Unit 4: Marine Animal Phylums

Concept 2: Vertebrates

LEQ's:

1. **What is a chordate?**
2. **What are some of the special adaptations of fish to their environments?**

LEQ 1: What is a chordate?

- Chordates are any animals that have a notochord and a dorsal nerve cord at some point in their life.
  - The notochord is a support rod along the animals dorsal (back) side.
  - The dorsal nerve cord is a tube of nervous tissue that runs just above the notochord.

LEQ 1: What is a chordate?

- All vertebrates are chordates.
  - The notochord and dorsal nerve cord become the spinal cord and brain before all vertebrates are born.
- Some Invertebrates are chordates.
  - Tunicates, Salps, and Lancelets.

LEQ 1: What is a chordate?

- Tunicates play a similar role to sponges in the marine environment.
  - They pump water and filter feed.
  - However they are very complex organisms while sponges are very simple.

LEQ 1: What is a chordate?

- Salps are gelatinous free-floating organisms that have barrel shaped bodies and feed on microplankton.
  - Salps are one of the most abundant types of zooplankton in the oceans.
  - Salps can grow faster than any other multicellular organisms.

LEQ 1: What is a chordate?

- Lancelets are small fish-shaped filter feeders that are very common in sand and gravel.
  - They resemble vertebrates however they are not.

LEQ 2: What are some special adaptations of fish to their environments?

- Ichthyology is the study of three types of fish:
  - Agnathans = jawless fish
  - Chondrichthyes = sharks and rays
  - Osteichthyes = ray finned or bony fish

LEQ 2: What are some special adaptations of fish to their environments?

- Agnathans are fish that have no jaws. Scientists believe ancestors of these species evolved into all other fish.
  - No paired appendages (fins)
  - Eel shaped bodies
  - No scales
  - Cartilage skeleton
  - Circular toothed mouths
  - Include Hagfish and Lampreys

LEQ 2: What are some special adaptations of fish to their environments?

- Hagfish are also known as slime eels, although they are not actually eels.
  - They live in cold saltwater.
  - They have skulls but no vertebrae (backbones).
  - They eat small invertebrates and dead or dying fish by crawling inside them and eating from the inside out.
  - They produce slime as a defense mechanism.

LEQ 2: What are some special adaptations of fish to their environments?

- Lampreys are also known as lamprey eels however they are not eels either.
  - Can live in both fresh and salt water.
  - Freshwater lampreys do not eat as adults they live off reserves of nutrients from filter feeding as larva.
  - Saltwater lampreys are parasitic; they attach to the outside of other animals and use their teeth to bore holes into their bodies and suck out the blood.

LEQ 2: What are some special adaptations of fish to their environments?

- Chondrichthyes are fish with cartilage skeletons. They include sharks and rays, also known as the teeth and wings of the sea.
  - Have jaws.
  - No swim bladder.
  - No true bones.
  - Predators.
  - Energy Efficient.

LEQ 2: What are some special adaptations of fish to their environments?

- Sharks have adapted to use less energy when they hunt so that they can strike quickly for the attack:
  1. Cartilage skeletons are lighter than bones, so they use less energy trying to maintain neutral buoyancy (not sinking or floating).
     - Their livers are filled with buoyant oil that also helps this.
  2. Shark fins sit at angles that keep them aloft in the water.

LEQ 2: What are some special adaptations of fish to their environments?

3. Shark skin is elastic which allows them to transfer energy to the tail for swimming.
   - Denticles (shark scales) point backwards to reduce drag.
4. Sharks are able to replace teeth quickly after they are lost, this allows them to keep hunting after they lose a tooth.

LEQ 2: What are some special adaptations of fish to their environments?

- Sharks have other adaptations that allow them to be successful predators:
  - Sharks have an incredible sense of smell that allows them to detect blood from a wounded animal even when it is diluted in the ocean water.
    - As much as one part of fish extract per 10 billion parts water.

LEQ 2: What are some special adaptations of fish to their environments?

- Sharks have Lateral lines. These are lines of sensory pores that run along the length of the sharks body that detect water motion.
  - Helps sharks detect motion from struggling prey even if they cannot see it.
- Sharks have electroreception, the ability to detect small amounts of electricity created by muscles and nerves of other animals.
  - This sense is located on the nose of sharks in pores called the ampullae of Lorenzini

LEQ 2: What are some special adaptations of fish to their environments?

- Sharks also have unique adaptations in reproduction:
  - Sharks produce less offspring than bony fish, but when sharks are born they are more mature and better able to survive than bony fish.
  - Fertilization occurs internally so some of the shark development occurs within the mother.
    - Sharks always produce egg cases, however some egg cases are held within the mother, hatch, and live sharks are born form the mother.
    - Shark egg cases hold one to two shark babies.

LEQ 2: What are some special adaptations of fish to their environments?

- Rays also have adaptations that allow them conserve energy:
  1. Cartilage skeletons.
  2. Large oily livers.
  3. Wing shaped bodies that help keep them aloft in the water.
  4. Denticles to reduce friction in the water.

LEQ 2: What are some special adaptations of fish to their environments?

- Rays have other adaptations that help them survive in the ocean as well:
  - Lateral Lines.
    - Ampullae of Lorenzini
  - Lay egg cases which each produce one to two young at a time.
  - Have modified fish anatomy that allows them to be closer to the sea floor where their food is.
  - Tails are not used for swimming but for protection.
  - Rays use their “wings” to fly through the water.

LEQ 2: What are some special adaptations of fish to their environments?

- Fish in the group Osteichthyes are known as bony fish because they have true bones.
  - They are the most common vertebrates in the ocean.
  - They make up about half of all vertebrates on Earth.
  - They are incredibly diverse, over 25,000 different species.

LEQ 2: What are some special adaptations of fish to their environments?

- Characteristics of Bony Fish:
  - They all have jaws, bones, scales, and swim bladders.
    - Swim bladders allow the fish to control their buoyancy by adding or releasing gas. The fish will either gulp air to add it to their swim bladders or exchange gas from their blood through special organs called gas glands.

LEQ 2: What are some special adaptations of fish to their environments?

- Fish reproduce externally.
  - Some species will protect the eggs and young from predators while others leave them to fend for themselves.

LEQ 2: What are some special adaptations of fish to their environments?

- Fish have lateral lines like sharks and rays that allow them to detect water motion around them.
  - This is what allows schools of fish to appear to move as one.

LEQ 2: What are some special adaptations of fish to their environments?

- Most open ocean fish have similar body shapes because they all live in the same place and have similar niches.
  - Torpedo shaped body and V shaped tail

LEQ 2: What are some special adaptations of fish to their environments?

- Reef fish are incredibly different because they live in different environments and have different niches.

LEQ 2: What are some special adaptations of fish to their environments?

- Color Adaptations:
  - Counter Shading is when a fish has a light belly and dark back. This is generally found on fish that swim in the open ocean.
  - Camouflage colors and patterns allows fish to blend into their environment to avoid being seen by a predator, others use it to ambush their prey.
    - Many fish can change their coloration to more easily match their environments.

LEQ 2: What are some special adaptations of fish to their environments?

- Disruptive markings that alter parts of the fishes body to confuse predators.
  - Such as stripes through the eyes to hide them or large spots on a fishes tail to make predators think that is the head. Horizontal stripes confuse the line of sight of the predator.

LEQ 2: What are some special adaptations of fish to their environments?

- Bioluminescence:
  - Many fish that live in the deep ocean have the ability to produce light through symbiosis with algae or light producing cells.
    - This can be used to attract prey (anglerfish) or attract mates (midshipman).

LEQ 2: What are some special adaptations of fish to their environments?

- Venom:
  - Some fish have venom spikes that they use as a defense mechanism when they feel threatened.

LEQ 2: What are some special adaptations of fish to their environments?

- Produce Electricity:
  - Electric eels are able to produce electricity to shock their prey. The amount of electricity they can produce is determined by the size of the eel. Larger eels produce more electricity.

LEQ 2: What are some special adaptations of fish to their environments?

- Deep Sea Adaptations: Deep sea means 200m and under.
  - Small size because of pressure
  - Reduced or no swim bladder
  - Large mouth to eat things larger than themselves
  - Hermaphrodites
  - Translucent or red colored to blend in to darkness.
  - Large eyes in twilight zone, small eyes on bottom.
  - Bioluminescence