Catch Me If You Can [MC]

Adapted from Earthwatch Institute

Grades: 9-12
Time: 45 minutes to 1 hour

Goal: To understand population dynamics using the capture/recapture method.

Objectives:
Students will be able to: understand population dynamics by using data collection; utilize the capture/recapture method in order to calculate how many individuals are in a given population; and understand how tagging and releasing assists scientific data collection.

Materials: (per group of 3-4 students)
    1 bowl
    1 cup of elbow macaroni
    1 colored marker
    1 small bathroom cup
    1 paper plate
    1 data sheet (provided)

Procedures:

1. Pre-Activity (introduction): Prior to the beginning of the lesson, make sure all your materials are divided up (do not hand out materials until you are ready for the activity). Discuss with the class as a whole the importance of population dynamics and estimating the total population size. Give examples of populations that were fished to commercial extinction, such as the Atlantic haddock off New England waters, populations that were hunted to near global extinction, such as the Right whale, and populations that make a tremendous comeback after they were tagged, evaluated, and recaptured, such as the Loggerhead sea turtle. Explain to the students that a local species along the coast, such as the bluefish or weakfish, has been noticeably declining (according to local fishermen). It is their job, as scientists, to go on an expedition to capture and recapture these fish to assess their population.

2. Activity: Divide the class into groups of 3-4 students and hand out the materials per group. Have each group decide on a recorder and a mathematician who will calculate the population in the experiment. The remaining students in the group will take turns capturing and recapturing the "fish species." Using the small plastic cup as a "trap," one expedition member will "capture" the fish from the "habitat" and place them on the plate. These will then be counted and "tagged" on **both sides** with the colored marker. Record the number of "tagged" fish under (C) on the data sheet; this will be used to calculate the population estimate later. Return this sample to the habitat and gently mix together.
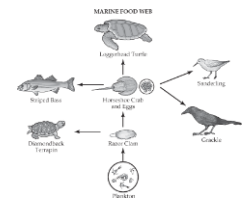
Continue capturing fish to fill in the data sheet with the number of "tagged" fish and the number of total fish collected in each sample. Expedition team members can double check each other's counts, each time returning the sample to the habitat and gently mixing it together.

3. Post-Activity (review): When all of the samples have been taken, the mathematician calculates the average number of "tagged" fish from the first column (A). Calculate the average total number of fish from the second column (B). The mathematician will then calculate the estimate of the total number of fish in the population by using the formula:

$$\frac{A}{B} = \frac{C}{X}$$

A = Average # Tagged Fish in Samples   C = # Tagged Fish Started With
B = Average # Total Fish in Samples   X = Estimated Total Population

Record the estimated total population (X) on the data sheet. Count out the entire bowl to get the Actual Total Population Number and record on the data sheet. Review the results of each group's collection as a class.

Key Words:
 Population dynamics   Habitat   Population decline
 Capture/Recapture   Allowable catch

Background Information:
Marine biologists often study the short-term and long-term changes to the size and age range of a population, especially if certain populations have shown a decline in numbers in recent years. This is known as population dynamics. To calculate how many individuals of a species are found in one specific habitat, the easiest and most accurate calculation is to count them. This would be a simple task if species tended to stay in one specific area all the time or did not migrate long distances seasonally. For these migratory species, such as fish to their spawning sites, or whales to their breeding grounds, getting a clear and precise number of individuals is a bit more difficult and requires estimation.

One method they will use to calculate this estimate is capture/recapture. This method will sample a smaller number of individuals in a given area and mark them or tag them as "captured." Then they will be released back into the population. They will continue to sample the population randomly, tallying how many marked and unmarked individuals they capture, continuously marking those previously unmarked. After several samples have been taken, they calculate the ratio of marked individuals to the total number of individuals in the study.

MARINE FOOD WEB
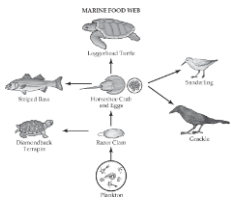
For conservation purposes, and especially in times of species decline, marine biologists will use these estimates to determine what changes have taken place over time to the population as a whole. They can then regulate the biological, environmental, and anthropogenic factors that are contributing to the decline. This method of sampling has been used for local fish species as well as larger, more migratory whale species along the Atlantic coast.
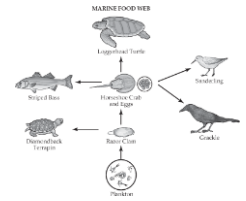
Capture/Recapture Student Data Sheet

Date: _____

Expedition Team Members: _____

_____

_____

_____

Total number of tagged fish from initial sampling: _____ (C)

Sample Number	Number of Tagged Fish	Total Number in Sample
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
Average		
	(A)	(B)

Calculate Estimated Population: _____ (X)

Actual Total Population: _____