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STUDY OF PHYTOPLANKTON COMPOSITION IN THE GUT CONTENTS OF SOME FISHES FROM KINJHAR LAKE

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Abstract. A study was undertaken to improve fish production in Kinjhar Lake, created artificially to supply water to Karachi. A survey of phytoplankton species, an important feeding material for fishes, was made and the gut contents of nine species of fishes, occurring in the lake, were recorded. This study indicated that commonly occurring phytoplankton species especially *Microcystis aeruginosa,* are preferred as food material by the fishes compared to aquatic macrophytes such as *Hydrilla, Potamogeton, Ceratophyllum, Myriophyllum* and *Lemna* during the phytoplankton blooming season.

It is suggested that fish production in the lake can perhaps be increased by carrying out annual cleaning and closing of the inlet and outlet of the lake in January instead of April to avoid disturbance during the period of the phytoplankton bloom and when the destruction of fish eggs and fingerlings in April would also occur.

Kinjhar Lake is situated 75 miles north of Karachi at 24°.47 N and 68°.2 E.[1] It is an artificial lake linked to the river Indus by Kalri Baghar Feeder Canal.[2] It is used mainly to supply drinking water to Karachi, a large city of about 4 million people and an important industrial centre of Pakistan. The lake is also used for fishing, both for economic reasons and pleasure. Its potential for fishing, however, has not been fully exploited and a detailed scientific study of the various factors affecting the lake is necessary to increase fish production.

With this in mind, the following work was undertaken to study the importance of phytoplankton as a source of food for fishes occurring in Kinjhar Lake.

Materials and Methods

Fishes for the study of gut contents were caught by hand net in Kinjhar Lake. They were preserved in the field in 10% formalin.[3] The guts were removed in the laboratory and were preserved in 80% alcohol[4] until the time of analysis. Each gut was teased out and the green mass was suspended in distilled water and the small pieces of empty gut were removed using a binocular microscope. All contents were washed in a measuring cylinder and adjusted to a known volume. From this, one ml of suspension was taken after vigorous shaking and the percentage composition of phytoplankton species were determined by the utermohl method[5] which was also used for the quantitative study of phytoplankton samples.[6]

Results and Discussion

Fishes can generally be classified into three types, carnivorous, omnivorous and herbivorous according to the presence of feeding material in the gut contents. It is believed that fishes are selective in their food materials while another opinion exists about non selectivity and preference for an easily available food by fishes, Griffith and Voorhees[3] observed preference of fishes for easily available food, but with a certain degree of selectivity.

An important fish food material is phytoplankton and a relationship exists between phytoplankton and consumers especially the fishes occupying the same environment. Phytoplankton is the basic link in the aquatic food chain and any increase in the phytoplankton productivity activates the whole food chain.

A survey of phytoplankton in Kinjhar Lake was carried out and 94 species of phytoplankton belonging to three algal groups namely Myxophyceae, Bacillariophyceae and Chlorophyceae were recorded. Myxophyceae, especially *Microcystis aeruginosa,* were most abundant while *Melosira granulata, Spirogyra* spp., *Zygnema* spp. and certain diatom species were also abundant but comparatively in lower concentration than *Microcystis aeruginosa.* Detailed results of this survey have been published earlier.[6]

To study the importance of phytoplankton as food material for fishes, gut contents of 35 specimens of 9 species of fishes were observed from June 1968 to June 1970. Fishes selected for study were *Puntius conchonius, P. terio, P. ticto, P. sophore, P. vittatus*

TABLE RELATIVE ABUNDANCE OF PHYTOPLANKTON IN GUT CONTENTS AND WATER SAMPLES.

Time of collection	Name of fish.	No. of fish examined	Length in cm.	Abundance of phytoplankton in stomach contents			Abundance of phytoplankton in water samples		
				Most abundant	Abundant.	Rare.	Most abundant	Abundant.	Rare.
June – December, 1968.	*Puntius sophore*	28	4–8	*Microcystis aeruginosa*	*Melosira granulata* *Diatom* spp.	*Synedra ulna* *Merismopedia glauca*	*Microcystis aeruginosa*	*Melosira granulata* *Lyngbya birgei* *Merismopedia* spp. *Anabaena* spp. *Fragilaria* spp.	*Cymbella spp.* *Diatom* spp.
	Rasbora sp.	8	7–10	,,	*Melosira granulata*	*Diatom* spp.			
	Chela sp.	4	6–7	,,	*Spirogyra* spp.	,,			
	Cirrhina latia	2	13–15	,,	*Melosira granulata*	,,			
	Labeo rohita	6	20–25	,,	*Spirogyra* spp.	,,			
January – June 1969	*Puntius sophore*	13	4–8	*Microcystis aeruginosa*	*Melosira granulata*	*Spirogyra* spp. *Zygnema* spp. *Diatom* spp.	*Microcystis aeruginosa*	*Melosira granulata* *Spirogyra* spp.	*Chlorhormidium flaccidum*
	P. terio	2	4.0–4.5	,,	*Lyngbya birqei*	*Diatom* spp.		*Zygnema* spp.	*Diatom* spp.
	P. vittatus	3	4.5–5.0	,,	*Zygnama* spp.	*Diatom* spp. *Spirogyra* spp.			
July – December, 1969.	*Puntius sophore*	10	4-8	*Microcystis. aeruginosa*	*Melasira granulata*	*Lyngbya birgei* *Diatom spp.*	*Microcystis aeruginosa*	*Melosira granulata* *Synedra ulna* *Pinnularia gibba*	*Lyngbya birgei.* *Cymbella* spp.
	P.conchonius	8	6-7	,,	*Spirogyra* spp.	,,		*Spirogyra* spp.	*Fragilaria* spp.
	P.terie	2	4-4.5	,,	*Melosira granulata*	,,		*Zygnema* spp.	*Diatom* spp.
	Labeo rohita	4	20-25	,,		,,			
January – June, 1970.	*Puntius sophore*	13	4-8	*Microcystis aeruginosa*	*Melosira granulata*	*Spirogyra* spp. *Zygnema* spp. *Diatom* spp.	*Microcystis aeruginosa*	*Melosira granulata* *Spirogyra* spp.	*Chlorhormidium flaccidum* *Fragilaria* spp.
	P.terio	2	4.0-4.5	,,	*Lyngbya birgei*	*Diatom* spp.		*Zygnema* spp.	*Diatom* spp.
	P.vittatus	3	4.5-5.0	,,	*Zygnema* spp.	*Diatom* spp. *Spirogyra* spp.			

Rasbora sp., *Chela* sp., *Cirrhina latia* and *Labeo rohita.* These fishes are of small size and they were selected because of their easy handling in the laboratory.

Study of phytoplankton in the gut contents indicated a predominance of the most abundant phytoplankton species in the lake water, *Microcystis aeruginosa* (Table).

A controversy exist about utilization of *Microcystis aeruginosa* as food material for fishes. Schelubsky[7] reported this species to be toxic to the fishes. George[8] has also observed that heavy growth of *Microcystis aeruginosa* in a fish tank causes and adverse effect on fishes increasing their mortality. He has suggested that this effect is not due to the toxicity of *Microcystis aeruginosa,* but rather due to nearly complete depletion of oxygen in the morning hours due to the heavy growth of this species. George[8] has also mentioned that thicker growth of *Microcystis aeruginosa* occurs in still water compared to continuously moving waters. Such heavy growth of this species was not observed in Kinjhar Lake and, therfore, oxygen was not depleted in water[9] for fishes. Supply of oxygen from atmosphere occurs in the lake even below the water surface due to water movements. Fishes in Kinjhar Lake therefore, do not experience anoxia of a serious nature as described by George[8] in his studies.

In contrast to the results obtained by Schelubsky,[7] Singh[10] noticed that *Microcystis aeruginosa* is utilized by fishes like *Gadusia chapra* and fingerlings of *Labeo rohita.* Ahmed[11] has even observed an increase of weight in fishes on feeding of *Microcystis aeruginosa* to *Cirrhina mirgala.* Our studies of the gut contents also suggest the utilization of this algal species as food and even its selection in comparison to other food materials by fishes due to its abundance. Highest concentrations of *Microcystis aeruginosa* was observed in the gut contents in July 1968 and June 1969 when the highest concentrations of this alga were also recorded in water samples.

Small fragments of green material other than phytoplankton were also observed in the gut contents. This material was not identified, but consisted perhaps of aquatic macrophytes which occur abundantly in the lake. The amount of this material was small in the gut contents during the blooming season of phytoplankton, but its quantity increased during winter in comparison to phytoplankton. It indicates that fishes start consuming a greater quantity of aquatic macrophytes in winter when phytoplankton is not easily available.

Both phytoplankton and aquatic macrophytes occur in the lake, but the studies indicate a preference of phytoplanton by herbivorous fishes for their food material compared to the aquatic macrophytes. Our results support the suggestion of Griffith and Voorhees[3] that fishes prefer easily available food, but will display a degree of selectivity.

The supply of water to Kinjhar Lake was stopped for a period of 15 days in late April by closing the upper Kalri Baghar Feeder Canal, the inlet of the lake. In addition, outlet of the lake was also closed and water to the city was supplied from another lake, i.e. Haleji Lake, situated nearby, during this period. This was done to clean the bed of the canal from overgrowing aquatic macrophytes and silt both manually and mechanically. By closing the inlet and outlet of the lake, the water of the lake became stagnant and this increased in turn the turbidity of the lake. Moreover, when water was again allowed to flow in lake after cleaning the canal bed, it brought with it heavy amount of silt and mud due to the floody condition of the river Indus. The water in the lake therefore became heavily turbid and muddy thus affecting both phytoplankton growth and fish production.

The loss of fish production can be avoided by shifting the canal closure time from April to the first week of January when the phytoplankton growth and fish population will not be much affected. The loss of fish production can be particularly controlled by transfering the fishes including their eggs and fingerlings from the lake during this period to the fish stock ponds which should be constructed adjacent to the lake. These ponds can also be used for the better fish production throughout the year by fertilizing them artificially and supplementary feeds. This practice would result in better income for local fishermen.

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