BIOLOGICAL PARAMETER

PLANKTON

INTRODUCTION:

Aquatic flora and fauna the biological basis the productivity of reservoir these consist of plankton aquatic plant and benthic animal. The term plankton refers to microscopic plants and animals mostly found in and around euphotic Zone in an aquatic ecosystem. Due to limited locomotion, plankton freely float in epilimnion and drift with water currents.

Planktonology the branch of limnology involves the study of diversity biomass spatial distribution in time and over all various biological aspects like role in primary and secondary productivity fecundity, pollution biology and over all energy dynamics of an aquatic ecosystem of different plankton species.

The plankton are further divided into phytoplankton that include micro flora and zooplankton including faunal component of these microscopic organisms the plankton are directly and indirectly influenced by the physicochemical characteristic of water. The study of planktons is necessary for proper assessment of aquatic potential they play an important role in food chain. The density of plankton in a water body determines the stoking rate of fishes because they are the chief source of a food of many economically important fishes. Plankton due to its key role in the ecosystem of the environment is directly a related to the fish catch potential of a reservoir. An insight into the distribution composition and succession of plankton gives valuable clue for determining the fishing grounds, selection of suitable species for stocking and determining the level of utilization of the available food by the existing fish stock plankton is also an index of eutroptication for efficient reservoir fisheries management, plankton by, virtue of drifting habit and short turnover period constitutes the major link in the tropic structure and events in the reservoir ecosystem and a rich plankton community with well marked serial succession is the hall mark of Indian reservoirs (Sugunan 1995).

Information is available on the temporal and spatial distribution of plankton from only a few Indian reservoirs Sugunan (1980) studied the plankton of Nagarjun Sagar reservoir of Andhra Pradesh and reported the seasonal abundance of planktons. Singh et al (1990 and 1993) furnished the information regarding plankton population in relation to fisheries in the Nanak agar reservoir of Utter Pradesh; Singh et al (1989)
studied the limnological features of same reservoir including physico chemical environment and plankton community.

**PHYTOPLANKTON: -**

**INTRODUCTION: -**

The aquatic microphytes in an aquatic environment belong mainly to algae. The algae in water may exist in several forms like phytoplankton. The study on algae are routinely carried out in ecological studies, pertaining to biotic components of the aquatic ecosystem as a part of water pollution investigation and in biological waste water treatment Plants. Algae serve as a very good indicator and pollution and have been extensively for this purpose (Palmer 1969 Trivedi 1986).

Phytoplankton constitute the first stage in tropic level by virtue of their capacity to transduce environmental radiant energy into the biological energy through photosynthesis. Also referred to as primary productivity, the magnitude of photosynthetic energy fixation depends primarily on diversity and biomass of phytoplankton. The planktonic photosynthesis plays a key role in conditioning the microclimate as it helps in regulating the atmospheric level of oxygen and carbon dioxide two gases vital for life. A part from primary production phytoplanktons also plays an important role as food for herbivorous animals. The fresh water algae mainly being to green algae blue green algae and the flagellates.

**MATERIAL AND METHOD:**

The first step is to select the suitable sites of sampling stations A,B, and C is described earlier the planktonic sample were collected on monthly basis for the period of August 2006 to July 2008.

The phytoplankton will have to be collected with the help of net made up of bolting silk. The net can be operated from a boat, from where it can be sent to the bottom and gradually hauled up.

The volume of water of filtered can be estimated by using the following formula.

\[ V = Ar^2 D \]

V= Volume of water sampled in liters.
R= Radius of the net’s orifice in m
D= The depth upto which the net’s has been sent in ml.
Alternatively the water can be obtained by using a bucket of a pump and filtered through the net. In this case known volume of water can be filtered.

All size of the phytoplankton can be collected by using a water sampler. The phytoplankton should be immediately preserved in 4% formalin Lugol’s solution (1%) can also be used for preservation. It sediments the phytoplankton and also satins them.

**PLANKTON ANALYSIS: -**

**LAKY’S DROP METHOD:**

This method requires no specialized equipment. The method gives very accurate results if number of replicates taken is more. In this method a known amount of water which fits below a 22 mm cover glass is placed. Organisms present in this drop are counted in high power. The number of drops which accomodate in one ml can be estimate separately.

The concentrate sample a phytoplankton is agitated and a drop is kept on the slide. It is very important to quickly transfer the sample to slide, otherwise the organisms may get concentrated. Now a cover glass is put in such a way that the liquid does not spill out of it. The width of a high power microscopic field is measured separately. Now focus the center of the cover glass and count the number of organisms in one microscopic field. Now move slide and count another filed well separated from the first one.

**Now calculate the density.**

\[
\text{Phytoplankton (units/L)} = \frac{n \times c \times 10}{V}
\]

Where: 
- \(N\) = No of plankton in 1 ml sample
- \(C\) = Volume of concentrate in ml
- \(V\) = Volume of total sample filtered or sedimened in ml

During the year Aug 2006 to July 2008 Phytoplankton analyzed are cyanophyceae, chlorophyceae, and Bacillariophyceae were recorded from Benetura Reservoir.
RESULT AND DISCUSSION:

The identified the three group of algae.

The phytoplankton species occurred in the reservoir during year August 2006 to July 2008 is listed in Table No. 1-A, 1-B and 1-C.

During the two year study period phytoplankton occur in three groups (Class) in different identify the 5 species 1) Myxophyceae in five species 2) chlorophyceae in five species and Bacillariophyceae in also five species and observed in three sampling stations at A, B, and C.

From Myxophyceae, oscillaria princes, Scytonema simplex and Nostoc Muscunum dominated the reservoir. The maximum population of myxophyceae was recorded in month of March, April and May 2007 to 2008 at station A, B, and C. The phytoplankton (-) is absent (+) present and this like (++) more present. The minimum population in myxophyceae species in Rivularia mahrai and Gloeotrichia indica in month of July, September, November and December 2008.

Chlorophyceae was represented by 5 species with dominance of chlamydomonas eugametos, volvax globater, and Ulothrix zonata. This species higher percentage in summer month of February, March, April and May 2007 and 2008, at stations (A, B, and C). The minimum population of chlorophyceae group in two species pediastrum duplex and odogonium nodulosum during the month of August, September, October and November 2006 and 2007 at different stations (A, B and C).

Bacillariophyceae was also more among the phytoplankton assemblage among the reservoir. Their population was maximum in March, April and May 2007 and 2008. It was mainly represented by pinnularia viridis, cyclolella operculata and Navicula mutica species. The minimum population was cymbella turgida and synedra ulna species during the month of April and May 2007 and 2008. Eight month not occur in this species in any station.

The distribution data of various groups of algae reveals that in all stations Chlorophyceae were dominant followed by Maxyphyceae and Bacillariophyceae.
DISSCUTION:

In present study the increased phytoplankton density in Summer season (April and May). A total of 15 phytoplankton species were recorded during first and second year of the study. Mishra and Tripathi (2000)-reported algae belonging to different group such as chlorophyceae, bacillariophyceae and cynophyceae at different sampling stations of river Ganga at Varanasi. The summer months should higher phytoplankton densely followed by winter and rainy season. The lower density during rainy season months May be due to high turbidity, low light intensity, cloudy weather and were water coverage with rains.

Identification of Phytoplankton in Following Three Groups (Class) at Benetura Reservoir in Aug 2006 to July 2008.

A) Myxophyceae or cynophyceae, B) Chlorophyceae, C) Bacillariophyceae.

A) Myxophyceae or (Cynophyceae).
1) **OSCILLATORIA**: 

**Classification**

- Division: Cyanophyta
- Class: Cyanophyceae
- Order: Oscillatoriales
- Family: Oscillatoriaceae
- Genus: Oscillatoria
- Species: princeps

**Characters**: 

It is an exceedingly common fresh water, filamentous, dark blue green algae. It occurs in a wide variety of habitats. Usually found in damp, soil, ponds, a temporary rain water pools, and ditches.

The thallus consists of free living trichomes which often from a compact, tangled floating mass or occur in the form a shiny mass on moist soil. It has distinct filamentous texture occasionally the trichomes singly. Each trichomes is a long very fine thead like unbranched Structure. A all the cells in the trichome are similar in structure.
2) NOSTOC : -

Classification

<table>
<thead>
<tr>
<th>Division</th>
<th>- Cyanophyta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class</td>
<td>- Cyanophyceae</td>
</tr>
<tr>
<td>Order</td>
<td>- Nostoccales</td>
</tr>
<tr>
<td>Family</td>
<td>- Nostocaceae</td>
</tr>
<tr>
<td>Genus</td>
<td>- Nostoc</td>
</tr>
<tr>
<td>Species</td>
<td>- muscorum</td>
</tr>
</tbody>
</table>

Characters : -

It is filamentous form of both terrestrial and aquatic habitat. It does not occur in single filamentous but grows in large colonies of closely packed trichomes embedded in a firm matrix of gelatinous materials. Nostoc colony thus forms a mucilaginous thallus which occurs floating or attached. The thalli are of various sizes and shapes and may be solid or hollow they may be balls of a jelly like substance or may be irregularly shaped. In size they may be microscopic, pea size walnut size or as large as a plum. The colour may be olive green or blue green and the surface of the colony smooth Aquatic species occur either as free floating thalli in the pools, ponds and lakes or lying at the bottom attached to submerged vegetation.
3. SCYTONEMA:

**Classification**

- **Division**: Cyanophyta
- **Class**: Cyanophyceae
- **Order**: Scytonematales
- **Family**: Scytonemataceae
- **Genus**: Scytonema
- **Species**: simplex.

**Characters**:

Is predominantly a sub aerial and aquatic mostly freshwater genus. The aquatic species from floccose woolly, tomentose and tufted thalli. They vary in colour from blue green, dirty blue green, blackish green and yellowish brown. They may float freely in the water of pond lakes and tanks. Scytonema is an extremely common aquatic species. Thalls is filamentous each filament consist of a single trichome. The trichome is composed of a single row of cells lying end to end to form a long or short thread like structure.
4 ) RIVULARIA :-

Classification

- Division : Cyanophyta
- Class : Cyanophyceae
- Order : Rivulariales
- Family : Rivulariceae
- Genus : Rivularia
- Species : mehria

Characters :-

Rivularia like nostoc is a conical form. The colonies occur in water or on the soil. The aquatic species are fresh water forms which occur either free floating on the surface of water or are attached to submerged plants or stones in the sunny ponds, pools and lakes. The colonies are macroscopic thalli of various sizes and shapes they are yellowish brown in color. The colony may be thick and discoid or a spherical hemispherical or irregularly lobed gelatinous mass it is soft, sometimes solids each colony contains numerous radially arranged trichomes. The trichomes are whip-like structures they are straight or slightly curved.
5) GLOEOTRICHIA

Classification

- Division: Cyanophyta
- Class: Cyanophyceae
- Order: Rivulariales
- Family: Rivalariaceae
- Genus: Gloeotrichia
- Species: indica

Characters:

Gloeotrichia like nostoc is a colonial form comprising about 10 species. The colonies occur in freshwater mostly they are found free floating on the water surface in sunny ponds, pools and paddy fields. With few exceptions the colonies are macroscopic thalli of mucilage with a firm boundary. The latter gives definite shape to the colony. The colonies vary in size, shape and are various tents. Usually they are soft, spherical or ellipsoids to an irregularly lobed gelatinous mass. The trichome are straight or slightly curved.
B) CHLOROPHYCEACE :-

1) CHLAMYDOMONAS :-

Classification

<table>
<thead>
<tr>
<th>Division</th>
<th>:- Chlorophyta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class</td>
<td>:- Chlorophyceae</td>
</tr>
<tr>
<td>Order</td>
<td>:- Volvales</td>
</tr>
<tr>
<td>Family</td>
<td>:- Chlamydomonadaceae</td>
</tr>
<tr>
<td>Genus</td>
<td>:- chlamydomonas</td>
</tr>
<tr>
<td>Species</td>
<td>:- Eugametos</td>
</tr>
</tbody>
</table>

Characters :

Chlamydomonas is one and the most primitive free swimming nucleated organisms. The principle plant characteristics are cellulose cell wall typical of plants, presence of chloroplast and autotrophic nutrition. The chief animal characteristic is its motility in the vegetative phase. It is frequently found in the standing water of ponds, ditches, pools and lakes often it occurs in such great number as to colour the water green. The unicellular thallus is biflagellate and usually oval or rather oblong in form. The cell wall is thin and transparent. The single nucleus is located centrally, sometimes nearer the anterior end.
2) VOLVOX:

**Classification**

- Division: chlorophyta
- Class: chlorophyceae
- Order: volvocales
- Family: Volvocaceae
- Genus: volvox
- Species: globater

**Characters:**

Volvox is a green, flagellate colonial alga of worldwide distribution. It occurs both in temporary and permanent fresh water of ponds pools and ditches. It is also found in the soft water of lakes. This motile coenobial genus grows in spring and summer but is abundant in the rainy season all over India. It is one of the planktonic organisms which help to colour the water of the pond green. The volvox colony is of constant size and shape for any given species. The number of cells in the colony varies between 500 or 1000 and 50000. Each cell has its own gelationous sheath or mucilaginous envelope.
3) PEDIASTRUM :

Classification

Division : Chlorophyta
Class : Chlorophyceae
Order : Chlorococcales
Family : Hydrodictyaceae
Genus : Pediastrum
Species : duplex

Characters :

It is a non motile coenobial green alga met with in ponds, ditches, and plankton of fresh water lakes. The coenobia are free-floating. They usually float on the surface of water alone or with other colonial forms and water plants. They sink to the bottom of the pond when water level is low. The chlorides are disc-shaped to satellite in form; the cells in the colony are in some multiples of two and are usually arranged in a single layer, forming a flat circular plate. The cells are generally polyhedral in shape. The cell consists of the cell wall and the protoplast.
4) OEDOGONIUM:

**Classification:**

- Division: Chlorophyta
- Class: Chlorophyceae
- Order: Oedogoniales
- Family: Oedogoniaceae
- Genus: Oedogonium
- Species: nodulosum

**Characters:**

It is common, submerged aquatic comprising about 285 species. It may occur attached to the solid objects stone, wood in quiet freshwater. The mature filaments are free floating but the younger ones are attached. It is less common in the running water. The plant body is a thallus which is along unbranched thread called the filament. The cells are elongated and cylindrical with more or less dilated upper end in some species. The cell wall is differentiated into two concentric layers. The protoplast is differentiated into a thin plasma membrane, cytoplast, chloroplast and nucleus.
5. ULOTHRIX:

Classification:

- Division: Chlorophyta
- Class: Chlorophyceae
- Order: Ulotrichales
- Family: Ulotrichaceae
- Genus: Ulothrix
- Species: zonata

Characters:

It is common freshwater thread-like alga found in rather cold, flowing water. It occurs in a variety of habitats. Usually it is found attached to the substratum such as rocks or stones. It is a thallus consisting of an extremely fine, unbranched filament. The cells of the filament are usually short, cylindric or quadrate and often numerous. All colonies of single celled algae are spherical or disc like or irregular. In ulothrix the basal cell may be colourless, some what modified in shape and attached to the substratum. It is different from the other cell in the filament, cell wall consist of the concentric layers, inner and outer.
C) BACILLARIOPHYCEAE :

1). PINNULARIA :

Classification :

- Division :- Bacillariophyta
- Class :- Bacillariophyceae
- Order :- Pennales
- Family :- Nariculoideae
- Genus :- Pinnularia
- Species :- varidis

Characters :

Pinnularia are widespread and occur in abundance, isolated or in colonies in almost every aquatic situation. Many form the major part of the bottom flora of lakes, ponds and ponds. The diatom thallus is essentially a diploid unicell. The tiny unicells occur isolated. The colonies may be filamentous or are enclosed in a common gelatinous envelope with no specialization of parts. Structurally the diatom cell consists of two parts, the cell wall and the protoplast. The cell wall is differentiated into two layers, inner and outer layer. Protoplast is differentiating into plasma membrane, cytoplasm and single nucleus.