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FECUNDITY ESTIMATION OF INDIAN POTASI, *Neotropius atherinoides* IN BANGLADESH

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A B S T R A C T

Fecundity estimation has obvious significance in aquaculture, since the size of brood stock, amount of rearing facilities and necessity of other equipment's are dependent on fecundity. The study has been conducted on fecundity estimation of Indian potasi, *Neotropius atherinoides*, based on 202 females collected from the Kangsha River flowing through Netrokona district during the period from January to June 2013. The standard length (SL) range of female were 47-66, 50-64, 57-68, 50-66, 56-66 and 60-76 mm and range of body weight were 1.07-3.56, 1.23-3.35, 2.36-3.81, 1.69-4.31, 2.33-5.59 and 3.18-5.14 g in January, February, March, April, May and June, respectively. The mean Gonado somatic indices (GSI) were very low from January to March but these were abruptly high during subsequent three months. Based on mean GSI the spawning season of this species was assumed from April to June over the study period. Scatter plot of standard length with corresponding GSI revealed that the minimum length of mature female was 50 mm SL. Egg diameter frequency distribution of a mature ovary showed almost only one major mode of egg size suggested that the fish is a single spawner, and summation of eggs in that mode was regarded as the fecundity of a female Indian potasi. The regression equation of the relationship between standard length and fecundity was as, Fecundity = 0.0017 $SL^{3.55}$. The relative fecundity and the absolute fecundity of a fish having SL of 62 mm was 1477 per g and 3921, respectively based on F-SL relationship. The relationship between body weight and fecundity was as, Fecundity = 1371.3 BW-650.8. The absolute fecundity of a fish having BW of 3.51 g was 4162 respectively based F-BW relationship. The relationship between ovary weight and fecundity was as, Fecundity = 6244.3 OW + 967.52. The absolute fecundity of a fish having ovary weight of 3.51 g was 7211 based F-OW relationship. The correlation coefficient of all above analyses were very high (>0.755) attributing that standard length, body weight and gonad weight were highly positively correlated with fecundity of Indian Potasi, *Neotropius atherinoides*.

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INTRODUCTION

Bangladesh, with its rich inland waters and river systems, has significant capture fishery and aquaculture potential. The favorable geographic position of Bangladesh comes with a large number of aquatic species and provides plenty of resources to support fisheries potential (DoF, 2012). In the country 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). SIS are considered to be those fishes, which grow at a length of maximum 25 cm at maturity (Felts *et al*., 1996). SIS has been considered as an important source of food rich in protein, vitamin and minerals. Many SIS are eaten whole contributing calcium, phosphorus and vitamins to the human diet. It also plays an important role in the elimination of night blindness in Bangladesh (Hossain and Afroze, 1994). The examples of some SIS are A*mblypharyngodon mola*, *Glossogobius giuris, Puntius sophore, Gudusia chapra, Chanda nama, Colisa fasciatus, Mystus vittatus, Ompok pabda, Rohtee cotio, Esomus danricus* etc.

SIS are decreasing due to man made and natural degradation of habitat. Our open water capture fisheries are under great stress and its sustainability is under danger because of changing aquatic ecosystems due to pollution, soil erosion, siltation, and construction of flood control and drainage structures. In Bangladesh 56 freshwater fish species are in threats of different levels of extinction (IUCN, 2000). Among SIS *Neotropius atherinoides* is one of the delicious one. It was very common fish item in any fish market throughout the country. But now-a-days this fish is not as available as past. The conservation of *N. atherinoides* is needed as it is over-exploited. Study of the fecundity of fishes has manifold importance in fishery biology. It is important to know the number of eggs, fry and young that could be produced from individual brood fish for purpose of fisheries management and aquaculture industry. The number of eggs produced has obvious significance in aquaculture, since the size of brood stock, amount of rearing facilities and necessity of other equipments are dependent on it. Regarding the importance of *N. atherinoides*, the research work was undertaken to estimate the fecundity of the species to determine the spawning season, ascertain the minimum length of first maturity and establish relationship between fecundity and standard length, fecundity and body weight and fecundity and ovary weight.

MATERIALS AND METHODS

Study area and period

For the study of the fecundity, a total of 362 *N. atherinoides* were collected from Kangsha river at Netrokona sadar Upazila in Netrokona district during the period of January 2013 to June 2013. Each month at least 25 females were collected.

Preservation of fish specimen

After collection of the specimen the color, fins, abdomen status were observed and recorded. The specimens were preserved in 10% formalin and labeled. Then the specimen was brought to the Water Quality and Pond Dynamics Laboratory of Bangladesh Agricultural University, Mymensingh, Bangladesh for further study.

Recording of length, weight and ovaries

The total length, fork length, standard length and the body weight of each specimen were recorded separately to the nearest centimeter scale and gram respectively. For the accuracy of weighing excess moisture attached to the fish was dried off with the help of blotting paper before taking the weight (Table 1).

Table 1. Description of *Neotropius atherinoides* samples collected from the Kangsha river

Sampling period	No. of Male	Size range		No. of female	Size range	
		SL(mm)[1]	BW(g)[2]		SL(mm)	BW(g)
January, 2013	27	47-67	1.07-3.43	24	47-66	1.07-3.56
February, 2013	32	46-60	1.02-2.60	29	50-64	1.23-3.35
March, 2013	36	53-62	1.96-2.69	39	57-68	2.36-3.81
April, 2013	22	51-63	1.88-3.05	53	50-66	1.69-4.31
May, 2013	32	49-63	1.49-2.55	43	56-66	2.33-5.59
June, 2013	11	56-68	2.13-3.85	14	60-76	3.18-5.14

[1]Standard length; [2]Body weight

Figure 1. Measurement of length, weight and collection of ovary from of *N. atherinoides*

The collected fishes were dissected out and whole mass were removed carefully form the ovarian wall. The paired ovary of the individual fish was removed and carefully placed on a petridish from female fishes. Ovary was washed, cleaned; weights and length of the ovary were taken by using electric balance and scale.

Fecundity estimation

In this experiment Gravimetric method (Lagler, 1956) was used for estimation of fecundity. Prior to estimation oocytes from samples (0.001 g) obtained from three portions (anterior, middle and posterior) of five ovarian lobes were randomly counted and measured to determine whether they had significant differences between locations.

A section of about 2 mm long was cut from middle part of the right ovary, weighing to nearest 0.001 g (gw). A frequency distribution of egg size by 1 mμ interval was constructed, the number of eggs in the largest modal group, b was summed. Fecundity, F was calculated by using the formula: $F = GW*(b/gw)$. Gonadosomatic index (GSI) of the females collected in January, February, and March were very small. Fecundity study was done with the females of larger GSI collected in April, May and June.

Relationship of fecundity on lengths, weights and ovary

The equation describing the relationship between fecundity and standard length, body weight and fecundity, ovary weight and fecundity (Bagenal *et al.*, 1967) are given as:

$$F = aSL^b$$
$$\ln F = b \ln L + a$$
$$F = bBW + a$$
$$F = bOW + a$$

where,

F = Fecundity, SL = Standard length in cm, b = Slope of the regression line (regression constant).

a = Intercept of the regression with the y- axis (regression coefficient)., BW= Body weight. OW= Ovary weight

Calculation of the gonadosomatic index (GSI)

Gonadosomatic index (GSI) is the percentage of gonad weight to the total weight of the fish. The GSI of the collected fish was calculated for each of the female separately. GSI for each specimen was calculate as GSI = (Weight of Overy/Weight of Fish) x 100

Measurement of ova diameter

To measure the diameter of ova, random sample of 50 ova was taken and separating in several rows on a glass slide under a microscope.

RESULTS AND DISCUSSION

Fish size

Fishes were collected on January, February, March, April, May and June months. Their standard lengths varied from 47-67, 46-60, 53-62, 51-63, 49-63 and 56-68 mm respectively from January to June. The male specimens collected in February month were small in size whereas in June were largest in size. Their body weight ranged from 1.02-3.85 g (Table 1). The body weight of the male samples were lowest in the month of February and that was varied from 1.02-2.60 g and highest in the month of June and varied from 2.13-3.85 g. Rest of the part of this experiment was conducted with only female individuals. So data that has given below is only about female specimens.

Standard length

For the experiment 362 specimens (female 202, male 160) of *N. atherinoides* were collected for the study, standard length ranged from 47mm to 76mm (Table1) over the study period. Female fishes, were collected from study period (January-June, 2013), their standard length were varied from 47-66, 50-64, 57-68, 50-66, 56-70 and 60-76 mm. respectively (Table 1). Specimens collected in January month were small in size and their size varied from 47-6 6mm. In the month of June fishes were largest in size and their size varied from 60-76 mm.

It is possible that the variation in fecundity of the *N. atherinoides* may be due to environmental conditions of the river. This type of variation was also reported by some previous workers in other fish (Doha and Hye, 1970). Different relationships were found to exist between the fecundity and various parameters. Clark (1934) reported that the fecundity of a species increases in proportion to the square of its length. Swarup (1962) and Singh *et al*., (1982) reported a direct relationship between fecundity and length of fish.

Body weight

Throughout the sampling period, 202 individual body weight of female from 1.07-5.59 g. The body weight of the specimens collected on January, February, March, April, May and June varied from 1.07-3.56, 1.23-3.35, 2.36-3.81, 1.69-4.31, 2.33-5.5 9 and 3.18-5.14 g respectively (Table 1).

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 0.01 to 1.21 g. The color of the ovary was yellowish. The ovary weight of the specimens collected on January, February, March, April, May and varied from 0.01-0.06, 0.02-0.05, and 0.03-0.14, 0.30-0.96, 0.20-1.21 and 0.41-0.91 g respectively.

Variation of fecundity among the population may result largely from selectivity different environmental factors (temperature, sunlight, weather etc.) of which temperature is considered the most probable selective factor (Jonsson and Jonsson, 1999). However, fecundity of fishes varies from species to species, also within the same species due to different factors such as age, size, body and gonad weight, ecological conditions of the water body etc (Lagler, 1956).

Gonadosomatic index

The values of gonadosomatic index (GSI) varied from 0.04 to 34.3. In January, February, March, April, May and June the GSI of *N. atherinoides* were recorded 0.04-2.9 with a mean of 1.57±0.641, 0.7-1.8 with a mean of 1.37±0.313, 0.9-3.7 with a mean of 1.72±0.429, 9.0-34.3 with a mean of 19.41±7.24, 7.0-24.3 with a mean of 17.30±5.35 and 11.81-18.88 with a mean of 15.98±2.26 respectively (Figure 2). The mean GSIs of January, February and March were extremely low, but mean GSI was suddenly higher in April, and it remained higher in the next two months. Monthly GSI plot demonstrated that the spawning season of this species was from April to June during the first six months of the year. The variation in gonadosomatic index of *N. atherinoides* might be associated with the degree of maturity of ova and spawning. This finding agree with the finding of Das (1998) for *N. notopterus* (Pallas).

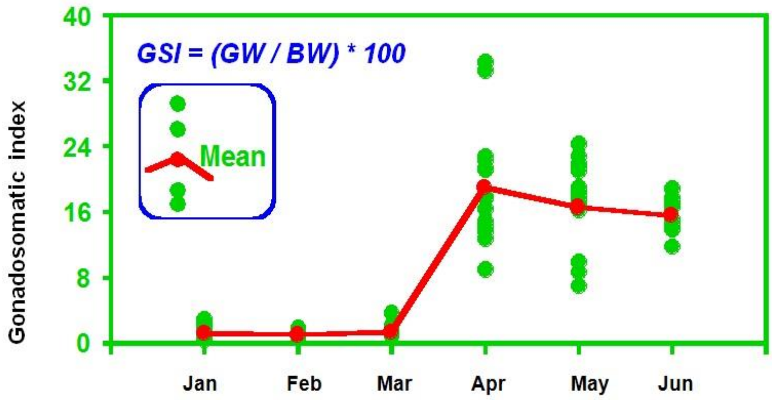

Figure 2. Monthly variation of gonadosomatic index of female

Length at first maturity

The GSI of individual specimens in January, February and March were very low, but higher in subsequent months. The study, therefore, considered the females with high GSI to estimate the length of youngest mature female. Scatter plot of standard length with corresponding GSI revealed that the minimum length of mature female was 50 mm SL (Figure 3).

Lagler *et al*., (1967) reported that the number of eggs produced by an individual female was dependent on various factors like size, age, condition and types of species of the fish. It was also observed in some cases that the fecundity of some larger fishes was much less than that of some smaller fish.

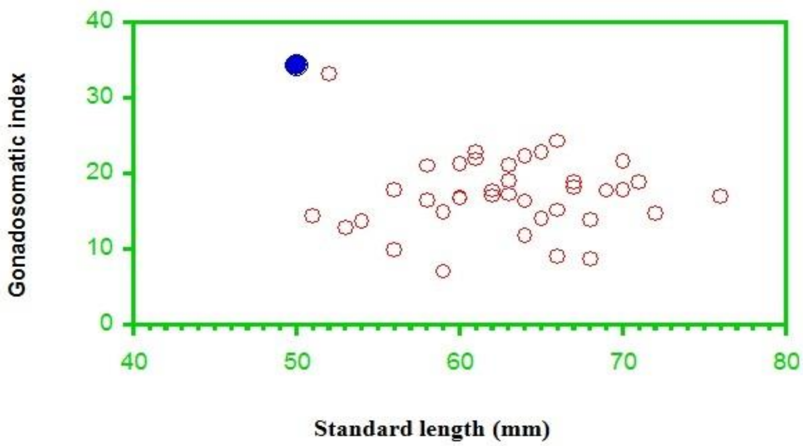

Figure 3. Gonadosomatic index of females with the corresponding standard length. Blue solid symbol indicates the GSI of youngest adult female having 50 mm SL in this study.

Fecundity

Egg diameter frequency distribution of a mature ovary showed almost only one major mode of egg size suggested that the fish is a single spawner, and summation of eggs in that mode was regarded as the fecundity of a female Indian potasi (Figure 4). The fecundity of *N. atherinoides* was between 1541 and 10043 for a corresponding standard length and weight 56 mm, 70 mm and 2.33 g, 5.59 g respectively. The highest fecundity of *N. atherinoides* was found in April and lowest fecundity was found in May (Table 2).

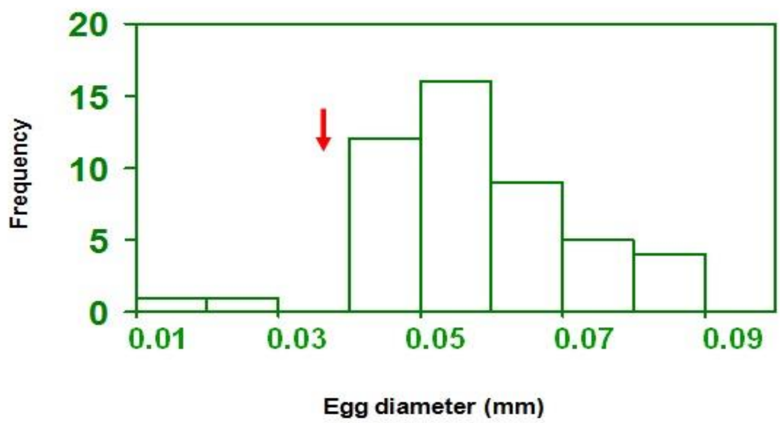

Figure 4. Egg diameter frequency histogram
Eggs at the right side of arrow were counted as fecundity of a female in this study.

The present observations on fecundity reveal that *N. atherinoides* (1541 to 10043 eggs) is a more fecund fish compared to other fishes like, *Esomus danrica* (392 to 2412 eggs), *Amblypharyngodon mola* (l02l to 13815 eggs), *Ambassis nama* (110 to 2448 eggs). Lower number of eggs might also be correlated with shorter development time rate of fingerling, which means higher survival rate. The higher number of eggs does not prove to be a disadvantage in reproductive potential. It is an indicator of population behavior and fecundity according to Panthulu (1961).

Table 2. Month wise fecundity of *N. atherinoides*

Month	No. of fish examined	Fecundity range	Mean fecundity
April	14	1980-8589	4346.35
May	14	1541-10043	3930.83
June	11	3936-5794	4147.64

Relationship between standard length and fecundity

The scatter diagrams obtained from the fecundity and standard length showed a nonlinear cubic relationship (Figure 5). In the determination of this relation, standard length was taken as independent variant, while fecundity as dependent variable. The relationship between the fecundity and standard length was expressed as: $F = 0.0017\ SL^{3.55}$ ($r^2 = 0.960$). The relative fecundity and the absolute fecundity of a fish having SL of 62 mm was 1477 per g, and 3921 respectively based on F-SL relationship.

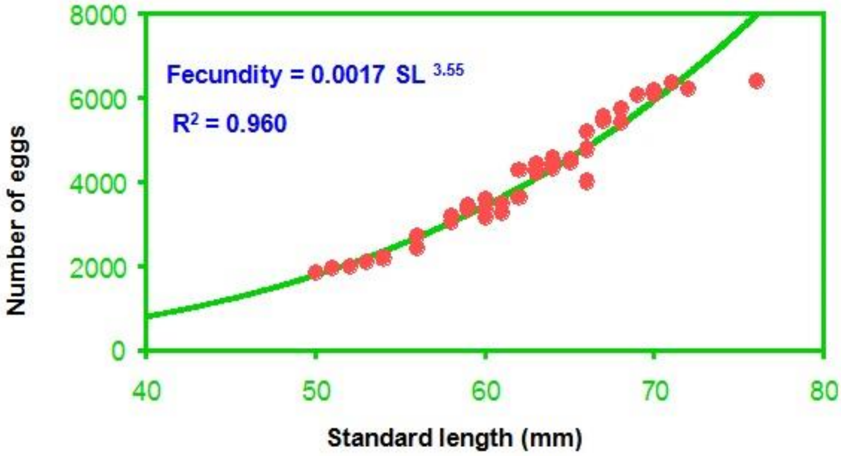

Figure 5. Relationship between standard length and fecundity

Relationship between body weight and fecundity

The scatter diagrams obtained from the fecundity and body weight showed a linear relationship (Figure 6). In the determination of this relation, body weight was taken as independent variant, while fecundity as dependent variable. The relationship between the fecundity and body weight was expressed as: F = 1371.3BW – 650.8 (r^2= 0.718). The absolute fecundity of a fish having BW of 3.51 g was 4162 respectively based F-BW relationship.

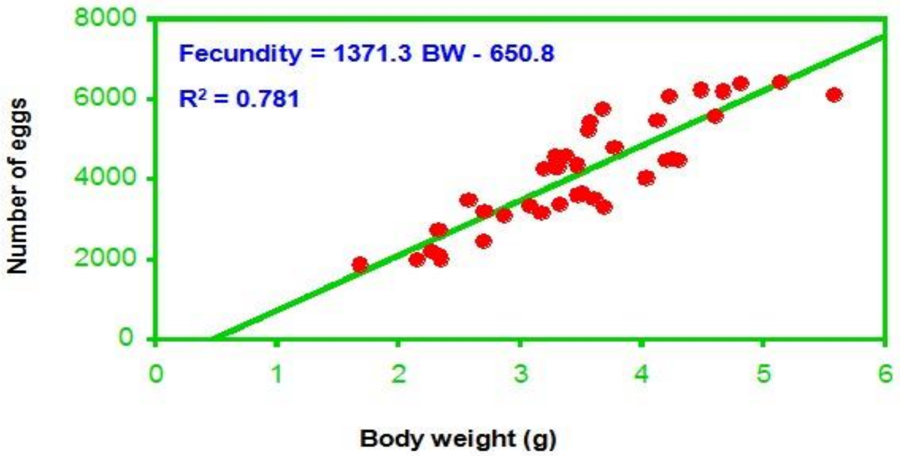

Figure 6. Relationship between body weight and fecundity

Relationship between ovary weight and fecundity

The scatter diagrams obtained from the fecundity and body weight showed a linear relationship (Figure 7).

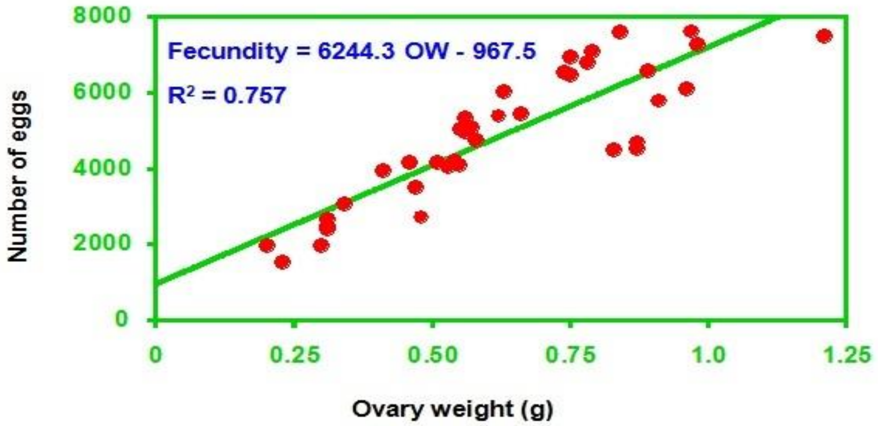

Figure 7. Relationship between ovary weight and fecundity

In the determination of this relation, body weight was taken as independent variant, while fecundity as dependent variable. The relationship between the fecundity and body weight was expressed as: F = 6244.3OW – 967.5 (r^2= 0.757). The absolute fecundity of a fish having ovary weight of 3.51 g was 7211 based F-OW relationship.

CONCLUSIONS

In the present study, the relationships between fecundity and body weight of the fishes were found to be linear and significant. The study has provided some basic information on the size at sexual maturity and fecundity for *N. atherinoides* that will be helpful to evaluate reproductive potential of individual fish species in similar studies. Further, it would be useful for fishery biologist or manager to impose adequate regulation for sustainable fishery management for the control of exploiting fishing of young individuals and when associated with other information aids in evaluation and prediction of fish stock in the different water bodies of Bangladesh.

CONFLICT OF INTEREST

There is no conflict of interest for this study.

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