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USING CITIZEN SCIENCE TO DETECT RARE AND ENDANGERED SPECIES: NEW RECORDS OF THE GREAT WHITE SHARK *CARCHARODON CARCHARIAS* OFF THE LIBYAN COAST

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ABSTRACT

*The presence of the great white shark (*Carcharodon carcharias*) in the Mediterranean Sea is well documented, but encounters with this species are rare and all assumptions about its spatial and temporal distribution are heavily relying on anecdotal observations. To date, only one record off the Libyan coast has been reported, raising the question if this species is underreported in these waters or simply represents a rare occasional transient. We utilised citizen science-sourced data to document the presence of the great white shark off the Libyan coast, and found six additional records for this species from the period between 2017 and 2020. Our study points out the need for scientific monitoring of this species along the Libyan coast to facilitate the establishment of effective conservation plans to protect this critically endangered species.*

Key words: Elasmobranchii, cartilaginous fish, conservation biology, fisheries, social media, threatened species

USO DELLA SCIENZA DEL CITTADINO PER INDIVIDUARE SPECIE RARE E IN PERICOLO: NUOVI RITROVAMENTI DEL GRANDE SQUALO BIANCO *CARCHARODON CARCHARIAS* AL LARGO DELLA COSTA LIBICA

SINTESI

*La presenza del grande squalo bianco (*Carcharodon carcharias*) nel Mediterraneo è ben documentata, ma gli incontri con questa specie sono rari e tutte le ipotesi sulla sua distribuzione spaziale e temporale sono fortemente basate su osservazioni aneddotiche. Fino ad oggi, è stato riportato un solo avvistamento al largo della costa libica, portando alla domanda se questa specie sia sotto-segnalata in queste acque o semplicemente rappresenti un raro transitorio occasionale. Gli autori hanno utilizzato i dati forniti dai cittadini per documentare la presenza del grande squalo bianco al largo della costa libica. Hanno trovato dati inerenti sei avvistamenti aggiuntivi di questa specie tra il 2017 e il 2020. Lo studio sottolinea la necessità di un monitoraggio scientifico di questa specie lungo la costa libica per facilitare l'istituzione di piani di conservazione efficaci per proteggere questa specie minacciata.*

Parole chiave: Elasmobranchii, pesci cartilaginei, biologia della conservazione, pesca, social media, specie minacciate

INTRODUCTION

The great white shark *Carcharodon carcharias* (L., 1758) is, with a total length of at least six meters (Randall, 1973; Castro, 2012), one of the largest marine predators worldwide. This cosmopolitan species inhabits mainly temperate and subtropical waters, with adult individuals rarely entering tropical waters (Compagno, 2001). In the Mediterranean Sea, white sharks have been frequently reported from the Strait of Sicily (Storai *et al.*, 2000; Ben-Amor *et al.*, 2020; Tiralongo *et al.*, 2020), the Tyrrhenian Sea (Storai *et al.*, 2000), the Gulf of Lions (De Maddalena & Zuffa, 2009), the Balearic Islands (Morey *et al.*, 2003), the Adriatic Sea (De Maddalena, 2000; Soldo & Jardas, 2002), the Ionian Sea (Papaconstantinou, 2014), the Marmara Sea, including the Bosphorus Strait (Kabasakal, 2003, 2014, 2016), and the Aegean Sea (Kabasakal, 2014, 2016, 2019; Papaconstantinou, 2014). Based on the occurrence of neonates, small juveniles and pregnant females, the existence of two possible nursery areas has been proposed in the Mediterranean Sea, one in the Strait of Sicily, Central Mediterranean Sea (Fergusson, 1996; Saïdi *et al.*, 2005; Bradaï & Saïdi, 2013) and another in Edremit Bay, northern Aegean Sea (Kabasakal, 2016, 2020a,b).

Molecular studies examining the genetic profile of white sharks via the mt-DNA control region have revealed the presence of an isolated Mediterranean population, which exhibits little genetic variability and only has limited genetic exchange with the Atlantic population (Gubili *et al.*, 2011; 2015; Leone *et al.*, 2020). This lack of genetic diversity coupled with little or no contemporary immigration from the Atlantic renders the Mediterranean population extraordinarily prone to extinction (Gubili *et al.*, 2011; 2015). According to the IUCN Red List of Threatened Species, white sharks are declared globally vulnerable (VU; Rigby *et al.*, 2019), while the Mediterranean population is listed as critically endangered (CR; Soldo *et al.*, 2016). In an attempt to assess population trends and dynamics for white sharks in the Mediterranean, Moro *et al.* (2020) compiled a comprehensive database of 773 white shark records between 1860 and 2016 and found a 52–96% overall population decline in different Mediterranean sectors and a contraction in spatial distribution. It should be noted that encounters with white sharks in the Mediterranean Sea are usually rare and very sporadic in nature. Therefore, all hypotheses about distribution, migration patterns, parturition, and the conservation status of white sharks in the Mediterranean Sea rely on anecdotal observations, like historical captures and sighting data (Fergusson, 1996; De Maddalena & Heim, 2012; Boldrochhi *et al.*, 2017; Moro *et al.*, 2020). Due to insufficient fishery data for many shark species, especially rare ones (Damalas & Megalofonou, 2012; Cashion *et al.*, 2019), and the absence of coordinated scientific surveys, citizen science has frequently been used to monitor the presence of rare shark species in the Mediterranean Sea (e.g., Giovos *et al.*, 2019; Kabasakal & Bilecenoğlu, 2020; Jambura *et al.*, 2021).

Landing almost 4.3 tonnes of chondrichthyan fishes in 2015, Libya is the leading country for chondrichthyan catches in the Mediterranean Sea (Jeffries, 2019). However, little is known about the presence of white sharks in Libyan waters and only a single record of a large female white shark off the Libyan coast does exist (Galaz & De Maddalena, 2004). Assessing the presence of white sharks in Libyan waters is, consequently, of utmost importance for future conservation planning of this iconic shark species. In our study, a systematic online search on popular social media platforms (i.e., Facebook, YouTube, Instagram, and Twitter) was conducted to document the presence of the great white shark *C. carcharias* along the Libyan coast and to augment our understanding of the distribution and ecology of this rare species in the Mediterranean Sea.

MATERIAL AND METHODS

Records of white shark *C. carcharias* off the Libyan coast were accumulated within the context of the citizen-science initiative "Monitoring Elasmobranchii in Libyan Waters", which was conducted by "Marine Biology in Libya". This programme puts a focus on the occurrence of chondrichthyan fishes in the Mediterranean Sea and applies a verified citizen science model, in which citizen-submitted observations are checked by experts (Gardiner *et al.*, 2012). The records either came directly from fishermen reporting their catch, or through systematic online searches on social media platforms, namely Facebook, YouTube, Instagram, and Twitter using the Arabic keyword for great white shark (القرش الأبيض, "alqarsh al'abyad") and shark (قرش , "qarash"; or كلب بحر, "kaleb baher"). Following the ethical code proposed by Monkman et al. (2018), all web scraping was performed responsibly to avoid compromising any personal data or images. All records had to be accompanied by photographic evidence confirming the identification of the reported species. Authenticity and originality of the images were checked with the Google automatic image recognition tool. Species identification was based on the following features: (1) heavily, long-snouted spindle-shaped body; (2) strong keels on caudal peduncle; (3) large first dorsal fin, very small second dorsal and anal fins; (4) lunate caudal fin; (5) large, flat, triangular, serrated teeth; (6) long

Tab. 1: Observations of great white sharks (*Carcharodon carcharias*) reported from the Mediterranean Sea between 2017 and 2020. Abbreviation: YOY, young-of-year. *size and ontogenetic stage estimated by the observer.
Tab. 1: Opazovanja belih morskih volkov (*Carcharodon carcharias*), ki so bila v Sredozemskem morju dokumentirana v letih 2017-2020. Okrajšava: YOY, enoletni primerek. *velikost in ontogenetski stadij, ki ga je ocenil opazovalec.

Country	Region	Date	Fishing type	Condition	Sex	Ontogeny	TL [cm]	Weight [kg]	Coordinates	Source
Italy	Lampedusa	23.05.2020	observation	alive	female	adult	500	-	-	Tiralongo *et al.* (2020)
Libya	Bouri field	29.07.2017	observation	alive	-	adult*	600*	-	34.054444°N, 12.789972°E	this study
	Buerat	16.05.2018	gillnet	dead	female	juvenile	230	135	31.399611°N, 15.736333°E	this study
	Brega	12.01.2020	observation	dead	male	adult	520	-	30.3475°N, 19.441528°E	this study
	Daryanah	23.04.2020	observation	alive	-	adult*	600*	-	32.398306°N, 20.339444°E	this study
	Tripoli	21.09.2020	gillnet	dead	female	YOY	140	-	-	this study
	Tripoli	04.11.2020	observation	alive	-	adult*	600*	-	32.959333°N, 13.167389°E	this study
Turkey	Gökçeada	01.2017	gillnet	dead	-	juvenile	180	-	-	Kabasakal (2020a)
	Altınoluk	04.2017	gillnet	alive	-	YOY	160	-	-	Kabasakal (2020a)
	Didim	04.06.2017	purse seine	dead	male	juvenile	200	60	-	Kabasakal *et al.* (2019)
	Izmir	14.04.2018	gillnet	dead	female	juvenile	180	-	-	Kabasakal *et al.* (2019)
	Sousse	28.04.2020	drift longline	dead	female	juvenile	232	90	35.016944°N, 12.186389°E	Ben-Amor *et al.* (2020)
	Kumkale	08.06.2020	gillnet	dead	-	YOY	155	-	-	Kabasakal (2020b)
	Enez	14.06.2020	observation	alive	-	juvenile	200	-	-	Kabasakal (2020b)

gill slits; (7) black eyes; (8) sharp colour change from greyish dorsally to white ventrally; (9) pectoral fins with black tips on the ventral side (Ebert *et al.*, 2013). Subsequent interviews were conducted with citizen scientists to confirm the reported data and obtain further information. If direct contact with the observer was not successful, the record was considered ambiguous and subsequently discarded. In addition to date and location, the following data were added to each record when possible: (1) time, (2) fishing method, (3) condition, (4) sex, (5) estimated total length (TL_{est}), (6) weight (Tab. 1). Estimated total lengths were validated by comparing the shark with objects of known size in the photos. When applicable, ontogenetic stages were identified based on the total length following Boldrocchi *et al.* (2017): young of the year (YOY) (TL ≤ 1.75 m), juvenile (TL 1.75–3.0 m), subadult (♂TL 3.0–3.6 m; ♀TL 3.0–4.5 m), adult (♂TL > 3.6 m; ♀TL > 4.5 m).

RESULTS

Between 2017 and 2020, six white sharks (*C. carcharias*) were reported off the Libyan coast, constituting 42.9% of all published records of this species in the entire Mediterranean Sea during the same period (Tab. 1). One record was from 2017, one from 2018, and four were from 2020. Half of the recorded white sharks were reported dead (n=3); two of them were caught in set gillnets and one was washed ashore (see cases 2, 3, and 5). Ontogenetic stage and sex could be determined for four and three individuals, respectively; two sharks were adults (one male, one of unknown sex) and two were juveniles (both female). A short description for each record is provided below.

Case 1: On 29 July 2017, a white shark was filmed from an oil platform while swimming near the surface in the Bouri Offshore Field, 120 km north of

the Libyan coast, (34.054444°N, 12.789972°E; Figs. 1, 2A; Tab. 1). It was not possible to determine the sex or size of this specimen. The observer, however, estimated it to be 6 m long, and, therefore, likely an adult specimen.

Case 2: On 16 May 2018, a small white shark was caught in a gillnet near the village of Buerat, 84 km west of Sirte (31.399611°N, 15.736333°E; Figs. 1, 2B; Tab. 1). The shark was alive when captured, but was landed and sold at the local fish market. The fishermen identified it as a shortfin mako shark (*Isurus oxyrinchus*), however, the black tips on the ventral side of the pectoral fins and the flat triangular teeth clearly indicate it was a white shark. The specimen was a female measuring 2.3 m (total length, TL) and, therefore, a juvenile.

Case 3: On 12 January 2020, a large white shark was washed ashore near the town of Brega, 300 km east of Sirte (30.3475°N, 19.441528°E; Figs. 1, 2C; Tab. 1). No external injuries that would explain the cause of death could be detected. The specimen was a male with well developed claspers and measuring 5.2 m (TL). We, therefore, conclude that this specimen represented an adult individual.

Case 4: On 23 April 2020, a white shark was observed swimming near the surface following a small fishing vessel, which carried out blast fishing near the town of Daryanah, 32 km east of Benghazi

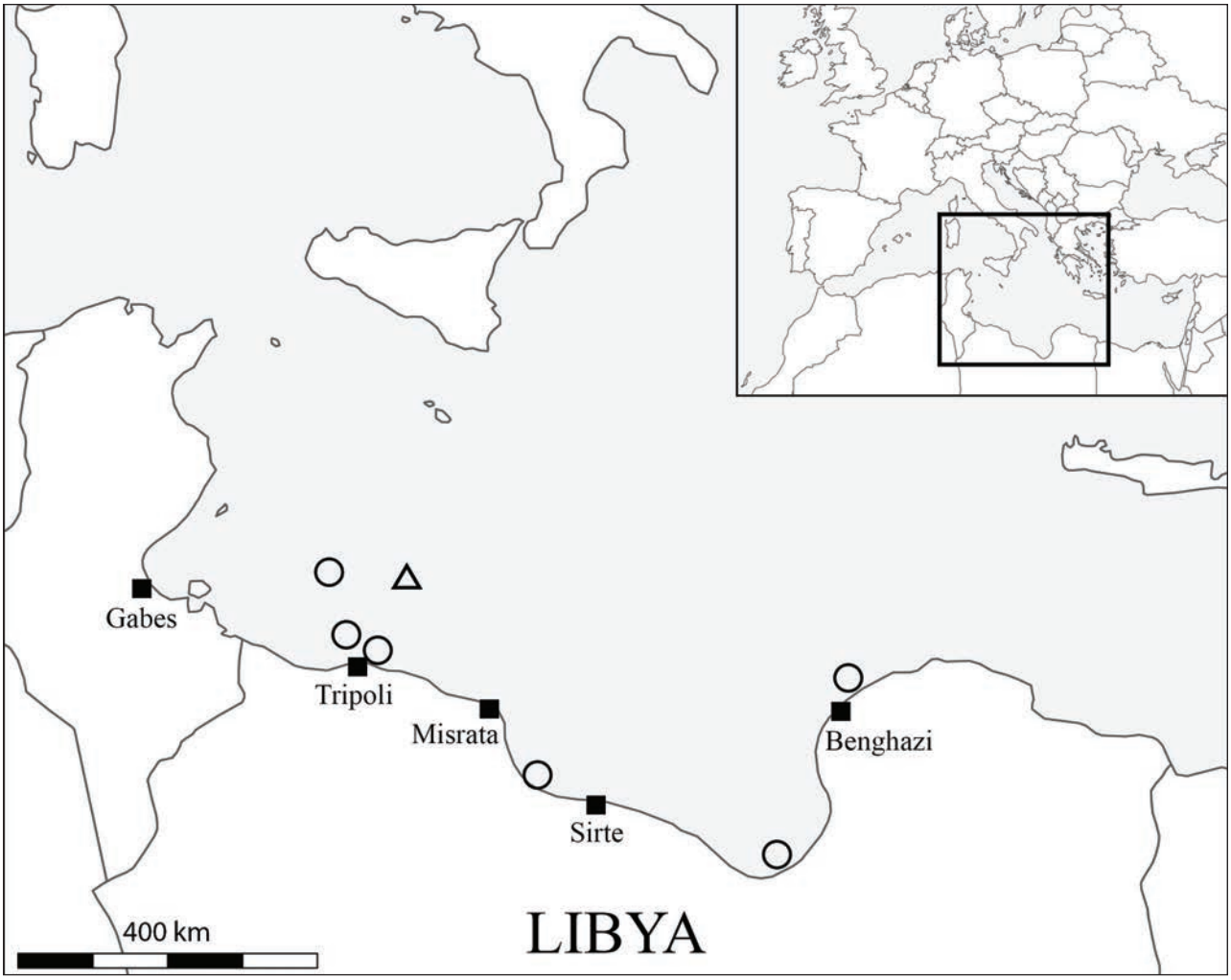

Fig. 1: Occurrence of the great white shark** (Carcharodon carcharias) **off the Libyan coast. Recent records (circle) were reported between 2017 and 2020, while the only previously published record (triangle) was reported in 2002. Detailed information about each observation is provided in Table 1.
Sl. 1: Pojavljanje belega morskega volka** (Carcharodon carcharias) **vzdolž libijske obale. Recentni podatki (krogci) izvirajo med leti 2017 in 2020, medtem ko je bil edini dokumentirani zapis o pojavljanju te vrste (trikotnik) objavljen leta 2002. Natančni podatki o vsakem od opazovanih primerov so navedeni v Tabeli 1.

(32.398306°N, 20.339444°E; Fig. 1; Tab. 1). The fishermen estimated the shark to be 6 m long. The video material, however, did not allow confirmation of this estimate. Although the shark was reported to be alive, at the end of the video sequence one of the fishermen threw dynamite towards the shark in order to chase it off and probably killed it.

Case 5: On 21 September 2020, a small white shark was caught in a set gillnet and landed in the Bab Albaher fish market in Tripoli (Figs 1, 2D; Tab. 1). The exact locality where this individual was caught could not be reconstructed. However, due to the ongoing civil war in Libya, fishing boats from Tripoli are not allowed to enter the Gulf of Sidra and are restricted to the area between the Libyan-Tunisian boundary to the west and the city of Misrata to the east. Therefore, it is certain that this individual was caught in the area around Tripoli. The shark was a female measuring 1.4 m. The presence or absence of an umbilical scar could not be verified because the whole ventral side of the shark was cut open. Nevertheless, the total length is well within the size category of young of year (YOY < 1.75 m) and, therefore, it is considered as such here. This record represents the southernmost occurrence of a YOY white shark in the Mediterranean Sea.

Case 6: On 4 November 2020, a white shark was observed in the proximity of two small fishing vessels near Tripoli (32.959333°N, 13.167389°E; Figs. 1, 2E; Tab. 1). The shark was swimming close to the surface and was accompanied by seven pilot fish (*Naucrates ductor*). The total length was estimated to be 6 m by the fishermen, but the video sequence did not allow confirmation of this estimate or identification of the sex of the specimen.

DISCUSSION

The presence of white sharks in the Mediterranean Sea has been known since the Middle Ages (476–1453) but is documented solely based on anecdotal reports of rather rare encounters (De Maddalena & Heim, 2012; Boldrocchi *et al.*, 2017). In the present paper, citizen science-sourced data from social media platforms was used to gain a more detailed insight into the occurrence, distribution, and ecology of this elusive species along the Libyan coast. The species was previously only reported from this region in a single record of an adult female shark caught in a tuna cage 55 miles off Tripoli (Galaz & De Maddalena, 2004). Our search resulted in six additional records reported over a relatively short period (between 2017 and 2020), indicating that this species might be more common in this area than previously thought. In a recent study, five specimens of *C. carcharias* were reported from the North East Aegean Sea, based on social media and internet sources (Kabasakal & Bilecenoğlu, 2020), further indicating the importance and potential of such data sources (and citizen science in general) for white shark research in the Mediterranean Sea.

Our results suggest that both immature and mature white sharks exploit the waters off the Libyan coast. The Central Mediterranean Sea is characterised by high biodiversity, especially in the area around the Strait of Sicily (Spanò & De Domenico, 2017), which is also an area displaying a high occurrence of white sharks (Fergusson, 1996; Boldrocchi *et al.*, 2017). Fergusson (1996) proposed that this region was critical for the species' reproduction and that the neritic waters of Sicily and Tunisia served as nursery areas, a hypothesis that has been supported by subsequent studies (e.g., Saïdi *et al.*, 2005; Bradaï & Saïdi, 2013; Boldrocchi *et al.*, 2017).

Our observations of a young of the year and a juvenile white shark along the Libyan coast represent the southernmost occurrence of immature individuals of this species in the Mediterranean Sea and suggest that the Central Mediterranean nursery area might not be restricted to Sicily and Tunisia but may extend as far south as Libya. This seems reasonable, as white sharks can inhabit vast nursery grounds with YOYs travelling up to 700 km within a month (Weng *et al.*, 2007). The Gulf of Gabes, a frequently suggested nursery ground for white sharks (Saïdi *et al.*, 2005; Bradaï & Saïdi, 2013), is situated ca. 350 km west of where the YOY reported here was landed. It should be noted that incidental captures of YOY and juvenile white sharks in Tunisia usually occur in winter and spring, with a peak in February, while no YOY or juvenile has been reported in September so far, when the specimen documented here was caught. Therefore, an eastwards movement of YOY and juvenile white sharks from their primary nursery area in the Gulf of Gabes cannot be excluded either. The juvenile specimen reported here was caught further east, ca. 700 km west of the Gulf of Gabes. Previously, juveniles were reported to travel greater distances than YOYs (Kabasakal, 2020a), further indicating that the Libyan coast might serve as an extension of the nursery ground of the Gulf of Gabes. More data, however, is needed to confirm this.

The great white shark *C. carcharias* is listed as an Appendix II species of the Convention on International Trade in Endangered Species (CITES) and is also included in the Barcelona Convention Annex II SPA/BD protocol. According to the Fisheries Commission for the Mediterranean Sea (GFCM), white sharks caught during fishing operations have to be released promptly and unharmed to the greatest extent possible. They cannot be retained on board, transferred, landed or sold (Recommendation GFCM/42/2018/2). Our study revealed that critically endangered white

Fig. 2: Reports of great white sharks** (Carcharodon carcharias) **observed off the Libyan coast between 2017 and 2020. Detailed information about each observation is provided in Table 1. Photo credits: (A) Jamal Al hamali, (B) Archive Marine Biology in Libya Society, (C) Mohamed Ahmed Salah, (D) Kamal Zager, (E) Aimen Al jerbie.
Sl. 2: Pojavljanje morskega volka** (Carcharodon carcharias) **vzdolž libijske obale v obdobju med 2017 in 2020. Natančni podatki o vsakem od opazovanih primerov so navedeni v Tabeli 1. Avtorji fotografij: (A) Jamal Al hamali, (B) Archive Marine Biology in Libya Society, (C) Mohamed Ahmed Salah, (D) Kamal Zager, (E) Aimen Al jerbie.

sharks are caught and sold in Libya, despite Libya being a member of the GFCM and, therefore, obliged to follow this recommendation. One of the main problems we identified when talking to fishermen about their records was that they were completely unaware of the presence of white sharks in their fishing area and usually mistook the reported specimens for shortfin makos (*Isurus oxyrinchus*). We therefore urge for the organisation of educational and awareness campaigns aimed at aiding fishermen in correctly identifying white sharks and informing them about the white shark's conservation status and regulations that are in place to help this species recover in the Mediterranean Sea.

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UPORABA LJUBITELJSKE ZNANOSTI ZA PRIDOBIVANJE PODATKOV O REDKI IN OGROŽENI VRSTI: NOVI PODATKI O POJAVLJANJU BELEGA MORSKEGA VOLKA *CARCHARODON CARCHARIAS* OB LIBIJSKI OBALI

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POVZETEK

*Čeprav je navzočnost belega morskega volka (*Carcharodon carcharias*) v Sredozemskem morju dobro raziskana, so srečanja s to vrsto redka, domneve o njeni prostorski in časovni razširjenosti pa temeljijo predvsem na anekdotičnih opazovanjih. Do zdaj je bil objavljen le en zapis o pojavljanju ob libijski obali, zaradi katerega ni jasno ali je pojavljanje te vrste podcenjeno ali pa gre za redko in slučajno vrsto. V tem prispevku so avtorji želeli z uporabo podatkov na osnovi ljubiteljske znanosti dokumentirati navzočnost belega morskega volka ob libijski obali. Zbrali so 6 dodatnih primerov pojavljanja te vrste med leti 2017 in 2020, ki se nanašajo na komaj skotene mladiče ter mladostne in odrasle primerke. V prispevku poudarjamo potrebo po raziskovalnem monitoringu te vrste vzdolž libijske obale, ki bi olajšala pripravo učinkovitih varstvenih načrtov za varovanje te kritično ogrožene vrste.*

Ključne besede: Elasmobranchii, hrustančnice, ohranitvena biologija, ribištvo, družbena omrežja, ogrožena vrsta

REFERENCES

Boldrocchi, G., J. Kiszka, S. Purkis, T. Storai, L. Zinzula & D. Burkholder (2017): Distribution, ecology, and status of the white shark, *Carcharodon carcharias*, in the Mediterranean Sea. Rev. Fish Biol. Fish., 27(3), 515-534.

Bradaï, M.N. & B. Saïdi (2013): On the occurrence of the great white shark (*Carcharodon carcharias*) in Tunisian coasts. Rapp. Comm. Int. Mer Médit., 40, 489.

Ben Amor, M.M., M. Bdioui, K. Ounifi-Ben Amor & C. Capapé (2020): Captures of large shark species from the northeastern Tunisian coast (Central Mediterranean). Ann. Ser. Hist. Nat., 30(1), 15-24.

Cashion, M.S., N. Bailly & D. Pauly (2019): Official catch data underrepresent shark and ray taxa caught in Mediterranean and Black Sea fisheries. Mar. Policy, 105, 1-9.

Castro, J.I. (2012): A summary of observations on the maximum size attained by the white shark, *Carcharodon carcharias*. In: Domeier, M.L. (ed.): Global Perspectives on the Biology and Life History of the White Shark. CRC Press, Boca Raton, pp. 85-90.

Compagno, L.J.V. (2001): Sharks of the world: an annotated and illustrated catalogue of shark species known to date, vol 2. Bullhead, mackerel and carpet sharks (Heterodontiformes, Lamniformes and Orectolobiformes). FAO Species Catalogue for Fishery Purposes, Rome, 269 pp.

Damalas, D. & P. Megalofonou (2012): Occurrences of large sharks in the open waters of the southeastern Mediterranean Sea. J. Nat. Hist., 46(43-44), 2701-2723.

De Maddalena, A. (2000): Historical and contemporary presence of the great white shark, *Carcharodon carcharias* (Linnaeus, 1758), in the Northern and Central Adriatic Sea. Ann. Ser. Hist. Nat., 10(1), 3-18.

De Maddalena, A. & W. Heim (2012): Mediterranean Great White Sharks: a Comprehensive Study Including All Recorded Sightings. McFarland, Jefferson, 256 pp.

De Maddalena, A. & M. Zuffa (2008): Historical and contemporary presence of the great white shark, *Carcharodon carcharias* (Linnaeus, 1758), along the Mediterranean coast of France. Boll. Mus. Civico Storia Nat. Venezia, 59, 81-94.

Ebert, D.A., S.L. Fowler & L.J.V. Compagno (2013): Sharks of the World: a Fully Illustrated Guide. Wild Nature Press, Plymouth, 528 pp.

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. & D.G. Ainley (eds.): Great White Sharks: the Biology of *Carcharodon carcharias*. Academic Press, London, pp. 321-345.

Galaz, T. & A. De Maddalena (2004): On a Great White Shark, *Carcharodon carcharias* (Linnaeus, 1758), trapped in a tuna cage off Libya, Mediterranean Sea. Ann. Ser. Hist. Nat., 14(2), 159-164.

Gardiner, M.M., L.L. Allee, P.M. Brown, J.E. Losey, H.E. Roy & R.R. Smyth (2012): Lessons from lady beetles: accuracy of monitoring data from US and UK citizen-science programs. Front. Ecol. Environ., 10(9), 471-476.

Giovos, I., V.O. Stoilas, S.A.A. Al-Mabruk, N. Doumpas, P. Marakis, M. Maximiadi, D. Moutopoulos, P. Kleitou, I. Keramidas, F. Tiralongo & A. De Maddalena (2019): Integrating local ecological knowledge, citizen science and long-term historical data for endangered species conservation: Additional records of angel sharks (Chondrichthyes: Squatinidae) in the Mediterranean Sea. Aquat. Conserv., 29(6), 881-890.

Gubili, C., R. Bilgin, E. Kalkan, S.Ü. Karhan, C.S. Jones, D.W. Sims, H. Kabasakal, A.P. Martin & L.R. Noble (2011): Antipodean white sharks on a Mediterranean walkabout? Historical dispersal leads to genetic discontinuity and an endangered anomalous population. Proc. Royal Soc. B, 278(1712), 1679-1686.

Gubili, C., C.E. Robinson, G. Cliff, S.P. Wintner, E. de Sabata, S. De Innocentiis, S. Canese, D.W. Sims, A.P. Martin, L.R. Noble & C.S. Jones (2015): DNA from historical and trophy samples provides insights into white shark population origins and genetic diversity. Endangered Species Res., 27(3), 233-241.

Jambura, P.L., I. Ćetković, J. Kriwet & J. Türtscher (2021): Using historical and citizen science data to improve knowledge about the occurrence of the elusive sandbar shark *Carcharhinus plumbeus* (Chondrichthyes – Carcharhinidae) in the Adriatic Sea. Mediterr. Mar. Sci., 22(1), 169-179.

Jeffries, E. (2019): Sharks in crisis: a call to action for the Mediterranean. World Wide Fund For Nature (WWF).

Leone, A., G.N. Puncher, F. Ferretti, E. Sperone, S. Tripepi, P. Micarelli, A. Gambarelli, M. Sarà, M. Arculeo, G. Doria & F. Garibaldi (2020): Pliocene colonization of the Mediterranean by Great White Shark inferred from fossil records, historical jaws, phylogeographic and divergence time analyses. J. Biogeogr., 47(5), 1119-1129.

Kabasakal, H. (2003): Historical and contemporary records of sharks from the Sea of Marmara, Turkey. Ann. Ser. Hist. Nat., 13(1), 1-12.

Kabasakal, H. (2014): The status of the great white shark (*Carcharodon carcharias*) in Turkey's waters. Mar. Biodivers. Rec., 7(e109), 1-8.

Kabasakal, H. (2016): Historical dispersal of the great white shark, *Carcharodon carcharias*, and bluefin tuna, *Thunnus thynnus*, in Turkish waters: decline of a predator in response to the loss of its prey. Ann. Ser. Hist. Nat., 26(2), 213-218.

Kabasakal, H. (2019): A review of shark research in Turkish waters. Ann. Ser. Hist. Nat., 29(1), 1-16.

Kabasakal, H. (2020a): Exploring a possible nursery ground of white shark (*Carcharodon carcharias*) in Edremit Bay (northeastern Aegean Sea, Turkey). J. Black Sea/Medit. Environ., 26(2), 176-189.

Kabasakal, H. (2020b): Agreement with the Monster - Lessons we learned from the Great White Shark in Turkish waters. TUDAV Turkish Marine Research Foundation, Istanbul, 74 pp.

Kabasakal, H. & M.B. Bilecenoğlu (2020): Shark infested internet: an analysis of internet-based media reports on rare and large sharks of Turkey**.** FishTaxa, 16, 8-18.

Morey, G., M. Martínez, E. Massutí & J. Moranta (2003): The occurrence of white sharks, *Carcharodon carcharias*, around the Balearic Islands (western Mediterranean Sea). Environ. Biol. Fishes, 68(4), 425-432.

Monkman, G.G., M. Kaiser & K. Hyder (2018): The ethics of using social media in fisheries research. Rev. Fish. Sci. Aquac., 26(2), 235-242.

Moro, S., G. Jona-Lasinio, B. Block, F. Micheli, G. De Leo, F. Serena, M. Bottaro, U. Scacco & F. Ferretti (2020): Abundance and distribution of the white shark in the Mediterranean Sea. Fish Fish, 21(2), 338-349.

Papaconstantinou, C. (2014): Fauna Graeciae. An updated checklist of the fishes in the Hellenic Seas, Monographs on Marine Sciences, 7, HCMR.

Randall, J.E. (1973): Size of the great white shark (*Carcharodon*). Science, 181(4095), 169-170.

Rigby, C.L., R. Barreto, J. Carlson, D. Fernando, S. Fordham, M.P. Francis, K. Herman, R.W. Jabado, K.M. Liu, C.G. Lowe, A. Marshall, N. Pacoureau, E. Romanov, R.B. Sherley & H. Winker (2019): *Carcharodon carcharias*. The IUCN Red List of Threatened Species 2019: e.T3855A2878674. https://dx.doi.org/10.2305/IUCN.UK.2019-3.RLTS.T3855A2878674.en. (Accessed 18 March 2021).

Saïdi, B., M.N. Bradaï, A. Bouain, O. Guelorget & C. Capapé (2005): Capture of a pregnant female white shark, *Carcharodon carcharias* (Lamnidae) in the Gulf of Gabes (southern Tunisia, central Mediterranean) with comments on oophagy in sharks. Cybium, 29(3), 303-307.

Soldo, A. & I. Jardas (2002): Occurrence of great white shark, *Carcharodon carcharias* (Linnaeus, 1758) and basking shark, *Cetorhinus maximus* (Gunnerus, 1758) in the Eastern Adriatic and their protection. Period. Biol., 104(2), 195-201.

Soldo, A., M.N. Bradai & R.H.L. Walls (2016): *Carcharodon carcharias*. The IUCN Red List of Threatened Species 2016: e.T3855A16527829. https://www.iucnredlist.org/species/3855/16527829. (Accessed 18 March 2021).

Spanò, N. & E. De Domenico (2017): Biodiversity in Central Mediterranean Sea. In: Fuerst-Bjelis, B. (ed.): Mediterranean Identities: Environment, Society, Culture. IntechOpen Limited, London, pp. 129-148.

Storai, T., A. Mojetta, M. Zuffa & S. Giuliani (2000): Nuove segnalazioni di *Carcharodon carcharias* (L.) nel Mediterraneo centrale. Atti Soc. Tosc. Sci. Nat. Pisa, Mem., 107, 139-142.

Tiralongo, F., C. Monaco & A. De Maddalena (2020): Report on a great white shark *Carcharodon carcharias* observed off Lampedusa, Italy. Ann. Ser. Hist. Nat., 30(2), 181-186.

Weng, K.C., J.B. O'Sullivan, C.G. Lowe, C.E. Winkler, H. Dewar & B.A. Block (2007): Movements, behavior and habitat preferences of juvenile white sharks *Carcharodon carcharias* in the eastern Pacific. Mar. Ecol. Prog. Ser., 338, 211-224.