OCEAN MONITORING: INTRODUCTION

This water quality and weather monitoring unit takes place over a nine month school year, with a two and a half hour session each month at a local monitoring site. The initial session trains the students the proper use of the tools used to conduct water quality and weather monitoring. All subsequent sessions are conducted in the field with students collecting their monitoring data. Each month data is recorded and can be shared with other classrooms. At the end of the year, students gather their nine month data and make interpretations. Collecting data over a nine month period of time will help students begin to understand the importance of long term monitoring, seasonal variability (difference between seasons/years), and compare inter-annual differences (daily, seasonal, decadal).

KEY WORDS

data
trends
Hydrolab
niskin sampler
phosphates
nitrates
iron
ammonia
weather monitoring

FOCUS QUESTIONS

1. Why do scientists collect ocean data?
2. What do scientists monitor to observe changes in the ocean?
3. How do scientists monitor the ocean for signs of change?

LEARNING OBJECTIVES

The students will:

observe how a hyroLab collects water termperature, salinity, pH, and dissolved oxygen data.
observe how a niskin bottle is used to collect water samples.
observe colormetric tests to determine the concentration of nutrients in water samples.
record their data on a master data sheet. *(Create BIG Chart/computer)*
explain why the collection of data through monitoring helps us understand environmental change.

MATERIALS

HydroLab with **meters marked on cable** or alternate instrument to measure
niskin sampler with **meters marked on cable**
sample bottle (1quart) for nutrient tests
nutrient test kits for: phosphates, nitrates, iron, ammonia
nutrient fact sheets
waste water/sharps containers
stop watches (4-5 one per nutrient test), paper towels, time keeping device

AUDIO-VISUAL MATERIALS

camera
computer with projector and screen
digital master data sheet

LEARNING PROCEDURE

Pre-Session

1. Prepare classroom:
    a. HydroLab with meters marked on cable or alternate instrument to measure, niskin sampler with meters marked on cable, sample bottle (1quart) for nutrient tests.
    b. Nutrient tests, clip boards, stopwatches, waste water and sharp containers, paper towels.

In-class Session

2. Teach Ocean Monitoring Jobs ***(2 .50 hours)***
   Divide into groups:
    - Photographer (1 student)
    - Nutrient Group (8 students)
    - Niskin Group (2-3 students)→ subgroup of Nutrient Group
    - HydroLab Group (2-3 students)
    - Weather Group (2-3 students)

3. Hand out clipboards to all students, data sheets and pencils: 1 "Photographer Checklist," 1 "Weather Monitoring" and 2 "HydroLab" (Water & Nutrients). Each group will have to designate a scribe to record results on the data sheet.

4. One adult starts with all students except Niskin Group to record weather while the water sample is retrieved. Then, 8 Nutrient testers perform tests inside while 1adult codnucts hydrolab.

5. Photographer designated first and "floats" and takes pictures/video using Checklist.

6. Niskin Sampler: 2-3 students from the Nutrient Group start by deploying Niskin bottle 1 meter below the surface to collect water sample for nutrient tests inside PWSSC.

7. Nutrient Testing: (Clipboard with Water Monitoring data sheet) 8 students take water sample inside, break into pairs and conduct nutrient tests. Results are recorded on student Water Monitoring data sheet and entered into MASTER DATA SHEET on the computer. Discuss results and review how each nutrient is relevant to herring as time allows.

8. HydroLab/Weather Monitoring: Take measurements from 1 meter below the surface→ watch the measuring tape/flagging on the cable.

9. HydroLab (Clipboard with HydroLab data sheet): Deploy HydroLab to 1 meter below the surface. HyrdoLab Scribe records location, date, time, and water data as it is reported on the HydroLab Monitoring data sheet. An instructor is hands-on with this group while HydroLab is in use. After that data is collected, HyrdoLab group completes tide information and wind/water condition observations on their own while instructor becomes more hands on with weather group.

10. Weather: (Clipboard with Weather Monitoring data sheet) Record weather measurements using tools in weather kit. Instructor assists this group after HydroLab data collection is complete.

11. Regroup: ***(10 minutes)***
    Discuss and compare data as a group as time allows (reiterating wherever possible the linkage between ocean conditions, nutrients, plankton, herring, ocean food web, fisheries etc.). Go over monitoring vocabulary worksheet.

12. Assessment:
    Students should keep a log book recording science challenge questions that will be presented at the beginning of each session, which can later be answered at the end of the session. How does collecting ocean data through monitoring help us understand environmental change?

Post Session (Instructor)

1. Update master data sheet on computer.
2. Rinse and dry nutrient test sample cups.
3. Coil the Niskin bottle line neatly in container.
4. HydroLab Procedures:
   - Disconnect HydroLab handheld screen from the cable. Double check that the HydroLab sensor storage cup is filled with tap water.
   - Log use and any issues noted in the HydroLab log book.
4. Organize and store monitoring supplies.

STANDARDS

Alaska State Standards:

SA The student will demonstrate an understanding of the processes and applications of scientific inquiry.

(5) SA1.1 asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring and communicating.

(5) SA1.2 using quantitative and qualitative observations to create their own inferences and predictions.

SA1 The student will develop an understanding of the processes of science used to investigate problems, design and conduct repeatable scientific investigations, and defend arguments.

SA2 The student will develop an understanding that the processes of science require integrity, logical reasoning, skepticism, openness, communication, and peer review.

(5) SA2.1 supporting their statements with facts from a variety of resources and by identifying their sources.

SA3 The student will develop an understanding that culture, local knowledge, history, and interactions with the environment contribute to the development of scientific knowledge, and local applications provide opportunity for understanding scientific concepts and global issues.

(5) SA3.1 identifying the limiting factors (e.g., weather, human influence, species interactions) that determine which plants and/or animals survives.

National Science Education Standards

Content Standard A: Scientific Inquiry

All students will develop abilities necessary to do scientific inquiry.

Identify questions that can be answered through scientific investigations.

Design and conduct a scientific investigation.

Use appropriate tools and techniques to gather, analyze and interpret data.

All students will gain an understanding about scientific inquiry.

Different kinds of questions suggest different kinds of scientific investigations.

Technology used to gather data enhances accuracy and allows scientists to analyze and quantify results of investigations.

Scientific explanations emphasize evidence, have logically consistent arguments and use scientific principles, models and theories.

Ocean Literacy Standards

5. The ocean is largely unexplored.
   b. Understanding the ocean is more than a matter of curiosity. Exploration, inquiry and study are required to better understand ocean systems and processes.

RESOURCES

National Research Council (U.S.), (1996). *National Science Education Standards: observe, interact, change, learn*. Washington, D.C.: National Academy Press.

Project 2061 (American Association for the Advancement of Science), (2001). Atlas of Science Literacy. Washington, DC: American Association for the Advancement of Science: National Science Teachers Association.

FEEDBACK

We value your feedback on this lesson.
Send us your comments to: khoffman@pwssc.org
PWSSC Discovery Programs
Prince William Sound Science Center
P.O. Box 705 Cordova, Alaska 99574
907-424-5800
907-424-5820 (fax)
info@pwssc.org

Acknowledgements
This lesson was developed and written for the PWSSC Discovery Room Program with funding from the Oil Spill Recovery Institute.