



Got Seaweed?

Birch Aquarium at Scripps

This activity outline was developed for use in a variety of informal venues. By design, it provides the content, pedagogy and strategy necessary for implementation by both the novice and experienced informal educator. It is expected that this outline will be adapted and improved upon by the user. We welcome your feedback!

Theme and Synopsis of the Activity

Explore seaweed samples and discover that seaweed plays a more important role in your life than you may think. Learners use different criteria to sort the seaweeds, and then are guided to sort the seaweed based on color. Visitors also may observe what happens when powdered seaweed is mixed with water, and predict why we might add such seaweed products to food found in our cupboards. They then find out which foods do contain seaweed by checking the ingredients lists of some common foods.

Audience and Setting Learners of all ages in groups up to 6 people. It may be possible for a facilitator to work with several of these groups if their start is staggered. Possible settings include anywhere outside or inside the informal science center, in the public exhibit space or in a classroom.

Activity Goals Learners will:

- Understand seaweeds are diverse plant-like organisms, with many shapes, colors and sizes
- Observe how seaweed acts as a binding/thickening agent in food, by mixing alginate with water
- Recognize and/or identify seaweed-based ingredients when reading product ingredient lists

Concepts

- Scientists sort seaweeds by color, into red, green and brown types.
- Seaweeds are edible plant-like organisms that grow in the ocean. People consume them as sea vegetables and in processed food products.
- Dried seaweed is able to absorb and hold on to water. We add dried seaweed to food products that we want to remain moist or maintain a slimy texture, to stabilize food, to thicken food and to add color.

Ocean Literacy Principles

5. The ocean supports a great diversity of life and ecosystems.

c. Some major groups are found exclusively in the ocean. The diversity of major groups of organisms is much greater in the ocean than on land.

d. Ocean biology provides many unique examples of life cycles, adaptations and important relationships among organisms (Symbiosis, predator-prey dynamics and energy transfer) that do not occur on land.

6. The ocean and humans are inextricably interconnected.

b. From the ocean we get foods, medicines, and mineral and energy resources. In addition, it provides jobs, supports our nation's economy, serves as a highway for transportation of goods and people, and plays a role in national security.

Materials

6' Table

Chair (optional)

Table cover

1-2 stools

Exploration 1—Seaweed, the real stuff:

Small samples of brown, red and green seaweed

Plastic animal tub, small or large, ¼ full of seawater

Dried seaweed, natural and/or packaged (optional)

Exploration 2—Seaweed slime:

Alginate (powdered brown seaweed)

1oz. Plastic cups with lids (enough for one set per participant) or 3 oz. paper cups

Beaker or jar of fresh water

Wooden stir sticks, 3-4 depending on number of participants

Damp cloth

Exploration 3—Seaweed in everything:

5-6 Product containers/boxes with seaweed in ingredients (see Prep Section)

3-4 Magnifying lens

Laminated list of seaweed “code names” found in ingredients lists:

Carrageenan, Algin/Alginate, Agar (see Prep Section)

Prep Section

Collect seaweed samples

Purchase Alginate powder

Write out the “code names” Carrageenan, Algin/Alginate, and Agar, and laminate the list

Collect containers that list seaweed and any of the following words as ingredients:

Carrageenan, Alginate, Sodium Alginate, Calcium Alginate, Alginic acid, and Agar).

Suggested items to include:

Fruit by the Foot

SaraLee Brand Original Cream Cheesecake

Dreyer's Grand Vanilla Ice Cream

Jell-O Brand Flan

Nestle Quik Chocolate Milk (and other ready-made refrigerated chocolate milks)

Lite Ranch dressing (and other brands of Lite, low oil, no oil salad dressings)

Fruit and Cereal Bars, such as Lucky Brand Fruit and Grain Cereal Bars

Dole Fruit and Cream Bars

Carnation evaporated milk

Soy milk

Agar or Agar pudding

Hostess Cup Cakes and Fruit Pies

Horchata mix (some)
Seaweed Ramen soup
Seaweed crackers
Hidden Valley Party Dip (dry)
Velveeta cheese
Similac baby formula
Yogurt (some brands)
Eggnog (some brands)
Sunny Delight fruit juice (not California style)
Tofutti
Lucerne non-fat cottage cheese
Hain's pudding mixes
Pie and bakery fillings and glaze on doughnuts
Danish Pastries (store-bought)
Slim Fast (canned drink)
Sushi (ie., California rolls)
Aqua-Fresh, Tom's and Ultra Brite toothpastes
Lucerne clam dip
Kraft Shells and Cheese
Entenmann's Cakes
Seaweed Candy
Nestle's Crunch Ice Cream Bars or Nuggets
Nestle's Quik Powder

Procedure and Set-up

Set up the table with three Exploration Stations.

Exploration #1—Seaweed, the real stuff. Place this station in the center. Keep the packaged seaweed in the package to prevent it getting wet or misplaced. Have a dry towel for wiping wet hands.

Exploration #2—Seaweed slime. Give a bit of extra room for the slime activity. This exploration can wrap around the corner of the table. Plan to have about 4-5 mini-stations for making slime. Lay out 4-5 cups with a stir stick and paper towel. Have a bowl with the 1 inch pieces of dried seaweed pieces and the container of Alginate clearly labeled with a measuring spoon and a pitcher of water closer to the presenter to control amounts used and to help younger learners.

Exploration #3—Seaweed in everything. Stack the product container boxes so they are easily seen and accessed by participants. Post the laminated sign and directions and lay out all the food containers with the hand lenses. This station can wrap around the corner as well. If you have two presenters, you can have one focus on the slime exploration and the other on the ingredient and algae explorations. If you have one presenter, the ingredient exploration can be primarily self-guided. Use signage to help direct your participants in their task.

Guiding Questions

Have you ever eaten seaweed before?

What did it taste like?

Have you ever seen or touched seaweed?

Where were you when you did this?

Do you remember what it looked like? Felt like?

What does this wet seaweed feel like?

What does this dried seaweed feel like?

What colors is seaweed?

How would you describe the texture of this seaweed?

What do you think would happen if we added this dried seaweed to some water?

How do you think some of these food products are connected to the ocean?

Activity Description

Introduction: Invite visitors to come and participate. Use different methods to pique their curiosity. For instance, ask them if they have eaten or used any seaweed today, or if they would like to make slime. Also, let them know that a lot of food manufacturers put seaweed into all kinds of food that we eat, and then ask them to “come over and we’ll find out together why they do that.” Once they are hooked, engage the guest in an exploration. Often the participant will be drawn to one part of the table or the other, let them guide you to a starting point. If they do not ‘choose’ a place to start, do it for them.

There is no order in which the explorations need to be done, and visitors do not need to do all three explorations. But the presenter does need to help visitors make the connections between the explorations if visitors do more than one exploration and are not making the connections on their own.

Seaweed, the real stuff: Initiate a conversation with the visitors where you talk with them by asking each other questions and offering to each other descriptions and explanations. In this exploration, visitors have the opportunity to examine (touch, smell, think about) many different kinds of seaweed. Two related tasks could help focus their close examination: compare and categorize the different species of seaweed. The following are some guiding questions you may want to ask, or tasks you may do with the visitors. Be sure to encourage visitors to ask their own questions.

- Give visitors free time to look at and feel the seaweed samples.
- Have you have seen, touched, or eaten seaweed before? Where did this happen/occur? What did they think about the experience? How are these samples same or different from the seaweed you have seen or eaten?
- Describe to each other what the seaweeds feel like. Which ones feel similar?
- How many different seaweed colors do you see?
- Feel free to ask me any questions about the seaweeds.
- Let’s sort these seaweeds into different groups. Use whatever features/criteria you want. You might want to group them according to what they have in common.
- Share with everyone the features/criteria you use to sort. (If there are multiple groups of visitors doing the exploration at the same time, point out how their criteria are similar and different.)

- If visitors have not done the other explorations, encourage them to check out the other explorations. Ask them which seaweeds they have eaten before or which seaweeds do they think that they eat. Tell them that green seaweeds are often called sea vegetables and recognizable when we eat them, but we may eat seaweeds all the time and not know. They could discover some foods that seaweeds are in that they didn't know about and perhaps be able to predict why we put seaweed in so many foods in the other two explorations.
- If visitors have done the other explorations, then try to make connections between ideas with visitors from the other seaweed explorations. Ask them how the sliminess of seaweeds would be helpful in food products.

Potential key ideas to address in this conversation

1. Seaweed comes in many varieties and is only found in certain parts of the ocean.
2. Seaweed needs to be in shallow cold water, rich in nutrients.
3. Seaweed, like the ones in the container, are classified or organized by color and other characteristics.
4. Some of the most common seaweed in restaurants or stores are red and brown seaweed.

Seaweed slime: Engage in a conversation with visitors about the slime property of seaweed. In this exploration, visitors have the opportunity to conduct an experiment to make seaweed slime in order to figure out why powdered seaweed is a common ingredient in many food products. They will use powdered seaweed (alginate) and water for this experiment. Below are some steps for the experiment; followed by some guiding questions you may want to ask, or tasks you may do with the visitors. Be sure to encourage visitors to ask their own questions.

1. Give each participant a small cup with a small amount of water in it (approximately one tablespoon of water in cup).
 2. Add a small amount of alginate with the wooden stir stick for each participant, approximately $\frac{1}{4}$ teaspoon of powder.
 3. Have participants stir the alginate into the water.
- Did you know that there is seaweed in many products we use and eat? These products include toothpaste, ice cream, pudding, and even chocolate milk. Any ideas why seaweed is necessary in these products? Let's see if we can figure this out together.
 - If visitors have done the "Seaweed, the real stuff" Exploration, then these questions might be a nice way to connect the two explorations.
 - What do you remember about how the real seaweed feels like?
 - What about when you rewetted the dried seaweed? What do you remember about how it felt?
 - So do you think this characteristic of seaweed would go away if the seaweed was dried and then ground up into a fine powder? Well let's find out.
 - After visitors have stirred the powder, invite them to take a closer examination of the mixture and compare it with others.

- What do you see? Does everyone's mix look the same? Feel the mixture. What does it feel like?
- A very little amount of powder was added to the cups. What do you notice? Describe to each other how this mixture moves and feels.
- Where did all the water go?
- Talk with each other and see if you can figure out how this mixture is helpful for products like ice cream, toothpaste, and pudding? Keep in mind what it feels like and what happened to the water.
- What is a question you may want to ask to find out more about this seaweed powder?

Potential Key ideas to address in this conversation

1. Alginate is a powdered extract of brown seaweed.
2. Alginate is used in many food and other products we use as an emulsifier (e.g., to keep ingredients mayonnaise, salad dressing, and chocolate milk in suspension); thickener (e.g., to thicken pie filling so it does not soften the pastry crust); and stabilizer (e.g., for ice cream, to keep it from forming large ice crystals).
3. These properties are also useful in other products like toothpaste, and in the textile industry to thicken pastes containing dye.
4. In this experiment, the seaweed powder absorbs the water and “holds onto it” in a slime. That slime is what emulsifies, thickens, and stabilizes the ingredients in the products we use.

Seaweed everywhere: Talk with visitors about the presence of seaweed in many products we use everyday, where we may not even know it. In this exploration, visitors explore the different products we use everyday that have seaweed in them. They will look in ingredient lists to find seaweed “codenames” since it is the powdered seaweed extract that is named in these products, not the actual seaweed itself. The following are some guiding questions you may find useful want to ask, or tasks you may do with the visitors. Be sure to encourage visitors to ask their own questions.

- What's the connection between some of these foods (hold up some of the food packages) and the ocean?
- Let's take a look at the ingredients list to find the common ingredients.
- Why do you think seaweed is in so many of these products? Encourage visitors to share their answers.
 - If visitors have not done the other explorations, then this question is a good way segue them. Tell visitors that they should explore some of the properties of seaweed in the explorations to try to figure out the answer to your question.
 - If visitors have done the other explorations, then remind visitors about what they did and noticed about seaweed in those explorations that would be useful to help them answer your question.

Potential key ideas to address in this conversation

1. Powdered seaweeds are known as agar, carrageenan, and alginate (or algin).
2. These powders come from different species of seaweed.

3. Depending on the seaweed species and the extraction process, the powder may have different properties for use in different kinds of products. For instance, *Macrocystis* can give a medium-viscosity alginate, or a high viscosity with a careful extraction procedure (lower temperature for the extraction). *Sargassum* usually gives a low viscosity product. *Laminaria digitata* gives a soft to medium strength gel, while *Laminaria hyperborea* and *Durvillaea* give strong gels. These are some of the reasons why alginate producers like to have a variety of seaweed sources, to match the alginate to the needs of particular applications.

Additional Resources

http://encarta.msn.com/encyclopedia_761573848/Algae.html

<http://www.fao.org/DOCREP/006/Y4765E/y4765e08.htm>

Kelp Forests. Judith Connor and Charles Baxter. Monterey Bay Aquarium.

<http://www.seaweed.ie>

Vocabulary

Seaweed – a form of marine algae.

Background

Many kinds of seaweed are edible and rich in vitamins and iodine. They are as common in many Asian countries as green beans and carrots are in the United States. But until more people here develop a taste for sea vegetables, it is alginates, carrageenan, and beta-carotene -- seaweed derivatives that act as stabilizers, thickeners, and colorants -- that end up on our dining room tables.

Seaweeds are not really weeds but large forms of marine algae that grow in the coastal ocean waters of many countries. Marine algae include thousands of species ranging from microscopic plants called phytoplankton to giant floating or anchored plants, seaweeds. The three main groups of seaweed are brown, red, and green algae, each providing important ingredients for the manufacture of food and other products. Carrageenan is a generic term for compounds extracted from species of red algae. Carrageenan is used in stabilizing and gelling foods, cosmetics, pharmaceuticals, and industrial products. From brown algae come alginates. They make water-based products thicker, creamier, and more stable over extreme differences in temperature, pH, and time. For example, alginates prevent ice crystals from forming in ice cream. Beta Carotene, a natural pigment derived from green algae, is used as a yellow-orange food coloring and may help prevent certain types of cancers.

These seaweed derivatives represent only a small part of the many living and nonliving products we derive from ocean plants, animals, minerals, and seawater. Together, they provide an important reason to protect the oceans.