**Grade 7/Life Science**

**Dichotomous Keys: An Essential Tool for Fish Detectives**

**Timeframe**: 90 Minutes

**Standard/Indicator(s)**

**LS.6**  The student will investigate and understand that populations in a biological community interact and are interdependent. Key ideas include:

  a) relationships exist between predators and prey and these relationships are modeled in food webs;

**LS.7**  The student will investigate and understand that adaptations support an organism's survival in an ecosystem. Key ideas include:

  b) physical and behavioral characteristics enable organisms to survive within a specific ecosystem.

| Enduring Understanding | Essential Knowledge & Practices |
|---|---|
| The life processes of plants and animals are interdependent and contribute to the flow of energy and cycles of matter within an ecosystem.<br>● The interaction between a consumer that captures and consumes another consumer is the predator-prey relationship (LS.6 a).<br><br>Organisms possess physical characteristics and behaviors that enable them to survive in their environment and obtain resources to meet basic needs and carry out life processes, increasing their chances of survival (LS.7 b). | -**Formulate** inferences based on graphs and other data about predator-prey populations (LS.6 a)<br><br>-**Analyze** and **describe** how physical characteristics and behaviors enable organisms to survive in an ecosystem (LS.7 a, b)<br>-**Investigate** how structural adaptations among populations allow organisms to survive with ecosystems (LS.7 b). |

**Essential Question**
How do scientists identify fishes and their trophic roles within the Chesapeake Bay through the use of dichotomous keys?

**Materials and Safety (Always refer to the VDOE Safety in Science Teaching)**

Computer and projector for accompanying PowerPoint presentation

Student worksheets #1-9

Dichotomous key, *laminate to reuse between classes* (optional)

**Lesson Preparation**

Prepare copies ahead of time. If possible, laminate dichotomous keys (can be reused) and print out worksheets in advance (2 pages each, preferably front/back).

Each group should have a copy of one worksheet and one dichotomous key. There are nine different worksheets total, restart from number one if more than nine are needed to supply all student teams.
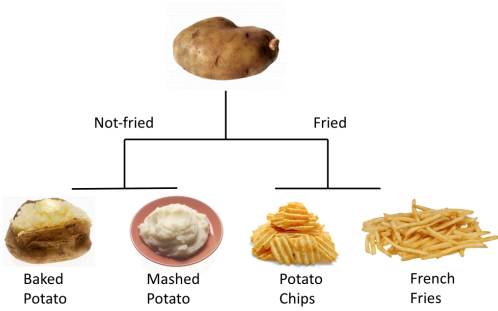
**Suggested Prior Instruction**

**Vertical Alignment:** Students learn how organisms respond to changes in temperature, light, and precipitation in first and second grade (1.7, 2.7). Students investigate the effect of large-scale changes on plants and animals in sixth grade and at a more complex level in Biology (6.9, BIO.8).

| **Engage:** The teacher will show a video on dichotomous keys in order to capture the students' attention and interest for the learning content. | |
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| **Teacher Directions** | **Additional Notes** |
| The teacher will show the "Dichotomous Key" video on YouTube by Mark Drollinger in order to facilitate a classroom discussion using the following guiding questions:<br><br>1. What is a **dichotomous key**?<br>2. How are dichotomous keys useful to scientists?<br><br>Time: 5 minutes | The student will be able to:<br>-**Analyze** and **describe** how physical characteristics and behaviors enable organisms to survive in an ecosystem (LS.7 a, b)<br><br>Students will use **critical thinking** and **communicate** their thoughts after watching the video.<br><br>Closed captions may be helpful for learners with accommodations and English language learners. |

| **Explore:** The teacher will provide students a blank piece of paper where students can create their own dichotomous key based on their prior knowledge. | |
| --- | --- |
| **Teacher Directions** | **Additional Notes** |
| The teacher will provide the appropriate background of how a dichotomous key works using a chart format. The teacher will then encourage students to categorize different types of food that can be made from a potato.<br><br>The students will compare their results with their peers. Students may have chosen to draw their flow charts differently but should show an understanding of how new categories are made based on similarities and differences.<br><br>Example:<br><br><br><br>Time: 10 minutes | The student will be able to:<br>-**Analyze** and **describe** how physical characteristics and behaviors enable organisms to survive in an ecosystem (LS.7 a, b)<br><br>Items can be classified based on their characteristics, such as these foods that can be made from the same potato. We can identify fishes in a similar way!<br><br>In this lesson, we will be using dichotomous keys to identify various fishes that are commonly found in the Chesapeake Bay. By using a diagram of a fish and its external anatomy, we will identify physical landmarks on the fish and positions of structures (fins) to aid in their identification. |

<table>
<tr><td colspan="2">**Explain:** The essential knowledge and practices with which students engaged and explored, are now made clear and comprehensible. This is also an opportunity for students to explain their understanding of the concept or practices.</td></tr>
<tr><td align="center">**Teacher Directions**</td><td align="center">**Additional Notes**</td></tr>
<tr><td>The teacher will introduce scientific concepts explicitly using the provided PowerPoint presentation.

- Ask students if there are fishes they like to see or eat, are there any that look similar?
- Do you know what any of these fishes are? Do you know what these fishes eat?
- Have you seen or caught a fish that you didn't know the name of?
- What about these fish that look similar? Different?

The students will engage in writing guided notes in their interactive notebook. Notes will include key vocabulary terms for students to define and interpret.

**Content Vocabulary:**
**-Classification** – the process of identifying shared characteristics or qualities to assign an object or organism to a group
**-Dichotomous key** – a classification tool used to identify an object or organism based on a series of contrasting physical characteristics that become more specific, leading to the point of identification
**Taxonomy** – the branch of science that deals with the classification of organisms
**Species** – a group of organisms that can interbreed and successfully create fertile offspring Binomial nomenclature – The system of naming organisms with two terms, one for its genus, and one for its species
**Fish** – refers to a single species or multiple individuals of a single species
**Fishes** − refers to more than one/multiple different species of fish
**Morphology** – the branch of biology that deals with the form and function of organisms

Time: 25 minutes</td><td>The student will be able to:
-**Formulate** inferences based on graphs and other data about predator-prey populations (LS.6 a)
-**Analyze** and **describe** how physical characteristics and behaviors enable organisms to survive in an ecosystem (LS.7 a, b)
-**Investigate** how structural adaptations among populations allow organisms to survive with ecosystems (LS.7 b).

**Background**:
The Chesapeake Bay is home to over 3,600 species of plants and animals. More than 350 species of fish can be found in the Bay, which is the largest estuary in the United States. Some of these fishes look very distinct, making their identification relatively straightforward. Other times, two species may look alike. One way to identify these similar-looking species is by looking closely at their morphology.</td></tr>
</table>

| Elaborate: The intention is to facilitate the transfer of concepts and abilities to related, but new situations. ||
|---|---|
| **Teacher Directions** | **Additional Notes** |
| Split class into teams of two and hand out one key and worksheet to each group. Explain that the identification step is to be completed before the trophic level step.<br><br>- Have each group check their identification with you before proceeding to the next step.<br><br>Additionally, after the trophic level step, have each group check their answer with you before moving on to the questions. | The student will be able to:<br>-**Formulate** inferences based on graphs and other data about predator-prey populations (LS.6 a)<br>-**Analyze** and **describe** how physical characteristics and behaviors enable organisms to survive in an ecosystem (LS.7 a, b)<br>-**Investigate** how structural adaptations among populations allow organisms to survive with ecosystems (LS.7 b).<br><br>**Background**: You and a friend have just caught a fish and you don't know what kind it is. As fish detectives, it's your job to figure out the identity of the unknown fish!<br><br>-Reading<br>-Writing<br>-Communicating<br>-Critical Thinking |

| Evaluate: The intention is for students to reflect on their new learning. ||
|---|---|
| **Teacher Directions** | **Additional Notes** |
| Once all groups have successfully identified their species, its trophic level, and have answered the questions, have everyone stand up and form groups in different parts of the classroom according to their trophic levels. Display images of each fish from the internet so that students can see their assigned fish in greater detail. Work through the Major Points slide in the PowerPoint and ask them the Take-Away Questions (below). | The student will be able to:<br>-**Formulate** inferences based on graphs and other data about predator-prey populations (LS.6 a)<br>-**Analyze** and **describe** how physical characteristics and behaviors enable organisms to survive in an ecosystem (LS.7 a, b)<br>-**Investigate** how structural adaptations among populations allow organisms to survive with ecosystems (LS.7 b).<br><br>**Major Points:** |

*Note*. Adapted from the "VDOE Science Instructional Plan Template," *VDOE*, 2020.
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| Within their respective trophic groups, students can discuss their fishes and how the trophic levels interact. | ● Both recreational fishers and scientists need to know how to identify fishes<br>● Fish identities can be found using dichotomous keys and morphology<br>● Fishes occupy many different trophic levels, which can be identified based on their feeding preferences<br>Fishes consume different prey types at different parts of their life stages (juvenile vs. adult) |
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**References**

Adapted from VA SEA Lesson Plan: Dichotomous Keys: An Essential Tool for Fish Detectives by Jackson Martinez (VIMS)

2018 Virginia Science Standards of Learning Curriculum Framework

Murdy, E. O., Musick, J. A., Kells, V. A. (2013). Field guide to fishes of the Chesapeake Bay. Baltimore, MD. JHU Press. Vocabulary definitions:

Definitions: https://biologydictionary.net/species/

**Suggested Post Instruction**

An exit ticket can be made from the worksheet questions and/or the Take-Away questions in order for students to reflect on their understanding of LS.6 and LS.7.

1. Do other fishes in your trophic level have the same mouth position?
2. What would happen if the fishes in the high trophic level disappeared?
3. Could fishes occupy different trophic levels during different stages of their life (juvenile vs. adult)?

**Student Page(s)**

VA SEA Dichotomous Key Lesson