

Diatoms as Component of Fish Diet in Natural Aquatic Environment

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Abstract- Studies on diatoms as component of fish diet were undertaken on freshwater fish namely, Catla catla (Catla), Labeo rohita (Rohu) and Labeo calbasu collected from two perennial water-bodies namely Jawahar Sagar Lake and Kishore Sagar Lake of Rajasthan. The observed gut contents belonged to 8 different groups. The results revealed that the most preferable food items were diatoms, green algae, blue-green algae and detritus. On the basis of different food items Labeo calbasu of these waters has been classified as illiophagic fish.

Key words- Diatom, illiophagic, productivity

I. INTRODUCTION

Diatoms constitute approximately 40% of phytoplankton in the aquatic domain and they, therefore, make up 20-25% of the world's net primary productivity. As the main component of plankton, diatoms are an important food source for fish and other aquatic animals. Diatoms are used as food for the larvae of echinoderms, molluscs and shrimp.

Many protists such as ciliates and dinoflagellates consume smaller diatoms as whole. There are number of small protists that can invade large diatoms and eat them out of their frustule. Attached diatoms are also eaten by animals that graze on the wide variety of surfaces on which diatom grows. There are two fairly distinct food chains in the plankton, one based on diatoms and the other based on bacteria and flagellates. Diatoms are consumed by mesozooplankton or by benthos (if they sink) and these organisms form the food of most commercially important fish stocks. For the rational management of fishery, it is essential to collect information on the various aspects of biology of fish. Food and feeding habits form one of the major parts of such studies.

During the present study an attempt has been made to determine the degree of preference for different food items especially the diatoms as component of fish diet in three Indian Major Carps under natural environmental conditions.

II. MATERIALS AND METHODS

A. Collection of fish samples

Specimen of fish namely, Catla catla (Catla), Labeo rohita (Rohu) and Labeo calbasu having average weight of 600 gms were collected from the landing centres of two water bodies viz Jawahar Sagar Lake and Kishore Sagar Lake. Subsequently, these were brought to the laboratory to study the gut contents. The intestine was taken out and preserved in 5% formalin. Catla is a surface and column feeder and its

large upturned mouth is adapted to feed on numerous organisms floating in water. Rohu is a column and bottom feeder and mostly feeds on planktonic algae. Labeo calbasu is a bottom feeder (benthophagic) fish.

Gut content analysis

Eye estimation method (Jaiswar et al. [1]) was followed for gut content analysis. The belly of the fish from thoracic region was split opened up to the vent by scissors. The gut was removed from below the oesophagus region up to the end of stomach. A longitudinal incision was given to gut and the contents were scraped out in a Petri dish. Different kinds of food items were segregated group wise for estimation. The entire contents of the fish were considered as a unit volume and noted the approximate percentage of each kind of food items in relation to total volume. Different kinds of food items were summed up and made total of all kinds of food items of all the samples and examined. The percentage of each kind of food items was estimated. The total of each column was expressed as the percentage of last column.

III. RESULTS

The preferred food items encountered in the gut contents of Catla catla (Catla), Labeo rohita (Rohu) and Labeo calbasu in Jawahar Sagar and Kishore Sagar Lakes is presented in Figures 6.1 to 6.5. The observations of the relative importance of main food components in the guts of these fishes are as follows:

A. Catla catla

In the gut contents of Catla collected from Jawahar Sagar Lake the diatoms dominated (45.1%) followed by copepods (13.2%), green algae (10.9%), others (10.3%), detritus (7.9%), blue green algae (7.1%), cladocerans (3.8%) and rotifers (1.7%). Catla was not observed in any catch at Kishore Sagar Lake. Qualitatively food organisms observed in Catla at Jawahar Sagar Lake were Merismopedia, Microcystis, Arthrodesmus, Cosmarium, Pediastrum, Staurastrum, Microsopra, Navicula, Diatoma, Pinnularia, Cocconeis, Gyrosigma, Ghomphonema, Epithemia, Melosira, Synedra, Cymbella, Keratella, Alonella, Philodina, Bosmina, Chydorus, Cyclops, Cypris, Phacus, Diffflugia and Euglypha (Fig. 6.1). Labeo rohita

In the case of Labeo rohita collected from Jawahar Sagar Lake the major components of the gut contents were diatoms (47.1%) followed by blue green algae (13.7%), detritus (11.8%), others (11.7%), green algae (9.8%), rotifers (2.5%), copepods (2.4%) and cladocerans (1.0%). The different types of food organisms noticed in gut of Rohu were Microcystis,

Anabaena, Microspora, Scenedesmus, Ghomphonema, Melosira, Cyclotella, Amphora, Cymbella, Achnanthes, Synedra, Navicula, Philodina and Cypris (Fig. 6.2).

In *Labeo rohita* (Fig. 6.4) inhabiting Kishore Sagar Lake gut contents also showed a dominance of diatoms (49.6%) followed by green algae (17.6%), others (14.0%), detritus (12.8%), blue green algae (4.0%) and copepods (2.0%). Rotifers and cladocerans were not observed in the guts of *Labeo rohita* from Kishore Sagar Lake. Types of food organisms observed in the gut contents of *Labeo rohita* from Kishore Sagar Lake were *Microcystis*, *Ulothrix*, *Oedogonium*, *Scenedesmus*, *Microspora*, *Maugeotia*, *Penium*, *Diatoma*, *Navicula*, *Achnanthes*, *Synedra*, *Ghomphonema*, *Cymbella*, *Fragilaria*, *Pinnularia*, *Cocconeis*, *Closterium* and *Diffugia*.

Labeo calbasu

Detritus (38.2%) dominated the gut contents of *Labeo calbasu* from Jawahar Sagar Lake followed by diatoms (20.8%), green algae (18.5%), blue green algae (15.0%) and others (7.5%). Zooplankton was not observed in the gut contents of *Labeo calbasu* at Jawahar Sagar Lake. The major food organisms observed were *Anabaena*, *Oscillatoria*, *Cymbella*, *Amphora* and *Centropyxis* (Fig. 6.3).

Interestingly, the gut contents of *Labeo calbasu* (Fig. 6.5) inhabiting Kishore Sagar Lake were dominated by diatoms (36.5%) followed by detritus (35.9%), green algae (18.9%) and blue green algae (8.9%). The zooplankton and other food items were not observed in the gut contents of *Labeo calbasu* from Kishore Sagar Lake. The major food organisms observed were *Anabaena*, *Cosmarium*, *Microspora*, *Diatoma*, *Ghomphonema*, *Melosira*, *Tabellaria*, *Cymbella*, *Synedra* and *Closterium*.

IV. DISCUSSION

During the present study it was observed that the fish species under study namely, *Catla catla* (*Catla*), *Labeo rohita* (*Rohu*) and *Labeo calbasu* preferred diatoms as main component of their diet in both the water bodies except Jawahar Sagar Lake where *Labeo calbasu* preferred detritus as its main food followed by diatoms. The occurrence of large quantity of detritus, sand and silt in the gut revealed the bottom feeding nature of *Labeo calbasu*. This also coincided with the findings of Khumar and Siddiqui [2] who has reported *Labeo calbasu* as a bottom dwelling "illiphagic (bottom feeder)" fish and stated that decaying organic matter and molluscs were the main food and diatoms, plant matter, green algae and blue green algae were of secondary importance as diet of the fish.

David and Rajgopal [3] also reported *Labeo calbasu* as bottom feeder but observed members of Bacillariophyceae (18.7%) as the main food followed by chlorophyceae (4%) along with the decayed organic matter and mud which also corroborate with the present findings for *Labeo calbasu*. The studies of Das and Moitra [4] have also reported the bottom feeding nature of *Labeo calbasu*.

Verma [5] reported that the gut contents of *Labeo rohita* contained decaying vegetable matter, organic debris, large quantities of mud and very little plankton. Khan and Siddiqui

[6] found a strong negative selection by *Labeo rohita* for all zooplanktonic organisms and a strong positive selection for most of the green algae and diatoms (*Ankistrodesmus*, *Zygnema*, *Spirogyra*, *Selenastrum*, *Pediastrum*, *Scenedesmus*, *Tetraspora*, *Stephanodiscus*, *Navicula*, *Diatoma*, *Synedra* and *Nitzschia*) which relatively supported the present findings of gut contents in *Labeo rohita*. However, Khan and Siddiqui [6] stated that all blue green algae were avoided by *Labeo rohita* which was not observed during the present investigations. During the present study it was observed that blue green algae were also preferred by *Labeo rohita* as its food.

Das and Moitra [4] studied the feeding habits of nine column feeder fish species including *Labeo rohita*. They reported that the food content of *Labeo rohita* consisted of algae, aquatic plants, adult crustaceans (mostly shrimps) and their larvae (water-bugs, may-flies), fish (carp fingerlings and cyprinids), fish scales and some times mud and sand. They concluded that *Rohu* is mid feeder since it feed essentially on sub-surface food organisms which coincided with the findings of present study also.

Verma [5] found gut of *Catla* full of *Microcystis aeruginosa* with stray specimens of other planktons like *Diatomus*, *Nostoc* and certain diatoms. Khumar and Siddiqui [2] observed copepods as the main food (57.3%) and some diatoms only (4.4%) in *Catla catla* while during the present study the diatoms constituted the main food of *Catla* followed by copepods. *Catla* was not observed in any catch at Kishore Sagar Lake which may be attributed to lack of its preferred food or absence of proper stocking of the seed of the fish.

Natarajan and Jhingran [7] reported that *Catla* feeds to a great extent on crustaceans followed by rotifers, insects, protozoans, algae and plants. They have stated that the dominant occurrence of the zooplankton represented by copepoda, cladocera, rotifera and protozoa as well as phytoplankton represented by diatoms namely, *Melosira*, *Cyclotella*, *Fragilaria*, *Synedra*, *Cocconeis*, *Gyrosigma*, *Pinnularia*, *Navicula*, *Cymbella* and *Amphora*, chlorophyceae, myxophyceae and xanthophyceae strongly indicate the surface feeding habit of the fish which was also observed during the present investigation. They have also concluded that while primarily a surface feeder, the animal has bottom browsing habit. The fact is supported by the presence of some percentage of detritus in the gut of *Catla* mingled with sand and mud during the present investigation. Mukerjee et al. [8] also held that fishes living at surface, feed on crustaceans and algae, whereas the fishes which feed on rotten plants, sand and mud are bottom feeders.

Das and Moitra [4] observed desmids (*Closterium*, *Cosmarium*) as main food of *Catla* followed by diatoms (*Cyclotella*, *Nitzschia*, *Synedra*), algae, rotifers and crustaceans.

V. CONCLUSION

During the present study it was observed that in both habitats all the three fish species were feed on almost similar types of food organisms and preferred diatoms as a major

component of their diet. Diatoms may act as major food even for bottom feeder fish in distinct environmental conditions.

Fig. 6.1 Relative occurrence of various food items in the guts of *Catla catla* at Jawahar Sagar Lake

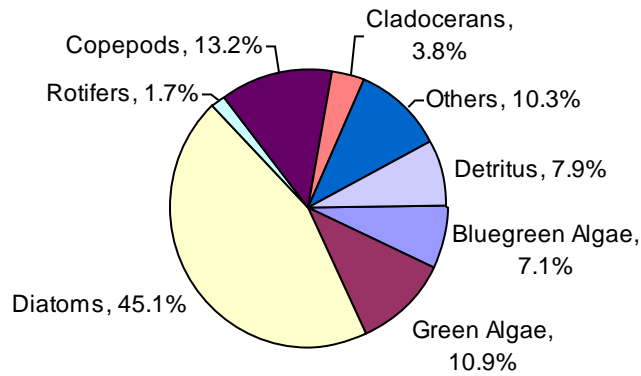


Fig. 6.2 Relative occurrence of various food items in the guts of *Labeo rohita* at Jawahar Sagar Lake

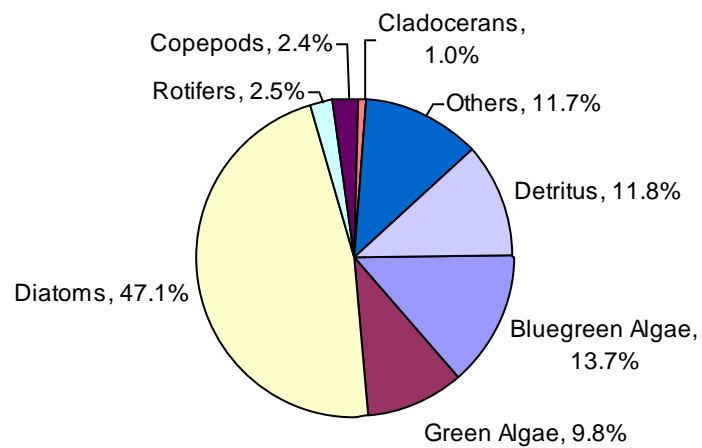


Fig. 6.3 Relative occurrence of various food items in the guts of *Labeo calbasu* at Jawahar Sagar Lake

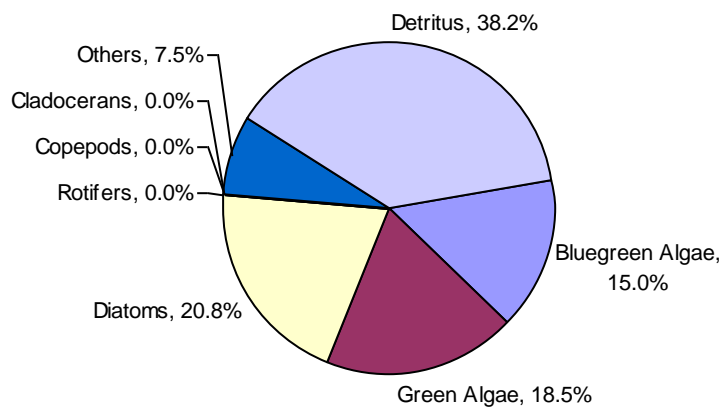


Fig.6.4 Relative occurrence of various food items in the guts of *Labeo rohita* at Kishore Sagar Lake

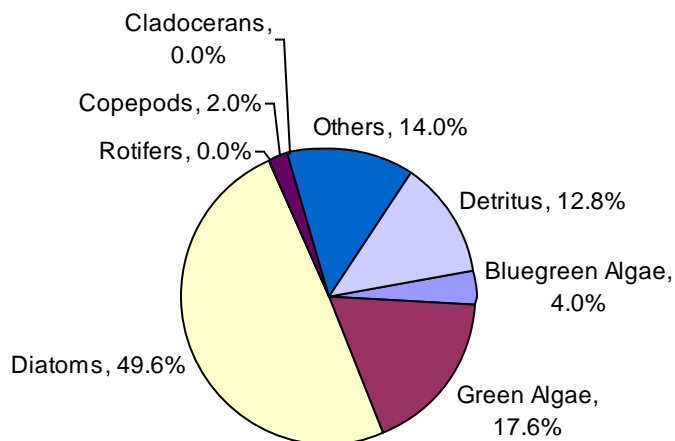
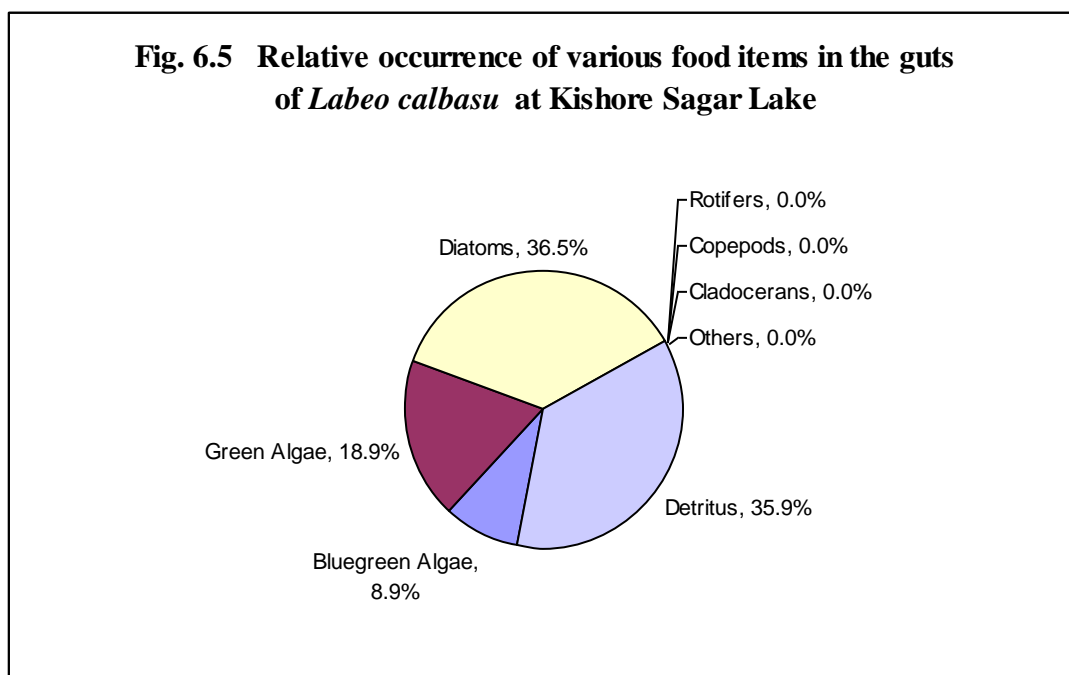


Fig. 6.5 Relative occurrence of various food items in the guts of *Labeo calbasu* at Kishore Sagar Lake



VI. REFERENCES

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