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## *Shoe Key*

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**Grade Level: 6-12**

**Subject Areas: Life Sciences**

**Duration: 50 minutes or less**

**Setting: classroom**

**Skills: gathering, organizing, and analyzing information; applying learned information**

**Vocabulary: dichotomous, classification**

### **Related State Content Benchmark Objectives**

- **Compare and classify familiar organisms on the basis of observable physical characteristics**
- **Compare and classify organisms into major groups on the basis of their structure**

### **Objectives**

Students will be able to:

- construct a dichotomous key using shoes; and,
- apply their understanding of how a dichotomous key works.

### **Materials**

- optional paper and pencils for students
- shoes

### **Background**

A dichotomous key is a tool that scientists use to identify species of living things. At each level of the key are two primary category descriptions, **a** or **b**. Students observe the living things that they are attempting to identify, and match a description to that organism. The answer will either lead students to the name of the species, or to another level within the key. (Students should understand that scientists sometimes have trouble classifying certain organisms. For example, the blue-green algae defies easy placement in either the plant or animal kingdom.) The Schoolship program has designed dichotomous keys for each biological station: benthos (bottom-dwelling organisms), plankton, and fish. At the fish station, students will be expected to identify fish by using a dichotomous key. Explain to the students that they will be constructing a key for shoes, and will apply that understanding of how a shoe key works to other dichotomous keys.

### **The Activity**

1. Have each student take off one shoe.
2. Gather the shoes in a pile in front of the group, arranging them so that everyone can see the shoes.
3. Save one shoe for later identification.
4. Tell the students they will have to come up with two main categories of shoes (a way to divide the shoes into two groups of approximately even numbers). Examples are sport and non-sport shoes, leather and non-leather shoes, shoes with ties and shoes without ties. There will always be some shoes that are hard to classify, for example shoes with Velcro fasteners--is this a tied shoe or not? The students will have to adjust their classification system to handle the types of shoes represented.
5. Write your classification system on the board. You may have students copy the key on their own paper, or you can save this until the end of the lesson--it's optional.

### **Example**

- 1a. shoes with ties.....**2**
- 1b. shoes without ties.....**4**

6. Now divide one of the subcategories again, roughly in half. Continue dividing the shoe piles until you reach a description for an individual shoe; this represents the species level. If two students have the exact same shoe, then there will be more than one of that species. (Note that keys do not describe individual differences within a given species.)

**Example**

- 2a. High-top shoes.....**3**
- 2b. Low-top shoes.....**5**

7. Now , bring out the shoe that you saved earlier for identification. Can students identify the mystery shoe using the key they designed?

## ***Gyotaku (Japanese Fish Printing): Art and Anatomy***

**Grade Level: 5-9**

**Subject Areas: Life Science, Art**

**Duration: 50 minutes**

**Setting: classroom**

**Skills: identify fish anatomy**

### **Objectives**

Students will be able to:

- learn the process of fish printing
- identify the parts of a fish, and see what it can reveal about the external fish structure

### **Materials**

- fresh fish (yellow perch or rainbow smelt work well)
- newspaper
- watercolor paper, newsprint or rice paper
- tempera or water-based ink (linoleum block ink is best)
- stiff ½ inch brush

### **Background**

Gyotaku is an ancient art, which now is used to record catches of sport fish and to document information about fish biology. Fish prints often show details of the fish's external structure that are not apparent when looking at the fish itself. Before making the print, identify the fish, list its characteristics, research its natural history, and learn when, where, and how it was caught.

Use Gyotaku Japanese Fish Printing as pre-trip preparation for using the dichotomous key at the fish station on the Schoolship, or as a fun post-trip activity to review. In order to use the key for the fish station aboard the Schoolship, students will have to recognize the parts of a fish.

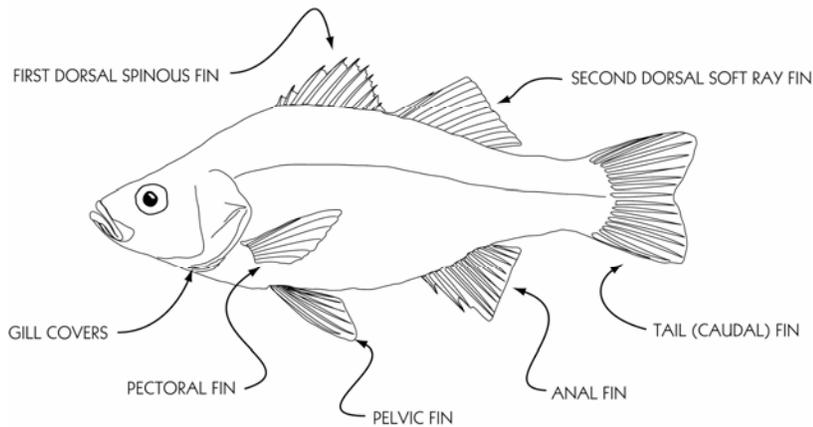
### **The Activity**

1. Obtain a whole (ungutted) fresh fish. Support your local fishing industry or fishermen. Rubber fish may be used in a pinch, but fresh fish result in much better prints.
2. Wash the fish with soap and water. Dry thoroughly.
3. Place the fish on newspaper on a wooden board. Arrange its fins properly.
4. Brush on a light, even coat of diluted tempera paint or water-base printer's ink.
5. Place paper over the fish and press lightly with your hand all over the body and fins, noticing scales, body structure, body shape, etc.
6. Lift paper with print (a small brush may be used to paint in the eye).
7. Notice shape and location of the eyes, gills, scales, fins, and lateral line. Do a print of another kind of fish and compare the two.
8. Label your print with both common and scientific names of the species, your name, and date of print.
9. You can also try the process with crayfish, shells, etc. Experiment and let us know what works!!

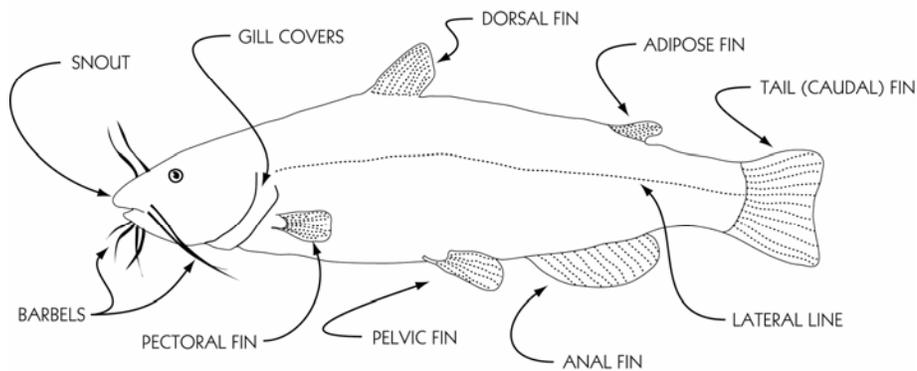
### **Wrap –Up Questions**

1. What features of the external structure of the fish can you see on the print?
2. Were you surprised by some of these details or by the sensation of touching the fish?
3. What parts of the fish give you clues about what they eat and where they may be in the food web?

### PARTS OF A SPINY RAYED FISH



### PARTS OF A SOFT-RAYED FISH



## Additional Resources

<http://www.glifwc.org/epicenter/>

Great Lakes Indian Fish and Wildlife Commission *Exotic Plant Information Center*

<http://www.invasivespecies.gov/>

*A gateway to federal and state invasive species activities and programs.*

<http://www.great-lakes.net/envt/flora-fauna/invasive/invasive.html>

GLIN (Great Lakes Information Network) *Invasive Species in the Great Lakes Region*

### Source:

Reference: *The Floating Lab Resource Manual Grade 7-12*

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