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CAPTURE OF A LARGE GREAT WHITE SHARK, *CARCHARODON CARCHARIAS* (LAMNIDAE) FROM THE TUNISIAN COAST (CENTRAL MEDITERRANEAN SEA): A HISTORICAL AND ICHTHYOLOGICAL EVENT

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ABSTRACT

*In this paper, the authors report an old capture of the great white shark, *Carcharodon carcharias*, the first in the Gulf of Hammamet, central Tunisia. The specimen probably reached 6 metres in total length and weighed approximately two tons. Additionally, some comments about the distribution of the species in the area and throughout the Mediterranean are provided, emphasizing the presence of nursery grounds in this sea.*

Key words: Great white shark, size and total body weight, Gulf of Hammamet, *mattanza*, *Thunnus thynnus*, nursery grounds

CATTURA DEL GRANDE SQUALO BIANCO, *CARCHARODON CARCHARIAS* (LAMNIDAE), LUNGO LA COSTA DELLA TUNISIA (MEDITERRANEO CENTRALE): EVENTO STORICO E ITTILOGICO

SINTESI

*Gli autori riportano una vecchia cattura del grande squalo bianco, *Carcharodon carcharias*, la prima nel Golfo di Hammamet, nella Tunisia centrale. L'esemplare probabilmente aveva raggiunto i 6 metri di lunghezza totale e circa due tonnellate di peso. Nell'articolo vengono inoltre forniti alcuni commenti sulla distribuzione delle specie nell'area in questione ed in tutto il Mediterraneo, sottolineando la presenza di zone di nursery nel bacino.*

Parole chiave: grande squalo bianco, dimensioni e peso corporeo totale, Golfo di Hammamet, *mattanza*, *Thunnus thynnus*, zone di nursery

INTRODUCTION

Carcharodon carcharias (Linnaeus, 1758) is a large shark with worldwide distribution, especially in temperate waters, and its occurrence is well documented throughout the Mediterranean Sea following De Maddalena & Heim (2012). Most of these records occurred in the central Mediterranean, especially in the Strait of Sicily, where several juvenile and adult specimens were recorded (Quéro, 1984; Fergusson 1996, 2002; Saïdi et al., 2005; Maliet et al., 2013; Kabasakal, 2014). Off the Tunisian coast, *C. carcharias* is as well-known as other large and dangerous elasmobranch species (Capapé et al., 1975). Bradaï & Saïdi (2013) noted that 59 reliable captures of *C. carcharias* were reported in the region between 1953 and 2012, the majority (56%) occurring in the Gulf

of Gabès. Additionally, basic data collected through historical literature, previous published documents, interviews with fishermen, and personal observations suggested other occurrences of *C. carcharias* in Tunisian marine waters. Among them, a large specimen captured several decades ago and landed at the fishing site of Monastir (Fig. 1), which we are going to present.

MATERIAL AND METHODS

The capture reported is that of a large female specimen of *C. carcharias* that occurred at the end of June 1975 in a *mattanza* set up in the waters surrounding the Kuriates Islands, located in the Gulf of Hammamet, central Tunisia (Fig. 1). A *mattanza* is an ancient traditional fishing technique used to catch thunnid species by trapping, mainly Atlantic bluefin tuna *Thunnus thynnus* (Linnaeus, 1758), when they are crossing the Mediterranean between February and July (Farrugio & Barbaroux, 2005). This kind of tuna fishing site is called a *tonnara* and is mainly targeted by large sharks, which can easily find available preys (Storai et al., 2011).

Furtherly, the specimen of *C. carcharias* was cut into slices and rapidly sold by fishermen, its flesh being greatly appreciated in the local traditional cuisine. According to fishermen, the estimated total weight of these slices reached 2 tons. Only the jaws were removed and preserved (Fig. 2), and finally purchased for the personal collection of Mr Mohamed Zaouali, formerly Head of the Office National des Pêches of Tunisia, and late husband of JZ, one of the present co-authors.

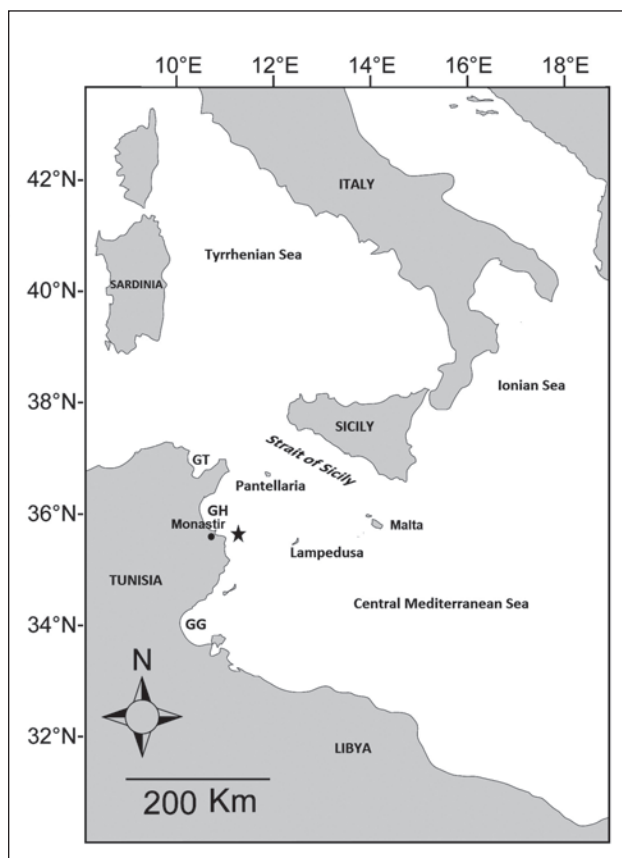


Fig. 1: Map of the central Mediterranean Sea, showing the capture site of the specimen of *Carcharodon carcharias* off the central Tunisian coast (black star). GT: Gulf of Tunis. GH: Gulf of Hammamet. GG: Gulf of Gabès.

Sl. 1: Zemljevid osrednjega Sredozemskega morja z označeno lokaliteto, kjer je bil ujet primerek vrste *Carcharodon carcharias* ob osrednji tunizijski obali (črna zvezdica). GT: Tuniški zaliv. GH: Hammameški zaliv. GG: Gabeški zaliv.



Fig. 2: Jaws of the specimen of *Carcharodon carcharias* captured in the waters surrounding Kuriates Islands, central Tunisia, scale bar = 1000 mm (Photo: Hédi Zaouali).

Sl. 2: Žrelo belega morskega volka, ujetega v vodah okoli Kuriatskih otokov (osrednja Tunizija), merilo = 1000 mm (Foto: Hédi Zaouali).



Fig. 3: Specimen of *Carcharodon carcharias* landed at the fishing site of Monastir, observed by His Excellency, Habib Bourguiba, President of the Tunisian Republic, surrounded by members of his Government and other people. Habib Bourguiba was a lawyer and a nationalist leader who played a major role in leading his country to independence, earning the title of Supreme Combatant (Chadli, 2013). He governed Tunisia for three decades and, considering education as the highest priority, promoted the foundation and development of universities and specialized institutes (Belkhodja, 1999). The presence of President Habib Bourguiba at the landing site of Monastir is evidence of his genuine interest for all that concerned fisheries and science, which is clearly visible from the photo. The white arrow indicates an Atlantic bluefin tuna *Thunnus thynnus*, which was captured together with the great white shark (Photo: Mohamed Zaouali).

Sl. 3: Primerek vrste *Carcharodon carcharias* si na ribji tržnici v Monastirju ogleduje Njegova Ekselenca, Habib Bourguiba, predsednik Tunizijske Republike, obkrožen s člani njegove vlade in drugimi ljudmi. Habib Bourguiba je bil pravnik in vodja nacionalistov, ki je odigral ključno vlogo pri neodvisnosti Tunizije, zaradi česar so mu podelili naslov vrhovnega poveljnika (Chadli, 2013). Tunizijo je vodil tri desetletja, pri čemer je zagovarjal edukacijo kot glavno prioriteto ter promoviral ustanovitev in razvoj univerz in specializiranih inštitutov (Belkhodja, 1999). Njegova prisotnost v Monastirju kaže na njegovo zanimanje za ribištvo in znanost, kar potrjuje tudi fotografija. Z belo puščico je označen tun *Thunnus thynnus*, ki je bil ujet hkrati z morskim volkom (Foto: Mohamed Zaouali).

The total length (TL) of the specimen was provided by the fishermen, however, to confirm this size, we have taken into consideration some methods recommended by Randall (1973) and Mollet *et al.* (1996). To estimate the size of a white shark, the latter authors used the relationships between the enamel height of the largest tooth in the upper jaw (UA1E1) and the dried upper jaw perimeter (DUJP) *versus* total length; such relationships are detailed in Mollet *et al.* (1996, Tab. 1).

RESULTS AND DISCUSSION

The great white shark specimen was landed at the fishing port of Monastir together with *T. thynnus* in July 1975 (Fig. 3). It was a huge female measuring slightly under 6 m in total length, with the estimated total weight of the slices reaching 2 tons approximately following the accounts of fishermen who discovered some *T. thynnus* in its stomach contents. This was the first capture of *C. carcharias* in the Gulf of Hammamet and is probably the only capture known to date in this area. The height of the largest tooth of the upper jaw (UA1E2) was 60 mm, the DUJP 1200 mm. These measurements allow us to estimate the size of the Tunisian great white shark between 4.5 and 6 m total length following Mollet *et al.* (1996).

The records of largest *C. carcharias* captured to date concern two specimens, both reaching 7 m in total length. One specimen was caught by gill-net near Kangaroo Island, South Australia (Jury, 1987; Cappel, 1988) and designated as KANGA by Mollet *et al.* (1996), the other was caught by steel line baited by tuna and swordfish (Abela, 1989) in waters surrounding Malta Islands and designated as MALTA by Mollet *et al.* (1996). The DUJP in KANGA and MALTA were 1.250 m and 1.120 m, respectively, the UA1E2 51.6 mm and 46.9 mm, respectively (Mollet *et al.*, 1996). The total length was assessed between 5.1 and 7.3 m for MANGA, and between 4.5 and 6.4 m for MALTA (Mollet *et al.*, 1996). Following these results a total length of 6 m reported for the present Tunisian specimen remains a plausible hypothesis. The TL reported for MALTA suggested that its total body weight could be estimated between 2.4 and 3.6 tons. A great white shark captured in the Gulf of Gabès measured 5.87 TL and probably weighed more than 2 tons (Saïdi *et al.*, 2005). The estimated weight of the present *C. carcharias* – 2 tons – seems valid. Therefore, this specimen probably constitutes the largest great white shark known to date in Tunisian waters and one of the largest caught in the Mediterranean Sea. Comparatively, the largest Italian

specimen of *C. carcharias* known to date, was estimated to reach a total length of 6.02 m, according to De Maddalena (1999).

Following Boldrocchi *et al.* (2017), *C. carcharias* exhibits a large range of prey species in stomach contents, indicating that it is a rather opportunistic feeder with a preference for scombrid and among them *Thunnus* spp. This pattern explains why captures of great white shark generally occur close to both traditional and modern tuna fisheries (Boldrocchi *et al.*, 2017). However, it appears that the collapse of tuna fisheries enhanced the decline of these captures in some Mediterranean areas, such as Catalanian waters (Barrull & Mate, 2001), eastern Adriatic Sea (Soldo & Jardas, 2002) and both Sea of Marmara and the Bosphorus Strait (Kabasakal, 2016). Conversely, some authors have noted a possible relationship between *C. carcharias* and tuna farming (Boldrocchi *et al.*, 2017). The last *mattanza* site located off Sidi Daoud, north-eastern Tunisia, was closed in 2005 (Rhomdane *et al.*, 2014), and since then captures of white sharks were only reported locally (Bradai & Saïdi, 2015). Some authors have noted a possible interrelationship between tuna and *C. carcharias*, due to the importance of thunnid species in the shark's diet (Boldrocchi, 2017).

A drastic decline of captures of *C. carcharias* in Tunisian waters remains uncertain and cannot be totally ruled out. However, based on the captures of pregnant females carrying developing embryos, young-of-the-year born in the wild and adults of both sexes, Fergusson (1996), Saïdi *et al.* (2005) and Bradai & Saïdi (2013) suggested the presence of a nursery grounds for *C. carcharias* in the central Mediterranean Sea, even though further records are needed to confirm this opinion. Recent studies, such as Kabasakal (2014), Kabasakal & Gedikoğlu (2008), Kabasakal *et al.* (2018) indicated that *C. carcharias* currently occurs in the eastern Mediterranean Sea and in the Aegean Sea, as well as records of new-born and juvenile specimens. Similarly, a nursery ground for *C. carcharias* in north-eastern Aegean Sea remains a valid hypothesis.

Recruitment of *C. carcharias* in the Mediterranean Sea cannot be totally ruled out even if significant records are needed to confirm it. Intrusion of *C. carcharias* and other large elasmobranch species through the Suez Canal and the Strait of Gibraltar remains questionable (Capapé, 1989). Boldrocchi *et al.* (2017) noted that between 1976 and 2015, 628 reliable records of *C. carcharias* were reported in the Mediterranean Sea, and informed us (Boldrocchi, 2020, *in letteris*) that no further record occurred in this region since 2015. Two records of *C. carcharias* reported by Rafrafi *et al.* (2015, 2019) from the north-eastern Tunisian coast are probably the last known to date in this sea.

ULOV VELIKEGA PRIMERKA BELEGA MORSKEGA VOLKA, *CARCHARODON CARCHARIAS* (LAMNIDAE) OB TUNIZIJSKI OBALI (OSREDNJE SREDOZEMSKO MORJE): ZGODOVINSKI IN IHTIOLOŠKI DOGODEK

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POVZETEK

Avtorji poročajo o starejšemu zapisu o pojavljanju belega morskega volka, *Carcharodon carcharias*, ki je prvi podatek te vrste za Hammameški zaliv v osrednji Tuniziji. Primerek je verjetno v dolžino meril 6 m in tehtal približno dve toni. Nadalje avtorji razpravljajo o razširjenosti vrste na obravnavanem območju in širšem Sredozemskem morju ter o možnih razmnoževalnih okoljih te vrste (jaslicah).

Ključne besede: beli morski volk, velikost in telesna teža, Hammameški zaliv, *mattanza*, *Thunnus thynnus*, jaslice

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