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RESEARCH ARTICLE

A new maximum length for the grey triggerfish, *Balistes capriscus* Gmelin, 1789 for the Mediterranean Sea and first confirmed record in the Çanakkale Strait (Turkish Strait System)

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ABSTRACT

A single specimen of the grey triggerfish, *Balistes capriscus* Gmelin, 1789, was caught by a speargun at 18 m water depth in the vicinity of the Çanakkale Strait in the Turkish Straits System, between the Aegean Sea and the Marmara Sea. Its total length was 57.8 cm and weight was 2270 g. The given size is the maximum observed length for the grey triggerfish, *B. capriscus,* in the Mediterranean Sea. In addition, this paper also documented the first confirmed record of the grey triggerfish, *B. capriscus* in the Çanakkale Strait (the Turkish Straits System).

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Introduction

The grey triggerfish, *Balistes capriscus* Gmelin, 1789, distributes around reefs and mainly over rocky bottoms (Dance & Wells, 2018). The body form is laterally flattened to let manoeuvring in shallow rocky areas or wrecks that it inhabits (Reeds, 2008). *B. capriscus* is a carnivorous fish species and does not leave its habitats (Tortonese, 1986). The species is mainly a demersal fish that feeds predominantly on benthic invertebrates such as marine molluscs and crustaceans (Ofori-Danson, 1981). The species also feeds on zooplankton like amphipods and copepods (Aggrey-Fynn, 2007). Dance & Wells

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(2018) claimed that grey triggerfish was more dependent on the reef structure for foraging opportunities. The authors also indicated that *Balistes capriscus* mostly consumed pelagic gastropods and reef-associated prey. It is an oviparous species and the sexes are separate (Tourenne et al., 2020). The spawning time of the species was indicated as the period between April and June for the Mediterranean Sea by Akşıray (1987). Tourenne et al. (2020) documented that the triggerfish can change colour during reproduction, and the head turns white, the dark bands are more contrasted with the rest of the body which clears. The spatial distribution range of the species covers both sides of the Atlantic coasts from Nova Scotia to Argentina in the western parts of the Atlantic and from Norway to South Africa in the eastern parts of the Atlantic, the Mediterranean Sea (Figure 1). Aggrey-Fynn (2007) noted that *B. capriscus* has a very wide bathymetric distribution in Ghanaian coastal waters. It is assessed as "Vulnerable" and is not considered to be threatened by IUCN (Liu et al., 2015). The maximum reported total length (TL) of the grey triggerfish is 61.7 cm in the Gulf of Mexico (Jefferson et al., 2019).

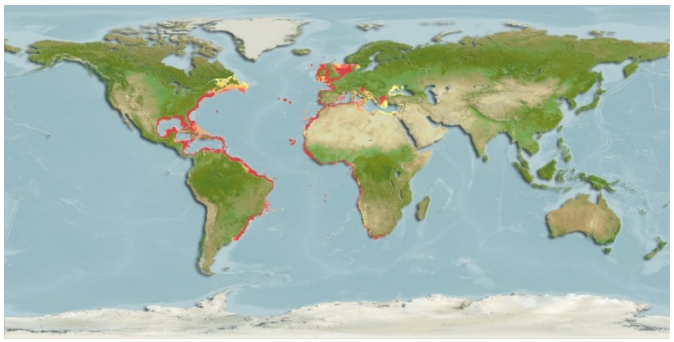

Figure 1. Distribution range of *Balistes capriscus* (Aquamaps, 2020) (Distribution range colours indicate degree of suitability of habitat which can be interpreted as probabilities of occurrence. Relative probabilities of occurrence ranges from high (red) to low (yellow))

The maximum length and maximum age are important theoretical parameters in fisheries science (Acarli et al., 2018). Dulčić & Soldo (2005) noted that the measurements of maximum length and maximum age have been commonly used directly or indirectly in most stock assessment models. Therefore, bringing information about maximum sizes up to date is important for fisheries-related sciences. The spatial distribution of the grey triggerfish B. capriscus was documented by several authors in the Greek exclusive economic zone of the Aegean Sea (Maldura, 1938; Konsuloff & Drenski, 1943; Kalogirou, 2009; Kalogirou et al., 2010, 2012). On the other hand, several authors previously reported the occurrence of the grey triggerfish in different locations of the Turkish continental shelf including the coasts of Gökçeada Island (Ulutürk, 1987), İskenderun Bay (İşmen et al., 2004), Edremit Bay (Meriç et al., 2007), Aegean Sea (Mater et al., 2009; Cerim et al., 2021), Saros Bay (Cengiz & Paruğ, 2020). However, there is no document reporting the occurrence of the species in the Çanakkale Strait or Turkish Straits System. The aim of this paper is to provide new data on the first record of the grey triggerfish in the Çanakkale Strait and the maximum observed length for the Mediterranean Sea.

Material and Methods

A specimen of the grey triggerfish, *B. capriscus*, was caught by a speargun off the coasts of Kumkale in the Çanakkale Strait (Figure 2). The specimen was captured on 6 October 2020 during the daytime at 18 m water depth. Fish species was classified according to Mater et al. (2009) by considering taxonomic determinations. The fish was stored under frozen conditions (at -18°C) and covered with ice for 5 hours to let the morphometric measurement successfully. The specimen was measured to the nearest millimetre and weighted to the nearest gram according to the manual for the measurement of fish proposed by FAO (Holden & Raitt, 1974). Unfortunately, the specimen could not be catalogued or deposited as the fisherman did not allow us to catalogue the specimen in the museum. The habitat structure was covered by reefs and sea grass. Figure 3 illustrates the habitat structure and the environment when the specimen has been caught by a speargun.

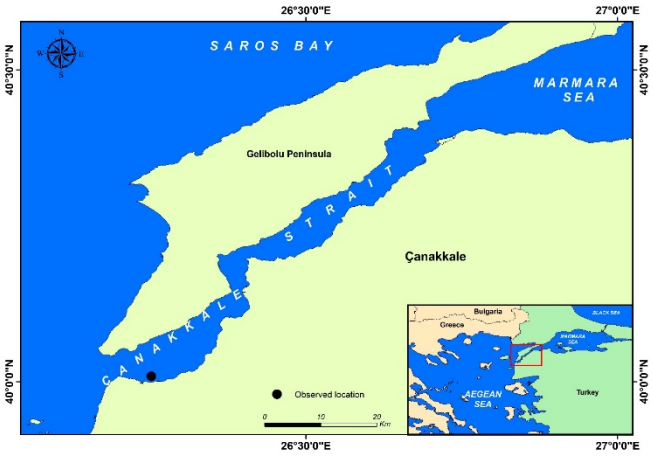

Figure 2. The observed location of the grey triggerfish *Balistes capriscus*

Results

This paper provides the first confirmed record of the grey triggerfish in the Çanakkale Strait. The total length of the specimen was measured as 57.8 cm (Figure 4) and the total

weight (TW) was calculated as 2270 g. Morphometric measurements considered for the species were given in Table 1.

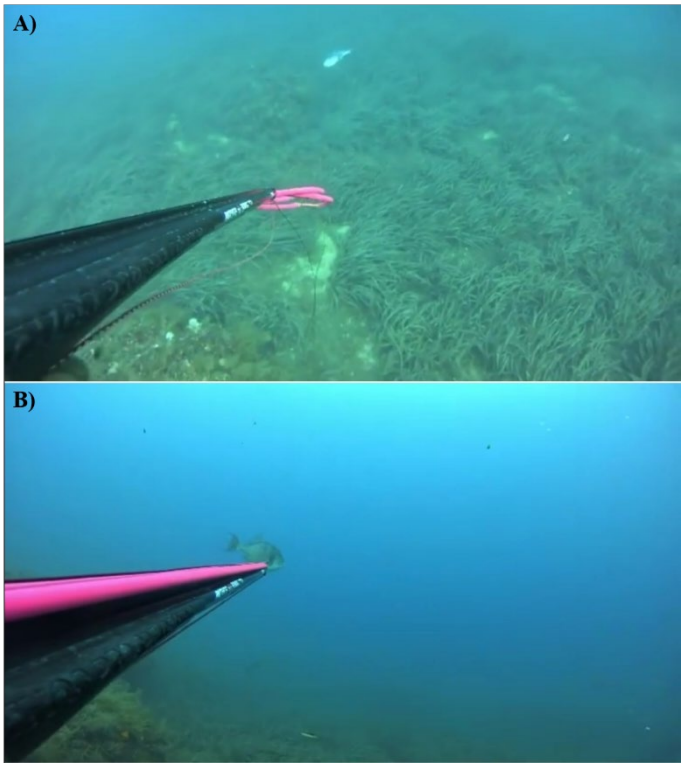

Figure 3. The habitat structure (A) and the environment (B) when the grey triggerfish *Balistes capriscus* caught by a speargun in the Çanakkale Strait

The total length measured in the present paper is the maximum length for the grey triggerfish in the Mediterranean Sea whereas the global maximum total length for the species was noted as 61.7 cm by Jefferson et al. (2019). The present paper provides recent data and significant contribution to our knowledge of the reported maximum size and the first record of *B. capriscus* in the Çanakkale Strait.

Figure 4. *Balistes capriscus*. The grey triggerfish (TL: 57.8 cm, TW: 2270 g) caught on 6 October 2020 in the Çanakkale Strait

Discussion

The maximum length of the species was previously reported as 61.7 cm (FL) by Jefferson et al. (2019) in the Gulf of Mexico. On the other hand, several maximum length reports have also been documented for different locations by several authors (Table 2). Harmelin-Vivien & Quéro (1990) noted that the maximum total length was 60.0 cm in the eastern tropical Atlantic coasts. Kelly-Stormer et al. (2017) documented that the maximum fork length was 57.8 cm for the Atlantic Coast of the South-eastern USA. In the Mediterranean Sea, Dulčić & Soldo (2005) reported the maximum total length as 52.50 cm for the Adriatic Sea. Kacem et al. (2015) reported the maximum fork length as 42.7 cm for Tunisian coasts. İşmen et al. (2004) noted that the maximum total length was 25.5 cm for İskenderun Bay. Cerim et al. (2021) recently documented the maximum total length as 53.5 cm in the Gökova Bay, southeastern Aegean Sea while Cengiz & Paruğ (2020) reported the occurrence of the species in the Saros Bay, northern Aegean Sea. The authors noted that the total length of the specimen was 36.4 cm. The present paper reports the maximum length not only for the Çanakkale Strait (Turkish Straits system, Aegean Sea) but also for the Mediterranean Sea. Moreover, this paper also documented the first confirmed record of the grey triggerfish, *B. capriscus* in the Çanakkale Strait.

Table 1. Morphometric measurements of *Balistes capriscus* caught on 6 October 2020 in the Çanakkale Strait

Morphometric Measurements	Values (cm)
Total length	57.8
Fork length	48.2
Standard length	42.6
Pre dorsal length	16.7
Pre anal length	26.8
Pre ventral length	20.2
First dorsal fin length	6.4
Second dorsal fin length	15.8
Anal fin length	14.1
Pectoral fin length	4.2
Girth	47.7
Head length	19.5
Ocular diameter	1.8
Pre orbital length	4.2
Post orbital length	1.4

Table 2. The comparison of the maximum lengths recorded in different areas for *Balistes capriscus* (TL refers to total length. FL refers to fork length)

Area	Author(s)	Length (cm)	Length type	Depth (m)	Fishing gear
Gulf of Mexico, Atlantic	Jefferson et al. (2019)	**61.7**	FL	20-40	Vertical longline, Hook-and-line, Trawl, Plankton purse seine, Pole-spear
Eastern Atlantic	Harmelin-Vivien & Quéro, (1990)	60.0	TL	UNK	UNK
Gulf of Mexico, Atlantic	Ingram (2001)	58.3	FL	21-32	Tagging trip
Southeastern USA, Atlantic	Kelly-Stormer et al. (2017)	57.8	FL	14-92	Chevron traps
Southeastern USA, Atlantic	Burton et al. (2015)	56.7	FL	UNK	Fishing line
Gökova Bay, Aegean Sea, Mediterranean	Cerim et al. (2021)	53.5	TL	15	Speargun
Adriatic Sea, Mediterranean	Dulčić & Soldo (2005)	52.5	TL	50	Bottom trawl
Western Gulf of Guinea, Atlantic	Aggrey-Fynn (2009)	52.0	TL	22-60	Bottom trawl, Pelagic trawl
South Carolina, Atlantic	Shervette et al. (2021)	52.0	FL	UNK	Conventional vertical hook-and-line gear
Gulf of Gabès, Mediterranean	Kacem et al. (2015)	42.7	FL	UNK	Pelagic trawl net
Southeastern Brazilian Coast, Atlantic	Bernardes (2002)	41.0	FL	UNK	Bottom trawl
Gulf of Mexico, Atlantic	Dance et al. (2018)	38.2	FL	13-32	Vertical longline, Trap
Saros Bay, Mediterranean	Cengiz & Paruğ (2020)	36.4	TL	30	Fishing line
Coasts of Ghana, Atlantic	Ofori-Danson (1981)	35.0	FL	UNK	Bottom trawl
İskenderun Bay, Mediterranean	İşmen et al. (2004)	25.5	TL	50	Bottom trawl
Çanakkale Strait, Mediterranean	**Present Paper**	**57.8**	**TL**	**18**	**Speargun**

Note: UNK indicates that there is no information on this data.

The observation of uncommon growth in total length could be associated with variations in morphologic characteristics (Bauer, 1961) or an outcome of hereditary factors (Borges, 2001). Fish populations exposed to high fishing pressure response to the fishing pressure by reproducing at smaller sizes and ages (Helfman et al., 2009). Individuals not exposed to high fishing pressure might extend the largest weight and length (Acarli et al., 2018). It seems that there is no potential high fishing pressure for this species in the Çanakkale Strait at the moment. Nevertheless, fisheries activities should be regulated to prevent the over-exploitation of the species and to ensure the fish stocks' sustainability. On the other hand, several factors may possibly affect the growth of the individuals such as environmental conditions (temperature, salinity, dissolved oxygen, light, pollutants, current speed, food availability) and biological competitions (pray-predator relationships, interspecific or intraspecific interactions, genetics) (Helfman et al., 2009).

As fisheries of some fish species have become exhausted and more closely controlled, previously untargeted species such as the *B. capriscus* have become more frequently harvested and progressively valuable (Kelly, 2014). Tourenne et al. (2020) pointed out that its workforce has grown significantly in 30 years and this was attributed to the warming of the waters. Increase in seawater temperature might have significant effects on the spatial distribution of fish species. Correspondingly, several researchers noted that climate change will affect the spatial and bathymetric distribution of fish species (Kale, 2019;

Kale & Acarli, 2019). Kacem et al. (2015) indicated that the spatial distribution of *B. capriscus* has expanded to the north over the last decade due to global warming and climate change. Cengiz & Paruğ (2020) reported the northernmost observation of the grey triggerfish in the Mediterranean Sea by pointing out the observation in Saros Bay. The present paper provides the recent further expansion of the grey triggerfish in the Mediterranean Sea. Çanakkale Strait has different environmental conditions (such as higher current speeds, two-layered current flows, maritime transportation activities, and human interventions) compared to Saros Bay. On the other hand, Saros Bay is closed to fishing activities by the local government, and therefore, it provides a protected area and lower fishing pressure on fish species. Therefore, the grey triggerfish may establish a new population in Saros Bay in the near future. On the other hand, the Çanakkale Strait is a part of the Turkish Straits System and a transition zone from the Mediterranean Sea to the Black Sea. Since the present paper has reported the first occurrence *of B. capriscus* in the Çanakkale Strait, the species may possibly migrate to the Black Sea through the straits system and it may also establish a new population there in the near future.

Kacem et al. (2015) reported that the catch amounts and commercial value of this species have increased due to its greatly appreciated flesh meat by local consumers in Tunisia. The same case might happen in the local fisheries in the Çanakkale Strait. Currently, *B. capriscus* is a non-targeted species for commercial fishing activities in Türkiye. However, it can be targeted if the catch amounts and commercial value increase. Therefore, although this paper documents the first occurrence of the species in the Çanakkale Strait, nevertheless, the population structure and dynamics of the species in the Çanakkale Strait should be continuously investigated in future studies. In addition, further investigations should be carried out to understand the prey-predator relationships between interspecies and intra-species in the Çanakkale Strait.

Citizen science and local ecological knowledge have demonstrated to be extremely important in discovering the occurrence and further distribution of rare or alien species in the Mediterranean Sea (Rizgalla et al., 2016; Crocetta et al., 2017; Rizgalla & Crocetta, 2020; Tiralongo et al., 2020). The present study appreciates the contributions of citizen science and local ecological knowledge in exploring the spatial distribution of rare species in the Çanakkale Strait.

Conclusion

This paper provides a new maximum length for the grey triggerfish, *Balistes capriscus* Gmelin, 1789, for the Mediterranean Sea from the Çanakkale Strait (Turkish Strait System, Aegean Sea). On the other hand, there is no paper reporting the occurrence of the species in the Turkish Straits System. Therefore, the present paper is also the first document that reports the first confirmed record of the grey triggerfish *B. capriscus* in the Çanakkale Strait.

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Compliance With Ethical Standards

Authors' Contributions

SK: Manuscript design, Writing, Editing
ET: Manuscript design
Both authors read and approved the final manuscript.

Conflict of Interest

The author declares that there is no conflict of interest.

Ethical Approval

For this type of study, formal consent is not required.

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