IB Biology
Population Sampling by the Peterson Method

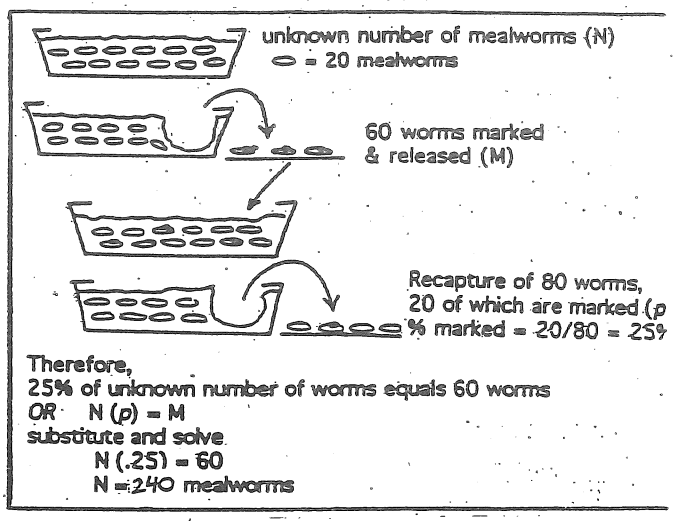
Name _____
Period _____ Date _____

Background: When we study a population in an ecosystem, it is useful to know how many individuals make up that population. In other words, how many salamanders are there in the Balch Creek Watershed? Or how many mealworms are there in a culture bowl? Marking and recapturing is a technique commonly used. This estimation of population size is reliable when the following assumptions are met:

1. The limits of the population are defined (e.g. fish in a lake)
2. There is no change in the ratio of marked to unmarked individuals between release and recapture. (No migration, death or birth)
3. Marked individuals and unmarked individuals are equally likely to be recaptured.
4. The area being studied must be uniform to the species or compensation for variations be made.

In this exercise you have an opportunity to use the Petersen method, a fundamental technique used in estimating the size of animal populations.

To understand the estimation formula read the procedure and consider the following diagram. The reasoning in the diagram was used to design the hypothesis & procedure.



M = Marked individuals in first sample
P = percent (decimal fraction) marked individuals bearing your group's mark in recapture sample.
e.g., $\frac{20 \text{ marked}}{80 \text{ total}} = 25\% = 0.25$
N = Number of individuals in the population; this is the *unknown* that you are trying to estimate; this is the answer to the question

$$N = \frac{M}{P}$$

Question: How many packing pieces are in the box?

Hypothesis: If individual packing pieces are captured and marked, then the percent of the recaptured population that are marked will equal the percent of the marked individuals in the whole population. In other words, N = M/p where N= estimated total population, M = marked individuals in first capture and p = percent of marked individuals in recapture.

Procedure:

1. Divide the packing pieces in approximately equal samples, one for each group.
2. Empty the contents of your container on the table. Count the number of individuals in your sample and record this number on the Data Table as the number of marked individuals (M). Mark each piece with a marker.

What problems occur in the counting? Record procedural decisions: .....
.....

3. Return the pieces to the population container.
4. After all groups have returned their samples to the population container, rotate the container to evenly mix and distribute packing pieces.
5. Reapportion the contents of the population container into new samples called recapture samples; provide each group with a recapture sample to count.
6. Count all of the packing pieces in the sample and count the number of pieces bearing you group's mark. Ignore pieces with marks other then yours. Record both these numbers on the Data Table.
7. Estimate the total number of packing pieces in the population using the formula.

8. Obtain the M values from each of the other teams to determine the number of packing pieces in the box. NOTE: In a true field situation this number would be unavailable.

Results:

Marked individuals in the first Sample	**M**	
Total number in Recapture Sample	**t**	
Number of individuals in Recapture Sample with you team mark		
Percent (decimal fraction) Marked Individuals in Recapture sample	**p**	
Population Size Estimate	**N**	
Percent Unmarked Individuals in Recapture Sample (1-p)	**q**	
Upper 95% Confidence Limit		
Lower 95 % Confidence Limit		
Actual Population size (sum of the M from each team)		

CONFIDENCE LIMITS: Because N is only an estimate of the population size, we need to know how accurate this estimate is. To do this we compute confidence limits (usually 95% degree of confidence). These calculations provide a confidence internal that indicates the upper and lower numbers between which the true population size lies with 95% reliability.

Limit calculations require a new p calculated with a statistical formula.

lower limit p value:

$$\text{new } p = \text{original } p + 1.96\sqrt{\frac{pq}{t}}$$

upper limit p value:

$$\text{new } p = \text{original } p - 1.96\sqrt{\frac{pq}{t}}$$

Use these new values of p in the formula N=M/p to find upper and lower limits.

Conclusion:

Write a paragraph in which you:

- answer the question in terms of your results
- describe how each of the **four** basic assumptions concerning this sampling method were fulfilled
- explain why different groups might have different results
- explain what problems you might face in nature with this method