Herring Survival Tag

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Objectives:
How do alewife populations survive? As a result of this activity, students will understand alewife populations, how humans and dams impact alewife survival, and how this affects the Ipswich River watershed.

Time to complete activity: 90 minutes

Background/Setting the Stage: 10 minutes

Ask students to brainstorm a list at their table of what factors might impact the population levels of species in a river ecosystem. Make sure they keep in mind both natural factors and human impact. Have groups share and develop some common themes.

Materials:

- Remembering River Herring slideshow (available here)
- NEED cards (included in document)
- Cones for playing field boundaries
- Barriers (example materials: pool noodles, chairs, additional cones)
- Clipboard, and Herring Population Chart (included in document)
- Herring Population Graph (included in document)
- Pencils or pens
- Timer/stopwatch

Part 1: Human Impact Brainstorm (20 minutes):

Explain to students that they will be demonstrating how humans have impacted Herring populations in the Ipswich River. Before they play the game, please use Remembering River Herring slideshow to give students some background information and understanding about herring and how they are impacted by humans.

If time allows, you may consider having them do some additional research on herring and other migratory aquatic species using their laptops or other resources.

Reflection Questions (Journal or Discussion):

- How are Herring important to Massachusetts fishermen and the economy?
- How are Herring important to other fish in and around Massachusetts?
- In addition to barriers, what other factors may have negatively impacted Herring populations?

Part 2: Outdoor Activity, Alewife Population Demonstration (30 minutes):

Set-up: Create a rectangular playing field, using cones to mark the boundaries of the field. For a 'normal flow' situation, which is how the game will begin, every participant should be able to stand in the field, arms raised, without touching another participant.

Scatter the NEED cards throughout the playing field. The cards should be upside down, to add an element of search and find to the game.

NEED cards are labeled pictures of three requirements for Herring survival: habitat, oxygen, and food. There are other important pieces for long-term survival, but the purpose of this demonstration helps to keep it simple.

The size of the group determines how many cards to put out.

Game Directions, Introducing the Herring (1 round)

1. Mark the perimeter of your playing field with the cones. This will be the river. Have the students scatter themselves around the outside perimeter of the playing field.
2. Explain to students that they are going to be part of a population explosion. Everyone is looking for the same resources in order to be a survivor. Herring resources are habitat, food, and oxygen. There should be enough cards out at this point that everyone could potentially survive.
3. When the leader says, "go," the students have 30 seconds to gather 1 habitat card, 1 oxygen card, and 2 food cards. Hoarding is not allowed.
4. When they have gathered their required resources, participants should return to the sideline. At the end of 30 seconds, anyone left in the middle is "out."
5. NEED cards should be returned to the playing field, face down.

Tracking Herring Populations (2 rounds)

1. Choose two students who were "out" at the end of Round 1 to be the Time Keeper and the Fish Counter. The Fish Counter should keep track of the data for each year, with each round representing a year (see the Herring Population Chart for what data to include.)
2. As in Round 1, give the students playing as Herring 30 seconds to collect their NEED cards. THe FIsh Counter should record the number of Herring who survived at the end of the round. Each round represents a year. Once the students have completed 2 rounds, move on.

A Keystone Species (introducing new player roles, 2 rounds)

1. Herring are a keystone species because of the wide range of other life they help support. That life is hungry! Select some students to be predators of herring like otter, heron, cormorants and kingfishers.
2. When play resumes, the predators will try to catch the herring by tagging them. A tagged herring is out, and must leave any NEED cards they have collected on the field before stepping out. Repeat for 2 rounds.

Low Flows (introducing new player roles, 2 rounds)

1. Time to change the playing field! Some of the eliminated herring can now serve as Water Users. Representing low flows, Water Users can shrink the boundaries of the game by moving the cones in.
2. Have the Water Users vary the playing conditions between normal flows and low flows for four rounds. Herring still have 30 seconds to collect their resources. Rotate jobs for those who are not herring.

Barriers (introducing a new element, remaining rounds)

1. Before play resumes, have the water users add barriers to the river. Barriers can be anywhere on the playing field, in any position. Once the game starts, they cannot be moved. Touching a barrier doesn't hurt the herring, but they must go around them, not over.
2. Each round, add another barrier and see what it does to the herring population. Be sure to record all data on the population data sheet.

Independent Practice/Group Work (30 minutes):

Reconvene inside and provide each student with a copy of the Herring Population Chart. Have students complete the line graph (they will have a total of three lines on the graph) then answer the questions on the front.

Closure (10 minutes):

Have students share out the answers to the questions and their rationale. Express the importance of using their data as evidence.

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Find more activities and information on https://extension.umaine.edu/4h/stem-toolkits/

Reflection Questions (Journal or Discussion)

- What did the students notice in this game? What happened to the herring in response to the availability of resources, humans, and barriers?
- What other factors might impact alewives in their natural ecosystem?
- What causes the alewife population to increase? To decrease?
- How we might go about restoring the alewife populations in Maine rivers?
- What steps might be necessary to make that happen? Who needs to be involved?

Life Experience Connections:

Many of the youth living in Maine may be familiar with bodies of water near their homes. Familiarity with the ecosystems of those water bodies and what might be important to the survival of alewives, or another species living there. student living in Maine will be able to connect the value added to Maine's economy by the survival of alewives.

Assessment:

- Journaling/Group Discussion
- Herring Population Lab Sheet

Vocabulary:

Barriers (aka barriers to flow): man-made structures such as bridges, culverts and dams that impede the natural flow of a waterway either by blockage, restriction (creating a smaller area to pass through), or diversion (forcing the waterway to change course).

Species: Any group of individuals that can breed with themselves but not with any other group.

Population: A group of individuals of a single species that live in a particular area and interact with one another.

Economy: The management of the resources of a community.

Human impact: How humans have adapted to and changed their environment to survive and make life more comfortable and convenient. The effects of these changes and adaptations.

Oxygen: A colorless, odorless, gaseous element constituting about one-fifth of the volume of the atmosphere and present in a combined state in nature.

Resources: The elements of the natural world, as mountains, trees, animals, or rivers; a source of supply, support, or aid, especially one that can be readily drawn upon when needed; the collective wealth of a country or its means of producing wealth; usually money, or any property that can be converted into money; assets.

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Herring Population Chart

YEAR (round)	# Herring	# Predators	Water Levels	# Barriers
1		**----**	Normal flow	**----**
2		**----**	Normal flow	**----**
3		**----**	Normal flow	**----**
4			Normal flow	**----**
5			Normal flow	**----**
6			Low flow	**----**
7				**----**
8				
9				
10				
11				
12				

Have the students create a multi-line graph on the next page. Herring, predators, and barriers should each have a line. For clarity, students should pick a different color for each.
Circle the low flow years on the x-axis.

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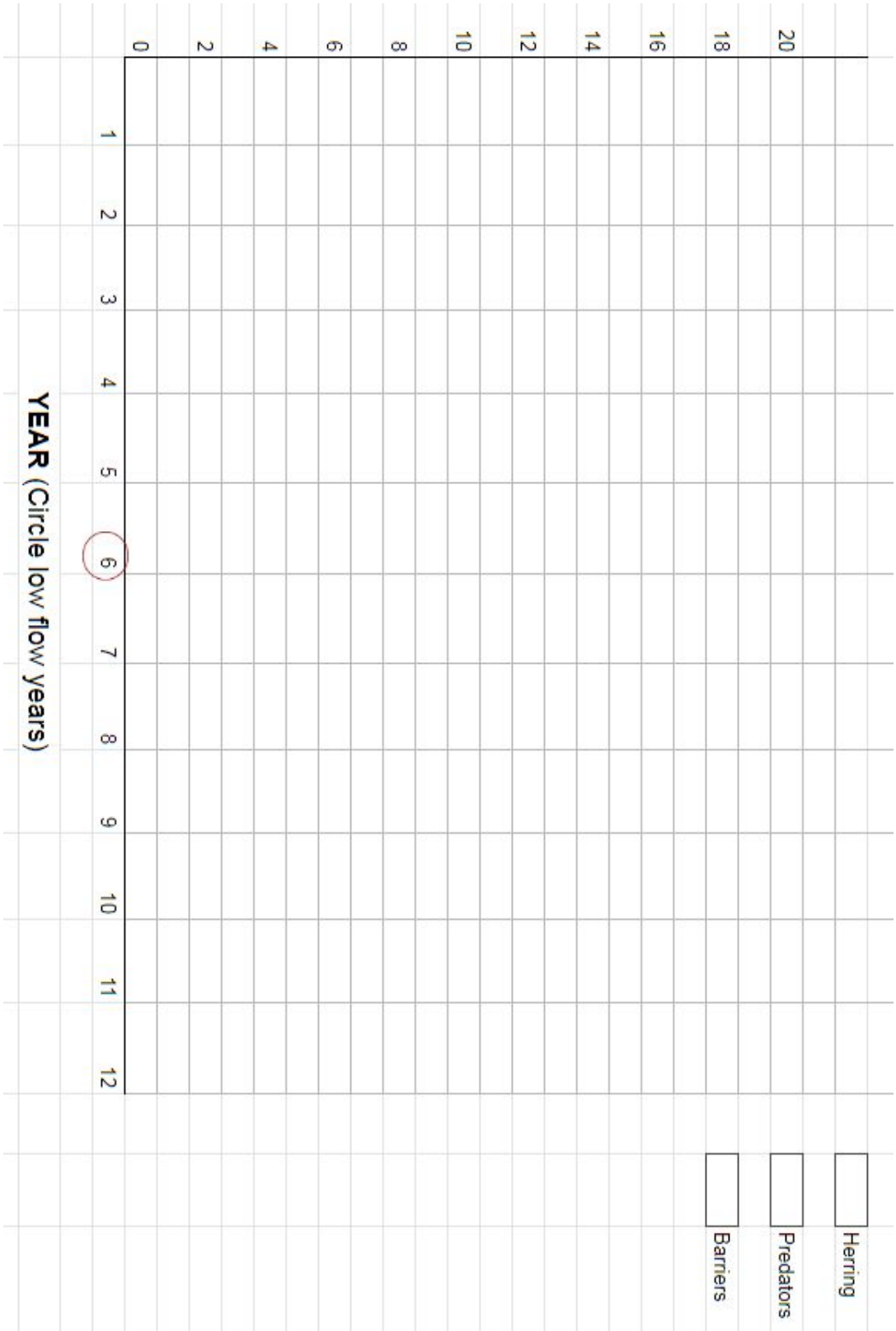

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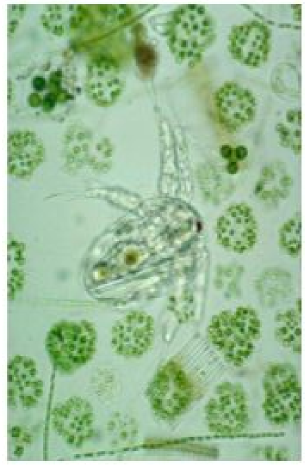
FOOD



plankton and zooplankton

OXYGEN

oxygen rich water

HABITAT

clean, healthy waterways

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HERRING
NEED
CARD

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