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Length - weight relationship and relative condition factor of gangetic hairfin anchovy *Setipinna phasa* (Hamilton, 1822) in Dhubri district of Assam, India

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ABSTRACT

The length-weight relationship and relative condition factor of the Gangetic Hairfin Anchovy, S. phasa (Ham.1822) collected from Panchughat of Dhubri district of Assam were studied by examination of 105 specimens during January to May, 2012. The correlation coefficient (r) shows highly correlation between length and weight of S. phasa (0.95 to 0.99). In different length groups, the 'n' value was ranged from 2.76 to 3.21 and it showed an isometric growth in the studied species. The highest condition factor (K) were recorded in S. phasa 1.096. The 'K' value reveals that the species were in good condition in their natural environment.

Keywords: Chelekona, Length-weight, Correlation, Dynamics etc.

INTRODUCTION

Setipinna phasa (Hamilton, 1822), is locally known as 'Chelekona' (meaning leaf-like due to its laterally compressed body) is an endemic clupeid fishery of river Brahmaputra of Assam. It is distributed in Assam, Bengal, Orissa and Burma[11].

Among Clupeiformes, *Setipinna phasa* (Ham.) is the most important food fish from commercial point of view. Herring fetches more economic returns to the fishermen community in Assam. Studies on length-weight relationship are of considerable importance in fishery because it shows relevance to fish population dynamics and pattern of growth on fish stocks. Growth is defined as the change in size with reference to time. Weight of a fish is expressed as a function of length. Knowledge of length-weight relationship is of paramount importance in fishery biology as it serves several practical purposes. The general length-weight relation equation provides a mathematical relationship between the two variables, length and weight, so that the unknown variable can be easily calculated from the known variable. This expression had been extensively used in the study of fish population dynamics for estimating the unknown weights from known lengths in yield assessment[19], in estimating the number of fish landed and in comparing the populations over space and time[4]. It also yields information on growth, gonadal development and general condition of fish[14]. Therefore, useful for comparison of body forms of different groups of fishes.

The length-weight relationship of cyprinids from India has been studied by many workers. Some of the recent studies in this aspects are that Jhingran[10], Choudhury *et al.*[5], Yousuf and Khurshid[24], Paswan *et al.*[18] and Abujam and Biswas[2]. There has been no specific information so far regarding the length-weight relationship and condition factor of *Setipinna phasa* (Ham.) in Assam and therefore, the present study was undertaken to establish the pattern of growth and general condition of this species from the natural waters for direct use in fishery assessment. Rampant killing of this small variety fishes throughout the year create a problem of population dwindling causing great economic loss in Assam. The study on length-weight relationship and condition factor of *Setipinna phasa* (Ham.) in Assam will definitely throw light upon the biology of the species at least in some aspects.

In the present context of study, it deals with such aim and objectives to assess the growth trend and condition factor of the particular locality. However, it should be noted that the present studies covers only the data of observation for a short period only.

MATERIALS AND METHODS

In the present study, the monthly observations are conducted during pre monsoon period

a) Sample Collection and Preservation:
The fresh samples of *Setipinna phasa* (Ham.) was obtained from the Panchughat of Dhubri district, Assam, which have been captured from the river Brahmaputra (Fig.-1). The samples were collected within the tenure of five months only (January to May, 2012). After collection, fish samples were preserved in 8% v/v aqueous formaldehyde solution and their total length and weight of each sample were measured and recorded with the help of measuring tap and digital pan balance.

b) Sample Study:
The total length (TL) and total weight (TW) of the fishes are noted to the nearest centimetre (cm) and gram (gm) respectively.

c) Length-Weight relationship and relative condition factor:
For the study of growth trend in *Setipinna phasa* (Ham.), specimens of variable size are taken. Then the length of each specimen collected is taken from the top of the snout to the longest lobe of the caudal fin in a scale. After that, weight of each specimen is taken by a sensitive digital pan balance and recorded in grams. Thus the length and weight of each specimen is noted.

To calculate the coefficient of correlation (r) between length (L) and weight (W), the following formula is used

$r = \sum lw \,/\, (\sqrt{\sum l^2 \sum w^2})$, where, l =L- ◌̄L

The standard error (SE) of r is estimated by SE of $r = \pm \frac{1-r^2}{\sqrt{N}}$, where, r = coefficient of correlation and N = No. of observation

To estimate the growth trend through the length-weight relationship, the following formula is used.

$\hat{W} = cL^n$ or, Logarithmically, LogW = log c + n log L, where, W = weight in gm.; L = length in cm. and c and n = two constant or exponent

Le Cren's Relative Condition Coefficient (Kn) with the equation $Kn = W/cL^2$, where, W = observed Log weight (gm). cL^n or $\hat{W}$ = expected Log weight in gm obtained by the formula

Log W ($\hat{W}$) = Log C + n Log L

Fulton's condition factor was not used because of its non-reliability and fluctuating results when applied to fishes of different size ranges. The condition factor states the condition of the water body, whether it is very suitable or not suitable for fish.

SYSTEMATIC NOTES

Gangetic Hairfin Anchovy : *Setipinna phasa* (Hamilton, 1822)

Systematic Position :
Phylum : Chordata
Class : Actinopterygii (Ray-finned fish)
Order : Clupeiformes (Herrings)
Family : Engraulidae (Anchovies)
Genus : *Setipinna*
Species : *S. phasa* (Ham. 1822)
Local Name : Chelekona
English Name : Gangetic Hairfin Anchovy
India : Phasa, Bindi, Phasa, Phasia and Tamparia[22]

Distribution : Ganges river system (India and Bangladesh) and Orissa[22]
Conservation Status : Non threatened in India[9]
Fin Formula :
Di 14-15; A iii 66-78; P i 14; V i 6 [22]

Colour : Greenish along the back, silvery below, Dorsal and Caudal yellow. Upper margin of dorsal black. Pectoral fin hyaline but bluish black in adult excepting the elongated ray which is colourless.

Maximum length : 28cm standard length [22]
Economic Importance : Used as food fish in Assam.
IUCN Red List Status : Least Concern (LC)
Threat to Humans : Harmless
Human Uses in Fisheries : Minor commercial

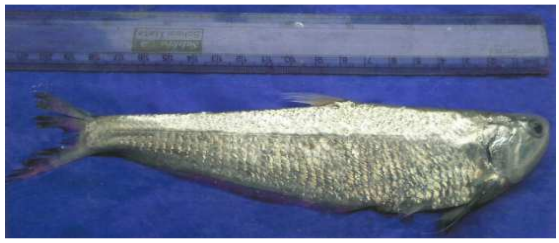

Fig. 1 : Lateral view of *S. phasa*

RESULTS

A. GROWTH - DYNAMICS

1.1 Length-Weight relationship

To study the length-weight relationship of *S. phasa* (Ham.), total length (TL) and body weight (BW) measurement of all the collected specimens were done month wise from January to May, 2012. The collected specimen had their total length from 8.7 cm to 24.9 cm and individual body weight from 2.0 gm. to 70.0 gm.

The correlation of length-weight relationship month wise (January to May, 2012) has been depicted in Table 2.

The length-weight relationship were calculated separately month wise (January to May, 2012) of *Setipinna phasa* (Ham.). The observation showed highly significant co-efficient correlation 'r' that ranged from 0.95 to 0.99.(Table 2)

The value of exponent 'n' varied from 2.76 to 3.21; the minimum value was observed in February, 2012 while the maximum value of the exponent was recorded in April,2012. The length-weight data of *Setipinna phasa* (Ham.) (from January to May, 2012) resembled parabolic when plotted on graph (Figure 2-6).

Month	Range	Average
January, 2012	0.854 to 1.252	1.096
February, 2012	0.706 to 1.070	0.848
March, 2012	0.882 to 1.175	1.011
April, 2012	0.870 to 1.151	0.998
May, 2012	0.995 to 1.223	1.020

Table 1: Range value and average of 'Kn' in *S. phasa*

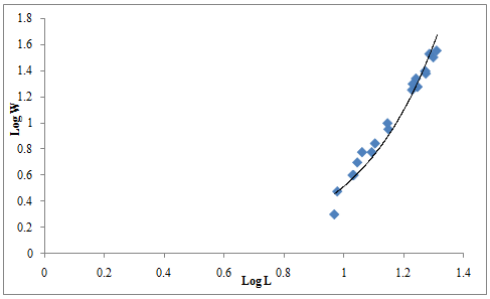

Fig-2 : L-W relationship of *S. phasa* (Jan.2012)

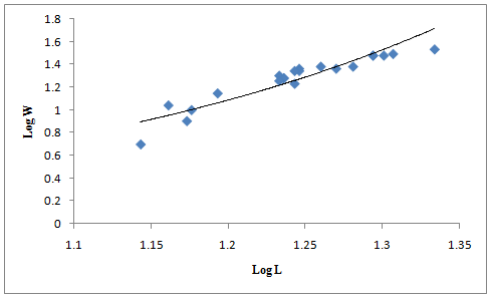

Fig-3 : L-W relationship of *S. phasa* (Feb.2012)

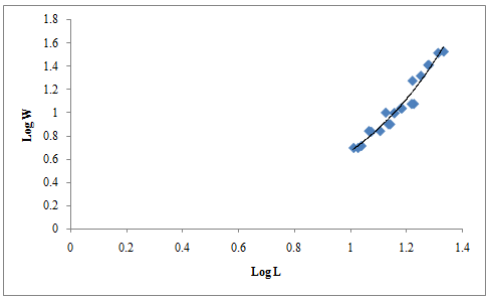

Fig-4 : L-W relationship of *S. phasa* (March,2012)

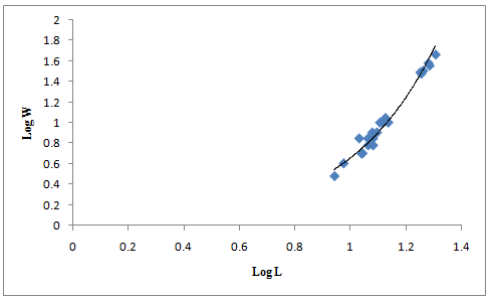

Fig-5 : L-W relationship of *S. phasa* (April,2012)

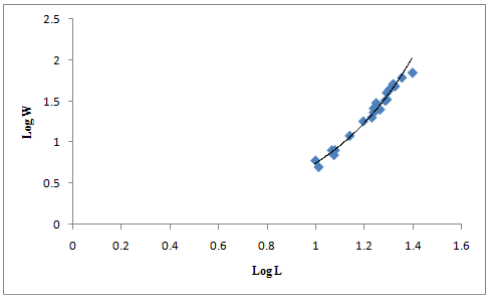

Fig-6 : L-W relationship of *S. phasa* (May,2012)

1.2 Relative Condition Factor (Kn) :

The relative condition factor (Kn) of *Setipinna phasa* (Ham.) has been studied to elucidate its well being. The relative condition factor or 'Kn' value exhibited variations in different length groups of *S. phasa* collected month wise (January to May, 2012).

The month wise values of relative condition factor of *S. phasa* (Ham.) and the range value and average of 'Kn' is represented in Table 1.

DISCUSSION

Studies on various aspects of fishery biology are not only of academic interest but also provide valuable information necessary for the development of pisciculture management and increasing the technological efficiencies of the fishing entrepreneurs. The present study reveals the results of observations on general biology of *Setipinna phasa* (Ham.) from Brahmaputra riverine system of Dhubri district of Assam. Studies on various aspects like length-weight relationship and condition factor have been analysed in this investigation.

Length-Weight relationship :

Length and weight of the fish are interrelated and measurements of these parameters in different size groups are very useful tools to assess the general well being of various species[14]. Present analysis of length-weight relationship between length and weight primarily show that one may be converted into other. Such a relationship also enables comparison of fish population in time and space[17].

The length-weight relationship in fishes is the basis for calculation of unknown weight from known length or unknown lengths from known weights. Since, the fish passes through several stages, the simple cube law[14] does not hold throughout the life span and equilibrium constant shows certain variability around them. Although, the general principle is that the weight increases as the cube of length[13,21].

Table 2 : Length-Weight relationship in *S. phasa*

Month	Regression Equation	Correlation coefficient (r)	Regression coefficient (c)
January, 2012	LogW = -2.65+3.10LogL	0.99	-2.65
February, 2012	LogW = -2.16+2.76LogL	0.95	-2.16
March, 2012	LogW = -2.33+2.90LogL	0.96	-2.33
April, 2012	LogW = -2.57+3.21LogL	0.99	-2.57
May, 2012	LogW = -2.45+3.10LogL	0.99	-2.45

In this investigation, length-weight relationship of *Setipinna phasa* are computed separately month wise from January-May, 2012. The values of correlation coefficient (r) ranged from 0.95 to 0.99 and all these values exhibited a degree of positive correlation between length and weight (highly significant at 1% level).

The values of 'n' in the equation $W = cL^n$ [14] generally is nearer 3 [1] or between 2.5 and 4.0 [8,15]. In the present investigation, the value of 'n' is found to be 3.10, 2.76, 2.90, 3.21 and 3.10 in January to May respectively which indicates an isometric growth and the results are conformity with the earlier workers. The length-weight relationship in fishes can be affected by several factors including habitat, area, seasonal effect, degree of stomach fullness, gonad maturity, sex, health, preservation techniques and differences in the observed length ranges of the specimen caught[23], all of which were not accounted in the present study. The regression co-efficient for isometric growth is '3' and values greater or less than '3' indicate allometric growth[7].

Condition Factor

The Relative condition factor 'Kn' gives an indication of fitness, general well being or gonad development and suitability of environments. Choudhury *et al*.[5] have studied that the value of relative condition factor 'Kn' becomes high due to the presence of mature gonad and low due to the spawning. It also indicated the general well being of the juveniles and proved their better condition as reported by many workers[16,12]. The factor which influenced the K-factor of the fishes were environental factor, food availability as has been reported by Le Cren[14], Jhingran[10], Kaur and Nasar[12] and Dasgupta[6].

In all the five groups of *Setipinna phasa*, Le Cren's relative condition factor is almost uniform Kn = 1.096 (Jan, 2012); 0.848 (Feb, 2012); 1.011 (March, 2012); 0.998 (April, 2012) and 1.020 (May, 2012). Therefore, the well being of the fish in all the five groups are almost uniform with marginal variation in order 1.096>1.020>1.011>0.998>0.848.

Low value of relative condition factor has been attributed to poor feeding activity. These may be due to changes in environmental conditions with the change of season that resulted in the changes in the amount of food supply and maturity of gonads[14]. It can be concluded from the present study that the body proportions of the studied fish changed as fish grew in size. It should however be mentioned that environmental factors highly influence the growth performance of an organism. The 'K" value was above the ideal value and indicated that the species were in good conditions in their natural habitats. In addition, it may be inferred from the present study that the studied species is highly suitable for culture in captive environment.

CONCLUSION

This study provides basic information on the length-weight relationship and condition factor of riverine fish *S. phasa* which may be useful for a sustainable management of this fish in the running water environment. This study may contribute to this invaluable database.

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