Got Crabs!: Lesson Outline I

**Title:** Got Crabs! - Estimating Population

**Grade Level:** 7th grade Life Science

**Science Content:**

Students learn to compile their own data which will then be used to estimate population and create graphs.

**Standard Addressed:**

7. Scientific progress is made by asking meaningful questions and conducting careful

investigations. As a basis for understanding this concept and addressing the content

in the other three strands, students should develop their own questions and perform

investigations. Students will:

1. Select and use appropriate tools and technology (including calculators, computers,

balances, spring scales, microscopes, and binoculars) to perform tests, collect

data, and display data.

1. Use a variety of print and electronic resources (including the World Wide Web) to collect information and evidence as part of a research project.
2. Communicate the logical connection among hypotheses, science concepts, tests

conducted, data collected, and conclusions drawn from the scientific evidence.

1. Construct scale models, maps, and appropriately labeled diagrams to communicate

scientific knowledge (e.g., motion of Earth’s plates and cell structure).

1. Communicate the steps and results from an investigation in written reports and

oral presentations.

**Learning Objective:**

Learning objectives that drive this lesson will be:

1. Student collaboration in small groups and later as an entire class.
2. Students learn how to process empirical data - data that is collected, compiled, and processed by the students.
3. Students will be able to display the data in a cognitive and relevant manner.

**Assessment, Evaluation, and Grading:**

Students will be graded on how well they work as a group. How well they were able to follow directions and take criticism. Students will also be graded on the sensibility of their estimates.

**Materials:**

* 4-6 Crabs: *Carcinus maenas* – European green crab

*Hemigrapsus oregonensis* – Green shore crab

*Pachygrapsus crassipes –* Line shore crab

* Crab Housing – 10 gallon tank for each species, including but not limited to brackish

water, sand, shelter (coconut shells), filter, and food

* Markers - Clothes pins or paper wristbands
* Clips boards, pens, pencils
* Access to all for the day P.E. class

Alternative

* 10 small brown paper bags
* 10 pounds red kidney beans
* 2 pounds white navy beans
* Data sheet
* 10 laminated maps of Stinson Beach/Bolinas Lagoon
* Game pieces that represent *Carcinus, Hemigrapsus, Pachygrapsus, Cancer magister* (Dungeness)*, Cancer productus* (red)*,* and *Cancer antennarius (rock)*

**Accommodations for ELLs and students with special needs:**

ELL and students with special needs will be paired with “regular” students for this activity. It is important for all students to feel part of the activity. It is also important for those students who are not classified as ELL or having special needs learn how to interact with peers who are in a respectful yet engaging manner.

**Lesson Sequence:**

**Vocabulary:**

Open population Immigration marked cohort

Closed population Emigration natality

Mortality marking effort sampling effort

Sigma

**Opening/Anticipatory Set**

The issue of invasive species will be discussed as an opener as well as the impact that invasions can have upon a given environment. Students will be told about Seadrift Lagoon and the impact that the European green crabs have had on that area. There will be a short presentation to provide a quick over view of the area. Students will be asked; how do researchers know how many crabs were there? The procedure will be explained followed by students being allowed to try the Lincoln-Peterson Index on students in the P.E. class during that class period or an alternative assignment. The question posed to students will be; how many students are on the P.E. field during your class period.

**Body**

The class will be divided into two teams, Team A and Team B. Each team will be divided into three groups, Team A1, A2, and A3 for example. Once teams and groups are assigned the students will be taken to the PE field. Groups A1 & B1 will be posted at top of the field and will be given 20 marks. Groups A2 & B2 will be placed in the middle of the field and will be responsible for counting students as they come by. They will need to note the number of students with marks as well as the number of students without marks. Groups A3 & B3 will also have this responsibility at another part of the field along with the collection of the markers handed out by Group A1 & B1. After the data is collected student will go back to class to calculate the data and estimate the size of the PE class for their period.

Alternative:

In the event it is not possible to gain access to the PE class, students can simulate mark-recapture using beans. Student will be placed into groups of no more than three students. Each group of students will receive 1pound of red kidney beans and a quarter pound of white navy beans. Students will be asked to remove a hand full of beans from the brown bag and replace each red bean removed with a white bean. Once the white beans are placed in the bag, the bag is shaken to mix the beans. A second hand full of beans is removed, the white beans are placed back into the bag and the red beans are replaced with white beans. This is continued until there are no more white beans. Students will be assisted throughout the process in filling out the data sheet.

In addition each group will be given a laminated map of the Stinson Beach/Bolinas Lagoon area and games pieces that represent the crabs that might inhabit the area. As a group students will be ask to place the crabs on the map where they believe they should go and will be asked to support their decision. Students will then be given basic information about each of the crabs as well as the opportunity to move the crabs to other locations on the map. At the conclusion of the exercise will be told where the crabs were actually found.

**Closure**

Students will be given the Lincoln-Peterson Index equation:

C = total number of individuals captured

R = number of individuals already marked

*U = number of individuals newly marked and released*

M = total number of individuals marked in population

N = estimated population

Students in group A1 and B1 will be asked to join one of the other four remaining groups. Students will be asked to tally their data and determine where the data should go in the equation. Once calculations are complete each group will share their estimated PE population with the class. Results will be discussed and a graph created as time permits.

**References:**

Brown, C.. Fighting European Green Crabs in Seadrift Lagoon. Smithsonian

Environmental Research Center. Smithsonian, Dec 2011. Web. 26 June 2012

Rivera, C.. “RE: Mark-Recapture.” Message to Gregory Ruiz. 12 July 2012. E-mail.

Grosholz, E. D. and Ruiz, G. (1994). Spread and potential impact of the recently

Introduced European green crab, Carcinus maenas, in Central California.

Marine Biology, 122, 239-247.

NAVTEQ, “Satellite Image of Bolinas, California.” 2012. Digital Image. Mpquest, Inc.,

Colorado. Mapquest. Web. 3 August 2012.

**Data Sheet:**

**Lincoln Peterson Index**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Time | C | R | U | M | C × M |
| Example | 26 | 0 | 26 | 0 |  |
| Example | 24 | 14 | 10 | 26 |  |
| 1 |  |  |  |  |  |
| 2 |  |  |  |  |  |
| 3 |  |  |  |  |  |
| 4 |  |  |  |  |  |
| 5 |  |  |  |  |  |
| 6 |  |  |  |  |  |
| 7 |  |  |  |  |  |
| 8 |  |  |  |  |  |
| 9 |  |  |  |  |  |
| 10 |  |  |  |  |  |
|  |  |  |  |  |  |

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