NOAA Teacher at Sea Lesson Plan

Deep Sea Exploration

Subject (Focus/Topic): Oceanography

Grade Level: 6th, 7th, 8th

Average Learning Time: six class days (five fifty-minute periods)

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LESSON PLAN DESCRIPTION

Lesson Summary (Overview/Purpose)

Students will plan a deep sea exploration expedition around the globe aboard a NOAA scientific research vessel. In a cooperative group, each student will have a different role/job/responsibility aboard the vessel.

Overall Concept (Big Idea/Essential Question)

What is the role and responsibilities of a NOAA fisheries biologist, a NOAA chief scientist, a NOAA Corps Officer, and NOAA Engineer/Mariner during an oceanographic/fisheries expedition aboard a NOAA scientific vessel?

Specific Concepts (Key Concepts)

- Students understand the importance of headings/bearings (latitude and longitude) in navigating the vessel between stations.
- Students understand the different oceanic zones, their unique characteristics, and how these characteristic affect marine life inhabiting these zones.
- Students can identify underwater geographic features/structures and how these features affect surrounding marine life.
- Students are able to identify different scientific tools, equipment and machinery NOAA scientists and mariners use aboard scientific expeditions.
- Students are able to identify and locate the oceans of the world.

Focus Questions (Specific Questions)

1. What are the zones of the ocean? (Describe these zones in detail)
2. Name ONE organism found in each oceanic zone.

3. What are latitude and longitude?
4. What are major underwater geographic features? (coral reefs, underwater mountains, trenches, etc.)
5. How does the underwater geographic feature affect the surrounding marine life?
6. Name three scientific tools, equipment, and/or machinery NOAA scientists use to collect data.
7. Where are the oceans of the world located?
8. Why is it important for scientists to use the same tools and technique for collecting data at each station?
9. Why is communication among scientists so important?

Objectives/Learning Goals

- Student will be able to identify underwater geographic features (trenches, vents, coral reefs, mountain ranges, etc.).
- Students will be able to explain the difference between latitude and longitude.
- Students will be able to use latitude and longitude to identify locations around the globe.
- Students will understand the roles and responsibilities of a NOAA fisheries biologist, a NOAA chief scientist, a NOAA Corps Officer, and NOAA Engineer/Mariner during an oceanographic/fisheries expedition aboard a NOAA scientific vessel.
- Students will be able to explain how each of these individual positions must work together to successfully complete research and collect data during each scientific expedition.
- Students will be able to explain what type of data is collected using equipment and instruments aboard a NOAA scientific research vessel.
- Students will be able to describe characteristics of each oceanic zone.

Background Information

Before students begin planning and researching their expedition, students should watch the following three videos to familiarize themselves with NOAA operations, careers, and research investigations.

- NOAA Wager Mariners: Careers Video Clip (17:06)
  https://youtu.be/LqJzLQ3K-1Q
- Tour of the NOAA Ship *Okeanos Explorer* (6:17)
  https://youtu.be/KoTh8esT9e4
- NOAA gives tour of ship that will explore Marianas (2:44)
  https://youtu.be/ItICWXH0t-0

Common Misconceptions/Preconceptions

N/A

Teaching Materials

- Each student must have access to Chromebook/Internet.
- Each student will need to have a hardcopy of project instructions and requirements.
- Students may use paper copy to take notes, collect data, etc. Final/finished project will be submitted electronically.

Technical Requirements

All students need to have one-to-one devices for Internet access. Students need to have a Google account to share/edit project components with one another electronically.

Teacher Preparation

Each student will need to have a copy of project instructions packet. Divide class into groups of four that will work well collaboratively.

Keywords

- trench
- latitude/longitude
- ROV/HOV
    - Sunlight zone/twilight zone/midnight zone/abyss

Pre-assessment Strategy/Anticipatory Set (Optional)

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Lesson Procedure

1. Explain to students that they will be working in a groups of four to plan an undersea exploration trip aboard a NOAA scientific research vessel.
2. Each member of the group will be assigned a specific job/role with different skills and responsibilities.
3. Each group's plan will include researching undersea life, designing your vehicle, plotting a course, writing a proposal (to get funding), and presenting the finished plan to the class.
4. Pass out project handout. Divide students into groups of four. Assign each student in a group a number 1-4.
    a. Student 1 will be a NOAA fisheries biologist. The NOAA fisheries biologist's responsibility is to research one underwater organism at each of the ten locations and describe the adaptations that enable them to survive.
    b. Student 2 will be a NOAA chief scientist. The NOAA chief scientist's responsibility is to keep the group members focused, write a proposal for the trip, and organize final project.
    c. Student 3 will be a NOAA Corps officer. The NOAA Corps Officer's responsibility is to research ten underwater geographic features (coral reefs, underwater mountains, trenches, etc.) and then plot the trip on a map.

   d. Student 4 will be a NOAA Engineer/Mariner. The NOAA Engineer/Mariner's responsibility is to research different types of NOAA scientific vessels, design one for the group, and create a blueprint of it.

5. Explain to students the timeline for project.
   a. Day 1: Watch videos; introduce project; assign groups and jobs/roles.
   b. Day 2: Student Work Day. Students should be using their hard copy of the project handout to draft their portion of the project.
   c. Day 3: Student Work Day. Students should be using their hard copy of the project handout to draft their portion of the project.
   d. Day 4: Student Work Day. Students should be starting to work on their portion of final product/presentation in Google slides.
   e. Day 5: Student Work Day. Students should be finalizing their Google Slides final product and presentation.
   f. Day 6: Group presentations.

Assessment and Evaluation

Final Product and Presentation **(100 points)**

All members will be expected to play some role in presenting the project. The final presentation should be created in Google slides and include images of:

- At least five of the geographic features and their locations from NOAA Corp Officer's list. Include a picture/image of each location. **(20 points)**
- Identify one organism from each location selected above from the NOAA fisheries biologist's list. Include a picture/image of each organism. **(20 points)**
- An image of the vessel designed by the NOAA Engineer/Mariner. Design must be labeled with equipment/tool features of vessel. **(20 points)**
- A map including the NOAA Corps Officers' route with the five locations selected above.
- A bulleted summary of the NOAA Chief Scientist's proposal. **(20 points)**

Standards

Next Generation Science Standards (NGSS) or State Science Standards Addressed

- MS-LS2-2 Ecosystems: Interactions, Energy, and Dynamics
  Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
- MS-LS1-5 From Molecules to Organisms: Structures and Processes
  Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.
- MS-LS2-1 Ecosystems: Interactions, Energy, and Dynamics
  Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
- MS-LS2-2 Ecosystems: Interactions, Energy, and Dynamics
  Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

- MS-ETS1-1 Engineering Design
  Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
- MS-ETS1-4 Engineering Design
  Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Ocean Literacy Principles Addressed

- 1. The Earth has one big ocean with many features.
  - Ocean basins are composed of the seafloor and all of its geological features (such as islands, trenches, mid-ocean ridges, and rift valleys) and vary in size, shape and features due to the movement of Earth's crust (lithosphere). Earth's highest peaks, deepest valleys and flattest plains are all in the ocean.
  - Throughout the ocean there is one interconnected circulation system powered by wind, tides, the force of Earth's rotation (Coriolis effect), the Sun and water density differences. The shape of ocean basins and adjacent land masses influence the path of circulation. This "global ocean conveyor belt" moves water throughout all of the ocean basins, transporting energy (heat), matter, and organisms around the ocean. Changes in ocean circulation have a large impact on the climate and cause changes in ecosystems.
- 5. The ocean supports a diversity of life and ecosystems.
  - Ocean biology provides many unique examples of life cycles, adaptations, and important relationships among organisms (symbiosis, predator-prey dynamics, and energy transfer) that do not occur on land.
  - The ocean provides a vast living space with diverse and unique ecosystems from the surface through the water column and down to, and below, the seafloor. Most of the living space on Earth is in the ocean.
  - Ocean ecosystems are defined by environmental factors and the community of organisms living there. Ocean life is not evenly distributed through time or space due to differences in abiotic factors such as oxygen, salinity, temperature, pH, light, nutrients, pressure, substrate, and circulation. A few regions of the ocean support the most abundant life on Earth, while most of the ocean does not support much life.
  - There are deep ocean ecosystems that are independent of energy from sunlight and photosynthetic organisms. Hydrothermal vents, submarine hot springs, and methane cold seeps, rely only on chemical energy and chemosynthetic organisms to support life.
  - Tides, waves, predation, substrate, and/or other factors cause vertical zonation patterns along the coast; density, pressure, and light levels cause vertical zonation patterns in the open ocean. Zonation patterns influence organisms' distribution and diversity.
- 7. The ocean is largely unexplored.
  - The ocean is the largest unexplored place on Earth—less than 5% of it has been explored. The next generation of explorers and researchers will find great opportunities for discovery, innovation, and investigation.
  - Understanding the ocean is more than a matter of curiosity. Exploration, experimentation, and discovery are required to better understand ocean systems and processes. Our very survival hinges upon it.

- Ocean exploration is truly interdisciplinary. It requires close collaboration among biologists, chemists, climatologists, computer programmers, engineers, geologists, meteorologists, physicists, animators, and illustrators. And these interactions foster new ideas and new perspectives for inquiries.
- New technologies, sensors, and tools are expanding our ability to explore the ocean. Scientists are relying more and more on satellites, drifters, buoys, subsea observatories, and unmanned submersibles.

Other National or State Science Standard(s) Addressed (optional)

N/A

Additional Resources

- NOAA Ship Rainer Tour
  https://youtu.be/59OqG9tB1RU
- NOAA Wager Mariners: Careers Video Clip
  https://youtu.be/LqJzLQ3K-1Q
- Tour of the NOAA Ship *Okeanos Explorer*
  https://youtu.be/KoTh8esT9e4
- NOAA gives tour of ship that will explore Marianas
  https://youtu.be/ItICWXH0t-0

NAMES: _____ DUE: _____

Deep Sea Exploration Project

Your group is planning an underwater exploration trip aboard a NOAA scientific research vessel.

- Each member of the group will be assigned a specific job/role with different skills and responsibilities.
- Each group's plan will include researching undersea life, designing your vehicle, plotting a course, writing a proposal (to get funding), and presenting the finished plan to the class.

Group Members

- Student 1 will be a NOAA fisheries biologist. The NOAA fisheries biologist's responsibility is to research one underwater organism at each of the ten locations and describe the adaptations that enable them to survive.

- Student 2 will be a NOAA chief scientist. The NOAA chief scientist's responsibility is to keep group members focused, write a proposal for the trip, and organize final project.

- Student 3 will be a NOAA Corps officer. The NOAA Corps Officer's responsibility is to research ten underwater geographic features (coral reefs, underwater mountains, trenches, etc.) and then plot the trip on a map.

- Student 4 will be a NOAA Engineer/Mariner. The NOAA Engineer/Mariner's responsibility is to research different types of scientific vessels, design one for the group, and create a blueprint of it.

Final Product and Presentation (100 points total)

All members will be expected to play some role in presenting the project. The final presentation should be created in Google slides and include images of:

- At least five of the geographic features and their locations from NOAA Corp Officer's list. Include a picture/image of each location. **(20 points)**
- Identify one organism from each location selected above from the NOAA fisheries biologist's list. Include a picture/image of each organism. **(20 points)**
- An image of the vessel designed by the NOAA Engineer/Mariner. Design must be labeled with equipment/tool features of vessel. **(20 points)**
- A map including the NOAA Corps Officers' route with the five locations selected above. **(20 points)**
- A bulleted summary of the NOAA Chief Scientist's proposal. **(20 points)**

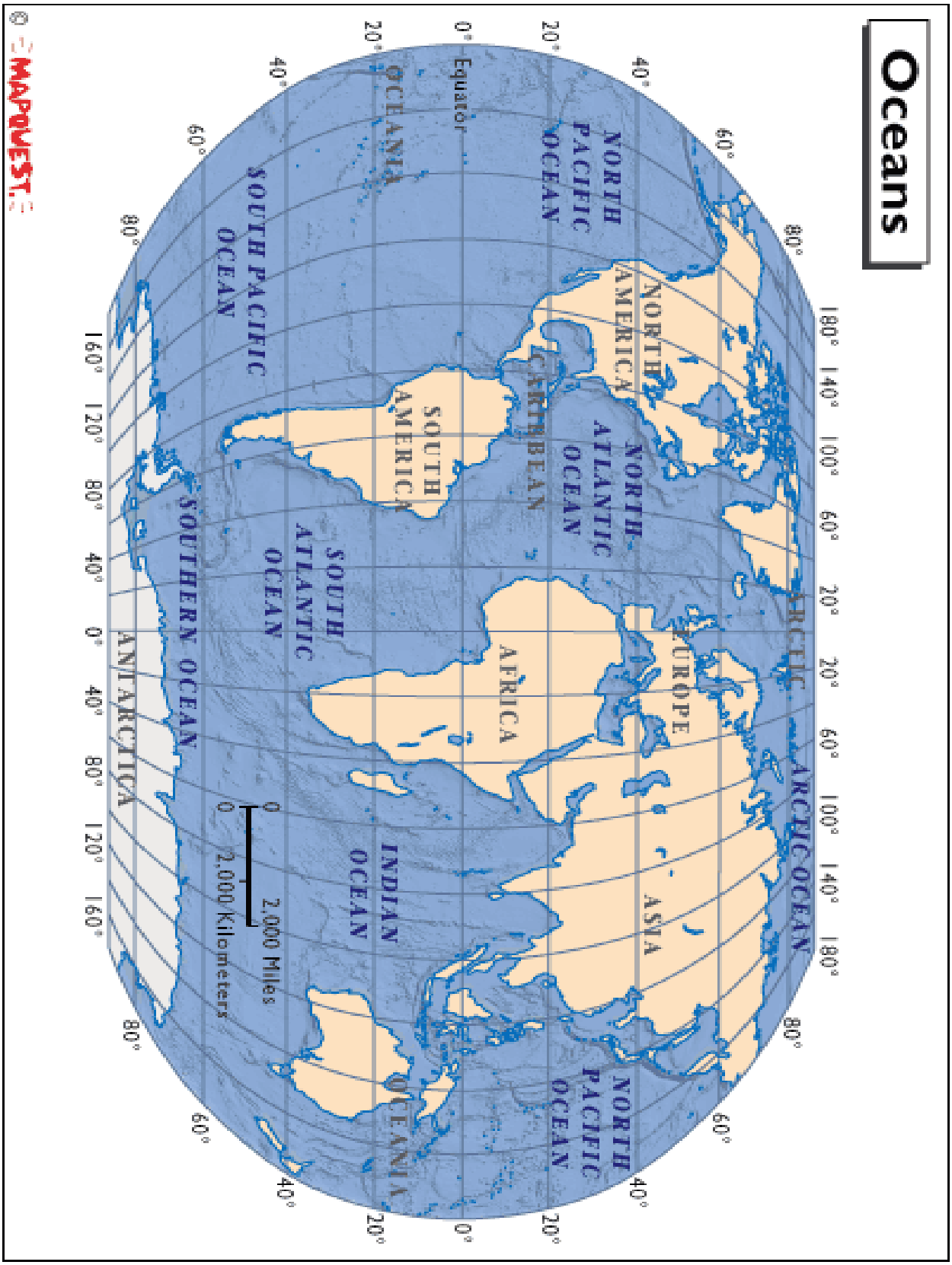
NOAA Corps Officer

The NOAA Corps Officer's responsibility is to research ten underwater geographic features (coral reefs, underwater mountains, trenches, etc.) and then plot the trip on a map.

Name of feature	Location (Latitude & Longitude)	Interesting characteristic
1		
2		
3		
4		
5		
6		
7		
8		

9		
10		

MAP YOUR COURSE ON THE NEXT PAGE


Oceans
MAPQUEST
NORTH PACIFIC OCEAN
NORTH AMERICA
NORTH ATLANTIC OCEAN
EUROPE
ASIA
ARCTIC OCEAN
NORTH PACIFIC OCEAN
CARIBBEAN
SOUTH AMERICA
AFRICA
SOUTH ATLANTIC OCEAN
INDIAN OCEAN
OCEANIA
SOUTH PACIFIC OCEAN
SOUTHERN OCEAN
ANTARCTICA
Equator
0 2,000 Miles
0 2,000 Kilometers

NOAA Fisheries Biologist

The NOAA fisheries biologist's responsibility is to research one underwater organism at each of the ten locations and describe the adaptations that enable them to survive.

Organism	Habitat/ Oceanic Zone	Adaptations
1		
2		
3		
4		
5		
6		
7		
8		

9		
10		

NOAA Engineer/Mariner

The NOAA Engineer/Mariner's responsibility is to research different types of submarines, design one for the group, and create a blueprint of it.

What specific equipment and necessities will be on board, and where will they be stored?

_____
_____
_____
_____
_____
_____
_____

How many crew members will be on board and what jobs will they have?

_____
_____
_____
_____
_____
_____
_____

What special features will your vessel have?

_____
_____
_____
_____
_____
_____
_____

DRAW THE BLUEPRINT ON THE NEXT PAGE. LABEL EQUIPMENT AND INSTRUMENTS.

SCIENTIFIC VESSEL BLUEPRINT

NOAA Chief Scientist

The NOAA chief scientist's responsibility is to keep the group members focused, write a proposal for the trip, and organize final project.

Part I. Checklist: Make sure that these tasks have been completed:

1. The fisheries biologist has a list of 10 researched organisms that will be observed on the trip. _____

2. The organisms on the fisheries biologist's observation list can be found along the route that was planned by the NOAA Corps Officer. _____

3. The NOAA Corps Officer has researched 10 specific underwater features and included them on the map using longitude and latitude. _____

4. The Engineer's vessel was appropriately designed for the trip and includes a blueprint. _____

Part II. The Proposal: Write a letter to the company that will pay for your trip. Your letter should include the following:

1. Introduction / Motivation – Who you are and why you would wish to go on this trip.

2. Destination - Details about where you would go.

3. Observation - What you would expect to observe on the trip.

4. Transportation - Details about your vessel.

5. Publication – How your team would present your findings.

Brainstorming / Notes:

WRITE YOUR PROPOSAL DRAFT BELOW