



NEW BEDFORD OCEANARIUM

WOW Mobile Curriculum

Our Living Waters: Algae, Seaweeds, and Marine Plants

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Introduction

This curriculum explores seaweed and other marine plants. Seaweeds are members of the algae family of organisms that capture light energy through photosynthesis. Photosynthesis is a process used by plants to manufacture their own food. Photosynthesis begins when light strikes a plant's leaves. Cells in the leaves, called chloroplasts, contain a green pigment called chlorophyll. When the light strikes the plant, the chlorophyll goes to work and, through a chemical reaction using water and carbon dioxide, produces food for the plant in the form of sugars. The plant uses some of this food immediately; the remainder is either stored in the plant as starch, fats or oils, or is used to build plant tissues. Photosynthesis is an important step in the food chain which connects all living things. Every creature on earth depends to some degree on green plants for food or oxygen. The oxygen that is released by the process of photosynthesis is an essential exchange for all living things.

There are three types of seaweed: greens, browns, and reds. All play significant roles in the marine environment. Seaweeds grow mostly in shallow marine waters and are dominant producers in the coastal zone. Seaweeds are a source of food and shelter for a great variety of marine organisms. Humans use some types of seaweed for food and other purposes. Seaweed is used as an additive to food and pharmaceuticals. It is widely used as a thickening agent in ice cream, to stop large ice crystals from forming. It makes chocolate milk creamier and holds the cocoa in suspension. It is also used in toothpaste and face creams. Worldwide, the seaweed business is estimated to be worth at least one billion dollars.

This curriculum module is one in a series of curricula that explore the connections between the natural environment and our social, cultural, and economic systems. Through this unit students learn that the ocean connects us to each other in ways that we are continually discovering.

Learning Experiences

The development of the unit and learning experiences in this curriculum unit was guided by the following *Understanding by Design* (UbD) principles:

- **W** The students know **where** they are going and **why**. They also know **what** is expected and required and how they will be evaluated.
- **H** Students are **hooked** or engaged in working with the enduring understandings and essential questions.
- **E** Students have opportunities to **explore** enduring understandings and essential questions and receive instruction they need for the required assessments.
- **R** Students have opportunities to **rethink, revise, and refine** their work based on feedback.
- **E** Students have opportunities to **evaluate** their own work and set learning goals.
- **T** Instruction is **tailored** to the needs of individual students using:
 - Differentiated instruction
 - Content area literacy strategies
 - Cooperative learning
 - Opportunities for oral language
- **O** **Organized** and sequenced

Sequence of Learning Experiences (LE's)

- LE One: Seaweed Observation and Identification
- LE Two: Seaweed in the Intertidal
- LE Three: So Why All the Fuss about Seaweed
- LE Four: Seaweed Pudding

Assessment and Evaluation

Each learning experience has been planned to give students the knowledge and skills necessary to meet the final assessment requirements. The teacher should allow time, throughout the unit, for students to form groups, plan, and research information for the final performances. The teacher should also work with students, throughout the unit, to develop criteria and rubrics for successful completion of the performances. Models and directions for creating rubrics can be found at

<http://school.discovery.com/schrockguide/assess.html#rubrics>

Stage 1 – Desired Results

Established Goals – Standards Massachusetts State Curriculum Frameworks

Science and Technology: Grades PreK – 5 and 6 – 8

Life Science:

PreK – 2

- 2.6 Recognize that people and other animals interact with the environment through their senses of sight, hearing, touch, smell and taste.
- 2.8 Identify the ways in which an organism’s habitat provides for its basic needs (plants require air, water, nutrients, and light; animals require food, water, air and shelter).

3 – 5

- 2.1 Classify plants and animals according to the physical characteristics that they share.
- 2.4 Give examples of how inherited characteristics may change over time as adaptations to change in the environment that enable organisms to survive, e.g., shape of beaks or feet, placement of eyes on head, length of neck, shape of teeth, color.
- 2.7 Give examples of how changes in the environment (drought, cold) have caused some plants and animals to die or move to new locations (migration).
- 2.10 Give examples of how organisms can cause changes in their environment to ensure survival. Explain how some of these changes may affect the ecosystem.

6 – 8

- 2.10 Give examples of ways in which genetic variation and environmental factors are causes of evolution and the diversity of organisms.
- 2.13 Give examples of ways in which organisms interact and have different functions within an ecosystem that enables the ecosystem to survive.
- 2.16 Recognize that producers (plants that contain chlorophyll) use the energy from sunlight to make sugars from carbon dioxide and water through a process called photosynthesis. This food can be used immediately, stored for later use, or used by other organisms.

Enduring Understandings

- The natural environment—particularly the ocean—plays a central role in shaping people, their cultures, and commerce.
- A reciprocal relationship exists between humans and Earth’s natural systems.
- Ocean and terrestrial systems are linked through food webs.
- Evolution explains both the unity and diversity of life.

Essential Questions

- How do food webs link ocean and terrestrial systems?
- How do researchers collect data and analyze the information?
- How can observation and classification serve as tools for understanding the natural environment?

Know: Students will:

- Identify the three classifications of seaweed (red, brown, and green);
- Describe the observable differences between different types of seaweed;
- Explain why the structure of seaweed is important to its survival;
- Describe why seaweed has different photosynthetic pigments;
- Describe the zones within a rocky intertidal zone; and
- Describe at least three chemicals extracted from seaweed for human use.

Skills: Students will be able to:

- Use observation skills to describe scientific phenomena;
- Classify data;
- Draw conclusions from data;
- Compare and contrast data; and
- Use visual images to create a representation of the intertidal zone

Stage 2 – Assessment Evidence

Performance Tasks

- Students will develop and deliver a presentation that demonstrates their understanding of the kinds of seaweed and how seaweeds grow and are used by humans. Their presentations should include a discussion of how they gathered analyzed, classified, and organized data to make inferences and draw conclusions.
- The teacher and/or students should develop a rubric for the presentation.

<http://school.discovery.com/schrockguide/assess.html#rubrics>

Other Evidence (e.g. tests, quizzes, dialogues, homework, journals, other work samples)

- Labs
- Brainstorming and Class Discussions
- Journal Writing

Student Self-Assessment: How will students reflect upon and assess their own learning?

- Journal writing
- Discussion

Learning Experience One

Seaweed Observation and Identification

Author's Name: Erin B. Gordon

Disciplinary Focus of This Learning Experience

- Seaweed observation, identification and classification

Grade Level: Elementary and Middle Grades

Enduring Understandings

- The natural environment—particularly the ocean—plays a central role in shaping people, their cultures, and commerce.
- A reciprocal relationship exists between humans and Earth's natural systems.
- Ocean and terrestrial systems are linked through food webs.

Essential Questions

- How do researchers collect data and analyze the information?
- How can observation and classification serve as tools for understanding the natural environment?

State Content Standards:

Life Science:

K-2

- 2.8 Identify the ways in which an organism's habitat provides for its basic needs (plants require air, water, nutrients, and light; animals require food, water, air and shelter).

3 – 5

- 2.4 Give examples of how inherited characteristics may change over time as adaptations to changes in the environment that enable organisms to survive, e.g., shape of beaks or feet, placement of eyes on head, length of neck, shape of teeth, color.
- 2.7 Give examples of how changes in the environment (drought, cold) have caused some plants and animals to die or move to new locations.

6 – 8

- 2.10 Give examples of ways in which genetic variation and environmental factors are causes of evolution and the diversity of organisms.

Overview

- In this Learning Experience, students will observe several species of seaweeds, marine algae, and other marine plants. They will separate the plants from the algae. They will discover and explain the observable differences between the different types of seaweeds. Students in grades 6 – 8 will conduct research and classify the various plants.

Evaluation

- Class discussion
- Handout One

Materials

- Seaweeds and marine grasses (fresh or frozen collections taken at low tide along rocky coastlines that have at least three colors of seaweed and some sea grasses.)
- Handout sheet
- Local seaweeds and marine grasses identification book

Activity One: Classifying Data

- Place students in groups of four. Each group should choose a Recorder and a Presenter.
- Provide each group with a bucket containing seaweeds, sea grasses and other green plants.
- Ask each group to sort and categorize the specimens in their buckets. Remind students that there is no right or wrong way to categorize their specimens.
- When students have completed their categorization, ask them to devise a list of the categories they created along with an explanation for each category. The Recorder will record the information.
- The teacher should move from group to group, checking for understanding, noting students' ideas and thoughts.
- Process with the class. The teacher will ask each group to report out. On the board or chart paper, the teacher will record the categories as the Presenter for each group provides them. This is your opportunity to determine students' current level of knowledge.
 - How have they classified their specimens?
 - What system have they used?
 - Have they separated grasses and plants from seaweed?
 - Have they separated by color?
- Your next teaching move will depend on how students have classified their specimens. You may be able to build upon their knowledge or you may have to show them an alternative way of classifying. Be certain to acknowledge the work they have done.
- Take a bucket containing seaweed, grasses, and other plants. Separate the seaweeds from the others. (Be certain that your bucket contains green, red, and brown seaweed.)
- Show a sample of sea grass to the class. Point out and write the parts of the sea grass on the board or chart paper:
 - Roots
 - Stems
 - Leaves
- Next show students samples of seaweed. Ask students to describe what they see. They will probably notice that:
 - There are three colors of seaweed: green (Chlorophyta), brown (Phaeophyta), and red (Rhodophyta).
 - Seaweed has a structure that keeps it attached to rocks (the Holdfast).
 - Seaweed has structures that resemble leaves (called Blades).
 - Seaweed has structures that resemble stems (Stipes).
 - Some seaweeds have air-filled sacs. These are used as flotation devices to help the seaweed reach the sun (for photosynthesis).
- Explain to students that seaweed is photosynthetic and that seaweed can live only as deep as the sunlight will penetrate and around the continental shelf where there are sufficient nutrients. You will probably have to teach about or provide a review of the concept of photosynthesis. Note: "Newton's Apple," a program developed by PBS,

provides an excellent explanation of and experiment on photosynthesis.

<http://www.newtonsapple.tv/TeacherGuide.php?id=915>

- Students return to their groups. With their new knowledge, they will reexamine the seaweed from their buckets.
- As they discuss and examine the characteristics of each sample, they will individually complete Handout One. The following website will help students determine the common and scientific names of their green, brown, and red seaweed samples:

<http://oceanlink.island.net/oinfo/seaweeds/seaweeds.html>

Notes to Teachers:

- The suggested time of activity is at least one hour. The time may vary depending on length of discussion and students' understanding of various concepts.
- Further investigations:
 - Why might there be three color variations in seaweed?
 - How might chemical variations in chloroplasts with ancillary pigments help seaweeds adapt to varying lengths of sunlight that may penetrate into deeper coastal waters?

Adaptations in Color Groups of Seaweeds

- The three major color groups of seaweeds, green, brown and red, have adaptations that allow them to exploit varying light conditions under the water. On land the surface atmosphere offers little interference to the direct rays of visible light from the sun. Things are quite different in the water. Water acts as a filter and absorbs the light waves. No sunlight can penetrate much below 80 to 100 meters.
- Visible light is the combination of all the light rays that make up the color spectrum. The longer, lower-energy waves of red, orange, yellow and green are filtered out in that order and do not reach much deeper than a dozen meters. The higher-energy, shorter wavelength of blue and violet light can penetrate much deeper, to depths of over 80 to 100 meters. Below this depth there is no visible light. This massive, deeper area, the middle and deep ocean, is the largest habitat on earth. It is an area of perpetual darkness called the *aphotic zone*; no photosynthesis can take place there.
- On land and in very shallow depths the green pigment chlorophyll is able to use and absorb red and blue light bands. It reflects green light bands and appears green to your eyes for that reason. Below a few meters, green plants do not get enough red light bands to thrive. Going deeper in coastal waters, brown and red seaweeds, that have additional pigments to supplement the diminished function of the chlorophylls, replace green plants. At depths to about 30 meters, green seaweeds are replaced mainly by brown seaweeds and kelps, which, in addition to chlorophyll, can produce auxiliary carotenoid pigments xanthophyll and carotene to assist photosynthesis in these lowered light zones. Red seaweeds, which can function at the lowest light levels below 75 meters, use only the blue and violet bands of light that penetrate there. Red seaweeds produce the auxiliary phycobilin-based pigments blue phycocyanin and pink-red phycoerythrin that assist in extreme low light photosynthesis. These red seaweeds can grow in the low light of waters up to 100 meters deep and also grow well in the dim light and shaded areas around rocky ledges.

Further Investigations and extension activities:

- Web searches for auxiliary pigment and effects of light wavelengths.
- Using a disposable waterproof camera or a camera with a waterproof housing, take a series of pictures in a pool, each one-foot deeper than the previous photo, of a laminated color wheel chart. Do not use any flash bulbs. Develop film and label each photo by depth and compare with the original color wheel. What do you predict might happen? Why?

Name _____

Date _____

Seaweed Observation and Identification

Color	Common Name	Scientific Name	Drawing

Name _____

Date _____

Seaweed Observation and Identification, Continued

Color	Common Name	Scientific Name	Drawing

Questions:

How many algal species were in your bucket?

How many algal species were red, brown, or green?

Which color algae did you have the most of? Why do you think that is the case?

Learning Experience Two

Seaweed in the Intertidal

Author's Name: Erin B. Gordon

Disciplinary Focus of This Learning Experience

- Seaweed in the intertidal

Grade Level: 3 – 5 and 6 – 8

Enduring Understandings

- The natural environment—particularly the ocean—plays a central role in shaping people, their cultures, and commerce.
- A reciprocal relationship exists between humans and Earth's natural systems.
- Ocean and terrestrial systems are linked through food webs.

Essential Questions

- How do researchers collect data and analyze the information?
- How can observation and classification serve as tools for understanding the natural environment?

State Content Standards: Life Science:

3 – 5

- 2.1 Classify plants and animals according to the physical characteristics that they share.
- 2.4 Give examples of how inherited characteristics may change over time as adaptations to changes in the environment that enable organisms to survive, e.g., shape of beaks or feet, placement of eyes on head, length of neck, shape of teeth, color.
- 2.7 Give examples of how changes in the environment (drought, cold) have caused some plants and animals to die or move to new locations.

6 – 8

- 2.10 Give examples of ways in which genetic variation and environmental factors are causes of evolution and the diversity of organisms.

Overview

In this Learning Experience, students will continue to study seaweed. Through observation and reading, they will identify the physical differences between the three kinds of seaweed and explain why the structure of seaweed is important to its survival. As a culminating activity, students will create an image of the intertidal zones using seaweed pressings.

Evaluation

- Class discussion
- Intertidal Mural

Materials

- Seaweed
- Photographs, Specimens, Drawings

- Glue, construction paper, crayons

Activity One: Seaweed Detectives

- In this activity, students will work in groups and teach each other about the characteristics of the three types of algae/seaweed.
- Use a “jigsaw” for this activity. For information about jigsaws, see <http://www.jigsaw.org/tips.htm>
 - Place students in “jigsaw groups” of three.
 - Assign one of the three types of algae/seaweed to each student in the group. If computers are available, students can use the following websites which contain excellent information. If computers are not available, you might consider downloading the information for them or locating texts that contain the relevant information.
 - Green: <http://oceanlink.island.net/oinfo/seaweeds/Chlorophyta.html>
 - Brown: <http://oceanlink.island.net/oinfo/seaweeds/Phaeophyta.html>
 - Red: <http://oceanlink.island.net/oinfo/seaweeds/Rhodophyta.html>
 - Student will study the information independently. They don’t need to memorize it.
 - Form temporary “expert groups” by having one student from each original group join other students assigned to that particular seaweed. Give these “expert groups” time to discuss the information and prepare and rehearse a presentation that will be made in their jigsaw groups. The presentation will focus on the characteristics and composition of each type of seaweed.
 - The teacher should circulate among the groups, clarifying, checking for understanding, and confirming that the information students are preparing is accurate.
 - Bring students back to their original “jigsaw groups.”
 - Each student will teach the other members of the group about his or her assigned reading. Encourage other students to ask questions.
 - The teacher should circulate among the groups, checking for understanding and monitoring student behavior.
 - At the end of the jigsaw, students will respond to the following prompt in their journals:
 - Explain what you learned about green, brown, and red algae/seaweed.
 - How are they the same? How are they different?

Activity Two: Creating a Tidal Zone Mural

In this activity, students create a mural that portrays the tidal zones and includes seaweeds and other organisms they find there. To complete this activity, students will need to learn about the tidal zones.

Materials:

- Chart Paper or White Board and Markers
- Local Tide Calendar
- Camera
- Large Colored Pins
- Class Mural: Paper Covered Bulletin Board
- Paint and Brushes

- Photos of beach at High and Low Tides

Mural Activity 1: Introducing the Tidal Zones

- Introduce students to the various tide zones and the organisms that inhabit these areas. You will find interesting and accessible information at <http://www.enchantedlearning.com/subjects/ocean/Intertidal.shtml>.
- If you have enough computers available, place students in small groups and let them explore the information. If you don't have available computers, download the information and/or find texts that contain simple and straightforward information. Provide the following prompts:
 - List and describe the characteristics of each of the tidal zones.
 - Explain the factors that make the tidal zones inhospitable or unfriendly to the organisms that live there.
- Check for understanding: Ask students to draw simple representations of the tidal zones in their journals. Each tidal zone should be labeled.

Mural Activity 2: Observing and Charting the Tidal Zones

- Students can observe and chart the tides if they are close to the shoreline. Ideally, students should make daily visits to the beach (either the whole class at a time, or in staggered groups). Alternate ways of making tidal observations can be used if you and your students do not have access to the beach (see teacher notes). However, at least one trip to the beach would be best for establishing a visual point of reference for future classroom chartings.
- Establishing a place of reference: (A trip to the beach)
 - Take a trip to a beach and look for one area that has distinguishing characteristics at low and high tides. Photograph a rock pile, beach walls, boat ramps, wooden pilings, the edges of a marsh or marsh vegetation, the edges of coral reefs, or even a pier at high and low tides. A landmark is a good spot by which you can measure the tides. If there is only sand, try photographing the area at high and low tides to show changes in the amount of exposed sandy area during low tide. This will be the subject of a class mural students will create to show the ebbing and flooding of the tides.
 - Students should collect specimens and photograph species that live in the various tidal zones.
 - You might try to find the high tide or "wrack line" of flotsam and jetsam and algae stain on the rocks. Above the wrack line you might find insects in the sand, broken shell parts, crab or clam bodies, and land plants.
 - Look in the intertidal area (between high and low tide) for snails, crabs, barnacles, and other creatures such as **seaweeds**, mollusks, mussels that might be hiding under the rocks,
 - Look in the sub-tidal area for starfish or other small creatures in the pools. Look for eel grass in the intertidal and sub-tidal areas.
 - Gather seaweed and plant samples. Photograph or draw the creatures.
 - Use a tide calendar or the daily paper to be sure you know the hour of the high and low tides for your pictures. Take several pictures of your landmark to get a good array to choose from. Keep a count of the photos so you can label each picture with the time it was taken. Also, try to wait for a lull or calm moment in which to get the most accurate sea level estimate.

Mural Activity 3: Creating the Mural

- Students will work in groups.
- On a wall in the classroom (covered with chart paper or newsprint), students will sketch and then paint a mural of the tidal zones. Assign one tidal zone to each group.
- Draw, and color organisms that live in the various tidal zones on the mural. Place samples of seaweeds in the tidal zones where they were found.
- Leave room on one side of the mural to mark tide levels relative to landmarks.
- **Labeling the Tide Zones:** From your photos labeled with the given hour and minute, estimate and mark these zone marks on your mural.
- **Explain** to students that people who study tides use a stick on which they mark the sea level at a given time. For safety's sake you will use photographs, which won't be completely accurate because the ocean is in constant change, but will give students a satisfactory sea level indicator. Teachers will have to identify normal high, mid, low, and sub-tide zones for their areas.
 - Spray Zone (the area that remains above water except during the most extreme high tides)
 - High Tide Zone
 - Mid Tide Zone
 - Low Tide Zone
 - Sub-Tide Zone (the area that remains underwater except during the most extreme low tides)
- Ongoing Assessment: As students are working on the mural, the teacher should be checking for understanding. Talk with students about their work on the mural.
 - What are the tide zones?
 - Why did they place certain organisms and/or plants and algae on the mural?
 - Why do they think they found these specimens in those particular zones?
- Check for Understanding: You will collect these responses to assess student learning and identify whether additional instruction is needed for specific students. Students will write responses to the following prompts in their journals:
 - What are the tide zones?
 - What organisms can be found in each of the tide zones? Why?
 - Why are the tidal zones "unfriendly" to living creatures?
 - Compare and contrast the kinds and amounts of seaweeds and marine plants you found in each zone. What theory do you have about what you found?

Learning Experience Three

So Why All the Fuss about Seaweed?

Disciplinary Focus of This Learning Experience

- The importance and awareness of seaweed for human consumption

Enduring Understandings

- Humans and oceans are intimately linked.
- Ocean and terrestrial systems are linked through food webs.

Essential Questions

- What are the observable differences between different types of seaweeds?
- Why is seaweed important to humans?
- In what ways do humans depend on seaweed everyday?

State Content Standards:

Science and Technology: Grades PreK – 5 and 6 – 8

Life Science:

PreK – 2

- 2.6 Recognize that people and other animals interact with the environment through their senses of sight, hearing, touch, smell and taste.

3 – 5

- 2.10 Give examples of how organisms can cause changes in their environment to ensure survival. Explain how some of these changes may affect the ecosystem.

6 – 8

- 2.13 Give examples of how organisms interact and have different functions within an ecosystem that enables the ecosystem to survive.

Overview

Students will learn about several products humans use on a daily basis that contain marine seaweeds.

Evaluation

- Data chart and activity

Materials

- Handout Two
- Samples of Items Containing Seaweed

Activity One: Activating and Assessing Background Knowledge

- Brainstorm: Ask students if they know of any uses people might have for seaweed. Record students' responses on the board or on chart paper.
- Place students in groups of four to six.
- Bring in samples of products. Your samples should include food products and cosmetics items that include one of the following ingredients.
 - Carrageenan
 - Alginates
 - Beta Carotene
- Give each group one of the samples. Ask students to make a list of the ingredients in one of the samples. One student should record the information. A second student will report out.
- Process: Ask each group to list the ingredients in the sample they were given.
- Explain each of the following to students. Have the information available on a handout or the board or chart paper.
 - **Carrageenan:** general term for compounds extracted from species of red algae used in stabilizing and gelling foods, cosmetics, pharmaceuticals, and industrial products.
 - **Alginates:** extracted from brown algae used to make water-based products thicker, creamier, and more stable over extreme temperatures and time, making the product last longer.
 - **Beta Carotene:** a natural pigment from green algae used as a yellow-orange food coloring in food products; currently believed to help prevent certain forms of cancer.
- In their groups, students should make hypotheses about why their sample product used one of the following: carrageenan, alginates, or beta-carotene.
- Each group will report out. You should check for understanding.
- Explain to students that in some cultures, people eat many kinds of seaweed because they are full of vitamins and iodine. Ask students if they are familiar with any seaweed menu items (sushi, seaweed salad, dulce, and the like).

Activity Two: Homework

- Distribute Handout Two.
- Ask students to look for the items on the list at their homes.
- They should read the ingredients and record whether they contain carrageenan, alginate, or beta-carotene.
- Discussion: When students return to the next class, review the information they've found.
- Process: Ask, "Why do you think the item contains that ingredient? What purpose does it serve?"
- The following chart contains the information students will discover.

Product Name	Carrageenan	Alginate	Beta Carotene
Brownie mix		X	
Cheese			X
Chocolate milk	X		
Coffee creamer	X		X
Cottage cheese	X		
Egg substitute			X
Evaporated milk	X		
Frozen foods/desserts		X	X
Frozen yogurt	X		
Ice cream	X		X
Infant formula	X		
Margarine			X
Mayonnaise			X
Multiple vitamins			X
Pudding (cooked)	X		
Relishes	X	X	
Salad dressing		X	X
Sauces and gravies	X	X	
Sour cream	X		
Toothpaste	X		
Whipped topping	X		X
Whipping cream	X		
Yogurt	X		

Handout Two

Name _____

Date _____

Are There Algae in the Food and Products in Your Home?

Data Chart

Product Name	Carrageenan	Alginate	Beta Carotene
Brownie mix			
Cheese			
Chocolate milk			
Coffee creamer			
Cottage cheese			
Egg substitute			
Evaporated milk			
Frozen foods/desserts			
Frozen yogurt			
Ice cream			
Infant formula			
Margarine			
Mayonnaise			
Multiple vitamins			
Pudding (cooked)			
Relishes			
Salad dressing			
Sauces and gravies			
Sour cream			
Toothpaste			
Whipped topping			
Whipping cream			
Yogurt			

Learning Experience Four

Seaweed Pudding

Disciplinary Focus of This Learning Experience

- Students will extract carrageenan from the red seaweed Irish Moss and make a seaweed pudding. This activity will provide students with a concrete experience that will provide evidence of the gelling properties of carrageenan. For some students, the hands-on, real world aspect of the learning experience will be invaluable.

Grade Level: PreK – 5 and 6 – 8

Enduring Understandings

- Humans and oceans are intimately linked
- Ocean and terrestrial systems are linked through food webs
- Evolution explains both the unity and diversity of life

Essential Questions

- What are the observable differences between different types of seaweeds?
- Why is seaweed important to humans?
- In what ways to humans depend on seaweed everyday?

State Content Standards:

Science and Technology: Grades PreK – 5 and 6 – 8

Life Science:

PreK – 2

- 2.6 Recognize that people and other animals interact with the environment through their senses of sight, hearing, touch, smell and taste

3 – 5

- 2.10 Give examples of how organisms can cause changes in their environment to ensure survival. Explain how some of these changes may affect the ecosystem.

6 – 8

- 2.13 Give an example of ways in which organisms interact and have different functions within an ecosystem that enables the ecosystem to survive.

Overview

Students will extract carrageenan from the red seaweed Irish Moss and make a seaweed pudding.

Evaluation

- Class discussion
- Journal writing

Materials

- Irish Moss seaweed
- Hot plate
- Double boiler (recommended)
- Water
- Milk
- Sugar
- Vanilla
- Salt

Activity: Seaweed Pudding

- Brainstorm and review with the class the various uses of seaweed in food products.
- Distribute a list of the ingredients to students.
- Describe to the class how they will be making a seaweed pudding using the following ingredients:
 - 1/2 cup dried Irish Moss (or 1 cup of fresh, washed Irish Moss)
 - 3 cups milk
 - 1/3 cup sugar
 - 1/8 teaspoon salt
 - 1 teaspoon vanilla
- Journal Writing: Ask students to write responses to the following questions in their journals:
 - What do you think will happen when you cook this recipe?
 - How do you think it will taste? Why? Be specific.
 - Why do you think the recipe calls for either ½ cup of dried moss or 1 cup of fresh moss? What difference could it make?
- Prepare the Seaweed Pudding
 - Combine the moss and milk in the top of a double boiler.
 - Cook over boiling water for twenty-five minutes.
 - Strain the milk to remove seaweed.
 - Add sugar, salt and vanilla.
 - Stir mixture and pour into individual molds.
 - Chill.
- Give each student a sample of the pudding.
- Food for thought: Students will go back to the responses they wrote before preparing the seaweed pudding. Ask them to assess their predictions. If they were accurate, they should indicate what they knew that helped them make the prediction. If their predictions were incorrect, they should answer the questions accurately.
 - When we cooked the seaweed....
 - The seaweed pudding didn't taste like....but instead tasted like....
 - I'm surprised about...