



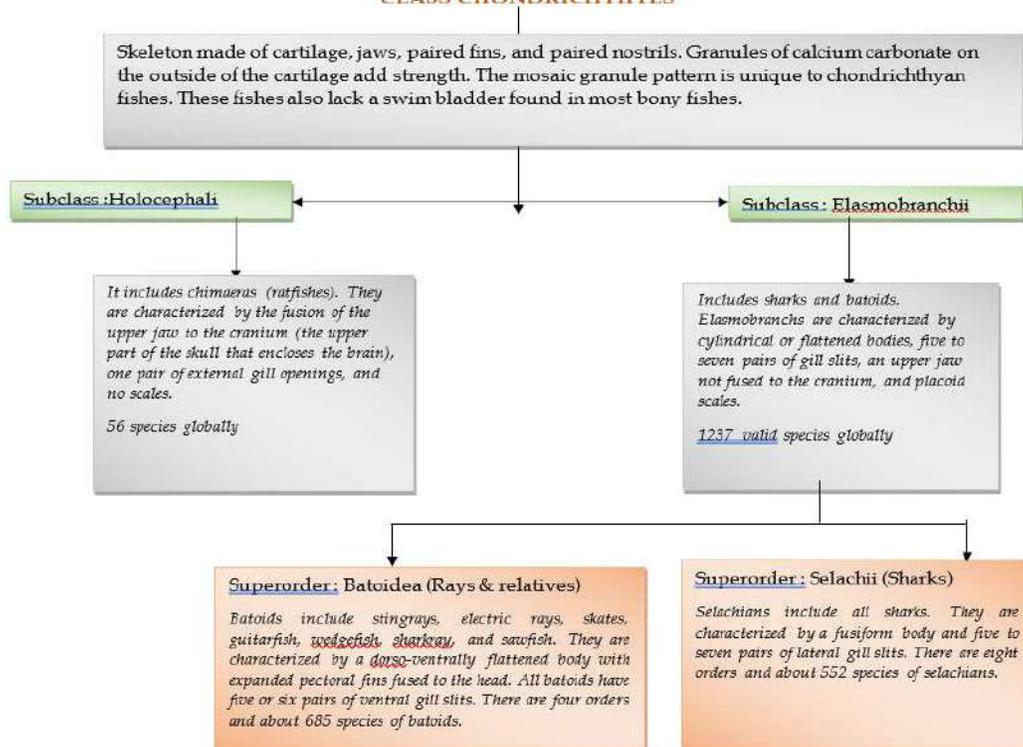
CHAPTER 28

Taxonomy of Sharks

Sharks, along with skates, guitarfishes, rays (batoids) and chimaeras belong to the Phylum Chordata, and the Class Chondrichthyes. Species in the class Chondrichthyes can be characterized by their cartilaginous skeleton, allowing their skeletal structure greater flexibility than rigid bone would. Chondrichthyes have placoid scales, sometimes referred to as dermal denticles; tiny hard modified teeth that aid in the movement of the fish through the water by reducing drag. Other anatomical features that all Chondrichthyes share are paired pectoral fins and ampullae of Lorenzini, which are used to sense electrical fields within their environment.

CLASSIFICATION OF ELASMOBRANCHS

CLASS CHONDRICHTHYES

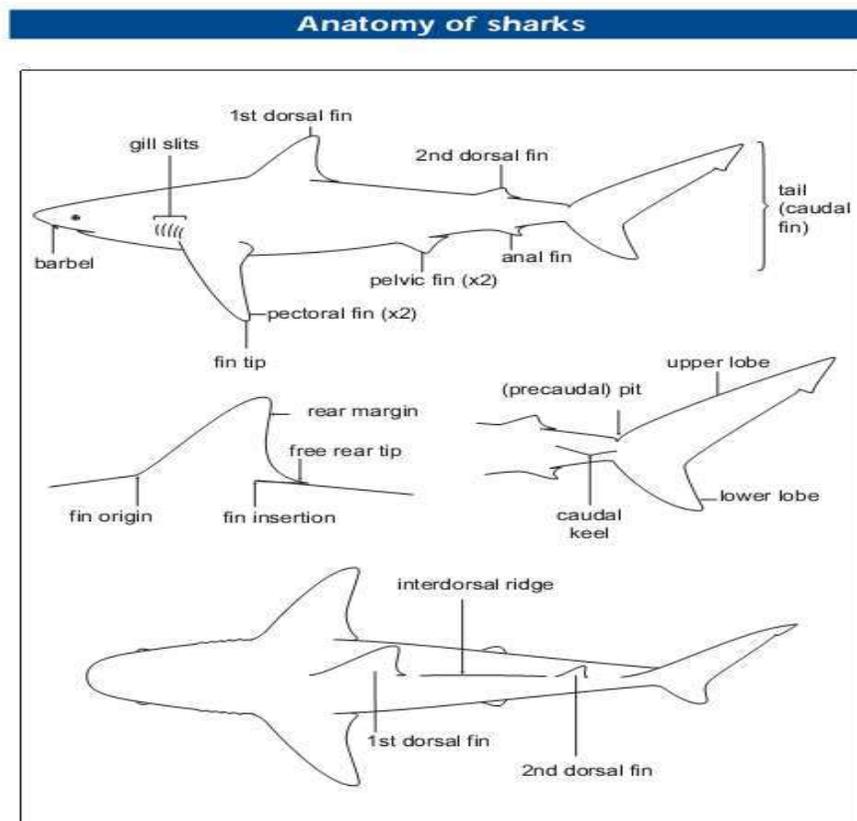


Class Chondrichthyes are divided into the subclass Elasmobranchii separate from subclass Holocephali containing chimaeras. Based on several anatomical and functional differences. Unlike chimaeras with only four gill slits, species in the Subclass Elasmobranchii have at least

five gillslits. And unlike chimaeras whose upper jaw is fused to their cranium, the sharks jaw is not fused and contains rows of replaceable teeth, not found in chimaeras.

Some of the key differences between sharks, skates and rays are in the shape and function of homologous body parts. The pectoral fins on skates and rays are much wider and used for movement and propulsion, while the pectoral fins on sharks are used for lift and directional changes while swimming. Sharks also have a shorter caudal fin with an upper and lower lobe used for propulsion, while the elongated and much narrower tail fin on skates and rays is used to help steer. And while sharks, skates and rays all have, for the most part, 5 gill slits, the gills on sharks are located on either side of the body, while the gills on skates and rays are found on the ventral side of the fish.

Compagno (2001) lists 60 families within the living orders of chondrichthyans. There are nearly 500 species of living sharks, over 600 species of batoids and 50 species of chimaeras, with new species constantly being described. For understanding the identification keys, the morphological characters should be known. Major morphological identifications are given in Fig 1 & 2.



Source: FAO, 1984

Identifying parts of the shark

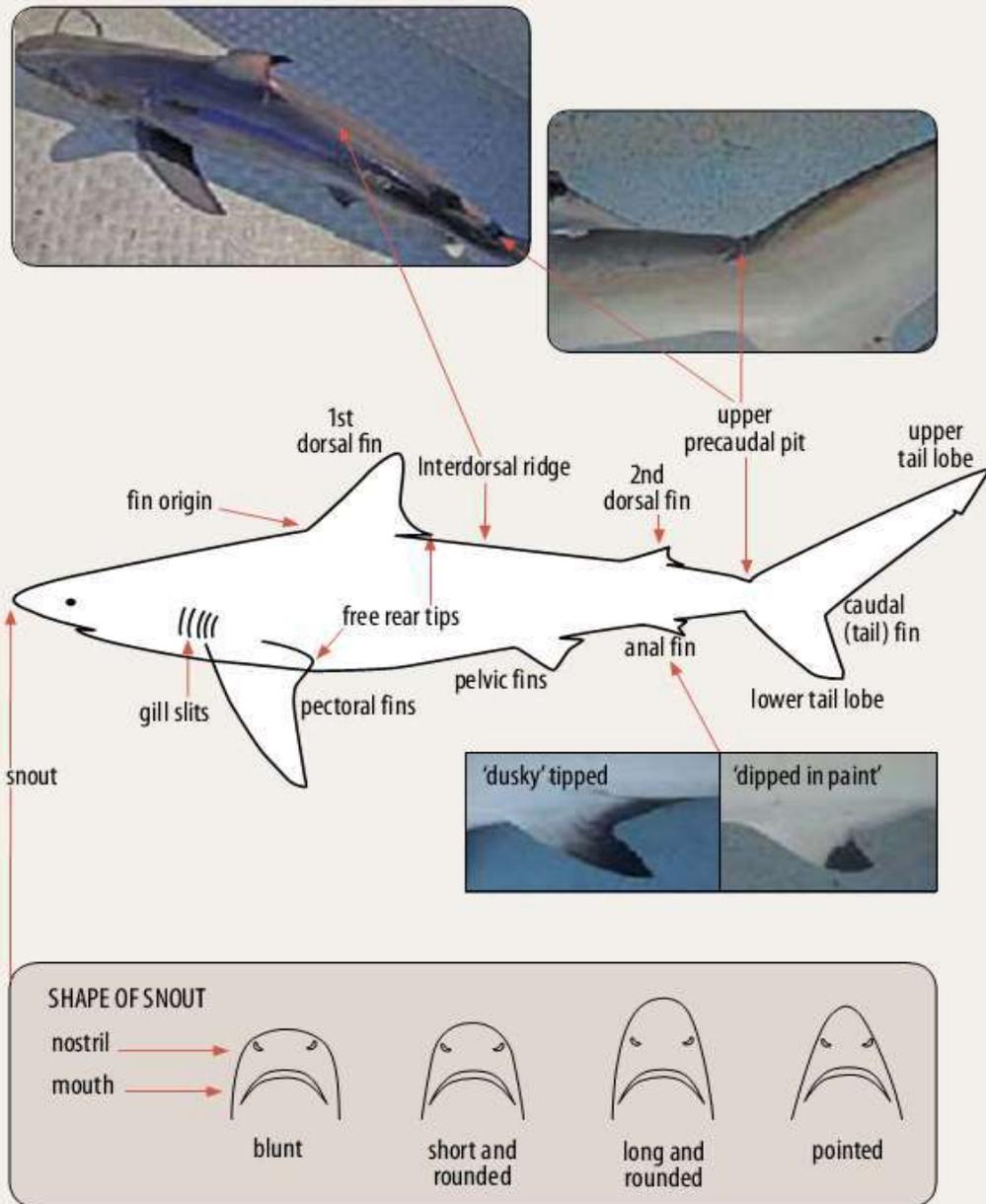


Illustration Source:

https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0004/264775/Identifying-sharks-and-rays.pdf

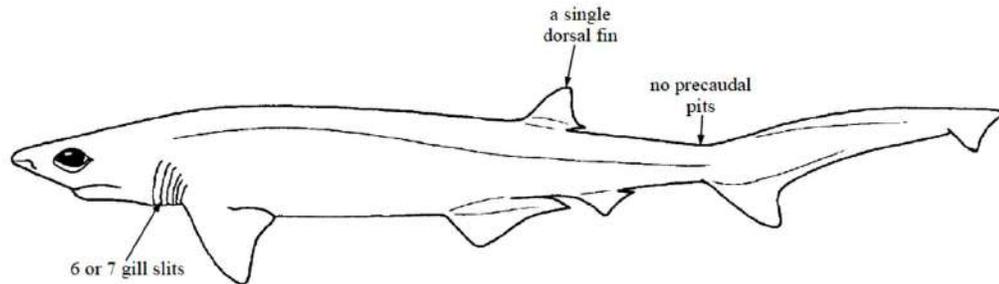
Sharks can be grouped into nine orders and 37 families according to their distinctive characters.

S. No	Order	Families
1	Hexanchiformes (frilled and cow sharks)	Chlamydoselachidae
		Hexanchidae
2	Squaliformes (dogfish sharks)	Squalidae
		Centrophoridae
		Etmopteridae
		Somniosidae
		Oxynotidae
		Dalatiidae
3	Pristiophoriformes (saw sharks)	Pristiophoridae
4	Squantiniformes (angel sharks)	Squatinae
5	Heterodontiformes (bullhead sharks)	Heterodontidae
6	Orectolobiformes (carpet sharks)	Parascylliidae
		Brachaeluridae
		Orectolobidae
		Hemiscylliidae
		Ginglymatidae
		Stegostomatidae
7	Lamniformes (mackerel sharks)	Rhincodontidae
		Odontaspidae
		Pseudocarchariidae
		Mitsukurinidae
		Megachasmidae
		Alopiidae
		Cetorhinidae
		Carchariidae
		Lamnidae
		8
9	Carcharhiniformes (ground sharks)	Pentanchidae
		Scyliorhinidae
		Proscylliidae
		Pseudotriakidae
		Leptochariidae
		Triakidae
		Hemigaleidae
		Carcharhinidae
		Galeocerdonidae
		Sphyrnidae

The key characters of the orders and major families from Indian waters and species in each order reported is given below

1. ORDER HEXANCHIFORMES (frilled and cow sharks)

Key characters: Trunk cylindrical or somewhat compressed, not flattened and raylike. Head conical to slightly depressed, not expanded laterally; 6 or 7 pairs of gill slits present on sides of head, with the posterior most in front of pectoral fin origins. A single spineless dorsal-fin present, with origin over or behind pelvic fin insertions.



Major families in the order are

Family Chlamydoselachidae - Frilled sharks

Mouth terminal on head; teeth tricuspidate, six pairs of gill slits, first pair connected across the underside of the throat; body elongated and eel-like.

Family Hexanchidae - Cowsharks, Sixgill sharks, Sevengill sharks

Mouth subterminal on head; front teeth unicuspidate in upper jaw and comb-shaped and blade-like in lower jaw, six or seven pairs of gill slits, first not connected across underside of throat; body fairly stocky, not eel-like.

Species from Indian waters:

1. *Heptranchias perlo*
2. *Hexanchus griseus*

2. ORDER SQUALIFORMES (dogfish sharks)

Two dorsal fins (with or without spines); no anal fin. Caudal fin with vertebral column elevated into a moderately long upper lobe; lower lobe absent to strong. Five gill slits, all in front of pectoral fin origins.

Family: Squalidae (Dogfish Sharks)

Teeth blade-like and similar in both jaws, with a deflected horizontal cusp, caudal peduncle usually with an upper precaudal pit (weak or absent in *Cirrhigaleus*); Caudal peduncle with strong lateral keels dorsal fin spines without grooves; caudal fin without subterminal notch.

Major species from Indian waters:

1. *Squalus mitsukurii*
2. *Squalus hemipinnis*

Family: Etmopteridae (Lanternsharks)

Hook-like or with cusps and cusplets teeth in both jaws, blade-like and more or less overlapping; underside of body, flanks, and tail usually with more or less conspicuous, dense, black markings with light organs (photophores).

Species from India waters:

1. *Centroscyllium ornatum*
2. *Etmopterus pusillus*

Family: Centrophoridae (Gulper Sharks)

Upper teeth relatively broad and blade-like; lower teeth low, wide and blade-like. compressed, blade-like and overlapping, much larger than uppers underside of body, flanks and tail without conspicuous, dense, black markings that have light organs, though light producing organs may be present elsewhere.

Species from Indian waters:

1. *Centrophorus atromarginatus*
2. *Centrophorus granulosus*
3. *Centrophorus moluccensis*
4. *Centrophorus squamosus*
5. *Centrophorus uyato*
6. *Deania profundorum*

Family: Somniosidae (Sleeper Sharks)

Moderately broad head and somewhat flattened or conical; snout flat and narrowly rounded to elongate-rounded in dorsoventral view; abdomen usually with lateral keels; both dorsal fins either with or without (Somniosus, Scymnodalarias) fin spines.

Species from Indian waters:

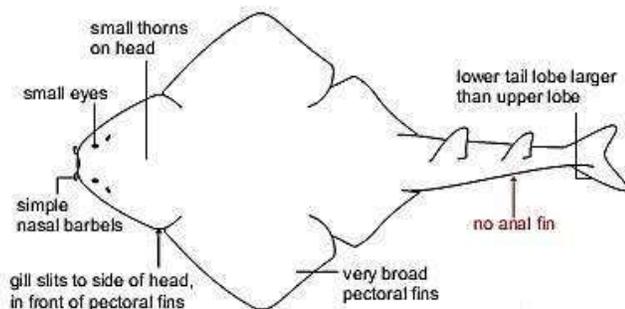
1. *Centroscymnus crepidator*
2. *Zameus squamulosus*
3. *Scymnodon ichiharai*

3. ORDER: SQUANTINIFORMES (Angelsharks)

Mouth at end of head body flat and ray-like; very large pectoral fins with triangular anterior lobes that overlap gill slits; caudal fin with base slanted ventrally (hypocercal)

Family: Squatinidae (Angelsharks)

Similar to rays, with a broad flattened body, short snout and large fins, but with gill openings on the sides of the head, not beneath, and very large pectoral fins not attached to the head opposite the gills (the hindmost gill opening is in front of pectoral fin origins, but covered by triangular anterior fin lobes).



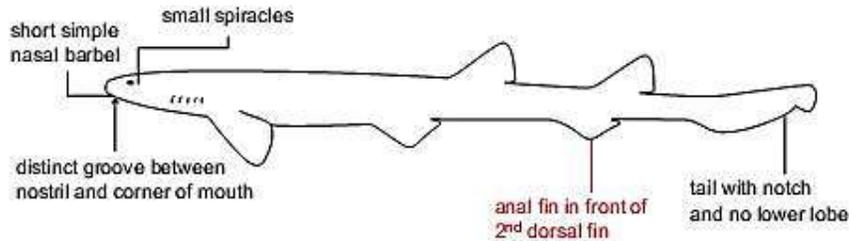
Species from Indian waters:

1. *Squatina africana*

4. ORDER

ORECTOLOBIFORMES (carpet sharks)

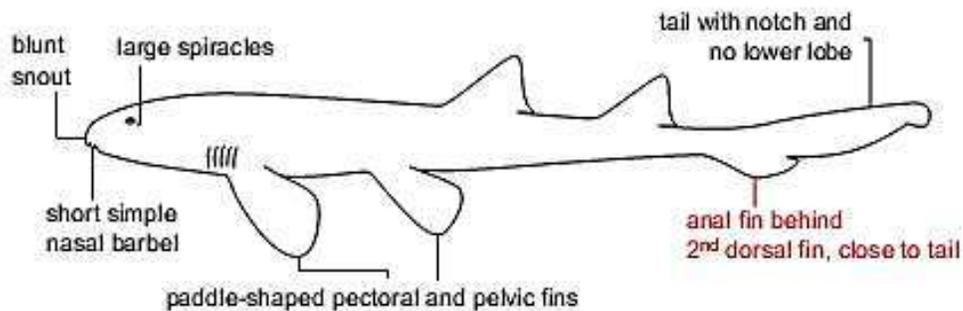
Eyes behind mouth; deep nasoral grooves connecting nostrils and mouth; a pair of barbels just medial to incurrent apertures of nostrils (rudimentary in Family Rhincodontidae).



Family:
Hemiscylliidae
(Longtailed)

carpetsharks)

Nasal barbels short; distance from vent to lower caudal origin longer than distance from snout to vent; anal fin low, rounded and keel-like.

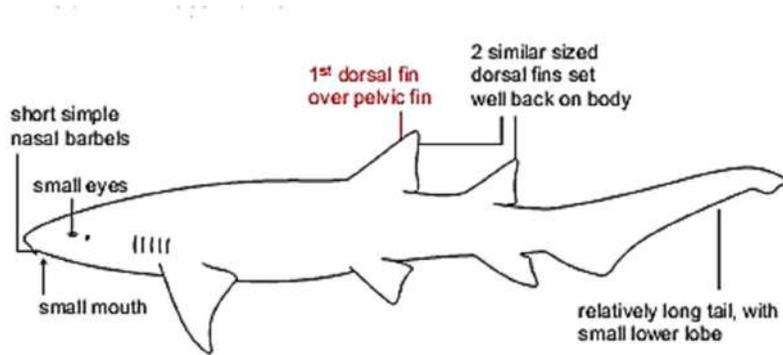


Species from Indian waters:

1. *Chiloscyllium arabicum*
2. *Chiloscyllium indicum*
3. *Chiloscyllium plagiosum*
4. *Chiloscyllium punctatum*
5. *Chiloscyllium griseum*
6. *Chiloscyllium burmer*

Family: Ginglymatidae (Nurse sharks)

Head and body cylindrical or moderately flattened, head without skin flaps; teeth small. No circumnarial lobe and groove around outer edges of nostrils

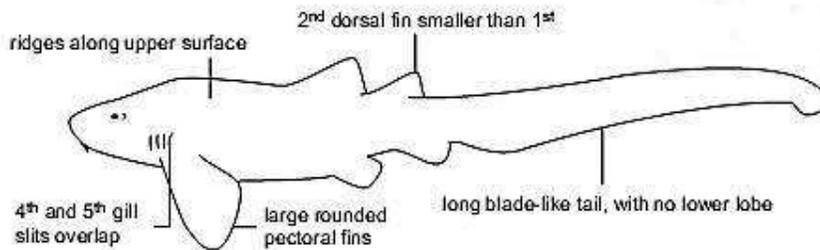


Species from Indian waters:

1. *Nebrius ferrugineus*

Family: Stegostomatidae (Zebra Shark)

Mouth smaller and subterminal; external gill slits small; caudal peduncle without strong lateral keels; caudal fin with a weak lower lobe or none, but with a strong terminal lobe and subterminal notch, Caudal fin about as long as rest of shark.

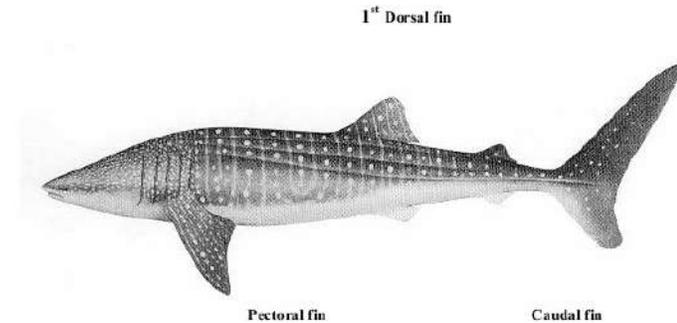


Species from Indian waters:

1. *Stegostoma fasciatum*

Family: Rhincodontidae (Whale shark)

Mouth huge and nearly at end of head; external gill slits very large; caudal peduncle with strong lateral keels; caudal fin with a strong lower lobe, but without a subterminal notch.



Species from Indian waters :

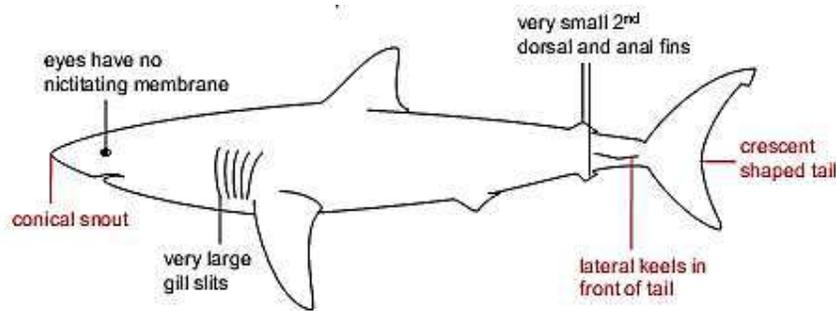
1. *Rhincodon typus*

5. ORDER: LAMNIFORMES (Mackerel sharks)

Eyes partly or entirely over mouth; nasoral grooves usually absent, when present (a few members of the Family Scyliorhinidae) broad and shallow; barbels, when present, developed from anterior nasal flaps of nostrils, not separate from them. No nictitating eyelids; largest teeth in mouth usually are two or three rows of anteriors on either side of upper and lower jaw symphyses.

Family: Lamnidae (Mackerel sharks)

A strong keel present on each side of caudal peduncle; caudal fin crescentic and nearly symmetrical, with a long lower lobe. Teeth large and few, sharp-edged; gill openings large but not extending onto upper surface of head; no gill rakers on internal gill arches

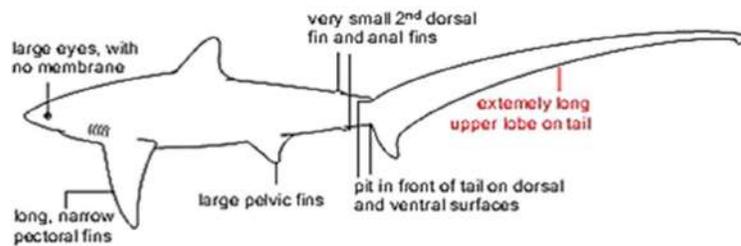


Species from Indian waters:

1. *Isurus oxyrinchus*
2. *Isurus paucus*

Family: Alopiidae (Thresher Shark)

Snout conical or flattened, short and not blade-like; anal fin subequal to dorsal fins in size or smaller than them; upper and sometimes lower precaudal pits present; caudal fin with strong lower lobe. Caudal fin about as long as rest of shark.



Major species from Indian water:

1. *Alopias pelagicus*
2. *Alopias superciliosus*
3. *Alopias vulpinus*

Family: Pseudocarchariidae (Crocodile Shark)

Subterminal small mouth, behind snout tip; teeth blade-like with large anterior teeth, intermediate teeth, and lateral teeth in upper jaw; internal gill openings without gill rakers. Eyes very large; gill slits extending onto upper surface of head; both upper and lower precaudal pits present; a low keel on each side of caudal peduncle.

Major Species from Indian waters:

1. *Pseudocarcharias kamoharai*

Family: Odontaspidae (Sandtiger Sharks)

Eyes smaller; gill slits not extending onto upper surface of head; lower precaudal pit absent; no keels on caudal peduncle. long conical snout, fairly large eyes; first dorsal fin closer to pectoral fins than pelvic fins, first dorsal fin larger than second dorsal and anal fins.

Species from Indian waters:

1. *Carcharias taurus*
2. *Odontaspis ferox*
3. *Odontaspis noronhai*

6. ORDER: ECHINORHINIFORMES (bramble and prickly sharks)

Flat broad head with tiny spiracles; similar sized dorsal fin placed close together well back, Anal fin absent; large thorn-like skin denticles.

Family: Echinorhinidae (bramble sharks)

Very large and thorn-like skin denticles. Cylindrical stout, body. Five gill openings in front of pectoral fin, fifth one larger than others., flat broad head and snout,; origin of first dorsal slightly behind pelvic fin origin. Lower caudal lobe poorly developed in adults, absent in young, subterminal caudal notch lacking or not obvious.

Species from Indian waters:

1. *Echinorhinus brucus*

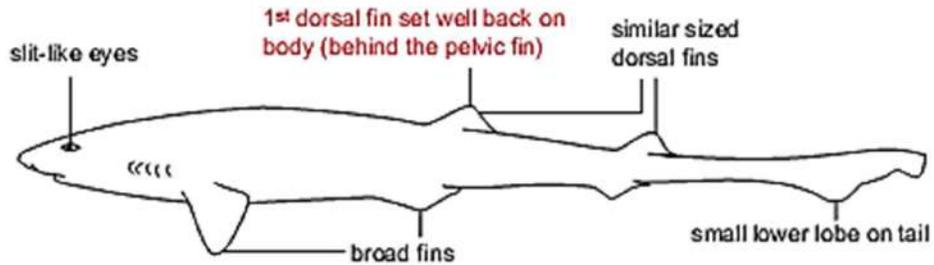
7. ORDER: CARCHARHINIFORMES (GROUND SHARKS)

This order is the largest, most diverse and widespread group of sharks. It contains at least 291 species in 10 families. Very wide range of appearances, from strange bottom-dwelling deepsea sharks, to typical large sharks. All have two spineless dorsal fins and an anal fin. A long mouth extends to or behind the eyes, Nasoral grooves are usually absent (or broad and shallow, when present in a few catsharks). If barbels are present, these are developed from the

anterior nasal flaps of nostrils. Largest teeth are distinctly lateral on dental band, with no gap or intermediate teeth separating the large anterior teeth from even larger teeth in upper jaw.

Family: Scyliorhinidae (Catsharks)

Supraorbital crest present on cranium above eyes. (Crest can be felt by running your fingers over the eye orbits)



Species from Indian waters: *Cephaloscyllium silasi*,

Family: Pentanchidae (Halaelurus catsharks)

1. *Apristurus investigatoris*
2. *Bythaelurus hispidus*
3. *Halaelurus quagga*

Family: Proscylliidae (Finback catsharks)

Rounded-parabolic snout or subangular in dorsoventral profile, without a deep groove in front of eye; internarial space less than 1.3 times nostril width; inside of mouth and edges of gill arches with papillae; first dorsal fin short, base closer to pelvic fins than pectoral fins.

Species from Indian waters:

1. *Eridacnis radcliffei*
2. *Proscyllium magnificum*

Family: Pseudotriakidae (False catsharks)

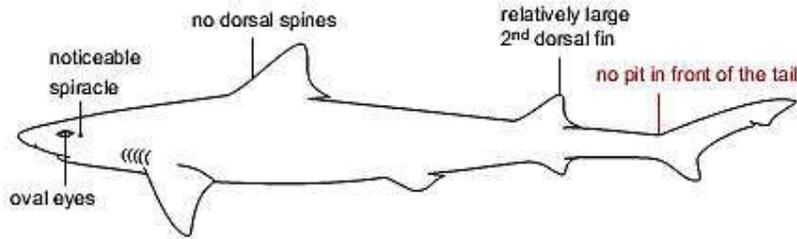
Bell-shaped snout in dorsoventral profile, with a deep groove in front of eye, internarial space over 1.5 times nostril width; inside of mouth and edges of gill arches without papillae; first dorsal fin more or less elongated, base closer to pectoral fins.

Species from Indian waters:

1. *Planonasmus indicus*

Family: Triakidae (Houndsharks)

Anterior nasal flaps usually not barbel-like (except for *Furgaleus*); upper labial furrows shorter, considerably less than internarial width and less than half of mouth width; intestinal valve with 4 to 10 turns; supraorbital crests present on cranium.

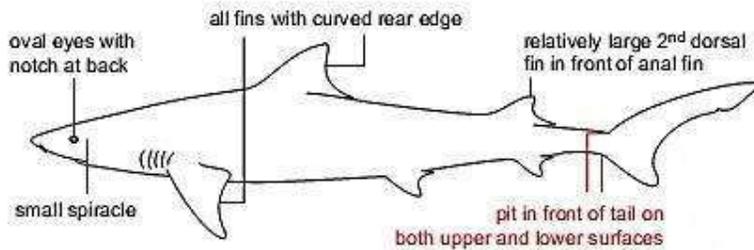


Species from Indian waters:

1. *Iago omanensis*
2. *Iago mangalorensis*
3. *Mustelus mosis*

Family: Hemigaleidae (Weasel sharks)

Posterior nasal flaps well developed on rear edges of excurrent apertures of nostrils, symphyseal tooth rows well developed in upper and lower jaws; second dorsal fin height about 0.4 to 0.7 times first dorsal fin height; intestine with a spiral valve containing 4 to 6 turns.



Species from Indian waters:

1. *Chaenogaleus macrostoma*
2. *Hemigaleus microstoma*
3. *Hemipristis elongata*

Family: Carcharhinidae

Two dorsal fins and one anal fin, Precaudal pit present, Caudal fin with strong ventral lobe Medium to large size; some small Long arched mouth with blade-like teeth No nasoral grooves or barbels Round eyes with internal nictitating eyelids Upper labial furrows short to long, but not extending to front of eyes; spiracles usually absent; posterior nasal flaps poorly developed on rear edge of excurrent apertures of nostrils; lateral keels usually absent (except weak ones) on Prionace caudal peduncle.

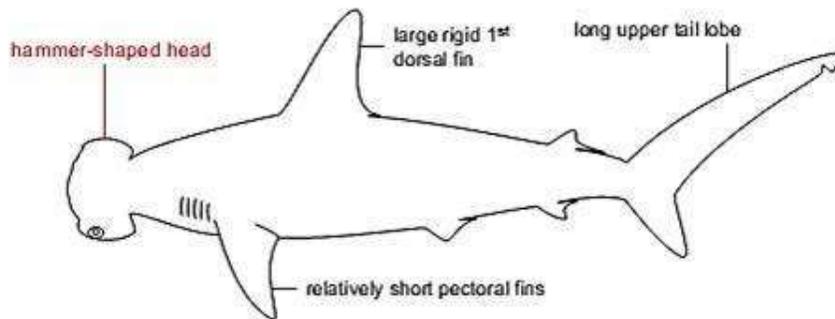
Major species from Indian waters:

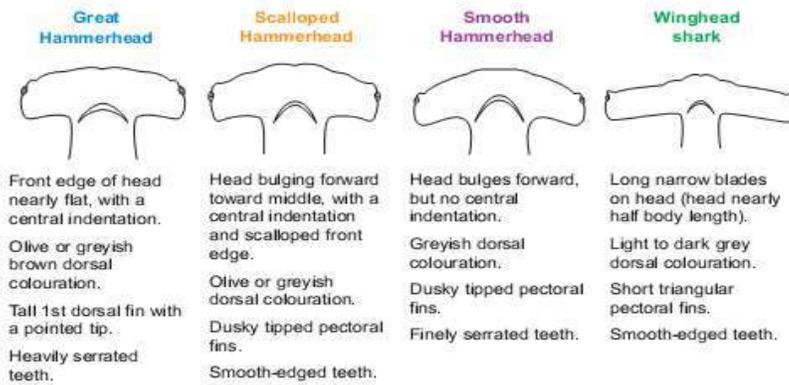
1. *Carcharhinus albimarginatus*
2. *Carcharhinus altimus*
3. *Carcharhinus amblyrhynchoides*
4. *Carcharhinus amblyrhynchos*
5. *Carcharhinus amboinensis*
6. *Carcharhinus brachyurus*

7. *Carcharhinus brevipinna*
8. *Carcharhinus dussumieri*
9. *Carcharhinus falciformis*
10. *Carcharhinus galapagensis*
11. *Carcharhinus hemiodon*
12. *Carcharhinus leucas*
13. *Carcharhinus limbatus*
14. *Carcharhinus longimanus*
15. *Carcharhinus macloti*
16. *Carcharhinus melanopterus*
17. *Carcharhinus obscurus*
18. *Carcharhinus plumbeus*
19. *Carcharhinus sealei*
20. *Carcharhinus sorrah*
21. *Glyphis gangeticus*
22. *Glyphis glyphis*
23. *Lamiopsis temminckii*
24. *Loxodon macrorhinus*
25. *Negaprion acutidens*
26. *Prionace glauca*
27. *Rhizoprionodon acutus*
28. *Rhizoprionodon oligolinx*
29. *Scoliodon laticaudus*
30. *Triaenodon obesus*

Family: Sphyrnidae (Hammerhead sharks)

Head with lateral expansions or blades, like a double-edged axe.





Species from Indian waters:

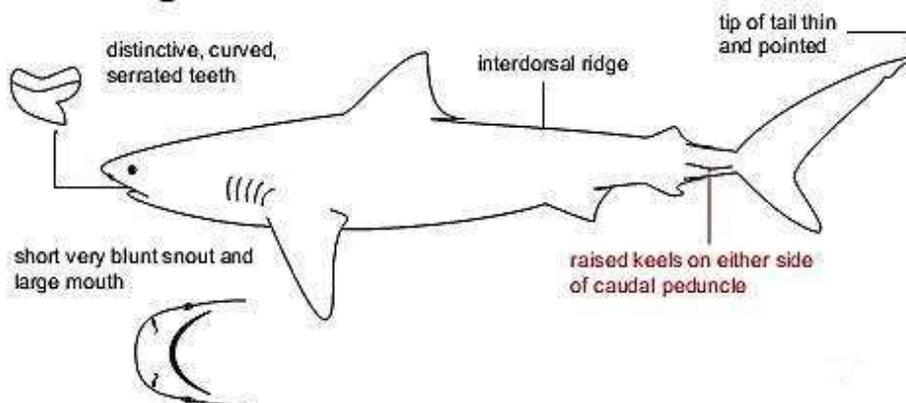
1. *Eusphyra blochii*
2. *Sphyrna lewini*
3. *Sphyrna mokarran*
4. *Sphyrna tudes*
5. *Sphyrna zygaena*

Family: Galeoceridae. Tiger sharks

Upper labial furrows very long, extending to front of eyes; spiracles present and relatively large; posterior nasal flaps well developed on rear edge of excurrent apertures of nostrils; prominent lateral keels on caudal peduncle

Species from Indian waters:

1. *Galeocerdo cuvier*



Major References

- Ebert A David, Marc Dando and Sarah Fowler. (2021). Sharks of The World- A Complete Guide. Princeton University Press, Woodstock, Oxfordshire OX20 1TR. 609 pp.

- Compagno Leonard J.V. (1984). FAO species catalogue VOL. 4, Part 1 & 2 Sharks Of The World An Annotated And Illustrated Catalogue Of Shark Species Known To Date FAO Fisheries Synopsis No. 125, Volume 4, Part 1&2
- Kizhakudan S.J., Zacharia P.U., Thomas S., Vivekanandan E. and Muktha M. (2015). Guidance on National Plan of Action for Sharks in India. CMFRI Marine Fisheries Policy Series No. 2, 104p.

