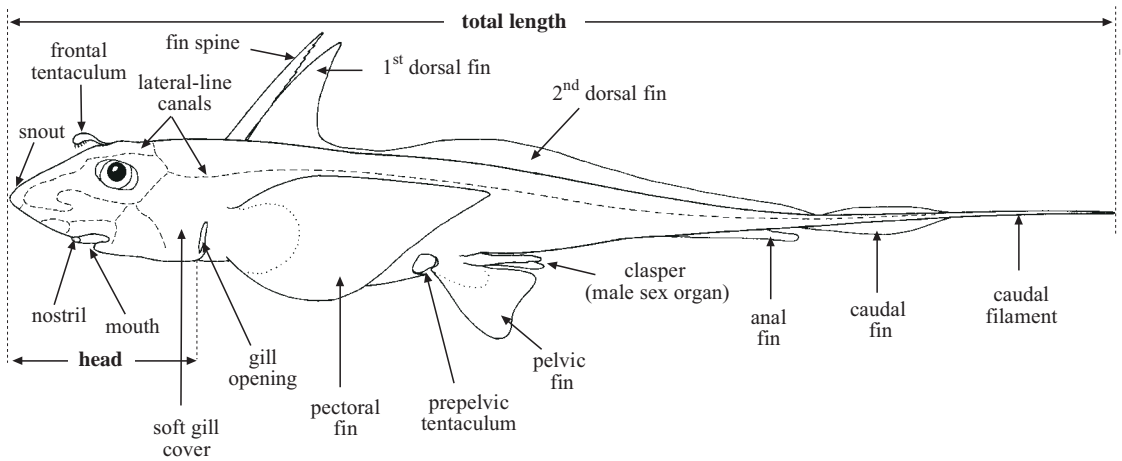


CHIMAERAS

by L.J.V. Compagno

TECHNICAL TERMS AND MEASUREMENTS



GENERAL REMARKS

Chimaeras (or chimaeroids) are somewhat compressed, shark-like fishes that resemble grenadiers (Macrouridae) and tadpole fishes (Ateleopodidae) in shape but are true cartilaginous fishes (Chondrichthyes), with **no bone in the skeleton, no bony fin rays, and no bony plate scales**. Unlike sharks and rays (Elasmobranchii), chimaeras (Holocephalii) have **only 4 pairs of gill openings on the sides of the head, which are hidden by a pair of soft gill covers** that extend to the base of the pectoral fins and form a **single external gill opening on each side of the head**. Chimaeras have prominent, large eyes on the sides of the head but **no spiracles**; the **mouth is small, ventral**, and connected to the nostrils by a pair of deep grooves, which serve to channel water from the nostrils to the mouth for respiration; the teeth in the mouth are formed into **2 pairs of ever-growing tooth plates in the upper jaw and 1 pair in the lower jaw**, which unlike sharks and rays are not serially replaced; **these protrude from the mouth like rodent's incisors**, and have suggested the names ratfish or rabbitfish for some of the species. Spookfish or ghostshark as used for Australian chimaeroids suggests their remarkable, spectral appearance. **The pectoral fins of chimaeras are broad, leaf-shaped**, and with a delicate external fin web supported by connective tissue fin rays (ceratotrichia); the pectoral fins serve to propel these fishes slowly through the water. **All chimaeras have 2 dorsal fins, the first erectile, with a slender, toxic spine** and the second long and spineless; an anal fin is either present or absent. **The tail of chimaeras is elongated and tapering**, with a shark-like, asymmetrical (heterocercal) or straight, leaf-shaped (diphycercal) caudal fin, often with a long terminal filament extending beyond the fin. **All living chimaeras have virtually naked skin**, except for a few dermal denticles on the back and along the lateral-line canals in some species and on the claspers and tentacula of males. **The canals of the lateral line system on the head and sides of the body and tail are superficial in the skin and very prominent**, unlike sharks and rays (batoids) where they are more or less hidden under the skin. Male chimaeras have a pair of cylindrical or forked copulatory organs or claspers on their pelvic fins, used for internal fertilization of the eggs of females; adult males additionally have a pair of denticle-studded grasping organs, the prepelvic tentaculæ, just in front of the pelvic-fin bases, and a doorknocker-like, denticle-covered frontal tentaculum on the forehead; these structures aid the male in grasping the female during copulation. Chimaeras are oviparous, depositing eggs on the bottom in long-necked, spindle or bottle-shaped egg cases with a pair of narrow or broad, delicate side fins. The egg cases are formed 1 to an oviduct and are laid in pairs or possibly singly on the bottom. In some species the egg cases may take up to 8 months to hatch after being laid. The hatchling young are formed like miniature adults, except for longer tails. Mature chimaeras vary in length from about 40 to 200 cm, the females being generally larger than males. Some continental shelf species are locally migratory and congregate in large breeding aggregations inshore, while some deepwater species segregate in unisexual groups of a similar size.

Chimaeras are predators on small bottom invertebrates (including sea urchins, bivalves, gastropods, and various crustaceans including isopods, crabs, shrimp, and mantis shrimps) and small fishes, which are crushed or cut up by their tooth plates and which makes stomach content analyses difficult. These fishes

are entirely marine and have their greatest diversity on the upper continental and insular slopes in temperate waters, down to at least 3 000 m (but with most species occurring between 200 and 2 000 m), but some species are common on continental and insular shelves in higher latitudes, from well offshore on the outer shelf to inside shallow bays and in the intertidal zone. Chimaeras are widely, although spottily distributed in all oceans, from arctic and subantarctic waters to the tropics. Chimaeroids are relatively undiverse and poorly known in the tropics, and none occur in warm inshore tropical waters; all tropical chimaeroids are deep-water slope inhabitants. Chimaeroids occur on or near the bottom close to land; none are oceanic and most occur near continental land masses but a few deep-water species occur off oceanic islands such as the Hawaiian chain.

The Western Central Pacific has a moderately diverse chimaera fauna, and includes only 2 of the 3 families, only 2 to 4 of the 6 genera and 6 to 8 of the approximately 43 or more living species. This is probably a result of poor and sporadic sampling of cartilaginous fishes in deep slope waters in the area, and it is quite likely that new discoveries of chimaeras (including undescribed species and range extensions) will be made in Fishing Area 71 and 77 with further exploratory fishing on the continental slopes below a depth of 200 m. In contrast, the southern parts of the western South and Central Pacific (Fishing Areas 57 and 81) have the greatest known diversity of chimaeroids worldwide, with all families and genera represented and with at least 13 species. This is primarily the result of major programs of exploratory deep-slope trawling around Australia and New Zealand during the past 3 decades. Basic knowledge of the biology of most chimaeras is extremely limited, and can be added to by fisheries researchers working aboard offshore trawlers in the area.

In the Western Central Pacific, chimaeras are apparently little utilized and are unlikely to become an important fishery resource, although they are occasionally taken as a minor bycatch in trawls. They are suitable for human consumption, can be processed for oil and fishmeal, and yield a fine quality oil from their livers for use in lubricating machinery. The most important fisheries for chimaeroids are in the Southern Hemisphere in temperate waters, and are targeted fisheries for elephantfishes (family Callorhynchidae) on the continental shelves of Australia, New Zealand, South America, and southern Africa. For purposes of research and conservation it is important to monitor deep-slope trawl and longline fisheries for deep-water teleosts such as oreo dories (Oreosomatidae), roughies (Trachichthyidae), and deep-water cods and hakes in the area for chimaeroids and other deep-water chondrichthyans that may occur as a discarded bycatch. These may be inadvertently subjected to overexploitation from such fisheries because of biological constraints (such as relative unavailability, long lives, and low fecundity) that may be less of a problem with the targeted teleosts.

KEY TO THE FAMILIES, GENERA, AND SPECIES OCCURRING IN THE AREA

- 1a. Snout elongated and pointed; caudal-fin axis weakly raised (heterocercal) and with the fin asymmetrical, epaxial caudal-fin lobe smaller than hypaxial lobe . . . (family **Rhinochimaeridae**) → 2
- 1b. Snout short and bluntly rounded; caudal-fin axis horizontal (diphycercal) and with the fin nearly symmetrical, epaxial and hypaxial lobes equal sized (family **Chimaeridae**) → 3
- 2a. Caudal fin with tubercles on dorsal margin; dorsal head profile nearly flat; eye well posterior to mouth; tooth plates narrow, sharp-edged and smooth; colour pale, grey-brown or olive-brown *Rhinochimaera pacifica*
(presence in the area uncertain)
- 2b. Caudal fin without tubercles on dorsal margin; dorsal head profile convex; eye above mouth; tooth plates broad and blunt-edged, with ridges and knobs (tritons); colour blackish brown *Harriotta raleighana*
(presence in the area uncertain)
- 3a. Anal fin present (Fig. 1a) (**Chimaera**) → 4
- 3b. Anal fin absent (Fig. 1b) (**Hydrolagus**) → 6

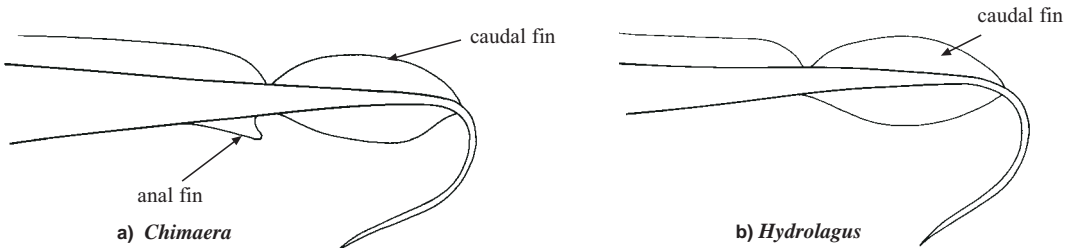



Fig. 1 lateral view of tail

- 4a. Ceratotrichia of epaxial caudal-fin lobe about 1/2 as high as those on rear half of second dorsal fin; body pale, with darker lateral stripes, paired fins, and dorsal-fin margins *Chimaera phantasma*
- 4b. Ceratotrichia of epaxial caudal-fin lobe as high as those on rear half of second dorsal fin; body and fins blackish brown → 5
- 5a. Dorsal-fin spine only as high as dorsal fin; dorsal fin uniformly dark *Chimaera* sp. B
- 5b. Dorsal-fin spine noticeably higher than dorsal fin; dorsal fin black distally, lighter basally *Chimaera* sp. C
- 6a. Posterior margin of second dorsal fin deeply concave and elevated anteriorly, height at midlength about 1/2 of that at anterior end of fin; body and fins uniform blackish brown *Hydrolagus deani*
- 6b. Posterior margin of second dorsal fin straight or nearly so, height at midlength about equal to that at anterior end of fin; body colour pale silvery white, fins darker, second dorsal with pale base and dark margin → 7
- 7a. Sides of body without a marbled pattern of light and dark reticulations, second dorsal-fin margin black, caudal with conspicuous black hypaxial lobe and light epaxial lobe with dark margin *Hydrolagus lemures*
- 7b. Sides of body with a marbled pattern of light and dark reticulations, second dorsal-fin margin brownish, caudal with both hypaxial and epaxial lobes with light bases and dark margins *Hydrolagus* sp. B

LIST OF FAMILIES AND SPECIES OCCURRING IN THE AREA

The symbol  is given when species accounts are included. For species with a question mark the presence in the area is uncertain.

RHINOCHIMAERIDAE: Longnose chimaeras

? *Harriotta raleighana* Goode and Bean, 1895


? *Rhinochimaera pacifica* (Mitsukuri, 1895)^{1/}

CHIMAERIDAE: Shortnose chimaeras


 *Chimaera phantasma* Jordan and Snyder, 1900

 *Chimaera* sp. B. [Last and Stevens, 1994]

 *Chimaera* sp. C. [Last and Stevens, 1994]

 *Hydrolagus deani* (Smith and Radcliffe, 1912)

 *Hydrolagus lemures* (Whitley, 1939)

 *Hydrolagus* sp. B. [Last and Stevens, 1994]

References

- Bigelow, H.B. and W.C. Schroeder. 1953. Chapter two, Chimaeroids. In Fishes of the Western North Atlantic. *Mem. Sears Fnd. Mar. Res.*, (1)2:515-562.
- Compagno, L.J.V., M. Stehmann, and D.A. Ebert. 1990. *Rhinochimaera africana*, a new longnose chimaera from southern Africa, with comments on the systematics and distribution of the genus *Rhinochimaera* Garman, 1901 (Chondrichthyes, Chimaeriformes, Rhinochimaeridae). *S. African J. Mar. Sci.*, 9:201-222.
- Dean, B. 1906. Chimaeroid fishes and their development. Carnegie Inst., *Washington, Pub.*, (32):195 p.

^{1/} Marginal north and south of the area (New South Wales, China, and Taiwan Province of China). An egg case from Sulawesi (Celebes) ascribed to *Rhinochimaera pacifica* is of uncertain identity but probably is from a member of the Rhinochimaeridae.

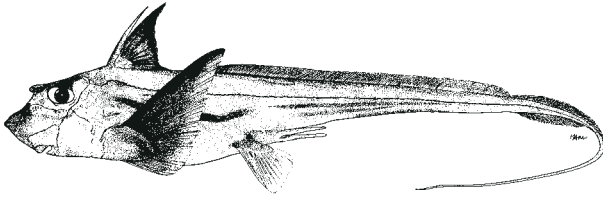
- Didier, D.A. 1995. Phylogenetic systematics of extant chimaeroid fishes (Holocephali, Chimaeroidei). *American Mus. Novitates*, (3119):86 p.
- Fowler, H.W. 1941. The fishes of the groups Elasmobranchii, Holocephali, Isospondyli, and Ostariophysi obtained by United States Bureau of Fisheries Steamer Albatross in 1907 to 1910, chiefly in the Philippine Islands and adjacent seas. *Bull. U. S. Natn. Mus.*, (100)13:879 p.
- Garman, S. 1901. Genera and families of the chimaeroids. *Proc. New England Zool. Club*, 3:75-78.
- Garman, S. 1904. The chimaeroids, especially *Rhinochimaera* and its allies. *Bull. Mus. Comp. Zool. Harvard*, 41:245-272.
- Garman, S. 1911. The Chismopnea (chimaeroids). *Mem. Mus. Comp. Zool. Harvard*, 40:79-102.
- Garrick, J.A.F. and T. Inada. 1975. Dimensions of long-nosed chimaera *Harriotta raleighana* from New Zealand. *New Zealand J. Mar. Freshw. Res.*, 9(2):159-167.
- Hardy, G.S. and M. Stehmann. 1990. A new deep-water ghost shark, *Hydrolagus pallidus* n.sp. (Holocephali, Chimaeridae), from the Eastern North Atlantic, and redescription of *Hydrolagus affinis* (Brito Capello, 1867). *Arch. Fisch. Wiss.*, 40(3):229-248.
- Inada, T. and J.A.F. Garrick. 1979. *Rhinochimaera pacifica*, a long-snouted chimaera (Rhinochimaeridae), in New Zealand waters. *Japan. J. Ichthyol.*, 25(4):235-243.
- Karrer, C. 1972. Die Gattung *Harriotta* Goode and Bean, 1895 (Chondrichthyes, Chimaeriformes, Rhinochimaeridae) mit Beschreibung einer neuen Art aus dem Nordatlantik. *Mitteil. Zool. Mus. Berlin*, 48(1): 203-221.
- Last, P.R. and J.D. Stevens. 1994. *Sharks and rays of Australia*. Australia, CSIRO, 513 p.

CHIMAERIDAE

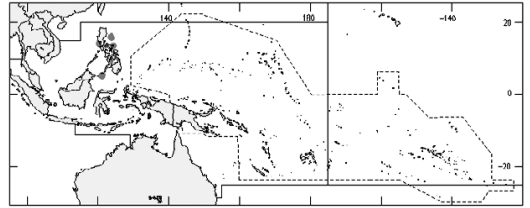
Chimaera phantasma Jordan and Snyder, 1900

En - Silver chimarea.

Maximum total length to about 1 m. A chimaera of the continental shelves and upper slopes, from depths of 90 to 540 m. Common in the North Pacific, but biology little known. Caught with bottom trawls, utilization uncertain in the area but utilized for fish balls (kamaboko) in Japan. Western Pacific from Japan, Korea, China, Taiwan Province of China, and Philippines. The Philippine representative needs confirmation to species.



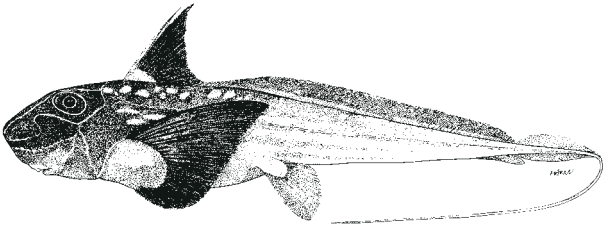
(after Masuda et al., 1984)



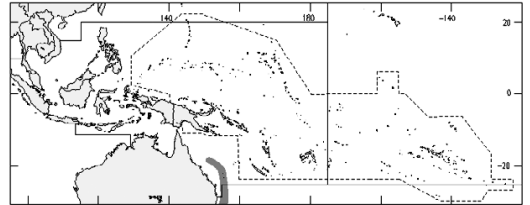
Chimaera sp. B [Last and Stevens, 1994]

En - Shortspine chimaera.

Maximum total length about 1 m, length without caudal filament to at least 69 cm. A common chimaera of the continental slope of the east coast of Australia, at depths of 450 to 1 000 m. Apparently not utilized at present. Occurs off New South Wales and Queensland, from Ulladulla north to Townsville.



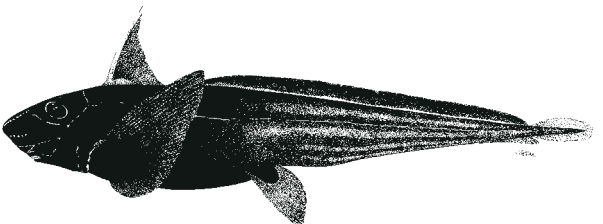
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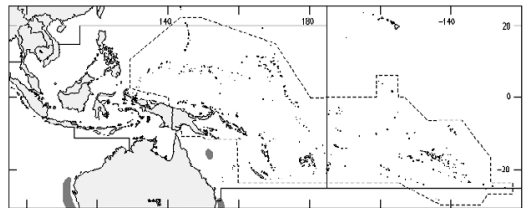
Chimaera sp. C [Last and Stevens, 1994]

En - Longspine chimaera.

Maximum total length about 1 m, length without caudal filament to at least 77 cm. A common large chimaera of the continental slopes of the east and southwest coasts of Australia, at depths of 440 to 1 300 m (mostly below 800 m). Apparently not utilized at present. Occurs off Western Australia (between Perth and North West Cape), New South Wales (Byron Bay to Wollongong) and on the Queensland Plateau east of Cape York. Possibly also occurs in New Zealand waters, and with a very similar species off southern Africa.

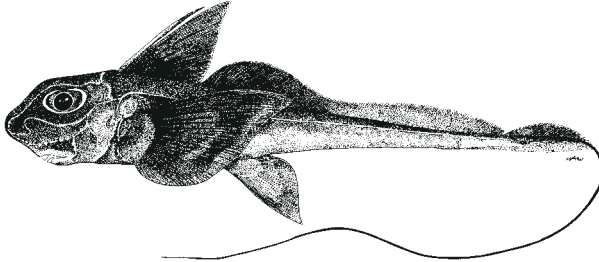


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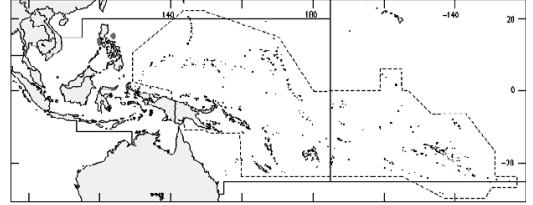


Hydrolagus deani* (Smith and Radcliffe, 1912)*En** - Philippine chimaera.

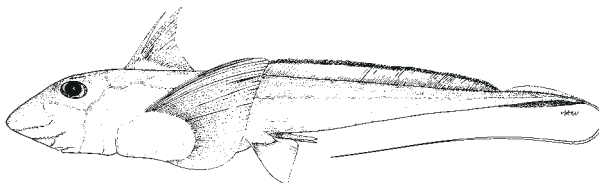
Maximum total length 67 cm. A rare, little-known chimaera endemic to the area on the upper slope at depths of 469 to 770 m. Biology and utilization unknown in the area. Known only from the Philippines (Luzon).



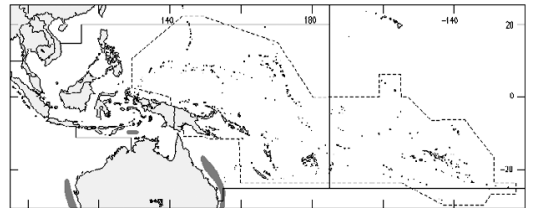
(after Smith and Radcliffe, 1912)

***Hydrolagus lemures* (Whitley, 1939)****En** - Blackfin ghostshark.

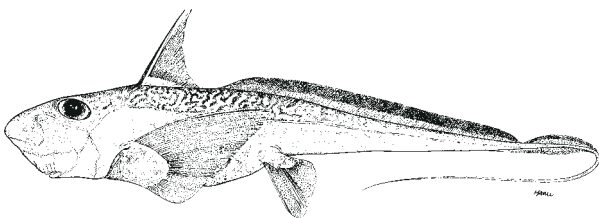
Maximum total length less than 1 m, length without caudal filament to 58 cm. A common and wide-ranging chimaera of the Australian outer continental shelf and upper slopes at depths of 146 to 510 m. Biology little known. Caught with bottom trawls, but not utilized at present although it has meat of high quality. Occurs off most of the coast of temperate Australia, from off northern Western Australia (Exmouth Gulf), South Australia, and Victoria (Portland), also from eastern Bass Strait, New South Wales to Queensland (Cairns); also off Darwin, Northern Territory. Not found off Tasmania and in Bass Straits, including the coast of Victoria fronting it.



(after Last and Stevens, 1994)

***Hydrolagus* sp. B [Last and Stevens, 1994]****En** - Marbled ghostshark.

Maximum total length less than 1 m, length without caudal filament to 53 cm. A chimaera of the Australian east coast on the upper slope at depths of 450 to 850 m. Biology little known, not utilized at present. Occurs off New South Wales and Queensland, from Sydney north to Townsville.



(after Last and Stevens, 1994)

