

yielded catches over 1 000 t during this period was the eastern central Atlantic (Fishing Area 34) in 1980 (1 054 t taken predominantly by Cuba). In 1981, 1% (22 t) of the total catch was taken in Fishing Area 21 (northwest Atlantic) by Japan exclusively, 38.1% (846 t) in Fishing Area 31 (western central Atlantic) by Cuba, Venezuela, Japan and others, 24% (532 t) in Fishing Area 34 (eastern central Atlantic) predominantly by Cuba, 14.3% (318 t) in Fishing Area 41 (southwest Atlantic) by several countries, and 22.5% (500 t) in Fishing Area 47 (southeastern Atlantic) by Japan and other several countries (FAO, 1983). In 1982, 0.12% (3 t) of the total catch was taken in Fishing Area 21 exclusively by Japan, 34.3% (839 t) in Fishing Area 31 by Cuba, Japan, Venezuela, Republic of Korea and others, 29.7% (726 t) in Fishing Area 34 by Cuba, Japan, Republic of Korea and others, 9.5% (232 t) in Fishing Area 41 by Japan and other countries, and 26.5% (648 t) in Fishing Area 47 by Japan and China (Taiwan Province)(FAO, 1984).

In the commercial fisheries, the fishing gear currently in use is the conventional or modified Japanese longline. Around Cuba, M. nigricans is caught commercially with "palangres" a type of gear similar to the ordinary longline, but with only a few hooks used. As regards vessels, Japanese-type longliners are used extensively in the commercial fisheries, with certain modifications in size and equipment according to purposes and localities. Small boats powered by sail and/or motors (inboard and outboard) are used for operating the Cuban palangres.

In the sportfisheries, M. nigricans is taken by ordinary rod and reel methods. Natural (mostly) or artificial baits are trolled along the surface at speeds varying from 4 to 8 knots and usually 2 to 5 lines are used simultaneously.

The quality of the flesh is excellent. It is marketed fresh or frozen.

Local Names : BRAZIL: Agulhao preto; CANADA: Blue marlin, Makaire bleu; CUBA: Abanico, Aguja, Aguja casta, Castero, Prieta, Voladora; FRANCE: Makaire bleu; JAPAN: Nishikuro, Nishikurokajiki; MEXICO: Marlín azul, Marlín negro; MOROCCO: Espadon; PORTUGAL: Espadium azul, Espadium azul do Atlantico, Peito, Peixe agulha; REPUBLIC OF KOREA: Nog-Sae-chi; SOUTH AFRICA: Blue marlin, Blou marlyn; SPAIN: Aguja azul; USA: Blue marlin, Cuban black marlin; USSR: Chernyi marlin, Goluboi marlin; VENEZUELA: Marlín azul; WEST INDIES: Blue marlin, Squadron.

Literature : Krumholz & deSyIva (1958); Erdman (1962, 1968); deSylva (1963); Ovchinnikov (1970); Ueyanagi et al. (1970); Mather, Jones and Beardsley (1972); Rivas (1975).

Remarks : The present author believes that the Indo-Pacific blue marlin Makaira mazara and the Atlantic blue marlin, Makaira nigricans, are distinct species chiefly because of differences in the pattern of the lateral line system (simple-looped in M. mazara and reticulated in M. nigricans). Many scientistis, however, do not recognize this character as specifically diagnostic and consider M. nigricans as a single pantropical species occurring in the Atlantic, Pacific, and Indian oceans (Rivas, 1956, 1975; Royce, 1957; Briggs, 1960; Robins & de Sylva, 1960; Jones & Silas, 1964; Morrow, 1964).

Tetrapturus Rafinesque, 1810

ISTIO Tetra

Genus : Tetrapturus Rafinesque, 1810, Caratteri di alcuni nuovi generi e nuove specie di animali e piante della Sicilia, con varie osservazioni sopra i medesimi. Palermo, 1810, 105 pp., 20 pl. (ref.p. 54-5, pl.1, fig.1).

Type Species : Tetrapturus belone Rafinesque, 1810.

Synonymy : Skeponopodus Nardo, 1833; Tetrapturus Bonnaterre, 1841 (amended spelling); Tetrapterus Agassiz, 1841 (amended spelling); Tetraplurus Verany, 1847 (? misprint); Scheponopodus Canestrini, 1872 (amended spelling); Marlina Grey; 1928; Kajikia Hirasaka and Nakamura, 1947; Pseudohistiophorus de Buen, 1950, Lamontella Smith, 1956.

Remarks : This genus includes six species of which one (Tetrapturus georgei) still requires proof with regard to its validity. The possibility of existence of a seventh species, the so-called hatchet marlin (Tetrapturus sp.) is even more doubtful.

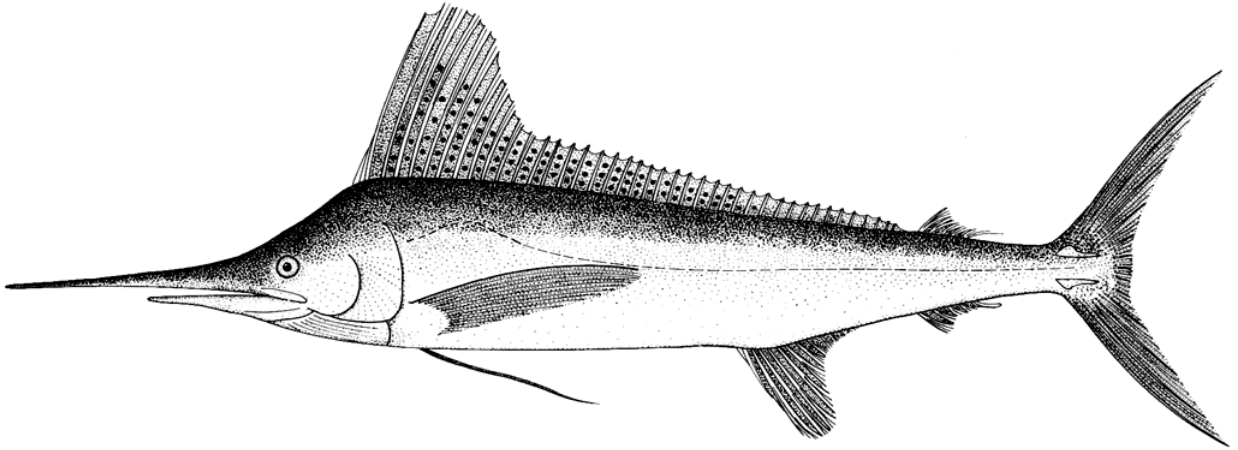
Tetrapturus albidus Poey, 1860

ISTIO Tetra I

Tetrapturus albidus Poey, Memorias sobrela historia natural de la isla de Cuba, 2:237-244, 258-60, pl. 151 (fig. 1), pl. 16 (figs 2-13), pl. 17 (figs 1,5,6-10,11,26) (Cuba).

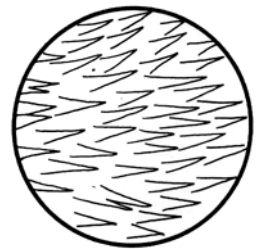
Synonymy: Tetrapturus lessonae Canestrini, 1861; Makaira lessonae-Jordan & Evermann, 1926; Makaira albida-Jordan & Evermann, 1926; Lamontella albida-Smith, 1956.

FAO Names : -Atlantic white marlin; Fr - Makaire blanc de l'Atlantique; Sp - Aguja blanca del Atlántico.



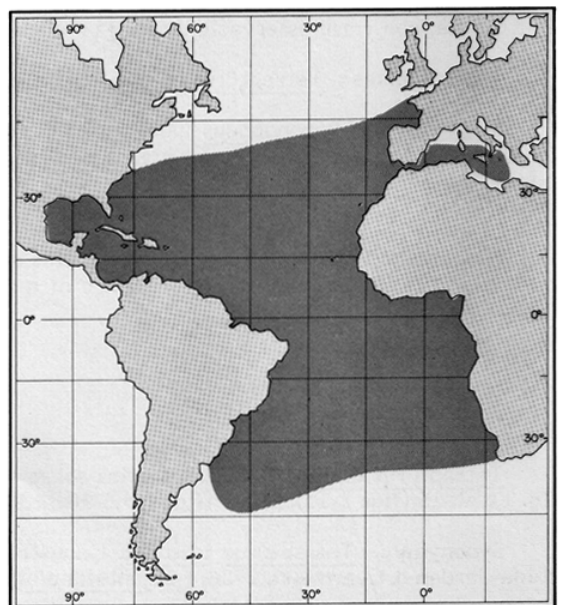
Field Marks : Anterior lobe of first dorsal fin rounded and higher than remainder of fin, the height decreasing gradually backward; anus situated near origin of first anal fin, the distance between them smaller than half of first anal fin height.

Diagnostic Features : Body elongate and fairly compressed. Bill stout and long, round in cross section; nape fairly 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 38 to 46 rays, usually with a rounded anterior lobe, higher than body depth anteriorly, then abruptly decreasing in height to about the 12th dorsal fin ray and gently decreasing further backward; first dorsal fin base long, extending from above posterior margin of preopercle to near second dorsal fin origin; second dorsal fin with 5 or 6 rays, its position slightly backward with respect to the second anal fin; two anal fins, the first with 12 to 17 rays, the second with 5 or 6 rays and very similar in size and shape to the second dorsal; pectoral fins long and wide, round-tipped, adpressible against sides of body and with 18 to 21 rays; pelvic fins slender and almost equal to, or slightly shorter than the pectorals. Caudal peduncle well 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 just in front of first anal fin origin. Lateral line single and obvious, curving above base of pectoral fin and then continuing in a straight line toward the caudal fin base. Body densely covered with elongate bony scales, each with 1 or 2 posterior points. Vertebrae 24 (12 precaudal and 12 caudal). Colour: body blue-black dorsally, silvery white splattered with brown laterally, and silvery white ventrally; usually no blotches or marks on body, but sometimes more than 15 rows of obscure whitish stripes. First dorsal fin dark blue with many black dots; second dorsal fin dark blue; pectoral fins blackish brown, sometimes tinged with silvery white; pelvic fins blue-black with a black fin membrane; caudal fin blackish brown.



scales

Geographical Distribution : Based on Japanese commercial longliner's catches, the distribution of *T. albidus* extends over most of the Atlantic, roughly from 45°N in the North Atlantic to 45°S in the western South Atlantic and 35°S in the eastern South Atlantic. *T. albidus* is also known from the Mediterranean Sea, and from Bretagne, France, though these records seem to correspond to a few straying individuals.



Habitat and Biology : This is a pelagic and oceanic species, usually swimming above the thermocline. Its distribution varies seasonally, reaching the higher latitudes in both the northern and southern hemispheres only during the respective warm seasons. It is usually found in deep (over 100 m) blue water with surface temperatures over 22°C and salinities of 35 to 37‰. Average air temperatures of regions where it occurs are usually moderate to warm (15° to 25°C). Currents of 0.5 to 2 knots occur over much of its habitat. Angling success for white marlin in the Gulf of Mexico is greater in proportion to the blueness of the water, and poorer in proportion to its greenness. In some areas, *T. albidus* is found to concentrate near rips (usually occurring at interfaces between different masses of water) or weed lines. Its differential distribution is also influenced by

bottom topography. Steep dropoffs, submarine canyons and shoals, when located in areas with suitable water conditions, are often the scene of important feeding concentrations of this species and exceptionally productive fishing.

The recovery of tagged individuals shows that this species may accomplish fairly long journeys, but not the extensive transoceanic migrations achieved by the bluefin tuna (Thunnus thynnus) and the albacore (Thunnus alalunga). Tagging experiments carried out the Cooperative Game fish Tagging Program of the Woods Hole Oceanographic Institution have produced considerable insights into the movements of T. albidus in the western North Atlantic. As of January 1973, some 9 000 of these fish had been marked in that area, and 144 tags had been returned (Mather, Clark and Mason, 1975).

The information presently available indicates that T. albidus spawns once a year. Knowledge of spawning seasons, areas, and mating behaviour is incomplete, because of difficulties in identifying the eggs and larvae and the lack of continuous and comprehensive gonad studies. Ueyanagi *et al.* (1970) concluded that this species migrates into subtropical waters to spawn, with peak spawning occurring in early summer. The spawning areas are found in deep and blue oceanic waters, generally at high surface temperatures (20 to 29°C, except in the southern Atlantic gyres) and high surface salinities (over 35‰). Except off Cabo Frio, Brazil, the productivity of these waters is considered to be low.

T. albidus is not generally considered a schooling fish, and is most often found as single individuals or in pairs "tailing" with only the dorsal lobe of their caudal fins showing. Small schools (5 to 12 fish), however, are occasionally seen feeding on schools of bait, or tailing, but loose aggregations of numerous fish scattered over fairly large areas are most typical. They may school according to size or sex at various seasons of the year.

Hemingway (1935) described "white marlins" breeding off Cuba in May: "they breed in the same way the groupers do, except that as current-dwelling fishes, they do this in the current instead of on the reef. The female marlin heads into the current while the male heads in the opposite direction, and while they are side by side, the female expels the eggs and the male the milt; the male then catches the eggs in the basket-like opening of his gill covers and lets them pass out through his mouth". The feasibility of the latter action seems questionable, but the observation of paired spawning may be true.

Atlantic white marlin are known to kill or stun their food by spearing it or hitting it with their bill. This may not always be true, however, as whole specimens found in the stomachs appeared to be unscathed. In such cases the marlin may have simply overtaken the prey. Squids seem to play a most important part as food of T. albidus in the different areas of its abundance. In the Gulf of Mexico, the most consistently important food items observed from 1966 to 1971 were squids, dolphinfish (Coryphaena hippurus), and hardtail jack, (Caranx crysos). Mackerels were next in importance and flying fishes and bonitos also played a big part. Other food items found were cutlassfishes, swellfishes, herrings, barracudas, moonfishes, triggerfishes, remoras, hammerhead sharks, and crabs, but to a much lesser and more inconsistent degree. Along the central Atlantic coasts, the favorite food items appear to be round herring (Etrumeus teres) and squid (Loligo pealei), but carangids are also well represented in addition to several other species.

Size : This species reaches a maximum size of over 280 cm in total length and over 82 kg in weight. The all tackle angling record given by the International Game Fish Association is a fish caught off Victoria, Brazil, on 8 December 1979, weighing 82.50 kg (181 lb 14 oz). Other large records (over 70 kg) are: 79 kg (174 lb 3 oz) off Victoria, Brazil, on 1 November 1975; 77.40 kg (170 lb 10 oz) off Gurapari, Espirito Santo, Brazil on 2 December 1978; and 73.2 kg/274.3 cm total length at Pompano Beach, Florida on 25 April 1953. The size of Atlantic white marlins caught by commercial longliners ranges from 130 to 210 cm body length (mostly around 165 cm body length).

Interest to Fisheries : In the period from 1978 to 1981, catches of T. albidus have been reported from five FAO Fishing Areas (21, 31, 34, 41 and 47) by Japan and the Republic of Korea. The world total catch was very small throughout these areas: 204 t in 1981, 93 t in 1979, 119 t in 1980, 121 t in 1981 and 131 t in 1982 (FAO, 1984).

The types of fishing gear used for billfishes and tunas, including T. albidus, vary somewhat from one area to another but all employ the basic hook and line technique. The major gear classifications are rod and reel, handline and longline. The fishing gear is operated from various types of boats, ranging from large ocean-going longliners and very luxurious sportsfishing crafts down to outboard wooden or FRP motorboats and small 4.5 to 6 m wooden sailboats and row boats in the Caribbean area.

The quality of the flesh is excellent. It is mostly marketed frozen in Japan, and fresh locally.

Local Names : BRAZIL: Agulhao, Agulhao branca, Bicuda, Espadarte meca; CANADA: Makaire blanc, White marlin; CUBA: Aguja blanca, Aguja de paladar, Blanca, Cabezona; FRANCE: Makaire blanc; ITALY: Marlin bianco; JAPAN: Nishimaka, Nishimakajiki (name for white marlin landed in Japan); MORROCO: Espadon; PORTUGAL: Agulha, Espadum branco, Espadum pequeno, Espadon branco do Atlantico; REPUBLIC OF KOREA: Bag-sae-chi; SOUTH AFRICA: White marlin, Wit marlyn; SPAIN: Aguja blanca, Alfiler, Alton, Cometa, Pez aguja; USA: Skilligalee, White marlin; USSR: Belyi marlin; VENEZUELA: Aguja blanca; WEST INDIES: White marlin.

Literature : Wallace & Wallace (1942); Gibbs (1957); de Sylva (1963); Stephens (1965); Ueyanagi et al. (1970); Nakamura (1971); Nakamura & Rivas (1972); Robins (1974); Mather, Clark & Mason (1975).

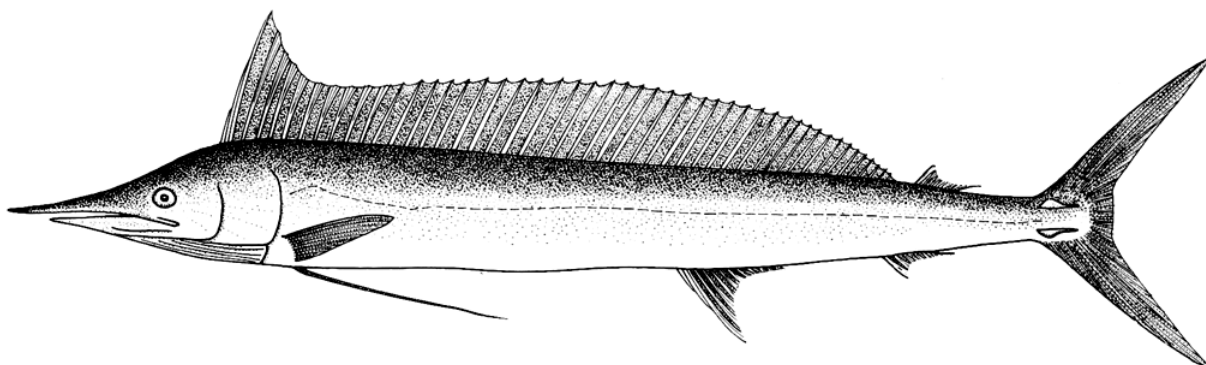
Tetrapturus angustirostris Tanaka, 1915

ISTIO tetra 3

Tetrapturus angustirostris Tanaka, 1914 to 1915, figures and description of the fishes of Japan, 18:p1.88 (fig.285 1914), 19:324 (1915) (Sagami Bay, Japan).

Synonymy : Tetrapturus illingworthi Jordan & Evermann, 1926; Tetrapturus kraussi Jordan & Evermann, 1926; Pseudohistiophorus angustirostris-de Buen, 1950; Pseudohistiophorus illingworthi-de Buen, 1950.

FAO Names : En - Shortbill spearfish; Fr -Makaire à rostre court; Sp - Marlin trompa corta



Field Marks : Bill very short, usually less than 15% of body length; pectoral fins narrow and short, less than 15% of body length; distance between anus and anal fin oriyin nearly equal to anal fin height.

Diagnostic Features : Body elongate and fairly compressed. Bill short and slender, round in cross section; lower jaw shorter than upper jaw, but still projecting; nape nearly straight; 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-shaped teeth. Two dorsal fins, the first with 45 to 50 rays and with a pointed anterior lobe, higher than body depth anteriorly, the fin then abruptly decreasing in height to about the 19th dorsal fin ray and gradually increasing thereafter, but maintaining a uniform height posteriorly; first dorsal fin base long, extending from above posterior margin of preopercle to near second dorsal fin origin; second dorsal fin with 6 or 7 rays, its position slightly backward with respect to the second anal fin; two anal fins, the first with 12 to 15 rays, and the second with 6 to 8 rays and very similar in size and shape to the second dorsal; pectoral fins with 17 to 19 rays; pelvic fins slender, about twice the length of the pectorals. Caudal peduncle fairly compressed (laterally) and slightly depressed (dorsoventrally) with double keels on each side and a shallow notch on both dorsal and ventral surfaces; anus situated far anterior to first anal fin origin, at a distance usually longer than the height of first anal fin. Lateral line single and well visible. Body densely covered with elongate bony scales, each scale with 3 to 5 posterior points. Vertebrae 24 (12 precaudal and 12 caudal). Gonad Y-shaped. Colour: body dark blue dorsally, blue splattered with brown laterally, and silvery white ventrally, without dots or stripes. First dorsal fin dark blue, without dots or blotches; remaining fins brown or dark brown; bases of first and second anal fins often tinged with silvery white.



ca. 55 cm.
body length

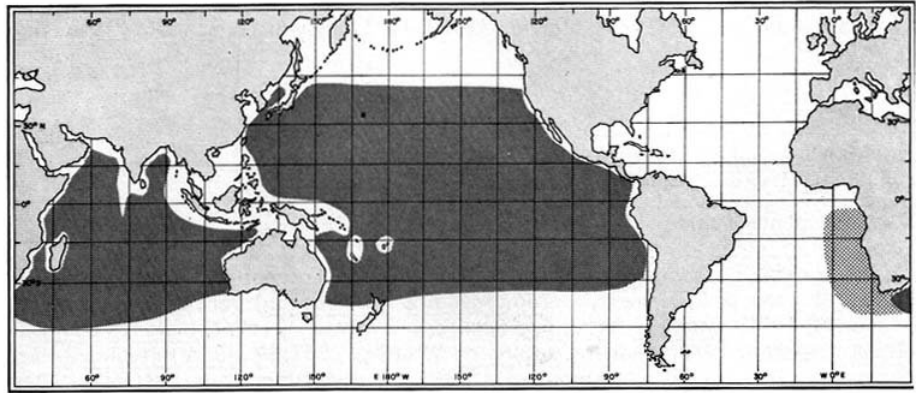


ca. 160 cm.
body length

Schematic drawings of scales (not same size)

Geographical Distribution :

T. angustirostris is distributed throughout the tropical and temperate waters of the Pacific and Indian oceans and is thought to be strongly oceanic, rarely entering coastal waters. Its latitudinal range based on longline catches, extends roughly from 40°N to 35°S in the Pacific Ocean and from 20°N to 35°-45°S in the Indian Ocean.



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

Habitat and Biology :

T. angustirostris is an oceanic pelagic fish which does not generally occur in coastal or enclosed waters but is found well offshore. Longline fisheries in the

equatorial Indian Ocean take relatively few individuals in the upper water layers (0 to 200 m) over depths shallower than 914 m (500 fathoms) while the highest catch rates are obtained above the 915 to 1830 m (501 to 1000 fathoms) isobaths. The catch rate decreases over deeper areas. The population density, based on catch per unit of effort data of the longline fishery appears to be usually low, except in the northwestern Pacific between 15° and 30°N where it is high from about November through February. This species is apparently more abundant during the southeast monsoon period in the western Indian Ocean, when the maturity of female fish is more advanced and the surface temperatures are at the lowest (mean 25.5°C). Although some stray individuals of this fish are found in the Atlantic Ocean, this species is believed to have its spawning grounds and principal populations only in the Pacific and Indian oceans.

Spawning is believed to occur mainly during the winter months, especially in warm offshore currents with surface temperatures of about 25°C. Thus fish caught in waters around Taiwan Island were found to release ripe eggs in November. Females with ripe ovaries were also reported to occur during the winter months in the western Indian Ocean, and in March in the central Pacific Ocean. From the occurrence of larvae and mature fish, spawning seems to be also more active in winter than in summer in the tropical and subtropical waters of the Pacific and Indian oceans between 25°N and 25°S. The frequency distribution of the diameters of eggs shed by the shortbill spearfish ranges roughly from 1.3 to 1.6 mm, with a mean of 1.442 mm in the equatorial western Indian Ocean. The eggs released from the ovaries around Taiwan Island and preserved in alcohol are spherical and about 1 mm in diameter. The ovarian eggs of nearly mature (not fully ripe) females are almost colourless and semitransparent, with slightly yellowish brown oil globules which later unite into two fairly large globules. At this stage, the diameter of the ovarian eggs is about 0.8 mm.

Like in other billfishes, stomach contents of T. angustirostris differ from place to place and from season to season. Data from Japanese longline research cruises show that (i) in the eastern Pacific Ocean this species feeds mainly on cephalopods and fishes, such as Gempylidae, Scombridae, Exocoetidae, Bramidae, Stromateidae, Alepisaurus spp., Auxis spp., Katsuwonus pelamis etc.; (ii) in the central South Pacific Ocean, the number of fish species preyed upon is more limited than in Tetrapturus audax and Makaira mazara, but the crustacean and cephalopod species found in stomachs are nearly the same as those taken by other billfishes. On the other hand, deepwater fishes such as Myctophidae, Triacanthidae and Polyipnus are lacking, which suggests that T. angustirostris swims in shallower waters than T. audax and M. mazara. A comparative analysis of the relative volume of stomach contents of tunas and billfishes from the central South Pacific shows that T. angustirostris and the yellowfin tuna (Thunnus albacares) have their stomachs filled with food more often than the albacore, (Thunnus alalunga), the striped marlin (Tetrapturus audax) or the blue marlin (Makaira mazara) and that T. angustirostris and T. alalunga tend to eat smaller food items than other billfishes and tunas.

Size : The maximum known size of this species is about 2 m in total length and 52 kg in weight. The average length of fish caught by the longline fishery is about 135 cm eye-fork length in the central South Pacific and approximately 150 cm in the eastern Pacific, and the average weight is about 18 kg.

Interest to Fisheries : There are no special fisheries for T. angustirostris, but this species is caught incidentally by tuna longlines and very rarely by trolling or sportfishing. The catch statistics by Japanese longliners for the Indo-Pacific sailfish (Istiophorus platypterus) includes a negligible proportion of T. angustirostris. Usually, nearshore records roughly apply to I. platypterus and offshore records to T. angustirostris. All in all, the annual total catch of this species is estimated at several hundred metric tons.

The shortbill spearfish is marketed mostly frozen in Japan. The flesh is scanty and not of high value, compared with that of other billfishes. It is mainly used for fish cakes and sausages.

Local Names : JAPAN: Furai, Fuuraikajiki, Sanmakajiki, Sugiyama; SOUTH AMERICA: Pez aguja corta; USA: Japanese spearfish, Shortbill spearfish, Shortnose spearfish, Shortnosed spearfish, Slender spearfish; USSR: Kop'jenosjets; VIET NAM: Cá cò Nhatban.