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ABSTRACT

This collection of teaching units were selected from materials developed during the Operation Pathfinder Institutes (OPI) which took place in the Pacific region between 1994 and 1999. The institutes were intended to provide upper elementary and middle school science teachers with an opportunity to develop a deeper understanding of the marine environment and to develop strategies for effectively utilizing the oceans and coastal environment as a teaching tool. The institutes were built around six major themes: (1) physical processes that shape our island coasts; (2) habitats; (3) plate tectonics; (4) deep ocean resources; (5) marine pollution; and (6) living marine resources of the Pacific islands. The materials were built around the Pacific Standards for Excellence in Science and include the following units: (1) "A Field Trip to Nan Madol" (Don Young and others); (2) "Organisms Around Our Island" (Maske Jim and others); (3) "The Island's Freshwater and Ecology" (Antero Latorres and Martin Weirlangt); (4) "Our Coral Reef" (Martin Weirlangt); (5) "Components of Pacific Sand" (Curriculum Research Group, University of Hawaii at Manoa); ; and (6) "Fish as a Marine Resource" (Jesus Sonsong and others). Each unit includes a context, a list of standards addresses, a driving question teaching guidelines, and a series of tasks. Each task contains sections on science as inquiry, habits of mind, connections, the designed world, and human society. (Contains 10 references.) (MM)

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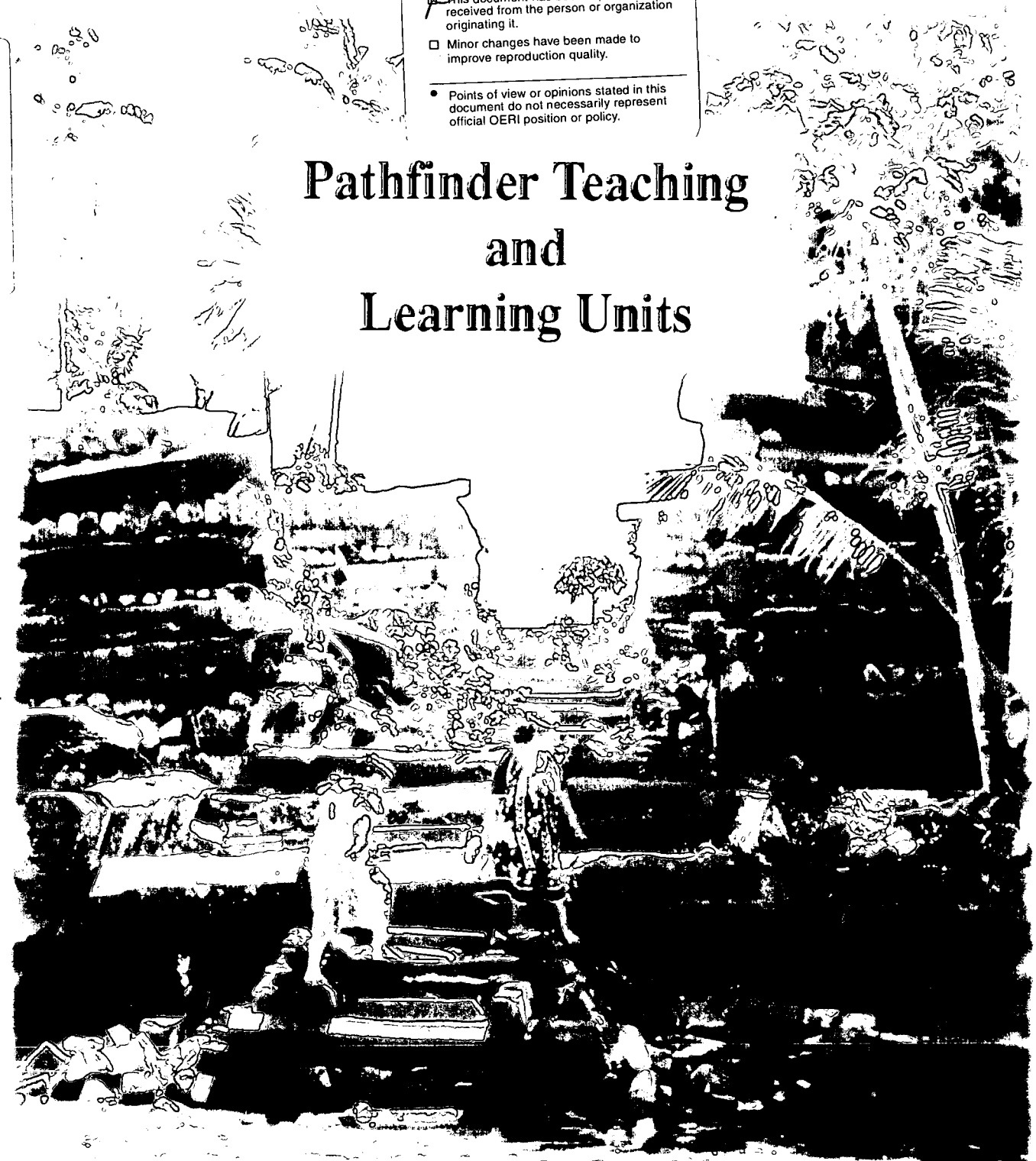
Pathfinder Teaching and Learning Units



University of Hawai'i Sea Grant College Program
School of Ocean and Earth Science and Technology (SOEST)

Pacific Mathematics and Science Regional Consortium
An Eisenhower Consortium
Pacific Resources for Education and Learning (PREL)

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Introduction

Operation Pathfinder Institutes took place in the Pacific region between 1994 and 1999. These institutes—collaborative undertakings of the University of Hawai'i Sea Grant Pacific Program, the Pacific Mathematics and Science Regional Consortium at Pacific Resources for Education and Learning, and the region's departments and ministries of education—were intended to provide upper elementary and middle school science teachers with an opportunity to develop a deeper understanding of the marine environment and to develop strategies for effectively utilizing the oceans and coastal environment as a teaching tool. Each institute was an exciting and intense 2 weeks of laboratory and field experiences and related classroom activities. Participants had opportunities to develop lessons, share ideas with other teacher participants, and receive resource materials to take back to their classrooms.

A major goal of the institutes was participants' increased awareness and understanding of oceanography and coastal processes. This was achieved by building the institutes around six major themes:

- physical processes that shape our island coasts—wind, wave action, currents, tides, and water quality;
- habitats—reef flats, tide pools, sandy beaches, lagoons, and coastal plant ecosystems;
- plate tectonics—the dynamics of the Pacific plate that affect all of us, deep sea trenches, and the hot spot theory;
- deep ocean resources—current research and technology to look at open ocean fisheries and deep ocean geology;
- marine pollution—point and non-point sources in the coastal and open ocean areas;
- living marine resources of the Pacific islands—larger marine animals through tide pool invertebrates, predator/prey relationships, and regional fisheries.

Participants in all five institutes took part in laboratory activities and fieldwork to increase their knowledge in these areas. They also had an opportunity to interact with scientists conducting island rainforest and marine research in the Pacific.

The adaptation and development of instructional materials was the second major component of the Pathfinder Institutes. Participants, working with science education specialists, developed materials for use in their classrooms upon returning home. These materials were built around the *Pacific Standards for Excellence in Science* (Pacific Mathematics and Science Leadership Team, 1995), and reflect important science presented in a context appropriate for and of interest to Pacific island communities. The units found in this publication are a selection from the materials developed during the institutes. It is hoped that they will be used in classrooms in the region and elsewhere, as well as serve as examples that demonstrate the development of instructional units that build upon the Pacific context to further standards-based teaching and learning in science.

The Pathfinder Teaching and Learning Units and the institutes themselves would not have been possible without the enthusiastic support of numerous agencies and individuals across the region including scientists and other resource people, departments and ministries of education, and the participants themselves. The institutes would also not have taken place without assistance from the Department of Interior's Office of Insular Affairs, the National Ocean Partnership Program grant to the University of Southern Mississippi from the Office of Naval Research, the University of Hawai'i Sea Grant Pacific Program, and the U.S. Department of Education's support through Pacific Resources for Education and Learning. This support enabled more than 200 teachers to participate in the program, leading to an increased use of the marine environment as a tool for teaching science and to this publication.

A Field Trip to Nan Madol

By Don Young, Bernie Kelderman, Ray Igechep,
and Sohnis Johnny

I. Setting the Focus for Learning

Context/Situation	Present-day visitors to Nan Madol, whether they are locals or foreigners, always leave with more unanswered questions than they had when they arrived. In past years, some have concocted answers and theories that would shed light on the purpose for the existence of this site and activities that might have taken place there. But, whether these explanations are scientific or supernatural, they never fully satisfy the human hunger for information. Nan Madol remains a mystery. This excursion will have a similar intention: inquiry. Students will inquire, as would paleontologists, and make connections between the care of the environment and the history of Pohnpei. They will attempt to find some answers and theories that can help contribute to the understanding or body of knowledge that now exists about Nan Madol.
Pacific Science Content Standards and Benchmarks Addressed (*Pacific Standards for Excellence in Science,* PREL, 1995)	• Science as Inquiry • Habits of Mind • Scientific Connections • Nature of Technology • The Design World • Motions and Force • The Living Environment • Matter: Its Structure and Changes • Human Society
Related Grade Level Goals and Objectives for Grade 9 Science Framework (from Bailey Olter High School, Pohnpei)	• Force, Work, and Energy • Changing Earth • Life on Earth • Plate Tectonics • Changing Ecosystem • Humans in the Environment
Topic/Theme	A Field Trip to Nan Madol to Study Physical and Environmental Features and to Understand More About Its Historical Perspectives
Driving Question	*What can we learn about the physical and living environment of Nan Madol in order to better understand its past history and appreciate/care for it in its present state?*
Resources	**Print resources:** D. H. Childress, 1988, *Ancient Micronesia and the Lost City of Nan Madol* W. S. Ballinger, 1978, *The Lost City of Stone* D. Hanlon, 1988, *Upon a Stone Altar* **Electronic resources:** http://pats.edu/nanmadol.htm

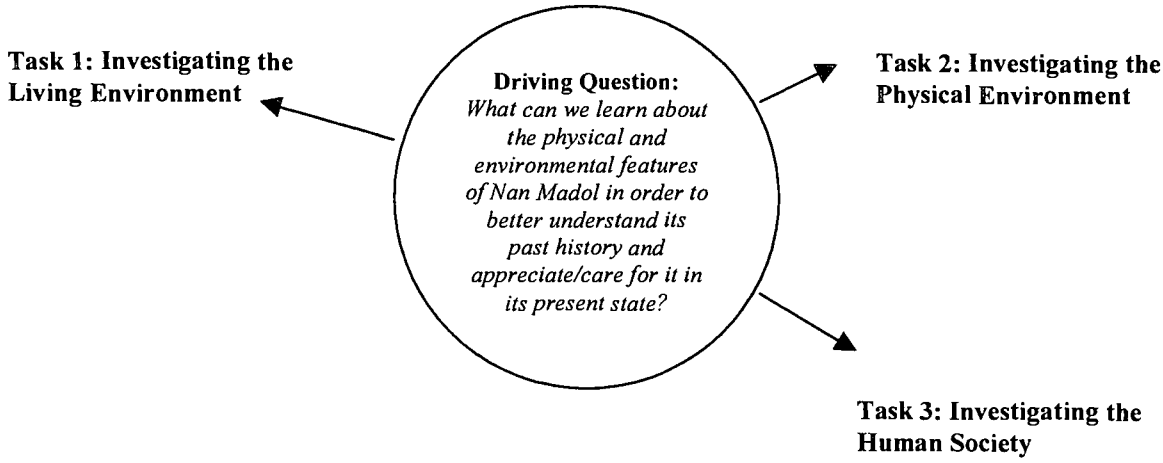
Resources (continued)	**Human resources:** Dr. Rufino Mauricio, Director of Historic Preservation, FSM National Government **Sites, organizations, and agencies:** Pohnpei Historic and Preservation Office Pohnpei Library and Archives

II. Making Sure the Desired Outcomes of the Unit Are Clear

Demonstration of Learning	**Criteria for Demonstration of Learning:** • Criteria for evaluation must be clear to the students. Students can (and should) help set these criteria. • All students must have an active role in the data collection, analysis, write-up, and presentation and performance. • All products and performance must address at least four of the multiple intelligences in an attempt to answer the Driving Question. • Criteria for the events of Demonstration of Learning must be clear and set in advance. **Events:** Exhibition of the student products and performances. **Audience:** Fellow students, teachers, administrators, and other community members. **Products:** Reports, essays, letters, journals, pictures, models, and video clips. **Performances:** Oral presentations, drama, oral stories, chants, poems, songs, and dances.

III. Assessment and Learning Experiences

Tasks for Building Knowledge, Skills, and Attitudes



Excursion Preparations	• Prepare students 2-3 days in advance. • Briefly review investigations to be done and tools needed. Data collection by transect line, pacing – do practice at school. • Assign students to groups. • Gather tools they will need. • Hand out assignments. • Distribute and collect permission slips.
Pacific Science Content Standards and Benchmarks Addressed (*Pacific Standards for Excellence in Science,* PREL, 1995)	**Science as Inquiry** *Students will . . .* • State testable hypotheses about natural phenomena. • Describe some interactions of science, technology, and society. • Identify sources of bias, and personal and local controversies. **Habits of Mind** *Students will . . .* • Use computers for producing tables and graphs, and preparing reports of investigation. • View science and technology thoughtfully, being neither antagonistic nor uncritically positive. **Connections** *Students will . . .* • Use probability and statistics to make accurate inferences from the data they collect, other research, and historical events. **Planet Earth: Ocean and Land** *Students will . . .* • Identify and describe changes in their own environment and in other parts of the Pacific region.

Pacific Science Content Standards and Benchmarks Addressed (continued)	• Identify and describe local examples of how living things affect the non-living environment and vice versa. **The Living Environment** *Students will . . .* • Describe why biodiversity is important to life on Earth. • Identify the impact of human activities on plants and animals in the local ecosystem. • Identify the various processes that utilize energy within an organism (photosynthesis, respiration, and decomposition), and describe how they work. • Identify examples of organisms uniquely adapted to their environment. • Work with others to design possible ways to sensitively address existing environmental problems and issues.
Pacific Mathematics Content Standards Addressed (*Pacific Standards for Excellence in Mathematics,* PREL, 1995)	**Mathematics as Communications** **Mathematics Connections**
Task 1: Investigating the Living Environment • **Reef** • **Land** • **Both Reef & Land**	**Teaching and Learning Activities:** ***Observations: Land/Reef/Both*** • What kinds of plants and animals are found? • How do they seem to interact with one another? • Which organisms seem to depend on one another? How do you know? • How do the mix of plants and animals change from place to place? ***Investigation:*** • Learn how to do a transect study. • Run 2-3 transects, working in pairs of students: one observer, one recorder. • Count different kinds of plants and animals within a 1-meter radius, every 2 meters along the transect. • Graph data. • What are your hypotheses about the data? • What factors cause change? • What additional questions could be investigated? ***Assessment:*** Based on the following student products and performances: • Quality of group reports, ability of students to effectively communicate investigations done, and the results. *Prior to the investigation, determine with students the criteria for the reports and communications.* • Quality and accuracy of the graphs. • Quality of hypotheses and identification of possible interactions between the physical and living environment. ***Expected Activity Outcome:*** Prepare a report of the investigation, and present it to the class.

Task 1: Investigating the Living Environment (continued)	**Materials:** 6 hand lenses, colored pens, chart paper, transect (50-100 meters, marked at 2-meter intervals)
Pacific Science Content Standards Addressed	**Science as Inquiry** *Students will . . .* • Design and carry out valid, controlled experiments, and report the results to others. • Apply scientific knowledge and skills to practical, everyday problems. • Formulate testable hypotheses regarding natural phenomena. • Identify sources of bias and personal opinion in personal and local controversies. **Habits of Mind** *Students will . . .* • Use tools safely to shape, smooth, and join wood, plastic, and other materials. • View science and technology thoughtfully, being neither antagonistic nor uncritically positive. • Notice and criticize arguments or reports that are based on faulty, incomplete, or misleading experimentation methods, use of numbers, or other methods of reporting or analyzing data. • Cooperate as a team by interacting with and listening to others. **Connections** *Students will . . .* • Accurately use measurement and functions to connect science to math, as well as connect different branches of science to each other and to other subject areas. • Use computers to perform computations, run simulations, and analyze models. • Make connections between science and other subject areas using systems, models, scaling, constancy, and change as useful themes. **Matter: Its Structure and Changes** *Students will . . .* • Explain why equal volumes of different substances usually have different masses. • Relate the properties of the materials to their atomic structure. • Describe Earth systems that cause physical and chemical changes. **Nature of Technology** *Students will . . .* • Design and carry out appropriate projects using the necessary tools. • Care about the traditional examples of engineering that enable Pacific Islanders to adapt the environment to meet their needs. • Gather information to make informed judgments regarding technological development and change, and be willing to communicate their opinions in an appropriate manner.

Pacific Science Content Standards Addressed (continued)	**Motion and Force** *Students will . . .* • Apply their knowledge of motion to construct simple motors. • Identify applications of principles of motion. • Identify the applications of the gravitational forces in technology. **The Planet Earth: Oceans and Land** *Students will . . .* • Describe the formation, weathering, sedimentation, and reformation of rock that constitute a continuing "rock cycle" in which the total amount of material remains the same even when the form changes. • Identify the solid crust of the Earth, including continents and ocean basins. Explain how the crust consists of separate plates that ride on the Earth's fluid mantle. • Predict how large-scale changes on the Earth's surface will affect local ecosystems.
Pacific Mathematics Content Standards Addressed	*Students will be able to understand . . .* • Mathematics as Problem Solving • Mathematics as Reasoning • Geometry • Mathematics as Communications • Mathematical Connections • Trigonometry

Task 2: Investigating the Physical Environment	**Teaching and Learning Experiences:**
	
	Observations:
	• What kinds of rocks are found here?
	• How many geometric shapes can you identify? Sketch shapes. Describe features.
	• Are the rocks flat? Round? In columns?
	• Where else do we see rocks like this?
	• How do you think they were formed?
	
	Investigation:
	• How big are these rocks?
	  • Choose two or three large rocks to measure.
	  • Measure the base (length and width).
	  • Estimate the height. Use a protractor. Measure the distance from the base. Calculate the height.
	• What is the volume of the rock you selected?
	• What is the mass of the rock? (Density of the volcanic rock averages 1.5g/cm3.)
	• How much force would it take to move one rock?
	  • Calculate the force in newtons needed to move one of the rocks you measured.
	  • How much work would be done in moving the rock 1 meter?

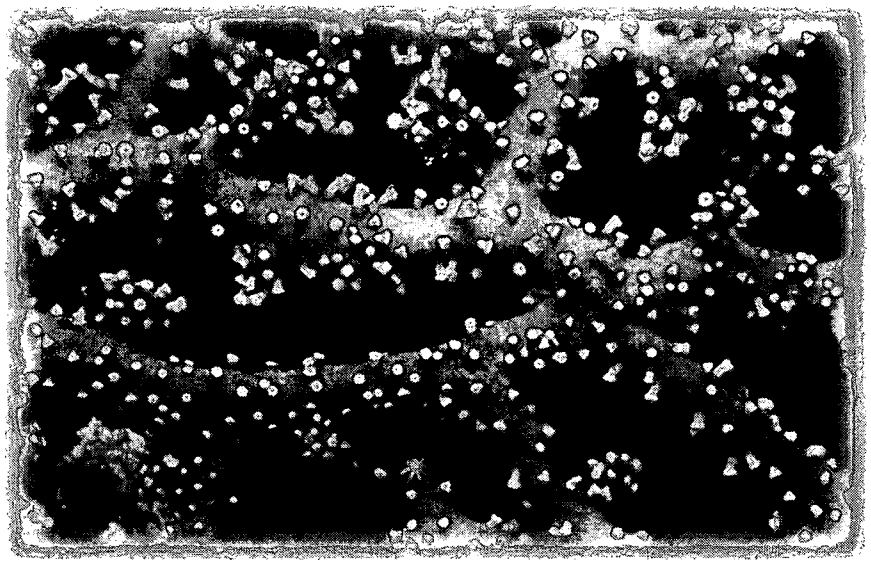
Task 2: Investigating the Physical Environment (continued)	• Invent a way to move the rocks into place without breaking them. Demonstrate your idea using a model. • Discuss how these rocks might have been brought here. How could it have been done? *Assessment:* Based on . . . • Quality and effectiveness of the report. Decide what constitutes a good report; define criteria ahead of time. • Demonstrated ability to make measurements and estimations. • Creativity in developing models of technology to move larger masses. *Reports:* • Prepare to give report of investigations to an audience. • Obtain a piece of basalt and determine its density in the laboratory. **Materials:** Hand lenses, chart paper, protractors, colored pens, tape measures, tangent table, and calculators with trigonometric functions.
Pacific Science Content Standards Addressed	**Science as Inquiry** *Students will . . .* • Apply scientific knowledge and skills to practical, everyday problems. • Identify possible explanations for anomalous events. **Habits of Mind** *Students will . . .* • Be curious, honest, open, and skeptical. • Use critical thinking skills in their own lives to make informed choices on issues. **Connections** *Students will . . .* • Use computers to compute, simulate systems, and analyze models. **The Designed World** *Students will . . .* • Identify some of the complex interactions of these technologies with economics, health and nutrition, politics, and their impact on culture. • Describe the traditional manufacturing processes and their relationship to culture. • Describe some complex communication technologies, including the traditional Pacific island communication systems designed to pass knowledge from one generation to another. • Describe the impact of health technologies in the Pacific. **Human Society** *Students will . . .* • Demonstrate sensitivity and respect for the ways in which science has evolved throughout the islands over time. • Describe the changes occurring in the Pacific, and their impact on their culture and traditions. Participate responsibly in community affairs and governance.

Task 3: Investigating the Human Society	**Teaching and Learning Experience:**
	
	Observations:
	• How is the area arranged? What do you think the purpose is for such arrangements?
	
	Investigation:
	• Sketch the area.
	• Pace the distances. Estimate heights, sizes of spaces, etc.
	• Record these in your notebook.
	• How is the environment designed to meet human needs? What are those human needs?
	• How do you think this environment was built?
	  • Discuss some of the legends you know. Which ones do you believe? Why?
	  • What other explanations can you suggest?
	• Archaeology is the science that tries to interpret how people long ago lived, based on observations that we can make today.
	  • What would it be like to live at Nan Madol?
	  • What kind of people might have lived here?
	  • Why do you think they lived here?
	  • Why did they build it?
	
	Assessment: Based on student products and performances.
	• Quality of the report. (Prior to making the assignment, establish criteria for report writing.)
	• Ability to interpret observations in terms of human needs.
	• Creativity and accuracy in making a model site.
	
	Expected Outcomes:
	• Imagine that you lived here long ago. Write an essay or poem expressing what it would be like to live at Nan Madol. Share it with the class.
	• Back in the classroom, make a model of Nan Madol using the data collected.
	
	Materials: Chart paper and colored pens

"From the islands to the west they came beating up the lagoon in canoe after canoe . . .
Their canoes will never sink, and the song holds true.
We'll sail, we'll sail on the waters so blue.
Like a feather, oh! We'll float in our breadfruit canoe."

(Traditional canoeing chant from the island of Oneop)

In remembrance of our beloved and late Pathfinder
Sohnis Johnny, BOHS Pohnpei



Organisms Around Our Island

By Maske Jim, Lenson Tauleng, and Lisa Riseleng

I. Setting the Focus for Learning

Context/Situation *(Why is this topic important to learn?)*	In this unit, the students will develop better understanding, skills, and awareness of organisms around their island, and of the interrelationships among island ecosystems (forest, coral reef, weedy sand flat, and mangrove swamp). The students will also increase their sense of stewardship toward their own environment. The organisms and their habitats are unique and play important roles in the lives of the students.
Pacific Science Content Standards and Benchmarks Addressed (*Pacific Standards for Excellence in Science,* PREL, 1995)	**Science as Inquiry** *Students will . . .* • Ask thoughtful questions about the organisms around our islands and their habitats. • Explore the habitats by observing, collecting data, and doing simple experiments. • Communicate their results in charts, graphs, and drawings, as well as verbally. • Work with others to get the job completed. **Habits of Mind** *Students will . . .* • Demonstrate the use of simple equipment. • Show honesty, clarity, and accuracy in recording and sharing data. • Show care of and respect for the environment. **Planet Earth: Oceans and Land** *Students will . . .* • Identify habitats in different environments. • Diagram a familiar ecosystem. • Identify and describe the effect of change on the environment caused by living things. **Living Environment** *Students will . . .* • Classify organisms in their habitats. • Identify the food chain and food web. • Identify examples of interdependence among organisms. • Work with others to design possible ways to sensitively address existing environmental problems and issues. **Human Society** *Students will . . .* • Describe the trade-offs in making choices that often have life-long consequences. • Participate in the community and cultural governing systems as responsible citizens.
Related Grade Level Goals and Objectives for Grade 8	Students will . . . • Identify the main groups of animals and plants in the various habitats of our islands. • Recognize similarities and differences among the different habitats. • Work cooperatively to produce an annotated, illustrated wall story.

Related Grade Level Goals and Objectives for Grade 8 (continued)	• Experience the natural environment through hands-on activities. • Use various equipment in testing and observing features of the habitat, and record data. • Share information through oral presentations. • Engender stewardship of the environment.
Topic/Theme	The Major Habitats of an Island Ecology
Driving Question	*How can we increase our understanding of the different organisms and their various habitats of our island, and how do we protect them?*
Resources	**Print resources:** E. L. Demanche, 1980, *Program Manual of the Hawai'i Nature Study Program: Field Trips Near and Far* *FASE Science Curriculum: Life and Environmental Science* **Human resources:** *To be determined by students and teacher* **Sites, organizations, and agencies:** *To be determined by students and teacher*

II. Making Sure the Desired Outcomes of the Unit Are Clear

Demonstration of Learning	**Criteria for Demonstration of Learning** To an audience of parents, teachers, school administrators, fellow students, and other invited guests, students will perform and present their products. *Students will . . .* • Present results, conclusions, recommendations of work on the excursions through reports, displays and presentations. • Create, perform, and recite poems, songs, and dances related to the organisms of the islands. • Dramatize the important issues and threats the habitats face. • Develop a video mini-series on the different habitats and show how human impact is changing them. • Debate issues of use of natural resources for economic gain versus conservation and protection. • Write letters to key persons and newspapers on the issues pertaining to use of and threats to our natural habitats.

III. Building and Assessing Knowledge and Skills

Task 1: Classification of Animals and Plants in the Various Habitats

Objectives:

Students will know . . .

- How/why animals and plants are classified.

Students will be able to . . .

- Classify selected animals and plants.
- Ask good questions about why animals and plants are grouped as they are.
- Work with others in a cooperative way.
- Demonstrate the use of tools and how to take care of them.

Students will value . . .

- Thinking critically and scientifically.
- Working with others to get their work done.
- Working safely with others.

Teaching Strategy and Procedure:

1. Organize students to work in groups. Give each group an assortment of objects like math blocks or anything readily available. Instruct the students to group the objects in a logical manner. They must be able to support their decisions. Facilitate follow-up discussions.
   - Why did you group objects in this manner?
   - Is there any other way of grouping them?
   - What is classification?

2. Using the enlarged chart of animal classification, review classification. Conduct a question and answer session. Some possible questions are:
   - Why is classification important?
   - How do scientists decide which items belong to each group?
   - Which group do you think is more important? Why?
   - Is there a group that is more important than the others? Support your responses.

3. Repeat above activity for the plant classification. (Change the questions to be specific to plants.)

Assessment: *How do we know they know?*

1. Short oral or written quiz:
   What is the difference between animals and plants?
   Why are animals and plants grouped the way they are?
   How do we classify?

2. Student work.

3. Anything else the teacher/students identify.

Task 2: Field Day Preparation

Objectives:

Students will know . . .

- The differences/similarities among the habitats: forest, coral reef, weedy sand flat, and mangrove.

Students will be able to . . .

- Work together in a cooperative way.
- List the organisms in the different habitats.
- List and explain some human impacts affecting these habitats.
- Make simple learning equipment or tools.

Students will value . . .

- Honesty, clarity, and accuracy in recording and sharing of information.
- Critical thinking skills to make informed decisions.

Teaching Strategy and Procedure:

1. Field Day preparation. Students must be proactive in planning for the field trip.
   - Discuss the field trip: purpose, site, why it was selected, what to bring, and other related matters.
   - Brainstorm on what is important for a field trip: safety measures, materials, clothing, and other items.
   - Use a checklist for preparing for a field trip.
   - Distribute and explain excursion data sheet.
   - Issue permission slips and remind students to bring them back with parental consent.

2. Classification grouping activity: Teacher prepares small cards with characteristics of each of the four habitats and distributes them to each of the students. The four groups will be forest, coral reef, weedy sand flat, and mangrove.

3. In groups, students can discuss/brainstorm expectations of habitat components. (The teachers will facilitate and monitor the activity.) Use an observation sheet and record observations.
   Some possible questions for discussion are:
   - What types of organisms might you find in this habitat?
   - What are some examples of human impact we might expect to see in this habitat?

4. Students will gather and prepare their *zipboards** and ensure that they have all of their handouts and necessary equipment ready for the field.

**Zipboards* require: Ziplock bag, rubber band, paper, data sheet and other handouts, cardboard, and pencil.

Task 3: Writing a Wall Story

Objectives:

Students will know . . .

- That organisms in the same habitats, although different, still need each other to live.
- That plants are producers of the food that animals need.
- That habitats can be changed by human activity.

Students will be able to . . .

- Ask thoughtful questions about different habitats.
- Continue learning more about different habitats on their own.
- Communicate their results by charts, graphs, and verbal explanations.
- Work collaboratively and cooperatively in groups to get work done.
- Show honesty, clarity, and accuracy in recording and sharing data.
- Show care of and respect for the environment.
- Classify organisms by habitat.
- Identify and describe the effect of human activity on the environment.

Teaching Strategy and Procedure:

1. Back in the classroom, ask the students to settle into groups and to write a story about their visit to the habitats.

2. Explain the suggested chapter heading for each group and have the students write their assignment on chart paper or a Bristol board.
   Chapter headings:
   - Purpose of the Visit and Getting Ready
   - What We Found in the Habitats
   - Conclusions and Feelings

3. Allocate the chapters to the groups and have them follow these suggested steps:
   - Ask the students to jot down things they remember most clearly.
   - Have them pencil in drafts in large print, then finalize the text and illustrations with markers.
   - Assemble the complete story by taping the sheets together in sequence and displaying them in a suitable place.
   - Call together the groups and invite each of them to read and talk about the chapter to the whole class.

Assessment:

Based on:

- Quality of the student product (wall story).
- Criteria for the wall story. (These should be made clear in advance.)
- Performance of the students on the task.
- Checklist of the indicators.

Task 4: Presenting a Creature Feature Task

Objectives:

Students will know . . .

- Different kinds of animals and plants of the habitats visited.
- The basic difference between the kinds of animal groups and plant groups.

Students will be able to . . .

- Present their results, conclusions, and recommendations to their classmates.
- Write about their results, conclusions, and recommendations in graphs, tables, charts, and journals.
- Classify the different animals and plants in each habitat.
- Diagram the simple food chain.

Students will value . . .

- Honesty, clarity, and accuracy in sharing their results, conclusions, and recommendations with fellow students and others.
- The care of the animals and plants and their habitats.
- The trade-offs between what community needs and maintenance of the habitats.

Teaching Strategy and Procedure:

- Provide directions on how to do the *creature feature tasks.**
- Explain and model to the students a good oral presentation.
- Prepare the classroom for the students' presentations.
- In presenting the creature features, the presenter will not disclose the identity of the creature immediately, but will ask his or her audience to guess or predict what the creature is after listening to all the features.

**Creature feature tasks* ask each individual student to select or adopt an organism from the habitats, study its features carefully, and share with a class.

Assessment: *How do we know they know?*

1) Give a simple written quiz.
   Sample questions:
   - List some examples of animals you find on the coral reef.
   - What are some characteristics of a sea cucumber?
   - Look at the poster of healthy and unhealthy reefs. What are the main differences you see?

2) For performance assessment tasks, use the rubric below.
   For individual presentations:

   The rubric, scale of 1 to 3:

   3 – Already there
   The student . . .
   - Speaks loudly and clearly.
   - Has an acceptable appearance.
   - Uses visuals with art and graphs.
   - Has content that is clear and accurate.
   - Has a good conclusion and recommendations.

2 – On the way

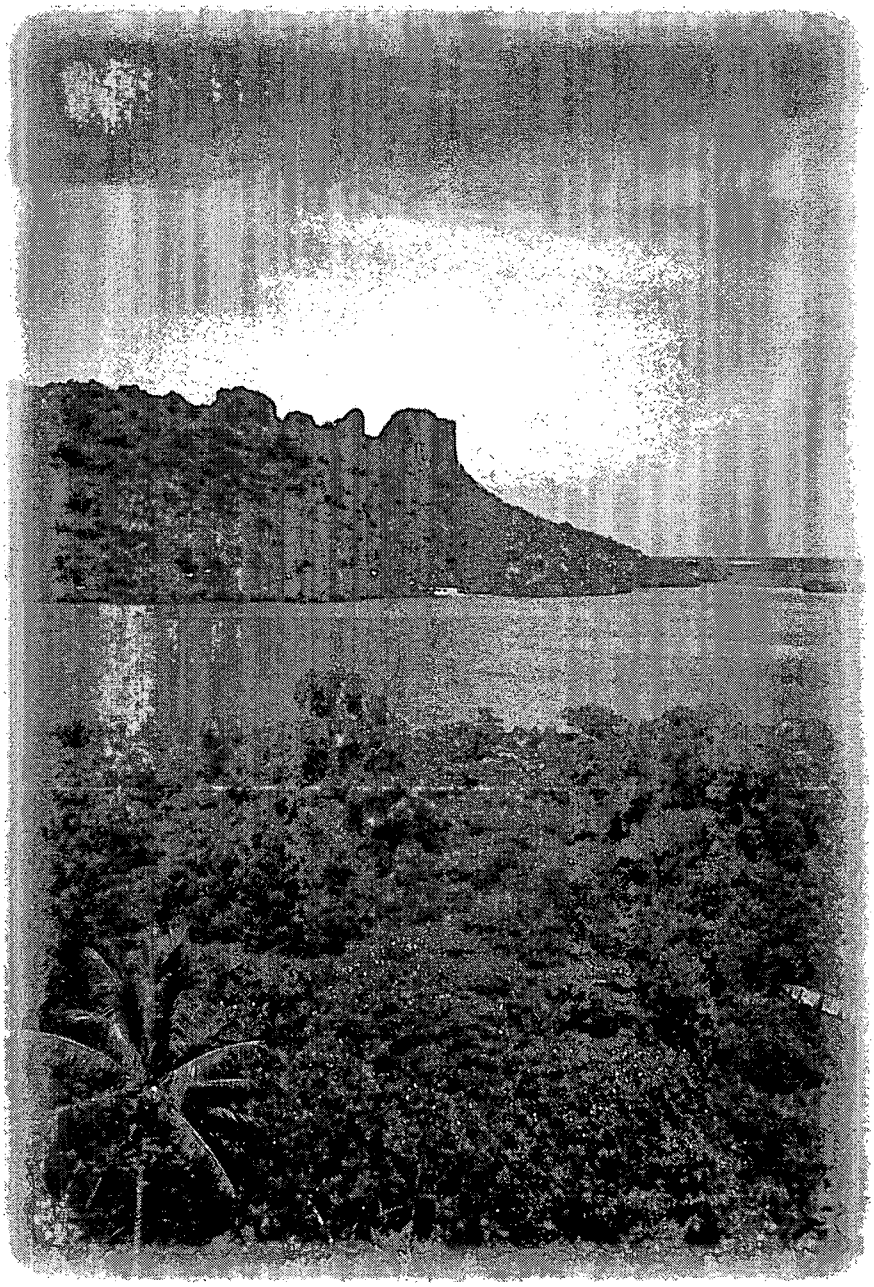
The student . . .

- Speaks loudly and clearly.
- Uses visuals.
- Has contents that are clear, but not too accurate.
- Has a conclusion.

1 – Still developing

The student . . .

- Does not speak loudly and clearly.
- Has no visuals, or visuals are not clear and legible.
- Presents contents that are not accurate, or contents are not clearly presented.
- Has no conclusion, or a conclusion that is not related to presentation, and no recommendations are suggested.



The Island's Freshwater and Ecology

By Antero Latorres and Martin Weirlangt

I. Setting the Focus for Learning

Context/Situation	Many of the volcanic islands in the Pacific are blessed with plentiful sources of freshwater. However, when we neglect this vital resource and do not take care of it, we destroy or pollute these freshwater sources and all the living things that call them home.
Pacific Science Content Standards and Benchmarks Addressed (*Pacific Standards for Excellence in Science*, PREL, 1995)	**Science as Inquiry** *Students will . . .* • Ask good questions about the world around them. • Explore phenomena using sensory and processing skills. • Record data clearly and accurately in logs and journals. • Communicate their results in charts, graphs, and drawings, as well as verbally. • Design and execute valid experiments which include use of controls, replication, and setting proper standards. • Collaborate effectively with others to get the work done. • Seek for and identify possible explanations for anomalous events. **Habits of Mind** *Students will . . .* • Read analog and digital scales on instruments to make direct measurements of length, volume, mass, elapsed time, rates, and temperature; choose appropriate units for reporting data. • Demonstrate actions that reflect caring and respect for living things and their environment. • Use thinking skills to make informed decisions and choices in their everyday lives. **Scientific Connections** *Students will . . .* • Predict changes in systems as a result of interactions. • Apply the concept of the interactions to materials, objects, events, organisms, and systems. **The Planet Earth: Oceans and Land** *Students will . . .* • Identify the different habitats in the different environments. • Identify and describe effects of changes in the environment on living things. **Matter: Its Structure and Changes** *Students will . . .* • Relate the properties of materials to products, structures, and substances useful in their lives. • Explain that changes in matter are part of all living and non-living systems.

Pacific Science Content Standards and Benchmarks Addressed (continued)	**Living Environment** *Students will . . .* • Classify plants and animals into groups based on similarities and differences. • Identify examples of interdependence among organisms. • Identify causes of pollution in a local environment due to temporary accumulation of unrecycled waste. • Investigate and implement traditional practices in one major area of stewardship (farming, waste disposal, recycling, or food preparation). **Human Society** *Students will . . .* • Participate meaningfully in local practices that encourage conservation of island resources. • Describe the impact of technology, immigration, emigration, and population growth on social changes, choices, and conflicts in the region.
Related Grade Level Goals and Objectives for Grades 7 and 8	**FASE Curriculum:** • *Life Science: Living Things in the Freshwater* • *Environmental Science: Caring for Our Water* *Students will know . . .* • The different sites/sources of freshwater. • Organisms in and around the freshwater sites and their similarities and differences. • Interdependence/interaction of freshwater sources. • Important uses of freshwater sites. • The important properties of water. • Threats and dangers facing our sources of freshwater and their major causes. *Students will be able to . . .* • Question, explore, observe, and record the sources of local freshwater and the different organisms that make these sites their habitat. • Communicate their findings by writing, speaking, and producing graphs, tables, and drawings. *Students will care about . . .* • Wise use of the freshwater sources. • The traditional uses and events pertaining the natural resources. • The proper use and maintenance of school materials and equipment. • Working together to complete a task. **Student Assessment:** *How do we know they know?* • Short limited testing on the important information. • Students' products. • Students' performance. • Students' actions and behaviors—what and how they communicate to the teacher and with one another.

Related Grade Level Goals and Objectives for Grades 7 and 8 (continued)	**Student Learning Experiences:** • Inquiry teaching: Concept mapping/brainstorming. • Direct teaching: Factual information, directions, measuring skills, and use of tools and equipment.
Topic/Theme	Freshwater as an Important Island Resource
Driving Question and Other Related Questions	*How can we help protect and conserve our vital sources of freshwater?* • What are some important sites and sources of freshwater on an island? • What are the different habitats of a freshwater ecology?
Resources	**Print and electronic resources:** *FASE Science Curriculum* Teacher's Reference: Hawai'i Department of Education, 1984, *Kaua'i: Streams and Estuaries* **Human resources:** *To be determined by the teacher and students* **Sites, organizations, and agencies:** *To be determined by the teacher and students*

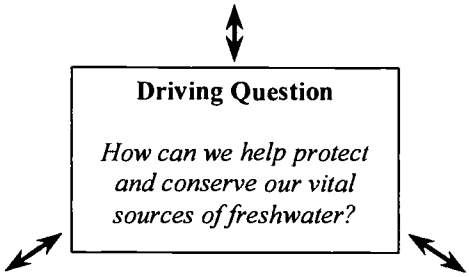
II. Making Sure the Desired Outcomes of the Unit Are Clear

Demonstration of Learning	**Criteria for Demonstration of Learning** • Students will display evidence of their work in posters, drawings, Big Books, wall stories, etc. • Students will make oral presentations on their completed or final work. • Students will share essays, reports, and journals which will include the use of graphs, tables, and diagrams. • Students will demonstrate their learning in the form of songs, chants, and dances. • Students will demonstrate their learning by dramatizing events, issues, and other concerns of cultural significance related to the topic. • All demonstration of learning activities will attempt to answer the core question. • All students must participate. • Evaluation criteria for each activity must be clear to and known by the students ahead of time. **Event:** Exhibition of student products/performances at end of the session. **Audience:** Parents, teachers, students, and other community members.

III. Building and Assessing Knowledge and Skills

Tasks for Building Knowledge, Skills, and Attitudes

Task 1: Classroom Investigation



Task 2: Excursion

Task 3: Survey and Interview

Task 1: Classroom Investigation

Objectives:

Students will . . .

- Name and identify the different sites/sources of freshwater.
- Diagram the interdependence/interaction of freshwater organisms.
- Explain the important properties of water.
- Explain the variations among the sources of freshwater.
- Communicate findings written/orally with help of graphs, diagrams, tables, picture, and other visual aids.
- Work together in groups.
- Respect their fellow students.
- Care for the proper use of school equipment.
- Respect and care for the environment.

Materials: Color markers, flip charts, island maps, globe, posters, equipment, folders, tapes, push pins, etc.

Teaching and Assessment Plan

Activity 1: *Introduction – What do we know and what do we want to know about freshwater and its sources?*

What does the teacher do?	What do the students do?	Teaching strategy	Assessment	Evidence
Introduce the context, the core question, and expected Demonstration of Learning (DOL).	Listen and ask questions; students will start DOL contracts.	Chalk and talk, whole group, and student contract.	Teacher observation, student participation, and responses.	Quality of questions asked, signed students' contracts, and checklist.
Brainstorm/concept web (teacher writes).	Share what they know.	Chalk and talk and whole group.	Teacher observations/notes on student level of participation.	Completed concept web.
Introduce What I Know/What I Want to Learn/What I Learned (KWL), and share objectives with students.	Work individually to decide what they want to know, and share in small groups.	Individual and small group work.	Teacher observations/notes, student performance, and student portfolio.	Student portfolio on the individual KWL forms and class KWL.

Activity 2: *Learning more about freshwater*

What does the teacher do?	What do the students do?	Teaching strategy	Assessment	Evidence
Facilitate Stacey's Activity*: *If Earth's water is 100 circles.* Chalk and talk on freshwater sources, types, and organisms. Freshwater vs. saltwater and our water cycle.	Students will work on Stacey's Activity. They listen and note teacher's chalk and talk.	Chalk and talk, whole group, and small group; use visual aids/videos/posters.	Teacher's observation and checklist, teacher's questions, student performances, and pencil and paper.	Completed Stacey's chart; students' notes and journals; and quiz and test results.

* *Stacey's Activity involves drawing 100 circles and determining how many of these circles represent the Earth's freshwater, salt water, and water in the air.*

Task 2: Excursion

Objectives:

Students will . . .

- Classify some of the organisms in and around freshwater sites based on similarities and differences.
- Identify some of the major pollutants, abuses, damages, and threats to these sites.
- Diagram the food web in these freshwater sites.
- Explain the interdependence of organisms in the freshwater sites.
- List the unique and complex features of these freshwater sites.
- Communicate their results in writing and orally using visual aids.
- Respect fellow students.
- Learn how to use and maintain school supplies and equipment.
- Use simple tools and equipment.
- Protect and respect all living things in the environment.

Materials: Thermometer, hand lens, noose, nets, jars, worksheets (for example: creature feature), posters, markers, Big Book papers, etc.

Teaching and Assessment Plan

Activity: *Field Excursion*

What does the teacher do?	What do the students do?	Teaching	Assessment	Evidence
Before: 1) Visit excursion sites in advance, prepare notes on the streams and springs, prepare worksheets (creature features and water quality test), and assessment checklist. 2) Do excursion readiness session in class, and send home student release forms.	Students on task: question, observe, compare, measure, record, predict, etc.	Chalk and talk, whole group, small group, rotating group, wall story and Big Books, poems, singing, writing, learning centers, puzzles, and other hands-on manipulatives.		
During: Clarify again what is expected, including safety precautions. Observe students on task and take notes or use checklist (skills and attitudes).	Sit quietly near the stream, look, listen, feel, and smell. Write a haiku or other poem about the stream, its organisms, and cultural connections.			
After: Do a STAR (Student Teacher Action Review) reflection and collect student feedback. Identify a guest speaker to speak on the cultural significance of the sites or other related cultural issues.	Students will present their findings in class, write wall stories, and add to their portfolios.	Guest speaker.	Teacher's notes, student performances in groups (checklist), student products (meeting criteria), and student journals and portfolios.	Poems, songs, other student products such as reflection notes, journal notes, portfolio, and quiz and test results. Checklists.

Task 3: Survey and Interview

Objectives:

Students will . . .

- Assess the threats facing our sources of freshwater.
- Discuss some important traditional and cultural values associated with use of local water sites.
- Participate in local conservation efforts on island freshwater sources.
- Name some traditional uses of some of the organisms found at these sites.
- Exhibit actions that could reflect that they care for the environment.
- Work effectively in a group.
- Respect their fellow students.
- Effectively communicate their findings, orally and in writing. They will also demonstrate their findings using graphs, tables, diagrams, and other such products.
- Research cultural stories regarding the historical use of some of these freshwater sites.

Materials: Flip charts, markers, cameras, computers, tape recorders, camcorders, etc.

Teaching and Assessment Plan

Activity: *Interview the older folks of the village or community.*

What does the teacher do?	What do the students do?	Teaching	Assessment	Evidence
Prepare topics to be researched, and make contact with community members on this project.	Students in small groups will make initial plans, including letters of invitation, plans for visits, and plans for briefing the interviewees of the class's purpose. Share with them the students' expectations. Design questions and reporting formats. Practice interviews. Set the stage for the interview. Conduct the interview.	Small group, whole group, journal writing, and note taking. Documenting.	Quality of questions designed, how students conduct interviews, invitations, student notes, and student responses. Interviewer/ interviewee interaction. Student presentations.	Notes, list of questions, teacher checklist, and student contracts. Results of interviews on audio and video. Student reports.

Related Standards Connections		
Mathematics	**Language Arts**	**Social Studies**
Students will . . . • Model situations using oral, pictorial, graphical, and algebraic methods. • Understand and apply reasoning processes with special attention to spatial reasoning and reasoning with proportions and graphing. • Explore problems and describe results using graphical, numerical, physical, algebraic, and verbal mathematical models and representations. • Develop number sense. • Use computation, estimations, and proportions to solve problems. • Describe and represent relationships with tables, graphs, and rules.	*Students will . . .* • Develop skills in oral presentations. • Use persuasive language. • Listen critically in order to analyze data. • Read in order to learn from reading. • Read to get information. • Use different forms of writing. • Review and revise writing mechanics and styles. • Demonstrate the ability to express emotions through singing and dancing. • Introduce graphic arts.	*Students will . . .* • Discuss land formation processes and land features. • List and draw geographical locations. • Identify and discuss cultural values and how they affect everyday life. • Name the major groups of islands in the Pacific and discuss their climate, weather, animals, and plants. • Discuss events that brought about changes in the Pacific islands. • Identify economic resources of the islands. • Name and discuss some of the services that are in great demand in the islands.

Our Coral Reef

By Martin Weirlangt

I. Setting the Focus for Learning

Context/Situation	Coral reefs are a crucial island resource. However, as our lifestyles change, this resource is increasingly endangered. It is important for our young ones to learn more about our coral reefs. As Pacific Islanders, regardless of our background, coral reefs play a very important part in all our lives. The reef is the source of the food that we bring to the table; it is a place we visit for our enjoyment and recreation; it provides the basic materials for the foundations of our homes; and it is the protection for our home islands against the ferocity that Mother Nature sometimes displays. These and other reasons are why our coral reefs are important to us. We are, however, at an important point in our history. We are currently being faced with the tremendous pressure of "development," or the need to keep pace with the global community and its technological revolution. In many of the Pacific islands, this may mean people striving for higher living standards, including better health services, better educational opportunities, and employment for our youth. These changes, for some of us, come at the expense of our traditional ways of life and our pristine environment. They impact the management of our natural resources, which include our coral reefs. The threats to our coral reefs are clear and present in many of our Pacific islands. These threats include the over-fishing and over-harvesting of the life stock on our coral reefs; dredging of harbors, airports, and other structures, which pollutes coral heads and suffocates them with sedimentation; the blasting and poisoning of the fish and corals; and the high frequency of human visitations on the coral reefs, which destroys corals.
Pacific Science Content Standards and Benchmarks Addressed (*Pacific Standards for Excellence in Science*, PREL, 1995)	**Science as Inquiry** *Students will . . .* • Ask thoughtful questions about the coral reefs: how they are formed, their importance, dangers they face, etc. • Explore the coral reef by observing, collecting data, and doing simple experiments. • Record their coral reef data clearly and accurately in logs and journals. • Communicate their results in charts, graphs, and drawings, as well as verbally. • Work with others in understanding more about coral reefs and working on the job until completion. **Habits of Mind** *Students will . . .* • Demonstrate the use of simple instruments in their study of coral reefs. • Show honesty, clarity, and accuracy in their recording and sharing of data. • Show that they care about and respect all the living things on the coral reef.

Pacific Science Content Standards and Benchmarks Addressed (continued)

- Use critical thinking skills to make informed decisions in daily life, which may include knowledge and use of the coral reefs.

Scientific Connections

Students will . . .

- Diagram the coral reef as part of an ecosystem that makes up island ecology.

Energy: Characteristics and Forms of Energy

Students will . . .

- Show the sun as the major source of energy for most living systems including the coral reef ecosystem.

Planet Earth

Students will . . .

- Show and explain how coral reefs are only found in certain locations of the earth and how this may be a result of the Earth's tilt on its axis, Earth's rotations, properties of water, etc.
- Describe how the Pacific islands are formed by natural rock formations such as volcanoes.
- Describe the different types of reefs (fringing reef, barrier reef, atoll) and geologic process from the formation of a volcanic island through the atoll stage.
- Identify and describe some effects of change on the local and regional environment, especially those on the coral reefs.

Living Environment

Students will . . .

- Classify organisms that live on the coral reefs.
- Identify coral reef food chains and food webs.
- Identify variations among individual corals on the coral reef.

Human Society

Students will . . .

- Participate meaningfully in local practices that encourage conservation of island resources including those of the coral reef.
- Describe the trade-offs in making choices that often have lifelong consequences.
- Participate in the community and cultural governing systems as responsible citizens.
- Identify traditional practices that include the use of the coral reefs, and explain that they are based upon understanding developed through years of study and observation of the environment.

Nature of Technology

Students will . . .

- Use tools (computer, calculators, and other conventional scientific equipment) to design and carry out projects.
- Cite examples of appropriate and inappropriate technologies in the Pacific islands.

Related Grade Level Goals and Objectives	*Students will learn . . .* • What a coral is. • What a coral reef is. • Identification of coral species. • Coral formation. • Parts of a reef. • Coral reef evolution. • Biological and physical agents of change on coral. • Physical agents affecting the growth of coral reefs.
Topic/Theme	Knowing About and Caring for Our Coral Reef
Driving Question and Other Related Questions	*What can we do to protect our unique and delicate coral reef ecosystem?* • Why is the coral reef important to us? • What can we do to understand more about threats that are facing coral reefs? • How can we reach some compromise with some of the social, economical, cultural, and political issues related to our use of coral and coral reefs?
Resources	**Print resources:** E. B. Klemm et al., 1995, *The Living Ocean: Biology and Technology of the Marine Environment* **Human resources:** *To be determined by students and teacher* **Sites, organizations, and agencies:** *To be determined by students and teacher*

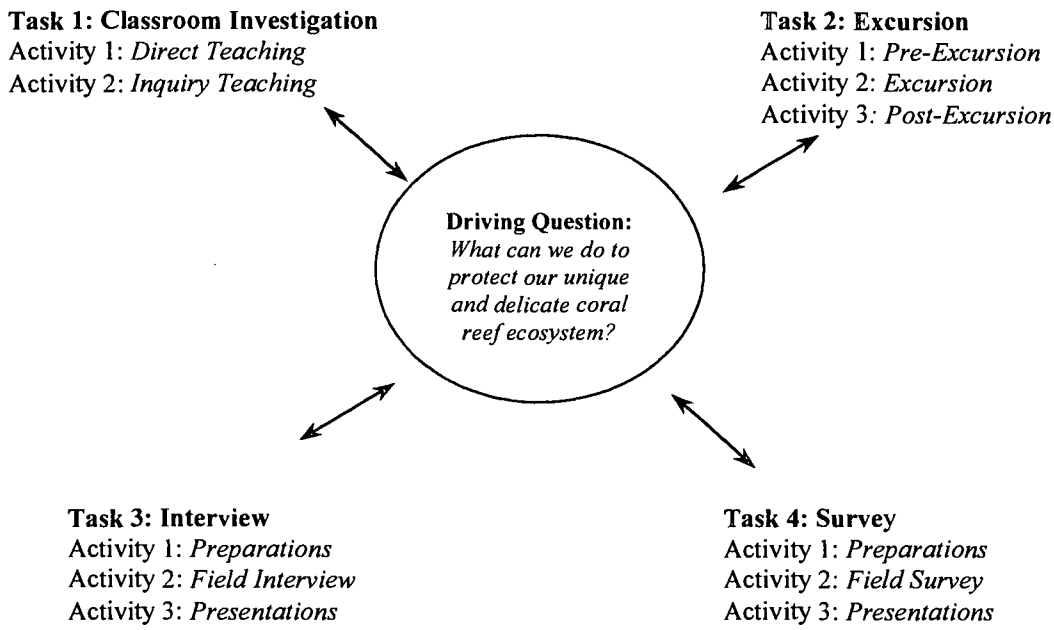
II. Making Sure the Desired Outcomes of the Unit Are Clear

Demonstration of Learning	**Criteria for Demonstration of Learning** *Students will perform and produce the following:* • **Write** an essay/letter/report on the importance to us of corals and coral reefs. • **Write** a report on the traditional/cultural uses, conservation methods, and other traditional practices and knowledge based on student-directed research. • **Participate** in a debate on the pros and cons of the issues of the community's use of coral reefs such as sand mining, dredging, fishing, and recreational uses. • **Make** presentations/displays/performances of student works, results of investigations, art, dances, and songs that students have learned in the course of their coral reef investigation and have selected to exhibit. • **Dramatize** the important uses of our coral reefs and threats that they face. • **Produce** videos, newsletters, and radio programs of a local coral reef site with documentation of the dangers it faces.

Demonstration of Learning (continued)	• All students must have a role and should participate. • Activities should answer the Driving Question and its related questions. • The performances must have an outside audience. • Criteria for evaluation for the study of products and performances must be made clear to the students at the outset. • Have a set and clear program of the event. • Other criteria are determined by the teacher and students.

III. Building and Assessing Knowledge and Skills

Tasks for Building Knowledge, Skills, and Attitudes



Task 1: Classroom Investigation

Activity 1: *Inquiry Teaching*

Objectives:

Students will . . .

- Generate a list of uses, importance, kinds of organisms, and anything else associated with coral reefs.
- Develop one or more guiding questions on why it is important to learn about coral reefs.
- Map the coral reef regions of an island.
- Name and explain threats that face our coral reefs.
- Develop some ideas about how to help lessen these threats, and communicate these ideas to others.
- Explain how coral reefs and the animals that live on/in them help each other survive.
- Explain how our islands are formed.
- Show and explain how the tilting of the Earth on its axis, and the relation to sunlight, help coral reefs grow.
- Name and group the different coral types.
- Describe the trade-offs in making choices.

Teaching Strategies:

- Concept Webbing and Mapping: *What is a coral reef?* This strategy is basically used as pre-assessment of what the students know about the topic.
- Video Viewing: *What is a coral reef?* Such videos are intended to support some of the ideas shared by the students and also to introduce some of the content materials on the topic.
- Watch videos on the damages of the coral reef in different parts of the world.
- In small groups, brainstorm for ideas on how to answer the core question, and design some related questions.
- Drop Everything and Read: Allow 10 minutes after recess for reading. Provide reading materials related to coral reefs. This strategy is intended to strengthen students' knowledge base; each student must agree to read a certain number of books. It is done immediately after recess to help calm or relax the students.
- Teacher Demonstration: Use models to show such concepts as the relation between tilting of the Earth and sunlight; and the coral reef as part of the larger island system.
- Learning Centers: Nature centers will contain organisms dead or alive, tools and equipment, working cards for instructions to support learning, aquariums, ponds; Reading/Language centers will contain computers and books including dictionaries, science books, magazines, and books by students. Science Activities centers will contain simple tools, instructions for setting experiments, and equipment.
- Dictogloss: Teacher reads from a book and students listen, share, write, and present. This helps improve students' listening skills, presentation skills, and ability to work with others.
- Homework Assignment: Students will gain important knowledge from books and people at home.
- Learning Contracts: Students set their goals and write simple contracts (agreements between students and teachers on a task and associated timeline). Examples include doing a project or taking care of learning centers.
- Guest Speakers and Field Visits: Topics/areas of expertise should be marine resources and other related agencies.

Assessment: *How do we know they know?*

1. By evidence of their work.
   Example of an objective being assessed: "*Map the coral regions of an island.*"

   Rubric: What counts in making a map?
   - Labeled properly: name of the map, legends, and directions
   - Clarity: neat, clean, and writing is legible
   - Accuracy: measurements, proportionality
   - Creativity: colors, sketches

2. By what they are able to do.

Examples of an objective being assessed:
"Generate a list of uses and the importance of coral reefs."
"Be able to work in groups to get the work done."

Checklist on what counts in group work:
Students will . . .

- Share in the discussion.
- Contribute to the task.
- Ask good probing questions.
- Encourage others to participate in work.
- Respect others' ideas.
- Honor ground rules.

Criteria for the list:

- Clean and presentable.
- Include names of students in the group.
- Include title of the work.
- Must list at least five different uses of corals and coral reef in their community.

Example of an objective being assessed: *"Coral reefs and the animals that live on/in them help each other survive."*

Methods of assessment: Pencil and paper test to assess knowledge of the content; checklist for assessing student performances; criteria identified by teacher and students for assessing products.

Presentation, songs/poems, drama, dances, oral presentations:
Some criteria for oral presentations:
The students will . . .

- Look at their audience.
- Keep it short.
- Use specific examples to get their points across.
- Other criteria.

Some criteria for the song and singing:
The students will . . .

- Practice reading and singing the song/poem.
- Learn to recite and sing in groups.
- Read and sing with feeling, facial expressions, and body movement.

Mastering the content

Pencil and paper test: *MC, matching, fill in the blank, T or F, short answers.*
Students will be able to . . .

- List coral types and describe coral reefs.
- List the names of different animals (fish, clams, lobsters, etc.) on coral reefs.
- Diagram and explain the food chain.
- List and explain why coral reefs are important to people.

Activity 2: *Direct Teaching*

Lesson Objectives:

The students will . . .

- Learn how to use tools or instruments such as hand lenses, thermometers, scales, and rulers.
- Learn the importance of listening, observing, and speaking.
- Learn measurement units and other mathematics conventions.
- Learn the conventions of graphing, charting, journal writing, logging, etc.
- Learn how to present verbally to an audience.
- Learn the skills of working in groups.
- Learn how the different parts of the coral reef ecosystem work together.
- Learn how the tilting of Earth's axis, its rotation, and sunlight are important to coral reef growth.
- Learn scientific names of some of the important corals and other organisms on the coral reef.

Teaching Strategies:

- Chalk and Talk
  - Get the attention of the whole class. (The chalk and talk strategy works only if everyone is listening.)
  - Tell the students what they are going to learn.
  - Ask questions to help the students remember what they already know.
  - Check student attention and understanding by questioning.
  - Check the success of your teaching by giving a quick oral or written quiz.
- Teacher Demonstration
  - Before the lesson, practice the demonstrations, so you know what will happen and whether or not they will work.
  - Bring the class forward in a tiered row so everyone can see.
  - Ask some questions to remind students what they already know.
  - Carry out the demonstration while constantly explaining and questioning.
  - Question further to help students draw some sensible conclusions.
  - Check the success of your demonstration by doing a quick oral or written quiz.

Assessment:

- Pencil and paper
- Personal communication, questioning and observing students

Task 2: Field Excursion

Activity 1: *Pre-Excursion*

Lesson Objectives:

Students will . . .

- Work together and develop some safety skills, social skills, and communication skills.
- Think critically and creatively to determine suitable clothes to wear and other preparations.
- Demonstrate the use of simple tools for measurement.
- Develop some questions related to the coral reef, both the living and nonliving parts of it. Why is it the way it is? What would happen if . . . ?
- Learn about the site of the visit and any associated cultural importance.
- Learn songs and poems about coral reefs.
- Learn the rules of handling the organisms on the coral reef.
- Learn some ways animals are classified (such as those with and without backbones).

Teaching Strategies:

- Forming Group Activity: Play games and work on puzzles.
- Shared Group Activity: Divide the activity into subtasks; each group is charged with doing something different at the end of the activity. Groups share work. (This grouping will be done in the field.)
- Common Group Activity: Students form groups doing the same tasks, and they share the results at the end. This should be done in the preparation stages to help determine what needs to happen before you go into the field.
- Teacher Demonstration: Teacher demonstrates the use and maintenance of the tools and equipment to be used.
- Songs and Poems: Learn to read and write songs and poems.
- Chalk and Talk: Provide knowledge, directions, rules, and safety features.

Activity 2: *Field Excursion*

Lesson Objectives:

Students will . . .

- Observe the coral reef environment with at least three different senses. For example: See the color of the water, measure the temperature of the water, and taste the saltiness of the water.
- Work with partners in collecting, observing, discussing, synthesizing, and analyzing data.
- Use instruments to measure and record data clearly and accurately.
- Observe and collect some of the rocks and sand that make up the coral reef.
- Ask thoughtful questions about the coral reef ecosystem.
- Show respect and care for the coral reef and animals found there by handling them with care.
- Measure the temperature of the water at predetermined depths.
- Describe the color or clarity of the water.
- Observe and describe the different kinds of fish/birds in the different parts of the reef.
- Observe and describe the different corals, anemones, crabs, sea cucumbers, mollusks, sponges, and other organisms.
- Observe and note plant types found on coral reefs.
- Observe and note animals found in these plants.
- Observe and note animals found under the rocks and logs.
- Observe and note animals found in the sand and gravel.

Teaching Strategies:

- Chalk and Talk: Remind students of rules of safety as well as use of equipment. Go over tasks for the day.
- Shared Group Activity: Each group is responsible for doing a task. Do "creature feature" activity for the different organisms of the reef.
- Using Songs and Poems: Songs can be sung and poems can be read during lunch breaks or on the way to the sites.
- Teacher Demonstration: Teacher will explain rules/safety of handling organisms on the reef and proper ways of using instruments.

Assessment:

- Quick written or oral quiz.
- Performance-based: Checklist for how students follow rules and safety procedures; how they contribute in the work groups; and their use and maintenance of the tools.

Activity 3: *Post-Excursion*

Objectives:

Students will . . .

- Record coral reef data and observations in logs and journals.
- Communicate their results in charts, graphs, and drawings, as well as verbally.
- Work with others in completing the job.
- Show clarity and honesty in recording and sharing of data.
- Show respect for living things on the coral reef.
- Classify the living things on the coral reef.
- Explain how coral reefs are formed.
- Identify and describe some changes happening on the coral reef, and what may be responsible for them.
- Identify and describe the coral reef food chain.
- Show why and where coral reefs grow on our island and other parts of the world.

Teaching Strategies:

- Chalk and Talk
- Homework Assignment: Students will polish up their excursion data for group presentation.
- Excursion Reports
- Songs and Poems: Students will write their own songs and poems about the field trip.
- Writing Wall Story: On 15"x12" paper, students will write and illustrate the excursion. Divide the excursion into different chapters (leaving, on site, and returning). Do one with class, and have them do the others in small groups. Students share their work with the class.
- Writing Big Books: In groups of 2-3, students talk about their experiences and observations. On a mock-up page or paper, each student then selects a topic and writes and illustrates his or her story. Teachers check student work, which is then transferred to larger papers. Students present by reading their Big Books to the class.
- Make story sequence consisting of 3-8 pictures (pictures from old books or magazines) of how coral reefs and islands are formed.

Assessment: *How do we know they know?*

- Quick oral or written quiz: Assesses important knowledge.
- Checklist on how the students are participating and contributing in the group.

- Criteria
  The students . . .
  - Share.
  - Do not dominate.
  - Respect one another and their property.
  - Use respectful language with their groups.
  - Help clean and store tools.

Rubric for creating the Big Book:

On standards	On the way	Not yet
Legible writing	Legible writing	
Large prints	Large prints	Large prints
Pictures match content	Pictures match content	
Clear and clean	Clear and clean	
Use of different colors		Use of different colors
Creative art work		
Title, legends, and labels	Title, legends, and labels	Title, legends, and labels
Words are correctly spelled		
Correct grammar used in sentences		

Presenting and reading the Big Book:

- Criteria:
  Students will . . .
  - Look at the audience.
  - Make sure the audience can hear.
  - Not fidget.
  - Point to pictures and words while reading.
  - Read slowly and clearly.

- Tools identification and proper use: *Oral quiz*

Task 3: Interview

Activities: *1. Preparation 2. Field work 3. Presentations*

Objectives:
Students will . . .
- Ask thoughtful questions about how islanders use coral reefs.
- Work with others to get the job done.
- Show honesty, clarity, and accuracy in their record keeping and sharing of data.
- Use critical thinking in developing skills to make informed decisions in daily life.
- Classify organisms that live on the reef and explain their cultural significance.
- Promote the conservation and protection of our coral reefs.
- Identify some cultural strategies the local island communities use in order to protect and conserve coral reefs.
- Collect songs, chants, poems, and dances pertaining to coral reefs.
- Show respect for the people with whom they are working.

Teaching Strategies:

- Chalk and Talk: Discuss rules, purpose, and expectations.
- Guest Speakers: Cultural resource persons.
- Group Work: Design instruments, plan work, complete task, analyze, and synthesize report.
- Group Presentation and Performance: Decide on audience, reporting format, and next steps.

Assessment: Criteria may be set by the teacher or by the teacher and students depending upon the teacher's judgment of the cognitive ability of the students.

- Set criteria for the students' work.
- Set criteria for the group and individual performances.
- Set criteria for the individual and group presentations.

Task 4: Survey

Activities: *1. Preparation 2. Field work 3. Presentations*

Objectives:

Students will . . .

- Develop thoughtful questions on the important uses of coral reefs.
- Name some demands upon coral reefs. (How do we use coral reefs?)
- Discuss events, past and present, that bring about changes on coral reefs.
- Work with others to decide what is best for our coral reefs.
- Show honesty, clarity, and accuracy in responding to questions and in sharing of data.
- Show respect while working with others.
- Identify and describe some local environmental impacts on the coral reef.
- Participate in the community and cultural governing systems as responsible citizens.
- Describe trade-offs in making choices.
- Use tools (computers) to design and carry out projects.
- Cite examples of appropriate and inappropriate technologies in the Pacific.

Teaching Strategies:

- Chalk and Talk: Provide purpose, insights, directions, and rules.
- As a group, plan instruments, decide who and why to survey, and plan and carry out work.
- Present results through forums, debates, rallies, reports, newspaper, TV, radio, and letters.

Assessment:

- Criteria for the students' work. (Make sure these are made clear to the students in advance.)
- Criteria for the students' performances. (Make sure these are made clear to the students in advance.)
- Public reactions.
- Checklist on student participation and contribution.
- Personal communications to determine the students' behaviors and beliefs.

Other Related Standards Connections		
Mathematics	**Language Arts**	**Social Studies**
Students will . . . • Model situations using oral, pictorial, graphical, and algebraic methods. • Understand and apply reasoning processes with special attention to spatial reasoning and reasoning with proportions and graphing. • Explore problems and describe results using graphical, numerical, physical, algebraic, and verbal mathematical models and representations. • Develop number sense. • Use computation, estimations, and proportions to solve problems. • Describe and represent relationships using tables, graphs, and rules.	*Students will . . .* • Develop skills in oral presentations. • Use persuasive language. • Listen critically to analyze data. • Read to learn from reading. • Read to get information. • Use different forms of writing. • Review and revise writing mechanics and styles. • Demonstrate the ability to express emotions through singing and dancing. • Be introduced to graphic arts.	*Students will . . .* • Discuss land formation processes and land features. • List and draw geographical locations. • Identify and discuss cultural values and how they affect everyday life. • Name the major groups of islands in the Pacific and discuss their climates, weather, animals, and plants. • Discuss events that brought about changes in the Pacific islands. • Identify economic resources of the islands. • Name and discuss some of the services that are in great demand in the islands.

Components of Pacific Sand

By the Curriculum Research and Development Group (CRDG),
University of Hawai'i at Mānoa

I. Setting the Focus for Learning

Context/Situation	**Components of Pacific Sand** The Pacific sands are unique. *But what is Pacific sand really made of?* Try some of these ideas to engage students in learning more about their Pacific island environment.
Pacific Science Standards and Benchmarks Addressed (*Pacific Standards for Excellence in Science*, PREL, 1995) **What should students know and be able to do in this activity?**	**Science as Inquiry** *Students will . . .* • Ask good questions about the world around them. • Collaborate with others to get the job done. **Habits of Mind** *Students will . . .* • Demonstrate their curiosity and willingness to engage in problem solving and learning. **Connections** *Students will . . .* • Use tables, graphs, and charts to describe data. **Matter: Its Structure and Changes** *Students will . . .* • Describe the changes in matter as part of all living and non-living things. **Planet Earth: Oceans and Land** *Students will . . .* • Explain and show that Pacific islands are formed by natural rock formation processes and living things. **Living Environment** *Students will . . .* • Classify some of the organisms on the coral reef and in the sand.
Pacific Mathematics Content Standards Addressed (*Pacific Standards for Excellence in Mathematics*, PREL, 1995)	**Mathematics as Communications** **Mathematical Connections**
What kinds of learning activities should students experience?	**Variety of Teaching Strategies** • Experiential – starting with what students already know, then moving on to new knowledge • Inquiry teaching strategies • Questioning strategies • Constructing knowledge – connecting what students already know to new knowledge • Sequence of investigation

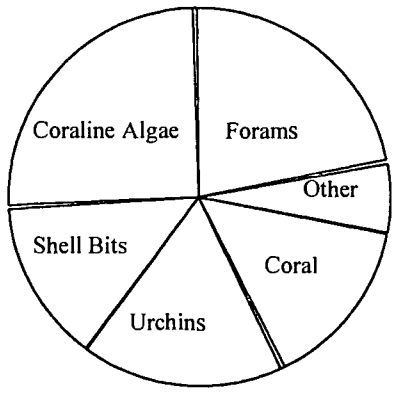
Demonstration of Learning	The students, with an audience of their parents, school administrators, teachers, fellow students, and other guests, will perform and show their conclusions and recommendations to these driving questions: What is Pacific sand made of? How can we help take care of it?
What materials are needed to help students carry out this activity?	**Materials:** • Sand samples • Samples of basalt, sea urchin test and spines, lobster shells, other shells • Hand lenses • Toothpicks • Cardboard for making sand sorters • Vinegar • Medicine droppers
Resources	**Electronic resource:** crdg@hawaii.edu

II. Building and Assessing Knowledge and Skills

Lesson Introduction:

1. Collect sand samples on various field trips or as a homework assignment. For those whose schools are near a beach area, students can collect samples as an introductory activity; or they may collect samples from several different sites. Also, have some pieces of known samples for students to test chemical composition such as pieces of shell, sea urchin test and spines, lobster shells, or basalt.
2. Connect these lessons on composition of sand to what students have been studying. For example, connect these lessons to their field trips or to what they have been learning about other aspects of island environments.
3. Hand out sand samples, toothpicks, and hand lenses. Observe sand samples with hand lenses. Students should work with partners and practice using the hand lenses and toothpicks.

Question 1: **a) What variety of sand sizes and shapes can you find?** **b) Is the composition of sand the same everywhere?**	**Activity Guidelines: Sort different kinds of sand with a sand sorter** • A sand-sorting board can be made by punching a series of round holes into a thick piece of cardboard. Glue this punched cardboard to unpunched cardboard. • Sand to be sorted is placed on the sand sorter. Different kinds of particles can be pushed into each hole using a toothpick • Holes filled with representative particles can be sealed over with a strip of transparent tape, or the whole sorter can be covered with transparent plastic glued firmly to the surface. • A label can be placed on the sand sorter indicating the sources of the sand samples. Individual holes can be labeled with the names of the identified components.
Question 2: **a) What is the composition of the sand? Or what is sand made of?** **b) Which components can you find in your sample?**	**Major Components of Pacific Sand** *Foraminifera*. Called forams for short. Tiny skeletons of one-celled animals. Usually flat, coiled discs. White, beige, brown, or red/orange. *Shell Fragments*. Usually white. Often worn smooth by sea action.

Question 2: (continued) **a) What is the composition of the sand? Or what is sand made of?** **b) Which components can you find in your sample?**	*Fragments of Coral or Seaweed.* Dull white bits of broken reef and calcareous seaweed. Irregular shapes until well-worn and rounded by sea action. *Coral Bits.* Small, white fragments of the coral skeletons with tiny holes in which the polyp animals lived. *Sea Urchin Skeletons.* White or purple-black. Broken bits of needles or spines and flat pieces of urchin test. *Particles of Black Lava or Other Basalt Minerals.* *Miscellaneous Items From Living Things.* Fish scales, broken teeth, or platelets of green algae. *Miscellaneous Items From Non-Living Things.* Glass, metals, plastics, and other debris.
Question 3: **What are the approximate percentages of different components of sand?**	**Activity:** Have the students calculate percentages of each kind of component in their samples. Graph data. Compare graphs of samples from different locations. **Typical Components and Composition of Most Pacific Sand** 

Question 4: **a) How do the components of the sand react to vinegar?** **b) Which components of the sand react? Which don't?**	**Situation:** Seashells, coral skeletons, coraline algae, pearls, and blackboard chalk are made up of calcium carbonate. Calcium carbonate ($CaCO_3$) in contact with vinegar or other weak acids reacts chemically, releasing carbon dioxide. The resulting bubbles cause the small bits of sand, shell, etc. to move about in the container, bumping one another and usually generating great excitement among students. **Activity:** • Hand out cups of vinegar, droppers, and empty cups. • With the class, create a data table similar to the one below to record observations.

Question 4: (continued)

a) How do the components of the sand react to vinegar?

b) Which components of the sand react? Which don't?

- Test different components. Place samples in jar lid, paper cup, or similar container. Add about one dropper of vinegar to the cup. Observe what happens.

Reactions of Sand Components With Vinegar

Component Sample	Prediction: Will it react?		Data: Did it react?		Observation
	Yes	No	Yes	No	

- Test known samples such as shells, sea urchin test/spines, lobster shells, etc.
- Test basalt.
- What do sand samples have in common? (Calcium Carbonate, $CaCO_3$)

Extensions

- Make a sand map of the island. Collect sand samples from the different beaches and glue them to an outline of a map of the island.
- Start a sand exchange with other students in the Pacific and other regions of the world. Make a map and locate the origins of the samples.
- Test other liquids besides vinegar. Which ones react? Which ones don't?
- Mount the different components of sand inside the slide mounts. Cover with plastic. Identify forams, coraline algae, shell parts, etc.
- Use the sand collected to create sand arts and crafts. Fun things to do are limited only by the imagination. For example, sketch an organism or scene. Place glue on the lines and sprinkle sand over the entire work. Let the glue dry, then shake off the excess sand.

Student Assessment

How do we know that they know?

Pencil and Paper

Short quiz on the names of the six major components of Pacific sand and their percentage of the composition.

Performance-Based

- Student Products: Example: Sand Sorter - What does it look like? Does it work?
- Student Performance: Collaboration with other students, creating a safe working environment.
- Students' Investigations: Experiment setup, worksheet results, observation notes, conclusions, and recommendations.
- Students' reporting their learnings.
- Criteria for student products and performances must be set in advance by both the teacher and students.

Student Assessment (continued)	**Personal Communications** ◦ Teacher's questioning ◦ Teacher's observation • Teacher's interviews • Students' questioning

Fish as a Marine Resource

By Jesus Sonsong, Elisapeta Alaimaleta, David Monore,
Jamil Ahmedia, and Toa Suoni

I. Setting the Focus for Learning

Context/Situation *(Creating interest and connecting students with the topic and the real world)*	In the Pacific islands, fish are and probably always will be the main source of protein for all of us. Besides providing high quality nutritional value, fish have the potential to become one of the major economical assets of the islands. This will be increasingly true as the world strives to feed its increasing population. However, it also has become alarmingly evident that this valuable resource is encountering serious mismanagement and depletion.
Pacific Science Content Standards and Benchmarks Addressed (*Pacific Standards for Excellence in Science*, PREL, 1995)	**Science as Inquiry** *Students will . . .* • Identify questions yet to be investigated and suggest ways of finding answers. • Record data clearly and accurately in logs and journals. • Communicate their results in charts, graphs, and drawings as well as verbally. • Collaborate effectively with others to get the job done. **Habits of Mind** *Students will . . .* • Show they care for and respect living things in the environment. • Use critical thinking skills to make informed decisions in their everyday lives. **Scientific Connections** *Students will . . .* • Apply the concept of interaction to materials, objects, events, organisms, and systems. **Planet Earth** *Students will . . .* • Identify habitats in different environments. • Identify and describe effects of environmental change on living things. **Living Environment** *Students will . . .* • Identify ocean and land food chains and food webs. • Describe the role of technology in selective breeding of certain organisms. Value the unique organisms, environments, and ecosystems in the Pacific. **Technology and Society** *Students will . . .* • Describe local food production and distribution technologies and complex interactions of these technologies with economics, health and nutrition, depletion of resources, and environmental impact. • Demonstrate how materials were used to make the inventions and devices they use for the science and technology investigations. • Compare local food production and distribution technologies with those of other places.

Pacific Science Content Standards and Benchmarks Addressed (continued)	**Human Society** *Students will . . .* • Participate meaningfully in local practices that encourage conservation of the island environment. • Describe the impact of technology, immigration, and population growth on social changes, choices, and conflict in the Pacific region. • Keep informed of new technologies and their potential impact on community and culture. **Human Organism** *Students will . . .* • Take personal actions applying their knowledge to ensure their own physical and mental health. • Identify agencies in the community that assist in maintaining and treating physical health.
Related Grade Level Goals and Objectives for Grades 8 and 9	*Students will . . .* • Identify at least 10 of the edible and non-edible fish in their entities (islands) by local and scientific names. • Prepare a recipe of their favorite fish. • Describe 1-3 methods of preparing (cooking) fish. • Discuss the values (both nutritional and economical) of fish. • Identify the seasons for the common fish sold in the local fish market. • Discuss fish exporting processes available on their islands. • Discuss strategies to prevent the rapid depletion of our fish.
Topic/Theme	Fish and Us
Driving Question	*As a good citizen, how will you help preserve our saltwater fish resources for the generations to come?*
Resources	**Print resources:** E. B. Klemm et al., 1995, *The Living Ocean: Biology and Technology of the Marine Environment* **Electronic resources:** crdg@hawaii.edu **Human resources:** *To be identified by teacher and students* **Sites, organizations, and agencies:** *To be identified by teacher and students*

II. Making Sure the Desired Outcomes of the Unit Are Clear

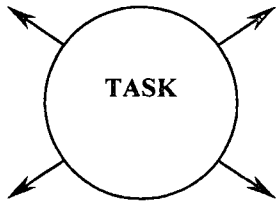
Demonstration of Learning	**Learning Fair** In this learning fair, parents and school administrators will be the primary audience. Students will present products, reports, and other student findings from the field trips and class investigations. **Cooking Fair** Students will showcase their recipes for cooking fish to the public (restaurant owners and others). **Criteria for Demonstration of Learning** *Students will . . .* • Make a well-organized oral presentation. • Support their findings with evidence from interviews, investigations, surveys, and other sources. • Demonstrate effective speaking skills by making eye contact, maintaining appropriate volume, rate, inflection, and posture. • Use pictures, diagrams, and other visual aids to enhance presentation. • Debate and dialogue with the audience on important issues facing the subject matter. • Write to policy makers on the important issues pertaining to fish as a resource. • Demonstrate a fish recipe.

III. Building and Assessing Knowledge and Skills

Tasks for Building Knowledge and Skills

Tasks that students need to do to develop the products and performances for Demonstration of Learning

1. Investigation **2. Guest Speaker**



3. Field Trip **4. Fish Recipe**

Task 1: Classroom Investigation

(What events or ideas do I want to clear up? What is already known? How can I defend my suggestions?)

What should students know, be able to do, and care about?

Students will . . .

- Explain how the ocean is an important resource to help feed the world population.
- Distinguish among some of the resources found in the ocean.
- Acknowledge that fish is one of the most important of these resources.
- Listen attentively and be able to ask good questions.
- Discuss the nutritional and economic values of fish.
- Consider technological/social impacts on our reef fish and their environment.
- Explore the local and cultural ways of harvesting, conserving, preparing, processing, and cooking our local fish.

Activity 1: *Direct Teaching*

Teaching Strategy and Procedure:

- Teacher will briefly talk about the world oceans and their important resources using visual aids.
- Teachers will give general overview of what will happen in the next few days and what is expected of the students.

Assessment: *How do we know they know?*

- Pencil and paper quiz. Identify and name some ocean resources. Explain why fish and other ocean resources are important.
- Teacher's questions and students' responses. Example of teacher's question: Name and explain some of the important resources found in our ocean.

Checklist for understanding:
1. I understand/can explain.
2. I am not completely sure.
3. I do not understand.

- Student-generated questions. Quality of these queries (Are they directly related to the topic? Do they encourage the students to want learn more about the topic?).
- Other criteria identified by teacher/students.

Materials: Map of the world oceans, map of the island, chart of local fish, slides or videos of fish, actual fish.

Activity 2: *Inquiry Teaching*

Teaching Strategy and Procedure:

- Teacher can use the *Webbing Strategy* or *Concept Mapping* to probe for students' prior knowledge on ocean resources, fish as a resource, local uses of fish, and related critical issues.
- Students in smaller groups take an issue or topic out of the concept map and elaborate on it and produce a report or make a presentation.

In groups, students will generate a list of questions for the task on Guest Speaker. Examples of student-generated questions:

- Do we sell our fish to outside countries? How often? How much?
- Is there legislation protecting our fish and their environment?
- How can we improve what we already have?
- Are we losing the traditional ways of fishing?

Asessessment: *How do we know they know?*

- Performance based: The degree of involvment the student has in the webbing activity.
  Checklist:
  1. Fully participating by listening and contributing
  2. Participating by listening only
  3. Seem uninterested

- Product: Concept Map. Assess content knowledge based upon the quality of students' responses that develop into the class's concept map. Note which students responded.

  - Products: Determine with students – What counts in a report? What counts in an oral presentation?
  - Performance based: Cooperation of each student in the group work.

  Checklist:
  1. Is the student contributing?
  2. Is the student making it easy for others to cooperate?
  3. Is the student encouraging others to participate?
  4. Continue list with teacher- and student-generated criteria.

  - Content assessment based on the quality of the questions generated.

Materials: Flip chart, markers, tape

Task 2: Guest Speaker

What should students know, be able to do, and care about?
Students will . . .

- Identify questions and find a way to get answers.
- Listen attentively and record notes.
- Use critical thinking skills to come up with questions to ask.
- Share what they learned with others.
- Effectively communicate their ideas to others.
- Show respect and courtesy.

Activity 1: *Inviting a Guest Speaker(s)*

Procedure:

- Class decides whom to invite. What do we expect to learn from a guest speaker? (Refer to the student-generated questions under Task 1, Activity 2.)
- Draft a letter of invitation or plan a visit to the speaker to brief him/her on what the class should learn from him/her.

Assessment:

- Product – Look at the quality of student criteria for selecting the guest speaker(s).
- Product – Look at the quality of the letter(s) of invitation for the guest speaker(s). What's in a letter?
- Personal Communication – Teacher asks questions and students respond.
- Performance – Students work in groups.

Activity 2: *Guest Speaker's Presentation*

Procedure:

- Introduce the speaker.
- Students listen attentively and take notes.
- Students pose questions and note responses.

Assessment:

- Teacher observes the students in order to note student involvement in the presentation. Use a checklist for who is paying attention.
- Note student questioning and follow-up questions.

Activity 3: *Group Discussion After the Speaker Departs*

Teaching Strategy and Procedure:

- Working as a whole group, the teacher quickly asks students to reflect on the key points presented by the speaker.
- Students should make connections between the speaker's points and what has already been learned in class.
- Students will write a short report on what the speaker presented.

Assessment:

- Performance – Student reflection: Did the students listen attentively and understand the speaker's main points? A checklist can be used to record who shares and with what frequency.
- Performance – Student responses, questions, and comments on the speaker's presentation.
- Product – Individual student reports. Criteria on writing a report can be developed collaboratively by the teacher and students.

Task 3: Field Trip - Public Fish Market

What should students know, be able to do, and care about?

Students will . . .

- Identify critical and important questions that need to be answered.
- Show they care about what is happening to the environment and the resources.
- Explain how fish are processed and packaged.
- Participate in local practices that promote the conservation of fish in the local environment.

Activity 1: *Field Trip - Preparations*

Teaching Strategy and Procedure:

- Teacher must visit local fish markets to make sure what students need to see is there.
- Teacher communicates with fish market managers or owners about purpose of the field trip.
- Students in small groups will brainstorm some key questions which may include:
  - What are the most common local fish purchased in the market?
  - How much fish is purchased per day, month, and year?
  - How are the fish priced?
  - Is there any interaction or friction between the fish market and other government-owned fishing agencies?
  - What is the impact both on the fish stock and job market of foreign fishing fleets in our waters?
  - How do local fish markets preserve their fish to maintain the freshness of the fish?
  - Are there any conservation laws on different types of fish? What are they?

- Preparation for the field trip:
  What to wear, what to do, what not to do, and other directions.
  Review fish names and key features of the different kinds of fish.

Assessment:

- Performance – Observe and note how students work in groups. Make sure the students are familiar with the criteria for group work.
- Product – Assess content knowledge and understanding based on the quality of the student-generated questions. Make sure the students are familiar with the criteria for good questions.
- Oral quiz on the names and kinds of fish.

Materials: Chart of the local fish

Activity 2: *Field Trip and Interview*

Teaching Strategy and Procedure:

- Product – Students, in their groups, observe and identify the different kinds of fish, noting names, numbers, key features, habitats, ways of cooking, etc.
- Performance – Students conduct interviews and take notes.

Assessment:

- Performance – Students will identify the different fish species.
- Product – Responses and notes from the interviews.
- Performance – How the interview was carried out. The interaction between the interviewer and interviewee; the language used by the students conducting the interview. Criteria must be developed in advance for each of these activities.

Activity 3: *After the Field Trip*

Teaching Strategy and Procedure:

- Student Teacher Action Review (STAR) reflects and records anything that might have interested the students.
- Compare the responses to questions posed to fisherman and fish managers. Make a concept map.
- Distinguish several major themes (conservation, legislation, economy, etc.) based on the questions generated by the students. Have students pursue these themes to write reports.

Assessment:

- Personal Communications – Note quality and accuracy of student responses.
- Product – Concept maps: Base content assessment on the quality of student responses.
- Project – Written and/or oral report. *Criteria:* What's in a report? Determine this with the students.

Materials: Flip charts and markers

Task 4: Your Favorite Recipe

Students will . . .

- Describe the impact of technology on the community and culture.
- Collaborate effectively to get the work done.
- Use critical thinking to make good decisions.
- Apply the concept of fish as a source of food to a real world situation.
- Display local food technology and other food-distribution technologies.

Activity 1: *Make Fish Cakes From an Underused Fish Species.*

Teaching Strategy and Procedure:

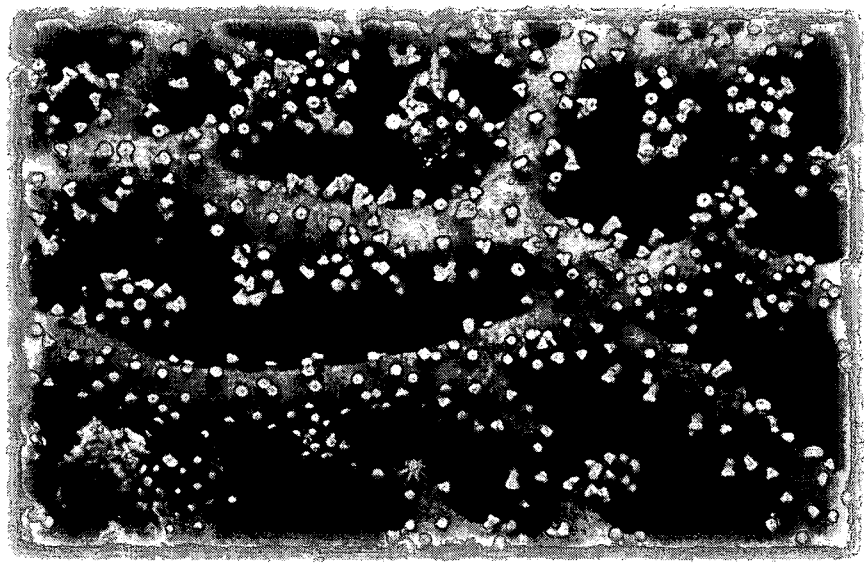
- Read and discuss *The Living Ocean,* Chapter 11: Fish as Food Resource.
- Explain some of the main concepts and terms in the reading.
- Perform the activity in Chapter 11: Make fish cakes from underused fish species.

Assessment:

- Pencil and Paper – A quiz on the reading on Chapter 11: Fish as Food Resource.
- Personal Communications – Teacher's questioning and observing while students are on task.
- Performance – Students working in groups. Use a checklist with descriptors.
- Product – The completed fish cakes. Remember to set criteria ahead of time.

Materials: See *The Living Ocean*, Chapter 11: Fish as Food Resource, pp. 127-132.

Related Standards Connections		
Mathematics	**Social Studies**	**Language Arts**
Students will . . . • Use computation and estimation. I do not understand. - Use computation, estimation, and proportion to solve problems. - Use estimation to check the reasonableness of the answers. • Explore problems and describe results using graphical, numerical, algebraic, and verbal mathematical models and representations.	*Students will . . .* • Identify economic resources of the islands. • Discuss fish as an important resource for the islands. • Discuss how foreign influences affect island practices and ways of doing things. • Name some of the Pacific Rim nations that influence the economy of our islands. • Discuss how/why the fishing industry is growing in the islands. • Discuss trading activities that have taken place in the islands since the 1500s. • Discuss the fishing rights agreements with foreign countries.	*Students will . . .* • Be learners who are highly competent listeners and speakers. - Give oral presentations. - Show respect for others' opinions. - Listen critically. - Use language persuasively. • Be learners who use proper language and value good writing skills. - Write to inform others. - Take notes and write summaries.



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