



# FISH DETECTIVES: IDENTIFYING AND CLASSIFYING FISHES USING A DICHOTOMOUS KEY

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**Grade Level**

4<sup>th</sup> – 8<sup>th</sup> Grade

**Subject area**

Life Science / Biology

*VA SEA is a collaborative project between the Chesapeake Bay National Estuarine Research Reserve, the Virginia Institute of Marine Science's Marine Advisory Program, and Virginia Sea Grant. The VA SEA project is made possible through funding from the National Estuarine Research Reserve System Science Collaborative, which supports collaborative research that addresses coastal management problems important to the reserves. The Science Collaborative is funded by the National Oceanic and Atmospheric Administration and managed by the University of Michigan Water Center.*



**Title** Fish Detectives: Identifying and Classifying Fishes Using a Dichotomous Key

**Focus** Understanding how a dichotomous key can be utilized to explore how to identify and a group of fishes based on their physical characteristics

**Grade Level** 4<sup>th</sup> – 8<sup>th</sup> grade

### **VA Science Standards**

**4.3** The student will investigate and understand that organisms, including humans, interact with one another and with the nonliving components in the ecosystem.

- (D) Classification can be used to identify organisms.

**LS.1** The student will demonstrate an understanding of scientific and engineering practices by interpreting, analyzing, and evaluating data.

- Students will analyze and draw inferences about how fish should be classified based on the data they are presented with.

**LS.3** The student will investigate and understand that there are levels of structural organization in living things.

- Although similar characteristics determine the classification of organisms, there is still large variation at the species level as well.

**BIO.6** The student will investigate and understand that modern classification systems can be used as organizational tools for scientists in the study of organisms.

- Different species have evolved, and we can use tools like dichotomous keys to identify and sort these animals.

**SOL 4.7** The student will investigate and understand that the ocean environment has characteristics.

- (C) Interaction of organisms in the ocean.

### **Learning Objectives**

- ✓ Students will review and apply their knowledge to practice how a dichotomous key works.
- ✓ Students will read and draw conclusions about selected fish and categorize them based on their similarities and differences.

### **Total length of time required for the lesson**

40-55 minutes total depending on grade level. Activity 1 and Reflection 1: 20 mins maximum; Activity 2 and Reflection 2: 35 mins maximum.

### **Preparing the lesson (Teacher Preparation)**

The teacher should familiarize themselves with the lesson plan and PowerPoint prior to use. No further preparation needed. This lesson can either be completed online or printed (black and white will work as well). Students can work individually or in pairs, up to the discretion of the instructor.

### **Materials**

Printed (black and white) or online lesson plan use needed. No further or supplemental materials utilized for this lesson plan.

### **Procedure**

The teacher should read over the lesson plan and PowerPoint ahead of time to familiarize themselves with the material. This lesson can be completed individually or in pairs and either printed or online. The instructor can introduce the lesson through the PowerPoint and then the lesson flows best when both activities are run one after the other. With review, the lesson activities can be completed in separate timeframes as well with material review ahead of time.

### **Key words, vocabulary: (review with students BEFORE the lesson)**

- **Common name:** The specific name given to an animal species to help with its classification.
- **Dichotomous key:** An identification method based on a series of grouped categories.
- **Teleost fish:** a fish with a skeleton made out of bones.
- **Cartilaginous fish:** a fish with a skeleton made out of cartilage, no bones.

### **Background**

It is often difficult to identify organisms at first glance. Instead, we rely on distinguishing the shared characteristics that separate organisms by species, or into groups of similar organisms that can then reproduce. The skill of learning to classify and identify organisms only come with practice. One tool to help with identification is using a dichotomous key!

### **Assessment**

Reflection check-points are found at the end of each activity. This should be used to help gauge student understanding of the material and highlight any areas of further assistance or attention going forward.

### **References**

All images were drawn by and belong to Kaitlyn Cisz. If any questions arise, please contact at [krcisz@vims.edu](mailto:krcisz@vims.edu).

## Fish Detectives: Identifying and Classifying Fishes Using a Dichotomous Key

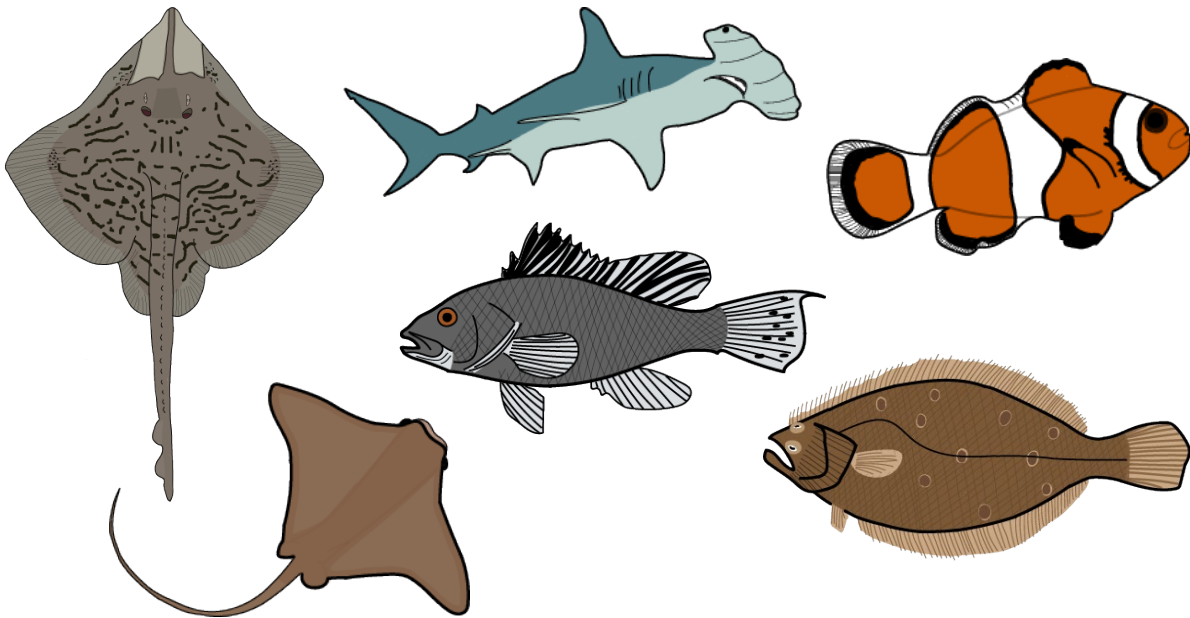
Name \_\_\_\_\_ **TEACHER'S GUIDE** \_\_\_\_\_

Date \_\_\_\_\_

Ahoy mateys! Welcome aboard the S.S. Fish, a special ship full of world-class detectives tasked with figuring out just what species we catch every day. Today, YOU are one of our detectives!

The first step to being a great fish detective is understanding that many different fish live in the ocean. The best way to identify these fish on our ship today is by using our eyes and context clues to figure out just which fish is which. After all, we don't want to write a letter bragging about a rare fish we found, only to find our detective skills led us in the wrong direction after all!

At first glance, we caught some pretty cool fish today on our boat. Take a look:



But oh no, how will we ever know how to figure out the correct names of all these species above? Have no fear, the fish detectives are here and on the case!

### **Directions: (~40 – 55 minutes total)**

Before becoming a true fish detective, we have to first go through training. Below is some important information about our animals that live in the ocean that will give you the security clearance needed today.

Let's start with a quick activity, teaching us about the animals we may encounter on our boats.

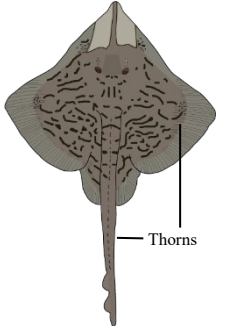
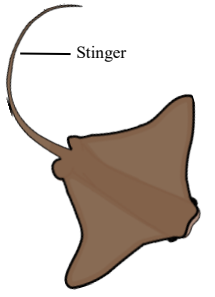
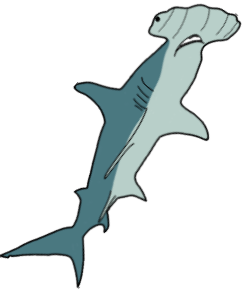
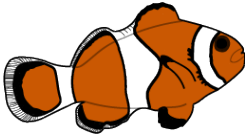
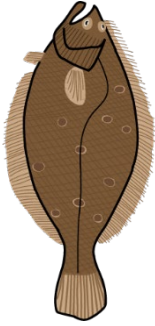

### **Activity 1: Learning how to classify animals (~20 minutes)**

Before we can assign our fish their **common name**, we first need to be able to identify them based on more generalized characteristics. This might sound tricky but think about land animals you may see in your own daily lives as an example. Before we can name a dog or cat by their breed, or common name, we first use more general categories of dog versus cat to figure out what we are looking at.

Below are some important descriptions about some of the animals we have caught today. For the first part of this activity, please read the descriptions listed and match the animal you may have into whichever category you believe they best belong (A-F). Each animal will only be used once, so although they might share some of the descriptions in the box listed with one another, it is important to make sure you label the animals based on all criteria being met.

**NOTE: To help students understand the difference between a teleost, or bony fish, versus a cartilaginous fish (no bones) have them touch/wiggle their nose and ears. This will help them understand what cartilage feels like versus touching their arms or other bony parts of their bodies.**

**KEY:**

FISH A	FISH B	FISH C	FISH D	FISH E	FISH F
					
<p>I am a very flat fish, meaning I like to live on the ocean floor. My skeleton is made out of cartilage, meaning I have no bones in my body. That makes me a cartilaginous fish. My tail is shorter and has thorns as a defense.</p>	<p>I am a very flat fish, but even though I like to live on the ocean floor, I can often be found swimming in the middle of the ocean. My skeleton is made out of cartilage, meaning I have no bones in my body. That makes me a cartilaginous fish. My tail is long and has a stinger as a defense.</p>	<p>I like to live in middle of the ocean, swimming around in the water column. My skeleton is made out of cartilage, meaning I have no bones in my body. That makes me a cartilaginous fish. My skin is sharp like sandpaper.</p>	<p>I like to live in the water column and in coral reefs. My skeleton is made up of bones, meaning I am a teleost fish. I am very colorful.</p>	<p>I am a very flat fish, meaning I like to live on the ocean floor. My skeleton is made up of bones, meaning I am a teleost fish. My eyes are on the same side of my head. My fins, that help me swim, are found along the outside of my flat body.</p>	<p>I like to live in deeper water, or water column, but not on the ocean floor. My skeleton is made up of bones, meaning I am a teleost fish. My fins and body are dark colors.</p>

Let's review these fishes! Read the key above and then circle the correct descriptions for each fish below. This can be tricky so read carefully. This short activity will help us later detectives!

FISH A	FISH B	FISH C	FISH D	FISH E	FISH F
Bones or <b>cartilage</b>	Bones or <b>cartilage</b>	Bones or <b>cartilage</b>	<b>Bones</b> or cartilage	<b>Bones</b> or cartilage	<b>Bones</b> or cartilage
Teleost or <b>cartilaginous fish</b>	Teleost or <b>cartilaginous fish</b>	Teleost or <b>cartilaginous fish</b>	<b>Teleost</b> or cartilaginous fish	<b>Teleost</b> or cartilaginous fish	<b>Teleost</b> or cartilaginous fish
<b>Flat body</b> or not flat body	<b>Flat body</b> or not flat body	Flat body or <b>not flat body</b>	Flat body or <b>not flat body</b>	<b>Flat body</b> or not flat body	Flat body or <b>not flat body</b>
<b>Lives on ocean floor</b> or lives in water column	<b>Lives on ocean floor</b> or <b>lives in water column</b>	Lives on ocean floor or <b>lives in water column</b>	Lives on ocean floor or <b>lives in water column</b>	<b>Lives on ocean floor</b> or lives in water column	Lives on ocean floor or <b>lives in water column</b>

Based on the key above, who am I?

- D.   1. I am a teleost who does not live on the ocean floor. Who am I?
- E.   2. I like to live on the ocean floor and my skeleton is made out of bones. Who am I?
- A.   3. I am a very flat fish with thorns on my tail. Who am I?
- B.   4. I like to swim in the water column and live on the ocean floor. Who am I?
- F.   5. I do not live on the ocean floor, but I do like deep water. Who am I?
- C.   6. I am a cartilaginous fish, but I am not flat at all. Who am I?

Did you notice that although these fishes may look different, they still share a lot of similarities as well? This is why classifying animals can be tricky! Let's explore these similarities. Answer with all correct animals (A-F) and know the animals can now be used more than once.

- 1. Which fish/fishes live on the ocean floor:           A., E.
- 2. Which fish/fishes are teleosts:           D., E., F.
- 3. Which fish/fishes have a stinger:           B.
- 4. Which fish/fishes are flat:           A., B., E.

Great sleuthing detectives! Let's reflect on what we have learned so far. In the space below please write down one thing you have learned about classifying animals into their more general groups:

**Answers will vary. The point of this question is to have the students start reflecting on the differences between fishes. Oftentimes, animals share characteristics that make telling them apart for identification even harder. Classifying them into larger groups first helps break down this process.**

Although these differences help us classify animals, why do you think fishes have different body shapes? (Hint: think about WHERE these different fishes may live)

**Different fish live different lives and have different food preferences. The body shape helps different animals live in different places, for example a flat body is ideal for living on the ocean floor!**

What I have always found so tricky is that many fish share a lot of the same characteristics! Now, you are ready for your biggest challenge yet. No, it's not conquering the high seas, it's using our **dichotomous keys**! Put on your detective hats, because it's time to figure out the common names of our fish caught today.

**Activity 2: Using a dichotomous key (~35 minutes)**

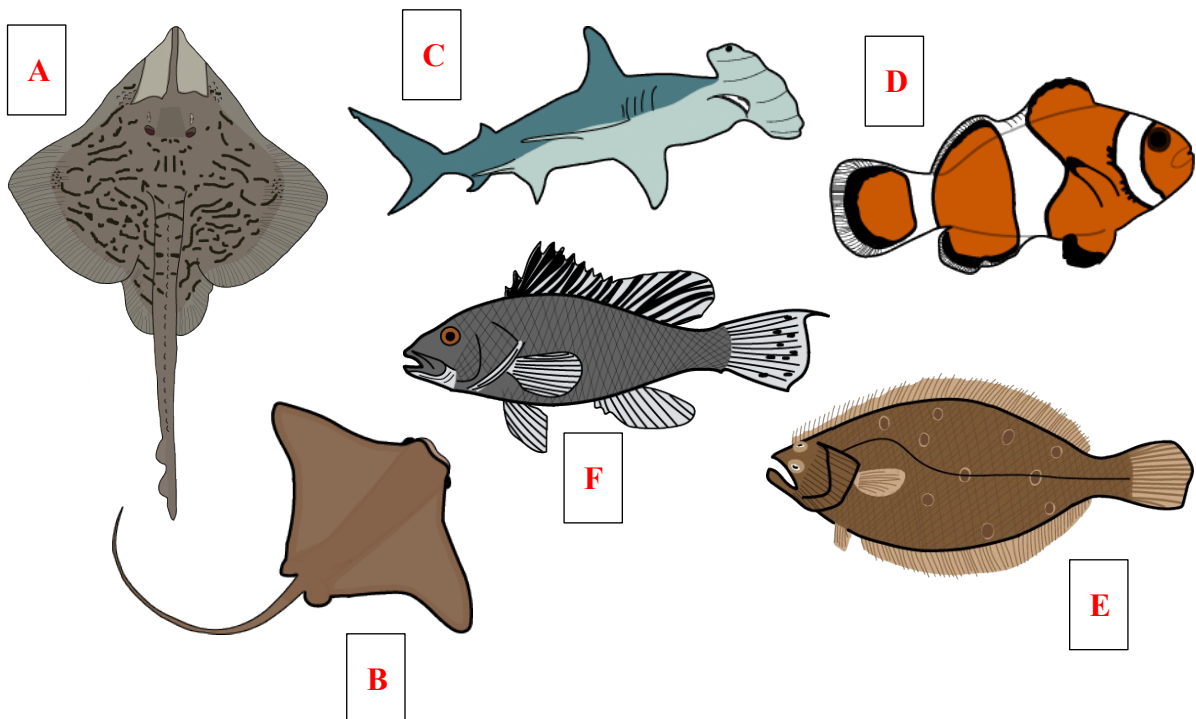


Let's figure out what we caught! Using the information we learned above about skates, rays, sharks, clownfish, and flounder, we can now answer a series of questions to figure out the common names for each of our fish! Follow along with the dichotomous key, or guide, answer the questions for each fish, and follow the prompts. Good luck detectives!

Key review from Activity 1:

- **A** – I am a very flat fish, meaning I like to live on the ocean floor. My skeleton is made out of cartilage, meaning I have no bones in my body. That makes me a cartilaginous fish. My tail is shorter and has thorns as a defense.
- **B** – I am a very flat fish, but even though I like to live on the ocean floor, I can often be found swimming in the middle of the ocean. My skeleton is made out of cartilage, meaning I have no bones in my body. That makes me a cartilaginous fish. My tail is long and has a stinger as a defense.
- **C** – I like to live in middle of the ocean, swimming around. My skeleton is made out of cartilage, meaning I have no bones in my body. That makes me a cartilaginous fish. My skin is sharp like sandpaper.
- **D** – I like to live in coral reefs. My skeleton is made up of bones, meaning I am a teleost fish. I am very colorful.
- **E** – I am a very flat fish, meaning I like to live on the ocean floor. My skeleton is made up of bones, meaning I am a teleost fish. My eyes are on the same side of my head. My fins, that help me swim, are found along the outside of my flat body.
- **F** – I like to live in deeper water but not on the ocean floor. My skeleton is made up of bones, meaning I am a teleost fish. My fins and body are dark colors.

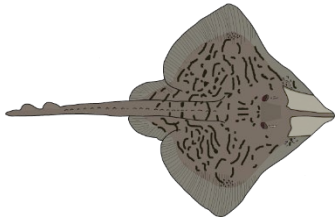
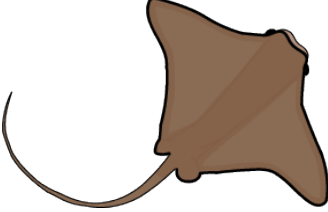
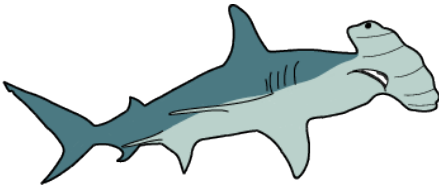
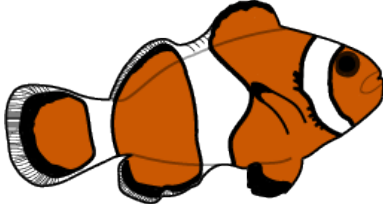
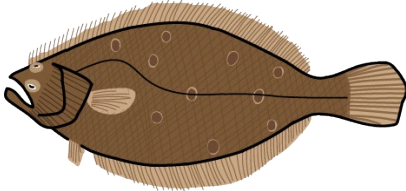
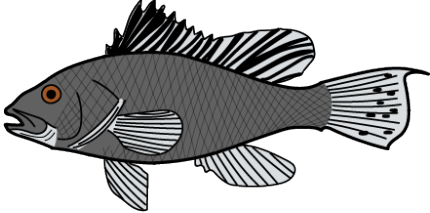
Please match the description above to each one of our fishes below and fill in the correct letter!



Below you will have to name our fish using common names! Feel free to circle the names as you find them to help:

1.
  - a. My skeleton is made out of cartilage.....Go to 2
  - b. My skeleton is made out of bone.....Go to 3
2.
  - a. I am a flat fish.....Go to 6
  - b. I am not a flat fish.....Go to 5
3.
  - a. I live on the ocean floor.....Go to 4
  - b. I swim around in the water off the ocean floor.....Go to 5
4.
  - a. My eyes are on the same side of my face.....Go to 11
  - b. My eyes are on opposite sides of my face.....Go to 5
5.
  - a. I only like to live in coral reefs.....Go to 10
  - c. I swim in most of the water column.....Go to 8
6.
  - a. I have thorns.....Go to 9
  - b. I have a stinger on my tail.....Go to 7
7.
  - a. I have a uniform, brown-colored body.....**Cownose ray**
  - b. I have spots on my body.....Eagle ray
8.
  - a. I have a uniform, dark-colored body.....Go to 13
  - b. I have a lighter underside than the top of my body.....Go to 12
9.
  - a. I have no dark stripes..... Roundel skate
  - b. I have dark stripes.....**Clearnose skate**
10.
  - a. I have a rounded tail.....**Clownfish**
  - b. I have a triangular tail.....Blue tang
11.
  - a. I have lighter colored fins, and spots on my body.....**Summer flounder**
  - b. I have a uniformly dark colored body and fins, and spots on my body.....Winter flounder
12.
  - a. My head is very long and bumpy with grooves.....**Scalloped hammerhead shark**
  - b. My head is sharp and pointy.....Great white shark
13.
  - a. My body has seven horizontal lines.....Striped bass
  - b. My body is full of scales.....**Black sea bass**

Wonderful work detectives. Now, just to make sure we are all on the same page with our identification, lets also write out the common name we have determined using our dichotomous key with the corresponding picture below:

Fish	Common Name
	<p><b>Clearnose skate</b></p>
	<p><b>Cownose ray</b></p>
	<p><b>Scalloped hammerhead shark</b></p>
	<p><b>Clownfish</b></p>
	<p><b>Summer flounder</b></p>
	<p><b>Black sea bass</b></p>

**Reflection:**

1. **What is one thing you have learned about a dichotomous key today?**

**Answers will vary. This is just a thought exercise about the tool, a dichotomous key.**

2. **What is one reason a scientist would use a dichotomous key?**

**Great tool in both the lab and the field, especially for species with very small differences.**

3. **What is one question you still have about using a dichotomous key after today?**

**Answers will vary. Hopefully this helps you as an educator see where your class may need more help with this subject going forward in other lesson plans.**