Size distribution and biometric relationships of little tunny *Euthynnus alletteratus* from the Algerian coast

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ABSTRACT: *This study is taken from data of commercial fishing of the little tunny, Euthynnus alletteratus (Rafinesque, 1810) caught in the Algerian coast, sampled between november 2011 and april 2016. Data were collected in order to determine size distributions of the population and biometric relationships of species including the size - weight relationships. A total of 601 fish ranged from 30.9 and 103 cm fork length (FL) were observed. The size distribution of Euthynnus alletteratus shows multiple modal values witch the most important cohort corresponds to the age class 2 (42-46 cm). The value of the allometric coefficient (b) of the FL/TW relationship is lower than 3, indicating a negative allometric growth.*
Keywords: Little tunny, Euthynnus alletteratus, commercial fishing, Algerian coast, size distribution, biometric relationships.

I. INTRODUCTION

The little tunny, *Euthynnus alletteratus* (Rafinesque, 1810) a member of Scombrids, is species with medium size. It is considered as minor tuna which is more coastal than other species. It is an epipelagic coastal species, typically occurring in inshore waters of the Atlantic and Mediterranean [1], but also occasionally found in offshore waters.

The fork length (FL) and total weight (TW) values of *E. alletteratus* are generally observed to be 45-80 cm, and 2500-7000 g respectively. The maximum length is about 100 cm. [2]

In Algeria, this species is known by fishermen as the thonine, bacorete and small tuna. It has been commercially exploited by artisanal fisheries. It is captured by using different fishing gears, such as purse seine, trawls, longlines and driftgillnet. However, catch data declared by the fisheries administration (341 t for 2014) are far from reality, because tracking of small vessels, present many difficulties. A large number of small boats land their production mainly in the stranding beaches which are at present even unattainable sites for collecting agents. [3]

There are several studies of biological features of little tunny. For example, the studies of [4- 17], presented the biometric analysis, age, growth parameters, length and weight relationships and reproductive biology of *E. alletteratus*. However, in Algeria, only [18], worked on this species.
The standing Committee on Research and Statistics of the International Commission for the Conservation of Atlantic Tunas, encourage studies on stock structure and species distribution [19]. However, this study of little tuna cached in Algerian waters, is the beginning of a contribution to bring elements of information and complement other studies of small tuna caught in the Mediterranean Sea.

II. MATERIAL AND METHODS

Fish were collected from commercial catches from Algerian coast. A total of 601 little tunny, sampled between november 2011 and april 2016.
For each specimen, fork length (FL) and total length (TL) were measured to the nearest centimeter. Total weight (TW) and eviscerated weight (EW) were determined to the nearest 0.01 g for the small fish and to the nearest 0.1 g for the big fish.

The length frequency distributions of all samples were arranged in 4.0 cm intervals in order to get an idea about the structure of the population which is commercially exploited in the Algerian coast.

For the biometric study, observations on length and weight were used to obtain different relationships.

The relationship between total length and fork length were calculated according to the standard linear regression:

$$TL = b + a \, FL \qquad\qquad \text{[Eq.1]}$$

The relationship between total weight and eviscerated weight were calculated according to the standard linear regression:

$$TW = b + a \, EW \qquad\qquad \text{[Eq.2]}$$

The length-weight relationships were calculated according to the power function:

$$W = b \, L \, a \qquad\qquad \text{[Eq.3]}$$

Equation parameters were calculated using a logarithm transformation:

$$Ln \, (W) = Ln \, (a) + b \, Ln \, (L) \qquad\qquad \text{[Eq.4]}$$

For each relations: a, is the factor and b, is the allometric coefficient.

III. RESULTS AND DISCUSSION

1. Size distribution
Size distribution of Algerian little tuna caught by the artisanal fisheries, are summarized in [Figure 1].

The fork length (FL) and total weight (TW) values of *Euthynnus alleteratus* are observed to be 30.9-103 cm, and 415-22840 g respectively.
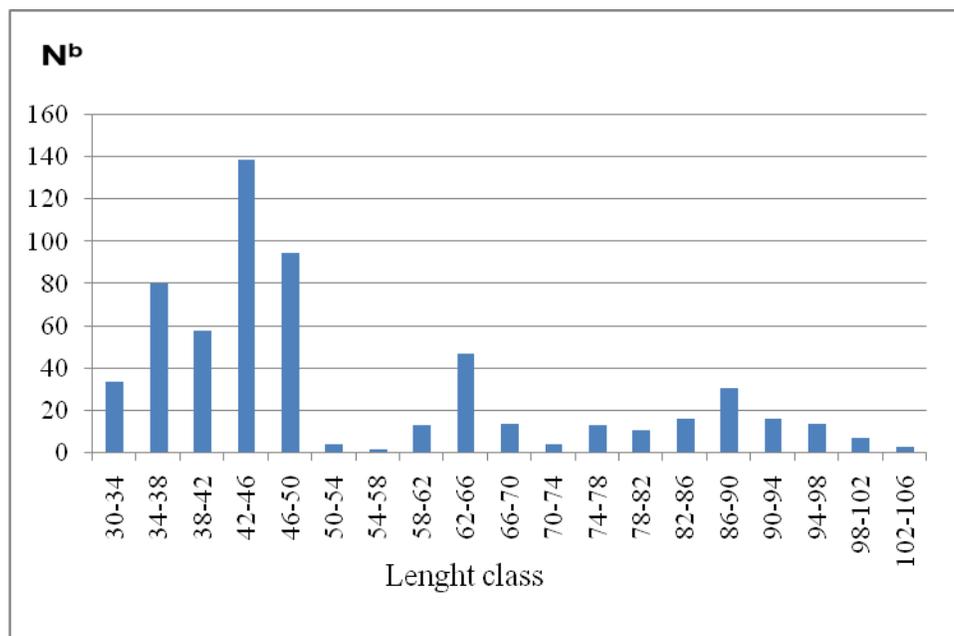

Figure 1. Size distribution of *Euthynnus alletteratus* caught by Algerian artisanal fisheries.

The size distribution of *E. alletteratus* shows multiple modal values. According to previous papers [6, 14, 20], the first mode around 34-38 cm corresponds to the age class 1. The following other modal values corresponds successively to the age classes 2 (42-46 cm), 3 (62-66 cm), 5 (74-78 cm) and 6 (86-90 cm). The most important cohort corresponds to the age class 2. Note that the sizes between 50 and 60 cm and higher than 100 cm are poorly represented.

2. Biometric relationships
In order to determine the relationship between TL and FL, TW and EW, FL and TW, FL and EW, TL and TW, TL and EW values, regression and correlation analyses were applied. The correlation coefficient (r) values calculated as to be around (1) indicate that all the relationships values show that a strong and positive relation was existent. All biometric relationships and correlation coefficient are summarized in [Table 1].
The estimated equations for linear regression relationships are shown in [Figure 2].The allometric coefficient value (b) indicates a negative allometry between TL and FL (0.485) and a positive allometry between TW and EW (7.459).
The estimated equations for power function relationships are shown in [Figure 3]. The exponent of the TL/EW, FL/TW and FL/EW relationships is lower than the 3 value (2.913, 2.914, 2.898 respectively) indicating a negative allometric growth. However, the exponent of the TL and TW relationships is not significantly different from 3 (3.056), indicating an isometric allometry.

Table 1. Biometric relationships of *Euthynnus alletteratus* from Algerian coast.

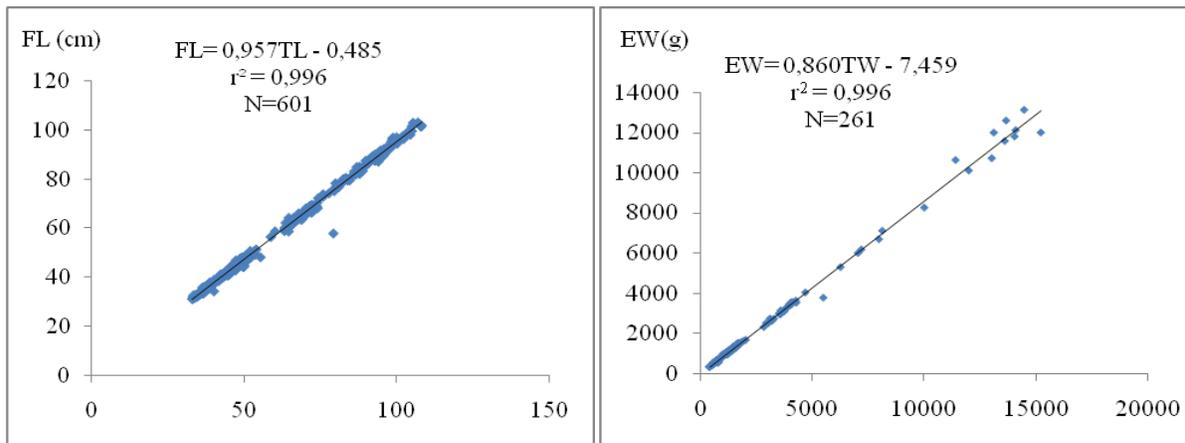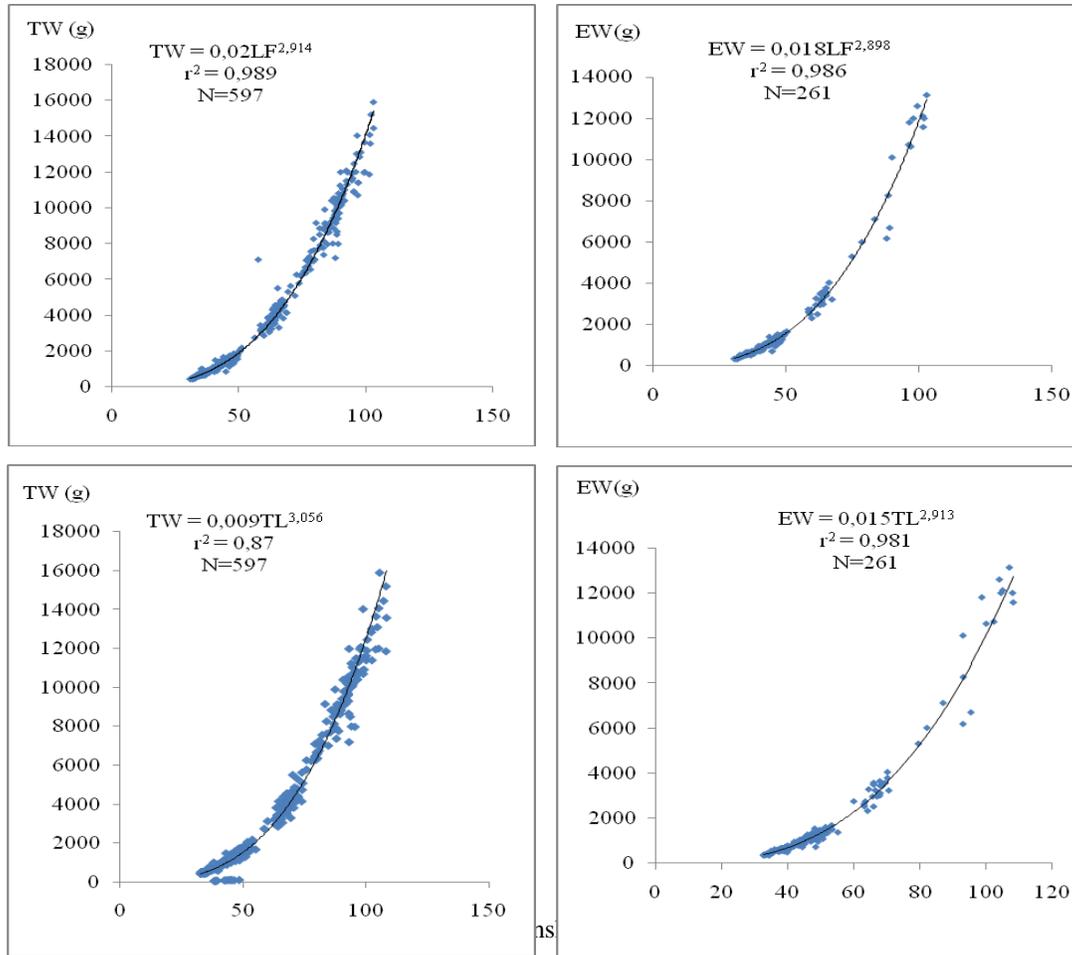| Relationship	Equation	r^2	Number
Total length (TL) and fork length (FL)	FL = 0,957 TL - 0,485	0,996	601
Total weight (TW) and eviscerated weight (EW)	EW = 0,860 TW - 7,459	0,996	261
Total length (TL) and total weight (TW)	TW = 0,009 $TL^{3,056}$	0,87	597
Total length (TL) and eviscerated weight (EW)	EW = 0,015 $TL^{2,913}$	0,981	261
Fork length (FL) and total weight (TW)	TW= 0,021 $FL^{2,914}$	0,989	597
Fork length (FL) and eviscerated weight (EW)	EW = 0,018 $FL^{2,898}$	0,986	261

Figure 2. Linear regression relationships for *Euthynnus alletteratus.*

The graphs show:

Top left: TW (g) vs fork length, $TW = 0{,}02LF^{2{,}914}$, $r^2 = 0{,}989$, $N = 597$

Top right: EW (g) vs length, $EW = 0{,}018LF^{2{,}898}$, $r^2 = 0{,}986$, $N = 261$

Bottom left: TW (g) vs total length, $TW = 0{,}009TL^{3{,}056}$, $r^2 = 0{,}87$, $N = 597$

Bottom right: EW (g) vs total length, $EW = 0{,}015TL^{2{,}913}$, $r^2 = 0{,}981$, $N = 261$

IV. CONCLUSION

In the end of this study, it is important to mention that the monitoring of catches of little tuna to reveal that is the most frequent species compared to other Scombridea species recorded in the Algerian basin.

Data from this study present the first report on demographic structure of little tunny in Algeria.

The minimum fork length value of *Euthynnus alleteratus* was measured as 30.9 cm. This value is lower than that observed by [6, 7, 8, 9, 10, 12, 21] and higher than that observed by [14, 15] in Mediterranean area. Also, the maximum fork length value of this species was measured as 103 cm. This size is higher than that observed by [6, 7, 8, 9, 10, 12, 15, 21] and lower than that observed in Tunisian waters [14].

The size distribution of *Euthynnus alletteratus* shows multiple modal values witch the most important cohort corresponds to the age class 2 (42-46 cm) [6, 14, 20]. The oldest exemplars found in catches were over 6 years old [6].

When comparing the fork length and total weight relationship parameters for *Euthynnus alletteratus* with the results of researches conducted on the same area and different regions of Mediterranean, it is observed that almost similar results were found [Table 2]. This may be attributed to the population growth characteristics special to Mediterranean Sea. [22]

Table 2. Different little tuna length-weight relationships published (FL: fork length, TW: total weight).

Reference	Area of study	Sex	FLmin-FLmax (cm)	Equation
Rodrigues-Roda, 1966	Western Méditerranean (Spain)	all	40-90	$TW= 0,00002218\ FL^{2,9149}$
Diouf, 1980	Senegal	all	20-90	$TW= 0,014\ FL^{3,035}$
Hattour, 1984	Tunisia	all	47,3 - 101,3	$TW= 0,016\ FL^{3}$
Kahraman, 2005	Eastern Méditerranean	all	58-83	$TW= 0,0001\ FL^{2,4683}$
Kahraman and *al*, 2008	Eastern Méditerranean	all	43-87	$TW= 0,0381\ FL^{2,77}$
Kahraman and Oray, 2001	Aegean Sea (Turkey)	all	55-85	$TW= 0,0000575\ FL^{2,697}$
Kahraman and Oray, 2001	Eastern Méditerranean (Turkey)	all	52-97	$TW= 0,0000476\ FL^{2,725}$
Macias and *al*, 2006	Western Méditerranean (Spain)	all	56-86	$TW= 0,044098\ FL^{2,7549}$
Gaykov and Bokhanov, 2008	Eastern Atlantic	all	38-63	$TW= 0,0153\ FL^{3,0085}$
Hattour, 2009	Tunisia	all	6,5 - 108	$TW= 0,00538\ FL^{3,264}$
Macias and *al*, 2009	Spain	all	-	$TW=1.6989E\text{-}05 * FL\ 2.966711$
Hajjej, 2009	Tunisia	all	19,2-97,8	$TW= 0,0207\ FL^{2,9264}$
This study	Algeria	all	30.9-103	$TW= 0,021\ FL^{2,914}$

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