Culminating Activity

Students: Develop hypotheses to explain why there was extensive development of shipwrecks in Hawaii compared to other areas of the Pacific. Hypotheses should be based on what they have learned. Direct students to write their conclusions based on their hypotheses. They should write these conclusions on what they have learned. Direct students to hypothesize which factors contributed to the extensive development of shipwrecks in Hawaii compared to other areas of the Pacific. The factors they should consider are: (1) human motivation, (2) the physical and human environment, and (3) unique features of the Pacific region.

Activity: From shipwrecks to Hawaiian culture and history.

Focus Questions:
1. How are shipwrecks different from traditional Hawai'ian culture?
2. Why were shipwrecks important to Hawaiian culture?
3. What are the factors that contributed to the extensive development of shipwrecks in Hawaii compared to other areas of the Pacific?
4. How do the factors that contributed to the extensive development of shipwrecks in Hawaii compare to other areas of the Pacific?

Assessment:
- Reflect on the shipwrecks and their importance to Hawaiian culture.
- Discuss the factors that contributed to the extensive development of shipwrecks in Hawaii compared to other areas of the Pacific.
- Write a summary that includes the shipwreck's location, date, and significance to Hawaiian culture.
- Create a timeline that shows the development of shipwrecks in Hawaii compared to other areas of the Pacific.
- Create a poster that highlights the factors that contributed to the extensive development of shipwrecks in Hawaii compared to other areas of the Pacific.
- Create a map that shows the location of shipwrecks in Hawaii and other areas of the Pacific.
- Create a video that explains the factors that contributed to the extensive development of shipwrecks in Hawaii compared to other areas of the Pacific.

Content Standards
- Social Studies: Model's purpose and identify several different social studies models. (Model)
- Science: Using Unifying Concepts and Themes
- Traditional Patterns and Land Use
- Activity: Focusing on a high priority Hawaiian Island, design activities that will lead the students to the following:
  - Recognize the importance of Hawaiian traditions and culture.
  - Understand the relationship between traditional Hawaiian culture and land use patterns.
  - Identify and describe the importance of Hawaiian traditions and culture to land use patterns.
  - Create a timeline that shows the development of Hawaiian traditions and culture.
  - Create a map that shows the location of Hawaiian traditions and culture.
  - Create a video that explains the importance of Hawaiian traditions and culture to land use patterns.

Note: To support students in their research, they should consider the following:
- Identify several different social studies models. (Model)
- Identify several different social studies concepts. (Model)
- Identify several different social studies theories. (Model)
- Identify several different social studies frameworks. (Model)
- Identify several different social studies perspectives. (Model)
- Identify several different social studies representations. (Model)

Social Studies: Places
- Recognize the importance of Hawaiian traditions and culture to land use patterns.
- Understand the relationship between traditional Hawaiian culture and land use patterns.
- Create a timeline that shows the development of Hawaiian traditions and culture.
- Create a map that shows the location of Hawaiian traditions and culture.
- Create a video that explains the importance of Hawaiian traditions and culture to land use patterns.
Review criteria for assessing students' writing and have them work with you to develop a rubric (see sample rubric below). Ask students to share their hypotheses with one another and discuss what they learned from their research. For additional information on this topic, see the background information in the activity *From Fishtraps to Fishponds.*

### Sample Rubric for Culminating Activity

|------------------------|------------------------|-------------------------|-----------------------------------|--------------------------------|
| **Social Studies: Places and Regions**
Show evidence of the physical and human characteristics of world regions, countries or cities.
**Points** ______ |
- Writing shows evidence of both physical and human characteristics that may have led to extensive fishpond development in Hawai‘i and offers new insights.
- Uses substantial data and cites references to compare evidence in Hawai‘i with physical and human characteristics in Micronesia or another area of the Pacific.
- Skillful use of conventions; writing is easy to read and fluid.
- Ideas are skillfully organized and logically sequenced to communicate well.
- Content is in-depth and develops more complex ideas.
- Points ______ |
- Writing shows evidence of both physical and human characteristics that may have led to extensive fishpond development in Hawai‘i.
- Uses sufficient data and cites references to compare evidence in Hawai‘i with physical and human characteristics in Micronesia or another area of the Pacific.
- Minimal errors; writing shows skillful use of writing conventions.
- Ideas are logically sequenced and organized to communicate well.
- Content is presented effectively; goes beyond facts and details to develop ideas.
- Points ______ |
- Writing shows evidence of only physical or human characteristics that may have led to extensive fishpond development in Hawai‘i.
- Uses limited data to compare evidence in Hawai‘i with physical and human characteristics in Micronesia or another area of the Pacific.
- Frequent errors make writing difficult to understand; more work needed on writing conventions.
- Ideas are not well organized so writing is difficult to follow.
- Content is valid but offers little depth or elaboration.
- Points ______ |
- Writing does not show evidence of physical or human characteristics that may have led to extensive fishpond development in Hawai‘i.
- Does not include data to compare evidence in Hawai‘i with physical and human characteristics in Micronesia or another area of the Pacific.
- Many errors make writing difficult to understand; more work needed on writing conventions.
- Ideas are not organized; writing is unclear.
- Content is lacking in information and/or accurate information.
- Points ______ |

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Pacific Patterns:
Traditional Fishing and Land Use

- What are the similarities and differences between traditional fishing and land use patterns on atolls in the Marshall Islands versus the high Hawaiian Islands?

Hawai‘i DOE Content Standard

Social Studies: World in Spatial Terms
- Students use geographic representations to organize, analyze, and present information on people, places, and environments.

Grades 6 - 8 Performance Indicators
- Make geographic representations that show title, directional indicators, and legend or key.
- Plot distribution of physical features.
- Explain patterns drawn from the distribution data.

Key Concept
- Traditional fishing practices and land use patterns on a Marshall Islands atoll are similar to those on a high Hawaiian Island, despite the greater availability of fresh water and other resources on a high island.

Activity at a Glance

Students read stories, compare traditional fishing and land use patterns on two Pacific islands, and create geographic representations of what they have learned.

Time
2 - 4 class periods

Skills
reading comprehension, reasoning, writing, mapping

Assessment
Students:
- Create geographic representations based on the readings to illustrate traditional fishing and land use patterns on a Marshall Islands atoll and a high Hawaiian island.
• Write a summary that:
  - describes any elements of the stories that are similar to students' personal experiences;
  - compares and contrasts patterns of land and water use in the wato and ahupua'a; and
  - compares past practices to present day fishing and land use patterns.

**Vocabulary**

atoll – a roughly circular reef surrounding a broad lagoon

fishtrap – a structure for trapping fish

estuary – the lower part of a stream where the current meets the tide of the ocean

wato – a land management system used in the Marshall Islands of Micronesia

ahupua'a – a traditional Hawaiian land unit usually extending from mountain summits to the outer edges of reefs

pā – a primitive type of fishtrap that has a single lane to guide fish at low or high tide, but not at both

**Materials**

Provided:
• student readings
• student activity sheets

Needed:
• map of the Pacific
• reference materials (optional: see suggestions at end of unit)

**Advance Preparation**

Make a copy of the student readings and activity sheet for each student. Optional: Gather some of the reference materials and check with the school librarian to see what other resources may be available to students.

**Background**

Traditional fishing knowledge of Pacific islanders has been acquired and passed down over centuries of studying fish responses to tides, currents and habitats. Methods of catching fish are as innovative and as varied as the colorful patterns that make up the myriad of fish found on tropical Pacific reefs. In Pacific island communities, men traditionally have been responsible for catching most of the fish, using spears, bone and shell hooks, many types of nets, and lures as well as walled fishtraps. Women still gather shellfish and seaweed and catch small fish in nearshore waters. Methods of trapping fish and sharing land resources are similar among the different Pacific island groups:

**Polynesia:** the islands of the central and south Pacific Ocean including Hawai‘i, the Line Islands, Phoenix Islands, Tonga, Cook Islands, and Samoa Islands, Tuvalu, Easter Island, French Polynesia, and often New Zealand

**Melanesia:** the islands in the Pacific Ocean northeast of Australia and south of Micronesia including Bismarck Archipelago, the Solomon, Vanuatu, New Caledonia, and the Fiji islands
**Micronesia:** the islands of the western Pacific Ocean east of the Philippines and north of Melanesia including the Caroline, Kiribati, Mariana, and Marshall groups.

The thousands of low islands in the Pacific are made of coral; many are coral atolls. Natural resources on these islands are mainly confined to the ocean.

On the coral atolls of the Marshall Islands are some of the most highly skilled fishers in Micronesia. Fishing is vital to survival on land-poor atolls that have thin topsoil, no rivers, and reach only 14 feet above sea level. Traditional ways of managing the limited land resources and using innovative techniques for trapping fish have helped the Marshallese to sustain themselves for centuries. The reading for students provided with this activity describes the traditional wato (Marshallese land division) and the large stone-walled fishtraps that are still used on some of the islands today (Spennemann, 1998).

On high volcanic islands, like the Hawaiian Islands, the soils are richer and rainfall is greater than on atolls. The fertile soils and greater rainfall sustain more agriculture, but subsistence fishing was still a vital part of early Hawaiian life. Like the Micronesians, Hawaiians managed their resources within traditional land units. These land units, known as ahupua'a, generally extend from the mountain summit to the edge of the reef. The ahupua'a provided the people with most of the resources they needed for survival.

Where conditions were suitable, Hawaiians constructed walled fishtraps to take advantage of currents and tides to trap fish. The stone-walled fishtrap described in the student reading, the pā, is similar to fishtraps found throughout the Pacific. Pā are a primitive type of fishtrap that have a single lane to guide fish at low or high tide, but not at both. The general V-shape and the height of the stone walls are designed to trap fish with the outgoing tide.
Hawaiian fishtraps and fishponds included stones to represent gods associated with fishing. The Kū stone represented Kūʻulakai, the god of fishing, who some say had control over all the other gods of the sea. When he died, one of the gifts he left for his son, Aiʻai, was a magic stone called Kūʻula, which had the power to attract fish. The son traveled about the Islands and set up fishing altars upon which to lay two fish from the first catch, one for his father, Kūʻula and one for his mother, Hina (Beckwith, 1970). The Kū stone was placed in an upright position on the eastern side of the fishpond. The Hina stone, representing Kū’s wife, lay flat on the western wall of the fishpond. At the fishponds, a small pile of coral or stones was erected where fish were offered in ceremony to Kūʻula by the kahuna (priest). The kahuna would call upon Kū or Hina to draw the fish from the sea and into the pond. If the fish tried to escape, they would sense Kūʻula’s presence and fear leaving the pond. If they tried to make their way over the wall of the pond, the stones – representing men – would prevent them from escaping (Wyban, 1992).

Teaching Suggestions

1. Display a picture of an atoll (photographs are available on the Web at http://hawaiianatolls.org) and ask students to comment on how living on an atoll would be different from living on their island. Discuss the differences in elevation above sea level at the islands’ highest points (for example, 14 feet on the atoll versus 4,000 – 13,000 feet on the high island); availability of resources in forests, streams, groundwater, and reefs.

2. Distribute the student readings and the student activity sheet. Have students read them together aloud in class or as a homework assignment. Ask students to complete the activity sheet summarizing similarities and differences between the two island groups.


Discussion Questions

- What were the similarities and differences between the physical settings and traditional land divisions in the Marshall Islands and Hawaiian Islands? 
  (Similarities: both are Pacific islands with tropical reefs; Differences: atolls are much smaller and lower; they have no streams, less rainfall and limited groundwater.)

- How is the wato similar to the ahupuaʻa? How is it different? 
  (Both land divisions provided access to resources needed for survival and included some of the same plants, especially cultivated taro. The wato is much smaller and is designed to meet needs of a smaller population. Taro is grown in depressions fed by groundwater instead of cultivated terraces fed by streams.)

- How did the traditional fishing practices and fishtraps in the Marshall Islands compare to the practices and traps in Hawai‘i? 
  (Both areas practiced some form of torch fishing and stunning fish with plant extracts; fishtraps were of similar designs.)
• How were the lifestyles similar?  
(Fishing was vital to survival; men were principal fishers; women and girls collected shellfish and limu near shore.)

4. Ask students to create geographic representations of a wato and ahupua’a based on the readings. Have students plot the physical features and major plant communities in these land management systems using the activity sheets provided or a blank page. Their work should include:

• a legend or key identifying the major plant communities
• directional indicators (mauka – makai or lagoon – seaward)
• highest elevation
• outlines of fishtraps in the areas where they were built.

Note: students could use Kid Pix to draw the diagrams and HyperStudio to present them. See examples of completed geographic representations provided below.

5. Ask students to complete the written assessment activity and share their ideas with their classmates.

Adaptations/Extensions

• Have students conduct some research and write their own stories depicting life in the day of an islander fishing on Majuro or O'ahu today. Have them analyze some of the changes that have taken place and the impact of moving from a subsistence to a market economy.

• See the activities in Unit 3 to explore what has happened to Hawaiian fishtraps and fishponds over time.

Examples of completed geographic representations.

Marshallese wato.
Student Reading

A Day on Majuro Island

It's early morning on Majuro Island. The year is A.D. 1400. Giltamag yawns and stretches, watching the still waters of the lagoon. He's still a little tired from torch fishing last night with his father. Giltamag likes fishing at night. It's exciting to paddle their canoes out in the water on a dark, moonless night with only a coconut frond torch to guide the way. Flying fish are attracted to the torch light and Giltamag and his father caught some in their nets. It was a good catch; his mother is pleased.

Giltamag's father is a great fisher, respected by everyone in the village and on islands nearby. He passes on his knowledge to his son, grateful that Giltamag learns so quickly. Giltamag has mastered the art of stupefying fish. He's learned to use an extract from the wop plant to stun the fish and make them easier to catch. He's shown his skill at fishing by the light of the moon, catching mon, the big-eyed squirrelfish that uses its big eyes to find food at night. By the time the moon is full again, Giltamag will have helped the islanders rebuild the stone fishtraps that were damaged in last week's storm out on the reef flat.

Heading for the reef, Giltamag and his father cross the family's traditional wato—their narrow land allotment that runs across the island from the lagoon to the ocean shore. In this wato, the family members have access to all of the different resources they need. Behind their thatched home, they walk through breadfruit trees that provide them with food and wood. They step over twigs and branches that were blown down in the storm. This is the highest point on the island, about 14 feet above sea level.

In the center of the island they pass the family's taro patch. They grow taro in a small pit where the plants' roots can reach the atoll's limited groundwater lens. There are no streams and there is little rainfall. Growing near the taro there are Pandanus (hala) trees that help to shelter the taro from salt spray. Women on the island weave the Pandanus leaves into mats and baskets. Walking on, Giltamag grins when he sees his cousin, Yanmog, coming out of his house to join them. Together they run through the coastal forest of Pandanus trees and Scaevola (naupaka) shrubs, past the coconut palms, heading for the beach. They jump over the large coral cobbles that have washed ashore and cool their feet in the ocean.
Other islanders are gathering on the beach to join them. Giltamag and Yanmog watch the girls gathering seaweed and shellfish in the shallow water. They share some coconut milk with them as they prepare for the work ahead. Looking across the water to Ajola Island, they can see the rocks of six long fishtraps just above the receding tide. Big waves from the storm have knocked down many coral stones that make up the traps. Giltamag and Yanmog race each other to the first fishtrap, Giltamag struggles for breath, swimming behind his older, faster cousin. They peek behind them and see the girls laughing from shore.

Then the work begins. The boys grab the coral cobbles from the ocean floor and hand them to their fathers who rebuild the long V-shaped walls of the fishtraps. It's hard work, but working together, they slowly make their way to the tip of the "V." Here the boys learn to rebuild a small, circular enclosure where the fish will be trapped. They watch the men place the stones just high enough so that the high tide will cover them and the fish will swim freely. They place a large "threshold" stone at the tip of the "V" that will help to trap the fish. When the tide goes out, the fish swimming next to the walls for cover will be trapped inside these circular enclosures, unable to escape over the stones.

The boys continue down the other wall of the trap, retrieving fallen stones and helping their fathers to rebuild. When they finally reach the end, their muscles are aching but they are smiling, looking forward to the next full moon when they will return to help with the harvest. Then the tide will be at its highest and lowest heights and the boys will participate in the kottoor—the practice of driving fish into the trap. Now they are eager to get home, but too tired to race for shore.

Waving to his cousin, Giltamag heads back across the island with his father. When they reach home, they can see the orange setting sun reflected in the lagoon. They are greeted by the delicious smell of taro and flying fish cooking. Giltamag will sleep well dreaming of fish coming into the trap, girls laughing on the shore, and Yanmog swimming breathless as he tries to catch up to him on the reef.

Kapono and his younger sister, Pua, step out of their thatched hale (house) to greet the dawn. This is the day they've been waiting for. The moon will be full tonight and the tide will be very low by mid-afternoon. The conditions are just right for a big fish catch. Kapono and Pua live near the shore of Pu'uloa, a beautiful area that will become known as Pearl Harbor some day. It is A.D. 1650 in Honouliuli—the largest ahupua'a (traditional land division) on the island of O'ahu. From the outer edge of the reef to the forested mountain summit approximately 2,000 feet high, this ahupua'a provides the families that dwell in Honouliuli with the resources they need for their survival.

Kapono stretches his sore muscles. Yesterday, he and his father had walked mauka (toward the mountain) where they worked in the family's lo'i kalo (taro patch). They had to repair the walls of the 'auwai (ditch) that diverts water from Honouliuli Stream into their lo'i. They had cared for the ulu (breadfruit) and mai'a (banana) growing near the stream. At the end of the day, they harvested kalo and made their way downslope to their home near the sea. Along the way, they stopped to harvest some 'uala (sweet potato) growing in plots nearby. In this dry, hot plain, the 'uala grows in natural sinkholes that retain some water after a rain.

Pua helps her mother clean the kalo and 'uala, but she never takes her eyes off of Kapono. Pua loves the sea and wishes she could spend more time learning to fish on the reef like her brother. He has learned from his father how to use extract of the 'ākia plant to stun fish and catch them. He has even learned to fish at night! One dark moonless night, Pua followed her father and brother to the beach and watched them catch i'ao (silversides)! From her perch on the shore, she could see the lights of her brother's coconut frond torch as he moved along the reef edge, attracting the fish. Today, she knows where Kapono is headed and she isn't going to be left behind. When their cousin Keoni shows up, Kapono and his father take up their nets and head for the beach. Pua jumps up and runs to join them.

They are fortunate to live near the shores of Pu'uloa. Here there is an estuary (the area where the stream meets the incoming tides) and the waters are rich in fish, shrimp and pipi (pearl oysters). Pua's father tells them that the pipi were gifts from Kānekua'ana, the akua mo'o (royal lizard) that guards the
area. The people believe that when the akua moʻo is pleased with them, there will be plenty of fish and shellfish. Hopefully, today will be such a day.

Kānekuʻana should be pleased. The people have learned the movements of the tides and currents and the habits of the fish at Puʻuloa. They have worked hard to build stone fishtraps that take advantage of these tides and currents. A few weeks ago, they prepared for this full moon by repairing some of the walls of the fishtrap. Kapono and Keoni waded out with their fathers and replaced the fallen stones, building the walls so that they would be submerged in the high tide, and about nine inches above water at the lowest tide. The fishtrap has two long stone walls. One wall is built out from the shore and the other runs parallel to it before curving into a large pocket at the seaward end. On the northern end of the wall there are dark stones about 13 feet apart. These stones are known as the “men” that drive the fish back over the wall if they try to escape. Another large, erect stone on the east side of the pond wall represents Kūʻulakai, the god of fishing. On the west end of the wall is a flat stone representing his wife, Hina.

When Kapono, Keoni and Pua reached the fishtrap, some of their neighbors were gathering with their nets. The kahuna made his way to the small walled koʻa (fishing shrine) near the shore. He offered fish to Kūʻulakai and chanted to Hina to draw the fish into the trap from the sea.

Everyone watched, holding their breath as the tide went out. In the low water of the receding tide, they soon spotted the fish trying to return to the sea. Silver flashes of akule, ʻōʻio, and weke fish glistened in the sun, thrashing about. They could not escape over the walls of the fishtrap. When the kahuna gave the signal the people moved in, scooping the fish up in their nets. The men sorted the fish, sharing the catch among the families. Kānekuʻana had blessed them with a plentiful catch. They placed the extra fish in large gourds and released them in the fishpond nearby. Along the shore, Pua and her friends gathered limu (seaweed) to have with the fish.

That night, the families gathered to feast on the fish and limu from the sea and the kalo and ‘uala from the land. Kapono and Pua fell asleep beneath the full moon, dreaming of fish glistening in the rich waters of Puʻuloa while Kānekuʻana, the akua moʻo, guarded over them.

*Fishtrap (pā) from Puʻuloa. Oʻahu. The first fish caught was offered to Kūʻulakai, the god of fishing, represented by a Kū stone.*
Complete this chart by listing the similarities and differences between the islands described in the stories.

<table>
<thead>
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<th></th>
<th>Majuro – Marshall Islands</th>
<th>O‘ahu – Hawaiian Islands</th>
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</thead>
<tbody>
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<td></td>
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<td><img src="image" alt="Lifestyles" /></td>
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</tr>
</tbody>
</table>
Student Activity Sheet
Ahupuaʻa

Complete this geographic representation (or draw a new one on a separate sheet) of the ahupuaʻa where Pua and Kapono live. Draw each item listed in the “key” in the general area where it is found in the ahupuaʻa. Be sure to include your symbol for each item in the key.

KEY

stream

ʻuala (sweet potato)

reef flat

loʻi kalo (taro patches)

fishtrap

maiʻa (bananas)

estuary

ʻulu (breadfruit)
Complete this geographic representation (or draw a new one on a separate sheet) of the wato where Giltmag lives. Draw each item listed in the "key" in the general area where it is found on the island. Be sure to include your symbol for each item in the key.

**KEY**

- palm trees
- lagoon
- fishtrap
- Pandanus trees
- seaward reef flat
- taro patches
- coastal shrubs
- breadfruit trees
From Fishtraps to Fishponds

How are fishtraps different from fishponds? What factors might have led to the extensive development of fishponds from fishtraps in Hawai‘i compared to other areas of the Pacific?

Hawai‘i DOE Content Standards

Science: Using Unifying Concepts and Themes (MODEL)
- Students use concepts and themes such as system, change, scale, and model to help them understand and explain the natural world.

Social Studies: Places and Regions
- Students understand how distinct physical and human characteristics shape places and regions.

Grades 6 – 8 Performance Indicators

- Explain how models are used to understand things that are too small, too vast, or too potentially dangerous. Explain how models are used to understand processes that happen too slowly or too quickly.
- Demonstrate how more than one model can represent the same thing or process.
- Show evidence of the physical and human characteristics of world regions, countries or cities.
- Use data to compare the regions, countries or cities (culminating activity)

Key Concepts

- Fishtraps rely on the receding tide for trapping fish within stone enclosures. Fishponds are a true form of aquaculture where fish are grown and raised to maturity within enclosures.
- Fishtraps were common in the Pacific, but nowhere as extensively as in Hawai‘i.
- The extensive development of fishponds in Hawai‘i compared to other areas of the Pacific may have been due to several factors including the physical resources - protected bays and estuaries, extensive coastal reefs and streams; and human innovation and resources - large populations with highly organized social structure.

Activity at a Glance

Groups of students create and demonstrate fishtrap models. Students hypothesize what led to the extensive development of fishponds from fishtraps in Hawai‘i compared to other areas of the Pacific.
Prerequisite

*Pacific Patterns: Traditional Fishing and Land Use*

Skills

reading comprehension, oral communication, reasoning, analysis, writing, model building

Assessment

Students:

• Create models of fishtraps and demonstrate how they work.
• Develop hypotheses to explain physical and human factors that might have led to the extensive development of fishponds in Hawai‘i compared to other areas in the Pacific.

Time

4 class periods

Vocabulary

loko ʻiʻa – fishpond
loko kuapā – seawater fishpond on reef flat
mākāhā – sluice grate
aquaculture – raising of plants or animals in water
ʻauwai – ditch or small canal in fresh water
ʻauwai kai – ditch or small canal; sluice connecting the fishpond to ocean
umu – a heap of rocks used to catch small fish
pā – a primitive type fishtrap that has a single lane to guide fish at low or high tide, but not at both
loko ʻume iki – a shore fishtrap with lanes to guide fish at both low and high tide

Materials

Provided:

• student reading
• Project Kāhea Loko video

Needed:

• modeling clay
• bag of cinders
• dishpans (one for each of 5 or 6 groups)
• one jar of oregano (or similar tiny leaves)
• one-gallon containers (for storing and siphoning off water)
• meat basters (2 or 3 for groups to share)
• rulers
• reference materials (see suggestions at end of unit)
Advance Preparation

Duplicate the student reading and activity sheet (one copy for each student).

Optional: Gather some of the reference materials and check with the school librarian to see what other resources may be available to students.

Background

Fishtaps

Stone-walled fishtaps were constructed by islanders throughout Micronesia, Melanesia and Polynesia (Apple and Kikuchi, 1975). As described in the prerequisite activity, long V-shaped stone-walled fishtaps are common on the atolls of the Marshall Islands. Similar stone fishtaps can be found on Yap in the Caroline Islands as well as in the Gilbert Islands of Micronesia (Brower, 1981). And ancient Chamorros on Guam constructed a wedge-shaped stone fishtap known as a gigao (Cunningham, 1992). In Polynesia, the Proto-Polynesian term “fota” refers to fishtaps that were built in Samoa, Futuna, Southern Cook Islands, Tahiti, Tuamotu and Mangareva (Kirch, 2001). Along the north shore of the ancient village of Maeva in Huahine (Society Islands) people still catch fish in the V-shaped stone fishtaps.

In Hawai‘i, different types of fishtaps were built on reef flats. The stone-walled fishtap described in the student reading in the prerequisite activity, the pā, is similar to fishtaps found throughout the Pacific. Pā are a primitive type fishtap with a general V-shape, single lane to guide fish at low or high tide, but not at both. Fish were swept along with the current of outgoing tides and caught within the stone walls where they could be scooped out with nets. Akule, ʻōio, weke, pualu, and makiawa [round herring] were all caught in this manner (Wyban, 1992).

In addition, Hawaiians constructed fishtaps known as umu and loko ʻume iki. The umu (heap of rocks) was the simplest type of fishtap. These small underwater “houses” were made of stones piled loosely into a mound with an opening on each end that allowed water to flow through. Women caught fish that hid inside these shelters by placing a woven net over one opening while shaking a palm frond or stick near the other opening. The fish inside the umu would swim away from the stick or palm and into the net.

The loko ʻume iki was a stone-walled fishtap with multiple funnel-shaped lanes; some of which were wider toward the shore, others were wider toward the ocean. Fish were attracted to the currents created by the changing tides. When the tide went out, fish swam into the lanes. When the tide came in, fish swam out. Twice a day, when the tide changed, women placed nets across the openings to catch the fish as they swam in or out.
From Fishtraps to Fishponds

According to Kikuchi (1973), the loko 'ume iki had unusual ownership rights. Each fish lane had dual ownership. The fishing rights were assigned based on a lane or lanes on the ebb and flow of the tide. Certain people had the right to fish during the rise of the tide known as kai ki, and the others during the ebb, or kai emi. The entire fishtrap was the property of the ahupua'a, but the inward and outward fish lanes belonged to individuals of a family and thus were 'ohana (family) oriented. Legally, the 'ohana owned neither the land nor any fishpond, fishtrap, mountain weir, or fish shelter occurring in their domain, but rather they simply had the right as tenants to the use of specified food sources and to a share of the food obtained from these sources.

Fishtraps were constructed on the east end of Moloka'i, at Pu'uloa (Pearl Harbor) on O'ahu, at 'Ai'ōpio and Honokōhau on Hawai'i, and on Lāna'i. As of 1975, all fishtraps in the Hawaiian Islands had fallen into various states of disrepair. The most intact fishtrap was at Palawai on Lāna'i (Apple and Kikuchi, 1975).

Fishponds

While fishtraps were common in the Pacific, fishponds were constructed nowhere as extensively as in Hawai'i where large-scale development of aquaculture led to growing and storing fish in large stone-walled fishponds (Apple and Kikuchi, 1975). The extensive aquaculture practiced by Hawaiians made use of nearly every waterway from upland streams to lowland estuaries and bays. According to Apple and Kikuchi, "Hawaiian irrigation systems are among the largest and most well developed recorded anywhere in Polynesia except Futuna Island in western Polynesia."

The type of fishpond found only in Hawai'i, the loko kuapā, had massive stone seawalls that were up to several feet thick and rose above high tide level. These large ponds, which ranged from one to 523 acres, were built for the ali'i (chiefs). When the ali'i and their entourage traveled into an ahupua'a, fish were harvested from the ponds to feed the royalty. Based on Kikuchi's estimate (1973) of yield, Hawaiian fishponds probably produced more than two million pounds of fish per year.

The question posed to students in this activity is, "What factors led to the extensive development of fishponds from fishtraps in Hawai'i compared to other areas of the Pacific?" There is no single answer to this question; many interrelated factors probably played a part. The physical setting of atolls with their lack of streams, and their low elevation, which exposes them to the storms and tsunamis (tidal waves caused by underwater earthquakes) in the south Pacific certainly played a part. The physical setting of the high Hawaiian Islands with protected bays and estuaries, extensive flat coastal reefs, and streams carrying nutrients and lava rocks was more conducive to the development of fishponds. While most of these conditions don't exist on atolls, they do exist on other high islands in the Pacific. So other factors must have played a role as well.
The human resources (the high number of people available in Hawai‘i to pass the stones and build the walls) were undoubtedly a factor. It’s estimated that it took thousands of men forming mile-long lines to pass the stones from the source to the site of a fishpond. The process of passing stones and constructing the walls of a loko kuapā could have taken up to a year.

On Kaua‘i, ‘Alekoko and Kalalalehua ponds were supposedly built from stone carried from Makali‘i beach to the pond sites, a distance of between one and two miles. Another story places the source of stone as Makaweli, a distance of 15 miles. On Moloka‘i, rocks were carried from Waialau Valley to Ka‘ope‘ahina pond in Kalua‘aha, a distance of four miles (Kikuchi, 1973).

Kamakau (1976) estimates that the reconstruction of Kaneo‘o and Kālepolepo ponds on Maui required approximately 10,000 men. Imagine the number of men needed in the original construction! Kikuchi (1973) adds that the massiveness of some of the shore type fishponds suggests that construction was intensive and lengthy, as well as costly in terms of material manpower, and subsidy in feeding and housing. The social organization of Hawaiian society that gave the ali‘i power to mobilize large populations to build these royal ponds was a factor as well. And according to Hawaiian scholar Samuel Kamakau (1976) there must have been prolonged periods of peace for large numbers of people to cooperate on such huge projects.

Another factor is innovation. A distinguishing feature of Hawaiian fishponds is the mākahā (sluice grate). The mākahā were placed in the sluices or opening channels—the ‘auwai kai near the sea, and ‘auwai in the upland ponds. These immovable grates trapped mature fish in the pond and allowed water to circulate. They were constructed of branches of young lama or ‘ōhi‘a ‘ai trees fastened together with cordage. The spaces between the branches were narrow enough to let young fish in and prevent mature fish from escaping.

According to researchers Apple and Kikuchi (1975), the only other known sluice grate in the Pacific was found in the Gilbert Islands of Micronesia, and there it was a moveable panel in a fishtrap used like a swinging gate. These researchers also point to the mākahā as the innovation that probably enabled Hawaiians to proceed from fishtraps to fishponds. Fishtraps rely on the receding tide for trapping fish within stone enclosures. Fishponds are a true form of aquaculture where fish are grown and raised to maturity within the enclosures. The original Hawaiian mākahā may have been developed in upland lo‘i kalo (taro terraces) where simple, smaller-scale sluice grates were used to control the water flow.

Some Hawaiian oral traditions associate the building of ponds with certain chiefs. By tracing the genealogy of the chiefs, the earliest dates of fishpond construction can roughly be estimated as early as the 13th century. There are also a number of references to Hawaiian fishponds constructed later in the 16 - 18th centuries (Wyban, 1992).
Teaching Suggestions

1. Review the readings from the prerequisite activity and discuss the features of the fishtraps in the Marshall Islands and in Hawai‘i. (See also annotated references at the end of this unit that list sources of fishtrap illustrations.)

2. Divide the class into five or six groups and challenge students to create their own fishtrap models. Discuss the advantages of using models to learn more about how fishtraps function. (Models provide opportunities to explore, in a relatively short time and on a small scale, processes that take place over many hours and on a large scale, such as water circulation and tidal changes.)

3. Display the materials for groups to use in the creation of models and encourage students to select from these or other materials of their choice.

Sample fishtrap model materials

- dishpan – fill with water to be “ocean”
- clay – make small balls to create “stone” walls (or use cinders)
- bay leaves – use as the “fish”
- gallon of water – add to the dishpan to raise the “tide”
- meat baster – use to lower the water level by one inch, simulating low tide

4. Have groups mark their dishpans to show where the “shore” would be. Discuss design considerations.

- What fishtrap shape would work with the outgoing “tide” to capture the most bay leaf “fish”?
- How will you make sure fish come into your traps?
- How will you keep the fish from escaping?
- How will the depth of the water at high and low tide affect your design?

5. Ask groups to present their models to the class. Each group should demonstrate the fishtrap at high tide, add bay leaf “fish” and then use the meat baster to lower the tide. Have each student explain one aspect of the model, including:

- the features of the fishtrap design;
- how it compares to the fishtraps in the Marshall Islands;
- how it compares to a Hawaiian fishtrap; and
- why they chose their particular design.

Discussion Questions

- Which fishtrap models were most efficient for catching fish? Why?
- Which elements of actual fishtraps were used most successfully?
- How might some of the fishtrap models be re-designed to be more effective? (Try it!)
- How could the fishtraps be modified to become fishponds used for growing fish?
- How did the different types of models represent the same thing or process?
6. Show the Project Kāhea Loko video to introduce your students to Hawaiian fishponds.

7. Discuss the video and ask students if they know of any fishponds or fishtraps on your island. Distribute the student reading and ask students to review it and answer the study questions.

8. Challenge students to develop hypotheses about why there was such extensive development from fishtraps to fishponds in Hawai‘i compared to other areas in the Pacific.

9. Collect students’ answers and written hypotheses and discuss their ideas. See culminating activity on the Grades 6 – 8 Unit 1 Grid that challenges students to conduct research to support their hypotheses.

Discussion Questions

• What is the major difference between a fishtrap and the fishpond described in the reading?
  *(Within stone walls of a fishtrap like the pā, fish are trapped with the outgoing tide. Fish are grown within the walls of a fishpond and are trapped by the mākāhā.)*

• What do you think were some of the physical features that led to the extensive development of fishponds in Hawai‘i?
  *(streams, large bays and estuaries; large quantity of stones)*

• What might some of the social factors have been?
  *(Large populations of commoners were available to do the work and they were organized and ruled by ali‘i. Extensive periods of peace allowed time for construction.)*

• What technological innovation described in the story was most important to the evolution of fishponds? Why?
  *(the mākāhā, since it allowed the water to circulate, but trapped the larger fish)*

Adaptations/Extensions

• Have students design and construct fishpond models. See Engineering Ingenuity in Unit 3, Grades 4 - 5 of this guide.

• Encourage students to research the extensive irrigation systems and aquaculture developed on Futuna Island in western Polynesia or the aquaculture practiced in the Gilbert Islands of Micronesia that were known to have developed sluice grates.
Pua and Kapono sit at the feet of their father, watching his eyes light up as he speaks. It is A.D. 1651 in Honolulu—the largest ahupua'a (traditional land division) on the island of O'ahu. The land is blessed with freshwater streams that flow into a large estuary. This protected harbor is excellent habitat for many types of fish and shellfish. Their father is the kia'i loko (fishpond caretaker) of one of the royal fishponds. This loko kuapā (fishpond) belongs to the ali'i (chief) that rules over this part of the island. It was built by his command with the labor of thousands of maka'ainana (commoners). Laboring for nearly a year, they formed a mile-long line from the streambed to the fishpond site, passing the stones from one person to the next.

Today, the massive pond walls have two openings to the sea. These sluices are known as 'auwai kai. Each has an immovable grate (mākahā) that controls the flow of water and traps the fish inside. Pua and Kapono are sitting near the mākahā next to the hale kia'i (guardhouse) that shelters their father while he watches over the pond. Keeping a watchful eye on the walls, their father makes sure no maka'ainana come and attempt to take fish from the pond.

"Will there be moi (Pacific threadfin) for the ali'i too?" asks Pua. She knows the ali'i favor this tasty fish that no commoners are allowed to eat. "'Ae, when the ali'i and all of his attendants come, there will be plenty of moi, 'ama'ama (striped mullet) and awa (milkfish) to feed them all. In the morning, Kapono, I want you to help me and your uncles with the large net to catch more fish in the pond."

The next day, Pua and Kapono help to prepare for the visiting ali'i. Like their father, they both love to fish and each of them has become skilled in different ways. Pua has learned to weave baskets.
for trapping fish using the strong rootlets of the ‘ie‘ie plant. She is also skilled at catching fish in the simple fish trap—the umu she and her brother built on the reef flat. When she wades out to the umu, she hopes there will be a big fish hiding in the pile of stones. She approaches cautiously, carefully placing a scoop net over the opening on one end of the umu and waves a palm frond on the other end. The big uhu (parrotfish) inside is frightened and darts into her net.

Pua places the fish in her basket and joins her mother who is collecting limu (seaweed) and shellfish nearby. As they head to shore, they are drawn by the sounds of the men at the loko kuapā. Mother and daughter walk carefully on the sand, avoiding the nets that are drying there. These are prized possessions of the ali‘i and it is kapu (forbidden) for women and children to step over or near a net. It is believed that this will ensure that the power of the nets will not be lost. Married women, like Pua’s mother, are also forbidden to walk on the walls of the loko kuapā. When Pua gets older and begins her monthly period, it will also be kapu for her to walk on the walls during that time.

Drawn to the excitement at the pond, mother and daughter watch the pai pai—men working together to drive fish into a big net. While some of the men hold the net, others are moving toward them, slapping the water with sticks. Kapono is slapping and shouting along with the others, frightening the fish into the net. The surface of the pond is churning with flashes of silver as the fish leap in the sunlight and become entangled.

Pua and her mother make their way home for there is much work to be done. The fish they’ve caught need to be cleaned. The kalo that was harvested from the lo‘i and then steamed, must be pounded to make poi. And lauhala mats need to be cleaned and ready for the lū‘au (feast). When the ali‘i and his attendants arrive, they will be fed well in Honouliuli.
From Fishtraps to Fishponds

Student Activity Sheet

Fishtraps were common in the Pacific; fishponds were not. No other island groups had such intensive development of fishponds as the Hawaiian Islands. In the Pacific, the only known usage of a sluice grate other than in Hawai‘i (where it is called mākāhā), is in a fishtrap in the Gilbert Islands of Micronesia. In that instance, the moveable sluice grate was used as “a panel which was closed a little before the ebb of the tide, trapping the fish” (Kikuchi, 1973). The loko kuapā described in this story is found only in Hawai‘i.

The loko kuapā is unique to Hawai‘i. By the end of the 18th century, there were more than 300 of these royal fishponds in the Hawaiian Islands.

1. Fishponds in Hawai‘i probably evolved from the simpler fishtrap structures. How is the fishtrap described in the previous reading (see Pacific Patterns activity) different from the fishpond described in this story?

2. What physical features of the Hawaiian Islands might have led to the development of so many fishponds?

3. What human factors might have contributed to the development of fishponds from fishtraps in Hawai‘i? Explain.

4. What technological feature described in the story was most important to the development of fishponds? Why?

Develop a hypothesis to explain why there was such extensive development from fishtraps to fishponds in the Hawaiian Islands compared to other areas of the Pacific.

My hypothesis: ____________________________


**Websites**

Lujan, Makahoa. *Na Loko I‘a o Hawai‘i Nei*. <mahakoa@niti.net> [http://www.niti.net/~mahakoa/loko.html](http://www.niti.net/~mahakoa/loko.html) (Site features an ahupua‘a diagram including different types of fishponds and links to other sites about fish and fishponds in Hawai‘i.)

Northwestern Hawaiian Islands Multi-Agency Education Project. <nwhiquestions@hawaii.edu> [http://hawaiianatolls.org](http://hawaiianatolls.org). (Site has maps, photographs and satellite images of atolls and various features on the Islands.)


The fertile soils and greater rainfall on high volcanic islands, like the Hawaiian Islands, sustain more agriculture than on atolls, but subsistence fishing was still a vital part of early Hawaiian life. Where conditions were suitable, Hawaiians constructed walled fishtraps to take advantage of currents and tides to trap fish.