DISCUSSION

The study on the Rajaram tank, at Kolhapur, has for the first time revealed the limnological picture of the representative small water body in Southern Maharashtra.

In the present investigation on Rajaram tank give some idea regarding the abiotic and biotic factors and their influence on the tank. In this present work productivity has been studied with the help of estimation of chlorophyll-a also important physical and chemical properties; and their seasonal changes were studied.

This tank is a perennial water body (mean depth 3.5 meters) with about eight inlets bringing surplus water from the catchment area. The arrangement of the iron gate for the discharge of water from tank provides best facility to control the out flow of water and introduction of aquaculture practice in the tank. The water from this tank is used mainly for irrigation purpose so that we can maintain the required water level and at the same time check the influx of waste water from the illegal liquor industry on eastern side and addition of detergents due to the cloth washing.

The air and water temperatures at all three stations show rather inverse correlation (fig.2). The fluctuations in the air and surface water temperature were in the range of 15.3°C to 32°C and 21°C to 29°C respectively. The increase in air and water temperature during summer months were observed. After the monsoon temperature drops down in both cases, specially more in air temperature.

Weekly humidity reading from October 1983 to July 1984 are represented in Table 2. The lowest relative humidity was recorded

on 1st March, 1984, while maximum humidity was recorded on 14th June, 1984. The percentage of relative humidity has a direct correlation with the monsoon rainfall, which can be seen from fig.3. The humidity values start increasing from the June and highest being in the month of August, again the values drop till the November.

Low humidity in summer months and with the help of strong wind action on the barren catchment of Rajaram tank must be causing a great loss of surface water due to evaporation. Thick vegetation, as suggested in the improvement of catchment, plantation in the catchment will reduce the water loss to a great extent.

The water level fluctuations showed a fixed pattern (fig.5) a gradual fall in the water level in the post monsoon months, since water is regularly supplied for irrigation. The tank is normally full in the month of September-October, because of some post monsoon showers. In preceding month water level will fall and it will be minimum in the month of May-June, Premonsoon rains cause little effect on water level fluctuations. In the present investigations lowest water level was recorded in the month of July 1984, which was 3.55 meters.

During the late summer months the water level being minimum in tank, this is an ideal season for fish harvesting. Because in less man efforts you are likely to get maximum harvest. This season also coincides with the maturities season of the weed fishes from the tank and there are better chances of irradicating them now before they release their eggs without burst of process.

Colour of water is due to the scattered light rays from

suspended particulate matters. It is generally blueish in lakes and reservoirs. But in Rajaram Tank, it was observed to be brownish in rainy days. It was due to the silt carried down by the runoff. Later changing the colour through browngreen to greenish in consucative months. Here water colour was recorded in Hazen's units (Table 5). Greenish colour to water in month of April was due to the increase in chlorophyllic substance of phytoplankton.

Turbidity plays a role as an important limiting factor in the productivity of the tank. In turbidity readings, the turbidity at different stations was though some what uniform (fig.7) at stn. 1, it was always little more than that of stn. 2 and stn. 3. This may be due to the human activity in this part of tank.

The turbidity and the transparancy has shown negetive correlation. Water transperancy drops gradually after October as the wave action, algal blooms and at last fishing activity in tank made the water to have increased turbidity in all stations.

In chemical parameters like pH, dissolved oxygen, free carbondioxide, hardness, phosphates and nitrates from the surface water were studied.

pH values recorded at all the stations (Table 8) shows the similar pattern except for the station 1, where the fluctuations. According to Swingle (1967,a) water having pH 6.5 to 9.0 are suitable for pond culture. In low pH values fishes get prone to attacks of parasites and diseases. Above 9.5 pH there will be absence of CO_2, which is badly required for phytoplankton growth. In Rajaram tank pH values are in between 6.9 to 9.3. It is

therefore, ideally suited for aquaculture practices on large scale.

Among all the dissolved gases, oxygen is the most important for fresh water life. Dissolved oxygen provides a valuable information about the biological and biochemical reactions going on in the waters, and of capacity of water to receive organic - matter with causing nuisance. The concentration of oxygen in water depends also upon temperature and hydrogen ion concentration (Wetzel, 1975). In summer days fresh water body will be reach in oxygen budget, while in cloudy days pohotosynthesis will be reduced to have a deficit in oxygen budget. In the Rajaram tank (3.5 meter mean depth) entire basin generally falls under euphotic zone. If there is low temperature, there is much more solubility of oxygen in water which is reduced after increase in temperature. Oxygen concentration of water in Rajaram tank shows fluctuations between 3.1 to 5.7 mg/liter. While lowest in October and November month may be due to short light durations (Table 9).

The low dissolved oxygen values in tank water can be attributec to high air or water temperature preventing diffusion of O_2 from air. But the increasing in dissolved oxygen values during hot summer days a contradictory fact, is due to the strong wind and high wave action allowing larger surface area for D.O. transport and the interfer.

In the period of investigation free carbondioxide ranges from 0.00 to 18.89 mg/liter. It was recorded maximum on 19-1-1984. The graph of free CO_2 shows rise and fall, free CO_2 was highest in January 1984 and April 1984, and lowest in November 1983 and July

1984 (Fig.11). Due to its unstable state free CO_2 escapes as soon as the saturation is reached. Therefore no correlation with any other abiotic or abiotic factor could be established.

Hardness of the water is due to the total of soluble Ca and Mg salts. This may be temperary or permanant. In Rajaram tank water hardness ranges from 50.00 to 85.32 mg $CaCO_3$/liter. According to Swingle (1967,a) tank waters having hardness of 15 mg $CaCO_3$/liter or above are satisfactory for growth of fishes, while less than 5 mg $CaCO_3$/liter gives slow growth and distress. So this factor indicates that Rajaram tank is conducive to fish growth. Also the values of the hardness observed at all the stations during summer months may be due to concentration of salts because of the water evaporation in the tank.

In natural waters, there will be small quantity of phosphate. This varies from, 0.001 mg/liter and its abundance directly depends on the geochemical changes. In Rajaram tank phosphate (phosphorus) recorded was minimum 0.03 mg/liter on 19-4-1984 and maximum 1.35 mg/liter in October 1983. The phosphate more than 2 mg/liter in open water gives a sign of organic pollution (Pomeroy et al.,1965).

Nitrogen occuring in the fresh water is in nitrogenious compound. In Rajaram tank nitrate values ranged between 0.05 to 0.95 mg/liter. Nitrate values were highest in December 1983 giving a peak value and then gradually decreasing in predeceding month (Fig.14).

The values of phosphate and nitrates in Rajaram tank showed correlation and much similar trend in the periodic fluctuations.

The high values of phosphate during October was perhaps due to high temperature enhancing degredation of organic matter from the tank. Thus releasing phosphates. The peak values for nitrates were observed in January.

The biota of the tank was surved during the investigations, phytoplankton was represented by 18 types of organisms where as Zooplankton consist of 14 types. There were animal species were recorded including fishes, amphibians reptiles and aves. In the present investigations plankton studies were carried out only for quantitative purpose. The plankton volume was estimated in CC/m^3 and represented in Table 14. The volume of the plankton was gradually increased from October to February and then decreased in April 1984. From April 1984 graph shows increase in plankton volume upto June 1984. Suggesting that there are two peaks (Fig.15). The maximum volume of plankton was 0.75 CC on 2-2-1984. While lowest 0.15 CC/m^3 on 12-4-1984 (Table 14).

The standing crop of phytoplankton was studied with the estimation of chlorophyll-a. In the period of investigations chlorophyll-a was maximum 8.73 mg/m^3 on 19-4-1984, while minimum 4.02 mg/m^3 on 21-6-1984. The average chlorophyll-a values for the period of investigation comes to be 6.34 mg/m^3 (Table 15)(fig.16).

David et al. (1969) have reported that the standing crop of fish in the water body is upto 3 to 5 times more than the yield at any given time. According to Turner (1960) even from the small ponds from Kentuncky, U.S.A., the yield of harvestible size of fish

could be only 15.48 % of the standing crop. In T.V.A. reservoirs out of 120 kg/hect. standing crop only about 30 % i.e. 38 kg/hect. is harvestable. Miller (1951), Carlander (1955), Jenkins(1958), has given few more examples of the relationship between the standing crop and actual fish yield.

In India, Natarajan et al. (1972) have estimated the standing crop and yield of the Tillaiya and Konar. The standing crop was 400 kg/hect. for Tillaiya 240 kg/hect. for Konar. While actual yield is 36 kg/hect. and 25 kg/hect. for Tilliaya and Konar respectively giving their percentage of yield to actual standing crop is 10 % for the Konar and 36 % for Tilliaya.

According to Bhimachar (1975), the perinnial and seasonal tanks in the country naturally produce fish to the extent of about 150 kg/hect. year and 25 kg/hect. year respectively. He mentions that with management techniques the same production could be easily reached about 500 kg/hect. year and 100 kg/hect. year in these two types of waterbodies. Considering the fish catch to the moderate 40 % of the standing crop of fish in the tank. This waterbody should support about 3450 kg of the fish according to above statement.

At the time of fishing operation efficiency of different gears were studied. Dragnet was found out to be most efficient gear for the shallower waterbodies like Rajaram tank (Ali et al., 1984). This gear assures more yield per human efforts.

In the present study the fish production in year 1983 and 1984 was studied, it was 63.1 kg/hect. year and 70.33 kg/hect. year

respectively. Considering the examples cited by David et al. (1969), Turner (1960), and Bhimachar (1975), it is evident that the average annual fish catch of 66.5 kg/hect. for the year 1983 and 1984 does not give us an idea about the standing crop of fish in the tank. However, if we consider this catch as just reasonable 40 % of the standing crop, the total fish available in the tank would be around 166.25 kg/hect. or 3823.75 kg for the 23 hect. tank.

With existing minimum retail price of fish Rs.10/- per kg, the standing crop amounts to Rs.38,237.50. The present standing crop of 166.25 kg/hect. would be increased upto 500 kg/hect./year by following measures :

1) By increasing the productivity of tank by the application of fertilizers on low manures as this tank does not supply water for drinking purpose.
2) By introduction of fingerlings, for the better survival of the culturable and fast growing varieties of fish at the rate of 500 advanced fingerlings per hecter.
3) By regulating the water height (minimising it during fishery operations) use of efficient gear and better transportation.
4) Irradication of weed fish and carnivorus from the tank like tilapia. All catfish varieties and trash fishes feeding on the plankton should be completly removed as all these fishes are local and increase their population size by autostocking. Small meshed nets should be used periodically to remove them.
5) A strict watch and ward is needed on the tank as on several

occassion poaching of Fish was noticed. Also during the investigations large nylon gill nets were confisticated from the tank. This very badly affects yield of the tank.

With proper improvement of the catchment area assuring continuous influx of biological decomposing material in the tank at a certain useful level and reduced silting will certainly help the well being of Rajaram tank. The introduction of suitable varieties of culturable species of fish in right stocking density and use of efficient management technique should give high fish yield from the Rajaram tank. This would prove as a good example to fisherman and farmers alike from the neighbouring rural area. Thus implementing similar techniques the fish production from number of village tanks, irrigation tanks, etc. would increase to a great extent.

The composite fish culture of Chainase and Indian major carps together in small ponds in India has resulted in the production as high as 3000 - 5000 kg/hect./6 months and 700 - 9000 kg/hect./year (Jhingran, 1983).