

REPRODUCTIVE BIOLOGY OF THE GREEN BARB, *PUNTIUS CHOLA* (HAMILTON) (CYPRINIFORMES: CYPRINIDAE) FROM THE KANGSA RIVER, NETRAKONA, BANGLADESH

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Abstract

An investigation was conducted on gonadal maturation and fecundity of the Green barb, *Puntius chola* (Hamilton) over a period of one year from January to December 2006. The overall fecundity was recorded as $1,184.73 \pm 1,117.35$. Relationships between fecundity and other body parameters were found to be linear, positive and highly significant. Five methods were applied to determine gonadal maturation. The overall GSI level was recorded as 7.05 ± 4.95 . The overall GLI level was recorded as 30.43 ± 10.41 . The overall percentage of gravid females was calculated as 90.47 ± 16.18 . The average ova diameter was determined as 0.44 ± 0.22 mm. The colour of ovary of the Green barb was found to be orange from April to July and September. The monsoon (April to July) and pre winter (September) were found to be the spawning season of the Green barb.

Key words: *Puntius chola*, Gonadal maturation, GSI, Gonadal-length index, Ova diameter, Fecundity, Kangsha river.

Introduction

The small indigenous fish species of Bangladesh are generally considered to be those fishes which grow to a length of less than 25cm (Felts *et al.* 1996). Among the fishery items, the small fishes occupy an important position in the diet of the people. Some of the small fishes have high nutritional value as they contain protein, vitamin A, iron, calcium, phosphorus, etc. (Banu *et al.* 1985).

The barbs of the genus *Puntius* (Family Cyprinidae) are among the most common species and most abundant as to individuals in the fish fauna of Bangladesh. There are 11 species of *Puntius* (Mustafa 1998) of which, *Puntius chola* (Hamilton) is very common. They are highly edible and consumed by the common people, as they contain a significant amount of protein, vitamin, calcium, phosphorus, iron etc. (IFADEP SP-2 1996 and Mustafa 1998). These fishes can also be reared as the aquarium fish. *Puntius chola*, locally known as Chola punti or the Green barb occurring in ponds, tanks, ditches, canals, rivers (Rahman 1989). The species is also distributed to India, Myanmar, Nepal, Pakistan and Srilanka (Talwar and Jhingran 1991).

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The reproductive biology of *Puntius stigma* had been studied in Bangladesh (Shafi and Quddus 1974, Latifa and Nahar 1987 and Islam and Hossain 1990). Besides Mustafa (1998) studied the growth and production while Bhuiyan and Biswas (1982) studied the morphology of *P. chola*. Saha and Saha (2010) studied some biology of *Puntius chola*. But no study has been conducted on reproductive biology of *P.chola* from river ecosystem especially from Netrakona district, Bangladesh. Thus the objective of this investigation was to determine gonadal maturation and fecundity of the Green barb (*Puntius chola*) from the Kangsa river of Netrakona district.

Materials and Methods

The fish samples were collected once a month from January to December 2006, from different points of the Kangsa river of Netrakona district. In total 198 samples of punti were collected by cast nets and drag nets. After collection, the fishes were preserved in 5% formalin. The fishes were measured in the nearest mm by means of a measuring board fitted with a centimeter scale and their weights were recorded by means of a sensitive Pan Balance (TG 928A, capacity 200g , China). The fishes were sexed after dissecting out the gonads. After dissecting out the ovaries, the same procedure was applied for length and weight measurements after dehydration. From anterior, central and posterior parts of each ovary of a female fish 15 to 20 ova were collected at random. Diameter of the collected ova was measured with the help of an ocular-micrometer (each division equivalent to 0.01 mm). Colour of the ovaries was observed throughout the year. Gravimetric method (Lagler 1956) was applied to determine fecundity. The values of the regression (b) and correlation(r) co-efficients, ninety five percent confidence limits of the regression coefficient, the intercept (a) and the standard deviation (SD) were calculated using standard statistical formulae to establish mathematical relationship between fecundity and other variables. Gonadal maturation of *P. chola* was determined by applying several methods like, Percentage of gravid females against time, Gonadosomatic index (GSI), Gonadal-length index (GLI), Ova diameter (OD) and Colour of ovay (CO). Gonado-somatic and Gonadal-length indices were calculated after Jhingran (1961) and Kader *et al.*(1988).

Results and Discussion

Gonadal maturation

Percentage of gravid females: The overall percentage of gravid females of *Puntius chola* was calculated as 90.47 ± 16.18 (Table1). The minimum percentage of gravid females was recorded as 55.56 in February while the maximum percentage was recorded as 100 from April to July and September. Saha *et al.* (2007) found the highest percentage of gravid females of *H. fossilis* from April to August which shows close similarity with this finding.

GSI level: The overall GSI level of *Puntius chola* was found to be 7.05 ± 4.95 . The highest GSI level for a female of *P. chola* was found to be 20.17 having total length of 8.8 mm and total weight of 5.95g in June (Fig. 1). The lowest GSI level for a female was calculated as 0.22 having total length of 8,5 mm and total weight of 9.1g in January. The minimum and maximum GSI levels were recorded as 0.68 in January and 14.652 in June respectively. Saha *et al.* (2007) determined the GSI level of *Heteropneustes fossilis* as 1.32 in January to 15.94 in June from Netrakona water. Saha *et al.* (2009) obtained the higher mean values of GSI level of *Amblypharyngodon mola* in the months of March – August with a peak in May.

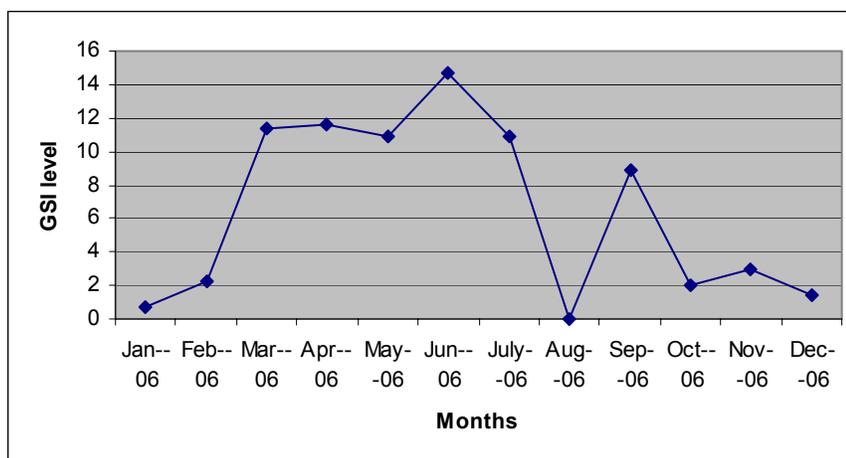


Fig.1.Gonado-somatic index (GSI) level of different months of *Puntius chola*.

GLI level: The overall GLI level of *P.chola* was calculated as 30.43 ± 10.41 . The highest GLI (53.24) level for a female was recorded in June having total length and total weight as 7.7 mm and 7.10 g respectively (Fig.2). The lowest GLI level (11.36) for a female was noted in November having total length as 8.8 and total weight as 11.20 g. The minimum and maximum GLI levels were recorded as 19.32 in February and 46.87 in July respectively. From the study of Saha *et al.* (2007), it is found that GLI level of *Heteropneustes fossilis* as 3.75 in February to 23.51 in June from Netrakona. Saha *et al.* (2009) found the higher mean values of GLI of *A. mola* in the months of February-August with a peak mean in May.

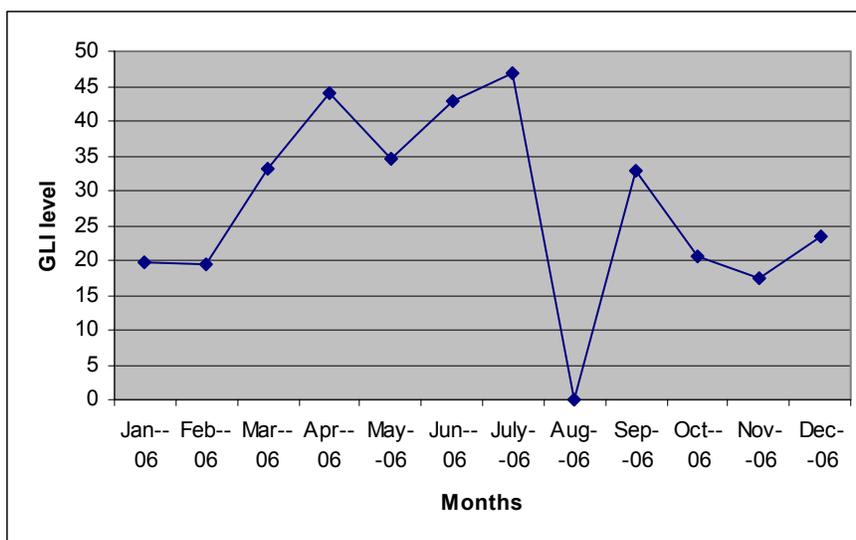


Fig.2. Gonadal-length index (GLI) level of different months of *Puntius chola*.

OD (mm): The overall ova diameter of *Puntius chola* was calculated as 0.44 ± 0.22 mm (Table1). The minimum ova diameter was recorded as 0.19 ± 0.09 mm in October while the maximum diameter was recorded as 1.0 ± 0.2 mm in June. The mean diameter of eggs of *Puntius stigma* was recorded as 0.60 mm with a range of 0.26 to 0.86 mm by Shafi and Quddus (1974). The range of ova diameter as 0.22 to 0.75 mm in *P. stigma* was recorded by Dewan (1973).

Table 1. Occurrence of gravid females, ova diameter (mm) and colour of ovary of *Puntius chola* collected from the Kangsa river of Netrakona.

Months/Year	Percentage of gravid females	Ova diameter mm range mean \pm SD	Colour of ovary
Jan 2006	-	0.2-0.4 0.307 \pm 0.092	Cream
Feb	55.56	0.3-0.7 0.4 \pm 0.053	Pink
Mar	77.78	0.35-0.65 0.505 \pm 0.118	Yellow
Apr	100	0.2-0.6 0.436 \pm 0.114	Orange
May	100	0.1-0.7 0.441 \pm 0.165	Orange
Jun	100	0.7-1.2 1.0 \pm 0.2	Reddish orange
Jul	100	0.35-0.9 0.684 \pm 0.177	Orange
Aug	-	-	-
Sep	100	0.1-0.6 0.4 \pm 0.16	Orange
Oct	-	0.1-0.5 0.191 \pm 0.099	Cream
Nov	-	0.1-0.6 0.283 \pm 0.081	Cream
Dec 2006	-	0.1-0.3 0.209 \pm 0.081	Cream
Average	90.477 \pm 16.185	0.441 \pm 0.221	-

CO: The colour of ovary of *P. chola* was found to be orange from April to July and September (Table1). This record is in conformity with the report made by Saha *et al.* (2007). *P. chola* was found to breed during monsoon (Qayum and Qasim 1964, Rashiduzzaman 1982, Latifa and Nahar 1987 and IFADEP SP-2 1996).

Fecundity

Estimation of fecundity: The overall fecundity of *Puntius chola* was calculated as $1,184.73 \pm 1,117.35$. The average number of eggs per gram of female fish was 155.06. The minimum fecundity was recorded as 135 (for a female fish having total length of 67 mm and total weight of 4.1g) in March while the maximum fecundity was recorded as 5,112 (for a female fish having total length of 102 mm and total weight of 16.3 g) in April. The fishes having same total length were found to contain different number of eggs in their ovaries. For example, 2 females of *P.chola* of total length of 85 mm possessed 609 and 1,330 eggs; 2 other females of total length of 77mm contained 900 and 1,200 eggs. Shafi and Quddus (1974) estimated the fecundity of *Puntius stigma* which varied from 1,242 to 6,831 with an average of 3,192. Average number of eggs per kilogram of *P. stigma* was 2,39,550 (Shafi and Quddus 1974). Saha *et al.* (2007) also found such type of variation in *Heteropneustes fossilis* from Netrakona.

A female fish of *P. chola* having the lowest total length of 64 mm and total weight of 4.8 g contained a number of 255 eggs while a female having the highest total length of 102 mm and total weight of 16.3 g contained 5,112 eggs. From the record of Shafi and Quddus (1974), the fecundity of *P. stigma* varied from 1,242 eggs (for a female fish with total length of 86 mm and total weight of 9.0 g) to 6,831 eggs(for a female fish with total length of 97mm and total weight of 15.2 g) with mean of 3,192 eggs from the Buriganga river. According to Dewan (1973) the fecundity from a single female punti (*P. stigma*) is found to be 18,569 from Mymensingh water.

Monthwise fecundity: The mean highest fecundity of *P.chola* was recorded as 3334.33 ± 1361.76 in April while the lowest as 283.71 ± 61.09 in February (Fig.3). No records of fecundity were available in August and from October to January.

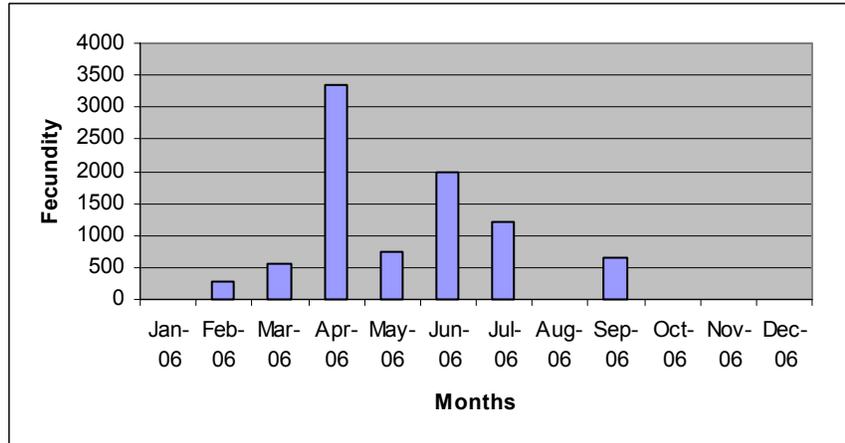


Fig. 3. Monthwise fecundity of *Puntius chola* sampled from the Kangsa river.

Fecundity and total length: The variability in the fecundity of *P. chola* is presented in scattered diagram (Fig.4) showing the relationship between fecundity and total length. It suggests a linear, positive and highly significant relationship ($r = 0.7882$) between them. The results have been summarised in Table 2.

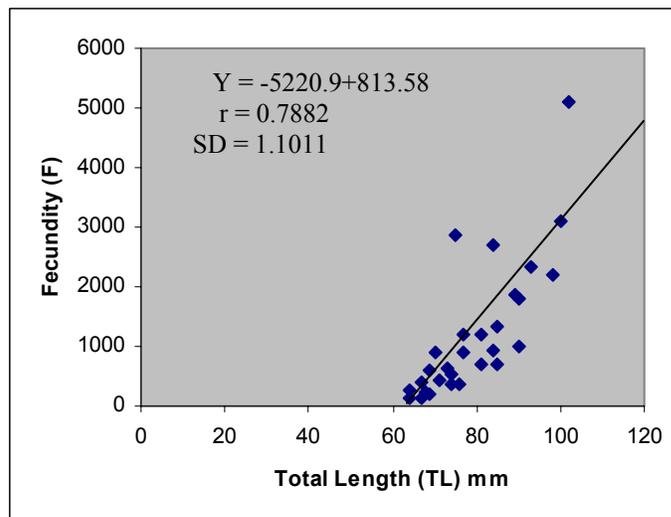


Fig. 4. Relationship between fecundity and total length of *Puntius chola*.

The equation for the regression of fecundity (Y) on total length (X) was set as follows:

$$Y = -5220.9 + 813.58x$$

Shafi and Quddus (1974) determined the regression equation in *P. stigma* as

$$Y = -2.07 + 5.68x.$$

Table 2. The regression equation, standard deviation and coefficient of correlation in the Fecundity-Total Length, Fecundity- Total weight and Fecundity-Ovary Weight relationships in *Puntius chola*.

Relationship	Regression equation ($y= a+bx$)	Standard deviation (SD)	Coefficient of correlation(r)
Fecundity-Total length	$y=-5220.9+813.58x$	1.10	0.78
Fecundity-Total weight	$y=-1308.4+325.71x$	3.27	0.93
Fecundity-Ovary weight	$y=-494.38+2039.4x$	0.50	0.90

Fecundity and total weight: Scattered diagram (Fig.5) shows the relationship between fecundity and total weight. It suggests a linear, positive and most highly significant relationship ($r = 0.9378$) between them. The observation coincides with the report of Shafi and Quddus (1974) who recorded the value of r as 0.808 in *Puntius stigma* from the Buriganga river. The results have been summarised in Table 2

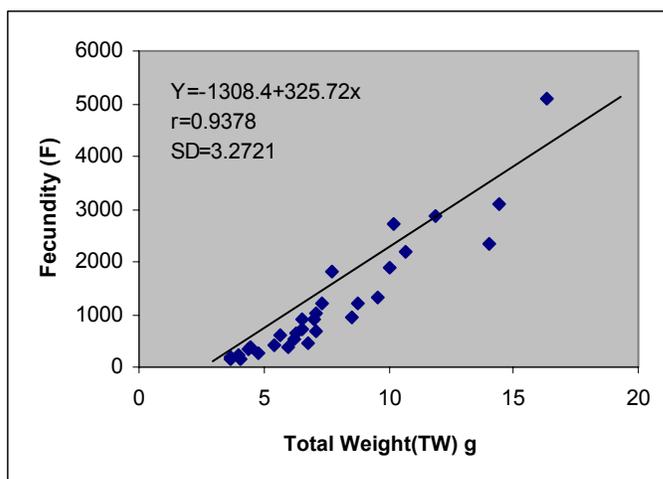


Fig.5. Relationship between fecundity and total weight of *Puntius chola*.

The equation for the regression of fecundity(Y) on total weight (X) was set as follows:

$$Y = -1308.4 + 325.72X.$$

Shafi and Quddus (1974) determined the regression equation in *Puntius stigma* as $Y=1.56+1.71X$ from Buriganga river of Dhaka.

Fecundity and ovary weight: Scattered diagram (Fig.6) shows the relationship between fecundity and ovary weight of *P. chola* where the variability in fecundity was observed. It depicts a linear, positive and most highly significant relationship ($r = 0.9027$) between

them (Table 2). The equation for the regression of fecundity (Y) on ovary weight (X) was established as follows: $Y = -494.38 + 2039.408X$. According to Shafi and Quddus (1974), the value of r is 1.0 in *Puntius stigma* from the Buriganga river which closely shows relationship with this finding. The regression equation of *P. stigma* was $Y = 2.49 + 0.99X$ (Shafi and Quddus 1974).

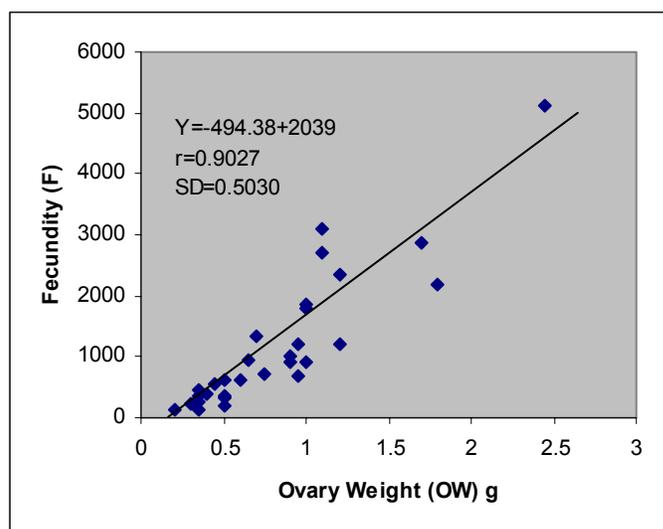


Fig.6. Relationship between fecundity and ovary weight of *Puntius chola*.

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References

- Banu, N. S., T. Ali, R. Shaha and N.C. Vakta. 1985. The studies on the fecundity of *Anabas testudineus* (Bloch) in a confined pond of Dhaka district. *Bangladesh J. Aquaculture*. **6-7**(1):45-49.
- Bhuiyan, A.S. and B. Biswas. 1982. Studies on the morphology of *Puntius chola*. *Univ. J. Zool. Rajshahi Univ.* **1**: 29-34.
- Dewan, S. 1973. Investigation into the ecology of a Mymensingh Lake. Ph.D. Thesis, Bangladesh Agricultural University, Mymensingh, 337 pp.
- Doha, S. and M.A. Hye. 1970. Fecundity of the Padma river Hilsa, *Hilsa ilisha* (Hamilton). *Pakistan J. Sci.* **22**: 176-183.
- Felts, R.A., F. Rajts and M. Akhteruzzaman, 1996. Small Indigenous fish species culture in Bangladesh. In: *Development of inland Fisheries*. Technical Brief, IFADEP Sub-project 2, 41pp.
- IFADEP SUB-PROJECT-2: 1996. Appendix 1- Some Small Indigenous Fish Species (SIS) of Bangladesh and their known Biology, p.28.

- Islam, M.S. and M.A. Hossain. 1990. The fecundity and sex ratio of the common punti *Puntius stigma* (Cuvier & Valenciennes) (Cypriniformes: Cyprinidae) from the river Padma near Rajshahi. *Univ. J. Zool. Rajshahi Univ.* **9**: 69-74.
- Jhingran, A.G. 1961. Studies on the maturity and fecundity of the Gangetic anchovy, *Setipinna phasa* (Hamilton). *Indian J. Fish.* **8**: 291-312.
- Kader, M.A., A.L. Bhuiyan and A.R.M.M. Manzur-i-khuda. 1988. The reproductive biology of *Gobioides rubicundus* (Ham.-Buch.) in the Karnafuli river estuary, Chittagong. *Indian J. Fish.* **35**: 139-250.
- Lagler, K.F. 1956. *Enumeration of fish eggs*. In freshwater fishery, 2nd. W.M. Brown (ed.) Company Publishers, Dubuque, 106-116.
- Latifa, G.A. and L. Nahar. 1987. Some aspects of biology of *Puntius stigma*. *Bangladesh J. Zool.* **15** (1): 51-58.
- Mustafa, G. 1998. Growth and production of the indigenous small fish *Puntius chola* (Ham.) in miniponds. *Bangladesh J. Zool.* **26** (2): 101-105.
- Qayum, A. and S.Z. Qasim. 1964. Studies on the biology of some freshwater fishes. 11 *Barbus stigma* (Cuv. & Val.). *J. Bom. Nat. Hist. Soc.* **61** (2): 330-347.
- Rahman, A.K.A. 1989. *Freshwater fishes of Bangladesh*. Published by the Zoological Society of Bangladesh, Department of Zoology, University of Dhaka, 264 pp.
- Rashiduzzaman, M. 1982. Limnology of Khosagar at Dalal Bazar in Noakhali district and some aspects of biology of the minor carp, *Puntius stigma* (Cuv. & Val.). M.Sc. Thesis, Dept. of Zool., Dhaka University, 79 pp.
- Saha, B.K., M. R. Islam and A. Saha. 2007. Some aspects of the reproductive biology of the catfish *Heteropneustes fossilis* (Bloch) (Siluriformes: Heteropneustidae). *J. Asiat. Soc. Bangladesh Sci.*, **33**(1): 51-56.
- Saha, B.K., M.R. Islam and M.A. Hossain. 2009. Reproductive biology of the mola carplet, *Amblypharyngodon mola* (Hamilton) (Cypriniformes: Cyprinidae) from Netrakona water. *Bangladesh J. Sci. Ind. Res.* **44** (3): 377-379.
- Saha, B.K. and A. Saha. 2010. Some aspects of biology of chola punti (*Puntius chola* Hamilton) from the Kangsa river. *Bangladesh J. Sci. Ind. Res.* **45** (4): 309-314.
- Shafi, M. and M.M.A. Quddus. 1974. The fecundity of the common punti *Puntius stigma* (Cuvier & Valenciennes) (Cyprinidae : Cypriniformes). *Bangladesh J. Zool.* **2** (2): 133-145.
- Simpson, G. G., A. Roe and R.C. Lewontin. 1960. *Quantitative Zoology*. Harcourt Brace & Co., New York, 440 pp.
- Snedecor, G.W. 1956. *Statistical Methods*. Iowa State University Press, Amer. Iowa, 534 pp.
- Talwar, P.K. and A.G. Jhingran. 1991. *Inland Fishes*. Vo.1. Oxford co., IBH Publishing Co., New Delhi, India.

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