5E Lesson Plan

Lesson: Diving into Deep Sea Data	

Date: Created 4/25/2018

Subject /grade level: Life Sciences/Middle School and High School

Materials:
- A computer/projector connected to the internet with speakers (for videos)
- Computers connected to the internet for students to explore online data portals
- Portal search guide
- Portal worksheet

This lesson should take a little over one hour of class time total but can be easily split between multiple days.

Next Generation Sunshine State Standards

Interdependence
SC7.L.17.3 Describe and investigate various limiting factors in the local ecosystem and their impact on native populations, including food, shelter, water, space, disease, parasitism, predation, and nesting sites.
SC.912.L.17.2 Explain the general distribution of life in aquatic systems as a function of chemistry, geography, light, depth, salinity, and temperature.

The Practice of Science
SC.7.N.1.5 Describe the methods used in the pursuit of a scientific explanation as seen in different fields of science such as biology, geology, and physics.
SC912.N1.4 Identify sources of information and assess their reliability according to the strict standards of scientific investigation.
SC912.N1.6 Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.

Lesson objective(s):
Upon completion of this lesson, each student should be able to:
- Understand how scientist explore the deep sea.
- Find valid scientific names for deep sea animals.
- Search for digitized natural history collection data in an online aggregated database.
- Evaluate the effectiveness of different search strategies.
- Discuss the different types of biodiversity data (remote sensing and collections).
- Discuss the importance of deep sea discovery.

Essential Questions
- What is the deep sea?
- How do scientists explore the deep oceans?
- How much of the world's surface does the ocean cover?
- What percent of the deep sea has been explored?
- What is remote sensing and how is it used?
- What are natural history collections and how are they used?
- Why is understanding deep sea biodiversity important?

Essential Vocabulary
Species
Scientific name
Common name
Natural history collection
Specimen
Remote sensing
Habitat
Deep sea

Differentiation strategies to meet diverse learner needs:

This lesson gives multiple strategies for delivering content and evaluating learners. Choose class-wide discussions vs worksheets and group work vs individual work based on learners needs. Consider mixing approaches to give each learner the chance to demonstrate gains.

ENGAGEMENT (10 minutes of class discussion)
Start with a discussion about deep ocean environments:

- What is it like in the deep oceans of our planet?
- What kinds of organisms live there and how diverse are deep sea environments?
- How do we answer questions about the deep sea?
- How do scientists collect data?
- What are the challenges specific to deep sea exploration?

Resources for Engagement:
Videos
Deep sea ecosystem introduction video: http://www.cpalms.org/Public/PreviewResourcePerspectivesVideo/Preview/156315
Physical Adaptation to Low Light in Aquatic Environments: http://www.cpalms.org/Public/PreviewResourcePerspectivesVideo/Preview/128424
Deep Sea Creature facts: http://mocomi.com/deep-sea-creatures/
Preserving large specimens from the deep sea for display in Natural History Museum: https://www.youtube.com/watch?v=YgvfF05BS4Y
Medicines from the oceans: https://oceantoday.noaa.gov/medicinesfromthesea/

Websites
The Deep Sea Ocean Portal from the Smithsonian: http://ocean.si.edu/deep-sea
The Deep Sea from MarineBio: http://marinebio.org/oceans/deep/
Medicines from the Deep Sea: https://oceanexplorer.noaa.gov/explorations/03bio/background/medicines/medicines.html

EXPLORATION (Depends on the video 15-30 minutes)

Two of the major ways that scientists learn about the deep sea is through collecting specimens and remote sensing. You will be exploring these two data types through video examples of each.

Remote Sensing (2-10 minutes):
1. Watch a video from Okeanos Explorer https://oceanexplorer.noaa.gov/okeanos/ by either:
   A. Watching the livestream
   B. Clicking "Live Video" to access all 3 camera views

For more detailed instructions see the **Okeanos Tutorial**.

During the video have students write down what animals are identified by the scientists. Also have them note any other important details such as any ecological or oceanographic information provided by the narration.

Specimen Collecting (5 minute video):
2. Watch this video about 3D scanning an angler fish: https://www.youtube.com/watch?v=AW93uB5fDLQ

While watching this video have students write down the kinds of data you could get from a physical specimen and how that differs from the kinds of data you can get from remote sensing.

Additional research videos (optional)
Deep Sea Research: https://www.youtube.com/watch?v=rs7iQ-mH3Zw
Exploring Antarctic Deepsea Life: https://www.youtube.com/watch?v=bMXbg9M3OVQ

Optional Activity: Ask students to name the organisms identified in the videos. Create a class list.

EXPLANATION (5-10 minutes of class discussion)

Lead the students in a discussion comparing and contrasting the two data types,

- What are the strengths of each data type?
- What are the limitations?
- What kinds of questions can you answer with these data types?

And ask them why does understanding what lives in the deep sea matter?
- Why do we need we study biodiversity?
- How does life on the sea bottom affect life on the surface?

ELABORATION (10-20 minutes of data exploration time)
Have students search for the species they wrote down from the remote sensing video and have them complete the **Portal Worksheet**.
Provide the **Portal Search Guide** for students or give a demonstration on how to use the search portal.

Students should try finding specimen records by using the *scientific name* field and by searching in the "*all fields*" box. All fields will look for your search term in every field of a specimen record, so you will sometimes get data returned that does not match your species. For example if you type "squirrel" you will not only have squirrel records in your search results, but also other unrelated organisms that have the word squirrel somewhere in their record like collected at "squirrel park" Or "this plant was consumed by a squirrel in the remarks field.

Have students experiment with different search methods and compare their results.

Students can use the Encyclopedia of Life http://eol.org/ to help find scientific names.

EVALUATION (10 minutes to complete the worksheet and 5-10 minutes of discussion of answers after worksheets are collected from students).
Have the students fill out the **Portal Worksheet** while they explore the iDigBio portal. At the end of the class period have students compare what they found in their searches and discuss why they may have gotten different results from different searches. Discuss what types of data you can get from natural history specimens and how the data could be used.