International Conference on Advances in Materials, Computing and Communication Technologies
In Association with International Journal of Scientific Research in Science and Technology
Volume 9 | Issue 1 | Print ISSN: 2395-6011 | Online ISSN: 2395-602X (www.ijsrst.com)

Assessment of Physical Chemical Parameters in the Fishing Harbours of Southeast Coast of India

V. Adlin Asha[1], Dr. Rexin Thusnavis[2]

[1]Research Scholar (Reg No: 18223162032018), Department of chemistry, Pioneer Kumaraswamy College, Nagercoil, Affiliated to Manonmanium University, Tirunelveli, Tamilnadu, India.

[2]Department of Chemistry, Pioneer Kumaraswamy College, Nagercoil, Tamil Nadu, India

ABSTRACT

The study concerns the physico-chemical parameters (Total dissolved solids ,pH ,Total Alkalinity, Total hardness, Calcium, Magnesium, Sodium ,Potassium, Iron, Manganese, Free Ammonia, Nitrite, Nitrate, Chlorides, Fluoride, Sulphate, Phosphate, Dissolved Oxygen) of Muttom ,Chinnamuttom, and Colachel harbour water from October 2019 to February 2020.Water exhibit an important role to carve the land and administer the climate. The people are at risk due to undesired changes in the physical, chemical characteristics of water. Because of increased human population, industrialization, usage of fertilizers and modern agriculture activity seawater is highly polluted with different toxic contaminants. The increased harbour activities like enormous boats with engines running on the dirtiest fuel available, usage of diesel fuels in beaked boats and other polluting equipment, and other activities in harbours cause an array of environmental crisis that can seriously affect local communities and the environment. This will lead to an increased risk of illness, such as respiratory disease or cancer, degradation of water quality. Necessary actions should be provided to safeguard seafood for human consumption and protect means of livelihood. By re-educating the citizen, minimizing motor fuel leakage from boats, reducing the hazardous discharges will protect the marine environment. Physicochemical characteristics of seawater play a crucial role for productive marine ecosystem and fisheries activities. A total of 15 water samples were collected during October 2019 to February 2020 and during the analyses a variation in certain parameters was found which can cause harmful effects for the aquatic life. In future, it is advisable to have an update in physicochemical parameters of harbour waters these areas.

Keywords: physico chemical, marine ecosystem, pollution, water quality

I. INTRODUCTION

The water in harbour and estuaries, they exhibit considerable seasonal variations depending on the local condition of rainfall, tidal incursions, and various abiotic and biotic processes. Even the fresh water runoff affects the nutrient cycle of different coastal environments1. The wellbeing of the any aquatic system depends upon its physical, chemical and biological characteristics, which actually changes

according with season and the extent of pollution2. Because of the instability in the parameters the assessing and monitoring of the quality of harbour water is mandatory. The water pollution is measured by assessing the physicochemical parameters of water.3The pollutants from land surface enters into the marine environment through the surface run off and by means of river water4.The quality of water in any aquatic ecosystem provides relavant information about the available resources for supporting life in that ecosystem. Good quality of water resources depends on a large number of physico-chemical parameters and biological characteristics.5 So, monitoring of these parameters is essential to identify the magnitude and source of any pollution . The maintenance of good water quality is essential for the survival of the aquatic habitats.6

The quality of water is an important feature preventing diseases and improving quality of life. Natural water contains different types of impurities are introduced in to aquatic system by different ways such as weathering of rocks and leaching of soils, dissolution of aerosol particles from the atmosphere and from several human activities, including mining, processing and the use of metal based materials.7The untreated effluents from Industrial sectors , when dumping in sea water results in the generation of industrial effluents, and if untreated results in water pollution ,sedimentation8.The recent research in Haryana (India) concluded that it is the high rate of exploration than its recharging, in appropriate dumping of solid and liquid wastes, lack of strict enforcement of law and loose governance are the cause of deterioration of ground water quality 9.It may cause the very low concentrations of many important trace metals 10.

Macer postulated that the presence of impurities, reduces the quality and serve as a major factor controlling the state of health in both cultured and wild fishes11. Water must be analysed to determine its acceptability for the intended purpose. Due to non-availability of water to settlements the necessity of coastal waters for domestic, agricultural or recreational purposes are needed. The possibility of trans-boundary transportation of coastal pollutants makes to determine the coastal water quality and monitoring essential12. According to the studies carried out in advanced countries, they declared that the environmental monitoring agencies are more effective and the environmental laws should be strictly followed. The harbor water monitoring should be done compulsory and is done on a regular basis13.The coastal waters support many fish species offering some of the most productive fisheries habitats in the world and support many other organisms like marine mammals, corals, and sea turtles and supports submerged aquaticvegetation14.The economic status of coastal areas has increased further with the growth of human settlements and the development of commercial harbours, fishery harbours, landing facilities, river training and outfall schemes, transport, communications, recreational facilities and tourism 15.

Due to pollutants like heavy metals, petro-chemicals, sediments and fecal matter degrade marshes, estuaries, lagoons, coral reefs and other coastal habitats and directly threaten the sustainability of the fishery harbours. It is a center of activities where a high potential of waste generators and thus considered as a hot spot of coastal pollution 16 .The rising of pollution level in harbour water is due to dumping of untreated sewage, waste from fishery activities and due to this activity the water born diseases and epidemics may occur. The quality of water in harbour is highly degraded by human activity and surrounding environment as well. The fishery harbour and its contiguous waters are part of the coastal zone, the pollution in the harbour water directly affects the coastal zone and vice versa17.During the fuel loading in fishery boats the

there is a chance to oil spillage and cleaning fishing vessels to harbour waters, production of load of organic wastes which derived from fish degutting, market floor runoff,cleaning and garbage dumping are main reasons for degradation of water quality and water pollution in fishery harbours18. While washing boats the oily waters are released in harbour water, solid waste derived from boat repairing that are washed into harbour with the rain runoff are the main boat generated sources of pollution 19. In addition, other pollution sources in a fishery harbour includes improper dumping of fish offal and other garbage into harbour waters, dumping of untreated sewage from toilets and defecation inside the harbor premises. Due to such activities, harbour water becomes rich in faecal coliforms 20The present study is to assess the physic chemical characteristics as well as to collect information on the chemical conditions of the selected harbour water.

II. MATERIALS AND METHODS

The economic status and the lifehood of coastal people mostly depends on fishery. The sample collection was carried out from the following three stations. Station -1 Chinnamuttom fishing harbour (S1) situated nearly 2 km away from Kanyakumari town. Station 2 –Colachel harbour (S2) is a natural harbour in Kanyakumari district located 20 km away from Nagercoil of Tamil Nadu. Station 3-Muttom Fishing harbour (S3) located near to Colachel. According to the standard procedures the water samples were collected in clean polythene bottles without any air bubbles. The bottles were rinsed before sampling and tightly sealed after collection and labelled in the field. The samples were kept in ice box maintained at 4°C and were analyzed according to following standard methods. The temperature of the water in both the stations was recorded in the spot using standard mercury thermometer. Total dissolved solids was estimated by modified gravimetric method. The pH, total alkalinity of the water samples can be determined by digital pH meter and volumetric method respectively. Total Hardness, Calcium, Magnesium can be determined by EDTA method. The sulphate is analyzed by Nephelometer.

III. RESULTS AND DISCUSSION

The quality of water can be used to analyze the physical, chemical and biological characteristics and circumstance of water that directly impact on the ability of water to support for the designated uses 21. Coastal water quality is mostly influenced due to natural, geological and oceanographic processes, as well as by both marine and land based human activities 22. So in the present study the three stations (Chinnamuttom S1 and Colachel S2 , Muttom S3) were chosen and their water quality was analyzed. It is estimated, that 80% of coastal pollution results due to land based activities. In this study surface water temperature varied between 25ºC and 27 ºC as shown in Figure1. The minimum (25ºC) was recorded in all the stations in the month of December 2019 while the maximum (27 ºC) was recorded at Chinnamuttom and Muttom in October 2019 and February 2020. High temperature reinforce the growth of microorganisms however the effect of changes in temperature on living organisms can be critical. Temperature controls the solubility of gases in water, and the reaction rate of chemicals, the toxicity of ammonia, and of chemotherapeutics to fish.

Temperature is the most important physical variable affecting the metabolic rate of fish and is therefore one of the most important water quality attributes in aquaculture 23.Also reported a temperature range between 27 °C and 30 °C as being ideal for growth and well-being of shell fishes. In Muttom total dissolved solids (TDS) show a high value 3720mg/l in the month of February2020, and in Chinnamuttom a less value of 3500mg/l falls in the month of December as shown in the figure3. This will impart a variation in ratio of dissolved salts in harbour water. In water

hydrogen ion concentration is measured in terms of pH, which is defined as the negative logarithm of hydrogen ion concentration 24. This concentration is the pH of neutrality and is equal to 7. When the pH is higher than 7 it indicates increasing salinity and basicity while values lower than 7 tend towards acidity i.e. increase in hydrogen ion concentration. The pH higher than 7, but lower than 8.5 is ideal for biological productivity while pH lower than 4 is detrimental to aquatic life 25.In Colachel and Muttom the pH values are above 7 which indicates increasing salinity and basicity while values lower than 7 tend towards acidity i.e. increase in hydrogen ion concentration. The pH higher than 7, but lower than 8.5 is ideal for biological productivity. The minimum pH value is noted 6.59 in Colachel in the month of October2019 is shown in the figure2. For the most part, variances in pH esteems during various as periods of the year can be credited to factors like evacuation of CO2 by photosynthesis through bicarbonate debasement, weakening of seawater by freshwater deluge, decrease of saltiness and temperature and disintegration of natural issue as expressed by 29,30,31.

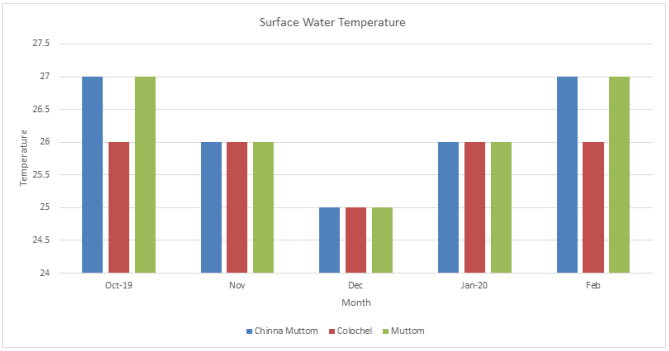
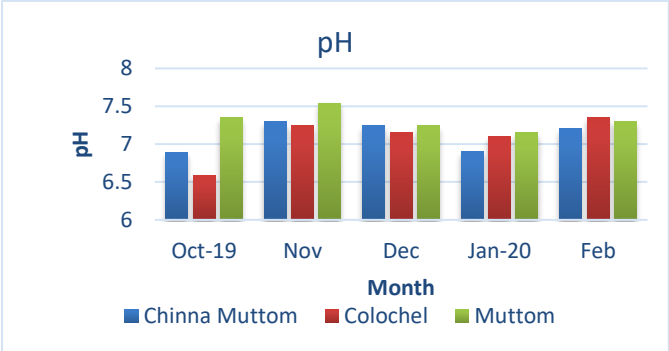


Figure 1



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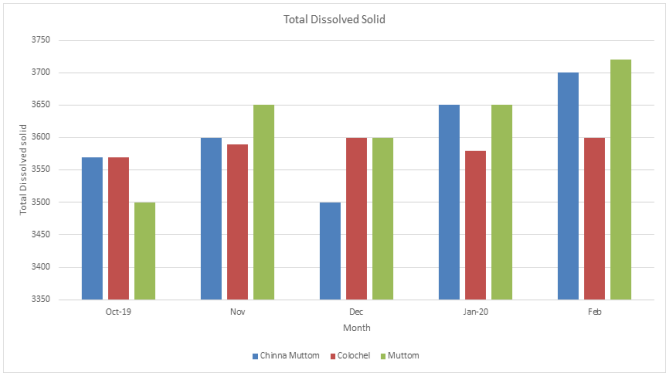

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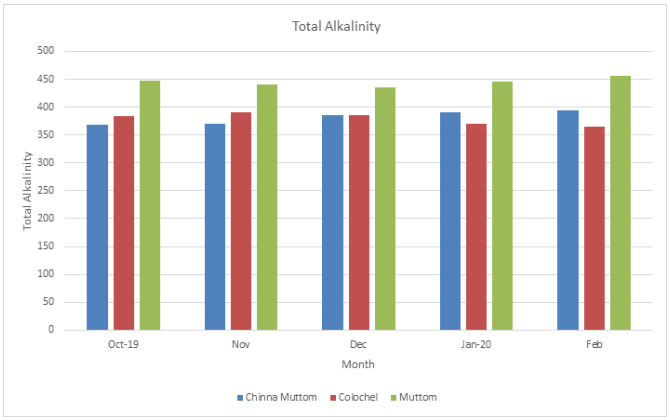

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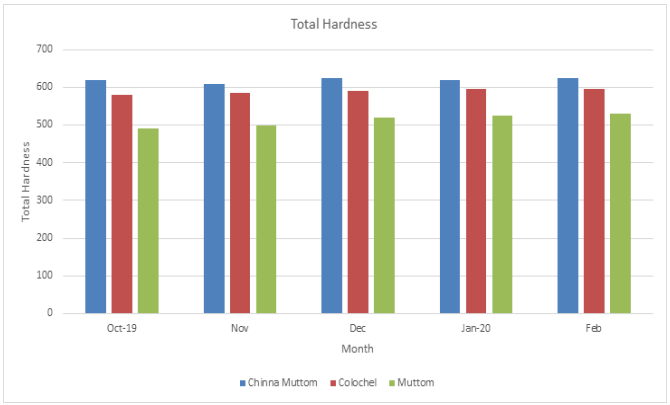

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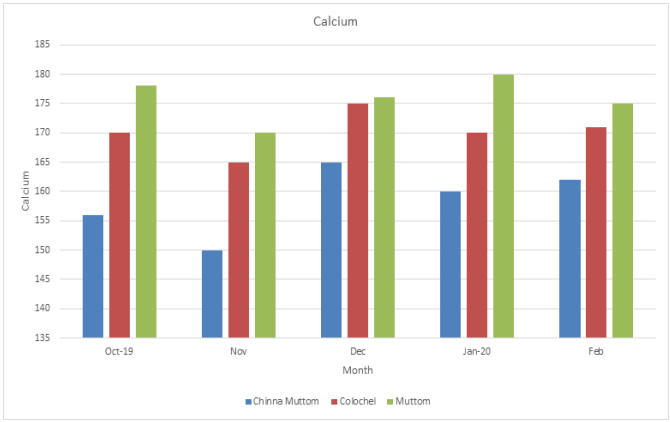
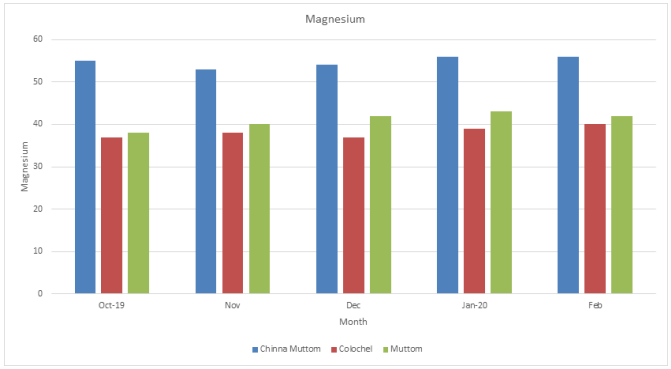


Figure 6



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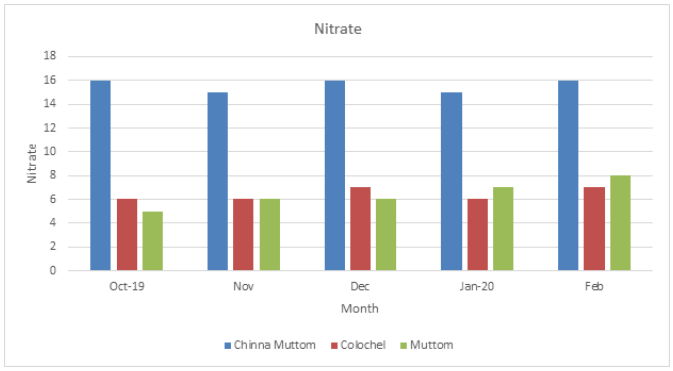

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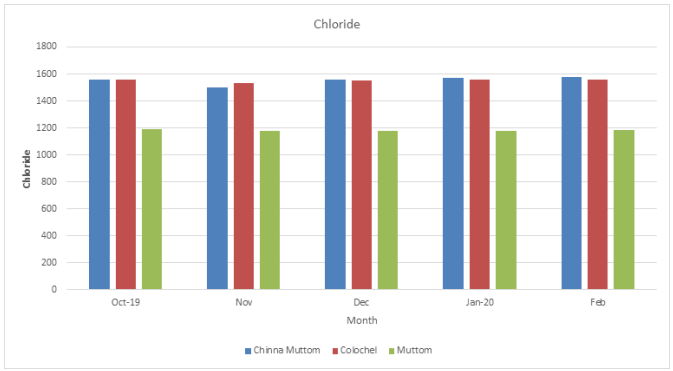

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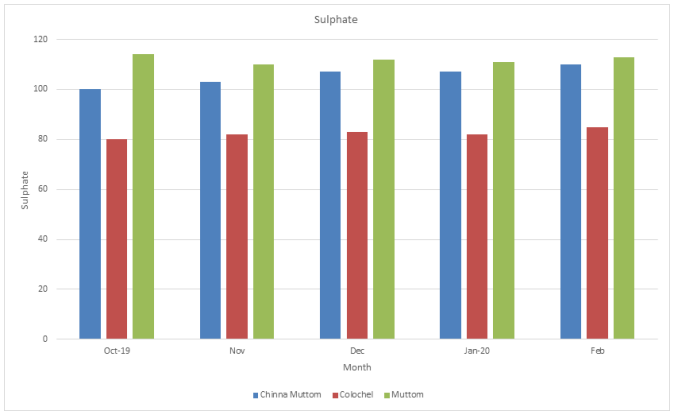

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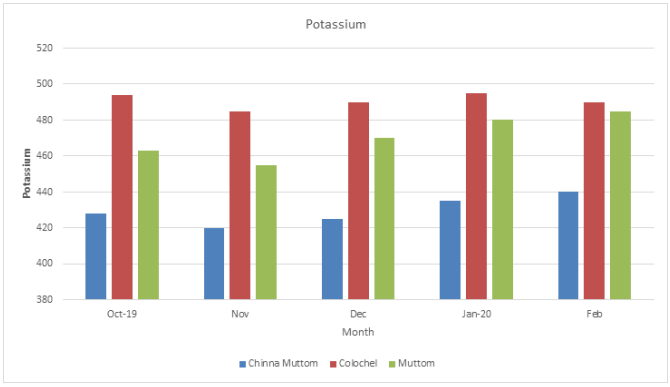

Figure 11

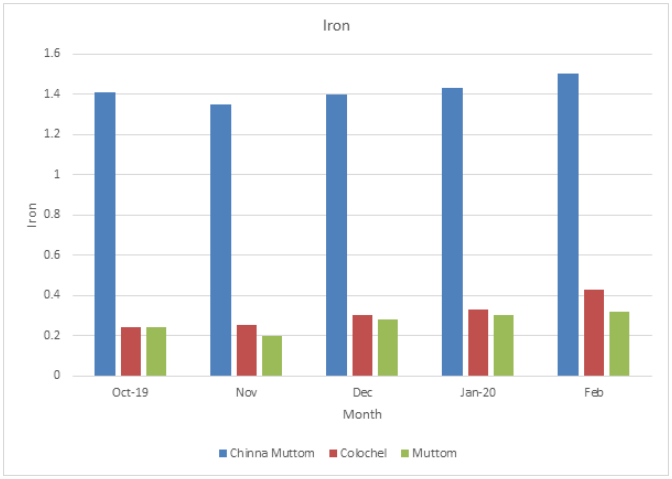

Figure 12

Total Dissolved Solids (TDS) analysis as shown in Figure 3 can be considered as the summation of all dissolves solids in the water, such as non-organic materials, carbonate, bicarbonate, nitrate, sodium, potassium, chloride, and magnesium. In Muttom total dissolved solids show a high value 3720mg/l in the month of February2020, and in Chinnamuttom a less value of 3500mg/l falls in the month of December 2019.This will impart a variation in ratio of dissolved salts in harbour water. TDS which will affects the other characteristics features of a hardness. It has been reported that, the amount of TDS is in between 3500mg/l to3720 mg/l. The highest value is noted in Muttom in the month of February 2020 .Alkalinity is important for fish and aquatic life because it protects or buffers against rapid pH change. High value in Alkalinity cause bitter taste to water. (Figure4)Higher alkalinity levels in surface water will buffer acid rain and other acid waste and prevent pH changes in water. The highest alkalinity value 456mg/l is noted

in Muttom in the month of February 2020.But in the month of December the lowest of 435mg/l is noted in the same station. This may be due to the variation in pH factor. The main reason of higher alkalinity in the harbour water may have been influenced by the presence of domestic waste and the absence of normal tidal action, which would accompany flushing and diluting effect on dissolved constituents as well as bi-carbonates which could increase alkalinity levels.

The simple definition of total hardness is the amount of dissolved calcium and magnesium in the water. Hard water is high in dissolved minerals, largely calcium and magnesium. Hardness varies in different ecosystems according to the topography, tides (high and low tide) and freshwater inflow. The hardness in the Muttom was minimum of 520mg/l as shown in figure 5 and maximum during the month February 2020 530mg/l. In Colachel the hardness ranges from 165 to171m/l. Minimum was recorded during the month of November 2019 may be because of freshwater discharge caused by precipitation and the maximum during the February due to higher solar radiation besides evaporation26

The calcium was varied from 150 mg/l to 180 mg/l as shown in Figure 6. The minimum calcium was recorded at station Chinnamuttom during November2019 and maximum calcium was recorded at station Muttom during January 2020 .In the same way magnesium was varied from 37mg/l to 56 mg/l as shown in figure 7. The minimum calcium was recorded at station Colachel during October 2019 and December 2019 and maximum calcium was recorded at station Chinnamuttom during January 2020 and February2020.These factors are closely correlated with the hardness of harbour water.

The recorded nitrate content was ranged between 5 to 16mg /l. The minimum 5mg /l was observed in October 2019 at Muttom while the maximum 16mg mg/1 at Chinnamuttom in October2019 and February2020. The nitrate in the Chinnamuttom varied from 15 to 16 mg/l. Minimum was recorded during the month of November2019 and the maximum during the month of November 2019. The nitrate in the Colachel was minimum in the month of October 6 mg/l (Figure8) and maximum in the month of February 2020 7mg/l. Nitrogen is a momentary nutrient and therefore its concentration is determined by the balance between the formation and distribution. The nitrate value recorded higher during monsoon could be due to the increased phytoplankton excretion, oxidation of ammonia and reduction of nitrate and by recycling of nitrogen and bacterial decomposition of planktonic detritus present in the environment 27,28. Chloride has a slight variation between1175 to1570mg/l as shown in the figure9 and sulphate value is between80 to 114mg/l(Figure 10) in the station samples but the impact should be more the aquatic life. Even the reproductive period of such aquatic life can change. The noted value for sulphate varies among the stations, highest value is seen in 500 mg/l and a lowest is 480mg/l. In the month of February 2020 the highest value is noted in Chinnamuttom Harbour as shown in the figure 10 . The Potassium and Iron ranged between 420-440(S1),485-495(S2),455-485(S3);1.35-1.4(S1),0.24-0.43(S2),0.2-0.3(S3) as shown in the figure 11 .The high value in the month of January 2020 and low value in November 2019 for Iron is noted in the harbour water. This may be attributed to the raw sewage and effluent dumped in the harbour water. Higher Potassium concentration is recorded due to the combined effect of imputed materials from the open waste dump sites33.

IV. CONCLUSION

The Physico-chemical and nutrients characteristics in Chinnamuttom, Colachel and Muttom harbour waters in monsoon and post monsoon inferred that the higher concentration of the hardness observed in Chinnamuttom harbour and lower in Colachel

harbour waters. The concentration of ammonia, chloride, and iron was high in Chinnamuttom comparing to other harbour waters during monsoon season and low during post monsoon season due to incoming of anthropogenic contaminants in the harbour region from the catchment area and discharge of domestic and ship wastes. It is further recommended that proper education, monitoring and clean up procedure be carried out promptly in these regions whenever they are stressed by pollutants generated from domestic, agricultural and industrial activities.

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