

Hawaiian Islands Humpback Whale National Marine Sanctuary



Photo: R. Finn/NOAA, under NOAA permit #15240

Grade Level

6-8

Timeframe

Two 45 Minute Sessions

Materials

Teacher Use: Computer, projector, and screen

Student computer access (1:1 or 1:2)

Student science journals or notebooks

Digital Materials (links provided):

- 360° Hawaii Experience
- HIHWNMS Map
- Diving Molokini Center
- Humpback Whale
- Phytoplankton
- Zooplankton
- Krill

Print Materials:

- Species Exploration Document
- Activity Rubric



Photo: Ocean First Education

Activity Summary

Students will explore the ecology of one of three different species in Hawaiian Islands Humpback Whale National Marine Sanctuary (HIHWNMS). They will also explore conservation measures in place for their species protection.

Students will produce a tri-fold brochure meant to teach visitors of the sanctuary about the ecology of their assigned species and its importance to Native Hawaiian culture.

Learning Objectives

Students will be able to:

- Describe the habitat of their assigned species, the adaptations it has to thrive in that habitat, and its role in the ecosystem
- Explain how the International Union for the Conservation of Nature (IUCN) classifies species for conservation and explain the conservation status of their assigned species as well as conservation measures undertaken to protect it
- Describe a food web and give an example of one that would exist in HIHWNMS
- Explain the three types of symbiotic relationships and give an example of each from HIHWNMS
- **Explain and discuss their species' cultural significance to Native Hawaiians**

Background Information

Hawaiian Islands Humpback Whale National Marine Sanctuary

Hawaiian Islands Humpback Whale National Marine Sanctuary was created by Congress in 1992 to protect humpback whales and their



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Key Words

adaptations, baleen, ecology, ecosystem, fitness, food web, krill, nekton, phytoplankton, population, species, zooplankton

habitat in Hawai'i. The sanctuary is located from the shoreline to the 100-fathom isobath (600 ft. depth) in the four-island area of Maui; Penguin Bank; and off the north shore of Kaua'i, the north and south shores of O'ahu, and the north Kona and Kohala coast of Hawai'i Island. A variety of charismatic and culturally significant marine life from humpback whales to green sea turtles migrate through this extraordinary habitat.

Role of Humpback Whales

The humpback whale, or koholā, was a part of ancient Hawaiian culture as evidenced by their appearance in various chants describing their role in the creation of Earth as well as men and women, and the unification of the Hawaiian islands. Whales were considered messengers of the god Kanaloa, one of the four main gods of ancient Hawaiian culture.

There are several locations around Hawai'i named after whales; of note, there is the nearly 3,500-foot peak named Kapalaoa, or The Whale, and the **waterfall called Koholālele, or Leaping Whale,** which are both on Kaua'i. On the big island, **Pu'ukoholā Heiau, or Whale Hill, is a monument** built in 1791 by Kamehameha, the founder and **first ruler of the Kingdom of Hawai'i.** Today, Whale Hill is a part of Hawaiian Islands Humpback Whale National Marine Sanctuary.

Humpback whales migrate to Hawai'i in the winter to mate, give birth, and nurse their young. No feeding is done during this time as the primary goal is reproduction or caring for young. The **average whale season in Hawai'i lasts for six** months; however, some individuals stay for as little as a couple of weeks, while others can be observed for several months. Humpback whales seem to prefer breeding areas that are warm and

shallow with flat seabeds near deep water. This is **part of what makes Hawai'i** the ideal location.

Humpback whales are carnivores and filter-feed on small crustaceans (mostly krill) and small fishes, consuming up to 3,000 pounds of food per day.

The whales only eat while in Alaska; Hawai'i does not offer a food source for them. This massive consumption of food results in a significant amount of feces. Whale feces is important because it transports nutrients, such as phosphorus, iron, and carbon to the surface, where it acts as a fertilizer for phytoplankton, the basis of most marine food webs. Given their size, humpback whales have few predators as adults; however, newborn calves and juvenile whales can be predated on by killer whales and white sharks. When whales die, often their carcass falls to the ocean floor and becomes its own localized, yet temporary, ecosystem for a variety of scavengers such as giant isopods, hagfish, various shrimp, and lobsters, as well as sleeper sharks. Known as a whale fall, the soft tissues are generally consumed in a matter of months, but the remaining skeleton can support diverse communities for years, or even decades. The bones are colonized by various invertebrate species and, as they break down, are an important source of organic compounds.

Like other large whales, humpbacks were targeted by the whaling industry. Once hunted to the brink of extinction, their population fell by an estimated 90% before the International Whaling Commission imposed a moratorium on whaling in 1966. While their populations have partially rebounded, entanglement in fishing gear, collisions with ships, and noise pollution continue to negatively affect the species. Currently, some humpback whale populations have been moved to a species of least concern on the Endangered Species List as well as the IUNC Red List, while other populations are still considered Endangered.

Role of Green Sea Turtles

The green turtle, or honu, in Hawaiian culture symbolizes a navigator that can find his way home

time after time. Honu is the navigator, the link between man, the land, and the sea. Ancient Hawaiian legends are filled with stories of the green sea turtles, including the story of Kauila, the turtle who could change into a girl to watch over **the children playing at Punalu'u Beach on the Big Island**. The green sea turtle is also represented by **petroglyphs on the Big Island's Pu'u Loa lava fields**. For some, green turtles were considered to **be the property of the ali'i, or chiefs, and were sometimes raised in fishponds as a type of livestock**. Some individuals or families did not take or consume honu, as they believed the turtles to be **family deities, or aumākua, and were worshipped and cared for**.

The green sea turtle is the most common species of sea turtle in Hawaii. Green sea turtles are one of the largest hard-shelled marine species (the loggerhead is about the same size; only the leatherback is larger, but does not have a hard shell).

The species is named after the color of its fat, which is tinted green by its herbivorous adult diet. Green turtles are important in maintaining healthy reefs and seagrass meadows. Green turtles crop the younger ends of seagrasses and seaweeds and, ultimately, the plants tend to stay healthy. There is little opportunity for other organisms to attach to the plants, shade them, or for diseases to establish when the blades of seagrass are constantly regrowing. Furthermore, because the turtles produce waste that is high in nitrogen and phosphorous compounds, they fertilize their feeding grounds. By feeding in one place, then moving to another, green turtles often move nutrients to the reefs or other ecological communities as they move about.

In the 20th century, the green sea turtle population declined so much that it was placed on



Photo: Claire Fackler/NOAA



Photo: Ed Lyman/NOAA

the Endangered Species List in 1978 where it remains today. It is also recognized as endangered by the IUCN Red List. In recent years, due to major conservation efforts, the green sea turtle population has rebounded in various locations. **Studies estimate that Hawai'i now has as many as 35,000 mature green sea turtles and a thriving juvenile population**. Today, all sea turtle species in **Hawai'i are protected under the federal Endangered Species Act as well as Hawai'i state law**. It is prohibited to hunt, handle, injure, or harass green sea turtles.

Role of White Tip Reef Sharks

The early Hawaiian culture viewed sharks as vessels that housed the family god or deified **ancestors called 'aumākua**. **As the spirit of the family member could appear at any time in the form of a shark**, families who had the shark as **their 'aumākua would not hunt or eat sharks**. Instead, believing that their departed ancestors took the form of the shark, these families would feed and protect sharks. In return, it was believed that the shark would protect their family. Known **as manō lālākea, white tip reef sharks are relatively small animals and were considered non-threatening to ancient Hawaiians**. Historically, as sharks that did attack humans were not eaten, these non-threatening species were viable food options. Their meat was often dried, while their skins were used for drums and their teeth for cutting edges of knives.

It is interesting to note, out of respect for the **sharks of Hawai'i, the Maui Ocean Center conducts a welcoming protocol for sharks under the aquarium's care**. **Every shark that enters the center is met by the aquarium's cultural advisor who asks the shark for guidance, permission to be there, forgiveness if any unintentional harm is caused,**

Vocabulary

Adaptation - An evolved trait which increases an organism's fitness.

Ecology - A branch of biology that studies how organisms interact with other organisms in their environment and the environment itself.

Ecosystem - A system of interactions between a community of organisms and their environment.

Food web - A visual representation of how energy is transferred in an ecosystem, made up of many interdependent food chains.

Mutualism - A symbiotic relationship in which both species benefit.

Nekton - Aquatic animals able to swim and move independently of aquatic currents.

Phytoplankton - The microscopic marine algae that float in water currents; they are the basis of most marine food webs.

Population - The number of organisms of the same species that live in a particular geographic area at the same time.

Zooplankton - The small animals that spend all or part of their lifecycle drifting on water currents.

and to educate visitors about sharks while also engendering respect for animals like it. A similar protocol is held when the shark is returned to the sea.

As an apex predator, sharks are the wolves of the sea, removing the sick, injured, diseased, and deceased animals, keeping the ocean clean, and marine life populations healthy. While sharks are highly effective predators, they are also scavengers readily consuming the weak and dead. Sharks are a vital part of marine ecosystems. They play a major role in structuring marine communities directly when they consume prey, but also indirectly when they are absent. The removal of sharks may alter the prey species composition or shift the preferred prey of another predator in that ecosystem. With fewer sharks in an ecosystem, the mesopredator species increase in population feeding on the smaller, mainly herbivorous fishes that keep algae populations in check.

As algae becomes overgrown, it can outcompete coral (for example) for space in the sun, leading to the degradation of the entire reef ecosystem.

White tip reef sharks, are described as near threatened by the IUCN Red List, and are not listed on the U.S. list of endangered species, it has been suggested that their numbers are dwindling due to increasing levels of unregulated fishing activity. Like most sharks, white tip reef sharks are K-selected species in that they are slow to reproduce, and when they do, only produce a small number of offspring at a time. The slow reproductive rate and limited habitat preferences, almost exclusively within coral reef habitats with a

preference for very clear water, make this species vulnerable to overfishing.

Preparation

1. Download or open links to all digital materials
2. Prepare teacher and student devices (e.g., laptop, computer/projector, handhelds, VR sets, etc.)
3. Preview digital and print materials
4. Print and copy the Species Exploration document (one per student)

Procedure

Part 1 - Exploring Hawaiian Islands
Humpback Whale National Marine
Sanctuary (HIHWNMS)

Time: 25 minutes

1. Project [Explore the Blue: 360° Hawaiian Experience video](#) on screen. Demonstrate how to “look around”: **up, down, left, right**. Explain to students that they should imagine



Photo: Ocean First Education



Photo: A. Debich/NOAA Permit#15240

that they are going scuba diving in HIHWNMS. Display a [map of the sanctuary](#) and explain that the sanctuary was created in 1992 to protect humpback whales and their habitat in Hawaiian waters. Explain that it is common practice for divers to record a summary of their dive in dive log. Explain to students that they will be tasked with writing a 5-7 sentence narrative that describes their dive in HIHWNMS.

2. Give students time to watch and explore *Explore the Blue: 360° Hawaiian Experience* video. Encourage them to pause **the video and “look around.”**
3. Give students time to write the narrative for **their “dive log” in their science notebooks or journals.**
4. Watch the NOAA Sanctuaries [video Diving Molokini Crater](#). Explain Molokini Crater is within HIHWNMS and is the type of habitat in which one might find green sea turtles, white tip reef sharks, and migrating humpback whales.
5. On the board, draw a basic food chain that includes the following components: sun, [seagrass](#), [phytoplankton](#), [zooplankton](#), and fish. Ask students to infer which organisms from the video (whale, turtle, shark) might feed on each link in the food chain and discuss their inferences.

Part 2 – Species Exploration

Time: 20 minutes

1. Distribute Species Exploration document to students. Assign each student one of the following species to explore: green sea turtle, whitetip reef shark, or humpback whale. Review directions and expectations. Circulate to answer clarifying questions as students work.

Part 3 – Species Exploration

Time: 20 minutes

1. Have students use Google Docs (or paper) to create a template for their brochure. Students should change the page layout to landscape and insert a table with one row and three columns. Their brochure should be two pages and have a total of six columns. Each column should correspond to one topic from their Species Exploration Document. The sixth column should include general information about HIHWNMS. Each section should include a picture that informs about the topic with a citation and a caption.
2. Circulate to answer clarifying questions as students work. Students can submit brochures electronically or print them to be displayed in the classroom,
3. If time permits or as an extension, have students combine by species. You may want to have multiple groups per species (no larger than groups of four). Have each group review **others’ brochures and decide on the five main points** they would like to share about their species with the rest of the class. Using Google Slides (or similar), have the group create one slide that summarizes their information. The slide should have a picture with a caption. Print the slides and display them around the room. Then, have students participate in a **“Gallery Walk.” Each student** must visit at least two slides, one for each organism that they did not research, and be prepared to report one thing they learned. **Lastly, do a “Whip Around” where** each student is expected to share one piece of new information.

Education Standards

Next Generation Science Standards	Supports NGSS Performance Expectation MS-LS2-4. Construct and argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect the population. Science and Engineering Practices: • Analyzing and Interpreting Data Crosscutting Concepts: • Cause and Effect • Stability and Change
Common Core State Standards	Language Arts: • Integration of Knowledge and Ideas: o CCSS.ELA-Literacy.RST.6-8.7 o CCSS.ELA-Literacy.RST.6-8.9 o CCSS.ELA-Literacy.RI.6.7 • Production and Distribution of Writing: o CCSS.ELA-Literacy.WHST.6-8.4 o CCSS.ELA-Literacy.WHST.6-8.6
Ocean Literacy Principles	5. The ocean supports a great diversity of life and ecosystems. 6. The ocean and humans are inextricably interconnected.

Links to Lesson Content

- Explore the Blue: 360° Hawaiian Experience video <https://sanctuaries.noaa.gov/vr/hawaii-humpback-whale/hawaiian-adventure/>
- Map of HIHWNMS: hawaii.humpbackwhale.noaa.gov/documents/images/MMAI.jpg
- Diving Molokini Crater: <https://www.youtube.com/watch?v=nACInxCZTpE>
- Seagrass <https://www.flickr.com/photos/NOAAphotoLib/5077876455/in/photolist-8JHrL4-8JLurG-8JHtzP-8Qvgjq-8QHw1i-8NVmyt-9fcThC>
- Phytoplankton <https://www.flickr.com/photos/onms/27226604253/in/photolist-HtVsTg-Myz9OA-HGsRTE>
- Zooplankton <https://www.flickr.com/photos/NOAAphotoLib/28136522286/in/photolist-8LWPgd-HJdoZg-24o3sZ8-JeL1oJ-JBtjFd-vR91BO-JSk2Pd-fK68yg-93oPGf-8Ust4Y-8OvjaL-93kCCt-JL8oAu-93oQim-93oPB1-93oLgj-93oLro>

Additional Information

Green Sea Turtle

- NOAA Fisheries <https://www.fisheries.noaa.gov/species/green-turtle>
- NOAA Education <https://www.noaa.gov/education/resource-collections/marine-life-education-resources/sea-turtles>
- U.S. Fish & Wildlife <https://www.fws.gov/northflorida/SeaTurtles/Turtle%20Factsheets/green-sea-turtle.htm>

White Tip Reef Shark

- Florida Museum of Natural History <https://www.floridamuseum.ufl.edu/discover-fish/species-profiles/triaenodon-obesus/>
- Aquarium of the Pacific http://www.aquariumofpacific.org/onlinelearningcenter/species/whitetip_reef_shark
- MarineBio Conservation Society <https://marinebio.org/species/whitetip-reef-sharks/triaenodon-obesus/>



Photo: Matt McIntosh/NOAA

Additional Information Cont.

Humpback Whale

- NOAA Fisheries: <https://www.fisheries.noaa.gov/species/humpback-whale>
- HIHWNMS: https://hawaiihumpbackwhale.noaa.gov/explore/humpback_whale.html
- Marine Mammal Laboratory: <https://www.afsc.noaa.gov/nmml/education/cetaceans/humpback.php>
- IUCN Red List (Humpback Whale): <https://www.iucnredlist.org/species/13006/50362794>
- IUCN Red List (Whitetip Reef Shark): <https://www.iucnredlist.org/species/39384/10188990>
- IUCN Red List (Green Sea Turtle): <https://www.iucnredlist.org/species/4615/11037468>
- NOAA Ocean Explorer: <https://oceanexplorer.noaa.gov/facts/symbiosis.html>
- Maui Ocean Center Information on Cultural Significance:
 - <https://mauiocenter.com/educate/hawaiis-marine-life/hawaiian-green-sea-turtle/>
 - <https://mauiocenter.com/humpback-whales-in-hawaiian-culture/>
 - <https://mauiocenter.com/hawaiis-sharks-should-be-revered-not-feared/>

Alternative/Extension Ideas

- Students complete the species brochure in their journal/notebook.
- Students create a PowerPoint (or similar) presentation about their assigned organism.
- Students write a newspaper or magazine-style article about their assigned organism.
- Students design a poster about their assigned organism.
- In small groups, students create a play, poem, short story, or other creative writing piece about their assigned organism and/or the ecosystem found within Hawaiian Islands Humpback Whale National Marine Sanctuary.
- In small groups or pairs, students design trading cards (i.e. Pokémon, baseball cards) for the biotic and abiotic components of the ecosystem.
- As a class, students design an ecosystem game based on the three key inhabitants of Hawaiian Islands Humpback Whale National Marine Sanctuary.

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If you have any further questions or need additional information, email sanctuary.education@noaa.gov.

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Species Exploration Document

Directions

Use the resources at the end of this document to research the species you were assigned.

Take notes as on each topic below in the designated box. Use bullet point phrases that could be understood by another person.

You will use your research to create a trifold brochure to be displayed in the visitor center of Hawaiian Humpback Whale National Marine Sanctuary to teach visitors about the ecology of the species assigned and its importance to native Hawaiian culture.

Species Assignment:



Photo: Mark Sullivan/NOAA

Describe three adaptations of the species you were assigned.

Explain at least one specific way your species is important to the ecosystem (as a predator, as prey, as a source of nutrients, etc.). Include an illustration/graphic to support your explanation.

Use the International Union for Conservation of Nature, or IUCN, website to determine your species conservation status and conservation actions being undertaken in order to protect it.



Explain why this species is culturally significant to Native Hawaiians.

Resources

Green Sea Turtle	Whitetip Reef Shark	Humpback Whale
<p>IUCN Red List: https://www.iucnredlist.org/species/4615/11037468</p> <p>NOAA Fisheries: https://www.fisheries.noaa.gov/species/green-turtle</p> <p>NOAA Education: https://www.noaa.gov/education/resource-collections/marine-life-education-resources/sea-turtles</p> <p>US Fish & Wildlife: https://www.fws.gov/northflorida/SeaTurtles/Turtle%20Factsheets/green-sea-turtle.htm</p> <p>Maui Ocean Center: https://mauiocenter.com/education/hawaiis-marine-life/hawaiian-green-sea-turtle/</p>	<p>IUCN Red List: https://www.iucnredlist.org/species/39384/10188990</p> <p>Florida Museum of Natural History: https://www.floridamuseum.ufl.edu/discover-fish/species-profiles/triaenodon-obesus/</p> <p>Aquarium of the Pacific: http://www.aquariumofpacific.org/onlinelearningcenter/species/whitetip_reef_shark</p> <p>MarineBio Conservation Society: https://marinebio.org/species/whitetip-reef-sharks/triaenodon-obesus/</p> <p>Maui Ocean Center: https://mauiocenter.com/hawaiis-sharks-should-be-revered-not-feared/</p>	<p>IUCN Red List: https://www.iucnredlist.org/species/13006/50362794</p> <p>NOAA Fisheries: https://www.fisheries.noaa.gov/species/humpback-whale</p> <p>HIHWNMS: https://hawaiihumpbackwhale.noaa.gov/explore/humpback_whale.html</p> <p>Marine Mammal Laboratory: https://www.afsc.noaa.gov/nmml/education/cetaceans/humpback.php</p> <p>Maui Ocean Center: https://mauiocenter.com/humpback-whales-in-hawaiian-culture/</p>

Activity Rubric

Activity Component	4 - Students exceeds assignment expectations	3 - Students meet assignment expectations	2 - Students approach assignment expectations	1 - Students' work is below assignment expectations
Dive Log Narrative	Dive log summary meets expectations Student includes extra details	Dive log summary meets expectations	Dive log summary meets most expectations	Dive log summary meets few expectations
Species Exploration Document	Research is detailed, specific, and complete Extra "fun facts" are included	Research is detailed, specific, and complete	Research needs some details and specifics	Research lacks details
Trifold Brochure	Brochure meets all expectations Extra information that enriches understanding is included	Brochure is organized correctly Brochure includes a heading for each section Each section includes a picture with a caption Brochure is written in complete sentences and uses best spelling, punctuation, and grammar Brochure includes all required information	Brochure is missing some required elements	Brochure is missing many required elements.

Comments: