

## The fecundity of *Hilsa ilisha* from the river Padma near Godagari of Rajshahi district

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**Abstract :** The fecundity of *Hilsa ilisha* (Hamilton, 1822) were estimated from 20 fully matured females caught from the Padma river near Godagari, Rajshahi and collected from different fish market of Rajshahi City from June to October 2002. The fecundity (F) was found to vary from 5,58,700 to 18,67,000, mean  $1239360.35 \pm 405068.97$  for the fishes with 350-557mm in total length and mean  $455.25 \pm 59.94$ mm and with 600 -1775g in total body weight and mean  $1181.85 \pm 356.12$ g. The co-efficient of correlation for F/TL, F/TW, F/GL and F/GW were 0.8036, 0.8853, 0.7606 and 0.7922 respectively. The regression line for the TL, TW, GL and GW of the sample fishes were found to be linear when they were plotted against their fecundity. All the variables observed ( $P < 0.05$ ) were highly significant. The best indicator of the fecundity of *H. ilisha* was found to be the total body weight.

**Key words:** Fecundity, gonad, GSI, *Hilsa ilisha*.

### Introduction

The term "fecundity" can be expressed as the number of eggs present in the ovary that should be laid in a single species not in a constant number but fluctuates within certain ranges which is species specific. The number of eggs contained in the ovary of a fish is termed as fecundity. Fecundity is an important aspect of the biology of fishes that must be understood to explain the variations in the level of population, as well to make efforts to increase the amount of harvest. In order to assess the population stock of any species the accurate estimation of the fecundity is essential.

*Hilsa ilisha* (Hamilton, 1822) is the most commercially important and the national fish of Bangladesh. It contributes a lot in the fish export earning of Bangladesh. The demand of this tasty fish is increasing day by day in home and abroad. *Hilsa* has long been described and established as *Hilsa ilisha* by many authors of India, Pakistan and Bangladesh

Several workers have made significant contribution to the fecundity of fishes in different countries of the world. Notable among them are June (1953); May (1967); Gupta (1968); Khan & Mukhopadhyaya (1972). But only a few workers have studied the fecundity on some of fishes in our country. Doha & Hye (1970); Shafi & Quddus (1974); Kader & Talukder (1978); Bhuiyan & Rahman (1982); Islam & Hossain (1984); Nargis & Hossain (1988) were among them. But in Bangladesh, very little works have so far been done on fecundity of *H. ilisha*.

The present investigation deals with the fecundity of *Hilsa ilisha* in order to estimate the range and the average number of ova laid by individual female during the breeding season and to establish a mathematical relationship of the fecundity (F) with

total length (TL), total weight (TW), gonadal length (GL) and gonadal weight (GW).

### Materials and Methods

A total of 20 fully matured females of *Hilsa* caught from the river Padma near Godagari of Rajshahi district and from Rajshahi fish markets (Katakhali Bazar, Shaheb Bazar and Laxmipur Bazar) from June to October, 2002 for the determination of fecundity and gonadal weight in relationship to other parameters. Eye observation and common experience were used in identifying the gravid females. Enlarged abdomen of the female fish was easily distinguished as gravid one. For detail study of fecundity the collected fishes were carried immediately to the laboratory of Department of Zoology, University of Rajshahi.

After through 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 fishes was removed with blotting paper before measuring the weight of fishes. The gonads (GSI) were dissected out and weighed. Gonado Somatic Index was measured as gonad weight divided by total weight multiplied by hundred.

Two lobes of the ovary from each sample fish were removed carefully by dissecting out the abdomen and placed in 5% formalin. It helped to preserve the ovary as well as made it much easier to separate the eggs from the ovarian wall (Shafi & Quddus, 1974). The stage of the ovary and the colour were noted. The two lobes of each ovary were dried off removing of excess moisture with blotting paper. Three cross sectional samples were taken from anterior, middle and posterior

portion of the two lobes of each ovary. The eggs in each of the three sections were counted and then the mean number of eggs was calculated.

For the estimation of fecundity from the ovarian eggs gravimetric method was applied (Doha & Hye, 1970; Das, 1977; Hossain *et al*, 1992). Using this method the eggs of three samples from both the ovaries of each Hilsa fish were counted. The number of eggs per 0.10g was computed from three samples and the total number of eggs for each fish was calculated from the sample unit average.

To establish a mathematical relationship with fecundity, the total length, standard length, body weight and gonadal weight of fish were estimated. The G.S.I and egg diameter were also estimated. To establish the relationship, the values of regression co-efficient (b), point of intercepts (a) and co-efficient of correlations (r) and standard deviation were calculated on those parameters by the least square method. 'T' test was done for testing the significance of co-efficient of correlation (r) were calculated on those parameters by the least square method (LeCren, 1951).

### Results

The ovary of the female *Hilsa ilisha* is bi-lobed elongated and situated in the body cavity. The shape, size and colour of the ovary considerably according to the degree of maturation of the oocytes; the immature ovary is small reddish and transparent in nature which turns into yellowish in ripe condition. The immature ova are microscopic in size, transparent and without yolk but with the advancement of the stages, the ova become large and opaque. In the ripe stage, the ova are yellowish in colour attaining maximum size.

From the study of 20 female fish it was found that the individual fecundity of fish varied from 6,20,000 eggs (for smallest sized fish with a total length 350 mm and body weight 600g) to 18,67,000 eggs (for a fish with a total length 530mm and total body weight 1700g). The mean fecundity of 20 females was recorded as  $123,93,60.35 \pm 405068.97$  eggs with mean total length  $455.25 \pm 59.94$ mm and mean body weight of  $1181.85 \pm 356.12$ g (Table 1).

The regression equation  $Y = a + bx$ , where, (Y= Fecundity (F), X= total length (TL), the values of intercept (a), regression co-efficient (b) and correlation co-efficient (r) are given in Table-2. The regression equation was calculated as  $F = -1232873.311 + 5430.4968 TL$ ,  $r = 0.8036$ . The calculated t-value is 5.7284 at 5% level of significant for 18 degrees of freedom, which is larger than the tabulated t-value for the same degree of freedom. The "r" value is highly significant (Table-3).

The correlation between fecundity (F) and total weight (TW) was computed as,  $F = 49231.47589 + 1007.0050TW$ ,  $r = 0.8853$  (Table-2). The calculated t-

value is 8.07708 at 5% level of significant for 18 degrees of freedom, which is larger than the tabulated t-value for the same degree of freedom. The "r" value is highly significant (Table-3).

The relationship between fecundity (F) and gonadal length (GL) is represented in Table-2 and the mean value of gonadal length was  $180.45 \pm 37.81$ mm. The regression equation was computed as,  $F = -230996.5747 + 8148.2788GL$  and  $r = 0.7606$ . The calculated t-value is 4.9705 at 5% level of significant for 18 degrees of freedom, which is larger than the tabulated t-value for the same degree of freedom. The "r" value is significant (Table-3).

The relationship between fecundity (F) and gonadal weight (GW) is also represented in Table 1 and the mean value of Gonadal weight was  $119.84 \pm 49.34$ g. The regression equation computed as,  $F = 459970.1871 + 6503.6437GW$ ,  $r = 0.7922$ . The calculated t-value is 5.5075 at 5% level of significant for 18 degrees of freedom, which is larger than the tabulated t-value for the same degree of freedom. The "r" value is highly significant (Table-3). All the relationships showed that the values of co-efficient of correlations (r) were significant.

### Discussion

The variation of fecundity is very common in fish (Doha & Hye 1970) and the number of eggs produced by an individual female is dependent on various factors like size, age, condition and type of species of the sample (Lagler *et al*, 1967). Mookerjee & Mazumder (1946) have concluded from the breeding experiments that the reproductive capacity of the species varies according to availability of space and food etc.

The largest specimen (total length 557 mm and body weight 1300g) was found to carry 11,19,980 eggs and the smallest sized fish (total length 350mm and body weight 600g) was found to carry 6,20,000 eggs. But variation was found in the fecundity of fish of equal length. A fish measuring 441mm in total length, 1018g in body weight and 79.78g in gonadal weight produced 9,24,436 eggs, whereas another fish of the same total length produced 9,48,840 eggs. This type of variation was also found in the fish with total length of 540mm (Table-1). The same type of variation was also reported by Hamilton (1822) and Hora (1938) in the same species. From the statistical analysis it was revealed that the relationship between fecundity and TL, TW, GL and GW were found significant at 5% level ( $p < 0.05$ ). It was revealed from the significant 't' values that the fecundity increases linearly with the increase of total length, total weight and gonadal weight (Table-1). The values of correlation co-efficient between fecundity and other parameters show that variation in fecundity

can be explained very clearly in terms of body weight of a fish.

The significant linear relationships between fecundity and TL, TW and GW were also reported earlier by Doha & Hye (1970) from the same fish, and that the other fish by Kader & Talukder (1978) and Alam *et al*, (1997).

Average diameter of ova in the present study was found to vary from 0.68 to 0.87 mm. Similar results were stated by Jones & Menon (1951), they reported ova diameter from 0.70 to 0.75 and 0.89 mm

respectively for the same species. Gonado Somatic Index (GSI) value was found to vary from 2.69 to 16.08.

This research work indicated that the fecundity of *Hilsa ilisha* from Padma River near Godagari in Rajshahi was significantly correlated with the TL, TW and GW and TW was the best indicator of fecundity of *Hilsa ilisha* and the fecundity was highly correlated with GW.

**Table 1:** Total length, total weight, gonadal length, gonadal weight, mean diameter of egg, gonado somatic index and estimated fecundity of 20 gravid females of *Hilsa ilisha*.

S.L. No.	Total length (TL) (mm)	Total weight (TW) (g)	Gonadal length (GL) (mm)	Gonadal weight (GW) (g)	Mean diameter of egg (mm)	Gonado Somatic Index (GSI)	No.of ova (Fecundity)
1	350	600	135	16.12	0.66	2.69	620000
2	370	650	140	38.44	0.69	5.91	558700
3	380	775	112	56.02	0.82	7.23	773850
4	396	800	120	99.15	0.65	12.39	838750
5	441	1018	155	79.78	0.74	7.84	924436
6	461	1078	175	124.99	0.78	11.59	1154210
7	488	1423	185	92.95	0.88	6.53	1332926
8	511	1775	177	121.19	0.86	6.83	1599405
9	540	1700	212	158.76	0.75	9.34	1806664
10	557	1300	235	208.88	0.85	16.08	1119980
11	420	1020	190	141.50	0.78	13.87	1358884
12	410	958	195	142.70	0.67	14.89	1362968
13	500	1500	225	176.21	0.72	11.75	1618822
14	470	1250	210	170.45	0.83	13.64	1620280
15	441	1100	160	82.96	0.69	7.54	948840
16	400	820	122	102.60	0.73	12.51	859700
17	430	1200	220	92.98	0.67	7.75	989020
18	470	1260	212	172.75	0.84	13.71	1622272
19	540	1710	215	160.25	0.77	9.37	1810500
20	530	1700	214	158.10	0.81	9.30	1867000
<b>Mean</b>	<b>455.25</b>	<b>1181.85</b>	<b>180.45</b>	<b>119.84</b>	<b>0.76</b>	<b>10.14</b>	<b>1239360.35</b>
<b>±SD</b>	<b>± 59.94</b>	<b>± 356.12</b>	<b>± 37.81</b>	<b>± 49.34</b>	<b>± 0.071</b>	<b>± 3.45</b>	<b>±405068.97</b>

**Table 2:** The Standard deviations (SD), regression co-efficients(b), intercepts(a), and correlation co-efficients(r) in the F/TL, F/TW, F/GL and F/GW relationships of *Hilsa ilisha*.

Relationship between		Values of SD of X	Values of SD of Y	Values of regression co-efficient (b)	Values of intercepts (a)	Values of correlation co-efficient (r)	Significant at 5% level
Ord. (Y)	Abs. (X)						
F	TL	± 455.25	±405068.97	5430.4968	- 1232873.311	0.8036	Highly significant
F	TW	± 356.12	±405068.97	1007.0050	49231.47589	0.8853	Highly significant
F	GL	± 37.81	±405068.97	8148.2788	-230996.5747	0.7606	Significant
F	GW	± 49.34	±405068.97	6503.6437	459970.1871	0.7922	Highly significant

**Table 3:** Test of significance ("t" test) between the fecundity and total length, total weight, gonadal length and gonadal weight of *H. ilisha*

Test between	Calculated value of "t"	Tabulated value of "t"	Degrees of freedom (df)	Level of significance	Remarks
Fecundity (F) and Total length (TL)	5.7284	1.734	18 (n-2)	5%	Highly significant
Fecundity (F) and Total weight (TW)	8.07708	1.734	18(n-2)	5%	Highly significant
Fecundity (F) and Gonadal length (GL)	4.9705	1.734	18(n-2)	5%	Significant
Fecundity (F) and Gonadal Weight (GW)	5.5075	1.734	18(n-2)	5%	Highly significant

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