Khulna University Studies **Volume 11 (1&2) and 12(1&2): ??-?? : December 2013**

LIFE SCIENCE

FECUNDITY, GONADO-SOMATIC INDEX (GSI), CONDITIONING FACTORS, FOOD AND FEEDING HABIT AND LENGTH- WEIGHT RELATIONSHIP OF GOLD SPOT MULLET, *Liza parsia*

Joyanta Bir*, Md. Rashedul Islam, Md. Saifuddin Shah, Shikder Saiful Islam and Wasim Sabbir

Fisheries and Marine Resource Technology Discipline, Khulna University, Khulna 9208, Bangladesh

KUS: 12/19-060612
Manuscript received: June 06, 2012 Accepted: February 20, 2013

Abstract: In order to estimate the fecundity, reproductive character and feeding habit of *Liza parsia*, 75 gravid females were collected from Pasur River and different shrimp farms of Khulna district. The equation for the total length-body weight and standard length-body weight relationship of the species were found to be BW = 9.769 x TL - 101.4 (R^2 = 0.883) and BW = 9.921 x SL - 77.19 (R^2 = 0.865) respectively. The condition factor ranged from 10.12-15.05 having mean value of 12.35±1.08. Fecundity of *Liza parsia* ranged from 56541 to 188860 and the mean fecundity was calculated as 122999±30035. Total weight of the gonad varied from 5.41 to 18.41 g where the left lobe of the ovary varied from 2.78 to 9.57 g and the right lobe varied from 2.63 to 9.25 g. The mean weight of the right lobe of the gonad was 5.942±1.409 g where the mean weight of the left lobe was 5.589±1.381 g and the mean weight of gonad was 11.532±2.773 g. The regression equation for fecundity with total length, standard length, body weight and gonad weight was estimated as F= -176359+16034.5 x TL (R^2=0.60), F= -132956+16059.9 x SL (R^2=0.57), F= -5595.3+1588.79 x TL (R^2=0.63), F= 9048.16+9881.27 x GW (R^2=0.83) respectively. The regression equation for total length, standard length and body weight with the gonad weight was estimated as GW= -19.154+1.64 x TL (R^2=0.74) and GW= -1.78+0.16 x BW (R^2=0.80) respectively. The GSI values obtained in the present study varied between 7.90 to 17.61 with mean value of 14.20±1.65. The stomach contents were algae, diatoms, desmids, plant materials, annelids, crustacean, bivalves, fishes, detritus and sand grains. Food items indicated that they are omnivorous in its feeding habits.

Keywords: *Liza parsia*, fecundity, gonado-somatic index, condition factor, food and feeding habit

Introduction

Fisheries sector contributes 4.92% of the gross domestic product (GDP), 23% of agricultural resources and 5.71% of foreign exchange earnings of Bangladesh (DoF, 2005). *Liza parsia* (Hamilton) locally known as "Parse" is one of the most popular and commercially important fish due to its high nutritive and market value. The fish *Liza parsia* (Ham.), belongs to the family Mugillidae commonly known as gold spot mullet is a catadromous fish and widely distributed in the coastal waters of tropical and sub-tropical regions extending from 42^0N to 42^0S (Talwar and Jhingran, 1991). It can tolerate wide ranges of environmental fluctuation and found in freshwater, brackish and marine water at a depth ranges 10 - 15 m (Riede, 2004). The popularity of this species in aquaculture is due to high quality of its flesh, its extreme tolerance of a wide range of

*Corresponding Author: <joy.fmrt@gmail.com>

DOI: https://doi.org/10.53808/KUS.2013.11and12.1219-L

temperature and salinity, which is important for culture in intertidal ponds (Nlewadim and Deekae, 1997). Fecundity, one of the most important biological aspects of fish, plays a significant role to evaluate the commercial potentialities of fish stock. The knowledge of the fecundity of fish is also essential for evaluating the commercial potentialities, life history study, practical culture and actual management of the fishery (Das, 1977; Doha and Hye, 1970). Fecundity of fishes varies from species to species, also within same species due to different factors such as size, age, gonad weight, ecological condition of the water body etc. (Saifullah *et al. 2004).*

The condition factor 'K' is to basically used to justify the condition of fish which is influenced by several factors including age of fish, sex, season, stage of maturation, fullness of gut, type of food consumed, amount of fat reserve and degree of muscular development. The condition factor of fish depends upon the availability and composition of food and the physico-chemical characteristics of water (Pathak, 1975; Saksena and Kulkarni, 1982).

The importance of studying of food and feeding habits of fishes lies in the fact that one can decide as to what programme should be taken up for the development of the water bodies to get more fish. According to David and Rajgopal (1974), there is a close relationship between the food ingested by the fishes and items of food available in the reservoir. In estuarine waters, grey mullet feed on detritus, diatoms, algae and microscopic invertebrates which they filter from mud and sand through their mouth and gills (McDonough and Werner, 2003).

Gonadosomatic index (GSI) is an indicator of gonadal development and maturity. GSI is calculated to know the maturity and exact time of spawning which is essential for providing better understanding of spawning.

Length-weight relationship and conditioning factor of fish is very important for the fish culture and management and also to be ascertaining the environmental suitability of a specific fish (Karim *et al*., 1988). Knowledge of Length -weight relationship is essential to establish growth equation in production computation (Rao, *et al*. 1987). It also provides data about seasonal variations multiple spawning, degrees of mortality, robustness and variation of food consumption (Rounsefell and Everhart, 1953)

Several studies have been carried out on mullet biology with brief accounts on fecundity, GSI, reproductive characteristics and spawning (Cherif *et al*., 2007). But so far, very few works have been done on the fecundity and GSI of *L. parsia* because of which it is difficult to assess reproductive potential and induced breeding of *L. parsia*. In view of this fact the present study was undertaken to determine fecundity, food and feeding habit, gonadosomatic index, conditioning factor and length weight relationship of gold spot mullet *Liza parsia*.

Materials and methods

A total of 75 male and female *Liza parsia* were examined to determine the gonadosomatic index, fecundity and Length- Weight relationship. To analyses feeding habit to match contents of specimens thirty of *L. parsia* were analyzed in microbiology laboratory. The total length (TL), standard length (SL) and body weight (BW) of the specimens were measured in centimeter (cm). Body weight was recorded by electric balance (OHAUS, 0.0001g-210g) of 0.001 gram (gm) denomination. Eye observation and common morphological symptoms like swollen abdomen and protruded anus was used for identifying the maturity stages. For feeding habit analysis live fish was collected from the Pashur River and shrimp farms.

The weight of ovaries was taken by electronic balance. Weights of both left and right lobes of ovaries ware taken in the same way. Then sample weight was taken from all parts of ovaries from each lobe. Finally the number of eggs was directly counted with a fine needle.

Fecundity estimation: Gravimetric method was used to determine the fecundity. Fecundity was estimated by using the following formula:

$$F = \frac{\text{N x Gonad weight (g)}}{\text{Sample gonad weight (g)}}$$

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

Gonadosomatic index: Gonadosomatic Index was calculated by the formula used by Parameswarn *et al.* (1974) as follows

$$GSI = \frac{W1\ (g)}{W2\ (g)} \times 100$$

Where, W_1= Wet weight of gonad and W_2= Total Wet weight of gonad

Conditioning factor: Conditioning factor (K) was calculated by using the following formula (King, 1997):

$$K = \frac{Wx10^3}{L^3}$$

Where, W= weight in g, L= length in cm and, K = conditioning factor, 10^3= the factors bringing the potential index

Food and feeding habit: Fishes under study were dissected and the stomachs were carefully cut from the rest of the digestive tract. The condition of feed was assessed by the degree of distension of the stomach and expressed as gorged, full, 3/4 full, 1/2 full, 1/4 full, tress and empty. This is known as index of fullness. The volume of stomach content estimated by observation was recorded on absolute scale. The largest volume found in the preliminary study was allocated 100 points, and each of the stomachs as examined was then rated in one of the following categories 0, 3, 6, 12, 25, 50 and 100 points, according to the volume of food present. The stomach contents were emptied into a Petri dish and examined under a binocular microscope with the help of Sedgewick Rafter Counting Cell Slide. Occurrence method was used for the qualitative analysis of food contents.

Length- weight relationship: Then length- weight relationship was calculated by using LeCren's (1951) formula, as follows:

$$W = aL^b$$

Where W= weight in g, L= length in cm, a= intercept and b= exponent

The exponential form of relationship in the formula was expressed in the logarithmic form

$$LogW = Loga + bLogL$$

In order to derive the arithmetic relationship between fecundity-total length, fecundity-standard length, fecundity-body weight and fecundity-gonad weight, the values of regression co-efficient was estimated by the least square method (Le Cren, l95l) and the co-efficient of correlation was also calculated.

Results

Length-weight relationship: The relationship between body weight and total length, and body weight and standard length gave the following equation:

BW = 9.769 x TL - 101.4 (R^2 = 0.883), BW = 179.0 x lnTL - 442.7 (R^2 = 0.885)

BW = 9.921 x SL - 77.19 (R^2 = 0.865), BW = 154.2 x lnSL - 345.6 (R^2 = 0.866)

All the relationships were found to be linear and positive (Fig. 1, 2, 3 and 4).

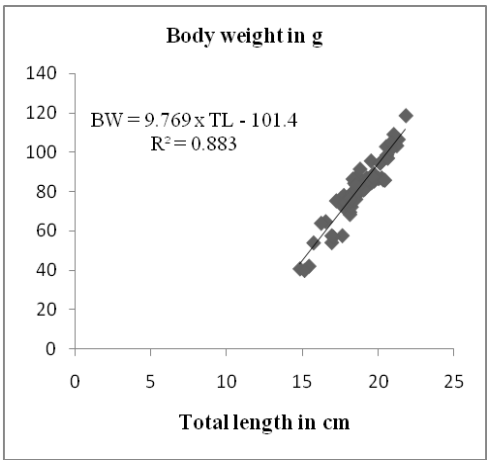

Fig. 1 : Relationship between total length (TL) and body weight (BW) of *L. parsia*

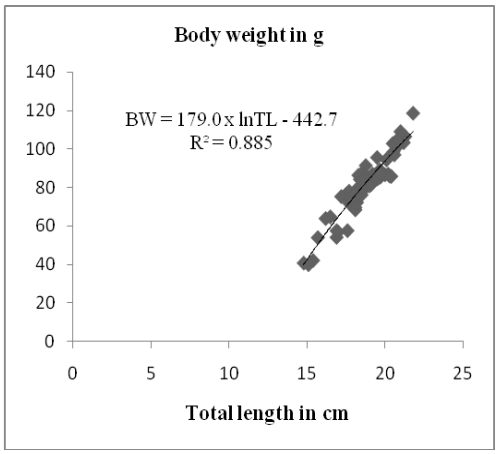

Fig.2: Relationship between log total length (LogTL) and logbody weight (LogBW) of *Liza parsia*

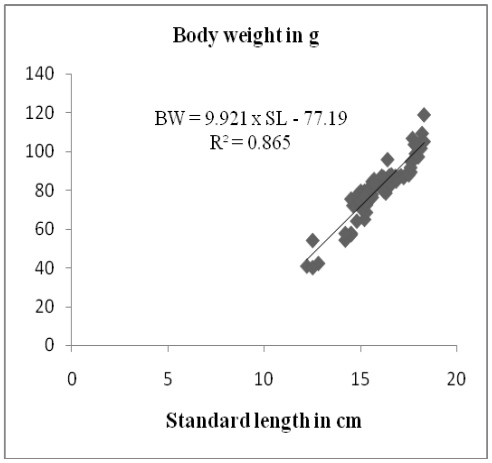

Fig. 3: Relationship between Standard length and Body weight of *Liza Parsia*

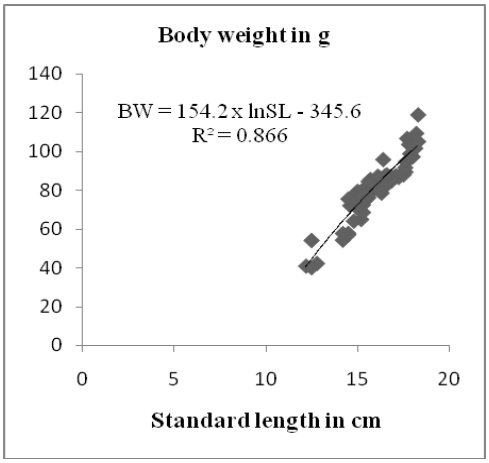

Fig. 4: Relationship between log Standard length (Log SL) and log body weight (Log BW) of *Liza parsia*

Description of the ovary: The total weight of the gonad varied from 5.41 to 18.82 g where the left lobe of the ovary varied from 2.63 to 9.25 g and the right lobe varied from 2.78 to 9.57 g. The mean total weight of the gonad was 11.532±2.77 g where the mean weight of the left lobe was 5.589±1.381 g and the right lobe was 5.942±1.409 g.

Estimation of fecundity: The fecundity of *Liza parsia* varied from 56,541 to 188,860 and the mean fecundity was calculated as 122999.80±30035.048. Fecundity varied depending on weight and length. In this study minimum fecundity was found in fish having total length of 18.1 cm, body weight 68.5 g and gonad weight 5.41 g while the maximum fecundity was found in a fish

having total length of 20.8 cm, body weight 104.54 g and gonad weight 18.41 g. Fecundity of *Liza parsia* according to different length and weight classes is presented in Fig. 5 and Fig. 6.

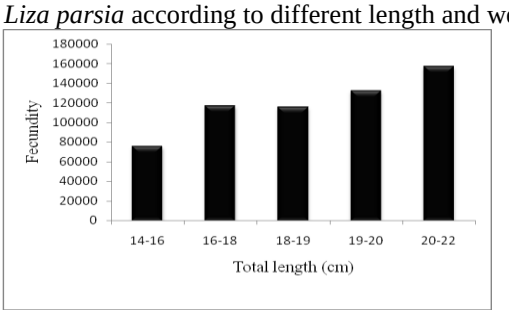

Figure 5: Fecundity of *Liza parsia* according to different length

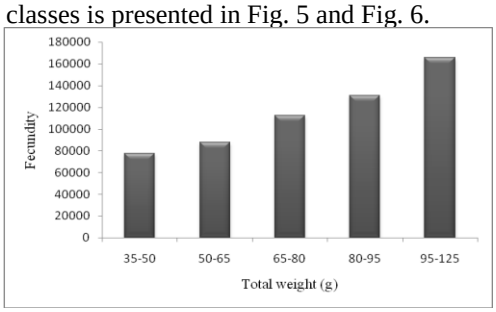

Fig. 6: Fecundity of *Liza parsia* according to different Weight

Relationship between standard length and fecundity: Linear and positive regression line was obtained between fecundity and standard length and the established equations were, F= -132956+16059.9 x SL (R^2=0.57)

And LogF= -5.75 + 5.39 x LogSL (R^2=0.56).

Relationship between body weight and fecundity: The relationship between fecundity and body weight was found linear and positive and the established equations were F= -5595.3 + 1588.79 x BW (R^2= 0.63) and LogF= - 5.55 + 5.04 x Log BW (R^2= 0.58)

Relationship between total gonad weight and fecundity: There was a linear and positive regression line between fecundity and gonad weight of *Liza parsia* and the established equations were F= 9048.16+9881.27 x GW (R^2=0.83) and LogF= -5.14 + 5.03 x LogGW (R^2= 0.81)

Relationship between total length and total gonad weight: The relationship between gonad weight and total length was found linear and positive and the established equations were GW= -19.154 + 1.64 x TL (R^2= 0.74) and LogGW= -1.88 + 1.47 x Log TL (R^2= 0.72)

Relationship between standard length and gonad weight: Linear and positive regression line was obtained between gonad weight and standard length and the established equations were GW= -15.41 + 1.69 x SL (R^2= 0.74) and LogGW= -1.78 + 1.41 x Log SL (R^2= 0.72)

Relationship between body weight and gonad weight: The relationship between gonad weight and body weight was foundto be linear and positive and the established equations were GW= -1.78 + 0.16 x BW (R^2= 0.80) and LogGW= -1.58 + 1.05 x Log BW (R^2= 0.79)

Condition factor

The condition factor obtained in the present study ranged from 10.12-15.05. The mean value of the condition factor was 12.35±1.08.

Relationship between condition factor and fecundity: There was not any significant relationship found between fecundity and condition factor *of Liza parsia* and the established equation were F = -7828.1 x CF + 21972 (R^2 = 0.079) and LogF= 5.56 – 4.99 x LogCF (R^2= 0.079).

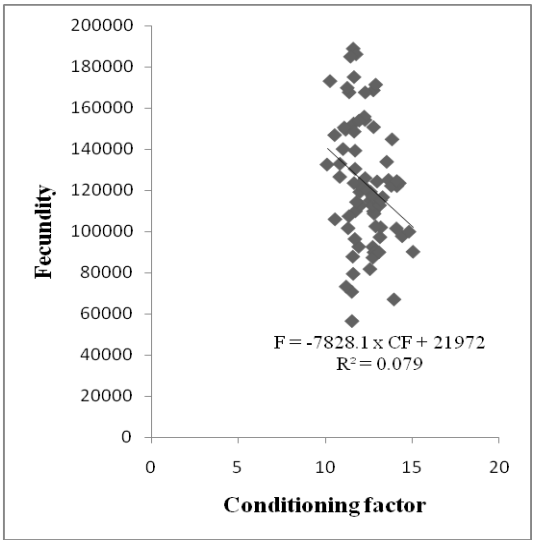

Fig. 7: Relationship between condition factor and fecundity *Liza parsia*

Gonadosomatic index: The GSI values obtained in the present study varied between 7.90 (for a female fish with a total length of 18.1 cm body weight 68.5 g and gonadweigh 5.41 g) to 17.61 (for a female fish with a total lengthof 20.8 cm, body weight 104.54 g and gonad weight 18.41 g. The mean value of the GSI was 14.2045 with a standard deviation of 1.65155.

Food and feeding habit

Food items in the stomach of Liza parsia: There are different types of food items found in the stomach of the species. The stomach contents are presented in Table 1.

Table 1: Different food Items found in the stomach of *Liza parsia*

Food category	Species
Algae	*Spirogyra sp.,Nostoc, Anabaen, Cosmarium sp., Thalassionema sp., Spirulina sp., Protococcus sp., Oscillatoria sp., Lyngbya sp., Enteromorpha sp., Polysiphonia sp., Cladophora sp., Chaetophora sp*
Diatoms	*Cyclotella sp., Fragillaria sp., Nitzschia sp., Synedra sp., Gyrosigma sp., Navicula sp., Epithemia sp.*
Crustacean	*Cyclops sp., Daphnia sp., Cypris sp., Eucypris sp., Paracyclops sp., Diaptomus sp.* *Moyna sp.,* Shrimp parts and prawn larvae
Desmids	*Closterium sp.*
Bivalves	*Iphigenia sp.*
Zooplankton	*Rotifer,* Copepods, copepods larval valves, Cladoceran, Moults of polychaete worms, Nauplius and zoea larvae and *mysids,* Microscopic organisms, *Polychaete* moults,
Other food items	Plant materials, Annelids, Nematode, Detritus, Sand grains, Pisces (fish bones, eyes, scales), Decayed organic matter

Discussion

In the present study it was observed that the values of the total length and standard length when plotted against the corresponding weight of fishes and the regression line drawn showed a linear relationship. The relationship indicated that weight of fish increases with the increase in total length and standard length. The values of the coefficient of correlation between total length-body weight (r^2= 0.88) and standard length-body weight (r^2=0.87) were also significant. The relationship between total length and body weight of the species in the present study agreed well with the results reported for *Catla catla* (Zafar *et al*., 2003) and for *Pampus argenteus* (Rahman *et al.,* 2004).

Fecundity may be varied with length, weight and other environmental factors. In this study fecundity of *Liza parsia* was found to vary from 56541 (total length of 18.1 cm, body weight 68.5 g and gonad weight 5.41 g) to 188,860 (total length of 20.8 cm, body weight 104.54 g and gonad weight l8.41g). The mean fecundity was calculated as 122999.80±30035.048. Rheman *et al*. (2002) observed the fecundity of *Liza parsia* varying between 19,343.33 to 301,700. Numerous factors like nutritional status (Scott, l961), time of sampling and maturity stage (Healy, l97l), environmental factors etc. have so far known to exhibit variation in fecundity both within and between fish populations.

In the present study the specimen having total length 20.8 cm, body weight 104.54 g was found to carry the highest number of eggs (188,860). However, variation was found in the fecundity of fish of equal length. A fish having total length of 18.2 cm, 86.1 g in body weight and 13.05 g in gonad weight produced 173,120 eggs whereas another three fish of the same total length and body weight of 69.67, 72.01 and 87.88 g and gonad weight 10.37, 10.86 and 13.27 g produced 109872, 124356 and 123546 eggs respectively. Even another two fish having total length of 20.8 cm and body weight of 105 and 101.51 g and gonad weight of 16.18 and 15.82g produced 175046 and 169816 eggs. Similar variation was also observed in the other length classes. This type of variation was also reported by other workers (Doha and Hye, 1970).

The regression line in both the arithmetic and logarithmic scales showed that the fecundity and body weight was linearly related. A marked increased in fecundity was observed with the increase in body weight. According to Bagenal (1967), the number of eggs was related more to weight of the fish than to length. The regression equation showed a positive body weight and fecundity relationship.

The condition factor is not constant and found to vary in an individual, species or a population having relationship between seasonal changes in the environment and with the changes of physiological conditions of the fishes (Doha and Dewan, 1967).

In the present study the condition factor ranged from 10.12 – 15.05. The scatter plot (Fig. 7) of fecundity and condition factor showed no significant relationship and the correlation coefficient r^2=0.079 also indicated that the relationship was very poor between condition factor and fecundity.

The GSI value indicates gonadal development and maturity of fish. It increases with the maturation of fish declining abruptly thereafter (Parameswam *et al.,* 1974). The GSI value indicates the spawning season of a fish species and the higher GSI value indicates the spawning period. The GSI value was found to vary from 7.90 (for a female fish with a total length of 18.1 cm, body weight 68.5 g and gonad weight 5.41 g) to 17.61 (for a female fish with a total length of 20.8 cm, body weight 104.54 g and gonad weight 18.41 g).

In this study it was found that the stomach contents were made up of ten major categories (Table 1). These were algae, diatoms, desmids, plant materials, annelids, crustacean, bivalves,

fishes, detritus and sand grains. Similar result was also observed by (Wells, 1984) for *Mugil cephalus.*

According to David and Rajgopal (1974), there is a close relationship between the food ingested by the fishes and items of food available in the reservoir.

Conclusion

Fish production in Bangladesh is increasing day by day because of extension of inland culture fisheries but the amount of capture from the natural water bodies is declining because of overharvesting and lack of proper biological knowledge of different fish stocks. *Liza parsia* is abundant in natural coastal water bodies and its culture is fully dependent on the natural fry source. So study of its detail biology was undertaken which will provide some basic information on the biology of this species. The major limitation of the present study was small sample size and data were collected for only three months so the differences in the GSI value during different months were not observed. Therefore, further year round study is needed. Some of the fish in the present investigation was not fully matured and the fecundity also varied within species of same length and same body weight.

Reference

Bagenal, T.B. 1967. A short review of fish fecundity. In: Gerking, S.D. ed. *The biological basis of freshwater fish production*. pp. 89-111.

Cherif, M.; Zarrad, R.; Gharbi, H.; Missaui, H. and Jarboui, O. 2007. Some biological Parameters of Red Mullet *Mullus barbatus* L. from the gulf of Tunis. *Acta Adriat*. 48(2):131-144.

Das, H.P. 1977. The fecundity of grey mullet, *Mugil cephalus* L. along the Goya coast. *Mahasagor Bulletin National Institute of oceanography*, 10: 79-82

David, A. and Rajgopal, K.V. 1974. Food and feeding relationships of some commercial fishes of the Tungabhadra Reservoir. *Proc. Ind. Natl. Sci. Acad*., 41B: 61-74.

DoF (Department of Fisheries), 2005. Fisheries Resources of Bangradesh and its Prospects. pp. 133-135.

Doha, S. and Dewan, S. 1967. Studies on the Biology of Tilapia (*Oreochromis mossambicus* Peters). III. Length-weight relationship and condition factor. *Pakistan Journal of Biological Sciences*, 19: 14-23.

Doha, S. and Hye, M.A. l970. Fecundify of Padma River Hilsa (*Hilsa ilisha*). *Pakistan Journal of Biological Sciences*, 22: 176-184.

Healy, M.C. 1971. Gonad Development and Fecundity of the Sand Goby, *Gobius minutes*. *Transactions of the American Fisheries society*, 100: 520-526.

Karim, K.A.T.A.; Dewan, S. and Hussain, M.G. 1988. Length-weight relationship, Condition Factor of *Puntius gonionatus* (Bleeker). *Bangladesh Journal of Aquaculture*, 10(2): 49-54.

King, M., 1997. Fisheries Biology, Assessment and Management.3rd edition. Fishing News Books Blackwell Science Ltd., London, p. 111.

Le Cren, E.D. 1951. The length-weight relationship and seasonal cycle in gonad weight and condition in perch (*Perca fluviatilis). Journal of animal ecology*, 20(2): 201-210.

McDonough, C.J. and Wenner, CA. 2003. Growth, recruitment and abundance of juvenile *Mugil cephalus* in South Carolina estuaries. *Fish. Bull.* 101: 343-357.

Nlewadim, A.A. and Deekae, S.N. 1997. Collection of juvenile mullet species from brackish water tidal farm in Nigeria. *NAGA, The ICLARM Quartery, April-June*, 20: 19-20.

Parameswarn, S.; Selvaraj, C. and Radhakrisshnan, S. 1974. Observation on the biology of *Labeo gonius* (Hamilton*). Indian Journal of Fisheries,* 2l: 54-75.

Pathak, S.C. 1975. Length-weight relationship, condition factor and study of *Labeo calbasu* (Ham.) from Loni reservoir. *J. Inland Fish Soc . India* , 7: 58-64.

Rahman, M.S.; Rahman, M.A.; Rahman, M.R. and Kamal, D. 2004. Length-weight Relationship, Condition Factor and Harvesting Records of Silver pomfret (*Pampum argenteus*) in the southwestern Region of Bangladesh. *Pakistan Journal of Biological Sciences,* 7 (4): 452-456.

Rao, K.S.; Nagabhushanam, R. and Sarojini, R. 1987. Acute toxicity of some pesticides the marine mud crab *Scylla serrata*. *Environment and Ecology*, 5(1):l8-182.

Riede, K. 2004. Global register of migratory species - from global to regional scales. Final Report of the R&D-Projekt 808 05 081. Federal Agency for Nature Conservation, Bonn, Germany. 329 p.

Rounsefell, G.A. and Everhart, W.H. 1953. Observations on the maturity and spawning of Psettodes *erumei* (schneider) . *Indian Journal of Fisheries,* 9: 580-589.

Saifullah, A.S.M.; Rahman, M.S. and Khan, Y.S.A. 2004. Fecundity of *Hilsa ilisha* (Hamilton, 1822) from the Bay of Bengal. *Pakistan Journal of Biological Sciences*, 7(8): 1394-1398.

Saksena, D.N. and Kulkarni, N. 1982. Observations on the condition factor (K) in an Indian major carp, Catla catla (Ham.) from two reservoirs. *Environ. India,* 5: 1-4.

Scott, D.P. 1961. Effects of food quantity on the fecundity of rainbow trout, *Salmo gairdneri*. *Journal of Fisheries Research Board of Canada,* 19: 715-731.

Talwar, P.K. and Jhingran A.G. 1991. Inland Fishes of India and Adjacent Countries. Vol 2.TYK Prokason, Dhaka, p. 561.

Wells, R.D.S. 1984. The food of the grey mullet, Mugil cephalus (L.) in Lake Waahi and the Waikato River at Huntly. *N. Z. J. Mar Freshwater Res*., 18: 13-19.

Zafar, M.; Mussaddeq, Y.; Akhter, S. and Sultan, A. 2003. Weight-length and condition Factor Relationship of Thaila *Catla catla* from Rawal Dam Islamabad, Pakistan. *Pakistan Journal of Biological Sciences,* 6(17): 1532-1534.