



Original article

Study of Some Biological Parameters of Spotted Flounder *Citharus linguatula* (Linnaeus, 1758) fished in Mostaganem bay

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Abstract

Some biological parameters of Spotted Flounder *Citharus linguatula* (Linnaeus, 1758), fished in Mostaganem bay were described based on 144 fishes, that were collected between January, March and April 2015. The study of sex ratio, showed that the females (61.07%) were more numerous than males (38.93%). The total vertebral number of is ranged from 31 to 32. The length-weight relationship of *C. linguatula*, indicated a negative allometry ($b < 3$).

Keywords: *Citharus linguatula*, Mostaganem bay, sex ratio, relationships length-length and length-weight

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INTRODUCTION

Citharus linguatula is a flat fish pleuronectidae that belongs to the family Citharidae (Linnaeus, 1758), (Türker et al., 2005). This is a benthic species that inhabits soft bottoms from the coastline to about 450 m depth, but it is rarely caught at depths greater than 200 m. It feeds on small fishes and crustaceans (Redon et al., 1984; Fischer et al., 1987). In the Mediterranean Sea, it occurred along the entire Mediterranean Sea coast (Redon et al., 1994). Its external anatomy is characterized by the presence of lateral line on both sides, the eyes are only on the left side of the head and two spots on the caudal peduncle (Figure 1). The aim of the present study was to study some aspects of the biology of *Citharus linguatula* in Mostaganem waters, such as sex ratio, vertebral number, the relationship length-length and length-weight.

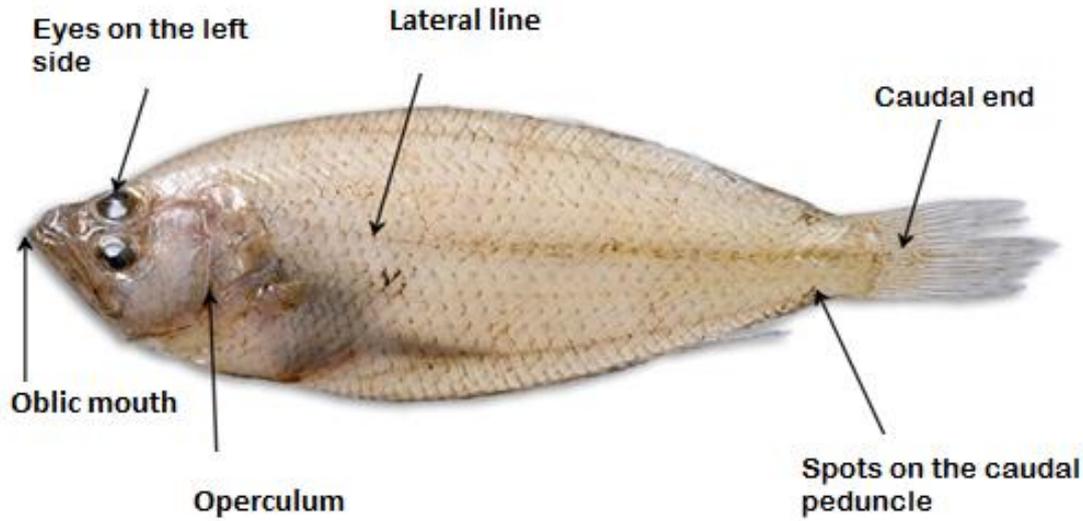


Figure 1. External anatomy of *C. linguatula*

Material and Methods

A total of 144 *C. linguatula*, were collected during the period from January to April 2015 from the commercial port of Mostaganem coast. The gulf of Mostaganem is located between Oran and Tenes (Figure 2). For each fish, a total length and standard length were measured to the nearest 1 mm. The total weight and sex was noted. The sex ratio was calculated according to the number of males to females. As recommended by FAO Fisheries Division, the vertebrae were counted by lens, from occipital condyle (not counted) to urostyle (included) (Dulcic, 2002).

The relationships between the total length and standard length have been established and represented by the equation: $Y = a + bx$. The coefficient of correlation (r) was calculated to know the degree of linear relationship between the two variables.

The length-weight relationships were determined according to the equation: $WT = aLT^b$, where: WT is the total body weight (g), LT - total length (cm), a is constant and b is length exponent. The “a”, “b” and “r” values were calculated from linear regression of the fish length and weight measurements, which was expressed as: $\text{Log } W = \text{Log } a + b \text{ Log } L_t$. The relation is isometric when $b = 3$, if $b < 3$, the allometry is positive, and when $b > 3$, the allometry is negative. Significant differences were tested by means of chi-squared test.



Figure 2. Localization of the gulf of Mostaganem

Results and Discussion

In the studied sample, the total length varied from 8.5 to 23.5 cm. The difference between the average size of females (14.94 cm) and males (14.22 cm) was significant ($\epsilon > 1.96$) (Table1).

Table 1. Comparison between the lengths of females and males of *C. linguatula*.

Item	♀	♂
Number	84	60
$L_{T \text{ min}}$ (cm)	8.5	10.7
$L_{T \text{ max}}$ (cm)	21.2	23.5
$L_{T \text{ average}}$ (cm)	14.94	14.22
Difference	$\epsilon=2.05$ significant	

The minimum lengths were 8.7 cm for the females and 10.7 cm for the males whereas the maximum was 21.2 cm for the females and 23.5 cm for the males. The length-frequency distribution throughout the study period showed a preponderance total length of 14 cm for males and 16 cm for females (Figure. 3).

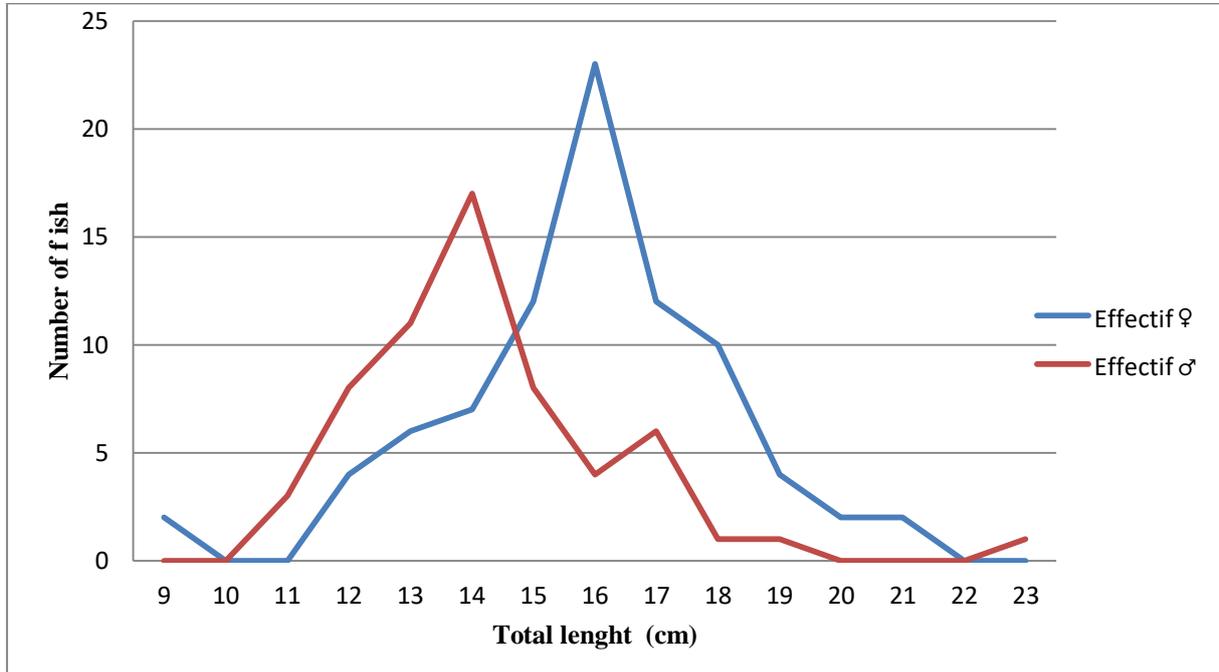


Figure 3. Length- frequency distribution of of *C. linguatula*

The total weight varied between 6.25 g and 81.97 g for females and between 9.1 g and 99.38 g for males (Table 2). The maximum size and weight of *C. linguatula* reported in Turkey by Bayhan (2009) is 23.20 cm and 107.80 g, respectively.

Table 2. Comparison between the weights of males and females of *C. linguatula*.

Item	♀	♂
Number	84	60
Weight min (g)	6.25	9.1
Weight_{max} (g)	81.97	99.38
Weight_{average}(g)	31.66	23.09
Difference	$\varepsilon = 11.9$ significant	

144 individuals of *C. linguatula* were sampled and were divided into 60 males and 84 females. Sex ratio for *C. linguatula*, showed a tendency for a major number of females (61.07 ± 3.20) than males (38.93 ± 3.20). The difference between the two sexes was significant (Table 3).

Table 3. Sex ratio of *C. linguatula*

Item	<i>C. linguatula</i>
Number ♀	84
Number ♂	60
% ♀±e	61.07±3.20
% ♂ ±e	38.93±3.20
ε (5%)	6.62
Difference	significant

On the Algerian coasts, the numerical dominance of *C. linguatula* females has been confirmed in the work of Bedda and Boufersaoui (2009), however, on the Turkish coasts, Bayhan (2009) found that the masculinity rate is 57%.

The total vertebral number of *C. linguatula* from the Mostaganem area ranged from 31 to 32 (mean value =31.7±1.73). Similar values were noted for other pleuronectidae family, we note between 30 and 33 vertebrae for *Limanda ferruginea*, and between 34 and 38 vertebrae for *Pleuronecte sputnami* (Hensley and Ahlstrom, 1984) and (Cooper and Chapleau, 1998). Some authors have demonstrated that environmental conditions during embryogenesis will influence the number of vertebrae (Boëly et al., 1982).

According to Moutopoulos and Stergiou (2002), the relationships length - length is important in fisheries management for comparative growth studies. In this study the regression equations, between total length and standard length, is as follows: $L_t = 1,1551 L_s - 0,1549$. The value for correlation coefficient (r) was 0.98, indicating a strong positive linear correlation between the two variables: total length and standard length. The variation of the relationship length - length in the same species from different locations was due to the ecological conditions of the habits or variation in the physiology of animals, or both, are responsible (Le Cren, 1951).

The length-weight relationship of *C. linguatula*, indicating a negative allometry ($b < 3$), was found out to be $W_T = 0,001 L_T^{2,85}$. The degree of association between the two variables length and weight, is expressed by a correlation coefficient (r). The correlation coefficient is higher when its value is close to 1. The coefficient estimated in this study was 0.99.

Conclusions

The present study provides some useful information about the biological parameters of Spotted Flounder *Citharus linguatula* (Linnaeus, 1758) fished in Mostaganem bay. The data concerning the sex ratio, vertebral number, the relationship length-length and length weight will help in devising strategies for managing the fishery of the particular resource at a healthy and sustainable level.

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