CULMINATING LESSON
Mariculture and Aquaculture

Lesson at a Glance
Students will review previous lessons about ecosystems, food chains, plants, and invasive species. They will use the information learned to discover how this knowledge has affected Hawai‘i and can affect and sustain Hawai‘i in the future, through modern day aquaculture and mariculture techniques. Students will read about current news on aquaculture in Hawai‘i, and work to incorporate the different lessons into their bottle aquarium project conclusion.

Lesson Duration
One 60 minute period

Essential Question(s)
How has technology influenced our understanding of food chains and food webs?
How can knowledge about ecosystems affect our economy and environment in Hawai‘i?

Key Concepts
- Technology has allowed aquaculture in Hawai‘i to progress from ancient fishponds to the extensive tanks and research being done today.
- Aquaculture impacts society, the environment and the economy.

Related HCPSIII Benchmark(s):

Science SC.4.2.1
Describe how the use of technology has influenced the economy, demography, and environment of Hawai‘i.

Language Arts LA.4.2.5
Summarize main points found
in informational texts.

Language Arts LA.4.6.1
Participate in grade-appropriate oral group activities.

Instructional Objectives
- I can describe how aquaculture impacts Hawai‘i’s economy and environment.
- I can describe how technology impacts aquaculture in Hawai‘i.
- I can describe how the bottle aquarium is a mini-ecosystem, and explain its importance to understanding the larger picture of conservation and sustainability in our marine environment.

Assessment Tools

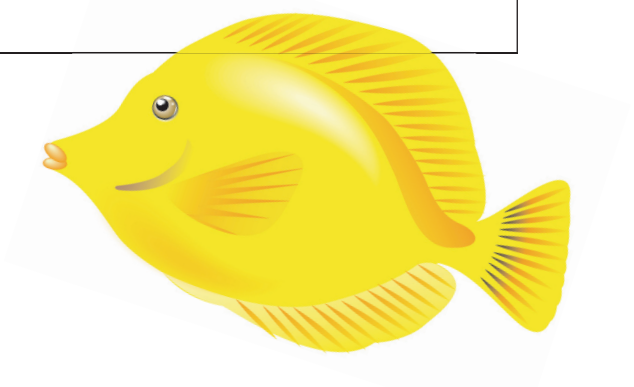
Benchmark Rubric:

Topic		Science, Technology, and Society	
Benchmark SC.4.2.1		Describe how the use of technology has influenced the economy, demography, and environment of Hawai‘i	
Rubric			
Advanced	**Proficient**	**Partially Proficient**	**Novice**
Explain how the use of technology has influenced the economy, demography, and environment of Hawai‘i and suggest ways to conserve the environment	Describe how the use of technology has influenced the economy, demography, and environment of Hawai‘i	Give examples of how the use of technology has influenced the economy, demography, and environment of Hawai‘i	Recognize that the use of technology has influenced the economy, demography, and environment of Hawai‘i
Topic		Constructing Meaning	
Benchmark LA.4.2.5		Summarize main points found in informational texts	
Rubric			
Advanced	**Proficient**	**Partially Proficient**	**Novice**
Summarize the main points and describe their connection to the main idea or focus in informational texts	Summarize the main points found in informational texts	Produce a summary that mixes insignificant points with main points	Summarize information not necessary to understanding the main points of informational texts, or repeat original text rather than summarize
Topic		Discussion and Presentation	
Benchmark LA.4.6.1		Participate in grade-appropriate oral group activities	
Rubric			
Advanced	**Proficient**	**Partially Proficient**	**Novice**
Participate in grade-appropriate oral group activities, in a highly effective way	Participate in grade-appropriate oral group activities	Participate in grade-appropriate oral group activities, in a limited way or in a way that only partially facilitates the group’s work	Participate very little in grade-appropriate oral group activities or participate in a way that does not facilitate the group’s work

Assessment/Evidence Pieces

Lesson

- *Section III. Making the connections*



Materials Needed

Teacher	Class	Group	Student
• None	• None	• Poster paper and markers for webbing activity • Copies of readings for groups	• None

Instructional Resources

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

Student Vocabulary Words

aquaculture: the cultivation of aquatic organisms such as fish or shellfish for food.
mariculture: the cultivation of marine organisms in their natural environment.

Lesson Plan

Lesson Preparation

- Review the Science Background provided in the unit overview.
- Gather materials and supplies for the lesson.

I. *Bringing it all together*

A. Review with the students the information that they have learned through the previous lessons. Create a web for the class with *ecosystem* in the middle, and branches of ideas on the sides. These terms can include, but are not limited to animals, plants, and food web. From these terms, ask students to continue webbing what they have learned. Students work in small groups, and then share their web with the class.

B. Once all groups have shared their webs, ask the students: Why do we need to know this? Why study ecosystems? Why is this bottle aquarium so important (*hold up aquarium*)? What does your bottle represent? Use this question to open a class discussion. Provide time for groups to think and share back their answers.

C. Explain to students that their bottle aquarium is a representation of a larger ecosystem. Our ecosystems are changing due to invasive species and other environmental issues. As a result, if we do not study all the plants, animals, and the relationships within an ecosystem, we may lose our living organisms. If that happens, what will the affect be on humans? (*no food, no life*)

II. *Exploring Mariculture and Aquaculture*

A. Explain to students that some companies are working to create an environment in which to raise certain species of plants and animals in Hawai‘i. Why would these companies do that? (*To save species whose populations have been depleted in the wild, to save native species that are near extinction due to invasive and other environmental events, to feed people, and to entertain people, for example, aquarium fish. You should also point out that unfortunately, this is not always the case. Most aquaculture operations’ primary goal is to feed people and make a profit. If they can successfully aquaculture an overfished species, that benefits the species.*

B. Provide each group with a different article to read based on the area. Students in the groups are responsible for taking notes on the reading, discussing their notes and questions with each other, and presenting a summary back to the class.
C. Summaries need to focus on the most important information in the article and omit insignificant information. When sharing their summaries, students will take notes on the information.
D. All readings deal with aquaculture in Hawai‘i and different aspects of the technology and business. The readings include:
    1) Hawaiian Fish Ponds
        http://www.oceanicinstitute.org/_oldsite/aboutus/aquaHawaiian.html (Addresses ancient aquaculture.)
        http://starbulletin.com/2000/06/23/news/story5.html (News article covers the culture significance of fish pond preservation.)
    2) Aquaculture Today
        http://www.oceanicinstitute.org/_oldsite/aboutus/aquatoday.html (Provides information on the technology, research, and purpose for aquaculture today.)
    3) Aquaculture and Coral Reef Conservation (Reef Fish)
        http://www.cdnn.info/eco/e020124/e020124.html (Article that highlights the research done to replenish fish populations.)
    4) Aquaculture to Maintain Fish Supply for Food
        http://www.noaanews.noaa.gov/stories/s293.htm (Off shore aquaculture for moi (thread fish)).
    5) Aquaculture and Environmental Concerns
        http://www.npr.org/templates/story/story.php?storyId=5291579 (Stories relate to the deep sea cages in Hawai‘i.)
    6) Cultivating Seaweed on *Molokai*
        http://cals.arizona.edu/landandpeople/spring2004/article_10l&p.pdf (Reports highlights of the *Molokai's long ogo* project.)
    7) Hawai‘i Shrimp Brood Stock
        http://www.bizjournals.com/pacific/stories/2004/10/04/daily26.html?jst=m_ln_hl (Talks about the international significance of aquaculture in Hawai‘i.)

III. *Making the connections*

A. Based on the different article summaries and readings, students add to their bottle aquarium conclusions:
    1) Why is it important to study ecosystems?
    2) How has technology influenced the study of ecosystems and Hawai‘i?
    3) What are the larger implications for a bottle aquarium? What could the bottle aquarium represent?
    4) Give two examples of observations and inferences that might lead to a hypothesis about the bottle aquarium ecosystem.

Extended Activities

1. Visit aquaculture or mariculture farms, or have a guest speaker from one of the companies come in to share what they do, and show their products.
2. Do more in-depth research on seahorses, and make a class donation to the seahorse foundation on the Big Island.
3. Plan a field trip to a fishpond (*He‘eia* Fishpond, for example, has set up an educational program for visitors.)