GENERAL SUMMERY & CONCLUSION

General Summary and Conclusion

The river Godavari is a perennial river, the second largest in India. It flows across the southern India and is considered to be one of the seven sacred rivers. It is holy to the Hindus. The river Godavari is considered as “Ganges of Deccan” and the “Gate of Hari”. It serves as source of water and plays an important role in improving socio-economic life of population residing on its bank.

The Jaikwadi Dam situated at Paithan is constructed on Godavari river at longitude $75^0$17’ and latitude $19^0$29’. The dam was constructed in 1975 on the upper ridges of River Godavari. With an extremely long dam-wall of 10.2 kms, and a vast submergence area of 33980 ha, it had an initial promise to irrigate the command area of 0.271 M Ha, and a capacity to hold 2909 MCM water. The Jaikwadi Dam was constructed mainly to overcome the irrigation and drinking water scarcity in the drought prone area of the Marathwada region. In absence of natural depressions and hilly terrain, this dam has been constructed on almost flat land, and as such, the impounded water-spread is large, measuring about 55 km in length and 27 km in width. This shallow water-spread, with receding water line attracts a large number of waterfowl. The dam is located 50 km south of Aurangabad city (M.S.). The dam-wall has about 610 meters long masonry work. The Jaikwadi project was conceived for irrigating about 2, 78,000 hectares (6, 85,000 acres) of land. The aquatic vegetation in the reservoir includes mainly the species of *Chara*, *Spirogyra*, *Hydrilla*, *Potamogeton* and *Vallisneria*. *Argemone mexicana* and *Ipomoea fistulosa* are found in the surrounding area.

Dams are a major part of the freshwater resources, and have multiple uses such as drinking, fishing, agriculture and aquaculture, conservation of biodiversity, recreation and tourism. When compared to rivers, the status of reservoirs is not very promising, in particular, of the water bodies are subjected to all kinds of negative processes like heavy siltation, pollution from untreated sewage and industrial effluents accompanying the surface run off from such parts where urban solids and industrial wastes are dumped. While nutrient enrichment leads to eutrophication with characteristic manifestations like algal bloom, wild growth of aquatic weeds, foul smell, vector breeding, loss of biodiversity,

(Kodarkar and Chandrasekhar, 1995; Venkateserlu *et. al.*, 1981). All these signs are evident at the Jaikwadi reservoir.

The domestic sewage entering into the reservoir is destroying the lentic ecosystem. The exact nature of pollutants is very difficult to determine, their impact can only be monitored in terms of changes in water quality, and that too has to be limited to certain general parameters (Trivedi *et. al.*, 1987).

The reservoirs maintain an ecological balance of flora and fauna inter-relationship, regulate the surrounding climate and recharge the ground water. Unfortunately, most reservoirs are getting polluted due to the influx of domestic effluents, apart from the pollution caused by washing of clothes, vehicles, buffaloes, and immersion of earthen idols at the banks of different tributaries (rivers) during certain festivals. Aquatic invertebrates are an important source of food for birds, mammals, amphibians, reptiles, and other invertebrates. Changes in terrestrial and aquatic habitat lead to changes in invertebrate assemblages which, in turn, increase, decrease, or alter the food supplies for other animals. As the impact occurs in a stream, the number of the species may decrease, but population a certain species may rise, often the large sized species getting replaced by the small ones.

With growing urbanization and industrialization, peripheral aquatic ecosystems comes to occupy the prime areas with a very high land value, with the promised volume of water being not impounded every consequent year, stretches of low lying land are often escape submergence and are reclaimed for cash-crop farming by the adjacent farmers who use abundant pesticides and fertilizers. This authorized reclamation effectively changes the morphology of water body. Similarly, whenever water line recedes during summer or due to inadequate monsoon, encroachment on the reservoir bed by unauthorized settlers is always a possibility in the prevailing socio-political environment. Soil and sand erosion due to excessive use of sand in construction activity in the catchment generates a lot of silt which, along with the surface runoff, ultimately ends up into dam reservoir.

Considering the ecological, economical and recreational promise of the water body, the present work was undertaken to assess the water quality in terms of determination of water and soil quality (physicochemical nature), seasonal

variations of bird fauna, and studies of diversity and population density of zooplankton for the conservation of the ecosystem.

In the Jaikwadi reservoir, water characteristics were adjudged in monsoon, winter and summer seasons. In the present study, the water characteristics can be explained on the basis of frequent clouds, high percentage of humidity, high current velocity and high water level. The temperature was higher in summer because of city solid wastes, industrial effluents and domestic material intrusion into the reservoir

In the present study, the pH was maximum in winter and minimum in monsoon ranged between 7.78 to 8.44. In summer, the pH was decreased non-significantly compared to both monsoon and winter.

The pH of water gets drastically changed with time due to exposure to air, biological activity and temperature changes. Significant changes in pH occur due to disposal of industrial wastes, acid drainage etc. In summer, higher level of pH may be due to reduced level of water in dam. The increased photosynthetic activities and intense sunlight causes the assimilation of bicarbonates by the increased phytoplankton that enhances the pH of water to some extent.

The alkalinity was high in summer and low in winter ranged between 330.86 mg/l to 549.54 mg/l. in summer, alkalinity increased significantly compared to both monsoon and winter. In monsoon, alkalinity was decreased significantly compared to both summer and winter. In winter, alkalinity decreased significantly compared to both summer and monsoon. Alkaline water is more productive and supports the diversity of life (Malathi, 1999, Auti, 2002 and Dahiwale, 2008). The total alkalinity of the water becomes high because of carbonates and bicarbonates, with high alkalinity, hardness and chlorides of the dam water are found to be more productive and support rich flora and fauna in summer.

The chloride was maximum in monsoon and minimum in summer ranged between 247.83 to 294.25 mg/l. In summer, chloride was decreased significantly compared to both monsoon and winter. In monsoon, chloride was increased non-significantly compared to winter but decreased significantly compared to summer. In winter, chloride was increased significantly compared to summer but decreased non-significantly compared to monsoon. Generally, sewage contributors to the salinity of water in case of urban wetlands are higher in summer due to the

evaporation water losses. Further, lower values were encountered in winter, which can be attributed to dilution effect from renewal for water mass from summer stagnation in monsoon. In winter, again low range is recorded due to high sedimentation rate in relatively stable environmental conditions. The high concentrations of chlorides are the indicators of large amount of organic matter in the water due to the eutrophication.

DO was high in winter and low in summer ranged between 5.94 to 7.70 mg/l. In summer, DO was decreased significantly compared to both monsoon and winter. In monsoon, DO was increased significantly compared to summer but decreased significantly compared to winter. In winter, DO was increased significantly compared to both summer and monsoon. Dissolved oxygen is one of the most important factors in any aquatic ecosystem. The dissolved oxygen levels in natural waters depend on the physical, chemical and biological activities in the water body. The main source of dissolved oxygen is from the atmospheric and the photosynthetic process of the aquatic green plants, which produces a distinct rise in the amount of oxygen.

COD was high in winter and low in monsoon ranged between 6.00 to 14.00 mg/l. In summer, COD was decreased non-significantly compared to both monsoon and winter. In monsoon, COD was increased significantly compared to summer but decreased significantly compared to winter. In winter, COD was increased significantly compared to both summer and monsoon. High organic pollution indicates high values of COD and its concentration depends upon the quantity of pollution in relation to dilution available from clear water flow. (Malathi, 1999; Auti, 2002; Anitha, 2002; Choudahari and Bharati, 2006). COD can be related empirically to BOD, organic carbon and organic matter Diwan *et al*, (1977) reported that chemical transformation influences the level of COD. In winter high values of COD indicated high organic load to the water body and high organic waste disposal and municipal waste discharge into the water body (Malathi, 1999; Auti, 2002; Anitha, 2002).

The sulphate content was high in summer and low in monsoon ranged between 132.00 to 160.08 mg/l. In summer, sulphate was increased significantly compared to both monsoon and winter. In monsoon, sulphate was decreased significantly compared to both summer and winter. In winter, sulpahte was increased significantly compared to summer but decreased significantly

compared to monsoon. The normal levels of sulphates are more than adequate to meet plants need. Under the aerobic conditions reduction of sulphate is an assimilatory process (Tuttle, 1980; Killhare *et al.,* 1981), whereas under the aerobic condition a specialized group of anaerobic bacteria, the sulphate reducing bacteria use sulphates as the terminal electron acceptors and form hydrogen sulphide as a result of the dissimilatory reduction of sulphate (Malathi, 1999; Anitha, 2002; Auti, 2002). The high concentration of chlorides, sulphates, nitrates and phosphates associated with the depletion of oxygen led to the anoxic or anaerobic condition in the water. It is one of the effective nutrients and also supplies oxygen in anaerobic condition (Nath, 1998; Malathi, 1999; Anitha, 2002). In the present study, high sulphate was observed in summer ranged between 133.75 to 160.08 mg/l. Similar results were observed by Malathi (1999), Bahura, (2001), Anitha, (2002) and Auti, (2002) due to the heavy rainfall in the catchment and water flow in the catchments area. Shaikh and Yeragi (2004) reported low sulphate of Tansa river in winter. Pawar and Mane (2006) reported high sulphate in monsoon and low in summer which was similarly created to the present study.

The BOD content was high in winter and low in summer ranged between 1.36 to 2.64 mg/l. In summer, BOD was decreased significantly compared to both monsoon and winter. In monsoon, BOD was decreased non-significantly compared to winter but increased significantly compared to summer. In winter, BOD was increased significantly compared to summer but increased non-significantly compared to monsoon. BOD affects the benthic diversity. Dhanpakiam *et al.,* (1999) showed the highest BOD during the summer months, which may be attributed to the maximum biological activity at elevated temperature. High BOD values during summer induced the high growth of bacteria (Pyatkin and Krivoshein, 1980). The study indicated that untreated domestic sewage is being dumped in to the dam, resulting in accumulation of large amounts of organic matter in the reservoir thereby giving a high biological oxygen demand. BOD gives an idea of the quantity of biodegradable organic substances to aerobic in water, which is subjected to aerobic decomposition of microorganisms It provides a direct measurement of state of pollution (Prashanthi and Jeevanrao, 1999; Malathi, 1999; Anitha, 2002; Matkar, 2008). Present study indicates that BOD was quite high in winter though the impact of pollution was

found to be localized, yet it creates the stress in environment for biotic communities (Anitha, 2002). The lower BOD values, which is been slashed down in summer indicating the retaining capacity of the water to recover from pollutional stress of organic substances (Malathi, 1999; Auti, 2002; Anitha, 2002; Patwari; 2002, Pondhe, 2005). The water of the dam from the BOD values is of doughtful quality and is rather unsatisfactory (Singh *et al.*, 1999; Anitha, 2002; Auti, 2002). The high values of BOD in winter may be due to the high pollution load and reduced water flow, while lower values in summer and winter may be due to dilution of water (Anitha, 2002; Auti, 2002). However, in the present study BOD values in monsoon and winter indicated that the reservoir have got the self purification capacity to dilute the organic load because of sufficient oxygen content as this dam do not receives directly the waste water discharges from municipal and industrial area (Malathi, 1999; Auti, 2002; Anitha; 2002).

The phosphate was high in winter and low in summer. ranged between 00.26 to 1.23 mg/l. In summer, phosphate was decreased non-significantly compared to monsoon but decreased significantly compared to winter. In monsoon, phosphate was increased non-significantly compared to summer but decreased significantly compared to winter. In winter, phosphate was increased significantly compared to both summer and monsoon. During the seasonal cycle when reducing conditions prevail in the bodies of water, some of the phosphate returns into the soluble form with the formation of ferrous and manganous forms from their respective oxidized forms (Malathi, 1999; Anitha, 2002). It is concluded that phosphorus is the most important limiting factor responsible for eutrophication of water.

Phosphates and nitrates are the main nutrients responsible for the process of eutrophication that leads to ultimate environmental degradation (Reynolds, 1991; Kodarkar *et al.*, 1991; Kodarkar and Chandrasakher, 1995; Pondhe, 2005). In most natural waters, where Ca^{+2} is the most common cation, the solubility product of $CaCO_3$ can also be increased by an extra amount of free CO_2 is present than is in equilibrium with the air much more $CaCO_3$ will dissolve, because this extra CO_2 keeps the pH low than causing a lower concentration of CO_3^{2-} (Kodarkar *et al.*, 1991; Kodarkar and Chandrasakher, 1995). Phosphates and nitrates are the main nutrients responsible for the process of eutrophication in the

some part of the reservoir that leads to ultimate degradation of an aquatic ecosystem.

Jaikwadi wetland is characterized by prolonged residence times of the water they contain and the limited mixing of water within them apart from that caused by wind driven currents and internal heat transfer processes. Deeper reservoir undergoes stronger thermal stratification during the warmer months of the year caused by preferential solar heating of the surface waters. Water density decreases as temperature increases, so warm water overlies colder water and creates horizontal density gradients that resist vertical mixing and enhance the stability of the water column. Chemical and biological demand for oxygen in deeper regions of the Jaikwadi reservoir accompanied by limited replenishment from the surface due to the lack of vertical mixing, can lead to very low oxygen levels in deep waters. Deoxygenating of the deeper waters has major effects on the chemistry of other substances especially nutrients, which can be mobilized from the reservoir sediments under such conditions. The thermal stratification and mixing regimes of Jaikwadi reservoir influences water column stability, nutrient availability and light availability at different times of the year and consequently, the plankton community structure and birds migration from such areas are abundance in this water body.

The seasonal fluctuations in grass primary productivity and net primary productivity were observed in summer, monsoon and winter season during the year 2006-2007 at Jaikwadi Dam. In the present study the gross primary productivity value for the first year of the study period (2006-2007) were ranged between 2606 $\pm$ 26.91 mg/c/m3/day to 3126 $\pm$ 28.47 mg/c/m3/day and net primary productivity(N.P.P.) value were ranged between 636.07$\pm$ 13.75 mg/c/m3/day to 773.57 $\pm$ 25.57 mg/c/m3/day. The gross primary production value was obtained maximum during summer and minimum during winter.

In summer, the gross primary productivity in the year 2007-2008 (GPP) was 2134.53 ± 28.32, in monsoon it was 2072.66 ± 26.48 and in winter it was 2096.58 ± 25.12. In summer, the gross primary productivity was increased non-significantly compared to both monsoon (NS, 3.85%) and winter (NS, 2.89%). In monsoon, the gross primary productivity was decreased non-significantly compared to both summer (NS, 1.15%) and winter (NS, 2.98%). In winter, the gross primary productivity was decreased non-significantly compared to summer

(NS, 1.81%) but increased significantly compared to monsoon 1.14%. Thus, from above results the GPP was maximum in summer and minimum in monsoon.

In summer net primary productivity (NPP) in the year 2007-2008 was 521.14 ± 7.53, in monsoon it was 286.74 ± 3.37 and in winter it was 505.55 ± 6.81. in summer, the NPP was increased significantly compared to monsoon ($P<0.001$, 44.97%) but increased non-significantly when it compared with winter (NS, 2.99%). In monsoon, the NPP was decreased significantly compared to both summer ($P<0.001$, 81.74%) and winter ($P<0.001$, 76.30%). In winter, the NPP was decreased non-significantly compared to summer (NS, 3.08%) but increased significantly compared to monsoon ($P<0.001$, 43.28%). The primary productivity was high during summer and low in monsoon period. The high rate of productivity during summer months was probably due to the high rate of photosynthesis, transparency and temperature. In monsoon photosynthetic activity and decrease in temperature stores low rate of sun's radiant energy.

In Jaikwadi reservoir the soil characteristics such as the values of pH was maximum in winter (8.4) season. The maximum value of pH was found in the month of December. While minimum values of pH was observed in summer season (6.06). In the second year of the study period (2007 - 2008) the values of pH was ranged between (6.3 to 8.4). The minimum value of pH (6.3) was observed in monsoon while maximum value of pH is observed (8.4) in winter season. A soil pH determines what nutrients are available to plants. Soil tends to become acidic as a result of rainwater leaching away basic ions (calcium, magnesium, sodium and potassium), carbon dioxide form decomposing organic matter and root respiration dissolving in soil, formation of strong organic and inorganic acids. In alkaline soils, essential nutrients such as manganese and iron become insoluble and unavailable to plants.

The alkalinity of soil in the Jaikwadi reservior was ranged between 143 to 299 mg/l in the first year study (2006-2007). The maximum alkalinity was observed in winter season while the minimum alkalinity was observed in summer season. In the second year (2007-2008), the values of alkalinity were ranged between 133 to 302 mg/lit minimum observed in summer and minimum value was in winter.

The values of sodium were ranged between (92 to 169 mg/lit) in the first year of study (2006-2007). The minimum value 92 mg/lit of sodium was

observed in the winter and maximum value 169 mg/lit was in the monsoon. In the second year study (2007-2008) the values of sodium were ranged between 86 to 147 mg.lit minimum values was in winter and maximum value was in monsoon.

In the first year study (2006-2007) the value of Potassium were ranged between 46 to 99 mg/lit. The maximum value 99mg/lit of potassium was observed in winter season while minimum value of potassium 46 mg/lit was observed in summer season. In the second year study period (2007-2008) it was ranged between 47 to 97 mg/lit minimum was observed in summer and maximum was observed in winter. Potassium or potash (K) regulates plant processes such as water balance, transpiration, photosynthesis, and resistance to disease, cold and drought. Potassium deficiency symptoms vary widely.

The values of sulphate were ranged between 109 to 354 mg/lit in first years of study period (2006-2007). The maximum value of sulphate was observed in monsoon season and minimum was observed in summer season. In the second year of study period (2007-2008) it was ranged between 117 to 302 mg/lit minimum in summer and maximum was in monsoon.

Phosphates and nitrates are the main nutrients responsible for the process of eutrophication that leads to ultimate environmental degradation (Reynolds, 1991; Kodarkar *et al.*, 1991; Kodarkar and Chandrasekhar, 1995). The values of phosphate were ranged between 1.9 to 5.80 mg/lit in the first year study period 2006-2007. The maximum value 5.80 mg/lit of phosphate was observed in winter season in the month of January and minimum of value was in the month of October. In the second year study 2007-2008 the value of phosphate was ranged between 1.4 to 5.9 mg/lit. Phosphorus (P) contributes to root growth, fruit growth and disease resistance.

The values of nitrate were ranged between 1.4 to 3.9 mg/lit in the first year of study period 2006-2007. Whereas in the second year of the study periods 2007-2008 it was ranged between 1.2 to 3.7 mg/lit.

Phytoplanktons are vital to the fishes' survival, because they are the main source of food for the fish. These fish in turn form a critical relation in the food web, because they serve as the dietary basis for many other species of birds and mammals.

The total phytoplankton at station S1 during the year 2006-2007 in summer was 175 per ml, in monsoon the total phytoplankton was recorded 118

per ml and in winter the total phytoplankton was 96 per ml was recorded. In summer, the chlorophyceae was maximum and recorded 78 per ml (44.57%) of total phytoplankton, followed by bacillariophyceae 67 per ml (38.58%), Euglenophyceae 18 per ml (10.28%) and Cynophyceae, 12 per ml (6.86%). In monsoon, the Chlorophyceae was maximum and counted 54 per ml (45.70%) of total phytoplankton followed by bacillariophyceae 26 per ml (22.03%), Cynophyceae 25 per ml (21.19%) and Euglenophyceae was 13 per ml (11.02%). In winter also the Chlorophyceae was maximum and counted as 42 per ml (43.75%) of the total phytoplankton followed by bacillariophyceae 33 per ml (34.37%), euglenophyceae 11 per ml (11.46%) amd Cynophyceae, 10 per ml (10.42%). In summer, monsoon and winter the chlorophyceae was recorded maximum while cynophyceae minimum in summer, euglenophyceae in monsoon and cynophyceae, in winter.

During second year (2007-2008) study at station S1 the total phytoplankton in summer season was 186 per ml, in monsoon it was recorded 124 per ml where as in winter there were 107 per ml of algae. In summer, the chlorophyceae was maximum and recorded 81 per ml (43.55%) of total phytoplankton followed by bacillariophyceae 66 per ml (35.48%), euglenophyceae 21 per ml (11.29%) and cynophyceae 18 per ml (9.68%). In monsoon, the chlorophyceae was maximum and counted 54 per ml (45.97%) followed by bacillariophyceae and cynophyceae 27 per ml (21.77%) and the euglenophyceae 16 per ml (12.90%). On the other hand, in winter the chlorophyceae 48 per ml (44.80%) was also recorded maximum followed by bacillariophyceae, 33 per ml (30.84%), euglenophyceae, 14 per ml (13.08%) and cynophyceae 12 per ml (11.21%). In summer, monsoon and winter the chlorophyceae was recorded maximum while cynophyceae was recorded minimum in summer, euglenophyceae in monsoon and cynophyceae in winter season. The chlorophyceae was recorded 183 per ml (43.88%) followed by bacillariophyceae 126 per ml (30.22%), Cynophyceae, 57 per ml (13.67%) and euglenophyceae 51 per ml (12.23%) (**Table A 3.2)**.

Some species of plankton disappear for certain period and reappear during the other period. Since plankton serve as a food for the economically important fish and their cultures it is necessary to study the correlation analysis of plankton with the physico-chemical characteristic for finding out the possibility and

suitability for fish culture (Alikunhi *et. al.*,1955; Khedkar, 2005; Dahiwale, 2008).

The seasonal variations in total phytoplankton numbers were due to some factors like temperature, intensity of light, bicarbonates and organic matter. Some plankton population disappeared at a specified period and reappeared during other period. This disappearance may be due to the fact that some species occur in spores, which are not easily detected. However, under favorable conditions spore germinate and appear as plankton. It was also observed that some species were not abundant during some months, but they reappeared in the samples of other months when the conditions are favorable.

Seasonal variations in total phytoplankton population showed that that chlorophyceae population dominated phytoplankton biomass (44.73%). In case of bacillariophyceae the percentage was 32.39%, while, cynophyceae population was 12.08% and euglenophyceae percentage was 10.80% (**Table A 3.1)** of total phytoplankton. Component wise study indicated that in summer, monsoon and winter chlorophyceae dominated the phytoplankton population. Extremely high population of chlorophyceae in summer with more dominating species. At the same time there was less fluctuation in overall population densities of rest of the groups during the investigation. The population during the study period when arranged in an increasing order during the three seasons is as follows.

Summer: Cynophyceae<Euglenophyceae<Bacillariophyceae<Chlorophyceae

Monsoon: Euglenophyceae<Bacillariophyceae<Cynophyceae<Chlorophyceae

Winter: Euglenophyceae<Cynophyceae<Bacillariophyceae< Chlorophyceae

Freshwater phytoplanktons in Jaikwadi reservoir are an integral part of freshwater ecosystems with representatives found from prestine to polluted water bodies. They contribute to the food webs of theses systems, along with benthic algae, and other aquatic macrophytes. In this system, freshwater phytoplanktons do not cause environmental problems. It is only when conditions are suitable for explosive growth, such as an excess in nutrients, that algal blooms cause water quality problems that many affect both aquatic and terrestrial the ecosystem in Jaikwadi reservoir in which this occurs and anthropogenic uses of the water. Of all the types of freshwater phytoplanktons that may blook, the cyanobacteria are of most concern because of the potential hazard these create through the ability of some species to produce potent toxins.

The aquatic pteridophytes are included in about 11 families, viz. Azollaceae, Blechnaceae, Equisetaceae, Isoetaceae, Marsileaceae, Oleondraceae, Parkeriaceae, Polypodiaceae, Pteridaceae, Salviniaceae and Thelypteridaceae. The aquatic fern Azolla belongs to family Azollaceae, which is a monogeneric family with about 06 species. Another genus Marsilea belongs to family Marsileaceae, which includes 03 genera and about 70 species. Only two aquatic pteridophytes viz. Azolla pinnata and Marsilea minuta were recorded.

In all 17 aquatic angiosperms belonging to 14 genera, have been observed nearly at both the locations of the study area (S1 and S2).

Zooplankton in water, that belongs to four main taxonomic groups viz. Rotifera, Copepoda, Cladocera and Ostracoda, was studied for diversity and seasonal abundance. 7 species of Rotifera, 5 species of Copepoda, 5 species of Cladocera and 3 species of Ostracoda were identified. Monsoon population of total zooplankton depleted in winter due to water temperature effect and rose to highest level in monsoon as a result of relatively stable and favorable environmental conditions like moderate temperature and abundance of food (particulate matter and fine detritus). Component-wise population density studies revealed that monsoon population of two groups, Rotifera and Cladocera was highest while Ostracoda was the lowest. Availability of particulate matter was the main controlling factor in the case of Ostracoda in monsoon.

Among the groups of zooplankton, the population density showed variations due to their adaptability to seasonal changes in water quality, availability to food and predatory pressure.

The populations during first year (2006-07) when arranged in an increasing order during the three seasons are:

Monsoon: Ostracoda <Copepoda <Cladocera <Rotifera

Winter: Ostracoda <Cladocera <Copepoda <Rotifera

Summer: Ostracoda <Copepoda <Cladocera <Rotifera

In the second year (2007-08) seasonal population domination was:

Monsoon: Ostracoda <Cladocera <Copepoda <Rotifera

Winter: Ostracoda <Cladocera <Copepoda <Rotifera

Summer: Ostracoda<Cladocera < Copepoda <Rotifera

The detrimental influence is mainly exerted by untreated domestic sewage, and untreated effluents. Control of sewage discharge may prevent enrichment and eutrophication.

Zooplankton occupy an intermediate trophic level functioning as an important food source for a variety of animals including longer fish, birds etc. zooplankton are also sensitive to various substances that enrich or pollute water and often been used as indicators to monitor and assess the condition and change of the freshwater environment. They display fairly constant measureable changes to water quality and various forms of pollution.

Pollution management and monitoring programs that depends on a small number of indicators may fail to consider the full complexity of ecosystems. It is necessary to use an indicators representative of the structure, function and composition of ecosystem of Jaikwadi reservoir. The useful application of zooplankton as indicators in such freshwater ecosystems can only be realized by understanding the characteristics and dynamics of ecosystems that are subject to various water resource management activities.

The study on bird habits, habitat, number and seasonality were carried out by regular field visits to the dam. The monthly observation sites were fixed. Maximum numbers of species were observed in winter season compared to monsoon and summer. In winter, greater food availability with favorable climatic conditions for nesting, roosting and breeding of the bird species exist. A total of 83 species was observed during the study period of (2006-07 and 2007-08) of which 52 species were observed as permanent residential, while 31 non-residential (migratory) bird species were observed in the Jaikwadi bird sanctuary.

The month wise occurrence of the birds at site S1 & S2 during the study period was varied from 42 (June) to 83 (Jan, Feb) at S1 and from 44 (June) to 82 (Jan, Feb) at S2.

During the month of January, February and March the bird population was almost similar at site S1 and S2 from April onwards its population started decreasing upto September and from October to December it again increased significantly during both the years of study period.

The population of bird was observed to be maximum i.e. from 81-83 at station S1 during October, November, December, 2006 and January (83), February (83) and March (82) 2007. The population at S2 was ranged maximum

up to 82 at January and February 2007 and upto 70 at January & February of 2008. The habitat wise bird population was observed at S1 & S2 on the basis of feeding, roosting and nesting period. Out of the total birds observed at station S1 & S2 the population in open water was decreased the population in open water was decreased by 68.57% in s1 and 68.29% at S2. At water edge habitat it was decreased upto 67 (19.27%) at s1 and 65 at S2 (21.65%). At rock midstream the bird population was decreased upto 76 (8.43%) at S1 and 73 at S2 (12.19%). On the back water of the Jaikwadi dam this population on the basis of habitat significantly decreased upto 28 (66.26%) at S1 and 30 (64.63%) at S2. The population at meadows for feeding roosting and nesting was 18 (78.31%) at S1 and 28 at (67.07%) S2 while on scrubland it was 53 (36.14%) at S1 and (37.80) at S2. On the other hand it was 49 (410.96%) both at S1 and S2 (41.46%).

Birds visit the dam waters in winter, as well as a few in summer and monsoon seasons. The main food for the birds was found to be insects, fishes, crabs, frogs, grasshoppers, worms and marshy plants. Some birds like, Red vented bulbul, etc. were observed as frugivorous. Most of the sampling sites were found to be green, showing higher population of algae and algal blooms ecologically, to attract and sustain large numbers of water birds in Jaikwadi reservoir. The non-residential birds use this habitat for the resting purpose. These birds visit to the dam waters in winter season and leave this habitat in early summer. These birds are abundant in Ladakh, North Europe to east Siberia, Bangladesh, Shri Lanka etc. and visits the reservoir waters regularly. The overall population of bird increases in December and declines from January as the water level recedes.

Conversion of the dam areas into terrestrial land seriously affects the food availability of water birds. Effort are to be initiated to remove the waste materials from the dam and clean the area. The total number of species of bird was low during the study period (2006-07&2007-08). Only 83 species were observed in dam waters. This can be attributed to the heavy pressure of tourism on dam. The impact of tourism has become increasingly evident. The demand for motorized boating and land development are the immediate threats to bird and their habitats. Apart from these the mud flats in these sites have been severely degraded by burning, drainage and clearing. This has affected the abundance of avifauna that depends on the mudflats as well as on the hydrological values and functions of

the mud flats. Reclamation of reservoir lands during inter-tidal cropping affects on roosting and breeding of water birds like *Little Cormorant, Indian Pond-Heron, Purple Heron* and *Night- Heron*. Putting harvested fields on fire also kills many birds. Every year, during the summer months, sugarcane farmers burn the field residue and the grasses on the bunds, by which nests of breeding birds like Warblers (*Prinia hodgsonii, Prinia inornata and Acrocephalus stentoreus*), *Tailorbirds* (*Orthotomus sutorius*) are destroyed. Fishing is frequent in the reservoir and is usually carried out using nets of small mesh size that reduces the food availability for the birds. It is already a known fact that heavy use of pesticides causes mortality of birds. Toxic industrial wastes also threatened the quality of water from the Jaikwadi dam.

The density and diversity of water birds are influenced by rainfall, temperature, humidity and cloudiness (Custer and Osborne, 1977; Goss-custard, 1985; Teylor and Tullock, 1985; and Briggs and Holmes, 1988). Rainfall has great influence on the bird population (Baylis, 1989). Water depth is reported to influence the population of migratory water birds (Sayre, 1984; Poysa, 1989 and Vijayan, 1990). In the present study, availability of suitable nesting sites, dispersal pattern of the young, differential rate of fledgling survival and changes in the environmental conditions may also influence the species as observed by Santharam and Menno, (1991). Observations on the Indian river Tern indicated that they are the good breeders here as they are observed throughout the study period (Personal observation).

After careful observation and analysis, it has been found that the extinction of the some of the migratory birds fauna form the Jaikwadi reservoir due to sudden climatic change, new diseases, reduced breeding potential, human interferences, habitat change, poarching, commercial and recreational exploitation of the lake, reclamation and encroachment of the lake for Government planning, lack of proper legislation and administrative lapses, lack of proper environmental education and training of the people. A portion of the reservoir needs to be declared as protected area and human exploitation should be stopped.

Urgent and decisive action is needed to conserve and maintain genes, species and ecosystem, in view of the sustainable management and use of biological resources. Capacities for the assessment, study, systematic observation and evaluation of biodiversity need to be reinforced at national and international

levels, cooperation sought for the in situ protection of ecosystems, as also for the ex-situ conservation of biological and genetic resources and enhancement of ecosystem functions. The participation and support of local communities are essential to the success of such an approach.

The conservation of dam is in the interest of man as it's ecological, cultural and tourist value is immense. This study will help in understanding the amount of toxic compounds (heavy metals) being received in the dam reservoir and its biological magnification in animals, particularly those at the lower level of food chain. This study will also help to make aware those local people or adjacent farmers for proper management of waste disposal and also to minimize use of synthetic inputs. The study indicated that increase in toxic waste day by day in dam reservoir produced biological magnification in food chain, which is a challenge to scientists, policy makers, administrators and all those involved in the conservation of the environment.

The project area of Jaikwadi belongs to the Deccan trap basement complex. The whole drainage basin comprises of rolling and undulating country with a series of ridges. The valley is interspersed with low range hills. The general slope is from west to east, and an overall elevation is between 450 and 550 m. above the sea level. The Nath-Sagar reservoir created by the Jaikwadi dam is a very large water body. It is joined by the rivers Godavari and Pravara, which have their water-shed formed by the hills at the west. It is 55 kms. long and 27 kms. wide, with about 34000 hectares of land under its submergence. Because of the flat terrain, the reservoir is very shallow, the difference between the highest and the lowest utilizable levels being only 10 meters. It has many locations where the sunlight penetrates the waters right through to its bottom. This has endowed upon the waters a high productivity at these spots, which show all the characteristics of a typical wetland. This reservoir does not attain its full capacity every year. It is filled once in a period of 3 or 4 years. Over the years, intense agricultural activities in the vicinity of this reservoir and influx of domestic and industrial waste have caused a multiple increase of productivity of this lake. Pollution is taking its toll on the lake habitat that harbours different aquatic and land vegetation, indigenous fish fauna, and many types of the waterfowl. Efforts at restoration of the habitat need to be carried out in a time bound manner, so as to prevent any further degradation of this ecosystem. Bank

restoration at the left and right edges of the reservoir has to be expressly carried out. A 50 meters strip of grasses could be developed from the water edge on to the land at left and right banks. This, supplemented with 6 to 8 rows of Acacia trees, would reduce the agricultural runoff pouring into the reservoir. Pitching, wherever necessary, be carried out so as to protect the natural sand bars and mud flats. An effective control on sand excavation will help the restoration to a greater extent. The reservoir has a huge catchment area admeasuring 21,000 sq.kms. For control of excessive rain runoff that also brings silt, methodical catchment area development programmes need to be undertaken, with extensive tree plantation on the ridges and slopes in the catchment. Construction activity near the left and right banks of the reservoir needs to be checked, encroachments are to be removed, and encroachers suitably resettled elsewhere. This will improve the drainage, and reduce pollution. The lake area has been notified as a bird sanctuary hence, regulation of the fishing and agricultural activity in and around the lake by the sanctuary authorities would help the process of habitat restoration. However, a participatory approach in the management of the water body is desirable. Creating awareness among the people in the neighborhood, and attempting reorientation of the stakeholders towards the cause of conservation of the reservoir is important from this point of view.