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Food and Feeding Habits of *Glyptosternon reticulatum* McClelland & Griffith in Torrential Streams of Kashmir Himalayas

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ABSTRACT

The food and feeding habits of *Glyptosternon reticulatum* McClelland and Griffith were studied during 2002. The fish is a benthophagic carnivore feeding almost exclusively on the benthic insects. Trichoptera constituted the major component of the diet, followed by Ephemeroptera and Diptera. The length-weight relationship in the fish deviated from the cube law, which seemed to be associated with shape of the fish and the nature of its habitat. Ponderal Index as well as the gastrosomatic index decreased with increase in the length of the fish.

Keywords: Kashmir, hill streams, *Glyptosternon reticulatum*, food

INTRODUCTION

The Valley of Kashmir, a well watered fertile Plain at an average elevation of above1200m, is located between the Pir Panjal and the Greater Himalaya mountains. Across this plain numerous hill streams originating from different positions, directions and altitudes join the river Jhelum, the lone drainage system of the valley, directly and indirectly. These torrential streams harbour a number of indigenous as well as exotic fishes, each adapted to a particular habitat. The catfish *Glyptosternon* (locally known as Nayyid) is represented in the Jhelum river system by *G. reticulatum* (Yousuf, 1996; Kullander et al, 1999). During a fishery survey of the river Jhelum and its tributaries in 2002, the species was found in very small numbers in the Lidder, Wangat, Boniyar and Haji Pir streams (Fig. 1). A perusal of the local literature (Das and Subla 1963; Jan and Das, 1970, 71; Subla and Das, 1970; Malhotra, 1970; Jyoti and Malhotra, 1975; Sunder *et al*, 1984; Pandit *et al*, 1992; Yousuf and Firdous, 1997, 2001; Yousuf *et al*, 1992, 2001, 2002; Enderlein and Yousuf, 1999) revealed that very little is known on the biology of this catfish from the valley of Kashmir. It was therefore thought worthwhile to study some biological parameters of the fish. The present article describes morphometry and food and feeding habits of the fish.

MATERIAL AND METHODS

The fishes were caught with the help of an electrofisher from the Lidder stream at Pahalgam (Kathsoo), the Wangat nallah (a tributary of Sindh stream) at Narayan Nag, the Boniyar nallah at Bela Salamabad, and the Haji Peer nallah at Nambla, Uri,. The location of the collection sites in the streams is given in Fig. 1. Immediately after the collection, the various morphometric parameters of the fish were noted down in accordance with Bagenal (1978). The length (L) and weight (W) relationship was determined by formula:

$$\text{Log } W = \text{Log } a + b \text{ Log } L, \quad \text{where a and b are constants.}$$

Relative length of gut (RLG) was computed as the ratio of the gut length and total fish length. The gastrosomatic index (GSI) was calculated by the formula:

$$G.S.I = [\text{Total wt. of full gut} / \text{Total wt. of fish}] \times 100$$

Ponderal Index or condition factor (K) was calculated by the formula,

$$K = W/L^3 \times 100.$$

The feeding intensity or the degree of satiation was estimated by calculating fullness index with the help of the formula

$$F.I = [\text{Total wt. of gut contents} / \text{Total wt. of fish}] \times 100$$

In all the above formulae weight was measured in mg and length in mm.

For the analysis of gut contents, the fish were dissected and their digestive tracts carefully removed from the body cavity and preserved in 5% formalin. The examined fish were distributed into four size groups on the basis of total length, viz., 51-100mm, 101-150mm, 151-200mm and 201-250mm to check if there was any change in the food preferences with age. The gut contents were screened under a stereoscopic microscope and each food item was counted after proper identification with the help of standard taxonomic works (Smith, 1950; Edmondson, 1959; Pennak, 1978). After noting down the average weight of a food item on the sensitive balance, total weight of each item in the gut contents was calculated. This gave the percent contribution of each food item, both by number and weight, in the gut (Hynes, 1950).

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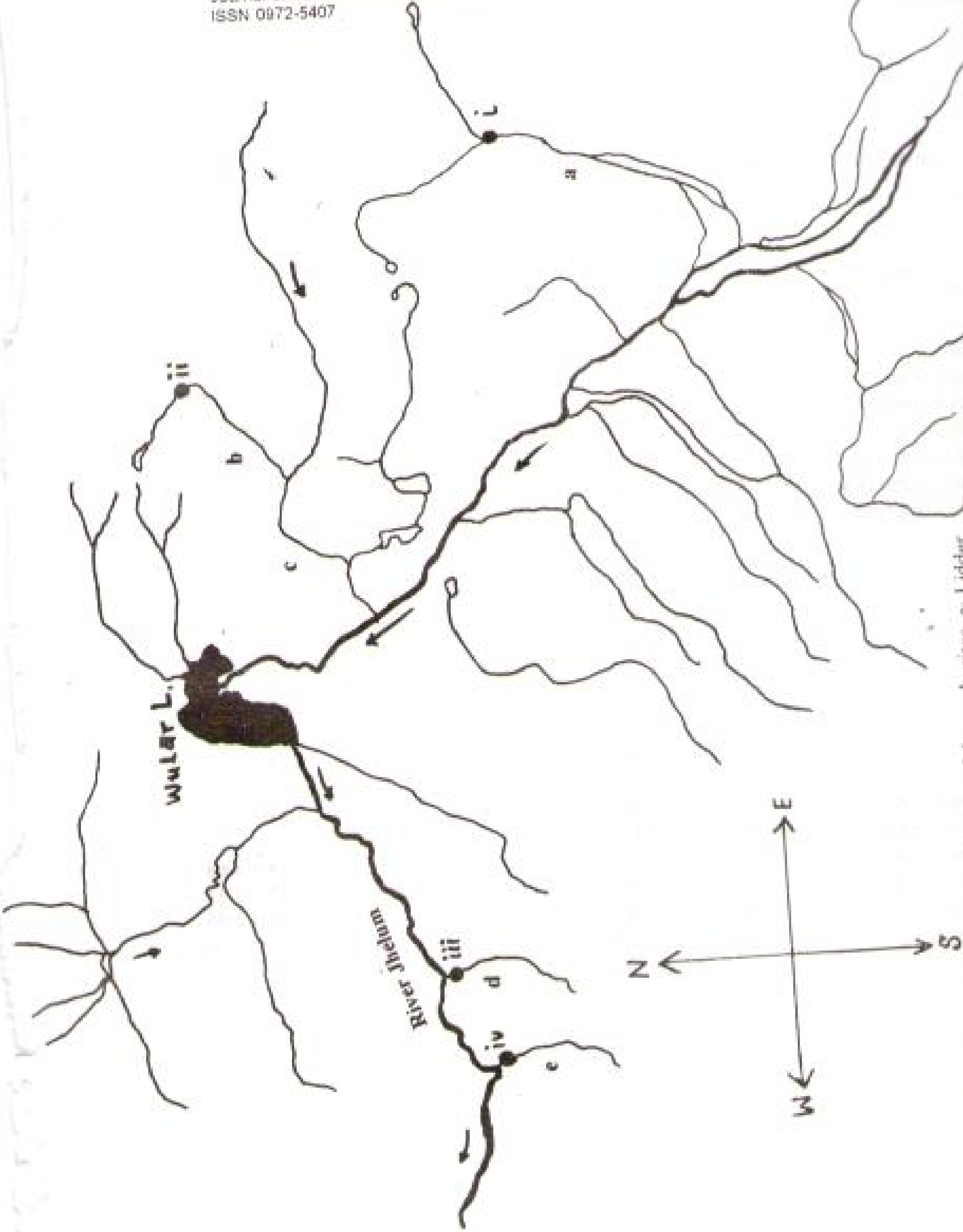

Fig 1 Map of the River Jhelum showing the location of the study sites a: Lidder stream, b: Wangat Nallah; c: Sindh stream, d: Bonyar stream, e: Haji Pir stream, i: Pahalgam; ii: Narayan Nag (Wangat), iii: Bela Salam Abad, iv: Nambla (Uri)

Table 1. Some morphometric measurements of *Glyptosternon reticulatum*.

Length group (mm)	51-100	101-150	151-200	201-250	Average
Total Length (mm)	84.5	123.3	170.3	220.3	149.6 ± 58.7
Body weight (g)	7.0	20.2	49.3	97.6	43.5 ± 40.2
Standard length (mm)	73.5	111.8	147.6	196.0	132.2 ± 52.1
Head length (mm)	16.5	19.3	33.3	38.3	26.8 ± 10.5
Snout length (mm)	3.0	5.3	6.6	9.6	6.1 ± 4.55
Eye diameter (mm)	1	1.7	2	3	1.9 ± 1.44
Body depth (mm)	12.0	16.3	22.3	28.0	19.6 ± 6.9
Pre-dorsal length (mm)	27.0	37.5	50.6	63.3	44.6 ± 15.7
Pre-pectoral length (mm)	11.5	14.3	23.0	26.3	18.8 ± 7.0
Pre-pelvic length (mm)	33.5	50.1	67.6	84.6	58.9 ± 22.0
Pre-anal length (mm)	48.5	75.5	98.0	126.3	87.1 ± 33.0
T/SL	1.14	1.10	1.52	1.12	1.22 ± 0.19
T/H	5.12	6.38	5.11	5.75	5.59 ± 0.66
T/BD	7.04	7.56	7.63	7.87	7.52 ± 0.35
T/PPC	7.34	8.62	7.40	8.38	7.93 ± 0.66
T/PPV	2.52	2.46	2.52	2.60	2.52 ± 0.06
T/PA	1.74	1.96	1.74	1.74	1.79 ± 0.11
T/PAD	1.67	1.55	1.82	1.56	1.65 ± 0.12
H/S	5.5	3.64	5.05	3.99	4.54 ± 0.87
H/E	16.5	11.35	16.65	12.77	14.32 ± 0.67
Ponderal Index (K)	1.15	1.06	0.97	0.91	1.02 ± 0.10
Weight of full gut (g)	0.75	1.45	3.00	5.83	2.76 ± 2.25
Weight of gut contents (g)	0.35	0.92	0.83	2.66	1.19 ± 1.01
Gastrosomatic Index	10.41	6.29	6.04	5.88	7.15 ± 2.18
Fullness Index	4.79	3.84	1.95	3.75	3.58 ± 1.85
Gut Length (mm)	75.5	122.8	154.6	205.0	139.5 ± 54.6

T = Total length ; SL = Standard length; H = Head length; PPC = Pre-pectoral length; PA = Pre -anal; BD = Body depth; PPV = Pre-pelvic length; PAD = Pre-adipose length; S = Snout; E=Eye

RESULTS AND DISCUSSION

Morphometry: *G. reticulatum* is elongate, sub-cylindrical in the abdominal region, with short but, wide and depressed, head having minute eyes and four pairs of barbels - one pair each of nasal and maxillary and two mental pairs. The mouth is wide and inferior (Fig. 2). The body is compressed towards the tail. In the Valley of Kashmir fish as long as 24 cm (standard length) have been reported (Kullander *et al*, 1999). The total length of the fish was found to be 1.13 ± 0.19 (standard deviation) times the standard length, 5.58 ± 0.60 times the head length, 7.63 ± 0.35 times the maximum body depth; 7.95 ± 0.66 times the pre-pectoral length, 1.71 ± 0.11 times the pre-anal length; 2.53 ± 0.06 times the pre-pelvic length. Head length is 4.39 ± 0.87 times the snout length; 14.10 ± 2.67 times the eye diameter. The highest growth with respect to the total length was observed in standard length, followed by pre-anal length, pre-pelvic length, head length, maximum body depth and pre-pectoral length.

The equation for Length - weight relationship in the fish was calculated as

$$\text{Log } W = -4.4639 + 2.757 \text{ Log } L$$
$$(r = 0.9802)$$

The value of "b" indicated that the relation between the length and the weight of the fish deviated from the cube law. Deviations from the cube law have also been reported by Yousuf *et. al* (1992) and have been reported to be influenced by the environmental conditions. The present fish lives in torrential waters having extremely low productivity. Because of the low primary productivity there is always scarcity of the secondary production as well.

Food and Feeding Habits: The herbivorous fishes generally possess long digestive tubes and the relative length of gut (RLG) values as high as 12 (*Labeo rohita*) have been reported (Das and Moitra, 1963). In the carnivorous fish, on the other hand, values less than 1 (e. g., 0.8 in *Bagarius bagarius*) are a common feature (Das and Moitra, 1956). The anatomy of the gut in *G. reticulatum* as well as the RLG value clearly indicates its carnivorous feeding habit. The digestive tube of the fish is short and oesophagus, stomach and intestine are well differentiated (Fig. 3). The relative length of the gut varied from 0.89 in the smallest length group to 0.99 in the 101 - 150 mm group, recording an average value of 0.93. The fish has undergone several structural modifications in its morphology, especially in the region of mouth and pectoral fins, which facilitate its adaptability to the fast flowing waters. The maxillary barbels fuse with the upper lip, thus helping in the formation of a sucker shaped mouth with thickened lips, by which it attaches itself to stones and rocks and hence avoids being carried away by the fast current (Subla and Das, 1970). However, while feeding, the

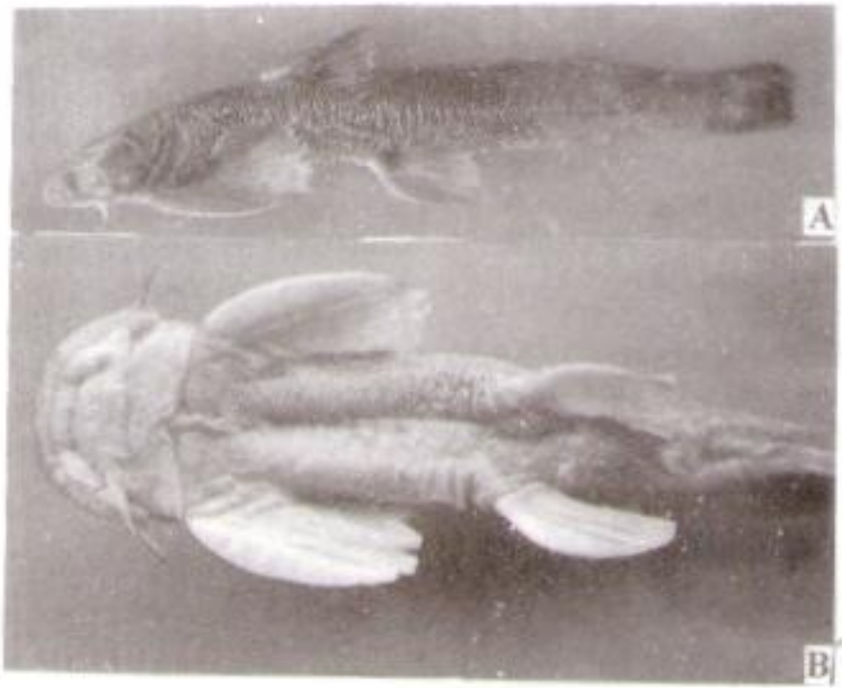

Fig. 2 *G. reticulatum*, showing structural modifications. a) Lateral view b) Ventral view

Fig. 3. Digestive tube of *G. reticulatum* showing well differentiated oesophagus (O), stomach (S) and intestine (I).

fish remains attached by its thoracic folds and pectoral fins and keeps its mouth free for catching its prey. Its long barbels help it in locating the food.

The gastrosomatic index fluctuated from 5.88 to 10.41 with a mean value of 7.15 Table 1). The index was maximum in the smallest length group (51-100mm) and decreased with increase in the length of the fish. A similar phenomenon was reported in *Rhinomugil corsula* (Hamilton) by Sugunan and Vinci (1981). Ponderal Index or condition factor (K) is widely used in fisheries as a measure to provide information about fitness of the fish with respect to its environment, and also about the attainment of maturity, spawning behaviour, feeding and growth (Bhat, 1968). The value of K in *G. reticulatum* decreased with increase in the fish length, varying in the different length groups from 1.15 to 0.91, with an average value of 1.02. The gradual fall in the ponderal index in the older size groups is related to increased metabolic strain of spawning in older fish (Yousuf and Pandit, 1989). K showed a positive co-relation with the gastrosomatic index in the present fish. Fullness index (degree of satiation) also recorded the highest value in the smallest length group (4.79) and then decreased gradually in the next two length groups. However, the largest group also recorded high Fullness index. On the whole the index recorded a mean value of 3.58 (Table 1).

Subla and Das (1970) reported the carnivorous behaviour of *G. reticulatum*. They found about 65 % of its food to be contributed by annelids, crustaceans and insects. According to them the filamentous algae and diatoms contributed some 5 - 8% of the food and about 10% of the gut contents was decaying organic matter. During the present study the gut analysis revealed that the insects and their larvae dominated the food of the fish (Fig. 4) and contributed about 96.1% of its diet and annelids and crustaceans were completely absent in the gut contents and the contribution of decaying organic matter also was negligible. Quantitatively Trichoptera formed 47.58% of the diet, while Ephemeroptera and Diptera formed 36.76% and 11.76% respectively. On the basis of number of individuals, the Ephemeroptera formed 48.09% of the total food items, whereas Trichoptera and Diptera contributed 35% and 16.86% respectively. Non - insect component formed about 4 % of the gut contents and consisted mainly of gravel, sand and a little periphytic algae. Ephemeroptera was represented by 5 taxa, viz., *Notacanthurus* (54.3%), *Baetis* (31.8%), *Nigrobatis* (4.3%), *Caenis* (4.3%) and *Batiela* (5.4%). *Notacanthurus* and *Baetis* were the main components contributing together more than 86% of the Ephemeropteran diet. Trichoptera was represented mainly by four taxa, among which the highest contribution was by *Nectopsyche* (57.70%). It was followed in importance by *Stenopsyche* (19.23%), *Rhyacophillia* (15.38%) and *Hydropsyche* (7.69%). Diptera formed 11.76% of the total food and was mainly represented by *Diamesa* (84.44%). *Atherix* (8.89%) and *Simulium* (6.67%) were the other contributors.

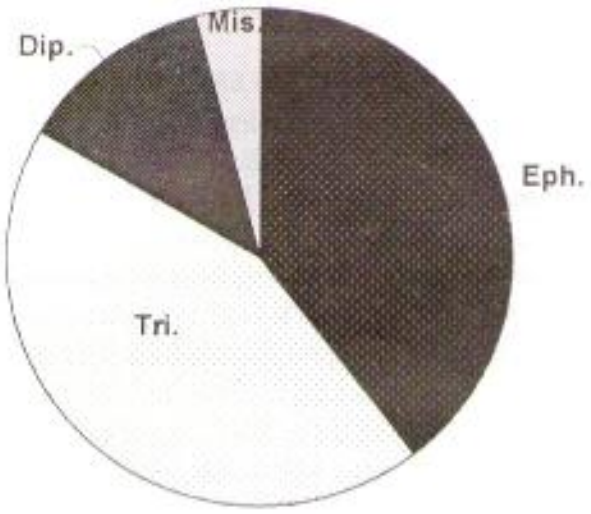

Fig. 4. Contribution of different items in the food of *G. reticulatum* in torrential streams.

CONCLUSION

On the basis of the anatomy of the digestive tube and relative gut length, structural modifications present in the head and mouth region and the analysis of the gut contents it can be concluded that *G. reticulatum* is a typical benthophagic carnivore. In the streams presently investigated the fish feeds mainly on the benthic insects. During the last several decades there has been increased human activity in the lotic systems of Kashmir Himalayas. Several hydroelectric power projects have already been commissioned (e. g., Lower Jhelum Project, Uri Hydroelectric Project, Upper Sindh Hydroelectric Project) and many more are in the process of construction. This has led to significant ecological changes in the natural habitat of *G. reticulatum*. In some cases diversion of water has led to drying of the original streambed, while in some others water level has significantly increased. Both these changes have directly (by the loss of breeding grounds) as well as indirectly (by influencing the availability of the food of the fish) greatly harmed the fish. If necessary measures are not taken for the conservation of the fish as well as its habitat in right earnest, the fish population may face further decline and the Valley may lose this important component of the fish fauna altogether in near future.

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