Fish Eating Contest

Grade Level:
5-12

Subject Area:
Biology, Anatomy, Aquaculture

Time:
Preparation: 2 minutes
Activity: 30 minutes
Clean-up: 5 minutes

Student Performance Standards (Sunshine State Standards):
10.03 List examples of aquatic crops and animals (LA.910.1.6.1, 2, 3, 4, 5; SC.912.L.17.9).

11.01 List and explain the meaning of morphology, anatomy, and physiology (LA.910.1.6.1, 2, 3, 4, 5; SC.912.L.14.7).

11.02 List and describe the physiology of aquatic animals (LA.910.1.6.1, 2, 3, 4, 5; SC.912.L. 18. 7, 8, 9).

11.05 Identify and describe the external and internal anatomy of fish (LA.910.1.6.1, 2, 3, 4, 5; SC.912.L.14.11, 12, 13, 14, 15, 16, 17, 18, 19, 21, 22, 28, 29, 31, 32, 33, 34, 36, 40, 41, 42, 43, 45, 46, 47,48, 51).

11.09 Develop an information file in aquaculture species (LA.910.1.6.1, 2, 3, 4, 5).

Objectives: Students will be able to:
1. Apply external anatomy to determine feeding behaviors of fish.
2. Develop an aquaculture diet (floating, sinking, etc.) based on external anatomy.

Abstract:
There are numerous fish species cultured around the world. Some are cultured in ponds, and some are cultured in tanks. Some are fed floating pelleted food and some are fed live algae. Each fish and the type of diets used in aquaculture have been developed specifically for the feeding strategies of the cultured animal. In this lesson, students will learn what kind of feeder they are by trying to capture

marshmallows without the use of their hands.

Interest Approach:

This lesson works best after you have completed a live or virtual dissection of the fish so that students are familiar with the external anatomy. Play the marshmallow feeding game (*see Fish Eating Contest presentation*). Have the students list types of fish species (from objective 1) based on their different feeding strategies. How would the culture methods change based on the way each animal feeds or based on whether they are salt water or freshwater?

Student Materials:

1. *Introduction to the Biology of Fish* handout
2. fishing line
3. clothespin
4. marshmallows (at least 2)
5. scissors
6. a partner

Teacher Materials:

Material	*Store*	*Estimated Cost*
Fish eating contest presentation	NA	NA
Bag of marshmallows	Grocery store	$3 and up
Fishing line	WalMart, Target, local fishing store	$8 and up
Bag of clothespins	WalMart, Target	$1.50 and up
Scissors	WalMart, Target	$8 and up

Student Instructions:

1. Read the handout *Introduction to Fish Biology* for homework in preparation for this laboratory.
2. Observe a live fish in an aquarium (if one is available).
3. Think of the way different fish (sharks, rays, eels, tuna, clownfish, seahorse) feed and where their mouthparts are located.
4. Find a partner.
5. Gather one set of materials for each group (fishing line, clothespin, marshmallow, scissors).
6. Tie the fishing line to the clothespin and clip the marshmallow onto the clothespin.

7. Have your partner try to eat the marshmallow from the clothespin without using their hands.
8. Switch roles.
9. Think about what kind of feeder you are (terminal, sub-terminal, up-pointing).
10. What kind of feed would be best for you in aquaculture (floating or sinking pellet, live feeds [rotifers, artemia], or microalgae)?

Teacher Instructions:

Preparations:

1. Give students a copy of the *Introduction to the Biology of Fish* handout and have them read this as homework (if they have not done so already).
2. Download the presentation with highlights.
3. Collect supplies.
4. Divide students into partner groups.

Activity:

1. Review the presentation with the students.
2. Ask them to actively engage and answer the questions to identify the different kinds of feeding strategies.
3. Ask them what kind of feeder they think they are (terminal, sub-terminal, up-pointing).
4. Divide students into partners and have them create a "fishing line" with the clothespin and their bait (marshmallows).
5. Without using their hands, have the students try to "feed" while their partner places the marshmallow bait in different positions.
6. Once finished, ask the students to list (on the board) which kind of diet would be best suited for feeders like themselves (i.e. floating or sinking pellets, live feeds (rotifers, artemia), or microalgae)?

Post work/Clean-up:

1. Have the students "eat" the rest of the bait.
2. You can save the fishing line and clothespins for future labs.

Anticipated Results:

1. Students will identify differences in feeding behaviors for fish based on their mouth type.
2. Students will be able to assign different types of aquaculture diets (floating, sinking, etc) to a particular mouthpart or feeding strategy of a fish.

Support Materials:

1. *Biology of Cultured Fish* presentation
2. *Aquariums in the Classroom* presentation
3. *Introduction to the Biology of Fish* handout

Explanation of Concepts:

1. Relationship of structure and function.
2. Anatomy and biology of vertebrates.

 **Support Materials** 

Introduction to the Biology of Fish

Fish are aquatic vertebrates that use gills to obtain oxygen from fresh or seawater. There are three main groups: the bony fishes or Osteichthyes (goldfish, cod, tuna); the cartilaginous fishes or Chondrichthyes (sharks, rays); and the jawless fishes or Agnatha (hagfishes, lampreys). Fishes of some form are found in virtually every body of water in the world except for the very salty water of the Dead Sea and some of the hot larval springs. Of the 30,000 fish species, approximately 2,500 are freshwater. The world's largest fish is the whale shark *Rhineodon typus*, more than 20 m/66 ft long; the smallest is the dwarf pygmy goby *Pandaka pygmaea*), 7.5–9.9 mm long. The study of fishes is called ichthyology.

The bony fishes constitute the majority of living fishes (about 20,000 species). The skeleton is bone, mobile fins control movement, and the body is usually covered with scales. A single flap covers the gills. Many have a swim bladder with which the fish adjusts its buoyancy. Most bony fishes are ray-finned fishes, but a few, including lungfishes and coelacanths, are fleshy-finned.

The cartilaginous fish are efficient hunters. There are fewer than 600 known species of sharks and rays. The skeleton is cartilage, the mouth is generally beneath the head, the nose is large and sensitive, and there is a series of open gill slits along the neck region. They have no swim-bladder and, in order to remain buoyant, must keep swimming. Some types of cartilaginous fishes, such as sharks, retain the shape they had millions of years ago.

Jawless fish have a body plan like that of some of the earliest vertebrates that existed before true fishes with jaws evolved. There is no true backbone but a notochord. The lamprey attaches itself to the fishes on which it feeds by a sucker-like rasping mouth. Hagfishes are entirely marine, very slimy, and feed on carrion and injured fishes.

All aquatic species may be classified in terms of their salinity tolerance as either: saltwater, brackish water, or freshwater species. Salinity requirements may differ for a given species at different stages in its life cycle. Species adapted to a narrow range of salinities are described as *stenohaline* . Species that are able to tolerate a wide range of salinities are described as *euryhaline.* **Osmoregulation** is the active regulation of the osmotic pressure of an organism's fluids to maintain the homeostasis of the organism's water content; that is it keeps the organism's fluids

from becoming too dilute or too concentrated. **Osmosis** is the net movement of a solvent across a permeable membrane from the side with the lower concentration to the side with the higher concentration. For fish we can think of the body fluids as one solution, the surrounding water as the other solution, and the parts of the body separating the two solutions as the membrane. In most organisms the gills are the primary membranes where osmosis occurs

Osmoregulation in marine fish is different than freshwater fish. The body fluids of saltwater species are *hypotonic* (dilute) relative to the surrounding water, so these species tend to lose water to the environment. Osmoregulation in saltwater species requires intake of water and excretion of excess salts. Osmoregulation in freshwater species involves excretion of water and active uptake and retention of salts. The ionic composition of the body fluids of freshwater species is *hypertonic* (more concentrated) to the surrounding water, so these species tend to accumulate water from the environment.