CHAPTER – II
MATERIAL AND METHODS

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Triputi Reservoir (Gopal Sarowar) study area :

Triputi village is located at 13 km East of Satara city in Maharashtra. This village has old temple water reservoir. This reservoir is situated on 1.2 hectres of an average water spread area having maximum length 70 meters and width 67 meters and depth approximately 7 meters. This reservoir is utilized as a source of drinking water and other anthropogenic activities by the local people and for the fishery purpose.

This reservoir is on the back side of Shrinath Temple, Triputi. It was constructed in 1743 by Brahmendra Swami, Guru of Great Maratha warrior first Bajirao Peshava. Skilled workers from Vrindavan (North India) were specially brought for the construction of reservoir. Total cost of construction of reservoir was Rs. 1 lakh at that time. A saint Shri. Gopal Maharaj from Himalaya was at Triputi for residence at Shrinath Temple. Later on this temple water reservoir was named as 'Gopal Sarowar' in the honor of Shri. Gopal Maharaj.

This old, monumental and heavily built water reservoir is the only source of water for the entire population of Triputi village.

LOCATION MAP

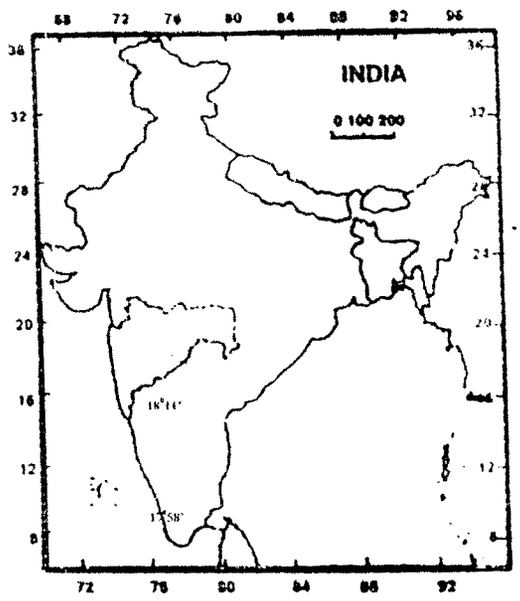


Fig. No. 1

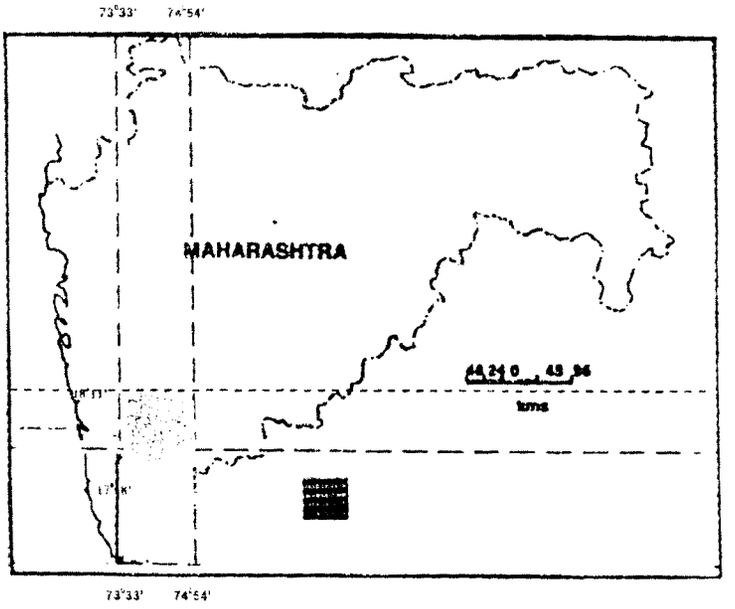


Fig. No. 2

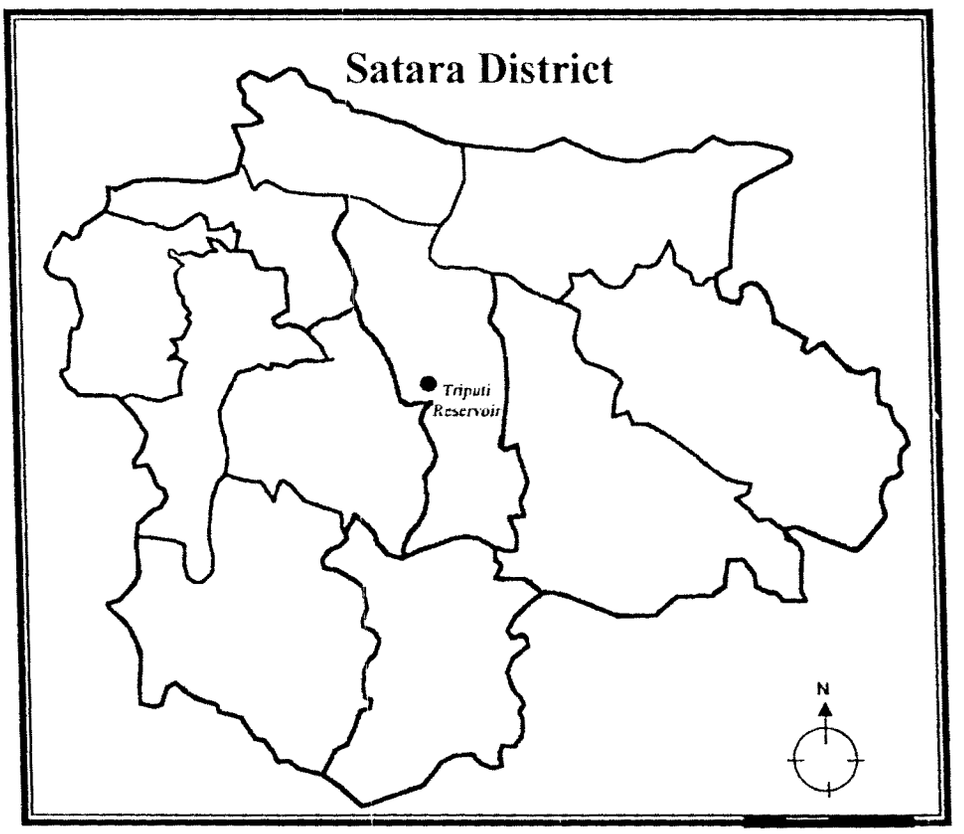
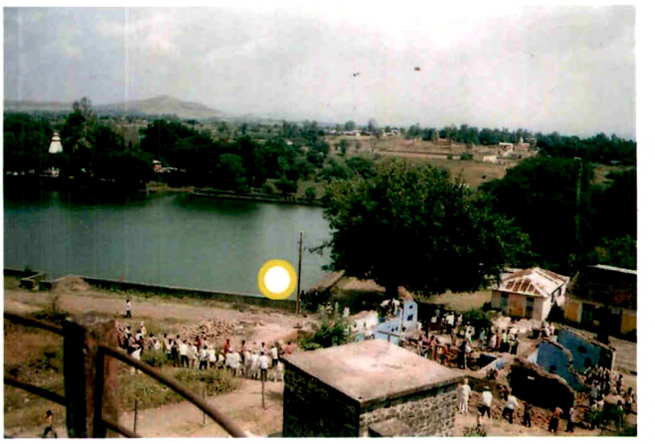


Fig. No. 3

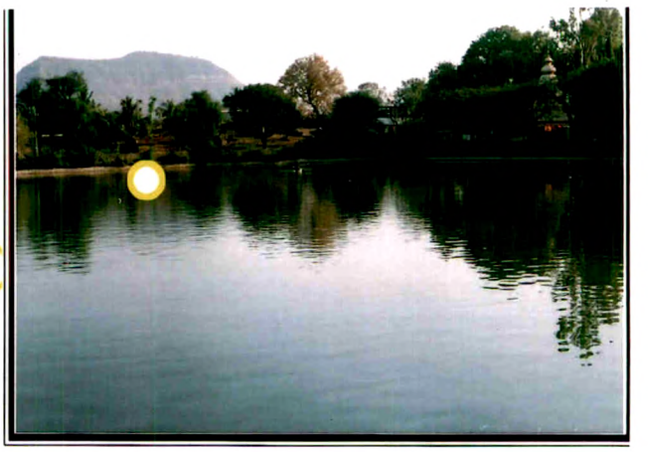
Plate No. 1

View of 'A' Station of Triputi Reservoir



View of 'B Station of Triputi Reservoir

View of 'C' Station of Triputi Reservoir



View of 'D' Station of Triputi Reservoir

Reduced water level of Triputi Reservoir during summer

Plate No. 2

View of Triputi Reservoir during fish catch

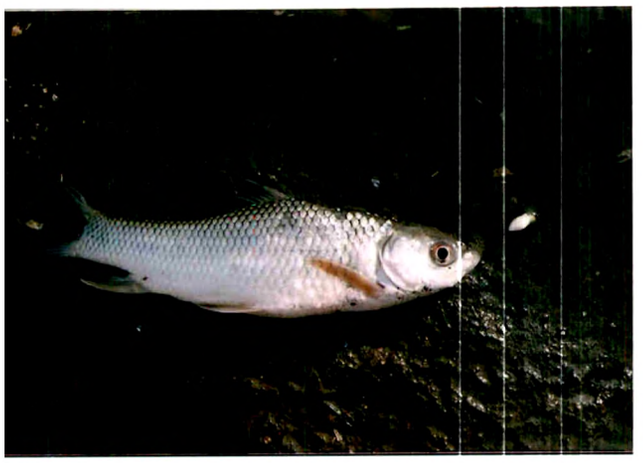
Fish catch by local fishermen at Triputi Reservoir

Separation of fishes from net by ocal fishermen at Triputi Reservoir

Collected fish during fish catch at Triputi Reservoir

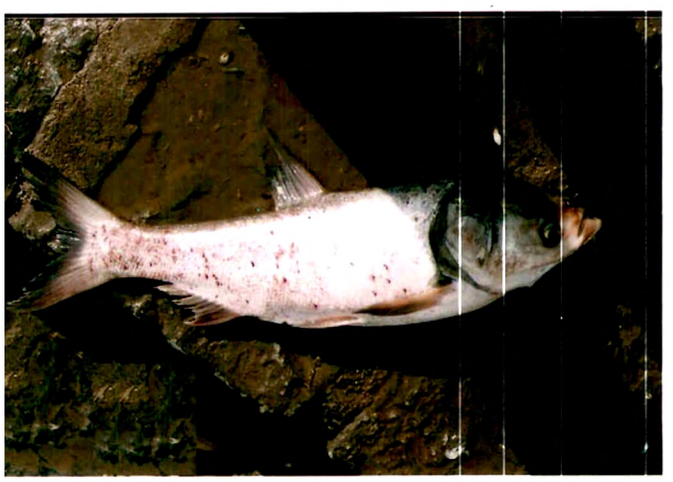
Triputi village people during auction of fish catch at Triputi Reservoir

Plate No. 3

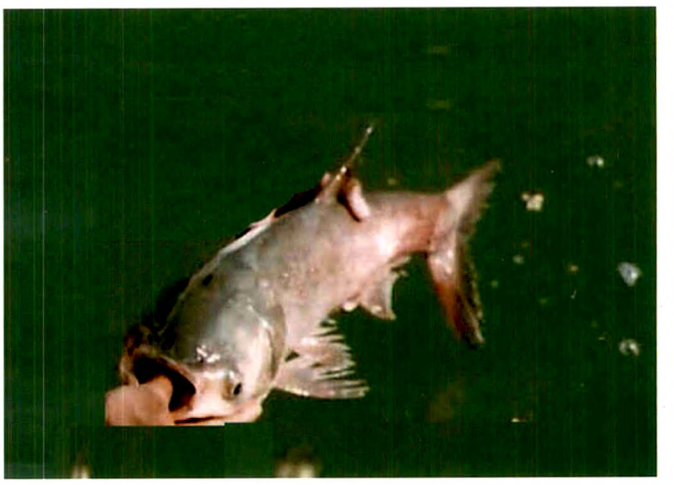


Labeo rohita

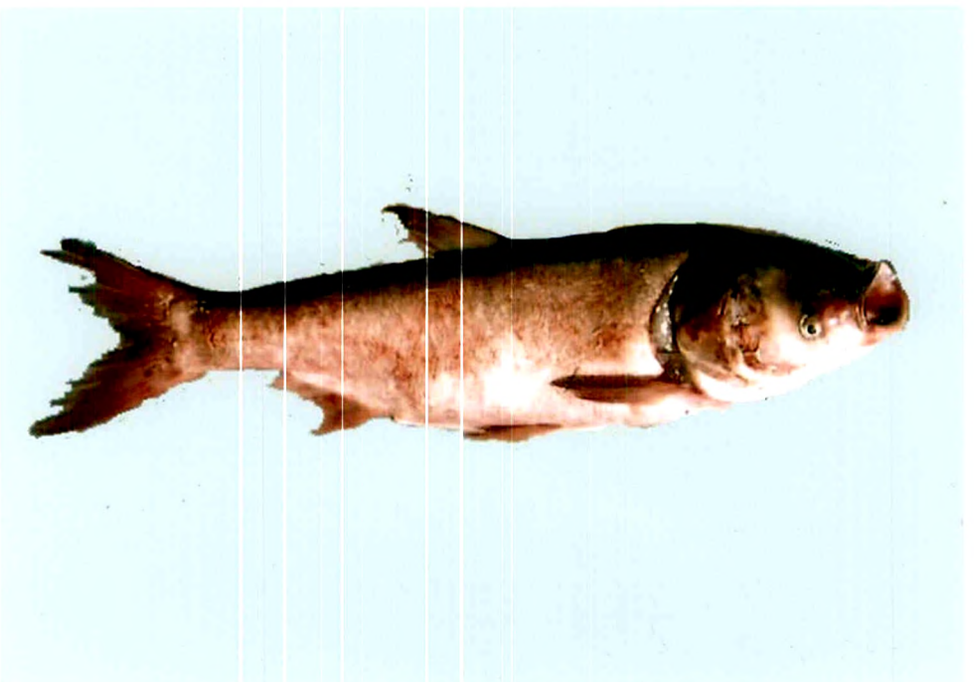
Cyprinus carpio



Hypothalymachthys molitrix



Catla catla



Hypothalymachthys molitrix

During the period of investigation Triputi reservoir was characterized by the presence of submerged and littoral vegetation in its limnotic and littoral zones. It is having two ingressing sources of water, one from percolation in reservoir and other from rain. It exhibited little fluctuations in its water level and it is characterized by coarse bottom nature and little anthropogenic activities in comparison with other reservoirs.

The fishing activities including release of seedling and harvesting are usually conducted by village Grampanchayat. The present investigation has been conducted during the period of Nov. 2006 to Oct. 2007. This work is more of an ecological nature and involves studies on certain physical, chemical and biological characteristics of the water body. The biological study was conducted considering the phytoplankton, zooplankton, fish fauna and fishery potential of the reservoir.

Basic investigation on physico-chemical and biological parameters were carried out during the above mentioned period and it was carried out partly in the field and partly in the laboratory. The different methods applied for various parameters were selected considering the field conditions and availability of the material.

For physico-chemical parameters, surface water samples from East, West, North and South sides of the reservoir as Station A, B, C and D were collected (Plate No. 1). The sampling stations were selected by considering the morphometery at different sites of the reservoir. The water samples were collected monthly from marginal areas at 1 meter depth from all the four stations of reservoir. However due to lack of boat facility the mid water sampling was not possible. The water samples were collected in the sterilized plastic cans of two liter capacity brought to the laboratory and analyzed immediately in order to obtain accurate results. All collections and observations were made during 7.00 am to 11.00 am throughout the period of investigation. The experiments for physico-chemical parameters were monitored monthly, while the biotic parameters i.e. phytoplankton, zooplankton, fish fauna and (commercial catches) were observed, throughout the period of investigation. This data was used for statistical analysis and comparison to make the final conclusions.

PHYSICAL PARAMETERS :

The five important parameters such as temperature, transparency, total solids and total suspended solids were taken into consideration for this reservoir. The methodologies for these

parameters were selected as described by Trivedy *et al* (1987), Saxena (1998) and Rao (1993)

Temperature :

The surface water temperature at all the four stations of the river Krishna was recorded in ^{0}C by using standard mercury thermometer (0 – 100^{0}C) with 0.5^{0}C graduation. The temperature was recorded in the field during the water sample collection.

Transparency :

The transparency or light penetration capacity of the water in river Krishna was recorded by immersing section disk of cm diameter and by observing its visuality at a suitable station. The results were expressed in SDT cm by using following formula.

Secchi disc transparency in cm = A + B / 2

Where A = Depth at which Secchi disc disappears

B = Depth at which Secchi disk reappears.

Total dissolved solids :

The values of the total dissolved solids of the water samples were determined as a residue left after the evaporation of the known amount of filtered sample at 100^{0}C. The results were expressed in mg/l by using following formula

TDS mg/l = (a - b) 1000 x 1000 / V

Where,

a = Final weight of dish

b = Initial weight of dish

V = Volume of sample taken.

Total solids :

Total solids of the water sample of all four stations were determined as a residue left after the evaporation of unfiltered samples at 100^0C and the results were expressed in mg/l by using following formula

$$\text{Total solids} = (a - b)\ 1000 \times 1000 / V$$

Where,

a = Final weight of dish

b = Initial weight of dish

V = Volume of sample taken.

Total Suspended Solids :

Total Suspended Solids of the water samples determine as the difference between the total solids and total dissolved solids by using following formula.

$$TSS = TS - TDS$$

Chemical parameters :

Important chemical parameters related with productivity such as pH (hydrogen ion concentration), dissolved oxygen, free carbon dioxide, total hardness, total alkalinity, chloride, nitrate and phosphate were studied for the water samples at all four stations of this reservoir. The standard methodologies for these parameters were applied as described by American Public Health Association APHA (1985), Trivedy et.al. (1987) and Saxena (1998).

Hydrogen ion concentration (pH) :

The pH values for the water samples were recorded in laboratory by using pocket sized pH meter (Hanna – model – Mauritins with a range from 0.0 to 14.0) as 7.0 being neutral, less than 7.0 acidic and above 7.0 as basic or alkaline.

Dissolved oxygen :

The dissolved oxygen content of the water samples was estimated by titrimetric unmodified Winkler's method and the results were expressed in mg/l. When Winkler's A ($MnSO_4$ and $MnCl_2$) and strong Winkler's B (Alkaline KI) were added to the samples. White precipitate of $Mn(OH)_2$ is formed which reacts with DO to form brown ppt ($Mn(OH)_3$). On acidification in presence of iodine, the

iodine equivalent to the original DO in the sample liberated was titrated against N/80 Hypo ($Na_2S_2O_3$) with starch as an indication.

Dissolved oxygen is calculated by following formula

$$\text{D. O. mg/l} = \frac{\text{Burrette reading X N/80 X 8 X 100}}{\text{Volume of Sample}}$$

Free Carbons dioxide :

Free carbon dioxide content of the water samples were estimated and it is measured in mg/lit. by titrimetric method using (0.2272N) NaOH as a titrant and phenolphthalein as indicator. The result were expressed in mg/l. The samples containing free CO_2 in the form of H_2CO_3 was titrated against alkali (0.2272N.NaOH) and resultant change in pH from acidity to neutrality to alkalinity was detected by phenolphthalein one ml of 0.2272 N NaOH is equivalent to one mg of free CO_2.

Free CO_2 is calculated by following formula -

$$\text{Free } CO_2 \text{ mg/l} = \frac{\text{Burrett reading X N of NaOH X 44 X 1000}}{\text{Volume of Sample}}$$

Total alkalinity :

The carbonate and bicarbonate alkalinity of the surface water samples were estimated by titrimetric method and results were expressed as total alkalinity as $CaCO_3$ mg/l. The carbonate alkalinity

was detected by using phenolphthalein indicator and bircarbonate by methyl orange.

The acid titrant (0.1 N HCl) converts carbonates into bicarbonates effectively reducing pH towards neutrality. The reduction in pH proportional to the content of CO_3^- is detected by phenolphthalein.

pH range produced by bicarbonate ions is indicated by methyl orange. The sample containing HCO_3^- when titrated against (0.1 N HCl) the quantity of acid required to reduce pH from alkaline to acidic direction is proportional to the quantity of HCO_3^-.

$$A = \text{By phenolphthalein} = \frac{\text{Burrett reading X 0.1 X 1000}}{\text{Volume of Sample}}$$

$$B = \text{By Methyl orange} = \frac{\text{Burrett reading X 0.1 X 1000}}{\text{Volume of Sample}}$$

Total Alkalinity = A + B

Hardness :

The total hardness of the water samples at each station in the given river Krishna were estimated by titrating the water samples with standard EDTA (0.01 N) using ammonia buffer solution and

eriochrome black T indicator The results were expressed is mg/l by using formula.

Formula : Total hardness of water ($CaCO_3$) mg/lit = T x 1000 / V

Where i) T = burette reading in ml.

ii) V = volume of water sample (50 ml)

Chloride :

Chloride concentration in the water samples was estimated by titrimetric method using (0.02 N) $AgNO_3$ as titrant and potassium chromate as an indicator. The resultant were presented as mg/l. The chlorides are estimated by precipitating Cl^- ions in water as (AgCl). These are titrated against 0.02 N silver nitrate ($AgNO_3$) with potassium chromate indicator.

Chloride mg/l = Burrett reading x 40

Phosphate :

The orthrophosphate content in the water sample was estimated by employing stannous chloride method. The resultant blue colour intensities were measured on colorimeter (Erma – model) at 690 nm range. The optical density values of phosphate concentrations of the water samples were calculated referring to the standard graph of phosphate and results were expressed in mg/l.

Nitrate :

The nitrate concentration in the water sample of these reservoir were estimated by Brucine method. In 10 ml. water sample, 2 ml NaCl solution, 10 ml dilute H_2SO_4 and 0.5 ml. Brucine reagent was added. These flasks were treated in boiling water bath for about 20 minutes. The resultant brown colour intensities were measured on colorimeter (Erma – Model) at 410 nm. The optical density values were calculated referring to the standard graph of nitrate and results were expressed in mg/l.

BIOLOGICAL PARAMETERS :

Plankton study :

In biological limnology main emphasis was given to phytoplankton and zooplankton as it forms the basic tropic level in the food chain of any aquatic ecosystem. The plankton sample were collected by filtering 50 liters of water through the plankton net made of bolting silk (No. 50), from a single suitable station of reservoir. It was concentrated to 100 ml and brought to the laboratory preserved in 4% formalin. For identification of phytoplankton and zooplankton the samples were thoroughly shaked 1 ml of concentrate was applied on a (Sedgwick Rafter cell) slide and from this phytoplankton and zooplankton species were identified and enumerated. The

phytoplankton organisms were identified up to generic level while some zooplankton organisms were identified up to species level.

The available observations on planktons were presented in present compositions and population dynamics for both the groups. Plankton sampling were made through the investigation (from No. 2006 to Oct. 2007) at suitable station of the reservoir.

The phytoplanktones were identified as described by Prescott (1969), Sharma (1992) and Chapman (1969) were as zooplankton were identified as per Tonapi (1980).

Fish Fauna :

For the study of fish Fauna, fish species from commercial catches were collected brought in the laboratory, cleaned and identified by comparing their characters by referring the standard literature (Day 1958, Datta and Shrivastava 1988 and Talwar and Jhingran 1991). Checklist of identified fish fauna is prepared.