



CHAPTER 2.1.8.2: MEDITERRANEAN SPEARFISH	AUTHORS: F. AROCHA and M. ORTIZ	LAST UPDATE: Sept. 4, 2006
---	--	---------------------------------------

2.1.8.2 Description of Mediterranean Spearfish (MSP)

1. Names

1.a Classification and taxonomy

Species name: *Tetrapturus belone* (Rafinesque 1810)

Synonyms in use: none

ICCAT species code: MSP

ICCAT names: Mediterranean spearfish (English), Marlin de la Méditerranée (French), Marlin del Mediterráneo (Spanish)

According to Nakamura (1985), Mediterranean spearfish is classified as follows:

- Phylum: Chordata
- Subphylum: Vertebrata
- Superclass: Gnathostomata
- Class: Osteichthyes
- Subclass: Actinopterygii
- Order: Perciformes
- Suborder: Xiphioidi
- Family: Istiophoridae

1.b Common names

List of vernacular names used according to ICCAT and Fishbase (www.fishbase.org). Those with (*) are national standard names according to a survey conducted by ICCAT. The list is not exhaustive and some local names might not be included.

Algeria: Auggia imbriaie

China: 地中海四鳍旗鱼

Croatia: Jaglun

Denmark: Middelhavsspydfisk

Finland: Marliini

France: Marlin de Méditerranée, Poisson-pique

Greece: Μαρλίνος Μεσογείου, Marlinos mesogiou

Italy: Aguglia imperiale, Aguglia pelerana, Ugulia imperiali

Japan: Chichukaifuurai

Malta: Imsella imperjali, Pastardella, Pixxispad

Monaco: Aguglia impériale

Norway: Middelhav-marlin

Poland: Marlin sródziemnomorski

Portugal: Espadim-do-Mediterrâneo

Serbia-Montenegro: Barikuda

Spain: Marlin del Mediterráneo

Sweden: Medelhavsspjutfisk

Turkey: Marlin baligi, Yelken baligi

United Kingdom: Mediterranean spearfish

United States of America: Mediterranean shortbill spearfish

2. Identification

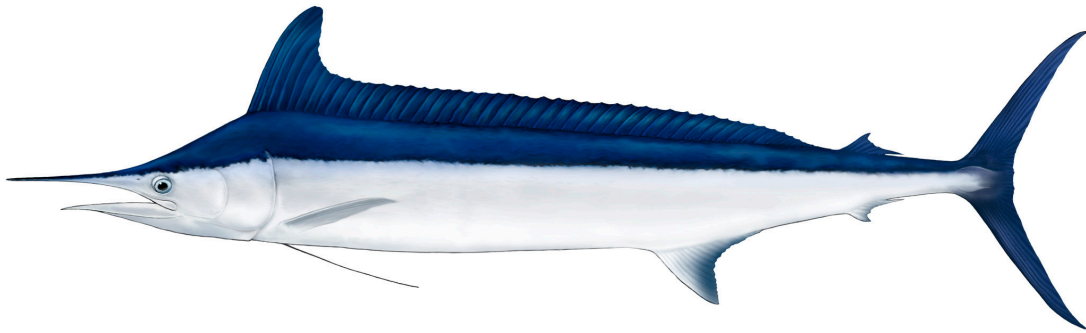


Figure 1. Drawing of an adult Mediterranean spearfish by Les Gallagher (Les Gallagher: fishpics).

Characteristics of Tetrapturus belone (see **Figure 1** and **Figure 2**)

Mediterranean spearfish is one of the small-size billfish species. Maximal size was reported by Nakamura (1985) in 240 cm total length, and 70 kg in weight. Common sizes in the Tyrrhenian Sea and Strait of Messina are 78-193 cm lower jaw to fork length (LJFL), and 14-36 kg round weight (Di Natale *et al.* 2003).

No studies on age, nor tagging experiments are available for Mediterranean spearfish.

External:

- Elongated and much compressed body, covered with densely imbedded scales ending in 3-5 posterior points.
- Upper jaw prolonged into a slender spear, short in length about 18% of body length, round in cross-section.
- Head profile (nape) between preorbital region and origin of first dorsal fin nearly straight.
- First dorsal fin long and rather high throughout its length, height of anterior part slightly greater than body depth.
- Pelvic fins slightly shorter than twice the pectoral fin length.
- Tips of first dorsal and first anal fins rounded.
- Pectoral fin narrow and short.
- Caudal peduncle with double keels on each side, with a caudal notch on the dorsal and ventral surface.
- Two separated anal fins, first anal 11-15 rays, and second anal fin with 6-7 rays.
- Dorsal spines: 39-46 rays in first fin, 5-7 rays in second fin.
Single lateral line visible, curved above pectoral fin, then straight towards tail.
- Anal opening far forward, located at distance from origin of first dorsal equal to height of longest anal fin ray.
- Vertebrae: 12 precaudal plus 12 caudal.
- No gillrakers, jaws and palatines with small teeth in adults.

Color:

- Dark blue on dorsal side and silvery white laterally and ventrally. No rows of vertical bars or spot on body.
- First dorsal fin membrane blue-black, no fin spots, remaining fins brown to black.

Internal:

- Gonads are asymmetrical.
- Swimming bladder present, made up of many bubble-shaped, small chambers.

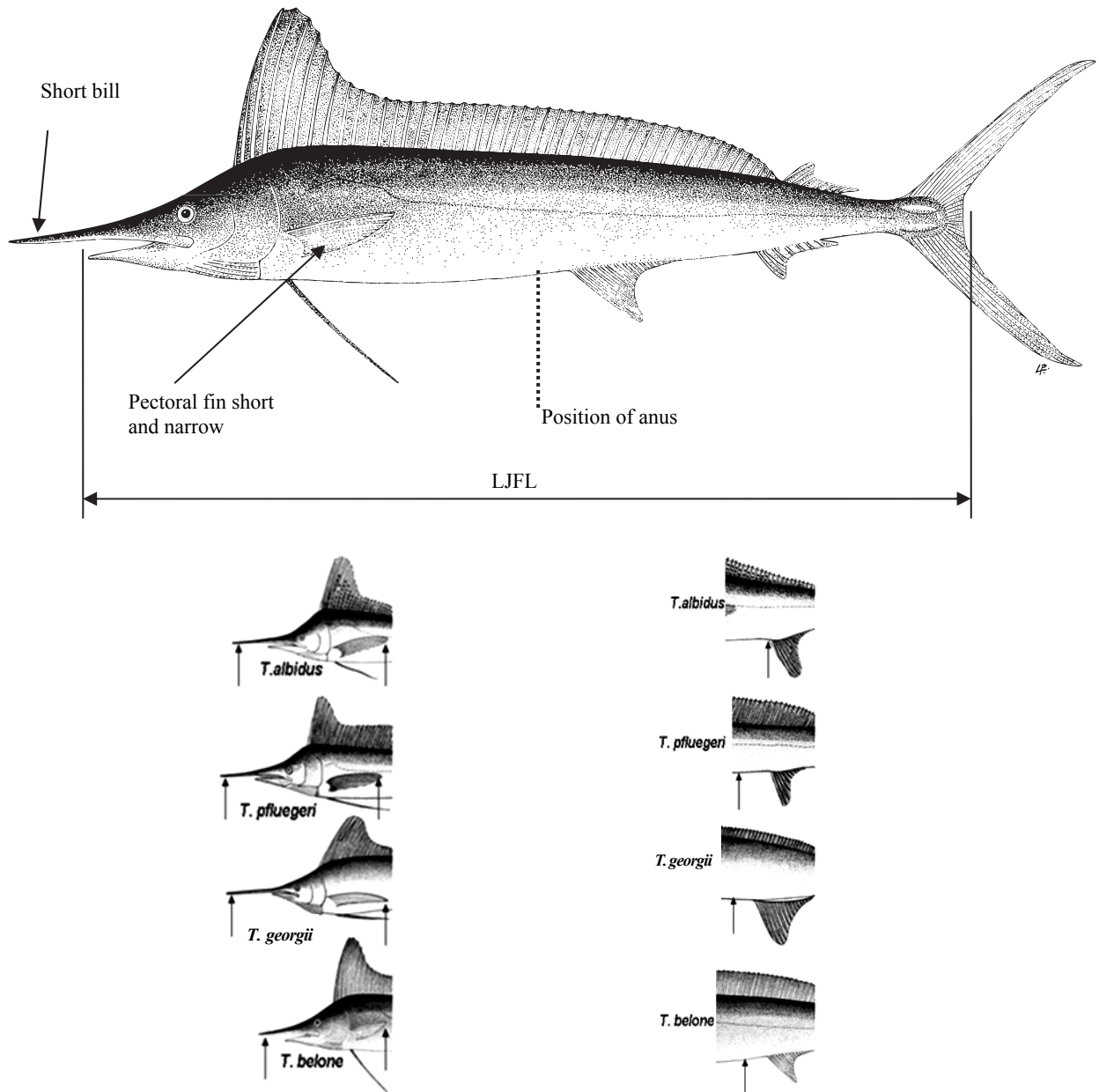


Figure 2. Synthesis of the most outstanding characteristics of *Tetrapturus belone* (top); distinguishing characters between Atlantic *Tetrapturus spp.* (bottom), arrows show length of bill, length and shape of pectoral fin and position of anus (images by FAO).

External characteristics of Mediterranean spearfish larvae

- Yolk-sac larvae about 2 mm.
- Post-larvae >25 mm SL, upper bill present, exceeding length of lower jaw; lateral line simple, forming a single unit. First dorsal fin appears sail-like and unspotted (Di Natale *et al.* 2003).
- Juveniles >300 mm, upper bill present, exceeding length of lower jaw; lateral line simple, forming a single unit. First dorsal fin appears sail-like and with several dark blotches at base of anterior rays and at tips of first few rays, the rest of the fin remains unmarked (de Sylva 1975).

3. Biology and population studies

3.a Habitat preferences

Like its counterparts (*Tetrapturus spp*), Mediterranean spearfish are probably an epipelagic species, found in waters over 200 m usually above the thermocline.

Temperature preferences for Mediterranean spearfish are poorly known. Inferences based on months when specimens are more available to the fishery (August-September) in Sicily (Italy), suggest that Mediterranean spearfish can be found in waters with maximum sea surface temperatures of 24°-29°C that occur in the area.

Depth distribution is probably similar to that of other billfish species when found in temperate waters, most likely within the first 10 m.

Dissolved oxygen requirements for marlins are poorly known. However, Prince and Goodyear (2006) proposed that the minimal oxygen concentration for billfish is 3.5 ml/l, defining it as the hypoxic threshold for these species. Their contention was partly supported by measurements of oxygen consumption of juvenile sailfish which indicated that this species has the high oxygen consumption and associated metabolic rates typical of tropical tunas (Idrisi *et al.* 2002; Brill 1996).

3.b Growth

Mediterranean spearfish age determination and growth studies have not been undertaken. No growth model is available for Mediterranean spearfish.

3.c Length-Weight relationship

There are no available length-weight relationships for Mediterranean spearfish.

3.d Maturity

There is no information regarding the size or weight at which sexual maturity is reached. However, based on the size range found in Sicily and its similarity with the size range found in spawning longbill spearfish in the Caribbean Sea, it could be inferred that female Mediterranean spearfish may start spawning at about 150 cm LJFL.

3.e Sex ratio

There is no information regarding sex ratio.

3.f Reproduction and first life stages

As the rest of the billfishes, Mediterranean spearfish do not show apparent sexual dimorphism in colour pattern or external morphological characters.

Spawning

Mediterranean spearfish are batch spawners, shedding batches of hydrated oocytes, in separate spawning events (de Sylva 1975), most likely directly into the sea where fertilization occurs.

Spawning appears to occur within the Mediterranean Sea.

Spawning success has been identified in the Strait of Messina (Sicily) from reported eggs and larvae collected in the plankton (de Sylva 1975).

It has been suggested that Mediterranean spearfish probably spawns in late spring, based on the occurrence of eggs and larvae recorded in May, and juveniles found in October.

Eggs and larvae

No estimates of batch fecundity are available.

Eggs are pelagic, spherical and transparent; ovulated eggs are on average 1.48 mm in diameter and contained an oil globule.

Recruitment

Knowledge of the early life stages in billfishes is very scarce. It is assumed that larval period is short due to fast growth during this period (Prince *et al.* 1991; Luthy 2004).

Young (immature) Mediterranean spearfish first appears in the catches when they are around 70 cm LJFL. From this time on, it is easier to track their migratory movements both by observing the fisheries and by tagging experiments.

3.g Migrations

Mediterranean spearfish probably displays movements in the within the Mediterranean and across the Strait of Gibraltar into the Atlantic Ocean, but there are no known tagging experiments. Therefore, little is known about Mediterranean spearfish movement patterns.

3.h Diet

Feeding habits of Mediterranean spearfish have not been reported in the scientific literature. However, like all apex predators, they most likely feed opportunistically on schooling fish and squids. It has been reported that Mediterranean spearfish follow (and probably feeds) on schools of Atlantic sauries, *Scomberesox saurus*, into the Strait of Messina (Robins and de Sylva 1963).

3.i Physiology

Billfishes, like tunas, have anatomical and physiological adaptations for continuous swimming, and cranial endothermy (brain and eyes) which facilitate foraging at different depths. Mediterranean spearfish, like the other billfishes, feature a thermogenic organ situated beneath the brain and close to the eyes that generates and maintains elevated temperatures in the cranial region (Block 1986). This thermogenic organ or 'brain heater' facilitates the deep diving behaviour in marlins by permitting ocular and physical functions at low temperatures.

3.j Behaviour

Mediterranean spearfish, like all marlins, are not schooling fish. They are considered rare and solitary species, but they are also known to occur in pairs, but sexes of the paired fish are unknown, and if caught, is usually one of the pair (Nakamura 1985). It has been suggested that this behaviour may be for hunting as well as for mating.

3.k Natural mortality

No reliable estimates of natural mortality rates are available. Tagging data are insufficient for that effort. Estimating M from growth parameters is limited because they have not been estimated. Natural mortality based on the estimated longevity would range from 0.15 to 0.30. However, based upon body size, behaviour, and physiology, estimates of adult fish would likely be fairly low (Anon. 1994, 1998).

3.l Conversion factors

There are no conversion factors available for Mediterranean spearfish.

4. Distribution and exploitation**4.a Geographical distribution**

Mediterranean spearfish is limited in distribution to the Mediterranean Sea (**Figure 3**).

Inside the Mediterranean Sea, adults are most common around Italy (south of Corsica), the Adriatic Sea, and the western Mediterranean. There are no reports from the Aegean Sea or the Black Sea, only juveniles are found in the eastern Mediterranean (off Israel and Lebanon).

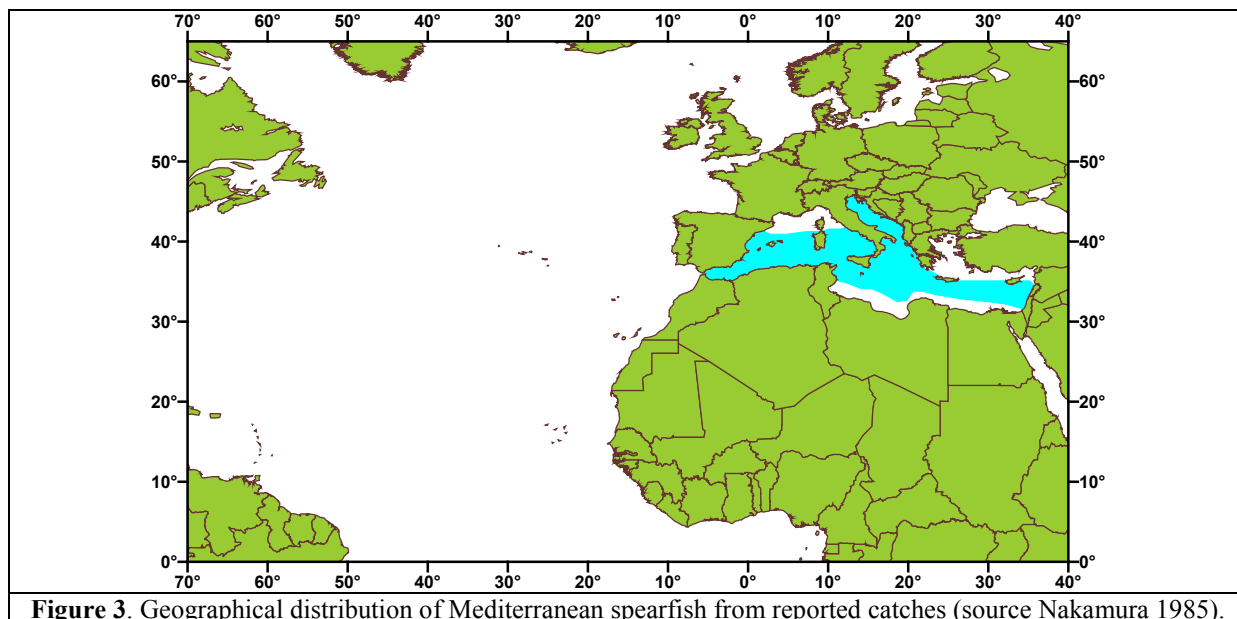


Figure 3. Geographical distribution of Mediterranean spearfish from reported catches (source Nakamura 1985).

4.b Populations/Stock structure

Landings of Mediterranean spearfish have been traditionally combined by ICCAT with those of Atlantic sailfish and the longbill spearfish, *T. pfluegeri*. Therefore, the species group sailfish+spearfish have been considered by ICCAT as a separate east and west stock for management purposes. However, in the sailfish assessment of 2001 (Anon. 2002) a procedure was developed to separate sailfish catch from that of spearfish, but without differentiating between the spearfish species caught by the fleets.

4.c Description of fisheries: Catches and effort

Mediterranean spearfish is traditionally taken by the harpoon fishery in the Strait of Messina (Sicily), during the months of July through September. It is also caught as a by-catch species by the driftnet, surface longline, and tuna trap fisheries (Nakamura 1985; Di Natale *et al.* 2003). Estimated catches for the Mediterranean spearfish as reported from Italian driftnet and harpoon fisheries for the period of 1994-2000 are presented in **Table 1**.

Table 1. Estimated catch for Mediterranean spearfish from Italian fisheries (Source Di Natale *et al.* 2003).

<i>Year</i>	1994	1995	1996	1997	1998	1999	2000
Catch (t)	74	99	81	98	95	91	102

4.d Catch-at-size

There are no estimates of catch-at-age for Mediterranean spearfish. Available catch-at-size information come from the Italian fisheries. Di Natale *et al.* (2003, 2005) indicate that for 1994 through 2003, size mode varied between years, from the smallest mode observed in 2001 between 98-99 cm LJFL to the largest one observed in 1998 for fish between 170-179 cm LJFL. The minimum size fish caught was 78 cm LJFL, and the maximum size was 193 cm LJFL.

5. Bibliography

- ANON. 1994. Report of the Second ICCAT Billfish Workshop. Collect. Vol. Sci. Pap. ICCAT, 41:587.
- ANON. 1998. Report of the Third ICCAT Billfish Workshop. Collect. Vol. Sci. Pap. ICCAT, 47: 352.
- ANON. 2002. Report of the 2001 Billfish Species Group Session. Collect. Vol. Sci. Pap. ICCAT, 54: 649-754.
- BLOCK, B.A. 1986. Structure of the brain and eye heater tissue in marlins, sailfish, spearfish. J. Morphol., 190: 169-189.
- BRILL, R.W. 1996. Selective advantages conferred by the high performance physiology of tunas, billfishes, and dolphin fish. Comp. Biochem. Physiol., 113: 3-15.
- DE SYLVA, D. 1975. Synopsis of biological data on the Mediterranean Spearfish *Tetrapturus belone* Rafinesque. Pages 121-131 in R.S. Shomura and F. Williams eds. Proc. Intl. Billfish Symp., Pt. 3. NOAA Tech. Rep. NMFS SSRF-675, 159 p.
- Di NATALE, A., A. Mangano, A. Celona, E. Navarra and M. Valastro. 2003. Size frequency composition of the Mediterranean spearfish catches in the Tyrrhenian Sea and the Strait of Messina in the period 1994-2002. ICCAT, Collect. Vol. Sci. Pap. ICCAT, 55: 692-709.
- Di NATALE, A., A. Mangano, A. Celona and M. Valastro. 2005. Size frequency composition of the Mediterranean spearfish catches in the Tyrrhenian Sea and the Strait of Messina in 2003. Collect. Vol. Sci. Pap. ICCAT, 58: 589-595.
- HOLLAND, K. 2003. A perspective on billfish biological research and recommendations for the future. Mar. Freshwater Res., 54: 343-348.
- IDRISI, N., T. Capo, S. Luthy and J. Seraphy. 2002. Behaviour, oxygen consumption and survival of stressed juvenile sailfish (*Istiophorus platypterus*) in captivity. Mar. Fresh. Behav. Physical. 36: 51-57.
- LUTHY, S.A. 2004. Billfish Larvae of the Straits of Florida. Ph.D. Thesis presented at the University of Miami, 112 p.
- NAKAMURA, I. 1985. An annotated and illustrated catalogue of marine sailfishes, spearfishes and swordfishes known to date. FAO Species Catalogue Vol.5. Billfishes of the World. FAO Fish. Synop. No.125: 65pp.
- PRINCE, E.D. and C.P. Goodyear. 2006. Hypoxia-based habitat compression of tropical pelagic fish. Fish. Oceanogr., doi:101111/j.1365-2419.2006.oehold999.x.
- PRINCE, E.D., D.W. Lee, J.R. Zweifel and E.B. Brothers. 1991. Estimating age and growth of young Atlantic Blue Marlin *Makaira nigricans* from otolith microstructure. Fish. Bull. 89: 441-459.
- ROBINS, C.R. and D.P. de Sylva. 1963. A new western Atlantic spearfish, *Tetrapturus pfluegeri*, with redescrptions of the Mediterranean spearfish *Tetrapturus belone*. Bull Mar. Sci. Gulf & Carib. 13: 84-122.