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Water is one of the most of important constituent of life support system. It is indeed a wonderful chemical medium which has unique properties of dissolving and carrying in suspensions a huge varieties of chemicals and get contaminated easily. Natural surface water bodies often have impurities from various sources. Various kinds of natural and man made activities, industrial, agricultural and other activity are day to day creating water pollution problems; particularly in fresh water system

Major lakes, rivers and reservoirs of the world are now getting polluted by various ways and thereby posing threat to the survivability of the life system on these diverse water bodies. There are a number of routes of entry of pollutants to surface water. Regular monitoring of these contaminating routes and their effective protective action plan has to be evolved for better conservation of surface water resources in future (Santra, 2005).

Limnology is the study of fresh and saline water contained within the confimental boundaries (Goldman and Horne, 1983). It is also referred as "Hydrobiology" or "Aquatic Biology".

Hydrobiology is the science of life and life processes in water. In modern context hydrobiology can be viewed as a sub discipline of ecology but in wider perspective hydrobiology includes Taxonomy, Economic biology, industrial biology, morphology, physiology etc. and the important aspect of all these disciplines is related to aquatic organisms. Much of the work closely related to limnology can be divided into lotic system ecology (flowing water) analectic system ecology (still water).

Limnology has become significant since the time of Forel (1892) in understanding the dynamics of the fresh water bodies. Limnology was studied with reference to the organisms especially planktons (Henson, 1887, Frisch 1907) which culminated in the development of more wider branch called Hydrobiology. The international association on limnology was formed by Tiedemann and Naumannin (1922). Initial systematic studies on Limnology in India were made by Ganapati (1940, 1956), Ganapati and Chacko(1951), Ganapati and Sreenivansan (1968). In recent years importance of limnology in decision making, to sort out the problems in dam construction, pollution control and aquaculture practices highlighted its application. Applied limnology has great scope in healthy existence

of natural and man made water bodies. And to harvest the natural resources at sustainable level (Goldman and Horne, 1983).

One of the significant areas of current research is eutrophication. Special attention has been paid to biotic interactions in plankton assemblage including the microbial loop, the mechanism of influencing water blooms, phosphorus load and lake turnover. Another subject of research is the acidification of mountain lakes. Long term studies are carried out on changes in the ionic composition of the water of rivers, lakes and reservoirs in connection with acid rain and fertilizers. One goal of current research is elucidation of the basic environmental functions of the ecosystem in reservoirs, which are important for water quality management and water supply.

Much of the early work of hydrobiology concentrated on the biological processes utilized in sewage treatment and water purification especially slow sand filters. Other historically important work sought to provide biotic indices for classifying waters according to the biotic communities that they supported. This work continues to this day in Europe in the development of classification tools for assessing water bodies for the EU water Frame work Directive.

Now a days it is assumed that for survival of mankind as todays way of life, it is necessary to increase our knowledge about the

environment and to acquire concomitant behaviour patterns to safeguard the proper functioning of the ecosystem. First of all the analysis of the aquatic network is the measure of the healthiness of the surrounding area.

Water is not only major component of environment but also the best solvent and a medium on which all organisms depend for their existence. A fresh water body, which provides a variety of human needs is full of value, only when if it is not abused and polluted. Therefore, it is important to gain knowledge and acquire skills to ensure the conservation of this vital resource. Animals can not live without fresh water and realization of the significance of planktons and factors controlling their growth has further coordinated the study of fresh water organisms and productivity of fresh water bodies.

The water available to plants and animals comes as a result of rainfall. Interchange of water between the earth's surface and the atmosphere, forms the water or hydrologic cycle. The two important events, which are involved in this cycle are precipitation and evapo + transpiration. In fact, water during rainfall is directly of little or no use to the organisms. It is used only after reaching to the soil. Precipitation is the result of gravitational pull on the vapor in

atmosphere. Precipitation occurs in various forms. These are drizzle, rain, snow, dew, frost, sleet and hail. Drizzle involves minute drops appearing as to float in air. Rain is the drop of liquid water and is larger than drizzle and also heavier. Snow is the moisture as solid state and dew and frost is formed due to condensation of moisture directly on the surface of objects, plants, animals, soil etc. sleet is the form of small grains or pellets of ice, whereas hail consists of balls or lumps of ice. Snow are injurious to plants, breaking tender branches, flowers and fruits. Hail and sleet also cause similar damage. Of all the above, precipitation, the rain is the most important. It is the source of soil water and also affects humidly of atmosphere. Rain in India is caused by monsoon. About 45% of the water available during annual precipitation flows in to rivers, 20% percolates in to the ground and remaining 35% is lost by evaporation (Sharma; 1998).

India has 3.4 million hectres of reservoirs and the area under tanks and ponds is estimated to about 2.2 million hectors. Every year there is an addition of man mace water bodies and these resources are spreading through the length and breadth of country. These water bodies are incorporating with variely of floral and faunal compositions useful to mankind, further, mankind has to depend on wild variefy of flora and fauna to retain and improve the genetic vigor

of economically important species on which his life quality, style and security depends. Of the earths total surface, which comprises approximately 510 million sq. km. out of which 361 million, or 71% is occupied by surface of oceans and seas. In addition, up to 2.5 million sq. km or ½%of earths surface, is occupied by inland water bodies. (Nikolsky. 1999). About three fourth of the earth surface (71%) is covered with hydrosphere, the main component of which is water. It is one of the most unusual natural, compound found on the earth. Life on earth began in sea and water is an absolutely essential component for the maintenance of the life on the earth. Further, water is found in three forms i. e., salt water, brackish water and fresh water forming marine, brackish and fresh water environments on the earth.

In Maharashtra state out of the 151,114,710 hectre area of total fresh water bodies, about 89% are is constituted by small reservoirs and tanks like Triputi reservoir. Such small freshwater bodies have been found to be much more productive than large impoundments. Therefore the real prospect of future increase in fish production appears to lie in the exploitation of these small water bodies where the factors involved in the production of fish can be properly controlled.

Water consists of primarily of a single compound H_2O. It is a universal solvent and most chemical compounds ionize readily in water and provide many radicals and considerable versatility in the rearrangement of chemical substances a hung amount of water exist on the earth in three world forms gaseous, liquid and solid (Verma 1987). The total volume of water in the remains constant as it is being constantly recycled by a system known as hydrological cycle. About 50% of water is used for power generation, 30% for irrigation, 13%for industrial consumption and 7% for domestic purpose. The industrial revolution increased agricultural activities and every growing population resulted in to maximum exploitation of water resources.

Only 3% of the global content of approximately 1.4 billion cubic kilometers of water is fresh and suitable for human use, of this again about 77.2 % is permanently frozen, 22.4% occur as ground water and soil moisture, 0.35% are contained in lakes and wet lands and less than 0.01% in rivers and streams (Water recourses, 1986). Thus fresh water is a very limited source (Shiringi, 1996).

In India we have great inland fresh water resources. In the fight against hunger and malnutrition, harvesting of these water bodies and increasing the fish production from it, therefore becomes a must. There are vast masses of impounded waters in India and every year

there is an addition of hundreds of hectres of new water masses in the form of water supply tanks, irrigation and flood control reservoirs etc. monsoon floods when the tank overflow. There is an immense scope for stepping up fish production in these tanks if suitable measures are undertaken.

The increasing demand for proteinaceus food has made it necessary to exploit more completely and efficiently the water resources other than domestic water uses especially those from inland.

Such investigations attempting to estimate the productivity of any water body involves mapping the shape and depths of the water body (Surface area and surface configurations), observations on the physical factors like temperature, humidity, rainfall, turbidity, light penetration, color of water and chemical factors like pH, dissolved oxygen free carbon dioxide, chlorinity, hardness of water and important nutrients like phosphate and nitrate and effect of pollution if any.

In biological investigation, study of micro and macro flora and fauna always provides the clear picture of the ecological relationship existing in the water body.

An investigation based on ecological appraisal can focus light on the effects of the variations in the abiotic factors on the biotic community, the inter relationship and consequent food chain.

Reservoir is an unique man made ecosystem where fluviatile and lacustrine conditions coexist. According to Jhingran (1985), the total man made reservoir area in India is about 1,094, 960.616 hectres. Out of which 40% is formed by small reservoirs and lakes. This area does not include the area occupied by rivers, natural lakes, etc.

However, with the introduction of the ecosystem concept in ecology, functional aspects along with the structural ones are also be strongly emphasized. Tansley (1931) emphasized the role of environment, with its various factors interacting with each other in his comprehensive term ecosystem, which involves all the non – living and living factors working in a complex.

When abiotic and biotic component are considered, the basic structural and functional units of nature are ecosystems. Discrete biological units consist of populations and communities, including biomes. Each population occupies a specific niche, a unique functional position with respect to other organisms with which it interacts.

There are also involved energetic of ecosystems as energy is the driving force of this system. The radiant energy is trapped by the autotrophic organisms (producers) and is transfered as organic molecule to the heterotrophic organisms (consumers). This energy flow is uni-directional and non-cyclic.

In aquatic ecosystem physico- chemical environment exert profound influence on its biotic components. It controls biodiversity, biomass and spatial distribution of biotic communities in time and space. The physical and chemical parameters exert their influence both, individually and collectively and their interaction creates an biotic environment, which ultimately conditions the origin, development and finally succession of the biotic communities (Salaskar and Yeragi, 1997). The knowledge of physico-chemical parameters along with its biological characteristics can provide clear idea about the trophic status of the water body. The inland water bodies in India except those situated at high attitude exhibit distinct seasonal fluctuations in their physico- chemical and biological features.

Therefore, the evaluation of the physico-chemical parameters and its annual minimum and maximum range in an aquatic ecosystem is very significant to determine the implementation of

species composition of fish, in order to obtain the maximum possible output in terms of fish from such water bodies. Physical parameters define those characteristics of water, that respond to the senses of sight, touch, taste and smell. Temperature, turbidity, suspended solids, colour, odour fall in this category. Water has been called universal solvent, and chemical parameters are related to the solvent capabilities of water. Total dissolved solids, pH, alkalinity, hardness, metals, organics and nutrients are chemical parameters of concern in water quality management (Abbasi, 1998).

Among the chemical factors, which play an important role in increased production of fish and the differences in the chemical constitution of waters are primarily responsible for varying fertility of the aquatic soil, on which entire fish food cycle is based. Phosphates, nitrates released in to water from bottom sediments due to microbial degradation of the highly complex dead organic substances and utilized by the chlorophyll bearing plant organisms for their assimilation. These organisms form the food of zooplankton, which in turn form the food of fish. The presence of above inorganic nutrient substances is therefore, essential for increasing the fish food. Whenever they are absent in lakes and ponds, frequent manuring with appropriate fertilizers, until there is a formation of plankton bloom in

water restoring their deficiency. The nature of bottom deposits is extremely important in the formation of nutrient substances of biological significance. If the sediments are composed of rotten organic matter derived from dead animals and plants found in the pond and fine black silt containing essentially black ferrous sulphide, the effect of the fertilizer spread at such bother will last for a longer period than the sediments of sand and mud. If productivity is to be augmented, mud bottom consisting of rotten vegetation and fine silt, should, therefore be created where there are none in fishponds. Along with the above substances, addition of calcium salts is also necessary for increasing fish production. It has been found that, fish production in "soft" water is far lower than in "hard" waters. Waters with higher concentration of carbonates tend to produce more crustaceans and, mollusks which form the food of fish (Belsare 1986).

The aquatic ecosystem divided into some basic component such as abiotic and biotic. The abiotic component includes the parameter such as heat, light, pH value of water and the biotic includes organic and inorganic compounds such as water itself. Carbon dioxide, oxygen, calcium, nitrogen, phosphates, amino acids, humic acids etc. the light intensity measured by Lux-Photometer. Turbidity index of water at different depths is obtained by Secchi's

disc. Rates of evapo-transpiration are calculated. The pH of water and mud is determined by digital pH meter. Dissolved oxygen content, free carbon dioxide content, solute contents including colloidal suspension, phosphate and nitrogen contents of water, plants and animal matters are estimated by using appropriate methods.

The biotic component of an aquatic ecosystem are classified as –

a) **Producers** : These are autotrophic, green plants and some photosynthetic bacteria. The producers fix the radiant energy and with the help of minerals derived form the water and mud, they manufacture complex organic substances as carbohydrates, proteins, lipids etc. Producers are of following types-

1) **Macrophytes** : These are mainly rooted larger plants, which include partly or completely submerged, floating and emergent hydrophytes.

2) **Phytoplankton** : These are minute, floating or suspended lower plants.

b) **Consumers** : These forms in aquatic ecosystems are heterotrophs which depend for their nutrition on the organic food manufactured by producers, the green plants, a few of insects and large fishes are carnivores feeding on herbivores. Some fish also feed on other

carnivores as well. The consumers of an aquatic ecosystem are distinguished as

1) **Primary Consumers :** These are herbivores directly feed on living plants or plant remains. They are small as well as large in size including benthic zooplanktons.

2) **Secondary Consumers :** These are carnivores, which feed on primary consumers including insects and fishes.

3) **Tertiary Consumers :** These are large fishes i.e. game fish feeding on the smaller fishes and hence tertiary or top consumer. (Sharma, 1998).

Hydrogen ion concentration (pH) is defined as negative logarithm of reciprocal of hydrogen ion activity and it is mathematically expressed as pH=log1/H where, it is the concentration of the hydrogen ion in moles per liter of the solution. The acidic and alkaline nature of water is measured by pH (an expantial scale of 1-14), pH unit is originally French as puissance hydrogen (strength of hydrogen). The acidic nature of water is denoted from controls the chemical state of many fresh water is denoted from 0-7 and alkaline from 7-14(Goldman,1983). Hydrogen ion also control the chemical state of many fresh water nutrient including carbon dioxide. Hydrogen ions (acidic) and hydroxyl ions (alkaline)both results from

ionization of water. In pure water the number acidic or nor alkaline but neutral (Micheal 1984). The main sources of hydrogen ions in natural water are carbonic acid , humic acid and mineral acids. However, presence or absence of calcium compounds in the water influence the pH.

The pH of unpolluted water occurs within a narrow range of value and major deviations from, the range , caused by natural and anthropogenic sources, may have very strong impact on the aquatic ecosystems. Physical, chemical and biological processes associated with water supply and sanitary engineering are also strongly pH dependent. Besides practically every analytical procedure associated with aquatic ecology and water pollution studies requires determinations and adjustment of pH during one step or the other (Abbasi,1998).

Hydrogen ion concentration is considered as one of the important parameter in understanding the chemical conditions of water as well as spawning and growth rate of fish if the pH below 4.0 or above pH 11.0 the water will kill fish. When pH is from 4.0 to 5.0 fish may not spawn and their growth rate will be slow. Water with pH range from 6.5to 9.0 is likely to be suited for good fish production.

Among all the biotic factors, dissolved oxygen is the most important factor in the fresh water bodies for the existence of biota as is responsible for biological and biochemical process undergoing in the water bodies. The fresh water body receives oxygen from atmospheric absorption at the surface and as product of photosynthesis from the aquatic plants and it is utilized by respiratory activities of aquatic organisms and in biochemical and inorganic chemical reactions in the water body.

The amount of oxygen involved in water depends on the surface area exposed, temperature and salinity. The amount of oxygen derived form green plants depends upon the density of plants, the duration and intensity of effective light. In undisturbed waters with thick vegetation, the photosynthesis activity of the plants produce a distinct rise in amount of dissolved oxygen, that reaches the maximum in the late afternoon and falls again at night, because of its utilization by respiration of both plants and animals. The rise and fall in the oxygen level within a day is termed as oxygen pulse. When oxygen is used up faster than it is replaced, the water quality begins to deteriorate. In absence of oxygen decomposition of organic matter will be carried out unaerobically releasing carbon dioxide, methane,

hydrogen sulphide and foul smelling organic sulphur compounds (Michael, 1984),

Entropic a wide range of dissolved oxygen content, while oligotrophic one have narrow range. Oxygen is considered to be limiting factor especially in lakes and in waters with a heavy load of organic material. Aquatic organisms have specific oxygen requirement e.g. 2-5 mg/l. for most the fishes. Subama and Sharma (1994) have recorded dissolved oxygen range between 1.6 to 7.4 ppm in a fish pond of Andhra Pradesh.

Though carbon dioxide is readily soluble in water, very little carbon dioxide is in simple solution because of the small about of it being present in the atmospheric air. Apart from this, decomposition of organic matter and the respiration of aquatic plants and animals contribute to the free carbon dioxide present. Water percolating through the revelation and soil take up carbon dioxide released from soil and air.

Carbon dioxide combines chemically with water to form carbonic acid which affects the pH of water. Carbonic acid (H_2CO_3) dissociates partly to produce hydrogen (H^+) and bicarbonate (HCO_3) ions. The bicarbonate ions decompose further forming of more hydrogen and carbonate ions. Normally about 0.5 mg/l of carbon

dioxide is present in water in simple solution. This amount of carbon dioxide is referred to a free carbon dioxide. Much more of carbon dioxide is present in the form of bicarbonate and carbonates. These sources of carbon dioxide are called as combined fixed or bound carbon dioxide.

In acidic water, where the pH is low, the combined carbon dioxide is converted into the free form, at close to the neutral pH values most carbon dioxide exists as carbonate. Thus with the increase in the carbonate and bicarbonate ions water tends to become alkaline and resist hydrogen ion fluctuations in fresh water systems. The alkalinity of neutral waters can, therefore, be defined as the amount of bicarbonate and carbonate ions present in solution.

Carbon dioxide, pH and alkalinity are directly related to each other since the pH depends upon the free carbon dioxide and bicarbonate – carbonate levels. Basically carbon dioxide plays the same role both in aquatic and terrestrial systems and plants utilize it during photosynthesis. Besides this in aquatic systems, the amount of free carbon dioxide influences the metabolic and developmental rates, orientation and movements of some aquatic invertebrates. The pH of the blood as well as oxygen carrying capacity of vertebrate

haemoglobin and respiratory pigments of invertebrates are affected by increase in the carbon dioxide concentration (Michael, 1984).

An aquatic ecosystem receives calcium from limestone, dolomite, and gypsum deposits in the catchments. Hardness in principle is total soluble calcium and magnesium salts present in water and expressed as its equivalent to carbonate. In fresh water bicarbonates are mainly associated with calcium and magnesium. These salts are useful for assimilation but, never assist to store CO_2. Hardness of water may be temporary by predominant bicarbonates and sulphates of calcium and magnesium.

It has also been suggested that, whenever hardness is lower than alkalinity it is due to carbonates. The level of hardness may range between zero to several hundred mg/l. Based on hardness, water is classified as – soft water with hardness from 0.0 – 75 mg/l, moderately hard water with hardness form 75 to 150 mg/l and very hard water with hardness from 150 to 300 mg/l (Sawyer, 1960).

Mairs (1966) has found that hardness and alkalinity are closely related with each other. Like alkalinity, hardness is important parameter in decreasing the toxic effect of poisonous element. However, hardness more than 15 mg/l is suitable for fish growth Magnesium hardness particularly associate with the sulfate ions has

flexative effect on person unaccustomed to it. Magnesium concentration less than 50 mg/l are desirable in potable waters. Calcium hardness presents no public health problem.

Though the terms "acidity", "alkalinity" and "neutrality" are in common use they refer to complex chemical situations. Acidity indicates the total available acid as well as the concentration of hydrogen ions. Water is said to be alkaline when concentration of hydroxyl (OH) ions exceed that of the hydrogen (H+) ions. Chemically pure water is neutral having equal amounts of hydrogen and hydroxyl ions.

In acid waters, productivity is low because, acidity not only inhibits nitrogen fixation, it also prevents the recirculation of nutrients by reducing the rate of decomposition. Alkaline waters are generally known to show high biological productivity. The presence of calcium carbonate improves aeration permeability indirectly by increasing the particle size of the soil due to flocculation of colloidal humus gel. Moreover, the ability of these colloids to interact with neutral salts results in the reduced production of hydrogen. This inhibition of hydrogen liberation brings about favorable conditions for rapid bacterial decomposition of the organic matter accumulating at

the bottom. Nutrients thus get released into the system favoring production of plant materials.

Alkalinity in natural waters is generally due to the presence of carbonates, bicarbonates and hydroxides. Alkalinity test therefore involve the chemical determination of these salts. two indicators, namely phenolphthalein and methyl orange and standard solution of strong acid are used. The alkalinity of the water samples that could be attributed to each of these salts is determined separately. (Michael, 1984). Natural color of the water samples, turbidity and presence of chlorine can effect the results. The phenolphthalein alkalinity is an indicator of higher rate of carbon assimilation.

The range of total alkalinity in Indian waters may be found from 40 mg/l to over 1000mg/l. Speence (1964) divided South Scottish lakes in three major categories based on alkalinity viz. –

i) Nutrient poor with alkalinity ranging from 1.0 to 15.00 mg/l.

ii) Moderately rich with alkalinity ranging from 16.0 to 60.00 mg/l.

iii) Nutrient rich with alkalinity ranging greater than 60.00 mg/l.

In large quantities, alkalinity imparts bitter taste to water. The principle objection to alkaline water, however, is the reactions that can occur between alkalinity and certain cations in the water. The

resultant precipitate can foul pipes and other water systems. (Abbasi, 1998).

Acidity of most of the natural waters, domestic sewage and industrial waters results from strong mineral acids such as HCl and H_2SO_4, weak acids such as carbonic acid and oxidizable ions of aluminum and manganese. In neutral unpolluted waters, the acidity is mainly contributed by dissolved carbon dioxide, through the acid produced by the reaction of carbon dioxide with water. In industrial waste waters, mineral acidity is frequently un countered. Acidity may influence the equilibrium and reaction rates of chemical and biological processes. Acidity is one of the important parameter considered during the treatment of water and waste water. Neutralization, lime soda water softening and CO_2 removal by aeration are some of the important treatment processes where acidity measurements are used (Abbassi, 1998).

Chlorides occur practically in all waters and waste waters and are often a major inorganic constituent. In natural waters, chloride results from the leaching of chloride containing rocks and solids with which the water comes in contact. In coastal regions salt water intrusion may contribute to the chloride content of inland waters.

Discharge of agricultural, industrial and domestic waste waters could also be a source of chlorides in natural waters. Water softener also adds the chloride content of the water. Human excreta contains about 6 gms chloride per person per day. Chlorides may impart salty taste to water, depending on the cation constituents. Some waters containing 280 mg/l may have typically salty taste, if the main cation is sodium, whereas in some other waters this taste may be absent even when chloride content is as high as 1000 mg/l if the predominant cations are calcium and magnesium. High calcium content may harm metallic pipes and structures. High chloride content in irrigation water may be harmful to many plant species (Abbasi, 1998)

Nutrients are the elements essential for the growth and reproduction of plants and animals, and aquatic species depends on the surrounding water to provide their nutrients. Although a wide variety of minerals and trace elements can be classified as nutrients, those required in most abundance by aquatic species are carbon, hydrogen and phosphorus. Carbon dioxide from the atmosphere, alkalinity and decay products of organic matter all supply carbon to the aquatic system. In most cases hydrogen and phosphorous are the nutrients that are the limiting factors in aquatic plant growth.

Phosphate – phosphorus is generally recognized as key nutrient in maintaining the producing of water. Hutchinson (1957) demonstrated that phosphorus is one of the major nutrients responsible for biological productivity. The main supply of phosphorus in natural waters comes from the weathering of phosphorus bearing rocks, leaching of soil of catchments area by rain, cattle dung and night soil (Jhingran, 1982). Other factors regulate the phosphorus content of the water bodies are the rate at which inorganic phosphate lost in the mud, bacterial activity, sewage contamination, agriculture fertilizers, pH of water and soil, aquatic vegetation, phytoplankton etc. There are several forms of phosphate, which may be present in aquatic systems in soluble or particulate form. These include orthophosphate, poly or metaphosphates and organically bound phosphates. 85% of total phosphorus is present in organic form constituting organism matter and remaining 15% phosphorous (as orthophosphates) plays a dynamic role in an aquatic ecosystem. When available supply is increased, overgrowth of aquatic plants usually results with severe consequences. In aquatic ecosystem, phosphorus is lost due to retro gradation of acid phosphates and alkaline soils forming insoluble ferric- calcium and aluminum phosphates and absorption on mud sediments as ferric hydroxide.

The phosphorus in mud is released from iron (ferric) phosphorous complex which is reduced to soluble ferrous form in the absence of oxygen and liberates the phosphorus. The rate of phosphorus release is regulated by the interaction of nutrients, soil texture, abiotic and biotic factors, and pollution potential and biological activity and the phosphorus more than 2 mg/l in open waters gives sign of organic pollution (Pomeroy *et. al* 1965). High phosphates are used extensively as foam builders in detergents and organic phosphates are the constituents of body waste and food residue. Phosphorus is not toxic in the concentration it usually occurs in water and does not represent any threat to the health of human and other organisms it does not represent a serious indirect threat to water quality. Phosphate can also interfere with water ferment processes, for example concentration as low as 0.2 mg/l interfere with the chemical coagulation of turbidly (Abbasi, 1998).

Nitrogen plays an important role in the synthesis, maintenance of proteins and productivity of water. It is an important nutrient in aquatic ecosystem. Nitrogen occurring in the fresh water is in the form nitrogenous compounds Nitrogen is mostly derived from atmosphere and denitrifying bacteria, giving nitrates, nitrites and ammonia. The nitrogen in the water occurs as bound forms like

nitrate, nitrites, ammonia and organic nitrogen viz. nitrogenous compound may be derived form outside sources like rain surface run off and seepage. In aquatic ecosystem nitrogel level, is regulated through precipitation, atmospheric solution and volatilization under meteorological process, sedimentation influence nitrogen fixation. Nitrates are the products of oxidation of organic nitrogen by the bacteria (a minifying bacteria, nitrosomonas and nitro-bacter) present in soil and water, where sufficient amount of oxygen is available. High concentration of nitrates is useful in irrigation but their entry in the water resources increase the growth of nuisance algae and trigger eutrophication. In Indian waters, wide ranges of variations in its concentration have been reported i.e. from its absence to presence in traces to 251.2 mg/l (Kyusha and Saxena, 1999). Consumption of high nitrate content (740 mg/l) drinking water may cause blue baby disease in human beings.

Primary production is one of the most important source of energy input in fresh water ecosystem. The aquatic autotrophs synthesize their basic food by transformation of solar electromagnetic waves to chemical energy. Therefore it is dependable parameter for assessing the potential energy resource of the aquatic ecosystem. Primary productivity is defined as the rate with which inorganic

carbon(CO_2) is reduced to sugar ($C_6H_{12}O_6$) through photosynthesis. It is represented as –

$$6CO_2 + 12\ H_2O + 708K\ cal \longrightarrow C_6H_{12}O_6 + 6\ H_2O + 6O_2 \uparrow$$

It is the basic step through which radiant energy form red (T680) and far red (T700) portion of visible spectrum is transferred into biological energy of carbohydrates, for instance the synthesis of one molecule of glucose from water and carbon dioxide involves the intake of 708 k cal of light energy. The phytoplankton fixation of carbon dioxide and its quantitative measurement of organic matter is a vital index of the product on potential of the ecosystem. Phytoplankton constitutes a major autotrophic component in fresh water ecosystem. The energy available to support the functions of an ecosystem can be evaluated by estimating periodic variations of primary production (Paul and Verma, 1999). Primary production of an aquatic ecosystem is the main reservoir of energy. The total primary organic production in an aquatic ecosystem is very often used for the assessment of the fishery resources.

The primary production is not constant but goes on changing from place to place and season to season. This is mainly due to variability in temperature, light illumination; carbon and minerals etc. pH, dissolved oxygen, free carbon dioxide, total alkalinity, nitrate,

phosphate and primary productivity are the important parameter which determine the chemical characteristics of pond water.

There is an intricate link between the physical and chemical parameters and living communities in water. For example temperature and DO determines to a very large extent the type and number of organism in water, but at the same time more presence or absence of living organisms would indicate the healthy or unhealthy state of affairs respectively. Water may serve as a medium in which literally thousands of biological species spend part, if not all of their life cycles. Aquatic organisms range in size and complexity from the smallest single celled micro organisms to large fishes, mammals and amphibians. A body of water hosting large number of species with well balanced, number of individuals is considered to be healthy system. When water gets polluted, the organisms sensitive to that type of pollution begin to die or migrate and the dominance of species and population shift towards tolerant organisms. Thus, based on their known tolerance for a given pollutant, tolerant organisms can be used as indicators of presence of pollutants (Abbasi, 1998).

The important abiotic factor that influence the fish production in small water bodies are depth of water, water level and shallow areas, wave action erosion and silt temperature color,

transferency and chemical factors, the shape size and depth of farm determine the relative amount of shallow waters. The greater the area of shallow water, the greater the biological productivity. Hence depth and not volume of water is most important factor determining the farms fish producing capacity. A farm of 20ha with an average depth of 20m would produce less fish than a farm of the same area but with average depth of 5m shallow farms, as it provides greater abundance of food weed beds for shelter suitable spawning grounds for fish (Belsare, 1986).

Pioneer work on plankton of Indian water has been carried out by Ganpati (1943), Philipose (1967). Extensive studies have been done on zooplanktonic community, specially regarding their identification and faunistic composition. (King 1972, Chandrasekher and Kodarkar 1994, Murugan *et. al.* 1998, Angadi 1985, Hujare 2005, Samba Ka *et. al.* 2006, Roman M. R. *et. al.* 2000, 2001).

In biological investigation, study of micro and macro flora and fauna always provide a clear picture of the ecological relationship exiting in the water body. The micro floral and faunal composition of the water bodies include planktonic forms. Plankton act as both, predator and consumer, plays an important role in

transformation of energy from one trophic level to the next highest, ultimately leading to the fish production which is the final product of the aquatic environment.

The phytoplankton's are microscopic plants forming communities, which live mostly suspended in water. the communities are found in marine, brackish and fresh water environments. Phytoplankton belongs to the most primitive plant groups. Various divisions of algae, bacteria and fungi, only algae possesses chlorophyll and other pigments together with biochemical systems which enable them to carry out carbon assimilation in presence of light, carbon dioxide, water, nutrient and trace organic substances such as vitamins. Because of the ability of many planktonic algae to synthesize organic mater in excess of their own respiratory requirement, the phytoplankton's are called primary producers. In many aqueous environments they form the basis of food chain or web and are frequently called the "grass of the sea" (Danial and Lepedes, 1974).

Planktons may be notorious as well. Blooms pose great problem in fish culture and may cause mass fish kill. Cultivated fish often get algae taint, which makes them disagreed in flavor and consequently less saleable. The common planktons of Indian water are:

1) **Phytoplankters** : Diatoms (Bascillariophyceae). Green algae (Chlorophyceas), Blue alage (Cyanophyceae), *Flagellate* (Euglenineae), *Volvox, Euglena, Ceratium, Anabena, Oscillatoria, Actinastrum, Closterum, Pediastrum, Microcystis, Scenedesmus* etc.)

2) **Zooplankpers** : Protozans (*Diffulugia, Arcella*, and many ciliates), Rotifers (*Keratella, Polyarthra, Pedalia, Brachionus, Filinia, Asplancha* etc.) Crustaceans (Cladocerans : *Daphinia, Ceriodaphnia, Moina, Simocephalus*) and Copepods : (*Cyclops, Diaptomus, Cypris* and Crustaceans Larvae *Nauplius*) (Shrivastava, 1988)

Lakes, ponds and tanks are standing water ecosystems and their ecology differs from those of running water ecosystems of the fresh waters, however in some respect common features are manifested. Littoral zone near the shore, rooted plants and in limonitic zone plankton also develops in lakes depending upon the depth to which sunlight can penetrate. A profoundal zone of deep waters with heterotrophs is equally developed. Unlike the case in rivers, in lakes the plankton shows a characteristic uneven distribution vertically. Also, zooplanktons are predominent over the phytoplankton. Crustaceans are the most important among the zooplankton. It may be

noted that plankton of lakes comprises "True Plankton" produce locally in the standing water of the surface to the depth sun light can penetrate, and also differ from "drift planktons" of the streams. (Shrivastava, 1988).

Unicellular organisms play a considerable role in the lives of the fishes. Many fishes in the early stages of their life eat various protozoa but they have no substantial significance as food for adult fishes. Protozoa have very great adverse effects upon fishes, many of them being the causes of serious diseases of fishes.

Only a few studies (Anithakumari and Aziz 1989 Maya *et al* 2000, 2001, Maya 2002) are available on temples ponds of Kerala. Several research workers, all over the world have made contribution in the field of limnology. Their study is mainly based on large man made reservoirs and lakes or North America, Canada, Europe etc. They have studied in detail some of the hydrobiological aspects of fresh water bodies. Notable among these workers are Judey (1932), Fish (1969, 1975), Burchart *et al.* (1982), Reinertsen (1982), Maaehl (1982), Toyama(1982), Steintzkannam(1983), Overbeck *et al.* (1982), Conzonno *et al.* (1983), Schiavone Jr.(1983). But very little work seems to have been done on the small water bodies from the tropical and subtropical regions.

In India workers like Chacko (1949, 1950), Ganapati(1940, 1956, 1957, 1962), Vijayaraghavan (1971, 1973) have done some hydrobiological work on shallow water bodies, temple tanks moats and village ponds.

Considerable literature exist on the limnology of several Indian freshwater lentic ecosystems [Ganpati 1940, Rao and Govind 1904, Zafar 1966, Sreenivas 1974, Munawar 1970), Pioneer work on plankton of Indian waters has been carried out by Ganpati (1943), Philipose (1967). Much work has been done in India on the algal flora [Gonzalves and Joshi 1946, Philipose 1960, Zafar 1966, Palmer 1984 Panday and Tripathi 1988].

Much of the work has been done on zooplanktonic community, specially regarding their identification and faunistic composition (George 1966, Michael 1969, King 1972, Chandrasekhar and Kodarkar 1994, Muragan *et al.* 2001). Some important contributions on primary productivity studies on Indian waters are those of Sreenivasan (1998), Ganpati and Sreenivasan 1970, Ganpati and Pathak (1969), Sumitra (1971) and Khan (1984). Most of the work on aquatic macro vegetation in India in earlier phase was carried out by some workers (Biswas and Calder 1964, Philipose et at 1970, Unni 1971).

Considerable hydrobiological investigations are carried out on the man made lakes and reservoirs in Maharashtra (Kamat 1965, Goel *et al* 1988, Goel and Chavan 1991, Bhosale *et. al.* 1994, Sathe *et. al.* 2001, Hujare 2005, Pailwan 2005, Khabade 2007.

Reasons for undertaking the present investigation :

Following reasons led us to undertake present investigation on Triputi Water reservoir.

1) Most of the hydrobiological studies were carried out in the lakes, tanks and reservoirs near the urban areas to evaluate the intensity of pollution. The reports on the studies of water bodies in rural areas are meager. Thus there is lack of baseline data on all hydrobiological characteristics of reservoirs situated in rural areas.
2) Triputi is a small village in the rural area near Satara city. The village is solely dependent on the water from this old reservoir. Water from the reservoir is used for drinking and other purposes by a population of 3000. Hence it is absolutely essential to access the quality of water from this reservoir.
3) The study has been designed to understand hydrobiological characters of the reservoirs and identify the factors governing the water quality which determine the potability of water and the suitability for fish culture.
4) In connection with the above reasons to undertake study of the Triputi water reservoir following objectives were also determined.

Physico-chemical parameters such as temperature, light penetration zone (transparency of water to light) pH, DO, free CO_2 total alkalinity, total hardness, chloride, phosphate, nitrate, TDS, TS, TSS.

5) The biological parameters such as phytoplanktons, zooplanktons and aquatic macrophytes are much more important in any water body because they acquire important position in the trophic structure of that ecosystem. More over several species of phytoplankton and zooplankton and aquatic macrophytes can play great role in early detection and monitoring the pollution of Triputi water reservoir. It is necessary to identify phytoplankton and zooplankton.

6) In the present investigation an attempt has been made to evaluate the important physico-chemical parameters, biological parameters such as phytoplankton and zooplankton, fish fauna of the Triputi reservoir.

7) Based on above mentioned reasons and the objectives and knowing the importance of water quality of Triputi reservoir the present investigation was undertaken.

Plan of the present work :

Initially four sampling sites are to be selected in the reservoir taking into account the human activities. The sample was collected during early morning hours in through out one year.

Choice of techniques :

Hydrobiological studies :

Well known methods for hydrobiological studies were used (Goel, Trivedy 1983, K. S. Rao 1993, APHA – 1985). Various physical, chemical and biological parameters were observed through out the year. Temperature, transparency, TDS, TSS, TS, pH, dissolved oxygen, free CO_2, hardness, total alkalinity, chloride, phosphate, nitrates, phytoplankton, zooplankton and fish fauna were studied.

Presentation of the Dissertation :

The dissertation of present investigation is divided into five chapters. First chapter is on introduction, review of literature on hydrobiological studies and related work. The reasons that stimulated to undertake the present investigation and plan of the proposed research work. The second chapter deals with material and methods employed in the present investigation. Chapter third is confined on results (observations) of physico-chemical parameters of Triputi reservoir near Satara city. Fourth chapter will include discussion on present investigation. Fifth chapter comprises the general summary and concluding remarks. The references cited in the various chapters will be summarized at the end of the dissertation as bibliography.