Name _____ Class _____ Date _____

INVESTIGATION 13.4

PEBBLE MARK-RECAPTURE

One popular and simple technique for estimating a wild population of animals is called the *mark-recapture method.* It works like this: Suppose that you want to estimate the population of goldfish in a pond. You catch, tag, and release 40 fish. A few days later, you catch 40 fish and notice that 10 of the fish were tagged from the first catch—in other words, they were recaptured. To estimate the population of fish in the pond (N), multiply the number of fish in the first sample (M) by the number in the second sample (n), and divide the product by the number of "recaptures" (R).

$$N = \frac{Mn}{R} = \frac{\text{(first sample)} \times \text{(second sample)}}{\text{number recaptured}} = \text{estimated population}$$

To estimate the fish population,

$$\frac{40 \times 40}{10} = \frac{1600}{10} = 160$$

Therefore, the estimated number of goldfish in the pond is 160. For the estimate to be accurate, you need to sample a fairly large population, and at least one animal must be captured in each sample. In general, the bigger your samples, the more accurate your estimate.

MATERIALS

- 1 qt. jar
- pebbles
- 2 shades of colored nail polish

USE THE FORMULA

1. You are an entomologist (a scientist who studies insects) trying to determine the population of Japanese beetles in your backyard. Two weeks ago you captured, marked, and released 100 beetles. Yesterday, you caught 40 beetles; 20 were recaptured from the first sample. Estimate the Japanese beetle population in your backyard. Show your work.

_____

_____

STALK THE WILD PEBBLE

2. Fill the jar half-way with pebbles. These pebbles represent a population of wild animals. Do not count the pebbles.

3. Remove a handful of pebbles from the jar. The handful represents your first sample of animals. Count the pebbles, and write the total on the line below. Paint each pebble in your sample with a drop of nail polish. After the polish dries, return the pebbles to the jar and thoroughly mix them with the others.

_____

4. Remove another handful of pebbles from the jar, and record the total below.

_____

5. Count and record the number of pebbles that were "recaptured."

_____

6. Use the formula to estimate the number of pebbles in the jar. Write your estimation on the line below. The formula is as follows:

$$\boxed{N = \frac{Mn}{R}} = \frac{\text{(first sample)} \times \text{(second sample)}}{\text{number recaptured}} = \text{estimated population}$$

_____

7. Repeat steps 2–6 with the same jar of pebbles but use a different color of nail polish. Record your data below.

Number in first sample = _____

Number in second sample = _____

Number recaptured = _____

Estimated population = _____

8. Count the total number of pebbles in the jar. Record the number below.

_____

9. Compare the actual number of pebbles with the estimates in steps 6 and 7.

_____

_____

10. Based on what you observed in this exercise, do you think that the mark-recapture method is a good way to estimate population? Explain your answer.

_____

_____

EVALUATE THE METHOD

11. Imagine two ponds, one large and one small. You catch, tag, and release 20 goldfish from each pond. The next day, you catch 20 goldfish from each pond and count 8 recaptures from the small pond and 2 from the large pond.

a. Estimate the population of goldfish in the small pond.

_____

b. Estimate the population of goldfish in the large pond.

_____

c. Why would a large pond tend to have fewer recaptures than a small pond?

_____

_____

_____

12. Which of the following examples do you think reflects the largest population? Which reflects the smallest? Explain your answer.

a. large first sample, large second sample, large recapture
b. large first sample, large second sample, small recapture
c. small first sample, large second sample, large recapture
d. small first sample, small second sample, large recapture

_____

_____

_____

_____

_____

_____

13. **a.** If you captured, marked, and released 5 turtles from a pond, and caught 10 unmarked turtles the next day, would you have enough information to estimate the population using the mark-recapture method?

_____

_____

b. If you captured and marked one turtle from a pond and captured the same turtle the next day, can you conclude that only one turtle lives in the pond? Explain your answer.

_____

_____

_____

_____

14. Imagine that you are studying birds that are flying south for the winter. How might their migration affect the results of a mark-recapture study? Can you accurately estimate the migrating bird population using the mark-recapture method? Explain your answer?

_____

_____

_____

_____