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PLANKTONIC ORGANISMS OF THE MANYAS LAKE

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Abstract

According to Ramsar Site, Manyas lake was declared one of the A"class wetland. The planktonic samples were collected from the lake between 1996 – 1997. Planktonic organisms of Manyas lake were evaluated systematically and discussed with the old literatures and the differences in the sampling date of the planktonic organisms were interpreted. In the lake a totally 93 species and 29 genera of phytoplanktonic organisms were determined. Among zooplanktonic organisms 11 species belong to Cladocera, 3 species to Copepoda and 16 species Rotifera were identified.

Key Words: Phytoplankton, Zooplankton, Manyas Lake

Introduction

The investigation of the planktonic organisms of Manyas lake was begun with Mann (1). After Mann (1940), the other researchers have given some publications about this lake; for example, Noodt (2) on copepods; Muckle (3) on cladocerans; Numann (4) on cyprinid fishes and limnology; Akdağ (5) on Cladocera and Copepod and latelly Ongan (6) on the hydrography and physico-chemical parameters of the lake water. Furthermore, Ustaoğlu (7) surveyed the zooplanktonic organisms.

In this study the planktonic organisms were investigated and the species list was given and the differences were discussed with the old literatures.

Material and Method

The planktonic organisms were collected between March 1996 and August 1997 from six stations (Fig.1). The plankton samples were taken by using plankton nets (mesh size 30 and 44 μm) by drawing horizantally 100 meters. Then the samples were fixed with 4 % formaldehit.

To determine the frequency of the phytoplanktonic organisms , the samples were taken 30 cm deep from the surface and fixed in the field. The frequencies of the samples were analysed in terms of individual /ml (Lund 8).The permanent slides were developed only to determine the diatom species using the metod of (Round , 9).

The following sources were used during the process of identification; 17-31.

The zooplanktonic species were identified using Hutchinson (10), Pejler (11) , Kuttikova (12) , Koste,(13,14), Kiefer. (15) and Herbst, (16).

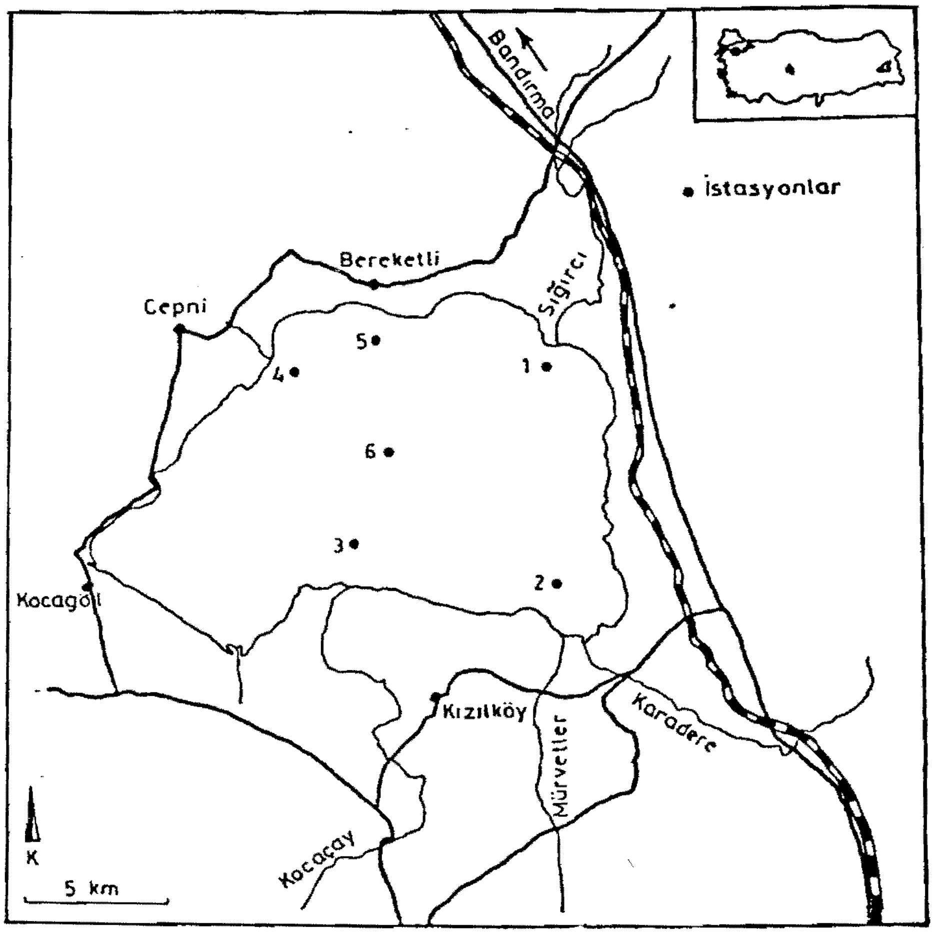

Fig 1:The study Area and The Stations

Results

Phytoplanktonic Organisms

The phytoplanktonic organisms living in the Manyas lake is given below.

Bacillariophyta
Aulocosira ambigua (Grun.) O. Müller
Aulocosira granulata (Ehr.) Ralfs.
Melosira varians Agardh
Cyclotella menenghiana Kütz.
C. ocellata Pantocksek
Diatoma vulgare Bory
D. elongatum Agardh
Fragilaria contruens (Ehr.) Grun.
F. pinnata Ehr.
F. capucina Demazieres
S. capitata Ehr.
Synedra ulna (Nitzsch.) Ehr.
S. pulchella Kütz.
S. acus Kütz.
S. berolinensis Lemm.
Cocconeis placentula Ehr.
C. placentula var. *euglypta* (Ehr.) Cleve.
Achnanthes microcephala (Kütz.) Grun.
A. minutissima Kütz.
Rhoicosphaenia curvata (Kütz.) Grun.
Mastogloia sp.
Neidium iridis Kütz.
Anomonoeis sphaerophora (Kütz.) Pfitzer
Stauroneis phoenicenteron
Navicula cuspitata Kütz.
N. radiosa Kütz.
N. hungarica var. *capitata* (Ehr.) Cleve
N. cryptocephala Kütz.
Pinnularia viridis (Nitzsch.) Ehr.
Amphiprora sp.
Cymbella cistula (Hemp.) Grun.
C. lanceolata (Ehr.) Cleve
C. microcephala Grun.
Amphora ovalis Kütz.
Gomphonema costrictum Ehr.
G. parvalum (Kütz.) Grun.
Epithemia turgida (Ehr.) Kütz.
E. sorex Kütz.
Gyrosigma sp.
Rhoipalodia gibba (Ehr.) O. Müll.
R. gibba var. ventricosa (Ehr.) Grun.
Hantzschia amphioxys (Ehr.) Grun.
Bacillaria paxillifer (Müll.) Hendey
Nitzschia sigmoidea (Ehr.) W. Smith
N. recta Hantzch.
N. amphibia Grun.
Cymatopleura solea (Breb.) W. Smith
C. elliptica (Breb.) W. Smith
Surirella ovalis Breb.
S. robusta Ehr.
S. biseriata Breb.
Chlorophyta
Eudorina elegans Ehr.
Pediastrum boryanum (Turp.) Menegh. 1840
P. simplex Meyen 1829
P. simplex var. echinulatum Wittr 1883
P. simplex var. biwaense Fukush
P. duplex Meyen 1829
P. duplex var. gracillimum W. & G. S. West 1895

P. tetras (Ehr.) Ralfs 1844
Oocystis sp.
O. borgei Snow 1903
Ankistrodesmus falcatus (Corda) Ralfs
Monoraphidium irregulare (G. M. Smith) Kom-Leng.
M. minutum (Näg.) Kom-Legn. 1969
Tetraedron minimum (A. Br.) Han.
T. trigorum (Naeg.) Hansg.
Coelastrum sp.
Scenedesmus quadricauda (Turp.) Breb. sensu Chod. 1913
S. acutus Meyen 1829
S. intermedius Chod. 1926
S. acuminatus (Lagerh.) Chod.
S. acuminatus var. acuminatus (Lagerh.) Chod.
S. disciformis (Chod.) Fott & Kom. 1960
Ulotrix sp.
Oedogonium sp.
Spirogyra spp.
Zygnema sp.
Maugetio sp.
Closterium dianaea Ehr. ex Ralfs. 1848
C. attenuatum Ralfs. 1848
C. acicularis T. West 1860
Cosmarium granatum Breb. ex Ralfs 1848
C. obtusatum (Schmidle) Schmidle 1898
Euastrum insulare (Wittr.) Roy 1883
Staurastrum spp.
Stigeoclonium sp.
Tetrastrum sp.
Cyanophyta
Microcystis flos-aquae (Wittr.) Kirchn.
M. aeruginosa Kütz.
Chrococcus turgidus (Kütz.) Naeg.
Gomphosphaeria aponina Kütz.
Merismopedia glauca (Ehr.) Kütz.
M. tenuissima Lemm.
Nodularia sp.
Anabaena affinis Lemm.
A. circinalis Raben. et Born et Floh.
Pseudoanabaena sp.
Spirulina sp.
S. major Kütz.
Oscillatoria rubescens D.C.
O. tenius Agardh
O. limosa Agardh
Gleotrichia sp.
Euglenophyta
Euglena oxyuris Schmarda
E. clavata Skuja
E. polymorpha Dang.
E. acus Ehr.
Lepocinclus sp.
Phacus orbicularis Hübn.
P. curvicauda Swirreko
Trachelomonas sp.
Pyrrophyta
Peridinium spp.
Cryptophyta
Cryptomonas spp.

In the Manyas lake, the phytoplanktonic organisms exhibits a great change up to the seasons (Fig.2-7). During the study the most dominant group was Bacillariophyta, within this group, *Diatoma* was increased in the fourth station by 216.94 ind/ml. This genera was high number all other stations too.The second dominant organism was *Melosira*. Within the Chlorophyta, *Scenedesmus* and *Pediastrum* were more common genera than others.

In May 24,1996, it was indicated that the total organism was more than the former sampling time. And the most dominant organism was again *Diatome*. It's highest rate was found as 795 ind/ml in the second station. In the same station *Nitszchia* spp. were the dominant organisms of diatom.

Within Chlorophyta, *Scenedesmus* and *Pediastrum* were the more common taxa. In the second station, *Scenedesmus* was an important part of the total organism with 460 ind./ml.Within Cyanophyta, *Anabaena affinis* was the second dominant organism. *Anabaena circinales* was recorded in high numbers .

In November 11, 1996, it was observed that the total number of organisms had decreased in an important ratio. There was no dominant organism. *Diatoma* spp., *Closterium* spp., *Scenedesmus* spp. *Gomphosphaeria aponia* commonly appeared in the lake even though the numbers were small.

In August 24,1997 the densitiy of *Anabaena affinis* was so high that anyone looking at the lake could see it with a gren-blue colour. *Anabaena affinis* reached maximum value particularly in the fourth and seventh stations, between 2113- 2600. ind./ml respectively. Furthermore, this species became the dominant organism of the entire surface of the lake.

As a general conclusion, it could be stated that during winter and spring periods, members of Bacilloriophyta and sometimes Chlorophyta were dominant while during summer period Cyanophyta group were dominant. The species belonging to Euglenophyta, Pyrrophyta, Crytophyta divisions had relatively small frequencies. Furthermore, these could not be identified in many sampling time and stations.

Throughout the stations in the Manyas lake, the least chlorophl-a value, that is μgr/lt 17.33, was found in mouth of Dutlu Streamlet in May 1996 and the highest value was 262.27 μgr in the mouth of Kocaçay. Figure 8-13 depicts the relations between the amount of chl-a found in the Manyas lake and the total phytoplanktonic organisms.

Zooplanktonic Organisms

The species of the Rotifera found in the Manyas lake and their existence in the lake based on the sampling data are given in Table 1. Cladocera and Copepoda species list were given as below

Table 1.The Species list of Rotifera

	March 96	May 96	November 96	August 97
Brachionus angularis Gosse, 1851	+	+	+	+
Brachionus calyciflorus Pallas, 1776	+	-	-	+
Brachionus quadridentatus Hermann, 1783	+	+	-	-
Brachionus diversicornis (Daday, 1883)	-	+	+	+
Notholca squamula (O.F.Müller, 1786)	+	-	+	+
Keratella quadrata (O.F.Müller, 1786)	+	+	+	+
Keratella cochlearis (Gosse, 1881)	-	+	-	+
Trichocerca cylindrica (Imhof, 1891)	-	-	-	+
Trichocerca similis (Wierzejskı, 1893)	-	-	+	+
Polyarthra vulgaris Carlin 1943	-	+	+	-
Polyarthra euryptera (Wierzejskı, 1893)	-	-	+	+
Hexartha oxyurus (Sernov, 1903)	-	-	+	+
Filinia longiseta (Ehrenberg, 1834)	+	-	-	+
Conochilus dossuarius (Hudson, 1885)	-	-	+	-
Testudinella patina (Hermann, 1783)	+	-	-	-
Pompholx complanata Gosse, 1851	-	+	-	-

Species of Cladocera and Copepoda (Anonymous, 32)

Diaphanosoma orghidani Negrea, 1981
Daphnia cucullata Sars, 1962
Simocephalus vetulus (O. F. Müller, 1776)
Ceriodaphnia reticulata (Jurine, 1820)
Scapholeberis kingi Sars, 1903
Moina micrura Kurz, 1874
Bosmina longirostris (O. F. Müller, 1785)
Chydorus sphaericus (O. F. Müller, 1776)
Alona rectangula Sars, 1862
Alona quadrangularis (O. F. Müller, 1785)
Leydigia acanthocercoides (Fischer, 1848)
Aretodiaptomus pectinicornis (Wierzejski, 1887)
Cyclops vicinus *Uljanin*, 1875
Acanthocyclops robustus (G. O. Sars, 1863)

In all the stations, *Brachionus cacyciflorus*, *Brachionus angularis* and *Filinia longiseta* were found in March 1996. *Notholca squamula* and *Brachionus quadridentatus* were also observed in the same sampling period. *Brachionus* species such as *Brachionus diverciconis*, *Brachionus quadridentatus* and *Brachionus angularis* were recorded especially following stations; Karadere, Sığırcı Streamlet Mouth, Bereketli in May 1996. Also in the same month, *Keratalla quadrata* was found intensively in the stations Sığırcı Streamlet Mound, Karadere and open water. Again *Keratalla cochlearis, Polyarthra vulgaris, Brachionus diversicornis* were observed frequently in the same period.

In November 1996, some species such as *Brachionus diversicornis, Brachionus angularis* and *Polyarthra vulgaris, Hexarthra oxyurus, Conochilus dossuarius, Trichocarca similis* and *Notholca squamula* species were found extensively in the stations Karadere, Bereketli and in the pelajik region.

In August 1997, *Brachionus diversicornis, Keratella cochlearis, Polyarthra europtera* were high in number *Notholca squamula, Trichocerca similis, Hexartha oxyuus, Polyarthra europtera* also were abundant species·

Discussion

Phytoplanktonic Organisms

In Manyas lake, the recorded temperature value was between 4.5-26 ^{o}C; dissolved oxygen parameter was between 0.2-8.2 mg/l; PH was between 7.53-9.52; Conductivity was between 325-2900 μS and Secchi Depth was between 15.67-57.33 cm (Anonymous, 32).

Distribution of phytoplanktonic organisms are affected by the physical and chemical properties of water. The physical and chemical properties of lake water exhibit great variance throughout the year; and affect directly the biological life. In relation to this fact, distrubition of the total phytoplanktonic organism in the Manyas Lake could be stated as follows: the phytoplankton density had decreced to lower level at the end of winter and gradually increaced during the spring period. During the winter sampling period, it had decreased dramatically. This finding is parallel with the results of other studies performed on the distrubition of phyplanktonic organisms. (Reynolds, 33) Their food becomes limited in winter; whereas it incereases in summer. Furthermore, heat and light also affect this fact.

51 taxa belonging to Bacillariophyta had been identified. Within this division *Synedra* was recorded as the most dominant organism. This species is the dominant organism during the spring and fall sampling months. According to Huchinson's (10) ecological classification, *Synedra* and *Melosira* are the characteristic organisms of the eutrophic lakes. Furthermore *Synedra* may be encountered frequently in the lake located at higher level (Bruce et. al. 34). Similarly Reynolds (33) and Husted (26) stated that these in the environments in which they increased could be regarded as an indicator of eutrophy. Additionally, it is known that these

taxa belonging to Bacillariophyta have reached a rate that may be regarded as significant in some eutrophic lakes and reservations in Turkey (Akbulut 35 ; Demirsoy et. al. 36; Gönülol & Çolak,37 ; 38).

36 taxa within the division Chlorophyta were identified. The most dominant genera of this division were *Scenedesmus* and *Pediastrum*. According to Harper (39) and Hutchinson (10), both genera are taxa of eutrophic lakes and they are mostly dominant. Additionally, *Closterium* was found as the dominant organism within Chlorophyta in November 1996. This increases match the results of Reynold (33) and Round (9) (assumptions that *Closterium, Cosmarium* and *Staurastrum* could be dominant in eutrophic lakes during summer and fall periods).

Blue-green algae are represented by 16 taxa in Manyas Lake. Altough this division is rare in terms of species number, it has become the most dominant organism within the total phyplankton in spring and summer sampling period. Particularly *Anabaena affinis* and *Anabaena circinalis* had reached the maximum density during the summer period. *Anabaena* species become so dence in Agust that it could change the colour of the Manyas Lake.

It is known that blue-green algae increase in the high productivite lakes during the summer period, in which the temperature of lake water increases. It includes such species as *Microcystis, Aphanizomenon* and *Anabaena* (Harper 39; Brock, 40;). The Anabaena species increased in the Manyas Lake reached a very high level particularly in IV and VI stations (2113 ind./ ml. and 2600 ind./ml. respectively). It is seen that they increase more in the summer period than other sampling phases when the values N and P are analysed becauce members of Cyanophyta have the ability to fix free nitrogen. Their development is mostly related to the quantity of nitrogen compozites within the environment.

In Manyas lake, the recorded nitrate concentration was between 11.56-13.51 mg/l and nitrite concentration was 1 mg/l in March 1996 and 2.63 mg/l in May 1996. The phosphate concentration was between 16.31-16.53 (Anonymous, 32).

As a result of increase in the nutrients, temparature and intensity and the light period, blue-green algae in the Manyas Lake had increased. The algal bloom which is a characteristic of the eutropic lakes can lead to some problems. The excess of nutrient in the water system causes the increase in the primary production combining with other physical factors and this causes negative outcomes. Particularly increase in tcertain ratio of blue-green algae might lead to a toxical effect on the other species (from planktonic organisms to mammalls and birds) (Bernardi & Güssani, 41) [thus it has been found out that the species belonging to *Anabaena* that increased highly in the Manyas Lake produced toxical items (Reynolds 33; Harris 42)]. Additionally algal bloom limits to pass of light into water and decreases the amount of dissolved oxygen in deep parts. There are many factors that cause algal bloom such as nutrient richness. These factors are mainly, those that affect the physiological development of species and that are external. As a result of industrial development near the lake, it has become a receiver of waste. This fact modifies the physical and chemical pattern of the water system and therefore damages ecological balance in the lake. This damage has reached a certain level that could change the types variance and frequency of the alg that are the primary producer of the Manyas Lake. To slow down this high level productive process, it is necessary to refine the industrial pollution sources and to implement carefully the agricultural activities.

While identifying 8 taxa from Euglenophyta, one taxon from both Phyrrophyta and Cryptophyta was also found. However their frequencies were recorded as low.

One of the indirect methods in determining the primary production in the lakes is chl-a (Round 43). Determination of chl-a gives information on the frequency of phytoplanktonic organisms and they have a parallel relationship with each other. In the stations testing and measurement tasks were carried out in the lake. There are a linear relationship between total phytoplanktonic organism and chl-a (Figure 8-13)

As a result, Bacillariophyta is the dominant organism in terms of species number. The other dominant phytoplanktonic groups are as follows; Chlorophyta, Cyanophyta, Euglenophyta, Pyrrophyta and Cryptophyta. Balık et.al (44) reached similar conclusions on the species richness of phytoplanktonic organisms. However, certain species in the various divisions were not recorded in the current study which were recorded in their study. Furthermore, in addition to certain species in other divisions, the divisions of Pyrrophyta and Cryptophyta are also presented in this study.

Zooplanktonic Organisms

The various researchers have used the rotiferan species as an indicator organisim in determining the water quality of the freshwater ecosystems. Seksena (45) regards the

Brachionus type as an indicator of eutrophication, whereas Baker (46) stated that *Keratella quadrata*, *Keratella cochlearis* and *Brachionus angularis* existed abundantly in the eutrophic lakes. These species were recorded in the Manyas Lake almost in all seasons. However their population density are not on the avarage level in the shallow and very eutrophic lakes.

In the Manyas Lake, the rotiferan species increas genarally in August and Nowember particularly during the sampling periods in which algae are frequent, the population density of the rotiferan species also increase. Most rotiferan species could be feed with either phytoplankton or on particules. Arndt (47) stated that rotatoria could be fed on the increased bacteria and unicellular species when their food concenration is lower. However since the feeding characteristics of such types as *Brachionus*, *Keratella* and *Polyarthra* found in the Manyas Lake range widely, they could not be determined almost in each season. Most rotifera species found in the Manyas Lake are cosmopolit and then it is possible for them to exist in all fresh water systems.The lake is rich in terms of Rotifera species. As a result of analyses, the most recent work carried out by Ustaoğlu (1990) recorded the same species, found in this study. However, *Brachionus quadridentatus*, *Pompholyx complanata*, *Trichocerca similis* and *Testudinella patina* are added to the list of Ustaoğlu (7).

Mann (1) carried out the first survey on the identification of the types of the zooplanktonic organisms in the Manyas lake. He collected three samples in July 26,1934, in July 17,1935 and in January 12,1936 and found out the existence of the following species *Moina brachiata*, *Diaponasoma brachyurum*, *Leptodora kindtii*, *Eucyclops serrulatus*, *Mesocyclops leucarti*, *Cyclops vicinus*, *Thermocyclops hyalinus*.

Muckle (3) found out the excistence *Daphnia cuculata* in the Manyas lake. Noodt (2) determined that *Nitocra hybernica* belonging to Harpacticoid copepods living in the Manyas lake, and Kieffer (48) reported that *Eucyclops serrueatus* and *Mesocyclop leukarti* species existed in the Manyas lake.

Comparing with the results of the other studies on the zooplanktonic species (Cladocera and Copepoda) living in the Manyas Lake indicates that the species recorded in the research is more. However this difference seems to be a result of the fact that the former studies are not so detailed. Such types as *Moina brachiata*, *Diaphanosama brachyurum* which were claimed to be recorded in the former studies seem to be identified falsely and indeed these species are *Moina micrura* and *Diaphanosoma orghidani* . Mann (1) stated that there was *Leptodora* *kindtii* in the lake. But in this study it was not recorded. Additionally *Eucyclops serrulatus* and *Mesocyclops leuckarti* were not also found in the study. The most dominant organisms during the sampling periods in the Manyas Lake are *Cyclops vicinus, Acanthocyclops robustus, Bosmina longirostis* and *Daphnia cuculata* (Anonymous, 32).

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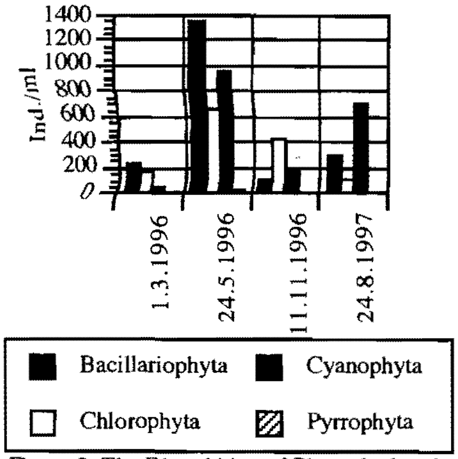

Figure 2: The Distrubition of Phytoplanktonic Organisims in I. Station

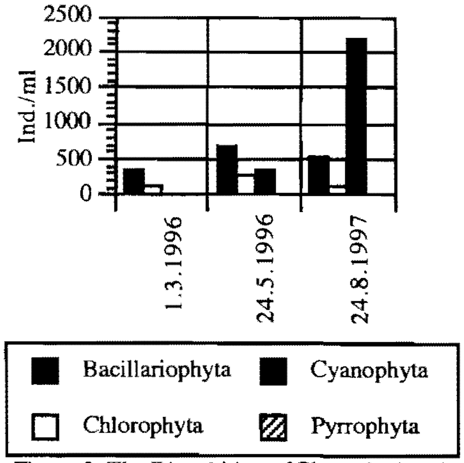

Figure 3: The Distrubition of Phytoplanktonic Organisims in II. Station

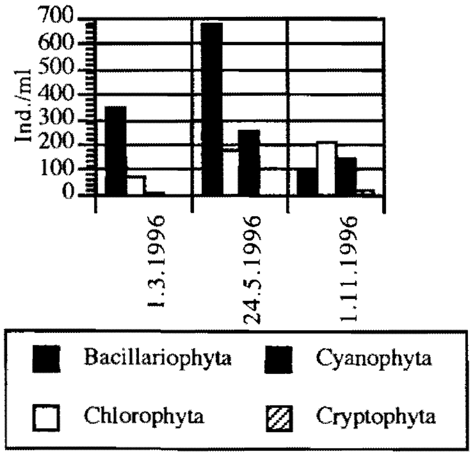

Figure 4: The Distrubition of Phytoplanktonic Organisims in III. Station

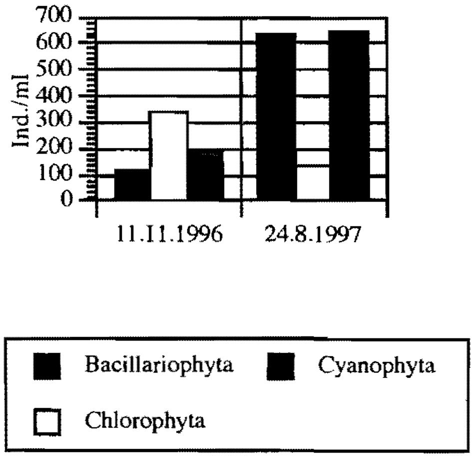

Figure 5: The Distrubition of Phytoplanktonic Organisims in IV. Station

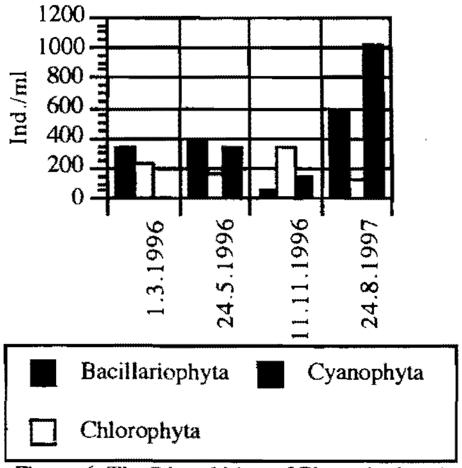

Figure 6: The Distrubition of Phytoplanktonic Organisims in V. Station

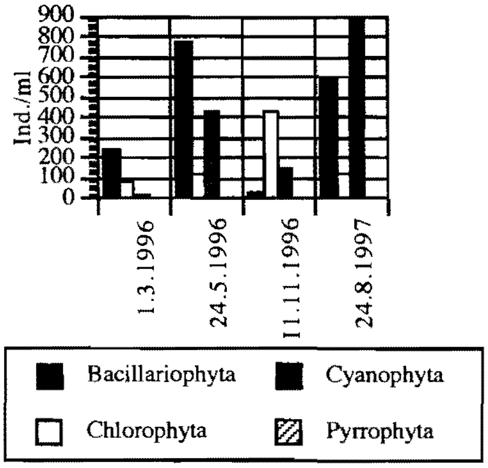

Figure 7: The Distrubition of Phytoplanktonic Organisims in VI. Station

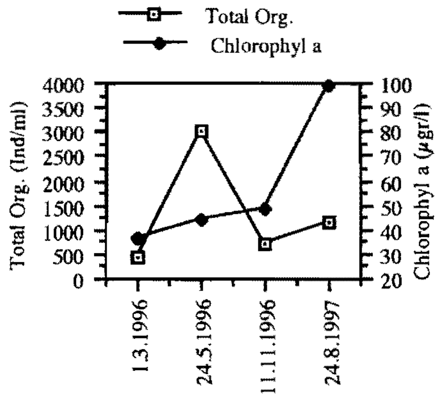

Figure 8: Comperation between
Total Phytoplanktonic Org.
and Chlorophyl a in I. Station

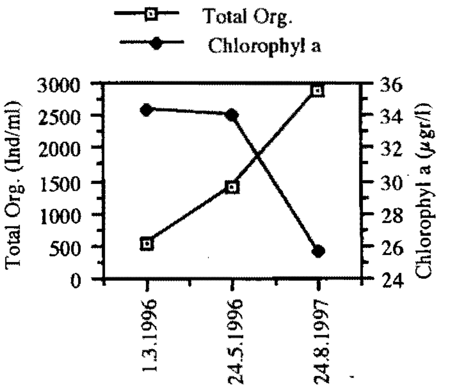

Figure 9: Comperation between
Total Phytoplanktonic Org.
and Chlorophyl a in II. Station

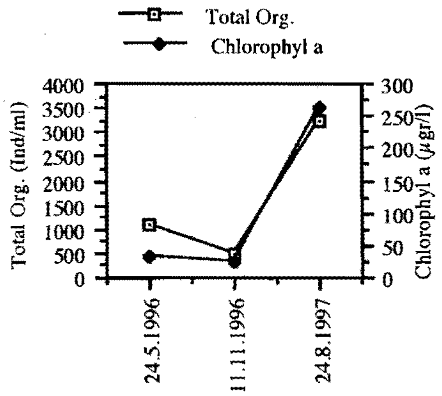

Figure 10: Comperation between
Total Phytoplanktonic Org.
and Chlorophyl a in III. Station

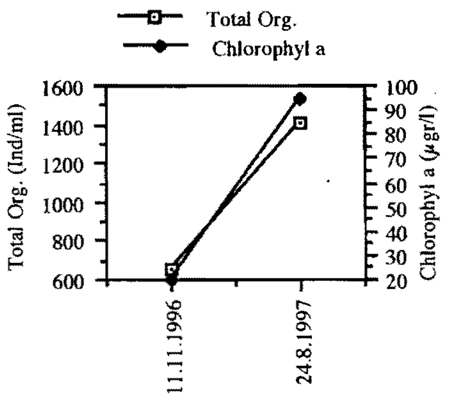

Figure 11: Comperation between
Total Phytoplanktonic Org.
and Chlorophyl a in IV. Station

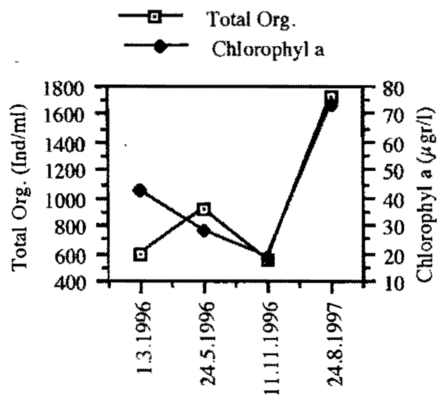

Figure 12: Comperation between
Total Phytoplanktonic Org.
and Chlorophyl a in V. Station

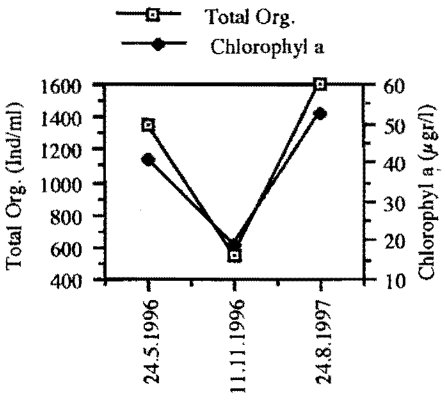

Figure 13: Comperation between
Total Phytoplanktonic Org.
and Chlorophyl a in VI. Station