BIOLOGICAL CHARACTERIZATION OF BIG EYE SCAD *SELAR CRUMENOPHTHALMUS* BLOCH (OSTEICHTHYES: CARANGIDAE)

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ABSTRACT

The small pelagic big eye scad (*Selar crumenophthalmus*) is a commercially valuable species in small-scale local fishery. A total of 120 samples *S. crumenophthalmus* were studied to determine its biological characteristics like length-length, length-weight relationship, and condition factor. Mean ± SD showed that females have the highest standard length (17.39± 0.81 cm), Fork length (18.27± 0.84 cm) and weight (115.82± 17.31g) than males. One Way -ANOVA revealed that there were significant difference between standard length, Fork length and weight $\alpha = 0.05$. The T-test correlation showed strong relationships between the length-length and length-weight. These results can be attributed to allometric growth, with females gaining weight at a much slower rate than males relative to increments in fork length. Biometric data allowed computation of Fulton condition factor, K=100*W/L3. K values indicated un-favourable condition of fishes which revealed no significant discrepancy between sexes. The increased in length is also the increase in corresponding weight. Sex variation can be attributed to environmental conditions, habitat and diet.

Keywords:

length-length relationship,

length-weight relationship,

condition factor.

I. INTRODUCTION

Fish are among the most diverse with at least 20,000 identified species worldwide; 60% inhabit marine ecosystems (Food and Agriculture Organization, 2003). Marine fisheries play a key role in the Philippine economy. Aside from being one of the major export earners, it is both a protein source and a means of livelihood (Bureau of Fisheries and Aquatic Resources, National Fisheries Research and Development Institute, & Western and Central Pacific Fisheries Commission, 2012). The 2010 data released by Bureau of Agricultural Statistics (BAS) estimated that total marine catch comprised almost half of the country's fisheries production. Small pelagic species including *Selar crumenophthalmus* named locally as matambaka form one of the most important fish caught in landing sites in Region IX, Philippines. Zamboanga City, Western Mindanao is heavily dependent on fisheries resources and stock assessment needs to be done given the perennial problem of over fishing in municipal waters. To optimize yield in fishing grounds with little effort while not depleting available stock, information on the biology of fish is essential.

No biological characterization of *S. crumenophthalmus* with respect to its length-length relationship (LLR), length-weight relationship (LWR), and condition factor was recorded in Zamboanga City Western Mindanao, Philippines. Hence, this study was carried out to determine any significant sex difference in LLR, LWR and condition factor as preliminary data on big eye scad. Conventionally, fish length is more often measured than mass. Thus, biometric relations of length-length and length-weight are greatly significant because it is possible to convert growth-in-length models for growth-in-weight used in biomass estimation from observed lengths, deduction on condition of fishes, and comparison of life histories (Simon & Maslan, 2008). Fish being can be inferred from calculated condition factors (LeCren, 1951), utilized in comparing the condition of fish (Tesch, 1968). This assumes that the heavier the fish for its length, the better is its condition. Fagade (1979) said that condition factor is both a growth and feeding intensity indicator, influenced by the reproductive cycle of fish (Welcome, 1979).

II. MATERIALS AND METHODS

This recent study investigated the LLR, LWR, and condition factor of S. crumenophthalmus collected in Labuan Fishport, Zamboanga City, Western Mindanao, Philippines on March-April 2013.

Figure 1. (a) Female

(b) Male (S. Crumenophthalmus)

Study I > Stock assessment

A total of 120 specimens were collected and sexes were determined by direct gonadal examination. The standard length (SL), fork length (FL) and total length (TL) were measured to the nearest 1 cm. The weight was measured to the nearest 0.1 g (Cherif, Zarrad, Gharbi, Missaoui, & Jarboui, 2008). Length-length and length-weight relationships will be determined using Type I linear regression model (Sokal & Rolf, 1981; Kohler, Casey, & Turner, 1996). Mathematically, length-weight relationship is expressed by the equation, $W=aL^b$ (Ricker, 1973); W is weight (g); a, intercept; L, fork length (cm); and b, slope (growth rate) (Beverton & Holt, 1996). Fork length, a widely used biological standard in fishery (Ricker, 1980) were measured. The growth parameters *a* and *b* in LLR and LWR were estimated. The *b* parameter in LWR was tested whether it is significantly different from 3.0 using the Student's t-test. If *b* is 3.0, the growth type is isometric; $b < 3.0$, negative allometric; and $b > 3.0$, positive allometric according to Spiegel (1991). LeCren (1951) stated that LWR variations among individuals may be attributed to a general condition. Analyses of deviations in this condition could be derived by computing condition factor or k-factor or ponderal index by: $K = (100xW)/L^3$; where: K=condition factor, W=weight, and L=fork length (Table 1).

Table 1. Metric and meristic characteristics of the *S. Crumenophthalmus.*

Landmark	Description
Total length	Distance from tip of nose to longest ray in caudal fin
Standard length	Distance from tip of nose to end of vertebral column
Head length	Distance from tip of nose to posterior margin of operculum
Pre-orbital length	Distance from snout tip to anterior margin of eye
Orbital length	Diameter of eye
Post-orbital length	Distance from posterior margin of eye to opercular end
Pre-dorsal fin length	Distance from tip of snout to anterior base of first dorsal fin
Post-dorsal fin length	Distance of posterior base of dorsal fin to longest ray in caudal fin
Pectoral fin base length	Length of base of pectoral fin
Pelvic fin base length	Length of base of pelvic fin
Anal fin base length	Length of base of anal fin
Least body depth	Caudal peduncle length
Highest body depth	Vertical distance from anterior of first dorsal fin and ventral body part

III. RESULTS AND DISCUSSION

Table 1 showed the mean ± SD of the length (SL, FL, TL) and weight measurements that were gathered from the 120 samples of *S. crumenophthalmus*. The females have higher length measurement (SL=17.39±0.81 cm; FL=18.27±0.84 cm; TL=20.47±1.06 cm) than the males (SL=17.01±1.12 cm; FL=17.97±1.17 cm; TL=20.07±1.24 cm). The females have greater weight (115.82± 17.31 g) compared to the males (109.53 ± 17.31 g).

Table 1. Mean ± SDof the standard length, fork length, total length and weight of *S. crumenophthalmus*.

Species	N	Standard length (cm)	Fork length (cm)	Totallength (cm)	Weight (g)
Female	30	17.39± 0.81	18.27± 0.84	20.47 ±1.06	115.82± 17.31
Male	30	17.01 ±1.12	17.97 ±1.17	20.07 ±1.24	109.53± 25.86

Type I linear regression analyses of standard-fork length, total-fork length, and fork length-weight of *S. crumenophthalmus* revealed very high correlation and highly significant. ANOVA showed that there were significant difference (P = 6.81) and high correlation (P = 24.59) among SL*FL of females. There were significant difference (P = 9.53) and high correlation (P = 19.84) among the SL*FL of males. ANOVA showed that there were significant difference (P = 8.98) and high correlation (P = 24.59) among SL*FL of females. There were significant difference (P = 9.53) and high correlation (P = 19.84) among the TL*FL of females. There were significant difference (P = 7.26) and high correlation (P = 24.21) among the TL*FL of males. ANOVA showed that there were significant difference (P = 8.73) and high correlation (P = 13.51) among the FL*W of the females. There were significant difference (P =8.06) and high correlation (P = 19.84) among the FL*W of the males(Table 2).

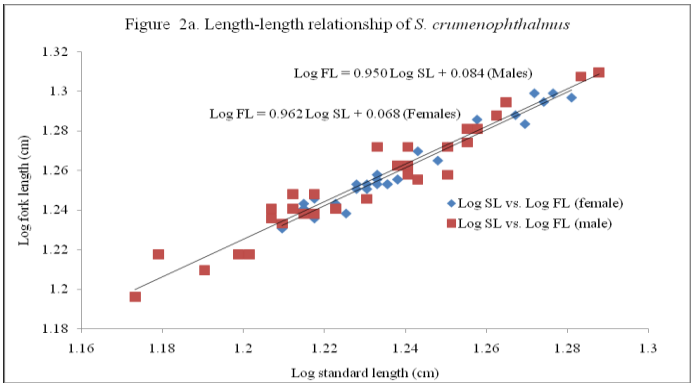
Values of b and t-test reflect allometric growth, with females gaining weight at a much slower rate than males relative to increments in fork length. However, evidence suggested these values are not statistically significant. Members of Family Carangidae display an allometric growth pattern (Santic, Jardas, & Pallaora, 2002); which the study demonstrated. However, b of combined samples is 3.29, slightly higher than existing literature of Gonzales, Palla, and Mishina (2000), Duarte, Garcia, Sandoval, von Schiller, Melo, and Navajas (1999), Letourneur, Kulbicki, and Labrosse (1998), Pauly and Martosubroto (1996), and Nair and Pillaf (1987).

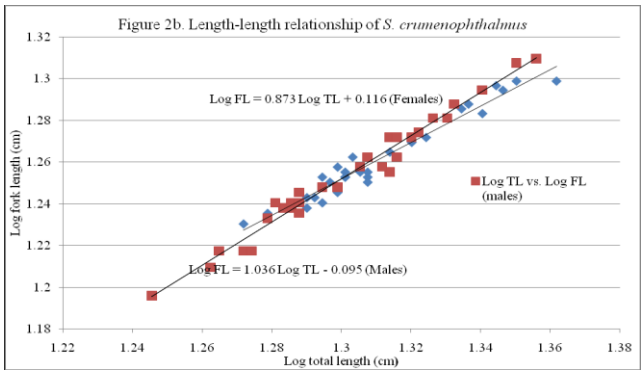
Table 2. Length-length and length-weight ANOVA and t- test correlation of *S. crumenophthalmus*.

Criteria	Sex	n	log a	b	SE(b)	R	ANOVA	t-test(a)
SL*FL	Female	30	0.07	0.96	0.04	0.98	6.81*	24.59*
	Male	30	0.08	0.95	0.05	0.97	9.53*	19.84*
TL*FL	Female	30	0.12	0.87	0.04	0.98	8.98*	24.21*
	Male	30	-0.095	1.04	0.03	0.99	7.26*	33.87*
FL*W	Female	30	-1.64	2.93	0.21	0.93	8.73*	13.51*
	Male	30	-2.29	3.44	0.18	0.96	8.06*	18.65*

*: p<0.05; significant
t-test correlation coefficient

According to Moutopoulos & Stergiou, (2002), in modeling length and weight characteristics of fish, it is imperative to account two characteristics. First, LWR violates linearity which implies that length is a linear variable whereas weight is related to volume. Therefore increasing length means adding a disk of volume carrying a corresponding weight. Second, higher weight differences result when fish length is increased. Earlier LWR studies did not account any sex difference. Variations in LWR cannot be attributed to a single factor; but combination of factors- physical like seasons, environmental conditions, habitat, biological sexual maturity, stomach fullness and diet (Figure2a and 2b).





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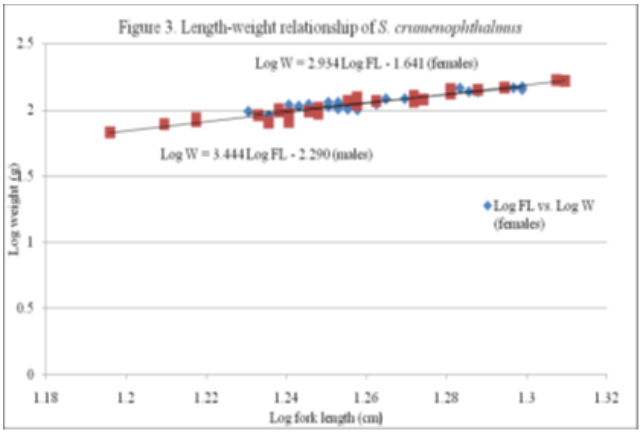
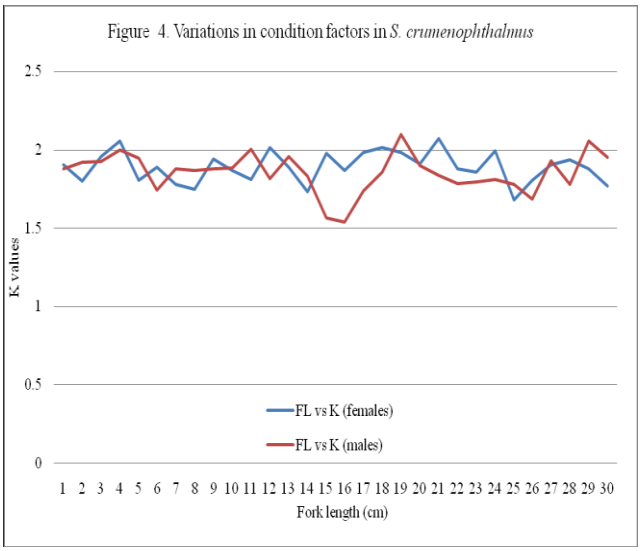


Sexual variations in condition factor as influenced by fork length are graphically illustrated in Figure 4. The highest K in the females is 2.09 while 1.53 is its lowest. In the males, K ranged from 1.53 to 2.09. Combined samples recorded a range of 1.53 to 2.09. T-test results showed condition factors did not considerably vary by sex (♀=1.88±0.09; ♂=1.85±0.12; t=1.23, p>0.05).



Assessment of condition factor holds a significant place in fisheries biology as it is an acknowledged quantitative indicator of a species' physiological state and welfare (Le Cren, 1951). A population-based comparison may also be possible taking into consideration climatic changes and feeding density (Weatherly & Gills, 1987). The study of Diaz, Roa, Garcia, Acero, and Navas (2000) and Alam, Ghaffar, Mokhtar, and Bari (2013) found demersal fishes had condition factors below the ideal 2.9 and 4.8 standardized by Bagenal and Tesch (1978), which means that samples reveal slow growth. Low condition factors were apparent in the present study. Their research results implied condition of fishes as very unfavorable. On the contrary, Aura, Munga, Kimani, Manyala, and Musa (2011) interpreted condition factors greater than 1.0 as healthy. However, conclusions on K values in the present study must be regarded with careful review and utmost caution.

Solid verification and research is imperative; thus conduct of physio-chemical assessment of fishing grounds during time of catch is recommended following Jenkins (2004) who maintained that both environmental and anthropogenic stressors affect a species' condition factor. In relation, Santic, Jardas, and Pallaoro (2002) concluded a significant association between growth and biotic as well as abiotic factors like quality, quantity, and size of food and water temperature. Espiritusanto (2000) studied nematode and trematode parasites found in *S. crumenophthalmus*. During rainy season, infestation is heavy due to rapid reproduction and colonization of parasites in the definitive host (Okaka & Akhigbe, 1999).

Another plausible explanation based on available literature is sexual maturity. Vazzoler (1996) as cited in Gomiero and Braga (2007) disclosed that later stages of gonadal development results in low condition factors due to intensive resource allocation to the gonads. At sexual maturity, a marked increase in protein of gonadal tissue occurs, simultaneously decreasing blood and muscles (Naidenova, 1977 as cited in Stantic, Rada, & Paladin, 2011). In the study, however, mean fork length in both sexes did not coincide with the species' sexual maturity, strengthening the assumption that the sample is mostly in the sub-adult stage. This length at maturity estimate was based on studies of *S. crumenophthalmus* in the 80s and 90s. Unfortunately no recent study recorded length at sexual maturity of *S. crumenophthalmus.* Thus, a more recent investigation is recommended. In Stantic, Rada, and Paladin (2011), lowest K values were calculated in immature *Trachurus trachurus* and *T. mediterraneus,* both relatives of *S. crumenophthalmus.*

IV. CONCLUSION

In this study, the female *Selar crumenophthalmus* has greater standard and fork length and weight compared to the male *S. crumenophthalmus*. These can be attributed to the allometric growth of the females and the gaining in weight can also be attributed to reproductive biology of the fish and condition factor. Sex variation of *S. crumenophthalm*us can be attributed to habitat and diet. It is also concluded that there is a strong relationships between the length-length and length-weight *S. crumenophthalmus.*

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