Anatomy of a Fish

Grade Level:
5-12

Subject Area:
Biology, Anatomy

Time:
Preparation-10 minutes
Activity-45-60 minutes
Clean-Up-10 minutes

Student Performance Standards (Sunshine State Standards):
02.02 Demonstrate proper safety precautions and use of personal protective equipment. (SC.912.L.14.6, SC.912.L.16.10; SC.912.L.17.12, 14, 15, 16; MA.012.A.2.1, 2)

06.04 Compare basic internal and external anatomy of animals (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; SC.912.L.15.6, 7)

10.03 List examples of aquatic crops and animals (LA.910.1.6.1, 2, 3, 4, 5; LA.910.2.2.2; 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; LA.910.2.2.2; SC.7.L.17.1; 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; LA.910.2.2.2; 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)

12.01 Recognize and observe safety practices necessary in carrying out aquaculture activities (LA.910.1.6.1, 2, 3, 4, 5).

Objectives: Students will be able to:
1. Categorize types of fishes and provide examples.
2. Describe basic biology of common aquaculture fish species.

3. Identify and explain the primary functions of key anatomical features of common aquacultured fish species.

Abstract:

About 50% of all aquacultured products are fish (freshwater, marine, and brackish). However, only one in every five seafood meals you eat have come from an aquacultured product. As the global aquaculture industry expands, freshwater and marine fish culture is becoming an important focus in the United States and in Florida. In this lesson, students will learn to distinguish between the three main types of fishes, and complete a live or a virtual dissection of a fish. Students will identify the external anatomy of a fish and describe the function of important external features. They will be able to identify the major internal organs of a fish and their functions related to swimming, digestion, and respiration. Additionally, students will demonstrate dissection skills (for live dissections). Using a dissection guide or a virtual dissection on the computer, the students will participate in a dissection of a fish (preserved or fresh).

Interest Approach:

Have the students list some of the different types of fish they have consumed or catch and ask them if they think they are an aquacultured species. Ask them to identify an example of a bony, cartilaginous, and jawless fish.

Student Materials:

1. *Introduction to Fish Biology* handout
2. Dissection equipment (or computer access for virtual dissection)
3. *External Anatomy* and *Internal Anatomy* worksheets

Teacher Materials:

Material	*Store*	*Estimated Cost*
LIVE DISSECTION		
Dissection kit	Carolina Biological	$16 and up
Fish dissection guide (Perch)	www.tobinslab.com	$1.99
Dissection pan	Carolina Biological	$15.50 and up
Fish (preserved or fresh)	Preserved-Carolina Biological Fresh-local markets	$1.95 and up
Paper towels	WalMart, Target, Publix	$2 and up
Mixed mild bleach solution	WalMart	$4
Hand sanitizer	WalMart, Target, Publix	$3 and up

VIRTUAL DISSECTION		
Carolina BioLab software	Carolina Biological	$80 and up
Virtual dissection	http://www.austmus.gov.au/fishes/students/dissect/scomber.htm	
Dissection game	http://library.thinkquest.org/05aug/00548/Dissection.html	
Classroom dissection	http://www.sf.adfg.state.ak.us/region2/ie/sicc/dissectn.cfm#external%20anatomy	
Video of salmon dissection	http://www.leechvideo.com/video/view484582.html	

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. Identify some of the key anatomical features.
4. Once assigned to a group, prepare the table for a live dissection (or prepare your worksheets for a virtual dissection).
5. Identify and label the external anatomy and their functions on your worksheet or in your lab notebook.
6. Follow the teacher's instructions and your dissection guide for the internal anatomy and the proper way to prepare your dissection.
7. Identify the internal organs and their functions in response to swimming, digestion, and respiration.

Teacher Instructions:

Preparations:

1. Obtain your fish specimens (fresh or preserved)
2. Divide your class into small groups (2-4 per group if possible)
3. Prepare one dissection kit, pan, and clean-up materials per group
4. Copy the dissection guide for each student
5. Copy the *External Anatomy* and *Internal Anatomy* handouts for each student
6. Give students a copy of the *Introduction to the Biology of Fish* handout and have them read this as homework, or touch on the different types of fishes prior to the dissection in classroom lectures

Activity:

1. Once students are in their groups, ask them to identify the external anatomy (perhaps put a drawing on the board)
2. Follow the dissection guide step by step in order to ensure each group is moving through the anatomy at the same time.

3. Ask the students to label and/or draw (if using lab notebooks) each step of the dissection and identify major organs and their uses (information will be in dissection guide)

Post work/Clean-up:

1. When students are finished with the dissection, have them fold all materials into their paper towels and set aside a separate trashcan for dissection materials.
2. Remind each group to thoroughly rinse and sanitize dissection equipment (water and mild bleach solution or other sanitizing agent). Have them dry the equipment and return it to the kit. Make sure that they rinse and dry their tray as well.
3. Dispose of dissection material appropriately (e.g., outside dumpster) and immediately.
4. Wipe all dissection stations with a sanitizer (mild bleach solution)

Anticipated Results:

1. Students will identify the external anatomy of a fish and describe the function of important external features.
2. Students will know the major internal organs of a fish and their functions related to swimming, digestion, and respiration.
3. Students will demonstrate dissection skills (for live dissections).

Support Materials:

1. *Introduction to the Biology of Fish* handout
2. *Biology of Cultured Fish* presentation
3. *Overview of Finfish Culture* presentation
4. *Aquariums in the Classroom* presentation
5. *Tilapia Culture* presentation
6. *Tropical Ornamental Culture* presentation
7. *Fish Reproduction and Hatchery* presentation
8. Fish Terminology: http://www.austmus.gov.au/fishes/fishfacts/fish/glossary.htm
9. Black, K.D. and A.D. Pickening. 1998. Biology of Farmed Fish, 1 Ed. Blackwell Publishing. 415 pp. ISBN-10: 0849397316. (*available at Amazon.com)*
10. Popma, T. and M. Masser. 1999. Tilapia: Life history and biology. SRAC Publication No. 283. (http://srac.tamu.edu)
11. About Fishes: http://www.austmus.gov.au/fishes/what/index.cfm
12. General Fish References: http://www.flmnh.ufl.edu/fish/kids/References/FishRef.htm

Explanation of Concepts:

1. Anatomy of vertebrates
2. Dissection skills
3. Relationship of structure and function

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.