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SHORT COMMUNICATION

A study on morphometric characteristics of otolith for a new maximum length record of the bluefish (*Pomatomus saltatrix*, Linneaus 1766) in the Sea of Marmara

Habib Bal[1*], Telat Yanık[2], Dilek Türker[3]

[1] Livestock Research Institute, Department of Fisheries, Bandırma, Balıkesir, TURKEY
[2] Department of Aquaculture, Fisheries Faculty, University of Atatürk, Erzurum, TURKEY
[3] Department of Biology, Faculty of Science and Arts, University of Balıkesir, Balıkesir, TURKEY

***Corresponding author:** habipbal@hotmail.com

Abstract

This study reports a third maximum length record for bluefish *Pomatomus saltatrix* (Linnaeus, 1766) for the Turkish water. The *P. saltatrix* specimen was captured in the Biga Peninsula in the southwestern Sea of Marmara. Its length was 73.4 cm and weight was 3600 g. The age was determined by the otolith as 6 years old. This is the first study to examine otolith of such a large specimen in Turkey.

Keywords: Bluefish, *Pomatomus saltatrix*, maximum length, Sea of Marmara

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Maximum length, weight and age are important theoretical parameters, in fisheries science. Directly or indirectly, these measurements are applied to most of the models used in stock assessment. In this sense, updating the maximum size of a species that might be commercially or recreationally exploited in the future gains importance (Dulcic and Soldo 2005).

The bluefish *Pomatomus saltatrix* (Linnaeus, 1766) is a migratory species, occurring in temperate and warm temperate zones throughout the world and are generally found in continental shelf waters (Briggs 1960).

On 10 May 2014, one specimen of the bluefish with 73.4 cm in total length (TL) and 3600.0 g in total weight (TW) was captured with hand lines in Biga Peninsula, Sea of Marmara. It was measured in total length, weighed, sexed and assigned a maturity stage based on macroscopic examination of gonads. Maturation stage

was classified as immature (I), resting (II), ripe (III), ripe and running (IV) and spent (V) (Holden and Raitt 1974). Sagittal otoliths were removed for age and some morphological characters determined. Otoliths were wiped clean, and stored dry in U-plates, and then were placed in glycerol and were examined under reflected light using a trio-ocular microscope (Leica M125). Between an opaque zone and hyaline zone was assumed to be an age mark (Salerno *et al*. 2001). Additionally otolith morphometric were investigated (by Leica application suite). The shape parameters, otolith length (OL, mm) and otolith width (OWI, mm) were measured in the otoliths using image processing systems. Otolith length was defined as the greatest distance between anterior and posterior edge, otolith width was described as the greatest distance from dorsal to the ventral edge (Figure 1). Furthermore, the otolith weight was measured with a sensitivity of 0.001 g.

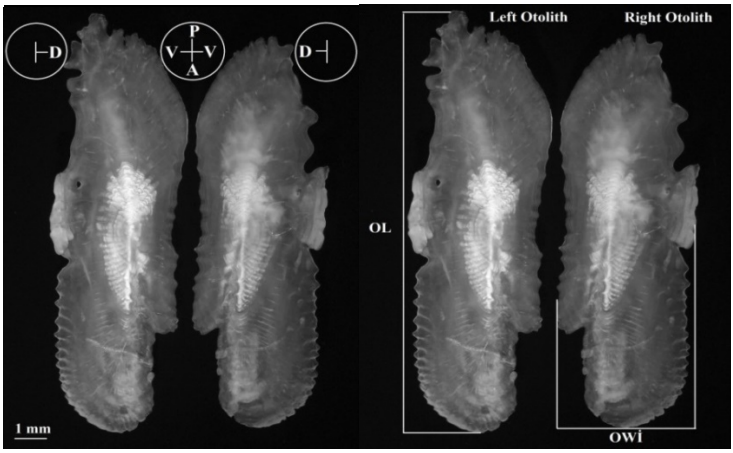

Figure 1. Sagittal otoliths of the examined *P. saltatrix* specimen (OL: Otolith length; OWI: Otolith width; D: Dorsal; V: Ventral; A: Anterior; P: Posterior)

Diagnostic characteristics were: First dorsal fin rays VIII, second dorsal fin rays I+25, anal fin rays II+25, pectoral fin rays 17, ventral fin rays I+5, Line lateral 105, Head length (HL) 21.5 %, pre-dorsal length 30.7 %, pre-anal length 54.5 %, maximum body depth 19.32 %, all to TL. Eye diameter 20.9 % to HL. All determined measurements, counts, and color patterns are in accordance with the descriptions of Golani *et al.* (2006). The age of the fish was determined as 6 years old as a result of age determination made from sagittal otoliths. Other morphological characteristics of the specimen are shown in Table 1.

Table 1. Some biological properties and measurements of the bluefish specimen

TL(cm)	W (g)	Age	Sex	MS	OW (g)	OL (mm)	OWI (mm)
73.4	3600	6	Male	IV	0.242	24.66	7.25

*TL: Total fish length; W: Fish body weight; MS: Maturity stage; OW: Otolith weight; OL: Otolith length; OWI: Otolith width

Bluefish is a fish species of great commercial value in all Turkish Seas. This species is caught with gillnets, purse-seiner and hand lines (Ceyhan *et al.* 2007). Length of bluefish is usually reported as 22 cm (Golani *et al.* 2006). However, this species can growth up to 120 cm in length. There are various studies providing information about maximum lengths of the species in other localities. Fowler (1936) reported the maximum length for bluefish off West Africa at 116 cm and Smith (1949) reported length over 4 feet (greater than 120 cm) off South Africa (Salerno *et al*. 2001). In addition, various studies have reported the age of the bluefish, such as 11 by Terceiro and Ross (1993), 12 by Chiarella and Conover (1990), 14 by Wilk (1977). It is thought that the maximum size of the bluefish is related to the environmental conditions. Such as nutrient availability, predators and other environmental factors (pollutants, salinity, and temperature). The maximum lengths (L_{max}) of the bluefish in the other studies are shown in Figure 2 and Table 2.

In this study, we reported a specimen with the length of 73.4 cm and weight 3600 g at the age of 6 years. There are a limited number of studies with a maximum length record for Turkish waters, because recent studies show that their stocks have declined due to fishing pressure (Özdemir *et al.* 2009; Cengiz *et al.* 2013). The maximum length of the bluefish for Turkish waters, however, is 86.0 cm (Türgan 1959) followed by 76.5 cm (Cengiz 2014). The present study presents the third maximum length. This is also the first study to examine otolith of such a large specimen in Turkey. Therefore it may be necessary and important for the management of fisheries in the region.

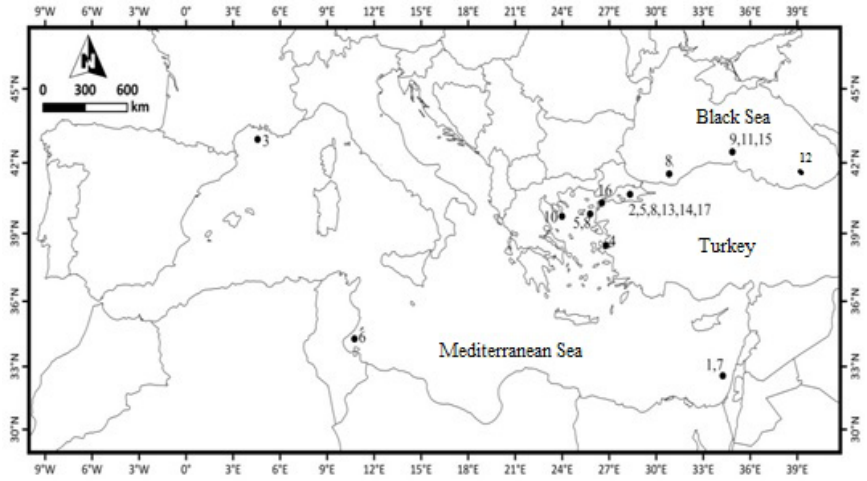

Figure 2. Locations where previous studies reporting maximum size of the bluefish in the Mediterranean and Black Seas (See Table 2 for numbers indicated in the map.)

Table 2. The comparison of the maximum length and weight of the bluefish

References	Location	Record date	n	Length type	L_{max} (cm)	W_{max} (g)
Ben Tuvia 1953 (1)	Israel Coast	1951-1953	-	TL	29.0	-
Türgan 1959 (2)	Sea of Marmara	-	2297	-	86.0	-
Tortonese 1986 (3)	Mediterranean Sea	1985-1986	-	TL	110.0	-
Alpbaz and Kınacıgil 1988 (4)	İzmir Bay	-	400	-	40.5	470.0
Ceyhan 2005 (14)	Sea of Marmara	-	2817	-	45.3	996.7
Dhieb *et al*. 2006 (6)	Gulf of Gabes (Tunisia)	1999-2003	577	TL	34.5	-
Golani *et al*. 2006 (7)	Eastern Mediterranean Sea	-	-	TL	80.0	-
Ceyhan *et al*. 2007 (5,8)	Northern Aegean Sea, Western Black Sea and Sea of Marmara	Jan 2003 Dec 2004	1114	FL	34.2	458.4
Kalaycı *et al*. 2007 (9)	Middle Black Sea	Nov 2004 Apr 2005	143	TL	21.7	88.1
Karachle and Konstantinos 2008 (10)	North Aegean Sea (Greece)	June 2001 Jan 2006	6	TL	18.5	-
Özdemir *et al*. 2009 (11)	Middle Black Sea	Oct-Nov 2005-2006	1049	TL	23.4	135.5
Ak *et al*. 2009 (12)	Eastern Black Sea	Jan-Dec 2007	14	TL	22.2	131.0
Bök *et al*. 2011 (13)	Sea of Marmara	Nov 2006 Mar 2007	290	TL	24.0	107.6
Demirel and Dalkara 2012 (17)	Sea of Marmara	Dec 2009 Feb 2011	17	TL	18.5	-
Kasapoğlu and Düzgüneş 2013 (15)	Black Sea	-	25	-	20.2	75.1
Cengiz *et al*. 2013 (16)	Gallipoli Peninsula & Dardanelles	Nov 2008 Dec 2009	673	TL	61.2	1980.0
Cengiz 2014 (16)	Gallipoli Peninsula & Dardanelles	Sep 2013	1	TL	76.5	4800.0
This study	Sea of Marmara	May 2014	1303	TL	73.4	3600.0

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Marmara Denizi' nde lüferin (*Pomatomus saltatrix*, Linneaus 1766) yeni bir maksimum boy kaydına ait otolitlerin morfometrik özellikleri üzerine bir çalışma

Öz

Bu çalışma, Türk denizleri için Lüfer'in *Pomatomus saltatrix* (Linnaeus, 1766) üçüncü maksimum boy kaydını vermektedir. *P. saltatrix* örneği, güneybatı Marmara Denizi'ndeki Biga Yarımadası açıklarında avlanmıştır. 73.4 cm boyunda ve 3600 g ağırlığında olan örneğin otolitinden yapılan yaş incelemesi ile 6 yaşında olduğu tespit edilmiştir. Bu çalışma, Türkiye'de bu büyüklükte bir örneğin otolitini inceleyen ilk çalışmadır.

Anahtar kelimeler: Bluefish, *Pomatomus saltatrix*, maksimum boy, Marmara Denizi

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