Nature Environment and Pollution Technology
An International Quarterly Scientific Journal

Vol. 8	No. 3	pp. 579-584	2009

Original Research Paper

Observations and Analysis of the Gut Contents of Six Species of Edible Fishes of Motijheel Lake, Motihari, Bihar

Goutam Ranjan, Pramod Kumar Kushwaha and Lal Babu Prasad Yadav
Department of Zoology, T.R.M. Campus, Tribhuwan University, Birganj, Nepal

Key Words:
Edible fishes
Feeding habits
Gut Contents
Motijheel lake

ABSTRACT

Observations on the gut contents of six species of edible fishes of Motijheel, Motihari were made at different intervals from January 2005 to December 2006. The results show that fishes feed on a particular type of food available in different zones of the water body. On the basis of food nature, the studied fishes may be grouped as herbivorous, carnivorous and omnivorous. Similarly, on the basis of feeding habits some fishes are found to be surface feeder, some mid feeder, and others as bottom feeder. In the present study special emphasis has been given on the nature of food contents examined in the gut of the studied fishes.

INTRODUCTION

The Motijheel lake, is a natural and perennial lake, situated in the heart of Motihari town, the district headquarters of East Champaran, Bihar. The total area of the lake is 80 hectare. It is about 3.5 km long and 250 to 300 m wide. The seasonal depth of the lake varies from 10 ft to 5 ft during rainy and summer season respectively. During rainy season water level may go up to 12 ft due to flood water and the water coming from surrounding areas. The excess water overflows in the Dhanauti river towards east, thus, saving the town from flood. Most of the drains of the town fall into the lake. The garbage of the town is also thrown into the lake.

In the aquaculture research, there is a prime need of knowledge of nutrition. In addition, the pisciculture needs a thorough knowledge of food and feeding habits of culturable fishes. On the basis of food and feeding habits, fishes may be herbivorous, carnivorous or omnivorous. On the other hand, some are plankton feeder, feeding on zoo and phytoplankton. The zooplankton include protozoans, microcrustaceans, microinvertebrates, larvae and eggs of various animals. Among the large animals consumed by fishes are, the annelids, snails, mussels, crustaceans, insects and their larvae, smaller fishes and even frogs and tadpoles. The plant material includes unicellular to multi-cellular, filamentous algae and the delicate parts of higher aquatic plants. Sand or mud is also taken in small quantities by several species of fishes along with other items of food. Nikol'sky (1963) divided natural food of fishes into following four categories.

1. Main or basic food - the natural food of fishes comprising main part of the gut contents.
2. Occasional or secondary food - taken by the fishes in small quantities, when available.
3. Incidental food - rarely enters the gut along with other items.
4. Emergency or obligatory food - it is ingested in the absence of basic food.

Khan (1934) and Das & Moitra (1955) have classified the fishes into three categories on the basis of feeding behaviour in occupied areas of their water bodies - 1. Surface feeder (*Catla catla*), 2. Mid or column feeder (*Labeo rohita, Labeo bata*), 3. Bottom feeder (*Cirrhina mrigala, Cirrhina reba, Labeo calbasu*).

Studies on this lake have been made in the past by various workers, especially on its physico-chemical characteristics, phytoplanktonic and zooplanktonic studies, fish fauna, primary productivity, etc. Studies on the feeding behaviour of the fishes of the present lake have recently been made earlier by Haque (2000) and Singh (2002), but the gut contents of the fishes in this lake remain untouched. Considering its importance, the present study was undertaken to observe and analyse the gut contents of the fishes.

MATERIALS AND METHODS

During the study period (2005-2006), the following six species of edible fishes were selected for the study of gut contents, 1. *Labeo rohita,* 2. *Catla catla,* 3. *Cirrhina mrigala,* 4. *Wallago attu, 5. Heteropneustes fossilis* and 6. *Channa punctatus.*

The fishes were collected from the lake at different intervals with the help of local fishermen using different types of fishing gears. The abdomen of each fish was dissected and the alimentary canal was taken out and treated with 10% formalin. The gut was opened and its contents were washed with water into petri dish. The gut contents containing the plant and animal materials were identified with the help of standard literature and counted under microscope. The percentage composition of gut contents was calculated as per the methods of Hynes (1950).

RESULTS

Average percentage of gut contents of studied fishes during 2005-2006 is given in Table 1, and the observations and analysis of food contents are summarised below.

***Labeo rohita*:** Both herbivorous and carnivorous foods were recorded in 2005. The herbivorous diet included unicellular to multicellular algae and aquatic weeds, while carnivorous diet was dominated by planktonic rotifers, crustaceans, insects and their larvae. Miscellaneous food was also observed. The algae were in very less quantity. The major share was occupied by aquatic weeds (about 55.5% of the total gut contents). The percentage of herbivorous and carnivorous food was observed to be 75.2% and 22.0% respectively along with miscellaneous food (about 2.8%).

Traces of unicellular to multicellular algae and large quantity of aquatic weeds were recorded during the study year 2006. In addition, the normal quantity of planktonic rotifers and crustaceans, and insects and their larvae were also noticed. Large amount of vegetable debris and mud was also present (15.5%). The overall percentage of herbivorous, carnivorous and miscellaneous food was 74.2%, 9.1% and 1.2% respectively.

***Catla catla*:** Both herbivorous and carnivorous foods were reported during 2005. The herbivorous food included unicellular and multicellular algae and aquatic weeds. The carnivorous food reported was planktonic rotifers and crustaceans. The percentage of herbivorous, carnivorous and miscellaneous food was 59.9%, 39.1% and 1.0% respectively.

The observed herbivorous as well as carnivorous food items in 2006 were somewhat similar to those as observed in 2005. The percentage of herbivorous and carnivorous food of total gut contents was 62.2% and 36.6% respectively, while miscellaneous food was 1.3% only.

***Cirrhina mrigala*:** Only herbivorous diet was observed consisting of unicellular to multicellular algae, aquatic weeds, and little amount of vegetable debris and mud in 2005. The total herbivorous food observed was 93.4% vegetable debris, 5.8% mud and 0.8% miscellaneous food particles.

In the year 2006 only herbivorous food was observed like in 2005. Herbivorous food shared most

of the total food contents (about 83.4%) along with vegetable debris (15.4%). The percentage of miscellaneous food was 1.2% only.

***Wallago attu*:** Only carnivorous food was recorded in the gut of this fish in 2006. The percentage of food observed was 99.0 % which included planktonic crustaceans, rotifers, insects and their larvae and small fishes. In addition, miscellaneous food particles (1.0%) were also present.

In the year 2006 only carnivorous food was noticed (99.2%). The quality of food was almost similar to as recognised in 2005.

***Heteropneustes fossilis*:** Both herbivorous and carnivorous foods were recorded in 2005. The herbivorous food was dominated by unicellular to multicellular algae and aquatic weeds with their percentage as 9.7%. The carnivorous food was 88.2%, which included planktonic crustaceans, rotifers, insects and their larvae, small fishes and molluscans, while percentage of miscellaneous food was 2.1%.

Both herbivorous and carnivorous food particles were recorded in 2006, which were almost similar to 2005. The percentage of herbivorous, carnivorous and miscellaneous food included 9.4%, 89.8% and 1.0% respectively.

***Channa punctatus*:** Only carnivorous food was observed, dominated by planktonic rotifers, crustaceans, insects and their larvae, molluscans, shrimps, small fishes including larvae together with fish fins and scales in 2005 . The percentage of total food particles was 99.1%, while miscellaneous food particles were 0.9% only.

In the year 2006 only carnivorous food particles were recorded. The percentage of carnivorous food recorded in 2006 was almost similar to 2005 (about 97.7%). The miscellaneous food observed was 2.3% only.

DISCUSSION

Investigations carried out on the gut contents of six edible fishes reveal that the fishes in different zones do not have a particular feeding habit. The percentage of herbivorous food in the gut contents of *Labeo rohita* was 75.2% and 74.2% and that of *Catla catla* was 59.9% and 62.2% in both the years of investigations (2005 and 2006). In addition, the percentage of carnivorous food material in *C. catla* (39.1% and 36.6%) was higher in comparison to that of *L. rohita* (22.0% and 9.1%). The above findings reveal that the presence of carnivorous food in both the fishes could not be regarded as accidental. Hence, these may be considered as omnivorous. Similar findings have also been made by Singh & Singh (1984).

In addition to herbivorous and carnivorous food, a little amount of vegetable debris and mud (15.5%) was also recorded in 2006 in *L. rohita.* But *C. catla* remain devoid of vegetable debris and mud in its gut contents. Both these fishes may be regarded as surface feeder as they feed on algae, planktonic rotifers, crustaceans, insects and their larvae together with aquatic weeds. However, Mookherjee & Das (1945) and Das & Moitra (1955) have classified *C. catla* as surface feeder and *L. rohita* as mid feeder due to their feeding behaviour where vegetable debris and mud contents were observed in their gut (Singh & Singh 1984).

In the gut contents of *Cirrhina mrigala,* unicellular to multicellular algae and aquatic weeds were observed mostly but a poor amount of vegetable debris and mud was also noticed. It is considered as bottom feeder. Singh & Singh (1984) have reported the similar findings. Though, it has been classified as omnivorous, no trace of carnivorous food was observed in the present investigation.

Table 1: Average percentage of gut contents of studied fishes during 2005-2006.

Gut contents	*Labeo rohita*		*Catla catla*		*Cirrhina mrigala*		*Wallago attu*		*Heteropn-eustes fossilis*		*Channa punctatus*	
	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006
1. Unicellular algae a. *Chlorella* sps. b. *Chlamydomonas* sps. c. Diatoms sps. d. Desmids sps. and others	9.5	4.9	23.8	21.6	22.5	11.2	-	-	2.8	3.2	-	-
2. Multicellular filamentous algae a. *Nostoc* sps. b. *Oscillatoria* sps. c. *Zygnema* sps. d. *Oedogonium* sps. e. *Spirogyra* sps. f. *Ulothrix* sps. and others	10.2	9.2	13.5	23.8	25.2	10.4	-	-	3.4	3.6	-	-
3. Aquatic Weeds a. *Hydrilla* sps. b. *Vallisneria* sps. c. *Potamogeton* sps. d. *Ceratophyllum* sps. e. *Ranunculus* sps. and others	55.5	60.1	22.6	16.8	45.7	61.8	-	-	3.5	2.6	-	-
4. Rotifers a. *Brachionus* sps. b. *Platyias* sps. c. *Asplanchna* sps. d. *Keratella* sps. and others	7.9	2.8	6.7	6.5	-	-	10.2	9.6	5.4	9.4	3.2	6.8
5. Crustaceans a. *Palaemon* sps. b. *Stenocypris* sps. c. *Cyclops* sps. d. *Mesocyclops* sps. e. *Diaptomus* sps. f. Neo-diaptomus sps. g. *Nauplius* sps and Others	11.2	5.1	32.4	30.1	-	-	25.9	26.4	3.6	5.8	22.2	23.2
6. Insects and their larvae a. *Chironomus* sps. b. *Corixa* sps. c. *Nepa* d. Nymph of dragonfly e. Nymph of mayfly f. Nymph of damselfly g. Larva of mosquito h. Coelopteran larva and others	2.9	1.2	-	-	-	-	15.7	16.4	22.4	18.4	35.8	36.4

Table cont...

Table cont...

7. Fishes and their larvae	-	-	-	-	-	-	47.2	46.8	54.2	56.2	18.5	16.1
a. *Glossogobius* sps.												
b. *Puntius* sps.												
c. *Oxygaster* sps.												
d. *Channa* sps.												
e. *Cirrhina* sps.												
f. *Botia* sps.												
8. Molluscs	-	-	-	-	-	-	-	-	2.6	-	4.8	4.6
a. *Pila* sps.												
b. *Lymnaea* sps.												
9. Shrimps												
a. *Daphnia* sps.												
b. *Apus* sps.												
c. *Cyprinus* sps.												
10. Fish fins and scales	-	-	-	-	-	-	-	-	-	-	8.2	4.8
11.Vegetable debris and mud	-	15.5	-	-	5.8	15.4	-	-	-	-	-	-
a. Potato												
b. Onion												
c. Tomato												
d. Ladies finger												
e. Cauliflower												
f. Brinjal etc.												
12. Miscellaneous	2.8	1.2	1.0	1.3	0.8	1.2	1.0	0.8	2.1	1.0	0.9	2.3

Wallago attu showed planktonic crustaceans, rotifers, insects and their larvae, and debris of fishes in its gut contents. It can be regarded as carnivorous in feeding habit. Similar findings have also been observed Srivastava et al. (2000) and Singh & Singh (1984). It is said to be mid feeder (Mishra 1953).

In the gut contents of *Heteropneustes fossilis,* both herbivorous and carnivorous food debris were noticed, but in the gut of *Channa punctatus* no trace of herbivorous food was observed. Thus, *H. fossilis* may be considered as omnivorous fish, and *C. punctatus* as carnivorous. Both these fishes are considered as bottom feeder.

Thus, on the basis of the present study and observations made on six edible fishes of Motijheel, it may be concluded that the lake is best suited for omnivorous fishes and least suited for herbivorous fishes.

REFERENCES

Das, S.M. and Moitra, S.K. 1955. Studies on the food of common fishes of U.P. India I. The surface feeders, the mid feeders and the bottom feeders. Proc. Nat. Acad. Sci. India, 25(B) (1&2):1-6.

Haque, S.A. 2000. The biometry (age, growth and length weight relationship) food and feeding behaviour and breeding and development of the fish *Mystus vittatus* (Bloch) in East Champaran, Ph.D. Thesis B.R.A.B.U. Muzaffarpur.

Hynes, H.B.N. 1950. The food of freshwater stickle lakes with a review of the methods used in the studies of the food and fishes. J. Anim. Ecol., 19: 36-58.

Khan, H. 1934. Habits and habitats of food fish of Punjab. J.Bombay. Nat. Hist. Soc., 37: 655-668.

Mishra, R.N. 1953. On the gut contents of *Labeo rohita* (Ham.), *Cirrhina mrigala* (Ham.), *Catla catla* (Ham.), Proc. 40th Ind. Sci. Congr., Abs. 210.

Mookherjee, H.K. and Das, B.K. 1945. Gut of carnivorous and herbivorous fishes in relation to the food at different stages of their life. Proc. 32nd. Indian Sci.Congr., Abs. 32.

Nikol'sky, G.V. 1963. The Ecology of Fishes. Academic Press, London, New York, 352 pp.

Singh, U.N. and Singh, D.K. 1984. Studies on ecological relationship and effects of effluents of sugar mill on fish fauna of Motipur (Muzaffarpur), Ph.D. Thesis, B.U.

Srivastava, S., Rao, K.S. and Sebastion, S. 2000. Studies on the food and feeding inter-relationship of *Mystus seenghala* with reference to growth from Kshipra river, Ujjain. Indian. J. Environ. and Ecoplan. 3(3): 307-311.

Singh, K.M. 2002. Studies on the age and growth of *Channa marulius* (Ham.) found in the lakes of East Champaran Distt. with special reference to its food and feeding habits. Ph.D. Thesis, B.R.A.B.U. Muzaffarpur.