

The invasive silver-cheeked toadfish, *Lagocephalus sceleratus* (Gmelin, 1789) appeared in the Sea of Marmara after more than a decade: A call for awareness

İstilacı benekli balon balığı, *Lagocephalus sceleratus* (Gmelin, 1789) on yıldan fazla bir süre sonra Marmara Denizi'nde görüldü: Bir farkındalık çağırısı

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Abstract: This study presents a new locality record of poisonous pufferfish, *Lagocephalus sceleratus* (Gmelin, 1789), one of the 18 worst invader fish species identified globally by IUCN, from the Sea of Marmara caught by a commercial purse seine fishing vessel while fishing anchovy on 22 February 2021. Previously, this invasive species was first recorded at the Gelibolu peninsula in the Sea of Marmara between September 2007 and October 2008. *Lagocephalus sceleratus* recorded in this study is larger in size with 142 mm total length than previous records (126 mm in 2007; 95 mm in 2008) for the Sea of Marmara. The presently reported record represents the first documented occurrence of this species in the Erdek Bay of the Sea of Marmara and the third documented record for the entire Sea of Marmara.

Keywords: Invasive alien species (IAS), lessepsian migration, range expansion, pufferfish, Tetraodontidae, Tetrodotoxin

Öz: Bu çalışma, Marmara Denizi'nde 22 Şubat 2021'de ticari gırgır balıkçı teknesi tarafından hamsi avı sırasında avlanan ve IUCN tarafından küresel olarak en tehlikeli 18 istilacı balık türünden biri olarak tanımlanan balon balığının *Lagocephalus sceleratus* (Gmelin, 1789)'un yeni bir lokalite kaydını sunmaktadır. Bu istilacı tür Marmara Denizi'nde ilk olarak Eylül 2007 ile Ekim 2008 arasında Gelibolu yarımadasında kaydedilmiştir. Bu çalışmada kaydedilen birey, 142 mm toplam boya sahip olup, Marmara Denizi için verilen önceki kayıtlardan (2007'de 126 mm; 2008'de 95 mm) daha büyüktür. Halihazırda rapor edilen kayıt, bu türün Marmara Denizi'nin Erdek Körfezi'ndeki varlığını ilk kez ortaya koymakta olup, tüm Marmara Denizi için belgelenmiş üçüncü kaydını temsil etmektedir.

Anahtar kelimeler: İstilacı yabancı türler (IAS), Isepsiyen göçü, menzil genişlemesi, balon balığı, Tetraodontidae, Tetrodotoksin

INTRODUCTION

The Suez Canal has cut the sailing distance between the edges of Europe and Asia by 43% and thus considerably reduced the cost of delivering goods between these continents since 1869 (Fletcher, 1958; Savitzky, 2015). This man-made sea-level waterway connects the Mediterranean Sea to the Indian Ocean through the Red Sea and currently handles up to 12% of global trade (Feyrer, 2021). On the other hand, the Suez Canal is considered a wormhole for bringing in marine alien invaders from the Red Sea into the Mediterranean Sea (MedECC, 2020). More than 600 invasive species, among them above 120, have flowed into the Mediterranean Sea, establishing populations in their new environment, potentially threatening the region's fisheries, endemic biodiversity, tourism, and human health (Fitt, 2020; Golani et al., 2020; Kovacic et al., 2021). The other concern is the permanent

colonies of poisonous species that have neurotoxins such as tetrodotoxin in their skin, ovaries, liver, and reproductive organs that can kill an adult at a dosage of as little as 2 mg (Noguchi and Ebesu, 2001). Consequently, such poisonous invaded species have posed severe problems, especially for fishermen unfamiliar with these newly established poisonous species. A fishmonger living in the eastern province of Van Türkiye died last year after eating Pufferfish *Lagocephalus sceleratus* (Gmelin, 1789), which he likened to the rockfish (Hürriyet Daily News, 2021).

Up to 13 different Pufferfishes and Porcupinefishes (viz., *L. sceleratus*, *L. lagocephalus*, *Ephippion guttiferum*, *L. guentheri*, *L. suezensis*, *Sphoeroides pachygaster*, *Sphoeroides spengleri*, *Sphoeroides marmoratus*, *Tylerius spinosissimus*, *Torquigener flavimaculosus* belong to the

family Tetraodontidae, and *Chilomycterus reticulatus*, *Cylichthys spilostylus*, *Diodon hystrix* belong to the family Diodontidae) have introduced their populations in the Mediterranean and adjacent seas (Ulman et al., 2021). Tetraodontidae species are known to contain the neurotoxin "tetrodotoxin" (Noguchi and Ebesu, 2001; Ulman et al., 2021).

The silver-cheeked toadfish, *L. sceleratus*, was reported for the first time from the Aegean Sea, Gökova Bay, in February 2003 (Filiz and Er, 2004). Later, the species of Pufferfish was also recorded in the Çanakkale Strait (Sea of Marmara) between 2007 and 2008 (Tuncer et al., 2008; Irmak and Altinagac, 2015).

In this paper, we presented a new locality record of this poisonous puffer fish species, which should be accounted as the first documented record for the Erdek Bay in the Sea of Marmara and the third documented record for the entire Sea of Marmara. The morphometric and meristic properties of the obtained *L. sceleratus* were provided in this paper.

MATERIALS AND METHODS

One male *L. sceleratus* specimen was caught in the Sea of Marmara (Erdek Bay; 40°26'28"N; 27°40'47"E) by a commercial purse seine fishing vessel (usually fishing between 110-130 m depth) while fishing anchovy on 22 February 2021 (Figure 1).

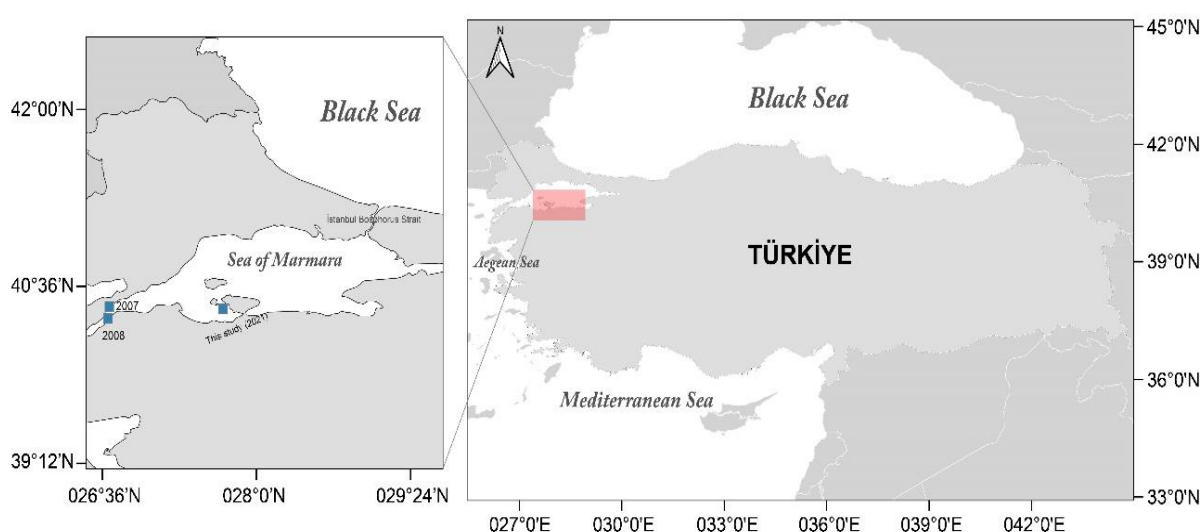


Figure 1. Map showing the area in the Sea of Marmara from where the current specimen of the poisonous Pufferfish, *Lagocephalus sceleratus*, was recorded on 22 February 2021.

The specimen was purchased from the fisherman and brought to the laboratory for a detailed examination. The identification keys provided by Akyol et al. (2005), Irmak and Altinagac (2015), and TUDAV (2022) were used to identify the obtained specimen. Body measurements such as weight (g) and various metric measurements such as total, fork and standard lengths, orbital diameter, head length, body depth, predorsal length, caudal peduncle length, and caudal peduncle depth were recorded. The meristic characteristics were also counted for dorsal fin rays, pectoral fin rays, caudal fin rays, and anal fin rays

RESULTS

The total length of obtained *L. sceleratus* was 142 mm with a body weight of 32.88 g. The morphometric and meristic data are provided in Table 1.

The dorsal of *L. sceleratus* was covered with dark spots with a dominant green-bluish colour. The dorsal fin was yellowish, while soft anal rays were whitish. The ventral part of the body was silver from the nose to the caudal. The eyes were big and wide in diameter (Figure 2).



Figure 2. The silver-cheeked toadfish pufferfish, *Lagocephalus sceleratus*, individual was caught in Erdek Bay of the Sea of Marmara by a commercial purse seine fishing vessel while fishing anchovy on 22 February 2021 (photo: Habib BAL).

Table 1. Morphometric and meristic of the poisonous Pufferfish, *Lagocephalus sceleratus* specimens captured in February 2021 Erdek Bay, together with previous records, from the Sea of Marmara.

Measurements	This study	Irmak and Altınagac (2015)	Tuncer et al. (2008)
Total length (L_T), mm	142	95.03	126
Fork length (L_F), mm	134	91.02	
Standard length (L_S), mm	123	82.24	111
Body depth, mm (% L_T)	36.6 (25.7)		
Head length, mm (% L_T)	17.4 (12.2)		
Orbital diameter, mm (% L_H)	12.2 (68.9)		
Predorsal length, mm (% L_T)	52.7 (37.1)	70.93 (86.24;% L_S)	
Caudal peduncle length, mm (% L_T)	31.8 (22.3)		
Caudal peduncle depth	4.23		
Dorsal fin rays	12	12	12
Pectoral fin rays	18	18	17
Caudal fin rays	20		
Anal fin rays	10	10	12

DISCUSSION

Lagocephalus sceleratus has been subsequently documented in the Adriatic Sea, the central Mediterranean Sea, the Italian coasts of the Ionian Sea, and the Levantine

Sea after its first occurrence in the Gökova Bay, the Aegean Sea in February 2003 (Figure 3, Irmak and Altınagac, 2015; Akyol and Ünal, 2017; Ulman et al., 2021).

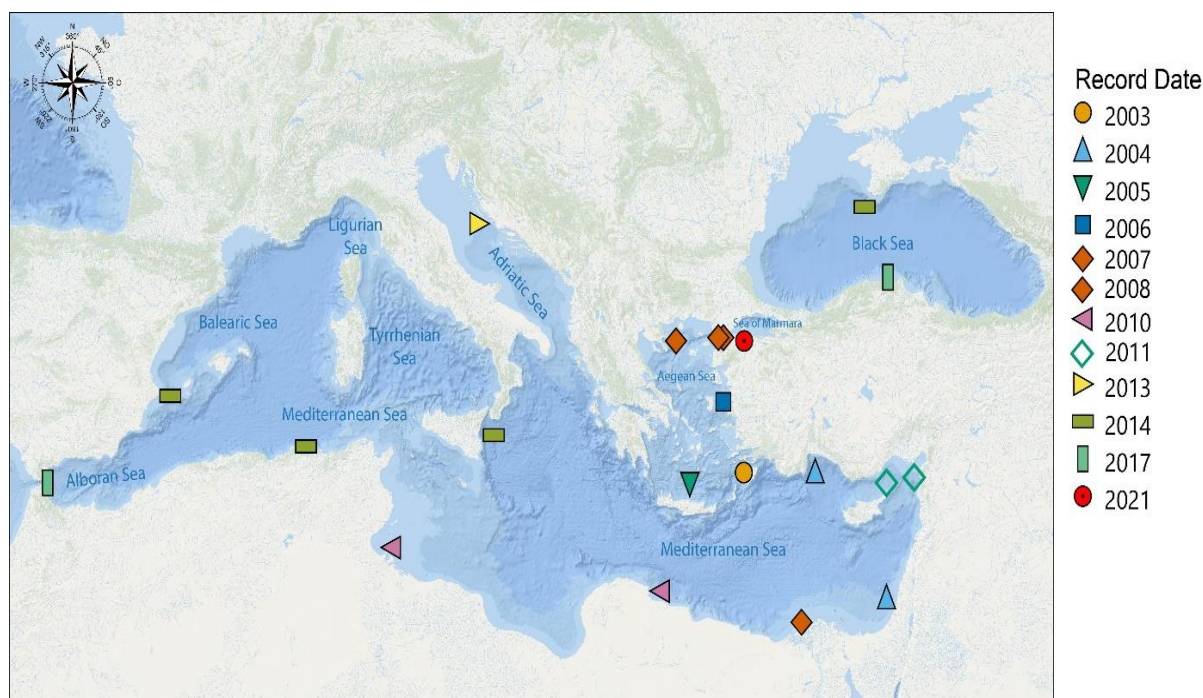


Figure 3. Range expansion of the poisonous Pufferfish, *Lagocephalus sceleratus* in the Mediterranean and the Black marine waters (consult Akyol and Ünal, (2017) for details)

The maximum length record for Turkish territorial waters was determined as 6 kg with 755 mm total length caught in Fethiye (Ulman et al., 2021), which is well below the maximum value of 8 kg with 12000 mm total length reported from the Eastern Mediterranean (Zakynthos, Greece) by Ulman et al. (2022). For the Sea of Marmara, this study documented the maximum size *L. sceleratus* compared to previous records of 126 mm in 2007 (Tuncer et al., 2008) and 95 mm in 2008 (Irmak and Altinagac, 2015). Both of these records were obtained on the off coast of Çanakkale Strait in the Sea of Marmara (Tuncer et al., 2008; Irmak and Altinagac, 2015). The current documentation has provided the third record for the entire Marmara Sea, constituting an important observation as

it was observations in the inner parts of the Sea of Marmara (Figure 2).

Pufferfishes are spreading rapidly in the Mediterranean Sea and the Aegean Sea, threatening native fish species in the area. These destructive invasive species negatively affect biodiversity and alter the food chain. The diet composition of such fish species is quite diverse, which consisting of 54% shrimp (Penaeidae), 17% crab (Portunidae), 14% fish, 4% squid, and cuttlefish (Cephalopods), and 11% other prey (Aydin, 2011). At a size of 420–430 mm, they reach maturity in their third year of life (El-Ganainy et al., 2006). The results of the previous research, which have been detected in Turkish marine waters, are given in Table 2.

Table 2. Historical records of the poisonous Pufferfish, *Lagocephalus sceleratus*, in the Turkish marine waters

LOCATION	Latitude ° N	Longitude ° E	Depth (m)	Record date	N	Total length (mm)	References
MEDITERRANEAN SEA							
Gökova Bay	37.2	28.3	15	2003–02–17	1	459	Akyol et al. (2005)
Gökova Bay	37.0	28.3	-	2003–01–08	1	-	Filiz and Er (2004)
Kemer, Antalya	37.4	31.1	-	2004–09–18	1	389	Bilecenoglu et al. (2006)
Bodrum, Gökova Bay	37.0	28.6	-	2005–03–10	2	-	Bilecenoglu et al. (2006)
Adrasan, Antalya	-	-	3	2005–05–14	2	200	Bilecenoglu et al. (2006)
Kaş, Antalya	-	-	-	2005–10–03	1	-	Bilecenoglu et al. (2006)
Iskenderun Bay	36.3	36.9	-	2009–01–02	4	388–611	Torcu Koç et al. (2011)
Antalya Bay	36.8	30.7	-	2010–08–20	656	125–650	Aydin (2011)
Mersin Bay	36.4	35.8	2	2010–11–10	2	75–84	Yaglioglu et al. (2011)
Iskenderun Bay	36.6	34.8	3	2010–11–29	2	65–75	Yaglioglu et al. (2011)
Antalya Bay	36.6	31.0	-	2011–2013	100	126–535*	Zengin (2014)
Iskenderun Bay	-	-	50	2012–11–20	77	89–784	Başusta et al. (2013)
AEGEAN SEA							
Hekim Island, Izmir	38.4	26.8	0–12	2006–04–21	1	498	Bilecenoglu et al. (2006)
Asos, Çanakkale	-	-	-	2008–01–07	1	-	Türker-Çakır et al. (2009)
Saros Bay	40.4	26.3	-	2017–01–12	1	556	Tunçer and Önal (2014)
SEA OF MARMARA							
Gelibolu coast	40.2	26.4	-	2007–09–23	1	126	Tuncer et al. (2008)
Gelibolu coast	40.4	26.7	-	2008–01–10	1	95	Irmak and Altinagac (2015)
Erdek Bay	40.4	27.7	-	2021–02–22	1	142	This study

*SL: standard length

CONCLUSION

The poisonous pufferfish, *L. sceleratus*, has been blacklisted by the International Union for Conservation of Nature (IUCN) as one of the 18 worst invasive fish species (Otero et al., 2013). The occurrence of this poisonous species in the Sea of Marmara strongly indicates that it can flow into

the Black Sea in the future. Though the first Black Sea record of the species was given from the western coast of Sevastopol, where two mature individuals with standard lengths of 59.0 and 50.3 cm were collected on 2 and 7 November 2014, respectively (Boltachev et al., 2014). It has also been observed on the Türkeli shore, Sinop Black Sea, based on a piece of news that appeared in a local Turkish newspaper (Bilecenoğlu and Öztürk, 2018). In addition to our record, this fish was reported again in the Sea of Marmara, and this time it was caught in the district of Gemlik by amateur fishing gear (NTV newspaper, 2021). This second record from the Sea of Marmara, in less than two months, could reaffirm the above statement of its subsequent flow into the Black Sea in the future. However, the specimens reported by Bilecenoğlu and Öztürk (2018) and NTV newspaper (2021) were not examined by an expert and thus certainly require a future confirmation.

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