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DISCUSSION

(A) Comparison of productivity by Pariphyton, Phytoplankton and Macrophytes.

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ii) Phytoplankton

iii) Macrophytes.

(B) Factors influencing production.

i) Diffusion of oxygen E (m/h)

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(A) Comparison of productivity by Periphyton, Phytoplankton and Macrophytes.

(i) Periphyton.

Any technique of the measurement or biomass in productivity studies has the advantage that it gives the net productivity because it is the production less any removal. But the method has to be adopted with great care. The inherent difficulties in sampling and biomass measurements have been discussed previously. The technique may vary with the workers in this field and may be considered most approximate (Wetzel,1964).

Periphyton plays an important role in the contribution to the total production in the lakes. It could be a major producer in the shallow eutrophic aquatic ecosystem where the littoral shelf is exposed to a great extent when the volume of water is reduced. Although this community is highly subjected to adverse physical conditions, its contribution to the lake productivity cannot be neglected. The littoral regions of most aquatic ecosystems represent some of the most productive communities of the world.

In the studies of the periphyton community and productivity, the researcher is almost left to the biomass method only. Dark and clear bottle method is very well discussed by Pomeroy (1959a,b) and Wetzel (1964).

The estimation of standing crop of periphyton by quantitative measurements of pigments has been done by a few workers, who have used the growth on the glass slides to estimate chlorophyll on the unit area. McConnell and Sigler (1959) and Yount (1956) obtained the rate of accumulation of chlorophyll as an index of periphyton productivity. But Waters (1961) demonstrated that chlorophyll quantity of periphyton of photosynthetically active capacity, reaches a saturation level in the approximate period of three weeks. Hence the quantities of the photosynthetic pigments after this period of three weeks would give higher production figures than the actual with regard to the constituent species.

Periphyton in natural conditions lack homoganity, hence the quantitative determinations of pigments add little to the understanding of true periphyton productivity to this interference of other substances or non-functional chlorophylls or their degradation products which make these estimations still less accurate.

The periphyton epiphytic on the higher aquatic plants is also not free from the lack of homogenity. Young (1945) measured the growth of periphyton and found it to be much more higher on the dead stems than on living plants which suggests that the growth on different materials is different in quality and quantity as well. A. Sladeckova (1962) measured the growth on glass slides and found it nearly two to three times higher than on natural substracts. Estimation of periphyton on natural plants demands great care. The development of marlencrustation in alkaline lakes (like the Ajwa Reservoir) may hinder the estimation of periphyton because the weight of such marl-encrustation may sometimes exceed the dry weight of the plant itself (Wetzel, 1964). The high selectivity of the organisms with respect to the substrates like glass slides, is the only draw-back of the method of measuring the biomass on the artificial substrates, as it does not represent the natural community as a whole. But in most of the studies of periphyton microscope glass slides have been used (A. Sladeckova, 1962).

In the present work the glass slides were suspended in the surface water (at a constant depth of 10 cm below surface) and at 2.5 m depth for a year long period. Every month a few slides were removed at random to estimate the biomass of periphyton. Tables 52 and 53 show the biomass expressed in various ways. The slides were put in the lake for incubation on 23.10.1969 and the biomass was estimated on 7.11.1969, the net growth during this period was 7.920 g/m^2 at surface and 4.722 g/m^2 at 2.5 m depth. The calculated production was 0.528 g/m^2/day at surface and 0.315 g/m^2/day at 2.5 m depth.

The slides were lost in December; another set of slides was introduced for incubation on 27-12-1969. In the initial phase the growth was higher. Once a thin film was formed the growth was found to be slightly slower. In the period of a month the growth was 10.70g/m^2

at surface and 11.98 g/m^2 at a depth of 2.5m; thus the production was 0.348 g/m^2/day at the surface and 0.387 g/m^2/day at 2.5 m depth. In February and March the growth was very slow, the rates were 0.246 and 0.284 g/m^2/day at surface and at 2.5 m depth respectively. From April onwards there was an increase in the rates of production at both the depths. In July, the highest rates of 1.256 g/m^2/day at surface and 2.230 g/m^2/day at 2.5 m depth were attained. From August there was removal of the attached material on the slides due to high rainfall, entry of new water and consequently high turbulance and the production was reduced to 0.604 g/m^2/day at surface and 1.610 g/m^2/day at 2.5 m depth. Table 51 and Figure 15 show the cumulative periphytic production for a year long period. The high rates of periphyton production in summer and in the beginning of monsoon can be attributed to the concentration of groups near the substrates due to reduced volume of water, increased solar radiations and the availability of the nutrients. In this period of the year, the macrophytes were represented mostly by their dead stalks. The retarded growth of the

Table - 51

Cumulative Periphyton Productivity in g/m^2/day of dry weight during sampling dates

Date	Surface	2.5 m depth
October - 10	0.000	0.000
November - 7	0.528	0.315
November - 27	0.607	0.756
December - 27	0.000	0.000
January - 27	0.348	0.387
February - 19	0.246	0.341
March - 24	0.284	0.504
April - 17	0.477	0.840
May - 25	1.050	0.918
June - 13	1.189	0.999
July - 15	1.256	2.230
August - 9	0.604	1.610
September- 19	0.101	1.304
October - 16	0.132	1.467

macrophytes resulted in better penetration of light to the deeper layers of water as the transparency increased and also in the absence of competition for the nutrients vis-a-vis periphyton and phytoplanktons. Removal of periphyton during the monsoon was affected by turbulence caused by incoming waters and this influenced the transparency of water and concentration of nutrient salts to some extent.

The average annual production in Ajwa Reservoir was 478.9 mg/m^2/day at surface while at 2.5 m depth it was 936.6 mg/m^2/day. These results are very well comparable to the results of many investigators of limnology. Newcombe (1949-1950) has obtained 11.8 and 37.5 mg/m^2/day as the mean values which are very low as compared to lake Ajwa. The growth rates in Silver Springs (Odum, 1957) seem to be the highest amounting to 12300 mg/m^2/day of oxygen. McIntire and Phenny(1970) have also observed higher values in the laboratory streams. On the other hand the results of Castenholz (1960) are 148 and 131 mg/m^2/day for two fresh water lakes in Washington. These values are more or less lower than those observed in this study for Ajwa lake. Similar results are reported by A. Sladeckova(1962) where the rates vary from 91 $mg/m^2/day$ to 280 $mg/m^2/day$.

Waters (1960) has suggested that the maximum growth of photosynthetically active pigments on the substrates is reached within a few weeks of incubation, then there is observed almost a stabilized constant ratio of production. The incubations which are longer than this period may yield a sigmoid curve of the growth rates. Incubation of fresh slides often gives higher values of periphyton production which, of course, will be higher than that under undisturbed natural conditions.

(ii) Phytoplankton.

In any aquatic ecosystem the most important photosynthetic cover is formed by the phytoplankton group and it represents a form of vegetation dispersed in the water and its requirements are less exact than those of periphyton (Talling, 1960). Immense work has been done on the ecology and life history of algae by

Prescott (1956) and Chapmann (1957). Various factors influencing the growth of algae have been reviewed by Blum (1956). Fogg (1953), Kraus (1958), Provasoli (1958), Bendix (1960) have reviewed the nutritional and other physiological aspects of Phototaxis. Voluminous data are available on the phytoplankton productivity (Odum, 1956; Verduin,1956; Steele, 1959; Steemann-Nielson,1960; Strickland,1960).

Various methods have been suggested for estimating the phytoplankton productivity. Estimation of chlorophyll of the standing crop has been reviewed by Wetzel (1964). Changes in oxygen in the bell-jar or dark and clear bottles have been used to estimate productivity (Odum,1956). The changes in the oxygen content in the clear bottles during a stipulated time of the day give the photosynthetic production which can be corrected for respiration by the changes in oxygen content in the dark bottles. Sometimes long incubation periods are required in this method. In polluted waters the bacterial respiration vitiates the production estimates.

1 Situations like Ajwa Reservoir where the phytoplankton mass is very small as compared to zooplankton offer certain difficulties. Separation of these zooplanktons and the lack of devices to concentrate the phytoplankton were major problems. The samples directly filled in dark and clear bottles without any concentration did not show any remarkable changes in the oxygen content in periods of four to six hours in comparison to changes in the surrounding water. This was probably due to depletion in the nutritional conditions and higher rates of respiration (of zooplankton and bacteria) in the closed chambers. Apart from these difficulties the suspension of the bottles which was tried several times in Ajwa Reservoir, was nearly impossible because of the huge number of crocodiles. Because of these difficulties the production and the respiration in Lake Ajwa were estimated from the diurnal changes in the oxygen content at all the depths.

Changes in the diurnal rates of photosynthesis and nocturnal rates of respiration were estimated for a period of one year in the Ajwa reservoir.

The results show that the day time photosynthesis and night time respiration exhibited a fairly regular pattern. In almost all the months, the rates of production were higher in the morning (Table-44) and the rates of respiration were higher in the first half of the night or the beginning of the dark period (Figure 9). These observations are in conformity with the results of Beyers (1965), Doty and Oguri (1957), Yentsch and Ryther (1957), McAllister (1963), Jackson and McFadden (1954), Park, Hood, and Odum (1958).

The tendency of the plant community to achieve the highest photosynthetic or respiratory activity at the onset of light or dark period indicates that there might be some type of rhythm in operation. Pittendrigh (1960), Harker (1964) and Aschoff (1960) have experimental shown in animals, the existence of such circadian rhythms (Harker,1964) or biological clocks which control various temporal activities of the animals. Beyers (1965) also has demonstrated these rhythms in laboratory microecosystems.

In natural communities, photosynthesis and respiration are affected by the increase in the light intensity at down or decrease in the light intensity at dusk, perhaps because of the increase or decrease in the intensity above or below the threshold value at down or dusk.

The phytoplankton in Lake Ajwa shows the peaks of production in summer mainly because of the reduction in the volume of water and the increased concentrations of salts. The rapid attenuation of light intensity and the consequent reduction of photo-inhibition because of the growth of phytoplankton resulting in high biogenic turbidity is probably a very important factor in the high levels of photosynthesis in the surface layer of water in Ajwa. The fall in the productivity in monsoon is mainly due to changes in the volume, turbidity and temperature of water suggesting that the changes due to rainfall have major influence on productivity. A slight rise in the productivity in winter is due to increased transparency in the lake. The higher values of production at surface and 1 m depth and the lowest at the 5 m depth may be attributed to the difference in the degree of illumination.

4 The seasonal changes were small which is a characteristic of tropical shallow lakes. Lake Ajwa has an average annual phytoplanktonic production of 1.44 g O_2/m^2/day which is very low as compared to Lake Victoria (7% O_2/m^2/day, Talling, 1965). The Baroda Municipal Corporation plays an active role in cleaning the water by mass removing the macrophytes and to some extent phytoplankton as the reservoir is a major source of water supply to Baroda city. This disturbance due to the human factor also reduces the total productivity in this ecosystem.

(iii) <u>Macrophytes</u>.

Measurement of biomass of macrophytes in fresh or dry weights is considered as most approximate. Fresh or wet weight is defined as 'weight of the plant without any adherent water' Westlake, 1966). Slight difference in the judgement in the measurement of these weights may lead to errers of more than 10%. Harvest of the macrophytes in area of one square meter is sometimes so high that the worker may find difficulties in the measuring that big mass in the field. Conversions of dry wet as 10% of wet weight is also an approximation as the previous one. The studies in this laboratory showed that it varied from 10 to 18% of the fresh weight.

No attempt was made to study the changes in the biomass of macrophytes along the transect every month; but in the months of April and May 1970, the standing crop of these plants was estimated when the level of water was low. Tables 41 shows the weight of the standing crop which was 1,986,000 kg for the whole lake.

Instead of measuring the biomass of these higher plants, samples of water were collected from an area with thick growth of macrophytes for the estimation of oxygen content. The productivity of this area was calculated from the diurnal changes in the oxygen content (Odum,1956; Sargent and Austin,1949; Odum and Hoskin,1958; Hoskin,1959; McConnell and Sigler,1959; Westlake, 1961; Edwards and Owens,1962). The author is aware of the fact that these changes in the oxygen

16 content are not only due to macrophytes but also due to periphyton (perticularly in situations like Lake Ajwa where periphyton productivity is very high) and to some extent due to phytoplankton photosynthesis.

The photosynthetic productivity at Station B has been given in Appendix Table-J and Figure 11. These values do not represent the productivity solely of the macrophytes because the area is not free from phytoplankton.

The distribution of the higher aquatic plants is related to the nature of the bottom of the lake, depth, transparency, etc. The muddy and sedimented bottoms and the large littoral shelf offer good sites for the growth of these plants. The vertical distribution of these plants is related to transparency of the water. The good penetration of light (0.5 m to 2.5 m Sacchi) allowed the growth of plants upto the depth of 3 m in Ajwa.

In Ajwa the production of these plants was higher than the planktonic production these plants formed a major group which not only competed with the suspended plankton but limited its growth.The total absence of phosphorous and Nitrogen in Ajwa water is suspected to be due to higher intake of these salts by macrophytes. In Table-50 all the production data are given in terms of carbon. The formulae used for interconversion of units are given by Westlake (1964) and Sladecekova (1962).

(B) Factors influencing production :

There are various factors known to influence the primary production. They can be classified into three main groups :

(i) Physical factors originating directly or indirectly from solar radiation, such as light conditions, temperatures, mixing and turbulence by action of wind; (ii) the content of nutrients in the euphotic zone of the lakes and (iii) the interaction of the organisms present in the ecosystem (Findenegg, 1966). These factors through their interdependence and interactions also promote or retard production.

(i) The Diffusion of Oxygen E(m/h)

The diffusion of oxygen at surface water is given by

$$E = f \quad \overline{C}_s - \overline{C} \quad - R$$

where E is the rate of diffusion of oxygen in metre/hr.

f is the coefficient of exchange,

$\overline{C}_s$ is the saturation concentration and

$\overline{C}$ is the actual concentration of O_2 during period of darkness and

R is the average rate of respiration.

When actual oxygen concentration of surface water is higher than saturation concentration, some quantity of oxygen is lost to the atmosphere. Oxygen is added to the water when actual concentration of oxygen is less than saturation concentration. This means that the observed content in the surface is net oxygen in water after the exchange with the atmosphere as explained above. In this case, to find out photosynthetic increase of oxygen, the values of diffusion will have to be deducted from the observed oxygen content; in Ajwa reservoir actual oxygen content during dark period was never higher than saturation concentration in any season.

Exchange coefficient f, wascalculated as

$$f = \frac{X_2 - X_1}{(\overline{C}_{s2} - \overline{C}_2) - (\overline{C}_{s1} - \overline{C}_1)}$$

where x_1 and x_2 are the rates of change of oxygen between stations at the average saturation deficits $(\overline{C}_{s1} - \overline{C}_1)$ and $(\overline{C}_{s2} - \overline{C}_2)$ respectively.

The average value of the exchange coefficient f = 0.08 for Ajwa reservoir has been calculated. The diffusion E in the reservoir varied from 0.03 to 0.12 m/h and the average was 0.073 m/h.

This value has to be deducted from the production values at surface. It will be seen that the average production in the month of June is 0.111 g $O_2/m^2/h$ and after the deducting the value of E, it was reduced to 0.101 g $O_2/m^2/h$. This shows that the values of E in Ajwa reservoir do not reduce the production figures to appreciable extents and hence have been neglected in the present work.

(ii) <u>Light, temperature and mixing.</u>

The Sacchi depth gives a rough estimate of the light penetration in water and the extinction coefficients are also very approximate. It has been found that the Sacchi depth estimation may involve

1 an error of 25%. If the euphotic zone is taken as the depth where I (intensity of light) is 1% of I_s, (intensity of light at surface) (Strickland,1958) this should be 3 to 5 time the Sacchi disc depth (Hogetsu,1958) and the standing crop per unit volume is an inverse function of this depth (Strickland,1958). Considering the minimal (2.5 times the Sacchi disc depth) depth of the euphotic zone in Ajwa reservoir, it extends nearly upto the bottom for most of the time of the year except in monsoon when the turbidity is higher.The generalised indication of an inverse relationship between transparency as measured by secchi disc and rainfall is most evident in Lake Ajwa. Secchi transparency is more than 2.5 meters in the late monsoon and winter. This promotes the growth of higher aquatic plants even at deeper layers in the reservoir. The appreciable quantities of oxygen content and the production rates at 5 m depth can be attributed to good penetration of light. Hence the bottom layers of shollow lakes in tropics may never be found totally unproductive. The photosynthetic efficiencies during various seasons of the years 1969

and 1970 have been studied (tables 47 and 49) and it has been found that at low levels of radiation, photosynthetic efficiency was relatively more than that at high radiation values (Figure 14). This probably suggests that intense solar radiation beyond a certain limit does not contribute to the photosynthetic efficiency. Ganapati and Sreenivasan (1970) have shown that the magnitude of photosynthetic efficiencies in south Indian reservoirs ranges from 0.41 to 2.62 %, but in very small water bodies the same may go as high as 10% (Ganapati,1970). Ganapati and Pathak (1970) found the average energy availing relationship to be 0.3% in Ajwa reservoir for the two year period of 1963 and 1964.

In the present work, the photosynthetic efficiency varied from 0.3 to 0.8 % with an average of 0.48 %.These values were higher than the values estimated by Ganapati and Pathak in 1963-64. The photosynthetic efficiency is a ratio of energy required for gross production to available solar energy and as the average gross production in 1969-70 was higher than in 1963-64, the average photosynthetic efficiency was also higher.

Intense surface illumination has been known to inhibit the planktonic and macrophytic photosynthesis (Manning and Juday, 1941; Edmonson, 1956; Talling, 1957; Jonasson and Mathiesen, 1959; Goldman and Wetzel, 1963), and such inhibition is due to photo-oxidative destruction of chloroplast and enzymes (Wetzel, 1964).

Temperature :

The changes in the temperature of air and the surface of the lake is caused by solar radiation at air/lake interface. The interactions manifest in two ways : (i) the rise or fall in the temperature of air; (ii) changes in the surface temperature of lake and subsequently the temperature changes in the deeper layers due to (i) penetration of radiant energy (ii) diffusion and (iii) mixing or turnover of water. The solubility of gases is dependent on the temperature of the solvent. Hence the percent saturation, particularly of oxygen in productivity studies depends on the temperature water at the surface. In Ajwa reservoir the oxygen was very close to 100% of the saturation value; the values of exchange coefficient were negligible.

In deep lakes air temperature plays a very important role in developing the thermal stratification. But in shallow air tropical lakes the whole body of water gets heated with the rise of temperature and permanent stratification never develops. In Ajwa lake also there was no permanent annual thermal stratification. But with the rise of temperature in the afternoon, everyday a slight thermal stratification developed whole at dawn there was more or less homothermal conditions (Table 16 and 17 and Figures 3,4, and 5). This brings about the mixing up or turn over of water making the surface layer richer in nutrients. During noon when water is thermally stratified for a short period, oxygen reduction was evident in the bottom layers.

Mixing :

Mixing of water from different depths results due to changes in temperature, water replenishment and

5 wind velocity. Lack of mixing does not allow good circulation and a complete turn over of the nutrients making the lake less productive. These nutrients do not come back into the trophogenic layers. The larger the lake and less sheltered it is from wind, more is the mixing which facilitates exchange of nutrients. Ajwa reservoir is a shallow lake least protected from wind which allows the complete turnover of the nutrients. The temperature also was higher in the noon and thermal stratification developed every day promoting the complete turnover. Complete mixing and replanishment of water occurs only once a year in monsoon.

(iii) The effect of water replanishment on primary production.

Primary effects of water replanishment are : (i) it dilutes the nutritional conditions of the old water and changes its physical and chemical conditions. The standing crop of vegetation might be deprived of the essential nutrients due to dilution; (ii) changes of high magnitude may occur due to inflow or outflow; (iii) photosynthetically active phytoplankton from the mass of water is drifted away towards the outlet, (iv) the tropogenic layers are displaced and (v) the perisistant thermoclime is disturbed.

There are also advantages of water replanishment. The new water that enters the lake might be rich in nutrients which might enhance the production. The disturbance in the thermocline may bring the mixing of water. Upwelling of the water from the bottom layers may bring the sedimented material to the surface layer thus enriching it.

Ajwa reservoir receives inflow of water only once in a year in monsoon and no significant changes are noted except in volume of water which becomes consequently diluted. Disturbances in thermocline, (which were normally absent in Ajwa reservoir) or in the photosynthetic zone are also observed only once in a year (mainly July to September). Whatever circulation occurs throughout the year, is due to wind only.

The outflow from the reservoir is mainly due to supply of water to the city of Baroda.

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Table - 52

Changes in the volume and area in Ajwa reservoir during 1969-1970

Date		Area of surface in 1000sq.m.	Depth of water (m)	Volume of water in 1000 cu.m.	Mean effective depth $\overline{Z}$(m)
1969					
June	- 13	4590	5.00	11510	2.51
July	- 30	5625	5.35	15650	2.78
August	- 15	9180	7.11	32750	3.57
September	- 15	15390	9.67	74590	4.85
October	- 23	15012	9.57	71970	4.76
November	- 6	14670	9.45	69450	4.73
November	- 26	14310	9.30	66680	4.66
December	- 27	13725	9.09	62530	4.56
1970					
January	- 7	12960	8.81	57200	4.41
January	- 27	12690	8.69	55270	4.35
February	- 19	12912	8.83	57120	4.42
March	- 23	12240	8.49	52080	4.25
April	- 17	11520	8.21	47420	4.12
May	- 25	10845	7.89	42900	3.96
June	- 13	10620	7.80	41540	3.91
July	- 15	12924	8.76	56740	4.39
August	- 9	12914	8.70	56300	4.36
September	- 19	15930	9.90	79000	4.96
October	- 16	16074	9.94	80040	4.98

Table 52 shows the changes in the volume of water in Ajwa Lake in different months of the year. The lake receives the water from the rivers Surya and Wagli from June to October. The volume of water in the month of June 1969 was 11510 x 10^3 cum while the inflow from the rivers in successive months made the total volueme of 74590 x 10^3 cu.m in September. The increase in the volume from 11510 x 10^3 to 15650 x 10^3 cu.m 15650 x 10^3 to 32750 x 10^3 cu.m and so on (Table-52) was caused by rains received during a period of few days in the respective months. The new water that enters into the lake has different physical and chemical characteristics which disturb the nutrient balance. It tends to change the transperancy and the thermal conditions also which bring about rapid fall in phytoplankton production. The continuous supply to the city allows some of the planktonic forms near intake tower only to flow away out of the lake and the lake as a whole is not devoid of phytoplankton any time of the year. Appendix Tables F show the decreased total gross production from 3.60 g O_2/m^2/day to 1.20 g O_2/m^2/day by the end of the rainy season. Both the incoming and outgoing waters to some extent make the photosynthetic zone of

29 water in its phytoplankton mass making the lake less productive for a few successive months.

The changes in the amount of salts during long term fluctuations in the closed lakes like Ajwa can be considered as very small (cf. Wetzel, 1964). The changes in the ion concentration in Lake Ajwa were once in monsoon on the basis of a year.

(iv) pH.

In natural waters of alkaline pH, carbondioxide exists in equilibrium HCO_3 and CO_3. Changes in the concentration of CO_2 are mainly due to photosynthesis. The CO_2 concentration in water influences pH. The pH in Ajwa reservoir varied from 8.1 to 8.8 suggesting that it is moderately alkaline. In the diurnal rhythm it was found to be higher in the afternoon and lower in the morning. Any pH over 8.1 shows that the photosynthesis exceeds respiration and may be taken to denote approximate saturation with oxygen. (Table 18). Higher pH values in the afternoon are often associated with super saturation with oxygen (Atkins and Harris, 1924) and the diurnal changes can be

30 attributed to photosynthesis. The spatial distribution also showed similar diurnal changes, but smaller in magnitude. Photosynthetic changes at the five meter depth were not as high as at the surface (Table G). The hypolimnion in Lake Ajwa was not so distinct to show any considerable decline of photosynthesis or pH. The seasonal fluctuations are not very big to suggest any profound effect on the primary productivity in Lake Ajwa.

(v) <u>Nutritional conditions in Ajwa reservoir</u>.

The importance of dissolved nutrients in the lake has been considered to be of great significance in the productivity studies (Naumann, 1932; Deevy, 1940; Moyle, 1946). These nutrients in the water are essential for production. Various researchers have stressed the importance of a particular single factor in the determination of productivity but it could be said that it is the sum total of all morphometric, physical and edaphic-factors concerned with quality and quantity of these dissolved nutrient present in water which should be considered. The nutritional conditions in

31 Ajwa reservoir are summarised in Table-53.

Table - 53

Analysis of Surface water samples from the Ajwa Lake (expressed as parts per million)

	Maximum	Minimum
Oxygen	110.0	47.0
pH	8.8	8.1
Alkalinity	170.0	140.0
Chlorides	76.0	40.0
Calcium	13.8	6.5
Magnesium	-	-
Total PO_4	Nil	Nil
Total N	Traces	Nil
Sodium	58.8	51.2
Potassium	1.9	1.4
Silicates SiO_2	0.2	0.1

It could be seen that the water of the reservoir is poor in the nutritional components. The silicates are mainly responsible for the diatom blooms in the reservoir. Phosphorous and Nitrogen were almost absent

32 and were never detected in the surface and bottom samples collected at noon every month.

(vi) Eutrophication :

Most of the man-made likes intended for civic water supply pose a problem of eutrophication. High biological productivity, denudation and silting of both the autotrophic and heterotrophic substances cause the major changes in the bathymetry of the lake.

The Ajwa reservoir is very well managed and the higher aquatic plants in the reservoir are removed by dredges, specialised boats and sometimes by human labour. The productivity of these plants is also low and hence the eutrophication due to these plants is maintained low.

The source of eutrophication in the lake is not mainly biogenic in origin. The rivers Surya and Wagli, though not perenial, carry the eroded material, emplying it into the lake during the monsoon. A priliminary survey of the bathemetry of the lake showed that at certain places there has been heavy silting and the lake has been shallowed at these places by nearly one to three meters within eighty years after construction.