



## **Estimation of the Fecundity of Threatened *Pethia ticto***

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. Author MAA designed the study, wrote the protocol, performed statistical analysis and wrote the first draft of the manuscript. Author MMR managed the literature searches. Authors MFI and MMR managed analyses of the study. All authors read and approved the final manuscript.*

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### **ABSTRACT**

In order to estimate fecundity of threatened small indigenous fish species, tit punti (*Pethia ticto*), an investigation was done at the Field Laboratory Complex, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh during June to August, 2017. The mean total lengths were  $5.39 \pm 0.58$ ,  $5.20 \pm 0.43$ ,  $5.79 \pm 0.97$  cm and mean ovary weights were  $0.45 \pm 0.20$ ,  $0.38 \pm 0.15$ ,  $0.53 \pm 0.26$  g for the month of June, July and August, respectively. The fecundity of *P. ticto* for the month of June was estimated to be 1120-13892 with a mean of  $5319.62 \pm 3169.16$ , for the month of July it was 1071-12325 with a mean of  $5407.68 \pm 3186.82$  and for the month of August it was 2268-14328 with a mean of  $5919.92 \pm 3436.29$ . The gonadosomatic index (GSI) were  $16.62 \pm 3.35$ ,  $19.01 \pm 4.55$  and  $14.75 \pm 2.53$  for the month of June, July and August, respectively. The highest GSI was observed in July (25.77) and the lowest was 10.53 in June. Information of fecundity and GSI of *P. ticto* will be helpful for artificial propagation, conservation, and management of this fish species.

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## 1. INTRODUCTION

Bangladesh is a riverine country and it has huge inland water bodies. Aquatic biodiversity of Bangladesh is very high. The country has 260 species of freshwater fish, 24 species of freshwater prawn, 475 species of marine fish and 36 species of marine water shrimp. Out of 260 freshwater fish species about 143 species are called as Small Indigenous Species (SIS) [1]. SIS are considered to be those fishes, which grow at a length of maximum 25 cm at maturity [2]. These fishes are at various threat levels, such as Threatened (25%), Critically Endangered (3%), Endangered (12%), Vulnerable (10%), Near Threatened (11%), Least Concern (48%), and Data Deficient (16%) [3,4]. *Pethia ticto* is under the Least Concern category.

The common name of *P. ticto* is also called ticto barb which is widely distributed in different geographical area viz. Pakistan, India, Nepal, Sri Lanka, Bangladesh, Myanmar and Thailand [5]. It occurs in the basins of the upper Mekong, Salween, Irrawaddy, Mekong and upper Chao Phraya [6]. The major habitats of *P. ticto* are found in still, shallow, marginal waters of tanks and rivers, mostly with muddy bottoms. In deeper water, they browse close to the substrate. The species has high economic value due to its nutritive status; ornamental value and market demand both as fresh and processed products. It has great importance for small-scale fishers in Bangladesh. Previous studies [7–9] reported that It is an essential food resource and a crucial source of micronutrients that prevents deficiencies in rural communities in terms of malnutrition, vitamins and minerals, particularly for vulnerable groups, such as poor women and children in Bangladesh. This species is also used to make fermented type products like Shidol. However, the abundance of *P. ticto* from natural resources are diminishing rapidly because of heavy fishing. Knowledge of fecundity, the gonadosomatic index (GSI) and observation of gonadal development are important for the proper management of *P. ticto*.

The reproductive capacity, i.e., fecundity is a critical biological parameter that plays a significant role in determining the commercial prospects of fish stocks [10]. Effective management of fisheries, including sustainable aquaculture, depends on a reliable evaluation of fecundity to consider the durability of fish stocks [4]. In the study of biology and population

dynamics of fish species, explanations of reproductive methods and fecundity determination are central topics [11]. Studies on reproduction including the assessment of size at maturity, fecundity, duration of reproductive season, daily spawning behaviour and spawning fraction, permit the quantification of the reproductive capacity of individual fish.

SIS breed in rainy season, the increase in atmospheric temperature during February and spawning starts after the first summer rain in the month of April to May and continued upto the end of October. The gravid females and fry are found throughout the year with less frequency in the winter season. The study of the fecundity of fishes has manifold importance in fishery biology. The conservation of *P. ticto* is needed as it is over-exploited. Considering the importance of tit punti (*P. ticto*) as a nutritive SIS the research work was undertaken to determine the fecundity and GSI of *P. ticto* from Mymensingh region of Bangladesh.

## 2. MATERIALS AND METHODS

### 2.1 Site of Experiment

The work was conducted at the hatchery of the Field Laboratory Complex, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh. The experiment was done from June to August 2017.

### 2.2 Collection of Brood Fish

The brood fish were collected from the ponds of the Field Laboratory Complex, Faculty of Fisheries, Bangladesh Agricultural University, Mymensingh. About 150 *P. ticto* both males and females were collected from the source in the months of June, July, and August, 2017.



**Fig. 1. Fresh specimen of *P. ticto***

### 2.3 Selection of Sample

The breeder's body structure was easily identified on the basis of external feature of their

abdomen, vent and pectoral fins. The female abdomen is enlarged; with a softy touch (during the breeding season) enable them to be identified correctly.

## 2.4 Measurement of Length and Weight

The standard length and total length were recorded separately to the nearest centimeter scale respectively. The standard length was measured from the anterior part of the head with the jaws closed, to the base of the caudal fin. The total length was measured from the anterior part of the head with the jaws closed, to the posterior end of the caudal fin. The measurement was taken along straight line and was not taken along the curved of the body. A steel scale was used to measure the length of the body. The weight of the specimens was taken by an electric balance and the weights were recorded to the nearest 0.01 g gram. The recording of the gutted weight of the fishes was not considered because of the small or insignificant size of the stomach.

## 2.5 Collection of Ovaries

The collected fishes were brought to the dissection tray and the abdomens of the fishes were cut to expose the gonads. The fishes were dissected out by scissors starting from anus to lower jaw and the belly was opened. The whole mass (stomach, intestine, and the ovary) were removed carefully from the ovarian wall by means of fine forceps and soft brush. The ovary of the individual fish was taken out carefully and preserved in 10% buffered formalin.

## 2.6 Measurement of Ovarian Weight

The preserved ovary of each fish was taken from the buffered formalin and washed and cleaned with distilled water. Excess moisture was removed as consistently as possible by tissue paper. Then the ovary was weighted to the nearest 0.01 g by an electric balance.

## 2.7 Calculation of Gonadosomatic Index (GSI)

Gonadosomatic index has been using as an indicator of gonadal development. The increase in GSI during the period of gonad maturation is mainly due to the deposition of large amount of protein and lipid in the developing eggs and spermatozoa. Part of these materials come directly from ingested food but a major proportion comes from reserves of food deposited during

the active feeding season in organs such as liver and muscles [12]. The values of Gonadosomatic index (GSI) were calculated by using following formula [13]:

$$GSI = \frac{\text{Weight of Ovary}}{\text{Weight of fish}} \times 100$$

## 2.8 Fecundity Estimation

The gravimetric method [14] has been used for the estimation of the fecundity of *P. ticto*. The ovaries were dissected by a pair of scissors in this process. The exterior connective tissues of each pair of ovaries have been separated from the surface. With the aid of a blotting paper, the moisture from the ovaries was removed. With the assistance of a digital electronic balance, the weight of each fish's ovaries was registered. The ovarian part was then precisely taken separately from the anterior, middle and posterior parts of each ovarian lobe. The eggs in the sample were counted. The number of eggs of the samples multiplied by the ratio of total weight of both part of the ovaries and the weight of the sample gave the total number eggs of a particular fish i.e.

$$F = \frac{N \times \text{Gonad weight}}{\text{Sample weight}}$$

Where,

F= Fecundity of fish

N= Number of eggs in sample

In this way fecundity of 86 fish were obtained.

## 2.9 Data Processing

Data analysis and processing was done by SPSS 23 and Microsoft Excel program. Significant differences ( $P < 0.05$ ) were done with HSD-Tukey test.

## 3. RESULTS AND DISCUSSION

### 3.1 Results

#### 3.1.1 Length and weight

##### 3.1.1.1 Standard length

For the experiment 86 females of *P. ticto* were collected for the study, standard length ranged from 3.10 cm to 6.40 cm. Brood fishes were collected on June, July, and August months and

divided into three groups. Their standard length was varied from 3.10-5.50, 3.30-5.00 and 3.70-6.40 cm respectively (Table 1).

### 3.1.1.2 Total length

For the study of fecundity 86 females of *P. ticto* were collected, Total length ranged from 4cm to 7.90cm. Total length of fish samples in group A (June), B (July), and C (August), varied from 4-6.7, 4.2-6.1 and 4.6-7.9cm respectively (Table 1).

### 3.1.1.3 Body weight

Throughout the sampling period 86 females body weight varied in the range of 1.56-9.22g. The body weight of the specimens collected on June, July, and August varied from 1.82-4.46, 1.56-4.20 and 1.79-9.22g respectively (Table 1).

### 3.1.2 Fecundity

In the present study, the estimated fecundity for *P. ticto* ranged from 1120 to 13892 with a mean of 5319.62±3169 for the corresponding body weight from 1.82 to 4.46 g with a mean of 2.69±0.74 and the total length from 4.00 to 6.70 cm with a mean of 5.39±0.58 and ovary weight from 0.20 to 0.92 g with a mean of 0.45 ±0.20 for the month of June. For the month of July, the estimated fecundity ranged from 1071 to 12325 with a mean of 5407.68±3186.82 for the corresponding body weight 1.56 to 4.20g with a

mean of 2.20±0.56 and total length ranged from 4.20 to 6.10cm with a mean of 5.20±0.43 and ovary weight ranged from 0.17 to 0.66g with a mean of 0.38±0.15. For the month of August, the estimated fecundity was ranged from 2268 to 14328 with a mean of 5919.92±3436.29 for the corresponding body weight 1.79 to 9.22g with a mean of 3.79±2.37 and the total length ranged from 4.60 to 7.90cm with a mean of 5.79±0.97 and ovary weight ranged from 0.24 to 1.08g with a mean of 0.53±0.26. The results of fecundity shown in Table 1.

### 3.1.3 Ovary weight

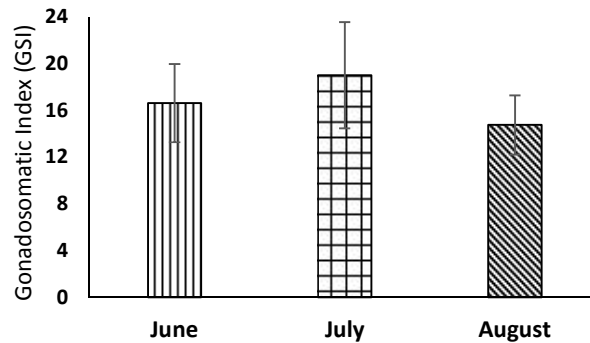
The ovary weight and size of the fishes varies with the size and maturity of the females. The weight of the ovary varied from 0.17 to 1.08g. The color of the ovary was yellowish. The ovary weight of the specimens collected on June, July, and August varied from 0.20-0.92, 0.17-0.66 and 0.24-1.08g respectively (Table 1).

### 3.1.4 Gonadosomatic index

The values of Gonadosomatic index (GSI) varied from 10.53 to 25.77. In June, July and August the Gonadosomatic index (GSI) of *P. ticto* were recorded 10.53-22.78 with a mean of 16.62 ± 3.35, 10.96-25.77 with a mean of 19.01 ± 4.55 and 11.11-19.20 with a mean of 14.75 ± 2.53 respectively (Table 1). GSI value in July was significantly higher than June and August.

**Table 1. Fecundity and GSI of female *P. ticto***

Group name	Statistical data	Total Length TL (cm)	Standard Length TL (cm)	Body Weight BW (g)	Ovary Weight OW (g)	Sample Weight SW (g)	No. of eggs in sample, N	Fecundity	GSI
June 2017	N	35	35	35	35	35	35	35	35
	Mean	5.39	4.39	2.69	0.45	0.03	296.00	5319.62	16.62 <sup>b</sup>
	Std. deviation	0.588	0.51	0.74	0.20	0.01	41.2	3169.16	3.35
	Min.	4.00	3.10	1.82	0.20	0.02	222.00	1120	10.53
	Max.	6.70	5.50	4.46	0.92	0.04	422.0	13892	22.78
July 2017	N	31	31	31	31	31	31	31	31
	Mean	5.20	4.29	2.20	0.38	0.03	398.03	5407.65	19.01 <sup>a</sup>
	Std. deviation	0.43	0.40	0.56	0.15	0.01	127.09	3186.82	4.55
	Min.	4.20	3.30	1.56	0.17	0.02	132	1071	10.96
	Max.	0.10	5.00	4.20	0.66	0.07	579	12325	25.77
August 2017	N	20	20	20	20	20	20	20	20
	Mean	5.79	4.75	3.79	0.53	0.03	315.70	5919.92	14.75 <sup>b</sup>
	Std. deviation	0.97	0.83	2.37	0.26	0.01	80.07	3436.29	2.53
	Min.	4.60	3.70	1.79	0.24	0.02	168	2268	11.11
	Max.	7.90	6.40	9.22	1.08	0.04	520	14328	19.20



**Fig. 2. Monthly fluctuations of gonadosomatic index for *Pethia ticto***

### 3.2 Discussion

Effective management of fisheries, including sustainable aquaculture, depends on an appropriate fecundity evaluation to consider the regeneration potential of fish species [14,15]. The value of total mean fecundity of *P. ticto* was estimated  $5490 \pm 3209.24$ . This is slight lower than the report for *P. sophore* [16] where fecundity of *P. sophore* collected from pond of the Fisheries Field Laboratory Complex ranged from 7951 to 23053 with a mean of  $13775 \pm 3613.94$ . [17] estimated the fecundity of *Corica soborna* from Mithamoin haor of Kishorgonj district. The estimated mean fecundity was  $2369.20 \pm 241.74$  which is slightly lower than the current study. The fecundity of *Chanda nama* from the river Old Brahmaputra near Bangladesh Agricultural University (BAU) Campus, Mymensingh [18]. The estimated fecundity was ranged from 805 to 6,631 which is lower than this study. Again, the fecundity of *Gudusia chapra*, collected from the pond of Fisheries Field Laboratory Complex, Bangladesh Agricultural University, Mymensingh [19]. The estimated fecundity was ranged from 25,220-1,54,528 which is higher than this study.

The highest mean gonadosomatic index of *P. ticto* was  $19.01 \pm 4.55$  recorded in July and lowest  $14.75 \pm 2.53$  in August. The highest value of GSI in July indicates that, *P. ticto* mainly breeds in July. [16] determined the highest GSI value of *P. sophore* in July ( $23.44 \pm 4.52$ ) which also agree with this study. The GSI of *C. nama* collected from the Old Brahmaputra river near BAU Campus. The calculated GSI ranged from 0.182 to 33.736 [18]. The highest GSI was recorded in August (33.736). This result indicates that, the peak breeding season of *P. ticto* and *C. nama* is nearly the similar time. The GSI of *C. soborna*

collected from Mithamoin haor of kishorgonj [17]. He determined the highest value of GSI in July ( $16.83 \pm 4.22$ ) and lowest in April ( $4.11 \pm 1.59$ ). This finding is also in coincides with our study.

### 4. CONCLUSION

Tit punti, *P. ticto* is a threatened SIS in Bangladesh. Information on reproductive biology, fecundity and GSI is important for induced breeding, conservation and management of any threatened species. There is a limited knowledge about stocks, habitats, behavior, fecundity, spawning of this species. Therefore, this study will provide the primary information about fecundity and GSI of *P. ticto*. The information of this study can potentially be used for the conservation, sustainable management and artificial propagation of *P. ticto* population.

### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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