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PHYTOPLANKTONIC COMMUNITIES AND PHYSICOCHEMICAL PARAM-ETERS OF FISH HATCHERY PONDS AT CHILLIA AND KEENJHAR LAKE

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ABSTRACT: Chillia fish hatchery ponds and Keenjhar Lake is located at Thatta district, water samples from Chillia fish hatchery ponds and Keenjhar Lake were analyzed for physicochemical properties and phytoplanktonic population during 2004 to 2007. The Keenjhar Lake water was slightly alkaline in nature, the range of physicochemical parameters were as, 265-372 mg L^{-1}, 7.2-8.3, 159-218 mg L^{-1}, 35-70 mg L^{-1}, 18-30 °C, 50-73 mg L^{-1}, 28-330 mg L^{-1}, 7.2-8.5 mg L^{-1} and 320- 495 µS cm^{-1}, and physicochemical parameters of Chillia fish hatchery ponds were as 124-187 mg L^{-1}, 7.4-8.4, 65-86 mg L^{-1},21-25 mg L^{-1}, 16-38.5 °C, 47-65 mg L^{-1}, 18-25 mg L^{-1}, 5.4-6.4 mg L^{-1}, and 5.4-6.4 µS cm^{-1}, for total dissolve solids, pH, alkalinity, chlorides, temperature, calcium, magnesium, dissolve oxygen and electrical conductivity respectively. A total 152 phytoplanktonic species belonging 49 genera were identified, as *Cyanophyceae* (83 spp), *Chlorophyceae* (57 spp), *Bacillariophyceae* (10 spp) and (1 spp) each belongs to *Euglenophyceae* and *Xanthophyceae* from Chilliafish hatchery ponds and Keenjhar Lake. Physicochemical properties of Chillia fish hatchery ponds and Keenjhar Lake were suitable for growth of aquatic biota. Keenjhar Lake was richer in primary productivity rather than Chillia fish hatchery ponds.

KEYWORDS: Phytoplankton, physicochemical, Chillia fish hatchery ponds and Keenjhar Lake.

INTRODUCTION

The fish hatchery ponds at Chillia are spread over an area of 77 acres, with an inflow of water of from Kalri Bhaggar feeder, located (68 24 E˚ Longitude and 21 23 N˚ Latitude), and Keenjhar Lake is situated nearly 120 Km. from Hyderabad at 24 47 N˚ and 68 2 E˚ (Korai *et al*., 2008). The importance of phytoplankton as food for fish in sub- tropical water remains a neglected area of research (Sahato & Arbani, 1997) even though studies of phytoplanktonic communities are simpler for tropical water bodies than for temperate water (Saunders and Lewis, 1988). Phytoplankton constitutes significant role in the food chain, as they are the primary producers, and play a gigantic role in the biosynthesis of organic material. Quantitative analyses of phytoplanktonic species are essential for determination of primary productivity in surface water bodies (Sahato & Arbani, 1997). Phytoplanktonic species are essential components of aquatic environment, especially from primary production aspect; as they play a basic role in primary production of water reservoirs, these species are a cheap source of food, both directly and indirectly, for the fish population (Leghari *et al*., 1997). Sahato *et al*., (2004) reported 33 species of phytoplankton (*Oscillatoriaceae*) from Keenjhar Lake district Thatta. Leghari *et al*., (2006) reported 116 species of phytoplankton from Hana Lake and Urak spring from Quetta, Baluchistan. Leghari *et al*., (1999) reported 157 algal species from Chotiari Reservoir, District Sanghar, Sindh. Korai *et al*., (2008) reported142 species of phytoplankton from Keenjhar Lake district Thatta. Therefore present work was conducted to analyze physicochemical properties, qualitative and quantitative analysis of phytoplanktonic population in Keenjhar Lake comparatively with Chillia fish hatchery ponds, district, Thatta, Sindh, Pakistan.

MATERIALS AND METHODS

Water samples were collected from two stations at Keenjhar Lake (1) Sunheri, Inlet water source from by canal Kalri Bhaggar feeder (2), Khumbo, out let of the lake (Fig. 1). Single sample was collected from fish hatchery ponds at Chillia on monthly basis.

Keenjhar Lake water samples collected from surface via Van Dorn plastic bottles (1.5 capacities) from 2-4 spots of each station randomly and 2-3 spots of water sample from each Chillia fish hatchery pond were reserved in well stoppard polythene plastic bottles, formerly soaked 10% nitric acid for 24 hours and rinsed with ultrapure water obtained from ELGA lab water system. Sampling was usually done in the morning. The physicochemical parameters were determined in laboratory following the standard protocols (APHA, 1998). Water samples from Chillia fish hatchery ponds and Keenjhar Lake were stored in an insulated cooler containing ice and delivered to laboratory and all samples were kept at 4 °C prior advance procedure and analysis after end of each sampling exercise. Epilimnion sample from same station were mixed into a washed plastic container to make a composite sample, after this mixture was filtered through 0.45 µm filter paper with the help of vacuum pump. The filtrate was further analyzed for physicochemical parameter.

Standard titration methods (APHA, 1998; Framan, 1981) were used to determine. Total dissolved solids and electrical conductivity (TDS) were determined with a WTW LF 320 conductivity meter. pH with an Orion model 420 pH meter, alkalinity was detected with titration (Sulfuric acid). Chloride with (silver nitrate). Temperature was measured with a mercury thermometer at site. Calcium and Magnesium was determined by titration (with EDTA). Water samples for the determination of dissolved oxygen (DO) samples were collected in colored bottles and analyzed by a modified Winkler method. The analytical procedure, abbreviations, units and the range with mean and standard deviations of physicochemical variables are given at (Table I).

Phytoplankton were collected with a planktonic net (No. 55 µm) towed with a motor boat traveling at slow speed at the depth of 0.5 meter from Keenjhar Lake and collection from Chilla fish hatchery ponds were simply by said net. The phytoplanktonic samples were stored in wide- mouth plastic bottles and fixed in 4% formalin. A qualitative study of the phytoplankton was made by authentic literature (Desikachary, 1959; Ward and Whiple, 1959; Prescott, 1962; Patric and Reimer, 1966; Starmach, 1966). The classification of algae has been followed after Shameel (2001).

RESULTS AND DISCUSSION

Phytoplanktonic studies

Phytoplanktonic population belonging to five different algal groups viz, Cyanophyta comprises as 55 and 50 %, Chlorophyta comprises as 37 and 41 %, Bacillariophyta comprises as 6 and 7 %, Euglenophyta and Xanthophyta comprises as 1 and 1 % each, from Keenjhar Lake and Chillia fish hatchery ponds. Fig. 2 and 3.

In general blue- green algae were dominant over the other algal groups at Keenjhar Lake even from Chillia fish hatchery ponds. Totally 152 species of phytoplankton were indentified. The identified taxa are represented in (Table II). The Keenjhar Lake was more productive rather than Chillia fish hatchery ponds (Fig. 4). 83 species of phylum Cyanophyta were identified from Keenjhar Lake and 68 species were identified from Chillia fish hatchery ponds. In which, *Aphanocapsa* (8 and 6 Spp), *Aphanothece* (1 and none Spp), *Anabaena* (6 and 3 spp), *Anabaenopsis* (1spp each), *Arthrospira* (2 spp each), *Calothrix* (3 spp each), *Chroococcus* (3 spp each), *Coelosphaerium* (2 and 1 spp), *Gloeocapsa* (5 spp each), *Gloeothece* (1and none spp), *Gloeotrichia* (2 and 1 spp), *Gomphosphaeria* (2 and 1 spp), *Lyngbya* (10 and 9 spp), *Merismopedia* (5 spp each), *Microcystis* (12 and 11 spp), *Nostoc* (6 and 5 spp), *Oscillatoria* (6 spp each), *Phormidium* (4 and 3 spp), *Rivularia* (1 spp each), *Spirulina* (2 spp each), and *Synechocystis* (1 and none spp), from Keenjhar Lake and Chillia fish hatchery respectively, (Fig. 5, and table II). By the excess growth of plankton in the lake, the color of the water was observed as bluish green; the transparency is affected by various factors such as algal blooms in Chillia fish hatchery ponds and suspended sediments at Keenjhar Lake and Chillia fish hatchery ponds. This confirms the observation made by (Hussain *et al*., 1984; Horn and Goldman, 1994; Leghari *et al*., 2006). 57 and 53 species of phylum Chlorophyta were identified from Keenjhar Lake and Chillia fish hatchery ponds, respectively, *Ankistrodesmus* (3 spp each), *Chlorella* (2 spp each), *Cladophora* (3 spp each), *Closteridium* (1 spp each), *Closterium* (4 spp each), *Coelastrium* (1 spp each), *Closteriopsis* (1 spp each), *Cosmarium* (4 spp each), *Characium* (3 spp each), *Dispora* (1 and none spp), *Euastrum* (2 spp each), *Kirchneriella* (2 spp each), *Microspora* (1 spp each), *Nephrocytium* (1 and none spp), *Oedogonium* (1 spp each), *Oocystis* (4 and 3 spp), *Pediastrum* (7 and 6 spp), *Scenedesmus* (7 spp each), *Spirogyra* (1 spp each), *Staurastrum* (3 spp each), *Tetraedron* (4 spp each) and *Ulothrix* (1 spp each), (Fig. 6 and table II). 10 species of phylum Bacillariophyta were collected, each from Keenjhar Lake and Chillia fish hatchery ponds, *Amphora* (2 spp each), *Cymbella* (4 spp each), *Cyclotella* (3 spp each), *Nitzschia* (1 spp each), Fig. 7. Furthermore, phylum Euglenophyta comprises only single specie *Botryococcus braunii* form Keenjhar Lake and Chillia fish hatchery ponds. Single specie *Euglna accus* belonging to Xanthophyta was recorded from Keenjhar Lake and Chillia fish hatchery ponds as well.

Nazneen and Bari, (1979) published a systematic account of the diatoms of the family *Epithemaceae* and also reported detailed information on seasonal distribution of phytoplankton in Haleji Lake, (Nazneen and Bari, 1984). Leghari and Sultana, (1992) reported 42 species of Blue green algae from Keenjhar Lake, Sindh. Arbani and Sahato, (1995) reported a few species of the family Chlorococcales in fish pond at Chillia, Sindh. Javed and Hayat, (1995) assesses water quality in the River Ravi and its influence on different plankton taxa. Leghari *et al*., (2001) reported 46 species of Chroococcus for Sindh. Sahato and Lashari, (2005) studied the genera causing phytoplankton bloom in fish hatchery ponds at Chillia, Sindh. Our results are not agreement with those of (Leghari *et al*., 2001; Sahato and Lashari 2005; Korai *et al*., 2008.

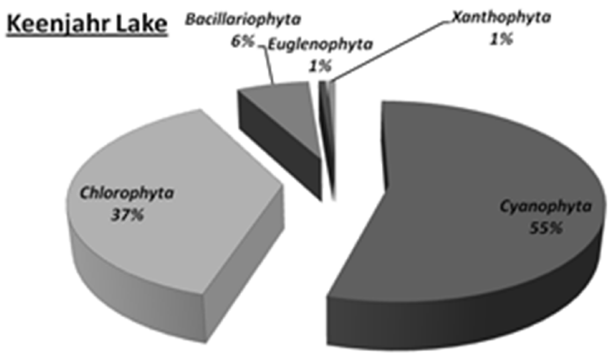

Fig. 2. Composition of algal phyla from Keenjhar Lake.

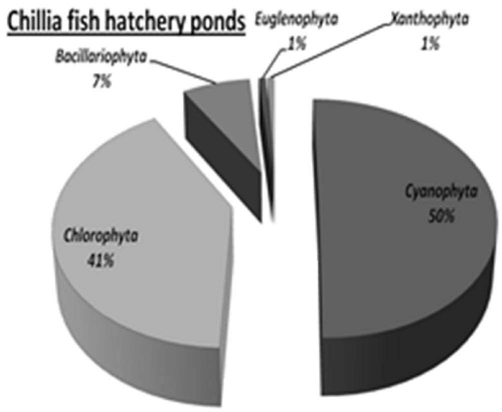

Fig. 3. Composition of algal phyla from Chillia fish hatchrey ponds.

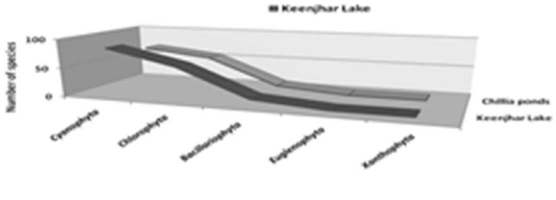

Fig. 4. Number of algal species with their concren phyla encountered from Keenjhar Lake and Chillia fish hatchrey ponds.

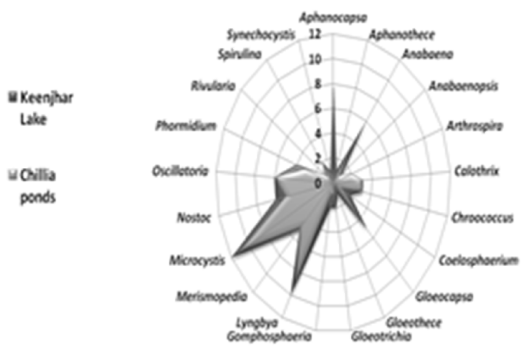

Fig. 5. Species composition of Cyanophyta from Keenjhar Lake and Chillia fish hatchery ponds.

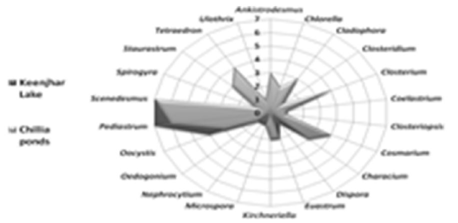

Figure 6, Species composition of Chlorophyta from Keenjhar Lake and Chillia fish hatchery ponds.

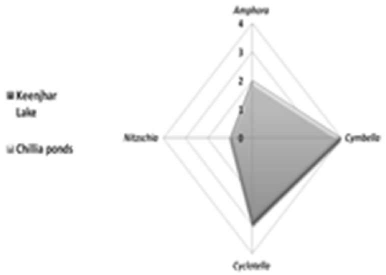

Fig. 7. Species composition of Bacillariophyta from Keenjhar Lake and Chillia fish hatchery ponds

Physicochemical parameters

The range of total dissolve solids from Keenjhar Lake were as 265-372 mg L^{-1} and from Chillia fish hatchery ponds were as 124-187 mg L^{-1} (Table I). Keenjhar lake has high TDS in winter and low TDS in autumn (Khatoon 1994), in contrast to ponds and smaller water bodies, where as TDS were maximum in autumn and minimum in winter. This may be due to the size of the water body, inflow of water, consumption of salt by algae and other aquatic plants, and the rate of evaporation. Our data coincide with those of Khatoon (1994) but disagree with observations of Kumar *et al*., (2000).

pH is a measure of the acidity or alkalinity of an aqueous solution. The variation in pH is due to the presence or absence of free carbon dioxide and carbonate and planktonic density during various months. It is well documented that pH is directly related to CO_3 and inversely related to free carbon dioxide (Nazneen *et al*., 2000). The pH range was 7.2- 8.3 from Keenjhar Lake and 7.4- 8.4 (Table I) from Chillia fish hatchery ponds. Among biotic factors, high photosynthetic activity due to increased production of phytoplankton may support an increase in pH. This type of observation has also been reported by Nazneen and Bari (1984).The capacity of water to neutralize a strong acid is known as alkalinity and is characterized by the presence of hydrogen ions; most of the alkalinity of water is due to dissolution of carbonate. The range of alkalinity was 159-218 mg L^{-1} (Table I), was noted at station I and II in March from Keenjhar Lake. Increase in alkalinity value may be due to decrease in the water level. Bicarbonate increase with decrease in water levels have also been reported by Singhal *et al*., (1986) and Rutne, (1963), reported that the accumulation of lesser quantities of carbonate during summer results in the liberation of free Co3 during decomposition of bottom deposits, which possibly converts insoluble $CaCO_3$ into soluble Ca $(HCO_3)_2$. The range of alkalinity was 65- 86 mg L^{-1} from Chillia fish hatchery ponds. The Keenjhar Lake was more alkaline than that of Chillia fish hatchery ponds. Natural water generally contains low concentrations of chlorides and higher levels always originate from contamination by sewage. Range of chlorides was as 35-70 mg L^{-1} from Keenjhar Lake and range from Chillia fish hatchery ponds were as 21-55 mg L^{-1} (Table I). The increase in chlorides in winter is in agreement with the observations of Munawar (1970). Kumar *et al*., (2000) suggested that this is probably because organic matter does not accumulate at a particular spot in flowing water and is washed away before it is broken down. The chlorides concentration depends on the water level, when the water level decreases, the chlorides concentration increases. They further observed that when water level rises due to rain, the consequent dilution decreases the chloride concentration. The chlorides content in Keenjhar Lake was high rather than Chillia fish hatchery ponds due to continue flow of water, ultimately increases the productivity of Keenjhar Lake water.

Temperature is important in terms of its effect on aquatic life. Temperature fluctuations are evident seasonal patterns in aquatic ecosystems. Its influence on limnological phenomena such as stratification, gas solubility, pH, conductivity and planktonic distribution are well known Singh *et al*., (1980). Temperature measurements are useful in indicating trends for various chemical, biochemical and biological activities. An increase in temperature leads to faster chemical and biochemical reactions. The growth and death of microorganisms and the kinetics of the biochemical oxygen demand are also regulated to some extent by water temperature Khuhawar and Mastoi (1995). Water temperature in the study lake closely followed air temperature, with maximum in summer and minimum in winter. Air and water temperatures showed a very characteristic annual cycle, with higher values during the day, and lower values in the dry season. The range of temperature from Keenjhar Lake was 18- 30 ˚C and from Chillia fish hatchery ponds were as 16-38.5˚C (Table I), due to low water volume at the Chillia fish hatchery ponds. The hardness of the natural water is mainly caused by the presence of carbonates, bicarbonates, sulfates and chlorides of calcium and magnesium. Other cat ions that affect the hardness are iron and magnesium. Carbonate and bicarbonates are the predominant anions in the lake, with calcium the major cation. Singh & Singh (2000) inferred that changes in the concentration of oxidizable organic matter in tropical waters did not influence the development of blue–green algae, as its concentration reaches a limiting factor for algal growth. The range of calcium was 50- 73 mg L^{-1} and 47- 65 mg L^{-1}, from Keenjhar Lake and Chillia fish hatchery ponds respectively. The range of magnesium was 28- 330 mg L^{-1} and 18- 25 mg L^{-1} (Table I) from Keenjhar Lake and Chillia fish hatchery ponds; it was apparently observed that the Keenjhar Lake has broad range of calcium and magnesium.

The concentration of dissolve oxygen was 7.2- 8.5mg L^{-1} from Keenjhar Lake and DO of Chillia fish hatchery ponds was ranged as 5.4- 6.4 mg L^{-1} (Table I). Keenjhar lake is exclusive source of fisheries potential, irrigation intention, picnic spot and broad range of biodiversity while contamination in Keenjhar Lake is accelerated by anthropogenic, imprudent activities of visitors and fisher folks, ultimately which increases the rate of biodegradation, hence increases the dissolve oxygen content. Electrical conductivity of Keenjhar Lake during present studies was 320- 495 µS cm^{-1} and conductivity of Chillia fish hatchery ponds were as 142- 260 µS cm^{-1}(Table I), during present studies the Keenjhar Lake water was more conductive rather than Chillia fish hatchery ponds. Keenjhar Lake is more productive than Chillia fish hatchery ponds, due to presence of high nutrients and their recycling, ultimately which increase the conductivity of water. Most of the salts dissolved in water are in ionic form, and thus can conduct electricity. The change in water conductivity followed the same seasonal pattern as that of salinity, the conductivity of Keenjhar Lake was similar than that of Kawar Lake, thus in agreement with (Kumar *et al*., 2000; Leghari *et al*., 2006; Korai *et al*., 2008).

CONCLUSION

Keenjhar Lake is richer in production of Cyanophyta 55 % rather than Chillia fish hatchery ponds, in contrast of rest of algal phyla Chlorophyta 41 %, and Bacillariophyta 7 % at Chillia fish hatchery ponds, hence shows good production in comparison with Keenjhar Lake. In account of Xanthophyta and Euglenophyta Keenjhar Lake and Chillia fish hatchery ponds were similarly productive. In Keenjhar Lake water broad range of physicochemical parameters were observed, however the Chillia fish hatchery ponds were in narrow range. Keenjhar Lake is slow moving water body with inconsistent depth because of this the range of various physicochemical parameters were extended. Conclusively the Keenjhar Lake water is good for the production of aquatic fauna and flora, besides of that Chillia fish hatchery ponds are feed with similar input, however they are low productive in account of higher aquatic animals.

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