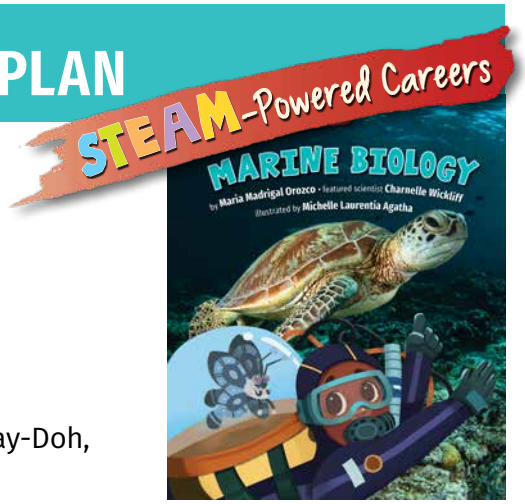
MARINE BIOLOGY LESSON PLAN



Author: **Maria Madrigal Orozco**
Scientist: **Charnelle Wickliff**

Subject / Grade Level: Marine Biology / Lower elementary

Materials:

- Craft supplies, such as pipe cleaners, to make quadrats (alternatives: wire hanger, shoelace, cardboard, etc.)
- Manipulatives (e.g., checkers pieces, confetti, LEGO bricks, jacks, Play-Doh, small plastic animals, etc.)
- Marking tools such as pencils/pens/crayons and drawing paper
- Bag or cup to hold the manipulatives
- Computer to watch videos

NGSS Essential Standards and Clarifying Objectives:

- **2-LS4-1**: Make observations of plants and animals to compare the diversity of life in different habitats.
- **K-2-ETS1-2:** Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

Disciplinary Core Idea:

- **LS4.D:** Biodiversity and humans

Science and Engineering Practice:

- Planning and carrying out investigations

Crosscutting Concepts:

- Structure and function: The shape and stability of structures of natural and designed objects are related to their functions.

Lesson Objective:

- Students will use a scientific tool (a quadrat) to estimate the number of organisms in a living area to understand the importance of population studies.

Differentiation Strategies to Meet Diverse Learner Needs:

- Students will use pictures and corresponding labels on a visual word wall to help them remember terms.
- Students will use manipulatives, for students who are tactile learners.

ENGAGEMENT

- Watch the following video with students: https://youtu.be/Y9_SkxEZyyc
- Ask students the following questions:
  - What did you see? What did you notice?
  - What animals did you see? Were the animals all the same?
  - How many did you see? Were there a few or many?

Room to Read

EXPLORATION

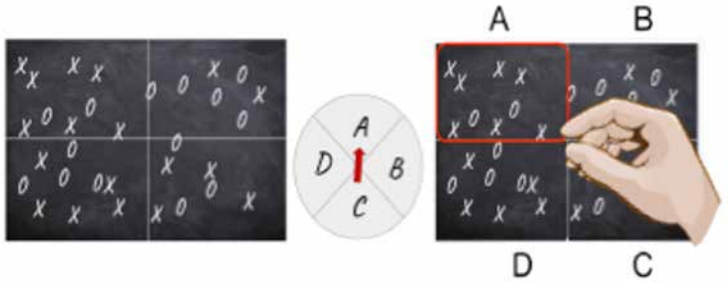
Learning to Categorize

- Distribute a prepared set of ten manipulatives/items to each student. Provide items that have at least one differentiation (e.g., color, shape, size, etc.).
- Have students sort their items into two or more categories, then ask:
  - How did you sort/categorize your items? What characteristics did you use (color, shape, size, etc.)?

Using the Quadrat

1. Remind students of the video they saw in which many animals were living in the rocky shore habitat (barnacles, sea stars, sea anemones, etc.).
2. Tell students to imagine they have to count all the barnacles on that rocky shore. How can they do that?

   - Ask: Do you remember what tool Cora and Bonnie used when they visited the rocky shore?
     - Answer: A quadrat: a rectangular sampling tool used to count organisms. Organisms are any living thing, like a plant or an animal.
   - Ask: Do you remember why they used the quadrat?
     - Answer: Counting every organism is often difficult to do, and that is why population studies are done using an estimation or a good guess based on information collected. The quadrat helps focus our attention so we can estimate how many organisms there are in a portion of the larger area. Habitats can be big, but we collect small samples to give us an idea of what might be there.
3. Draw a simple diagram on the board: a large square divided into four smaller squares, with X's and O's. The X's and O's represent organisms. Each of the squares is a quadrat.
4. Demonstrate how to use the quadrat. Label the quadrats A, B, C, and D in a clockwise pattern. Tell the students that you'll focus on one quadrat at a time. Inform the students that areas should be chosen at random. For this example, we'll use the top left quadrat, designated as A. Hold your physical quadrat over your drawing, highlighting the square inside which you'll be counting. As a class, count the number of X's and O's in one quadrat. Create a chart on the board to record your results.



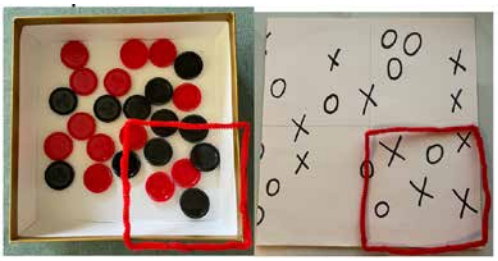
Organism	Xs	Os	Total
# in quadrat A			
# in quadrat B			
# in quadrat C			
# in quadrat D			

Organism	Xs	Os	Total
# in quadrat A	7	2	9
# in quadrat B			
# in quadrat C			
# in quadrat D			

5. As you count, help the students determine the rules they'll follow for counting organisms. Have students work in pairs or in groups to discuss their ideas.
   Ask the following:
   - Will you count any items/organisms that are partially in the quadrat? (For example, they should decide whether to count or not count the organism if it is partially inside the quadrat. They should follow that same rule for any other quadrats they count.)

- Are you allowed to move the items/organisms? (Scientists do not move organisms, as it would change what would normally occur in that habitat. Population studies help scientists count how many animals live in a particular area and also monitor their distribution and range over time, so moving animals would not be a good idea. Distribution means how the animals are spread out in their habitat; some animals prefer to be right next to each other, whereas others prefer to have more space for themselves. The range refers to where we can find these animals, and that can be influenced by many factors—for example, water temperatures.)

6. Once you have completed your first count, ask students the following reflection questions:
   - What can you say about the population of the organisms in that quadrat?
     - Responses may include: there are more X's than O's, there are nine organisms living in that sample.
   - Is collecting one sample enough to give us a good estimate?
     - No. Multiple samples of an area are needed to get an estimate.
     - At random, choose to count another quadrat with the group.
   - Repeat the procedure if you feel students need more guidance before they do the activity on their own.
7. Give each student a quadrat. Direct the students to use the manipulatives they sorted earlier. It can be helpful to put all the manipulatives in a bag or a cup, depending on their size. Have the students lift the bag/cup about six inches over their desk and pour the manipulatives onto their desk. Tell the students they can't move the manipulatives unless they fall to the floor or off their desk. If you use the student's desk area for the activity, limit the "study area" to 4 quadrats to keep the math simple. If you don't have manipulatives, you may also use a paper with X's and O's marked on it. Or you can use blank pieces of paper and have students mark the X's and O's on it. Students can then exchange their pieces of paper with a partner.



8. Provide students with a worksheet to write down their results. Go over the worksheet with them, explaining each column and row. For the younger grade levels, use a similar format to the one you used during your explanation. Have them complete all four samples and add their totals.

Organism	Draw your organism	Draw your organism
# in quadrat A		
# in quadrat B	+	+
# in quadrat C	+	+
# in quadrat D	+	+
TOTAL	=	=

Organism	Draw your organism	Draw your organism
# in quadrat A	X 7	O 2
# in quadrat B	+ 2	+ 5
# in quadrat C	+ 5	+ 4
# in quadrat D	+ 4	+ 3
TOTAL	= 18	= 16

9. Students can estimate using one random sample of the area. Have students drop their quadrat over the area. This is a random sampling. Have them multiply this random sampling by the number of quadrats that fit in their area. In this example, the number of quadrats that fit in the area is four. This number may differ.

Organism	Xs	Os
# in quadrat		
# of quadrats in area		
Calculations	×	×
Estimate	=	=

Organism	Xs	Os
# in quadrat	3	3
# of quadrats in area	4	4
Calculations	3 × 4	3 × 4
Estimate	= 12	= 12

10. Ask students the following reflection questions:
    - What can you say about the population of the organisms in this area?
        - Responses may include: There are probably the same amount of X's and O's in this area.
    - How did your multiplied calculations compare to the totals you got by adding all your sampled quadrats?

EXPLANATION

Have students work in a group and discuss one or two of these questions or assign a different question to each group.

- Why is it important to know the number of organisms in an area?
- What can cause a change in the population of a living organism/animal?
- Does it matter when a population study is done?
- How often should we count a living organism/animal?
- Are humans counted? Why do we need to know how many people there are in our communities?

Population Studies Summary:

- Scientists take multiple samples to make sure the data is accurate and representative of the study area.
- Scientists estimate once they have multiple samples.
- Population studies can inform us if a species is endangered, overpopulated, or sustainable by comparing current population counts to previous years.
- Studies are used to determine the effects of urban development, pollution, and fishing methods.
- Population studies can help protect species.
- The population, distribution, and range of species may be affected by tides, seasons, and other cycles.

ELABORATION

Vocabulary:

- **distribution:** how individual species are spread out within an area
- **estimate:** to calculate or count approximately, or to make a rough guess
- **population:** the number of a specific species
- **population studies:** scientific investigations of the number of a specific species in an area
- **quadrat:** a rectangular tool used for sampling or counting organisms
- **range:** the area where a species can be found

EVALUATION

Ask students to explain the population study process with a partner.

- Students refer to the tool as a quadrat.
- Students mention counting organisms inside the area where the quadrat is placed.
- Students understand that the quadrat represents a sample of a larger area.
- Students establish rules/guidelines/steps for how and what they count.
- Students understand that they need to count multiple samples to get a more accurate estimate, or rough count, of the population.
- Students understand the meaning of the word "population" by using it correctly in discussion.
- Students can begin to interpret their results (i.e., more than, less than, equal, etc.).
- Students can give at least one reason why it's important to do population studies/counts.