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ADDITIONAL RECORDS OF RARE SHARKS FROM NORTHERN TUNISIA (CENTRAL MEDITERRANEAN SEA)

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ABSTRACT

*Routine investigative monitoring conducted along the northern Tunisian coast allowed us to collect some specimens of large predatory sharks, such as the great white shark, *Carcharodon carcharias* (Linnaeus, 1758), the shortfin mako *Isurus oxyrinchus Rafinesque, 1810*, and the common thresher shark *Alopias vulpinus* (Bonnaterre, 1788). These captures indicate that these sharks occur in the Mediterranean Sea, however, further records are needed before declaring that viable populations may still be established in the region. On the other hand, the captured specimen of smoothback angelshark *Squatina oculata Bonaparte, 1840* could probably be considered as one of the last ones recorded to date in the Mediterranean Sea. The status of the species remains undetermined between extinct and critically endangered.*

Key words: Large predatory sharks, distribution, status, central Mediterranean, endangered species

NUOVI RITROVAMENTI DI SQUALI RARI NELLE ACQUE DELLA TUNISIA SETTENTRIONALE (MEDITERRANEO CENTRALE)

SINTESI

*Il monitoraggio investigativo di routine condotto lungo la costa tunisina settentrionale ci ha permesso di raccogliere alcuni esemplari di grandi squali predatori, come il grande squalo bianco, *Carcharodon carcharias* (Linnaeus, 1758), il mako *Isurus oxyrinchus Rafinesque, 1810*, e lo squalo volpe *Alopias vulpinus* (Bonnaterre, 1788). Queste catture indicano che tali squali sono presenti nel mare Mediterraneo; sono tuttavia necessari ulteriori ritrovamenti al fine di asserire che nella regione possano essersi stabilite popolazioni vitali. D'altra parte, l'esemplare catturato di squalo angelo *Squatina oculata Bonaparte, 1840*, potrebbe venir considerato come uno degli ultimi ritrovamenti nel mare Mediterraneo. Lo stato della specie rimane indeterminato, tra estinto e in pericolo critico.*

Parole chiave: grandi squali predatori, distribuzione, stato, Mediterraneo centrale, specie in via di estinzione

INTRODUCTION

Studies carried out during the last two decades showed migrations of elasmobranch species towards northern areas, including brackish lagoons (Méjri *et al.*, 2004; El Kamel *et al.*, 2009, 2010; Rafrafi-Nouira *et al.*, 2015). The species identified among these were the blackchin guitarfish *Glaucostegus cemiculus* (E. Geoffroy Saint Hilaire, 1817), the spiny butterfly ray *Gymnura altavela* (Linnaeus, 1758), and the sandbar shark *Carcharhinus plumbeus* (Nardo, 1827). Several large specimens of the latter were recorded (Rafrafi-Nouira *et al.*, 2015; Soufi-Kechaou *et al.*, 2018; Capapé *et al.*, 2018a). Since the capture included male and female adults, it suggested that a viable population was established in an area where the species was formerly unknown (Capapé, 1989).

Additionally, these studies enabled the finding of species considered to be highly threatened, such as the sharpnose sevengill shark *Heptranchias perlo* (Bonnaterre, 1788), a deep-sea species recorded in the Eskerkis Bank (El Kamel-Moutalibi *et al.*, 2014), which migrated southward to lower than usual depths (Capapé *et al.*, 2018b), and a critically endangered species, the Maltese skate *Leucoraja melitensis* (Clark, 1926), which is the latest specimen recorded to date (Ben Amor *et al.*, 2018).

In this paper, we report additional and unusual records of rare species from northern Tunisian waters, among them the smoothback angelshark *Squatina oculata* Bonaparte, 1840, which is affected by drastic population decline.

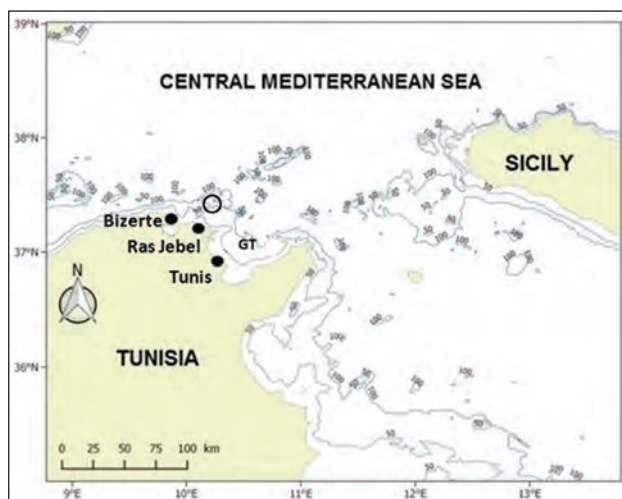


Fig. 1: Map of the northern coast of Tunisia indicating (circle) the capture sites of the elasmobranch species presented in the paper.

Sl. 1: Zemljevid severno tunizijske obale z označenimi (krogec) lokalitetami ulova vrst, ki jih avtorji obravnavajo v prispevku.

MATERIAL AND METHODS

The four studied species reported in the present article were caught in marine waters of northern Tunisia and directly landed at the fishing sites of Bizerte and Ras Jebel (Fig. 1), where they were examined, measured for total length (TL) and weighed for total body weight (TBW). They were identified *in situ* using field guides, such as Whitehead *et al.* (1984), Louisy (2002) and Quéro *et al.* (2003), then delivered to the laboratory for confirmation and a thorough scientific analysis. Some specimens were measured to the nearest mm (including the percentage of total length), and the total body mass was weighed to the nearest gram following Compagno (1984a) for sharks, and Capapé & Roux (1980) for *Squatina oculata*. For each specimen, all available data related to their capture were given, including fishing gear, depth, type of bottom and, wherever possible, associated ichthyofauna. After being carefully measured and analysed, each specimen was fixed in 10% buffered formaldehyde, preserved in ethanol and deposited in the Ichthyological Collection of the Institut Supérieur de Pêche et d'Aquaculture de Bizerte, where it was assigned a catalogue number.

RESULTS

Great white shark, *Carcharodon carcharias* (Linnaeus, 1758)

Carcharodon carcharias is a large shark with worldwide distribution, inhabiting temperate waters especially, but known to penetrate tropical marine areas, too. Its occurrence is well documented in the entire Mediterranean Sea (De Maddalena & Heim, 2012). However, most of these records occurred in the central Mediterranean, especially in the Strait of Sicily, where several juvenile and adult specimens were recorded. Some authors consider this area a nursery ground for the species (Saïdi *et al.*, 2005; Maliet *et al.*, 2013; Bradaï & Saïdi, 2013). Historical and contemporary occurrences of *C. carcharias* in eastern Mediterranean are also well documented (Kabasakal, 2014, 2016). Based on the recent captures of newborn, young-of-the-year and juvenile specimens, a possible nursery ground for the great white shark in the Aegean Sea was also suggested (Kabasakal & Gedikoğlu, 2008; Kabasakal *et al.*, 2018).

C. carcharias is known off the Tunisian coast, and Bradaï & Saïdi (2013) noted that 59 reliable captures had been reported in the region between 1953 and 2012, with most captures (56%) occurring in the Gulf of Gabès, which was considered as a probable nursery area for the species. On 12 April 2015, a male measuring 1.8 m approximately was caught by longline in the waters surrounding the Cani Rocks (37°25'35.90" N and 10°08'43.28" E), at a depth of approximately 100 m, on rocky bottom. More recently, on 26 December 2018, a female was captured by a benthic trawl at the same



Fig. 2: Snout of *Carcharodon carcharias* (Ref. ISPB-Car-carch-01), scale bar = 200 mm.

Sl. 2: Gobec velikega belega morskega volka (Ref. ISPB-Car-carch-01), merilo = 200 mm.

depth on sandy-muddy bottom (37° 25' 50.08" N and 10°02' 50. 96 E). It reached 2.80 m in total length and weighed 400 kg. As soon as it was landed on deck, the specimen was cut into slices to be sold, but it was still identified as a great white shark by experienced fishermen. Only the head of the specimen was preserved, which was more conical, sharper and pointier than it usually appears in this species. It was also slightly curved, but since no injuries or scars were observed in this atypical formation (Fig. 2), this could be considered an abnormality that had not been recorded before in any shark species. The teeth of both upper and lower jaws were huge, triangular, bladelike and serrated, confirming the identification made by the fishermen. The head was deposited in the ichthyological collection of the Institut Supérieur de Pêche et d'Aquaculture de Bizerte (Tunisia) under catalogue number ISPB-Car-carch -01.

In addition, on 11 April 2019, a second female of *C. carcharias* was captured by a bottom trawler in the very same area, measuring 2 m in TL and weighing 250 kg according to the information given by fishermen. It was sold immediately, but the fishermen provided us with a photograph, based on which we could confirm the identification of the species (Fig. 3).

Shortfin mako *Isurus oxyrinchus* Rafinesque, 1810

Isurus oxyrinchus is a pelagic, coastal and oceanic shark that can be found in tropical and temperate waters worldwide ranging from the surface to depths of



Fig. 3: The *Carcharodon carcharias* specimen captured on 11 April 2019, scale bar = 200 mm.

Sl. 3: Primerek velikega belega morskega volka, ujet 11. aprila 2019, merilo = 200 mm.

400 m. It is well known in the eastern Atlantic and throughout the Mediterranean Sea (Quéro, 1984). The species was first recorded in the northern Tunisian area

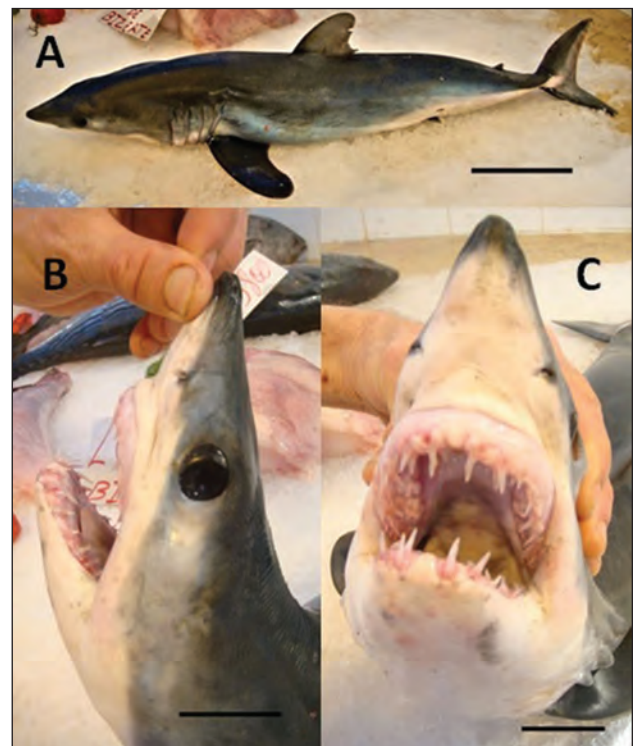


Fig. 4: *Isurus oxyrinchus* (Ref. FSB-Isu-oxy-01). A. General morphology, scale bar: 150 mm. B. Snout lateral view, scale bar = 40 mm. Snout ventral view, scale bar = 30 mm.

Sl. 4: *Isurus oxyrinchus* (Ref. FSB-Isu-oxy-01). A. Morfologija, merilo: 150 mm. B. stranski pogled na gobec, merilo = 40 mm. Pogled na gobec od spodaj, merilo = 30 mm.

Tab. 1: Morphometric measurements (mm and %TL) of the specimen of *Isurus oxyrinchus* (Ref. FSB-Isu-oxy-01).
Tab. 1: Morfometrične meritve (mm in %TL) primerka vrste *Isurus oxyrinchus* (Ref. FSB-Isu-oxy-01).

| Reference | FSB-Isu-oxy-01 | |
|---------------------------------|----------------|------|
| Sex | Female | |
| Morphometric measurements | mm | % TL |
| Total length (TL) | 880 | 100 |
| Head length | 270 | 30.7 |
| Prebranchial length | 190 | 21.6 |
| Preorale length | 60 | 6.8 |
| Prenasal length | 45 | 5.1 |
| Intergill length | 80 | 9.1 |
| Eye with | 22 | 2.5 |
| Eye height | 18 | 2.0 |
| Internasal length | 4 | 0.5 |
| Mouth width | 85 | 9.7 |
| Distance between snout 1st gill | 210 | 23.9 |
| Precaudal length | 670 | 76.1 |
| Pelvic fin length | 45 | 5.1 |
| Pelvic height | 45 | 5.1 |
| Pelvic inner margin | 20 | 2.3 |
| Pelvic anterior margin | 30 | 3.4 |
| Pelvic posterior margin | 30 | 3.4 |
| First dorsal height | 55 | 6.3 |
| First dorsal base | 75 | 8.5 |
| First dorsal inner margin | 25 | 2.8 |
| First dorsal posterior margin | 43 | 4.9 |
| First dorsal anterior margin | 80 | 9.1 |
| Second dorsal height | 13 | 1.5 |
| Second dorsal base | 15 | 1.7 |
| Second dorsal inner margin | 10 | 1.1 |
| Second dorsal posterior margin | 10 | 1.1 |
| Second dorsal anterior margin | 23 | 2.6 |
| Pectoral inner margin | 35 | 4.0 |
| Pectoral anterior margin | 160 | 18.2 |
| Pectoral posterior margin | 90 | 10.2 |
| Pectoral fin length | 50 | 5.7 |
| Total body mass (g) | 4200 | |

by Vinciguerra (1884). The shortfin shark is sporadically captured throughout the Tunisian coast. (Capapé, 1989; Bradaï *et al.*, 2002). Additionally, Capapé (1980)

noted that *I. oxyrinchus* is caught off the northern Cape Bon Peninsula in spring and early summer, and following Bradaï *et al.* (2002), it rarely occurs in southern regions.

Recently, investigations conducted in the same study area have allowed us to record the capture of several mako specimens. On 15 May 2015 and 7 July 2015, two males were caught by longline at a depth of approximately 150 m. They measured 1300 mm and 800 mm and weighed 24 kg and 4.2 kg, respectively. Several other specimens were collected during June 2018 by bottom trawlers according to the information provided by fishermen. The smallest specimen was delivered to our laboratory for examination and measurements (Fig. 4, Tab. 1).

All specimens were identified as *Isurus oxyrinchus* based on the combination of the following characters: body fusiform, snout very pointed; first dorsal with apex acutely pointed, pectoral fins shorter than head fins and falcate, origin of anal fin below the middle of second dorsal fin base, teeth very slender, alike in both jaws. Such description is in total accordance with Cadenat & Blache (1981), Compagno (1984b) and Quérou (1984). *Isurus oxyrinchus*' congeneric species, the longfin mako *I. paucus* Guitart Manday, 1966, occurs off the Algerian coast (Hemida & Capapé, 2008). It differs from *I. oxyrinchus* in pectoral fins being as long as the head, anal fin originating below the posterior end of the second dorsal fin base, and teeth widening towards the base.

The smallest specimen was deposited in the Ichthyological Collection of the Faculté des Sciences de Bizerte (Tunisia) under catalogue number FSB-Isu-oxy-01 (see Tab. 1). All these captures suggest that the species is not extinct in this area and that the presence of a viable population remains a hypothesis that cannot be totally ruled out.

Common thresher shark *Alopias vulpinus* (Bonnaterre, 1788)

Alopias vulpinus is a large global coastal and pelagic shark occurring in depths up to 650 m (Compagno, 1984b). The species is present in the entire Mediterranean, but commoner in the western basin (Capapé, 1989). The species seems to be rather abundant off the Algerian coast, where it is caught as target or bycatch in pelagic and coastal commercial and small-scale longline, purse seine and gillnet fisheries. It is locally used for human consumption, especially the meat and fins, despite the fact that international regulations prohibit retention. Observations were carried out from 1999 to 2002 in the great fish market of Algiers, where all captures occurring throughout the Algerian coast are landed. A total of 194 specimens were examined. Conversely, recent observations carried out in the area and information provided by fishermen indicated a drastic decline of captures of the species (Hemida *et al.*, *in press*).

Quignard & Capapé (1971) noted that *A. vulpinus* occurs throughout the Tunisian coast, but more

Tab. 2: Morphometric measurements (mm and %TL) of the specimen of *Alopias vulpinus* (Ref. ISPB-Alo-vul-01).
Tab. 2: Morfometrične meritve (mm in %TL) primerka vrste *Alopias vulpinus* (Ref. ISPB-Alo-vul-01).

| Reference | ISPB- Alo-vul-01 | |
|--------------------------------|------------------|--------|
| Sex | Male | |
| Morphometric measurements | mm | % TL |
| Total length (TL) | 3775 | 100.00 |
| Precaudal length | 1840 | 48.74 |
| Pre first dorsal length | 830 | 21.99 |
| Pre first dorsal length | 160 | 4.24 |
| Pre pectoral length | 530 | 14.04 |
| Head length | 580 | 15.36 |
| Prebranchial length | 430 | 11.39 |
| Preorale length | 120 | 3.18 |
| Pre-pelvic length | 1350 | 35.76 |
| Distance between | 210 | 5.56 |
| Eye with | 35 | 0.93 |
| Eye height | 50 | 1.32 |
| Mouth width | 170 | 4.50 |
| Pectoral fin length | 335 | 8.87 |
| Pectoral inner margin | 480 | 12.72 |
| Pectoral anterior margin | 605 | 16.03 |
| Pectoral posterior margin | 200 | 5.30 |
| Anal fin length | 30 | 0.79 |
| First dorsal posterior margin | 290 | 7.68 |
| First dorsal base | 230 | 6.09 |
| First dorsal inner margin | 260 | 6.89 |
| First dorsal anterior margin | 345 | 9.14 |
| Second dorsal height | 30 | 0.79 |
| Second dorsal base | 35 | 0.93 |
| Second dorsal inner margin | 20 | 0.53 |
| Second dorsal anterior margin | 40 | 1.06 |
| Second dorsal posterior margin | 220 | 5.83 |
| Tail anterior margin | 1935 | 51.26 |
| Total body mass (kg) | 120 | |

frequently in northern areas. However, Bradaï *et al.* (2002) reported the capture of 3 specimens in the Gulf of Gabès in the south. Routine monitoring of elasmobranch species in the area of Bizerte-Ras Jebel offered us the opportunity to collect 4 specimens: on 14 May 2015, two specimens were captured measuring 4 m and 3.8 m, and weighing 130 kg and 120 kg, respec-

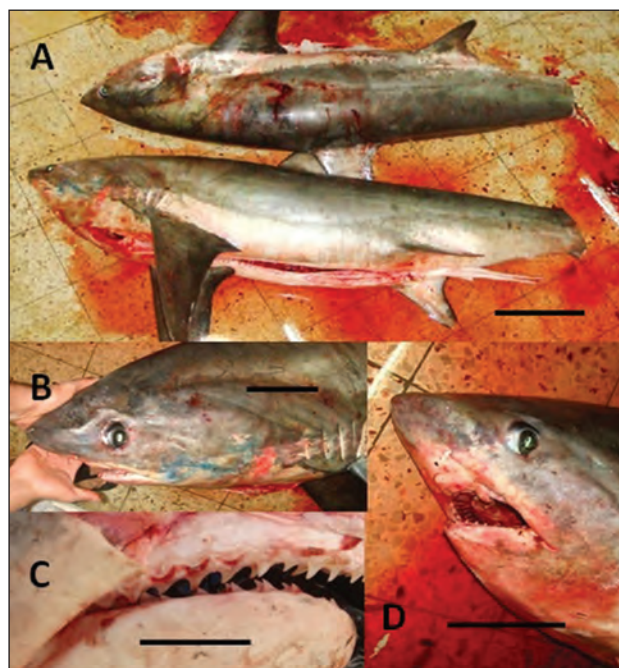


Fig. 5: *Alopias vulpinus* (Ref. ISPB-Alo-vul-01). A. General morphology without tail, scale bar = 300 mm. B. Head, lateral view, scale bar = 100 mm. C. Jaws, lateral view, scale bar = 30 mm. D. Snout, lateral view, scale bar = 200 mm.

Sl. 5: *Alopias vulpinus* (Ref. ISPB-Alo-vul-01). A. Morfologija morskega psa brez repa, merilo = 300 mm. B. Glava s strani, merilo = 100 mm. C. čeljusti s strani, merilo = 30 mm. D. Gobec s strani, merilo = 200 mm.

tively. Morphometric measurements were recorded for the smallest *A. vulpinus* and summarized in Table 2, its head was recovered and deposited in the Institut Supérieur de Pêche et d'Aquaculture de Bizerte (Tunisia), under catalogue number ISPB-Alo-vul-01 (Fig. 5). On 5 December 2018, a third specimen measuring 3.0 m in TL and weighing 80 kg was captured. A fourth specimen was captured on 4 April 2019 measuring 4.0 m and weighing 150 kg.

The four specimens were captured by longlines at a depth of approximately 100 m, on muddy-sandy bottoms. They were identified as *A. vulpinus* following the main characters: short snout, eyes rather small and not reaching the dorsal surface of the head, first dorsal fin closer to pectoral than pelvic fins. A related thresher shark, *A. superciliosus*, differs from *A. vulpinus* in having larger eyes, which reach the dorsal surface of the head, and the first dorsal closer to pelvic than pectoral fins (Quéro *et al.*, 2003). It is the first time that so many specimens were captured in such a short time, though according to fishermen such captures are rather common in the area, which may indicate a viable population inhabiting the area.

Smoothback angelshark *Squatina oculata* Bonaparte, 1840

Squatina oculata is known in the eastern Atlantic, south of the Strait of Gibraltar, from Morocco (Lloris & Rucabado, 1998) to Angola (Capapé *et al.*, 2002). The species is rather abundant off the coast of Senegal, where it plays an important role in craft fishery. There the sharks are exploited for their fins, meat and the oil extracted from their livers for therapeutic purposes (Capapé *et al.*, 2002).

Roux (1984) wrongly noted that *S. oculata* is only present in the western Mediterranean Basin, however, the species is indeed unknown off the Mediterranean coast of France (Capapé *et al.*, 2000). Tortonese (1956) noted its occurrence in Italian waters, and Zava *et al.* (2016) collected 4 juvenile specimens from the Strait of Sicily. Ergüden *et al.* (2019) found a female *S. oculata* in Turkish waters and eastwards the species is also recorded in the Levant Basin (Golani, 2005).

S. oculata used to be caught quite abundantly off the Tunisian coast, especially in northern areas. The captured specimens were used to provide information about the species' reproductive biology (Capapé *et al.*, 1991). Additionally, Bradaï *et al.* (2002) noted the

captures of some specimens southwards, in the Gulf of Gabès. Later, 4 adult specimens, 2 males and 2 females, were caught in the study area, their average total length was 1020 mm (Mnasri, 2008). On 26 December 2018, a female was captured in our study area, reaching 1300 mm in TL and weighing 5 kg. It was recorded based on a photograph taken by a fisherman (Fig. 6), which was helpful in identifying the specimen as *S. oculata* owing to the lack of the median line of spines, the hind tips of pelvic fins not reaching the level of first dorsal fins, and the specimen displaying a greyish colour with white spots on dorsal surface and dark bars on tail. This was probably one of the latest Mediterranean specimens found to date and confirmed the scarcity of the species in this sea. Similarly, its closely related congeneric species *S. squatina* (Linnaeus, 1758) has also been subjected to fishing pressure and has, following Giusto & Ragonese (2014), almost disappeared not only from Sicilian waters, but other areas as well.

DISCUSSION

Previous and new discoveries of the mentioned elasmobranch species suggest that the northern Tunisian



Fig. 6: Smoothback angelshark *Squatina oculata*, general morphology, scale bar = 200 mm.

Sl. 6: Pegasti sklat *Squatina oculata*, morfologija, merilo = 200 mm.

coast could be a hotspot for large sharks. Such phenomenon could be explained by the geographical location of the Tunisian waters in the central Mediterranean Sea, an inevitable passageway between western and eastern basins at a halfway between Atlantic and sub-tropical marine influences. Additionally, the richness of marine biodiversity sustains the hypothesis of nursery areas, especially for viviparous species, which look for the best environmental conditions before laying their litters in the wild (Rafrafi-Nouira, 2016). Biological richness minimizes the pressure of inter- and intraspecific competition for food between sharks considered as top predators (Stergiou & Karpouzi, 2002).

On the other hand, the warming of the Mediterranean waters encourages the occurrence of species in areas where they were previously unknown or rare. The best instance of this phenomenon is *Carcharhinus plumbeus*, abundantly captured in the Gulf of Gabès and at present in northern areas as well (Capapé *et al.*, 2018a). Captures of *C. plumbeus* are equally numerous off the Algerian coast (Hemida *et al.*, 2002), the sharks probably migrating along Maghreb shores from west to east. Similar patterns could also be taken into consideration in relation to the recent abundance of *Isurus oxyrinchus* and *Alopias vulpinus* off the northern Tunisian coast. Information provided by experienced fishermen

indicates that both species are regularly captured there.

Since large sharks are locally targeted due to their high economical value, they are not discarded at sea after the capture. They are landed at fishing sites, where they are immediately sold, despite recommendations from Tunisian authorities. Thus, it appears that large sharks have not disappeared from Tunisian waters completely, therefore the opinion of Ferretti *et al.* (2008) about the loss of large sharks in the area is partially contrasted. However, due to their K-selected characteristics (Camhi *et al.*, 1998), most elasmobranch species are considered to be threatened. Still, the actual relative abundance of large sharks captured from the northern Tunisian coast shows their populations have not experienced a drastic decline in this area.

The captures of few *S. oculata* along the northern Tunisian coast remain questionable. Were they occasional or is a viable population of this species still present? For fishermen, captures of squatinid species are considered a rather amazing event. Recent findings of *S. oculata* (Mnasri 2008; Zava *et al.*, 2016; Ergüden *et al.*, 2019; this study) suggest that the species is critically endangered, following Morey (2019), yet not extirpated. In any case, further records are needed before it is possible to confirm or refute the presence of a viable population of this species in the central Mediterranean.

DODATNI ZAPISI O POJAVLJANJU REDKIH MORSKIH PSOV IZ SEVERNE TUNIZIJE (OSREDNJE SREDOZEMSKO MORJE)

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POVZETEK

Na podlagi rutinskega monitoringa vzdolž severne tunizijske obale so bili pridobljeni podatki o primerkih nekih večjih plenilskih vrst kot so beli morski volk, *Carcharodon carcharias* (Linnaeus, 1758), atlantski mako *Isurus oxyrinchus Rafinesque, 1810*, in navadna morska lisica *Alopias vulpinus (Bonnaterre, 1788)*. Ti ulovi kažejo, da se ti morski psi še vedno pojavljajo v Sredozemskem morju, vendar so za oceno prisotnosti viabilne populacije na raziskanem predelu potrebni še dodatni podatki. Ujeti primerek pegastega sklata *Squatina oculata Bonaparte, 1840* pa je verjetno eden izmed zadnjih primerkov te vrste v Sredozemskem morju. Status te vrste je tako še vedno nejasen, saj ni jasno ali je vrsta kritično ogrožena ali morda izumrla.

Ključne besede: veliki plenilski morski psi, razširjenost, status, osrednje Sredozemsko morje, ogrožene vrste

REFERENCES

- Ben Amor, M.M., K. Ounifi-Ben Amor & C. Capapé (2018):** Record of a critically endangered skate, *Leucoraja melitensis* (Chondrichthyes: Rajidae) from Tunisian coast (central Mediterranean). *Thalassia sal.*, 40, 9-16.
- 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.
- Bradaï M.N., B. Saïdi., M. Ghorbel, A. Bouaïn, O. Guélorget & C. Capapé (2002):** Observations sur les requins du golfe de Gabès (Tunisie méridionale, Méditerranée centrale). *Mésogée*, 60, 61-77.
- Cadenat, J. & J. Blache (1981):** Requins de Méditerranée et d'Atlantique (plus particulièrement de la côte occidentale d'Afrique). *Faune trop.*, ORSTOM, 21, 1-330.
- Camhi, M., S.L. Fowler, J.A. Musick, A. Bräutigam & S.V. Fordham (1998):** Sharks and their Relatives – Ecology and Conservation. IUCN/SSC Shark Specialist Group. IUCN, Gland, Switzerland and Cambridge, UK. iv + 39 pp.
- Capapé, C. (1980):** Etude morphologique des ptérygopodes de *Isurus oxyrinchus* Rafinesque, 1810 (Pisces, Lamnidae). *Bull. Off. natn Pêch.*, Tunisie, 42 (2), 231-264.
- Capapé, C. (1989):** Les Sélaciens des côtes méditerranéennes: aspects généraux de leur écologie et exemples de peuplements. *Océanis*, 15 (3), 309-331.
- Capapé, C., J.A. Tomasini. & J.-P. Quignard (2000):** Les Elasmobranches Pleurotrèmes de la côte du Languedoc (France méridionale, Méditerranée septentrionale). Observations biologiques et démographiques. *Vie Milieu*, 50 (2), 123-133.
- Capapé, C., A.A. Seck., A. Gueye-Ndiaye, Y. Diatta & M. Diop (2002):** Reproductive biology of the smooth-back angelshark, *Squatina oculata* (Elasmobranchii: Squatinidae), from the coast of Senegal (eastern tropical Atlantic). *J. Mar. Biol. Ass. U. K.*, 82(4), 635-640.
- Capapé, C., S. Rafrafi-Nouira, K. Ounifi-Ben Amor & M.M. Ben Amor (2018a):** Additional records of sandbar shark, *Carcharhinus plumbeus* (Chondrichthyes: Carcharhinidae) from the northern Tunisian coast (central Mediterranean Sea). *Annales, Ser. Hist. Nat.*, 28(2), 99-104.
- Capapé C., S. Rafrafi-Nouira, K. Ounifi-Ben Amor K., & M.M. Ben Amor (2018b):** Unusual and substantiated records of *Heptranchias perlo* (Chondrichthyes: Hexanchidae) in the N-E Tunisian waters (central Mediterranean Sea). *Thalassia sal.*, 40, 17-24.
- Capapé, C. & C. Roux (1980):** Etude anatomique des ptérygiopodes des Squatinidae (Pisces, Pleurotremata) des côtes tunisiennes. *Bull. Mus. natn Hist. nat.*, Paris, 4 ème série, 2ème sectionA, 4, 1161-1180.
- Compagno, L.J.V. (1984a):** FAO Species Catalogue, vol. 4, Sharks of the World. An Annotated and Illustrated Catalogue of Shark Species known to Date. FAO Fisheries Synopsis, 125, vol. 4, part 1 (non carcharhinoids): viii+1–250 pp.
- Compagno, L.J.V. (1984b):** FAO Species Catalogue, vol. 4, Sharks of the World. An Annotated and Illustrated Catalogue of Shark Species known to Date. FAO Fisheries Synopsis, 125, vol. 4, part 2 (non carcharhinoids), x +251-655.
- De Maddalena A. & W. Heim (2012):** Mediterranean Great white shark. A comprehensive study including all recorded sightings. McFarland and Co editors, Jefferson, London., 254 pp.
- El Kamel, O., N. Mnasri, J. Ben Souissi, M. Boumaïza, M.M. Ben Amor & C. Capapé (2009):** Inventory of elasmobranch species caught in the Lagoon of Bizerte (north-eastern Tunisia, central Mediterranean). *Pan-Amer. J. Aquat. Sci.*, 4(4), 383-412.
- El Kamel, O., N. Mnasri, M. Boumaïza, M.M. Ben Amor, C. Reynaud & C. Capapé (2010):** Additional records of the bull ray *Pteromylaeus bovinus* (Chondrichthyes: Myliobatidae), in the Lagoon of Bizerte (northern Tunisia, central Mediterranean). *Annales, Ser. Hist. Nat.*, 20 (2), 169-174.
- El Kamel-Moutalibi, O., N. Mnasri-Sioudi, S. Rafrafi-Nouira., M. Boumaïza, C. Reynaud & C. Capapé (2014):** Additional records of a rare elasmobranch species, sharpnose seven-gill shark *Heptranchias perlo* (Hexanchidae) off the northern Tunisian coast (central Mediterranean). *Annales, Ser. Hist. Nat.*, 24(2), 99-106.
- Ergüden, D., D. Ayas, M. Gürlek, S. Karan & C. Turan (2019):** First documented smooth angelshark, *Squatina oculata* Bonaparte, 1840. *Cah. Biol. Mar.*, 60(2), 189-194.
- Ferretti, F., R.A. Myers, F. Serena & H.K. Lotze (2008):** Loss of large predatory sharks from the Mediterranean Sea. *Conserv. Biol.*, 22(4), 952-964.
- Giusto, J.B. & S. Ragonese (2014):** Finding of the almost disappeared angel shark (*Squatina squatina* Linnaeus, 1758) (Chondrichthyes Squatinidae), off the south coasts of Sicily (Mediterranean Sea). *Nat. Sicil.*, 37(1), 113-114.
- Golani, D. (2005):** Check-list of the Mediterranean Fishes of Israel. *Zootaxa*, 2005(947), 1-200.
- Hemida, F., R. Seridji, N. Labidi, J. Bensaci & C. Capapé (2002):** New data on *Carcharhinus* spp (Chondrichthyes: Carcharhinidae) from off the Algerian coast (southern Mediterranean). *Acta. Adriat.*, 43 (2), 83-93.
- Hemida F. & C. Capapé (2008):** On the occurrence of the longfin shark, *Isurus paucus* (Chondrichthyes: Isuridae) off the Algerian coast (Southwestern Mediterranean). *Acta Adriat.*, 49(2), 185-189.
- Hemida, F., J. Bensaci & C. Capapé (in press):** Occurrence of common thresher shark *Alopias vulpinus* (Chondrichthyes: Alopiidae) from the Algerian coast (southwestern Mediterranean Sea). *Rapp Comm. inter. Explor. Sci. Mer Médit.*

- Kabasakal, H. (2014):** The status of the great white shark (*Carcharodon carcharias*) in Turkey's waters. Marine Biodiversity Records. doi:10.1017/S1755267214000980; Vol. 7; e109.
- 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. Annales, Ser. Hist. Nat., 26, 213-220.
- Kabasakal, H. & S.Ö. Gedikoğlu (2008):** Two newborn great white sharks, *Carcharodon carcharias* (Linnaeus, 1758) (Lamniformes; Lamnidae) from Turkish waters of the northern Aegean Sea. Acta Adriat., 49, 125-135.
- Kabasakal, H., E. Bayrı & E. Ataç (2018):** Recent records of the great white shark, *Carcharodon carcharias* (Linnaeus, 1758) (Chondrichthyes: Lamnidae), in Turkish waters (Eastern Mediterranean). Annales, Ser. Hist. Nat., 28(2), 93-98.
- Lloris, D. & J. Rucabado (1998):** Guide FAO d'identification des espèces pour les besoins de la pêche. Guide d'identification des ressources marines vivantes pour le Maroc. FAO, Rome, 263 pp.
- Louisy, P. (2002):** Guide d'identification des poissons marins Europe et Méditerranée. Paris, Ulmer édition, Paris, 430 pp.
- Maliet, V., C. Reynaud & C. Capapé (2013):** Occurrence of white shark, *Carcharodon carcharias* (Elasmobranchii: Lamniformes: Carchariidae) off Corsica (northern Mediterranean): historical and contemporary records. Acta Ichthyol. Piscat., 43(4), 323-326.
- Mejri, H., J. Ben Souissi, J. Zaouali, A. El Abed, Y. Vergne, O. Guélorget & C. Capapé (2004):** On the recent occurrence of elasmobranch species in a perimediterranean lagoon: the Tunis Southern Lagoon (Northern Tunisia). Annales, Ser. Hist. Nat., 14(2), 143-158.
- Mnasri, N. (2008):** Les élasmobranches de la Tunisie septentrionale : Biodiversité et méthode d'approche de la production débarquée. Ph. Dissertation, Faculté des Sciences de Bizerte, Université de Carthage (Tunisia), 125 pp.
- Morey, G., J. Barker, A. Bartolí, C. Gordon, A. Hood, E.K.M. Meyers, & R. Pollom (2019):** *Squatina oculata*. The IUCN Red List of Threatened Species 2019: e.T61418A116782036. Downloaded on 10 April 2019.
- Quéro, J. C. (1984):** Lamnidae. In: P.J.P. Whitehead, M.L. Bauchot, J.C. Hureau, J. Nielsen & Tortonese. E. (Editors), pp. 83-88. Fishes of the North-western Atlantic and the Mediterranean, Vol I, UNESCO, Paris.
- Quéro, J.C., P. Porché & J.J. Vayne (2003):** Guide des poissons de l'Atlantique européen. Les Guides du naturaliste. Delachaux & Niestlé: Lonay (Switzerland)-Paris, 465p.
- Quignard, J.P. & C. Capapé (1971):** Liste commentée des Sélaciens de Tunisie. Bull. Inst. natn. sci. tech. Océanogr. Pêche, Salammbô, 2 (2), 131-141.
- Rafrafi-Nouira, S., O. El Kamel-Moutalibi, C. Reynaud, M. Boumaïza & C. Capapé (2015):** Additional and unusual captures of elasmobranch species from the northern coast of Tunisia (central Mediterranean). J. Ichthyol., 55 (6), 337-345.
- Rafrafi-Nouira, S. (2016):** Catalogue raisonné des espèces de poissons capturées devant Ras Jebel et autres régions marines de Tunisie septentrionale: aspects morphologiques, biométriques et bio-écologiques. Thesis, University of Carthage (Tunisia), 509 pp.
- Roux, C. (1984):** Squatinidae. In: P.J.P. Whitehead, M.L. Bauchot, J.C. Hureau, J. Nielsen & Tortonese. E. (Editors), pp. 83-88. Fishes of the North-western Atlantic and the Mediterranean, Vol I, UNESCO, Paris.
- Saïdi, B., M.N. Bradaï, A. Bouaïn, O. Guélorget & C. Capapé (2005):** Capture of a pregnant female white shark, *Carcharodon carcharias* (Lamnidae) in the Gulf of Gabès (southern Tunisia, central Mediterranean) with comments on oophagy in sharks. Cybium, 29(3), 303-307.
- Soufi-Kechaou, E., K. Ounifi Ben Amor, J. Ben Souissi, M.M. Ben Amor & C. Capapé (2018):** The capture of a large predatory shark, *Carcharhinus plumbeus* (Chondrichthyes: Carcharhinidae), off the Tunisian coast (Central Mediterranean). Annales, Ser. Hist. Nat., 28(1), 23-287.
- Stergiou, K.I. & V.S. Karpouzi (2002):** Feeding habits and trophic levels of Mediterranean fish. Rev. Fish Biol. Fish., 11, 217-254.
- Tortonese, E. (1956):** Fauna d'Italia vol.II. Leptocardi, Ciclostomata, Selachii., Calderini, Bologna, Italy. [In Italian.], 332 p.
- Vinciguerra, D. (1884):** Materiali per lo studio della fauna tunisina raccolti da G. e L. Doria. 1. Pesci. Ann. Mus. Civ. Sto. Natur. Genova, 1, 393-445.
- Whitehead, P.J.P., M.L. Bauchot, J.-C. Hureau, J. Nielsen & E. Tortonese (1984-1986):** Fishes of the North-eastern Atlantic and the Mediterranean, Unesco, Paris, Vol. 1., Vol. 2., Vol. 3, 1473 pp.
- Zava, R., F. Fiorentino & F. Serena (2016):** Occurrence of juveniles *Squatina oculata* Bonaparte, 1840 (Elasmobranchii: Squatinidae) in the Strait of Sicily (Central Mediterranean). Cybium, 40(4), 341-343.