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A Comprehensive Review on Feeding and Breeding Biology of Freshwater Garfish, Xenentodon cancila (Hamilton, 1822) for Captive Culture

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Abstract: ***Xenentodon cancila is a freshwater fish species, commonly known as freshwater garfish. It is used as food fish and its acceptability and high demand as an ornamental species among the fish hobbyists have already been reported. Not much research has so far been conducted on food, feeding habit and reproductive biology of this species. The present review aims to consolidate the earlier documented information on feeding habit and reproductive biology of Xenentodon cancila along with pointing out the information gap which to be filled up to sustain its trade as an ornamental fish and table fish as well.***

Keywords: Xenentodon cancila; feeding habit; reproductive biology

1. Introduction

Xenentodon cancila is commonly known as freshwater garfish which belongs to the family Belonidae under the order Beloniformes. Though no such information is so far available on its nutritional quality, this fish species is almost common in fish markets of its native ranges where it is used to come along with the catch of other indigenous fish varieties. It has been reported from domestic ornamental fish markets of India; having high market demand among the aquarium fish hobbyists and recently has also been exported from India to other countries as indigenous ornamental fish Xenentodon cancila (Hamilton, 1822), the long striped needle garfish is found in Bangladesh, India, Pakistan, Myanmar and Ceylone. It lives in fresh water bodies; some common habitats are ponds ditches, canals, floodplains, rivers and lake. It was recorded from different places of Assam and other North Eastern states of India by different workers. It is a predatory fish depending mainly on animal matter, fish, insects and nematodes. It is used as food fish and captured from open freshwater bodies of Bangladesh and India. It has been reported that X. cancila has some medicinal value. The market price of this fish is comparatively cheap and individuals of 6 - 15 cm size group are highly rated and suitable for aquarium rearing. Campbell et al., 2005 studied the morphological characteristics of X. cancila in relation to diet. Dasgupta studied the adaptation of the alimentary tract of the species in relation to their food and feeding habits. Parihar and Saksena, 2016 studied the food and feeding habits of X. cancila and revealed that it is a carnivorous fish. Though X. cancila was previously found widely in different parts of India, its population has been decreasing day by day. It was declared as threatened species by IUCN in 2006.

Xenentodon cancila (freshwater garfish) is a needlefish found in freshwater and brackish habitats in South and Southeast Asia. As a reasonably popular fish, it has been traded under a variety of common names, including needlefish, silver needlefish, Asian freshwater needlefish, needle - nose halfbeak, freshwater gar, needle nose gar and other local dialects (Rahman, 1989; Al - Mamun, 2003). The fish is one of the costly indigenous fresh food in the country (Rahman, 2005) and the market price is around BDT 400/kg (US$ 5). It is also a potential aquarium fish in the country. It is rich with vitamin - A which plays an important role in preventing child blindness. The distribution of this fish is transboundary in the greater area of South Asia and thus contributes a global significance with its taste and nutrition (Talwar and Jhingran, 1991; Frose and Pauly, 2012). The major part of the catch is consumed locally. However, the small part of the harvested fish is exported to the Middle East, Europe and America as a human consumable food item (Dutta, 2015). Our neighbour country Bangladesh is reportedly one of the largest producers of garfish for the global market and thus attention should be given to unveil ecological aspects of this fish for its further conservation. Upstream of the rivers and the freshwater reservoirs are the main habitat of X. cancila; for instance, it is highly abundant in the Ganges - Brahmaputra system in the Indian subcontinent (Rahman, 1989; Talwar and Jhingran, 1991). The adult freshwater garfish prefers habitat that contains minimal floating vegetation (Pethiyagoda, 1991). It is reported from Sri Lanka that the fish mostly feeds on crustaceans, small fishes and insects (Pethiyagoda, 1991). However, this feeding habit depends on the context of their local habitat, for instance, food availability and types of prey in its ecological niche (Bhuiyan et al., 2006). Xenentodon cancila is declining from natural habitat compared to other small indigenous species due to habitat destruction and fishing pressure (Islam et al., 2016). Therefore, the management of the fishery is necessary for the target fish, such as this garfish. The knowledge of the food and feeding habits is one of the important biological information which is essential for the management of any fish (Begum et al., 2008; Sarkar and Deepak, 2009). Also, understanding different aspects of reproduction biology such as maturity size, breeding season and fecundity are the prerequisites for both culture and fisheries management strategy (Islam et al., 2016). There is scanty literature on the breeding biology of the fish particularly about the breeding season and fecundity of this species. Understanding reproductive behaviour of fishes is not only important for elucidating the basic biology of the fishes but it can also help in their management and conservation. Thus, studies on reproduction behavior of fish

are important and a basic requirement for artificial breeding of the fish species. Considering the above background, the present study is proposed to ascertain the feeding and breeding biology of the X. cancila fish.

Vernacular names *Xenentodon cancila* is vernacularly known as kokila/kakila/kankley in India; kakila/kaikka in Bangladesh; kauwa/kauwo in Nepal; Yonna in Sri Lanka and Pla katung heo mueng in Thailand

Morphological characters: Talwar and Jhingran, 1991 and Day, 1878 have described the morphological characters of Xenentodon cancila which has been summarized here. Body is very elongated and slightly compressed. A deep longitudinal groove is present along the upper surface of the head. Lower jaw is the longer; the maxilla, which is partially concealed by the preorbital, reaches to beneath the first - third of the eye. Eyes are rather small. Teeth: a row of large, sharp, widely separated ones in both the jaws; with an external row of numerous fine ones; none is present on the vomer. Scales are small; present over the body and in irregular rows, some over front end of the groove on head, also on sides of head except on opercles. Dorsal fin commences opposite to the anal fin; and is rather more than, or else twice as far from the anterior extremity of the orbit as it is from the posterior extremity of the tail. Pectoral fin equals half the distance of the head behind the front edge of the eye. Pelvic fin is inserted rather nearer to the base of the caudal fin than the hind edge of the eye. Caudal fin is slightly emarginated. The last dorsal fin and anal fin rays are not elongated.

Color: greenish gray superiorly, becoming whitish along the abdomen. A silvery streak having a dark margin extends along the body from opposite the orbit to the centre of base of the caudal fin. The whole upper two - thirds of the body is closely marked with fine black spots; while there are from 4 to 6 larger blotches along the side between the bases of the pectoral and anal fins, these are absent in the young. Dorsal and caudal fins are dark edged; anal fin is whitish with a greyish margin. Eyes are golden.

Food and feeding habit Information so far available on food and feeding habit of Xenentodon cancila is very much scanty. Bhuiyan, 1964; Gupta, 1971 and Ward - Campbell et al.2005 have reported carnivorous feeding habit of this fish species. Bhuiyan 1964 has documented its maximum preference for fishes while Ward - Campbell et al.2005 have reported that this fish species fed primarily on fishes (41.2 %), crustacean (22.5 %) and immature forms of Odonata (20 %) and to a lesser extent on immature Ephemeroptera (12.4 %) and Hemiptera (7.7 %).

8. Reproductive biology 8.1 Sexual dimorphism Sehgal et al.1989 have documented some sexual dimorphic characters for Xenentodon cancila which has been enlisted in Table 1.

Table 1: Sexual dimorphic characters of Xenentodon cancila as described by Sehgal et al. (1989)

S. No.	Characters	Male	Female
1.	Shape of the body	A hump in the mid-dorsal region, just behind the head groove.	Hump absent.
2.	Vent	Small deep, pit like.	Projecting like a small papilla with a narrow median slit.
3.	Abdomen	Not round.	Rounded, bulging.
4.	Body coloration		
5.	Abdomen	With yellow patches up to pelvic fin, rest part of the body is white.	White
6.	Dorsal (above lateral line)	Olive green	Olive green predominant with greyish tinge.

Fecundity: No such research so far has been done to study the fecundity of Xenentodon cancila except by Bhuiyan and Islam, 1990 who has reported average fecundity of 1, 432 with a range of 750 to 2, 852 for this fish species.

The gut contents in the present study determined that the species X. cancila is a carnivorous fish. The males were significantly (P>0.01) higher in composition (1: 0.) than the female. The breeding season of the species is April to September and females get maturity at the size of 178.58 mm of total length. These findings may help fish biologists to manage X. cancila fishery in the country of present study as well as in nearby territories.

2. Conclusion

This fish so far has not been considered as a highly relished table fish; is used to be consumed by the poor people mainly. In markets this fish species is used to come along with the collection of other indigenous fish varieties. On the other hand, in ornamental fish markets this fish species is just recently introduced. So may be considering its less importance in fishery and ornamental trade, earlier researchers have not paid much attention to study its biology. The supply of Xenentodon cancila both in food fish markets as well as in ornamental fish markets is capture based. The population declination of this fish species has already been reported in its native ranges thus unscrupulous collection of this species may even further accelerate the declination. Hence to sustain the trade of this fish species, initiatives to be taken to start its captive culture and in this regard, proper information on its feeding habit and reproductive biology is required. Thus, the information so far available on its biology to be used judiciously and the existing information gap demarcated in this review to be filled up with further research to support its trade.

As per the information documented in this review, it is quite clear that no such contradiction regarding feeding habit as reported earlier for some other indigenous fish varieties is present for Xenentodon cancila. All the earlier researchers have reported carnivorous feeding habit for this fish species. So far, food preference of only adult Xenentodon cancila has

been reported; but for captive culture, proper knowledge on food preference of different life stages is required.

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