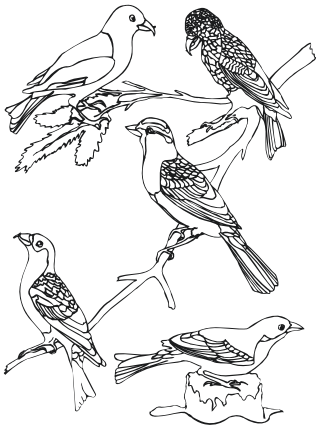
Population Estimation with Capture and Recapture

NAME _____

The idea behind capture and recapture is:

- Capture and tag some birds in a forest, allowing each of them to go free after being tagged.
- Recapture a set of birds from the forest, and count how many from that set are tagged.
- Use the ratio of tagged birds in your set to generate a proportion. Use the proportion to estimate the total population of birds in the forest.



1. From the cup, CAPTURE a handful of beans. Count the number of beans that you've captured. Mark each of them with a marker. How many beans did you mark? (This number will be important for Questions 8 and 9.)

2. Put the marked beans back in the cup and shake up the cup.

3. From the cup, RECAPTURE a new handful of beans.

How many total beans are in your new handful? _____

How many marked beans are in your new handful? _____

4. Write a ratio representing

$$\frac{\text{marked beans (in handful)}}{\text{total beans (in handful)}}:$$ _____

5. Fill in the three labeled columns in the first row (across) of the table, using your answers from Questions 3 and 4. (For now, leave the grey column blank; you will fill it in for Question 9.)

TRIAL NUMBER	NUMBER OF MARKED BEANS	TOTAL NUMBER OF BEANS	RATIO OF MARKED TO TOTAL	
1				
2				
3				
4				
5				
6				

Return the beans to the cup, and then take a new handful as another trial. Record your numbers in the table. Repeat for a total of six trials.

6. Remember, the goal of these trials is to determine _____ .

$$\frac{\text{marked beans (in handful)}}{\text{total beans (in handful)}} = \frac{\text{total marked beans (in cup)}}{\text{total number of beans (in cup)}}$$

7. **Using the data from the first trial** and the formula above, write and solve a proportion that can be used to calculate the total number of beans in the cup.

$$\frac{\qquad}{\qquad} = \frac{\qquad}{x}$$

Now, solve this proportion to determine the value of x.

8. Label the grey column in the table of Question 5 with the title **Estimated Total**. Using each of your other trials (handfuls), **write a proportion and solve it** to estimate the total number of beans in the cup. Each time you calculate a result, enter the value in the grey column of the table in Question 5.

9. Based on your trials, how many beans do you think are in the cup? Why?

10. How does this bean-counting exercise simulate the determination of a population of birds in a forest?

11. What relationship exists between the ratios that appear in the Estimated Total column in the data table of Question 5?

What is a *reasonable* estimate?

12. Based on your estimate (your answer to #9 on the last page), what do you think is a reasonable range for the trials? Explain why you chose your range.

13. In the space below, perform enough more experiments so that you have a total of 20 experiments, including the 6 from the first page.

TRIAL NUMBER	NUMBER OF MARKED BEANS	TOTAL NUMBER OF BEANS	RATIO OF MARKED TO TOTAL	

14. Based on what you decided was a reasonable range for the estimates in question #12, look at which of the 20 experiments you did would you consider 'good'? How many experiments are 'good'? What percent of your experiments are 'good'?

15. How many experiments would you think are necessary to assure an accurate overall estimate for the number of robins in the forest? Why?