GRADE 4 UNIT 5 OVERVIEW

Threatened and Endangered Species

Introduction

The Hawaiian Islands have more animals and plants that have been categorized as threatened and endangered species than any other state in the union. These endangered and threatened species are managed under a program administered by the U.S. Wildlife Services and NOAA Fisheries that was enabled by the Endangered Species Act of 1973. This program describes the conservation status of specific animal and plant species.

In this unit, students are introduced to the fundamental significance of these categorizations, and acquaint themselves with Hawaiian animal and plant species listed under each of these categories. This provides the supporting background that sets the stage for student expert pair group investigations in subsequent lessons.

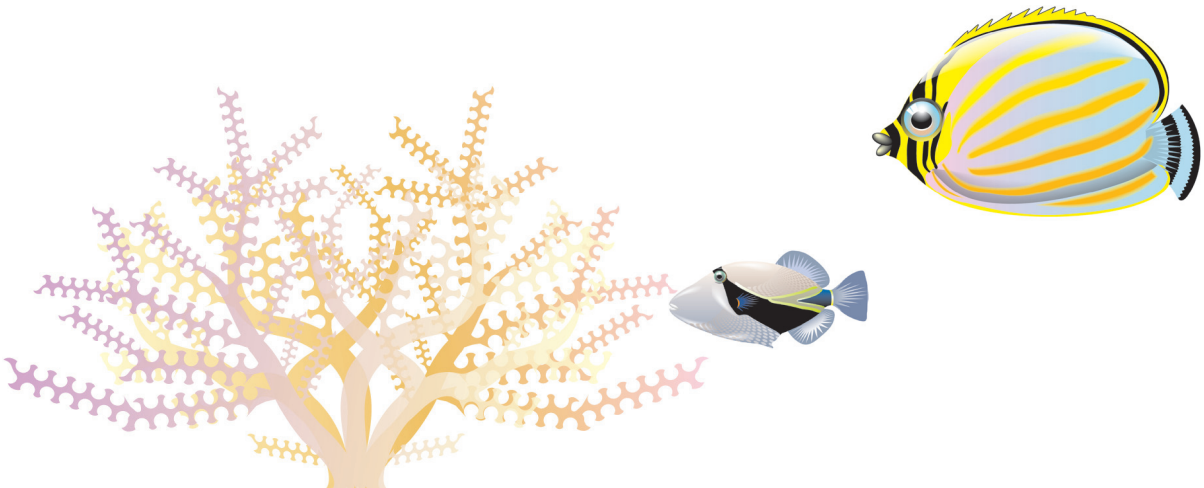
Through textbook readings and class instruction, guided online searches, and PowerPoint presentations, students find that changes in environmental conditions come from natural causes or human activities, or a combination of both. Environmental changes may cause decreases in endemic populations of plants and animals, or could also increase invasive species populations.

In class discussions, *expert* teams ponder whether the intentional importation of live plants and animals to the islands is beneficial to Hawai‘i’s environment, and in an extended activity, debate whether sharks should be hunted. They also use data and observations compiled in previous lessons to discuss how human developments in coastal habitats negatively impact the marine environment. Students also get acquainted with sophisticated technologies scientists use to assess populations of at-risk species and track migratory animals. These technologies create reliable population estimates and lead to effective conservation plans.

Following reviews testing their retention of acquired knowledge, students prepare and deliver in-class presentations concerning Hawai‘i’s changing environment, invasive species, and at-risk species based on compiled data, observations, and inferences. Students also study existing programs aimed at protecting marine life and habitats, and write laws that they believe might help protect threatened endemic species.

In culminating exercises, students write Public Service Announcements based on what they learned, and present these announcements to their parents and to their peers in other classes.

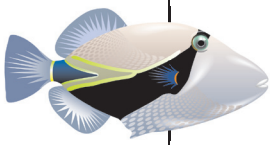
Special Note to Teachers: This unit, especially Lessons 2 and 3, can be enhanced by inviting scientists as guest speakers and/or visiting places such as the Waikiki Aquarium. The DLNR, HIMB Northwestern Hawaiian Islands Coral Reef Research Partnership Outreach Education, or the Pacific Islands Fisheries Science Center are all good options for coordinating a special guest speaker or outing for your students. See the end of this unit for contact information.



At a Glance

Each Lesson addresses HCPS III Benchmarks.
The Lessons provide an opportunity for students to move toward mastery of the indicated benchmarks.

ESSENTIAL QUESTIONS	HCPSIII BENCHMARKS*	LESSON, Brief Summary, Duration
What are the differences between threatened, endangered, and extinct species?	Social Studies Standard 7: Geography: SS.4.7.2 Collect, organize, and analyze data to interpret and construct geographic representations. Language Arts Standard 1: LA.4.1.1 Use new grade-appropriate vocabulary, including homophones and homographs, learned through reading and word study, including root words, affixes, and word origins.	**Lesson 1: Are these Animals Threatened, Endangered, or Extinct?** This first lesson introduces students to the concepts of extinct, endangered, and threatened species using examples delineated in a PowerPoint presentation, *Are These Animals Extinct, Endangered, or Threatened?* Students learn that Hawai'i has the greatest number of threatened and endangered species of any state in the United States, and that almost all of these species are endangered (and not threatened). This lesson sets the stage for subsequent student investigations of several Hawai'i marine animals and seabirds to determine what environmental conditions each species needs to survive, and what has caused their populations to decline. One 45-minute period
What conditions make so many species in Hawai'i vulnerable to becoming threatened or endangered? Why does Hawai'i have more threatened and endangered species than any other state?	Science Standard 5: Life and Environmental Sciences: SC.4.5.3 Describe how different organisms need specific environmental conditions to survive. Science Standard 3: Life and Environmental Sciences: SC.4.3.2 Describe how an organism's behavior is determined by its environment. Standard 2: Reading Comprehension:Language Arts 4.2.5 Summarize main points found in informational texts Standard 6: Oral Communication: Language Arts 4.6.1 Participate in grade appropriate oral group activities Language Arts 4.6.2 Give short, informal presentations to inform or persuade	**Lesson 2: Taking a Closer Look** Students work in expert groups to learn more about the threatened and endangered marine animals they saw in the Lesson 1 PowerPoint presentation. Using information given to them on task cards, and from their own research, they plan a presentation to teach their classmates about their animal, environmental conditions it needs to survive, threats to its survival, and possible actions to protect and sustain them. Two 45-minute periods



ESSENTIAL QUESTIONS	HCPSIII BENCHMARKS*	LESSON, Brief Summary, Duration
What do threatened and endangered Hawaiian animals need to survive? How have changes in environmental conditions affected species in Hawai‘i?	Science Standard 1: Life and Environmental Sciences: SC. 4.1.2 Differentiate between an observation and an inference Science Standard 5: Life and Environmental Sciences: SC.4.5.3 Describe how different organisms need specific environmental conditions to survive. Science Standard 3: Life and Environmental Sciences: SC.4.3.2 Describe how an organism’s behavior is determined by its environment.	**Lesson 3: Changes in Environmental Conditions** In Lesson 3, students view and think about images and information provided in a PowerPoint presentation to address the question: What are some current examples of changes in environmental conditions that cause problems for plants and animals? The examples used in this lesson relate to recent and specific situations with which many students should be familiar, or which they can observe today. The purpose is to show that changes in environmental conditions may stem from natural causes or human actions, or a combination of these. Changed environmental conditions may cause the decrease in some populations of plants and animals, particularly those endemic to Hawai‘i, but can also bring about increases which are detrimental to the natural state of the ecosystem. One 45-minute period
How has technology affected our ability to study plant and animal species in Hawai‘i? How can information obtained through this technology be used to protect threatened and endangered species?	Science Standard 5: Life and Environmental Sciences: SC.4.5.3 Describe how different organisms need specific environmental conditions to survive. Science Standard 2: The Scientific Process: SC.4.2.1 Describe how the use of technology has influenced the economy, demography, and environment of Hawai‘i.	**Lesson 4: Guess Who?** Students investigate some of the technologies used to study and monitor marine wildlife, including devices that enable scientists to listen as well as see living animals and their behaviors. Other devices help in tracking their movements as they forage for food, migrate to other areas, and interact with each other as well as with their predators. Data obtained with these devices provide information on human activities that threaten animal survival. Students discuss how this information can be used to enact and enforce laws to protect marine animals.

ESSENTIAL QUESTIONS	HCPSIII BENCHMARKS*	LESSON, Brief Summary, Duration
How are threatened and endangered species in Hawai‘i unique?	Science Standard 5: Life and Environmental Sciences: SC.4.5.3 Describe how different organisms need specific environmental conditions to survive. Science Standard 3: Life and Environmental Sciences: SC.4.3.2 Describe how an organism's behavior is determined by its environment. Science Standard 2: The Scientific Process: SC.4.2.1 Describe how the use of technology has influenced the economy, demography, and environment of Hawai‘i.	**Culminating Lesson: Species in Jeopardy!** Students demonstrate their knowledge of threatened and endangered species in Hawai‘i by creating and playing a game to test their knowledge. One 45-minute period
Why should we care about these threatened and endangered species? How can we help?	Science Standard 5: Life and Environmental Sciences: SC.4.5.3 Describe how different organisms need specific environmental conditions to survive. Science Standard 3: Life and Environmental Sciences: SC.4.3.2 Describe how an organism's behavior is determined by its environment. Language Arts 6: Oral Communication: LA.4.6.2 Give short, informal presentations to inform or persuade.	**Extension Culminating Lesson: A Public Service Announcement** Students demonstrate their knowledge of threatened and endangered species in general, and in Hawai‘i, by creating a public service announcement that can be used for education of their peers (and parents). Three to four 45-minute period

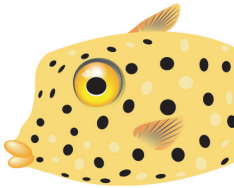
**HCPS III Benchmarks from the Hawai‘i Department of Education, from* Website: http://doe.k12.hi.us/standards/index.htm

Benchmark Rubric

I. HCPS III Benchmarks*

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

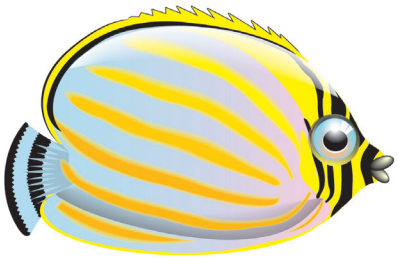
Topic		Scientific Knowledge	
Benchmark SC.4.1.2		Differentiate between an observation and an inference	
Rubric			
Advanced	Proficient	Partially Proficient	Novice
Explain the difference between an observation and an inference and give examples	Differentiate between an observation and an inference	Provide examples of observations and inferences	Define an observation and an inference
Topic		Science, Technology, and Society	
Benchmark SC.4.2.1		Describe how the use of technology has influenced the economy, demography, and environment of Hawai‘i	
Rubric			
Advanced	Proficient	Partially Proficient	Novice
Explain how the use of technology has influenced the economy, demography, and environment of Hawai‘i and suggest ways to conserve the environment	Describe how the use of technology has influenced the economy, demography, and environment of Hawai‘i	Give examples of how the use of technology has influenced the economy, demography, and environment of Hawai‘i	Recognize that the use of technology has influenced the economy, demography, and environment of Hawai‘i
Topic		Interdependence	
Benchmark SC.4.3.2		Describe how an organism’s behavior is determined by its environment	
Rubric			
Advanced	Proficient	Partially Proficient	Novice
Explain and give examples of how different organisms’ behaviors are determined by their environments	Describe how an organism’s behavior is determined by its environment	Identify a way that an organism’s behavior is influenced by its environment	Recognize that an organism’s behavior is influenced by its environment
Topic		Unity and Diversity	
Benchmark SC.4.5.3		Describe how different organisms need specific environmental conditions to survive	
Rubric			
Advanced	Proficient	Partially Proficient	Novice
Explain why different organisms need specific environmental conditions to survive	Describe how different organisms need specific environmental conditions to survive	List specific environmental conditions that organisms need to survive	Recall that organisms need specific environmental conditions to survive
Topic		World In Spatial Terms	

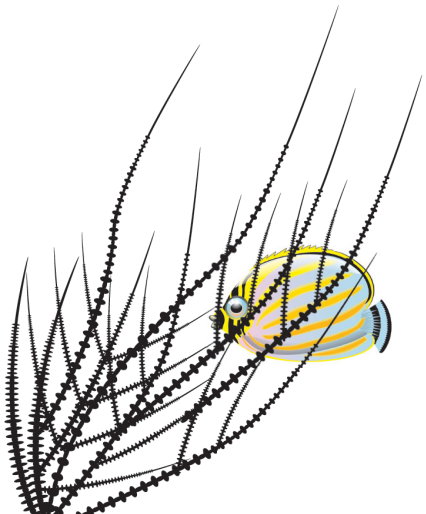


Benchmark SS.4.7.2		Collect, organize, and analyze data to interpret and construct geographic representations	
Rubric			
Advanced	Proficient	Partially Proficient	Novice
Collect, organize, and analyze data to interpret and construct geographic representations, with accuracy	Collect, organize, and analyze data to interpret and construct geographic representations, with no significant errors	Collect, organize, and analyze data to interpret and construct geographic representations, with a few significant errors	Collect, organize, and analyze data to interpret and construct geographic representations, with many significant errors

Topic		Vocabulary and Concept Development	
Benchmark LA.4.1.1		Use new grade-appropriate vocabulary, including homophones and homographs, learned through reading and word study, including root words, affixes, and word origins	
Rubric			
Advanced	Proficient	Partially Proficient	Novice
Use new grade-appropriate vocabulary, including homophones and homographs, with fluency, accuracy, and precision	Use new grade-appropriate vocabulary, including homophones and homographs, with no significant errors	Use new grade-appropriate vocabulary, including homophones and homographs, with difficulty and a few significant and/or many minor errors	Use new grade-appropriate vocabulary, including homophones and homographs, with great difficulty and many significant errors or rarely use new vocabulary

Topic		Constructing Meaning	
Benchmark LA.4.2.5		Summarize main points found in informational texts	
Rubric			
Advanced	Proficient	Partially Proficient	Novice
Summarize the main points and describe their connection to the main idea or focus in informational texts	Summarize the main points found in informational texts	Produce a summary that mixes insignificant points with main points	Summarize information not necessary to understanding the main points of informational texts, or repeat original text rather than summarize





Topic		Discussion and Presentation	
Benchmark LA.4.6.1		Participate in grade-appropriate oral group activities	
Rubric			
Advanced	Proficient	Partially Proficient	Novice
Participate in grade-appropriate oral group activities, in a highly effective way	Participate in grade-appropriate oral group activities	Participate in grade-appropriate oral group activities, in a limited way or in a way that only partially facilitates the group's work	Participate very little in grade-appropriate oral group activities or participate in a way that does not facilitate the group's work

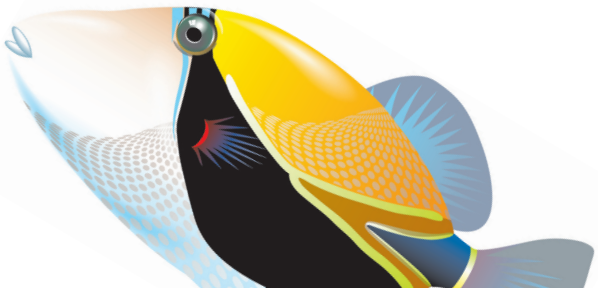
Topic		Discussion and Presentation	
Benchmark LA.4.6.2		Give short, informal presentations to inform or persuade	
Rubric			
Advanced	Proficient	Partially Proficient	Novice
Give creative, short, highly effective informal presentations to inform or persuade	Give short, informal presentations to inform or persuade	Give short, informal presentations that are somewhat informative or persuasive	Give short, informal presentations that do not inform or persuade

II. General Learner Outcomes*

A list of the Hawai'i Department of Education's General Learner Outcomes (GLOs) follows. Each Unit of the Lessons from the Sea Curriculum addresses the GLOs. Within some lessons, there is more specific mention of individual GLOs with specific pertinence.

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

**HCPS III Benchmarks and General Learner Outcomes,* from the Hawai'i Department of Education Website: http://doe.k12.hi.us/standards/index.htm .



Science Background for the Teacher

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

What are threatened and endangered species?[1] (Lesson 1)

According to the Endangered Species Act (ESA) of 1973, which is administered by the U.S. Fish and Wildlife Services and NOAA Fisheries, there are currently four categories used to describe the conservation status of a particular species: **extinct, endangered, threatened,** and **de-listed.** The categories are based on a combination of biological factors including rate of decline, **population size** and distribution, and area of **geographic distribution** or **range.** The ESA defines a threatened species as any species that is likely to become an endangered species within the foreseeable future throughout all, or a significant portion of its range. An endangered species is defined under the ESA as any species that is in danger of extinction throughout all, or a significant portion of its range. An extinct species is a species that no longer exists. According to these definitions, the ESA currently lists 1,175 animals and 747 plants as threatened or endangered within the United States and associated territories, and an additional 567 foreign plants and animals are included on the list. De-listed species are removed from the list because they have either gone extinct or have recovered, or in some cases, errors in the data originally used to list the species as threatened or endangered have misrepresented the species status. There are approximately 45 species that have been de-listed since the implementation of the ESA in 1973. Nine of these species have been de-listed due to extinction, 20 have been de-listed due to recovery (recovery levels are specific to each species), and the remainder were de-listed due to errors in the original data that was used for listing them. For additional information concerning the Federal list of threatened and endangered species, see http://www.fws.gov/endangered/wildlife.html#Species

At the international level, the International Union for the Conservation of Nature and Natural Resources (IUCN) is the world's foremost authority on threatened species. The IUCN works with nations around the globe to update the Red List of Threatened Species, a searchable database of the world's threatened species and their status, which is the most comprehensive inventory of the global conservation status of plant and animal species. There are currently 7,725 animals and 8,394 plants and lichens that are considered threatened by the IUCN. For details of how the IUCN categorizes threatened species, and for additional information concerning the Red List of Threatened Species, go to http://www.iucnredlist.org

Natural rates of extinction are approximately one to five species per year. However, modern extinction rates have increased more than 100 times, in large part as a result of human activity. Currently, the IUCN Red List documents 784 extinctions. Habitat loss and degradation are the leading causes, affecting 86% of all threatened birds, 86% of threatened mammals assessed, and 88% of threatened amphibians. Introduction of alien species is another threat caused by human activities, which can happen both deliberately and unintentionally, for example, by organisms *hitch-hiking* in containers, ships, cars, or soil. Over-exploitation of species for resource extraction, medicinal use, hunting, and fishing for food, and the exotic pet trade threatens many species. Pollution, disease prevalence, and human-induced climate change that can alter migratory patterns and cause coral reef bleaching are increasingly recognized as serious concerns.

List threatened and endangered marine animals found in Hawai'i.[2] (Lesson 2)

Hawai'i has more animals and plants on the ESA List of Threatened and Endangered Species than any other state in the U.S. To date, 56 animals and 273 plants are included, most of which are **terrestrial** birds and plants. Hawai'i's plants and animals are particularly susceptible because of the high numbers of endemic species in Hawai'i. The major factors affecting species at risk on the Hawaiian Islands include habitat loss due to human development and introduction of alien species. There are five endangered and four threatened **marine** animals in the Hawaiian Islands. A partial list of species at risk follows; additional information can be obtained at http://www.fws.gov/pacificislands/species.html

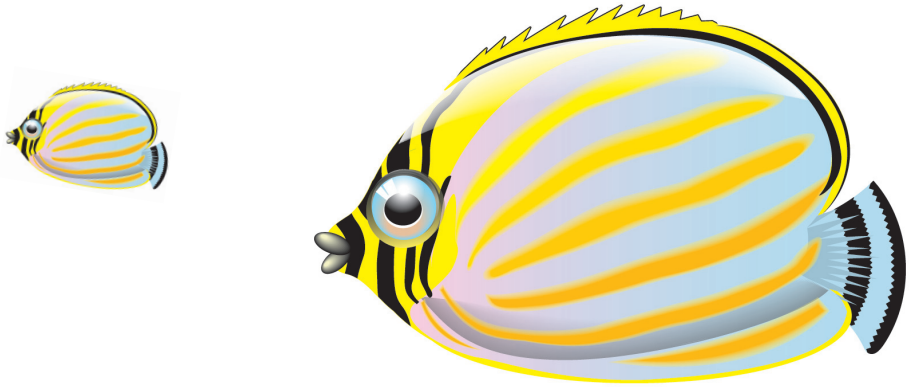
- **Hawaiian Dark-rumped Petrel** (*'Ua'u*) **Status: Endangered endemic:** Also known as the Hawaiian Petrel, it has a dark gray head, wings, and tail, and a white forehead and belly, and a stout grayish-black bill that is hooked at the tip, and pink and black feet. It has a wing span of one meter (3.28 feet) and is approximately 41 centimeters long (16 inches), and has a distinctive call during breeding season that sounds like *oo ah oo.* It spends most of its life on the open ocean feeding

on squid, fish, and crustaceans, and passes food on to chicks through regurgitation. Breeding season is from March–October, and breeding colonies were once **abundant** on all main Hawaiian islands except *Niʻihau*.

These birds nest in rock burrows 3 to 6 feet (1 to 2 meters) long, although some may be as long as 15 feet (5 meters), at elevations above 7,200 feet (2,194.56 meters), laying a single, white egg deep within the burrow. Today, the largest breeding colony is found at *Haleakalā Crater* on Maui. Threats to the petrel include predation by introduced mammals, development, ocean pollution, and disturbance of their breeding grounds. The petrels, like many Hawaiian endemic birds, possess no natural defenses against predators such as rats, feral cats, and mongooses, making their burrows very vulnerable to predation.

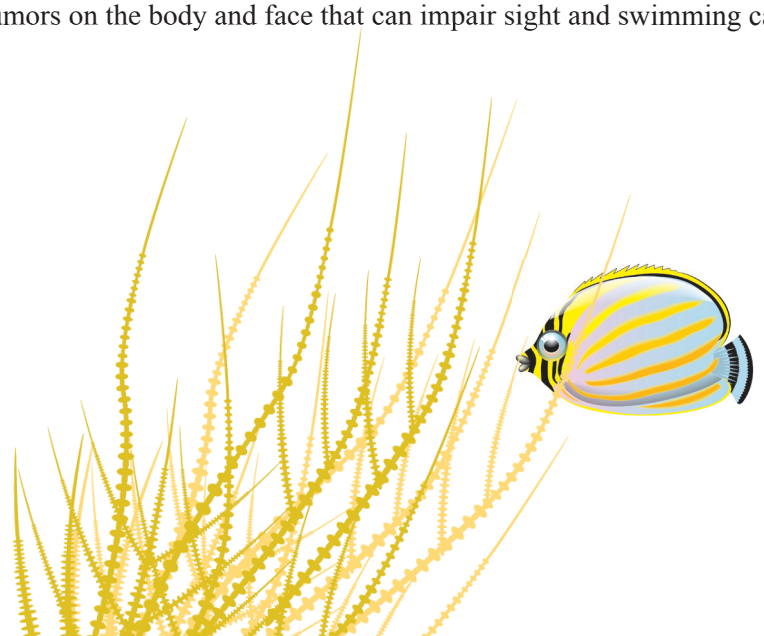
- **Hawaiian Stilt (*Aeʻo*) Status: Endangered endemic:** The Hawaiian Stilt is a slender wading bird that grows up to 41 centimeters (16 inches) in length, with a black back and white forehead, and underside with very long pink legs and long black bill. Stilts use a variety of aquatic habitats, having nesting sites adjacent to or on low islands within bodies of fresh, brackish, or salt water, and feeding along shallow bodies of water that provide a wide variety of invertebrates and other aquatic organisms. Stilts have a loud chirp that sounds like **kip kip kip.** Loss of wetland habitats and introduced predators reduced populations to a low of 1,000 individuals in the late 1940s. Inhabiting all major islands, except *Kahoʻolawe* and *Lānaʻi*, the population today has stabilized at 1,200 to 1,600 birds, with Maui and Oʻahu accounting for 60–70% of the population.

- **Newell's Shearwater (*ʻAʻo*) Status: Threatened endemic:** The Newell's Shearwater is a medium-sized shearwater approximately 30.48 centimeters (12 inches) long with a wingspan of 76 to 89 centimeters (30–35 inches). The *ʻAʻo* is black on the back and white underneath, and has a sharply hooked, black bill, with claws well-adapted for burrow excavation and climbing. The *ʻAʻo* spends most of its time offshore in the open ocean, and during their breeding season, from April through November, they live in burrows under ferns on forested mountain slopes. These burrows are revisited by the same pair of birds year after year. The *ʻAʻo* feeds on squid, and has been described as having loud and nasal calls resembling the braying of a donkey, or the call of a crow. Once abundant on all main Hawaiian Islands, today they only nest along mountainous terrain between 500 to 2,300 feet (152.4 to 701.4 meters) on *Kauaʻi*. The introduction of the mongoose, black rat, and Norway rat may have played a primary role in the reduction of ground nesting, and they were incorrectly reported as extinct in the 1930s. More recently, increasing urbanization has resulted in substantial problems for juvenile *ʻAʻo* during their first flight to the ocean from their nesting grounds. Attracted to manmade lights, fledglings become confused and may suffer temporary night blindness, often flying into utility wires, poles, trees, and buildings and falling to the ground. Between 1978 and 1981, more than 5,000 Newell's Shearwaters fell on *Kauaʻi's* highways, athletic fields, and hotel grounds.



- **Hawaiian Monk Seal (*ʻīlio holo i ka uaua*) Status: Endangered:** Adult monk seals are dark grey or brown, and can weigh from 180–270 kilograms (396 to 595 pounds), with a lifespan of approximately 25–30 years. The monk seal's common name is derived from its folds of skin that look like a monk's hood, and because it spends most of its time alone or in very small groups. Most Hawaiian monk seals live in the remote habitats of the Northwestern Hawaiian Islands as well as a small population that inhabit the main Hawaiian Islands. While it was long believed that monk seals utilize the reef to hunt for spiny lobsters, octopuses, eels, and various fishes, recent research has shown that these seals prefer to forage for fish along sandy, deep bottom habitats, and deep coral gardens, where light is limiting and fish have less hiding spaces then on the shallow reefs. The reduced hiding spaces for fish make it easier for seals to catch their prey. In the 1950s the population was estimated at approximately 3,000 individuals. Today, however, that number has plummeted to an alarming 1,300. The species has seen steady declines of 11% per year since 1989 and is the most endangered U.S. marine mammal. Threats to monk seals include marine debris, generally comprised of lost or abandoned fishing nets and line. Especially in the Northern Hawaiian Islands, where large amounts of lost or discarded fishing gear tend to accumulate, serious entanglement threats can cause strangulation, and/or starvation for adult seals. There are also many threats to monk seal pups, when the first two years of a seal's life are the most challenging for survival. After six weeks, a mother weans her pup, leaving it to forage for food on its own. Many of these pups are extremely vulnerable to starvation and predation during this period. Aggressive males can also crush pups; an estimated 10 pups a year are killed in this manner in the Northern Hawaiian Islands.

- **Green Sea Turtle (*Honu*) Status: Threatened:** The Green Sea Turtle is one of seven species of sea turtles found throughout the world. The term **green** refers to the color of the turtle's fat. An adult turtle can measure more than 1 meter (3.28 feet) in length, and weigh 100 kilograms (220 pounds). The turtle's **carapace,** or shell, is light to dark brown, with wavy or mottled markings of a darker color or dark brown blotches. In the Pacific United States (U.S.) and its territories, Green Sea Turtles are found along the coasts of Hawaiʻi, American Samoa, Guam, the Commonwealth of the Northern Mariana Islands (CNMI), unincorporated U.S. island possessions, and a small resident group in San Diego Bay, California. They graze in pastures of sea grasses or algae, but may also feed over coral reefs and rocky bottoms. In the Hawaiian population, nesting occurs throughout the archipelago, but more than 90% of the turtle population nests at the French Frigate Shoals in the Northwestern Hawaiian Islands. Approximately 200–700 females are estimated to nest annually. The turtles and their eggs were once a food source for native Pacific Islanders, providing a nutritious and tasty alternative to the more common food sources, such as fish, birds, shellfish, coconuts, breadfruit, and taro. The utilization of Green Sea Turtles for food and other purposes was often under strict control, usually from some form of island council or tribal chief. Religious, ceremonial, and other traditional restrictions on the capture, killing, distribution, and consumption of Green Sea Turtles played an important role in their utilization. For example, in the Hawaiian Islands there were families that considered the Green Sea Turtle to be a personal family deity or *aumakua.* Over-harvesting of turtles and eggs by humans caused major declines in the population until they were protected from harvest in the 1970s. Recent threats include habitat loss, capture in fishing nets, boat collisions, marine debris entanglement, and a debilitating disease, *fibropapilloma,* that causes tumors on the body and face that can impair sight and swimming capabilities.



- **Humpback Whale (*Koholā*) Status: Endangered:** North Pacific humpbacks spend summer months feeding on plankton in temperate waters from Alaska to central California. During winter, November–May, a majority of the North Pacific population (approximately 60%) come to the warm waters of Hawai‘i to mate, calve, and nurse their young. The other part of the population (approximately 40%) travel to the coast of Baja California, Mexico, and throughout the southern islands of Japan to do the same. Humpbacks can attain speeds of up to 20 mph (32.1868 kilometers) for brief periods, but average 2 to 4 mph (3.219 to 6.437 kilometers) during migration. Satellite tagging and sightings of individual whales have recorded migration journeys to take 30 to 39 days or less to travel the 2,500 miles (4,023.36 kilometers) between the feeding and breeding areas in Alaska and Hawai‘i, using currents, temperature changes, and even the Earth's magnetic field to navigate across the Pacific Ocean. In the early 1900s, commercial whaling severely decreased the population of humpback whales in the North Pacific. Humpback whales received protection from the ESA, and in the 1980s commercial whaling of the Humpbacks was banned. As a result of these protective measures, the current population of North Pacific humpback whales is estimated as 11,000–14,000 today. In 1997, NOAA established the Hawaiian Islands Humpback Whales National Marine Sanctuary to increase protection of humpback populations migrating to the islands. Recent threats include marine debris, pollution (including underwater noise pollution), destructive fishing practices, illegal whaling, collisions with ships, and loss of habitat.

What is being done to protect threatened and endangered species? [3]

(Lessons 2, 4 and Culminating)

Endangered Species Act Background

In the United States, the Endangered Species Act (ESA) of 1973, widely regarded as the world's strongest and most effective wildlife conservation law, was put forth by Congress in an effort to reverse the alarming trend of human-caused extinctions that threaten ecosystems nationwide. The ESA sets forth a strong scientific basis for decisions on endangered species, facilitates large-scale planning to accommodate land use and wildlife habitat, and promotes innovative public/private partnerships. In 1975, the United States aligned the ESA to include provisions set forth by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) to limit and monitor the trade, poaching, and exploitation of endangered and threatened wildlife (for example the illegal trade of ivory) around the world. For a timeline of our nation's history of environmental conservation, see http://www.fws.gov/endangered/esasum.html
For additional information on CITES, see http://www.cites.org/eng/disc/what.shtml

Critical Habitat
The ESA also provides for the designation of **critical habitat,** specific geographic areas essential for conservation of threatened or endangered species. Besides the Fish and Wildlife Service, several other governmental entities including NOAA, Environmental Protection Agency (EPA), and certain branches of the military, are responsible for preserving the habitat that endangered or threatened species utilize. These agencies often work in collaboration with non-governmental and not-for-profit organizations such as the Sierra Club, Natural Resources Defense Council, and Environmental Defense, public and private universities, and even private landowners whose land contains vital habitat for certain endangered species.

Recovery Plans
Species under different threats require individualized approaches to protection. For example, for both the *‘A‘o* (Newell's Shearwater) and the *‘Ua‘u* (Hawaiian Petrel), predator control in key habitat areas is vital to protecting nesting sites from alien species. Bird Salvage–Aid Stations for Shearwater recovery, nest translocation, and light attraction studies have been established to help save these endemic Hawaiian birds. Outreach to *Kaua‘i's* local community has resulted in people picking up and bringing the *‘A‘o* to aid stations for care and release, giving the seabirds a chance to live. The *‘A‘o* was listed as a threatened species by the Fish and Wildlife Service in 1975. The *‘Ua‘u* was listed as an endangered species in 1967. The recovery plan for both birds was established in 1983, and a report released in 2003 on the population status of both birds revealed that the *‘A‘o* colony on *Kaua‘i* has declined, while visits from the *‘Ua‘u* to Kaua‘i were increasing.

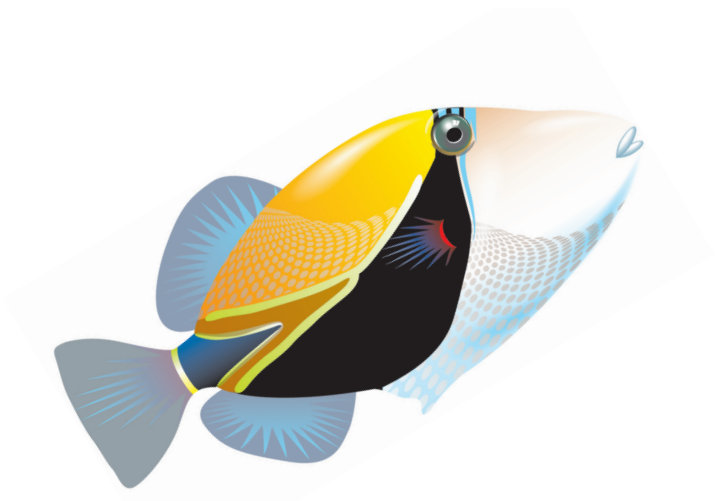
In Hawai‘i, conservation efforts to protect the Hawaiian monk seal have resulted in research that includes monitoring monk seal reproduction, survival techniques, and behavior. In the main Hawaiian Islands, volunteer groups routinely remove marine debris from the ocean and beaches. In remote areas, NOAA, the U.S. Coast Guard, and the U.S. Navy lend a helping hand in removing more than 14 tons of marine debris per year from the Northwestern Hawaiian Islands. The Hawaiian monk seal was listed as an endangered species in 1976 under the ESA, and critical habitat was designated in 1988, which includes the area from beaches to a depth of 20 fathoms (120 feet) around the Northwestern Hawaiian Islands.

Green Sea Turtles are listed as threatened under the ESA throughout all areas under U.S. jurisdiction. Inclusion of Green Sea Turtles under CITES has made it illegal to trade any products made from this species in the U.S. and 130 other countries. The final **recovery plan,** or guide for activities to be undertaken by Federal, State, or private entities in helping to recover and conserve endangered or threatened species for Green Sea Turtles, were recently completed by the NOAA Fisheries, and serve as guidance for actions to recover this threatened species.

Describe the uses and methods of satellite data that are tracking threatened and endangered species and what biologists, naturalists, and conservationists are hoping to learn. [4] (Lesson 4)

Data collected through **satellite** tracking, also called **satellite telemetry,** helps us understand and protect the endangered and threatened species of the world. A wildlife-tracking satellite is a useful tool for biologists, naturalists, and conservationists working with animals, birds, and fish in their natural environments. Scientists attach tiny **transmitters** to wild animals, tracking their radio signals with **receivers** nearby. With the use of satellites, scientists can track wildlife ranging over much wider areas. A receiver in an orbiting space satellite can detect a transmitter attached to an animal and repeat its signal down to trackers on the ground. Information collected is impressed on a signal sent from the transmitter up to a special section of a NOAA weather satellite called ARGOS, orbiting far above Earth. A signal sent up to a satellite is an **uplink.** A signal sent down from a satellite to a ground station is a **downlink.** At the end of the transmission link, the data downlinks to wildlife researchers, revealing movements and positions of organisms under study.

Several other kinds of information may be sent up to the satellite depending on the purpose of the radio transmitter. For example, the data might include the local temperature, record activity patterns, or physical characteristics, depending on the type of transmitter used.

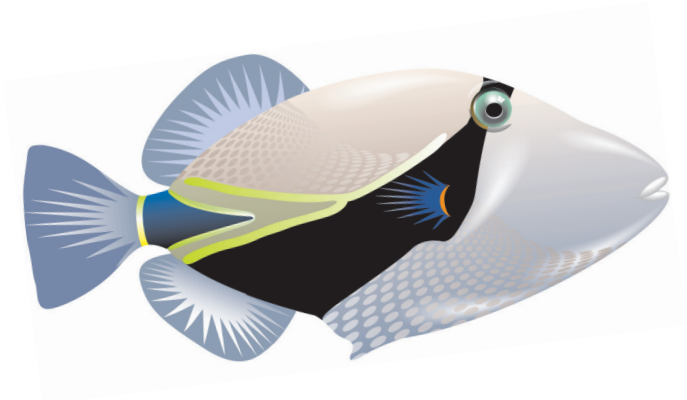


Sea turtles, seals, otters, whales, tuna, and sharks have been tagged with satellite transmitters over the years to obtain information vital to their protection. Our ability to conserve and help endangered and threatened species on their road to recovery relies heavily on answering natural history questions about migratory breeding and nesting patterns, feeding habits and home ranges. Our ability, however, to track these animals through short-range techniques is very limited.
Many of these species travel long distances between breeding and feeding grounds, and information is gathered to track their **migration** patterns and movements. Following are some active research programs that use satellite-tracking technology:

- The NOAA Fisheries Laboratory in Honolulu has been tracking the migratory routes Hawaiian Green Sea Turtles take by using radio transmitters back-packed onto adults to learn about their migratory pathways in the open ocean. This information is critical to helping NOAA understand the habitat of turtles in the open ocean and to find ways of avoiding incidental catches of sea turtles in fishing gear. This data was combined with oceanographic data to discover foraging habitat used by turtles on their migratory routes to and from nesting and foraging sites around the North West Hawaiian Islands (NWHI) and Main Hawaiian Islands (MHI). For additional information, see http://www.turtles.org/hawgrnd.htm

- Many species of whales are tagged to track their migration patterns and movements from their breeding grounds to their feeding grounds. To follow up on the migration patterns of 12 different tagged whales per year on their annual journey, go to http://whale.wheelock.edu/whalenet-stuff/stop.html.
- Seven monk seal pups, as part of the Captive Care and Release Project administered by scientists from NOAA, have been tagged and released to monitor their movements, behavior, and survival in the wild. Monk seals are in drastic decline and the pups, once weaned from their mothers, are thought to only have a one in five chance of surviving to age seven. For additional information about this program, visit http://www.pifsc.noaa.gov/psd/captivecareproject.php

- The endangered Atlantic blue-fin tuna has almost been fished out of existence. Tagging of these large pelagic predators revealed that populations in the North Atlantic and Mediterranean breed separately, but share feeding grounds. This information is vital to managing what is left of the fishery. For additional information on the tagging of tuna, as well as other pelagic fish, go to http://www.toppcensus.org/Default.aspx



Science Background for the Teacher Glossary

alien species: species that occur outside their natural range and often threaten the existence of native plants and animals; sometimes also referred to as a non-native species, or an invasive species.
biodiversity: the variety of life and its processes, including the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur.
carapace: the shell of a turtle or tortoise, or the dorsal (back) portion of an exoskeleton.
critical habitat: specific geographic areas, whether occupied by a listed species or not, that are essential for its conservation and that have been formally designated by rule.
delisted: to remove an animal or plant species from the list of endangered and threatened wildlife and plants.
downlink: link that transmits information from a satellite to a ground station.
endangered species: an animal or plant species in danger of extinction throughout all, or a significant portion of its range.
endemic species: a species native and confined to a certain region; generally used for species with comparatively restricted distribution.
extinct species: a species that no longer exists; for the U.S. Endangered Species Act, a species currently believed to be extinct.
geographic distribution: the geographical range of a species.
marine: related to, or living in the ocean, as opposed to freshwater or on land.
migration: the periodic movement of a group of species from one region to the other.
population size: the number of individuals in a population.
range: the geographic area a species is known, or believed, to occupy.
receiver: electronic device that converts a signal from a transmitter into useful information, such as migratory patterns, or air or water temperature.
recovery plan: a document drafted by the U.S. Fish and Wildlife Service, NOAA Fisheries, or other knowledgeable individuals or groups, that serves as a guide for activities to be undertaken by Federal, State, or private entities in helping to recover and conserve endangered or threatened species.
satellite: any object that orbits around another object.
satellite telemetry: technology that allows remote measurements and reporting of those measurements into useful data.
species: for purposes of the U.S. Endangered Species Act, this term includes any species or subspecies of fish or wildlife or plants, and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature. This is different from the biological definition of a species: a group of individuals that can interbreed with each other to produce fertile offspring.
terrestrial: related to, or living on land, as opposed to in water.
threatened: an animal or plant species likely to become endangered within the foreseeable future throughout all, or a significant portion of its range.
transmitter: electronic device that releases a signal to a receiver.
uplink: transmission of a signal from a ground station, such as a transmitter on an animal, to a satellite.

Science Background for the Teacher- Bibliography

1-4 Science background information condensed and/or compiled from the following sources:

1: IUCN, (2007) *Facts about threatened species* Retrieved April 25, 2007, from http://www.iucn.org/themes/ssc/redlist2006/threatened_species_facts.htm

IUCN, (2007) *Species Survival Commission* Retrieved April 25, 2007, from http://www.iucn.org/themes/ssc/index.htm

NOAA, (2007) *Species under the endangered species act* Retrieved April 25, 2007, from http://www.nmfs.noaa.gov/pr/species/esa/

U.S Fish and Wildlife Service, (March 23, 2007) *Species information threatened and endangered animals and plants* Retrieved April 30, 2007, from http://www.fws.gov/endangered/wildlife.html#Species

2: U.S Fish and Wildlife Service, (March 8, 2007) *Pacific islands threatened and endangered species* Retrieved April 25, 2007, from http://www.fws.gov/pacificislands/wesa/endspindex.html

NOAA, (April 6, 2007) *Captive Care and Release Project Seeks to Aid Recovery of the Endangered Hawaiian Monk Seal* Retrieved April 30, 2007, from http://www.pifsc.noaa.gov/psd/captivecareproject.php

NOAA, (2007) *Species under the endangered species act* Retrieved April 25, 2007, from http://www.nmfs.noaa.gov/pr/species/esa/

3: U.S Fish and Wildlife Service, (March 23, 2007) *Species information threatened and endangered animals and plants* Retrieved April 30, 2007, from http://www.fws.gov/endangered/wildlife.html#Species

CITES (2007). What is CITES? Retrieved on April 25, 2007, from, http://www.cites.org/eng/disc/what.shtml

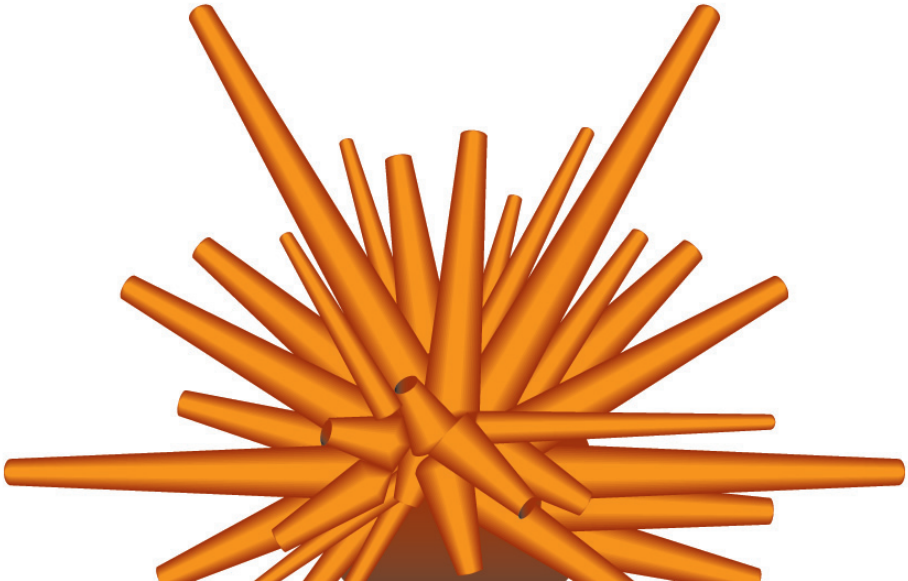
4: Curtis, A. R. (2007) Satellite tracking endangered birds and animals. In Space Today Online. Retrieved April 25, 2007, from http://www.spacetoday.org/Satellites/Tracking/SatTracking.html

NOAA, (April 6, 2007) *Captive Care and Release Project Seeks to Aid Recovery of the Endangered Hawaiian Monk Seal* Retrieved April 30, 2007, from http://www.pifsc.noaa.gov/psd/captivecareproject.php#monkseal

Turtles.org. (2001). The Hawaiian green turtle. Retrieved on April 25, 2007, from, http://www.turtles.org/hawgrnd.htm

Williamson, M. (2004). WhaleNets Satellite Tagging Observation Program (STOP). Retrieved on April 25, 2007, from, http://whale.wheelock.edu/whalenet-stuff/stop.html

Tagging Of Pacific Predators (TOPP). (2007). TOPP home page. Retrieved on April 25, 2007, from, http://topp.org/



NOAA Resources

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

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

Resources:

- **Ocean Service Discovery Kit on "Corals" (developed for grades 9–12, but can be adapted) http://oceanservice.noaa.gov/education/kits/corals/supp_coral_lessons.html**
- **NWHI lesson "Honu Survivor" for grades 3-6 http://www.Hawaiiatolls.org/teachers/lesson_gst_biology.php**
- **NOAA Fisheries "The Kid's Times" found at http://www.nmfs.noaa.gov/pr/education/turtles.htm and http://www.nmfs.noaa.gov/pr/education/whales.htm**
- **Discover NOAA Protected Resources in the Pacific Islands**
  - **http://www.fpir.noaa.gov/PRD/prd_index.html**
- **Learn about NOAA efforts to protect various species:**
  - **Monk Seal http://www.fpir.noaa.gov/PRD/prd_Hawaiian_monk_seal.html**
  - **Spinner Dolphins http://www.fpir.noaa.gov/PRD/prd_spinner.html**
  - **Green Turtles http://www.fpir.noaa.gov/PRD/prd_green_sea_turtle.html**
  - **Hawksbill Turtles http://www.fpir.noaa.gov/PRD/prd_hawksbill.html**
- **Critical habitat for threatened and endangered species http://www.fpir.noaa.gov/PRD/prd_critical_habitat.html**

OCEAN LITERACY ESSENTIAL PRINCIPLES

5. The ocean supports a great diversity of life and ecosystems.
   5d. Ocean biology provides many unique examples of life cycles, adaptations and important relationships among organisms (symbiosis, predator-prey dynamics and energy transfer) that do not occur on land.
   5e. The ocean is three-dimensional, offering vast living space and diverse habitats from the surface through the water column to the seafloor. Most of the living space on Earth is in the ocean.
   5f. Ocean habitats are defined by environmental factors. Due to interactions of abiotic factors such as salinity, temperature, oxygen, pH, light, nutrients, pressure, substrate and circulation, ocean life is not evenly distributed temporally or spatially, i.e. it is "patchy." Some regions of the ocean support more diverse and abundant life than anywhere on Earth, while much of the ocean is considered a desert.

6. The ocean and humans are inextricably interconnected.
   6e. Humans affect the ocean in a variety of ways. Laws, regulations and resource management affect what is taken out and put into the ocean. Human development and activity leads to pollution (point source, non-point source, and noise pollution) and physical modifications (changes to beaches, shores and rivers). In addition, humans have removed most of the large vertebrates from the ocean.
   6g. Everyone is responsible for caring for the ocean. The ocean sustains life on Earth and humans must live in ways that sustain the ocean. Individual and collective actions are needed to effectively manage ocean resources for all.

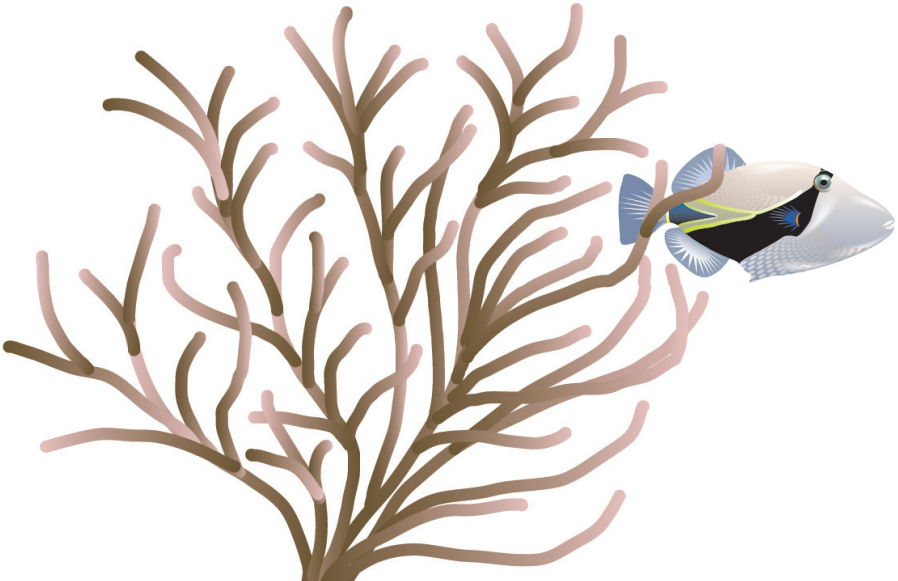
7. The ocean is largely unexplored.
   7d. New technologies, sensors and tools are expanding our ability to explore the ocean. Ocean scientists are relying more and more on satellites, drifters, buoys, subsea observatories and unmanned submersibles.

Lesson 1: 6e.
Lesson 2: 5d. 5e. 5f. 6e.
Lesson 3: 5f. 6e. 6g.
Lesson 4: 7d.
Culminating: 5d. 5e. 5f. 6e. 6g. 7d.

CLIMATE LITERACY ESSENTIAL PRINCIPLES

3. Life on Earth depends on, is shaped by, and affects climate.
   3a. Individual organisms survive within specific ranges of temperature, precipitation, humidity, and sunlight. Organisms exposed to climate conditions outside their normal range must adapt or migrate, or they will perish.
   3c. Changes in climate conditions can affect the health and function of ecosystems and the survival of entire species. The distribution patterns of fossils show evidence of gradual as well as abrupt extinctions related to climate change in the past.

Lesson 1: 3a. 3c
Lesson 2: 3a.
Lesson 3: 3a. 3c.
Culminating: 3a. 3c.



Glossary of Cooperative Learning Techniques

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

What is Cooperative Learning?

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

Jigsaw

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

Think-Pair-Share

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

Numbered Heads

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

KWL Chart

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

KWL CHART

Be sure to bullet your list.

Use content words only (nouns, verbs, names of people and places, dates, numbers, etc.).

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

Role Cards

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

Example of role cards:

Role Card #1

Facilitator:

Makes certain that everyone contributes and keeps the group

Role Card #2

Recorder:

Keeps notes on important thoughts expressed in the group. Writes

Role Card #3

Reporter:

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

Role Card #4

Materials Manager:

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

Role Card #5

Time Keeper:

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

Role Card #6

Checker:

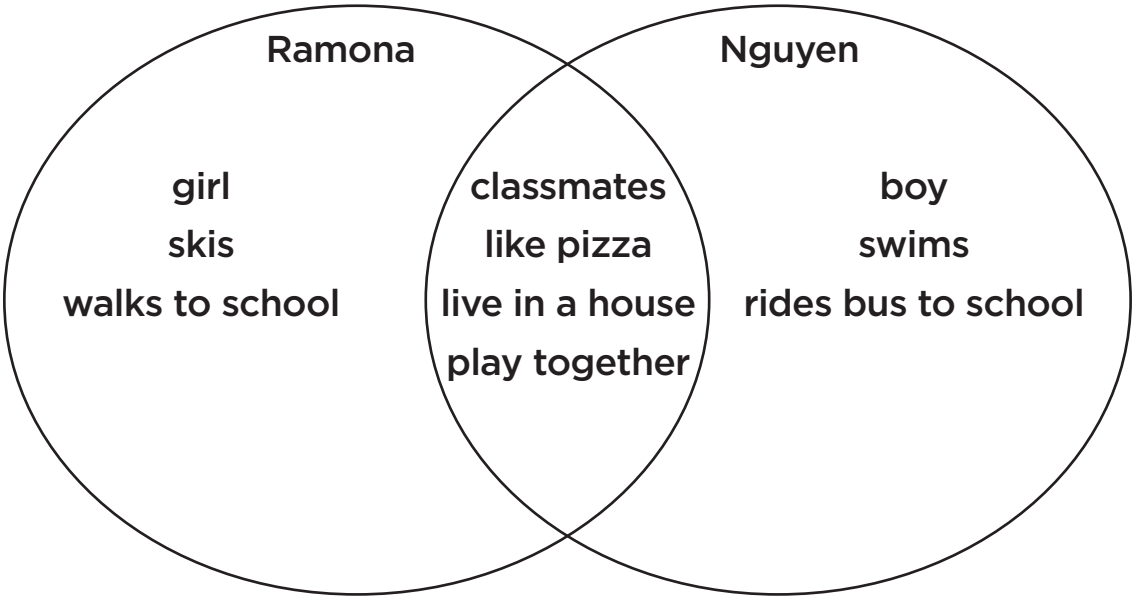
Checks for accuracy and clarity of thinking during discussions. May also check written work and keeps track of group point scores.

Round Table

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

Three-Step Interview

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

Venn Diagram

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