

**Focus:**

Recent explorers of deep-sea environments  
The relationship between science and history

**Grade Level:**

9-12

**Learning Objectives:**

Students will learn what it means to be an explorer, both modern and historic.

Students will recognize that not all exploration occurs on land. They will understand the importance of curiosity, exploration, and the ability to document what one studies.

Students will gain insight into the vastness of unexplored places in the deep sea.

Students will gain appreciation of science mentors and role models.

**Materials**

- Web Quest NOAA Site:  
<http://www.oceanexplorer.noaa.gov/explorations/deepeast01>
- Student Activity Sheets – one of each part per student
- Part I: Team Exploration – Cooperative Explorers Web Quest Data Sheet
- Part II: Individual Exploration – Individual Explorers Reflection Sheet

**Teaching Time**

Part I: Team Exploration: One 45-minute period

Part II: Individual Exploration: One 45-minute period

Note: If Background Information is read aloud

and discussed with students, an extra 20 minutes of introductory time is needed before the lesson is begun.

**Seating Arrangement**

Part I: Team Exploration: Groups that will work best in your computer arrangement/setting for a Web Quest.

Part II: Individual Exploration: Students should work individually in a place that lends itself to reflection.

**Key Words**

Exploration  
Documentation  
Science role models  
Biodiversity  
Extreme environments

**Background Information**

From the 1500s on, the Portuguese, Spanish, and English explored the world. Artists often accompanied them on expeditions. Vancouver explored the west coast of the United States with a science illustrator. Sir Walter Raleigh employed John White to draw species from the Chesapeake and Virginia area. Mark Catesby was sent from England in 1724 to explore the East coast of "the colonies" for Sir Hans Sloan in England. He water colored over 220 plates and sent back countless specimens during his four-year collecting journey. During the Lewis and Clark Expedition, Merewether Lewis recorded his discoveries through his own scientific illustrations. The work of these men and their artists is interesting to look into. They were

the first explorers to chart and draw the natural history of the United States.

The Challenger Expedition of 1874 was one of the first concentrated deep ocean explorations. It was completely underwritten by the British government and its explorers were charged with mapping the oceans of the world. This four-year expedition, which would cost \$10 million to conduct today, produced 50 volumes of scientific writing and illustrations over a 10-year period. It is known as one of the most factual and complete documentation of the oceans with its specimen collections still archived and curated to this day.

In recent years, technological developments have made the oceans more visible than they have ever been before. With these new “technological eyes,” new species, new ecosystems, and new metabolic processes have been discovered. Some of these discoveries may, in fact, hold clues to the origin(s) of life on Earth and cures for human diseases. With the National Oceanic and Atmospheric Administration’s Office of Ocean Exploration, a new era of ocean exploration has been launched by our Nation. In the years ahead, ocean explorers are certain to find many more fascinating discoveries about our Ocean Planet—and our intrinsic connections to it.

#### LEARNING PROCEDURE

Part I: Team Exploration: See Activity Sheet  
Part II: Individual Exploration: See Activity Sheet

#### THE BRIDGE CONNECTION

[www.vims.edu/bridge](http://www.vims.edu/bridge)

#### THE “ME” CONNECTION

All of Part II: Individual Exploration represents “Me” Connections

#### CONNECTION TO OTHER SUBJECTS

English/Language Arts, Physical Earth, Life Sciences, Art/Design

#### EVALUATION

Use Student Evaluation Sheets. See Teacher Key, Part I and Part II

#### EXTENSIONS

Ask students to investigate career opportunities as ocean explorers, ocean scientists, and others whose careers support ocean science and exploration.

Visit the Ocean Exploration Web Site at:  
[www.oceanexplorer.noaa.gov](http://www.oceanexplorer.noaa.gov)

#### NATIONAL SCIENCE EDUCATION STANDARDS

##### Science as Inquiry – Content Standard A:

- Abilities necessary to do scientific inquiry
- Understandings about scientific inquiry

##### Life Science – Content Standard C

- Interdependence of organisms
- Matter, energy, and organization in living systems
- Populations and ecosystems
- Diversity and adaptations of organisms
- Behavior of organisms

##### Earth and Space Science – Content Standard D

- Understand structure of the Earth system
- Understand Earth’s history

**Science and Technology – Content Standard E**

- Develop understandings about science and technology

**Science in Personal and Social Perspectives – Content Standard F**

- Understand the importance of personal and community health
- Understand the value of natural resources
- Have an appreciation for environmental quality

**History and Nature of Science – Content Standard G**

- Science as a human endeavor
- The nature of science

*Activity developed by Kimberly Williams, Miller Place High School, Long Island, New York*



5) In some ways, deep sea explorers of modern times are similar to historic explorers. They are brave, curious men and women who are at the cutting edge of their field of interest. They are very unique individuals. For example, one of the scientists shown in your Web Quest is the only woman certified to pilot the deep sea submersible known as the Alvin. Can you find her name and what type of science she does?

Dr. \_\_\_\_\_ studies in the field of \_\_\_\_\_

6) Often our first inspiration to be curious and to explore comes from our parents and our teachers. Which explorer's elementary teacher inspired him by making him read *A Half Mile Down*, by William Beebe, a book about the first deep dive? Have you read this book?

Dr. \_\_\_\_\_

Bonus: Can you find other explorers who were inspired by parents &/or teachers?

Dr. \_\_\_\_\_

Dr. \_\_\_\_\_

Dr. \_\_\_\_\_

7) How do you think that exploring the deep sea is similar to exploring outer space?

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8) Which scientist explorer studies biodiversity and believes that extreme environments (such as those in the deep sea) may give us insight into life on other planets?

Dr. \_\_\_\_\_

9) There is a big world waiting for you to explore it, and the technology to do so gets better every day. Yesterday's discoveries are today's necessities. Which explorer hopes that new compounds from the deep sea will be used in the future to treat diseases?

Dr. \_\_\_\_\_

10) As we learn more about the vastness of the planet we inhabit, we realize how little we know about the creatures and plants that share it with us. Which scientist studies the relationship between food supply and egg production in deep water invertebrates?

Dr. \_\_\_\_\_

11) Another group of creatures that shares the Earth with us are beautiful single celled, shelled protozoans. Name these creatures and the explorer who studies them:

The creatures are known as \_\_\_\_\_

They are studied by Dr. \_\_\_\_\_

12) On the back of this data sheet, document your time of exploration on the Deep Sea Explorer Web Quest by drawing something that represents your favorite part of the site. Label your drawing and tell why this part of the site was interesting to you.

Congratulations, Explorers! You have successfully navigated the Deep Sea Explorer Web Quest! Now you are ready for some quiet reflection of what you learned with your colleagues. Tell your teacher that you are ready to begin Part II: Individual Exploration!

Evaluation of Cooperative Explorers Web Quest Data Sheet  
Teacher Answer Key for Part I site:

Welcome, Ocean Explorers! Please proceed to the following web  
[www.oceanexplorer.noaa.gov/explorations](http://www.oceanexplorer.noaa.gov/explorations)

Your first mission is to find the link to the deep sea explorers.

1) Write that link here:

[www.oceanexplorer.noaa.gov/explorations/deepeast01/background/explorers/explorers.html](http://www.oceanexplorer.noaa.gov/explorations/deepeast01/background/explorers/explorers.html)

2) List three places in the deep sea where science explorers have done their recent research:

- a) George's Bank Canyon
- b) Hudson River Canyon
- c) Blake Ridge

3) There are many individuals studying the deep sea. List at least five here and describe their field of research.

Answers may vary, some answers include:

Dr. Les Watling	Dr. Scott C. France	Mr. Andrew Shepard
Dr. Peter Auster	Ms. Caren Menard	Dr. Mary Scranton
Dr. Kevin Eckelbarger	Mr. Karl Stanford	Dr. Peter Rona
Dr. Barbara Hecker	Dr. Fred Grassle	Dr. Ellen K. Pikitch
Ms. Diana Payne	Dr. Michael Bothner	Dr. Michael Bothner
Ms. Holly Donovan	Ms. Tanya Podchaski	Ms. Rebecca Cerroni
Dr. Michael DeLuca	Dr. Cindy Lee Van Dover	Dr. Joan Bernhard
Dr. Carolyn Ruppel	Dr. Barun Sen Gupta	Ms. Paula Keener-Chavis

4) Describe what your day might be like if you were a marine chemist:

If I were a marine chemist, I would. . . .

Answers will vary-students will probably take information from the interviews of the marine chemists listed above for the descriptions of their imaginary day as a marine chemist.

5) In some ways, deep sea explorers of modern times are similar to historic explorers. They are brave, curious men and women who are at the cutting edge of their field of interest. They are very unique individuals. For example, one of the scientists shown in your Web Quest is the only woman certified to pilot the deep sea submersible known as the Alvin. Can you find her name and what type of science she does?

Dr. Cindy Lee Van Dover studies in the field of Marine Chemistry

6) Often our first inspiration to be curious and to explore comes from our parents and our teachers. Which explorer's elementary teacher inspired him by making him read *A Half Mile Down*, by William Beebe, a book about the first deep dive? Have you read this book?

Dr. Peter Rona I have/have not read *A Half Mile Down*

Bonus: Can you find other explorers who were inspired by parents and/or teachers? Some are:

Dr. Fred Grassle

Dr. Mary Scranton

Dr. Joan Bernhard

7) How do you think that exploring the deep sea is similar to exploring outer space?

Answers will vary. Some include:

Humans would need special equipment to survive and explore there.

Humans know very little about both places.

Humans get very excited about the prospect of finding life in both places.

8) Which explorer studies biodiversity and believes that extreme environments (such as those in the deep sea) may give us insight into life on other planets?

Dr. Joan Bernhard

9) There is a big world waiting for you to explore it, and the technology to do so gets better every day. Yesterday's discoveries are today's necessities. Which explorer

hopes that new compounds from the deep sea will be used in the future to treat diseases?

Dr. Fred Grassle

10) As we learn more about the vastness of the planet we inhabit, we realize how little we know about the creatures and plants that share it with us. Which scientist studies the relationship between food supply and egg production in deep water invertebrates?

Dr. Kevin Eckelbarger

11) Another group of creatures that shares the Earth with us are beautiful single celled, shelled protozoans. Name these creatures and the explorer who studies them.

The creatures are known as Foraminifera

They are studied by Dr. Barun Sen Gupta

12) On the back of this data sheet, document your time of exploration on the Deep Sea Explorer Web Quest by drawing something that represents your favorite part of the site. Label your drawing and tell why this part of the site was interesting to you.

Enjoy your students' drawings and celebrate the diversity of their interests.

Congratulations, Explorers! You have successfully navigated the Deep Sea Explorer Web Quest! Now you are ready for some quiet reflection of what you learned with your colleagues. Tell your teacher that you are ready to begin Part II: Individual Exploration!



3) Name places that were explored during the early history of humans.

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4) Name a place that you have explored. What was unique about it that you think another visitor to that site would not have noticed?

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5) Name a place that you would like to explore. What do you think you would find there? Why?

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6) Why is it important to document your explorations? What is your favorite way to remember your own adventures?

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7) On the space provided, list a few of your science and exploration role models (alive or historic) and why they inspire you. On a sheet of notebook paper or on the computer, compose a letter to one of your science and exploration role models. Write something you would want them to know about you and why you consider them an inspiration.

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Evaluation of Part II: Individual Explorers Reflections Sheet  
Teacher Answer Key for Part II

1) Reflect and write about differences and similarities between explorers of the past and modern day explorers. What types of hardships do both have in common?

Answers will vary.

Some Similarities:

Funding for both usually comes from an outside source. Explorers do not usually “own” most of the equipment, but the equipment is usually “cutting edge” for the time it is used by the explorers.

Exploration is undertaken by brave, curious individuals.

Often explorers seek resources that can be obtained from a newly-discovered site (raw materials, medicines, etc.)

Some Differences:

Nowadays, it is common for different countries to work together on exploratory projects; whereas in the past, many countries wanted to explore for the sake of conquering a particular region.

Nowadays, it is not uncommon for men and women to explore together; whereas many of the past explorers were men.

Hardships may include:

Funding for their explorations

Broken equipment while they are in the field

Lack of maps and directions

Discomfort while they are exploring extreme environments for long periods of time

Finding like-minded individuals to explore with them

2) Name some places that have been explored in modern times.

Answers will vary, but may include: the deep ocean, space, the Arctic, the Antarctic, the Western coast of the United States, etc.

3) Name places that were explored during the early history of humans.

Answers will vary, but may include: navigation around the continents, rivers, new passages from one country to another, etc.

4) Name a place that you have explored. What was unique about it that you think another visitor to that site would not have noticed?

Answers will vary.

5) Name a place that you would like to explore. What do you think you would find there? Why?

Answers will vary.

6) Why is it important to document your explorations? What is your favorite way to remember your own adventures?

Answers will vary, and may include:

To learn from the past, to remember places and people that we meet, so that others can learn from our work, etc.

Students may keep journals, scrapbooks, boxes of memories, etc.

7) On the space provided, list a few of your science and exploration role models (alive or historic) and why they inspire you. On a sheet of notebook paper or on the computer, compose a letter to one of your science and exploration role models. Write something you would want them to know about you and why you consider them an inspiration.

Answers will vary.