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Supplementary material

Mobulid ray by-catch in longline fisheries in the south-western Atlantic Ocean

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Mobulid species identification

Diagnostic morphological characteristics (Fig. S2) that helped identify specimens of *Mobula japanica* were: dark dorsal coloration, a white blotch on tip of dorsal fin, presence of a caudal spine, spiracle in an upper position relative to the origin of pectoral fins, space between eye and spiracle white, straight anterior edge of rostrum, and white coloration on the ventral side (see Notarbartolo-Di-Sciara 1987). Given that other authors have noticed that the caudal spine in *Mo. japanica* may sometimes be missing (Paulin *et al*. 1982; Notarbartolo-Di-Sciara 1987), its absence was not considered to be reason enough to discard *Mo. japanica* during identification. *Mo. japanica* has also been considered morphologically identical to *Mo. mobular* and hence very difficult to tell apart from the latter. However, *Mo. mobular* reaches larger sizes (Notarbartolo-Di-Sciara 1987; Notarbartolo-Di-Sciara *et al*. 2006) and it has been recently shown that both species can also be differentiated by tooth morphology (Adnet *et al*. 2012). Moreover, Notarbartolo-Di-Sciara *et al*. (2006) stated that *Mo. mobular* is endemic of the Mediterranean Sea, and that records of this species from the north-eastern Atlantic are probably misidentified *Mo. japanica*. Hence, although it was not possible to examine either a whole individual or a jaw in the present study, the high endemism of *Mo. mobular* allows us to discard this species from consideration in by-catch samples.

In the case of *Mo. thurstoni*, the following morphologic features helped with identification (Fig. S3): dark dorsal coloration and a white blotch on tip of dorsal fin, a conspicuous double curvature on anterior margin of pectoral fins, distal half of pectoral fins silver with a dark rim along the anterior margin on their ventral side, absence of a caudal spine, spiracle below the origin of pectoral fins, and space between eye and spiracle dark grey to silver (see Notarbartolo-Di-Sciara 1987). One individual of *Mo. thurstoni* captured on May 2009 (36°06′S, 52°46′W) was collected and brought frozen to the laboratory (male, 95.5 cm W_D) where it was more thoroughly examined. Although it lacked the tail and dorsal fin, other morphologic features in addition to those mentioned above were also observed and further confirm the identity of the species: ventral side densely covered by lateral line pores organised in numerous transverse lines, presence of four ridges on the mouth floor, one on each side near mouth corners and two in the middle converging (but not touching) towards the jaw margin;

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irregular silvery band along the lower jaw with a darker rim on the edge; and upper and lower tooth bands 8.8 and 9.1% of W_D. A light grey quadrangular area situated in the nuchal region between the bases of the pectoral fins was also noticed but was not conspicuous. A full list of morphologic measurements as well as their relative size in hundreds of W_D is presented in Table S1.

Table S1. Morphometric measurements (hundreds of disc width) of a male *Mobula thurstoni*

Measurements proposed by Notarbartolo-Di-Sciara (1987) are indicated with numbers in italic, and ranges provided by the same author are also shown for comparison. Proportional measures that did not fall inside these ranges are shown in bold

	Measurement	Size (mm)	%W_D	Range
1	Disc width	955	100.0	
2	Disc length	458	48.0	47.8–55.7
3	Anterior projection	323	33.8	33.3–39.2
4	Rostrum to pelvic fins	475	**49.7**	51.1–59.2
8	Rostrum to vent	396	41.5	38.8–46.9
10	1st gill slit length	48.6	5.1	4.2–5.7
11	2nd gill slit length	47.3	5.0	4.8–6.2
12	3rd gill slit length	51.3	5.4	4.5–6.2
13	4th gill slit length	48.1	5.0	4.6–5.8
14	5th gill slit length	30.7	3.2	3.1–4.1
15	Between 1st gill slits	112	11.7	11.7–13.8
	Between 2nd gill slits	103	10.8	–
	Between 3rd gill slits	86	9.0	–
	Between 4th gill slits	65	6.8	–
16	Between 5th gill slits	48	5.0	4.6–5.5
	Branchial basquet	111	11.6	–
20	Tip of cephalic fin to mouth	111	11.6	11.3–13.5
22	Orbit height	14.7	**1.5**	2.5–3.4
23	Between antorbitals	158	16.5	15.8–18.1
24	Preoral	34	**3.6**	3.7–4.3
25	Tip of cephalic fin to spiracle	124	13.0	12.6–14.2
26	Mouth width	106.1	**11.1**	11.2–13.3
	Internarial, minimum	97.0	10.2	–
	Internarial, maximum	103.2	10.8	–
28	Upper toothband length	84.1	8.8	8.0–9.7
29	Lower toothband length	86.6	9.1	8.7–10.2
	Preorbital length	80	8.4	–
	Spiracle length	1.1	0.1	–
	Interspiracle length	151.9	15.9	–
	Nasal curtain width	102.8	10.8	–
	Nasal curtain length	16.2	1.7	–

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Fig. S1. Different hooking positions in mobulids: (*a*) *Mobula thurstoni* foul-hooked at the rostrum; (*b*) *Mo. thurstoni* foul-hooked at the ventral side; (*c*) *Mo. japanica* entangled in the branchline; (*d*) *Mo. japanica* foul-hooked at the rostrum.

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Fig. S2. *Mobula japanica* captured in longline fisheries over the south-western Atlantic. Photographs show different diagnostic features that allowed species identification: (*a*–*c*) dark dorsal coloration, (*b*) position of spiracles above origin of pectoral fins, (*a*, *b*) white space between eye and spiracle, (*a*, *b*) straight anterior margin of rostrum, (*c*) a white blotch on tip of dorsal fin, (*c*) caudal spine and (*d*) white coloration on ventral side.

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Fig. S3. *Mobula thurstoni* captured in longline fisheries over the south-western Atlantic. Photographs show different diagnostic features that allowed species identification: (*a*) dark dorsal coloration and white blotch on tip of dorsal fin, (*b*) double curvature on anterior margin of pectoral fins and grey to dark pigmentation in distal half, (*a*, *c*) silver to grey space between eye and spiracle, (*c*) position of spiracle below origin of pectoral fins, (*d*) ventral side densely covered with lateral lines pores arranged in transversal lines, (*e*) four ridges on mouth floor, and (*f*) irregular silvery band below lower jaw with a dark rim on its margin.

Fig. S4. Captured mobulids being held with the aid of pike poles while cutting the branch line. Pike poles may sometimes inflict serious injuries to captured mobulids.

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