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## ***OXYNOTUS CENTRINA* (OXYNOTIDAE) FROM THE TUNISIAN COAST (MEDITERRANEAN SEA)**

### **SUMMARY**

The authors report in the present paper the capture of two specimens of a rare shark, angular rough shark *Oxynotus centrina* (Linnaeus, 1758), from the northern coast of Tunisia. A first specimen was a juvenile female caught off Ras Jebel, the second specimen was a juvenile male caught off Kelibia. These captures occurred after two decades in the area where it appears that the species is not totally extinct. The Mediterranean distribution of *O. centrina* appears to be different according to the region, absent from the coast of France, specimens were still sporadically caught in the Adriatic Sea, and mainly in the Aegean Sea and the eastern Basin.

### **INTRODUCTION**

Angular rough shark *Oxynotus centrina* (Linnaeus, 1758) is rather considered as a rare species, known in the eastern Atlantic from the British Isles (WHEELER, 1969) to Mauritania (MAURIN and BONNET, 1970) and Senegal (CAPAPÉ *et al.*, 2001). Records of the species from the southern and southwestern Africa needs to be re-examined and therefore, its occurrence in these regions requires confirmation (EBERT and STEHMANN, 2013; SOLDI and GALLART, 2016).

*Oxynotus centrina* is known in the entire Mediterranean Sea and particularly the eastern Basin according to the old works of CARUS (1889-1893) and

HOFFMAN and JORDAN (1982), and PARENZAN (1983) who defined it as a bathypelagic. More recently, species several records were reported in these regions following KABASAKAL (2015). Additionally, recent captures occurred from the Greek waters (MEGALOFONO and DAMALAS, 2004; KOUSTENI and MEGALOFONO, 2012, 2016) and from the Turkish waters including the Sea of Marmara, these latter listed by KABASAKAL (2010, 2015). The species is also recorded in different areas from the Levant Basin such as Israel (GOLANI, 2005), Syria (ALI, 2018), Lebanon (BARICHE and FRICKE, 2019) and the Mediterranean coast of Egypt (EL SAYED *et al.*, 2017).

*Oxynotus centrina* occurs throughout the Maghreb shore, Morocco (LLO-RIS and RUCABADO, 1998), Algeria (DIEUZEIDE *et al.*, 1953; REFES *et al.*, 2010) and Tunisia where the species was reported off the northern coast (CAPAPÉ, 1989), and southward in the Gulf of Gabès (BRADAÏ *et al.*, 2002). The last captures of *O. centrina* occurred during year 2001 following BRADAÏ *et al.* (2002), and since no specimen was recorded in the Tunisian waters to our knowledge. Investigations and regular monitoring conducted off the northern coast of Tunisia allowed to capture two specimens of the species which are described in the present paper. Additionally, comments about the distribution and some aspects of the reproductive biology of *O. centrina* are provided locally and in the Mediterranean Sea.

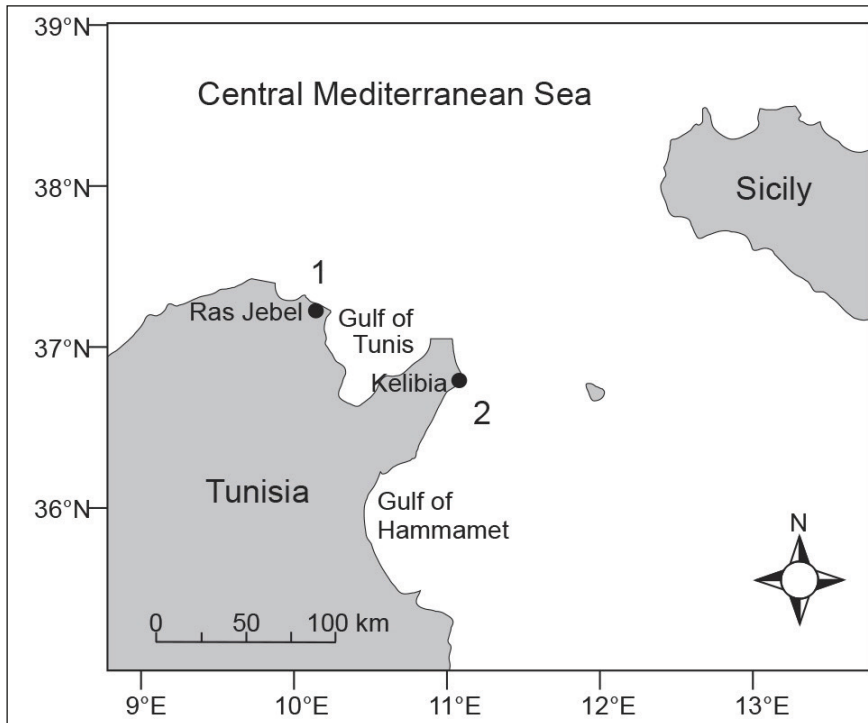
## MATERIALS AND METHODS

The capture of the first specimen occurred on 11 July 2019; off Ras Jebel by trawl at a depth of 70 m, on sandy-rocky bottoms partially covered by seagrass and algae, by 37° 20' 54" N and 10° 11' 38. 56" E (Fig. 1), together with smoothhound *Mustelus mustelus* (LINNAEUS, 1758) and some sparid species. The second specimen was caught on 08 September 2019 by trawl off Kelibia, at a depth of ca 195-198 m on sandy-rocky bottoms, 36° 51' 02" N and 11° 23' 08" E (Fig. 1), together with common cuttlefish *Sepia officinalis* Linnaeus, 1758; long finned squid *Loligo vulgaris*, Lamarck, 1798, hake *Merluccius merluccius* (Linnaeus, 1758) and striped mullet *Mullus barbatus* Linnaeus, 1758. The total landing of captures on board reached 1750 kg, and 105 kg was discarded at sea, mainly including *L. vulgaris* and *M. merluccius*.

## RESULTS AND DISCUSSION

The specimens were identified as *Oxynotus centrina* from the combination of main morphological characters such as

- body triangular in cross-section, very deep and very compressed with



**Fig. 1.** - Map of the northeastern coast of Tunisia indicating the capture sites of both specimens of *Oxynotus centrina*. **1.** Specimen caught off Ras Jebel (ref. ISPAB-Oxy-cent-01). **2.** Specimen caught off Kelibia (ref. INSTM-Oxy-cent-01).

longitudinal dermal ridges, no anal fin, sail-like dorsal fins with spines, first dorsal spine inclined forward, interdorsal space comprised five times in total length, distance from tip of second dorsal spine to tip of fin rather shorter than the spine (tip to base);

- five small opening gills;
  - head small, strongly depressed with snout rounded (Fig. 2A);
  - mouth very small, lips thick, spongy, with a complex series of cross-folds;
  - 9 tooth rows in upper and 7 in lower jaws, lower teeth blade like, serrate edged in the cusp (Fig. 2B) while upper teeth slender, compressed and lanceolate;
  - spiracle large and elongated;
  - skin entirely covered with rough, tricarinate dermal denticles with a median cuspidate produced and sharp, lateral keels short (Fig. 2C);
- colour black with darkish notches on sides and head, belly rather greyish. All morphometric measurements taken in millimetre from the female *O.*



**Fig. 2.** - **A.** General morphology of the specimen of *Oxynotus centrina* (ref. (ref. ISP-AB-Oxy-cent-01) caught off Ras Jebel, scale bar = 70mm. **B.** Jaw of the same specimen showing upper and lower teeth., scale bar =10mm. **C.** Denticles removed from the dorsal surface of the same specimen, scale bar = 2mm.

*centrina* caught in the Tunisian waters are given in Table 1, and for each measurement, we have calculated percentage of TL. They are similar to those recorded by MEGALOFONO and DAMALAS (2004) for the Aegean Sea. Additionally, dental formula and colour are in total agreement with TORTONESE (1956), COMPAGNO (1984), QUÉRO (1984) and EBERT and STEHMANN, (2013).

The specimen caught off Ras Jebel was a female measuring 500 mm in total length (TL) and weighed 790 g for total body weight (TBW). It was a juvenile specimen which exhibited thread-like ovaries and oviducts, and inconspicuous oviducal glands. The second specimen caught off Kelibia was a juvenile male displaying minute and flexible claspers, smaller than the pelvic fins. It measured 410 mm TL and weighed 505 g for TBW. Both specimens were fixed in 10 % buffered formaline and preserved in 75 % ethanol. The female was deposited in the Ichthyological Collection of the Institut de Pêche et d'Aquaculture of Bizerte (Menzel Jemil, Tunisia), under catalogue number ISPAB-Oxy-cent-01; the male in the Institut des Sciences et Technologies de la Mer of Salammbô (La Goulette, Tunisia), under catalogue number INSTM-Oxy-cent-01.

**Table 1.** - Morphometric measurements (in mm, and as % total length, TL), total body weight and dental formula recorded in both specimens of *Oxynotus centrina*, ref. ISPAB-Oxy-cent-01 and ref. INSTM-Oxy-cent-01 from the coast of Tunisia.

References	ISPAB-Oxy-cent-01		INSTM-Oxy-cent-01	
	Sex		Sex	
	Female		Male	
Measurements	mm	TL	mm	TL
Total length (TL)	500	100.0	410	100.0
Fork length	465	93.0	390	95.1
Standard length	370	74.0	310	73.2
Pre-caudal length	375	75.0	325	79.2
Pre-first dorsal length	130	26.0	98	24.0
Pre-second dorsal length	280	56.0	253	61.7
Head length	80	16.0	62	15.1
Head height	44	8.8	35	8.5
Mouth width	30	6.0	25	6.1
Abdomen height	90	18.0	69	16.8
Eye length	24	4.8	20	4.8
Eye height	10	2.0	8	1.9
Pre-pectoral fin length	100	20.0	82	20.0
Interdorsal space	110	22.0	100	23.4
Pectoral fin base	34	6.8	29	7.1
Pectoral fin anterior margin	90	18.0	78	1.9
Pectoral inner margin	20	4.0	16	3.9
Pectoral posterior margin	70	14.0	58	14.1
First dorsal fin base	75	15.0	68	15.1
First dorsal fin anterior margin	90	18.0	80	19.5
First dorsal fin inner margin	30	6.0	25	6.1
First dorsal fin posterior margin	83	16.6	74	18.0
Second dorsal fin base	50	10.0	40	9.7
Second dorsal fin anterior margin	66	13.2	60	14.6
Second dorsal fin inner margin	23	4.6	18	4.4
Second dorsal fin posterior margin	50	10.0	42	10.2
Pelvic fin base	40	8.0	33	8.1
Pelvic fin anterior margin	50	10.0	43	10.5
Pelvic inner margin	13	2.6	10	2.3
Pelvic fin posterior margin	43	8.6	36	8.8
Caudal base	22	4.4	20	4.8
Dorsal caudal margin	105	21.0	90	21.9
Terminal caudal lobe	30	6.0	24	5.8
Lower post-ventral caudal margin	70	14.0	59	14.3
Pre-ventral caudal margin	70	14.0	60	14.6
Clasper length	-	-	36	4.8
<b>Dental formula</b>	9 / 3 +1 + 3		9 / 3 +1 + 3	
<b>Total body weight (g)</b>	790		505	

These findings of two juvenile specimens, female and male, from the northern coast of Tunisia indicate that the species is not totally extinct in the area despite a lack of captures during a two decade years at least. Such opinion is corroborated by the fact some specimens were sighted and caught in the central Mediterranean Sea especially in the waters surrounding Maltese Islands (SCHEMBRI *et al.*, 2003; KOEHLER, 2016). *Oxynotus centrina* is known in the entire Mediterranean Sea but trawl surveys pointed out that the species is differently distributed according to the regions (SOLDO and GALLART, 2016). The species was formerly considered as rather commonly caught in the Gulf of Lions (southern France) following MOREAU (1881) and GRANIER (1964). From years 1990 to 1995, CAPAPÉ *et al.* (2000) noted that in the same area, 64 specimens were recorded at depths between 80 and 200 m maximum. Since, no specimens were observed in the area, where SOLDO and GUALLART (2016) suggested a possible extinction of the species. Such phenomenon should be considered as the main negative consequence of an important fishing pressure in this area (ALDEBERT, 1997).

*O. centrina* is reported as very rare off Balearic Islands but more common from the the western central Mediterranean Sea, such as the Tyrrhenian Sea, and the waters surrounding Corsica, Sardinia, Sicily and Malta Islands, where two specimens were recently collected (KOEHLER, 2018). The angular rough shark is sporadically occurring along the eastern Adriatic coast (JARDAS, 1996), although it is more common in the middle and southern regions (LIPEJ *et al.*, 2004). However, CUGINI and DE MADDALENA (2003) noted the capture of pregnant female carrying developing embryos and DRAGICEVIĆ *et al.* (2008) a large female displaying fully yolked oocytes ready to be ovulated.

Similarly, from the Aegean Sea, reported captures of pregnant females were reported by MEGALOGONO and DAMALAS (2004) and KOUSTENI and MEGALOFONO (2016), and females carrying large yolked oocytes by BAŞUSTA *et al.* (2015) and YİĞİN *et al.* (2016). Additionally, several specimens of *Oxynotus centrina* specimens of both sexes and different sizes were found in the region (KABASAKAL, 2010, 2015). Therefore, the occurrence of nurseries grounds in the area cannot be totally ruled out despite a scarcity of captures. Such pattern could be explained by the fact that *O. centrina* is a benthic species living on upper slope, and deep bottoms which are poorly exploited by commercial vessels. Additionally, the species has a low economical values, its flesh is not appreciated by consumers and captured specimens are generally discarded at sea by fishermen. The *K*-selected parameters of the species following CAPAPÉ *et al.* (1999) make it threatened and considered as endangered (SOLDO and GUALLART, 2016). Nevertheless, a constant decline of the species in the Mediterranean remains probable following KABASAKAL (2010). However, in total accordance with KABASAKAL (2015). Its total extinction in this sea could be avoided by a strong monitoring of the species by fishermen, releasing for instance the specimens after captures, until the successful establishment of viable populations will be really assessed.

## REFERENCES

- ALI M., 2018 - An updated Checklist of the Marine fishes from Syria with emphasis on alien species. *Mediterranean Marine Science*, **19**(2): 388-393.
- ALDEBERT Y., 1997 - Demersal resources of the Gulf of Lions (NW Mediterranean). Impact of exploitation of fish diversity. *Vie et Milieu* **47**(4), 275-284.
- BARICHE M., FRICKE R., 2020 - The marine ichthyofauna of Lebanon: an annotated checklist, history, biogeography, and conservation status. *Zootaxa*, **4775** (1): 1-157. DOI: <https://doi.org/10.11646/zootaxa.4775.1.1>.
- BAŞUSTA N., TURAN C., BAŞUSTA A., 2015 - New records of gravid female and adult male of the angular rough shark, *Oxynotus centrina* (Oxynotidae) from the northeastern Mediterranean. *Journal of the Black Sea/ Mediterranean Environment*, **21**(1): 92-95 (2015)
- BRADAÏ M.N., SAÏDI B., GHORBEL M., BOUAÏN A., GUÉLORGET O., CAPAPÉ C., 2002.- Observations sur les requins du golfe de Gabès (Tunisie méridionale, Méditerranée centrale). *Mésogée*, **60**: 61-77.
- CAPAPÉ, C. 1989 - Les Sélaciens des côtes méditerranéennes: aspects généraux de leur écologie et exemples de peuplements. *Océanis*, **15**(3): 309-331.
- CAPAPÉ C., SECK A.A., QUIGNARD J.-P., 1999 - Aspects of the reproductive biology of the angular rough shark, *Oxynotus centrina* (Oxynotidae). *Cybium* **23**(3): 259-271.
- CAPAPÉ C., TOMASINI J.A., QUIGNARD J.-P., 2000 - Les Elasmobranches pleurotrèmes de la côte du Languedoc (France méridionale, Méditerranée septentrionale). Observations biologiques et démographiques. *Vie et Milieu*, **50**(2): 123-133.
- CAPAPÉ C., GUEYE-NDIAYE A., DIATTA Y., DIOP M., SECK A.A., 2001 - Observations on six elasmobranch species recorded from off the coast of Senegal (eastern tropical Atlantic). *Acta Adriatica*, **42**(1): 89-102.
- CARUS J.V., 1889-1893 - *Prodromus Faunae Mediterraneae*. Vol. II. Brachiostomata, Mollusca, Tunica- ta, Vertebrata. E. Schweizerbart'sche Verlagshandlung, Stuttgart, 854 p.
- CUGINI G., DE MADDALENA A., 2003 - Sharks captured off Pescara (Italy, western Adriatic Sea). *Annales, Series Historia naturalis*, **13**(2): 20 1-208.
- COMPAGNO L.V.J., 1984 - *FAO species catalogue*. Vol 4. Sharks of the world. An annotated and illustrated catalogue of sharks species known to date. Part 2. Carcharhiniformes. FAO Fish. Syn. (125), Part 1., FAO, Rome, pp. 1-269.
- DIEUZEIDE R., NOVELLA M., ROLAND J., 1953 - Catalogue des poissons des côtes algériennes, Volume I. Squales – Raies – Chimères. *Bulletin de la Station d'Aquiculture et de Pêche de Castiglione*, nouvelle série 6, volume I: 1-274.
- DRAGICEVIĆ B., DULČIĆ J., CAPAPÉ C. - Capture of a rare shark, *Oxynotus centrina* (Oxynotidae), in the eastern Adriatic Sea. *Journal of Applied Ichthyology*, **25** (Supplement 1): 56-59. <https://doi.org/10.1111/j.1439.0426.2009.01256x>.
- EBERT D.A., STEHMANN M.F.W., 2013 - Sharks batoids and Chimaeras of the North Atlantic. FAO species Catalogue for Fisheries Purposes, n° 7, Rome, FAO, 523 pp.
- EL SAYED H., AKEL K., KARACHILE P., 2017 - The Marine Ichthyofauna of Egypt. *Egyptian Journal of Aquatic Biology and Fisheries*, **21**(3): 81-116. DOI: 10.21608/ejabf.2017.4130.
- GOLANI D., 2005 - Check-list of the Mediterranean Fishes of Israel. *Zootaxa*, **947**: 1-200.
- GRANIER J., 1964. - Les Eusélaciens dans le golfe d'Aigues-Mortes. *Bulletin du Muséum d'Histoire naturelle de Marseille*, **25**: 33-62.
- HOFFMAN H. A., JORDAN D.S., 1892 - A catalogue of the fishes of Greece, with notes on the names now in use and those employed by classical authors. *Proceeding of the*



- Academy of Natural Sciences of Philadelphia*, **44**: 230-286.
- JARDAS I., 1996 - *Adriatic ichthyofauna*. Skolska knjiga, Zagreb, 533 pp.
- KABASAKAL H., 2010 - Historical and contemporary records of the angular rough shark *Oxynotus centrina* (Chondrichthyes: Oxynotidae) in Turkish waters. *Mediterranean Marine Science*, **11**(2): 361-368.
- KABASAKAL H., 2015 - Occurrence of the angular rough shark, *Oxynotus centrina* (Chondrichthyes: Oxynotidae) in the eastern Mediterranean. *Annales, Series Historia naturalis*, **25**(1): 1-10.
- KOEHLER L., 2108. - New records of angular rough sharks *Oxynotus centrina* in the coastal waters of Malta, with observations on post-capture resilience and release behaviour. *Journal of Fish Biology*, **92** (6): 2039-2044. doi:10.1111/jfb.13461
- KOUSTENI V., MEGALOFONO P., 2016. - Observations on the biological traits of the rare shark *Oxynotus centrina* (Chondrichthyes: Oxynotidae) in the Hellenic Seas. *Journal of Fish Biology*, **89**(3): 1880-1888. doi: 10.1111/jfb.13077
- LIPEJ L., DE MADDALENA A., SOLDI A., 2004 - *Sharks of the Adriatic Sea*. Knjiznica Annales Majora, Koper, 253 pp.
- LLORIS D., RUCABADO J., 1998 - *Guide FAO d'identification des espèces pour les besoins de la pêche*. Guide d'identification des ressources marines vivantes pour le Maroc. Rome. FAO, 263 pp.
- MAURIN C., BONNET M., 1970 - Poissons des côtes nord-ouest africaines (Campagnes de la «Thalassa», 1962 et 1968). *Revue des Travaux de l'Institut Scientifique et Technique des Pêches Maritimes*, **34**: 125-170.
- MEGALOFONO P., DAMALAS D., 2004 - Morphological and biological characteristics of a gravid angular rough shark (*Oxynotus centrina*) and its embryos from the eastern Mediterranean. *Cybium*, **28**(2): 105-110.
- MOREAU E., 1881. - *Histoire naturelle des poissons de la France*. Volume 1. G. Masson, éditeur, Paris, 478 pp.
- PARENZAN P., 1983 - *Puglia Marittima*. Congedo Publ., Galatina, **2**: 555.
- QUÉRO J.-C., 1984 - Oxynotidae. In: Fishes of the north-eastern Atlantic and the Mediterranean. Whitehead P.J.P., M.-L. Bauchot, J.-C. Hureau, J. Nielsen and E. Tortonese, (eds.), Paris, UNESCO, pp. 126-127.
- REFES W., SEMAHI N., BOULAHIDJ M., QUIGNARD J.-P. - 2010. Inventaire de la faune ichthyologique du secteur oriental de la côte algérienne (El Kala; Skikda; Jijel; Bejaïa). Rapports de la Commission internationale pour la mer Méditerranée, **39**: 646.
- SCHEMBRI T., FERGUSSON I. K., SCHEMBRI P.J., 2003 - Revision of the records of shark and ray species from the Maltese Islands (Chordata: Chondrichthyes). *The Central Mediterranean Naturalist*, **4**(1): 71-104.
- SOLDI A., GUALLART J., 2016 - *Oxynotus centrina*. The IUCN Red List of Threatened Species 2016. E.T63141A97834254. Available at [www.iucnredlist.org/details/63141/3](http://www.iucnredlist.org/details/63141/3) (last accessed on 20 January 2021).
- TORTONESE E., 1956 - *Leptocardia, Ciclostomata, Selachii*. In: Fauna d'Italia. Calderini, Bologna, 334 pp.
- WHEELER A., 1969 - *The fishes of the British Isles and North-West Europe*. McMillan editor: London, Melbourne and Toronto, I-XVII + 613 pp.
- YİĞİN C. Ç., İSMEN A., ÖNAL U., 2016 - Occurrence of a rare shark, *Oxynotus centrina* (Chondrichthyes: Oxynotidae), from Saros Bay, North Aegean Sea, Turkey. *Journal of the Black Sea/ Mediterranean Environment*, **22**(1): 103-109.