

**A New Maximum Length of the *Spicara flexuosa* Rafinesque (1810) in the Coastal Waters of the Turkey**

**Türkiye Kıyı Sularında *Spicara flexuosa* Rafinesque (1810) için Yeni Bir Maksimum Uzunluk Kaydı**

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**ABSTRACT**

A five years old male individual of *Spicara flexuosa* was captured by trammel nets on February 13, 2021, at 15 m depths from Black Sea region. The total length and weight were measured as 235 mm and 144.06 g. This specimen is the largest that has been reported in coastal waters of the Turkey. Some morphometric aspects of the sampled picarel were also measured. The otolith weight was determined as 0.0563 g. Otolith length and width were measured as 8044.31 µm and 4596.48 µm, respectively. Further studies the abundance and distribution of *S. flexuosa* should be conducted in the Black Sea.

**Keywords:** Maximum size, Centranchidae, Picarel, Morphology, Turkey

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## ÖZET

Karadeniz'de 13 Şubat 2021'de beş yaşında erkek *Spicara flexuosa* bireyi 15 m derinlikte fanyalı ağlarla yakalandı. Bireyin toplam uzunluğu 235 mm ve ağırlığı 144.06 g olarak ölçüldü. Bu birey Türkiye'nin kıyı sularında bildirilen en büyük örnektir. Ayrıca, bireyin bazı morfometrik ölçümleri de belirlendi. Otolit ağırlığı 0.0563 g olarak belirlendi. Otolit uzunluğu ve genişliği sırasıyla 8044.31 µm ve 4596.48 µm olarak ölçüldü. Karadeniz'de *S. flexuosa* bolluğu ve dağılımı daha fazla çalışmalar yapılmalıdır.

**Anahtar sözcükler:** Maksimum boy, Centracanthidae, İzmarit, Morfoloji, Türkiye

**Kısa başlık:** *Spicara flexuosa*'nın yeni maksimum boyu

### 1. INTRODUCTION

The picarel, *Spicara flexuosa* Rafinesque (1810) is a demersal fish species and found in the Canaries, Atlantic, Black Sea and Mediterranean (Tortonese, 1986). Species begins his life as a female and later changing into a male, so it is a protogynous hermaphrodite (İşmen, 1995). Imsiridou et al. (2011) indicated that there is a clear discrimination between the two species, as all the individuals of *S. flexuosa* revealed the same 16S rDNA haplotype while the *S. maena* haplotype differs in 15 distinct nucleotides. In another study conducted recently and in which up-to-date genetic analysis of the species was made, it was stated that all of the picarels living in the Black Sea coast are *S. flexuosa*, and the other two species (*S. maena* and *S. smarís*) do not enter the Black Sea, probably due to their salinity tolerance (Bektaş et al., 2018). In the light of the mentioned study, it is thought that the fishes studied in Şahin and Genç (1999) and İşmen (1995), which were previously conducted in the Black Sea, were *S. flexuosa* instead of *S. smarís*. Information about length and weight of a fish species is useful in fisheries and ecological studies (Richter et al., 2000; Hossain et al., 2015). Maximum size parameters are essential for marine science (Dulčić and Soldo, 2005). These measurements benefit for stock assessments directly or indirectly (Borges, 2001). Therefore, it is necessary to update the maximum length information of important species (Dulčić and Soldo, 2006; Navarro et al., 2012). Some studies were carried out on fisheries, biology, growth, genetic,

morphological characterization (İşmen, 1995; Çiçek et al., 2007; Karakulak and Erk, 2008; Altınağaç et al., 2009; Soykan et al., 2010; Saygılı et al., 2016; Cengiz, 2019; Sever, 2019) and length-weight relationship (Karakulak et al., 2006; İşmen et al., 2007; Demirel and Murat Dalkara, 2012; Bilge et al., 2014; Özvarol, 2014; Altın et al., 2015; Daban et al., 2020) of picarels in coastal waters of Turkey. Lastly, Dalgıç et al. (2021) reported the maximum size as 21.8 cm for the *S. flexuosa* in the eastern Black Sea coasts of Turkey. We reported the maximum size of *S. flexuosa* (including all picarel species) in Turkish coastal waters in this study. This paper also aims to emphasize the fauna changes (new occurrences, geographical records and maximum size records) of the Black Sea in the last decade.

### 2. MATERIALS AND METHODS

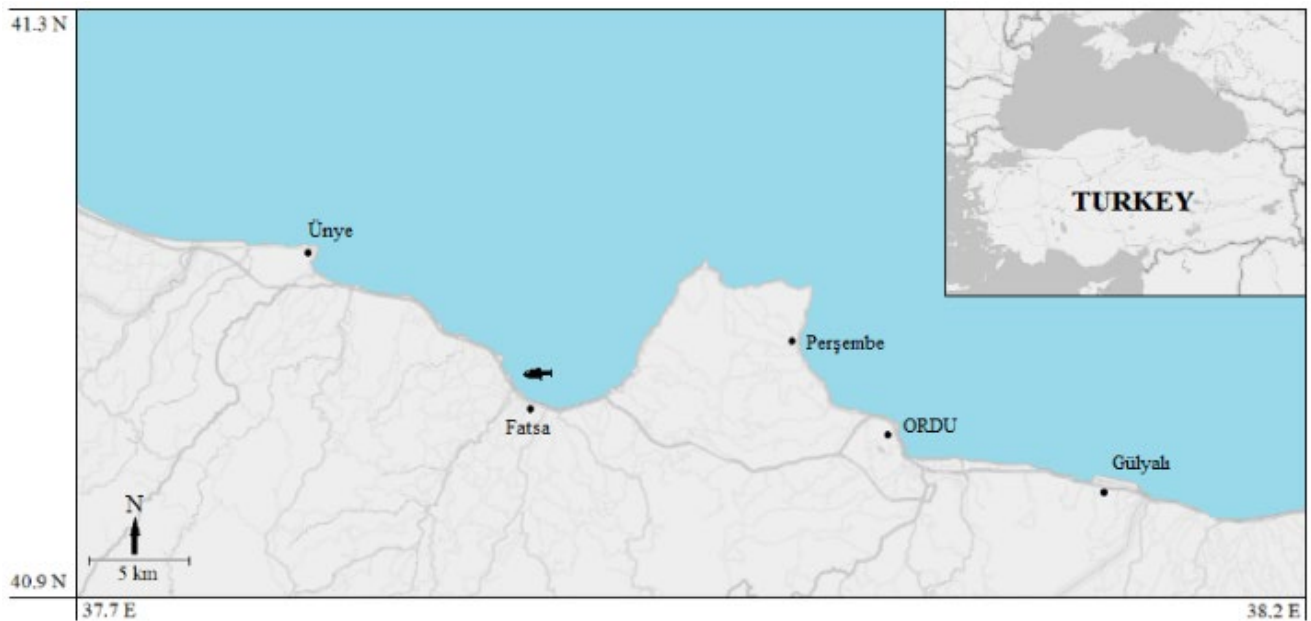
This study was performed within a field survey about biodiversity, from the Turkish coasts of eastern Black Sea. A male specimen of *S. flexuosa* (Figure 1) was caught with trammel nets at about 15 m depth. Sampling was carried out on February 13, 2021 in the Fatsa region (Ordu, eastern Black Sea) (Figure 2). This individual was identified according to Kuzminova and Martemyanova (2020), and its scientific name was checked from Fishbase (Froese and Pauly, 2019). Eighteen morphometric and five meristic characters were measured on sample (Gharai, 2012). Morphometric characters were measured with a Vernier caliper to the nearest 0.1 cm and body weight (W) was taken to the nearest 0.01 g with a digital balance. Sex was determined

macroscopically according to Gunderson (1993). Otoliths of the specimen was weighed by digital balance to the nearest 0.0001 g (Ross and Hüsey, 2013). The otolith length and width (Figure 3)

were measured using imaging software (Nikon NIS Elements 3.0) to the nearest 0.01  $\mu\text{m}$  under a stereo microscope (Javor *et al.*, 2011).



**Figure 1.** The male *Spicara flexuosa* with 235 mm total length and 144.06 g weight from the Fatsa region, Ordu, Turkey.



**Figure 2.** Sampling locality. The sampling coordinate ( $41^{\circ}03'29.8''$  N– $37^{\circ}30'04.6''$  E) located approximately 2.5 km off coast, 15 m depth near Fatsa lighthouse (Fatsa, Ordu, Turkey). The black fish symbol in the figure represents the location of the sampling station.

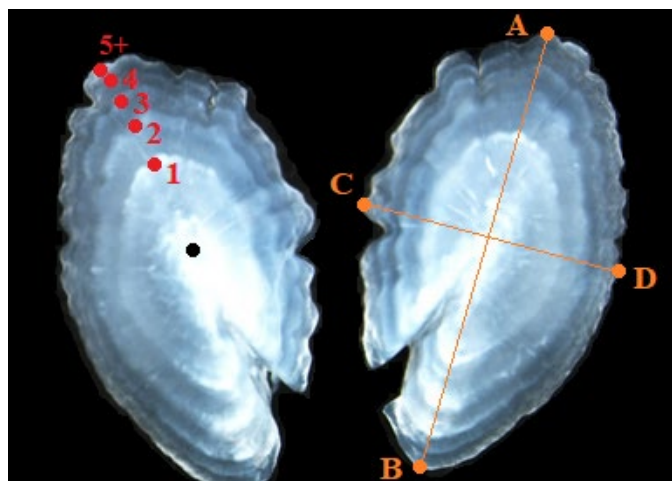
### 3. RESULTS

The captured *S. flexuosa* was 235 mm total length and weighing 144.06 g in this study. Some morphometric and meristic characters of specimen was presented in Table 1. Dorsal fin ray XI + 12; anal fin ray III + 9; pelvic fin ray 5; pectoral fin ray 12; lateral line scales 70; eye small 5 times in HL. Body color is blue-grey above silvery sides and small dark spots scattering along the body. There is one large dark blotch above the tip of the pectoral fin (Figure 1) below line lateral. It was determined that the fish was a male and 5+ years old (Figure 3). The otolith weight was determined as 0.0563 g. Measurements were made from right otolith and otolith length and width were measured as 8044.31 µm and 4596.48 µm, respectively.

**Table 1.** Some morphometric and meristic properties of *Spicara flexuosa*

Character	Measurement	TL%
Total length (mm)	235	-
Fork length (mm)	216	91.91
Standard length (mm)	200	85.11
Head length (mm)	50.10	21.32
Eye diameter (mm)	11.46	4.88
Post-orbital length (mm)	23.05	9.81
Pre-dorsal length (mm)	60.14	25.59
Pre-anal length (mm)	119.87	51.01
Pre-pelvic length (mm)	66.58	28.33
Pre-pectoral length (mm)	58.23	24.78
Dorsal fin base length (mm)	104.42	44.43
Anal fin base length (mm)	41.78	17.78
Anal fin height (mm)	28.89	12.29
Pelvic fin length (mm)	49.90	21.23
Pectoral fin length (mm)	40.96	17.43
Maximum body depth (mm)	54.69	23.27
Caudal fin length (mm)	38.50	16.38
Minimum caudal peduncle depth (mm)	16.75	7.13
Dorsal fin ray	XI + 12	
Anal fin ray	III + 9	
Pelvic fin ray	5	
Pectoral fin ray	12	
Line lateral scales	70	
Total weight (g)	144.06	
Sex	Male	

\* TL%: Proportion of total length



**Figure 3.** Surface view of the sagittal otoliths of *Spicara flexuosa* (5+ years old). Black and red points represent nucleus ring (birth) and annuli rings (years), respectively. Otolith length (from A to B point) and width (from C to D point) measures are shown right side.

### 4. DISCUSSION

The previous studies of the lengths and weights recorded for all picarel species in coastal waters of the Turkey is given in Table 2. This maximum length record in coastal waters of the Turkey is comparable to the results in the eastern Black Sea, where the maximum size recorded was 21.8 cm total length (Dalgıç et al., 2021). Mater et al. (2001) reported the mean fork length as 15.08 cm for 4 years old *S. flexuosa* from the Izmir Bay (Aegean Sea). İşmen (1995) reported 5 years maximum age and reported that individuals at this age were 17.9 cm mean length for in eastern Black Sea *S. smarıs*. Şahin and Genç (1999) reported the mean length as 22.4 cm for 6 years old female individual and a 6 years old male of 22.0 cm was found in eastern Black Sea for *S. smarıs*. The total lengths reported for picarels in previous studies are considerably smaller than in our study. This situation indicates that picarel species in the Black Sea have a habitat with good environmental conditions.

The Black Sea is one of the largest anoxic basins in the world. It covers an area of 422.000 km<sup>2</sup> with a volume of 534.000 km<sup>3</sup> and the Turkey has the longest coast in the Black Sea with 1,700 km (Stanchev et al., 2011). The Black Sea, contains the largest permanent anoxic-sulfidic

water in the world and the deeper area than 150 m of the Black Sea is almost completely oxygen free due to hydrogen sulphide (Algan *et al.*, 2002). The Black Sea is a semi-enclosed basin connected to the Mediterranean Sea via the Turkish Straits System (Bosporus Strait, Marmara Sea and Dardanelles). The Black Sea has been in a continuous dynamic process since the first geological periods. In addition to many negative characters (anoxic-sulfidic water body, narrow continental shelf, semi-closed basin feature etc.) in terms of biodiversity (Gray, 2010), the flora and fauna composition are diverse with the contribution of low salinity, sudden temperature increase and the Turkish Strait System (Zengin, 2019). The Black Sea is considered brackish water, as it has low salinity (Affholder and Valiron, 2001) and many freshwater fishes are found in the Black Sea, such as Acipenseridae, Centrarchidae, Cyprinidae,

Cyprinodontidae, Gasterosteidae, Gobiidae and Salmonidae families. In addition, several problems such as marine pollution, alien species, eutrophication, overfishing, illegal unreported unregulated (IUU) fishing and habitat destruction adversely affects biodiversity in Black Sea (Kıdeys, 2002; Topçu and Öztürk, 2012). In this process, fish species that have settled in the Black Sea ecosystem are in constant change/development (Van der Voo, 1990). In recent years, the physical, chemical and biological properties of the Black Sea change significantly with the impact of global climate change and through the Red Sea and Suez Canal. Oral *et al.* (2013) defined this phenomenon is defined as the "Mediterraneanization" of the Black Sea. So that Yankova *et al.* (2013) reported 180 different fish species in the Black Sea, 109 of which are Atlanto-Mediterranean origin.

**Table 2.** Length and weight of picarels reported in previous studies in coastal waters of the Turkey

Author(s)	Synonym	Sea	N	L <sub>max</sub> (cm)	W <sub>max</sub> (g)
İşmen (1995)	<i>S. smaris</i>	Eastern Black Sea (Trabzon)	517	18.5	64.53
Şahin and Genç (1999)	<i>S. smaris</i>	Eastern Black Sea (Trabzon)	456	22.5	120.03
Mater <i>et al.</i> (2001)	<i>S. flexuosa</i>	Aegean Sea (İzmir Bay)	412	15.50*	55.06
Özvarol (2014)	<i>S. flexuosa</i>	Mediterranean Sea (Gulf of Antalya)	440	17.3	-
Sever (2019)	<i>S. flexuosa</i>	Aegean Sea (Sığacık Bay)	400	16.8	-
Dalgıç <i>et al.</i> (2021)	<i>S. flexuosa</i>	Eastern Black Sea (Rize-Hopa)	599	21.8	129.94
This study	<i>S. flexuosa</i>	Eastern Black Sea (Ordu)	1	23.5	144.06

\*This measurement is given as fork length

Especially since the beginning of the 21<sup>st</sup> century, new invasive/exotic species are settling in the Black Sea fauna day by day. *Gobius cruentatus* (Aydın and Bodur, 2018) and *Serranus hepatus* (Aydın, 2015), which entered the Black Sea with the sudden temperature increase in 2007 and spread to the entire basin, are just one example of this change. Turan *et al.* (2016) warned that the increased of temperature in the Black Sea may increase the number of lessepsian and Mediterranean Atlantic fish species. Lipej *et al.* (2017) verified their prediction with reported several Atlanto-Mediterranean species in the Black Sea. First occurrences and new geographical records were

reported for *Lithognathus mormyrus* (Engin *et al.*, 2015), *Alepes djedaba* (Turan *et al.*, 2017) and *Symphodus melops* (Aydın, 2020) in the Black Sea coast of Turkey in the last decade. In addition, new maximum lengths have been reported for many species such as *Chelidonichthys lucerna* (Haşimoğlu *et al.*, 2016), *Lophius budegassa* (Sümer *et al.*, 2016), *Sparus aurata* (Aydın, 2018a), *Lithognathus mormyrus* (Aydın, 2018b), *Diplodus puntazzo* (Aydın, 2019) and *Umbrina cirrosa* -also in the world- (Aydın, 2021) in the Black Sea. These are just some examples of the impact of the change in the Black Sea fauna.

This study records new maximum length for *S.*

*flexuosa* in Turkish coastal waters. Our study and recent reports show that the fishes have the chance to survive until they reach large sizes. There may be several reasons of this situation. We think that the introduction of new species into the Black Sea inventory and recording of larger fish sizes is related to high nutritional concentration. In recent years, large stretches of coastal areas have been filled due to artificial structures (airport construction, land acquisition and road construction) (Aydın, 2018a). These artificial structure in Black Sea may have bring ideal conditions for picarel species, which have allowed them to reach larger sizes than other regions. Uras (2006) reported that cliffs, sandy and rocky beaches and small isolated bays supports to biodiversity along the Black Sea coasts. The benthic pollution and fishing pressure on demersal fish populations is increasing day by day in Turkey Seas, despite all the preventions (Pollard *et al.*, 2014). Despite large individuals of the fish are constantly reported in Turkey, the fact that the species is on this list indicates that it is facing a threat. Therefore, monitoring and management of fish populations including *S. flexuosa* in Turkey Sea have special importance.

In fisheries science maximum size and maximum age are essential parameters that are applied in most of the fisheries management studies (Pauly, 1980). Hence, it is important to regularly update the maximum length of a fish species in a region (Navarro *et al.*, 2012). This paper reports new maximum length for *S. flexuosa* in coastal waters of the Turkey and will be helpful for scientists in fisheries management studies. There are limited studies on the population structure and growth of the picarel in different seas. So far no one appears to no one has studied the population structure of *S. flexuosa* in the Black Sea. Further studies including age, growth and reproductive of picarel in Black Sea may help to manage fishery of this species and thus such studies are highly recommended.

## 5. CONCLUSION

It is necessary to regularly update the maximum size information of a fish species in a region. The size of the present specimen was the maximum

length ever registered not only for the Black Sea and but also for coastal waters of the Turkey. The information presented here is hoped to contribute to fisheries biology and international scientific literature.

## DISCLOSURE STATEMENT

The authors declare that there is no conflict of interest.

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