Study on the Diversity and Seasonal Variation of Phytoplankton in Kanya Pond Sitamarhi, Bihar

Kirti Kumari

Post Graduate Department of Zoology, J.P University, Chapra, Bihar, India

ABSTRACT

As we can observe that the phytoplankton population is declining rapidly because of climate changes around the world. Phytoplankton being base for the Ecosystem, food chain and also it accounts for about half of global primary productivity or creation of organic matter. Phytoplankton is the major consumer of CO_2. The rate of carbon fixation at the primary level provides the best assessment of physical, chemical and biological interaction determining the actual fertility of any environment. Primary productivity of Phytoplankton and its regulating factors were studied in a pond in Sitamarhi Distric of Bihar, for duration from January 2009 to December 2010. Primary productivity was determined by light and dark bottle method, physicochemical factor, water temperature, life penetration depth, pH, DO, alkalinity, hardness, PSS, PDS, nitrate, phosphate and phytoplankton density were determined following the standard methods. Primary productivity was found maximum in the post monsoon and monsoon season. Mean value of primary productivity was lower in summer and winter season.

Key words: Phytoplankton factors, physicochemical, seasonal variation, primary productivity

INTRODUCTION

The term ecology is derived from 2 Greek words Oikos meaning household or home or the place to live or habitation and Logos meaning discourse or study. It is also called environmental biology (smith 1977). This branch deals with relationship between the organisms and its environment. Ecology was of practical interest early in human history, In Indian classical books like the Veda Upanishad and Epic literature; Ernst Haeckel (1869) defined ecology as investigations of the total relations of animals to both their organic and inorganic environment. Charles Elton (1927) a British ecologist defined ecology as "the scientific natural history concerned with the sociology and the economics of animals". Mishra (1970) defined it in a broad sense, as study of ecosystem. Taylor (1936) defined it as "the science of all relations of all organisms to their environment". Odum E.P.(1963) defined it as" study of structure and function of nature" Ecology emerged from biology as an essentially new, integrative discipline that links physical chemical and biological process, forming a bridge between natural

and social sciences(E.P.Odum, 1977) In modern concept of ecology A.G. Tansley (1935) proposed the term ecosystem and defined it as “the basic fundamental unit of ecology which include the both the organisms and the non- living environment, each influencing others properties and necessary for maintenance of life. As per stand point of trophic structure, an ecosystem is two layered. The upper autotrophic stratum or green belt of chlorophyll containing plant for fixation of light energy .A lower heterotrophic stratum or brown belt of soils and sediments, decaying matter, roots and so on. The following components constitute the ecosystem- inorganic substances involved in material cycles, organic compounds , air, water, substrates and other physical factors, producers (autotrophic organisms), phagotrophs (heterotrophic organisms, chiefly animals) and saprophytes (organisms feeding on dead organic matter)The decomposing activities of saprotrophs release inorganic nutrients that are usable by the producers, and also provide food for the macro consumers and often excrete substances that inhibit or stimulate other biotic components of the ecosystem. Different organisms of an ecosystem, plants & animals, are linked together by their nutritional requirements. Individuals related in this manner constitute the food chain". The various steps in food chain are called trophic level. In an ecosystem the various food chains are interconnected with each other to form a network called "food web" Water forms the biggest ecosystem i.e. the aquatic ecosystem of the biosphere Global aquatic system fall into two classes-the fresh water ecosystems and salt water ecosystems. Fresh water ecosystems, the study of which is known as limnology, are conventionally divided into two groups. Lentic, standing or still water habitats and lotic or running water habitats. The lotic follows a gradient from springs to mountain brooks to streams to rivers (Smith, 1991). The lentic involves a gradient from lakes to ponds to bags, swamps, ditches & marshes. Fresh water ponds play an important role in determining the nutritional and health status of the people. Pond is a good example of aquatic ecosystem and has both biotic & abiotic components. The living beings are born, they live, breath, feed, excrete, move, grow, mate, reproduce, become food for each other and die within the pond itself. The decomposers act on dead plants and animals for their existence & convert the stored materials in them to their elementary forms. Bihar is one of the few states with large inland fisheries & adequate Resources with plentiful water resources in the form of ponds and tanks (covering approximately 95000 hectares) and major flowing rivers. The annual consumption of fish is around 4.5 lakh tons against the present annual production of 2.25 to 2.50 lakh tons.

MATERIALS AND METHODS

The pond under study is situated in Sitamarhi district of Bihar. The present project limnological evaluation at kanya pond at Ramnagra Sitamarhi district with special reference to fish productivity was carried regularly for duration of 2 years from January 2009 to December 2010. The sample were collected monthly from the pond for various studies and were carried out at the laboratory of P.G department of zoology. This pond is surrounded by human habitation. The pond was found affected by various anthropogenic activities mainly by domestic and municipal sewage, domestic waste disposal, bathing of animals, washing of cloths etc. few cow shed and vacant land were also present in the vicinity of pond from this place the monsoon run of also mix with the pond water. The pond is also used in aquaculture, fish culture. A preview of available literature has revealed that no other scientific study has been carried out with respect to ecological characteristics of this pond with same back ground, the present study was proposed– sampling and analysis was carried out periodically on monthly basis for 24 months duration from January 2009 to December 2010. Sampling and analysis of physicochemical parameter of water- temperature turbidity and transparency of water. Determination of pH by the help of pH paper. Planktons were collected every month and were regularly analysed by use of various methods. Daily rate ($gc/m^2/day$) can be obtained by multiplying the maximum hourly rate obtained during the day. In the present study respiration rate refers to only those organism which are suspended in water together with phytoplankton. 50 liter of surface water was filtered for sampling of phytoplankton through the standard plankton net (mesh 25, diameter of the pore 60 miu) quantitative analysis of phytoplankton was done by using Sedgwick – Refter cell.

Discussion

Water is the soul of nature. Clean water is one of nature's gifts to the mankind. A water body has its own ecological importance the animal and plants living in different hydrosphere have their respective adaptability. The maintenance of aquaculture may lead to the enactment of the fish production and interrelationships of aquatic flora and fauna of that particular water body. Kanya pond, located in the Sitamarhi district of Bihar, which has a number of ponds and reservoirs of similar kind. Among the biotic components discussed before are the main and discussed according to their position in the food chain of the pond, regarding phytoplankton. The phytoplankton are the product of aquaculture and play a significant role as food of the fishes. The rich water body has abundance of planktons population and fluctuations in planktonic population is a common phenomenon of fresh water body. In the Kanya pond the phytoplankton was studied in detail during 2009-2010. In the year 2009 the green algae was found to be

dominant and pick period was In April, May and June. In 2010 again the algae topped the list and especially in the month from march to June. There is great variation is recording the plankton peaks by different workers. Michael 1969 and Saha et al. did not observe two peaks in their works. They recorded a single pick in a year. Michael found such peak in September whereas Jana, Dey and Doy (1980) found 3 distinct peaks in a fresh water pond. As per Seenayya (1971) work on fresh water, there were several peaks due to change in hydro climates or biological complexes

Observation

For a good going ecosystem like the Kanya pond there is a well-established food chain. It exhibits the biotic components linked with other as a chain. They are producer, consumer, and decomposers. The producers are represented by emerged and submerged plant, free floating plants and the phytoplankton. Study the phytoplankton where study in detail. In addition to this the flora of the pond will also be discussed. The Kanya pond has been found to contain very less vegetation but on the other hand plenty of phytoplankton were observed. Emerged vegetation - it included rooted plants the rooted aquatic vegetation recover nutrients form the deep sediments and thus provide "Nutrient Pump" these form a link between water and land environment. Floating vegetation are the rooted plants whose leafs floats on the water surface whereas remaining part lies under water. These ponds are found to consist very rarely and floating plants. In the cold weather some Pistia and Wolfia were found however they were nil during other climatic condition. Submerged vegetation, includes rooted or fixed plants which are completely submerged under water, there leafs are thin and finely divided and adapted for exchange of nutrients with water. Some plants which were collected from the bottom of the pond are Vallisnaeria, Hydrilla, Cara, Putamogeton, Utricularia etc. Investigator took help of some workers of Botany for identifying these plants. The amount of these plants were found to vary abundantly in the month of October to April. they were less in number in later months. There are minute floating plants (Mainly algae) distributed throughout the pond as deep as light penetrates, when in abundance phytoplankton give a greenish color to the pond water. These are autotrophs and represent the producer of the pond. Phytoplankton population of the pond consisted mainly of green color (chlorophyceae), diatoms (bacillariophyeae) and blue green algae (cyanophyceae). They form basic food for the fish in the case of herbivores fishes. They play major role in enhancing the rate of productivity of a water body. There is a variation in composition, distribution and abundance of phytoplankton. They fluctuated in different seasons and moths. List of phytoplankton of Kanya pond **Group A**- chlorophyceae (green algae) Cosmarium, chlorella species, zygema sps, Spirogyra sps, ulothrix, tertapore sps, chlamydomonas sps, oedogonium sps. In **Group B** - cyanophyceae (blue green algae) Oscillatoria, nostoc sps, Anabaena sps, spirulina sps, microcytosis sps. In **Group C** - bacillariophyeae (diatoms) Melosira, diatoma sps, synedra sps, cymbella sps, cyclotella sps, navicula sps. So phytoplankton

of the studied pond is dominated mainly by 3 groups. The chlorophyceae consisted of 10 genra in which Spirogyra, oedogonium, ulothrix, zygnena was maximum. The bacillariophyeae was presented by 5 genra where as the myxophyceae by 6 genra respectively. The dominant of them are listed in the figure 1 and 2

	Major groups	Jan.	Feb.	Mar.	Apr.	may	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total	%
1	Chlorophyceae (Green algae)	30	22	60	78	100	90	14	02	16	50	58	40	560	37.50
2	Bacillariophyceae (Diatoms)	15	13	43	58	85	80	12	10	16	62	52	30	476	31.55
3	Myxophyceae (Blue- Green Algae)	10	12	40	83	80	83	15	5	25	46	36	30	465	30.95
Total		55	47	143	219	265	253	41	14	57	178	146	103	1501	

Table 1. monthly fluctuations in the phytoplankton per litre of water in Kanya pond 2009

Sno	Major groups	Jan.	Feb.	Mar.	Apr.	may	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total	%
1	Chlorophyceae (Green algae)	13	24	72	80	105	102	12	3	14	73	46	36	600	38.26
2	Bacillariophyceae (Diatoms)	20	11	45	60	85	84	11	18	11	55	50	45	495	31.56
3	Myxophyceae (Blue- Green Algae)	18	10	45	80	85	76	10	16	20	42	38	33	473	30.16
Total		51	45	162	220	275	262	33	37	45	170	134	114	1568	

Table 2. Monthly fluctuations in the phytoplankton per litre of water in Kanya pond 2010

REFRENCES

- Kumar Nirmal, 1991 Seasonal primary production of Phytoplankton of Temple Tank Vada et Tal, Gujrat J.Indian Bot: SOC, 70: 427-428.
- Patnaik, S. and Sarker, S.K. 1976 observation of the distribution of phytoplankton in Chilka lake. J. Inland fish , SOC. India 8:38-39.
- Patralekh, L.N. (1994) : phytoplankton periodicity in a perennial pond of Bhagalpur lake, India environ and Ecol.g (20) : 356-358 .
- Pearsall, W.H. 1932 phytoplankton in English lakes. The compostion of the phytoplankton in relation to dissolved substances. J.Ecol.20 : 241-262
- Philipose, M.T. 1959 fresh water phytoplankton of Indian fisheries proc.symp. Algology. 272-291
- Philipose M.T. 1960. Fresh water phytoplankton of fisheries. Proc. Symposium on algology ICAR New Delhi ; 273-91
- Singh, V.P. (1960). Phytoplankton ecology of the inland waters of Uttar Pradesh Proc. symp. Algal. L.C.A. r.N. Delhi, 243271 singh, R.K.Srivastava, N.P. and Desai, V.R. (1980) : Ses and diurnal variation in physico-chemical condition of water and plankton in lotic sector of Rihand reserver.
- Talzar, M.M. and Beese, B.(1988) :The Seasonal productivity cycle of phytoplankton and controlling factors in lake Constance Schweiz., Z. Hydrol : 50:1-39
- V.Soni, S.Khwaja and M.Visavadia, “Pre-impoundmental Studies on Water Quality of Narmada River of India,” INT. Res J.Environ. Sci., vol.6, no. 2, pp. 31-38, 2013.
- S.Rashmi, “Seasonal variation in physico-chemical and biological analysis of Moti Lake, Motihari East Chamapran Bihar,” Res. J.Chem. Environ. Sci.vol.4, pp.56-61, 2016.