

Objective: You will be expected to estimate the size of a sample population using the mark-recapture technique. Be able to apply the technique to new population problems and compare the mark and recapture technique to other methods of population estimating.

Question: Pretend you are in charge of a team given the responsibility to determine the number of Rainbow Trout in Fish Lake. How will you accomplish this task? Discuss with your partner how you do this. Be prepared to share your answers with the class.

**Technique 1: Sampling**

A technique called sampling is sometimes used to estimate population size. In this procedure, the organisms in a few small areas are counted and projected to the entire area. For instance, if a biologist counts 10 squirrels living in a 200 square foot area, she could predict that there are 100 squirrels living in a 2000 square foot area.

- A biologist collected 1 gallon of pond water and counted 50 paramecia. Based on the sampling technique, how many paramecia could be found in the pond if the pond were 1,000 gallons?
- What are some problems with this technique? What could affect its accuracy?

**Technique 2 - Mark and Recapture**

In this procedure, biologists use traps to capture the animals alive and mark them in some way. The animals are returned unharmed to their environment. Over a long time period, the animals from the population continue to be trapped and data is taken on how many are captured with tags. A mathematical formula is then used to estimate population size.

**Procedure:**

- You will receive a bag containing an unknown number of white beans that represents a population of fish in a lake. Record your bag number below.
- Add 10 dark beans to the bag. These represent fish that were caught, tagged, and then released.
- Shake the bag well before each sampling.
- With your eyes closed, grab a handful of the population. This is the **recapture** step. Record the number of “animals” recaptured in total and the number that have “tags” on the data table.
- Return the “animals” to the bag and repeat. Do 20 recaptures.
- When the 20 recaptures are completed, enter the totals on the data table. When done, the teacher will tell you the actual size.

**Calculations - Find your Population Estimate**

Bag Number \_\_\_\_\_

$\text{Population Estimate} = \frac{(\text{Total number captured}) \times (\text{Number tagged})}{(\text{Total number recaptured with "tag"})}$
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Estimated Size \_\_\_\_\_

Actual Size \_\_\_\_\_

Trial Number	Number Captured	Number Recaptured with “tag”
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
<b>Total:</b>		

## Analysis

1. Compare the actual size to the estimated size. Did you overestimate or underestimate?
2. Calculate how far away you were from the original by calculating the percent error (**Show work**).

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

Percent Error \_\_\_\_\_%

3. What could you do to make your estimated size closer to the actual size?
4. Compare your percent error with others in your class. What is the average Percent Error for the entire class (the teacher will ask for your numbers, then someone in the class will average them)?
5. What are some methods that Biologists use to “tag” living creatures?
6. Name 5 environmental factors that could affect the population of real fish in a real lake?
  - 1.
  - 2.
  - 3.
  - 4.
  - 5.
7. Given the following information, what would be the estimated size of a butterfly population in Wilson Park?

A biologist originally marked 40 butterflies in Wilson Park. Over a month long period butterfly traps caught 200 butterflies. Of those 200, 80 were found to have tags. Based on this information, what is the estimated population size of the butterflies in Wilson Park? **SHOW WORK** to get credit.