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FIRST RECORD OF A YOUNG-OF-THE-YEAR *CARCHARODON CARCHARIAS* IN THE STRAIT OF THE DARDANELLES

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ABSTRACT

*On 8 June 2020, a young-of-the-year (YOY) white shark, *Carcharodon carcharias* (Linnaeus, 1758), measuring 155 cm total length, was incidentally gillnetted off the Kumkale coast, at the southern end of the Dardanelles. The captures of this and other specimens highlight the potential importance of the northeastern Aegean Sea as a nursery grounds for the species.*

Key words: white shark, nursery ground, young-of-the-year, Aegean Sea

PRIMA SEGNALEZIONE DI UN ESEMPLARE DI ETÀ INFERIORE A UN ANNO DI *CARCHARODON CARCHARIAS* NELLO STRETTO DEI DARDANELLI

SINTESI

*L'8 giugno 2020, uno squalo bianco di età inferiore a un anno, *Carcharodon carcharias* (Linnaeus, 1758), che misurava 155 cm di lunghezza totale, è stato accidentalmente catturato con reti da posta al largo della costa di Kumkale, all'estremità meridionale dei Dardanelli. Le catture di questo e altri esemplari evidenziano l'importanza potenziale del mar Egeo nord-orientale come area di riproduzione per la specie.*

Parole chiave: squalo bianco, area di riproduzione, giovane dell'anno, mar Egeo

INTRODUCTION

Limited information is available on the reproductive biology of the white shark, *Carcharodon carcharias* (Linnaeus, 1758) (Lamniformes: Lamnidae), because of its elusive character and long-distance movements across its global distribution ranges (Huvneers *et al.*, 2018). Due to its large size, high media profile, dramatic interactions with humans, and charismatic nature, the large white shark has long attracted remarkable public attention; however, encounters or cap-

tures of young-of-the-year (YOY) and juvenile white sharks also provide valuable data for researchers, as they may inform on the locations of parturition and nursery grounds.

Whilst *C. carcharias* is listed as globally vulnerable (Rigby *et al.*, 2019), it is categorised as critically endangered in the Mediterranean Sea (Soldo *et al.*, 2016; Otero *et al.*, 2019), highlighting that an improved knowledge of the species is required in this area. Due to the occurrence of YOY specimens, De Maddalena & Heim (2012) and, more recently,



Fig. 1: Present YOY white shark, incidentally captured off Kumkale coast, in the southern Dardanelles. (A) dorsolateral view, (B) ventral view, (C) close-up of the mouth and dentition highlighting triangular teeth, and (D) caudal view showing keels and anal fin. (Photo: E. Bayri).

Sl. 1: Primererek prvoletnega mladiča, ki je bil naključno ujet ob obali Kumkale v južnem delu dardanelske ožine. (A) dorzolateralni pogled, (B) pogled s trebušne strani, (C) bližinski posnetek ust in trikotnega zobovja in (D) pogled na repni del z očitnimi gredlji in podrepno plavutjo. (Foto: E. Bayri = skopirati iz angleškega)

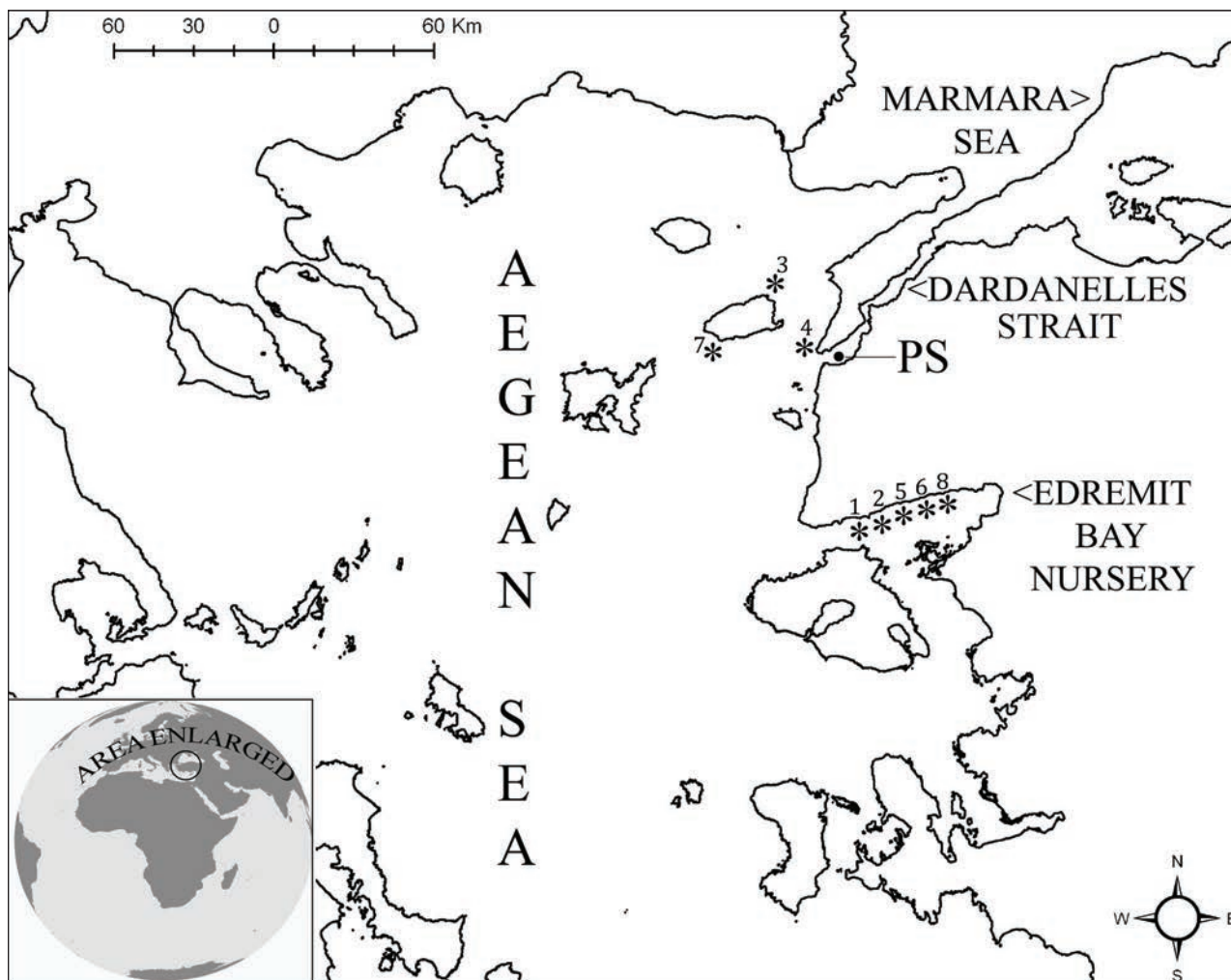


Fig. 2: Map depicting the approximate capture localities of previous specimens (*) and of the present (PS) white shark YOY. The numbers are the same as in the 'No.' column of Table 2.

Sl. 2: Zemljevid obravnavanega območja z označenimi približnimi lokacijami predhodnih primerkov (*) in obravnavanega prvoletnega primerka (PS). Številke so identične tistim iz Tabele 2.

Boldrocchi *et al.* (2017) emphasized that the Sicilian Channel could serve as a nursery ground for white shark in the central Mediterranean Sea. The incidental captures of two new-born white sharks between late spring and mid-summer 2008 in the waters of Edremit Bay (Turkey) (Kabasakal & Gedikoğlu, 2008), and the subsequent occurrences of further YOY and juveniles in the same area (Kabasakal *et al.*, 2018), suggest that the northeastern Aegean Sea could also serve as a nursery ground for *C. carcharias* in the Mediterranean.

Given that *C. carcharias* is considered critically endangered in the Mediterranean (Soldo *et al.*, 2016; Otero *et al.*, 2019), the examination and reporting of any incidentally captured specimens can provide important data, which are generally only collected on an opportunistic basis (Jessup, 2003). In the present

article, the authors report on the first record of a YOY white shark from the southern entrance to the Dardanelles (the strait connecting the Aegean Sea to the Sea of Marmara), and provide morphometric measurements as well.

MATERIAL AND METHODS

The present specimen of *C. carcharias* was incidentally caught in gill net on 8 June 2020. Morphometric measurements, following Compagno (2001), were recorded, and photographs were taken on site by the second author. Total length and other measurements were performed by means of a tape measure, with the specimen laid on the flat ground laterally and the caudal fin placed in natural position (Compagno, 2001). Species identification followed

Compagno (2001) and Ebert & Stehmann (2013). The YOY and juvenile white sharks were identified using the following length categories (Boldrocchi *et al.*, 2017): YOY ≤ 1.75 m total length (TL), and juveniles >1.75 -3.0 m TL.

RESULTS AND DISCUSSION

The present specimen of a YOY white shark (Fig. 1) was incidentally captured in a gill net off the coast of Kumkale, at the southern entrance to the Dardanelles (Fig. 2). The following descriptive characters, which were in agreement with the descriptions by Compagno (2001) and Ebert & Stehmann (2013), were observed on the examined fresh specimen, allowing the authors to identify it as *C. carcharias*: stout, spindle-shaped body with conical snout (Fig. 1a, b, c); mouth broadly rounded, large triangular teeth with serrated edges (Fig. 1b, c); origin of the first dorsal fin above the pectoral inner margin (Fig. 1a); strong keels on the caudal peduncle (Fig. 1c). Unlike in adult specimens, the apex of the first dorsal fin in the YOY specimen was more rounded (Fig. 1a), coinciding with the morphology of the smallest free-living white sharks (Santana-Morales *et al.*, 2020). The dorsal colouration was dark grey, the ventral surface white, the tips of the pectoral fins with black blotches (ventrally), and the anal fin white (Fig. 1a, c, d). No umbilical scar was observed on the belly of the examined specimen. The morphometric measurements of the examined specimen are given in Table 1.

The occurrence of new-born and YOY white sharks in the coastal waters of the northeastern Aegean Sea was documented over ten years ago (Kabasakal & Gedikoğlu, 2008), with the account providing detailed descriptions and morphometrics for new-born *C. carcharias* from Edremit Bay. Further new-born, YOY and juvenile white sharks have since been incidentally captured in this area (see Table 2 for capture details and biological information).

While all of these previous YOY specimens from the Aegean Sea were reported from outside the Dardanelles (Fig. 2), the present specimen was incidentally captured at the southern entrance to this strait that leads to the Sea of Marmara. This raises the question of whether the present YOY white shark was born in the northeastern Aegean or whether it is indicative of a link to the Sea of Marmara. Although white shark historically occurred in the Sea of Marmara (Kabasakal, 2003; Boldrocchi *et al.*, 2017), *C. carcharias* is thought to have disappeared from that area following the local depletion of bluefin tuna *Thunnus thynnus* (Linnaeus, 1758), with the last confirmed record dating from 1985 (Kabasakal, 2016). Interestingly, Boldrocchi *et al.* (2017) noted that juvenile *C. carcharias* had not been recorded from

Tab. 1: Morphometric measurements of the present young-of-the-year white shark, *C. carcharias*. The abbreviations in parentheses follow those given by Compagno (2001).

Tab. 1: Morfometrične meritve prvoletnega mladiča belega morskega volka, *C. carcharias*. Okrajšave v oklepaju so povzete po Compagno (2001).

Morphometric measurement	Value (cm)	% of TL
Total length (TL)	155	-
Fork length (FL)	133	86
Precaudal length (PCL)	121.5	78
Presecond dorsal fin length (PCL)	101.5	65
Head length (HDL)	37	24
Prebranchial length (PG1)	28	18
Interdorsal space (IDS)	34	22
Dorsal-caudal fin space (DCS)	17	11
Prespiracular length (PSP)	14	9
Preorbital length (POB)	10	6
Prepectoral fin length (PP1)	36	23
Prepelvic fin length (PP2)	80	52
Snout-ventral length (SVL)	86	55
Preanal fin length (PAL)	105	68
Ventral-caudal fin length (VCL)	46	30
Pelvic fin-anal fin space (PAS)	17	11
Anal fin-caudal fin space (ACS)	15	10
Pelvic fin-caudal fin space (PCA)	29	19
Pectoral fin-pelvic fin space (PPS)	37	24
Prenarial length (PRN)	5.8	4
Preoral length (POR)	10	6
Eye length (EYL)	2	1
Eye height (EYH)	2	1
First gill slit height (GS1)	6	4
Intergill length (ING)	12	8
Fifth gill slit height (GS5)	12	8
Pectoral fin radial length (PIR)	19	12
Pectoral fin anterior margin (PIA)	30	19
Pectoral fin length (P1L)	7	5
Pectoral fin inner margin (P1I)	24	15
Pectoral fin posterior margin (P1P)	21	14
Pectoral fin height (P1H)	26	17

Tab. 2: Capture data and relevant references of the young-of-the-year and juvenile white sharks, *C. carcharias*, caught in the previous years and of the YOY examined in the present study, in chronological order. The numbers in the 'No.' column match those marked by an asterisks (*) in Figure 2. PS: present specimen.

Tab. 2: Datumi ulova in pomembni viri prvoletnih in juvenilnih primerkov belega morskega volka, *C. carcharias*, ujetih v preteklih letih, upošteva tudi prvoletni primerek iz pričujoče raziskave, nanizani po kronološkem redosledu. Številke v prvem stolpcu se navezujejo na primerke, označene z zvezdico (*) v sliki 2. PS: pričujoči primerek.

No	Date	Locality	TL (cm)	W (kg)	Gear	References
1	1 July 2008	Altınoluk	125,5	-	Gill-net	Kabasakal and Gedikoğlu (2008)
2	4 July 2008	Altınoluk	145	-	Gill-net	Kabasakal and Gedikoğlu (2008)
3	21 February 2009	Gökçeada	180	47.5	Bottom-trawl	Kabasakal <i>et al.</i> (2009)
4	15 April 2009	Çanakkale	300	102	Purse-seine	Kabasakal <i>et al.</i> (2009)
5	6 July 2011	Altınoluk	85		Trammel-net	Kabasakal (2014)
6	2 January 2016	Altınoluk	175	-	Trammel-net	Kabasakal <i>et al.</i> (2018)
7	January 2017	Gökçeada	180	-	Trammel-net	(H. Kabasakal, pers. obs.)
8	April 2017	Altınoluk	160	-	Gill-net	(H. Kabasakal, pers. obs.)
PS	8 June 2020	Kumkale	155	-	Gill-net	Unpublished data

the Sea of Marmara either. Consequently, whilst the present record of a YOY white shark in the southern Dardanelles further supports the possibility of a nursery ground for the species in the northeastern Mediterranean, it may also be a sign that the species is beginning to recolonise its former habitat in the vicinity of the Sea of Marmara.

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PRVI ZAPIS O POJAVLJANJU PRVOLETNEGA BELEGA MORSKEGA VOLKA
(*CARCHARODON CARCHARIAS*) V DARDANELSKI OŽINI

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POVZETEK

Osmega junija 2020 je bil blizu obale Kumkale na južnem koncu dardanelske ožine naključno ujet v zabodno mrežo prvoletni mladič (YOY) belega morskega volka, Carcharodon carcharias (Linnaeus, 1758), ki je meril 155 cm v dolžino. Ulov tega in drugih primerkov te vrste potrjuje, da predstavlja severovzhodno Egejsko morje jaslice za to vrsto.

Ključne besede: beli morski volk, jaslice, prvoletni mladič, Egejsko morje.

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