



Islands in the Stream 2002: Exploring Underwater Oases

The Sea with No Shores

FOCUS

Sargassum ecosystem in the Sargasso Sea

GRADE LEVEL

5-6

FOCUS QUESTION

Do *Sargassum* mats in the Sargasso Sea support life?

LEARNING OBJECTIVES

Students will be able to infer why the brown alga, *Sargassum*, is likely to be home to many marine organisms.

Students can infer that the populations of organisms in the *Sargassum* are dependent on each other for survival.

ADDITIONAL INFORMATION FOR TEACHERS OF DEAF STUDENTS

In addition to the words listed as Key Words, the following words should be part of the vocabulary list.

Salinity

Nitrates

Phosphates

Ecosystems

Alginate

There are no formal signs in American Sign Language for any of these words listed as key words and many are difficult to lipread. Having the vocabulary list on the board as a reference during the lesson will be extremely helpful. The first „Me Connection% activity is excellent to allow students to tie home into the lesson. The reading in

this activity may be difficult for some deaf students to grasp. It would be helpful to go over the direction sheet prior to the activity to be certain they understand all the vocabulary and directions.

MATERIALS

- 1 *Sargassum* Organism Student Sheet per group
- 1 *Sargassum* Organism Teacher Guide
- The Sea Within A Sea* by Ruth Heller
- 2 sheets of chart paper
- Bulletin board
- Light blue bulletin board paper (enough to cover the bulletin board)
- 1 pair of scissors per student
- 10 bottles of glue or 10 glue sticks (2 per group)
- 1 stapler or 1 package of 100 tacks
- 5 packs of markers or crayons (1 per group)
- 10 paper plates (2 per group)
- 1 package of card stock paper
- 5 newspapers (for stuffing three-dimensional animals)
- 5 packs of multi-color construction paper (1 per group)
- Reference books and/or computers to access websites
- 1 package of dark blue yarn
- Photographs of animals that live in *Sargassum* seaweed. Use photos from books or encyclopedias. Download photos from the Internet. See Resources list - #5, #8, #12, #14, #16, & #18.
- Student Science Journal or other paper for individual student reflection during activity

AUDIO/VISUAL MATERIALS

Computers to access the Internet

TEACHING TIME

Three to four 45-minute periods

SEATING ARRANGEMENT

Five groups of five students

MAXIMUM NUMBER OF STUDENTS

25

KEY WORDS

Sargassum
Jacks
Sea turtle
Sargassum pipefish
Dolphin fish
Sargassum sea slug (nudibranch)
American eel
Sargassum crab
Algae
Sargassum fish (angler fish)
Flying fish
Symbiosis
Sargassum hydroids
Sargassum shrimp
Anemones
Bryozoans

BACKGROUND INFORMATION

The Sargasso Sea is an area in the northwest Atlantic Ocean bordered by the Gulf Stream, the North Atlantic Current, the Canary Current and the North Equatorial Current. It is estimated to be between 20 N and 35 N latitude and 30 W and 70 W longitude. Because it is bordered by these currents, the Sargasso Sea is a slowly rotating body of water. The weather and water are very warm, humid, and calm. It has a high evaporation rate of water and little rainfall, which causes the Sargasso Sea to have high salinity (about 37 ppt). There are clumps, clusters, and mats of the brown algae, *Sargassum*. It is thought to have originally broken off from *Sargassum* in the West

Indies, but some scientists do not agree with this theory. This *Sargassum* provides refuge, habitat, and breeding grounds for many diverse kinds of organisms such as hatchling sea turtles, *Sargassum* fish, crabs, hydroids, flying fish, shrimp, anemones, bryozoans, jacks, and eels. In addition, these animals produce wastes composed of nitrates and phosphates which the *Sargassum* uses for nutrients. This symbiotic relationship is beneficial to both animals and plants. These organisms live within a unique ecosystem in the northwestern portion of the Atlantic Ocean, very different from the marine environment that surrounds it.

LEARNING PROCEDURE

The following procedure is adapted from the activity entitled "A Web on the Wall" found in *Ranger Rick's NatureScope: Diving Into Oceans*.

1. Duplicate the *Sargassum* Organism Student Sheet five times (or as many groups of five students as there are in your class).
2. Tell students that you are going to take an imaginary trip to a diverse ecosystem. They should listen to the story about this special ecosystem and try to imagine that they are there. Read the book, *The Sea Within A Sea*, by Ruth Heller. Hide the cover of the book and leave out all the references to *Sargassum*, seaweed, and the Sargasso Sea as you read.
3. Have a discussion about where they think the story takes place. Then read the book again in its entirety as you show each picture. Tell them where they really are and that the *Sargassum* in the Sargasso Sea is an ecosystem that contains many unusual populations of animals and plants, just like the pictures they saw in the book. Record what they know about the Sargasso Sea on a sheet of chart paper. Let them know that they will be investigating this unusual "sea" filled with biodiversity.
4. Pass out a *Sargassum* Organism Student Sheets and index cards (one or two per student) to each

group. This is just a small sampling of all the hundreds of organisms that live in or near the *Sargassum*.

5. Have each student research one of the organisms on the Student Sheet. Have the students find any information about the following for the organism on the selected card: feeding habits, habitat, characteristics, adaptations and reproduction. They may wish to use the websites and books listed in the Resource Section of this activity if needed. Encyclopedias may be helpful as well. Have them record the information on the bottom of each card and make a drawing of the organism on the top of the card.
6. When everyone has finished their research, make another chart labeled "*Sargassum* Ecosystem Facts." Have each student write one fact that they learned on the chart paper. Discuss what they have learned since they made the first chart. Refer to the *Sargassum* Organism Teacher Cards for information. Tell students that many of the organisms depend on the *Sargassum* for food and shelter. Also tell them that the *Sargassum* depends on the ammonia and phosphates that many animals emit as waste for nutrition. This creates a symbiotic relationship. Compare and contrast their predictions to their real findings.
7. Then tell the students they will be making a three-dimensional bulletin board using what they have learned about the *Sargassum* ecosystem. Each child should use the information and drawing on their card to make a figure for the bulletin board. They should form a paper ecosystem on the bulletin board, putting populations of like species together. Add the animal's prey if it is not included on the bulletin board. They should not forget the sun to begin the food chain.
8. Pass out the following supplies to each table: one pack of construction paper, 5 pairs of scissors, two bottles of glue, several sheets of cardstock paper, 2 paper plates, a newspaper and a pack-

age of markers or crayons.

9. Using the information that they have learned from research, each student will make at least one three-dimensional figure of his/her plant or animal using the supplies on their table. If students finish their organism before others are finished, they should do research to find another type of *Sargassum* organism that is not listed on the card. Make a 3-D figure using the results of this research.
10. The figures will be stapled or tacked on the bulletin board. Students will use yarn to connect organisms with their prey on the bulletin board. Have students infer that the yarn connections represent a food web. Discuss characteristics of a food web.
11. Discuss the accuracy of the bulletin board when it is finished.
12. Students should write their understandings and drawings about the Sargasso Sea in their science journal.

THE BRIDGE CONNECTION

www.vims.edu/bridge/biology

THE "ME" CONNECTION

Find ingredients on food labels that contain alginate. This ingredient comes from brown algae, of which *Sargassum* is a species. Do the activity from the OCEAN PLANET website called "There are Algae in Your House!"

Research how seaweed can be used to make medicines.

Find out how *Sargassum* and any other plant in the ocean helps produce oxygen for us to breathe and gets rid of carbon dioxide, especially that given off by burning fossil fuels.

CONNECTIONS TO OTHER SUBJECTS

English/Language Arts - Read books or Internet articles about the Sargasso Sea, *Sargassum* and the *Sargassum* ecosystem (or use the facts that students wrote on chart paper). Then read Part 2, Chapter 11, of *20,000 Leagues Under the Sea*. Use a Venn diagram to compare and contrast Jules Verne's description of the Sargasso Sea with the descriptions of the real Sargasso Sea. (See Resource section for a web site that contains the Sargasso Sea chapter from *20,000 Leagues Under the Sea*.)

Geography - Locate the Sargasso Sea on a world map using latitudes and longitudes. Draw an approximate oval of its location. Add the locations of currents that surround it.

EVALUATION

Students are evaluated on the accuracy of the facts that they wrote on their cards. Students are evaluated on their ability to construct an accurate *Sargassum* ecosystem on the bulletin board. Evaluate student writings and drawings about the Sargasso Sea in their science journal.

EXTENSIONS

Research sea animals and plants that live in the water column below the *Sargassum* mat (middle level and deep sea) in the Sargasso Sea. Make a classroom environment (mobiles, wall hangings, posters, etc.) of the *Sargassum* ecosystem using animals and plants from all levels of the water column in the Sargasso Sea.

Find out why the Sargasso Sea gets little rainfall.

Investigate how *Sargassum* reproduces. If possible, obtain a piece of living or dead *Sargassum* for students to observe and identify its structures with their naked eyes and with a microscope.

Students compare and contrast a land food chain to a *Sargassum* food chain using a chart or a Venn diagram.

Find examples of other symbiotic relationships.

Visit an aquarium. Have a scavenger hunt to find any of the *Sargassum* animal or plant species.

RESOURCES

Heller, Ruth. *A Sea Within A Sea*. New York: Grosset & Dunlap, 2000.

Ranger Rick's NatureScope: Diving Into Oceans. Volume 4, No. 2, Philadelphia: Chelsea Publishers 1997.

Schweid, Richard. *Consider the Eel*. Chapel Hill: University Of North Carolina Press, 2002.

Dipper, Frances. *Extraordinary Fish*. New York: DK Publishing, Inc., 2001, pp. 88-89.

Wallace, Karen. *Think of an Eel*. Cambridge: Candlewick Press, 2001.

<http://oceanexplorer.noaa.gov> - Follow the South Atlantic Bight Expedition daily as logs and discoveries are posted. Also, see the article entitled "A Profile of the Point" at

http://oceanexplorer.noaa.gov/80/explorations/islands01/background/islands/sup8_thepoint.html

<http://.aoml.noaa.gov/general/lib/seagrass.html> - This NOAA web article is somewhat complex for fifth and sixth graders, but teachers could interpret sections as needed, especially the parts describing the *Sargassum* food web.

http://jv.gilead.org.il/martin/20000_2-11.html - Part 2, Chapter 11 (The Sargasso Sea) Jules Verne, *20,000 Leagues Under the Sea*.

<http://mbgnet.mobot.org/salt/plants/sargass.htm> - Information on *Sargassum*, the Sargasso Sea and the *Sargassum* fish.

<http://www.ccturtle.org/bermuda/environment.htm> - Describes the special environment of Bermuda and the effect of the Sargasso Sea on it.

http://www.ccturtle.org/a_Sargassum.htm - Ecological information about the importance of the Sargasso Sea mats and why we should protect them from being harvested.

http://seawifs.gsfc.nasa.gov/OCEAN_PLANET/HTML/search_educational_materials.html - A list of great educational resources from the Ocean Planet website. The second listing, "There are Algae in Your House!" is a lesson plan about finding food products that contain types of marine algae.

http://www.discover.com/mar_02/featsea.html - This article, entitled "The Sea of Life", appears in *Discover* magazine in the March, 2002, Issue. It outlines why the Sargasso Sea can be described as a nursery of biodiversity.

<http://www.tamug.tamu.edu/marb/estuarin/reports97/sargass.html> - An article about *Sargassum* weed and the animal community that depends on it.

<http://www.ucmp.berkeley.edu/chromista/browns/phaeolh.html> - This article about brown algae includes a close-up photo of *Sargassum* and a short article about the Sargasso Sea.

<http://www.extraweb.com/pirates/sargasso.htm> - An article with information, history, legends, diagrams, and satellite photographs of the Sargasso Sea.

http://www.globaldialog.com/~jrice/algae_page/Sargassum.htm - A nice description of *Sargassum* and "The Sargassum City."

<http://www.wkpp.org/articles/Science/Wisenbaker3.html> - An article about the freshwater eels that migrate to the Sargasso Sea to reproduce.

<http://www246.pair.com/iq3d/stock/findimage.htm> - Lots of great photos of flora and fauna at the Image Quest 3-D web site. Scroll down the page to the bottom and type "gulf weed community" in the search box for great photos of animals and plants in the Sargasso Sea.

<http://www.pictonb.freemove.co.uk/nudibranchs/scypel.html>

- A very descriptive article about the nudibranch, *Scyllaea pelagica*, which lives in the Sargasso Sea.

NATIONAL SCIENCE EDUCATION STANDARDS

Content Standard A: Science as Inquiry

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

Content Standard C: Life Science

- Reproduction and heredity
- Regulation and behavior
- Populations and ecosystems
- Diversity and adaptations of organisms

Content Standard G: History and Nature of Science

- Nature of science

FOR MORE INFORMATION

Paula Keener-Chavis, National Education Coordinator/Marine Biologist
NOAA Office of Exploration
Hollings Marine Laboratory
331 Fort Johnson Road, Charleston SC 29412
843.762.8818
843.762.8737 (fax)
paula.keener-chavis@noaa.gov

ACKNOWLEDGEMENTS

This lesson plan was produced Robin Rutherford, Porter Gaud School, Charleston, SC for the National Oceanic and Atmospheric Administration. If reproducing this lesson, please cite NOAA as the source, and provide the following URL:

<http://oceanexplorer.noaa.gov>

Student Handout

Sargassum Organism Student Sheet

Write the name of each organism on an index card. Do your research and record the information you find on the index card.

Sargassum

Sargassum Fish

Flying Fish

Pipefish

Nudibranch

Sargassum Crab

Freshwater Eel

Sea Turtle

Dolphin Fish

Jack

Bryozoan

Sargassum Shrimp

Sargassum Organism Teacher Reference

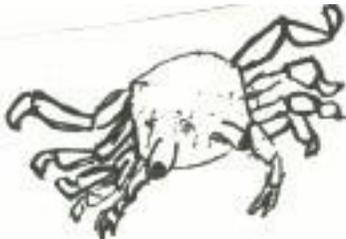
Sargassum (*Sargassum fluitans/nutans*)



Free-floating brown algae composed of stems, leaves and floats. An estimated 7 million tons of *Sargassum* live in the Sargasso Sea. It reproduces when pieces break off and begin growing as a new plant. Bryozoans, encrusting invertebrates, often cover the leaves. As they multiply, they weigh down the leaves and eventually pull the plant to the bottom where it decomposes and becomes food to other organisms.

Sargassum Crab (*Portunus*)

This animal is a generalist carnivore, meaning that



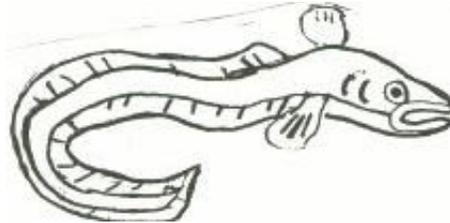
it eats all kinds of animals on the *Sargassum*. This animal resembles a marsh crab, but is specially camouflaged to look like the *Sargassum*.

Sargassum Fish (*Histrio histrio*)



This fish is perfectly camouflaged in the *Sargassum*. It may eat *Sargassum*, invertebrates, fish eggs, smaller fish and shrimp. It attracts its prey by a lure at the end of its snout.

Freshwater Eel (*Anguilla rostrata*)



All eels from rivers in North America and Europe come to the Sargasso Sea to spawn in the fall. The larvae, which look like small, clear willow leaves, hatch here. After the adult eels spawn they die and fall to the ocean floor as food for other animals.

Flying Fish (Family: *Exocoetidae*)



Flying fish lay their eggs in long strings anchored to the *Sargassum*. They are pursued by larger fish from the surrounding area. However, the flying fish use the *Sargassum* to hide from their predators.

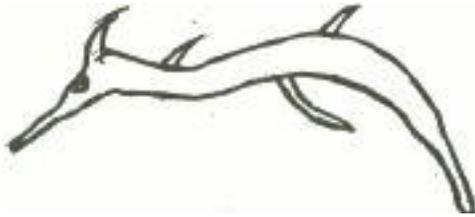
Sea Turtles



After hatching on beaches along the east coast, young turtles swim to the Sargasso Sea for shelter and food. Hiding in the *Sargassum* mats helps increase their survival chances and also provides food sources like shrimp and crabs. They sometimes even eat *Sargassum* floats and leaves.

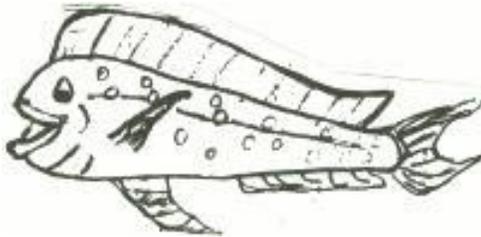
Sargassum Organism Teacher Reference - pg 2

Pipefish (*Syngnathus pelagius*)



This relative of the seahorse has excellent camouflage with the *Sargassum*. It is brownish-green and covered by flaps of skin that resemble the *Sargassum* blades.

Dolphin Fish (Family: *Coryphaenidae*)



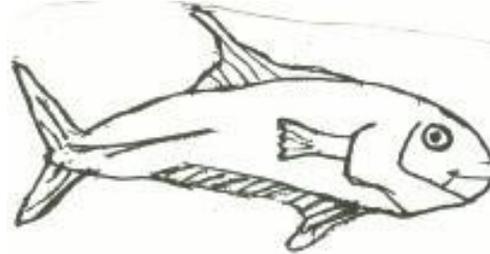
The dolphin fish come here to breed. It takes shelter under the *Sargassum* mats because of the availability of prey such as jack, flying fish, puffers, file fish, and trigger fish.

Nudibranch (*Syllaea pelagica*)



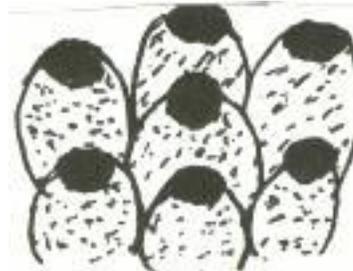
This invertebrate is green or brown in color with white patches. These colors are great camouflage with the *Sargassum*. It feeds on tiny hydroids that are attached to the *Sargassum*.

Jack (Family: *Carangidae*)



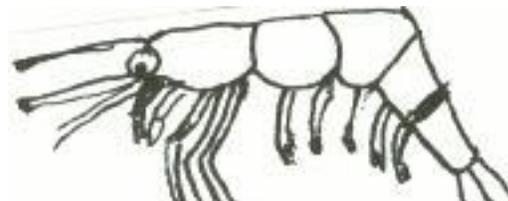
Adult jacks spawn in the Sargasso Sea. Young fish live in the protective branches of *Sargassum*. They feed on shrimp and young fish.

Bryozoan (*Stenolaemata*)



A bryozoan is an aquatic invertebrate living for most of its life in colonies. The bryozoan can encrust on algae, shells and other surfaces. They feed on diatoms and other one-celled organisms. They are prey for sea urchins and fish.

Sargassum Shrimp



This invertebrate can be up to an inch long. It can feed on other smaller animals that live on the *Sargassum* weed. It is perfectly camouflaged in the *Sargassum*, as each organism is colored slightly differently to blend in with different parts of the *Sargassum*.