

## Food and Feeding Habits of *Glossogobius giuris* (Hamilton and Buchanan, 1822) Collected from Manchar Lake distt. Jamshoro, Sindh, Pakistan

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**Abstract:** *Glossogobius giuris* a gobiid, is commercially important fish and widely distributed in lakes of Pakistan especially Manchar Lake Sindh, Pakistan. The food preference of this fish showed some variations and most often it was found to be cannibalistic. Fish specimens were monthly collected from August 2011 to July 2013 from fish landing center Bubak, Manchar Lake District Jamshoro Sindh, Pakistan. During this study 314 specimens (163 male and 151 female) ranging from 4.8-22cm in total length (TL) and 1.8-125.1g in weight. Out of 314 guts the percentage assigned as empty, quarter, half, three quarter and full were 8.59, 12.42, 32.80, 26.11 and 20.06% respectively. The maximum fullness was observed in March to July and highest emptiness was observed in September. The main food items in guts were recorded as; fishes (31.65,16.45%), Insects (29.46,33.41%), Crustacean (11.75,12.05%), Mollusk (9.48, 11.12%), Miscellaneous (6.75,8.49%), Beetles (4.27,5.64%), Higher plants (3.22,4.87%), Annelids (2.14,3.14%), algae (0.75,2.45%) and Nematodes (0.53,2.38%) by volume and occurrence respectively. The mean value of Gastroscopic index (GaSI) was maximum 3.2 in October 2012, while minimum in July 2013 due to spawning. The fish mainly feed on various types of fishes (mostly *G. giuris*), insects and mollusks. The food and feeding of this fish showed that it is cannibalistic and carnivore in nature.

**Key words:** *Glossogobius giuris* • Manchar Lake • Gastroscopic index • Feeding habits

### INTRODUCTION

*Glossogobius giuris* (Perciformes, Gobiidae) is bottom dwellers having worldwide distribution and burrow in sand or mud among branching corals [1]. The available information on the food and feeding habits of *G. giuris* is very limited among which noteworthy contributions are those of many investigators [2-9] and extensive studies on gobioid fishes throughout the world had been reported by Chesalin *et al.* [10], Borek and Sapota [11] and La Mesa *et al.* [12]. Studies on Indian gobioid fishes are very few and those available are restricted mostly to the large Indian Goby *Glossogobius giuris*, a commercially important fish growing to considerable size. Tandon [7] studied the feeding biology of the species in the river

Ganga. Bhowmick [13] made a preliminary study of the food and feeding habits of *G. giuris* from West Bengal Hoogly estuary India. Geevarghese [14] carried out a detailed study on *G. giuris* from Lake Veli, Kerala, India. The aim of the study was to determine the feeding analysis of *G. giuris* found in Manchar Lake of Pakistan in order to provide useful information that later would also be valuable for the fisheries management and conservation and helpful for fish culturists.

### MATERIALS AND METHODS

**Fish Collection:** A total of 314 specimens (163 male and 151 female), were collected from fish landing center Bubak, Manchar Lake, Sindh, Pakistan. Total length was

ranged from 4.9-22cm for males and 4.8-22cm for females. Body weight of fishes was determined as 1.8-110.7g for males and 1.9-125.1g for females.

**Identification of Fish:** Fish was identified by using keys of Rainboth [15], Vidthayanon [16] and Talwar and Jhingran [17].

**Preservation of Fishes:** Fish samples were preserved in 90% ethanol and abdominal cavities were first opened to facilitate penetration of the preservative. The fish samples were transported to the laboratory for food analysis.

**Dissection and Isolation of Gut Contents:** All the guts were isolated from fish in the laboratory. Fish and their guts were weighed for calculating the Gastro somatic index (GaSI) Hynes [18]. After taking the weights the guts were preserved in 70% ethanol diluted in glycerin.

**Analysis of Gut Contents:** Stomach fullness was determined by the gravimetric method Hynes, [18] and categorized into five levels as full, three quarter, half, quarter and empty (100, 75, 50, 25 and 0 %, respectively). The gut contents were then placed in a Petri dish and identified under binocular microscope to the lowest possible taxon using identification keys given by different authorities [19-23]. The percent volume of major gut items was estimated by the points method adopted from [24] and occurrence method by [18].

For evaluating the relative importance of all food items, the index of preponderance after Biswas [26] was obtained using formula:

$$I = \frac{V_i O_i}{\sum V_i O_i} \times 100$$

Where,

- I = Index of preponderance
- V<sub>i</sub> = Volume percentage
- O<sub>i</sub> = Occurrence percentage
- Σ = Summation

Gastrosomatic Index (GaSI) was calculated using the formula given by Biswas [26] GaSI (%) =  $\frac{\text{Weight of gut (g)}}{\text{Weight of fish (g)}} \times 100$

## RESULTS

The results of the present study showed that *Glossogobius giuris* mainly feeds on a variety of fish species including *G. giuris* and shows piscivorous

habit of feeding. Different food items found in the gut of *G. giuris* and their percentage compositions (by volume and occurrence), the preponderance indices of different food items observed in the guts and fluctuation in the percentage composition of food items in different months were presented in Table 1.

**Fish:** Fishes were recorded as a dominant food item from analysis of gut contents of *G. giuris*, forming 31.65% by volume and 16.45% by occurrence (Table 1). Maximum percentage of fishes was recorded in January (after spawning) and minimum was found in September to November in higher length groups (18-22 cm). Juvenile or young fishes of about 6-9mm were observed as undigested, semi-digested and completely digested state (only vertebral column was present) from the gut contents. The specimens of *G. giuris* were also recorded from gut content of adult fishes of this study, which shows the piscivorous and cannibalistic habits of adult *G. giuris*.

**Insects:** The insects were next in the order of dominance forming 29.46% by volume and 33.41% by occurrence (Table 1). The most dominated food item in the gut of young *G. giuris* was various types of insects such as *chironomids* were in both larval and pupal stages. Larval stages appeared throughout the year. Pupal stages occurred only in April. The maximum *chironomids* were recorded in June and minimum were in December. *Notonecta* (Back swimmers) were seen in the gut contents throughout the year except in winter (November to January). Maximum percentage composition was seen in October and minimum in June. Trichopterans were only observed from April to June. Dragonfly nymph was found only during the monsoon season. Maximum percentage was observed in June to July and minimum in August to September.

**Crustacean:** Crustaceans were dominated in small and medium size fishes. They occupy 11.75% by volume and 12.05% by occurrence. Cladocerans and copepods in the diet (mainly *Daphnia*, *Moina*, *Macrothrix*, *Bosmina*, *Cyclops*, *Diatamus*, Nauplius larvae and *Canthocampus*) were higher in April to August and lower from November to February. Some other crustaceans such as amphipods, ostracods and stomatopods were maximum in the gut of *G. giuris* in early summer (March- April) and minimum in September.

Table 1: Grading of various gut contents in *Glossogobius giuris* from Manchar Lake, Sindh (2011-12 and 2012-13)

S.No	Food items	% composition of food items		ViOi	Index of preponderance $I = \frac{ViOi \times 100}{\sum ViOi}$	Grade by Volume
		Volume (Vi)	Occurrence (Oi)			
1	Insects	29.46	33.41	984.26	52.95	I
2	Fish	31.65	16.45	520.64	28.01	II
3	Crustacean	11.75	12.05	141.59	7.62	III
4	Mollusk	9.48	11.12	105.42	5.67	IV
5	Miscellaneous	6.75	8.49	57.31	3.08	V
6	Beetles	4.27	5.64	24.08	1.30	VI
7	Higher plants	3.22	4.87	15.68	0.84	VII
8	Annelids	2.14	3.14	6.72	0.36	VIII
9	Algae	0.75	2.45	1.84	0.10	IX
10	Nematodes	0.53	2.38	1.26	0.07	X
				$\sum ViOi = 1858.7964$		

**Mollusks:** The next important food item of the gut forming 9.48% by volume and 11.12% by occurrence was mollusks (Table 1). The important gastropods found in the gut were *Thiara tuberculata* (Muller), and *Physa acuta* Drapanaud etc. The higher percentages of mollusks in gut content were studied from December to March, while lower percentages were observed from September to October.

**Miscellaneous:** Fish scales, rice husks, roots of aquatic weeds, unidentified fragments were characterized as miscellaneous food items. These were observed 6.75% by volume and 8.49% by occurrence. Miscellaneous food items were recorded throughout the year in all the length groups.

**Beetles:** Beetles were examined 4.27% by volume and 5.64% by occurrence. Hydrophilid beetles (aquatic Insects) was the most common beetle in the guts content of *G. giuris*, which occurred maximum in January to March and minimum in August.

**Higher Plants:** The higher plants were observed 3.22% by volume and 4.87% by occurrence. The plant remnants were the fragments of various plants such as *Typha* etc. The percentages of plants were found higher from March to April and lower in December.

**Annelids:** The percentage of annelids in food item was recorded 2.14% by volume and 3.14% by occurrence. The Polychaete worms were observed dominant in annelids examined from the gut content of *G. giuris*. The most common annelids from gut content were identified as

*Nereis* and *Dendronereis* spp. It was observed that annelids were only present during summer season (April-June).

**Algae:** This food item is 0.75% by volume and 2.45% by occurrence. The most common algae were *Chlorella pyrenoidosa*, Filamentous algae *Spirogyra* and *Cladophora* which were maximum in March to April and minimum in December to January.

**Nematodes:** They were 0.53% by volume and 2.38% by occurrence. The nematodes mainly occurred through food contents from October to January in the mature fishes of length group 18-22 cm.

**Gastrosomatic Index (GaSI):** GaSI of *G. giuris* was calculated from the fish samples collected during winter and summer months only, November to February and April to July (Table 2, Figure 1). Out of 251 only 50 fishes were selected for GaSI, mainly because of variations in summer and winter and specimen selected from each length groups (9) each group with an interval of 2cm. The values of Gastrosomatic Index were higher in winter months as compared to summer months. These results showed that feeding intensity was higher in summer as compared to winter shown in Table 3 and Figure 2. From the present study on the food and feeding habits, it appeared that the basic food of *G. giuris* from Manchar Lake mainly comprised insects (52.95%), fishes (28.01%) and followed by Crustaceans (7.62%), Mollusks (5.67%), Miscellaneous (3.08%), Beetles (1.30%), Higher plants (0.84%), Annelids (0.36%), Algae (0.10%) and Nematodes (0.07%) amount of the gut content.

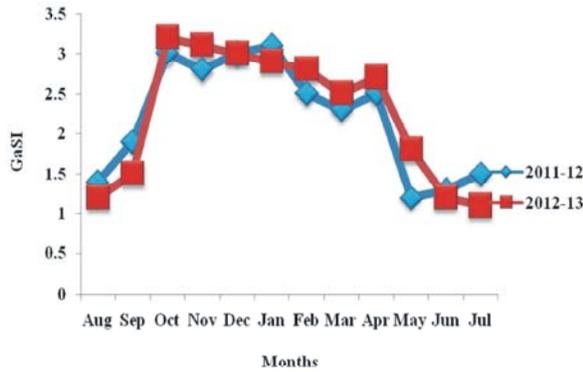


Fig. 1: Comparison of GaSI of *G. giuris* (August 2011 to July 2012 and August 2012 to July 2013).

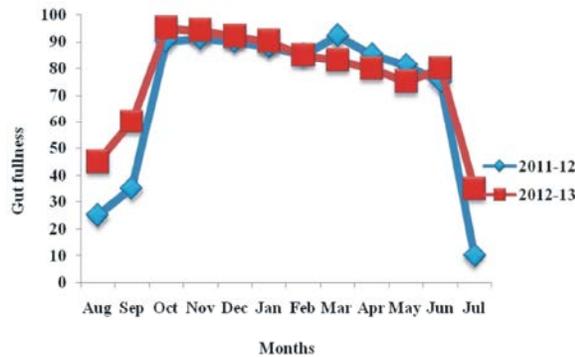


Fig. 2: Comparison of gut fullness of *G. giuris* (August 2011 to July 2012 and August 2012 to July 2013).

Table 2: Monthly gut fullness and gastroscopic index (GaSI) of *Glossogobius giuris* from Manchar Lake Sindh (2011-12 and 2012-13)

Months	2011-12		2012-13	
	Gut fullness	GaSI	Gut fullness	GaSI
August	25	1.4	45	1.2
September	35	1.9	60	1.5
October	90	3	95	3.2
November	91	2.8	94	3.1
December	90	3	92	3
January	88	3.1	90	2.9
February	85	2.5	85	2.8
March	92	2.3	83	2.5
April	85	2.5	80	2.7
May	81	1.2	75	1.8
June	75	1.3	80	1.2
July	10	1.5	35	1.1
Average	70.58	2.21	76.17	2.25

Table 3: State gut fullness of *Glossogobius giuris* (2011-12 and 2012-13).

State	No of guts	Percentage
Empty 0%	27	8.59
Quarter 25%	39	12.42
Half 50%	103	32.80
Three Quarter 75%	82	26.11
Full 100%	63	20.06
Total	314	100

**Stomach Categories:** Out of 314 guts 27 were empty, (8.59%), 39 Quarter (12.42%), 103 Half (32.80%) 82 Three Quarter (26.11%) and full 63 (20.06) were observed during entire study period shown in Table 3 and Figure 2.

### DISCUSSION

In the present study, the food and feeding of *G. giuris* depended mainly on fishes, insects, crustacean, mollusks, beetles, higher plants, annelids, algae and semi digested materials.

According to Roa *et al.* [28] fishes which feed on mollusks are bottom dwellers; similar type of feeding was observed in *G. giuris*. Our study concluded that in *G. giuris* feeding intensity increase voraciously after spawning and decreases before spawning. Our finding strongly agrees with Hatikakoty and Biswas [29] and Low feeding rate during spawning has also been reported by Shrivastava and Desai [30]. Hora [2] reported that shrimps, crabs and insects formed the main food item of *G. giuris*, while Mookerjee [3] stated that animal and plant component was 7:3 in adults but in juveniles the occurrence of plant component was higher. Alikunhi *et al.* [4] described that the adult feeds on teleost and the juveniles feed on aquatic insects. Das and Moitra [5] observed that the *G. giuris* of 20-53 mm size feeds on carp fry. Bhowmich [8] described that teleost fishes formed the major food item of adults and crustaceans of the juveniles in the Hooghly estuary. Natarajan [9] stated that *G. giuris* are planktonic feeders but adults subsequently become carnivorous; subsisting on insect larvae up to certain stage (51-100 mm) and then turn predatory by feeding on fish. According to Das and Moitra [5] the juveniles are mainly insectivorous while adults are piscivorous have confirmed the piscivorous and cannibalistic nature of *G. giuris* in the river Ganga.

### CONCLUSIONS

In the present study the gut contents of *Glossogobius giuris* were strongly supported by the

above mentioned researchers. Present study concluded that the fish is insectivore in juvenile stage while piscivorous and cannibalistic in adult stage. Thus the fish on basis of food and feeding named as Insectivorous.

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