POLAR TREC

TEACHERS AND RESEARCHERS EXPLORING AND COLLABORATING

Investigations Beneath the Surface—Studying Underwater Life

Technology geared to the instruction and learning of science concepts, skills, and processes is instrumental to a deeper understanding of science phenomena and content.

Overview

This lesson is intended to introduce students to the concept of scientific exploration and investigation. Students will model the technology used in the Jellyfish in the Bering Sea expedition by using underwater cameras and tow nets. They will then devise their own experiments based on observations and data gathered from their own underwater investigations.

Objectives

- At the completion of this lesson, students will gain a greater understanding how scientists investigate and explore natural phenomena in bodies of water.
- Students will be able to conduct long-term investigations and devise experiments based on lengthy observations and data collection.

Safety Concerns

- There must be safety precautions taken if students sample in a body of water.
- Life jackets should be worn if students are in boats or near rivers, lakes or oceans.

Lesson Preparation

- Prior to the lesson, the teacher needs to show students how the scientists on the PolarTREC Jellyfish in the Bering Sea expedition were able to observe

Details

Lesson
Arctic
More than a week
Download, Share, and Remix
High school and Up

Materials

Nets: either tow nets or fish aquarium nets
pH meter, refractometer, Secchi disk
Identification guides for underwater organisms
Dissecting scope or magnifying lens
Access to computers with Microsoft Excel

Standards

Virginia State Standards

VA Earth Science1.B

The student will plan and conduct investigations in which technologies, including computers, probeware, and

underwater life via the technological tools ZOOVIS and ARIS.

- Review with the students the following journals from the expedition: https://www.polartrec.com/expeditions/jellyfish-in-the-bering-sea/journa... https://www.polartrec.com/expeditions/jellyfish-in-the-bering-sea/journa... https://www.polartrec.com/expeditions/jellyfish-in-the-bering-sea/journa...
- The teacher also needs to explain how the scientists chose sampling sites and data collection protocols.
- Students need to be made aware that scientific investigation entails observation and establishment of research plans based on insight gained from observation.
- Students should know that scientific research can be carried out in their surroundings. All students are capable of carrying out scientific research.
- School district protocol must be followed when students are involved in scientific research, particularly if the research involves leaving the classroom setting.

Procedure

1. Show images of jellyfish and ask students the advantages and disadvantages of studying jellyfish in their natural habitat versus in a lab.
2. Have students skim the three PolarTREC journal entries listed above and make a list of what can be learned from imaging living organisms such as jellyfish in the water column and from sampling using tow nets.
3. Ask the students about the about the advantages and disadvantages of using imaging systems to study jellyfish instead of collecting them with nets.
4. Find a local site with water (a bay, inlet, river, pond, lake, or a large classroom aquarium with the sides covered during sampling) and discuss the potential of investigating the living organisms in the chosen body of water.
5. Have the students map out the area using survey tools (The district vocational school might be helpful if there is a program using these tools.) Otherwise, topographic maps of the chosen site may be available online on a local government website. With Internet capabilities, Google Maps with satellite views would be helpful.

geospatial technologies, are used to collect, analyze, and report data and to demonstrate concepts and simulate experimental conditions

VA Biology 1.i

The student will demonstrate an understanding of scientific reasoning, logic, and the nature of science by planning and conducting investigations in which appropriate technology including computers, graphing calculators, and probeware, is used for gathering and analyzing data, communicating results, modeling concepts, and simulating experimental conditions

Next Generation Science Standards

HS-ETS1-2

Design a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

6. Have the students devise a plan for surveying the chosen body of water. Students will have to consider whether to sample specific areas or those chosen at random. The advantages and disadvantages of each should be discussed. The students can read about the planning of the cruise here: https://www.polartrec.com/expeditions/jellyfish-in-the-bering-sea/journa...
7. Students will devise a sampling schedule and submit sampling data in an Excel spreadsheet over a designated period of time. The data should include abiotic factors such as air and water temperatures, salinity and pH. The data pertaining to the biotic factors should include the species of underwater organisms observed and their abundances. Students will view the organisms captured via tow nets and underwater cameras and list the species identified and the abundances witnessed.
8. To sample biotic factors, students should use the nets and the underwater cameras. They will follow established protocol as to the depth and length of time for each sampling site.
9. To sample abiotic factors, the students will use a refractometer to measure salinity and thermometers to measure both air and water temperature. In addition, Secchi disks can be used to measure turbidity. A pH meter will be used to measure the pH of the selected sampling sites.
10. After sampling, students will input the data into an Excel spreadsheet. Over time, from a month to several months, students will have collected a large data set pertaining to the selected body of water. Over time, patterns may emerge as the location experiences seasonal temperature, salinity and daylight changes.
11. Have students answer the following questions:

- What are some patterns you notice regarding the species abundances and temperature/salinity/pH/turbidity?
- How might watershed activity affect any changes you see over time in the underwater species and their abundances?
- What are some possible research questions you have based on your observations and data collection?
- What are some possible ways you could investigate your research question? What are the important variables (independent and dependent) as well as constants and confounding variables?

12. After the students have devised a research strategy, the teacher should evaluate the strategy in terms of its feasibility and purpose. If done in small groups, the research plans should be discussed in the context of the entire classroom so that students can provide feedback to one another. If done as a whole class research project, the teacher should facilitate a classroom discussion about the purpose and strategy.
13. From participating in relevant scientific research, students should learn that:

- Scientific research is a collaborative effort and all members of the research team have important roles to carry out.
- Scientific research requires time and planning.
- From the observation of natural phenomena and its interpretation, important research questions arise.

- Technology provides scientists a means to observe organisms in their natural state. In the case of underwater research, tools such as ZOOVIS and the ARIS as well as underwater cameras, allow scientists to observe and collect data pertaining to underwater organisms and their interactions and abundances.
- The communication of scientific research is essential to the process of research. This communication can be accomplished through a science fair or publishing results in a district newsletter.

14. Students will communicate their results and conclusions to a wider audience such as the school district or city.

Extension

- Scientists from a nearby university can mentor students during the research process.
- Scientists from a nearby university or company can schedule a classroom visit to discuss their research processes.

Resources

Journals from the expedition https://www.polartrec.com/expeditions/jellyfish-in-the-bering-sea
Especially:
https://www.polartrec.com/expeditions/jellyfish-in-the-bering-sea/journa...
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Assessment

Students will be assessed by evaluation of their research and the communication of this research to a wider audience.

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