

LENGTH-WEIGHT RELATIONSHIP FOR SMALL TUNAS SPECIES CAUGHT BY PURSE SEINE IN THE GULF OF GABES (IONIAN SEA-MEDITERRANEAN)

G. Hajjej¹, A. Hattour², H. Missaoui², O. Jarboui³

SUMMARY

*Length-weight relationships (LWR) were estimated for 3 small tunas species which are of economic relevance in the commercial fisheries of the Gulf of Gabes (southern Tunisia). A total of 574 fish caught by purse seine were sampled from January to December 2016. Significant length-weight relationships with high correlation coefficient were found for all species. The value of the parameter b varied between 2.792 to 2.885 for *Euthynnus alletteratus*; 3.035 to 3.296 for *Sarda sarda* and 3.304 to 3.678 for *Auxis rochei*.*

RÉSUMÉ

*Des relations taille-poids ont été estimées pour trois espèces de thonidés mineurs qui revêtent une importance économique dans les pêcheries commerciales du golfe de Gabès (Sud tunisien). Au total, 574 poissons capturés par des senneurs ont été échantillonnés de janvier à décembre 2016. Des relations importantes longueur-poids dotées d'un fort coefficient de corrélation ont été observées chez toutes les espèces. La valeur du paramètre b variait entre 2,792 et 2,885 pour *Euthynnus alletteratus*, entre 3,035 et 3,296 pour *Sarda sarda* et 3,304 et 3,678 pour *Auxis rochei*.*

RESUMEN

*Se estimaron las relaciones talla peso (LWR) para tres pequeños túnidos, especies que tienen importancia económica en las pesquerías comerciales del Golfo de Gabes (Túnez meridional). Se muestreó un total de 574 peces capturados con cerco de enero a diciembre de 2016. Se encontraron relaciones talla-peso significativas con un alto coeficiente de correlación para todas las especies. El valor del parámetro b osciló entre 2,792 y 2,885 para *Euthynnus alletteratus*; entre 3,035 y 3,296 para *Sarda sarda* y entre 3,304 y 3,678 para *Auxis rochei*.*

KEYWORDS

Length-weight relationships, small tunas, Gulf of Gabes

¹ National Institute of Marine Sciences and Technologies (I.N.S.T.M), 6000 Gabès, Tunisia, E-mail: ghailen3@yahoo.fr.

² National Institute of Marine Sciences and Technologies (I.N.S.T.M), 28 rue 2 Mars 2025 Salammbô, Tunisia.

³ National Institute of Marine Sciences and Technologies (I.N.S.T.M), 3018 Sfax, Tunisia.

1. Introduction

In Tunisian waters, the family of Scombridae (mackerels and tunas) is represented by seven genera, respectively *Thunnus*, *Euthynnus*, *Katsuwonus*, *Auxis*, *Sarda*, *Orcynopsis* and *Scomber* and eight different species (Hattour, 2009).

Little tunny (*Euthynnus alletteratus*), Atlantic bonito (*Sarda sarda*) and bullet tuna (*Auxis rochei*) are a commercially important species of small tunas inhabiting the Tunisian waters. They are mainly harvested by using different fishing gears such as purse seine, light fishing, gill nets, longlines, pelagic trawl and beach seine (Hattour, 2000).

In this study length–weight relationships were estimated for three small tunas species, *Euthynnus alletteratus*, *Sarda sarda* and *Auxis rochei*, caught off the gulf of Gabes, Tunisia.

2. Material and methods

Random samples were taken monthly from a commercial fishery in the Gulf of Gabes, which extends from Ras Kapoudia (on parallel 35°N) to the Tunisian-Libyan border (**Figure 1**), from January to December 2016. Total samples numbered 574 specimens of three species ranging in size from 31 cm (*Auxis rochei*) to 95.5 cm (*Euthynnus alletteratus*) of fork length. Fishes were caught by purse seine.

The measurement of fish fork length was made with a tape measure to the nearest 1 mm, and individual weighting was determined with a top loading digital balance to an accuracy of 0.1 g.

Length–weight relationships for all specimens were calculated using the equation $W=aL^b$, where W is total weight, L is fork length, a is the intercept and b is the slope of the log transformed linear regression (Zar, 1984). Student's t-test was used to determine if the coefficient b was significantly different from 3 (Teissier 1948). The statistical significance level of R^2 and 95% confidence limits of the parameter b were estimated (Santos *et al.*, 2002).

3. Results

A total of 295 little tunny specimens ranging in fork length from 38 to 95.5 cm L (0.825-11.8 kg W), 165 bullet tuna specimens from 31 to 44.5 cm L (0.425-1.605 kg W) and 114 Atlantic bonito specimens from 34 to 47.5 cm L (0.475-1.615kg W) were analyzed. The fork length-weight relationships obtained by species are given in **Table 1** and **Figures 2, 3 and 4**.

The high statistical significance of the determination coefficient (R^2), which varied in the range of 0.89 - 0.97, attested to the existence of a strong correlation between length and weight.

In the present study, negative allometric growth ($P < 0.05$) was observed for *E. alletteratus* and positive allometric growth ($P < 0.05$) was observed for *Auxis rochei* and *Sarda sarda*.

4. Discussion

According to this study, the fork length regression as a function of the total weight indicates that *Euthynnus alletteratus* exhibits negative allometric growth. It therefore seems that this species shows a proportionally higher length increase than weight increase. This result agrees with those given by Hajje *et al.* (2010) in the same place, Kahraman & Oray (2001) in the Aegean Sea, Kahraman (2005) in the Eastern Mediterranean Sea, Kahraman *et al.* (2008) in the North-Eastern Mediterranean, and Macias *et al.*, (2006) in the South-East of Spain.

In the gulf of Gabes, the fork length regression as a function of the total weight indicates that *Auxis rochei* exhibits positive allometric growth. This result was compared with another one that was reported previously for the Tunisian waters using 254 fish (Allaya *et al.*, 2013).

For *Sarda sarda* the relationships established using total fish weight showed always an allometric growth (positive allometry). This result is similar to that found by Di Natale *et al.* (2006) for the same species in the Strait of Sicily.

This study updates length-weight parameters for three small tuna species collected from the Gulf of Gabes. The parameters as shown in this study can be used in studying growth and population dynamics for any of the 3 species of fish exploited from this region.

Acknowledgements

Financial support was given by the Fisheries Science Laboratory of the National Institute of Marine Sciences and Technologies (INSTM).

References

- Allaya, H., A. Hattour, G. Hajjej, M. Trabelsi, 2013. Some biological parameters of the bullet tuna *Auxis rochei* (Risso, 1810) in Tunisian waters Cah. Biol. Mar. 54: 287-292.
- Di Natale, A., Mangano, A., Celona, A., Navarra, E. and Valastro, M. 2006. Atlantic bonito (*Sarda sarda*) catch composition in the Tyrrhenian Sea and in the Strait of Sicily in 2004. ICCAT, Coll. Vol. Sci. Pap., 59 (2): 564-570.
- Hajjej, G., A. Hattour¹, H. Allaya, O. Jarboui, A. Bouain. 2010. Biology of little tunny *Euthynnus alletteratus* in the Gulf of Gabes, Southern Tunisia (Central Mediterranean Sea). Revista de Biología Marina y Oceanografía (45), 3: 399-406.
- Hattour, A. 2000. Contribution à l'étude des poissons pélagiques des eaux tunisiennes. Thèse de doctorat en sciences biologiques, Faculté des sciences de Tunis, Tunisie, 344 pp.
- Hattour, A. 2009. Les thons mineurs tunisiens : Etude biologiques et pêche. Collective Volume of Scientific Papers of International Commission for the Conservation of Atlantic Tunas 64 (7): 2230-2271.
- Kahraman, AE. 2005. Investigation on little tunny (*Euthynnus alletteratus*, Rafinesque 1810) in the Eastern Mediterranean Sea. Collective Volume of Scientific Papers of International Commission for the Conservation of Atlantic Tunas 58:502-509.
- Kahraman AE & IK Oray. 2001. Age and growth of Atlantic little tunny (*Euthynnus alletteratus* Raf., 1810) in Turkish waters. Collective Volume of Scientific Papers of International Commission for the Conservation of Atlantic Tunas 49: 719-732.
- Kahraman, AE, TZ Alicli, T Akayli & IK Oray. 2008. Reproductive biology of little tunny, *Euthynnus alletteratus* (Rafinesque, 1810), from the north-eastern Mediterranean Sea. Journal Applied of Ichthyology 24: 551-554.
- Macias D, MJ Lema, MJ Gomez-Vives, JM Ortiz de Urbina & JM de la Serna. 2006. Some biological aspects of small tunas (*Euthynnus alletteratus*, *Sarda sarda* & *Auxis rochei*) from the south western Spanish Mediterranean traps. Collective Volume of Scientific Papers of International Commission for the Conservation of Atlantic Tunas 59: 579-589.
- Santos, M.N., Gaspar, M.B., Vasconcelos, P.V. and Monteiro, C.C. 2002. Weight-length relationship for 50 selected fish species of the Algarve coast (Southern Portugal). Fisheries Res., 9: 289-295.
- Teissier, G. 1948. Allometry relationships: Its statistical and biological significance. Biometrika 4: 14-18.
- Zar, JH. 1984. Biostatistical analysis, 718 pp. Prentice-Hall, Englewood Cliffs.

Table 1. Descriptive statistics and length-weight relationship parameters for three small tunas caught off the gulf of Gabes (southern Tunisia). N: sample size; L: fork length (cm); W: weight (kg); min: minimum; max: maximum; SD: standard deviation; SE: standard error; CI: confidence interval; *b*: slope; *t*: t-test; *S'*: significance.

Species	N	L mean $\pm$ SD (L min - L max)	W mean $\pm$ SD (W min - W max)	Equation	Determination coefficient (r^2)	SE of <i>b</i> (95% C.I. of <i>b</i>)	<i>t</i>	<i>S'</i>
<i>Euthynnus alletteratus</i>	295	51.63 $\pm$ 11.72 38 - 95.5	2.522 $\pm$ 2.234 0.825 - 11.8	$W = 0.029L^{2.839}$	0.979	0.024 (2.792 - 2.885)	6.630	+
<i>Sarda sarda</i>	114	41.23 $\pm$ 3.05 34 - 47.5	1.10 $\pm$ 0.24 0.475 - 1.615	$W = 8E-06L^{3.165}$	0.953	0.066 (3.035 - 3.296)	2.484	+
<i>Auxis rochei</i>	165	36.26 $\pm$ 2.99 31 - 44.5	0.917 $\pm$ 0.264 0.425 - 1.605	$W = 3E-06L^{3.491}$	0.893	0.094 (3.304 - 3.678)	5.187	+

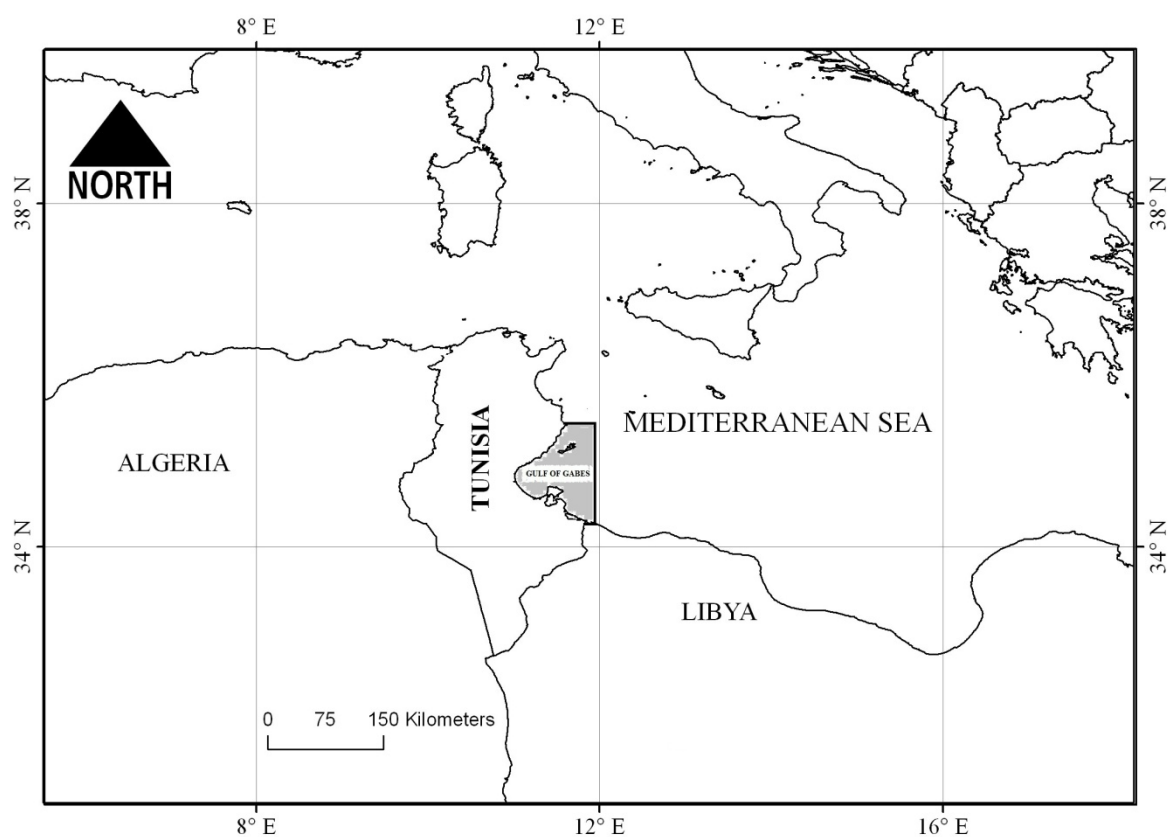


Figure 1. Map of the study area.

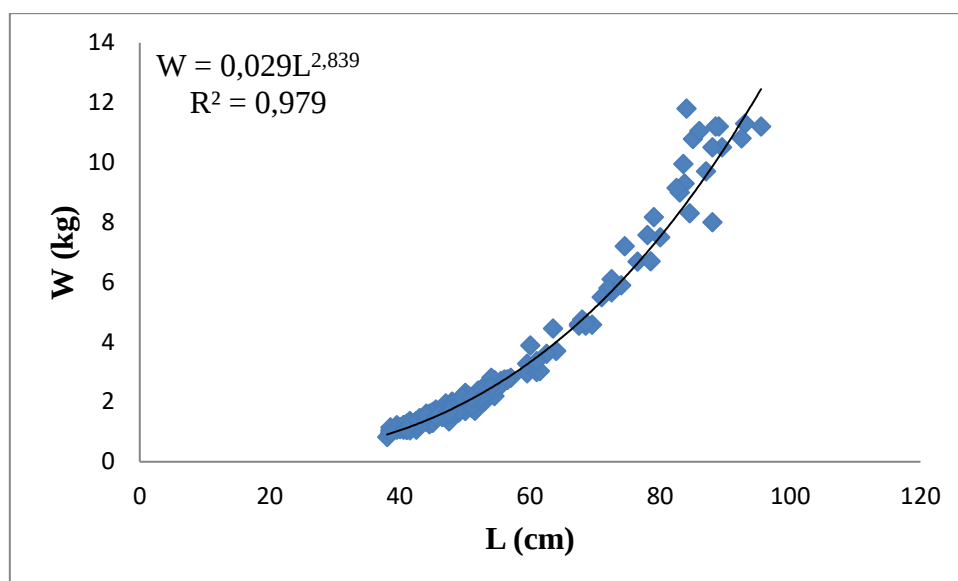


Figure 2. Relationship between fork length (L) with total weight (W) of *Euthynnus alletteratus* from the Gulf of Gabes.

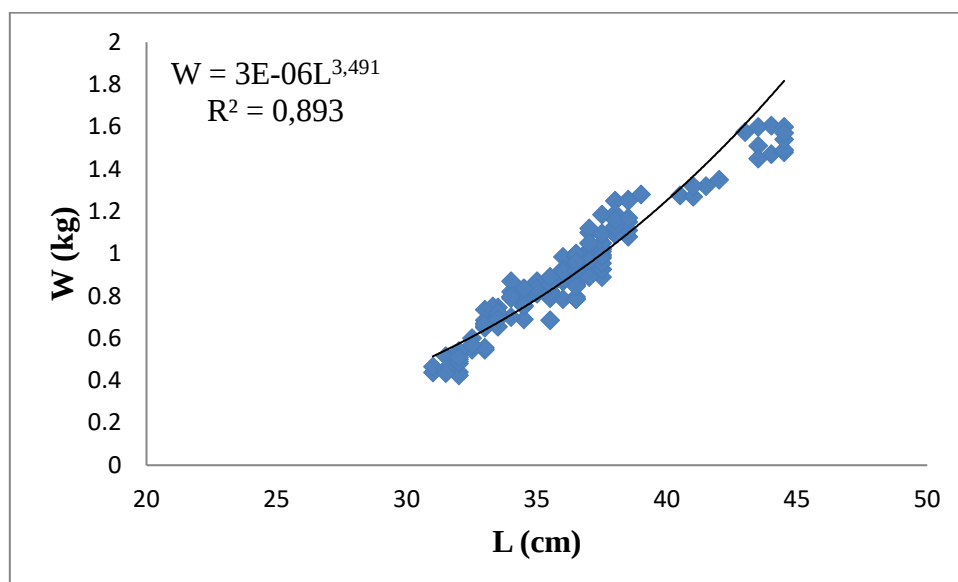


Figure 3. Relationship between fork length (L) with total weight (W) of *Auxis rochei* from the Gulf of Gabes.

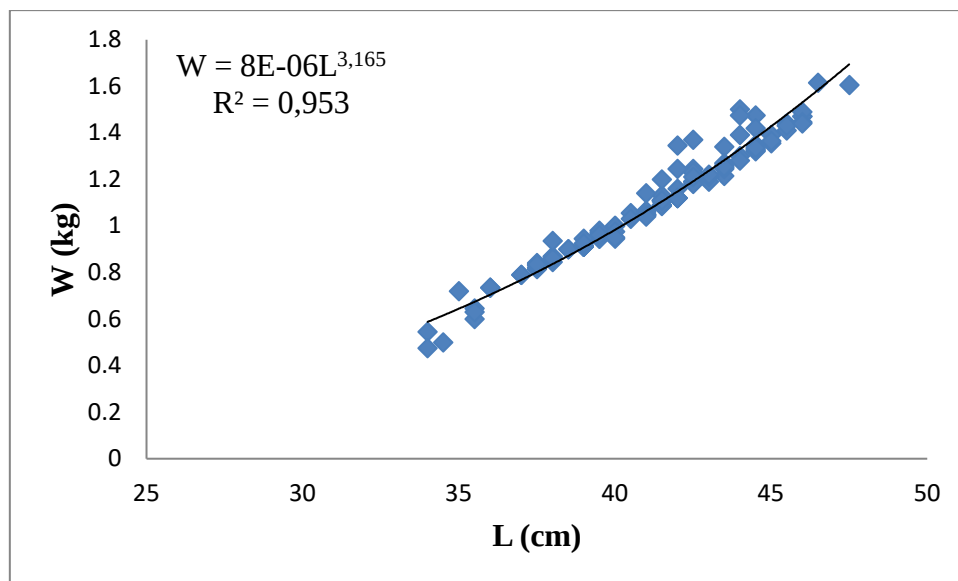


Figure 4. Relationship between fork length (L) with total weight (W) of *Sarda sarda* from the Gulf of Gabes.