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HISTORICAL RECORDS OF THE GREAT WHITE SHARK, *CARCHARODON CARCHARIAS* (LINNAEUS, 1758) (LAMNIFORMES, LAMNIDAE), FROM THE SEA OF MARMARA

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ABSTRACT

Fifteen historical records of the great white shark *Carcharodon carcharias* (Linnaeus, 1758), from the Sea of Marmara are presented. The available data suggest that the great white sharks used to be captured regularly in the Sea of Marmara in the period between the late 1800s and the late 1960s. The majority of sharks were accidentally captured by bluefin tuna (9 cases) and swordfish (1 case) hand-liners. Therefore, the occurrence of great white sharks is closely associated with pelagic fishery, especially with hand-lining of bluefin tuna *Thunnus thynnus*. Karakulak & Oray (1994) reported that the bluefin tuna had not occurred in the Black Sea and in the Sea of Marmara since 1937, which means that one of the great white shark's main preys became extinct in the above-mentioned seas. The seasonality of records has shown an increase in their occurrence during the winter months. In view of the last confirmed record of great white shark in the Sea of Marmara (in 1985), the species had been present in this sea until the last quarter of the 20th century.

Key words: Great white shark, *Carcharodon carcharias*, distribution, historical records, Sea of Marmara

SEGNALAZIONI STORICHE DI SQUALO BIANCO, *CARCHARODON CARCHARIAS* (LINNAEUS, 1758)(LAMNIFORMES, LAMNIDAE), NEL MAR DI MARMARA

SINTESI

L'articolo riporta quindici segnalazioni storiche di squalo bianco, *Carcharodon carcharias* (Linnaeus, 1758), nel Mar di Marmara. I dati disponibili suggeriscono che tra il tardo 1800 e la fine degli anni sessanta lo squalo bianco è stato catturato con regolarità nel Mar di Marmara. La presenza di squali bianchi viene collegata alla pesca del pesce pelagico, specialmente del tonno, *Thunnus thynnus*. Un incremento delle catture di squalo bianco è stato registrato durante i mesi invernali, quando tale specie ricerca acque più fredde. Visto che l'ultima cattura di squalo bianco nel Mar di Marmara risale al 1985, l'autore conclude che la presenza della specie in tale mare era certa fino all'ultimo quarto del ventesimo secolo.

Parole chiave: squalo bianco, *Carcharodon carcharias*, distribuzione, segnalazioni storiche, Mar di Marmara

INTRODUCTION

Great white shark, *Carcharodon carcharias* (Linnaeus, 1758) is a cosmopolitan species of coastal and temperate waters (Compagno, 1984). Its presence in the Mediterranean Sea has been well-documented in many general ichthyological or faunistic studies (for example Carus, 1889-1893; Riedl, 1983; Quéro, 1984; Bauchot, 1987), and has been broadly registered in many regional ichthyological works, for example, by Quignard & Capapé (1971) in Tunisian, Risso (1810) and Moreau (1881) in French, Tortonese (1956) and Bini (1967) in Italian, Papaconstantinou (1988) in Greek, and Ninni (1912) and Šoljan (1948) in Adriatic waters. Furthermore, general and regional distribution of the great white shark in the Mediterranean Sea as well as its historical and contemporary presence in the mentioned region has been investigated in detail (Fergusson, 1996; De Maddalena, 2000, 2002; Barrull & Mate, 2001; Celona *et al.*, 2001; Celona, 2002). One of the common aspects of these studies is, however, that the species is generally considered to be distributed in the western and central Mediterranean.

The first account on the presence of the great white shark in Turkish waters was made by Karakin Devedjian, former director of the Istanbul Fish Market at the beginning of the 20th century (Devedjian, 1926). In his pioneering study, Devedjian (1926) stated that the great white sharks (originally referred to as "*karkharias*" in his book) rarely landed at Istanbul fish market, and also gave some information on a captured specimen. In the general ichthyological work of Alşıray (1987), concerning Turkish marine fishes, its author stated the presence of *C. carcharias* in Turkish waters, but gave no information on the species distribution in the mentioned region. The presence of *C. carcharias* in Turkish waters has also been documented in the most recent lists of Turkish marine fishes by Mater & Meriç (1996), Bilecenoğlu *et al.* (2002) and Kabasakal (2002), whose last account deals exclusively with the elasmobranchs of Turkish seas. However, the available information on the historical and contemporary presence of the great white shark in Turkish waters still includes many uncertainties.

Although the presence of great white shark in the Sea of Marmara had been reported by Devedjian (1926), its historical records from this inland sea is remarkably limited, neither has it been included in the ichthyological lists of the Sea of Marmara (Ayaşlı, 1937; Erazi, 1942; Kocataş *et al.*, 1993). In the present study, a retrospective survey of the historical presence of great white shark in Marmaric waters, based on the available scientific and popular literature as well as interviews with fishermen, is presented.

MATERIAL AND METHODS

The area encompassed by the present research is a subunit of the Mediterranean Sea and known as the Sea of Marmara (Fig. 1). It is linked with the Mediterranean Sea via the Dardanelles and with the Black Sea via the Bosphorus Strait. For this reason, while the surface waters of Marmara are affected by the Black Sea, its deeper layers remain under Mediterranean influence (Kocataş *et al.*, 1993). According to Öztürk & Öztürk (1996), the Sea of Marmara is an ecological barrier, a transition zone or an acclimatisation area, influencing the dispersal of the species between the Mediterranean and the Black Seas.

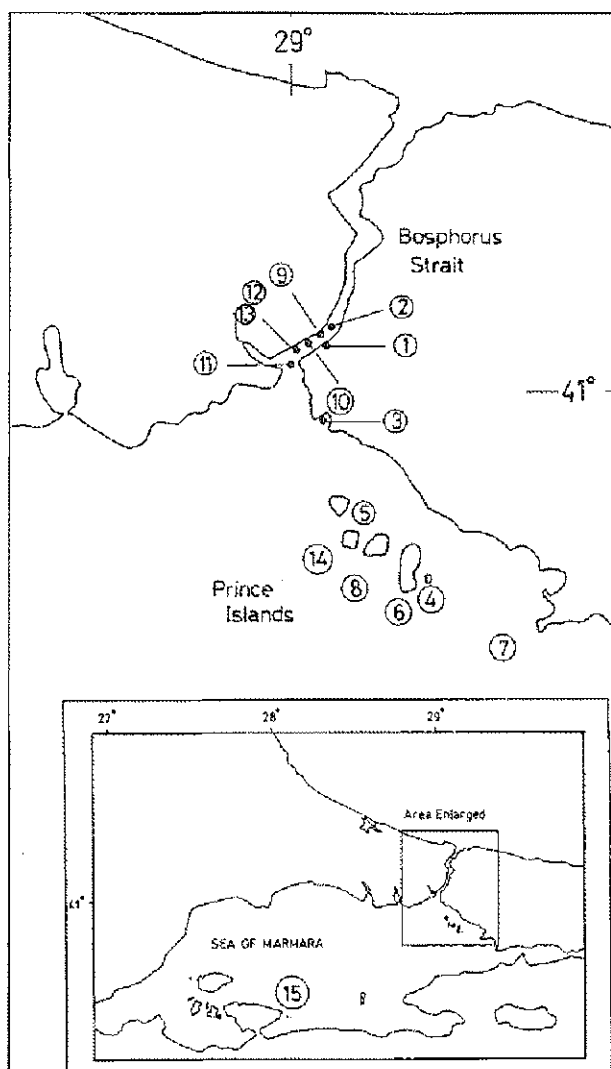


Fig. 1: Localities of the recorded great white sharks in the Sea of Marmara. Circled numbers are the same as case numbers in Table 1.

Sl. 1: Lokalizacije zabeleženih belih morskih volkov v Marmarskem morju. Obkrožene številke so iste kot številke posameznih primerov v tabeli 1.

Data on the historical presence of great white shark in Marmaric waters have been obtained from the following sources: (a) available scientific literature, (b) popular literature, such as newspapers, magazines, etc., and (c) interview with fishermen, especially with old tuna hand-liners, scuba divers or private citizens. Whenever possible, the following data were recorded for each specimen: date, locality of capture, total length (TL, in cm; TOT in Compagno, 1984), weight (W, in kg),

sex and type of capture. Photographs of some of these previous records have also been provided.

RESULTS

Fifteen historical records of *C. carcharias* have been determined from the Sea of Marmara. These records are summarised in Tab. 1.

Tab. 1: Summary of the historical records of *Carcharodon carcharias* from the Sea of Marmara. Case numbers are same as the circled numbers on Figure 1, showing approximate locations of captures.

Tab. 1: Povzetek zgodovinskih pojavljanj belega morskega volka *Carcharodon carcharias* v Marmarskem morju. Številke posameznih primerov ponazarjajo približne lokacije, kjer so bili morski psi ujeti, in so iste kot številke, obkrožene na sliki 1.

No.	DATE	LOCATION	TL (cm)	W (kg)	SEX	REMARKS	REFERENCE
1	February, 1881	Bosporus Strait	391	-	-	Stranded near Beylerbeyi coast	Fergusson (1996)
2	17 November 1881	Bosporus Strait	470	1500	♀	Captured; type of fishing gear unknown	Fergusson (1996)
3	1916	Sea of Marmara	ca. 700	-	-	Entrapped in Salistra fish trap; shot by fishermen with 3 bullets in its head.	Devedjian (1945)
4	May 1920	Sea of Marmara	465	ca. 1200	-	Captured off the coast of Sedef adası; a bluefin tuna, weighing ca. 200 kg, remains of a swordfish, a few bonitos, and a small stone found in its stomach.	Devedjian (1945)
5	before 1926	Sea of Marmara	ca. 400	-	-	Eight large bonitos found in its stomach.	Devedjian (1926)
6	20 February 1926	Sea of Marmara	450	over 1500	-	Captured off the coast of Büyükkada (Fig. 2)	Agop Savul, pers. comm.
7	30 March 1954	Sea of Marmara	450	1500	-	Captured off the coast of Tuzla (Fig. 3)	Agop Savul, pers. comm.
8	15 April 1956	Sea of Marmara	618	ca. 3000	♀	Captured off the coast of Prince Islands; its mass surely miss-estimated	Agop Savul, pers. comm.
9	February 1962	Bosporus Strait	500+	3750	♀	Mass surely miss-estimated	Fergusson (1996)
10	28 December 1965	Bosporus Strait	500	ca. 4000	♀	Captured off the coast of Dolmabahçe; mass surely miss-estimated	Agop Savul, pers. comm.
11	28 December 1965	Bosporus Strait	700	ca. 3000	♀	Captured near Maiden's Tower (Fig. 4)	Agop Savul, pers. comm.
12	13 January 1966	Bosporus Strait	ca. 400	ca. 2000	-	Harpooned off the coast of Kabataş (Fig. 5)	Agop Savul, pers. comm.
13	13 January 1966	Bosporus Strait	ca. 400	ca. 2000	-	Harpooned off the coast of Kabataş (Fig. 5, belly of the second specimen shown overturned on the left of the picture)	Agop Savul, pers. comm.
14	before 1974	Sea of Marmara	-	ca. 2000	-	Captured off the coast of Prince Islands	Güney (1974)
15	May 1985	Sea of Marmara	ca. 500	-	-	Sighted off the coast of Kapıdağ peninsula	Kabasakal (unpublished data)

Although the dates of two records of *C. carcharias* from the Bosphorus Strait by Fergusson (1996) are earlier (both in 1881) than those of Devedjian (1926), the former author has not given any detailed information on the presence of great white sharks in Turkish waters. However, concerning the 3 data reported by Fergusson (1996), two of which were reported without source and the third as a personal communication from G. Wood, a confirmation of these recordings from the Sea of Marmara is strongly required, as some other data presented by the same author from the Mediterranean Sea, especially its western basin, have been indicated as unreliable by Barrull & Mate (2001) and Celona *et al.* (2001).

In 1916, an enormous great white shark (700 cm TL) entered the Salistra fish trap near Fenerbahçe harbour (northern Sea of Marmara) (Devedjian, 1945; case No. 3 in Tab. 1). The shark, entangled in the nets and ropes of the fish trap, was killed by fishermen after shot three times in its head. According to the author, it was impossible to transport the shark to the auction place of the fish market, so it was eviscerated and cut at the fish trap and sold. Devedjian (1945) stated that its head only weighed nearly 200 kilograms. Since there are very few records from all over the world on great white sharks exceeding the length of 650 cm (Compagno, 1984), the size of this individual (700 cm), as estimated by Devedjian (1945), seems unreliable.

On May of 1920, another great white shark (465 cm TL and weighing nearly 1,200 kg) was been captured with a swordfish line off the coast of Sedef adası (Devedjian, 1945; case No. 4 in Tab. 1). This specimen, whose stomach contents are presented in Tab. 1, was displayed at the İstanbul Fish Market for a long time. Devedjian (1945) stated that the length of each pectoral fin of the specimen was 80 cm and the height of the first

dorsal fin 60 cm. A capture of another great white shark prior to 1926 was also reported by Devedjian (1926). Total length of this specimen (case No. 5 in Tab. 1) was 400 cm, and it was landed at the İstanbul Fish Market. Devedjian (1926) reported that 8 large bonitos were found in the stomach contents of this specimen and that the width at the widest part of its body was 135 cm. According to Devedjian (1926), the meat of great white sharks captured in İstanbul waters (northern Sea of Marmara) is seldom consumed by people.

Another great white shark (450 cm TL) was captured on 20 February 1926 off the coast of Büyükdada (Fig. 2; case No. 6 in Tab. 1), with its reported weight exceeding 1,500 kg (Agop Savul, *pers. comm.*).

On 30 March 1954, a great white shark (450 cm TL and 1,500 kg W) was captured by a tuna hand-liner off the coast of Tuzla (Agop Savul, *pers. comm.*; Fig. 3, case No. 7 in Tab. 1). This shark, too, was displayed at the İstanbul Fish Market for a long time. Two years later, on 15 April 1956, an enormous great white shark (618 cm

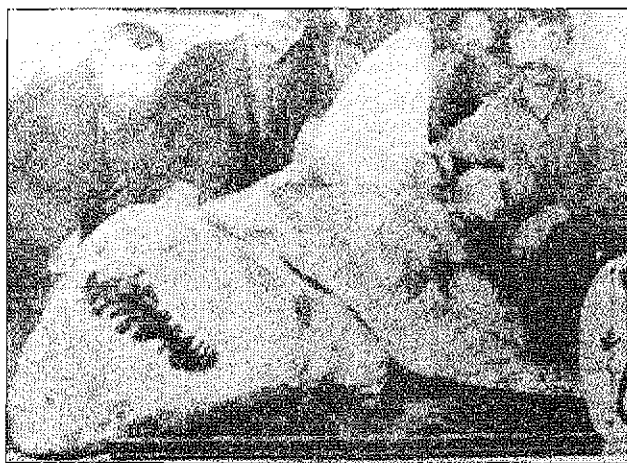


Fig. 2: 450 cm TL specimen captured off the coast of Büyükdada (case No. 6) (Agop Savul's archive).

Sl. 2: 450 cm (TL) dolgi primerek, ujet v bližini Büyükdade (primer št. 6) (arhiv Agopa Savula).



Fig. 3: 450 cm TL specimen captured off the coast of Tuzla (case No. 7) (Agop Savul's archive).

Sl. 3: 450 cm (TL) dolgi primerek, ujet v bližini turškega obmorskega mesteca Tuzla (primer št. 7) (arhiv Agopa Savula).

TL and 3000 kg W) was captured by a tuna hand-liner, Aziz Ünlü, off the coast of Prince Islands in the northern Sea of Marmara (Agop Savul, *pers. comm.*; case No. 8 in Tab. 1). While he was cruising along the coast of Prince Islands during the early morning hours, the mentioned great white shark was hooked, and he was able to harpoon it only after a 7-hour fighting with the shark.

Six years later, on February 1962, another great white shark (500+ cm TL and 3750 kg W) was captured in the Bosphorus Strait (Fergusson, 1996; case No. 9 in Tab. 1). Fergusson (1996) stated that the mass of this specimen had surely been miss-estimated. On 28 December 1965, another great white shark (500 cm TL and 4000 kg W) was captured by three fishermen in the Bosphorus Strait during bluefin tuna fishing. After a long and hard fight, the fishermen harpooned the shark and landed it on Dolmabahçe coast (Agop Savul, *pers. comm.*; case No. 10 in Tab. 1). On the same day, another great white shark (700 cm TL and nearly 3000 kg W) was caught by Hüseyin Şalvarlı off the coast of Maiden's Tower in southern part of the Bosphorus Strait

(Agop Savul, *pers. comm.*; Fig. 4, case No. 11 in Tab. 1). After capturing a bluefin tuna (weighing nearly 390 kg) he dropped his line into the water, but this time the mentioned great white shark was hooked. The shark towed the small fishing boat in the Strait for quite some time, but finally the fisherman succeeded in gaffing the shark with the anchor of his boat. On 13 January 1966, two great white sharks (both 400 cm TL and 2000 kg W) were captured in the Bosphorus Strait by Hakkı Baba and Ali Yavur, fishermen from Karaköy Port, İstanbul. After 4.5 hours of fighting, the fishermen harpooned the sharks near Kabataş coast (Agop Savul, *pers. comm.*; Fig. 5, case nos. 12 & 13 in Tab. 1). No great white sharks have been captured neither in the Sea of Marmara nor in the Bosphorus Strait between 1966 and 1974. The capture of a great white shark, weighing nearly 2000 kg, off the coast of Prince islands in northern Marmara has been reported by Güney (1974), however, the exact date of capture of this specimen is uncertain (case No. 14 in Tab. 1).

One of the more recent records of the great white shark in the Sea of Marmara is dated to 1985. A specimen, nearly 500 cm in total length, was sighted by a fisherman off the north-eastern coast of Kapıdağ peninsula (southern Sea of Marmara, Fig. 1) (case No. 15 in Tab. 1). The fisherman stated that the shark had circled around his boat for a few minutes and then disappeared (Agop Savul, *pers. comm.*).

DISCUSSION

As it can be seen from the above data, all but one (No. 15 in Tab. 1) great white sharks were reported from northern Marmaric waters, around Prince Islands and southern Bosphorus Strait (Fig. 1). Besides the entrapped specimen in Salistra fish trap (case No. 3 in Tab. 1), the three records by Fergusson (1996; case nos. 1, 2 & 9 in Tab. 1) who gave no information on the type of their capture, and the specimen sighted off the coast of Kapıdağ peninsula while swimming near the surface (case No. 15 in Tab. 1), the remaining 10 great white sharks were accidentally captured by bluefin tuna (9 cases) and swordfish (1 case) hand-liners. Accidental captures of great white sharks are therefore closely associated with artisan fishery (hand-lining) of the bluefin tuna.

Although the abundance of bluefin tuna, *Thunnus thynnus*, reaches its peak in pre-Bosporic waters of the Black Sea and in the Bosphorus Strait especially in July, this period may be extended to the end of August. Bluefin tunas migrate towards the Aegean Sea from October to the end of December (Akşiray, 1987; Karakulak & Oray, 1994). However, in some years, when air and sea winter temperatures are higher than usual averages, some bluefin tunas do not continue with their southwestern migration, but overwinter in the waters of Prince Is-

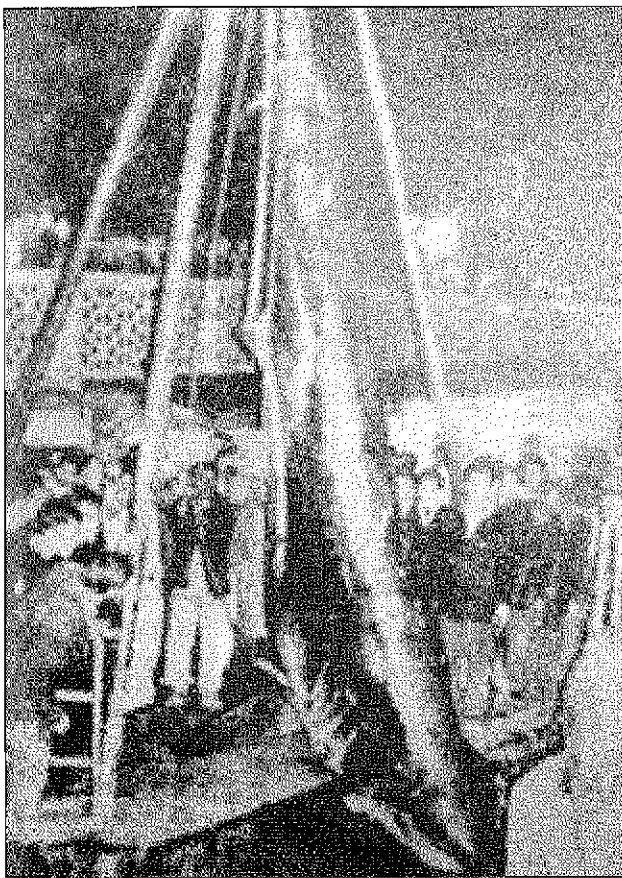


Fig. 4: 700 cm TL specimen captured near Maiden's Tower (case No. 11) (Agop Savul's archive).

Sl. 4: 700 cm (TL) dolgi beli morski volk, ujet v bližini Dekliškega stolpa (primer št. 11) (arhiv Agopa Savula).

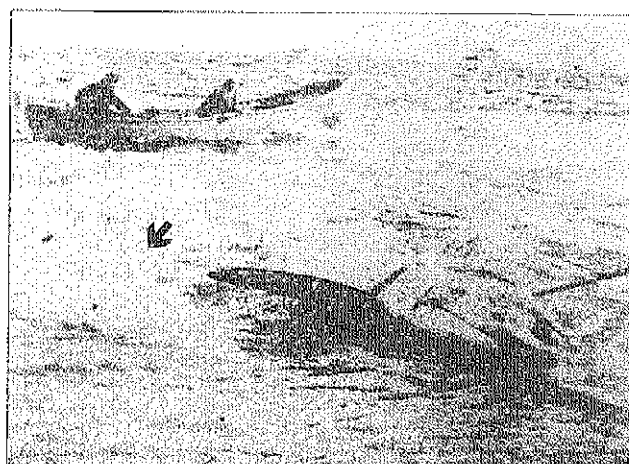


Fig. 5: 400 cm TL specimens harpooned off the coast of Kabataş, with arrow indicating the belly of the second specimen overturned on the left of the photograph (case Nos 12 & 13) (Agop Savul's archive).

Sl. 5: 400 cm (TL) dolga primerka, harpunirana blizu Kabataşa; puščica kaže na trebuh drugega primerka, obrnjenega na hrbtu na levi strani fotografije (primeri št. 12 in 13) (arhiv Agopa Savula).

lands and in the channel area of the Bosphorus Strait (Üner, 1984). Güney (1974) and Üner (1984) reported that the great white sharks were rarely seen entering the Bosphorus Strait, while in pursuit of bonitos and bluefin tunas. Accidental capture of these predatory sharks in the waters of Prince Islands and in the Bosphorus Strait was usually a consequence of the great white sharks chasing these large bony fishes (Üner, 1984). Karakulak & Oray (1994) reported that the bluefin tuna had not occurred in the Black and Marmara Seas since 1987, which means that one of the great white shark's main preys became extinct in the mentioned seas. The latest recording of the great white shark from the Sea of Marmara (1985, case No. 15 in Tab. 1) remarkably correlates with the latest recording of the bluefin tunas from the same area (1987). Still, such situation in the area may be due to: (1) the absence of one of their main prey, bluefin tuna, in the Sea of Marmara and owing to the great white sharks not entering this sea at least since their last recording, or (2) great white sharks are still present in the Sea of Marmara but there has been no accidental capture of this species due to the disuse of bluefin tuna lines (or lines for other large bony fishes). Some extensive investigations would be thus required to give reliable answers to the above questions.

Akşiray (1987) reported that great white sharks had been absent in the Sea of Marmara and in the Bosphorus Strait for the last 20 to 25 years. Regarding the year of publication of his book (1987), this span covers the period between 1962 and 1967. Despite Akşiray's suggestion, at least one great white shark was captured or

sighted in 1974 and 1985 (case nos. 14 & 15 in Tab. 1).

With the exception of 5 cases (case nos. 3, 4, 5, 14 & 15 in Tab. 1), the great white sharks were captured between mid-November and mid-April. Two of the 5 cases (nos. 4 & 15 in Tab. 1) were captured in May, while the date of capture of the remaining 3 specimens is unknown. Üner (1984) reported that great white sharks were captured in the waters of Prince Islands and Bosphorus Strait from December to the end of March, but added that this period could vary depending on temperature of the sea. Still, no great white sharks were captured or sighted in the Sea of Marmara between May and November (or December). Annual temperatures of the Sea of Marmara surface waters range from 4 to 24°C, while during November and April, when the accidental captures of great white sharks reached their peak, they range from 7°C (November) and 21°C (April). Great white sharks are known to occur in waters with temperatures ranging from 7 to 27°C (mainly 15 to 22°C) (Nakaya, 1994). The thermal tolerance of this species is demonstrated by its latitudinal distribution (Compagno, 1984). In the Catalanian Sea, the seasonality of great white shark recordings showed an increase during the winter months and it has been suggested that this is due to the great white sharks searching for colder waters (Barull & Mate, 2001). Eurythermal nature of the great white shark suggests that the species can remain in Marmaric waters all year round and that winter presence of these sharks in surface waters and their summer presence in deeper parts of the Sea of Marmara are therefore probably the result of this species searching for cold waters.

CONCLUSIONS

The available data suggest that great white sharks used to be regularly although somewhat rarely captured in Marmaric waters between the late 1800s and the late 1960s. The seasonality of records has shown an increase in their occurrence during the winter months. In view of the last confirmed record of this shark in the Sea of Marmara (in the year 1985), the species had been present in this sea until the last quarter of the 20th century. The occurrences as well as capture of great white sharks are closely associated with pelagic fishery, especially with hand-lining of bluefin tuna. Bluefin tunas, one of the great white shark's main preys, are known to have been absent in the Sea of Marmara since 1987. Because of this reason, hand-lining of this large pelagic bony fish was also abandoned in Marmaric and Bosphoric waters at least 25 years ago. Although commercial purse-seining vessels still operate in the Sea of Marmara for capturing bonito, *Sarda sarda*, bluefish, *Pomatomus saltator*, and other pelagic bony fishes, no current capture record of the great white shark has been reported by these vessels from Marmaric waters. The available data suggest that great white sharks no longer occur in the Sea of Marmara. Ex-

tensive investigations and cooperation with commercial fishermen are required in order to clarify the current status of this apex predator in this small inland sea.

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ZGODOVINSKI PODATKI O POJAVLJANJU BELEGA MORSKEGA VOLKA *CARCHARODON CARCHARIAS* (LINNÉ, 1758) (LAMNIFORMES, LAMNIDAE) V MARMARSKEM MORJU

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POVZETEK

Avtor članka navaja petnajst zgodovinskih podatkov o pojavljanju belega morskega volka *Carcharodon carcharias* (Linné, 1758) v Marmarskem morju (Turčija). Zapis, ki so mu bili na voljo, govorijo, da so te morske pse lovili kar redno, čeprav ne ravno pogosto, med koncem 19. stoletja in koncem 60. let dvajsetega stoletja. Večina teh morskih plenilcev je bila ujeta naključno, in sicer ročno z vrvico med lovom na tuna (9 primerov) in mečarico (1 primer). Pojavljanje belega morskega volka je zatorej tesno povezano s pelaškim ribištvom, posebno lovom na tuna *Thunnus thynnus*. Karakulak & Oray (1994) sta poročala, da se ta tun ne pojavlja v Črnem in Marmarskem morju že od leta 1987, kar seveda pomeni, da je najpomembnejši plen belega morskega volka kratko malo izumrl v omenjenih dveh morjih. Sicer pa čas, v katerem so bili ujeti ti morski psi, kaže na to, da so se pogosteje pojavljali v zimskih mesecih. Glede na zadnje potrjeno pojavljanje belega morskega volka v Marmarskem morju (iz leta 1985) vse kaže, da je ta beli morski volk živel v tem morju do zadnje četrtine dvajsetega stoletja.

Key words: beli morski volk, *Carcharodon carcharias*, razširjenost, zgodovinski podatki, Marmarsko morje

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