



Wild Kids

Identifying Arizona's Native Fish

STUDENT GUIDE

At one time as many as 35 species of native fish could be found in the waters of Arizona. Most are small, but one reaches over 5 feet in length. Today many are endangered, threatened and even extinct. But could you name all of the fish native to Arizona? Unless you are an expert in identifying fish, many of Arizona's fish are hard to identify without help. One resource that many people use is called a dichotomous key. Dichotomous means "the division into two usually contradictory parts or categories."

Dichotomous keys can be used to identify just about anything, from fish to birds and mammals, wildflowers and trees, and even mushrooms and grasses. A dichotomous key of fish uses characteristics such as the shape of the tail fin, number and type of fins, location of the mouth, location of the eye, number and type of teeth, shape of scales, and overall body shape to name a few. Some characteristics need a magnifying glass to see and count. But these are characteristics that anyone can see with the right equipment. So, how does a dichotomous key work?

A dichotomous key is a series of "either/or" statements. You start at the top and choose between a pair of statements based on the characteristics. At the end of each statement is a number or name. The number refers to the next set of statements you need to look at. You keep going until you have reached one that gives you a name.

Suppose an alien came to earth. It went into a pet store which sold a variety of animals. But the alien did not know what they were. Fortunately she had a dichotomous key for such animals. It looked something like this:

- | | |
|---|---|
| 1. Animal has scales.....go to 2 | 3. Animal has gills.....fish |
| 1. Animal does not have scales.....go to 4 | 3. Animal does not have gills.....snake |
| 2. Animal has eyelids.....turtle | 4. Animal has longer hind legs than front legs.....frog |
| 2. Animal does not have eyelids.....go to 3 | 4. Animal has legs all about the same length.....salamander |



The alien tried to identify this animal. She read the first set of statements: "Animal has scales (go to statement 2) / Animal does not have scales (go to statement 4)." The animal did not have scales, so she moved to 4 as directed. She observed the legs and noticed they were all about the same length. Reading the two options in the set again, she identified the animal as a salamander.

Again dichotomous keys use paired "either/or" statements. Each set of statements refers to one and only one specific characteristic. You cannot combine two characteristics in a set of statements. For example, statements 1 could not read: "1. Animal has scales.....go to 2 / 1. Animal has eyelids.....go to 4." Why? Well, the two characteristics might not be exclusive. How would you identify a turtle which has been scales and eyelids? You wouldn't know where to go!

Using a dichotomous key is not difficult if you remember the following:

1. Always start with the FIRST set of statements.
2. Take the paired statements one at a time - do not rush ahead to what you think the answer is (you will probably be wrong).
3. Look closely at the object you want to identify. If the object is a picture, determine if it is life-size or not (this will help if you need to measure something).

USING A DICHOTOMOUS KEY

Identify the fish drawings in the right-hand column using the following dichotomous key. Write your answers in the space provided next to each fish. The fish are not drawn life-size. Remember, take one set of statements at a time.

Dichotomous Key

- 1. Distinct hump on back.....2
- 1. No distinct hump on back.....3
- 2. Dorsal fin (top one) longer than anal fin (fin on bottom just before tail).....**Razorback Sucker**
- 2. Dorsal fin the same length or shorter than anal fin.....**Bonytail Chub**
- 3. Adult with a stripe on its side.....4
- 3. Adult without a stripe on its side.....5
- 4. Tail forked.....**Longfin Dace**
- 4. Tail not forked, but rounded.....**Gila Topminnow**
- 5. Small adipose fin (between dorsal fin and tail) absent.....6
- 5. Small adipose fin present.....**Gila Trout**
- 6. Body much longer than it is tall.....7
- 6. Body almost as tall as it is long.....**Desert Pupfish**
- 7. Body speckled.....**Speckled Dace**
- 7. Body not speckled.....**Colorado Pikeminnow**

MAKING YOUR OWN KEY

Now that you understand how to use a dichotomous key, it is time to make one. Using the same pictures of the fish, make a new key with different characteristics. Or, change the order. Remember you can only use something you can readily see in drawings.

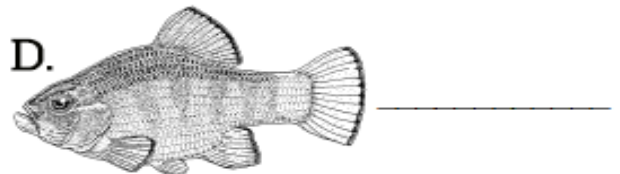
APPLYING YOUR KNOWLEDGE

Find pictures of something new that can be classified. It could be mammals, birds, books, fruit, flowers or even Pokemon. Cut out the pictures and paste them onto a large sheet of paper. Then, make up a classification key to identify each individual just like you did for the fish above. Have fun and be creative!

CRITICAL THINKING

- 1. Why is it important to keep each step of the dichotomous key to one characteristic?

- 2. How might dichotous keys help us understand natural selection?





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TEACHING GUIDE

Overview

In this activity, students will read about dichotomous keys and how to use them. Then, they will apply their knowledge in a couple of different ways. First, they are asked to use a simple dichotomous key to identify native fish from images. Then, they are asked to use the same images to create a new dichotomous key. Finally, they are asked to find other objects (not fish) that can be classified and create another dichotomous key to help identifying individual objects in that group.

Suggested Procedures

1. Print the worksheet above. If possible, print it double sided.
2. Have the students read the first page.
3. Ask students the following questions and discuss:
 - What is a dichotomous key? How is it useful to biologists?
 - How do you use a dichotomous key?
4. Have students complete the "Using a Dichotomous Key" activity on the second page. They will need to use the key provided to identify the fish on the right side of the paper. They can write the names of the fish on the line next to each fish.
5. Discuss the results. Did everyone get the same answers? If not, where was the confusion and/or disagreement?
6. Have students complete the "Making Your Own Key" activity. For this, they should use the same fish images. Remind them of the challenges they had using the key above. How might they create a key that would avoid those same challenges?
7. Have the students share their key with a partner. That person should use their key to identify the fish. Partners can discuss the results. Then, come back together as a class and discuss the activity. Was everyone successful? Why or why not? What are some considerations that need to be taken when making your own key?
8. Inform students that they will now be making another key, this time with whatever objects they want. Some examples are in the text (mammals, books, fruit, etc.) but it can be any group of objects that can be sorted and identified by visual characteristics. They should find pictures of their objects and tape them to a piece of paper. Then, they can create a key using those visual characteristics.
9. Have students share their key with a partner. That person should use the key to identify the different objects. Discuss the results as a class.
10. Ask students to answer the critical thinking questions at the end. Discuss.

Grade

8th

AZ Science Standards

- 8.L4.U1.12

Science and Engineering Practices

- Develop and use models
- Engage in argument from evidence

Crosscutting Concepts

- Patterns
- Stability and Change