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Elasmobranchii: Taxonomy, Systematics and Biological Significance

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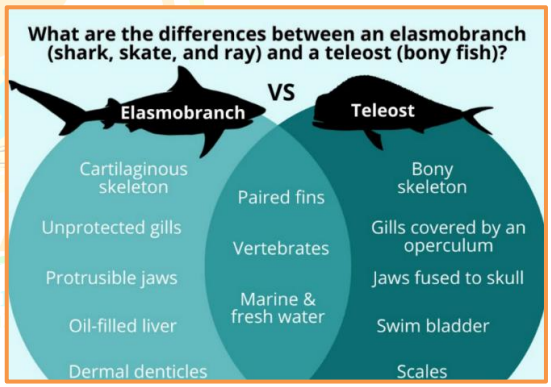
Elasmobranchii, a major subclass of cartilaginous fishes under the class Chondrichthyes, comprises sharks, skates, rays, and sawfishes. This group represents one of the most ancient lineages of jawed vertebrates, exhibiting a unique combination of primitive and advanced anatomical, physiological, and reproductive characteristics. The present technical article provides a systematic overview of Elasmobranchii, emphasizing their taxonomy, diagnostic characters, evolutionary significance, ecological role, and conservation status. The article is intended to serve as a comprehensive undergraduate-level reference for zoology and fisheries science students.

Keywords: Elasmobranchii, Chondrichthyes, sharks, rays, taxonomy, cartilaginous fishes.

Introduction

Elasmobranchii is an important subclass of cartilaginous fishes that includes sharks, skates, rays, and sawfishes. These fishes are among the oldest living jawed vertebrates and have existed for more than 400 million years. They are mainly marine animals, though a few species can live in freshwater. Elasmobranchs show several primitive as well as advanced features, making them an interesting group for zoological and taxonomic studies. Understanding the taxonomy of elasmobranchs helps in identifying species, studying their evolution, and planning conservation strategies.



Systematic Position

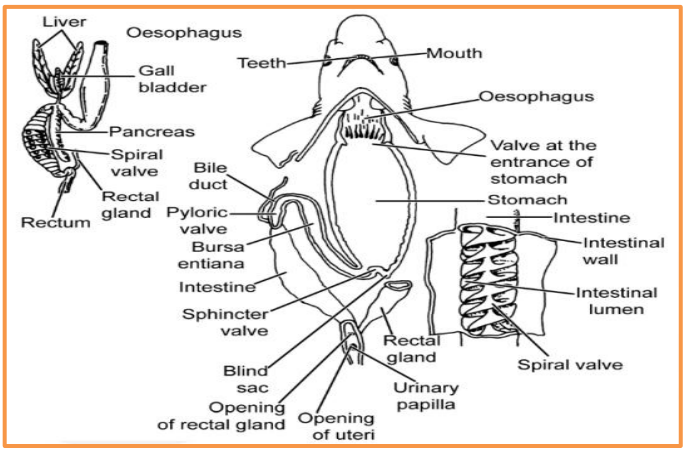
Kingdom: Animalia
Phylum: Chordata
Subphylum: Vertebrata
Superclass: Gnathostomata
Class: Chondrichthyes
Subclass: Elasmobranchii

The class Chondrichthyes is divided into two subclasses: Elasmobranchii (sharks and rays) and Holocephali (chimaeras). Elasmobranchii differs from Holocephali by the presence of multiple gill slits, placoid scales, and absence of an operculum.

General Characters of Elasmobranchii

Endoskeleton

The skeleton is entirely cartilaginous and lacks true bone. In many species, the cartilage is strengthened by calcium deposits. The notochord is partially or completely replaced by cartilaginous vertebrae.

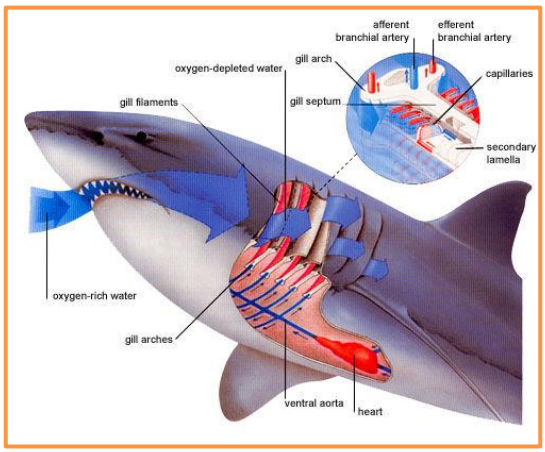


Skin and Scales

The skin is tough and covered with placoid scales, also called dermal denticles. These scales reduce friction during swimming and protect the body. Placoid scales are similar in structure to teeth.

Digestive System

The mouth is located on the ventral side of the head. Teeth are sharp and arranged in several rows and are continuously replaced. The intestine contains a spiral valve which increases the surface area for absorption. The liver is large and oily and helps in buoyancy.



Respiratory System

Elasmobranchs have 5–7 pairs of gill slits which open directly to the outside. An operculum is absent. Spiracles are present in many species and help in respiration, especially when the animal is resting on the sea floor.

Circulatory System

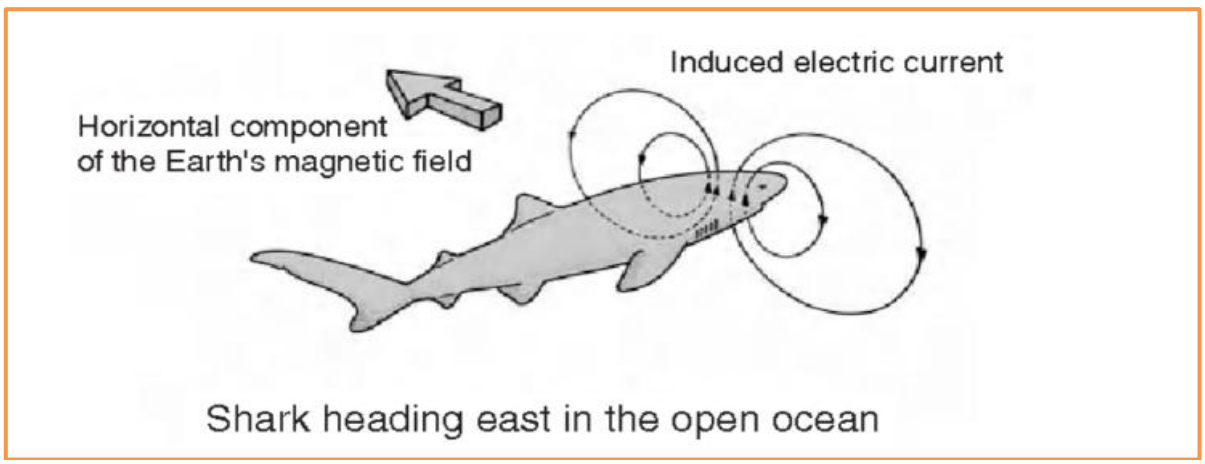
The heart is two-chambered with one auricle and one ventricle. Blood circulation is single. Red blood cells are nucleated.

Excretion and Osmoregulation

Elasmobranchs are mainly ureotelic and retain urea in their blood. This helps them maintain osmotic balance with seawater. The kidneys are mesonephric in nature.

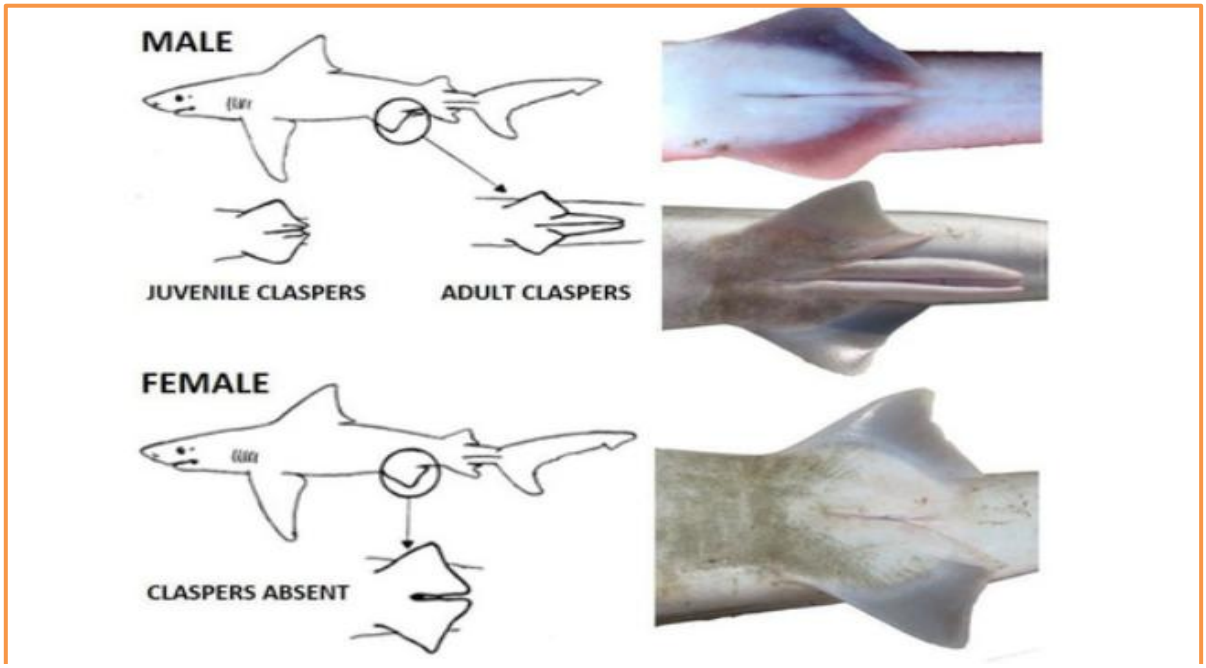
Nervous and Sensory Organs

The brain is well developed. Sensory organs include the lateral line system for detecting water movements and the ampullae of Lorenzini for detecting electrical signals produced by prey.



Reproduction

Sexes are separate. Fertilization is internal. Males possess claspers which are modified pelvic fins. Development may be oviparous (egg-laying), ovoviviparous, or viviparous.



Evolutionary Significance

Elasmobranchs are considered primitive fishes, yet they show many advanced adaptations. They form an important link in vertebrate evolution and help in understanding the origin of jaws and paired fins.

Major Groups of Elasmobranchii

Elasmobranchii is divided into two major groups:

1. Selachii – Sharks
2. Batoidea – Rays and Skates

Selachii (Sharks)

General Characters

Sharks have a streamlined, spindle-shaped body adapted for fast swimming. Pectoral fins are free and not attached to the head. Gill slits are present on the sides of the body. The caudal fin is heterocercal.

Important Orders of Sharks

Order: Hexanchiformes

- Primitive sharks
- Six or seven gill slits
- Example: *Hexanchus*

Order: Squaliformes

- Two dorsal fins with spines
- Anal fin absent
- Example: *Squalus*

Order: Carcharhiniformes

- Anal fin present
- Nictitating membrane present
- Example: *Carcharhinus*

Order: Lamniformes

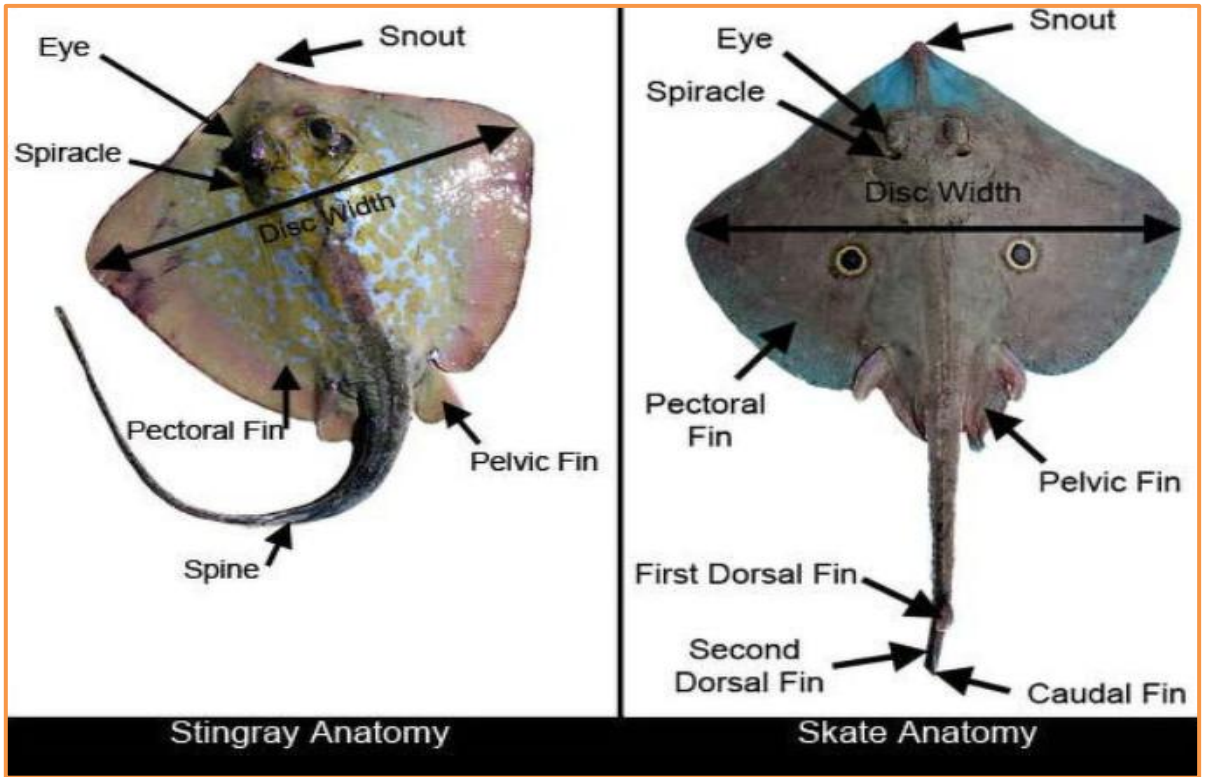
- Large predatory sharks
- No nictitating membrane
- Example: *Carcharodon carcharias*

Order: Orectolobiformes
- Carpet sharks
- Mouth at the front
- Example: *Rhincodon typus*

Batoidea (Rays and Skates)

General Characters

Rays and skates have a flattened body. Pectoral fins are enlarged and fused with the head to form a disc. Gill slits are located on the ventral side. They mostly live on the sea bottom.



Important Orders of Rays

Order: Rajiformes (Skates)
- Oviparous
- Tail slender
- Example: *Raja*

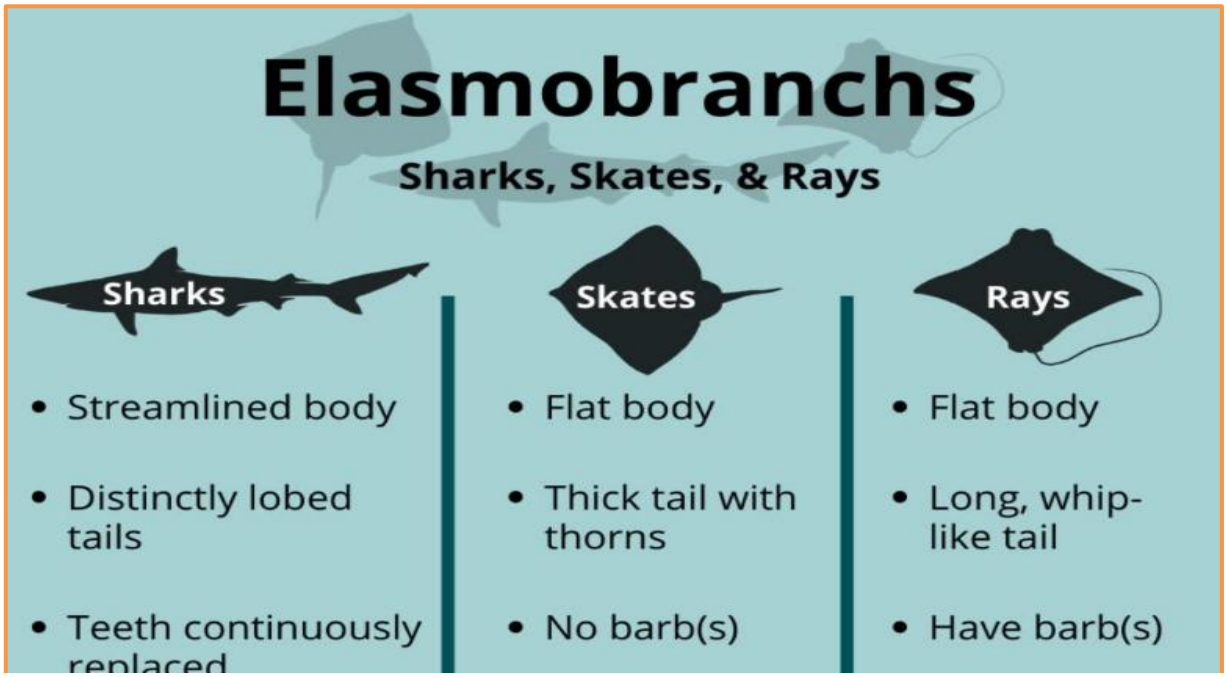
Order: Myliobatiformes (Stingrays)
- Tail with venomous spine
- Mostly viviparous
- Example: *Dasyatis*

Order: Torpediniformes (Electric Rays)
- Electric organs present
- Example: *Torpedo*

Order: Pristiformes (Sawfishes)
- Long saw-like rostrum
- Example: *Pristis*

Differences Between Sharks and Rays

Feature	Sharks	Rays
Body shape	Fusiform	Flattened
Gill slits	Lateral	Ventral
Pectoral fins	Free	Fused to head
Habitat	Pelagic/Benthic	Benthic



Economic and Ecological Importance

Elasmobranchs play an important role in maintaining marine food chains. They control prey populations and maintain ecosystem balance. They are used as a source of food, liver oil, and other by-products.

Conservation Status

Many elasmobranch species are threatened due to overfishing, habitat loss, and slow growth rates. Conservation measures and correct taxonomic identification are essential for their protection.

Conclusion

Elasmobranchii is a unique and important group of fishes with distinct taxonomic characters. Their study is essential for understanding fish diversity, evolution, and marine ecology. This group holds great academic and ecological significance at the undergraduate level.

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