BE A WATER WATCHER

Grade 2

Lesson at a Glance

Students discover how much water they use in one day and initiate a water conservation campaign. Students also learn how to desalinate water.

Key Concepts

When people use water faster than it is restored by rainfall, water shortages and reduced stream flow may result. Pollution can affect the health of our ecosystems, water quality, and water supply. Our water resources must be protected and conserved.

Hawai'i Content and Performance Standards III, Science

Strand		Physical, Earth and Space Sciences	
Standard 8: Physical, Earth, and Space Sciences: EARTH AND SPACE SCIENCE: Understand the Earth and its processes, the solar system, and the universe and its contents			
Topic		Earth Materials	
Benchmark SC.2.8.2		Identify the limited supply of natural resources and how they can be extended through conservation, reuse, and recycling	
Sample Performance Assessment (SPA)		The student: Identifies natural resources that are limited and ways to conserve those resources (e.g., fresh water, fuel, trees).	
Rubric			
Advanced	Proficient	Partially Proficient	Novice
Explain why a resource is limited and why it needs to be extended through conservation, reuse, and recycling.	Identify some of the natural resources that are limited and how they can be extended through conservation, reuse, and recycling.	Recognize that the supply of natural resources is limited and suggest a way to extend it.	Recall that the supply of natural resources is limited.

Hawai'i Content and Performance Standards III, Math

Strand		Measurement	
Standard 4: Measurement: FLUENCY WITH MEASUREMENT: Understand attributes, units, and systems of units in measurement; and develop and use techniques, tools, and formulas for measuring.			
Topic		Measurement Attributes and Units	
Benchmark MA.2.4.2		Identify appropriate units for measuring length, area, capacity, and weight.	
Sample Performance Assessment (SPA)		The student: Matches the measuring attribute to the appropriate unit (e.g., length—inch, area—feet squared, capacity—cups, weight—pound). (*Student estimates how much water in gallons or liters s/he uses in one day; student measures and calculates daily water usage in gallons or liters.*)	
Rubric			
Advanced	Proficient	Partially Proficient	Novice
Identify appropriate units for measuring length, area, capacity, and weight, with accuracy.	Identify appropriate units for measuring length, area, capacity, and weight, with no significant errors.	Identify appropriate units for measuring length, area, capacity, and weight, with a few significant errors.	Identify appropriate units for measuring length, area, capacity, and weight, with many significant errors.

Strand		Measurement	
Standard 4: Measurement: FLUENCY WITH MEASUREMENT: Understand attributes, units, and systems of units in measurement; and develop and use techniques, tools, and formulas for measuring.			
Topic		Measurement Attributes and Units	
Benchmark MA.2.4.3		Estimate and measure water usage using gallons and/or liters as standard units.	
Sample Performance Assessment (SPA)		The student: Estimates water usage in a day and determines how close his or her prediction was.	
Rubric			
Advanced	Proficient	Partially Proficient	Novice
Estimate and measure temperature using standard units, with accuracy	Estimate and measure temperature using standard units, with no significant errors	Estimate and measure temperature using standard units, with a few significant errors	Estimate and measure temperature using standard units, with many significant errors

Strand		Data Analysis, Statistics, and Probability	
Standard 11: Data Analysis, Statistics, and Probability: FLUENCY WITH DATA: Pose questions and collect, organize, and represent data to answer those questions.			
Topic		Data Collection and Representation	
Benchmark MA.2.11.1		Pose questions, collect data, and display the data using a graph (e.g., bar graphs, pictographs).	
Sample Performance Assessment (SPA)		The student: Collects data to answer a specific question (e.g., "How much water do I use when I take a shower?") and makes a bar graph to display the responses.	
Rubric			
Advanced	Proficient	Partially Proficient	Novice
Pose questions, collect data, and display the data using a graph, with accuracy.	Pose questions, collect data, and display the data using a graph, with no significant errors.	Pose questions, collect data, and display the data using a graph, with a few significant errors.	Pose questions, collect data, and display the data using a graph, with many significant errors.

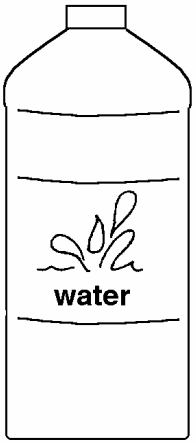
Objectives

Students will be able to:

1. identify our water resources and their value;
2. conserve water through a water conservation campaign and describe the consequences of using too much water;
3. identify sources of pollution and how to prevent water pollution;

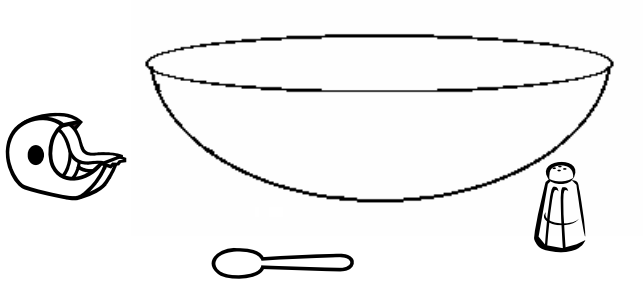
Prerequisite

"Wheel of Water," Grade 2, Geography



Materials
take-me-home sheet (provided)
student data sheet (provided)
1 large beverage bottle—either 2 liter or gallon
large mixing bowl
small mixing bowl (bowl should be able to hold 1 c water)
plastic wrap
adhesive tape
1 T salt
1 c water

Time
two to six class periods



Subject Areas
science, social studies, math

Teacher Background

Every living thing on earth depends on water for without it, there would be no life. Water is also a basic component of many ecosystems. An **ecosystem** is a community of living things, people, their environment and the way they interact with one another. An example of an ecosystem is our native mountain rainforests.

The mountain rainforests of Hawai‘i are our watersheds. Watersheds are areas that drain to a particular body of water, such as a stream. Healthy watersheds have native forest plants that absorb water like a sponge and allow it to drain slowly into the ground and streams. Tall trees capture drifting rain and clouds in their leaves and branches. Some of this water will be absorbed by roots and transpired through leaves. Many rainforests are situated in valleys that were formed by the eroding forces of streams flowing down a mountain. Ancient Hawaiians recognized that rainforests were the source of fresh water. When they went to the mountains and rainforests to obtain their resources, they took only what they needed. All native plants and stream life benefit from a healthy watershed, which in itself is a healthy ecosystem. The introduction of non-native life to our mountain rainforests has devastated the health of many of our forest ecosystems, which in turn could disrupt our water supply. We must all do our part to ensure that our ecosystems remain healthy.

The early Hawaiians depended on water from streams and springs for human consumption and agricultural use. In coastal areas they also dug pits in the ground to reach the **water table**, or dove into the ocean with gourds and collected water entering the sea from freshwater springs. In the 1880s, wells and tunnels were dug to produce water for sugar plantations and a growing human population. Streams were diverted by dams and tunnels to fill reservoirs for sugar irrigation. As water demand increased, overpumped wells began drawing salt water and additional wells were drilled farther inland. Some of these deep wells required pumps to draw the water out. Tunnels were dug in the sides of mountains to extract water and shafts were dug to skim water from the surface of the water table. On the island of O‘ahu, 70 percent of all stream waters never reach the ocean!

The population of the Hawaiian Islands has grown tremendously over the years, and the demand for water has grown at an even faster pace. Today, **groundwater** supplies more than 90 percent of the state's total daily domestic water use. It also provides water for agricultural, commercial, military, industrial, and other private uses. On O'ahu, streams, springs, and water catchments are not used much for domestic demands but do provide most of the water needed for agricultural purposes. On the other islands, surface water is used primarily for agriculture and secondarily for drinking water and hydroelectric purposes.

Due to the large demand for groundwater, pumping rates must be monitored and regulated to prevent water from being pumped faster than it is naturally replaced. If the water table or stream levels drop too low, water usage must be limited.

Overuse of water affects stream life that needs a steady supply of water to survive. Streams not only obtain water from rain, but also from underground springs. When the level of groundwater drops, springs may dry up, causing stream flow to decrease.

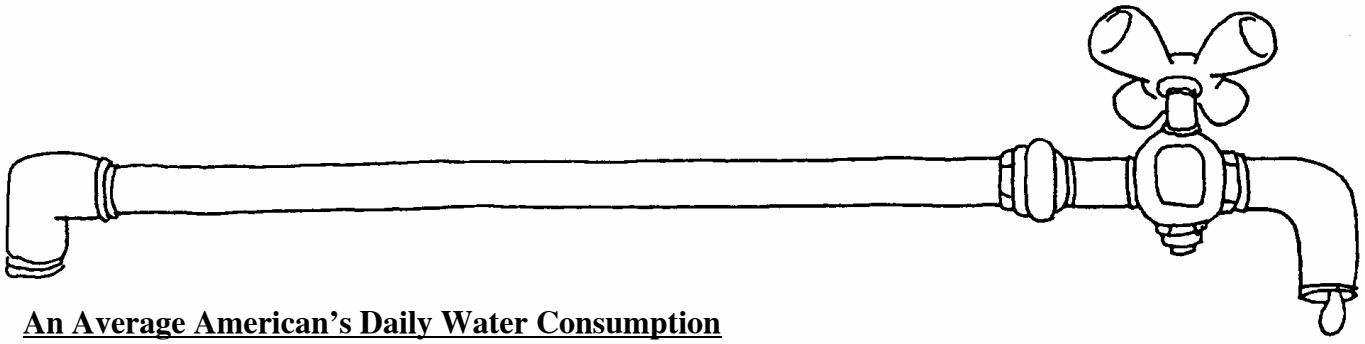
Water is one of the most precious resources on Earth. A large number of our daily activities require the use of water. By helping students understand that their personal use of water affects the supply of fresh water on the island on which they live, they may appreciate the need to conserve water. As the demand for water continues to grow, it will become increasingly important that we learn to incorporate water **conservation** strategies into our daily lives.

Another method of water conservation is desalination. **Desalination** is the process of removing minerals and salts from seawater and brackish water to create fresh water. By desalinating water, we help conserve our limited water supply. In parts of the world where there are major water shortages such as the Middle East, desalinating is an important way for people to get water for drinking or irrigation. Desalination is an expensive process. Countries such as those in the Middle East use money from the sale of oil to pay for the desalination.

Pollution of our environment can affect the health of all ecosystems, water quality, and water supply. Pesticides, herbicides, fertilizers, paint, oil, gas, cleaning solvents, and other contaminants can seep into the ground and reach our groundwater supply. Pollutants can also enter streams via sewer systems, killing stream and ocean life. Beaches in Hawai'i have been closed periodically due to pollution washed down from streams.

Congress passed the Clean Water Act (CWA) in 1972 to help restore and maintain our waters free of pollution. At that time, many industries polluted our nation's rivers and streams. The CWA was further amended in 1977 and 1987 to control the discharge of pollutants into our waters. The goal is to return all waterways to their original levels of cleanliness suitable for fishing and swimming. Any source of water pollution is subject to state effluent and water quality standards.

Our water supplies must be carefully managed so that we can continue to provide people and wildlife with clean, pure water. After all, water is the source of life. We cannot live without it. *E mālama i ka wai* ("care for the fresh water").



An Average American's Daily Water Consumption

Use	Liter (gal)/day		Conservative Use**	
Drinking and cooking	8	2	8	2
Flushing toilets	23	6	17	4.5
Bathing				
Shower	58	15	15	4
Bath	115	30	46	12
Dishwashing				
By hand	115	30*	19	5
In dishwasher (one load)	61	16*	27	7
Washing clothes (machine) (one load)	231	60*	104	27
Watering gardens, lawns, washing cars, etc. (per minute)	38	10	19	5

*Individual share in a family of four

**Water can be conserved by using a water displacement device in toilets, turning off the shower while soaping, using a shorter wash cycle in dishwashers and washing machines, watering plants outdoors in early or late hours of the day, and by landscaping with plants that require little water.

Teaching Suggestions

1. Generate a list of the many ways students use fresh water.

2. Show students a plastic 2-liter soda bottle (a popular size) or a gallon plastic milk container (choose a unit of measure). Using the water usage chart above, tell students that the average American uses in one day's time the equivalent of four 2-liter soda bottles of water (or 2 milk jugs of water) to drink and cook with, and so on. Ask them to guess how many of (either of) these containers of fresh water they use in one day.

3. Explain to students how they could find out how much water they use in one day. Pass out the take home sheet at the end of the week. On either Saturday or Sunday, students should keep track of the number of times they complete water-related activities listed on the sheet. They should enlist the help of their parents especially when the students need to multiply their usage amounts with the average number of gallons/liters.

4. On the following Monday have students share their results. Discuss their experiences. Compare water usage among students. Compare results to predictions.

5. Distribute the data sheets and have students graph their water use.

6. Discuss where Hawai'i's fresh water comes from and the consequences of using too much water.

   Discussion Questions

   a. Where does our fresh water come from? (groundwater, rain catchment or surface water, watersheds)
   b. What might happen if we use too much water? (Wells could run dry or become filled with salt water, stream levels would drop and stream life would be affected.)
   c. Why should we try to save or conserve water?
   d. How might we use less water?

7. Discuss ways pollution in our environment affects our water supply and how we can prevent it.

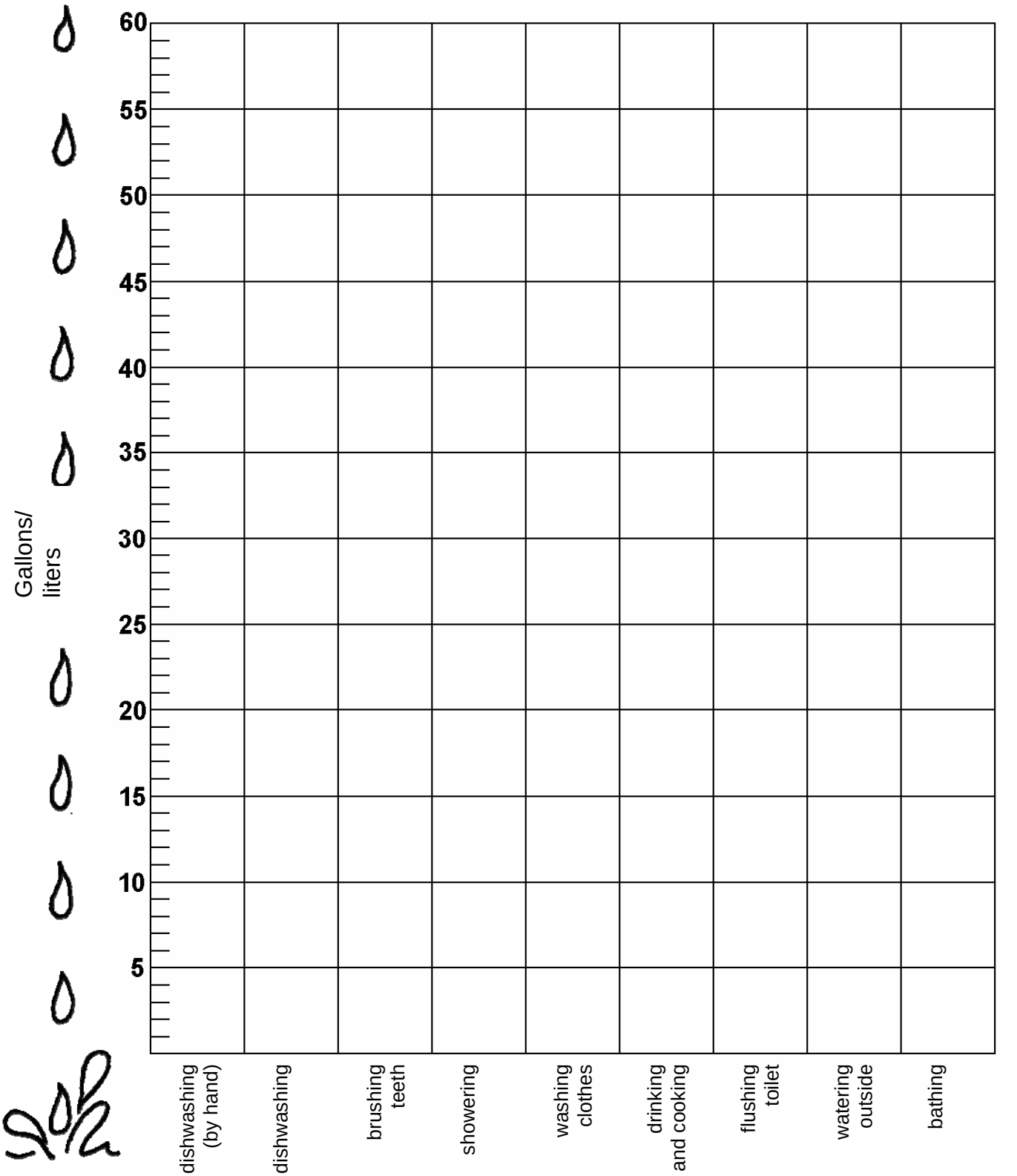
8. Explain the ways in which we measure rainfall (water gauges) and water usage (water meters).

9. Conduct the "Taking the Salt out of Water" student activity.

Extended Activities

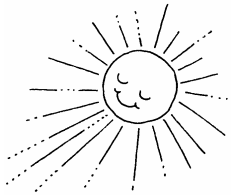
- Have students put a dollar value on the amount of water they've measured. Rates can be found in water bills from their local water supplier. Calculate a total for the entire class. Discuss with students how the money they've saved could be put to another use. Repeat the lesson several times throughout the year while incorporating conservation methods and chart the data collected.
- Students could go on a "water watch" around the school and report any leaky toilets, faucets, or water left running. Make sure students follow through to see that appropriate repairs are made.
- Have students investigate the plants in the schoolyard or their homes to determine whether they are "thirsty" or "unthirsty" plants. Use the Honolulu Board of Water Supply brochure "Save Water By Growing Unthirsty Plants" by Horace Clay as a reference. Make a recommendation to the school administration to plant unthirsty trees in the future, or have students plant seeds of such trees in a designated area.
- Spread the word about the need for water conservation. Have the class implement a strategy for teaching others, such as making posters, booklets, or displays to distribute around the school. Students can also present a show for the rest of the school.
- Students can contact a local environmental agency or organization such as the Department of Land and Natural Resources or county water department to see how they can participate in projects that preserve our ecosystems and water resources.

Color the bars to show your use of water for one day on the bar graph below.



Taking the Salt out of Water

In some parts of the world, there are water shortages. To help ease the shortage, sea water is often desalinated for drinking and other uses. Desalination is the process of removing salt and minerals from water. The end product is pure water. The process is expensive; however, some desert countries such as those in the Middle East have no choice but to desalinate. There are different methods of desalination. Students can use this easy and inexpensive distillation method to desalinate water in the classroom.



Procedure

1. Put the small bowl in the middle of the large bowl.
2. Mix the salt and the water.
3. Have students taste the salty water and write down their observations.
4. Pour the salty water into the large bowl while being careful not to get any in the smaller bowl. The small bowl should remain empty and clean.
5. Cover the large bowl with plastic wrap and tape the wrap down leaving a little slack in the plastic wrap.
6. Place a weight on the plastic wrap right above the small bowl. Make sure the weight is not too heavy and the wrap is not too loose so that the weight falls in the small bowl. The weight will help direct the water into the small bowl.
7. Leave the bowls out in the sun.
8. After a few days, have students check on their bowls. There should be some water in the small bowl.
9. Have students write their predictions of the kind of water they will find in each bowl.
10. Have students taste the water in the bowls.
11. Students should record their observations on the water in the two bowls.

Discussion

- What kind of water was found in each bowl?
- How do the waters in the two bowls compare to the initial taste test at the beginning of the experiment? (The water in the small bowl should be fresh water while the water in the large bowl should be saltier than at the beginning of the experiment.)
- How did the water get into the small bowl? (The water in the large bowl evaporated leaving behind the salt. Moisture on the plastic wrap condensed. With the help of the weight, the water dripped directly into the smaller bowl.)
- Relate this experiment to the water cycle and the process of desalination.