2.3 Order ORECTOLOBIFORMES - Carpet sharks

Order: Orectolobiformes: Compagno, 1973, *J. Linn. Soc. (Zool.)*, 53, suppl. 1: 28; also Applegate, 1974, *J. Mar. Biol. Ass. India*, 14(2): 743.

Number of Recognized Families: 7.

Synonyms: [Part] 1 Squali, Abtheilung [Division] 1: Müller and Henle, 1838d: 3. [Part] 1 Squali, Abtheilung [Division] 2, Unterabtheilung [Subdivision] 3: Müller and Henle, 1839: 66. Ordo Plagiostomi, Subordo Squalini, Sectio Proktopterides, Tribus Dinotopterini: Bleeker, 1859: xi. Order Squali, Suborder Squali: Gill, 1862b: 394, 396. Order Squali, Suborder Galei: Gill, 1872: 22, 23. Order Plagiostomi diplospondyli, Suborder Plagiostomi asterospondyli, Group 1 Scyllia: Hasse, 1879: 52. Order Plagiostomi diplospondyli, Suborder Plagiostomi asterospondyli, Group 2 Scylliolamnidae: Hasse, 1879: 51. Order Selachii, Suborder Asterospondyli: Woodward, 1889: 157. Order Asterospondyli, suborder unnamed: Gill, 1893: 130; Fowler, 1941: 4, 13; Smith, 1949: 37, 39. Order Asterospondyli, Suborder Galei: Jordan and Evermann, 1896: 19, 21. Order Euselachii, Suborder Pleurotremata, Division Galeoidei: Regan, 1906a: 723. Order Selachii, Group 2, Division B, Subdivision 1, Suborder Scylliodei: Goodrich, 1909: 148. Order Pleurotremata, Suborder Galeoidei: Engelhardt, 1913: 97. Order Plagiostoma, Suborder Antacea, "Group" Catuloidei: Garman, 1913: 11, 12. Order Plagiostoma, Suborder Antacea, "Group" Isuroidei: Garman, 1913: 10, 12. Order Euselachii, Suborder Galei, [Series] Scyllioidei: Jordan, 1923: 97. Order Plagiostomi, Suborder Galeiformes: Lozano y Rey, 1928: 280. Order Galea, Suborder Isurida, Superfamily Orectoloboidea: White, 1936: 4; White, 1937: 36, tab. 1. Order Euselachii, Suborder Scylliformes: Bertin, 1939a: 9. Order Lamniformes, Suborder Lamnoidei: Berg, 1940: 137; Berg and Svetovidov, 1955: 65; Patterson, 1967: 670; Lindberg, 1971: 8, 257; Nelson, 1976: 33; Nelson, 1984: 51. Order Euselachii, Suborder Galeoidei, Superfamily Orectoloboidea: Whitley, 1940: 68-69. Order Selachii, Suborder Galeoidea: Romer, 1945: 576; Bigelow and Schroeder, 1948: 77, 95; Romer, 1966: 350. Order Lamnoidea, Suborder Galeoidea: Schultz and Stern, 1948: 224. Order Lamnida, Suborder Lamnina: Matsubara, 1955: 1-789. Order Galeiformes, Suborder Isuroidei: Arambourg and Bertin, 1958: 2030. Order Pleurotrema, Suborder Galeoidea: Norman, 1966: 7. Order Carchariida, Suborder Carchariina, Superfamily Orectolobicae: Fowler, 1967a: 89. Order Carchariida, Suborder Carchariina, Superfamily Lamnicae: Fowler, 1967a: 104. Order Squatinida, Suborder Ginglymostomatoidei: Glikman, 1967: 216. Order Euselachii, Suborder Galeoidei: Blot, 1969: 702-776. Order Pleurotremata, Suborder Galeiformes: Budker and Whitehead, 1971: 5, tab. 2. Order Carcharhiniformes: Rass and Lindberg, 1971: 304; Gubanov, Kondyurin and Myagkov, 1986: 3, 61. Order Orectolobiformes: Chu and Meng, 1979: 114, tab. 2; Compagno, 1984: 165; Cappetta, 1987: 26, 71; Compagno, 1988: 382; Eschmeyer, 1990: 435; Nelson, 1994: 45; de Carvalho, 1996: 55; Shirai, 1996: 32; Eschmeyer, 1998: CD-ROM. Order Orectolobiformes, Suborder Orectoloboidei: Applegate, 1974: 74. Order Orectolobiformes, Suborder Parascylloidei: Applegate, 1974: 749. Order Orectolobiformes, Suborder Rhincodontoidei: Applegate, 1974: 744. Order Orectolobiformes, Suborder Rhincodontoidea: Chu and Meng, 1979: 114, tab. 2. Order Orectolobiformes, Suborder Orectoloboidea: Chu and Meng, 1979: 114, tab. 2. Order Galeomorpha, Suborder Heterodontoidea: Carroll, 1988: 598.

FAO Names: En - Carpet sharks; **Fr** - Requins-tapis; **Sp** - Tiburones tapiceros and Gatas nodrizas.

Field Marks: Moderate-sized to gigantic, sluggish, demersal to active sharks without nictitating eyelids, with barbels and nasoral grooves, nostrils connected with mouth, short mouths that end in front of eyes, usually without enlarged anterior teeth and without a gap or small intermediate teeth between anteriors and lateral teeth on each side of the upper jaw, five narrow to broad gill openings, two spineless dorsal fins and an anal fin.

Diagnostic Features: Head conical to greatly depressed, expanded laterally or not. Snout short to very short, truncated to flattened-conical, not greatly elongated nor blade-like and without lateral teeth or rostral barbels. Eyes usually dorsolateral on head but lateral in a few derived taxa (***Stegostoma***, ***Nebrius*** and ***Rhincodon***), without nictitating lower eyelids or secondary lower eyelids, but with shallow subocular pouches in some taxa; upper eyelids not fused to eyeball. Spiracles small to large, close behind and about opposite level of eyes. Five pairs of gill openings present on sides of head, with the posteriormost two to four above pectoral-fin origins. Nostrils longitudinal on snout, usually with barbels (rudimentary in ***Rhincodon***), circumnarial grooves primitively present around incurrent aperture but absent in some derived taxa; nasoral grooves present and connecting excurrent apertures of nostrils with mouth; anterior nasal flaps short to elongate and reaching mouth. Mouth small to large, usually subterminal (terminal in ***Rhincodon***), arched to nearly transverse and short, ending in front of eyes. Labial furrows well-developed on both jaws. Teeth weakly to strongly differentiated along the jaws, with (Orectolobidae) or usually without enlarged anterior teeth and without enlarged molariform posterior teeth; without a gap or small intermediate teeth between anterior and lateral teeth in the upper jaw; teeth primitively with orthodont histological structure but osteodont in ***Ginglymostoma*** and ***Nebrius***. Trunk cylindrical to depressed and somewhat ray-like (Orectolobidae). Caudal peduncle with or without lateral dermal ridges or lateral keels on caudal peduncle. Dermal denticles covering entire body, not enlarged as thorns or spines. Pectoral fins small to large, somewhat expanded and ray-like in some Orectolobidae, without triangular anterior lobes that cover the gill slits. Pectoral girdle (scapulocoracoid) fairly high, U-shaped, without a medial joint, and with superscapulae directed posterodorsally and not contacting vertebral column. Pectoral-fin skeleton primitively tribasal (dibasal in some taxa), with propterygium in contact with radials and metapterygium without a proximal segment; pectoral fins primitively aplesodic, with radials confined to the fin bases, but plesodic in derived taxa and supporting the fin webs; radial count 14 to 28, with 2 to 10 segments. Pelvic fins small to large, with vent usually continuous with their inner margins (may be separate in Orectolobidae). Claspers generally with siphons in the abdomen but without clasper sacs; clasper glans with a pseudosiphon (sometimes absent), cover rhipidion (sometimes reduced), rhipidion (sometimes absent), exorhipidion, and often lateral clasper spurs or spines; dorsal and ventral marginals of clasper

skeleton rolled into a tube for the clasper canal. Two spineless dorsal fins present, with origin of first dorsal fin varying from anterior to pelvic-fin origins to behind pelvic-fin insertions; dorsal-fin skeleton with segmented radials but without segmented basal plates. Anal fin present. Caudal fin with a long dorsal lobe and the ventral lobe strong to absent; vertebral axis weakly to strongly elevated into the dorsal caudal-fin lobe (heterocercal caudal fin). Vertebral calcification strong, secondary calcification usually in form of strong branched radii in intermedial spaces although sometimes wedge-shaped and solid (Parascylliidae), intermedialia sometimes with annular rings (Rhincodontidae), usually without diagonal lamellae in the basal spaces (present in ***Rhincodon*** and ***Parascyllium***). Total vertebral count 117 to 243, precaudal vertebrae 69 to 138. Neurocranium with a short to rudimentary monopodal rostrum consisting of a ventral rostral cartilage without ventral keel, rostral space open dorsally; nasal capsules trumpet-shaped and more or less flattened, without subnasal fenestrae (basal communicating canals) or antorbital cartilages; orbits with incomplete preorbital walls, usually strong supraorbital crests (greatly reduced in Parascylliidae), usually strong suborbital shelves (greatly reduced in Parascylliidae), separate foramina for superficial ophthalmic nerves but not for hyomandibular nerves, and incomplete postorbital walls without lateral commissures for lateral head vein; occipital condyles low, occipital hemicentrum present between them. Jaws short to moderately elongated, upper jaws (palatoquadrates) with low, ridge-like orbital processes that articulate with nasal capsules and orbits in horizontal grooves contacting ethmoid region, basal plate and suborbital shelves; orbital processes not penetrating supraorbital crests. Hyobranchial skeleton with moderately broad, short to elongated basihyoid; posterior two pharyngobranchials and last epibranchial fused into a yoke-shaped element. Head muscles include vertical broad preorbitalis; short levator palatoquadrati and separate first dorsal constrictors that do not extend behind the postorbital processes, adductor mandibulae muscles segmented into two or three groups of divergently biased fibres, not notched anteriorly for mouth gape; no craniomandibular muscle between the lower jaw and orbital walls; no mandibulocutaneous muscle between upper jaw and skin; and no postocular eyelid muscles (an anterior palpebral depressor muscle present in Parascylliidae). Intestinal valve of conicospiral or (usually) ring type, with 6 to 74 turns. Reproduction oviparous in some species, which lay eggs in oval cases; other species are ovoviviparous (aplacental viviparous), with foetal nutriment from the yolk sack or from uterine cannibalism (oophagy or egg-eating in ***Nebrius***), but without placental vivipary or nutritive trophonemata.

Distribution: Circumglobal in warm-temperate and tropical seas, absent or marginal in cold-temperate areas and not reaching cold boreal and subantarctic waters. Most species occur in tropical seas and are most diverse in the western Pacific. The whale shark is circumglobal, and some large carpet sharks have wide ranges in the Atlantic and eastern Pacific (***Ginglymostoma***), or the Indo-West Pacific (***Nebrius*** and ***Stegostoma***). Most carpet sharks have more limited ranges in the Indo-West Pacific, with several species confined to Australia and New Guinea and a few occurring only off Taiwan (Province of China) or Japan.

Habitat: Carpet sharks or orectoloboids occur in a variety of marine habitats from shallow open and enclosed bays, rocky and coral reefs, estuaries, and sandy beaches on the continental shelves to the outer shelves, uppermost slopes, and the epipelagic zone (Rhincodontidae). They range in depth from the intertidal to the outer shelves and exceptionally between 200 and 435 m on the upper slopes (Parascylliidae) and in the epipelagic zone at the surface (whale shark, ***Rhincodon***). Although many species are found in shallow inshore waters only a few species of Hemiscylliidae may penetrate the lower brackish reaches of rivers but are not definitely recorded from freshwater rivers and lakes. No carpet sharks are specialized deep-slope or oceanic species.

Biology: Carpet sharks are small to gigantic, rather varied sharks that are mostly small, benthic, and sluggish, while larger species are generally more active swimmers. Morphotypes (Compagno, 1990a) include generalized benthic and littoral species (Ginglymostomatidae and Brachaeluridae), elongated leptobenthic bottom-dwelling species (Parascylliidae and Hemiscylliidae), squatinobenthic depressed specialists (Orectolobidae), and a macroceanic, filter-feeder (Rhincodontidae). The squatinobenthic wobbegongs are ambush-hunters that take relatively large prey, swallowed whole, and parallel the mostly allopatric angel sharks (Squatinidae). The prey of orectoloboids includes microscopic zooplankton, small to moderate-sized bony fishes, smaller chondrichthyans, crabs, lobsters, shrimp, octopuses, cuttlefish, squid, gastropods, bivalves, sea urchins, sea anemones, and corals. Information on movements is limited or absent for most species; the whale shark is highly migratory, and seasonally visits favoured areas including concentrations of food (reefs with plankton blooms.) The whale shark is apparently social and forms aggregations, but the sociobiology of most species is poorly known. Modes of reproduction include oviparity (egg-laying, in Parascylliidae, Hemiscylliidae, and Stegostomatidae), ovoviviparity or aplacental vivipary (Brachaeluridae, Orectolobidae, Rhincodontidae, ***Ginglymostoma***), and uterine cannibalism or cannibal vivipary in the form of egg-eating or oophagy (***Nebrius***).

Interest to Fisheries and Human Impact: Several families of orectoloboids are minor to important fisheries sharks in coastal and oceanic waters, particularly members of the Orectolobidae, Hemiscylliidae, Stegostomatidae and Ginglymostomatidae. These are regular components of targeted shark fisheries and as bycatch of other fisheries targeting teleost fishes or marine invertebrates. Some species are discarded bycatch of demersal fisheries (Parascylliidae), while the whale shark is targeted by specialized fisheries. Orectoloboids are caught in bottom trawls, in fixed and possibly pelagic gill nets, in fish traps, on bottom longlines, with harpoons, and with hook-and-line and rod-and-reel. Several species are used for human consumption; the flesh of some species is excellent, and large fins are of high value in the oriental soup-fin trade. Whale sharks were formerly caught by very small artisanal fisheries for local use, but values of whale shark fins, flesh and other products for the international market have soared during the last decade and have encouraged intensive targeted fisheries in certain countries (India, Philippines, and Taiwan (Province of China)). Several inshore and offshore species are caught by sportsfishing anglers.

Wobbegongs and larger nurse sharks (Ginglymostomatidae) rarely bite people. Whale sharks occasionally butt fishing boats, but are more often run down and injured or killed by ships.

Whale sharks, nurse sharks, wobbegongs, and zebra sharks are currently sought by ecotouristic divers and film-makers in the tropics, with whale sharks the subject of dedicated dive tours in the Indo-Pacific from South Africa to Costa Rica. Orectoloboids as a group are very hardy in captivity and are among the most important aquarium sharks, both for public viewing and for home aquaria. Most species have been kept in captivity, with the wobbegongs (Orectolobidae), bamboo sharks (Hemiscylliidae), nurse sharks (Ginglymostomatidae), and zebra sharks (Stegostomatidae) being the most popular orectoloboids for public aquaria and oceanaria. Whale sharks are kept in a few Japanese oceanaria with sufficiently huge tanks to accommodate them.

The diversity of orectoloboid sharks is greatest in inshore and offshore continental waters of the tropical Indo-West Pacific, where intensive fisheries occur. The conservation problems facing the whale shark are the most urgent and widely publicized, but most species of orectoloboids are taken in targeted and bycatch demersal fisheries and several species are coral-reef dwellers that are adversely affected by reef destruction. Some species have limited geographic and bathymetric distributions in continental inshore and offshore tropical waters (some Parascylliidae, Orectolobidae, Brachaeluridae and Hemiscylliidae) and are at potential risk from habitat degradation and fisheries. Fisheries statistics are unavailable for almost all species, including catches of carpet sharks for the aquarium trade. The whale shark is included on the IUCN Red List and protected off Belize, Honduras, the Philippines, and the USA (east coast) while nurse sharks (***Ginglymostoma***) are protected off the east coast of the United States.

Remarks: The concept of the orectoloboids as a discrete, monophyletic group is relatively recent and stems from the work of Regan (1906a), White (1936, 1937), Compagno (1973) and Applegate (1974). Most researchers in the nineteenth and twentieth centuries followed Müller and Henle (1839) in placing the highly distinctive whale shark (***Rhincodon***) in a separate, monotypic family (Rhincodontidae or its synonyms). Müller and Henle (1838d) included orectoloboids other than the whale shark in the carcharhinoid catshark family (Scyliorhinidae or its synonyms), and this was followed by several earlier authors (Müller, 1845; Gray, 1851; Bleeker, 1859; Dumeril, 1865; Günther, 1870; Jordan and Gilbert, 1883; Woodward, 1889; Goodrich, 1909; Bertin, 1939a).

Gill (1862b, 1872) divided the orectoloboids into the families Rhinodontoidae (Rhinodontidae) for the whale shark, Ginglymostomatidae for the nurse sharks (***Ginglymostoma***, ***Nebrius***), Crossorhinoidae for the wobbegongs (***Orectolobus***), and Scylliorhinoidae for other orectoloboids and the scyliorhinid catsharks. Gill (1862b) subdivided the Scylliorhinoidae into the subfamilies Scylliorhininae for the catsharks and Parascylliinae, Hemiscylliinae, Chiloscylliinae, and Stegostomatinae for other orectoloboids, and later (Gill, 1893) transferred the Stegostomatinae to the Ginglymostomatidae. Hasse (1879) named a “Group 2 Scylliolamnidae” as a family for ***Stegostoma***, ***Ginglymostoma***, and ***Orectolobus*** and a “Family Chiloscyllium” for the hemiscylliid orectoloboid ***Chiloscyllium***.

Regan (1906a; followed by Engelhardt, 1913 and Berg, 1940) was the first author to associate the whale shark with other orectoloboids in a common family Orectolobidae. White (1936, 1937) expanded Regan’s arrangement by placing the whale shark (Rhincodontidae) and the carpet sharks (Orectolobidae) in a common superfamily Orectoloboidea. White was followed by Whitley (1940), who further subdivided the Orectoloboidea into the families Hemiscylliidae, Orectolobidae, Ginglymostomatidae and Rhincodontidae in the superfamily Orectoloboidea. This arrangement and the orectoloboid families and subfamilies of Gill (1862b, 1872, 1893) were revived and expanded by Compagno (1973) and Applegate (1974), who proposed a common order Orectolobiformes for all orectoloboids, and recognized the separate families Parascylliidae, Brachaeluridae, Orectolobidae, Hemiscylliidae, Stegostomatidae, Ginglymostomatidae and Rhiniodontidae, while Applegate (1974) proposed an additional family Cirrhoscylliidae (here ranked as a synonym of Parascylliidae). This was followed by several authors (Compagno, 1981b, 1982, 1984, 1988, 1999; Cappetta, 1987; Nelson, 1994; Eschmeyer, 1990, 1998; de Carvalho, 1996; Helfman, Collette and Facey, 1997). Dingerkus (1986) and Shirai (1996) modified this classification by synonymizing the Ginglymostomatidae and Stegostomatidae with the family Rhincodontidae. Chu and Meng (1979) recognized the order Orectolobiformes with three families, Orectolobidae, Cirrhoscylliidae and Rhincodontidae. Carroll (1988) recognized a suborder Orectoloboidea for the families Orectolobidae, Rhinocodontidae [sic], Hemiscylliidae and Parascylliidae.

There are several alternative arrangements for the classification of orectoloboids. Orectoloboids were often included in a common and undifferentiated ‘galeoid’ group along with the lamnoids and carcharhinoids (and occasionally the heterodontoids) as the families Orectolobidae and Rhincodontidae (Fowler, 1941; Romer, 1945, 1966; Bigelow and Schroeder, 1948; Schultz and Stern, 1948; Smith, 1949; Matsubara, 1955; Garrick and Schultz, 1963; Norman, 1966; Blot, 1969; Pinchuk, 1972). Some authors associated the Rhincodontidae or equivalents with more derived lamnoids or all of the lamnoids in a common group (Bonaparte, 1838; Goodrich, 1909; Garman, 1913; Fowler, 1947, 1967a; Berg and Svetovidov, 1955; Nelson, 1976, 1984). Arambourg and Bertin (1958) included all orectoloboids with the lamnoids in a common higher group. Glikman (1964, 1967) included the orectoloboids with most of the squalomorph sharks (squatinoids, squaloids, and pristiophoroids). Jordan (1923) named a Series Scyllioidei for the orectoloboid families Hemiscylliidae, Orectolobidae, Ginglystomidae (sic.), and Rhincodontidae, which also included the carcharhinoid catsharks. Rass and Lindberg (1971) and Gubanov, Kondyurin and Myagkov (1986) grouped the orectoloboids in a common, undifferentiated order Carcharhiniformes with certain lamnoids (***Cetorhinus***, ***Megachasma***), and the carcharhinoids.

Continuing work on the morphology of orectoloboid sharks by the writer as an extension of previous research (Compagno, 1979, 1984, 1988) supports the recognition of the Orectolobiformes as a monophyletic if morphologically varied group. The

arrangement of orectoloboid families recognized in Compagno (1973, 1984) are retained here, but one notes that Dingerkus' (1986) cladistic classification united the more derived orectoloboids in a single family Rhincodontidae. Compagno's (1988) cladistic analysis of orectoloboids was at variance with Dingerkus (1986) but supported the monophyly of the group of 'higher' orectoloboids placed in his Rhincodontidae (***Stegostoma***, ***Pseudoginglymostoma***, ***Nebrius***, ***Ginglymostoma*** and ***Rhincodon***). A problem remains on the familial position of the genus ***Pseudoginglymostoma***, which is retained provisionally in Ginglymostomatidae here. Alternative cladograms (Dingerkus, 1986, Compagno, 1988) suggested that this genus may be either the plesiomorphic sister group of all other 'higher' orectoloboids (which seems more likely), or alternatively is the plesiomorphic sister group of ***Stegostoma***. Alternatives include placing ***Pseudoginglymostoma*** in its own family, in the Stegostomatidae, or accepting Dingerkus' arrangement of an expanded and morphologically diverse Rhincodontidae. The writer favours the former arrangement, but reserves action for the completion of a detailed study of the anatomy of ***Pseudoginglymostoma*** and comparison with other higher orectoloboids.

Key to Families:

1a. Mouth huge and nearly terminal; external gill slits very large, internal gill slits inside mouth cavity with filter screens; caudal peduncle with strong lateral keels; caudal fin with a strong ventral lobe, but without a strong terminal lobe and subterminal notch (Fig. 80) . . . . . **family Rhincodontidae**

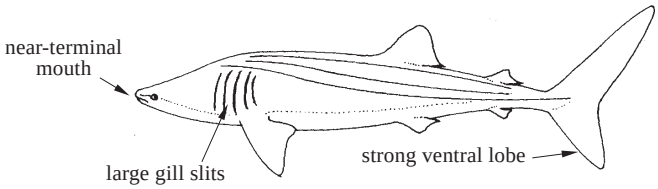


Fig. 80 Rhincodontidae

1b. Mouth smaller and subterminal; external gill slits small, internal gill slits without filter screens; caudal peduncle without strong lateral keels; caudal fin with a weak ventral lobe or none, but with a strong terminal lobe and subterminal notch (Fig. 81) . . . . . → **2**

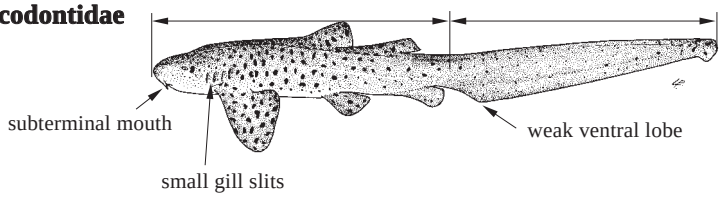
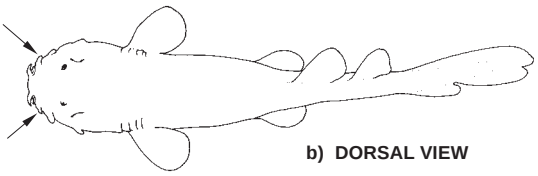


Fig. 81 Stegostomatidae

a) FRONTAL VIEW OF HEAD



b) DORSAL VIEW

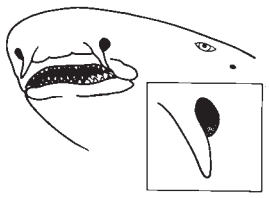
Fig. 82 Orectolobidae

2a. Caudal fin about as long as rest of shark (Fig. 81) . . . . . **family Stegostomatidae**

2b. Caudal fin much shorter than rest of shark . . . . . → **3**

3a. Head and body greatly flattened, head with skin flaps on sides; two rows of large, fang-like teeth at symphysis of upper jaw and three in lower jaw (Fig. 82) . . . . **family Orectolobidae**

3b. Head and body cylindrical or moderately flattened, head without skin flaps; teeth small, not enlarged and fang-like at symphysis . . . . . → **4**

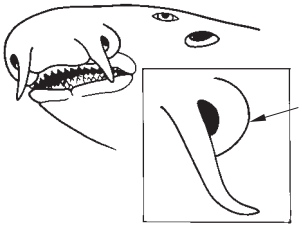


HEAD AND DETAIL OF NOSTRIL

Fig. 83 Ginglymostomatidae

4a. No circumnarial lobe and groove around outer edges of nostrils (Fig. 83)**. family Ginglymostomatidae**

4b. A circumnarial lobe and groove around outer edges of nostrils (Fig. 84) . . . . . → **5**



HEAD AND DETAIL OF NOSTRIL

Fig. 84

5a. Spiracles minute; origin of anal fin well in front of second dorsal-fin origin, separated from lower caudal-fin origin by space equal or greater than its base length (Fig. 85) . . . . . **family Parascylliidae**

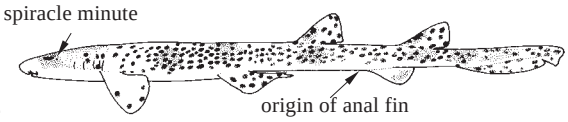


Fig. 85 Parascylliidae

5b. Spiracles large; origin of anal fin well behind second dorsal-fin origin, separated from lower caudal-fin origin by space less than its base length (Fig. 86) . . . . . **→ 6**

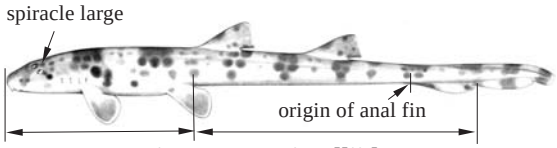


Fig. 86 Hemiscylliidae

6a. Nasal barbels very long; longitudinal groove on middle of chin; anal fin high and angular; distance from vent to lower caudal-fin origin shorter than distance from snout to vent (Fig. 87) . . . . . **family Brachaeluridae**

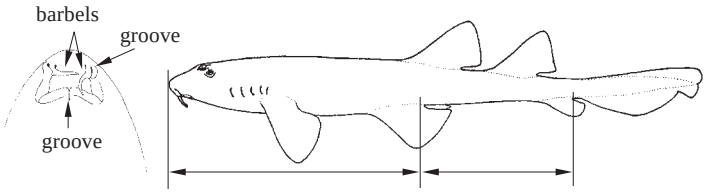


Fig. 87 Brachaeluridae

6b. Nasal barbels short; no groove on chin; anal fin low, rounded and keel-like; distance from vent to lower caudal-fin origin longer than distance from snout to vent (Figs 86 and 88) . . . . . **family Hemiscylliidae**

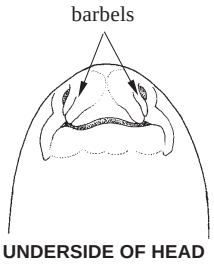


Fig. 88 Hemiscylliidae

2.3.1 Family PARASCYLLIIDAE

Family: Subfamily Parascylliinae Gill, 1862b, *Ann. Lyceum Nat. Hist. New York*, 7(32): 407, 408, 412 (Family Scylliorhinoidae Gill, 1862). Also as Subfamily Parascylliinae Fowler, 1934, *Proc. Acad. Nat. Sci. Philadelphia*, 85: 238 (Family Orectolobidae).

Type Genus: ***Parascyllium*** Gill, 1862.

Number of Recognized Genera: 2.

Synonyms: Family Parascylliidae Applegate, 1974: 749. Type genus: ***Parascyllium*** Gill, 1862. Independently proposed as a family. Family Cirrhoscylliidae Applegate, 1974: 749; Chu and Meng, 1979: 37, 114, tab. 2 (independently proposed from Applegate, 1974). Type genus: ***Cirrhoscyllium*** Smith and Radcliffe, 1913.

FAO Names: En - Collared carpet sharks; **Fr** - Requins-carpettes; **Sp** - Alfombreras.

Field Marks: Small sharks, superficially similar to members of the family Scyliorhinidae in their slender form, cat-like eyes with subocular pockets, first dorsal-fin origin behind pelvic-fin bases, and fin proportions, but differing in having their mouths entirely in front of eyes and in having narrow nasoral grooves, circumnarial grooves and folds around the nostrils, and medial barbels not derived from the anterior nasal flaps. Their mouth and nostril structures, two spineless dorsal fins and an anal fin, anal-fin origin well ahead of second dorsal-fin origin, and minute spiracles distinguish them from other sharks.

Diagnostic Features: Head narrow and somewhat flattened, without lateral flaps of skin. Snout broadly rounded to slightly pointed. Eyes dorsolaterally situated on head and with strong subocular ridges below them. Eyes with movable upper eyelids and shallow subocular pockets and ridges. Spiracles minute and much smaller than eyes, without raised external rims; spiracles somewhat behind but not below eyes. Gill slits small, fifth gill slit overlapping fourth; internal gill slits without filter screens. Nostrils with short, pointed barbels, circumnarial folds and circumnarial grooves around outer edges of incurrent apertures. Nasoral grooves long and strongly developed. Mouth small, moderately arched, and subterminal on

head. Lower lip not trilobate and without lateral orolabial grooves connecting edge of lip with medial ends of lower labial furrows; no symphysial groove on chin. Lower labial furrows ending well lateral to symphysis, not connected medially by a mental groove nor mental groove and flap. Teeth not strongly differentiated in upper and lower jaws, with symphysial teeth not enlarged and fang-like. Tooth row count 23 to 54/22 to 49. Teeth with a strong medial cusp, a pair of short lateral cusplets, and strong labial root lobes. Teeth orthodont with a central pulp cavity and no plug of osteodentine. Body cylindrical or slightly depressed, without ridges on sides. Precaudal tail about as long as body or slightly longer. Caudal peduncle without lateral keels or precaudal pits. Pectoral fins small, broad and rounded. Pectoral fins aplesodic and with fin radials not expanded into fin web. Pectoral propterygium small and fused with mesopterygium; pectoral-fin radial segments mostly 3 or (rarely) 2 or 4, and with longest distal segments less than 0.3 of length of longest proximal segments. Pelvic fins about as large as dorsal fins and slightly larger than anal fin, noticeably smaller than pectorals and with anterior margins 0.6 to 0.8 of pectoral-fin anterior margins. Claspers with unique mesospurs, claws and dactyls (Compagno, 1988). Dorsal fins equal-sized. First dorsal-fin origin and insertion well behind the pelvic-fin bases. Anal fin somewhat smaller than second dorsal fin, with broad base, angular apex, origin well ahead of second dorsal-fin origin, and insertion separated by a space much greater than its base length from lower caudal origin. Caudal fin horizontally elongated and not crescentic, weakly heterocercal and with its upper lobe hardly elevated above the body axis; dorsal caudal-fin margin less than one-fourth as long as the entire shark. Caudal fin with a strong terminal lobe and subterminal notch but without a ventral lobe, preventral and postventral margins not differentiated but forming a continuous curve. Vertebral centra without radii, with solid or hollow intermedialia and diagonal calcified knobs present or absent. Total vertebral count 159 to 199, monospondylous precaudal count 35 to 48, diplospondylous precaudal count 72 to 95, diplospondylous caudal count 51 to 65, and precaudal count 111 to 138. Cranium narrow and not greatly expanded laterally. Medial rostral cartilage moderately long and not reduced to a low nubbin. Nasal capsules elevated and not greatly depressed but strongly fenestrated, internarial septum high and compressed. Orbits with enlarged fenestrae for preorbital canals, medial walls greatly fenestrated around the optic nerve foramina. Supraorbital crests absent from cranium. Suborbital shelves strongly reduced. Cranial roof with a continuous fenestra from the anterior fontanelle to the parietal fossa. Basal plate of cranium with a pair of internal carotid foramina but no stapedial foramina. Adductor mandibulae muscle of jaws with two divisions. Preorbitalis muscles not extending onto posterodorsal surface of cranium. Anterodorsal palpebral depressor, rostromandibular, rostronuchal and ethmonuchal muscles present (Compagno, 1988) and unique to the family. Valvular intestine of conicospiral type with 6 to 9 turns. Development oviparous. Size small with adults 34 to 91 cm. Colour pattern of obscure or prominent dark saddles, with or without numerous small to large black or white spots, blotches and collar markings around branchial region.

Distribution: These are little-known sharks of inshore to deepish temperate and tropical, continental waters of the western Pacific. One genus (***Parascyllium***) is confined to Australian waters while the second (***Cirrhoscyllium***) occurs in the South China sea from Viet Nam north to Taiwan (Province of China) and Japan.

Habitat: These sharks occur on the bottom from close inshore to at least 435 m deep offshore. They are found on muddy, sandy or rocky bottom.

Biology: These small, harmless bottom sharks are rare to common in some areas but are poorly known biologically. They apparently can change colour somewhat to match the bottom type. All species are small, less than a metre long when mature. At least some and possibly all of the species are oviparous, depositing eggs in elongated, flattened egg cases on the bottom. Food habits are little known, but probably these sharks include small fishes, crustaceans, and other bottom invertebrates in their diet.

Interest to Fisheries and Human Impact: Several species are taken in bottom trawls as incidental and minimal bycatch, but utilization is probably minimal. They are harmless to people. Conservation status is uncertain, but should be monitored as they have restricted and localized distributions and some of them occur in areas of heavy inshore and offshore fishing activity, including demersal trawling. Some members of the family have been kept in captivity in public aquaria and make attractive displays, particularly the spectacularly marked ***Parascyllium variolatum***. Michael (1993) suggested that these sharks are suitable for captive breeding programmes, being small and hardy in captivity.

Local Names: Collared carpet sharks, Australian cat sharks.

Remarks: Applegate (1974) proposed a separate family for the genus ***Cirrhoscyllium***, but external and anatomical studies (Compagno, 1984, 1988) suggested that this genus is closely related to ***Parascyllium*** although readily distinguishable from it, and that both genera are referable to a single family Parascylliidae. These sharks are remote from other orectoloboids and are distinguishable from them by their unique, carcharhinoid-like teeth with strong labial root lobes and low basal ledges, arched mouths, position of the anal-fin origin well anterior to the second dorsal-fin origin, cranial morphology, extraordinarily derived cranial muscles, and spiral intestinal valves with few turns. The clasper morphology of parascylliids is unique and highly derived, with a unique, medial, finger-like, spur-bearing lobe (dactyl) supported by the dorsal terminal cartilage as well as a row of unique clasper hooks on the ventral terminal cartilage.

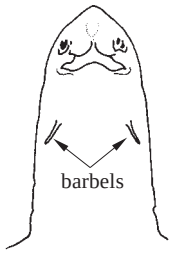
Applegate (1974) placed the two parascylliid genera in a separate suborder of the Orectolobiformes, emphasizing their distinctiveness. Compagno (1988) suggested that the Parascylliidae is the plesiomorphic sister group of all other orectoloboids. Dingerkus (1986), in contrast made Parascylliidae the sister group of Orectolobidae and Brachaeluridae only.

Literature: Regan (1908a); Smith (1913); Garman (1913); Whitley (1940); Fowler (1941, 1967a); Stead (1963); Compagno (1973, 1984, 1988); Applegate (1974); Dingerkus (1986); Last and Stevens (1994); Goto and Nakaya (1996).

Key to Genera:

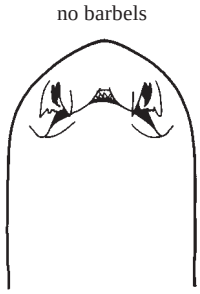
1a. A pair of barbels on throat (Fig. 89); colour pattern of dark saddles, no light or dark spots . . . . . ***Cirrhoscyllium***

1b. No barbels on throat (Fig. 90); colour pattern of saddles, dark spots, or dark and light spots . . . . . ***Parascyllium***



UNDERSIDE OF HEAD

Fig. 89 ***Cirrhoscyllium***



UNDERSIDE OF HEAD

Fig. 90 ***Parascyllium***

Cirrhoscyllium Smith and Radcliffe, 1913

Genus: ***Cirrhoscyllium*** Smith and Radcliffe *in* Smith, 1913, *Proc. U.S. Natl. Mus.,* 45(1997): 568.

Type Species: ***Cirrhoscyllium expolitum*** Smith and Radcliffe, 1913, by original designation.

Number of Recognized Species: 3.

Synonyms: Genus ***Zev*** Whitley, 1927: 289. Unjustified replacement name for ***Cirrhoscyllium*** Smith and Radcliffe, 1913, thought by Whitley to be a junior synonym of ***Cirriscyllium*** Ogilby, 1908 = ***Brachaelurus*** Ogilby, 1907. Type species: ***Cirrhoscyllium expolitum*** Smith and Radcliffe, 1913, by replacement and by original designation.

Diagnostic Features: Snout relatively long, narrow and pointed, head broad and flattened. A pair of cartilage-cored barbels present on ventrolateral surface of throat below rear corners of eyes, unique to this genus and found in no other sharks. Eyes horizontally oval. Tooth count 23 to 32/22 to 27 in adults and subadult juveniles. Pectoral fins relatively thin and rather large, their anterior margins nearly equal to head length and to distance between bases of pectoral and pelvic fins. Vertebrae few, total count 159 to 175. Size small, adults 34 to 49 cm long. Colour pattern of dark saddles present, but no spots on body or collar markings around gills.

Remarks: Data for the three species of ***Cirrhoscyllium*** are from Smith and Radcliffe *in* Smith (1913), Kamohara (1943), Teng (1959b), Shiino (1972), Compagno (1984), Nakaya and Shirai (1984), Goto, Nakaya and Amaoka (1994), and Goto and Nakaya (1996), who reviewed the genus. Compagno (1984) based keys and diagnoses for the three species of ***Cirrhoscyllium*** on Smith and Radcliffe (1913), Kamohara (1943), and Teng (1959b) as well as on examination of the holotype of ***C. expolitum***, but noted: "It is not certain at present whether the characters used to distinguish the three species are valid, and if so, if the three species are synonyms. Pending further studies on the genus these species are provisionally recognized."

Goto and Nakaya (1996) examined a sample of 22 ***C. japonicum*** as well as the 11 paratypes of ***C. formosanum*** and the holotype of ***C. expolitum***. They indicated that the characters used by Compagno (1984) were variable and not entirely diagnostic. These characters include position of first dorsal-fin origin relative to the pelvic fins, position of first dorsal-fin origin relative to the snout tip and subterminal notch, position of anal-fin insertion relative to second dorsal fin, size of anal-fin base relative to the dorso-caudal space, and number of dark saddle markings on sides. They provided additional morphometric and colour characters (adopted here) to separate the three species. Their account suggests that ***C. japonicum*** is readily separable from the two other species, but that additional comparative material of ***C. expolitum*** and ***C. formosanum*** is desirable to determine if the morphometric and vertebral count characters of these species are valid. The humped back suggested by Compagno (1984) as a characteristic of ***Cirrhoscyllium*** was thought by Goto and Nakaya (1996) to be an artefact of preservation.

Key to Species (modified from Goto and Nakaya, 1996)**:**

1a. Saddle-markings bold, saddles on back over abdomen discrete C-shaped; second dorsal-fin base usually shorter and rarely equal to anal-caudal space; precaudal vertebral count 117 to 123 (Fig. 91)**. . . . . *Cirrhoscyllium japonicum***

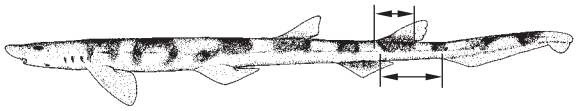


Fig. 91 ***Cirrhoscyllium japonicum***

1b. Saddle-markings diffuse, saddles on back over abdomen rounded and confluent with saddles over pelvic fins; second dorsal-fin base equal to or longer than anal-caudal space (Fig. 92); precaudal vertebral count 108 to 117 **. . . . . → 2**

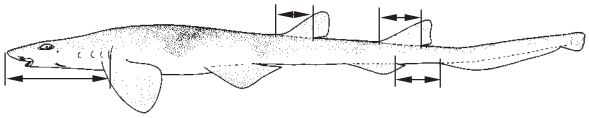


Fig. 92 ***Cirrhoscyllium expolitum***

2a. Head length 3.0 times first dorsal-fin base (Fig. 92); total vertebral count 154, precaudal vertebral count 108 **. . . . . *Cirrhoscyllium expolitum***

2b. Head length 2.3 to 2.6 times first dorsal-fin base (Fig. 93); total vertebral count 159 to 167, precaudal vertebral count 112 to 117 **. . . . . *Cirrhoscyllium formosanum***

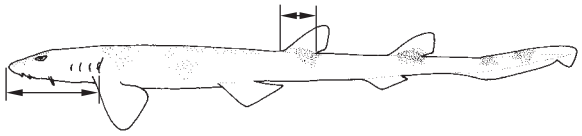


Fig. 93 ***Cirrhoscyllium formosanum***

Cirrhoscyllium expolitum Smith and Radcliffe, 1913 Fig. 94

Cirrhoscyllium expolitum Smith and Radcliffe *in* Smith, 1913, *Proc. U.S. Natl. Mus.*, 45(1997): 568, figs 1-2, pl. 45. Holotype: US National Museum of Natural History, USNM-74603, 335 mm adult female, 21° 33' N, 116° 13' E, South China Sea between northern Luzon, Philippines, and China, 183 m. Status and correction in longitude from Howe and Springer (1993, *Smiths. Contr. Zool.*, [540]: 7); also by author's examination of the holotype.

Synonyms: None.

Other Combinations: None.

FAO Names: En - Barbelthroat carpet shark; **Fr** - Requin-carpette á moustache; **Sp** - Alfombrera barbuda.

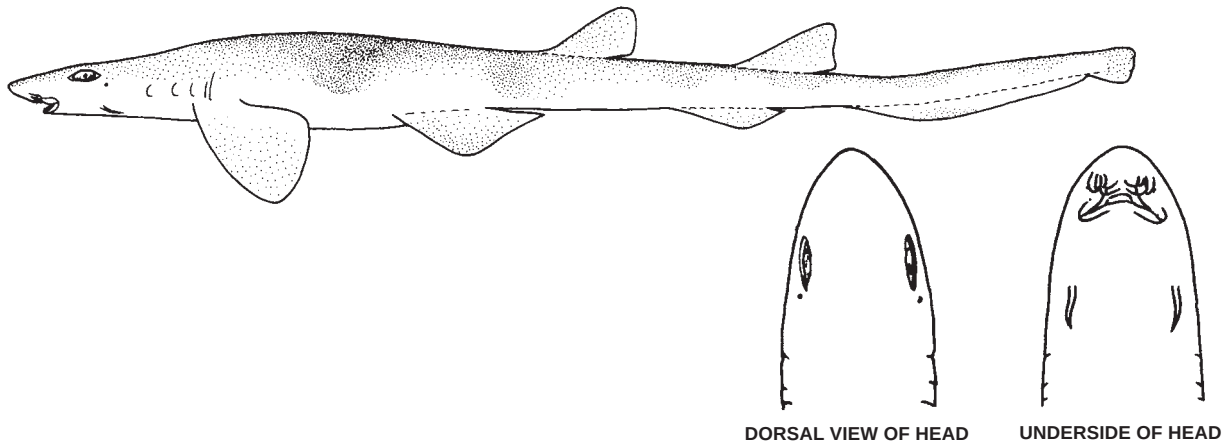
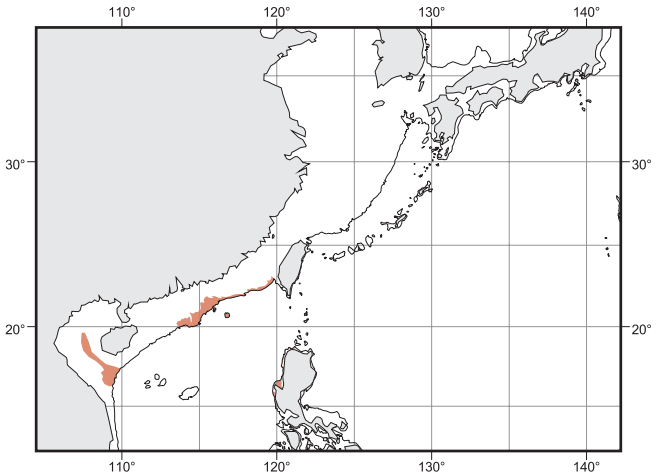


Fig. 94 ***Cirrhoscyllium expolitum***

Field Marks: Barbels on throat, nasoral grooves, mouth in front of eyes, six or possibly ten diffuse saddle marks on dorsal surface, saddles above abdomen rounded and continuing above pelvic-fin bases, not C-shaped, head length three times first dorsal-fin base.

Diagnostic Features: Head length 3.0 times first dorsal-fin base. Anal-caudal space 7.7% of total length, 43% of head length. Second dorsal-fin base equal to or longer than anal-caudal space. Precaudal vertebral count 108, total count 154. **Colour:** six to possibly ten indistinct pairs of saddle markings on sides of back and tail; an elongated rounded saddle on each side of back between bases of pectoral and pelvic fins and extending over pelvic-fin bases.

Distribution: Western North Pacific: South China Sea off the coast of China between China and Luzon, Philippines, and in the Gulf of Tonkin off Viet Nam. Nominal from Okinawa (Uchida, 1982) but record uncertain, possibly ***C. japonicum***?



Habitat: Outer continental shelf, South China Sea on bottom at 183 to 190 m depth.

Biology: A little-known and presumably rare or uncommon tropical bottom shark. Probably oviparous, judging from large nidamental glands. Food habits unknown.

Size: The adult female holotype is 335 mm long while a Vietnamese female (maturity stage unknown) is 306 cm long (Kharin, 1987).

Interest to Fisheries and Human Impact: Interest to fisheries unknown, probably taken as discarded bycatch of offshore trawl fisheries in the area, conservation status unknown.

Local Names: Higezame (Japan).

Literature: Smith (1913); Fowler (1941); Teng (1959b); Compagno (1984); Kharin (1987); Goto and Nakaya (1996).

Cirrhoscyllium formosanum Teng, 1959 — Fig. 95

Cirrhoscyllium formosanum Teng, 1959b, *Taiwan Fish. Res. Inst., Keelung, Lab. Fish. Biol. Rep.*, (7): 1, pl. 1. Holotype: Taiwan Fisheries Research Institute, TFRI 3574, 367 mm female, off Kao-hsiung, Taiwan (Province of China), 110 m.

Synonyms: None.

Other Combinations: None.

FAO Names: En - Taiwan saddled carpet shark; **Fr** - Requin-carpette chin; **Sp** - Alfombrera de Taiwan.

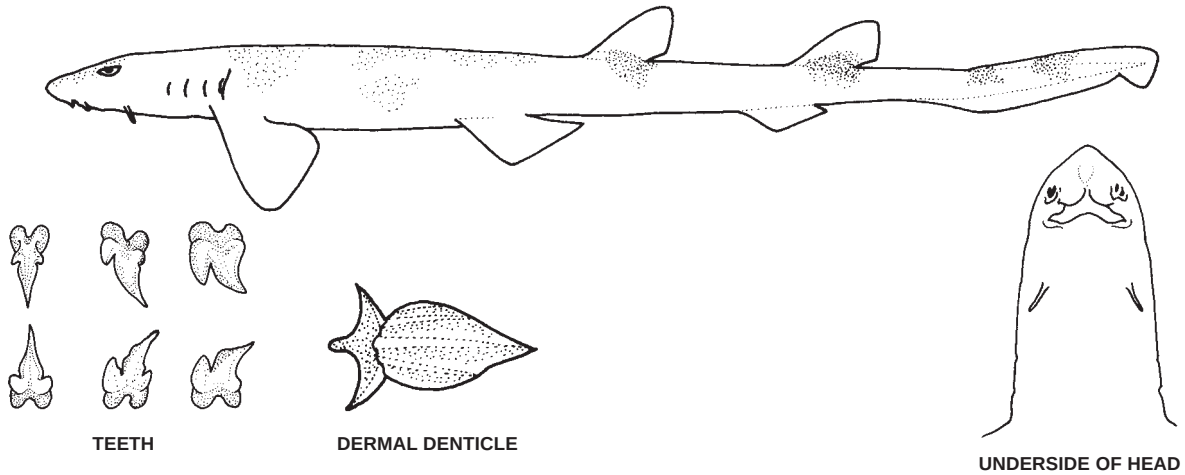
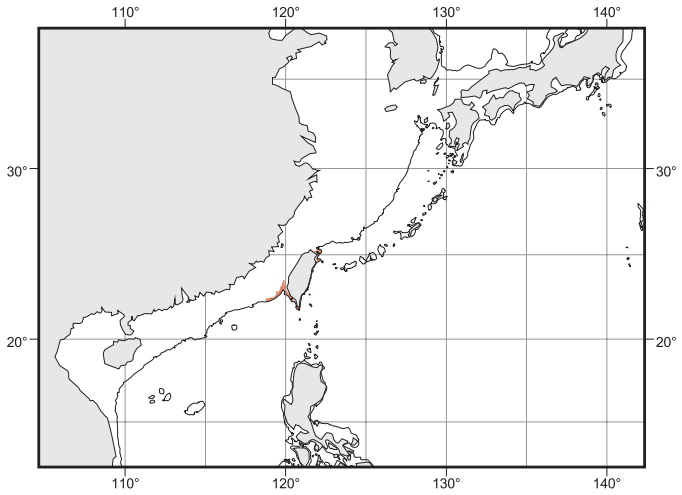


Fig. 95 ***Cirrhoscyllium formosanum***

Field Marks: Barbels on throat, nasoral grooves, mouth in front of eyes, six diffuse saddle marks on dorsal surface, saddles above abdomen rounded and continuing above pelvic-fin bases, not C-shaped, head length 2.3 to 2.6 times first dorsal-fin base.

Diagnostic Features: Head length 2.3 to 2.6 times first dorsal-fin base. Anal-caudal space 6.8 to 7.7% of total length, 38 to 45% of head length. Second dorsal-fin base equal to or longer than anal-caudal space. Precaudal vertebral count 112 to 117, total count 159 to 167. **Colour:** six pairs of indistinct saddle markings on sides of back and tail; an elongated rounded saddle on each side of back between bases of pectoral and pelvic fins and extending over pelvic-fin bases.

Distribution: Western North Pacific: Taiwan Island (Province of China).



Habitat: Outer shelf of Taiwan (Province of China) at depth of about 110 m.

Biology: A little-known small, tropical or subtropical shark, biology essentially unknown. Twelve specimens (11 paratypes and the holotype) are in the Taiwan Fisheries Research Institute, all collected off Kao-hsiung, Taiwan (Province of China). That all the paratypes were collected in one day on longlines suggests that the species may be or was common although possibly localized.

Size: Maximum 39 cm; eight males 35.2 to 37.7 cm; one paratype male 35.9 cm TL from this series was adult according to Goto and Nakaya (1996), and presumably the larger males were also mature. Females 35.2 to 38.5 cm possibly adult if adult females attain a size similar to ***C. expolitum***.

Interest to Fisheries and Human Impact: Interest to fisheries unknown, taken on bottom longlines off Taiwan (Province of China), presumably also as discarded trawl bycatch. Conservation status unknown.

Literature: Teng (1959b); Compagno (1984); Goto and Nakaya (1996).

Cirrhoscyllium japonicum Kamohara, 1943 Fig. 96

Cirrhoscyllium japonicum Kamohara, 1943, *Bull. Biogeogr. Soc. Japan*, 13(17): 126, fig. 1. Holotype: 485 mm female from Mimase, Shikoku, Japan, possibly at Kochi University, Kochi City, Japan (Dr T. Abe, pers. comm.). According to Goto and Nakaya (1996: 205), Kamohara (1961, *Rep. Usa Mar. Biol. St.* 8: 1-9, not seen) designated a neotype (Kochi University, Department of Biology, Faculty of Science, BSKU-3656, 291 mm immature female, from Mimase Fish Market) to replace the holotype, which was destroyed during the second world war. Goto and Nakaya suggested that Kamohara's designation was invalid according to the International Code of Zoological Nomenclature (1985, Art. 75b[i] and 75d[1,2]), but redesignated the same specimen as neotype.

Synonyms: None.

Other Combinations: None.

FAO Names: En - Saddled carpet shark; **Fr** - Requin-carpette chat; **Sp** - Alfombrera japonesa.

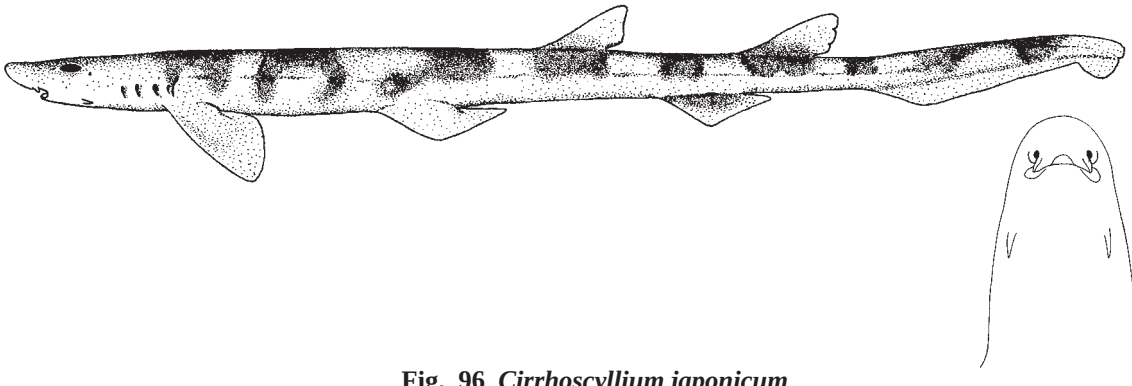
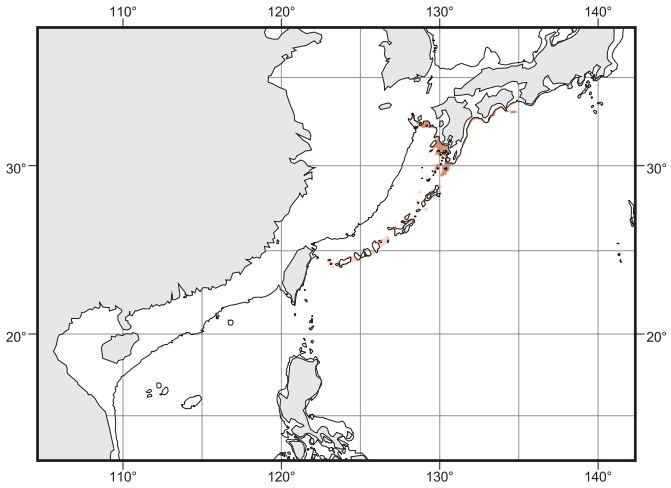


Fig. 96 ***Cirrhoscyllium japonicum***

Field Marks: Barbels on throat, nasoral grooves, mouth in front of eyes, nine well-defined saddle marks on sides of body, with C-shaped saddles on abdomen.

Diagnostic Features: Head length 2.2 to 2.6 times first dorsal-fin base. Anal-caudal space 7.5 to 9.7% of total length. Anal-caudal space 45 to 62% of head length. Second dorsal-fin base usually shorter and rarely equal to anal-caudal space. Precaudal vertebral count 117 to 123. Total vertebral count 165 to 175. **Colour:** nine well-defined pairs of saddle-markings on sides of back and tail; a strongly marked C-shaped saddle on each side of back between pectoral and pelvic-fin bases and discrete from saddles over pelvic-fin bases.

Distribution: Western North Pacific: Japan, off southwest coast from Shikoku and Kyushu southwest to Yakushima Island and possibly the Riu-Kyu Islands.



Habitat: Uppermost slope of southwestern Japan at depths of 250 to 290 m.

Biology: Biology poorly known. Apparently oviparous, as cased eggs were discovered in a 445 mm female. A morphological study of the throat barbels of this shark (Goto, Nakaya and Amaoka, 1994) suggested that they were mechanical sensors, without obvious chemical or other sense organs, and that they were unique to the genus ***Cirrhoscyllium***.

Size: Maximum 48.5 cm; females immature at 25.7 to 42.4 cm, adolescent at 43.1 cm, and adult at 44.5 cm, maximum 48.5 cm; males immature at 22.8 cm, adolescent at 36.6 cm, and adult at 36.7 to 40.7 cm.

Interest to Fisheries and Human Impact: Interest to fisheries unknown. Possibly taken as a bycatch of trawl fisheries. Conservation status unknown.

Local Names: Kurakake-zame, or Kurakakezame, Higezame, Saddled catshark (Japan).

Remarks: A female specimen nominally referred to ***C. expolitum*** (Uchida, 1982) was collected off the Riu-Kyu Islands and kept in an aquarium in Okinawa where it laid eggs; it may refer to this species.

Literature: Kamohara (1943); Teng (1959b); Uchida (1982); Compagno (1984); Goto, Nakaya and Amaoka (1994); Goto and Nakaya (1996).

Parascyllium Gill, 1862

Genus: ***Parascyllium*** Gill, 1862b, *Ann. Lyceum Nat. Hist. New York*, 7(32): 408, 412.

Type Species: ***Hemiscyllium variolatum*** Dumeril, 1853, by original designation.

Number of Recognized Species: 4.

Synonyms: Subgenus ***Neoparascyllium*** Whitley, 1939: 227 (Genus ***Parascyllium*** Gill, 1862). Type species: ***Parascyllium multimaculatum*** Scott, 1935, by original designation.

Diagnostic Features: Snout relatively short, thick, and broadly rounded, head narrow and cylindrical. No barbels on throat. Eyes more elongated and slit-like. Tooth count 37 to 54/33 to 49 in adults. Pectoral fins thick, muscular, and rather small, their anterior margins much less than head length and than distance between pectoral and pelvic-fin bases. Vertebrae numerous, total count 188 to 199. Size of adults 60 to 91 cm long. Colour pattern of light or dark spots present, sometimes with dark saddles, black blotches, and collar markings around gills.

Remarks: The present arrangement of the species of ***Parascyllium*** follows Whitley (1940), Compagno (1984), and Last and Stevens (1994) in most details.

Key to Species (after Compagno, 1984, and Last and Stevens, 1994)**:**

1a. Gill region with a prominent dark collar marking dotted with dense white spots; body with brown blotches and small white spots; fins with very prominent large black blotches (Fig. 97) . . . . . ***Parascyllium variolatum***

1b. Gill region with or without an indistinct to prominent dusky collar marking, with or without a few brown spots but lacking white spots; body with small to moderately large brown spots but no blotches; fins without black blotches (Fig. 98) . . . . . → **2**

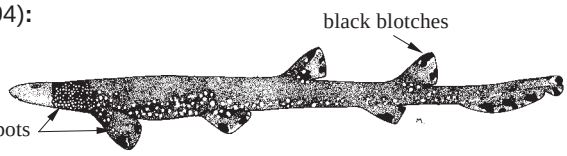


Fig. 97 ***Parascyllium variolatum***

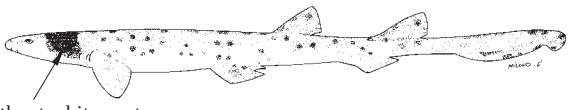


Fig. 98 ***Parascyllium collare***

2a. Gill region with a prominent dusky collar, sharply delimited from front of head; dark spots absent from pectoral fins (Fig. 98) . . . . . ***Parascyllium collare***

2b. Gill region with collar marking absent, pale or obscure, not sharply delimited from front of head; dark spots usually present on pectoral fins . . . . . → **3**

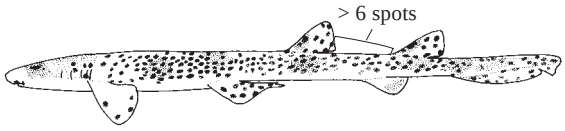


Fig. 99 ***Parascyllium ferrugineum***

3a. More than six spots on flanks between dorsal fins (Fig. 99); a littoral species on the continental shelves . . . . . ***Parascyllium ferrugineum***

3b. Less than six dark spots on flanks between dorsal fins (Fig. 100); a deepwater species on the continental slopes . . . . . ***Parascyllium* sp. A**

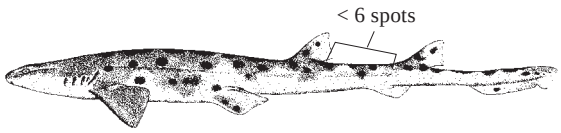


Fig. 100 ***Parascyllium* sp. A**

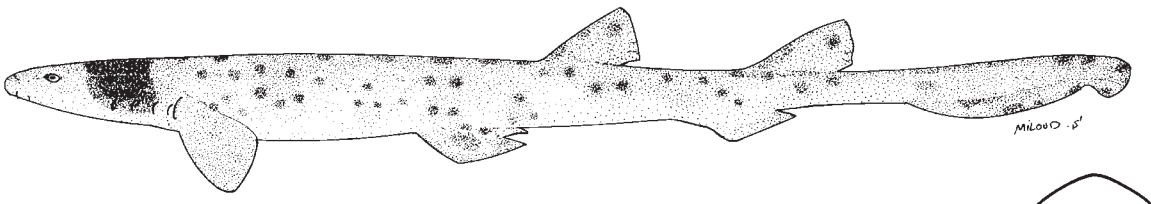
Parascyllium collare Ramsay and Ogilby, 1888 | Fig. 101

Parascyllium collare Ramsay and Ogilby, 1888, *Proc. Linn. Soc. New South Wales*, ser. 2, 3: 1310. Holotype: Australian Museum, Sydney, AMS-I.1874, > 76 cm (30 in) TL adult male, in deep water off Port Jackson, New South Wales, Australia.

Synonyms: None.

Other Combinations: None.

FAO Names: En - Collared carpet shark; **Fr** - Requin-carpette à collarette; **Sp** - Alfombrera collareja.



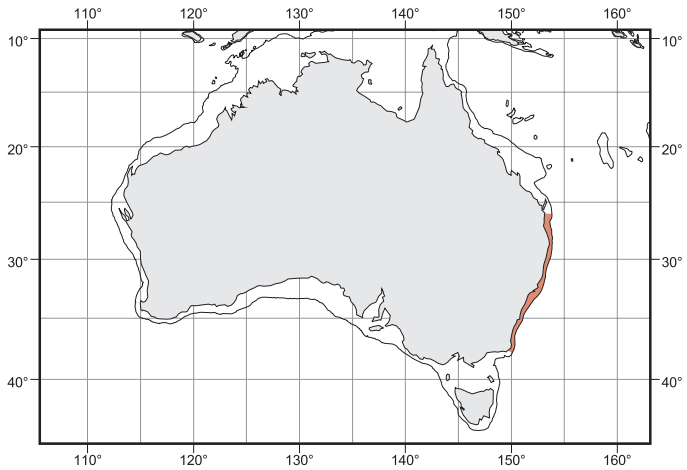
UNDERSIDE OF HEAD

Fig. 101 ***Parascyllium collare***

Field Marks: Prominent dark, unspotted, sharp-edged collar mark around the gills, dusky saddles on back and tail, and sparse, large dark spots on body, tail and fins; nasal barbels, nasoral and circumnarial grooves present; mouth in front of eyes, two equal-sized, spineless dorsal fins and an anal fin, the first dorsal-fin origin behind the pelvic-fin bases, the anal-fin origin well in front of the second dorsal-fin origin.

Diagnostic Features: Colour: light yellowish to reddish brown with five dusky saddles on trunk and tail; a prominent dark, unspotted collar marking around gill region; no white spots on body; no bold black blotches and spots on fins; sparse, scattered, large dark brown spots on sides and fins, except for pectoral fins, no more than two or three irregular longitudinal rows of spots on sides and less than six spots on sides of tail between the dorsal fins.

Distribution: Western South Pacific: confined to the east coast of Australia (Victoria, New South Wales, and southern Queensland from Gabo Island to Mooloolaba).



Habitat: A little-known temperate bottom shark of the eastern Australian continental shelf, found at depths of 20 to 160 m on hard bottom including inshore rocky reefs and hard-bottomed trawling grounds.

Biology: Development oviparous, but details little-known. Eggcase described as flattened and elongate, but details not given. Apparently common or formerly common on hard bottom at depths of 55 to 128 m on trawling grounds off New South Wales.

Size: Maximum about 87 cm; adult males 80 to 85 cm long; adult females 85 to 87 cm.

Interest to Fisheries and Human Impact: Interest to fisheries essentially none, not utilized but taken as bycatch by commercial vessels, including trawlers and possibly line boats. Conservation status unknown.

Local Names: Collared catshark or Cat shark, Collared carpet shark.

Remarks: According to Last and Stevens (1994) this species was confused with other species of ***Parascyllium*** and is somewhat less wide-ranging than previously thought. It was recorded from Tasmania but these records are apparently based on ***P. ferrugineum.***

Literature: McCulloch (1911); Whitley (1940); Fowler (1941); Stead (1963); Compagno (1984); Last and Stevens (1994).

Parascyllium ferrugineum McCulloch, 1911 — Fig. 102

Parascyllium ferrugineum McCulloch, 1911, *Zool. Resul. Fish. Exper. F.I.S. "ENDEAVOUR"*, 1: 7, pl. 2, fig. 2, text fig. 2. Holotype: Australian Museum, Sydney, possibly AMS E.4604 (Eschmeyer, 1998, *Cat. Fish.*: CD-ROM), 730 mm female, outside Port Phillip Heads, Victoria.

Synonyms: ***Parascyllium multimaculatum*** Scott, 1935: 63, fig. 1. Holotype: Queen Victoria Museum and Art Gallery, Launceston, Tasmania, QVM old no. H.T.983 (mounted, missing in 1974 according to Eschmeyer, 1998: CD-ROM), 710 mm adult male, Tamar Heads, Devon Dorset, Tasmania, Australia. Synonymy after Last and Stevens (1994: 120).

Other Combinations: None.

FAO Names: En - Rusty carpet shark; **Fr** - Requin-carpette roux; **Sp** - Alfombrera mohosa.

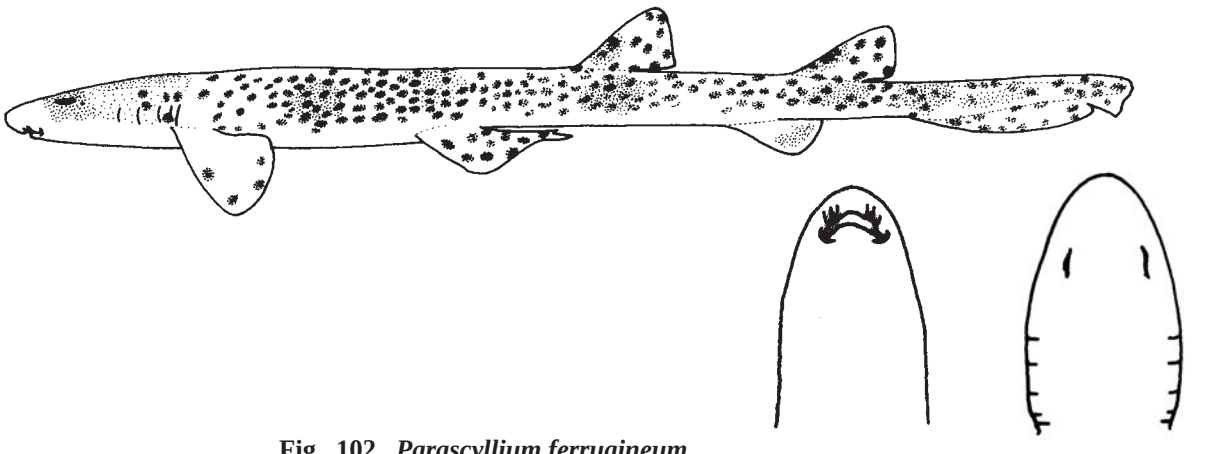
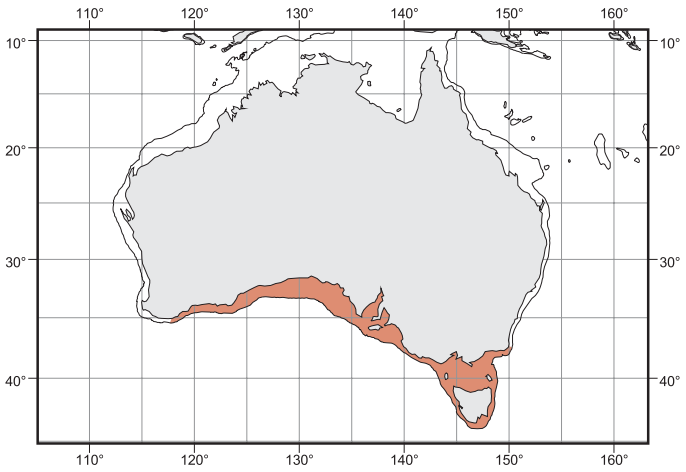


Fig. 102 ***Parascyllium ferrugineum***

Field Marks: Inconspicuous dusky collar around the gills, with or without three or four dark spots; six or seven dusky saddles on back and tail; moderately sparse to dense, large to small dark brown or blackish spots on body, tail and fins, more than six dark spots on the sides of the tail between the dorsal fins; nasal barbels, nasoral and circumnarial grooves present, mouth in front of eyes; two equal-sized, spineless dorsal fins and an anal fin, the first dorsal-fin origin behind the pelvic-fin bases, the anal-fin origin well in front of the second dorsal-fin origin.

Diagnostic Features: Colour: grey-brown with six dusky saddles on trunk, tail and caudal fin; an indistinct dark, collar marking around gill region, unspotted or with up to three or four dark spots; no white spots on body; no bold large black blotches on fins though unpaired fins usually have small to large rounded black spots on them; moderately sparse to dense, scattered, large dark brown spots on body and fins, three or four (mainland) to five or six (Tasmania) irregular longitudinal rows of dark spots on sides, and more than six spots on the sides of the tail between the dorsal fins.

Distribution: Western South Pacific: Confined to the south and east coasts of Australia (Western Australia, South Australia, Victoria, from Albany to Gabo Island, and Tasmania).



Habitat: A little-known temperate-water shark of the Australian continental shelf, on or near the bottom at depths of 5 to 150 m. Off Tasmania close inshore near rocks and river mouths. Occurs in beds of algae on reefs or in seagrass. Hides in rocky caves and ledges during the day.

Biology: A poorly known nocturnal shark. Oviparous, lays eggs in yellow cases with long tendrils during the summer. Feeds on bottom-dwelling crustaceans and molluscs.

Size: Maximum about 80 cm; possible hatchling about 17 cm; males mature by 60 cm, adult males recorded at 71 to 75 cm; adolescent female 74 cm.

Interest to Fisheries and Human Impact: Interest to fisheries essentially none, not utilized but taken as bycatch by commercial vessels, captured in bottom trawls and possibly by line gear. Conservation status unknown.

Local Names: Rusty carpet shark, Rusty catshark or Cat shark, Tasmanian spotted catshark or Cat shark, Tasmanian carpet shark, Requin-carpette tacheté, Alfombrera tasmánica.

Remarks: Scott (1935) named ***Parascyllium multimaculatum*** as a distinct species for an adult female specimen of ***Parascyllium*** from Tasmania with densely scattered small dark spots. Whitley (1939, 1940) recognized this species and proposed a new subgenus, ***Neoparascyllium*** Whitley, 1939, for it because it differed from other species in having the first dorsal "insertion" (= origin) behind the middle of the total length and by its markings (more numerous small dark brown spots). Compagno (1984) examined specimens of ***Parascyllium multimaculatum*** from Tasmania and recognized the species, but noted that the species differed little from ***P. ferrugineum*** and ***P. collare*** except in colour pattern and did not warrant a separate subgenus. The morphometric character was thought to be invalid by Compagno (1984), as two Tasmanian specimens from Green's Beach near the Tamar River mouth with numerous spots (one of these was illustrated in Compagno, 1984) varied in this character (PD1 60% TL in an adult female vs. 48% TL in the illustrated adult male). This suggests that the position of the dorsal fin relative to the middle of the total length may be individually variable and may also vary according to size and even sex in this shark and in other species of ***Parascyllium***. Compagno (1984) distinguished ***P. ferrugineum*** and ***P. multimaculatum*** by colour pattern only as follows:

> ***P. ferrugineum***: Sparse, scattered, large dark brown spots on sides and fins, no more than three or four irregular rows of spots on sides.
>
> ***P. multimaculatum:*** Numerous small to large dark brown spots on sides and fins, five or six irregular rows of spots on sides.

Last and Stevens (1994) synonymized ***P. multimaculatum*** with ***P. ferrugineum***, and noted that "Tasmanian specimens [of ***P. ferrugineum***] have a variable but greater average density of spots which has led to their recognition as a separate species." The present account follows Last and Stevens' synonymy while noting that it is desirable to learn more about the nature of variation (including ontogenetic changes) in the colour pattern of these poorly-known sharks. Genetic comparisons between Tasmanian and mainland animals are also desirable.

Literature: McCulloch (1911); Whitley (1939, 1940); Fowler (1941); Scott (1961); Stead (1963); Compagno (1984); Michael (1993); Last and Stevens (1994).

Parascyllium variolatum (Dumeril, 1853) **Fig. 103**

Hemiscyllium variolatum Dumeril, 1853, *Rev. Mag. Zool.* (2) 5: 121, fig. 1. Holotype: Museum National d'Histoire Naturelle, Paris, MNHN-1004, 36 cm TL female, from "côtes de l'Australie" (= Tasmania).

Synonyms: ***Parascyllium nuchalis*** McCoy, 1874: 15, pl. 2. Holotype: National Museum of Victoria, Melbourne, Australia, NMV no number (apparently lost according to Eschmeyer, 1998: CD-ROM), 84 cm adult female, Hobson's Bay, Victoria, Australia.

Other Combinations: None.

FAO Names: En - Necklace carpet shark; **Fr** - Requin-carpette à collier; **Sp** - Alfombrera colarina.

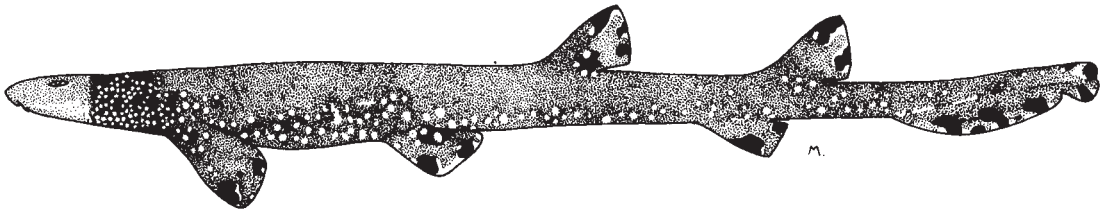
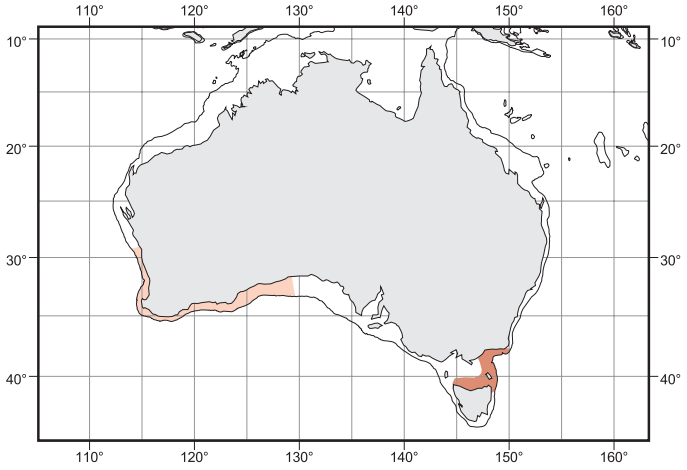


Fig. 103 ***Parascyllium variolatum***

Field Marks: The bold, beautiful colour pattern of this shark is unmistakable: a unique, broad, dark, white-spotted collar around the gills, striking black spots or blotches on all fins, dark blotches and dense white spots on body; also, barbels, nasoral and circumnarial grooves present, mouth in front of eyes, two equal-sized, spineless dorsal fins and an anal fin, the first dorsal-fin origin behind the pelvic-fin bases, and the anal-fin origin well in front of the second dorsal-fin origin.

Diagnostic Features: Colour: dark greyish or brown (to chocolate brown) above and below, with six indistinct dark saddles variably present or obscure on trunk and tail; a blackish brown, extremely conspicuous collar marking around the gill region, densely spotted with white like a necklace of pearls; body clouded with irregular dark brown blotches and closely sprinkled with small to large white spots; bold black spots or blotches present on all fins, including prominent blotches on the precaudal fins and black spots alternating with white on the dorsal and ventral web of the caudal fin; discrete dark spots not present on sides of trunk and tail.



Distribution: Western South Pacific: South coast of Australia (Western Australia off Dongara to South Australia, and Victoria off Lakes Entrance, also north coast of Tasmania, but possibly including more than one species, the typical eastern form with type locality Tasmania and an additional western form from Western Australia).

Habitat: A temperate-water bottom shark of the Australian continental shelf at depths from inshore down to about 180 m. Apparently found in a variety of habitats, including sandy bottom, on rocky reefs, in beds of kelp, and in seagrass beds, but details of its ecology are virtually unknown.

Biology: Biology little-known, probably oviparous. Common or unabundant, but nocturnal and seldom seen during the day. Juveniles hide under rocks and bottom debris in shallow water. Coloration may vary considerably, and individuals taken on different bottoms vary in coloration including light spots and dark mottling and saddles, but little is known of the basis of these differences.

Size: Maximum about 91 cm.

Interest to Fisheries and Human Impact: Probably not utilized at present in fisheries. Role in aquarium trade unknown, but an obvious candidate for public display and for private aquaria. Conservation status uncertain.

Local Names: Varied carpet shark, Southern catshark, Southern collared cat shark, Necklace carpet shark, Varied catshark or cat shark, Hémiscylle tacheté.

Remarks: Last and Stevens (1994) noted that "Another white-spotted form occurring off southern Western Australia may be an additional undescribed species."

Literature: McCulloch (1911); Whitley (1940); Fowler (1941); Stead (1963); Compagno (1984); Michael (1993); Last and Stevens (1994).

Parascyllium sp. A Last and Stevens, 1994 Fig. 104

***Parascyllium* sp. A** Last and Stevens, 1994, *Sharks Rays Australia*: 118, pl. 16.

Synonyms: Not named.

Other Combinations: None.

FAO Names: En - Ginger carpet shark; **Fr** - Requin-carpette beige; **Sp** - Alfombrera jengibre.

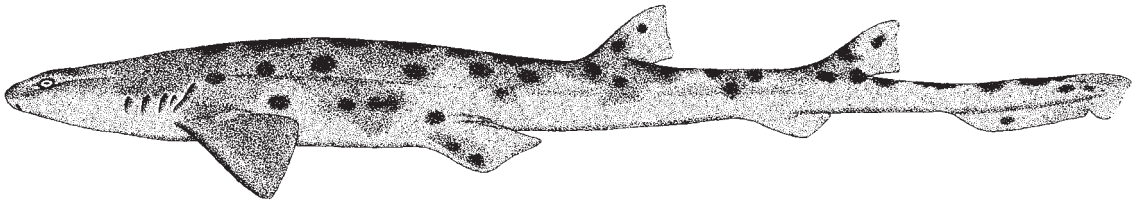
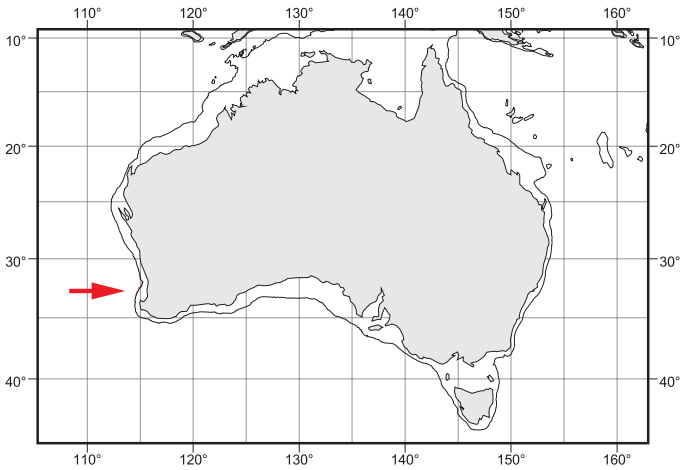


Fig. 104 ***Parascyllium* sp. A**

Field Marks: Inconspicuous dusky half collar around the gills without spots, five indistinct dusky saddles on back and tail, and sparse, large dark diffuse spots and blotches on the body and fins with fewer than six on the sides of the tail between the dorsal fins; nasal barbels, nasoral and circumnarial grooves present, mouth in front of eyes; two equal-sized, spineless dorsal fins and an anal fin, the first dorsal-fin origin behind the pelvic-fin bases and rear tips, the anal-fin origin well in front of the second dorsal-fin origin.

Diagnostic Features: Colour: pale brownish or greyish above, lighter below, with five inconspicuous saddles on trunk and tail; inconspicuous dusky half collar without spots around the gills; no white spots on body; no bold black spots or blotches on fins; sparse, large dark diffuse spots and blotches on the body and fins, sparse dark spots of sides not in rows, with fewer than six spots on the sides of the tail between the dorsal fins.

Distribution: Southeastern Indian Ocean: Continental slope of Australia (Western Australia between Lancelin and Bunbury).



Habitat: Upper continental slope at 245 to 435 m.

Biology: Virtually unknown.

Size: To at least 79 cm total length.

Interest to Fisheries and Human Impact: Unknown.

Local Names: Ginger carpet shark.

Literature: Last and Stevens (1994).

2.3.2 Family BRACHAELURIDAE

Family: Family Brachaeluridae Compagno, 1973, *J. Linn. Soc. (Zool.)*, 53, suppl. 1: 28. Name only, with the genera ***Brachaelurus*** and ***Heteroscyllium*** assigned to the family; Applegate, 1974, *J. Mar. Biol. Assoc. India*, 14(2): 745.

Type Genus: ***Brachaelurus*** Ogilby, 1907.

Number of Recognized Genera: 2.

Synonyms: Family Brachyaeluridae Eschmeyer and Bailey, 1990: 63; Eschmeyer, 1990: 435. Consistent emendation or error for Brachaeluridae Compagno, 1973 or Applegate, 1974.

FAO Names: En - Blind sharks; **Fr** - Requins aveugles; **Sp** - Tiburones ciegos.

Field Marks: Small sharks with nasoral grooves, perinasal grooves, long barbels, small transverse mouths in front of eyes, symphysial grooves, dorsolateral eyes, large spiracles below and behind eyes, no lateral skin flaps on head, two spineless dorsal fins and an anal fin, the second dorsal-fin origin well ahead of the anal-fin origin, and a short precaudal tail much shorter than the head and body.

Diagnostic Features: Head broad and somewhat flattened, without lateral flaps of skin. Snout broadly rounded. Eyes dorsolaterally situated on head and with strong subocular ridges below them. Eyes without movable upper eyelids but with subocular pockets and ridges below them. Spiracles very large and subequal or larger than eyes, with prominent raised external rims; spiracles somewhat below and behind eyes. Gill slits small, fifth gill slit close to fourth but not overlapping it; internal gill slits without filter screens. Nostrils with very long pointed barbels; circumnarial folds and circumnarial grooves present around outer edges of incurrent apertures. Nasoral grooves long and strongly developed. Mouth small, slightly arched and nearly transverse, subterminal on head. Lower lip not trilobate and without lateral orolabial grooves connecting edge of lip with medial ends of lower labial furrows, but with a longitudinal symphysial groove on chin. Lower labial furrows extending medially nearly to symphysis, but not connected medially by a mental groove or mental flap. Teeth not strongly differentiated in upper and lower jaws, with symphysial teeth not enlarged nor fang-like. Tooth row count 32 to 34/21 to 29. Teeth with a strong medial cusp, a pair of short lateral cusplets, and weak labial root lobes. Teeth orthodont with a central pulp cavity in crowns and no plug of osteodentine. Body cylindrical or moderately depressed, without ridges on sides. Precaudal tail shorter than body. Caudal peduncle without lateral keels or precaudal pits. Pectoral fins moderately large, broad and rounded. Pectoral fins aplesodic and with fin radials not expanded into fin web. Pectoral fin tribasal, propterygium very large and separate from mesopterygium and metapterygium; pectoral-fin radial segments three at most, and with longest distal segments less than 0.3 times the length of longest proximal segments. Pelvic fins about as large as dorsal fins and much larger than anal fin, nearly as large as pectoral fins and with anterior margins 0.5 to 0.7 times the pectoral-fin anterior margins. Claspers poorly known but probably without mesospurs, claws or dactyls. Dorsal fins equal-sized or with second dorsal fin slightly smaller than first. First dorsal-fin origin over pelvic-fin bases, insertion well behind the pelvic-fin rear tips. Anal fin less than half as large as second dorsal fin, with broad base, angular apex, origin about opposite second dorsal-fin midbase or insertion, and insertion separated by a space or narrow notch much less than base length from lower caudal-fin origin. Caudal fin horizontally elongated and not crescentic, weakly heterocercal with its upper lobe at a low angle above the body axis; dorsal caudal-fin margin about a fourth as long as the entire shark. Caudal fin with a strong terminal lobe and subterminal notch but without a ventral lobe, preventral and postventral margins not differentiated and forming a continuous curve. Vertebral centra with well-developed radii. Total vertebral count 117 to 142, monospondylous precaudal count 30 to 40, diplospondylous precaudal count 35 to 50, diplospondylous caudal count 46 to 62, and precaudal count 69 to 90. Cranium narrow and not greatly expanded laterally. Medial rostral cartilage moderately long and not reduced to a low nubbin. Nasal capsules elevated and not greatly depressed or fenestrated, internarial septum high and compressed. Orbits with small foramina for preorbital canals, medial walls not fenestrated around the optic nerve foramina. Supraorbital crests present on cranium but not laterally expanded and pedicellate. Suborbital shelves moderately broad and not greatly reduced. Cranial roof with isolated small frontal and parietal fenestrae but without a continuous fenestra from the anterior fontanelle to the parietal fossa. Basal plate of cranium with a pair of stapediocarotid foramina. Adductor mandibulae muscle of jaws with two divisions. Preorbitalis muscles not extending onto posterodorsal surface of cranium. No anterodorsal palpebral depressor, rostromandibular, rostronuchal or ethmonuchal muscles. Valvular intestine of spiral-ring type with 11 or 12 turns. Development ovoviviparous. Colour pattern of a few broad darker saddles present on back in young but obscure or absent in adults; small white spots present or absent. Size small, with adults between 52 and 122 cm but exceptionally over 1 m total length; young are born at 15 to 18 cm.

Distribution: Blind sharks are known from the western South Pacific, in the coastal waters of Australia from the east coast off New South Wales and Queensland; additional records from Western Australia and Northern Territory need confirmation.

Habitat: These are inshore bottom sharks of temperate and tropical continental coastal waters, ranging in depth from the intertidal down to 137 m. They commonly occur on rocky reefs, in seaweed, or on coral close inshore, sometimes in water only sufficient to cover them.

Biology: These are small sharks that attain a total length of less than 1.3 m, with most individuals less than 80 cm long. Live-bearing (ovoviviparous or aplacental viviparous), with foetal nutrition primarily from the large, yolky eggs; foetuses have large yolk-sacks which are reabsorbed just before birth. Litter size 6 to 8. Known prey of these sharks include small fishes, crustaceans, squid, and sea anemones. At least one of the species is very hardy and can live a long time out of water as well

as surviving readily in captivity. The name 'blind shark' stems not from lack of vision but because these sharks close their eyelids when removed from the water.

Local Names: Blind sharks.

Remarks: There are two living and monotypic genera in this family: ***Brachaelurus*** Ogilby, 1907 and ***Heteroscyllium*** Regan, 1908, which are confined to Australian inshore coastal waters. The members of this family were included in the family Orectolobidae or Crossorhinidae until Compagno (1973) and Applegate (1974) placed them in their own family Brachaeluridae, which has been followed by various authors including Compagno (1981b, 1982, 1984, 1988), Cappetta (1986), Eschmeyer (1990, 1998), and Last and Stevens (1994), but not Nelson (1976, 1984), Gubanov, Kondyurin and Myagkov (1986), and Carroll (1986), who retain them in the Orectolobidae.

The systematic status of the genera of Brachaeluridae was uncertain until recently and was confounded by nomenclatural problems and doubts on the validity of the species ***Heteroscyllium colcloughi.*** Ogilby (1907) proposed his new genus ***Brachaelurus*** for ***Chiloscyllium modestum*** Günther, 1871 (equals ***Squalus waddi*** Bloch and Schneider, 1801). ***Brachaelurus*** has been uniformly recognized by subsequent authors. Ogilby (1908) proposed a second new genus, ***Cirriscyllium***, for ***C. modestum*** while transferring ***Brachaelurus*** to his new species ***B. colcloughi***. Regan (1908c) noted that as the two species are apparently generically distinct, ***Cirriscyllium*** was a junior synonym of ***Brachaelurus*** Ogilby, 1907 and that a new generic name, ***Heteroscyllium*** Regan, 1908, was necessary to replace ***Brachaelurus*** sensu Ogilby (1908) for the species ***B. colcloughi.***

Ogilby and McCulloch (1908), in a review of Australian Orectolobidae, adapted Regan's arrangement of ***Heteroscyllium*** as a genus for ***B. colcloughi*** and ***Brachaelurus*** as a genus for ***Chiloscyllium modestum*** (= ***Brachaelurus waddi***). Engelhardt (1913), Ogilby (1916), McCulloch and Whitley (1925), Whitley (1934, 1940), Bigelow and Schroeder (1948), Fowler (1967a), Compagno (1973, 1981b, 1982, 1984), and Applegate (1974) all followed this arrangement. Exceptionally and inexplicably Fowler (1967a) listed ***Hemiscyllium trispeculare*** Richardson, 1843 as a species of ***Brachaelurus*** along with ***B. waddi***.

Garman (1913) ranked ***Heteroscyllium*** as a subgenus for ***B. colcloughi*** within ***Brachaelurus***, which also included ***B. modestus***. Fowler (1929), White (1937), and more recently Last and Stevens (1994) placed ***H. colcloughi*** and ***B. modestum*** or ***B. waddi*** in ***Brachaelurus*** but did not recognize ***Heteroscyllium*** as a genus or subgenus. In contrast Fowler (1941) followed Ogilby (1908) in recognizing ***Brachaelurus*** as a genus based on ***B. colcloughi***, but reduced ***Cirriscyllium*** to a subgenus of ***Brachaelurus*** for inclusion of ***B. waddi***.

Whitley (1940) provided the first published illustrations of ***Heteroscyllium colcloughi*** (lateral view and underside of head) and a short diagnosis and description of the species. According to Whitley (1940), the type and only known specimen of ***H. colcloughi*** was a young male 45.7 cm (1.5 ft) long that was no longer preserved (as noted by Ogilby, 1916) and the illustrations (Whitley, 1940, fig. 77, 78) were from sketches of "the type" by A.R. McCulloch made "some years ago". Whitley apparently overlooked the existence of the second, Queensland Museum syntype of ***H. colcloughi*** (QM I-965, designated as lectotype below) as mentioned by Ogilby (1908, 1916) and Ogilby and McCulloch (1908), and which still exists. It is also unclear from Whitley's account if the sketches of the "type" were made from the specimen that was lost (AFAQ no. 410, see species account of ***H. colcloughi*** below) or from QM I-965.

Unfortunately Whitley's illustrations of the "type" of ***H. colcloughi*** are deceptive, leading Compagno (1984) to suggest that ***Heteroscyllium*** differed from ***Brachaelurus*** by lacking a symphysial groove and by having a much longer caudal fin, smaller spiracles well behind eyes, subterminal nostrils, a more anterior anal-fin origin, and a longer anal-caudal space. Dingerkus (1986) followed Whitley (1934, 1940) in suggesting that only a single specimen of ***H. colcloughi*** existed and stated: "Except for its lack of a chin cleft, descriptions of it fall within the variability of ***Brachaelurus waddi.*** Unless other specimens are collected to confirm its existence, I consider ***Heteroscyllium colcloughi*** to be based on an aberrant specimen of ***Brachaelurus waddi*** and thus synonymize ***Heteroscyllium colcloughi*** (Ogilby) under ***Brachaelurus waddi*** (Bloch et Schneider)".

Apart from the Queensland Museum syntype, an additional smaller specimen of ***Heteroscyllium colcloughi*** is preserved in the collection of the Australian Museum, Sydney (P. Last, pers. comm.). Last and Stevens (1994) noted that both ***H. colcloughi*** and ***B. waddi*** had symphysial grooves and were valid species. They considered ***Heteroscyllium*** a synonym of ***Brachaelurus*** on the suggestion that Compagno (1984) had primarily based the separation of the two genera on the symphysial groove character (which is not correct). They also gave a descriptive account of ***H. colcloughi*** and an accurate illustration presumably based on the Australian Museum specimen.

The Queensland Museum has over the past few decades acquired several additional specimens of ***Heteroscyllium colcloughi*** from Moreton Bay near Brisbane, and currently has 13 catalogued lots with all stages from late foetuses to adult females. Several of these specimens were examined by the writer (including the surviving syntype), and compared with specimens of ***Brachaelurus waddi*** during a visit to the Queensland Museum in July 1996. This suggests that a symphysial groove may have been omitted from Whitley's (1940) head sketch of ***H. colcloughi,*** which was otherwise accurate in comparison with specimens of ***H. colcloughi*** (all of which have the symphysial groove present). Also, Whitley's lateral view sketch shows the caudal fin too long and the spiracles are too small and too far from the eyes in comparison with specimens. With spurious characters eliminated, ***H. colcloughi*** can be separated from ***B. waddi*** in its own genus as clearly demonstrated by Ogilby (1908) and as redefined below.

Literature: Ogilby (1907, 1908); Regan (1908a,c); Ogilby and McCulloch (1908); Garman (1913); Whitley (1934, 1940); Fowler (1941); Bigelow and Schroeder (1948); Compagno (1973, 1984); Applegate (1974); Dingerkus (1986); Michael (1993); Last and Stevens (1994).

Key to Genera:

1a. Barbels without expanded posterior flaps; second dorsal fin about as large as first; anal-fin insertion just anterior to lower caudal-fin origin; usually brown above with white spots, no white patches on anterior margins and webs of dorsal fins (Fig. 105) . . . . . ***Brachaelurus***

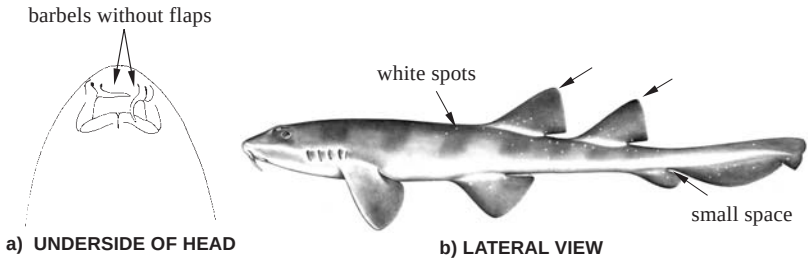


Fig. 105 ***Brachaelurus waddi***

1b. Barbels with expanded posterior flaps at their mid-lengths; second dorsal fin smaller than first; anal-fin insertion separated from lower caudal origin by a space about equal to anal-fin inner margin; usually grey above without white spots, white patches on anterior margins and webs of dorsal fins (Fig. 106) . . . . . ***Heteroscyllium***

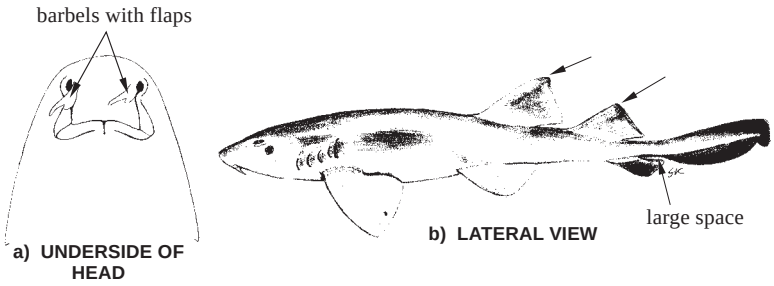


Fig. 106 ***Heteroscyllium colcloughi***

Brachaelurus Ogilby, 1907

Genus: ***Brachaelurus*** Ogilby, 1907, *Proc. R. Soc. Queensland*, 1906, 20: 27.

Type Species: ***Hemiscyllium modestum*** = ***Chiloscyllium modestum*** Günther, 1871, by original designation.

Number of Recognized Species: 1.

Synonyms: Genus ***Cheloscyllium*** Ramsay, 1880: 97, in part. Name only, apparent error for ***Chiloscyllium*** Müller and Henle, 1837. Genus ***Cirriscyllium*** Ogilby, 1908: 2, 4. Type species: ***Chiloscyllium modestum*** Günther, 1871, by original designation. Unjustified replacement for genus ***Brachaelurus*** Ogilby, 1907.

Field Marks: See species account of ***Brachaelurus waddi***.

Diagnostic Features: Head short and flat in adults, head about 19% of total length, maximum head height about 0.6 times head width; head broadly arched in dorsoventral view; snout very short, prenarial snout about 1.5% and preoral snout about 3.2% of total length; snout bluntly rounded in lateral view, with ventral surface of prenarial snout nearly vertical. Eye small and ovate with length about 1.5% of total length; eyes elevated above level of head. Spiracles horizontally situated and ovate, about opposite rear ends of eyes. Nostrils nearly terminal on snout; nasal barbel without an expanded posterior flap at its midlength. Anal-caudal space virtually obsolete and much less than anal-fin inner margin. Denticles large and rough. First dorsal fin with origin usually slightly posterior to middle of pelvic-fin bases; apex posterior to insertion; free rear tip bluntly angular or rounded. Dorsal fins about equal-sized, with similar height and base length. Second dorsal-fin apex posterior to insertion; rear tip bluntly angular. Anal-fin origin about under second dorsal-fin insertion or under last fourth of second dorsal-fin base; anal-fin free rear tip extends well behind dorsal caudal-fin origin. Total vertebral count 140 to 142, precaudal count 88 to 90, monospondylous precaudal count 39 to 40, diplospondylous precaudal count 49 to 50. **Colour:** background colour of the dorsal surface dark brown, with scattered white spots on fins and body; adults with faint saddles but without white blotches on anterior webs of dorsal fins; young without black blotches on posterior dorsal-fin webs and along caudal base but with dark saddles with very narrow transverse light lines between them.

Brachaelurus waddi (Bloch and Schneider, 1801) Fig. 107

Squalus waddi Bloch and Schneider, 1801, *Syst. Ichthyol.*: 130. No type material. Australia?? Whitley, 1934, *Mem. Queensland Mus.* 10(4): 182 considered ***S. waddi*** to be the earliest name for this species, but the description could apply also to ***Chiloscyllium punctatum*** Müller and Henle, 1838. Bloch and Schneider mention an illustration of ***S. waddi*** made by Dr Latham, but unfortunately did not reproduce it in their plates. Whitley (1934) stated: "The type painting was evidently prepared from a specimen collected near Sydney, New South Wales, by Dr Latham, and the description most nearly applies to the 'blind shark', which was later called ***Chiloscyllium modestum*** by Günther and ***C. furvum*** by Ramsay." However, Whitley, 1941, *Fish. Australia* 1: 78, stated that he was unable to find the illustration either in the British Museum (Natural History) or Berlin Museum, and apparently never saw it.

Synonyms: ***Squalus (Scyliorhinus) waddii*** Blainville, 1816: 121 (variant spelling). ***Chiloscyllium modestum*** Günther, 1871: 654, pl. 54. Holotype: British Museum (Natural History), skin of 52 cm (20.5 in) female. ***Cheloscyllium furvum*** Ramsay, 1880: 97. Name only (*nomen nudum*), possibly quoted from a personal communication to him by W. Macleay, genus apparently an error for ***Chiloscyllium*** Müller and Henle, 1837. According to Ramsay (1880): "A new species, closely allied to ***C. modestum*** Günth.". ***Chiloscyllium furvum*** Macleay, 1881a: 364 (description); also Macleay, 1881b: 300 (verbatim copy of earlier work). No type material mentioned, type locality "Port Jackson" [= Sydney Harbour]. ***Chiloscyllium fuscum*** Parker and Haswell, 1897: 135. No type material, Australia, possible error for ***C. furvum***?

Other Combinations: ***Brachaelurus modestum*** (Günther, 1871).

FAO Names: En - Blind shark; **Fr** - Requin aveugle des roches; **Sp** - Tiburón ciego de roca.

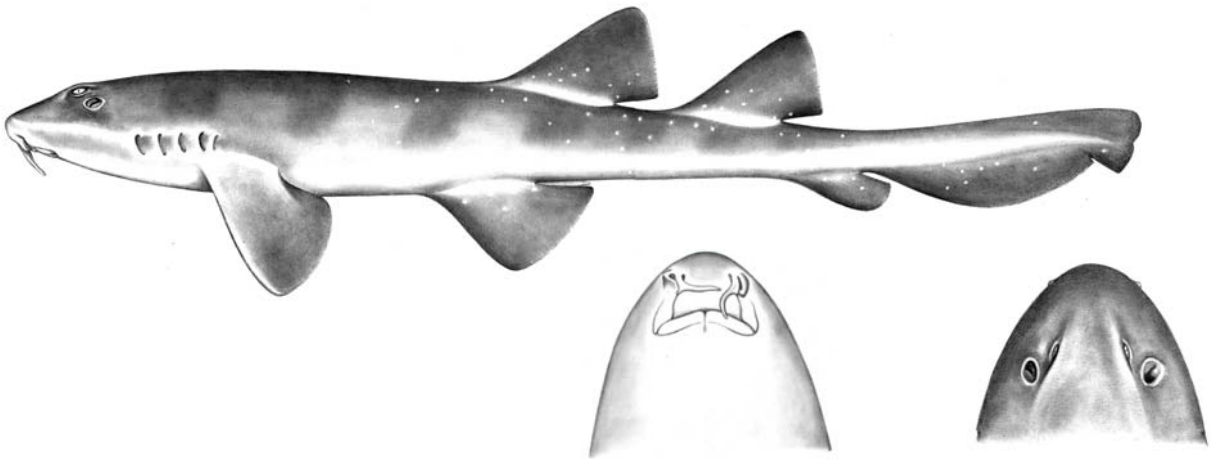
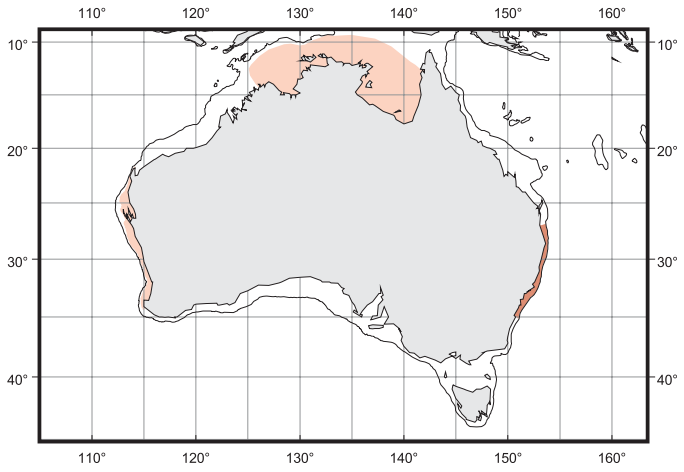


Fig. 107 ***Brachaelurus waddi***

Field Marks: A small stout shark with long tapering barbels, nasoral grooves and circumnarial grooves, very large spiracles, a short mouth ahead of the eyes, a median symphysial groove on the chin, no dermal lobes on sides of head, two equal-sized spineless dorsal fins and an anal fin, the first dorsal-fin origin over the pelvic-fin bases, a short precaudal tail and short caudal fin, and colour blackish to light brown above with or without darker saddles, light yellowish on underside, usually with many small white spots.

Diagnostic Features: See genus ***Brachaelurus*** above.

Distribution: Confined to the western South Pacific off eastern Australia (southern Queensland and New South Wales from Moreton Bay near Brisbane south to Jervis Bay). Records from Western Australia and northern Territory need confirmation.



Habitat: An inshore bottom shark of temperate Australian waters, often close inshore in tidepools that are barely deep enough to cover it and at the surf line but occasionally down to about 73 m and exceptionally to about 137 m. It favours rocky shoreline areas, patches of seaweed and coral reefs. Adults occur in caves and under ledges during the day, while juveniles may be in shallow areas with wave surge in crevices and under ledges.

Biology: A common sluggish shark that is night-active but will take angler's baits during the daytime. Development ovoviviparous, with 7 or 8 young in a litter. Said to breed in summer (November in the Sydney area). Feeds on small reef invertebrates, including crabs, shrimp, cuttlefish, squid and sea anemones, and small fishes; a coralline alga was found in the stomach of one shark. Termed 'blind shark' by anglers because it retracts its eyeballs, which causes its thick eyelids to close, when removed from the water. It can apparently live a long time out of water.

Size: Maximum exceptionally to between 90 and 122 cm, most individuals smaller; an adult male was 62 cm long and an adult female, 66 cm; size at birth 15 to 18 cm.

Interest to Fisheries and Human Impact: A harmless and hardy shark that thrives in aquaria. Taken offshore in bottom trawls but not utilized commercially. Commonly caught by sports anglers with rod-and-reel from shore in rocky areas, off reefs, and in seaweed patches, particularly around Sydney and in southern Queensland. Regarded as a pest by anglers, because it sucks in baited hooks which are hard to remove from its pharynx through its small mouth and strong jaws. It may nip people when provoked. Its flesh is regarded as unpalatable because of an ammoniacal taste that is not readily removed by soaking in seawater. The conservation status of this shark is uncertain.

Local Names: Brown cat-shark, Catshark or Cat shark, Dusky dogfish.

Remarks: Whitley (1934: 182) suggested that ***Squalus waddi*** is the earliest name for the Australian 'blind shark', which Bloch and Schneider described from an illustration of an Australian shark by Dr John Latham. Although there are problems with this interpretation (see species name above) Whitley's substitution of ***waddi*** for ***modestum*** (which had universal use prior to Whitley's note) for this species has been widely followed by subsequent authors.

Literature: Waite (1901); Whitley (1940); Fowler (1941, 1967a); Stead (1963); Grant (1972, 1982); Shiino (1976); Compagno (1984); Dingerkus (1986); Last and Stevens (1994).

Heteroscyllium Regan, 1908

Genus: ***Heteroscyllium*** Regan, 1908c, *Ann. Mag. Nat. Hist.*, (8), 2(11): 455.

Type Species: ***Brachaelurus colcloughi*** Ogilby, 1907, by original designation. Replacement name for genus ***Brachaelurus*** Ogilby, 1908.

Number of Recognized Species: 1.

Synonyms: Genus ***Brachaelurus*** Ogilby, 1908: 2, 3. Type species: ***Brachaelurus colcloughi*** Ogilby, 1908, by original designation. A junior homonym of genus ***Brachaelurus*** Ogilby, 1907.

Field Marks: See ***Heteroscyllium colcloughi*** below.

Diagnostic Features: Head long and slightly flattened in adults, about 22% of total length and with maximum head height 0.7 to 0.8 times head width; head narrowly arched and parabolic in dorsoventral view. Snout moderately long, prenarial snout about 2.5% and preoral snout about 5.4 to 6.0% of total length; snout wedge-shaped in lateral view, with ventral surface of prenarial snout nearly horizontal. Eyes large and elongated-fusiform with length 2.4 to 2.5% of total length in adults; eyes not elevated above level of head. Spiracle rounded, lateral and vertical on head, just behind eyes. Nostrils ventral and well behind snout tip; nasal barbel with an expanded, hooked or rounded posterior flap at its midlength. Anal-caudal space elongated, about equal to anal-fin inner margin. Denticles small and smooth. First dorsal-fin origin usually anterior to middle of pelvic-fin bases; apex anterior to insertion; free rear tip acutely angular. Second dorsal fin noticeably smaller than first and with height and base length less than 0.9 times first dorsal fin. Second dorsal-fin apex anterior to insertion; free rear tip acutely angular. Anal-fin origin about under midbase to second third of second dorsal fin; free rear tip just reaches lower caudal origin. Total vertebral count 117 to 120, precaudal count 69 to 73, monospondylous precaudal count 30 to 35, diplospondylous precaudal count 36 to 39. **Colour:** background colour of the dorsal surface light grey-brown, sometimes golden brown, without white spots on fins and body; adults plain with indistinct saddles and white blotches on anterior webs of dorsal fins; young have conspicuous black blotches on posterior dorsal-fin webs and along base of caudal fin and dark saddles with broad light spaces between them.