



Deep Crisis

Activity 1: Grades 5-8

Salmon Homing

Although the ability of salmon to return to a home stream may depend on a variety of cues, most researchers believe that scents within the water are the primary cues the fish rely on for homing to a specific stream. Scientists believe the specific odor cues of a stream might be embedded within the genetic makeup of each fish. Factoring in this possible genetic influence is critical when raising new stocks.



This activity page will offer:

- An opportunity to detect and differentiate odors
- An opportunity to apply odor discrimination to uncovering a trail
- A cooperative challenge in which students work together to uncover a series of trails

Finding Your Way

In this activity, students will be challenged to record a path based upon olfactory cues. Scents placed at critical junctures will set the fixed path that each team must follow.

Materials

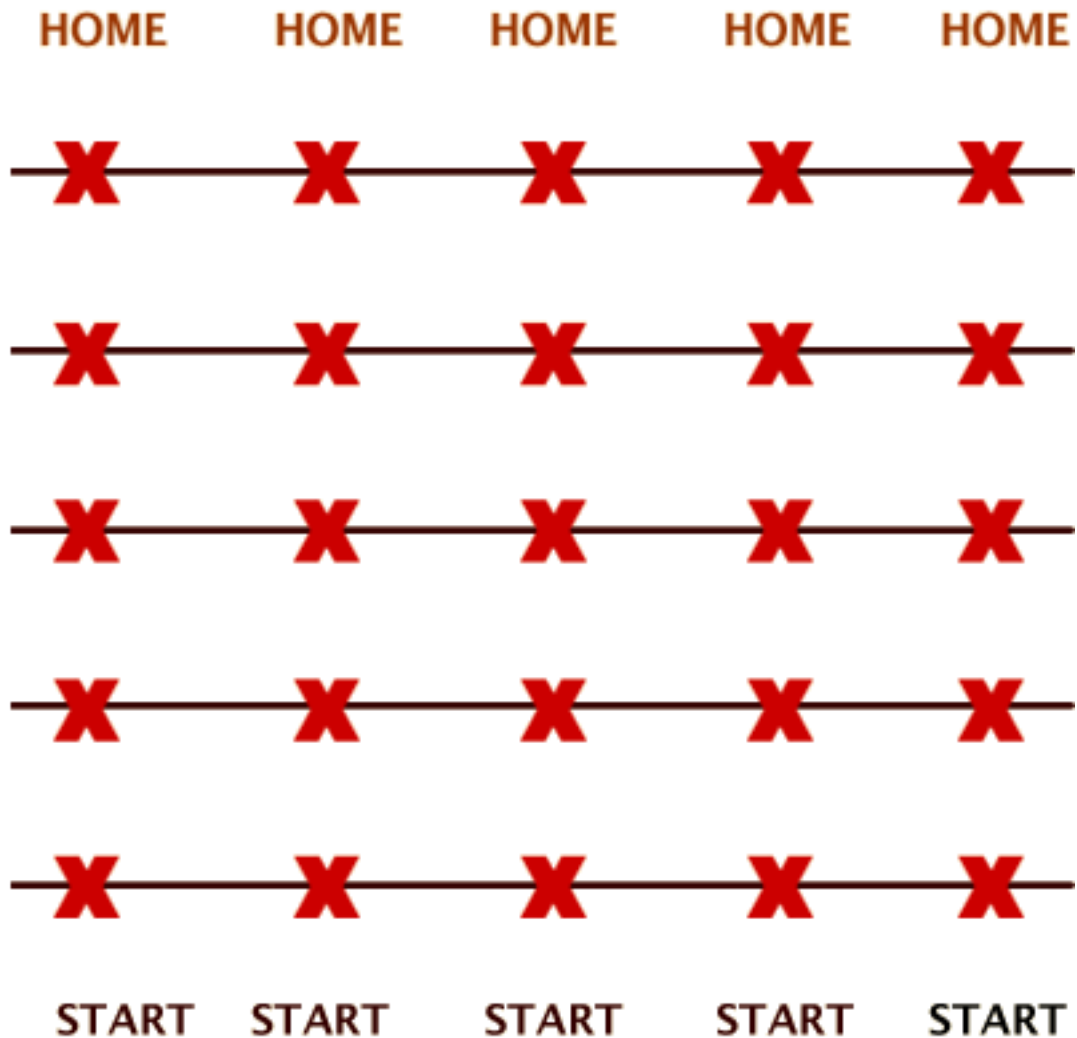
- Paper cups
- Paper towels
- Pencil
- Yard stick
- Five different and distinct scents
- Yarn
- Tape

NOTE: To best perform this activity, the class should be divided into two

groups. One group creates the scent trails. The other group uncovers them.

Before You Begin

The activity is performed on a grid that has been laid out on a large flat surface area (such as a gymnasium floor.) To build the grid, you'll need to use a yard stick and tape. Each line of the grid is separated by one yard. In addition, the distance between neighboring grid points (marked by a taped "X") is also one yard. Using the same distances, identify both the starting point and the home stream. Here's what the completed grid looks like:

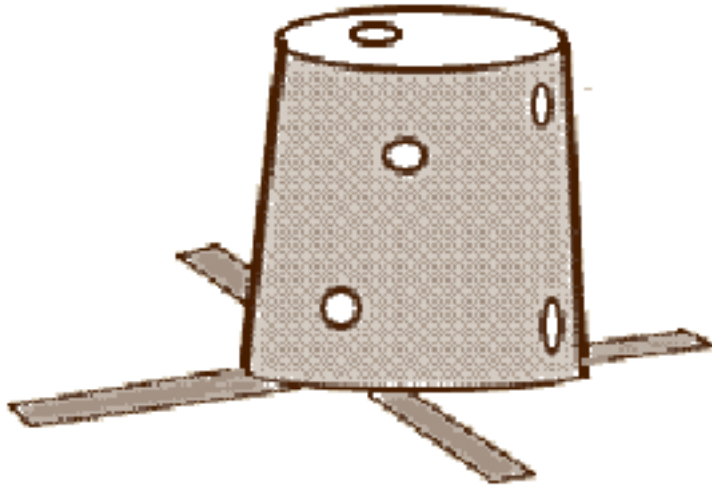


Steps (For the set-up)

1. Work in teams of two. Obtain a homing scent from your instructor.
2. Obtain seven paper cups. Use a pencil or other sharp object to carefully punch several holes into the cup.
3. Crumble a piece of paper toweling and stuff it into the cup.
4. Add several drops of your scent to the paper toweling.
5. Invert the cup and place one cup at any of the grid "X"s.

6. You'll need to agree with other teams on cup placement. Place a second cup on the next line. Try to mix up the positions so a zigzag pattern emerges.
7. Keep placing your scented cups until one has been positioned on each of the five lines.
8. Don't forget to place one cup at the starting line and another at the "home" target.
9. Make a record of this pattern.

Here's what the punched cup over the mark looks like:

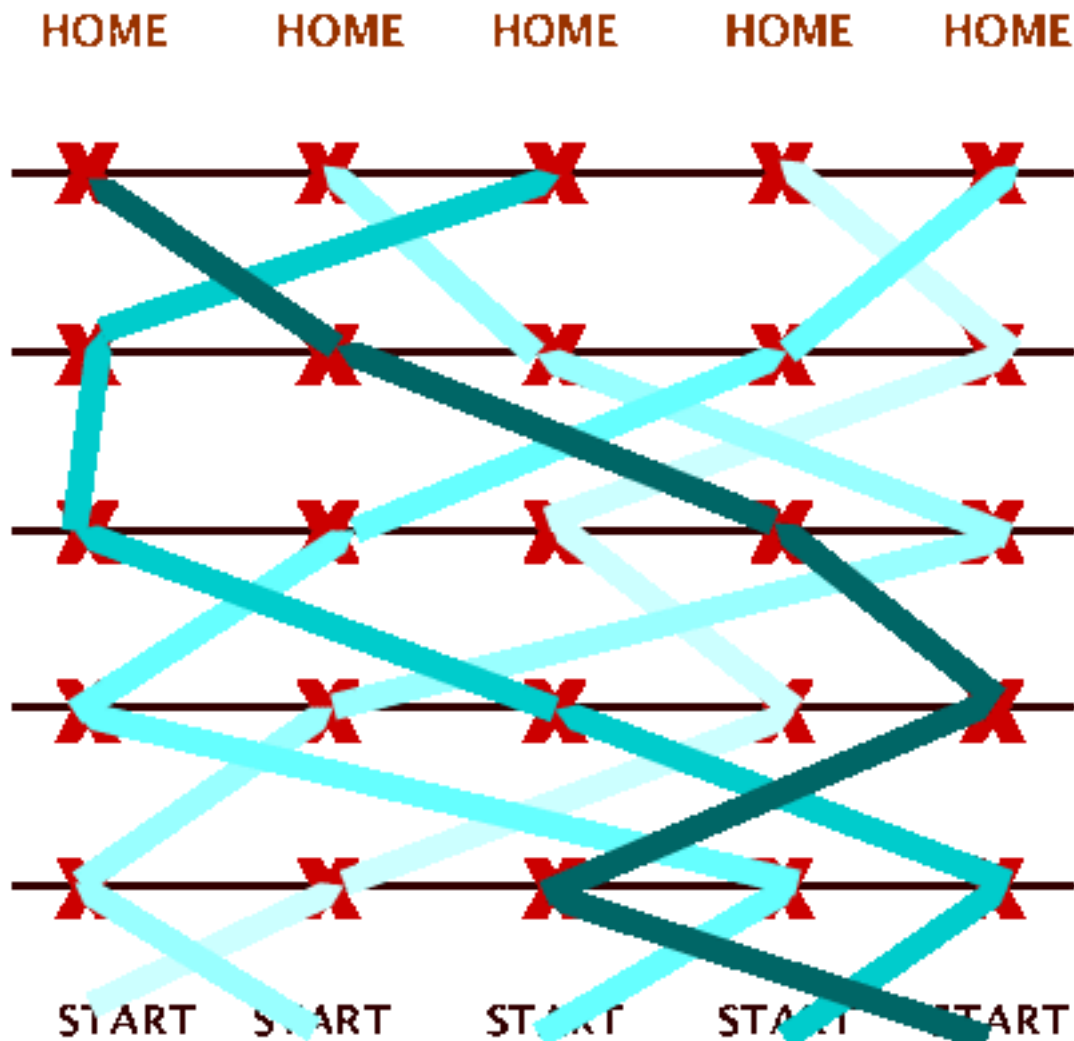


Steps (For uncovering trails)

1. Work in groups of two. Randomly select one of the five scents.
2. Begin at the starting point. You should have a long length of yarn and a roll of adhesive tape.
3. When the instructor gives the signal, find the cup in the first line that contains your assigned scent.

(NOTE: Your instructor will demonstrate the proper sniffing technique.)

4. Tape one end of the yarn to spot where your starting cup is positioned.
5. Move on to the next row. Locate your scent cup. Continue to lay down a yarn trail and tape it to the appropriate spot.
6. Continue uncovering and recording your scent trail until you reach the finish.
7. Make sure that all of the scent trails have been completed and all the cups used in determining the separate and distinct trails. Here's an example of what the finished the finished scent trails might look like.



Questions

1. Why was it necessary to punch holes in the scent cups?
(You needed holes through which the odor could escape.)
2. What was the purpose of the yarn?
(It was used to record the travel from the start to the finish.)
3. What was the purpose of the cups?
(They were odor landmarks on which the course was based.)

Communicating by Dance

Could you demonstrate the homing of salmon by choreographing and performing a dance? In addition to the fish, make sure to include scents and several branching streams that support different salmon populations.

Genetic Window?

Is the ability to detect certain odors in humans genetic? Is your immediate family more sensitive to certain odors than members of another family? With your instructor's approval, design a strategy for inquiry that would explore this relationship. Create a controlled experiment that might show if there is a genetic component to sensitivity to different odors.

Diluting Odors

How does diluting odors affect a person's ability to detect them? Think about it. Then, with your instructor's approval, design an experiment that would test how a dilution of different scents affects their ability to be detected. Use a variety of odors. Which ones can be diluted most and still be detected? Which odors become undetectable with even the slightest dilution?

Web Connection

[Investigations into how salmon find their home stream](http://zebra.sc.edu/smell/nitin/nitin.html)

<http://zebra.sc.edu/smell/nitin/nitin.html>

This site offers an overview of salmon homing and some of the classic behavior experiments.

[Salmon Genetics at Heart of Endangered Species Listing Debate](http://www.umaine.edu/mainesci/Archives/MarineSciences/Kornfield-salmon.htm)

<http://www.umaine.edu/mainesci/Archives/MarineSciences/Kornfield-salmon.htm>

This site presents a rich overview of salmon genetics studies.

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Steps

1. Examine the counting grid above. It represents an area that measures four meters by six meters. What is the total area of this full-size grid?
(24 square meters)
2. Make a guess before you do any counting. Estimate the number of fish found within these 24 square meters?
(Accept all reasonable answers)
3. Use a pencil and number the squares one through 24.
4. Devise a method for picking six random numbers from that same range of twenty-four numbers .
5. Examine the six squares identified by the selection of your six random numbers.
6. Tally the total number of fish found in these six squares. Remember, you'll need to devise a plan to deal with fish that lie on a dividing line.
7. Once you've tallied the number of your fish in your sample, multiply this number by four. The number you arrive at is the estimate for the number of fish in the 24 square meter grid. Record this as your first estimate.
8. Pick three random squares. Tally the total number of fish in these squares. Multiply your count by eight. Record this value as your second estimate.
9. Randomly select one number. Count the number of fish in that square. Multiple this number by 24 to arrive at an estimate of the number of fish in the entire area.
10. Repeat step 9 two more times.
11. Count the actual fish that are in the entire grid.
(81 fish)
Compare and contrast this number to the estimates made based upon 6

samples, 3 samples, and the 1 sample calculations.

Questions

1. Why was it important to devise a way of picking random numbers.
(You needed a random sample and not a sample influenced by selection bias.)
2. Why did you need to develop a method for counting fish that were positioned on a grid line?
(You needed to assign one fish to one grid block. You didn't want to count it twice.)
3. In step 7, why was the number of counted fish multiplied by four?
(Since one-fourth of the total area was tallied, you needed to multiply your data by four to represent the full area)
4. How did the number of samples on which the estimate was based affect the accuracy of the estimate?
(Accept all reasonable answers. Most likely, the greater number of samples produced the greatest accuracy. The fewer the sample blocks, the lower the accuracy and repeatability among the samples.)

More Math

Based upon your count and observed concentration, how many fish can be found in a square kilometer with the same population density?

(To uncover the population size, solve the equation $81/x = 24/1,000,000$; Answer: 3, 375,000 fish)