Biodiversity: What is living in your lagoon mud?

Overview

Biodiversity is the impressive variety of life on Earth and essential interdependence among all living things. Students will measure animal diversity in an arctic marine lagoon. By the end of this lesson, students will have practiced collecting and identifying organisms and analyzing and organizing data. These experiences will help each student develop a better understanding of biodiversity, obtain important scientific skills and develop a sense of how organisms interact with their environment.

Objectives

At the conclusion of the lesson, students will be able to:

- Define biodiversity
- Discuss facts and issues related to biodiversity
- Recognize that diversity exists in the ocean
- List reasons why biodiversity is important
- Practice different ways that scientists collect data
- Name animal species and classify the common ones using pictures and guides
- Observe characteristics of different organisms
- Collect infauna abundance and biomass data
- Organize data in tables and graphs

Length of Lesson

Two to three 60-minute class periods.

Grade Level

Middle School

National Standards covered

6th Grade through 8th grade

INQUIRY

S.IP.M.1 Inquiry involves generating questions, conducting investigations, and developing solutions to problems through reasoning and observation.
S.IP.05.11 Generate scientific questions based on observations, investigations, and research.
S.IP.05.12 Design and conduct scientific investigations.
S.IP.05.13 Use tools and equipment (stereoscopes, sieves, forceps) appropriate to scientific investigations.
S.IP.05.14 Use metric measurement devices in an investigation.
S.IP.05.15 Construct charts and graphs from data and observations.
S.IP.05.16 Identify patterns in data.
S.IA.M.1 Inquiry includes an analysis and presentation of findings
S.IA.05.11 Analyze information from data tables and graphs to answer scientific questions.
S.IA.05.12 Evaluate data, claims, and personal knowledge through collaborative science discourse.
S.IA.05.13 Communicate and defend findings of observations and investigations using evidence.
S.IA.05.14 Draw conclusions from sets of data from multiple trials of a scientific investigation.

CONTENT

L.EV.05.11 Explain how behavioral characteristics (adaptation, instinct, learning, habit) of plants and

animals help them to survive in their environment.

L.EV.05.12 Describe the physical characteristics (traits) of organisms that help them survive in their environment.

L.EC.M.3 Biotic and Abiotic Factors- The number of organisms and populations an ecosystem can support depends on the biotic (living) resources available and abiotic (nonliving) factors, such as quality of light and water salinity, water temperature range and turbidity.

L.EC.06.31 Identify the living (biotic) and nonliving (abiotic) components of an ecosystem.

Before this lesson

Your students likely need practice identifying organisms they may find in the samples.

1) Practice identifying biota:

- Make copies of the common invertebrate pictures but cover up the name in the .picture.
- Give each student a picture and have them find other students with the same picture.
- Have students name 2-3 things about their organism that might make it easier to identify.
- Have groups that have similar plants (i.e., polychaetes, amphipods, bivalves) get together and decide what makes the organisms within their group distinguishable. Have small groups report what they have learned to the class.

Background

Researchers exploring biodiversity want to understand the variety of life. The first step in understanding biodiversity is to find out what organisms exist, where they live and how many and how big they are.

In this activity, students will have a chance to explore the diversity of life in their backyard lagoons. They'll also get an introduction to how scientists size up the biodiversity of an area.

Biodiversity can be affected by events created by people or by nature. For example, an ice dam on a nearby river can cause a large pool of freshwater to collect. When that dam breaks, a large flood of water pours into the estuary scouring off surface sediments and inhabitants. A second example is the effects of nutrient rich input of sewage into a lagoon that can cause certain species to thrive and eliminate others.

Activities of the session

1. I**ntroduction** (10-15 minutes)
    a. Give the class a set of questions to find out how much students know about biodiversity.
    b. Discuss the answers as a fun introduction to biodiversity. Were they surprised by any of the answers? Which ones?

2. **Develop a class definition of biodiversity and a list of reasons of why it's important** (5-10 minutes)
    a. Ask the students what they think biodiversity means, and have them write their ideas on the easel pad.
    b. Next, have the students use the information on the pad to list reasons biodiversity is important. Afterward, combine their group lists to form a single class list.

3. **Explain the task** (5-10 minutes)
    a. Explain to the students where their study sites are located and study a map of the locations.
    b. Talk with the students about how they will either collect grab samples on the boat (weather and time permitting) or explain the procedure and show pictures of how this is done.
    c. Divide the group into teams of 3-4 students and explain that the team members must work together to sieve their sediment core sample in the field and carry the remains back to the laboratory.

4. **Conduct the field task** (60 minutes)
    a. Take the students to the study area and either collect and sieve the grabs or sieve pre-collected grabs on the beach.
    b. Remind students to:
        - Be sure they have all the needed materials before heading to the study site.
        - Be a careful observer.
        - Handle samples with care.
        - Stay together and work with your team.

5. **Conduct the lab task** (60 minutes)
    a. Talk about how they will process the grab by carefully removing the organisms with forceps. Larger species will be removed and placed in small petri dishes by groups. After the visible individuals are removed, the remaining sediments will be searched for tiny invertebrates under a stereoscope.
    b. Data sheets with species identifications, abundance (counts) and biomass (weights) need to be filled out
        i. Teams should discuss: What are they going to look for? How will they record what they find? How are they going to divide up the work?
        ii. Remind the teams that they should work together to determine what larger taxonomic group and organism they have by using provided pictures (example: mollusk, polychaete, amphipod) and then try to determine the species name if possible.
        iii.
6. **Share results** (10-15 minutes)
    a. Have the groups report on their findings and discuss the processes they used. How many different living things did they find? Where did they find different things? Were species evenly distributed across the site or did the students find greater variety in particular areas? If there were distribution differences, where did they find the greatest diversity? Do they think that as a group they found everything out there?
    b. What factors might have affected the number of species they found? For example, would they have expected to find the same number and types of species if they'd done this at a different time of year? What was the hardest thing about conducting this task? Were they surprised by anything they found or didn't find?

7. **Finalize findings** (15-25 minutes, variable depending on scope of analysis)
    a. Have students discuss their findings. Which organisms were very common? Which seemed to be rare? Teams report out answers to these questions. As a class, create a chart to illustrate abundance of organism types. Practice reading the graph as a class. Ask students why some species/types might be more common than others. Connect to plants' and animals' needs in their environments.
        i. As a class, create a graph to illustrate your findings. Exs: pictograph using species pictures stacked up, pie chart, bar graph, line graph.

If there is time:

Write each letter of the alphabet on a separate slip of paper. Fold the slips, put them into a container and have each student pick one. Then have each student write a poem about an organism that has the letter in its name. Have pictures of Kaktovik lagoon species that they can cut out to go along with their writings and compile them into a book. The book title would be Poems to Kaktovik Lagoon. You could also have the students present their poems to younger students.

This lesson plan was developed with ideas and inspiration from the Michigan State University website http://datanuggets.org/.

Classroom materials:

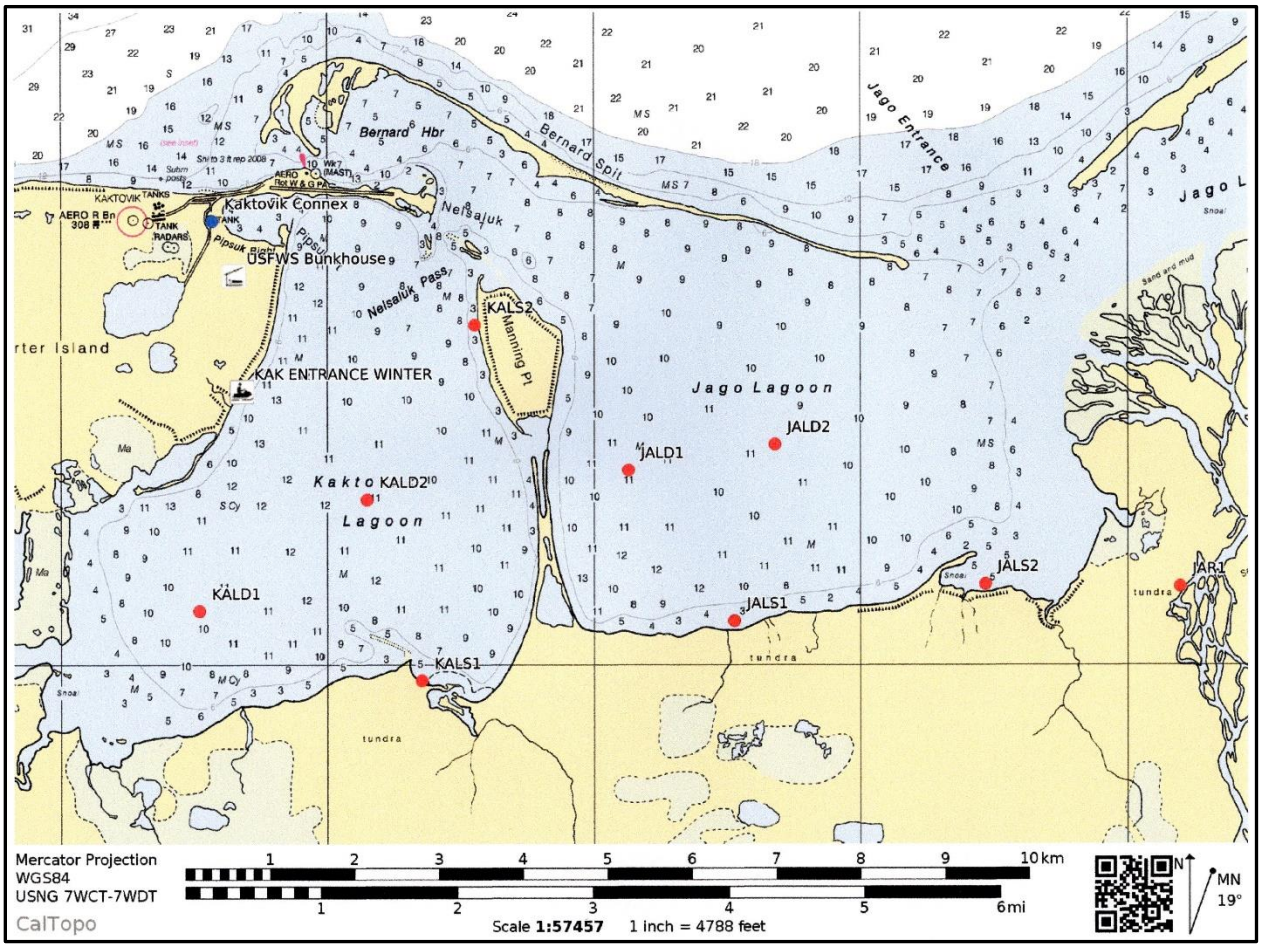


Figure 1. Map of benthic sampling station locations in Kaktovik Lagoon.

Table 1. Names and pictures of some invertebrates found in Kaktovik Lagoon.

COMMONLY FOUND SPECIES					FOUND IN CERTAIN AREAS/ NOT AS COMMON		
Gastropod							
	Cylichna alba		Rusty brown		Cingula castanea		Dark maroon
	Tachyrhyncus erosus		2 T. species				
Bivalve							
	Lyocyma fluctuosa		Shiny		Portlandia		Several species.
	Astarte borealis		Heavy shells. Lighter brown when young. Almost black when old. Several A. species.				
	Macoma moesta		Chalky. Common. Can have a little tan or brown on shell. Several M. species.				
Copepod							
	Calanus		Two C. species.				
Amphipod							
	Onisimus litoralis		A larger amphipod. Look for zig zag edges.				
	Ampelisca		Several A. species.				
	Pontoporeia femorata		Look for 2 spikes near telson.				
Mysid							
	Mysis		Two M. species.				
Cumacean							
	Diastylis		Multiple D. species.				
Isopod							
	Saduria entomon		S. sabini has no eyes.				

Table 1. Names and pictures of some invertebrates found in Kaktovik Lagoon (continued)

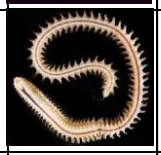
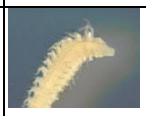
Bryozoan							
	Eucratea loricata		Golden brown.		Alcyonidium disciforme		
Hydozoan							
	Sertularia		Several S. species.		Tubularia indivisa		
Priapulid							
	Priapulus caudatus						
Oligochaete							
					Oligochaete		
Polychaetes							
	Chaetozone		Several C. species.				
	Mediomastus		Four anterior segments with filiform setae.				
	Pholoe minuta		Small, with scales. Usually in pieces. Numerous.		Aricidea		Head of worm. Several A. species.
	Nephtys		Bottom side of worm with dark stripe. Several N. species		Potamilla neglecta		Large. Often still in tube. Crown has brown bands.
	Cistenides		Cone shaped tube. Two C. species		Nereimyra aphroditoides		Usually beat up. Has greenish color on head.
	Spio filicornis		Often has a bit of black on prostomium (face).				
	Prionospio		Shovel shaped prostomium. Several P. species.				
	Terebellides sp.		Species undetermined				
Ascidian							
	Molgula griffithsii		Clear, see-through				

Table 1. Names and pictures of some invertebrates found in Kaktovik Lagoon (continued)

Fish							
	Boreogadus saida		Cod with 3 dorsal fins and a barbel on chin.				
	Myoxocephalus quadricornis		Sculpin with four horns.				

KAKTOVIK LAGOON BENTHIC GRAB DATA							
STA	**REP**	**DATE**	**GROUP**	**SPECIES NAME**	**CNT**	**WT**	**COMMENTS**

Table 2. Datasheet for recording information on grab organisms.