

HISTORICAL AND CONTEMPORARY PRESENCE OF THE GREAT WHITE SHARK, *CARCHARODON CARCHARIAS* (LINNAEUS, 1758), IN THE NORTHERN AND CENTRAL ADRIATIC SEA

Alessandro DE MADDALENA

Italian Great White Shark Data Bank, via L. Ariosto 4, I-20145 Milano, Italy
E-mail: a-demaddalena@tiscali.it

ABSTRACT

Data concerning the presence of *Carcharodon carcharias* (Linnaeus, 1758) in the Northern and Central Adriatic Sea, as recorded in the Italian Great White Shark Data Bank, is presented herewith. A total of 79 cases, corresponding to about 83 specimens, are presented, complete with all biological details collected. Moreover, a brief analysis of the data is given.

Key words: Great white shark, *Carcharodon carcharias*, Adriatic Sea

PRESENZA STORICA E ATTUALE DELLO SQUALO BIANCO, *CARCHARODON CARCHARIAS* (LINNAEUS, 1758), NELL'ALTO E MEDIO ADRIATICO

SINTESI

Vengono esposti i dati in merito alla presenza di *Carcharodon carcharias* (Linnaeus, 1758) nell'Alto e Medio Mare Adriatico registrati nella Banca Dati Italiana Squalo Bianco. È riportato un totale di 79 casi, corrispondenti a circa 83 esemplari, completo di tutti i dettagli che è stato possibile rilevare. I dati vengono quindi brevemente analizzati.

Parole chiave: Squalo bianco, *Carcharodon carcharias*, Mare Adriatico

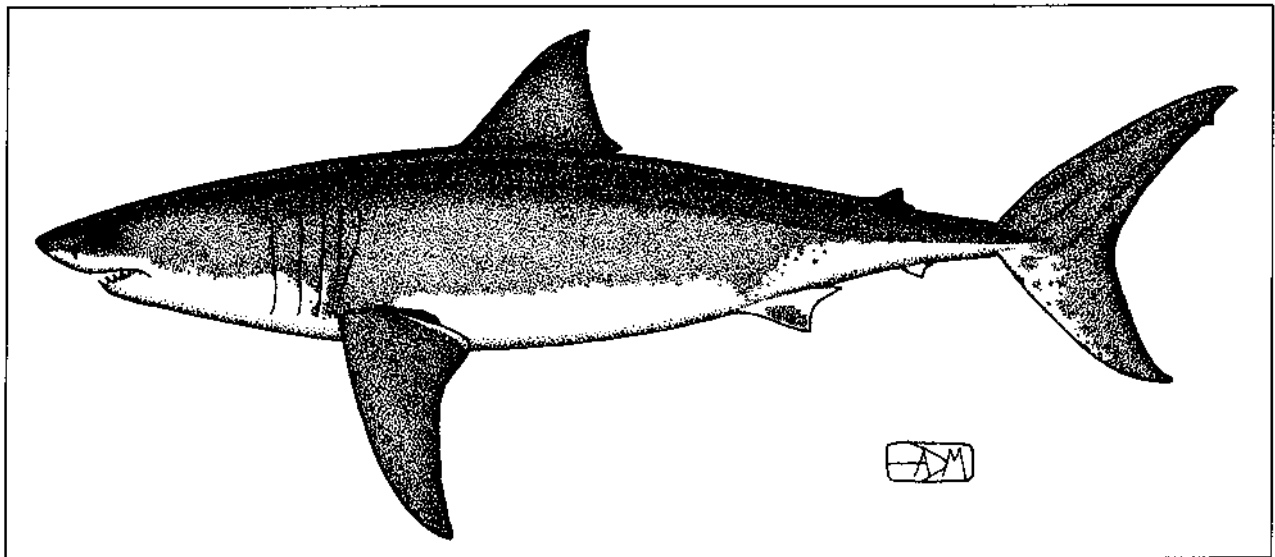
INTRODUCTION

Although the great white shark, *Carcharodon carcharias* (Linnaeus, 1758) (Fig. 1), has never been the subject of specific studies in the Adriatic Sea, its presence in these waters has been known for a long time, being recorded on many occasions by several authors. As a result of a program of data collection called the "Italian Great White Shark Data Bank" ("Banca Dati Italiana Squalo Bianco") and instigated in 1996, substantial information about historical and recent records

of this species from the Adriatic Sea have been collected. These data are reported here in full.

MATERIALS AND METHODS

The search for data on white sharks from the Adriatic was effected by bibliographical research, location and study of materials preserved in natural history museums, collaborations with other researchers, coast guards, and private citizens. For every case, whenever possible, the following data were collected: date and location of the



**Fig. 1: Great white shark *Carcharodon carcharias* (Linnaeus, 1758). Drawing by Alessandro De Maddalena.
Sl. 1: Beli morski volk *Carcharodon carcharias* (Linné, 1758). Risba: Alessandro De Maddalena.**

record, total length (TL) in cm, mass (P) in kg and sex (S) of the specimen, type of record (sighting, capture, attack on human or boat), register number in the International Shark Attack File (ISAF), depth of the sea at record location, distance from the coast, weather, information about specimens preserved in museums and catalogue number (cat. no.) in the collections, as well as any additional details.

RESULTS

326 records of *Carcharodon carcharias* in the Mediterranean Sea have been collected in the Italian Great White Shark Data Bank. Of these, a total of 79 cases (77 of which are deemed reliable) are referred to the Adriatic Sea (including Italy, Slovenia, Croatia, and unknown Country), corresponding to about 83 specimens (81 reliable) (Tab. 1). Only the large region encompassing Sicily, Egadi, Pantelleria, Pelagie, Malta and Tunisia has a larger number of records (105 specimens in total) as far as the Mediterranean is concerned.

With the exception of a few cases in which neither exact location nor Country is indicated - consequently they are indicated as occurring in the "Adriatic Sea" - the records are geographically well clustered in two zones: in the Eastern and Western Adriatic (Fig. 2). The lack of data from the Southern Adriatic supports a statement made by Bini (1967), who reported the great white shark as very rare in this zone.

The Eastern Adriatic

The high number of cases of great white sharks recorded from the Eastern Adriatic during the 19th century

and in the first half of the 20th century indicate that a population - perhaps of substantial size - must be present in the northern part of this zone, particularly in the Gulf of Trieste and in the Kvarner. The presence of this population in the Northeastern Adriatic may be causally



Fig. 2: Record location of great white sharks in the Adriatic Sea.

Sl. 2: Lokacije belih morskih volkov, zabeleženih v Jadranskem morju.

Tab. 1: Data on great white sharks registered in the Adriatic Sea.

Tab. 1: Podatki o belih morskih volkovih, zabeleženih v Jadranu.

DATE	LOCATION	TL (cm)	P (kg)	S	REMARKS	REFERENCES
1827	Adriatic Sea ITALY				Capture; jaws preserved in the Museo di Anatomia Comparata of Bologna (cat. no. AC P 114).	M. Zuffa (<i>pers. comm.</i>), De Maddalena (2000)
Beginning of February 1839	Civitanova ITALY	600 ca. (602)	1814		Capture or stranding; skeleton preserved in the Museo di Anatomia Comparata, Rome (cat. no. 111-95).	Bonaparte (1839), Metaxà (1839), Vinciguerra (1885-1892), Condorelli & Perrando (1909), De Maddalena (1998-1999-)
September 14 th 1868	Jablanac, CROATIA				Capture. Preserved in the Croatian Museum Zagreb.	Brusina (1888)
December 16 th 1868	Sv. Gjuraj, Near Senj CROATIA	460			Capture. Preserved in the Croatian Museum Zagreb.	Brusina (1888)
April 1872 - July 1882	Eastern North Adriatic Sea	from 146 to 530			21 specimens captured. Surely some of these individuals are reported further.	Marchesetti (1884)
April 16 th 1872	Preluka harbour CROATIA	490			Capture	Brusina (1888)
April 19 th 1872	Grado ITALY	300			Capture, 4 miles offshore	Brusina (1888)
May 12 th 1872	Opuzen CROATIA	95			Capture, 10 miles offshore	Brusina (1888)
May 12 th 1872	Konao (Mljet) CROATIA	237			Capture	Brusina (1888)
June 8 th 1872	Preluka harbour CROATIA	131			Capture	Brusina (1888)
June 16 th 1872	Dugi Otok CROATIA	146			Capture	Brusina (1888)
July 25 th 1872	Cavtat CROATIA	260			Capture	Brusina (1888)
August 8 th 1872	Rab CROATIA	130			Capture	Brusina (1888)
1873	Trieste ITALY	460		M	Capture	Doderlein (1881), Graeffe (1886)
May 5 th 1877	Ustrine (Cres) CROATIA	460			Capture	Brusina (1888)
May 8 th 1877	Sv. Martin (Cres) CROATIA	413			Capture	Brusina (1888)
May 12 th 1877	Adriatic Sea ITALY				Capture	Perugia (1881), Ninni (1912)
May 12 th 1877	Adriatic Sea ITALY				Capture	Perugia (1881), Ninni (1912)
June 17 th 1878	Osor -Cres- CROATIA	371			Capture	Perugia (1881), Brusina (1888), Ninni (1912)
May 21 st 1879	Sv. Martin Cres CROATIA	382			Capture	Brusina (1888)

DATE	LOCATION	TL (cm)	P (kg)	S	REMARKS	REFERENCES
June 1879	Kvarner CROATIA				Capture. Maybe in fact one of the two following cases.	Graeffe (1886), Tortonese (1956), Fergusson (1996)
June 17 th 1879	Adriatic Sea				Capture	Perugia (1881), Ninni (1912)
July 23 rd 1879	Split CROATIA	402 or 445			Capture	Perugia (1881), Brusina (1888), Ninni (1912)
September 21 st 1879	Ustrine -Cres- CROATIA	530			Capture	Perugia (1881), Faber (1883), Brusina (1888), Ninni (1912)
November 5 th 1879	Grado ITALY	250			Capture	Perugia (1881), Ninni (1912)
1880	Golfo di Trieste ITALY	460			Capture	Ninni (1912), Fergusson (1996), Mojetta <i>et al.</i> (1997)
April 22 nd 1881	Rab CROATIA	380			Capture	Brusina (1888)
October 16 th 1881	Rab CROATIA	405			Capture	Brusina (1888)
April 13 th 1882	Sv. Martin (Cres) CROATIA	529			Capture	Brusina (1888)
June 13 th 1883	Vrboska (Hvar) CROATIA	300			Capture	Brusina (1888)
September 26 th 1883	Rab CROATIA	396			Capture	Brusina (1888)
September 14 th 1885	Santa Croce di Trieste ITALIA	400			Capture	Brusina (1888)
March 3 rd 1886	Korčula CROATIA	560			Capture	Brusina (1888)
September 2 nd 1887	Krk CROATIA	470			Capture	Brusina (1888)
1902	Trieste ITALY	375		M	Capture; preserved taxidermied in the Museo di Storia Naturale of Venezia (cat. no. 2039).	Mizzan (1994), De Maddalena (2000)
May 29 th 1906	Kvarner CROATIA	522		F	Capture; preserved taxidermied in the Museo di Storia Naturale of Trieste (without cat. no.).	De Maddalena (2000)
January 1908	Medola CROATIA				Possible great white shark attack on Milena Scambelli.	M. Zuffa (<i>pers. comm.</i>), Anonymous (1908)
May 19 th 1908	Stadival CROATIA	170			Captured by Simeone Armanini and Simeone Franceschini.	M. Zuffa (<i>pers. comm.</i>)
June 1908	Golfo di Trieste ITALY		1400		Captured by Stelio Candela.	Arrassich (1994)
October 1909	Kraljevica CROATIA	550 ?			Capture	A. Mojetta (<i>pers. comm.</i>), Mojetta <i>et al.</i> (1997)
1927	Rovinj CROATIA	600 ca.	1000		Capture. Stomach contained inedible objects.	De Maddalena (1999)

DATE	LOCATION	TL (cm)	P (kg)	S	REMARKS	REFERENCES
August 21 st 1934	Susak CROATIA				Unprovoked fatal attack on swimmer Agnes Novak. ISAF no. 370.	Giudici & Fino (1989)
August 23 rd and 30 th 1934	Rijeka CROATIA	600 ca. >700			At least 2 specimens sighted.	Giudici & Fino (1989)
August 30 th 1934	Rijeka CROATIA	600			Doubtful unprovoked fatal attack on swimmer Zorica Princ (or Prinz?). ISAF no. 974.	Fergusson (1996)
September 2 nd 1934	Kraljevica CROATIA	>700	>2000		Capture	Giudici & Fino (1989)
September 7 th 1934	Moschiena CROATIA	500 ca.	800 ca.		Capture; pursuing school of tunas.	Giudici & Fino (1989)
September 7 th 1934	Martinschizza CROATIA	>600 ca.			Sightings; eating a small board of cork.	Giudici & Fino (1989)
August 24 th 1938	Koper SLOVENIA	500 ca.			Sighted by Nicola Lubrano.	State Archives of Trieste
1940 ca.	Koper SLOVENIA				Attack on boat.	M. Zuffa (<i>pers. comm.</i>)
September 24 th 1961	Opatija CROATIA				Unprovoked fatal attack on swimmer Sabit Plan. ISAF no. 946.	Anonymous (1961), Giudici & Fino (1989), Fergusson (1996)
July 7 th 1963	Riccione ITALY	450 ?			Unprovoked nonfatal attack on diver Manfred Gregor. ISAF no. 1220.	Ellis (1983), Fergusson (1996), Mojetta <i>et al.</i> (1997)
October 22 nd 1963	Izola SLOVENIA	600	1100		Capture. Stomach contained 1 dolphin.	Lipej (1993-1994)
August 16 th 1966	Dalmatia CROATIA				Fatal attack.	A. Mojetta (<i>pers. comm.</i>)
1970	Novigrad CROATIA				Unprovoked attack on diver Jurinčić.	A. Mojetta (<i>pers. comm.</i>)
September 1971	Ika CROATIA				Fatal attack on Stanislav Klepna.	Gilioli (1989)
1971	Opatija CROATIA				Unprovoked fatal attack on a swimmer. ISAF no. 1640.	Fergusson (1996)
August 10 th 1974	Omiš CROATIA	500 ca.			Fatal attack on Rolf Schneider.	M. Zuffa (<i>pers. comm.</i>)
June 7 th 1978	Golfo di Venezia ITALY	500 ca.			Sighted by Luigi Alberotanza and Luigi Cavaleri; regurgitated a bottlenose dolphin.	L. Alberotanza (<i>pers. comm.</i>), L. Cavaleri (<i>pers. comm.</i>), Beltrame (1983), Albertarelli (1990), Fergusson (1996)
A few days later	Caorle ITALY				Sighting	L. Alberotanza (<i>pers. comm.</i>)
End of September 1986	Western Adriatic Sea (Rimini, Pesaro) ITALY	600 ca.?		F	Repeated sightings and a possible nonfatal attack on a boat.	Anonymous (1986), Gilioli (1989), Giudici & Fino (1989), Marini (1989), Martelli (1989), Fergusson (1996)
August-September 1987	Pesaro ITALY	>600			Sighting	Cardellini (1987), Mojetta <i>et al.</i> (1997)

DATE	LOCATION	TL (cm)	P (kg)	S	REMARKS	REFERENCES
May 1988	Numana ITALY	450 ca.			Sighted by Fausto Fioretti.	M. Marconi (<i>pers. comm.</i>)
September 9 th 1988	Porto Barricata ITALY	>550			Sighting or possible attack on a boat.	A. Mojetta (<i>pers. comm.</i>), Mojetta <i>et al.</i> (1997)
September 1989	Pesaro ITALY	>500			Sighting	Fergusson (1996)
December 17 th 1991	Ancona ITALY	210	180		Capture	Fergusson (1996)
Mid-March 1992	Termoli ITALY	230	200 ca.	F	4 or 5 juveniles captured.	Anonymous (1992), Fergusson (1996)
August 1993	Šibenik CROATIA	500		F	Capture	Fergusson (1996)
August 1993	Lošinj CROATIA				Repeated sightings by fishermen.	Fergusson (1996)
September 4 th 1998	Dubrovnik CROATIA				Sighted offshore.	De Sabata <i>et al.</i> (1999)
August 2 nd 1998	Mljet CROATIA				Sighting	De Sabata <i>et al.</i> (1999)
August 27 th 1998	Senigallia ITALY	500-600 ca.	1200 ca.		Sighted by Stefano Catalani; feeding on a thresher shark carcass.	Imarisio (1998), Montefiori (1998)
September 26 th 1999	Giulianova ITALY	600 ca.			Sighted by Elvio Mazzagufo; feeding on tuna carcass.	Graziosi (1999)
?	Foce del Po ITALY				Sighting	M. Zuffa (<i>pers. comm.</i>)
?	Adriatic Sea				Capture. Set of jaws preserved in the Museo di Storia Naturale of Trieste (without cat. no.).	De Maddalena (2000)
Before 1881	Golfo di Venezia ITALY	490			Capture	Doderlein (1881), Carus (1893), Fergusson (1996)
Before September 1891	Adriatic Sea	1005	4000		Capture	Anonymous (1891), Ellis & McCosker (1991)
Before 1969	Adriatic Sea				Capture; stomach contained inedible objects.	Lineaweaver III & Backus (1969), Gianturco (1978)
Before 1992	Northern Adriatic Sea ITALY				2 specimens captured.	Anonymous (1992)

linked to the fact that there were once several commercial fisheries dedicated to catching tunas in this region. The fisheries were established in response to the massive and well-known quantity of tunas that passed along this part of the Adriatic. It is well known that tunas are among the favoured prey for great white sharks. Moreover, the long Croatian coast - consisting of several islands, straits and small bays - seems to be a habitat congenial to this species.

Between the years 1872 and 1905, the Imperial Maritime Austrian Government issued three circulars offering a reward of up to 500 florins for every great

white shark captured. These circulars also mentioned other shark species, but primarily referred to *Carcharodon carcharias*. At the State Archives of Trieste, the orders of payment for these rewards are available but, unfortunately, in most cases the species for which they were issued is not listed. To obtain the monetary reward, fishermen must present their captured specimens to the Museo di Storia Naturale of Trieste to verify the species identification. From April 1872 to July 1882, 21 shark specimens were presented to the Museo di Storia Naturale of Trieste; the size of these specimens ranged from 1.46 to 5.3 metres, of which 7 (33.33%) were over 4

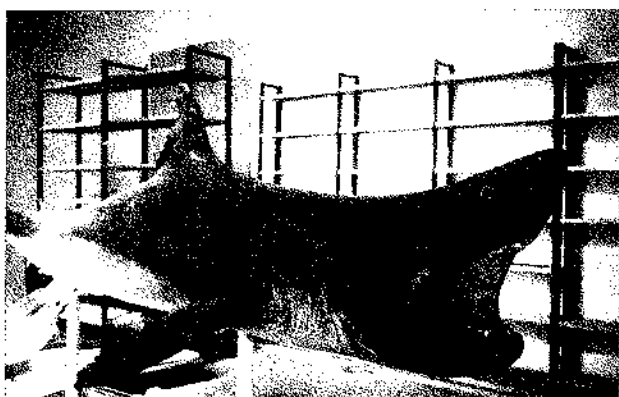


Fig. 3: 3.75 m specimen preserved in the Museo di Storia Naturale of Venezia (cat. no. 2039), caught off Trieste (Italy) in 1902. (Photo: A. De Maddalena)
Sl. 3: 3,75 m dolgi primerek belega morskega volka v beneškem prirodoslovnem muzeju (kat. št. 2039), ujet leta 1902 v bližini Trsta. (Foto: A. De Maddalena)



Fig. 4: 5.22 m specimen preserved in the Museo di Storia Naturale of Trieste (without cat. no.), caught in Kvarner (Croatia) on May 29th 1906. (Photo: A. De Maddalena)
Sl. 4: 5,22 m dolgi primerek v tržaškem prirodoslovnem muzeju (brez kat. št.), ujet 29. maja 1906 v Kvarnerju. (Foto: A. De Maddalena)

meters in length (Marchesetti, 1884). Among these 21 specimens are 11 captures recorded over the same period from the waters of Trieste, Grado (Italy), Osor, Kvarner, Split, Ustrine (Croatia) and other unspecified locations (Doderlein, 1881; Graeffe, 1886; Perugia, 1881; Faber, 1883; Ninni, 1912; Tortonese, 1956; Fergusson, 1996; Mojetta *et al.*, 1997). Moreover, Brusina (1888) reports 24 specimens, ranging from 1.3 to 5.6 meters in length, caught between September 1868 and September 1887 in the Eastern Adriatic; it is certain that some of these individuals are the same as those reported by Marchesetti (1884). This measure apparently produced the desired result, since from 1887 to 1902 no other records of large sharks from the Eastern Adriatic are known.

But from 1902, a number of the shark capture records were made again. These include several sightings of large sharks as well as attacks on humans and even boats. According to Boulenger (1939), "there does not pass a bathing season, especially on the Liburnian and Dalmatian coasts, without an attack on a bold swimmer by one of these tigers of the sea". In the museums of Venezia and Trieste there are two large taxidermied great white shark specimens captured in the Eastern Adriatic during the early years of the 20th century. The specimen in the Museo di Storia Naturale of Venezia (cat. no. 2039; Fig. 3) is a 3.75 m TL male caught off Trieste (Italy) in 1902 (Mizzan, 1994; De Maddalena, 2000), while that in the Museo di Storia Naturale of Trieste (without cat. no.; Fig. 4) is a 5.22 m TL female caught in Kvarner (Croatia) on May 29th 1906 and is the largest taxidermied *C. carcharias* preserved in Italy (De Maddalena, 2000).

In January 1908, some sharks approached a boat full of young women near Medola (Croatia). Perhaps one of

the sharks attacked the boat, because Milena Scambelli fell suddenly into the sea. A shark bit her leg, lacerating it. Ms. Scambelli was rescued and taken to hospital, but did not survive (M. Zuffa, *pers. comm.*; Anonymous, 1908). Whatever precipitated the attack, the identity of the causal species must remain highly uncertain. It seems very strange that a witness specified that the sharks, "jumped around the boat". In fact, *C. carcharias* can breach entirely out of water, but does so relatively rarely.

On May 19th 1908, there was another capture of a shark in the Eastern Adriatic. The shark was caught near Stadival (Croatia) by fishermen Simeone Armanini and Simeone Franceschini. At the time it was identified as a shortfin mako (*Isurus oxyrinchus*), but subsequent examination of the available evidence suggests that it was probably a young *C. carcharias* (M. Zuffa, *pers. comm.*). The differences in the teeth of these two members of the Lamnidae family are less obvious in very young specimens and can sometimes generate some confusion. A short time after this capture of a small great white shark, in June 1908, Stelio Candela caught a large specimen weighing 1,400 kg in the Gulf of Trieste. A conclusive photographic evidence has been preserved about this incident (Arrassich, 1994). Another, 5.5 m long great white shark was caught in October of the following year in Kraljevica (Croatia) (A. Mojetta, *pers. comm.*; Mojetta *et al.*, 1997).

In Rovinj (Croatia), nine fishing boats captured, in 1927, a large specimen of great white shark, about 6 m long and weighing some 1,000 kg. Its stomach contained several inedible objects.

During the summer of 1934, there were a series of records of great white sharks in Croatian waters. On August 21st 1934, the island of Susak witnessed an attack



Fig. 5: 6 m specimen caught in the waters off Izola (Slovenia) on October 22nd 1963. (L. Lipej's archive)
Sl. 5: Šestmetrski beli morski volk, ujet 22. oktobra 1963 v bližini Izole. (Arhiv L. Lipeja)

on a young woman, Agnes Novak, who was swimming near a tuna catching station. There was an anti-shark net, but Agnes entered the water outside this net. Eye-witnesses from a fishing boat heard the woman scream and they saw a large great white shark biting Agnes's abdomen and dragging her underwater (Giudici & Fino, 1989). This fatal attack is no. 370 in the ISAF.

In the days that followed the attack on Agnes Novak, there were many sightings of sharks. The possibility cannot be excluded that one or more of these sharks could have been responsible for the attack on Novak. Sightings of at least two sharks occurred on August 23rd and 30th near Rijeka. On August 23, a large shark - estimated to be about 6 m long - was seen by some soldiers to be swimming near a torpedo-factory. Possibly the same shark was sighted later that afternoon by some fishermen, where it was seen swimming towards the shore off Diga Cagno. On August 30th, two large sharks were reported between Punta Baro and Diga Cagno. An hour later a shark - estimated to be more than 7 meters long - was swimming towards Labin channel, when it was encountered by some fishermen (Giudici & Fino, 1989).

A few days later, on September 2, an enormous shark - reportedly measuring 7 m in length and weighing 2 t - was caught at Kraljevica. Examination of its stomach contents did not indicate that it had been responsi-

ble for the attack on Novak (Giudici & Fino, 1989). A few days later yet another capture of a great white shark occurred: it was almost 5 m long and weighed 800 kg. The shark became trapped in a tuna net (Moščenicka Draga) while pursuing a school of tuna. On the same day, only a few hours after this capture, a shark longer than 6 m was seen near Martinščica and, an hour later, probably the same shark was sighted near a fishing boat eating a small board of cork (Giudici & Fino, 1989).

This series of well-documented records ends with a very doubtful incident. ISAF case no. 974 concerns a fatal attack on a swimmer, named Zorica Princ (or Prinz?), that occurred on August 30th near Rijeka, by a 6 m *C. carcharias*. Although Fergusson (1996) included it in his list of the Mediterranean great white shark attacks, the veracity of this incident must be regarded as questionable, because there is a strong possibility that it was merely a fabrication organised by a local newspaper.

At the State Archives of Trieste, I found a note attesting the following event: at 3 o'clock in the morning of August 24th 1938, a large shark of undisclosed species but measuring about 5 m TL carried away, in the Koper waters (Slovenia), a mile off the Ospizio Marino, the net of the fishing boat "S. Giovanni" belonging to Nicola Lubrano. On the basis of the shark's behaviour and its sheer size, it seems reasonable to infer that it was probably a *C. carcharias*. Again in the Koper waters, an attack on a boat occurred around 1940, as a result of which a fragment of a tooth of the shark remained embedded in the wood of the hull (M. Zuffa, *pers. comm.*).

From that moment, the records of great white sharks in the Eastern Adriatic become quite rare. The following incident occurred at Opatija, 21 years after the boat attack in the Koper waters, the record dated September 24th 1961. In the early afternoon of that day, student Sabit Plan was attacked by a large shark, which was subsequently identified as *C. carcharias* by Fergusson (1996). The young man was 100 m offshore when attacked. A boat was deployed to rescue him, but he had lost an arm and both legs so that - by the time it reached him - he was already dead (Anonymous, 1961; Giudici & Fino, 1989). This case is no. 946 in the ISAF.

On October 22nd 1963, a large shark measuring 6 m TL was caught near Izola (Slovenia) (Figs. 5 and 6). It approached a fishing boat while fishermen were turning in their nets and was killed with 23 rifle shots. According to the local newspapers, its stomach contained a dolphin, weighing about 200 kg (L. Lipej, *pers. comm.*; Lipej, 1993-1994). The source reports photographic evidence of this capture. A series of five attacks occurred in the Croatian waters between 1966 and 1974 (Dalmatia, August 16th 1966; Novigrad, 1970; Ika, September 1971; Opatija, 1971; Omiš, August 10th 1974). Afterward, for many years, there were no other records of great white sharks in the Eastern Adriatic. More recently, four cases occurred in the Croatian waters. In August 1993, there

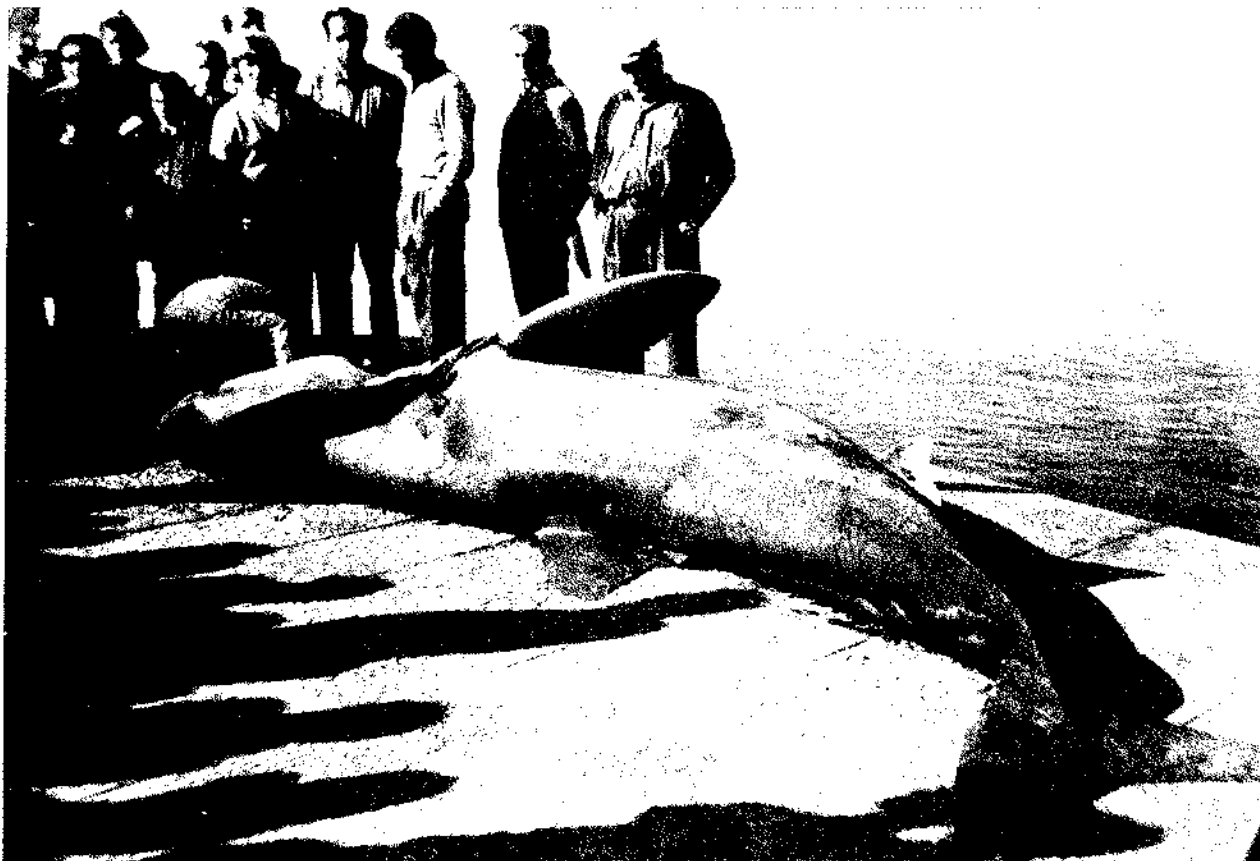


Fig. 6: 6 m specimen caught in the waters off Izola (Slovenia) on October 22nd 1963. (L. Lipej's archive)
 Sl. 6: Šestmetrski beli morski volk, ujet 22. oktobra 1963 v bližini Izole. (Arhiv L. Lipeja)

was a capture of a 5-m specimen at Šibenik, followed by some sightings by fishermen at Lošinj (Fergusson, 1996; Mojetta *et al.*, 1997). In the summer of 1998, there was a sighting of a great white shark at Dubrovnik (on September 4th), and another at Mljet on August 2nd (De Sabata *et al.*, 1999).

The Western Adriatic

Records of great white sharks from the Western Adriatic have never been as frequent as those from along the eastern coast. This may be because the greater uniformity of the eastern coast of Italy does not favour this species approaching the shore. Historical evidence for the presence of *C. carcharias* on this side of the Adriatic is provided by a set of jaws preserved in the Museo di Anatomia Comparata of Bologna (cat. no. AC P 114; Fig. 7) from a specimen caught in 1827 at an unknown locality in the Western Adriatic which, upon capture, was exhibited at the Bologna fish market (M. Zuffa, *pers. comm.*; De Maddalena, 2000).

Early in February 1839, a very large great white shark was captured or stranded (the various sources differ on this point) in Civitanova, reported to be over 6 m

long and weighing 1,814 kg. Shipped to Rome, the specimen was preserved at the University (Bonaparte, 1839; Metaxà, 1839; Vinciguerra, 1885-1892; Condorelli & Perrando, 1909). Not long ago, in the Museo Civico di Zoologia of Rome, the skin of this large shark was again preserved, but it has since then been lost or destroyed. The Museo di Anatomia Comparata of Rome keeps the cranium, jaws and the vertebral column of this large shark. From an analysis of the largest vertebra, I calculated a TL of 6.02 m, making this the largest verified specimen preserved in an Italian museum (De Maddalena, 1998-1999). Among the undated cases, but probably referable to the 19th century, is a 4.9 m specimen caught in Golfo di Venezia some time before 1881 (Doderlein, 1881; Carus, 1893; Fergusson, 1996).

The following documented case occurred much later than the Golfo di Venezia specimen. On July 7th 1963 (and not in 1961 as erroneously reported in Ellis, 1983), in Riccione, spearfishing diver Manfred Gregor was the victim of an unprovoked non-fatal attack by a *C. carcharias* about 4.5 m long (Fergusson, 1996; Mojetta *et al.*, 1997). This incident constitutes case no. 1220 of the ISAF.



Fig. 7: Set of jaws preserved in the Museo di Anatomia Comparata of Bologna (cat. no. AC P 114), from a specimen caught in 1827 in the Adriatic. (Photo: A. De Maddalena)

Sl. 7: Čeljust belega morskega volka, ujetega leta 1827 v Jadranu, v zbirki bolonjskega muzeja komparativne anatomije. (Foto: A. De Maddalena)

A well documented case occurred on June 7th 1978 in the Golfo di Venezia. Luigi Alberotanza and Luigi Cavaleri, two researchers of the Centro Nazionale delle Ricerche (C.N.R.), were on the research platform "Acqua alta", located 13 km off Lido, in waters 16 m deep. They were returning from a dive to clean the legs of the platform when they saw two dark fins on the surface. Imagining it was a shark, they waited in hopes of seeing it better. Alberotanza tried to attract it by throwing a large steak in the water. Suddenly, the fins disappeared. Some moments later, while the men headed inside the platform to take off their wetsuits, the platform was shaken by a powerful bump. The men saw clearly a great white shark swimming close to the platform. They estimated the shark's length based on the known distance between the legs of the platform: it was about 5 m long. Luigi Cavaleri took even some photos of the shark. The shark disappe-

ared, but the remains of a bottlenose dolphin, *Tursiops truncatus* (Montagu, 1821), were found near the platform. Examination of the dolphin remains indicated that they were regurgitated by the shark, perhaps following its collision with the platform (L. Alberotanza, *pers. comm.*; Luigi Cavaleri, *pers. comm.*; Beltrame, 1983; Albertarelli, 1990). In Fergusson (1996) this incident is erroneously dated and located as happening in July 1977 in the Venice Lagoon. Possibly the same specimen was sighted a few days later, near Caorle (L. Alberotanza, *pers. comm.*).

Late in September 1986, between Rimini and Pesaro, several sightings of a large great white shark occurred (Gilioli, 1989; Giudici & Fino, 1989; Marini, 1989; Martelli, 1989; Fergusson, 1996). This specimen was described as being about 6 m long, but some estimates ranged as much as 8-9 m. It may also be the same individual that had attacked the fishermen's boat and - possibly the same incident - snatched from the hand of a fisherman a whole crate of pilchards (Anonymous, 1986). This shark was first sighted on September 20th by the captain of the hydrofoil covering the Rimini-Yugoslavia route. On September 23rd, the shark was sighted off Rimini near the oil-platform "Antonella". On another occasion, it was seen 13 miles off Pesaro, near the oil-platform "Basil". It seems that Roberto Bartomioli photographed and Marco Benelli filmed this shark but, to my knowledge, the pictures of this animal were never reproduced. Many anglers tried to capture the shark: Gabriele Bartoletti and Stefano Dragoni, on two separate occasions, succeeded in getting the shark swallow the bait, but they could not catch it. Several eyewitnesses described the shark as having a white coloration; perhaps they mistook a pale grey for white or possibly it was an albino specimen. Dubbed "Willy" by the fishermen of Rimini, this shark was resighted and recognized (based on characteristics unknown to me) during the period from 1986 to 1989. It seems that the shark was seen near Pesaro between August and September 1986, and resighted during the same period of the following year (Cardellini, 1987; Mojetta *et al.*, 1997). In September 1989, there was a sighting, near Pesaro, of a large shark, estimated to be 5 m long and supported by photographic evidence (Fergusson, 1996). In the opinion of Notarbartolo di Sciarra (1986), "Willy" was a basking shark, *Cetorhinus maximus* (Gunnerus, 1765), but this seems highly improbable, considering that the species was recognized as *C. carcharias* by many eyewitnesses. Moreover, if the reported attack on a fishing boat actually occurred, this hypothesis can be excluded.

Not far from Pesaro, in May 1988, 28 miles offshore 100° from Numana, Fausto Fioretti sighted from his boat a great white shark that he estimated to be 4.5 m long, in water 85-90 m deep. This occurred during a fishing tournament, so possibly the shark was attracted by the activity (M. Marconi, *pers. comm.*). Fioretti took some photos of this shark (Fig. 8).

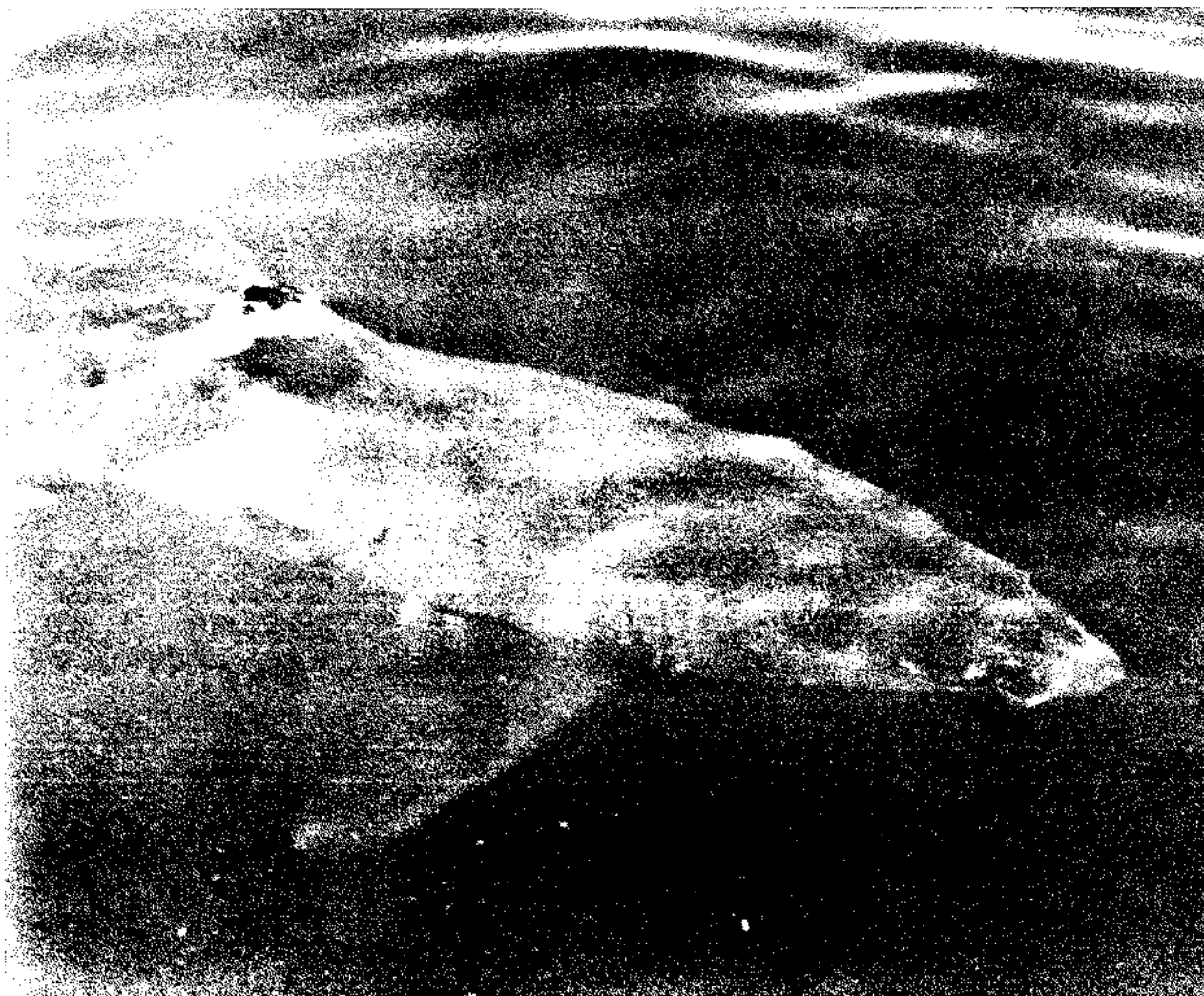


Fig. 8: Specimen sighted off the shore of Numana (Italy) in May 1988, estimated to be about 4.5 m long. (Photo: Fausto Fioretti)

Sl. 8: Primerek, dolg približno 4,5 m, opažen maja leta 1988 v bližini Numane (Italija). (Foto: Fausto Fioretti)

In 1988, there was a documented record, dated September 9, of an encounter that occurred near Porto Barricata, but it is not clear whether it was a simple sighting or an attack on a boat (A. Mojetta, *pers. comm.*; Mojetta *et al.*, 1997).

Over the years 1991-1992, captures of some young specimens were recorded, unfortunately with very few details. One specimen, captured in Ancona on December 17th 1991, was 2.1 m long (Fergusson, 1996), and 4 or 5 young specimens - of which one was a female measuring 2.3 m and weighing about 200 kg - were captured in Termoli, in Mid-March 1992 (Anonymous, 1992; Fergusson, 1996).

A very well documented case, one which Italian mass-media gave great publicity, occurred in 1998, on August 27th at 3 p.m., some 22 miles off Senigallia, in

waters 72 m deep. A great white shark specimen, estimated 5-6 m long, came alongside the boat of Stefano Catalani. The angler had caught a thresher shark, *Alopias vulpinus* (Bonnaterre, 1788), which was subsequently fixed to the side of the hull. The shark circled the boat for about ten minutes, then bit the sack containing the bait and finally took a piece of the thresher shark carcass. Frightened, Catalani surrendered the carcass, but the great white shark remained close to the boat. After having filmed the shark for about half an hour, Catalani decided to leave (Imarisio, 1998; Montefiori, 1998).

Another recent well documented case involves an encounter offshore from Giulianova. It was September 1999, and the angler Elvio Mazzagufo was fishing for tunas in waters 250 m deep. A *C. carcharias*, estimated

to be 6 m long, approached the boat and started to eat one of the hooked tunas. When the tuna was hauled on to the boat, the shark bit the vessel's hull. Contrary to that reported by the press, no such attack occurred. The shark was even photographed (Fig. 9) (Graziosi, 1999).

Lastly, it must be mentioned that a sighting of a great white shark occurred on an unknown date near the mouth of the Po that is verified by photographic evidence (M. Zuffa, *pers. comm.*).

In addition to the records described above, in the interests of completeness, it is of some interest to report that in some Italian natural history museums there are additional specimens of which the capture location is unknown, but for which is easy to hypothesise that in some cases they may be from the Adriatic. Among these could be the 7 specimens preserved in the museums of Venezia, Padova, Modena, Ferrara, Reggio-Emilia, which are mostly referable to the 19th century (De Maddalena, 2000).

DISCUSSION

During the 19th century and the first half of the 20th,

a population of great white shark perhaps of considerable size was present in the Eastern North Adriatic Sea in Kvarner (Croatia) and in the Gulf of Trieste (Italy), but has with the passing of time decreased significantly. Surely it must be the hunting of this species that has contributed to this decrease, although a more important factor may be an impoverishment - caused by an excessive exploitation by fisheries - of the species on which *C. carcharias* preys. Another possible factor could be the increasing pollution caused by human activities suffered by the Adriatic. In my opinion, the great white shark must be at this time considered sporadic in the Northern and Central Adriatic.

For 69 specimens (85.18% of all reliable specimens recorded), the months of encounters are indicated. Most great white shark specimens (51 or 73.91%) have been reported from May to September, with a peak in August-September (28 or 40.58%). Obviously it must be taken into account that in the summer months, due to the increasing frequentation of Adriatic coasts by humans, there are more possibilities of encounters between men and sharks. But, strangely, only 3 specimens have been recorded from the region during the month of July.

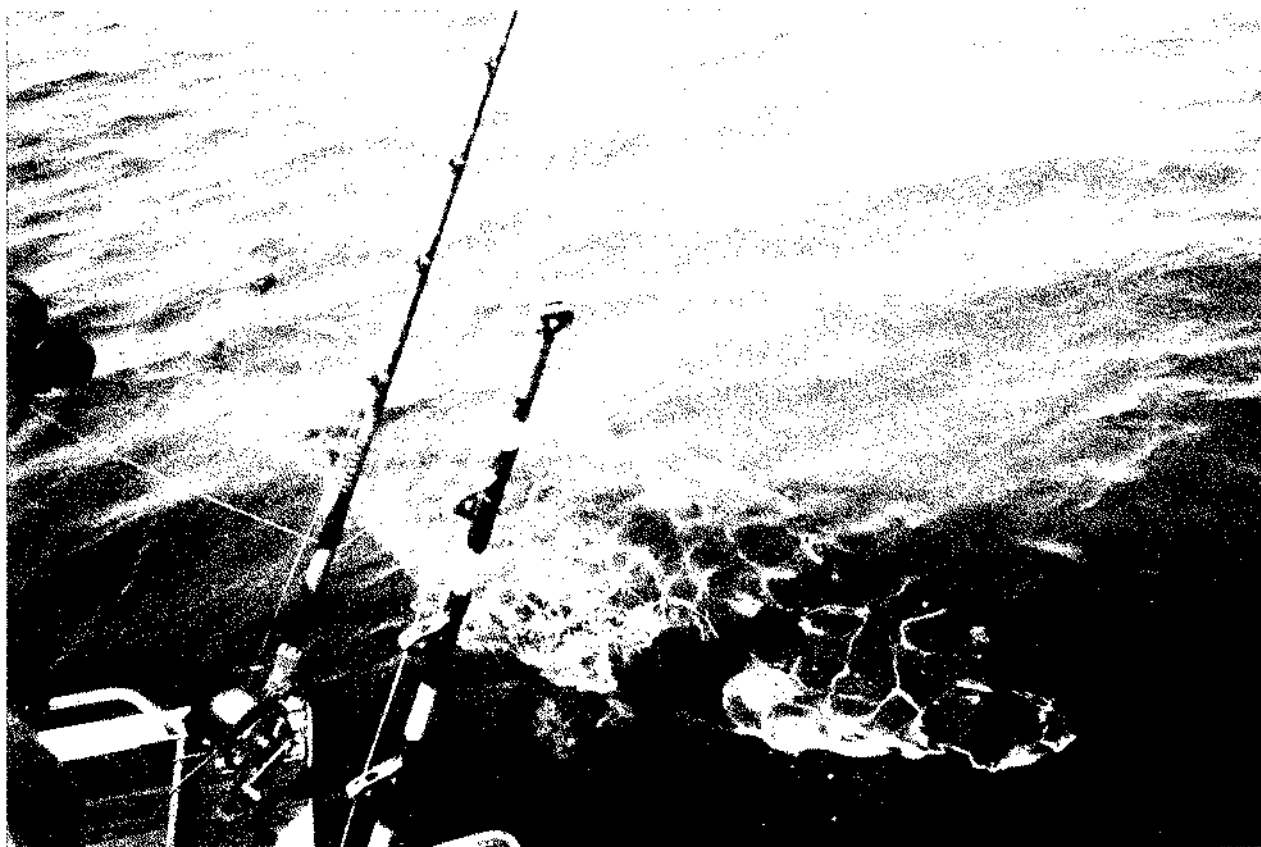


Fig. 9: Specimen sighted off the shore of Giulianova (Italy) on September 26th 1999, estimated to be about 6 m long. (Photo: Elvio Mazzagufu)

Sl. 9: Primerek, dolg kakih 6 m, opažen 26. septembra 1999 v bližini Giulianove (Italija). (Foto: Elvio Mazzagufu)

On the matter of size, there are some interesting cases of very large great white shark specimens reported from the Adriatic, particularly of the enormous 1,005 cm TL great white shark caught before 1891 in an unspecified location (Anonymous, 1891; Ellis & McCosker, 1991), and other 11 specimens 6-7 m in length. Of the latter, in some cases length was merely estimated at the time of sighting, but in others the sharks were probably even measured. Unfortunately, there is no way of verifying or refuting the reported lengths of very large sharks like these, because it is unknown how these measurements were taken. The only verified case is that of the 6.02 m specimen caught near Civitanova in 1839 (De Maddalena, 1998-1999). Moreover in Lipej (1993-1994) it was possible to examine a photo of the 6 m TL specimen caught in Izola in 1963 (Figs. 5 and 6); the shark's length can be compared to the dimensions of the humans photographed next it. There is also a photograph of the specimen, estimated to be 6 m long, sighted in September 1999 off Giulianova (Graziosi, 1999); unfortunately there are no objects visible near the shark that could be used to confirm its length (Fig. 9). There are 11 records of young specimens of great white sharks under 3 m in length, from the Adriatic. The smallest of these, caught in May 1872 off Opuzen, measured 95 cm (Brusina, 1888).

The number of cases in which great white shark stomach contents were reported, or in which the shark was observed during predation, are few. There are 2 cases of predation on dolphins (in 1 case the species was *Tursiops truncatus*; in the other, the species is not mentioned), 1 case of a specimen observed pursuing a school of tunas, and another of a shark feeding on a dead tuna (species not mentioned), 1 case of a great white shark feeding on a dead thresher, *Alopias vulpinus*, and 3 cases of sharks that had eaten inedible items (in 1 case, the kinds of objects is not mentioned, in another it was a small board of cork, and in another the items were a raincoat, 2 or 3 coats, and an automobile number-plate). In the Adriatic, the great white shark probably has the same diet as observed in the rest of the Mediterranean - and similar that noticed elsewhere in the world - being based on cetaceans, tunas, marine turtles, sharks, and swordfishes (Fergusson, 1996; De Maddalena, 1999).

Regarding the attacks on humans in the Adriatic, there are 9 reliable records (excluding 4 doubtful cases):

7 along the Croatian coast, 1 in Slovenian waters, and 1 in Italian waters. The attacks occurred against swimmers (3), divers doing underwater spearfishing (2), and a boat (1). The number of fatal attacks from the Adriatic is 6, of which none was reported as provoked. All attacks occurred in the 20th century, the most recent of which is dated 1974.

CONCLUSIONS

It is very important to continue collecting new and historical data on the occurrence of great white sharks in the Adriatic. This will, in time, permit filling the gaps in our knowledge of this species in general, and in the Adriatic in particular.

Everyone who wishes to communicate to the author records of great white sharks not represented in this work, from Adriatic and, more generally, from the Mediterranean Sea, can contact him at the address listed in the byline of this work. Whenever possible, please report the following: date, time, location of the encounter, depth of the sea, distance from the coast, weather, activity of observer at the time of the encounter, total length (in a straight line from the tip of the snout to the tip of the upper lobe of caudal fin), mass, sex, stomach contents and behaviour of the specimen, presence of other species in the immediate area, comments, photographs, names of all eyewitnesses, your name and contact address. It is very important, if at all possible, to retain teeth, vertebrae, samples of skin, and any embryos. Please also specify whether or not you authorize the publication of your data and pictures.

ACKNOWLEDGEMENTS

Very special thanks to Rick Martin, who very kindly edited the English text of this work, and to Lovrenc Lipej, who offered the opportunity to prepare this work. The most important help in the collection of the data was given firstly by Marco Zuffa and Tiziano Storai, then by Angelo Mojetta, Luigi Alberotanza, Luigi Cavaleri, Mario Marconi, Ernesto Capanna, Sergio Dolce, Nicola Bressi, Luca Mizzan, Antonio Quaglia, Daniela Minelli, the library of the Hydrobiological Station of Milano and the State Archives of Trieste. A particular thank goes to Alessandra Baldi, Chiara Serino and João Pedro Correia.

ZGODOVINSKA IN NEDAVNA POJAVLJANJA BELEGA MORSKEGA VOLKA *CARCHARODON CARCHARIAS* (LINNÉ, 1758) V SEVERNEM IN SREDNJEM JADRANU

Alessandro DE MADDALENA

Italian Great White Shark Data Bank, via V. Foppa 25, I-20144 Milano, Italy

E-mail: ademaddalena@tiscalinet.it

POVZETEK

V 19. stoletju in v prvi polovici 20. stoletja se je v Kvarnerju (Hrvaška) in Tržaškem zalivu pojavljala populacija belih morskih volkov precejšnje velikosti, ki pa se je sčasoma občutno zmanjšala. Ta upad lahko brez dvoma pripišemo lovu na to vrsto, še bolj pa ribiški industriji in njenemu pretiranemu izkoriščanju vrst, s katerimi se beli morski volk hrani. Nadaljnji možni dejavnik bi lahko bilo naraščajoče onesnaževanje zaradi vseh mogočih človekovih dejavnosti na Jadranu. Sicer pa avtor članka meni, da je treba na belega morskega volka gledati kot na sporadično vrsto v severnem in srednjem Jadranu.

Za 69 osebkov (85,18% vseh zanesljivo opaženih) so podani meseci, v katerih so bili zabeleženi. Največ (51 ali 73,91%) jih je bilo opaženih med majem in septembrom, z vrhuncem v avgustu in septembru (28 ali 40,58%). Seveda pa je treba upoštevati dejstvo, da je v poletnih mesecih, ko je na jadranskih obalah precej več obiskovalcev kot sicer, možnosti za srečanje z morskimi psi neprimerno večje. Pa vendar so bili v mesecu juliju v tem območju zabeleženi samo trije beli morski volkovi.

O pojavljanju zelo velikih belih morskih volkov obstaja nekaj zelo zanimivih poročil, posebno o orjaškem 1005 cm dolgem osebkku, ujetem pred letom 1891 na nespacificirani lokaciji (Anonymous, 1891; Ellis & McCosker, 1991), in še 11 osebkkih, dolgih od 6 do 7 m. Kar zadeva slednje, je bila dolžina nekaterih izmed njih ocenjena v času, ko so bili opaženi, medtem ko so bili drugi verjetno celo izmerjeni. Žal pa ni načina, da bi preverili ali zavrnili podatke o dolžinah teh zelo velikih morskih volkov, saj ni znano, kako so bile meritve opravljene. Edini preverjeni primer je 602 cm dolgi osebek, ujet leta 1839 blizu Civitanove (De Maddalena, 1998-1999). Kar zadeva podatke L. Lipeja (1993-1994), pa si je mogoče natančno ogledati fotografijo 6-metrskega osebkka, ujetega leta 1963 v Izoli (Sl. 5 in 6); dolžino tega volka lahko namreč primerjamo z dimenzijo ljudi, fotografiranih ob njem. Obstaja tudi fotografija osebkka, opaženega oktobra 1999 v bližini Giulianove (Graziosi, 1999); dolg naj bi bil 6 m, vendar pa v bližini tega volka niso vidni nobeni predmeti, ki bi jih lahko uporabili za potrditev njegove dolžine (Sl. 9). Iz Jadrana obstaja 5 zapisov o mladih osebkkih, krajših od 3 metrov; najmanjši med njimi, ujet maja 1872 blizu Opuzna, je meril 95 cm (Brusina, 1888).

Število primerov, v katerih so poročali o vsebini volčjih želodcev ali pa je bil volk opazovan med plenjenjem, so zelo redki. Obstajata 2 primera, ko sta morska volka uplenila delfina (v enem primeru veliko pliskavko, v drugem pa vrsta ni omenjena), potem imamo 1 primer, ko je morski volk zasledoval jato tun, 1 primer, ko se je osebek hranil z mrtvo tuno (vrsta tune ni omenjena), 1 primer, ko se je beli morski volk hranil z morsko lisico *Alopias vulpinus*, in 3 primere, ko so morski volkovi trgali neužitne predmete (v 1 primeru predmet ni omenjen, v drugem je šlo za plutovinasto tablo, v tretjem pa za dežni plašč, dva ali 3 zimske plašče in avtomobilsko registrsko tablico). V Jadranu se veliki morski volk najbrž prehranjuje bolj ali manj enako kot njegovi vrstniki drugod v Sredozemlju - in tudi drugod po svetu - in sicer predvsem s kiti, tunami, morskimi želvami, morskimi psi in mečaricami (Fergusson, 1996; De Maddalena, 1999; De Maddalena, 2000).

Kar zadeva napade na ljudi v Jadranskem morju, imamo 9 zanesljivih poročil (neupoštevaje 4 dvomljive primere): 7 iz hrvaškega obalnega morja, 1 iz slovenskega in 1 iz italijanskega. V 3 primerih so beli morski volkovi napadli kopalce, v 2 podvodne ribiče in v 1 primeru čoln z ljudmi. Šest napadov v Jadranskem morju je bilo pogubnih, pa čeprav poročila govorijo, da ti niso bili izzvani. Vsi so se zgodili v 20. stoletju, zadnji leta 1974.

Ključne besede: beli morski volk, *Carcharodon carcharias*, Jadransko morje

REFERENCES

- Albertarelli, M. (1990):** Spaventatevi ma con calma. *Natura Oggi*, 8, Agosto 1990. Milano, De Agostini-Rizzoli Periodici, 30-41.
- Anonymous (1891):** Great white shark in the Mediterranean. *Mediterranean Naturalist*, 1(4). 76.
- Anonymous (1908):** Fanciulla straziata da un pesce-cane. *La Domenica del Corriere*, 2 Agosto. Milano, Corriere della Sera.
- Anonymous (1961):** Uno squalo ha divorato un giovane studente che faceva il bagno ad Abbazia (Opatija). *Il Piccolo*, 26 Novembre. Trieste.
- Anonymous (1986):** Strappa le sardine dalle mani dei pescatori Willy, Squalo bianco gigante in Adriatico. *Corriere della Sera*, 22 Settembre. Milano, RCS.
- Anonymous (1992):** Raro Squalo bianco pescato in Adriatico. *Corriere della Sera*, 19 Marzo. Milano, RCS.
- Arrassich, F. (1994):** Trieste in cento cartoline. Roma, Edizioni La Cartolina.
- Beltrame, M. (1983):** Lo squalo in casa nostra. *Natura Oggi* 3, Luglio 1983. Milano, De Agostini-Rizzoli Periodici, 52-61.
- Bini, G. (1967):** Atlante dei Pesci delle coste Italiane - vol. 1 - Leptocardi, Ciclostomi, Selaci. Roma, Mondo Sommerso.
- Bonaparte, C. (1839):** Iconografia della Fauna Italica per le quattro Classi degli Animali Vertebrati - Tomo III. Pesci. Roma, Tipografia Salviucci.
- Brusina, S. (1888):** Morski psi Sredozemnoga i Crljenog mora. *Glasnik hrvatskoga naravoslovnoga društva*. Zagreb. pp. 167-230.
- Canestrini, G. (1874):** Fauna d'Italia - Parte Terza - Pesci. Milano, Vallardi.
- Cardellini, S. (1987):** Si è rifatto vivo Willy lo squalo bianco della riviera. *Resto del Carlino*, 25 Agosto.
- Carus, J. V. (1893):** *Prodromus faunae mediterraneae* II. Plagiostomi - Selachioidei. Stuttgart.
- Condorelli, M. & G. G. Perrando (1909):** Notizie sul *Carcharodon carcharias* L., catturato nelle acque di Augusta e considerazioni medico-legali sui resti umani trovati nel tubo digerente. *Bollettino della Società Zoologica Italiana*, 1909. Roma, Società Zoologica Italiana, 164-183.
- De Maddalena, A. (1998 -1999):** Il più grande esemplare Italiano di squalo bianco, *Carcharodon carcharias* (Linnaeus, 1758) individuato nei reperti conservati presso il Museo di Anatomia Comparata dell'Università "La Sapienza" di Roma. *Museologia Scientifica*, 15(2). Firenze, Associazione Nazionale Musei Scientifici, 195-198.
- De Maddalena, A. (1999):** Records of the Great White Shark in the Mediterranean Sea. Milano, private publication.
- De Maddalena, A. (2000):** Reperti di Squalo Bianco, *Carcharodon carcharias* (Linnaeus, 1758), conservati nei Musei Italiani. *Annali del Museo Civico di Storia Naturale "G. Doria"*. Genova, Museo di Storia Naturale "G. Doria". In press.
- De Sabata, E., Meloni, M., Miliani, M. & S. Nava (1999):** Bianchi di casa nostra. *Pesca in Mare*, 3. Firenze, EDAI, 92-99.
- Doderlein, P. (1881):** *Manuale Ittiologico del Mediterraneo*. Parti 1-2. Palermo.
- Ellis, R. (1983):** *The book of Sharks*. London, Robert Hale.
- Ellis, R. & J. E. McCosker (1991):** *Great White Shark*. Stanford, Stanford University Press.
- Faber, G. L. (1883):** *Fisheries of the Adriatic and the Fish of thereof*. London, Bernard Quaritch.
- Fergusson, I. K. (1996):** Distribution and Autecology of the White Shark in the Eastern North Atlantic Ocean and the Mediterranean Sea. In Klimley, A. P. & Ainley, D. G. (eds.): *Great White Sharks: The Biology of Carcharodon carcharias*. San Diego, Academic Press, 321-345.
- Gianturco, C. (1978):** *Lo Squalo*. Torino, Società Editrice Internazionale.
- Gilioli, S. (1989):** *Caccia al killer*. Sette, 7. Milano, RCS, 50-61.
- Giudici, A. & F. Fino (1989):** *Squali del Mediterraneo*. Roma, Atlantis.
- Graeffe, E. (1886):** *Carcharodon rondeleti*, in Uebersicht der Seethierfauna des Golfes von Triest, etc. *Arb. Zool. Inst. Univ. Wien, Zool. St. Trieste*, 7. 446.
- Graziosi, G. (1999):** Squalo bianco attacca peschereccio. *Corriere della Sera*, 27 Settembre. Milano, RCS, 19.
- Imarisio, M. (1998):** Non date la caccia allo squalo. *Corriere della Sera*, 30 Agosto. Milano, RCS, 16.
- Lawley, R. (1881):** Studi comparativi sui Pesci fossili coi viventi dei Generi *Carcharodon*, *Oxyrhina* e *Galeocerdo*. Pisa, Nistri.
- Lineaweaver III, T. H. & R. H. Backus (1969):** *The Natural History of Sharks*. London, André Deutsch Ltd.
- Lipej, L. (1993-1994):** Še o izolskem belem morskem volku. *Proteus*, 56. 208-209.
- Marchesetti, C. (1884):** La pesca lungo le coste Orientali dell'Adria. *Atti del Museo Civico di Storia Naturale di Trieste*, 1884. Trieste, Museo Civico di Storia Naturale di Trieste.
- Marini, F. (1989):** Pochi secondi lunghi un'eternità. *Pesca in mare*, 4. Firenze, EDAI, 78-79.
- Martelli, F. (1989):** *Caccia alla morte bianca*. Pesca in mare, 4. Firenze, EDAI, 80-83.
- Metaxà, L. (1839):** Smisurato pesce del peso di 4000 libre. *Annali della Società Medico-Chirurgica Metaxà*, 1839. Società Medico-Chirurgica Metaxà, 35-38.

- Mizzan, L. (1994):** I Leptocardi, Ciclostomi e Selaci delle collezioni del Museo Civico di Storia Naturale di Venezia - 1) Leptocardia, Agnatha, Gnathostomata - Chondrichthyes (esclusi Rajiformes). Bollettino del Museo Civico di Storia Naturale di Venezia, 45. Venezia, Museo Civico di Storia Naturale "Fontego dei Turchi", 123-137.
- Mojetta, A., Storai, T. & M. Zuffa (1997):** Segnalazioni di squalo bianco (*Carcharodon carcharias*) in acque italiane. Quaderni della Civica Stazione Idrobiologica di Milano, 22. Milano, Civica Stazione Idrobiologica, 23-38.
- Montefiori, S. (1998):** Squalo all'attacco, paura nelle Marche. Corriere della Sera, 29 Agosto. Milano, RCS, 14.
- Ninni, E. (1912):** Catalogo dei Pesci del Mare Adriatico. Venezia, Bertotti.
- Notarbartolo di Sciara, G. (1986):** Sullo Squalo bianco al largo della costa marchigiana. Aqua, 8. Milano, Edizioni del Cormorano, 6.
- Perugia, A. (1881):** Elenco dei Pesci dell'Adriatico. Milano, Hoepli.
- Tortonese, E. (1956):** Fauna d'Italia vol. II - Leptocardia, Ciclostomata, Selachii. Bologna, Calderini.
- Vinciguerra, D. (1885-1892):** Guida del Museo di Zoologia della R. Università di Roma - Fauna locale - Specie animali della provincia di Roma esistenti nella nuova collezione. Parte III - Pesci. Roma, Istituto di Zoologia della Reale Università di Roma.