PRELIMINARY STUDY OF PHYSICO -CHEMICAL PARAMETERS OF ASHTAMUDI LAKE, KOLLAM

Dissertation submitted to the University of Kerala in partial fulfillment of

the requirements for the award of the degree of

BACHELOR OF SCIENCE

in
ZOOLOGY
(2018-21 Batch)

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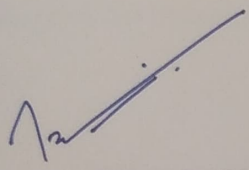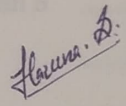### March 2021

CERTIFICATE

This is to certify that the dissertation entitled 'Preliminary study of Physico-Chemical Para meters of Ashtamudi Lake, Kollam, Kerala' is an authentic record of the work done by **Group of Students** of B. Sc. Zoology, 2018-21 batch under my supervision as partial fulfillment of the requirements for the award of the Degree of **Bachelor of Science in Zoology** and this report has not been submitted earlier for the award of any degree or diploma or any other similar titles anywhere.

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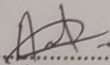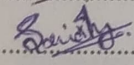TKM College of Arts & Science
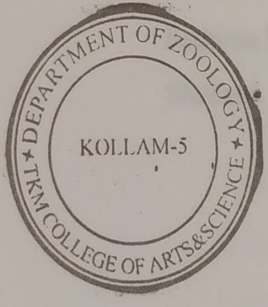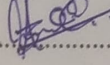
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EXAMINERS:

1.

2.

DECLARATION

We do hereby declare that this dissertation 'Preliminary Study of Physico-Chemical Parameters of Ashtamudi Lake, Kollam, Kerala' is a bonafide report of the project work carried out by us under the supervision and guidance of **Hazeena S**, guest Lecturer Department of Zoology, TKM College of Arts and Science, Kollam as a partial fulfillment of the requirements for the award of the Degree of **Bachelor of Science** in **Zoology**.

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ACKNOWLEDGEMENT

We have got many people to thank for their encouragement and support to accomplish the objectives of our work. First we would like to thank our research supervisor, Hazeena S in the Department of Zoology, TKM College of Arts and Science, for her expert guidance, valuable suggestions, constructive criticism and incessant encouragement. She has been an excellent mentor and support during the course of our study. She gave us freedom to plan surveys, accompanied to field at times and went through the drafts of our writing in no time. Our enormous debt of gratitude can hardly be paid to her.

We would also like to place on record our appreciation and thanks to all our beloved teachers for their great encouragement.

Finally but immensely we remember with sincere gratitude, all our classmates and parents for their cooperation, love and concern without which this work would not have been materialized.

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CONTENTS

CHAPTERS

DEDICATED TO OUR PARENTS AND
TEACHERS....

INTRODUCTION

A large proportion of the world's population lives along the coast line, riverbanks and estuaries. Estuaries are vital natural resources of man. They are used for commercial, industrial and recreational activities and play an important role in the natural cycles of fish animal and plant life. India is some great land rich with natural beauty, wonderful diversity and it offers the natural backwaters with scenic beauty. One of the most important of estuaries is the free mixing of fresh and sea water consequently permitting a variety of organisms from microscopic species to fish, birds, and mammals to flourish. They also provide excellent grounds for clam and oyster farming and often shrimps move from sea to estuarine nursery areas. Estuaries are highly populated bodies of water supported by luxuriant growth of a variety of plants from algae to mangroves. The luxuriant growth of a variety of plants from algae to mangroves.

The backwaters and the adjoining coastal waters are one of the richest areas of fishery resources in India. They from permanent and temporary habitat for several species as nurseries. Optimum utilization of these resources can lead to a manifold increase in inland fish production nations of the world. one of the threads of these natural resources is pollution due to industrialization and temporary habitat for several species an nurseries. Optimum utilization of these resources can lead to a manifold increase in inland fish production nations of the world. One of the threads of these natural resources is pollution due to industrialization and all other anthropogenic activities. Knowledge on the adverse effects of pollution on the physico-chemical and biological aspects of these natural water bodies can to some extent, the utilized for proper management of these systems on scientific lines.

India is well known for the huge variance in its lakes, there is no orderly or scientific census of lakes. There is no specific definition for lakes in India. The word "Lake" is used loosely to describe many types of water bodies-natural, manmade and ephemeral including wetlands. India bounds in water bodies, a preponderance of them manmade, typical of

tropics. The manmade water bodies are generally called reservoirs, ponds and tanks though it is not unusual for some to be referred as lakes.

Kerala is small state stunk away in the south west corner of India peninsular lying in the north latitude 8^0C and 8^0-48' and east longitude 74^0-52'. It is a narrow strip of territory wedged between the Western Ghats on the east.

Lakshadweep sea on the west having an area of 38,863sq.km an outstanding phenomenon of coastal belt of Kerala is its extensive system of estuarine and brackish water lakes lying roughly parallel to the Lakshadweep sea with an area.

In recent years most of the Kerala backwaters are being studies by many scientists. The primary objective is to study the hydrological features of Ashtamudi Kayal.

In August 19, 2012 it will be 10 years since the brackish water, Ashtamudi lake with 8th creeks was recorded a Ramsar site by designating it's as a wetland of international importance. The cake was recommended by the Ramsar Conservations. Partner organization as a wetland of 61.4sq.km. And the lake entered the Ramsarlist as site number 1.204.

However, since then the area of the lake has shrunk to 34 sq.km and it is facing serious environmental degradation. Revenue authorities dispute the 614 sq.km extends but agree that the lake may have shrunk bijat least 57 sq. km in the past 10 years

HYDROLOGY

Astamudi, the deepest estuary in kerala, receives discharge of Kallada River basin receiving an average annual rainfall of 2400 mm The Ashtamudi city wetland have of had Kollam also an adverse serves. The the major impact role intervention of on containing the thickly affecting the populated flood hydrology waters coastal, which of land the construction of Kallada dam in the upper catchment, built to irrigate 61630 hectar of paddy.

BIODIVERSITY

Ashtamudi wetland ecosystem, a home to a wide variety of flora and fauna, once had good mangrove vegetation but now stands reduced to a very small patch near the Ashramam Park. Around 7 species of true and mangrove occur in this area. The florist diversity covers around 72 species of herbs, shrubs and grasses of which about 35 % are medicinalplants and 92 tree species have been identified from the area. Ashramam area was once a repository of a variety of plants and its dependantanimal species.The woody trees like *Holigharra Carnottiana, Syzigium travencorium. Z.zeylanucum* etc, are still present, of which carnottiana, *Syzigium travencoricum. Z. zeylanicum* etc. are still present of which *z.travencoricum* is an endangered species (Red Data Book of Plants), *Calamus rotang,* an endangered species is present mainly in this site. *Rhizophora apiculate, R. muconata, Ardesia littoralis and Avicennia marina,,*once abundant in this mangrove area comp degraded. The land supports 57 species of birds (6 m Migrations and 51 Resident species) and 97 species of fish (42 Typically Marine 3 Esturine. 9 Estuarin- Riverine and 15 Marine- Estuarine) About 40 species of wetland dependant birds are noted in Ashtamudi, Lake out of which 45 % are long distant migrants, Terns, Plovers, cormorants and herons are most abundant birds .

REVIEW OF LITERATURE

OBJECTIVES

Current study is an attempt to collect the physico-Chemical parameters of different sites of Ashtamudi lake in relation to polluted and unpolluted zones.

REVIEW OF LITERATURE

Hyland et al (1998) analysed the sediment quality of estuaries in South eastern U.S (aboon of et al (1999) conducted a study on the sediment grain size in (Carolina Estuary Adriana (2000) analysed the physical and a chemical characteristic of Sediment in the estuarine region of Cananeia, Brazil, Johannesson et al (2000) studied the sediment character in a micro tidal harbour estuary. Lofty (2002) studied the particle size distribution of Rosette Nile Branch (Egypt). David and Elizabeth (2004) observed the nitrogen and phosphorus available in the water column and sediment at Ria Lagartos coastal lagoon. The grain size of sediment from Suez Bay, Egypt was examined by El Mosethy and Azim (2005) deloffre et al. (2007) studied the sedimentation on interdial mudflats in the lower part of macro tidal estuaries. Akiko Sasaki et al. (2009) observed the effect of tide on the organic carbon mineralization rate in Sediments under aerobic condition of an interdial estuary of the kurose River. Uncles and Stephen (2010) analysed the turbidity and sediment transport in Tavy estuary, a sub- estuary of Tamar estuary Sediment characteristics and vegetation composition in a restored and natural salt marsh and mudflat at wallasea, Island were studied by Margaret et al. (2011). The nature of sediment and its dynamics in various important estuarine habitats in india have been studied by several authors The textural features and the organic matter in the Vellar estuary were studied by Chandran (1982) The sediment characteristics of Mulki estuary were studied by studied by Chandran Ramachandran et al (1984) Pragatheeswaran et al (1986), Estimated the organic carbon load in the sediment of coastal water off Mandras and vishakapattanam The textural composition and organic carbon content in the sediment of Hoogly estuary were explained by Sasamal et al (1986) and Ghosh and Choudhary (1987) Purnachandra (1991) monitored the clay mineral distribution in the continental shelf sediments from Krishna to Ganges river mouth, east wast of India. Murty and Murty (1993) analysed the sediment characteristics of Godavari estuary Reddy et al (1994) studied seasonal changes in suspended sediment lond is the Gauthami Godavari estuary. Cauvery estuary was estimated by Ramanathan et al (1996) Nayak (1996) described the sediment characteristics of kali estuary. Gandhi et al (2000) reviewed the sedimentation of Krishna

delta. Das *et al* (2001) studied sediment characteristics and benthic bio mass in a low saline confined pond of Orissa. The organic carbon load in the sediment cores of estuary and tidal zones between Chennai and Pondicherry was analysed by Hema Achyuthan *et al* (2002) Hamde and Madhyasta (2003) observed the bottom water hydrography and sediment profile of the malpe and Gangoli estuary. Hedge *et al* (2004) explained to understand the variation in the textural character of the Sharavati estuarine sediment.

THE STUDY AREA

Ashtamudi lake is of great importance because of its Psysico-Chemical properties and geographical distribution. It lies at 8^0-53' to its 9^0 02' North- lattitude and 76 ° 31' to 76^0 41' East longitude covering an area of 32 sq.km. At Neendakara permanent region Ashtamudi lake opens the into sea The sea through 200-metre is an-attempt wide bar mouth has a permanent connection with the sea. The Present study is an attempt to understand the hydrological features of Ashtamudi Lake. For this, three sites were selected.

❖ **SITE I - The Kadavoor Kadavu**

   This site is the Thevally Kadavoor region of Ashtamudi Lake. The water here is clear with abundant vegetation. So this region was taken as site I which is unpolluted.

❖ **SITE II - Thevally Kadavu**

   This site is the Thevally Kadavu region of Ashtasmudi lake. Large quantities of untreated sewage disposal of garbage etc. lead to the electroration of this region. So this region was taken as site II which is polluted.

❖ **SITE III - KSRTC BUS STAND**

   KSRTC Bus stand region was taken site III water sample from the region were collected to study the hydrographical feature of water Large quantities of untreated sewage, wastes from slaughter houses and sanitary wastes from households would lead to hazardous level of pollution on this site

STUDY AREA

Site I

Site II

Site III

05-Mar-2021 8:03:16 am
Hospital Road
Taluk Kachery
Kollam
Kerala
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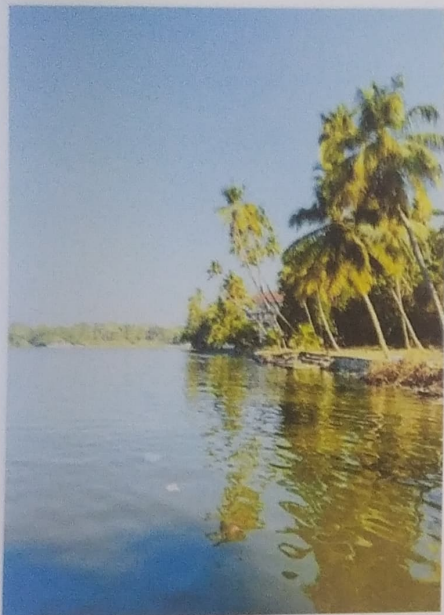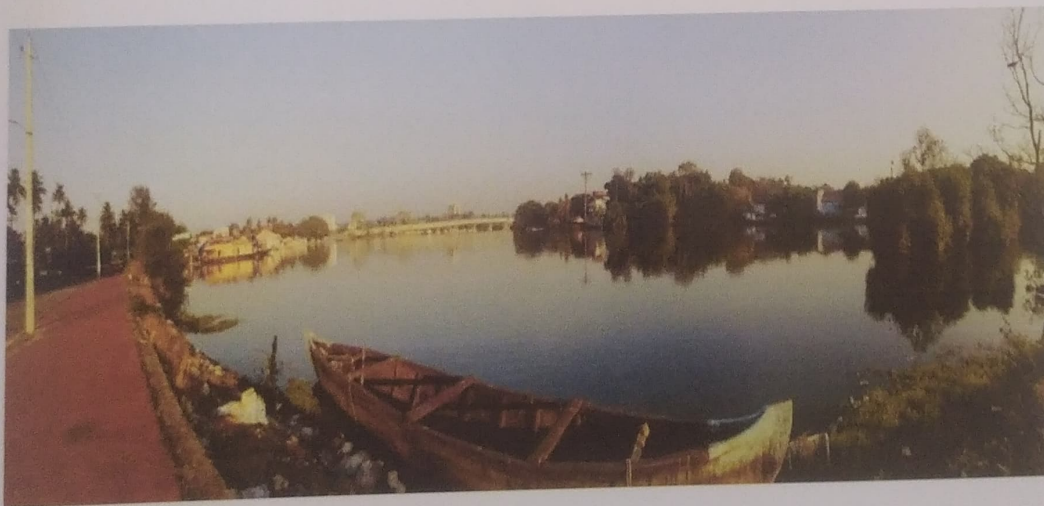
SATELLITE VIEW OF THE SITE
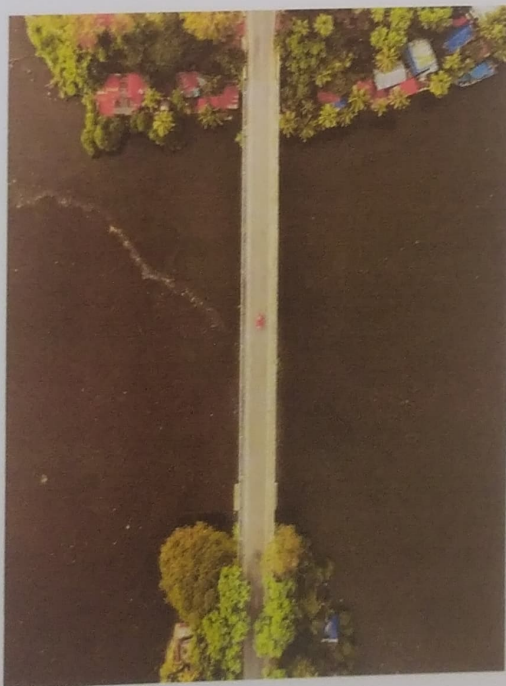
MATERIALS AND METHODS

For getting hydrographical data, water samples were collected and analysed the collection was made at the same time of the day every month. The water samples were collected from the study sites using BOD bottles and also using plastic bottles.

The following parameters have been studied

i. Water temperature

ii. Water PH

iii. Dissolved CO_2

iv. Dissolved O_2

V. Hardness of Water

The details of the methods used and materials employed for determining the different parameters are described below.

1. **Water Temperature**

   Water temperature was recorded at the site itself using an Ordinary Celsius thermometer was immersed in water for one minute and noted the reading,

2. **Water pH**

   pH is the measure of the intensity of acidity or alkalinity and measure the hydrogen ion concentration in water.pH of the water is determined using pH meter

3. **Dissolved CO_2**

   The amount of co, in water can be estimated by titrating against standard sodium hydroxide solution using phenolphthalein as indicator

   Reagents

   1. Standard sodium hydroxide solution (0.01 N)

   2. Phenophthalein Indicator

Method

For the estimation of CO_2., took 50 ml of water sample in a conical flask and added a few drops of phenolphthalein indicator. If the colour of the water sample turned pink free CO_2 is absent. If the sample remains colourless titrate it against 0.0IN NAOH taken in a burette. The end point was reached when persistent pink colour appeared in the sample.

$$\text{Dissolved } CO_2 \text{ in mg/l} = \frac{(\text{Volume x Normality })\text{of NaOH x 22x1000}}{\text{volume of water sample}}$$

4. Dissolved Oxygen

Winkler's method is used to estimate the amount of oxygen dissolved in unit volume of water In this method, KOH reacts with $MnSO_4$ to give a white precipitate of Mn $(OH)_2$.

$$MnSO_4 + 2 \text{ NaoH} + Mn(OH)_2 + Na_2SO_4$$
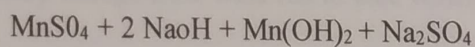
In a highly alkaline solution in presence of Oz the white Mn (OH) was oxidized to brown coloured Manganous anhydrate Mn(OH): and its amount is directly proportional to the amount of O_2 present. In a strongly acidic medium Mn ions become free and react with iodine ions of KI and release free iodide and the quantity of free iodine is equivalent to the amount of on

$$Mn (OH)_2 + 2 \text{ NaHSO}_4. + 2KI - +Mn SO_4 + K_2SO_4 + Na_2 SO_4 + 3H_2O$$
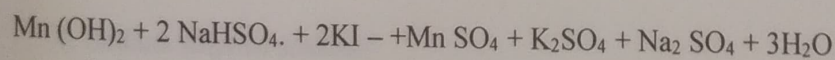
REAGENTS

- 0.01 N Sodium thiosulphate
- Alkaline potassium iodide
- Manganese sulphate solution
- 1 % Starch Solution
- Concentrated Sulphuric acid

METHOD

Pipette 50 ml of the solution into the conical flask, add 2-3 drops of starch solution as an indicator and titrate against standerd sodium thiosulphate (0.01N) from the burette, until the blue colour of the solution almost disappears. Complete the titration as quickly as possible. The endpoint is marked by the first complete disappearance of the colour.

$$\text{Dissolved Oxygen in mg/L of the Sample:} \frac{(Volume X \; normality) \; of \; Na_2S_2O_3 8 x 1000}{Volume \; of \; sample}$$

HARDNESS

In alkaline condition ethylene diamine tetra acetic acid (EDTA) or in sodium salt (Na_2EDTA) react with Calcium and Magnesium to a soluble chelated complex Ca and Mg ions developed a red colour when small amount of dye such as Erichrome Black-T is added under alkaline condition. When EDTA is added as titrant, The Ca and Mg will be complexed with EDTA. Resulting a sharp change from wine red to blue which indicates the end point of titration

$$MG^{2+} + EDTA^4 \longrightarrow MgEDTA^{2-} \text{ Complex (Blue)}$$
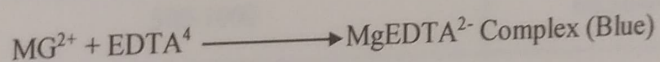
Reagents

1. 0.01N EDTA solution

2. Buffer solution

3. Erichrome Black-T indicator

4. Sodium sulptide solution

Method

Pipette 50ml of the water sample into the conical flask, add 2ml of Erichrome Black-T indicator and titrate it against 0.01 EDTA Solution until the wine red colour changes to blue colour.

Amount of hardness in mg/ltr of the water sample =

$$\frac{(Volume X\ normality)\ of\ EDTA X 1000}{Volume\ of\ sample}$$

Table: 1 showing Classification of Hardness(mg/ltr)

Serial No:	Hardness	Remark
1	0-40	Soft
2	40-100	Moderately Hard
3	100-300	Hard
4	300-500	Very Hard
5	500-1000	Extremely Hard

RESULT

The data obtained on physico-chemical parameters of three sites of Ashtamudi Lake data (March) were presented in Table 1

1. Water temperature

The variation in the Water temperature temperature is graphically represented in Figure V. In the site I the water temperature is 28 °C , site II is 30°C and site III is 31°C. The minimum temperature is recorded at site I and maximum temperature is at site III.

2. Water pH

The variation in water pH is graphically represented in figure No VI In the site I the PH of water sample is 6 sites II It is 5 and in site III 3. The minimum PH is recorded at site III and maximum at site I.

3. Dissolved Oxygen

The variation of dissolved oxygen in water samples are graphically represented in figure No VII. The amount of dissolved Oxygen recorded. At site 1 Is 8 mg/L, site II is 4.8 mg/L, site III is 16 mg/L The minimum amount of dissolved O, is recorded at site III and maximum is at site 1

4. Free Carbon dioxide

The variation of free carbon dioxide in water sample are graphically represented in figure-VIII the amount of dissolved CO_2 at site I is 0.8 mg/L site II is 2.6 mg/L and at site III is 4.4 mg/L. The minimum amount of CO_2 is recorded at site I and maximum is at site III

5. <u>**Hardness**</u>

The variation of hardness in water samples are graphically represented in Fig. IX. The hardness recorded in site I is 475 mg/ltr site II is 675 mg/ltr and site III is 760 mg/1tr the minimum amount is recorded at site I and maximum at site III However, all these sites possess extremely hard water.

Table 1: Showing physico-Chemical parameters three sites of Ashtamudi Lake

Parameters	Site I	Site II	Site III
Water Temperature(^{0}C)	28	30	31
Water pH	6	5	3
Dissolved Oxygen(mg/ml)	8	4.8	1.6
Hardness(mg/ml)	475	675	760
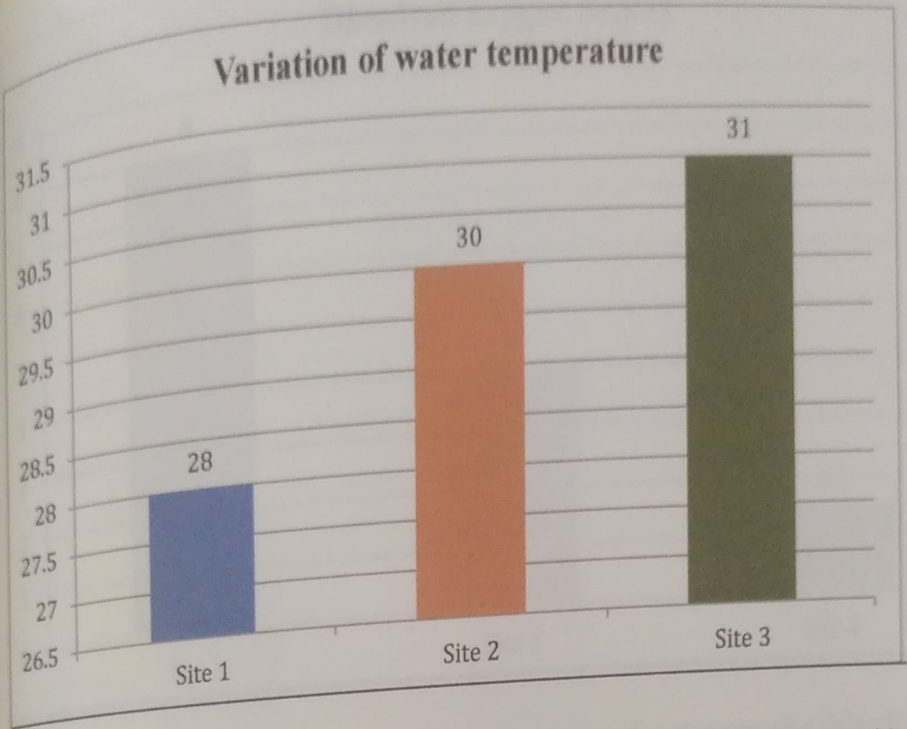
Figure v : Showing variation of temperature of water samples (March)
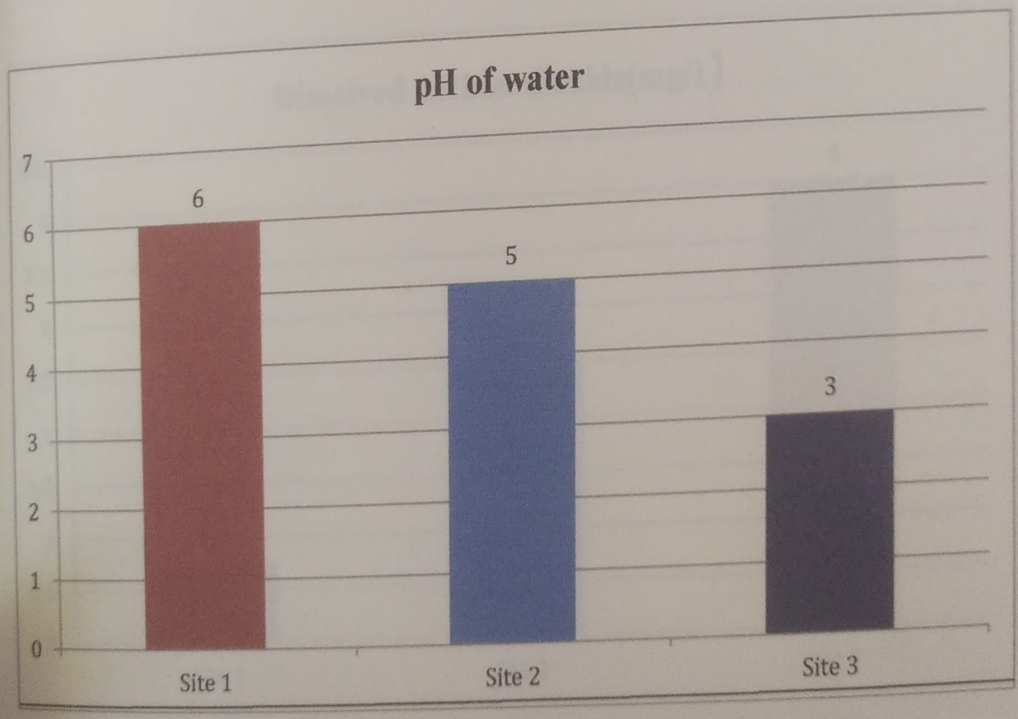
Figure VI :Variation of pH of water samples (March)

Dissolved oxygen (mg/1)
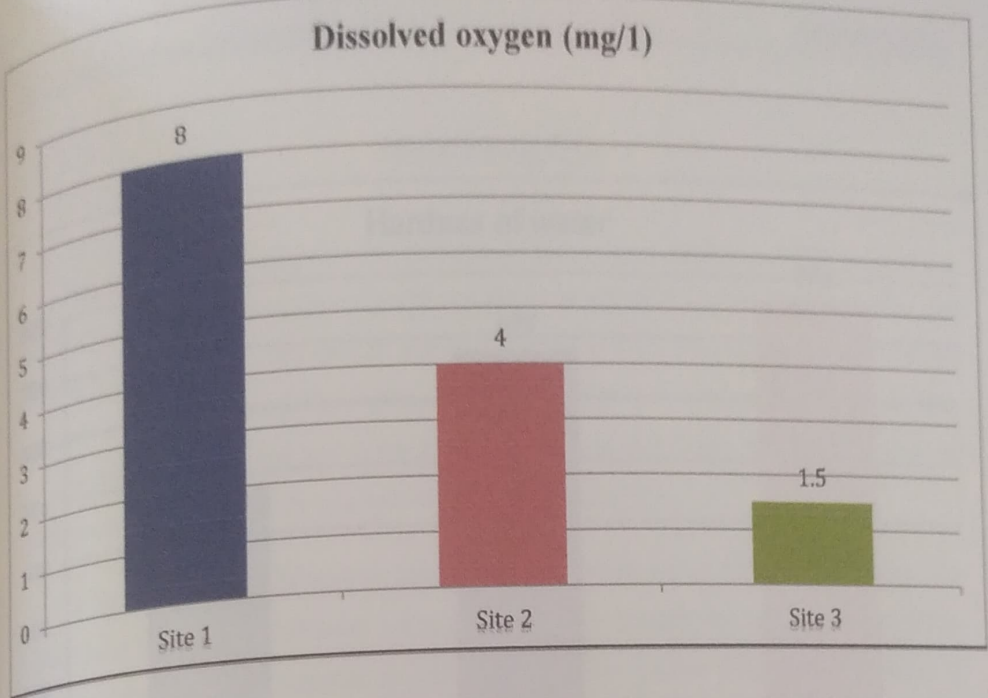
Figure VII :Variation of dissolved oxygen of water samples (March)

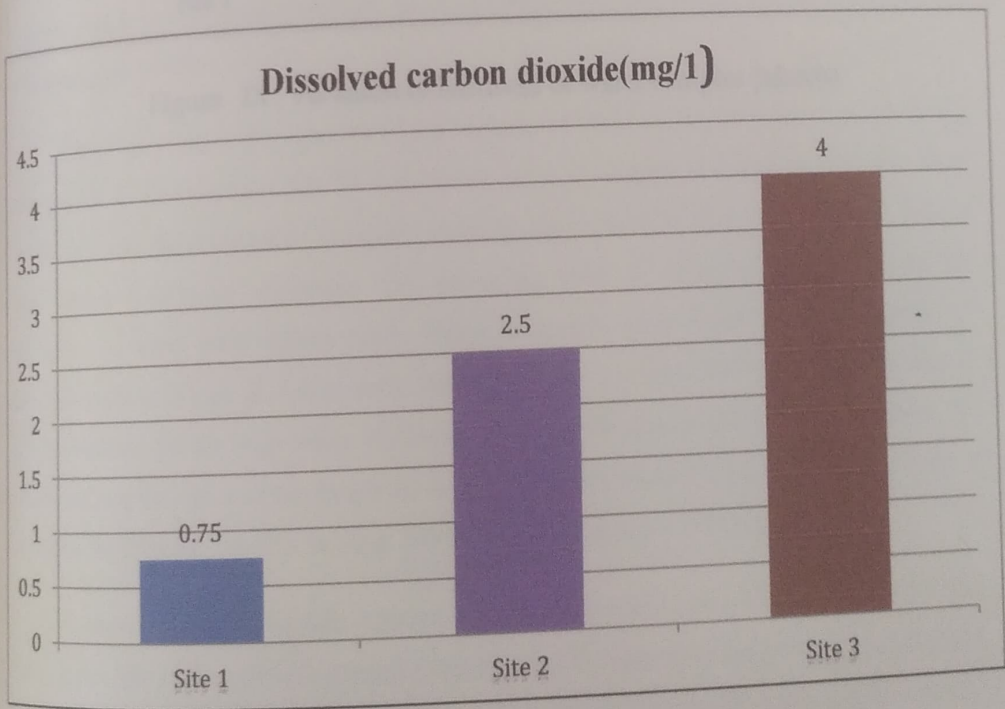## Dissolved carbon dioxide(mg/1)

Figure VIII :Variation of dissolved Carbon dioxide of water samples (March)
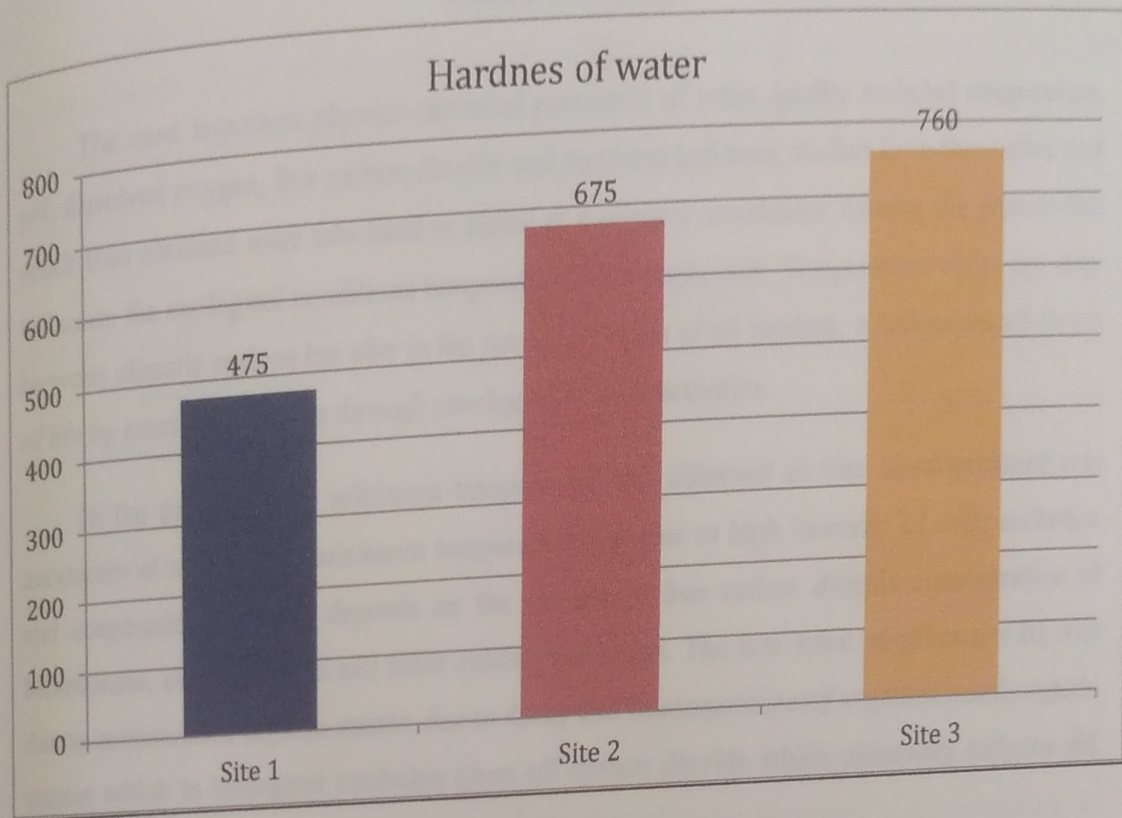
Hardnes of water

Figure IX : Variation of hardness of water samples (March)

DISCUSSION

The most important physico-chemical parameter of water quality included temperature, pH, dissolved oxygen, free carbon dioxide and hardness had been studied from these sites and result thus obtained were tabulated to arrive at a primary conclusion Among the factors that influence the ecological conditions temperature has a major role. Temperature varies not only between climatic regions but also in the temporal region of all habitats. It influences all forms of life by exerting its action through altering of its vital activities.

In the present study minimum temperature was observed at Site 1, temperature was maximum at site III The minimum temperature was due to high intensity of solar radiation and evaporation of water depends on the amount of free carbon dioxide concentration of bicarbonate, carbonate ions and other cations and anion. The low value of pH at site III was due to accumulated organic matter, due to decay and decomposition of vegetation and organic wastes which in biological oxidation gives off carbon dioxide which ultimately reduces pH (Shobba et al. 1998)

Dissolved oxygen is a measure of the capacity of water to receive organic matter During the period of investigation site III had lowest value of oxygen It is due to minimum fresh water low and the presence of inorganic reducing agents such as H2S, NH3, Nitrites. Ferroin and certain oxidisable substances The exceeding value of dissolved oxygen reveals the pollution of water with organic waste Dissolve oxygen value define when the activity of aerobic bacteria is high Increased solar radiation favour a considerable good standing crop of phytoplankton for the high value of dissolved oxygen in summer (Vijayakumar 1999) The study reveals that most of the dissolved oxygen value are above 3mg/lt and have the water is suitable for drinking, outdoor bathing, fish culture and irrigation (Radhika et al 2004).

Carbon dioxide is abundant in water, as its solubility in water is 30 times more than that of oxygen. The carbon-dioxide content of water depends upon the temperature of water, depth of water, rate of respiration, decomposition of organic matter etc. The amount of free carbon dioxide showed maximum at site III. The low value of carbon dioxide is at site I due to vegetation and evaporation of water which removes free carbon dioxide. The presence of

carbon dioxide affects buffering capacity of water. Carbon dioxide act to convert the calcium and magnesium salts in water into bicarbonates and causes hardness in water (Kataria 2000). Also carbon dioxide was utilized by aquatic plants for photosynthesis..

Hardness of water is caused due to the presence of sulphates and chloride of Ca and Mg Since all the sites of study possess extremely hard water, which reveals the threatening of living creatures in this Ramsar site. The maximum value of hardness recorded site III indicates high level pollution occurring in this area and the day to day enhancement of the rate of pollution

S. Bijoy Nandan and P.K. Abdul Aziz (Department of Aquatic Biology and Fisheries) published their work about retting in International journal of Environmental Studies March 1995, about Retting Which is brought about by the Activity of Bacteria, Fungi, and yeasts degrading the Fibre binding and material of the husk and liberating large quantities of organic matter and chemicals into environment? It includes pectin, pentosan, tannins and Poly phenols, there by leading to anoxic conditions along with increase in Hydrogen sulphide with depletion in biotic communities. In my study retting acting a minor role comparing other sources of pollution, as coir industry is now declining in lake waters due to increase in labour charges Studies by S. Meera and S.Bijoy Nandhan on water quality status and primary productivity of Valanthakad Back water in Kerala on march 2009 showed back water locality called as Kayal are important. Wetland system on the south west coast of India is under tremendous pressure due to increasing human population and rapid industrialization. Prof. Dr. C.V. Jayamani (2008) studied about backwaters and estuaries and found out that the coir workers and the fisherman were worst effected, since there was no lake to sook husks, the kanjiracode coir industry became extinct and the coir workers had to look elsewhere for a living. According to old survey Reports Ashtamudi Lake had an area off 54 sq km but now it has shrunk to 34 sq km as a result of encroachments which I mentioned in conclusion. As a part of conservation programme of Ashtamudi Lake, the Ministry of Environment and Forest took much initiative in protecting mangroves to plant mangrove trees on the bangs of the lake

Under this programme 2,40,000 mangrove saplings were planted, that began two years ago Only around 30,000 are surviving. Its destruction done by Tourism mafia noted environment activist and former province chancellor of Calicut University M.K Prasad said it appeared as though the government was not aware that Ashtamudi Lake was a Ramsar site that could be a reason for the apathy on the part of the authorities concerned towards conserving the precious wetlands pity that the lake continues to be destroyed"

SUMMARY

The present study is an attempt to study the primary hydrological features of Ashtamudi Lake, the deepest estuary, the water of Ashtamudi also mixes with Sea water. The study was carried out in the month of March 2019, three different sites from the data collected it is evident that Ashtamudi Lake is polluted in several ways. In this study the physico-chemical parameter obtained also reveals that Ashtamudi will become a graveyard for aquatic flora and fauna Here the temperature and pil were measured using phenolphthalein and ph paper. Free carbon dioxide was estimated using phenolphthalein method. Modified Winkler's method was used for the estimation of dissolved oxygen. EDTA erichrome Black T method is used for the estimation of Hardness.

The result obtained from three site revealed that the atmospheric temperature ranged between and water temperature fluctuated between 28' c-31'c. The value recorded also showed that pH in three sites are moderately acidic ranging between 3-6. A high concentration of free carbon dioxide occurred in site 1II i.e. in the KSRTC stand. Marked variation of carbon dioxide also occurred in site II and site I is the unpolluted zone Similarly, the concentration of dissolved oxygen found to be high in site I (8mg/1) and a low concentration of site III (16 mg/l). Thus the data gives a clear idea that pollution a dreadful and incurable disease like cancer had capture Ashtamudi Lake, All three sites possess extremely hard water and site III (KSRTC stand) records maximum amount of $CaCO_2$. So this site is highly polluted one.

CONCLUSION

The human settlement and public effluent sources are the chief factors for the degradation of Lakes. A lake front property has social prestige, which causes intense shoreline development in urban centres and thus adversely impacts on the lake water quality. The anthropogenic pressure in the catchments area due to deforestation, extensive agricultural use and consequent erosion and increased silt flowsf, which have deviatiated the quality of water stored in lakes. Infrastructure development, housing pressure and encroachments have resulted in converting in all lakes into hyper eutrophic state. In the lakes which have survived, the drinking water supply has been substantially reduced or become totally non potable, flood absorption capacity impaired, biodiversity threatened and livelihood of fisher folks affected. The water quality of lake has deteriorated so much as to cause serious disturbance to the biodiversity of the lake environment.

Back water are unique to Kerala it is a network of lakes, canals and estuaries opening in to the sea. The canals connect the villages together and are still used for local transport. There is almost a dozen of such backwater in Kerala of which Ashtamudi is the second largest. Thus through my study I had arrived at a conclusion that anthropogenic activities, waste from slaughter houses, sanitary waste and Sewages from houses and hotels etc. would acting as a major source of pollution in Ashtamudi lake even though retting had a minor role.

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