

FINALLY UNDER PROTECTION! STATUS OF THE ANGEL SHARK, *SQUATINA SQUATINA* (LINNAEUS, 1758) IN TURKISH SEAS, WITH NOTES ON A RECENT SIGHTING AND INCIDENTAL CAPTURES

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ABSTRACT

Nine angel sharks, Squatina squatina, were recorded in different regions of Turkish waters between 21 March 2009 and February 2019. Eight specimens were captured by different means of bottom fishing gear (e.g., gill or trammel net, or longline) or harpoon, and 1 specimen was sighted alive. Considering the fishery statistics of angel sharks in the last 10 years and biomass and numerical abundance data on the species in Turkish waters as baseline data, an alarming reduction in the populations of S. squatina in the mentioned regions has been observed. An extensive study providing baseline information on the current spatial distribution patterns, habitat use, abundance and population structure of S. squatina in Turkish waters is an urgent necessity.

Key words: Angel shark, *Squatina*, protection, baseline shift, rarity, eastern Mediterranean

FINALMENTE PROTETTO! STATO DELLO SQUALO ANGELO, *SQUATINA SQUATINA* (LINNAEUS, 1758) IN MARE TURCO, CON NOTE SU AVVISTAMENTI RECENTI E CATTURE ACCIDENTALI

SINTESI

Nove squali angelo, Squatina squatina, sono stati registrati in diverse regioni delle acque turche tra il 21 marzo 2009 e il febbraio 2019. Otto esemplari sono stati catturati con diversi attrezzi da pesca a fondo o con l'arpione, mentre un esemplare è stato avvistato vivo. Considerando le statistiche sulla pesca degli squali angelo negli ultimi 10 anni e i dati di biomassa e abbondanza numerica delle specie presenti nelle acque turche come dati di riferimento, è stata osservata una riduzione allarmante delle popolazioni di S. squatina nelle regioni considerate. Uno studio approfondito che fornisca informazioni di base sugli attuali modelli di distribuzione spaziale, sull'uso dell'habitat, e sull'abbondanza e la struttura demografica di S. squatina nelle acque turche è una necessità urgente.

Parole chiave: squalo angelo, *Squatina*, protezione, deviazione dal riferimento, rarità, Mediterraneo orientale

INTRODUCTION

In natural systems, rarity of a species is a common phenomenon and most often defined by two attributes: the species' distribution and its abundance (Flather & Sieg, 2007). According to Flather and Sieg (2007), a species is considered rare if its area of occupancy or its number is small when compared to the other species that are taxonomically or ecologically comparable. The angel shark, *Squatina squatina* (Linnaeus, 1758), used to be reported as abundant in the entire Mediterranean Sea (Serena, 2005). Nowadays, it is supposed to be absent or even extirpated from several areas in the region (Bradai *et al.*, 2012).

Due to the low overall number of records or a complete absence of the species in scientific trawl surveys conducted since 1958 (Holcer & Lazar, 2017), *S. squatina* is today considered a rare shark species throughout the Mediterranean Sea and its rarity has been emphasized by several researchers from different parts of the region (e.g., Golani, 2006; Serena & Relini, 2006; Kabasakal & Kabasakal, 2014; Akyol *et al.*, 2015; Cavallaro *et al.*, 2015).

Although the occurrence of *S. squatina* in Turkish waters has been noted in historical inventory studies of Turkish marine fishes (e.g., Ninni, 1923; Devciyan, 1926; Akşiray, 1987), all of which attributed an economic value to the species and mentioned mass captures, current statistics indicate a drastic decline in

annual landings of incidentally captured angel sharks in Turkish waters (TUIK, 2017). As in many parts of the Mediterranean, populations of *S. squatina* have been severely depleted in Turkish waters as well, which calls for the protection of the species.

The present article provides a summary of the captures and of the single sighting of *S. squatina* in Turkish waters in the last 10 years, and discusses the causes of the species' depletion. These events have eventually resulted in the implementation of effective protective measures for the species in the mentioned region.

MATERIAL AND METHODS

Data on captures and a single sighting of *S. squatina* in Turkish waters were obtained from the following sources: (1) scientific literature; (2) preserved samples in public or private collections; (3) newspaper accounts or internet news reporting on the capture of angel sharks in the studied area and (4) visits to fishing ports. As far as popular sources are concerned, the validity of the records was confirmed through direct contact with the fishermen cited by the sources, or else, based on a reliable photograph of the specimen accompanying such news. The following data were recorded for the examined specimens of angel shark: date, depth and locality of capture, total length (TL), weight (W), sex and fishing gear.

Commercial landings data on angel sharks from 2008 to 2017 were used to indicate the trend of annual

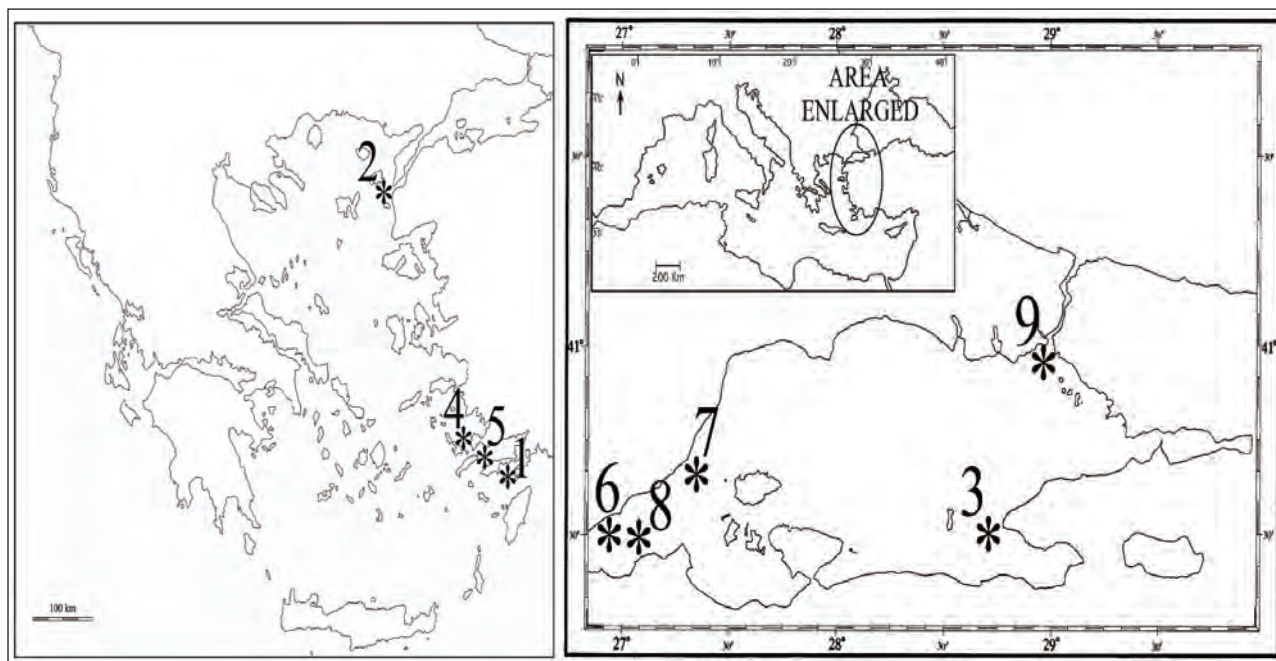


Fig. 1: Maps showing the approximate locations of recent captures and the single sighting of *S. squatina*, in Turkish waters. The numbers correspond to those in Table 1.

Sl. 1: Zemljevidi o recentnih ulovih in opazovanih navadnega sklata v turških vodah. Številke ustrezajo tistim v Tabeli 1.

Tab. 1: Old and recent captures or sightings of the angel shark, *Squatina squatina*, in Turkish waters since 2009. The numbers in the “No.” column are same as those in Fig. 1 indicating the approximate localities of capture.**Tab. 1: Stari in novejši zapisi o opazovanju navadnih sklatov, *Squatina squatina*, v turških vodah od leta 2009. Številke v stolpcih so enake kot v Sliki 1 in ponazarjajo približno lokaliteto ulova.**

No	Date	Locality	Depth (m)	Sex	TL (cm)	W (kg)	Remarks
1	21 March 2009	Bodrum	-	♀	160	ca. 60	Entangled in coastal stationary-nets
2	October 2013	Çanakkale	1.5	-	ca. 100	-	Harpooned by a freediver in shallow water
3	4 January 2014	Mudanya	ca. 50	♀	174	35	Entangled in a trammel-net, after the auction it was sold (Kabasakal & Kabasakal, 2014)
4	5 February 2015	Gökova Bay	20	♀	156	32.6	Entangled in a trammel-net; it was a pregnant female carrying at least four developing embryos, which were expelled during the handling (Akyol <i>et al.</i> , 2015)
5	5 March 2015	Gökova Bay	-	♀	160	-	Found dead while entangled in a stationary-net (unpublished data)
6	December 2015	Dardanelles Strait	ca. 30	♀	ca. 150	-	Sighted by Mr. Mert Gökalp during a SCUBA diving expedition in the vicinity of the northern entrance of the Dardanelles Strait (unpublished data) (Fig. 2)
7	21 March 2018	Şarköy	ca. 40	♂	114	-	Captured by long-lining set for sea breams (Sparidae), displayed in Beşiktaş fishmarket in İstanbul (unpublished data) (Fig. 3).
8	3 April 2018	Dardanelles Strait	ca. 30	♂	90	-	Captured by stationary-netting, displayed in Beşiktaş fishmarket in İstanbul (unpublished data) (Fig. 4).
9	February 2019	Bosphorus Strait	20 m	♀	ca. 140	30	Captured by gill-netting around the southern entrance of the Bosphorus Strait, transported to Edirne city and sold (unpublished data)

catches of *Squatina* species in Turkish waters (TUIK, 2017). To date, three species of angel shark, *S. aculeata* Dumeril, in Cuvier, 1817, *S. oculata* Bonaparte, 1840 and *S. squatina* have been recorded in Turkish waters (Bilecenoğlu *et al.*, 2014). Since no species-specific discrimination of angel shark catches is reported in TUIK statistics, the annual landings data represent the combined data on the landings of three congeneric angel sharks in Turkish waters. Raw data and individual records of angel sharks are kept in the archive of the Ichthyological Research Society.

RESULTS AND DISCUSSION

Nine angel sharks, *S. squatina*, were recorded in several regions of Turkish waters between 21 March 2009 and February 2019 (Tab. 1; Fig. 1). Eight specimens were

captured by different means of bottom fishing gear (e.g., gill or trammel net, or longline) or harpoon, and 1 specimen was sighted alive (see Tab. 1 for specimen-specific details). Six specimens were females, 2 were males and the sex of 1 angel shark was unknown. The total length of the specimens varied from 90 to 174 cm. Five angel sharks were captured in Aegean waters, three in the Sea of Marmara and 1 specimen was sighted in the southeastern part of the region near the northern entrance to the Dardanelles Strait (Fig. 1). The angel sharks were recorded in very shallow (specimen no. 2 at a depth of 1.5 m) to quite deep waters (specimen no. 3 at a depth of ca. 50 m) of the coastal zone (Tab. 1).

Based on the information obtained from available literature, the occurrence of the angel shark, *S. squatina*, in Turkish waters dates back to the early 20th century, when Devciyan (1926) reported on angel sharks landed



Fig. 2: A live specimen of *S. squatina* (specimen no. 6 in Table 1) sighted in the Dardanelles Strait at a depth of 30 m (Photo: Mert Gökalp).

Sl. 2: Opaženi primerek navadnega sklata (primerek št. 6 v Tabeli 1), opažen v prelivu Dardanel na globini 30 m (Foto: Mert Gökalp).

at the İstanbul fish market. According to his report (Deveciyan, 1926), angel shark was a regularly captured, landed and consumed shark species; however, the author did not provide any specific information, such as annual catch data, etc., on the species. Kabasakal (2002) reported captures of 51 angel sharks in total off the coast of Turkey between 1995 and 1999. Kabasakal (2003) reported the capture of a female angel shark of 87 cm TL in the southern Sea of Marmara, in November 1995. According to Kabasakal and Kabasakal (2004), 5 males in total were captured off the coast of Gökçeada in the northeastern Aegean Sea in October 1996 (3 specimens) and July 1997 (2 specimens), all by means of bottom fishing gear. In the 1950s, *S. squatina* was a popular gamefish among spearfishermen in the Sea of Marmara (Kabasakal & Kabasakal, 2014).

According to Deveciyan (1926), Akşiray (1987) and Kocataş *et al.* (1993), *S. squatina* is a valuable commercial species of shark in Turkish marine fishery. Deveciyan (1926) and Akşiray (1987) in particular pointed out the significant landings and high economical value of angel sharks captured in Turkish waters in the 20th century. However, like many other shark species, populations of *S. squatina* in Turkish waters have drastically declined and the rarity or the absence of angel shark from the general ichthyological inventory or shark specific studies provides alarming evidence that the survival of the species is threatened. In two recent surveys on the composition of bycatch in pink-shrimp (*Parapenaeus longirostris*) beam trawl fishery in southern and northern Sea of Marmara, Bayhan *et al.* (2006) and Bök *et al.* (2011) reported the absence of *S. squatina* from both marine regions. Karakulak *et al.* (2000) also reported the absence of *S. squatina* in surveys on demersal fish populations of the northern Sea of Marmara. Keskin and Eryılmaz (2010) reviewed the demersal fish populations



Fig. 3: A *S. squatina* incidentally captured off Şarköy coast (southwestern Sea of Marmara; specimen no. 7 in Tab. 1), on display at the fishmonger's (Photo: Hakan Kabasakal).

Sl. 3: Naključno ujeti primerek navadnega sklata ob obali Şarköy (jugozahodno Marmarsko morje; primerek št. 7 v Tabeli 1), razkazan na ribji tržnici (Foto: Hakan Kabasakal).

of the Sea of Marmara and found *S. squatina* to be rare in the mentioned region, which was further corroborated by Kabasakal (2016).

The rarity of *S. squatina* in Turkish waters was also emphasised by Kabasakal and Kabasakal (2014) and Akyol *et al.* (2015). According to Başusta *et al.* (2016), the paucity of publications on *S. squatina* (less than 5) is conspicuous among the studies on cartilaginous fishes occurring in Turkish Mediterranean waters. Recently, Filiz *et al.* (2018) estimated the biomass and numerical



Fig. 4: A *S. squatina* incidentally captured in Dardanelles Strait (specimen no. 8 in Tab. 1), on display at the fishmonger's (Photo: Hakan Kabasakal).

Sl. 4: Navadni sklat naključno ujet v prelivu Dardanel (primerek št. 8 v Tabeli 1), razkazan na ribji tržnici (Foto: Hakan Kabasakal).

abundance of *S. squatina* at 13 kg/km² and 5 individuals/km² based on the bycatch composition of bottom trawl fishery in southern Aegean Sea. Since no species-specific discrimination of angel shark catches is reported in TUIK statistics, the annual landings data represent the combined data on the landings of three congeneric angel sharks, *S. aculeata*, *S. oculata* and *S. squatina*, captured in Turkish waters. A dramatic decline in the annual landings of *Squatina* species is clear from the fishery statistics for the 2008–2017 period (TUIK, 2017; Fig. 5). While in 2008 the annual landings of *Squatina* species by commercial fishermen amounted to 34 tons,

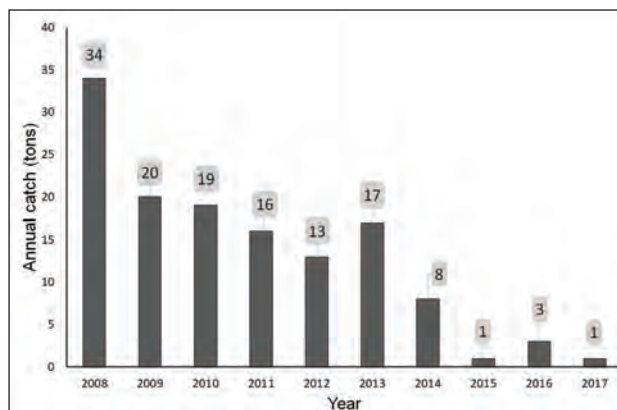


Fig. 5: Annual landings of *Squatina* species by Turkish fishermen in the 2008–2017 period. The graph based on the annual landings data of *Squatina* species is extracted from fisheries statistics (TUIK, 2017).

Sl. 5: Letni ulov različnih vrst iz rodu *Squatina*, ki so jih ujeli turški ribiči v obdobju 2008–2017. Graf temelji na letnih ulovih sklatov, pridobljenih iz statističnih ribiških podatkih (TUIK, 2017).

in 2017 they came nearly 1 ton (Fig. 5). Although the landings rose to 17 tons in 2013, the declining trend in the annual landings during the 2008–2017 period did not change (Fig. 5).

The first records of *S. squatina* in Turkish waters date back to the early 20th century (Ninni, 1923; Deveciyan, 1926). The occurrence of *S. squatina* in Turkish waters was also reported in later studies (e.g., Roux, 1984; Akşiray, 1987). Both in the earliest and later studies, *S. squatina* was reported as an abundant shark population sustaining a fishery based on it (Deveciyan, 1926; Akşiray, 1987). Furthermore, the maximum total lengths reported for the species ranged between 200 cm (Akşiray, 1987) and 250 cm (Roux, 1984). Unfortunately, there are no studies reporting about the population dynamics and abundance of *S. squatina* in Turkish waters during the last century, however, recent data show drastic declines in terms of biomass, numerical abundance and annual landings (TUIK, 2017; Filiz *et al.*, 2018; Fig. 5). Also, the maximum total length of angel sharks captured in recent years (174 cm TL in the present study; specimen no: 3, Tab. 1) is remarkably below the historically reported sizes (200 to 250 cm TL).

Based on the limited historical and contemporary data on biomass, numerical abundance, annual landings and maximum total length of the *S. squatina* observed in Turkish waters, the 'shifting baseline syndrome' outlined by Pauly (1995) is dramatically present among young generations of fishermen, a common phenomenon that was also highlighted by Holcer and Lazar (2017) for the angel sharks from the Adriatic Sea. Due to the absence of baseline data indicating the status of *S. squatina* in Turkish waters during the last century, we cannot carry

out a reasonable comparison between the historical and contemporary statuses of the species. However, based on available data it is possible to speculate that the abundance of *S. squatina* in demersal catch composition significantly declined over time, with the maximum total length of the species decreasing (Deveciyan, 1926; Roux, 1984; Akşiray, 1987; TUIK, 2017; Filiz *et al.*, 2018). According to Meyers *et al.* (2017), in regions where baseline information on the current spatial distribution patterns, habitat use, abundance and population structure of the angel shark is lacking, urgent conservation policies should be implemented. Therefore, the inclusion of *S. squatina*, as well as the congeneric angel sharks, *S. aculeata* and *S. oculata*, in the list of marine protected species, which was declared in the Official Gazette in 2018 (Resmi Gazete, 2018), was a correct decision with respect to the status of angel shark in Turkish seas, where the baseline data of squatinid sharks is inadequate.

Except for the single live sighting, the angel sharks examined in the present study were incidentally captured specimens (Tab. 1); however, bycatch pressure on this rare shark by untargeted fisheries can also become a serious threat to its future survival. In an extensive study on the reproductive biology of *S. squatina* in the Mediterranean Sea, Capapé *et al.* (1990) reported that males and females mature between the total lengths of 80–132 cm and 128–169 cm, respectively. According to Capapé *et al.* (1990), males and females of over 80 cm and 128 cm in TL, respectively, can be considered as reproducing adult angel sharks. Recently, a pregnant female angel shark of 156 cm TL got entangled in a trammel net in Gökova Bay (southern Aegean Sea) and expelled its developing embryos during handling (Akyol *et al.*, 2015). Based on the sizes of the reproducing adults of angel sharks reported by Capapé *et al.* (1990) and Akyol *et al.* (2015), it can be concluded that all of the specimens examined in the present study were mature males and females (Tab. 1). Incidental captures of reproducing adults create another threat to the survival of *S. squatina*. Fishing-gear induced injuries, keeping sharks on the deck in rough conditions and subjecting them to harsh handling before releasing them into the sea negatively impact the post-release survival rate of specimens (see Kabasakal, 2010 for relevant references), and cannot be ruled out as causes of mortality in the incidentally captured specimens of *S. squatina* in the present study.

CONCLUSIONS

Although the protective legislation concerning angel sharks applies to all 3 species, *S. aculeata*, *S. oculata* and

S. squatina (Resmi Gazete, 2018), it is still very early to observe any positive results of the recent enactment of this legal protection on the angel shark populations occurring in Turkish waters. Since a “shifting baseline” effect is possibly present among younger fishermen, as reported by Holcer & Lazar (2017), the latter can lack incentive to act upon catching angel sharks, not recognising that as important. Due to life history parameters of *S. squatina*, such as low fecundity, long reproductive cycle (2 year) and the large size at which females reach sexual maturity (128 cm, which equals 51.2% of the reported maximum total length, 250 cm) (Roux, 1984; Capapé *et al.*, 1990), the species is considered as highly vulnerable to targeted and untargeted fisheries alike. Taking the fishery statistics of *Squatina* species during the last 10 years (TUIK, 2017) and the biomass and numerical abundance data on the species in Turkish waters (Filiz *et al.*, 2018) as baseline data, we should point out an alarming reduction in the populations of *S. squatina* in the mentioned region. An extensive study providing baseline information on the current spatial distribution patterns, habitat use, abundance and population structure of *S. squatina* in Turkish waters is therefore an urgent necessity. Given the Red List status of *S. squatina* (critically endangered; Cavanagh & Gibson, 2007) and its rarity (Golani, 2006; Serena & Relini, 2006; Kabasakal & Kabasakal, 2014; Akyol *et al.*, 2015; Cavallaro *et al.*, 2015), the proposed study should employ non-invasive methods, such as capture and release of live specimens after satellite tagging and underwater imaging, perhaps with the contribution of citizen scientist divers. Last but not least, although *S. aculeata*, *S. oculata* and *S. squatina* are currently under full protection in Turkish seas (Resmi Gazete, 2018), it would be reasonable to expect cryptic mortality of the released angel sharks due to fishing-gear induced injuries and harsh handling before release. To prevent this and insure the safety of both fishermen and captured sharks, training of fishermen on which species of sharks are endangered and under protection and how these species should be kept alive on deck and handled before release, is critical.

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KONČNO ZAVAROVAN! STATUS NAVADNEGA SKLATA, *SQUATINA SQUATINA* (LINNAEUS, 1758) V TURŠKIH MORJIH S POSEBNIM POUČENJEM NA NOVEJŠA OPAZOVANJA IN NAKLJUČNE ULOVE

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POVZETEK

Devet navadnih sklatov, *Squatina squatina*, je bilo popisanih v različnih predelih turških voda med 21. marcem 2009 in februarjem 2019. Osem primerkov je bilo ujetih z različnimi ribiškimi orodji (npr. zabodne in trislojne mreže, ribolov s parangali) ali harpuno, en primerek pa je bil opažen. Upošteva je ribiško statistiko v zvezi s sklato v zadnjih desetih letih in podatke o abundanci in biomasi o vrsti v turških morjih kot temeljne podatke, je razviden veliki upad populacij sklatov v omenjenih okoljih. Zato je potrebno čimprej pripraviti obsežno raziskavo o vzorcih prostorske razširjenosti, izbiri habitata, abundanci in populacijski strukturi navadnega sklata v turških morjih.

Ključne besede: sklat, *Squatina*, varovanje, bazični odmik, redkost, vzhodno Sredozemlje

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