

Maximum size of Marbled spinefoot (*Siganus rivulatus* Forsskal & Niebuhr, 1775) for Aegean Sea

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ABSTRACT

This study presents the maximum size record of *Siganus rivulatus* for the Aegean Sea with some additional biological information. The biggest individual of *S. rivulatus* was caught in Akbük Bight, Gökova Bay (Southern Aegean Sea) at 15 m depth with trammel nets on 29.01.2018. Specimen of marbled spinefoot was 27.1 cm in total length and 414.8 g in total weight. The specimen was female with a gonad weight of 2.43 g and it was determined to be 9 years old. The total length of the mentioned individual is the longest for Aegean Sea among the reported studies so far and weight measurement displays the maximum value not only for Turkey but also for European waters.

Keywords: *Siganus rivulatus*, marbled spinefoot, maximum size

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INTRODUCTION

The marbled spinefoot (*Siganus rivulatus* Forsskal & Niebuhr, 1775) is a marine and reef associated fish, which inhabits shallow waters on rocky or sandy bottoms down to 30 m depth (Froese & Pauly, 2019). The *S. rivulatus* mostly occurs in the Western Indian Ocean, various localities in East Africa and from the Red Sea to the eastern Mediterranean. It was reported to be a Lessepsian migrant species (Ben-Tuvia, 1985) which invaded the Mediterranean and became one of the commercial alien fish for capture fishery (Saoud & Ghanawi, 2010). Although it has a high commercial importance in the Mediterranean and Southern Aegean coasts of Turkey, scientific studies focusing on the biology (Yeldan & Avcı, 2000; Bilecenoğlu & Kaya, 2002; Ergenler, 2016) and the fisheries of the species are limited.

Maximum length and weight (MLW) are useful and important parameters in fisheries management (Dulčić & Soldo, 2005). Information obtained from MLW measurements is directly or

indirectly applied to most stock assessment models (Borges, 2001). Therefore updated information on MLW of commercial species has become very important (Navarro et al., 2012; Cengiz et al., 2019). Despite its commercial importance and invasive character, no regulative tool has been applied on the fishery of *S. rivulatus* in Turkey.

This study presents the maximum size record of *S. rivulatus* for Aegean Sea with some additional biological information and the paper is considered to make a contribution to fisheries biology.

MATERIALS AND METHODS

The specimen was captured on 29 January 2018 in Gökova Bay, Southern Aegean Sea. Gökova Bay is located in the connection zone of the Aegean Sea and the Mediterranean which has been declared as "special environmental protection area -SEPA" in 1988 on account of its natural, historical and cultural significance. (GDPNA, 2014). The Maximum length sample

was collected by trammel net by a fisherman thus ethic committee approval was not required for the study. The biggest individual of *S. rivulatus* was caught off Akbük Bight (37°01.851'N, 028°08.669'E) (Gökova Bay) (Figure 1) at 15 m depth with trammel nets. The Total length of the specimen was subsequently measured to the nearest mm and weighted to the nearest g, where total length is expressed as the projection length between the front end of the fish head and the end point of the longest ray of the caudal fin when the mouth is closed in commercial fishery regulations of Turkey (communique no: 2016/35). Age estimation was based on otolith examination and supported with scale readings. Sagittal otoliths were removed and prepared for age readings by profiling, rubbing, and polishing. They were embedded in polyester molds and sections were obtained by cutting the mold with an IsoMet Low Speed Saw. Then, otoliths sections were polished with sandpaper (types 400, 800, and 1200) and with 3, 1, and 1/4 μ particulate alumina respectively (Metin & Kinacigil, 2001). Age determination was carried out by a stereoscopic microscope under reflected light against a black background. Opaque and transparent rings were counted: 1 opaque zone, together with 1 transparent zone, was considered as the annual growth indicator.



Figure 1. Sampling location of the maximum size *Siganus rivulatus* from Gökova Bay, southern Aegean Sea.

RESULTS AND DISCUSSION

The Captured individual of marbled spinefoot was 27.1 cm in total length (TL) and 414.8 g in total weight (TW) (Figure. 2). Some morphometric characters for *S. rivulatus* are given in Table 1. Sex of the specimen was female with a gonad weight of 2.43 g. Age of the specimen was determined to be 9 years (Figure 3). The number of scientific studies with regard to the biology and other aspects of *S. rivulatus* are unfortunately low in Turkey due to poor scientific interest in this species and difficulties during sampling. Therefore, length and weight records for *S. rivulatus* were given for all possible localities from Turkey instead of only from the Aegean Sea, in order to make a better comparison (Table 2).

Although our TL value is the highest for Aegean Sea among the reported studies so far, it was seen that, the maximum length record of the species for Turkish waters belonged to Ergenler, (2016) with a TL value of 29.5 cm. Even so, our individual weight measurement (414.8 g) is the highest value not only for Turkey but also for European waters. Discrepancies in weight measure-

ments between two studies are attributable to sampling season which resulted in too much fat accumulation in our sample (Figure 2) to be used during the upcoming spawning season and stomach fullness.

The concept of maximum length is generally linked to overfishing. Individuals which are exposed to high fishing pressure will respond by reproducing at smaller sizes. This mechanism results in reducing the maximum size of the species. Furthermore, feeding habits of the species, prey-predator relationships and parameters such as nutrient availability, oxygen, salinity, temperature and pollution have serious effects on growth (Helfman et al.,



Figure 2. The maximum sized *Siganus rivulatus* and fat accumulation.

Table 1. Some morphometric characters for *Siganus rivulatus* captured from Gökova Bay, Southern Aegean Sea.

Morphometric characters	Value
Total length (cm)	27.1
Total weight (g)	414.8
Standard length (cm)	21.9
Fork length (cm)	25.2
Max. body depth (cm)	9.5
Girth (cm)	22.7
Head length (cm)	4.7
Preorbital length (cm)	1.8
Eye diameter (cm)	1.4
Predorsal length (cm)	4.9
Preanal length (cm)	11.9
Prepelvic length (cm)	6.4
Prepectoral fin length (cm)	4.8
Caudal peduncle minimal depth	1.2
Interorbital width	1.5
1. Length of Dorsal fin basis (cm)	13.2
2. Length of Dorsal fin basis (cm)	4.3
Total Dorsal Length	17.1
Length of anal fin basis	9.6
Gonad W (g)	2.4
Liver W (g)	16.8

Table 2. Reported maximum length and weight of *Siganus rivulatus* in Turkish waters in previous studies.

Author(s)	Sex	Area	N	Lmax (cm)	Wmax (g)
Yeldan and Avşar (2000)	♀	Mersin and İskenderun Bays	224	24.0	-
	♂		190	22.0	-
Taşkavak and Bilecenoğlu (2001)	Σ	Mersin and İskenderun Bays	355	24.1	125.5*
Bilecenoğlu and Kaya (2002)	♀	Antalya Bay	292	21,5	128.7
	♂		229	20,6	101.3
Ergüden et al. (2009)	Σ	İskenderun Bay	122	18.0	54.2
Ceyhan et al. (2009)	Σ	Gökova Bay	56	23.0	152,1*
Ergenler (2016)	♀	İskenderun Bay	166	29.5	284,9
	♂		365	26.9	249,9
Present study	♀	Gökova Bay	1	27.1	414.8

*Values were calculated according to length-weight relationship of the given studies

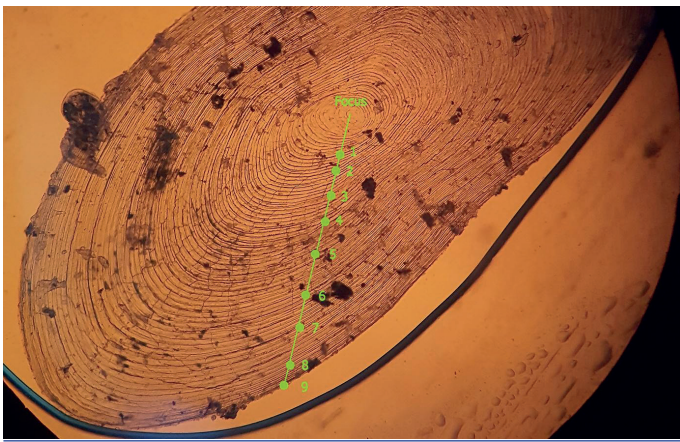


Figure 3. Age reading of the captured individual.

2009). Therefore, regional discrepancies in maximum length and weight values can be attributed to level of fishing pressure and environmental factors.

CONCLUSION

Consequently, the present study proves that this species can grow above the previously reported maximum length values in the Aegean Sea and presents the maximum weight record for Turkish waters. The information presented here is considered to make a contribution to fisheries biology and international scientific literature.

Conflict of interests: The authors have no conflicts of interest to declare.

Ethics committee approval: This study was conducted in accordance with ethics committee procedures of animal experiments.

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