Fish SD: Fish Population Estimation

Background information: Review Chapter 9: *Fisheries Management* in <u>Going Fishing</u>

Duration: 30 minutes

Materials:
Mixing bowl

Small paper cups or napkins

Large package of cheddar Goldfish crackers*30 oz.

Small package of pretzel Goldfish crackers*10 oz.

Fish Population Estimation Worksheet

Calculator

*Non-edible or perishable objects such as stones or dried beans may be substituted.

Objectives: Student will learn a common method used in making estimations of the number of animals in a wild animal population. This activity demonstrates how math is used in the field of biology.

Background: Mark and recapture is a method commonly used in ecology to estimate an animal population size. A portion of the population is captured, marked, and released. Later, another portion is captured and the number of marked individuals within the sample is counted. The Lincoln–Petersen method (also known as the Petersen–Lincoln index or Lincoln index) can be used to estimate population size if only two visits are made to the study area. This method assumes that the study population is "closed", as in a lake. In other words, the two visits to the study area are close enough in time so that no individuals die, are born, move into the study area (immigrate) or move out of the study area (emigrate) between visits. The model also assumes that no marks fall off animals between visits to the field site by the researcher, and that the researcher correctly records all marks.

Lincoln-Peterson Method: N = MC/R,
N = Estimated number of fish in population
M = Number of fish marked (also called K)
C = Sample size at recapture (also called n)
R = Number of marked-fish recaptured

Method Procedure:
Catch fish, mark them and return to them to the lake (M)
Catch some fish again (C)
Count the marked (recaptured) fish (R)
Estimate the population (N) = (M x C)/R

Example: In your first sample, you collect 243 fish (M). In your second sample, you collect 325 fish (C). Of those 325 fish, 27 were marked from the 1st sample. Your population estimate (N) is: N = (243 x 235)/ 27 = 2,115

Warm up: Ask the student how or if it is possible to determine the number of fish that live in a lake. Ask for suggestions on how they might accomplish this. Explain that complicating factors involved with counting the fish can include a very large lake and huge number of fish, fish are not visible under the water, capturing all of the fish to count them would be almost impossible and detrimental to the fish population, and it would take too much time and effort to capture and count all of the fish.

Activity: Students can work individually or in groups.
Place the cheddar Goldfish in a large mixing bowl. Decide on a name for this "lake".

Ask each student to make a guess at the number of fish in the Lake.

Have one student remove a few cups full of the cheddar Goldfish from the Lake.

Have one group of students count these removed cheddar Goldfish, while another group of students counts out an equal number of pretzel Goldfish. This emulates the act of marking the fish. Write this number on the worksheet in space M.

Place the marked pretzel fish into the Lake and mix well with the cheddar fish.

Have each student or student pair capture a cupful of fish from the Lake.

Instruct the students to count all of the fish in this capture. Write this number on the worksheet in space C.

Instruct the students to count the number of pretzel fish in this capture. Write this number on the worksheet in space R.

Compute the population estimate, and eat the Goldfish.

Wrap up: To further refine the accuracy of the sample method, have the students average their estimates and see which student population estimate came closest to the average population estimate. Discuss how well the different estimates agree and how close each student's estimate is to the average of the estimates.
Discuss with the students the possible methods of collecting fish and the purposes of determining a fish population estimate. Examples include; if there are too many fish for the habitat to support then biologists can allow for more to be caught and kept by anglers, if there are not enough fish then biologists can stock more fish or investigate if poor habitat is limiting the number of fish. Ask the students if they can think of other animal species populations that could be estimated by a mark and recapture survey.

Fish Population Estimation Worksheet

Lincoln-Peterson Index, N = **MC/R**

N = Estimated number of fish in population

M = Number of fish marked

C = Total number of fish captured during second sampling

R = Number of marked-fish recaptured during the second sampling

N ______________ =

M _________x **C _________ / R ___________**

Average of multiple **N** estimates = sum of **N** estimates / number of **N** estimates

$\mathbf{N}_{\text{average}}$ **______________ =**

$\mathbf{N}_1$ **_______ +** $\mathbf{N}_2$ **_______ +** $\mathbf{N}_3$ **_______ +** $\mathbf{N}_4$ **_______**

+ $\mathbf{N}_5$ **_______ +** $\mathbf{N}_6$ **_______ + N… / #N ___________**