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Food and feeding habits of striped spiny eel, *Macrognathus pancalus* (Hamilton)

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ABSTRACT

The striped spiny eel, *Macrognathus pancalus,* is highly predacious in nature. Feeding intensity with respect to season, maturity stages and food items of this fish were investigated. There was no major shift from the carnivorous orientation of the fish during its various life stages. Aquatic insects, crustaceans, annelids, small forage fish were the main food of this fish. Feeding intensity was high in early maturity and post spawning stages and was relatively lower in the specimens with ripe gonads. Adults consumed more food in autumn than in winter and rainy season. Food intake in younger specimens was greater during monsoon and post monsoon seasons. Well developed dentition, strongly built stomach and short intestine besides other characteristics are related to its dietary habit.

Introduction

The striped spiny eel, *Macrognathus pancalus* is an economically important inland water fish, which is quite palatable as a table fish. It is the most beautiful species among the spiny eels. The smaller sized fish has often been placed in aquaria while large size fish are used as food. Demand for the spiny eel almost exceeds the supply, particularly in India and neighboring countries such as Pakistan, Sri Lanka and Bangladesh. There is little information on the biology of spiny eel despite its palatability and consumer appeal. Karim and Hossain (1972) studied the sexual maturity and fecundity of *M.pancalus*. Srivastava (1975) studied the unusual development of the caudal fin of this species. Sikder and Das (1980) carried out works on skin structure and Mittal *et al.* (1994) on histochemical analysis of glycoproteins. Dutta (1989), Serajuddin and Mustafa (1994) and Serajuudin *et al.* (1998) investigated the food and feeding habits of a closely related species, *Mastacembelus armatus*. Keeping in mind the paucity of information on the biology, the present study focuses the food and feeding habits of the species.

Materials and methods

Monthly samples of the fish were obtained from January to December 2001, with each sample comprising about 20-30 fish. The fish were caught from Ganga river, canals and ponds at Bhadohi by using cast and drag nets and brought to the laboratory packed in ice. The time of collection was fixed during

the early hours of the morning to minimize the possible effects of digestion of food items.

Total length of each fish was measured to the nearest 0.1mm. The fish (size range 1-20 cm) were sexed and divided into four length groups on the basis of their size. Gonadal condition was examined and the stage of maturation of the samples were determined following the scheme of classification used by Qayyum and Qasim (1964) for *Ophiocephalus punctatus*.

The intensity of feeding was studied by determining the gastrosomatic index (gut weight expressed as percentage of body weight) using the method suggested by Khan *et al*. (1988). For the analysis of gut contents, methods like the frequency of occurrence, numerical counts and gravimetric method were applied as summarized by Lagler (1956). For qualitative analysis, the prey items were identified and categorized according to their systematic status.

Results and discussion

The shape of the body and mouth, structure of the buccopharynx, short and strong dentition in the mouth, absence of gill rakers, well developed and strongly built stomach, short intestine and dominance of animals and their body parts in the gut contents indicate the carnivorous and predatory habits of *M. pancalus*. The percentage of the body width with respect to the total body length varied between 10.30-15.15 with a mean of 13.33, resulting in a slender body that indicated an agile life style, suited to its predatory nature. Body width and body length were found to have a significant correlation (0.8987). The structure of the alimentary canal and external morphology are greatly influenced by ecology of the food and feeding regimes (Thomas, 1962; Sinha, 1968).

The organs concerned with feeding and digestion are modified according to its feeding behaviour. The mouth is sub-terminal, equipped with fine but firm jaws and forming an inverted 'y' shaped opening bordered by long and muscular upper jaw and short, triangular, less muscular lower jaw. A ventral shallow groove in the upper jaw leads to the mouth, which helps in directing the food materials towards the mouth. Mouth is pointed, which facilitate the probing of the food materials that are concealed under submerged objects and bottom deposits.

There are numerous teeth on both the jaws. They are small, strong, sharp, pointed and villiform. Nature of dentition suggests that they help in grasping and holding the active prey and checking it from its escape. The gill rakers are absent and in place of it there are backwardly directed horny notches, which play an important role in immobilizing the ingested food items. Buccopharyngeal cavity is narrow and dorsoventrally compressed. Two pairs of oval patches of superior and inferior pharyngeal teeth directed towards gullet, help in pushing of the prey into the stomach. Ingested organisms are generally swallowed. The mouth gap and buccopharyngeal cavity are wide enough to support intake of small to medium sized forage items. Oesophagus is long, tubular and broad anteriorly and narrows posteriorly. The elongated stomach is well developed with thick muscular wall and a pair of appendix, epiloicae. The thick muscular wall allows the stomach to perform its mechanical function of macerating the food in addition to working as a significant site for digestion. Stomach opens into

straight and thick walled intestine comprising of duodenum and ileum.

Relative gut index (RGI)

The values of relative gut indices of different age groups of *M. pancalus* are given in Fig. 1. The gut length/total body length ratio in the entire size range of the fish inclusive of both juveniles and adults varied from 1:0.48 to 1:0.66 (S.E. 0.52±0.022). The absence of appreciable differences in this index in juveniles and adult fish indicated that growth does not involve any major shift in the basically carnivorous habits of this fish. The relationship between gut length and body length can be expressed by the equation:

Log gut length= -0.2961+1.0534 log body length.

There existed a significant correlation between gut length and total body length ('r'= 0.91324; $p < 0.01$).

Feeding intensity in relation to seasons and maturity stages

The gastrosomatic index of both sexes of different age groups of *M. pancalus* for different months is given in Fig. 2. The feeding intensity of young individuals (1-5cm) was high during monsoon and post monsoon seasons (August-September) than in winter (November-January). Individuals in the size range 6-10 cm consumed food at uniform rate during all months except October-December. The adult specimens (11-20 cm) were found to be feeding voraciously during March-June. However, they consumed a lesser amount of food during monsoon (July-September) and winter (November-January). While pronounced feeding activity in the younger individuals of size range 1-5 cm of both sexes was observed in October, it was extremely low in December. The highest values of GSI for the adult size groups of 11-15 cm and 16-20 cm were observed in June and April respectively while lowest during August in both groups.

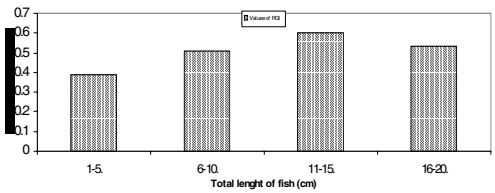

Fig. 1. Relative gut index (RGI) of *M. pancalus* in different length groups

The values of feeding intensity of males and females of *M. pancalus* at different stages of sexual maturity are given in Table 1. Maximum feeding intensity was observed in both sexes in the maturing stage (III). Presence of medium full guts in all months (Table 1) in the present study suggested that feeding was never discontinued and even during the spawning seasons, there was no cessation of feeding. Khan *et al.* (1988) and Serajuddin *et al.* (1998) also reported the same type of feeding intensity in relation to the stage of maturity in *Mystus nemurus* and *Mastacembelus armatus* respectively. The foraging activity of this fish fluctuated with season and maturity stages. The intensity of feeding declined when fish became ripe and were ready for spawning. Working on the other species of spiny eel, *Mastacembelus armatus* similar result has also been reported by Serajuddin *et al.* (1998). The occurrence of poor feeding in other fishes coinciding with peak breeding has been reported by Jhingran (1961), Desai (1970), Bhatnagar and Karamchandani (1970), Wijeyaratne and Costa (1988), Khan *et al.* (1988), Rao and Rao (1991) and Piska *et al.* (1991). Low feeding intensity in other months may be due to the non-

TABLE 1: *Feeding intensity of* M. pancalus *in different stages of sexual maturity*

Male				Female			
Maturity stages	Empty guts (%)	Medium fullness guts (%)	Full guts (%)	Maturity stages	Empty guts (%)	Medium fullness guts (%)	Full guts (%)
I	51	29	20	I	50	35	15
II	48	30	22	II	50	30	20
III	45	13	42	III	45	15	40
IV	65	20	15	IV	60	30	10
V	40	35	25	V	45	25	30

TABLE 2: *Food items of* M. pancalus

	Food items	Numerical Count (%)	Frequency of Occurrence (%)	Gravimetric index (%)
I	Annelids			
	Earthworm	Numerous	24.5	12.00
II	Crustaceans			
	Prawn	58	43.2	75.02
	Caridina	20	15.0	02.76
	Daphnia	16	10.0	00.00
	Branchinella	05	06.8	22.39
III	Aquatic insects			
	Chaoborus	65	55.3	95.33
	Tipula	12	22.3	05.56
	Unidentified	Numerous	21.5	02.43
IV	Teleostomi			
	Esomus	09	08.7	10.67
	Unidentified	30	58.6	67.21
	Scale	35	30.6	00.89
V	Molluscs Gastropods	04	03.6	00.32
VI	Digested matter	-	28.5	25.67
VII	Aquatic vegetation	Numerous	07.8	03.25

availability of food organisms.

The food items investigated in *M. pancalus* are divided into seven broad categories (Table 2). The most preferred prey items of this fish were aquatic insects (*Chaoborus* spp.) and crustaceans (prawn) in adults, whereas young ones mainly subsisted on annelids (earthworm) and aquatic insects. Other organisms consumed by this fish were *Caridina* and minor carps depending upon the frequency of their occurrence. Aquatic vegetation and gastropods were considered as an accidental food. According to Nikolsky (1963), food items

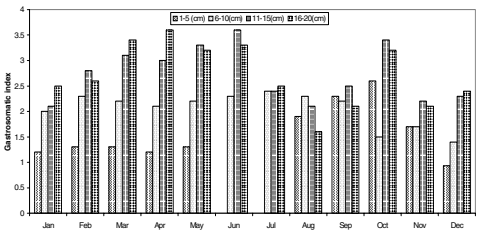

Fig. 2 . Gastrosomatic index (GSI) of *M. pancalus* in different season

of *M. pancalus* could be grouped into four categories: aquatic insects and crustaceans as basic food for adults and annelids as basic food for young individuals (Table 2). However, annelids could be considered as the secondary food for adults, while aquatic insect larvae and crustaceans for juveniles. Molluscs and aquatic vegetation together could be regarded as incidental food for both adults and juveniles. Selective feeding behaviour of this fish cannot be ruled out. Hinde (1958) pointed out that the fish spends much of its energy in selecting and capturing the prey of large size in order to get more energy. But, this fact was disputed by Cramer and Marzolf (1970). The present study indicated that the *M. pancalus* showed a stenophagism by selecting few organisms in their diet despite the presence of large number of different organisms in the habitat. Similar result was reported by Khan (1934), Das and Moitra (1955 a&b), Dutta (1989) and Serajuddin *et al.* (1998) in a closely related species *Mastacembelus armatus.*

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