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Length–weight relationship of the lizardfish *Saurida tumbil* (Bloch, 1795) from the Visayan Sea, Philippines

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ABSTRACT

This study determined the length–weight relationship (LWR) and growth pattern of the lizardfish *Saurida tumbil* (Bloch, 1795) collected from commercial bottom trawl landings in the Visayan Sea, Philippines. A total of 433 specimens collected between October 2024 and September 2025 were analyzed. Total length ranged from 12.1 to 38.5 cm, while body weight ranged from 14.4 to 517.0 g. The length–weight relationship was estimated using least-squares regression of log-transformed length and weight data. The resulting equation was $W = 0.006L^{3.05}$, with a coefficient of determination (r^2) of 0.91, indicating an excellent fit of the regression model. The estimated growth exponent ($b = 3.05$) did not differ significantly from the theoretical isometric value of 3, indicating isometric growth. These findings provide updated biological information on *S. tumbil* and serve as a useful reference for biomass estimation, stock assessment, and science-based fisheries management in the Visayan Sea.

Keywords: Length–weight relationship, Lizardfish, *Saurida tumbil*, Visayan Sea, Fisheries biology

Introduction

Saurida tumbil (Bloch, 1795), locally referred to as "karaho," is a demersal species in the family Synodontidae. The species occurs throughout tropical and subtropical waters of the Indo–West Pacific and predominantly occupies sandy and muddy substrates in relatively shallow coastal areas (Raza et al., 2022; Srihari et al., 2021). *S. tumbil* is one of the commercial fishes in Southeast Asia, such as in the Philippines (Mirzaei et al., 2015; Federizon, 1993). It is also an important contributor to fish production as well as the food security and livelihoods of many coastal communities (Raza et al., 2022).

S. tumbil is caught by both municipal (small-scale coastal) and commercial fishers in the Philippines. The Visayan Sea is one of the country's major fishing grounds for this species and contributes significantly to national fish production (Guanco et al., 2009). A large portion of the Visayan Sea borders the coastal municipalities of northern Iloilo Province and is known for its rich marine biodiversity, which supports the livelihoods and food security of thousands of coastal residents (Barut et al., 1997; Ferrer, 2009; Clarito & Suerte, 2021). However, increasing fishing pressure in the area highlights the need for updated biological information on this species to support effective fisheries management (Guanco et al., 2009; Clarito & Suerte, 2021).

Fisheries research widely uses length–weight relationships (LWRs) to describe the relationship between fish length and body weight. Length–weight relationships are important for estimating fish biomass, evaluating growth patterns, and providing biological information for stock assessment and fisheries management (Le Cren, 1951; Froese, 2006). Numerous studies have reported LWRs for commercially important marine fishes in different regions, demonstrating their value in fisheries biology and fisheries research (Ateş et al., 2017). In addition, the growth exponent (*b*) derived from the LWR provides information on the growth pattern of a species and may reflect environmental or ecological conditions that influence its life history (Froese, 2006; Dash et al., 2023).

Despite the commercial importance of *S. tumbil* in the Visayan Sea, updated information on its growth characteristics remains limited. Information on the length–weight relationship of this species is needed to support future studies on its population status and to provide a scientific basis for fisheries management in the Visayan Sea and adjacent fishing grounds. This study aimed to determine the length–weight relationship and growth pattern of *S. tumbil* collected from commercial bottom trawl landings in the Visayan Sea, Philippines.

Materials and Methods

Study Area and Sampling Procedures

Fish specimens of *S. tumbil* were collected from commercial bottom trawl landings in the Visayan Sea. Sampling was conducted twice a month from October 2024 to September 2025 at Bancal Feeder Port in Carles and Estancia Feeder Port in Estancia, Northern Iloilo, where commercial bottom trawl vessels regularly landed their catches. During each sampling visit, *S. tumbil* specimens were randomly selected from the landings, resulting in a total of 433 specimens.

Total length (TL) was measured to the nearest 0.1 cm using a calibrated measuring board, while body weight (BW) was recorded to the nearest 0.1 g using a portable electronic balance. Species identification was confirmed using standard taxonomic references for marine fishes, including FishBase (Froese & Pauly, 2025) and Motomura et al. (2017). Since the objective of the study was to determine the overall length–weight relationship of the species, only total length and body weight were recorded, and sex was not determined.

Length–Weight Relationship Analysis

The relationship between body weight and total length was described using the power model (Eq. 1):

$$W = a\,L^{b} \qquad (1)$$

where *W* denotes body weight (g), *L* represents total length (cm), *a* is the intercept, and b is the growth exponent. To enable linear regression analysis, the model was expressed in logarithmic form (Eq. *2*):

$$\log W = \log a + b \log L \qquad (2)$$

The parameters *a* and *b* were estimated using least-squares linear regression of the log-transformed length and weight data in Microsoft Excel 2021. The coefficient of determination (r^2) was used to assess the goodness of fit of the regression model. A Student's t-test was performed to determine whether the estimated growth exponent (*b*) differed significantly from the theoretical isometric value of 3 at $\alpha = 0.05$ (Froese, 2006). Isometric growth was inferred when *b* did not differ significantly from 3 ($p > 0.05$); otherwise, the growth pattern was considered allometric.

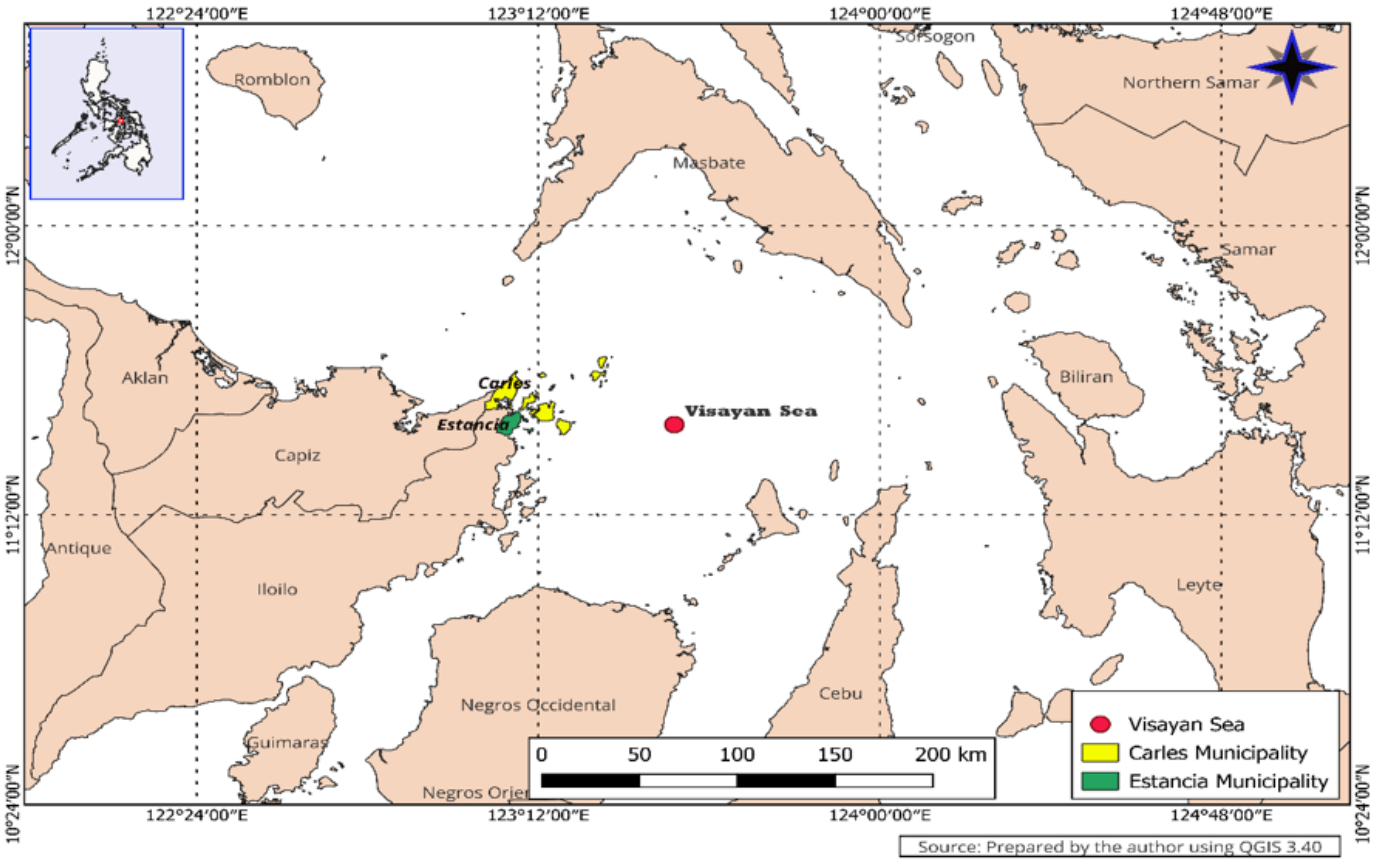

Figure 1. Map of the Visayan Sea, Philippines, showing the sampling sites in Carles and Estancia, Northern Iloilo

Results and Discussion

A total of 433 *Saurida tumbil* specimens were examined during the one-year sampling period. Total length ranged from 12.1 to 38.5 cm, while body weight varied from 14.4 to 517.0 g. The monthly distribution of the collected *S. tumbil* specimens is presented in Table 1.

The estimated length–weight relationship of *S. tumbil* is expressed by Equation (3). The regression plot illustrating the relationship between total length and body weight is presented in Figure 2.

$$W = 0.006L^{3.05} \quad (3)$$

The estimated length–weight relationship for *S. tumbil* was $W = 0.006L^{3.05}$, with a coefficient of determination (r^2) of 0.91, indicating a strong relationship between total length and body weight. The estimated growth exponent (b = 3.05 ± 0.046 SE) was not significantly different from the theoretical isometric value of 3 (Student's t = 1.12, p = 0.26), indicating an isometric growth pattern. The corresponding regression statistics are summarized in Table 2.

Student's t-test was performed to determine whether the estimated growth exponent (b) differed significantly from the theoretical isometric value of 3 (H_0: b = 3). Since $p > 0.05$, the null hypothesis was not rejected, indicating that the growth of *Saurida tumbil* did not differ significantly from isometric growth.

Table 1. Monthly distribution of *Saurida tumbil* specimens collected from commercial bottom trawl landings in the Visayan Sea, Philippines, between October 2024 and September 2025

Sampling Month	Number of Specimens (n)
October 2024	35
November 2024	37
December 2024	34
January 2025	36
February 2025	32
March 2025	38
April 2025	35
May 2025	39
June 2025	37
July 2025	36
August 2025	38
September 2025	36
Total	**433**

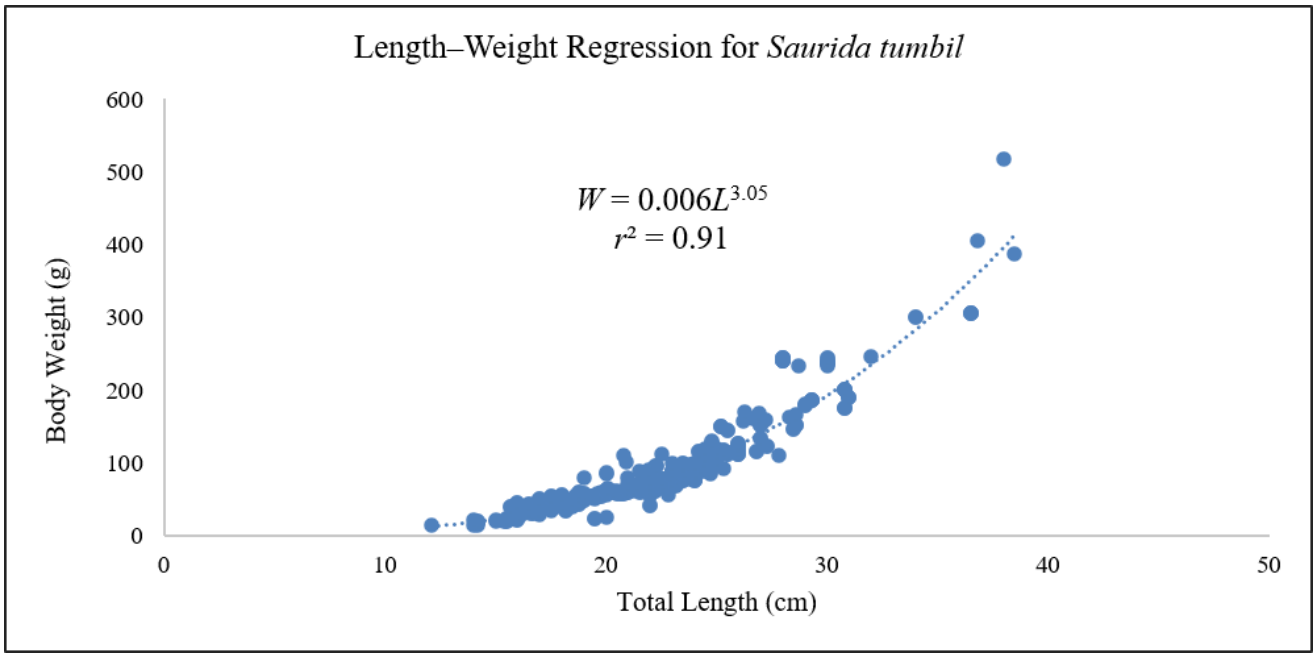

Figure 2. Length–weight relationship between total length and body weight of *Saurida tumbil* collected from commercial bottom trawl landings in the Visayan Sea, Philippines.

Table 2. Summary statistics of the length–weight relationship of *Saurida tumbil* collected from commercial bottom trawl landings in the Visayan Sea, Philippines

Parameter	Estimate
Sample size (*n*)	433
Intercept (*a*)	0.006
Growth exponent (*b*)	3.05
Standard error of *b* [SE(*b*)]	0.046
95% Confidence interval of *b*	2.961–3.14
Coefficient of determination (r^2)	0.91
Student's *t*-value†	1.12
p-value†	0.26
Growth pattern	Isometric

Table 3. Comparison of length–weight relationship (LWR) parameters of *Saurida tumbil* reported in selected studies.

Study / Source	Location	*b*	*a*	r^2	Sex	Growth pattern
Federizon (1993)	Visayan Sea, Philippines	3.00	0.00716	-	F + M	Isometric
Wang et al. (2011)	China	3.04	0.0096	0.999	F + M	Isometric
Kalhoro et al. (2015)	Pakistani waters	2.93	0.011	0.976	F + M	Near-isometric
Mohanchander et al. (2015)	India	3.025	0.00007	0.961	M	Isometric
Mali et al. (2017)	North-western Indian EEZ	2.98	0.0082	0.944	F + M	Near-isometric
Purushottama et al. (2018)	Eastern Arabian Sea, Mumbai	3.00	0.00704	0.955	F + M	Isometric
Hartono et al. (2024)	Jizan, Saudi Arabia	3.114	0.0053	0.965	F + M	Allometric positive
Present study	Visayan Sea, Philippines	3.05	0.006	0.91	Not determined	Isometric

Note: Differences in the reported LWR parameters may reflect variations in sampling design, size range, measurement units, environmental conditions, and analytical methods among studies

The present study showed an isometric growth pattern (b = 3.05), which is consistent with the findings of Federizon (1993), who likewise reported isometric growth (b = 3.00) for *Saurida tumbil* from the Visayan Sea. Similar results have been reported from China (Wang et al., 2011), India (Mohanchander et al., 2015), and the eastern Arabian Sea (Purushottama et al., 2018), suggesting that proportional growth is a common characteristic of this species throughout much of its Indo-West Pacific distribution (Table 3).

In contrast, studies conducted in Pakistani waters (Kalhoro et al., 2015) and the north-western Indian Exclusive Economic Zone (Mali et al., 2017) reported near-isometric growth, whereas Hartono et al. (2024) observed positive allometric growth in the Red Sea. These differences are not uncommon in length–weight relationship studies and may be attributed to variations in sampling period, size composition of the specimens, fishing gear, environmental conditions, food availability, and analytical methods. Although such factors can influence the estimated parameters, the growth exponent obtained in the present study falls within the expected range reported for the species.

These findings provide baseline biological information that can support future biomass estimation, stock assessment, and science-based management of *S. tumbil* in the Visayan Sea.

Conclusion

The present study established the length–weight relationship of *Saurida tumbil* collected from commercial bottom trawl landings in the Visayan Sea over a one-year sampling period. The estimated growth exponent ($b = 3.05$) indicated isometric growth, supported by a strong correlation between total length and body weight ($r^2 = 0.91$). These findings provide updated baseline information that can be directly applied to biomass estimation, stock assessments, and science-based fisheries management in the region. To build upon these results and track population shifts over time, continuous monitoring of landings is advised. Moreover, future studies should

address critical life-history traits—including sex-specific differences, seasonal growth patterns, size at first maturity (L_m), size at first capture (L_c), and gear selectivity—to strengthen the long-term management framework for this commercially important species.

Compliance with Ethical Standards

Conflict of interest: The author(s) declare no actual, potential, or perceived conflict of interest for this article.

Ethics committee approval: The authors declare that this study does not involve experiments with human or animal subjects, and therefore, ethics committee approval is not required.

Data availability: The data will be made available upon request from the author.

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Disclosure: -

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