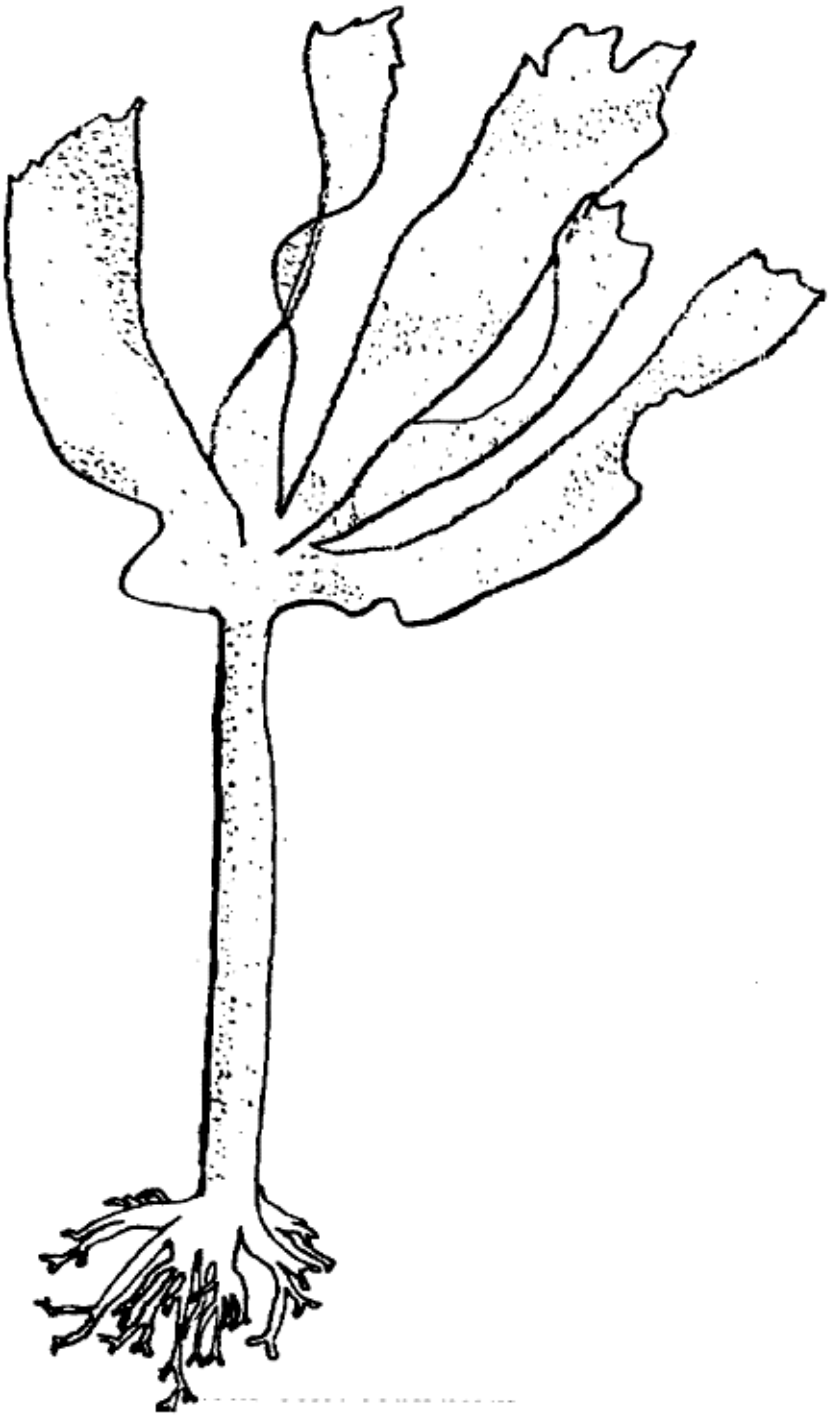
SEAWEED SOUP



FOR THE TEACHER

Discipline
Biological Science, People and the Sea

Theme
Patterns of Change; Systems and Interactions

Key Concepts
Seaweed is used for food by people around the world. Seaweed can dry out at low tide and then "come back to life" when the tide is high.

Synopsis
Students compare seaweed to a tree to learn about the similarities and differences between ocean and land plants. They participate in guided imagery about seaweed and tides. Students also observe dried seaweed, then rehydrate some seaweed into a soup snack.

Science Process Skills
Observing, Communicating, Comparing

Social Skills
Check for Understanding, Encouraging

Vocabulary
seaweed, plant, blade, holdfast, stipe, frond

MATERIALS

INTO the activities
• pictures from magazines, calendars, or books showing various types of seaweed. (See Resource Books in the Literature Connections section for detailed information on useful books.)

THROUGH the activities
• Key Concepts written in large letters on butcher or chart paper

For Seaweed Poster Talk activities
• crayons or colored markers

For Class Big Book activity
• 40 sheets of legal (11 x 14) paper.
Label 10 sheets with the heading: Here I am
Label 10 sheets with the heading: Here I am at high tide
Label 10 sheets with the heading: Here I am at low tide
Label 10 sheets with the heading: Here I am at high tide again

• a three hole punch
• colored yarn or brads

For Seaweed Samples activity
• dried seaweed samples (Hijiki, Ajitsuke Nori or Temaki Yaki Nori—available at most natural and Asian food stores)
• Miso soup with Hijiki seaweed
• drift kelp found along a sandy beach (remember, it is illegal to remove anything from a reserve or protected area)
or seaweed samples purchased from Carolina Biological Supply (800) 334-5551 or Wards Biology Catalog (800) 462-2660 or borrowed from the MARE library
or visuals of seaweed (books, videos, slides and/or pictures)
Recommended books:
One Small Square Seashore. by Donald Silver (W.H. Freeman and Company. New York. 1993).
Exploring an Ocean Tide Pool. by Jeanne Bendick (Henry Holt and Company. New York. 1992).
Kelp Forests by Judith Connor and Charles Baxter (Monterey Bay Aquarium. Monterey, CA. 1989).
(See Resource Books in the Literature Connections section for detailed information on these and other useful books.)
• small tasting cups and/or plates (one per student)
• two or more food samples containing seaweed for tasting—pick tasty treats from different cultures

Food Containing Seaweed
These are some examples of foods that contain seaweed. The brand we know that has seaweed in it is listed in parentheses after the product.
Agar or Agar Pudding
Baby Formula (Similac)
Cakes (Entenmann's)
Cheese (Velveeta)
Cheesecake (Royal Real No-Bake and Sara Lee)
Chocolate Milk Powder
(Hershey's Mix and Nestle's Quick Powder)
Clam Dip (Lucerne)
Cottage Cheese—non-fat (Lucerne)
Kelp or Seaweed Crackers
Cup Cakes and Fruit Pies (Hostess)
Danish Pastries
Eggnog
Evaporated Milk (Carnation)
Flan (Jell-O)
Fruit and Cream Bars (Dole)
Fruit Juice (Sunny Delight)
Hidden Valley Party Dip (dry)

Horchata—Mexican rice drink (Don José)
Ice Cream
(Dreyer's)
Fudge Bars (Chip 'N Dale Rescue Rangers)
Ice Cream Bars or Nuggets (Nestle's Crunch)
Tofutti—frozen dessert
Instant Breakfast
Macaroni and Cheese (Kraft's Shells and Cheese)
Pie and Bakery Fillings and Glaze on Doughnuts
Pudding Mixes (Hain's)
Roasted Seaweed (Ajitsuke Nori or Temaki Yaki Nori)
Salad Dressing (low or no oil— bottled)
Salt (seaweed flavored)
Sea Seasonings Nori Granules
Seaweed Candy
Slim Fast
Soups—dried (Seaweed Ramen and Miso Seaweed)
Soy Milk (Vitasoy creamy original)
Sushi
Toothpastes (Aqua-fresh, Tom's, and Ultra Brite)
Yogurt (Continental and Yoplait)

BEYOND the activities
For Art Project activity
• four large sheets of butcher paper
• crayons or colored markers
• reference books

INTRODUCTION

People living by the sea have used seaweeds for thousands of years. Vikings and Celts chewed it for nourishment on their travels. In Japan seaweeds have always been and still are such an important and integral part of everyone's diet that they are grown commercially in mariculture farms. Seaweeds, or sea vegetables as they are sometimes called, are eaten fresh, dried, or made into pickles or candy. Sea vegetables are often labeled as Nori (from *Porphyra*), Hijiki, Wakame, Ogo (from *Gracilaria*) or Kombu (from *Laminaria*). Although eating seaweeds directly is an important use of this resource, it is by no means the only or most common use of seaweeds.

Most of the seaweeds harvested around the world are processed to get particular ingredients or derivatives (agar, carrageenan, and alginate) from the seaweed. These derivatives are used in processed foods to extend the food's "shelf life." They prevent separating (such as in foods with oil and water), settling (such as in salad dressings with spices, or cocoa in chocolate milk), and help to stabilize, thicken, and give the right texture to the processed food.

Seaweeds are so well suited to our modern food industry because of their remarkable ability to dry out and rehydrate, and because they are so pliable. Seaweeds live in an environment buffeted by storms, currents, waves, and tides. On the rocky seashore at high tide, seaweeds are covered with water, and at low tide they are exposed to the drying effects of the sun and wind. Seaweeds may appear totally shriveled and dried out (desiccated) and feel almost crispy, and yet become supple and completely rehydrated when immersed in water.

Agar, carrageenan, and alginate (the three main seaweed derivatives) are used in processed and dairy products to help keep foods well mixed and creamy (**emulsifiers** and **stabilizers),** or as **gelling agents**.

AGAR is found in the red seaweeds, including agarweed (*Gelidium robustum*), the red, spaghetti-like *Gracilaria* (there is no common name), and feather branch seaweed (*Pterocladia*).

As a research tool, agar is used as a gel for growing samples of disease organisms. It is also used in canning fish, thickening ice cream, cream cheese, and for making jams. It is used in Japan as a sweetened gel.

Japan is the largest producer and exporter of agar, followed by South Korea. However, it is produced all over the world, from Norway to Australia.

CARRAGEENAN is a stabilizer produced from the red seaweeds. The major source of carrageenam is Irish moss (*Chondrus chrispus*), but it is also found in Turkish towel (*Gigartina*) and iridescent seaweed (*Iridaea cordata*). It is found extensively on rocky seashores off the coasts of Ireland, France, Portugal, and the United States. It is scraped from the rocks with special long-handled rakes.

Carrageenan is used to make thick and creamy dairy products such as ice creams, sherbets, chocolate milks, and whipped creams. It is also used in a variety of syrups, toppings, health food products, and it is what makes the foam on beer. In creamed soups and chowders, carrageenan is used to get the right texture and body.

ALGINATES are obtained from the large brown algae called giant kelp (*Macrocystis pyrifera*). Alginates are used for thickening, gelling, emulsifying, and stabilizing many different types of food products such as puddings, milk shake powders, dietetic salad dressings, icings, tomato sauces, gravies, and frozen foods. This derivative can often be found on ingredient lists as sodium alginate, calcium alginate, or algin.

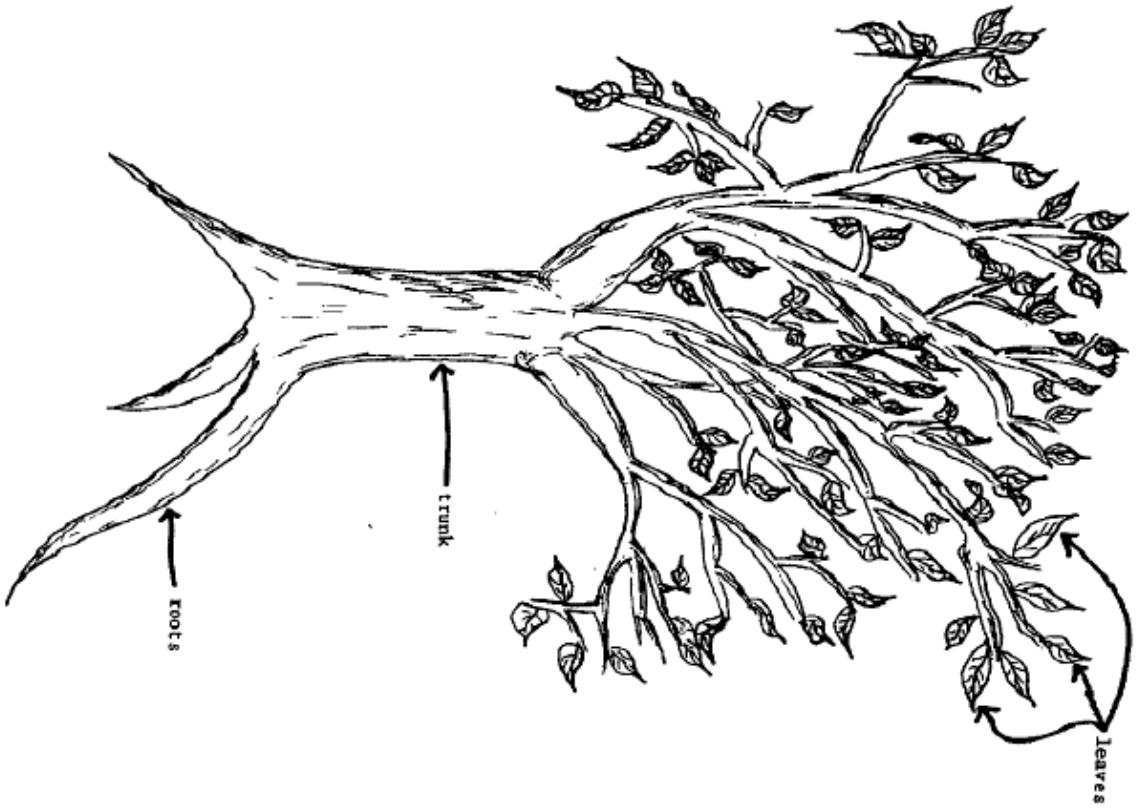
The giant kelp plants are harvested annually from dense beds growing along the southern California coast and along the coast of Norway.

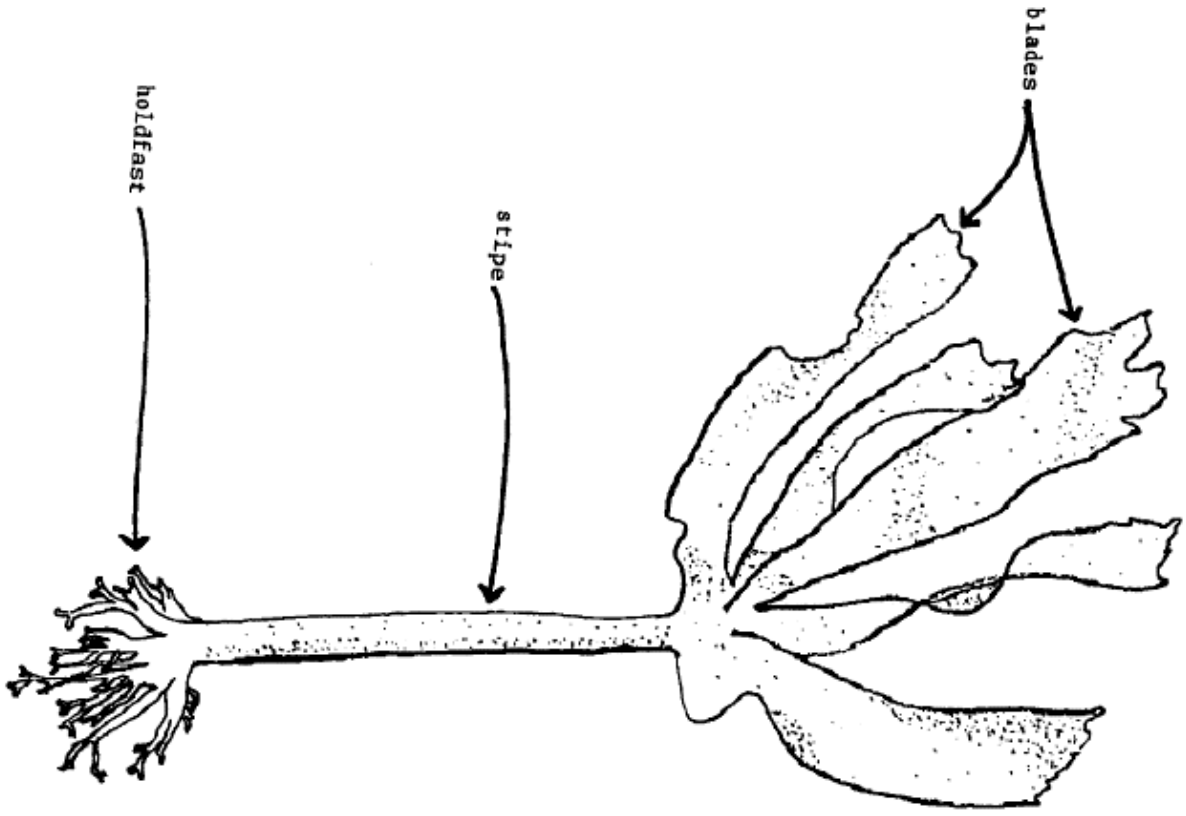
INTO
THE ACTIVITIES

Partner Parade
See the Teaching Strategies section for how to present this activity.
Review what the students have already learned about tides and how they affect the organisms that live at the rocky seashore.
• Have you ever seen seaweed before? Where?
• What does seaweed look like?
• What does seaweed feel like?
• Have you ever tasted seaweed? Did you like it?
• Imagine you are a seaweed at the rocky seashore at high tide. What would you feel like?
• What would you feel like at low tide?

THROUGH
THE ACTIVITIES

Seaweed Poster Talk
Post a large sheet of butcher paper in the front of the class. Pass out the picture of seaweed and a tree. As you compare the parts of seaweed to the parts of a tree, copy it onto the butcher paper.





Point out the holdfast, which holds the seaweed to the rock as the roots of a tree hold the tree in the ground. The roots of a tree also take nutrients and water out of the soil, while a seaweed holdfast does not. The holdfast is only an anchor that prevents the seaweed from being washed away by the waves. Seaweeds absorb nutrients from the sea water through all parts of their bodies. Point out the stipe of the seaweed, which is its body as the trunk is the body of a tree. Both seaweed stipes and tree trunks transport nutrients, but stipes absorb nutrients from the water as well.

Point out the fronds of seaweed, which wave in the wind and water as the branches of a tree wave in the wind and rain. Fronds take nutrients out of the water and transport them throughout the plant. A tree's branches just transport nutrients.

Point out the blades of the seaweed, which extend from the fronds or stipe like the leaves that grow from a tree. Blades take nutrients out of the water as tree leaves absorb nutrients from the sun.

Seaweed and the Tides Guided Imagery
Have students imagine they are a seaweed and lead them through the following description:
1) Stand and reach your arms up to feel the warm sun shining down on you. Your arms are green, branch-like fronds that glitter in the sun. Your body is a tall, thin stipe, like the trunk of a tree. You can taste the salty ocean water as it sprays over you. Your brown, vine-like feet have become your holdfast, like the roots of a tree, gluing you to the rock you are standing on. You feel the water pulling at your feet.
2) The gurgling water turns into a rumbling roar as you feel a wave of water churning, pushing and pulling at you. Your feet hold on tightly, waiting for the wave to pass. The sun feels warm and dry and the wind blows the ocean spray from your frond arms. Another wet, rumbling wave pushes and bends your stipe body until your frond arms touch the rock and sand at your feet. The salty sand-filled water churns around you for a moment and then washes away. You stand up straight again and stretch your frond arms up to be warmed and dried by the sun. The waves wash over you. The waves are becoming gentler now. You feel the warmth of the sun drying you. Even your holdfast feet are drying in the warm sun and wind.
3) It feels good to stand in the gentle wind. You start to forget what it was like to have the strong waves push and pull at you. The sun is getting hot now. You are completely dry on your surface and you start to change color in the heat. Your shiny green body becomes a dull brown color. Your frond arms slowly fall to your side as the sun dries all the water out of them. Your skin is wrinkling now. Your holdfast feet are still attached to the rock as you lie down crumpled in the warmth of the sun. Your frond arms are so dry and stiff that you can no longer move them, but they rattle against each other as the wind

gently blows through them. You are so dry and warm, it is hard to image that soon you will be underwater.
4) The next thing you know a cold wave of salty ocean water gently washes over you. Your crunchy, dry body floats on the surface for a few seconds and then the water is gone. Another wave washes over you and you can feel it trying to pull you away, but your holdfast feet are still anchored to the rock. You shake your sleepy head. The ocean waves get stronger, pushing and pulling at your body. You feel the cold wetness quickly soaking into your skin. Your dry wrinkles are disappearing as you fill up with water, becoming smooth and shiny, and plump again. Your body is like a dry sponge soaking up the water. You feel the strength returning to your frond arms as they fill with water. It feels good as the cold ocean waves pull, push, and bend you again after your long dry sleep in the hot seashore sun.

Ask students to describe:
• What did it feel like to be a seaweed at high tide when the ocean waves were covering you with water?
• What color were you at high tide?
• What did it feel like to be a seaweed at low tide when there was no water and the sun was shining down on you?
• What color were you at low tide?
• How did it feel when you were all dried out in the sun. What happened when you were covered in water again?
• When you were pretending to be a seaweed, what were your arms, your body, your feet?

Class Big Book
See the Teaching Strategies section for how to present this activity.
Divide the class into four expert groups. Have each group become the expert on one paragraph of the guided imagery which they then illustrate. Give each student a sheet of letter paper titled:
Group 1: Here I am
Group 2: Here I am at high tide
Group 3: Here I am at low tide
Group 4: Here I am at high tide again
Distribute crayons or colored markers to each group, and reread their paragraph of the guided imagery to them and ask them to illustrate their scene.
When students have completed their illustrations, regroup the students into cooperative groups that includes at least one student from each of the original groups. Have the students combine and order their illustrations to follow the guided imagery story. Three hole punch the pages of their book and bind them together with yarn or brads.

Seaweed Samples
Pass out dried samples of seaweed for the students to hold. Have students look for different colors, textures, shapes, and sizes of seaweed. Ask if the seaweed they are holding is alive. How might the seaweed look and feel if it was still living in the tidepools at the rocky seashore. The same activity can be done with pictures of seaweed instead of dried samples. Another option is to pass out food samples of seaweed and ask the same questions.

Give each student a strip of roasted seaweed to hold (Ajitsuke Nori or Temaki Yaki Nori). Ask them what color it is. What does it feel like? Ask them to taste it if they want to (most children like the flavor and texture). What does it taste like? Do they like it? Does it feel different in their mouth than in their hands? Softer? Slimy? Do they know of any other kinds of food where they might find seaweed?

Taste Test
Explain to the students that sometimes seaweed is added to processed food in order to make it a certain texture. Usually you cannot taste the seaweed. Pass out two or three samples of different foods that contain seaweed. (Horchata Mexican rice drink, Sunny Delight fruit juice, and Sara Lee Cheesecake are popular examples.) If possible, choose foods to sample that represent a variety of countries and cultures.

Show students a package of dried miso and seaweed soup. Open the package and display the dried soup in your hand. Pass pieces around the room and ask students to look at it, feel it and smell it. Now open another package. Put the dried contents into a bowl (preferably clear so that the students can see what is happening) and add boiling water in front of the class. The tiny, unrecognizable balls of seaweed will quickly turn into brilliant green, leafy, "fresh" vegetables. Bring the bowl around the room so that students can see the rehydrated seaweed. Give students a small cup of this prepared miso soup to taste, making sure that every student's cup contains a piece of seaweed. Explain to students that people throughout the world, especially in Asia, have dried seaweed as a means of preserving vegetables without refrigeration. Dried seaweed is just as healthy and nutritious as seaweed taken fresh from the ocean.

Key Concept
Hold up the key concept and have one or two students read it aloud. Post it near other work from this activity.

BEYOND
THE ACTIVITIES

Seaweed Mini-Drama
See the Teaching Strategies section for how to present this activity.
Have students act out what would happen to them if they were a seaweed at high or low tide.

Art Project
Distribute reference books about seaweed to students if available. On pieces of large butcher paper draw the outlines of a tree and an oversized piece of seaweed. Label the roots, trunk, branches, holdfast, stipe and fronds. Divide the students into two terrestrial and two marine groups. Have the terrestrial group color the tree and decorate the landscape around it. Have the marine group color the seaweed and decorate the landscape around it.

Post the murals next to each other and ask the students to compare the parts of the tree and of the seaweed. Use yarn to make lines that join analogous parts.
• What are the similarities?
• What are the differences?

Scavenger Hunt
Have students with their parents do a scavenger hunt at home and in the grocery store for items with the words carrageenan, agar, alginates, or sea vegetables in their ingredients. Send students home with the page of Foods Containing Seaweed to share with their parents and to use as a starting point for their scavenger hunt.

Bring in the empty boxes of the foods found during the scavenger hunt to make a seaweed product display.