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FIRST MEDITERRANEAN RECORDS OF SPINETAIL DEVIL RAY, *MOBULA JAPANICA* (ELASMOBRANCHII: RAJIFORMES: MOBULIDAE)

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Abstract. Captures of 11 spinetail devil rays, *Mobula japanica* (Müller et Henle, 1841), from the northern coast of Tunisian (central Mediterranean) are reported in the present paper. Of these 11 specimens, five specimens were described. These captures constitute the first records of the species in the Tunisian waters, but also in the Mediterranean Sea, extending its distribution. This unusual occurrence of *M. japanica* is probably due to a migration from the eastern tropical Atlantic into the Mediterranean Sea through the Strait of Gibraltar.

Keywords: Chondrichthyes, migration, Tunisian coast, white-tipped dorsal fin, gill filter plates, morphometric measurements

Of the nine recognized species belonging to the genus *Mobula* Rafinesque, 1810 (see Notarbartolo Di Sciara 1987), only a single species, giant devil ray, *Mobula mobular* (Bonnaterre, 1788), has hitherto been reported from the Mediterranean Sea (McEachran and Capapé 1984). This species is sporadically caught off southern France (Granier 1964, Capapé et al. 1990) and along the Tunisian coast (Capapé and Zaouali 1976, Bradaï and Capapé 2001). It is, however, rather common off the Algerian coast (Hemida et al. 2002) and in the Adriatic Sea (Bello et al. 2012).

Observations and surveys conducted since 2004 along the northern coast of Tunisia allowed to record elasmobranch species in areas where they were not usually observed such as the Tunis Southern Lagoon (Mejri et al 2004) and the Lagoon of Bizerte (El Kamel et al. 2009). Additionally, our actions were also supported by local divers and fishermen who actively helped us, in reporting sightings and captures of specimens. In the wake of this collaboration, the authors were promptly informed that a devil ray was captured on 23 August 2014 off Cani Rocks (Fig. 1), and landed at the fishing site of Ras Jebel, a town located 50 km north of Tunis. The specimen was carefully examined, photographed, measured to the nearest 1 mm, and weighed to the nearest 1 kg. It was a female of 2600 mm disc width (DW), 1200 mm disc length, and its eviscerated body mass reached 100 kg (Fig. 2). The head was recovered and delivered to the laboratory for further examinations. On 24 August 2014, the heads of 3 other specimens caught in the same area were observed. Additionally, on 28 August 2014, a female was captured having 2180 mm DW and weighing 67 kg. In all, 11 specimens were caught by light fishing focusing European pilchard, *Sardina pilchardus* (Walbaum, 1792), and mackerel *Scomber* spp., at a depth of 54 m approximately, by gillnets of 16 mm mesh size, off Cani Rocks by 37°24′25.76″N and 10°10′55.00″E (Fig. 1).

The diagnosis was as follows: disc broad, short length measured from mid-snout 44.7%–46.2% in disc width, anterior margins of pectoral slightly convex, posterior concave, angles acute, rounded at apex, head very short, distance from tip of cephalic lobes to fifth gill slit

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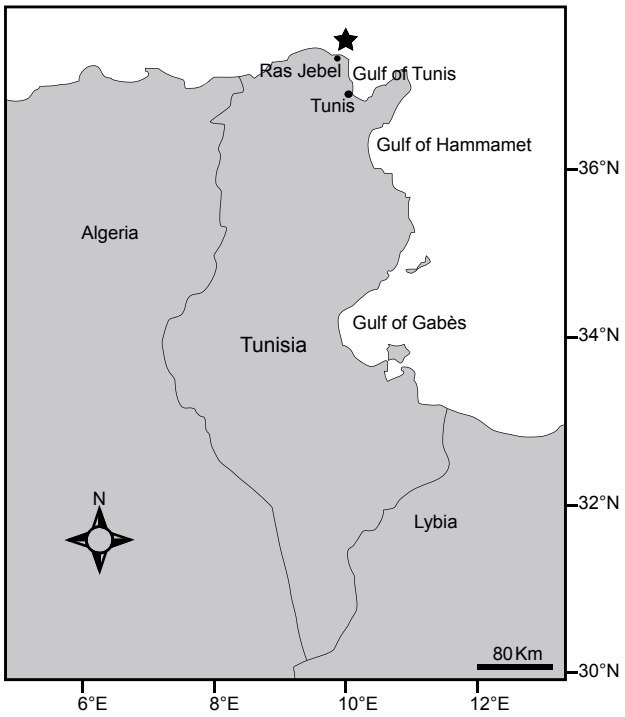

Fig. 1. Map of Tunisia showing the capture sites of *Mobula japanica* (black stars)

Fig. 2. Female of *Mobula japanica* (Ref. FSB Mob-jap01) captured from the northern Tunisian coast, with arrow showing white tip on dorsal fin, scale bar = 400 mm

in 22.2%–23.1% and in disc width, and to mouth corner 10.1%–11.1% in disc width, rostral margin rather straight, elliptical spiracles above level of pectoral fins, oval-based stinging spine in base of tail, origin of dorsal fin little in advance of beginning of pelvic fins. Gill filter plates not fused with 18–28 lateral lobes (Fig. 3), terminal lobe leaf-shaped with longitudinal ridges (Fig. 4). Mouth on ventral surface of head, teeth minute not arranged in rows, but spaced from each other, tooth height larger than crown width (Fig. 5). Denticles dense, minute, shagreen on hinder areas of dorsal surface (Fig. 6). Dorsal surface dark blue with occasional lighter shoulder patches, characteristic white tip on dorsal fin, belly whitish with dark patches, no dark margin anteriorly.

All observations about morphology, colour, morphometric measurements, head proportions and meristic counts are

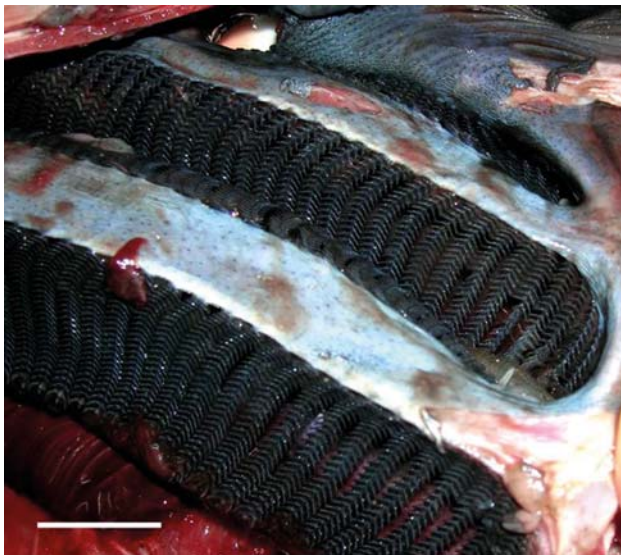

Fig. 3. Gill of *Mobula japanica* (Ref. FSB Mob-jap 01) captured from the northern Tunisian coast; scale bar = 50 mm

Fig. 4. *Mobula japanica* (Ref. FSB Mob-jap 01) captured from the northern Tunisian coast; gill filter with leaf-shaped terminal lobe, exhibiting longitudinal ridges, scale bar = 3 mm

summarized in Table 1, and are consistent with those provided by Garman (1913), Cadenat (1959, 1960), Blache et al. (1970), Notarbartolo Di Sciara (1987), Last and Stevens (1994), Townsend and Kyne (2010), and Bustamante et al. (2012). They allowed to conclude that all collected specimens were spinetail devil rays, *Mobula japanica* (Müller et Henle, 1841). These occurrences constitute the first well documented records of the species from the Tunisian coast and also, from the entire Mediterranean. *Mobula japanica* and *M. mobular* are closely related species, and consequently misidentifications cannot be totally ruled out. The

Table 1

Measurements carried out in five specimens of *Mobula japanica* captured from the northern Tunisian coast

Parameter	FSB-Mob-jap01	FSB-Mob-jap02	FSB-Mob-jap03	FSB-Mob-jap04	FSB-Mob-jap05
Sex	Female	Male	Male	Female	Female
Disc length	1200	—	—	—	975
Disc width	2600	—	—	—	2180
Cephalic fin length	270	235	260	240	240
Diameter of eye ball	44	44	42	42	43
Cranial width	400	340	350	355	360
Preoral length	90	75	80	80	75
Mouth width	270	225	235	230	240
Internarial distance	220	190	190	210	190
Cephalic fin width	230	130	120	110	120
Width between first gill slit	260	230	210	230	230
Width between second gill slit	290	260	230	255	215
Width between third gill slit	300	255	255	270	210
Width between fourth gill slit	300	260	250	280	240
Width between fifth gill slit	305	260	240	270	250
Pre-first gill slit length	385	340	345	345	350
Pre-second gill slit length	440	380	380	375	380
Pre-third gill slit length	500	420	420	405	420
Pre-fourth gill slit length	540	460	460	445	460
Pre-fifth gill slit length	600	490	510	483	500
Rostrum to 1st gill openings	240	200	210	215	210
Rostrum to 5th gill openings	410	350	350	360	340
Distance between cephalic fins tips	290	220	25	220	210
Distance between cephalic fins	250	210	230	220	220
Distance between eyes	350	320	325	330	320
Interspiracular width	370	325	330	330	340
Pre-orbital length	190	170	170	175	175
Pre-spiracle length	290	265	270	280	273
Snout tip to spiracle	115	105	100	85	100
Pre-nostril length	220	190	200	190	190
Snout tip to nostril	45	40	42	40	39
Pre-oral length	265	230	235	230	220
Anterior dorsal fin	127	—	—	—	125
Posterior dorsal fin	70	—	—	—	75
Dorsal fin base length	—	—	—	—	95
Posterior pectoral fin	—	1090	1160	1113	1150
Interior pectoral fin	—	120	120	100	110
Anterior pelvic fin	—	115	140	112	115
Posterior pelvic fin	—	53	60	50	50
Interior pelvic fin	—	92	100	100	95
Clasper	—	80	80	—	—
Eviscerated mass [kg]	100	—	—	—	65

All measurements in mm.

presence in Mediterranean Sea, out of the recent distribution range could be explained (among others) by the absence of rigorous specific fishery reports of landings, making it difficult to differentiate between mobulid species in the area.

Mobula japanica and *M. mobular* are large species and both exhibit a spine on the tail, however they differ by some major characters. So, with the addition of *M. japanica* to the Tunisian ichthyofauna, it seems appropriate to present a key allowing to distinguish *M. mobular* from *M. japanica* in the region and the entire Mediterranean:

1. Location of the dorsal fin which is behind the posterior margin of the pectoral fins; teeth arranged in rows; absence of a white tip in the dorsal fin .....*Mobula mobular*
2. Origin of the dorsal fin a little in advance of the beginning of pelvic fins; teeth minute not arranged in rows, but spaced from each other, tooth height larger than crown width; presence of a white tip in the dorsal fin.....*Mobula japonica*

Due to the large body size of spinetail devil rays, only the heads were preserved and deposited in the Ichthyologi-

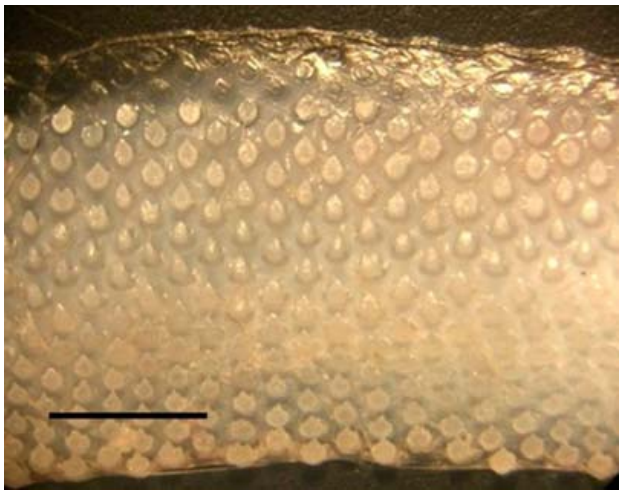

Fig. 5. *Mobula japanica* (Ref. FSB Mob-jap 01) captured from the northern Tunisian coast; minute teeth arranged in diagonal rows, in a small distance from each other; tooth height exceeding crown width, scale bar = 3 mm

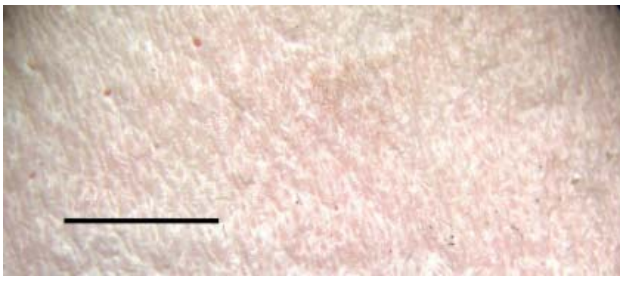

Fig. 6. Skin of *Mobula japanica* (Ref. FSB Mob-jap 01) captured from the northern Tunisian coast, showing minutes scales ; scale bar = 4 mm

cal Collection of the Faculté des Sciences de Bizerte under the catalogue numbers: FSB-Mob-jap01, FSB-Mob-jap02, FSB-Mob-jap03, FSB-Mob-jap04, and FSB-Mob-jap05.

Mobula japanica is known as a large zooplanktivorous ray widely distributed in tropical to warm temperate waters (Bustamante et al 2012, Couturier et al. 2012). Captures of the species are generally reported in both Pacific and western Atlantic (Bustamante et al. 2012). Previously, the species was described as *M. rancureli* by Cadenat (1959) from specimens caught off the Coast of Ivory, in eastern Atlantic (Cadenat 1960) and probably throughout the Gulf of Guinea (Blache et al. 1970). *Mobula rancureli* was subsequently considered a junior synonym of *M. japanica*, which consequently occurs off the western coast of Africa (Louisy 2002). Consequently, the records of *M. japanica* presented in this paper are probably due to a migration of the species toward northern areas and entering the Mediterranean Sea through the Strait of Gibraltar, constituting a Herculean migration *sensu* Quignard and Tomasini (2000). Similar migrations were recently reported off the northern Tunisian coast but they rather concerned teleost species (Azzouz et al. 2011, Ben Souissi et al. 2011, Mansour et al. 2011)

Records of alien species and especially those described in this paper are consistent with data provide by Ben Rais Lasram and Mouillot (2009) who noted a significant increase of species incoming to the Mediterranean Sea from the Red Sea and eastern tropical Atlantic. Such intrusions are due to the fact that the waters of this sea are becoming warmer for several decades now (Francour et al. 1994, Golani 1998, Dulčić and Grbec 2000, Macias et al. 2013). The new Mediterranean findings of *M. japanica* extend the distribution of the species, and increase the number of fish species in this sea, but also in the Tunisian waters, where captures of 11 specimens showed that the species should considered as locally present, but other records are needed to state if a sustainable population inhabits the area, *M. japanica* being a large migratory species (Couturier et al. 2012).

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REFERENCES

Azzouz K., Diatta Y., Mansour S., Boumaïza M., Ben Amor M.M., Capapé C. 2011. First record of the west African goatfish, *Pseudupeneus prayensis* (Actinopterygii: Perciformes: Mullidae), off the Tunisian coast (central Mediterranean). Acta Ichthyologia et Piscatoria **41** (2): 133–136.
DOI: 10.3750/AIP2011.41.2.10

Bello G., Lipej L., Dulčić J. 2012. Comments on a finding of *Mobula mobular* (Mobulidae) in the Adriatic Sea. Cybium **36** (4): 575–577.

Ben Rais Lasram F., **Mouillot D.** 2009. Increasing southern invasion enhances congruence between endemic and exotic Mediterranean fish fauna. Biological Invasions **11** (3): 697–711.
DOI: 10.1007/s10530-008-9284-4

Ben Souissi J., Diatta Y., Gargouri Ben Abdallah L., Capapé C. 2011. Occurrence of the Monrovian surgeonfish *Acanthurus monroviae* (Osteichthyes: Acanthuridae) off the coast of Tunisia (central Mediterranean). Cahiers de Biologie Marine **52** (3): 331–335.

Blache J., Cadenat J., Stauch A. 1970. Clé de détermination des poissons de mer signalés dans l'Atlantique oriental (entre le 20ième parallèle N et le 15ième parallèle S). Faune tropicale ORSTOM **18**: 1–479.

Bradaï M.N., Capapé C. 2001. Captures du diable de mer, *Mobula mobular*, dans le golfe de Gabès (Tunisie méridionale, Méditerranée centrale). Cybium **25** (4): 389–391.

Bustamante C., Couturier L.I.E., Bennett M.B. 2012. First record of *Mobula japanica* (Rajiformes: Myliobatidae) from the south-eastern Pacific Ocean. Marine Biodiversity Records **5**: e48.
DOI: 10.1017/S1755267212000310

Cadenat J. 1959. Notes d'Ichtyologie ouest-africaine, XXV.—Description d'une *Mobula* de grande taille à aiguillon caudal, de Côte d'Ivoire: *Mobula rancureli*, sp. nov. Bulletin de l'Institut français d'Afrique noire Série A **21** (4): 1326–1331.

Cadenat J. 1960. Notes d'Ichtyologie ouest-africaine. XXIX. Les Mobulidae de côte occidentale d'Afrique. Bulletin de l'Institut français d'Afrique noire Série A **22** (3): 1053–1084.

Capapé C., Bouchereau J.L., Tomasini J.A. 1990. Présence du diable de mer, *Mobula mobular* (Bonnaterre, 1788) (Pisces, Rajiformes, Mobulidæ) dans le golfe d'Aigues-Mortes. Anatomie de la ceinture pelvienne et des ptérygopodes. Mésogée **50**: 9–14.

Capapé C., Zaouali J. 1976. Note sur la présence de la Mante de mer *Mobula mobular* (Bonnaterre, 1788) (Sélaciens, Rajiformes) dans les eaux tunisiennes. Doriana **5** (223): 1–8.

Couturier L.I.E., Marshall A.D., Jaine F.R.A., Kashiwagi T., Pierce S.J., Townsend K.A., Weeks S.J., Bennett M.B., Richardson A.J. 2012. Biology, ecology and conservation of the Mobulidae. Journal of Fish Biology **80** (5): 1075–1119.
DOI: 10.1111/j.1095-8649.2012.03264.x

Dulčić J., Grbec B. 2000. Climate change and Adriatic ichthyofauna. Fisheries Oceanography **9** (2): 187–191.
DOI: 10.1046/j.1365-2419.2000.00128.x

El Kamel O., Mnasri N., Ben Souissi J., Boumaïza M., Ben Amor M.M., Capapé C. 2009. Inventory of elasmobranch species caught in the Lagoon of Bizerte (north-eastern Tunisia, central Mediterranean). Pan-American Journal of Aquatic Sciences **4** (4): 383–412.

Francour P., Boudouresque C.F., Harmelin J.G., Harmelin-Vivien M.L., Quignard J.P. 1994. Are the Mediterranean waters becoming warmer? Information from biological indicators. Marine Pollution Bulletin **28** (9): 523–526.

Garman S. 1913. The Plagiostomia. (Sharks, skates, and rays). Memoirs of the Museum of Comparative Zoölogy at Harvard College **36** (2): 1–528.
DOI: 10.5962/bhl.title.43732

Golani D. 1998. Distribution of Lessepsian migrant fish in the Mediterranean. Italian Journal of Zoology **65** (Suppl. 1): 95–99.
DOI: 10.1080/11250009809386801

Granier J. 1964. Les eusélaciens dans le golfe d'Aigues-Mortes. Bulletin du Muséum d'Histoire naturelle de Marseille **24**: 34–52.

Hemida F., Mehezem S., Capapé C. 2002. Captures of the giant devil ray, *Mobula mobular* (Bonnaterre, 1788) (Chondrichthyes: Mobulidae) off the Algerian coast (southern Mediterranean). Acta Adriatica **43** (2): 69–76.

Last P.R., Stevens J.D. 1994. Sharks and rays of Australia. CSIRO, Melbourne, Australia.

Louisy P. 2002. Guide d'identification des poissons marins Europe et Méditerranée. Ulmer édition, Paris, France.

Macias D., Garcia-Gorriz E., Stips A. 2013. Understanding the causes of recent warming of Mediterranean waters. How much could be attributed to climate change? PLoS ONE **8** (11): e81591.
DOI: 10.1371/journal.pone.0081591

Mansour S., Azzouz K., Boumaïza M., Ben Amor M.M., Capapé C. 2011. First record of a rare carnagid species, the Almaco jack, *Seriola rivoliana* (Osteichthyes: Carangidae) in Tunisian marine waters (central Mediterranean). Cahiers de Biologie Marine **52** (2): 193–202.

McEachran J.D., Capapé C. 1984. Mobulidae. Pp. 210–211. *In*: Whitehead P.J.P., Bauchot, M.-L., Hureau J.-C., Nielsen J., Tortonese E. (eds.) Fishes of the North-western Atlantic and the Mediterranean. Vol. 1. UNESCO, Paris.

Mejri H., Ben Souissi J., Zaouali J., El Abed A., Guélorget O., Capapé C. 2004. On the recent occurrence of elasmobranch species in a perimediterranean lagoon: the Tunis Southern Lagoon (northern Tunisia). Annales Series Historia Naturalis 14 (2): 143–158.

Notarbartolo Di Sciara G. 1987. A revisionary study of the genus *Mobula* Rafinesque, 1810 (Chondrichthyes: Mobulidae) with the description of a new species. Zoological Journal of the Linnean Society **91** (1): 1–91.
DOI: 10.1111/j.1096-3642.1987.tb01723.x

Quignard J.-P., Tomasini J.A. 2000. Mediterranean fish biodiversity. Biologia Marina Mediterranea **7**: 1–66.

Townsend K.A., Kyne P.M. 2010. New records of the Japanese devilray *Mobula japanica* (Müller & Henle 1814) for Australian waters. Memoirs of the Queensland Museum-Nature **55** (1): 225–230.

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