

Hawaii's Freshwater Ecosystems

Developed by:
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Grade Level: Seventh Grade

Purpose: This curriculum is designed to communicate:

- I. Environmental conditions that influence species distributions and drive adaptations
- II. Specialization between coexisting species
- III. Unique characteristics of native and successful invasive species.

Hawaii Content and Performance Standards (HCPSIII):

Standard 1: The Scientific Process: Scientific Investigation: Discover, invent, and investigate using the skills necessary to engage in the scientific process.

Benchmarks

- SC.7.1.1. Design and safely conduct a scientific investigation to answer a question or test a hypothesis
- SC.7.1.2. Explain the importance of replicable trials
- SC.7.1.3 Explain the need to revise conclusions and explanations based on new scientific evidence

Standard 2: The Scientific Process: Nature of Science: Understand that science, technology, and society are interrelated.

Benchmarks

- SC.7.2.1 Explain the use of reliable print and electronic sources to provide scientific information and evidence

Standard 3: Life and Environmental Sciences: Organisms And The Environment: Understand the unity, diversity, and interrelationships of organisms, including their relationship to cycles of matter and energy in the environment.

Benchmark

- SC.7.3.2. Explain the interaction and dependence of organisms on one another

Standard 5: Life and Environmental Sciences: Diversity, Genetics, And Evolution: Understand genetics and biological evolution and their impact on the unity and diversity of organisms.

Benchmark

SC.7.5.4 Analyze how organisms' body structure contribute to their ability to survive and reproduce

Topic and Driving Question:

What are some important animals, biological processes, and environmental factors in Hawaii's freshwater ecosystems?

Rationale:

Growing up surrounded by ocean, Hawaiian students are often well exposed to marine animals and issues. However, the fresh and brackish waters of Hawaii are full of wonderfully adapted native animals as well as noxious invasive animals. These animals and ecosystems, which are found in every student's backyard and require neither a boat nor a fishing pole to investigate, are an excellent topic to make science relevant and interesting. This curriculum uses inquiry-based lessons to teach important scientific issues, such as experimental design, relatedness between species, and adaptations, within the context of Hawaii's fresh and brackish water ecosystems.

Concept Map for Unit: See below

Formative Assessment:

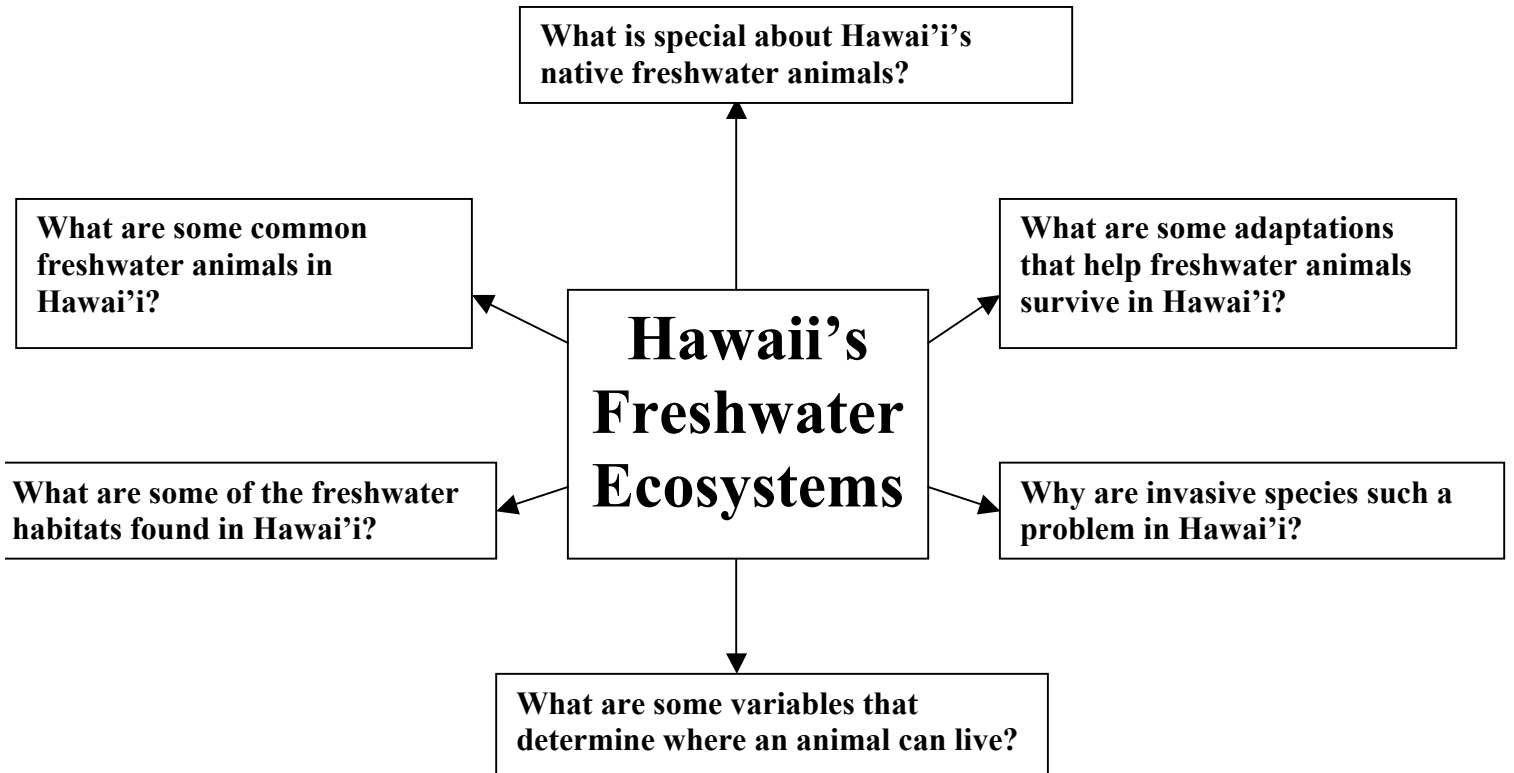
Students will demonstrate continued learning throughout the unit through completion of lab worksheets

Summative Assessment:

Completion of a 2 page cumulative test that includes true/false, matching, fill in the blank, and short answer questions.

Overview of Lessons Chart: See below

Unit Concept Map



Timeline	Lesson and Topic	Concepts	Student Objectives	Activity description	Assessment
<i>Week 1</i> <i>20 minutes</i>	Unit Introduction and Pre-assessment			Students complete a 2 page pre-assessment	“Hawaii’s Freshwater Ecosystems”
<i>~1 hour</i>	Build an Island Lab	Freshwater ecosystems change with the local substrate, slope, and rainfall patterns.	Students will learn how to conduct a rigorous scientific experiment using treatments and controlled variables.	Students create “islands” and subject them to “rain” to study how different environmental conditions effect can create different habitats.	“Build an Island” worksheet
<i>Week 2</i> <i>~1 hour</i>	Populations and Life Cycles	All species have unique growth and reproductive characteristics that can be learned through careful observation.	Students will learn how to design up a rigorous scientific experiment and make careful observations.	Students begin a 6 week experiment into the growth and reproductive characteristics of the invasive Pouch Snail.	“Pouch Snail Observation Sheet”
<i>Week 3</i> <i>~1 hour</i>	Species Report	Hawaii’s fresh and brackish water contains many native and invasive animals.	Students will learn how to conduct research and write a scientific report using their findings	Students research and write a 1-page report on one of a dozen common fresh and brackish water species	
<i>Week 4</i> <i>~1 hour</i>	Species Report	Hawaii’s fresh and brackish water contains many native and invasive animals.	Students will learn to present their findings to their peers and take notes from other presentations.	Students make a short presentation to the class summarizing what they learned about their selected species.	Report and Presentation
<i>20 minutes</i>	Populations and Life Cycles			Students conduct another round of observations	“Pouch Snail Observation Sheet”
<i>Week 5</i> <i>~1 hour</i>	Relatives in the River	All animals are related and can be classified accordingly.	Students learn to identify important similarities and differences between species.	Students classify 10 fresh and brackish water organisms and develop a dichotomous key	“Relatives in the River” worksheet
<i>Week 6</i> <i>~1 hour</i>	Backyard Scientists	Careful and detailed observation is a foundation of good science.	Students will be able to identify, observe, and describe some common local freshwater organisms	Students identify, observe, and describe some common local freshwater organisms	“Backyard Scientist” worksheet
<i>20 minutes</i>	Populations and Life Cycles			Students conduct another round of observations	“Pouch Snail Observation Sheet”

Week 7 <i>~1 hour</i>	Animal Adaptations	Adaptations help an organism survive in a specific environment.	Students will learn some important aquatic adaptations and will be able to relate them to environmental pressures.	Students pick a location then design a novel animal that is particularly well adapted to the stresses of that location.	“Animal Adaptation” worksheet
Week 8 <i>~1 hour</i>	Populations and Life Cycles	All species have unique growth and reproductive characteristics that can be learned through careful observation.	Students will learn to analyze data and draw conclusions.	Students conduct a final round of observations then a concluding worksheet to help them analyze and understand their data.	“Pouch Snail Observation Sheet” “Pouch Snails – Species Summary” worksheet
<i>20 minutes</i>	Brine Shrimp Hatching Experiment	Every species is specifically adapted to certain environmental conditions.	Students will practice designing an experiment to test a hypothesis	Students design an experiment to test for the optimal hatching conditions for brine shrimp.	“Brine Shrimp Hatching Experiment – Week 1”
Week 9 <i>½ hour</i>	Brine Shrimp Hatching Experiment	Every species is specifically adapted to certain environmental conditions.	Students will learn to collect data and draw conclusions regarding their hypothesis	Students collect data from brine shrimp hatched under different conditions and draw conclusions about the effect of the variables.	“Brine Shrimp Hatching Experiment – Week 2”
<i>20 minutes</i>	Post Assessment			Students complete a 2 page post-assessment, identical to the pre-assessment.	“Hawaii’s Freshwater Ecosystems”



Hawaii's Freshwater Ecosystems

Duration

15-20 minutes

Source Material

PRISM

Pre/Post Assessment

Summary

This is a 2 page test to be used as a measure of the student's knowledge of Hawaii's freshwater ecosystems before and after this curriculum.

Materials

"Hawaii's Freshwater Ecosystems" Handout

Teacher Prep for Activity

- Print out attached "Hawaii's Freshwater Ecosystems" handout, one per student
- Study the teacher's copy of the assessment

Procedure

As a pre-assessment:

- 1) Briefly introduce the curriculum (using the unit blueprint as an overview) without giving away any of the answers.
- 2) Handout assessments, one per student, and allow 15-20 minutes for the students to complete them.

As a post-assessment:

- 1) Briefly, and without giving away any answers, summarize what the students have learned during this curriculum.
- 2) Handout assessments, one per student, and allow 15-20 minutes for the students to complete them.



Name:

Date:

Hawaii's Freshwater Ecosystems

These are a series of questions to show how much you know about Hawaii's freshwater ecosystems. You will see these questions twice, once at the beginning of the quarter and once at the end. The first time you will not be graded but try to fill in as much as you can.

1) What is the biggest difference between ocean water and most water found in streams, rivers, or ponds?

2) What is "brackish" water?

3) Name two locations on the Big Island that have different freshwater environments and briefly describe each.

4) What are two environmental factors that might account for why these places are different?

True or False

10) A "native" species is one that arrived in a place without help from humans. T / F

11) Brackish water is saltier than ocean water. T / F

12) It is relatively easy for freshwater organisms to get to Hawaii from other places without any help from humans. T / F

13) Exotic aquarium fish (guppies, swordtails, etc) that are dumped into Hawaiian streams do not survive for long because they are not from here. T / F



Matching: Below are several organisms that can be found in the streams surrounding Hilo. For each, pick the description that goes with the organism and write the letter next to the name.

- | | |
|------------------------|--|
| 4) 'O'opu nopili ____ | a) This is the juvenile form of a frog |
| 5) Hihiwai ____ | b) This is an invasive fish that lives in the mouth of streams |
| 6) Tadpole ____ | c) This is also known as the "mountain shrimp" because it can climb to high elevations |
| 7) 'Opaekala'ole ____ | d) This is a small native fish that can climb waterfalls |
| 8) Tilapia ____ | e) This is an invasive shrimp |
| 9) Tahitian Prawn ____ | f) This is a native freshwater snail |

An adaptation is something that allows an organism to survive or overcome a particular threat, obstacle, or stressful situation. Below are some examples of adaptations that can be found in freshwater organisms in Hawaii. Below each example briefly describe the situation that makes the adaptation useful.

14) Several species of native gobies (O'opu) have fused pelvic fins that act as a sucker disc that helps these fish cling tightly to rocks and climb over obstacles.

15) The invasive Apple Snail has a snorkel-like breathing tube and a simple lung, in addition to a gill.

16) O'pae ula, a small shrimp found in anchialine ponds in Kona, often hide in underground cracks in the lava during the afternoon.

17) As scientists, it is often useful to bring an organism into the laboratory instead of just watching it in nature. Pick a fresh or brackish water organism that could be brought into a laboratory. What would you try to learn from it there? Briefly describe how you would do this.



Name:

Date:

Hawaii's Freshwater Ecosystems – Teacher's Version

These are a series of questions to show how much you know about Hawaii's freshwater ecosystems. You will see these questions twice, once at the beginning of the quarter and once at the end. The first time you will not be graded but try to fill in as much as you can.

1) What is the biggest difference between ocean water and most water found in streams, rivers, or ponds?

Salinity (saltiness)

2) What is "brackish" water?

Water that is less salty than ocean water but more salty than fresh. Usually found where the two are mixing.

3) Name two locations on the Big Island that have different freshwater environments and briefly describe each.

See the "Freshwater Habitats and Adaptations" lab for examples

4) What are two environmental factors that might account for why these places are different?

See the "Freshwater Habitats and Adaptations" lab for examples

True or False

- 10) A "native" species is one that arrived in a place without help from humans. **T / F**
- 11) Brackish water is saltier than ocean water. **T / F**
- 12) It is relatively easy for freshwater organisms to get to Hawaii from other places without any help from humans. **T / F**
- 13) Exotic aquarium fish (guppies, swordtails, etc) that are dumped into Hawaiian streams do not survive for long because they are not from here. **T / F**



Matching: Below are several organisms that can be found in the streams surrounding Hilo. For each, pick the description that goes with the organism and write the letter next to the name.

- | | |
|-------------------------|--|
| 4) 'O'opu nopili __d__ | a) This is the juvenile form of a frog |
| 5) Hihiwai __f__ | b) This is an invasive fish that lives in the mouth of streams |
| 6) Tadpole __a__ | c) This is also known as the "mountain shrimp" because it can climb to high elevations |
| 7) 'Opaekala'ole __c__ | d) This is a small native fish that can climb waterfalls |
| 8) Tilapia __b__ | e) This is an invasive shrimp |
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- 14) Several species of native gobies (O'opu) have fused pelvic fins that act as a sucker disc that helps these fish cling tightly to rocks and climb over obstacles.

Flooding, waterfalls

- 15) The invasive Apple Snail has a snorkel-like breathing tube and a simple lung, in addition to a gill.

Stagnant water with low oxygen

- 16) O'pae ula, a small shrimp found in anchialine ponds in Kona, often hide in underground cracks in the lava during the afternoon.

Escape predators or heat

- 17) As scientists, it is often useful to bring an organism into the laboratory instead of just watching it in nature. Pick a fresh or brackish water organism that could be brought into a laboratory. What would you try to learn from it there? Briefly describe how you would do this.**