

Ka Pili Kai

ALL THINGS RELATED TO THE SEA · VOL 2, NO 1 · HO'OILO 2019

Limu
Gifts from
the sea

A publication of the University of Hawai'i Sea Grant College Program

Ka Pili Kai (ISSN 1550-641X) is published biannually by the University of Hawai'i Sea Grant College Program (Hawai'i Sea Grant), School of Ocean and Earth Science and Technology (SOEST). Hawai'i Sea Grant is a unique partnership of university, government, and industry, focusing on marine research, education, and advisory/extension services.

University of Hawai'i
Sea Grant College Program
2525 Correa Road, HIG 208
Honolulu, HI 96822

Director

Darren T. Lerner, PhD

Communications Leader

Cindy Knapman

Assistant Communications Leader

Heather Dudock

Ka Pili Kai

Editorial Team

Cindy Knapman

Rachel Lentz

Darren T. Lerner

Maya Walton

Layout and Design

Heather Dudock

Contributing Writers

Rachel Lentz

Josh McDaniel

Lurline Wallana McGregor

Paula Moehlenkamp

Celia Smith

Miwa Tamanaha

Bill Thomas

Kawika Winter

Outreach Publication Photographer

Andre P. Seale

Postage paid at Honolulu, HI

Postmaster: Send address changes to:
Ka Pili Kai, 2525 Correa Road, HIG 208
Honolulu, HI 96822
(808) 956-7410; fax: (808) 956-3014
uhsgcomm@hawaii.edu
hawaii.seagrant.org

The University of Hawai'i Sea Grant Program was established in 1968 and designated a Sea Grant College in 1972, following the National Sea Grant College and Program Act of 1966.

Ka Pili Kai is funded by a grant/cooperative agreement from the National Oceanic and Atmospheric Administration, Project C/CC-1, which is sponsored by the University of Hawai'i Sea Grant College Program, SOEST, under Institutional Grant No. NA18OAR4170076 from NOAA

WELCOME

The legendary Dr. Isabella (Izzie) Kauakea Aiona Abbott, fondly (and aptly) nicknamed "The First Lady of Limu," would have celebrated her 100th birthday this year. In tribute to her, and to celebrate the importance of limu (seaweed) to Hawai'i dating back more than a century, we are dedicating this issue of *Ka Pili Kai* to Izzie and her legacy. Not only was she a world-renowned scientist, author, professor, mentor, and inspiration to all who knew her, but she also embodied the true spirit of one who dedicated her life to ensuring that the next generation of students of all different backgrounds and cultures had invaluable opportunities to learn and thrive. In the pages of this issue you will read firsthand accounts from just a handful of people, among many, whose lives she shaped, and who are now in a position to carry on her legacy.

In another very special tribute to Izzie this year, a brand-new species of red algae, *Martensia abbottiae*, first found on the deep coral reefs off the coast of Moloka'i, Hawai'i, was named after her.

I invite you to browse this issue to read more about Izzie through engaging stories and images, and also learn how limu has helped shape the history of Hawai'i and its people.

Cindy Knapman

Hawai'i Sea Grant Communications Leader



ON THE COVER:

A Hawaiian species of limu named *Kallymenia thompsonii* which was first discovered in Midway Atoll in the Northwestern Hawaiian Islands. This endemic limu was named by Dr. Abbott and Dr. Karla McDermid for Mark Thompson who was involved in the opening of Midway Atoll for controlled ecotourism.

Subscribe to *Ka Pili Kai*

Office of Sea Grant, Department of Commerce. The views expressed herein are those of the author(s) and do not necessarily reflect the views of NOAA or any of its subagencies. UNHI-SEAGRANT-NP-19-04.

SUBSCRIBE TO Ka Pili Kai

Visit: seagrant.soest.hawaii.edu/resources/ka-pili-kai



Contents

Limu 'eie 'ele.
Photo: Pelika Andrade

1

PRESERVING KNOWLEDGE, RESTORING LIMU ABUNDANCE: GROWING A NETWORK OF LIMU PRACTITIONERS

by JOSH MCDANIEL

9

FIRST LADY OF LIMU: MEMORIES OF AN INSPIRING MENTOR AND BOTANIST

by DR. CELIA SMITH, BILL THOMAS, KAWIKA WINTER, AND MAZIE K. HIRONO, U.S. SENATOR

17

A COMMUNITY APPROACH: REMOVING INVASIVE ALGAE TO RESTORE NATIVE ECOSYSTEMS

by PAULA MOEHLKAMP

23

LIMU TRADITIONS

by LURLINE WAILANA MCGREGOR



Dr. Isabella Abbott (center front) holding limu specimens with students in Waikiki, O'ahu.

31

PLANTING AN IDEA: A GUIDE TO THE WONDER OF MARINE PLANTS

by RACHEL LENTZ

32

BOOK REVIEW: HAWAIIAN REEF PLANTS

by JAN TENBRÜGGENCATE

33

HAWAIIAN ALGAE HIGHLIGHTS

35

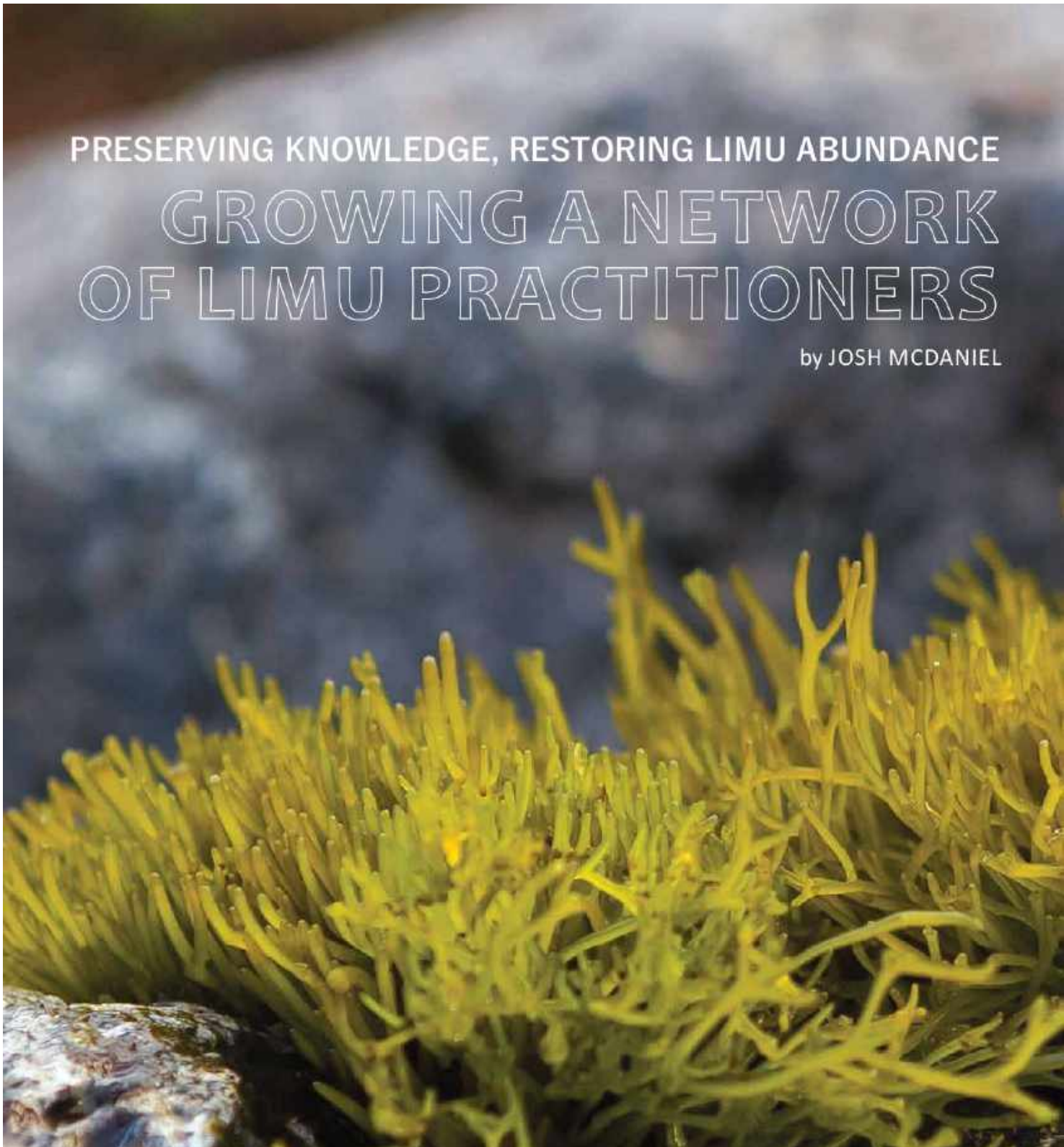
THE JOY OF LIMU

by MIWA TAMANAHA





Uncle Wally Ito, Kua'āina Ulu 'Ōuamo Limu Hui Coordinator, in 2014 at One'ula Beach Park in Ewa Beach, Hawai'i, collecting limu specimens. Photo Kim Maa, courtesy of KUA



PRESERVING KNOWLEDGE, RESTORING LIMU ABUNDANCE
GROWING A NETWORK
OF LIMU PRACTITIONERS

by JOSH MCDANIEL



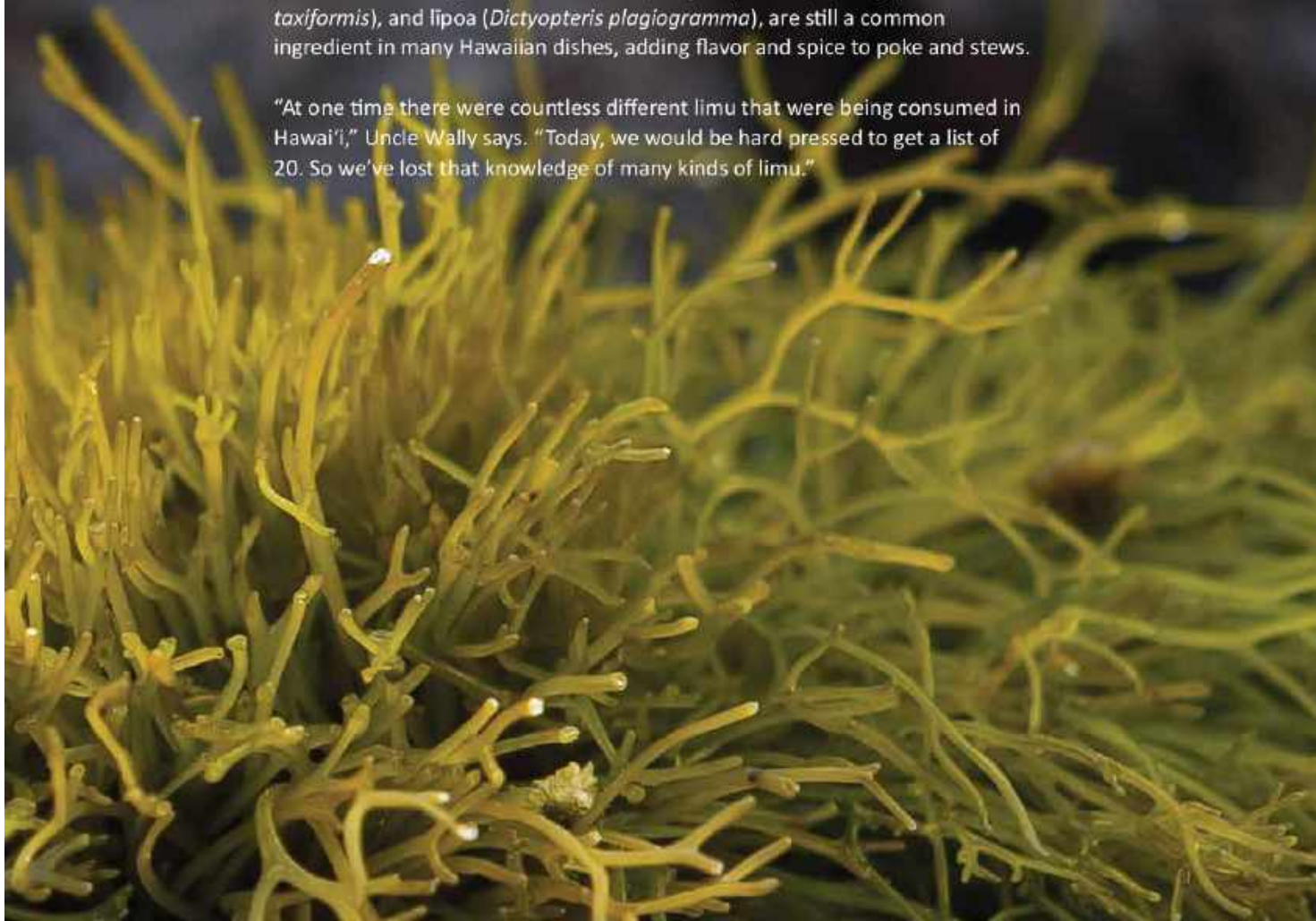
Limu 'aki'aki grows in the high intertidal zone, usually on basalt rocks. Limu 'aki'aki is very tough and has to be cooked to be eaten. Traditionally, it was cooked with boiled meats or added to soups. It is also boiled with squid to produce a jelly. The 'aki'aki in this photo has been grazed. Photo: Kim Moa, courtesy of KUA

Uncle Wally Ito is passionate about limu, or seaweed.

He says limu has always been an integral part of Hawaiian culture, with uses in food, medicine, and religious ceremonies.

In a traditional Hawaiian diet, limu was the third component of a nutritionally balanced diet along with fish and poi, providing an important source of minerals and vitamins. Limu, such as wawae'iole (*Codium edule*), manaua (*Gracilaria coronopifolia*), ele'ele (*Ulva prolifera*), kohu (*Asparagopsis taxiformis*), and lipoa (*Dictyopteris plagiogramma*), are still a common ingredient in many Hawaiian dishes, adding flavor and spice to poke and stews.

"At one time there were countless different limu that were being consumed in Hawai'i," Uncle Wally says. "Today, we would be hard pressed to get a list of 20. So we've lost that knowledge of many kinds of limu."





The Waimānalo Limu Hui has been hosting monthly limu planting events in Waimānalo Bay at Kaiona Beach Park on O'ahu since November, 2017. Photo: Ikaika Rogerson



In 2014, Uncle Wally, along with Uncle Henry Chang Wo Jr., helped to organize a gathering of limu practitioners with the support of the nonprofit organization Kua'āina Ulu 'Auamo, or KUA, a community-based grassroots organization that supports creative and collective community-based solutions to problems stemming from environmental degradation in Hawai'i.

"We believe that people in their communities are experts in their resources," says Tamanaha. "So, fishers, farmers, and families that have been caring for a place for generations have a lot to offer conservation as a practice. This is Hawai'i, so that means Hawaiian-centered practice and Hawaiian-centered knowledge."

Uncle Wally says the Limu Hui is dedicated to finding and recruiting kuauna, or elders, who still gather

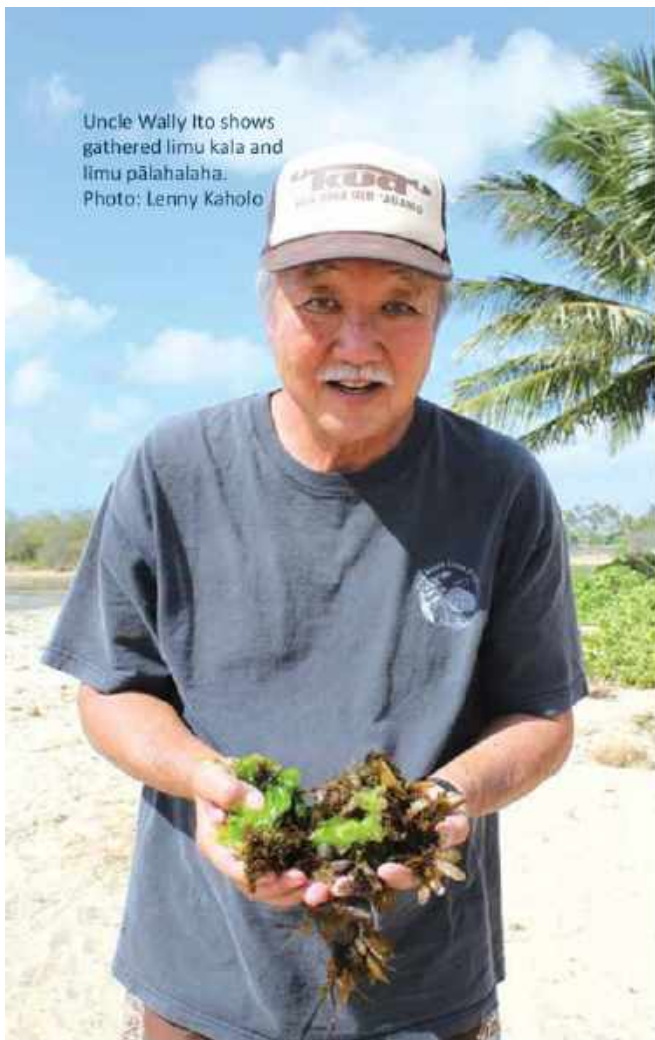
Uncle Wally says the annual gathering (now in its sixth year) is an opportunity for limu practitioners to come together to nurture trust, accelerate knowledge sharing, and collaborate toward common goals.

Miwa Tamanaha, the co-director of KUA, says that the Limu Hui fits in with the organization's place-based and Hawaiian-centered approach to stewardship.

and recruiting kupuna, or elders, who still gather limu and continue traditional practices. The hui is committed to passing on limu knowledge, educating people about limu, and supporting efforts to restore limu through community-based aquaculture and replanting.

Uncle Wally remembers, when he was young, going to Ewa Beach near the mouth of Pearl Harbor to collect limu manauea (*Gracilaria coronopifolia*). His

3 Ka Pili Kai • Ho'oulo 2019 • hawaiiseagrant.org



Uncle Wally Ito shows gathered limu kala and limu pālahalaha.
Photo: Lenny Kāhōlo

mom, who was Okinawan, pickled manauea in the Japanese namasu style with vinegar and sugar. "I grew up eating limu," he says.

Uncle Wally says one of his favorite things to do is walk the shoreline and try different limu: "That way you get the full flavor and texture."

Finding native limu has become more difficult in most parts of Hawai'i. Ewa Beach, which Uncle Wally visited with his mother as a child, was once known as the Hale o Limu, or House of Limu, for the abundant varieties of limu available there. "Limu was just piled up on the beach," he recalls, "but now it is difficult to find in Ewa."

"If you talk to limu gatherers from urban areas in Honolulu or on Maui, they say that even 20 years ago there was still a lot of limu on the shoreline, but it has declined over the past two decades," Uncle Wally says. "And if you talk to people who harvested limu 40 or 50 years ago, they will tell you it's an even greater decline."



Volunteers gather limu during the 2018 Limu Gathering in Kalaemano on Hawai'i Island. Photo: Kim Moa, courtesy of KUA



The main culprits in the decrease of available limu are urbanization, improper harvesting, and shifting ocean conditions related to climate change. Native limu are also crowded out by the ubiquitous invasive “gorilla ogo” (*Gracilaria salicornia*), which has taken over many reefs around the islands.

Despite the decline, demand for edible limu has actually increased in recent decades with the surge in popularity of poke, both in Hawai’i and on the continental U.S. Most of the limu found in poke bowls or in the grocery stores is red seaweed, either the invasive gorilla ogo or the native limu manaua, grown from commercial aquaculture operations across the islands that have been established in the past few decades to meet the growing demand.

Many limu varieties also have medicinal and ceremonial uses. Limu kala (*Sargassum aquifolium*) is used as a poultice to treat cuts and wounds from coral, and kala, which means to forgive in Hawaiian. It also plays an important role in ho’oponopono, a ritual to resolve disagreements between family members.

Uncle Wally says he learned from one kupuna of how the ho’oponopono ceremony is done differently in Kalapana on Hawai’i Island. In this case, the two sides in conflict sit on a beach, and a lei made of limu kala is placed on their heads. The two people then stand up and walk into the water up to the point where the lei floats off their head, and all the conflict and trouble floats away with it. Then they come back, sit on the beach, and celebrate the end of the conflict.

practitioners to pass on their knowledge of where certain varieties of limu grow or how to prepare it for eating.

Maintaining Tradition on Moloka’i

In 2014, when the KUA Limu Hui held their first “gathering of the gatherers” on O’ahu, bringing together limu practitioners from all over the six main Hawaiian Islands, one of the limu experts who made the trip was Auntie Vani (Vivian Ainoa) from Moloka’i.

At Auntie Vani’s home on the south side of Moloka’i near the Ali’i fishpond, she has been experimenting with growing a number of different limu, including limu ele’ele and limu pālahalaha (*Ulva lactuca*).



He also tells of a legend from Maui of limu make-o-Hana, or the seaweed of death, that could only be found in one tide pool in eastern Maui. Only a few people knew the exact location of the pool and visiting it was taboo. However, warriors could break the taboo and visit the pool to dip their spears into the limu to access the lethal poison. According to the legend, all the warriors had to do was scratch their enemy with the poisoned tip and their enemy would die.

Limu knowledge and practices are still maintained, primarily by kupuna in rural, sometimes isolated, parts of the islands, but the scarcity of this once-abundant resource has made it difficult for

5 Ka Pili Kai • Ho'oulu 2019 • hawaiiseagrant.org



"I'm so fortunate, it's right outside my back door," says Aunty Vani. "And I don't really have to go anywhere to gather limu except to get in my water outside."

Blessed with a clear mountain stream, the bay in front of her home is brackish most of the time, and she says the green limu like ele'ele thrive in the brackish water. Aunty Vani places different types of rocks and stones in the bay and observes how the different limu grow on those surfaces.

"I've been trying to generate my own limu from starting spores," she says. "I experiment with placing new rocks in the water and observing how the limu grows. I've been documenting my work and sharing that with the hui."

Aunty Vani also hosts groups of school kids at her house and shows them how to pick and clean the limu.

"You've got to massage the limu ele'ele after you pick it," she says. "That makes it really nice and silky. Then, all you do is add a little salt before you eat it."

She says many of the kids she teaches are interested in collecting limu to sell, but she tells them limu is for sharing.

"I tell the kids once you get to the point where you start selling limu and it's more commercial, the next thing you know, we won't have it anymore because they will overpick," she says. "I teach them to just give it to your family and to the kupuna. You're going to feel so good when you share it."





Limu tied to rock before being placed in the ocean for limu restoration. Photo: Ikaika Rogerson

Engaging the Community

Uncle Wally works tirelessly to spread knowledge and awareness about limu, but he also supports community groups who have begun to replant limu. He cultivates limu in aquaculture tanks at the Ānuenue Fisheries Research Center run by the State of Hawai'i Department of Land and Natural Resources - Division of Aquatic Resources, and then distributes it to community groups who are organizing replanting events.

Since November 2017, the Waimānalo Limu Hui has been hosting monthly community planting events in Waimānalo Bay at Kaiona Beach Park on the east side of O'ahu. The events regularly attract 75 community members who come out to spend the day working and enjoying the beach with their families.

"These events are growing the community," says Ikaika Rogerson, president of the Waimānalo Limu Hui and one of the organizers of the event. "There are people that come every month, religiously. They believe in this and want to participate."

Planting limu is labor intensive. The hui members start by making leis, with sprigs of limu braided into a base, such as raffia fiber. Then, they tie the leis to rocks that range in size from a softball to a basketball. The hui uses a raft constructed from a large inner tube and a

Rogerson says the planting efforts are having a positive effect on the bay.

"We are definitely seeing a whole lot more fish because as soon as we plant the limu, the fish come and eat them, which is fine because just like the birds spread plant seeds on land, the fish spread the limu spores," he says. "We're hoping the fish spread the spores throughout the bay and maybe over into the next town's bay."

The Waimānalo Limu Hui has also taken on the task of restoring the nearby Pāhōnu fishpond in the bay. Every three months they combine limu planting with wall restoration of the fishpond. For those events, they get an average of 350 participants. The events have become so popular that even visitors have begun to show up to volunteer and participate.

Rogerson says fishpond restoration is part of the hui's efforts to take a more holistic view of the mauka to makai, or the mountain to ocean, connections. Many of the hui members are also involved in an organic farm in Waimānalo that specializes in medicinal plants, and others help with an ulu, or breadfruit, orchard.

"If we are talking about restoring something on the shoreline, it's a process that starts at the top of the mountain," says Uncle Wally. "Replanting is

piece of plywood to float the rock-anchored limu leis out into the bay for placement in strategic spots.

important, but the replanting events are also an opportunity to create awareness and understanding



Gatherer searching for limu kala in a tide pool. Photo: Kim Moe, courtesy of KUA

in the community that in order to bring back the limu, we have to restore the water—we have to recharge the aquifer.”

No Limu, No Fish

Uncle Wally also points to the role of limu as a primary producer that is an essential part of the food web.

“Limu is the base. Just like on land where the primary producers are the plants and grasses that feed the cows—for the nearshore environment, it’s limu,” he says. “Limu creates a habitat for a lot of other invertebrates, such as small shrimp, and provides hiding places for fish. The loss of our limu beds is a huge part of the decline of our fishery. No limu, no fish.”

“Many people want to restore the fishery, but they are looking at it from a top-down approach where they protect the fish, or put more fish into the ocean,” Uncle Wally says. “I try to make the point: if you want the fishery to recover, start with the limu.” Everyone interviewed for this article said that the key to bringing back limu lies in increasing awareness among young people about their environment and their resources, and also in engaging the community to get involved.



Pelika Andrade and Uncle Wally Ito at the 2018 Limu Gathering. Photo: Kim Moe, courtesy of KUA



“To me, planting limu is great, and I hope eventually it brings it back in Waimānalo Bay,” says Rogerson. “But I think the whole community aspect is even better, because if we can rally up 350 people to come and do manual labor, make limu leis and move rocks...well, I think that’s the real accomplishment: growing the sense of community.”

Miwa Tamanaha says that the work of the Limu Hui really captures the spirit of the Kua’āina Ulu ‘Auamo organization.

“Our name includes the metaphor of ‘Auamo, which is a carrying stick that goes across the shoulders,” Tamanaha says. “By working together, we can carry our responsibilities together, and we can go farther together. We are building an unstoppable limu movement.”



Auntie Vani (Vivian Alhoa) and other gatherers. Photo: Kim Mōa, courtesy of KUA



Uncle Wally, Nohēa Mahoney, and Emily Akamine identifying gathered limu. Photo: Kim Mōa, courtesy of KUA





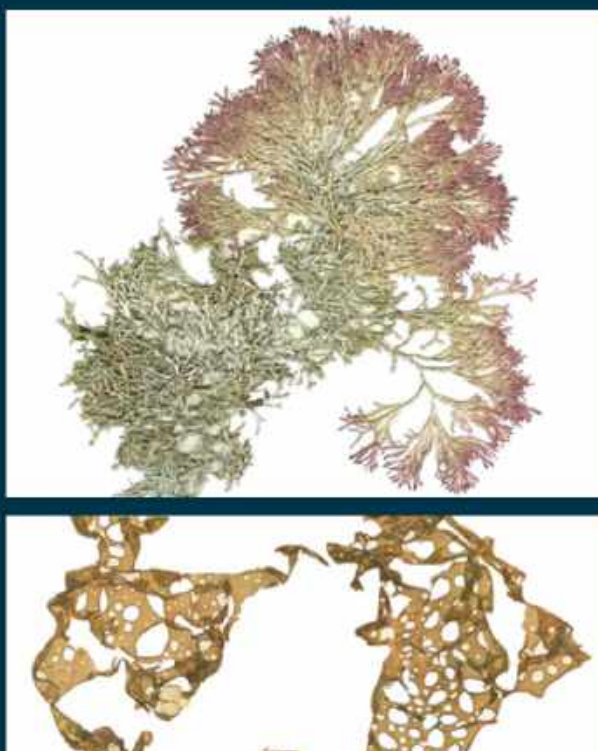
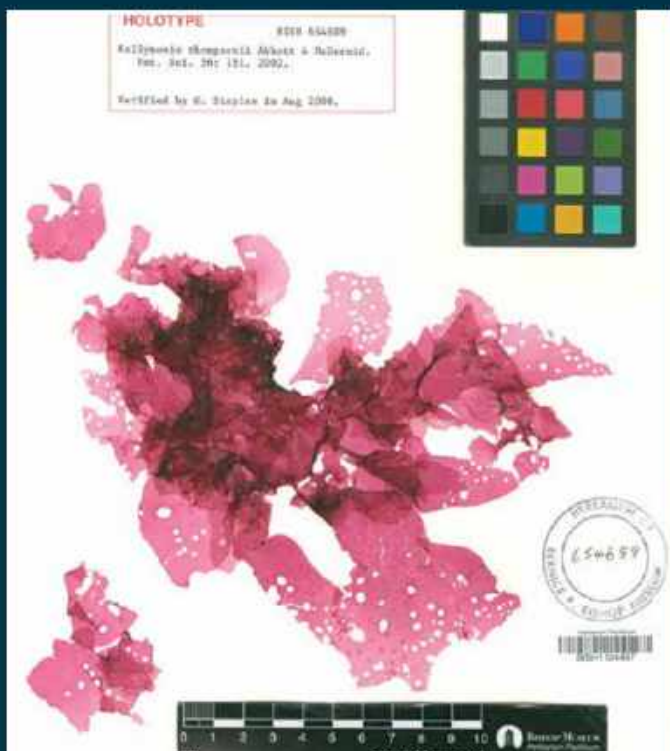
FIRST LADY OF LIMU

MEMORIES OF AN INSPIRING MENTOR AND BOTANIST

I first met Dr. Isabella Abbott as she emerged from nearly 30 years at Hopkins Marine Station of Stanford University, as its first woman, and first minority, full professor in the Department of Biology. The year was 1976, and Dr. Abbott was already a force of nature. As a visiting professor at the University of Hawai'i at Mānoa's Botany Department, and later as the G. P. Wilder Professor, the Botany Department's endowed chair, Dr. Abbott had returned to her alma mater to teach the stories of her Maui family from Lahaina, the Kailiho 'ohana. Through these teachings, she built a lecture and hands-on lab in the ethnobotany

of Hawaiian culture. She is credited with converting many students to a lifelong love of plants and Hawaiian uses. As a part of the cultural renaissance in the 1970s, from 1976 to 1995 Dr. Abbott taught over 1000 undergraduate students who sat in the aisles and crowded into a standing-room-only lecture hall to learn about the science behind Hawaiian cultural uses.

It was some years later that I came to realize the fullness of Dr. Abbott's "other career" - marine botany. Trained at the University of California,





Previous page: Isabella "Izzie" Abbott taught at Stanford's Hopkins Marine Station from 1960 to 1982. Photo: Chuck Painter. Above: Major herbaria are part of a multinational effort to digitize specimens and make those high resolution images available via several online portals. These algal specimens are examples of Dr. Abbott's scientific work, now deposited at Bishop Museum. The color grid with the specimen ensures balance in color while scanning. A herbarium is a repository for dried plant specimens, as the basis for future scientific study.

Berkeley, Dr. Abbott taught marine botany summer courses for more than 10 years at Hopkins Marine Station. These students were the upcoming leaders in marine botany on the continental U.S. and went on to lead the Department of Botany at the Smithsonian's National Museum of Natural History, teach at marine stations around the country and on university campuses, and her students remained her friends for life. Many things stand out through these years: her discipline (eight books and over 150 papers describing the marine algae of California and over 50 percent of the Hawaiian algal flora); inclusiveness and loyalty (colleagues in Europe, the U.S., and across the Pacific); ability to navigate unknowns (graduate degrees from the University of Michigan and the

University of California, Berkeley); and especially her work to perpetuate her culture and her science.

Dr. Abbott, as a Hawaiian, led by example, and lived in two worlds – her culture and her science – with grace and humor. She nurtured diverse generations of mainland and local students while maintaining high standards and also offering a helping hand. As a fitting tribute to an amazing individual, on June 20, 2019, many friends and family gathered to celebrate 100 years of Hawaiian science and culture on the anniversary of her birth. To share one of her favorite sayings, let's all "Be Hawaiian!! Eat limu!!"

DR. CELIA SMITH

“...A HEALTHY OCEAN ALSO MEANS HEALTHY PEOPLE. BUT HEALTHY LANDS AND OCEAN MEANS A *RESILIENT* PEOPLE...”

-DR. ISABELLA ABBOTT

During the mid-1980's, while visiting with Dr. Isabella Abbott, who I knew as Aunty Izzie, she turned to me and said, "You know what Hawaiian says healthy..."

Her path to inspiring so many began in 1976 with her offering of ethnobotany at UH. Over a 20-year period, this provided a transformative experience...

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.

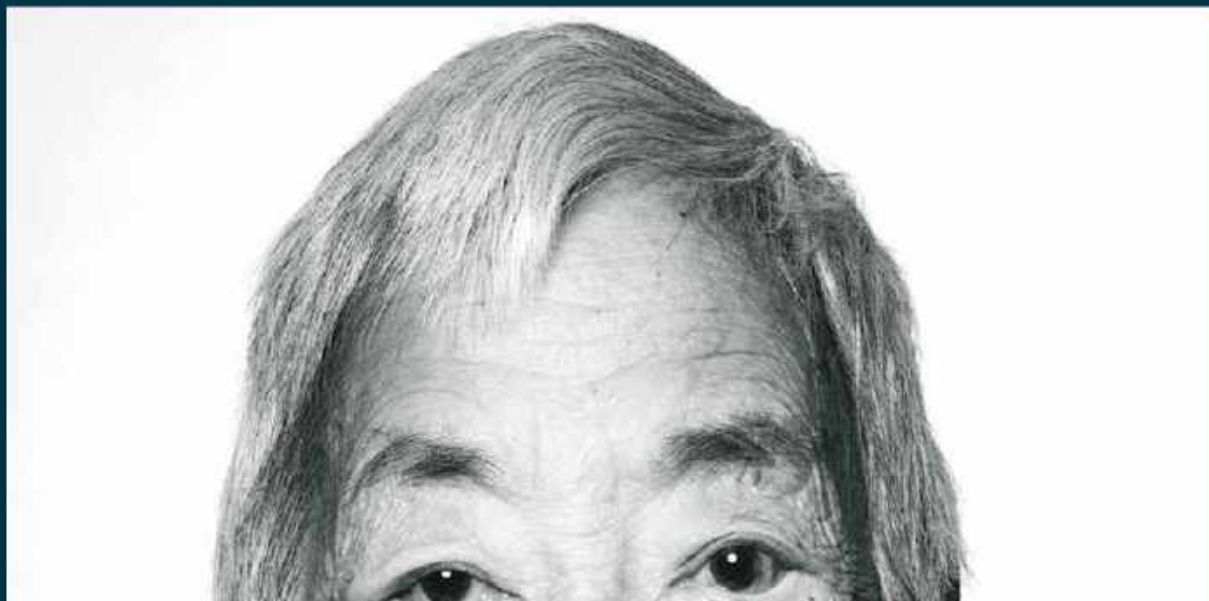
As we talked she went on to tell me that the distance from mauka (inland, toward the mountain) to makai (ocean) in some ahupua’a was so great that it was inefficient for families to access its resources directly. Instead, Hawaiians practiced “ko kula uka, ko kula kai,” an informal exchange among “those 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.

Aunty 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.

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.

Aunty 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





Dr. Isabella Aiona Abbott
Photo: Mark Arbeit

“...MY ABILITY TO DO A
THESIS IN HAWAIIAN
ETHNOBOTANY WOULD
NOT HAVE BEEN POSSIBLE
WITHOUT THE PATH SHE
PAVED...”

-DR. KAWIKA WINTER

It is said that one does not choose their own legacy, but rather one's legacy is decided by those they leave behind. In the case of Dr. Isabella Abbott, a woman who had touched the lives of thousands of people in her 93 years on this earth and deeply influenced the lives of several hundred, including mine, the definition of her legacy is ours to tell. In my case, I was one of her last students, and I certainly benefited from the experience and wisdom she gained over a long and illustrious career.

As an undergraduate, I was in the last ethnobotany class that Dr. Abbott taught before she retired. While pursuing a Master's degree, my ability to do a thesis in Hawaiian ethnobotany would not have been possible without the path she paved, and she knew my research was to be a part of her legacy. After finishing my PhD and working for more than a decade in biocultural resource management, I took the helm of the recently designated National Estuarine Research Reserve (NERR) in He'eia, O'ahu.

Founded in 2017, the He'eia NERR's 1,385 acres include the estuary of the He'eia ahupua'a on Kāne'ohe Bay. It was initiated because community leaders saw the powerful role science could play in saving the place that they loved, and is the culmination of more than 25 years of community-based efforts. It is the newest NERR and the first in

the nation to incorporate indigenous culture into its structure and function.

It wasn't long before it hit me that the work that is happening in the He'eia NERR, melding indigenous and conventional science, is an integral part of Dr. Abbott's legacy. Not only was the designation process led by people who learned from her, but the people leading the restoration of the He'eia ahupua'a and conducting the research are former students of Dr. Abbott's, in one way or another, and whose journeys would not have been possible without her.

Dr. Abbott was also a trailblazer for Hawaiian faculty and scientists at the University of Hawai'i (UH) and beyond. At the age of 31, she earned a PhD in botany from the University of California, Berkeley and became the very first Native Hawaiian to earn a doctoral degree in the field of science. Several years later she became the first woman faculty member in biological sciences at Stanford before returning home to Hawai'i in 1982 to teach at UH and not only share her passion with her students, but work tirelessly to provide students of Native Hawaiian descent the opportunity to follow in her footsteps.

To name just a few of her past students or mentees, Kanekoa Kukea-Shultz is the executive director of Kāko'o 'Ōiwi; Hi'ilei Kawelo is the executive director

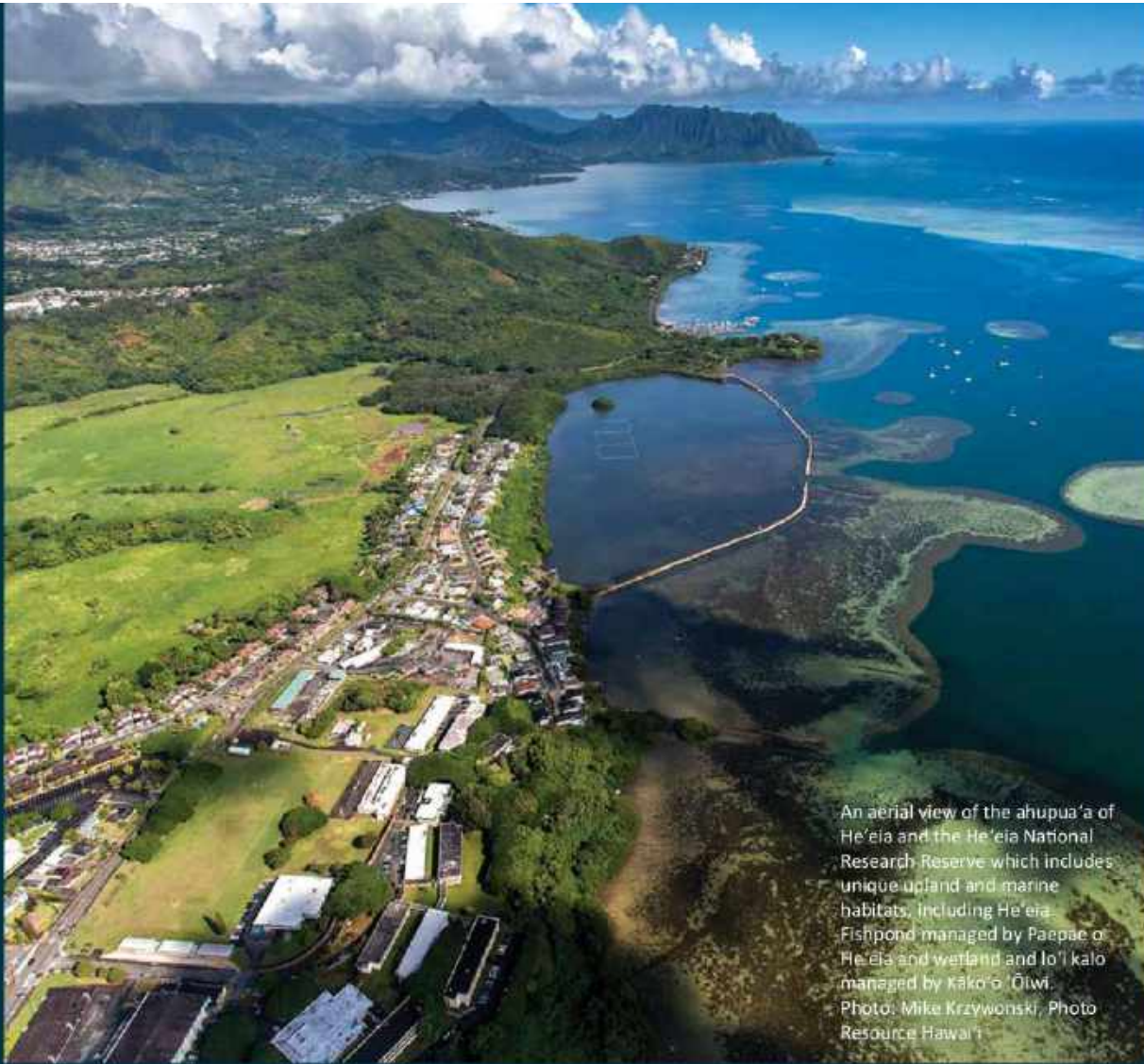
13 Ka Pili Kai • Ho'oulo 2019 • hawaiiagrant.org

of Paepae o He'eia; Celia Smith is a full professor at UH Mānoa teaching students about limu; Karla McDermid is a full professor at UH Hilo; and Rosie Alegado is an associate professor in the UH Mānoa Department of Oceanography and conducts collaborative research within the NERR. In addition, faculty members throughout the Hawai'i Institute of Marine Biology at UH Mānoa were touched by Dr.

Abbott through her influence on this institution in its formative years until today.

Without Dr. Abbott, none of us could be walking the paths that we are now on; but, because of her, we are all walking on this path together.

DR. KAWIKA WINTER



An aerial view of the ahupua'a of He'eia and the He'eia National Research Reserve which includes unique upland and marine habitats, including He'eia Fishpond managed by Paepae o He'eia and wetland and lo'i kalo managed by Kāko'o 'Ōiwi. Photo: Mike Krzywonski, Photo Resource Hawaii

DR. ISABELLA KAUAKEA YAU YUNG AIONA

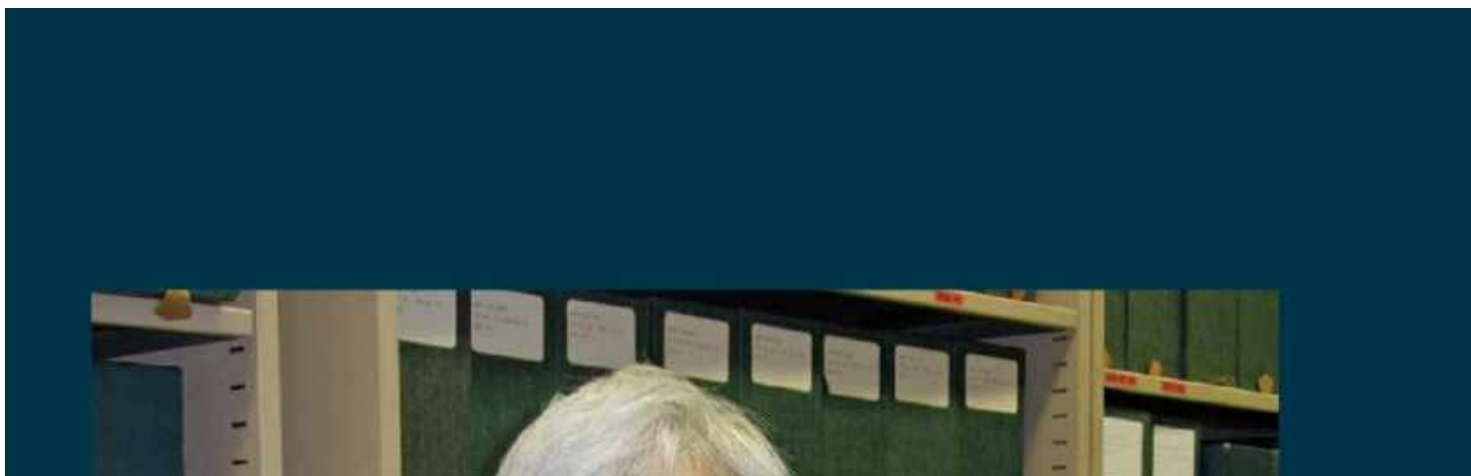
ABBOTT WILL FOREVER BE AN ICON IN HAWAI‘I

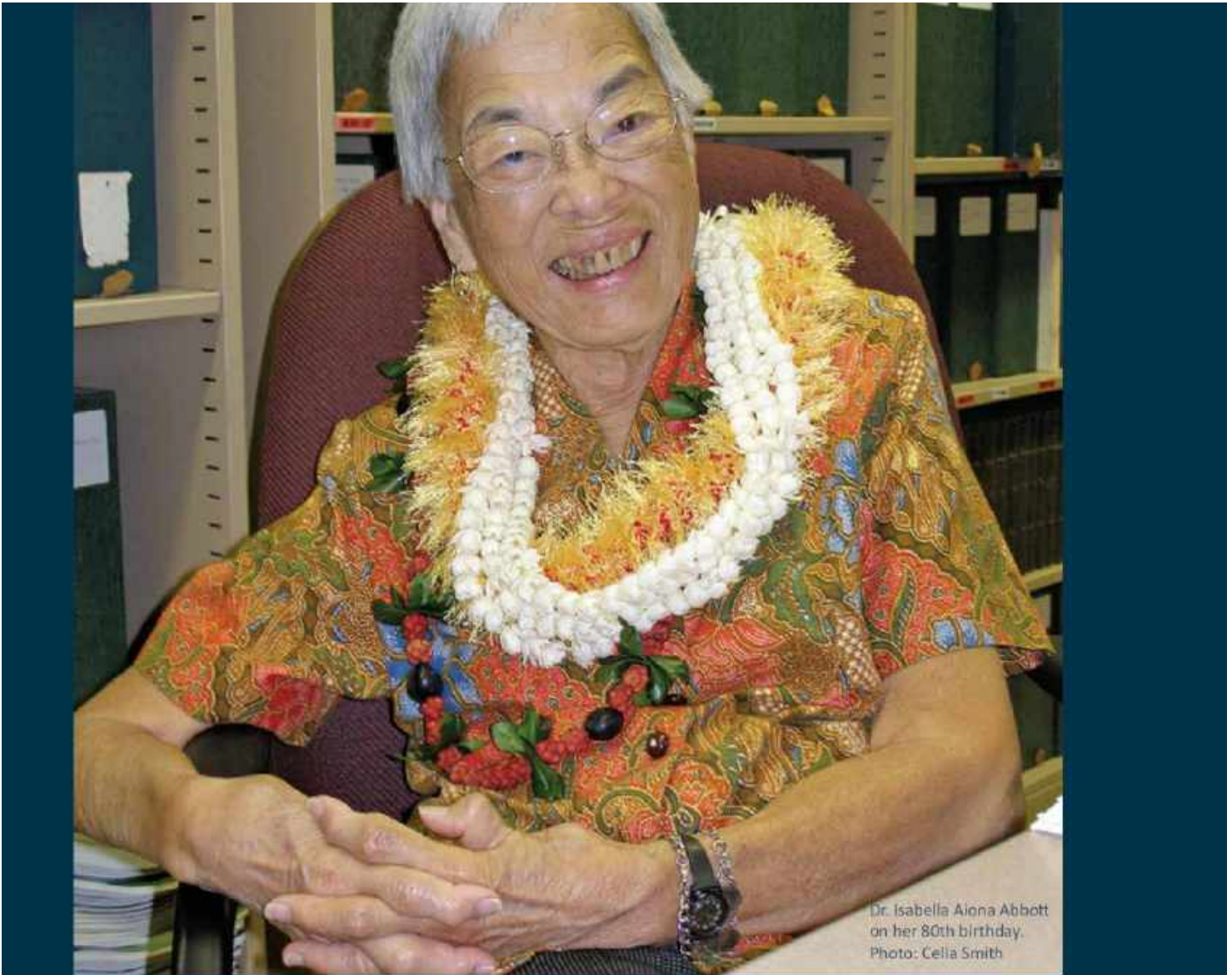
for her academic achievements, revolutionary seaweed research, various accolades, and over a hundred limu-related publications. However, it's the values she embodied as a person that make her a timeless inspiration to Native Hawaiians and to the entire state of Hawai‘i.

Dr. Abbott grew up in an era when Native Hawaiians confronted harmful misconceptions and offensive stereotypes, and a time when women were seen as lesser than men. She rejected those narratives and instead lived authentically as a passionate young Native Hawaiian woman who became the world's leading expert on algae in the Pacific. She always credited her love for algae to the limu lessons she learned from her mom while playing on the beach as a child. Her upbringing led her to understand that Hawaiians have always been scientists. She uplifted Hawaiian culture and the relationship that Western science has with Hawaiian culture throughout her algal research in Hawai‘i and California. She inspired University of Hawai‘i at Mānoa to create a Hawaiian ethnobotany bachelor's degree and touched the lives of countless students through her teachings. She once said in an interview, "Hawaiian culture is unbelievably sophisticated," and every day she embodied the meaning of those words.

Dr. Abbott is a treasure to scientists, Hawai‘i, Native Hawaiians, and anyone told that they can't do something because of their background. She will always be remembered and honored as one of Hawai‘i's most inspirational leaders.

MAZIE K. HIRONO, U.S. SENATOR





Dr. Isabella Aiona Abbott on her 80th birthday.
Photo: Celia Smith



Volunteers removing invasive, non-native seaweeds during a community workday in Maunaloa Bay. Photo courtesy of Mālama Maunaloa



A COMMUNITY APPROACH

REMOVING INVASIVE ALGAE TO RESTORE

REMOVING INVASIVE ALGAE TO RESTORE NATIVE ECOSYSTEMS

by PAULA MOEHLENKAMP

While the diversity and beauty of plants on land are easily seen by us, we may often overlook their aquatic counterparts hidden beneath the sea. Algae, photosynthetic plants ranging from microscopic phytoplankton to larger seaweeds, live in fresh and seawater and fulfill a variety of important functions, including the production of oxygen and the provision of habitat and food. Although limu, various species of seaweed native to Hawai'i, are an integral part of the environment, the rapid spread of invasive algae over recent decades has raised concern for the future health of limu and their ecosystems.

Originally, multiple species of invasive algae were purposely brought to Hawai'i for commercial aquaculture projects, while others were introduced unintentionally over time by ship fouling. Many of these alien species flourish in high-runoff

environments characterized by excessive nutrient concentrations and sedimentation. As invasive alien algae (IAA) spread, they cause a cascade of ecological and economic damage. Research has recognized IAA as particularly problematic for Hawaiian reefs as they smother coral reefs and native algal communities, permanently altering natural habitats and reducing biodiversity. Two areas particularly hard hit on O'ahu were Kāne'ohe Bay and Maunalua Bay.

In Kāne'ohe Bay, decades of encroaching IAA created a visible shift from healthy coral reef ecosystems to overgrown algal patches and inspired a pioneering, two-pronged management approach. Beginning in 2005, the "Super Sucker" was introduced to Kāne'ohe, a maneuverable suction system designed for divers to vacuum large quantities of invasive algae off acres of reefs. The "Super Sucker" system



Left: Mālama Maunalua volunteers conducting a benthic-algae cover survey. Photo: Mālama Maunalua

Right: Hawaiian collector sea urchins, *Tripneustes gratilla*, eat the small pieces of algae in the cracks in the reef to help prevent regrowth. Photo courtesy of NOAA

Ka Pili Kai • Ho'ouilo 2019 • hawaiiseagrant.org 18





Super Sucker platform in Kāneʻohe Bay. Photo: John De Mello, Nature Conservancy

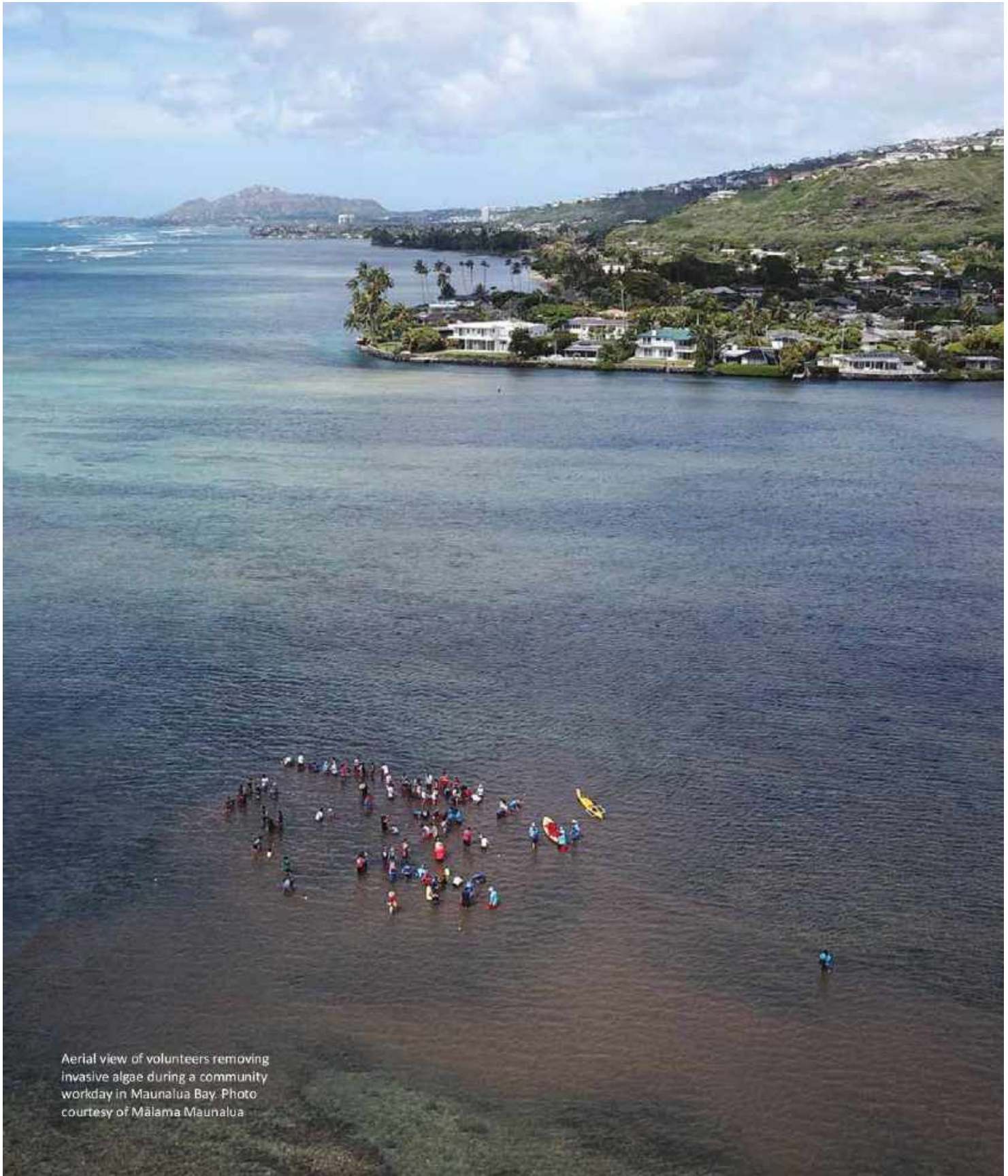
targeted *Gracilaria salicornia* and *Kappaphycus/Eucheuma spp.*, troublesome species of smothering algae. The second phase of management began in 2011 with the introduction of tens of thousands of nickel-sized Hawaiian collector urchins, which naturally graze on algae, clearing reefs and promoting coral growth.

Researchers soon saw a drastic decline of non-native seaweeds, with some invasive populations disappearing entirely from Kāneʻohe by 2015. Adding further encouragement, studies have shown that the mechanical removal had minimal environmental impact and did not cause damage to important reef building species such as corals and crustose coralline algae.

Managers of Maunalua Bay have taken a different approach. Historically, the bay was a complex coral reef ecosystem, including sandy and grassy sectors, now surrounded by urbanized watersheds in southeast Oʻahu. Known to be one of the first settlements when Polynesians migrated to Hawaiʻi, Maunalua

Bay is rich with Native Hawaiian history and culture. Its abundant marine life made it an ideal place for fishing, and it became home to multiple fishponds. Over time, human activities, such as excessive land-use, pollution, and overfishing, have combined with the spread of invasive algae to cause the degradation of coastal coral reefs, affecting marine life and impacting the ecological, economic, and cultural value of Maunalua Bay. For Mālama Maunalua, a local grassroots organization committed to preserving and protecting the area's remaining natural and cultural resources, invasive algae removal is one of its key management practices.

In 2009, Mālama Maunalua partnered with The Nature Conservancy and Pono Pacific, a local business, to use government stimulus funds to address the invasive algae problem. The group targeted removal of three invasive algae: Gorilla Ogo (*Gracilaria salicornia*), Leather Mudweed (*Avrainvillea lacerata*), and Prickly Seaweed (*Acanthophora spicifera*). Their goal was to

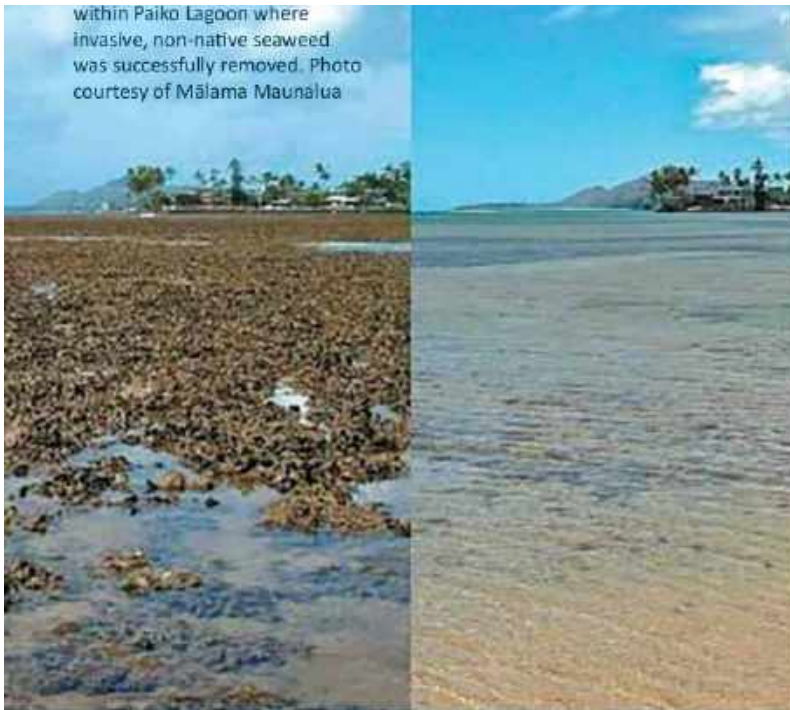


Aerial view of volunteers removing invasive algae during a community workday in Maunalua Bay. Photo courtesy of Mālama Maunalua



Before and after photos of area

within Paiko Lagoon where invasive, non-native seaweed was successfully removed. Photo courtesy of Mālama Maunalua



encourage community participation in removing the densest invasive algae growth to promote ecological restoration of coral reefs and seagrass beds. Ultimately, this stimulated not just the ecosystem but also local employment and community engagement, and these efforts are thriving even a decade later.

On organized community workdays, called huki, volunteers collectively remove invasive, non-native seaweeds from pre-selected plots in neighboring Paiko Bay, an area within Maunalua. "Every plot is scientifically assessed both before and after each removal event to determine impact. We maintain data on each assessment to help guide future removal efforts," explains Doug Harper, executive director of Mālama Maunalua.

Invasive algae are collected in sacks by community members and transported to local farms to be used on crops. Photo courtesy of Mālama Maunalua



Its management strategy also includes seeding native limu, enhancing native herbivory with sea urchins, and decreasing local nutrient and sediment runoff to create an ideal environment for native species to succeed.

"One of the biggest issues we confront is the inaccessibility of some algae populations. We are making significant strides in the Paiko area due to our fantastic community support, but some parts of the bay remain inaccessible. We suspect there are colonies of invasive algae in those locations we worry are able to prosper and seed other parts of the bay."

Nevertheless, the results are rewarding. Due to its efforts, Mālama Maunalua has seen the extent and volume of invasive algae drop, the return of native

algae increase, and consequently a shift back to benthic sand instead of choking mud. A secondary benefit is that the nutrient-dense algae removed are sustainably utilized at local farms and serve as excellent fertilizer and insect repellent on crops like taro and sweet potatoes.

For these important sites around O'ahu, the battle against invasive algae will continue, whether by applying vacuums, recruiting urchins, or through old-fashioned manual weeding. But the efforts have proven invaluable: wherever native limu has been given a second chance to thrive, local ecosystems and communities have been equally enriched.



Divers using Super Sucker to vacuum invasive algae off the reef. Photo: Kanako Uchino, Nature Conservancy

LIMU TRADITIONS

by LURLINE WAILANA MCGREGOR



“When I was growing up, if you went to a lū’au, you would know who prepared the food and what area it came from by just knowing the taste of the limu and the kinds of limu that were utilized. Basically, you could tell where the families came from by the raw stuff they made,” says Malia Akutagawa, who was raised on the east end of Moloka‘i. Now 48 years old and an assistant professor of law and Hawaiian Studies with both the University of Hawai‘i at Mānoa’s William S. Richardson School of Law and the Kamakakūokalani Center for Hawaiian Studies in the Hawai‘inuiākea School of Hawaiian Knowledge, Malia Akutagawa was taught by her grandmother from a young age how to pick limu. She says her grandmother, Katharine Kalua Hagemann Akutagawa, or Grandma Kitty, was known as one of the best limu pickers on the island. Grandma Kitty learned from Tūtū Hapa Kalua, who was cousin to Malia’s great grandmother, Ha‘aheo.

Just as the generational transmission of fishing traditions has tended to remain in the domain of the men, it was the women who were the limu pickers and who passed down the knowledge to the women in their family, even until today. From the time of the earliest settlements, laws and regulations known as the Kapu system dictated every aspect of life in Hawai‘i, from the proper time to fish, plant, or harvest, to appropriate behavior towards chiefs. Kapu is most

Left: A print from an instructional module published in June, 1987 by the Hawai‘i State Department of Education entitled “Limu: Learning about Hawai‘i’s Edible Seaweeds.”

Right: Katherine Kalua Hagemann Akutagawa, who Malia Akutagawa calls “Grandma Kitty”, sitting. Her sisters Anita and Leone stand in back at the old Kamalō Wharf in East Moloka‘i.



Left: Historical photo of women in Hawai'i collecting limu. Photo courtesy of Bishop Museum Archives

Right: Fresh limu kohu for sale at Tamashiro Market in Kalihi at \$21.95 a pound.

often translated as forbidden or prohibited, as in 'keep out'. Yet it also means sacred, or consecrated; thus a place, an object, a person, or a way of doing things is likely to be kapu if it is sacred and must be protected. There were prescribed punishments for breaking a kapu, sometimes as severe as death, which assured that people respected and abided by them.

The Hawaiians were very much attuned to their environment, and the Kapu system helped to protect ecosystems, assuring a sustainable food supply that would provide for future generations. Land and ocean resources were held in trust by the ali'i, or chiefs. Harvest rights were overseen by a konohiki, who was an expert resource manager and steward of the ahupua'a, which was the land division that extended from the mountains to the sea, including watersheds and all nearshore marine resources that lived in the intertidal zone. The konohiki had the knowledge of the life cycles of the fish, limu, crab, and other invertebrates in the ocean that were near shore in the ahupua'a. Konohiki, in turn, were advised by kūpuna, or elders, known for their particular expertise in specific areas, and konohiki could place a kapu on whatever resource needed protection, whether that resource was dwindling or it was simply the wrong

time of year to be harvesting.

Ka Pili Kai • Ho'ouilo 2019 • hawaiiseagrant.org 24

There were many kapu that dictated which foods women were allowed to eat. Foods that were embodiments of the gods or that were used for sacrificial offerings, for example pork, bananas, coconuts, and many deep sea creatures such as ulua and sea turtle, were strictly forbidden. However, women could gather and prepare certain foods that they were not allowed to eat, and could eat varieties of kapu foods, like certain types of bananas. There were times during the year and certain occasions that the kapu were relaxed, but otherwise the lines were clearly drawn, and women had their own realm of foods that they gathered, prepared, and ate.

Limu played a vital role in the Hawaiian diet, and it was entirely within the purview of the women's role not only to gather and prepare, but to provide for its consumption and use by the entire community. It is not surprising, then, that women became the foremost limu experts. Limu was as integral to a meal as fish and poi, and although it was considered a condiment that was eaten primarily to spice up other foods, the minerals and nutrients that it provided were essential to a healthy diet. While the word limu encompasses marine and freshwater algae, mosses, liverworts, lichens, and even some corals, there were specific names for each limu. Different limu were used for different purposes, including consumption, medicine, and ceremonies.

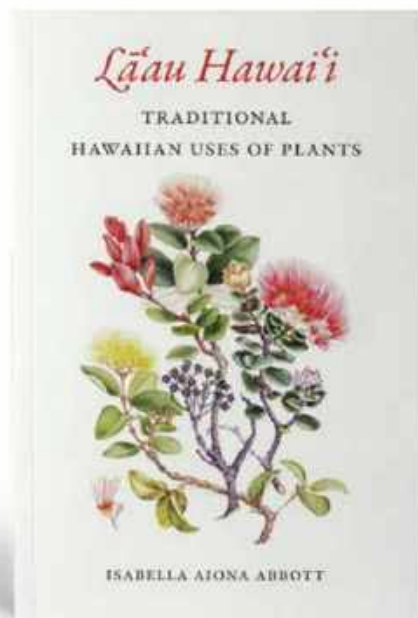
Limu that didn't serve any purpose were often not given a name, and were simply referred to as 'opala limu, or rubbish limu.

The Kapu system formally ended in 1819 with the 'ai noa, when Kamehameha II not only sat down to a meal with women, which was kapu, but the women ate foods that were kapu for them to consume. But despite the end of the system two hundred years ago, women continued to pass down the knowledge of limu to the next generation of women to become limu gatherers and preparers.

Isabella Aiona Abbott, born in Hana, Maui in 1919, one hundred years after the 'ai noa, learned about every edible limu around her grandmother's house in Lahaina from her mother. This knowledge inspired her to become an expert in ethnobotany, documenting the gathering, preparation, and uses of edible seaweeds. Dr. Abbott's work included the documentation of countless edible varieties of limu, and inspired new interest and even new respect for the sophistication of Native Hawaiians who had always had this knowledge. She toured the islands and recorded which kinds of limu were most common and abundant in which areas. Kaua'i, for example, was especially well known for its limu kohu. She also learned from her research that Hawaiians consumed more different kinds of limu than any other Polynesian or Pacific Islander



Close-up image of limu tied to rock before being placed in the ocean for limu restoration. Photo: Kim Moea, courtesy of KUA



Dr. Isabella Aiona Abbott. Photo: Celia Smith

communities. She hypothesized that this may have been a result of the kapu that dictated what women could eat, and not eat, which inspired them to investigate other nutritional alternatives, both plant and animal. "I can think of no other case in which, for religious reasons, a generally neglected food source came to figure so greatly in a year-round diet," writes Dr. Abbott in *La'au Hawai'i: Traditional Hawaiian Uses of Plants*.

Dr. Abbott only found two limu species that were kapu to both men and women: limu pakaiea was not eaten by anyone who had shark 'aumakua in their families because this limu served as a blanket for young sharks; and limu lipe'epe'e would not be consumed by hula dancers. Limu lipe'epe'e grows in underwater cavities where it is hidden, and the intangible secrets of the hula would become hidden from anyone who consumed it.

Dr. Abbott also documented other uses of limu in

dissention, participants would be given a piece of limu kala, followed by prayers to make the family whole again. Upon forgiveness, each person would eat their limu. Limu kala was also used for cleansing: a kahu, or priest, would purify a person, object, or place by sprinkling a mixture of 'olena (turmeric) and salt water with the limu. This ritual was commonly used following the burial of a relative, when someone who had been with the body prior to burial had to be cleansed. It was also used for fishermen before they set out at the beginning of the season in July to fish for 'opelu.

When the Kapu system ended, so did the authority of konohiki to manage the lands and impose restrictions when resources were being overused. The expansion of westernization often resulted in overharvesting of local resources to fabricate products to trade for foreign goods. This contributed to the breakdown of the ahupua'a, and in 1839, Kamehameha III codified fishing rights and

addition to consumption. 'A'ala'ula is a limu that was paired with 'ala'alawainui, a forest plant, for opening and closing medicinal treatments. Limu kala was essential, but used in different ways, in several ceremonies. For example, kala means to forgive, so in ho'oponopono, a ceremony to heal family

management of the marine environment inside the reef to konohiki and the tenants of the ahupua'a. The konohiki became more of a landlord than a resource expert, who might be more influenced by political and social forces than the need to protect resources.

Ka Pili Kai • Ho'ouilo 2019 • hawaiiseagrant.org 26

Notwithstanding the passing of time, political, and social change, Hawaiians never lost their preference for traditional foods and gathering practices, and the knowledge continued to be passed down through the generations. There are many accounts that document how limu continued to be a favored food during the first part of the twentieth century. Queen Lili'uokalani's fondness for limu huluhuluwaena was well known, and in 1906, several years after the annexation of Hawai'i to the United States, Lili'uokalani had a restriction notice posted in the *Kuokoa Nupepa*:

The news is being made known to all who go sea bathing or fishing in the waters of Hamohamo in Waikiki Kai, Honolulu, O'ahu, that Queen Lili'uokalani is placing a restriction that no one is to go and take the Limu Paka'eleawa'a and the Limu Huluhuluwaena, the 'Opihi, the A'alealea shells, 'Ina urchins, Ha'ue'ue pencil urchins or the Pipipi shells in the area directly in front of the Royal Grounds. Her own royal hands planted and cultivated all of these things noted above, and anyone who goes to get these things which are now being restricted will be arrested and punished by law. All of these things that were planted by the Queen were brought here from Hilo, with some from Lahaina, some from Moloka'i, some from Kaua'i, and others from Waialua, here on O'ahu.

Heed this restriction. J. O. Carter Agent
Honolulu, T.H. March 1, 1906

Waikiki was famous for its limu, and oral histories of Waikiki residents during the early part of the twentieth century, recorded by the Center for Oral History at the University of Hawai'i in the latter part of the century, document the abundance of limu. Wilbur Craw, born in 1914, recalls picking

HOOLAHA HOOKAPU.

Ke hoike ia aku nei ka lohe i na mea apau, e hele nei ka auau kai, a lawaia paha ma ke kai o Hamohamo, ma Waikiki-kai, Honolulu, Oahu, ke hookapu nei ka Moiwahine Liliuokalani aole e kii i ka Limu Paka'eleawaa, me ka Limu Huluhuluwaena, Opihi, Pupualealea, I-na. Haueue ame ka Pipipi, ma ke alo ponoi iho o ka Pa Alii. Na kona mau lima alii ponoi no i kanu a hookawowo i kela mau mea apau i hoike la ae la maluna, a o ka mea e kilana i kela mau mea e hookapu ia nei, e hopu la no oia, a hoopai la e ke kanawai. O kela mau mea apau i kanu la e ka Moiwahine ma' Hilo i lawe ia ma' ai kekahi no Lahaina kekahi, no Molokai kekahi, no Kauai kekahi, no Waialua. Oahu nei, kekahi.

E hoolohe i kela hookapu.
J. O. CARTER,
Agena.

Honolulu, T. H., Malaki 1, 1906.
3091—Mar. 2, 9, 16, 23, 30

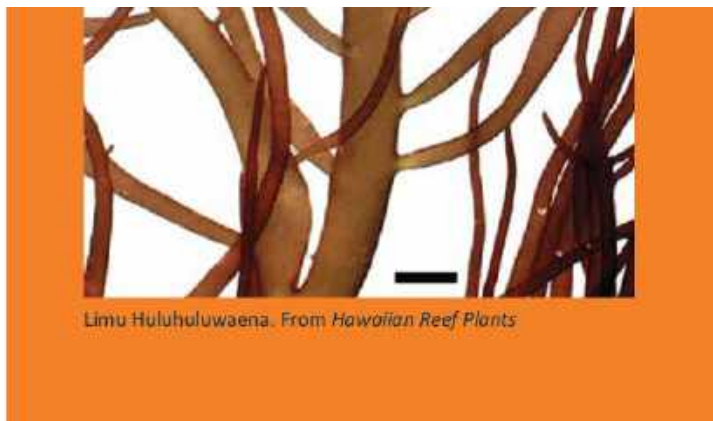
From *Ka Nupepa Kuokoa*, volume XLIV, Number 9, 2 March 1906, page 5 Advertisements Column.



limu at Waikīkī when he was growing up:

“When we first moved out there [to Diamond Head], Waikīkī was loaded with limu līpoa. Oh, just loaded! That young limu would come up and there was a sort of golden brown, you could see it on the rocks. That līpoa, new līpoa, tender. We’d go out and we’d be always careful to pinch it off or you took a cheap pair of scissors and cut so you don’t

27 Ka Pili Kai • Ho’oilo 2019 • hawaiiseagrant.org



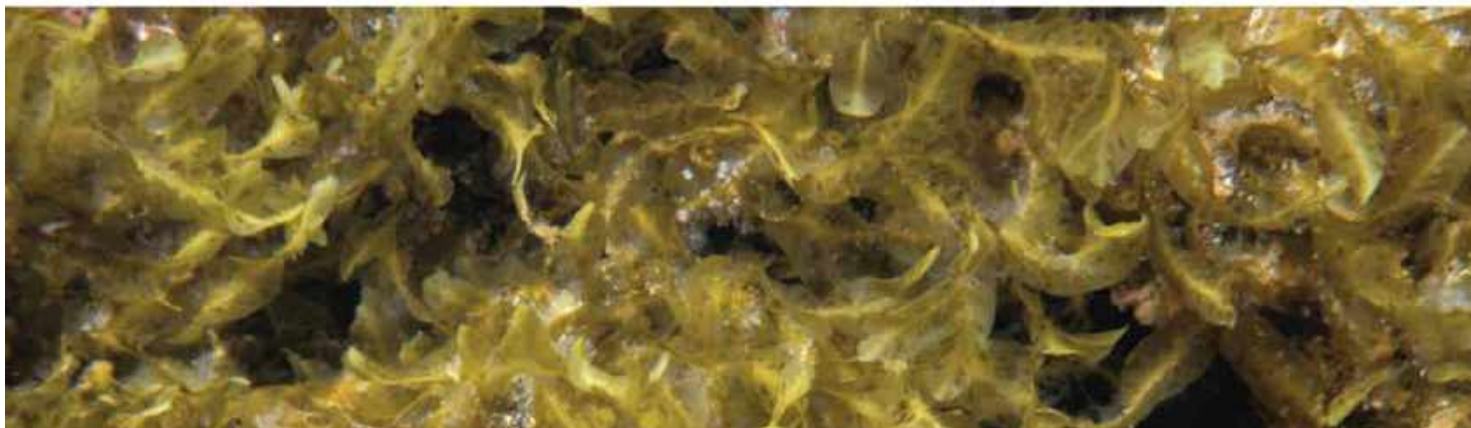
Limu Huluhuluwaena. From *Hawaiian Reef Plants*

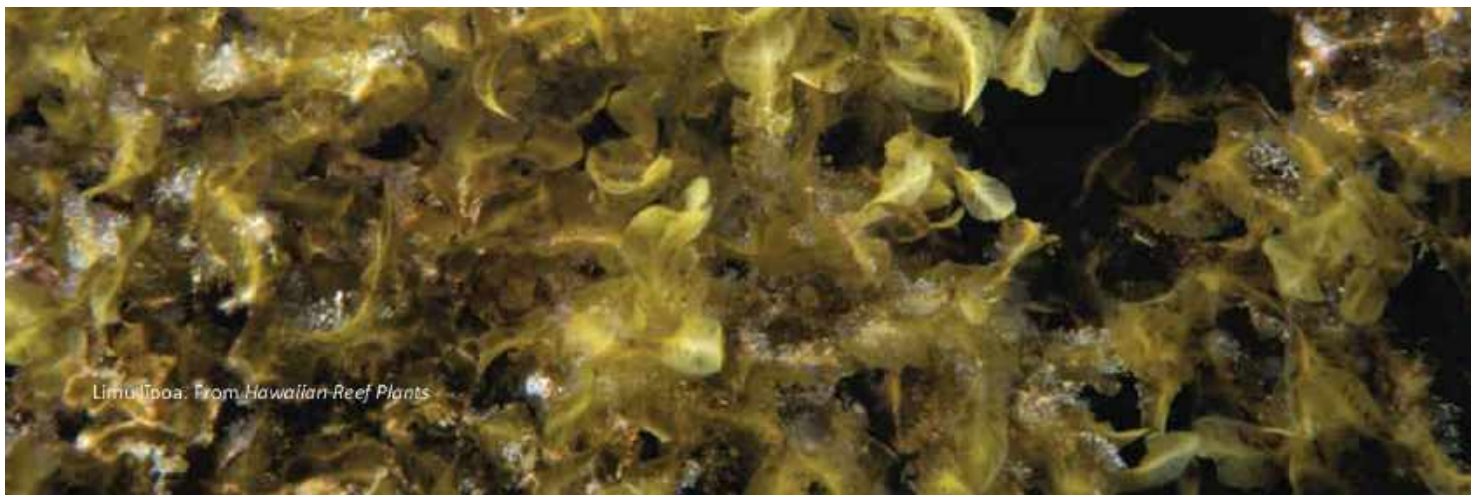
disturb the roots. We used to put it into flour sacks and take it out to Lunaliilo Home, that’s where the old Hawaiians were. Yeah, my mother used to take it out there and she used to give it to the people out there. Oh, they’d go crazy over it. Soon, everybody along the coastline or the hotels put in swimming tanks. To keep the algae from growing, they put chlorine in it. Then to save pumping it into the sewer, they drain it into the water. So as a result, the limu beds that used to be plentiful around Diamond Head, [were] all wiped out.”

Despite dwindling limu resources in the more populated areas, kūpuna were still passing down their traditions well into the 1970s, especially in the rural areas, where Malia Akutagawa was growing up:

“The way my grandmother would teach me to pick limu is we would always look at the moon calendar and track the tide and we would go out at low tide. We would go to the beach in front of her house at Ulapu’e. A stream came out, and the limu would

attach to these little kukui nuts. We would see a pile of kukui nuts along the intertidal zone and we would just pluck the limu ele’ele from there, pinch an inch from the root. She would make me gather my own and she would gather her own and she would test me. You would have to clean it in the water, then do the fine tune cleaning at home in fresh water. She was really meticulous about it. The good ele’ele is like fine baby hair, it’s really about touch, you have to pluck out all the bumps. You know, Hawaiian style, they want you to become masterful at it, you don’t want someone to bite a piece of sand. If you cleaned it kapulu (carelessly), you would be ridiculed and scolded by your elders, so my way of cleaning is very meticulous, the way my grandmother’s was. We would rinse it two or three times, not too much because you still wanted the ocean taste. Then we would make them into little balls, squeeze the excess water out, put it in a bowl, then my grandmother would put Hawaiian salt on it and cover it. The limu would absorb the salt, and it would taste better over the next few





Limu Lipoa: From *Hawaiian Reef Plants*



Limu Kohu: From *Hawaiian Reef Plants*

days. She would store some in the freezer and put some in a jar in the ice box and practically every dinner, we would have stew or fish and poi and you'd always have limu with it. There are times when I have a powerful craving for limu ele'ele the same way I enjoyed it as a daily snack stored in Grandma's icebox."

Before refrigeration, prepared limu would be kept in small calabashes covered with ti leaves. Only limu kohu or limu lipoa, which was stored in a pū'olu, or ti leaf packet, would keep longer, sometimes for months. Dr. Abbott observed that "it was a rare Hawaiian household that did not have some kind of limu at all times."

Dr. Abbott wrote that during the first half of the twentieth century, it was common to see small groups of Hawaiian women in mu'umu'u and hats cleaning limu on sandy beaches during low tide. This was a familiar sight in places like the shoreline from





29 Ka Pili Kai • Ho'ōilo 2019 • hawaiiseagrant.org

Kahala to Waikīkī and in Ewa, on O'ahu, and along Hilo Bay on Hawai'i Island. During her lifetime this sight began disappearing, and the amount of edible limu has continued to diminish during Akutagawa's lifetime. In rural East Moloka'i, where Hawaiian traditions and practices remained stronger than other places, there have been changes.

"We couldn't go beyond the edge of the ahupua'a, my grandmother always told us to stay in our own territory," Akutagawa said. There were zones for where you could do things. You would not surf where people would be spearfishing along the reef or where the kupuna would be gathering limu. That's your ice box. I've seen an erosion of cultural practices and a total lack of understanding of these unspoken rules.

"We're losing our access to the limu and all the delicacies that our kūpuna knew. The limu ele'ele has started to disappear from changes in the

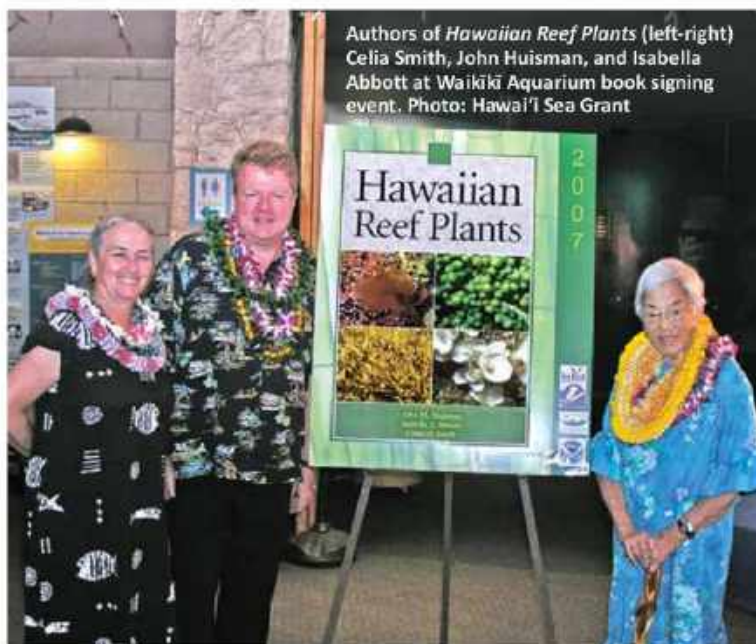
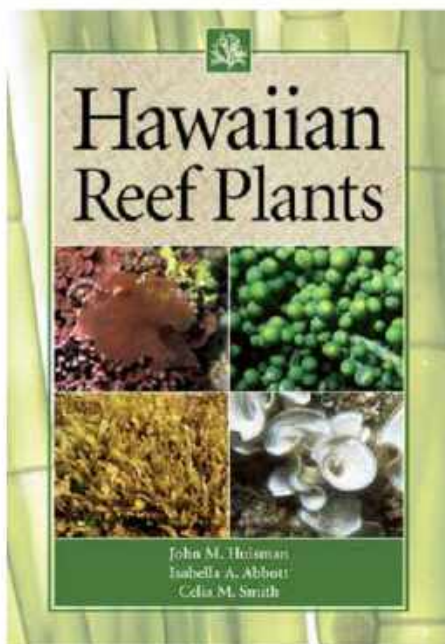
weather patterns from when my grandmother was little. There's drought, torrential rains, introduced limu coming in on the bottom of ships to Maui that break free, all those things affect the limu. The generation under twenty-five years old probably no longer has the knowledge; over thirty, they still know."

Dr. Abbott closes *La'au Hawai'i: Traditional Hawaiian Uses of Plants*, written almost three decades ago, with this food for thought:

"...Considerable knowledge of limu can still be found among Hawaiian elders, so this, too, qualifies as an area of cultural continuity. Unfortunately, degradation of the reefs and the ease of purchasing limu instead of gathering it threatens the transmission of this living body of knowledge to subsequent generations. I hope that every Hawaiian who has a parent or a grandparent to instruct them in this skill will make it a high, personal priority to learn it. Otherwise, we will be reduced to re-educating ourselves from scholarly literature – the equivalent of reinventing the wheel."



Historical photo of women gathering limu and 'opihī in an area called Coconut Island, Hawai'i. Photo: Bishop Museum Archives



PLANTING AN IDEA

A GUIDE TO THE WONDER OF MARINE PLANTS

by RACHEL LENTZ

For most, when they hear the word "reef," a mental image of multi-colored corals and fish of all

celebrate, and protect these amazingly diverse, yet vulnerable, plants. *Hawaiian Reef Plants* has been

mental image of multi-colored corals and fish of all sizes, shapes, and hues springs to the mind's eye, perhaps bearing a resemblance to a *Finding Nemo* background. But often missing from this enticing mental landscape are the plants, a wide variety of colors, shapes, and structures filling in the gaps and completing the complex, abundant ecosystem. Algae are ubiquitous, and though we come across them routinely while swimming or snorkeling, many tend to overlook them when thinking of what species inhabit coral reefs.

In 2007, when she was 88, Isabella Abbott collaborated with two other renowned botanists, John Huisman and Celia Smith, to produce an unparalleled resource for those interested in filling that knowledge gap by learning how to identify,

vulnerable, plants. *Hawaiian Reef Plants* has been celebrated for over a decade now as the go-to work that delivers not just identification information (with gorgeous photos and illustrations) of over 200 commonly found species, but is also a primer on Hawaiian shorelines, marine plants' roles in the reef ecosystem, and their cultural significance to the people of the islands.

In order to protect vulnerable reef systems, it becomes critical to recognize the interactions of all the species that contribute to these complex ecosystems. These marine plants, so carefully detailed in *Hawaiian Reef Plants*, are a vital component of the reefs that should be acknowledged, understood, and appreciated by all.

31 *Ka Pili Kai* • Ho'oulo 2019 • hawaiiseagrant.org

FROM THE ARCHIVES OF..



The Honolulu Advertiser

MONDAY | February 26, 2007

BREAKING NEWS 24/7 AT HONOLULUADVERTISER

HAWAII'S ENVIRONMENT

Book on reef plants satisfies

By Jan TenBruggencate
Advertiser Columnist

There are lots of books, popular and technical, on the colorful fish of the Hawaiian reefs, a number on shells and other invertebrates, and even some on the Hawaiian cultural uses of marine resources. But there are few comprehensive books on the plants of the reefs.

That's a little like bird-watching and not noticing you're in the forest.

A new volume, "Hawaiian Reef Plants," produced by the University of Hawai'i Sea Grant, steps into the void, striding the line between popular and

your reds, blue-greens, greens and browns. You've got big leafy ones, stout rubbery ones, ones that wave like hair in the current, and rocky forms that on some shores are more important for building reefs than corals.

The authors, Australian botanist John Huisman and University of Hawai'i botanists Isabella Abbott and Celia Smith, open with a short course in marine botany, plant identification and other information, and strongly make the point that while the book identifies individual plant species, the overriding key for

tourists and industrialists, and limu pickers."

The volume discusses pollutants, aggressive alien seaweeds, Hawaiian cultural uses, how to avoid becoming part of the problem on Hawaiian reefs and more.

If you decide to become a student of Hawaiian seaweeds, the book has tips on how to collect them, including how to press specimens so you can keep them for years.

A few other books contain useful information on seaweeds

the line between popular and scientific, providing photographs that will help the average beachgoers identify the seaweeds they're seeing, and enough technical detail to satisfy more accomplished sea folk. It's a 264-page paperback listed at \$24.95.*

If you've been impressed by shapes of the corals and the variety of fish on the reef, consider the algae. You've got

species, the overriding key to understanding them is the reef as a community.

"Let's not be simplistic. Our marine plants live or die as members of complex ecosystems of interacting plants, animals and physical factors," the authors write in their foreword. They warn readers that the book "will occasionally lead you into that wider world of fishes and coral,

useful information on seaweeds although some may be difficult to find. Among them, "La'au Hawai'i: Traditional Hawaiian Uses of Plants" and "Marine Red Algae of the Hawaiian Islands," both by Abbott, "Plants in Hawaiian Culture" by Beatrice Krauss, and "Seaweeds of Hawai'i, A Photographic Identification Guide," by William Magruder and Jeffrey Hunt.

© COPYRIGHT 2007 The Honolulu Advertiser
*Publication cost increased with second printing.

Ka Pili Kai • Ho'ōilo 2019 • hawaiiaseagrant.org 32

HAWAIIAN ALGAE HIGHLIGHTS

ADAPTED FROM HAWAIIAN REEF PLANTS

Hawaiian reefs are home to about 300 species of large, visible native algae, about 150 small native species, and another 100 species that are still unidentified or suspected of being introduced. These reef algae, or limu, are the plants of our coasts. They trap the sun's energy and scrub surrounding nutrients from the water to grow into blades, fronds, turfs, or crusts.



LIMU KOHU
Asparigopsis taxiformis
RED ALGAE



Plants of *Asparigopsis* have creeping runners that hold fluffy pink or grayish upright columns. *Asparigopsis* is one of many red algae which have, during their life, an alternate phase with a radically different appearance. This limu is probably the most highly valued algae used as food by Hawaiians. If

you collect these plants for food, leave behind the creeping portions, which will readily regenerate.

RED



Photo: Pelika Andrade

LIMU MANAUEA

Gracilaria coronopifolia

RED ALGAE



Photo: Pelika Andrade

This limu can be recognized by its cylindrical or slightly tapering branches, and generally it displays two equally thick branches at each branching point. This food limu was once common in the islands, but its popularity has caused the depletion of many natural populations. *Gracilaria* species are an important food sources throughout the world, and in Hawai'i, they are often offered as ogo, a Japanese name for the genus.

33 Ka Pili Kai • Ho'oulo 2019 • hawaiiseagrant.org

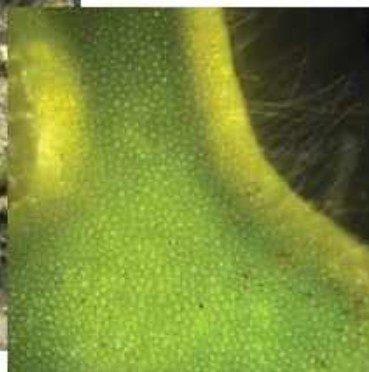
GREEN



LIMU WAWAE'IOLE

Codium edule

GREEN ALGAE

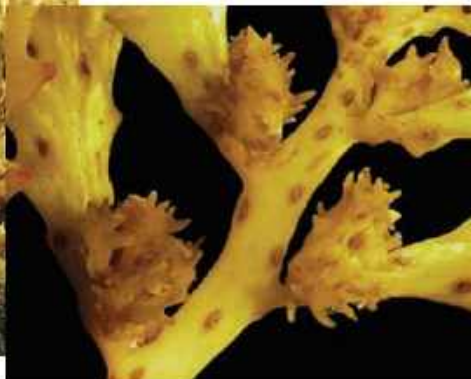


This limu sometimes branches irregularly, sometimes displays two equally thick branches at each branching point, and sometimes forms mats on reef flats. Despite the range of growth forms, all members of the genus *Codium* are readily recognized by their spongy consistency. When limu wawae'iole (meaning "rat's foot") is prepared as food it is usually chopped or pounded and mixed with salt.

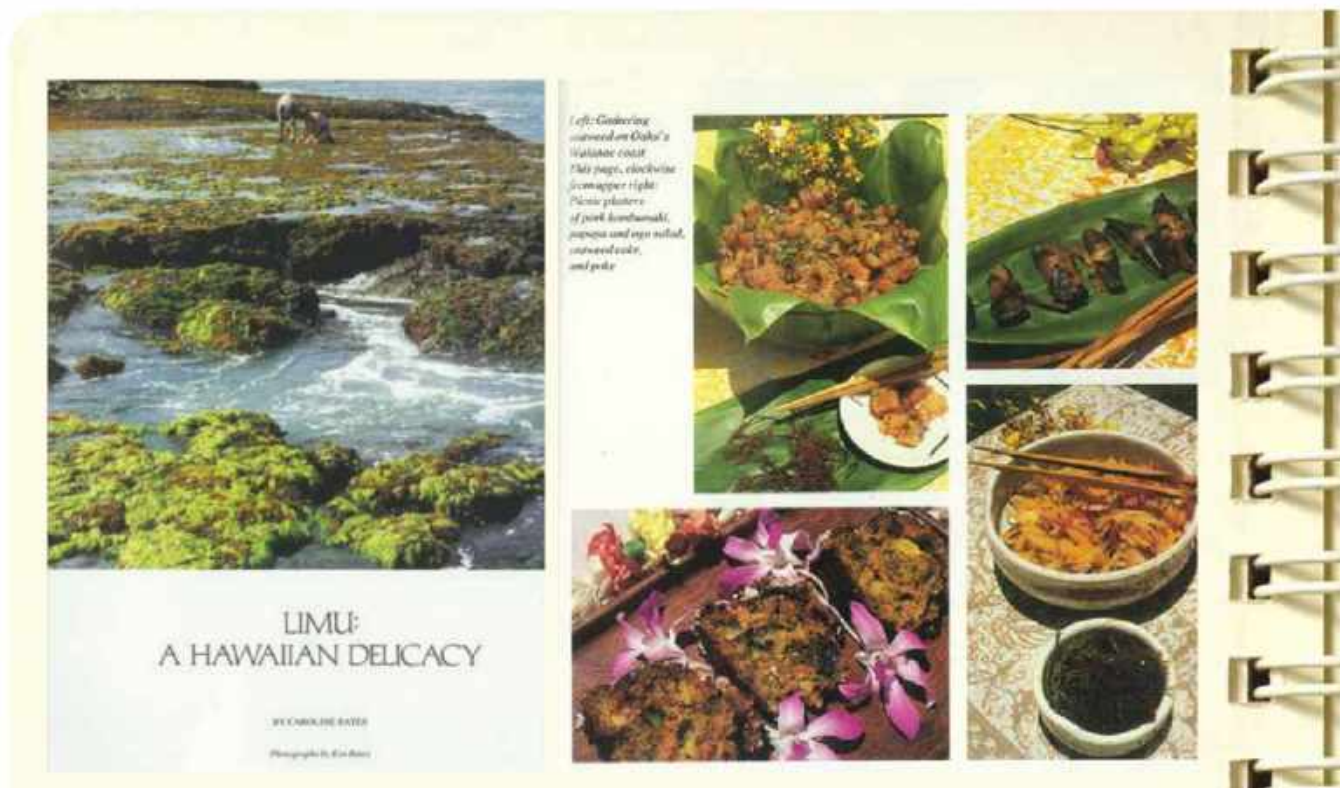
BROWN

LIMU KALA

Sargassum aquifolium
BROWN ALGAE



The limu kala body consists of distinct stem and leaflike branches. Specialized branches, known as receptacles, serve as containers of reproductive structures, and are so tightly branched that they appear burr-like. This limu is used by Native Hawaiians for food, medicine, and ceremonies including special hula, and purification and forgiveness encounters. Limu kala helps ho'oponopono participants cleanse their hearts and minds to forgive any real or imagined slights.



In 1987, *Gourmet Magazine*, the epicurean's former favorite source of information about food, included a feature article on cooking with limu. The author travelled to Hawai'i and even interviewed Izzie Abbott for the story. The above images are select photos from that article, depicting (left) limu gatherers and (clockwise from upper right) "picnic platters of pork kombumaki, papaya and ogo salad, seaweed cake, and poke."

THE JOY OF LIMU

by MIWA TAMANAHA

Limu is food, first and foremost, for fish, forming part of the foundation of a complex trophic web that spans from plankton to people. Limu is also food for people, probably most commonly brought to mind as an essential ingredient in our lunchtime poke bowls. Limu has extensive uses in all manner of foods, both Hawaiian and the many other ethnic types represented in our communities, and at events from baby parties to New Year celebrations. Pickled, salted, dried, raw, chopped, fried, boiled, no matter the form, limu for eating is a gift shared among friends and family for affirming ties.

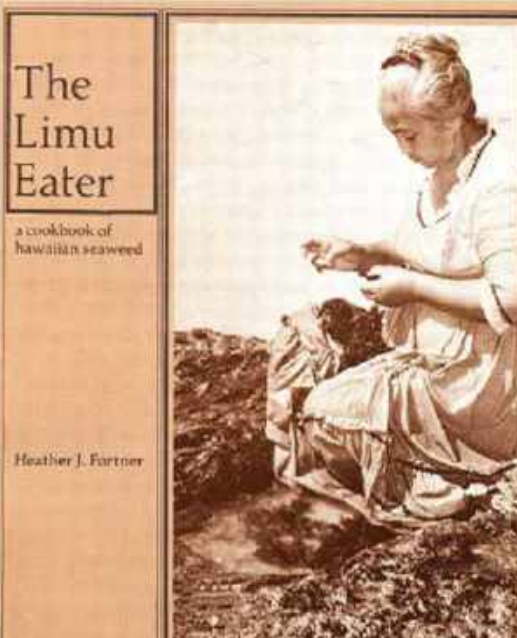
Unfortunately, as urbanization and invasive species pressures increase, the limu which we eat so fondly is disappearing from our coastlines, and only by deliberate effort can we reverse that trend. The recipes on the following pages propose a different, more abundant relationship with limu, from a taste being lost to us, to an ingredient that is vibrantly present, both on our shorelines and in our bellies. In caring for our ocean places, we can all be a part of bringing these recipes to life and to our tables. From soups and salads to crispy snacks, explore and experiment with the tastes and textures of this traditional, yet novel, ingredient.

EXCERPT FROM THE LIMU EATER PUBLICATION PREFACE

By Heather J. Fortner

In 1974 a class called "Living Wealth of the Oceans" was taught by Dr. John Bardach, then director of the Hawai'i Institute of Marine Biology. Six of us shared an interest in Hawaiian seaweed, or limu, and selected "Seaweed Use in Hawai'i" as our class project. We researched historical and contemporary uses of limu in Hawai'i, made up and tested recipes, held limu cooking demonstrations, made displays, and decided to make a collection of Hawaiian seaweed recipes.

We discovered that some seaweeds are essentially spices, used sparingly to flavor or accent dishes, while others are as different and versatile as land vegetables. We looked at how



the Hawaiians had used over 70 varieties of the local limu and compared this with how other Pacific people prepare their native seaweeds. We discovered that different ethnic groups have different uses and names for particular seaweeds and also use different ingredients to prepare them.

The next summer I received a joint grant from the University of Hawai'i Sea Grant College Program and the Marine Option Program to continue this study with the objective of creating a cookbook on Hawaiian seaweed.

The result of this study has become more than a cookbook. *The Limu Eater* introduces a food that is unfamiliar to most and identifies where it grows, what it looks like, how it is used, and where it can be found. In addition, it describes some of the ethnobotanical uses of local seaweed such as for medicine or in ceremony. Thus, what started out to be just a collection of recipes has become an introduction to the art and craftsmanship of limu eating.

This publication is currently out of print, but an electronic copy can be obtained by contacting Hawai'i Sea Grant at (808) 956-7410 or lknapman@hawaii.edu.

The Limu Eater: a cookbook of Hawaiian seaweed was produced by Hawai'i Sea Grant in 1978.

RECIPES

LIMU-TOFU DRESSING

Limu added to this tofu dressing lends a distinctive flavor. Limu 'ele'ele, limu huluhuluwaena, and limu lipoa can each be used, together or singly. Originally intended for a green salad, this dressing is just as good with a limu salad.

1/2 C limu, salted and prepared
1 C tofu (1/2 block)
1/2 clove garlic
4 T shoyu
Juice and pulp of 1 lemon
Dash of oregano
Dash of marjoram

Chop the limu very fine. Add all of the ingredients to a blender and mix, using sufficient water to make a creamy consistency. This dressing should be used within a week.

LAVER SOUP

1 C limu pahe'e or rehydrated nori
2 C water
1 10-1/2 oz. can beef consommé
Juice of 1/2 lemon

Bring the water to a boil, then add the limu (if using nori, cut into small pieces). Add the consommé and lemon juice, heat just to boiling. Add a twist of lemon peel in each bowl. Serve with toast or saltine crackers.

LIMU LEPE 'ULA'ULA SOUP

1 C wet limu lepe 'ula'ula, packed
1 onion, thinly sliced
1 T oil
1/4 C rolled oats
5 C water
3 T shoyu
1 t salt
1 t black pepper

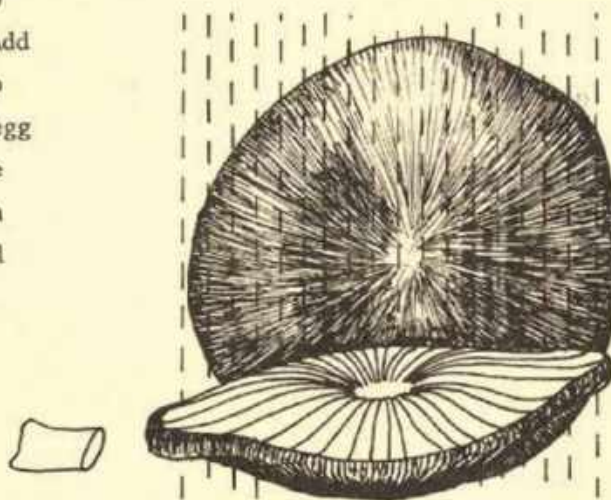
In a medium saucepan stir-fry the onion in oil until the strong smell goes away. Add the oats and cook until slightly browned. Cut or break the limu into bite-sized pieces, then

MISO SOUP WITH LIMU

1/4 C limu 'ele'ele or
 2 T limu kohu or limu lipoa
 1/4 C dried shrimp
 5 C water
 1/4 C miso, dissolved in 2 T water
 1 egg, beaten
 Green onions

Soak the shrimp in water for at least 15 minutes, then boil for 10 minutes or longer until tender. Add the miso mixture, then slowly drip the egg into the water to create egg "flowers." Stir gently and remove from heat. Just before serving in small soup bowls, add the limu and onions.

add the water and limu to the soup pot. Bring to a boil, then lower heat and simmer for 20 minutes. The soup should not be too thick. Add shoyu and seasoning.



LIMU KALA CHIPS

Deep fat frying changes the texture of limu kala from tough and leathery to crisp and brittle. Use only the large, clean, holly-like "leaves"--their size and shape make suitable chips. Serve with a dip or crush and sprinkle on a fish casserole.

Limu kala
 Fat for deep frying
 Salt

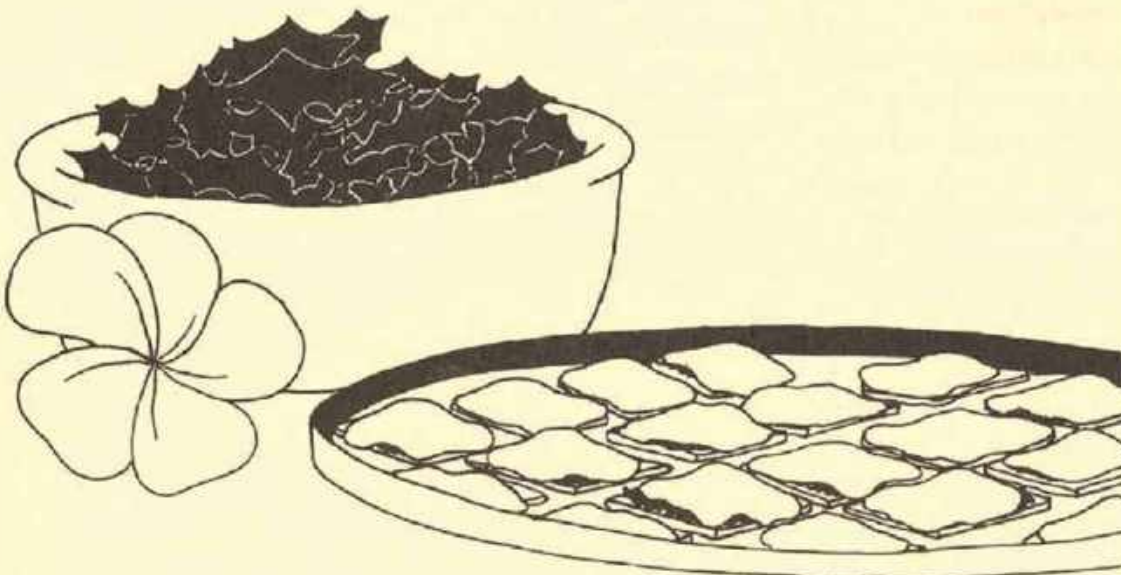
Cut the clean leaves from the

LIMU PAHE'E SNACK CRISPS

1 C limu pahe'e, washed (if using nori sheets, cut to cracker size and dampen slightly)
 20 rye or wheat crackers
 1 Maui onion, cut in small chunks
 1 C grated cheddar cheese

Arrange a layer of limu on each cracker, top with an onion piece, sprinkle with cheese. Toast under the broiler until the cheese melts. Serve hot.

stem, discard the rest of the plant. Rinse with fresh water, then drain well. Pat dry before frying; any water will cause the oil to spatter. Heat the fat to 375°F, add a few leaves at a time, and cook until brown and crisp. Drain well, season with salt. Serve hot.



Season descriptions below are from the Huli 'ia seasonal calendar, available at HawaiiSeaGrant.org

WELEHU

In Welehu, we see an increase in huge weather systems...

NOV/DEC



MAKALI'I

Makali'i is marked by the presence of the star constellation Makali'i in the night sky...

DEC/JAN



KĀ'ELO

Vibrant sunrises and sunsets mark this time of year...

JAN/FEB



KAULUA

The sandy shoreline is shifting and moving while schools of Mui are seen in the shallows.

FEB/MAR





2019

21 NOV
SCIENCES AND
THE SACRED:
CONVERSATIONS ON
MAUNAKEA

Seminars will pair a Hawaiian practitioner with a UH Mānoa faculty member to explore topics from various knowledge systems. Art Auditorium, UH Mānoa campus, 5:30-7:00 PM. More info. at: <http://bit.ly/SciencesAndTheSacred>



06 DEC
VOLUNTEER FOR
ALOHA BOWL

Volunteers needed for this fun and educational event where teams of high school students compete in a Jeopardy-style tournament and are tested on their knowledge of the ocean sciences and ocean policy. Positions include science and rules judges, score and time keepers, graders, and set-up/breakdown crew. Contact mworkman@hawaii.edu. More info at: <http://bit.ly/AlohaBowl>



2020
13-14 JAN
HAWAII STATE
CLIMATE CONFERENCE
HĀ O KE KAI

Showcasing Hawaii's response to climate change through policy implementation, citizen engagement, and research. East-West Center, UH Mānoa Campus, 8:30AM-4:30PM. More info. at: <http://climate.hawaii.gov/conference>

09-12 FEB
AQUACULTURE
AMERICA
CONFERENCE

Hawai'i Convention Center, Honolulu. "Navigating with Innovation, Technology and Culture." <https://www.was.org/meeting/code/AA2020>

15 FEB
ALOHA BOWL

Hawai'i's only academic marine science competition for high schoolers will be held on the UH Mānoa campus, 8am-5:30pm. To register a team: 808-956-7410 or uhsgcomm@hawaii.edu

SCIENCES AND THE SACRED

The University of Hawai'i Provost's Office, together with the Biocultural Initiative of the Pacific and the Hawai'i Sea Grant Center of Excellence in Integrated Knowledge Systems, is hosting a lecture series titled "Sciences and the Sacred: Conversations on Maunakea." Each lecture is pairing a Native Hawaiian practitioner with a UH faculty member and is intended to inspire and inform subsequent discussions of the contemporary issues surrounding Maunakea. Visit <http://seagrant.soest.hawaii.edu/integrated-knowledge-systems/> for more information.

39 *Ka Pili Kai* • He'ōilo 2019 • hawaiiseagrant.org

NANA

Through the transition into summer, the colors surrounding us become less vibrant.

MAR/APR



WELO

The characteristics of winter have gone and we settle into summer.

APR/MAY



IKIIKI

The ocean has calmed with some days of perfect glassy conditions.

MAY/JUN



KA'AONA

As sky and ocean conditions calm, activity beneath the ocean surface seems to increase.

JUN/JUL





10-13 MAR PRIMO CONFERENCE

The Pacific Risk Management 'Ohana focuses on making Pacific Islands more resilient to the impacts of natural hazards. Hawai'i Convention Center, Honolulu.
<https://coast.noaa.gov/primof/>

22 APR EARTH DAY

Celebrate with your local community. UH campuses will host activities throughout the day. Visit www.hawaii.edu/calendar for updated information.



APR MĀLAMA MAUNALUA HUKI

Help remove invasive algae in Maunalua Bay at the community Huki. Mālama Maunalua Huki events include a short lesson on the Maunalua Bay region, invasive algae, and the ecology of Maunalua Bay. Visit <http://www.malamamaunalua.org> for more info. and hukidates/times.



MAY GRAU FELLOWSHIP APPLICATIONS

A unique degree-to-work experience for postgraduate students who have an interest in ocean resources in Hawai'i and the management and policy decisions affecting those resources. More info. and dates at: <http://bit.ly/HawaiiSeaGrantOpps>

08 JUN WORLD OCEANS DAY

Celebrate locally this global event honoring our oceans. Past events have included ocean education, sustainability activities, and fun for all ages. Visit worldoceansday.org for details.



JUL KING TIDES PHOTO SURVEY

Join us in photographing the highest high tides of the year so that we can learn about the impact of sea-level rise. Visit PacificIslandsKingTides.org for dates and details.

JUL 13-17 NATIONAL MARINE EDUCATORS ASSOCIATION (NMEA) CONFERENCE

OCEANIA invites you to Honolulu to come and learn about the people, culture, and marine organisms of Hawai'i! For details visit: <https://www.marine-ed.org/conference/2020>

HĀNA LIMU FESTIVAL

The annual festival held in November in Hāna, Maui, aims to promote deeper understanding of native limu as an 'ono, nutritious part of the traditional Hawaiian diet. As an educational event, emphasis is placed on sharing information and celebrating limu as indicators of the health of nearshore ecosystems. Each year the festival brings people from across the islands to enjoy a weekend of music, hula, games, arts and crafts, and a silent auction. Please visit <http://www.muolea.org/> for more information.

Ka Pili Kai • Ho'ouilo 2019 • hawaiiseagrant.org 40

KA PILI KAI (ISSN 1550-641X)

University of Hawai'i
Sea Grant College Program
2525 Correa Road, HIG 208
Honolulu, HI 96822

NON PROFIT
U.S. POSTAGE
PAID
HONOLULU, HI
PERMIT NO. 278

Isabella Aiona Abbott Hawaiian Marine Algae Notecards

Bishop Museum Press

Developed by the Bishop Museum, this set of notecards features specimens from the Bishop Museum Herbarium Pacificum and was published in honor of the 100th anniversary of the birth of Isabella Aiona Kauakea Abbott. The chosen specimens are from Dr. Abbott's scientific research where she described these new species, adding them to our native Hawaiian marine flora.



10 notecards + white envelopes

Date of Publication: June 2019

Size: 5 x 7 in.

ISBN: 9781581781335

Place your order at: bishopmuseumpress.org