

## ASPECTS OF THE FOOD AND FEEDING BIOLOGY OF THE YELLOW MAHSEER *TOR KHUDREE* (SYKES)<sup>1</sup> (OSTEICHTHYES, CYPRINIDAE) IN SRI LANKA

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### ABSTRACT

The food and the feeding biology of *Tor khudree* were studied in a river for 12 months. The fish was found to feed on both animal and plant matter. Insects predominated in the diet of the juveniles of <21 cm total length, whereas plant matter predominated in that of the higher size classes. The larger adults (>30 cm) fed on a considerable amount of terrestrial plant matter (leaves, flowers, fruits, etc.) fallen into water. Fish does not form an important constituent of their diet at any stage. The juveniles, especially the small ones, lived at the edge of streams and rivers and fed mainly on benthos. As they mature, they moved downstream into the deeper regions and pools of the main river and also into the hydroelectric and irrigation reservoirs.

### INTRODUCTION

The genus *Tor* contains some of the largest freshwater fishes of Cyprinidae, which is one of the common families of the freshwater fishes in the tropics and is the most common Family of freshwater fishes of Sri Lanka. *Tor* spp. constitute most important sports fishes where they occur. They are distributed from Arabian Peninsula south of Yemen through Syria, Israel, Pakistan, India, Sri Lanka, Nepal, Bangladesh, Burma and Thailand to China (Jayaram, 1981). Only a single species namely, *Tor khudree* (see taxonomic note), a species indigenous to India as well, occurs in Sri Lanka, and is widely distributed in the central hills of the island. *Tor khudree* is perhaps the largest freshwater fish in Sri Lanka, but its biology and ecology have not been studied in detail, although several other cyprinid species of the island have been previously studied by De Silva *et al.* (1977), De Silva & Kortmulder (1977), De Silva *et al.* (1980), Schiemer & Hofer (1983), De Silva *et al.* (1985) and de Silva & Somarathna (1994). Food and feeding of the Indian *Tor putitora* and *T. tor* have been studied by Joshi & Kumar (1980), Kaushal, *et al.* (1980) and Nautiyal & Lal, 1982; Pathani & Joshi, 1979; Das & Pathani, (1978).

The present study deals with the food and feeding biology of *T. khudree* in River Mahaweli at its upper reaches in the central part of the island.

<sup>1</sup>Taxonomic note: The species found in Sri Lanka had been apparently first described as *Barbus longispinnis* by Günther (1868). Deraniyagala (1930) assigned the specimens of *Tor* that he collected, probably the same species as Günther's *B. longispinnis*, to *Tor tor*. Deraniyagala (1952), later changed the identification of his *T. tor* to *T. khudree longispinnis*. Mendis & Fernando (1962) followed Deraniyagala (1952) in identification of the species. This identification has recently been questioned by Pethiyagoda (1991). The identification of the fish species in the present work follows that of Deraniyagala (1952) and Mendis & Fernando (1962), and therefore, should be regarded as tentative.

## MATERIALS AND METHODS

### Habitat

A preliminary study of the upper and middle parts of the river showed that the juveniles of *T. khudree* could be easily collected from Mahaweli river and the streams associated with it in the Ginigathena area (7°00'N, 80°30'E) at an elevation of about 690 m a.s.l. Along this stretch, the river passes mostly over sandy and muddy substratum with occasional rocky patches. The rocks were covered with algae and other aufwuchs and sometimes there were floating masses of green algae. The streams had mainly a stony or pebbly substratum. The margins were usually devoid of marginal vegetation, but patches of *Lagenandra* sp., *Alocasia cucullata* and *Colocasia esculenta* were occasionally found, especially along the margins of the streams. On some places, patches of submerged vegetation consisting of *Elodea canadensis* and *Blyxa zeylanica* were present.

The larger specimens (>30 cm total length) were rare in this stretch and therefore, such specimens (30-60 cm) were procured from "Hulu ganga" (7°20'N, 80°44'E), a tributary of Mahaweli river flowing into Victoria reservoir. The stretch of Hulu ganga that was sampled was deep (>3 m) and the substratum in the region was rocky.

### Sampling

The juveniles (5-25 cm) were found in shallow water often closer to the banks and occurred together with several other fish species. Individuals of >25 cm were found in the deeper parts of the river. Samples of juveniles were obtained monthly from a stretch of about 500 m along during the period of June 1986 to May 1987. A monthly sample usually contained over 25 individuals. These samples of fish were collected between 0900 and 1200 hrs using a cast net and a hand net and were immediately injected with 10% formalin into the body cavity and preserved in 10% formalin. Larger specimens were collected from the deeper parts of river using a gill net. Samples from Hulu ganga were also obtained using gill nets.

Important physico-chemical parameters of water were measured at the sites of sampling at the time of each sampling. Temperature, pH, conductivity and concentration of dissolved oxygen of water were measured using calibrated portable electronic meters between 0930 and 1030 hrs. The speed of water flow was estimated by noting the time taken by a floating cork to travel a specified distance along the middle of the stream or river. Monthly mean depth of water at the same sampling station was calculated by measuring the depth at 1 m intervals along a line transect. The rainfall data were obtained from the Meteorological Station at Blackwater Tea Estate, which is situated at the same elevation about 2 km away from the Ginigathena sampling site.

### Analysis

The fish were grouped into the following total length (cm) categories: 5.0-8.9; 9.0-12.9; 13.0-16.9; 17.0-20.9; 21.0-24.9; 25.0-29.9; 30.0-39.9; 40.0-49.9; 50.0-59.9. Gut of each fish was completely removed, uncoiled and the length was measured to the nearest 1mm. The ratio of the length of gut to total length was calculated in each individual and the mean for each length class category of all monthly samples was taken as the relative gut length (RGL) of that total length category. In *T. khudree*, as in other cyprinids, there is no distinct stomach, although the anterior part of the gut is enlarged into the so-called 'intestinal bulb'. The posterior part of the gut is narrow and coiled. This enlarged anterior portion was taken as the "stomach" in the present study. The "stomach" was separated, weighed, and cut open. The fullness of each "stomach" was visually estimated and assigned a value from 0 to 4 in the following manner: 0=<5% full; 1=5%-25% full; 2=25%-50% full; 3=50%-75% full; 4=75%-100% full. The mean value of the monthly sample was taken as the monthly index of the fullness of gut.

The contents of the "stomach" of each fish were carefully suspended in 5 ml or more of water as necessary and were analysed separately. The percentage frequency of each food item was determined by scoring the presence of that food item in the individual fishes in the monthly sample. At least two samples of 1 ml of the suspension were studied in a Sedgewick Rafter Cell under a stereo-microscope, and the relative abundance of each food item was estimated by counting the number of each item present in 50 squares along the diagonals of the counting grid.

## RESULTS

Temperature, pH, conductivity and dissolved oxygen concentration of the water in the streams at Ginigathena varied from 20.3-25.1°C, 6.4-7.1, 49-73mS<sup>25</sup> and 7.8-9.8 mg l<sup>-1</sup>, respectively. Water flow and mean depth varied from 4.0-14.4 cm sec<sup>-1</sup> and 45-140 cm. Monthly rainfall varied from 0-640 mm. The flow was usually moderate (5-15 cm sec<sup>-1</sup>) except during heavy rains.

The small stages or fingerlings (<10 cm total length (TL)) were found at the edges of the streams and rivers, feeding among the stones and pebbles. However, where marginal vegetation was present, they rarely moved into the vegetation. The larger size classes were found more in the central part of the streams and those of >25 cm TL were usually not found in streams but in the deeper main canal of the river.

The analysis of the gut contents of *T. khudree* revealed that it feeds on animal as well as plant matter, and therefore, the species could be categorised as omnivorous. However, the animal matter on which it fed consisted mainly of aquatic insects and aquatic larvae of insects and vary rarely of fish. Thus, it is more appropriate to categorise the species as an insecti-herbivore. The importance of food changed from animal matter to plant matter as the fish grew (Fig.1). Up to about 30 cm TL the ratio of plant matter to animal matter remains about 1 but in higher size groups it increased rapidly (Fig.1). The juveniles fed mainly on bottom living aquatic larvae and adults of insects but also took other animal matter (gastropods, fish and fish eggs, and crustaceans) and some plant matter (both aquatic and terrestrial) (Table 1). There were some spider remains also in the "stomach" contents, but these may have been accidentally ingested. The insects taken included the nymphs of may flies and stone flies, larvae of chironomids, caddis flies, beetles and *Simulium*, and the adults of *Simulium*, beetles, water bugs. The crustaceans included potamonid crabs and atyid shrimps. The snails included mainly the *Paludomus* spp. The algae included filamentous green algae, desmids, diatoms and blue green algae. Of these, the filamentous green algae included *Spirogyra* and *Lyngbya*, while the blue green algae included *Nostoc* and *Microcystis*; diatoms included *Pinnularia*, *Navicula* and *Cymbella* while desmids included *Closterium*, *Cosmarium*, *Hyalotheca*, *Micrasterias* and *Pleurotaenium*. Sand particles were also found among gut contents, but these must be inadvertently ingested along with the food items.

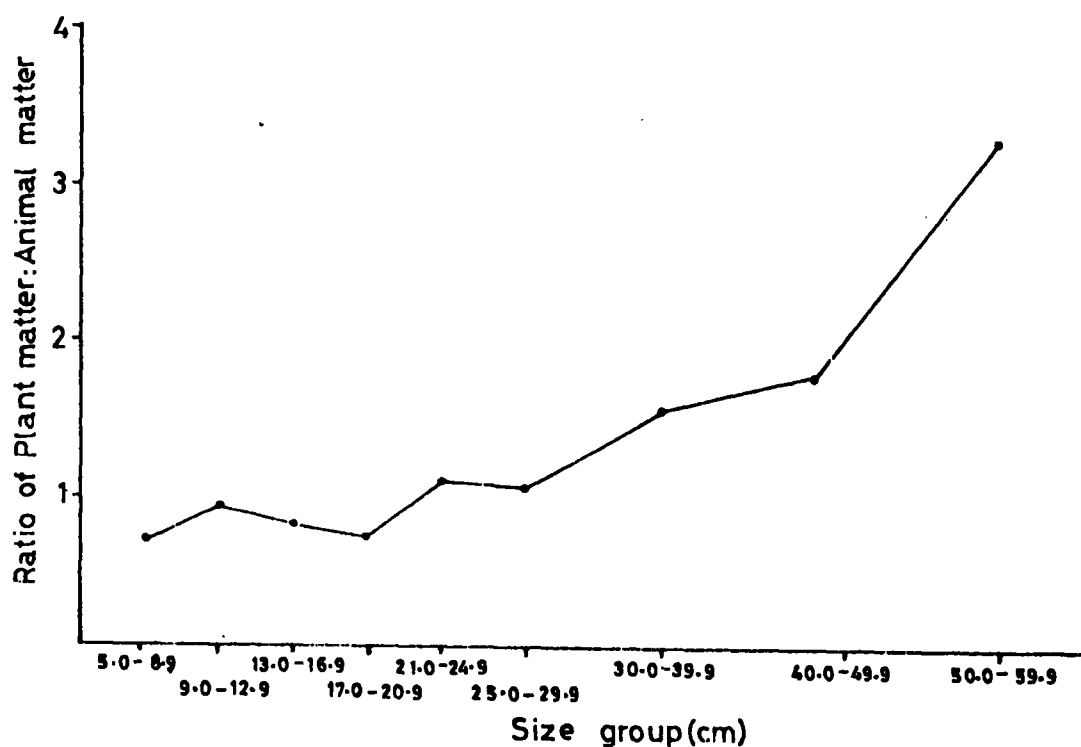


Fig.1 - The variation of the ratio of plant matter to animal matter in the diet of different size groups

The percentage frequency of each food item in different size groups, as obtained by scoring the presence of a particular food item in individuals, is given in Fig.2. The relative abundance of various food items in different size groups, as determined using the counts in the Sedgewick Rafter Cell, is given in Table 1. The percentage frequencies show that almost all individuals in all size groups fed on algae. The number of individuals ingesting insects were also high but their percentage decreased with increasing size. The frequency of individuals feeding on snails remained rather constant over the size groups, whereas the frequency of individuals feeding on aquatic as well as terrestrial plant matter, particularly the latter, increased with size of individual. Detritus were present in the "stomach" contents of almost all individuals. The relative abundance of individual food items also show the importance of insects in the lower size classes and the importance of aquatic and terrestrial plant matter in higher size groups.

Table 1  
The relative abundance of various food items in different size groups

| Size Group              | 5.0-<br>8.9 | 9.0-<br>12.9 | 13.0-<br>16.9 | 17.0-<br>20.9 | 21.0-<br>24.9 | 25.0-<br>29.9 | 30.0-<br>39.9 | 40.0-<br>49.9 | 50.0-<br>59.9 |
|-------------------------|-------------|--------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Food Item               |             |              |               |               |               |               |               |               |               |
| Insects                 | 41.1        | 34.2         | 21.4          | 18.6          | 11.2          | 8.2           | 9.9           | 8.8           | 9.3           |
| Snails                  | 6.8         | 8.6          | 15.7          | 10.7          | 11.2          | 11.4          | 11.1          | 10.3          | 9.5           |
| Crustaceans             | 6.0         | 6.8          | 16.5          | 22.1          | 12.9          | 21.2          | 9.2           | 10.8          | 4.5           |
| Fish                    | 4.8         | 2.4          | 2.0           | 5.8           | 12.2          | 7.4           | 8.6           | 6.1           | 0             |
| Algae                   | 21.4        | 26.3         | 17.4          | 16.0          | 13.2          | 11.2          | 9.4           | 8.4           | 10.2          |
| Aq. plants <sup>1</sup> | 8.8         | 6.8          | 9.8           | 3.9           | 5.2           | 7.8           | 18.0          | 14.1          | 19.2          |
| Tr. plants <sup>2</sup> | 11.1        | 14.9         | 17.2          | 20.1          | 28.6          | 21.3          | 20.2          | 23.9          | 27.2          |
| Tr. plants <sup>3</sup> | 0           | 0            | 0             | 2.8           | 5.5           | 11.5          | 13.6          | 17.6          | 20.1          |
| n                       | 30          | 55           | 85            | 51            | 36            | 32            | 39            | 31            | 11            |

(<sup>1</sup>aquatic plants; <sup>2</sup>leaves and flowers of terrestrial plants; <sup>3</sup>fruits and seeds of terrestrial plants)

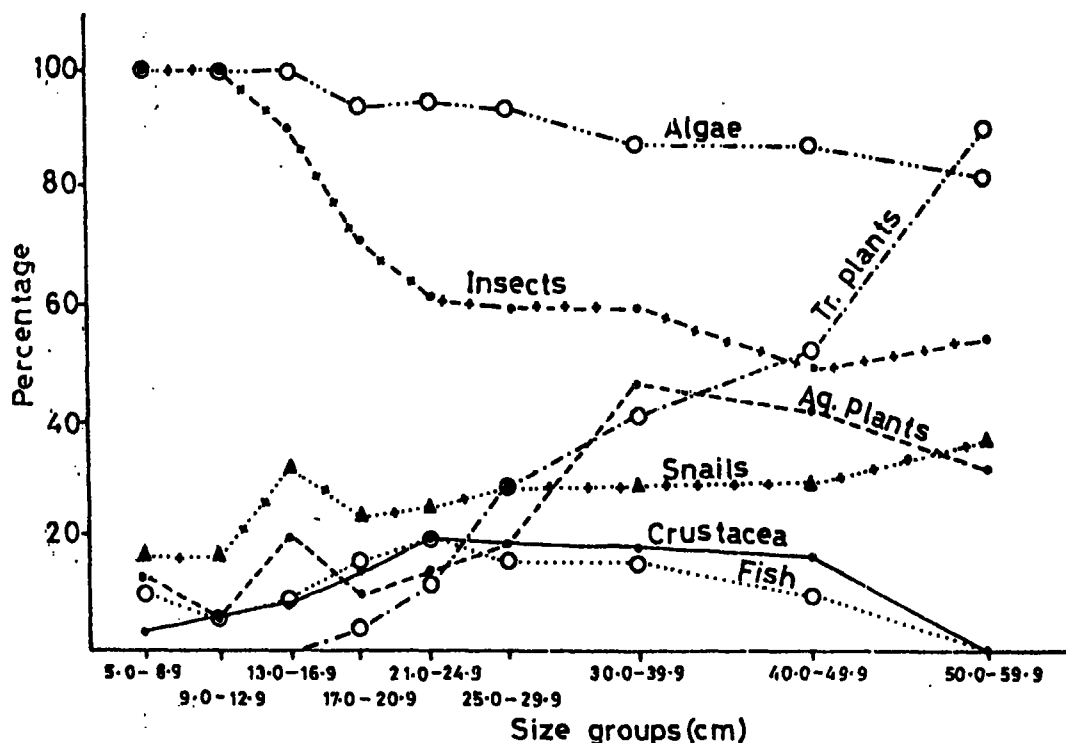


Fig. 2 - The percentage frequencies of various food items in the diet of different size groups. (Aq. plants=parts of aquatic plants; Tr. plants=parts of terrestrial plants)

The small fish were observed feeding on the material present on the substratum, on which there were attached algae and other aufwuchs, insect larvae, snails, and sometimes shrimps and crabs. On the lower surface of the rocks and stones in the substratum also various insect larvae were present. Thus, the "stomach" contents of the small individuals reflected the common constituents of the benthos. The small individuals did not move into the marginal vegetation. Absence of dragonfly- and damselfly-larvae in the "stomach contents" reflects this habit. The larger fish (>25 cm TL) were found in the deeper parts of the river and the still larger ones in deep pools. They were also found to feed on the bottom layer and aufwuchs attached to the rocks and boulders, when the latter were present. They fed on parts of aquatic vegetation as well as on the leaves, flowers, fruits and seeds of the riparian vegetation when these plant components settled in the bottom.

Monthly variation of the fullness of "stomach" is shown in Fig.3. In general, the fullness of "stomach" was higher during "less rainy months" than during "heavy rainy months". It may be that the fast flow of water during the "heavy rainy months" washes away a part of aufwuchs layer and some insect larvae thus reducing the availability of food. Also the increased water speed may make it difficult for the fish to maintain the position for feeding on the aufwuchs layer. The high turbidity of water during heavy rains also may make it difficult for the fish to feed on insect larvae, etc.

Since the ratio of plant matter to animal matter did not change markedly in the size groups of <30 cm TL, the relative frequencies of animal matter and plant matter as well as that of detritus of these size classes were examined on a monthly basis (Fig.4). It was found that during "less rainy months" the frequency of insects is higher in the diet. The frequencies of both plant matter and detritus are low during these months. During the periods of heavy rain, the frequency of insects is reduced and those of plant matter and detritus are increased. The increase of detritus during the "rainy" months also indicate that it also forms an important component of the diet.

Although samples were collected for analysis only between 0900-1200 hrs, observations were made on the feeding of juveniles of *T. khudree* throughout daytime in the natural habitat. They were found to feed throughout the daylight period. The feeding of adults was observed only on a few occasions, but these indicate that they too feed throughout the daytime.

The relative gut length (RGL) (ie. the ratio between the gut length and the total length) increased from 1.74 to 2.55 with increase in length up to a total length of about 30 cm and then remained almost constant (Fig.5).

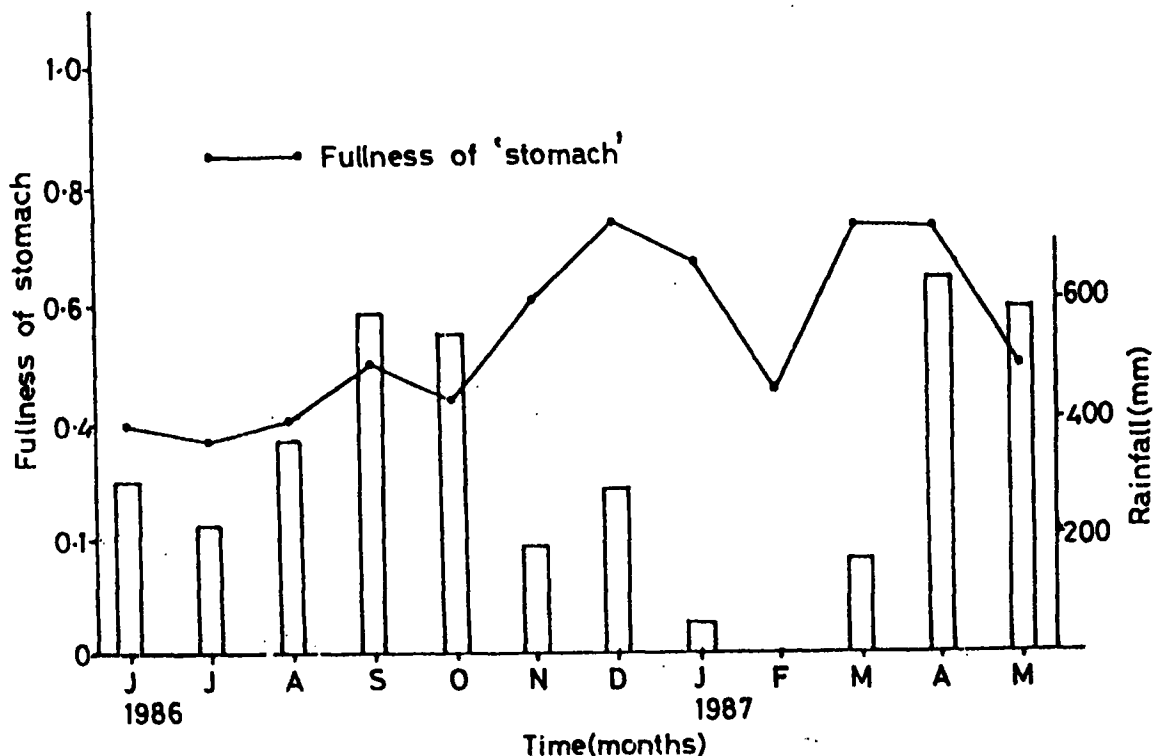


Fig. 3 - The variation of fullness of 'stomach' in different months. Monthly rainfall is also shown

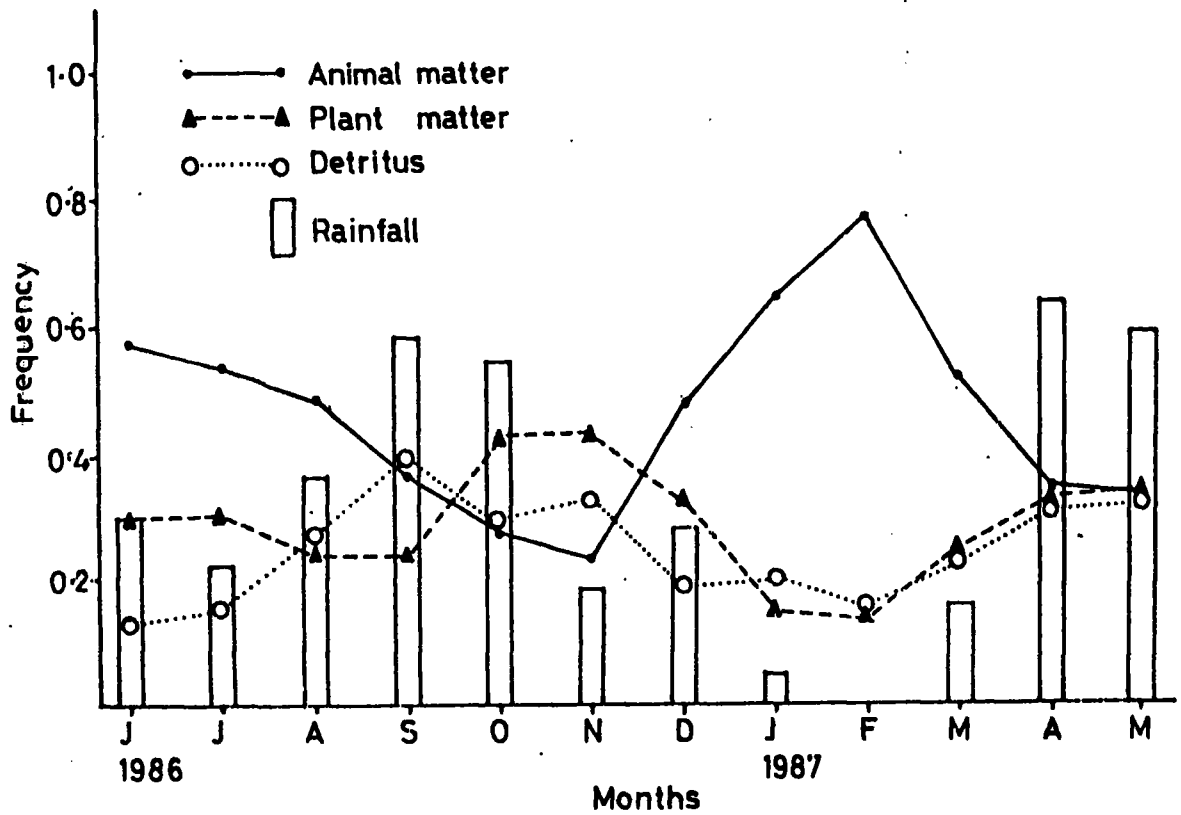


Fig. 4 - The monthly variation of the relative frequencies of animal matter, plant matter and detritus in the diet of the size classes of <30 cm TL> Monthly rainfall is also shown.

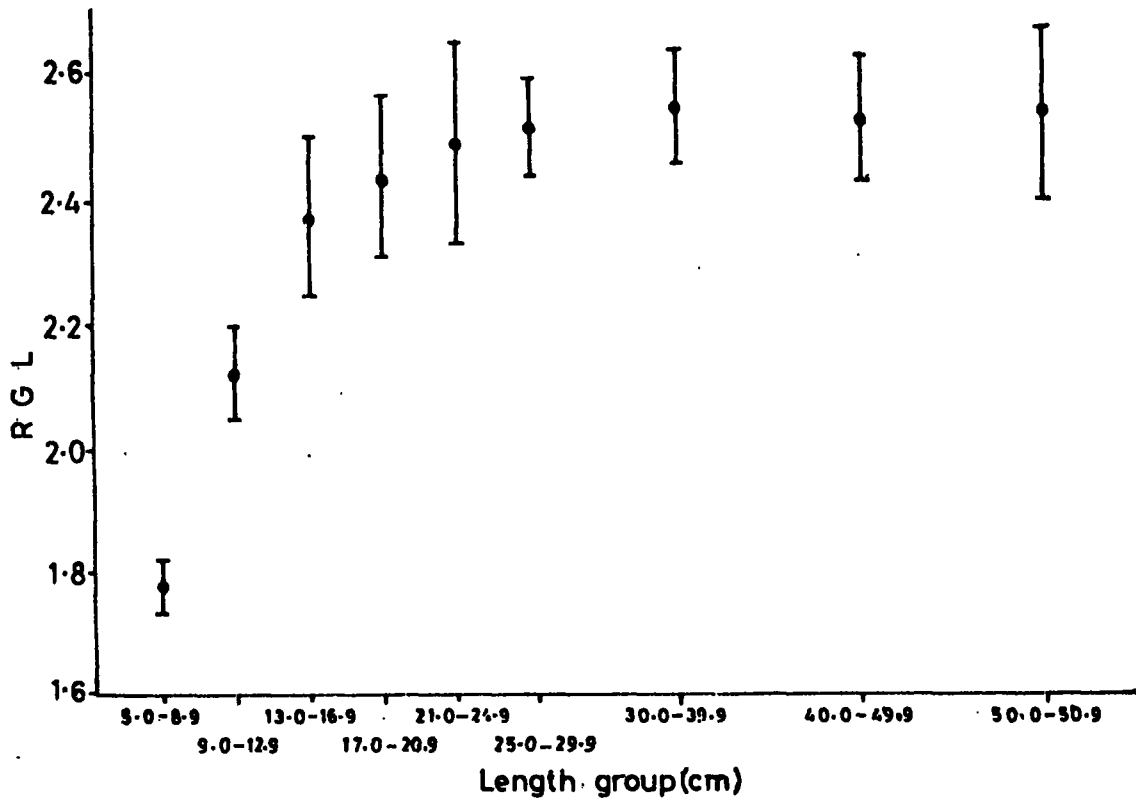


Fig. 5 - The variation of Relative Gut Length (RGL) with total length

## DISCUSSION

Cyprinids are usually either herbivorous or omnivorous, and *T. khudree* could be considered as omnivorous, as it depends on both animal matter and plant matter, as earlier works also show. For instance, Sri Lankan *T. khudree* is said to feed on crabs, molluscs and small fish (Willey, 1903), algal material, freshwater molluscs, and leaves and flowers that fall into the water (Deraniyagala, 1952) and insects and higher plants (Fernando, 1965). However, it depends mainly on insects, and to some extent on snails, but very little on fish. Among omnivorous fish also, some may be more dependent on animal matter while others may be more dependent on plant matter. The juveniles of *T. khudree* depend more on animal matter while the adults depend more on plant matter. Such change of food items as the fish grows was shown in several cyprinid species. For instance, both *Puntius dorsalis* and *P. amphibius*, as they grow, change their diet from one of predominantly crustaceans to one of predominantly higher plants (De Silva *et al.*, 1980). Similarly, *Acrossocheilus hexagonolepis* changes its dietary emphasis from animal matter to plant matter (Dasgupta, 1988), while *P. filamentosus*, in the adult stage, depends more on filamentous algae, macrophytes and detritus and less on protozoans, diatoms and desmids (Kumar *et al.*, 1986). Both *Puntius cumingii* and *P. nigrofasciatus* depend more on diatoms and less on detritus as they grow (de Silva and Somarathna, 1994).

The juveniles of *T. khudree* depend mainly on aquatic insects and aquatic insect larvae and are therefore predominantly insectivorous. The adults depend mainly on aquatic weeds as well as on leaves, flowers, fruits and seeds, etc. of terrestrial plants that are fallen on to water, and therefore, are predominantly macrophytophagous.

Das & Pathani (1978) consider *T. putitora* to be a "herbi-omnivore" stressing the importance of plant matter in its diet. Pathani & Joshi (1979) consider the diet of fingerlings of both *T. putitora* and *T. tor* as zoophagous. Thus, apparently, in these two species of *Tor* also the food emphasis changes from a predominantly zoophagy to predominantly herbivory as the fishes grow.

Nautiyal & Lal (1982) showed that *T. putitora* fingerlings and juveniles (40-350 mm TL) in Nayar river, North India, were predominantly insectivorous and depended mainly on ephemeropteran nymphs. They also showed that while trichopteran larvae were also common in the diet and plecopteran nymphs were found occasionally, adult Coleoptera and Hemiptera were only rarely found. In the present study also, it was found that among the insect larvae in the diet, ephemeropteran larvae predominated while coleopteran larvae came second in importance. The examination of the habitat showed these larvae to be abundant there. Therefore, it appears that there is no food selection but the fish takes what is available.

However, it is significant that no dragonfly or damselfly nymphs were found in the "stomach" contents of fingerlings and juveniles, in the study of Nautiyal & Lal (1982) as well as in the present study. These nymphs, although common in the river and stream edges, are found in the marginal vegetation and the mahseer fingerlings and juveniles did not usually venture into the marginal vegetation.

The relative gut length (RGL) of a fish species is usually related to its food habit (Kapoor *et al.*, 1975; de Silva & Somarathna, 1994). The RGL of 1.78-2.55 of *T. khudree* is in the range of that of the omnivorous fish (de Silva & Somarathna, 1994). However, the increase of RGL as the size increases indicates that the animal component of the food becomes less important while the vegetable component becomes more important as the fish grows. The "stomach" contents of various size groups indicated that this is indeed true. Such a change of food habit with growth will reduce the competition between the adults and juveniles for food. However, juveniles and adults of *T. khudree* live in different habitats, the former in streams and shallow regions of the rivers, and the latter in the deeper parts of rivers and deep pools. Kumar *et al.*, (1986) pointed out that, at least in some species, such changes may result simply from larger fish being able to consume more of the larger food items such as filamentous algae, macrophytes and detritus.

An increase of RGL with size was also observed in *T. putitora* (Nautiyal & Lal, 1982). They showed that the fingerlings (40-70 mm total length (TL)) have a RGL range of 0.819 to 0.918 and the juveniles (70-350 mm TL) have a RGL range of 1.056 to 1.825. They state that the main food of both fingerlings and juveniles were insects, but, do not present quantitative data separately for fingerlings and juveniles. In several other cyprinids also such increase in RGL with body length was observed, although it was found not to be a universal feature. For instance, an increase in RGL with body length was observed in *Acrossocheilus hexagonolepis* (Dasgupta, 1988), *Puntius bimaculatus* (De Silva *et al.*, 1977), *P. amphibius* and *P. dorsalis* (De Silva *et al.*, 1980), *Amblypharyngodon melettinus*, *P. chola*, *P. dorsalis* and *P. filamentosus* (Wijegoonawardana, 1990), *P. cumingii* and *P. nigrofasciatus* (de Silva & Somarathna, 1994) and *Garra ceylonensis* (P.K. de Silva, unpublished data). However, the RGL appears to decrease with increase in body length in *Rasbora daniconius* (Wijegoonawardana,

1990), and it does not seem to change significantly with increase in body length in *P. sarana* (Wijegoonawardana, 1990), *P. titteya* (De Silva *et al.* 1977) and *Danio aequipinnatus* (= *D. malabaricus*) (De Silva *et al.*, 1980). The change of RGL in *P. amphibius*, *P. filamentosus*, *Acrossocheilus hexagonolepis*, *P. cuningii* and *P. nigrofasciatus* has been shown to accompany a change of food habit with more emphasis on plant matter in higher size groups (De Silva *et al.* 1980; Dasgupta, 1988; de Silva & Somarathna, 1994).

**Table 2**  
**Food habits of the fish species cohabiting with *Tor khudree***

| Species                        | General Food habit | Major food item(s)                        | Usual position in the habitat | Authority |
|--------------------------------|--------------------|---|-------------------------------|-----------|
| <b>Ginigathena habitat:</b>    |                    |   |                               |           |
| <i>Belontia signata</i>        | Insectivorous      | insect, larvae, insects, detritus         | Column                        | 2,5       |
| <i>Danio malabaricus</i>       | Insectivorous      | crustaceans, insects, detritus            | Column                        | 3,5       |
| <i>Garra ceylonensis</i>       | Herbivorous        | diatoms, algae, detritus                  | Benthic                       | 2,5       |
| <i>Mastacembelus armatus</i>   | Insectivorous      | insects, insect larvae                    | Benthic                       | 2,5       |
| <i>Puntius cuningii</i>        | Herbivorous        | diatoms, detritus                         | Benthic                       | 7         |
| <i>P. dorsalis</i>             | Omnivorous         | algae, crustaceans, insects               | Column                        | 1,3,4,5   |
| <i>P. nigrofasciatus</i>       | Herbivorous        | diatoms, detritus                         | Benthic                       | 7         |
| <i>Rasbora daniconius</i>      | Omnivorous         | aquatic and terrestrial insects, detritus | Column                        | 2,3,4     |
| <i>Shistura notostigma</i>     | Omnivorous         | insects, detritus                         | Benthic                       | 2,5       |
| <b>Hulu ganga habitat:</b>     |                    |   |                               |           |
| <i>Cyprinus carpio</i>         | Detritivorous      | detritus, insect larvae                   | Benthic                       | 6         |
| <i>Labeo fisheri</i>           | Herbivorous        | algae, detritus                           | Benthic                       | 8         |
| <i>L. rohita</i>               | Herbivorous        | algae, decaying vegetation                | Column                        | 6         |
| <i>Oreochromis mossambicus</i> | Omnivorous         | detritus, phytoplankton                   | Column                        | 4         |
| <i>O. niloticus</i>            | Omnivorous         | phytoplankton, detritus                   | Column                        | 8         |
| <i>Ompok bimaculatus</i>       | Omnivorous         | fish, aquatic plant matter                | Benthic                       | 1         |
| <i>Puntius sarana</i>          | Omnivorous         | algae, insect larvae, fish, aufwuchs      | Column                        | 1,4       |

1. Fernando (1965); Costa & Fernando (1967); 3. De Silva, *et al.* (1980); 4. Schiemer & Hofer (1983); 5. Moyle & Senanayake, (1984); 6. Jhingran & Pullin (1988); 7. de Silva & Somarathna (1994); 8. P.K. de Silva (unpublished data).

The observed monthly variation of the relative abundance of different food categories (animal matter, plant matter and detritus) is probably due to changes in water conditions, particularly in those changes in the water flow. When the water flow was fast there were less insects in the diet. Fast flow of water may dislodge and wash away the insect larvae. Under very fast flow conditions the turbidity of water is high and this will decrease the light penetration and thus reduce the aufwuchs growth. Very fast flow conditions could also wash away a part of the aufwuchs layer. Also, under very fast flow conditions, the small fish may not be able to maintain position to feed at the substratum and on the

layer of aufwuchs. Seasonal changes of the abundance of food items due to flow characteristics were also observed in the diet of *Puntius cuningii* and *P. nigrofasciatus* living in the nearby streams (de Silva & Somarathna, 1994). In *P. amphibius* and *P. filamentosus* in southern India, Kumar *et al.*, (1986) observed that the detritus component in the diet increased markedly during the peak rainy periods.

Most of the cyprinid species are reported as daytime feeders. For instance, *Puntius cuningii* and *P. nigrofasciatus* are shown to feed during daylight hours (Kortmulder *et al.*, 1978; de Silva & Somarathna, 1994). Similarly, *Amblypharyngodon melettinus*, *P. filamentosus*, *P. sarana* and *R. daniconius* have also been reported as daytime feeders (Wijegoonawardana, 1990). Kumar & John (1985) showed that *Rasbora daniconius* is a visual feeder and needs sufficient daylight for feeding. However, although Wijegoonawardana (1990) reported that *P. chola* in the southern part of Sri Lanka as a daytime feeder, reported that, in Parakrama Samudra reservoir in the eastern part of the country, the fullness of stomach of *B. chola* remained more or less constant throughout the 24-hour cycle. Similarly, although Wijegoonawardana (1990) found *P. dorsalis* to be a daytime feeder, Schiemer & Hofer (1983) found that the stomach contents of *B. dorsalis* increased from sunset to midnight and remained high until sunrise. Nautiyal & Lal (1982) found that the juveniles of *T. putitora* feed on the river margins during early morning hours but moved into the middle section during day while larger juveniles confined themselves to deeper pools. The observations of the present study are in agreement with those of Nautiyal & Lal (1982).

Other fish species, which were commonly present together with small size groups of *T. khudree* in the Ginigathena habitat were *Belontia signata*, *Danio malabaricus*, *Garra ceylonensis*, *Mastacembelus armatus*, *Puntius cuningii*, *P. dorsalis*, *P. nigrofasciatus*, *Rasbora daniconius* and *Shistura notostigma*. The members of this assemblage of fishes showed different feeding habits (Table 2). Therefore, the competition among them for food was apparently minimised.

The adult *T. khudree* in Hulu ganga habitat was found together with *Cyprinus carpio*, *Labeo fisheri*, *L. rohita*, *Puntius sarana*, *Oreochromis mossambicus*, *O. niloticus* and *Ompok bimaculatus*. Among these species also, differences in the food habits were seen (Table 2).

Such differences in food habits among cohabiting fish have been demonstrated by other authors as well (De Silva *et al.*, 1980; De Silva *et al.*, 1977; Kumar *et al.*, 1986; de Silva & Somarathna, 1994). The different food habits of cohabiting species is obviously important in the niche segregation.

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