

The Catalog

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Oceans: Beyond the Reef

A Major Flower Show and Horticulture Show

Presented by The Garden Club of Honolulu

June 23 – 25, 2023

Division V: Education Exhibit

Native Hawaiian Bio-Cultural Ocean Management

Statement of Intent: Pre-contact Hawaiians maintained a thriving ocean by applying a systems approach employing both culture and science to promote balance and sustained abundance. Learn how a renaissance of this biocultural system is being revisited in Hawaii and abroad to improve ocean health and the related ecosystems that support it.

I. Introduction: 'Aina Momona - Creating an Ecosystem of Abundance

Native Hawaiians understood that the health of the ocean, land, and atmosphere is interconnected. With rich but limited island resources, Hawaiian culture placed great importance on protecting an ecosystem in which ALL creatures great and small are necessary to a healthy, balanced ecology. They cultivated deep relationships between its people and nature to promote healthy, balanced ecosystems teeming with biodiversity and abundance that experts estimate sustainably supported a human population exceeding one million during pre-contact history.^{1 2}

Through oral traditions, Kupuna (elders) taught their Keiki (children) that Nature is their living ancestor, deserving of great respect, and that their very survival depended on pono (right) relationships between every creature and object in the 'aina (earth). The native Hawaiian origin chant, the Kumulipo³, taught that man was born of the earth and sky, and as a child of the 'aina, it is man's kuleana (responsibility) to malama (care for) the 'aina (earth), wai (life-giving water) and kai (ocean) into perpetuity.

With the recent focus on climate change and the need to heal our 'aina, a renaissance of bio-cultural management principles are being revisited in Hawaii and exchanged globally to help protect and restore our planet, *Island Earth*.⁴ The United Nations has acknowledged the success of native Hawaiian management by designating Hawaii Green Growth as its first Global Island Partner and Local2030 Hub so that other cultures around the world can look to Hawaii's model for lessons on how to create abundance in the face of finite resources.⁵

¹ "Aquaculture in Hawai'i – Ancient Traditions, Modern Innovation" *World Aquaculture Society* December 16, 2019, https://www.was.org/articles/Aquaculture-in-Hawaii-Ancient-Traditions-Modern-Innovation.aspx#.Y_530i-B1f0

² Samuel 'Ohukani 'Ohia Gon III, Ph.D., "Lessons from a thousand years of island sustainability", 4:48 & 5:57 of 13:29, https://www.youtube.com/watch?v=l9fv_2XIJBk May 29, 2014 TEDxMaui

³ Gon III, Ph.D. "Lessons from island sustainability", 7:45 to 10:30,

⁴ Gon III, Ph.D. "Lessons from island sustainability", 10:30 to 13:22

⁵ "Hawaii Green Growth accepts United Nations Invitation as a Local2030 Hub", by Hawaii Green Growth, December 12, 2018, <https://www.hawaiigreengrowth.org/hawaii-green-growth-accepts-united-nations-invitation-as-a-local2030-hub/>

In our two part exhibit:

- **Watch “Protecting Island Earth”, the GCA Conservation Study Conference**, in which 8 native speakers present on the success of native Hawaiian bio-cultural management practices that are being shared with the rest of the planet, Island Earth to protect us all.
- **See examples of biocultural management in five focus areas** where ecosystem abundance was cultivated in a manner that also supported the health and biodiversity of the ocean.

KUMULIPO - A HAWAIIAN CREATION CHANT

KA WA AKAHI - CHANT ONE

(Lines 1 thru 39)

The Awakening(1-11)

O ke au i kahuli wela ka honua

At the time when the earth became hot

O ke au i kahuli lole ka lani

At the time when the heavens turned about

O ke au i kuka’iaka ka la

At the time when the sun was darkened

E ho’omalalama i ka malama

To cause the moon to shine

O ke au o Makali’i ka po

The time of the rise of the Pleiades

O ka walewale ho’okumu honua ia

The slime, this was the source of the earth

O ke kumu o ka lipo, i lipo ai

The source of the darkness that made darkness

O ke kumu o ka Po, i po ai

The source of the night that made night

O ka lipolipo, o ka lipolipo

The intense darkness, the deep darkness

O ka lipo o ka la, o ka lipo o ka po

Darkness of the sun, darkness of the night

Po wale ho--’i

Nothing, but night

The Coming Forth of Life (12-39)

Hanau ka po

The night gave birth

Hanau Kumulipo i ka po, he kane

Born was Kumulipo in the night, a male

Hanau Po'ele i ka po, he wahine

Born was Po'ele in the night, a female

Hanau ka 'Uku-ko'ako'a, hanau kana, he 'Ako'ako'a, puka

**Born was the coral polyp,
born was the coral, came forth**

Hanau ke Ko'e-enuhe 'eli ho'opu'u honua

**Born was the grub that digs and heaps up the
earth, came forth**

Hanau kana, he Ko'e, puka

**Born was his [child] an earthworm,
came forth**

Hanau ka Pe'a, ka Pe'ape'a kana keiki puka

**Born was the starfish,
his child the small starfish, came forth**

Hanau ka Weli, he Weliweli kana keiki, puka

**Born was the sea cucumber, his child
the small sea cucumber came forth**

Hanau ka 'Ina, ka 'Ina

**Born was the sea urchin,
the sea urchin [tribe]**

Hanau kana, he Halula, puka

Born was the short-spiked sea urchin, came forth

Hanau ka Hawa'e, o ka Wana-ku kana keiki, puka

**Born was the smooth sea urchin,
his child the long-spiked came forth**

Hanau ka Ha'uke'uke, o ka 'Uhalula kana keiki, puka

**Born was the ring-shaped sea urchin,
his child the thin-spiked came forth**

Hanau ka Pi'oe, o ka Pipi kana keiki, puka

**Born was the barnacle,
his child the pearl oyster came forth**

Hanau ka Papaua, o ka 'Olepe kana keiki, puka
**Born was the mother-of-pearl,
his child the oyster came forth**

Hanau ka Nahawele, o ka Unauna kana keiki, puka
**Born was the mussel,
his child the hermit crab came forth**

Hanau ka Makaiauli, o ka 'Opihi kana keiki, puka
**Born was the big limpet,
his child the small limpet came forth**

Hanau ka Leho, o ka Puleholeho kana keiki, puka
**Born was the cowry,
his child the small cowry came forth**

Hanau ka Naka, o ke Kupekala kana keiki, puka
**Born was the naka shellfish,
the rock oyster his child came forth**

Hanau ka Makaloo, o ka Pupu'awa kana keiki, puka
**Born was the drupa shellfish,
child the bitter white shell fish came forth**

Hanau ka 'Ole, o ka 'Ole'ole kana keiki, puka
**Born was the conch shell,
his child the small conch shell came forth**

Hanau ka Pipipi, o ke Kupe'e kana keiki, puka
**Born was the nerita shellfish,
the sand-burrowing shellfish
his child came forth**

Hanau ka Wi, o ke Kiki kana keiki, puka
**Born was the fresh water shellfish,
his child the small fresh water shellfish came
forth**

Hanau kane ia Wai'ololi, o ka wahine ia Wai'olola
**Born was man for the narrow stream,
the woman for the broad stream**

Hanau ka Ekaha noho i kai
Born was the Ekaha moss living in the sea

Kia'i ia e ka Ekahakaha noho i uka
**Guarded by the Ekahakaha fern
living on land**

He po uhe'e i ka wawa

Darkness slips into light

He nuku, he wai ka 'ai a ka la'au

Earth and water are the food of the plant

O ke Akua ke komo, 'a'oe komo kanaka

The god enters, man can not enter

O kane ia Wai'ololi, o ka wahine ia Wai'olola

**Man for the narrow stream,
woman for the broad stream**

Hanau ka 'Aki'aki noho i kai

**Born was the tough seagrass
living in the sea**

Kia'i ia e ka Manienie-'aki'aki noho i uka

**Guarded by the tough landgrass
living on land**

He po uhe'e i ka wawa

Darkness slips into light

He nuku, he wai ka 'ai a ka la'au

Earth and water are the food of the plant

O ke Akua ke komo, 'a'oe komo kanaka

The god enters, man can not enter

O kane ia Wai'ololi, o ka wahine ia Wai'olola

**Man for the narrow stream,
woman for the broad stream**

Hanau ka 'A'ala'ula noho i kai

**Born was the 'Ala'ala moss
living in the sea**

Kia'i ia e ka 'Ala'ala-wai-nui noho i uka

Guarded by the 'Ala'ala mint living on land

He po uhe'e i ka wawa

Darkness slips into light

He nuku, he wai ka 'ai a ka la'au

Earth and water are the food of the plant

O ke Akua ke komo, 'a'oe komo kanaka

The god enters, man can not enter

II. Watch “Protecting Island Earth”, the GCA Conservation Study Conference:

Doris Duke Theater

Friday, June 23 thru Sunday, June 25,

2:00 pm to 6 pm daily

To learn how the ingenuity of bio-cultural interventions devised by native Hawaiians for the management of our interconnected ‘aina amplified the health and productivity of our ecosystem to exceed what nature alone could produce:

- a. Visit the Doris Duke Theatre from 2:00 pm to 6:00 pm daily throughout this Flower Show to view “Protecting Island Earth”, the Conservation Study Conference hosted by the Garden Club of America.
- b. Listen and watch eight native experts explain the interconnected bio-cultural management of the ‘aina from the top of mountain watersheds, down valleys to the shore, over limu, fishponds, and reefs into ocean depths that connect us with the rest of our planet, Island Earth.
- c. Learn how Hawai’i has become a global model that others look to for environmental leadership; how the success of this bio-cultural systems approach resulted in healthy & productive ecosystems that sustained the health and well being of the ‘aina over centuries, is now being shared with the rest of the planet, *Island Earth*.

The Garden Club of America and The Garden Club of Honolulu are grateful for the following eight community leaders who shared their bio-cultural knowledge in video presentations created for the 2022 GCA Conservation Study Conference being shared with you throughout this Flower Show:

2:00 pm: “Lessons from a Thousand Years of Island Sustainability”

By Samuel ‘Ohukani ‘Ohia Gon III, PhD

Senior Scientist and Cultural Advisor for The Nature Conservancy

Subject: History: Pre-contact resource management practices

~2:18 pm: “The Ahupua‘a – Ancient Wisdom and Modern Practice”

By Charles R. “Chipper” Wichman, Jr., PhD, FLS

President, Director and Chief Executive Officer

National Tropical Botanical Garden

Subject: Native Hawaiian Land Management: The Ahupua‘a

~ 2:44 pm: "I ola ‘oe, i ola mākou nei - Community-based Efforts to Perpetuate Our Unique Flora"

By Matthew J. Keir

Hawaii State Botanist (DLNR), Division of Forestry Wildlife & Manager, Plant Extinction Prevention Program

Subject: Protect and reverse extinction of endangered native Hawaiian plants

~3:06 pm: "From Our Gardens to Our Commons: Aloha Aina, Malama Aina, Community-based Natural Resource Management"

By Kevin Chang

Executive Director,

Kua'aina Ulu 'Auamo (KUA)

Subject: Nurturing community kuleana for our resources to perpetuate abundance (with near shore focus on Limu, & Fishponds

~3:54 pm: "Bringing Local & Global Wisdom Together at Scale to Mitigate Climate Change and Perpetuate Biocultural Resources"

By Ulalia Woodside

Executive Director, Hawai'i and Palmyra

The Nature Conservancy

Hawai'i and Palmyra

Subject: How global partnerships bring the best of native Hawaiian and global conservation practices together to protect our natural ecosystems and mitigate climate change.

~4:25 pm: "The importance of ocean conservation and of viewing our planet as "Island Earth"

By Nainoa Thompson

Navigator and CEO

Polynesian Voyaging Society

Subject: How the revival of ancient voyaging connected with space travel to shift the perspective of our planet & has galvanized the global fight against climate change.

~5:05 pm: "The Role of Bio-Cultural Conservation in Ocean Protection at-Scale"

By Aulani Wilhelm

Asst. Director for Ocean Conservation, Climate and Equity

The White House, Office of Science and Technology Policy

On secondment from:

Conservation International

As Senior Vice President, Center for Oceans

Subject: Sharing Local practices Globally to speed protection of our planet together

~5:36 pm: "Sharing an island Worldview with the Rest of the World"

By Celeste A. Connors

CEO, Hawaii Green Growth

UN Local 2030 Hub

Adjunct Senior Fellow, East-West Center

Subject: What the world is looking to Hawaii to learn how to protect Island Earth

III. Mediterranean Court Displays: See examples of biocultural management in five focus areas

In the spirit of our Flower Show, *Oceans: Beyond the Reef*, members of The Garden Club of Honolulu have created displays that focus on examples of biocultural management practices employed in the following areas of the 'aina:

- i. Lo'i (Kalo wetlands)
- ii. Limu (Seaweed beds)
- iii. Loko'la (Fishponds)
- iv. Ko'a (Coral Reefs)
- v. Kai (Deep Ocean)

Each display answers three questions:

1. What kind of abundance was addressed in this focus area?
2. What native Hawaiian intervention was employed to increase abundance and support ocean health?
3. How have some of these biocultural management practices been exchanged globally to improve ocean health and related ecosystems both in Hawaii and abroad?

We hope you enjoy learning about these ingenious, sustainable management practices!

**The Garden Club of Honolulu
Flower Show Education Committee:**

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<https://www.chingfoster.com>

Mr. & Mrs. Sherman Hee,
The Garden Club of Honolulu

Stan Calma & Larry Heim of HONBLUE

III.i. LO'I (Kalo Wetlands)

In support of abundance and ocean health in both land and marine ecosystems

1. What kind of abundance was addressed in this focus area?

The terraced, flooded field system for agriculture called the Lo'i (wetlands) helped Precontact Hawaiians to cultivate abundance by nurturing deeply interconnected aspects of their culture within the 'aina.

The Lo'i was used to farm an abundance of **Kalo**, the staple food source of Precontact Hawaiians, and considered essential to Hawaiian survival and prosperity. *Kalo, the root of life*, is at the center of spiritualism, mythology, and social structure in Hawaiian culture. Kalo was the stillborn elder brother of the first Hawaiian man, who would sustain and nourish his younger brother and future descendants into perpetuity, if he were always respected and cared for.^{6 7}

Precontact Hawaiians observed that famine and drought often followed natural disasters, leaving but a fraction of plant and marine life, known as "famine foods", available during recovery. To facilitate resilience and abundance, resource managers learned to cultivate high levels of biodiversity in the ecosystem. Lo'i wetlands attracted a **variety of plants and animals** to the habitat, and native Hawaiians used tools such as *Kapu* and harvest/access restrictions during phases of the moon, to sustain key species. They understood the importance of holistically managing land and shore based resources as a complex, interconnected system.⁸

Lo'i Irrigation from valley streams or underground springs required mastering the rate of water flowing across wetland terraces, finding angles of elevation, and proper circulation to prevent stagnant, overheated water from causing Kalo corms to rot.⁹ They developed a system of auwais (canals) to help modulate the flow of water which was especially critical during heavy storms to prevent silt from flowing downstream to damage shoreline ecosystems. This helped to preserve the **health and biodiversity in both land and marine-based ecosystems, and increased food abundance throughout the ahupua'a.**¹⁰

⁶ "Kalo (Taro)", Manoa Heritage Center, <https://www.manoaheritagecenter.org/moolelo/polynesian-introduction-plants/kalo-taro/#:~:text=Kalo%20is%20indisputably%20the%20most,the%20elder%20brother%20of%20mankind.>

⁷ Marissa Kobayashi, "Hawai's Kalo and Culture", Part 1, Introduction and History, <https://coe.hawaii.edu/ethnomath/wp-content/uploads/sites/12/2019/10/Hawai'i's-Kalo-and-Culture.pdf>

⁸ Kawika B. Winter, Kamanamaikalani Beamer, Mehana Bleach Vaughan et. al., "The Moku System: Managing Biocultural Resources for Abundance within Social-Ecological Regions in Hawaii" *Sustainability 2022 Biocultural Restoration in Hawai'i*. Pages 22-26.

⁹ Marissa Kobayashi, "Hawai's Kalo and Culture", Part 1, Introduction and History

¹⁰ Kawika B. Winter, Noa Kekuewa Lincoln, and Fikret Berkes, "The social-Ecological Keystone Concept: A Quantifiable Metaphor for Understanding the Structure, Function, and Resilience of a Biocultural System" *Sustainability 2022 Biocultural Restoration in Hawai'i*. Pages 113 – 131.



2. What native Hawaiian intervention was employed to increase abundance and support ocean health and how are they being redeployed today?

Precontact Hawaiians converted lowland forests into flooded wetlands, which increased aquifer recharge and enriched surface water -- with nutrient dense organic matter and phosphorous rich anaerobic soils feeding fish-loving phytoplanktons – that flowed into near shore areas and aquaculture fish ponds. This detour of rain water on its path to the ocean also helped to slow flood waters during large storm events, allowing its muddy sediment to settle before being able to pollute the estuaries and reef ecosystems below. Fish pond walls trapped enriched water containing fish loving phytoplankton, fattening herbivorous fish for farming, safe from outside predators, while maintaining a healthy reef and ocean beyond.¹¹

¹¹ Kawika B. Winter, Noa Kekuewa Lincoln, and Fikret Berkes, “The social-Ecological Keystone Concept: A Quantifiable Metaphor for Understanding the Structure, Function, and Resilience of a Biocultural System” Pages 125 – 126.

3. How have some of these bio-cultural management practices been exchanged globally to improve ocean health and related ecosystems both in Hawaii and abroad?

Interest in the biocultural restoration of traditional Hawaiian agriculture is growing around the world¹² Wetlands exist on every continent except Antarctica¹³ and those used for agriculture have provided valuable benefits such as clean water, soil retention and nutrient cycling. However, an awareness of its impact on interrelated ecosystems requires care to maintain a healthy balance.¹⁴

Precontact Hawaiians were careful to return water diverted to the Lo'i from the main source back into the flow prior to reaching near shore areas of transition (eg: Limu beds or Fish ponds). They created a model that increased local food production, recharged the aquifer, increased phytoplanktons to Limu beds and herbivorous fish, and decreased damaging sediment delivery to downstream coastal systems and coral reefs¹⁵ in an interconnected ahupua'a system from ridge to reef.

In 2016, Hawaii organizers brought the **International Union for Conservation of Nature (IUCN)** to Hawaii, where they showcased native Hawaiian "diversity in nature, culture, conservation and sustainability through a combination of traditional wisdom and modern knowledge."¹⁶ They shared their deep reverence for the natural world, the interconnected Ahupua'a, the Kapu system of management, cultural revival, the Reef, Forest, and oral communication such as chants, stories, songs and dances.¹⁷

In 2018, the United Nations invited **Hawai'i Green Growth to become its first island based Local2030 Sustainability Hub** and designated the **State of Hawaii its first Global Island Partner** showcasing the Hawaiian Islands as laboratories for innovation that catalyze and scale integrated ridge-to-reef projects, cutting across the energy, water, food and urban nexus.^{18 19}

¹² Leah L Bremer, Kim Falinski, Casey Ching, et. al, "Biocultural Restoration of Traditional Agriculture: Cultural, Environmental, and Economic Outcomes of Lo'i Kalo Restoration in He'eia, O'ahu" *Sustainability 2022 Biocultural Restoration in Hawai'i*, Pages 231.

¹³ "Wetland" *National Geographic Encyclopedic Entry*, <https://education.nationalgeographic.org/resource/wetland/>

¹⁴ "Wetlands and agriculture" *Australian Government Department of Climate Change, Energy, and Environment and Water*, <https://www.dcceew.gov.au/water/wetlands/publications/factsheet-wetlands-agriculture>.

¹⁵ Leah L Bremer, Kim Falinski, Casey Ching, et. al, "Biocultural Restoration of Traditional Agriculture: Cultural, Environmental, and Economic Outcomes of Lo'i Kalo Restoration in He'eia, O'ahu", Pages 231 - 233.

¹⁶ "Planet at the crossroads" *IUCN World Conservation Congress Hawaii 2016, 1-10 September 2016*, <https://2016congress.iucn.org/hawaii/about-the-host/conservation-in-hawaii/index.html>

¹⁷ "Planet at the crossroads" *IUCN World Conservation Congress Hawaii 2016, 1-10 September 2016*, <https://2016congress.iucn.org/hawaii/about-the-host/hawaiian-culture/index.html>

¹⁸ Kate Brown, "Hawaii launches first island-based UN Local2030 Hub". *IN*, <https://www.linkedin.com/pulse/hawaii-launches-first-island-based-un-local2030-hub-kate-brown/>

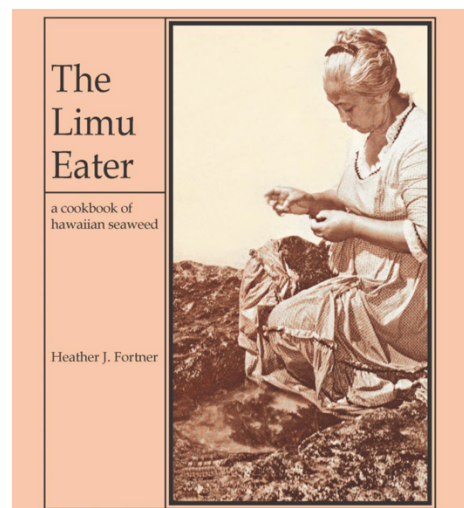
¹⁹ "Local SDG Action Around The World" LOCAL 2030 Localizing the SDGs, <https://www.local2030.org/local-action>.

III.ii LIMU (Seaweed)

1. What kind of abundance was addressed in this focus area?

Limu includes numerous endemic and indigenous species of plants and algae which grow in fresh water, salt water, and other damp habitats throughout Hawaii. Traditionally for Native Hawaiians, limu was the third major component of a balanced diet which also consisted of fish and poi. Limu's high mineral and vitamin content made it a valuable food and medicinal resource. Limu was also used in religious and cultural ceremonies. Expertise about limu has been transmitted largely through Native Hawaiian women for generations. In ancient times there were many different types of limu, however today there are approximately only twenty identifiable types of limu in Hawaii.

Limu serve as key ecological and economic functions, preventing erosion and coral breakage, creating oxygen, producing sand, serving as food and shelter for marine animals, mitigating global warming through carbon sequestration, and acting as the base of the food-web on which fisheries rely.



(References ^{20, 21, 22})

²⁰ Lurline Waimānalo McGregor, "Limu Traditions," Ka Pili Kai, Ho'oilō 2019, accessed January 22, 2023, <https://sea-grant.soest.hawaii.edu/Limu-traditions>.

²¹ Catherine Toth Fox, "How Botanists Are Trying To Spur A Limu Rebound In Hawaii," Honolulu Civil Beat, November 11, 2022, accessed January 22, 2023, <https://www.civilbeat.org>.

²² "The Limu Eater-A Cookbook Of Hawaiian Seaweed," accessed January 22, 2023, <https://sea-grant.soest.hawaii.edu>

2. What native Hawaiian intervention was employed to increase abundance and support ocean health and how are they being redeployed today?

Through the stewardship of the ahupua'a, native Hawaiians ensured the health of the land and water from the peak of the mountain and into the ocean. In this environment, limu thrived and there was plenty of limu to feed the people and fish. Supplies of limu have been decreasing over the decades due to shoreline development and compromised water quality due to pollution and climate change. Native Hawaiian limu have also been impacted by rapid spreading of invasive seaweeds such as "gorilla ogo" (*Gracilaria salicornia*).

Today through the combined efforts of non-profit organizations, government initiatives and private volunteers, there is a movement to revive the ahupua'a system of land management and aquaculture by utilizing a combination of current scientific and native Hawaiian knowledge and practices.

Ancient knowledge of ahupua'a stewardship has been implemented in many areas to rebuild ecosystems in which plants and animals can thrive in clean water. A yearly meeting of traditional limu gathers has been hosted by the 'Ewa Limu Project since 2014. The idea is to gather the gatherers so that knowledge can be shared regarding areas that limu still thrive and best practices for gathering the limu. By official state proclamation, Governor David Ige publicly announced 2022 as "Year of the Limu" recognizing the critical role that limu play in our environment and culture, and in recognizing the crucial endeavor of protecting, restoring, and perpetuating both limu and knowledge about limu.

(References ^{23, 24})



Limu (seaweed) is an important part of the traditional Hawaiian diet. Used to add flavor and variety to meals, it's also a source of vitamins and minerals. Since noticing native species in decline, Napua Barrows has been replanting the reef, and teaching youth how to identify different types of limu and harvest it sustainably.

²³ "Cultivating Ancient Hawaiian Wisdom," Maui Na Ka Oi Magazine, May-June 2016, accessed January 22, 2023, <https://mauiagazine.net>.

²⁴ Erica Gies, "Hawaii's Ancient Aquaculture Revival," June 16, 2019, accessed January 22, 2023, <https://www.biographic.com>.

3. How have some of these bio-cultural management practices been exchanged globally to improve ocean health and related ecosystems in Hawaii and abroad?

Through its ongoing efforts in ecosystem and aquaculture restoration, Hawaii is now recognized throughout the Pacific Basin and further abroad as a model for successful rehabilitation through culturally based restoration practices. Through the Aquaculture Collaborative Network, places like He'eia Fishpond have welcomed people from international locations such as New Zealand, Thailand, and Bangladesh who are eager to learn from its successes. At the University of Hawaii School of Ocean and Earth Science and Technology (SOEST) and through its Sea Grant College Program (Hawaii Sea Grant) researchers study various systems of cultivating native limu through extracting essential nutrients to feed the limu grown in aquaculture from nutrient rich groundwater or fish aquaculture. The goal is to create large-scale and sustainable limu aquaculture throughout the state of Hawaii. These efforts are a part of a larger movement existing also on the Continent that led to the introduction of the Seaweed Farming Act of 2023. This bill would direct NOAA and the USDA to produce a study evaluating the benefits and impacts of coastal seaweed farming. The bill would also create the Indigenous Seaweed Farming Fund, a grant offering funding to indigenous people to help implement bio-cultural, sustainable alternatives to harmful commercial farming seafood practices and to further promote seaweed as a nutritious food product and as a key component to regenerating marine ecosystems. (References ^{25, 26, 27, 28})



He'eia Fishpond



Wally Ito of Limu Hui

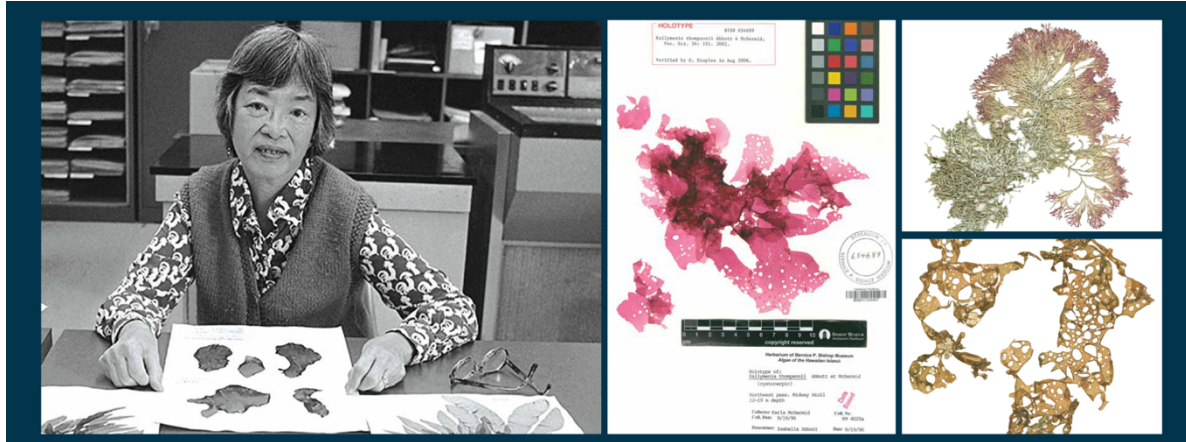
²⁵ Erica Gies, "Hawaii's Ancient Aquaculture Revival," June 16, 2019, accessed January 22, 2023, <https://www.biographic.com>.

²⁶ Cliff White, "Jared Huffman, Mary Peltola Introduce Bill in US Congress to Support Seaweed Farming," March 2, 2023, accessed March 2, 2023, <https://seafoodsource.com>.

²⁷ Claudia Geib, "Restoring Indigenous Connects to the Ocean: Seaweed Cultivation," January 14, 2022, accessed March 2, 2023, <https://news.mongabay.com>.

²⁸ "Exploring Nutrient Utilization in Native Hawaiian Seaweeds for Parallel Aquaculture Development Across Restoration and Sustainability Applications" *Hawaii Sea Grant*, <https://seagrant.soest.hawaii.edu/research/current-research-projects/2022-2024-nelson-nutrient-utilization-native-hawaiian-seaweeds/>. Accessed 10 May 2023.

Dr. Isabella Abbott²⁹



During the mid-1980's, while visiting with Dr. Isabella Abbott, who I knew as Auntie Izzie, she turned to me and said, "You know what Hawaiians say: healthy land means healthy people. A healthy ocean also means healthy people. But healthy lands and ocean means a resilient people. And that's who Hawaiians were." She also added, "Pala ka hala, momona ka ha'uke'uke - When the pandanus fruit ripens, the ha'uke'uke sea urchin is fat." With this 'ōlelo no'eau (proverb), Izzie reminded me of the bigger picture: while Hawaiians ate the sea urchin, the real prize was the parrot fish, which fed on the urchin.

As we talked she went on to tell me that the distance from mauka (inland, toward the mountain) to makai (ocean) in some ahupua'a was so great that it was inefficient for families to access its resources directly. Instead, Hawaiians practiced "ko kula uka, ko kula kai," an informal exchange among "those of the upland" and "those of the shore." Fundamentally, while the ahupua'a system managed mauka-makai resources, it also united Hawaiians from mauka to makai. Auntie Izzie taught these principles to many others, informally while just visiting with her and formally during her tenure as a professor at the University of Hawai'i (UH), influencing many to become current resource management leaders in Hawai'i.

Her path to inspiring so many began in 1976 with her offering of ethnobotany at UH. Over a 20-year period, Izzie provided a transformative experience for over 1,000 students, enthraling them with stories of the many ways these plants provided the underpinnings of culture. She also examined the ahupua'a from a functional perspective. In 1992, she published *La'au Hawai'i: Traditional Hawaiian Uses of Plants*, mainly to explain to students the ahupua'a and why the cultural uses of these plants across mauka-to-makai gradients were critical to Hawaiian society. She made science accessible by tying culture and science together while reinforcing the importance of understanding the intimate connections between the land, ocean, and people, and how complex ecosystems and their resources could be sustained.

Auntie Izzie took the ahupua'a, an amorphous concept to many, and gave it substance. She taught students about staple crops from the land and gifts from sea, clothing made from kapa, cordage for all occasions (the botany of canoes as she would say), and the sticky plant sap that allowed birds to be caught for a feather or two and released unharmed. She gave them the insight to see how a complex land-sea gradient could allow mature Hawaiian communities to thrive. And they loved her for it.

-Bill Thomas

²⁹ Dr. Celia Smith, Bill Thomas, Kawika Winter, and Mazie K. Hirono, U.S. Senator, "First Lady of Limu: Memories of an Inspiring Mentor and Botanist," *Ka Pili Kai*, accessed January 22, 2023, <https://seagrant.soest.hawaii.edu>

III.iii LOKO 'IA (Fishponds)

1. What kind of abundance was addressed in this focus area?

Our Hawaiian ancestors adapted to island life with its finite resources, but also discovered innovative ways to enhance what nature provided. They found it more advantageous to work with nature than to impose on it. In near shore areas, this is shown in an aquaculture that utilized walled fishponds to more efficiently cultivate **marine abundance - fish, limu, crabs, invertebrates** – while enhancing habitat protection and water filtration in the estuary necessary to sustain a healthy ocean ecosystem beyond. Within the Loko I'a this ingenious design produced marine resources, more efficiently, at a higher catch per unit of effort.³⁰

2. What native Hawaiian intervention was employed to increase abundance and support ocean health and how are they being redeployed today?

Native Hawaiians raised marine life in man-made ponds to ensure a readily available supply for their community. Different kinds of ponds were located up in the mountains and along the ahupua'a down to the sea depending on their need to catch, raise, or store fish for their meals. Having observed that fish gathered in currents, they built *Kuapa* (stone wall fishponds) along the coasts, and placed *makaha* (sluice gates) near the ebb and flow of tidal water to lure them in and to keep the water circulating. The loko I'a became nurseries for small fish, drawn to the smell of *Kalo* and *Limu* nutrients, who could come and go through the narrowly spaced, vertical wood slats of the *makaha* gates until they fattened inside and grew too large to escape their harvest.³¹

The diversion of water at the top of the *ahupua'a* (watershed) via *auwai* (canals) into *Lo'i* (*Kalo* wetlands) helped to regulate the flow of water carrying plant nutrients down to marine life at the shore, while allowing silt to settle along the way. At the shore, sluice gates at the upstream entry into the Loko I'a (fishpond) further regulated sediment from flowing into the enclosure and beyond, resulting in a healthier reef and deep ocean ecosystem for all marine creatures.³²

Organizations such as *Kua'aina Ulu Auamo* (KUA) are facilitating the return of community-based management of *Loko I'a* with support for *Hui Malama Loko I'a* -- a growing network of fishpond practitioners who have gathered to leverage their skills, knowledge and resources to support the active restoration of *Loko I'a* across the Hawaiian archipelago. Of 488 ancient fishpond sites identified in a 1990 statewide survey, the *Hui* currently represents 38 fishponds sites and over 100 owners.³³

³⁰ Kawika B. Winter, Kevin Chang and Not Kekuewa Lincoln, "Hawai'i in Focus: Navigating Pathways in Global Biocultural Leadership" *Sustainability 2022 Biocultural Restoration in Hawai'i*. Page 3.

³¹ "Maui Fishpond, Revitalizing a wall, revitalizing a culture" *'Ao'ao O Na Loko I'a O Maui*, Maui Fishpond Association, Copyright 2013, <http://mauifishpond.com/koieie/fishpond-basics/>

³² Kawika B. Winter, Kevin Chang and Not Kekuewa Lincoln, "Hawai'i in Focus: Navigating Pathways in Global Biocultural Leadership". Page 3.

³³ "Hui Malama Loko I'a" *Kua 'Aina Ulu 'Auamo*, <https://kuahawaii.org/huimalamalokoia/>

3. **How have some of these bio-cultural management practices been exchanged globally to improve ocean health and related ecosystems both in Hawaii and abroad?**

KUA has been connecting with indigenous and local community networks committed to action that help to protect their endangered homelands around the world, including support for the UN Sustainable Development Goals that mitigate the impacts of climate change.³⁴ They were a member host of the 2016 *International Union for the Conservation of Nature (IUCN) World Conservation Congress (WCC)*³⁵, and currently have a seat on the inaugural steering committee for *America the Beautiful for All Coalition*, whose purpose is “to restore, and conserve 30% of US lands and waters by 2030 (30x30) by uniting land, freshwater, ocean, wildlife, community, recreation, and equity advocates across the nation” to drive urgent action by government decisions makers in support of shared goals.³⁶

KUA Executive Director, Kevin Chang recently met with National Parks System (NPS) officials who issued a memo stating they would manage federal parks in collaboration with indigenous peoples and tribal entities, noting “Through increased and collaborative engagement with Tribes, Alaska Native entities, and **the Native Hawaiian Community**, we will make better land management decisions, acknowledge and hopefully heal some deep wounds, benefit from Traditional Ecological Knowledge, and better interpret the history of the lands we administer and all the plants and animals that live in them.”³⁷



³⁴ “Two Grassroots Hawai’i Hui Share Global Equator Prize” *Kua’aina Ulu ‘Auamo*, June 6, 2019, <https://kuahawaii.org/equator-prize/>

³⁵ “E Alu Pu Global Gathering & IUCN World Conservation Congress” *Kua ‘Aina Ulu ‘Auamo*, June 1, 2016, <https://kuahawaii.org/global-e-alu-pu/>

³⁶ “America the Beautiful for All Coalition” 2023, <https://americathebeautifulforall.org/steeringcommittee/>

³⁷ Kevin Chang, “Enough with The Deferred Maintenance: Time To Reinvest in Environmental Infrastructure”, March 1, 2023, <https://www.civilbeat.org/2023/03/enough-with-the-deferred-maintenance-time-to-reinvest-in-environmental-infrastructure/>

III.iv KO'A (Coral Reefs)

1. What kind of abundance was addressed in the coral reef focus area?

Researchers have found fossilized evidence of massive coral colonies, a wide variety of fish and invertebrate species on ancient Hawaiian coral reefs³⁸. In the Hawaiian creation chant, coral polyps were the origin of life and set the stage for the development of a rich and diverse coral reef ecosystem³⁹. The abundance of new underwater land formed by coral reefs created a structural framework upon which other species would live and thrive⁴⁰. The intricate three-dimensional architecture of coral reefs created a variety of microhabitats, providing many options for shelter, food and breeding for countless underwater species⁴¹. Coral reefs also provided Precontact Hawaiians with many resources from food and medicine to building materials and provided spiritual inspiration⁴². Many Precontact Hawaiians believed a healthy coral reef reflected the health of people on land as both are interconnected⁴³.

Jiri Mikolas (free images on Pexels website) Coral polyp – origin of life



"Bamboo Coral Polyps" by [Papahānaumokuākea Marine National Monument](#) is marked with [Public Domain Mark 1.0](#).

³⁸ McCoy, E.D. and Boland, R.C. (1991). Coral Reef Fisheries of Hawaii: A Review. *Marine Fisheries Review*, 53(3), pp. 17-27.

³⁹ Martha Lauren Beckwith "The Coral Polyp and the Origin of Life" (2016) <https://coral.org/en/blog/the-coral-polyp-and-the-origin-of-life/>

⁴⁰ Knowlton, N. (2001). The Future of Coral Reefs. *Proceedings of the National Academy of Sciences*, 98(10), pp. 5419-5425.

⁴¹ Hughes, T.P. et al. (2018). Spatial and Temporal Patterns of Mass Bleaching of Corals in the Anthropocene. *Science*, 359(6371), pp. 80-83.

⁴² Kikuchi, R.K.P. et al. (2013). *Ancient Hawaiian Fishponds: Ecosystems of the Past*. Springer.

⁴³ Kanahale, G.S. (1986). *Ku Kanaka Stand Tall, A Search for Hawaiian Values*. University of Hawaii Press

Photo credit: NOAA and Hawaii Undersea Research Laboratory,
<https://oceanservice.noaa.gov/news/oct16/hawaii-coral.html>

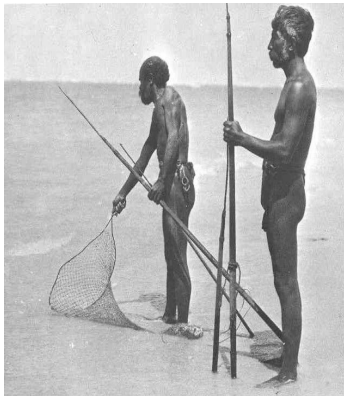
Taken at Maui's 'Au'au Channel. A mesophotic or deep coral ecosystem and its incredible *structural framework*. Reef at 230 feet deep covers 3 sq. miles. The deep coral ecosystem contains organisms with specialized defenses to ward off predators and microbial infections and can be used to develop natural products that benefit *human health*. Of the fish species documented on these deep coral reefs, *43 percent were endemic*, species found only in the Hawaiian Islands. <https://oceanservice.noaa.gov/news/oct16/hawaii-coral.html>



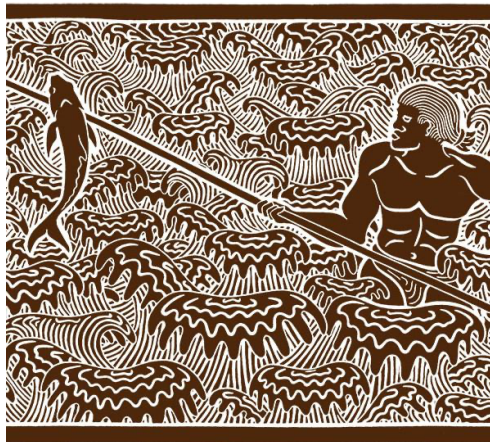
2. What native Hawaiian intervention was employed to increase abundance and support ocean health and how are they being redeployed today?

Coral reefs are the rainforests of the sea and provide respite and shelter to over 25% of fish in the ocean.⁴⁴ The Ahupua'a system helped to filter and reduce the runoff of land pollutants into the ocean, allowing fish populations and corals to thrive.⁴⁵ Precontact Hawaiians managed coral reefs by harvesting fish in a sustainable and responsible manner. This allowed them to maintain a balance between human needs and the health of the coral reef ecosystem. Precontact Hawaiians followed Kapu laws that protected certain species from being overharvested and regulated the size of fish that could be taken from the reef.⁴⁶ Fishing cooperatives were formed, which worked in unison to protect the reef and its resources.

Traditional fishing practices <https://www.pinterest.com/hawaiianmania/old-hawaiian-photos/>



Dietrich Varez (Big Island artist, linocut print)
<https://dietrichvarez.com/collections/blockprints/fishermen>



⁴⁴ "Hard Coral", *Ocean Conservancy*, accessed February 26, 2023 2016, <https://oceanconservancy.org/wildlife-factsheet/coral/>

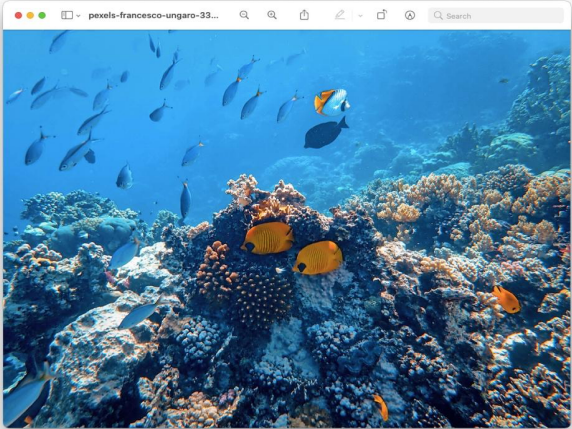
⁴⁵ "Reviving Wetlands in He'eia", *The Nature Conservancy in Hawaii*, accessed February 26, 2023, <https://www.nature.org/en-us/get-involved/how-to-help/places-we-protect/heeia/>

⁴⁶ Dennis Kawaharada, "Introduction: Hawaiian Fishing Traditions", *University of Hawaii*, 2006, <https://www2.hawaii.edu/~dennisk/texts/introfishing.html>

Sarah Nieman artist. <https://sarahnemann.com/island-earth> (fyi, made for a documentary film on Island Earth, also has fishpond illustration and more levels of ahupua'a)



Coral reef providing shelter to fish (pexel free photo)



3. How have some of these bio-cultural management practices been exchanged globally to improve ocean health and related ecosystems in Hawaii and abroad?

Today, coral restoration and growing corals are popular around the world, but coral nurseries and the out planting of these corals alone won't save coral reefs. True coral management must consider reducing land-based pollution, addressing overfishing, and considering the effects of climate change.⁴⁷

In Honduras, after fixing a wastewater treatment plant, the country observed a drop in coral disease.⁴⁸ Considered part of the Coral Triangle, Papua New Guinea implemented sustainable fishing practices requiring local fisherman to fish in alternating areas to ensure an adequate supply of fish remained in the ocean.⁴⁹

The United Nations Sustainable Development Goal 14 describes the need to reduce marine pollution, regulate the harvesting of fish, end overfishing and destructive fishing practices, and restore fish stocks⁵⁰ – all goals achieved by Pre-contact Hawaiians using the Ahupua'a system, fishponds, and Kapu laws.

Precontact Hawaiians recognized the interdependence of land and ocean and understood the inclusive approach to conservation management - perhaps SDG 14 mirrors Hawaiian practices of long ago?

⁴⁷ "Restore Viable Coral Populations", *NOAA Coral Reef Conservation Program*, accessed February 26, 2023, <https://coralreef.noaa.gov/issues/restoration.html>

⁴⁸ "Honduras – Wastewater Pollution," *Reef Resilience Network*, April 10, 2021 <https://reefresilience.org/case-studies/honduras-wastewater-pollution/>

⁴⁹ "New Investment in Papua New Guinea's Coral Reefs and Blue Economy", *United Nations Development Programme*, Oct 29, 2021, <https://earthobservatory.nasa.gov/images/6276/coral-reef-management-papua-new-guinea> <https://www.undp.org/papua-new-guinea/news/new-investment-papua-new-guinea%E2%80%99s-coral-reefs-and-blue-economy>

⁵⁰ "Goal 14 Conserve and Sustainably use the Oceans, Seas and Marine Resources for Sustainable Development", *United Nations Department of Economic and Social Affairs Sustainable Development*, accessed February 26, 2023, <https://sdgs.un.org/goals/goal14>

Pic showing Western technology - using a coral platform to propagate resilient baby corals in Maunalua Bay by Malama Maunalua. Photo credit Malama Maunalua

<https://www.malamamaunalua.org/habitat-restoration-program/coral-reef-restoration-in-maunalua-bay/>



Coral outplanting. Photo credit NOAA <https://coralreef.noaa.gov/issues/restoration.html>



III.v KAI (Deep Ocean)

1. What kind of abundance was addressed in the coral reef focus area?

The deep ocean is vast, with an incredible biodiversity to keep our planet healthy.⁵¹ Living organisms at these depths are incredibly diverse and include fish, whales, squid, shrimp and numerous species of plankton. Non-living factors such as minerals, rocks, ocean temperature and oxygen saturation can affect the survival of all deep ocean marine life. Both biotic (living) and abiotic (nonliving) components of the deep ocean are intertwined and interconnected and play a crucial role in maintaining the health of the deep ocean.⁵² Deep ocean fish like the Hapuka groper and Hawaiian Ahi are highly sought after and commercially harvested but sustainable management practices are needed to ensure these deep ocean fish populations are not overexploited.⁵³ The deep ocean contains sources of energy such as methane and hydrothermal vents and have the potential to provide an abundant source of renewable energy for our planet.⁵⁴ The ocean is the largest carbon sink pulling CO₂ out of the atmosphere helping us to combat climate change.⁵⁵ Undoubtedly, the deep ocean is a complex ecosystem that needs to be protected as it is essential for the health and well-being of our planet.



“Bluefin Tuna | Species | WWF,” World Wildlife Fund, n.d., <https://worldwildlife.org/species/bluefin-tuna>

⁵¹ NOAA Office of Ocean Exploration and Research. (n.d.). The Deep Ocean. National Oceanic and Atmospheric Administration (NOAA). <https://oceanexplorer.noaa.gov/facts/deep-ocean.html>

⁵² "The Diversity of Deep-Sea Life" published in the journal "Biology International" (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3267178/>)

⁵³ New Zealand Ministry for Primary Industries' Fisheries Management website (<https://www.mpi.govt.nz/dmsdocument/1746-deepwater-and-species-fact-sheets>),

⁵⁴ National Renewable Energy Laboratory (NREL) titled "Deep Ocean Resource Assessment: Hawaii" (<https://www.nrel.gov/docs/fy14osti/61337.pdf>)

⁵⁵ Intergovernmental Panel on Climate Change's (IPCC) Fifth Assessment Report (<https://www.ipcc.ch/report/ar5/wg1/>)

2. What native Hawaiian intervention was employed to increase abundance and support ocean health?

“The “biocultural resource management” (BRM) approaches developed and employed by Hawaiians to manage an archipelago-scale social-ecological system—in the pre-contact era—sustained an abundance of resources for more than a millennium”.^{56, 57} Precontact Hawaiians adhered to a strict code on regulated fishing including catch limits and temporary fishing bans in certain areas.

“Centuries ago, Hawaiians caught three times more fish annually than scientists generally consider to be sustainable in modern times and yet maintained this level of harvest for more than 400 years”.⁵⁸ In maintaining healthy fish populations, ancient Hawaiians took into account moon cycles, spawning behavior, currents, weather and feeding habits.⁵⁹ During his reign (1795-1819), Kamehameha I put restrictions on ocean fishing for 5-6 month periods, called a fishing kapu. Violation of this kapu could result in a penalty of death.⁶⁰ These practices, vital to their survival, was developed by ancient Hawaiians over generations, based on their deep spiritual connection with nature.

Modern marine environmental management is increasingly turning to the traditional practices of Pre-contact Hawaiians to improve the management of ocean resources, leading to the establishment of Marine Protected Areas (MPAs). Large scale MPAs, like Papahānaumokuākea Marine National Monument – which is managed by a native Hawaiian guidance document called *Mai Ka Po Mai*⁶¹ – allow once scarce species to recover and thrive, resulting in a positive global impact on the health of marine ecosystems.⁶² Successful MPAs are experiencing a spillover effect where some fish species spill over beyond the boundaries of the MPA into

⁵⁶ Kittinger, J. N., et al. "Community-based marine resource management in Hawai'i." *Pacific Science* 69, no. 4 (2015): 441-457.

⁵⁷ Winter, Kawika B., Kamanamaikalani Beamer, Mehana Blaich Vaughan, Alan M. Friedlander, Mike H. Kido, A. Nāmaka Whitehead, Malia K.H. Akutagawa, Natalie Kurashima, Matthew Paul Lucas, and Ben Nyberg. 2018. "The Moku System: Managing Biocultural Resources for Abundance within Social-Ecological Regions in Hawai'i" *Sustainability* 10, no. 10: 3554. <https://doi.org/10.3390/su10103554>

⁵⁸ Douglas M. Main, “Ancient Hawaiians Caught More By Fishing Less,” *Green Blog*, March 23, 2012, <https://archive.nytimes.com/green.blogs.nytimes.com/2012/03/23/ancient-hawaiians-caught-more-by-fishing-less/>.

⁵⁹ Kelson K. Poepoe, “The Use of Traditional Hawaiian Knowledge in the Contemporary Management of Marine Resources,” 2003, <https://pubs.er.usgs.gov/publication/70039858>.

⁶⁰ “Introduction: Hawaiian Fishing Traditions,” n.d., <https://www2.hawaii.edu/~dennisk/texts/introfishing.html>.

⁶¹ Office of Hawaiian Affairs, National Oceanic and Atmospheric Administration, U.S. Fish and Wildlife Service, and State of Hawaii (2021). *Mai Ka Po Mai: A Native Hawaiian Guidance Document for Papahānaumokuākea Marine National Monument*. Honolulu, HI: Office of Hawaiian Affairs”.

⁶² Friedlander, Alan M., et al. "The state of coral reef ecosystems of the Hawaiian archipelago." pp. 313-358 In: J.E. Waddell and A.M. Clarke (eds.). *The State of Coral Reef Ecosystems of the United States and Pacific Freely Associated States*: 2008. NOAA Technical Memorandum NOS NCCOS 73. Silver Spring, MD. (2010).

neighboring areas where fishing is allowed.⁶³ Evidence that large, migratory fish have benefited from this protection are reflected by a recent increase in catch rates of yellowfin tuna by 54%.⁶⁴

3. What native Hawaiian intervention was employed to increase abundance and support ocean health?

The establishment of Marine Protected Areas (MPA) places limits on human activity to protect marine ecosystems addressing the issues of overfishing, pollution, and climate change.⁶⁵ MPAs are coordinated management efforts, with the goal to sustainably manage ocean resources for generations to come.⁶⁶

Currently, there are over 5000 MPAs globally.⁶⁷ Some of the world's most successful MPAs include Papahānumokuākea in the northwestern Hawaiian Islands (four times the size of California⁶⁸), Chagos found in the British Indian Ocean (largest in the world⁶⁹), and the Great Barrier Reef Marine Park in Australia (home of the world's largest coral reef⁷⁰).

Today, in 2023, Native Hawaiian and Oahu resident Aulani Wilhelm, Founder of Big Ocean, a leader in the design and establishment of Papahānumokuākea, and White House advisor (amongst other roles), advocates for large MPAs around the globe. Aulani continues the quest of her ancestors, driven by her kuleana (responsibility and privilege) to save the ocean and our planet. It's reasonable to assume that it was Wilhelm's voice behind the current White House designation of an additional 777,000 square miles of MPA around the U.S. Pacific Remote Islands in the Central Pacific.⁷¹

⁶³ Papahānumokuākea Marine National Monument. "Frequently Asked Questions." National Oceanic and Atmospheric Administration. Accessed May 10, 2023. <https://www.papahanaumokuakea.gov/faq.html>.

⁶⁴UH News, "Ahi Recovery up, More Fish Caught Thanks to No-Fishing Zones," University of Hawai'i System News, October 21, 2022, <https://www.hawaii.edu/news/2022/10/20/no-fishing-zones/>.

⁶⁵ C. Pomeroy, et al., "Marine Protected Areas: A Multidisciplinary Approach," (Cambridge: Cambridge University Press, 2006).

⁶⁶ K. McLeod, et al., "Marine Ecosystem-Based Management in Practice," (London: Elsevier, 2011).

⁶⁷ UNEP-WCMC, "Protected Planet," United Nations Environment Programme World Conservation Monitoring Centre, accessed May 10, 2023, <https://www.protectedplanet.net/>.

⁶⁸ NOAA, "Papahānumokuākea Marine National Monument," National Oceanic and Atmospheric Administration, accessed May 10, 2023,

⁶⁹ The Pew Charitable Trusts, "The World's Largest Marine Protected Areas," The Pew Charitable Trusts, accessed May 10, 2023, <https://www.pewtrusts.org/en/research-and-analysis/articles/2017/10/27/the-worlds-largest-marine-protected-areas>.

⁷⁰ Great Barrier Reef Marine Park Authority, "About the Great Barrier Reef Marine Park," Great Barrier Reef Marine Park Authority, accessed May 10, 2023, <https://www.gbrmpa.gov.au/the-reef/about-the-reef>.

⁷¹ N. Eagle, "Biden to Create New Marine Sanctuary in Pacific", Honolulu Civil Beat, March 21, 2023, accessed 6/2/23, <https://www.civilbeat.org/2023/03/biden-to-create-new-marine-sanctuary-in-pacific/>

