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CONTENTS

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SEASONAL VARIATIONS OF ZOOPLANKTONS OF PALAIR RESERVOIR, KHAMMAM, TELANGANA, INDIA

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Abstract: *Seasonal dynamics of plankton diversity with reference to physico-chemical conditions in Palair reservoir, Khammam district of Andhra Pradesh. India, for two years starting from August 2004 to July 2006. In the present study various parameters like physico-chemical parameters of water and biological parameters like zooplankton were studied. Along with the physico-chemical parameters, water samples were also characterized for plankton community composition and density. The physico-chemical parameters also showed positive correlation with different zooplankton group. The water samples were analyzed for various physico-chemical factors. Totally 4 groups of zooplankton taxa were identified (Rotifera, Cladocerans, Ostracodans and Copepods). Zooplankton population density was maximum during summer (100 units/litre) and minimum (8.85 units/litre) during monsoon season. A total of 19 taxa were recorded (Rotifera 3, cladocerans 4, Ostracodans 6 and Copepods 6). Among the Rotifera, Branchionus and Keratella species; among the Cladocerans, Moina and Bosmina species; among the Ostracodans, Heterocypris and Physocypria species and among Copepods, Undinula and Pontellopsis species were abundant. The abundance of zooplankton in the pond follows a sequence as: Ostracodans = Copepods > Cladocerans > Rotifera. Correlation between various physico-chemical parameters and zooplankton density was calculated.*

Keywords: *Biodiversity, correlation, limnology, physico-chemical parameter, seasonal variations, zooplankton.*

Introduction:

The lakes comprise the one of the most productive ecosystems. Lake ecosystems are made up of physical, chemical and biological properties contained within these water bodies. Mountain Lakes is a very important component of the water storage system. Zooplankton community always acts as a key component which transfers the energy in different trophic level in an aquatic ecosystem and it helps to regulate the productivity of the water body. When any variation occurs in the physico-chemical variables, it will bring the comparing changes in the life forms dwelling in the aquatic ecosystem. Zooplanktons are a significant indicator of change in any water quality, trophic status and pollution level. Mostly the population of fish depends on the dynamics of the plankton population especially the population of zooplankton community. Lake Ecosystem is affected by various stresses which considerably changes the zooplankton biodiversity. To evaluate these changes various multivariate methods were applied by the use of different software to get better and appropriate results. The present study was undertaken on the analysis of seasonal changes in the zooplankton structure and community influenced by the parameters in the Palair Reservoir, Khammam, Telangana, India.

Review of Literature:

The fresh water communities i.e., phytoplankton zooplankton macrophytes and macroinvertebrates are sensitive to environmental factors. Different species of planktons vary in different seasons due to changes in physico-chemical nature of water. The diversity index is also governed by physico-chemical characteristics of waters i.e., free CO2 alkalinity, chloride, Nitrate, Phosphate, dissolved oxygen,Temperature, color and dissolved solids. (Himansu et al., 2005).

Limnological investigations on Indian waters are extensive studies on the ecology of few lentic water bodies have been made by Kumar and Pal (1991), Dayal (1992), Baruah et al (1997) and

Hazarikaa and Datta (1999), Devidas Kamath et al., 2006).

Zooplanktons are the microscopic, free-swimming animalcule components of an aquatic ecosystem, which are primary consumers of phytoplankton. Verma and Munshi (1987) have suggested that zooplankton provide the main food item of fishes and can be used as indicators of the trophic status of a water body. Zooplankton play an integral role in transforming energy to the consumers, hence, they form the next higher trophic level in the energy flow after phytoplankton. Therefore, in view of importance in studies related to their distribution, ecological requirement, mode of reproduction, the zooplankton have attracted the attention of several workers throughout the world. The density and diversity of the zooplankton are controlled by the several physico-chemical factors of water (Quasim 1979; Nair et al., 1983). The producers and consumers play an important role in the transformation of energy from one trophic level to the next higher trophic level ultimately leading to the fish production, which is the final product of aquatic environment. Such studies are made by George (1966) and Singh (2000). Studies have been made on the limnobiological status of natural and man-made water bodies in India mainly with an intention to assess the water quality (Singh 2000; Shastri and Pendse 2001 and Hulyal et al., 2008).

Zooplankton is an important constituent of the food chain in pelagic ecosystems. The zooplankton organisms feed on the phytoplankton, on bacteria, on aggregates of detritus and microorganisms as well as on other zooplanktonspecies; furthermore, almost all freshwater fish feed on zooplanktons at some stage in their life history (Moss 1988; Lampert & Sommer 1997). Zooplankton may be of interest in the prediction of long-term changes in lake ecosystems. Despite some unavoidable taxonomic and methodological uncertainties, the comparison of measurements carried out in recent years with measurements made many years ago may give significant results in indicating signs of environmental changes (Brock 1985). (Nico salmaso et al.,1999).

Objective of the Work:

Analysis of biological communities and the estimation of water quality are the most significant contributions for the monitoring of the reservoir. It will provide an useful and inexpensive tool in pollution detection and pollution abatement, and this aspect have not yet been sufficiently appreciated and the control of pollution requires involvement of fresh water biologists and chemists to tackle the problem is most effective manner like other living organisms. Zooplankton is largely affected by the environment in their vicinity. Therefore, it is quite significant to enumerate zooplankton of the reservoir as bioindicators to assess the quality of water.

Research Methodology:

The present study carried out in Palair reservoir, Khammam district of Andhra Pradesh. India, for two years starting from August 2004 to July 2006. In the present study various parameters like physico-chemical parameters of water and biological parameters like zooplankton were studied.

Heavy Metals –A Analyst 300model

Atomic Absorption Spectroscopy. Perkin elmer (USA) Company.

Acid digestable metal ions used in finding of heavy metals**.** (Co,Cd.Zn,Cu) .

Zooplankton:

Biological examination of water was done by collecting 20-25 litres of water from each site. The water was collected by sampler and filtered through net. In total around 100 litres of water were collected from each lake, each month, from which the zooplankton studies were made. The zooplanktons copepods, cladocerans, rotifers, ostracods and certain larvae were drained out from the planktonic sampler which had been accumulated in the sample cylinder. They were fixed 4 % formalin and identified to the genus level with the help of fresh water biology Edmondson (1965). Counting of organisms was done using Sedgwick- Rafter counter and the dilution technique and the population density of each organism is represented per litre of water.

Result and Discussion:

Zooplanktons

Water is one of the basic needs of the mankind and is vital to all forms of life, which exist in lentic and lotic habitats. All lentic habitats such as reservoirs, ponds, and lakes are extremely important because they are endowed with abundance of natural resource. Reservoirs are important to impound surface water runoff for the requirement of drinking, domestic, agricultural and industrial uses. The consideration of the physico-chemical factors in the study of limnology is basic in understanding the tropic dynamics of that water body. Each factor does play its individual role but at the same time the final effect is really the result of interaction of all the factors. In a broad sense, plankters are considered as an index of fertility and the landings of fish are directly proportional to the quantity of plankton (Chidambaram and Menon 1945). Of these, zooplankters provide the main food item of fishes and can be used as indicators of the trophic phase of a water body (Verma and Munshi 1987). The density and diversity of the zooplanktons are controlled by the several physico-chemical factors of water (Bais and Agarwal 1995). Zooplankton communities consist mainly of Protozoans, Crustacean (Cladocera and Copepoda) and Rotifers. Plankton densities are highest in the summer time when algae levels are at their maximum. In the winter period population consist most of Copepodas and Rotifers while Cladocerans are the fewest. Next few chapters tell something about general information of Rotifers, Cladocerans and Copepodas, which were the species, found in our samples.

The main purpose of reservoir is to provide irrigation, drinking water and power generation. The present study was undertaken to investigate the seasonal dynamics of zooplankton in relation to physico-chemical factors. The results obtained are discussed in light of available literature along with the comments on recorded ecological correlations.

Cladocera

Most of the cladocerans are filter feeders and consume microscopic algae and particulate organic matter in detritus thereby playing an important role in recycling of matter and energy.Cladocerans are preferred as live food for early stages of culture fishes due to their high levels of proteins, free amino acid, fat and carbohydrate contents.

Cladocerans have been observed seasonally but they are not present constantly in every month. In general, cladocerans accounted the second dominant group among the zooplankton population and contributed 25.32 and 26.40% in2004-05and 2005-06 respectively, the maximum density of cladocerans were found in monsoon and minimum in pre monsoon during both the years of study (Table 1).

	Cladocera			
Seasons/Stations	**Station-I**	**Station-II**	**Station-III**	**Station-IV**
PreMansoon	40	50	30	40
Mansoon	200	210	180	190
PostMansoon	90	100	70	90

Org/l

Table: 1: Cladocera in Different Stations in Different Seasons

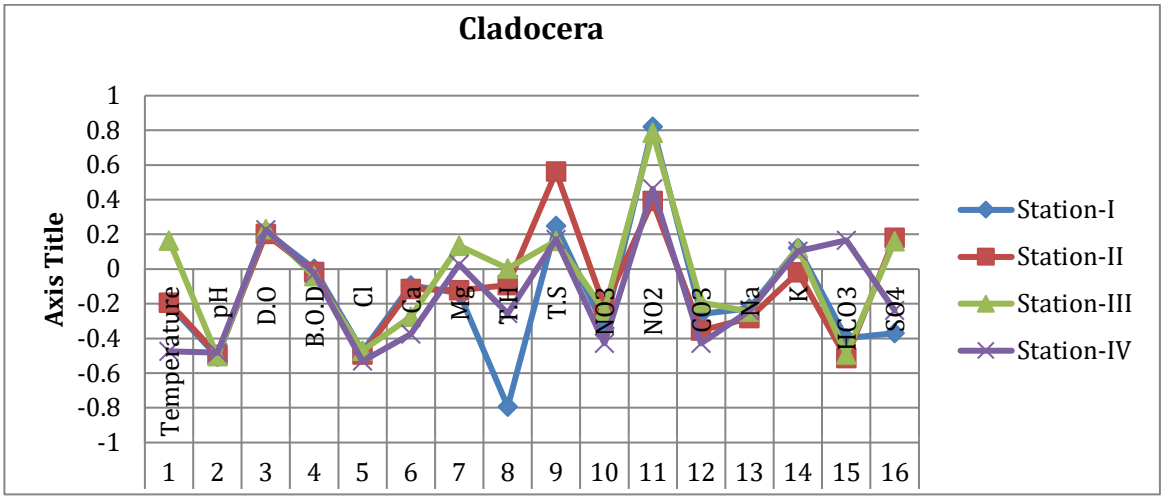

Fig: 1. Showing the Coefficient Correlation of Cladocerans with remaining Physico Chemical parameters in different stations.

In the present study Dissolved Oxygen, Magnesium (except station-I&II), Total Solids, Nitrates, Potassium (except station-II) and Sulphates are positively correlated to Cladocerans in different stations in Palair reservoir.

Copepoda

Copepod population was recorded throughout the study period and was found abundant in post monsoon season and less during monsoon seasons. The annual cyclic fluctuations in the members of copepod density during 2 years are presented in Table 2. This group constituted 17.73 and 17.480% of the total zooplankton population in 2004-05 and 2005-06 respectively. Copepods were present in moderately good numbers throughout the year. The highest number was recorded in February 109 org/l in 2004-05 and 116 org/l during 2005-06 declined gradually up to July and then it was increased till October.

	COPEPODE			
Seasons/Stations	**Station-I**	**Station-II**	**Station-III**	**Station-IV**
Pre monsoon	70	90	10	70
Monsoon	40	50	50	40
Post monsoon	100	120	110	90

Org/l

Table 2: in Different Stations in Different Seasons

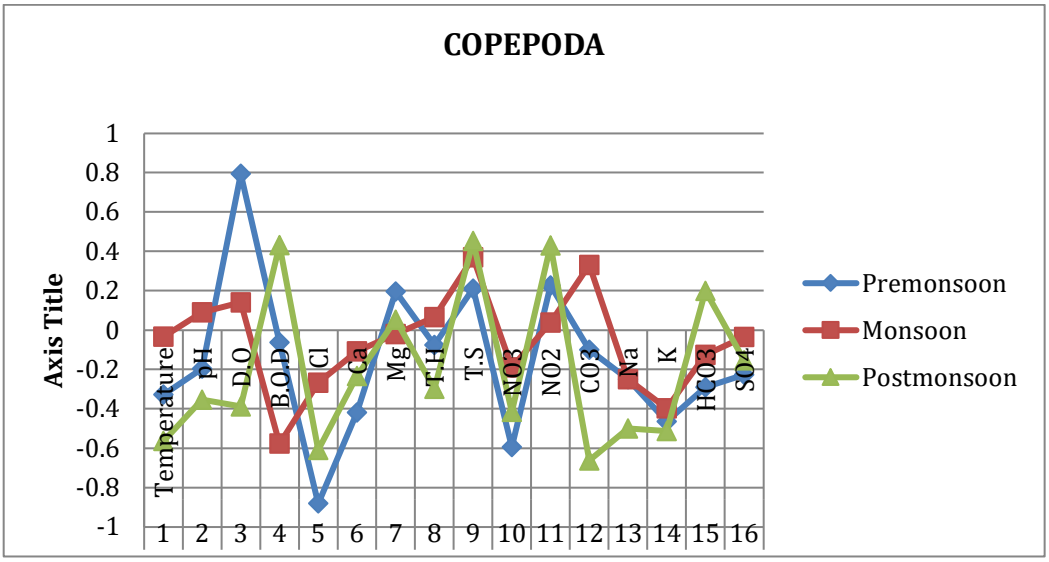

Fig 2. Showing the Coefficient Correlation of Copepod with remaining Physico Chemical parameters in different seasons.

In the present study Dissolved oxygen (except in post monsoon), Magnesium (except in monsoon), Total Solids, Nitrites are positively correlated with Copepod population in all seasons in Palair reservoir.

Ostracoda

Ostracods contributed only 7.65 and 6.69% of the total zooplankton community. This group was also found abundantly in post monsoon season followed by monsoon season during both the years of study period. The monthly distribution and seasonal fluctuations in the members of ostracods density during 2 years are presented in Table 3. The density of the species fluctuated between 4 org/l (March) and 73org/l (Nov.) in 2004-05 whereas in 2005-06 the number ranged from 6 org/l (March) to 76 org/l (Nov.) The species of this group appeared in February and March, but disappeared from April to July and reappeared in August with progressive increase in the density.

	OSTRACODA			
Seasons	**Station-I**	**Station-II**	**Station-III**	**Station-IV**
Pre monsoon	5	10	10	10
Monsoon	25	32	30	30
Post monsoon	60	77	50	50

Org/l

Table: 3: Ostracods in Different Stations in Different Seasons

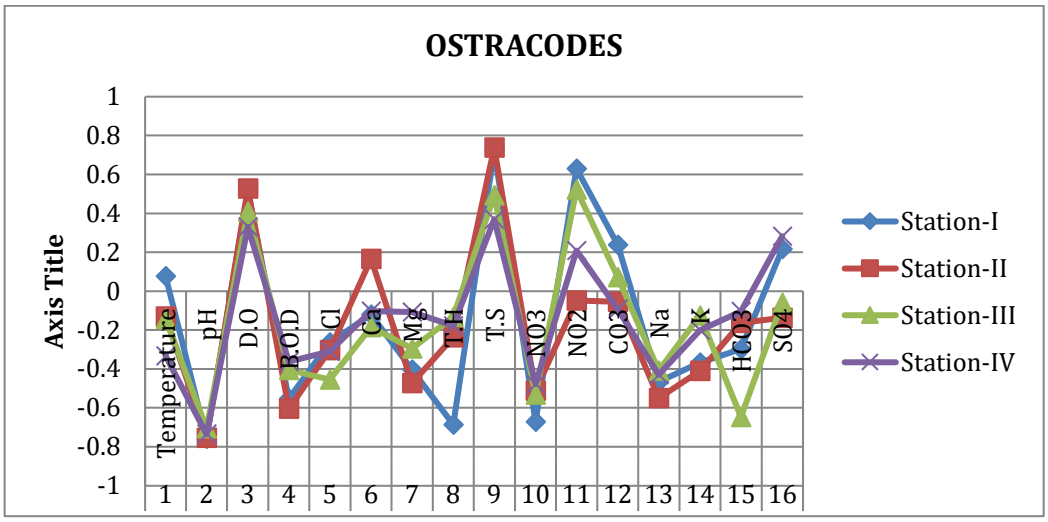

Fig 3: showing the Coefficient Correlation of Ostracodes with remaining Physico Chemical parameters in different stations.

In the present study Dissolved Oxygen, Total Solids, Nitrites (except station-II), Carbonates (except station-II&IV) and Sulphates (except station-II) are positively correlated to Ostracodes in

Temperature, Dissolved oxygen, Chlorides, Calcium (except in post monsoon), Total Hardness (except in monsoon), Nitrates (except in monsoon), and Potassium (except in pre monsoon) are negatively correlated to Ostracodes in all different seasons in Palair reservoir as shown in fig 3.

Rotifera

The density of Rotifers was maximum in Palair reservoir when compared to other planktonic groups their richness is common in tropical fresh water reservoirs. The presence of rotifers indicates the Palair reservoir is appeared to be progressing towards eutrophication; this may be due to the location of reservoir situated on the roadside and easily accessible for the anthropogenic intervention.

The rotifera was the most dominant group and contributed 49.08 and 49.34% of the total zooplankton population during first and second year respectively. The maximum numerical abundance recorded in February was 250 org/l during 2004-05 and 340 org/l in 2005-06 (Jan.) Minimum abundance recorded was 120 org/l and 135 org/l in Aug during 2004-05 and 2005-06 respectively.

	Rotifera			
Seasons	Station-I	Station-II	Station-III	Station-IV
Pre mansoon	222	240	228	222
Mansoon	21	160	147	220
Post mansoon	240	250	240	240

Org/l

Table 4: Rotifers in Different Stations in Different Seasons

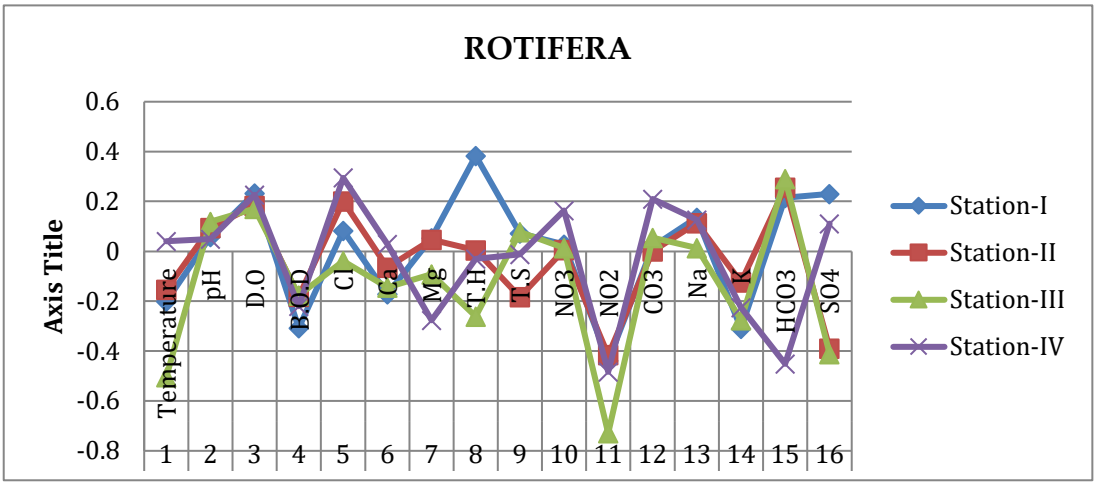

Fig 4. Showing the Coefficient Correlation of Rotifers with remaining Physico Chemical parameters in different stations.

In the present study pH, Dissolved Oxygen, Chlorides (except station-III), Magnesium (except station-II&IV), Total Hardness (except station-III&IV), Total Solids (except station-I&IV), Nitrates, Carbonates, Sodium, Bicarbonates (except station-IV) and Sulphates (except station-II&III) are positively correlated to Rotifers in different stations in Palair reservoir.

Discussion:

Cladocerans were maximum in monsoon season when rotifer number was minimum indicating an inverse relationship. Similar observations were made by Mathew (1985) in tropical lake.

In the present study, similar observations were made where the cladocerans were abundant when the food supply (phytoplankton) was maximum. During pre monsoon season the low density could be due to more dense growth of rotifers thus avoiding competition and negative correlation with rotifer population. (Wright 1954; Singh 2000), Quadri and Yousuf (1980) found that the temperature is the primary factor affecting the occurrence and distribution of cladocerans.

Occurrence and distribution of cladocerans showed an inverse relationship with total hardness, magnesium, bicarbonates. Similar observations were found in Almatti reservoir, Bijapur. (Hulyal.et al., 2007)

Irregular occurrence of copepod peaks indicated no distinct correlation with the temperature of water, which is in agreement with the findings of Mathew (1985). Wetanabele (1983) has reported that the copepods are excellent food for zooplanktivorous fish and their nutritional value was also very high. Thus, abundant population density of copepods in Palair reservoir is favorable for pisciculture practices. In the present study copepods showed direct correlation with the rotifer population and with ostracods during the study period.

In the present study in Palair reservoir maximum copepods were observed in pre monsoon season and minimum in post monsoon season. Similar observations were made by Chouhan, 1993 in Renuka Lake, Himachal Pradesh.

In the Palair reservoir poor number of ostracods were reported the ostracods grow well in hard water (Harshey et al. 1987). This group was represented only by *Cypris* species.

The Ostracodes were abundant in post monsoon and very few in number in pre monsoon season indicating their preference towards low temperature of the reservoir. Hujare (2005) has reported on Talsande and Attigre reservoir that ostracods did not show any seasonal trend in their occurrence. Kaushik and Sharma (1994) reported that ostracods occur in greater number when the temperature of the reservoir is 20°C. Hence, our present observation is also in conformity with their findings.

Conclusion:

Reservoirs are the most important and effective water storage facilities in modifying uneven distribution of water both in space and time. They not only provide water, hydroelectric energy and irrigation, but also smooth out extreme inflows to mitigate floods or droughts. To make the best use of the available water, the optimal operation of reservoirs in a system is undoubtedly very important. Reservoir operation requires a series of decisions that determine the accumulation and release of water over time. In the face of natural uncertainty, forecasts of future reservoir inflow can be helpful in making efficient operating decisions. A particular problem in the case of water quality monitoring is the complexity associated with analysing the large number of measured variables.

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