

STUDY OF PHYSICO-CHEMICAL PARAMETERS FROM *BURSATELLA LEACHII* HABITATED IN PULICAT LAKE, T.N

Mahadev Rama Kokane¹, K. Revathi², K.Sundaravalli³, A.Anitha³

¹Central Institute of Fisheries Nautical and Engineering Training, Royapuram, Chennai, India,
Research Scholar of Mohamed Sathak College, Chennai, India

²Director of Research, Meenakshi Academy of Higher Education and Research, Chennai, India

³Research Scholars, Central Research Laboratory, Meenakshi Academy of Higher Education
and Research, Chennai, India

Email: reva63@rediffmail.com

ABSTRACT: Pulicat Lake constitutes a unique and interesting fragile ecosystem in Coromandal coastal zone in South East coast of India. Lake serve as a nursery and breeding ground for many species of aquatic flora & fauna and nesting ground for several species of native & migratory birds. Physico-chemical parameters are the important indicators of environmental degradation like Temp. Salinity, pH, Turbidity, DO, BOD, COD, Total Alkalinity, Total Hardness, Ca, Mg, Nitrate, Phosphate, Carbonate and Bicarbonate, which are essential for ecological balancing and supporting growth of many aquatic organisms. The water samples were collected on monthly basis using small outboard engine motor by reaching particular habitat sites/location of *Bursatella leachii* species were earlier it found, since sudden out break and sudden disappearance of *B. leachii* has been noticed worldwide. It was made an attempt to co-relate the availability of *B. leachii* with Physico-chemical parameters. In the present study it has been observed that the physico-chemical condition requires for the species *Bursatella leachii* present in the Pulicat lake. Lake is not affected by the sea water as there are sand bars and shoals in the eastern side of the Lake.

Keywords: Pulicat Lake, Water Quality Parameters, *Bursatella leachii*

INTRODUCTION

The variation in water quality changes were assessed for two sampling sites in Pulicat lake to know the physical and chemical parameters with reference to the favourability of *Bursatella leachii* species. Sea hare species *Bursatella leachii* exhibits boom-and-bust cycles, forming large aggregation and then disappearing. There are hypothesis for the populations of sea hares exhibiting this kind of dynamic. Hypothesis of aggregation is due to hydrological conditions (Clarke 2006). Lowe and Turner (1976) hypothesized that aggregation of juvenile *Bursatella leachii* is by the hydrological conditions in subtidal habitats. The sea hare *Bursatella leachii* is a mollusc from Ophisthobranchia order, Sub class Gastropoda Family Aplysiidae. This marine

invertebrate is a soft bodied, medium/large size animal that can reach more than 10mm in length and 20g of weight (Otero et al., 2013; Sethi et al., 2015; Kokane et al., 2016) A natural lagoon, features a unique and interesting ecosystem, with diverse fauna and flora, serving as a nursery and breeding ground for many species of marine fauna, nesting place for several species of birds and supporting various commercial fishing activities, thus enriching the livelihood of many thousands of fisher folk (Shyamala et al 2018). During monsoon period Pulicat lake receives water through three major rivers: the Swarnamukhi, the Kalangi and Arani. These river discharges municipal and industrial waste water and run-off from agricultural land which may leads large numbers of physical and chemical changes take place, it influences water quality (Kumar et al 2007). The geochemical characteristics of Pulicat lake is highly variable due to the mixing of river and seawater. Submerged macrophytes include species of Enteromorpha, Hypnea, Ulva, Halophila and Enhalus (Bhagyaraj et al 2016). So, it is biologically productive than freshwater or sea water. It has rich aquatic population diversity which includes suspended, free floating, submerged, marginal, amphibious plants along with mangroves and halophytes. The distribution of aquatic flora & fauna depends on environmental physio-chemical parameters variability like Temperature, Salinity, pH, Turbidity, DO, COD, BOD, Total Alkalinity, Total Hardness, Calcium, Magnesium, Nitrate, Phosphate, Carbonate and Bicarbonate of the lake.

MATERIALS & METHODS

Water samples collected from two stations in the Pulicat lake is the habitat of *Bursatella leachii*. Earlier *B. leachii* samples were collected from these sites (Fig. 1).

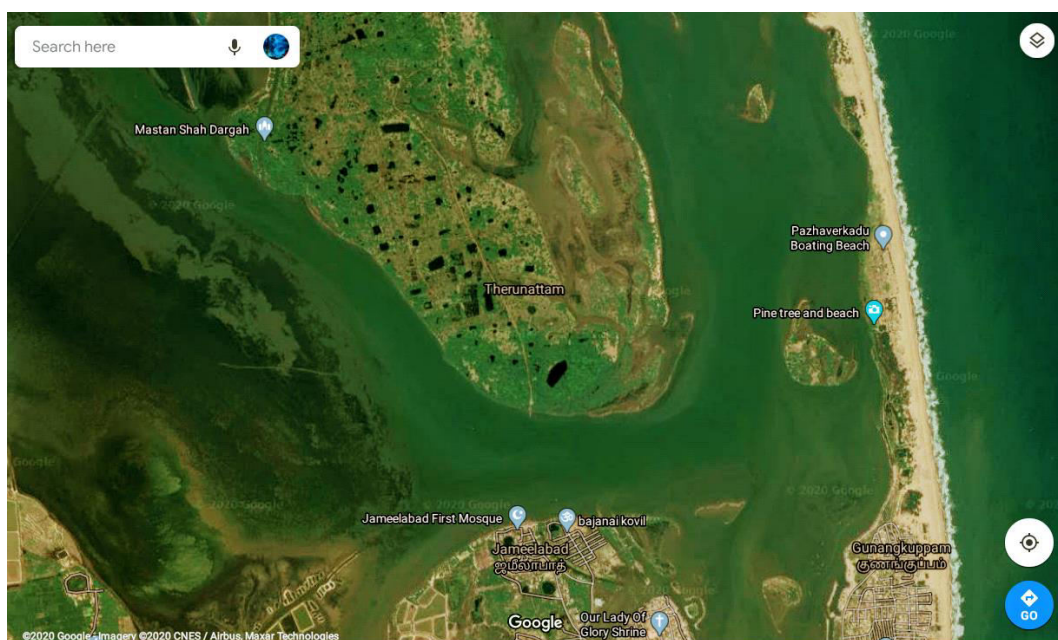


Fig 1: Sampling site 1 & 2 location in Pulicat lake (Site 1 position - lat 13.436221⁰ Long 80.324163⁰ +/- .00250 ; Site 2 position- lat 13.452523⁰ Long 80.319133⁰ +/- .00250)

The water samples were collected undisturbed from the surface water in the study area as the depth of water was very low (< 4m) during early morning in two new one-liter plastic bottles

after repeated rinsing and washing with deionized water for the period January 2017 to December 2017 on a monthly basis. The water temperature was recorded by using a mercury-in-glass thermometer and Salinity was measured using a hand-held refractometer. The collected water samples were brought to the laboratory and preserved for the analysis. The various physicochemical parameters like temperature ($^{\circ}\text{C}$), pH, Turbidity (NTU), Salinity (ppt), DO (mg/L), BOD (mg/L), COD (mg/L), Total Alkalinity (mg/L), Total hardness (TH) (mg/L), Calcium (Ca) (mg/L), Magnesium (Mg) (mg/L) Nitrate (mg/L), Phosphate (mg/L), Carbonate (mg/L) and Bicarbonate (mg/L) were analyzed by adopting the standard methods established by the APHA for the examination of water and waste water.

RESULTS AND DISCUSSION

The values for physico-chemical parameters of Pulicat lake during the study period from January 2017 to December 2017 are presented in Table 1 & 2. Whereas the Table 3 shows the Physico-chemical parameters during the outbreak of species *Bursatella leachii* i.e in March and April 2017.

Table 1: Physicochemical parameters of water sample from station 1

Sr. No.	Parameters	Jan 2017	Feb. 2017	Mar. 2017	April 2017	May 2017	June 2017	July 2017	Aug. 2017	Sep. 2017	Oct. 2017	Nov. 2017	Dec. 2017
01	Temp.	30	32.2	32	33	33.4	34	31.5	28.8	29	29.5	29	29.5
02	Salinity	31	33	33	34	35	33	34	33	32	30	30	29
03	pH	8.3	8.3	8.4	8.5	8.7	8.6	8.8	8.6	8.5	8.3	8.4	8.6
04	Turbidity	1.1	1	1.1	1	1	1	1	1.5	1.5	1.2	1.2	1
05	DO	3.2	3.0	2.8	2.5	2.7	2.7	2.9	2.6	3.3	3.4	3.5	3.4
06	BOD	35.1	42.8	56.8	54.7	68.6	63.2	51.1	45.5	33.9	29	25.6	31.7
07	COD	280.5	300	298.6	320.6	342	330.7	340.2	310.8	290	250.3	220.3	235.6
08	Total Alkalinity	146.2	140.3	134.6	130.5	125	130.4	133	131.3	143.4	130.5	137.1	140
09.	Total Hardness	8190	8003	7300	8105	9333	8913	7919	6509	6378	6001	7058	7452
10.	Calcium	462.9	460.1	440.88	450.4	461	410	456	467	410	392	425	436
11.	Magnesium	1711	1650	1507.8	1304	1834	1796	2316	1204	1688	1679	1766	1881
12.	Nitrate	0.039	0.041	0.0783	0.05	0.04	0.03	0.04	0.03	0.02	0.03	0.03	0.04
13	Phosphate	0.020	0.0204	0.0191	0.019	0.02	0.03	0.01	0.03	0.02	0.02	0.03	0.02
14.	Carbonate	18.72	20.36	23.76	25.03	24.03	26.03	21.3	22.3	21.04	24.9	25.1	22.7
15.	Bicarbonate	142.7	120	115.95	114	132.6	143.7	139	128	130	130	125	129

Table 2: Physicochemical parameters of water sample from Station 2

Sr. No.	Parameters	Jan 2017	Feb. 2017	Mar 2017	Apr. 2017	May 2017	June 2017	July 2017	Aug 2017	Sep. 2017	Oct. 2017	Nov. 2017	Dec. 2017
•	Temperature	30.1	32.1	32	33.2	33.1	33.9	31.3	29.0	29	29.5	29.1	29.5
2.	Salinity	31	32.5	33	34.4	35	33.5	34	33	32	30	30.2	29
3.	pH	7.8	8.0	8.41	8.5	8.7	8.6	8.7	8.5	8.5	8.3	8.5	8.4
4.	Turbidity	1	1	1	1	1	1	1	1.5	1.4	1.2	1.2	1.1
5.	DO	3.2	3.1	2.8	2.4	2.9	2.7	2.7	2.6	3.4	3.4	3.3	3.4
6.	BOD	35.1	42.8	56.8	54.7	68.6	63.2	51.1	45.5	33.9	25	25.6	31.7
7.	COD	282.5	310	300.3	320.6	340.5	335	340	315	275.5	250	225	240
8.	Total Alkalinity	141.2	145	124.5	131.5	129	135.5	132	131	143.4	135	136.5	138
9.	Total Hardness	8000	8100	7100	8115	9000	8910	8000	7500	6517	6000	7550	7550
10.	Calcium	452	465	443	450.5	460	390	425	460	450	400	425	400
11.	Magnesium	1690	1660	1500	1250	1708	1805	2020	1400	1530	1609	1665	1800

12.	Nitrate	0.04	0.041	0.05	0.06	0.04	0.04	0.04	0.03	0.04	0.03	0.03	0.03
13	Phosphate	0.019	0.020	0.025	0.019	0.02	0.03	0.01	0.03	0.02	0.02	0.02	0.02
14.	Carbonate	19	19	25.5	25	23.5	25	20	22	19.5	25	25	25.5
15.	Bicarbonate	140.5	122	118	122	130	145.5	125	120	125	132	129	135

Table 3: Physicochemical parameters during outbreak of *Bursatella leachii* at Station 1 & 2

Sr. No.	Parameters	Station 1		Station 2	
		March 2017	April 2017	March 2017	April 2017
•	Temperature	32	33	32	33.2
2.	Salinity	33	34	33	34.4
3.	pH	8.4	8.5	8.41	8.5
4.	Turbidity	1.1	1	1	1
5.	DO	2.8	2.5	2.8	2.4
6.	BOD	56.8	54.7	56.8	54.7
7.	COD	298.6	320.6	300.3	320.6
8.	Total Alkalinity	134.6	130.5	124.5	131.5
9.	Total Hardness	7300	8105	7100	8115
10.	Calcium	440.88	450.4	443	450.5
11.	Magnesium	1507.8	1304	1500	1250
12.	Nitrate	0.0783	0.05	0.05	0.06
13	Phosphate	0.0191	0.019	0.025	0.019
14.	Carbonate	23.76	25.03	25.5	25
15.	Bicarbonate	115.95	114	118	122

Temperature

Temperature the significant factor regulates the biochemical activities in the aquatic environment. In 2017 average temperature of Pulicat lake in early morning was recorded 31⁰C, Lowest temperature was recorded during North- East monsoon and highest during pre & post monsoon in both the sites. Whereas the during outbreak of species temperature was recorded between 32 to 33⁰C. The surface water temperature usually is influenced by the intensity of solar radiation, evaporation, fresh water influx and cooling and mixed up with ebb and flow from the adjoining neritic waters (Ravanaiah et al 2010; Dhinamala et al., 2015)

pH

The pH ranged between 8.03 to 8.8 in 2017. During the availability of *Bursatella leachii* both the sites pH was same it was ranges between 8.4 to 8.5. The highest pH recorded in site one was 8.8 in the month of July and lowest 8 in month of January whereas in Site two highest pH recorded in May & July and lowest in January month Temporal fluctuations in pH could be attributed to factors like removal of carbon dioxide by photosynthesis through bicarbonate degradation, dilution of sea water by freshwater influx, low primary productivity, reduction of salinity and temperature besides decomposition of organic matter (Paramasivam et al., 2005; Dhinamala et al., 2015 and Muralikrishna et al 2018).

Turbidity

In 2017 the turbidity varied between 1 to 1.5 because sampling area no strong movement of underwater current and depth of the water was low i.e 20cm to 1.5meter

Salinity

Salinity, the main factor influences the abundance and distribution of the animals in estuarine/lagoon environment. Salinity acts as a limiting factor in the distribution of living organisms and its variation caused by dilution and evaporation which influence the characteristic change of fauna in the intertidal zone (Kumar et al., 2010). In the present study the highest salinity was recorded in month of May and lowest in the month of December. Moreover, salinity variation is depending flow of fresh water in the lake. *Bursatella leachii* preferred salinity 33 to 34.4ppt

Dissolved Oxygen

DO in sea water plays a very crucial role in aquatic marine life, sudden increase or decrease of DO level may destroy the ecosystem. Dissolved oxygen concentration was high when the pH was high suggesting the abundant growth of phytoplankton and zooplankton leading to high biological activity. The low DO during summer is related to lesser input of freshwater and also due to the biochemical oxidation of organic matter and also the combined effects of temperature, salinity and photosynthetic activity. In 2017 the dissolved oxygen varied between 3.5 to 2.4 mg/L in both the sites there is no much variation has been observed. In species outbreak (Sudden appearance of *Bursatella leachii*) period DO was ranges 2.5 to 2.8 mg/L in the month of March & April 2017 whereas, Arkronrat et al., 2016 has reported DO 4.26-5.83 mg/L in marine shrimp pond which is higher side than the Pulicat lake.

Biochemical Oxygen Demand

The BOD ranged between 25.6 and 68.6mg/L during post monsoon and pre monsoon in 2017. Shyamala et al 2018 observed that during summer BOD activity more it plays a vital role in assessing the organic pollution of aquatic ecosystem.

Chemical Oxygen Demand

In 2017 the COD varied between 225 and 342 mg/L. Site one and two almost similar trend was noticed no much difference. COD level is based on the flow of river run-off, land drainage, industrial inputs, increase in salinity, temperature, productivity of phytoplankton and microbial utilization of oxygen at the time of decomposition. COD was low due to heavy river run-off, mixing of domestic and agricultural wastes, land drainage into the estuary. Decreased biological activity could be due to decrease in salinity and temperature. The elevated levels of COD indicate an increased load of organic and inorganic pollution that require more oxygen to oxidize under increased thermal conditions (Muralikrishna et al., 2018 and Shyamala et al., 2018)

Alkalinity

The alkalinity ranged between 125 to 146.2 mg/L. Site one has recorded highest Alkalinity in the month of January and lowest in the month of May whereas highest total alkalinity was recorded in the month of February in site two. Moreover, the alkalinity is directly related to the monsoon i.e flow of water in the lake. In both the sites the highest alkalinity total was recorded during post monsoon. High levels of alkalinity indicate the presence of strongly alkaline industrial waste water and sewage in the estuary. The degradation of plants, living organisms and organic waste

in the estuary might also be one of the reasons for increase in carbonate and bicarbonate levels, thereby showing an increase in alkalinity (Wang et al., 2006)

Total Hardness

Total hardness is used to describe the effect of dissolved minerals in the water bodies (Dhinamala et al., 2015). In the Pulicat lake total hardness ranged between 9333 to 6001 mg/L in 2017; the highest total hardness recorded in the month of May and lowest in the month of September in both the sites.

Calcium & Magnesium

Calcium and Magnesium are important elements in metabolism at the organism and the system levels. Calcium is a constituent of cell wall material and Magnesium is a component of the Chlorophyll molecule. In 2017 value of Calcium ranges from 392 to 467mg/L whereas, Magnesium 1204 to 2020mg/L. Both the sites no major changes have recorded only minor. Calcium is the major element that is abundant in the Lake in different forms, viz, rock oyster, clams, mussels and other gastropod shells. Therefore, shell mining is the major activity in the Pulicat lake regularly (Murali Krishna 2018).

Nitrate & Phosphate

In pulicat lake quantity of Nitrates and the Phosphates elements is almost negligible. Nitrate is an oxidized form of nitrogen. The high level of Nitrate lowers the Dissolved Oxygen levels in the water, which disrupts the entire system. Phosphorus migrates in groundwater which accelerates the eutrophication of the Lake when drained. The Nitrate values are ranging from 0.02 to 0.07ppm and the phosphate values are ranging from 0.01 to 0.03 ppm, which is very low in the Pulicat Lake, Arkronrat et al., 2016 reported similar range values in marine pond in Thailand. Phosphate and Nitrates are the plant nutrient, which stimulates the growth of aquatic weeds and algae (Murali Krishna 2018)

Carbonate & Bicarbonate

Gastropods are abundant in the less alkali lakes but disappear in the higher bicarbonate and carbonate lake. Three times increase in alkalinity during post monsoon period could be due to the input of fresh water and dissolution of calcium carbonate from the sediments. This increases the carbonate and bicarbonate ion concentration in the water column (Padma 1999) Bicarbonate value ranges from 114 to 145.5ppm whereas carbonate value ranges 18.72 to 26.03 ppm. Carbonate value recorded highest in the month of June and lowest in the month of January in site one. In site two highest carbonate value recorded in December and March, lowest in the month of January and February. Similar way Bicarbonate value recorded highest in site two and lowest in site one.

CONCLUSION

All the physicochemical parameter at Pulicat lake mouth area within the prescribed limit of WHO. Arkronrat et al., 2016 has reported Salinity 32-33ppt. Water temperature 27.2-29.4⁰C DO 4.26-5.83 mg/L, pH 8.01-8.57 total ammonia 0.000-0.213mg/L, nitrite 0.000 - 0.159 mg/L and alkalinity 111-134 mg/L as CaCO₃ in collection pond of *Bursatella leachii* specimens at

Klongwan Fisheries Research Station (KFRS), Thailand during December 2014 - January 2015. Whereas, in Pulicat lake during the outbreak of *Bursatella leachii* in the month of March and April 2017, Temp. ranges 32-33.2°C Salinity 33-34.4ppt, DO 2.5 to 2.8 mg/L, pH 8.4-8.5, Turbidity 1-1.1NTU, BOD 54.7-56.8 mg/L, COD 298.6-320.6 mg/L, Total alkalinity 124.5-134.6 mg/L, Total hardness 7100-73000 mg/L, Calcium 443-450.5 mg/L, Magnesium 1250-1507.8 mg/L, Nitrate 0.05-0.078 mg/L, Phosphate 0.019-0.025 mg/L, Carbonate 23.76-25.5 mg/L, Bicarbonate 114-122 mg/L. Paige (1988) has observed that normal development through hatchery egg masses of *Bursatella leachii* maintained at temperature ranging from 20-30°C and salinity from 25-40ppt. Vue et al., (2014) reported that the optimum seawater temperature for *B. leachii* in hatchery was 25°C. However desirable limits for the physicochemical parameters for the species *Bursatella leachii* were not reported clearly (Arkronrat et al., 2016). Through this assignment it was made an attempt to indicate the physicochemical parameters for the species *Bursatella leachii* in Pulicat lake. It has been observed that the physico-chemical condition requires for the species *Bursatella leachii* more or less present in the Pulicat lake, it indicates that Lake is not much affected by the sea water due to presence of sand bars and shoals in the eastern side of the Lake.

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