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The effects of physiochemical parameters on planktonic species population of Keenjhar lake, district Thatta, Sindh, Pakistan

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Abstract: The significance of Keenjhar Lake is due to irrigation, wild life sanctuary and supply of drinking water to the local population at vicinity. The objective of present studies was organized to explore the primary productivity and physicochemical properties of Keenjhar Lake. In present study 210 planktonic species were identified they belongs to 11 classes and 85 genera. Out of them 173 species were phytoplanktonic, 83 Cyanophyceae, 57 Chlorophyceae, 24 Bacillariophyceae, 5 Euglenophyceae, 2 species of Dinophyceae and 1 specie belonged to each Xanthophyceae and Chrysophyceae respectively. Whilst, a part of them 37 species were belonged to zooplankton comprising 15 species each of Cladocera and Rotifera, 4 species of Ostracoda and 3 species of Copepoda. The physicochemical properties such as (temperature, alkalinity, dissolved oxygen, electrical conductivity, total dissolved solids, and pH) were recorded from keenjhar lake district, Thatta, Sindh, Pakistan, range between 33.1-18.5°C, 223-170 mg L-1, 9.6-6.9 mg L-1, 512-350 µS cm-1, 410-270 mg L-1, and 8.9-7.6 respectively on monthly basis. The physicochemical properties of Keenjhar Lake were suitable for growth of aquatic biota.

Keywords: Keenjhar Lake, Planktons and Physicochemical Parameters

1. Introduction

The Sindh province is rich in freshwater fishery potential; it covers over 65% of the freshwater resources of this Country. Inland fishery resources majorly includes the River Indus and its tributaries, extensive canal system, number of dhands (small water bodies) and natural lakes such as (Manchar, Bakar, Phoosna, Hub, Haleji, Hadero and Keenjhar Lake) are located in various districts of the Sindh province. Lakes in Sindh are important for a multiple aspects, such as sources of drinking water, irrigation, wildlife sanctuaries and sources of a cheap diet rich in protein. The populations at the vicinity of these lakes are dependent on these water bodies by means of either directly or indirectly.

Keenjhar Lake was shaped by connecting two natural aquatic bodies, Keenjhar (Green) and Sunehri (Golden) by dynamiting the splitting hills, in 1958 to make single composite lake, which was initially called as Kalri Lake. In 1972 this artificial composite lake was again renamed as Keenjhar Lake. Keenjhar is located at the distance of 120 km from Hyderabad at 24°47´ N and 68°2´ E. It is 27.2 km long and covers an area of 80 km^2. It receives water from the River Indus via a canal called the Kalri Baghar Feeder, which starts from Ghulam Mohammad Barrage. Keenjhar Lake initially was deep about 25 meters, but continuous siltation from feeder and deposition of dead organic matter has decreased the depth up to 5–8 meters and average depth is 6 meters (Blatter et al., 1929; Sufi, 1957; Lashari et al., 2009; Korai et al., 2010). In order to cover maximum area, six stations were selected, viz; 1-Sunheri spot; 2-Helaya spot; 3-Noori spot; 4-Boating spot; 5-Resting spot and 6-Khumbo spot.

Prominence of planktons as diet for higher aquatic animals in sub-tropical water remains a neglected area of research (Sahato & Arbani 1997). Inadequate data is present on qualitative and quantitative statistics of planktons recorded from sub-tropical waters (Ganpati & Pathak, 1969; Baqui et al., 1974; Iqbal & Bari, 1975; Leghari & Sultana, 1992; Naila et al., 2005; Sahato & Lashari, 2005; Abdo 2005; Mehwish & Aliya, 2005; Lashari et al., 2008; Lashari et al., 2009).

Dynamic link is being established by planktons in food chain and hence plays major role in the biosynthesis of organic material. Qualitative and quantitative analysis of planktons are very crucial for determining the productivity of aquatic ecosystems (Sahato & Arbani, 1997).

Planktonic species are essential components of aquatic ecosystems, especially for productivity of water bodies, hence the plays role of producers in aquatic ecosystems, fish population is dependent on these species directly either indirectly (Leghari et al., 1991).

It is very familiar that the phytoplanktonic abundance and composition regulates the production of zooplankton. Studies have recommended that abundant phytoplanktonic population would result an increased population of zooplankton (Reynolds, 1988; Gerletti, 1968). The grazing nature and its importance of zooplankton have been reported in litrature (Porter, 1977; DePauw 1981; Reynolds 1984). In the aquatic food chain, phytoplanktonic species serves as food for zooplankton, which latterly in turn consumed by higher aquatic animals and so on. Knowledge of the feeding habits of zooplanktonic species is scanty; some feeds phytoplankton and some on debris (Reynolds, 1988). To maximize utilization of producers by zooplanktons we require detailed information regarding individual components of the phytoplankton population rather than the population as a whole. In this regards the present study was revealed the identification of planktonic species and effect of physico-chemical parameters on planktonic species population of Keenjhar Lake.

2. Materials and Methods

Water samples were collected at designated sites on monthly basis randomly from surface via Van Dorn plastic bottles and the map of Keenjhar Lake indicating the sampling location reported earlier (Lashari et al., 2012). Sampling was usually done in the morning (8:00 to 9:30 am PST). The physicochemical parameters were determined in laboratory following the standard protocols (APHA, 1998). Water samples were stored in an insulated cooler containing ice and delivered to laboratory and all samples were kept at 4 °C for analysis. Epilimnion sample from same station were mixed into a washed plastic container to make a composite sample and filtered through 0.45 µm filter paper with the help of vacuum pump. The filtrate was further analyzed for physico-chemical parameters.

Temperature was measured with a mercury thermometer at concern sites; alkalinity was detected with titration (Sulfuric acid), chloride with (silver nitrate). Water samples for the determination of dissolved oxygen (DO) samples were collected in colored bottles and analyzed by a modified Winkler method (Welch, 1984). Electrical conductivity (TDS) was determined with a WTW LF 320 conductivity meter. Standard titration methods (Framan, 1981; APHA, 1998) were used to determine total dissolved solids and pH with an Orion model 420 pH meter. The analytical procedure, abbreviations, units and the range with mean and standard deviations of variables are shown in (Table-1).

Planktons were collected with a planktonic net (No. 50 µm) towed with a motor boat traveling at slow speed at the depth of 0.5 meter from Keenjhar Lake. The planktonic species either zooplankton or phytoplankton samples were stored in wide-mouth plastic bottles, collectively and fixed in 4% formalin. Identification of the planktons was made by authentic literature (Desikachary, 1959; Ward & Whiple, 1959; Prescott, 1962). The algae were classified by Shameel (2001).

3. Results and Discussion

210 planktonic species were identified belonging to 11 classes and 85 genera. Majorly *Cyanophyceae* consist of 40%; afterwards *Chlorophyceae* 27%; *Bacillariophyceae* 11%; 7% each to *Cladocera* and *Rotifera*; 2% each to *Euglenophyceae* and *Ostracoda*; 1% each to *Dinophyceae*, *Xanthophyceae*, *Chrysophyceae* and *Copepoda* total of planktonic species (Table-2) physico-chemical variable were also with the range.

3.1. Phytoplanktonic Population

A total of 173 phytoplanktonic species were identified belonging to 7 classes and 60 genera. *Cyanophyceae* was the dominant genera comprising 83 species and 48% as represented in (Table-2). Secondly *Chlorophyceae* comprises 57 species and 33%, *Bacillariophyceae* consist 24 species and 14%, *Euglenophyceae* represents 5 species and 3%, 2 species and 1% belonged to *Dinophyceae*, one specie and 1% belonged each to Xanthophyceae and *Chrysophyceae* of phytoplanktonic species recorded from Keenjhar Lake, (Table-2).

The qualitative composition of algal flora shows that the blue green alga was dominant in Keenjhar Lake. Microcystis, Lyngbya and Aphanocapsa, were found dominant as compared to heterocystis species. During present observations the numbers of cyanophycean species were represented as, Microcystis 12 species, Lyngbya 10 species; Aphanocapsa 8 species; 6 species to each Anabaena, Nostoc and Oscillatoria; 5 species to each Gloeocapsa and Merismopedia; Phormidium consist of 4 species; 3 species each to Calothrix and Chroococcus; 2 species belonging to each Arthrospira, Coelosphaerium, Gloeotrichia, Gomphosphaeria and Spirulina; one species belonging to each Aphanothece, Anabaenopsis, Gloeothece, Rivularia, and Synechocystis (Table-2). The excessive growth of blue green algae, give arise the bluish green color to the Keenjhar Lake. The numbers of cyanophycean species were higher than that of (Hussain et al., 1984; Horn & Goldman, 1994; Lashari, 2002; Leghari et al., 2006; Korai et al., 2008; Lashari et al., 2009). The green alga possesses second highest number. Chlorophyceaen species consist of 7 species each to Pediastrum and Scenedesmus; 4 species each to Closterium, Cosmarium, Oocystis and Tetraedron; 3 species each to Ankistrodesmus, Cladophora, Characium and Staurastrum; 2 species each to Chlorella, Euastrum and Kirchneriella; one specie each to Closteridium, Coelastrium, Closteriopsis, Dispora, Microspora, Nephrocytium, Oedogonium, Spirogyra and Ulothrix (Table-2). The numbers of green algal species were higher than that of (Jahangir et al., 2000; Lashari, 2002; Korai et al., 2008; Lashari et al., 2009) observed from Keenjhar Lake. The composition of Bacillariophyceaen species were as Cymbilla 5 species; Nitzschia 4 species; Cyclotella 3 species; 2 species each to Amphora, Cocconeis and Gomphonema; one specie each to Achnanthes, Eunatia, Gyrosigma, Melosira, Navicula and Synedra (Table-2). Identified bacillariophyceaen were higher than that of (Hussain et al., 1984; Jahangir et al., 2000; Lashari, 2002; Kamran et al., 2003; Leghari et al., 2006; Korai et al., 2008). The euglenophyceae species comprising of Phacus 3 species and Euglena 2 species. Dinophyceae were composed of 2 species and single specie belonged to Chrysophyceae and Xanthophyceae (Table-2). Similar with than that of (Jahangir et al., 2000; Lashari, 2002; Kamran et al., 2003; Leghari et al., 2006; Korai et al., 2008; Lashari et al., 2009).

3.2. Zooplanktonic Population

Zooplanktons are the necessary diet for the higher aquatic animals i.e. fishes. A total 37 zooplanktonic species were identified during present studies. 15 species belonging to each Cladocera and Rotifera comprising 40%, 4 species to Ostracoda comprising 12% and 3 species to Copepoda comprising 8% (Table-2, Figure-8 and 9), more than that of reported by (Iqbal & Bari, 1975; Jahangir et al., 2000; Lashari, 2002; Kamran et al., 2003; Muhammad et al., 2003) and similar to than that of (Korai et al., 2008).

3.3. Physico-Chemical Variables

The influence of physicochemical variables directly effects distribution and growth of phytoplanktons and ultimately zooplanktons. Current studies emphasize on the population and distribution of plankton by the limitation of physicochemical variables.

Temperature is an important controlling factor for the growth of phytoplankton and zooplankton. The range of temperature was 33.1-18.5ºC during present studies (Table-1 and Figure-1). This effects positively the growth of Cyanophycean species. In Keenjhar Lake Microsystis aeruginosa was the dominant species throughout the year and blooms was formed during summer. Chlorophyceae though well represented by number of species and population density compared with Cyanophyceae. The winter season appeared to be favorable growth of Chlorophyceae. The filamentous members of genera Zygnema, Chlorococcales, Desmis and Spirogyra were found dominant in winter, in agreement with (Gonzalves & Joshi 1946; Nazneen, 1980; Khatoon, 1994). The population of diatoms such as Cymbella, Amphora, Melosira, Cocconies and Navicula attains maximum in winter season. Zooplanktonic species such as Ceriodaphnia, Bosmina, Simocephalus, Keratella, Brachionus, Copepods and Calonids were found abundantly throughout whole year in agreement with (Lashari, 2002; Lashari et al., 2008; Korai et al., 2008). The range of alkalinity during present studies was 230-170 mg L^{-1} (Table-1 and Figure-2) and remains variable throughout the year. In winter and autumn season it spears as high comparatively than summer and spring season. The blue green algae possess the great range of tolerance against alkalinity. Spirulina and Anabaenopsis grow well, especially at lower altitudes of alkalinity. The concentration of dissolve oxygen ranges between was 9.5-6.9 mg L^{-1} in the month of October at Station-2.Mimimum 6.9 mg L^{-1} was observed in the month of April at Station-3 (Table-1 and Figure-3) Dissolve oxygen remains variable throughout the year with indefinite minima and maxima. Dissolve oxygen supports the aquatic biota especially aquatic flora, purely depends on two major factors temperature and algal density. Maximum conductivity was observed 512µScm^{-1} in month of January and October respectively Station-1. The minimum conductivity was recorded 350µScm^{-1} in the month of August and September at Station 6. At Station 2 maximum observed conductivity was 500 µScm^{-1} in the month of April and minimum 330 µScm^{-1} in month of February Station-5 (Table-1 and Figure-4). At Station-1 the maximum value of Total dissolved solids was 410 mg L^{-1} in October and minimum was 270 mg L^{-1} in month of August at Station 6.A minimum of 250 mg L^{-1} was recorded in April at Station 6 and maximum 380 mg L^{-1} -39 mg L^{-1} 0 was recorded in month of January and May at Station 1 and 6. (Table-1 and Figure-5,) while TDS were not appeared as uniform throughout the year during present studies. At some sampling stations it was appeared as high while low at some stations. However, pH range was noted 8.9-7.6.The maximum value of pH was 8.9 in March at Station 6 and minimum value of 7.6 in July at Station 6. At Station 3 the maximum value 8.7 in June and minimum value was 7.4 in the month of September at station 6.in (Table-1 and Figure-6).The pH was affected by Temperature, Salinity and Alkalinity. During present study pH remains high at the peaks of summer and winter. The maximum value of Temperature was 33.1℃ in August at Station 6 and minimum value of Temperature 18.5 ° C in January at Station 4. (Table-1 and Figure-1). Maximum Alkalinity was observed 230 mg L^{-1} in month of January at Station 2. and minimum value of Alkalinity 170 mg L^{-1} in July at Station 3.. (Table-1 and Figure-2).

3.4. Conclusion

The highest number of planktonic species was recorded during present studies, which ultimately increases the primary and secondary productivity of Keenjhar Lake. Physico-chemical properties of Keenjhar Lake were noted in tolerance limits; no excessive value was recorded during throughout study, On the basis of presented study, the water of Keenjhar Lake is suitable for irrigation, drinking if it purified and growth of aquatic fauna and flora.

Table 1. *Maximum and minimum ranges of physicochemical variables and analytical procedures.*

Variables	Abbreviations	Units	Analytical methods	Maximum	Minimum
Temperature	Temp	˚ C	Mercury thermometer	33.1	18.5
Alkalinity	Alkaline	mg L^{-1}	Titration (H_2SO_4)	230	170
Dissolved Oxygen	DO	mg L^{-1}	Winkler method	9.5	6.9
Electrical Conductivity	EC	µS cm^{-1}	Conductivity meter WTW LF 320	512	350
Total Dissolved Solids	TDS	mg L^{-1}	Standard titration methods	410	270
pH	pH	pH unit	420 pH meter	8.9	7.6

Table 2. *Planktonic species identified form Keenjhar Lake.*

S. #	Phytoplanktonic species	Keenjhar lake
	Phylum Cyanophyta	
1	Aphanocapsa koordersi Strom	+ +
2	A. thermalis (Kuetz.) Brugg	++
3	A. elachista W. and W.	+++
4	A. rivularis (Carm.) Rabenh	+
5	A. richteriana Heir	++
6	A. grevillei (Hass) Rabenh	+++
7	A. endophytica Smith	++
8	A. biformis (A. Br.) Geitler	++
9	Aphanothece castagnei Breb.	+
10	Anabaena viguieri Denis and Frey	++
11	A. flos- aquae var. Treleasii	+
12	A. variabilis Kuetz.	++
13	A. circinalis var. crassa Ghose	++
14	A. spiroides var. crassa Lemm.	+
15	A. oryzae Fritsch	++
16	Anabaenopsis reciborskii Wolos.	+
17	Arthrospira jenneri Stizbenb ex. Gomont	+++
18	A. massartii Kuffareh	++
19	Calothrix viguieri Fremy	+
20	C. gradeneri J. De. Toni.	+++
21	C. marchica Lemm.	+++
22	Chroococcus limneticus Lemm.	+++
23	C. disperses Lemm.	++
24	C. giganteus W. and W.	++
25	Coelosphaerium kuetzingiam Nag.	+
26	C. naegelianum Ungaer	++
27	Gloeocapsa punctata Nag.	+++
28	G. minuta (Kuetz.) Hollerb.	+
29	G. lithophila Erceg.	+++
30	G. aeruginosa (Carm.) Kuetz.	+++
31	G. magma (Berg.) Kuetz.	++
32	Gloeothece rupestris (Lyng.) Bornet	+
33	Gloeotrichia reciborskii var. salsetteunse. Dixit	++
34	G. echinulata Smith	+
35	Gomphosphaeria aponina var. delicatula Elenk.	+
36	G. aponina var. cordifomis Elenk.	+
37	Lyngbya contorta Lemm.	++
38	L. aestuarii Liebm ex. Gomont	++
39	L. majuscula Harvey ex. Gomont.	+
40	L. hieronymussii Lemm.	++
41	L. putealis Mont. Ex. Gomont.	+
42	L. digueti Gomont.	+
43	L. taylorii Gomont.	++
44	L. spiralis Geitler.	+
45	L. sordida Zonard.	+
46	L. confervoides C.A Ex. Gomont.	++
47	Merismopedia punctata Meyen	+++
48	M. glauca (Ehrenb) Nag.	+
49	M. convoluta (Breb.)	++
50	M. angularis B.P.nor.	+++
51	M. minima Beck.	++
52	Microcystis viridis (A. Br.) Lemm.	+++
53	M. flos- aquae (Wittr.) Kirchner.	++
54	M. pulveraa (Wood) Forti.	++
55	M. lameliformis Holsinger	++
56	M. aeruginosa Kuetz.	+++
57	M. aeruginosa var. elongata Rao, C. B	+++
58	M. robusta (Clark.) Nygaard.	++
59	M. pulverea var. recmiformis	+
60	M. orissica W. and W.	+++
61	M. holsatica Lemm.	++
62	M. pseudofilamentosa Crow	+
63	M. elabens (Breb.) Kuetz.	+
64	Nostoc calcicola Brebission ex. Born. Et. Flah.	++
65	N. puntiformis (Kuetz.) Hariot	+++
66	N. sparium Vaucher ex. Bornet. Et. Flah.	+
67	N. linckia Bornet ex. Born. Et. Flah.	++
68	N. paludosum (Kuetz.) ex. Bornet. Et. Flah.	+
69	N. ellipsorum var. violaceae Rao, C. B.	++
70	Oscillatoria sancta (Kuetz.) Gomont.	++
71	O. vizagapatennsis Rao, C. B.	+
72	O. limosa Ag. Ex. Gomont.	++
73	O. subbrevis Schmidle.	++
74	O. chlorina (Kuetz.) Fremy.	+
75	O. prolifica (Grev.) Gomont	+
76	Phormidium anomala Rao, C. B	+
77	P. corium (Ag.) Gomont.	++
78	P. ambiguum Gomont.	+++
79	P. calcicola Gardner.	++
80	Rivularia aquatica Wilde.	+
81	Spirulina subtillisma (Kuetz.) ex Gomont.	++
82	S. laxissima W. and W.	++
83	Synechocystis septentrrionalis Tafeln.	+
Total Cyanophycean Species		83
	Phylum Chlorophyta	
84	Ankistrodesmus falcatus Corda.	+++
85	A. falcatus var. stipitatus Corda.	++
86	A. convolutus Corda.	++
87	Chlorella ellipsoidea Gerneck.	+
88	C. prenoidosa Chick.	++
89	Cladophora profunda var.Nordshed	+

S. #	Phytoplanktonic species	Keenjhar lake
90	C. insigins Kuetz.	++
91	C. glomerata (L.) Kuetz.	++
92	Closteridium venus	+++
93	Closterium parvulum var. maius W. and W.	++
94	C. acrosum (Schrank) Her.	+
95	C. acherianum Cleve.	++
96	C. leikbleinii Kuetz.	+
97	Coelastrium microporum Nag.	+++
98	Closteriopsis longissima Lemm.	+++
99	Cosmarium depressum Lund.	++
100	C. grantum var. ocellatum W. and W.	+
101	C. javanicum Nordst.	++
102	C. rectangulum Reinsch.	+++
103	Characium obtusum A. Braun.	++
104	C. orinithocephalum A. Braun.	++
105	C. limneticum Lemm.	+++
106	Dispora crucigenioides Tafe. In.	+
107	Euastrum spinulosum Delp	+++
108	E. substellatum Nordst	+++
109	Kirchneriella microscopica Nag.	++
110	K. lunaris var. lunaris (Krichnaris)	+
111	Microspora tumidula	+
112	Nephrocytium edysiscephanum W. and W.	+
113	Oedogonium nanum Wittrock	++
114	Oocystis pusilla Hansgirg	+++
115	O. elliptica W. and W.	++
116	O. solitaria Wittrock	++
117	O. naegelii A. Braun.	+
118	Pediastrum simplex Meyen	+++
119	P. tetras var.tetras (Her.) Ralf.	+++
120	P. simplex var. microporum Lemm.	++
121	P. clathratrum var. duodenarium Lemm.	++
122	P. simplex var. duodenarium (Bail) Rab.	+++
123	P. duplex Meyen	++
124	P. boryanum Turp.	+
125	Scenedesmus arcuatus Lemm.	+++
126	S. incrassatulus Bohlin.	++
127	S. quadricauda (Turp.) Breb.	+
128	S. dimorphis (Turp.) Kuetz.	+++
129	S. obliquus (Turp.) Kuetz.	++
130	S. abundans Chod.	+++
131	S. armatus (Chod.) Smith	++
132	Spirogyra gratiana Transean	++
133	Staurastrum natator var. crassum W and W.	+
134	S. chaetoceros (Schord) G. M. Smith	+
135	S. tetracerum Tafeln	++
136	Tetraedron muticum (Braun.) Hansgirg.	+++
137	T. quadratum Reinsch	+++
138	T. hastatum (Reinsch) Hansgirg	++
139	T. trigonium (Nag.) Hansgirg	++
140	Ulothrix subconstricta W. and W.	+
Total Chlorophycean Species		57
	Phylum Bacillariophyta	
141	Amphora ovalis Kuetz.	+++
142	A. verneta Kuetz.	+++
143	Achnanthes hungarica Grun.	++
144	Cymbella novices Kuetz.	++
145	C. cistula (Hempr)	+++
146	C. ventricosa Kuetz.	++
147	C. leavis Nag.	++
148	C. tumida (Breb) Van Hanerck	++
149	Cyclotella operculata Kuetz.	+++
150	C. stelligera Grun.	++
151	C. striatata Grun.	++
152	Cocconeis pediculus Ehr.	++
153	C. placentula var. Lineata Ehr.	+++
154	Eunatia pectinatis Rab.	++
155	Gomphonema helveticum Grun.	+
156	G. parvulum Grun.	++
157	Gyrosigma attenuatum Kuetz.	+++
158	Melosira granulate Ehr. Ralfs.	++
159	Nitzschia acuminata Grun.	++
160	N. hungarica Grun.	+++
161	N. amphibia Grun.	++
162	N. gracilis Hantzsch	++
163	Navicula dicephala Ehr. Smith	+
164	Synedra affinis Kuetz.	++
Total Bacillariophycean Species		24
	Phylum Euglenophyta	
165	Euglna accus Ehrenberg	+++
166	E. sociabilis Dang.	++
167	Phacus tortus (Lemm) Skr.	++
168	P. curvicauda Swir.	+++
169	P. ranula Pochm.	++
Total Euglenophycean Species		05
	Phylum Dinophyta	
170	Ceratium teridenella (Lemm) Skr.	++
171	C. hirundinella (Muell) Dujardin	++
Total Dinophycean Species		02
	Phylum Xanthophyta	
172	Botryococcus braunii	++
Total Xanthophycean Species		01
	Phylum Chrysophyceae	
173	Langynion scherffelii Pascher	++
Total Chrysophyceaen Species		01
Total of Phytoplanktonic Species		173
Zooplanktonic species		
	Phylum Cladocera	
174	Alona rectangula Sars.	++
175	Bosminopsis deitersi Richard.	+++
176	Bosmina longirostris O. F. Muller.	++
177	Ceriodaphnia reticulata Jurine.	++
178	C. cornuta Sars.	+++
179	Chydorus eurynotus.	++
180	C. eurynotus brehmi Biswas.	++
181	C. ovalis Kuetz.	++
182	C. parvuus Daday	+++
183	Daphnia sp. O. F. Muller.	++
184	D. lumholtzi.	+
185	Macrocthrix rosea Jurine.	++
186	Moina sp. Baird.	++
187	Sida sp. Straus.	+++
188	Simocephalus vetulus King.	++
Total Cladoceran Species		15
	Phylum Rotifera	
189	Brachionus buda pestinensis Daday.	++
190	B. falcatus Zacharias.	++
191	B. rubens Ehrenberg	+++
192	B. quadridentatus Hermann.	+
193	Euchlanis sp. Ehrenberg.	++
194	Keratella cochlearis Gosse.	++
195	K. cochlearis var. Tecta Gosse.	+++
196	K. tropica Apstein.	++
197	K. volga Ehrenberg.	+
198	Lecane sp. Nitzsch.	+++
199	Macrochaetus sp. Prety.	++
200	Monostyla sp. Ehrenberg.	+
201	Mytilina sp. Bory de st Vincent.	++
202	Platyias quadricoruns Ehrenberg.	++
203	Tetramatrix opotiensis.	++
Total Rotiferan Species		15
	Phylum Ostracoda	
204	Cyclocypris sp.	++
205	Cypris sp.	++
206	Cypria mediana.	+++
207	Eucypris sp.	+
Total Ostracodan Species		04
	Phylum Copepoda.	
208	Calonoid copepods.	+++
209	C. copepods.	++
210	Limnoncaea genuine Kokubo.	++
Total Copepodan Species		03
Total of Zooplanktonic Species		37
Grand total of Planktonic Species		210

+ = Rare; ++ = Common; +++ = Dominant.

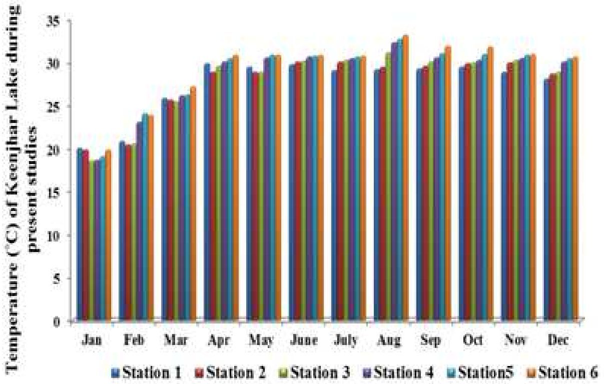

Figure 1. *Temperature of Keenjhar Lake.*

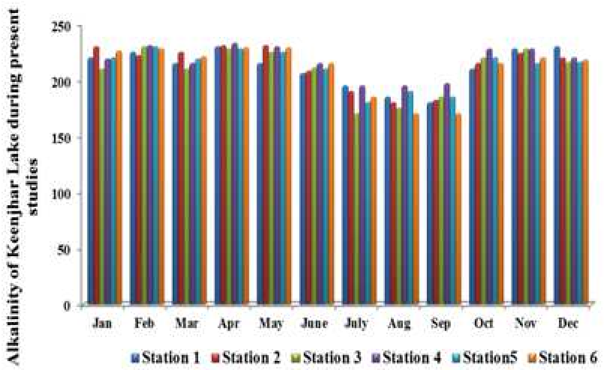

Figure 2. *Alkalinity of Keenjhar Lake.*

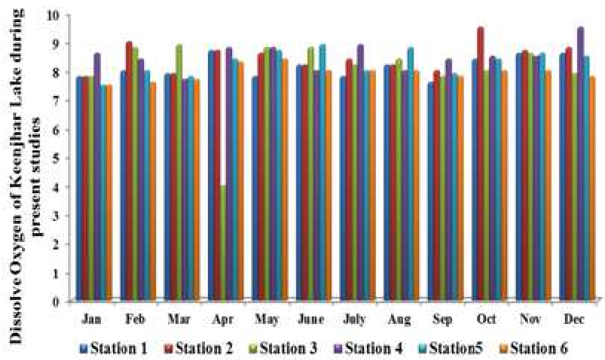

Figure 3. *Dissolve Oxygen of Keenjhar Lake.*

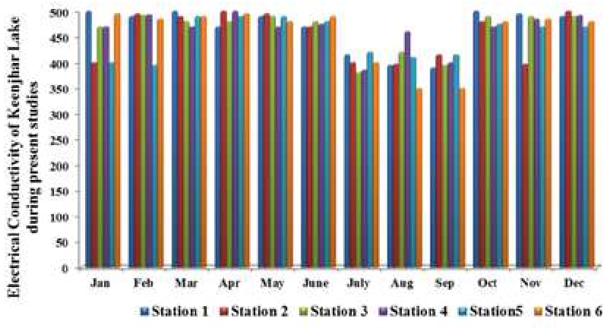

Figure 4. *Electrical conductivity of Keenjhar Lake.*

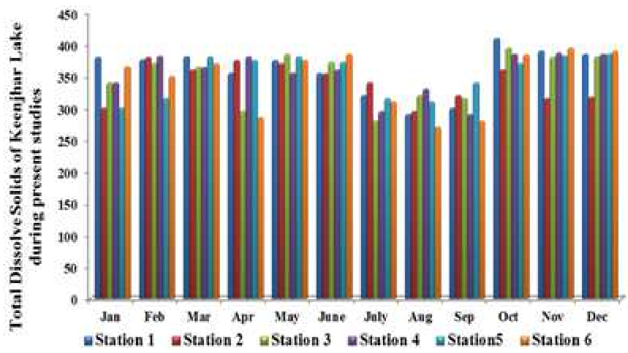

Figure 5. *Total dissolve solids of Keenjhar Lake.*

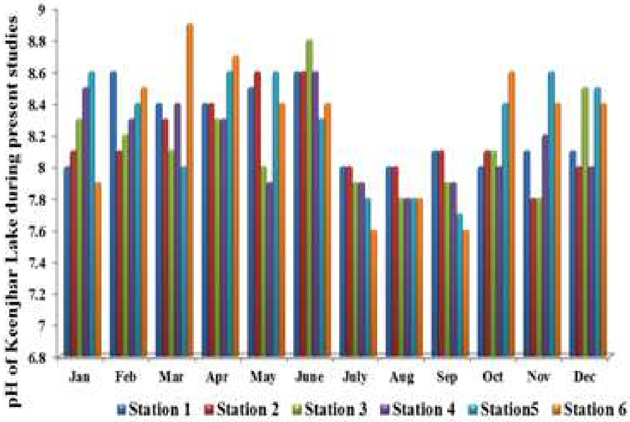

Figure 6. *pH of Keenjhar Lake.*

References

[1] Abdo, M. H., (2005). Physico–chemical characteristics of Abu Za' baal ponds, Egypt. Egyptian J. Aquatic Res., 31(2): 1–15.

[2] LS, Clesceri;AE Greenberg;AD Eaton (1998) *Standard Methods for the Examination of Water and Waste water.* American Public Health Association (APHA), *20th edition,* Washington D.C.

[3] Baquai, I.U., Perwaiz, A.S. and Iqbal, M. (1974b). Limnological studies of Haleji Lake. Agri. Pakistan. 25(4): 321-344.

[4] Blatter, E., Mc. Cann, C. and Sabnus, T.S. (1929). The flora of Indus delta. Ind. Bot. Soc. Methodist. Pub. House, Madras, 173.-178

[5] Depauw, N., (1981). Use of production of micro algae as food for nursery bivalve. In. Claus C. (Eds.), Proc. Int. work shop on nursery culturing of bivalve molluscs. University of Chent Belgium, 35–63.

[6] Desikachary, T.V. (1959). *Cyanophyta. Publisher Indian Council of Agricultural Research.* New Delhi.

[7] Framan, M.A.H. (1981). *Standard Methods for the Analysis of Water and Waste water. 20th edition. American Public Health Association* (APHA), Washington, DC.

[8] Ganpati, S. V. and Pathak C. H., (1969). Primary productivity in the Sayaji Sarovar (a manmade lake) at Baroda. In seminar on the ecology and Fisheries of reservoir. ICAR at CIFRI Barrackpore, 27–29.

[9] Gerletti, M., (1968). Dark bottle measurements in primary productivity studies. Mem. Inst. Ital Idrobiol, 23:197–208.

[10] Gonzalves, E. A. and Joshi, D. B. (1946). Fresh Water algae near Bombay (The seasonal succession of the algae in a tank at Bandra). J. Bombay Nat. Hist. Soc. 46(1): 152-179 +8 pls.

[11] Hussain, F., Anjum G., Zaidi M.I. and Faridi M.A.. (1984). Fresh water algae of Hanna Urak Valley Quetta. *Pak. J. Bot*., 16 (1): 81- 84.

[12] Horn, A.J. and Goldman C.R.. (1994). *Limnology*. Mc Graw- Hill. Publishing. New York.

[13] Iqbal, M. and Bari, G. A., (1975). Preliminary observation on seasonal abundance of *Cladocera* genera in Keenjhar Lake with notes on phytoplankton production. Agriculture Pakistan. 26 (2): 251–257.

[14] Jahangir, T. M., Khuhawar, M. Y., Leghari, S. M., Baloch, W. A., Leghari, A. A., and Leghari, A., (2000). Some studies on water quality and biological life at Keenjhar and Haleji Lakes of District Thatta, Sindh, Pakistan. Pak. J. Biol. Sci. 3: 1965–1972.

[15] Kamran, T., Muhammad, A., A. Salam, M. Latif and T. Zahra, (2003). Study of the seasonal variation in the physico-chemical and biological aspects of Indus River Pakistan. Pak. J. Biol. Sci. 6 (21): 1795–1801.

[16] Khatoon, U., (1994). To study seasonal variation and the effect of some chemical constituents on species composition of algal flora in the water supplies of Karachi city and its surroundings. Thesis for Ph. D. Department of Botany, University of Sindh. Jamshoro, Pakistan

[17] Korai, A. L., Sahato, G. A., Lashari, K. H. and Arbani S. N. (2008). Biodiversity in relation to physicochemical properties of Keenjhar Lake, Thatta district, Sindh, Pakistan. Turk. J. Fish. Aquatic Sci., 8: 259-268.

[18] Korai, A. L., Lashari, K. H., Sahato, G. A. and Kazi, T. G. (2010). Histological lesions in gills of feral Cyprinids, related to uptake of waterborne toxicants from Keenjhar Lake. Rev. Fisher. Sci., 18(2): 157-176.

[19] Lashari, K. H. (2002). Ecological studies of Plankton of Keenjhar Lake, district Thatta, Sindh, Pakistan. M. Phil. dissertation, Department of Fresh Water Biology and Fisheries, University of Sindh, Jamshoro, Pakistan

[20] Lashari, K. H., Sahato, G. A., Korai, A. L. and Kazi, T. G. (2008). Taxonomic study of *Chroocophyceae* (*Cyanophyta*) in Keenjhar Lake, Dist: Thatta, Sindh, Pakistan. Res. J. Fisher. Hydrobiol., 3(1):11-21.

[21] Lashari, K. H., Korai, A. L., Sahato, G. A. and Kazi, T. G. (2009). Limnological studies of Keenjhar Lake, District, Thatta, Sindh, Pakistan. Pak. J. Anal. Environ. Chem. 10(1-2): 39-47.

[22] Lashari, K. H., Sahato, G. A., Korai, A. L., S. Habib Naqvi, Palh, Z. A. and Urooj, N. (2012). Heavy metals burden of Keenjhar Lake, District Thatta, Sindh, Pakistan. Afri. J. Biotech. 11(59): 12305-12313,

[23] Leghari, M. K., Sultana, K. and Bano, T., (1991). Taxonomical studies under Noviculates, Malka Parbat Kaghan (Part–I) Biologia. 37 (2): 9–12.

[24] Leghari, M. K. and Sultana, K., (1992). Blue- Green algal flora of Keenjhar Lake, Sindh, Pakistan. Cryptogamic flora of Pakistan. National Science Museum Tokyo. 1: 69–73.

[25] Leghari, S.M., Leghari, M.Y., Mahar, M.A., Khuhawar, M.Y. and Jahangir T.M. (2006). Limnological study of Hanna Lake and Urak spring of Quetta, Baluchistan. Pak. Int. J. Phycochem., 2 (1): 33-38.

[26] Mehwish, H. and Aliya R., (2005). Occurrence of fresh water algae in different localities of Karachi University. Int. J. Phycol. Phycochem. 1 (2):117–124.

[27] Muhammad A., Salam A., Jamshaid S. and Zahra T., (2003). Studies on biodiversity in relation to seasonal variation in water of River Indus at Ghazi Ghatt, Punjab, Pakistan. Pak. J. Biol. Sci. 6 (21): 1840–1844.

[28] Naila, B., Ghazala B., Shameel M., Choudhry M. I. and Leghari S. M., (2005). Phycochemistry and Bio activity of *Lyngbya* (Nostocophyceae Shameel) from Sindh. Int. J. Phycol. Phycochem. 1(2): 125–134.

[29] Nazneen, S. (1980). Influence of hydro biological factors on the seasonal abundance of phytoplankton in Keenjhar Lake. Int Review Res. Hydrobiology, 65(2): 269-282.

[30] Prescott, G.W. (1962). *Algae of the Western Great lakes Area*. Brown Company publishers Dubuque, Lowa..Book

[31] Porter, K. G. (1977). The plant animal interface in fresh water ecosystem. Am. Sci. 65: 59–70.

[32] Reynolds, C. S., (1984). The ecology of fresh water phytoplankton. Cambridge University Press Cambridge.

[33] Reynolds, C. S., (1988). Functional morphology and the adaptive strategies of fresh water phytoplankton. In C. D. Sandgrain (ed.) Growth and reproductive strategies of fresh water phytoplankton. Cambridge University Press Cambridge. : 388–430…..

[34] Sahato, G. A. and Arbani, S. N. (1997). Quantitative distribution and percentage density of planktonic algae of fish hatchery ponds at Chillia district Thatta, Sindh, Pakistan. Sindh. Univ. Res. Jour (Sci. Ser.), 29(1): 127-135.

[35] Sahato, G. A. and Lashari, K. H., (2005). Studies on the causative genera of phytoplankton blooms forming species in fresh hatchery ponds at Chillia District Thatta Sindh. J. Sc. and Tech. Univ. Peshawar. 29 (1): 35–39.

[36] Shameel, M., (2001). An approach to the classification of algae in the new millennium. Pak. J. Mar. Biol. 7: 233–250.

[37] Sufi, S.M.K. (1957). Fish fauna of the Keenjhar Lake with an account of the major fishing implements employed by local fisher man. Agri. Pakistan, 8 (3): 208-229.

[38] Ward, H.B. and G.C. Whipple. (1959). *Fresh Water Biology*. *2nd Ed. Publisher; John Willey and Sons*. Inc. New York.

[39] Welch, P.S. (1984). *Limnological Method* Mc Graw Hill Book Company Inc. London. : 101- 297……