Indian J. Fish., 44(3) : 295-300, Jul.-Sep., 1997

NOTE

Food spectrum and feeding intensity of *Accrossocheilus hexagonolepis* (McClelland), an enedemic rheophilic teleost of commercial importance of Assam Himalayas

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ABSTRACT

The food of *Accrossocheilus hexagonolepis* (McClelland) consists mainly of algae, unidentified vegetable matter, protozoan species, rotifers, nematodes, insects, crustaceans, unidentified animal matter, sand and detritus. Algae is the principal (20-43 %) food item (Bacillariophyceae, Chlorophyceae, Cyanophyceae, Euglenophyceae and Rhodophyceae). The gastrosomatic and stomach fullness indices of the species showed a high feeding intensity in either prespawning or post spawning period

Accrossocheilus hexagonolepis (McClelland) is a potential fishery in the rheophilic environment of the northeast Himalayan regions. The species is endemic in the eastern and northeastern Himalayas, and extends its distribution further to the southeast Asian countries (Jayaram, 1981; Menon, 1974). It is a highly priced fish both in the plain and hilly regions. Considering its availability, attainment of large size and consumer acceptance, there are prospects of culturing and breeding the same in the upper reaches as well as its propagation in foot hill plains. In the present studies, the food spectrum of the fish of different sizes collected near the Indo-Bhutan border (91° 03'E 26° 09' N) is reported.

The fish were collected every month for 3 years (1987 to 1990) from the Uttarkuchi (26° 09'N 91° 03'E) region of the Indo-Bhutan border and segregated into three groups according to length such as 50-100 mm (n=50), 100-200 mm (n=50) and 200-300 mm (n=50). Sexes could be separated in the latter two size groups. Food spectrum, gastrosomatic and stomach fullness characteristics were analysed.

The percentage of occurrence of each food item was determined after summing the total occurrence of the items (Hynes, 1950; Pillay, 1952; Kohli, 1984). The guts were removed from the specimens and preserved in 5 % formaldehyde solution after recording its sex,

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length and weight. The pereserved guts of each size group (n=50)/month were uncoiled, cleaned and gut contents were flushed out separately.

The gastrosomatic index has been calculated from the weight of the gut as a percentage oftotal body weight (Desai, 1970; Kohli, 1984). Stomach fullness index of group-2 & 3 specimens was determined by defining the stomach fullness score as cited by Kohli, 1984 and later referred by Kohli and Goswami, 1996 and Goswami and Sarma, 1996. It may be mentioned that gastrosomatic and stomach fullness index were not studied in group-1 and group-3 specimens and only group-2 specimens were included which could provide the information for both the sexes.

Specimens of the particular size group were examined in each month together with the food content in their guts and worked out the percentage of occurrence. In Table 1, the types of food and their percentage composition are shown for size group-3. Besides these there was negligible amount of algae belonging to Cyanophyceae in all sizes of A. *hexagonolepis.*

TABLE 1. *Percentage of occurrence (mean, ± standard deviation) of different families of algae in different months (200-300 mm; 50 specimens) in males and females of* A. hexagonolepis

Month	Bacillariophycea in :		Chlorophyceae in:		Euglenophyceae in:		Myxophyceae in:		Rhodophyceae in:	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
January	16.7 (±0.8)	15.5 (±1.2)	14.5 (±1.0)	14.7 (±1.0)	0.9 (±0.2)	0.8 (±0.1)	3.9 (±0.5)	4.3 (±0.5)	0.7 (±0.2)	0.8 (±0.2)
February	14.8 (±1.2)	16.6 (±0.4)	18.6 (±1.1)	13.6 (±0.6)	0.8 (±0.1)	0.9 (±0.1)	3.4 (±0.3)	4.5 (±0.5)	1.1 (±0.2)	0.9 (±0.2)
March	14.7 (±1.0)	14.6 (±0.6)	17.7 (±0.5)	15.2 (±1.1)	0.7 (±0.2)	0.9 (±0.2)	3.5 (±1.0)	3.4 (±0.5)	1.0 (±0.3)	1.1 (+0.3)
April	15.9 (±1.5)	16.5 (±1.3)	17.5 (±1.0)	15.7 (±1.4)	0.9 (±0.2)	0.8 (±0.3)	3.1 (±0.5)	3.4 (±1.0)	1.0 (±0.2)	1.0 (±0.2)
May	14.7 (±0.7)	14.9 (±0.5)	18.5 (±1.4)	19.8 (±1.2)	1.1 (±0.3)	0.9 (±0.1)	3.0 (±0.2)	3.1 (±0.5)	1.1 (0.4)	0.9 (±0.3)
June	15.6 (±1.3)	16.7 (±2.0)	18.7 (±1.6)	17.4 (±1.3)	1.1 (±0.5)	1.0 (±0.2)	4.1 (±0.2)	3.5 (±1.0)	0.8 (0.5)	0.9 (±0.1)
July	18.7 (±0.5)	15.8 (±2.1)	16.5 (±0.7)	18.5 (±1.3)	1.2 (±1.0)	1.0 (±0.5)	3.9 (±2.0)	3.5 (±1.6)	0.9 (±0.2)	0.8 (±0.2)
August	15.7 (±1.6)	16.5 (±1.2)	18.6 (±2.0)	16.1 (±2.1)	1.0 (±0.3)	1.1 (±0.4)	3.9 (±1.2)	3.4 (±0.5)	0.9 (±0.2)	1.0 (±0.1)
September	15.8 (±2.1)	14.7 (±1.7)	17.5 (±1.3)	17.6 (±2.0)	1.0 (±0.2)	0.9 (±0.2)	3.7 (±1.0)	3.4 (±1.1)	0.8 (±0.1)	1.0 (±0.2)
October	15.4 (±1.6)	14.4 (±2.1)	16.3 (±1:5)	15.5 (±1.0)	1.1 (±0.4)	0.9 (±0.5)	3.3 (±1.3)	4.4 (±2.2)	1.0 (±0.2)	1.1 (±0.3)
November	15.5 (±1.1)	16.3 (±1.0)	17.3 (±2.0)	15.4 (±1.2)	1.0 (±0.5)	1.1 (±0.2)	3.4 (±1.2)	3.5 (±1.1)	3.9 (±0.3)	3.8 (±0.1)
December	4.4 (±2.0)	13.4 (±1.2)	18.3 (±2.5)	16.3 (±1.6)	1.0 (±0.2)	1.1 (±0.3)	3.6 (±1.0)	4.3 (±1.5)	0.9 (±0.1)	1.0 (±0.3)

In the 50-100 mm group although some fry have been collected, the food habits and the contents could not be identified. In this stage algae was counted as the major food item and four families viz. Bacillariophyceae, Chlorophyceae, Euglenophyceae and Myxophyceae were identified as the predominant groups.

The fishes of the size groups 100-200 and 200-300 mm were sexually mature and the gut content were analysed for both the sexes. Basically the type of food taken was the same as that observed in juveniles (group-1).

The details of components of each food item in different size groups are given below.

Algae: The algal Species under different families identified were *Spirogyra, Ulothrix, Diatoma, Oscillatoria, Pediastrum, Euglena, Surirella, Closterium, Dinohryon, Anabeanea, Asterinella, Microcystis* and *Arthodesmus.* The percentage occurrence was 25.75, 33 and 41 in both sexes of size groups 2 and 3 respectively.

Unidentified vegetable matter *:* Roots, seeds, leaves of higher plants, macrophytic tissues, some stems of lower plants and other vegetable matter in a decaying state of digestion were found next to algae. Some of the common macrophytes like *Marsalia, Vallisneria* and *Lemna* were the frequently occurring plants. The percentage occurrence was 23.4 in group-1, 26.41 and 29.61 respectively in male and female of group-2 and 35 and 36 (male and female) in group-3.

Protozoans : Various protozoans like *Volvox, Campanella* and *Zoothamnium* were the main gut components. These items had the higher percentage in size group-1 (11.3), whereas their occurrence was less (8-9 and 4-5 %) in the other two size groups.

Rotifers : Species like *Brachionus, Chromogaster, Keratellua* and *Lecane* have been identified. Their percentage occurrence was higher in group-1 (9.1) than in groups 2 and 3 (5-6 %).

Nematodes : Nematodes are not preferred food items for A. *hexagonolepis.* Some nematodes like *Aphelenchoides, Micloaimus* and *Chronogaster* are identified as casual food items. The occurrence of nematodes in 200-300 mm size group was noticed in all the months.

Insects : Insects which occurred in all the months showed a higher percentage in size group-1 (10 %) and gradually their occurrence was significantly reduced in size groups-2 and 3 showing respectively 6-8 and 2-3 % in both sexes. Various species of Diptera (Chironomid larvae and pupae), Hemiptera *(Corixa, Micronotonecta, Notonecta),* Odoneta, Coleopetra (family Hydrophilidae, Haliplidae and Noteridae) were observed.

Crustacea *:* Various crustaceans such as copepods and caldocerans *(Cyclops, Diaptomus, Daphnia, Moina* and *Bosmina)* were found in the gut contents of A. *hexagonolepis.* Size group-1 consumed a higher percentage (9.75 %) than the other two groups (4 %).

Unidentified animal matter Various tissues, scales of fish and shell of molluscs were also found (3-22 %) particularly in July and August (20-22 %).

Sand and detritus : The occurrence of sand and detritus was insignificant as compared to the other food items.

Feeding intensity and stomach fullness conditions : Monthwise fluctuation of feeding intensity was measured by calculating the gastrosomatic index (Fig.l) and stomach fullness characteristics of the fish (Fig. 2). A comprehensive food spectrum of the species is illustrated after summing up the per cent of occurrence of each food item as shown in Fig. 3.

Information on the food and feeding habits of rheophilic fishes of northeastern Himalayas is rather meagre (Biswas, 1986, 1987; Das, 1990; Dasgupta, 1989; Nath, 1978). In juveniles of *A. hexagonolepis* (50-100 mm), algae (25.752 %) and other unidentified plant matter (23.41 %) formed the major food, whereas protozoans (11.33 %)., insects (10.08 %) and crustaceans (9.75 %) were the next preferred food items. It may be mentioned that the juvenile fish did not prefer nematodes. There was complete absence of nematodes in their gut contents during February, May, August, September and December. However, the samples collected in November showed 4 % nematodes followed by 3 % in March - April and 2 % in October. It may be concluded that only very small sized nematodes were occasionally captured by the juvenile fish. The occurrence of fragments of some animal matter in the stomach was about 3 %. Juvenile groups

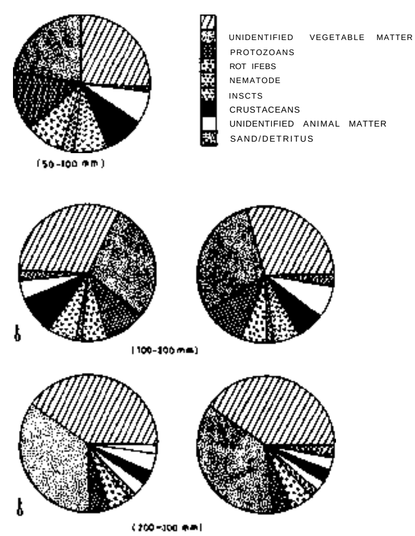
S 0 N D Months

Fig. 1. Gastrosomatic idex during different months in A. *hexagonolepis.*

Fig. 2. Stomach fullness during different months in *A. hexagonolepis*

usually did not gulp sand or detritus, however, the occasional presence of sand particles was accidental due to the high velocity of the water flow.

Medium sized *A, hexagonolepis* (size group -2) also showed a similar pattern of food preference. The occurrence of algae and other plant matter decreased gradually from April to September-October, and after that the percentage of occurrence increased until March. The turbulence of the water from April



FiS- 3- Food Spectrum of A. *hexagonolepis*

TABLE 2. *Food spectrum* of A. hexagonolepis *of different sizes. The values are the mean* ***t*** *standard deviation obtained after examining the occurrence of various food items for 3 consecutive years, during different months*

Food Items	Fish	Jan.	Feb.	Mar.	Apr.	May	Jun,	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Algae	"j	29(11.5)	30(13)	27(11.5)	29(13)	26(12)	23(13)	20(13)	17(11.5)	22(12)	27(12.5)	29(12.5)	30(12.4)
	IM	36(12)	37(11.5)	38(12.2)	34(13)	33(11.6)	32(13.2)	32(13.2)	31(12.8)	30(11.7)	31(12.2)	34(11.5)	35(13,5)
	IF	33(11.5)	35(13)	34(12.5)	33(11.5)	33(12.2)	32(12)	31(13.5)	31(12.2)	31(12.5)	30(11.8)	33(11.8)	34(12.2)
	IIM	42(13.7)	43(13)	42(13.8)	41(12.1)	48(12.2)	39(12.5)	38(14.2)	40(14.5)	41(13.2)	42(12.2)	44(1.5)	43(12.2)
	JIF	41(11.5)	45(12.2)	44(12.1)	40(11.6)	40(12.5)	38(14.2)	37(13.2)	38(12.1)	42(12)	43(15.2)	43(18.5)	43(13.5)
Unidetified plant matter	J	27(12)	25(12)	25(12)	26(14)	33(12.5)	20(12.2)	16(12.2)	20(11.5)	20(12.2)	22(12)	25(11.2)	22(10.8)
	IM	26(1.5)	22(11.2)	20(10.8)	23(12)	18(12)	22(11.5)	32(11.5)	34(11.2)	34(12.5)	37(11.2)	35(12.5)	33(13.8)
	IF	20(12.2)	21(12)	24(12)	28(12.5)	28(11.5)	26(12)	10(11.5)	8(12.2)	8(13.2)	10(11)	8(10.5)	8(11.8)
	IIM	36(11.2)	34(13.2)	39(12)	32(12.5)	35(13)	35(11.5)	33(12.8)	37(13)	38(14)	37(13)	32(14)	35(13.5)
	JIF	39(12)	38(11.5)	36(14)	35(11.5)	36(11.2)	34(13.5)	35(14.2)	38(11.8)	37(12)	39(12.2)	35(11.5)	38(11.5)
Protozoans	J	9(11)	13(11)	(1112)	7(12)	10(11.5)	16(11.5)	12(12)	14(12.2)	15(11.8)	8(11.5)	13(12)	8(12)
	IM	8(11)	10(12.2)	10(12.2)	9(11.2)	12(12)	10(10.5)	10(12)	8(11.2)	9(12.5)	10(10.5)	8(11.2)	8(11.6)
	IF	9(12)	10(11)	13(11.5)	8(11.4)	10(11.5)	9(11.5)	9(11.2)	7(11.5)	10(10.5)	8(11)	7(11.5)	6(12.2)
	IIM	6(11.2)	5(11.8)	2(10.5)	8(11.5)	5(10.5)	6(11)	8(12.2)	7(11.2)	5(11.2)	4(10.5)	5(11.5)	4(11.2)
	JIF	4(11)	3(11)	4(11.2)	6(10.5)	6(12,2)	6(11.5)	6(11.5)	6(12.2)	6(10.5)	2(11.2)	5(10.5)	3(10.5)
Rotifers	J	7(11)	9(11.5)	12(10.5)	10(12.0	9(12)	7(11)	11(11.2)	8(12)	11(11)	9(12)	8(11)	9(11.5)
	IM	6(11.5)	7(11)	8(11)	8(11)	9(11.5)	7(10.5)	6(11)	6(11)	5(10.5)	7(12)	7(11.5)	6(11.5)
	IF	8(12)	9(10.5)	9(11)	6(11.5)	8(11.5)	5(11)	6(11.2)	5(11.1)	5(11.2)	6(10.5)	7(10.5)	6(11)
	IIM	5(10.5)	8(10,5)	4(11)	5(11)	4(11)	6(12)	6(11)	6(12)	5(11)	6(12.5)	5(10.5)	4(11)
	JIF	6(11)	4(11)	3(11)	3(10.5)	2(11.2)	8(12.8)	8(12)	5(11.5)	6(12)	6(11.5)	6(13)	3(12)
Nematodes	J	I		3(12)	3911	-	1	2	-	2(10.5)		4(11)	
	IM	1	1	2	1	2	1	1	2	1	2	1	1
	IF	1	2	2	1	1	1	1	2	1	2	1	2
	IIM	1	1	2	2	5(11)	1	2	1	1	1	1	2
	JIF	1	1	3	2	3(10.5)	4	4	1	2	1	2	2
Insects	J	8(12)	7(11)	5(11.5)	12(12)	8(11.5)	14(12.5)	10(12.2)	7(11.5)	12(12)	14(12.5)	11(12)	13(12)
	IM	10(18)	8(11.2)	4(10.5)	8(11.5)	9(11.2)	11(11)	8(12)	8(11.2)	7(11)	8(11.2)	6(12)	8(11)
	IF	8(12)	8(12)	4(10.5)	5(11)	7(11.1)	10(10.5)	6(11.5)	7(10.5)	6(11.5)	6(11)	5(11.8)	7(11.5)
	IIM	3(10.5)	4(11)	3(10.5)	4(11)	4(11.5)	3(1.5)	2	3	2	3(11.5)		
	JIF	2	3(11.5)	4(11)	3(11)	2	3(11)	2	2(11)	2	2	1	2(10.5)
Crustaceans	J	11(11.5)	10(11.5)	12(12)	10(11.5)	9(12)	11(12.2)	7(12)	11(12.5)	10(11.5)	9(11)	7(11.5)	10(10.5)
	IM	10(10.5)	12(11)	10(11)	10(12)	8(10.2)	10(10.5)	6(11.5)	7(10.5)	6(10.5)	6(11)	5(11.8)	7(11.5)
	IF	10(10.5)	8(11)	7(10.8)	10(11.2)	6(12)	10(11)	8(12)	6(11)	6(12)	8(11.5)	6(12)	6(10.5)
	IIM	3(11)	2	3(11)	3(11)	4	2	6(12)	3(10.5)	3	2	4(11.5)	4(10.5)
	JIF	4(11)	3(10.5)	5(11.5)	4(12)	3	4	4(10.5)	2	2	2	3(12)	5(12)
Unidetified animal	J	7(11.5)	3(11)	3(10.5)	2(10.5)	4(10.5)	9(11.5)	20(12.5)	22(11)	9(12)	7(11)	3(10.5)	7(11)
	IM	2	2	6(11.2)	3	4(12)	5(11)	6(12)	5(11.5)	5(10.5)	5(11.2)	6(10.5)	2
	IF	2	5(11)	5(11)	3	3(11)	5(11)	5	5(10.5)	4(11)	5(11)	4(11)	3
	IIM	2	2	3	3	3	2	3(11)	2	2	3(10.5)	4(12)	4(10.5)
	JIF	3(10.5)	2	2	5	5(11.5)	3	4(11.5)	3	2	2	3(10.5)	4(11.2)
Sand and detritus	J	1		1	1		2	1	1	1	2	-	1
	IM	1		2	1	2	1	2	2	1	2	2	2
	IF	1		2	3	6(12)	3	3	2	2	2	2	3
	IIM	2		2	2	1	2	3	1	2	2	2	2
	IIF	1		1	1	3	3	2	3	22	2	1	1

There is no significant variation to the gut content between sexes of particular sizes.

Abbreviation : J = Juvenile; IM = Male, 100-200 mm; IF = Female, 100-200 mm; IIM = Male 200-300 mm; IIF = Female, 200-300mm.

to September may be the reason for a lower percentage of plant matter in the gut of fish. This size-group also did not prefer nematodes.

The group-3 fishes (200-300 mm) showed the maximum quantity of algae in the gut in both sexes (41 %) followed by plant matter (35 %). Thus more than 75 % of the food items was of plant origin and the rest consisted of animal matter. The consumption of insects, crustaceans and undefined animal matter was comparatively lower in group-2 specimens. There was positive correlation between gastrosomatic and stomach fullness indices in group-2 specimens. It has been found that both indices were low during the period of gonadial maturation and continued till the end of spawning seasons. However, the indices geared up from September onwards in both the sexes.

Acknowledgment

We thank Dr. F. Krupp, Schongsinstitut Senchenberg, Abtailung Ichthyologie Senckenber-gganglage, Frankfurt, Germany for his assistance and suggestions and for sponsoring Dr. B. K. Das for working in his laboratory in Germany.

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