

Where Have You Been Hiding? Re-Emergence of *Squatina oculata* in the Sea of Marmara, with a Review of Captures in Turkish Seas

Hakan Kabasakal^{1,2} , Uğur Uzer³ , F. Saadet Karakulak³ 

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ABSTRACT

On February 27, 2018, a female smoothback angelshark, *Squatina oculata*, was incidentally captured in a gill-net fishery off the Mudanya coast (southeastern Sea of Marmara). An opportunistic photographic record confirmed the emergence of *S. oculata* in the Sea of Marmara, where its status in the area is considered questionable because of its absence for many years in the region. The current opportunistic records are valuable data sources, which can provide complementary information to fill the knowledge gaps in the life histories of rare, rarely caught, or endangered sharks and rays.

Keywords: *Squatina oculata*, Turkish Sea, emergence, endangered, opportunistic

INTRODUCTION

Angelsharks (Squatiniformes: Squatinidae) are represented by 22 species and *Squatina oculata* Bonaparte, 1840, commonly known as the smoothback angelshark, emerged in the Eastern Atlantic, from Senegal to Ghana coast, and in the Mediterranean Sea (Ebert et al., 2021). Although its present emergence in the Mediterranean Sea has long been well-recognized (Miller, 2016; Serena et al., 2020; Barone et al., 2022), *S. oculata* is considered a rare and one of the least-known species of Mediterranean sharks for which data collection is clearly required owing to knowledge gaps (Zava et al., 2016; Barone et al., 2022; Zava et al., 2022). First accounts of the emergence of smoothback angelshark in Turkish waters were mentioned in the inventories of Slastenenko (1955–1956; cited in Bilecenoğlu et al., 2002, 2014), Akşiray (1987), and Bauchot (1987). Despite being reported in the Sea of Marmara for the first time in the 1950s and then reported from the same region in the early 1990s (Slastenenko, 1955–1956; Meriç, 1994; both were cited in Bilecenoğlu

et al., 2002, 2014), the species has not been reported in several bycatch inventories (Bayhan et al., 2006; Bök et al., 2011) or general ichthyological inventories (Karakulak et al., 2017; Daban et al., 2021; ÇŞİDB-TUBİTAK-MAM, 2021) of the Sea of Marmara, which were previously published. Although the emergence of *S. oculata* in the region was also reported by Eryılmaz and Meriç (2005), this review study is based on the ichthyological report by Meriç (1994; cited in Bilecenoğlu et al., 2002). Due to the absence of a recent record of smoothback angelsharks from the region, the emergence status of *S. oculata* was considered questionable (Kabasakal, 2022); thus, it requires confirmation. In the present study, the re-emergence of the smoothback angelshark in the Sea of Marmara after nearly 30 years is reported, and a review of captures of the species in Turkish waters is provided.

MATERIAL AND METHODS

The present record of *S. oculata* was obtained following data mining to extract shark-specific

ORCID IDs of the author:
H.K. 0000-0001-8189-9748;
U.U. 0000-0002-7038-6469;
F.S.K. 0000-0002-6053-5256

¹Istanbul University, Institute of Science, Fisheries Technologies and Management Program, Istanbul, Türkiye

²WWF Türkiye, Asmalı Mescit, Istanbul, Türkiye

³Faculty of Aquatic Sciences, Istanbul University, Istanbul, Türkiye

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Correspondence:
Hakan Kabasakal
E-mail:
kabasakal.hakan@gmail.com



information (printed or digital articles, social media posts or films, etc.) as part of an ongoing data acquisition survey to regularly update the information on sharks of Turkish seas, which has been continuing since 2000 through monthly screening of published media (2000–2009 records) and Internet media (post2009 records). While scanning and extracting data shared by digital content owners on the Internet or social media, ethical rules proposed by Monkman et al. (2017) were followed using the data in question. Furthermore, care was taken to not violate the rights of content owners and show the faces of people in the visual content to prevent revealing their identities. Information regarding the present smooth angelshark is available on the website of a mainstream newspaper of Turkish media (Türk, 2018).

Species identification follows the descriptions by Miller (2016), Ebert et al. (2021), and Barone et al. (2022). Taxonomic nomenclature follows that reported by Froese and Pauly (2023). Regarding the sampling methodology, the present study is a usual practice of opportunistic sampling, of which opportunistic records are not the direct results of scientific fisheries surveys but are acquired from printed or digital media, social media, logs of naturalists, or recreational fishermen (Grant et al., 2022; Hiddink et al., 2023). Previous captures of *S. oculata* in Turkish waters were extracted from relevant references presented in Table 1.

RESULTS AND DISCUSSION

On February 27, 2018, a female smoothback angelshark (Figure 1) was incidentally captured in a gill-net fishery off the Mudanya coast (southeastern Sea of Marmara; Figure 2). The present specimen was identified as *S. oculata* based on the following characteristics: a ray-like shark species with a strongly dorsoventrally flattened body, a very wide head, widened pectoral and dorsal fins, and no anal fin; however, the head is separated from the pectoral fins with very deep insertions. The origin of the first dorsal fin is located well behind the free rear tips of the pelvic fins, a primary descriptive characteristic of the three species of angelsharks occurring in the Mediterranean Sea (Figure 1). The area between the eyes is strongly concave. The lower lobe of the caudal fin is larger than the upper lobe. Nasal barbels are quite simple; however, because of the resolution and sight angle of the present image, no details of the nasal barbels, defined as “moderately fringed” in the literature, can be observed in the photo of the present specimen. Large spiracles are observed behind the eyes. The mouth is terminal and wide, and the teeth on the upper and lower jaws are small, pointed, and with one cusp. The above description of the present specimen is in agreement with the published descriptions of *S. oculata* (Miller, 2016; Ebert et al., 2021; Barone et al., 2022).

Captures of *S. oculata* reported from the Sea of Marmara and off the Turkish coasts of the Aegean Sea and the Mediterranean are presented in Table 1. In this table, 22 smoothback angelsharks have been incidentally captured in Turkish waters between pre1956 and 2023. The majority of smoothback angelsharks have been captured in Turkish Mediterranean waters (n = 13; 59.09%), followed by Turkish Aegean waters (n = 6; 27.2%) and Sea of Marmara (n = 3; 13.6%). The size (TL) of the captured smoothback angelsharks varied between approximately 24 and 120 cm, and the

Table 1. Review of captured specimens of *Squatina oculata* in Turkish waters.

No	Date	Locality	TL (cm)	W (g)	Sex	Depth (m)	Fishing gear	Remarks	Reference
1	Pre1956	SoM	-	-	-	-	-	-	Slattenenko (1955–1956; cited in Bilecenoğlu et al., 2002, 2014)
2	Pre1994	SoM	-	-	-	-	-	-	Meriç (1994; cited in Bilecenoğlu et al., 2002)
3	Pre1996	İskenderun Bay, northeastern MS	75.6	4,000	-	60	BT	Captured over mixed muddy-sandy bottom off Karataş	Başusta ve Erdem (2000)
4	Pre2002	Gökçeada, northern AE	-	-	-	-	-	-	Kabasakal (2002)
5	Pre2002	Fethiye, southern AE	-	-	-	-	-	-	Kabasakal (2002)
6	Pre2002	İskenderun Bay, northeastern MS	-	-	-	-	-	-	Kabasakal (2002)
7	Jul 1997	Gökçeada, northern AE	30	180	♂	-	BT	Captured over sandy bottom mixed with small pebbles and vegetation of <i>Posidonia oceanica</i>	Kabasakal & Kabasakal (2004)

Table 1. Continue.

No	Date	Locality	TL (cm)	W (g)	Sex	Depth (m)	Fishing gear	Remarks	Reference
8	Sep 1999	Gökçeada, northern Aegean Sea	95	6,000	♀	-	BT	Captured over sandy bottom	Kabasakal & Kabasakal (2004)
9	Aug 2009	Bay of Antalya, eastern MS	80	4,500	-	100	BT	-	Özgür Özbek & Kabasakal (2022)
10	Spring 2010	Bay of Antalya, eastern MS	50	850	-	100	BT	-	Özgür Özbek & Kabasakal (2022)
11	Spring 2010	Bay of Antalya, eastern MS	88	5,550	♀	50	BT	A total of seven developing embryos, with a total weight of 500 g, were found in uteri. Photographic documentation of the intra-uterine embryos is available in the relevant reference	Özgür Özbek & Kabasakal (2022)
12	Spring 2010	Bay of Antalya, eastern MS	59	1,600	-	50	BT	-	Özgür Özbek & Kabasakal (2022)
13	Spring 2010	Bay of Antalya, eastern MS	52	1,000	-	100	BT	-	Özgür Özbek & Kabasakal (2022)
14	Winter 2010	Bay of Antalya, eastern MS	67	1,700	-	50	BT	-	Özgür Özbek & Kabasakal (2022)
15	Winter 2010	Bay of Antalya, eastern MS	69	1,800	-	50	BT	-	Özgür Özbek & Kabasakal (2022)
16	Winter 2010	Bay of Antalya, eastern MS	66	2,000	-	50	BT	-	Özgür Özbek & Kabasakal (2022)
17	Winter 2010	Bay of Antalya, eastern MS	88	5,500	-	50	BT	-	Özgür Özbek & Kabasakal (2022)
18	Winter 2010	Bay of Antalya, eastern MS	24	71	-	50	BT	-	Özgür Özbek & Kabasakal (2022)
19	4 Nov 2017	Aydıncık coast, eastern MS	72.6	3,450	♀	65	BT	Captured over sandy bottom	Ergüden et al. (2019)
20	27 Feb 2018	Mudanya coast, southwestern SoM	-	-	-	-	GN	Displayed in the fishmonger	Present study
21	22 Mar 2018	Gökçeada, northern Aegean Sea	87.5	5,536	♀	110	BT	Symmetrically distributed developing oocytes (n = 6) ranging from 55.22 to 59.55 mm, were found in ovaries	Yiğın et al. (2019)
22	8 Aug 2023	Gökçeada, northern Aegean Sea	ca. 120	-	♀	224–300	TN	Released alive	Kabasakal (2023, in press)

SoM, Sea of Marmara; AE, Aegean Sea; MS, Mediterranean Sea; BT, bottom trawl; GN, gill net; TN, trammel net

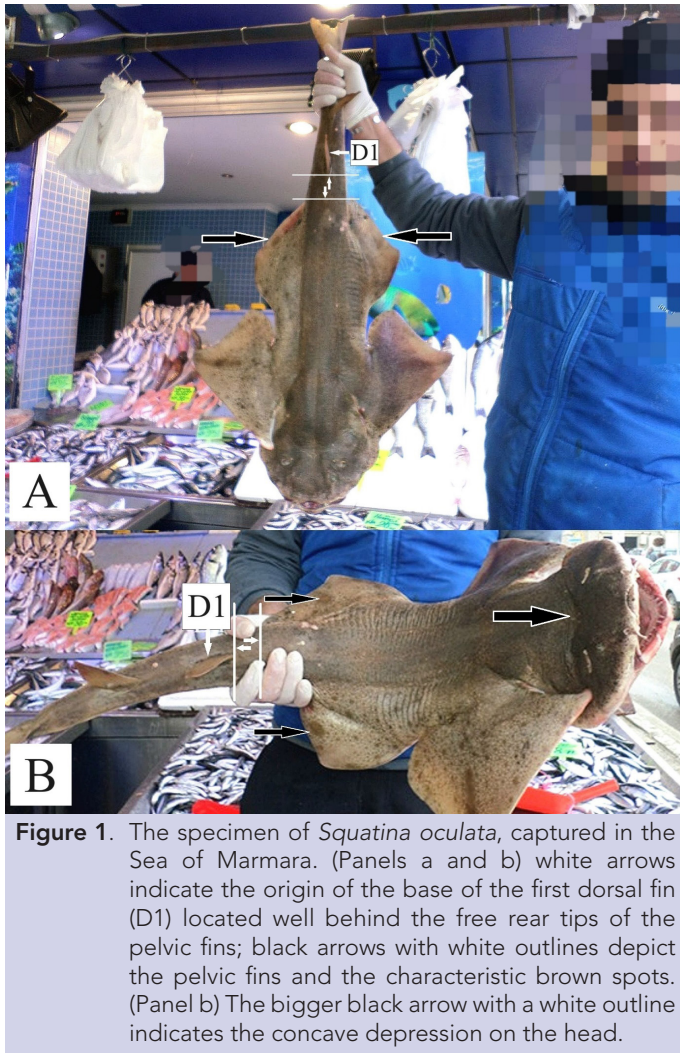


Figure 1. The specimen of *Squatina oculata*, captured in the Sea of Marmara. (Panels a and b) white arrows indicate the origin of the base of the first dorsal fin (D1) located well behind the free rear tips of the pelvic fins; black arrows with white outlines depict the pelvic fins and the characteristic brown spots. (Panel b) The bigger black arrow with a white outline indicates the concave depression on the head.

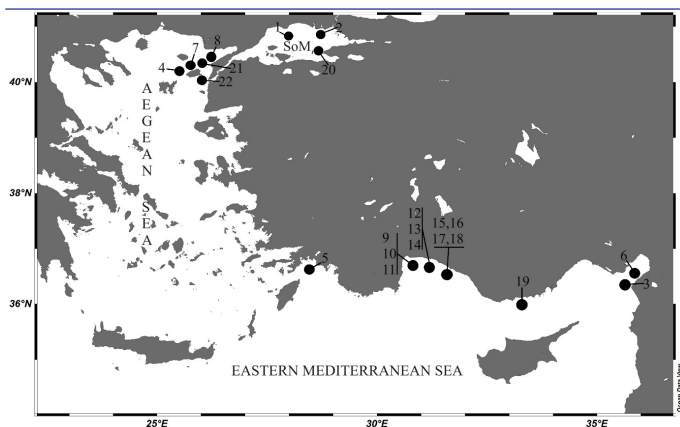


Figure 2. Black dots depict the approximate localities of captures of *Squatina oculata* in Turkish waters. The numbers on the map correspond to the same individual numbers listed under column "No" in Table 1. SoM, Sea of Marmara.

weight varied between 71 and 6,000 g (Table 1). The collated data by Zava et al. (2022), between September 2005 and March 2021, revealed that 34 smoothback angelsharks have been either captured or sighted from several regions of the Mediterranean Sea. When the study results and data by Zava et al. (2022) are combined, the number of confirmed records of *S. oculata* in the Mediterranean Sea rises to 56, 39.28% of which have been captured in Turkish waters.

During the second phase of the extensive MEDITS survey performed in northern Mediterranean waters between 2012 and 2015, no *S. oculata* was captured (Follesa et al., 2019). Furthermore, during the first phase of the MEDLEM project, which is aimed at collating data on the large elasmobranch species of the Mediterranean Sea between 1666 and 2017, *S. oculata* is considered a "rarely observed" shark species (Mancusi et al., 2020). During the second phase of the MEDLEM, covering 2017–2022, no smoothback angelshark has been recorded in the area (Gallo et al., 2022). Therefore, the smoothback angelshark sighted in the trammel net fishery on August 8, 2023, off the island of Gökçeada (sp No. 22 in Table 1; Kabasakal, 2023), is a recent record of species in the Mediterranean Sea, without ruling out the rarity of *S. oculata*. Pregnant females captured in the Bay of Antalya and off the island of Gökçeada (sp Nos. 11 and 21, respectively, in Table 1) indicate that *S. oculata* reproduction may simultaneously emerge in remote regions of the northern Aegean Sea and Turkish Mediterranean waters. The emergence of pregnant females provides further justification for the International Union for Conservation of Nature Shark Specialists Group's declaration of the Tracean Sea Shelf (northern Aegean Sea) and Bay of Antalya (eastern Mediterranean) important shark and ray areas (Jabado et al., 2023).

Recent records of *S. oculata* in Turkish seas are mostly composed of individuals captured after 2000 ($n = 19$; 86.36%; Table 1). Similarly, Zava et al. (2022) reported that all 34 smoothback angelsharks were either captured or sighted in 2005 and thereafter. Again, when the results of this study and those of Zava et al. (2022) are combined, the majority of contemporary records of smoothback angelsharks ($n = 53$; 94.64%) have either been captured or sighted in the last 23 years, which corresponds to 2.3 individuals per year. Although the number of smoothback angelsharks per annum reflects the rarity of the species, the paucity of records may be due to the absence of reporting captures or sightings. Therefore, the available number of records may increase by unraveling the retrospective unpublished smoothback angelshark captures. For example, despite the present capture of a smoothback angelshark on February 27, 2018, the discovery of this unpublished record occurred following an Internet search performed on December 14, 2023, which emphasizes the importance of retrospective data searches with novel investigation methods and digital tools.

In recent years, a notable increase in the use of digital tools, such as digital media, and social media, among others, in searching for rare elasmobranchs and in the number of studies focusing on captures and/or sightings of these species has been reported (Bengil, 2020; Kabasakal & Bilecenoğlu, 2020; Grant et al., 2022; Hiddink et al., 2023; Kabasakal, 2023). A quick review of the contents of such research articles reveals a wide spectrum of topics, such as providing complementary data on the distribution of

well-recognized elasmobranchs (Bengil, 2020) or rare and large sharks (Kabasakal and Bilecenoğlu, 2020) in Turkish waters, filling the knowledge gaps of the distribution range of an endangered elasmobranch species (Grant et al., 2022), or determining spatial and temporal variations of the distribution and abundance of a certain elasmobranch (Hiddink et al., 2023). Compared with traditional systematic scientific sampling, opportunistic methodologies obviously suffer from several drawbacks, such as uncertainties (e.g., fisher's statement-dependent information) and weaknesses (e.g., fisher's data cannot be representative of the true periodicity of fishing days). However, as emphasized by Tsikliras and Dimarchopoulou (2021), the current opportunistic records are considered valuable data sources; these can provide complementary information to fill the knowledge gaps in the life histories of rare, rarely caught, or endangered sharks and rays. Finally, the identifying a species from the photo provided, which is also the case for the present study, is considered a confirmed emergence of a fish species in a given region (Kovačić et al., 2020).

CONCLUSIONS

As a consequence, the contemporary emergence of *S. oculata* in the Sea of Marmara, where the status of the species in the region is considered questionable due to its absence for many years in the area (Kabasakal, 2022), is confirmed based on an opportunistic photographic record (Figure 1). Being a "critically endangered" elasmobranch species of the Mediterranean Sea (Ferretti et al., 2016) and being included in the Annex II of the SPA/BD protocol covered by GFCM/36/2012/3 and GFCM/42/2018/2 recommendations (Barone et al., 2022), *S. oculata* is also a protected species in Turkish seas (Resmi Gazete, 2018). However, even the protected species can be incidentally captured in commercial fisheries, which is also the case for the present smoothback angelshark. Since the data in question can often be hidden due to fear of punishment, social media posts or digital news reports of such hidden captures may be used as an efficient and complementary data-providing tool for monitoring the bycatch of endangered and protected species in commercial fisheries.

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Ethics Committee Approval: Since no experimental animal was used in the submitted study, approval of the ethics committee is not required.

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