

MORPHOMETRY, FOOD, FEEDING AND
REPRODUCTIVE BIOLOGY OF
Xenentodon cancila - HAMILTON BUCHANAN
(PISCES, BELONIDAE) FROM SOME STREAMS
IN SRI LANKA

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Introduction

Xenentodon cancila Hamilton Buchanan is the smallest of the belonid fishes in Sri Lanka. Of the five species of fish belonging to the family Belonidae that have been recorded from Sri Lanka, *X. cancila* is the only one that is found exclusively in freshwaters. Other four species namely *Ablennes hians* (Valenciennes), *Tylosurus strongylurus* (Van Hasselt), *T. leiurus* (Bleeker) and *T. crocodilus* (Lesueur) are either freshwater or marine (Munro, 1955). *X. cancila* is also known to live in freshwaters in India and Burma (Day, 1878).

Originally two species, namely *Belon cancila* and *X. cancila* were identified from Sri Lankan freshwaters. *B. cancila* was described by Day (1878) and *X. cancila* was described by Deraniyagala (1933). Deraniyagala identified these as two different species but later Munro (1955) categorized these two species into one and named the species as *X. cancila*.

Although some studies have been carried out in India on this fish (Bhalerao, 1937) yet no work has been done on the biology of *X. cancila* in Sri Lanka. The present work deals with the morphometric characteristics, food, feeding and reproduction of this fish from two streams in Sri Lanka.

Materials and Methods

Collections of *X. cancila* were made from two locations namely Attanagalu Oya at Gampaha and Dandagamu Oya at Kuliypitiya. All the fish were caught using a cast net of 1.2 cm stretched mesh size. The fish were immediately preserved in 4% formalin and brought to the laboratory for further studies. *In situ* observations were made with respect to its habitat and general activity patterns.

Morphometry

In the laboratory fish were weighed to the nearest 0.01g. Then 4% formalin were injected into their guts through the anus. External features of the fish were examined. The total length, standard length and opercular length were measured to the nearest mm and the body height was measured to the nearest 0.5 mm.

Alimentary tract morphology

The distance between the tip of the beak and beginning of the lower jaw was measured to the nearest mm as mandibular length. Teeth and other features of the mouth were examined. Each fish was dissected and the general features of the gut were observed. Gut was then removed and the length was measured to the nearest mm for each fish. Gut length was taken as the length from the posterior point of the pharynx to the anal pore.

Diet

Gut contents were analysed using the gravimetric method, which was adopted by Windell (1968), in which the different kinds of food items were sorted and weighed. Values for the various kinds of food items were summed and results are expressed as percentages of the weight of the total food in each fish.

Reproduction

Fish were sexed by examining the gonads. Maturity stages of the gonads were determined with slight modifications according to the maturity scale given by Kesteven (1960). Gonads were removed and weighed to the nearest 0.001 g. Mature female gonads were preserved in Gilson's fluid for egg diameter measurements and fecundity studies. As it was difficult to count all the eggs in a female, they were counted by sub sampling using the wet method according to Kandler and Priwitz (1957).

Results

Habits and habitats

X. cancila was found to inhabit deep areas of streams, which have slow water current. Adults prefer deeper areas than younger ones. The fish tend to inhabit places where water is generally turbid and covered with debris. They are generally not seen at the surface of the water. The altitude and depth range of the habitat from which *X. cancila* was collected for this study are given in Table I.

Table 1: The altitudes and depth ranges of the habitats from which *X. cancila* was collected

Region	Altitude (m)	Depth range (m)
1. Gampaha	100	0.9-1.8
2. Kuliyaipitiya	200	0.9-2.6

X. cancila is a very active and fast swimmer. It was observed that the fish move rapidly with its rounded slender body almost resembling a snake. They were caught with very great difficulty using a cast net. Large numbers of other fish species such as *Aplocheilichthys dayi*, *Rasbora daniconius*, *Puntius filamentosus* and *Wallago attu* were also taken by the cast net during the period of collection, indicating that they share a common habitat with *X. cancila*.

External features:

Body is slender and elongate. Head is long and accounts for about 3/8th of the body length. A deep longitudinal groove can be seen along the upper surface of the head. Both jaws are much elongated. The lower jaw is, however, longer by about 1 mm than the upper jaw. Both jaws have sharp needle like teeth and numerous fine small teeth among them. Eyes are in a dorso-lateral position on the head and are relatively large. Gills are almost without gill rakers. The origin of the dorsal fin is opposite to that of the anal fin. Pectoral and ventral fins are present. Caudal fin is truncate. This fish has a greenish grey colour dorsally and white colour ventrally. A silvery lateral line extends along the body from the eye to the centre of the base of the caudal fin.

Morphometry and length weight relationship:

The weights of the fish in the collections made ranged from 3.5 g to 26.0 g. The mean length-weight relationship for the combined sexes gave the following relationship.

$$W = 0.000329 L^{3.67} \quad (r = 0.98) \quad (W = \text{Weight and } L = \text{Total Length})$$

The relationship between the total length (L) and the body height (H) gave the following regression equation.

$$H = 0.1374 L - 1.0674 \quad (r = 0.89).$$

Morphology of the alimentary tract:

Both jaws have sharp teeth. But no teeth can be found on the roof of the mouth, on the palate or on gill arches. The relationship between the mandibular length (ML) and the total length (TL) gave the following regression equation.

$$ML = 0.2386 TL + 0.941 \quad (r = 0.94)$$

The alimentary tract is an almost straight, undifferentiated tube. But the anterior part of the gut is stretchable from its original size to accommodate a large food mass. This portion of the gut was designated as the stomach.

Statistical analysis of the relationship between the mean relative gut length and total length shows that the correlation coefficient (r) is 0.2895 and the regression line is almost parallel to the 'X' axis having a very small slope (Slope = 0.0039).

Food:

There is not much of a difference in the diet of fish collected from the two locations and also in the diet of male and female fish. Mean composition of the diet is shown in Table II. The number of fish examined with food items amounted to 48.

Table II: Composition of the diet of *X. cancila*

Food item	Percentage weight
1. <i>Rasbora daniconius</i>	81.4
2. <i>Puntius</i> spp.	8.8
3. Fish species unidentified	8.0
4. Mud and sand	0.4

X. cancila feeds only on fish and the stomachs always contained only one fish at a time. *R. daniconius* formed the most important food item. Empty stomachs contained only mucus. The number of fish with empty stomachs was relatively high amounting to 40 % ($n = 78$).

Reproduction:

The ratio of males to females is about 1 : 1. Some males can be readily recognized externally by a red swelling on the dorsal surface just behind the head, but this is not seen in all the males. Fish which bear this feature however, were always males. Except for this character the males and females were very similar in external appearance.

Table III summarizes the data on the reproductive biology of *X. cancila*.

Table III: Summary of data on reproductive biology of *X. cancila*

Percentage of male animals in the collection.....	51%
Percentage of males bearing a red swelling on the upper surface of the body.....	42%
Minimum size at first maturity (a) Males.....	15.6 cm
(b) Females.....	15.8 cm
Size at first maturity as a percentage of the maximum size	
(a) Males.....	52%
(b) Females.....	52%
Average fecundity.....	2000-2570
Length range:	18.4-19.7 cm

A considerable difference was not noted between the minimum sizes of maturity for males and females.

Mean egg diameter distribution for *X. cancila* shows that there are three modes in the frequency distribution of egg diameters. It is most likely that the reserve oocytes correspond to those with a diameter less than 0.22 mm.

Discussion

The elongated body of *X. Cancila* is adapted to an anguilliform swimming pattern. Jaws with sharp needle like teeth, relatively large eyes and well defined lateral line system testify to an adaptation for a predatory behavior pattern. Quentin and Bone (1971) studied a similar predatory fish, *Aphanopus carbo*, which is an elongated trichurid and have shown that they use their lateral line system as well as their large eyes to detect the prey. As it has been observed, *X. cancila* do not prefer to live in groups. This may be an attempt to decrease the competition for prey items.

This species is found only in the deeper levels of streams. Costa and Starmuhler (1970) have also collected this species from depth levels of about 5 m.

Increase in standard length, opercular length, iris diameter and body height tend to take place proportionately with respect to growth in body length. The length weight relationship of *X. cancila* conforms to the general pattern known for most species of fish where in the statistical relationship, $W = aL^b$, the exponent "b" is in the range of three.

Mandibular length increases proportionately with respect to the growth in body length and there is no significant relationship shown for the mean relative gut length with body length. It means that the ratio, gut length : body length, is fairly constant throughout the life time. These two features together show that the feeding behaviour of *X. cancila* does not change with growth. This may be the reason for the tendency for young ones to inhabit shallow areas which are not preferred by adults.

The alimentary tract of *X. cancila* is typical for a carnivorous fish, having a large stretchable stomach and a short intestine. The intestine is so short that it occupies less than one third of the gut length. This alimentary tract shows close resemblances to those of pike (Blucke, 1971) and eel (Clark and Witcomb, 1979), which are adapted to a totally carnivorous life. Ability to increase the volume of the stomach enormously was also observed for *X. cancila*. Similar observations have been made for eels (Clark and Witcomb, 1979). This feature of the stomach may provide the space to store the prey items as a large mass. The large size of the items in the diet of this species may be reflected in the small number of food organisms consumed (most of the time one.) *X. cancila*, therefore, appears to be a macropredator. It was observed that nearly 98.2% of the stomach contents of *X. cancila* were made up of fish and the rest consist of mucous, mud and sand. Although

many other fish species such as *Etroplus maculatus*, *Aplocheilichthys dayi*, *Puntius* sp. and *Wallago attu* inhabit the same habitat with *X. cancila*, it feeds mainly on *Rasbora daniconius*. Therefore, this species may not be an opportunistic feeder.

Although gill rakers are absent, the lack of even a minute amount of phytoplankton in the food shows that *X. cancila* may be inhabiting deep areas of the water body. It is evident from Table II, that *X. cancila* gains a relatively large amount of food from one ingestion, that is about 4.08% of the body weight. Such a large amount may be sufficient to fulfill the energy requirements for a long period. Therefore, *X. cancila* may avoid feeding for considerable time after the digestion of a prey resulting in a higher % of empty stomachs. Keast and Welsh (1968) who made studies on yellow perch, rock bass and pumpkin-seed which are predatory fishes, found that these species consume a diet of about 2-4% of the body weight daily. They obtain their food requirements within certain times of the day and rest of the time their stomachs are empty.

The sex ratio of *X. cancila* approximates to the 1 : 1 ratio. This may be an indication of the lack of difference in the longevity of the two sexes (Nikolsky, 1965). It is evident that the % occurrence of the red swelling is higher with the maturity stage of the male. Therefore, it can be thought that there is some relationship between the occurrence of this feature and changes of physiological conditions due to sexual maturity. There have been several observations on the appearance of secondary sexual characters among fishes. Overbreek and Bride (1971) observed the changes in colouration and appearance of dark spots on the body of mature males of *Callionymus maculatus*.

Both male and female fish were found to mature at the same size. Sexual maturity is attained at an early size approximately when 50% of the maximum attainable size is reached. This is thought to reflect the short life span of this species (Nikolsky, 1965). Egg diameter distribution pattern of the mature female fish showed that there are two peaks. It is therefore, evident that this species is a serial spawner.

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