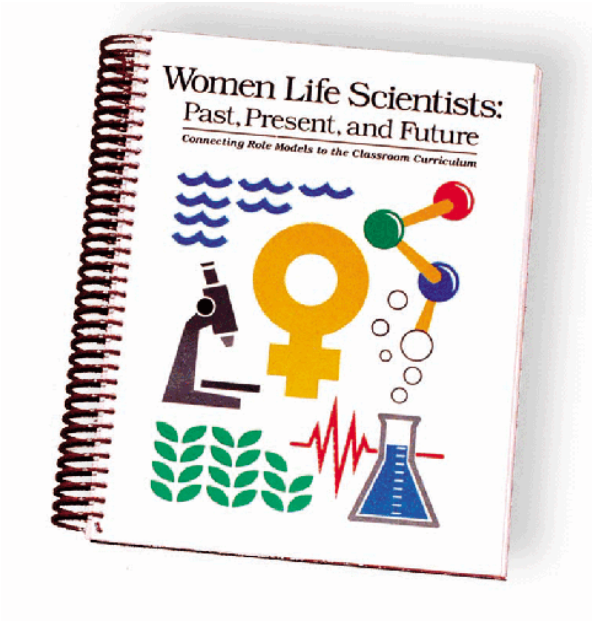


Sylvia Earle

Citation:
Haley-Oliphant, A.E. (1997). "Sylvia Earle, Marine Biologist, 1935-present," in Matyas, M.L. & Haley-Oliphant, A.E. (Editors). (1997). *Women Life Scientists: Past, Present, and Future – Connecting Role Models to the Classroom Curriculum.* Bethesda, MD: American Physiological Society, p. 139-150.

This publication was supported by a grant from the National Science Foundation (HRD-9353760). Any interpretations and conclusions in this publication are those of the authors and/or the role models and do not necessarily represent the views of the National Science Foundation or The American Physiological Society.

Copies of the activities from *Women Life Scientists: Past, Present, and Future* can be found at http://www.the-aps.org/education/k12curric/index.asp. To purchase bound copies, visit the APS store at http://www.the-aps.org/cgi-bin/ecom/productcatalog/Product_catalog.htm.

Visit the APS Education Online Website for more resources:
http://www.the-aps.org/education/

Sylvia Earle
Marine Biologist
1935-

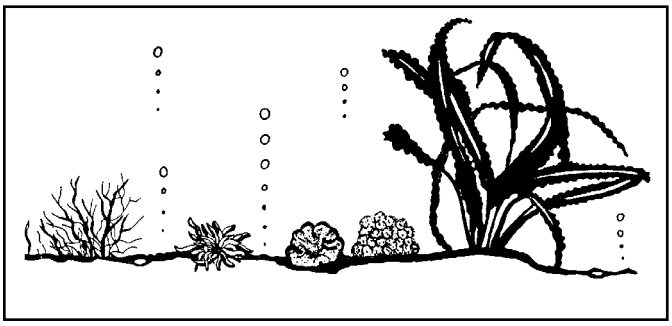
Unit developed by
Ann E. Haley-Oliphant
Miami University, Oxford, Ohio

Who is Sylvia Earle?

Imagine being an explorer who could truly "go where no one has gone before." Imagine seeing 8-foot-long tube worms and watching 64-foot-long giant squids float by. Imagine that you could predict changes in wind and weather patterns, such as El Niño, by looking at changes in ocean currents. Imagine exploring mountains higher than the Himalayas. You might see these things right before your eyes if you were exploring along with Dr. Sylvia Earle, not in outer space, but in the vast unexplored regions of the earth's oceans. Sylvia Earle is a marine biologist and is perhaps the best-known woman marine scientist in the world today. This renowned marine explorer has deep-sea dived all over the world in various *submersibles* (a type of submarine), has lived in several undersea laboratories, and has developed cutting-edge experimental marine equipment.

What were her early years like?

Sylvia Alice Earle was born in Gibbstown, New Jersey, in 1935. Her father, Lewis, was an electrician for the DuPont company. Her mother, Alice, was a housewife. When Sylvia was three, the family moved to a farmhouse south of Camden, New Jersey. There she first became interested in biology. With the encouragement of her parents, Sylvia made observations and kept notebooks detailing the many types of living things she found in and around the farm. During a family vacation to Ocean City, New Jersey, Sylvia had her first chance to learn about marine life — the animals and plants that inhabit the oceans. Soon after, Sylvia had even more opportunity to learn about the oceans and marine life; her family moved to Dunedin, Florida, on a bay of the Gulf of Mexico in 1948.



In 1952, Sylvia graduated from high school and a year later she earned an Associate's degree from St. Petersburg Junior College. Then she earned a Bachelor's degree from Florida State University in 1955 and a Master's degree from Duke University one year later. Sylvia feels that her aunt, Helen Richie, a teacher, was an inspirational force in her academic pursuits.

Sylvia began her doctoral work at Duke University in 1956, where she worked with Dr. Harold Humm, investigating algae. The following year, she married John (Jack) Taylor. Sylvia and Jack went to work for the National Park Service and, in 1960, their daughter Elizabeth was born. Two years later, they had a son, Richie.

What interested her during her early career years?

In 1964, Sylvia was invited on a 6-week voyage to the Indian Ocean on the vessel *Anton Bruun*. At that time, it was very unusual for a woman to be part of this type of expedition. For the next two years, Sylvia went on many expeditions while completing coursework and working on her doctoral research. She developed a strong network of colleagues and friends during these expeditions. While Sylvia traveled, her parents and husband looked after the two children.

When Sylvia became Dr. Sylvia Earle, earning her doctoral degree (Ph.D.) in botany from Duke University, her *doctoral dissertation* (that is, the summary of her research findings) was enti-

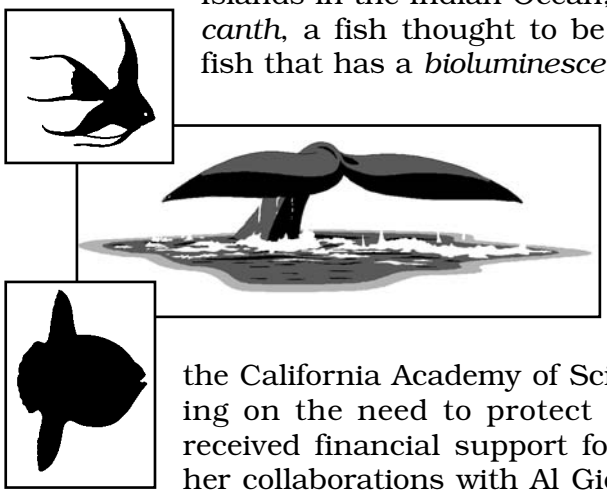
tled "*Phaeophyta* [brown algae] of the Eastern Gulf of Mexico." Dr. Earle's research findings were especially important to the researchers in her field because she was able to monitor and show significant changes in the *flora* (plants) and *fauna* (animals) in the waters of the Gulf. When Dr. Earle prepared her research findings for publication in *Phycologia*, a major international research journal, the journal editors felt that her work was so important that they devoted the entire issue of the journal to her findings. Her work also was significant because she was one of the first researchers in marine science to use scuba equipment, which had been developed by explorers Jacques-Yves Cousteau and Emile Gagnan in 1943.

Dr. Earle continued to be interested in exploring marine life firsthand at various depths in the ocean. In 1968, she made history when she joined the Man-in-the-Sea Project in the Bahamas and descended in a vehicle called the Deep Diver. She was the first woman scientist to look at the ocean through the windows of a *lock-out* submersible, one that can be pressurized so divers can swim in and out. She was also the first pregnant woman to undertake such a task. Four months later, Dr. Earle and her second husband, Giles Mead, celebrated the arrival of their daughter, Gale.

Dr. Earle moved to California in 1970 and became involved in the Tektite Project, jointly sponsored by the U.S. Navy, the U.S. Department of the Interior, NASA, and the Smithsonian Institution. The Tektike Project built an underwater habitat near the Virgin Islands. Scientists lived and worked in this underwater city, 50 feet under the surface. Dr. Earle led Tektite II's Mission 6, an all-female team. Her love for and commitment to the oceans was deepened during the 2 weeks of the mission. She was named "Woman of the Year" by the *L.A. Times* newspaper as a result of her dedication to the study of ocean life.

What did Sylvia find on her expeditions?

After the Tektite mission, Dr. Earle set out on a series of deep sea expeditions, including exploring the oceans around the Galapagos Islands and gaining more experience in *saturation diving* from an underwater habitat in the Florida Keys. On an expedition to the Comoro Islands in the Indian Ocean, the team hoped to find a living specimen of a *coelacanth*, a fish thought to be extinct. Instead, she found *Photoblepharon*, a rare fish that has a *bioluminescent* (glowing) spot under each eye. Later, she explored the Truk Lagoon with Al Giddings, a prominent underwater photographer and filmmaker. This lagoon is a graveyard of sunken Japanese World War II ships. They found these ships to be a living laboratory, covered with living marine creatures.



In 1976, Dr. Earle moved to San Francisco and became a research associate in aquatic biology at the California Academy of Sciences. She spoke to the World Wildlife Fund, focusing on the need to protect and preserve the oceans; she also asked for and received financial support for various conservation efforts. Dr. Earle continued her collaborations with Al Giddings, bringing the wonder of the oceans to people

throughout the world. Earle and Giddings, along with several whale experts, spent three months on a ship, studying and filming whales; their work was used to create the movie, *Gentle Giant of the Pacific*, narrated by Richard Widmark. In 1978, Earle, Giddings, and Christopher Dann, a former World Wildlife Fund director, created the Ocean Trust Fund.

Why is Dr. Earle called "Her Deepness"?

In 1979, Dr. Earle made a 1,250-foot dive into deep ocean waters using a *Jim Suit*, a metal diving suit that maintains a normal atmospheric pressure inside the suit (as would a suit worn by an astronaut) and allows divers to go to depths of up to 1,500 feet. By comparison, a diver using scuba equipment can't go much further than 150 feet deep. The Jim Dive is the deepest dive ever made without a cable to the surface. It was because of the dive that Dr. Earle was given the nickname of "Her Deepness." Over the course of her career, Dr. Earle has logged more than 6,000 hours of diving time (Lemonick, 1995).

Helping scientists to explore the deepest ocean floor

In 1981, Dr. Earle founded a new corporation, Deep Ocean Engineering, Inc. with Graham Hawkes, a British engineer. Their first project was to design a submersible vehicle called the *Deep Rover*, which carries one to two people and can descend 3,300 feet below the surface, providing life support for the crew for a week. The Deep Rover has a spherical acrylic hull that gives the pilot a 360-degree view of the surrounding ocean (Lemonick, 1995). In 1985, Dr. Earle made record-making dives in California — the deepest solo dives ever made — and in 1988, Dr. Earle used the Deep Rover to examine Crater Lake in Oregon.

Why is deep ocean exploration important?

Dr. Earle stated, "I think there's a perception that we have already explored the sea. The reality is we know more about Mars than we know about the oceans" (Lemonick, 1995). According to a recent article in *Time* magazine, many scientists feel that exploring the oceans could provide enormous rewards: "Oil and mineral wealth to rival Alaska's North Slope and California's Gold Rush; scientific discoveries that could change our view of how the planet — and the life-forms on it — evolved; natural substances that could yield new medicines and whole new classes of industrial chemicals. Beyond those practical benefits there is the intangible but real satisfaction that comes from exploring the earth's last great frontier" (Lemonick, 1995).

The work of Dr. Sylvia Earle and future scientists who choose to follow in her footsteps will continue to bring to light the secrets of the oceans. Perhaps one day, as both space exploration and oceanographic exploration progress, we will have the option to live and work among the stars, on the land, or among the diverse creatures of the earth's oceans.

SUGGESTIONS FOR TEACHERS

ACTIVITY #1: Marine Habitat Rummy

Purpose

To reinforce the knowledge of the characteristics of several marine invertebrate groups within an ecological framework. This activity is designed for a first year biology course and works best as a review or reinforcement activity during an invertebrate unit.

Objectives

1) To identify components of habitat as food, water, shelter, and space;
2) To identify specific features characteristic of the following phyla: porifera, coelenterates, echinoderms, mollusca, and arthropods;
3) To apply knowledge of the components of habitats to the special features of animals living in the ocean.

Materials

For each group of two to three students

- a copy of the Chart "Animal Habitat Information" on page 146
- 1 set of the "Marine Habitat Rummy Cards" on pages 147-149
- photos and illustrations of the creatures featured in the rummy game
- class notes, labs, and other reference materials focusing on these various phyla

Before You Begin

1) Prepare a set of the "Marine Habitat Rummy Cards" (see pages 147-149) for each group of students. If possible, photocopy pages onto card stock.
2) Find photos and illustrations of the creatures featured in the rummy game.

Safety Considerations

None.

Questions to Ask

- What is a habitat? What are the components of a habitat?
- What happens when one component of a habitat is affected? Example: a fire causing loss of natural shelter.
- How does the mobility of an animal affect its habitat?
- What relationships occur among invertebrates living in the ocean?
- What impact would an oil spill have on invertebrate life in the ocean?
- What kind of an experiment could you design to explore the effects of a pollutant on a particular invertebrate?

Where to Go From Here

- Have students develop their own set of cards based on their knowledge of the other phyla and their habitats.
- Have students make an illustrated chart of marine animals that sting or bite and show the effect each has on humans.
- Help students remember the various characteristics of the marine phyla by having the students prepare ads, puns, one-liners, or jokes about the various marine phyla. For example: "Call Porifera...we can soak up your problems," or "Call The Echinoderm Talent Agency...and we'll make you a star."
- Students can draw a comic strip about one of the marine creatures featured in the rummy game.
- Students can make a diorama of marine life.
- Have students make a food web of 15 marine plants and animals.
- Have students make a nature picture out of seashells or seaweed.
- Ask students to design a poster, postage stamp, or ad campaign honoring Sylvia Earle and her contributions to marine biology.
- Students can design an underwater city on paper or prepare a three dimensional model.
- Have students write a science fiction story starring a coelenterate, a porifera, and an echinoderm.
- Encourage students to become involved with one of the many agencies trying to protect the oceans. Have them write letters to legislators, prepare brochures describing the destruction of the oceans, hold a

fundraiser and donate the money to agencies working to protect the oceans.

Ideas for Assessment

- Evaluate cooperative learning teams with team evaluation forms.
- Evaluate a team poster focusing on Sylvia Earle and her work as it relates to our knowledge of invertebrates.
- Evaluate an experimental design protocol focusing on the effects of pollutants on ocean life.

References and Resources

✓*By Sylvia Earle:*

Sea Change: A Message of the Oceans. (1995). New York: Putnam Publishing.

A walk in the deep. (1981). *National Geographic, 157*, p. 624-631.

Undersea world of a kelp forest. (1980). *National Geographic, 158*, p. 411-426.

Humpbacks: The gentle whales. (1979). *National Geographic, 155*, p. 2-25.

Life springs from death in Truk Lagoon. (1976). *National Geographic, 149*, p. 578-603.

Tektite 11: Part two, all-girl team tests the habitat. (1971). *National Geographic, 140*, p. 290-296.

✓*About Sylvia Earle and/or ocean exploration:*

Gomez, L. (September/October 1995). On the water front. *Modern Maturity*, p. 46-51.

Lemonick, M. D. (August 14, 1995). The last frontier. *Time*, p. 52-60.

Stover, D. (April 1995). Queen of the deep. *Popular Science*, p. 67.

Vanderwalker, J. G., & Littlehales, B. (1971). Tektite 11: Part one, science's window on the sea. *National Geographic, 140*, p. 256-289.

White, W. (July 3, 1989). Profiles: Her deepness. *The New Yorker*, p. 41-65.

✓*About the activity:*

Adapted with permission from Habitat Rummy, (1985). *Project WILD K-12 Activity Guide*, Western Regional Environmental Education Council. To locate the Project WILD Coordinator in your state, contact the headquarters at 5430 Grosvenor Lane, Bethesda, MD 20814, (301) 493-5447, fax (301) 493-5627.

✓*Photo credit:*

Photos on pages 139, 142, and 143 courtesy of Sylvia Earle, Deep Ocean Engineering, Inc., San Leandro, CA.

Chart:
Animal Habitat Information

	Animal					
Habitat Component	**Sponge** ***(Porifera)***	**Jellyfish** ***(Coelenterate)***	**Coral** ***(Coelenterate)***	**Squid** ***(Mollusk)***	**Starfish** ***(Echinoderm)***	**Hermit Crab** ***(Crustacean)***
Food	Filters microbes through pores	Fish and other marine organisms	Plankton-like animals	Fish	Oysters and clams	Beach scavenger
Water	Lives in ocean waters	Found on the surface of oceans	Found in shallow seas	Found at all levels of the ocean	Lives on ocean floor	Found at the seashore
Shelter and Space	Attaches to rocks and shells on ocean floor in shallow water	Floats adrift on ocean surface	Forms reefs in warm, shallow areas	Prefers deeper water than octopus; common on both U.S. coasts	Bottom-dwelling on ocean floor	Lives in tide pools or shallow water
Mobility	Sessile (not mobile)	*Medusa* form is free-floating	Sessile (not mobile)	Jet-propelled; mobile; active swimmer	Moves with tube feet	Walks along the beach
Special Characteristics	Resembles plants; produces ciliated motile (swimming) larvae	Stinging cells; bell-shaped; long tentacles; central digestive cavity	Resembles flowers; stinging cells; nocturnal; symbiotic relationship with algae	Predatory; internal shell with soft body; travels in schools	Spiny skinned	Carries shells from periwinkles as protection

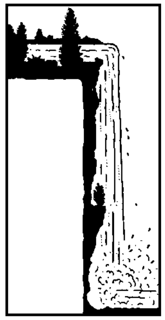
Marine Habitat Rummy Cards

SPONGE *(Porifera)*

FOOD

filters microbes through pores

WATER

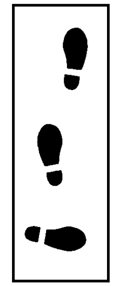


lives in ocean waters

SHELTER AND SPACE

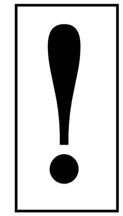
attaches to rocks and shells on ocean floor in shallow water

MOBILITY



sessile (not mobile)

SPECIAL CHARACTERISTICS



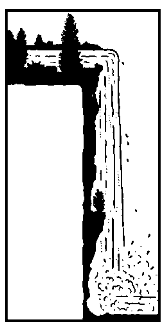
resembles plants; produces ciliated motile (swimming) larvae

JELLYFISH *(Coelenterate)*

FOOD

fish and other marine organisms

WATER

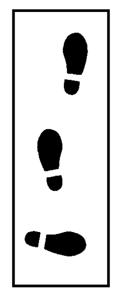


found on the surface of oceans

SHELTER AND SPACE

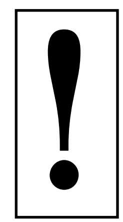
floats adrift on ocean surface

MOBILITY



medusa form is free-floating

SPECIAL CHARACTERISTICS



stinging cells; bell-shaped; long tentacles; central digestive cavity

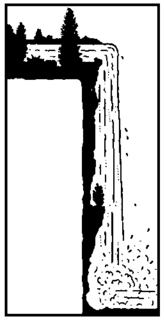
Marine Habitat Rummy Cards (continued)

CORAL *(Coelenterate)*

FOOD

plankton-like animals

WATER

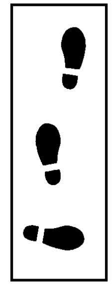


found in shallow seas

SHELTER AND SPACE

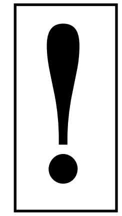
forms reefs in warm, shallow areas

MOBILITY



sessile (not mobile)

SPECIAL CHARACTERISTICS



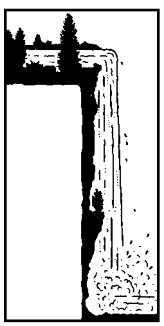
resembles flowers; stinging cells; nocturnal; symbiotic relationship with algae

SQUID *(Mollusk)*

FOOD

fish

WATER

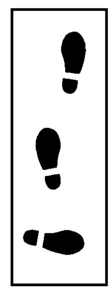


found at all levels of the sea

SHELTER AND SPACE

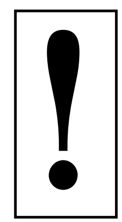
prefers deeper water than octopus; common on both U.S. coasts

MOBILITY



jet-propelled; mobile; active swimmer

SPECIAL CHARACTERISTICS



predatory; internal shell with soft body; travels in schools

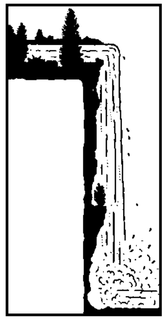
Marine Habitat Rummy Cards (continued)

STARFISH *(Echinoderm)*

FOOD

oysters and clams

WATER

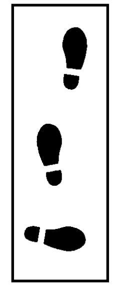


lives on ocean floor

SHELTER AND SPACE

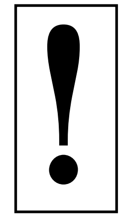
bottom-dwelling on ocean floor

MOBILITY



moves with tube feet

SPECIAL CHARACTERISTICS



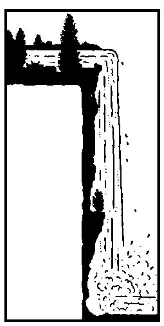
spiny skinned

HERMIT CRAB *(crustacean)*

FOOD

beach scavenger

WATER

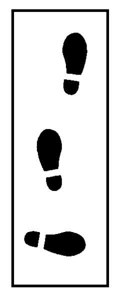


found at the seashore

SHELTER AND SPACE

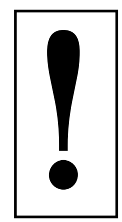
lives in tide pools of shallow water

MOBILITY



walks along the beach

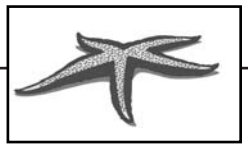
SPECIAL CHARACTERISTICS



carries shells from periwinkles as protection

ACTIVITY #1: Marine Habitat Rummy





How to Play the Game

1. The object of the game is for a player to get five cards (one book) from one vertical column of the Chart "Animal Habitat Information" on page 146.

2. The game ends when all books (all complete sets of habitat components) have been made.

3. The winner is the person with the greatest number of complete books.

4. The game begins as one student deals five cards to each of the players in the group.

5. The first player may discard an unwanted card and select another from the remaining deck.

6. Play progresses around the circle with discarded cards being added to the leftover cards in the center and new cards being drawn until one player gets a book. When a player does get a book, he or she calls out "Marine Habitat!" This process continues until all "habitats" are completed.

7. By the end of the game, you should be able to summarize what you have learned about marine habitats and some of the creatures living in the oceans!