

Title: Marine Mammal Populations



Problem:

One of the goals of the Navy is to study the density and projected locations of marine mammals in order to better understand marine populations. Understanding marine populations will help guide decision making to minimize negative human impact on marine life. How can you determine how many animals are in a population without counting every organism? You are in charge of a Navy research team and your mission is to determine the number of dolphins in a region off the coast of the United States. Describe (in detail) below how you would accomplish this mission.

Materials:

- Lab sheet
- Bowl or other container
- Small paper cup
- Cheddar goldfish crackers
- Colored or pretzel goldfish crackers
- Calculators
- Computer with Internet



Background:

Students should have some prior knowledge of sampling techniques, the definition and characteristics of a population, and the reason for measuring population size. Students should also understand basic algebra and how to create a basic computer presentation.

Procedures:

This activity simulates a population census technique commonly used by wildlife biologists in the field called mark-recapture sampling (or tagging). Mark-recapture sampling is based on estimating a whole population by carefully counting and marking a small sample. First the biologists capture and tag/mark a small sample of the desired species. The animals are returned unharmed to their environment to redistribute themselves among the population. Over a long period of time, animals from the population are trapped and data is taken on how many on how many are captured with tags. Using a simple ratio, the biologist can estimate the population.

1. Collect your materials (bowl of goldfish, small cup, colored goldfish)

2. Make an estimate of how many goldfish are in the bowl/container
3. Use the small cup to collect a sample by scooping a cup of goldfish from the bowl and count them. This is your number of originally tagged fish.
4. To tag these goldfish, replace them with the same number of colored/pretzel goldfish.
5. Release the tagged goldfish back into the population (bowl) and mix thoroughly so they can be redistributed among the population.
6. Without looking, collect another sample by scooping another cup of goldfish. Count the total number of goldfish in your sample. Count the number of tagged goldfish in your sample (number of tagged fish in sample). Record these numbers in your table.
7. Mix the populations and continue taking sample until you have 10 samples (sample sizes do not have to be identical, but should be similar)

DATA

Trial Number	Number of tagged fish in sample	Total fish in sample
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
Mean:		

Predicting Population Size

How do we calculate the population estimate? If a specific number of individuals are captured, marked, and released into the wild population, it is possible to estimate the total population using the following ratio:

$$\frac{\text{POPULATION SIZE}}{\text{NUMBER ORIGINALLY TAGGED}} = \frac{\text{TOTAL SAMPLE SIZE TAKEN OUT}}{\text{NUMBER OF TAGGED FISH IN SAMPLE}}$$

$$\text{POPULATION SIZE} = \frac{\text{TOTAL SAMPLE SIZE TAKEN OUT}}{\text{\# OF TAGGED FISH IN SAMPLE}} \times \text{\# ORIGINALLY TAGGED}$$

Using your information, find the predicted population size: _____

Now, count your entire population and determine how close your estimate was.

Actual population: _____

$$\text{Percent Error} = \frac{\text{Estimated Population} - \text{Actual Population}}{\text{Actual Population}} \times 100 = \frac{\text{-----}}{\text{-----}} \times 100 = \text{-----}$$

Questions and Discussion

1. Compare the actual size to the estimated size. Did you overestimate or underestimate?
2. What could cause your results to be off from the actual population?
3. What do the goldfish represent in this activity? What do the colored/prezel goldfish represent?
4. How would the number of samples affect your results?
5. How will knowing the population size of dolphins in this area of the ocean affect the Navy's use of sonar?

Extension

1. Determine two species of animal this technique would work well for and explain why.
2. Determine at least one species of animal this technique would not work well for and explain why.
3. Use the internet and/or other resources to evaluate at least two other method of determining population size. Give examples of each, the best use of each method, and explain factors that affect data collection with each method.

4. Create a list of questions that you would ask a wildlife scientist regarding estimating populations. Contact and interview a wildlife scientist that uses the mark-recapture technique or a method you researched and ask about their experiences estimating populations.
5. Research some of the new methods being used (or developed) by the Navy to track marine mammals and/or other organisms. Compare the new method/s to the mark-recapture method.