LIMNOBIOLOGICALSTUDIES ON TWO PONDS OF VIZIANAGARAM

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Abstract: Limnology is the study of the structural and functional relationships and productivity of organisms of inland aquatic ecosystem as they are regulated by the dynamics of their physical, chemical and biotic communities. Studies pertaining to our understanding of freshwater bodies of water in the tropics are very meager. Study of ecosystem regulation is a perennial theme in ecology and from such studies we know that communities are influenced by a variety of physical, chemical and biological factors. One of the main problems in ecology is to untangle the interactions among these factors and to measure their relative importance. The relative role of different ecological forces may vary among biological systems or within the same system (Hunter & Price, 1992).

Many limnologists have laid stress on the statement, that an inland lake or pond is a "self conditional institution" or "closed community "enjoying considerable independence of the adjacent land mass. But due to rapid industrial and urban development some of the physiographical features of these fresh water bodies have under gone rapid changes and some of these environments are also subjected to certain harmful effluents.Various aspects of the study of Limnoplankton are of paramount importance since Limnoplankton serves as food for many larger organisms and plays an important role in food cycle of a pond. The population related to cilliophora Protozoans, Rotifers, crustaceans and larval forms of other animals play vital role as the main constituents of freshwater zooplankton. In order to have complete knowledge of the role played by these organisms in the trophic dynamics of the ecosystem the present investigations were undertaken.

Introduction: A pond is defined in different ways by Forel (1892), Whipple (1947) and Welch (1952) and no exact limits of area and depth have been laid down. According to Oven and Vass (1961) "a pond is a small body of water operated by man for fish culture". V.G.Jhingran (1975) stated that the basic principles of soil and water qualities governing the productivity of lakes and ponds are the same. But unlike lakes, a pond is subject to subsequent changes such as filling, stocking and finally draining which influence the pond water considerably.What the pond at 8.00 am. is not the same at 11.00 a.m. The more fluctuating factors are Carbon dioxide, Dissolved oxygen, Temperature, pH and other physico-chemical factors.In a pond the production of green plants which form the first link in the food chain, is the most important process, which then leads other factors to grow and influence the pond. A conventional approach of analysis the various physico-chemical and biological parameters over a long period is necessary to understand the fundamental aspects and to evaluate the trophic nature of the ecosystem. Likens (1975) is of the view that the biological productivity of the tropical waters is high owing to rapid photosynthesis, favorable temperature and adequate intensity of light.

Under the leadership of **Annandale** who became the first Director of the Zoological Survey of India in 1916, a number of expeditions were conducted on Hydro-biological conditions of freshwater bodies in British India. Several prominent native Indian scientists were associated with Annandale during that period. Practically all kinds of habitats such as lakes, swamps, ponds, thermal springs, streams, torrents, rivers, coastal lagoons and estuaries of about 269 were surveyed (Annandale, 1915–24, 1918, 1919, 1921, 1923; Annandale et al., 1921; Annandale & Chopra, 1924; Annandale &Rao, 1923; G.L. Arora, 1931; Chopra, 1927; Gurney, 1907; Hora, 1922; Prashad,1919, 1922, 1923; Preston, 1909, 1914; Sewell, 1924, 1934). These surveys included detailed observations on water quality and related habitat characteristics, and their relationships with the organisms were often discussed (Prashad 1916). Unfortunately these studies, made long before the Sunda Expedition of 1928, do not find a mention in the history of tropical limnology. (BrijGopal&D.P.Zutshi, 1998).

The first IndianLimnological report by an Indian on the seasonal conditions governing the pond life is that of Prasad (1916) from Punjab. After two decades Pruthi (1933) studied the seasonal changes of the physico-chemical characteristics of a fresh water tank in Calcutta, India. Das and Srivatsava (1956 and 1959) reported on the bimodal pattern of the plankton production in fresh water ponds of Uttar Pradesh. Departures from the above observed patterns were reported by Michel (1969) and Saha et.al (1971), Alikuni et.al (1955) reported on the occurrence of variables of planktons in nursery ponds manure with cow dung. Sreenivasan (1968) and Zutshi (1981) explained the limnology and primary production trends based on the productivity estimates in ponds. The importance of bottom Fauna is the context of its role in the tropic cycle in a body Water is well recognized. The abundance and distribution of the bottom Fauna have a bearing of fisheries.Each pond

is a dynamic system.Hence, the study of Ecology of various groups of organisms is essential in order to know their role in the circulation of food materials. The zooplankton are the most dominant group, which play a very important link in the food chain.

Present work and Methodology: The work on present ponds was done between May 2009 to April 2011, for a period of two years. The ponds PeddaCheruvu (Pond-I) and AyyaKoneru (Pond-II) are perennial ponds used also as fish cultured ponds .I have given below a data of Biota available in both these ponds. Water samples were collected in all the localities during May-2009 to April, 2011 at the rate of four collections in a month with weekly intervals in all the three major ponds. Each collection was made at three different stations in each locality. The samples were taken between 6.00am to 8.00am. The data presented in the tables and figures are the monthly averages.

Water samples for hydrographical analysis were collected by dipping a 250 ml wide mouthed glass stopered or polythene bottle just below the surface of water in open condition. The water was immediately transported to the laboratory after replacing the stopper, for chemical analysis. The analysis was generally completed within 24hrs.after collection. Temperature was recorded in the field by an ordinary centigrade thermometer Transparency is measured by a Secchi disc.Hydrogen-ion concentration was noted in the field by using narrow range p^H paper (BDH), universal indicator solution (BDH) and a portable p^H meter (systronics, Type 323). Turbidity was determined by the Hellige Turbid meter with help of standard curves supplied with the instrument.

Water samples collected into 125 ml capacity bottles were treated in the field for the determination of dissolved oxygen (DO2) according to Winkler's method but for final corrections the Do content was determined by a DO meter (model-JENWAY-9015). Carbonate and bicarbonate alkalinity were determined by titration with standard hydrochloric acid of N/20 (0.05 N) using phenolphthalein and methyl orange as indicators. Hardness of water was determined by titration with standard EDTA solution using the Erichrome Black T. mixture as indicator. Chlorides were estimated by titrating the sample against the standard silver nitrate solution (0.0141N) using the potassium chromate indicator (Mohr method).

Free Carbon dioxide was determined by titrating the sample against the standard alkali titrant (standard sodium carbonate of 0.0454 N) using phenolphthalein indicator. Biochemical oxygen demand (BOD) was estimated by dilution method, after 5 days incubation at 20^o C. All these above methods of analysis were according to the "standard" methods for the examination of water and waste water "U.S.A (1971) and as per Standard Methods for the Examination of water and wate water adopted by American Public Health Association, APHA (1989). The collection of plankton samples were taken up by a tow net of No.20 made up of silk bolting cloth (mesh size 70 μm), with about 1 foot in diameter. For quantitative analysis of plankton known quantity (100 lts) of water was passed through the net. The volume of water filtered through the net varied in different localities depending on the plankton concentration. The inside of the net was thoroughly washed with water to obtain any adhering organisms within the meshes.

For systematic study of planktons, samples were collected separately. The organisms were first observed in live condition and then the concentrate was divided generally into three parts. The first part was treated with 5% procaine hydrochloride and then fixed in Schaudinn's fixative. The second part was treated with 5-10% formaldehyde and third part was treated with boiled water and then fixed in formalin. When the organisms treated directly in formaldehyde, the soft parts contracted considerably leaving the clear outline of the Lorica, thus making the identification easy. Hot water treatment gives satisfactory results as well as can fix the organisim in its natural position which no other relaxing agent can do. A large number of organisms were placed in a Petri dish somewhat less than half full. An equal amount of boiling water was suddenly poured into the middle of the dish. This method worked well for basically free swimmingorganisms.The forms were stained in Haematoxylin and Alum carmine. Then they were mounted in pure glycerin and glycerin jelly. For the observation of Mastax, specimens were treated with KOH according to the method described by Myers (1937) and forms so treated were mounted in a glycerin. Forms treated with sodium hypochlorite also gave good results. For the genomic and biochemical analysis samples were segregated as per their genus and preserved separately for future use.

Check list of biota recorded from the ponds: The present investigation has enabled to identify a total number of about 200 species of various organisms in these two ponds. Of which 22 are Phytoplanktons, 4 Hydrophytes and over 95 types of Zooplanktons, few Nektons and many varieties of Benthos accounted for the remaining part. The classification adopted in this work is based on that given in Edmondson (1959). The identification of Rotifera, Cladocera and Copepoda was made possible with the help of availableliterature. In all 22 genera of Phytoplankton belonging to three classes of algae were identified and designated as 'forms'.

FLORA: PHYTOPLANKTONS		
CLASS	**ORDER**	**FORMS**
CHLOROPHYCEA:	Volvocale	Form: Eudorinasp
		Form: Volvox sp
	Chlorococcales	Form: Coelastrumsp
		Form: Cocytissp
		Form: Pediastrumsp
	Oedogoniales	Form: Oedogoniumsp
	Conjugales	Form: Closteriumsp
		Form: Spirogyra sp
		Form: Staurastrumsp
BACILLARIOPHYCEAE	Bacillariales	Form: coscinodiscussp
		Form: Bacillariasp
		Form: Synedrasp
		Form: Naviculasp
MYXOPHYCEAE	Chlorococcales	Form: Mycrocystissp
		Form: Merismopediasp
		Form: Gloeocapsasp
	Hormogonials	Form: Oscillatoriasp
		Form: Spirulinesp
		Form: Lyngbyasp
	Nostocal	Form: Anabaenasp
		Form: Nostocsp

HYDROPHYTES	
I. Hydrophytes with Floating	Ipomoea aquaticaForsk
II. Submerged hydrophytes :	Chara Vulgaris L.
	Hydrillaverticillata (L.fil) Royle
	Nitella sp.

FAUNA:		
PHYLUM	**CLASS**	**FORMS**
PROTOZOA	CILIATA	Vorticellasp
CNIDERIA	HYDROZOA	Hydra sp
ROTIFERA	BDELLOIDEA	Philodina citrine Ehrenberg

Philodinamegalotrocha Ehrenberg.
Rotariarotatoria (Pallas)
Rotariavalgaris (Schrank).
Rotarianeptunia (Ehrenberg)
i.MONOGONONTBrachionuscalyciflorus (Pallas)
B.calyciflorus forma anuraeformis
B.calyciflorusvarhymaniDhanapathi.
B.calyciflorusvardorcas (Gosse).
B.calyciflorusvardorcas forma spinosus (Wierzejski).
B.calyciflorusvarpala (Ehrenberg)
B.calyciflorusvarbrycei (Bauchamp).
B.forficula (Wierzejski)
B.forficula forma typicusurawaensis (Sudzuki).
B.forficula forma volgensis (Sudzuki).
B.forficula forma asymetricus (Sudzuki).
B.falcatuszachariasvarLyratusLammermann.
B.bidentata (Anderson).
B.caudatusBarrois and Daday.
B.diversicornia (Daday).
B.longipes (Anderson).
B.angularis (Gosse)
B.budapestensis (Daday)
Dipleuchlanispropatuls (Gosse).
Tripleuchlanisplicata (Levander).
E.triquetra (Ehrenberg).
Keratellatropica (Apstein).
K.procurva (Thorpe).
K.cochlearis (Gosse).
Platyiasquadricornis (Ehrenberg).
P.patulus (O.F.Muller)
P.patulus forma militaris (Herrick).
Epiphanusclavulata (Ehrenberg).
Mytilinaventralis (Ehrenberg).
BeauchampiellaedactylotumRemane.
Lepadellaovalis (O.F.Muller).
L.patella (O.F.Muller).
L.similis Lucks.
Lecanepapuana (Murray).
L.curvicornis (Murray).
L.curvicornis var. padespares (Arora).
L.hornemanni (Ehrenberg).
L.crepida (Harring).
L.inopinata (Harring and Myers).
Monostyla bulla (Gosse).
M.obtusa (Murray).
M.quadridentata (Ehrenberg).
Cephalodellagibba (Ehrenberg).
Enteroplealacustris (Ehrenberg).
Eosphoranajas (Ehrenberg).

ANNELIDA	OLIGOCHAETA	AulophorusFurcatus (Muller)
		NaisCommunis(Piguet)
		DeroIndica (Naidu)
	HIRUDINEA	HirudinariaGranulosa
ARTHROPODA		
Sub-phylum MANDIBULATA - CRUSTACEA		
	Subclass: BRANCHIOPODA	Cladocera
		Eucladocera
		Diaphanosoma Fischer
		DiaphanosomaSarsi Richard
		Pseudosida Herrick
		Pseudosida Szalayi Daday
		LatonopsisSars
		LatonopsisAustralisSars
	Super family: Chydoroidea (= **Tribe:** Anomopoda)-	Family: Daphnidae Straus
		SimocephalusSchoedler
		SimocephalusVetulus Muller
		CeriodaphniaDana
		CeriodaphniaCornutaSars
		Family: Chydoridae
		ChydorusLeach
		ChydorusBarroisi (Richard)
	Order: Ostracoda	Cyprissp.
		Heterocypris sp.
		StrandesiaElongata
	Order: Copepoda-Calanoida	HeliodiaptomusKiefer
		HeliodiaptomusViduusGurney
		Neodiaptomuskiefer
		NeodiaptomusStrigilipesGurney
		PhyllodiaptomusKiefer
	Suborder: Cyclopoida-Cyclopidae-MicrocyclopsClaus	
		MicrocyclopsVaricans(Sars)
		MesocyclopsSars
		MesocyclopsLeuckarti(Claus)
		Thermocyclops(Fischer)
		Thermocyclops Crassus (Rehberg)

Scaridiumlongicaudum (Ehrenberg).
Asplanchnellaintermedia (Hudson).
Asplanchnellasieboldii (Leydig) urawaensis (Sudzuki)
Polyarthraremata (Skorikow).
P.vulgaris (Carlin).
Filinialongiseta (Ehrenberg).
F.pejleri (Hutchinson).
Pedalia sp.
Testudinella patina (Hermann).
Conochiloidesdossuarias (Hudson).
Conochilus Madurai (Michael).

	Class: INSECTA- **Order:** Ephemeroptera	Naiad of Hay-fly
		Baetis sp.
		Order: Odonata Naiad of dragonfly
		Naiad of damselfly
	Order: Hemiptera (Heteroptera)	RanatraSordidula
		NepaCinaria
		NotonectaGlauca
		GerrisDissortis
	Order: Coleoptera	Dytiscussp
	Order: Diptera	Tendipessp (= Chironomussp)
	Class: Crustaceans	Macrobrachiummalcomsonii sp.
		Macrobrachiumrosenbergii sp.
MOLLUSCA	GASTROPODA	Alocinma(=Amnicola)travencorica
		Indoplanorbisexustus(deshayes)
		Lymnaealuteola(lamarck)
		Helanoidestuberculata(muller)
		Bellamyahengalensis(lamarck)
CHORDATA	**Class:** PISCES	
	Subclass: OSTEICHTHYES	Channapunctata
		Barbus Stigma
		Labeomacronotus
		Cyprinusdanrica
		CatlacatlA
		Labeocalabasu
		Cyrrihinusmrigal

A number of Protozoans and Nematod parasites are noticed causing much damage to the fisheries of both the ponds. It is interesting to note that the frog population is absolutely meager near pond-I while some few numbers are encountered near pond-II. Hence, as a whole it can be understood that the population of crustaceans is the largest followed by rotifers and cilliophora protozoans among the Zooplanktons. The seasonal dynamics of all these species was also studiedduring the same period.

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