

Length-Weight Relationship of Two Puffer Fishes, *Lagocephalus sceleratus* and *Lagocephalus spadiceus*, From Iskenderun Bay, Northeastern Mediterranean, Turkey

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Abstract.- In recent years, a noticeable increase in the population of puffer fish in the Northeastern Mediterranean has been reported by the fishermen in the region. But there are no any studies on these fishes in term of fisheries management. This study is to determine the length-weight relationships of *Lagocephalus sceleratus* and *Lagocephalus spadiceus* captured by commercial bottom trawlers using trawl nets at 24 and 50 meter depths and gill nets at depths approximately 8 to 20 meters in the northeastern Mediterranean Sea. The exponent b values were 2.6733 for male and 2.7183 for female of *L. spadiceus*, and 2.6446 for male and 2.915 for female of *L. sceleratus*. The types of growth for both sexes was negative allometric growth for *L. spadiceus*, but an indicated isometric growth for females and negative allometric growth for males of *L. sceleratus*. This study also provides a maximum total length of 37.4 cm for *L. spadiceus*.

Key words: *Lagocephalus sceleratus*, *Lagocephalus spadiceus*, Length-weight relationships, pufferfish, Eastern Mediterranean

INTRODUCTION

The pufferfish that belongs to the Tetraodontidae family consists of approximately 120 species, of which seven are found in the Mediterranean Sea. Six are in this area of which four are Lessepsian migrants (Golani *et al.*, 2006; Sabrah *et al.*, 2006). With the opening of the Suez Canal, the puffer fish quickly spread into the Mediterranean and the Sea of Marmara. The natural range of Indo-Pacific fish species, especially *Lagocephalus sceleratus* and *Lagocephalus spadiceus*, has dramatically increased in the last decade and has spread along the coast of the Aegean Sea (Basusta and Erdem, 2000; Golani and Levy, 2005; Corsini *et al.*, 2006; Kasapidis *et al.*, 2007; Katsanevakis *et al.*, 2009; Jribi and Bradai, 2012). For the first time these species have spread to a wide area in the seas around Turkey since first being noted in the early 2000s (Akyol *et al.*, 2005; Bilecenoglu *et al.*, 2002). Some of these fishes are known to produce a virulent neurotoxic substance called tetrodotoxin. Although these fish are highly

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toxic, they are consumed in some countries (Sabrah *et al.*, 2006; Bilecenoglu *et al.*, 2006; Sirisha and Rao, 2007; Kasapidis *et al.*, 2007; Bentur *et al.*, 2008; Katsanevakis *et al.*, 2009; Aydın, 2011). There is very limited information about puffer fish at the present time, including the systematic, zoogeography and growth in this area. This study is to determine the length-weight relationships of *Lagocephalus sceleratus* and *Lagocephalus spadiceus* from the northeastern Mediterranean Sea.

MATERIAL AND METHODS

The Puffer Fish were captured by commercial bottom trawlers using purse seine nets at 24 and 50 meter depths and gill nets at approximate depths from 8 to 20 meters in the northeastern Mediterranean Sea (36°37' 830" E, 35°38' 520" N; 36° 33'717" E, 35° 34'872" N; 36° 33'360" E, 35° 34'154" N; 36° 30'946" E, 35° 21'385" N) between September 2011 and March 2012. The trawler was equipped with 44 mm stretched mesh size nets at the cod-end. Trawling lasted 2 hours and the trawling speed was 2.5 knots. Samples were transported to the laboratory where the total weights and total lengths were recorded to within 0.01g and to 0.1mm.

All total lengths and weights were fitted to

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0030-9923/2013/0004-1047 \$ 8.00/0

the length-weight equation: $W=aL^b$, by using least

Table I.- Length-weight relationships for two puffer fish, northeastern Mediterranean

Species	Sex	n	Total length range (cm)	Weight range (g)	LWR*	R ²	Type of growth (b=3, P=0.05)
<i>Lagocephalus sceleratus</i>	M	49	8.9-78.4	7.59-4750	$W = 0.0381TL^{2.6446}$	0.9392	-(A)*
	F	28	15.4-52.3	37.04-1324	$W = 0.0138TL^{2.915}$	0.9730	I*
<i>Lagocephalus spadiceus</i>	M	574	6.8-37.4	4.38-695.97	$W = 0.0388TL^{2.6735}$	0.8557	-(A)
	F	515	10.6-43.1	19.05-1144	$W = 0.0343TL^{2.7183}$	0.8725	-(A)

I*: Isometric growth;-(A)*: Negative allometric growth; LWR*: Length-Weight Relationship

Table II.- Maximum size, weight ranges and b values of puffer fish as reported.

Species	Sex	n	Total length range (cm)	Weight range (g)	b	R ²	References
<i>Lagocephalus spadiceus</i>	M+F	19	15.9-19.9	-	2.951	0.97	Taskavak and Bilecenoglu, 2001
<i>Lagocephalus sceleratus</i>	M+F	176	18.5-78.5	82.9-5100	2.8676	0.9835	Sabrah <i>et al.</i> , 2006
<i>Lagocephalus sceleratus</i>	M+F	665	6.0-77.0	3.0-5600	3.018	-	Michailidis, 2010
<i>Lagocephalus sceleratus</i>	M	336	12.5-65.0	22.8-3463	2.974	0.994	Aydin, 2011
	F	320	13.5-63.0	29-3465	2.984	0.994	Aydin, 2011

square methods with Statistica software. In the length-weight equation a and b are intercept and the slope (=exponent) of the length-weight curve, respectively (King, 1995; Can *et al.*, 2002; Basusta and Cicek, 2006; Erguden *et al.*, 2011; Basusta *et al.*, 2012; Turker-Cakir *et al.*, 2008; Koc *et al.*, 2008; Mahmood *et al.*, 2012).

The b value for these species were tested by a t -test at the 0.05 significance level to verify if it was significantly different from 3.

RESULTS

A total of 77 specimens of *L. sceleratus* and 1089 specimens of *L. spadiceus* were collected during the study (Table I). Fish species were identified according to Golani *et al.* (2006). The estimated parameters of the length-weight relationships and length characteristics (number of fish (n), size range and weight range), the coefficient of determination (R²) and type of growth are given in Table I.

The captured *L. spadiceus* was 37.4 cm in total length and 695.97g in weight. This species is the most abundant species and also has the maximum length registered so far. Maximum total

length and maximum weight of *L. sceleratus* were 78.4cm and 4750g respectively in this study (Table I).

The results showed that the exponent b values were 2.6733 for males and 2.7183 for females of *L. spadiceus* (Fig. 1), and 2.6446 for males and 2.915 for females of *L. sceleratus* (Fig. 2).

The type of growth for both sexes was negative allometric growth ($b<3$) for *L. spadiceus*, but indicated isometric growth ($b=3$) for females and negative allometric growth ($b<3$) for males of *L. sceleratus*. No significant differences ($P>0.05$) were found between males and females of any sampled species, thus sexes were combined for all species specific length-weight analyses.

DISCUSSION

There have been studies on the length-weight relationships for the puffer fish (Taskavak and Bilecenoglu, 2001; Sabrah *et al.*, 2006; Michailidis, 2010; Aydin, 2011). There are studies proving b values of these species (Table II). The maximum observed total length of *L. sceleratus* (78.4 cm) is well below the 110 cm recorded in Japan by Masuda *et al.* (1984). But almost the same length (78.5cm)

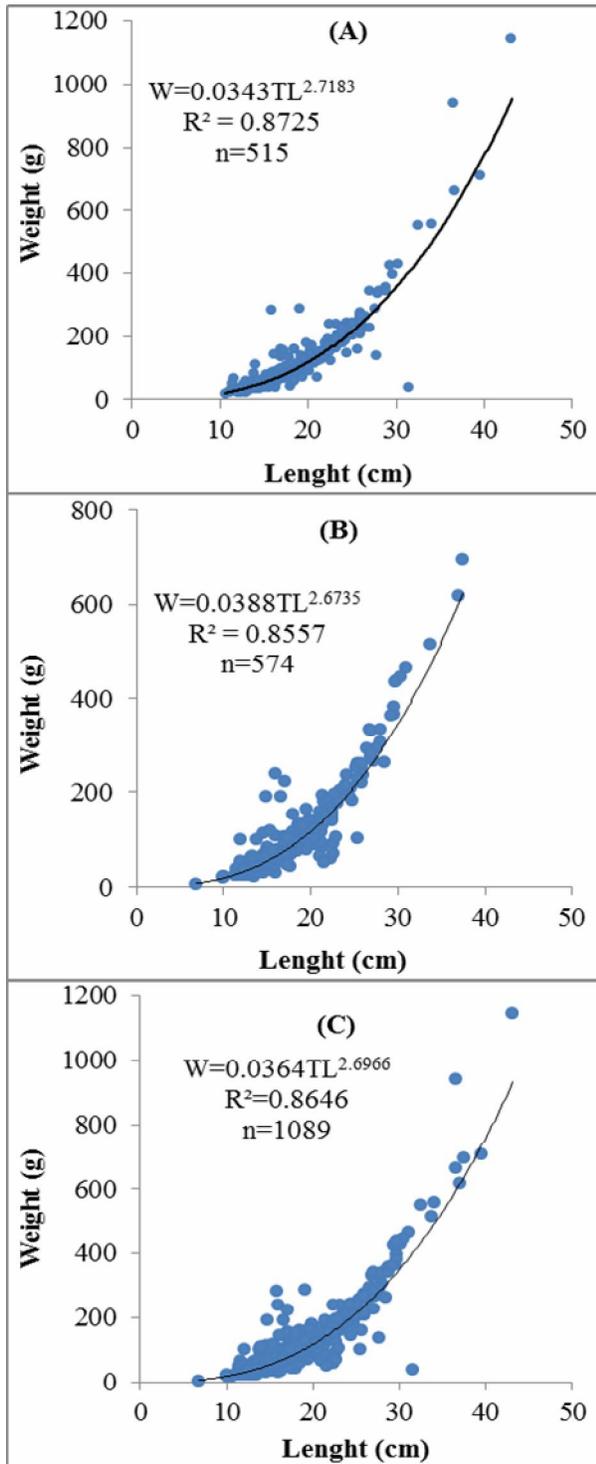


Fig. 1. Length-weight relationships for *L. spadiceus*; A, female; B, male; C, all individuals.

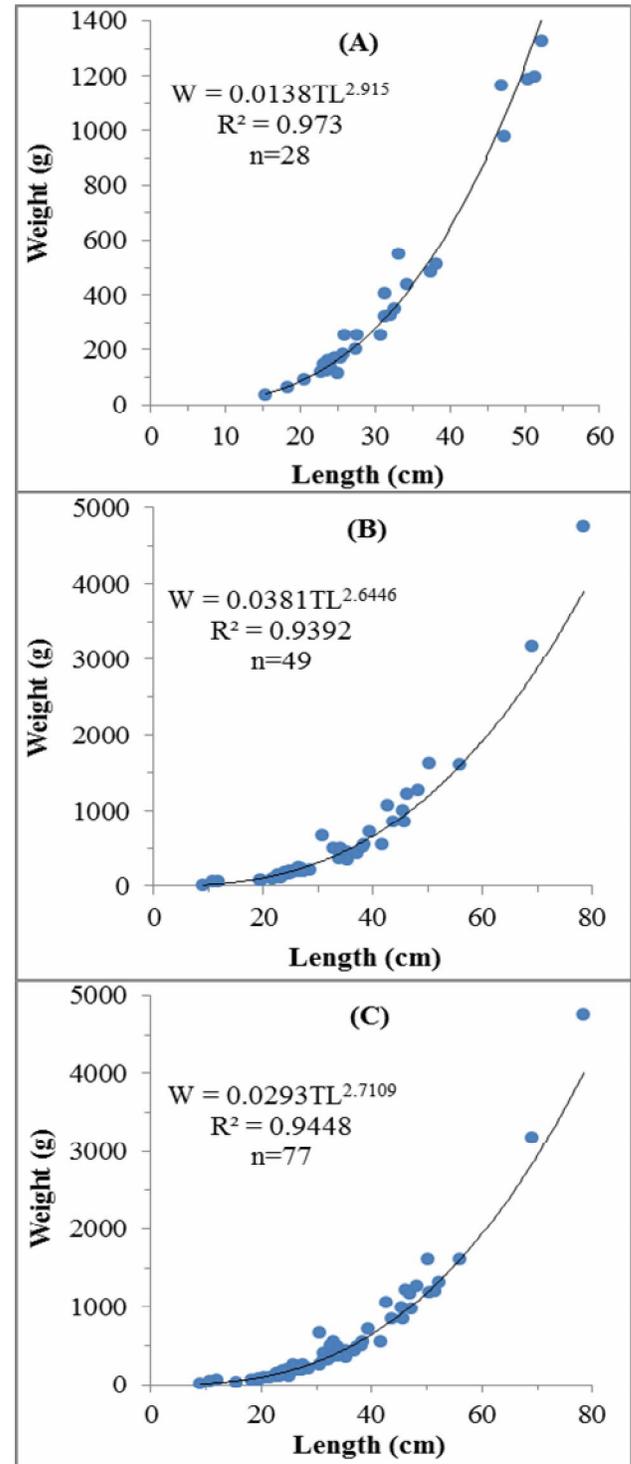


Fig. 2. Length-weight relationships for *L. scleleratus*; A, female; B, male; C, all individuals.

was found in the Suez Canal by Sabrah *et al.* (2006) and 71.5 cm in New Caledonia by Letourneur *et al.* (1998).

Although the previous maximum length was recorded as 28.7cm by Sirisha and Rao, (2007), this study showed the maximum length as 37.4 cm total length (TL) for *L. spadiceus*.

As shown in Table II, the *b* values have changed between the isometric and negative allometric growth for these species. In this study the data did not represent a total year. Therefore these calculated parameters should be considered to represent only a particular season or time of the year. According to Bagenal and Tesch (1978) *b* parameters generally do not vary significantly throughout the year unlike parameter *a* that may vary seasonally, daily and in different habitats (Can *et al.*, 2002). Over the last ten years the puffer fish has spread and reproduced quickly in the Mediterranean Sea. There is no current information about the landing and effects to the Mediterranean ecosystems at this time. Information on the kind of growth of each species is provided, as well as the type of the fishing gear that caught it. The present study provides baseline information on length-weight relationships for puffer fishes. These findings will be useful for researchers and fishery managers in future.

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