

## Insides and Outsides – Teacher Worksheet

### Outsides - External anatomy

- Shape and color of the fish
  - Describe the general shape of the fish. *Most of the fish will be fusiform (streamlined); some fish, like bluegills, are laterally compressed (flattened from side to side).*
  - What does the shape tell about where the fish lives? *Fusiform fish tend to live in open water. Laterally compressed fish tend to live where there is cover to hide in*
  - What are other possible fish shapes? *Flat like a flounder; snakelike like an eel*
  - Describe the color pattern of the fish. What does the color tell about where the fish lives? *Striped fish tend to live where there is cover such as submerged aquatic vegetation. Silvery colored fish tend to live in open water. Fish that are spotted tend to live in clear water with dappled sunlight.*
- Skin and scales
  - What does the fish feel like?
  - What is the purpose of the slime? *It protects the fish from disease (primary function) and allows it to glide through the water more easily.*
  - What is the purpose of the scales? *Protection and reducing drag*
  - Remove a scale look at it under a microscope. What might the rings mean? *The number of prominent dark bands often correlates with the age of the fish. Scientists also use the internal ring structure of the otoliths (ear bones) to determine a fish's age.*
- Most fish have a lateral line running from the head to the tail. What purpose does it serve? *Senses sound, vibrations, moving water, and changes in pressure*
- Fins
  - Locate and identify the fins. What is the purpose of each fin?
    - Caudal (tail) fin – *Usually provides propulsion. A rounded, slightly forked tail means the fish swims slowly but can accelerate quickly and is more maneuverable. A deeply forked tail often means the fish is a fast constant swimmer.*

- Dorsal fin – These are the fins on the fish’s back; there may be one or two dorsal fins. *These fins usually serve to keep the fish upright but some fish use them for propulsion.*
- Anal fin – This is the single fin on the bottom of the fish near the tail. *This fin is used to help keep the fish upright.*
- Pectoral fins – These are the pair of fins on either side of the body. *These fins are usually used for stopping and steering but some fish, like bluegill, also use them for propulsion.*
- Pelvic fins – This is the pair of fins on the bottom of the fish nearer the head. *These fins are used for steering and balance.*
- Note the location of the spines (hard and sharp) or rays (soft) in the fins; what is their purpose? *They support the fin and may serve as protection by making the fish hard to swallow.*
- Locate the nares (nostrils), two tiny holes in front of the eyes. What are they for? *Unlike humans, fish only use their nostrils for smelling; they breathe through their mouth.*
- Eye
  - Does the fish have an eyelid? *No*
  - Notice the size of the eye and pupil. A relatively large eye and pupil often indicates that vision is important to the fish,
- Mouth – have the students pick up their fish and look in its mouth
  - Does the fish have a tongue? *Most fish have "tongues" which are formed from a fold in the floor of the mouth; they are not like the muscular tongues of humans.*
  - Have them use their finger to carefully feel inside the mouth. Does the fish have teeth? Where? *Fish can have teeth on their jaws (like humans), on their tongue, on the roof of the mouth or in the back of the throat.* What do the teeth feel like?
  - Look at the location and size of the mouth. Based on the location and the type of teeth, predict how the fish catches food and the fish might eat.
  - Have the students open the fish’s mouth wide and look in. They should be able to see the red gills on either side of the throat.
    - Using the probe, stick it in the mouth and see where it comes out. *It should come out the side of the head.*

- If a fish took water into its mouth where would it go? What about food? *Have the students think about this; the question will be answered in the next section.*
  - Gills
    - Place the fish back in the tray and lift the hard flap on the side of the head. This flap is called the operculum. What is its purpose? *To protect the gills*
    - Using the scissors, cut away the operculum to expose the gills.
      - Remove the gills by cutting the upper and lower attachments of the gill arch.
      - The bony projections along the inside curve of the arches are the gill rakers. What is their purpose? *Food taken into the mouth is directed by the gill rakers back to the esophagus, instead of going out through the gills.*
      - Notice the feathery gill filaments attached to the gill arches. What is their purpose? *They provide a lot of surface area. This is where oxygen and carbon dioxide exchange takes place.*

#### Insides – Internal anatomy

- Locate the vent, a small hole on the bottom of the fish near the tail. Insert the scissors into the vent and make a **shallow** cut all the way to the head. Carefully lift and cut away the flap of skin so the internal organs can be seen.
- Digestive system
  - Find the beginning of the digestive tract by inserting the probe into the mouth and into the esophagus – the esophagus is usually fairly short.
  - The large reddish organ on top of the stomach is the liver.
    - The liver maintains proper blood chemistry and produces enzymes that help digest fats.
    - The dark greenish tissue in the liver is the gall bladder - produces bile which digests fats and neutralizes acid
  - Stomach
    - The esophagus empties into a J-shaped bag called the cardiac stomach; this is where digestion of food begins.
    - The spleen is attached to the lower end of the cardiac stomach; the spleen produces red blood cells.
    - The area below the cardiac stomach is the pyloric stomach; the branching projections are called pyloric

ceca and provide additional surface area for nutrient absorption.

- The pancreas surrounds the ceca and produces digestive enzymes.
- The pyloric stomach empties into the intestine.
  - This is where digestion is completed and food is absorbed.
  - Herbivorous fish have a longer intestine than carnivorous fish because plant material is more difficult to digest. Have students make a hypothesis concerning the diet of their fish, based on the length of the intestine.
- Waste products are eliminated through the vent.
- Have students cut open the stomach and examine the contents. Was there a correlation between the type of teeth, the length of the intestine and the stomach contents?
- Swim bladder
  - The swim bladder is the silvery sack that runs the entire length of the fish's body between the digestive tract and the backbone.
  - The swim bladder is filled with air and provides buoyancy. It may also be involved in respiration (lungfish), hearing and sound production.
  - In some fish the swim bladder is connected to the throat and the fish swallows air; in most fish oxygen is absorbed from the blood.
  - Some fish, such as sharks, rays and lampreys do not have a swim bladder.
- Kidney – the streak of red tissue along the backbone is the kidney; its function is to filter waste from the blood and regulate salt/water concentrations.
- Heart
  - The heart is the small dark triangular shaped organ just below the esophagus near the fish's mouth.
  - Fish have a four chambered heart, like humans. Have students discuss the flow of blood through the heart.
  - Are fish warm-blooded or cold-blooded?
- Some students may find a large sack filled with little round yellow, red or black things. The sack is an ovary. These are eggs or roe and indicate that the fish was ready to reproduce. Some specimens may be mature males in which case the testes are long, thin to thick, ribbon-like, and whitish cream colored.



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