Study on morphology of digestive system and relative length of gut of *Channa punctatus* from Kaigaon Toka region of Aurangabad.

Dr.Ajit .K.Gedam

Jijamata College of Arts and science.

Bhenda , Nevasa, Ahmadnagar (M.S).

mail - gajit2000@gmail.com

Contact : +918669474077

Abstract :

For a correct understanding of the feeding habits of a fish, a study of the anatomy of the organs of feeding and digestion is necessary. 'An examination of the special relations of food and feeding structures gives clues, not only to the present significance of fishes but also their past effect on life at large, showing how they must have modified the course of evolution' (Forbes, 1888). While observing the morphological characters of alimentary canal of *Channa punctatus* it is found that the alimentary canal is demarked into oesophagus, stomach, pyloric caecae, intestine and rectum.The mean alimentary canal length (ACL) observed was 17.4 ± 1.57cm. The Pearson correlation coefficient of alimentary canal length (ACL) and total length (TL) of *Channa punctatus* (r) = 0.999.

Keywords : *Channa punctatus*, oesophagus, stomach, pyloric caecae.

Introduction:

Studies on trophic morphology expanded following the classic work of Suyehiro (1942), Al- Hussaini (1949), and Angelescu and Gneri (1949), among others, who demonstrated that a correlation exists between the structures of the digestive apparatus and the feeding habit of fishes. Particular morphological traces give insights on the feeding ecology of a species, since these peculiarities suggest how a fish is able to feed. Wootton (1990) emphasized that there may be evolutionary convergence in the morphology of phylogenetically unrelated species that use similar food resources. Although the relationship between the morphology of the digestive apparatus and diet of fishes have been well documented (Suyehiro, 1942; Al- Hussaini, 1949; Angelescu and Gneri, 1949; Junger et al., 1989; Veregina, 1990), the morphological variations within trophic categories in tropical fishes appear to be poorly known, specially among detritivores and other benthic feeding fishes.

For a correct understanding of the feeding habits of a fish, a study of the anatomy of the organs of feeding and digestion is necessary. 'An examination of the special relations of food and feeding structures gives clues, not only to the present significance of fishes but also their past effect on life at large, showing how they must have modified the course of evolution' (Forbes, 1888). The longer digestive tracts observed in herbivorous vertebrates are thought to increase the volume of food that can be ingested per feeding and lead to lengthier retention times of refractory compounds in the alimentary canal, thereby increasing exposure of ingest to the battery of digestive processes in the gut (Ribble and Smith 1983; Sibley and Calow 1986; Horn 1989; Starck 2005). Such an increase in exposure can increase the efficiency by which an herbivorous diet can be digested (Starck, 2005). Relatively long digestive tracts have been documented in both freshwater (Zihler 1982; Ribble and Smith 1983; Kramer and Bryant, 1995b; Drewe et al. 2004) and marine (Al-Hussaini 1947; Kapoor et al. 1975; Horn, 1989; Benavides et al., 1994; Horn and Ojeda 1999) herbivorous fishes. Even atherinopsids, which have relatively short, stomach less digestive tracts (Logothetis et al. 2001), exhibit increased gut length with increased degree of herbivory (Horn et al., 2006). Many herbivorous fish species appear to begin life as carnivores or omnivores and shift to a more herbivorous diet as they grow (White, 1985), and their gut lengths usually increase accordingly (Montgomery, 1977; Stoner and Livingston 1984; Gallagher et al. 2001; Drewe et al.,. 2004). In fact, many fishes, regardless of diet, show an ontogenetic increase in their gut length relative to their body length, but those that consume more plant material as they increase in size can show disproportionate ontogenetic increases in gut length (Kramer and Bryant 1995a). Gut length can also vary among fish species with different body shapes (e.g., elongate versus deep-bodied), as deeper- bodied fishes generally have more space in their peritoneal cavities to accommodate longer, more highly coiled guts (Montgomery, 1977; Barton, 1982;Kramer and Bryant 1995b). Differences in body mass can also produce misleading results in comparisons of gut length because fishes that grow at faster rates tend to be heavier and exhibit longer guts than those that grow more slowly (Kramer and Bryant 1995a).

Materials and Methods :

Live fish specimen of *Channa panctatus* were collected from Kaigaon Toka, Dist. Aurangabad, (M.S.) India. Immediately the specimens were fixed in 4% formaldehyde. The intestine was separated from the viscera and the length was measured from the insertion of the stomach to the urinogenital aperture and morphological studies of the various parts of the alimentary canal of *Channa panctatus* was carried out. To study the relationship between total length and alimentary canl length and relative length of gut, statistically by regression analysis and correlation method by Pearson correlation method, a total number of 30 specimens each of *Channa panctatus* was studied.

Results and discussion :

While observing the morphological characters of alimentary canal of *Channa punctatus* it is found that the alimentary canal is demarked into oesophagus, stomach, pyloric caecae, intestine and rectum.The mean alimentary canal length (ACL) observed was 17.4 ± 1.57cm.(Table 3.1)

Oesophagus

In the present investigation it is observed that the oesophagus of *Channa punctatus* is short, straight, highly muscular tube. Oesophageal variations are almost negligible (Plate 10 c). Similar results were observed by Nijaguna (1989) in *Channa gachua*. Kaul(1999) reported that oesophagus in predatory fishes is short, straight, and muscular. It was also reported that, in predaceous fishes (e.g. *Channa gachua*) oesophagus is capable of great contraction and extension which helps in swallowing larger prey. The only function of oesophagus, however, seems to transport food from bucco-pharyngeal cavity to gut of the fishes. Moitra and Das (2002) reported that the oesophagus is short in carnivorous fishes *Ambassis ranga* and *Channa striatus.*

Stomach

It is observed that the stomach of *Channa punctatus* is large demarcated into anterior cardiac and posterior pyloric region. (Plate 10b and 10c). The stomach of *Channa punctatus* acts as a food storage organ and helps in physical treatment of the stored food, and finally digest the food (Table No. 6.4). Similar results were observed by Nijaguna (1989) in *Channa gachua*. Kaul (1999) reported that highly developed stomach is present only in *Channa gachua* because of its carnivore and predatory nature. Barrington (1957); Lagler et al., (1962); Romer (1969) earlier reported the gastric nature of alimentary canal in carnivorous fishes. Lagler et al., (1962) reported that the primary criterion for being able to do with or without stomach does not seem to be true whether fish is an herbivore or carnivore, but whether accessory adaptation for trituration and very fine grinding of food exists in the form of teeth or other accessory grinding apparatus or organ viz. gizzard. According to Mookerjee et al. (1946), Quayyum and Qasim (1964), Tandon (1963), stomach in *Channa gachua* is highly developed and resembles with the stomach of *Channa punctatus* and *Channa striatus*. Subla (1967) reported that well developed musculature of the stomach helps in accommodating prey larger than stomach and prevent escape of the prey by cardiac spinchter. Moitra and Das (2002) reported that the stomach iswell developed in carnivorous fishes *Ambassis ranga* and *Channa striatus*.

Pyloric caecae

It is observed that *Channa punctatus* bears a pair of pyloric caeca one on either side of the stomach. The left pyloric caeca is longer than the right (Plate 10b and 10c). Pyloric caeca helps in accommodating the prey besides helping in digestion and absorption, as observed by Kapoor et al. (1975). Similar results were observed by Nijaguna (1989). Pyloric caeca and their extreme numerical variations have been reported by Suyehiro (1942) and Rahimulla (1945). Moitra and Das (2002) reported that the stomach is provided with a pair of pyloric caeca in carnivorous fishes *Ambassis ranga* and *Channa striatus.*

Intestine

The intestine of the *Channa punctatus* is a short, coiled tube, having descending limb and ascending limb (Plate 10). Similar results were observed by Nijaguna (1989). Modification in the intestine (short, moderate, lengthy or coiled) is an indication of its feeding habit (carnivore, omnivore or herbivore) as observed by Fukusho, (1969). Moitra and Das (2002) reported that the intestine is short and muscular in carnivorous fishes *Ambassis ranga* and *Channa striatus*.

Rectum

The rectum of *Channa punctatus* is well defined (Plate 10). Similar results were observed by Moitra and Das (2002) in carnivorous fishes *Ambassis ranga* and *Channa striatus*. Relationship between Total length (TL) and Alimentary canal length (ACL) of *Channa punctatus* The mean total length (TL) of *Channa punctatus* was calculated 19.8 ± 1.79 cm and the mean alimentary canal length (ACL) was 17.4 ± 1.57 cm. (Table 4.1) The ratio of alimentary canal length to total length of *Channa punctatus* was 0.88:1. The mean relative length of gut (RLG) of *Channa punctatus* obtained was 0.88± 0.004. (Table 4.1)

For Regression Analysis:-

i) Dependent variable is alimentary canal length (ACL) and

ii) Independent variable is total length (TL) of *Channa punctatus*.

Then the regression equation (Graph 4.1) for relationship between total length

(TL) and alimentary canal length (ACL) of *Channa punctatus* is ACL = 0.0541 +0.877 TL.

Thus as the total length (TL) increases, then the alimentary canal length (ACL) increases by 0.877 per unit of total length (TL) of *Channa punctatus*. The Pearson correlation coefficient of alimentary canal length (ACL) and total length (TL) of *Channa punctatus* (r) = 0.999

The above analysis of relationship between the total length (TL) and alimentary canal length (ACL) of *Channa punctatus* reveals that there is positive correlation between the total length (TL) and alimentary canal length (ACL) of *Channa punctatus*.

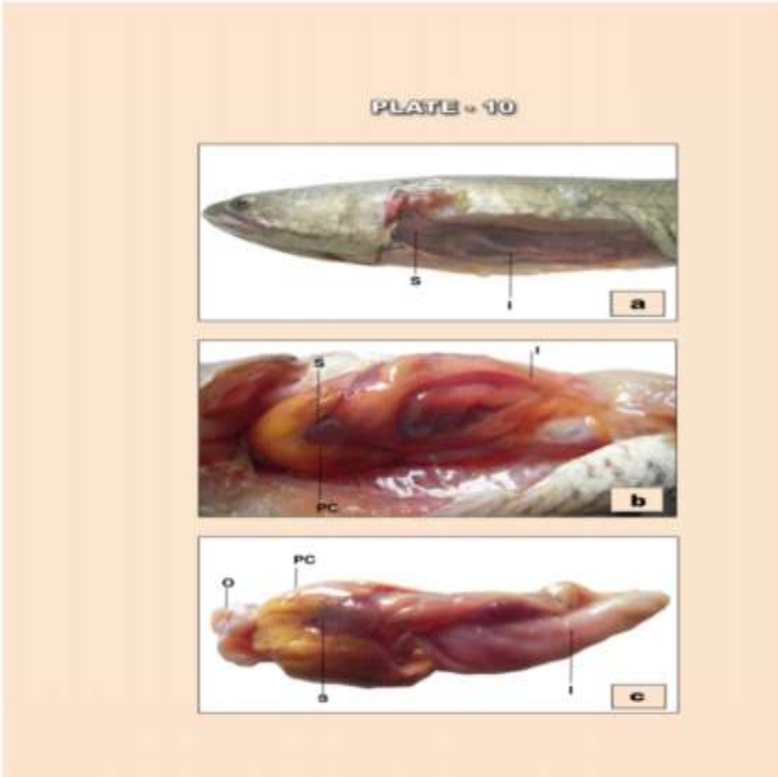


Plate 10

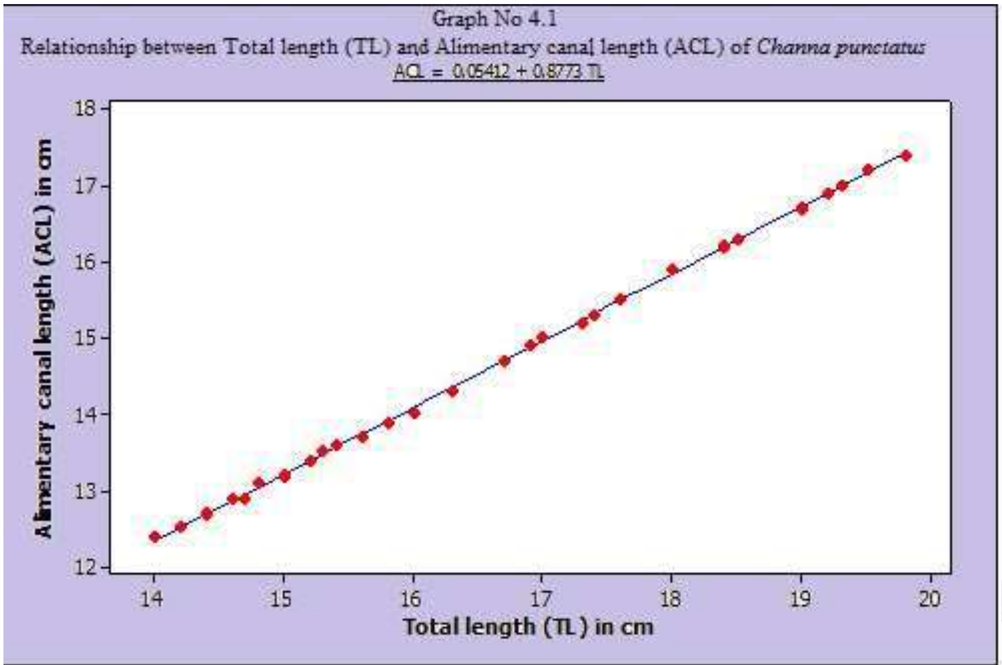
a) In situ alimentary canal of *Channa punctatus* showing (S) stomach and (I) intestine.

b) In situ alimentary canal of *Channa punctatus* showing (S) stomach, (I) intestine and (PC) pyloric caeca.

c) Ex- situ alimentary canal of *Channa punctatus* showing (S) stomach, (I) intestine, (PC) pyloric caeca and (O) oesophagus.

Table 3.1 ***Channa punctatus*** **Relative Length of Gut.**

Observation	**Total Length of Fish (TL) in cm**	**Length of Alimentary Canal (ACL) in cm**	**Relative length of gut (RLG)= (ACL) / (TL)**
1	14	12.4	0.88
2	14.2	12.5	0.88
3	14.4	12.7	0.88
4	14.6	12.9	0.88
5	14.7	12.9	0.87
6	14.7	12.9	0.87
7	14.8	13.1	0.88
8	15	13.2	0.88
9	15.2	13.4	0.88
10	15.2	13.4	0.88
11	15.3	13.5	0.88
12	15.4	13.6	0.88
13	15.6	13.7	0.87
14	15.8	13.9	0.87
15	16	14	0.87
16	16.3	14.3	0.87
17	16.7	14.7	0.88
18	16.9	14.9	0.88
19	17	15	0.88
20	17.3	15.2	0.87
21	17.4	15.3	0.87
22	17.6	15.5	0.88
23	18	15.9	0.88
24	18.4	16.2	0.88
25	18.5	16.3	0.88
26	19	16.7	0.87
27	19.2	16.9	0.88
28	19.3	17	0.88
29	19.5	17.2	0.88
30	19.8	17.4	0.87
Mean	**16.52**	**14.55**	**0.87**



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