



# MID TERM

## OBJECTIVE

1. **Systematics** is the study of the diversity of fish and the evolutionary relationships between these organisms.
2. **L.S. Berg** classified fishes in to seven classes and separated lampreys and hagfishes into a separate class.
3. **Agnatha** ... Do not have an identifiable stomach or any appendages.
4. Gnathostome diversity comprises roughly ....**60,000** species
5. **700** species Elasmobranchs
6. **Ostichthys** is the largest class of vertebrates.
7. **Lobe-finned fish** ... Have muscular lobes associated with their fins and usually use lungs for gas exchange.
8. **Beaklike mouth** ..used to graze on small algae growing on hard surfaces
9. First jawed fishes appeared in the geologic record about ....**100 million years**
10. Proportion (**40–60%**).. Of the mass of a fish's muscle is made up of locomotory muscle
11. . The circulatory, or blood vascular, system consists of ... (**the heart, the arteries, the capillaries, and the veins**)
12. **Romer's** classified fishes into three classes
13. **J.S Nelson** Classified fishes into five classes and removed class osteichthyes raised sarcopterygii and actinopterygii to class level.
14. Shark is about ..... In length. **15m**
15. Hagfish are typically about **50** cm in length.
16. Hag fishes, belong to Class ...**MYXINI**
17. A feeding strategy involving the consumption of feces. **Coprophagy**
18. Less voracious fish species in Africa **Hemichromis**
19. Herbivory is one of the most important processes in maintaining ecological balance on the **Mesoamerican Reef**.
20. Gnathostome diversity comprises roughly **60,000 species**, which accounts for 99% of all living vertebrates, including humans.
21. Sub class Elasmobranchi contain **700 species**
22. (**Lobe-finned fish**) Have muscular lobes associated with their fins and usually use lungs for gas exchange.
23. A **protrusible mouth** allows a fish to extend its Reach when attempting to snatch prey or food particles
24. Three dorsal fins for **locomotion**





25. The **Caudal fin or Tail** fin is the primary fin of the fish That gives it forward propulsion and speed.
26. Placoid scales are found in the **sharks and rays**.
27. **Placoid scales** are made of a flattened base with A spine protruding towards the rear of the fish.
28. **Lateral lines** in some species contain electroreceptors, which can detect electric Signals in water generated by other organisms.
29. **Paddlefishes** are large, freshwater chondrostean.
30. **Tetrodotoxic** poisoning occurs following the ingestion of pufferfish, boxfish Or porcupine fish.
31. **Cannibalism** is the act of consuming another individual of the same species as food.
32. Example of omnivores fish is **Goldfish**
33. **Larvivorous** fish are those that feed on immature stages of mosquitoes.
34. Swedish naturalist \_ is known as father of ichthyology. **Peter artedi**
35. ; Subclass Dipnoi contains.. **Lungfish**
36. Sharks have \_ scales. **Placoid**
37. \_\_\_are located on the back or on the top of the fish, and aid the fish in sharp turns or stops, and assist the fish in rolling. **Dorsal fin**
38. ; lateral line system consists of \_ or more sensory organs. **100**
39. Fish belong to phylum. **Chordata**.
40. Fish class maxini has..... Pair of tentacles **4**.
41. Type of mouth small alge growing on hard surfaces **beak-like**
42. Role of tunked dorsal fin Snake like **locomotions**
43. In advanced teleosts, especially the acanthopterygians, the bladder has lost its connection with the digestive tract, a condition called.. **Physoclistic**

## SUBJECTIVE

### 1. Cannibalism

Cannibalism is the act of consuming another individual of the same species as food.

### 2. Detritovores

↗ Fish consume decaying plants and animals.

### 3. Pufferfish poisoning/Fugu poisoning:

↗ Tetrodotoxin poisoning occurs following the ingestion of pufferfish, boxfish or porcupine fish.  
↗ This is also known as puffer or fugu poisoning.





- ❖ The poisoning is due to toxin known as tetrodotoxin which is concentrated in the internal organs such as liver, ovary and intestines.
- ❖ The skin also contains some glands which secrete these toxins.
- ❖ Usually the body muscles are free of the toxin.

## 4. Lateral line system:

Lateral line system consists of 100 or more sensory organs(neuromasts) that are typically arranged in lines on or just under the skin of head and body. It is absent from all reptiles, birds, mammals even those that are aquatic (such as turtles, dolphins and whales).

## 5. Chondrostean

- ❖ Chondrostean are thought to be the most primitive of the ray-finned fishes.
- ❖ They were at their greatest diversity during the Paleozoic and Mesozoic eras.
- ❖ Ancestral chondrostean had a bony skeleton, but living members, the sturgeons and paddlefishes, have cartilaginous skeletons.
- ❖ Chondrostean also have a tail with a large upper lobe.

## 6. Bottom feeders (dwellers):

- ❖ Bottom feeders (dwellers) are fish that inhabit the lower level of the aquarium or feed off the bottom.
- ❖ Their mouth may be turned down or “under slung”
- ❖ And they may have barbs to help them locate food. They eat bottom food such as rotten food.

### Example:

- ❖ Barbs, Marigal, Labeo calbasu, Cyprinus carpio, Cirrhina cirrhosus.
- ❖ Some fish do not show a preference for the level of the aquarium.

### Example:

- ❖ Goldfish

## 7. Muller's classification (1844):

- ❖ Earliest classification was proposed by J. Muller (1844) who proposed six subclasses in class
- ❖ Pieces.

### Class PISCES Subclasses:

- ❖ DIPNOI (Lung fishes); TELEOSTEI (Bony fishes); GANOIDEI (Polypterus, Amia, Lepidosteus); ELASMOBRANCHI (Cartilagenous fishes); MARSPOBRANCHI (Cyclostomes); LEPTOCARDII (Amphioxus)





## 8. What kind of food do herbivorous fish eat?

Herbivorous Fish exclusively consume plant matters as food. This type of fish eats aquatic plants, flowers, fruits, seeds, leaves and young stems. They also eat algae that grow on rocks or pebbles by mouth using wide lips under their snout.

## 9. General characteristics of Fish:

- ❖ Fish are aquatic, gill-bearing animals
- ❖ That lack limbs with digits.
- ❖ Most fish are cold-blooded,
- ❖ Allowing their body temperatures to
- ❖ Vary as ambient temperatures change.

## 10. Class cephalospidomorph

- ❖ Sucking mouth
- ❖ Teeth are present
- ❖ Rasping tongue
- ❖ Seven pairs of slits
- ❖ Blind olfactory sacs
- ❖ Cephalospidomorph were, like most contemporary fishes, very well armored.
- ❖ They also lacked a swim bladder, and would not have been able to keep afloat without actively swimming.
- ❖ The head shield provided some lift though, and would have made the cephalospidomorph better swimmers than most of their contemporaries.
- ❖ The head shield was particularly well developed, protecting the head, gills and the anterior section of the viscera.

### Example

- ❖ Lampreys

## 11. Systematics and Taxonomy:

Systematics is the study of the diversity of fish and the evolutionary relationships between these organisms

- ❖ Taxonomy is the scientific study of naming, defining and classifying groups of biological organisms based on shared characteristics

### Importance of Taxonomy and systematics

- ❖ Sound systematic data are important for conservation. Without accurate taxonomy,
- ❖ It is impossible to identify the species and evaluate their conservation status,





- ❖ It is impossible to properly manage their fisheries,
- ❖ It is impossible to evaluate

## 12. Classification of fish on the basis of feeding habitats

**Basic eating groups among fish are:**

- ❖ **Carnivores:** Fish exclusively consume animal matters as food.
- ❖ **Herbivores:** Fish exclusively consume plant matters as food.
- ❖ **Omnivores:** Fish consume both plant and animal matters as food.
- ❖ **Larvivores:** Fish exclusively consume insect larvae as food.
- ❖ **Planktivorous:** Fish exclusively consume plankton as food.
- ❖ **Voracious:** Fish consuming or craving large quantities of food.
- ❖ **Detritovores:** Fish consume decaying plants and animals.
- ❖ **Cannibalistic:** Cannibalism is the act of consuming another individual of the same species as food.
- ❖ **Piscivores:** A piscivore is a carnivorous animal that eats primarily fish.

## 13. Difference between Actinopterygii and Sarcopterygii.

**Subclass Actinopterygii: (Ray-finned fish)**

- ❖ Their fins lack muscular lobes that is why called as ray-finned fishes.
- ❖ They usually possess swim bladders, gas filled sacs along dorsal wall of the cavity that regulate buoyancy.
- ❖ Paired fins supported by dermal rays
- ❖ Base of fins is not muscular
- ❖ Tail fins almost equal to upper and lower lobes
- ❖ Blind olfactory sacs

**Examples**

- ❖ Ray finned fishes

**Subclass Sarcopterygii: (Lobe-finned fish)**

- ❖ Have muscular lobes associated with their fins and usually use lungs for gas exchange.
- ❖ Pneumatic sacs function as lungs or swim bladder
- ❖ Paired fins with muscular lobes
- ❖ Some bony fishes are hermaphrodites and a number of species exhibit parthenogenesis
- ❖ Fertilization is usually external
- ❖ Development is usually oviparous (egg laying) but can be ovoviviparous or viviparous

**Examples**





- ❖ Lungfishes, coelacanths

## 14. Types of scales in fish Scales in fish

- ❖ Different fishes have different types of scales.
- ❖ These different types of scales are made of different types of tissue.
- ❖ Types of scales also correspond to evolutionary relationships.
- ❖ There are four main kinds of scales and numerous variations of each kind.
- ❖ Placoid (sharks and rays)
- ❖ Cosmoid (lungfishes and some fossil fishes)
- ❖ Ganoid (bichirs, Bowfin, paddlefishes, gars, sturgeons)
- ❖ Cycloid and Ctenoid (most bony fishes)

### **Placoid scales are found in the sharks and rays**

- ❖ Placoid scales are made of a flattened base with a spine protruding towards the rear of the fish.
- ❖ These scales are often called dermal denticles because they are made from dentin and enamel, which is similar to the material teeth are made of.

### **Ganoid scales are flat and do not overlap very much on the body of the fish.**

- ❖ They are found on gars and paddlefishes.
- ❖ In the sturgeon, ganoid scales are modified into body plates called scutes.

### **Cycloid scales**

- ❖ Cycloid are found in the vast majority of bony fishes.
- ❖ These types of scales can overlap like shingles on a roof, which gives more flexibility to the fish.
- ❖ These scales also form growth rings like trees that can be used for determining age

### **Ctenoid scales**

- ❖ Ctenoid scales are different than cycloid scales in that cycloid scales tend to be more oval in shape.
- ❖ Ctenoid scales are more clam shaped and have spines over one edge.
- ❖ Cycloid scales are found on fishes such as eels, goldfish, and trout.
- ❖ Ctenoid scales are found on fishes like perches, wrasses, and parrotfish. Some flatfishes, like flounder, have both cycloid and ctenoid scales.

### **Cosmoid Scales:**

- ❖ Beside the scale types, there are also Cosmoid scales, as well scaleless fishes (many catfish, sculpins, some eels and swordfish) and fishes which have scales so deeply buried that they look scaleless (many tunas and anguillid).





## 15. Pneumatic sacs ?

These as lungs or swim bladder in fishes to provide buoyancy

## 16. 16 Class Osteichthyes general features

- ❖ With more than 29,000 species of bony fishes, it is the largest class of vertebrates.
- ❖ It includes both marine and freshwater fishes, most of the commercially used fishes are included in this class.
- ❖ The size ranges from less than 8 mm in Paedocypris progenetica, which is also the smallest known vertebrate to 4 m and weigh about 1500 kg in the ocean sunfish (Mola mola).
- ❖ Their endoskeleton is made up of bones.
- ❖ Bony skeleton
- ❖ Operculum cover gills opening
- ❖ 20,000 species
- ❖ Present in Freshwater and saltwater
- ❖ Pneumatic sacs functions as lungs or swim bladder
- ❖ Bone in their skeleton, bony operculum covering the gills openings, lungs or swim bladder.
- ❖ Lateral line system

### Fins:

- ❖ Dorsal, pectoral, caudal, pelvic, anal.
- ❖ Paired and median fins are present, which are supported by long rays of cartilage or bone.
- ❖ Fleshy lobed fins are present in sarcopterygians.
- ❖ These types of fins are supported by bones having joints.
- ❖ These are adapted to live at the bottom of the sea.
- ❖ First fossils of bony fishes are from late Silurian deposits

### Example: bony fishes

## 17. Super class Agnatha

- ❖ No jaws
- ❖ No paired appendages
- ❖ Persistent Notochord
- ❖ Cartilaginous skeleton
- ❖ All living and most extinct
- ❖ Agnatha do not have an identifiable stomach or any appendages.
- ❖ Two semicircular canals
- ❖ Hag fishes, one semicircular canals
- ❖ Ostracoderm belong to several classes
- ❖ 15cm long





## Fossils:

- ❖ With water scorpions
- ❖ Sluggish Body armor for defense
- ❖ Bottom dwellers
- ❖ Filter feeders
- ❖ Crack Gastropods shells and Arthropod exoskeleton
- ❖ Annelids feeders
- ❖ The Agnatha are ectothermic or cold blooded,
- ❖ With a cartilaginous skeleton,
- ❖ And the heart contains 2 chambers.
- ❖ Fertilization and development are both external.
- ❖ There is no parental care in the Agnatha class.

## 18. Inferior, or sub-terminal, mouths are turned downward.

- ❖ Also called a sub-terminal or ventral mouth, the inferior mouth is turned downward. The lower jaw is shorter than the upper jaw, and the jaw will often be protrusible.
- ❖ Most members of the catfish family have inferior jaws, and many of them also have a sucker mouth as well.

## 19. Respiration in hag fish

- ❖ A hagfish generally respites by taking in water through its pharynx and bringing the water through the internal gill pouches, which can vary in number from five to 16 pairs, depending on species.
- ❖ The gill pouches open individually, but in Myxini, the openings have coalesced, with canals running backwards from each opening under the skin, uniting to form a common aperture on the ventral side known as the branchial opening
- ❖ The esophagus is also connected to the left branchial opening, which is therefore larger than the right one, through a pharyngocutaneous duct (esophageocutaneous duct), which has no respiratory tissue.
- ❖ Hagfish also have a well-developed dermal capillary network that supplies the skin with oxygen when the animal is buried in anoxic mud, as well as a high tolerance for both hypoxia and anoxia, with a well developed anaerobic metabolism.
- ❖ The skin has also been suggested to be capable of cutaneous respiration.

## 20. Pelvic fins

The pelvic fins sit horizontally on the ventral side of the fish, past the pectoral fins.

- ❖ Pelvic fins are similar to legs. Just like human legs, pelvic fins are associated with the pelvis of the fish. Pelvic fins are usually abdominal, that they are attached midway down the belly.





- ❖ When pelvic fins are below the pectoral fins, they termed thoracic. When a thoracic pelvic fin is attached under gills, it may called jugular.
- ❖ Sucker-like pelvic fins grabbing rocks by suction
- ❖ Thickened rays on pelvic fins Sitting on substrate
- ❖ Moderate sized pelvic fins Locomotion

## 21. Taxonomic Characters

Systematic characters, also known as phylogenetic characters, are traits or features that are specifically used to infer evolutionary relationships and construct phylogenetic trees. These characters provide insights into the shared ancestry and evolutionary history of organisms.

- ❖ **Morphological features:** Physical attributes or structures of an organism.
- ❖ **Genetic sequences:** Specific sequences of nucleotides in DNA or RNA.
- ❖ **Behavioral patterns:** Observable actions or behaviors exhibited by organisms.
- ❖ **Physiological characteristics:** Functional or biological traits and processes of an organism.

### Taxonomic character of fishes

#### Taxonomic characters:

Taxonomic Characters, used to classify organisms on the basis of similarities and differences.

##### 1. Morphometric characters:

- ❖ Used for measurable structures

##### 2. Meristic characters:

- ❖ Used for any countable structures

##### 3. Molecular characters:

- ❖ Nuclear DNA and Mitochondrial DNA

##### 4. Anatomical character:

- ❖ Skeleton and characters of the soft anatomy

## 22. Nervous System Of Fishes.

### Nervous system

As in all vertebrates, the nervous system of fishes is the primary mechanism coordinating body activities, as well as integrating these activities in the appropriate manner with stimuli from the environment.

- ❖ Fish typically have quite small brains relative to body size compared with other vertebrates.





- ❖ But some fishes like moemyrids and sharks have large brains.
- ❖ Brain never fills the entire cavity of the cranium. Remaining space filled with a soft gelatinous mass generally fat.
- ❖ At the front of olfactory lobes a pair of structures that receive and process signals from the nostrils via two olfactory nerves.
- ❖ The nervous system in fishes can be divided into two parts: the central nervous system and the peripheral nervous system.

## Central nervous system,

- ❖ The central nervous system, consisting of the brain and spinal cord, is the primary integrating mechanism.
- ❖ peripheral nervous system,
- ❖ The peripheral nervous system, consisting of nerves that connect the brain and spinal cord to various body organs, carries sensory information from special receptor organs such as the eyes, internal ears, nares (sense of smell), taste glands.

## 23. Significance of habituation

Significance of habituation in fishes:

- ❖ **Adaptation:** Habituation helps fishes adjust to their environment by reducing response to non-threatening stimuli.
- ❖ **Energy conservation:** Habituation allows fishes to save energy by minimizing unnecessary responses.
- ❖ **Predator-prey interactions:** Habituation plays a role in predator avoidance by reducing the reaction to predator cues.
- ❖ **Fishing effectiveness:** Habituated fishes are less startled by anglers, increasing the chances of successful catches.
- ❖ **Conservation:** Understanding habituation is crucial for conservation efforts and minimizing human-induced disturbances.

## 24. Class of cephalaspidomorphi

### Sucking mouth

- ❖ Teeth are present
- ❖ Rasp tongued
- ❖ Seven pairs of slits
- ❖ Blind olfactory sacs
- ❖ Cephalaspidomorph were, like most contemporary fishes, very well armored.
- ❖ They also lacked a swim bladder, and would not have been able to keep afloat without actively swimming.





- ❖ The head shield provided some lift though, and would have made the cephalaspidomorphi better swimmers than most of their contemporaries.
- ❖ The head shield was particularly well developed, protecting the head, gills and the anterior section of the viscera.

### Example

Lampreys

## 25. Classification of fishes on basis of habitat? Marks 5

Classification of fishes based on habitat:

- ❖ **Freshwater fish:** These fishes inhabit freshwater environments such as rivers, lakes, and streams. Examples include trout, catfish, and carp.
- ❖ **Marine fish:** Marine fishes live in saltwater habitats such as oceans and seas. They are adapted to the saline conditions and include species like tuna, sharks, and clownfish.
- ❖ **Brackish water fish:** Brackish water fish reside in estuaries, where freshwater and saltwater mix. They can tolerate varying levels of salinity and include species like mudskippers and some types of snook.
- ❖ **Deep-sea fish:** These fishes inhabit the abyssal depths of the ocean. They are adapted to extreme pressure, darkness, and low temperatures. Examples include anglerfish, gulper eels, and hatchetfish.
- ❖ **Coral reef fish:** Coral reef fish live in the vibrant and diverse ecosystems of coral reefs. They rely on the reef for food and shelter. Species such as clownfish, butterflyfish, and parrotfish are found in coral reef habitats.

## 26. What you know about chondrosteans marks 5

Chondrostean are a group of ancient ray-finned fish with a cartilaginous skeleton. They are known for their distinctive ganoid scales, which are thick and diamond-shaped. Chondrostean are thought to be the most primitive of the ray-finned fishes.

- ❖ They were at their greatest diversity during the Paleozoic and Mesozoic eras.
- ❖ Ancestral chondrostean had a bony skeleton, but living members, the sturgeons and paddlefishes, have cartilaginous skeletons.
- ❖ Chondrostean also have a tail with a large upper lobe.
- ❖ Most sturgeons live in the sea and migrate into rivers to breed.
- ❖ (Some sturgeons live in freshwater but maintain the migratory habits of their marine relatives.)
- ❖ They are large (up to 1,000 kg), and bony plates cover the anterior portion of the body.
- ❖ Heavy scales cover the tail.





- ❖ The sturgeon mouth is small, and jaws are weak. Sturgeons feed on invertebrates that they stir up from the sea or riverbed using their snouts.
- ❖ Because sturgeons are valued for their caviar (eggs), they have been severely overfished.

# FINAL TERM

## OBJECTIVE

1. **Frogs** are used to make bait to catch game fish
2. Carp belongs to class **actinopterygii**
3. The second group of **actinopterygians (neopterygii)** flourished in the jurassic period and succeeded most chondrosteans.
4. **Actinopterygi**.... (ray-finned fish)
5. **Paddlefishes** are large, freshwater chondrosteans.
6. They feed by sieving through large gill rakers or by mucus secreted from the **epibranchial glands**.
7. (**leporinus macrochirus**) often eat the larvae of dipteran insects from the bottom of lakes.
8. There are currently over **1,100 species** of fish that are at risk of extinction.
9. Members of this subclass are characterized by having **five to seven** pairs of gill
- 10.. Cichlids and poecilids are example of ..... : **secondary fresh water fish**
- 11.. ..... Fishes migrate from sea water to fresh water and vice versa : **diadromous**
- 12.The circulatory, or blood vascular, system consists of the **heart, the arteries, the capillaries, and the veins**.
- 13.Fish that eat large animals as food are called **predatory fish**.
- 14.Roughly .....f species inhabit freshwater environments, ranging from desert springs to high altitude streams. **40%**
- 15.Most of the earth surface (**around 70%**) is covered with water, but not all the water is freshwater.
- 16.Only **3.5% is** freshwater, and the rest **96.5% is** saltwater in the form of oceans.
- 17.80% of available fish stock fully exploited, overexploited, or depleted/recovering belongs to.....  
**overfishing**
- 18.Herbivores also eat algae that grow on rocks or pebbles by mouth using **wide lips under their snout**.





- 19.....presented the classification of fishes in particular and chordata in general in a linear order. **J.s nelson (2006)**
20. Scientific name for shovelnose sturgeons (**scaphirhynchus platorynchus**)
21. Most of the surface around **70%** covered with water 3.5% fresh water **96.5%** salt water
22. **Lamprey** generally inhabited shallow coastal regions a freshwater environment
23. Class of hagfish **myxini**.
24. Type of ecosystem **2** 1-aquatic ecosystem 2-terrestrial ecosystem
25. Rohu fish is an example of **marginal feeders**.
26. Driftnets or gill nets banned in **1989**.
27. Which species of voracious fish is found in africa **hemichromis**.
28. Marine ecosystem includes **sea and ocean**
29. Ecology derived from two words **oikas and logos**
30. The gonadotropin hormone (**fsh and lh**) secreted by pituitary gland
31. Influences the maturation of gonads and spawning in fishes.
32. Some **deep sea male argb (ceration)** fish are mandatory parasites of female fish of some species.
33. The characiformes constitute more than **30%** of the total fish yield in the amazon basin, whereas the catfishes are of minor importance
34. The detritivores living in the beneath region. These organisms often called **bottom** feeder.
35. Many shark species are **pelagic**, meaning that they spend much of
36. Their lives swimming throughout the open ocean (**pelagic zone**).
37. The gill rot (branchyomycetes) of carps involves the attack of **saprolegnia** on the gills of carps.
38. The number of individuals and total biomass **decreases** at successive trophic levels as organisms **increase** in size.
39. The fish flesh is an excellent source of protein, has very little fat, carries a good amount of minerals and vitamins **a and d** and rich in iodine
40. The water examines for global fisheries employment are **1.75 time** higher than the food and agriculture organization estimates.
41. The freshwater system is mainly divided into **three** types based on range lotic, lentic and wetland.
42. The **freshwater ecosystem** is an aquatic ecosystem that includes lakes, ponds,
43. Rivers, streams and wetlands
44. During summers, the temperature of the freshwater ecosystem generally ranges from **30-71f** degrees fahrenheit. Whereas during winters, the temperature. Ranges from **35-45f** degrees fahrenheit
45. Rohu fish is an example of **marginal feeders**
46. **Marine water** has a more substantial salt content and greater biodiversity in comparison to the **freshwater ecosystem**
47. Hag fish belong to class **mixini**





48.. Amia is commonly referred to as the **dog fish or bowfin**

49..... have a more substantial salt content and greater biodiversity in comparison to the **marine water ecosystem, freshwater ecosystem.**

50.the **freshwater ecosystem is** an aquatic ecosystem that includes lakes, ponds,rivers, streams and wetlands.

## SUBJECTIVE

### 27.Fugu/ puffer poisoning

- ❖ Pufferfish poisoning
- ❖ Tetrodotoxic poisoning occurs following the ingestion of pufferfish, boxfish or porcupine fish.
- ❖ This is also known as puffer or fugu poisoning.
- ❖ The poisoning is due to toxin known as tetrodotoxin which is concentrated in the internal organs such as liver, ovary and intestines.
- ❖ The skin also contains some glands which secrete these toxins.
- ❖ Usually the body muscles are free of the toxin.

### 28.Muller's classification (1844):

- ❖ J. Muller proposed an early classification system in 1844, dividing class Pisces into six subclasses.
- ❖ The six subclasses proposed by Muller were: Dipnoi (lungfishes), Teleostei (bony fishes), Ganoidie (Polypterus, Amia, Lepidosteus), Elasmobranchii (cartilaginous fishes), Marsipobranchii (cyclostomes), and Leptocardii (amphioxus)

### 29.Define ``PUFA

It stands for polyunsaturated fatty acids, a type of fat that is essential for human health. This category includes both omega-3 and omega-6 fatty acids, which are important for brain health, heart health, and overall inflammation regulation in the body. Good sources of PUFA include fatty fish, nuts, seeds, and vegetable oils.``

### 30.General characteristics of fish

- ❖ Fish are aquatic, gill-bearing animals
- ❖ That lack limbs with digits.
- ❖ Most fish are cold-blooded,
- ❖ Allowing their body temperatures to
- ❖ Vary as ambient temperatures change.





- ❖ Fish share with vertebrates a basic body plan of bilateral symmetry with a dorsal supporting structure the notochord as a precursor to the series of harder vertebrae.
- ❖ Their body is divisible into head, trunk and tail. Neck is absent.
- ❖ It has a spindle shaped body. It is helpful in swimming.
- ❖ Respiration is by gills. Gills are the extensions of the pharynx. In the elasmobranchs fishes, the gills will open separately. In bony fishes the gill slits are covered by operculum.
- ❖ On the head a pair of nostrils are present internal nostril are absent.
- ❖ In Diplopoda Internal nostrils are present
- ❖ 10 pairs of cranial nerves are present.
- ❖ Kidneys are mesonephric.
- ❖ Urinary bladder is absent
- ❖ The scales of fish originate from the mesoderm (skin);
- ❖ They may be similar in structure to teeth.

## **31. Bottom feeders (dwellers)**

These are fish that inhabit the lower level of the aquarium or feed off the bottom.

- ❖ Their mouth may be turned down or “under slung” And they may have barbs to help them locate food.
- ❖ They eat bottom food such as rotten food.

**Example:**

- ❖ Barbs, Marigal, Labeo calbasu, Cyprinus carpio, Cirrhinus cirrhosus.
- ❖ Some fish do not show a preference for the level of the aquarium.

**Example:**

- ❖ Goldfish

## **32. Feeding behavior of Pfeffer herring like fish?**

- ❖ Young forage fish mostly feed on phytoplankton and as they mature they start to consume larger organisms.
- ❖ Older herrings feed on zooplankton, tiny animals that are found in oceanic surface water and fish larvae and fry.

## **33. Function of ecosystem**

**Functions of Ecosystem**

**The functions of the ecosystem are as follows:**

- ❖ It regulates the essential ecological processes, supports life systems and renders stability.





- ❖ It is also responsible for the cycling of nutrients between biotic and abiotic components.
- ❖ It maintains a balance among the various trophic levels in the ecosystem.
- ❖ It cycles the minerals through the biosphere.
- ❖ The abiotic components help in the synthesis of organic components that involve the exchange of energy.

## **34. Ecological importance of cartilaginous fish?**

Cartilaginous fish, like sharks, rays, and chimaeras, play a vital role in the ecosystem. They live in various habitats and have diverse feeding habits. Some sharks are efficient predators, while others, like the whale shark, filter plankton. Rays and skates feed on crustaceans and mollusks using special teeth that crush tough shells.

These creatures inhabit both deep ocean and open water areas. Cartilaginous fish help maintain balance by controlling prey populations and supporting the health of marine ecosystems. Additionally, their diverse hunting and feeding strategies, such as fast-start predation, ram feeding, and sit-and-wait tactics, contribute to the intricate web of interactions in aquatic environments. These behaviors help regulate the populations of other marine species, ensuring the overall stability and health of the underwater ecosystems.

## **35. Name pathogenic and parasite that causes diseases in fishes?**

Fish diseases can be caused by a variety of parasites and pathogens. In this overview, we will discuss some notable examples of these disease-causing agents:

### **1. Bacterial Diseases**

Bacterial infections can significantly impact fish health. Two important bacterial diseases are:

- ❖ Abdominal Dropsy of Carps: This disease is caused by the bacterium *Aeromonas punctuata*. It affects the abdominal area of carps.
- ❖ Furunculosis of Salmons and Trout: Salmons and trouts are susceptible to *Aeromonas salmonicida*, which is responsible for causing furunculosis.

### **2. Viral Diseases**

Viral infections can lead to severe outbreaks in fish populations. One economically significant viral disease is:

- ❖ Viral Haemorrhage Septicaemia (VHS) of Rainbow Trouts: VHS affects rainbow trouts and can have significant economic implications.

### **3. Protozoan Diseases**

Protozoans are another class of pathogens causing fish diseases. Notable protozoan diseases are associated with:





## Costia, Myxobolus, and Trypanosoma:

- ❖ These protozoans can induce diseases in fish populations.

## 4. Fungal Diseases

Fungi can also be responsible for fish diseases. For instance:

- ❖ Gill Rot (Branchiomyces) of Carps: This disease involves the attack of the fungus Saprolegnia on the gills of carps.

## 5. Worm Diseases

Various groups of worms act as parasites in fish. These include:

- ❖ Flatworms (Trematodes)
- ❖ Tapeworms (Cestodes)
- ❖ Roundworms (Nematodes)
- ❖ Thorny-Headed Worms (Acanthocephalans)

## 6. Common Ectoparasites

Ectoparasites are external parasites that can weaken fish by feeding on their blood. Two notable ectoparasites are:

- ❖ Fish Lice (Argulus, Lernaea, and Ergasilus)
- ❖ Fish Leech (Piscicola)

## 36. Types of scales?

There are four main kinds of scales and numerous variations of each kind.

- ❖ Placoid (sharks and rays)
- ❖ Cosmoid (lungfishes and some fossil fishes)
- ❖ Ganoid (bichirs, Bowfin, paddlefishes, gars, sturgeons)
- ❖ Cycloid and Ctenoid (most bony fishes)
- ❖ Placoid scales are found in the sharks and rays.

## 37. Important characteristic of chondrichthyes

Chondrichthyes is a class of fishes

- ❖ They have jaws.
- ❖ Tail fins
- ❖ No swim bladder or lungs
- ❖ Large upper lobe
- ❖ Cartilage skeleton





- ❖ Paired appendages
- ❖ Have no operculum

## **38. Three functions of ecosystem?**

The functions of the ecosystem are as follows:

- ❖ It regulates the essential ecological processes, supports life systems and renders stability.
- ❖ It is also responsible for the cycling of nutrients between biotic and abiotic components.
- ❖ It maintains a balance among the various trophic levels in the ecosystem.
- ❖ It cycles the minerals through the biosphere.

## **39. Later line system in fishes? From mid**

The lateral line system in fish is an important sensory organ. It helps fish detect vibrations and movements in the surrounding water. The system consists of a network of small canals called lateral lines that run along the sides of the fish's body. Inside these canals are sensory cells called neuromasts, which are sensitive to changes in water pressure. The lateral line system plays a crucial role in helping fish navigate, find prey, and avoid predators.

## **40. Detritivore fishes? Marks3**

### **Detritivorous Feeding in Fish**

Fish engage in detritivorous feeding by consuming decaying organic matter. Approximately 10 percent of fish species adopt this strategy, aiding in ecosystem nutrient cycling. Detritivores may also practice coprophagy, consuming feces for nutrition.

#### **Examples:**

- ❖ Lobsters
- ❖ Fiddler Crabs

#### **Ecological Significance:**

Detritivorous fish species, particularly in the Amazon basin, contribute significantly to ichthyomass, mainly in Characiformes and Siluriformes orders.

#### **Marine Detritivores:**

- ❖ Crustaceans (crabs, lobsters)
- ❖ Echinoderms (sea stars, sea cucumbers) Detritivory sustains ecosystem balance in freshwater and marine environments.

## **41. Economic Importance Of Fishes?**





### (i) Fish as food:

- ❖ The fish flesh is an excellent source of protein, has very little fat, carries a good amount of minerals and vitamins A and D and rich in iodine.
- ❖ Above all man can digest it easily.

### Some edible fish

- ❖ 1. Rohu (Labeo rohita)
- ❖ 2. Calbasu (L. Calbasu)
- ❖ 3. Catla (Catla catla)

### (ii) Fish for controlling diseases:

- ❖ Diseases like malaria, yellow fever and other dreadful diseases that are spread through mosquitoes can be controlled.
- ❖ Larvivorous fish eat larva of mosquito.
- ❖ The important larvivorous fish are Gambusia, Panchax, Haplochitius, Trichogaster, etc.

### (iii) Scientific value

- ❖ Some fish like the lung fish are of zoological importance because of their discontinuous distribution and anatomical features.

### (iv) Aesthetic value

- ❖ A large number of fish are cultured in aquarium for their beauty and graceful movements.
- ❖ The important aquarium fish are Macropodus, Trichogaster, Carassius (gold fish) and Pterophyllum (angel fish).

### (v) Fishery Bye-products:

- ❖ **Fish oil:** It is extracted from the liver of the sharks, sawfishes, skates and rays and has medicinal value. These mainly include cod liver oil and shark liver oil.

### (b) Fish Manure:

- ❖ The fish waste after the extraction of oil, is used as fertilizers,

### (c) Fish Glue:

- ❖ It is a sticky product, obtained from the skin of the cod and is used as gum.

### (d) Isinglass:





- ❖ It is a gelatinous substance, obtained from the air bladder of perches, Indian Salmons and cat fish used in the preparation of special cement and in the clarification of wine and beer.

## **42. Freshwater and marine water?**

The freshwater ecosystem is an aquatic ecosystem that includes lakes, ponds, rivers, streams and wetlands. These have no salt content in contrast with the marine ecosystem. The marine ecosystem includes seas and oceans.

These have a more substantial salt content and greater biodiversity in comparison to the freshwater ecosystem. Fishes have a higher rate of endangerment than all other classes of vertebrates, due the varied and intensive human use of aquatic resources. Ecology of Fishes is a course focusing on the interactions between fishes and their environments

## **43. Difference between fresh water and marine water fishes?**

### **Inland or Fresh Water Fisheries:**

- ❖ Marine Fisheries:
- ❖ Inland or Fresh Water Fisheries:
- ❖ Inland fishery deals with the fishery aspects of waters other than marine water. Potentially, the vast and varied inland fishery resources of India are one of the richest in the world.
- ❖ They pertain to two types of waters, namely, the fresh and the brackish.
- ❖ The former includes the country's great river systems, an extensive network of irrigation canals, reservoirs, lakes, tanks, ponds, etc.
- ❖ The estuaries, lagoons and mangrove swamps constitute the brackish type of water. In pisciculture (culture fisheries), which generally pertains to small water bodies, the fish seed has to be sown, tended, nursed, reared and finally harvested when grown to table size.
- ❖ In the case of capture fisheries, which pertain to the rivers, estuaries, large reservoirs, as well as big lakes, man has only to reap without having to sow.

### **Marine Fisheries:**

- ❖ Marine fisheries are conducted in all the oceans and seas of the world, including bays and estuaries .
- ❖ The capture and culture of aquatic organisms in salt water accounts for the bulk of the fishery products that reach world markets.
- ❖ Marine fishery deals with the fishery aspects of the sea water or ocean

## **44. Classify fish on basis of food?/ Types of fishes on their feeding type?**

### **Carnivores**

- ❖ Fish exclusively consume animal matters as food.





## Herbivores

- ❖ Fish exclusively consume plant matters as food.

## Omnivores

- ❖ Fish consume both plant and animal matters as food.

## Larvivores

- ❖ Fish exclusively consume insect larvae as food.

## Planktivorous

- ❖ Fish exclusively consume plankton as food.

## Voracious

- ❖ Fish consuming or craving large quantities of food.

## Detritovores

- ❖ Fish consume decaying plants and animals.

## Cannibalistic

- ❖ Cannibalism is the act of consuming another individual of the same species as food.

## Piscivores

- ❖ A piscivore is a carnivorous animal that eats primarily fish.

## 45. Name of causative agent of furunculosis and abdominal dropsy

- ❖ Abdominal dropsy of Carps is caused by Aeromonas punctuata.
- ❖ Furunculosis of Salmons and trout's is caused by Aeromonas salminicida.

## 46. Taxonomic characters to classify organisms on the basis of similarity and difference

Taxonomic Characters, used to classify organisms on the basis of similarities and differences.

### 1. Morphometric characters:

- ❖ Used for measurable structures

### 2. Meristic characters:

- ❖ Used for any countable structures

### 3. Molecular characters:





- ❖ Nuclear DNA and Mitochondrial DNA

#### 4. Anatomical character:

- ❖ Skeleton and characters of the soft anatomy

### 47. Disease causing by bacteria?

#### Bacterial Diseases:

Two bacterial diseases are very important.

- ❖ Abdominal dropsy of Carps is caused by aeromonas punctuata.
- ❖ Furunculosis of Salmons and trout's is caused by aeromonas salminicida.

### 48. Types of freshwater fishes?

Rainbow Trout, Bass, Catfish, Pike, Perch, Tilapia, Carp, Bluegill, Crappie, Salmon

### 49. Which worms causes disease in fishes?

Worms of four groups are parasites on fish. The flatworms (trematodes), tapeworms (cestodes), round worms (nematodes) and thorny-headed worms (acanthocephalans).

### 50. Fish diseases in detail? Marks 5

Fish Diseases Caused by Parasites and Pathogens:

#### 1. Bacterial Diseases:

Two bacterial diseases are very important.

- ❖ Abdominal dropsy of Carps is caused by Aeromonas punctuata.
- ❖ Furunculosis of Salmons and trout's is caused by Aeromonas salminicida.

#### Viral Diseases:

- ❖ Economically most important is the viral haemorrhage septicaemia (VHS) of rainbow trouts.

#### Protozoan Diseases:

- ❖ Main protozoan diseases are caused by Costia, Myxobolus and Trypanosoma.

#### Fungal Diseases:

- ❖ The gill rot (branchyomycetes) of carps involves the attack of Saprolegnia on the gills of carps.

#### Worm Diseases:





- ❖ Worms of four groups are parasites on fish. The flatworms (trematodes), tapeworms (cestodes), round worms (nematodes) and thorny-headed worms (acanthocephalans).

## Common Ectoparasites:

- ❖ Two ectoparasites of fish are most important, the fish lice (*Argulus*, *Lernaea andergasilus*) and the fish leech (*Piscicolid*).
- ❖ Both parasites weaken fish by feeding on its blood.

## 51. Importance of systematic and taxonomy?

### Taxonomy marks 3 Importance of Taxonomy and systematics

- ❖ Sound systematic data are important for conservation. Without accurate taxonomy,
- ❖ It is impossible to identify the species and evaluate their conservation status,
- ❖ It is impossible to properly manage their fisheries,
- ❖ It is impossible to evaluate
- ❖ The conservation value of habitats or areas,
- ❖ It is impossible to establish strategies
- ❖ It is impossible to set priorities.

## 52. Law of tolerance

### Law of Tolerance:

**"The presence and success of an organism depend upon the completeness of a complex of conditions. Absence or failure of an organism can be controlled by the qualitative or quantitative deficiency or excess with respect to any one of several factors which may approach the limits of tolerance for that organism."**

### For example:

The ability to exist and thrive may depend on such physical factors as dissolved oxygen, temperature, salinity, pH, etc.

"Steno" refers to species with narrow tolerances (e.g., stenothermal = narrow temperature tolerance); "eury" refers to those with wide tolerances (e.g., euryhaline = wide salinity tolerance).

