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# Food and Feeding Behavior of Gangetic Fishes at Anga Region Bhagalpur with Special Reference to *Sililonia silondia* (Ham.)

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## ABSTRACT

Gut contents of each fish was observed in each month from September to January 2008-2009. The intensity of feeding was good in September, October and November. During this period when the river was highly productive, the intensity of feeding was also high. In low productive season, i.e. in December and January, the feeding intensity of observed fishes was poor and high percentage of sand and mud was found in the stomach contents.The insects form one of the main constituents of their gut contents.

The following aquatic insects have been identified up to species level:

*Gerris spinolae*, *Corixa hieroglvohica*, *Oceophvla smargdine*, *Cicindela nitide*, *Dinentus spinosus* and *Orectochillus gangeticus*. Nymphs of insects were also present. Small fishes like *Puntius sophore*, *Puntius titus*, *Osteobrama cotio*, *Aila coila*, *Gudusia chapra*, *Chanda nama*, *Barilius bola* and *Puntius ticto* are frequently found in their guts. The bucco-pharyngeal length was found to have a negative relationship with the intestinal relationship and can be expressed by the formula: Y=36.909-0.314 X. The bucco-pharyngeal length was found to have a positive relationship with the stomach length. (r=0.559: P<0.001). This relationship can be expressed by the formula: Y=8.21+0.544 X. The stomach length was found to have a negative relationship with the intestinal length (r = –0.713; P<0.001). This relationship can be expressed by the formula: Y = 2.357 + 0.202 X.

**Keywords:** *Gerris spinolae, Corixa hieroglvohica, Oceophvla smargdine, Cicindela nitide, Dinentus spinosus and Orectochillus gangeticus.*

## INTRODUCTION

Fishes are the most attractive form of animal type (Hoenig and Gruber, 1990). They dominate the water of the world through a marvelous variety of morphological, physiological and behavioral adaptations (Hughes *et al*., 1974 ; Dasgupta, 1991). The success of fishes in terms of their diversity and number is to a large extent the measure of their success in finding adequate food, sometimes in the most unlikely situations. The magnitude of fish stocks in a region is a function of its food potentialities. Food is an important factor in the biology of fishes to the extent of governing their growth, feeding and migratory movements. The basic function of an organism is its growth, development and reproduction and it takes place at the expense of energy which enters the organism in the form of its food (Bagenal and Tesch, 1978). The first stage in the life cycle of a fish is completed at the expense of food reserves contained in yolk in the egg (Hoff and Musick, 1990). These resources however sustain it only for a short period which is subject to some variations depending on the quantity of yolk stored and conditions under which the eggs develop. After the complete utilization of the yolk, the young fish commences feeding from its habitat. During the process of development of the fish, changes takes place in its food which are connected with changes in the structure

of the feeding and digestive organs (Pandey *et al*., 1974). Fishes have become adapted to a wide variety of food. The importance of the knowledge of food and feeding habits of fish in understanding its fishery biology has been well established. Feeding is usually a part of the daily routine. Sometimes rate of feeding has a bearing on the spawning of the fish. The nature of food composition of fish will also throw light on the possible habitats it frequents. Variation in the seasonal and diurnal abundance of the favorite food organisms of different species of fish in any region may influence the horizontal and vertical movements of the fish stocks. Hence the correct knowledge of the relationship between the fishes and food organism is essential for the production and exploitation of the fish stocks (Froese, 1998). Fishes are well designed, especially well for food gathering. Feeding in some species may require extended periods of time. The amount of food ingested per day and the times of day that feeding is performed depends on many factor. Active predators with their high metabolic rates require more food energy than do sluggish fishes. Daily and seasonal temperature fluctuations affect food intake in most fishes. Some species feed mainly by sight and are active by day although peaks of feeding actively occur in mourning and evening. Other fishes that depend more on chemical sense can feed effectively in the absence of light or at night. So they may be most active in early morning and late evening (Bolger and Connoly, 1989). Food and feeding habit of the fishes have been studied by numerous workers which have been variously described as plankton feeder, vegetable feeder, slime feeder and foul feeder, but so far no systemic investigations covering all the size groups, seasons and availability of food item in different environments has been conducted. Temperature and turbidity of the environment play an important role in influencing the intensity of feeding. In the case of aquatic animals, it is not easy to directly observe their habits. It is only the examination of the gut contents of fishes which will indicate their natural food and feeding habits (Barrie, 1972). Several workers have investigated the problem of food and feeding habits of mullets along with their diverse feeding adaptation and behavior (Allen,1938 ;Al-Hussaini,1947; Sarojni, 1954,1958; Singh, 1972; Das and Moitra in a series of paper 1955 a,b,c, 1956a,b,c and 1958) have concluded the qualitative and quantitative correlation of food and feeding habits of fresh water teleostean fishes and their alimentary canal.

*Sililonia silondia* (Ham.) is an important fresh water fish of the river Ganga. Very little information is available about their food and feeding habits. Keeping in view the above mentioned facts, investigation on food and feeding habits of *Sililonia silondia* was conducted. The bucco-pharyngeal region of fishes is modified in various ways according to their feeding habits. Several workers have referred region in their descriptions of the alimentary canal of fishes, but the work is scarce. Hughes *et al*.,1974 studied the structure of the gill rakers of *Saccobranchus* found them to be setiform structures forming a straining mechanism to prevent the escape of the microscopic organisms on which the fish fed. Dasgupta (1991) briefly referred to the buccal cavity and the pharynx of *Boleophthalmus* and found numerous goblet cells and taste buds in these parts.

## MATERIALS AND METHODS

Gut contents of each fish was observed in each month from September to January 2008-2009. The intensity of feeding was good in September, October and November. During this period when the river was highly productive, the intensity of feeding was also high. In low productive season, i.e. in December and January, the feeding intensity of observed fishes was poor and high percentage of sand and mud was found in the stomach contents.

**FOOD COMPOSITION OF FISH**

1. Unidentified vegetable matter: It comprises Husk, pieces of plant stems, roots, leaves, seeds, parts of macrophytes. They get into the riverine system along with flood and water.
2. Insects: Insects form one of the main constituents of their gut contents

   The following aquatic insects have been identified up to species level:-

   Gerris spinolae, Corixa hieroglvohica, Oceophvla smargdine, Cicindela nitide, Dinentus spinosus and Orectochillus gangeticus. Nymphs of insects were also present.
3. Crustacean: Prawn and parts of the crabs were categorized in this column which is found in the guts.
4. Fishes: Small fishes like Puntius sophore, Puntius titus, Osteobrama cotio, Aila coila, Gudusia chapra, Chanda nama, Barilius bola and Puntius ticto are frequently found in their guts.
5. Molluscs: The bivalves present in the gut contents have been identified as a Sophaeriun simile and Unio sp.
6. Unidentified animal matter: This item is in the form of dead and digested animal matter.
7. Debris: Mainly in the form of mud, sand, stones, pebbles and charcoal pieces.
8. Mucous: the inner portion of the stomach is coated with thick mucous.
9. Scales: Some

The fishes were grouped in to five groups for GSI.

| | |
|---|---|
| Group I | 7.00 - 14.00 cm. |
| Group II | 15.00 - 20.00 cm. |
| Group III | 21.00 - 27.00 cm. |
| Group IV | 28.00 - 34.00 cm. |
| Group V | 35.00 - 40.00 cm. |

**Feeding Intensity:**

The gastro-somatic index (GSI) or in other words feeding intensity at different length groups of Silonia silondia has been presented in Table -1. Feeding intensity in different length group: It can be observed from Table-2 that there is increasing trend in feeding intensity till they become adult. The highest GSI was observed in Group-I (9.102 ) and lowest was observed in Group-V ( 6.622 )

Relative length of the gut (RLG): The variation of the relative length of the gut (RLG) with the total length of the fish has been shown in Table 3 and Table 3.1. The RLG value shows a gradual increase from 2.16 in length group I to 2.2 in length group-V. It has been observed that there exists a positive relationship between gut length and the percentage of vegetable matters in the gut, where as a negative relationship exists between gut length, and the percentage of animal matters in the gut (Table 3.2).

**Bucco-pharyngeal region of Silonia silondia**:

The mouth is a large opening at the fore end of the snout and leads into a spacious

bucco-pharyngeal cavity which is provided with round knobbed teeth. The pre-maxillary and the palatine teeth are present anteriorly. The pre-maxillary teeth are followed by a wide fold of skin known as the velum. The palatine teeth are also numerous and lie just behind the velum carried by a pair of large oval plates in the form of round calcareous knobs. Numerous teeth also occur in the floor of the buccal cavity. The lower section of the gill-arches is comparatively longer in length than the upper one and supports the ventro-lateral side of the pharynx, while their upper portion supports the lateral-dorsal part of the pharynx. The gill-rakers are of moderate size, hard and projected structures projecting into the pharyngeal cavity and serving to restrain the escape of food through the gill-slits (Figs.1, 2 and 3). The first and second gill-arches bear only one row of gill-rakers, whereas the third and the fourth ones bear two rows of them (Figs. 4, 5, 6 and 7). The fish branchial arch does not bear gill-lamellae but only a single row of gill-rakers (Figs 8). At the hinder end of the pharyngeal cavity is the large circular aperture of the gullet which opens into the oesophagus.

The bucco-pharyngeal length was found to have a negative relationship with the intestinal relationship and can be expressed by the formula: Y=36.909-0.314 X. The bucco-pharyngeal length was found to have a positive relationship with the stomach length. ($r=0.559$: $P<0.001$). This relationship can be expressed by the formula: Y=8.21+0.544 X. The stomach length was found to have a negative relationship with the intestinal length ($r = -0.713$; $P<0.001$). This relationship can be expressed by the formula: $Y = 2.357 + 0.202$ X

It is an established fact that the gut length varies in fishes with different food and feeding habits (Das and Moitra, 1956 a and b; 1963). The findings of the present study are in agreement with that of earlier workers mentioned above. The relative dimensions of different parts of the alimentary tract (Bucco-pharynx, oesophagus, stomach and intestine) also show variation in fishes. The importance of these variations can be clearly understood if we consider the food taken by different species (De Groot, 1971).

In the present study the morphometric parameters of the alimentary canal showed interspecific variation in fishes with different food and feeding habits. It can be inferred from the present study that carnivorous fishes with large buccal cavity have large stomach for capture and storage of big sized prey. But they require relatively shorter intestine to digest the animal mater. On the other hand herbivorous and plankton feeding fishes have a small buccopharynx to catch small size vegetable food and small stomach/intestinal bulk for storage, but they require a long intestine to digest the vegetable matter.

**Relative Gut index (RGI):**

The values of relative gut indices of different age group of S silondia are given in Fig. 1. The gut length/Total body length ratio is 1:1.8 to 1:2.12 in young individuals while the same ratio varied from 1:0.88 to 1: .03 in adult. De and Datta (1990) reported high feeding intensity during September to October in the closely related fish Hilsa, *Tenualosa ilisha* (Hamilton).The food items investigated in are given in table 2 Adult S silondia is found to be carni-omnivorous feeding predominantly on crustaceans (Prawn) and aquatic insects. The food categories of lesser importance of the group were molluscs barbels that appeared to have been accidentally swallowed. In the case of catfish S silondia the crustaceans and aquatic insects were basic food for the adults while phytoplankton (Blue green algae, diatoms and desmids) crustaceans and macrophytes constitute basic food for juveniles. Teleostomi, zooplankton and phytoplankton could be considered as the secondary food for adults while

macrophytes aquatic insects and zooplankton together could be considered as secondary food for juveniles. Selective feeding behavior of this fish cannot be ruled out. Therefore, S. silondia may be referred as carni-omnivorous fish prefer large size food items.

## RESULTS AND DISCUSSION

Examination of the stomach contents of Silondia revealed that the food contained both plants materials and animal matter. So it is an omnivorous fish. Occasionally fish scales and diatoms were seen. About 50% and more of the food constituents were animal matter. Usually plankton and small organisms are seen. Stomach contents include 23. 84% worms, 32.11% plankton, 5% egg mass, 23.98% plant material and 15.07% sand. Robinson and. Motta (2002) recorded a cessation of feeding activity in fishes during winter season. In the present observations also a low rate of feeding was found to occur during the colder month. The fishes do not seem to restrict themselves only to some particular varieties. This is proved by the fact that most of the items present in the habitat that fall within the ingestible size range were represented in their guts as well. This would suggest that there is little selection on the part of the fish. Some of the reported difference in the feeding habits of these fishes is perhaps due to the variations in the abundance and availability of food items in the water bodies studied.

**Table 1**

**Relative Length of the gut (RLG), with different length group of *Silonia silondia* (Ham.)**

| Length groups (cm) | Relative length of gut |
|---|---|
| Length groups I (07.00- 14.00) | 02.16 |
| Length groups II (15.00- 20.00) | 02.10 |
| Length groups III (21.00- 27.00) | 02.00 |
| Length groups IV (28.00- 34.00) | 02.00 |
| Length groups V (35.00- 40.00) | 02.20 |

**Table 2**

**Fluctuation in the Gastro-Somatic Index in different length group of *Silonia silondia* (Ham.)**

| Length groups (cm) | Gastro Somatic Index |
|---|---|
| Length groups I (07.00- 14.00) | 09.102 |
| Length groups II (15.00- 20.00) | 07.241 |
| Length groups III (21.00- 27.00) | 07.882 |
| Length groups IV (28.00- 34.00) | 06.752 |
| Length groups V (35.00- 40.00) | 06.633 |

**Table 3**

**Relative Gut index of *S. silondia* of different sizes**

| Food items | Numerical Frequency of | Gravimetric | |
|---|---|---|---|
| **Mollusca** | **Counts (%)** | **Occurrence** | **Index (%)** |
| Gastropod | 04 | 02.9 | 0.19 |
| **Debris** | | | |
| unidentified | 26 | 09.3 | 0.135 |
| **Barbels** | **29** | **9.5** | **0.40** |
| Grains (wheat) | 30 | 11.6 | 02.81 |

**Table 3.1**
**Feeding Intensity of *S. silondia* in different stages of maturity**

| Maturity Stage | Male | | | Female | | |
|---|---|---|---|---|---|---|
| | Empty guts (%) | Medium Fullness guts (%) | Full guts (%) | Empty guts (%) | Medium Fullness guts (%) | Full guts (%) |
| I | 19 | 41 | 43 | 21 | 41 | 40 |
| II | 18 | 34 | 48 | 15 | 35 | 51 |
| III | 17 | 35 | 51 | 11 | 41 | 51 |
| IV | 21 | 41 | 40 | 30 | 36 | 36 |
| V | 21 | 41 | 31 | 21 | 40 | 40 |

**Table 3.2**
**Gut Content of Gangetic Fish *S. silondia***

| Food items | Numerical Frequency of | Gravimetric | | |
|---|---|---|---|---|
| | Crustacea | Counts (%) | Occurrence | Index (%) |
| Prawn | | 80 | 51.0 | 82. |
| Daphnia | | 25 | 22.7 | 0.98 |
| Nauplius | | 09 | 07 | 0.45 |
| **Aquatic insects** | | | | |
| Regimbartia | Diptera | 18.2 | 19.3 | 0.55 |
| | Hemipetra | 03 | 0.58 | - |
| **Teleostomi** | | | | |
| Puntius spp | | 13 | 21.8 | 25.9 |
| Channa spp | | 01 | 05.9 | 07.58 |
| Fish scale | | 35 | 33.4 | 0.90 |
| **Food items** | **Numerical Frequency of** | | **Gravimetric** | |
| | | **Counts (%)** | **Occurrence** | **Index (%)** |
| Unidentified | | 26 | 48.5 | 60.8 |
| **Phytoplankton (Blue green algae, Desmid, Diatoms)** | | | | |
| Anabaena | | 05.8 | 0.23 | |
| Netrium | | Z | 05.6 | 0.40 |
| Diatoma | | 06.5 | 0.42 | |
| Unidentified | | 10.9 | 02.31 | |
| **Zooplankton** | | | | |
| Spirostones | | 15 | 23 | 26.87 |
| Vorticella | | 09 | 07.8 | 09.89 |

The fact that these fishes can subset on a wide variety of food material as revealed by the present study, as well as the earlier studies carried out by others, indicates that the species can adapt itself and if necessary even change its preference to certain food items, depending on the availability of such items in a particular environment. This aspect seems to be important in so far as the culture of this species in fresh water pond is concerned. Moreover the preliminary observations have revealed that these fishes accept artificial feed also. These advantages often give a wide scope for successful culture of these fishes in fresh water ponds either separately or in combination with other compatible species.

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