Population estimation activity

This activity will teach you how researchers estimate the number of animals in a population using a method called mark-recapture. When researchers use this method, they capture animals and mark them somehow (ear tag, bird band, etc.) and then release them. Then they go back to the field and capture animals again, seeing which are marked and which are not marked. Using these data, researchers can apply the Peterson method to estimate the total number of animals in the population.

Materials needed:
Beans, beads, candy, etc. to represent individuals in each population
-   Need 800 per group
-   Need two colors (one for unmarked individuals, one for marked)
-   Example – white and red beans
Cups, Tupperware, Ziploc bags to represent populations
-   Need 4 per group

Note: You can either have the students set up four separate populations following the instructions below and sample each, or you can give each group of students just one cup and a set of 200 white beans and 100 red beans and have them set up one population scenario and run through it, and then restart with the next scenario. This is a good option if materials are limited, but may be confusing for students.

Part 1: Mark-recapture data collection
In place of real animals, we will use beans to represent individuals in a population. White beans represent unmarked individuals (never captured), and red beans represent marked individuals.

Directions:
1. Start by setting up four "populations" with the following combinations of beans: (the number of red beans in each population represents column C in your data table below)
    • Population 1 – 190 white beans, 10 red beans
    • Population 2 – 180 white beans, 20 red beans
    • Population 3 – 150 white beans, 50 red beans
    • Population 4 – 100 white beans, 100 red beans
2. For each population, stir or shake the beans well to mix, then reach in without looking to pull out the following number of beans: (this number represents column R in your data table below)
    • Population 1 – 10 beans
    • Population 2 – 20 beans
    • Population 3 – 50 beans
    • Population 4 – 100 beans

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3. Count the number of red beans you captured for each population, and record this number in column M in your data table below

Table 1. Data table for mark-recapture

Population	C	R	M
1	10	10	
2	20	20	
3	50	50	
4	100	100	

C = number of animals captured and marked on first trapping occasion
R = number of animals captured on second trapping occasion
M = number of marked animals captured on the second trapping occasion
N = estimated population size

Part 2: Data analysis

Peterson estimation method: N = (C * R) / M

Percent error: [(Actual – Observed) / Actual] * 100
        Hint: Your "actual" population size is 200

Directions:
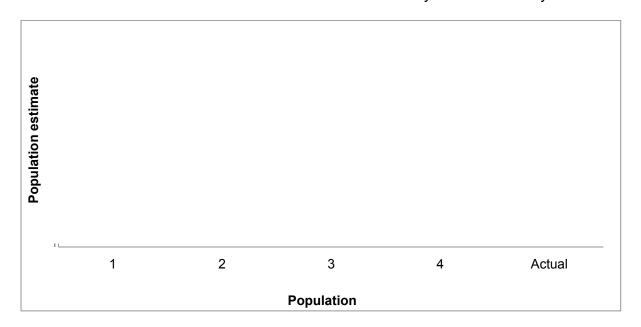Use the Peterson estimation method to estimate the population size for each of your populations.

1. Population 1

2. Population 2

3. Population 3

4. Population 4

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Calculate the percent error for each of your population estimates using the equation given above.

1. Population 1

2. Population 2

3. Population 3

4. Population 4

Analysis

1. Create a bar graph of your population estimates and the actual population size on the chart area below. Add axis tick mark labels to the y-axis based on your data.

Population estimate

| 1 | 2 | 3 | 4 | Actual |

Population

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2. How did your four sample populations compare to your true census of the population?

3. Which population resulted in the most accurate estimate? Which population resulted in the least accurate estimate? What were the sample sizes for those populations and how do you think this affected your results?

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