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Short Communication

On the food and feeding habit of an estuarine catfish (*Mystus gulio* Hamilton) in the south-west coast of Bangladesh

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Food is the main source of energy and plays an important role in determining the population levels, rate of growth and condition of fishes. Food and feeding habits of fishes have a great significance in aquaculture practice. It helps to select such species of fishes for culture which will utilize all the available potential food of the water bodies without any competition with one another but will live in association with other fishes. *Mystus gulio* (Ham.) is a native catfish of family Bagridae distributed around India to Malay Archipelago, especially estuarine and tidal waters (Jhingran, 1997). In Bangladesh, this catfish is locally known as "nuna tengra", and commonly occurring in brackishwater environment. Despite of its enormous importance in brachishwater aquaculture, the food and feeding habits of this valuable species has not been adequately studied except some observations made by Pandian (1966), Sarker *et al*. (2002), Alam *et al.* (2006a & 2006b) and Islam *et al.* (2007) on the feeding and reproductive cycle, fecundity, induced spawning, spawning behavior and larvae rearing. Other workers who worked on food and feeding habits of other fishes include these of Bhuiyan (1988), Bhuiyan & Haque (1985) and others. However, for developing culture technologies, biological studies of this species are indispensable. Therefore, this work was carried out to identify the food and feeding habits of *M. gulio* to generate the base line information for facilitating the sustainable aquaculture especially in the coastal belt of the country.

A total of 250 fishes of different size, maturity and sex groups were collected randomly from different places of Paikgacha Upazila, under Khulna district of Bangladesh during the period of September, 2005 to August, 2006. Immediately after collection the fishes were preserved in 10% formalin solution to prevent the break down of the food materials. In the laboratory, fishes were washed, cleaned and total length in mm of each fish was measured and then the qualitative and quantitative analyses of stomach contents of each fish were done by point and percentage of frequency of occurrence methods as followed by Dewan & Shaha (1979).The different food items eaten by the fishes were identified under microscope by following the keys given by Pennak (1953), Ward & Whipple (1959), Prescott (1962) and Needham & Needham (1962).
To study the gut content each stomach was analyzed separately. The stomach of individual fish was cut open and removed on to petridish with the help of very fine forceps. The percentage of occurrence of a particular food item was calculated on the basis of the following formula:

$$\text{Percentage of occurrence of a food type} = \frac{\textit{Number of gut where the food occurred}}{\textit{Total no. of gut analyzed}} \times 100$$

To apply the point's methods all the food items eaten by the species were identified. Then the volume of the stomach contents of each fish was estimated by observation and recorded on an absolute scale and points were allotted to each stomach according to the volume of its contents. In case of Index of fullness methods, the index of fullness of the stomach was recorded irrespective of the size of the stomach of the fish using '0' for empty; '1' for one fourth full, '2' for half full, '3' for three fourth full and '4' for full stomach.

The gut contents analyses of *M. gulio* were performed by three methods namely frequency of occurrence method, points method and index of fullness method. It is well known that no single method is adequate for analysis of stomach contents of food. The total length of the fishes ranged from 40-180 mm.

The gut contents analysis of fishes from each size showed that the fish feed on a variety food items. The food types recorded are cladocerans (*Daphnia, Ceriodaphmia, Scapholebris, Diaptomus, Moina*); copepods (*Cyclops*), rotifers (*Keratella, Brachionus, Pleurotracha*), grastropods (*Physa*), insects (C*orixa, Chironomus, Notonecta, Tubifera, Lepidoptera)*, diatoms (*Synedra, Bacillaria, Fragillaria*), green algae (*Spirogyra, Closterium, Ulothrix, Cosmarium)*; prawns, small fishes and others which include unidentified items.

All these food organisms were categorized into 9 main food groups viz. cladocerans, copepods, rotifers, gastropods, insects, diatoms, green algae, prawn and

small fishes and others (semi digested unidentifiable parts of plants and animals). Amongst these food groups, insect was the most dominant food item both by percentage of total points (43.25%) and percentage of occurrence (60%).The next preferred food items were diatoms and green algae. But the percentage occurrence of diatom (55%) was found to be the most dominant, food group which was closely followed by green algae (45%). Cladocerans, copepods and rotifers were recorded only in the stomach of immature and juvenile fishes. The food group prawns and small fishes, gastropods and others were recorded rarely in the stomach of the adult fish

Table 1. Diet composition of *Mystus gulio* based on percentage of occurrence and percentage of total points.

Items	Food groups								
	Cladocerans	**Copepods**	**Rotifers**	**Gastro - pods**	**Insects**	**Diatoms**	**Green alage**	**Prawn and Small fishes**	**Others**
No. of fish in which occurred	76	94	70	12	140	112	80	7	46
Percentage of occurrence	7.2%	7.8%	5.6%	6.0%	60%	55%	45%	12.14%	8.14%
Average Points/fish	2.71	1.22	0.51	0.02	12.38	4.05	3.33	0.04	1.22
Percentage of total points	4.63%	3.05%	3.22%	0.14%	43.25%	29.63%	12.08%	2.60%	1.40%

All the food groups showed considerable monthly variations in the gut contents of the fish (Table: 2). Among all the food groups insects was found to be the most dominant food item by average points per fish in most of the months of the year. Next to insects, diatoms, green algae, cladocerans and Copepods occupied the successive position by average point per fish. Comparatively greater amount of insects was found to occur during winter and summer months whereas diatoms and green algae was found to be most dominant during autumn months in the gut contents of the fish. The food groups such as copepods and cladocerans were recorded mostly in the gut contents of immature and juvenile fishes.

Table 2. Monthly variations in the amount of food taken by *Mystus gulio* based on average index of fullness and average points per fish.

Months	Items				
	No. of fish examined	**No. of stomach with food**	**% of empty stomach**	**Av. index of fullness**	**Av. Points per fish**
September	15	15	0	3.0	56.00
October	13	10	23.07	1.60	33.33
November	18	6	11.11	2.70	14.30
December	10	8	20.00	1.60	19.34
January	13	1	23.07	2.33	33.38
February	27	6	40.74	3.8	46.67
March	19	8	47.36	2.11	15.30
April	25	14	84.00	1.75	26.39
May	50	12	76.00	1.70	23.39
June	47	14	70.20	1.20	8.39
July	8	6	25.00	2.58	28.29
August	5	4	20.00	1.60	4.60

The results of the study of the seasonal feeding patterns of fishes have been presented in table 2. It is observed that during the pre-spawning period of April to May the fish minimized its feeding rate, and later, in August again a marked rise in the feeding rate was observed. An inverse relationship between feeding and breeding cycles has been reported by many workers (Homans & Vladykov, 1954; Pandian, 1966). Pantulu (1961) also reported a similar observation from his studies on the feeding intensity of *M. gulio* in the Hooghly estuary of India. He mentioned that, about 50-100% of the investigated *M. gulio* had 'empty'

stomachs during the pre-spawning months to May and June respectively. After spawning in July, the fish fed intensively, more than 60% of the investigated fishes had either full or 'gorged' stomach. This high feeding intensity steadily decreased during the subsequent months, about 30% of the investigated fishes had hardly any food in their stomachs during December~January. These findings agreed with the findings of Pandian (1966), who reported that analyses of the stomachs of the fishes collected in April revealed that more than 80% were starving, and the rest had only tracer quantities of food in the stomachs.

Reddy and Rao (1987) studied the food of *M. vittatus* and observed seasonal variation in the rate of feeding. They recorded no uniform pattern is discernible in the two years of study. However, in general, the maximum rate of active feeding is during December to February as was observed by Bhatt (1971a) in *M. vittatus* from Aligarh.

The food items in the stomach of *M. gulio* suggest that they are euryphagous (i.e. feeding on a wide range of organisms). It was also observed that *M. gulio* can be classified as an omnivorous feeder as the diet covers a wide spectrum of food ranging from various types of plankton to invertebrates and plants. The fish also exhibits an overlapping in food and feeding habits in order to avoid inter and intra specific competition for available food. This is an important strategy for survival and an advantage over the fish species competing for a specific food item. This explains the availability of *M. gulio* all the year round. Such an eryphagous feeding behaviour is documented in many of the catfishes (David, 1963; Thomas, 1966). The determination of food habit was also reported by Mustafa *et al*. (1980) for *Nandus nandus*, Bisht and Das (1981) for *Puntius ticto, Cyprinus carpio, Tor tor, Nemaechilus rupicola* and *Channa gachua.* Bhuiyan and Rahman (1983) for *Channa gachua*, Reddy & Rao (1987) for *M. vittatus*, Khan e*t. al.* (1988) for *M. nemurus*; Bais *et al*. (1994) for *Channa punctatus*, Dutta (1994) for *Channa punctatus* and Ali *et. al*. (2003) for Mastacembelidae. They categorized these fishes either as carnivore or omnivore. From the above findings it can be concluded that the different food groups varied monthly in their abundance in the gut contents of the fish where it showed some seasonal preference to certain food groups. The adult fish preferred to feed insects and crustaceans where the immature and juvenile fish preferred to feed on diatoms, copepods, cladocerans and rotifers.

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