



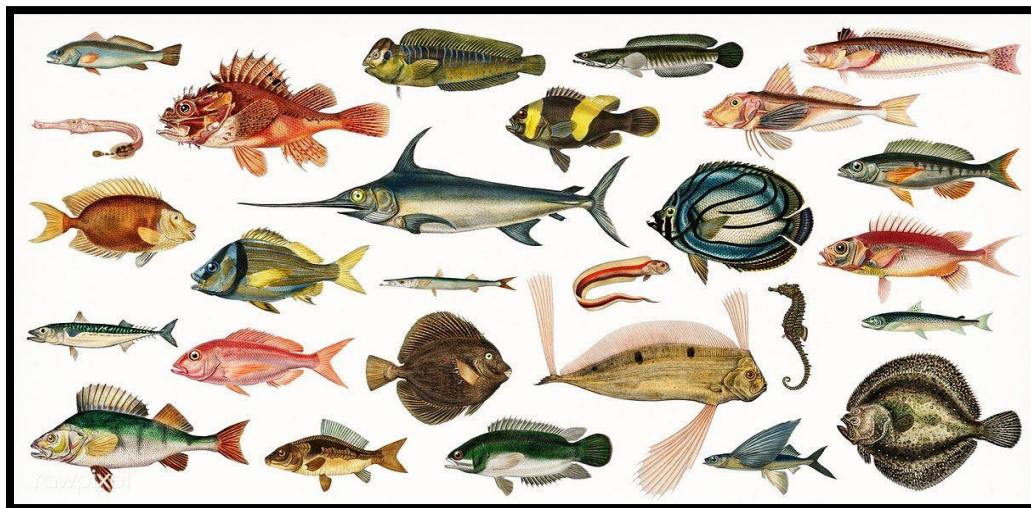
SUBJECT	ZOOLOGY
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SuperClass-Pisces



Learning outcome:

Develop understanding on the diversity of life with regard to chordates.

- Group animals on the basis of their morphological characteristics/ structures.
- Develop critical understanding how important are Fishes.

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Introduction:

- Fish are gill bearing aquatic craniate animals that lack limbs with digits.
- These are true, jawed vertebrates with specific organs for respiration, excretion and blood circulation.
- The organisms belonging to this class are poikilotherms, meaning that they cannot regulate their own body temperature.

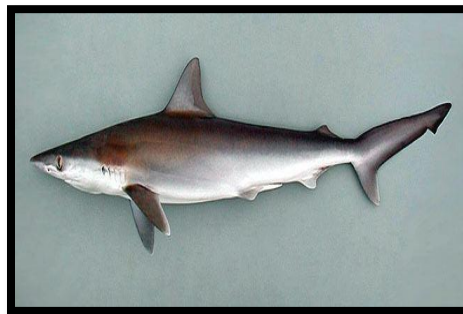
General characters of Pisces

- They are aquatic, fresh water or marine , cold blooded vertebrates.
- Skin is covered with scales, dermal denticles or bony plates.
- Generally streamline body but some are elongated, few are dorsoventrally compressed.

- The unpaired fins are dorsal, caudal and anal fins. The paired fins are pectoral and pelvic fins.
 - Tail is muscular with tail fin used for propulsion.
 - Endoskeleton is cartilaginous or bony.
 - Respiratory organs are gills. Accessory organs may also be present.
- Gill slits are usually 5 in pairs but in some cases 6 or 7 pairs

Chondrichthyes General characters:

- Body spindle shaped, laterally compressed or dorsoventrally flattened and disc like.
- Skin is tough, covered with minute placoid scales.
- Median and paired fins are present which are supported by horny fin rays. Caudal fin is heterocercle.
- Endoskeleton is cartilaginous.
- Five to seven pairs of gills are present. Gill slits are uncovered, no operculum. Air bladder is present
- Heart is two chambered. Stomach is J shaped. Intestine is short.
- Brain is large, olfactory lobes and cerebellum is large, pairs of cranial nerves. Well developed sense organs.
- Kidney is mesonephric, large amount of urea is retained in the body.
- Sexes are separate, paired gonads, fertilization internal, some are oviparous or ovoviviparous and some are viviparous.
- Example: Scoliodon, Pristis, Raja.



Scoliodon-Dog Fish

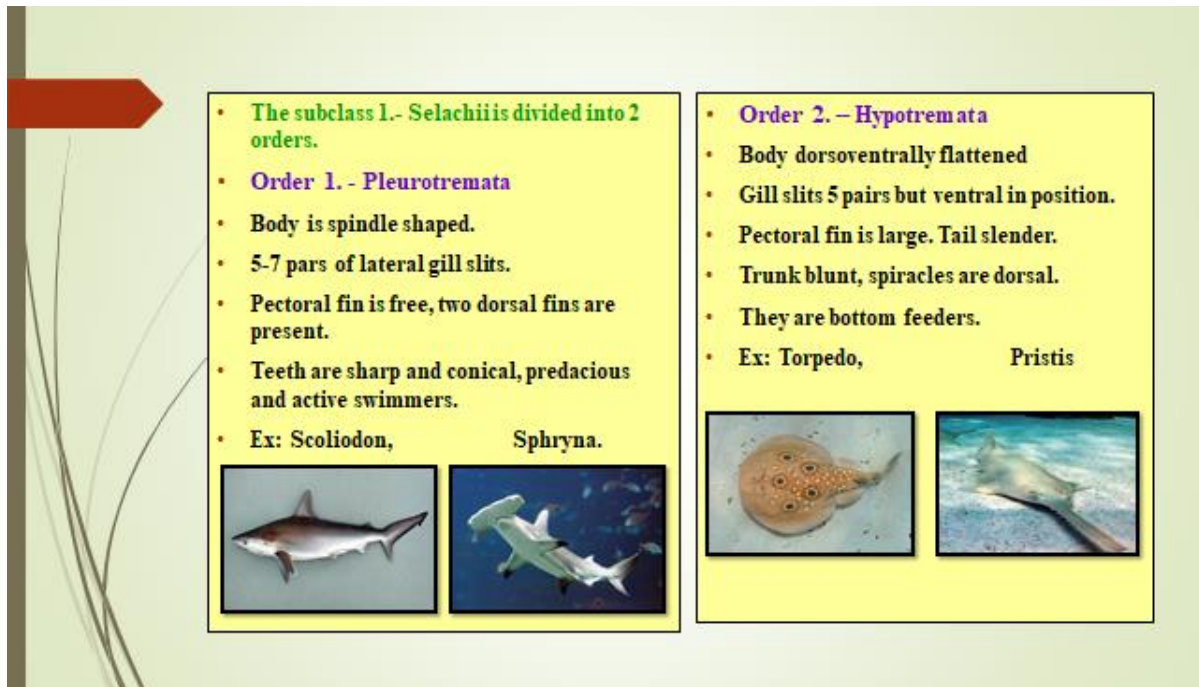
Chondrichthyes- classification

- Class- Chondrichthyes is divided in to 2 subclasses Subclass 1. – Selachii or Elasmobranchii and Subclass 2. Holocephali.

Sub class 1.- Selachii or Elasmobranchii


- Body laterally compressed or dorsoventrally flattened.
- Exoskeleton is of placoid scales.
- Teeth numerous which are modified placoid scales.
- Spiracles may be present.
- 5-7 pairs of gill; no operculum.
- Cloaca is present. Mostly marine
- Ex: Sharks, Rays and skates.

Class - Chondrichthyes





The subclass 1.- Selachii is divided into 2 orders.


- Order 1. - Pleurotremata
- Body is spindle shaped.
- 5-7 pairs of lateral gill slits.
- Pectoral fin is free, two dorsal fins are present.
- Teeth are sharp and conical, predacious and active swimmers.
- Ex: Scoliodon, Sphryna.



- Order 2. – Hypotremata
- Body dorsoventrally flattened
- Gill slits 5 pairs but ventral in position.
- Pectoral fin is large. Tail slender.
- Trunk blunt, spiracles are dorsal.
- They are bottom feeders.
- Ex: Torpedo, Pristis





<ul style="list-style-type: none"> • Subclass 2. Holocephali • Body including head laterally compressed. • Scales are absent in adults. • Teeth are fused to form plates. • Spiracles absent tail slender and whip like. • Four pairs of gill and gill slits, covered by flap of skin, the operculum. • Vertebrae poorly developed. Cloaca is absent. • There is single order- Chimeriformes. 	<ul style="list-style-type: none"> • Order- 3 Chimaeriformes. • It has similar characters of sub-class. • Ex: Chimaera . 
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Class- Osteichthyes or Bony fishes

General characters:

- Body spindle shaped and laterally compressed.
- Median and paired fins are present and are supported by cartilaginous or bony fin rays.
- Homocercal caudal fin. Single dorsal fin.
- Body covered by either ganoid, cycloid or ctenoid scales.
- Mouth usually terminal with numerous teeth. Jaw well developed and articulated with skull.
- Endoskeleton is partly of wholly bony-vertebrae.
- Cloaca absent. Anus is present.
- Heart is 2 chambered. Brain has small olfactory lobes and cerebellum 10 pairs of cranial nerves.
- Sexes are separate. Fertilization external. Most forms are oviparous. Some are ovoviviparous or viviparous.
- Ex: Amia, Anguilla, Exocoetetus, Acipenser.

- **Class Osteichthyes is divided into 2 subclass.**
- **Subclass- Actinopterygii.**
- They are called as ray fishes. Dorsal fin is single with spine. Pair of external nares. Air bladder serves as a hydrostatic organ. Operculum covers the gills of each side.
- **Subclass 1. Actinopterygii is divided into three infra- classes.**
- **Infraclass 1. Chondrostei:**
- They are called primitive ray finned fishes. Most of them have become extinct. Scales are ganoid, jaws are toothless. Tail fin heterocercal. Air bladder functions as a lung. Intestine has spiral valve.

- **Infraclass- 1. Chondrostei is divided into 2 orders.**
- **Order 1.- Polypteriformes**
- Dorsal fin is split into numerous finlets. Ex- Polypterus.



- **Order 2.- Acipenseriformes.**
- Body is snake like and bears rows of heavy, bony scales. Ex: Acipenser.



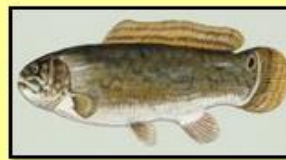
Infra-class 2. - Holostei.

They are called as intermediate ray-finned fishes, ancient and most of which are extinct. Ganoid or cycloid scales. Tail hemiheterocercal. Skeleton is moderately ossified. Air bladder is single, spiracle is absent.

- The Infraclass Holostei is divided into 2 orders.
- **Order 1. Semionotiformes**
- The snout is elongated.
- Ex: Lepiosteus.



- **Order 2.- Amiiformes**
- The snout is rounded and dorsal fin is very long.
- Ex: Amia.



• **Infraclass 3.- Teleostei**

They are advanced ray-finned fishes. They are cycloid or ctenoid. Mouth small. Tail fin is homocercal. Spiracle absent. Skeleton is fully ossified. Single air bladder and hydrostatic in function. 4 pairs of gills covered by operculum. Teleostei is divided into following orders.

- **Order 1 - Anguilliformes-** Snake like body, without scales and pelvic fins. Ex: Anguila



Anguila



Wallago

- **Order2 - Siluriformes-** Head bears long, sensory barbels. scales are absent. Ex: Wallago, Rita.

- **Order 3 - Cypriniformes-** Body has cycloid scales, fins without spines. Ex: Labeo, Cyprinus.



Cyprinus

- **Order 4 - Gasterosteiformes-** Mouth is small at the end of snout, trunk is invested in bony armour.

Ex: Hippocampus, Syngnathus.



Hippocampus



Exocoetus

- **Order 5 - Atheriniformes-** Cycloid scales, fins soft-rayed and spineless, pelvic fins are abdominal. Ex: Exocoetus.

- **Order 6 - Perciformes-** Fin rays are hard and spiny, scales with serrated edge.

Ex: Anabas and Echeineis.

- **Order 7 - Tetradontiformes-** Body short, covered with spines, mouth with heavy teeth, pelvic fins are small or absent. Ex: Diodon, Tetradon.

- **Order8 - Lophiiformes-** Flat square body with huge head and wide mouth. Ex: Lophius.

- **Order 9 - Pleuronectiformes-** Body is highly compressed and both eye on one side. Bottom dwellers. Ex: Solea.

- **Order 10 - Channiformes-** Extra lung like respiratory organ, hence able to live outside the water for long time. Ex: Phiocephalus.



Anabas



Tetradon



Lophius



Solea



Phiocephalus

- **Subclass 2.- Sarcopterygii**
They are commonly called as lobe finned fishes. Lobe is fringed with dermal rays. Single or double lung is present. They are air breathing fishes. Tail fin is diphyccercal.
- **Subclass Sarcopterygii is divided into 2 orders-**
- **Order 1- Crossopterygii.**
- Fins are lobed. Separate median fins.
- Tail is 3 lobed. Cartilaginous skeleton.
- Spiracles are present. Most of them are extinct.
- Ex- Latimeria.
- **Order 2- Dipnoi**
- Commonly called as lung fish.
- They breath by gills and also by air bladder.
- Body is long and slender covered by cycloid scales.
- Gills are reduced, spiracle is absent.
- Ex.- Neoceratodus, Lepidosiren, Protopterus.



Latimeria

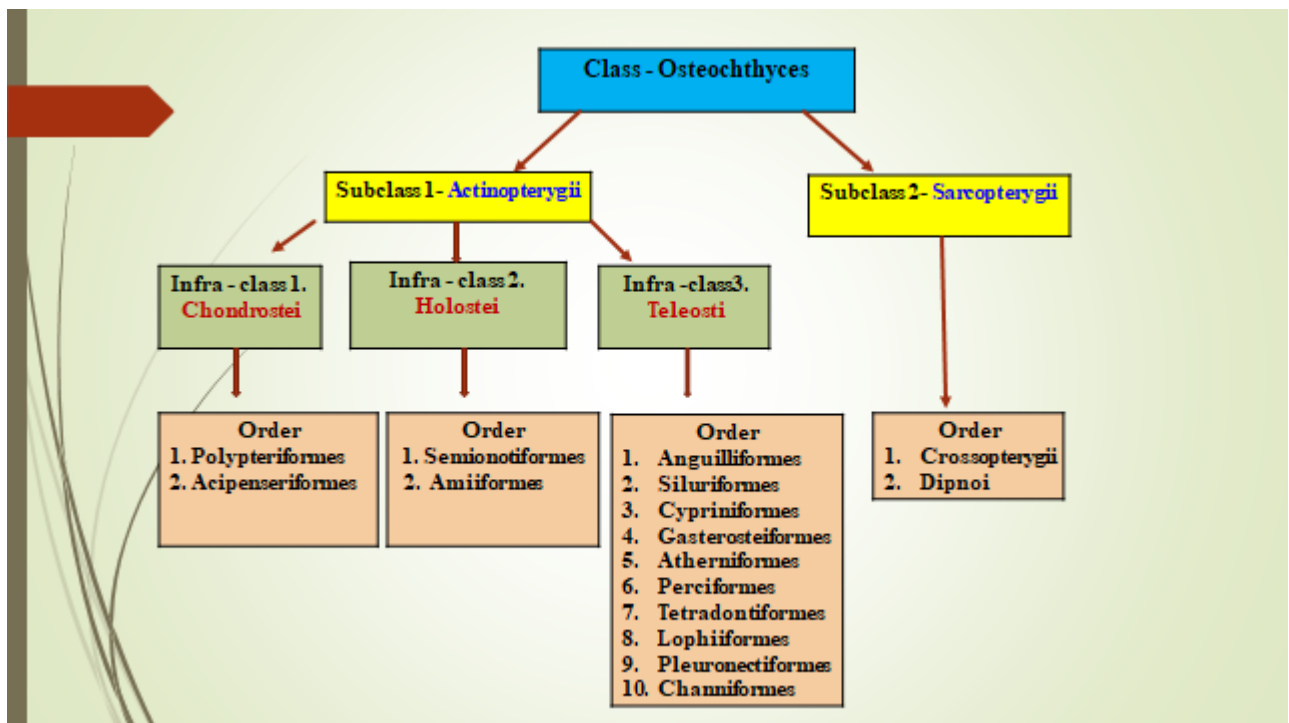
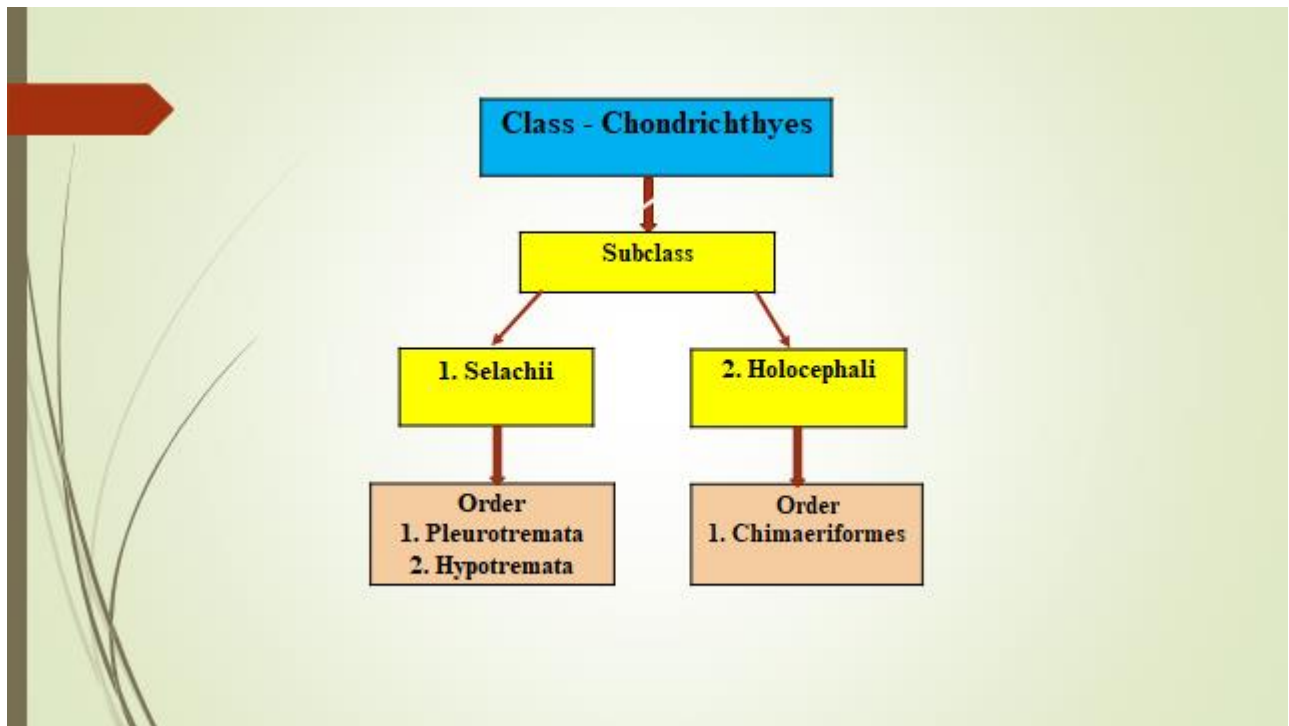


Lepidosiren

Economic importance of Fishes

- Fish is of great importance to human beings because it provides highly nutritious food. Fish is easily available source of protein. In India edible fish are abundantly available from sea, rivers, lakes, ponds and marshes.
- In addition to food following are the other chief and important fish products and by-products of the fishing industry.
- **Oil:** Oil is extracted from fatty tissues of the fishes. Two types of oil are extracted i.e. body oil and liver oil
- **Fish meal:** It is prepared from wastes of fish oil. It contains protein, minerals, calcium, phospholipids, vitamins A, D, K. It is used for domestic animals.

- **Fish protein:** Extracted from waste of fish by removing fat. It is used in cream, paints, varnishes, textile, cosmetics etc.
- **Fish flour:** It is highly nutritive for human beings. It can be used in the form of biscuits, breads, cakes, sweets and soup.
- **Fish fertilizer:** Fishes and fish waste is used in the production of fertilizers. It is used for tea, coffee, tobacco plantation.
- **Fish fins:** Fins of large sized sharks are used for the preparation of soups.
- **Fish skin:** Skin of shark fish is used by carpenters for smoothing and polishing. Dried skin is called shagreen used for covering card cases, jewel boxes or other ornamental purpose. Shark skin is used for making shoes, hand bags, wallets and tobacco pouches. Skin of large fish is used as leather.
- **Fish glue:** It is by-product obtained from the skins, trimmings and bones of Cod.
- **Poultry feed:** After extraction of glue, the remaining residue is dried and used as poultry feed or fertilizer.
- **Medicines:** Sharks are used in cure of duodenal ulcers. Certain by-products are used in night-blindness, skin diseases, colds, cough, bronchitis, asthma and tuberculosis.
- **Fancy articles:** Scales of garpike fish are used for jewellery and novelties.
- **Scientific study:** Fish are largely used as experimental animals in the field of Genetics, Embryology, Animal behaviour, Pharmacology for research purpose



<https://docs.google.com/presentation/d/1dJPaTjntZNt6kDKmHQtbvHpbDw7eDYn0/edit#slide=id.p1>

<https://drive.google.com/file/d/1aHvSps0XQmvK5s9IX9pVNtej0sGFxyHb/view>

Explore more:

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- Kardong, K.V. (2006) Vertebrates: Comparative Anatomy, Function, Evolution (4th edition), McGraw- Hill.

Assessment

Units	Out-of –class activity Details of Activity	In-class activity Details of Activity	Assessment
1.1	Students should observe the specimens study importance of fishes	Discussion on the topic Check the level of understanding through Question – answer session	Question – answer session
1.2	Students should classify the specimens Students should observe characters and identify cartilaginous and bony fishes	Discussion on the topic Check the level of understanding through Question – answer session Help students to apply the knowledge	Question to write in detail classification with examples