Study of comparative anatomy of gill rakers and digestive system of some fresh water fishes in relation to their food and feeding habits.

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Abstract:

As far as number of species concern the fish form most dominating group among vertebrates and they have adapted many nutritional habits. Fishes shows many modifications according to their feeding habits. Present study is an attempt to observe the gill rakers , position of mouth and length of digestive system of some freshwater fishes *Catla catla, Cirrhinus mrigala, Channa orientalis*, feeding habits of fishes are closely related to their Gill rakers mouth position and gut length. Depending on their feedig habits these fishes are classified as herbivorous carnivorous and omnivorous. The Gill rakers are filamentous in *Catla catla*, pointed in *Channa orientalis* where as short and stumpy in *Cirhhinus mrigala* .The mouth position of herbivorous fishes is terminal, in carnivorous it is sub terminal and in omnivorous inferior. The gut length of herbivorous fishes is 2-3 times bigger than its length, it is very short in carnivorous fishes and moderate in omnivorous fishes.

Introduction:

Fishes are the rich source of protein, they contains minerals such as calcium, iron, zinc and vitamin A especially retinol. It is ready available, inexpensive because it is cheaper than meat and provide benificial fats that contributes to healthy food. Omega 3 fatty acid appears to have passive effects on heart rhythm. Bhuiyan et al., (2006) observed like all organisms fishes require energy to fuel their body machinery and tue processes including growth , metabolism and reproduction. Hynes (1950) describe that foof and feeding habits of fishes vary with the day, season, size of fish, various ecological factors and different food substances present in the water body. The importance of food in daily life of a fish is reflected in the form of mouth, jaws, dentition, shape and size of gill rakers etc and therefore the difference occur in their feeding habits (Dasgupta, 2000).According to Miller and Hartly (1996) food habits of fishes could be related to its structural morphology, the way it capture food and how it digests it.

Keast and Webb (1966) described mouth structure is related to the feeding type and habitat of fish and is highly variable between fish species and variations in mouth structure may partly explain the evolutionary success of fish. Sinha (1986) noted that the adaptations of the buccal cavity and certain other morphological features of the mouth are greatly influenced by ecology, ethology of the food and feeding regimes of the species. Abbas (2010) reported that the position of mouth provide clue of eating habits of fishes. Munshi, et al., (1984) reported gill rakers of fishes differs considerably according to the food and feeding habits of type fishes. Yashpal, et al.,(2009) described buccal cavity constitute an important element in the organization of the alimentary tract, it is concerned with seizure and selection of food and rejection of undesirable items ingested by fish. According to Deshmukh, et al., (2015) fish digestive tract shows remarkable difference in their morphology and function due to variations in their feeding habits, food and habits. Diet is a strong predictor of intestine length at both

intra and interspecific scales indicating that fish adjust their phenotype to balance nutritional needs against energetic cost (Wagner, et al., 2009).

Materials and Methods:

Specimens for the present study were brought from Kaigaon Toka region of Aurangabad. Gills were removed from chambers and washed under tap water and further observed under dissecting microscope. Total number of gill rakers and teeth are counted. Total length of fish was measured from tip of snout to the end of caudal fin and gut length was measured by dissecting the fish, uncoiling the intestine from oesophagus to anus. Relative length of gut is measured as a ratio of total length to gut length.

Result:

In the present study it was observed that the mouth position of *Catla catla* is upturned , it is wide, upper lip thin while the lower lip is thick. The gill rakers in *Catla catla* are thin, long fine. They project from the branchial arch and involved with suspensions feeding on tiny prey.Gill opening is wide.Total legth of *Catla catla* varried from 8.0-11.0cm to RLG 4.81-4.86cm.

In the present study it was observed that the mouth structure of *Cirrhinus mrigala* is terminal in position. In *Cirrhinus mrigala* gill rakers are present on the pharyngeal side of the gill arches. Gill rakers are flattened, triangular, broad at the base and tapering toward the apex. It is curved on the head region. Teeth like projections are observed at the inner surface of the gill rakers. Inner margin of the gill rakers appears to be sickle shaped while outer margin is rounded in appearance. Gill rakers in *Cirrhinus mrigala* is small, villiform structure arranged in such away that they prevent everything except water. The RLG in *Cirrhinus mrigala* varried from 10.90-10.5 for the total length 11.0-14.0.

In the present study it was found that the mouth structure of *Channa orientalis* is terminal while gill rakers of *Channa orientalis* are short, hard and pointed structure. These gill rakers are flap like structure, the height of gill rakers shows gradual decline at dorsal and ventral end. Four pairs of gill arches located on either side of the pharynx .Gill arches support the gill rakers on pharyngeal side. Gill rakers bears teeth like projections which help to prevent the large prey from scape. The RLG in *Channa orientalis* varried from 0.86- 0.97 for the total length 8.0-10.0.

Discussion:

According to Panday and Shukla (2015) there is a remarkable correlation between the

structure of gill rakers and feeding habits of fishes, the filtering efficiency increases considerably from carnivorous to omnivorous fishes and is maximum in herbivorous fish species. The position and size of the mouth shows a close relationship to the location and size of food items, and the relative size of the mouth can be used to determine the size of food particles ingested (Hepher, 1988). Particles which are too small may not be detected or captured easily by the fish, while those which are too large may be too difficult to ingest quickly or whole (Lovell, 1989). Moreover, loss of nutrients from large and small food particles after soaking and softening, inevitably lead to wastage. For that mouth size appears to be a limiting factor in feeding with both live and artificial diets (Hyatt, 1979).

In the present study it was observed that the mouth position of *Catla catla i*s upturned , it is wide, upper lip thin while the lower lip is thick. Similar results were obtained by S.S.Khanna in (2013).

The intestinal length of *Catla catla* was longer than that of the body length because it mainly subsists on plant food like algae, rotifers, crustaceans, plant matter. The total length shows positive corelation with alimentary canal length of *Catla catla.* Similar results were found by Dasgupta (1996) who observed linear relationship between total length and alimentary canal length of *Catla catla.* Nath and Moitra (2014) studied alimentary tract of *Catla catla* and found the relative length of gut as 3.4. Similarly Dasgupta (2004) worked on relative length of gut of some fishes of West Bengal ,the gill rakers in *Catla catla* are thin, long fine.relation to food and feeding habit and reported that *Catla catla,* planktivorous fish having value of relative gut length 6.76.

In the present study it was observed that the mouth position of *Channa orientalis* is terminal ,similar observations were reported by Rehman M.M et al., (2012).

It is found that the gill rakers of *Channa orientalis* are sharp, pointed teeth like structures that prevent the escape of food materials. Similarly Chaudhary.,et al (2014) examine that the gill rakers of *Channa punctatus* was modified into pointed teeth like rasping organs. Ashraf Abbas (2010) reported that the fish that consume large prey may have gill rakers that are few in number and small but rough prominence or denticles that aid in holding and swallowing prey.Das and Moitra (1955) belived that the gill rakers ,pharyngeal teeth and other teeth patches are responsible for sieving ,crushing and masticating food in carnivoros and omnivores.Yadav and Singh (2013) suggested gill rakers diminish in number and size ,and become spinose to obstruct the escape of prey and this type of structure help the fishes in scrapping the food material.

Result shows that the length of alimentary canal is smaller than its body length, varried from 0.86- 0.97 for the total length 8.0-10.0. Similarly Dasgupta (2000) found the relative gut length value of *Channa orientalis* 1.14 ,Channa punctatus 0.69 , *Channa striatus* 0.57 and *Channa marulius* 0.82 .Chaudhary et al.,(2014) recorded standard length of *Channa punctatus* ranging from 9-24 and the length of alimentary canal ranging from 7-22 cm.

In the present study it was observed that the mouth of *Cirrhinus mrigala* is wide ,subterminal and transverse . According to Shrivastava (1971) the mouth of Cirrhinus rebe ,*Osteobrama cotio* are subterminal crecentric and protrusible where as the Sabesian .,et al (2011) noticed that the downward directed mouth tube opening is obvious an adaptation for the bottom grazing. Similarly Chawla and Tylor (2014) the subterminal and slightly protrusible mouth help the fish in extracting food from mud as well as enabling it to engulf small prey and other food particles by a quick snap. Helfman.,et al (1984) described ,mouth that opens downward ,termed sub terminal or inferior ,charecteriz fishes that feeds on algae or benthic organisms.Gill rakers of *Cirrhinus mrigala* are flattened ,triangular ,broad at the base tapering ,pointed curved head . Munshi m,et al (1984) reported gill rakers of *Cirrhinus mrigala* help to strain food particles and other material ,it also protect the Gill filaments from getting damaged.

It was observed that the length of alimentary canal of *Cirrhinus mrigala* was greater than its body length and the intestine was highly coiled around its belly.Dasgupta (2004) who reported relative length of gut value increase with increase of vegetable matter and decrease with increase of animal matter in the gut content .According to Tarun and Akin (2013) the digestive tract length increase for easy digestion of plant material.

Table 1 : Main morphological characters of mouth,gill rakers and intestine of three fish species.

Name of the Species	**Mouth type**	**Gill rakers**	**Relative length of gut**
Catla catla	Terminal	Filamentous	Longer
Cirrhinus mrigala	Inferior	Stumpy	Moderate
Channa orientalis	Subterminal	Pointed	Short

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