DOLPHIN RESEARCH CENTER
Estimating Population Size

Grade Level: 6th-8th

Objectives: Students will be able to describe the reasons that cetacean populations are constantly fluctuating by participating in a class discussion. Students will also be able to explain how cetacean population estimates are calculated by completing a population sampling activity.

Florida Sunshine State Standards:
Science
SC.G.2.3.3**:** The student knows that a brief change in the limited resources of an ecosystem may alter the size of a population or the average size of individual organisms and that long-term change may result in the elimination of animal and plant populations inhabiting the Earth.

National Science Education Standards:
Content Standard A (5-8) - Abilities Necessary to do Scientific Inquiry: Use mathematics in all aspects of scientific inquiry.
Content Standard A (5-8) - Understandings about Scientific Inquiry: Different kinds of questions involve observing and describing objects, organisms, or events; some involve collecting specimens; some involve experiments; some involve seeking more information; some involve discovery of new objects and phenomena; and some involve making models.
Content Standard C (5-8) - Populations and Ecosystems: A population consists of all individuals of a species that occur together at a given place and time.

Background: Researchers are constantly gathering new information about marine mammals in the wild. However, there is still much to learn. Studies are currently being conducted in a wide variety of areas, ranging from social structure to physiology to impacts of human interactions in the wild. One important area of marine mammal research involves population studies. A population refers to all of the individuals of a species that occur together at a given place and time. Scientists may monitor populations to learn more about their structures, or to assess their size for conservation purposes. Populations will fluctuate naturally because of immigration, emigration, births and deaths. Changes in the environment—either natural or anthropogenic—can also impact population size. Temperature changes, alterations in prey distributions, pollution, fishing practices, and conservation efforts are just a few reasons why population size and range may change. It can be difficult to assess whale and dolphin populations because it is obviously impossible to gather all members of a population in one place and count them. As a result, scientists rely on a variety of methods to estimate and monitor population size.

Key Terms

Population: All of the individuals of a species that occur together at a given place and time.

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In this activity, students will have an opportunity to experience a simplified version of one of these methods, sometimes referred to as "sight, resight". This is a modified version of a population sampling technique known as "capture, mark, recapture" which can be used for both land and marine animals. The "sight, resight" method does not require animals to be captured and tagged. Instead, they are identified using photo identification techniques. In the most common version of this method, some of the individuals in a population are identified by their unique dorsal fins, and their identification photographs are cataloged. These animals mix with the unmarked animals in a population. Scientists will then survey a second sample group of animals. Scientists will count the number of previously identified individuals in this second group, as well as the total number of animals in the survey second group, and then solve a proportion in order to estimate the total size of the population. In true population studies, this process is followed by complex statistical analysis to allow for immigration, emigration, births, and mortality.

Materials:

For each pair:

- 1 paper bag
- 2 cups of uncooked macaroni
- 2 different colored markers

For each student:

- ***Estimating Population Size*** handout

Teacher Prep Notes: Students will need to be placed in pairs to complete this activity. Prior to the class period, macaroni needs to be placed in the paper bags for each group. Measure out approximately 2 cups of macaroni into each bag. It is recommended that students have some prior knowledge of photo identification techniques before completing this activity. (This information is covered in the **Photo Identification** lesson.)

Procedures:

1. Discuss the definition of the word "population" with the class. Have students brainstorm reasons (both natural and anthropogenic) why population sizes are always fluctuating.
2. Ask students to share ways they believe scientists may estimate population size, and why it might be important for scientists to assess and monitor population size.
3. Describe the "sight, resight" method of estimating population size, and tell students they will have an opportunity to see how this method works.
4. Pair off the students. Distribute the ***Estimating Population Size*** handout to each student, and provide each pair with the materials listed above.
5. Read through the handout with students, and model the methods for the class.
6. Allow students to complete the activity in pairs.
7. Have each pair record their results (estimated and actual population sizes) on the board.

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Wrap Up: Ask students to examine the class results. Have students share advantages and disadvantages of this method, as well as responses to the other conclusion questions.

Taking it Further:

- Ask students to calculate their percentage of error for their population surveys.
- Have students examine how sample size impacts the accuracy of their results.
- Allow students to research other methods of estimating marine mammal population sizes.
- Provide students with population data, and have students graph the population sizes of a marine mammal species over a period of time. Grey whales would be a good species to try, as their populations declined drastically and are now rebounding due to conservation efforts.