

ON A HUGE SHORTFIN MAKO SHARK *ISURUS OXYRINCHUS*
RAFINESQUE, 1810 (CHONDRICHTHYES: LAMNIDAE) OBSERVED AT
CABRERA GRANDE, BALEARIC ISLANDS, SPAIN

Fernando LOPEZ-MIRONES

calle Rio Alagon 1209, El Casar, 19170 Guadalajara, Spain
e-mail: fernandomirones@telefonica.net

Alessandro DE MADDALENA

Shark Museum, 26 Forest Hill Road, Simon's Town, 7995 Cape Town, South Africa
e-mail: alessandrodemaddalena@gmail.com

Ricardo SAGARMINAGA VAN BUITEN

ALNITAK, Calle nalon 16, 28240 Hoyo De Manzanares, Spain
e-mail: ric@alnitak.org

ABSTRACT

A huge female shortfin mako shark, Isurus oxyrinchus, was observed on 28 June 2018 near Cabrera Grande, in the Balearic Islands, Spain. Its total length was carefully estimated at 500 cm based on a comparison with a 520-cm inflatable boat. This specimen is therefore the largest mako known alive and the second largest mako ever recorded worldwide.

Key words: shortfin mako shark, *Isurus oxyrinchus*, maximum size, Spain, Cabrera National Park, Mediterranean Sea

IN MERITO A UN ENORME SQUALO MAKO DALLE PINNE CORTE *ISURUS*
OXYRINCHUS RAFINESQUE, 1810 (CHONDRICHTHYES: LAMNIDAE) OSSERVATO ALLE
ISOLE BALEARI, SPAGNA

SINTESI

Un'enorme femmina di squalo mako dalle pinne corte Isurus oxyrinchus, fu osservato nei pressi di Cabrera Grande, alle Isole Baleari, in Spagna, il 28 giugno 2018. La lunghezza totale dell'esemplare fu stimata con accuratezza pari a 500 cm sulla base delle dimensioni di un gommone di 520 cm. Tale esemplare è pertanto il più grande mako mai osservato vivo ed il secondo più grande registrato a livello mondiale.

Parole chiave: squalo mako dalle pinne corte, *Isurus oxyrinchus*, dimensioni massime, Spagna, Parco Nazionale dell'Arcipelago di Cabrera, mare Mediterraneo

INTRODUCTION

The shortfin mako *Isurus oxyrinchus* Rafinesque, 1810, inhabits temperate and tropical waters of the Atlantic, Pacific and Indian Oceans. It is pelagic, coastal and oceanic, occurring at a depth range from 0 to 500 m (Compagno, 2001). The shortfin mako is present in the entire Mediterranean (De Maddalena & Baensch, 2005), where it is caught mainly by tuna longline fishery and occasionally by swordfish fishery using longlines and driftnets (Celona *et al.*, 2004; Megalofonou *et al.*, 2005). Although the majority of shortfin mako catches are recorded in pelagic fisheries, in a recent report, Kabasakal (2015) emphasized that new-born and juvenile specimens of *I. oxyrinchus* can be incidentally captured by coastal stationary netting and bottom longline fishing, as well.

In the present article we report a record of a huge shortfin mako spotted in June 2018 by the team of Alnitak Marine Research and Education Center in the Balearic Islands, in Spanish Mediterranean waters.

MATERIAL AND METHODS

The observation took place from the research vessel *Toftevaag*, an 18-metre LOA converted historic Norwegian fishing boat, and from a 520-cm-long inflatable boat. The shark was encountered during a shipboard survey in the waters of the proposed extension of Cabrera National Park (Parque Nacional del Archipiélago de Cabrera), while tracking cetaceans, sea turtles, seabirds, devil rays and bluefin tuna. The crew of the *Toftevaag* at the time of the encounter was composed of Ricardo Sagarminaga van Buiten as captain, Fernando López-Mirones as biologist and filmmaker for ORCA-Films, and Beat von Niederhausern as boatswain. A few volunteers were also on board, including Sam Laederach, Georgina Stevens, Doris Juen, Cornelia Luxner, Susanne Luxner, Naim Lasgaa and Miguel Félix.

On 28 June 2018, at 07:00 UT, three hours after sunrise, at 39° 5.35' N and 003° 4.31' E, with wind force 0 (Beaufort) and sea state 0 (Douglas), the dorsal



Fig. 1: Map showing the exact location where the estimated 500-cm TL female shortfin mako shark was observed on 28 June 2018.

Sl. 1: Zemljevid obravnavanega območja z označeno lokaliteto, kjer so avtorji 28. junija 2018 opazovali na 500 cm dolžine ocenjeno samico atlantskega maka.

fin was observed of a shark gliding slowly through the surface in 700-m-deep waters of the Emile Baudot escarpment, 5 nmi ESE of the Cabrera Grande Island (Fig. 1).

On the same day, a small juvenile loggerhead turtle *Caretta caretta* (Linnaeus, 1758) had been seen basking just one hour before 3.8 miles north from the sighting position, and a pod of 40 Risso's dolphins *Grampus griseus* (Cuvier, 1812) was observed slowly travelling north at a distance of 1000 m just after the encounter with the shark.

According to data from the Balearic Islands Coastal Ocean Observing and Forecasting System (SOCIB) and observation by Alnitak, 14 days prior to the shark encounter there had been particularly numerous observations of bluefin tuna *Thunnus thynnus* (Linnaeus, 1758), giant devil rays *Mobula mobular* (Bonnaterre, 1788), sperm whales *Physeter macrocephalus* Linnaeus, 1758 with calves, and large dolphin groups, while 7 days before the shark encounter there had been an important reduction in the number of sightings, except for turtles and Risso's dolphins, while sperm whales appeared to be silent, not clicking, just frequently breaching.



Fig. 2: The estimated 500-cm TL female shortfin mako shark, observed near Cabrera Grande, Balearic Islands, Spain, on 28 June 2018. This mako is believed to be the largest of its species observed alive, and the second largest ever recorded worldwide (photo by ALNITAK/ORCA-Films).
Sl. 2: Pet metrov dolga samica atlantskega maka, fotografirana 28. junija 2018 blizu otoka Cabrera na Balearih (Španija). Avtorji menijo, da gre za največji živeči primerek in drugi največji doslej zabeleženi primerek (foto: ALNITAK/ORCA-Films).

Pictures and videos of the shark were taken with a Nikon D750 camera, a Panasonic AG-DVX 200 video camera and a GoPro Hero3 video camera for subsequent analysis (Figs. 2-4). Underwater videos were filmed from the inflatable boat by the second author, but in them

the shark was barely visible. A short, 25-second high-resolution aerial video was filmed by the first author from the mast of the boat from a height of 7 m, and was fundamental for identification purposes.



Fig. 3: Dorsal fin of the sighted shortfin mako shark (photo by ALNITAK/ORCA-Films).
Sl. 3: Hrbtina plavut opazovanega atlantskega maka (foto: ALNITAK/ORCA-Films).



Fig. 4: Close-up of the shortfin mako shark showing the whitish band visible at the base of the dorsal fin, which is a peculiar feature of very large shortfin makos (photo by ALNITAK/ORCA-Films).
Sl. 4: Bližinski posnetek atlantskega maka, na katerem je razvidna belkasta proga na korenu hrbtne plavuti, ki je značilna za večje primerke te vrste (foto: ALNITAK/ORCA-Films).

RESULTS AND DISCUSSION

The shark was observed by the first two authors for 70 minutes. The size of the shark was carefully estimated by the first two authors at 500 cm total length (TL), based on the size of the inflatable boat, which was 520 cm LOA.

Some evident morphological features of the animal, including markedly spindle-shaped body, pointed conical snout, presence of caudal keel, and long gill slits, allowed the authors to make an immediate identification of the shark as a representative of the family Lamnidae. Although the shark was initially identified as a great white shark *Carcharodon carcharias* (Linnaeus, 1758), after careful examination of the high-resolution video and the photos we were able to conclude that the species observed by the team of Alnitak was actually an unusually large shortfin mako shark.

Large individuals of shortfin mako may bear a similarity with the great white shark, considerably more conspicuous than small or medium-sized individuals, however the two species can be told apart by various features (De Maddalena *et al.*, 2005). The identification of the Cabrera shark as *I. oxyrinchus* is therefore based on many morphological characteristics, which are listed below. Some of these also constitute a solid confirmation of the fact that the shark was indeed a shortfin mako of a very large size.

The estimated 500-cm size may seem barely acceptable for *I. oxyrinchus*, considering that only three other individuals of over 400 cm have been recorded to date worldwide (Kabasakal & De Maddalena, 2011), but on the other hand these records show that while the occurrence of such gigantic makos is extremely rare, it is still a reality.

The colouration is grey brown with a hint of blue. This can be observed in large makos, while smaller individuals display a much more brilliant blue colour with strong metallic reflection.

The shape of the first dorsal fin, high and more erect than in *C. carcharias*, corresponds to what is normally observed in *I. oxyrinchus* (Fig. 5).

The posterior margin of the first dorsal fin is mostly smooth and with only a few notches, which is typical of *I. oxyrinchus*, while *C. carcharias* shows a much more irregular posterior margin with a high number of notches (Fig. 5).

The whitish band visible at the base of the dorsal fin is a peculiar feature of very large shortfin makos and is not observed in great white sharks (Fig. 4).

The shape of the body, both the head and trunk stout and very massive, can suggest either a great white shark or a very large shortfin mako, but are definitely not compatible with small or medium-sized mako specimens.

The pectoral fins are long, conspicuously longer than in an average shortfin mako. It is known that neonate specimens of *I. oxyrinchus* have very short pectoral fins, however, these get conspicuously longer as the individual grows, up to the point of reaching a similar length as in *C. carcharias*.

The caudal fin's terminal lobe is not as prominent as in *C. carcharias*, and its size fits the one normally observable in *I. oxyrinchus* (Fig. 5).

The large size of the caudal keel may fit both *C. carcharias* and a very large *I. oxyrinchus*, but its angular shape definitely indicates the latter species.

The lower lobe of the caudal fin is as big as, or perhaps even bigger than, the upper lobe. In this regard we have to consider that while in *C. carcharias* the proportion of the two lobes tends to remain similar in small and large individuals, in *I. oxyrinchus* the lower lobe is much shorter than the upper lobe in juveniles, but becomes much larger when the individual grows bigger, and eventually it may match the size of the upper lobe.

On the head and the trunk there are bite scars that are likely the result of love bites by a mako, not by a great white shark.

The fast and somewhat nervous swimming pattern is typical of shortfin mako shark but not of great white shark.

Other features that differentiate *I. oxyrinchus* from *C. carcharias*, like the absence of a black tip on the underside of pectoral fins, the shape of the teeth, the respective position of the dorsal fin origin and pectoral fin free rear tip, the boundary between the colouration of the lateral and ventral surfaces, could not be observed. However, the totality of the observable features listed above, leads to a solid conclusive identification of the species as *I. oxyrinchus*.

While a study of 199 shortfin mako sharks showed an average total length of 171 cm (Kohler *et al.*, 1996) this species can sometimes attain incredibly larger sizes. The largest shortfin mako reported to date worldwide was a female caught in the late 1950s in the Aegean Sea off Marmaris, Turkey, which was estimated at 585 cm TL with a 577–619 cm range (Kabasakal & De Maddalena, 2011). Other large specimens have been recorded in the Mediterranean area. A 445-cm-long specimen was caught off Six-Fours les-Plages, France, in September 1973 (Capapé, 1977). A 425-cm-long shortfin mako was caught off La Galite Island, Tunisia, on 24 September 1876, and its jaws are preserved in the Natural History Museum of Genoa, Italy (Doria & Gestro, 1877). Lawley (1881) reported a 4-metre-long specimen that weighed 1000 kg, which was observed in a warehouse of a fishmonger in Livorno and was caught off Piombino, Italy. A 400-cm-long shortfin mako captured off Caska, Novalja, Croatia, on 13 May 1882 was reported by Brusina (1888). A 390-cm-long shortfin mako was caught on 30 November 1991 off Bagnara Calabria, Italy (Storai *et al.*, 2001). Another 390-cm-long specimen, weighing 513 kg, was caught on 20 September 2000 off Punta Alice, Italy (Storai *et al.*, 2001). A 390-cm-long female was caught on 26 July 2003 off Scaletta Zanclea, Italy, and another female, measuring 370 cm TL, was caught between Portopalo di Capo Passero and Marzamemi, Italy, on 22 June 2004 (Celona *et al.*, 2004). A 380-cm-long female was caught in summer 2012, by a commercial purse-seiner operating in İskenderun Bay, eastern Levantine Sea (Kabasakal, 2015).

Taking into account these records, the estimated 500-cm TL female shortfin mako shark observed near Cabrera Grande is believed to be the largest of its species observed alive, and the second largest ever recorded worldwide.

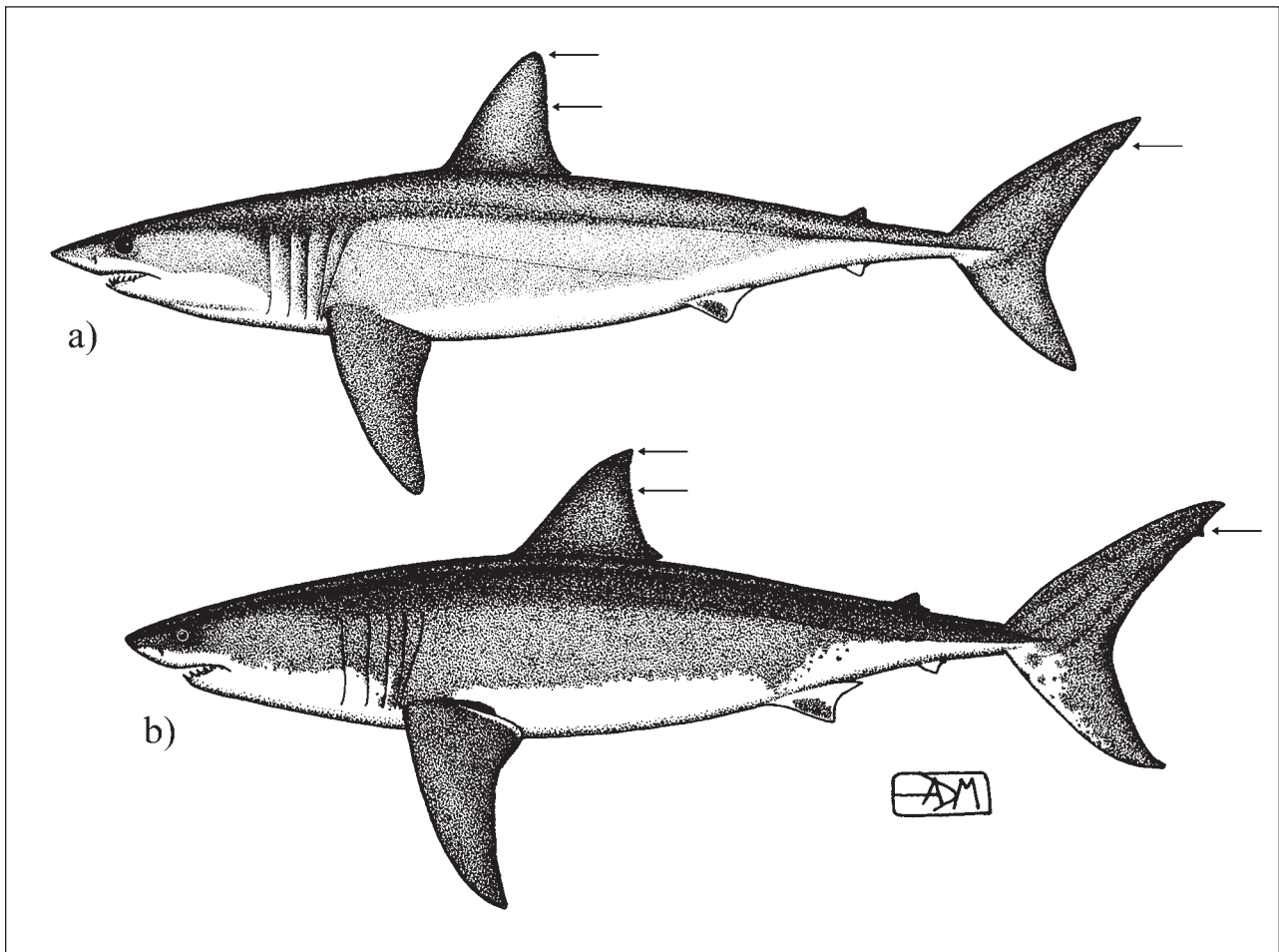


Fig. 5: Morphology of the shortfin mako (a) and the great white shark *Carcharodon carcharias* (Linnaeus, 1758) (b). The arrows mark some of the features that differentiate *I. oxyrinchus* from *C. carcharias*: a more erect first dorsal fin, a smoother posterior margin of the dorsal fin and a less prominent caudal fin's terminal lobe (illustration by Alessandro De Maddalena).

Sl. 5: Morfološke značilnosti atlantskega maka (a) in belega morskega volka *Carcharodon carcharias* (Linnaeus, 1758) (b). Puščice označujejo znake, po katerih je možno razlikovati vrsto *I. oxyrinchus* od *C. carcharias*: bolj pokončna hrbtne plavut, bolj gladek zadnji rob hrbtne plavuti in manj očitna krpica na repni plavuti (ilustracija: A. De Maddalena).

ACKNOWLEDGEMENTS

Very special thanks to all the people that were on board at the time of the observation reported in this article. The authors wish to thank Andrew Fox for his constructive comments on the Cabrera mako

shark, and Eric Glenn Haenni for taking the time to edit the manuscript. Fernando López-Mirones thanks Tatu, Santiago, Sebastian and Marina for their love and Alexander Sanchez Jones for his help. Alessandro De Maddalena thanks Alessandra, Antonio and Phoebe for their support and love.

O OPAZOVANJU VELIKEGA PRIMERKA ATLANTSKEGA MAKI *ISURUS OXYRINCHUS* RAFINESQUE, 1810 (CHONDRICHTHYES: LAMNIDAE) V BLIŽINI OTOKA CABRERA GRANDE, BALEARSKO OTOČJE, ŠPANIJA

Fernando LOPEZ-MIRONES

calle Rio Alagon 1209, El Casar, 19170 Guadalajara, Spain, e-mail: fernandomirones@telefonica.net

Alessandro DE MADDALENA

Shark Museum, 26 Forest Hill Road, Simon's Town, 7995 Cape Town, South Africa, e-mail: alessandrodemaddalena@gmail.com

Ricardo SAGARMINAGA VAN BUITEN

ALNITAK, Calle nalon 16, 28240 Hoyo De Manzanares, Spain, e-mail: ric@alnitak.org

POVZETEK

Osemindvajsetega junija 2018 so blizu otoka Cabrera Grande na Balearih (Španija) opazovali veliko samico atlantskega mako (*Isurus oxyrinchus*). Na podlagi primerjave z gumenjakom, ki je meril 520 cm, so ocenili, da je samica merila 500 cm v dolžino. Gre za največji živeči primerek te vrste in drugi največji doslej zabeleženi primerek.

Ključne besede: atlantski mako, *Isurus oxyrinchus*, največja dolžina, Španija, Nacionalni park Cabrera, Sredozemsko morje

REFERENCES

- Brusina, S. (1888):** *Morski psi Sredozemnoga i Crljenog mora (Sharks of the Adriatic and the Black Sea)*. Glasnik hrvatskoga naravoslovnoga društva, III: 167-230, Zagreb.
- Capapé, C. (1977):** Liste commentée des sélachiens de la région de Toulon (de La Ciotat à Saint-Tropez). Bull. Mus. Hist. Nat. Marseille, 37, 5-9.
- Celona, A., L. Piscitelli & A. De Maddalena (2004):** Two large shortfin makos, *Isurus oxyrinchus*, Rafinesque, 1809, caught off Sicily, western Ionian Sea. Annales, Series Historia Naturalis, 14, 35-42.
- Cliff, G., S.F.J. Dudley & B. Davis (1989):** Sharks caught in the protective gill nets off Natal, South Africa. 3. The shortfin mako shark *Isurus oxyrinchus* (Linnaeus). S. Afr. J. Mar. Sci., 9, 115-126.
- Compagno, L.J.V. (2001):** Sharks of the world. An annotated and illustrated catalogue of shark species known to date. Volume 2. Bullhead, mackerel and carpet sharks (Heterodontiformes, Lamniformes and Orectolobiformes). FAO Species Catalogue for Fishery Purposes. No. 1, Vol. 2. FAO, Rome, 269 pp.
- De Maddalena, A. & H. Baensch (2005):** Haie im Mittelmeer. Franckh-Kosmos Verlags-GmbH & Co., Stuttgart, 240 pp.
- De Maddalena, A., A. Preti & R. Smith (2005):** Mako sharks. Krieger Publishing, Malabar, 72 pp.
- De Maddalena, A., M. Zuffa, L. Lipej & A. Celona (2001):** An analysis of the photographic evidences of the largest great white sharks, *Carcharodon carcharias* (Linnaeus, 1758), captured in the Mediterranean Sea with considerations about the maximum size of the species. Annales, Series Historia Naturalis, 11, 193-206.
- Doria, G. & R. Gestro (1877):** Crociera del "Violante" comandato dal capitano armatore Enrico D'Alberis durante l'anno 1876. Ann. Mus. Civ. Sto. Nat. "G. Doria", Genova, 11, 302-304.
- Kabasakal, H. (2015):** Occurrence of shortfin mako shark, *Isurus oxyrinchus* Rafinesque, 1810, off Turkey's coast. Marine Biodiversity Records. doi:10.1017/S1755267215001104, Vol. 8, e134.
- Kabasakal, H. & A. De Maddalena (2011):** A huge shortfin mako shark *Isurus oxyrinchus* Rafinesque, 1810 (Chondrichthyes: Lamnidae) from the waters of Marmaris, Turkey. Annales, Series Historia Naturalis, 21(1), 21-24.
- Kohler, N.E., J.G. Casey & P.A. Turner (1996):** Length-length and length-weight relationships for 13 shark species from the Western North Atlantic. NOAA Tech. Memo. NMFS-NE-110, 1-22.
- Lawley, R. (1881):** Studi comparativi sui pesci fossili coi viventi dei generi *Carcharodon*, *Oxyrhina* e *Galeocerdo*. Nistri, Pisa, 151 pp.
- Megalofonou, P., C. Yannopoulos, D. Damalas, G. De Metrio, M. Deflorio, J. M. De La Serna & D. Macias (2005):** Incidental catch and estimated discards of pelagic sharks from the swordfish and tuna fisheries in the Mediterranean Sea. Fish. Bull., 103, 620-634.
- Storai, T., Zuffa, M. & R. Gioia (2001):** Evidenze di predazione su odontoceti da parte di *Isurus oxyrinchus* (Rafinesque, 1810) nel Tirreno Meridionale e Mar Ionio (Mediterraneo). Atti Soc. tosc. Sci. nat., Mem., Serie B, 108, 71-75.