



## Length-weight relationships for four fish species from the coast of Benghazi, Libya

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## Highlights

- The length-weight relationship in fish is very important in fisheries management
- Information about Libyan Ichthyofauna is very scarce

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## ABSTRACT

In this short paper, we estimated length-weight relationships for four fish species off Benghazi (Oct-Dec 2023) using  $W = a L^b$  on log-transformed data and tested isometry at 0.05. Across 343 individuals,  $r^2$  ranged 0.30-0.91;  $b$  indicated isometry in *L. mormyrus* and *M. cephalus*, negative allometry in *P. forsskali*, and an anomalously low value in *S. scriba* requiring verification. These baseline support biomass conversion and regional stock assessments.

## 1. Introduction

The Libyan coast is one of the least explored regions in the Mediterranean, and little is known about Libyan ichthyofauna (Elbaraasi *et al.*, 2019). Furthermore, a small number of environmental and biological studies aimed at improving marine fisheries management have been conducted, with the majority of them revealing that Libya's coasts are rich in fisheries resources that have largely gone unused (Elbaraasi *et al.*, 2022).

The coasts of Libya are generally a fascinating place for fish and other marine life to spawn. Nonetheless, the coast of Benghazi is regarded as a significant fishing area in the area (Al-Hassan and El-Silini, 1999).

Length-weight relationships equations and parameters have been used in fisheries science to show data regarding fish population status (Bagenal *et al.*, 1978). These data are needed to investigate many other biological features in population dynamics of fish such as: life history, growth status and age conditions (Dartay *et al.*, 2014). Moreover, length-weight relationships are important to studying the differences in the morphological data of fishes from different coastal regions (Goncalves *et al.*, 1979).

Information on the fisheries science and population dynamics of fish in Libya is incomplete. Therefore, in this short research, I provided data on the length-weight relationships for four economically important fish species collected from the coast of Benghazi, Libya. The fish species used are: *Serranus scriba* (Serranidae), *Lithognathus mormyrus* (Sparidae), *Mugil cephalus* (Mugilidae), and *Parupeneus forsskali* (Mullidae).

## 2. Material and Methods

Between October and December 2023, trammel nets (mesh size = 2 cm) were used to collect samples of *Serranus scriba* (n=31), *Lithognathus mormyrus* (n=171), *Mugil cephalus* (n=102), and

*Parupeneus forsskali* (n=39) from the coast off Benghazi (32.1166° N 20.0666° E), Libya, at depths ranging from 5 to 15 metres. The samples were kept in ice for a few hours and transferred to the Aquaculture and Fisheries Lab., Faculty of Science, University of Benghazi, for further work. Upon arriving at the laboratory, fish species were identified and checked according to Froese and Pauly 2024. After that, each specimen was weighed with a digital balance to the nearest 0.1 g and measured in total length to the nearest mm.

The length-weight relationships was calculated by the equation,  $W = a L^b$  (Ricker, 1973) since  $W$ =bodyweight (g),  $L$ =total length (cm),  $a$ =intercept, and  $b$ = regression line slope. The relationship was changed to the logarithmic form as follows:  $\log W = \log a + b \log L$ . Statistical analysis (T-test) was used to determine whether the regression coefficients differed from the isometric value of 3 ( $p < 0.05$ ).

## 3. Results and Discussion

Fisheries science is the study of economically important fish populations. The length-weight relationship in fish is one of the studies that provided indicators of the fish population's status. Furthermore, in order to prevent fish populations from declining, we must have basic data about their condition, which will aid in the development of a management program to control the fish population as part of Fisheries Management.

Four fish species were investigated in this study. Length and weight analysis of 343 individuals of the fish species were used and calculated. The estimated parameters of the length-weight relationship are found in (Table 1).

The sample sizes of the fishes were: *Serranus scriba* (n=31), *Lithognathus mormyrus* (n=171), *Mugil cephalus* (n=102), and *Parupeneus forsskali* (n=39). From the results,  $r^2$  values were in *Serranus scriba* ( $r^2 = 0.3$ ), *Lithognathus mormyrus* ( $r^2 = 0.8$ ), *Mugil cephalus* ( $r^2 = 0.9$ ), and *Parupeneus forsskali* ( $r^2 = 0.6$ ).

Exponent  $b$  values indicate the type of fish growth, which can be isometric ( $b=3.0$ ), positive allometric ( $b>3.0$ ), or negative allometric. Moreover, in this study, the  $b$  values of *Serranus scriba* ( $b=0.7$ ), *Lithognathus mormyrus* ( $b=3.0$ ), *Mugil cephalus* ( $b=3.0$ ), and *Parupeneus forsskali* ( $b=2.5$ ). However, two species showed allometric growth ( $b=3.0$ ), which are *Lithognathus mormyrus*

( $b=3.0$ ), *Mugil cephalus* ( $b=3.0$ ). The other two species found to be negative allometric growth ( $b<3.0$ ) which are *Parupeneus forsskali* ( $b=2.5$ ) and *Serranus scriba* ( $b=0.7$ ) (see Table 1). Furthermore, regression values were highly significant ( $P < 0.05$ ) in *Serranus scriba* in contrast to the other species of fish, which showed no significant difference in regression values.

**Table 1.**

Summary data of the Length-weight relationship for the four fish species investigated in this study.

Family	Species	n	Length range (cm)	Weight range (g)	a	b	r <sup>2</sup>
Serranidae	<i>Serranus scriba</i>	31	12.3-32.5	83-173	14.1	0.7	0.30
Sparidae	<i>Lithognathus mormyrus</i>	171	14.3-20.2	35-96	0.010	3.0	0.80
Mugilidae	<i>Mugil cephalus</i>	102	22.3-30	92-224	0.018	3.0	0.91
Mullidae	<i>Parupeneus forsskali</i>	39	19.5-24.2	67-185	0.005	2.50	0.63

There are many factors that affect the length-weight relationship in fish, such as: maturity status of fish, trophic behavior and strategy, seasons and feeding type (Petrakis and Stergiou, 1995). Furthermore, population dynamics parameters such as the length-weight relationship might be more accurate when taking into consideration data collected during the year. Nevertheless, the  $b$  value usually does not change significantly during the year-round, in contrast to value  $a$ , which varies with the habitats, behaviour and reproduction of fish (O'Hea, 2013; Balart et al., 2006).

In conclusion, the weight-length relationships of numerous fish species found along the Libyan coast are unknown. Thus, the current study serves as an initial reference on the management of fisheries for *Parupeneus forsskali*, *Lithognathus mormyrus*, *Mugil cephalus*, and *Serranus scriba* in the southern Mediterranean. Moreover, the data reported in this short study are very important for the creation of suitable management strategies for the sustainable use of marine species. Future research will include condition factors and length-weight relationships for more fish species throughout the year.

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