



OCEAN GRAZERS

Concepts

This lesson includes an introduction to and a pre-assessment of the unit to come. Activities will gauge where students' knowledge and science enthusiasm is at, and touch upon the marine foodweb that is based on herbivory of *limu*.

HCPS III Benchmarks

SC 3.3.1

SC 3.1.1

Duration

(2) 45-min periods

Source Material

PRISM

Vocabulary

Herbivore

Ocean Grazer

Introduction to Ocean Grazers

Summary

Hawaii's coral reefs are home to a wide variety of plant and animal life. In this unit students will explore the great diversity of algae (*limu*) that exists within Hawaiian waters and delve into the rich array of ocean grazers (herbivores) that rely on limu as their main food source. Limu can be visibly attached to rocks, living on top of corals or amongst sandy patches, or microscopic and free-floating within the water column (this variety is called phytoplankton).

Some algae-eating animals in Hawai'i include the Sally Lightfooted (*a'ama*) crab, the Green Sea Turtle (*honu*), Spiny sea urchins (*wana*), and herbivorous fish species like the Convict tang (*manini*). The lessons in this unit incorporate a range of media and techniques to teach these hands-on science activities and to ensure that inquiry-based learning is taking place. This curriculum focuses on the concepts of structure and function and the link between them, as well as the interconnections that exist between plant and animal life (e.g. symbiotic interactions and foodwebs).

Objectives

- Students will be able to identify limu as an ocean resource and an essential part of the marine foodweb.
- Students will recognize several examples of limu-plant relationships from the foodweb.

Materials

One copy of the Pre-Assessment per student (11 x 14" paper where possible, or 8.5 x 11" paper otherwise)
One copy of Writing a Research Paper per student
One copy of Research Project worksheet per student
Two posterboards (any color will do – but black or white is best)
Colored construction paper

Making Connections

It is imperative that students make connections to previous lessons and personal experiences (for example: collecting limu or fishing at the beach) throughout the unit to ensure that they are confident with the take-home messages and unit objectives. For this reason, it would be beneficial to begin each lesson with a short "RPK" period (recalling previous knowledge) and never hesitate to interrupt a lesson to question, "Now boys and girls, how is this an example of an ocean grazer?" or, "What do marine herbivores (ocean grazers) eat?" or even, "What body parts do an 'opihi have?". Repetition will



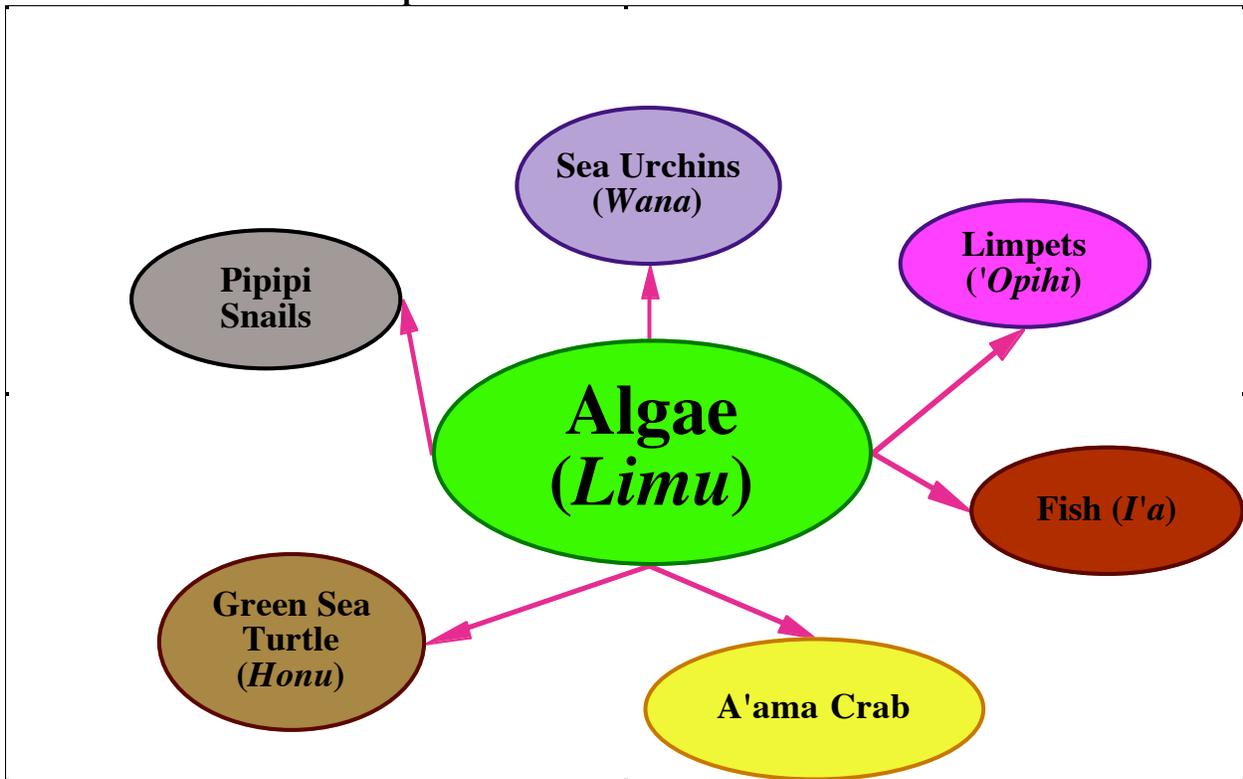
allow students to make connections between the lessons and build on their personal knowledge with what they have learned (and apply it elsewhere) which is an essential part of the learning process.

Teacher Prep for Activity

To begin the unit on Ocean Grazers, it is important to gauge where the students are (in terms of content knowledge, science attitude and enthusiasm, as well as inquiry skills). To accomplish these objectives, we have attached a Pre-Assessment to this lesson plan. Print the Pre-Assessment on single double-sided 11 x 14" sheet of paper (if possible, otherwise 8.5 x 11" will do). Make one copy for each of the students.

The introductory lesson is an ideal time to introduce the entire unit to the class by going through the Hawaiian Ocean Grazers Map. Before class, compile the Hawaiian Ocean Grazers Map (below) onto one of the posterboards (using construction paper circles) beforehand. Try to color coordinate the main organisms. For example, make limu green, honu brown, fish orange, wana purple, 'opihi dark brown, and pipipi black... etc. Otherwise, create a similar map on a chalkboard (or whiteboard or smartboard) during class. A simplified map of the different organisms to be studied during this unit is provided below. Wherever possible, go through some of the student questions from the Pre-Assessment activity and relate them to the individual animals or concepts that will be covered in the Ocean Grazers unit.

Hawaiian Ocean Grazers Map:





Attached to this lesson plan are two documents relating to the end-of-quarter research project. To introduce the research paper, print a copy of the (1) Writing A Research Paper, and (2) Research Project Worksheet and make enough copies of both for every student. In addition, there is a Research Project Rubric document available for the teacher that is found attached to Lesson 9: Conclusion Period. If the teacher prefers, they can also share this rubric with the class.

It is best to introduce the idea of a final project to the students in advance so they can start to think about which sea creature (especially which type of ocean grazer) would be of interest to them for further investigation. *Depending on each particular class and teacher preference, the teacher may instead decide to introduce the idea of a research project initially with the Ocean Grazer Intro period without passing out the actual assignment (Research Project) until several of the ocean grazers organisms have been covered (as in Lesson 3 - 5).*

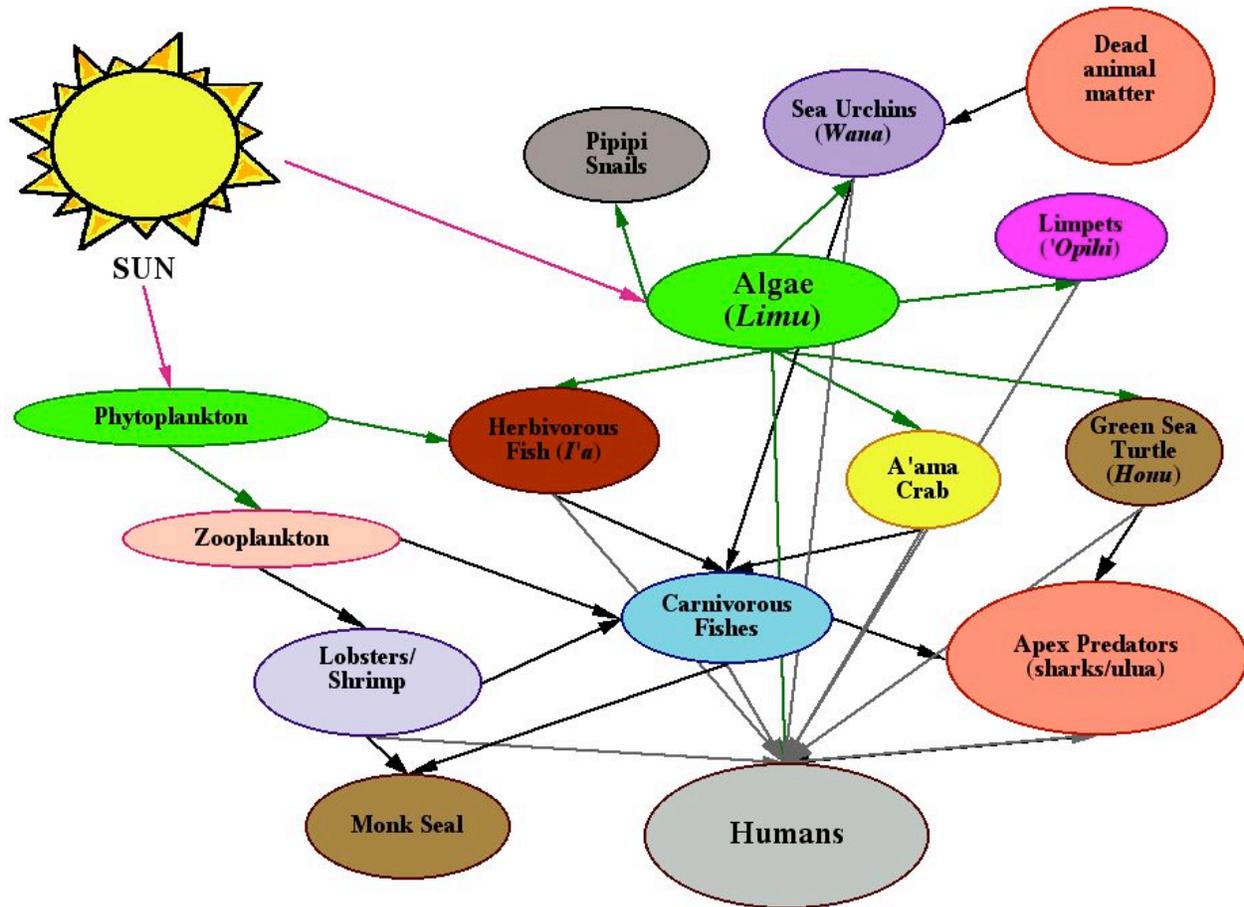
Background

Early on in the unit, it is important to keep the big picture in mind. This unit focuses on specific ocean grazers (herbivores) and their food sources (e.g. algae, phytoplankton) as a means to satisfy the 3rd-grade science benchmarks. In addition, the unit is designed to encourage inquiry-based learning in the classroom and strives to increase student knowledge of the sea around them. The Life Science HCPS III standards for 3rd graders focus on (1) the relationship between structure and function; (2) how specific structures are suited to survival; and (3) how plants depend on animals. The latter of which is a more tedious benchmark to ensure in the marine realm because relationships aren't as cut and dry as birds and bees pollinating plants.

Because the concept of foodwebs and the Ocean Grazers unit requires students to know the differences between plants and animals, it is also a good idea to at least briefly touch upon this concept prior to the unit's start. As this simplified foodweb displays, a lot of the sun's energy is passed onto the marine animal kingdom via phytoplankton and limu. The main difference between plants and animals is that plants produce their own food (carbohydrates) using sunlight alone via the process of photosynthesis. Animals, on the other hand, are reliant on other plants and animals as sources of food. This concept is sometimes easier to grasp using a terrestrial system as a model (e.g. sunlight → grass → cow → human). In fact, many science texts even omit passages on herbivores and invertebrates in the ocean (besides larger fish and cetaceans like whales, sharks and dolphins), but ocean grazers are of utmost importance to coral reef and open ocean ecosystems and a very fun topic to study!

Below, is a very basic Food Web/Energy Cycle to outline some of the relationships between plants and animals in the ocean. *(One thing to note is that the idea of a foodchain is outdated, the more scientists learn about the ecology and biology of life in the ocean, the more they realize the connectivity and intricate networks complicating of the system. In other words, foodweb is a much more appropriate word to be using with students.)*

Ocean Grazers Basic Foodweb:



Limu are extremely important to the herbivorous animals, a.k.a grazers, that rely on them as a food source. In Hawai‘i, limu is defined as any aquatic plant (e.g. moss, algae, seaweed). Grazers include animals such as *wana* (Spiny sea urchins), *pipipi* snails, myriad fish species, and ‘*opih*i (limpets). Some of these grazers, such as sea urchins, are fairly opportunistic and will eat almost any limu that they encounter. On the other hand, most herbivorous fishes tend to be finicky in their eating habits, preferring the native species of algae to most invasive ones. This has led to some major examples of invasive algal blooms in beaches in certain parts of Maui and O‘ahu. An algal bloom is the sudden development of a large mass of algae over a short period of time. A larger conservation issue arises when the delicate balance of coral and algae is altered because too many ocean grazers are removed from the system. This leads to a decrease in coral coverage and an ecosystem dominated by algae, an overall blow to the health of any coral reef.

- **FUN FACT:** Huismann and colleagues (2007) share that in any given square meter of reef space, coral reef fishes take over 2,000 bites of limu daily!!
- **FUN FACT:** For over two billion years in the ocean, algae were the only living organisms. By their presence, these aquatic plants produced oxygenated environments that allowed animals to begin life in the ocean (Francis M. Pottenger III *in* The Living Ocean Textbook).



Vocabulary

Herbivore – Same as a grazer, an animal that eats only plant materials.

Ocean Grazer – A grazer is any animal that relies on herbivory (feeds on plants) as its primary food source. Examples of ocean grazers include herbivorous reef fish and wana (sea urchins), some land-based grazers include deer, horses and rabbits.

Procedure

Activity 1. Pre-Assessment (45 minutes)

1. Pass out Pre-Assessment to each of the students.
2. Go over each of the questions (on both sides). *(The front-side of the Pre-Assessment addresses students' content knowledge on the ocean and grazers as well as science attitude and enthusiasm. The back-side (or second page) asks students to write down any questions they may have about the ocean or about grazers. What do they want to learn about these topics? Here is a chance for teachers to explain that "I don't know" is a valid answer, but that more important is hearing what they want to learn about – so please try and think of at least a few questions. At the end we are testing their inquiry skills by asking them to write any ideas they may have about how to find the answers to their ocean/grazer questions).*
3. Give the students ample time (~30 minutes) to complete this activity.
4. If extra time allows, students may color their drawings.

As a linking activity following the Pre-Assessment, ask the students to share their answers with the class:

5. Formulate a list (using a posterboard, an overhead projector, the whiteboard, Smartboard ... etc.) of what the class knows about the ocean, and another about their knowledge of grazers.
(Where class interest and time allows, ask students to individually come up to the front and write their ideas on the posterboards (to make them their own), or initiate a "gallery walk" and allow students to see what other students drew.)
6. Next, use a third and final posterboard to list out students' interests and questions (about the ocean and grazers).

Activity 2. Introductory Period & Research Paper (45 minutes)

1. Post any vocabulary words that come up during this discussion on an additional posterboard designated for vocabulary.
2. Place these posterboards around the classroom in an easily accessible and visible area.

Now, introduce the research paper to the students:

3. Pass out the Writing a Research Paper document to students.
4. Go over the main points and clarify any confusing parts.
5. Explain the intent of having an Ocean Grazers research project.
(The teacher may decide to save the actual Research Project document (with guidelines/expectations) for a little later in the unit once the students are more familiar with specific types of ocean grazers and have also had more time to conduct Internet and library research.)



Assessments

The main assessment included in the Introduction Period is the Pre-Assessment. The Pre-Assessment can be used at the end of the Unit as a comparison with the Post-Assessment to see how students' concept knowledge, science enthusiasm, and inquiry skills have changed. Vocabulary can also be included as a form of assessment using a variety of methods (e.g. crossword puzzles, word search, vocabulary quizzes).

Resources

A variety of resources specific to the lesson of interest are provided within the specific lessons (e.g. Lesson 2: Exploring Limu Diversity). However, there are many great reference and picture books about reef creatures available at school and public libraries. Also, there are several great websites to check out for species identification and coral reef ecology overviews. These references are provided as additional links for teachers to explore if they so choose. The children's books here might be incorporated in a silent/group reading extension activity.

Children's Activity Books:

- Alpert, T. The Incredible Coral Reef: Another Active-Learning Book for Kids 1996 (\$10.95 new)
- Niesen, T.M. The Marine Biology Coloring Book by Harper Perennial, 2000 (\$21.95 new) or 1982 (\$6.99 used on Amazon.com).
- Toki, W., Hoover, J.P., and K. Stender Know Your Fishes in Hawaii: A Fun Fish Identification Book for Kids 2005 (\$12.95 new)

Teacher Links:

- Tissot, B.N. "The Hawaiian Reef Ecosystem" – available at: <http://www.coralreefnetwork.com/reefs/ecology/ecology.htm>
- Waikiki Aquarium's Marine Life Profiles (see Hawaiian Limpet Snail, Sea Urchin, Coral Reef Fishes and many more) – available at: <http://www.waquarium.org/MLP/index.html>

Extension Activities

Choose one of the children's books about coral reefs (from list above or school's library) and read it to students as a read-a-loud.

Culture/Art/Math/Literature Connections

This unit uses a variety of means to stay connected to other disciplines (e.g. art, math, literature, culture). Where possible, the Hawaiian names of specific animals have been included.

However, there is always room for improvement. Ask local friends and *kupuna* to come in and share their knowledge and stories, to participate in fieldtrips, and to bring in things for show & tell. And give us feedback too! If there is anything that could add to one or all of our curricula please let us know – prism@hawaii.edu.



Writing a Research Paper 😊

Step 1: SELECT A TOPIC- Choose a topic you care about.

Step 2: RESEARCH STRATEGY-

- Write questions about your topic. What do you want to know and learn about?
- Learn all you can about your topic. Find at least (4) different sources of information (books, magazines, internet articles, encyclopedias, videos, interviews).
- Answer your questions as you read. Write your answers on note cards. Write down main ideas in your own words.

Step 3: WRITING THE FIRST DRAFT

- Put the information together in paragraph form.
- Do you have an introduction, a middle, and an end?
- Do you need more information? Do some parts seem unclear?

Step 4: WRITING THE FINAL REPORT

- If possible, please type your final research report.
- Is the information clear and organized?
- Is this your best work?

Step 5: Bibliography

- The bibliography lets the reader know what resources you used, and it tells the reader where you got your information.
- It is usually the last page of the research report.
- Follow the bibliography format.



RESEARCH PROJECT

- Science 3.5.1: Ss describe the relationship between structure and function in organisms.
- Language Arts 3.4.1: Ss write in a variety of formats for a variety of purposes and audiences.
- Language Arts 3.6.2: Ss give a planned speech to share information with peers.

TASK:

- Choose an ocean grazer (an aquatic organism that eats plants). For example, a type of crab, sea urchin, fish, sea snail, turtles. Focus on the animal's structure and function.
- Conduct the research.
- Create a visual display (poster, model, crossword puzzle, poem, diorama).
- Present your research paper and visual to the class.

DUE DATE: _____



Pre-Assessment

Name: _____

Date: _____

What do you think you know about Life in the Ocean?	What do you think you know about animals that Graze?	How do you feel about science?
Draw an ocean scene (picture of environment).		Draw animals grazing.



What do you want to know about how animals survive in the ocean?	What do you want know about plants in the ocean?
How do you think we could find the answers to the questions you have?	