



You Make the Difference

La Piétra - Hawai'i School for Girls
Environmental Science Class

No task is too big when done together by all.
— Mary Kawena Pukui, 'Ōlelo No'eau 142

You Make the Difference



Photo by Carey Morishige

Early Hawaiians managed the land and water resources within ahupua'a—land divisions that typically ran from the mountains to the sea. People farming and fishing within the ahupua'a recognized the connection between activities on land and the health of the coral reefs in the sea. Wai (fresh water) was considered sacred; it was essential for all life. Wai also connected the land to the sea, carrying nutrients down to the reef. Fishing was regulated by strict kapu (prohibitions) based on the spawning seasons of different fish. Traditional fishing methods and practices enabled Hawaiians to maintain healthy fish populations that sustained them for centuries. Returning to a sense of reverence for the environment that sustains us is a critical need as we witness the deterioration of our land and ocean resources today.

We look to the past for guidance in ways to live sustainably, just as we look to the “kūpuna” islands today for knowledge of what healthy reefs and coastal areas should be. Peering through the clear waters around the NWHI and walking on the islands is like seeing through a window to our past where diverse healthy reefs and islands supported an astonishing number of native species. Using this as a baseline for where we are today, we see the deterioration that comes from overfishing, land development, alien species, pollution, and marine debris. Having seen what once was, we have a vision to work toward, to “navigate change” as a way to reach for a better tomorrow.

Communities all over the state are involved in a variety of projects to navigate change. The Navigating Change video provided with this teacher's guide provides a few examples of projects that students are undertaking. These projects provide an inspiration for what we can all do to make the difference. The community resources and the student investigations provided on the following pages await those who are ready to take action!



Community Resources for Taking Action

Note: See the Navigating Change web site www.navigatingchange.org for updates to this list.

Contacts	Description
<p>City and County of Honolulu Department of Environmental Services Storm Water Quality Branch 1000 Uluohia St., Suite 303 Kapolei, HI 96707 Iwalani Sato Phone: (808) 768-3248 isato@honolulu.gov http://www.cleanwaterhonolulu.com/storm/hero/hero.html.</p>	<p>Contact the Storm Water Quality Branch to become involved in any of the following programs: Adopt-A-Stream, Adopt-A-Block, Storm Drain Stenciling, Earth Month Teen Video Contest (by invitation only, middle and high schools), Keiki Water Festival, Mauka to Makai Expo and Adopt-A-Stream Cleanups (April). The Keiki Water Festivals are conducted in partnership with the Department of Health, Clean Water Branch, at select locations.</p>
<p>The Friends of He'eia State Park Post Office Box 698 46-465 Kamehameha Hwy Kāne'ohe, HI 96744 Phone: (808) 247-3156 Web site: www.inix.com/heeia/ Fax: (808) 247-8510 E-mail: friends@inix.com</p>	<p>The Friends of He'eia organize community work days during the second and fourth Saturday of every month. Volunteer days focus on gardening, stream restoration, picking up marine debris and mangrove removal. Volunteers help in maintaining and planting a native Hawaiian garden and help with the potting of mīlo seedlings to be transplanted in the estuary system. Participants learn the best techniques for pruning, mulching, transplanting, and much more.</p>
<p>'Imi Pono no ka 'Āina Seeking Excellence for the Land Contact: Kuhea Paracuelles Office is located in Hawai'i Volcanoes National Park 808-985-6196 Kuhea_Paracuelles@contractor.nps.gov</p>	<p>Established as an environmental education position on Hawai'i Island under a partnership agreement with the National Park Service, U.S. Army, and U.S. Fish and Wildlife Service, Kuhea designs and facilitates teacher workshops and assists teachers and classrooms with hands-on restoration projects particularly related to native forest restoration.</p>
<p>Kalihi Stream Clean-ups Malama Souza: 236-4400 E-mail: malamasouza@hawaii.rr.com.</p>	<p>The Kalihi Stream Project holds regular stream clean-ups and volunteer work days. Volunteers help remove trash and invasive weeds from Kalihi stream, stabilize stream banks to prevent erosion, and replant native Hawaiian plants.</p>
<p>Kōkua Hawai'i Foundation http:// www.kokuahawaiifoundation.org</p>	<p>The Foundation provides grants for environmental field trips. Their Kōkua Earth Action Projects (KEAP) is a student-lead environmental service learning initiative aimed at taking care of our islands and encouraging long-lasting change in our classrooms, schools or community.</p>



Contacts	Description
<p>Kuleana Project Mālama o Mānoa Contact Project Coordinator Helen Nakano at 988-5671 or nakano@aloha.net</p>	<p>The purpose of this project is to effect change of activities and practices of 1,000 households in the Mānoa subwatershed on O‘ahu. The project engages students in education and outreach utilizing a community-based grassroots approach.</p>
<p>Mālama Hawai‘i Volunteer Project web site: http://www.malahawaii.org/get_involved/volunteer.php</p>	<p>Mālama Hawai‘i is a hui of over 70 organizations and hundreds of individuals committed to the vision that Hawai‘i, our special island home, be a place where the people, land, and sea are cared for, and communities are healthy and safe.</p>
<p>Mālama Maunalua Contact: Alyssa Miller greenwaveproductions@gmail.com</p>	<p>Mālama Maunalua is a community-based alliance dedicated to creating a more culturally and ecologically healthy Maunalua region in Southeast O‘ahu. The group shares a vision where the fish are once again plentiful, pollution and sedimentation are mitigated, and where people, community groups, businesses and agencies take kuleana in caring for and sustainably managing the bay.</p>
<p>MARE Hawai‘i Robin Newbold Education and Research Director (808) 875-7661</p>	<p>MARE (Marine Awareness, Research, and Education) Hawai‘i is a Maui-based nonprofit organization that conducts and coordinates ongoing studies of the reef environment using community-based programs such as REEF and Reef Check in order to scientifically document reef status, evaluate conservation efforts, and provide information to management agencies. The organization encourages broad participation through public awareness campaigns, community events, educational initiatives, sponsorship programs, and collaborations with other nonprofit organizations and governmental agencies.</p>
<p>Matson Navigation Donation Program Honolulu, O‘ahu Keahi Birch, 848-1252 or Cliff Mattos, 848-1263 Matson Navigation Company 1411 Sand Island Parkway Hilo, Hawai‘i Russell Chin, 961-5286 Matson Navigation Company Pier 1 Kahului, Maui Buzz Fernandez, 871-7351 Matson Navigation Company 105 Ala Luina Street Nawiliwili, Kaula Dewayne Kong, 246-9494 Matson Navigation Company Pier 2</p>	<p>Through the Ka Ipu ‘Āina program, Matson will donate the use of container equipment on O‘ahu, Maui, Hawai‘i Island, and Kaula for environmental clean-up projects arranged by non-profit organizations. Matson will pay for the trucking expenses incurred in the delivery and pickup of the containers. In addition, Matson will make a \$1,000 cash contribution to each of the non-profits that successfully complete a clean-up initiative. Matson personnel in each of the Hawai‘i offices will work directly with the non-profits to ensure all arrangements are made in the time frame requested. For more details, the non-profit group should call its local Matson contact to request an information packet, which details the program, including requirements and restrictions.</p>



Contacts	Description
<p>Maui County Frog Squad Maui Invasive Species Council: http://www.hear.org/misc/index.html</p> <p>Got Frogs? Flyer: http://www.hear.org/misc/pdfs/misc_got-frogs.pdf</p> <p>Maui County Department of Public Works and Environmental Management: http://www.co.maui.hi.us/departments/Public/</p> <p>Rob Parsons Maui County Environmental Coordinator E-mail: rob.parsons@co.maui.hi.us for availability of the citric acid</p>	<p>Maui County, Hawai'i, residents are being urged to form frog squads to combat coqui frogs. The Maui Invasive Species Committee (MISC) has joined forces with the county to help landowners rid their properties of the unwanted intruder. The "MISC Got Frogs?" flyer encourages homeowners to work with their neighbors to watch for coqui frogs, and the Maui County Department of Public Works and Environmental Management is providing citric acid to Maui County residents who wish to use it as a pesticide on the frogs.</p>
<p>The Nature Conservancy 923 Nu'uuanu Avenue Honolulu, HI 96817</p> <p>Office Managers/Volunteer Coordinators O'ahu: (808) 621-2008 or (808) 537-4508 Moloka'i: (808) 553-5236 Maui : (808) 572-7849 Hawai'i Island: (808) 885-1786 E-mail: volunteerhawaii@tnc.org</p>	<p>The mission of The Nature Conservancy (TNC) is to preserve the plants, animals, and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive. TNC works closely with communities, businesses, and people like you! Help preserve and protect Hawaiian natural areas—there are ongoing volunteer opportunities in the field, baseyard, and office. You can help build and maintain trails and fences, control weeds, out-plant native species, help in the nursery, maintain a resource library, and much more.</p>
<p>Paepae o He'eia - Friends of He'eia Fishpond P.O. Box 6355 Kāne'ohe, HI 96744 (808) 236-6178 http://www.paepaeoheeia.org</p>	<p>Students can become involved in caring for He'eia Fishpond through school field trips or community work days. Service learning projects are aimed at sharing ways that Hawaiians cared for this special place and learning the mo'olelo (stories) of the He'eia ahupua'a.</p>
<p>Project S.E.A. – Link Liz Foote 32 Polohina Lane #6 Lahaina, HI 96761 Phone: (808) 669 -9062</p>	<p>Project S.E.A.-Link is a non-profit organization based on Maui, Hawai'i. Its goals include: encouraging and inspiring the next generation of marine scientists, educators, and stewards of the ocean environment; supporting the inquiry-based reform in science education; and promoting conservation and stewardship in order to preserve and protect marine resources. Project S.E.A.-Link is carrying out its goals through educational programs, the development of an interactive web site providing resources for students and teachers, and through scientific efforts consisting of community-based coral reef monitoring.</p>



Contacts

Description

<p>Protect the Planet Web site: http://www.protecttheplanet.org/</p>	<p>Protect The Planet is a grass-roots movement to make caring for the Earth part of everyday life. Protect the Planet showcases the ability of people of all ages and backgrounds to take on challenges and demonstrate leadership. They encourage everyone to get involved in their own way to make good things happen for the Earth. See their web site for current events.</p>
<p>Save Our Seas Captain Paul Clark President – Save Our Seas P.O. Box 813 Hanalei, HI 96714 Phone: (808) 651-3452</p>	<p>“Save Our Seas” (SOS) is an international Hawai‘i-based non-profit organization that utilizes education and research to preserve, protect, and restore the world’s oceans for future generations. SOS project elements include: how to organize and develop stakeholders for community-based support, watershed-based problem identification, the mix of voluntary and regulatory programs, and monitoring and restoring wetlands, coral reefs, and oceanic habitats.</p>
<p>University of Hawai‘i Curriculum Research and Development Group (CRDG) Contact: Kanesa Duncan (808) 956-5545. http://www.hawaii.edu/gk-12/evolution/.</p>	<p>The University of Hawai‘i (CRDG) provides connections to UH graduate students who are available to bring scientific expertise into elementary school classrooms and field trips.</p>
<p>Volunteer Hawai‘i http://volunteerhawaii.org/volunteer/</p>	<p>Volunteer Hawai‘i is a web site where United Way in Hawai‘i provides a clearinghouse for agencies to post volunteer opportunities for the public.</p>
<p>Waimea Valley Hi‘ipaka LLC Contact: Jaime Raduenzel Phone: (808) 638-7766</p>	<p>There are many volunteer opportunities at Waimea Valley. Some groups have adopted areas within the park that they help to care for on an ongoing basis. The need is constant, the time commitment is flexible.</p>
<p>Waipā Foundation P.O. Box 1816 Hanalei, HI 96714 (808) 826-9969 fax (808) 826-1478 waipa_foundation@yahoo.com http://www.waipafoundation.org/pages/aboutwaipa.html</p>	<p>Groups can participate in learning and stewardship opportunities within the Waipā ahupua‘a. The vision of the Waipā Foundation is to restore the Waipā ahupua‘a as a Hawaiian community and learning center, and to create a sustainable culturally and community-based model for land use and management, inspired in part by the traditional values of the ahupua‘a.</p>
<p>Waikalua Loko Fishpond Preservation Society http://www.waikalualokofishpond.org</p> <p>Contact: Ka‘ōhua Lucas to pre-register your group. Email: kaohua@hawaii.rr.com Phone: (808) 843-1217</p>	<p>Waikalua Loko Fishpond Preservation Society conducts community work days where school groups, families, nonprofit groups and anyone interested in helping to mālama the fishpond come together to remove mangrove, rebuild the fishpond wall, or remove invasive limu.</p>





You Make the Difference

Grades 4 - 5 Unit Map

Unit Essential Question: How do we “navigate change” to create a healthier environment within our own ahupua‘a?

Hawai‘i DOE Standards & Nā Honua Maui Ola	Focus Questions & Activities	Key Concepts	DOE Benchmarks
<p>Grade 4 Social Studies 7: Geography: World in Spatial Terms Environment and Society</p> <p>Nā Honua Maui Ola 14 - 1 Learners will be keen observers of their natural environment.</p>	<p>What do Hawaiian loko i‘a (fishponds) teach us about wise use of resources within an ahupua‘a?</p> <p>ACTIVITY 1 Mālama Loko l‘a</p>	<ul style="list-style-type: none"> Water flowing through an ahupua‘a carried nutrients from upland fishponds (loko i‘a kalo) down to shoreline fishponds (loko kuapā) that were constructed for the ali‘i (chiefs). The Hawaiian relationship to the ‘āina was demonstrated in their wise use of resources from the mountains to the sea. Wise use is reflected in practices such as taking only fish that are needed, returning water from the lo‘i to the stream, and using available resources (rocks, wood, cordage) to grow fish, which takes fishing pressure off of the reef.) 	<p>SS.4.7.3 Analyze the consequences of human modification of the physical environment in Hawai‘i using geographic representations (including lo‘i kalo and loko i‘a).</p>
<p>Grade 5 Science 1: The Scientific Process: Scientific Investigation - Scientific Inquiry</p> <p>Math 12: Data Analysis, Statistics, and Probability Data Interpretation</p>	<p>How can we mālama (care for) the marine environment?</p> <p>ACTIVITY 2 Mālama i ke Kai</p>	<ul style="list-style-type: none"> People have affected the balance of life on a coral reef by introducing invasive species and adding sediments, polluted run-off, and debris. We can test our hypotheses about how human activities on land impact the marine environment by comparing conditions at different sites. 	<p>SC.5.1.1 Identify the variables in scientific investigations and recognize the importance of controlling variables in scientific experiments.</p> <p>SC.5.1.2 Formulate and defend conclusions based on evidence.</p> <p>MA.5.12.1 Determine the range, median, mode, and mean for a data set.</p>

Hawai'i DOE Standards, GLOs, & Nā Honua Maui Ola	Focus Questions & Activities	Key Concepts	DOE Benchmarks
<p>Grade 4 Social Studies 6: Cultural Anthropology: Systems, Dynamics, and Inquiry - Cultural Inquiry</p> <p>Grades 4 - 5 Language Arts 5: Writing: Rhetoric - Meaning</p> <p>Language Arts 7: Oral Communication: Rhetoric - Meaning</p> <p>GLO 2: Community Contributor GLO 5 Effective Communicator</p> <p>Nā Honua Maui Ola 15 - 3 Teach others about the concept of mālama through example.</p> <p>Nā Honua Maui Ola 5 - 3 & 8 Appreciate and respect the diverse views of others. Become actively involved in local activities and organizations that contribute to the quality of life in the community.</p>	<p>How do we “navigate change” to create a healthier environment within our own ahupua'a?</p> <p>ACTIVITY 3 Navigating Change</p>	<ul style="list-style-type: none"> • Within our ahupua'a today, we can “navigate change” and work with others in our community to mālama our land and water resources. • It is our kuleana (responsibility) to contribute to the community where we live. 	<p>SS.4.6.2 Describe how individuals or groups deal with conflict, cooperation, and interdependence within the ahupua'a.</p> <p>LA.4.5.1 Use appropriate facts and interesting details that develop the intended meaning and anticipate the needs of the audience.</p> <p>LA.5.5.1 Use information from appropriate sources: self, peers, and a variety of grade-appropriate sources.</p> <p>LA.5.5.2 Use significant details and relevant information to develop meaning.</p> <p>LA.4.7.1 Use prior knowledge, input from others, and text resources to develop ideas for speaking.</p> <p>LA.5.7.1 Combine ideas from prior knowledge, input from others, and text resources to elaborate on and support ideas.</p>



Student Journal

Unit 5 – You Make the Difference



'A'ohe hana nui ke alu 'ia.

No task is too big when done together by all.

—Mary Kawena Pukui, *'Ōlelo No'eau* 142

Student's Name: _____

School: _____

Date started: _____

Date ended: _____



Student Assessment Overview

Unit Essential Question: How do we “navigate change” to create a healthier environment within our own ahupua‘a?

Nā Honua Maui Ola (Hawaiian Guidelines) in this unit

- Be keen observers of their natural environment.
- Appreciate and respect the diverse views of others.
- Become actively involved in local activities and organizations that contribute to the quality of life in the community
- Teach others about the concept of mālama through example.

General Learner Outcomes (GLOs) in this unit

- GLO 2: Cooperate with and help and encourage others in group situations.
- GLO 5: Listen to, interpret, and use information effectively

How you will be graded for this unit:

Individual Journal

It is your responsibility (kuleana) to complete a journal for this unit. Following is a checklist of the pages you will need to include in your journal. Place this page in your journal and make a check next to each item when you complete it. You will be given more details during each lesson.

Standards and Journal Pages	✓ Completed
1. Mālama Loko I‘a - Grade 4 – Standards: Social Studies 7 Journal 24: Illustrating an ahupua‘a with different types of loko i‘a (fishponds) and using new vocabulary to reflect on field study	
2. Mālama i ke Kai - Grade 5 - Standards: Science 1 and Math 12 Journal 24: Summarizing data on water quality from field study	
3. Navigating Change – Standards: Language Arts 5 and 7 Journal 25: an action plan for your group project to mālama (care for) your ahupua‘a	

Culminating Activity – Group Project Due Date: _____

This is your opportunity to “navigate change” in your community! Select a problem that you and other students want to address in your ahupua‘a. Work with the group to think about ways to help solve the problem by demonstrating mālama ‘āina (caring for the land and sea). For example, help solve the over-fishing problem by educating others through a group project (web page, song, book, skit, or computer presentation) that you present to the community. Or develop a new project to address a different problem in your ahupua‘a.



Your group will need to:

- Identify the problem you want to address in your ahupua'a
- Do some research (Internet, interviews, books) to find relevant facts and interesting information that will help you learn more about the problem and how to address it
- Identify different views of others about the issue or problem and what can be done to resolve conflicts
- Keep a bibliography of your sources of information
- Take pictures or record video segments of your group in action
- Laulima! Work together cooperatively and be sure everyone understands his/her role in the group.

Individual Project – Due Date:_____

Become a “Navigating Change” Reporter

Imagine that you are a television or radio reporter producing a segment on the project that your group completed. Write a two-page script for that segment that summarizes your group project to “navigate change” within your ahupua'a. Each student is responsible for being a reporter and writing his/her own report.

The report should:

- Identify the problem the group tried to solve, including relevant facts and interesting details.
- Describe the action taken to solve the problem, and your conclusions about how well your project worked.

We will review a rubric to help guide you in developing your report. Practice reading your script before sharing it with your classmates.



Unit 5 Culminating Activity: Rubric for Self-Assessment - Grade 4

Team Names _____

Student Name _____

Date _____

Total Points _____

Unit Essential Question: How do we “navigate change” to create a healthier environment within our own ahupua’a?

Nā Honua Mauii Ola & DOE Benchmarks	Kūlia (Exceeds Standard)	Mākaukau (Meets Standard)	‘Ano Mākaukau (Almost at Standard)	Mākaukau ‘Ole (Below Standard)
Nā Honua Mauii Ola 5 - 3 Appreciate and respect the diverse views of others. Points _____	My report described, in great detail, how we appreciate and respect the diverse views of others.	My report described, with detail, how we appreciate and respect the diverse views of others.	My report described, with minimal detail, how we appreciate and respect the diverse views of others.	My report did not show how we appreciate and respect the diverse views of others.
Nā Honua Mauii Ola 5 – 8 Become actively involved in local activities and organizations that contribute to the quality of life in their community Points _____	I described, in great detail, how we were actively involved in the community and really made a big difference.	I described, in detail, how we took action in our community and made a difference.	I described, in some detail, how we took action in our community and made a difference.	I described, in minimal detail, how we took action in our community and made a difference.
Social Studies 6: Cultural Anthropology: Systems, Dynamics, and Inquiry Cultural Inquiry Describe how individuals or groups deal with conflict, cooperation, and interdependence within the ahupua’a. Points _____	I described, with clear and precise detail, how individuals or groups deal with conflict, cooperation, and interdependence within the ahupua’a.	I described, with detail, how individuals or groups deal with conflict, cooperation, and interdependence within the ahupua’a.	I described, with minimal detail, how individuals or groups deal with conflict, cooperation, and interdependence within the ahupua’a.	I did not describe how individuals or groups deal with conflict, cooperation, and interdependence within the ahupua’a.
Language Arts 5: Writing: Rhetoric Meaning Use appropriate facts and interesting details that develop the intended meaning and anticipate the needs of the audience. Points _____	My report described our project with lots of relevant facts and interesting details. I used creativity to communicate to my audience.	My report described our project with relevant facts and interesting details.	My report described our project with a few relevant facts but it needed more interesting details.	My report lacked relevant facts and interesting details.





Unit 5 Culminating Activity: Rubric for Self-Assessment - Grade 4

Team Names _____ Student Name _____ Date _____ Total Points _____

Unit Essential Question: How do we “navigate change” to create a healthier environment within our own ahupua’a?

Nā Honua Maui Ola & DOE Benchmarks	Kūlia (Exceeds Standard)	Mākaukau (Meets Standard)	‘Ano Mākaukau (Almost at Standard)	Mākaukau ‘Ole (Below Standard)
Nā Honua Maui Ola 5 - 3 Appreciate and respect the diverse views of others. Points ____	My report described, in great detail, how we appreciate and respect the diverse views of others.	My report described, with detail, how we appreciated and respected the diverse views of others.	My report described, with some detail, how we appreciated and respected the diverse views of others.	My report did not show how we appreciated and respected the diverse views of others.
Nā Honua Maui Ola 5 - 8 Become actively involved in local activities and organizations that contribute to the quality of life in their communities. Points ____	I described, in great detail, how we were actively involved in the community and really made a big difference.	I described, in detail, how we took action in our community and made a difference.	I described, in some detail, how we took action in our community and made a difference.	I described, in minimal detail, how we took action in our community and made a difference.
Language Arts 5: Writing: Rhetoric - Meaning Use information from appropriate sources: self, peers, and a variety of grade-appropriate sources. Points ____	My report integrated information from an extensive variety of appropriate sources (from my team and from my own library research, Internet search engines, and/or interviews).	My report used information from a variety of appropriate sources (from my team and from my own library research, Internet search engines, and/or interviews).	My report used information from a few appropriate sources (from my team or from my own library research, Internet search engines, or interviews).	My report used information one or two appropriate sources (from my team or from my own library research, Internet search engines, or interviews).
Language Arts 5: Writing: Rhetoric - Meaning Use significant details and relevant information to develop meaning. Points ____	I used significant details and clear, relevant information to insightfully develop meaning in my report.	I used significant details and relevant information to develop meaning.	I used some obvious details and typical information that are related to but do not develop meaning.	I used insignificant details and irrelevant information that do not develop meaning. I can do better work.



Mālama Loko I‘a - Grade 4

What do Hawaiian loko i‘a (fishponds) teach us about wise use of resources within an ahupua‘a?

Hawai‘i DOE Standard Benchmark

Grade 4

Social Studies 7: Geography: World in Spatial Terms - Environment and Society

- **SS.4.7.3** Analyze the consequences of human modification of the physical environment in Hawai‘i using geographic representations (including lo‘i kalo and loko i‘a).

Nā Honua Maui Ola 14 - 1

Plan for meaningful learner outcomes that foster the relationship and interaction among people, time, space, places, and natural elements around them to enhance one’s ability to maintain a “local” disposition with global understandings.

- Learners will be keen observers of their natural environment.

Key Concepts

- Water flowing through an ahupua‘a carried nutrients from upland fishponds (loko i‘a kalo) down to shoreline fishponds (loko kuapā) that were constructed for the ali‘i (chiefs).
- The Hawaiian relationship to the ‘āina was demonstrated in their wise use of resources from the mountains to the sea.
- Wise use is reflected in practices such as taking only fish that are needed, returning water from the lo‘i to the stream, and using available resources (rocks, wood, cordage) to grow fish, which takes fishing pressure off of the reef.)

Activity at a Glance

Students view a DVD about Hawaiian fishponds and illustrate an ahupua‘a with two different types of fishponds. On a field trip to Waikalua Loko fishpond, students discover how Hawaiians’ relationship to the ‘āina was demonstrated in wise use of resources within the ahupua‘a.

Time

2 class periods plus a field trip

Prerequisite

Unit 4 Activity 4 - *From the Land to the Sea*

Assessment

Students:

- Draw an ahupua‘a diagram that includes different types of fishponds and shows the connection from the mountains to the sea.
- Write a caption for their diagram explaining how Hawaiians modified the environment to create fishponds.
- Explain what Hawaiian fishponds teach us about wise use of resources in an ahupua‘a.



Hawai'i DOE Rubric

Advanced	Proficient	Partially Proficient	Novice
Social Studies Grade 4			
Evaluate the consequences of human modification of the physical environment in Hawai'i using geographic representations, drawing relevant and insightful conclusions	Analyze the consequences of human modification of the physical environment in Hawai'i using geographic representations, drawing relevant conclusions	Describe the consequences of human modification of the physical environment in Hawai'i using geographic representations	Recognize that there are consequences of human modification of the physical environment in Hawai'i

Vocabulary

'auwai kai - channel in fishpond wall
 laulima - cooperate; work together
 loko i'a - fishpond
 loko kuapā - shoreline fishpond unique to Hawai'i
 lo'i kalo - taro patch
 loko i'a - fishpond
 loko i'a kalo - taro fishpond
 mākāhā - sluice grate

Materials

- *Kāhea Loko: The Call of the Pond* (DVD available from the Pacific American Foundation: www.thepaf.org)
- student reading (provided)
- student journal - 24 (provided)
- oli (E Ho Mai and Oli Mahalo) (provided)
- Student Assessment Overview (provided in Unit Introduction)
- colored markers



Pulling mangrove at Waikalua Loko. Photo: Maura O'Connor

Field Trip Checklist

- cell phone
- first aid kit
- students' list: hat, sunscreen, tabi or old shoes (no slippers), bottled water in backpack, rain poncho
- garbage bag (for picking up marine debris)

Advance Preparation

- Copy the student reading and journal sheet - 24 for each student, and if appropriate, the chants provided with this lesson.
- Copy the Student Assessment Overview (provided in the Unit Introduction) for each student.
- Contact the Waikalua Loko Fishpond Preservation Society to set up the class visit to the site (Ka'ōhua Lucas: kaohua@hawaii.rr.com or 843-1217).
- See the Navigating Change web site: <http://navigatingchange.org> for a list of field trips sites available for this activity on other islands.
- Review the DOE safety guidelines for water field trips: <http://doe.k12.hi.us/>. Type in "water safety" under Search to download the four-page document.



Teacher Background Information

Hawaiians began engineering fishponds as early as the 13th century. With the innovation of the mākāhā (sluice gates), they designed fishponds that were unique to the Hawaiian Islands (PAF, 2003). These early forms of aquaculture enabled Hawaiians to progress from catching fish to growing fish. Fish grown in the ponds were attracted to the protected shoreline areas where freshwater streams or springs created brackish water conditions. The mākāhā built in the fishpond walls allowed young fish to enter the ponds while keeping large predators out. When the fish matured, they were trapped in the ponds and easily caught. (See the student reading provided with this activity for more information and diagrams.)

Different types of fishponds from loko kuapā (shoreline ponds) to upland loko i'a kalo (taro fishponds) were developed to take advantage of conditions within an ahupua'a. Of the original 488 fishponds that were built in old Hawai'i (Farber, 1977), only a handful remain. Restoring and car-

ing for fishponds today is essential to preserve this vital part of Hawaiian heritage. And by studying the ancient fishponds, students see how harvesting practices that are based on a deep understanding of natural rhythms promotes living in harmony with the environment.

Navigating Change is partnering with the Pacific American Foundation to offer students an opportunity to investigate a Hawaiian fishpond. The reading provided with this lesson is adapted from *Aloha 'Āina*, Grade 4 teacher's guide activity "Engineering Ingenuity". The full lesson, which challenges students to build models of a fishpond and explore the function of the mākāhā, is available online. See: www.ulukau.org/aloha_aina. When students visit the fishpond, they will have an opportunity to mālama (care for) the pond. Service projects include helping to remove invasive mangrove and limu and helping to rebuild the fishpond wall.

Teaching Suggestions

1. Pose the essential question for this unit and discuss unit projects.

- Distribute the Student Assessment Overview and review assignments and projects that students will be conducting in the unit.
- Present the focus question for this activity and let students know they will be going on a field trip to investigate a Hawaiian fishpond.

2. Show students the *Kāhea Loko, Call of the Pond* DVD, which introduces students to Hawaiian fishponds.

- As students watch the video, challenge them to discover: a) the important feature in the pond (the mākāhā) and b) why Hawaiians built fishponds.
- Discussion Questions:
 - Why is the mākāhā such an important feature in the pond? (The grate lets small fish in, keeps large predators out, and traps the mature fish in the pond. The opening in the pond wall allows water to circulate and sediments to be flushed out. The current also attracts fish to the pond and attracts the fish in the pond, making them easier to catch.)
 - Why did Hawaiians build fishponds? (Fishponds provided a way to grow fish; they were like the "refrigerator" for Hawaiians, enabling them to keep a vital source of protein available for the ali'i in the loko kuapā, and for themselves in the loko i'a kalo in the uplands.)

3. Distribute the student reading and journal sheet - 24 and review them with the class.

- Review vocabulary words presented in the DVD and in the student reading.
- Challenge students to summarize what they've learned about fishponds by completing the drawing and writing exercise on Journal - 24.



4. Explore the knowledge and resources that Hawaiians needed to construct fishponds.

- Divide the class into groups and ask half of the groups to brainstorm a list of the knowledge that Hawaiians would need to create fishponds. (Knowledge of currents; fish habitats, food and life cycles; stone wall and mākāhā construction)
- Ask the remaining group to brainstorm a list of the resources that Hawaiians needed for their fishponds (fish, nutrients and plants for fish to eat, rocks, wood, cordage for lashing and nets, ipu (gourds) for carrying fish to uplands) and how these resources were used wisely.
- Ask groups to share their lists with the class and discuss what makes for “wise use” of resources (e.g., taking only what is needed, returning water from the lo’i to the stream where it flows into the pond and nourishes it, growing fish which takes fishing pressure off of the reef.)

5. Discuss the need to mālama (care for) fishponds and how students will become involved.

- Explain that there were once many more fishponds than there are today and that many ponds have been filled in for development.
- Tell students that they will have an opportunity to help mālama the fishpond and ask students if they have any thoughts about why it might be important to do so.

6. Prepare for the field trip.

- Review what students will need to wear and bring on the field trip (see Materials).
- Divide the class into four or five teams (use name tags with team numbers) for the rotations during the field trip. The field trips can be set up to accommodate large groups by having five stations or smaller groups with four stations.
- Discuss the importance of Hawaiian protocol and teach the oli (chant) or ask a kupuna to come and teach the oli that students will be presenting when they arrive at the field trip site.
- Discuss the meaning of the oli and how these chants reflect relationships to the land and to one another.

Field Trip - Schedule - Waikalua Loko

- 9:00 Arrive at the fishpond in Kāneʻohe - protocol and orientation
- 9:15 - 11:15 Teams rotate every 20 minutes and participate in each station
 - Station 1: Ahupuaʻa and moʻolelo
 - Station 2: Kukini run
 - Station 3: Life in the fishpond
 - Station 4: Mākāhā - how the pond works
 - Station 5: Service - pond wall building; invasive species removal
- 11:15 Oli Mahalo and summary
- 11:30 Lunch
- 12:30 Return to school

7. Ask students to write journal reflections that summarize learning.

- Have students write a journal reflection that answers the focus question for this activity:
What do Hawaiian loko iʻa (fishponds) teach us about wise use of resources within an ahupuaʻa?

References

Pacific American Foundation (PAF). (2003). *Kāhea Loko: The Call of the Pond*. Honolulu, HI: Pacific American Foundation.

Farber, Joseph M. (1977). *Ancient Hawaiian Fishponds: Can Restoration Succeed in Molokaʻi?* Encinitas, CA: Nepturpe House Publications



E Hō Mai

Composed by: Edith Kekuhikuhipu'uoneo'naali'iokohala Kanāka'ole

E hō mai ka 'ike mai luna mai e	Grant us the knowledge from above
O nā mea huna no'eau no nā mele e	Concerning the hidden wisdom of songs,
E hō mai	Grant,
E hō mai	Grant,
E hō mai	Grant us these things

Background

Kumu hula master and Hawaiian cultural and language expert, Edith K. Kanāka'ole (affectionately known as Auntie Edith), composed this oli (chant) for her hula troupe, Hālau O Kekuhi. The chant was originally performed by students at the beginning of class to request knowledge and wisdom from the ancestral deities to accomplish the task at hand.

Today, this oli is commonly used at the start of an event or small gathering to focus a group's energies and ultimately carry out the kuleana (responsibility) they have undertaken. It is recommended to use this chant to help you to seek knowledge and clear your mind of any negativity.

Oli Mahalo

Composed by: Kehau Smith and Malia Nobriga

'U hola 'ia ka maka loa la	To spread forth, open up the most fine quality mat
Pū'ai ke aloha la	Exchange/share as potluck or aloha
Kūka'i 'ia ka Hāloa la	Exchange as greetings (between man and wife and descendants)
Pā wehi mai nā lehua	To adorn with the lehua flower
Mai ka ho'oku'i a ka hālāwai la	From East to West; sunrise to sunset, we are discoverers, navigators, take care of our 'āina
Mahalo, e nā akua	We thank our creators
Mahalo, e nā kūpuna la ea	We thank our ancestors
Mahalo, me ke aloha la	We thank you with love
Mahalo, me ke aloha la	We thank you with love

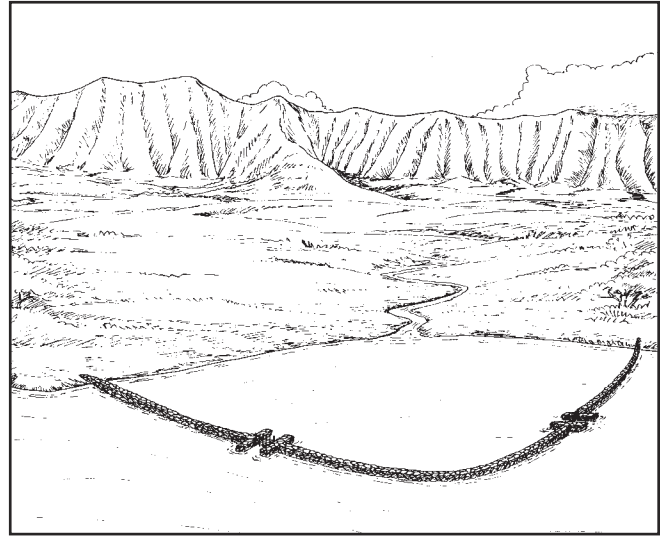
Background

This oli was composed as a greeting of thanks for hospitality, love, generosity and knowledge that is given to us. It also gives thanks to the beauty of the islands and our people. Hāloa is ever-lasting breath. The kalo plant is considered our ancestor that is cherished and preserved. Makaloa is the finest mat woven. It is considered higher quality than lau hala. The message is that it's important for us to practice being "thankful" every day.

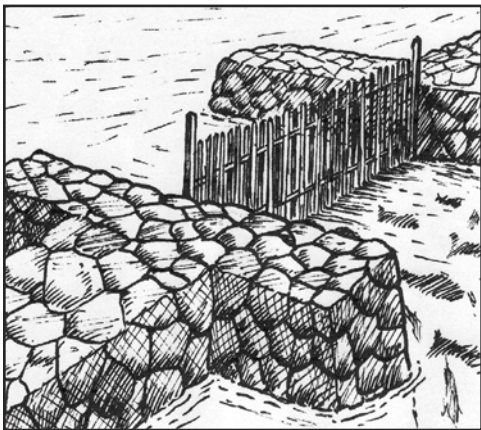
Reprinted with permission from the Pacific American Foundation. Source: *Project Aloha 'Āina*.



Hawaiians built shoreline fishponds with kuapā (seawalls) that were made of stone and coral. The ponds walls had openings or channels called ‘auwai kai. In these channels, Hawaiians constructed mākāhā (wooden grates). This type of pond with a mākāhā is found only in Hawai‘i. Hawaiians built these fishponds on a reef flat near a freshwater stream or spring. The fresh water carried minerals and nutrients into the pond. Nutrients are like fertilizer for phytoplankton (tiny plants) and algae. Fish like the ‘ama‘ama (striped mullet) and awa (milkfish) that feed on these plants were attracted to the fishponds.



How did Hawaiians fill their fishpond with fish? Their method was brilliant! They used knowledge of nature’s own “technology” to grow fish. The pua (baby) fish like awa come to the brackish water inside the fishpond. They are attracted by the large amount of food and the safety of the habitat. While still small, the pua can easily squeeze between the individual bars of the mākāhā spaced one-half inch apart (Uyemura, 2007). When the fish grow up, they are too big to fit through the mākāhā. They are attracted to the current in the mākāhā, which brings food to them. Hawaiians could easily catch the fish in the ‘auwai kai when the tide changed. With the invention of the mākāhā, Hawaiians developed a major change in fishing technology. Instead of just catching fish, Hawaiians began growing or farming fish!



After the stone walls of the kuapā shore ponds were completed, it was time to make the wooden mākāhā. When the wood for the mākāhā was ready, and the proper day had arrived for its construction, the kahuna was fetched to set up the first piece of timber. The kahuna made an offering of a pig or a dog to inspire an increase of fish. Then he reached for a timber and set it up for the mākāhā and offered pule ho‘ona (the prayer that released the kapu and allowed the work to proceed). The men built the mākāhā by binding the wood together with ‘ie cords (aerial root of the ‘ie‘ie plant). After that they arranged foundation stones with the mākāhā and poured in pebbles. It was in this way that all mākāhā were built (Kamakau, 1869).

Hawaiians built loko kuapā for their ali‘i (chiefs). The maka‘āinana (commoners) harvested and ate fish from the loko i‘a kalo (taro fishponds). These are ponds that they built in the mountains next to streams. The fishponds of old Hawai‘i were like the “refrigerator” of today. The fish grown in fishponds were there when people needed them.

Adapted with permission from the Pacific American Foundation. Source: *Project Aloha ‘Āina* - Grade 4.



References

Kamakau, Samuel Manaiakalani. (1869). *Mo'olelo Hawai'i (Hawaiian Traditions), Ke Au Okoa* (newspaper). Honolulu, 1869-71. Translation in manuscript. Bishop Museum Collection. Honolulu, HI. Retrieved November 11, 2006, from www.sacred-texts.com/pac/ku/ku33.htm

Pacific American Foundation. (2003). *Kāheha Loko: The Call of the Pond. A Teacher's Guide to Hawaiian Fishponds* Grades 4 – 12. Honolulu, HI: Pacific American Foundation.

Pacific American Foundation. (2003). *Kāheha Loko: The Call of the Pond*. Video.

Uyemura, George. 2007. Personal Communication.



Name _____ **Date** _____

Draw a picture of an ahupua'a - from the mountains to the outer edge of the reef. Include a loko kuapā and a loko i'a kalo. On the back of this page, write a caption for your picture. In your drawing and writing, be sure to include the following:

- 'auwai kai
- loko kuapā
- mākāhā
- fish



Mālama i ke Kai - Grade 5

How can we mālama (care for) the marine environment?

Hawai'i DOE Standard Benchmarks

Grade 5

Science 1: The Scientific Process: Scientific Investigation - Scientific Inquiry

- **SC.5.1.1** Identify the variables in scientific investigations and recognize the importance of controlling variables in scientific experiments.
- **SC.5.1.2** Formulate and defend conclusions based on evidence.

Math 12: Data Analysis, Statistics, and Probability – Data Interpretation

- **MA.5.12.1** Determine the range, median, mode, and mean for a data set.

Nā Honua Maui Ola 14 - 1

Plan for meaningful learner outcomes that foster the relationship and interaction among people, time, space, places, and natural elements around them to enhance one's ability to maintain a "local" disposition with global understandings.

- Learners will be keen observers of their natural environment.

Key Concepts

- People have affected the balance of life on a coral reef by introducing invasive species and adding sediments, polluted run-off, and debris.
- We can test our hypotheses about how human activities on land impact the marine environment by comparing conditions at different sites.

Activity at a Glance

Students develop hypotheses about water quality at nearshore areas near streams compared with another site away from streams. They conduct water quality tests, investigate marine life, and take notes and photographs to share what they have learned with the community.

Time

2 - 3 class periods plus a field trip

Prerequisite

Unit 4 Activity 4 - *From the Land to the Sea*

Assessment

Students:

- Describe their testable hypothesis and the experimental procedure their team used to collect data.
- Formulate and defend conclusions based on evidence gathered during their field trip.
- Determine the range, median, and mode for the data the class collected in the field.
- Complete an assessment of their group participation and ability to laulima (work together).



Hawai'i DOE Rubric

Advanced	Proficient	Partially Proficient	Novice
Science Grade 5			
Identify the variables in scientific investigations, explain why variables need to be controlled, and give examples of how to control variables in scientific experiments.	Identify the variables in scientific investigations and recognize the importance of controlling variables in scientific experiments.	Identify, with assistance, the variables in a scientific investigation or the importance of controlling the variables.	Recognize, with much assistance, the variables in scientific investigations.
Formulate and defend conclusions that are supported by detailed evidence and make connections to the real world.	Formulate and defend conclusions that are supported by evidence.	Make conclusions that are partially supported by evidence.	Make conclusions without evidence.
Math Grade 5			
Determine the range, median, mode, and mean for a data set, with accuracy	Determine the range, median, mode, and mean for a data set, with no significant errors	Determine the range, median, mode, and mean for a data set, with a few significant errors	Determine the range, median, mode, and mean for a data set, with many significant errors

Vocabulary

laulima - cooperate; work together

nitrate – nutrients released from decomposition process; also released into environment from fertilizer and sewage

ppt - parts per thousand

ppm - parts per million

phosphate – nutrients released from decomposition process; also released into environment from detergents

salinity – the total amount of dissolved salts in the water; often expressed in ppt (parts per thousand)

turbidity – a measure of water clarity or transparency as a result of the amount of particles suspended in water

Materials

- video clips of reefs in main Hawaiian Islands (provided on DVD)
- student journal - 24 (provided)
- student data sheets (provided)
- Student Assessment Overview (provided in the Unit Introduction)
- water quality monitoring equipment (depending on tests students will conduct)
 - - water quality test kits (phosphates, nitrates and dissolved oxygen)
 - - Secchi disc and clothespin- turbidity
 - - thermometer (hydrometer for salinity is optional)
- small bucket with rope attached (for gathering water sample from dock)
- glass of water
- 1/2 cup of soil

Field Trip Checklist

- student data sheets on clipboards
- pencils



- cell phone
- first aid kit
- students' list: hat, sunscreen, tabi or old shoes, bottled water in backpack, rain poncho
- garbage bag (for picking up marine debris)

Advance Preparation

- Copy the Student Assessment Overview and student journal - 24 for each student, and copy a data sheet for each team member. (Students will work in 4 teams that each conduct one water test.)
- Contact the resource agency that will assist with the field trip:
 - O'ahu: Moku o Lo'e (Coconut Island) - visits must be scheduled through the Hawai'i Institute of Marine Biology (HIMB) Community Education Program (236-7415 or himbcep@hawaii.edu). Request a class field trip at least one month in advance. Note that it will be best to record turbidity readings with a Secchi disk when the water is deeper (at high tide).
- See the Navigating Change web site: <http://navigatingchange.org> for a list of field trips sites available for this activity on other islands.
- Review the DOE safety guidelines for water field trips: <http://doe.k12.hi.us/>. Type in "water safety" under Search to download the four-page document.

Teacher Background Information

This activity provides students with an opportunity to compare nearshore water quality where a stream flows into the sea to a site that is not directly affected by streams. In this way, students will be measuring potential impacts from stream runoff and other shoreline activities.

Testing Water Quality

The data sheets provided with this activity have student guidelines for collecting data in the nearshore environment. Students will be measuring water temperature, nitrates, phosphates, dissolved oxygen and turbidity or water clarity. Additional information about each of these tests is provided on the student data sheets.

Depending on conditions at the site, students may use either a Secchi disk or a turbidity tube to measure the water clarity. A Secchi disk is a disk with a black and white pattern that is lowered into the water with a line that is marked in meters. The point where the disk disappears from view is a measure of the water clarity. If the water is too shallow, the turbidity tube is a better option. In this method, water from the site is poured into the tube until the black and white pattern at the bottom of the tube is no longer clearly visible. Students record the height of the water in the tube (in centimeters) and use a conversion chart to get the turbidity reading. With this method, students are actually measuring the scattering of light by

the suspended particles in the water. The unit of measurement is NTUs (Nephelometric Turbidity Units). A data sheet for each of these methods is provided with this lesson. Equipment for both methods will be available on site when students arrive for the field trip.

In addition to the water quality testing, on the field trip students will have an opportunity to discover how scientists make observations and collect data. They will also discover why invasive limu is being removed from the reef and the innovative method that scientists have developed to remove it.

Invasive Limu (Seaweed)

Since 1950, 18 different species of limu (seaweed) have been introduced to O'ahu. Some of these species, like *Gracillaria salicornia*, were introduced as potential food sources, others were introduced accidentally on ship hulls (Russell, 1992). Five of the introduced species have become highly invasive. These species overgrow the coral, which upsets the natural balance of the reef ecosystem. In a healthy reef, corals and coralline algae are dominant, and fleshy limu are less dominant. When human activities increase nutrients in the water (from sewage or fertilizers) the alien fleshy limu population tends to increase, upsetting the natural balance of the reef.



Teaching Suggestions

1. Pose the essential question for this unit and discuss unit projects.

- Distribute the Student Assessment Overview and review assignments and projects that students will be conducting in the unit.
- Present the focus question for this activity and let students know they will be going on a field trip to investigate the marine environment.

2. Review the video clips of the reefs from the main Hawaiian Islands.

- Have students summarize what they have learned about the changes to our reefs over time.
- Ask them to identify human activities on land that could impact the nearshore environment (i.e., plastics and other debris that get into the water, nitrates from lawn and garden fertilizers, phosphates from detergents when we wash cars, sediments from erosion when ground cover is disturbed).

3. Explain that students will be investigating water quality in a shoreline area influenced by a stream flowing into the sea, and comparing it to another area that is farther away from the stream. If you have water test kits, show students the kind of water quality test kits that they will be using at the two sites to monitor water quality.

4. Divide students into four teams and give team members each a copy of one data sheet.

- Ask students to read the information on the data sheet including the procedure to use in the field.

5. Provide a demonstration of turbidity and work with students to develop a sample hypothesis.

- Pour some water into a glass and hold it up to the class. Ask them to describe the clarity of the water.
- Sprinkle a tablespoon of soil into the glass of water and stir it up. Ask students to describe the clarity of the water. Stir in some additional soil and hold up the water for the class to observe.
- Define turbidity and ask students when they notice that the nearshore water has high turbidity (after a heavy rainfall).
- As a class, develop a sample hypothesis. For example: The turbidity of the ocean water will be greater near the stream than away from the stream because of soil erosion from land.
- Discuss what students would need to do to test this hypothesis (i.e., measure the turbidity at the nearshore stream site and at a second ocean site away from the stream).
- Help other teams to develop hypotheses by writing a template on the board:
The (factor to be studied) of the ocean water will be (higher or lower) near the stream than away from the stream because (give reason).

6. Challenge students to write a hypothesis about the water quality they will be testing in the field.

- If only one field trip will be scheduled to the site, remind students that their hypotheses need to be tested with the materials and conditions available.
- Distribute **journal - 24** and ask students to record their hypotheses and the methods they will use to test them.

7. Discuss the concept of controlling variables in scientific investigations.

- Discuss why it is important to control variables so that you isolate whatever is causing the effect. For example, when comparing nitrates at the two sites, students would need to use the same equipment and follow the same procedure.

8. Prepare for the field trip.

- Review what students will need to wear and bring on the field trip. Have some students take pictures so that students can share what they learn with others in the unit culminating activity.
- Have students divided into three teams (use name tags with team numbers) for the rotations during the field trip.
- If your students will be conducting Hawaiian protocol upon arrival, review the oli (chant) that they will share. (See previous activity for Gr. 4.)



Field Trip - Schedule - Moku o Lo'e

- 8:15 Arrive at the He'eia Pier - Students use the Secchi disk to test turbidity from the dock and collect water using a bucket and rope to conduct water quality tests on board the boat. (Tests will be conducted during the trip to the island.)
- 9:00 Arrive at island - protocol and orientation - walk to site
- 9:30 - 11:45 Teams rotate every 45 minutes and participate in each station
 - Station 1: Observation Station - Virtual transects
 - Station 2: Human Impact - Testing water quality and marine debris
 - Station 3: Invertebrates and Invasives - Hands-on study of invasive limu and invertebrates
- 11:45 Lunch
- 12:30 Return to dock and board boat
- 1:00 Arrive at He'eia Pier and return to school

After the Field Trip

9. Distribute student journal - 24 and discuss it.

- Ask students how they will determine if their hypotheses were supported.
- Discuss their ideas and explain that they need to analyze the data they collected.

10. Show students how to calculate the range, median, mode and mean for their simple data sets.*

- Write the sample data from the following page on the board.
- Discuss what the numbers mean and how they help to interpret the data.

Discussion Questions

- What is the difference between the median and the mode?
- Is there always a mode in a data set? Why or why not?
- How do you compute a median when you have an even number of data?
- Which numbers are most useful for interpreting the data? Why?

Sample Data Sets

Wave faces for a local surf spot over a 7-day period

7 feet, 4 feet, 2 feet, 2 feet, 3 feet, 6 feet, 4 feet

Arrange in numerical order: 2, 2, 3, 4, 4, 6, 7

Median (middle number): 4

Mode (most frequent): 2 and 4

Range: 2 – 7

Mean (average): 4

(Calculate by dividing the sum of all values by the number of values: $28 \div 7 = 4$)

Height of students on the first-string high school basketball team

66 inches, 72 inches, 76 inches, 64 inches, 77 inches, 65 inches

Arrange in numerical order: 64, 65, 66, 72, 76, and 77

Median (number halfway between 66 and 72): 69

Mode: none

Range: 64 – 77

Mean: 70

* This section is reprinted with permission from *Project Aloha 'Aina Teacher's Guide* - Grade 5.

11. Have students complete their calculations for their data on journal - 24 and share their findings with the class.

- Check students' work and ask students to help their peers as needed.
- Have groups share their data with the class and conduct a summary discussion about ways that we can reduce our impact on the marine environment. This will lead into the culminating activity for this unit.



Extended Activities

The Aloha 'Āina Grade 5 Unit focuses on investigating water quality in streams. Explore the ahupua'a through these field investigations with your students. The unit is available online at: www.ulukau.org/aloha_aina.

The culminating activity for this unit challenges students to come up with creative ways to share what they have learned with others in the school or community. One of the field-testing classes worked with elders in their community on a culminating activity to paint a mural showing how their reef contrasted with a reef in the NWHI. The mural became a focal point that generated lots of interest in the community.

Have students explore the issue of invasive limu in more depth. A teacher's guide, *Looking at Limu*, that can be adapted from the high school level, is available online: <http://manoa.hawaii.edu/limu/>. The guide includes student activities, information about cultural uses of limu, and color photographs of different species.

Resources

Inexpensive water quality test kits that are easy for students to use are available from the sources listed below. Kits that use tablet reagents instead of powder are recommended for ease of use in the field. See: Acorn Naturalists.

Acorn Naturalists
Online Store
<http://www.acornnaturalists.com>
(800) 422-8886

LaMotte Company
www.lamotte.com/
P.O.Box 329
802 Washington Avenue
Chestertown, MD 21260
(800) 344-3100

References

- Pacific American Foundation. (2007). *Project Aloha 'Āina*. Honolulu, HI: Pacific American Foundation.
- Russell, D. J. (1992). *The Ecological Invasion of Hawaiian Reefs by Two Marine Red Algae, Acanthophora spicifera (Vahl) Boerg and Hypnea musciformis (Wulfen) J. Ag., and their association with two native Laurencia nidifica J. Ag. and Hypnea cervicornis J. Ag.* ICES Marine Science Symposium 194: 110-125.
- U.S. Environmental Protection Agency. (March, 2006). *Voluntary Estuary Monitoring Manual*. <http://www.epa.gov/owow/estuaries/monitor/documents>



Student Data Sheet: Turbidity (Secchi Disk)

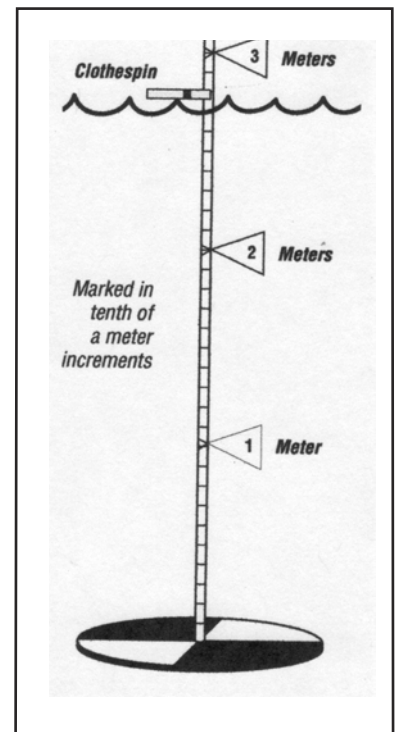
Name _____ Date _____

Hypothesis: _____

Turbidity is a measure of how clear the water is. Water is turbid when clay, silt or other particles are suspended in the water. This makes the water cloudy or dirty. When turbidity is high in coastal waters, this has a negative impact on marine life. Sediments block light which can limit the growth of limu (seaweed). The sediments suspended in the water also absorb heat, which can cause the water temperature to increase. These conditions can cause the dissolved oxygen in the water to decrease. Since most marine animals need oxygen to survive, this affects the reef. When sediments wash into the ocean, they can also smother corals on the reef.

Procedure:

1. Hold the end of the line tight and carefully lower the Secchi disk into the water. Keep your back toward the sun so that you block the sun's glare. Remove sunglasses.
2. Lower the disk until the disk is no longer visible.
3. Note the reading on the line at the point where the disk just disappears from view. Mark this spot with a clothespin. (See drawing.)
4. Record the depth (in meters) where the disk was no longer visible.
5. Repeat this test 2 more times and record the results below. If the disk does not disappear, record the depth to the bottom.



Weather and Surf Conditions:

Source: <http://www.epa.gov/owow/estuaries/monitor/doc>

What **variables** does your group need to control when you compare the turbidity at the two sites? Why?



Student Data Sheet: Turbidity (Secchi Disk)

Results

Site 1. Ocean Site Near Stream	Turbidity - depth where disk just disappears (meters)	Site 2. Ocean Site Away from Stream	Turbidity - depth where disk just disappears (meters)

Note that a Secchi disk reading of a depth of less than 1 meter indicates poor water clarity and may indicate a high concentration of suspended solids in the water.

Additional Observations

Describe the water conditions: Is the water cloudy, murky, or clear? What is the color of the water? Do you see particles floating in water?

Site 1:

Site 2:

Describe the shoreline conditions in this area. Is it residential, commercial, natural, or a combination of these? What kinds of human activities are happening in this area?

Site 1:

Site 2:



Student Data Sheet: Turbidity (Tube)

Name _____ Date _____

Hypothesis: _____

Turbidity is a measure of how clear the water is. Water is turbid when clay, silt or other particles are suspended in the water. This makes the water cloudy or dirty. A turbidity chart is provided on the back of this page. When turbidity is high in streams, this has a negative impact on stream life. When sediments wash into the ocean, they can smother the reef.

Procedure:

1. Lower a bucket from the dock into the ocean.
2. Collect a water sample about halfway down from the surface.
3. Stir the sample for about 15 seconds (to suspend all of the particles in the water).
4. Slowly pour the water into the turbidity tube until the black and white markings in the bottom of the tube just disappear from sight.
5. Record the height of water in the tube (in cm). Figure out the average or mean for each site.
6. Use the conversion chart to get the turbidity value (NTU) and record those numbers below.

What **variables** does your group need to control when you compare the turbidity at the two sites? Why?

Results

Site 1. Ocean Near Stream	Turbidity (cm. of water in tube)	NTU (from conversion chart - see other side of this page)	Description of Water
Site 2. Ocean			



Student Data Sheet: Turbidity (Tube)

Turbidity Conversion Chart

Centimeters	Approximate NTUs (transparency values)
6.4 – 7.0	240
7.1 – 8.2	185
8.3 – 9.5	150
9.6 – 10.8	120
10.9 – 12.0	100
12.1 – 14.0	90
14.1 – 16.5	65
16.6 – 19.1	50
19.2 – 21.6	40
21.7 – 24.1	35
24.2 – 26.7	30
26.8 – 29.2	27
29.3 – 31.8	24
31.9 – 34.3	21
34.4 – 36.8	19
36.9 – 39.4	17
39.5 – 41.9	15
42.0 – 44.5	14
44.6 – 47.0	13
47.1 – 49.5	12
49.6 – 52.1	11
52.2 – 54.6	10
>54.7	<10

(Chart adapted from: University of Wisconsin Extension. 2006. Water Action Volunteers – Volunteer Stream Monitoring Factsheet Series. Retrieved on 4/10/07 from: <http://clean-water.uwex.edu/wav/monitoring/WAV2006PDFs/turbidity2.pdf>)

Additional Observations

Describe the water conditions at each site.

Describe the shoreline activities at each site.

Clean Water Standards

In Hawai'i, the following NTU values are considered good for streams:

- Ho'oilō (wet season) - Nov. 1 - Apr. 30) Turbidity should not be higher than 15.0 NTU 10% of the time or 25.0 NTU 2% of the time.
- Kau wela (dry season - May 1 - Oct. 31) Turbidity should not be higher than 5.5 NTU 10% of the time, or 10 NTU 2% of the time.

(Source: AECOS, International.
<http://www.aecos.com/CPIE/Turbidity.html>)

This data sheet is adapted with permission from the Pacific American Foundation. Source: *Project Aloha 'Āina* - Grade 5.



Student Data Sheet: Nitrates

Name _____ Date _____

Hypothesis: _____

Nitrogen is an element that all living plants and animals use to build protein. Nitrates are nutrients that all plants and animals need. Nitrates are released into water when dead plants and animals decompose. They are also added to water from runoff from our lawns, farms and golf courses and from sewage spills. If nitrate levels are too high, this can upset the balance of life on the reef, causing limu (seaweed) to increase. At levels of more than 40 ppm, nitrates can become toxic to juvenile fish.

Procedure:

1. At the dock, use a bucket with a rope attached to collect water. Wear safety goggles and carefully follow the directions on the water test kit.
2. Record your results for 3 areas at each site in the table below.
3. Figure out the average or mean for each site.
3. Compare your results to the standard for healthy stream and ocean water listed below.

What variables does your group need to control when you compare the nitrates at the two sites? Why?

Time: _____ **Weather Conditions:** _____

Results

Site	Nitrates in mg/L	(same as ppm) Clean Water Standards
1. Ocean Near Stream		Standards for nitrates not to be higher than: .07 mg/L in ho’oilō (wet season - Nov. 1 - Apr. 30) .03 mg/L in kau wela (dry season - May 1 - Oct. 31) <i>Chapter 54 of Title 11 Hawai’i Administrative Rules</i>
Test 1		
Test 2		
Test 3		
2. Ocean		
Test 1		
Test 2		
Test 3		

This data sheet is adapted with permission from the Pacific American Foundation. Source: *Project Aloha ‘Āina* - Grade 5.



Student Data Sheet: Phosphates

Name _____ Date _____

Hypothesis: _____

Phosphorus is an element that living things need. It is usually present in the water as a compound called phosphate. Phosphates are released into the water when dead plants and animals decompose. Phosphates are also added to water from sewage and animal wastes. Soaps or detergents and lawn fertilizers are another source of phosphates. If phosphates in the water are too high, limu (seaweed) grows rapidly. This upsets the balance of life on the reef.

Procedure:

1. At the dock, use a bucket with a rope attached to collect water. Wear safety goggles and carefully follow the directions on the water test kit.
2. Record your results for 3 tests at each site in the table below.
3. Figure out the average or mean for each site.
3. Compare your results to the standard for healthy stream and ocean water listed below.

What variables does your group need to control when you compare the phosphates at the two sites? Why?

Time: _____ **Weather Conditions:** _____

Results

Site	Phosphates in mg/L	(same as ppm) Clean Water Standards
1. Ocean		Standards for phosphates not to be higher than: .05 mg/L in ho'oilō (wet season - Nov. 1 - Apr. 30) .03 mg/L in kau wela (dry season - May 1 - Oct. 31) <i>Chapter 54 of Title 11 Hawai'i Administrative Rules</i>
Near Stream		
Test 1		
Test 2		
Test 3		
2. Ocean		
Test 1		
Test 2		
Test 3		

This data sheet is adapted with permission from the Pacific American Foundation. Source: *Project Aloha 'Āina - Grade 5.*



Student Data Sheet: Dissolved Oxygen & Temperature

Name _____ Date _____

Hypothesis: _____

Dissolved oxygen (DO) is the amount of oxygen dissolved in water. When water temperature goes up, the amount of oxygen the water can hold goes down. Water temperature can increase when there are lots of sediments suspended in the water. These particles absorb heat, which increases the temperature. Since most marine life needs oxygen to survive, dissolved oxygen is an important indicator of water quality. It is also important to note that dissolved oxygen will change during the day and night. Be sure to record the time that you test the water.

Procedure:

1. Wear safety goggles and carefully follow the directions on the water test kit.
2. Record your results for 3 tests at each site in the table below.
3. Hold the thermometer so that the bottom is submerged 4 inches under the water. Wait until the temperature reading stops changing. Then record the amount below.
3. Compare your results to the standard for healthy stream and ocean water listed below.

What **variables** does your group need to control when you compare dissolved oxygen at the two sites? Why?

Time: _____ Weather Conditions: _____

Results

Site	DO mg/L	Water Temperature	EPA Clean Water Standards
1. Ocean Near Stream			A minimum DO of 5 mg/L is usually needed to fully support aquatic life. A level of 3 mg/L is stressful to most aquatic organisms. DO at 2 mg/L usually will not support fish.
Test 1			
Test 2			
Test 3			
2. Ocean			
Test 1			
Test 2			
Test 3			



Name _____ Date _____

Summary Data Sheet

Study the data your team collected and calculate the following:

Site 1 (Ocean Near Stream)	Site 2 (Ocean Away from Stream)
Range	
Mode	
Median	
Mean (Average)	

Hypothesis: Was your hypothesis validated by your data? Explain.

Method: Describe the method your group used to collect your data.

Conclusion: What do you conclude from the data your group collected? What is your overall conclusion about how human activities on land affect the marine environment?



How do we “navigate change” to create a healthier environment within our own ahupua‘a?

Hawai‘i DOE Standard Benchmarks

Grade 4

Social Studies 6: Cultural Anthropology: Systems, Dynamics, and Inquiry - Cultural Inquiry

- **SS.4.6.2** Describe how individuals or groups deal with conflict, cooperation, and interdependence within the ahupua‘a.

Grades 4 - 5

Language Arts 5: Writing: Rhetoric - Meaning

- **LA.4.5.1** Use appropriate facts and interesting details that develop the intended meaning and anticipate the needs of the audience.
- **LA.5.5.1** Use information from appropriate sources: self, peers, and a variety of grade-appropriate sources.
- **LA.5.5.2** Use significant details and relevant information to develop meaning.

Language Arts 7: Oral Communication: Rhetoric - Meaning

- **LA.4.7.1** Use prior knowledge, input from others, and text resources to develop ideas for speaking.
- **LA.5.7.1** Combine ideas from prior knowledge, input from others, and text resources to elaborate on and support ideas.

Nā Honua Maui Ola 5 – 3 & 8; 15 - 3

Provide safe and supportive places to nurture the physical, mental/intellectual, social, emotional, and spiritual health of the total community. Learners:

- Appreciate and respect the diverse views of others.
- Become actively involved in local activities and organizations that contribute to the quality of life in the community.
- Teach others about the concept of mālama through example.

General Learner Outcomes

Community Contributor: The understanding that it is essential for human beings to work together

- **GLO 2** Cooperates with and helps and encourages others in group situations.

Effective Communicator: The ability to communicate effectively

- **GLO 5** Listens to, interprets, and uses information effectively.

Key Concepts

- Within our ahupua‘a today, we can “navigate change” and work with others in our community to mālama (care for) our land and water resources.
- It is our kuleana (responsibility) to contribute to the community where we live.

Activity at a Glance

Students collaborate with classmates to plan and carry out projects that contribute to a healthier environment in their community. They take on the role of television or radio reporters and write scripts to describe their projects. Students share their project at a hō‘ike (exhibit) for the school community.



Time

4 – 5 class periods (or longer depending on students' projects)

Assessment

Students:

- Work cooperatively with others to complete a project to mālama the environment within their ahupua'a.
- Write individual scripts for a media report that describes the project. (See Student Assessment Overview and rubrics provided for more details on criteria for reports.)

Rubric (Provided in Unit Introduction)

Vocabulary

laulima – work together

diverse – differing from one another; having various forms or qualities

Materials

- Navigating Change video segment “You Make the Difference” (provided)
- student journal - 25 (provided)
- community resources list (provided in Unit Introduction)

Advance Preparation

- Make a copy of journal - 25 for each student.
- Review culminating activity rubrics with students.

Teacher Background Information

Taking collective action to “navigate change” for a healthier environment challenges students to apply what they have been learning to real-world situations. Taking action involves many skills, including critical thinking, organization, advocacy, communication, and collaboration. Perhaps most importantly, it allows students to see that each of us truly can make the difference.

The action plan provided in this instructional activity and the list of contacts for conducting projects (provided in the Unit Introduction)

are presented as guidelines for students. The actual projects that students undertake should be determined by their interests and the needs in your community. The Navigating Change team encourages students to send summaries and pictures of students in action for posting on the project web site. Please send to Andy Collins at the NOAA office: andy.collins@noaa.gov. As these projects are posted for others to see, students' actions will motivate, encourage, and challenge us to take care of our land and sea.

Teaching Suggestions

1. **Show the Navigating Change video segment “You Make the Difference” and discuss it with your class.**
 - What kinds of actions were students involved in to mālama their environment?
2. **Brainstorm ways to navigate change.**
 - Create two columns on the board and label them: 1) “environmental problems in our ahupua'a,” and 2) “navigating change.”



- Ask students to make a list of environmental concerns and write their ideas on the board.
- Brainstorm positive ways to address each concern and list these under “navigating change.” (Note: If students need help determining the boundaries of the ahupua‘a where your school is located, refer to the *Let’s Go Voyaging* materials available at <http://www.mgf-hawaii.org> under resources.)

3. Discuss different points of view.

- Ask students if they believe everyone has the same point of view regarding how environmental problems should be solved. For example, some commercial fishers may have different point of view about overfishing than marine biologists. Discuss why it is important to appreciate and respect diverse views.

Discussion Questions:

- How are people or groups within our ahupua‘a interdependent?
- Give an example of ways in which people can cooperate to accomplish something important in our ahupua‘a.
- Give an example of ways that people with different points of view can resolve conflicts.

4. Have students decide on projects to take action and navigate change.

- Review the Student Assessment Overview (provided in Unit Introduction) with students. Ask students to decide on a project (either the whole class or small group) that they would like to plan and carry out to address a problem related to the environment in their ahupua‘a.
- Discuss the individual reports (two-page media scripts) that students will need to complete for their culminating projects.
- Ask students to think about what they will need to do during their projects in order to write a media report about it. For example, take notes of significant events or interviews, take pictures, or record videos.

5. Distribute journal - 25 - the action plan sheet to students and review it with them.

- Refer to the sample plan below.

Sample Action Plan

Steps	Notes
Describe the problem to be addressed.	For example: overfishing in our ahupua‘a
List alternative actions to take.	<ul style="list-style-type: none"> • Produce educational Public Service Announcements and submit them to ‘Ōlelo for airing on community television. • Paint posters with messages about caring for our ocean resources and display them in public areas. • Create colorful minimum catch-size rulers with information on fishing regulations (bag limits and minimum size) and distribute them in the community. • Conduct a “Fishing Fair” for the school community that includes games, educational displays, and speakers such as elder fishers who can provide some perspective of changes over time. • Conduct a study to determine the abundance of fish in the reef ecosystem.



<p>Discuss potential difficulties with your action ideas and how to overcome them.</p> <p>Select an action project.</p>	<ul style="list-style-type: none"> • Lack of interest or conflicts in the community: Interview friends and relatives and share fishing facts with them. • Lack of funding to put on a dynamic fair: Conduct a fund-raising event or ask for donations from the community. • Need for community resource person to help guide effort: Contact resource person from list provided in the Unit Introduction. 		
<p>Develop a timeline to implement the plan by the due date.</p>	<ul style="list-style-type: none"> • List all of the steps involved including researching, interviewing, creating materials, etc. 		
<p>Divide tasks among group members and be sure everyone understands roles.</p>	<table border="0"> <tr> <td>• Names</td> <td>Tasks</td> </tr> </table>	• Names	Tasks
• Names	Tasks		
<p>Take action!</p>	<ul style="list-style-type: none"> • Conduct research to gather some facts, data, or evidence about your problem. • Cite your references for research. (Show standard way of citing references.) • Carry out your plan. • Take on the role of a television or radio reporter and write a script for a report that describes your project. The report should include how you considered diverse views of others. • Ask others in your group to review your report and provide feedback. Make revisions based on feedback. 		
<p>Assess the effectiveness of action taken.</p>	<ul style="list-style-type: none"> • Describe what worked well to accomplish your goal. (How did people cooperate and resolve conflicts?) • List what could be done to carry on the effort or improve on it. 		

6. Guide students through the planning process and help them to establish a timeline that will lead to completing the project by the due date.

- Ask groups to share their completed plans and ideas with the class.
- Have groups give feedback to one another and discuss the merits of their plans.
- Invite others in the school community to a hō'ike (exhibit) where students will share their projects to navigate change.

7. When group projects are completed, check students' progress on their individual projects.

- Review the culminating project rubric with students to guide their work.
- Encourage students to practice reading their scripts and set aside time for students to be "reporters" on the scene and share what their group accomplished.



Extended Activities

Teacher Reni Bello from Waialua High and Intermediate School had her students each think carefully about a promise they could make to a kūpuna (elder) to mālama their environment. Students thought long and hard about meaningful promises they could make, and shared them with their chosen kūpuna. They then wrote their promises on paper and placed them in their wallets, carrying the reminders with them. Mahalo, Reni, for sharing this activity with us! Hopefully others will be inspired to try this or a similar activity with their students.

Students could make an interactive “Aunty Fish” display for others in the school to learn about fishing rules and regulations designed to conserve fish populations. Ask students to each create a color cut-out of a big aunty fish using the “Actual Reproductive Size” poster as a guide. They could include the L_{50} size information, fishing regulations, and the name of the fish on the reverse side of the cut-out. The fish cut-outs could be attached to a display board so that they flip up to reveal information on the back. The header for the display could challenge users to identify: “Who am I and how big do I need to be before you catch me?” See the Aunty Ulua activity in Unit 3.

Have students write letters to the editor of the local newspaper to communicate their concerns about declining fish populations and what can be done to increase the number of fish in nearshore environments.

Students could write letters to the Division of Aquatic resources recommending rule changes for species that are legally harvested at a size below the L_{50} size.

Allow students to earn extra credit by writing one-page responses to the following journal prompt:

- When you get involved in your community by navigating change...

In game show-like fashion, students “navigate change” by testing festival-goers about their knowledge of Hawai‘i’s coral reef animals.



Name _____ **Date** _____

Project Due Date _____

The problem we want to help solve is:

Some different actions we could take to help solve the problem are:

-
-
-
-
-

After discussing potential difficulties with the actions listed above, we decided on the following action.

Our Action Project is:

Laulima! Work together!

Names of Group Members

Kuleana (Responsibility)

On the other side of this sheet, list all the steps you will take, such as researching, interviewing, and creating materials. Be sure to cite references for your research. List the dates when you plan to complete each step—this will be your action timeline!

Write a report that describes your project. The report should include how you considered diverse views of others. Ask students in your group to review your report and provide feedback. Make revisions based on their feedback.



