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ADDITIONAL HISTORICAL RECORDS OF GREAT WHITE SHARKS, *CARCHARODON CARCHARIAS*, CAUGHT IN THE GULF OF LION, NORTHWESTERN MEDITERRANEAN SEA, BETWEEN THE 1920s AND 1950s

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ABSTRACT

Extensive archival investigations have led to the discovery of unpublished records of three specimens of the great white shark, *Carcharodon carcharias* (Linnaeus, 1758), captured in the Gulf of Lion (NW Mediterranean Sea, GSA07). The materials examined consisted of archival photographs and a newspaper report (specimens Nos. 1 and 3), as well as a complete set of upper and lower jaws (specimen No. 2). These unpublished records pertain to specimens caught in an artisanal trammel-net fishery by fishermen from Brusc Port, Toulon (France), on 31 July 1926, in 1930, and in 1954, respectively. The total lengths (TL) of these adult specimens were estimated to be between 400 and 480 cm.

Key words: Lamnidae, *Carcharodon*, GSA07, historical, jaws, conservation

ULTERIORI DATI STORICI DI GRANDI SQUALI BIANCHI, *CARCHARODON CARCHARIAS*, CATTURATI NEL GOLFO DEL LEONE, MAR MEDITERRANEO NORD-OCCIDENTALE, TRA GLI ANNI '20 E '50

SINTESI

Un'ampia ricerca d'archivio ha portato alla scoperta di documenti inediti relativi a tre esemplari di squalo bianco, *Carcharodon carcharias* (Linnaeus, 1758), catturati nel Golfo del Leone (Mediterraneo occidentale, GSA07). I materiali esaminati consistevano in fotografie d'archivio e in un resoconto giornalistico (esemplari n. 1 e 3), oltre a un set completo di mascelle superiori e inferiori (esemplare n. 2). Questi documenti inediti si riferiscono a esemplari catturati da pesca artigianale con tramaglio da pescatori del porto di Brusc, Tolone (Francia), rispettivamente il 31 luglio 1926, nel 1930 e nel 1954. Le lunghezze totali (TL) di questi esemplari adulti sono state stimate tra i 400 e i 480 cm.

Parole chiave: Lamnidae, *Carcharodon*, GSA07, dati storici, mascelle, conservazione

INTRODUCTION

The great white shark, *Carcharodon carcharias* (Linnaeus, 1758) (Lamniformes: Lamnidae), is one of the largest species of coastal and oceanic macro-predatory sharks (Compagno, 2001; De Maddalena & Heim, 2012; Ebert & Dando, 2020; Ebert *et al.*, 2021; Rigby *et al.*, 2022). Six genetically distinct and geographically isolated philopatric populations have been identified worldwide: Australian, South African, Northwest Atlantic, Northeast Pacific, Japanese, and Mediterranean (Villafañá *et al.*, 2020; Ebert *et al.*, 2021). The Mediterranean population is identified as genetically distinct (Gubili *et al.*, 2012; Ebert & Dando, 2020).

C. carcharias preys on large pelagic bony fishes such as bluefin tuna (*Thunnus thynnus*) and swordfish (*Xiphias gladius*), along with other elasmobranchs, pinnipeds, and cetaceans (Fergusson, 1996; De Maddalena & Heim, 2012; Boldrocchi *et al.*, 2017; Kabasakal *et al.*, 2022). It is also one of the most necrophagous species among large macrophagous sharks, with numerous cases of scavenging on large cetacean carcasses recorded to date (De Maddalena & Heim, 2012). *C. carcharias* is mainly solitary, exhibiting migration patterns tied to environmental conditions, reproduction, and prey movements (Milankovic *et al.*, 2021). Data on the global population size of the great white shark are insufficient, and only approximate estimates are available (Rigby *et al.*, 2022). The historical census of the species indicates that 789 records of its presence have been documented across the Mediterranean to date (Kabasakal *et al.*, 2022; Soldo & Bakiu, 2024).

The Mediterranean basin, stretching from the Strait of Gibraltar to the Sea of Marmara, has been the site of small but regular annual sightings of the great white shark, particularly its central and western parts (Barrull, 1993; Barrull & Mate, 2001; De Maddalena & Heim, 2012; Kabasakal, 2014; Moro *et al.*, 2020). Moreover, as regards the sea's primary production, it is described as oligotrophic in the western region and ultra-oligotrophic in the central part (Stambler, 2013). However, the coastal and upwelling zones of the western Mediterranean, specifically the Gulf of Lion, are localised areas of high productivity and abundance of diverse marine species, including large predatory fish and apex predators (*Parc Naturel Régional de Camargue*, 2012; Roos, 2012; Bănarău *et al.*, 2013; Fromentin & Lopuszanski, 2014; Di-Méglio *et al.*, 2015; Poisson *et al.*, 2015; Strady *et al.*, 2015; Rouyer *et al.*, 2021). The highest productivity occurs from spring to early autumn (Monaco *et al.*, 2009; Carpaye & Maurel, 2023).

C. carcharias has been categorised as vulnerable in the Mediterranean since 1996 and is currently classified as critically endangered (CR, IUCN) (Fer-

retti *et al.*, 2008; Otero *et al.*, 2019; Rigby *et al.*, 2018, 2022). Historically, it has been affected by overfishing for its prized teeth and fins. Although less frequent, accidental catches still occur, and increasing urbanisation continues to deteriorate its coastal habitat. Research and enhanced management are crucial for its conservation in the Mediterranean (Ferretti *et al.*, 2010; Boldrocchi *et al.*, 2017; Jenrette *et al.*, 2023; Micarelli *et al.*, 2023). Moreover, De Maddalena & Heim (2012) and Moro *et al.* (2020) reported a marked decline in the *C. carcharias* population in this region since the mid-20th century. Consequently, conservation measures have been implemented, including the listing of this species in Appendices I and II of the Commission on Migratory Species (CMS) in 2002 and in Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in 2004. More recently, in 2012, the General Fisheries Commission for the Mediterranean (GFCM) banned the retention of great white sharks and mandated their release in the event of capture (Rigby *et al.*, 2022). Since 2018, the GFCM has intensified efforts to protect the species throughout the Mediterranean Basin (Bradai *et al.*, 2018).

Historically, the species has been recorded only sporadically in the Gulf of Lion since the 16th century, with a total of 40 specimens documented (De Maddalena & Zuffa, 2009; De Maddalena & Heim, 2012) and the records based solely on an inventory of dried jaws and teeth, a small sample of accidentally caught dead animals, and a limited number of reports from sea users, who often lack precision in their descriptions and data. *C. carcharias* remains largely unknown in terms of its ecology in this part of the Mediterranean. The very rare current sightings in the area involve an extremely small number of individuals, likely remnants of the original Mediterranean population, now nearing extinction. While it is well-documented that *C. carcharias* uses the central Mediterranean as a parturition and nursery area (De Maddalena & Heim, 2012; Boldrocchi *et al.*, 2017; Bradai *et al.*, 2018; Kabasakal *et al.*, 2022), and despite its historical abundance in the region, the life history of the great white shark in the western Mediterranean remains unknown, with most sightings concentrated in the northwest (Morey *et al.*, 2003; De Maddalena & Heim, 2012; Maliet *et al.*, 2013; Boldrocchi *et al.*, 2017).

MATERIAL AND METHODS

The Groupe Phocéén d'Étude des Requins (GPER) is a French research NGO founded in 2015 in Marseille. Since its inception, GPER has rigorously updated and expanded the records of *C. carcharias* in French waters, drawing on both historical archives

and contemporary data. This article, which is part of this ongoing systematic research, exemplifies the strategic use of historical data to enhance current studies and increase knowledge and protection of the species in the Mediterranean.

The localities where the three great white shark specimens examined in this study were captured were plotted on a map, all geographically located in the Gulf of Lion (France, NW Mediterranean Sea, Fig. 1). Relevant information about the captures was obtained from a news report published on 4 September 1926, in the daily newspaper *L'Illustra-*

tion (for specimen No. 1), and from interviews with relatives of the fishers who captured the other two individuals (specimen No. 2 and No. 3).

Species identification follows Barone et al. (2022). The total length (TL) for specimen No. 1 is that reported in the newspaper (*L'Illustration*, 1926), the estimated TL of specimen No. 3 was provided by the local fisher who took the archival photo during the landing in 1954, while the estimate for specimen No. 2 is based on morphometric measurements of the examined jaws conducted by the GPER, following the methods of Shimada (2002, 2019).

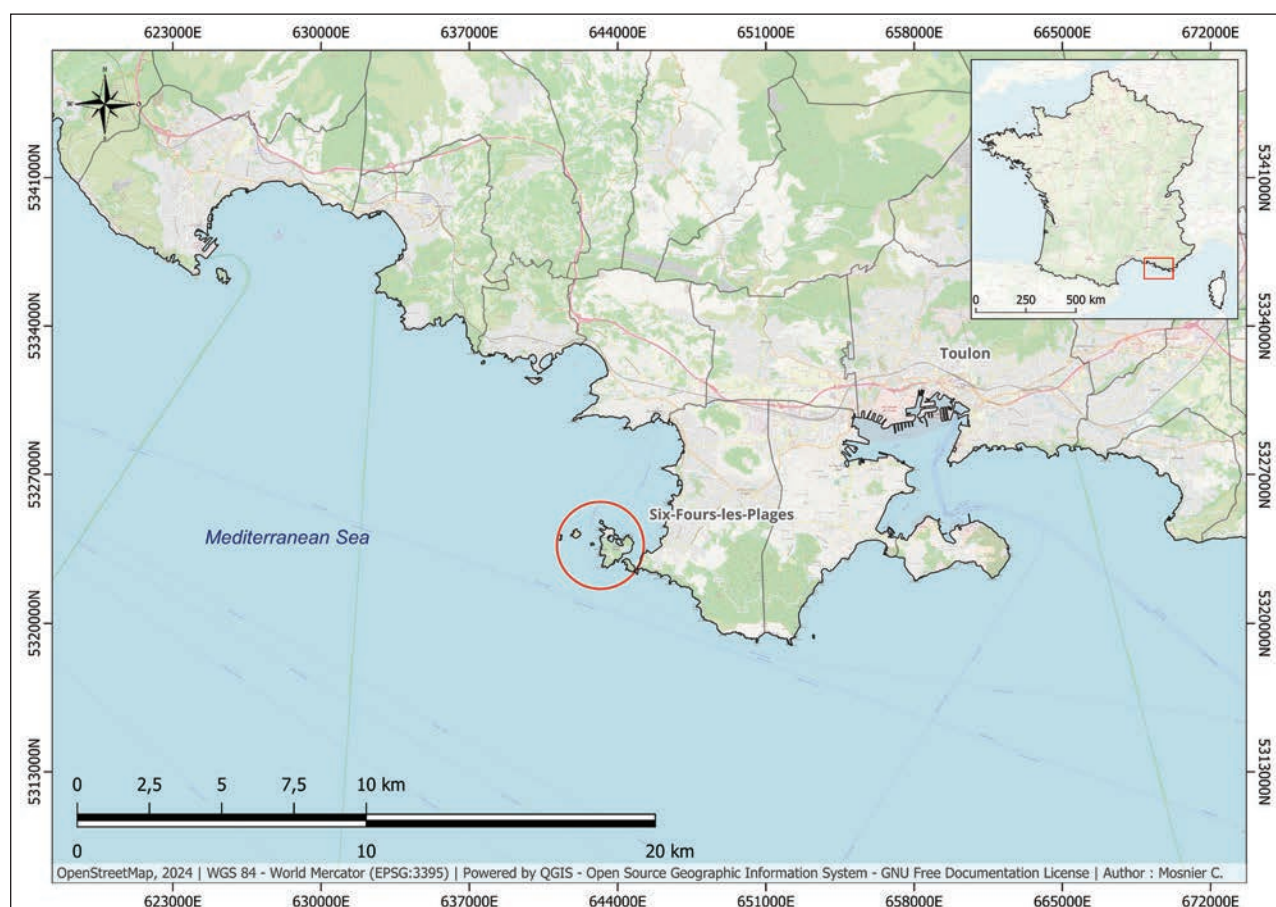


Fig. 1: The map in the upper panel shows the general location of the investigated area within the Gulf of Lion (northwestern Mediterranean). In the lower panel, the red frame indicates the approximate location where the three examined white shark specimens were caught in the Brusc Port area (Six-Fours-les-Plages, France). Since exact coordinates are unavailable, the capture locations of the three great white sharks cannot be indicated individually on the lower map. (OpenStreetMap, 2024; QGIS - Free and Open Source Geographic Information System, 2024).

Sl. 1: Zemljevid na zgornji plošči prikazuje lokacijo raziskanega območja znotraj Lionskega zaliva (severo-zahodno Sredozemsko morje). Na spodnji plošči rdeči okvir označuje približno lokacijo, kjer so bili ujeti trije pregledani primerki belega morskega volka na območju pristanišča Brusc (Six-Fours-les-Plages, Francija). Ker točne koordinate niso na voljo, lokacij ulova treh belih morskih volkov ni mogoče prikazati posamezno na spodnjem zemljevidu. (OpenStreetMap, 2024; QGIS – brezplačen in odprtokodni geografski informacijski sistem, 2024).



Fig. 2: (a) Lateral view and (b) head and buccal view of specimen No. 1. The arrows indicate the triangular teeth, the main identifying feature of *C. carcharias*. (Photo credit: L'illustration, 1926).

Sl. 2: (a) Pogled s strani in (b) pogled na glavo in ustno votlino primerka št. 1. Puščice označujejo trikotne zobe, ki je glavna prepoznavna značilnost vrste *C. carcharias*. (Avtor fotografije: L'illustration, 1926).

RESULTS

Specimen No. 1

According to the news article published in *L'illustration* on 4 September 1926, a great white shark with a reported TL ≥ 450 cm was caught by a trammel-net fisherman from the small port of Le Brusc, near Toulon, on 31 July 1926 (Fig. 1). The main identifying feature of *C. carcharias* is its large, triangular tooth morphology (Barone et al., 2022), and the dental characteristics of specimen No. 1 are consistent with this description of the species (Fig. 2). The article reports that “the fisherman ‘drowned’ the great white shark, but not before the animal had damaged the equipment” of the fishing fleet targeting it. When it was exhausted and trapped in the net, the fishermen were able to approach it by boat, and “one of them harpooned it.” The great white shark was then brought to the beach, where it was eviscerated in front of a crowd of onlookers fascinated by this unexpected catch. The shark measured over 450 cm, with the liver alone measuring 200 cm. The second photograph shows the specimen's head with its mouth open, revealing the large triangular teeth of the jaws. The next day, the shark's flesh was sold at the Toulon market at three francs per pound under the name “white tuna,” a common name used for *Thunnus alalunga* (Bonnaterre, 1788). Based on its reported TL, specimen No. 1 is identified as an adult, but its sex remains undetermined (Ebert et al., 2021).

Specimen No. 2

In 1930, a specimen of *C. carcharias* was caught by an artisanal trammel-net fisherman, also from the fishing port of Le Brusc in the Gulf of Lion (Fig. 1). The jaws of specimen No. 2 were dissected by the fisherman, and today they are preserved and displayed in his grandson's café in Le Brusc (Fig. 3). Morphometric measurements of the teeth arranged in the functional rows of the upper and lower jaws are presented in Tables 1, 2, and 3. The dried upper jaw perimeter (DUJP) and dried lower jaw perimeter (DLJP) of the examined jaws are 98.6 cm and 87.2 cm, respectively (Tab. 2).

The TL of specimen No. 2 was estimated using Shimada's (2002, 2019) method, applying linear regression equations to the upper anterior teeth: $TL = 11.788 \cdot CH + 2.143$; $r^2 = 0.983$, and lower anterior teeth $TL = 14.060 \cdot CH - 3.914$; $r^2 = 0.930$. These equations are based on crown height (CH) measurements, labelled E2. The E2 values were taken from the left side of the jaw, as it was considered the most complete after excluding missing and damaged teeth.

The crown height measurements (E2) used for the estimation were taken from the largest and most robust teeth, identified as $E2_{ua1}$ and $E2_{ua2}$ for the upper anterior jaw, and $E2_{la1}$ and $E2_{la2}$ for the lower anterior jaw. The estimates based on the upper anterior teeth exhibited high consistency ($R^2 = 0.983$), with a TL estimated between 464.2 cm and 480.7

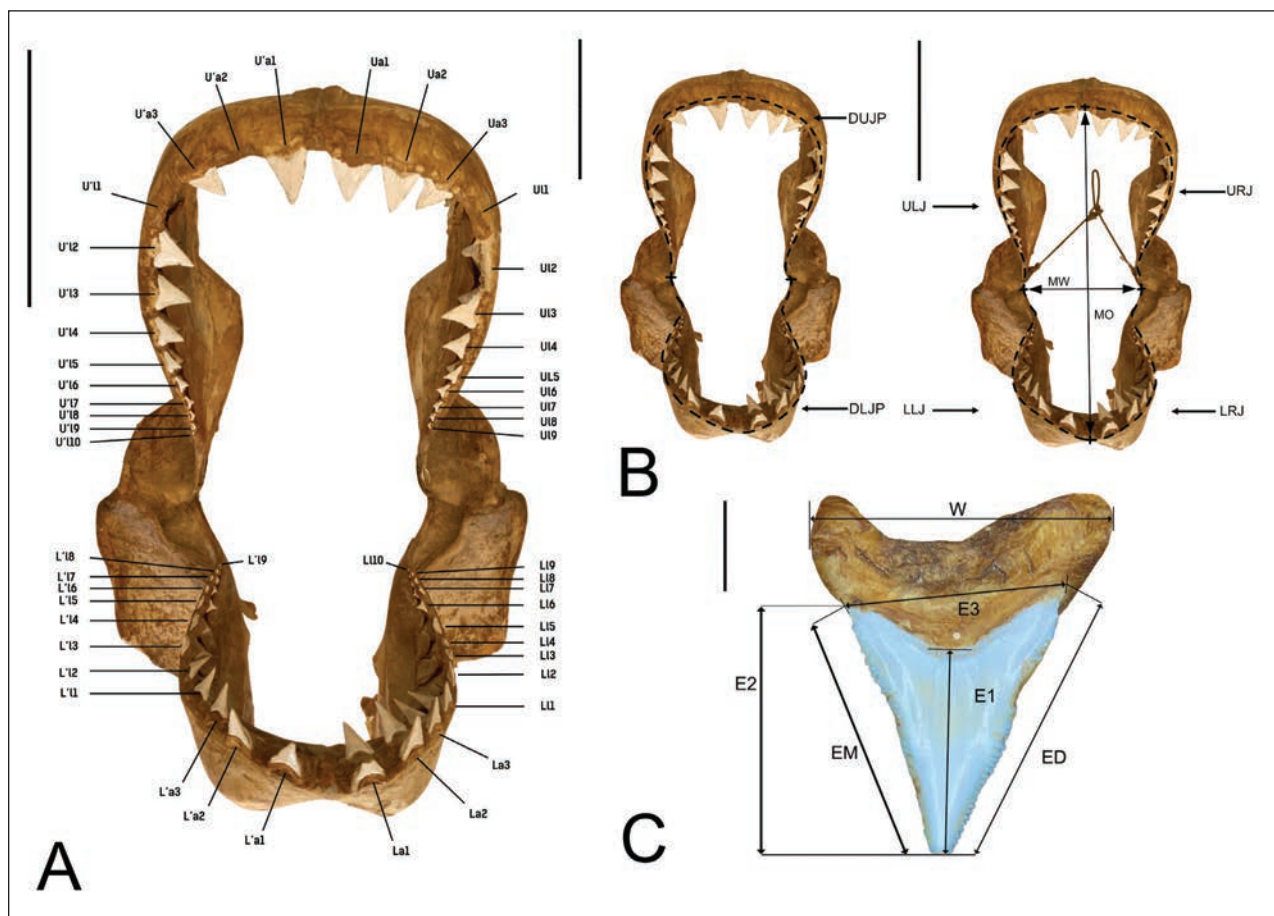


Fig. 3: (a) Upper and lower jaws of specimen No. 2 with teeth ID codes. Scale bar = 300 mm. (b) DUJP: Dried Upper Jaw Perimeter, DLJP: Dried Lower Jaw Perimeter, ULJ: Upper Left Jaw, LLJ: Lower Left Jaw, URJ: Upper Right Jaw, LRJ: Lower Right Jaw. Scale bars = 300 mm. (c) Detailed view of upper anterior tooth 1 (UA1). W: Tooth length including root, E1: Length from root tip to tooth tip, E2: Length from the line creating the root tip to the tip of the tooth, E3: Length of the visible part, EM: Length of the left side from the root tip, ED: Length of the right side from the root tip, RD: Tooth width. Scale bar = 10 mm. Measurements of upper and lower jaws: DUJP = 98.6 cm, MW = 26.8 cm, DLJP = 87.2 cm, MO = 69 cm, ULJ = 49.4 cm, URJ = 47.8 cm, LLJ = 42.4 cm, and LRJ = 44.0 cm. (Photo credit: GPER).

Sl. 3: (a) Zgornja in spodnja čeljust primerka št. 2 z ID kodami zob. Merilo = 300 mm. (b) DUJP: posušen obod zgornje čeljusti, DLJP: posušen obod spodnje čeljusti, ULJ: zgornja leva čeljust, LLJ: spodnja leva čeljust, URJ: zgornja desna čeljust, LRJ: spodnja desna čeljust. Merilo = 300 mm. (c) Podroben pogled na zgornji sprednji zob 1 (UA1). W: dolžina zoba vključno s korenino, E1: dolžina od konice korena do konice zoba, E2: dolžina od črte, ki tvori konico korena, do konice zoba, E3: dolžina vidnega dela, EM: dolžina leve strani od koreninske konice, ED: dolžina desne strani od koreninske konice, RD: širina zoba. Merilo = 10 mm. Mere zgornje in spodnje čeljusti: DUJP = 98,6 cm, MW = 26,8 cm, DLJP = 87,2 cm, MO = 69 cm, ULJ = 49,4 cm, URJ = 47,8 cm, LLJ = 42,4 cm in LRJ = 44,0 cm. (Avtorstvo fotografije: GPER).

cm. In contrast, estimates using the lower anterior teeth showed greater variability ($R^2 = 0.930$), with a TL estimated between 434.7 cm and 588.0 cm. Following Shimada's (2002, 2019) recommendations, it was advisable to use the upper anterior teeth for more precise estimates. The TL of specimen No. 2 is therefore more reliably estimated between 4.64 m and 4.80 m. Like specimen No. 1, specimen No. 2 is an adult individual of undetermined sex.

Specimen No. 3

In 1954, a great white shark with an estimated TL of 400 cm was caught in the same area, again using artisanal trammel nets. Several distinctive morphological features, including a massive body, large conical snout, relatively small eyes, long gill slits, a large first dorsal fin, and a wide caudal keel identified the shark as a *C. carcharias* individual

Tab. 1: Measurements (in cm) of teeth on the functional rows of jaws in specimen No. 2. The dental codes in the "Teeth ID" column are the same as those seen in Figure 4. *: missing tooth, **: broken tooth, *: in small teeth, E1 = E2, EM and ED measurements not available, ****: malformed teeth, ': broken tooth tip, NA: Not available, W: Tooth length including root, E1: Length from root tip to tooth tip, E2: Length from the line creating the root tip to the tip of the tooth, E3: Length of the visible part, EM: Length of left side from the root tip, ED: Length of the right side from the root tip, RD: Tooth width. Each measurement refers to Fig. 3.**

Tab. 1: Mere (v cm) zob na funkcionalnih vrstah čeljusti primerka št. 2. Kode zob v stolpcu »ID zob« so enake kot na sliki 4. *: manjka zob, **: zlomljen zob, *: pri majhnih zobeh, E1 = E2, meritve EM in ED niso na voljo, ****: nepravilno oblikovani zobje, ': zlomljena konica zoba, NA: ni na voljo, W: dolžina zoba vključno s korenino, E1: dolžina od konice korena do konice zoba, E2: dolžina od črte, ki tvori konico korenine, do konice zoba, E3: dolžina vidnega dela, EM: dolžina leve strani od koreninske konice, ED: dolžina desne strani od koreninske konice, RD: širina zoba. Vsaka meritev se nanaša na sliko 3.**

Teeth ID	W	E1	E2	E3	EM	ED	RD	Teeth ID	W	E1	E2	E3	EM	ED	RD
Ua1	4.00	3.61	4.06	3.35	4.58	4.11	1.05	U'a1	4.00	3.56	3.56	3.28	4.01	4.56	1.16
Ua2	3.67	3.34	3.92	3.41	4.37	4.05	1.14	U'a2	NA*	NA*	NA*	NA*	NA*	NA*	NA*
Ua3'	3.14	2.65	3.12	3.02	2.90	3.40	0.87	U'a3	3.22	2.65	2.81	3.13	3.52	3.28	0.94
UI1	NA*	NA*	NA*	NA*	NA*	NA*	NA*	U'I1	NA*	NA*	NA*	NA*	NA*	NA*	NA*
UI2	NA*	NA*	NA*	NA*	NA*	NA*	NA*	U'I2	4.01	3.22	3.52	3.71	3.53	4.00	0.97
UI3	3.88	2.91	3.26	3.59	3.91	3.40	0.86	U'I3	3.71	3.07	3.39	3.51	3.27	3.99	0.84
UI4	3.16	2.22	2.33	3.00	2.95	2.45	0.91	U'I4	3.12	2.47	2.68	3.08	2.57	3.31	0.82
UI5	2.39	1.52	1.69	2.21	2.18	1.64	0.72	U'I5	2.38	1.61	1.78	2.30	1.73	2.38	0.77
UI6	1.87	0.98	1.18	1.73	1.48	1.20	0.53	U'I6	1.84	1.06	1.21	1.74	1.26	1.62	0.62
UI7	1.39	0.60	0.81	1.31	1.06	0.79	0.58	U'I7	1.34	0.70	0.90	1.40	1.12	0.88	0.56
UI8	1.09	0.50	NA***	1.00	0.73	0.67	0.54	U'I8	0.98	0.36	NA***	0.96	0.66	0.67	0.34
UI9	0.80	0.30	NA***	0.77	0.46	0.50	0.40	U'I9	0.82	0.29	NA***	0.68	0.45	0.46	0.27
								U'I10	0.39	0.10	NA***	0.38	NA***	NA***	0.28
La1'	3.39	1.49	3.12	2.43	2.12	2.05	1.30	L'a1'	3.42	2.56	3.14	2.56	3.28	3.38	1.33
La2'	3.83	2.69	4.21	2.85	3.26	3.42	1.13	L'a2'	3.61	2.79	3.01	2.86	3.55	3.41	1.17
La3	3.29	2.42	4.11	2.53	3.01	3.00	0.77	L'a3	2.92	2.45	2.80	2.36	2.89	2.83	1.03
LI1'	3.02	2.01	3.50	2.48	2.65	2.56	0.72	L'I1	3.14	2.43	2.54	2.46	3.05	2.87	0.96
LI2'	2.80	2.11	2.40	2.21	2.57	2.54	0.88	L'I2	2.62	2.22	2.47	2.19	2.61	2.51	0.97
LI3****'	1.13	1.05	NA	1.15	0.61	1.15	0.79	L'I3'	2.30	1.83	2.17	2.40	2.26	2.28	0.98
LI4****	1.06	1.09	NA	0.92	0.89	0.55	0.84	L'I4	2.00	1.42	1.48	1.79	1.85	1.95	0.77
LI5	1.90	NA**	NA**	1.72	NA**	NA**	0.69	L'I5	1.54	0.85	0.95	1.42	1.29	1.21	0.64
LI6	1.53	0.93	1.04	1.41	1.1	1.13	0.49	L'I6	1.15	0.57	NA***	0.99	0.77	0.74	0.43
LI7	1.09	0.51	NA***	1.02	0.55	0.64	0.43	L'I7	0.74	0.34	NA***	0.73	0.51	0.51	0.33
LI8	0.72	0.45	NA***	0.78	0.48	0.52	0.32	L'I8	0.62	0.21	NA***	0.56	0.33	0.32	0.27
LI9	0.52	0.24	NA***	0.47	0.37	0.32	0.23	L'I9	0.16	0.13	NA***	0.29	NA	NA	0.29
LI10	NA	0.11	NA***	0.33	NA***	NA***	0.22								

Tab. 2: Measurements (in cm) of jaws of specimen No. 2. Each measurement refers to Fig. 3.**Tab. 2: Meritve (v cm) čeljusti primerka št. 2. Vsaka meritev se nanaša na sliko 3.**

DUJP	98.6	MW	26.8
DLJP	87.2	MO	69.0
ULJ	49.4	URJ	47.8
LLJ	42.4	LRJ	44.0

(Fig. 4). Additionally, the image of the captured animal clearly shows the irregular white marks on the anterior portion of the caudal fin's lower lobe, a typical trait of *C. carcharias* and one commonly used for photo-identification purposes (De Maddalena & Heim, 2012). The picture also reveals the presence of claspers, indicating that the shark was male. According to Ebert *et al.* (2021), males of *C. carcharias* attain sexual maturity between 310 and 410 cm. The size of the claspers, along with the reported total length of the shark, suggests that specimen No. 3 was sexually mature.

DISCUSSION AND CONCLUSIONS

Despite uncertainty about how accurately the current distribution of the species correlates with historical observations – given significant anthropogenic influences (Carpaye & Maurel, 2023) –, studies on the abundance and distribution of the great white shark in the Mediterranean indicate a decline of 60 to 90 percent in the population compared to the Middle Ages (Moro *et al.*, 2020; Soldo & Bakiu, 2024). From this perspective, the Gulf of Lion is one of the sub-regions in the Mediterranean where the decline of the species is most pronounced (Moro *et al.*, 2020).

While each discovery of historical material adds a new record to the great white shark's past, ongoing threats jeopardise the addition of young individuals to the population of this apex predator in the Mediterranean. Combining the results of all studies carried out to date (De Maddalena & Heim, 2012; Boldrocchi *et al.*, 2017; Moro *et al.*, 2020; Zaouali *et al.*, 2020; Jambura *et al.*, 2021; Kabasakal *et al.*, 2022; Soldo & Bakiu, 2024) with those of the present article, it is estimated that the total number of great white sharks recorded in the Mediterranean since the 1600s is 793. The Red List assessment of *C. carcharias* in the Mediterranean Sea, which is based on anecdotal records and limited fisheries data, suggests that the great white shark population

Tab. 3: Glossary of measurements. Each measurement refers to Fig. 3.**Tab. 3: Slovar meritev. Vsaka meritev se nanaša na sliko 3.**

W	Tooth length of tooth with root
E1	Tooth length from root tip to tooth tip
E2	Tooth length from the line creating the root tip to the tip of the tooth
E3	Tooth length according to the visible part
EM	Enamoile M.: length of left side of tooth from root tip
ED	Enamoile D.: length of right side of tooth from root tip
RD	Tooth width
DUJP	Diameter Upper Jaw Perimeter
DLJP	Diameter Lower Jaw Perimeter
ULJ	Upper Left Jaw
LLJ	Lower Left Jaw
URJ	Upper Right Jaw
LRJ	Lower Right Jaw

has declined by at least 80 percent over 69 years, from 1947–2016 (Soldo *et al.*, 2016). As a result, the species is classified as critically endangered in the region, with the number of mature individuals estimated to be fewer than 250 (Soldo *et al.*, 2016). Today, hotspots (e.g., nursery grounds) for the species in the Mediterranean are attracting attention as potential research opportunities that could yield valuable insights (Jenrette *et al.*, 2023). However, the main priority in the Mediterranean remains reducing threats to species conservation (Jenrette *et al.*, 2023; Soldo & Bakiu, 2024). Although *C. carcharias* is still considered to have a continuous worldwide distribution, interchange between some regions appears to be quite limited (Gubili *et al.*, 2012; Rigby *et al.*, 2018). Protecting the genetically isolated Mediterranean population is crucial (Gubili *et al.*, 2012; Ebert *et al.*, 2021), as it has been decreasing since the Middle Ages (circa 1600) (Moro *et al.*, 2020; Soldo & Bakiu, 2024), with little to no contemporary immigration from the Atlantic suggesting that it is extraordinarily vulnerable (Gubili *et al.*, 2012; Ebert & Dando, 2020). If current trends continue, future Mediterranean societies may only recognise *C. carcharias* from materials displayed in museums or hidden in archives. Undocumented records from the Gulf of Lion are believed to be



Fig. 4: Lateral view of specimen No. 3. The white arrows, left to right: (↓) large conical snout, (←) relatively small eye, (↓) long gill slits, (→) large first dorsal fin, (←) wide caudal keel, (↓) irregular white marks on the anterior portion of the caudal fin's lower lobe, typical of *C. carcharias* (photo credit: GPER Archive).

Sl. 4: Pogled s strani na primerek št. 3. Bele puščice, od leve proti desni: (↓) velik stožčast gobec, (←) razmeroma majhno oko, (↓) dolge škržne reže, (→) velika prva hrbtna plavut, (←) široka greben na repu, (↓) nepravilne bele lise na sprednjem delu spodnjega režnja repne plavuti, značilne za *C. carcharias* (fotografija: arhiv GPER).

frequent, but this general observation may be biased by the common confusion of the species with another large lamnid shark, *Isurus oxyrinchus*, as seen in other parts of the Mediterranean (Soldo & Bakiu, 2024). The most significant sighting in the Gulf of Lion in decades was of a live adult individual on 12 September 2022 in the waters of the Parc Naturel Régional de Camargue (N. Ziani, *personal communication*).

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DODATNI ZGODOVINSKI ZAPISI O BELIH MORSKIH VOLKIH,
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V DVAJSETIH IN PETDESETIH LETIH

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POVZETEK

Obsežne arhivske preiskave so privedle do odkritja neobjavljenih zapisov o treh primerkih belega morskega volka, *Carcharodon carcharias* (Linnaeus, 1758), ujetih v zalivu Lyon (SZ Sredozemsko morje, GSA07). Avtorji so preiskali gradivo kot so arhivske fotografije in časopisno poročilo (primerka št. 1 in 3) ter celoten komplet zgornje in spodnje čeljusti (primerek št. 2). Ti neobjavljeni zapisi se nanašajo na primerke, ki so jih ribiči iz pristanišča Brusca v Toulonu (Francija) ulovili pri ribolovu s trislojno mrežo 31. julija 1926, leta 1930 in 1954. Primerki so bili odrasli morski volkovi, ki so merili med 400 in 480 cm.

Ključne besede: Lamnidae, *Carcharodon*, GSA07, čeljusti, ohranjanje

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