Ocean Market

The ocean is the source of many materials, from ores mined from its depths to relaxing mineral salts for a bath. Exquisite mother-of-pearl inlay, decorative shells, and pearl jewelry are found in gift shops worldwide. And whether your tastes run to the exotic, like yellowfin tuna sushi, or the mundane of fast food milkshakes, products from the sea are probably in your diet. Many species of vertebrate and invertebrate marine animals as well as marine algae are important sources of food worldwide. Examine the foods in your own kitchen and you may find the terms "alginate" and "carrageenan" on the labels. Carrageenans are compounds extracted from red algae that are used to stabilize and jell foods and pharmaceuticals. Brown algae contain alginates that make foods thicker and creamier and add to shelf life. They are used to prevent ice crystals from forming in ice cream. Alginates and carrageenans are often used in puddings, milkshakes, and ice cream. The commonly used color additive beta-carotene often comes from green algae as well as many vegetables, including carrots. On the grocer's shelf and in the pharmacy, in industry and in the arts, the ocean is a resource without equal. However, exploitation of these natural resources carries with it the responsibility to use them wisely and preserve them globally.

Ocean Market Lesson Plan

Objectives

Identify some consumer goods that come from the ocean.

Classify these items into groups and identify their source.

Calculate the cost of buying such goods.

Materials

Student Pages A and B

Optional: labels from products containing algae; menu from a seafood restaurant

Subjects

biology, mathematics, nutrition, social studies

Procedure

1. Begin by asking students to think about the variety of things that come from the sea. You might have a student write the suggestions on the board as they are mentioned. Students will probably name foods such as fish and shellfish. Ask them to categorize their suggestions into "vertebrates" and "invertebrates." Under vertebrates they might include bony fish with which they are familiar such as tuna, salmon, flounder, cod, halibut, and sole. Less familiar but of commercial value are pollack (used in imitation crabmeat) and Mako shark (a vertebrate with a cartilage rather than bone skeleton). Ask students about the relative sizes of these fish. They might know that a tuna, for example, may weigh hundreds of pounds whereas a flounder weighs only several pounds. Ask if students have ever noticed the symbol for "dolphin safe" on a can of tuna. They should know that it means the tuna were caught using fishing techniques that do not endanger dolphins. (All tuna are caught this way today.) Under invertebrates students may think of shrimp, crabs, clams, mussels, oysters, and lobsters. Shrimp, crabs, and lobsters are crustaceans; clams, mussels, and oysters are mollusks with a hard, calcified shell. Most of the time when we refer to a "seashell," we mean the remains of the hard shell of a mollusk such as a conch, snail, nautilus, or abalone. The inside of an abalone shell is a source of mother-of-pearl.

2. Ask students if they have ever been to a seafood store or seafood restaurant. Ask questions about the source of this seafood and whether it was shipped from far away. Ask if it is important to keep seafood on ice. Tell students that many commercial fishing boats are actually factories on which workers clean the fish and freeze it immediately to ensure freshness at the market. If you have a price list from a local seafood store or a menu from a restaurant, discuss it with students. If regional dishes containing seafood are popular in your area, ask students to bring in recipes for them. If fishing is an important regional activity, ask students to bring in pictures or "fish stories" to share with the class.

3. Some students may suggest seaweed as a food. Types of algae are eaten most typically in Japanese cooking. Nori and hijiki are two types generally found in specialty stores. Nori is the dark brown variety used to roll rice and fish for sushi. Tell students that even if you live thousands of miles from the ocean, the vanilla shake that you enjoy at your local fast food restaurant probably contains some seaweed because carrageenans are usually added to thicken shakes. If you have any labels from packaged foods or personal care products that contain alginates or carrageenans, show them to students and explain what these compounds do. Ask students to look for these compounds on the labels of products they have at home or notice them the next time they visit a supermarket or drugstore.

4. Tell students that they will be doing an activity that will give them some imaginary money to

go on a Sea Shopping Spree. Hand out the student pages and tell students that they will visit the Fair Harbor Mall, where they will browse for gifts at Fantasea Creations; buy health and beauty products at Mermaid's Tresses; have lunch at the Ship's Galley; then take home some fresh seafood and videos for the evening. Have them "enter" the mall at the welcome sign. They might want to plan their own route; the order suggested above is one logical way.

5. Ask students why they would want to buy the seafood near the end of their shopping spree. (Because seafood should be kept cold.) If students would rather skip buying or eating seafood, you might turn the discussion toward how people have made a living from the sea throughout history. Ask students why they think seafood prices seem so high. They may suggest that some kinds of seafood must be flown in from other regions as suggested by the names. Tell them also that the season for certain kinds of fish and shellfish is limited and certain species may have been overfished in local waters.

6. Students may work independently to come up with their personalized shopping list and tally the cost. Under the category "Where did it come from?" students should decide if the item comes from algae, an invertebrate animal, a vertebrate animal, or a mineral. When they have finished, have them compare their shopping lists and how much money they spent. Even by choosing the most expensive item at each stop, students should still stay within the budget. Have them discuss their answers about the source of each item.

Fresh Catch Seafood

Maine lobster and Gulf shrimp are invertebrates (crustaceans); Atlantic Mako shark is a vertebrate, although sharks have no bones, only a cartilage skeleton; Nova Scotia salmon, yellowfin tuna, and flounder are vertebrates.

Ship's Galley

Shrimp are invertebrates. Sushi is rolled nori (algae) with rice and fish (vertebrate); flounder is a vertebrate, although the stuffing might contain shrimp, an invertebrate. Pudding and ice cream might contain algae in the form of carrageenans or alginates.

Fantasea Creations

The treasure chest contains mother-of-pearl, which usually comes from abalone, an invertebrate. Scrimshaw in the key ring traditionally comes from whale tooth or bone (vertebrate). However, tell students that sperm whale teeth and walrus tusks are protected. Pearls come from the oyster, an invertebrate (mollusk). You might tell students that oyster shells are also used in natural calcium supplements. Shells such as a conch as well as those that would be used in a necklace come from shelled invertebrates, mollusks. Red coral in a pendant comes from the coral-producing invertebrate

animals (coelenterates). Tell students that black coral is endangered. In discussing these answers, pose this question to students: "Suppose you saw a beautiful item made from the shell of an endangered turtle. Would you buy it?" This may lead to a discussion of being a responsible consumer and not buying goods that threaten marginal species.

Mermaid's Tresses

Seaweed shampoo and kelp iodine supplement contain algae. Cod liver oil (which often comes from Norwegian cod, a vertebrate ocean fish) is a source of omega-3 oil. Natural sponge is the dried outer framework of an invertebrate (porifera). Sea bath salts contain minerals that make the sea salty: sodium chloride, magnesium chloride, and potassium chloride, among others. Mention to students that there is a huge potential for pharmaceuticals from the ocean, particularly from coral reefs. The diversity and density of coral reef organisms rivals that of the rainforest. Denizens of the reef have evolved the ability to synthesize unusual compounds to avoid being eaten or grown over. These compounds could prove to be lifesaving pharmaceuticals for humans.

Video Harbor

Twenty Thousand Leagues Under the Sea is a Jules Verne fantasy that includes a battle with a giant squid, an invertebrate. *Moby Dick*, based on Herman Melville's novel, is the story of the hunt for a sperm whale, a vertebrate. If students are unfamiliar with these classics, you might get copies of the books from the library to have on hand. Also, encourage students to make a list of other videos about the ocean, such as *Jaws* or *The Abyss*.

7. To follow up the discussion of the importance of products from the sea, have students use the library or go online to find out how scientists use organisms from the sea in research. For example, sea urchins are used in embryology, and sharks are studied in immunology because of the shark's amazing immunity to diseases such as cancer.

8. Encourage students to try their hand at making a work of art inspired by the sea. They might try carving "scrimshaw" out of a bar of soap, using fishbones to make jewelry, or using seaweed to make a picture. Students might also make a display case for a shell collection.

Ocean Market

Student Page A

You are about to go on an imaginary Sea Shopping Spree at the Fair Harbor Mall. Imagine you have been given a hundred "clams" ($100) to spend at the mall. But the "catch" is that you have to buy certain things on your shopping list to take home. Look at some of the ocean products that are advertised at each store. List the ones you would buy in the chart. Tally up the total cost to stay within your budget.

Of the items you purchase, you will find that some come from vertebrate animals and some from invertebrates. Some items are made with substances that come from algae and some are made with minerals from the sea. In the column under "Where did it come from?" identify the source of each item you select.

Item	*Your selection*	*Cost*	*Where did it come from?*
A gift for an important person in your life.			
Three personal care products for you or someone else.			
Lunch for you and a friend while shopping.			
Fresh seafood (at least two pounds) to take home for dinner.			
A video or two to rent for the evening.			
Total (not to exceed $100)			

Ocean Market
Student Page B

Fresh Catch Seafood

Live Maine lobster $8/lb
Yellow fin tuna $7/lb
Atlantic Mako shark steaks $6/lb
Nova Scotia salmon $8/lb
Jumbo gulf shrimp $14/lb
Local flounder $9/lb

Ship's Galley

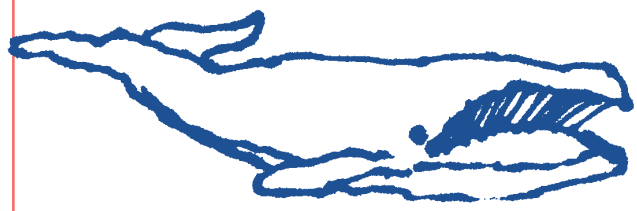
Shrimp cocktail, Sushi, or
Stuffed flounder
Only $8.00

Pudding, Ice Cream $1.50

Welcome to the
FAIR HARBOR MALL

Video Harbor Rentals $2

Classics Week
Moby Dick
20,000 Leagues Under the Sea



Fantasea Creations Unique Gifts

Mother-of Pearl Treasure Chest $30
Scrimshaw Key Ring $29
Pearl Earrings $30
Seashell Necklace $20
Coral Pendant $25
Conch Shell $20

Mermaid's Tresses

Health and Beauty Products from the Sea

Seaweed shampoo $4.50
Kelp iodine supplement $4
Cod liver oil $5
Natural sponge $3
Relaxing sea salts for the bath $6

Resources

Online resources

Visit Ocean Planet online at **http://seawifs.gsfc.nasa.gov/ocean_planet.html**

Using the Exhibition Topic Outline, go to PharmaSEA and SEAfoods under SeaSTORE. A lesson plan and activity sheet are available by clicking on "Sea Store Lesson Plan: There Are Algae in Your House!" under Educational Materials in the Ocean Planet Exhibition Floor Plan. Under Resource Room, use the Image Catalog to get photographs and illustrations of specific marine organisms and products suggested in the activities above.

Resources for students

Pringle, Laurence P. *Coral Reefs: Earth's Undersea Treasures*. New York: Simon and Schuster, 1995.

Taylor, Barbara. *Coral Reef*. London: Dorling Kindersley, 1992.

Resources for teachers

Benchley, Peter. *Ocean Planet: Writings and Images of the Sea*. Edited by Judith Gradwohl. New York: Harry Abrams, in association with the Smithsonian Institution, 1995.

Chapman, V. J., and D. C. Chapman. *Seaweeds and Their Uses*. New York: Chapman and Hall, 1970.

Earle, Sylvia A. *Sea Change, A Message of the Oceans*. New York: G.P. Putnam's Sons, 1995.