

## **A new record of a great white shark, *Carcharodon carcharias* (Chondrichthyes: Lamnidae) in the Strait of Sicily, Central Mediterranean Sea**

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*In November 2015 an immature male individual of great white shark, *Carcharodon carcharias* (Linnaeus 1758), was caught as by-catch by a bottom trawler in the Strait of Sicily, in the Central Mediterranean Sea. The shark, reaching 266 cm in length and weighing 290 Kg, was identified and measured by means of a video provided by fishers. This record is discussed considering the available information on the presence of the great white shark in the area and confirms the importance of the Strait of Sicily for the conservation of this vulnerable species.*

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**Key words:** Mediterranean Sea, elasmobranchs, large pelagic shark, biodiversity, threatened species

## INTRODUCTION

Conservation of large pelagic sharks is challenging (VINCENT, A.C.J. & H.J HALL 1996; ROBERTS, C.M. & J.P. HAWKINS 1999) because they are vulnerable to extinction and recover slowly from stock exploitation (BARKER, M. J. & V. SCHLUESSEL 2005; GARCÍA *et al.*, 2008). It is well known that pelagic sharks are in a high position in the trophic food web, slow growth, delayed sexual maturity, low fecundity/fertility, and long-life spans (DULVY *et al.*, 2014). Globally, apex predators, such as the great white shark *Carcharodon carcharias* (Linnaeus, 1758), play important controlling roles to the structure and functioning of marine ecosystems through direct and indirect predatory effects (STEVENS *et al.*, 2000; BASCOMPTE *et al.*, 2005; HEITHAUS *et al.*, 2008). Several studies have indicated that trophic cascades might be occurring in marine ecosystems because of the decreasing apex predator abundance and the consequent predator release effect on their prey (MYERS *et al.*, 2007; BAUM, J. K. & B. WORM 2009; GRUBBS *et al.*, 2016).

The great white shark is probably the most charismatic species of shark and, although intensively studied around the world many aspects of its natural history, biology and ecology remain poorly understood (HUVENEERS *et al.*, 2018). The distribution of the species in the oceans appears to be discontinuous and major aggregations tend to occur close to highly productive habitats where marine mammals, particularly pinnipeds, and big fish (e.g. blue fin tuna) are abundant (COMPAGNO, 1984; FERGUSSON, 2002).

MORO *et al.* (2020) reported 773 records of great white shark in Mediterranean Sea from the end of the Middle Ages (1453) to 2016, mainly distributed in the central-western Mediterranean Sea. In the Strait of Sicily (central Mediterranean), this species was documented either along the coast of Sicily (56 times from 1666 to 2016: KARACHLE *et al.*, 2016) or in Tunisian and Maltese waters (FERGUSSON, 1996; STORAI *et al.*, 2000; FERGUSSON, 2002; SAIDI *et al.*, 2005).

Genetic studies (GUBILI *et al.*, 2010; ANDREOTTI *et al.*, 2016; LEONE *et al.*, 2020), suggested that the Mediterranean population of *C. carcharias* has probably the lowest genetic diversity at global

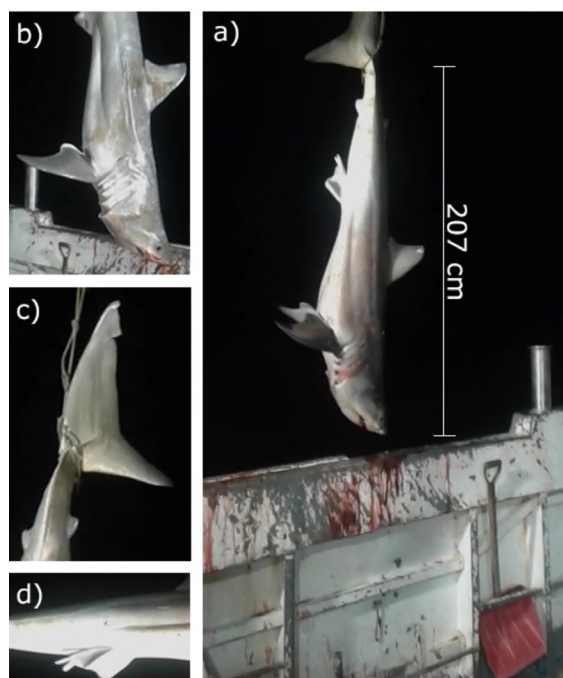


Fig. 1. *Carcharodon carcharias* immature male caught during trawl fishery operation, a) whole individual, b) details of pectoral fins, c) caudal fin, d) claspers

level also due to a lack of connectivity with the closer ocean populations. Low levels of genetic diversity would prevent this species from recovering quickly to a healthier population status and thus increasing its extinction risks.

The great white shark is widely recognized as a highly threatened species, haunted and worthy of protection. Indeed, it is listed at global level as “vulnerable” by the International Union for Conservation of Nature (IUCN) (FERGUSSON *et al.*, 2009) and is included in Appendix II of the Convention on International Trade in Endangered Species (CITES).

At Mediterranean level, this species is classified as “critically endangered” by IUCN (DULVY *et al.*, 2016; SOLDI *et al.*, 2016) and it is also included in the Barcelona Convention Annex II SPA/BD Protocol. Furthermore, the General Fisheries Commission for the Mediterranean Sea (GFCM) states that white sharks caught during fishing operation must be promptly released unharmed and alive to the greatest extent possible. Otherwise, specimens of sharks shall not be retained on board, landed or sold (Recommendation GFCM/42/2018/2).

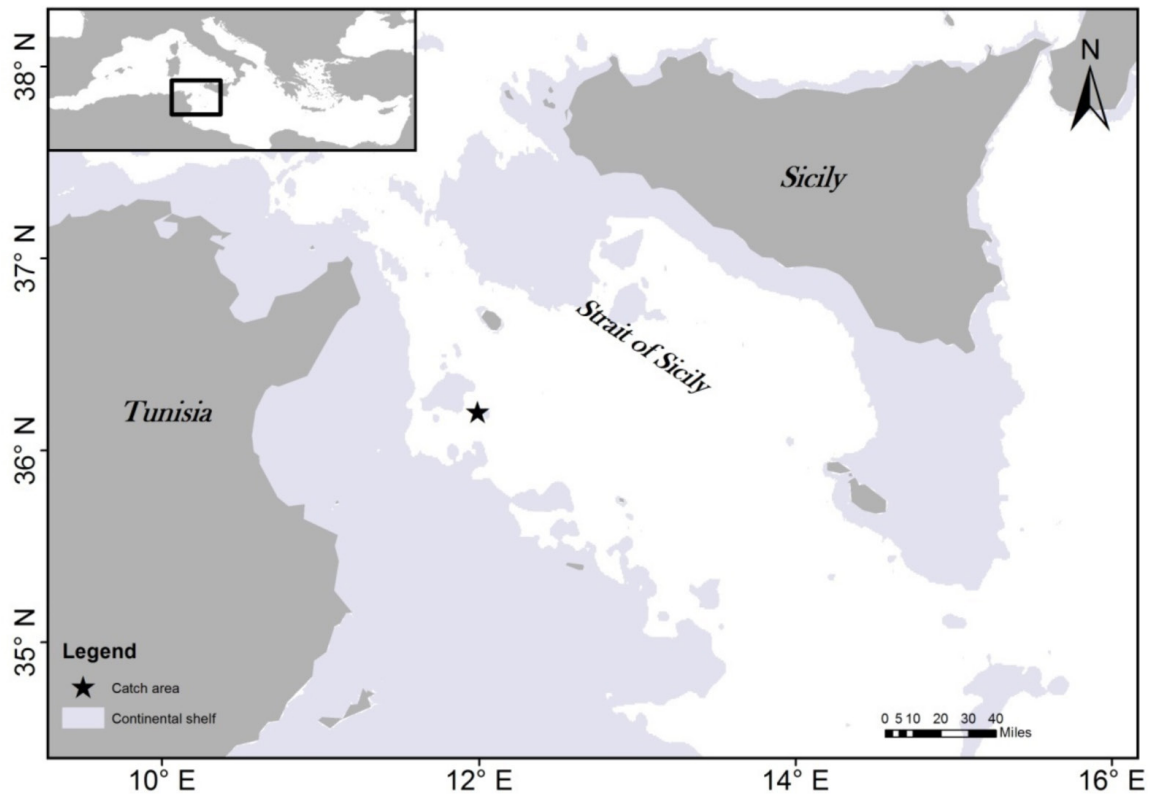


Fig. 2. Map showing the approximate location of the great white shark capture reported in the present contribution

Consequently, it is worth highlighting the importance of each single record of *C. carcharias* with the overall goal to update its presence and improve our understanding on the spatial pattern of its life cycle.

## MATERIAL AND METHODS

In November 2015 an individual of great white shark was accidentally caught by a commercial bottom trawler at about 300 m depth, 27 miles off the south coast of Pantelleria Island (approximate coordinates 36° 18' N, 11° 55' E) (Fig.1 & Fig.2). The shark was identified according to descriptions given by COMPAGNO (1984). The biometric data were obtained by frames of a video taken by a fisher with his smartphone by means of ImageJ software (SCHNEIDER *et al.*, 2012) using as standard the size of the shovel (Fig.1a). Then, measurements were compared as percentage of total length (TL) with information reported by KABAKASAL, H.

& S. Ö. GEDIKOGLU (2008) (Table 1). Afterwards, the weight was estimated from the total length-weight relationship reported by MANCUSI *et al.* (2020). The maturity stage was attributed using the relationship between clasper length and total length provided by KLIMLEY, A.P. & D.G. AINLEY (1998).

It's worth pointing out that the shark was released still alive by the fishers even if the poor state of health of the shark was clear due to some blood loss in addition to the long handling time on the vessel deck.

## RESULTS AND DISCUSSION

The individual was estimated to be 266 cm TL, 207 cm PCL (pre-caudal length) and about 290 kg of total weight. As shown in table 1, biometry expressed as percentage of TL resulted quite similar to the measurements reported for a male individual caught in Turkey (KABAKASAL, H. & S. Ö. GEDIKOGLU 2008). Slight differences

were recorded for head length, pre-first dorsal length, pre-second dorsal length, pre-pelvic length, interdorsal space, pectoral-pelvic space and pelvic-anal space (Table 1).

The dimension of the claspers indicated that the young white male shark was still immature as expected considering that previous studies indicated that males attain their first maturity at 350 - 400 cm TL (PRATT, 1996; COMPAGNO, 2001; SERENA *et al.*, 2014). However, a wide geographic variation in length at first sexual maturity was reported by CLIFF *et al.* (1989).

In the Mediterranean Sea, maturity data on the species are scattered, mainly limited to incidental captures or sightings. Only a few studies concern these bio-ecological aspects (e.g. SERENA *et al.*, 2014; BOLDROCCHI *et al.*, 2017). The great white shark is a “K-selected” species with slow growth rate and high longevity, late maturity, long gestation period, low fecundity and probably small sized populations. These peculiar life-history traits indicate that the rebuilding time of great white shark populations in response to fisheries can be very high (BRUCE, 2008). Therefore, the decline of the Mediterranean great white shark population (DULVY *et al.*, 2016; SOLDI *et al.*, 2016), like highlighted for other large predatory sharks (FERRETTI *et al.*, 2008), might be due to both their reproductive strategy and to the strong increase of fishing pressure recorded in the last decades (RUSSO *et al.*, 2014; BOLDROCCHI *et al.*, 2017; MANCUSI *et al.*, 2020; MORO *et al.*, 2020).

The present record of a young great white shark in the Strait of Sicily, although incidentally fished, confirms that trawl fisheries can impact juvenile and neonatal specimens as reported by VACCHI, M. & F. SERENA (1997). Fisheries that catch both juvenile and adult specimens have been documented in Tunisian waters whilst using different gear such as longliners (FERGUSSON, 2002), trawlers and purse seiners (BRADAĪ, M. N. AND B. SAĪDI 2013) indicating the importance of the area for the Mediterranean great white shark population. The Strait of Sicily is indeed considered the “core area” of the population also playing a key role as a parturition and nursery area (FERGUSSON, 1996, SAIDI *et al.*, 2005; BRADAĪ, M. N. AND B. SAĪDI 2013; RAFRAFINOUIRA *et al.*, 2015).

Given the high risks of extinction of the great white shark in the Mediterranean Sea, it would be advisable to enforce measures to minimize the mortality due to commercial fishing. With this aim in mind any improvement on the ongoing knowledge on the species-fisheries interactions (e.g main gears, periods, areas, sizes, etc.) would be important to enforce *ad-hoc* conservation measures for pelagic as well as demersal sharks (RAGONESE *et al.*, 2013; GERACI *et al.*, 2017; COLLOCA *et al.*, 2019). Raising fishermen awareness on the ecological importance of the species for the Mediterranean marine ecosystem is also extremely important in terms of species conservation. In this regard it would be advisable to also disseminate protocols for properly handling and releasing safely the captured individuals.

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**Novi nalaz velike bijele psine, *Carcharodon carcharias*  
(Chondrichthyes: Lamnidae) u Sicilijskom tjesnacu,  
Sredozemno more**

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**SAŽETAK**

U studenom 2015. ulovljen je nezreli mužjak velike bijele psine, *Carcharodon carcharias* (Linnaeus 1758), koćom u Sicilijskom tjesnacu (srednje Sredozemno more).

Morski pas, koji je dosegao 266 cm duljine i težinu od 290 kg, identificiran je i izmjeren pomoću videozapisa koji su osigurali ribari.

U ovom se radu raspravlja, s obzirom na dostupne informacije o prisutnosti velike bijele psine a na tom području i potvrđuje važnost Sicilijskog tjesnaca za očuvanje ove ranjive vrste.

**Ključne riječi:** Sredozemno more, hrskavičnjače, *Carcharodon carcharias*, biološka raznolikost, ugrožene vrste