

Makaira Lacepède, 1802

ISTIO Mak

Genus : Makaira Lacepède, 1802. Histoire naturelle des poissons, 1802, 4:688-95, pl.13 (fig.3).

Type Species : Makaira nigricans Lacepède, 1802.

Synonymy : Machaera Cuvier, 1832 (amended spelling); Macaira Nardo, 1833 (amended spelling); Istiompax Whitley, 1931; Marlina Hirasaka & Nakamura, 1947; Eumakaira Hirasaka & Nakamura, 1947; Orthocraeros Smith, 1956; Istiomax Abe, 1963 (? missprint).

Remarks: There have been different opinions regarding the species composition of this genus (see discussion on page 3.5).

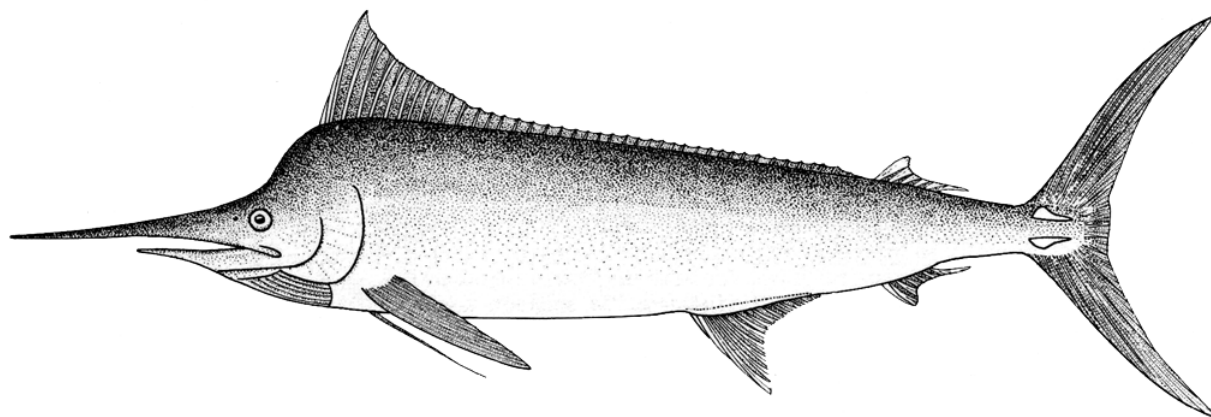
Makaira indica (Cuvier, 1832)

ISTIO Mak 2

Tetrapturus indicus Cuvier, in Cuvier & Valenciennes, 1832, Histoire Naturelle des Poissons, 8:209-10 (Sumatra, Indonesia).

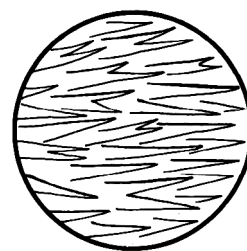
Synonymy : Tetrapturus australis Macleay, 1854; Histiophorus brevirostris Playfair, in Playfair & Günther, 1866; Tetrapturus brevirostris-Goode, 1882; Makaira marlina Jordan & Hill, in Jordan & Evermann, 1926; Makaira indica-Jordan & Evermann, 1926; Istiompax australis-Whitley, 1931; Makaira indicus-Deraniyagala, 1933; Makaira australis-Fowler, 1934; Makaira nigricans marlina-Nichols & LaMonte, 1935; Makaira nigricans tahitiensis Nichols & LaMonte, 1935; Makaira brevirostris-LaMonte & Marcy, 1941; Makaira ampla marlina-LaMonte & Marcy, 1941; Makaira ampla tahitiensis-LaMonte & Marty, 1941; Marlina marlina-Hirasaka & Nakamura, 1947; Malina malina-Chen, 1951; Makaira marhina-Mori, 1952; Istiompax dombraini Whitley, 1954; Makaira marhina-Chyung, 1954; Makaira mazara tahitiensis-LaMonte, 1955; Makaira xantholineatus Deraniyagala, 1956; Makaira herscheri-Fournmanoir, 1957; Makaira marlina marlina-Morrow, 1957; Makaira marlina tahitiensis-Morrow, 1957; Istiompax marlina-Royce, 1957; Istiompax brevirostris-Morrow, 1958; Istiompax indicus-Morrow, 1959; Makaira (Istiompax) indica-Robins & de Sylva, 1961; Istiomax indicus-Abe, 1963.

FAO Names : En - Black marlin; Fr - Makaïre noir; Sp - Aguja negra.



Field Marks : Body not very compressed; nape highly elevated; height of anterior lobe of first dorsal fin smaller than greatest body depth; second dorsal fin slightly forward of second anal fin; pectoral fins rigid, not adpressible against sides of body.

Diagnostic Features : Body not strongly compressed. Bill long, extremely stout, and round in cross section; nape conspicuously elevated; right and left branchiostegal membranes completely united to each other, but free from isthmus; no gillrakers; both jaws and palatines (roof of mouth) with small, file-like teeth. Two dorsal fins, the first with 34 to 43 rays, low (anterior lobe lower than body depth); with a long base ending close to second dorsal fin origin; second dorsal fin with 5 to 7 rays, its position slightly forward with respect to that of second anal fin; two anal fins, the first with 10 to 14 and the second with 6 or 7 rays; pectoral fins with 12 to 20 rays, rigid, not adpressible to sides of body; pelvic fins with a poorly developed membrane, shorter than the pectorals and depressible into ventral grooves. Caudal peduncle fairly

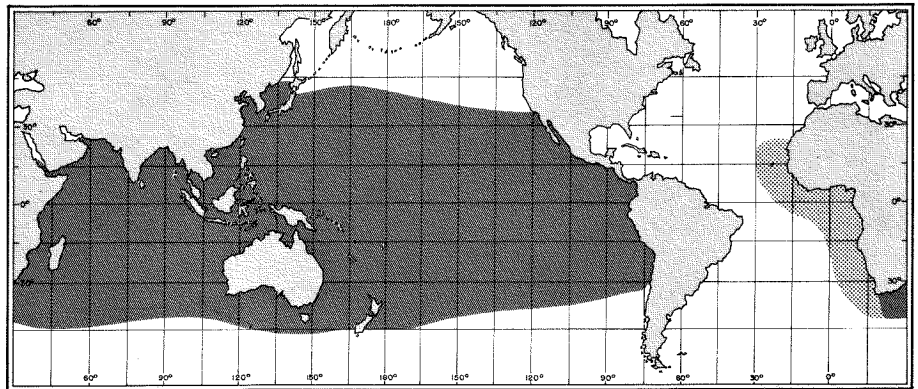


scales

compressed (laterally) and slightly depressed (dorso-ventrally), with strong double keels on each side and a poorly developed notch on both, the dorsal and ventral surfaces; anus situated near first anal fin origin. Lateral line single but obscured, especially in larger fish. Body densely covered with thick, elongate bony scales, each with 1 or 2 (mostly 1) sharp posterior points. Vertebrae 24 (11 precaudal and 13 caudal). Colour: body dark blue dorsally and silvery white ventrally; usually no blotches or dark stripes on body in adults, although light blue vertical stripes may occur in a few fish. First dorsal fin blackish to dark blue; other fins usually dark brown, sometimes tinged with dark blue.

Geographical Distribution :

The black marlin is distributed throughout the tropical and sub-tropical waters of the Pacific and Indian oceans where the main population and the spawning grounds occur, but it occasionally also enters temperate waters. Stray individuals have been found to migrate into the Atlantic Ocean by way of the Cape of Good Hope, but the existence of Atlantic breeding stocks is unlikely. The latitudinal range of this species, based on Japanese commercial long-liners' catches extends northward to 35°-40°N in the North Pacific and southward to 45°S in the western Pacific and 30°-35°S in the eastern Pacific, and northward to 25°N and southward to 45°S in the Indian Ocean.



Area of occasional distribution, or invasion, (no spawning)

Habitat and Biology : This is an epipelagic and oceanic species usually found in surface waters above the thermocline at temperatures ranging from 15° to 30°C often in nearshore waters close to land masses, islands, and coral reef areas. In tropical oceanic areas its distribution is continuous, although rather scattered, whereas its presence in temperate waters is occasional.

M. indica usually occurs nearer to the surface than most other billfishes (except the sailfish), but this is by no means a general rule. The commercial longline fishery generally operates in waters deeper than 100 m, and in the equatorial western Indian Ocean, peak catch rates of black marlin have been reported to occur in the upper water layers (0 to 200 m) over depths of 365 to 915 m (200 to 500 fathoms).

Like other billfishes, the black marlin effects seasonal migrations. In the East China Sea, schools of this species move northward during spring and summer and southward during autumn and winter. In the Sea of Japan, the north-bound migration occurs in late summer and early autumn following the core of the Tsushima Current (a warm branch of the Kuroshio Current), and the return to southern waters takes place in autumn, with the fish swimming against the current.

The sexes are separate in *M. indica*, but males and females are indistinguishable by external features. In the waters around Taiwan Island, these-ratio was found to be 53/414 males in fish ranging from 20 to 200 kg weight. As in other marlins, females become larger than males. *M. indica* is densely distributed in the northwestern part of the Coral Sea between October and December. Almost all fish caught at that time in this area have well-developed gonads, and are therefore believed to belong to spawning schools. The skewed sex ratio (541/615 females) may also be indicative of this possibility. Sportfishermen from Cairns, Queensland (Australia) eyewitnessed what might be the courtship behaviour of the black marlin: a group composed of one large fish (supposed to be female) followed by several smaller fish (supposed to be males) was seen swimming on an undulating course, sometimes back and forth, the fish being closer together than is usual in the shallow coral reef areas near Cairns.

On the basis of records of the presence of larvae and mature females, spawning is believed to occur in the vicinity of Hainan Island and in the South China Sea in May and June, around Taiwan Island from August to October, in the northwestern part of the Coral Sea between October and December, and off Cairns (Australia) from August to November. Black marlin are believed to prefer water temperatures around 27° to 28°C during spawning. Egg counts of ripe roe totalled about 40 million per female.

Black marlins use their long and stout bill for feeding. Analyses of stomach contents show that the prey is usually swallowed head first and bears slashes that had obviously been inflicted by the predator's bill. The prey includes skipjack (*Katsuwonus pelamis*), yellowfin tuna (*Thunnus albacares*), bigeye tuna (*Thunnus obesus*), frigate tunas (*Auxis* species) and other tuna species. The feeding of *M. indica* vary from area to area and by seasons. In Pacific equatorial waters, food items include mainly Scombridae, Gempylidae, Coryphaenidae, Xiphiidae and Carangidae, squids and cuttlefishes, while other groups, i.e., Sternoptychidae, Paralepididae, Alepisauridae, Chiasmodontidae, Chaetodontidae, Balistidae, Ostraciidae and Tetraodontidae, octopods and large decapod crustaceans are of lesser importance.

The larvae and juveniles of the black marlin are predated upon by pelagic carnivorous fishes such as large sharks, scombrids, carangids, dolphinfishes and other billfishes. There are no true predators of the adults except for the killer whale (Orcinus orca) and related species (only a few cases known). The main food competitors for the black marlin are thought to be large sharks, swordfish, large tunas and other marlins.

Size : This species reaches sizes beyond 448 cm in total length and 700 kg in weight. The heaviest record of black marlin in sportsfishing (the all tackle angling record) is a specimen of 442 cm (body length) and 707.61 kg weight, caught at Cabo Blanco, Peru, on 4 August 1953. Considerable numbers of black marlin weighing in excess of 500 kg are often caught off Cairns, Queensland, Australia. The measurements taken of the two female black marlins in excess of 1 000 lb caught during the First International Black Marlin Tournament held at Cairns in October 1973, were 448 cm total length (481.4 kg) and 437.2 cm total length (484.3 kg). Other examples of gamefishing records are specimens of 426.7 cm total length (509.8 kg), 436.9 cm total length (691.7 kg) and 447 cm total length (552.5 kg).

The size range of black marlin taken by commercial longline fisheries is 150 to 310 cm (mostly 170 to 210 cm) body length in the western Indian Ocean and 170 to 310 cm (mostly 185 to 240 cm) body length in the Coral Sea.

Interest to Fisheries : There are important longlining, harpooning, trolling and setnet fisheries for M. indica in the Pacific as well as in the Indian Ocean. Catches are reported from five FAO Fishing Areas (51, 57, 61, 77 and 81) by various nations. The world catch was 2 909 t in 1978, 3 440 metric tons in 1979, 2 465 t in 1980, 2 453 t in 1981 and 2 373 t in 1982. About 80 to 90% of this catch was taken by Chinese (Taiwan Province) vessels in Fishing Area 61 (northwestern Pacific), amounting to 2 591 t (89%) in 1978, 3 183 t (93%) in 1979, 1 991 t (81%) in 1980, 1 981 t (81%) in 1981 and 2 416 t (91%) in 1982 (FAO, 1984). In addition, it is estimated that Japan and the Republic of Korea, though excluded from FAO statistics, are currently catching about 2 000 t of this species in Fishing Area 61.

M. indica is mostly caught by ordinary surface tuna longliners. These vessels vary considerably in size, the largest being about 2 000 GRT mother ships with several small catch boats on either side of the deck (this type of ship stopped operating recently), but the majority are between 250 and 350 GRT, as this size appears to be the most economical and efficient. Longlining vessels larger than 100 GRT are usually made of steel, while the smaller boats are mostly wooden.

Harpoon-fishing is carried out on the fishing grounds off Taiwan Island and southern Japan. Small (about 10 m long) wooden, engine; powered boats are used in this activity. Optimum temperatures for harpoon-fishing for this species range from 23° to 25° C (westward of Uotsurijima, in the East China Sea, between October and April).

Sportsfishing off northeastern Australia, Peru and Ecuador is usually carried out from ordinary trolling boats (36 to 42 feet long with inboard engines). In these areas, black marlins are more dominant among big game fishes than on other sportsfishing grounds.

Finally, black marlins are also often taken by setnets displayed to catch the "yellowtail", (Seriola quinqueradiata) in southern and western Japan during summer and autumn.

Good fishing grounds for black marlin (shallower than those of other billfishes) are found in the East China Sea in the area where the Kuroshio and Tsushima currents mix with the waters of the Yellow Sea. The fishing season extends from July to January (peak between August and October) between 30° and 34°N; from May to July and from October to April (peaks in June and July and October and January, respectively), between 25° and 30°N, and throughout the year around Taiwan Island (peak between October and December in the South China Sea and in February and March off eastern Taiwan Island). Juvenile and young black marlin migrate in schools in July and August, and in the coral reef areas of northern Queensland, adults come near the shore between September and November.

Data on fishing effort and intensity are insufficient in all of the above areas. However, it is known that most of the fishing effort and intensity are displayed in the East China Sea, the waters around Taiwan Island, off northwestern Australia, in the Coral Sea, Arafura Sea, Sulu Sea, Celebes Sea and northwestern Arabian Sea.

Local Names : AUSTRALIA: Black marlin; CHINA: Kyau-shit-á, Lih-ch'ih-Ch'i-yü; JAPAN: Genba, Katakari, Shiro, Shiroka, Shirokajiki, Shirokawa, Shirokawajiki, Shiromazaara, Shiruachi; NEW ZEALAND: Black marlin; PAPUA NEW GUINEA: Black marlin; REPUBLIC OF KOREA: Baek-sae-chi; SRI LANKA: Ahin koppara, Kopparaikulla, Kopparan, Kopparava, Makara, Marlin, Sapparava; USA: Black marlin, Giant black marlin, Pacific black marlin, Silver marlin; USSR: Sere bristi marlin.

Literature : Howard & Ueyanagi (1965); Ueyanagi (1960); Merrett (1971); Nakamura (1975, 1983); Goadby (1972); Howard & Starck (1975); Mather (1976).

Remarks : The English common name "black marlin" had not been universally accepted for Makaira indica until the midsixties. Prior to this agreement, many authors, particularly Japanese, called this species "white marlin" which is a direct translation from the Japanese common name, "Shirokajiki" (shiro = white, kajiki = marlin). The general colour of this species is black or blueblack while alive, but after death it changes to white and this seems to be the cause of the above-mentioned nomenclatorial discrepancy.

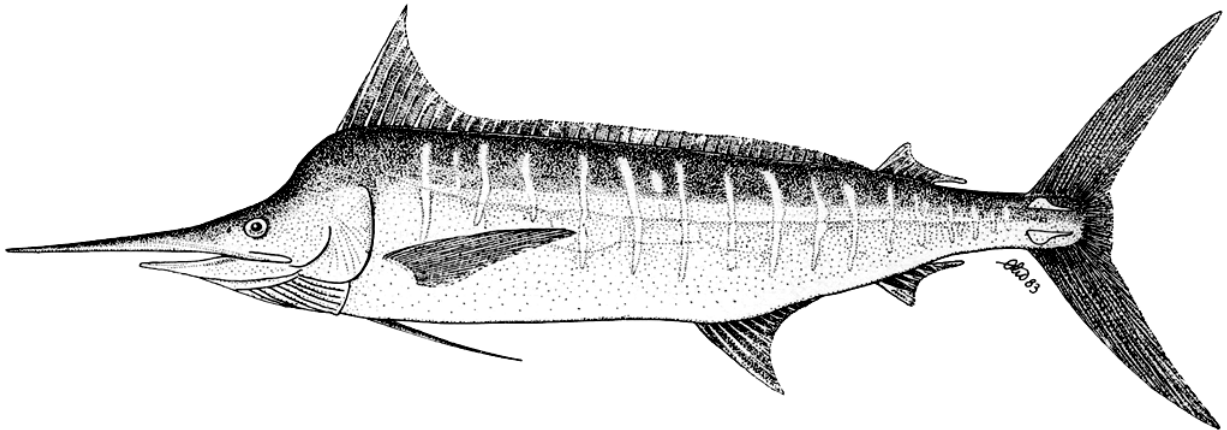
Makaira mazara (Jordan & Snyder, 1901)

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Tetrapturus mazara Jordan & Snyder, 1901, J.Coll.Sci.Imp.Univ.Tokyo, 15(2):305 (Japan).

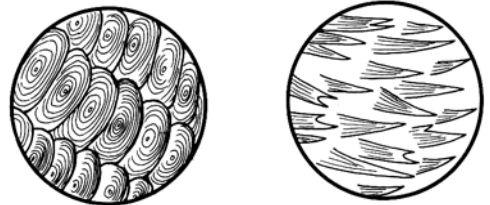
Synonymy : Makaira mazara Jordan & Evermann, 1926; Makaira ampla mazara-LaMonte, 1941; Makaira nigricans-Fowler, 1944 (many authors erroneously use the name Makaira nigricans for this species); Eumakaira nigra Hirasaka & Nakamura, 1947; Makaira nigricans mazara-Rosa, 1950; Istiompax howardi Whitley, 1954; Istiompax mazara-Whitley, 1968; Makaira nigra-Abe, 1957; Makaira (Makaira) nigricans-Robins & de Sylva, 1961.

FAO Names : En - Indo-Pacific blue marlin; Fr -Makaire bleu de l'Indo-Pacifique; Sp - Aguja azul del Indo-Pacifico

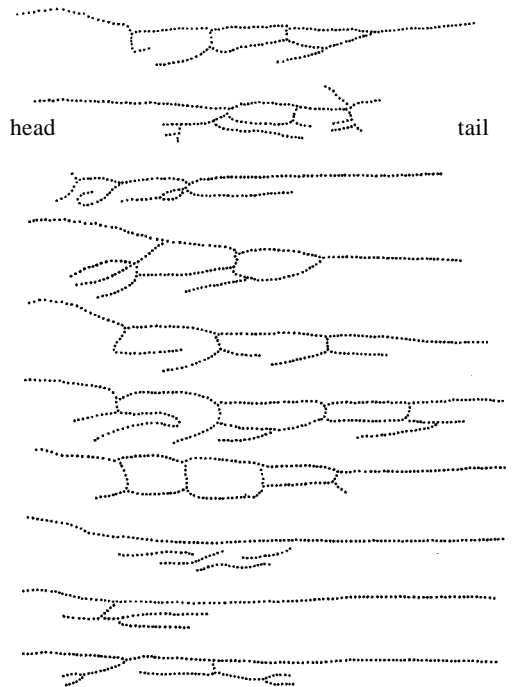


Field Marks : Body not very compressed; nape highly elevated; height of anterior lobe of first dorsal fin less than greatest body depth; lateral line system with simple loops.

Diagnostic Features : Body not strongly compressed. Bill long, extremely stout and round in cross section; nape conspicuously elevated; right and left branchiostegal membranes completely united to each other, but free from isthmus; no gillrakers; both jaws and palatines (roof of mouth) with small, file-like teeth. Two dorsal fins, the first with 40 to 45 rays, lower than body depth throughout its length, with a pointed anterior lobe and a long base, originating above the posterior margin of preopercle and ending close to the second dorsal fin origin; second dorsal fin with 6 or 7 rays, its position slightly backward with respect to that of second anal fin; two anal fins, the first with 12 to 17 rays and the second with 6 or 7 rays; pectoral fins long and narrow, adpressible to sides of body, with 20 to 23 rays; pelvic fins shorter than the pectorals, with a poorly developed membrane and depressible into deep ventral grooves. Caudal peduncle fairly compressed (laterally) and slightly depressed (dorsoventrally), with strong double keels on each side and a shallow notch on both the dorsal and ventral surfaces; anus situated near first anal fin origin. Lateral line single, following a single loop pattern, obvious in juveniles and immature fish, but obscure in adults, as it becomes progressively imbedded in the skin with growth (however, the line becomes always clearly visible when the epidermis is removed). Body densely covered with elongate, thick, bony scales, each with usually 1 or 2, sometimes with 3 posterior points. Vertebrae 24 (11 precaudal and 13 caudal). Colour: body blue-black dorsally and silvery white ventrally, with about 15 rows of



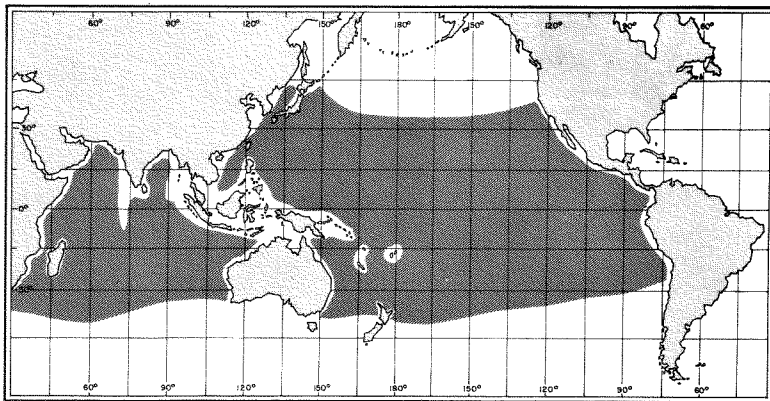
ca. 17 cm body length ca. 170 cm. body length
Schematic drawings of scales (not same size)



Lateral line systems of left side in size growth
(schematic)

pale, cobalt-coloured stripes, each consisting of round dots and/or narrow bars (these stripes may not always be visible, especially in long-preserved specimens). First dorsal fin blackish or dark blue, other fins blackish brown, sometimes tinged with dark blue; bases of first and second anal fins tinged with silvery white.

Geographical Distribution : The Indo-Pacific blue marlin is found primarily in the tropical and subtropical waters of the Pacific and Indian oceans. It is the most tropical billfish species and is frequent in equatorial waters. Its latitudinal range, based on data from the commercial longline fishery, extends to about 45°N in the western North Pacific Ocean, 35°N in the eastern North Pacific, 35°S in the western South Pacific, 25°S in the eastern South Pacific, 40 to 45°S in the southwestern Indian Ocean and 35°S in the southeastern Indian Ocean.



Habitat and Biology : This is an epipelagic and oceanic species mostly confined to the waters on the warmer-side of the 24°C surface isotherm and known to effect seasonal north-south migrations. Pacific blue marlins are not usually seen close to land masses or islands, unless there is a deep drop-off of the shelf (900 to 1 800 m as in the waters off Kailua-Kona, Hawaii Island).

The monthly distribution of catches by Japanese longliners shows two main seasonal concentrations of *M. mazara*: one from December through March in the western and central South Pacific between 8° and 26°S, and the other from May through October in the western and central North Pacific between 2° and 24°N. In the remaining two months (April and November) the fish tend to concentrate in the equatorial Pacific between 10°N and 10°S. This species becomes less abundant toward the eastern Pacific; in the Indian Ocean, it is known to be relatively abundant around Sri Lanka and Mauritius; off the east coast of Africa, it is apparently abundant between the equator and 13°S during the southeast monsoon period (from April to October).

In Hawaiian waters, an ecological interaction is known between *M. mazara* and the striped marlin, *Tetrapturus audax*, with the two species responding in different, respectively; exclusive ways, to certain environmental factors such as temperature or food.

Of 170 individuals of *M. mazara* tagged from 1963 through 1970 in the Pacific Ocean, no recoveries were made up to 1972. Five specimens were tagged with ultrasonic transmitters and tracked off Hawaii in 1971 and 1972. A fish of 270 kg was successfully tagged and tracked on 14 and 15 July 1971, 3.1 miles west of Keauhou, Hawaii Island (Yuen, Dizon & Uchiyama, 1974). The tag was inserted on 14 July at 09:35 hours and the fish was tracked by the R.V. CHARLES H. GILBERT until 08.00 hours of the next morning. A temperature-sensitive tag was used on this occasion for the purpose of obtaining information on depth. During the tracking period, the fish moved to about 25 miles north of the point of release on an erratic course cruising between the 183 m and 1 830 m (100 and 1 000 fathom) isobaths. The calculated speed of the fish ranged from 0.6 to 4.4 knots (0.09 to 0.62 body length/sec) with an average of 1.6 knots (0.23 body length/sec). Swimming depth varied from the surface to 73 m, but the fish remained mostly within the upper 37 m.

Larvae of *M. mazara* have been extensively collected in the tropical and subtropical waters of the western and central Pacific, and south of the Maldive Islands, around the Mascarene Islands, and off the south coasts of Java and Sumatra in the Indian Ocean. Ripe eggs in the ovary are transparent with a yellow oil globule, and measure about 0.8 to 0.9 mm in diameter.

This species is believed by commercial fishermen to form small-scale schools consisting of at most ten individuals. Larger fish tend to swim solitary.

M. mazara is known to feed in and near surface waters, but sometimes takes food in relatively deep waters as is suggested by the finding of the deep-dwelling squirrel fish (*Holocentrus laeteoguttatus*) in the stomachs of this species off Hawaii. The feeding behaviour has been observed by a fishery biologist off Baja California: after a fish of about 3 m body length had found a school of squids (*Dosidicus gigas* measuring about 40 cm mantle length) that was gathering under the night-light of a squid-fishing boat, it approached the school at almost full speed with its fins completely held back in the grooves, then suddenly hit the squids with its bill, subsequently nudging the stunned prey and eating it head first. This species has also been observed to swallow big tunas like skipjack (*Katsuwonus pelamis*), yellowfin tuna (*Thunnus albacares*) and bigeye tuna (*Thunnus obesus*) head first, and the fishes found in stomachs of *M. mazara* often showed deep slashes on their bodies, presumably caused by the bill of the marlin. These observations show that this species seems to use its bill quite often for feeding.

Stomachs of M. mazara contained mostly squids (Philippine Sea), and tuna-like fishes (off New Zealand and in the central Pacific) In Hawaiian waters, tuna-like fishes make up more than 85% in volume of the Indo-Pacific blue marlin's diet. A large individual caught off Hawaii had a 29 kg bigeye tuna in its stomach and its weight, including the bigeye was 340 kg. In the eastern North Pacific, M. mazara has been shown (from the results of Japanese longline research cruises) to feed primarily on squids and fishes, in particular Bramidae, Carangidae, Gempylidae, Auxis spp., Xiphias gladius, etc.

Dr Radtke estimated the age of this species based on otolith readings (Pacific Gamefish Research News, 1982) as follows: (1) Males: 52.1 kg=6 years; 68.3 to 71.2 kg=7 to 8 years; 82 kg=9 years; 96.9 to 114.2 kg=11 to 12 years; (2) Females: 135.4 to 147.4 kg=8 years; 209.2 to 228.8 kg=13 to 15 years; 286.3 kg=16 years, 336.5 kg=17 years.

Large pelagic sharks like Isurus, Prionace, Lamna and Carcharhinus, as well as the killer whale (Orcinus orca) and related species have often been observed to attack tunas and billfishes (including this species) hooked on longlines. The author believes that such attacks are highly improbable under natural conditions.

Size : M. mazara attains sizes over 906 kg (2 000 lb) in commercial longline fisheries and to about 820 kg in sportsfishing activities. The heaviest record in sportsfishing (unofficial data, since more than one person was on the fishing rod) is the 818 kg (1 805 lb) "Choys monster" caught by Captain Cornelius Choy and his party off Waikiki, Hawaii; the second-largest is a specimen of 447 cm total length, 523 kg (1 153 lb) weight, and 185 cm of girth caught at Ritidian Point in Guam (this is the all tackle angling record). The heaviest record listed in "World Record Game Fishes, 1982" published by the International Game Fish Association is a fish of 498.95 kg (1 100 lb) weight, 420.4 cm total length, and 200 cm girth width from Le Morne, Mauritius. The size range of M. mazara caught by commercial longliners averages approximately 200 to 285 cm body length in Pacific equatorial waters and 215 to 300 cm body length in the Indian Ocean.

In the Pacific, size at first maturity of males is thought to range from 130 to 140 cm eye-fork length (86.8 to 87.8% of body length). Females attain larger sizes than males; around the Bonin-Islands, fish over 200 cm eye-fork length are all females; around Taiwan Island males attain less than 120 kg weight, while females grow to over 300 kg.

Interest to Fisheries : Catches of M. mazara have been reported by about 10 countries from seven FAO Fishing Areas (51, 57, 61, 71, 77, 81 and 87). The major fishing nations in the period from 1978 to 1982 were Japan and the Republic of Korea. The total world catch was 18 193 t in 1978, 18 654 t in 1979, 21 109 t in 1980, 21 413 t in 1981 and 20 727 t in 1982. Only 8.2% (1 761 t) of the 1981 catch came from the Indian Ocean, while 91.8% (19 652 t) were taken in the Pacific Ocean, particularly in Fishing Area 61, northwest Pacific (7 543 t), by Japanese and Chinese (Taiwan Province) vessels (about equal shares); in Fishing Area 71, western central Pacific (6 048 t) by Japan, Malaysia, the Philippines and the Republic of Korea; and in Fishing Area 77, eastern central Pacific (4 979 t) by Japan and the Republic of Korea. In 1982, 8.3% of the total catch were taken in the Indian Ocean, while 91.7% came from the Pacific Ocean, particularly from Fishing Areas 61, 71 and 77 (FAO, 1984).

The gear most commonly used for fishing M. mazara is the Japanese type of longline and its derivatives, but this species is most often caught incidental to fisheries directed at other marlins (M. indica and Tetrapturus audax) and tunas (Thunnus thynnus, Thunnus obesus and Thunnus albacares). Most Japanese tuna longline vessels range in size from 240 to 340 GRT. Recently many of them have been equipped with freezing facilities capable of preserving the fish in excellent condition at very low temperatures, between -40° and -50°C or at even lower temperatures in the most modern vessels. M. mazara is also taken incidentally by harpooning boats aiming at Makaira indica, Tetrapturus audax or Xiphias gladius southern Japan and Taiwan Island.

The quality of the flesh is excellent for sashimi (sliced raw fresh flesh with soy-sauce and horse radish). Most of it is marketed frozen.

Local Names : AUSTRALIA: Blue marlin; CHILE: Pez zuncho; CHINA: Lan fu yii; JAPAN: Aburakajiki, Genba, Katokui, Katsuokui, Kudamaki, Kuro, Kuroka, Kurokajiki, Kurokawa, Kurokawakajiki, Kuromazaara, Mazaara, Njiachi, Njiara, Tsun; MALAYSIA: Mersudji; MEXICO: Marín azul, Marín negro; NEW CALEDONIA: Empéreur, Marlin bleu; NEW ZEALAND: Marlin, Taketonga; REPUBLIC OF KOREA: Nok-sae-chi; TAHITI: Haura; USA: Blue marlin, Cuban black marlin; USSR: Ch'joernij marlin; VIET NAM: cá cè' den.

Literature : Nakamura, H. (1938, 1942); Royce (1957); Ueyanagi (1964); Howard & Ueyanagi (1965); Nakamura, Iwai & Matsubara (1968); Strasburg (1969, 1970); Merrett (1971); Nakamura, I. (1974, 1983); Howard & Starck (1975).

Remarks : The English name "black marlin" was often used among Japanese scientists for Makaira mazara until the mid-sixties. "Black marlin" is a direct translation of the Japanese common name, "Kurokajiki" (kuro= black, kajiki = marlin) for this species. See also "Remarks" under Makaira nigricans.

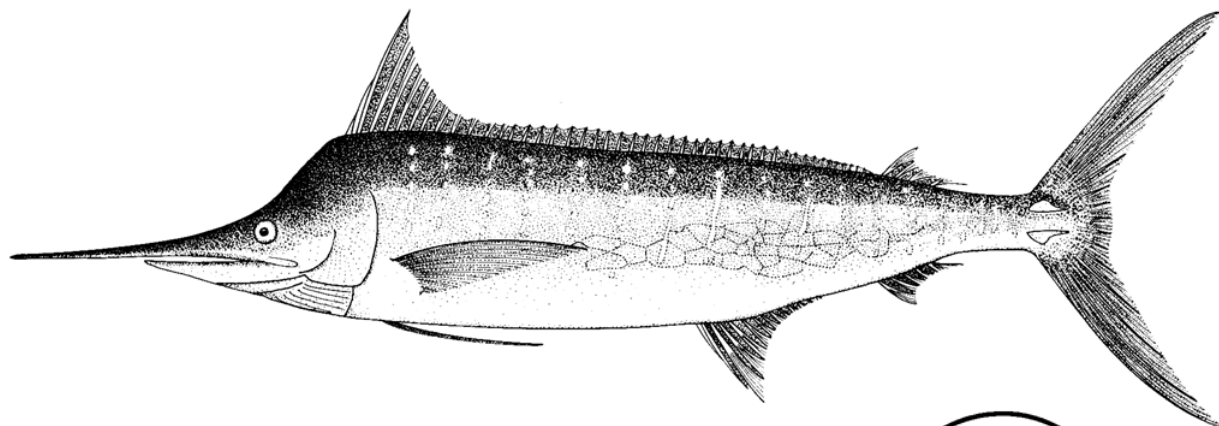
Makaira nigricans Lacepède, 1802

ISTIO Mak 1

Makaira nigricans Lacepède, 1802, Histoire naturelle des Poissons, 4:688-91, pl. 12 (Fig. 3). (Ile de Re, Bay of Biscay).

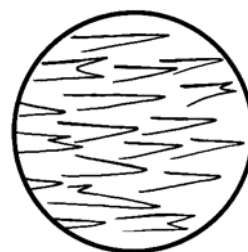
Synonymy : Tetrapturus herschelii Gray, 1838; Histiophorus herschelii-Günther, 1860; Tetrapturus amplus Poey, 1860; Tetrapturus Herschelii-Lütken, 1880; Makaira herschelii-Jordan & Evermann, 1896; Makaira ampla-Jordan & Evermann, 1926; Makaira ensis Jordan & Evermann, 1926; Makaira bermudae Mowbray, 1931; Makaira nigricans nigricans-Nichols & LaMonte, 1935; Makaira nigricans ampla-Nichols & LaMonte, 1935; Makaira ampla ampla-LaMonte & Marcy, 1941; Makaira perezii deBuen, 1950; Orthocraeros bermudae-Smith, 1956; Makaira herschelii-Smith, 1956; Makaira (Makaira) nigricans-Robins & deSylva.

FAO Names : En - Atlantic blue marlin; Fr - Makaïre bleu de l'Atlantique; Sp - Aguja azul del Atlántico

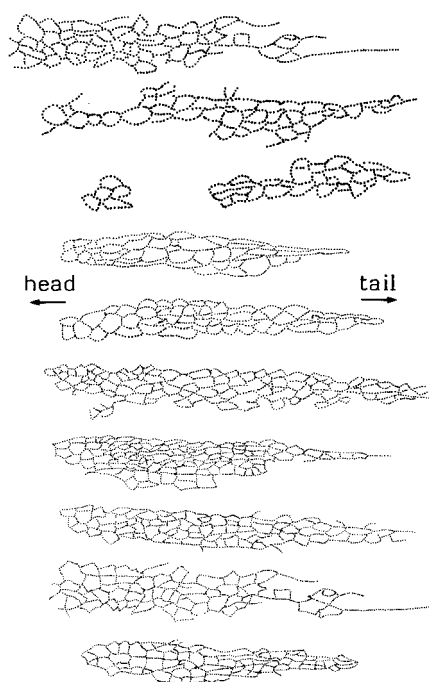


Field Marks : Body not very compressed; nape highly elevated; height of anterior lobe of first dorsal fin less than greatest body depth; lateral line system chickenwire-shaped.

Diagnostic Features : Body not strongly compressed. Bill long, very stout and round in cross section; nape conspicuously elevated; right and left branchiostegal membranes completely united to each other, but free from isthmus; no gillrakers; both jaws and palatines (roof of mouth) with small, file-like teeth. Two dorsal fins, the first with 39 to 43 rays, lower than maximum body depth throughout its length, with a pointed anterior lobe and a long base, originating above the posterior margin of preopercle and ending near second dorsal fin origin; second dorsal fin with 6 or 7 rays, its position slightly backward with respect to that of second anal fin; two anal fins, the first with 13 to 16, the second with 6 or 7 rays, and very similar in size and shape to the second dorsal; pectoral fins long and narrow, adpressible to sides of body, with 19 to 22 rays; pelvic fins shorter than the pectorals, with a poorly developed membrane, and depressible into deep ventral grooves. Caudal peduncle fairly compressed (laterally) and slightly depressed (dorsoventrally), with strong double keels on each side and a poorly developed notch on both the dorsal and ventral surfaces; anus situated just in front of first anal fin origin. Lateral line forming a complicated network pattern, obvious in immature fish but obscure in adults, as it becomes progressively imbedded in the skin (however, the line becomes always clearly visible when the epidermis is removed). Body densely covered with elongate, thick, bony scales, each with usually 1 or 2 (mostly 1), sometimes with 3 posterior points. Vertebrae 24 (11 precaudal and 13 caudal). Colour: body blue-black dorsally and silvery white ventrally, with about 15 rows of pale cobalt-coloured stripes, each consisting of round dots and/or narrow bars. First dorsal fin membrane blackish or dark blue, without any dots or marks, other fins usually brown black, sometimes tinged with dark blue; bases of first and second anal fins tinged with silvery white.



scales

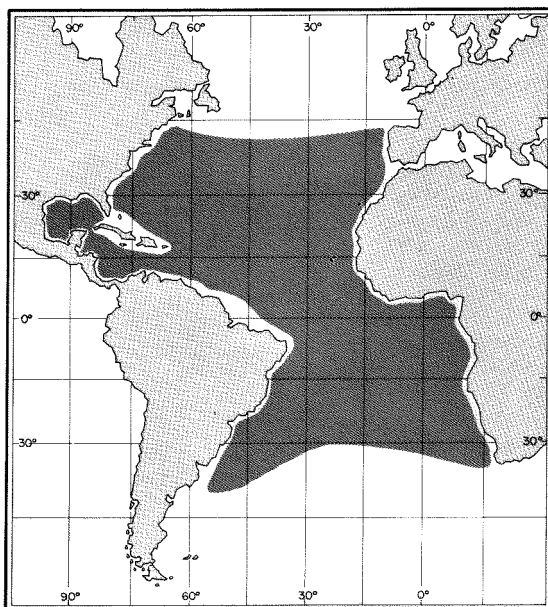


Lateral line systems of left side in size growth
(schematic)

Geographical Distribution : This species is distributed mainly in the tropical and temperate waters of the Atlantic. It is the most tropical of all Atlantic billfishes and probably more abundant in the western than in the eastern Atlantic, judging from the hook rates attained by commercial fisheries in both areas. Its latitudinal range, based on data from the commercial longline fishery, extends from about 40° to 45°N in the North Atlantic to 40°S in the western South Atlantic, 30°S in the central South Atlantic, and 35°S in the eastern South Atlantic.

Habitat and Biology : This is an epipelagic and oceanic species usually found in waters with surface temperatures ranging from 22° to 31°C. Water colour affects the occurrence of M. nigricans, at least in the northern Gulf of Mexico, where the fish show preference for blue water.

In the western Atlantic, the monthly distribution of Japanese longliner catches shows two main seasonal concentrations; one from January through April in the western South Atlantic, between 5° and 30°S, and the other from June through October, in the western North Atlantic, between 10° and 35°N. May, November and December appear to be transitional months. In the eastern Atlantic, where the blue marlin is less abundant, it occurs mostly off the east coast of Africa between 25°N and 25°S. There are indications of a periodical fluctuation in abundance of this species which is probably due to ecological interaction with other species of marlin. For example, during the fishing season in the northern Gulf of Mexico (April to November), anglers tend to catch more M. nigricans at times when white marlin (Tetrapturus albidus) catches are lowest and *vice versa*.



In the northwestern Atlantic, 561 individuals of M. nigricans were tagged from 1955 to 1971, but only 4 have been recaptured, all near their respective release points. Although these tag returns are inconclusive, they suggest that this technique might be successful if applied on a larger scale. Unlike Istiophorus albicans, M. nigricans does not form concentrations in coastal waters. In the open ocean, it rarely gathers in schools and is usually found as scattered single individuals.

Little is known about the spawning grounds and seasons. In the western central Atlantic, three larvae have been recorded off Georgia (30°5'N/79°37'W), two off Cat Cay, Bahamas, one at 32°06'N/72°00'W, and one at about 40 miles northeast of Fort Pierce, Florida. Several juveniles were recorded from off Jamaica. In the southwestern Atlantic, 85 larvae were found from off Brazil, between Cabo de Sao Roque and 26 S. Subripe ova are opaque, white to yellow, and 0.3 to 0.5 mm in diameter. Transparent spherical eggs flowing out of a ripe ovary measured 1 mm in diameter.

The Atlantic blue marlin feeds mostly in near-surface waters but sometimes makes trips to relatively deep water for feeding, as is shown by the presence of deep sea fishes such as Pseudoscopelus in the stomachs of specimens caught off Puerto Rico. However, the Atlantic blue marlin is believed not to feed on the surface at night; surface-trolled baits are taken by this species especially in the morning between 10:00 and 11:00 hours. Ovchinnikov (1970) and Rivas (1975) both concluded that the marlin's bill does not play an important role in the capture of food, based on observations that marlins without bills or with broken or malformed bills are as healthy as normal fish. The present author disagrees with these conclusions.

Stomachs of M. nigricans contained dolphinfishes (Coryphaena) and tuna-like fishes, especially frigate mackerel (Auxis) around the Bahamas; tuna-like fishes, predominant in both number and volume, off Puerto Rico and Jamaica, and mainly dolphinfishes and scombrids in the northern Gulf of Mexico.

The size range of the prey taken by this species is relatively wide, including fishes from about 20 to 102 cm total length and octopods from at least 15 cm to about 61 cm (Bimini, Bahamas). Off Puerto Rico, a 135 kg Atlantic blue marlin was found to have swallowed a 38 mm long postlarval surgeonfish while another fish of similar size had ingested a 11 kg squid. In the Gulf of Guinea, a 290 kg M. nigricans had swallowed a bigeye tuna, (Thunnus obesus) weighing about 50 kg.

Size : M. nigricans is smaller than M. mazara, averaging between 136 kg (300 lb) and 181 kg (400 lb). The maximum size of this species exceeds 375 cm body length and 580 kg in weight. However, many anglers report having seen this species reaching sizes up to 680 kg (1 500 lb). The largest specimen recorded by the International Game Fish Association (the all tackle angling record) was from St. Thomas, Virgin Islands and weighed 581.51 kg (1 282 lb). The second-largest was a fish of 461.98 kg (1 018 lb 8 oz) from South Pass, Louisiana, USA. Generally, M. nigricans heavier than 136 kg (300 lb) are females. Throughout the Atlantic, the size of fish caught by commercial longliners ranges from about 230 cm to 345 cm total length (200 to 275 cm body length).

Interest to Fisheries : From 1978 to 1982, catches of M. nigricans have been recorded by several countries from five FAO Fishing Areas (21, 31, 34, 41 and 47). The total world catch was 1 842 t in 1978, 2 160 t in 1979, 2 328 t in 1980, 2 218 t in 1981 and 2 448 t in 1982. Of the above-mentioned five Fishing Areas, the only one that