The water in a river is usually confined to a channel, made up of a stream bed between banks. In larger rivers there is also a wider floodplain shaped by flood waters over topping the channel. Floodplains may be very wide in relation to the size of the river channel. This distinction between river channel and floodplain can be blurred especially in urban areas where the flood plain of a river channel can become greatly developed by housing and industry.

The excellent works on limnology were done by Welch (1952), Green (1960), Needham and Needham (1962), Pennak (1978), Hutchinson (1991), Edmondson (1997), APHA (2005), Brooks and Dodson (2005), Krishnamurti and Shakthivel (2007).

These aquatic habitats and their biota have been extensively investigated since the early 19th century and interest has grown rapidly in recent years due to the rising demand for water and fish, and the need for managing the water quality. A comprehensive review of aquatic resources and the status of limonolgical/ hydrological research (both pure and applied, including physical and chemical limnology) in India, has however never been attempted. Two brief over view were published in 1980 in hydrobiologia in a volume dedicated to late Prof. S. V. Ganapati (1995) on the occasion of his 80th birthday.

The studies on some of the water bodies and from certain geographic areas which have been investigated in detailed for many years have been summarized in several publications by Unni (1997), Krishnamurti et al., (1994).

The physiochemical parameters such as temperature, light, pH, organic and inorganic constituents and the interrelationship with their organisms play an important role in determining the nature and pattern of fluctuation of population densities of zooplanktons in an environmental unit. The importance of these factors has been stressed by several workers including Arora (1966), John et al., (1980), Rajendra (1992), Kodarkar (1992) and Desilva
Phytoplanktons have often been utilized to evaluate the overall health of an estuarine ecosystem and in management strategies to ensure sustainable use of the estuaries. Earlier investigations on the three variables in the Mandovi and Zuari estuaries include studies by Devassy and Goes (1988, 1989) and Krishnakumari et al., (2002), who proposed a three-season regime in the biology of the estuaries; other authors noted a similar pattern in primary production (Dehadrai and Bhargava 1972; Bhattathiri et al., 1976; Devassy 1983).

Limnological studies on Indian rivers are comparatively scanty. Prominent studies in this regard’s is of Ganpati (1943) who made the report on zooplankton in a garden river Arora (1966), Balani and Sarkar (1965), Arora et al., (1973) Kaul (1977), Yadav et al., (1987).

There is indication that the headwaters to mouth, the physical features vary significantly within a lotic water system and present a continuous gradient of physical variations, which evolves association within biota and other a-biotic features (Pathani and Upadhyay, 2006). Thus the biota of an aquatic ecosystem directly reflects the conditions existing in the environment (Bhatt et al., 1984). Monitoring of zooplankton communities is needed to allow us to predictively model the ecosystem (Deborah and Robert, 2009). The Zooplankton are known not only to form an integral part of the lotic community but also contribute significantly to the biological productivity of the fresh water ecosystem (Makarewicz & Likens, 1979). Zooplankton populations can expand in rivers by growth of the suspended organisms (Talling & Rzoska, 1967) or by the hatching of resting eggs in river sediments (Moghraby, 1977).


Majority of the water bodies in India are temporary, shallow or exhibit such large washer level changes annually that a large proportion of the basins is exposed to drying. The survival strategies of the zooplankton have been reported in a few studies and examined in some detail recently by Khatavkar (1992).

The planktonic study is a very useful tool for the assessment of water quality in any type of water body and also contributes to understanding of the basic nature and general economy of the lake (Pawar et al., 2006). In these systems phytoplankton is of great importance as a major source of organic carbon is located at the base (Gaikwad et al., 2004).
The maintenance of healthy aquatic ecosystem are dependents on the abiotic properties of water and the biological diversity of the ecosystem (Harikrishnan et al., 1999).

The monitoring of water quality of Narmada River was carried out for one year by Sharma et al., (2011). The seasonal variation in physicochemical properties and distribution of diatom species was studied at estuaries of Dakshina Kannada and Udupi Districts for a period of one year by Shruthi et al., (2011). A study has been carried out on the physico-chemical status of Muthupettai mangrove, South east coast of India by Srilatha et al., (2012). Seasonal variations in physico-chemical parameters of Vellar River, Vellar Estuary and Portonovo Coastal Waters, Southeast coast of India were worked out by Prabhakar et al., (2011). Mohamed et al., (2012) examined the levels of varying physico-chemical parameters such as temperature, salinity, pH, alkalinity, dissolved oxygen, biological oxygen demand and chemical oxygen demand of five different environs along the Thondi coastal waters, southeast coast of India. The temporal and spatial distribution of salinity, DO, BOD, turbidity, pH, hardness and dissolved nutrients of surface water collected from different points of Dhamra estuary were measured by Muduli & Panda (2010). An assessment of the nutrient profile and biotic components of Mahi estuary and Vamleshwar mangrove of Gulf of Kambhat, Gujarat, India A study was carried out to determine the physico-chemical characteristics and heavy metals in water and sediments in Uppanar Estuary, Nagapattinam, Southeast coast of India by Sankar et al., (2010). Statistical evaluation of hydrobiological parameters of Narmada River water at Hoshangabad City, India was carried out by Shraddha et al., (2008).

A study on population dynamics and seasonal abundance of zooplankton community in Narmada River was carried out by Sharma et al., (2010) and they found that Rotifera was the most dominant group among Protozoa, Cladocera and Copepoda which were reported from the estuary.

Annalakshmi & Amsath (2012) investigated the composition, abundance, frequency of occurrence and diversity of net zooplankton species inhabiting in river Cauvery and its tributaries Arasalar at Kumbakonam, Tamil Nadu. The spatial, temporal and tidal dynamics of zooplankton communities of Kodaikkari coastal waters were investigated by Damotharan et al., (2010) to study the role of physico-chemical parameters in determining zooplankton distribution.

Plankton are organisms of relatively small size mostly microscopic, which have either relatively small powers of locomotion or else none at all and which drift in the water subject
to the action of waves, currents and other forms of water motion and is essential links in food chain in aquatic system (Kumari et al., 2014).

Stream or a river channel is said to be a basin containing flowing water from a major river. The channel is described physically in terms of length, width, depth and slope and most of the streams flow in valley have a control over the major river (Wetzel and Likens, 1991). The hydrological, chemical and biological characteristics of a stream or river reflect the climate, geology and vegetational cover of the drainage basin. (Likens, 1970) In the recent past, the quality of the water in Indian rivers has been deteriorating due to continuous discharge of industrial wastes and domestic sewage (Dyniel and Wood, 1980, kumar et al., 2001). The nutrient rich water in warm climate promotes huge growth of aquatic weeds and algal blooms (Altab Alam, 1995). A great damage to the riverine biota, particularly fish population as a result of alteration of physico-chemical parameters at Dalmianagar (Sinha, 2002). The quality of water is usually determined by its physical and chemical characteristics.

**Community structure and dynamics**

Numerous studies have been made on the species composition, population densities and their seasonal dynamic in phytoplankton and zooplankton communities of all kinds of water bodies throughout the country. These studies had begun in late 1930s in relation to the food availability for fishes but in recent years, these studies have focused on the relationship with water quality (particularly eutrophication and organic pollution) and have been extended also to the benthic communities.

Phytoplankton converts solar radiant energy into biological energy through photosynthesis as primary production. It plays an important role in conditioning the microclimate, helps in regulating the atmospheric level of O2 and CO2, vital gases for life. Apart from primary production, phytoplankton plays an important role as food for herbivorous animals. Distribution of phytoplankton and their variation at different zones of a water body is known to be influenced by physico-chemical parameters of water. Phytoplankton study provides a relevant and convenient point of focus for research on the mechanism of eutrophication and its adverse impact on an aquatic ecosystem. Algal flora constitutes a vital link in food chain and its productivity depends on water quality at a given time (Meshram and Dhande, 2000).

Planktons are minute organism and is essential links in food chain in aquatic system. Phytoplanktons and zooplanktons are the major group of planktons. Phytoplanktons play a phenomenal role in the biosynthesis of organic material while zooplankton forms important
components of secondary production. The zooplankton forms of link between phytoplankton and micro invertebrates which in turn provide food to fishes and aquatic birds. Planktonic primal in fresh water are dominated by rotifers, cladocera and copepods. Rotifers are most sensitive bio indicators of water quality and their presence may be used as a reference to the physio-chemical characteristics of water (Hafsa & Gupta 2009).

Planktons are of immense value as food and play an important role in the disposal of sewage and in the natural purification of polluted water. However some plankton from a harmful bloom that may cause high mortality among the aquatic organisms and pose a serious hazard in the water supply for domestic and industrial use (Hasan et al., 2010).

**Phytoplankton communities:-**

Phytoplanktons are limited to the uppermost layers of the ocean where light intensity is sufficient for photosynthesis to occur. The light incidence at different depths of water depends on a number of factors, like absorption of light by the water, the wave length of light, transparency of the water, reflection from the surface of the water, reflection from suspended particles, latitude and seasons of the year. When light strikes the surface of the water, a certain amount of light is reflected the amount depends on the angle at which the light strikes the surface of the water. For most phytoplankton, the photosynthetic rate varies with light intensity. Different species have different curves of photosynthetic rate when plotted against light intensity, giving different optimal light intensified for maximum photosynthesis.

The phytoplankton in a water body is an important biological indicator of the water quality. While phytoplankton are important primary producers and the basis of the food chain in open water, some species on the other hand can be harmful to human and other vertebrates by releasing toxic substances (hepatotoxins or neurotoxins etc.) into the water. Proliferation of harmful organisms, particularly species should be monitored. Phytoplankton studies and monitoring are useful for control of the physico-chemical and biological conditions of the water in any irrigation project. Therefore certain groups of phytoplankton, especially blue green algae, can degraded recreational value of surface water, particularly thick surface scum, which reduces the use of amenities for contact sports, or large concentrations, which cause deoxygenation of the water leading to fish death (Whitton and Patts, 2000).

Over the last few decades, there has been much interest in the processes influencing the development of phytoplankton communities, primarily in relation to physico-chemical factors (Akbay et al., 1999; Peerapornpisal et al., 1999; Elliott et al., 2002). The algae co-
occur even though each species has a specific niche based on its physiological requirements and the constraints of the environment. These are many detailed descriptions of phytoplankton succession being correlated with changes in environmental parameters particularly temperature, light, nutrients availability and mortality factors such as grazing and parasitism. Because the variation of phytoplankton succession is strongly linked to meteorological and water stratification mixing processes, patterns in temperate ecosystems differ considerably from those of tropical waters (Wetzel, 2001).

Phytoplankton is of great importance as a major source of organic carbon located at the base (Gaikwad et al., 2004). Their sensitivity and large variations in species composition are often a reflection of significant alteration in ambient condition within an ecosystem (Devassy and Goes, 1988, 1989). Hence for any scientific utilization of water resources plankton study is of primary interest. Several studies on phytoplankton diversity made in India and abroad on the ponds, lakes and reservoirs (Tiwari and Chauhan, 2006; Sridhar et al., 2006; Senthikumar and kumar 2008) also revealed the importance of this type of study. In this paper an attempt has been made to study the seasonal variation of phytoplankton diversity and dynamics of a part of Chatla floodplain lake and its correlations with the physico-chemical properties of water. This study may be of help to the poor people of Chatla as abundance of phytoplankton is of considerable assistance in evolving fish culture programmes (Bohra and Kumar 2002).

Das and Panda (2010) studied Water Quality and Phytoplankton Population in Sewage Fed River and reported that the deterioration of water quality in the river due to industrialization and human activities. Intensive studies concerning the pattern of colonization and succession of phytoplankton’s from diverse sites of Indian subcontinent has earlier been highlighted (Bhowmick and Singh 1985; Bahura 1991; Tripathy and Pandey 1990; Vyas and Nama 1990; Pradhan et al., 1998, Mishra 2005). But such type of studies in Mahanadi River are limited (Samantray et al., 2009).

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The phytoplankton studies however suffer from the fact that the majority of them have employed nets with mesh size of 50-60 µm and the Sedgwick Rafter cell has often been used to count them. Both methods result is gross underestimation of species richness as well as population densities. A few reports on primary production by different methods suggest that the phytoplankton of India lakes and reservoirs (and also probably the rivers) are dominated by nanoplanckton (Pandey & Singh 2002).

**Zooplankton communities**

The zooplanktons are animal plankton and move at the mercy of water currents. They occupy central position between the autotrophs and other heterotrophs in an aquatic ecosystem and form a major link in the entire food chain and main energy source for fishes truly planktonic animals in fresh waters are dominated by Rotifera, Cladocera and Copepoda. Protozoans also form a significant part of fresh water Zooplankton.

Zooplanktons are microscopic animals that eat other plankton. Zooplanktons occupy a central position between the autotrophs and other heterotrophs and form an important link in food web of the freshwater ecosystem. Zooplanktons constitute the food source of organisms at higher trophic levels. The Zooplankton and fish production depend to large degree on the phytoplankton (Boney 1975). Zooplankton is a good indicator of changes in water quality because it is strongly affected by environmental conditions and responds quickly to changes in environmental quality. The major Zooplankton groups vary in their relative abundance and they belong to these groups Rotifera, Cladocera, Copepoda, and Ostracoda. In ecologically, Zooplankton are one of the most important biotic components influencing all the functional aspects of an aquatic ecosystem, such as food chains, food webs, energy flow and cycling of matter ( Dadhick and Sexena 1999; Sinha and Islam 2002). The distribution of Zooplankton community depends on a complex of factors such as, change of climatic conditions, physical
and chemical parameters and vegetation cover. Most of the species of planktonic organisms are cosmopolitan in distribution (Mukherjee 1997).

Studies on the Zooplankton communities of rivers are very few. The studies on River Yamuna Chakraborty et al., (1959). Show large spatica and temporal variations and a dominance of rotifers in polluted section of the river. The overall species richness appears to have declined with growing levels of pollution. Zooplankton in River Ganga have been investigated only in certain stretches but the result are highly variable that making it impossible to draw any conclusion about their seasonal trend or along the river course Krishnamurti et al., (1991).

The dominance of Zooplankton in shallow water bodies by rotifers cladocera or copepods varies according to the degree of organic pollution Moitra & Bhowmik, (1968), Verma & Munshi, (1995). The studies on the impact of pollution due to sewage and industrial effluents in different rivers is well studied (Saha et al., 1985; Tiwari and Ali 1987). Prasanna (2011) studies the qualitative and quantitative studies of zooplanktons in Rajura Lake and reported 20 genera belonging to four major groups i.e. Rotifera (five genera), Cladocera (six genera), Copepoda (six genera) and Ostracoda (three genera). The Zooplankton and fish production depend to large degree on the phytoplankton (Boney 1975).

Zooplanktons are often an important link in the transformation of energy from producers to consumers Shastree and Pathak, (1993), due to their large density, shorter life span, drifting nature, high group or species diversity and different tolerance to the stress, Zooplankton are being used as a indicator organisms for the physical, chemical and biological process in the aquatic ecosystem Ganguli (1999). Pawar and Sharma (2001) started that the species richness and evenness were inversely related to the Zooplankton biomass. Patil et al., (2013) observed that cladocera and meroplanktonic larva reached peak abundance in saline water mass. Mishra (2005) noticed that displacement volume were higher at those stations where swarms of hydromedusae and ctenophores occurred.

Ganapati (1955) observed that environmental parameters like saliity, dissolved oxygen, BOD and nutrients directly influence the abundance and diversity of zooplankton. Rajput (1996) studies the close association between salinity changes in the environment and abundance of Zooplankton. Spatial and temporal distribution of zooplankton in relation to salinity showed their preference to specific salinity regimes in the Vishishtha – Godavari
estuary and in other Indian estuaries. Salinity is attributed as an important factor regulating distribution of copepods species in nearshore areas Kolkwitz (1908), Nassar et al., (1998), Hussain and Ahmed (2002). Observed that the environmental parameters such as water temperature, salinity, cloud cover, wind force, rainfall and tide influence the distribution and abundance of Zooplankton.

Copepod dominate the marine Zooplankton community and often contribute over 90% of the total Zooplankton count in near shore and estuarine habitat Chaturvedi (1999). Copepod as the major herbivore community 76% - 83% to total Zooplankton population. Decapods were relatively more in the outer (average 11%) as compared to interior zone (average 7%) Naik et al., (2001).

Therefore, the successful reproduction of these ‘herbivorous’ Zooplankton depends not only on an adequate supply of phytoplankton, but also on sufficient supply of appropriately sized ‘animal’ food. Phytoplankton functions best, it seems, only as ‘baby food’ for many Zooplankton species, therefore a vigorous population growth cannot be expected if that is the only food that is provided in abundance. The density of an organism depends upon the availability of suitable food material Khanna and Malik (1999).

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green algae, can degraded recreational value of surface water, particularly thick surface scum, which reduces the use of amenities for contact sports, or large concentrations, which cause deoxygenation of the water leading to fish death (Whitton and Patts, 2000).

The dynamics of phytoplankton are a function of many of the some environmental processes that affect species diversity. For example, the onset of the spring bloom in dimitic lakes is controlled by the relief of light limitation at a time when nutrient concentrations are high and growth abundance is low (Roelke and Buyukates, 2002). The abundance of algae of different kinds is rather closely associated with restricted seasonal periodicity, differing of course in widely separated geographical locations (Smith, 1951). Within reservoirs, the irregular dynamics of inflow and variable flushing rates markedly alter environmental conditions for biotic communities. A reservoir can be viewed as a very dynamic lake in which a significant portion of its volume possesses characteristics of, and functions biologically as, a river (Wetzel, 2001).

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Zooplankton assume a great ecological significance in ecosystem as they play vital role in food web of the food chain, nutrient recycling, and in transfer of organic matter from primary producers to secondary consumers like fishes (Krishnamurti et al., 1979). They are more abundant within mangrove water ways than in adjacent coastal waters, and a large proportion of the juvenile fish of mangroves are Zooplanktivorous (Robertson and Blabber, 1992). The zooplankton determine the quantum of fish stock. The failure of fishery resources
is attributed to the reduced copepod (zooplankton) population (Stottrup, 2000, Sharma et al., 2013). Hence, zooplankton communities, based on their quality and species diversity, are used for assessing the productivity viz-a-viz fishery resource, fertility and health status of the ecosystem.

Zooplankton species have different types of life histories influenced by seasonal variations of biotic factors, feeding ecology and predation pressure. Zooplankton forms a major link in the energy transfer at secondary level in aquatic food webs between autotrophs and heterotrophs (Deivanai et al., 2004). The distribution and diversity of zooplankton in aquatic ecosystems depend mainly on the physicochemical properties of water (Harikrishnan and Azis, 1989). Zooplankton communities of fresh water bodies constitute an extremely diverse assemblage of organisms represented by most of the invertebrate phyla (Kumar et al., 2001, Kanagasabapathi and Rajan, 2010).

Zooplankton includes many kinds of protozoans, microcrustaceans and other micro invertebrates that are planktonic in water bodies. These are heterotrophic planktonic animals which constitute an important food source for many species of aquatic organism. It may serve as indicators of water quality. Zooplankton to be rich in the essential amino and fatty acids, docosahexacnoic acid (DHA) and elcosaptaenoic acid (EPA). Zooplankton provides fish with nutrients since fish require proteins, fats, carbohydrates, mineral salts and water in the right proportion. The freshwater forms of zooplankton are generally smaller in size and are represented by fewer animal phyla than their marine counterparts (Farshad and Venkataramana, 2012).

The freshwater Zooplankton form an important group as most of them feed upon and incorporate the primary producers into their bodies and make themselves available to higher organisms in food chain (Michael, 1979). With the global loss of many species everyday as a result of pollution and habitat disturbance assessment of species diversity is needed today (Mary, 1986).

The Zooplankton diversity is one of the most important ecological parameters in water quality assessment. Zooplankton as indicators are extensively used due to their important role, in fast emerging concepts in environmental management. The planktonic organisms in lakes show distinct seasonal dynamics that have been attributed mainly to changes in ambient physico-chemical parameters like light, temperature and nutrients which in turn govern primary production and autotroph-herbivore interactions (Hessen et al., 2005, Sitre, 2014).