

LESSON 4 Taking a Closer look at Seaweeds

Lesson at a Glance

Students are introduced to seaweeds, the marine algae, by thinking about ways in which humans use them for foods and other products. They then engage in a *scavenger hunt* in which they learn to recognize and describe common native seaweeds. Looking at the term *seaweed*, students ponder the meaning of the term *weed*, and discuss whether, and under what circumstances, seaweeds should be considered weeds. The lesson closes with connections to the on-going bottle aquarium project, pointing out that the elodea and duckweeds are aquatic plants, not seaweeds.

Lesson Duration

Two 45-minute periods

Essential Question(s)

What are seaweeds?

What are the roles of seaweeds in coastal waters?

How do seaweeds support organisms in a food chain or food web?

How do invasive seaweeds impact Hawai‘i’s environment?

Key Concepts

- Seaweeds are marine algae, not aquatic plants, because they do not have true roots or leaves. But they do carry out photosynthesis similar to plants.
- Seaweeds are primary producers that support a complex web of coastal and near-shore marine life. Many simple food chains and food webs for tide pools, rocky intertidal areas, and reef flats can be traced back to seaweeds (marine algae).
- Calcium carbonate depositing seaweeds help form and maintain the reef edge and reef flat, and their cementing action helps to form reef-flat limestone.
- Invasive species upset ecosystems by becoming strong competitors for food and space, and lead to the loss or reduction of indigenous species.

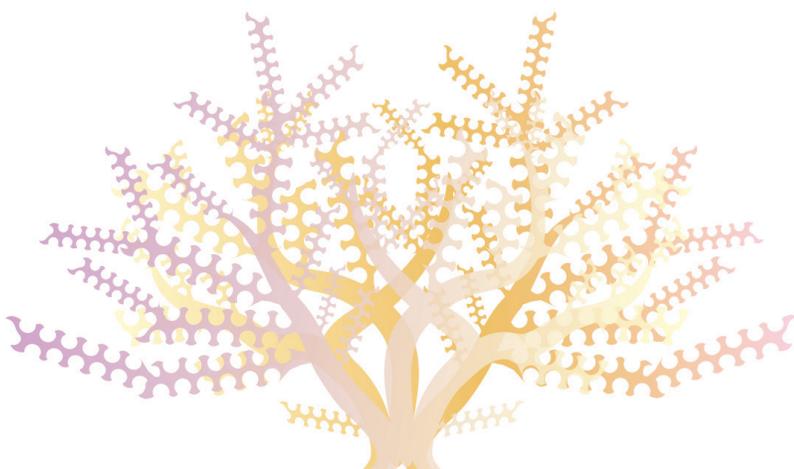
Instructional Objectives

- I can explain to others what a seaweed is.
- I can explain the role of seaweeds in a food chain or food web.
- I can explain to others an example of a problem caused by invasive seaweeds

Related HCPSIII Benchmark(s):

Science SC.4.3.1
Explain how simple food chains and food webs can be traced back to plants.

Language Arts LA.4.5.1
Use appropriate facts and interesting details that develop the intended meaning and anticipate the needs of the audience.



Assessment Tools

Benchmark Rubric:

Topic		Cycles of Matter and Energy	
Benchmark SC.4.3.1		Explain how simple food chains and food webs can be traced back to plants	
Rubric			
Advanced	Proficient	Partially Proficient	Novice
Compare the characteristics of simple food chains with those of food webs	Explain how both simple food chains and food webs can be traced back to plants	Describe how simple food chains or food webs can be traced back to plants	Recognize that simple food chains or food webs can be traced back to plants
Topic		Meaning	
Benchmark LA.4.5.1		Use appropriate facts and interesting details that develop the intended meaning and anticipate the needs of the audience	
Rubric			
Advanced	Proficient	Partially Proficient	Novice
Use appropriate facts and interesting details that creatively develop the intended meaning and clearly anticipate the needs of the audience	Use appropriate facts and interesting details that develop the intended meaning and anticipate the needs of the audience	Use some trivial facts and obvious details that relate to but do not develop the intended meaning or anticipate the needs of the audience	Use inappropriate facts and irrelevant details that do not develop the intended meaning or anticipate the needs of the audience

Assessment/Evidence Pieces

Lesson

- Seaweed Scavenger Hunt student worksheet

Materials Needed

Teacher	Class	Group	Student
<ul style="list-style-type: none"> None 	<ul style="list-style-type: none"> Research materials (books and access to the Internet) 	<ul style="list-style-type: none"> Variety (at least five different species) of seaweeds Seaweed Scavenger Hunt worksheets 	<ul style="list-style-type: none"> None

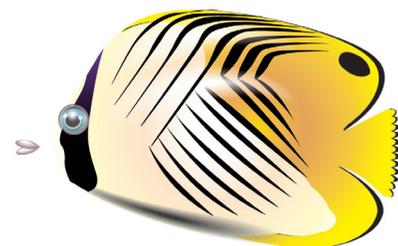
Instructional Resources

Student Worksheet: *Seaweed Scavenger Hunt*

Teacher Answer Key: *Seaweed Scavenger Hunt*

Variety of vascular plants (at least five species) such as plumeria, ferns, hibiscus, or any tree

Supplemental Resource: *Aquatic Food Chains Interactive Game (CD-ROM)*



Student Vocabulary Words

endemic: native to, and only found in a particular region.

indigenous species: species that are native, or occur naturally in a region.

introduced species: a species that is not native or indigenous to a given place or area, and that has been accidentally or deliberately transported to this new location by human activity.

invasive species: species that enter into new ecosystems and spread, causing damage to native species and their habitats (no natural predator).

native species: species that are naturally found in an area or habitat; not introduced by humans.

Lesson Plan

Lesson Preparation

- Review the Science Background provided in the unit overview.
- Preview and make copies of Student Worksheet *Seaweed Scavenger Hunt*, one per student.
- Gather materials and resources, and reserve the computer lab and research areas for students.

I. *Seaweeds*

- A. As a way to motivate students' attention on the topic of seaweeds, ask how many of the students in the class have eaten or used seaweeds recently. Ask them to give you some examples, and list these on the board.
- 1) Anticipate that in Hawai'i, many students are familiar with eating food recipes using seaweeds, including ogo (*limu*) Hawaiian dishes, or Japanese sushi and nori.
 - 2) Also explain that seaweed extracts are used as gels and thickening agents. (Show pictures or real examples of items such ice cream, whipped cream, hair gel, and toothpaste.) Both carrageen and agar are edible extracts made from seaweed. (Some students may be familiar with the term agar, which is listed in some local agar recipes.)
 - 3) Explain that in this lesson, the class will be investigating the seaweeds. Without going into details, tell students that scientists call the seaweeds *algae*, and that Hawaiians call them *limu*.
- B. If possible, have one or more samples of fresh seaweeds available for students to examine. If you cannot collect fresh seaweeds, fresh limu are often available in supermarkets. (For example, local recipes such as poke often use limu manaua, a type of *Gracilaria* that is often called by its Japanese name, ogo.)

II. *What do we know about seaweeds?*

- A. Develop a KWL chart with the students.
- 1) List what the students know, or think they know, in the left column (K). Later in the lesson, have the class return to this list to check the statements.
 - 2) Have students make a list of questions concerning what they want to learn for the middle column (W). Prompt students, as needed, to ask such questions as:
 - a. What is seaweed?
Explain that seaweeds are marine algae. They are not considered plants because they lack true roots, stems, and leaves.
 - b. Are the elodea and duckweed in the bottle aquariums seaweeds?
Explain to students that the elodea and duckweeds are not seaweeds because they have roots and produce flowers as well as live in freshwater. They are examples of aquatic plants.
 - c. Where do seaweeds grow?
 - d. How do they grow?
 - e. What animals depend on them?

III. *Seaweed Scavenger Hunt*

- A. Divide the class into groups of two or three. Distribute the scavenger hunt worksheets. Explain that they are going on a scavenger hunt to find information about seaweeds. Have students assist in establishing the scavenger hunt rules and timelines.
- B. Have each group choose 1 or 2 seaweeds from the list on their worksheet. Instruct the students that they may use either Internet resources or reference books to find their seaweed information. Write on the board a few suggested websites that might help from the list below.

Websites useful for this activity include:

www.Hawaii.edu/reefalgae/default.htm Click on Native Algae, and then click on Reef Watchers Field Guide to Alien and Native Hawaiian Marine Algae and scroll down.

http://www.waquarium.org/_library/images/education/marinelifeprofiles/seaweeds0909.pdf

- C. Compile all the group's findings into a class matrix table. (NOTE: You may want to create a large matrix on butcher paper, the chalk board or on an overhead for the students to see.) Then begin a discussion with the students' about their research and findings.

IV. *Seaweed in a Marine Food Chain*

- A. This "A" is an optional step: What is a weed? Ask students to come up with a definition. Here students might want to look up the definition. Simple definitions include a *plant that is undesirable*. Briefly discuss weeds that grow in yards or parks, in gardens, or among farm crops.
 - 1) Point out that, generally, plants considered weeds are growing very well, but are *out-of-place*.
 - 2) Discuss examples of plants that are weeds in one setting, but could be beneficial in another setting. (For example, grasses are weeds in a garden, but food for horses and cows in a meadow.)
 - 3) Ask students whether they think seaweeds are beneficial, or as their name implies, weeds.
- B. Beneficial seaweeds.
 - 1) Give some examples of how seaweeds play a variety of roles in coastal ecosystems that are beneficial or desirable:
 - a. Seaweed is a primary producer as food for animals, for example, herbivores, such as
 - > turtles, known to eat even alien seaweed species
 - > manini, known to eat even alien seaweed species
 - > opihi (limpets) which graze on *pahé'e* (Porphyra, green algae) found on wave-splashed rocky areas
 - b. As habitats (e.g., crabs, shrimps, brittle stars, bryozoans, and encrusting sponges.) Point out that this is why it is necessary to rinse and remove these organisms before taking home and eating edible limu.
 - c. As builders and protectors of the reef edges, reef flats, and white sandy beaches (See Suggested Reference: *Algal Meadows in Hawai'i : Gardens of the Deep*)
 - > Calcium carbonate depositing seaweeds help form and maintain the reef edge and reef flat, and their cementing action helps to form reef-flat limestones. An example of this seaweed is the pinkish or maroon-colored encrusting red algae that may be seen on rocky walls at low tides.
 - > White sand builders include **Halimeda**, which forms small calcified disks that make up a substantial portion of the sand on beaches, such as Kailua on O'ahu.
 - d. As food for humans: edible limu; seaweed extracts.
 - 2) Draw simple food chains that begin with seaweeds. For example:
 - seaweed > sea turtle > sharks
 - seaweed > sea urchin > fish (triggerfish, wrasse)
 - seaweed > opihi (limpets)
- C. Engage in a post-activity conversation to discuss "Do we ever consider seaweeds as weeds or undesirable?" Discuss the following problems involving seaweeds:

- stinging seaweeds (seaweed dermatitis)
- seaweed algal blooms that occur when nutrient levels rise from sewage or fertilizer runoff
- seaweed and algal blooms overgrowth smothers coral
- alien and invasive species outcompete native and endemic species for habitat space and light

V. *Revisit KWL Chart*

Ask students to update their KWL chart. *Were your questions answered? What other questions do you have? What have you learned?*

Extended Activities

1. Collect seaweeds, keeping them in a bucket with seawater.
 - a) Sort through the seaweeds, looking carefully for other organisms that attach themselves to the seaweeds, or live in the seaweeds, as for example, sponges.
 - b) Identify native seaweeds, and look for possible alien (introduced seaweeds).
 - c) Press samples of the seaweeds.
 - d) Make a pressed seaweed art project. Arrange several seaweeds onto cardstock or other craft paper. Consider making a collage for framing, or make gift cards.
 - e) Select a piece of seaweed, clean and rinse it. Float it in a pan with a little bit of water. (Add a drop of bleach to prevent mold formation.) Slide a file card under the seaweed. Using a toothpick or tweezers, gently arrange the seaweed so that all of its parts are spread out and visible. Carefully remove the card and drain off the water. Place a sheet of wax paper over the card, then sandwich the card and the seaweed sample between sections of old newspapers. Place a weight on top of the newspaper to flatten the seaweed sample. Change the newspaper several times until the card and seaweed sample are completely dried.
2. Have students explain what product is from seaweed, or how seaweed is used in the recipe. The teacher can provide ice cream samples for the class (ice cream contains carrageenan). This is an exciting way to get parents involved. Students can write a letter to their parents informing them about the seaweed knowledge learned in the lesson, and ask them whether they could help them find something that has a seaweed product to share with the class.
3. Learn more about ways that Hawaiians used limu for food and culture.
4. Create an educational song to sing about invasive species to share with other students in the school.



LESSON 4

Seaweed Scavenger Hunt

Teacher Answer Key

Choose one or two of the seaweeds listed and do research on the Internet or using reference books to fill in the missing information.

Go to: www.Hawai'i.edu/reefalgae/default.htm Click on Native Algae, then click on Reef Watchers Field Guide to Alien and Native Hawaiian Marine Algae and scroll down.

Name of Seaweed	Features	Native, Alien, or Unknown	Interesting Facts
Caulerpa racemosa	Grape-like spherical branchlets, thick clusters, light green, found in tidepools and reef flats	Native	Native
Codium edule	Soft, spongy to touch, forked branches, dark green, Hawaiian name means rat's feet	Native	Native and edible; can be found at the Open Markets
Halimeda opuntia	Thick, kidney-shaped, calcified, blade green to chalky white, found in subtidal areas	Native	Native, major producer of carbonate sand in many tropical reef areas
Acanthophora specifera	Spiny like branches, red, brown to yellow in bright sunlight, found in intertidal, shallow reef flats, most successful alien	Alien	Invasive, most widespread and successful alien in Hawai'i because it's brittle, it breaks off easily, and large floating population of the seaweed makes for widespread distribution; outcompetes native seaweeds for space on the reef
Dictyosphaeria	Convoluting mass, large, "bubble" cell, commonly known as the green bubble algae	Native	Native, but has shown invasive tendencies where there is pollution or overfishing
Ulva fasciata	Flat, thin, sheet-like, thick clumps attached to basalt, bright green, found in intertidal and reef flats areas of high wave exposure	Native	Native, edible in soups, salads or as a relish. Abundant in high nutrient waters near stream mouths and outfall pipes.
Gracilaria salicornia	Brittle, easily fragmented, short, pointed side branches, yellow to dark red, found in calm intertidal and shallow reef flats, large, floating blooms in west Maui known as the gorilla ogo	Alien	Invasive, grows quickly, forming large, thick mats, killing coral and other seaweed. Spread primarily by fragmentation (pieces of seaweed floating to a new location)
Hypnea musciformis	Tips flattened, with "hooks," short, pointed side branches, yellow to dark red, calm, found in intertidal and shallow reef flats	Alien	Invasive, outcompetes native seaweeds for space on the reef; reproduces readily and spreads quickly attaching to hulls of boats and by floating pieces of seaweed. Makes the boats less fuel efficient. Is a food source for green turtles.

LESSON 4 Seaweed Scavenger Hunt

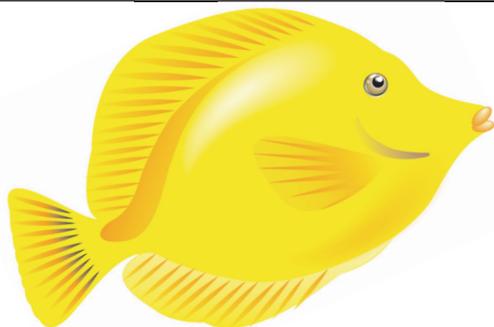
Team members: _____

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