1.1 INTRODUCTION

Water is a transparent fluid and the priceless gift of nature. There is no life on earth without water. Our earth is a blue planet and about 75% of its surface is covered by water. Human history is tied directly or indirectly to water source such as Fresh water, Marine water and Brackish water.

The water plays an important role in the manufacture of essential commodities such as generation of electric power, transportation, recreation, industrial activities etc. Thus water can be considered as most important raw materials of civilization because of the fact that without water man cannot live and industry cannot operate. With our growing population and industrial development the demand of water is also increasing day by day and hence every country has to take preventive measure to avoid over population and contamination of the water resources.

The water resources are certainly exhaustible gift for all living organism. But is ensure their survive for all the time to come it becomes necessary to main line conserve and used the resources very carefully. It is an established fact that proper maintenance, conservation and other uses of water resources will definitely avoid the chance of water famine for future generation. It is for the reason that remedial measures will have to be found out is in nature to increase the availability of water resources and to improve the quantity of water and the requirement of water is also essential for the growth to crops.

Naturally water may be broadly divided into four types such as surface water, underground water, rain water and sea water. From the point of view of applications it is not usually feasible to use rain water and sea water. Rain water is irregular in
supply and generally expensive to collect. Sea water is too saline to use. So the major categories of usable water are surface water and underground water. In surface water, there are two types, such as lotic and lentic water. The lotic water sources are streams and rivers. Water from these sources is fairly constant for composition. It is generally clear and slightly acidic due to the presence of dissolved CO$_2$ and of weak organic acid which renders it corrosive. Water is soft in nature. It contains some strains of bacteria. The source like ponds, lakes and reservoirs are lentic waters. It is not generally coloured but many contain fine mud in suspension, which does not easily settle unless coagulants are used. It is hard in nature and hence can cause serious scale formation in boilers, economizers and coolers, unless the water is properly treated before use.

The use of water by plants and animals including human being is universal. As a matter of fact every living soul requires water for its survival. It is the principle that raw materials for food production and for many other uses outside the home and on the farm. Man can live without food for about two months. But he cannot survive 3 or 4 days without water. In a similar way if there is a shortage of water there will be a decline in farm production. In addition to the direct consumption of water at homes and farm there are many indirect ways in which water affects our daily life.

The available fresh water is always associated with some impurities. Rainwater the purest form of natural water contains dust particles and dissolved gases. Sea water is highly impure with around 3.5 % dissolved minerals and is unfit for human consumption and other uses. Water pollution is the contamination of water with soluble and suspended impurities i.e. pollution is to mean the conditions distributing the balance of natural environment is such a way that its beneficial use is adversely
affected. It is a vital problem for mankind since the quality of water is linked with human health.

The pollution causes undesirable changes and it threatens the terrestrial, aquatic, atmospheric and outer space ecosystem. Man requires a clean and ecologically well balanced environment to promote healthy living. The people as such desire to have their environment beautiful, clear, healthy, scenic and refreshing. The effects of pollution are becoming more prominent in day by day and hence a serious attention has to be concerned.

Development of industrialization leads to a severe problems of water pollution. The industrialization along with urbanization releases domestic and industrial effluents which mainly released into the rivers or streams and finally entered into ocean through the estuaries. If the residents of the municipality are suffering from disease like dysentery, typhoid, cholera etc. The faces and urine discharged by such patient contain micro organism. Which are transmitted through water supplies and thus produces disease in other living beings. A large quantity of crude petroleum oil is spilled accidently or intentionally into the sea water from the tankers or during the drilling and shipping operations. This oil pollutes sea water. For example the accidental leakage of 118000 tons of crude petroleum oil from the big oil tanker called Torry Canyon, into water of English Channel, polluted water of surrounding area in a few hours time. The effects of oil pollutions are serious since oil lighter than water it forms a layer on the surface water which is called oil stick. The oil stick check the oxygenation of water and water eventually becomes devoid of oxygen. Phytoplankton at the surface of the water absorbs directly and act as pollution
filter. But the oil film on water surface checks the growth of plankton. The knocking out of plankton by oil film disturb the entire cycle of marine life.

Organic compounds include detergents and pesticides like DDT, Entrin, BHC etc, are toxic to fish and other aquatic creatures. Chemical fertilizers, nutrients also polluted the water. When these fertilizers are used in excess, the unused quantity is washed away from the agriculture land into ponds, lakes and rivers with rain water and thus pollute the estuarine water. The presence of fertilizers induce the growth of algae and other aquatic plants which in later undergo decomposition and produce disagreeable odour. This also deplete the amount of dissolved oxygen. After a long period the lakes and slow moving waters which contain fertilizers are converted into swamps ie an area of very wet land with wild plants growing init. The water containing nitrate salt is not fit for drinking purpose.

The total life of the world depends on water and hence the hydrological study is very much essential to understand the relationship between its different tropic levels and food webs. The environmental conditions such as topography, water movement and stratification, salinity, oxygen, temperature and nutrients characterizing particular water mass also determining the composition of its biota (Karande, 1991). Usually in the near shore waters and estuaries, they exhibit considerable seasonal variations depending on the local conditions of rainfall, tidal incursions, various a biotic and biotic processes, quantum of fresh water inflow affecting the nutrient cycle of different coastal environments (Choudhury and Panigraphy, 1991).

India is rich in water resources, being endowed with a network of rivers and blessed with natural surroundings that can meet a variety of water requirements of the
country. However, with the increase in population of the country and the need to meet the increasing demands of irrigation, human and industrial consumption, the available water resources in many parts of the country are getting depleted and the water quality has deteriorated. Even though river waters are the main sources of drinking water of India, they are severely polluted due to the discharge of untreated sewage and industrial effluents. Safe and clean drinking water is one of the major issues of health and sanitation aspect of India.

All living organisms are affected by pollutants both directly or indirectly in various aspect. Some of the effects produced are as given below: An increase in the osmotic pressure, violent alteration in the pH of water, reduction of oxygen content in water by substances with a high oxygen demand, specific toxic ingredients which may injure the gills and other external structures which cause death either from anoxemia or by intake and absorption. All organism are affected indirectly when its habitat, food organisms are destroyed. The covering of the bottom of a water body by a coating of waste matter greatly reduces the food supply. Destruction of spawning grounds can be serious in respect of major carps and other fishes which require special environment for breeding (Muchmore and Dziegielewski, 1983; Chessman and Robinson, 1987; Muduli et al., 2006).

Natural water may be acidic or alkaline depending on the surface of water and extent and nature of pollutants from industry and municipal sanitary disposal. Water may be acidic due to the presence of CO$_2$ or organic acids formed by the decaying of organic matter. Water may be alkaline due to the presence of wide variety of salt such as carbonates, bicarbonates, borates, silicates, phosphates etc, and also due to the
presence of weak and strong base from the industrial waste. The Indian standard institution has assessed the $p^H$ of drinking water to be within 6-9.

The most important manifestation of the dissolved minerals maters from the point of industrial application includes hardness and alkalinity. Hardness is originally defined as a soap consuming capacity of a water sample. Hardness is more than water is not suitable for drinking purpose. If it is very low then becomes corrosives. Thus hardness estimation is very important in the case of portable water.

To access quality of water, water quality and standard have been established. The quality standard have the maximum permissible or harmless concentration to toxic substances and permissible limit of certain physico chemical parameters in water. The permissible limits of various parameters depends on the purpose for which water is to be used.

Water quality is the physical, chemical and biological characteristics of water. It is most frequently used by references to set of standards against which compliance can be assessed. The most common standards used to assess water quality to drinking water, safety of human contact and for the health of ecosystems. The parameters for water quality are determined by the intended use. Work in the area of water quality tends to be focused on water that is treated for human consumption or in the environment.

Good quality of water resource depends on a large number of physicochemical parameters and the magnitude and source of any pollution load and to assess that monitoring of these parameters is essential (Reddi et al., 1993). Assessment of water resource quality of any region is an important aspect of developmental activities of
the region, because rivers, lakes and manmade reservoirs are used for water supply to domestic, industrial, agricultural and fish culture (Jakher and Rawat, 2003). Fertility and healthiness of mangrove environment is reflected in productivity of phytoplankton and zooplankton as primary and secondary producers. They are the key players in controlling food webs in mangrove waters. Larval retention and high productivity in mangrove-lined estuaries have been attributed to the abundant food supply in comparison to adjacent marine areas. Organic materials derives from decaying mangrove leaves are used as primary food source in sustaining larval and juvenile stocks. Influence of physical, chemical and biological variables on planktonic communities in mangrove waters are more pronounced than the near shore coastal environment resulting in seasonal changes of planktonic species composition and densities (Kannan and Vasantha, 1992).

An estuary is a partly enclosed coastal body of brackish water with one or more rivers or streams flowing into it, and with a free connection to the open sea. Estuaries form a transition zone between river environments and maritime environments and are subject to both marine influences such as tides, waves, and the influx of saline water; and riverine influences, such as flows of fresh water and sediment. The inflows of both sea water and fresh water provide high levels of nutrients in both the water column and sediment, making estuaries among the most productive natural habitats in the world.

Most existing estuaries were formed during the Holocene epoch by the flooding of river-eroded or glacially scoured valleys when the sea level began to rise about 10,000-12,000 years ago estuaries are typically classified by their
geomorphological features or by water circulation patterns and can be referred to by many different names such as bays, harbors, lagoons, inlets, or sounds, although some of these water bodies do not strictly meet the above definition of an estuary and may be fully saline.

The banks of many estuaries are amongst the most heavily populated areas of the world, with about 60% of the world's population living along estuaries and the coast. As a result, many estuaries are suffering degradation by many factors, including sedimentation from soil erosion from deforestation, overgrazing, and other poor farming practices; overfishing; drainage and filling of wetlands; eutrophication due to excessive nutrients from sewage and animal wastes; pollutants including heavy metals, polychlorinated biphenyls, radionuclides and hydrocarbons from sewage inputs; and diking or damming for flood control or water diversion.

Estuarine environments are among the most productive on earth, creating more organic matter each year than comparably-sized areas of forest, grassland, or agricultural land. The tidal, sheltered waters of estuaries also support unique communities of plants and animals especially adapted for life at the margin of the sea. Many different habitat types are found in and around estuaries, including shallow open waters, freshwater and salt marshes, swamps, sandy beaches, mud and sand flats, rocky shores, oyster reefs, mangrove forests, river deltas, tidal pools, and sea grasses.

Estuaries provide us with a suite of resources, benefits, and services. Some of these can be measured in dollars and cents, others cannot. Estuaries provide places for recreational activities, scientific study, and aesthetic enjoyment. Estuaries are an
irreplaceable natural resource that must be managed carefully for the mutual benefit of all who enjoy and depend on them. Thousands of species of birds, mammals, fish, and other wildlife depend on estuarine habitats as places to live, feed, and reproduce. And many marine organisms, including most commercially-important species of fish, depend on estuaries at some point during their development. Because they are biologically productive, estuaries provide ideal areas for migratory birds to rest and re-fuel during their long journeys. Because many species of fish and wildlife rely on the sheltered waters of estuaries as protected spawning places, estuaries are often called the "nurseries of the sea." Estuaries have an important commercial value and their resources provide economic benefits for tourism, fisheries, and recreational activities. The protected coastal waters of estuaries also support important public infrastructure, serving as harbors and ports vital for shipping and transportation.

The water from the study area are used for various purpose such as drinking, agriculture, many micro and macro industries. Micro industries such as brick chamber, coir industries also used to this river water. So for recently there is no one seasonal changes or hydro biological studies focuses on in and around to this river estuary. Hence the present study is mainly focused on the analyzing of the physico-chemical parameters and biological diversity in Tamirabarani river estuary.