GRADE 3 UNIT 4 OVERVIEW

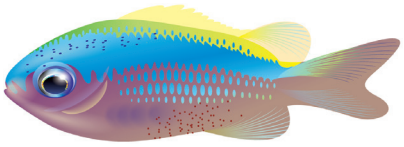
Navigating the Water Cycle

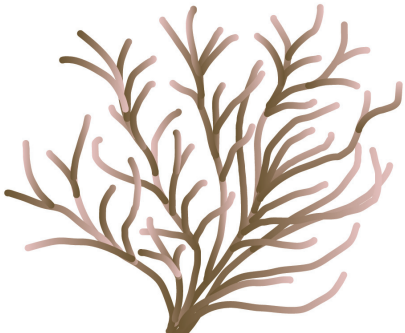
Introduction

The ocean is an integral part of the water cycle that sustains all of life on Earth. The water cycle is connected to all of the Earth's water reservoirs via evaporation and precipitation processes. As scientists seek to better understand the ocean and the Earth's processes, the water cycle is an integral part of their work. Water is one of the most powerful forces that shape our Earth, moving over the surface of the Earth creating wonders such as the Grand Canyon. Along with temperature, the water cycle shapes the Earth's climates.

In this unit, students engage in a variety of activities as they "navigate" the water cycle. Students learn how weather and climate are related to water by observing and analyzing their own climate. After exploring the history of water from the time of the dinosaurs, the students diagram the water cycle and act it out in a skit. They create and use a rain gauge to measure rainfall at their own home. In the role of weather reporters, they exchange information with students on other islands.

Students investigate their local watershed and water usage, and engage in a survey of their own family's water conservation and pollution prevention efforts. They study water usage and conservation. To demonstrate what they learned, the students host a Water Conference in which they share displays and hands-on activities with others.





At A Glance

ESSENTIAL QUESTIONS	HCPSIII BENCHMARKS*	LESSON, *Brief Summary,* Duration
Why is water important to my life? How much water do I use in my everyday activities?	Science Standard 1: The Scientific Process: SC.3.1.2 Safely collect and analyze data to answer a question. Language Arts Standard 3: Reading: LA 3.1.3 Use new grade-appropriate vocabulary. Language Arts Standard 5: Writing: LA.3.5.3 Group related ideas into paragraphs. Math Standard 11: Data Analysis: Math MA 3.11.1 Pose questions, collect data using surveys, and organize the data into tables and graphs Math Standard 13: Data Analysis, Statistics, and Probability: Math MA 3.11.2 Organize and represent data in more than one way (e.g. tallies) Math MA 3.13.1 Answer questions based on data represented in graphs	**Lesson 1: Water in My Life** This lesson introduces the unit by calling attention to the importance of water in daily life. It also establishes schema for learning about water, the water cycle, and the need to conserve water. Students chart their water usage over a one-day period and compare their water use to a classmate's, write about their water usage and how it might change in a drought, and create a set of water vocabulary flash cards to begin developing a working vocabulary of water-related words that they continue adding to throughout this unit. Two 45-minute periods
How old is water? What is the water cycle? How do the processes of the water cycle relate to weather?	Science Standard 8: Physical, Earth, and Space Sciences: SC.3.8.2 Describe how the water cycle is related to weather and climate. Language Arts Standards: LA 3.1.6 Locate information in a variety of grade appropriate resources LA 3.6.1 Use oral language to obtain info, complete a task and share ideas and information with others	**Lesson 2: The Cycle of Water** In this lesson students realize that water from billions of years ago has been cycling around the Earth and is being used by each one of them today. Through a PowerPoint presentation the class is introduced to the various forms or states of water and the processes that make up the water cycle; evaporation, condensation, transpiration, precipitation and accumulation. In groups, students will engage in several hands-on demonstrations to observe the water processes of condensation, evaporation, and transpiration. The lesson ends with groups of students researching a part of the water cycle to become an "expert" and teach the rest of the class what they learned. Three 45-minute periods

ESSENTIAL QUESTIONS	HCPSIII BENCHMARKS*	LESSON, *Brief Summary,* Duration
What are weather and climate and how do they relate to the water cycle?	Science Standard 8: Physical, Earth, and Space Sciences: SC.3.8.2 Describe how the water cycle is related to weather and climate. Science Standard 1: The Scientific Process: SC.3.1.2 Safely collect and analyze data to answer a question. Language Arts Standard 5: Writing: LA.3.5.3 Group related ideas into paragraphs	**Lesson 3: Close Relations: Weather, Climate, and Water** This lesson introduces the terms weather and climate, and explores how these relate to the water cycle. Students collect weather data from online sources, local media (weather reports), and their own observations of daily weather to compare weather, climate, and water cycles in Hawai'i and two other locales. Students will also discuss rainfall and weather patterns during Hawai'i's wet and dry seasons. Using a large map of the island, student teams exchange their local weather data and rainfall measurements with schools on neighbor islands. They compare similarities and differences in their local weather, and discuss the impact that weather and climate have on the water cycle in Hawai'i. Three 45-minute
How can we conserve water resources and protect them from pollution?	Science Standard 1: The Scientific Process: SC.3.1.2 Safely collect and analyze data to answer a question. SC 3.1.1 Pose a question and develop a hypothesis based on observations Language Arts Standard 5: Writing: LA.3.5.3 Group related ideas into paragraphs	**Lesson 4: We Are Responsible Water Users!** This lesson addresses the impact humans have on our water resources. It covers the necessity and methods for promoting water conservation and prevention of water pollution. Students engage in a hands-on activity to explore how easy it is to conserve water. Each student will observe their families' water conservation and pollution prevention efforts, and score their habits. Then using an informative online presentation by NOAA called, "Water Cycle and Global Impact," the teacher guides students into discussing the global importance of water, reinforcing the importance of understanding how the water cycle functions all over the globe, and how this knowledge can be used to conserve water and prevent water pollution. Two 45-minute periods
How does the water cycle relate to weather and climate? Does teaching others about the water cycle help in conserving water and preventing pollution?	Science Standard 8: Physical, Earth, and Space Sciences: SC.3.8.2 Describe how the water cycle is related to weather and climate. Language Arts Standard 6: Oral Communication: LA.3.6.2 Give a planned speech to share information with peers.	**Culminating Lesson: A Water Conference** Students will host a Water Conference for classmates and/or the greater school community. The class will work together in teams of four to six on Water Cycle topics. Each topic corresponds with understandings developed in each of the lessons in this Water Cycle Unit. Four 45-minute periods

* *"Hawai'i Content & Performance Standards III Database." Hawai'i Department of Education. June 2007. Department of Education. 17 Dec. 2007..*

Benchmark Rubric

I. HCPS III Benchmarks*

Below is a general Benchmark Rubric. Within each lesson, there are other assessment tools and additional rubrics specific to the performance tasks within each lesson.

Topic		**Scientific Inquiry**	
Benchmark SC.3.1.1		Pose a question and develop a hypothesis based on observations	
Rubric			
Advanced	**Proficient**	**Partially Proficient**	**Novice**
Pose a question and develop a hypothesis based on logical inferences and observations	Pose a question and develop a hypothesis based on observations	Pose a question or develop a hypothesis partially based on observations	With assistance, pose a question or develop a hypothesis

Topic		**Scientific Inquiry**	
Benchmark SC.3.1.2		Safely collect and analyze data to answer a question	
Rubric			
Advanced	**Proficient**	**Partially Proficient**	**Novice**
Summarize and share analysis of data collected safely to answer a question	Safely collect and analyze data to answer a question	With assistance, safely collect and analyze data	With assistance, safely collect data and attempt to analyze data

Topic		**Forces that Shape the Earth**	
Benchmark SC.3.8.2		Describe how the water cycle is related to weather and climate	
Sample Performance Assessment (SPA)		The student: Illustrates the water cycle and explains its relationship to weather and climate.	
Rubric			
Advanced	**Proficient**	**Partially Proficient**	**Novice**
Describe how the phases of the water cycle relate to weather and climate	Describe how the water cycle is related to weather and climate	Give an example of how the water cycle is related to weather or climate	Recognize that the water cycle is related to weather and climate

Topic		**Vocabulary and Concept Development**	
Benchmark LA.3.1.3		Use new grade-appropriate vocabulary, including homophones and homographs, introduced in stories, informational texts, word study, and reading	
Rubric			
Advanced	**Proficient**	**Partially Proficient**	**Novice**
Use new grade-appropriate vocabulary, including homophones and homographs, with precision, fluency, and accuracy	Use new grade-appropriate vocabulary, including homophones and homographs, with no significant errors	Use new grade-appropriate vocabulary, including homophones and homographs, with difficulty and a few significant and/or many minor errors	Use new grade-appropriate vocabulary, including homophones and homographs, with great difficulty and/or many significant errors

Topic		**Locating Sources/ Gathering Information**	
Benchmark LA.3.1.6		Locate information in a variety of grade-appropriate sources	
Rubric			
Advanced	**Proficient**	**Partially Proficient**	**Novice**
Locate substantive information in an extensive variety of grade-appropriate resources	Locate information in a variety of grade-appropriate resources	Locate limited information in a few grade-appropriate resources	Locate information in one or two grade-appropriate resources or locate irrelevant information

Topic		Design	
Benchmark LA.3.5.3		Group related ideas into paragraphs	
Rubric			
Advanced	**Proficient**	**Partially Proficient**	**Novice**
Group related ideas into paragraphs to create a clear and logical organization that guides the reader	Group related ideas into paragraphs	Group some related ideas into paragraphs, but the relationship between other ideas may be superficial or unclear	Group very few related ideas into paragraphs

Topic		Discussion and Presentation	
Benchmark LA.3.6.1		Use oral language to obtain information, complete a task, and share ideas and personal opinions with others	
Rubric			
Advanced	**Proficient**	**Partially Proficient**	**Novice**
Use creative oral language to obtain information, complete a task, and share ideas and personal opinions with others, in a highly effective way	Use oral language to obtain information, complete a task, and share ideas and personal opinions with others	Use typical oral language that sometimes aids in obtaining information, completing a task, or sharing ideas and personal opinions with others	Use inappropriate oral language that does not aid in obtaining information, completing a task, or sharing ideas and personal opinions with others

Topic		Discussion and Presentation	
Benchmark LA.3.6.2		Give a planned speech to share information with peers	
Rubric			
Advanced	**Proficient**	**Partially Proficient**	**Novice**
Give a planned speech to share information with peers, in a highly effective way	Give a planned speech to share information with peers	Give a speech that shows some planning but shares limited information with peers	Give a speech that shows little planning and does not share information with peers

Topic		Data Collection and Representation	
Benchmark MA.3.11.1		Pose questions, collect data using surveys, and organize the data into tables and graphs	
Rubric			
Advanced	**Proficient**	**Partially Proficient**	**Novice**
Pose meaningful questions, collect data using surveys, and effectively and accurately organize the data into tables and graphs	Pose questions, collect data using surveys, and organize the data into tables and graphs, with no significant errors	Pose questions, collect data using surveys, and organize the data into tables and graphs, with a few significant errors	Pose questions, collect data using surveys, and organize the data into tables and graphs, with many significant errors

Topic		Data Collection and Representation	
Benchmark MA.3.11.2		Organize and represent data in more than one way (e.g., tallies, chart, tables, bar graphs, line plots, line graphs)	
Rubric			
Advanced	**Proficient**	**Partially Proficient**	**Novice**
Strategically and effectively organize data, and accurately represent data in more than one way	Organize and represent data in more than one way, with no significant errors	Organize and represent data in more than one way, with a few significant errors	Organize and represent data in more than one way, with many significant errors

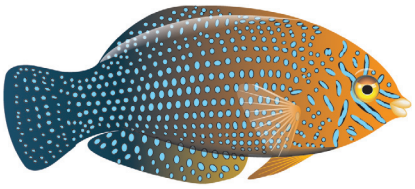
Topic		Predictions and Inferences	
Benchmark MA.3.13.1		Answer questions based on data represented in graphs	
Rubric			
Advanced	**Proficient**	**Partially Proficient**	**Novice**
Answer questions based on data represented in graphs, with accuracy, and effectively justify the answer	Answer questions based on data represented in graphs, with no significant error	Answer questions based on data represented in graphs, with a few significant errors	Answer questions based on data represented in graphs, with many significant errors

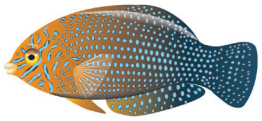
II. General Learner Outcomes*

Below is a list of the HIDOE General Learner Outcomes (GLOs). Each Unit of the Lessons from the Sea Curriculum addresses the GLOs. Within some lessons, there is more specific mention of individual GLOs with specific pertinence.

I. Self-directed Learner. (The ability to be responsible for one's own learning.)
II. Community Contributor. (The understanding that it is essential for human beings to work together.)
III. Complex Thinker. (The ability to demonstrate critical thinking and problem solving.)
IV. Quality Producer. (The ability to recognize and produce quality performance and quality products.)
V. Effective Communicator. (The ability to communicate effectively.)
VI. Effective and Ethical User of Technology. (The ability to use a variety of technologies effectively and ethically.)

** "Hawai'i Content & Performance Standards III Database." Hawai'i Department of Education. June 2007. Department of Education. 17 Dec. 2007.*





Science Background for the Teacher

Note: Bolded words found within this section are defined in the *Science Background for the Teacher Glossary*. The footnotes refer to the references found in the *Science Background for the Teacher Bibliography* at the end of this section.

Where is water found and how long has it been around[1]? (Lesson 3)

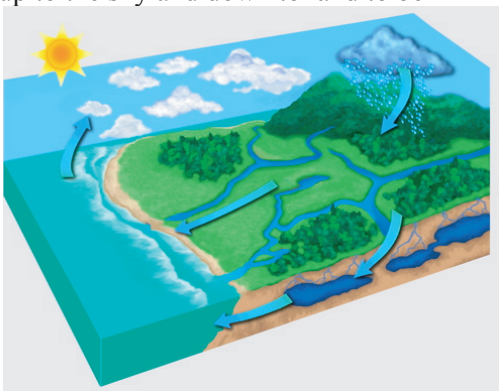
Water is found everywhere. The most common places to find water would be in oceans, rivers, streams and lakes. Less obvious places where water can be found in abundance is in glaciers, underground aquifers, and in the air as water vapor. Planet Earth is called the water planet because roughly 71% of the surface of earth is covered in water. About 97% of that water is found in the oceans and is therefore undrinkable. Freshwater comprises the remaining 3% and of that, 68% is locked up in glaciers, 32% exists in underground aquifers and <1% can be found in our freshwater lakes, rivers and streams. The water that exists today is the same water that existed when the Earth first had water, about 4 billion years ago. This water is continually recycled over and over throughout time by a process called the **hydrologic cycle**, or the water cycle (see question below "What is the water cycle?").

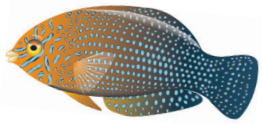
What are the states of water[2]? (Lesson 2)

Water is found in three different physical states, also known as states of matter. Most water on Earth is in the liquid form and can be found in oceans, lakes, streams, and rivers. A good amount of water can be in the solid form, ice, and is found in higher elevations where it is cold, like on mountaintops and in the form of glaciers. When water gets heated, it is transformed into its gaseous state and turns into water vapor, steam or fog. Water vapor forms when the sun heats the surface of a body of water. The water at the surface evaporates, and rises into the atmosphere. When this happens on large bodies of water like lakes or oceans, so much water vapor is produced that it eventually condenses, forming clouds in the atmosphere. **Steam** forms when a body of water is heated to its boiling point, 100°C or 212°F, transforming liquid water into gaseous water that rises into the air. Fog forms from water vapor in the air and condenses when it come in contact with the ground. Therefore, fog is a cloud that comes in contact with the ground.

What is the water cycle[3]? (Lesson 2)

The water cycle is the continuous recycling of water on Earth; from the oceans, up to the sky and down to land to be transported back to the oceans and sky again. Water is constantly changing states due to the energy of the sun transforming surface water into water vapor. The water vapor eventually attaches to a solid (such as dust or salt) and forms clouds, and clouds condense back into water droplets. When the droplets become very dense in the clouds, the force of **gravity** pulls them back down to the Earth where the cycle begins all over again. To demonstrate this concept, start with a drop of water in the ocean, since the ocean is where most of the Earth's water is found. This drop of ocean water gets heated by the sun and turns into **water vapor.** When many drops of water turn into vapor and rise up into the higher altitudes where air pressure is lower, clouds form. Many different types of clouds exist and depending on what they look like and where they are in the sky (i.e., way high up or closer to the Earth), one can try to predict whether rain will occur or not. (For types of clouds see: http://www.econet.org.uk/weather/cloud.html or http://archive.globe.gov/sda-bin/m2h?gl/clouds.men.)





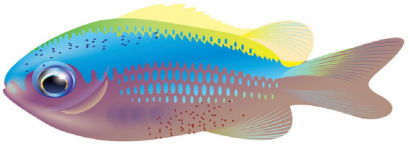
When the clouds cool, the water vapor turns back into liquid water, forming droplets through a process called condensation. When too much of the water vapor condenses into liquid water, the clouds get so heavy that they release water in the form of ***rain*** or ***snow*** called **precipitation**. The water that falls from clouds can take many paths. It can flow into rivers and streams and eventually back into the oceans. Water on the surface of the ground can evaporate back into the air. The water can also seep through the surface into the ground where it may become trapped in aquifers. Plants need water to survive and they obtain it from groundwater in the soil and to a lesser extent via absorption of water through their leaves, but plants can also 'sweat' water out through their leaves during really hot days; this is called **transpiration**. (For more information see: http://ga.water.usgs.gov/edu/followadrip.html and http://ww2010.atmos.uiuc.edu/(Gh)/guides/mtr/hyd/home.rxml.)

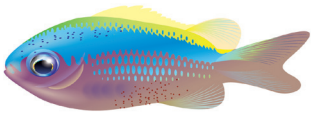
What are weather and climate and how are they related to the water cycle[4]? (Lesson 4)

The **weather** is all around us and has a profound influence on our day to day lives, like how and where we live, what we do each day, what we wear, and what we eat. Weather is made up of many different atmospheric factors like wind, precipitation, humidity, temperature, pressure, sunshine, clouds, and visibility. Someone who studies the weather is called a meteorologist. **Meteorologists** make predictions of the weather based on what is known about how the different things that make up weather interact with each other.

The **climate** is the common, average weather conditions at a particular place over a long period of time. We learn about different climates around the world; deserts have a hot and dry climate while the Antarctic has a very cold and dry climate. Tropical places like Hawai'i have warm, humid climates. While the weather in a particular place can change from day to day, climate changes typically take place over many years (for example, more than 30 years). Evaporation and precipitation are ways in which water moves through the water cycle on any given day during a weather event. During certain times of the year, it might rain often causing plants, soils, rivers, and lakes to absorb more water. During other times of the year, hot, dry weather can lead to water evaporation causing plants and soil to dry out and streams and rivers to have lower elevations, but over the course of a year or several years, a balance occurs in the water cycle so the amount of water entering the system is equal to the amount exiting. This balance or equilibrium in the water cycle helps stabilize the climate. Climate is affected by the natural fluctuation of the balance of water entering and exiting the system on a global scale. It depends on whether water is available in the ocean, in the atmosphere, or in large freshwater lakes and glaciers. Natural hazards like floods, droughts, sea level rise, and elevated sea surface temperature can be isolated weather events or related to climatic changes that impact the water cycle over a longer time scale.

Scientists are studying how different factors impact the climate to understand when and why these events might be occurring. They also observe local weather for patterns that can be predicted on reliable timescales. The majority of climate scientists agree that one of the biggest threats to our Earth is the rapid global climate change taking place as a result of human influence. The energy and resources we use are converted into gases that change the chemistry of the atmosphere. Climate change can alter the water cycle by increasing the likelihood of floods in usually dry regions and droughts in historically wet regions. As a result, many of the Earth's glaciers are melting and can contribute significantly to a rise in sea level. It also changes weather patterns in some areas making them harder to predict, ultimately producing more severe weather as a result. In tropical regions such as Hawai'i, global climate change can contribute to a rise in sea surface temperatures. Even small increases can have big effects on coral reef, causing coral reef bleaching that could eventually lead to the demise of the corals. (For more information see: http://www.econet.org.uk/weather/index.html, and http://www.windows.ucar.edu/tour/link=/earth/climate/cli_effects.html.)





What is a watershed[5]? (Lesson 1)

A **watershed** is a region or area of land within which all water flows into a common water source or body of water. Watersheds are often valleys bounded by higher elevation lands such as mountains. In the middle of the valley, a stream or river often collects the rainwater and transports it to the ocean. In Hawai‘i, the mountains are steep and the water doesn’t have to travel far to reach the sea. In other places, there may be many watersheds that empty into a major river which flows for many miles before reaching the ocean. An example of this is the Mississippi River that flows into the Gulf of Mexico after traveling 2,300 miles. The watershed of the Mississippi covers 41% of the continental U.S., and encompasses about 1.1 million square miles. (For more information on the Mississippi River and watershed, see: http://www.nps.gov/miss/riverfacts.htm.)

Watersheds are similar in geography to the *ahupua‘a*, or traditional land divisions of old Hawai‘i, although their boundaries are not always identical. In Hawaiian culture, the division of land by *ahupua‘a* was a form of sustainable ecosystem management, where food was cultivated and resources utilized according to the natural resource availability of the area. The *ahupua‘a* is usually characterized by wedged shaped tracts of land that stretch from the ridge tops of the mountains all the way down to beyond the edge of the reef (or some say in a more spiritual sense, from the “heavens to the horizons”), often with a stream that funnels water to the sea. At the tops of the ahupua‘a, trees in the upland forest were used for building materials. In the lower parts of the *ahupua‘a,* crops such as taro (*kalo*) were grown. Where the land meets the sea, fish ponds (*loko*) were often built to capture and maintain fish populations for food, and depending on the geography, nearby stream mouths brought in additional nutrients to the fishponds to support the cultivation of fish. (For more information, see: http://eastmauiwatershed.org/Watersheds/Watersheds.htm.)

Science Background for the Teacher Glossary

aquifer: a water-bearing stratum of permeable rock, sand, or gravel.
atmosphere: the mass of air surrounding the Earth.
climate: the average weather conditions over a period of years.
clouds: visible masses of condensed water vapor suspended in the atmosphere.
condensation: the transformation of water vapor back into liquid water by cooling.
evaporation: the process in which the sun heats up water in rivers or lakes or the ocean and turns it into vapor; the water vapor goes into the air where it becomes a cloud.
fog: water vapor that is suspended in the lower altitudes; similar to a cloud except for its proximity to the ground.
gravity: the force of attraction that exists between all objects; the force that pulls things back down to the Earth.
humidity: the measure of how much water vapor is in the air; warmer air holds more water vapor and has higher humidity.
hydrologic cycle: the cyclic transfer of water among the oceans, land and atmosphere.
meteorology: the science that studies the atmosphere and its phenomena in relation to the weather and weather forecasting.
precipitation: rain, hail, or snow falling from the clouds due to the condensation of water.
pressure: the weight of the air on the Earth’s surface; at sea level, the air pressure is higher compared to high up on the tops of mountains because there is less air between the atmosphere and the tops of mountains than sea level.
rain: water form of precipitate falling in drops from condensed vapor or clouds in the atmosphere.
steam: water converted into vapor form when it is heated to the boiling point.
transpiration: the process in which water evaporates through pores in the leaves of plants.
water vapor: transformed liquid water into gaseous water by heat.
watershed: a region or area bounded on either side by a divide such as mountains, draining ultimately to a particular watercourse or body of water.
weather: the state of the atmosphere in regard to heat or cold, wetness or dryness, calm or storm, clearness or cloudiness. It is the day-to-day conditions of the atmosphere.
wind: the movement of air; both direction and speed are measured for weather observations.

Science Background for the Teacher - Bibliography

[1-5] Science background information condensed and/or compiled from the following sources:

1: Bramer, D., Wojtowicz, D., Hall, S. E. (July 21, 1997). The hydrologic cycle online meteorology *guide*. Retrieved March 14, 2007, from http://ww2010.atmos.uiuc.edu/(Gh)/guides/mtr/hyd/home.rxml

Opie, A., & Rickards, J. *Weather Explorer.* Retrieved March 14, 2007, from http://www.econet.org.uk/weather/index.html

2: Perlman, H. (August 28, 2006). *Water science for schools: Follow a drop of water through the water cycle.* Retrieved March 14, 2007, from http://ga.water.usgs.gov/edu/followadrip.html

3: Bramer, D., Wojtowicz, D., Hall, S. E. (July 21, 1997). The hydrologic cycle online meteorology *guide*. Retrieved March 14, 2007, from http://ww2010.atmos.uiuc.edu/(Gh)/guides/mtr/hyd/home.rxml

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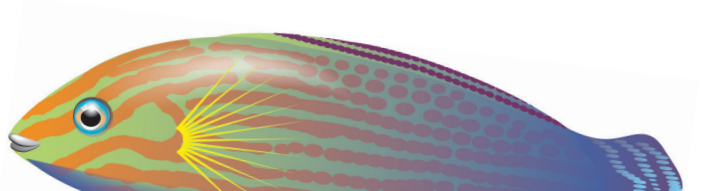
Windows to the Universe team. (June 23, 2004). *Effects of climate change today*. Boulder, CO: ©2000-04 University Corporation of Atmospheric Research (UCAR), ©1995-1999, 2000 The Regents of the University of Michigan. Retrieved March 14, 2007, from http://www.windows.ucar.edu/

5: East Maui Watershed Partnership. (January 2007). *What is a watershed?* Retrieved March 14, 2007, from http://eastmauiwatershed.org/Watersheds/Watersheds.htm

Mississippi National River and Recreation Area. (April 12, 2004). *General information about the Mississippi River*. Retrieved March 14, 2007, from http://www.nps.gov/archive/miss/features/factoids/



NOAA Resources

Below is a list of resources compiled by the Outreach Education Office of the National Oceanic and Atmospheric Administration. The science standards and the ocean literacy principles addressed in this unit were used as a guideline in selecting the following resources. To access the print resources listed below, contact NOAA's Outreach Education Office directly:

Outreach Unit
NOAA Office of Public and Constituent Affairs
1305 East West Highway #1W514
Silver Spring, MD 20910
Phone: (301) 713-1208
Email: NOAA-OUTREACH@noaa.gov
http://www.education.noaa.gov/

Resources:

• Jet Stream: An Online Weather School -- Hydrologic Cycle section of "The Atmosphere" found at:
http://www.srh.noaa.gov/srh/jetstream/matrix.htm

• Billy and Maria Weather Coloring Books
http://www.nssl.noaa.gov/edu/bm/bm_main.html

• National Weather Service Cloud Charts –
http://www.nws.noaa.gov/os/brochures/cloudchart.pdf
http://www.nws.noaa.gov/os/reachout/res-posters.shtml

• Water Cycle Video primer –
http://www.montereyinstitute.org/noaa/

• A good Water Cycle Game
http://response.restoration.noaa.gov/book_shelf/1064_Watercycle_instructions.pdf

OCEAN LITERACY ESSENTIAL PRINCIPLES

1. The Earth has one big ocean with many features
   1f. The ocean is an integral part of the water cycle and is connected to all of the Earth's water reservoirs via evaporation and precipitation processes.
   1g. The ocean is connected to major lakes, watersheds and waterways because all major watersheds on Earth drain to the ocean. Rivers and streams transport nutrients, salts, sediments, and pollutants from watersheds to estuaries and to the ocean.

3. The ocean is a major influence on weather and climate
   3a. The ocean controls weather and climate by dominating the Earth's energy, water and carbon systems.
   3b. The ocean absorbs much of the solar radiation reaching Earth. The ocean loses heat by evaporation. This heat loss drives atmospheric circulation when, after it is released into the atmosphere as water vapor, it condenses and forms rain. Condensation of water evaporated from warm seas provides the energy for hurricanes and cyclones.

6. The ocean and humans are inextricably interconnected.
   6g. Everyone is responsible for caring for the ocean. The ocean sustains life on Earth and humans must live in ways that sustain the ocean. Individual and collective actions are needed to effectively manage ocean resources for all.

Lesson 1: There were no principles which properly aligned.
Lesson 2: 1f. 3b.
Lesson 3: 1f. 3a. 3b.
Lesson 4: 1f. 1g. 3b. 6g.
Culminating: 1f. 3b. 6g.

CLIMATE LITERACY ESSENTIAL PRINCIPLES

1. The Sun is the primary source of energy for Earth's climate system.
   1c. The tilt of Earth's axis relative to its orbit around the Sun results in predictable changes in the duration of daylight and the amount of sunlight received at any latitude throughout a year. These changes cause the annual cycle of seasons and associated temperature changes.

2. Climate is regulated by complex interactions among components of the Earth's system.
   2b. Covering 70% of Earth's surface, the ocean exerts a major control on climate by dominating Earth's energy and water cycles. It has the capacity to absorb large amounts of solar energy. Heat and water vapor are redistributed globally through density-driven ocean currents and atmospheric circulation. Changes in ocean circulation caused by tectonic movements or large influxes of fresh water from melting polar ice can lead to significant and even abrupt changes in climate, both locally and on global scales.

4. Climate varies over space and time through both natural and man-made processes.
   4a. Climate is determined by the long-term pattern of temperature and precipitation averages and extremes at a location. Climate descriptions can refer to areas that are local, regional, or global in extent. Climate can be described for different time intervals, such as decades, years, seasons, months, or specific dates of the year.
   4b. Climate is not the same thing as weather. Weather is the minute-by-minute variable condition of the atmosphere on a local scale. Climate is a conceptual description of an area's average weather conditions and the extent to which those conditions vary over long time intervals.

Lesson 1: There were no principles which properly aligned.
Lesson 2: 2a. 2b.
Lesson 3: 1c. 2b. 4a. 4b.
Lesson 4: There were no principles which properly aligned.
Culminating: 1c. 2b. 4a. 4b.

NOAA Marine Science Career - Case Studies

Ian Morrison, Incident Meteorologist

National Weather Service Hawai'i

We interviewed our friend Ian Morrison, who is an Incident Meteorologist for the National Weather Service here in Honolulu, Hawai'i.

An incident meteorologist is a specially trained meteorologist who provides site specific weather forecasts and information at an incident, like a wild fire for example. Ian shares with us why he became interested in the field of meteorology.

What sparked your interest in meteorology?

Since I can remember, weather has always been a big interest of mine. Growing up on the coast of Massachusetts I witnessed the effects of weather on the ocean first hand. One of my favorite things was when big storms like blizzards and hurricanes
would blow in. Even though I had no idea exactly how the weather affected the ocean, I was still fascinated by its power, which sparked many questions for me. Those questions and my passion for learning
more about weather drew me into the field of meteorology.

How can I become a meteorologist?

If you want to be a meteorologist, you need to do well in school now, in order to create strong study habits for future classes. A strong background in math and science is required to study meteorology. When it's time for college, there are many schools, including the University of Hawai'i, that have undergraduate meteorology programs.

Can you tell us briefly about the water cycle in Hawai'i?

The Hawaiian Islands are surrounded by water, and that water moves through a never-ending cycle all the time. We can see this cycle happening all around us. Under normal circumstances, late night and early morning skies have the fewest clouds. As the sun heats up the islands, the cloud cover increases gradually throughout the day. The heating from the sun helps to evaporate water from the ocean into water vapor, which is water in its gaseous state (evaporation). The water vapor is lifted up into the atmosphere by the newly heated rising air. As that water vapor rises, the air temperature cools, and that water vapor is transformed back into liquid water, in the form of little tiny water droplets (condensation). Those water droplets are called clouds. As the clouds grow thicker and thicker, the water droplets get bigger and bigger until they form rain drops, and finally fall to the ground (precipitation). The rain drops then seep into the ground to become ground water or run off and flow back into the ocean (infiltration). With that, the water cycle has gone around full circle, ready to begin again.
So just by looking outside we can see the entire water cycle in action!

Glossary of Cooperative Learning Techniques

In an effort to maximize student engagement and learning, the NOAA Sea Earth and Atmosphere curricular resources were designed using cooperative learning techniques. This guide defines the expectations for implementation of each technique.

What is Cooperative Learning?

Cooperative learning may be broadly defined as any classroom learning situation in which students of all levels of performance work together in structured groups toward a shared or common goal. According to Johnson, Johnson and Holubc, (1994): "Cooperative learning is the instructional use of small groups through which students work together to maximize their own and each other's learning." In classrooms where collaboration is practiced, students pursue learning in groups of varying size: negotiating, initiating, planning and evaluating together. Rather than working as individuals in competition with every other individual in the classroom, students are given the responsibility of creating a learning community where all students participate in significant and meaningful ways. Cooperative learning requires that students work together to achieve goals which they could not achieve individually.

Jigsaw

To Jigsaw materials refers to the use of a strategy in which each student on a team receives only a piece of the material that is to be learned in which that student becomes the "expert." Once the material is learned each member of the team takes a turn teaching the other members their assigned content. This type of dynamic makes the students rely on the other members of their team to learn all of the material.

Think-Pair-Share

This four-step discussion strategy incorporates wait time and aspects of cooperative learning. Students (and teachers) learn to LISTEN while a question is posed, THINK (without raising hands) of a response, PAIR with a neighbor to discuss responses, and SHARE their responses with the whole class. Time limits and transition cues help the discussion move smoothly. Students are able to rehearse responses mentally and verbally, and all students have an opportunity to talk.

Numbered Heads

This structure is useful for quickly reviewing objective material in a fun way. The students in each team are numbered (each team might have 4 students numbered 1, 2, 3, 4). Students coach each other on material to be mastered. Teachers pose a question and call a number. Only the students with that number are eligible to answer and earn points for their team, building both individual accountability and positive interdependence.

KWL Chart

A pre-assessment tool consisting of three vertical columns. Students list what they "**K**now" about a topic. What they "**W**ant" to know about a topic. The last column students share what they have "**L**earned" about a topic.

KWL CHART

Be sure to bullet your list.
Use content words only (nouns, verbs, names of people and places, dates, numbers, etc.).

WHAT DO I KNOW?	WHAT DO I WANT TO KNOW? *or* WHAT DO I WANT TO SOLVE?	WHAT HAVE I LEARNED?
•		•

Role Cards

Assign students to cooperative learning groups. Once students are in their groups the teacher will hand out premade role cards that will help each member of the group contribute to the completion of the given task. Before roles are assigned, the teacher should explain and model the task as well as the individual roles for students so that they know and understand how his/her individual role will contribute to the success of the group completing the task. When this technique is used, taking on a different role will aide in student proficiency.

Example of role cards:

Role Card #1

Facilitator:

Makes certain that everyone contributes and keeps the group on task.

Role Card #2

Recorder:

Keeps notes on important thoughts expressed in the group. Writes final summary.

Role Card #3

Reporter:

Shares summary of group with large group. Speaks for the group, not just a personal view.

Role Card #4

Materials Manager:

Picks up, distributes, collects, turns in, or puts away materials. Manages materials in the group during work.

Role Card #5

Time Keeper:

Keeps track of time and reminds groups how much time is left.

Role Card #6

Checker:

Checks for accuracy and clarity of thinking during discussions. May also check written work and keeps track of group point scores.

Round Table

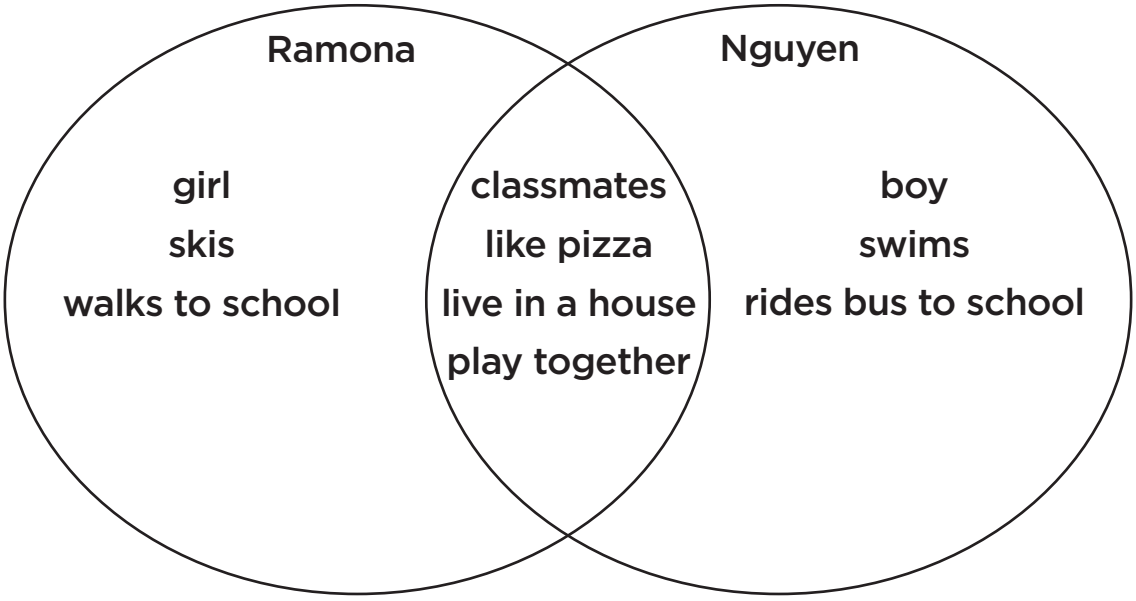
Round table can be used for brainstorming, reviewing, or practicing while also serving as a team builder. Students sit in teams of 3 or more, with one piece of paper and one pencil. The teacher asks a question which has multiple answers. Students take turns writing one answer on the paper, then passing the paper and pencil clockwise to the next person. When time is called, teams with the most correct answers are recognized. Teams reflect on their strategies and consider ways they could improve.

Three-Step Interview

This involves structured group activity with students. Using interviews/listening techniques that have been modeled; one student interviews another about an announced topic. Once time is up, students switch roles as interviewer and interviewee. Pairs then join to form groups of four. Students take turns introducing their pair partners and sharing what the pair partners had to say. This structure can be used as a team builder, and also for opinion questions, predicting, evaluation, sharing book reports, etc.

Venn Diagram

A diagram using circles to represent sets, with the position and overlap of the circles comparing and contrasting the relationships between two given pieces of information.



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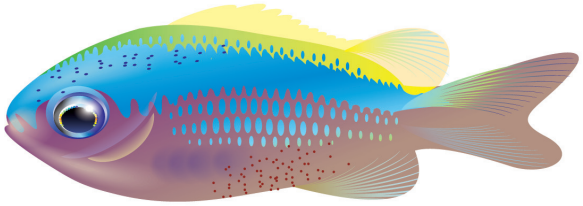
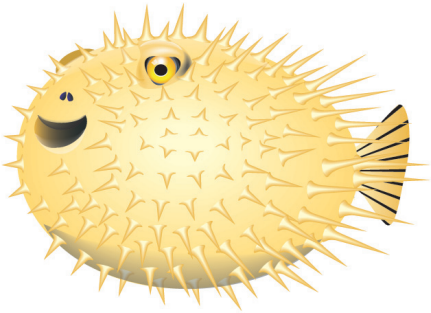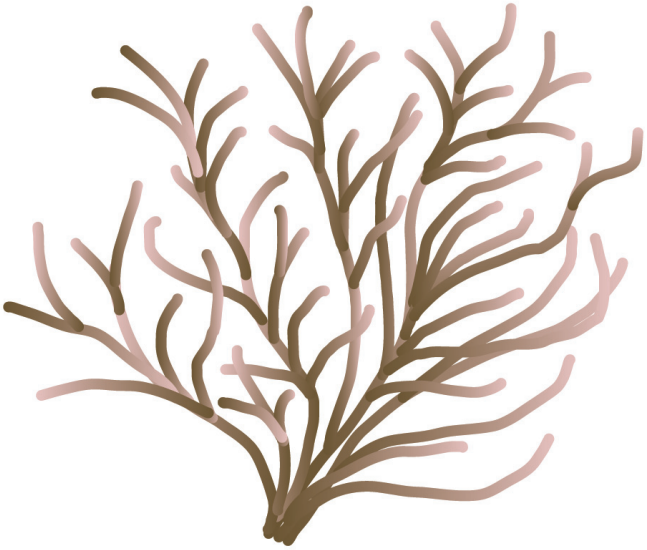
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