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Study of gonadosomatic index and fecundity of fresh water fish *Xenontedon cancila*

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Abstract
Gonado-somatic index and fecundity of the fresh water fish *Xenontedon cancila* was studied. The Gonadosomatic index of the ovary ranged from 0.912 to 10.870 and testis ranged from 0.186 to 1.298. Highest GSI values were recorded in the month of July in the gonads and lowest GSI value were recorded in the month of November during the study period. The fecundity of the fish was recorded low as the number of eggs ranged from 144 to 194. The diameter of ova of *X.cancila* was found to range from 1.20 to 1.61 mm in mature fish.

Keywords: *Xenontedon cancila*, gonado-somatic index, fecundity, ova diameter

Introduction
Xenentodon cancila (Hamilton, 1822) [1], the long striped needle garfish is found in Bangladesh, India, Pakistan, Myanmar and Ceylone [2]. It lives in fresh water bodies; some common habitats are ponds ditches, canals, floodplains, rivers and lake [3]. It was recorded from different places of Assam and other North Eastern states of India by different workers [4, 5, 6]. It is a predatory fish depending mainly on animal matter, fish, insects and nematodes [7, 8]. It is used as food fish and captured from open freshwater bodies of Bangladesh and India [9, 10]. It has been reported that *X. cancila* has some medicinal value [11]. 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 [12]. Campbell *et al.* [7] studied the morphological characteristics of *X.cancila* in relation to diet. Chandrika *et al.* [13] studied about length weight relationship of *X.cancila*. Dasgupta [8] studied the adaptation of the alimentary tract of the species in relation to their food and feeding habits. Parihar and Saksena [14] 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. 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. Knowledge of fecundity and spawning habit of a fish is also an important aspect in stock size assessment, stock discrimination [15] and rational utilization of stock and in explaining the variation of population as well as to make efforts for increasing the amount of fish yield. Thus, studies on reproduction behavior of fish are important and a basic requirement for improvement of and effective fishery resources management and conservation [16]. Considering the above background**,** the present study is proposed to ascertain the breeding biology of the *X. cancila* fish.

Materials and Methods
Fish specimens were collected from different habitats of Kamrup (M) district of Assam, India. Fishes were collected in every month of the year during the study period i.e., from March, 2014 to September, 2015.

Gonado- Somatic Index
The Gonado- Somatic Index (GSI) is the calculation of the gonad mass as a proportion of the total body mass. The Gonado- Somatic Index was studied to ascertain the spawning season in both male and female. GSI was calculated on monthly basis by following standard method [17].

For this, weight of collected fish was taken using digital balance. The gonads were removed by abdominal dissection and weight was taken. The GSI was calculated using the formula below:

$$GSI = (GW/ (BW- GW) \times 100$$

Where GSI is gonado-somatic index, GW is gonad weight and BW is total body weight with intact gonad.

Determination of fecundity of the fish in relation to its size and weight

Matured females of *X.cancila* were collected from different habitats of Kamrup (m) district, Assam. Enlarged abdomen of the female fish was easily distinguished as gravid one. The fecundity was studied following the method of Armando *et al* [18]. For detail study of fecundity the collected fishes were carried immediately to the laboratory. After thorough wash with tap water the total length of each fish was measured with a measuring scale to the nearest millimeter and the body weight in gram by an electronic balance. Excess water from the fishes was removed with blotting paper before measuring the weight of the fishes. The gonads were dissected out and weighted. Two lobes of the ovary from each sample fish were removed carefully by dissecting out the abdomen. Then fresh ovary was fixed in buffered 10% formalin for 12 hours and stored in 70% ethanol. All the eggs from both the lobes of ovary were emptied into a beaker of water and were shacked gently to cause uniform mixing. Then all the eggs are counted. The size of the oocyte was recorded with the help of micrometer fitted with the microscope.

Results

(i) Gonadosomatic index (GSI)

Gonado-somatic index (GSI) of ovary and testis of *Xenentodon cancila* were recorded in every month of the study period. The results are tabulated in table 1. Highest GSI values were recorded in the month of July in the gonads and lowest GSI value were recorded in the month of November during the study period.

Photograph of ovary of *X.cancila*

Table 1: Showing Gonadosomatic index (GSI) of Ovary and Testis of *X. cancila* in different months of the year (n= 10)

Month	GSI of Ovary (Mean ± S.E.M)	GSI of Testis (Mean ± S.E.M)
January	1.980 ± 0.140	0.287± 0.015
February	2.741 ± 0.171	0.384 ± 0.017
March	4.892 ± 0.270	0.443 ± 0.023
April	5.072 ± 0.292	0.501 ± 0.030
May	6.960 ± 0.310	0.712 ± 0.034
June	9.682 ± 0.390	1.034 ± 0.038
July	10.870 ± 0.40	1.298 ± 0.048
August	9.601 ± 0.430	1.010 ± 0.041
September	1.704 ± 0.120	0.220 ± 0.017
October	1.120 ± 0.042	0.193 ± 0.009
November	0.912 ± 0.035	0.186 ± 0.008
December	1.252 ± 0.048	0.248 ± 0.012

(ii) Fecundity

The number of eggs contained in ovary of a fish is termed as fecundity. The term fecundity denotes the egg laying capacity of a fish or it refers to the number of ripe eggs produced by a fish in one spawning season. Knowledge about fecundity of a fish is essential for evaluating the commercial potentialities of its stock, life history, practical culture and actual management of the fishery. Fecundity of the fish in relation to length and body weight and ova diameter was studied from April to August, 2015. The results are given in the Table: 2.

Table 2: Showing Mean ± SEM of total length(cm), body weight (gram), ovary weight, (gram) fecundity and ova diameter (mm) of mature *X.cancila* fish during study period (n=10)

Months	Total length	Body weight	Ovary weight	Fecundity	Ova diameter
April	18.52 ± 0.86	21.421 ± 0.93	1.086 ± .043	144 ± 11	1.20 ± .032
May	18.67 ± 0.78	21.623 ± 0.76	1.504 ±.048	152 ± 13	1.53 ± .028
June	18.88±0.68	23.214 ± 0.82	2.247 ±.053	168 ± 14	1.58 ± .034
July	19.23± 0.73	23.840 ± 0.78	2.591 ±.064	194 ± 12	1.61± .042
August	19.12 ± 0.69	22.19 ±0.86	2.145± .067	176 ± 13	1.45 ± .040

In the present study, fecundity of *X. cancila* varies from 144 ± 11 to 194± 12. It is observed that fecundity of the fish is closely related to the fish length and weight. The study reveals that with an increase in total length, fecundity

increases significantly. The rise is linear. If a linear curve is fitted to the observed data, the regression equation is Y = -1.06+65.15X with a significant R^2 value of 0.7 (where Y= fecundity and X= total length).

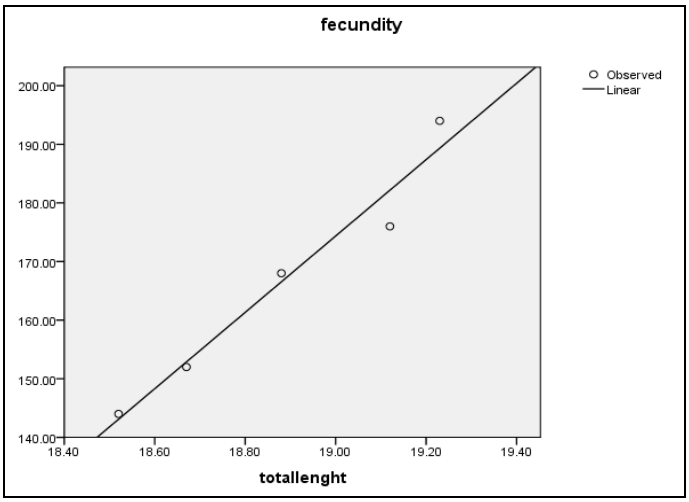


Fig 1: Relation between fecundity and total length

The present study also finds that the increase in body weight results in increase in fecundity. Plotting a linear line to the data the regression line is Y= -207.16 + 16.65X with a significant R^2 value of 0.77. (Where Y= fecundity and X= body weight. Thus, it is observed that fecundity of the fish linearly increases with the increase of ovary weight.

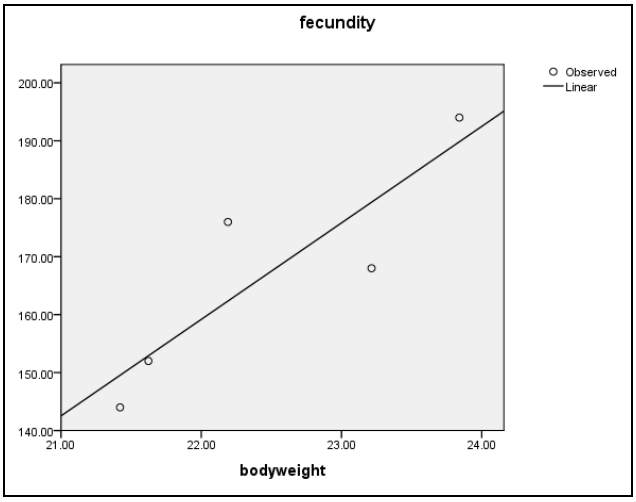
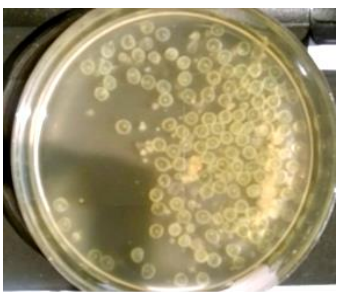


Fig 2: Relation between fecundity and body weight

(iii) Ova diameter

The diameter of *X.cancila* ova was measured in millimeter and the values were found to range from 1.20 to 1.61 mm (Table: 2).The measurement of ova diameter was made to determine the relative sexual maturity. The highest mean values were 1.61 mm for the month of July and lowest values were 1.20 for April.



Photograph of matured ova

The present study also finds that the increase in ovary weight results in increase in fecundity. The rise is linear. Plotting a linear line to the data the regression line is Y= 107.25 + 31.08X with a significant R^2 value of 0.91. (Where Y= fecundity and X= ovary weight). Thus, it is observed that fecundity of the fish linearly increases with the increase of ovary weight.

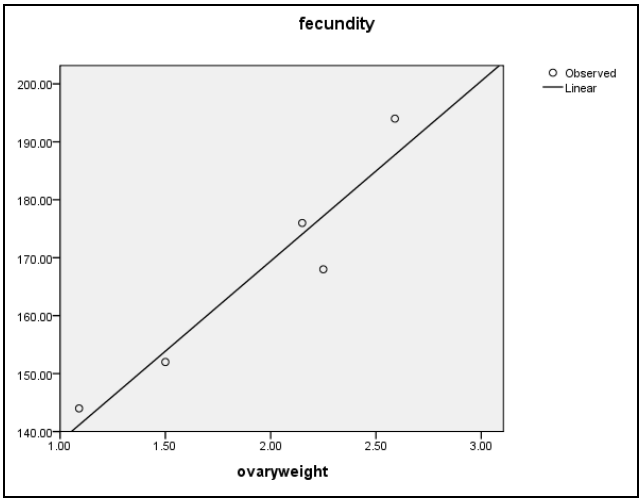


Fig 3: Relation between fecundity and ovary weight

Discussion

Gonadosomatic index (GSI)

Highest GSI values were recorded in the month of July in the gonads and lowest GSI value were recorded in the month of November during the study period. This variation might be associated with the degree of maturity of ova and spawning of fish in different months. Though peak GSI value was maximum in the month of July, mean GSI values were also higher in June and August. It was observed that from March to August, the mean Gonad-somatic index of ovaries and testis show a gradual increase and they attain the peak in the month of July and then from September onwards these values gradually decrease. The observed result indicates the high metabolic activity of the fish during the spawning period (May to August). During the study period it was observed that maximum spawning of the fish takes place in July and August. From September to November, the mean Gonado-somatic index of the female fish decreases gradually which

justifies the gradual shrinkage in the ovaries during this period. It indicates that during this period, the metabolic activity of the fish becomes low after spawning. During the pre-spawning period (January to April), the Gonado-somatic index is observed in an increasing order. It indicates that the ovaries are in active state during this period and the process of oogenesis has been accelerated. It is well established that GSI is more during breeding season. Normally the gonad somatic index increases with the maturation of fish, being maximum during the period of peak maturity and declining abruptly thereafter. Similar types of finding are also reported by Sarker *et al*. [19] in *Mystus gulio*.

In the present study it has been observed that the values of GSI of testis in *X. cancila* follow a regular cyclical change during growth, maturation, spawning and post-spawning phases. The lowest GSI value was noticed in November. From December onwards mean GSI value increases gradually till April. However, from May onwards when the testes enter into the maturation phase GSI is increases rapidly and in July GSI value attains peak. In August the GSI value shows a declining trend. In the post spawning period i.e. in September to November the GSI value is significantly declined.

Fecundity

In the present study, the number of eggs was found to increase with the increase in total length, body weight, and ovary weight. All the relationships between fecundity and total length, body weight, and ovary weight found to be highly significant. These findings are supported by the findings of previous workers [20]. From the regression equation obtained by total length and fecundity, it was evident that the fecundity of *X.cancila* had a positive relationship with the total length of the fish This finding agree with the findings of Hussain *et al*. [20] for *Osteobrama cotio*, Mohan, 2005 [21] for snow trout and Bahuguna and Khatri, 2009 [22] for *Noemacheilus montanus.* The regression equation showed a positive and linear relationship between body weight and fecundity. This finding supports the findings of Rishi and Kaul [23] and Misra [24].

The diameter of ova of *X.cancila* were found to range from 1.20 to 1.61 mm (Table: 2) in mature fish. These variations might be associated with the degree of maturity of ova. These findings agree with the findings of Das *et al* [25] for *H. fossilis*. The present study indicates that the *X.cancila* is a low fecund fish as the number of eggs range from 144 to 194 0nly.

Conclusion:

It can be concluded from the present study that the spawning period of *X.cancila* starts from May and it continues till August. It was observed that maximum spawning of the fish takes place in July and August. The fecundity of *X.cancila* is low as compared to other fishes.

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