

Title of Lesson or Unit: Counting Coral Reef Organisms

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Subject Area(s): Marine Science **Grade level(s):** Informal Setting, All Ages

Duration: 5 minutes to 1 hour, based on visitor interest

In order to prepare our unique activity, we utilized the Backwards Design Model (Wiggins and McTighe 2006). This model allows the instructor to work backward from the desired learning outcomes using the three-stage approach (I-III below). Through this process we were able to focus on the information, materials, and exercises allowing us to achieve the desired learning outcomes in our “Counting Coral Reef Organisms” lesson.

I. Identified Desired Results/Learning Outcomes

Most Basic: Visitors will be able to quantify organisms on coral reefs

Most Complex: Visitors will be able to identify characteristics that make coral reefs an important ecosystem

II. Determined Acceptable Evidence

Evidence of Assessment:

- a. Verbal affirmation
- b. Photographic evidence
- c. Data recording
- d. Comparison of data with other visitors, repeated recordings made by an individual, or comparison with instructors counts

III. Planned Learning Experience

a. Lesson Goal and Setup (5-10 minutes Prior to instruction)

The goals of the lesson are primarily to demonstrate how we assess reef health (i.e. how we count reef inhabitants) and secondarily to explain the importance of coral reef ecosystems. Corals, algae, and animals (Figs. 1 and 2) are spread across the lawn and scientific tools such as transect tapes and quadrats used by visitors to conduct the study. You can also have a large database on a white board (Fig. 3b) with all the counts for the day to compare to another reef as a discussion aid.



Figure 1. Instructors with reef transect activity and marine biologist “costumes”.

b. Hook Visitors and Assess Prior Knowledge (1-2 minutes)

Primary Hooks:

Would you like to know more about how marine biologists study coral reefs? Can you help us count the animals on the reef? Can you help us compare our reef's health to another reef?

Further points of interest:

Have you been to the Coral Reef exhibit? Have you ever been snorkeling? Have you seen the rock-like structures in the ocean? These are actually living organisms called corals. What do you know about corals? Did you know corals provide houses for fish, crabs, sea stars, and other animals? Did you know they provide protection from big waves and storms? Did you know that coral reefs provide fisheries for human consumption, many millions of dollars per year in recreation like snorkeling and diving (have visitors guess how much \$), and potential medical compounds that can treat and cure disease?

c. Equip the Visitors (1-2 minutes of verbal information)

Give any background information they might ask about. Introduce in 1-2 sentences why it is important to count the critters on the reef.

Example for younger audience:

Coral reefs are the houses for lots of animals and to check if the reef is healthy we need to count the animals. Can you identify the different animals we have on our "reef" here today? Have you seen these animals before in the ocean? Did you see any of them at the Coral Reefs exhibit? Have them guess what the animals are. Show them pictures of the real organisms (corals, urchins, sponges, sea cucumbers, sea stars, and algae). Show them that the pictures on the datasheet match the animals on the transect.

Example for older audience:

Coral reefs are threatened by over-fishing, coral bleaching, run-off from coastal development, and other factors and are very sensitive to these stress events. But how do you know how sensitive corals are to these factors? How do we determine the health of different reefs and at the same reef over time? How can we measure the response of the coral? (Ask visitors for ideas and help them explore how their ideas may be used). Show them pictures of the real organisms represented in the transect and on the data sheet.

For a formal setting, the background information would retain the same questions, but become more detailed in the explanation of coral reef organisms, threats, and ecosystem health/function (e.g. some organisms have a high stress tolerance and their presence can indicate a degraded reef, while some animals can only live in pristine habitats and indicate the health of the reef).

d. Provide the Tools and Demonstrate Lesson (up to 5 minutes of instructions and materials)

Materials for 30 visitors over a 2 hour period:

- Data Sheets, ~30 each copied onto four different paper colors (Appendix I). Color-code data sheets to lead visitors to transect location on which to lay quadrat
- Clipboards with pen or pencil (Four, one for each color sheet)
- 10m Transect, or underwater measuring tape (Fig. 2)
- Quadrat, or PVC Square (Fig. 2b; four, one for each color)
- Reef animal replicas (~20 of each organism for one 10m transect, see Appendix I for pictures)

Materials (continued)

- Large white dry erase board (Fig. 3b; one for overall database/counts)
- “Marine Biologist in Training” Stickers (Appendix II)

Description of activity:

To count the animals, first decide what method to use. Described below are two different options.

Option 1: Pick a place on the transect to conduct count. To do this, match the color of the paper or datasheet to the color of the tape on the transect, set down the square quadrat over the tape, and count everything inside of the square. Record what was counted on the datasheet and dry-erase board and compare it to another reef.

Option 2: Count one type of organism along the entire transect or ruler. To do this, walk the length of the transect and count all of each type of ‘species’ selected to count (e.g. sea stars). Then record the counts on the datasheet and dry-erase board and compare it to another reef.

Adaptations for older audience:

These are several of the tools scientists use to measure or monitor coral reefs. A major tool scientists use is a transect line, or measuring tape (Fig. 2a). This measuring tape can be run across the reef to get an idea of distance between animals and/or the size of organisms, to identify locations to count organisms, or to place quadrats. A quadrat is a PVC square with a known interior area (Fig. 2b) and is used to delineate the distinct area to quantify or count the number of organisms. Because the quadrats standardize the area counted, these counts can be compared between reef locations, or over time, to understand differences in coral communities at different sites or the same site at different times. This type of quantification is often called coral reef monitoring.

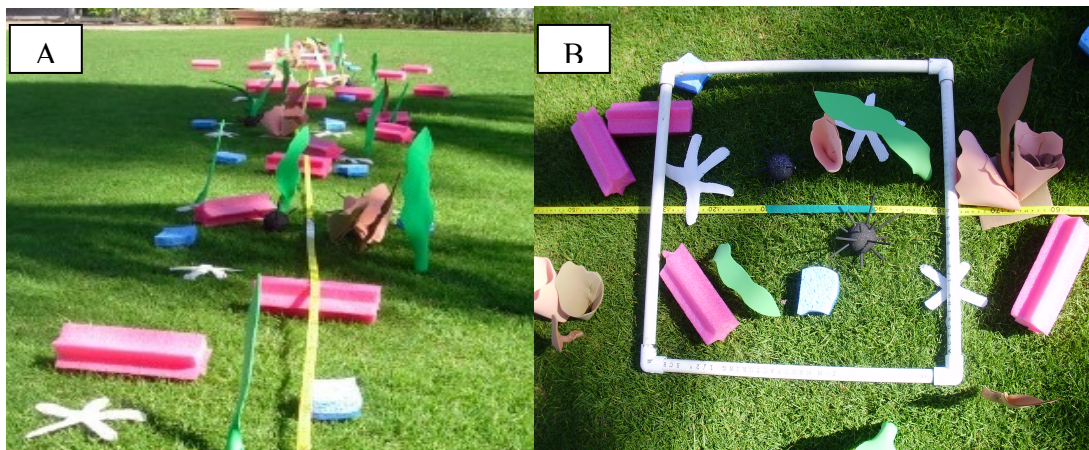


Figure 2. A) Transect running across the lawn with reef animals and algae placed around transect B) Quadrat laid over green tape location identifying the area in which all organisms are counted and recorded on the green datasheet

Instructor should demonstrate how to place a quadrat on a transect and help count animals as necessary. Instructor should ask again: “Can you help us count the animals or monitor our reef? Can you use these tools to tell us how many of each animal or algae are on the reef?” Let visitors try to count the organism they are most interested in (walk down transect) or a specific site (place quadrat on one of four colors of tape). If they are interested in further

learning, they could repeat the exercise for another animal or at another color (site) on the tape. Alternately, they can count and compare between people. Tailor this portion of the activity to the age group of the visitors and their interest level (as stated above). Ask them if they want to try different things and ask why they think it is important to count animals on the reef.



Figure 3. A) Instructors assisting visitors with counts within a quadrat B) Instructors reviewing main points of lesson following data recording on the white board, and assessing visitors learning.

IV. Assessment and Reinforcement of Learning Outcomes

Following counting, instructors should 1) review main points of importance of reef structure and animals listed above 2) explain why scientists count the animals on the reef, and 3) ask if there are any questions again at the end of the review. In order to encourage retention of the lesson, the instructors should let people take their datasheet with them and give out “Marine Biologist In Training” Stickers (Appendix II). Throughout activity and wrap-up the instructor should remember to look for evidence of assessment as mentioned above.

- a. Verbal affirmation (verbal indications of understanding, e.g. counting out loud, responding to instructor’s questions)
- b. Photographic evidence (documentation of visitor’s actual physical engagement with the activity, see Figures)
- c. Data recording (visitors use of data sheets [Appendix I] and incorporation of data into database on white board [Fig. 3b])
- d. Comparison of data (comparison with repeated recordings made by an individual, other visitors, or comparison with instructor’s counts)

Appendix I.

Critter Counts

		Number
	Coral	
	Sea Cucumber	
	Sea Star	
	Sponge	
	Urchin	
	Algae	

Appendix II.



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