Chapter – 3

RESULTS

Water Quality Parameters

Biological Analysis

Soil Quality Parameters

Biodiversity Status

Fisheries Data Analysis

RESULTS:

THE RESERVOIR, Nyari – II, was analyzed critically for its ecology and fisheries. The samples collected were analyzed for various quality and quantity parameters either at site or in the laboratory. This chapter contains all observations made in the form of result tables and graphs. Appropriate photo documentation is also presented herein.

Water quality parameters:

Physical parameters:

Physical characteristic of the sample water were estimated on the basis of standard methods. Surface temperature, turbidity, electric conductivity and solids were estimated, the results obtained are presented as tables and graphs.

Surface temperature:

Surface temperature ranged from 20°C to 33°C in the reservoir throughout analysis period. During 1st year the range of temperature was between 21°C to 33°C, and the average was 28.83° C. During 2nd year the range of temperature was 20°C to 33°C (Table – 3.1, Fig. 3.1)

Turbidity:

The turbidity was estimated by Nephlometer and represented in the unit of NTU (Table 3.2, Fig. 3.2). During 1st year the turbidity ranged from 2.1 NTU to 5.8 NTU, and the average was 3.96 NTU, the minimum turbidity was found in the month of October and maximum was in the month of May. While, in the 2nd year the range of turbidity was 0.2 NTU to 10.7 NTU, and average was 2.48 NTU, the minimum turbidity was in the month of November and maximum was recorded like that of 1st year in the month of May.

Electrical Conductivity (EC):

Dissolved salts impart electrical or ionization properties to water. The observations (Table 3.3, Fig. 3.3) ranged from 0.66 to 1.1 mho and average was 0.896 mho during 1st year. The minimum value was in October month and maximum was in the month

of April. During 2nd year the average was 1.01 mho, the minimum EC was in September (0.66 mho) and maximum was in June (1.99 mho).

Solids:

The solids in the water samples were estimated (Table - 3.4) as Total Dissolved Solids (TDS), Suspended Solids (SS) and Total Solids (TS). Salts or solids in water are the indicators of active chemical nature whether suspended or dissolved. Hence, the estimation of total solids as well as dissolved and suspended solids was required. The Total Dissolved solids (Fig. 3.4.1) during the 1st year ranged from 436 to 732 mg/l, and average was 521 mg/l the minimum TDS was in October and maximum was recorded in the month of June. During 2nd year the range of TDS was 422 to 1274 mg/l, and average was 645.33. The suspended solids (Fig. 3.4.2) ranged from 49.0 to 572.0 mg/l, and the average was 197.33 mg/l, in the 1st year. During 2nd year the range of SS was 34.0 to 680.0 mg/l. The total solids in the 1st year varied from 501.0 to 1304.0 mg/l, and the average was 718.17 mg/l, the minimum was in October month and maximum was in the month of June. During 2nd year the average was 861.83 mg/l, the minimum TS (Fig. 3.4.3) was in August (469) and the maximum (1954) was in the month of June.

Chemical parameters:

pH:

During 1st year the range of pH (Table 3.5, Fig. 3.5) was 6.52 to 8.37, and the average was 7.76, the minimum pH was observed in July while the maximum was in the month of January. During 2nd year the average pH was 8.19, the minimum (7.14) pH was in March and the maximum (9.28) was in the month of July. During second year the pH was alkaline all throughout the year.

Gases:

Various gases get dissolved from the atmosphere in the water of the reservoir through air – water interactions. These gases plays very important role in sustenance of life and productivity of the reservoirs. Gases like Dissolved Oxygen (DO), free CO_2 and Chloride were estimated from the water samples.

Dissolved Oxygen (DO):

The state of the dissolved oxygen (Table 3.6.1, Fig. 3.6.1) during 1st year ranged from 3.77 to 10.9 mg/l, and the average was 7.19 mg/l, the minimum DO was in August and maximum was in the month of January. In the 2nd year DO ranged from 4.07 to 8.16 mg/l, and the average was 6.66 mg/l, the minimum DO was recorded in February and maximum DO was in the month of May.

Free CO_2:

During 1st year the range of Free CO_2 (Table 3.6.2, Fig. 3.6.2) between 13.20 to 33.00 mg/l, and average was 28.83 mg/l, the minimum Free CO_2 was in August month and maximum was in the month of December. While in the 2nd year the range of Free CO_2 was 15.4 to 35.2 mg/l, and average was 24.38 mg/l, the minimum Free CO_2 was in September month and maximum was in the month of December.

Chloride:

The minimum Chloride (Table 3.6.3, Fig. 3.6.3) was in the month of October and maximum was in the month of June in 1st year the range was 95.0 to 390.0 mg/l, and average was 186.25 mg/l, while in 2nd year the range of Cl^- was 105.0 to 460.0 mg/l, and average was 196.92 mg/l, the minimum Cl^- was in October month and maximum was in the month of June.

Biological oxygen demand (BOD):

In the 1st year the range of BOD (Table 3.7, Fig. 3.7) was 0.71 to 9.71 mg/l, and average was 3.08 mg/l, the minimum BOD was in the month of June and maximum was in the month of May While in the 2nd year the range of BOD from 1.08 to 4.50 mg/l, and average was 2.02 mg/l the minimum BOD was in the month of November and maximum was in the month of September.

Chemical Oxygen Demand (COD):

The range of COD (Table 3.8, Fig. 3.8) from 8.0 to 37.0 mg/l, and average was 19.0 mg/l, the minimum COD was in the month of July maximum was in the month of May. While in the 2nd year the range of COD between 10.0 to 35.0 mg/l, and average was 20.33 mg/l the minimum COD was in the month of June and maximum was in the month of July.

Nitrate (NO_3^-):

The Nitrate in the 1st year the range (Table 3.9, Fig. 3.9) between 0.018 to 2.047 mg/l, and average was 0.329 mg/l, the minimum NO_3^- was in December month and maximum was in the month of November. While in the 2nd year the range of NO_3^- from 1.15 to 4.50 mg/l, and average was 2.015 mg/l, the minimum NO_3^- was in the month of June and maximum was in the month of September.

Phosphate (PO_4^{-3}):

The range of PO_4^{-3} (Table 3.10, Fig. 3.10) from 0.01 to 0.33 mg/l, and average was 0.163 mg/l, the minimum PO_4^{-3} was in the month of August and maximum was in the month of December. During 2nd year the range of PO_4^{-3} from 0.16 to 0.42 mg/l, and average was 0.35 mg/l, the minimum PO_4^{-3} was in the month of August and maximum was in the month of September.

Sulphate (SO_4^{-2}):

During 1st year the range of SO_4^{-2} (Table 3.11, Fig. 3.11) between 28.0 to 122.0 mg/l, and average was 68.5, the minimum SO_4^{-2} was in the month of March and maximum was in the month of June. While in the 2nd year the range of SO_4^{-2} between 32.0 to 138.0 mg/l, and average was 70.75 mg/l, the minimum SO_4^{-2} was in December month and maximum was in the month of June.

Total hardness (as $CaCO_3$):

In the 1st year the range of Total Hardness (Table 3.12, Fig. 3.12) was from 210.0 to 540.0 mg/l, and average was 326.67 mg/l, the minimum Total Hardness was in October month and maximum was in the month of June. While in 2nd year the range of Total Hardness from 210.0 to 520.0 mg/l, and average was 317.50 mg/l, the minimum Total Hardness was in the month of October and maximum was in the month of June.

Calcium Hardness (as $CaCO_3$):

In the 1st year the range of Calcium Hardness (Table 3.13, Fig. 3.13) from 70.0 to 260.0 mg/l, and average was 150.0 mg/l, the minimum Calcium Hardness was in the month of October and maximum was in the month of June. During 2nd year the range of Calcium Hardness from 80.0 to 250.0 mg/l, and average was 156.67 mg/l, the

minimum Calcium Hardness was in the month of October and maximum was in the month of June.

Magnesium Hardness (as $CaCO_3$):

The range of Magnesium Hardness (Table 3.14, Fig. 3.14) from100.0 to 280.0 mg/l, and average was 176.67 mg/l, the minimum Magnessium Hardness was in the month of December and maximum was in the month of June. While in the 2nd year the range of Magnesium Hardness from 110.0 to 270.0 mg/l, and average was 160.83 mg/l, the minimum Magnessium Hardness was in the month of December and maximum was in the month of June.

Total alkalinity:

During 1st year the range of Total Alkalinity (Table 3.15, Fig. 3.15) from 100.0 to 330.0 mg/l, and average was 180.83 mg/l, the minimum Total Alkalinity was in the month of October and maximum was in the month of June. While in the 2nd year the range of Total Alkalinity from 110.0 to 350.0 mg/l, and average was 185.0 mg/l, the minimum Total Alkalinity was in the month of October and maximum was in the month of June.

Biological analysis:

Chlorophyll – *a*

During 1st year the range of Chlorophyll – a between 0.16 to 8.32, and average 2.72 was, the minimum Chlorophyll – *a* was in September month and maximum was in the month of April. During 2nd year the range of Chlorophyll – *a* between 0.54 to 7.81, and average was 3.31, the minimum Chlorophyll – *a* was in September month and maximum was in the month of April (Fig. 3.16).

Primary productivity:

Net primary productivity (NPP):

During 1st year the range of NPP between 40.63 to 446.88, and average was 199.48, the minimum NPP was in September month and maximum was in the month of August. During 2nd year the range of NPP between 93.75 to 559.38, and average was 269.27, the minimum NPP was in April month and maximum was in the month of February (Table 3.17.1 and Fig 3.17.1).

Gross primary productivity (GPP):

During 1st year the range of GPP between 425.00 to 1231.25, and average was 862.24, the minimum GPP was in June month and maximum was in the month of August. During 1st year the range of GPP between 643.75 to 1359.38, and average was 986.98, the minimum GPP was in November month and maximum was in the month of May (Table 3.17.2 and Fig. 3.17.2).

Soil quality parameters:

Physical parameters:

Soil quality is very much important parameter for estimation of ecological state of the reservoir. Here, in this study comprehensive soil quantity analysis carried out and reported.

Bulk density:

Average of Bulk density was 1.38 mg/cm^3 and ranged from 1.22 mg/cm^3 to 1.52 mg/cm^3 and minimum was in January month and maximum was in the month of March (Table 3.18 and Fig. 3.18).

Particle density:

The particle density of the soil was recorded average 2.38 mg/cm^{3}and minimum was 1.99 mg/cm^3 in February month and maximum was 3.10 mg/cm^3 in the month of June (Table 3.19 and Fig. 3.19).

Porosity:

The porosity is reported as an average 4%. The minimum porosity was 31.44 % and maximum was 51.74 % in month of February and June respectively (Table and Fig 3.20).

Maximum water holding capacity (MWHC):

Maximum water holding capacity was observed during November while minimum in the month of May and an average water holding capacity of reservoir was recorded as 46% (Table and Fig. 3.21).

Chemical parameters:

The nature of bottom soil is equally important which can be categorized in to general chemical nature and nutritive state.

Electrical conductivity:

The EC was minimum 0.34 and maximum was 0.92mho while average was 0.64 mho (Table and Fig. 3.22).

pH:

The soil pH reported to be alkaline, the minimum pH value was recorded in the month of December and maximum was in the month of July. The range of pH from 7.86 to 8.36 and average was 8.04 (Table and Fig. 3.23).

Nitrogen:

Total nitrogen content of soil ranged from 0.03 to 0.09 ppm and reported maximum in month of September and minimum in the month of July. The average of total Nitrogen was 0.06 ppm (Table and Fig. 3.24).

Phosphorus:

The minimum phosphorus was 0.7 ppm in the month of July and maximum was 96.03ppm in the month of October and the average was 26.29 ppm (Table and Fig 3.25).

Potassium:

The range of potassium from 69.83 to 250.33 ppm and average was 195.81 ppm of the reservoir samples. The minimum and maximum potassium were in the month of March and December respectively (Table and Fig. 3.26).

Organic Carbon:

The minimum organic carbon was 0.38 % in the month of July and maximum 0.94 % was in the month of September while average organic matter was 0.64 % (Table and Fig. 3.27).

Organic matter:

The average Organic matter was 1.12 % of the samples of the reservoir. The range of organic carbon was from 0.66 to 1.62 %. The minimum organic carbon was in the month of July and maximum was in September month (Table and Fig. 3.28).

Soil texture:

This soil is a Sandy Clay Loam containing 52.48 % Total sand, 29.88 % Silt and 17.64 % Clay. The minimum value of total sand, Clay and Silt were 26.15 %, 3.27 % and 9.85 %, while minimum in the month of September and May respectively. Average of coarse sand and fine sand were 33.52 % and 18.93 % respectively (Table and Fig. 3.29).

Micronutrients:

The average values of the micronutrients for the samples were Cu (3.5 ppm), Zn (1.04 ppm) and Fe (12.7 ppm). The maximum Cu was in the month of October while Zn in November and Fe in December month (Table and Fig. 3.30).

Biodiversity status:

Phytoplankton (Plate – 3 a):

The phytoplankton (Table 3.31) were represented by various algae like, chlorophyceae, diatoms as bascillariophyceae, cyanophyceae etc. During 1st year the Phytoplankton were dominated by algal matter where as Diatoms were dominating in the year 2007 – 08. The phytoplankton, a major group of primary production was represented by Spirogyra, Spirulina, Oedogonium, Zygnema, Oscillatoria, Ulothrix, Navicula, Euglena and Volvox etc. (Fig. 3.31).

Zooplankton (Plate – 3 b):

During 1st year the range of Zooplankton between 174 to 769 n/l, and average was 378.42 n/l, the minimum Zooplankton was in March and maximum was in the month of October. During 2nd year the range of Zooplankton between 167 to 771 n/l, and average was 353.25 n/l, the minimum Zooplankton was in March and maximum was in the month of October. Detailed account of various zoolanktonic groups is enumerated in Table 3.32.

Aquatic Macrophytes:

Variety of macrophytes has been collected from this reservoir. Large amount of submerged weeds like Hydrilla, Vallicenaria, Ceratophyllum etc. were found in healthy conditions and distributed from periphery to deeper zone in the centre. Marginal and emergent weeds were comparatively less in density due to better managed periphery of reservoir. Few types of floating macrophytes like Pistia, Lamina etc. were also very common (Table 3.33).

Molluscan diversity (Plate – 4):

The faunal groups like molluscs were taken in to consideration to understand their role in reservoir ecosystem. Largely they were represented by varied gastropods who are the controllers of unwanted weeds and contribute to organic matter in the bottom layer (Table 3.34).

Ichthyofauna (Plate – 5):

Native fishes were represented by major families like Cyprinidae, Siluridae, Gobidae, Channidae and Cichlidae (Table 3.35). The regular and organized fishing activities going on in this reservoir and good amount of inland fish catch has been regularly reported from Nyari–II reservoir. Regular stocking of Indian Major Carps like Rohu, Catla and Mrigal is done by the government fisheries department considering the water budget of the reservoir. Total fish yield return of this group has been reported well and since 2004 – 05 the yield has increased, the catch of Catla and Rohu was above 10,000 kg in the year 2005-06 (Plate – 6). The past records revealed good state of fisheries in Nyari–II reservoir, was one of the important key factors to select the site for ecological analysis.

Fisheries data analysis:

This reservoir has been operational for capture fisheries since its development and impoundment time. Traditionally, the fishes were caught using non-motorized catamarans and FRP boats. Mainly gillnet is operational, while occasionally cast net and drift nets were used. The fish catch comprised of Barbs, Tilapians, Snake heads and Cat fishes (Table 3.36). Apart from this variety of fishes, Indian Major Carps (IMC) were the major components of fish catch (Table 3.37). During last decade the fish catch trend has been increasing for both Rajkot district and Nyari – II reservoir.

The contribution in fish catch of IMC's has been significant for Nyari – II reservoir. Except for the year 2003 – 04 when the catch was drastically changed, the fish catch was not only sold fresh to Rajkot market or marketed nearby major cities in ice stored state, but also large bulk was dehydrated around reservoir by sun drying method. Marketing of fresh catch was an increasing and positive trend in last decade.

This reservoir has been covered by Government Fisheries Department under their experiments of fish stocking. Regularly, fish seeds of all Indian Major Carps (IMC) like Catla, Rohu and Mrigal were brought from other resource and were stocked in this reservoir. Average catch trend of such stocked IMC good return of grown fishes. The Mrigal catch remained low during last decade period of stocking compared to other two varieties of IMC.

Plate – 3: Planktonic forms

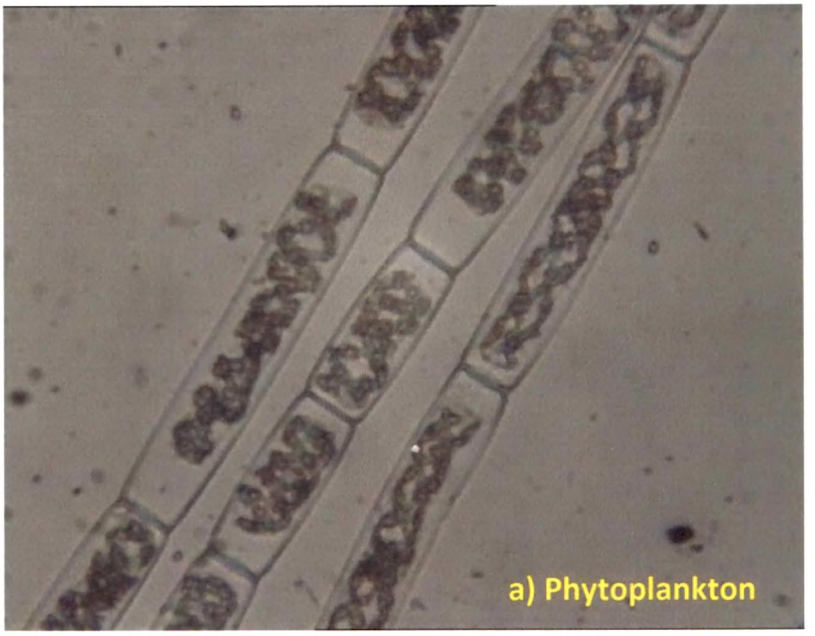

Plate – 4: Molluscan diversity at Nyari – II Reservoir

Plate – 5: Ichthyodiversity of Nyari – II Reservoir

Oriochromis mossambicus

Clarius batrachus

Plate – 6 Hauled Indian Major Carps from Nyari – II Reservoir

Cirrhenus mrigala

Labeo rohita

Table: 3.1 showing surface water Temperatures (°C) for year 2006 – 2008.

Month	2006-07	2007-08
Jun	31	32
Jul	31	31
Aug	32	32
Sep	33	33
Oct	33	33
Nov	31	30
Dec	24	23
Jan	21	20
Feb	22	23
Mar	27	28
Apr	30	30
May	31	31

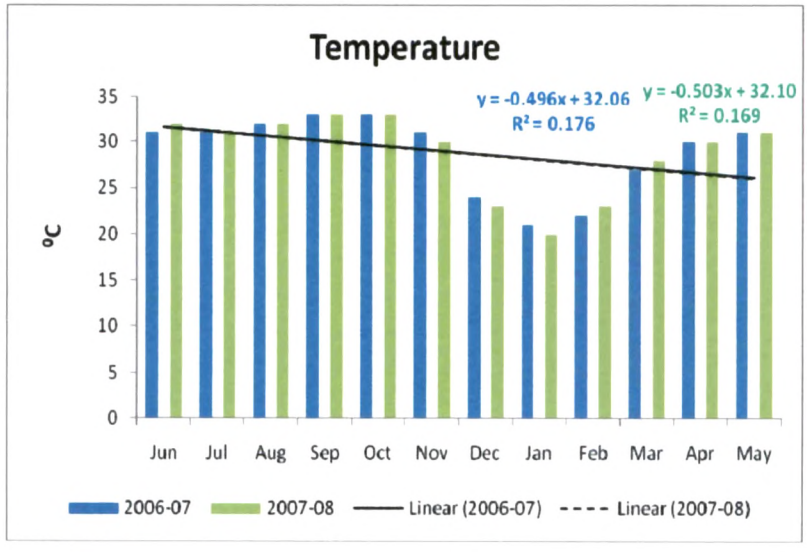

Fig. 3.1 Variation in the Temperature for year 2006 - 07 and 2007 – 08

Table: 3.2 showing turbidity in for year 2006 – 2008:

Month	2006-07	2007-08
Jun	3.5	3.9
Jul	3.9	2
Aug	2.5	1.6
Sep	2.8	0.7
Oct	3.5	3.9
Nov	3.9	2
Dec	2.5	1.6
Jan	2.8	0.7
Feb	3.7	0.6
Mar	4.8	3.5
Apr	4.6	2.9
May	5.8	10.7

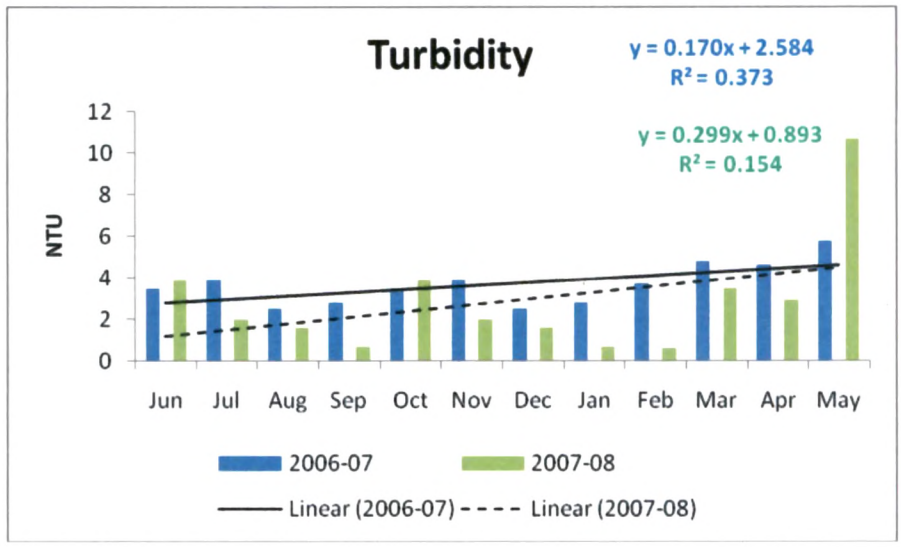

Fig. 3.2 Variation in the Turbidity for year 2006- 07 & 2007 – 08

Table: 3.3 showing Electricle conductivity (EC) for year 2006 – 2008:

Month	2006-07	2007-08
Jun	1.01	1.99
Jul	0.92	0.98
Aug	0.68	0.68
Sep	0.69	0.66
Oct	0.66	0.69
Nov	0.82	0.76
Dec	0.9	0.84
Jan	0.92	0.91
Feb	0.99	1.03
Mar	1.02	1.05
Apr	1.1	1.16
May	1.05	1.35

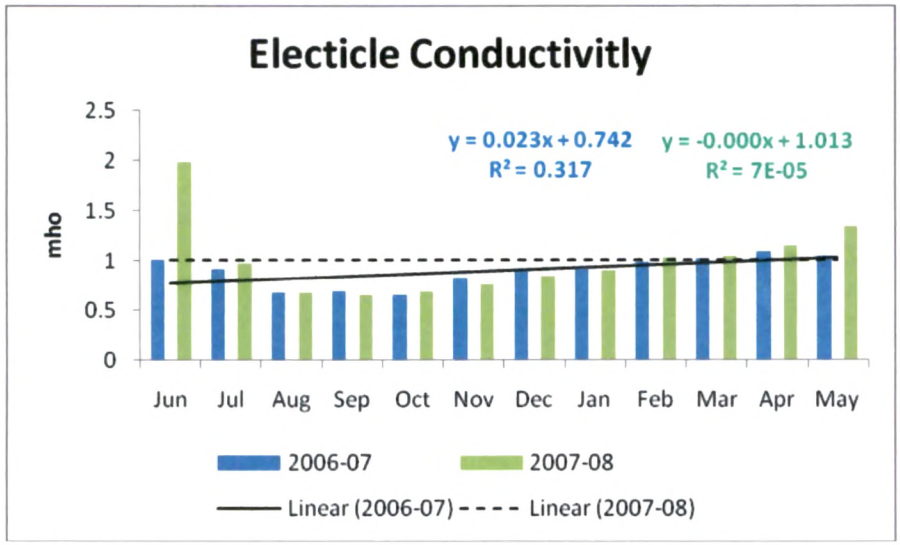

Fig. 3.3 Variation in the Electrical Conductivity for year 2006- 07 & 2007 – 08

Table: 3.4.1 showing Total Dissolved Solid (TDS) for year 2006 – 2008.

Month	2006-07	2007-08
Jun	732	1274
Jul	576	627
Aug	606	435
Sep	452	422
Oct	436	442
Nov	450	486
Dec	454	538
Jan	438	582
Feb	492	659
Mar	504	672
Apr	564	743
May	542	864

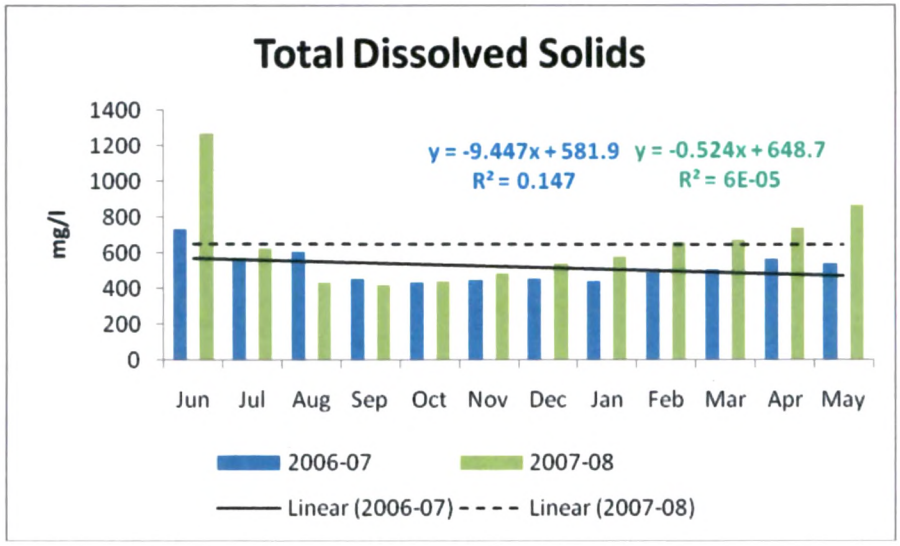

Fig. 3.4.1 Variation in the TDS for year 2006- 07 & 2007 – 08

Table: 3.4.2 showing Suspended Solids (SS) for year 2006 – 2008:

Month	2006-07	2007-08
Jun	572	680
Jul	58	45
Aug	49	34
Sep	82	60
Oct	65	84
Nov	95	112
Dec	135	148
Jan	158	176
Feb	195	226
Mar	205	231
Apr	289	284
May	469	512

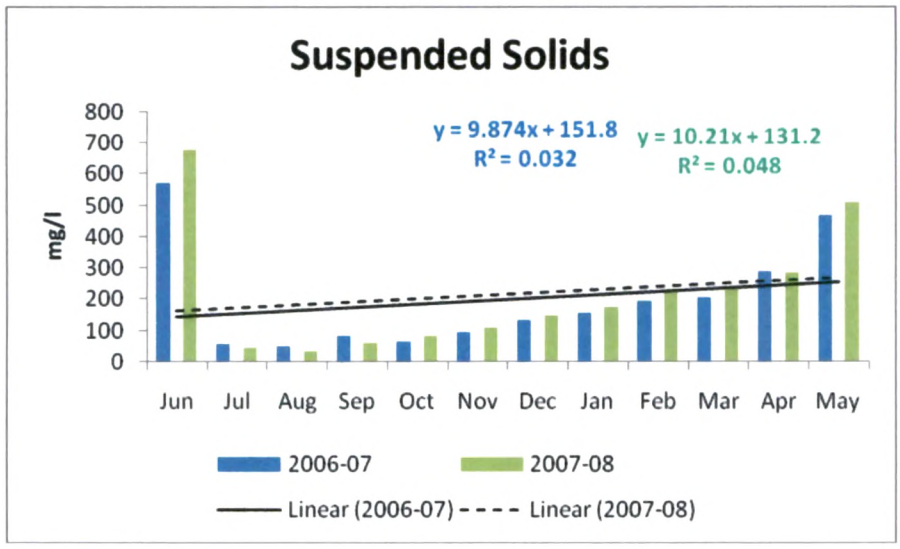

Fig. 3.4.2 Variation in the SS for year 2006- 07 & 2007 – 08

Table 3.4.3: showing Total Solid (TS) for year 2006 – 2008:

Month	2006-07	2007-08
Jun	1304	1954
Jul	634	672
Aug	655	469
Sep	534	488
Oct	501	526
Nov	545	598
Dec	589	686
Jan	596	758
Feb	687	885
Mar	709	903
Apr	853	1027
May	1011	1376

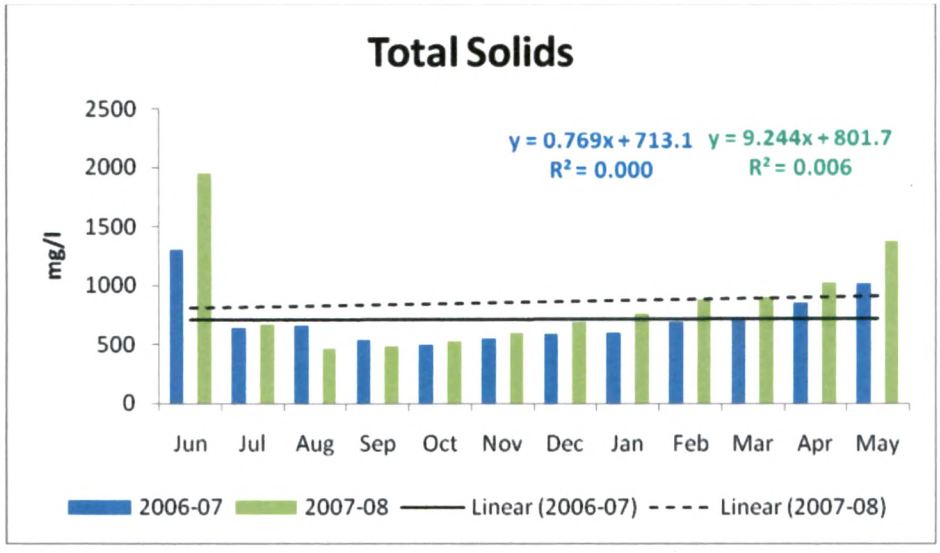

Fig. 4.4.3 Variation in the TS for year 2006- 07 & 2007 – 08

Table 3.5: showing pH of water for year 2006 – 2008:

Month	2006-07	2007-08
Jun	8.23	8.43
Jul	6.52	9.28
Aug	7.19	7.46
Sep	7.96	8.17
Oct	7.89	7.46
Nov	8.02	8.53
Dec	8.15	8.20
Jan	8.37	8.53
Feb	7.42	8.39
Mar	7.71	7.14
Apr	7.77	8.07
May	7.90	8.65

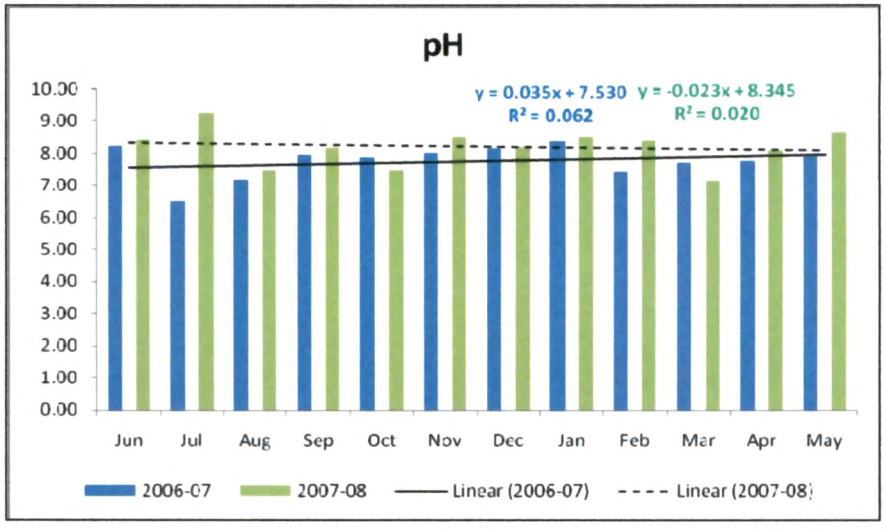

Fig. 3.5Variation in the pH for year 2006- 07 & 2007 – 08

Table: 3.6.1: showing Dissolved Oxygen (DO) content for year 2006 – 2008:

Month	2006-07	2007-08
Jun	6.37	7.00
Jul	6.50	4.75
Aug	3.77	6.37
Sep	8.67	7.36
Oct	7.68	6.47
Nov	6.82	7.32
Dec	8.15	7.16
Jan	10.90	7.01
Feb	6.14	4.07
Mar	6.94	6.67
Apr	4.77	7.58
May	4.72	8.16

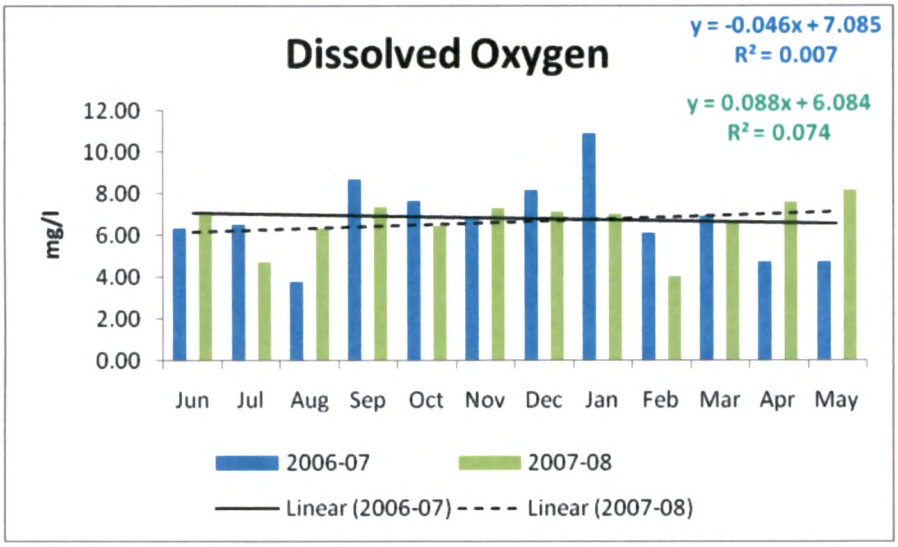

Fig. 3.6.1 Variation in the Dissolved Oxygen for year 2006 - 07 and 2007 – 08.

Table: 3.6.2 showing free CO_2 for year 2006 – 2008

Month	2006-07	2007-08
Jun	19.8	24.2
Jul	17.6	19.8
Aug	13.2	17.6
Sep	15.4	15.4
Oct	26.4	28.6
Nov	28.6	33
Dec	33	35.2
Jan	30.8	33
Feb	22	17.6
Mar	24.2	22
Apr	26.4	24.2
May	28.6	22

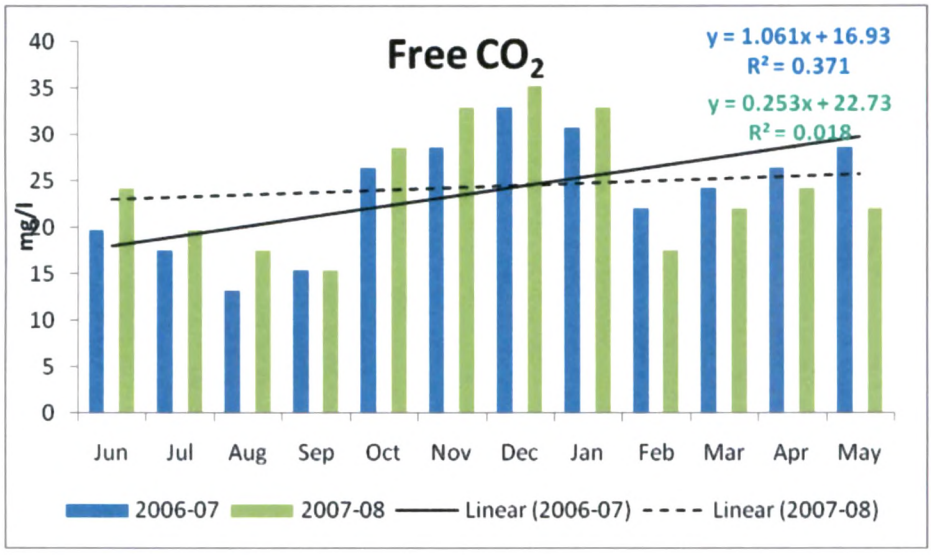

Fig. 3.6.2 Variation in the Free CO_2 for year 2006- 07 and 2007 – 08.

Table: 3.6.3 showing Chloride content for year 2006 – 2008:

Month	2006-07	2007-08
Jun	390	460
Jul	155	150
Aug	115	110
Sep	105	114
Oct	95	105
Nov	135	145
Dec	140	150
Jan	155	165
Feb	180	195
Mar	195	210
Apr	235	234
May	335	325

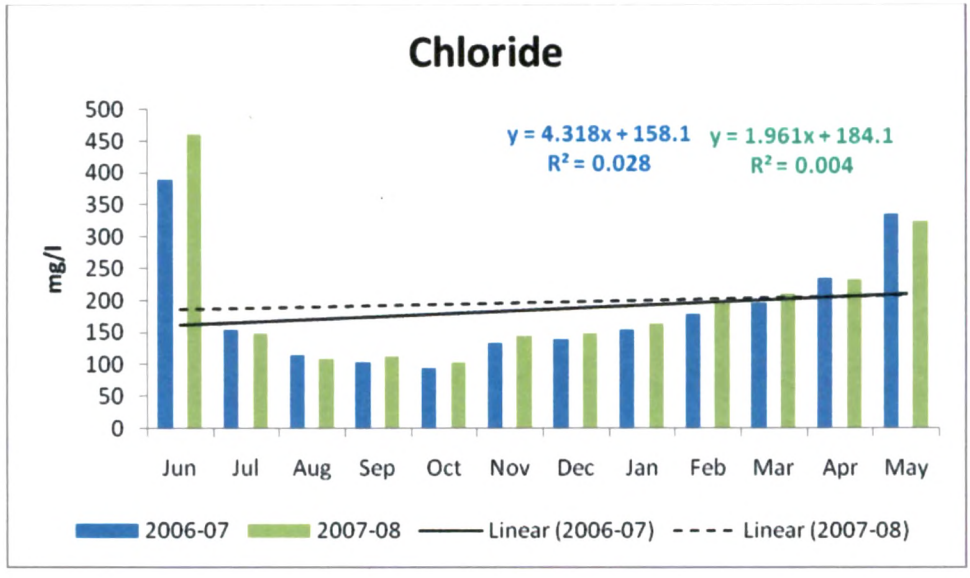

Fig. 3.6.3 Variation in the Chloride for year 2006- 07 & 2007 – 08

Table: 3.7 showing Biological Oxygen Demand (BOD) for year 2006 – 2008:

Month	2006-07	2007-08
Jun	0.71	1.15
Jul	2.88	4.11
Aug	2.74	1.97
Sep	7.77	4.50
Oct	1.03	1.33
Nov	0.84	1.08
Dec	1.81	2.09
Jan	3.65	1.37
Feb	3.11	1.18
Mar	1.87	1.99
Apr	0.79	1.80
May	9.71	1.61

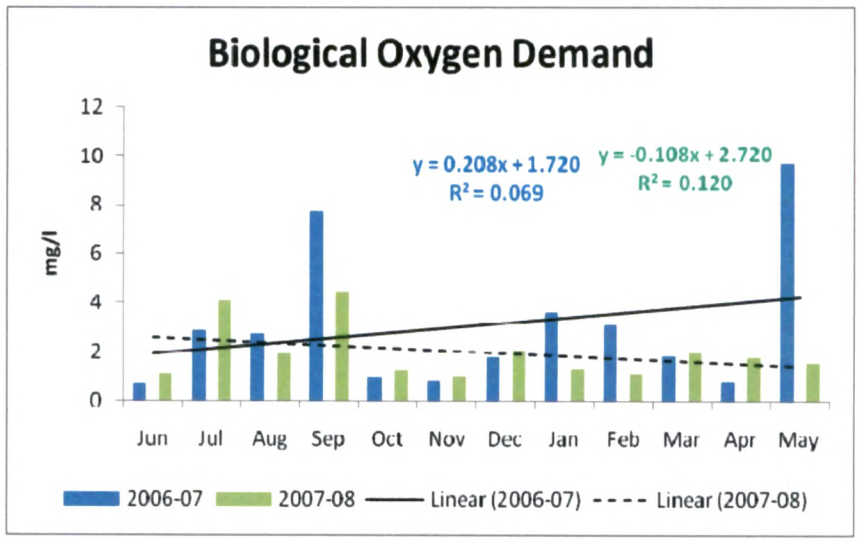

Fig. 3.7 Variation in the Biological Oxygen Demand for year 2006- 07 & 2007 – 08.

Table: 3.8 showing Chemical Oxygen Demand (COD) for year 2006 – 2008::

Month	2006-07	2007-08
Jun	22	10.00
Jul	08	35.00
Aug	13	17.00
Sep	20	12.00
Oct	23	21.00
Nov	22	25.00
Dec	28	21.00
Jan	14	20.00
Feb	26	27.00
Mar	17	18.00
Apr	21	18.00
May	37	20.00

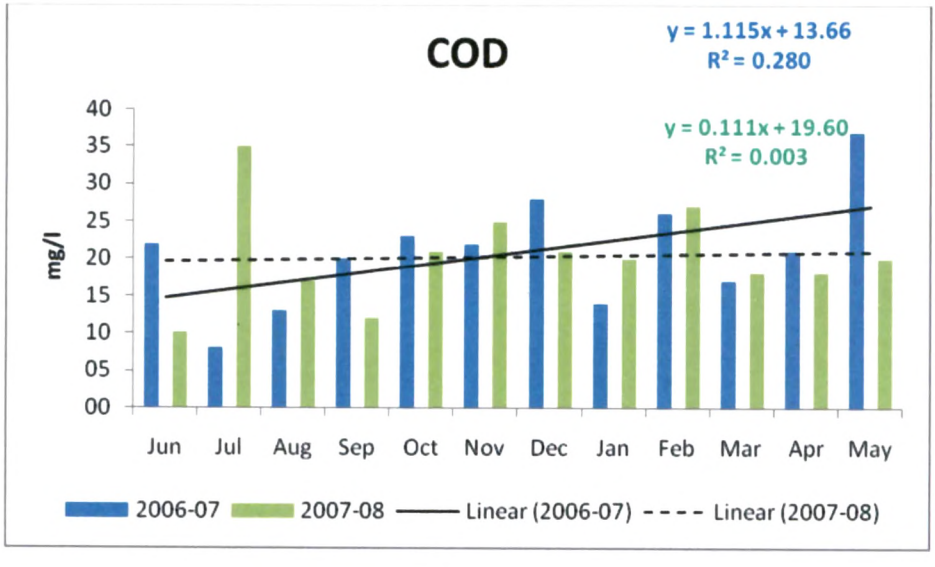

Fig. 3.8 Variation in the Chemical Oxygen Demand for year 2006- 07 & 2007 – 08.

Table: 3.9 showing Nitrate (NO_3^-) for year 2006 – 2008:

Month	2006-07	2007-08
Jun	0.09	1.15
Jul	0.08	4.11
Aug	0.07	1.97
Sep	0.15	4.5
Oct	0.68	1.33
Nov	2.047	1.08
Dec	0.018	2.09
Jan	0.093	1.37
Feb	0.023	1.18
Mar	0.041	1.99
Apr	0.135	1.8
May	0.13	1.61

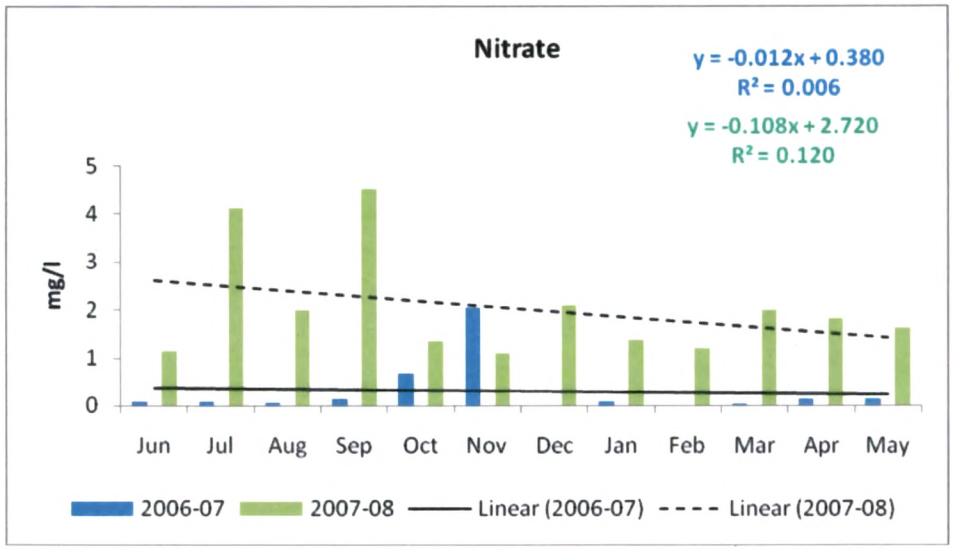

Fig. 3.9 Variation in the Nitrite (NO_3^-) for year 2006- 07 & 2007 – 08.

Table: 3.10 showing Phosphate (PO_4^{-3}) for year 2006 – 2008:

Month	2006-07	2007-08
Jun	0.060	0.33
Jul	0.210	0.41
Aug	0.010	0.16
Sep	0.035	0.42
Oct	0.050	0.41
Nov	0.210	0.28
Dec	0.330	0.31
Jan	0.230	0.41
Feb	0.310	0.34
Mar	0.180	0.34
Apr	0.008	0.38
May	0.007	0.35

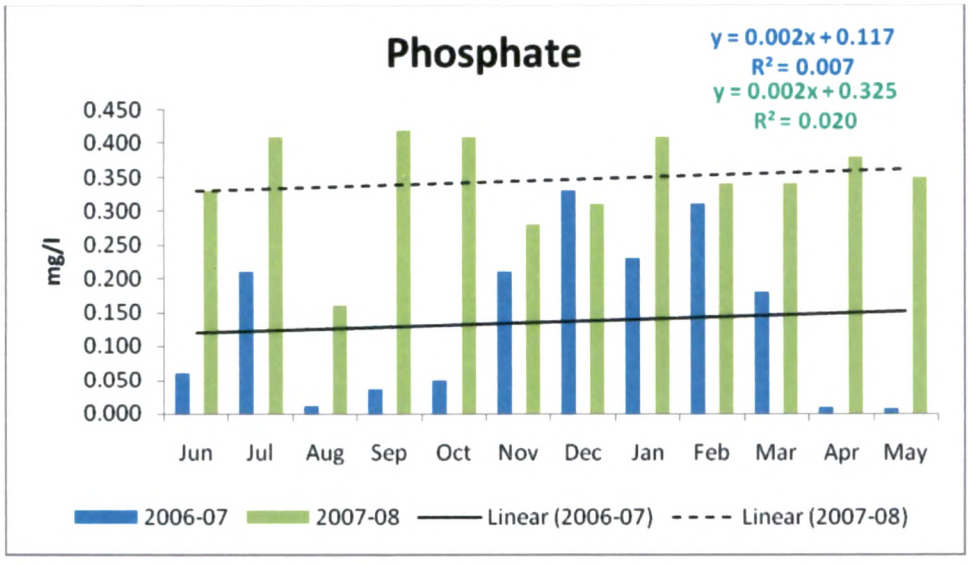

Fig. 3.10 Variation in the Phosphate (PO_4^{-3}) for year 2006- 07 & 2007 – 08.

Table- 3.11: showing Sulphate (SO_4^{-2}) for year 2006 – 2008:

Month	2006-07	2007-08
Jun	122	138
Jul	45	51
Aug	64	58
Sep	58	60
Oct	105	100
Nov	82	70
Dec	38	32
Jan	45	50
Feb	65	75
Mar	28	35
Apr	105	110
May	65	70

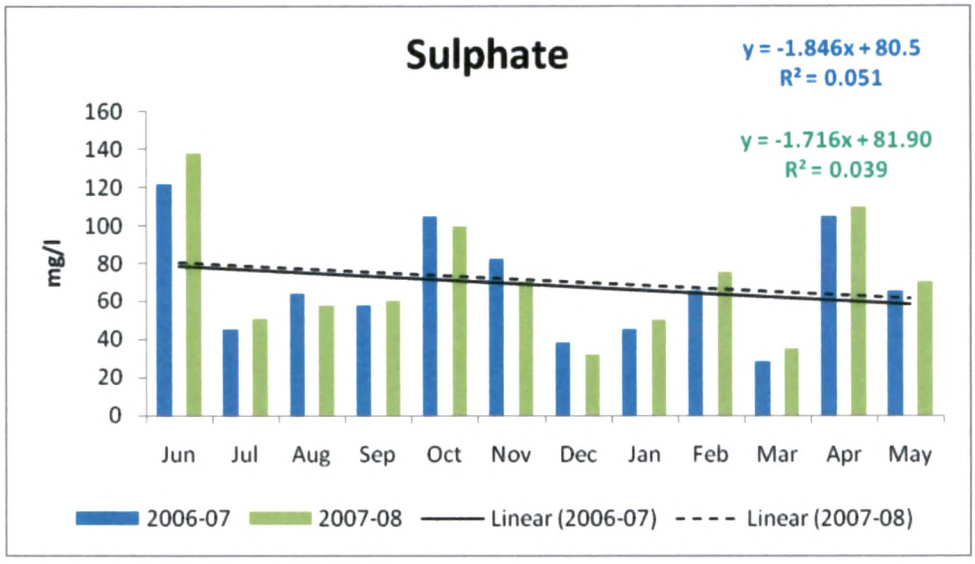

Fig. 3.11 Variation in the Sulphate (SO_4^{-2}) for year 2006- 07 & 2007 – 08.

Table- 3.12 showing Total Hardness (as $CaCO_3$) for year 2006 – 2008:

Month	2006-07	2007-08
Jun	540	520
Jul	270	250
Aug	240	220
Sep	220	210
Oct	210	210
Nov	230	240
Dec	240	250
Jan	330	340
Feb	370	360
Mar	360	360
Apr	430	410
May	480	440

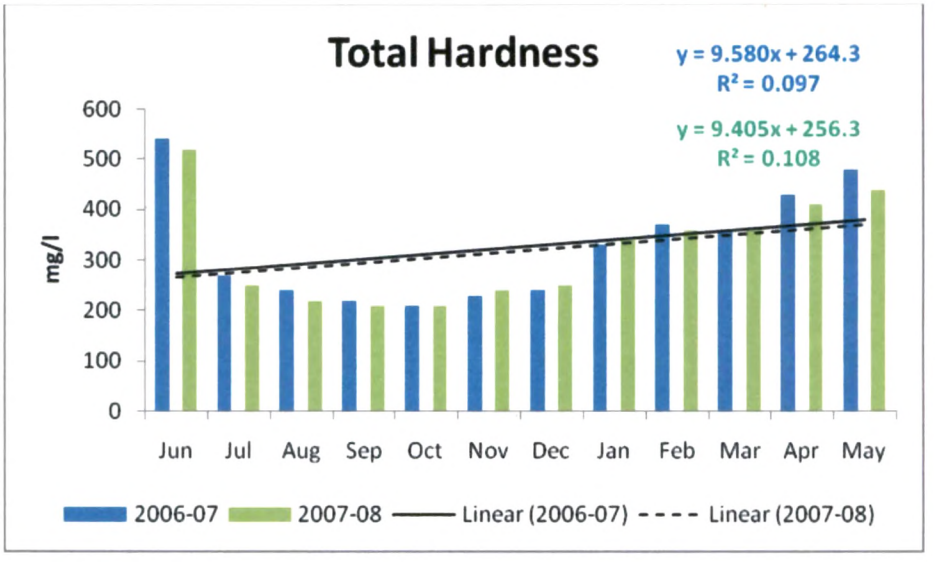

Fig. 3.12 Variation in the Total Hardness (as $CaCO_3$) for year 2006- 07 & 2007 – 08.

Table- 3.13 showing Calcium Hardness (as $CaCO_3$) for year 2006 – 2008:

Month	2006-07	2007-08
Jun	260	250
Jul	110	120
Aug	90	110
Sep	100	110
Oct	70	80
Nov	80	80
Dec	140	150
Jan	150	160
Feb	170	180
Mar	180	190
Apr	230	240
May	220	210

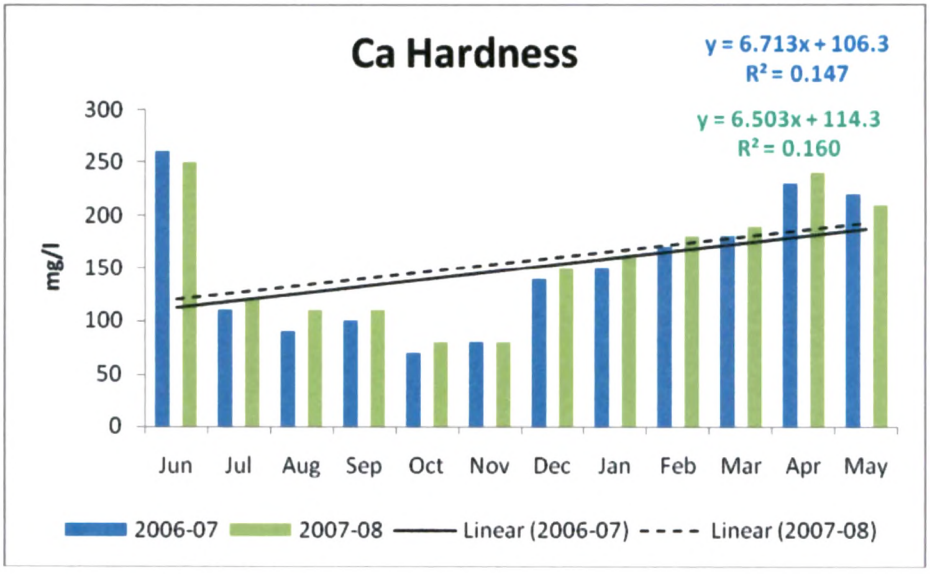

Fig. 3.13 Variation in the Calcium Hardness for year 2006- 07 & 2007 – 08.

Table – 3.14 showing Magnesium Hardness (as $CaCO_3$) for year 2006 – 2008:

Month	2006-07	2007-08
Jun	280	270
Jul	160	130
Aug	150	110
Sep	120	100
Oct	140	130
Nov	150	160
Dec	100	100
Jan	180	180
Feb	200	180
Mar	180	170
Apr	200	170
May	260	230

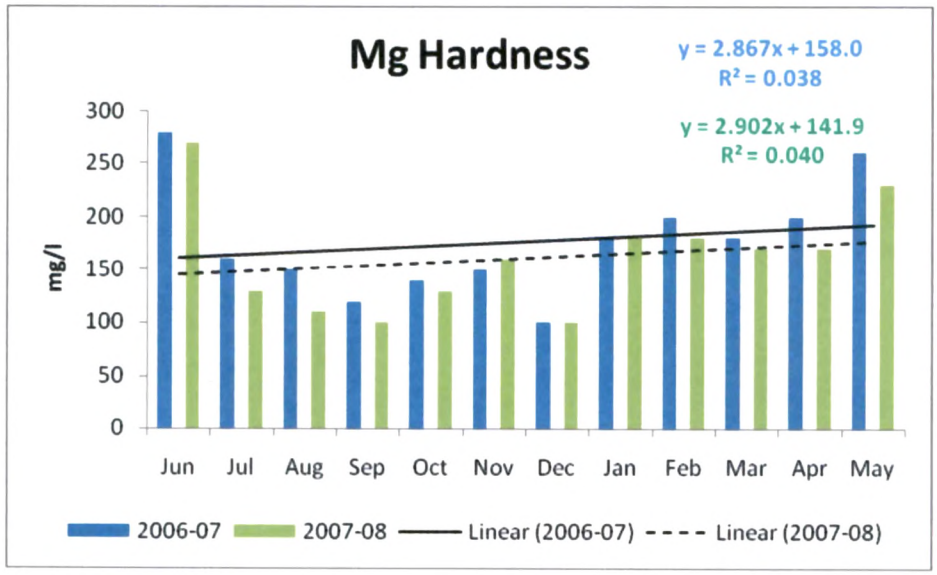

Fig. 3.14 Variation in the Magnesium Hardness for year 2006- 07 & 2007 – 08

Table – 3.15 showing Total Alkalinity for year 2006 – 2008:

Month	2006-07	2007-08
Jun	330	350
Jul	190	200
Aug	160	170
Sep	140	160
Oct	100	110
Nov	110	120
Dec	110	120
Jan	170	160
Feb	190	190
Mar	210	200
Apr	220	210
May	240	230

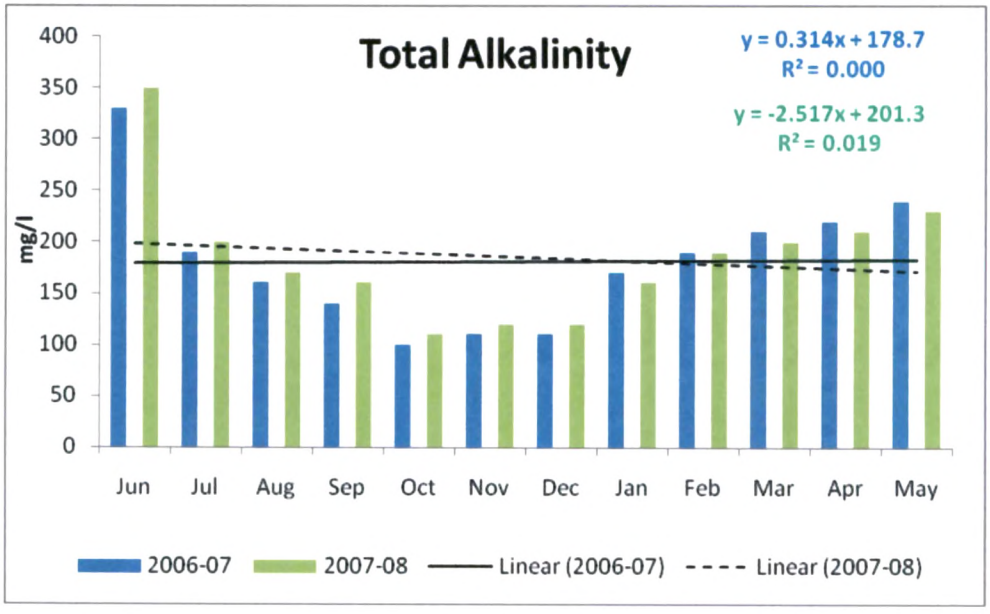

Fig. 3.15 Variation in the Total Alkalinity for year 2006- 07 & 2007 – 08

Table – 3.16: showing Chlorophyll – *a* for year 2006 – 2008:

Month	2006-07	2007-08
Jun	1.48	1.36
Jul	0.46	1.13
Aug	0.27	0.95
Sep	0.16	0.54
Oct	0.36	1.03
Nov	0.34	1.34
Dec	0.7	3.67
Jan	3.5	4.77
Feb	5.18	5.87
Mar	7.15	6.85
Apr	8.32	7.81
May	4.67	4.42

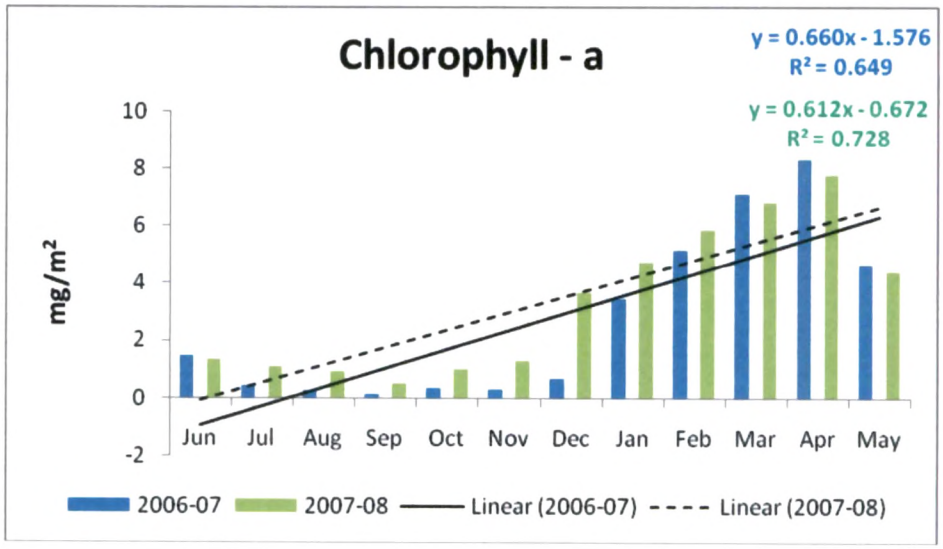

Fig. 3.16 Variation in the Chlorophyll -a for year 2006- 07 & 2007 – 08

Table: 3.17.1 showing Net Primary Productivity for year 2006 – 2008:

Month	2006-07	2007-08
Jun	265.63	287.5
Jul	409.38	290.63
Aug	446.88	390.63
Sep	40.63	262.5
Oct	68.75	234.38
Nov	221.88	181.25
Dec	87.5	306.25
Jan	237.5	265.63
Feb	106.25	559.38
Mar	125	134.38
Apr	265.63	93.75
May	118.75	225

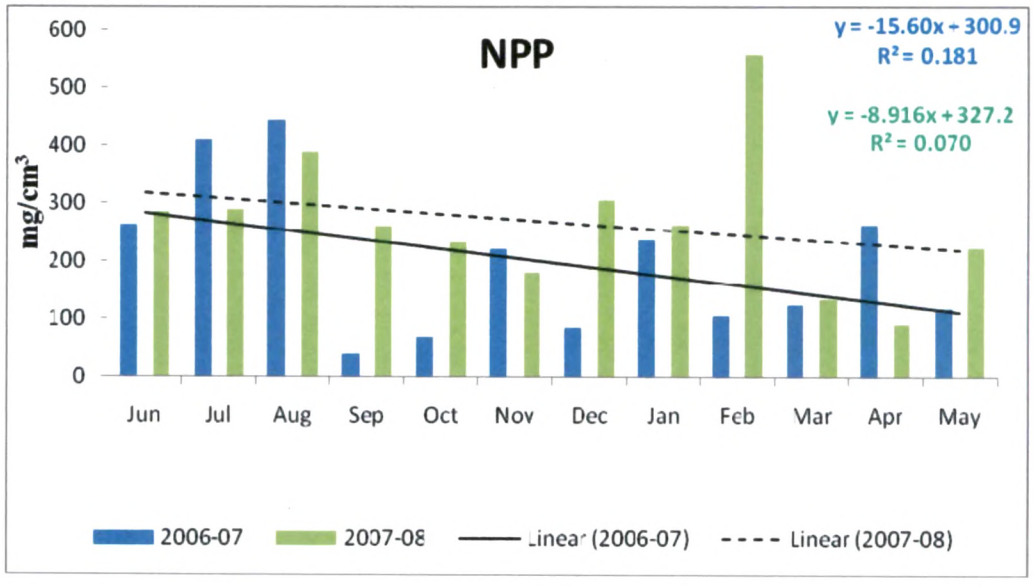

Fig. 3.17.1 Variation in the NPP for year 2006- 07 & 2007 – 08

Table: 3.17.2 showing Gross Primary Productivity for year 2006 – 2008:

Month	2006-07	2007-08
Jun	265.63	840.63
Jul	425	881.25
Aug	1025	1065.63
Sep	1231.25	956.25
Oct	1009.38	950
Nov	903.13	643.75
Dec	578.13	1037.5
Jan	493.75	1128.13
Feb	687.5	1168.75
Mar	1068.75	956.25
Apr	956.25	856.25
May	868.75	1359.38

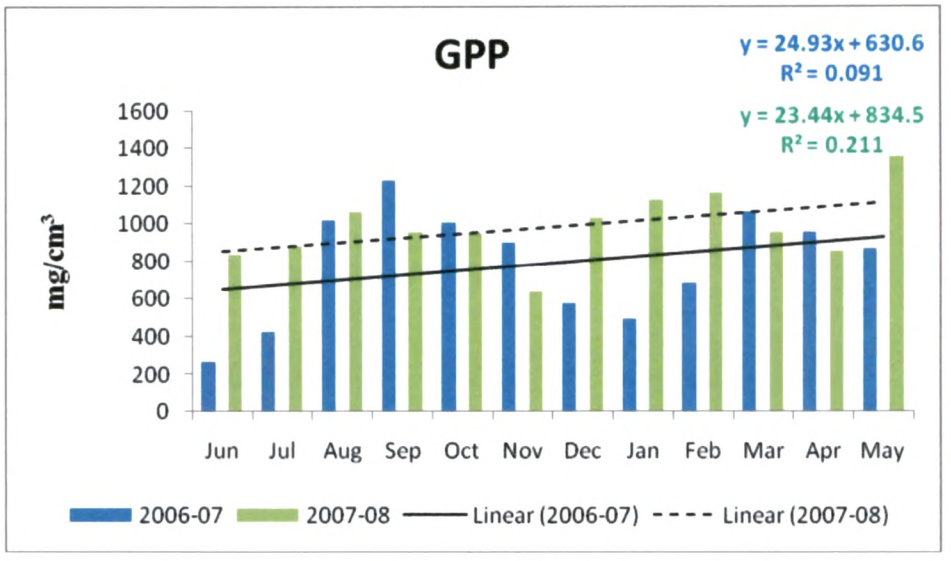

Fig. 3.17.2 Variation in the GPP for year 2006- 07 & 2007 – 08

Table- 3.18 showing Bulk density of soil:

Month	Db
Jun	1.40
Jul	1.41
Aug	1.35
Sep	1.43
Oct	1.45
Nov	1.33
Dec	1.33
Jan	1.22
Feb	1.27
Mar	1.52
Apr	1.37
May	1.49

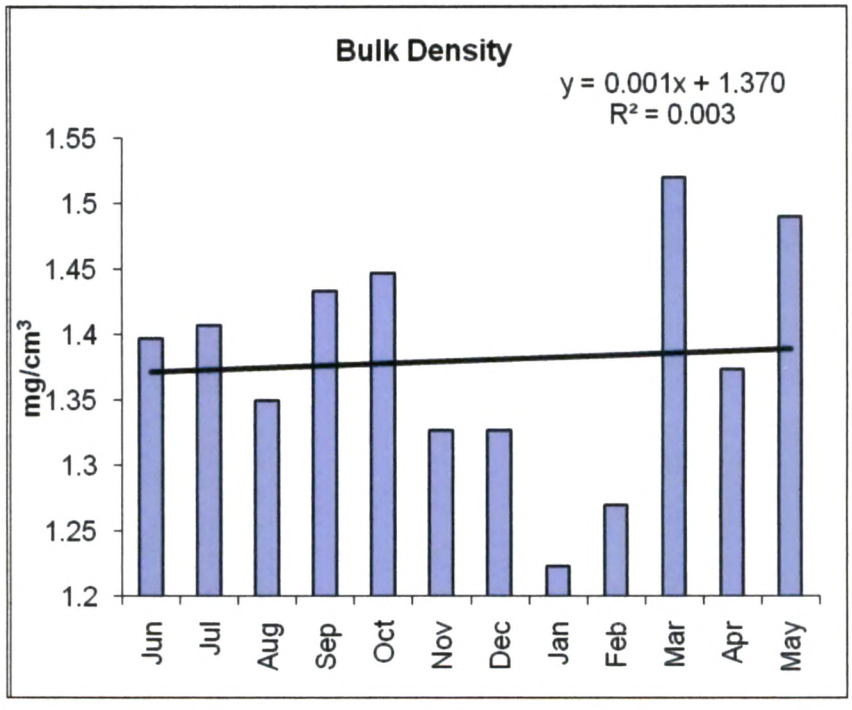

Fig. 3.18 Variation in the Bulk density for year 2007 – 08

Table – 3.19 showing Particle density of soil:

Month	Dp
Jun	3.10
Jul	2.31
Aug	2.09
Sep	2.20
Oct	2.12
Nov	2.23
Dec	2.49
Jan	2.41
Feb	1.99
Mar	2.47
Apr	2.45
May	2.61

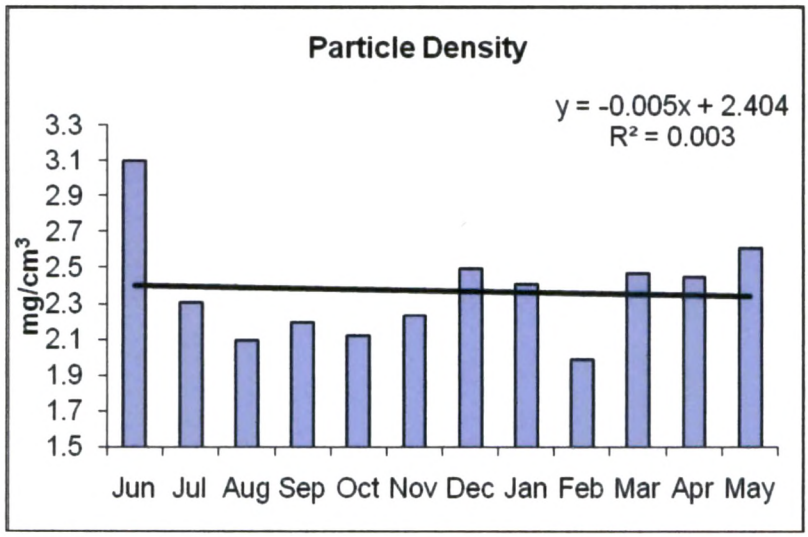

Fig. 3.19 Variation in the Particle density for year 2007 – 08

Table – 3.20 showing Porosity of soil:

Month	Porosity %
Jun	51.74
Jul	38.96
Aug	35.49
Sep	34.78
Oct	31.59
Nov	40.43
Dec	45.87
Jan	49.11
Feb	31.44
Mar	38.30
Apr	43.75
May	42.80

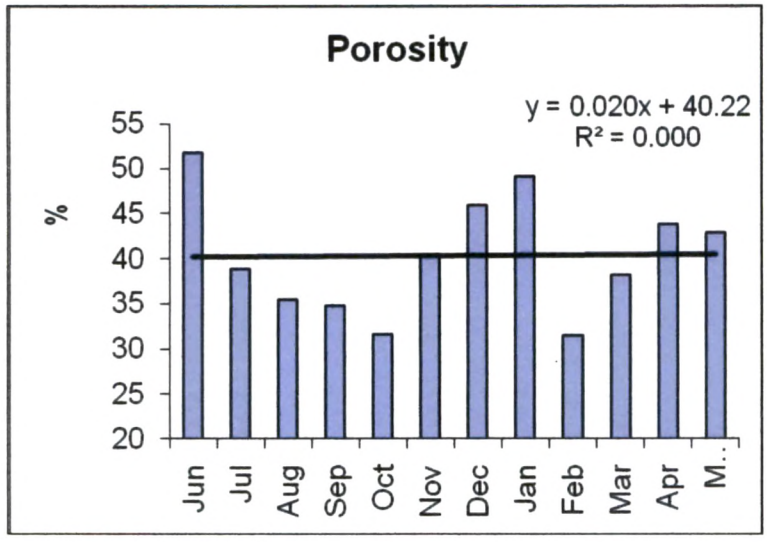

Fig. 3.20 Variation in the Porosity for year 2007 – 08

Table – 3.21 showing Maximum Water Holding Capacity (MWHC) of soil:

Months	MWHC %
Jun	44.30
Jul	41.55
Aug	53.41
Sep	50.20
Oct	46.74
Nov	55.17
Dec	46.29
Jan	53.29
Feb	50.58
Mar	35.73
Apr	44.03
May	33.04

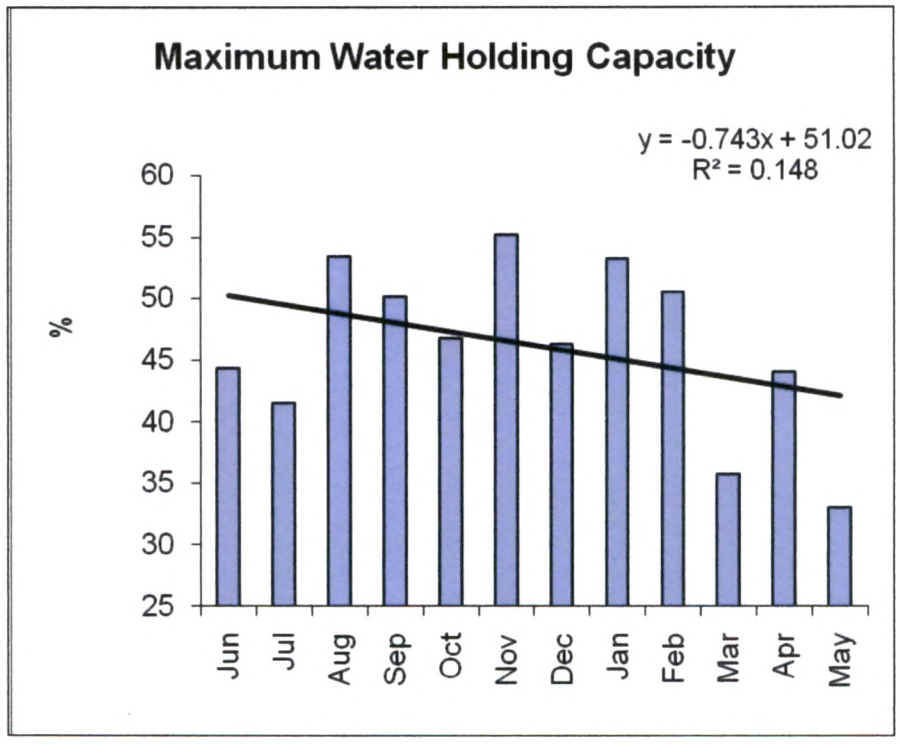

Fig. 3.21 Variation in the Maximum Water Holding Capasity for year 2007 – 08

Table – 3.22 showing EC of soil:

Month	E.C. (mho)
Jun	0.95
Jul	0.47
Aug	0.77
Sep	0.67
Oct	0.72
Nov	0.86
Dec	0.92
Jan	0.67
Feb	0.53
Mar	0.34
Apr	0.69
May	0.42

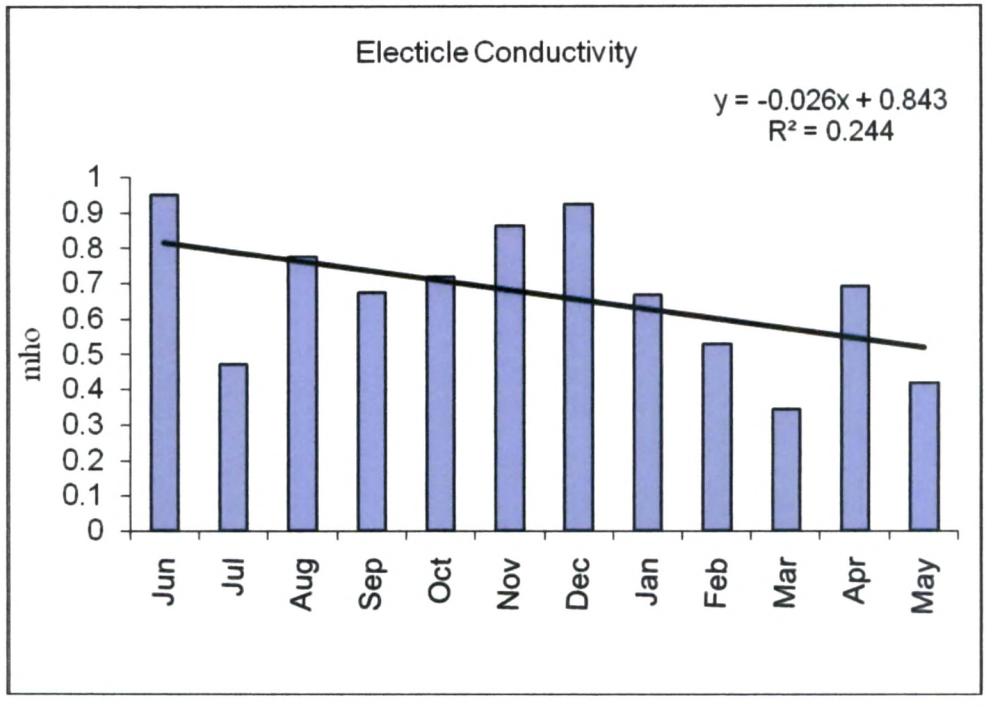

Fig. 3.22 Variation in the Electrical Conductivity for year 2007 – 08

Table – 3.23 showing pH of soil:

Month	pH
Jun	8.01
Jul	8.36
Aug	8.00
Sep	7.89
Oct	7.81
Nov	7.89
Dec	7.86
Jan	8.09
Feb	8.17
Mar	8.24
Apr	7.98
May	8.17

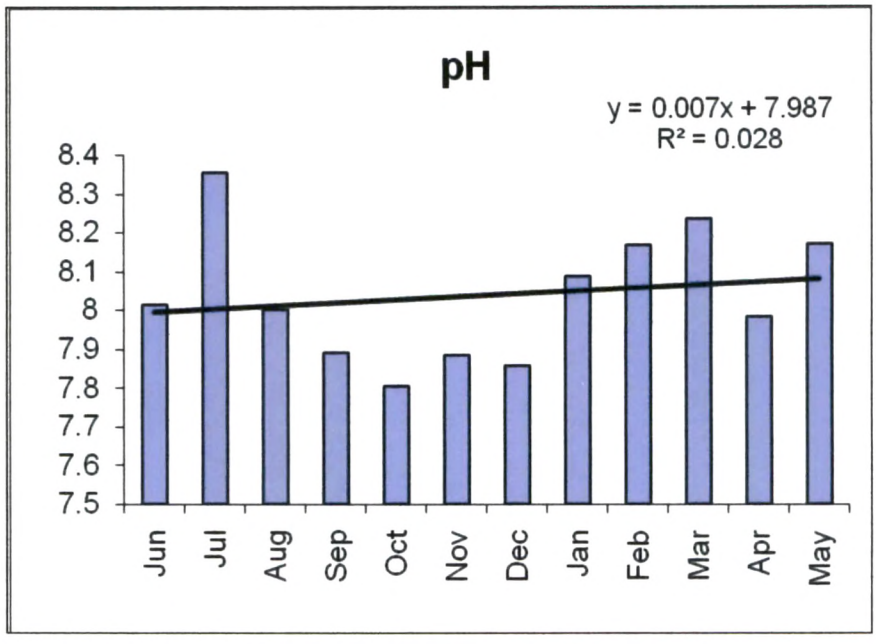

Fig. 3.23 Variation in the pH for year 2007 – 08

Table – 3.24 showing Total Nitrogen of soil:

Month	N (ppm)
Jun	0.037
Jul	0.033
Aug	0.073
Sep	0.097
Oct	0.06
Nov	0.07
Dec	0.07
Jan	0.057
Feb	0.053
Mar	0.043
Apr	0.043
May	0.04

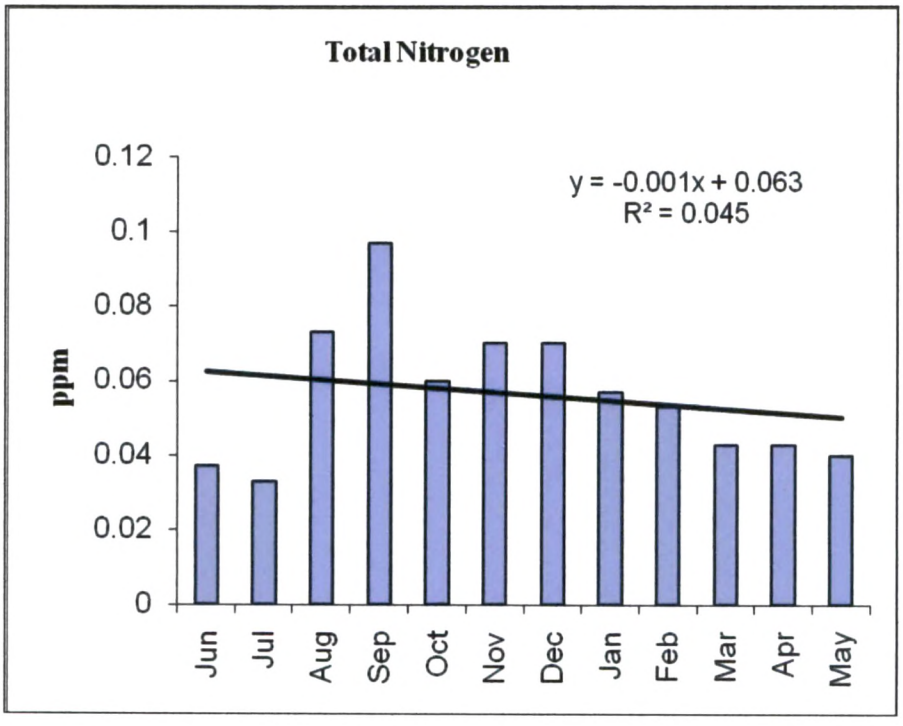

Fig. 3.24 Variation in the Total Nitrogen for year 2007 – 08

Table – 3.25 showing Available Phosphorus of soil:

Month	ppm
Jun	0.85
Jul	0.70
Aug	27.31
Sep	34.32
Oct	22.36
Nov	16.21
Dec	9.68
Jan	7.46
Feb	13.44
Mar	2.60
Apri	13.63
May	17.77

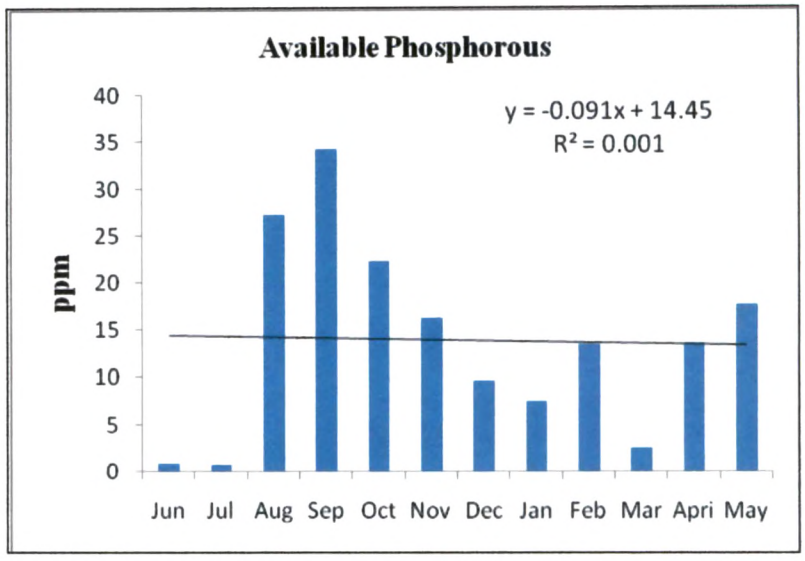

Fig. 3.25 Variation in the Available Phosphorous for year 2007 – 08

Table – 3.26 showing Available potassium of soil:

Month	Available K
Jun	213.67
Jul	196.00
Aug	197.50
Sep	227.17
Oct	219.00
Nov	241.33
Dec	250.33
Jan	203.67
Feb	191.17
Mar	69.83
Apr	191.67
May	148.50

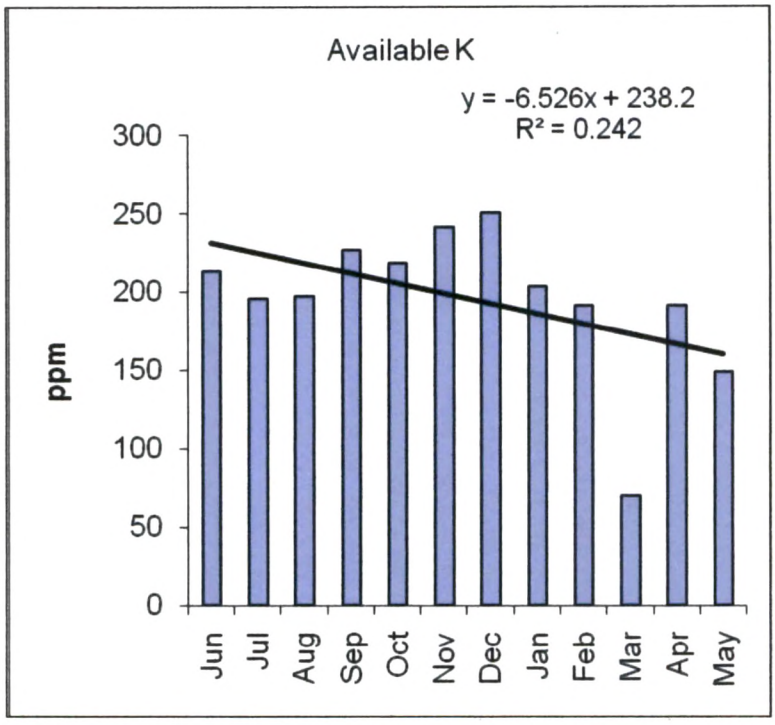

Fig. 3.26 Variation in the Available Potassium for year 2007 – 08

Table 3.27 showing Organic matter of soil:

Month	O.M. %
Jun	0.71
Jul	0.66
Aug	1.48
Sep	1.62
Oct	1.30
Nov	1.47
Dec	1.35
Jan	1.10
Feb	1.07
Mar	0.89
Apr	1.02
May	0.77

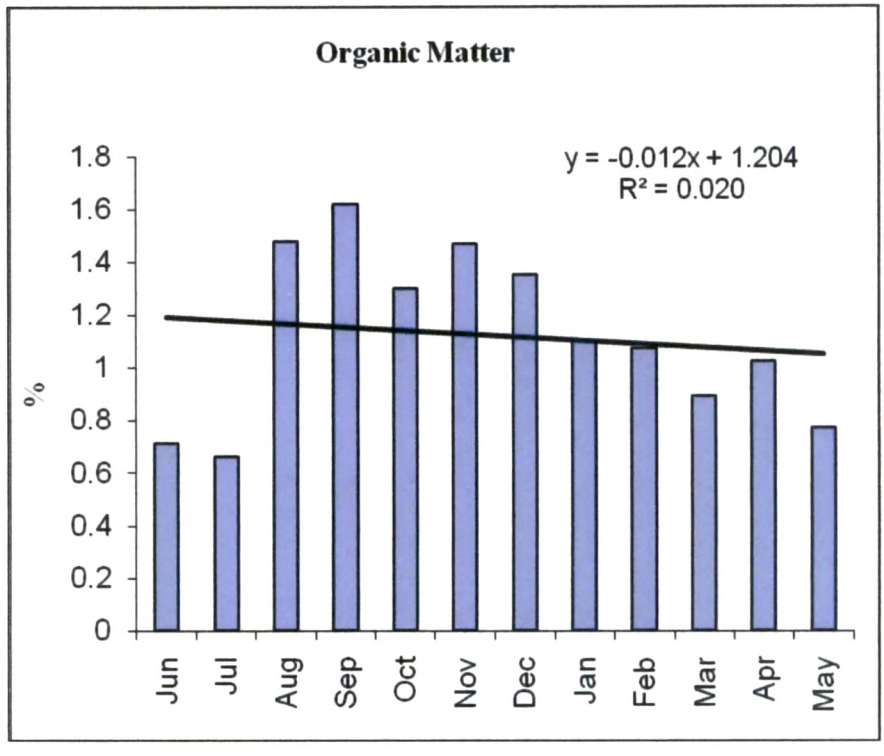

Fig. 3.27 Variation in the Organic matter for year 2007 – 08

Table – 3.28 showing Organic Carbon of soil:

Month	O.C. %
Jun	0.41
Jul	0.38
Aug	0.86
Sep	0.94
Oct	0.75
Nov	0.85
Dec	0.78
Jan	0.64
Feb	0.62
Mar	0.52
Apr	0.48
May	0.45

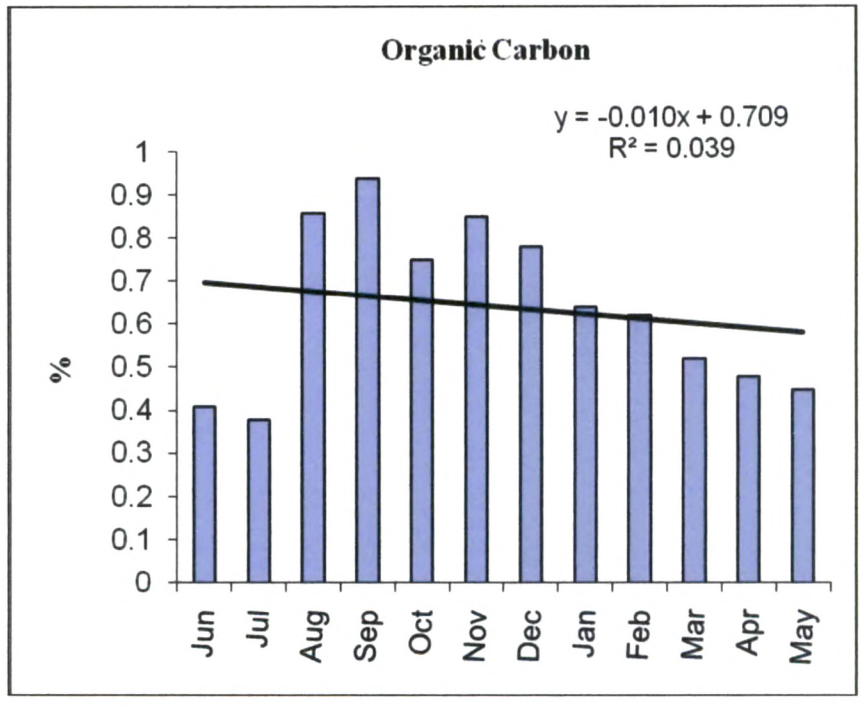

Fig. 3.28 Variation in the Organic Carbon for year 2007 – 08

Table 3.29: showing Soil Texture of soil:

Month	C.S. %	F.S. %	Clay %	Silt %
Jun	15.5302	25.7946	38.5532	20.1219
Jul	43.7687	21.9259	21.9525	12.3726
Aug	29.4108	6.4181	47.8342	16.3738
Sep	14.8929	11.2594	53.5513	20.2008
Oct	22.3161	13.2532	41.8117	22.6188
Nov	23.8692	7.8021	42.1151	26.2189
Dec	28.2338	20.8535	31.5988	18.9815
Jan	26.1575	24.3718	24.3718	25.0987
Feb	29.8672	23.7348	32.3504	14.0474
Mar	53.8664	24.9692	7.9063	13.2579
Apr	58.9038	15.3611	13.2003	12.5347
May	55.4788	31.3935	3.2721	9.8555

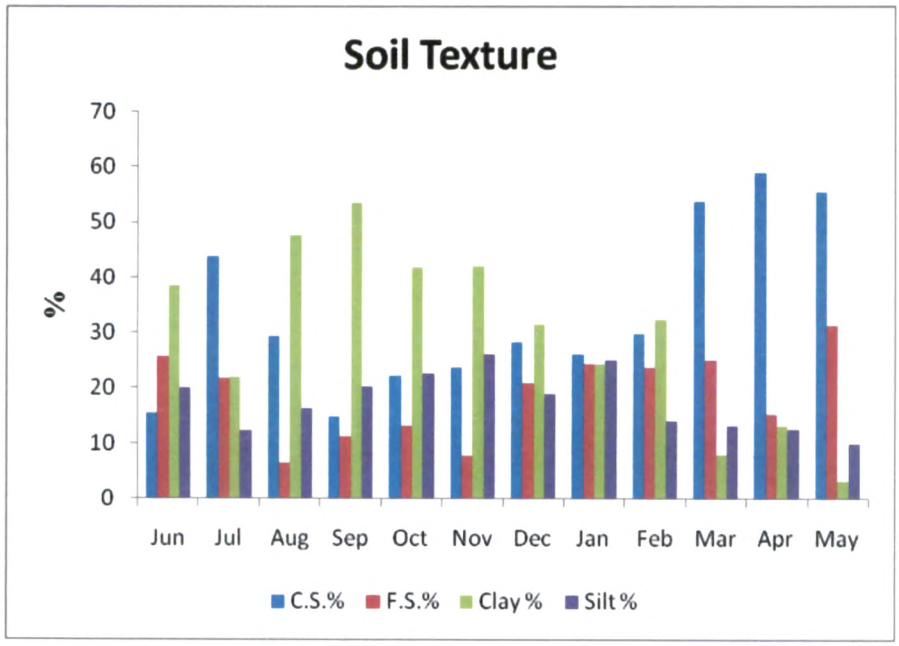

Fig. 3.29 Soil texture for year 2007 – 08

Table 3.30 showing Micro Nutrient values of soil:

Month	Cu ppm	Zn ppm	Fe ppm
Jun	4.4664	0.7077	2.2980
Jul	2.9791	0.6092	1.6367
Aug	4.5508	0.7511	6.9241
Sep	4.8892	0.7628	5.9631
Oct	6.0259	1.2328	11.5092
Nov	3.6340	1.6650	16.5333
Dec	3.6943	1.6490	22.1937
Jan	3.2380	1.3920	16.0347
Feb	2.4883	0.7473	13.5053
Mar	2.0070	0.4653	16.0173
Apr	2.6863	1.4363	18.6497
May	2.0037	1.0780	21.0410

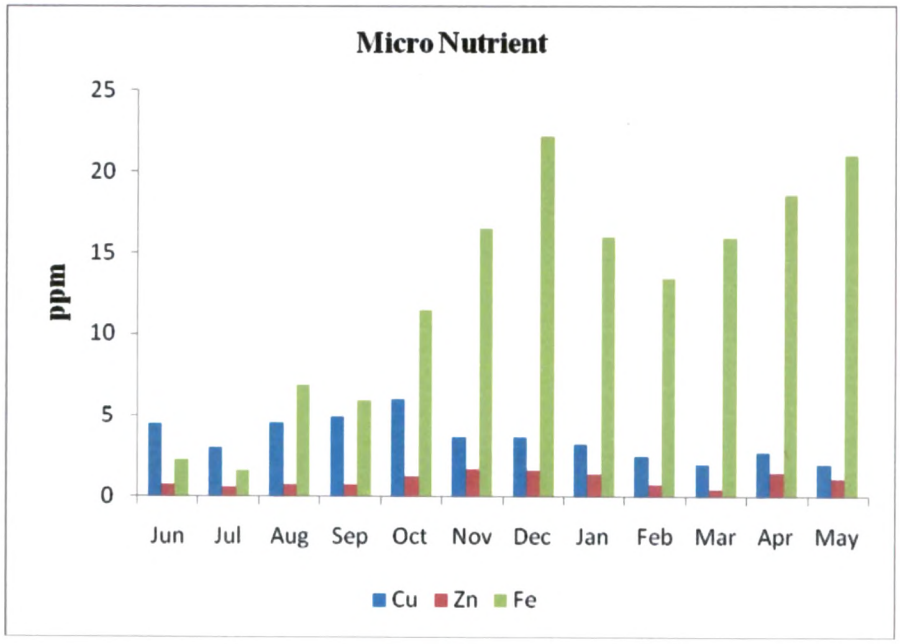

Fig. 3.30 Micronutrients comparison 2007-08

Table: 3.31 List of phytoplankton:

Sr. No.	Phytoplankton
1	*Ulothrix zonata*
2	*Coelastrum chodati*
3	*Dispora crucigenioides*
4	*Dimorphococcus lunatus*
5	*Quadrigula closterioides*
6	*Pinnularia nobilis*
7	*Navicula radiosa*
8	*Gyrosigma kutzingii*
9	*Diatomella balfouriana*
10	*Cymbella cistula*
11	*Diploneis elliptica*
12	*Amphipleura pellucida*
13	*Nephrocytium agardhianum*
14	*Scenedesmus brasiliensis*
15	*Microcystis*
16	*Volvox*
17	*Senadesmous*
18	*Croococcous*
19	*Cosmerium*
20	*Merismopedia*
21	*Gloeocapsa*
22	*Diatoms*
23	*Euglena*

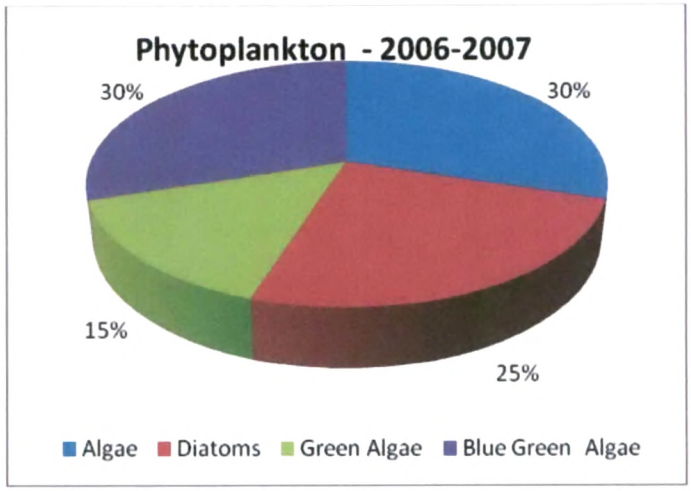

Fig. 3.31.1 Variation in the Phytoplankton for year 2006- 07

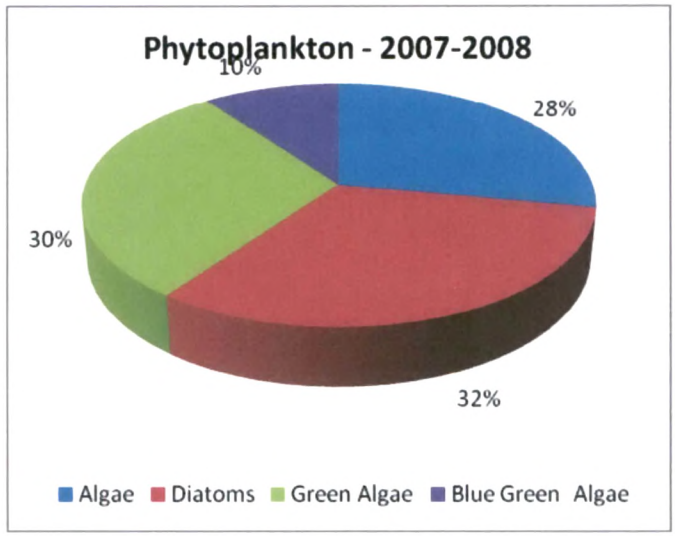

Fig. 3.31.2 Variation in the Phytoplankton for year 2007 – 08

Table 3.32 Details of zooplankton groups:

Table 3.32.1 Protozoa

Month	2006-07	2007-08
Jun	16	14
Jul	32	33
Aug	34	35
Sep	44	45
Oct	82	86
Nov	34	37
Dec	12	10
Jan	17	16
Feb	19	14
Mar	12	33
Apr	22	35
May	35	45

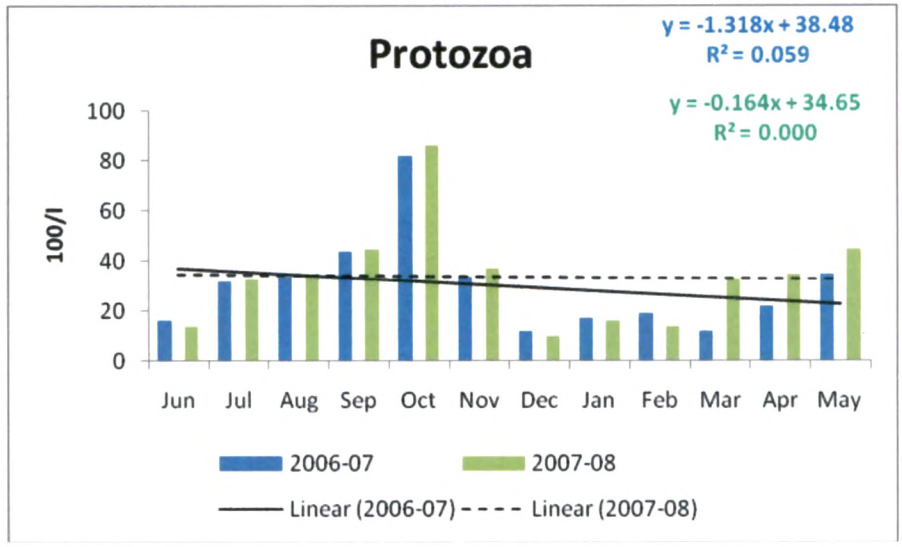

Fig. 3.32.1 Variation in the Protozoa for year 2006 – 07 & 2007 – 08

Table 3.32.2 Rotifer

Month	2006-07	2007-08
Jun	71	69
Jul	126	128
Aug	160	162
Sep	239	242
Oct	241	244
Nov	171	165
Dec	79	74
Jan	88	84
Feb	131	106
Mar	52	49
Apr	81	76
May	165	161

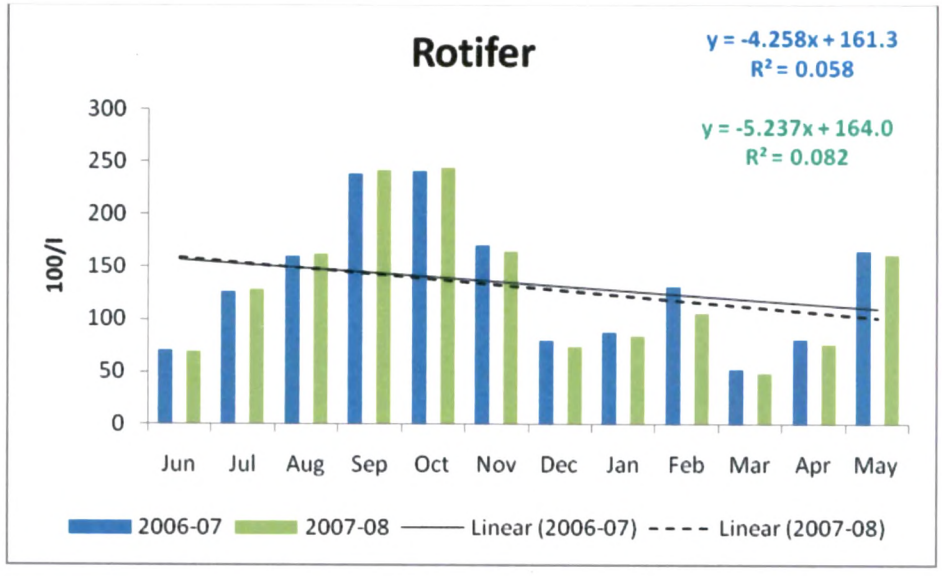

Fig. 3.32.2 Variation in the Rotifer for year 2006 – 07 & 2007 – 08

Table 3.32.3 Total Arthropod

Month	2006-07	2007-08
Jun	160	149
Jul	239	230
Aug	246	234
Sep	341	332
Oct	437	430
Nov	258	92
Dec	96	90
Jan	143	136
Feb	127	119
Mar	103	102
Apr	111	102
May	197	186

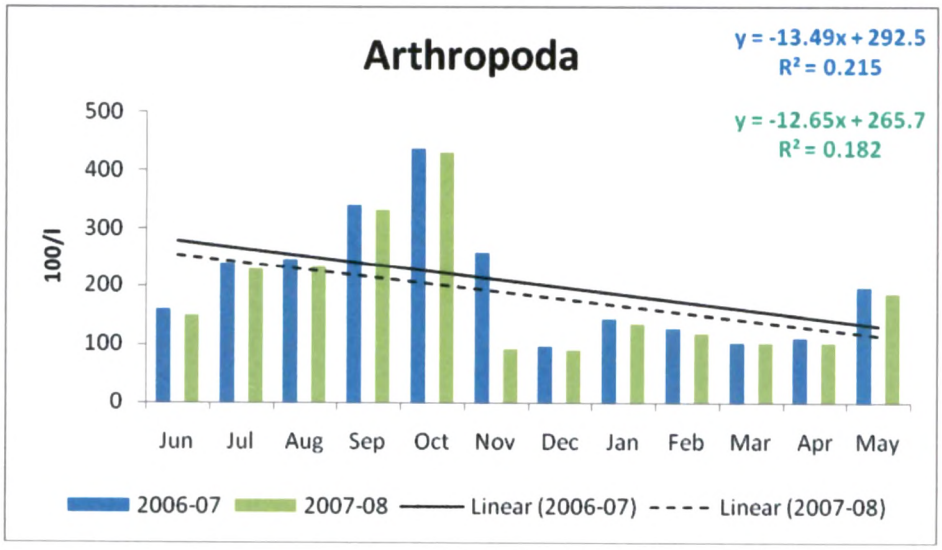

Fig. 3.32.3 Variation in the Arthropod for year 2006 – 07 & 2007 – 08

Table 3.32.4 Copepod

Month	2006-07	2007-08
Jun	120	116
Jul	168	164
Aug	189	182
Sep	235	231
Oct	304	299
Nov	186	18
Dec	76	65
Jan	110	104
Feb	102	98
Mar	85	84
Apr	69	63
May	161	156

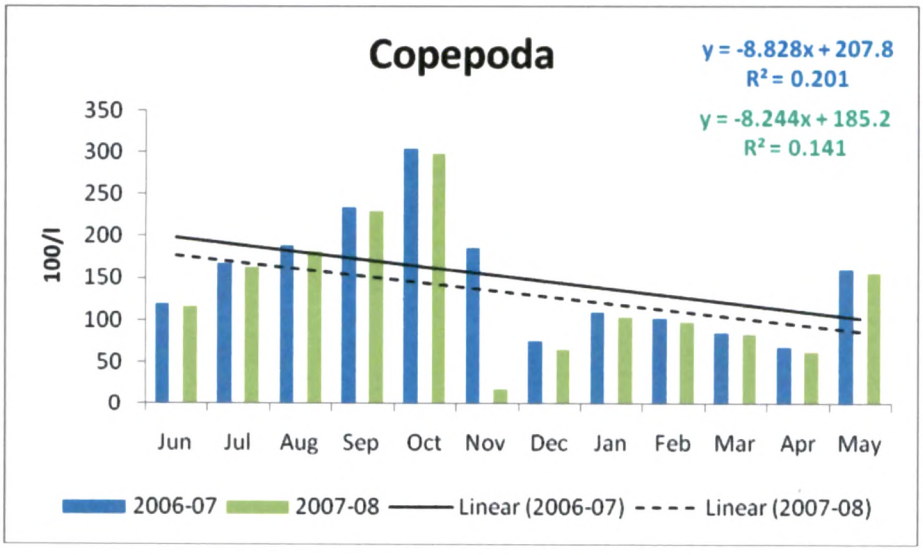

Fig. 3.32.4 Variation in the Copepod for year 2006 – 07 & 2007 – 08

Table 3.32.5 Cladocera

Month	2006-07	2007-08
Jun	40	33
Jul	71	66
Aug	57	52
Sep	106	101
Oct	133	131
Nov	72	74
Dec	20	25
Jan	33	32
Feb	25	21
Mar	18	18
Apr	42	39
May	36	30

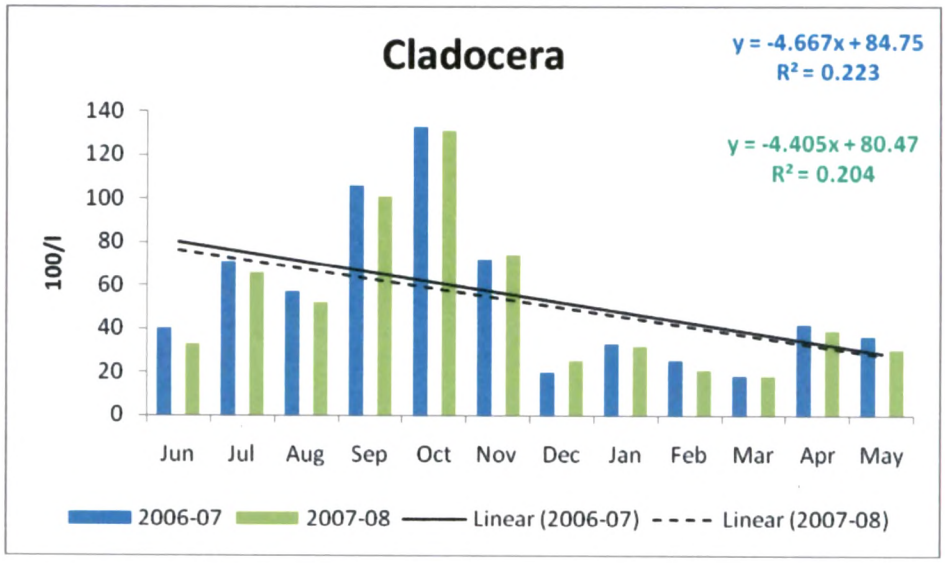

Fig. 3.32.5 Variation in the Cladocera for year 2006 – 07 & 2007 – 08

Title 3.32.6 Total Zooplankton

Month	2006-07	2007-08
Jun	247	232
Jul	397	391
Aug	440	431
Sep	624	619
Oct	760	760
Nov	463	294
Dec	187	174
Jan	248	236
Feb	277	240
Mar	167	161
Apr	214	198
May	397	377

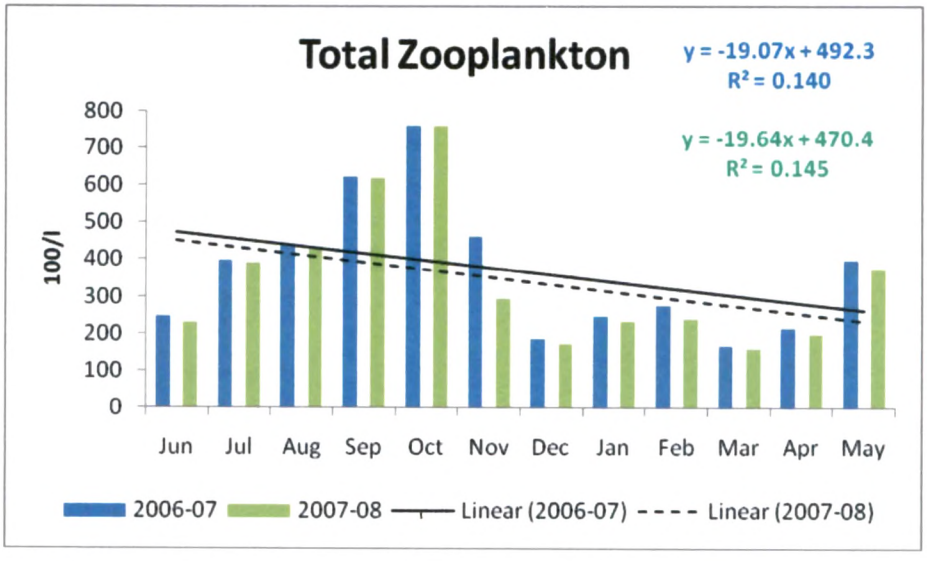

Fig. 3.32.6 Variation in the Total Zooplankton for year 2006 – 07 & 2007 – 08

Table : 3.33 List of Alge:

Sr. No.	Blue Green Algae
1	*Oscillatoria*
2	*Rivularia*
3	*Nostoc*
4	*Lingbya spiralis*
5	*Cytonema*
6	*Anabaena*
7	*Glaeotrichia*
8	*Microcystis*
	Green Algae
1	*Spirogyra*
2	*Chara*
3	*Coeledesmous*
4	*Oedogonoum*
5	*Chaetophora*
6	*Ulothrix*
7	*Coleochete*
8	Mougetia
9	Zygnema
10	Chladophora
11	Pediastrum
12	Spirulina

Table 3.34: List of freshwater molluscs from Nyari – II Reservoir

No.	PHYLUM	CLASS	ORDER	FAMILY	SPECIES
1	Mollusca	Gastropoda	Basommatophora	Lymnaeidae	*Lymnae luteola*
2					*Indoplanorbis exustus*
3					*Planorbis rotundutus*
4					*Gyroulus. pankangensis*
5					*G. labiatus*
6					*G. convexiusculus*
7			Mesogastropoda	Bithyniidae	*Digoniostama textum*
8				Thiaradae	*Thiara mainwaringia*
9					*T. tuberculata crebra*
10					*T. tuberculata*
11				Viviparidae	*Bellamya bengalensis*
12					*B. bengalensis*
13		Bivalvia	Unionoida	Amblemidae	*Trapezoideus exolescens*
14					*Parreysia caerulea*
15					*P. khadakvaslaensia*
16			Veneroida	Corbiculidae	*Corbicula annandalei*
17					*C. peninsularis*

Table: 3.35 Diversity of fish of Nyari-II Reservoir

Sr. No.	Class	Order	Family	Common name	Scientific name
1	Actinopterygii	Cypriniformes	Cyprinidae	Barb	*Puntius stigma*
2					*Puntius amphibious*
3					*Puntius pinaratus*
4					*Chela anastoma*
5					*Chela punjabensis*
6				Catla	*Catla catla*
7				Mrigal	*Cirrhenus mrigala)*
8				Rohu	*Labeo rohita*
9				Sucker head	*Garra lissorhynchus*
10		Perciformes	Channidae	Snake head	*Ophiocephalus punctatus*
11			Percidae	Glass fish	*Ambasis nalua*
12			Gobiidae	Goby	*Gobius biocelatus*
13			Cichlidae	Tilapia	*Oriochromis mossambica*
14		Siluriformes	Siluridae	Cat fish	*Macrones caltus*
15			Clariidae	Magur	*Clarius batrachus*

Table – 3.36: Fresh and dehydrated fish catch of Nyari-II Reservoir

Sr.No.	Year	Fresh Fish kg	Dehydrated Fish kg	Total kg
1	1998-99	9380	3450	12830
2	1999-00	5335	1100	6435
3	2000-01	14396	6000	20396
4	2001-02	24192	6250	30442
5	2002-03	14890	6250	21140
6	2003-04	12920	100	13020
7	2004-05	73990	5600	79590
8	2005-06	78360	100	78460
9	2006-07	8170	3450	12830
10	2007-08	2340	1100	6435

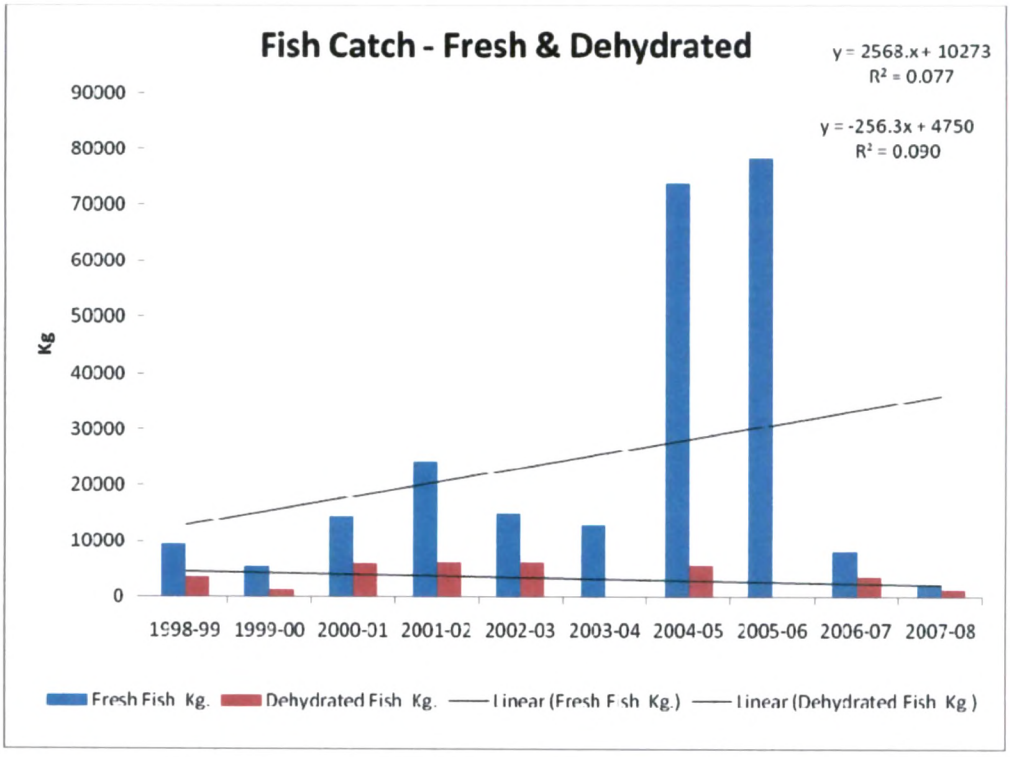

Fig. 3.36 Fresh and dehydrated Fish Catch data of Nyari-II Reservoir

Table – 3.37: Species wise Fish catch Nyari – II Reservoir

Sr. No.	Year	Catla kg	Rohu kg	Mriga l kg
1	1998-99	1700	2200	2040
2	1999-00	750	1510	1200
3	2000-01	2370	1840	3510
4	2001-02	5480	5152	5610
5	2002-03	3300	2500	3760
6	2003-04	1320	2000	2200
7	2004-05	8120	8440	5130
8	2005-06	12120	10000	2800
9	2006-07	2610	2500	2400
10	2007-08	6300	4600	6400

(Source: Fish catch data of Government of Gujarat)

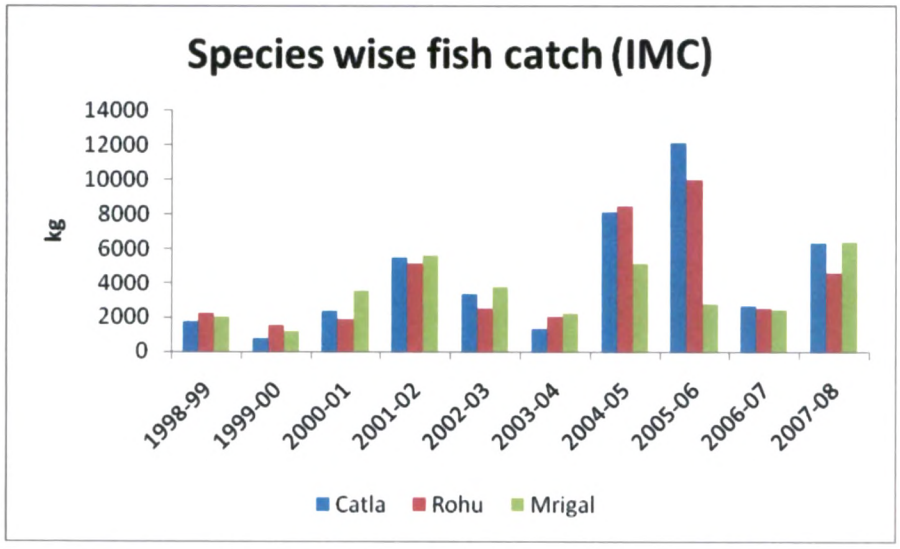

Fig. 3.37 Species wise Fish Catch data of Nyari-II Reservoir