

Length-Weight Relationships And Condition Factors Of Big Eye Hilsa, *Ilisha Megaloptera* From Estuarine Region Of Diamond Harbour, West Bengal

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ABSTRACT

This study describes the length-weight relationships, condition factors, Growth, mortality and exploitation level of Big Eye Hilsa, *Ilisha megaloptera* from estuarine region of Diamond Harbour, West Bengal. A total of 354 specimens were studied, which were captured mostly by stationary bag-net, (locally called *Beenjal*, *Behundijal*) Gill net, Trawl net. These are non-selective multispecies small mesh sized nets operated from June 2014 to March 2015. The exponent 'b' values for both the forms were not significantly different from hypothetical cube value 3 ($P < 0.05$; $t=1.062$ for TL) indicating the isometric growth. The monthly mean relative condition factor (Kn) was maximum in the month of November (Kn = 1.06626) and minimum in the month of February (Kn = 0.18520). The Kn values also express healthy condition showing good compatibility with the nature or environment.

Key words: *Ilisha megaloptera*, length-weight relationship, Condition factor, isometric growth.

1. Introduction

Fishery has important economic activities all over the world. Fisheries resources of India are diverse and vast providing a long range of opportunities for sustainable food production in general, and protein in particular, both through capture and farming sector.

Big eye hilsha is one of the commercially important food fishes in Hoogly Matla estuarine system and ranks first in abundance in the commercial catches. Due to advantage of mechanization of fishing crafts, the fishing activity of the West Bengal coast considerably increased in recent years. Consequently the area of exploitation of fishery has increased and presently big eye hilsha fishery is considered as a major fishery in west Bengal.

The length-weight relationship of fish is an important fishery management tool. The length-weight relationship gives an idea about the mathematical relationship between length and weight. The variation is influenced by fatness, feeding intensity or gonadal development of the fish (Le Cren, 1951). Length and weight measurements can give information on the stock composition, life span, mortality, growth and production (Orhan et al., 2009). The results obtained from this study will be useful to fisheries biologist.

Thus 'b' exponent describes the rate of change of weight with length. It is reported that the value of 'b' generally lies between 2.5 and 4.0, though the ideal value of 'b' is 3.0 (Hile, 1936). Any deviation from ideal value suggests the fish growth is allometric. The relative condition factor is the ratio between observed weight and calculated weight of the fish. The values of this factor depend on physiological features of fish namely maturity, spawning, environmental factors and food availability in a water body (Ujjania *et al.*, 2012). Condition factor also influences the reproductive cycle in fish (Welcome, 1979).

Studies on the length and weight of fishes also help easy estimation of fish population. Very little information is available about the current condition of length and weight relationship of

big eye hilsha in estuarine region of Diamond Harbour. In this context the present work has been taken to study the length-weight relationship, relative condition factor of the collected samples.

2. Materials and Methods

2.1 Collection of data

The length frequency data of unsexes fresh samples of *Ilisha megaloptera* were collected at regular intervals from Samples of *Ilisha megaloptera* were collected from Diamond harbour landing center, 24 Parganas, West Bengal, India from June 2014 to March 2015. These samples were procured from different areas such as Sagar Island, Nagendra Bazar, 8-Jetighat etc. These samples were collected from stationary bag-net, (locally called *Beenjal*, *Behundijal*) Gill net, Trawl net, which are non-selective multispecies small meshed nets. The samples were brought to laboratory in each month to study the length-weight relationship and relative condition factor. Total length and standard length were measured in market itself by using the centimeter scale. Total weight was measured with a monopan balance for individual fish in grams.

2.2 Length Weight Relationshi

This study was conducted based on a total 354 numbers of specimens of *Ilisha megaloptera* with size ranged from 15.0 cm to 51.5 cm during the period of investigation. This study was based on a total of 354 individuals of *Ilisha megaloptera*. The non linear equation in the form of $W = aL^b$ [Le Cren, 1951], which explains the length and weight relationship of fishes, was used in the present study. The equation in linear form is written as, $y = A + Bx$, where $y = \log W$ where $A = \log a$ and $x = \log L$. The isometric or allometric growth was tested by 't' test. Analysis of co-variance was employed to test whether the 'b' values of two equations significantly differed at 5 % level (Snedecor and Cochran, 1967). The 't' test was used (by dividing the differences between 'b' and '3' by standard error of 'b' to the whether the regression co- efficient significantly deviated from the expected cubic value (Snedecor and Cochran, 1967).

2.3 Relative Condition Factor (K_n)

The data used for length weight relationship were also utilized for calculating relative condition factor of the fishes. The relative condition factor is given by the formula,

$K_n = W_o / \widehat{W}$ Where, W_o = observed weight and \widehat{W} = calculated weight. Monthly

mean values of K_n were calculated and mean relative condition factor and variations of mean relative condition factor amongst length group were also calculated

2.4 Statistical Analysis

The exponent (b value) in the length- weight relationship was tested for significance following Fisher's t- test. The mean values of condition factor were analyzed following Analysis of Variance technique (ANOVA) for testing their significance. Correlation coefficient (r-value) between length and weight were also found out and tested for significance

3. Result And Discussion

3.1 Length weight relationship of *Ilisha megaloptera*

The length-weight relationships of *Ilisha megaloptera* based on 354 individuals ranging from the total length of 15.00 cm to 51.5 cm, and weighing from 28.5 g to 785 g were given in the Tables 1. The log transformation of linear regression of total length-weight relationship of *Ilisha megaloptera* and its corresponding exponential forms are represented in Fig 1 and Fig 2. The log transformation of linear regression and its corresponding exponential form of standard length-weight relationship of *Ilisha megaloptera* are depicted in Figs1 and 2. The total length - weight relationship of non-linear and linear forms were

$W = 0.031TL^{2.546}$ and $\ln W = -1.500 + 2.546 \ln TL$, with the correlation co-efficient (R^2) of 0.869 respectively. The analysis of co-variance between the 'b' values estimated for total length-weight and standard length-weight were in significant (Table 2). It was also revealed from the 't'-test that the exponent 'b' values for both the forms were not significantly different from hypothetical cube value 3 (Table 2) ($P < 0.05$; $t=1.062$ for TL).

The length-weight relationship is usefully in differentiating small taxonomic units, biology, growth and predicting the potential yield, which in turn helps in fishery management. The exponential forms of equation obtained for the total length-weight and the standard length-weight relationship of *Ilisha megaloptera* in the present study were found to

be $W = 0.031TL^{2.546}$ ($R^2=0.869$). The respective linear relationship could be expressed as $\ln W = - 1.500 + 2.546 \ln TL$. The exponent 'b' values for both the forms were significantly different from cube value 3 ($P<0.05$; $t = 1.062$ for TL) indicating the isometric growth pattern of *Ilisha megaloptera*. The 'b' value obtained for total length-weight and standard length weight did not differ significantly ($P<0.05$). Studied the length –weight relationship of Big eyed hilsa, which was $\log W = - 1.920 + \log L$.

The present findings are in accordance with the earlier reports of Mahmood et al., (2012), Daliri (2014) , have recorded the isometric growth pattern of *Ilisha melastoma* and *Ilisha megaloptera* with the b values 2.68 and 2.83, respectively from Pakistan and North eastern Persian Gulf in Persia. Amin et al., (2001) reported the 'b' value in *Tenulosa ilisha* 2.878 from the coastal region of Chittagang while Mohan and Jhahria (2001) reported the value as 2.967. Nath, A.K. (2013) has found the 'b' value in female and male *Tenulosa ilisha* of Hooghly estuary is found 2.8474 and 3.2278 respectively. Contrary to the above results Behera et. al., (2015), Krishnaya (1968), Bapat (1970) and Kurian (1992) who have also reported allometric growth pattern in *Harpodon nehereus* from the, Kakadw (b=3.4262), Bay of Bengal (b = 3.2657) water, Arabian Sea (3.4444 in female and 3.7169 in males) and north west coast (2.0279), respectively.

According to Mitra (2001) the 'b' values in different species of Diamond Harbour ranged from 2.9615 to 3.3686. In general, adult fishes follow an isometric growth (Beverton and Holt, 1957). The variation in 'b' values could be attributed to environmental factors, food availability and the physiological factors including sex and life stage (LeCren, 1951; Ricker, 1975).

3.2 Relative condition factor (Kn) of *Ilisha megaloptera*

The mean relative condition factor (Kn) of *Ilisha megaloptera* during different month is represented in Table 3 and Table 4. The mean Kn value of *Ilisha megaloptera* calculated

during June to March months was found to be 0.9542. The monthly fluctuation of the relative condition factor (Kn) showed the lowest condition (0.18520) in the month of February and the highest of condition (1.06626) in the month of November.

The Ponderal Index or condition factor (K) and the relative condition factor (Kn) are the measures to study the condition of fish during different stages of growth and different seasons. They indicate the physiological state and general well being of fish (Brown, 1957). The monthly fluctuation of the relative condition factor (Kn) showed the lowest condition (0.18520) in the month of February and the highest of condition (1.06626) in the month of November.

The Kn mean values exhibited an increased trend from June to July with a slight fall in August and reached the maximum fall in the month of February. Krishnayya (1968) recorded the lowest condition (1.7392 to 1.849) of *Harpodon nehereus* in the period between April and June. Further, he also noticed the Kn values of more than 2 from the month of October through March. However, Bapat (1970) reported an increased condition factor value of *Harpodon nehereus* in the month of April and low condition factor values during December to March.

Mahmood et al., (2012) has found relative condition factor (Kn) varied from 0.90 ± 0.08 to 1.03 ± 0.08 of *Ilisha melastoma* from Pakistan. Nath, A.K. (2013) has found the mean value of relative condition factor (Kn) is 1.0496801 and 1.010145 in female and male of *Tenualosa ilishaas*.

The high values of the Kn in different length groups indicated a general well being and adaptability of the fishes. The increased Kn values after May could also attributed be to the peak feeding periods for the species, as observed by Bapat (1951). Such relations of high Kn values during peak spawning periods and low Kn values after spawning periods has also been reported in other fishes like *Tenualosa ilisha* (Khan et al., 2001), *Osteobrama belangiri* (Singh, 2003) and *Puntius sophore* (Mitra et al., 2005). Generally the low Kn

values of *Harpodon nehereus* were observed in the length group of 9-15 cm (Krishnayya, 1968). Fluctuations in the Kn values are common in fishes due to differential feeding intensity, size of the fish and most importantly the sexual cycle (Le-cren, 1951; Thakur, 1975). The mean Kn values recorded in the present investigation indicated that the species exhibit healthy condition showing good compatibility with the environment.

4. References

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Table 1 Length weight relationship of *Ilisha megaloptera*

Length Type	No. Of individuals studied	Range of Length(cm)	Range of Weight(g)	Sex	Regression coefficient (b)	Exponential/Non-linear form of equation	Linear/Logarithmic equations	Correlation determination coefficient(R ²)
Total Length	354	15 – 51.5	28.5 - 785	Unsex	2.546	W = 0.031T.L. ^{2.546}	ln W = - 1.500+2.546 ln T.L.	0.869

Table 2 Statistical Analysis to test deviation from cube law

Length type	Degree of Freedom (n-2)	Regression Co-efficient	Deviation from regression(S ²)	Standard deviation (S _b ²)	Standard error (S _b)	t-test	Probability at 5% Level of significance
Total Length	352	2.546	3017.224	0.2016	0.449	1.062	Non-significance

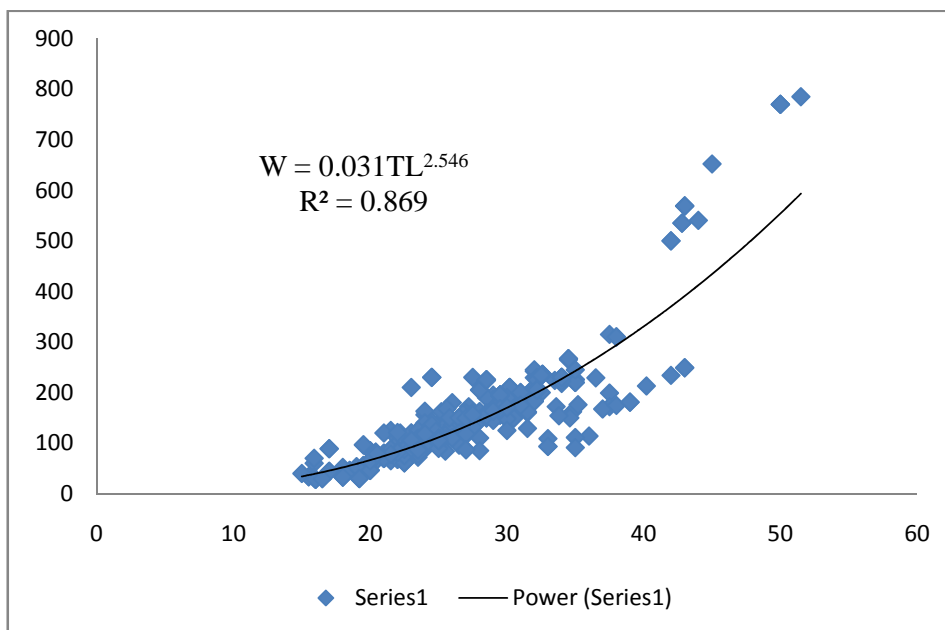


Fig1.Exponential (non-linear) form of Total Length- weight relationship of *Ilisha megaloptera*

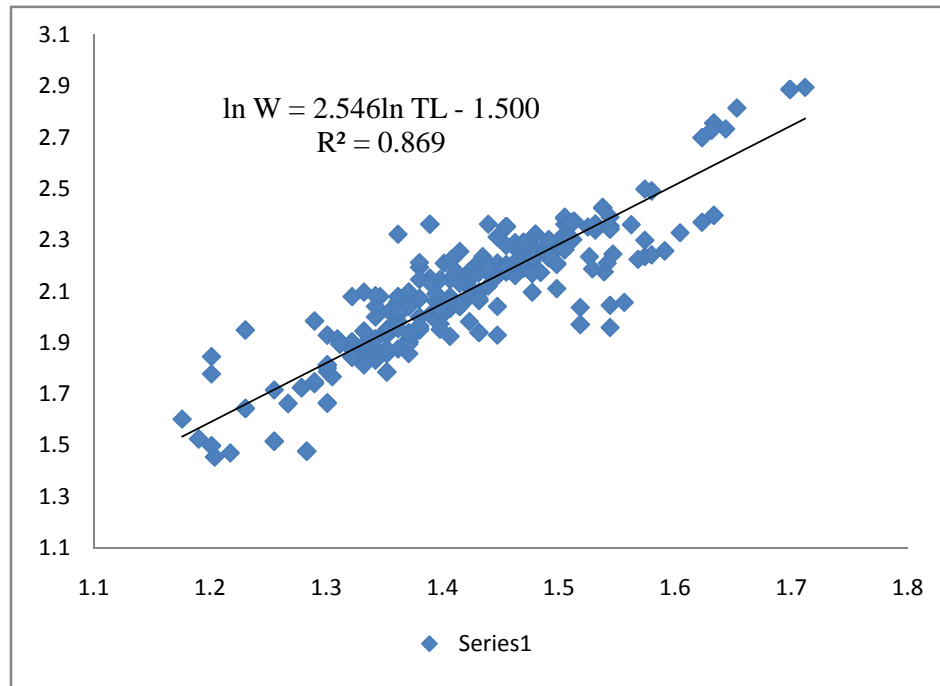


Fig2. Linear form of Total Length- weight relationship of *Ilisha megaloptera*

Table 3 The mean relative condition factor (Kn) of *Ilisha megaloptera* during different months

Sampling month	Mean relative condition factor(Kn)
June	1.03871
July	1.04454
August	1.01293
September	1.03944
October	1.02690
November	1.06626
December	1.02815
January	1.04563
February	0.18520
March	1.05429
Mean	0.954206

Table 4 The mean relative condition factor (Kn) of *Ilisha megaloptera* in different length group

Length group	Mean relative condition factor(Kn)
15-18	0.917595
18-21	1.041161
21-24	0.94287
24-27	1.024698
27-30	0.900549
30-33	0.886314
33-36	0.867492
36-39	1.040858
39-42	0.635086
42-45	0.953271
45-48	0
48-51	1.031077
51-54	0.891468