**Culminating Activity**

**Human Activities Over Time:**
- The humpbacks have been modified by interactions, and now the physical features in inhabited regions are a reflection of Humpback whale migration patterns.
- Modifications have resulted in the creation of habitats for humpback whale migration.
- Students are expected to describe how easy or difficult it is to engage in activities that create a habitat during a migration.

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Key Concepts</th>
<th>Focus Questions and Activities</th>
<th>Focus Standards</th>
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<tr>
<td>Students:</td>
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<table>
<thead>
<tr>
<th>Regions and Processes</th>
<th>Content Standards</th>
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</tr>
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<tbody>
<tr>
<td>Region:</td>
<td></td>
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<tr>
<td>Processes and Events</td>
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</tbody>
</table>

**Nature of Knowledge:**

**Activity: Ha Hana**
- Students observe the physical modifications of humpback whale migration patterns.
- They engage in physical processes to create habitats for humpback whales.

**Mathematics:**
- Students are expected to describe how easy or difficult it is to engage in activities that create a habitat during a migration.

**Project Kahua Loko:** ©2003 Pacific American Foundation

Grades 9 - 12

Unit 1, Page 61
Students' written work and oral presentations should include: a) an explanation of the human and physical characteristics that are important to their topic; b) the human and physical changes to the fishpond or ahupua'a over time; and c) a summary that predicts human and/or physical changes to the fishpond or ahupua'a in the future.

Review criteria for assessing students' research and presentations and have them work with you to develop a rubric (see sample rubric below).

### Sample Rubric for Culminating Activity

<table>
<thead>
<tr>
<th>Performance Indicators</th>
<th>Kūlia (Exceeds Standard)</th>
<th>Mākaukau (Meets Standard)</th>
<th>'Ano Mākaukau (Almost at Standard)</th>
<th>Mākaukau 'Ole (Below Standard)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Social Studies: Places and Regions</strong></td>
<td>Explain types and/or functions of regional systems based on multiple human and physical characteristics.</td>
<td>Explain types and/or functions of regional systems based on multiple human and physical characteristics.</td>
<td>Explain types and/or functions of regional systems based on multiple human and physical characteristics.</td>
<td>Explain types and/or functions of regional systems based on multiple human and physical characteristics.</td>
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<tr>
<td><strong>Points</strong></td>
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<tr>
<td><strong>Identify human and physical changes (boundaries, migration) within a regional system over time.</strong></td>
<td>Content clearly identifies changes over time and shows skilful organization of ideas with logical sequence of thoughts.</td>
<td>Content is organized and clearly identifies changes over time.</td>
<td>Content is valid, but lacks organization so that changes over time are difficult to understand.</td>
<td>Content is lacking in information or accurate information.</td>
</tr>
<tr>
<td><strong>Points</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Use the information gathered to evaluate (predict, conclude judge or summarize) the human and/or physical effects on regions.</strong></td>
<td>Predictions make logical use of information gathered and show innovative well-developed ideas.</td>
<td>Predictions make logical use of information gathered and show critical thinking.</td>
<td>Predictions build on information gathered but cover only human or physical effects.</td>
<td>Predictions don't connect logically to information gathered.</td>
</tr>
<tr>
<td><strong>Points</strong></td>
<td></td>
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</tr>
<tr>
<td><strong>Visual Aids</strong></td>
<td>Visual aids enhance understanding of content; and have high visual appeal.</td>
<td>Visual aids support content and are appropriate quality.</td>
<td>Visual aids are minimal and not entirely effective.</td>
<td>Visual aids are incomplete or not appropriate.</td>
</tr>
<tr>
<td><strong>Points</strong></td>
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</table>
He 'Āina Momona
A Land Sweet and Fertile

What physical conditions and human characteristics determined where loko i'a (fishponds) and fishtraps were located on an island?

Hawai'i DOE Content Standard
Social Studies: Places and Regions
  • Students understand how distinct physical and human characteristics shape places and regions.

Grades 9 - 12 Performance Indicators
  • Explain types and/or functions of regional systems based on multiple human and physical characteristics.
  • Explain the interrelationship(s) within parts of regional systems.

Key Concepts
  • The variability of physical conditions in different regions of the Islands—location of perennial flowing streams, natural depressions in the land, extensive reef flats, sand bars, and protected bays—determined where Hawaiians could build different types of fishponds and fishtraps.
  • The social organization of Hawaiian society gave the ali'i (chiefs) power to mobilize large populations to build fishponds, and prolonged periods of peace enabled people to laulima (cooperate) on such huge projects.

Activity at a Glance
Students create a map showing the main physical features of one of the Hawaiian Islands. They select a time period in early Hawai'i and decide where they would build fishponds and fishtraps on the island and identify the physical and human characteristics that influenced their choices.
Skills
mapping, analysis, problem solving, writing

Assessment
Students:
• Draw an island map showing key physical features and designating where they would build different types of fishponds or fishtraps.
• Write a summary describing:
  - the types of fishponds or fishtraps they would build in different regions of the island;
  - the physical characteristics of each region that would enable them to build the ponds or traps; and
  - the human characteristics that will help them to succeed.

Time
2 – 3 class periods

Vocabulary
loko i’a – fishpond
kuapā – seawall
mākāhā – sluice grate
survey – to look over and examine carefully
kuhikihiʻuone – an architect or priest who advised concerning the building and locating of fishponds, temples, or homes
perennial stream – stream that flows year-round

Materials
Provided:
• student activity sheet
• student reading
• fishpond and fishtrap illustrations (See Loko I’a lesson, Unit 1, Gr. 4 – 5.)
• Kāhea Loko videotape

Needed:
• color pencils
• island maps

Advance Preparation
Copy the student reading and the activity sheet for each student. Make copies or transparencies of the fishpond and fishtrap illustrations in the Loko I’a lesson. Gather different types of maps of your island, including relief maps that depict physical features such as streams and mountains or contour maps that show elevation with contour lines (see Resources at the end of this lesson).
Background

Physical conditions and rainfall vary considerably from windward to leeward sides of the Hawaiian Islands. Most rainfall is the result of northeast trade winds carrying moisture to the windward sides of the Islands. The highest rainfall occurs just to the leeward side of the summits on islands that are lower than 6,000 feet in elevation. The highest rainfall on higher islands occurs on the windward slopes between 1,500 and 6,000 feet elevation. The location of perennial flowing streams determined where Hawaiians could build their extensive irrigation systems for lo‘i kalo (taro terraces). And the presence of streams and groundwater springs was critical to the location of fishponds. Natural depressions in the land, extensive reef flats, sand bars, and protected bays also determined where Hawaiians could build different types of fishponds and fishtraps.

The human resources—the high number of people available in Hawai‘i to pass the stones and build the walls was an important factor in the construction of fishponds. 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. The social organization of Hawaiian society gave the ali‘i (chiefs) power to mobilize large populations to build these royal ponds. 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.

Teaching Suggestions

1. Write “loko i‘a” and “he ‘āina momona” on the board and ask students what they think these mean. Explain that “loko” is pond and “i‘a” is fish and that “he ‘āina momona” is a fat land or a land sweet and fertile—a land with many fishponds. Ask students which areas on their island they would refer to as “he ‘āina momona.”

2. Distribute the student reading and discuss the importance of the loko i‘a, the amount of time and effort it took to build a loko kuapā, and the different types of fishponds and fishtraps that Hawaiians built.

3. Show the Kāhea Loko video. Discuss the video using the full-page illustrations of the fishponds and fishtraps (provided in the Loko I‘a lesson).

Discussion Questions

- What features do most Hawaiian fishponds have in common? 
  (They have mākahā [sluice grates], ‘auwai or ‘auwai kai [channels], and they are fed by streams or springs.)

- Which fishponds and fishtraps were located near the sea?
  (loko kuapā, loko pu‘uone, loko ume iki, umu and sometimes loko wai)

- Which were located inland?
  (loko wai and loko i‘a kalo)

- How do you think fishponds are different from fishtraps?
  (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.)
4. Divide the class into groups and give each group some sample maps to review. Ask students to locate the main physical features such as streams, mountains, and bays or estuaries on the maps and conduct a discussion.

**Discussion Questions**

- How do maps show physical features on the island?
- Which type of map is most useful for locating physical features? Why?
- How is elevation shown?
- What are the major differences between windward and leeward sides of the island?

5. Distribute the student activity sheet and review the instructions for students to create their own maps. Give students time to work on the activity and complete it as homework.

6. Have students complete the writing assessment activity to summarize their maps and the human and physical characteristics that would enable them to build fishponds or fishtraps in the sites they select on their maps.

7. Have students compare their maps to maps that show where fishponds are located on the island. See [http://mano.iced.hawaii.gov/~ckomoek/](http://mano.iced.hawaii.gov/~ckomoek/). This site by the Hawai'i Office of Historic Preservation includes maps with traditional ahupua'a and fishponds.

**Adaptation/Extension**

- Have students complete a second map that shows how their island could change after a few hundred years. Have them estimate the island population and indicate what types of fishponds they would build.

**Resources**


**Sources of Island Maps**

Ahupua'a Action Alliance. [crucer@hawaii.edu](mailto:crucer@hawaii.edu) [http://www.ahupuua.net/gislink.html](http://www.ahupuua.net/gislink.html). (This site provides links to sites with maps and mapping tools.)

Hawai'i Stream Research Center (HSRC). 1996. *Perennial Streams.* (University of Hawai'i Center for Conservation Research and Training, the State Department of Land and Natural Resources Aquatic Resources Division, and the National Tropical Botanical Garden Limahuli Gardens) mkido@hawaii.edu [http://www2.hawaii.edu/hsr/home/welcome.htm](http://www2.hawaii.edu/hsr/home/welcome.htm). (This site provides color maps that show where streams are located on each island.)

Historic Preservation Office. *Experimental Database Server.* Hawai'i Department of Land and Natural Resources. [Clifford_G_Inn@exec.state.hi.us](mailto:Clifford_G_Inn@exec.state.hi.us). [http://mano.iced.hawaii.gov/~ckomoek/](http://mano.iced.hawaii.gov/~ckomoek/). (This site, which is still being developed, provides maps by island that include traditional ahupua'a and fishponds.)


Kailua Bay Advisory Council. [http://www.kbac-hi.org](http://www.kbac-hi.org). (Has excellent maps of the Kailua Bay area.)
Student Reading

"He 'āina momona nō ia."
(It is a land sweet and fat.)
This was said of an area with many fishponds.

Hawaiians built different types of fishponds to take advantage of the landform or terrain of the 'āina (land) and the resources available, such as water and rocks. The loko kuapā is the type of fishpond that most people think of when referring to loko ʻiʻa (fishpond). It is a seawater fishpond with rock walls built on a reef flat. This type of fishpond was built only in the Hawaiian Islands. These fishponds were prized areas that were kept securely by the chiefs and the mōʻī (king).

The Loko ʻIʻa

Constructing a loko ʻiʻa was no easy feat. First, a kuhikuhipuʻuone (architect) would select the construction area. He and his team of kahuna (experts) would determine the type and size of the pond and choose a site with conditions (such as protected areas, large flat coastal reefs or the flow of streams) that would allow the pond to work efficiently and effectively. If the pond was to be a loko kuapā, a large supply of rocks for the construction of the walls had to be available. And most importantly, thousands of men (and women) were needed to build the kuapā (walls) on the seaside. 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. The social organization of

Hawaiian society gave the aliʻi (chiefs) power to mobilize large populations to build these royal ponds. 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.

In the legend of Kūʻulakai, the god of fishing, Kūʻula's fishpond at Lehoʻula, Hāna, Maui, was said to be 20 feet thick and 10 feet high. The loko kuapā in the Islands were from one to 523 acres in size. These kuapā were not only masterfully built, they are also great works of art. Fishponds added to the environment both aesthetically and economically.

After the kuapā was finished, the mākāhā (sluice grates) had to be made. The mākāhā were constructed of wood from lama or ʻōhiʻa ʻai trees. They were placed in openings ('auwai kai) in the pond wall, which allowed water to circulate and fish to be trapped. The narrow slits in the wooden grate allowed young fish to enter the pond, and then trapped them inside the pond when the fish grew larger than one half inch thick. Fish could be harvested from the pond as they gathered at the mākāhā during changes in the tide.
Hawaiians also stocked their fishponds with pua i'a (juvenile fish). The type of fish depended on the type of fishpond. Loko wai, loko pu'uone and loko kuapā were usually stocked with fish such as 'o'opu (goby), 'ama'ama (striped mullet), or awa (milkfish). A kia'i loko (pond keeper) was selected by the ali'i (chief) to maintain, repair and protect the loko i'a. It was a big responsibility and the kia'i loko received a lot of respect from the villagers.

**Different Types of Loko I'a**

In addition to the loko kuapā, Hawaiians built three other types of fishponds. The loko pu'uone was built along the shore where there was a pu'uone (a sand dune or heap of sand) to hold the water in the pond. Fresh water flowed into these ponds from streams or groundwater springs and fish were attracted to the brackish water that resulted from the mix of salt and fresh water.

Inland they built loko wai by digging out natural pools and constructing 'auwai (ditches) to connect the pond to a stream. Another type of fishpond was the loko i'a kalo (taro fishpond) that was used to raise fish and kalo. In these freshwater ponds, kalo was planted in mounds of soil that provided habitat for the fish.

Hawaiians also built different types of fishtraps along the coast. These were simpler structures that did not have a mākāhā. The simplest form was the umu—a heap of rocks that provided shelter for fish. Hawaiians made these traps by piling stones loosely into a mound. Fish were attracted to the limu (seaweed) that grew on the surface of the stones. Women caught fish by placing a net over the opening on one side while shaking a palm frond or stick along the other opening.

A much larger fishtrap, the loko 'ume iki, was built on the reef flat. The walls of this fishtrap had many funnel-shaped openings or lanes. Some of the lanes were wider toward the shore, and others were wider toward the ocean. Twice a day, women came to gather fish that were attracted to the currents in the lanes produced by the changing tide.

Another type of fishtrap was a V-shaped structure known as a pā (a wall, fence, or enclosure). This primitive type of fishtrap had a single lane to guide fish at low or high tide, but not at both.

*pā (V-shaped fishtrap)*
Student Activity Sheet

Name: __________________________
Date: ________________________

Select a time period in the past between A.D. 400 and 1830, when the last fishpond was built in Hawai‘i. Imagine that you are a Hawaiian ali‘i (chief) living in that period. As the leader, you must decide what needs to be done to ensure survival and future sustenance for your people. You wish to create agricultural plots, fishponds and fishtraps on your island. You must decide which places on your island have the physical features needed to support lo‘i kalo (taro patches) and different types of fishponds and fishtraps. You also need to delegate various tasks among the people, according to their expertise. Think about the human resources available—what the population of your island would be for the time period selected. Decide which values and human characteristics will be important for you to succeed. Think about the tools that are available to you for constructing lo‘i, fishponds and fishtraps.

- Create a map of your island. Include the following features and label them on your map:
  - major streams, bays, and estuaries
  - inland ponds or lakes
  - major sand dunes
  - mountains
  - reef flats

- Determine where you will build lo‘i kalo and at least two different types of fishponds or fishtraps. Use colored pencils to outline the areas that will be lo‘i and fishponds or fishtraps. Label each feature with the type of pond and a name of your choice.

- Include directions (windward, leeward) and mark the highest elevations.

- Write a summary describing:
  - types of fishponds or fishtraps that you would build in different regions of the island;
  - the physical characteristics of each region that you selected for your sites and why they were important; and
  - the human characteristics that will help you and all of the ‘ohana to succeed.

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Estimates of the Total Hawaiian Population in Different Time Periods*

<table>
<thead>
<tr>
<th>A.D.</th>
<th>Population</th>
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</thead>
<tbody>
<tr>
<td>400</td>
<td>20-30</td>
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<tr>
<td>1000</td>
<td>3,000</td>
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<td>200,000</td>
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<td>80,641</td>
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<td>1872</td>
<td>56,897</td>
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<tr>
<td>1876</td>
<td>45,000</td>
</tr>
<tr>
<td>1891</td>
<td>34,436</td>
</tr>
</tbody>
</table>

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Ka Hana No‘eau a nā Kūpuna  
The Wise Deeds of our Ancestors

Huaka‘i (Field Trip) 1

- How are the early Hawaiian irrigation systems and fishponds in an ahupua‘a reflections of Hawaiian ingenuity?
- How have the physical features in the ahupua‘a been modified by human activities over time?

Hawai‘i DOE Content Standard

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

Grades 9 - 12 Performance Indicators

- Explain types and/or functions of regional systems based on multiple human and physical characteristics.
- Explain the interrelationship(s) within parts of regional systems.
- Identify human and physical changes (boundaries, migration) within a regional system over time.
- Use the information gathered to evaluate (predict, conclude judge or summarize) the human and/or physical effects on regions. (culminating activity)

Key Concepts

- Irrigation systems and fishponds in an ahupua‘a are evidence of Hawaiians’ engineering and organizational skills to make effective and efficient use of water to grow food and cultivate fish.
- Human activities have modified the courses of streams and replaced many early irrigation systems and fishponds with modern development.

Prerequisite

He ‘Āina Momona

Activity at a Glance

Students visit a fishpond and conduct an informal survey of the site to discover the interrelationships between parts of the ahupua‘a system and the ingenuity involved in the construction of Hawaiian fishponds.
Skills
analytical/deductive reasoning, problem solving, drawing, writing

Assessment
Students:
• Complete drawings they create during a field trip and label the major
  natural features of an ahupua’a and the key features in a fishpond.
• Write a summary describing how early Hawaiian irrigation systems and
  fishponds in an ahupua’a are a reflection of Hawaiian ingenuity, and how
  the physical features in the ahupua’a have been modified by human
  activities over time.

Time
1 day field trip (at least 3 hours at the site)

Vocabulary
huaka’i – field trip; excursion
ahupua’a – traditional Hawaiian land unit usually extending from mountain
  summits to the outer edges of reefs
loko i’a – fishpond
kuapā – walls of a fishpond
mākahā – sluice grate
‘auwai kai – ditch or small canal connecting the fishpond to the ocean
survey – to look over and examine carefully
environment – all the conditions, circumstances, and influences affecting an area
biodegradable – material that will decompose into the environment
non-biodegradable – material that will not decompose into the environment
moku – land district
ili – land division, next in importance to an ahupua’a
hukilau – a seine; to fish with a seine

Materials
Provided:                        Needed:
• student activity/data sheets   • 8.5" x 11" graph or grid paper (optional for drawing
  fishpond)
• 8.5” x 11” drawing paper
• 10 feet of rope
• plastic portfolios (optional)
• clipboard
• pencils or pens
• rubber bands (to place over papers on clipboards)

Advance Preparation
Make arrangements to visit a fishpond. (See field sites in the Appendices for more
information.) Contact the fishpond manager to set dates for a visitation. Allow time for travel
and at least three hours at the site. Proper protocol should be discussed and information on the
area should be shared prior to the visitation. Students should also be instructed on proper procedures in collecting samples and recording data as well as appropriate attire for working with water and soil. Make sure students have clipboards and if desired, plastic portfolios to protect their work.

Copy the data sheets (one set of sheets for each student). Note that some loko i'a are further restored or better maintained than others, so surveying and measuring and mapping activities should be tailored to the particular site. Some adjustments to the instructions on the activity sheets may be necessary if, for example, all features of the loko i'a are not measureable or accessible to the students. Note: this activity was designed for one class of 25 - 30 students. See Adaptations at the end of this lesson for taking more than one class to the loko i'a.

Background

The social organization of Hawaiian society was reflected in the land divisions and the social structure of the ruling ali'i. "In old Hawai'i, kings awarded custody of lands to their loyal supporters. Island kingdoms (mokupuni) were divided into districts (moku) which were further parcelled into minor chiefdoms (ahupua'a). Because boundaries with neighboring ahupua'a were not crossed with impunity, these land divisions typically extended from the high forested mountains to offshore fishing grounds, providing the residents with access to the resources of all elevations without crossing borders. Within each ahupua'a were "ili, smaller holdings, each typically worked by one extended family" (Kane, 2001). Each ahupua'a was ruled by a konohiki who was responsible for the distribution of water and land.

Within ahupua'a that had the essential natural resources, Hawaiians demonstrated exceptional organizational and engineering skills in their construction of irrigation systems and fishponds. The engineering involved constructing multiple stone lo'i (terraces) for growing kalo (taro) and extensive 'auwai (ditches) to transport water from the streams into the many terraces. The flow of water was diverted from the stream into the lo'i, then back into the stream, and finally down to the fishpond, where the combination of fresh and salt water attracted fish.

As the human population increased, the land within an ahupua'a was put into more intensive cultivation and the organization of the society became more complex as well. By the 15th century, moku (land districts) comprised of multiple ahupua'a were formed. Each moku had fixed boundaries and was overseen by an aliʻi 'ai moku who answered to the aliʻi nui that ruled the island.

These moku and some 'ili are still recognized today as land districts in the Islands. The extensive network of 'auwai, the stone terraces and fishpond walls, however, are mostly deteriorated. Those features that remain are silent testimony to the engineering ingenuity of the Hawaiians who constructed them.

Teaching Suggestions

1. Highlight and summarize the prerequisite activity, He 'Āina Momona.

Discussion Questions

- What did you learn from the activity?
- Describe one type of loko i'a you placed on your map. Why did you select it for that location?
• What were your limitations in building different types of fishponds?
  (availability of streams, protected bays, reef flats, estuaries and sufficient number of
  people to conduct the work)

• What were the most important human characteristics? Why?
  (ability to laulima [cooperate] and organize; leadership ability; engineering skills to build
  ponds and terraces that work)

• If you were to complete a map when your population had grown much larger, how might
  your map be different?
  (There would be more fishponds and lo'i, and there would be land divisions such as moku
  and ahupua'a to organize people and resources.)

2. Read the following quote and discuss it with your class.

  "From a very early time in their history, Hawaiians, to a greater extent than any other
  Polynesians, exhibited engineering and building skill, ingenuity, industry, and planning and
  organizing ability in three types of construction: the grading and building of terraces for
  growing wet taro; construction of irrigation ditches and aqueducts to bring water to these
  terraces; and construction of fresh- and salt-water fishponds."

  - E.S. Craighill Handy, Elizabeth Green Handy and Mary Kawena Pukui, 1972

Discussion Questions
• What skills were involved in the three types of construction?
• How did Hawaiians make efficient use of fresh water within an ahupua'a?

3. Discuss protocol for visiting the pond. If students would like to compose an oli (chant) or
   mele (song) to share with the fishpond coordinator encourage them to do so. For
   suggestions on composing simple mele, see Haku Mele Aloha, Unit 3, Grades 4 - 5.

4. Divide the class into four teams. You may give Hawaiian names to the teams or have the
   students name them. Explain that the class will be visiting a fishpond and that the teams
   will rotate at regular intervals (30 - 45 minutes) to different stations set up at the pond.
   The four stations and the tasks for each one are:

   a. Physical Environment Station – Take measurements of the loko i'a and water flow rate,
      if the pond has an opening.

   b. Human Factors Station – Note the human influences on the fishpond and its
      environment.

   c. Fishpond Mapping Station – Draw the loko i'a and label the important features.

   d. Ahupua'a Mapping Station – Sketch the ahupua'a where the fishpond is located to gain
      a wider perspective on the interrelationships between different parts of the ahupua'a.

5. Review the instructions on the student activity/data sheets to help students focus on their
   responsibilities during the field trip. Have the class practice measuring and mapping an
   area at school. If a Walking Wheel is available, practice using it or have students determine
   how many normal paces equal 10 feet. Measure a 10-foot rope and have students pace the
   rope and count their paces. Also calculate how many inches are in one normal pace. (See
   the FAST module on “Initial Survey” listed in the Resources at the end of this lesson.)
Investigations at the Pond

- Every student should be actively working with team members to sketch and record information at each station. This information will be useful when sharing with other teams.
- After activities are completed, time could be given for large group activities or, if time allows, give students additional time to write a reflection about what they learned and the significance of the loko i'a.

After Visiting the Fishpond

5. Ask teams to share what they learned at each station and hold a class discussion.

Discussion Questions

- What is the function of the mākāhā? What does the meaning of mākāhā (mākā = type of stone and hā = breath) reveal about the Hawaiian perspective?
- What physical features of the pond are the most significant?
- What physical features in the ahupua'a enabled Hawaiians to build a fishpond in that location?
- What changes do you think were made to the existing fishpond over time? What is the evidence of change?
  (Pond walls may have been cemented, which cuts down on pond circulation, or fresh water streams may have been diverted away from the pond. Runoff of soil from upslope may have changed the water quality.)
- How have the physical features in the ahupua'a been modified by human activities over time?
  (Streams may have been diverted for use in other areas, or channeled to prevent flooding. Coastal areas may have been developed for recreation, housing or hotels.)

6. Ask students to complete the drawing and writing assessment activities that address the focus questions of this lesson. See the culminating activity for regional comparisons.

Adaptations/Extensions

- If two or three classes (about 90 students) are participating in the huaka'i, plan some large group activities, such as throwing net, participating in hukilau, or loko i'a clean up. Work with the field site coordinator to plan activities.
- Arrange for students to use gill nets at the fishpond to see how the nets are used and to demonstrate laulima; working together to catch the most fish with the least amount of effort. An additional benefit of this exercise is that the bottom of the pond becomes stirred-up and, if the tide is outgoing, the silt can be flushed from the pond.
- Have students write mini-research papers about the ahupua'a they have studied. They could look for maps that show changes over time or research Hawaiian legends that mention certain significant or unusual land formations such as 'Alekoko on Kaua'i, and Kealiiakahoe on O'ahu). Alternatively, they could create a short story that explains a landform in the ahupua'a.
• Ask students to read case studies on fishponds to construct the history from the pre-contact era until today. A table could be created comparing older maps and surveys with those of today. Moli'i, He'eia, Nu'upia, and Waikalua fishponds on O'ahu, 'Ualapu'e fishpond on Moloka'i, Kaloko fishpond on Hawai'i, 'Alekoko fishpond on Kaua'i and Ko'ie'ie fishpond on Maui are fishponds that could be studied. See Resources listed for each island in Unit 3, Huli Kanaka activity.

<table>
<thead>
<tr>
<th>year</th>
<th>similarities</th>
<th>differences</th>
<th>changes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1800s</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1900s</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>present</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Resources


Titcomb, Margaret. 1972. Native Use of Fish in Hawai'i. University of Hawai'i Press. Honolulu, HI.
Student Data Sheet

Name ____________________________ Date ______ Time ______

Type of pond: ____________________________ Tide Notes ____________________________

Does this pond have mākāhā? ____________________________

---

A. Use the Walking Wheel and measure:
   1: Length of wall
   2: Width of 'auwai kai
   3: Width of wall

Record your measurements on the numbered lines above.

B. Draw an arrow in the diagram above to indicate the direction the tide is flowing through the 'auwai kai.

C. Measure:
   • the speed that a float travels from one end of the 'auwai kai to the other:
     _______ ft. per second
   • the water depth in the 'auwai kai:
     _______ ft.

D. Calculate the flow rate:

\[
\text{Depth (ft.)} \times \text{Width of 'auwai kai (ft.)} \times \text{Flow (ft. per sec.)} \times 60/7.5 = \text{GPM (gal. per min.)}
\]

\[
\text{_______} \times \text{_______} \times \text{_______} \times 60/7.5 = \text{_______}
\]

E. What is the function of the mākāhā and the 'auwai kai?

---

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**Student Activity Sheet**  
**Human Factors Station: Scavenger Hunt**

Team Name ________________________________ Date ____________

**INSTRUCTIONS:** Work with your team to find evidence of things that may have changed the fishpond (directly or indirectly) and its environment. Find items listed in the left column and describe them and their effect or connection to the loko i'a.

<table>
<thead>
<tr>
<th>Find</th>
<th>Describe (what it is and its relationship to the loko i'a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a landform that is included in Hawaiian mo'olelo (legend)</td>
<td></td>
</tr>
<tr>
<td>evidence of people caring for this environment</td>
<td></td>
</tr>
<tr>
<td>a negative human impact on this environment</td>
<td></td>
</tr>
<tr>
<td>a human-made object that is biodegradable and one that is non-</td>
<td></td>
</tr>
<tr>
<td>biodegradable</td>
<td></td>
</tr>
<tr>
<td>evidence of a significant human change to this environment</td>
<td></td>
</tr>
<tr>
<td>something human-made that is beautiful</td>
<td></td>
</tr>
<tr>
<td>evidence of Hawaiian ingenuity</td>
<td></td>
</tr>
</tbody>
</table>

Completed by: ________________________________
Student Activity Sheet  

Loko I'a Mapping Station

Team Name ____________________________________________ Date __________

Name of Ahupua'a ____________________________________________

Name of Moku ____________________________________________

INSTRUCTIONS:
1. Find an area at the loko i'a where you have a good view and perspective of the fishpond.
2. On the reverse side of this sheet draw a detailed diagram of the loko i'a.
3. Label the mākāhā, 'auwai kai, and the kuapā.
4. Include directions on your drawing (showing mauka and makai) and show where any streams flow into or close to the pond.

REFLECTIONS:
Describe how the fishpond functions.

How is the fishpond a reflection of Hawaiian ingenuity or skill?

How do you think the fishpond has changed over time?

Your name here: ____________________________________________
Student Activity Sheet  Ahupua'a Mapping Station

Team Name ____________________________________ Date ____________

Name of Ahupua'a _____________________________________________

Name of Moku _________________________________________________

INSTRUCTIONS:
1. Find an area at the loko i'a where you have a good view and perspective of the ahupua'a – from mauka to makai.
2. On the reverse side of this sheet sketch the ahupua'a showing significant natural features such as streams, peaks, ridges, and coastline.
3. Add the fishpond to your sketch and other features of Hawaiian culture that are visible, such as heiau or lo'i kalo (taro terraces)

QUESTIONS:
What is the relationship between the stream and the fishpond?

What physical characteristics of this ahupua'a make this a good site for a fishpond? Explain your answer.

What do you think are the most significant changes that people have made to this ahupua'a over time?

Your name here: _____________________________________________