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MORPHOMETRICS OF AN INCIDENTALLY CAPTURED LITTLE GULPER SHARK, *CENTROPHORUS UYATO* (SQUALIFORMES: CENTROPHORIDAE), FROM THE GULF OF ANTALYA, WITH NOTES ON ITS BIOLOGY

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ABSTRACT

On 19 May 2022, a specimen of *Centrophorus uyato* (Rafinesque, 1810) was incidentally hooked by a commercial longliner at a depth of 140 m in the Gulf of Antalya (northeastern Mediterranean Sea). It was an immature female with a total length of 663 mm and a total weight of 1,505 g. The reproductive tract was thin and threadlike. Remains of teleostean fishes (*Scomber sp.*, $n=1$; *Boops boops*, $n=1$) were found in the stomach contents. The morphometric measurements of this specimen coincided with those of *C. uyato* Clade A previously outlined.

Key words: Elasmobranchii, *Centrophorus*, Levant, bathyal

MORFOMETRIA DI UN PICCOLO CENTROFORO BOCCANERA, *CENTROPHORUS UYATO* (SQUALIFORMES: CENTROPHORIDAE), CATTURATO ACCIDENTALMENTE NEL GOLFO DI ANTALYA, CON NOTE SULLA SUA BIOLOGIA

SINTESI

Il 19 maggio 2022, un esemplare di *Centrophorus uyato* (Rafinesque, 1810) è stato accidentalmente agganciato da un peschereccio con palangari commerciali a 140 m di profondità nel Golfo di Antalya (Mediterraneo nord-orientale). Si trattava di una femmina immatura con una lunghezza totale di 663 mm e un peso totale di 1.505 g. Il tratto riproduttivo era sottile e filiforme. Nel contenuto dello stomaco sono stati trovati resti di pesci teleostei (*Scomber sp.*, $n=1$; *Boops boops*, $n=1$). Le misure morfometriche di questo esemplare coincidono con quelle del clade A di *C. uyato* precedentemente delineato.

Parole chiave: Elasmobranchii, *Centrophorus*, Levante, batiale

INTRODUCTION

The genus *Centrophorus* Müller and Henle, 1837 is comprised of small- to medium-sized (<200 cm TL) deepwater bentopelagic sharks often found along outer continental shelves and upper continental and insular slopes at depths between 50 and 2,350 m throughout the world's oceans (Ebert & Stehmann, 2013; Veríssimo et al., 2014). Although the type species of the genus was first described in the early 19th century as *Squalus granulosus* Bloch and Schneider, 1801 (Ebert & Stehmann, 2013), the validity of several *Centrophorus* species has been considered controversial for the last few decades (Veríssimo et al., 2014; White et al., 2013, 2017; Serena et al., 2020; Bellodi et al., 2022). For many years, two *Centrophorus* species (*granulosus* and *uyato*) had been reported to occur in the Mediterranean Sea (Tortonese, 1956; Compagno, 1984; McEachran & Branstetter, 1984; Serena, 2005), however, recent studies support the presence of a single *Centrophoridae* species in the Mediterranean and, following the recommendation

by White et al. (2022), *Centrophorus uyato* (Rafinesque, 1810) should be the name used for it until the taxonomical issue is resolved.

Still, any morphometric data of specimens from different geographical localities may contribute to a better description of intraspecific variation of *C. uyato*. Thus, in the present paper, the authors report the morphometric measurements of a *C. uyato* from Turkish Mediterranean waters, complete with brief biological notes on the examined specimen, and compare the percentages of TL for the present measurements with those reported in Kousteni et al. (2021), Bellodi et al. (2022) and White et al. (2022).

MATERIAL AND METHODS

On 19 May 2022, a female specimen of *Centrophorus uyato* (663 mm TL) was incidentally hooked by a commercial longliner at a depth of 140 m in the Gulf of Antalya (Fig. 1). No longer alive when hauled on deck, it was preserved on ice and sent to first author for further inspection. Species identifica-

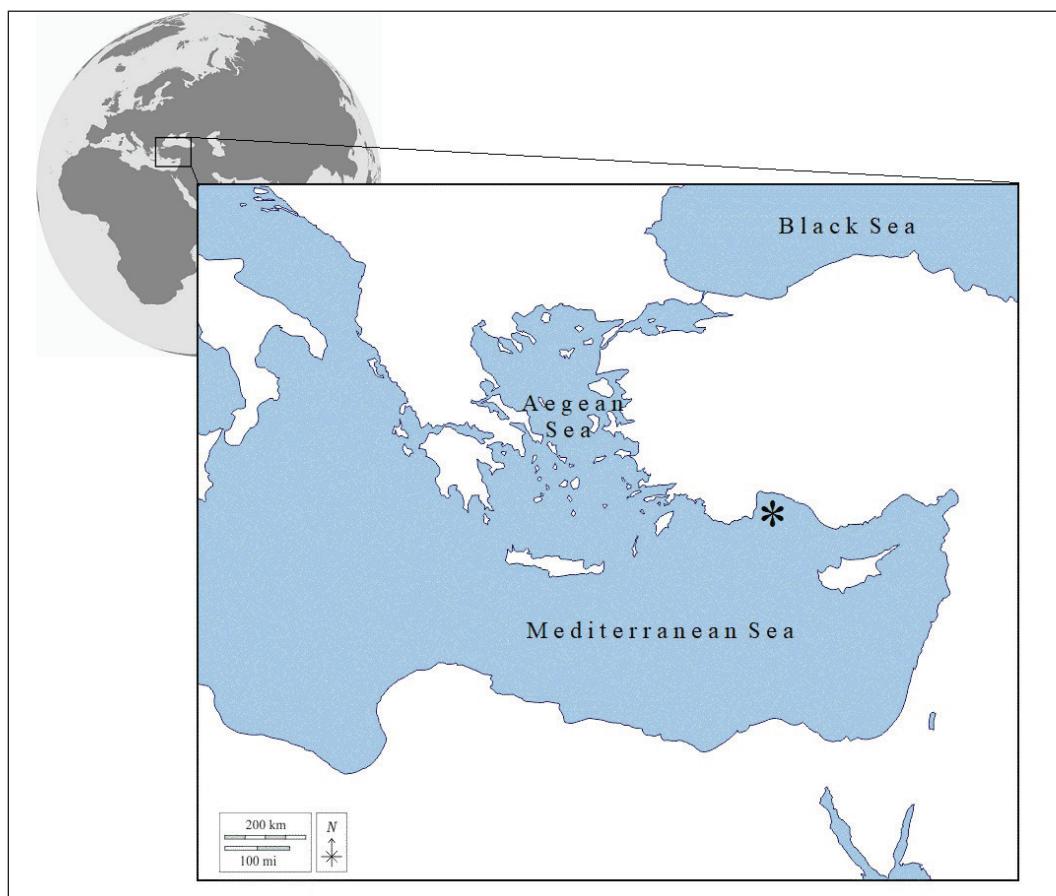


Fig. 1: Map showing the locality of capture (*) of the female *Centrophorus uyato* in the Gulf of Antalya.
Sl. 1: Zemljevid obravnavanega območja z lokaliteto ulova (*) samice vrste *Centrophorus uyato* v Antalijskem zalivu.

Tab. 1: Morphometric measurements for the present specimen of *Centrophorus uyato* in mm, and expressed as percentages of total length (TL) for the present specimen and the specimens examined by Kousteni et al. (2021), from neighbouring Cypriot waters, and specimens examined by Bellodi et al. (2022) and White et al. (2022).

Tab. 1: Morfometrične meritve primerka vrste *Centrophorus uyato* v mm, in izražene kot delež celotne dolžine (TL) v primerjavi s primerki iz bližnjih ciprskih voda, ki so jih pregledali Kousteni et al. (2021), ter primerki, ki so jih pregledali Bellodi et al. (2022) in White et al. (2022).

Measurements mm		Present Specimen (TOT = 663 mm)		Kousteni et al. (2021)		Bellodi et al. (2022)	White et al. (2022)
		mm	% of TL	% of TL sp1 (TL = 522 mm)	% of TL sp2 (TL = 483 mm)	Mean of measurements	% of TL (TL = 983 mm)
PRC	Precaudal length	505	76.17	79.5	79.11		79.3
PD2	Pre-second dorsal length	431	65.01	63.51	63.69	69.72	64.6
PD1	Pre-first dorsal length	205	30.92	32.6	32.23	32.89	28.7
PP1	Prepectoral length	146	22.02	24.05	24.47		22.1
PP2	Prepelvic length	383	57.77	58.18	60.69	62.90	57.1
PCA	Pelvic-caudal space	95.8	14.45	14.48	12.67		13.9
SVL	Snout-vent length	396	59.73	61.13	63.9		
IDS	Interdorsal space	161	24.28	20.27	20.04	31.28	23.2
DCS	Dorsal-caudal space	53.5	8.07	7.89	6.9		6.4
PPS	Pectoral-pelvic space	211	31.83	28.49	29.82		31.3
HDL	Head length	150	22.62	24.82	23.82	21.93	22.5
PGL	Prebranchial length	122.4	18.46	20.5	20.2	17.23	18.5
PSP	Prespiracular length	86.9	13.11	14.66	14.1		12.1
POB	Preorbital length	44.1	6.65	7.44	6.9		5.3
PRN	Prenarial length	21.5	3.24	4.7	4.29		3.7
POR	Preoral length	63.7	9.61	10.33	9.29		9.5
EYL	Eye length	31.6	4.77	6.3	6.54		5.3
EYH	Eye height	15	2.26	1.73	1.77		1.4
INO	Interorbital space	37.9	5.72	7.9	8.27		8.3
SPL	Spiracle length	12.3	1.86	1.27	1.07		1.2
ESL	Eye-spiracle space	17.4	2.62	2	1.55		
MOW	Mouth width	55	8.30	8.1	6.91		
ING	Intergill length	34.1	5.14	4.32	3.62		
GS1	First gill slit height	13.8	2.08	1.82	1.8		
GS2	Second gill slit height	15.7	2.37	1.93	1.97		
GS3	Third gill slit height	18.1	2.73	2.07	2.07		
GS4	Fourth gill slit height	20.1	3.03	2.21	2.36		
GS5	Fifth gill slit height	20.2	3.05	2.38	2.57		
P1A	Pectoral anterior margin	77.4	11.67	11.63	11.36		12.3
P1B	Pectoral base	45.1	6.80	5.71	5.86		5.8
P1I	Pectoral inner margin	85.1	12.84	11.71	11.95	13.57	12.3

P1P	Pectoral posterior margin	59.7	9.00	10.46	10.53		
P2A	Pelvic anterior margin	40.7	6.14	6.52	6.71		
P2L	Pelvic length	65.8	9.92	10.42	9.9		11.2
P2B	Pelvic base	23.6	3.56	4.85	4.36		5.8
P2I	Pelvic inner margin length	49	7.39	5.84	5.86		5.8
D1L	First dorsal length	119.2	17.98	17.39	16.7		19.0
D1H	First dorsal height	41.7	6.29	6.37	6.31		5.8
D1A	First dorsal anterior margin	60.8	9.17	12.15	10.28		12.6
D1B	First dorsal base	69.4	10.47	11.54	11.49		13.5
D1I	First dorsal inner margin	47.3	7.13	5.84	5.2		5.8
D1P	First dorsal posterior margin	64.7	9.76	8.68	8.31		9.3
D2L	Second dorsal length	75.4	11.37	12.36	12.69		12
D2H	Second dorsal height	32.9	4.96	3.86	4.28		4.7
D2A	Second dorsal anterior margin	45.9	6.92	9.23	9.13		8.6
D2B	Second dorsal base	42.9	6.47	8.1	8.53		8.3
D2I	Second dorsal inner margin	27.1	4.09	4.26	4.17		4.1
D2P	Second dorsal posterior margin	43.6	6.58	6.36	5.44		6.3
CDM	Dorsal caudal margin	132.5	19.98	20.44	20.62	17.88	20.1
CPV	Preventral caudal margin	76.3	11.51	12.89	11.52		11.9
CST	Subterminal caudal margin	23.3	3.51	3.1	3.23		2.9
CTR	Terminal caudal margin	51.9	7.83	5.5	5.72		

tion was performed in accordance with Veríssimo *et al.* (2014) and taxonomic nomenclature follows White *et al.* (2022). Fifty-three morphometric measurements (Compagno, 1984) were performed either with a measurement tape to the nearest 1 mm (for measurements >10 cm) or with a vernier caliper to the nearest 0.05 mm (for measurements <10 cm). Although 53 measurements were recorded on the present specimen, only eight of them, which are typed bold in Table 1, were used to describe the present specimen or compared with the published morphometric data (Kousteni *et al.*, 2021; Bellodi *et al.*, 2022; White *et al.*, 2022). Total length (TL) is the distance between the tip of the snout and tip of the upper caudal lobe, where the upper caudal lobe is in depressed position (Compagno, 1984). Total, eviscerated and liver weights (TW, EW and HW) were weighed with an electronic hand balance to the nearest 1-gram precision. Stomach contents were identified to the lowest possible taxonomical level. Since the specimen could not be formalin-fixed and preserved, the upper and lower jaws were excised and preserved in the archive of the first author as

local proof of specimen. The maturity stage of the specimen was evaluated following the FAO guidelines on the maturity stages of Mediterranean fishery resources (Follesa & Carbonara, 2019). The present study was supported by the WWF Turkey Wildlife Program within the scope of Cartilaginous Fish (Chondrichthyes) Data Generation project.

RESULTS AND DISCUSSION

Description of the present female little gulper shark (TL = 663 mm): a typical squaliform shark with spines in front of dorsal fins. No anal fin. Pelvic insertion to lower caudal origin (PCA) is 14.45% of TL. Tip of snout to anterior edge of eye distance (POB) is 0.29 of head length (HDL). Height of first dorsal fin (D1H) is 6.29% of TL. First dorsal base (D1B) is 10.47% of TL. First dorsal fin moderately high and short, second dorsal moderately large, nearly as high as first; length of second dorsal base (D2B) is 0.61 of first dorsal base (D1B). Free rear tips of pectoral fins formed into narrow, angular and elongated lobes that reach well beyond the

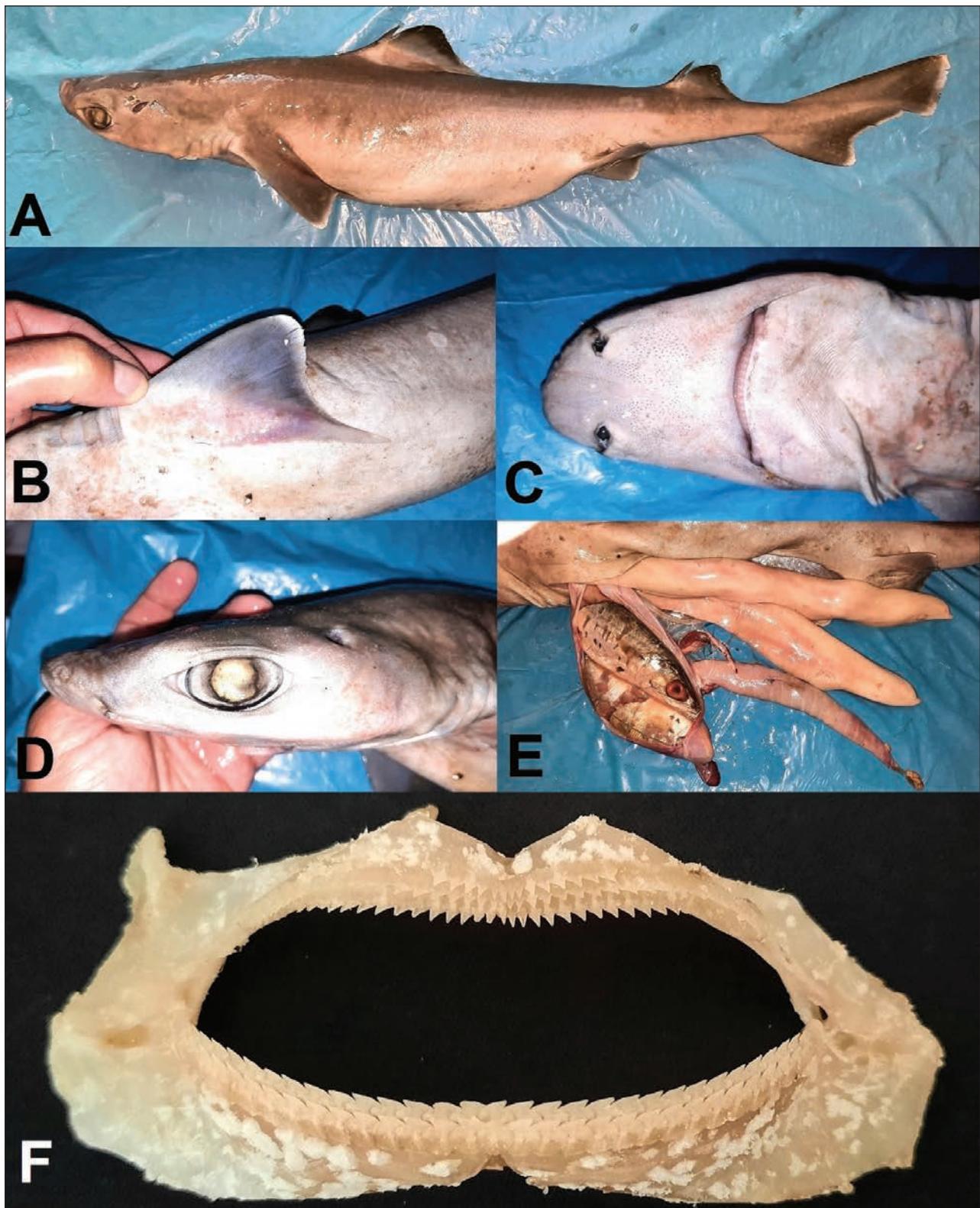


Fig. 2: Examined specimen of *Centrophorus uyato*: (a) lateral view, (b) pectoral fin in ventral view, (c) mouth and snout, (d) eye and spiracle from left, (e) stomach contents, spiral valve and bilobed liver, and (f) upper and lower jaws.
Sl. 2: Pregledan primerek vrste *Centrophorus uyato*: (a) pogled s strani, (b) prsna plavut s trebušne strani, (c) usta in gobec, (d) oko in spirakel z leve, (e) vsebina želodca, zavitnica in dvokrpa jetra, ter (f) zgornja in spodnja čeljust.

level of first dorsal spine. Caudal fin with a strongly notched posterior margin. Bladelike unicuspids teeth in upper and lower jaws, lower teeth much larger than the upper; tooth counts for upper and lower jaws are 21–21 and 16–16, respectively. Coloration is brownish-grey dorsally and lighter in the same colour ventrally; wide blackish-dark bands on posterior margins of dorsal fins; pectoral, pelvic and caudal fins with conspicuous white margins. The diagnostic features of the examined specimen are depicted in Figure 2. Morphometric measurements are presented in Table 1. TW, EW and HW of the present specimen are 1505, 1045 and 255 grams, respectively.

Reproductive tract was thin and threadlike. *Centrophorus uyato* is an ovoviparous shark and females mature at a length between 75 and 89 cm (Serena, 2005). The condition of the reproductive organs and size (663 mm TL) of the present specimen confirm that it was an immature female (maturity stage 1) (Follesa & Carbonara, 2019). Remains of teleostean fishes (*Scomber* sp., n=1; *Boops boops*, n=1) were found in the stomach contents; total mass of stomach contents was 132 grams (Fig. 2). According to Compagno (1984), major food items of *C. uyato* are bony fishes and squid.

Veríssimo et al. (2014) reported that in *C. uyato*, PCA is <16% of TL and POB is ≤ 0.33 of HDL, which equals 14.45% and 0.29, respectively, in the examined specimen. According to McEachran and Branstetter (1984), in *C. uyato* D1H is 6.5% of TL and D1B 11% of TL, which equals 6.29% of TL and 10.47% of TL, respectively, in the examined specimen. Finally, D2B was reported to be about $\frac{3}{4}$ or 0.75 of D1B, which equals 0.61 in the examined little gulper shark. Since the observed morphometric measurements were very close to or coincided with those reported in the literature, the present specimen was identified as *C. uyato*. The slight differences observed between the ratios in the present specimen and those reported in the taxonomic literature may be due to intraspecific or intraregional variation. Kousteni et al. (2021) reported morphometric data of two females captured in Cypriot waters identified and genetically confirmed as *C. uyato*. According to Kousteni et al. (2021), the POB to HDL ratios of the two females (483 and 522 mm TL, respectively) varied between 0.28 and 0.29. Moreover, the PCA to TL percentage ratios in these Cypriot specimens were 12.67% (483 mm TL) and 14.48% (522 mm TL). The ratios for the present specimen coincide with or are within the ranges of those reported for specimens from neighbouring Cypriot waters (Tab. 1).

For the Mediterranean Sea, Veríssimo et al. (2014) retain the globally distributed species historically referred to as *Centrophorus granulosus* or *C. uyato* in Clade A, under the name of *C. cf. uyato*, until nomenclatural confusion associated with this clade is resolved. In addition to above-mentioned POB/HDL and PCA/TL ratios, Veríssimo et al. (2014) propose further ratios for Clade A as follows: PN/POR < 0.45, D1H/D2H > 1.0 and P1A/P1I < 1.14. In the present specimen PN/POR, D1H/D2H and P1A/P1I were 0.33 (<0.45), 1.26 (>1.0) and 0.9 (<1.14), respectively. In terms of these further ratios, the morphometric measurements of the examined specimen coincide with those reported by Veríssimo et al. (2014); however, the morphological classification of Clade A is based on the measurement of mere 19 specimens, while for more precise mean values of these ratios that could distinguish the northeastern Mediterranean population of *C. cf. uyato*, further specimens would be necessary. In a recent assessment of Mediterranean *Centrophorus*, Bellodi et al. (2022) reported that morphometric results supporting the presence of a unique and distinct morphological group and indicating the occurrence of a single species in the region, are ascribable to *C. cf. uyato*. Finally, White et al. (2022) concluded that to preserve nomenclatural stability within the genus, the name *Centrophorus uyato* should be retained for this species and a neotype from close to the original type locality off Italy should be designated.

Geographically distant (allopatric) populations of the same fish species tend to exhibit morphometric characters at the opposite margins of the value ranges (Cailliet et al., 1986). Although slight differences have been observed between the present morphometrics and those reported in Bellodi et al. (2022) and White et al. (2022), these variations can be considered admissible in view of the mentioned situation.

In conclusion, morphometric measurements reported for a single specimen from the Gulf of Antalya can contribute to providing a more accurate description of *Centrophorus uyato*, a squaliform shark with remarkable intraspecific variation, and to filling the gap in the data on the northeastern Mediterranean population of this species.

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MORFOMETRIJA NAKLJUČNO UJETEGA GLOBINSKEGA TRNEŽA,
CENTROPHORUS UYATO (SQUALIFORMES: CENTROPHORIDAE),
IZ ANTALIJSKEGA ZALIVA Z ZAPISKI O NJEGOVI BIOLOGIJI

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POVZETEK

Devetnjstega maja 2022 se je na parangal naključno ujel primerek globinskega trneža, *Centrophorus uyato* (Rafinesque, 1810), na globini 140 m v Antalijskem zalivu (severovzhodno Sredozemsko morje). Bila je nedorasla samica, ki je merila 663 mm v dolžino in tehtala 1,505 g. Razmnoževalni trakt je bil tanek in nitaste oblike. Avtorji so v želodcu našli ostanka dveh primerkov plena in sicer skuše (*Scomber sp.*) in bukve (*Boops boops*). Morfometrične meritve so se ujemale s tistimi od predhodno odkritega klada *C. uyato* Clade A.

Ključne besede: Elasmobranchii, *Centrophorus*, Levant, batijal

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