

TWO LARGE SHORTFIN MAKOS, *ISURUS OXYRINCHUS*, RAFINESQUE,
1809, CAUGHT OFF SICILY, WESTERN IONIAN SEA*Antonio CELONA*

Aquistudio Research Institute, I-98121 Messina, via Trapani 6, Italy

Luigi PISCITELLI

Mercato Ittico, I-20137 Milano, viale Molise 62, Italy

*Alessandro DE MADDALENA*Banca Dati Italiana Squalo Bianco (Italian Great White Shark Data Bank), I-20145 Milano, via L. Ariosto 4, Italy
E-mail: a-demaddalena@tiscali.it

ABSTRACT

The authors report on two large shortfin makos *Isurus oxyrinchus* captured off Sicily, Western Ionian Sea (Central Mediterranean Sea). A female shortfin mako was caught on 26 July 2003 off Scaletta Zanclea. The specimen's total length of 390 cm was estimated on the basis of a photograph and measurements of the pectoral and first dorsal fins. Another 370-cm female shortfin mako was captured between Portopalo di Capo Passero and Marzamemi and transported to the fish market in Milan, Italy, on 22 June 2004. The two specimens reported in this work are the largest ever recorded in Sicilian waters, and among the largest recorded from the entire Mediterranean Sea.

Key words: shortfin mako, *Isurus oxyrinchus*, size, Mediterranean Sea

DUE GRANDI SQUALI MAKO DALLE PINNE CORTE, *ISURUS OXYRINCHUS*, RAFI-
NESQUE, 1809, CATTURATI IN SICILIA, MARE IONIO OCCIDENTALE

SINTESI

Vengono segnalati due grandi squali mako dalle pinne corte *Isurus oxyrinchus* catturati in acque siciliane, Mare Ionio Occidentale (Mare Mediterraneo Centrale). Il primo, una femmina, venne catturato nel Luglio 2003 al largo di Scaletta Zanclea. La lunghezza totale di questo esemplare è stata stimata pari a circa 390 cm sulla base di una fotografia e delle misure delle pinne pettorali e prima dorsale. Un altro mako dalle pinne corte, di 370 cm di lunghezza, venne catturato tra Portopalo di Capo Passero e Marzamemi e portato al Mercato Ittico di Milano, Italia, il 22 Giugno 2004. I due esemplari qui riportati sono i più grandi mai catturati nelle acque della Sicilia e tra i maggiori registrati sino ad oggi nell'intero Mare Mediterraneo.

Parole chiave: squalo mako dalle pinne corte, *Isurus oxyrinchus*, dimensioni, Mare Mediterraneo

INTRODUCTION

As in most shark species, female shortfin makos, *Isurus oxyrinchus*, Rafinesque, 1809 (Order Lamniformes, family Lamnidae), reach larger sizes than males. The average total length is 171 cm, based on a recent study of 199 specimens bearing a total length ranging from 70 and 368 cm (Kohler *et al.*, 1996). The maximum length is 445 cm: a huge specimen of this size was caught off Six-Fours les-Plages, France, in September 1973 (Capapé, 1977). Other large specimens have been recorded in the Mediterranean area. A large 425-cm shortfin mako was caught off La Galite Island, Tunisia, on September 24, 1876, with its jaws preserved in the Natural History Museum of Genoa, Italy (Doria & Gestro, 1877). Lawley (1881) reports on a 4 m long and 1,000 kg heavy specimen observed in a warehouse of a fishmonger in Livorno, Italy; it was caught off Piombino, Italy, but the

author does not indicate the time of the event and the specimen's weight and measurements seem, unfortunately, to be only approximate as well. A 400-cm shortfin mako captured off Caska, Novalja, Croatia, on May 13, 1882, was reported by Brusina (1888). A 390-cm long shortfin mako was caught on November 30, 1991, off Bagnara Calabra, Italy (Storai *et al.*, 2001). Another 390-cm specimen, weighing 513 kg, was caught on September 20, 2000 off Punta Alice, Italy (Storai *et al.*, 2001).

The shortfin mako's distribution includes the Mediterranean Sea, the Atlantic, and the Indian and Pacific Oceans (Garrick, 1967). Its presence in Sicilian waters is well known (Spallanzani, 1793; Rafinesque, 1809; Tortonese, 1956; Celona *et al.*, 2001; De Maddalena *et al.*, *in press*). Here, we report on two recent records of large shortfin makos from Sicilian waters.

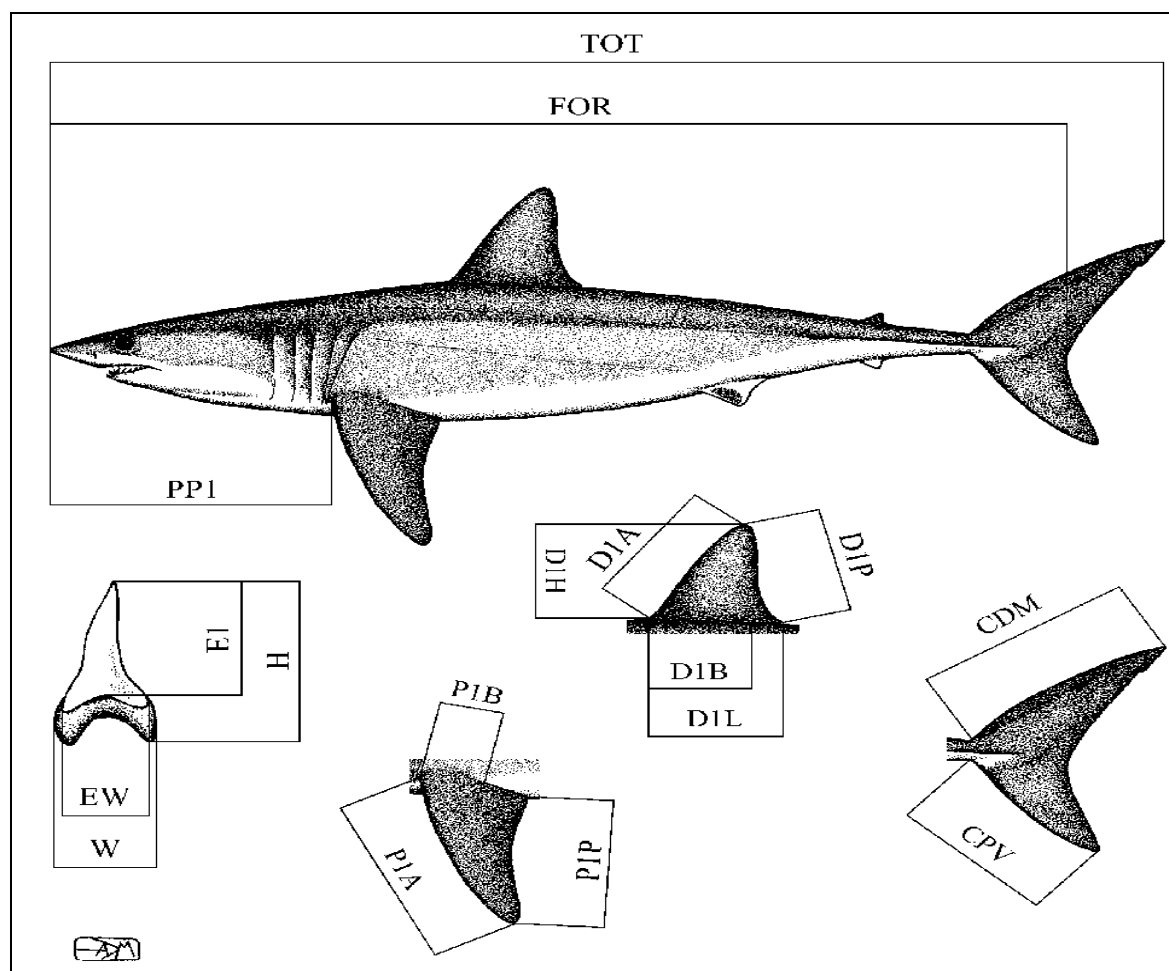


Fig. 1: Shortfin mako *Isurus oxyrinchus*: measurements used in this work follow the terminology and parameters of Compagno (1984) and Mollet *et al.* (1996). (Drawing: A. De Maddalena)

Sl. 1: Atlantski mako *Isurus oxyrinchus*: meritve, uporabljene v tem delu, so v skladu s terminologijo in parametri Compagna (1984) in Molleta *et al.* (1996). (Risba: A. De Maddalena)

MATERIALS AND METHODS

We collected all the data available for the two specimens presented in this work. Morphometric measurements were made following Compagno (1984) and Mollet *et al.* (1996) (Fig. 1). Photographic evidence was collected for both specimens. The pectoral fins, first dorsal fin and the jaws of the shortfin mako caught off Scaletta Zanclea were preserved by the fisherman, and eventually examined and measured by one of the authors (A. Celona). The specimen caught between Portopalo di Capo Passero and Marzamemi was thoroughly examined, its photos taken and fins preserved in one of the author's (L. Piscitelli) personal collection. Total length of the Scaletta Zanclea specimen was estimated according to the literature (Garrick, 1967; Moreno, 1991; Kohler *et al.*, 1996; De Maddalena *et al.*, 2001). Three estimates (from the pectoral fin size, from the first dorsal fin size and from the photographic evidence) were obtained and then the three resulting intervals compared. Moreover, the following relationship between fork length and total length, based on 199 specimens with lengths ranging from 70 to 368 cm, was used (Kohler *et al.*, 1996):

$$FL = (a)TL + b$$

where FL is fork length, TL total length, and a and b are 0.9286 and -1.7101, respectively.

RESULTS

A mature female shortfin mako shark was captured by fisherman F. Arturo on 26 July, 2003, off Sicily, in the Western Ionian Sea, Italy (Figs. 3–6). It was caught at 6 m depth, 3 km east of Scaletta Zanclea (Fig. 2). The sea was smooth and the north-westerly wind blowing at that time reached 4–5 knots. The mako was caught in a swordfish drift net ("spadara"), 7500 m long and 30 m high. On the same night, five swordfish were actually caught. When the fisherman crew saw the shark discussed, it was still alive and moving vigorously to escape. It was killed with two rifle shots. Some scars, maybe "love bites" or mating scars, behind the shark's gill slits were observed. The lower part of the head, under the snout and around the mouth, was dark, but lighter than the upper parts. The fisherman estimated the shark's fork length (FOR) at 420 cm and its weight at 500 kg. The shark was sold at a low price (about 300 €). Unidentified remains, almost completely digested, were found in the stomach. Data of the specimen's jaws and fins morphometrics are presented in Table 1.

Another mature female shortfin mako shark was transported to the fish market in Milan (Figs. 7, 8) on 22 June, 2004. The shark was accidentally captured 15 miles offshore between Portopalo di Capo Passero and Marzamemi, Sicily, in the Western Ionian Sea (Fig. 2), in



Fig. 2: Map of Sicily, Italy (Mediterranean Sea), showing the location of the shortfin mako captures presented in this work. (Drawing: A. De Maddalena)

Sl. 2: Zemljevid Sicilije (Sredozemsko morje) z lokalitetami ulova atlantskih makojev, opisanih v tem delu. (Risba: A. De Maddalena)

the area from which other captures of large sharks had been previously reported (Celona, 2002; De Maddalena, 2002). The mako was caught by "Vittorio Veneto" fishing vessel belonging to International Fish of Acireale, Sicily. The pelagic longline, in which the mako was caught, was actually used for catching swordfish. The about 76-km main line carried a total of 1500 6-cm hooks (Mustad hooks, the kind used more commonly for swordfish

Tab. 1: Measurements (in cm) of jaws and fins of the shortfin makos caught off Scaletta Zanclea and between Portopalo di Capo Passero and Marzamemi, Sicily.**Tab. 1: Velikost (v cm) čeljusti in plavuti dveh atlantskih makojev, ujetih v bližini Scalette Zanclee ter med Portopalom di Capo Passero in Marzamemijem, Sicilija.**

Shortfin mako caught on 26 July, 2003 (off Scaletta Zanclea)				
Dental formula	12 – 12 / 12 – 12			
Dried upper jaw perimeter	80			
Dried lower jaw perimeter	69			
1 st upper anterior tooth	3.7 (E1)	1.9 (EW)	2.5 (W)	5.3 (H)
2 nd upper anterior tooth	3.0 (E1)	2.0 (EW)	2.9 (W)	4.7 (H)
Upper intermediate tooth	1.5 (E1)	1.8 (EW)	2.0 (W)	2.9 (H)
1 st lower anterior tooth	3.5 (E1)	1.5 (EW)	2.3 (W)	4.5 (H)
2 nd lower anterior tooth	3.7 (E1)	1.8 (EW)	2.5 (W)	4.8 (H)
3 rd lower anterior tooth	2.3 (E1)	2.3 (EW)	2.4 (W)	3.5 (H)
Pectoral anterior margin (P1A)	66 (measured dried)			
Pectoral posterior margin (P1P)	57 (measured dried)			
1 st dorsal anterior margin (D1A)	44 (measured dried)			
1 st dorsal posterior margin (D1P)	43 (measured dried)			
1 st dorsal height (D1H)	39 (measured dried)			
Shortfin mako caught between Portopalo di Capo Passero and Marzamemi				
Total length (TOT)	370 (measured frozen)			
Pectoral anterior margin (P1A)	71 (measured frozen)			
Pectoral base (P1B)	12 (measured frozen)			
1 st dorsal length (D1L)	35 (measured frozen)			
1 st dorsal base (D1B)	25 (measured frozen)			
1 st dorsal height (D1H)	42 (measured frozen)			
Dorsal caudal margin (CDM)	61 (measured frozen)			
Preventral caudal margin (CPV)	56.5 (measured frozen)			

fishing in the Mediterranean), at intervals of about 51 m. The baits used were the Atlantic mackerel *Scomber scombrus* Linnaeus, 1758 and the European squid *Loligo vulgaris* Lamarck, 1798 (Mr. Castorina and A. Leonardi, *pers. comm.*). The gutted mako was 370 cm long and weighed 330 kg. The shark lacked the jaws, which had been cut off after its capture. This specimen also lacked the left pelvic fin, bearing a healed scar apparently inflicted by another shark's bite (Fig. 8). Its morphometrics are presented in Table 1.

DISCUSSION

Kohler *et al.* (1996) reported the relationship between fork length and total length of the shortfin mako as $FL = (0.9286)TL - 1.7101$. We then estimated that the Scaletta Zanclea specimen's total length, according to this relationship and the fork length reported by the fisherman, was 454 cm. If the estimate is correct, this specimen should be the largest of its species ever recorded, surpassing even the huge 445-cm shortfin mako reported by Capapé (1977). We decided to check the validity of this estimate using the elements at our disposal. There are three different estimates that can be obtained from the available materials: from the pectoral

fin size, from the first dorsal fin size, and from the photographic evidence.

The shortfin mako shows changes in morphology with size. Therefore, only data obtained from the measurements of large specimens can be utilised as a useful reference to effect a precise size estimate of the Scaletta Zanclea specimen. We used the measurements of three shortfin makos of 246, 270 and 296 cm in length, compiled by Moreno (1991) (Tab. 2).

Tab. 2: Data obtained from the measurements of three shortfin makos of 246, 270 and 296 cm in length, compiled by Moreno (1991). Measurements (following terminology and parameters of Compagno, 1984) are expressed as percentage of total length.

Tab. 2: Podatki, ki jih je na osnovi meritev treh atlantskih makojev, dolgih 246, 270 in 296 cm, zbral Moreno (1991). Meritve (po terminologiji in parametrih Compagno, 1984) so podane kot odstotek celotne dolžine.

Measurement	Abbreviation	%TOT
Prepectoral length	PP1	28.3 – 29.2
Pectoral anterior margin	PIA	18.4 – 19.2
1 st dorsal height	DIH	10.1 – 10.9



Fig. 3: Estimated 390-cm female shortfin mako caught on 26 July, 2003, off Scaletta Zanclea, Sicily. (Photo: G. Manganaro)

Sl. 3: Samica atlantskega makoja, ujeta 26. 7. 2003 v bližini Scalette Zanclee, Sicilija, je po oceni avtorjev v dolžino merila 390 cm. (Foto: G. Manganaro)



Fig. 4: Head of the estimated 390-cm female shortfin mako caught on 26 July, 2003, off Scaletta Zanclea. (Photo: G. Manganaro)

Sl. 4: Glava 390 cm dolge samice atlantskega makoja, ujete 26. 7. 2003 v bližini Scalette Zanclee. (Foto: G. Manganaro)

It is important to note that while fins of the mako caught between Portopalo di Capo Passero and Marzamemi were measured frozen, which means that their size was very close to the size of the fresh ones, the fins of the specimen caught off Scaletta Zanclea were measured dried, about five months after capture, which means that their size may be conspicuously smaller than of the fresh fins. Therefore we need to consider a shrinkage between 3.8 and 7.4% for the Portopalo di Capo Passero specimen (Duffy & Francis, 2001) and between 10% and 15% for the Scaletta Zanclea specimen (Mollet *et al.*, 1996). The original P1A of the Scaletta Zanclea specimen should therefore be between 73 and 78 cm, and the original D1H between 43 and 46 cm. We estimated the TOT to be 380–424 cm on the basis of P1A, and 394–455 cm on the basis of D1H.

Following the indications given by De Maddalena *et*

al. (2001) for estimating the size of large sharks from photographic evidences, we concluded that one of the photographs (Fig. 4) of the Scaletta Zanclea mako is applicable to produce an accurate estimate of this specimen. We assumed as references the body of the man on the right of the photograph, and the hand of the man on the left. We then estimated the PP1 at 94–110 cm, corresponding to 322–389 cm TOT.

Finally, comparing the three intervals obtained from these three estimates (322–389 cm, 380–424 cm, 394–455 cm TOT), we concluded that the total length of Scaletta Zanclea specimen should be about 390 cm. Therefore the 420-cm fork length estimated by the fisherman seems to be exaggerated. However, the two specimens reported in this work are the largest ever recorded in Sicilian waters, and among the largest recorded from the entire Mediterranean Sea.



Fig. 5: Anterior view of the estimated 390-cm female shortfin mako caught on 26 July, 2003, off Scaletta Zanclea. (Photo: G. Manganaro)

Sl. 5: Pogled od spredaj na 390 cm dolgo samico atlantskega makoja, ujeta 26. 7. 2003 v bližini Scalette Zanclee. (Foto: G. Manganaro)

ACKNOWLEDGMENTS

We thank the following people for freely sharing their observations: the Forzini family, Giuseppe Manganaro, Renato Malandra, International Fish srl. and especially Mr. Castorina and Alessio Leonardi. We also thank the referees for their helpful comments. A particular thanks goes from Alessandro De Maddalena to his wife Alessandra.

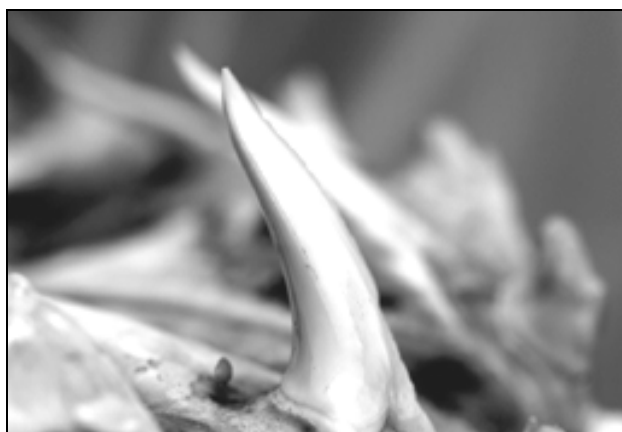


Fig. 6: Tooth of the estimated 390-cm female shortfin mako caught on 26 July, 2003, off Scaletta Zanclea. (Photo: G. Manganaro)

Sl. 6: Zob 390 cm dolge samice atlantskega makoja, ujeta 26. 7. 2003 v bližini Scalette Zanclee. (Foto: G. Manganaro)



Fig. 7: The 370-cm female shortfin mako caught between Portopalo di Capo Passero and Marzamemi, Sicily, and examined at the fish market in Milan on 22 June, 2004. (Photo: L. Piscitelli)

Sl. 7: 370 cm dolg atlantski mako, ujet med Portopalom di Capo Passero in Marzamemijem na Siciliji ter 22. junija 2004 izmerjen na ribji tržnici v Milanu. (Foto: L. Piscitelli)

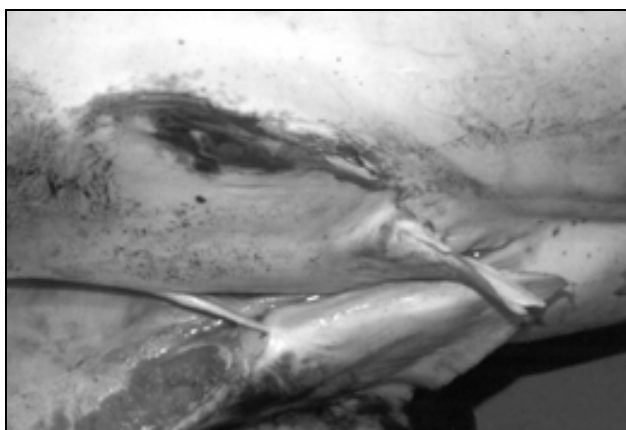


Fig. 8: Pelvic region of the 370-cm female shortfin mako caught between Portopalo di Capo Passero and Marzamemi, lacking the left pelvic fin and bearing a healed scar apparently inflicted by another shark's bite. (Photo: L. Piscitelli)

Sl. 8: Trebušni del 370 cm dolgega atlantskega makoja, ujetega med Portopalom di Capo Passero in Marzame-mijem, brez leve trebušne plavuti, a z zaceljeno braz-gotino, ki je najbrž posledica ugriza kakega drugega morskega psa. (Foto: L. Piscitelli)

PRIMER DVEH IZREDNO VELIKIH ATLANTSKIH MAKOJEV *ISURUS OXYRINCHUS*, RAFINESQUE, 1809, UJETIH V VODAH ZAHODNEGA JONSKEGA MORJA NEDALEČ OD SICILIJE

Antonio CELONA

Aquastudio Research Institute, I-98121 Messina, via Trapani 6, Italy

Luigi PISCITELLI

Mercato Ittico, I-20137 Milano, viale Molise 62, Italy

Alessandro DE MADDALENA

Banca Dati Italiana Squalo Bianco (Italian Great White Shark Data Bank), I-20145 Milano, via L. Ariosto 4, Italy

E-mail: a-demaddalena@tiscali.it

POVZETEK

Avtorji pričujočega članka poročajo o dveh nenavadno velikih atlantskih makojih Isurus oxyrinchus, ujetih nedaleč od Sicilije v vodah zahodnega Jonskega morja. Prvi primerek, samica atlantskega makoja, je bil ujet 26. julija 2003 blizu Scalette Zanclee. Na osnovi fotografije in izmerjenih dolžin prsne plavuti in prve hrbtna plavuti je bila ocenjena samičina celotna dolžina, in sicer 390 cm. Drugi primerek, 370 cm dolga samica, je bil ujet 22. junija 2004 med Portopalom di Capo Passero in Marzame-mijem in prepeljan na ribjo tržnico v Milanu. Primerka sta največja, kar so jih kdaj ujeli v sicilskih vodah in med največjimi, kar jih je bilo kdaj zabeleženih v celotnem Sredozemskem morju.

Ključne besede: atlantski mako, *Isurus oxyrinchus*, velikost, Sredozemsko morje

REFERENCES

- Brusina, S. (1888):** Morski psi Sredozemnoga i Crljenoga mora. Glasnik hrvatskoga naravoslovnoga društva, Zagreb, p. 167–230.
- Capapé, C. (1977):** Liste commentée des sélaciens de la région de Toulon (de la Ciotat à Saint-Tropez). Bull. Mus. Hist. Natl. Marseille, 37, 5–9.
- Celona, A. (2002):** Due catture di squalo bianco, *Carcharodon carcharias* (Linnaeus, 1758) avvenute nelle acque di Marzamemi (Sicilia) negli anni 1937 e 1964. Annales Ser. hist. nat., 12(1), 207–210.
- Celona, A., N. Donato & A. De Maddalena (2001):** In relation to the captures of a great white shark *Carcharodon carcharias* (Linnaeus, 1758) and a shortfin mako, *Isurus oxyrinchus* Rafinesque, 1809 in the Messina Strait. Annales Ser. hist. nat., 11(1), 13–16.
- Compagno, L. J. V. (1984):** FAO specie catalogue. Vol. 4. Sharks of the World. An annotated and illustrated catalogue of the shark species known to date. Part 1. FAO Fisheries Synopsis, 125, 1–250.
- De Maddalena, A. (2002):** Lo squalo bianco nei mari d'Italia. Ireco, Formello, 144 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 Ser. hist. nat., 11(2), 193–206.
- De Maddalena, A., A. Preti & R. Smith (2005):** Mako sharks. Krieger Publishing. (*In press*)
- Doria, G. & R. Gestro (1877):** Crociera del "Violante" comandato dal capitano armatore Enrico D'Albertis durante l'anno 1876. Ann. Mus. Civ. Stor. Nat. Giacomo Doria, 11, 302–304.
- Duffy, C. & M. P. Francis (2001):** Evidence of summer parturition in shortfin mako (*Isurus oxyrinchus*) sharks from New Zealand waters. N. Z. J. Mar. Freshw. Res., 35, 319–324.
- Garrick, J. A. F. (1967):** Revision of sharks of genus *Isurus* with description of a new species (Galeoidea, Lamnidae). Proc. U. S. Natl. Mus., 118, 663–690.
- 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 Technical Memorandum, NMFS-NE-110, 1–22.
- Lawley, R. (1881):** Studi comparativi sui pesci fossili coi viventi dei generi *Carcharodon*, *Oxyrhina* e *Galeocerdo*. Nistri, Pisa.
- Mollet, H. F., G. M. Cailliet, A. P. Klimley, D. A. Ebert, A. D. Testi & L. J. V. Compagno (1996):** A review of length validation methods and protocols to measure large white sharks. In: Klimley, A. P. & D. G. Ainley (eds.): Great white sharks. The biology of *Carcharodon carcharias*. Academic Press, San Diego, p. 91–108.
- Moreno, J. A. (1991):** Lamnidae y Alopiidae (Chondrichthyes Euselachii) del Atlántico Nororiental y Mediterráneo Occidental: Sistemática, biología y aspectos pesqueros. Tesis doctoral. Universidad Complutense de Madrid.
- Rafinesque, C. S. (1809):** Caratteri di alcuni nuovi generi e nuove spece di animali e piante della Sicilia. Palermo, 105 pp.
- Spallanzani, L. (1793):** Viaggio alle due Sicilie. Vol. IV. Pavia.
- Storai, T., M. Zuffa & R. Gioia (2001):** Evidenze di predazione su odontoceti da parte di *Isurus oxyrinchus* (Rafinesque, 1810) nel Tirreno Meridionale e Mar Ionio (Mediterraneo). Atti Soc. toscana Sci. Nat. B, 108, 71–75.
- Tortonese, E. (1956):** Fauna d'Italia vol. II. Leptocardia, Ciclostomata, Selachii. Calderini, Bologna, 334 pp.