

Hawaii's Coral Reef Ecosystem Curriculum



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Grade Level: Fourth Grade

Purpose: This curriculum is designed to communicate:

- I. Corals as Organisms
- II. How the coral reefs of Hawaii are physically and biologically structured.
- III. What the major natural and human induced impacts to the coral reef habitat are and how our actions directly tie into the survival of Hawaii's coral reefs

Hawaii Content and Performance Standards (HCPSIII) Addressed:

Standard 1: The Scientific Process: Scientific Investigation: Discover, invent, and investigate using the skills necessary to engage in the scientific process.

Benchmarks

- SC.4.1.1 Describe a testable hypothesis and an experimental procedure
SC.4.1.2 Differentiate between an observation and an inference

Standard 2: The Scientific Process: Nature of Science: Understand that science, technology, and society are interrelated.

Benchmarks

- SC.4.2.1 Describe how the use of technology has influenced the economy, demography, and the environment of Hawaii.

Standard 3: Life and Environmental Sciences: Organisms and the Environment: Understand the unity, diversity, and interrelationships of organisms, including their relationship to cycles of matter and energy in the environment.

Benchmark

SC.4.3.1 Explain how simple food chains and food webs can be traced back to plants.

SC.4.3.2 Describe how an organisms behavior is affected by its environment (e.g. courting, nesting, feeding patterns)

Standard 5: Life and Environmental Sciences: Diversity, Genetics, and Evolution: Understand genetics and biological evolution and their impact on the unity and diversity of organisms.

Benchmark

SC.4.5.2 Describe the roles of various organisms in the same environment

SC.4.5.3 Describe how different organisms need specific environmental conditions to survive

Standard 6: Physical, Earth, and Space Sciences: Nature of Matter and Energy: Understand the nature of matter and energy, forms of energy (including waves), and energy transformations, and their significance in understanding the structure of the universe.

Benchmark

SC.4.6.1. Describe how some materials may be combined to form new substances.

Math Standards:

Standard 6: Geometry and Spatial Sense; Transformations and Symmetry: use transformations and symmetry to analyze mathematical situations.

Benchmark

MA.4.6.2 Locate the plane of symmetry in three dimensional objects

Standard 11: Data Analysis, Statistics, and Probability; Fluency with Data: Pose questions and collect, organize and represent data to answer those questions.

Benchmark

MA.4.11.1 Pose questions, collect data using observations and experiments, and organize data into tables and graphs.

MA.4.11.2 Label the parts of a graph(e.g. axes, scale, legend, title)

Standard 13: Data Analysis, Statistics, and Probability; Data Analysis: Develop and evaluate inferences, predictions, and arguments based on data.

Benchmark

MA.4.13.1 Propose and justify conclusions/predictions based on data.

Rationale:

Coral reefs in the Hawaiian archipelago comprise over 80% of U.S. coral reefs and span over 2,000km. Hawaiian reefs possess some of the most abundant levels of marine endemic (native) species in the world as well as sheltering over 700 species of fish, 400 species of algae and over 2000 species of invertebrates. Coral reefs are also important for protecting our shoreline from storms and wave damage and for providing economic benefits to our local communities through marine tourism and near shore fisheries.

Reef-building corals are the keystone organisms in coral reefs, meaning a decline in coral health will have direct and immediate effect to the entire coral reef ecosystem thereby threatening endemic species. For this reason, it is important for our youth to understand that corals are not colorful rocks but are living organisms. This curriculum uses hands-on activities to promote interactive learning about Hawaii's coral as organisms and the coral reef ecosystem.

Concept Map for Unit: See attached sheet

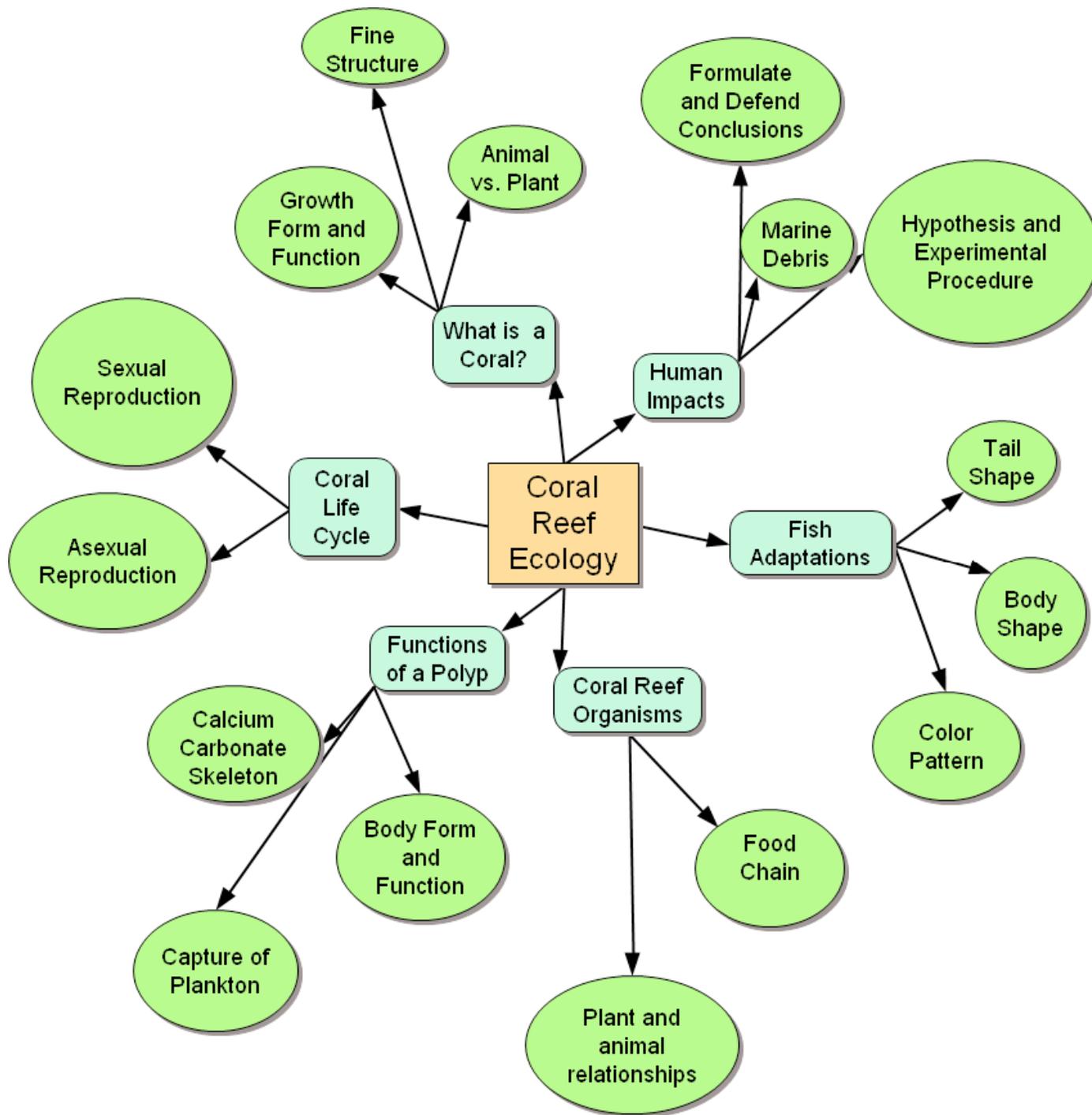
Formative Assessment:

Students will demonstrate continued learning throughout the unit by successful completion of activity worksheets, and incorporation of theatrical arts into their daily science lessons by acting out coral organism biology. Student learning will also be demonstrated through storyboard writing, production of dioramas, artistic performance and achievement on written tests. Checklists are given at the end of each lesson which can then be compared to a rubric for a cumulative grade for each lesson.

Summative Assessment:

Students will demonstrate knowledge of corals and the coral reef ecosystem by describing in detail about designated topics on a blank piece of paper, using pictures and words. Through this method the bulk content knowledge can be assessed.

Overview of Lessons Chart: See attached sheet



Coral Reef Ecology
**Curriculum Concept
 Map**

Coral Reef Ecology Overview of Lessons Chart

Lesson Name		Benchmarks	GLO's	Materials	Lesson Overview	Worksheets	Assessment	
What is Coral	1.1	Plant and Animal Cells	SC. 4.4.1 SC 4.1.2	5, 6	Coral fragments or pictures of coral, plant and animal cell slides, microscopes, magnifying glasses, overhead projector, worksheets, index cards, small cardboard boxes.	Students will understand the differences between plant and animals by looking at cells under a microscope and enacting a play that highlights the differences between plant and animal cells.	"Plant and Animal Cells", "Cell Parts", transparency of "Coral Cell with Zooxanthellae"	1.Complete Worksheets 2. Created a diorama displaying at least 3 out of 5 growth forms.
What is Coral	1.2	KWL chart and Background Reading	SC. 4.4.1	1,3,5	Worksheets	Students will read a background article with interesting facts about corals, such as where corals grow, and why corals are important in Hawaii.	"What is Coral" Background article, KWL chart	
What is Coral	1.3	Describe a Coral	SC. 4.1.2 SC. 4.5.3	3,4,5	Coral Cards, a blank sheet of paper	Students will view coral pictures and write and draw their observations about the coral they have. Their observations will be given to another group that will need to match their description and drawing with the coral picture.		
What is Coral	1.4	Coral Growth Forms	SC. 4.5.3	3	Worksheets	Students will learn that corals take on different growth forms depending on the environment they are in. They will also describe similarities and differences between the corals.	David Gulko's, "A layperson's guide to identifying coral growth forms", 2-circle Venn Diagram, "Identify the Type of Coral Growth Forms".	
What is Coral	1.5	Learning Scientific Coral Terminology	SC. 4.5.3	2,3	Coral Cards, Worksheet	Students will learn scientific description terms using the coral cards from lesson 1.3.	"Observation Words"	
What is Coral	1.6	Observations and Inferences	SC. 4.1.2 MA. 4.6.2	3,4,6	Overhead projector, Jewelers loop, magnifying glass, digital microscope, rulers, coral skeletons, worksheet.	Students will measure, draw and describe a piece of coral. They will use observations and inferences to describe their piece of coral.	"Our Observations", "Inference and Observation Warm-up" on a transparency	

Life Cycle of a Coral	2.1	Background reading and Coral Dramas	SC. 4.3.2.		KWL Chart, Background Article, Video Clips of reproducing corals	Students will learn vocabulary pertaining to a coral's lifecycle and use drama to act out the different types of sexual and asexual reproduction	Student background article, KWL chart	1. Coral dramas 2. Can describe the lifecycle stages 3. Can state corals reproduce using asexual and sexual reproduction 4. Life cycle test
Life Cycle of a Coral	2.2	Life Stages of a Sexually reproducing Coral	National Life Science Standard C		Worksheets, video clip of coral life cycle, Coral Life Cycle Stage Poster	Students will describe sexual and asexual reproduction in corals and arrange life cycle stages in order	"Coral Life Cycle Pictures","Coral Life Cycle Diagram", "Coral Life Cycle Descriptions"	
Functions of a Polyp	3.1	Background reading and Coral Dramas	SC. 4.6.1	1,3,5	background article, worksheet	Students will learn vocabulary pertaining to coral polyp anatomy, learn how polyps feed and perform dramas on polyp functions	"Polyp Anatomy"	1. Coral dramas 2. Anatomy test 3. Comic strip on the coral wars that occur on a reef including life and death
Functions of a Polyp	3.2	Making an Edible Coral Polyp	SC. 4.6.1	1,2,4	white baking chocolate, one marshmallow for each student, toothpicks, red licorice, blue, red or green sprinkles, microwave or hot plate, pan for candy coating, paper plates	Students will review the parts of a coral polyp by building an edible coral polyp model		
Functions of a Polyp	3.3	Growing a Coral Skeleton	SC. 4.6.1	1,2,3,5	plastic bowls, pieces of charcoal, porous brick, tile, cement, or sponge, water, table salt (iodized or plain), liquid bluing , measuring tablespoons, masking tape, pens, ammonia, sugar, clear glass,worksheet	Students will observe and describe the growth of crystals from that is similar to how corals create their calcium cups	"Crystal Growth Observations"	
Functions of a Polyp	3.4	Mealtime for Corals	SC. 4.3.2	2, 5	An old bed sheet, Surgical gloves for every child in the class, Markers, Goldfish crackers	Students will demonstrate that individual polyps, though connected, feed independently in a coral colony		
Coral Reef Organisms	4.1	KWL chart and Background Reading	SC. 4.5.2 SC. 4.5.3	1,3,5	Worksheets	Students will read about the complexities of a coral reef community and food web dynamics.	Background article, KWL chart	1. Coral reef mural organism 2. Food Chain test

Coral Reef Organisms	4.2	Create a Reef	SC.4.5.2 SC.4.5.3 SC.4.3.1	3,4	Crayons, paints, markers, pictures of coral, drawing paper, and various other art supplies. Also, a computer to view videos over the internet as well as a computer projector..	Students will design and populate a coral reef mural with corals and other organisms within their specific habitat zones.		
Coral Reef Organisms	4.3	Circle of Life	SC. 4.1.3 SC. 4.4.1 SC. 4.5.3	2,3	Worksheets, tape, stapler, string or yarn, scissors, construction paper, drawing pens, colored markers.	Students will learn about the coral reef food chain and use their knowledge of the different coral reef communities to create cards that they will use to play "Circle of Life" card games.	"Coral Community Cards", "Coral Community Drawings", "Food Chain Diagram" and "teacher answer sheet.	
Human impact to Coral Reefs	6.1	Background reading and Discussion	SC. 4.5.3	1,3,5	Worksheets, a sheet of paper	Students will read a background article on the impacts human technology has made on the environment and how it can affect the organisms that live there.	"Marine Debris in Hawaii" brochure, "How long does it take for marine debris to decompose?" and "Healthy Reef"	1. Complete worksheets 2. poster to communicate the negative impact of marine debris to the community
Human impact to Coral Reefs	6.2	Types of Marine Debris	SC. 4.1.1 SC. 4.5.3	2,3,4	Worksheet, deep pan, sink, water, different types of "debris"	Students will make predictions about what types of trash can become marine debris, and learn how things from the land makes it to the ocean by testing different types of materials to see if it can sink, float or be carried by the wind.	"What Will Become of Marine Debris?"	
Human impact to Coral Reefs	6.3	Collecting Data Using a Transect Line	SC. 4.2.1 MA. 4.11.1 MA. 4.11.2 MA. 4.13.1	2,6	Various types of trash (can be the same as lesson 6.2) and worksheet	Students will learn how to collect data using a scientific technique called a "transect line".	"Collecting Data Using a Transect Line"	
Human impact to Coral Reefs	6.4	Research Question, Hypothesis and Experimental Design	SC. 4.1.1	1,3,4	Worksheet, and information and pictures of the beach where a cleanup will be held	Students will think of a research question, design a hypothesis and create a study design to test their hypothesis.	"Human Impacts"	

Human impact to Coral Reefs	6.5	Beach Cleanup at a Local Beach (Field Trip)	SC. 4.1.1	1,2	Trash bags, gloves, sun protection, worksheets, overhead projector	Students will visit a local beach and test their marine debris hypothesis using their study design. They will collect marine debris at the beach of your choice.	"Data Collection Spreadsheet" (or your own custom spreadsheet), "Dealing with Marine Debris" transparency.
Human impact to Coral Reefs	6.6	Results and Conclusion	SC. 4.1.1 MA. 4.11.1 MA. 4.11.2 MA. 4.13.1	1,2,3,4	Worksheet, graph paper	Students will finish their "Human Impacts" worksheet from lesson 6.4 using the results of their beach cleanup.	"Human Impacts"