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RESEARCH ARTICLE LIFE SCIENCE

FECUNDITY OF *GLOSSOGOBIUS GIURIS* (HAM.) AND RELATIONSHIP BETWEEN FECUNDITY AND LENGTH-WEIGHT

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Abstract: The fecundity of *Glossogobius giuris* (Hamilton) was estimated from 60 gravid females collected from local markets of Khulna during May to July 2005. Total length (TL), standard length (SL), total weight (W) and gonad weight (GW) were recorded and standard methods were used to calculate the fecundity and length-weight relationship. The fecundity of the species ranged from 39,173 (total length of 14.4 cm, body weight 22.79 g and egg weight 1.49 g) to 557,892 (total length of 24.06 cm, body weight 104.56 g and egg weight 11.5 g). The mean fecundity was recorded as 280,315.89±102,223.51. The total gonad weight varied from 1.49 g to 11.5 g where the weight of the left lobe and right lobe of the ovary varied significantly ($p<=0.05$; t-value= - 2.536, equal variances assumed) from 0.7 g to 4.98 g and 0.71 g to 5.06 g respectively. The mean total egg weight was calculated at 5.99±1.82 g where the mean left lobe was calculated at 2.75±0.91 g and right lobe 3.17±0.90 g. The condition factor varied from 4.47 to 9.69 and the mean value was 8.09±0.72. The regression equation for total length and fecundity of the fish was estimated as F = 39,515.10 T – 531,548.17 (r = 0.683), Standard length and fecundity estimated as F = 50,366.48 S –502,295.20 (r = 0.664), Body weight and fecundity estimated as F = 4,430.22 W – 35,322.55 (r = 0.715), Gonad weight and fecundity estimated as F = 51,556.05 G – 28,762.62 (r =0.918), fecundity and condition factor estimated as F = 213,986.53 + 8,203.75 cf (r = 0.058). The diameter of the eggs of the left lobe varied from 5.3 to 8.6 µm with a mean of 7.4±0.6 µm while the right lobe varied from 5.1 to 8.9 µm with a mean of 7.2±0.8 µm. At 5% level of significance, log value of fecundity-gonad weight and fecundity-condition factor showed the most and the least significant relationship respectively.

Key words: Fecundity, freshwater gobi, *Glossogobius giuris*, condition factor, south-western region, Bangladesh

Introduction

The freshwater gobi, *Glossogobius giuris* (Hamilton) is locally known as *bele* or *bailla*. It is one of the most popular and commercially important fish due to its high nutritive and market values and palatability. It contains 14.5 g protein, 0.5 g fat, 1 g iron, 370 mg calcium and 330 mg phosphorous (Siddique and Chowdhary, 1996). It is a fresh water species, bottom feeder and lives in the muddy bottoms of rivers, canals, lakes, ponds, hoars, boars etc. and is commonly found in Bangladesh, India and Pakistan. It has the ability to tolerate adverse ecological conditions. The species attains its maturity at the age of one year. The breeding season of *G. giuris* is rainy season and the gravid females are found during May to July(Siddique and Chowdhary, 1996).

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Fecundity is the general term used to describe the number of mature eggs produced by an individual female per breeding cycle (Lagler, 1949). A knowledge on fecundity of a fish is essential for evaluating the commercial potential of its stock, life history, culture and management of the fishery (Lagler, 1956; Doha and Hye, 1970; Das, 1977 and Ahamed *et al.*, 1979). For efficient fish culture, artificial fry production and effective management practices it is of prime importance to know the fecundity of a fish (Miah and Dewan, 1984). In Bangladesh *G. giuris* has not yet a cultivable species due to inadequate abundance of natural fry and demand for its fry. Considering the commercial importance of the species, adequate research in this field is required. Study has not been done on the fecundity of *G. giuris* to initiate aquaculture production of the species. However, some works have been done on the fecundity of some species of fishes in Bangladesh (Doha and Hye, 1970; Karim and Hossain, 1972; Shafi *et al.*, 1979; Dewan and Doha, 1979; Miah and Dewan, 1984 and Das *et al.*, 1989). In this perspective the present study was undertaken to determine the fecundity and average egg diameter of *G. giuris.* The relationships between the fecundity and total length, standard length, body weight and gonadal weight of the species have also been carried out.

Materials and Methods

Sample collection: Sixty gravid female of *G. giuris* were collected from the local market of Khulna during May to July 2005. Only mature females of different size were collected by examining the swallowen abdomen and anus. The collected specimens were brought to the Biological Laboratory of FMRT Discipline, Khulna University, Khulna.

Laboratory Measurements: The total and standard lengths were measured in centimeters (cm) a measuring scale. The weight of the individuals was measured with a sensitive (3 decimal places) electric balance in gram (g). The fishes were dissected out by scissors, cleaned with distilled water and then were measured to the nearest to 0.1 g by an electric balance. The two lobes of the gonad were also measured in g separately. Diameters of the eggs were measured in microns under a sterio microscope using ocular and stage micrometer. Egg samples were taken from anterior, middle and posterior parts of each of the lobes.

Fecundity estimation: Gravimetric method was applied in the present study. From the ovary six cross-sectional samples were dissected along with the accompanying membranes from the anterior, central, posterior regions of each of the lobes of each gonad. Total eggs in each of the six sub-samples were counted with the help of a magnifying glass and a needle. The number of eggs of the samples was multiplied by the total weight of both lobes of ovaries to get the total number of eggs of a particular fish. Thus the fecundity was obtained by using the following formula:

$$F = \frac{N \times \text{Gonad weight}}{\text{Sample weight}}$$ (Shafi *et al.*, 1979; Dewan and Doha, 1979 and Miah and Dewan, 1984)

Where F is the fecundity and N is the number of eggs in the sample.

Condition factor estimation: The condition factor was calculated using the following formula:

$$K = \frac{W \times 10^3}{L^3}$$ (King, 1997)

Where, W= weight of the fish; L= length of the fish; K= condition factor and 10^3 = the factor bringing the ponderal index or condition factor (K) near unity.

Results

The fecundity *Glossogobius giuris* varied from 39,173 to 55,7892 and mean fecundity was calculated as 280,315±102,223. Minimum fecundity found in the fish having total length of 14.4 cm, body weight 22.79 g, egg weight 1.49 g while the maximum fecundity was found in a fish having total length of 24.6 cm, body weight 104.56 g and egg weight 11.5 g. The total weight of the gonads varied from 1.49 g to 11.5 g where the left lobe of the ovary varied from 0.7 g to 5.70 g and right lobe 0.71 g to 5.60 g and the mean of the total egg weight was calculated as 6.00±1.82 g where the mean left lobe was calculated as 2.75±0.91 g and right lobe 3.17 ±0.90 g. The eggs were elliptical and elongated in shape and the mature ovary was yellow to orange in colour with a length of 3.5 to 5.5 cm (Fig 1 and 2). The diameter of left lobe of the eggs varied from 5.3 to 8.6 µm whereas in case of right lobe it varied from 5.1 to 8.9 µm.

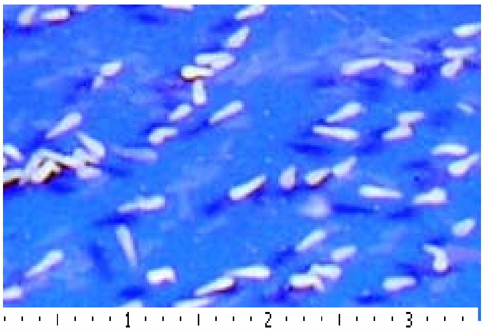

Fig. 1. A closer view of individual eggs of *G. giuris* (1 unit= 3 µm).

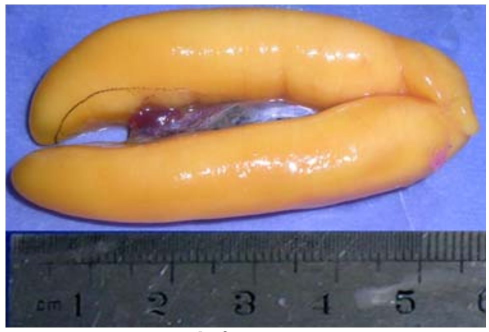

Fig. 2. A mature gonad of *G. giuris*.

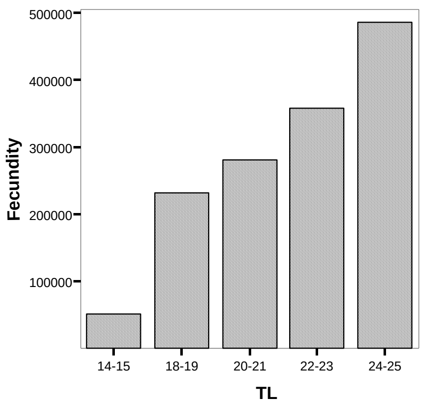

Fig. 3. Left and right lobe mean egg diameter of *G. giuris* according to different length-classes.

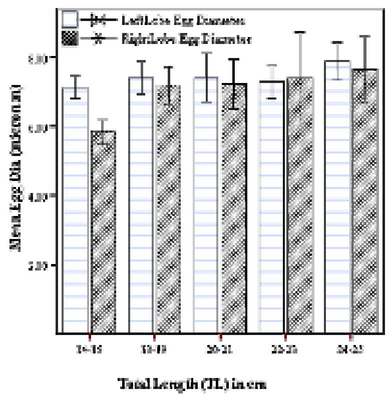

Fig. 4. Fecundity of *G. giuris* according to different length-classes.

The mean egg diameter for left lobe and right lobe was found very close in case of different length classes except the length class 14-15 cm (Fig. 3). Considering the gonad itself, the mean egg diameter of the two lobes did not differ significantly ($p<=0.05$ with t-value= 1.424, equal variances not assumed) whereas the weight of the two lobes differ significantly ($p<=0.05$; t-value= - 2.536, equal variances assumed). The highest and the lowest fecundity were found in the length class 24-25 cm and 14-15 cm respectively (Fig. 4).

Linear and positive relationships were obtained in between total length and fecundity, standard length and fecundity, body weight and fecundity, gonad weight and fecundity, gonad weight and total length, gonad weight and standard length, gonad weight and body weight but there was no significant relationship found in between condition factor and fecundity and linear and positive relationship were found in between gonad weight and total length, gonad weight and standard length, gonad weight and body weight as well. The basic components of the different relationships are summarized in Table 1.

Table 1. Relationship between fecundity, gonad weight and different measurement of *Glossogobius giuris.*

Relationship	Regression coefficient(b)	Intercept(a)	Regression Co-efficient (R^2)	t- test at 5% sig.
Fecundity – total length	39515.10	– 531548.17	0.47	7.125
Log fecundity – Log total length	3.70	0.56	0.68	8.074
Fecundity – standard length	50366.48	– 502295.20	0.44	6.765
Log fecundity – Log standard length	3.59	1.14	0.61	7.742
Fecundity – Body weight	4430.22	– 35322.55	0.51	7.785
Log fecundity – Log body weight	1.27	3.07	0.68	8.892
Fecundity – Gonad weight	51556.05	– 28762.62	0.84	17.629
Log fecundity – Log gonad weight	1.24	4.48	0.89	21.961
Gonad weight – total length	0.75	– 9.33	0.52	7.997
Log gonad weight – Log total length	2.86	– 3.01	0.55	8.362
Gonad weight – standard length	0.95	– 8.74	0.49	7.516
Log gonad weight – Log standard length	2.79	– 2.56	0.52	7.961
Gonad weight – Body weight	0.08	0.11	0.56	8.587
Log gonad weight – Log body weight	0.97	– 1.03	0.57	8.794
Fecundity – Condition factor	8203.75	213986.53	0.00	0.439

Different relationships are fitted with a regression line on the following figures (Fig. 5 to 19).

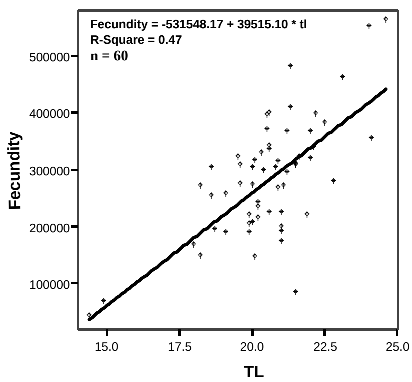

Fig .5. Relationship between total length and fecundity of *G. giuris.*

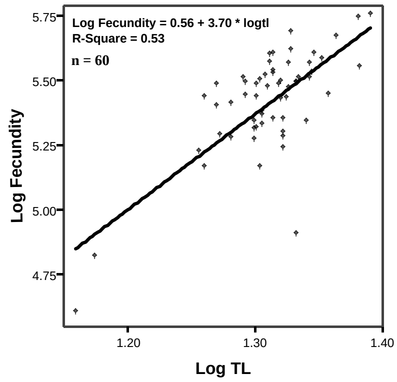

Fig. 6. Relationship between Log total length and Log Fecundity *G. giuris.*

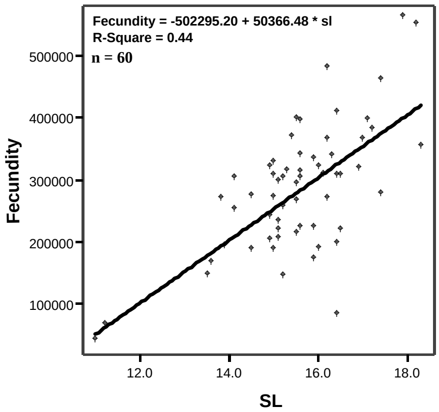

Fig. 7. Relationship between standard length and fecundity of *G. giuris.*

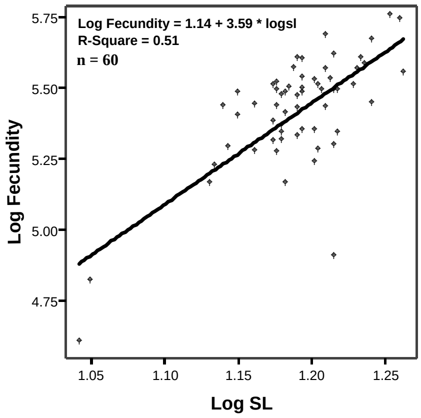

Fig. 8. Relationship between Log standard length and Log fecundity of *G. giuris*

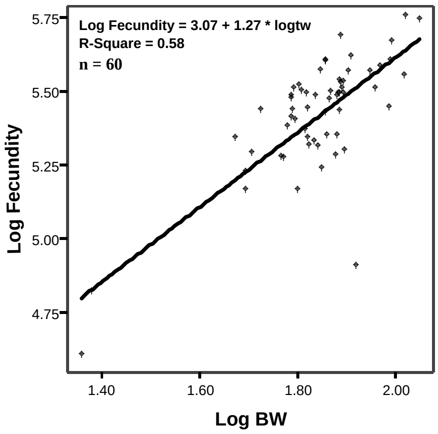

Fig. 9. Relationship between body weight and fecundity of *G. giuris.*

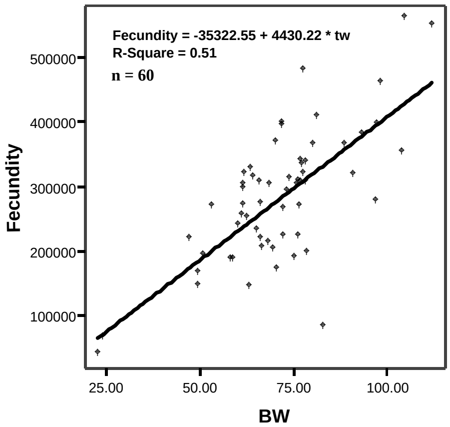

Fig. 10. Relationship between Log body weight and Log Fecundity of *G. giuris.*

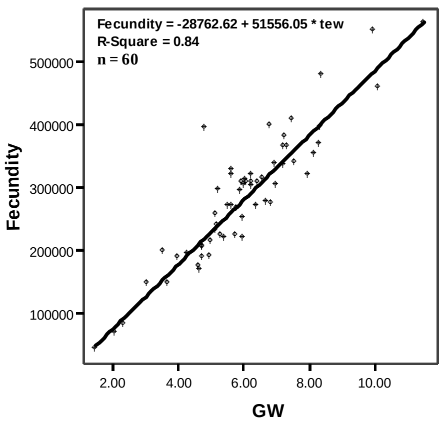

Fig. 11: Relationship between gonad weight and fecundity of *G. giuris.*

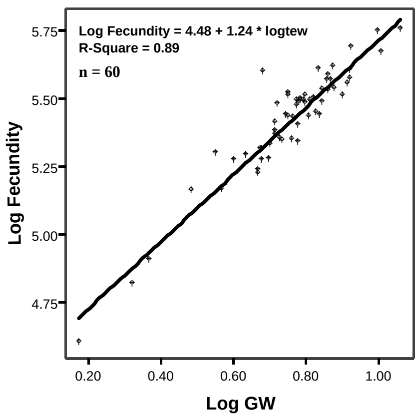

Fig. 12. Relationship between Log gonad weight and Log fecundity of *G. giuris.*

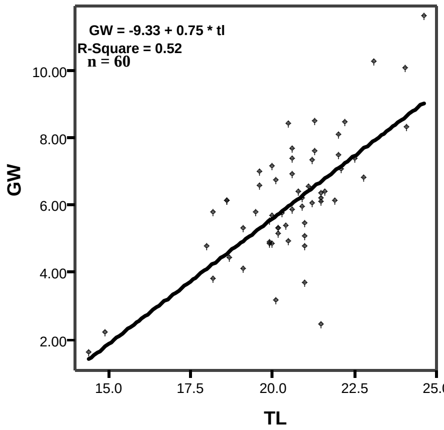

Fig. 13: Relationship between gonad weight and total length of *G. giuris.*

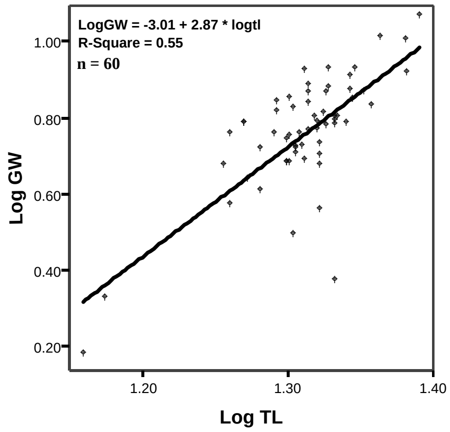

Fig. 14. Relationship between Log gonad weight and Log Total length of *G. giuris.*

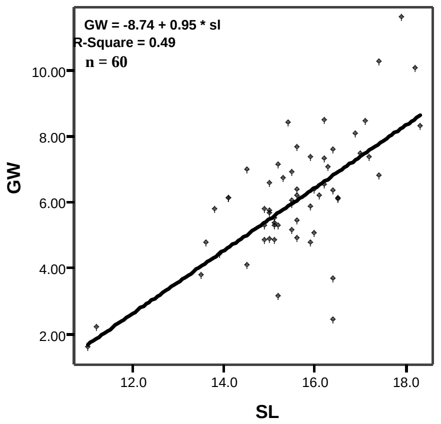

Fig. 15. Relationship between gonad weight and standard length.

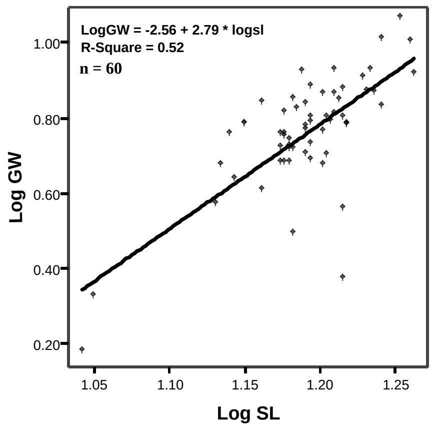

Fig. 16. Relationship between Log gonad weight and of *G. giuris.* Log standard length of *G. giuris.*

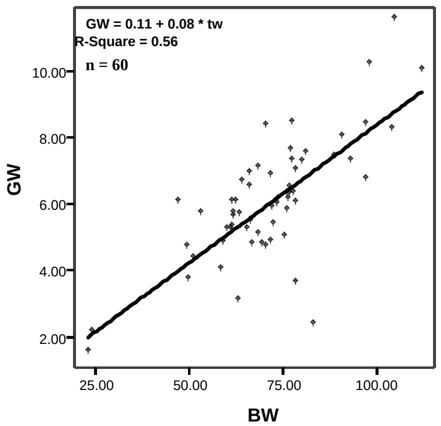

Fig. 17. Relationship between gonad weight and body weight of *G. giuris.*

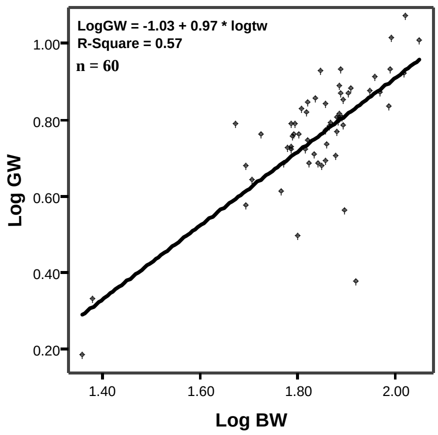

Fig. 18. Relationship between Log gonad weight and Log body weight of *G. giuris*.

Discussion

The regression line in both the arithmetic and logarithmic scales showed that the fecundity - total length and fecundity – standard length were linearly related (Fig. 5, 6, 7 and 8). Having calculated the values of regression co-efficient, intercept and co-efficient of regression, the regression equations of fecundity on total length and standard length were estimated in both arithmetic and logarithmic scale. The relationships were found significant (R^2= 0.47 and R^2= 0.68; R^2= 0.44 and R^2= 0.61) respectively.

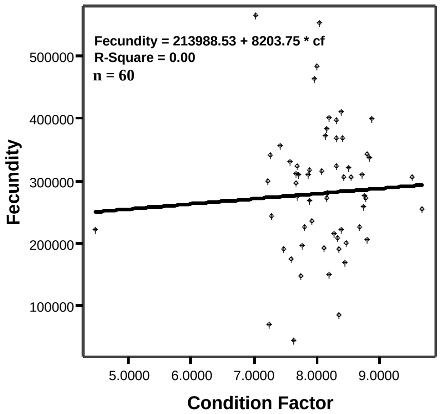

Fig. 19. Relationship between fecundity and condition factor of *G. giuris.*

A marked increase in fecundity was noticed with the increase in length. The increased fecundity with the increase in length was also reported by Doha and Hye (1970) for *Hilsa tenualosa*, Karim and Hossain (1972) for *Mastacembelus pancalus*, Shafi and Quddus (1974) for *Puntius sigma*, Shafi and Mustafa (1976) for *Anabus testudineus*, Mustafa *et al.* (1980) for *Nandas nandus*, Mustafa *et al*. (1983) for *Puntius sarana*, Azadi *et al*. (1987) for *Mystus vittatus*, Das *et al*. (1989) for *Heteropneustes fossilis* and Kabir *et al*. (1998) for *Gudusia chapra*.

The relationship of body weight and fecundity was calculated and expressed by both the arithmetic and logarithmic formula (Fig. 9 and 10). The estimated lines showed that the relationship between body weight and fecundity was linear. According to Bagenal (1967), the number of egg was related more to weight of the fish than to the length. The regression equation showed a positive body weight-fecundity relationship. Increase in fecundity with the increase in body weight was also reported by Mustafa *et al*. (1983), the regression co-efficient between fecundity and body weight for both arithmetic (R^2= 0.51) and logarithmic (R^2= 0.68) expression was found significant.

Linear positive relationship between fecundity and body weight was reported by many workers like, Doha and Hye (1970), Grant (1972), Shafi and Mustafa (1976), Das (1977), Shafi and Quddus (1977), Mian and Dewan (1978), Bhuiyan and Rahman (1982), Kader *et al*. (1982), Afroze and Hossain (1983), Nargis *et al*. (1983) and Kader (1984) for different species of fish.

The relationship between gonad weight and fecundity was found to be the most significant (Fig. 11 and 12) than that of other factors with fecundity. This type of strongest relationship of gonad weight fecundity was reported by Mustafa *et al.* (1983), Crivelli (1981), Azadi *et al*. (1987), Das *et al*. (1989) for other fishes. Shafi *et al.* (1978), Shafi *et al*. (1979), Crivelli (1981), Bhuiyan and Rahman (1982), Nargis *et al*. (1983) and Kader (1984) also reported the relationship between fecundity and gonad weight to be the most significant one than that of fecundity and other parameters.

The relationship between fecundity and standard length, body weight and gonad weight were found statistically significant ($p<0.01$). Das *et al*. (1989) recorded highly significant relationship between fecundity and gonad weight in *H. fossillis.*

A comparison of the regression co-efficient of fecundity-total length (R^2= 0.47), fecundity-standard length (R^2= 0.44), fecundity-body weight (R^2= 0.51) and fecundity-gonad weight (R^2= 0.84) indicates a much closer relationship of fecundity with gonad weight than the other factors like total length, standard length and body weight.

A comparison of the regression co-efficient of gonad weight- total length (R^2= 0.52), gonad weight -standard length (R^2= 0.49), gonad weight - body weight (R^2= 0.56) indicates a much closer relationship of gonad weight with body weight than the other factors like total length and standard length.

From the significant *'t'* values in the present study it may be concluded that fecundity increases in *G. giuris* with the increase of its total length, standard length, body weight and gonad weight.

The peak condition factor values for combined sexes, male and female *Glossogobius giuris* decreased gradually with increasing size is reported by Akter (2000). But no significant relationship (R^2= 0.00) was found between fecundity and condition factor.

It should be considered that fecundity of fish may vary with different level of sexual maturity and also with seasons, climatic conditions and environmental habitat, nutritional status and genetic potential. This study had few limitation like comparatively small sample size and the sample was not collected throughout the year. Therefore, more studies are needed to get clear picture on it.

References

Afroze, S. and Hussain, M.A. 1983. The fecundity and sex ratio of the freshwater fish *Amblypharyngodon mola*. Forth National Zoological Conference Abstracts: Section IV, Dhaka, Bangladesh, p. 24.

Ahamed, K.M.A.; Hussain, N.; Huda N. and Abdullah, M. 1979. Nutritional Survey of Rural Bangladesh. Institute of Nutrition and Food Science, Dhaka University, 66 pp.

Akter, R. 2000. Some Aspects of Biology of *Glossogobius giuris* From Markets of Khulna. Khulna University, Khulna, 37-48 pp.

Azadi, M.A.; Islam, M.A. and Dev, S.R. 1987. Some aspects of the biology of *Mystus vittatus* (Bloch): 1: Food and feeding habits and fecundity. Proceeding of 12th Annual Bangladesh Science Conference, Section 2, Bangladesh Association for Advancement of Science, Dhaka, 36 pp.

Bagenal, T.B. 1967. A short review of fish fecundity. In: Gerking, S.D. (ed.), *The Biological Basis of Fresh Water Fish Production*, New Delhi, pp. 89-111.

Bhuiyan, A.S. and Rahman, K. 1982. On the fecundity of Snake headed fish, *Channa gachua* (Hamilton). *Bangladesh Journal of Zoology*, 10(2): 101-110.

Crivelli, A.J. 1981. The biology of the common carp, *Cyprinus carpio* in the camargue, Southern France. *Journal of Fisheries Biology*, 18: 271-290.

Das, M.S.; Dewan S. and Debnath, S.C. 1989. Studies on fecundity of *Heteropneustes fossillis* (Bloch) in a minipond of Bangladesh Agriculture University, Mymensingh. *Bangladesh Journal of Agricultural Science*, 16(1): 1-6.

Das, H.P. 1977. The fecundity of gray mullet *Mugil cephalus* along the Goa coast. *Mahasagar Bullettin* National Institute of Oceanography, 10(1&2): 79-82.

Dewan, S. and Doha, S. 1979. Spawning and fecundity of certain pond fishes. *Bangladesh Journal of Agriculture*, 4(1): 1-8.

Doha, S. and Hye, M.A. 1970. Fecundity of Padma River hilsa (*Hilsa ilisha*, Hamilton). *Pakistan Journal of Science*, 22(3 & 4): 176-184 pp.

Grant, C.J. 1972. The biology of the soldier fish, *Gymnapistes marmoratus. Australian Journal of Marine and Freshwater Research*, 23:151-163.

Kabir, A.K.; Hossain, M.A.; Rahmatullah, S.M.; Dewan S. and Islam, M.S. 1998. Studies on the gonadosomatic index and fecundity of chapila (*Gudusia chapra* Ham.). *Bangladesh Journal of Fisheries Research*, 2: 189-194.

Kader, M.A. 1984. Studies on *Gobiodes rubicandus* Hamilton-Bachanan from the Karnafully estuary. Ph.D. Thesis, University of Chittagong, Chittagong, pp. 1-117.

Kader, M.A.; Hossain M.A. and Mohi, S.A. 1982. The fecundity of *Lepturacanthus savala*, James. *Journal of the Asiatic Society of Bangladesh (Sc.),* VII(1): 53-57.

Karim, M.A. and Hossain, A. 1972. Studies on the biology of *Mastacembelus pancalus* (Spiny Eel, Hamilton) in artificial ponds. Part II. Sexual maturity and Fecundity. *Bangladesh Journal of Biological and Agricultural Sciience*, 1(2): 15-18.

King, M. 1997. *Fisheries Biology, Assessment and Management*. Third edn.; Fishing News Books, Blackwell Science Ltd., London, p. 111.

Laglar, K.F. 1956. *Freshwater Biology*. Second edn., William C. Beren Co., Dubuque, Lowa, 421 pp.

Laglar, K.F. 1949. *Studies of Freshwater Biology*. Ann Arbor., Michigan, 119 pp.

Miah, A.M. and Dewan, S. 1984. Studies on the fecundity of *Sarotherodon nilotica* (Linnaeus) in a fish pond. *Bangladesh Journal of Zoology*, 12(2): 99-103.

Mian, A.M. and Dewan, S. 1978. Studies on some aspects of *Tilapia nilotica* (Linnaeus) in a fish pond II. Fecundity abstracts: Section II. Third Bangladesh Science Conference, Dhaka, Bangladesh, p. 58.

Mustafa, G.; Ahmed, A.T.A. and Islam, K.R. 1980. Food and feeding habits and fecundity of a fresh water Perch, meni fish, *Nandus nandus*. *Bangladesh Journal of Agriculture*, 5: 205-210.

Mustafa, G.; Islam, K.R.; Ali, S. and Alam, A.K.M.A. 1983. Some aspect of the biology of *Puntius sarana* (Hamilton): 1. Food and feeding habits in relation to fish size and fecundity. *Bangladesh Journal of Zoology*, 10: 92-100.

Nargis, A.; Hossain, M.A. and Kasem, M.A. 1983. On the food, feeding, fecundity and sex ratio of *Anabas testudineus* (Bloch). Forth National Zoological Conference Abstract: Section IV, Dhaka, Bangladesh, pp. 24-32.

Shafi, M.; Quddus, M.M.A. and Chakraborty, S. 1979. Food and feeding habits, spawning and fecundity of spotted mackerel *Cybium guttatum* (Euv. & Valen). *Bangladesh Journal of Agriculture*, 4(1): 47-56.

Shafi, M.; Quddus, M.M.A. and Rahman, S. 1978. Fecundity of the Indian Halibut, *Psettodes erumei* (Bloch and Schneider) from the Bay of Bengal. *Bangladesh Journal of Zoology*, 6(2): 113-120.

Shafi, M. and Quddus, M.M.A. 1977. Observation on the biology of the brown pomfret *Parastromateus niger* (Bloch) from the Bay of Bengal. *Bangladesh Journal of Inland Research*, XIII (1&2): 28-33.

Shafi, M. and Mustafa, G. 1976. Observation on some aspects of the biology of the climbing perch, *Anabus testudineus* (Bloch). *Bangladesh Journal of Zoology*, 4: 21-28.

Shafi, M. and Quddus, M.M.A. 1974. The fecundity of the common punti, *Puntius stigma* (Cuv. And Val.). *Bangladesh Journal of Zoology*, 2(2): 133-145.

Siddique, K. and Chowdhary S.N. (ed.). 1996. Pukure Machh Chas Manual. National Institute of Local Government, Dhaka.

Tareque, A.M.H.B; Huque, S. and Rahman, M.M. 2007. Fecundity of *glossogobius giuris* (Ham.) and relationship between fecundity and length-weight**.** *Khulna University Studies*, 8(1): 99-107.