THE UNIVERSITY OF MAINE Cooperative Extension

4-H STEM Toolkit

Activity 3: Finding Fish

Topic: Youth will be introduced to what a fishery is and will explore various fishing techniques.

Time: This lesson should take approximately 45-60 minutes to complete.

Learning Outcomes

At the end of this activity, youth should be able to…

1 Explain why it's hard to find fish.
2 Explain how sonar technology works to help find fish using observations from the demonstrations and models.
3 Carry out a scientific investigation.

Background Information for Facilitator

A fishery is an area where fish are caught for commercial purposes (i.e. catching, processing, and selling fish). Fisheries can be a defined area of the sea or it can be an area where a collection of fishing boats have agreed upon. Most of the time there are different fisheries for each kind of fish, so one fisherman's boat could be just for lobster and another one could be just for salmon. A big question: how do fishermen find fish in bodies of water that are so large? Fishermen use the knowledge that has been passed down from generations (and/or mentors) through story and song, they take from their experiences (ex. this is where the salmon have been at this time of the month in the past few years), and they utilize technology. One example of that technology is the sonar technology onboard boats that send sonar sound waves into the water. When the sound waves hit objects, such as fish, those waves are reflected back to the boat, allowing the fishermen to 'see' where fish are underwater. This is one way to get a sense of where fish populations are in bodies of water. Searching for fish and collecting them is only one step in the process of a fishery. Other steps include the process or mechanisms of the vessel, techniques to catching fish, sorting them, and selling them. However, those all depend on collecting enough fish to sustain the operation and the people involved financially.

Materials

- Aluminum pie plates
- Water
- Eyedroppers
- Rubber ball for demonstration
- Paper towels

Vocabulary

- **Fishery =** an area where fish are caught for commercial purposes, usually including the catching, processing, and selling of fish
- **Sonar technology =** fish-finding technology that sends and receives sound waves multiple times a second. When the waves hit something that is different than water, they are sent back to the boat, appearing as 'echos'
- **Echolocation =** the location of objects using sound wave reflection
- **Population =** a group of the same animal in a certain area

Methods

Engage

1 "During the last lesson, we learned that knowing an animal's species range helps us know where to find them, where they could be. How do we know they are actually there?"
   - Provide an example or give an analogy. For example, say you work as a fisherman for a place that sells fish. They tell you they have a demand (need) for landlocked salmon. You know their species range (based on what we learned last class we know they live in large, deep cold lakes and ponds with rocky bottoms, which tend to be the depth and temperature they like). This means you know where to look, where they likely could be. How do you know for sure that they're there? What evidence tells you they are present?"
      - Another example could be a school, students being the species. We know that classrooms are a part of a student's range, that students could be in the classroom. What evidence could you use to make the claim that students are present?"

2 Ask youth how they know when an animal is present. "What evidence tells us an animal is there?"
   - For example, a deer can leave behind fur, tracks, scat, and antlers.
   - We can hear squirrels 'chipping', they also leave behind tracks and acorn scraps.

3 Ask youth to consider what aquatic animals leave behind. "How do you know that a fish is present?" "What evidence do you think they leave behind?"
   - "What makes it hard to find fish?"
   - It's harder to tell when aquatic animals are present because we can't see underneath the water, the body of water can be really deep, they can swim away or could be hiding.

Explore

1 Let's take a moment to imagine what that is like.
   - Set the scene. You are going to be a fish under the surface of the water. The youth are going to be fishermen, trying to pinpoint exactly where to cast their nets to catch you.
   - Have all youth close their eyes. Ask one person (could be a youth or another facilitator) to count to 10. When the counting is happening, move to another location in the room as quietly as possible. Once the counting is finished, have youth, with their eyes still closed, point to where they think you are in the room.
   - Have the youth open their eyes. Were they correct?
   - You may have to try this a few times for (1) youth to understand when to open and close their eyes and (2) to drive home the concept that when you can't see where things (fish or people) are moving it's hard to know where they are! This is similar to fishermen trying to find fish underneath the water.

2 Try this activity again, but this time clap as you walk around and have the youth point to where they think you are, with their eyes closed.

- Discuss with youth how the first couple rounds (without sound) compared to the round(s) with sound.
- "Why was it easier to locate with sound?"

Explain

1 Some fishing boats have sonar technology on them that helps find fish. The technology sends sound waves to the water's floor and they bounce back to the boat. This happens multiple times a second. From the waves that are received or echoed back, a picture forms on a screen, showing some idea of what is underneath the water.
   - Ask youth if any of them have seen or used this before. It can also be called a 'Fish Finder'. If so, ask them to tell the group about their experience and what the picture looked like.

2 Below are two analogies to help drive home the concept of sonar technology. You can also share the video in the Additional Resources section if you have access to technology.
   - Analogy 1: Sonar technology is similar to how bats find their food using echolocation. Bats send out sound waves, which they receive back. These sound waves communicate to the bat the size and structure of objects around them. The sound waves bouncing off a tree are going to sound different than those bouncing off a moth.
     - Once again, if youth are familiar with echolocation, you can ask them to share what they know and make any clarifications.
   - Analogy 2: Bounce a rubber ball on the ground. Tell youth to imagine the ball as the sound waves. They are released from the boat's technology (your hand) and bounce back when they hit an object. Just like the ball, the sound waves communicate if an object (the floor) is closer or far away.
     - You can show this by bouncing the ball off the floor and then a table. If you bounced the ball off of every surface in the room you could map out the whole room!

Elaborate

1 Split youth up into small groups.

2 Hand out aluminum pie plates to each youth.

3 Fill each tray with some water (enough to cover the bottom, about halfway full).

4 Give every youth an eyedropper and allow them to use the water in their tray to fill the eyedropper.
   - Demonstrate how to use an eyedropper: place the opening of the dropper in the water so it is completely submerged. Then, squeeze the end of the dropper and take it out of the water.

5 Have the youth drop one drop of water into the tray. Ask them to make some observations and share them with their group.

6 Ask youth if they have any questions they are wondering about or "what-ifs" about this phenomenon they are observing.
   - If needed, share some of your own! Here are some examples: "What determines how the ripples move?" "Can you make the ripple effect different" "What happens if I change the height of the dropper?"

7 Explain to the youth that together you will be carrying out an investigation. Have them choose one question to investigate (either one of theirs or yours).
   - Share what you know so far. "What do we know from our initial observations?" (option to write these out on the whiteboard).
   - "How should we change what we are doing to answer the question?"
     - Make sure you're only changing one variable at a time (just the height of the dropper or the volume of water in the plate, putting an object in the water and leaving the other variables the same, etc.).

- Have youth make predictions of what they think is going to happen.
- Observe what happens when you change the variable.
- Have youth share observations.
  - "What happened?" "What was the effect?"
  - "What was the cause of that effect?" "What did you do?"
  - "Were your predictions correct?" "Did the effect surprise you?"

8 Allow youth to carry out an investigation of cause and effect in their groups, coming up with a question they can investigate collaboratively.
- Have them choose another variable to test. You may want to have them check with you before they get the go-ahead to investigate.
  - Have them make predictions of what they think will happen.

9 Allow groups to share what happened. Encourage youth to ask each other questions!
- "What happened?" "What was the effect?"
- "What was the cause of that effect?" "What did you do?"
- "Were your predictions correct?" "Did the effect surprise you?"

10 Clean up before coming back to discuss as a group.

Evaluate

Have youth turn to someone next to them to discuss the following questions.

1 "How would you explain to someone else how sonar technology works?"

2 "How could sonar technology help fishermen?"

Additional Resources

The Gulf of Maine Research Institute (GMRI) website hosts a video, Visit the **Gulf of Maine, Explained: Fisheries Acoustics** gmri.org/stories/gulf-maine-explained-fisheries-acoustics/?play=true (Gulf of Maine, Explained, May 30, 2018), which describes how sound can be used to tell us how deep fish are in the water, how many there are, and what they are.

Aluminum pie plate with eyedropper.

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