



COMPARATIVE STUDY OF PHYTOPLANKTON AND ZOOPLANKTON DIVERSITY OF MAISDODKA LAKE AND WAI LAKE IN DISTRICT YAVATMAL, (M.S.) INDIA

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ABSTRACT:

Living and non-living component of any lake so far as proper balance of water yield product is concerned some aquatic plant and animals play an important role in any inland water ecosystem. To analyze the quality of water various planktons were found to study regarding their population present in these two water bodies. In any stagnant water body such as dam, pond, wetland and lakes there is qualitative and quantitative research work is needed for normal growth and development of fishes present in the same water bodies. In this current finding of two water bodies research work has been mainly concerned with the compares of planktons present to study relation with the production of food for fishes during the said study period of both the lakes. In this current finding mainly, observations are study on the climatic changes affects the plankton population in relation with the yield of fishes in both the water bodies. Research work done during period of Feb.2017 to March.2019 two years in which various planktons and fishes were collected and identified from these two water bodies. Maisdodaka lake and Wai lake have great number of green algae as well as various other faunal diversity found during this current research work of said study period of time. In this study various diverse groups of plants and animals recorded such as zooplankton and phytoplankton during these study period of time in Yavatmal District of Maisdodaka lake and Wai lake respectively. The recorded groups of zooplankton belonged to Protozoa, Rotifera, Cladocera, Copepoda and Ostracoda respectively. So far as the comparative study of both lakes is concerned research work is mainly stress on the production of fishes' relation with plankton present in these water bodies according to the changing environmental conditions. Maisdodaka lake and Wai lake provide self-employed for local fisherman and people residing nearby these two water bodies get water for irrigation and various delicious fishes which is a very cheap source of nutrition.

Keywords: Zooplankton, Seasons, Population, Ecosystem.

INTRODUCTION:

Maisdodaka lake and Wai lake provide water for irrigation, drinking, and various other purposes for nearby villages as well as many poor fishermen they fulfill their basic requirement of life by selling yield of fishes in weekly market of nearby villages. So, these lakes play an important role in Yavatmal District for social and economic progress during the past five decades. Lakes, dams, ponds provide opportunity for the growth of various planktons in different seasons so far as the production of different species of fresh water fishes are concerned in Yavatmal District of Maharashtra State. Stagnant water bodies help to prevent loss of soil erosion as well as preservation of species amongst the phytoplankton and zooplankton groups of flora and fauna in Maisdodaka and Wai lakes respectively during the study of research work. Maisdodaka and Wai lakes harvest rainwater for large group of aquatic plants and animals present in the water as

well as people for drinking and irrigation purpose in the Yavatmal District.

Phytoplankton play an important role in an any aquatic food chain. The productivity of an aquatic environment is directly correlated, with the density of phytoplankton and zooplankton. The physico-chemical factors are directly related with their productions. The phytoplankton is the base of most of the lake food webs and fish production is linked to phytoplankton. Moreover, number and species of phytoplankton serves to determine the quality of water body. It was then the subsequent works were aimed at finding out the causative factors responsible for the growth and sustenance of groups of phytoplankton or zooplankton.

Zooplankton is an important part of aquatic ecosystem and comprises of microscopic animal life that passively float or swim freely. The main components of zooplankton in lentic environment are represented by taxonomic groups of Rotifer,

Cladocera, Copepod and Ostracoda respectively. The study of fresh water fauna specially zooplankton even in a particular area is extensive and complicated phenomenon due to environmental, physical, geographical and chemical variation involving ecological extrinsic and intrinsic factor. Distribution of zooplankton and their variation at different zones of water body is known to be influence by physico-chemical parameters of water and production of fishes.

Cultivation of fishes in Maisdodaka and Wai lake in Yavatmal district provide various species of fresh water fishes so far as requirement of proteins, vitamins and other nutritional values having great importance for social and economic conditions of local people. Flora of various species plays an important role in the production of physical and chemical properties of water quality with respect to the yield of fishes. Similarly, microscopic fauna of various species also plays a vital role in the production of good quality of fresh water locally available fishes in different seasons. Hence, Maisdodaka and Wai lake contain important groups of phytoplankton and zooplankton diversity for the maintenance of equilibrium amongst the quality of water as well as fish fauna respectively during the course of study period of time of research work.

Diversity in the groups of phytoplankton and zooplankton regarding the physical and chemical properties of stagnant water bodies produces balance aquatic ecosystem for any kind of fish species and their marketable values with respect to food nutrition for common people health is concerned. During the present observation various groups of phytoplankton such as green algae, brown algae, yellow algae, purple algae and blue algae were found during the study period of two years research work on Maisdodaka and Wai lake respectively.

Flora and fauna of Maisdodaka and Wai lake are mostly use as a biological alarm because they give a lot of information regarding water pollution as well as the presence of various other microorganisms in the water body for penetration of sun rays and availability of food materials. Generally, any stagnant water body consists of three layers such as surface layer, middle layer and bottom layer which contains various types of fish species. In fresh water body some fishes are found on surface layer for example, *Catla catla*, while in the middle layer for example, *Labeo rohita* and in the bottom layer for example, *Cirrhina mrigala* respectively. Hence, their food and sunlight requirement are concerned which depends on the specific level of place according to the available species of flora and fauna found in the

fresh water for their mode of nutrition trophic level energy obtained.

Various species of flora and fauna are used as an integral part of any aquatic fresh water qualitative and quantitative properties depends on presence of physical, chemical and biological parameters to produce the nutritious fish and other aquatic yield products. This study definitely useful for the common people because of new findings of species of flora and fauna available food for the fishes and quality of water for irrigation, drinking, bathing purposes. Maisdodaka and Wai lake are not eutrophic lakes because a lot of oxygen is available for the fishes and other aquatic plants, hence the prevention of anthropological activities and agricultural residue runoff must be reduced.

Now a days fresh water bodies provide employment for local poor fisherman to fulfill their basic needs of daily life by selling fishes in the weekly market in an affordable price. Various species of fresh water fishes are found in Maisdodaka and Wai lake which have a great demand in the nearby market because of due to delicious taste of fish and freshly available on the market day at affordable rate in which common man can purchase it easily as compare to other vegetable like onion etc.

A fresh water body which fulfills variety of human needs and it is full of value only when it is not abused. The changes in the global environmental parameters have been resulted in great alteration in the pattern of summer, winter, rainfall, wind direction etc. These fresh water body are now under threat due to encroachment, silting, weed infestation, civilization and industrial contamination respectively. The combination of all these factors has given rise to problems like decrease in biodiversity, deterioration of water quality, sedimentation and shrinkage in area of fresh water bodies.

The aquatic ecosystem is under threat due to various manual hazardous activities. Human seemed to be adjusting well to these changing circumstances with the help of modern technology and equipment's, but animal is still struggling to adjust themselves to such a great and sudden change. It has also led to decrease in migratory bird's population and loss of fish diversity (Khekare and Sawane, 2015).

India is endowed with both marine and inland fisheries. The coast line of India runs to an estimated 6090 km. Maharashtra ranks second among the maritime states in marine fish production, with 5 coastal districts, 720 km of coastline, the state share in the countries total marine production formed about 18-22% in recent years (Jhingran, 1991). India is among the seventeen mega biodiversity hotspot countries of the world. India is now on the third position in fisheries, and got second position in aquaculture in the whole world (Choudhary and Kumar, 2017). The wetland in India provides excellent ecological conditions for

the propagation of fish, which plays an important role in augmenting in food supply and raising nutritional level. River and lakes conserve a rich variety of fish species which also support the commercial fishery. Rivers in India constitute the backbone of the capture fisheries.

Right from the time immemorial, it can be said that possibly the first source of man's food was fish, which he derived from inland water. Evidences from the cave drawing, paintings, sculptures drawing on hunting implements show that, man cultivated fish in ponds for thousands of years (Kamdi, 2000). The habit of fish consumption and the tradition of fish farming dates back to the pre-Christian era when the Asians had fish ponds where they breed up to fifty different species of fishes. Back then, many Christian used to have fish every Friday in honors of Christ. Japanese too love their raw fish commonly known as Sushi. The Roman traded fertilizer fish eggs for farming purposes and Chinese also farmed fish for eggs on their rice field when the field remained waterlogged. (Nandi and Chatterjee, 2006).

In India the interest in fish and fisheries date back two third millennium BC. Diggings at Mohenjo-Daro and Harappa of the Indus valley civilization proves fishes being used as a food at that time. While Aristotle (384-327 B.C.) is said to be founder of Ichthyology. In 1127 AD the son of King Vikramaditya VI King Someswara, composed a book entitled 'Manasolatarā' where he first of all recorded the common sport fishes of India and grouped them into marine and riverine forms (Gupta and Gupta, 2006).

In recent years the nutritional importance of aquatic food has increased factually because of scientifically recognized beneficial effects of eating aquatic food. Fish is highly nutritious, tasty and easily digestible. It is much sought after by a broad cross-section of the world's population, especially in developing countries. It is estimated that around 60% people in developing countries depends on fish for over 30% of their animal protein supplies. However, with the increased awareness of the health benefits of eating fish and then forthcoming rise in fish species these figures will definitely changing (Sujatha, 2013).

An inland fishery in India distinguish in two parts, culture and capture fisheries, operates in river, lakes, reservoirs, tanks and irrigation canals. Except river fishing all other water resources of the country are under-exploited. The yield level of fishes is far below the potential yield (Dantwala, 1983). A state government promotes culture fisheries through the establishment of Fish Farmers' Development Agencies, which provides subsidies for renovation of tanks and providing subsidized fish seeds (Kent, 1987). About 21,730 species of fishes have been recorded in the world, of which 11.7% are found in Indian waters. Out of the 2546 species so far Listed, 73 belongs to cold water regime, 544 to the warm

fresh water domain. 143 to the brackish water, and 1,440 to the marine water ecosystem.

Worldwide about 450 families of freshwater fishes are found. In that near about 40 families are present in India. Merely 25 families contain fish species which has commercial value. (Thirumala *et al.*, 2011). Fishes are the good supplement for cereals grains because nutritional point of view man cannot survive on bread diet alone; moreover, all cereal grains are low protein quantity and quality. Cereals particularly low in lysine and methionine which are essential amino acids while fish protein comparatively rich in these amino acids and it contain all other essential amino acids which are required for balanced diet (Talat and Azmat, 2006). Biochemical studies are of great importance from the nutritional point of view. Proteins are essential for the sustenance of life and accordingly have largest quantity of all nutrients (Sudhakar, 2011). In various fish species proteins required as structural compound, biocatalyst, and hormones for control of growth and differentiation (Amal, 2012). Protein in fish is the main component constituent of tissue and organ of the body. They are the precursor for other nitrogenous compounds

In India first fishery cooperative society begins in 1913. Name of that society is 'Karla Machimar' started in Maharashtra (Gupta and Gupta, 2006). As early as 1945, the Fish commodity of the Indian Council of Agricultural Research (ICAR) pointed out the need for accurate fishery statistics. The government of India established the central Inland Fisheries Research institute at Barrackpore (West Bengal) in 1947. This institute developed in to a premier research center of India and is now on the fishery map of the world (Jhingran, 1991). In 1973-1974 government of India starts two programmes for fisheries. These are 'Fish Farmer Development Agencies' (FFDAs) and 'National Programme for Fish Seed Development' (Gupta and Gupta, 2006).

Organic chemical nutrients such as phosphate (PO₄) and nitrate (NO₃), then also require carbon in form of carbon dioxide (CO₂). Some phytoplankton, the diatom also requires a form of silicon (Silicate, SiO₄) because they have a glasslike shell. Zooplankton and phytoplankton itself can be further divided with three orders of algae predominating. Water is a scarce and valuable natural resource available to mankind. Water is of prime importance not only for survival of human beings but also for animals, plants and all other living organisms. The local water bodies are used for multiple purposes like drinking, fish culture, irrigation, domestic use, washing clothes and animals etc.

Due to uncontrolled urbanization, environmental degradation has been occurring very rapidly causing depletion of aquatic biota (Veena *et*

al.,2016). Hence, there is a need to check the water quality regularly and then control the contamination of water which causes water borne diseases. Functional parameters of an ecosystem attributes to the ecological significance and resulting from the interactions between its physical, chemical, and biological components. These interactions result in the creation of a variety of niches which are inhabited by various organisms thus providing a habitat for plants, animals and microorganisms in an ecosystem and thus determine the tropic dynamics of the aquatic body for its proper fish production. The members of plankton community are important for their role in tropic dynamics and in energy transfer in the aquatic ecosystem. They provide the food for fishes in the fresh water and play a major role in fish production.

Biological production in any aquatic body gives direct correlation with its physico-chemical status which can be used as trophic status and fisheries resources potential. Life in aquatic environment is largely governed by physico-chemical characteristics and their stability. These characteristics have enabled biota to develop many adaptations that improve sustained productivity and regulate lake metabolism.

METHOD AND MATERIAL:

Study Area: Govt. of Maharashtra, in the year 1997, Wai lake and Maisdodaka lake was constructed as part of irrigation project. Wai lake is situated in Kelapur Taluka and Maisdodaka lake is situated in Maregaon Taluka of Yavatmal District of Maharashtra state.

Plankton net, Sample bottles, Microscope slide, Microscope cover, 70% ethanol, Light binocular microscope and Pipette.

Sampling collection and data analysis:

The experiment was between Feb. 2017 to March 2019. The sample of zooplankton and phytoplankton were collected between 9.00am – 11.00 am twice in a week. Sample were taken by using plankton net about 5cm below the water surface which are then transferred into samples bottles.

By using 70% ethanol added into 50 ml each were collected in each sample bottle. Samples then stored for three days before laboratory analysis for planktons. In the laboratory, samples were decanted; the sediment was dropped on a glass slide using a pipette and was cover with a microscope cover.

The samples were then viewed under a light binocular microscope with magnification of x25. The duplicate sediment was decanted and analyzed for comparison. Identification of planktons was takes place in this way. The frequency level and

occurrence, number of abundances of each species in monthly samples were estimated.

The water of Maisdodaka and Wai lake is perennial and is utilized for irrigation, drinking, washing purpose as well as for pisciculture activities. The data was collected in different seasons such as summer, winter and monsoon respectively. The zooplankton sample was collected by filtering 10 to 20 liters of water by using plankton net which is made up of bolting silk cloth no.22 and sample was preserved in 4% formalin. The qualitative analysis of the organisms is carried out using microscopic study. Sample was analyzed by using the microscope in 10x and 3.2X magnification for identification of zooplankton and phytoplankton.

For the collection of phytoplankton, were made employing a modified Heron Tranter net with square metallic frame of 0.625m area. The filtering cone was made up of Nylon bolting silk plankton net (No. 25 mesh size 50mue) was used for collection of phytoplankton. Collected samples were transferred to labelled vial bottles containing 5% formalin. Quantitative analysis and identification were done on a Sedgwick Rafter Counter cell by taking 1 mL sample. Zooplankton samples were collected by means of a plankton hand net of bolting nylon cloth (mesh size 45mm). The net was prepared according to the design given by Welch (1952). Samples were collected by filtering 50litres of water through net, from each water body in early morning hours (between 9 to 11 a.m.), for a period of two years i.e. February 2017 to March 2019.

3. RESULT & DISCUSSION

The current study findings of the flora and fauna of various species from the research sites of Maisdodaka and Wai lake belonging to various groups during the period of two years. In this current finding of various groups of phytoplankton was found to different classes namely Chlorophyceae, Cynophyceae, Bacillariophyceae and Euglenophyceae respectively.

Chlorophyceae (green algae) were found to be on ranks first in all observations was next to Cynophyceae, and Bacillariophyceae was the third abundant group and Euglenophyceae was found to be recorded very less number observed in the **Table No.1.** during the study period of two years from the two research sites of Maisdodaka and Wai lake respectively. In case of variety of phytoplankton, Chlorophyceae is abundantly found in both the water bodies as compare to other group of members during the study period of two years.

In the present research work regarding the variety of zooplankton, Rotifers found in a large number during the study period as compare to other groups of members such as Protozoans, Cladocerans, Copepods, Ostracods respectively observed in the **Table No.2**. Rotifers was found to be on first rank in all the observations next to Cladocerans, and Protozoans were on third abundant group followed by Copepods. Ostracods was found to be very less in number observed in the **Table No.2** during the study period of two years from the two research sites of Maisdodaka and Wai lake respectively.

In the present research work, maximum number of phytoplankton were observed during summer season i.e., Chlorophyceae (green algae) were found abundantly due to because of evaporation of water loss by high temperature while minimum number of phytoplankton observed during rainy season may be due to dilution of rainwater in the lakes.

Maximum number of Zooplankton were observed in the Maisdodaka and Wai lake during summer season due to evaporation of water loss while minimum number of Zooplankton were observed during rainy season due to dilution effect, during the study period of two years from the two different research sites. Comparatively, according to the values of **Table No. 1 and 2** given below, phytoplankton and zooplankton average number of groups were found maximum during summer season and minimum number of groups were found during monsoon season due to different climatic conditions of the lakes.

The number of group of phytoplankton such as Dinophyceae is less and Chlorophyceae is more in both the lakes. Similarly, in case of zooplankton the number of group of Ostracods are less in number while Rotifers are more in number during two years research work. Hence, according to different seasons there is a variation occurs in the number of groups of flora and fauna which affects the production of various types of fresh water fishes found in the locally available species for marketable values of mode of nutrition's among the people of residents of nearby water bodies. So, both the water bodies are suitable for fish culture.

CONCLUSION:

Every organism is dependent on water for its survival. There is inimitable correlation in between water and life. Without water we can't even think

about living organisms. Water is the most important natural resource of the life support system. Dams, ponds, reservoir and lakes are the important source of water and aquatic organisms such as fishes.

The changes in the global environmental parameter have been resulted in great alteration in the pattern of summer, winter, rainfall, wind direction etc. The lakes are now under threat due to encroachment, silting, weed infestation, pollution, urbanization, industrialization etc.

The aquatic biodiversity of world is changes and getting exhausted terrifyingly fast. Destructions caused by loss of habitat, pollution, invading of exotic species, over exploitation and other anthropogenic activities are responsible for these changes and degradation. So, it is need of an hour to protect water bodies for the survival and conservation of ecosystem and biodiversity. The present research work reveals flora and fauna in the lake analyzing the physical, chemical and biological properties of water with respect to the production of locally available fishes. The green algae and rotifer have been used as an important flora and fauna in both the lake observation relatively used for the production of fishes for human consumption. Mostly the group of members of phytoplankton and zooplankton observed in Maisdodaka and Wai lake found without pollution water organisms for the betterment of the future fish breeding culture programme. This research investigation observes that the both water bodies are safe for drinking, fishing, birds, domestic animals and human beings for various purposes utilization of water.

ACKNOWLEDGEMENT

We are grateful to, Dr.R.P. Ingole Sir, Principal, S. P. College, Ganj Ward, Chandrapur, Dr. Mrunal Kale Sir, Principal, Anand Niketan College, Anandwan, Warora, Dist.-Chandrapur, for their constant encouragement and valuable suggestions.

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Table No.-1: Seasonal variations of Phytoplankton of Maisdodaka Lake and Wai lake during Feb.2017 to March. 2019.

Phytoplanktons	Maisdodaka Lake			Wai Lake		
	Monsoon	Summer	Winter	Monsoon	Summer	Winter
Chlorophyceae	1101	1403	1207	1126	1637	1346
Cynophyceae	504	657	553	538	757	608
Bacillariophyceae	706	1503	856	813	1323	978
Euglenophyceae	257	804	458	348	727	459
Dinophyceae	209	705	353	239	673	375
Average	555.4	1014.4	685.4	612.8	1023.4	753.2

Table No.-2: Seasonal variations of Zooplankton in Maisdodaka Lake and Wai Lake during Feb. 2017 to March 2019.

Zooplankton	Maisdodaka Lake			Wai Lake		
	Winter	Summer	Monsoon	Winter	Summer	Monsoon
Protozoans	249	449	168	254	501	199
Rotifers	499	660	204	533	701	220
Cladocerans	197	530	192	184	621	119
Copepods	94	191	163	301	330	106
Ostracods	84	93	69	93	83	57
Average	224.6	384.6	159.2	273	447.2	140.2