Reproductive Biology, Length-Weight Relationship and Condition Factor of *Channa striata (Bloch, 1793)* from tributaries of Lake Kilobidan, Agusan Marsh, Philippines

Ferdinand A.Dumalagan*, Juarlito V. Garcines, Lilia Z. Boyles

Abstract*--Channa striata*, locally known as haruan or snakehead murrel, an eminent tropical freshwater fish widely used for food medicinal and pharmaceutical purposes. The fish samples with a total of 56 specimens were collected from the fisher folks of the study area in Agusan River of Bunawan, Agusan Del Sur. The fish were caught using gill nets. These fishermen use various fishing gears including hand nets, cast nets and gill nets of various standard mesh. Moreover, the total length of male ranges from 23.5-33.3 cm. while female ranges from 22.2- 40.7 cm that has mean of 28.868 cm. Futher more, the body weight of the male specimens ranges from 99.85-416.42 g. while female has weight that ranges from 93.5-485.58 g. The *Channa striata* length-weight relationship indicated Allometric growth. Moreover, the condition factor of male is 1.50 and 1.49 for female. On the other hand, there was no significant difference between the both sexes of *Channa striata* in terms of their condition factor. This implies that both sexes of the specimens were in poor condition. Four stages of gonadal development were obtained in fish sampled. Maturation specimens dominated the catch with the percentage of 45. On the other hand, immaturity of gonads as stage of the fish has the least percentage.

Keywords*-Channa stiata*, reproductive biology, condition factor, gonado-somatic index.

I. Introduction

A rational management of a fishery resource, requires an in-depth knowledge of its biology and ecology [5]. Knowledge of some quantitative aspects such as length-weight relationship is important in studying fish biology. Length-weight relationships can be used to predict weight from length measurements made in the yield assessment [8]. Fish can attain either isometric growth, negative allometric growth or positive allometric growth. Isometric growth is associated with no change of body shape as an organism grows. Negative allometric growth implies the fish becomes more slender as it increase in weight while positive allometric growth implies the fish becomes relatively stouter or deeper-bodied as it increases in length [10].

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Channa striata, locally known as haruan or snakehead murrel, an eminent tropical freshwater fish widely used for medicinal and pharmaceutical purposes (Mat Jais *et al.*, 1994; Michelle *et al.*, 2004), is also an important food source in the Asia-Pacific region (Froese and Pauly, 2008; Hossain *et al.*, 2008). This carnivorous air-breather species is encountered in rivers, swamps, ponds, canals, drains, reservoirs, rice fields, small streams, mining pools, roadside ditches and lakes, across southern Asia, southern China, Indochina and the Sunda Islands (Mohsin and Ambak, 1983; Lee and Ng, 1994; Hossain *et al.*, 2008).

Length-weight relationship (LWR) studies are important in determining the population status of fish species. The condition factor or 'fatness' (K) is worked out to assess the well-being of the fish species. It is the assumption of the growth in fish on ideal conditions maintains equal in length and weight. Fisheries and management and research require using of biometric relationship to transform the data collected in the field into acceptable and reliable indices. Condition factor of fish species can be affected by some factors of stressors, sex, season, availability of foods, and other water quality parameters.

The studies on length-weight relationship and condition factor of fish species are necessary and are applied or practically used in culturing, managing and improving or conserving local fishery.

In Agusan River, Bunawan, Agusan del Sur where tributaries of Lake Kilobidan found and there was no studies have been conducted on length-weight relationship and condition factor of *Channa striata* in the place. Infact, mostly of the *f*ish supplies of the place and of the nearby municipality were coming from these areas.

The importance of this study is to give valuable information about the recent condition of fishes in the area. This paper aimed to provide information on aspects of Biology of *Channa striata* which will aid in the culture of the species.

II. Procedure For Paper Submission

A. Study area

In Agusan River, Bunawan, Agusan del Sur where one of the tributaries of Lake Kilobidan of Agusan marsh land found. This small river was a good source of freshwater fishes for the locality and even for the nearby municipalities.

B. Fish Samples

The fish samples with a total of 56 specimens were collected from the fisher folks of the study area in, Bunawan,

Agusan Del Sur. The fish were caught using gill nets. These fishermen use various fishing gears including hand nets, cast nets and gill nets of various standard mesh sizes (20.2, 25.4, and 30.5mm).

C. Measurements

Total length (cm) of each fish was taken from the tip of the mouth to the extended tip of the caudal fin using a measuring ruler to the nearest 0.1 cm. Standard length (cm) for each fish was taken as measurement from the tip of the mouth to the caudal peduncle to the nearest 0.1 cm. The total body weight in grams was measured for each fish species to the nearest 0.01 g using a top loading Mettler balance. The specimens were cut open on the ventral side and the gonads were carefully removed and weighed on the top loading electric balance.Fish were mopped on a filter paper before they were weighed to remove excess water from their body in order to ensure accuracy (Anderson and Gutreuter, 1985). The length was measured as distance from the snout to the tip of the caudal fin.The sex of each specimen was recorded and the gonads were classified into gonadal stages of development according to Nikolsky (1963) (Table 1).

TABLE 1. STAGES OF GONAD DEVELOPMENT CLASSIFIED BY NIKOLSKY (1963)

Variables	Stages	Gonad development
Immaturity	I	Young individuals which have not yet engaged in reproduction. Gonads of very small size.
Resting Stage	II	Sexual products have not yet begun to develop. Gonads of very small eggs not distinguished to the naked eyes.
Maturation	III	Eggs distinguishable to the naked eyes. A very rapid increase in weight of the gonad in progress, testes changes from transparent to a pale rose colour.
Maturity	IV	Sexual product, ripe gonads have achieved their maximum weights but the sexual products are not still extruded when light preasure is applied.
Reproduction	V	Sexual products are extruded in responses to very light pressure on the belly. Weight of the gonads decreases rapidly from the start of spawning to its completion.
Spent	VI	The sexual products have been discharged, genital aperture is inflamed, gonads have appearance of a deflated sac and ovaries usually containing a few left over eggs and the testes contain residual sperm.

Length-weight relationship was estimated using the equation (Ricker, 1971):

$$W = a\,Lb$$

The values of constant '*a*' and '*b*' were estimated from the log transformed values of length and weight, that is, linear regression equation:

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

where a = intercept on y-axis; b = an exponent between 2 and 4 (Bagenal and Tesch, 1978); W = Weight in grams; L = length in cm.

The equation was log transformed to estimate the parameters 'a' and'b'. When b is equal to three (3), isometric pattern of growth occurs but when b is not equal to 3, allometric pattern of growth occurs, which may be positive if >3or negative if <3.

The condition factor which measures the state of well-being was determined using the formula by Tesch (1971):

$$K = 100W/Lb$$

Where K = Condition factor; W = Weight in g; L = Length in cm

This value (K) is used in assessing the health condition of fish of different sex and in different seasons. According to Wooton (2002), the fish in good condition will have high K-value greater than 3, than those in poor condition.

The Gonado-somatic index (GSI) was calculated as the percentage of the gonad weight over the body weight (Lagler, 1971):

$$\text{GSI} = \frac{\text{Gonad weight (g)}}{\text{Body weight (g)}} \times 100$$

According to Amtyaz et al (2013),that the GSI values higher than 1 mean that fish are fecund or capable of producing an abundance of offspring or new growth.

D. Data analysis

Data were analyzed using the statistical package (SPSS version15). Means were. Relationships between variables (weight vs. length,) were carried out using correlation and regression analyses. Values were significant at $p \leq 0.05$.

III. RESULTS AND DISCUSSION

Total length body weight and sex distribution of *Channa striata*

Table 1 depicts the total length and body weight and sex distribution of *Channa striata*. The results revealed that there were 21 males and 25 females specimens caught and examined. Moreover, the total length of male ranges from 23.5-33.1 with the mean of 27.39 cm. while female ranges from 22.2- 40.7 cm that has mean of 28.868 cm. Futher more, the body weight of the male specimens ranges from 99.9-416.4 g with the mean of 204.70 g. while female has weight that ranges from 93.5-485.6 g with a mean of 199.69 g.

TABLE 2. TOTAL LENGTH AND BODY WEIGHT AND SEX DISTRIBUTION OF *CHANNA STRIATA.*

Parameter	Sex	Number	Range	Mean
Total length (cm)	Male	21	23.5-33.1	27.39
	Female	25	22.2-40.7	28.87
Body weight (g)	Male	21	99.9-416.4	204.70
	Female	25	93.5-485.6	199.69

Length-weight relationship of *Channa striata*.

Table 2 presents the relationship of the length-weight of the specimens. The results revealed that the 'a' value for male and female *Channa striata* was -0.222 and -0.222 respectively, while the combined values for both sexes was -0.615. All of the three exponents of 'b' obtained for males and females and both sexes were less than 3. This means that the growth pattern was Allometric. The exponent 'b' values for male and female of the species were 1.70 and 1.70 respectively. Both of the sexes exhibited negative allometric growth pattern. The growth implies that the fish becomes more slender as it increases in weight.

The Length-Weight relationship equation for male and female *Channa striata* is expressed by the regression equation: Log W = - 0.222 + 1.70 Log L (R-Sq = 54.1%) and Log W = - 0.222 + 1.70 Log L (R-Sq = 54.1%), respectively.

The combined length weight relationship for both sexes is expressed by the regression equation: Log OW = - 0.615 + 1.98 Log OL (R-Sq = 38.1).

There was a correlation coefficient value in the length-weight for both sexes of *Channa striata*. The correlation coefficients were all positive and highly significant. The females weighed more than the males.

TABLE 3. TEST OF SIGNIFICANT RELATIONSHIP OF LENGTH-WEIGHT OF CHANNA STRIATA.

		BODY_WEIGHT	BODY_LENGHT
BODY_WEIGHT	Pearson Correlation	1	.441**
	Sig. (2-tailed)		.001
	N	56	56
BODY_LENGHT	Pearson Correlation	.441**	1
	Sig. (2-tailed)	.001	
	N	56	56

**. Correlation is significant at the 0.05 level (2-tailed).

TABLE 4A. REGRESSION ANALYSIS: LOG WEIGHT VERSUS LOG LENGTH OF FEMALE *CHANNA STRIATA*

Coefficient

Predictor	Coef	SE Coef	T	P
Constant	-0.2223	0.4761	-0.47	0.645
LL	1.7042	0.3273	5.21	0.000

S = 0.1299 R-Sq = 54.1% R-Sq(adj) = 52.1%

The regression equation or model can be translated into:

LW = - 0.222 + 1.70 LL

Or

Weight= -0.222 + 1.70 Lenght

TABLE 4B. REGRESSION ANALYSIS: LOG WEIGHT VERSUS LOG LENGTH OF MALE *CHANNA STRIATA*

Coeffficient

Predictor	Coef	SE Coef	T	P
Constant	-0.2223	0.4761	-0.47	0.645
LL	1.7042	0.3273	5.21	0.000

S = 0.1299 R-Sq = 54.1% R-Sq(adj) = 52.1%

The regression equation or model can be translated into:

LW = - 0.222 + 1.70 LL

Or

Weight= -0.222 + 1.70 Lenght

TABLE 4C. REGRESSION ANALYSIS: LOG OVER ALL WEIGHT VERSUS LOG OVER ALL LENGTH OF MALE AND FEMALE *CHANNA STRIATA*.

Coefficient

Predictor	Coef	SE Coef	T	P
Constant	-0.6147	0.4965	-1.24	0.221
LOL	1.9813	0.3437	5.76	0.000

S = 0.1554 R-Sq = 38.1% R-Sq(adj) = 36.9%

The regression equation or model can be translated into:

LOW = - 0.615 + 1.98 LOL

or

Overall Weight= -0.222 + 1.70 overall Lenght

Stage of gonadal development of *Channa striata.*

Four stages of gonadal development were obtained in fish sampled as shown in figure 1. Maturation specimens dominated the catch with the percentage of 45. On the other hand, immaturity of gonads as stage of the fish has the least percentage.

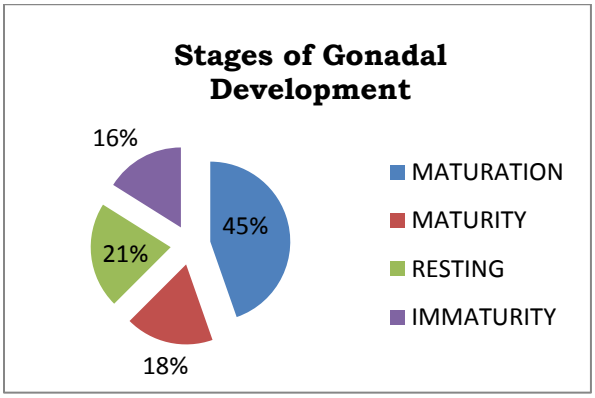

Fig. 1. The stage of gonadal development of *Channa striata*.

The gonado- somatic index of female and male of *Channa striata*.

The gonado-somatic index ranged in the females from 0.22 to 3.903 with a mean of 0.902. On the other hand, the gonado-somatic index of male ranges from 0.122 to 2.993 with a mean of 0.686. This implies that there were fishes that are fecund or capable of producing offspring those hwo has GSI of higher than 1.

According to Amtyaz et al (2013),that the GSI values higher than 1 mean that fish are fecund or capable of producing an abundance of offspring or new growth.

TABLE 5. THE GONADO- SOMATIC INDEX OF FEMALE AND MALE *CHANNA STRIATA*.

Sex	Number	Range	Mean
Male	**21**	**0.122-2.993**	**0.686**
Female	**25**	**0.22-3.903**	**0.902**

The condition factor for males and females of *Channa striata*.

Table 6 depicts the mean condition factor of males and females of *Channa striata*. The results revealed that the condition factor of male is 1.50 and 1.49 for female. On the other hand, there was no significant difference between the both sexes of *Channa striata* in terms of their condition factor. This implies that both sexes of the specimens were in poor condition. Condition factor of fish species can be affected by some factors of stressors, sex, season, availability of foods, and other water quality parameters.

TABLE 6. THE MEAN CONDITION FACTOR OF MALES AND FEMALES OF *CHANNA STRIATA*.

Sex	N	Condition factor (K)	P value
Male	**21**	**1.50**	**0.846**
Female	**25**	**1.49**	

IV. CONCLUSION

There was a correlation coefficient value in the length-weight for both sexes of *Channa striata*. The correlation coefficients were all positive and highly significant. The females weighed more than the males. Four stages of gonadal development were obtained in fish samples. Furthermore, there was no significant difference between the both sexes of *Channa striata* in terms of their condition factor. This implies that both sexes of the specimens were in poor condition.

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