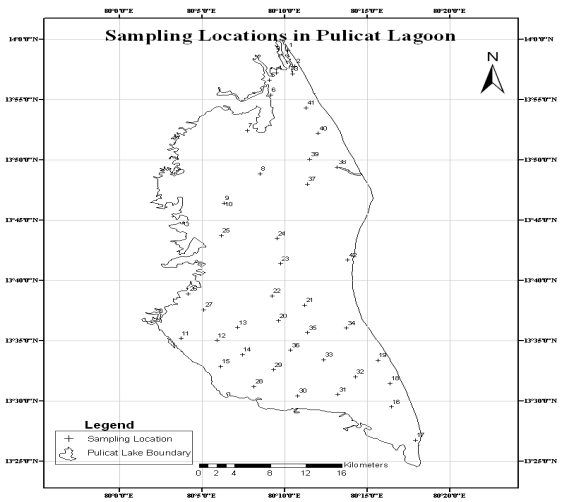

Fig. Sampling location of Pulicat Lagoon.

2.Temparature (°c)
The normal range to which fish is adapted in the tropics is between 8°C and 30°C (Alabaster and Lloyd, 1980). Bottom water temperature ranged between 34.1-35.6.°C was recorded. The lower temperature value with 34.0°C was recorded in two stations (12,13) and the higher value 35.6°C was recorded at sampling station nos 36,37. The air temperature ranged between 34.1°C and 35.6°C was recorded respectively. There were variations in air and bottom water temperatures across all the stations.

3. Electrical conductivity (µmho/cm)
Electrical conductivity is a measure of the capacity of a substance or solution to conduct electric current. The electrical conductivity (EC) shows variation with respect to different studies. It highly depends on the amount of dissolved matter in water. The conductivity of water is affected by the suspended particles and also depends upon the amount of ions in the water. The maximum conductivity (85 µmho/cm) was observed at station 21 and minimum conductivity (37 µmho/cm) was observed at station 37.

4. Salinity (ppt)
Salinity is a fundamental water quality parameter monitored by freshwater and marine ecologists because of its influence on the fauna and flora of marine life. Most are adapted to only a narrow range of salinity, beyond which they cannot maintain their osmotic and ionic balance. Some species tolerate only intermediate levels of salinity

while broadly adopted species can acclimate to variable salinity ranging from fresh water to seawater. Generally, the range of salinity in brackish water is from 0.5 ppt to 30 ppt (Karleskint et al. 2009,; Sreenivasulu et al. 2015). In this study salinity ranged between 35.2 and 36.8 ppt was recorded. Lower value with 35.1 ppt was similar at eight locations (17,18,19,25,28,38,39,41) in the study area. The higher value of 36.8 ppt was observed at the stations 1,3,6,10,11.

5.Dissolved Oxygen (mg/l)
Number if studies suggest that 4 – 9 mg/L of Dissolved Oxygen is the optimal range that will support a large, diverse fish population (Abdus-Salam et al. 2010). As a general rule, concentrations of Dissolved Oxygen above 5 mg/L are considered supportive of marine life, while concentrations below this are potentially harmful. In the study area, the DO ranged from 3 to 4.9 mg/l with overall mean value of 4.0 mg/l. The highest value of 4.9 mg/l observed at sampling station no.4 and lower value of 3 mg/l observed at station 29.

(N)
L6 ***6. Organic matter (mg/l)***
Maximum levels of pollutants in river water cause an increase in biological oxygen demand (Kulkarni, 1997). Generally, all natural waters contain organic matter. Some of these are living organisms, where the size range from that of bacteria to whales; some are decaying matter and atmospheric fallout. The naturally dissolved organic matter is made up of the transformation products of biogenic material and biological excretion products. In this study the organic matter ranged between 0.86 and 2.64 mg/l obtained from sampling station 8 and 37,38 respectively.

7.Silica (mg/l)
Silica is an important nutrient in the marine environment. Diatoms, radiolarian, siliceous sponges and silicoflagellates utilize this nutrient for growth and the formation of skeletal material (David, 1981). Silica supplied to the ocean from the pore waters of marine sediments (Fanning and Pilson, 1973). Silica ranged between 10-44 mg/l obtained from sampling station 21 and 5 respectively.

CONCLUSIONS
In this study the water quality properties in terms of its physico-chemical parameters of Pulicat lagoon, Nellore district, Southeast coast of India were assessed. The values obtained for the pH, temperatures, electrical conductivity, salinity, dissolved oxygen, Organic matter and silica were within the recommended values of the World Health Organization (WHO) for survival, metabolism and physiology of aquatic organisms.

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Sample station No	Temperature(°C)		pH	Depth (Meters)	Ec at 25°C	Salinity	DO	Silica	Organic Matter
	Air	Bottom							
1	35.6	34.4	7.7	2.6	84	36.8	4.2	14	0.97
2	35.8	34.6	7.6	2.7	77	36.7	4.4	15	1.23
3	35.6	34.4	7.5	2.1	74	36.8	4.3	12	0.98
4	35.4	34.2	7.8	2.3	62	35.7	4.9	18	1.23
5	35.4	34.3	7.9	1.7	64	35.5	4.3	44	1.33
6	35.6	34.4	7.8	1.8	79	36.8	4.4	34	1.63
7	35.8	34.6	7.7	2.5	83	35.6	4.4	41	1.51
8	35.5	34.2	7.7	2.7	81	36.5	4.3	34	0.86
9	35.6	34.1	7.4	2.6	58	36.4	4.1	33	0.94
10	35.7	35.4	7.8	2.1	68	36.8	3.8	24	1.24
11	35.7	34.3	7.7	1.8	78	36.8	3.1	25	1.22
12	35.4	34.1	7.4	1.1	68	36.2	4.7	26	1.10
13	35,4	34.1	7.4	1.1	68	36.3	4.7	27	1.44
14	35.7	34.5	7.7	1.1	64	36.6	3.8	31	1.43
15	35.5	34.4	7.6	1.1	85	36.7	3.9	13	0.98
16	35.7	34.4	7.5	1.9	79	36.2	4.4	15	1.05
17	35.8	34.7	7.4	1.7	73	35.1	4.5	26	1.97
18	35.7	34.4	7.7	1.4	58	35.1	4.3	29	1.55
19	35.5	34.3	7.8	1.3	58	35.1	3.8	29	0.98
20	35.6	34.4	7.7	0.6	80	35.8	3.4	19	0.97
21	35.7	34.4	7.6	1.4	85	36.7	4.0	10	1.24

22	35.6	35.7	7.1	1.7	80	36.1	4.2	25	2.21
23	35.6	34.4	7.7	2.0	60	35.5	4.1	23	2.36
24	38.6	34.6	7.8	1.4	67	35.5	4.6	20	1.98
25	35.7	34.3	7.7	1.5	80	35.1	3.5	18	1.98
26	35.4	34.4	7.4	1.8	70	36.4	4.4	17	1.34
27	35.6	34.4	7.4	0.8	70	35.5	4.1	27	1.64
28	35.7	34.4	7.8	0.6	65	35.1	4.6	34	1.11
29	36.4	34.8	7.8	0.7	64	36.4	3	17	0.98
30	36.6	35.4	7.7	0.8	84	36.3	4.1	14	1.34
31	36.4	35.2	7.0	1.4	48	35.5	4.4	28	1.97
32	36.6	35.5	7.6	1.8	55	35.5	4.7	30	1.66
33	36.7	35.3	7.4	1.7	73	35.5	4.5	31	1.96
34	36.7	35.1	7.7	1.8	55	35.1	3.1	21	1.65
35	36.4	35.3	7.8	1.9	80	36.4	4.4	15	1.55
36	36.7	35.6	7.9	0.8	80	35.4	4.0	29	2.20
37	36.4	35.6	7.8	0.6	37	36.4	4.4	21	2.64
38	36.7	35.5	7.6	1.4	74	35.1	4.1	23	2.64
39	36.6	35.6	7.8	1.5	75	35.1	4.7	18	1.24
40	36.5	35.5	7.7	1.4	77	36.1	3.5	16	1.86
41	36.3	35.3	7.6	0.7	70	35.1	4.0	21	1.66

Table.1. Physicao-chemical parameters of Pulicat Lagoon.

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