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Basic Finfish Features

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Taxonomy is the practice of identifying different organisms, classifying them into categories and naming them. The whole life (living or extinct) of the world are classified into distinct groups with other similar organisms and given a scientific name. The classification of organisms has various hierarchical categories. Categories gradually shift from being very broad and includes many different organisms to very specific and identifying single species.

The most common system of classification in use today is the Five Kingdom Classification, proposed by R.H Whittaker in 1969. Five kingdom classification of living organisms is as follows:

1. Kingdom: Monera

It consists of primitive organisms. The organisms are very small and single celled. It includes species like the Bacteria, Archae bacteria, Cyanobacteria and Mycoplasma.

2. Kingdom: Protista

It is single-celled eukaryotes and mainly belongs to aquatic. It includes diatoms, euglena and protozoans like Amoeba, Paramecium, Plasmodium, etc.

3. Kingdom: Fungi

Kingdom Fungi is also called Kingdom Mycota and consists of network of thread-like structures called as mycelium. The bodies consist of long, thread-like structures which is called hyphae. These organisms are mostly saprophytes or parasites and also symbionts. This kingdom of fungi also includes Lichens, Mycorrhiza, etc. Example: Aspergillus.

4. Kingdom Plantae

Kingdom Plantae is also known as Kingdom Metaphyta. It is eukaryotic, mutlicellular plants. This kingdom includes all types of plants like herbs, shrubs, trees, flowering and non-flowering plants. Example: Rose plant, Mango tree, etc.

4. Kingdom Animalia

Kingdom Animalia is also called Kingdom Metazoa. It is heterotrophic, eukaryotic, multicellular organisms. They lack cell wall. This kingdom includes all types of animals. Example: Fish, Shrimp, Crab, Lobster, Chank, etc.

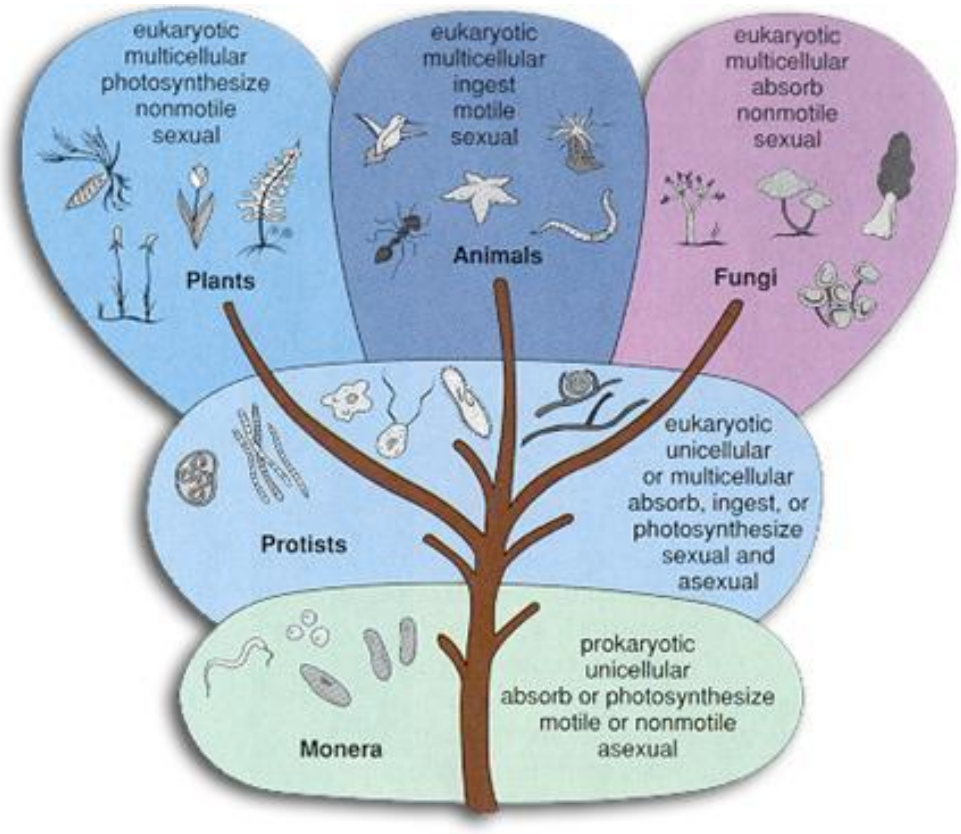

Figure 1. Five Kingdom Classification

Taxonomic hierarchy

Taxonomic hierarchy is the arrangement of various categories in successive levels of the biological classification. Each of this level or hierarchy is called as the taxonomic category or rank. Every organism can be classified at 7 different levels - kingdom, phylum, class, order, family, genus and species. Each level contains organisms with similar characteristics. The kingdom is the largest group and very broad. Each successive group contains fewer organisms, but the organisms are more similar. The species is the smallest group and is very narrow.

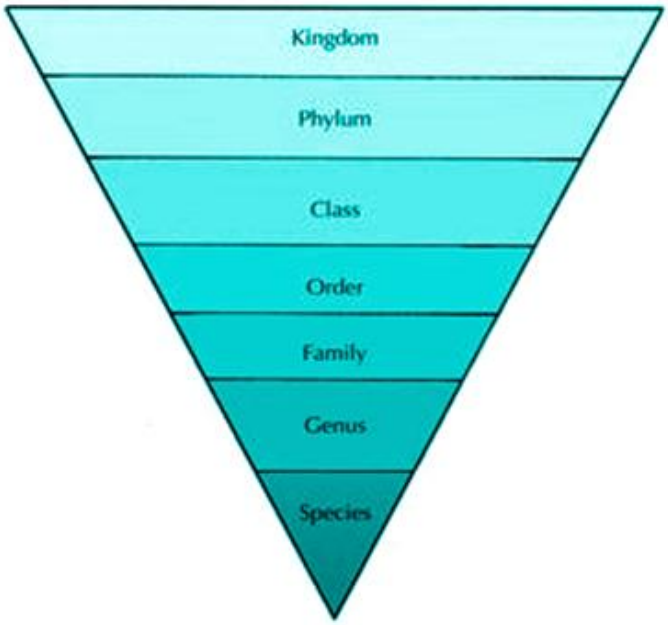

Figure 2. Taxonomic hierarchy

Species

An individual belonging to a group of organisms that are very similar to each other and are having common characteristics and are capable of mating with one another to produce fertile offspring. The species is the fundamental category of taxonomic classification, ranking below a genus or subgenus.

Biological Nomenclature

Biological nomenclature is a language that we use to communicate ideas and information about the diversity of life. It is an information retrieval system conveying information about diversity and relationships. It was introduced by Carl Linnaeus.

Common *Vs* Scientific Names

Common names for species are words in the language of the layperson. These names can often be misleading.

Disadvantages

1. They are not useful to people with a different language or dialect
2. Some species have several common names
3. Some species share the same common name
4. Some species may not have a common name

General rules

The scientific name of each species is formed by the combination of two words - as signified equally by "binomial," "binominal," and "binary - and the two words are in a modern form of Latin.

1. Latin language
2. Consists of a genus and species name
3. Generic names always begin with a capital letter
4. Species names always begin with lower-case letter

Example: - *Sardinella longiceps*, *Rastrelliger kanagurta, Thunnus albacares,* etc.

Finfish

Finfish can be defined as cold-blooded aquatic craniate vertebrate with fins for locomotion and gill for respiration. About 33,218 species of finfish has been identified in the world at present time. It may live in freshwater, brackish water and marine water. The skeleton of finfish is made up of either bone (called bony finfish) or cartilaginous (called cartilaginous finfish).

Identification

The external morphological characters of finfish are used for identification of species. There are two main features - morphometric characters and meristic characters. Morphometric characters include body shape/parts, mouth location and size, tail shape and colour. Meristic characters are the counting of spine, ray, etc in fin or other part of body. External part of finfish is commonly divided in two parts, 1) Head consist of Snout, Lips, Mouth, Jaws, Teeth, Barbels, Nostril, Eyes, Operculum and Gills; 2) Body incudes Fins, Lateral Line, Skin and Scales.

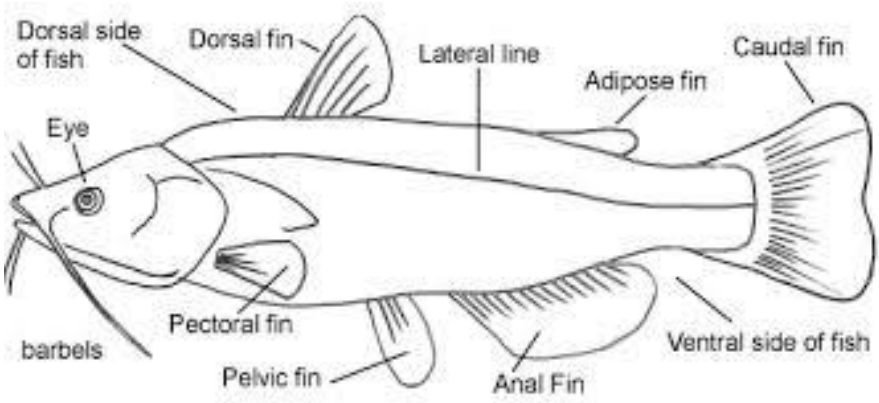

Figure 3. Finfish external features

Section of finfish

Finfish may be dissected into dorsal side, ventral side, anterior end and posterior end.

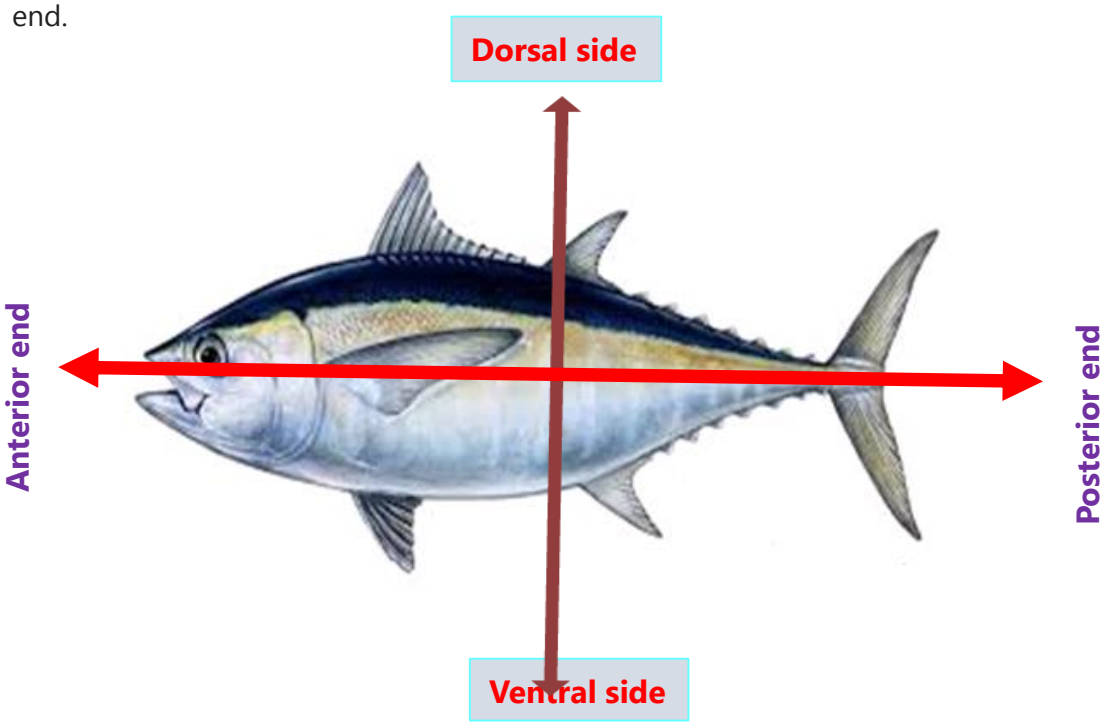

Figure 4. Section of finfish

Snout

Snout is the anterior most part of the fish (forward end of head). It is rounded or obtuse in most cases. There can be many variations to the shape of snout.

1. Pointed and sharp (Eels)
2. Tubular with jaws at tip
3. Smooth in most cases

Lips

The bone of the upper and lower jaw is covered by lips. Mostly they are thin smooth membranes but in some cases they may have pores, stripes or modified to form a sucker like disc in Garra species.

Mouth

Mouth is the main organ which fish use while feeding. The position and shape of the mouth depends on the type of food a fish eats and the level at which it swims. The mouth shapes can be

1. **Terminal Mouth**: - Terminal mouth is found in those fish, which feed from water column on other fish or zooplankton. Terminal mouths are located in the middle of the head and point straight forward; both jaws are of the same length. Example Danios, Rasbora, Putnius, etc.
2. **Superior Mouth**: - The superior mouth is oriented upwards and the lower jaw is longer than the upper jaw. Usually, fish with this type of mouth feed at the surface. They lay in wait for prey to appear above them, then strike suddenly from below. Many species of fish with a superior mouth feed largely on insects, however, some may feed on other fish that swim near the surface.
3. **Sub-terminal Mouth**: - It is also called an inferior or ventral mouth. The inferior mouth is turned downward. The lower jaw is shorter than the upper jaw. Fish with inferior mouths are bottom feeders and often possess barbels that assist in locating food particles.
4. **Protrusible Mouth**: - Often fish will have a protrusible mouth feature, which allows them to extend their reach when attempting to snatch prey or food particles.

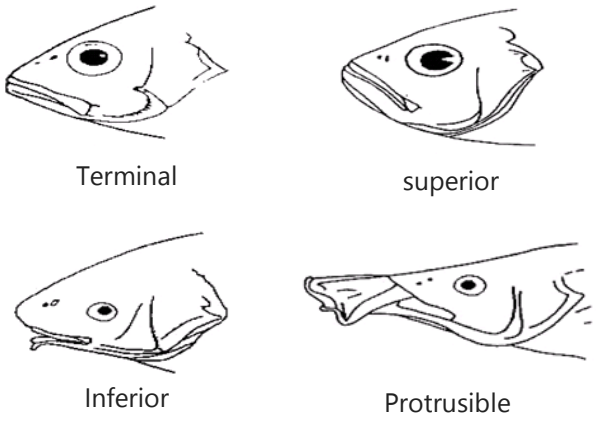

Figure 5. Type of mouth

Jaws

The jaw consists of the upper jaw and lower jaw. The upper jaw consists of bones called pre-maxillaries and maxillaries, while the lower jaw consists of mandible bones. These are connected by a joint which enables the fish to open and close the mouth. Jaws contain teeth and frame the shape of the mouth**.**

Teeth

Most fish have teeth on jaws and palate. In addition to these teeth some fish have pharyngeal teeth also. However not all fish have teeth like cyprinids. There are many types of teeth :-

1. **Canine**: - It is large conical teeth frequently located at the corners of the mouth, for example, snappers.
2. **Viliform**: - Villiform teeth is small and fine teeth.
3. **Molar form**: - Molariform teeth is molar like broad and rounded. It is used for crushing molluscs and crustaceans.
4. **Cardiform**: - It is fine, pointed teeth arranged as in a wool card; for example, the pharyngeal teeth in pickerels (Esox).
5. **Incisor**: - Large teeth with flattened cutting surfaces adapted for feeding on molluscs and crustaceans; for example, chimaeras (*Holocephali*).

Barbels

Barbels are slender, whisker like tactile organs near the mouth. They are found in fish like catfish, carps etc, they house the taste buds used by fish to find food.

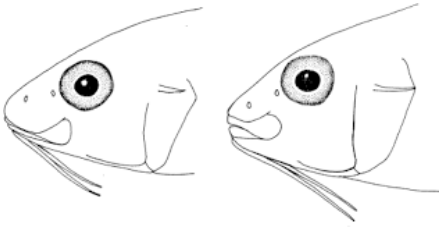

Figure 6. Barbels in finfish

Nostrils

Nostrils are pair of apertures or slits on the snout of the fish. They are openings for the smell organs leading to the nasal canal on the skull. They are small to medium and are sunk in snout, in some fish like catfish they are covered with mucus. Position and type of nostrils is often used for identifying a fish.

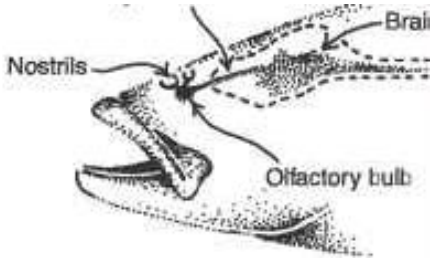

Figure 7. Nostrils in finfish

Eyes

Eyes are mainly used by fish for seeing, food, enemies and predators. They are placed dorso-laterally (upper part- on the side) in most fish. However, the placement depends upon the habitat of fish. They can be placed at the top or bottom of the skull. Deepwater swimming fish have large eyes as they receive less light at that depth, on the other hand eyes of hill stream fish are small as they live near the surface and receive a large amount of light.

Figure 8. Eye in finfish

Operculum and gills

Operculum along with gills form breathing apparatus for the fish. On each side of fish there are slits called gills. The gills are composed of comb-like filaments, the gill lamellae, which help increase their surface area for oxygen exchange. In bony fish, the gills lie in a branchial chamber covered by a bony operculum. A fish breathes by taking in water through its mouth and forcing it out from gills. There are tissue linings in the gills which absorb oxygen, CO_2 is also expelled from the gills. The majority of bony fishes have 5 pairs of gills. In cartilaginous fish, gill slits are not covered and lie in a row behind the head. In general, there are five pairs in cartilaginous fish, but a few species have 6 or 7 pairs.

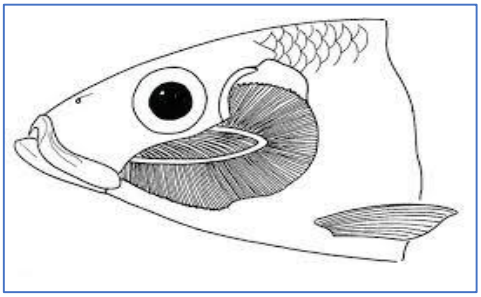

Figure 9. Gill slit in bony finfish

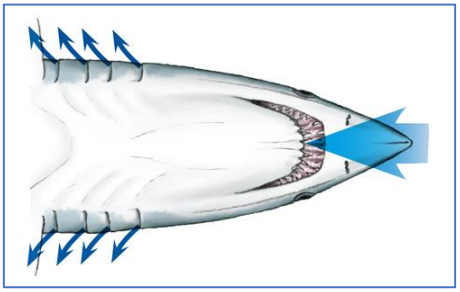

Figure 10. Gill slit in shark

Fins

Fins are thin appendages on the body of fish. They are made of bony spines protruding from the body of fish with skin covering them and joining them together in case of bony fish or Osteichthyes. In case of cartilaginous fish, fins are present as flippers. They are foil shaped and are primary means of locomotion for the fish. Some generate thrust when moved, others are used for stabilizing and treeing. In bony fish (Osteichthyes), most fins may have spines or rays. A fin may contain only

spiny rays, only soft rays, or a combination of both. If both are present, the spiny rays are always anterior. Spines are generally stiff and sharp. Rays are generally soft, flexible, segmented, and may be branched. This segmentation of rays is the main difference that separates them from spines; spines may be flexible in certain species, but they will never be segmented. Fins occur in both pairs and single, they may be covered with scales or without scales.

1. Pectoral Fins

The pectoral fins occur in pair and are located on each side, usually just behind the operculum (gill cover), and are homologous to the forelimbs of tetrapods. There are many adaptions to these fins in some cases they create a dynamic lifting force that assists some fish, such as sharks, in maintaining depth and also enables the "flight" for flying fish. In many fish, the pectoral fins aid in walking, especially in the lobe-like fins of some anglerfish and in the mudskipper.

2. Pelvic Fins

Pelvic fins occur in pairs and are found on the ventral (lower) side of the fish below the pectoral fins. They assist the fish in going up and down in water, turning and stopping. In some fish like gobies they are joined into a single sucker like disc which is used to attach to objects.

3. Dorsal Fin

Dorsal fin is a single fin present on the dorsal side of body. The dorsal fin serves to protect the fish against rolling, and assists in sudden turns and stops. When the top of rays is connected with membrane they are called soft, else they are called hard spines. In many fish it is single and concave in shape with first spine being largest and last spine shortest. In perches there are two dorsal fins, one after another. The first fin is separated by either a short or long gap, or it may be combined.

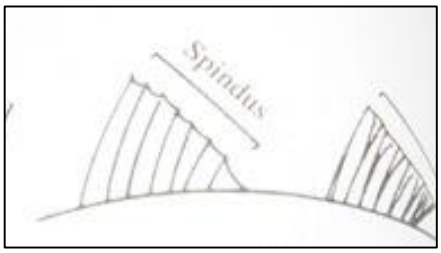

Figure 11. Separate Dorsal fin

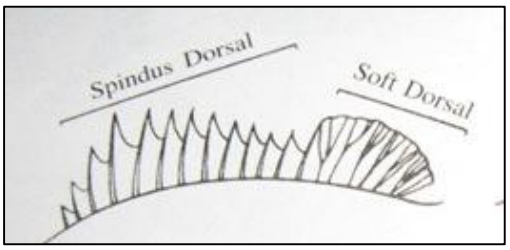

Figure 12. Combined Dorsal fin

Caudal Fin

Caudal or tail fin is located at the end caudal peduncle of the fish. The caudal peduncle is the narrow part of the fish's body to which the caudal or tail fin is attached. It is always a single fin and acts as rudder for the fish. On the basis of external and internal structure, caudal fins are Protocercal, Heterocercal, Diphycercal, Hypocercal, Homocercal, Isocercal and Gephyrocercal. The posterior end of the vertebral column is bent upward and continues upto the end of the caudal fin in the case of Heterocercal Caudal fin. Heterocercal caudal fin is found in elasmobranch (shark) and primitive fish such as Acipenser. Homocercal caudal fin looks externally symmetrical with equal epi-and hypochordal lobes, but internally hind end of the vertebral column is tuned upward and shortened. Thus, Homocercal caudal fin is internally asymmetrical. It is found in higher teleost.

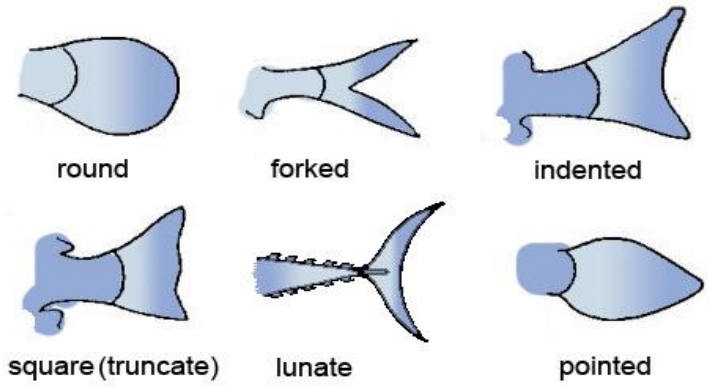

Figure 13. Caudal fin bony finfish

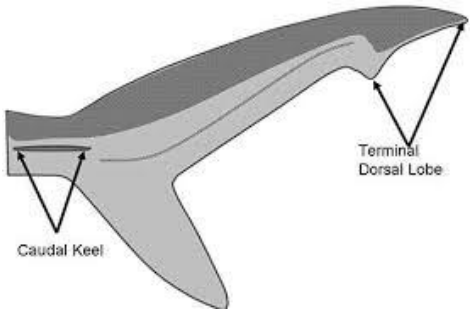

Figure 14. Heterocercal caudal fin

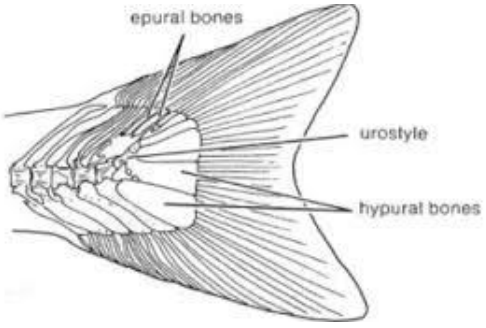

Figure 15. Homocercal caudal fin

Adipose Fins

The adipose fin is a soft, fleshy fin found on the back behind the dorsal fin and just forward of the caudal fin. It is absent in many fish families, but is found in Salmonidae, characins and catfishes.

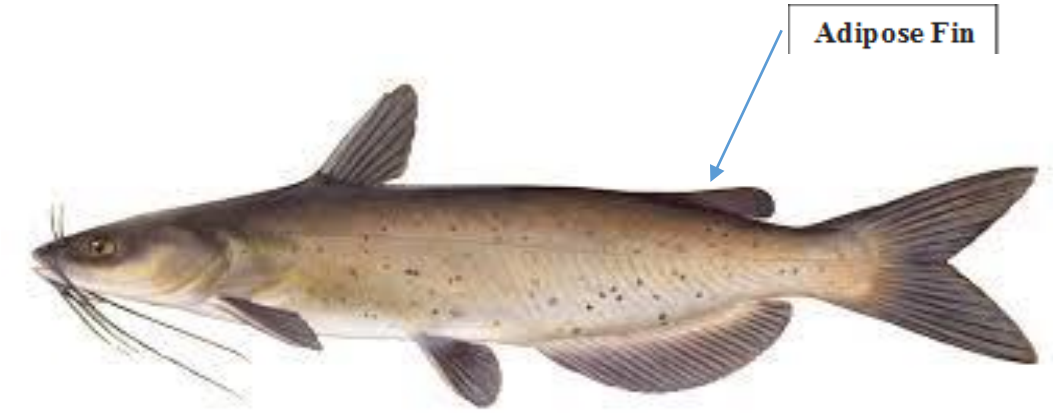

Figure 16. Adipose fin

Caudal Keel

Many fast swimming fish have a horizontal keel just in front of tail fin. It is present as ridge in caudal peduncle. It provides stability and support to the tail fin. They are always present as either a single pair or double pair, one of each side.

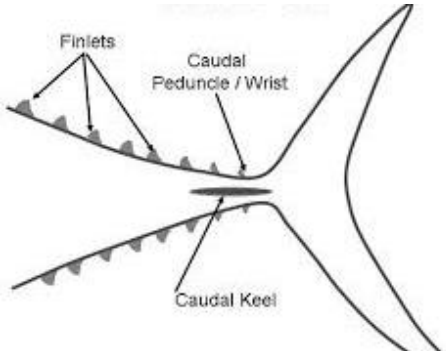

Figure 17. Caudal Keel

Fin lets

Fin lets are small fins, generally behind the dorsal and anal fins. Example, Tuna.

Figure 18. Fin lets

Skin

The skin of fish consists of live cells, there is very superficial amount of keratin in outermost layer. It is generally permeable. Fish typically have numerous individual mucus-secreting skin cells that aid in insulation and protection, but may also have poison glands, photospheres, or cells that produce a more watery, serous fluid. The colour in skin is mostly provided by melanin, however often the skin is colourless. The colour is provided by largely due to chromatophores in the dermis, which, in addition to melanin, may contain guanine or carotenoid pigments.

Scale

The outer body of many fish is covered with scales. Some fishes have a type of scale known as the scute, which is an external shield-like bony plate, or a modified, thickened scale that often is keeled or spiny. eg. clupeids and carangids.

There are four principal types of fish scales, which are following:

1. Placoid Scales

Placoid scales also called dermal denticles, are similar to teeth in that they are made of dentin covered by enamel. They are typically found in sharks and rays.

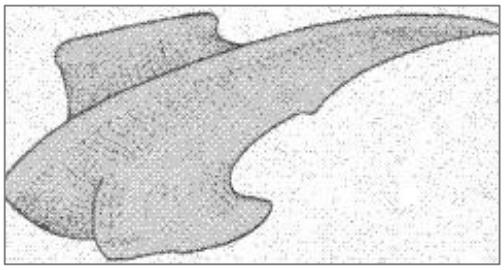

Figure 19. Placoid Scales

2. Ganoid scales

Ganoid scales are flat, basal-looking scales that cover a fish body with little overlapping. They are typical of gar and bichirs.

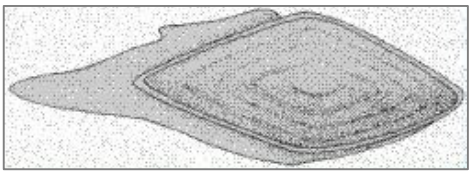

Figure 20. Ganoid scales

3. Cycloid scales

Cycloid scales are small oval-shaped scales with growth rings. They are found in many teleosts.

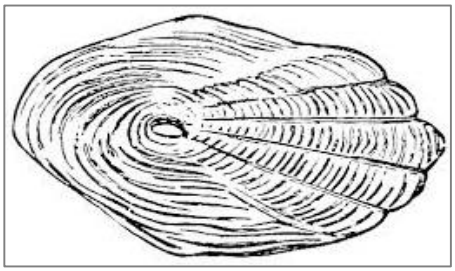

Figure 21. Cycloid scales

4. Ctenoid scales

Ctenoid scales are similar to the cycloid scales, with growth rings. They are distinguished by spines that cover one edge.

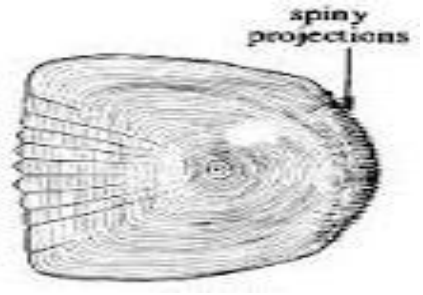

Figure 22. Ctenoid scales

Lateral Line

The lateral line is a sense organ used to detect movement and vibration in the surrounding water. In most species, it consists of a line of receptors running along each side of the fish. It can be complete (eg. Pomfrets, Sciaenids), incomplete (eg. Pomacentridae) and interrupted (eg. Serranids, Cichlids).

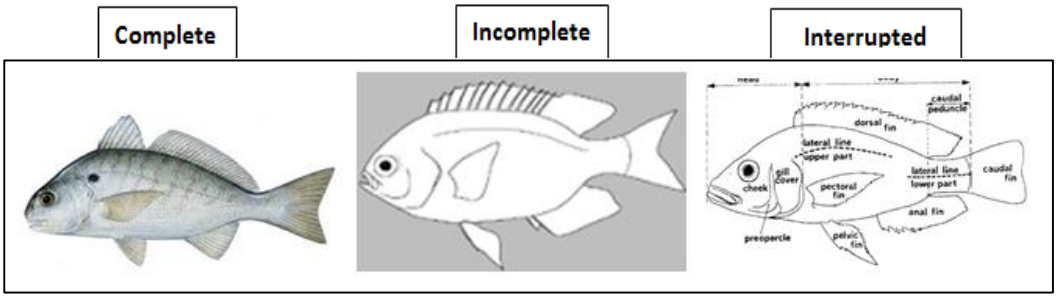

Figure 23. Lateral line

Body shapes

Anguilliform: Greatly elongated snake like fish with an almost circular cross section

eg. Eel

Taeniform : Body is laterally compressed and greatly elongated bodies. eg. Gunnels

Ovate or **Truncated:** eg. File fish and pomfrets

Depressiform: Dorsoventrally compressed and bottom oriented fish. eg. skate, rays, toad fish