

**GENERAL CHARACTER AND  
CLASSIFICATION OF FISH  
(CHONDRICHTHYES FISHES)  
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INTRODUCTION -

Chondrichthyes is a class of jawed fishes having a cartilaginous skeleton. The class includes a diverse group of fishes including sharks, rays, skates and chimaeras. They are mostly marine fishes.

The other group of fishes are bony fishes, which are included in the class Osteichthyes.

### CHONDRICHTHYES CLASSIFICATION (OUTLINE )

Chondrichthyes is a class of fishes included in the division Gnathostomata as they have jaws. The division Gnathostomata includes all the vertebrates having jaws. Gnathostomata is divided into two superclasses, viz. Pisces (having fins) and Tetrapoda (bear limbs).

Pisces is divided into two classes:

1. Chondrichthyes- Cartilaginous fishes
2. Osteichthyes- Bony fishes

Kingdom - Animalia

Phylum - Chordata

Subphylum - Vertebrata

Division - Gnathostomata

Superclass- Pisces

Class -Chondrichthyes

Chondrichthyes is subdivided into two subclasses:

- Elasmobranchii- Sharks and rays, skates, sawfishes
- Holocephali- Chimaeras, also known as ghost sharks

## GENERAL CHARACTERS OF CHONDRICHTHYES-

- They are mostly marine fishes.
- They contain a pair of jaws. Their jaws are very powerful.
- Whale sharks are the second largest vertebrate and the largest fish. Some whale sharks measure up to 15 m in length.
- The mouth is present ventrally.
- They contain cartilaginous endoskeleton, the deposits of calcium salts provide strength to it.
- The notochord is present throughout life.
- Most of them contain a heterocercal tail. The tail has two lobes, the upper lobe is elongated and vertebrae extends into it and a shorter lower lobe, giving rise to the distinct heterocercal tail.
- The skin is covered by minute tooth-like structures called placoid scales.
- Their teeth are modified placoid scales and are not attached to jawbones. They are embedded in the tissue. Old teeth fall and are continuously replaced by the new teeth formed behind it.
- They contain 5-7 pairs of gills. Gaseous exchange occurs through the water current that passes over the gills.
- They lack air bladders so they swim actively to avoid sinking.
- They are poikilotherms or cold-blooded animals and lack the capacity to regulate their internal body temperature.
- They are predatory fishes, they feed on other fishes, crustaceans and molluscs. They filter food particles like planktons from the water current that passes through the mouth, pharynx and gills.
- The heart is two-chambered, contains one auricle and one ventricle.

- They contain a brain and a spinal cord, which is protected by vertebrae.
- Sense organs are well developed. They have the ability to detect their prey electrically. Sharks contain electroreceptors on their head, which can sense the electric current generated by the movement of their prey. It also helps them in navigation.
- It also has sensory cells in the lateral line organ, which detect all the kinds of vibration, motion, water pressure surrounding them.
- Some of them possess electric organs or poison sting, which are used for defence as well as predation.
- The digestive system comprises a mouth, pharynx, stomach, intestine (straight) and cloaca present on the ventral side. Cloaca has a dual function in females and also acts as a reproductive organ apart from excretion.
- Male and females are separate and have internal fertilization. Skates and some sharks are oviparous, most of the sharks are ovoviviparous and a few are viviparous.
- Adult males bear claspers on their pelvic fins. These are used to transfer sperms to the cloaca of a female.

## CLASSIFICATION OF CHONDRICTHYES

The cartilaginous fishes first appear in the Devonian period. They can be divided into two groups

- <sup>Bony</sup>
- i. **Holocephali** having a single external gill aperture (Rat fish and *Chimaera*).
  - ii. **Elasmobranchii** (plate-gilled) having five to seven gill openings on each side of the head. Of these, the *Pleurotremata* (sharks) have a cylindrical body with seven gill slits on each side, while the *Hypotremata* (skates and rays) have a dorsoventrally flattened body, and five pairs of gill slits on the ventral side.

### THE EARLIEST ELASMOBRANCHS

The extinct shark-like fishes are represented by the Palaeozoic genus *Cladoselache* and *Xenacanthus*. The *Cladoselache* (Fig. 4.1) grew upto 2 m with terminal mouth, heterocercal tail, persistent notochord and five gill apertures. The characteristic feature was the large pectoral fin showing primitive structure, having a wide base with no anterior and posterior constriction to separate the fin from the body. The first and sometimes the second dorsal fins were preceded by stout spines. Pelvic fins were smaller but had structure similar to the pectorals. The caudal fin was externally symmetrical, but its internal structure was asymmetrical. Teeth were sharp, pointed and efficient for feeding on fishes.

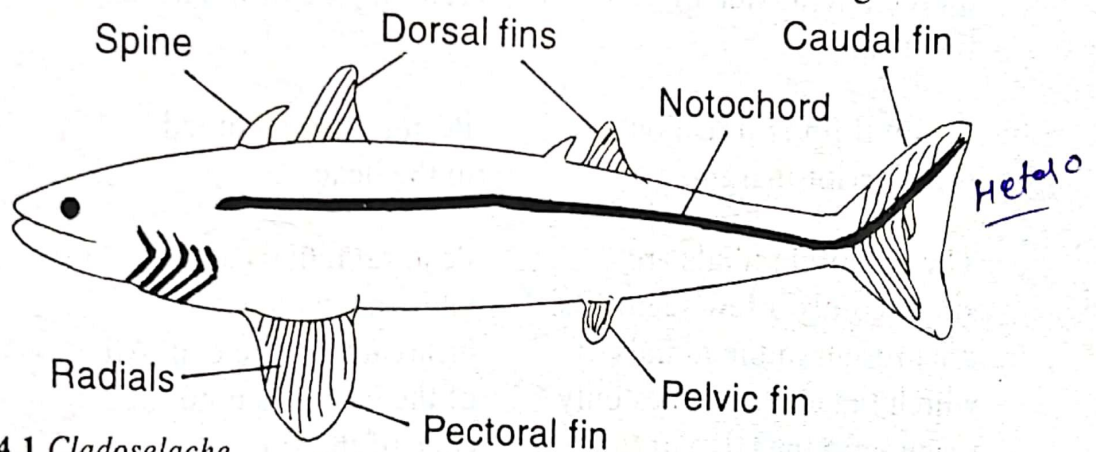


Fig. 4.1 *Cladoselache*.



## THE SHARKS AND RAYS

Sharks, skates and rays (the *Neoselachii*) probably evolved from a *Cladoselache*-like ancestor. The sharks (pleurotremate elasmobranchs) are characterised by elongated or fusiform body, amphi- or hyostylic skull, and heterocercal tail. The gill openings (*trem*) are situated on the sides of the head. The skates and rays (hypotremate elasmobranchs) have the gill openings on the ventral side of the head.



The Elasmobranch is divided into as follows -

Pleurotremata:

1. Gill slits lateral (on each side of the gill).
2. Body more or less cylindrical.
3. Anterior margin of the pectoral fins free.
4. In the skull, cartilage is not attached to the olfactory capsule.
5. Two halves of pectoral girdle is separate.

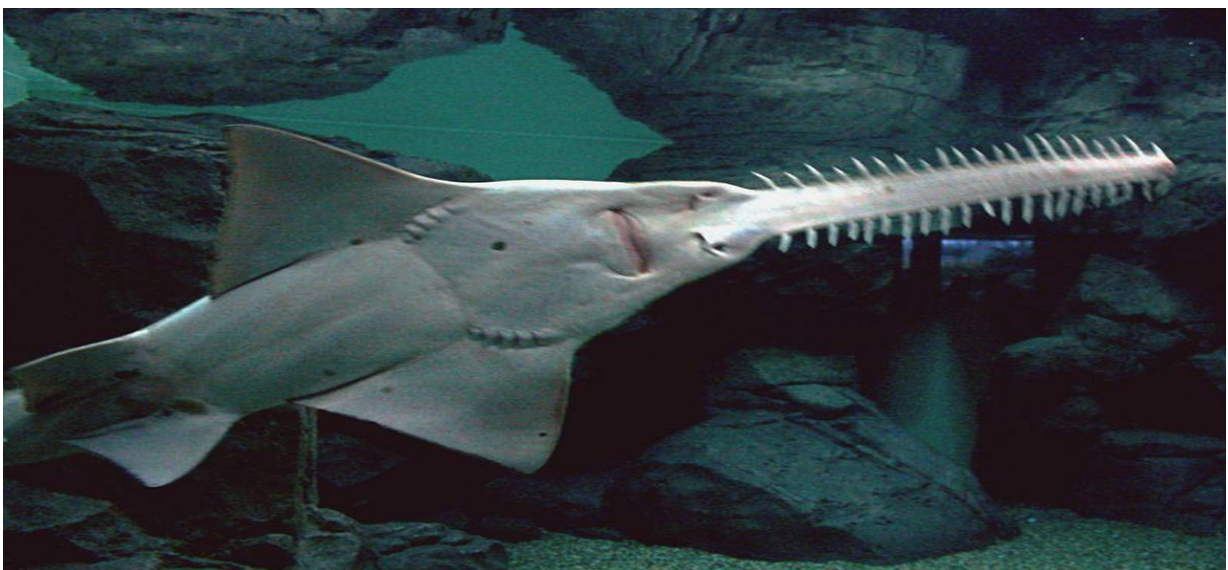
Ex. Sharks viz.; Scoliodon, Sphyrna, Charcharinus



Difference # Hypotremata (Batoidea):

1. Gill slits ventral.
2. Body depressed; flat or disc-like.
3. Anterior margins of the pectorals fused with sides of the body and head.
4. Paired preorbital cartilage is attached to the olfactory capsule.
5. Two halves of pectoral girdle are joined with each other or with vertebral column.

Ex. *Dasyatis* (Sting ray), *Torpedo* (Electric ray), *Pristis* (Saw fish), *Rhinobatus* (Guitar fish)





## THE HOLOCEPHALI

A small group of cartilaginous fishes became highly specialised and are included in the sub class Holocephali. They appeared in the Jurassic and are represented by three existing genera, *Chimaera*, *Callorhynchus* and *Harriotta*. The extinct representatives are *Squaloraja* and *Myriacanthus*. The Holocephali appear to have descended from some primitive elasmobranch ancestor and became highly specialised while retaining a soft anatomy similar to sharks. They are all marine found in water below 80 m, but move to shallow areas to deposit eggs.

*Chimaera* (Fig. 4.13), popularly known as the 'rat fish' or the 'king of Herrings,' is abundantly found along the coasts of Europe, Japan, Australia, North America and New Zealand. *Chimaera* has a shark-like body with a blunt conical snout. Pectoral fins are large fan-like. Tail is filamentous and looks like diphycercal. The male has a peculiar club-like frontal clasper on the head. A pair of claspers armed with denticles are present in front of the pelvic fins. A pair of ordinary claspers are also present behind the pelvic fins, as in sharks.

There is a single external gill aperture due to the presence of a fold of skin forming the operculum. The fish feeds on small invertebrates and fishes.

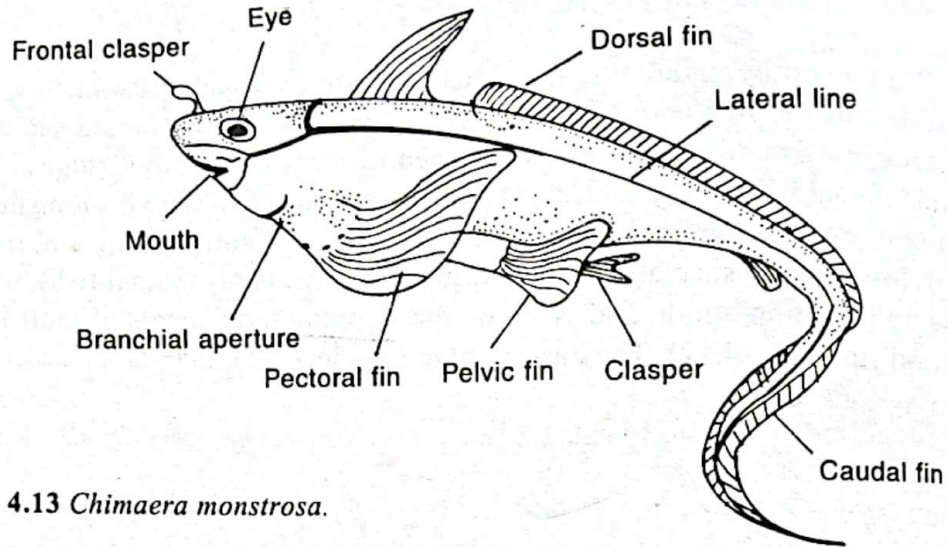


Fig. 4.13 *Chimaera monstrosa*.

*Callorhynchus* (Fig. 4.14) is characterised by the presence of a rostrum which is produced forward and has a ventrally directed flap serving as a tactile organ. The male has a frontal clasper on the head, and the tail is heterocercal. This species is abundantly found in the South Pacific.

*Harriotta* (Fig. 4.15) has an elongated body with large pectoral fins. Head is produced into an elongated, depressed rostrum. Frontal clasper is not present in the male, and other claspers are also of small size. The tail is straight, tapering and not turned upwards. It is found in the North Atlantic.

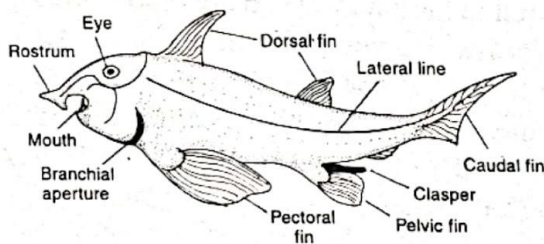


Fig. 4.14 *Callorhynchus antarcticus*.

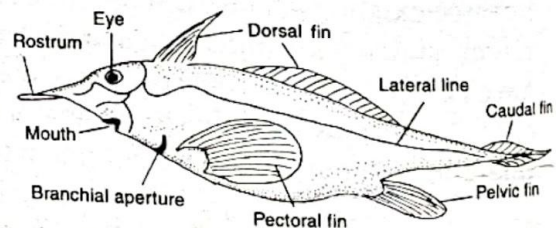


Fig. 4.15 *Harriotta* spp.

### SALIENT FEATURES

The holocephali exhibit the following important features:

1. These fishes have a shark-like body with a relatively large compressed head, a small mouth and large eyes.
2. Skin is smooth, silvery and placoid scales occur in patches in *Chimaera*.
3. Spiracle is absent.
4. The urinogenital aperture and the anus are separate, and there is no cloaca.
5. Two dorsal and a ventral fin are present. The second dorsal fin in *Chimaera* is fairly long. Pectoral fins are relatively large in size and pelvics are smaller.
6. Tail is generally heterocercal, but in *Chimaera* it appears to be diphyrcercal and in the form of a whip-like filament.
7. A peculiar frontal clasper is present on the head of male *Chimaera*, which also has a pair of claspers covered with denticles, situated anterior to the pelvic fins. A pair of ordinary claspers are present behind the pelvic fins, as in sharks. The function of the anterior clasper is not known.
8. The lateral line system is well developed. It is in the form of a groove in *Chimaera*, but a closed tube in *Callorhynchus*.
9. Mouth is small in size and ventrally placed. The alimentary canal is a simple straight tube from mouth to anus. A true stomach is not present and the intestine has a spiral valve.
10. Teeth are large and in the form of hard plates composed of vasodentine. These crushing plates have irregular surface and sharp cutting edge. The upper jaw has two such pairs of teeth, while only one pair is present in the lower jaw. In addition to these a small vomerine tooth and a pair of palatine teeth are also present in the roof of the buccal cavity.

### ENDOSKELETON

### REFERENCE

- BY SS Khanna
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