

2.3

Population Estimation

Purpose



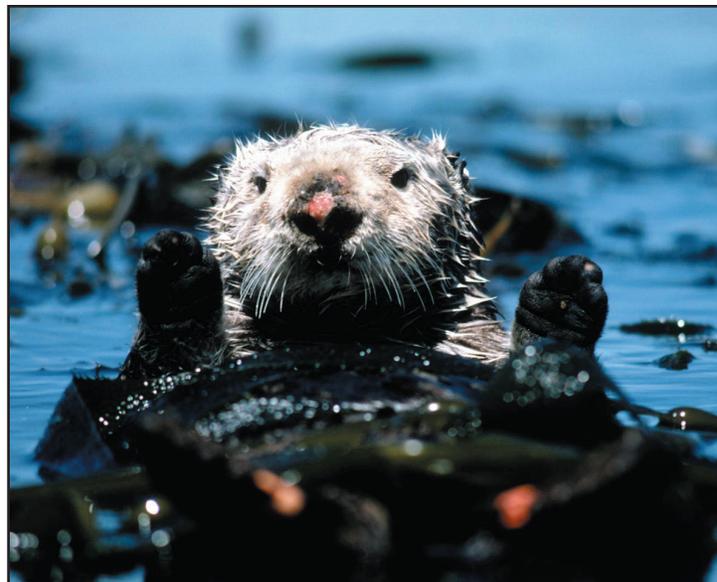
Evaluate a method used by wildlife biologists to estimate population size.

Introduction



Understanding the interactions among the various organisms of an ecosystem requires a reasonable estimate of the **population** size of each species. A population is a group of organisms of the same species living in the same area at the same time. How could you determine the size of the population of animals living in the wild?

Wildlife biologists use a variety of sampling and data analysis methods to estimate population size. In this activity you will model a sampling method called “capture-tag-recapture” to investigate a population of sea otters.



Otters often float on their backs while feeding, as is shown here. In this activity you will use plastic chips to represent a population of otters.

Materials



For each group of four students

- 1 bag containing plastic disks
- masking tape

Procedure



Part A Capturing the Otters

1. The bag represents a bay in Alaska. Each plastic disk in the bag represents one sea otter. Capture a random group of otters by closing your eyes and removing one handful of plastic disks (10–20) from the bag.
2. Count the number of disks you removed from the bag. These disks represent your captured otters.

Part B Tagging and Releasing the Otters

3. Tag each of your captured otters by placing a small piece of masking tape on each of the disks.
4. Release the tagged otters into the bay by placing them back into the bag.
5. Shake the bag for 30 seconds to simulate the passage of enough time to allow the tagged otters to mix back in with the rest of the otter population.

Part C Recapturing a Sample of Otters

6. Capture another random group of otters by removing a handful of disks (10–20) from the bag.
7. Count and record the total number of otters you captured.
8. Count and record the number of tagged otters you captured.
9. Release the captured otters into the bay by placing them back into the bag.

Part D Recapturing a Second Sample of Otters

10. Repeat Steps 6–9.
11. Remove the tape from all of the tagged otters.
12. Make a table that clearly displays the data you collected in this activity.

Analysis

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Group Analysis

1. Based on the number of otters you recaptured in Part C, calculate an estimate for the total population using the following proportion:

$$\frac{\text{total number of tagged otters}}{\text{estimated total population of otters}} = \frac{\text{number of tagged otters captured in Part C}}{\text{total number of otters captured in Part C}}$$

2. Based on the number of otters you recaptured in Part D, use the same proportion to calculate an estimate for the total population of otters.
3. Which captured sample do you think gives you the better estimate for the number of otters in the bay? Explain.
4. Based on all your experimental results, predict the actual otter population in the bay. Explain.
5. Count the total number of disks in your bag. How close is the prediction you made for Analysis Question 4 to the total number of disks?
6. Use the following equation to calculate the **experimental error** for each of your samples. Convert each error value to a percent.

$$\text{error} = \frac{\text{actual population} - \text{estimated population}}{\text{actual population}}$$

Individual Analysis

7. Why are biologists and ecologists interested in determining the sizes of populations of organisms other than humans?
8. Do you think the capture-tag-recapture method would be useful for estimating the population of every type of organism? Explain why or why not.
9. You did not investigate how well the capture-tag-recapture method of population estimation would work in more realistic settings, where organisms are born and die, or migrate into and out of the ecosystem. Form a hypothesis that states whether or not the capture-tag-recapture method would still provide a reasonable estimate under those conditions. Explain why or why not.
10. Design an experiment that would test your hypothesis from Analysis Question 9.

Extension

Carry out the experiment you designed for Analysis Question 10. Prepare any appropriate data tables and report your findings.