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Length-weight relationship of yellow-wing Flyingfish, *Cypselurus poecilopterus* (Valenciennes) in the Western Coast of Surigao del Norte, Philippines

Bernard C. Gomez

Surigao State College of Technology - Malimono Campus, Malimono, Surigao del Norte, Philippines

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Abstract

This study was conducted to determine the length-weight relationship of yellow-wing flyingfish, *Cypselurus poecilopterus* landed on the western coast of Surigao del Norte, Philippines. Sampling was performed from June 2018 to May 2019. A total of 959 fish samples were gathered and measured. Total length was measured to the nearest centimeter (cm), while weight was measured to the nearest grams (g). The parameters *a* and *b* of the length and weight relationship were estimated using the formula $W= aL^b$ which was transformed into logarithmic form Log W = Log a + b Log L. The correlation coefficient (r^2) ranged from 0.877 to 0.963 indicating a strong correlation between length and weight. The *b* values were continually increasing from June (2.898) to March (3.499), which is within the range of 2.5 to 3.5. Pooled data of 959 fish samples have a strong correlation between length and weight and followed positive allometric growth.

* **Corresponding Author:** Bernard C. Gomez ✉ nardgomez2019@gmail.com

Introduction

The flyingfish locally known as "bangsi" is a group of small pelagic fish that belongs to family Exocoetidae. It is one of the primary fishery resources on the west coast of Surigao del Norte, as it provides a means of livelihood for many people. Flyingfish is commonly caught by using modified surface drive-in net locally called as "sari" and surface drift gillnet locally known as "anod" (Gomez *et al.,* 2019).

The flyingfish contributed an average of about 84% of the annual catch production in the Philippines. However, they showed a declining trend over the three years from 2013 to 2015, indicating declining abundance and unsustainable status of flyingfish fishery (Emperua *et al.,* 2017).

Gomez *et al.* (2019) also reported that *Cypselurus poecilopterus* (Valenciennes, 1847), *Cheilopogon spilopterus* (Valenciennes, 1847) and *Hirundichthys affinis* (Gunther, 1866) *are* in the state of recruitment overfishing.

The length-weight relationship (LWR) is one of the essential assessment tools for proper exploitation and management of the population of fish species.

It gives details about stock composition, size increase, growth trends, and fish well-being (Fafioye and Oluajo, 2005). LWR shows population dynamics, growth patterns, and conditions of a species (King, 1995).

It can also be used to predict weight from length measurements made in the yield assessment (Pauly, 1993), estimate biomass, and determines fish condition (Deekae *et al*., 2010). LWR is a vital fishery resource management tool used in the average calculating weight at a given growth period of fishes.

It can be applied to studies on gonadal development, feeding rate, and maturity condition (Beyer, 1987). LWR is also an indicator of the changes in fisheries and is used to assess the species' current status. Thus, the study aimed to determine the length-weight relationship of the yellow-wing flyingfish, *C. poecilopterus,* on the western coast of Surigao del Norte, Philippines.

The present study served as the essential information for the proper use and management of the species in the area.

Materials and methods

Study area

The study was carried out on the western coast of Surigao del Norte between June 2018 and May 2019 following the Gomez *et al*. (2019) sampling stations. Station 1, 9° 2' 55.45" N, 125° 23' 45.19" E (Linongganan), Station 2, 9° 38' 26.54" N, 125° 23' 42.27" E (Cagtinae), and Station 3, 9° 34' 43.70" N, 125° 24' 43.09" E (Cansayong). The sampling stations are landing points for surface drift gillnet boats engaged in catching flyingfish (Fig. 1).

Sampling procedures

Fish sampling was performed once a week, and two (2) kilograms of samples from each station were taken randomly. A total of 6 kg of *C. poecilopterus* samples was purchased directly from fishers every sampling.

The total length of the sample was measured to the nearest 0.1 cm using a fish board. Bodyweight was also recorded to the nearest 0.01 gram using a 500g × 0.01g Electronic Digital Jewelry Scale. Samples with broken tails are not included in the measurement.

Statistical analysis

The length-weight relationship was estimated by using the equation $W = a L^b$ (Pauly, 1984) which was transformed into logarithmic form Log W = Log a + b Log L; where *W* is the body weight of fish (g), *L* is the total length of fish (cm), *a* is the intercept and *b* is the regression line slope which was used to calculate the relationship between total length (L) and body weight (W) of fish.

The Microsoft Excel 2010 and Minitab 17 were used in the processing of data.

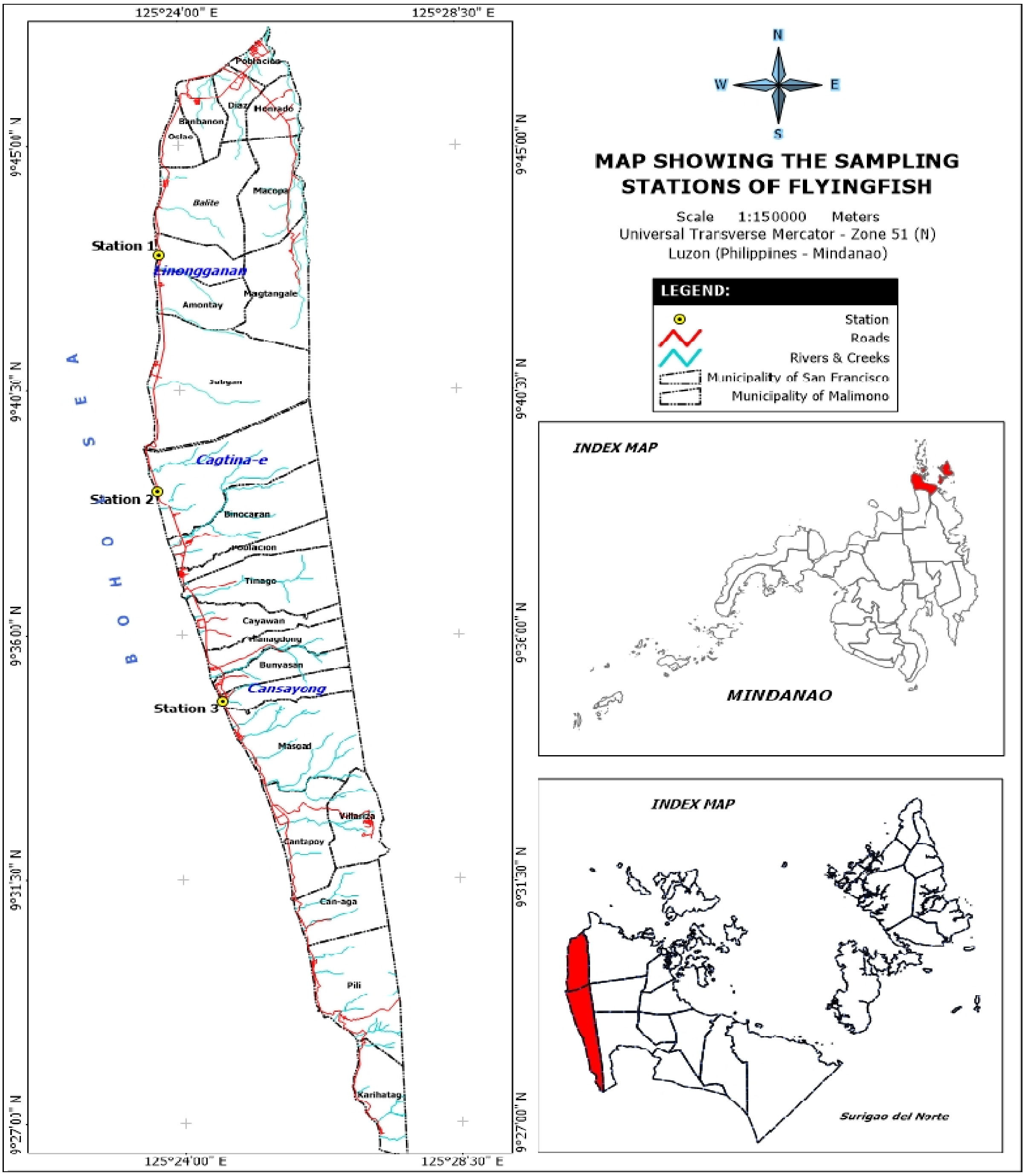

Fig. 1. Location map of the study area in western coast of Surigao del Norte, Philippines.

Results and discussion

Table 1 displays the sample size, parameter estimates, and determination coefficients (r^2) from non-linear regressions of the *C. poecilopterus* sampled from the western coast of Surigao del Norte, Philippines. A total of 959 *C. poecilopterus* individuals were examined with *b* values of the length-weight relationship ranging from 2.898 to 3.499, showing both negative and positive allometric growth. Growth is said to be positive allometric when the weight of an organism increases more than length (b>3) and negative allometric when length increases more than weight (b<3) (Wootton, 1992).

The value of *b* found in this study is within the range of 2.5 to 3.5, reported by Froese (2006) for several fish species. The table also reveals that the *b* values increased from June (2.898) and reached a peak in March (3.499). Then, it was gradually decreasing in April (3.006) to May (2.892).

Table 1. Length-weight relationship data of the yellow-wing flyingfish, *C. poecilopterus*.

Month	n	a	b	r^2
June	88	0.0123	2.898	0.963
July	112	0.0096	2.972	0.934
August	60	0.0117	2.912	0.960
September	47	0.0105	2.949	0.920
October	89	0.0100	2.967	0.932
November	114	0.0092	2.992	0.892
December	126	0.0074	3.072	0.933
January	132	0.0071	3.096	0.927
February	48	0.0034	3.358	0.877
March	49	0.0020	3.499	0.945
April	56	0.0091	3.006	0.948
May	38	0.0129	2.892	0.947
Pooled Data	959	0.0071	3.084	0.926

The result indicates that the growth of *C. poecilopterus* changes from negative to positive allometric increase in the months from June to March. Then, positive to negative allometric growth was followed from April to May. Gomez *et al.* (2019) reported the ova diameter of *C. poecilopterus* increased significantly from 589.4±161.5µm (September) with a maximum diameter of 1416.7±54.7µm (March) and decreased slightly from April (1411.7±53.9 µm) to May (1403.6±59.2 µm).

They also recorded that the spawning peak and highest gonadosomatic index mean values of this species were observed during March.

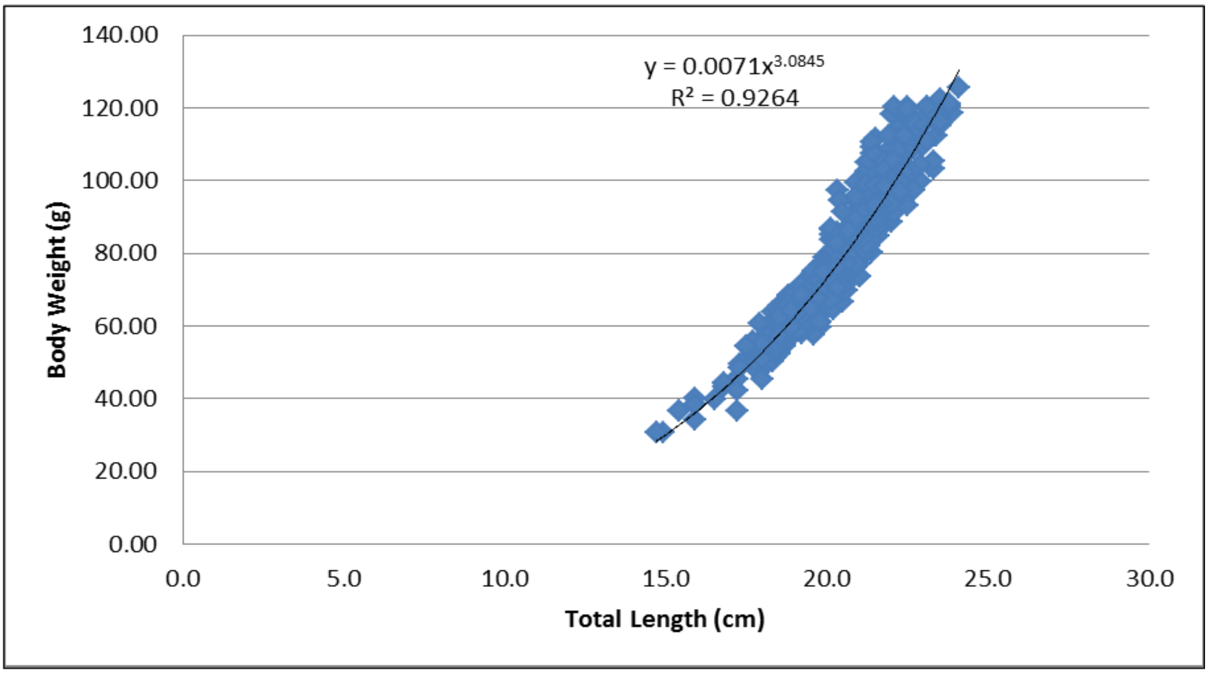

Fig. 2. Scatter plot diagram showing the length-weight relationship of 959 samples of yellow-wing flyingfish, *C. poecilopterus*.

The result showed that gonadal development and spawning cycles could alter the growth patterns of *C. poecilopterus*. Adequate feeding and gonad development increased fish weight and *b* values (Nikolsky 1963; Arslan 2003). Flura *et al.* (2015) claimed that the *b*-value might change during different periods illustrating the fullness of the stomach, general condition of appetite, and gonads stages. LWRs differ among fish species depending on the inherited body shape and the physiological factors such as maturity and spawning (Schneider *et al.*, 2000). Moutopoulos and Stergiou (2002) stated that the variations in *b*-values could be due to several factors such as age, body shape and amount of fat present, sex, maturity stage, season, temperature, salinity, and available nutrient food.

A scatter plot diagram for the pooled data is presented in Fig. 2 to show the relationship between length and weight. The determination coefficient (r^2) varied between 0.877 and 0.963 (Table 1) and r^2 = 0.926 for the pooled data suggesting a strong correlation between length and weight. Pooled data of 959 fish samples collected resulted in a *b* value of 3.084, showing positive allometry (b >3), which is almost similar compared to its Bayesian estimate (3.12) (Froese *et al.,* 2014).

Conclusion

Based on the result, *C. poecilopterus* species observed from the western coast of Surigao del Norte followed both negative and positive allometric growth patterns. Pooled data of 959 fish samples indicates that total length and weight are strongly correlated to each other, showing positive allometric growth.

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