**CRAB COUNT:**

**ESTIMATING POPULATIONS USING MARK AND RECAPTURE METHODS**

It is often extremely difficult and impractical to try and count all the individuals in a population, so scientists, and ecologists in particular, have developed many methods to estimate the total size of a population by taking limited samples and extrapolating the data collected. Each method has its strengths and is used under varying circumstances and conditions. The theory behind mark and recapture is that a portion of the population is captured, marked, and released. A short time later, another portion is captured and the number of marked individuals within the sample is counted. The number of marked individuals within the second sample should be proportional to the number of marked individuals in the whole population, so an estimate of the total population size can be obtained by dividing the number of marked individuals by the proportion of marked individuals in the second sample.

For example, if there is limited access to a site, **The Lincoln–Peterson method** can be used to estimate the size of an animal population when only two visits can be made to the study area. However, for the estimate to be valid, some assumptions are made about the population being investigated; mainly that many variables remain constant between the two visits. This method assumes that population is "closed"duringthe period of observations to outside factors like the death of individual animals or movement into (immigration) or out of (emigration) the study area. The model also assumes that the markings put on captured animals initially remain between the visits, and that the researcher correctly counts and records all marked animals.

Given those conditions, population size can be estimated using this equation:

N$=\frac{MC}{R}$ *N* = Estimate of total population size

*M* = Total number of animals captured and marked on the

first visit

*C* = Total number of animals captured on the second visit *R* = Number of animals captured on the first visit that

 were then recaptured on the second visit

**THE CRAB COUNT CHALLENGE**

The mission for your group is to estimate the number of blue crabs in a section of Potter Pond, a tidal salt water pond in South Kingstown.

**MATERIALS:**

* PASTA TUBES-ZITI, PENNE ETC.
* PAPER BAGS (ONE PER TEAM)
* 3 DIFFERENT COLORED MARKERS (RED,GREEN,BLUE FOR EXAMPLE)
* CALCULATORS (OPTIONAL)

**PROCEDURE:**

1. REMOVE 10 PIECES OF PASTA FROM THE PAPER BAG. THESE REPRESENT A SAMPLE OF THE CRAB POPULATION IN YOUR WETLAND SITE. **NOTE**: THERE IS AN UNKNOWN QUANTITY OF PASTA IN EACH BAG. DO NOT COUNT THEM!
2. MARK AT SMALL DOT ON EACH PASTA PIECE (CRAB) USING A RED MARKER. ENTER THIS NUMBER UNDER COLUMN ‘M’ IN THE DATA CHART.
3. RETURN THESE INDIVIDUALS TO THE BAG AND SHAKE THEM UP TO RANDOMLY DISTRIBUTE THE MARKED CRABS WITHIN THE TOTAL CRAB POPULATION. MAKE SURE THE BAG DOES NOT BREAK AND THAT NO CRABS ESCAPE (THIS WOULD REPRESENT DEATH OR EMMIGRATION WITHIN THE POPULATION, AND THIS METHOD OF ESTIMATION WOULD NOT BE VALID).
4. REMOVE 10 CRABS FROM THE BAG. ENTER THIS UNDER ‘C’ FOR TOTAL NUMBER OF ANIMALS CAPTURED ON SECOND VISIT. COUNT THE NUMBER OF MARKED CRABS, REPRESENTING THE NUMBER OF ANIMALS RECAPTURED. FILL IN UNDER ‘R’. RETURN CRABS TO THE BAG AND MIX THEM UP.
5. CALCULATE THE ESTIMATE OF TOTAL POPULATION USING THE FORMULA **N**$=\frac{MC}{R}$AND FILL IN DATA SHEET. WHAT IS THE LINCOLN-PETERSON ESTIMATE OF TOTAL POPULATION? **\_\_\_\_\_\_\_**

**WHAT HAPPENS IF YOU CHANGE THE SAMPLE SIZE?**

1. REMOVE 25 CRABS FROM THE BAG AND MARK WITH A GREEN DOT (OR ANY COLOR OTHER THAN RED-YOU MAY USE ALREADY MARKED CRABS, JUST PUT A GREEN DOT ON THEM). ENTER 25 ON DATA SHEET UNDER ‘M’. RETURN TO BAG AND SHAKE WELL.
2. REMOVE ANOTHER RANDOM SAMPLE OF 25 CRABS. COUNT ONLY THE CRABS WITH GREEN DOTS. RECORD DATA UNDER ‘C’ AND ‘R’ AND CALCULATE POPULATION. RETURN CRABS TO THE BAG. WHAT IS THE LINCOLN-PETERSON ESTIMATE OF THIS TOTAL POPULATION? **\_\_\_\_\_\_\_**
3. REMOVE 40 CRABS FROM THE BAG AND MARK WITH A BLUE DOT (OR ANY

COLOR OTHER THAN RED OR GREEN-YOU MAY USE ALREADY MARKED CRABS, JUST PUT A BLUE DOT ON THEM). ENTER 40 ON DATA SHEET UNDER ‘M’. RETURN TO BAG AND SHAKE WELL.

1. REMOVE ANOTHER RANDOM SAMPLE OF 40 CRABS. COUNT ONLY THE CRABS WITH BLUE DOTS. RECORD DATA UNDER ‘C’AND ‘R’ AND CALCULATE POPULATION. RETURN CRABS TO BAG. WHAT IS THE LINCOLN-PETERSON ESTIMATE OF THIS TOTAL POPULATION? **\_\_\_\_\_\_\_**
2. WHEN FINISHED WITH ALL THREE SAMPLES, EMPTY THE BAG AND COUNT THE NUMBER OF CRABS, HOW MANY CRABS WERE THERE IN THE YOUR SITE? \_\_\_\_\_\_\_\_
3. REVIEW YOUR DATA TO SEE WHICH SAMPLE SIZE WAS MOST ACCURATE. WHICH SAMPLE GAVE THE BEST ESTIMATE OF POPULATION? WHY? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| SAMPLE | MCRABS CAPTURED& MARKEDFIRST TIME | CTOTAL CRABSCAPTURED ON SECOND VISIT | RCRABS MARKED & RECAPTURED ON SECOND VISIT | NTOTAL POPULATIONOF CRABS |
| 1 |  |  |  |  |
| 2 |  |  |  |  |
| 3 |  |  |  |  |
| 4 |  |  |  |  |
| TOTAL: |  |  |  |  |

Adapted from activity from University of Wisconsin at Superior: <http://acad.uwsuper.edu/uwssied/Life/LABS/Recapture.htm>