

Diagnostic Features: Snout rather short and moderately broad, preoral length about 0.7 to 0.9 times mouth width; gill region greatly expanded, distance from spiracle to 5th gill slit greater than prespiracular head; width of longest gill slits nearly equal to eye length; labial furrows shorter, uppers falling well behind level of lower symphysis. Ventral caudal lobe hardly expanded in adults. Colour brownish or greyish above and lighter below, with no conspicuous markings; margins of dorsal fins often somewhat darker.

Geographical Distribution : Red Sea and Gulf of Oman to Pakistan and southwestern India. A low-finned, somewhat short-headed lago is largely sympatric with l. omanensis at least off southwestern India, and in the Bay of Bengal there is a possibly dwarf, omanensis-like lago that may or may not be distinct.

Habitat and Biology : A small, deepwater tropical shark of the continental shelf and slope from 110 m or less depth to at least 1000 m depth and possibly down to 2195 m in the Red Sea, on or near the bottom. This species has been regularly caught in warm water with oxygen levels often at a low level, at 16 to 25 C and 0.2 to 2.4 ml/l oxygen (mostly at 0.2 to 0.6 ml/l). Compared to l. garricki and the Philippine lago, this species has an enlarged branchial region, with larger gill slits and expanded branchial septa with much greater expanses of gill lamellae; these are apparently adaptations for living in warm, relatively anoxic, and probably (especially in the Red Sea) hypersaline waters.

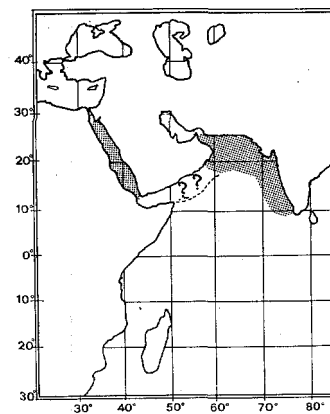
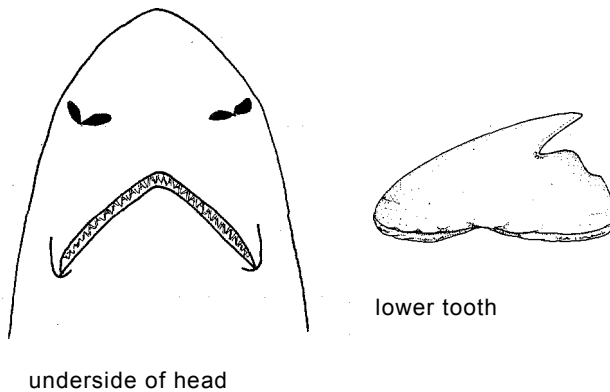
Viviparous, with a yolk-sac placenta; litter size probably about 2 to 10 young.

Definitely known to eat bony fishes and cephalopods. Nair & Appukuttan (1973) note that bony fishes, particularly lanternfishes, were the most important food item of this species off southern India, followed by deepwater squid, crustaceans (shrimp and larvae of mantis shrimp), bivalves and gastropods; sea grass and mud were found in a few stomachs. It is probable, however, that at least some of the lago examined by these writers were not l. omanensis but its low-finned sympatriot (K.K. Appukuttan, pers.comm.).

Size : Maximum size 58 cm; adult males 30 to 37 cm, adult females 40 to 58 cm. Sexual dimorphism in size in this species is considerable, with the largest males about 63% as long as the longest female (37 versus 58 cm) and weighing about 1/6 as much (Compagno & Springer, 1971); size at birth at least 17 cm (A. Baranes, pers.comm., term fetuses).

Interest to Fisheries: Limited, taken in gillnet fisheries in southern India and also caught by handline fisheries in Israel in the Gulf of Aqaba (Elat). In India, utilized fresh for human consumption.

Literature : Compagno & Springer (1971); Nair & Lal Mohan (1973); Nair & Appukuttan (1973); Baranes & Ben-Tuvia (1979).



Mustelus Linck, 1790

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Genus : Mustelus Linck, 1790, Mag.Neue.Phys.Naturges., Gotha, 6(3):31.

Type Species : Squalus mustelus Linnaeus, 1758, by subsequent designation of the International Commission of Zoological Nomenclature, Opinion 93 (1925:5).

Synonymy : Genus Mustellus Fischer, 1813 (emended spelling); Genus Galeus Leach, 1818 (junior homonym of Galeus Rafinesque, 1810 and Galeus Cuvier, 1817); Genus Emissola Jarocki, 1822; Genus Myrmillo Gistel, 1848; Genus Rhinotriacis Gill, 1863; Genus Pleuracromylon Gill, 1864; Genus Cynias Gill, 1903; Genus Murmille Setna & Sarangdhar, 1946; Genus Allomycter Guitart, 1972.

Field Marks: Usually slender houndsharks with long, parabolic subangular snouts, dorsolateral eyes and strong subocular ridges, angular mouths, teeth formed into a pavement, with cusps and cusplets variably developed but usually obsolete or absent; medial teeth not differentiated from anterolaterals, and second dorsal fin nearly as large as first.

Diagnostic Features : Snout long and parabolic-subangular in dorsoventral view, preoral length less than 1.3 times the mouth width; eyes horizontally elongated or oval and dorsolateral, subocular ridges strong; anterior nasal flaps rather elongated and lobate, well separated from each other and mouth; no nasoral grooves; internarial width about 1 to 2 times the nostril width; mouth angular and moderately long; labial furrows moderately long, uppers falling well behind level of upper symphysis; teeth not bladeliike and similar in both jaws, varying from somewhat compressed and with short erect cusps and cusplets to rounded, molariform, and without cusps and cusplets; medial teeth not differentiated from anteroposteriors. First dorsal fin moderately large, its base less than 3/4 of dorsal caudal margin, its origin over pectoral inner margins or slightly behind their free rear tips, its midbase about equidistant between pectoral and pelvic bases or closer to pectoral bases; second dorsal nearly as large as first, its height about 2/3 to 3/4 as high as first; anal fin considerably smaller than second dorsal; ventral caudal lobe hardly developed in young but varying from poorly developed to short and strong in adults; terminal lobe of caudal fin moderately long and about 2.3 to 3 times in dorsal caudal margin.

Remarks : The arrangement of this genus is based on Heemstra's (1973, pers.comm.) revisions, from which much information on nomenclature, range, and size are taken. When preparing the account of Mustelus at the J.L.B. Smith Institute of Ichthyology, the author was able to freely utilize the knowledge and unpublished data of Or P.C. Heemstra, for which he is very grateful; the writer suspects that the present section would have been far poorer without this help and information. Or Heemstra intends to publish an updated version of his 1973 revision of the genus, in which five new species will be described, two in the western Atlantic, two in the tropical eastern Pacific, and one in tropical Australian waters (not sympatric with Mustelus antarcticus). Revisionary works by Springer (1939), Bigelow & Schroeder (1940, 1948), and Kato, Springer & Wagner (1967) were also utilized.

The species of Mustelus (smooth-hounds, emissoles, palombos, tollos, gummy sharks, etc.) are abundant temperate to tropical, inshore bottom-dwelling sharks that figure prominently in artisanal and inshore commercial fisheries.

There have been a number of attempts to divide or subdivide Mustelus on mode of reproduction, but these have in general run afoul of the formerly confused generic nomenclature and of lack of knowledge on the reproduction of quite a number of species. Mustelus species are ovoviviparous (aplacental viviparous) or viviparous (placental viviparous or placentoviviparous), but it is not known if placental species have evolved more than once within the genus or if the aplacental species have secondarily evolved from placental species. If ovoviviparity is primitive within Mustelus, viviparity in the genus has evolved separately from that in other carcharhinoids. For further discussion of the taxonomic and nomenclatural aspects of reproduction in Mustelus, see Heemstra (1973) and Compagno (1979).

The genus Allomycter was described by Guitart (1972) for a species, A. dissutus, known only from photographs (type specimen lost). This was tentatively recognized by Compagno (1973b) but photographs of, the species supplied later by Or D. Guitart suggested that it was based on a Mustelus (probably M. canis) with an abnormal, possibly damaged or teratological snout (see Heemstra (1973) and Compagno (1979) for further discussion).

There has been considerable difficulty in the past with separating this genus from Triakis. See Kato (1968), Heemstra (1973), Bass, D'Aubrey & Kistnasamy (1975b), but especially Compagno (1970, 1973b, 1979) for discussion of this problem and its resolution.

Members of the genus Mustelus are unusually difficult to separate from one another, particularly without the use of internal characters. Many of the morphological, morphometric and meristic characters that distinguish species partially overlap and considerable variation occurs within species. The following key should be used with EXTREME CAUTION, as not every individual of a given species may fit the criteria given. A tentative identification made with the key should be carefully and thoroughly checked with the diagnostic features and the distribution for the species. As Mustelus species have limited geographic distributions a tentative identification of Mustelus lunulatus from, say, the western North Pacific is probably not that species but another, perhaps M. griseus. See Heemstra (1973) for regional keys to species.

Key to Species

- 1a. Cusps high on teeth
 - 2a. Fins without frayed posterior margins. Interorbital space broader, 5.1 to 6.2% of total length. Eye length 2.6 to 3.7 times in preorbital snout: Size small, maximum less than 70 cm (eastern Pacific) **M. dorsalis**
 - 2b. Posterior margins of dorsal and occasionally caudal and anal fins with a dark margin of bare ceratotrichia which gives fins a frayed appearance. Interorbital space narrower, 3.9 to 5.6% of total length. Eye length less than 2.5 times in preorbital snout. Size larger, maximum about 90 cm

- 3a. Denticles usually tricuspidate. Internarial space moderate, 2.6 to 3.3% of total length. Interdorsal space greater, 19 to 24% of total length. Postanal space greater, 6.9 to 8.6% of total length (eastern Pacific) **M. henlei**
- 3b. Denticles lanceolate. Internarial space broader, 2.9 to 3.7% of total length. Interdorsal space less, 16 to 21% of total length. Postanal space less, 4.7 to 7.4% of total length (eastern Pacific) **M. whitneyi**
- 1b. Cusps low to absent on teeth
 - 4a. No cusps on teeth, crowns broadly rounded
 - 5a. Preorbital snout longer and more pointed, 9.4 to 10.2% of total length. Mouth wider, 6.7 to 7% of total length. Postanal space 4.2 to 5.6% of total length. Precaudal vertebrae 58 to 63. No white spots on body; vertical narrow dark bands present in adults (western South Atlantic) **M. fasciatus**
 - 5b. Preorbital snout shorter and blunter, 6.9 to 9% of total length. Mouth narrower, 4.5 to 6.4% of total length. Postanal space 5.7 to 7.5% of total length. Precaudal vertebrae 64 to 90. Small white spots present on body; vertical dark bands present only in young (eastern South Pacific)..... **M. mento**
 - 4b. Low blunt cusps present on teeth, crowns asymmetrical
 - 6a. Numerous small white spots on dorsal surface of body, particularly along lateral line (sometimes absent). Upper labial furrows considerably longer than lowers
 - 7a. Posterior margins of dorsal fins usually with a narrow dark margin of bare ceratotrichia. Internarial space very narrow, 1.8 to 2.4% of total length (western South Atlantic) **M. schmitti**
 - 7b. Posterior margins of dorsal fins without bare ceratotrichia. Internarial space broader, 2.0 to 3.8% of total length
 - 8a. Denticles covering anterior third of palate and floor of mouth. Interorbital averaging broader, 3.7 to 5.2 of total length
 - 9a. Pelvic fins larger, anterior margins 7.2 to 8.7% of total length. Precaudal diplospondylous centra 50 to 60, pre-caudal centra 87 to 95 (New Zealand) **M. lenticulatus**
 - 9b. Pelvic fins smaller, anterior margins 6.2 to 7.9% of total length. Precaudal diplospondylous centra 40 to 50, pre-caudal centra 76 to 86 (Australia)..... **M. antarcticus**
 - 8b. Denticles covering entire palate and floor of mouth. Interorbital averaging narrower, 3.4 to 4.7% of total length
 - 10a. Internarial space averaging broader, 2.4 to 3% of total length. Pectoral fins larger, posterior margin 12 to 16% of total length (southern Africa) **M. palumbes**
 - 10b. Internarial space averaging narrower, 2 to 2.6% of total length. Pectoral fins smaller, posterior margin 7.5 to 14% of total length
 - 11a. Precaudal diplospondylous centra 49 to 61, pre-caudal centra 90 to 100. Size larger, adults 78 to 140 cm (eastern North Atlantic and Mediterranean) **M. asterias**
 - 11b. Precaudal diplospondylous centra 35 to 53, pre-caudal centra 72 to 92. Size smaller, adults 55 to 90 cm (Indo-West Pacific) **M. manazo**
 - 6b. Dorsal surface uniform grey or with a few dark spots. Upper labial furrows usually about as long or hardly longer than lowers (noticeably longer in **M. canis** and to a lesser extent in **M. mustelus**)

- 12a. Posterior margins of dorsal fins usually with a narrow darker margin of bare ceratotrichia, giving the fins a frayed appearance. Internarial space narrower, 1.9 to 2.3% of total length. Usually a few small dark spots or blotches on dorsal surface of body (eastern North Atlantic and Mediterranean) **M. punctulatus**
- 12b. Posterior margins of dorsal fins without a narrow darker margin of bare ceratotrichia. Internarial space broader, 2.2 to 3.8% of total length. Usually no dark spots or blotches on dorsal surface of body (except for some M. mustelus)
- 13a. Crowns of lateral trunk denticles tricuspidate. Interorbital rather broad, 4.5 to 6.3% of total length. Size small, adults 43 to 64 cm (western Atlantic) **M. higmani**
- 13b. Crowns of lateral trunk denticles usually lanceolate (variably tricuspidate or lanceolate in M. mosis). Interorbital narrower, 3.3 to 4.6% of total length. Size larger, adults 57 to 100 cm or more
- 14a. Upper labial furrows usually distinctly longer than lowers. Buccopharyngeal denticles usually covering anteriormost part of palate and tongue. Size larger, maturing at 70 to 80 cm and reaching at least 150 cm
- 15a. Internarial space broader, 2.7 to 3.6% of total length. Labial furrows somewhat longer, 1.6 to 2.7% of total length. Precaudal centra more numerous 85 to 100 (western Atlantic) **M. canis**
- 15b. Internarial space narrower, 2.4 to 3% of total length. Labial furrows somewhat shorter, 1.4 to 2% of total length. Precaudal centra fewer, 70 to 93 (eastern Atlantic, Mediterranean and Cape Coast of South Africa) **M. mustelus**
- 14b. Upper labial furrows subequal to or shorter than lowers. Buccopharyngeal denticles more extensive, extending nearly halfway to internal openings of fifth gill slits (condition uncertain in M. californicus and M. lunulatus). Size smaller, adults maturing at 58 to 70 cm and reaching 115 cm
- 16a. Mouth rather short, length about equal to eye length. First dorsal midbase somewhat closer to pelvic fins than pectorals. Ventral caudal lobe not expanded and falcate in adults or little falcate (eastern North Pacific) **M. californicus**
- 16b. Mouth longer, length usually greater than eye length. First dorsal midbase about equidistant between pectoral and pelvic fins. Ventral caudal lobe more or less expanded and falcate in adults
- 17a. Precaudal centra more numerous, 87 to 100 (western Atlantic) **M. norrisi**
- 17b. Precaudal centra less numerous, 59 to 81
- 18a. Lower labial furrows longer than uppers. Lateral trunk denticles with ridges extending two-thirds length of crown (eastern Pacific) **M. lunulatus**
- 18b. Upper and lower labial furrows usually subequal. Lateral trunk denticles with ridges extending entire length of crown
- 19a. Labial furrows longer, 1.3 to 2% of total length. Rostral cartilages and supraorbital crests hypercalcified in adults (Red Sea and western Indian Ocean) **M. mosis**
- 19b. Labial furrows shorter, 0.8 to 1.4% of total length. Cranium not hypercalcified (western Pacific) **M. griseus**

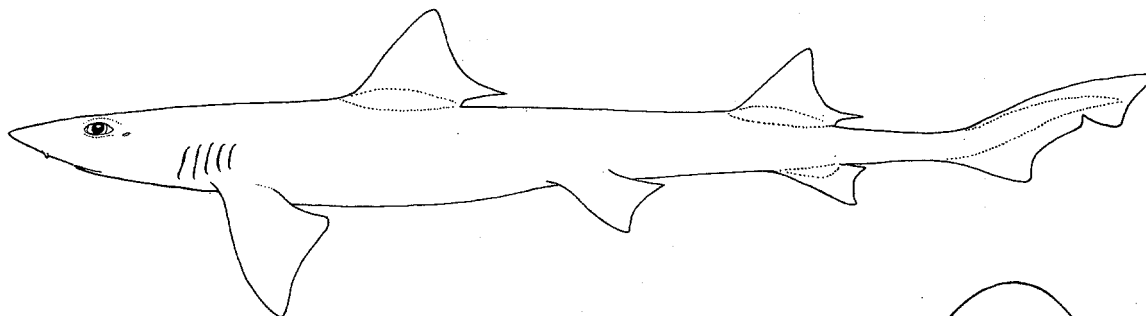
Mustelus antarcticus Günther, 1870

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Mustelus antarcticus Günther, 1870, Cat.Fish.British Mus., 8:387. Syntypes: British Museum (Natural History); BMNH 1869.6.7.1, 870 mm female, New South Wales; BMNH 1868.8.18.5, 1030 mm adult male, Tasmania; an additional syntype, BMNH 1823.2.10.12, is not this species but M. lenticulatus (Heemstra, 1973). Type Locality: "South Pacific" (New South Wales, Tasmania, New Zealand).

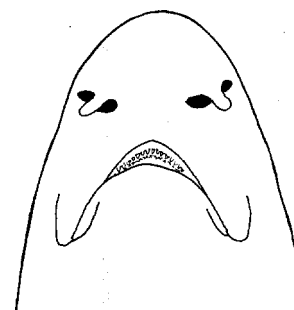
Synonymy : Emissola maugeana Whitley, 1939; Emissola ganearum Whitley, 1945.

FAO Names : En - Gummy shark; Fr - Emissole gommée; Sp - Musola austral.



Field Marks : A white-spotted Mustelus with a broad internarial space, short head, low-cusped teeth, long upper labial furrows, dorsal fin margins not frayed, relatively small pectoral and pelvic fins, buccopharyngeal denticles confined to anterior end of mouth, and 76 to 86 precaudal centra. It is the only species of Mustelus in temperate Australian waters.

Diagnostic Features : Body fairly slender. Head short, prepectoral length 17 to 21% of total length; snout moderately long and bluntly angular in lateral view, preoral snout 5.7 to 7.4% of total length, preorbital snout 5.8 to 7.8% of total length; internarial space broad, 2.6 to 3.2% of total length; eyes fairly large, eye length 1.6 to 3.2 times in preorbital snout and 2.4 to 4.2% of total length; interorbital space fairly broad, 3.7 to 5.1% of total length; mouth short, its length subequal to eye length and 3.0 to 3.6% of total length; upper labial furrows considerably longer than lowers and 2.0 to 2.8% of total length; teeth molariform and asymmetric, with cusp reduced to a low point; buccopharyngeal denticles confined to tongue and anteriormost part of palate. Interdorsal space 19 to 23% of total length; trailing edges of dorsal fins denticulate, without bare ceratotrichia; pectoral fins moderately large, length of anterior margins 12 to 16% of total length, width of posterior margin 8 to 13% of total length; pelvic anterior margins 6.2 to 7.9% of total length; anal height 2.5 to 4.4% of total length; anal-caudal space greater than second dorsal height, 6.9 to 8.3% of total length; ventral caudal lobe more or less falcate in adults. Crowns of lateral trunk denticles lanceolate, with longitudinal ridges extending at least half their length. Cranium, hyomandibulae and scapulocoracoids not hypercalcified in adults; palatoquadrates not subdivided; monospondylous precaudal centra 35 to 38, diplospondylous precaudal centra 39 to 50, precaudal centra 76 to 86. Colour grey or grey-brown, above, light below, usually with numerous small white spots but without dark spots or dark bars. Development ovoviviparous. Size large, adults 68 to 157 cm.



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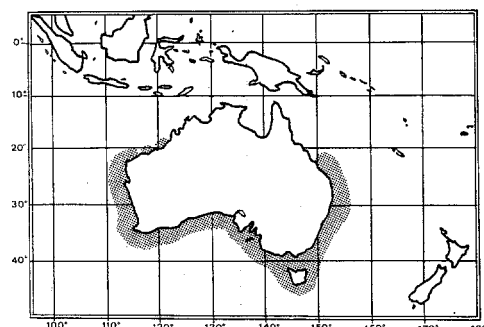
Geographical Distribution : Western South Pacific: Australia (Western and South Australia, Victoria, Tasmania, New South Wales, southern Queensland).

Habitat and Biology : An abundant inshore and offshore shark of temperate waters, found on or near the bottom and from the intertidal to 183 m. Ovoviviparous, without a yolk-sac placenta, number of young 5 to 16 per litter. Eats crustaceans, including crabs, marine worms and small fishes.

Size: Maximum 157 cm, males maturing at about 68 cm, females at about 80 cm.

Interest to Fisheries : This small shark is widely fished in Australia, and utilized. fresh for human consumption.

Literature : Whitley (1940, 1967); Stead (1963); Heemstra (1973 and pers. comm.).



Remarks: This species is closest to the New Zealand *M. lenticulatus*, but differs in having slightly larger pelvic fins and fewer precaudal vertebrae. The author follows Heemstra (1973) in synonymizing *Emissola naugeana* with this species. Dr P.C. Heemstra (pers. comm.) regards the larger Western Australian gummy sharks (*E. ganearum*) as conspecific with *M. antarcticus*, although he had previously (Heemstra, 1973) kept them as separate species following Whitley.

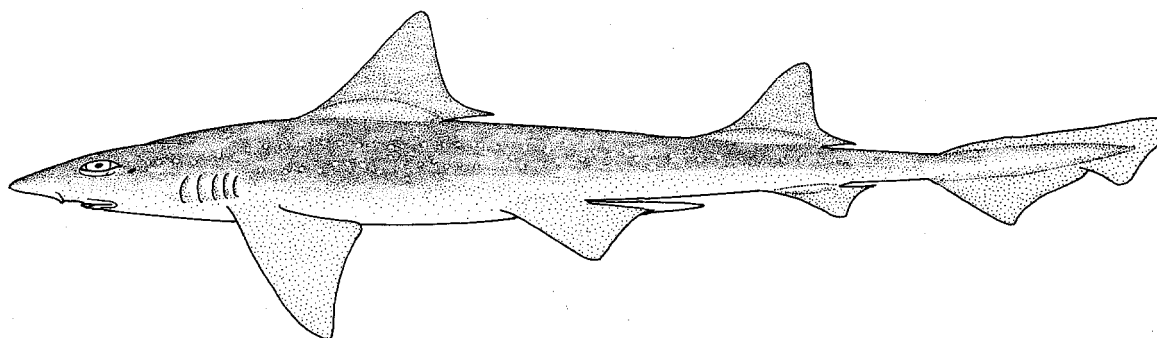
Mustelus asterias Cloquet, 1821

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Mustelus asterias Cloquet, 1821, *Emissola*, in *Dict.Sci.Nat.*, 14:401. Holotype: None. Type Locality: None mentioned.

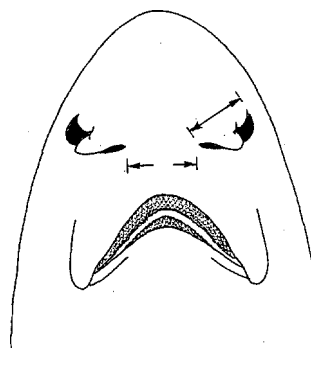
Synonymy : *Squalus hinnulus* Blainville, 1825; *Mustellus stellatus* Risso, 1826; *Mustelus plebejus* Bonaparte, 1834; *Mustelus equestris* Bonaparte (in part; also *M. mustelus*, *Squalus albomaculatus* Plucar, 1846; *Squalus edentulus* Doderlein, 1881.

FAO Names : En - Starry smooth-hound; Fr - Emissole tachetée; Sp - Musola estrellada.

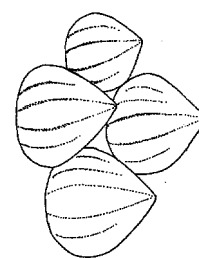


Field Marks : A large, white-spotted *Mustelus* with a relatively narrow internarial space, buccopharyngeal denticles covering almost entire oral cavity, unfringed dorsal fins, relatively small pectoral and pelvic fins, and 90 to 100 precaudal centra. It is the only white-spotted smooth-hound in European waters.

Diagnostic Features : Body fairly slender. Head short, prepectoral length 13 to 17% of total length; snout moderately long and bluntly angular in lateral view, preoral snout 5.4 to 7.2% of total length, preorbital snout 5.7 to 7.2% of total length; internarial space fairly narrow, 2 to 2.6% of total length; eyes large, eye length 1.6 to 2.2 times in preorbital snout and 2.5 to 4.1% of total length; interorbital space relatively narrow, 3.4 to 4.5% of total length; mouth relatively short, subequal or smaller than eye length, its length 2.2 to 3.5% of total length; upper labial furrows considerably longer than lowers, upper furrows 1.8 to 2.5% of total length; teeth molariform and asymmetric, with cusp reduced to a low point, cusplets absent except in very young sharks; buccopharyngeal denticles covering entire palate and floor of mouth. Interdorsal space 19 to 25% of total length; trailing edges of dorsal fins denticulate, without bare ceratotrichia; pectoral fins moderate-sized, length of anterior margins 12 to 16% of total length, width of posterior margins 7.8 to 13% of total length; pelvic anterior margins 6.6 to 9.1% of total length; anal height 2.4 to 3.9% of total length; anal-caudal space usually greater than second dorsal height, 6.8 to 11% of total length; ventral caudal lobe not falcate in adults. Crowns of lateral trunk denticles broadly lanceolate, with longitudinal ridges extending at least half their lengths. Skeleton not hypercalcified in adults; palatoquadrates not subdivided; monospondylous precaudal centra 36 to 40, diplospondylous precaudal centra 49 to 61, precaudal centra 90 to 100. Colour grey or grey-brown, above, light below, usually with numerous small white spots on sides and back, but without dark spots or dark bars. Development ovoviviparous. Size large, adults 80 to 140 cm.



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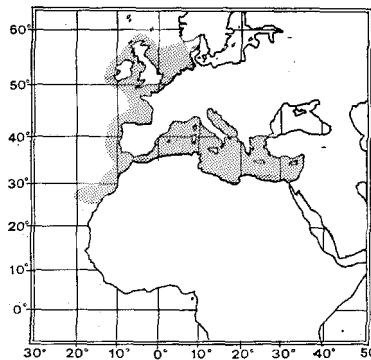


dermal denticles

Geographical Distribution : Eastern North Atlantic: British Isles and North Sea to Canary Islands, Mediterranean and Mauritania.

Habitat and Biology : A common inshore and offshore shark of the continental and insular shelves, on or near the bottom at depths from the intertidal down to at least 100 m. Prefers sandy and gravelly bottoms.

Ovoviviparous, without a yolk-sac placenta; number of young 7 to 15 per litter, with litter size proportionate to maternal size. The gestation period is about 12 months. Young are dropped inshore in summer, and presumably mating occurs in the same season. From growth-curve data it has been suggested that this species is fast-growing, maturing at an age of two- to three years, but this has not been confirmed with direct ageing methods such as calibrating vertebral rings.



Primarily a crustacean feeder, that eats crabs, hermit crabs, lobsters and slipper lobsters. Hermit crabs are eaten complete with the whelk shells they live in and sometimes with the commensal sea anemones that live on their shells.

Size : Maximum about 140 cm, males maturing between 78 and 85 cm, females at about 85 cm; size at birth about 30 cm.

Interest to Fisheries : Caught by bottom trawls, line gear, and probably gillnets; utilized fresh and probably dried salted; also taken by shore anglers.

Literature : Lozano y Rey (1928); Springer (1939); Bigelow & Schroeder (1948); Tortonese (1956); Heemstra (1973); Wheeler (1978); Compagno (1981); Francis (1981).

Remarks : This species is very similar to other Eastern Hemisphere smooth-hounds with white spots and oviviparous reproduction, including *M. manazo*, *M. antarcticus*, *M. lenticulatus*, and *M. palumbes*. All of these species are allopatric to *M. asterias*, but, according to Heemstra (1973 and pers. comm.), all are distinct if little-differentiated. *M. manazo* is most similar, but differs in being smaller and in having fewer vertebrae; *M. lenticulatus* and *M. antarcticus* have broader internarials and less extensive buccopharyngeal denticles; and *M. palumbes* has larger paired fins, a broader internarial, and somewhat fewer vertebrae. The white-spotted smooth-hounds from the Western Hemisphere, *M. mento* and *M. schmitti*, are very different from *M. asterias* and can be distinguished from it in the key to species.

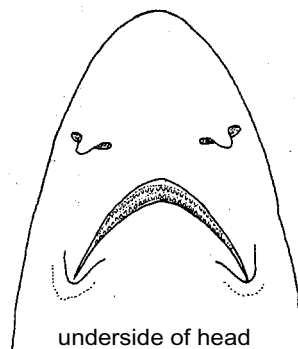
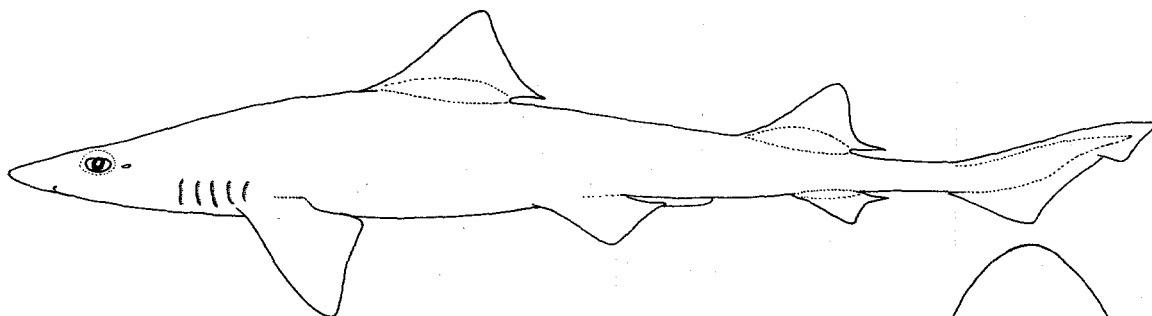
Mustelus californicus Gill, 1864

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Mustelus californicus Gill, 1864, *Proc.Acad.Nat.Sci.Philad.*, 16:148. Holotype: ?. Type Locality: San Francisco, California.

Synonymy : None

FAO Names : En - Grey smooth-hound; Fr - Emissole grise; Sp - Musola gris.



Field Marks: A spotless *Mustelus* with short head, broad internarial space, relatively small eye, narrow head, short mouth, upper labial furrows about equal to lowers, lanceolate lateral denticles with ridges incomplete when present, triangular dorsal fins, with the first dorsal closer to the pelvis than the pectorals, a poorly developed ventral caudal lobe, and 89 to 98 precaudal vertebral centra.

Diagnostic Features : Body fairly slender. Head short, prepectoral length 16 to 20% of total length; snout moderately long and bluntly angular in lateral view, preoral snout 5 to 7.2% of total length, preorbital snout 6.1 to 8% of total length; internarial space broad, 2.1 to 2.9% of total length; eyes fairly small, eye length 2.5 to 3.4 times in preorbital snout and 1.9 to 3.3% of total length; interorbital space narrow, 3.5 to 4.5% of total length; mouth short, subequal to eye length, its length 2.3 to 3.3% of total length; upper labial furrows usually equal to lowers, upper furrows 0.9 to 1.8% of total length; teeth molariform and asymmetric, with cusp reduced to a low point, cusplets absent; condition of buccopharyngeal denticles unknown. Interdorsal space 17 to 21% of total length; trailing edges of dorsal fins denticulate, without bare ceratotrichia; first dorsal broadly triangular to semifalcate with posteroventrally sloping or nearly vertical posterior margin, its midbase closer to pelvic bases than to pectorals; pectoral fins moderate-sized, length of their anterior margins 12 to 15% of total length, width of posterior margins 7.4 to 12% of total length; pelvic fins moderate-sized, length of anterior margins 7.1 to 9.2% of total length; anal height 2.3 to 3.7% of total length; anal-caudal space greater than second dorsal height, 5.9 to 8.6% of total length; ventral caudal lobe not falcate or somewhat falcate in adults. Crowns of lateral trunk denticles lanceolate, longitudinal ridges absent or extending about half of their entire length. Skeleton not hypercalcified in adults; palatine processes of palatoquadrates subdivided at symphysis, with a short separate medial segment on each side; monospondylous precaudal centra 32 to 40, diplospondylous precaudal centra 52 to 61, precaudal centra 89 to 98. Colour uniform grey above, light below, no white or dark spots or dark bars. Development viviparous. Size large, adults 57 to 124 cm.

Geographical Distribution : Eastern North Pacific: Northern California to Gulf of California.

Habitat and Biology : A common inshore and offshore warm-temperate to tropical bottom-dwelling shark of the continental shelves, entering shallow muddy bays. In north-central Californian waters in the USA it is primarily a summer visitor, but is resident in warmer waters from southern California south.

Viviparous, with a yolk-sac placenta; number of young 2 to 5 per litter.

Feeds mostly on crabs, including cancrids and grapsids, with the smaller grapsids being more important to younger sharks than larger ones, which eat more cancrids; also ghost shrimp, innkeeper (echiuroid) worms (*Urechis*), and small fish (herring and midshipmen, *Porichthys*) are occasionally taken. Burrowing invertebrates such as ghost shrimp and innkeeper worms are uncommon prey, indicating that this shark probably seldom roots out or sucks out such food, and may take only the stray individuals washed out of their burrows by the tide.

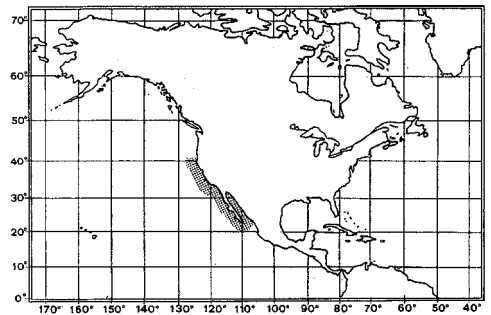
Size : Maximum about 124 cm, males maturing between 57 and 65 cm and reaching 116 cm; females maturing about 70 cm and reaching at least 124 cm.

Interest to Fisheries : Regularly caught by longline fisheries in the Gulf of California and utilized for human consumption; also caught by anglers in California.

Literature: Beebe & Tee-Van (1941); Roedel & Ripley (1950); Kato, Springer & Wagner (1967); Heemstra (1973); Talent (1982).

Remarks : According to Heemstra (1973), the holotype of this species was apparently lost. The holotype was said to have been collected at San Francisco, California, USA. As this species is not resident in the San Francisco area but is a summer visitor to the Monterey area, some 160 km south, Heemstra (1973) doubted the type locality of this species, and suggested that the holotype was collected in southern California. Another possibility suggests itself, that the specimen actually was taken at San Francisco, but was further north than the usual range of the species because of a warm water mass ('el Niño') moving up the coast.

In the southern part of its range this species is sympatric with *M. lunulatus*, but the latter can be distinguished by a broader interorbital, shorter mouth, often more falcate fins, shorter upper labial furrows, and fewer precaudal centra.



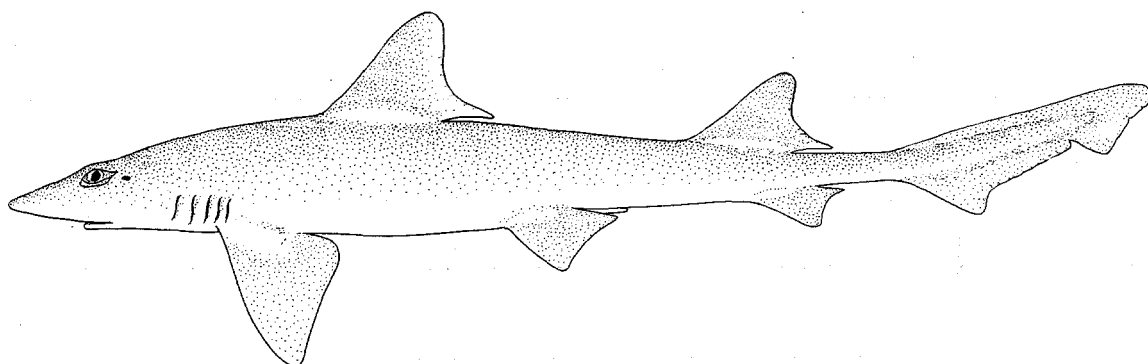
Mustelus canis (Mitchell, 1815)

TRIAK Must 3

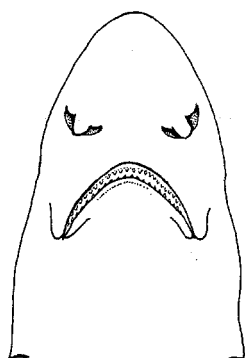
Squalus canis Mitchell, 1815, *Trans. Lit.Philos.Soc. New York*, 1:486. Holotype: ?. Type locality: New York.

Synonymy : *Allomycter dissutus* Guitart, 1972.

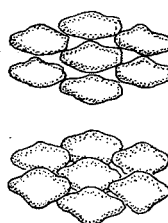
FAO Names: En - Dusky smooth-hound; Fr - Emissole douce; Sp - Musola dentuda.



Field Marks: An unspotted, large *Mustelus* with a short head and snout, broad internarial, large eyes, narrow interorbital, upper labial furrows somewhat longer than lowers, low-crowned teeth with weak cusps, buccopharyngeal denticles confined to extreme front of mouth, lateral trunk denticles usually lanceolate and with complete ridges, unfringed dorsal fins, 85 to 100 precaudal centra, and a non-falcate but moderately expanded ventral caudal lobe.



underside of head



upper and lower teeth

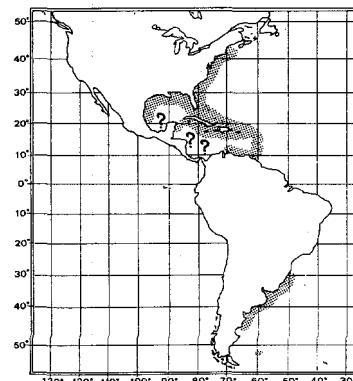


dermal denticles

Diagnostic Features : Body fairly slender. Head short, prepectoral length 17 to 21% of total length; snout moderately long and bluntly angular in lateral view, preoral snout 5.5 to 8.1% of total length, preorbital snout 5.9 to 8.3% of total length; internarial space broad, 2.7 to 3.7% of total length; eyes fairly large, eye length 1.9 to 2.3 times in preorbital snout and 2.2 to 4.2% of total length; interorbital space narrow, 3.6 to 4.6% of total length; mouth fairly short, subequal to or slightly longer than eye length, its length 2.3 to 3.5% of total length; upper labial furrows slightly longer than lowers, upper furrows 1.6 to 2.7% of total length; teeth molariform and asymmetric, with cusp reduced to a low point, cusplets absent except in very young sharks; buccopharyngeal denticles confined to tongue and anteriormost part of palate. Interdorsal space 16 to 23% of total length; pelvic fins moderately large, anterior margin length 6.6 to 8.6% of total length; trailing edges of dorsal fins denticulate, without bare ceratotrichia; first dorsal somewhat falcate, with nearly vertical posterior margin, midbase closer to pectoral bases than to pelvics; pectoral fins moderately large, length of anterior margin's 11 to 16% of total length, width of posterior margins 8 to 14% of total length; anal height 2.5 to 4.5% of total length; anal caudal space greater or subequal to second dorsal height, 6.3 to 9.2% of total length; ventral caudal lobe not falcate but somewhat expanded in adults. Crowns of lateral trunk denticles lanceolate, with longitudinal ridges extending at least half their length, and often their entire length. Skeleton not hypercalcified in adults; palatoquadrates not subdivided; monospondylous precaudal centra 34 to 42, diplospondylous precaudal centra 48 to 60, precaudal centra 85 to 100. Colour uniform grey above, light below, no white or dark spots or dark bars, but newborn young with dusky-tipped dorsal and caudal fins. Development viviparous. Size large, adults 82 to 150) cm.

Geographical Distribution : Western Atlantic: Massachusetts to Florida, northern Gulf of Mexico, Venezuela, including Cuba, Jamaica, Barbados, Bermuda, Bahamas; southern Brazil to northern Argentina.

Habitat and Biology : A common to abundant temperate and tropical shark of the continental and insular shelves and upper slopes, ranging from shallow inshore waters and the intertidal to 200 m depth, but occasionally down to 579 m. In US temperate waters it prefers inshore waters less than 18 m deep, with many coming into enclosed bays and harbours, especially with mud or sandy bottoms; in tropical areas it apparently avoids coral reefs. Some smooth-hounds penetrate the lowermost reaches of rivers and are said to occur in fresh water, though it is doubtful that this shark can live in fresh water for extended periods of time like the bull shark, *Carcharhinus leucas*. Caribbean island populations inhabit deeper water (most below 200 m depth) than continental ones, and prefer rocky bottoms. It is primarily found near or on the bottom, but may occur in midwater off Cuba.



Off southern New England and the middle Atlantic States of the USA this is the second most abundant shark, although falling far short of the spurdog, Squalus acanthias, in numbers. It is said to be the most common local shark in Uruguayan waters.

There is some indication that this shark is divided into several discrete populations, with few or no members of the species occurring in the broad gaps between them (Bigelow & Schroeder, 1948). The best known population is the possibly cold-adapted one which occurs from the Carolinas north along the US Atlantic Coast to New England and southern Canada. The species is uncommon south of North Carolina but is again common off Florida and turns up at many localities in the Gulf of Mexico to southern Mexico, off Bermuda, the Bahamas, and various Caribbean islands and again from southern Brazil to Argentina.

Off the Atlantic coast of the USA the species is migratory, and responds to changes in water temperature by moving. It primarily winters in the area between southern North Carolina and Chesapeake Bay. In the springtime as water warms up on the bottom to at least 6 to 7⁰ C, it moves northward along the coast to New England, and southward to South Carolina. As summer wanes smooth-hounds move offshore and withdraw centrally to their wintering area.

A behavioural experiment involving 10 smooth-hounds apparently of this species (Allee & Dickinson, 1954; Myrberg & Gruber, 1974) indicated that a dominance hierarchy was formed in the experimental population, based on size and not sex, and that individual smooth-hounds, regardless of their position in the hierarchy did not defend territories.

Viviparous, with a yolk-sac placenta; number of young 4 to 20 per litter. The gestation period of smooth-hounds off New England is about 10 months, with mating in midsummer (July) and birth between early May and mid-July of the next year. It has been suggested from growth-curve calculations that the growth rate of this shark is very fast, with maturation after one to two years, but this remains to be confirmed from direct ageing techniques.

Feeds primarily on large crustaceans, especially crabs, but also heavily on American lobsters (Homarus). It also takes small bony fish, including menhaden, stickleback, wrasses, porgies, sculpins and puffers, squid (in springtime in New England waters), gastropods, bivalves, marine annelid worms, and occasional garbage (chicken-heads and other human debris has been found in stomachs of smooth-hounds caught in Cuban waters). Some have been found with quantities of eel-grass (Zostera) in their stomachs, but this may be incidentally taken in while the smooth-hounds are capturing animal prey.

This is a very active shark, constantly patrolling the bottom for food, which can be located when hidden as when in sight, indicating use of other senses including olfactory and electrosense. In captivity they readily attack crabs and shake them vigorously sideways before devouring them, but rarely molest active bony fishes; however, sick, injured or dead fish are quickly devoured. Dusky smooth-hounds are harmless to humans, except for competing with them for crustaceans, especially the valuable American lobster. One estimate quoted in Bigelow & Schroeder (1948) suggested that in Buzzard's Bay, Massachusetts, at the turn of the century, these sharks annually ate 200 000 crabs, 60 000 lobsters, and 70 000 small fish.

Size : Maximum 150 cm, males maturing at about 82 cm, females maturing at about 90 cm and reaching at least 122 cm; size at birth between 34 and 39 cm.

Interest to Fisheries : A locally abundant shark that is primarily fished off Cuba, Venezuela, and Brazil, but no doubt utilized elsewhere in the Caribbean; it is caught with bottom and floating longlines, occasionally with bottom trawls, and utilized fresh and dried salted for human consumption.

Literature: Bigelow & Schroeder (1948); Allee & Dickinson (1954); Heemstra (1973); Myrberg & Gruber (1974).

Remarks : This species is very close to the allopatric Mustelus mustelus and sympatric M. norrisi; the former differs from it in having somewhat shorter labial furrows, a slightly narrower internarial, and less precaudal centra, while the latter is a smaller, slenderer, narrower-headed shark with a narrower internarial, shorter labial furrows, more extensive buccopharyngeal denticles, more diplospondylous precaudal centra, and usually a more falcate ventral caudal lobe in adults (Heemstra, 1973). In addition, there are two new allopatric species of canis-norrisi-like smooth-hounds in the western Atlantic, one of which has often been confused with M. canis, which will be described by P.C. Heemstra.

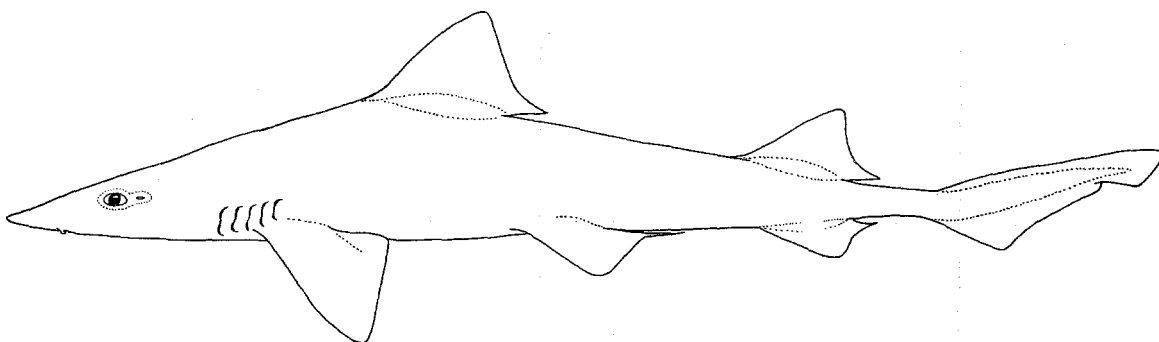
Mustelus dorsalis Gill, 1864

TRIAK Must 5

Mustelus dorsalis Gill, 1864, Proc.Acad.Nat.Sci.Philad., 16:149. Syntypes: U.S. National Museum of Natural History, USNM 8068, 2 specimens 430 to 450 mm; another specimen included under the same catalogue number is M. lunulatus (Heemstra, 1973). Type Locality: "Panama".

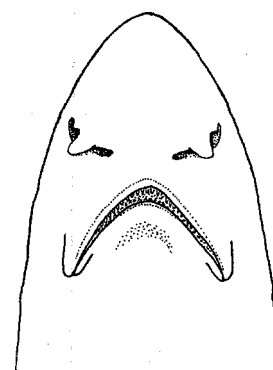
Synonymy : None.

FAO Names : En - Sharptooth smooth-hound; Fr - Emissole blanche; Sp - Musola blanca.



Field Marks : A small, plain Mustelus with high-cusped teeth, a long, acutely pointed snout, very small eyes, broad interorbital, lanceolate lateral trunk denticles, and unfringed dorsal fins.

Diagnostic Features : Body fairly slender. Head moderately long, prepectoral length 19 to 23% of total length; snout long and acutely angular in lateral view, preoral snout 6 to 8.8% of total length, preorbital snout 7.1 to 9.7% of total length; internarial space moderate, 2.1 to 3% of total length; eyes small, eye length 2.6 to 3.5 times in preorbital snout (over 3 times in adults) and 1.8 to 2.9% of total length; interorbital space very broad, 5.1 to 6.2% of total length; mouth long, greater than eye length, 3 to 4% of total length; upper labial furrows slightly longer than lowers or about as long, uppers 1.3 to 2.2% of total length; teeth cuspidate and asymmetric, with cusp prominent and cusplets occasionally present at all sizes; buccopharyngeal denticles present on anterior thirds of mouth floor and palate, and on gill arches. Interdorsal space 16 to 21% of total length; trailing edges of dorsal fins denticulate, without bare ceratotrichia; first dorsal broadly triangular, with posteroventrally sloping posterior margin, its midbase closer to pelvic bases than to pectorals; pectoral fins moderately large, length of anterior margins 12 to 16% of total length, width of posterior margins 8 to 14% of total length; pelvic fins moderately large, anterior margin length 6.7 to 9.1% of total length; anal height 2.7 to 3.4% of total length; anal-caudal space greater than second dorsal space and 4.8 to 6.8% of total length; ventral caudal lobe not falcate and weakly developed in adults. Crowns of lateral trunk denticles lanceolate, with longitudinal ridges extending their entire length. Skeleton not hypercalcified in adults; palatoquadrate not subdivided; monospondylous precaudal centra 38 to 44, diplospondylous precaudal centra 49 to 58, precaudal centra 92 to 99. Colour uniform grey or grey-brown above, light below, no white or dark spots or dark bars. Development viviparous. Size small, adults 43 to 64 cm.



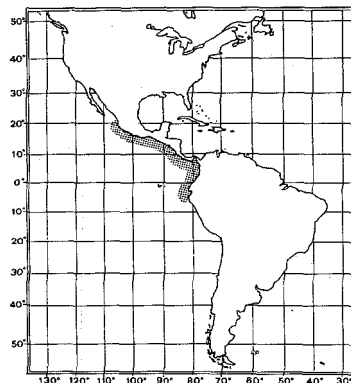
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Geographical Distribution : Eastern Pacific: Southern Mexico to Gulf of Guayaquil, Ecuador.

Habitat and Biology : An uncommon, little-known inshore tropical bottom-dwelling shark of the Central and South American continental shelves. Viviparous, with a yolk-sac placenta; number of young 4 per litter. Eats manis shrimps and probably other crustaceans.

Size : Maximum 64 cm, adult males maturing at about 43 cm, adult females at about 43 cm and reaching 64 cm; size at birth 21 to 23 cm.

Interest to Fisheries : Probably caught along with other species of "tollo" (Mustelus) and utilized by fisheries where it occurs, but details are lacking.



Literature : Beebe & Tee-Van (1941); Hildebrand (1946); Kato, Springer & Wagner (1967); Heemstra (1973).

Remarks: This small, distinctive smooth-hound has been confused with other eastern Pacific species. It somewhat resembles the western Atlantic *M. higmani*, but differs in its higher-cusped teeth, less falcate fins, lanceolate denticles, and more numerous vertebral centra.

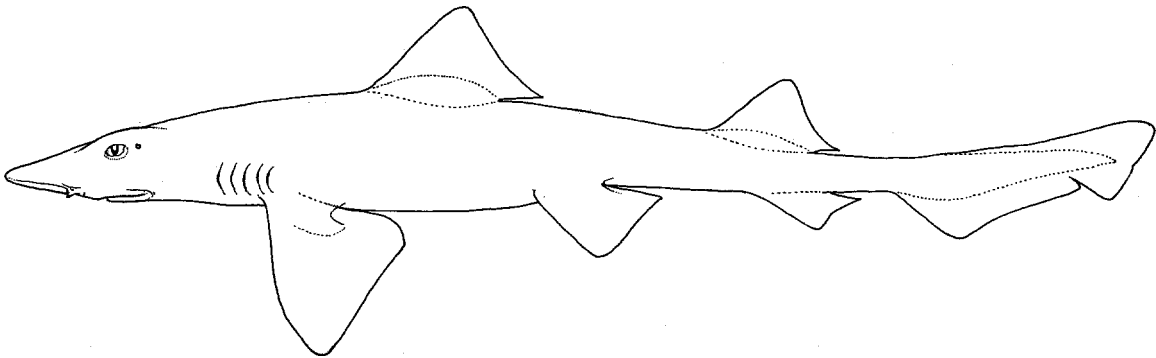
Mustelus fasciatus Garman, 1913

TRIAK Must 9

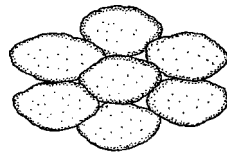
Galeorhinus fasciatus Garman, 1913, *Mem.Mus.Comp.Zool.Harv.Coll.*, 36:172. Holotype: Museum of Comparative Zoology, Harvard, MCZ 154, 607 mm immature male. Type Locality: Rio Grande do Sul, Brazil.

Synonymy : *Mustelus striatus* Devincenzi, 1920

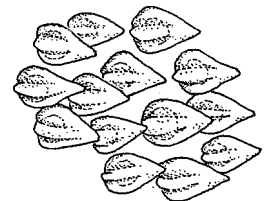
FAO Names: En - Striped smooth-hound; Fr - Emissole rayée; Sp - Musola listada.



Field Marks: A fairly stocky *Mustelus* with a very long head and long, angular, acutely pointed snout, very small eyes, broadly rounded tooth crowns, short caudal peduncle, relatively few precaudal vertebral centra, 58 to 63, and, at least in young and preadolescents, vertical dark bars on the body.



lower teeth



dermal denticles

Diagnostic Features : Body fairly stout. Head very long, prepectoral length 22 to 24.5% of total length; snout very long and angular in lateral view, preoral snout 8 to 9% of total length, preorbital snout 9.4 to 10.2% of total length; internarial space broad, 2.9 to 3.4% of total length; eyes small, eye length 3.8 to 4.3 times (largest juveniles at about 62 cm have it over 4) in preorbital snout and 1.9 to 2.5% of total length; interorbital space broad, 4.8 to 5.2% of total length; mouth long, greater than eye length and 3.4 to 4.2% of total length; upper labial furrows considerably longer than lowers, upper furrows 2 to 2.4% of total length; teeth molariform and symmetrical, with cusp and cusplets absent and crown broadly rounded; buccopharyngeal denticles covering most of palate and floor of mouth except medial rear third. Interdorsal space 16 to 19% of total length; trailing edges of dorsal fins denticulate, without bare ceratotrichia; first dorsal broadly triangular, with posteroventrally sloping posterior margin, midbase closer to pelvic bases than pectorals; pectoral fins moderate-sized, length of anterior margins 13 to 15% of total length, width of posterior margins 11 to 13% of total length; pelvic fins large, anterior margin length 7.4 to 9.2% of total length; anal height 2.8 to 3.2% of total length; anal-caudal space shorter than second dorsal height, 4.2 to 5.6% of total length; ventral caudal lobe hardly developed in large juveniles. Crowns of lateral trunk denticles lanceolate, without longitudinal ridges or when present extending up to only half of their length. Skeleton not hypercalcified in large juveniles; palatoquadrates not subdivided; monospondylous precaudal centra 32 to 35, diplospondylous precaudal centra 23 to 30, precaudal centra 58 to 63. Colour grey or grey-brown, above, light below, no white or dark spots but with dark vertical bars on at least young and juveniles. Development unknown. Size large, adults above 62 cm.

Geographical Distribution : Western South Atlantic: Southern Brazil to northern Argentina.

Habitat and Biology : A little-known temperate-water inshore bottom dwelling shark of the Atlantic South American continental shelf. Live bearing, but mode of reproduction unknown. Presumably eats crustaceans and other bottom-dwelling invertebrates.

Size : Maximum size probably between 1 and 1.5 m; size at maturity for males above 62 cm; size at birth at or below about 39 cm.



Interest to Fisheries: Fished commercially in Uruguay, and probably elsewhere where it occurs, and utilized fresh-frozen and dried salted for human consumption and for its oil.

Literature : Bigelow & Schroeder (1948); Heemstra (1973).

Remarks : This is a very distinctive species, closest to M. mento but easily separable by its longer and more angular head.

Mustelus griseus Pietschmann, 1908

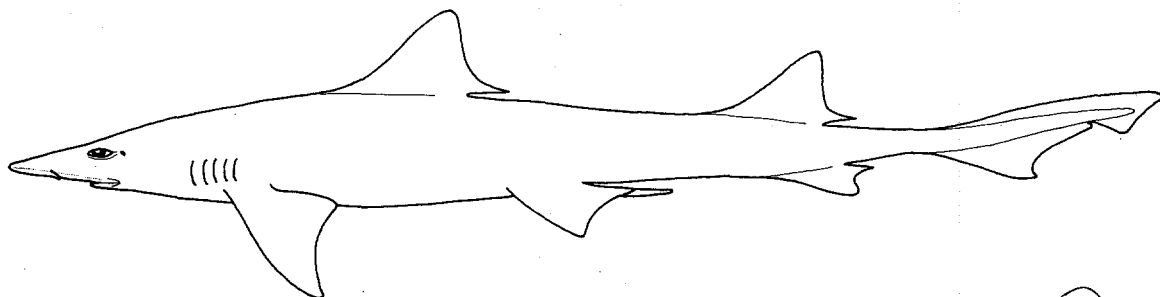
TRIAK Must 10

Mustelus griseus Pietschmann, 1908, Sitzungsber.K.Akad.Wiss.Wien, 45:132. Holotype: Specimen of 633 mm formerly in Naturhistorisches Museum, Vienna, apparently lost (Heemstra, 1973). Type Locality: Japan.

Synonymy : Cynias kanekonis Tanaka, 1916.

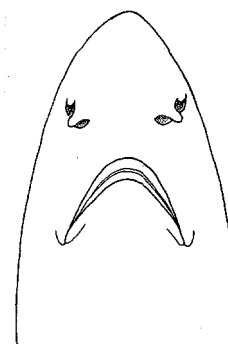
Other Scientific Names Recently in Use : Mustelus kanekonis (Tanaka, 1916).

FAO Names : En - Spotless smooth-hound; Fr - Emissole c ti re; Sp - Musola gris.



Field Marks : An unspotted, moderate-sized Mustelus with a short head and snout, broad internarial space, fairly small eyes, narrow interorbital, upper labial furrows equal to or slightly shorter than lowers, low-crowned teeth with weak cusps, buccopharyngeal denticles covering anterior half of buccal cavity, lateral trunk denticles usually lanceolate and with complete ridges, unfringed dorsal fins, 73 to 80 precaudal centra, and a semifalcate ventral caudal lobe. It is the only smooth-hound with the above characters where it occurs.

Diagnostic Features : Body fairly slender. Head short, prepectoral length 17 to 21% of total length; snout moderately long and bluntly angular in lateral view, preoral snout 5.7 to 7.1% of total length, preorbital snout 6.2 to 7.7% of total length; internarial space broad, 2.4 to 3.2% of total length; eyes fairly small, eye length 2.3 to 3.1 times in preorbital snout and 2.1 to 3.5% of total length; interorbital space narrow, 3.6 to 4.5% of total length; mouth fairly long, somewhat greater than eye length and 2.5 to 3.7% of total length; upper labial furrows equal or slightly shorter than lowers and 0.8 to 1.4% of total length; teeth molariform and asymmetric, with cusp reduced to a low point, cusplets absent except in very young sharks; buccopharyngeal denticles covering anterior half of palate and mouth floor. Interdorsal space 18 to 22% of total length; trailing edges of dorsal fins denticulate, without bare ceratotrichia; first dorsal somewhat falcate, with posterior margin abruptly vertical from apex, its midbase about equidistant between pectoral and pelvic bases; pectoral fins moderate-sized, length of anterior margins 12 to 14% of total length, width of posterior margin 8.3 to 11% of total length; pelvic fins moderately large, anterior margin length 6.8 to 8.4% of total length; anal height 2.7 to 3.4% of total length; anal caudal space greater than second dorsal height, 6.1 to 8.1% of total length; ventral caudal lobe more or less falcate in adults. Crowns of lateral trunk denticles lanceolate or weakly tricuspidate, with longitudinal ridges extending their entire length. Skeleton not hypercalcified in adults, except for slight expansion of scapulocoracoid tips; palatine processes of palatoquadrates subdivides at symphysis, with a short separate medial segment on each side; monospondylous precaudal centra 29 to 35, diplospondylous precaudal centra 40 to 48, precaudal centra 73 to 80. Colour uniform grey or grey-brown, above, light below, no white or dark spots or dark bars. Development viviparous. Size moderate, adults 65 to 101 cm.



underside of head