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Research Article

STUDY ON GROWTH, MORTALITY AND LENGTH-WEIGHT RELATIONSHIP OF BIG EYE SHAD *(Ilisha filigera)* CAPTURED FROM SOUTH-EAST COAST OF BANGLADESH

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ABSTRACT

Present study was conducted to investigate the growth parameters, length-weight relationship and different mortality rates of the population *Ilisha filigera*, the big eye shad from south-east coast of Bangladesh. From January 2013 to December 2014, a total of 852 individuals (both sex together) of fish specimens were collected and the respective analysis was done by using FAO-ICLARM stock assessment tools (FiSAT-II). The von Bertalanffy growth parameters, the asymptotic length $L\infty$ (cm) and the growth constant K ($year^{-1}$), were found to be 42.80 and 0.88, respectively. The growth performance index (Ø) was found to be 3.207. The total length and body weight (L-W) relationship was found as $W=0.116\ L^{2.205}$, indicating that the growth rate showed negative allometric pattern (b=2.205<3) with a coefficient of determination (r^2) value of 0.979. The annual fishing morality rate (F) was 1.04, whereas the natural mortality rate M (1.49) was comparatively higher than the fishing mortality. The obtained value of the exploitation rate (E=0.41) indicated that the said population was not in over-exploited condition.

Keywords: Growth; Mortality; Length-Weight relationship

INTRODUCTION

Ilisha filigera (Valenciennes, 1847), the big eye shad is commonly known as 'Chowkkha Ilish' in the coastal area of Bangladesh. It is a pelagic fish species belongs to family Clupeiformes and mostly found in clear water in the sandy and weedy grounds along the coast and also in lower estuaries (Mustafa, 1999). The distribution of the fish species found up to 100 m in depth from the coast line and found to tolerate a wide range of salinity (5-38 ppt). At the upper coast of the Bay of Bengal, it is caught by trawl nets, estuarine set bag nets (ESBN), marine set bag nets (MSBN) and beach seine nets. It is also found to appear from Indian coast to New Guinea and to the South China Sea (Rashid et al., 2007).

I. filigera, one of the most commercially important fish species of Bangladesh coast is of delicious taste and high market price. Besides these, it is classified as long lived species among the family Clupeiformes. To estimate the status of the demersal fishery resources of Bangladesh by trawl net survey during 1984-86 revealed that this species contributed to 0.44% of demersal fish catch (Khan et al., 2003).

To meet up the demand of the growing population of the country, fishing intensity is increasing very rapidly in the coast of Bangladesh rather considering the ideal situation of the stock and there is no recent research about the population dynamics of the species *I. filigera*. Therefore, the objectives of the present study was to estimate the growth parameters and mortality rates with the establishment of length-weight relationship of *I. filigera*, which will ultimately help to assess the stock status for sustainable management of this species in south-east coast of Bangladesh.

MATERIALS AND METHODS

Two major fish landing stations were selected for collecting samples; one is the Fishery Ghat (20°19′38.33′′N and 91°50′ 50.15′′E) at Chattogram and another is the BFDC Ghat (21°27′ 04.05′′N and 91°58′ 16.62′′E) at Cox's Bazar from south east coast of Bangladesh. Total number of specimens was 852; those were collected randomly from the landings on monthly basis started from January 2013 to December 2014 (consecutive twenty four months). Length and weight data were measured by metric scale nearest to centimeter (cm) and gram (g) respectively.

The relationship between body weight and length of the fish expressed as the equation given by Le Cren (1951) as:

$$W = aL^b$$

Length-Weight Relationship was established using the log-transformed equation as follows:

$$Log\ W = log\ a + b\ Log\ L$$

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Where W is body weight (g), L is total length (cm), a is the intercept and b is the slope of this linear equation (Froese, 2006). For ease of calculation and estimation of growth parameters and mortality of the *I. filigera* population, the length frequency data were grouped month wise in 3 (Three) cm class interval. Two years data were pooled into one year and data analysis were based on the Electronic Length Frequency Analysis (ELEFAN I and II) computer program that was incorporated in the FAO-ICLARM stock assessment tools (FiSAT; Gayalino et al., 1994).

The growth equation conventionally used in fisheries science, the von Bertalanffy growth equation whereas with the notation of Beverton and Holt (1956) this equation is expressed as:

$$L_t = L_\infty [1 - exp^{-k(t-t_0)}]$$

Where, L_t is the length at age t, L∞ is asymptotic length, k is the growth coefficient and t_0 is the theoretical age of fish at 0 (zero) length.

The growth performance index (Ǿ) for *I. filigera* population was calculated based on the equation given by Pauly and Munro (1984), is as follows:

$$Ø' = log\ K + 2\ log\ L_\infty$$

Here, k and L∞ were used from von Bertalanffy growth parameters.

The total mortality rate Z (instantaneous mortality) was estimated by length converted catch curve produced by the ELEFAN II routine (Pauly, 1983; Saeger and Gayanilo, 1986) and natural mortality rate (M) was estimated using the following empirical equation proposed by Pauly (1980) is as:

$$Log\ M = -0.0066 - 0.279\ log\ L\infty + 0.6543\ log\ K + 0.4634\ log\ T$$

Where, L∞ is the asymptotic length expressed in cm, T is the mean annual habitat temperature expressed in 0 °C, which is taken 28 °C. Annual fishing mortality was estimated by subtracting of M from Z. Estimation of exploitation rate E was calculated by the Gulland's (1971) equation of

$$E = F / Z = F / (F + M)$$

RESULT AND DISCUSSIONS

The von Bertalanffy growth parameters were estimated as L∞ = 42.80 cm and K = 0.88 year^{-1} using FiSAT program, when t_0 was set at 0 (zero). Among the other available estimates of growth parameters for *I. filigera* from Bay of Bengal, this study obtained the 2nd highest L∞ estimates so far noted (Table 1). However, Rashid et al. (2007) reported the highest L∞ (48.90 cm) estimates from the Bay of Bengal coast of Bangladesh. The estimate L∞ value of the present study is much closer to the value of L∞ (41.10 cm) reported by Khan et al., (2003). Moreover, Blaber et al. (1998) obtained the highest L∞ (83.43 cm) value from South China Sea.

The present study revealed that the growth constant K 0.88 year^{-1} value is very close to K (0.90 year^{-1}) value reported by Ashraful (1998) (Table 1). Rashid et al., (2007) also reported around similar high growth constant K (0.80 year^{-1}) value rather Khan et al., (2003) and Mustafa (1999) reported comparatively lower K (0.63 and 0.75 year^{-1} respectively) values. The growth performance index (Ǿ) was found to be 3.207.

The total length and body weight (L-W) relationship of the I. filigera was found as $W=0.116\ L^{2.205}$. It's indicating that the growth rate showed negative allometric growth pattern (b=2.205<3) with a coefficient of determination (r^2) value of 0.979.

In the present study, total mortality rate Z (2.53 year^{-1}) was obtained through length converted catch curve using FiSAT II program, whereas the natural mortality M was estimated 1.49 year^{-1}. Among the available studies on mortality of *I. filigera* the highest natural mortality M (1.63 year^{-1}) was estimated by Ashraful (1998) and highest total mortality Z (3.37 year^{-1}) was reported by Mustafa (1999). Only the estimation of the exploitation rate E (0.58) by Mustafa (1999) indicating the over-exploitation condition of the *I. filigera* stock of the Bay of Bengal, but all other estimation of E of the same stock is not at over-exploitation condition (Table 1).

CONCLUSION

This is the newest study on the growth parameters, estimation

Table 1: Comparison between current study and previous studies (Growth parameters, mortality rates and exploitation rate of *I. filigera*).

Authors	Study Period	Study Area	Asymptotic Length (cm) (L_∞)	Growth constant (year^{-1}) (K)	Mortality rate (year^{-1})			Exploitation rate (E)
					Natural (M)	Fishing (F)	Total (Z)	
Current study	2013-2014	Bay of Bengal	42.8	0.88	1.49	1.04	2.53	0.41
Rashid et al. (2007)	1999-2000	Bay of Bengal	48.9	0.8	1.35	0.91	2.26	0.4
Khan et al. (2003)	1984-1987	Bay of Bengal	41.1	0.63	1.21	0.71	1.92	0.37
Mustafa (1999)	1995-1997	Bay of Bengal	35	0.75	1.42	1.95	3.37	0.58
Ashraful (1998)	1996-1997	Bay of Bengal	32.5	0.9	1.63	1.25	2.88	0.44
Blaber et al. (1998)	1996-1997	South China Sea	83.43	0.0014 (per day)	-	-	-	-

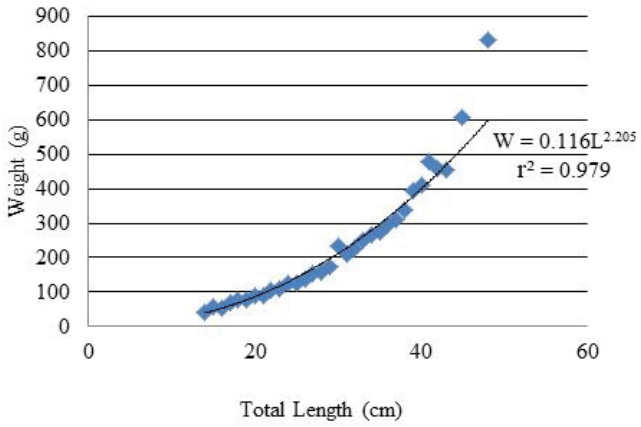

Figure 1: The total length (cm) and body weight (g) relationship of *I. filigera.*

of mortality rates and establishment of length-weight relationship of *I. filigera* about 15 years later from last study. This study revealed that, said population is not under proper harvesting schedule from its habitat, because the exploitation level is below the optimum fishing pressure. So, this information will ultimately help to assess the stock of *I. filigera* for sustainable management of this species in south-east coast of the Bay of Bengal of Bangladesh. Moreover, the intense study is needed to assess, monitor and sustainable management of this commercially important fish stock of the Bay of Bengal coast.

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