G**5** U**2 L**2

LESSON 2 - Nature's Water Filter

Lesson at a Glance

In this lesson, students learn more about how the wetland plays a role in maintaining healthy marine environments. Through participation in a lab simulation that will demonstrate how water filtration occurs in a wetland, students will discover why it is important to preserve our wetlands. The lesson encourages students to work cooperatively in small groups to conduct the filtration simulation and prepare a lab report.

Lesson Duration

One 45-minute period

Essential Question(s)

How do wetlands play a role in the healthy marine environments? How are wetlands and ocean environments related? Why is it important to preserve the wetlands?

Related HCPSIII Benchmark(s):

Science SC.5.1.2 Formulate and defend conclusions based on evidence.

Science SC.5.2.1 Use models and/or simulations to represent and investigate features of objects, events, and processes in the real world.

Key Concepts

- Wetlands act as a natural water filter.
- A decrease in coastal wetlands areas can negatively affect coral reefs.
- Models and simulations can help us understand how natural processes work as well as possible effects to an environment when changes occur.

Instructional Objectives

- I can formulate and defend conclusions based on evidence.
- I can use a simulation to represent and investigate features of objects, events, and processes in the real world.
- I can describe the role of wetlands in maintaining healthy marine environments.





Assessment Tools

Benchmark Rubric:

Торіс	Scientific Inquiry
Benchmark SC.5.1.2	Formulate and defend conclusions based on evidence

Rubric			
Advanced	Proficient	Partially Proficient	Novice
Formulate and defend conclusions that are supported by detailed evidence and make connections to the real worldFormulate and defend conclusions that are supported by evidence		Make conclusions that are partially supported by evidence	Make conclusions without evidence
Торіс		Unifying Concepts and Themes	
Benchmark <u>SC.5.2.1</u>		Use models and/or simulations to represent and investigate features of objects, events, and processes in the real world	

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Rabile			
Advanced	Proficient	Partially Proficient	Novice
Consistently select and use models and simulations to effectively represent and investigate features of objects, events, and processes in the real world	Use models and/or simulations to represent and investigate features of objects, events, and processes in the real world	With assistance, use models or simulations to represent features of objects, events, or processes in the real world	Recognize examples of models or simulations that can be used to represent features of objects, events, or processes

Assessment/Evidence Pieces

Lesson

- Water Filtration Lab worksheets
- Water Filtration Lab Self-Reflection

Unit

• Student additions to their concept maps from Lesson 1.







Materials Needed

Teacher	Class	Group	Student
Board and markers	None	Two clear 2L bowls or deep plastic tray	 Safety equipment
 Demonstration set of 		(e.g., refrigerator drawer).	(gloves, goggles,
lab materials		 4 cups sphagnum moss (aka peat moss) 	apron)
		packed onto a wire mesh piece with handles.	Ruler
		4 cups of small rocks (larger than the wire	 Data table
		mesh squares).	
		1 two-liter bottle of turbid water.	
		• For turbid water, fill bottle with water, add ~1/2	
		cup dirt.	
		Shake bottle.	
		Worksheet Water Filtration Lab.	

Instructional Resources

Teacher Reading: *Wetland Water Filtration* Student Worksheet: *Water Filtration Lab* Teacher Answer Key: *Water Filtration Lab* Student Worksheet: *Water Filtration Lab Self-Reflection*

Student Vocabulary Words

nutrient: a substance that, when consumed, aids in growth and energy.

- **pollutant:** any substance, as certain chemicals or waste products, that renders the air, soil, water, or other natural resource harmful or unsuitable for a specific purpose.
- **sediment:** any particulate matter that can be transported by fluid flow, and which eventually is deposited as a layer of solid particles on the bed or bottom of a body of water or other liquid.
- **sphagnum moss:** mosses of the genus Sphagnum that grow in wet or hydric soil and whose decomposed remains together with other material form peat.
- **water filtration:** a process that removes impurities from water by means of a fine physical barrier, chemical processes, and/or biological process.



Lesson Plan

Lesson Preparation

- Review the Science Background provided in the Unit Overview and the Teacher Reading *Wetland Water Filtration*.
- Make copies of the Student Worksheet *Water Filtration Lab* (4 pages) and *Water Filtration Lab Self-Reflection*, one per student.
- Prepare the materials for each group to conduct the water filtration simulation.

I. Water Filtration Simulation

- A. Establish the small groups that will work together, distribute the *Water Filtration Lab* worksheets to each student. Pass out the required materials, or have them readily available at lab stations.
- B. Review the directions on how to do the simulation. Instruct students to pour the turbid water through the sphagnum moss until it comes clear, noting in their lab worksheets how long this process takes.
- C. Then, have students do the same with the rocks instead of the moss. Collect the lab worksheets for assessment.

Safety Note:

During the lesson, students may spill water onto the floors. This may cause slippery conditions. ALL students should be using covered shoes to do this lab activity.

Remind students to walk carefully (NO running and/or horseplay) and to follow all classroom safety rules. Students should also tell the teacher when they see water on the ground so that the teacher can clean it up.

Safety Note:

Goggles should be worn over the eyes at all times and should not be removed until the end of the lab when the teacher instructs them to.

Aprons should also be properly worn over clothing and should not be removed until the end of the lab when the teacher instructs them to.

Gloves should be worn properly and should not be removed until the end of the lab when the teacher instructs them to. Please see the Blood borne pathogens video for proper procedures to remove gloves.

ALL students should thoroughly wash their hands with soap and water at the end of the lab activity.

- D. Have students clean up the lab stations. Have students wash their hands thoroughly with soap and water after removing their gloves, but before removing their aprons and goggles.
- E. Have a post discussion with students about what they discovered during their lab simulation. Discuss what and how wetlands function as a filtering system based on what they observed during the simulation. Ask students why it is important that we try to protect and preserve our wetlands. Discuss any other questions, concerns or comments students may have regarding what they have just learned.

II. Assessment

- A. Conduct formative assessment for the unit by reviewing the Water Filtration Lab Self-Reflection.
- B. Have students add to their concept maps from Lesson 1 in a different color (You may want to have them include a color key to make it easier to monitor changes over time.).

Extended Activities

Science:

- 1. Expand the filtration simulation into an actual scientific study by having students implement the scientific method. Have students develop a clear hypothesis, test it by using a control, draw conclusions, and develop further questions (HCPS III Science Standards SC.5.1.1 and SC.5.1.2 apply.).
- 2. Take a field trip to a local coastal wetland and an adjacent coral reef at low tide. The students should investigate the waterways that connect the coastal wetland and coral reef, and test the water for turbidity and temperature.

Language Arts:

Have students make flashcards of the vocabulary words using their own definitions with graphic representations.

Technology Integration Ideas:

1. Sign up for time in your school computer lab, or make your classroom computers available to students to read additional information about the topics introduced in Lesson 3, such as Hawai'i's coastal marsh predators and the sanctuaries and refuges that have been established to protect endangered organisms.





LESSON 2 - Teacher Reading

Wetland Water Filtration

While preservation of Hawai'i's wetland ecosystems is important for the protection of endangered species and endangered habitats, there are other important reasons to preserve our wetlands. They are productive ecosystems harboring a variety of species of microbes, plants, insects, amphibians, reptiles, fish, birds, and mammals. They provide refuge and food to these organisms, many of which live some, or part, of their life cycle in a wetland. Wetlands trap sediments and excess nutrients from surface water run-off before it reaches open water, acting as a natural filter in maintaining water quality. Wetlands are important in flood protection, acting as sponges that slowly release surface water, rain, and snowmelt to the surrounding environment, controlling flood heights. Wetland plants hold soil in place with their roots, absorb wave energy, and break up the flow of rivers and streams, therefore, protecting shorelines and river banks from erosion.

The wetlands have a big job because they serve as a natural water filtration device that protects the delicate marine ecosystems of the ocean. The filtration process begins as surface water flows through a wetland area and moves around plants, which cause the water to slow down. Once this happens, the sediment carried by the water begins to drop out and settle on the wetland floor. Plant roots usually absorb nutrients from fertilizer application, manure, and local sewage that are dissolved in the water. Other pollutants that may be in the water stick to soil particles. In many cases, the wetland filtration process removes much of the water's nutrient and pollutant load by the time it leaves a wetland, therefore, allowing quality water to enter the ocean.

The following resources provide additional information: Environmental Protection Agency <u>http://www.epa.gov/OWOW/wetlands/index.html</u>

National Academies' Water Information Center

http://water.nationalacademies.org/basics_part_2.shtml

WestEd. (2000). Matter cycles. Retrieved January 29, 2007,

from www.planetguide.net/book/chapter_2/chapter2.html

WQM. (2004). Aquatic ecosystem health – bioaccumulation as a monitoring tool. Retrieved January 18, 2007,

A Toolkit for Water Quality Monitoring for Local Government,

from http://www.nwrc.usgs.gov/fringe/function.html





LESSON 2

Name: _

Date: _____

Water Filtration Lab

How does a wetland filter water?

In this lab, you will simulate the water filtration that occurs in a bog, one of the four main types of wetlands. Part of the water cycle involves a certain amount of water flowing into, and through, wetland areas. This includes rainwater and surface water, such as streams and rivers.

Sphagnum moss is one of the plants that grow in a bog. A bog is a soft, spongy, water-saturated area. It usually has acidic soil in an area full of dead plant material. Sphagnum moss is also called *peat moss* because it is often found in a type of bog called a peat bog. Sphagnum moss can hold large quantities of water inside its cells, sometimes holding up to 20 times its dry weight in water. How much water would you hold if you were a Sphagnum moss plant? 20 x your weight = ______. That's a lot of water! Wetlands are home to many plants that have special adaptations that allow them to thrive in water-saturated environments. Let's find out just how wetland plants play a role in filtering water that flows through the wetlands!

Materials Needed for Your Group

- Gloves, goggles, and aprons for everyone
- 2 bowls that can each hold 2 liters (2.11 quarts) of water either white or clear (you can also use a clear, deep plastic tray, such as a refrigerator drawer)
- 4 cups of sphagnum moss packed
- 1 wire mesh piece with handles, size: approximately 1 square foot (0.09 square meters)
- One 2-liter (2.11 quarts) bottle of turbid water (mixture of water and 1/2 cup of dirt)

Preparation:

- Safety First Everyone wears gloves, goggles, and aprons.
- Pack the four cups of sphagnum moss onto one of the wire mesh pieces with handles.
- Put the empty bowl (clear or white) on the table.
- Have the bottle of turbid water and the second bowl (clear or white) at the ready.



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Conducting the Simulation:

*Turbidity is a word that describes how clear or cloudy water can be. You would describe clear water as having *low turbidity* and muddy water has having *high turbidity*.

In this simulation, you will be monitoring water turbidity and how the wetlands affect it.

- 1. Shake the *turbid* water in its bottle for 30 seconds, mixing all of the solids in the water together. Students should avoid allowing the solids to gather at the bottom.
- 2. Pour the *turbid* water into one bowl.
- 3. Observation 1: Note how clear the water is in the *turbidity* chart below. Add detailed descriptions of how cloudy the water is.
- 4. Have one person hold the Sphagnum moss above the second bowl, while another person carefully pours the *turbid* water <u>through</u> the moss into the second bowl.
- 5. Observation 2: Note the level of *turbidity* in the water in the chart below. Add details of how the *turbidity* changes after pouring the water through the moss.
- 6. Repeat steps 4 and 5 until one of these two things happens: the water becomes totally clear (has low *turbidity*), or you have poured the water through the moss 25 times. Record your observations with each pour.



Observations on the Turbidity of Water

Trial	Describe Level of Turbidity
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	

Conclusions

As a group, discuss your observations of the simulation, and draw some conclusions. How did the water's turbidity change?

How do wetlands filter water?

What would happen if there were no wetlands to filter water?



LESSON 2 - Teacher Answer Key

Water Filtration Lab

Answers provided below are possibilities. As long as students are recording "honest" observations and conclusions, they are successful.

Observations on the Turbidity of Water

Trial	Describe Level of Turbidity	
1	Very turbid, bits of stuff floating, muddy	
2	Still turbid, less chunks, light brown	
3	Still turbid, no floating stuff	
4	Pretty clear, slight color to water	
5	Totally clear	
6		
7		

Conclusions

The sphagnum moss filtered out the sediment in the water after pouring the water only three times. After six pours, the water was totally clear.

Moss is a good filter.

Wetland plants can filter turbid water.

Without wetland, plants like moss, the dirt, or turbidity would end up in our drinking water, or probably in the ocean.

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LESSON 2

Water Filtration Lab Self-Reflection

Name: ______

Date: _____

Check the appropriate column with an X below.

Benchmark	l can	Almost	Not yet	Evidence (list where someone could find evidence of your meeting the expectation.)
I can use a simulation to represent and investigate features of objects, events, and processes in the real world.				
I can formulate and defend conclusions based on evidence.				
I can safely conduct a laboratory experiment.				

Reflections:

How did the simulation help you to understand the wetlands as a filtration system?