9. ORDER CARCHARHINIFORMES - GROUND SHARKS

Order Carcharhiniformes Compagno, 1973, J.Linn.Soc.(Zool.)London, 53, suppl. 1

Synonymy : Order Asterospondyli: Gill, 1893 (in part), Fowler, 1941 (in part), Smith, 1949 (in part). Order Asterospondyli, Suborder Galei: Jordan & Evermann, 1896 (in part). Order Carcharhinida: Glikman, 1967 (in part). Order Carcharhiniformes: Rass & Lindberg, 1971 (in part), Applegate, 1974. "Group" Carcharinoidei: Garman, 1913 (in part). "Group" Catuloidei: Garman, 1913 (in part). Order Euselachii, Suborder Galei: Jordan, 1923 (in part), Whitley, 1940 (in part). Order Euselachii, Suborder Galeoidei: Blot, 1969 (in part). Order Galea, Suborder Carcharhinida: White, 1936, 1937. Suborder Galei: Gill, 1872 (in part). Order Galeiformes, Suborder Carcharhinoidei: Arambourg & Bertin, 1958. Suborder Galeiformes:. Lozano Rey, 1928 (in part), Budker & Whitehead, 1971 (in part). Suborder Galeoidea: Romer, 1945, 1966 (in part), Bigelow & Schroeder, 1948 (in part), Norman, 1966 (in part). "Division" Galeoidei: Regan, 1906. Suborder Galeoidei: Engelhardt, 1913. Suborder Galeorhinina: Fowler, 1967b. Order Lamniformes, Suborder Scyliorhinoidei: Berg, 1940, Berg & Svedovidov, 1955, Patterson, 1967. Suborder Lamniformes: Bertin, 1939 (in part). Suborder Lamnina: Matsubara, 1955 (in part). Order Lamnoidea, Suborder Scyliorhinoidea: Schultz & Stern, 1948. Suborder Musteliformes: Bertin, 1939 (in part). Suborder Plagiostomi Asterospondyli: Hasse, 1879 (in part). Suborder Scyliorhinoidei: Lindberg, 1971, Nelson, 1976. Suborder Scylliiformes: Bertin, 1939 (in part). Suborder Scyllioidei: Goodrich, 1909. Suborder Squali: Gill, 1868 (in part).

Diagnostic Features : Trunk cylindrical to slightly compressed or depressed but not raylike. Head conical to depressed and usually not anteriorly expanded, except for the prebranchial head in Sphyrnidae; 5 pairs of gill slits present on sides of head (partly dorsolateral in some Scyliorhinidae), with the last l to 3 over pectoral bases; spiracles present in many species, small to large and close behind eyes, or absent; nostrils usually without barbels and nasoral grooves and always without circumnarial grooves, barbels when present developed from anterior nasal flaps rather than from lateral surfaces of flaps, anterior nasal flaps varying from well separated from mouth to overlapping it posteriorly; eyes lateral or dorsolateral on head, with true nictitating lower eyelids; snout varying from very short to moderately long and almost bladelike, but not greatly elongated and not formed as a rostral saw with lateral teeth and barbels; mouth moderately large to very large, arched, and extending behind anterior ends of eyes; labial furrows varying from large and on both jaws to absent; teeth variably differentiated along jaws, but usually without enlarged molariform posterior teeth and with anterior teeth not separated by small intermediate teeth or a gap from the lateral teeth. Two dorsal fins (possibly only one in Pentanchus, family Scyliorhinidae), without spines, the first with origin varying from over the gill slits to behind the pelvic bases; pectoral fins moderate-sized to large but not raylike, without triangular anterior lobes; pelvic fins small to moderately large, with vent continuous with their inner margins; anal fin present; caudal fin with a long dorsal lobe but with ventral lobe varying from long (but considerably shorter than the dorsal lobe) to absent; vertebral axis raised into the dorsal caudal lobe. Intestinal valve of spiral or scroll type.

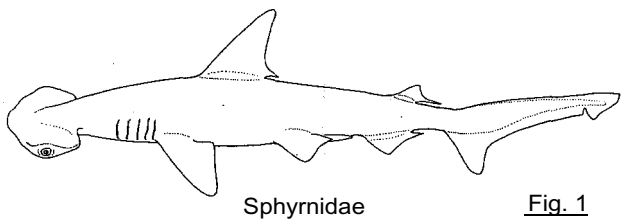
Key to Families

1a. Head with lateral, bladelike expansions (Figs 1,2a) – Hammerhead sharks ..... **Family Sphyrnidae**

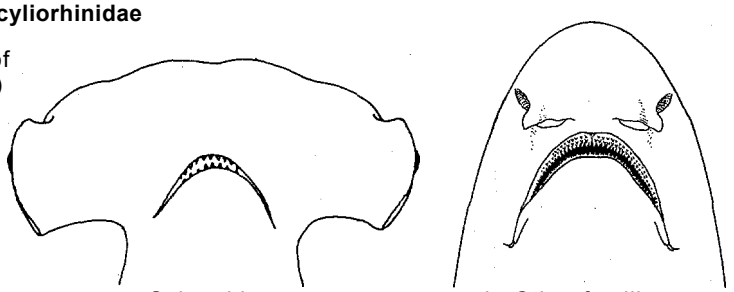
1b. Head normal, without lateral expansions (Fig. 2b)

2a. First dorsal fin base opposite (Fig. 3) or behind (Fig. 4) pelvic bases – Catsharks ..... **Family Scyliorhinidae**

2b. First dorsal base in front of pelvic bases (Figs 8,10,11,14,15)

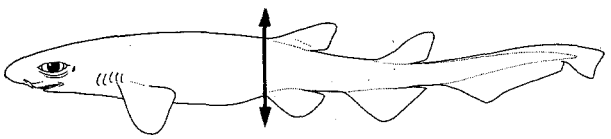


Sphyrnidae Fig. 1

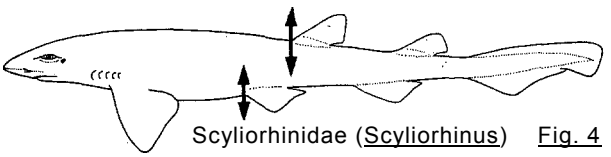


a. Sphyrnidae b. Other families

underside of head Fig. 2

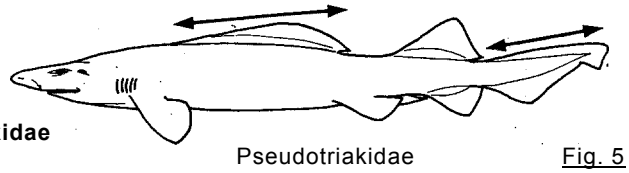


Scyliorhinidae (Parmaturus) Fig. 3



Scyliorhinidae (Scyliorhinus) Fig. 4

3a. First dorsal fin low, elongated, and keel-like, as long as, or slightly longer than the caudal fin (Fig. 5). Over 200 rows of teeth in either jaw - False catsharks ..... **Family Pseudotriakidae**



Pseudotriakidae Fig. 5

3b. First dorsal fin high, relatively short, and not keel-like, usually shorter than the caudal fin (except in Gogolia of Family Triakidae)

4a. Precaudal pits absent. Dorsal caudal margin not undulated (Fig. 6)

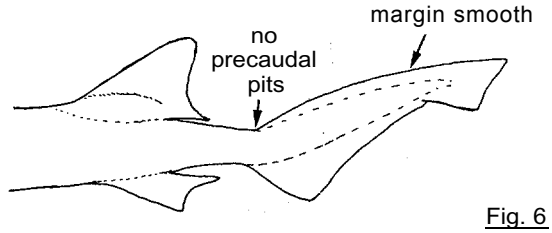
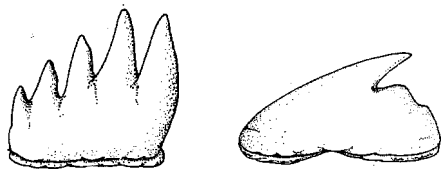


Fig. 6

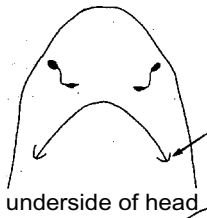
5a. Posterior teeth on dental bands comblike (Fig. 7a). Labial furrows very short or absent, when present confined to mouth corners (Fig. 8) - Finback catsharks ..... **Family Proscylliidae**

5b. Posterior teeth on dental bands not comblike (Fig. 7b): Labial furrows relatively long with uppers extending partway or all the way anterior to level of symphysis (Fig. 9)



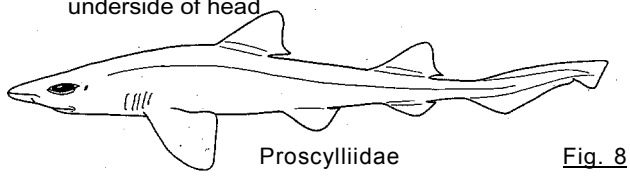
a. Proscylliidae b. (Triakidae)
lower posterior tooth Fig. 7

6a. Anterior nasal flaps formed as slender barbels. Upper labial furrows extremely long, nearly equal to internarial and over half mouth width (Fig. 9a). Intestinal valve with 14 to 16 turns. No supraorbital crests on cranium (Fig. 10) - Barbeled houndsharks .... **Family Leptochariidae**

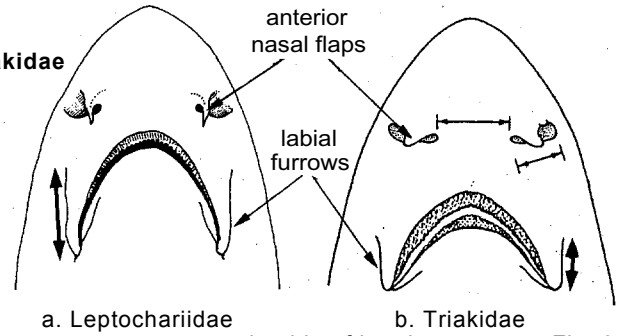


underside of head

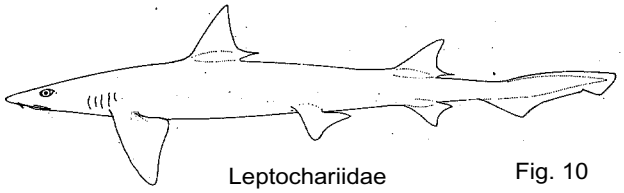
6b. Anterior nasal flaps usually not barbel-like (except for Furgaleus). Upper labial furrows shorter, considerably less than internarial and less than half of mouth width (Fig. 9b). Intestinal valve with 4 to . 10 turns. Supraorbital crests present on cranium* (Fig. 11) - Houndsharks ..... **Family Triakidae**



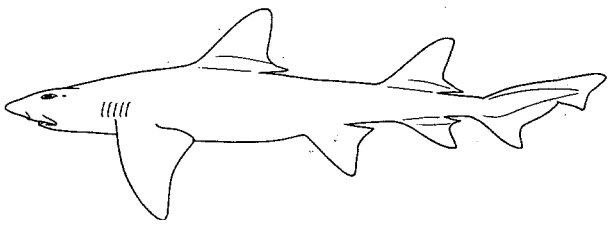
Proscylliidae Fig. 8



a. Leptochariidae b. Triakidae
underside of head Fig. 9



Leptochariidae Fig. 10



* Often revealed externally as a hard ridge over each eye, but some species may require dissection to show the crest

4b. Precaudal pits present. Dorsal caudal margin undulated (Fig. 12)

7a. Intestinal valve of spiral type (Fig. 13a) - Fig. 14 - Weasel sharks..... **Family Hemigaleidae**

7b. Intestinal valve of scroll type (Fig. 13b) - Fig. 15 - Requiem sharks .... **Family Carcharhinidae**

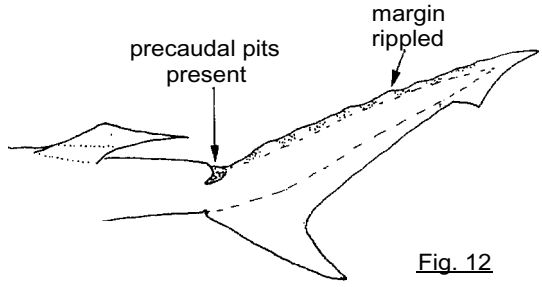


Fig. 12

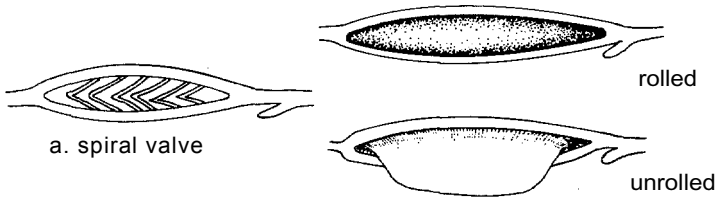
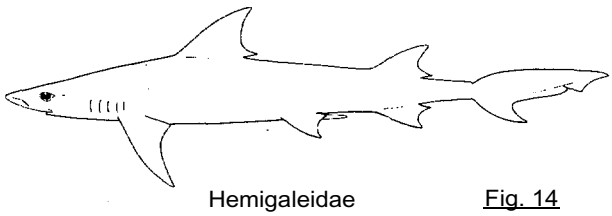
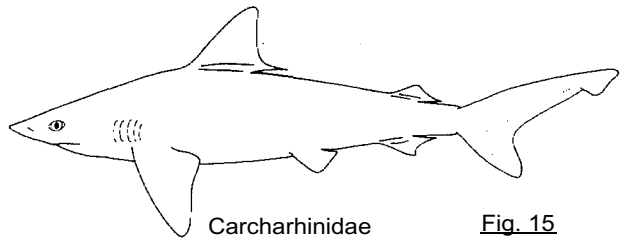


Fig. 13



Hemigaleidae Fig. 14



Carcharhinidae Fig. 15

9.1 FAMILY SCYLIORHINIDAE Gill, 1862

SCYL

Family Scylliorhinoidae Gill, 1862, Ann.Lyceum Nat.Hist.N.Y., 7(32):393; emended to Family Scyliorhinidae by Jordan & Fowler (1903).

Synonymy : Family Scyllia or Scyllium Müller & Henle, 1838; Family Pentachidae Smith & Radcliffe, 1912; Family Catulidae Garman, 1913; Subfamily Galeinae Fowler, 1934 (Family Scyliorhinidae); Family Halaeluridae White, 1936; Family Atelomycteridae White, 2936; Subfamily Cephaloscylliinae Fowler, 1947 (Family Scyliorhinidae).

FAO Names : En - Catsharks; Fr - Chiens, Holbiches, Roussettes; Sp - Alitanes, Pejegatos, Pintarrojas.

Field Marks : Usually elongated, catlike eyes with nictitating eyelids; nostrils usually without nasoral grooves but, when present, these are broad and shallow; mouth long, arched and reaching past anterior ends of eyes; small cuspidate teeth. Two small, spineless dorsal fins and an anal fin, the first dorsal base over or behind pelvic bases, no precaudal pits, and the caudal fin without a strong ventral lobe or lateral undulations on its dorsal margin.

Diagnostic Features : Head without laterally expanded blades; eyes elongated and fusiform, oval, or slitlike, their length over 1.5 times the height; nictitating eyelids rudimentary; spiracles present and moderately large; anterior nasal flaps variably shaped, but not barbel-like, except for one genus (Poroderma) with a barbel formed from a separate ridge on each anterior nasal flap; internarial width about 0.6 to 1.3 times nostril width; labial furrows absent or very short to very long; teeth small, with acute narrow cusps, often lateral cusplets, and basal ledges, not bladelike, and similar in both jaws; posterior teeth comblike or not; tooth rows 40 to 101/34 to 111. Precaudal pits absent. First dorsal fin small and not keel-like, much shorter than caudal fin; first dorsal base over or behind pelvic bases, its origin either slightly ahead of pelvic origins (Cephalurus) or well behind them; midpoint o€ first dorsal base always posterior to pelvic origins; pectoral fins with radials confined to bases of fins; ventral caudal lobe absent or very weak; no undulations or ripples in dorsal caudal margin. Neurocranium with or without a supraorbital crest. Vertebral centra with or without strong, wedge-shaped intermedial calcifications. Valvular intestine with a spiral valve of 5 to 21 turns. Many species with variegated colour patterns, some without them. Development usually oviparous, but some species ovoviviparous.

Habitat, Distribution and Biology : This is by far the largest family of sharks, with a broad worldwide geographic range in tropical to cold-temperate and arctic waters; catsharks occur from the intertidal zone to the edges of the continental and insular shelves and down the slopes to depths greater than 2000 m. Catsharks are generally found on or near the bottom in coastal waters inshore and offshore; none are oceanic, although some deepwater species may range a considerable distance off the bottom. Most species are small, less than 80 cm long, and while some may be mature at about 30 cm, a few may reach about 1.6 m length. Catsharks are generally weak swimmers and do not migrate over great distances; this is shown in their geographic distribution, which is often much more localized than that of families with strong swimming species. Some inshore species are nocturnal, sleeping often in groups in rocky crevices in day-time and dispersing to feed at night. Many species show the primitive single oviparity, in which only one fertilized egg enters each oviduct and is deposited on the substrate at a time; the large eggs, encapsulated in tough egg-cases with corner tendrils to anchor them, have most of their embryonic development outside the mother shark and may take nearly a year to produce a hatchling shark. Others possibly in areas of intense egg predation, have multiple oviparity, in which several encased eggs remain in the oviducts for an extended period, during which time the embryos develop to advanced stages before the eggs are laid; such eggs may hatch in less than a month. Still other species have eliminated oviparity altogether and are ovoviviparous, retaining the eggs until the young are ready to be born. Catsharks feed chiefly on invertebrates and small fishes, and are harmless to people. Most species are very poorly known biologically.

Interest to Fisheries : A minority of the species in this family are of importance to fisheries, particularly the spotted catsharks (Scyliorhinus) of the eastern Atlantic, which are much utilized for human food. Some are rather common and regularly taken as a bycatch in the trawl fisheries worldwide, and may be used for fishmeal and oil. Many are deepwater sharks, and are not known to be utilized to .any great extent, although they may be a minor component of the catch of large, deep-fishing offshore trawlers. Several inshore species are commonly caught by sportfishers.

Remarks : The present arrangement of this family follows the revision of the Scyliorhinidae by Springer (1979) in most details.

Fowler (1941) placed the dubious genus Caninoa Nardo, 1841, with Thalassokephetes Gistel, 1848 a junior synonym, in the family Scyliorhinidae, on the possibility that it may be a one-dorsaled catshark like Pentanchus profundicolus. I follow Tortonese (1952) in considering Caninoa and its single species C. chiereghini dubious and possibly mythical shark taxa, that are not placeable in modern shark families.

Smith & Radcliffe (1912) proposed a new family for their new genus and species of one dorsal-finned shark, Pentanchus profundicolus, on the assumption that the species was a hexanchoid with five gill openings. However, Regan (1912), Garman (1913), and subsequent writers noted that Pentanchus profundicolus was a scyliorhinid, the genus Pentanchus was close to Apristurus or a senior synonym of it, and that the Pentanchidae was a junior synonym of the Scyliorhinidae.

The following nomina nuda, named by Blainville (1816) and placed in his subgenus Scyliorhinus (Genus Squalus) may refer either to scyliorhinids or orectoloboids: Squalus myops, S. breviculus, S. punctatus, S. punctulatus, S. unicolor, S. variegatus, S. lambarda.

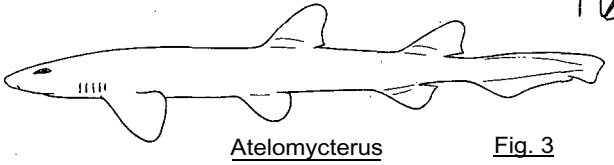
Key to Genera

1a. Supraorbital crests present on cranium, above eyes (Fig. la)

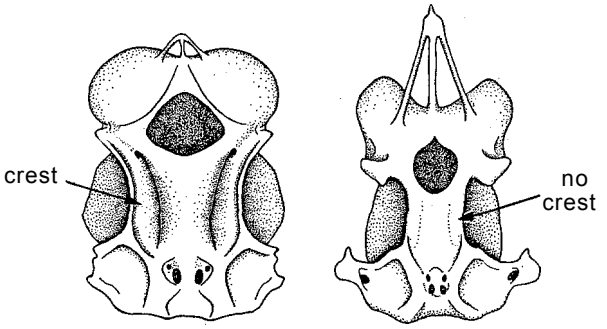
2a. Second dorsal fin about as large as first (Figs 3 to 5)

3a. Anterior nasal flaps greatly expanded, reaching mouth; nasoral grooves present (Fig. 2a) ..... **Atelomycterus** (Fig. 3)

3b. Anterior nasal flaps not expanded and not reaching mouth; nasoral grooves absent (Fig. 2b,c)

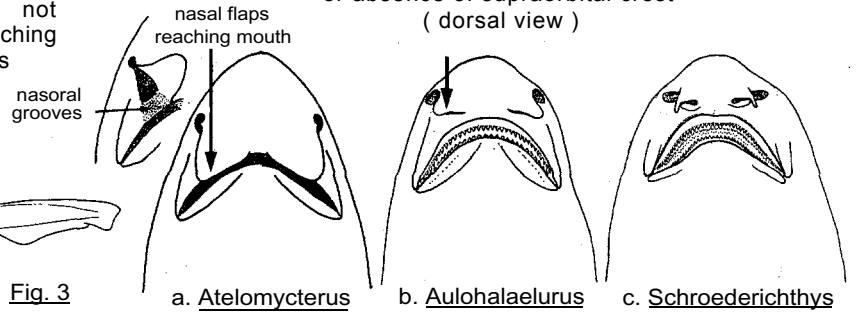


Atelomycterus Fig. 3



a. (Cephaloscyllium) b. (Galeus)

crania showing presence or absence of supraorbital crest (dorsal view) Fig. 1



a. Atelomycterus b. Aulohalaelurus c. Schroederichthys

underside of head Fig. 2

4a. Labial furrows very long, uppers reaching level of upper symphysis (Fig. 2b) ..... **Aulohalaelurus** (Fig. 4)

4b. Labial furrows shorter, uppers not reaching level of upper symphysis (Fig. 2c) ..... **Schroederichthys** (Fig. 5)

2b. Second dorsal fin considerably smaller than first (Figs 7 to 9)

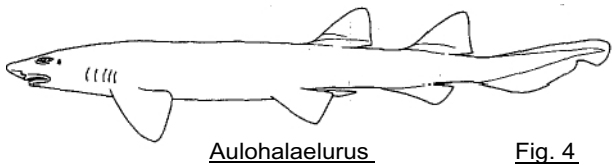
5a. Labial furrows absent or rudimentary (Fig. 6a) ..... **Cephaloscyllium** (Fig. 7)

5b. Labial furrows present on one or both jaws (Fig. 6b,c)

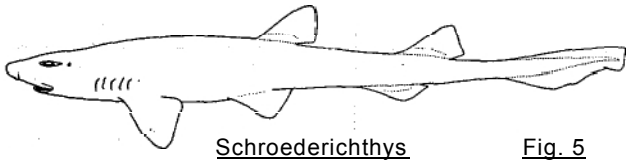
6a. Anterior nasal flaps trilobate, with prominent barbels. Short upper labial furrows present in addition to lowers (Fig. 6b)..... **Poroderma** (Fig. 8)

6b. Anterior nasal flaps entire, without barbels or at most medial projections. Lower labial furrows present, uppers absent (Fig. 6c).. **Scyliorhinus** (Fig. 9)

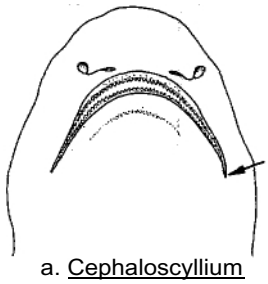
1b. Supraorbital crests absent from cranium (Fig. 1b)



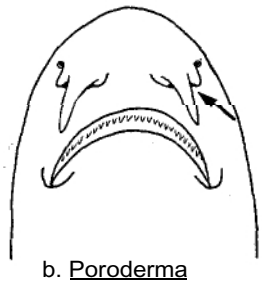
Aulohalaelurus Fig. 4



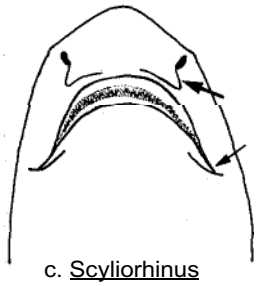
Schroederichthys Fig. 5



a. Cephaloscyllium

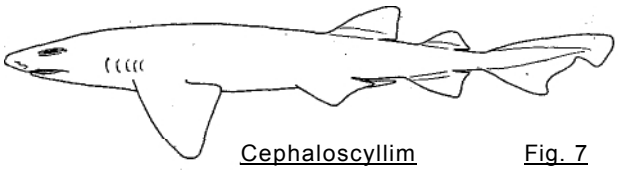


b. Poroderma

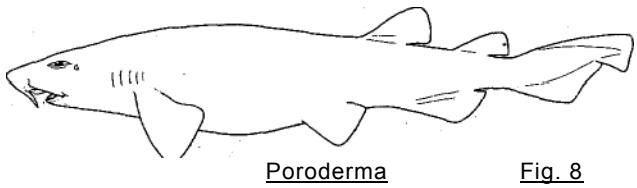


c. Scyliorhinus

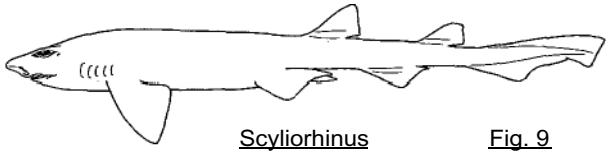
underside of head Fig. 6



Cephaloscyllim Fig. 7



Poroderma Fig. 8



Scyliorhinus Fig. 9

7a. Head broadly flattened and spatulate, snout elongated and usually longer than mouth width. Labial furrows very long, uppers reaching upper symphysis (Fig. 10a)

8a. One dorsal fin (Fig. 11) ..... **Pentanchus**

8b. Two dorsal fins (Fig. 12) ..... **Apristurus**

7b. Head moderately or little-flattened, not spatulate, snout equal or usually shorter than mouth width. Labial furrows shorter or absent, when present not reaching upper symphysis (Fig. 10b)

9a. Dorsal caudal margin, and sometimes preventral margin, with a crest of enlarged denticles (Fig. 13a)

10a Pectoral fins relatively large, width of their posterior margins usually larger than mouth width. Subocular ridges obsolete or nearly so, eye lateral. Body firm. Colour pattern of blotches and spots often present (Fig. 14). **Galeus**

10b Pectoral fins relatively small, width of their posterior margins usually smaller than mouth width. Subocular ridges well-developed, eyes dorsolateral. Body soft. Colour plain, no pattern (Fig. 15) ..... **Parmaturus**

9b. No caudal crests of denticles (Fig. 13b)

11a. Head and especially branchial region greatly enlarged, giving adults a tadpole-shape. Origin of first dorsal fin slightly anterior to pelvic origins (Fig. 16)..**Cephalurus**

11b. Head not greatly enlarged, adults not tadpole-shaped. Origin of first dorsal fin posterior to pelvic origins

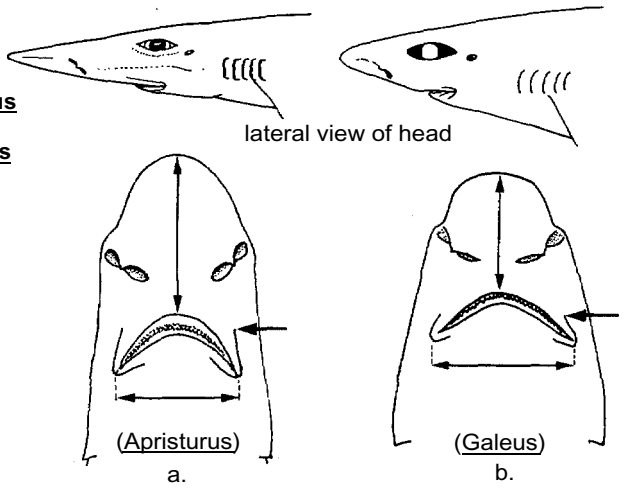
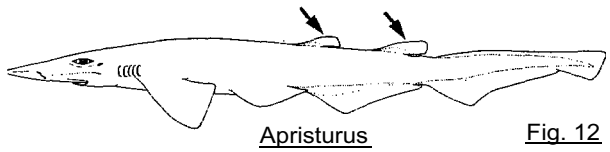
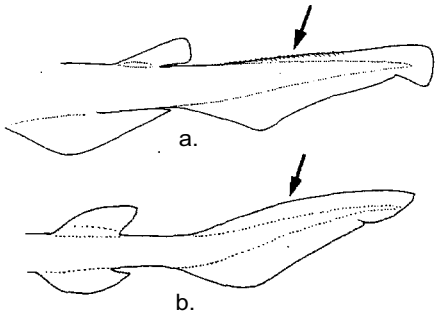


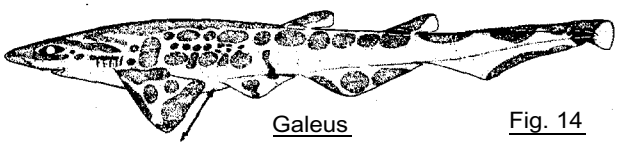
Fig. 10

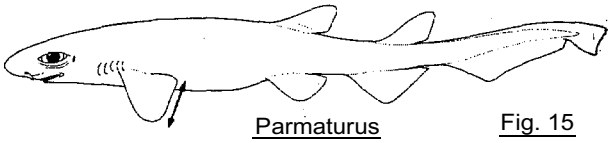

Pentanchus Fig. 11

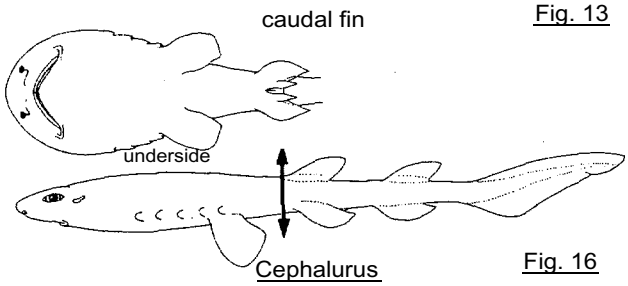

Apristurus Fig. 12



caudal fin Fig. 13


Galeus Fig. 14


Parmaturus Fig. 15



Cephalurus Fig. 16

12a. Anterior nasal flaps greatly enlarged, overlapping mouth; nasoral grooves present (Fig. 17a) ..... **Haploblepharus** (Fig. 18)

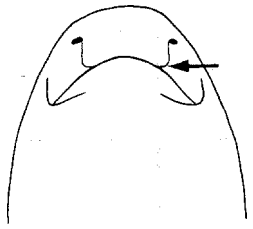
12b. Anterior nasal flaps not enlarged and not overlapping mouth; no nasoral grooves (Fig. 17b,c)

13a. Head very broad. Labial furrows absent. Small black dots on underside of head (Fig. 17b) ..... **Holohalaelurus** (Fig. 19)

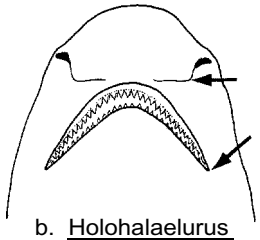
13b. Head narrower. Labial furrows usually present. No black dots, or larger dark spots, on underside of head (Fig. 17c)

14a. Adult males without inner margins of pelvic fins fused over claspers. Either no colour pattern or, if pattern is present, gill slits elevated above level of mouth and snout pointed ..... **Halaelurus** (Fig. 20)

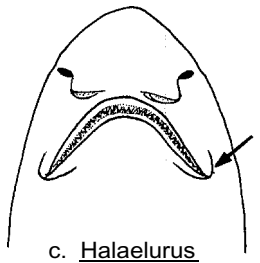
14b. Adult males with inner margins of pelvic fins fused over claspers, forming an "apron". A colour pattern of spots present, but gill slits not elevated and snout rounded (Fig. 21) ..... **Asymbolus**



a. Haploblepharus

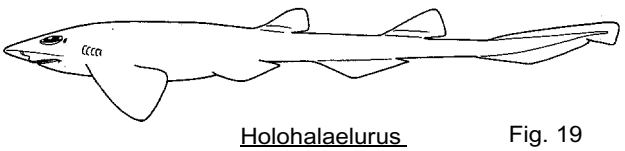


b. Holohalaelurus

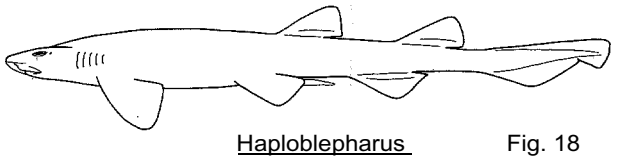


c. Halaelurus

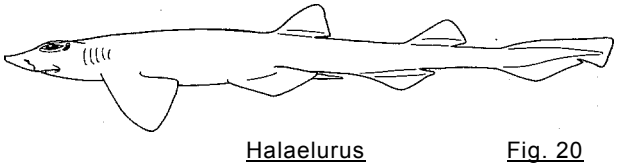
underside of head Fig. 17



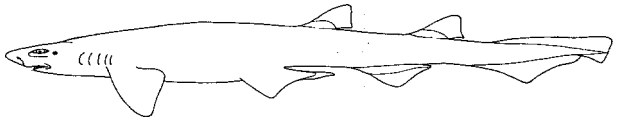
Holohalaelurus Fig. 19



Haploblepharus Fig. 18



Halaelurus Fig. 20



Asymbolus Fig. 21

Apristurus Garman, 1913

SCYL Aprist

Genus : Apristurus Garman, 1913, Mem.Mus.Comp.Zool.Harv.Coll., 36:96.

Type Species : Scylliorhinus indicus Brauer, 1906, by original designation.

Synonymy : Genus Pentanchus Smith & Radcliffe, 1912 (see discussion under that genus); Genus Apristurius Schultze, Kuekenthal & Heider, 1926 (error); Subgenus Parapristurus Fowler, 1934 (Genus Pentanchus); Subgenus Compagnoia Springer, 1979 (Genus Parmaturus).

Field Marks: Scyliorhinids with "the Apristurus look" - Long laterally expanded snout and head, enlarged nostrils with reduced anterior nasal flaps, very long labial furrows, small rear-sited, spineless dorsal fins, very large, elongated anal fin separated from elongated caudal by a notch only, and uniform coloration.

Diagnostic Features : Body not tadpole-shaped, stocky and more or less compressed, increasing in height up to the pectoral and trunk region and tapering posteriorly; body very soft and flabby, with thin skin and weakly calcified dermal denticles; stomach not inflatable; tail short, length from vent to lower caudal origin about 2/5 to 3/5 of snout-vent length. Head greatly depressed, pointed and wedge-shaped in lateral view, rather elongated, but usually slightly less than 1/4 of total length in adults; snout elongated, about equal to mouth width or greater, greatly flattened, narrow and pointed in lateral view; snout expanded laterally, narrowly spade-shaped to broadly spatulate and usually more or less bell-shaped in dorsoventral view; ampullal pores enlarged and prominent on snout; nostrils more or less enlarged, with incurrent and excurrent apertures broadly open to exterior; anterior nasal flaps reduced to angular lobes, without barbels, widely separate from each other and falling far anterior to mouth; internarial space 0.8 to 1.7 times the nostril width; no nasoral grooves; eyes dorsolateral on head, broad subocular ridges present below eyes; mouth angular or broadly arched, with lower symphysis well behind upper so that upper teeth are exposed in ventral view; labial furrows present along both upper and lower jaws, these long and reaching nearly or quite to level of upper symphysis of mouth; branchial region not greatly enlarged, distance from spiracles to fifth gill slits less than half head length; gill slits lateral on head. Two dorsal fins present, equal-sized or with the second dorsal larger than the first; origin of first dorsal varying from over the pelvic midbases to over the pelvic free rear tips; origin of second dorsal about over or slightly behind the anal midbase, anal fin enlarged and more or less elongated, larger than pelvic and dorsal fins, base length at least twice second dorsal base; origin of anal just behind pelvic bases, and insertion separated from lower caudal origin by a narrow notch; pectoral fins variable in size, their width less to greater than mouth width; inner margins of pelvic fins not fused over claspers in adult males; claspers short, thick, and distally pointed, not extending more than 2/3 of their lengths behind the pelvic fin tips and sometimes not extending past their tips. Caudal fin more or less elongated, over a fifth and often over a fourth of total length. A crest of enlarged denticles absent or variably developed on the dorsal caudal margin; supraorbital crests absent from cranium. No colour pattern, uniformly jet black, brownish-black, brown, pinkish or whitish.

Remarks : This is one of the largest and perhaps least known of shark genera, having some 25 described species and several unnamed taxa. Springer (1966, 1979) recently revised the genus while Nakaya (1975) reviewed the Japanese species. Despite their efforts, several species are of uncertain validity, with over a third of the species known from the holotypes only, at least four species having the holotypes lost, and less than a third of the species known from modest to good series of specimens. Judging from the frequency that new species are discovered, the wide geographic range of the genus, and the paucity of knowledge: of slope faunas in many areas of the world, this may eventually become the largest genus of sharks.

The present treatment of Apristurus contains much new data and differs from Springer's (1979) revision in a number of ways; but most importantly it includes three species placed by him in separate genera. A. spongiceps was placed by Springer in the genus Parapristurus, raised in rank from a subgenus proposed by Fowler 1934. It was primarily distinguished from Apristurus by its pleated gills and throat, but although no Apristurus have pleats and grooves on their gills, several have them on their throats, including A. manis, A. riveri photo in Springer, 1979, fig. 18), and a possibly undescribed Galapagos-Peruvian species close to A. stenseni. Also, other species of Apristurus including A. kampae, A. manis, and A. microps approach A. spongiceps in its unusually stocky body and high rounded fins. The writer prefers to retain Parapristurus in Apristurus, and thinks it may be worthy of subgeneric ranking at best.

Springer's earlier (1966) revision of western Atlantic Apristurus included a species with a crest of enlarged denticles on its caudal fin, which he termed A. profundorum. However, he later (Springer, 1979) noted that two species were confused under this name, the true profundorum without a crest and a new species with a crest. This latter he placed in Parmaturus rather than Apristurus, as P. manis, along with a second new species, P. stenseni, in the new subgenus Compagnoia.

Compagnoia was an anomaly within Parmaturus because although it supposedly agreed with that genus and differed from Apristurus in its supracaudal crest, its members otherwise closely resembled Apristurus species and not typical Parmaturus (such as P. pilosus and P. xaniurus) in their long, laterally expanded snouts and heads, enlarged nostrils, long labial furrows, compressed bodies, long low anal fins separated by a notch from the caudal fin, and long narrow caudal fins. Investigation of the caudal fins of Apristurus species by the writer showed that caudal crests are not confined to manis and stenseni, but are variably developed in A. canutus, A. investigatoris, A. microps, A. parvipinnis, the true A. profundorum, and at least two apparently undescribed species. Rather than placing these species in an increasingly heterogeneous Parmaturus, I prefer to transfer the subgenus Compagnoia to Apristurus, and place manis and stenseni in that genus. Those Apristurus with caudal crests are sufficiently heterogeneous so as not to warrant their inclusion in the subgenus Compagnoia as distinct from all other Apristurus. A. microps and A. profundorum are isolated in the genus and not particularly close to either A. manis or A. stenseni, A. canutus and A. parvipinnis are closest to A. platyrhynchus and A. verweyi, while A. investigatoris is apparently close to A. indicus. A. stenseni appears to be not particularly close to A. manis but forms a species groups or superspecies with A. riveri, A. kampae, a possibly new Galapagos-Peruvian species, a whitish species from the eastern Atlantic (possibly A. atlanticus), and a possibly new dark western Atlantic species. If the subgenus Compagnoia is recognized it would be best utilized for its type alone, the distinctive and isolated A. manis.

Key to Species

1a. First dorsal fin much smaller than second, about half its area or less, with its origin usually behind pelvic insertions but over last fourth of pelvic bases in some species

2a. Origin of first dorsal somewhat in front of pelvic insertions

3a. Nostrils small, internarial space 1.5 times their width or more. Mouth very long, expanded in front of eyes. Gill slits enlarged, the widest nearly equal to length of eyes in adults ..... **A**. **riveri**

3b. Nostrils larger, internarial space about equal to their width. Mouth short, not expanded in front of eyes. Gill slits short, the widest much less than eye length

4a. Prenarial snout angular. Gill septa with medial projections. Distance between pectoral and pelvic bases long, at least length of prespiracular, rear tips of pectoral fins far in front of pelvic origins ..... **A**. **sinensis**

4b. Prenarial snout broadly rounded. Gill septa incised, without medial projections. Distance between pectoral and pelvic bases extremely short, less than preoral snout, rear tips of pectoral fins about opposite or just in front of pelvic origins ..... **A**. **herklotsi**

2b. Origin of first dorsal behind pelvic insertions

5a. Colour white or reddish white. Snout relatively narrow and pointed. Mouth extending well in front of eyes. Eyes very small, about equal to longest gill slit ..... **A**. **sibogae**

5b. Colour black, brown or grey. Snout broad and rounded. Mouth mostly under eyes. Eyes larger, their length much greater than widest gill slit

6a. Distance between pectoral and pelvic bases short, 6 to 9% of total length. Anal fin base 2.5 to 3 times fin height ..... **A**. **canutus**

6b. Distance between pectoral and pelvic bases longer, 10 to 14% of total length. Anal base 4 to 5 times fin height

7a. Anal base shorter, 16 to 18% of total length. Dorsal caudal margin with a fairly prominent crest of enlarged denticles ..... **A**. **parvipinnis**

7b. Anal base longer, 18 to 19% of total length. Dorsal caudal margin without a crest of denticles

8a. Pelvic fins relatively high and broadly rounded. Interdorsal space slightly less or greater than preorbital snout ..... **A**. **platyrhynchus**

8b. Pelvic fins low and angular. Interdorsal space about 2/3 of preorbital snout ..... **A**. **verweyi**

1b. First dorsal fin nearly or quite as large as second, two-thirds to equal its area, with its origin usually about opposite pelvic midbases but more posterior and about opposite last third or fourth of pelvic bases in a few species

9a. Nostrils rather narrow, internarial space at least 1.5 times the nostril width. Gill slits very wide, greater than eye length in adults

10a. Fins with prominent white edges. Anal fin very high and broadly rounded, its length about twice its height. Distance between pectoral and pelvic. bases long, greater than preorbital snout. Dorsal crest of denticles absent from caudal fin ..... **A**. **kampae**

10b. Fins without white edges. Anal fin low and subangular, its length over three times its height. Distance between pectoral and pelvic bases short, much less than preorbital snout. A prominent dorsal crest of denticles on caudal fin..... **A**. **stenseni**

9b. Nostrils rather broad, internarial space 1.3 times the nostril width or less, usually about equal to it. Gill slits narrower, less than eye length in adults

11a. Gill slits covered with grooves and pleats that extend to the epibranchial area and to the entire throat region behind the jaws ..... **A**. **spongiceps**

11b. Gill slits not covered with grooves and pleats, these, where present, confined to throat

12a. Eye very large, horizontal diameter more than 4.2% of total length ..... **A. atlanticus**

12b. Eye smaller, horizontal diameter generally less than 4% of total length and often about 3% of total length

13a. Interdorsal space very long, about equal to prespiracular head ..... **A. saldanha**

13b. Interdorsal space shorter, less than prespiracular head

14a. Snout extremely long, preoral length about 12% of total length ..... **A. longicephalus**

14b. Snout shorter, preoral length about 7 to 11% of total length

15a. Interdorsal space equal to, or slightly less than first dorsal base Pectoral inner margins very short, about a third of pectoral bases ..... **A. microps**

15b. Interdorsal space greater than first dorsal base. Pectoral inner margins longer, half to about equal to pectoral bases

16a. Gill septa with prominent medial projections ..... **A. maderensis**

16b. Gill septa with no, or at most only weak, projections

17a. First dorsal origin over last fourth of pelvic bases ..... **A. macrorhynchus**

17b. First dorsal origin over pelvic midbases

18a. Distance between pectoral and pelvic bases greater than prebranchial head ..... **A. japonicus**

18b. Distance between pectoral and pelvic bases subequal or less than prebranchial head

19a. Distance between pectoral and pelvic bases greater than prespiracular head

20a. Interdorsal space about equal to preoral snout ..... **A. brunneus**

20b. Interdorsal space greater than preoral snout ..... **A. nasutus**

19b. Distance between pectoral and pelvic bases less than prespiracular head

21a. Caudal fin without a crest of enlarged denticles

22a. First dorsal lower than the second and extending anteriorly as a long, low ridge. Mouth very short, with dental bands hardly expanded ..... **A. indicus**

22b. First dorsal as high as second and not extending anteriorly as a low ridge. Mouth longer, with dental bands somewhat expanded ..... **A. laurussoni**

21b. Caudal fin with a crest of enlarged denticles

23a. Mouth very short and relatively small, not expanded in front of eyes and with dental bands not greatly enlarged. First dorsal about two-thirds of area of second, extending anteriorly as a long, low ridge to nearly over pelvic origins ..... **A. investigatoris**

click for next page