

# ANNALES

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## NOTES ON A NEWBORN KITEFIN SHARK, *DALATIAS LICHA*: NEW EVIDENCE ON THE NURSERY OF A RARE DEEP-SEA SHARK IN NORTHEASTERN LEVANT (TURKEY)

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### ABSTRACT

On 2 April 2022, a kitefin shark, *Dalatias licha* (Bonnaterre, 1788), was incidentally captured by a commercial bottom trawler off Taşucu coast (northeastern Levant), over a mixed mud-sand bottom and at a depth of nearly 550 m. It measured 373 mm in total length and 190 g in undressed weight. The healing birthmark, which was visible on the ventral surface between the pectoral fins, revealed that it was a newborn kitefin shark. Published data suggests that the area may serve as a nursery ground for 15 shark species, including *D. licha*, and the present record of newborn kitefin shark in the region supports this suggestion.

**Key words:** *Dalatias*, kitefin shark, pups, vulnerable, conservation

## NOTE SU UN NEONATO DI SQUALO ZIGRINO, *DALATIAS LICHA*: NUOVE PROVE SULLA NURSERY DI UNO SQUALO RARO DI ACQUE PROFONDE NEL LEVANTE NORD-ORIENTALE (TURCHIA)

### SINTESI

Il 2 aprile 2022, uno squalo zigrino, *Dalatias licha* (Bonnaterre, 1788), è stato catturato accidentalmente da un peschereccio commerciale a strascico al largo della costa di Taşucu (Levante nord-orientale), su un fondale misto fango-sabbia, a una profondità di circa 550 m. Misurava 373 mm di lunghezza totale e 190 g di peso. La voglia visibile sulla superficie ventrale tra le pinne pettorali, ha rivelato che si trattava di uno squalo zigrino neonato. I dati pubblicati suggeriscono che l'area può servire da nursery per 15 specie di squali, tra cui *D. licha*, e il presente ritrovamento di squalo zigrino neonato nella regione supporta questa ipotesi.

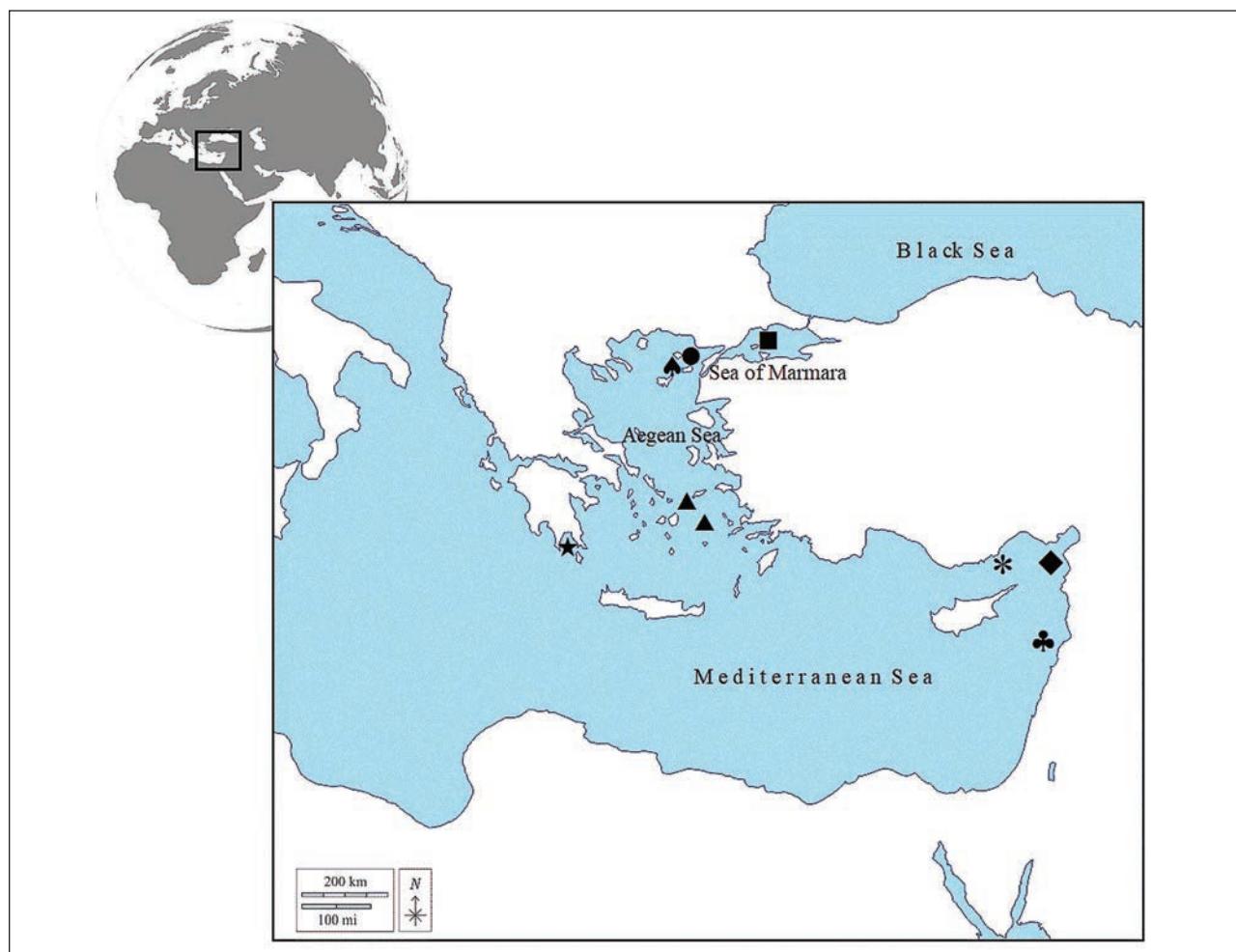
**Parole chiave:** *Dalatias*, squalo zigrino, neonati, vulnerabile, conservazione

## INTRODUCTION

The identification and mapping of nursery grounds and other essential fish habitats of exploited stocks is a key requirement for the development of spatial conservation planning aimed at reducing the adverse impact of fishing on exploited populations and ecosystems (Colloca *et al.*, 2015). Castro (1993) defined nursery areas, or simply nurseries, as geographically discrete parts of a species' range where gravid females deliver their young or deposit their eggs and where

the young spend their first weeks, months, or years. Since the nurseries of viviparous sharks can be detected by the presence of gravid females, neonates and small juveniles in a given marine area (Castro, 1993), observations of newborn or young-of-the-year (YOY) individuals bearing birthmarks are reliable indications of a possible nursery ground located nearby.

The kitefin shark, *Dalatias licha* (Bonnaterre, 1788), is a sporadically distributed deep-water shark of the outer continental shelf and insular shelves and slopes, found in depths between 37 to at least 1800 m,



**Fig. 1: Approximate locations of capture of *Dalatias licha* specimens reported from the eastern Mediterranean Sea:** (\*) free-swimming newborn reported in this study; (▲) subadult female kitefin shark reported by Golani (1986); (■) newborn kitefin shark reported by Meriç (1995); (●) newborn kitefin sharks ( $n=3$ ) reported by Kabasakal & Kabasakal (2002); (▲) specimens ( $n=5$ ) reported by Gönülal (2016); (◆) adult female kitefin shark reported by Ergüden *et al.* (2017); (★) subadult female reported by Chatzispyrou *et al.* (2018); and (▲) kitefin sharks ( $n=2$ ) reported by Spyridopoulou *et al.* (2020).

**Sl. 1: Približne lokalitete ulova primerkov vrste *Dalatias licha* v vzhodnem Sredozemskem morju:** (\*) prosto plavajoči primerek mladiča iz pričujoče raziskave; (▲) subadultna samica, o kateri je poročal Golani (1986); (■) komaj skotenji primerek, o katerem je poročal Meriç (1995); (●) komaj skotenji primerki ( $n=3$ ), o katerih sta poročala Kabasakal & Kabasakal (2002); (▲) primerki ( $n=5$ ), o katerih je poročal Gönülal (2016); (◆) odrasla samica, o kateri so poročali Ergüden *et al.* (2017); (★) subadultna samica, o kateri je poročal Chatzispyrou *et al.* (2018); in (▲) primerka ( $n=2$ ), o katerih poročajo Spyridopoulou *et al.* (2020).

but most commonly below 200 m (Ebert & Stehmann, 2013). Its distribution range extends from the Atlantic Ocean to the entire Mediterranean Sea, the central and western Pacific, and the Indian Ocean (Serena, 2005; Ebert & Stehmann, 2013). While we know that *D. licha* is a yolk-sac viviparous shark, the information on its reproductive cycle or age at maturity is limited (Ebert & Stehmann, 2013). Recently, Ergüden *et al.* (2022) reported on the capture of an adult female (1180 mm TOT) by a commercial trawler at a depth of 40 m in the northeastern Levant. Although, Ergüden *et al.* (2022) assumed there was a nursery ground of *D. licha* in the region, the presence of gravid females bearing term embryos alone is not indication enough of a nursery area (Castro, 1993); instead, the occurrence of neonates is required as well. In the present article, authors report on the occurrence of a newborn kitefin shark in the bathyal zone of northeastern Levant, and provide further evidence supporting the possibility of a nursery of *D. licha* in the region. The authors also provide morphometric measurements and biological notes of the examined kitefin shark to contribute to the knowledge of *D. licha* populations in the eastern Mediterranean.

## MATERIAL AND METHODS

The examined kitefin shark was incidentally captured on 2 April 2022 by a commercial bottom trawler towing over a mixed sand-mud bottom, at the depth of nearly 550 m, off Taşucu coast (northeastern Levant; Fig. 1). One of the authors of this paper checked whether the animal was alive in order to release it immediately back to the sea in the event it was. Unfortunately, the animal showed no signs of life, thus it was frozen on board for long-term storage and ultimately delivered to the laboratory for further inspection. Following the procedure of Compagno (1984), the total length (TOT) and 46 morphometric measurements were recorded to the nearest 0.05 mm using a vernier caliper. TOT is the distance between the tip of the snout and the tip of the upper caudal lobe, where the caudal fin was depressed to body axis (Compagno, 1984). Morphometric measurements are expressed as percentages of TOT in Table 1. The total weight, where internal organs were not eviscerated, and liver mass were weighed to the nearest gram by means of a precision spring balance (PESOLA Precision scales, Switzerland). Stomach and spiral valve were examined under a binocular dissecting microscope for any remains of food, such as cephalopod beaks or teleostean otoliths. The eviscerated body of the examined kitefin shark was preserved in a 5-percent formalin solution neutralised with borax, and stored in the personal collection of the first author. The present study was supported by the WWF Turkey Wildlife Programme within the scope of the Cartilaginous Fish (Chondrichthyes) Data Generation project.

## RESULTS AND DISCUSSION

The female kitefin shark, *Dalatias licha*, which was identified based on the descriptions of Compagno (1984) and Ebert & Stehmann (2013), is depicted in Fig. 2a. The healing birthmark, observed on the ventral surface between the pectoral fins (Fig. 2b), revealed that it was a newborn kitefin shark. The specimen measured 373 mm in TOT; its undressed weight was 190 g, liver weight 30 g (Fig. 2c). Digested remains of a teleost fish were found in the stomach contents; however, due to the level of digestion, it could not be identified at species or genera level.

Data on the size at birth of *Dalatias licha* from different parts of the Mediterranean Sea and the Atlantic Ocean are available in the literature. According to Capapé *et al.* (2008), the size of the smallest free-swimming specimens, caught off the Maghreb coast (south-western Mediterranean), were between 320 and 390 mm TOT, their weight between 256 and 300 g. The TOT of the present newborn kitefin shark (373 mm) coincided with the TOT range given by Capapé *et al.* (2008); however, the weight of the present specimen was clearly lower than that of the smallest free-swimming kitefin shark (320 mm TOT) caught in Maghrebin waters. Kabasakal & Kabasakal (2002) reported the size range of the smallest free-swimming kitefin sharks with birthmarks to be between 338 and 372.5 mm in TOT, with the largest specimen being of similar size to the one in the present study. An unhealed and prominently open umbilical scar was observed on a free-swimming newborn kitefin shark caught in south Atlantic waters (Soto & Mincarone, 2001) and matching the size range of newborn kitefin sharks from the Mediterranean Sea (Kabasakal & Kabasakal, 2002; Capapé *et al.*, 2008; present study). Finally, size of the only kitefin shark that has been reported from the Sea of Marmara to date (345 mm TOT; Meriç, 1995), also matched the TOT range of smallest free-swimming specimens of *D. licha*. The Marmara specimen was captured in commercial trammel-net fishery on the northern slope at a depth of 270 m, on 5 July 1991 (Meriç, 1995).

In the Mediterranean Sea, the depths of capture of newborn specimens of *Dalatias licha* ranged between 200 and 600 m (Kabasakal & Kabasakal, 2002; Capapé *et al.*, 2008; present study); however, the newborn kitefin shark reported by Soto & Mincarone (2001) was collected alive near the surface, and authors interpreted this finding as the expansion of the bathymetrical range of the species from a few meters to 1800 m of depth. The mentioned depths of capture of newborn kitefin sharks in the Mediterranean and in south Atlantic waters raised the question whether gravid females give birth in very shallow waters and then the newborns migrate to deep bathyal grounds or whether encountering a newborn specimen of *D. licha* near the surface was just an unexplainable coincidence.

**Tab. 1: Morphometric measurements of kitefin shark *Dalatias licha* carried out in the present study, and previous studies in the Mediterranean Sea.****Tab. 1: Morfometrične meritve na primerku klinoplavutega morskega psa iz pričujoče raziskave in iz prejšnjih raziskav v Sredozemskem morju.**

Measurements (mm)	Present Study		Golani (1986)		Soto & Mincarone (2001)		Kabasakal & Kabasakal (2002)		Ergüden <i>et al.</i> (2017)		Chatzispyrou <i>et al.</i> (2018)	
		% of TOT		% of TOT		% of TOT		% of mean TOT		% of TOT		% of TOT
<b>Total Length (TOT)</b>	373		932		344		338-372.5		1180		990	
<b>Snout tip to</b>												
Outer nostrils	4.15	1.11				2		1.15		2.03		
Eye	11.65	3.12				4.1		3.11		4.06		
Spiracle	35.65	9.56				9.6		9.24		9.59		
Mouth	24.5	6.57				6.1		5.48		6.1		
1 <sup>st</sup> gill opening	65.2	17.48				17.2		16.16		17.15		
3 <sup>rd</sup> gill opening	75.65	20.28						18.72				
5 <sup>th</sup> gill opening	81.85	21.94		20.9		21.2		20.58				21.21
Pectoral origin	82	21.98				21.8		20.69		21.8		
Pelvic origin	200.95	53.87		58.5		54.1		52.73		54.06		62.63
Cloaca	220.5	59.12						57.16				
1 <sup>st</sup> dorsal origin	129.3	34.66		36.8		35.5		34.11		35.46		56.57
2 <sup>nd</sup> dorsal origin	223.15	59.83		62.3		59.9		58.08		59.88		69.7
Dorsal caudal origin	280.1	75.09				75		74.32		75		80.81
Ventral caudal origin	270.05	72.40						71.23				
<b>Distance between bases</b>												
1 <sup>st</sup> and 2 <sup>nd</sup> dorsal fins	78.9	21.15				21.2		20.09		21.22		
2 <sup>nd</sup> and caudal fins	33.25	8.91				10.5		10.67		10.46		
Pectoral and pelvic fins	111.1	29.79				29.1		27.88		29.08		
<b>Nostrils: distance</b>												
Between inner corners	10.65	2.86				2.9		3.34		2.9		
<b>Mouth</b>												
Width	30.4	8.15				7.3		7.42		5.32		
<b>Gill opening lengths</b>												
1 <sup>st</sup>	4.3	1.15				1.5		1.43		1.45		
3 <sup>rd</sup>	5	1.34				1.5		1.34		1.54		
5 <sup>th</sup>	7.15	1.92				1.7		1.69		1.74		
Spiracle: maximum width	7.65	2.05				0.9		1.58		0.87		
<b>Eye</b>												
Horizontal diameter	15.8	4.24				3.5		3.96		3.48		
Vertical diameter	7.2	1.93				1.7		1.97		1.74		
Interorbital width	21.2	5.68				6.1		6.18				
<b>1<sup>st</sup> dorsal fin</b>												
Overall length	36.65	9.83				9.3		9.65		9.3		
Length base	16.7	4.48				4.1		3.99				
Length posterior margin	12.55	3.36				3.5		4.01				
Height	19.15	5.13				4.1		4.05				
<b>2<sup>nd</sup> dorsal fin</b>												
Overall length	38.3	10.27				10.2		10.55		9.3		
Length base	21.7	5.82				5.5		5.97				
Length posterior margin	15.1	4.05				4.9		4.82				
Height	16.7	4.48				4.7		4.94				
<b>Pectoral fin</b>												
Length base	16.05	4.30				4.4		4.65				
Length anterior margin	48.25	12.94				12.2		12.23		14.24		
Length distal margin	13.15	3.53						5.56				
Length posterior margin	22.95	6.15				6.1		6.37				
<b>Pelvic fin</b>												
Overall length	49.6	13.30				11		11.65		11.04		
Length base	28.55	7.65				6.4		7.07				
Length anterior margin	33	8.85				8.4		8.24				
Length clasper	---	---				3.8		4.17				
<b>Caudal fin</b>												
Length dorsal lobe	92.2	24.72				25.9		24.43				
Length ventral lobe	42.95	11.51				12.5		11.5				
Dorsal tip to notch	17.1	4.58				5.5		6.01				
Depth notch	15.55	4.17				4.1		4.22				
<b>Trunk at pectoral origin</b>												
Height	40.65	10.9				10.8		9.59		10.75		
Total weight (g)	190											

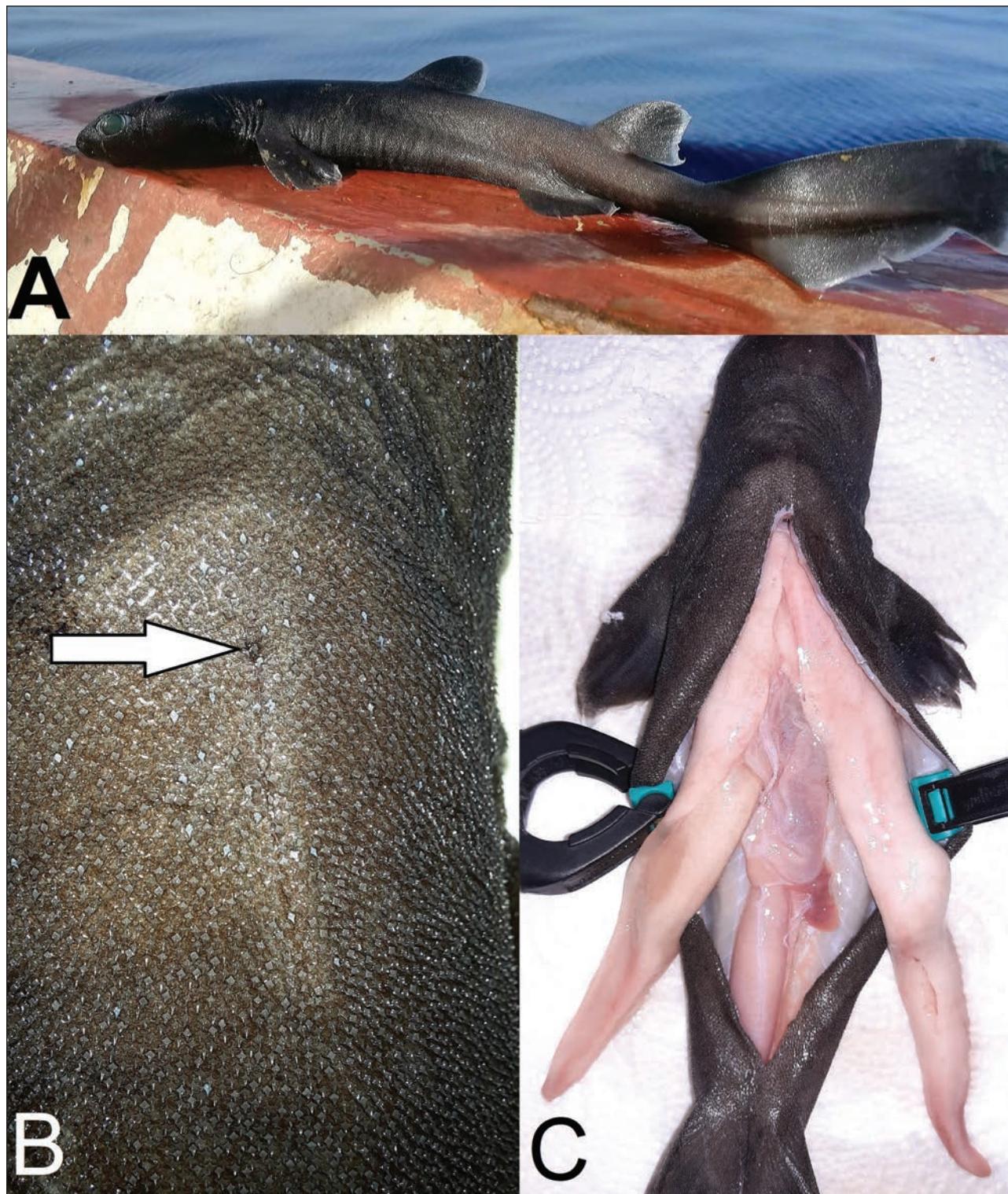


Fig. 2: (a) Lateral view of the newborn kitefin shark, *Dalatias licha*, captured off Taşucu coast, NE Levant; (b) arrow pointing to the healing birthmark on the ventral surface of examined newborn specimen, between the pectoral fins; and (c) internal examination of specimen showing bi-lobed liver and stomach.

Sl. 2: Pogled s strani na komaj skotenega mladiča klinoplavutega morskega psa, *Dalatias licha*, ujetega ob obali Taşucu, SV Levant; (b) puščica označuje poporodno brazgotino na trebušni strani skotenega primerka med prsnimi plavutmi; in (c) notranji pregled primerka z vidnimi dvokrpastimi jetri in želodcem.

Morphometric measurements of the examined kitefin shark, accompanied by previously published morphometric data on *Dalatias licha*, are presented in Table 1. Minor differences were observed between the results of the present study and published morphometrics of *D. licha*, which were statistically insignificant (Table 1; t-test,  $p>0.10$ ). Although the morphometric ratios of any fish can run between certain minimum and maximum extremes, the condition of the specimen (fresh, preserved, or decomposing in case of stranded specimens), the measurement tool (e.g., an ordinary measurement tape or a vernier caliper) and experience of the measurer etc., can also affect the accuracy of morphometric measurements (Takács *et al.*, 2016).

In the majority of the literature, *Dalatias licha* is considered a rare or data-limited shark (e.g., Capapé *et al.*, 2008; Ergüden *et al.*, 2017; Chatzispyrou *et al.*, 2018; Spyridopoulou *et al.*, 2020). Furthermore, in a recent review of species diversity, taxonomy and distribution of chondrichthytes in the Mediterranean Sea, Serena *et al.* (2020) stated that *D. licha* is not an abundant shark species in any region of its distribution range in the Mediterranean Sea. Serena *et al.* (2020) emphasised that kitefin shark is more frequent in the western basin. However, in two very comprehensive surveys investigating the distribution and abundance of demersal cartilaginous fish in the Mediterranean it was noted that the species is more abundant than expected throughout the investigated region (Baino *et al.*, 2001; Sion *et al.*, 2004). In a MEDITS survey, frequency of occurrence of *D. licha* was 2 percent, with kitefin sharks recorded in 152 out of 6336 bottom trawl hauls (Baino *et al.*, 2001). During a DESEAS survey carried out in three areas of the Mediterranean Sea (Balearic Sea, western and eastern Ionian Sea), *D. licha* specimens were caught in all three areas in the 800–1200 m depth strata (Sion *et al.*, 2004). Moreover, Sion *et al.* (2004) reported that abundance of *D. licha* decreased with depth. Ragonese *et al.* (2013) analysed the data gathered in scientific bottom trawl surveys carried out off the southern coasts of Sicily from 1994 to 2009, and concluded that *D. licha* was common, mainly on the

slope. Survey data also indicated an exclusive bathyal presence (376–783 m) for *D. licha* throughout the area of investigation, with a preference for central and eastern grounds and deeper waters (550–783 m) (Ragonese *et al.*, 2013). Last but not least, based on the results of a deep-sea (500–1000 m) long-line survey conducted off the Island of Gökçeada (NE Aegean Sea), Gönülal (2016) stated that *D. licha* is a “frequent” deep-sea shark in the region.

As seen in the map (Fig. 1), the capture localities of free-swimming newborns of *D. licha* in the eastern Mediterranean are widely scattered, suggesting the possibility of multiple nurseries in the region. From the perspective of conservation, the possibility of multiple nurseries of *D. licha* in the eastern Mediterranean could raise the chance of survival and the continuity of the generations; however, this advantageous situation could also pose new challenges in areas where commercial demersal fishery overlaps with those nurseries, as is the case with nurseries of many demersal fishes in the Mediterranean (Colloca *et al.*, 2015). Based on the data reported by Meriç (1995) and Kabasakal & Kabasakal (2002), the suggested nurseries of *D. licha* in the northern Aegean Sea and in the northern slope of the Sea of Marmara (Fig. 1) are overlapped with the fishing zones of commercial trawlers, gill- and trammel-netters, and long-liners. According to Ergüden *et al.* (2022), the Bays of İskenderun and Mersin, which are also important commercial bottom trawling grounds, may serve as nursery grounds of 15 species of sharks, including *D. licha*, and the present record of newborn kitefin shark in the region provides supporting data for this suggestion. *D. licha* is a “vulnerable” shark (Finucci *et al.*, 2018; Serena *et al.*, 2020), and effective conservation of these nursery grounds should also be included among any fishery management measures to be implemented in the vicinity of these areas.

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ZAPIS O NAJDBI SKOTENEGA KLINOPLAVUTEGA MORSKEGA PSA, *DALATIAS LICHA*:  
NOVI DOKAZ O JASLICAH REDKEGA GLOBOKOMORSKEGA MORSKEGA PSA V  
SEVEROVZHODNEM LEVANTU (TURČIJA)

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POVZETEK

Dvaindvajsetega aprila 2022 so v bližini obale Tašcu (severovzhodni Levant) na mešanem peščenem muljastem dnu na globini 550 m v pridneno kočo naključno ujeli primerek klinoplavutega morskega psa, *Dalatias licha* (Bonnaterre, 1788). Meril je 373 mm v dolžino in očiščen (brez kože) tehtal 190 g. Na podlagi poporodne brazgotine na trebušni strani med prsnimi plavutmi se je izkazalo, da gre za pred kratkim skotenega mladiča klinoplavutega morskega psa. Avtorji na podlagi objavljenih podatkov domnevajo, da bi lahko bilo območje severovzhodnega Levanta vzrejno območje (jaslice) za najmanj 15 vrst morskih psov, vključno s klinoplavutim morskim psom, kar potrjuje tudi pričajoča najdba komaj skotenega mladiča.

**Ključne besede:** *Dalatias*, klinoplavuti morski pes, mladič, ranljiva vrsta, varovanje

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