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"Without sharks, you take away the apex predator of the ocean,
and you destroy the entire food chain."
Peter Benchley

SHARK ATTACKS AGAINST HUMANS AND BOATS IN TURKEY'S WATERS IN THE TWENTIETH CENTURY

HAKAN KABASAKAL & SAİT ÖZGÜR GEDİKOĞLU
Ichthyological Research Society, Tantavi mahallesi, Menteşoğlu caddesi, İdil apartmanı, No: 30, D: 4, Ümraniye TR-34764, Istanbul, Turkey
E-mail: kabasakal.hakan@gmail.com

ABSTRACT

Thirteen shark attacks were recorded in Turkey's waters between 1931 and 1983. Ten out of the 13 attacks (76.9 %) occurred in the Sea of Marmara, and were followed by 2 attacks recorded in the Mediterranean and 1 attack in the Aegean Sea. In 7 attacks (53.8 %) targets were the fishing boats, of which 6 of them were boats of tuna handliners, while 6 attacks (46.2 %) were directly against humans. In 3 incidents (23.1 %) skin or scuba divers, who caught fish with a harpoon were attacked, while 3 attacks were against swimmers. Two attacks (15.3 %) were fatal. Large predatory sharks have been occurring in the vicinity of aquaculture cages, which are located along Turkey's Aegean and Mediterranean coasts, as seen in the Güllük Bay incident; however, threats to public safety caused by the predator aggregations close to shorelines is still unknown.

Keywords: shark attack, Turkey, fishery, aquaculture, public safety

ATTACCHI DI SQUALI A UOMINI E BARCHE IN ACQUE TURCHE NEL VENTESIMO SECOLO

SINTESI

Tredici attacchi di squali sono stati registrati nelle acque della Turchia tra il 1931 e il 1983. Dieci dei 13 attacchi (il 76,9 %) si sono verificati nel Mar di Marmara, due attacchi nel Mediterraneo e un attacco nel mar Egeo. Sette volte (ossia nel 53,8 % dei casi) sono state attaccate barche da pesca, di cui sei erano barche per la pesca del tonno con le lenze. I bersagli dei restanti sei attacchi (pari al 46,2% dei casi) erano umani. In tre casi (23,1 %) sono stati attaccati apneisti o subacquei che pescavano con un arpione, mentre per tre volte gli squali hanno attaccato nuotatori. Due attacchi (15,3 %) sono stati fatali. I grandi squali predatori sono stati avvistati in prossimità delle gabbie per l'acquacoltura che si trovano lungo le coste turche dell'Egeo e del Mediterraneo, come nel caso dell'incidente nella baia di Güllük. Tuttavia, le conseguenze delle minacce alla sicurezza pubblica relative ai raggruppamenti di predatori vicino alle linee costiere restano sconosciute.

Parole chiave: attacco dello squalo, Turchia, pesca, acquacoltura, sicurezza pubblica

INTRODUCTION

The term shark attack has been considered to be any forceful or injurious exchange between man and any shark (Baldridge, 1988). This frightening incident has always been one of the more thoroughly examined issues of the challenge between man and shark. Because of their feeding mechanisms, including sharp teeth and powerful jaws, and since they could attain very large sizes (*i.e.*, >4 m, in case of white or tiger sharks; Ebert & Stehmann, 2013), sharks are considered to be the top predators of the marine world, and as Baldridge (1988) stated, regardless of its size, any shark having both opportunity and physical capacity for injuring humans can be considered dangerous. In an aquatic environment where most humans can at best keep their heads above the water, the physical and predatory capabilities of these top predators render land-based humans easy prey in such forceful encounters (Caldicott *et al.*, 2001). In the early days of shark attack science, the opinion was that sharks, being cowardly scavengers, reserved their attention solely for the wounded and the dead. Most of the scientists of that era also believed that they did not attack live human beings, without being provoked (Baldridge, 1988). However, recent case studies have shown that sharks can attack live and active human beings due to a multiplicity of motivations (see Clua & Reid, 2013; Clua *et al.*, 2014; Levine *et al.*, 2014).

Of more than 5700 cases recorded in the Global Shark Attack File (GSAF), 160 have occurred in the Mediterranean Sea. According to the GSAF, only 2 attacks occurred in Turkey's waters in the 1930's. Until the last quarter of twentieth century, our knowledge on sharks occurring in Turkey's waters had many gaps. Nowadays, one of the major questions to be answered is, whether the knowledge on shark attacks allegedly occurring in Turkey's waters, reflects the real situation or not? Following several studies carried by the Ichthyological Research Society (IRS), a non-governmental and non-profit institution, dedicated for the research of sharks since 2000, authors acquired more data on several shark attacks that occurred in Turkey's waters during the twentieth century. Some preliminary data has been published previously (Kabasakal, 2014, 2015a).

In the present article, authors analyse the details of several fatal and non-fatal shark attacks against humans and boats that occurred in Turkey's waters, in the light of available data. Furthermore, a brief discussion on predatory aggregations around aquaculture cages and the possible consequences in terms of public safety in coastal waters is also made.

MATERIAL AND METHODS

Data on shark attacks in Turkey's waters were obtained from the following sources: (1) news that has appeared in printed and internet media; (2) GSAF data base which is accessible via the following link: www.sharkattackfile.net; (3) interviews with fishermen, especially old tuna handliners, who actively fished in Bosphoric waters

Tab. 1: Chronological list of shark attacks occurred in Turkish waters. Numbers in the No column are same as the numbers in Figure 1. AE - Aegean Sea, MS - Mediterranean Sea, SM - Sea of Marmara.
Tab. 1. Kronološki pregled napadov morskihpsov v turških vodah. Številke v stolpcih se ujemajo s številkami na zemljevidu obravnavanega območja na sliki 1. AE: Egejsko morje, MS: Sredozemsko morje, SM: Marmarsko morje.

No	Date	Region	Locality	Activity	Fatality	Reference
1	1930	SM	Yeşilköy	Handlining	No	De Maddalena & Heim (2012)
2	17 Mar 1931	SM	Bakırköy	Handlining	No	Unpubl. data
3	8 Feb 1934	SM	Haydarpaşa	Handlining	No	Unpubl. data
4	16 Aug 1937	SM	İstanbul	Swimming	No	GSAF (2015)
5	17 Sept 1948	MS	Yumurtalık	Swimming	Yes	Unpubl. data
6	1958	SM	Ahırkapı	Handlining	No	Kabasakal (2014, 2015a)
7	1958	SM	Ahırkapı	Handlining	No	Kabasakal (2014, 2015a)
8	25 Dec 1958	SM	Ahırkapı	Handlining	No	Kabasakal (2014, 2015a)
9	1966	SM	Sivriada	Scuba diving and spearfishing	No	Unpubl. data
10	7 July 1967	SM	Tuzla	Scuba diving and spearfishing	Yes	Unpubl. data
11	1970	MS	Antalya	Swimming	No	Unpubl. data
12	1970	AE	İzmir	Handlining	No	Unpubl. data
13	1983	SM	Dilovası	Spearfishing	No	Unpubl. data

between the 1930's and 1990's; and (4) available scientific literature. The selection of specific newspapers, magazines and websites for this study depended on their availability. The news were gathered through the use of library archives for the years prior to their inclusion in online newspaper databases, screening the daily issues of newspapers, and through an internet search. Approximate locality of each shark attack was plotted on the map (Fig. 1). Voice records of interviews with fishermen, screened newspaper pages and internet articles saved as pdf files are kept in the archives of IRS and available for inspection upon request.

RESULTS AND DISCUSSION

Analysis of the mentioned data sources revealed 13 shark attacks occurred in Turkey's waters between 1931 and 1983. Ten out of the 13 attacks (76.9 %) occurred in the Sea of Marmara, and were followed by 2 attacks (15.3 %) recorded in the Mediterranean and 1 attack (7.7 %) in the Aegean sea. Four attacks (30.7 %) occurred during late spring (May), summer (July and August) and early autumn (September) months, when sea surface temperatures were > 20 ºC, while 3 attacks (23.1 %) occurred during winter (December and February) and early spring (March) months, when sea surface temperatures were < 20 ºC (Tab. 1). In 7 attacks (53.8 %) targets were the fishing boats, of which 6 of them were boats of tuna handliners, while 6 attacks (46.2 %) were directed against humans. In 3 incidents (23.1 %) skin or scuba divers, who were harpooning fish, were attacked. Additional 3 attacks were against swimmers. Two attacks (15.3 %) were fatal.

The story of shark attacks in Turkey's waters started in 1930. In that year, two British citizens went to sea aboard a small fishing boat off Santo Stefano (Yeşilköy, Sea of Marmara; Fig. 1, Tab. 1), and were attacked by a large shark (De Maddalena & Heim, 2012). The species of the shark was assumed to be a great white shark (*Carcharodon carcharias*), although this assumption has

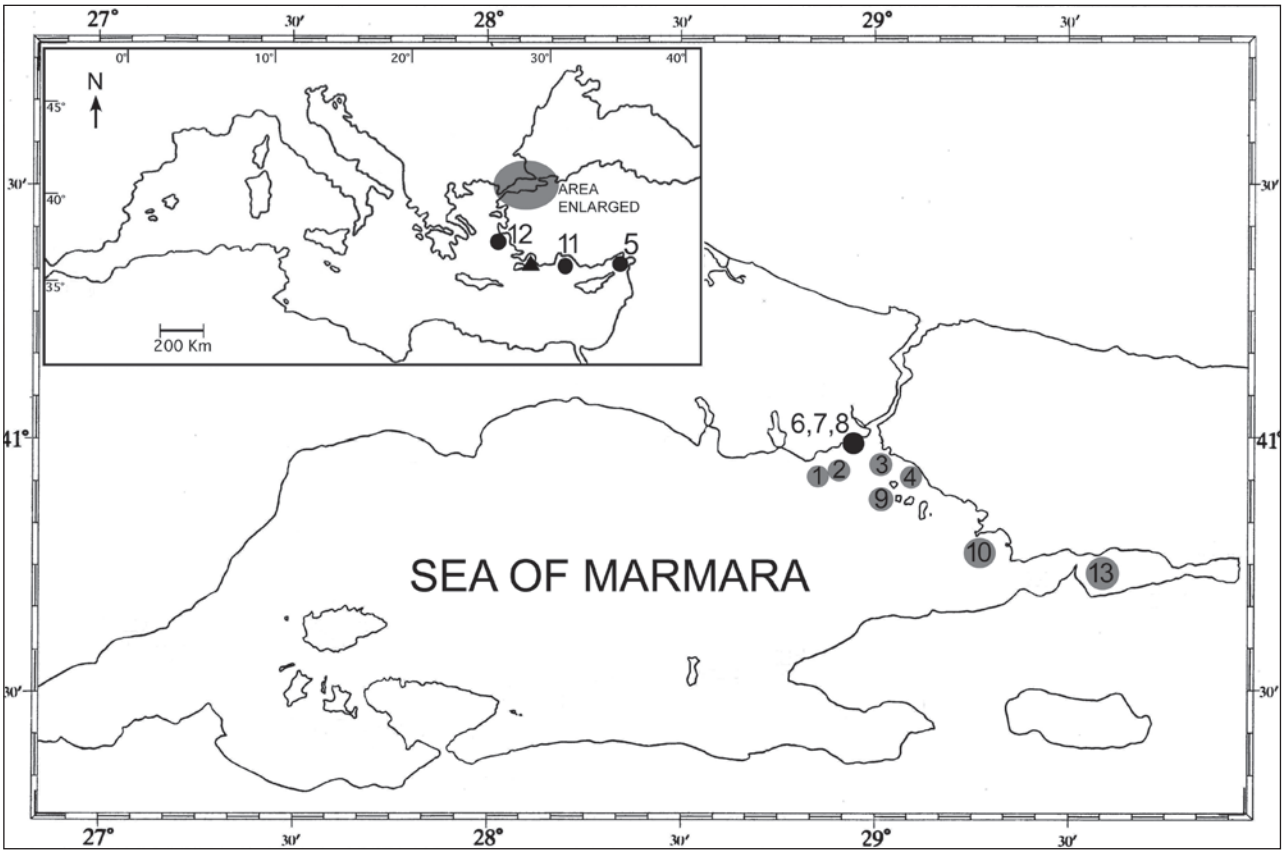
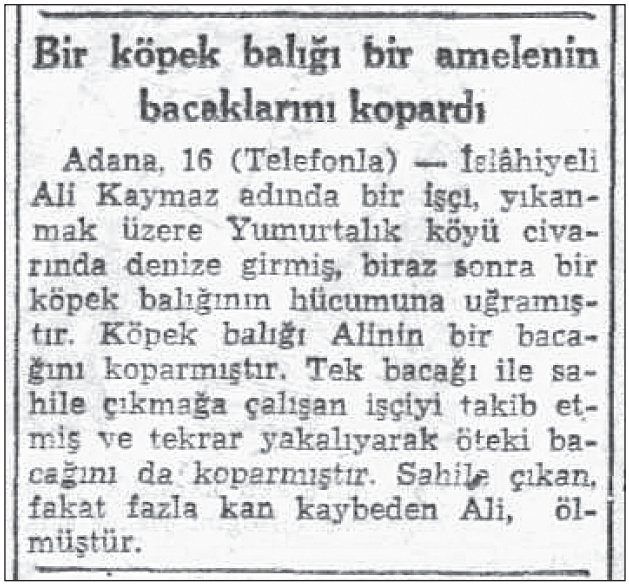


Fig. 1: Map showing the localities of shark attacks occurred in Turkey's waters. (▲) In the small map showing the approximate locality, where a spearfishing skindiver encountered a great white shark off Marmaris coast on 28 September 2011. Numbers on the map are same as the numbers in Table 1.
Sl.1: Zemljevid obravnavanega območja z lokalitetami, kjer so se zgodili napadi moskih psov v turških vodah. Trikotnik (▲) na manjšem zemljevidu označuje približno lokaliteto, kjer je ribič s podvodno puško srečal belega morskega volka blizu marmarske obale 28 septembra 2011. Številke na zemljevidu se ujemajo s številkami v tabeli 1.

never been confirmed (De Maddalena & Heim, 2012). Following the Santo Stefano incident, a second shark attack on a tuna handliner's boat occurred on 17 March 1931, in close vicinity to Bakırköy (Sea of Marmara; Fig. 1, Tab. 1). According to the newspaper report, on that date three fishermen went to sea for handlining tuna and their boat was attacked by a large shark. The fishermen hit the shark with paddles to fend it off, but the predatory shark continued attacking the boat and eventually broke it up. Once overboard the fishermen spent almost 2 hours in water with shark, but fortunately none of them were harmed and all were rescued alive. Three years later, another tuna handliner's boat was attacked by a large shark on 8 February 1934 off Haydarpaşa (Sea of Marmara; Fig. 1, Tab. 1). Following the shark attack the fishing boat was damaged and sunk, and the wounded fishermen were saved. On 16 August 1937, a non-fatal attack to a swimmer occurred off the Istanbul coast (Sea of Marmara; Fig. 1, Tab. 1) (GSAF, 2015). The species of the shark which attacked the boats and a swimmer in 1930's remained unknown.



Bir köpek balığı bir amelenin bacaklarını kopardı

Adana, 16 (Telefonla) — İslâhiyeli Ali Kaymaz adında bir işçi, yıkanmak üzere Yumurtalık köyü civarında denize girmiş, biraz sonra bir köpek balığının hücumuna uğramıştır. Köpek balığı Alinin bir bacağını koparmıştır. Tek bacağı ile sahile çıkmağa çalışan işçiyi takib etmiş ve tekrar yakalıyarak öteki bacağını da koparmıştır. Sahile çıkan, fakat fazla kan kaybeden Ali, ölmüştür.

Fig. 2: Newspaper clip reporting the fatal shark attack occurred of Yumurtalık coast on 17 September 1948 (case No 5 in Table 1). Translation of the newspaper clip reads: "Adana (interview via phone call) - A construction worker, Mr. Ali Kaymaz from village of İslahiye, has been attacked by a shark, while he was swimming off Yumurtalık coast near Adana city. At first strike shark severed one of his legs, then he struggled to leave the water but the shark attacked again and severed the other leg. The worker died because of severe bleeding."
Slika 2: Časopisni prispevek o napadu morskega psa na človeka s smrtnim izzidom ob obali Yumurtalık 17 septembra 1948 (primer št. 5 v tabeli 1). Prevod prispevka se glasi: "Adana (intervju po telefonu) – Gradbenega delavca, gospoda Ali Kaymaz iz vasi İslahiye, je napadel morski pes, medtem ko je plaval ob obali Yumurtalık blikzu mesta Adana. V prvem napadu mu je morski pes odtrgal nogo, v drugem pa, medtem ko je Ali poskušal zbežati iz vode, še drugo nogo. Gradbeni delavec je kasneje umrl zaradi prehude izgube krvi."

On 17 September 1948, a non-provoked fatal shark attack occurred off Yumurtalık (NE Mediterranean Sea; Fig. 1, Tab. 1). According to the newspaper report, a migrant worker was attacked by a shark while swimming off Yumurtalık. In the first strike the shark severed one of his legs, and then as the victim struggled to leave the water, the shark made a second attack, which resulted in severing his other leg. The victim died a very short time later due to hemorrhaging. The Yumurtalık incident is considered the first confirmed fatal shark attack to have occurred in Turkey's waters, which was proved by the newspaper report (Fig. 2). The species of the shark remains unknown.

Ten years later, 3 shark attacks occurred against fishing boats in Bosphoric waters. In 1958, two fishing boats of tuna handliners were attacked by great white sharks, which were attempting to prey on hooked tunas off Ahırkapı (Sea of Marmara; Fig. 1, Tab. 1). According to the interview with Mr. İrfan Yürür, one of the few surviving legendary tuna handliners, who was active in the Bosporus Strait waters between the 1930's and 1980's, in one instance, a nearly 6 m long great white shark attacked his fellow fishing boat. The shark was hooked while it was attempting to feed on the captured tuna and attacked the boat (Kabasakal, 2015a).

The great white shark struggled to get off the hook and attacked another boat upon getting free. Two of the many triangular and serrated edged teeth got stuck in the lagging of the boat, Mr. Yürür reported in the interview. Following these two incidents, on 25 December 1958, a third attack by a great white shark on a tuna handliners fishing boat occurred off Ahırkapı (Fig. 1, Tab. 1; Kabasakal, 2014). According to the newspaper report of the same date, the boat had been bitten several times by the great white shark and several teeth got stuck in boat's hull, which are visible in the photograph accompanying the report.

In 1966, an Istanbul based SCUBA diver Mr. Zareh Magar was spearfishing off Sivriada (Sea of Marmara; Fig. 1, Tab. 1). While he was searching fish in the caverns, he suddenly noticed that a huge shark was approaching him. According to the report by Mr. Magar, which was published in Hayat magazine on 12 May 1966, the shark attacked the diver, but he left the water as soon as possible without injuries (Magar, 1966). According to Mr. Magar's statement, dozens of tuna jumped out of the sea just a short time following his ascent.

On 7 July 1967, another Istanbul based Scuba diver Mr. Güngör Güven dived off Tuzla coast (Sea of Marmara; Fig. 1, Tab. 1). According to the newspaper report of the same date, Mr. Güven was spearfishing only 200

m off the coast at a depth of 10 m. Suddenly the water turned red and Mr. Güven never ascended to the surface. Just a few minutes later a large dorsal fin appeared at the surface, where Mr. Güven had been spearfishing. Search and rescue divers could only find the right hand, a finger bearing teeth marks, the Scuba tank and the torn diving suit of the victim. Before 1970, a non-fatal shark attack occurred against a fishing boat off Kilizman near the city of Izmir (Aegean Sea; Fig. 1, Tab. 1), while a fisherman was hauling a drop-line set for red sea bream (*Pagrus* spp.). According to a newspaper report a 200 kg weighted shark attacked the hooked fish, meanwhile the fisherman attempted to harpoon the shark. Following the response of the fisherman the shark attacked the boat and caused severe damage.

Following the Kilizman incident, a shark attack against a swimmer occurred off Antalya near Konyaaltı beach (Mediterranean Sea; Fig. 1, Tab. 1) in the early 1970's. During that time, there had been a slaughterhouse built along the seaside, which dumped its' waste directly into the sea. Finally, in 1983 a non-fatal shark attack against a diver who was spearfishing, occurred off Dilovası (Sea of Marmara; Fig. 1, Tab. 1). Although a great white shark is assumed to be responsible for this attack, this assertion is considered doubtful.

The sea temperatures above 20 ºC have been assumed to be a triggering factor for a shark attack (Springer & Gold, 1989). The extent of humans' use of the sea and therefore their availability for attack was suggested by Baldridge (1988) to be certainly closely related to temperature. However, despite this environmental fact, significant numbers of attacks have also been reported in the areas where water temperatures were below this assumed critical limit (Baldridge, 1988; Springer & Gold, 1989; GSAF, 2015). Based on the dates of attacks, 30.7 % of the attacks occurred in the periods of the year where the temperature is above 20 ºC and 23.1 % of attacks occurred in cold seasons (< 20 ºC sea surface temperature). Chronological data of the attacks with confirmed dates show that the shark attacks in Turkey's waters have occurred throughout the year (Tab. 1).

Ten (76.9 %) out of 13 shark attacks mentioned appear to be motivated by handlining or spearfishing (Tab. 1). Furthermore, the motivation of 1 attack (7.6 %; case 11, Tab. 1) was the waste from a slaughterhouse which was operating along the seaside. Thus, based on the present results, motivation of 11 (84.6 %) out of 13 shark attacks which occurred in Turkey's waters had anthropogenic factors such as fishing or waste dumping. Only 1 incident (7.6 %; case no 5, Tab. 1) was a non-provoked fatal shark attack on a swimmer. According to Baldridge (1988), shark attacks can occur due to several motivations and 50 to 75 % of attacks against humans might have been triggered by non-feeding factors. Nevertheless, feeding might very well be the primary motivation for attacks, as Baldridge (1988) suggested, and regarding the sharks as opportunistic feeders, a hooked tuna or a speared fish can provide an easy feeding opportunity for the predator. The fact that 83 % of all documented shark attacks in Turkey's waters occurred during fishing activities emphasize the relationship between the attacks and the opportunistic feeding behaviour of sharks.

According to Springer & Gold (1989) the length of the sharks which have been known to attack people varies from 2 to 8 m; however, Caldicott *et al*. (2001) stated that the lower limit of this scale might be as short as 45 cm. In general, any shark that can grow larger than 1.8-2.0 m is potentially lethal to a human (Baldridge & Williams, 1969; *op cit* Caldicott *et al*., 2001). Juveniles of some of the prominent man eaters, (*e.g.* the great white shark, *C. carcharias*, and the tiger shark, *Galeocerdo cuvieri*; Compagno, 1984), can make fatal attacks against humans (Clua & Reid, 2013; Clua *et al*., 2014). On 26 March 2009, a non-provoked fatal shark attack on a 19 year old male surfer occurred in waters off the western coast of New Caledonia (Clua & Reid, 2013). The information provided by a witness and the analysis of a partial bite on the right calf allowed the authors to identify a juvenile great white shark with an estimated total length of 2.7 m. Similarly, on 21 May 2011, a 15 year old male died following an attack by a juvenile tiger shark with an estimated total length of 2.8 m, in New Caledonia's waters (Clua *et al*., 2014).

Tricas & McCosker (1984) postulated that an ontogenetic development in dentition of *C. carcharias* at approximately 3.0 m in total length, may account for the shift in preferences of prey types and predatory behaviour. Young and juvenile great white sharks less than 3.0 m in total length are known to feed on squid, small teleosts and cartilaginous fishes, while larger sharks feed on more energetic prey, like marine mammals and bluefin tuna (Fergusson *et al*., 2000; Kabasakal, 2009, 2015a; De Maddalena & Heim, 2012). Furthermore, McCosker (1985) suggested that young great white sharks (≥ 2.5 m total length) can feed on pinnipeds and other marine mammals. Thus, attacks of juvenile great white sharks against humans can be the consequence of a learning phase, in which a young shark is improving its predatory abilities as a top predator (Clua & Reid, 2013). According to Guttridge *et al*. (2009), sharks can learn in an associative or non-associative means by which they can counteract the behavioural plasticity of their prey, fine tuning foraging tactics and capture.

Since the 1990's a total of 14 great white sharks were either sighted or captured in coastal waters of Turkey's Aegean Sea (Kabasakal, 2014; Kabasakal & Kabasakal, 2015). Total lengths of 5 out of 14 specimens were ≥ 4.5 m; sizes of 3 out of 14 varied from 1.8 to 3.0 m, and the remaining 6 specimens which include new-borns had total lengths which were ≤ 1.4 m. On 28 September 2011, the great white shark with an estimated total length of 5.0 m approached a skin diver who was spearfishing off Marmaris (Fig. 1) at a depth of 15 m (Kabasakal, 2014). The shark circled around the diver a

few times before it moved away. Based on the data provided by Kabasakal (2014) and Kabasakal & Kabasakal (2015), it is obvious that juvenile and adult specimens of *C. carcharias* are occurring in coastal waters of Turkey's Aegean Sea from February to late September. *C. carcharias* is the only species occurring in Turkey's waters, which is categorized as very dangerous by Compagno (1984) and responsible for many sharks attacks which have occurred over the entire Mediterranean Sea (De Maddalena & Heim, 2012).

Besides the great white shark, the shortfin mako (*Isurus oxyrinchus*) and blue sharks (*Prionace glauca*), which are categorized as dangerous sharks by Compagno (1984), are known to occur in the coastal waters of Turkey's Aegean and Mediterranean seas (Kabasakal, 2010, 2015b). On 16 August 2009 a female blue shark (3.5 m total length) was caught off Ayvacık (NE Aegean Sea; Kabasakal, 2010), while another specimen (≥ 2 m total length) was observed near aquaculture cages in Güllük Bay (SE Aegean Sea; G. Balkan, *pers. comm.*). In 2 out of the 5 shark attacks that occurred in Sharm El Sheikh (Red Sea) in 2010, shortfin mako sharks were the causal species, and the attacks occurred at most 40 m off the coast (Levine *et al.*, 2014). Authors suggested that the dumping of sheep carcasses off the resort areas and the hand-feeding of sharks were likely triggers for the incidents. A similar shark attack outbreak due to anthropogenic waste was observed off Recife (Brazil) over the 1992-2006 period (Hazin *et al.*, 2008), which was also the causal factor of the shark attack that occurred off Antalya coast in 1970 (case no 11, Tab. 1).

Based on GSAF (2015) data base, 54 shark attacks occurred in the Eastern Mediterranean to date, of which 34 of them were the incidents recorded in adjacent waters of Turkey. However, with the addition of present results these numbers are increased to 65 and 45 respectively. The most recent shark attack in adjacent waters to Turkey occurred on 29 September 2013 off Ashod (Israel; GSAF, 2015).

CONCLUSIONS

Chronological analyses of the shark attacks that have occurred in Turkey's waters show that the incidents cover almost the entire 20th century (Tab. 1). The majority (84.6 %) of these attacks occurred during fishery operations (handlining or spearfishing). Moreover, the causal factor of one of these shark attacks was the dumping of waste, as was the case for the attacks that occurred in Sharm El Sheikh and Recife. Therefore, it should be kept in mind that anthropogenic waste dumping from slaughterhouses or similar facilities can create sensorial stimulus for sharks to come closer to coastal areas. From this point of view, aquaculture cages set too close to shore lines or offshore transport cages of pelagic fish like bluefin tuna can also create a stimulus for the attraction of predatory sharks (Galaz & De Maddalena, 2004; Papastamatiou *et al.*, 2010; Kabasakal, 2014). Galaz & De Maddalena (2004) and Kabasakal (2014) reported on two cases from Mediterranean waters, in which the great white sharks followed and entered the tow cages of bluefin tuna. Historically, the coexistence of great white sharks and bluefin tuna in Mediterranean Sea is a very well known phenomenon (De Maddalena & Heim, 2012). According to Papastamatiou *et al.* (2010), predatory sharks exhibit site fidelity around aquaculture cages in Hawaiian waters. As in the case of Güllük Bay incident, large predatory sharks can occur in the vicinity of aquaculture farms set along Turkey's coast, occasionally. Although, for the moment, threats to public safety of these aggregating top-predators is unknown, aquaculture farm planners should bear in mind that such marine cages can create sensorial stimulus of easy source of prey for sharks, a predator capable of learning.

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NAPADI MORSKIH PSOV NA LJUDI IN PLOVILA V TURŠKIH VODAH V DVAJSETEM STOLETJU

Hakan KABASAKAL & Sait Özgür GEDİKOĞLU
Ichthyological Research Society, Tantavi mahallesi, Menteşoğlu caddesi, İdil apartmanı, No: 30, D: 4, Ümraniye TR-34764, Istanbul, Turkey
E-mail: kabasakal.hakan@gmail.com

POVZETEK

Med letoma 1931 in 1983 so v turških vodah zabeležili trinajst napadov morskih psov. Deset od teh (76,9 %) se je zgodilo v Marmarskem morju, nadaljnja dva napada v sredozemskih vodah in eden v Egejskem morju. V sedmih primerih (53,8 %) so morski psi napadli plovila, med katerimi je bilo 6, s katerih so lovili tune na trnek. V ostalih šestih primerih pa je morski pes napadel človeka. V treh primerih (23,1 %) je morski pes napadel potapljača na dah oziroma potapljača z jeklenko, v drugih treh pa plavalce. Velike plenilske morske pse so pogosto opazovali ob kletkah ribogojnic, ki se nahajajo vzdolž turške egejske in sredozemske obale, npr. v zalivu Güllük. Kakorkoli že, o morebitni nevarnosti za varnost ljudi zaradi zbiranja morskih psov za zdaj ni nobenih podatkov.

Ključne besede: napadi morskih psov, Turčija, ribištvo, akvakultura, varnost ljudi

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