The Limu Eater

a cookbook of
hawaiian seaweed

Heather J. Fortner

Cover photo of Hawaiian woman cleaning limu by Conrad Schaefer.

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by

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Sea Grant Miscellaneous Report
UNIHI-SEAGRANT-MR-79-01

November 1978

This work is the result of research sponsored in part by the University of Hawaii Sea Grant College Program under Institutional Grant No. 04-5-158-17 from NOAA Office of Sea Grant, Department of Commerce, and the University of Hawaii Marine Option Program. The US Government is authorized to produce and distribute reprints for governmental purposes notwithstanding any copyright notations that may appear hereon.

Preface

In the spring of 1974 a class called "Living Wealth of the Oceans" was held at the University of Hawaii Manoa campus. Taught by Dr. John Bardach, then director of the Hawaii Institute of Marine Biology, it was a survey of all that the oceans offered --minerals, water, energy, food, medicine, recreation, transportation, and art. Six of us shared an interest in Hawaiian seaweed, or limu, and selected "Seaweed Use in Hawaii" as our class project. We researched historical and contemporary uses of limu in Hawaii, 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. We found that there are too many food uses for us to complete our project in that semester.

The next summer I received a joint grant from the University of Hawaii Sea Grant College Program and the Marine Option Program to continue this study with the objective of creating a cookbook on Hawaiian seaweed. Most of my research was conducted on the island of Hawaii, with occasional forays to the other islands. I collected data on indigenous and contemporary uses of limu in Hawaii and looked at how seaweeds are used on the US mainland and in Eastern Asia. From these data I culled much of the information that is included in this book.

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.

The recipes are from several sources. About a third of the 86 presented have already been published either locally or nationally. Some are used without modification. Several of the nationally published recipes were developed for seaweed that is not found here--for these I substituted similar Hawaiian species of seaweed and adjusted the recipe. Many are the result of casual interviews at the shore. It was up to me to quantify these into a recipe format. Several times I chose to use the recipe in full variability. A number came from formal interviews with people knowledgeable in limu cookery. The remaining recipes were created through experimental cookery, aided by imagination, whimsy, and an appetite for seafood.

To many native Hawaiians a seaweed cookbook will be out of place with their methods of preparing and using limu. Often when I asked limu pickers how they prepared the plants, they answered that there were no recipes or standard methods of preparation. Rather, they combine whatever they found with Hawaiian salt and serve it as a relish or salad. The result depends on what and how much they found, which in turn is dependent upon the tide, weather, and season.

Conflict of opinions furthered this ambiguity. To one veteran limu eater, a certain plant is prized and relished. To another, it is 'ōpala (rubbish), to be ignored or discarded. But not everyone likes spinach or green peppers either. So this cookbook is a compromise of opinions, and the recipes reflect personal tastes and preferences.

I have also displayed preferences in naming. Although the Hawaiian language has one or more names for each edible seaweed, these names are often lengthy and cumbersome. In several instances I have opted to substitute popular English or Japanese names, such as sea lettuce and ogo, all the time using "limu" as a general term for seaweed.

The Limu Eater, a guide to the discovery and culinary appreciation of Hawaii's seaweed, has drawn much information from past and present seaweed users. The input and energy of these people have contributed immeasurably to the creation of this book, I wish to acknowledge their assistance and support.

Many thanks to the anonymous limu pickers who shared their knowledge of and aloha for limu with me, and to those of Hawaiian ancestry who recalled for me the limu names and uses from the past. My special thanks to those who offered logistic support during the research and writing, particularly to members of the University of Hawaii Marine Option Program at Hilo and other individuals on the Big Island of Hawaii.

Without the encouragement, admonitions, and suggestions of the indomitable director of the Marine Option Program, John McMahon, this would still be unwritten. Further thanks are due to Donna Noborikawa, Marie McDonald of Kamuela, and Claire Nakayama for logistical and administrative assistance. William Magruder

and other graduate students in the University of Hawaii Department of Phycology have identified innumerable alga specimens; Bill helped with my herbarium and reviewed parts of the manuscript.

My thanks to Roen McDonald and Hannah Kia Kalilimoku Kaneakua who appear in photos taken by Conrad Schaefer. Dr. E. Alison Kay also provided a photo. The early 1900 photos are provided courtesy of the Bishop Museum.

Noel Sutherland compiled most of the glossary definitions. Sea Grant artist Wendy Nakano did the excellent line drawings, and Robert Hearn typed illegible drafts into readable form.

This research was made possible through a grant from the University of Hawaii Sea Grant College Program and the Marine Option Program of the University of Hawaii.

Inspiration is the greater part of creation and my thanks to the very inspirational ethnobotanist Beatrice Krauss and the authors of the booklet on limu ethnobotany, Dr. Isabella Abbott and Eleanor Williamson.

Recipe Acknowledgments

The following people and institutions have allowed their recipes to be included in this cookbook:

Thecla Bennet of Waimanalo, Hawaii, "Ogo-Vegetable Smoothie"

David McKay Co., Inc., New York, "Laver Soup" and "Stuffed Laver Fronds," by Euell Gibbons from *Stalking the Blue-Eyed Scallop* (1964)

Mary Davis of Kaneohe, Hawaii, "Ogo Namasu"

Vic Eharis of Waimanalo, Hawaii, "Limu-Wrapped Baked Fish"

Dave Epp of the Geology and Geophysics Department, University of Hawaii, "Ogo Guacamole"

Filipino Women's Club of Pearl City, "Pokpoklo Salad" from *Hawaii Filipina's Favorite Recipes* (1973)

Penelope Gabriel of Nanakuli, Hawaii, "Poke--Raw Fish" and "Limu Manauea--Hawaiian Style," from the *Honolulu Star-Bulletin and Advertiser*, June 24, 1975

Hawaiian Botanical Gardens Foundation, Inc., Honolulu, Hawaii, "Martini with Limu 'Olive'," by Alvin Miyatake and David Cox from Newsletter V, Vol. 1, August 1971

Honpa Hongwanji Buddhist Temple of Honolulu, Hawaii, "Ogo Sanbai-zuke" and "Korean Ogo Kim Chee," from *Favorite Island Cookery* (1973)

Iolani School, Third Grade Class of 1972, "Korean Seaweed" from *Iolani Ono Ono Kau Kau* (1972)

KGU Radio Station, "Ogo-Cucumber Salad" and "Four Bean Vegetable-Limu Salad," modified from *KGU Hawaiian Cookbook*

Edna and Masae Kawamura of Hanapepe, Kauai, "Lomi Salmon with Ogo" and "'Opihi Limu Pickle"

Marie McDonald of Kamuela, Hawaii, "Chinese Fried Rice," "Meat Stew with Limu," and "Meat Stew with Limu Lepe 'ula'ula"

Maui Extension Homemaker's Council (Maui Home Demonstration Council) of Wailuku, Maui, "Limu Sunomono" from *Our Favorite Recipes* (1957); "Chicken Soup with Ogo" from *More of Our Favorite Recipes* (1963); "Limu Niku Gobo" and "Traditional Ogo Kim Chee," from *Still More of Our Favorite Recipes* (1967); and "Nuoc Mam Sauce" from *Still Many More of Our Favorite Recipes* (1974)

Mrs. Akone Pule of Kohala, Hawaii, "Ake with Limu Huluhuluwaena"

Dr. Gertrudes Santos of the Botany Department, University of Hawaii, "Tambalang Relish"

Shufunomoto Co., Ltd., Japan, "I'a Maka--Raw Lomi Fish" from *Hawaiian Cooking 1972 Golden Cooking Cardbook* (1972)

Simon and Schuster, New York, "Limu Appetizer (Ogo)" and "Seaweed Soup (Nori or Limu Pahe'e)," by Alex Hawkes from *A World of Vegetable Cookery: An Encyclopedic Treasury of the Vegetable Kingdom* (1968)

Audrey Sutherland of Haleiwa, Hawaii, "'Opihi in Escargot Sauce" and "Limu Dip"

Paula Tamura of Honolulu, Hawaii, "Limu Meatballs"

Tongg Publishing Co., Ltd., Honolulu, Hawaii, "Limu Delight (Ogo)" from *Hawaiian Homemaker's Favorite Recipes* (1956)

Bonnie Tuell, Home Economist with Maui Electric Co., Wailuku, Maui, "Limu-Onion Relish" and "Cucumber-Seaweed Namasu" from *Cooking on Maui with Bonnie* (1971)

Unitarian Church of Honolulu, Hawaii, "Pickled Ogo" from *Truth Seeker's Cookbook* (1973)

Waialua Hongwanji Fujinkai of Waialua, Hawaii, "Limu Pahe'e Soup" from *Country Cookbook* (1975)

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Introduction

In the search for alternate or expanded food sources, the ocean's resources have been heralded as one answer to our nutritional needs. The latest hue and cry has been "farm the seas, harvest the oceans." Soon it may be that food from the ocean will no longer be an alternative, but an imperative.

The concept of marine aquaculture has long been with us, but only in recent years has it become an economic reality. It is a limited reality in North America, but a growing one. This business of farming the sea has given our society a very feasible alternative to the present high energy level of food consumption.

There are some inherent problems, however. New foods are often prepared and served only as a novelty or experiment in American cuisine. Culture and lifestyle dictate food habits and in our society often block the acceptance of unfamiliar food. A new source of nutrition may have all the accoutrements of a popular food, but, lacking established use, is often met with objection.

Seaweeds have been particularly vulnerable to this prejudice. The word "weed" has a negative connotation, so often depicting the unwanted and aggressive plants of the wayside. This is a disservice to marine plants for they are, in fact, sea vegetables --food plants as diverse and versatile as their land relatives. Currently, there is a movement abroad in the United States to accredit edible seaweeds their fully deserved status and name: sea vegetables. This is the first step to sea vegetable acceptance.

The acceptance of innovative or foreign foods has not been such a great problem in Hawaii, however. The cosmopolitan aspect of our population has contributed to the acceptance of many varieties of food. This subtle blend of Polynesian, Western, and Eastern cultures makes the typical Hawaiian cuisine a potpourri of ethnic foods. Each is as uniquely "Hawaiian" as the next in our modern day.

This diverse cuisine is a far cry from the diet of old Hawaii. Limited to the native flora and fauna and a

few food plants imported from Polynesia, the residents of pre-contact Hawaii subsisted on a diet that would be termed monotonous by modern standards. Fish, taro, sweet potatoes, and pork were the main staples of their diet. Limu, the seaweeds, served as salad, spice, and relish. Under the demands of a subsistence economy, the Hawaiians developed food uses for every possible edible plant and reef fish. They were familiar with the crustaceans--the crabs, lobsters, and shrimp--and with the molluscs--squid, 'opihi, octopus, and marine snails. They had names for the growth stages of animals, and names for the various colors, sizes, and forms of their food plants. To manage these resources the ruling class imposed a kapu system which declared some foods off-limits during certain periods of the year or to certain classes of people.

By way of this wise resource management the Hawaiian Islands supported 300 to 500 thousand residents in the days before European arrival. In contrast, less than 15 percent of the food for 886,000 residents of modern Hawaii is produced locally. It is a considerable difference.

Captain Cook's arrival in the Sandwich Isles in 1778 introduced the islanders to western customs and foods. The subsequent immigration of different peoples and foreign ideas precipitated the breakdown of the ancient island culture. The Hawaiian lifestyle was gradually assimilated into a unique blend of the Pacific, the East, and the West. With the year-round availability of imported foods, the vitality of a subsistence economy based on limited food staples decreased. During this transition much of the knowledge of old Hawaii was lost or forgotten.

We in Hawaii are concerned with this loss of knowledge and are looking at island heritage and history. It is important to the Hawaiian identity. In looking back we see that the Hawaiians practiced crude to sophisticated forms of aquaculture. They built fishponds near the shoreline to raise and store varieties of fish. They transported limu from one island to another to insure its availability and observed seasons on the capture of certain fish.

In Hawaii today there are, in varying stages of development, aquacultural farms for prawns, baitfish, oysters, catfish, seaweed, and clams. And there are many more in the planning. In an attempt to create alternatives to its dependence on high-energy-level imported foods, Hawaii is moving toward using its ocean resources to their full advantage as they had once been used in the old Hawaiian days.

Ocean Flora

When an alga becomes a seaweed

Seaweeds need no formal introduction in Hawaii. The word brings to mind the brown, odoriferous tangles at tideline, and the green, red, and brown mats on limestone flats and lava shores. Beachgoers and divers alike are familiar with these ocean plants. The versatility of Hawaiian seaweeds as food is well-known to those of island heritage--but these plants are more.

Seaweeds are members of a group of remarkably diverse plants--the algae. The members are grouped into seven distinct divisions, each taxonomically equivalent to the one comprising all of the flowering plants. Including some of the most primitive members of the plant kingdom, this broad assemblage of plants shares a characteristic simplicity which distinguishes it from the more familiar land plants. Algae lack the specialized parts of land plants such as flowers, leaves, roots, and stems. Some of the algae in the more advanced divisions possess root-like holdfasts, stalk-like stipes, or leaf-like laminae. These parts mimic parts of a flowering plant in structure, but not in function, for the entire body (thallus) serves as a single organ of photosynthesis. Seaweeds do not reproduce by flowers, fruits, or seeds; they have reproductive bodies (spores) and a very complex life cycle.

Simplicity of structure, then, is a major feature of this group. Another is the possession of chlorophyll which is critical to the photosynthetic process. But this is a limiting characteristic: the food producing process of photosynthesis requires sunlight, and the intensity of light decreases with depth in the ocean. Even in the clearest water no seaweed can exist below 600 feet; the optimum conditions are in depths of less than 100 feet.

Algae range in size and structure from the minute, single-celled plankton to the giant Pacific kelp with fronds of 100 feet or more in length. Their usual habitat is in water, but they are by no means restricted to it: the simpler the plant, the greater the diversity of habitats available for colonization. Primitive algae are everywhere in the soil environment, grow in hot springs

having water temperatures greater than 80°C, and form dry encrustations on tree trunks and walls. Occasionally algae enter into symbiosis, a give-and-take relationship with another organism, such as lichens, coral polyps, giant clams, and marine worms.

It remains that all seaweed are algae, but not all algae are seaweed. Seaweeds are typically the large algae of marine habitats. Sea vegetables, or edible seaweeds, are found in only three of the seven divisions of algae--the Chlorophyta or green, the Phaeophyta or brown, and the Rhodophyta or red. Although not exclusively marine, members of these three divisions are typically large plants of the ocean and shore. The divisions were made partly on the basis of pigmentation, but this makes identification difficult, for some red seaweeds are brown and some brown seaweeds are green. A combination of pigments in each type of seaweed accounts for variations even within the divisions.

The members of the Chlorophyta are always shades of green, often a distinctive grass-green. Their marine development is the least advanced of the three major divisions, but they dominate in freshwater habitats. Forms of the green algae vary from single-celled to thread-like to flattened and leaf-like. They exhibit poor diversity in temperate oceans, but in warmer waters they constitute a prominent component of tropical marine flora. Genera in Hawaii are the cosmopolitan *Ulva* and *Enteromorpha*, as well as the less common *Codium* and *Caulerpa*.

In contrast, representatives of the Phaeophyta (brown algae) in the tropical habitat are common but relatively small. Members of this division obtain their optimum development in nutrient-rich temperate waters and dominate the temperate marine flora with their size and abundance. The extensive kelp beds off California are an impressive example of this bulk. The brown algae are almost entirely marine and include the largest as well as the most common of all seaweed. In Hawaii, the species of *Sargassum*, *Padina*, and *Dictyopteris* are notable Phaeophyta.

The Rhodophyta has a wide assemblage of forms, sizes, and colors in tropical waters. Like the browns they are almost entirely marine. In numbers and abundance, though not in size, they are by far the predominant species in the tropics. Their coloration is the most diverse of all algae and, according to relative proportions of their many pigments, they exhibit colors ranging from red to yellow and green and from blue to black. The Rhodophyta are noteworthy to the botanist not only for their complex structure, but also for details of their intricate and involved life history and reproductive cycles. Most of the edible seaweeds in Hawaii are members of this group, including the very common *Gracilaria* and *Asparagopsis*, as well as *Laurencia*, *Grateloupia*, and *Porphyra*.

Tropical marine algae display a great diversity in form, habit, size, and color, all of which are factors in the large variety of edible species in Hawaii. This variety will become evident to the aspiring limu eater as he progresses to botanical as well as culinary proficiency with edible marine algae.

Edible Hawaiia Sea weed

When a seaweed becomes a limu

Some of the common edible seaweeds of Hawaii are described in this section. In most cases, they are discussed either by genera or individually by species. In cases where two species of the same genera are similar in taste or are eaten in the same way, they are discussed together.

Scientific, Hawaiian, and other common names are offered. In addition, the meaning or derivation of the Hawaiian name is provided.

Other aspects include data on seaweed color, size, physical characteristics, and habitat. Ecological information is also given, as well as recommendations for collecting, cleaning, storing, and preparing the seaweed. In addition, food uses in Hawaii and elsewhere are discussed.

The detailed line drawings aid in identifying the various seaweeds and show the differences between species. The scale provided for each drawing gives relative size.

Ahnfeltia concinna

Limu 'aki'aki

Along the rugged lava coastlines of Maui, Kauai, and Hawaii, *Ahnfeltia concinna* forms a distinct band at the high intertidal level. The erect branches of this red seaweed grow in dense, extensive patches which sometimes cover large sections of exposed lava rock.

The appearance and color of *A. concinna* vary with season, sunlight, and wave action. The wiry branches, 1 to 14 inches in height, are typically stiff and straight, sometimes branching densely in the upper sections. Plants in the reproductive stage have tiny nodes along the branches; these reproductive organs do not affect the taste or texture of the plant. In full sunlight its color is a bright golden-yellow, in the shade it is reddish-brown.

The Hawaiians call this seaweed "limu 'aki'aki," meaning "bite, bite as a fish." It is also called "sea nibbles." Both names reflect its tough and rubbery texture. It is so tough to eat that some islanders call it "pig limu"--fit only as food for pigs.

It was eaten by the early Hawaiians--baked with fish or chicken in an imu or chopped fine with opihi. Later they used it to thicken chicken and pork stews. When cooked, limu 'aki'aki releases a high quality gel--a carrageenan. It can be used as a base for a gelled salad or as a thickener in soups. The young, tender tips of the plant can be eaten fresh in a salad.

Collecting is simple. The stems can be easily cut with a pair of scissors or a knife. The plants, typically free of 'ōpala or epiphytes, require only a saltwater rinse before eating. They will store indefinitely either dried or frozen.

Asparagopsis taxiformis

Limu kohu

In the ancient Hawaiian civilization this was the "ultimate" seaweed. This small, red limu was so esteemed that it was forbidden to all but the ali'i and was even cultivated in limu gardens on various islands. Today it is the most prized and expensive of the marketed seaweeds. It can be found in almost every island market.

Limu kohu is an unusual seaweed. Most edible species of tropical algae are also used as food in other tropical areas, but limu kohu appears to be an exclusively Hawaiian commodity. It may be that the strong, bitter, iodine taste does not appeal to others. Within the islands there is a distinction made between limu kohu lipehe or lipehu (light-red) and limu kohu koko (dark-red). The deep, salmon-red color and strong flavor of limu koko is preferred over the light, yellowish-red color and milder flavor of the limu lipehe.

Asparagopsis taxiformis

In the water, *A. taxiformis* looks like a forest of tiny, pink pine trees. From the creeping base stalks arise sporting tufts of fuzzy branches which taper towards the apex. Its height varies from 1 to 8 inches.

Limu kohu grows well in intertidal levels to depths of 100 feet around all of the islands, but always where there is a constant flow of water. The subtidal forms are often encrusted with sand and diatoms and are extremely difficult to clean. Most of the commercial supply is collected from the intertidal lava benches of Hawaii and Kauai where the plants grow clean and dark.

Both subtidal and intertidal forms of limu kohu can be collected by pinching or cutting the upright stems, leaving the base or "seed" to grow new stems. Most plants are entangled with coral pieces and sand and should be gently pounded and rubbed until the branches are clean. Traditionally, the limu is soaked overnight in fresh water to reduce the bitter iodine flavor. After this the plants are drained, lightly salted in a process called pa'akai, and rolled into tight balls or packed in airtight containers. They will keep indefinitely under refrigeration.

Limu kohu is prized for its peppery flavor and is usually used sparingly as a spice. It may be combined with meat or fish in a stew, added to i'a maka and i'a palu, or served straight as a condiment with many island foods. Recipes calling for limu kohu all refer to the soaked and salted limu.

Caulerpa racemosa

Ararucip, Sea Grapes

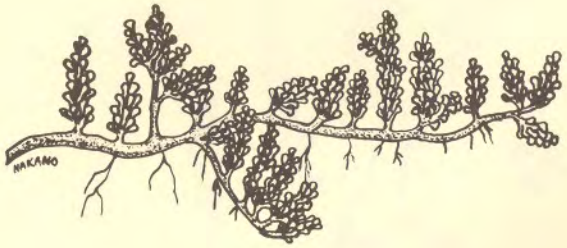
This is an unusual Hawaiian sea vegetable. Most edible limu have a Hawaiian name and a history of food use; *Caulerpa racemosa* has neither. The Filipino term "ararucip" is its only common name in Hawaii, although the descriptive English "sea grapes" is used on the mainland.

In the water it has an almost iridescent turquoise hue which is actually a light shade of green out of the water. When bruised, it acquires yellowish tints.

It exhibits different thallus structures--prostrate or stolonous, rhizoidal or root-like, and foliar or erect--which are unusual for green algae. The entire plant appears to be a creeping vine with short delicate roots and upright grape-like clusters. These clusters vary from 1/2 to 2 inches in height. The plant grows tight and closely adhering to loose and rambling, but it is always "rooted" to the substrate.

The species is widely distributed in a variety of habitats, particularly in lava tide pools, and is common in the shallow reefs off Honolulu. It grows extensively in Kaneohe Bay, the source of the commercial supply. The sea grapes are usually collected by pinching off sections of the prostrate runners.

C. racemosa has a slightly crunchy texture with a salty, piquant flavor not found in the other sea vegetables. It requires careful cleaning to remove the bits of coral which adhere to the "roots" and should be eaten soon after collection for it does not store well. It seems to be preferred almost exclusively by Filipinos. The single recipe offered for it is of this origin.



Caulerpa racemosa

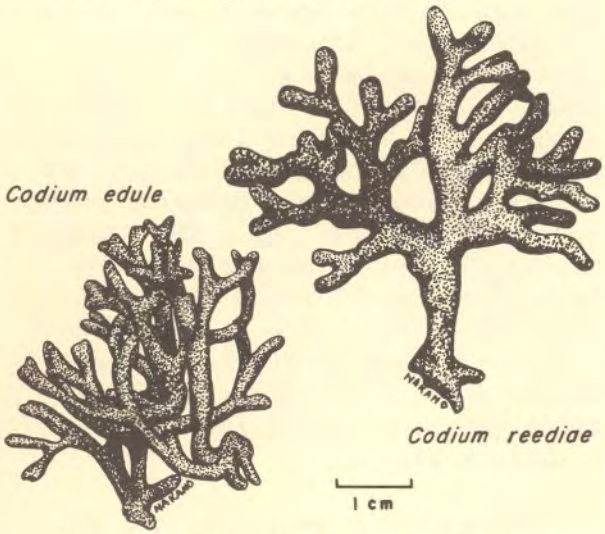
1 cm

Codium edule, Codium reediae

Limu wāwae'iole

Codium is a seaweed known and eaten by most ethnic groups in Hawaii. It is frequently sold in fish and supermarkets. It has a variety of names. Limu wāwae'iole--"rat's feet"--is the most widely used, but it is also known as "miru" to the Japanese and "pokpoklo" to the Filipinos.

There are two commonly eaten species--*C. edule* and *C. reediae*. Both are dark green and velvety-soft, with a spongy, almost cottony texture. They are prepared and eaten in the same way, although *C. reediae* is preferred.



The resemblance to rat's feet is evident in the slightly flattened upright branches of *C. reediae*. The 3 to 12-inch high branches arise from a single holdfast and branch in the upper sections to form a dense, rounded bush.

C. edule, in contrast, grows in the form of a creeping mat over coral rock and sand, without definite holdfasts. Its branches are cylindrical and usually larger than those of *C. reediae*.

Both species grow in the coral reef habitat at depths of 1 to 15 feet and are common and abundant on all islands. In the water, a layer of sand and silt often covers the plant, making identification and cleaning difficult. The plants can be collected from shallow water by pinching the main stem above the base, then cleaned by rubbing and washing in salt water. Most people prefer to collect the shore-drifted plants that have been washed clean by wave action.

In island markets this seaweed is labeled pokpoklo or limu wāwae'iole. It is particularly prized by the Filipinos and most of the recipes for *Codium* are of Filipino origin. The old Hawaiians used to prepare the seaweed by soaking it in a brine solution. In the brine the branches would shrink, become limp, and exude a red liquid. From this it acquired the name "limu 'a'ala'ula" or "the seaweed making a red fragrance." The wilted plant was prepared with sea cucumber, sea urchin gonads, or raw octopus.

This preparation is still used today, but most people prefer to use limu wāwae'iole fresh in a salad or as a pickle. When using in a salad, the freshly collected plants should be rinsed in salt water, then mixed with the dressing immediately before serving. Limu wāwae'iole wilts very rapidly. The fresh plant can be refrigerated for only a few days before it softens and wilts.

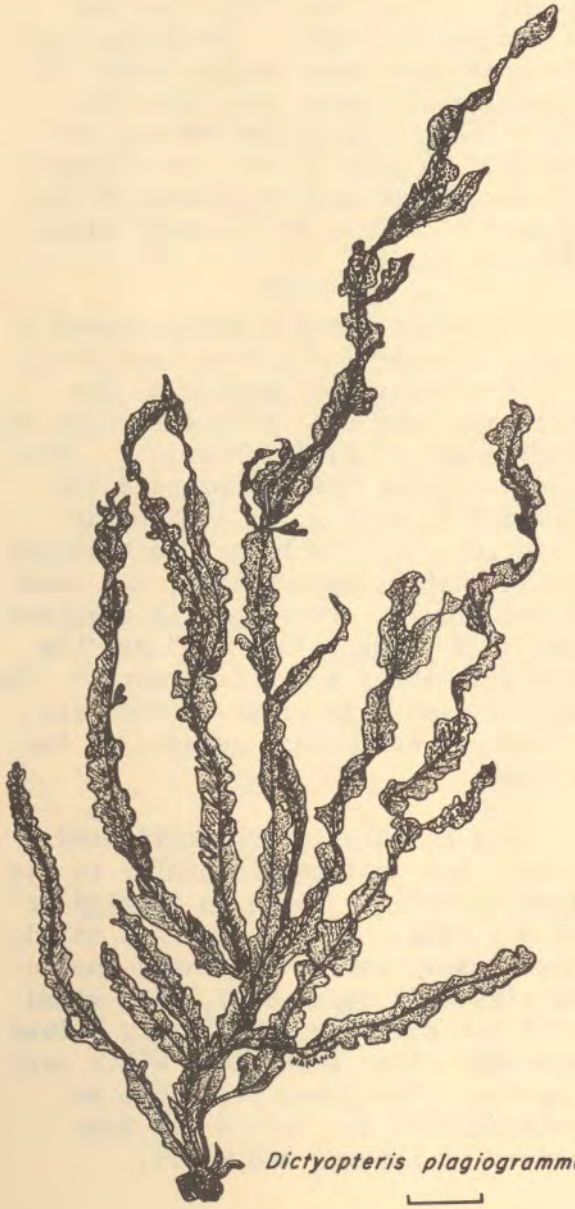
Dictyopteris australis, Dictyopteris plagiogramma

Limu lipoa

Dictyopteris is one of the better-known seaweeds in Hawaii. It is familiar to both the limu connoisseur and the body surfer for its strong, perfume-like aroma. Yet, while it is valued by the limu eater, it is scorned by the body surfer and beach-goer because it washes onto many beaches and clutters the water and shore.

Two species of this brown seaweed grow subtidally at depths between 3 and 40 feet on coral reefs. The Hawaiian name "lipoa" reflects this habitat, for it means "gathered from the deep." Both species are similar in appearance, although *D. plagiogramma* is smaller and less common than *D. australis*. The leaf-like fronds, 2 to 8 inches long, branch dichotomously and have a dark brown midrib. Several main branches arise from a single holdfast. The "leaves" are usually tattered close to the base, leaving the round midrib to serve as a stem. The golden brown blades are usually ruffled at the margin and are sometimes spiraled, often sporting a thin layer of coralline algae.

Collection is easy for both the diver and beachcomber. The plants grow in abundance on coral rubble--sometimes to the exclusion of other seaweed. Collecting is done by breaking off the tender upper sections of the fronds. Limu lipoa can be collected year-round from the shore drift of many beaches.



Dictyopteris plagiogramma

1 cm

Traditionally, the collected limu is carefully cleaned and washed, removing all coralline algae, then salted in a process known as pa'akai. The salted limu will keep indefinitely under refrigeration. Recipes calling for lipoa refer to the salted limu.

Limu lipoa took the place of sage and pepper in the old Hawaiian diet and today serves as a spice, usually accompanying raw fish or octopus. It can be used in a meat stew or as a substitute for an olive in a martini.

Dictyopteris australis

1 cm

Enteromorpha spp.

Limu 'ele'ele

The long, green strands of *Enteromorpha* can be found at the mouth of many island streams. The presence of this genus is a reliable indicator of the occurrence of fresh or brackish water. It can also be found in oceanside ponds and at springs near the water's edge.

Several Hawaiian species of *Enteromorpha* are used as vegetable and spice. One of them, *E. intestinalis*, occurs throughout the Pacific and Asia. The other species, *E. prolifera*, is the more familiar limu 'ele'ele which means "black seaweed," descriptive of the dark color of the prepared seaweed.

Enteromorpha sp.

E. prolifera is a long, hollow cylinder with many fine and irregular side branches. The narrow main filament grows to more than 3 feet long, always displaying the grass-green color typical of the green alga division. The tube of *E. intestinalis* is larger and has no side branches. Both species are edible, although *E. prolifera* is preferred.

There are many methods of collecting. Some people dip a bucket into the water and let the filaments flow in. Others use a strainer or shrimp net to scoop the limu out of the water. If the slippery filaments are long enough they can be wrapped around the fingers like spaghetti and cut off above the base. There is always a considerable amount of sand caught in the collected mass. It takes at least 5 to 6 rinses to thoroughly clean the limu.

Traditionally, the cleaned seaweed is rinsed and drained, then all of the excess water is squeezed out. It is then lightly tossed with Hawaiian salt, about a tablespoon per cup of limu, and allowed to stand until "miko" or ripened. This partial fermentation process enhances the flavor and darkens the color. The salted seaweed will keep up to 10 days refrigerated or indefinitely by freezing.

The salted, ripened limu adds a nutty flavor to stew, saimin, and raw fish and its green color makes it a good garnish. Recipes for limu 'ele'ele usually refer to the prepared seaweed.

Although usually eaten as a spice, it can also be dried in Japanese fashion to make a seasoning salt or thin sheets of sushi nori.

Eucheuma spinosum

Tambalang

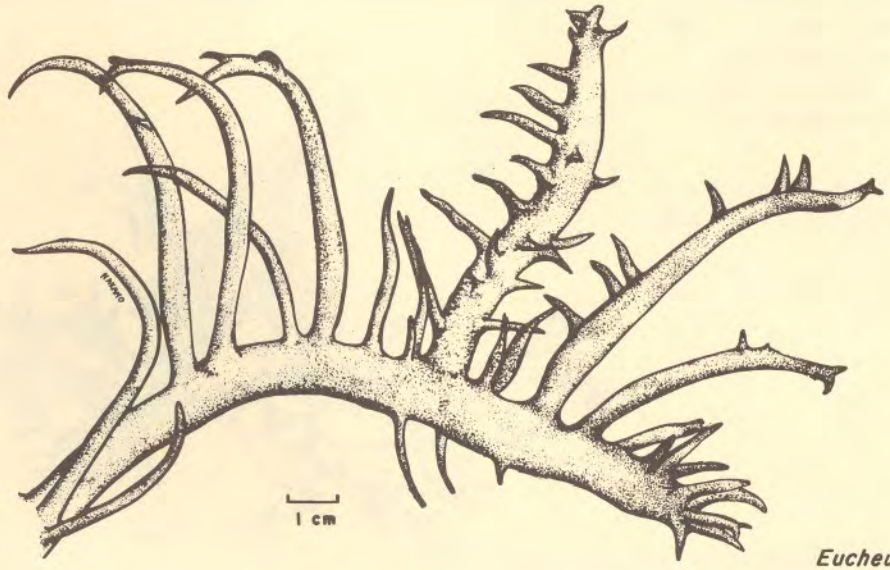
Eucheuma is a genus of red alga. It is cultivated extensively in the Philippines, not only for food, but also for its high content of carrageenan (colloid gel). This carrageenan is an important industrial additive which is used as a stabilizer and emulsifier in dairy and pharmaceutical products. There is a burgeoning industry in the southern Philippine Islands where this seaweed is grown for an American colloid company.

In the 1970s *Eucheuma* was introduced to Hawaii on an experimental basis to determine the feasibility of a similar industry here. It is presently caught in the netherland between the concerns of ecology and business. Environmentalists oppose its presence, fearing interference with native algal species, while businessmen and aquaculturists foresee a new industry.

In 1976 *Eucheuma* was sold fresh in some Honolulu markets. Sales were very poor, thus it has not been on the market since. Right now, the amount that can be foraged is very limited. The once thriving experimental plots in Kaneohe Bay have since become parts of a wildlife refuge and plants there can no longer be collected. There are, however, a few patches growing off the Honolulu airport area and elsewhere in Kaneohe Bay.

Eucheuma grows prolifically forming great masses over 6 feet high and extending for many yards. *E. spinosum* has thick, round, succulent "stems" supporting pointed whorled "spines" and "branches."

Tambalang, as it is known in the Philippines, is prized as a salad vegetable and can be picked whole or grated as a relish. It is quite succulent and crunchy and adapts well to kim chee and namasu recipes.



Eucheuma spinosum

Gracilaria bursapastoris, Gracilaria coronopifolia

Ogo, limu manauea

To many islanders, "limu" is synonymous with the species of *Gracilaria*, locally called ogo or limu manauea. This seaweed is sold in almost every island grocery store and fishmarket. It has a variety of uses and is enjoyed by all ethnic groups.

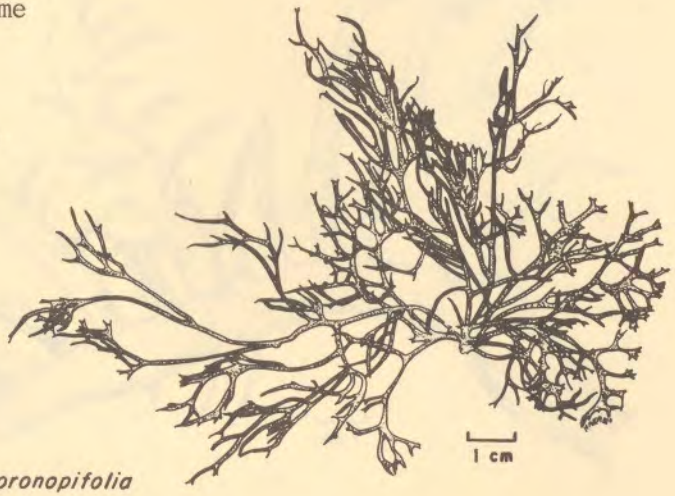
Of the six species of *Gracilaria* identified in the Hawaiian Islands, two--*G. coronopifolia* and *G. bursapastoris*--are eaten regularly. *G. coronopifolia*, the shorter of the two, was called limu manauea by the old Hawaiians and was used as a fresh or salted vegetable. The longer *G. bursapastoris* is probably a newcomer to island waters since the Hawaiians, who are notorious for naming every variation of every plant, have no name for this species. Its common name is "ogo," the name for the Japanese species of *Gracilaria*. The two species are similar in taste, texture, and color and can be used interchangeably in all recipes. Because they are so similar the name difference is often overlooked.

G. bursapastoris has firm, cylindrical main stems of the same diameter as the many side branches that taper towards the end. Its length is 6 to 24 inches, and its color varies from pinkish-brown to light yellowish-green. It grows well in coral rubble on reefs at depths of 8 to 12 feet.

G. coronopifolia has shorter and smaller main stems, usually less than 8 inches long, which branch more densely in the upper sections. Its color varies from deep rose to deep yellow. Like *G. bursapastoris*, it grows in coral rubble on reefs, but usually in shallow water.

Occasionally there are small, dark-colored bumps along the lower portions of the branches. These are reproductive organs which do not affect the flavor or texture of the plant.

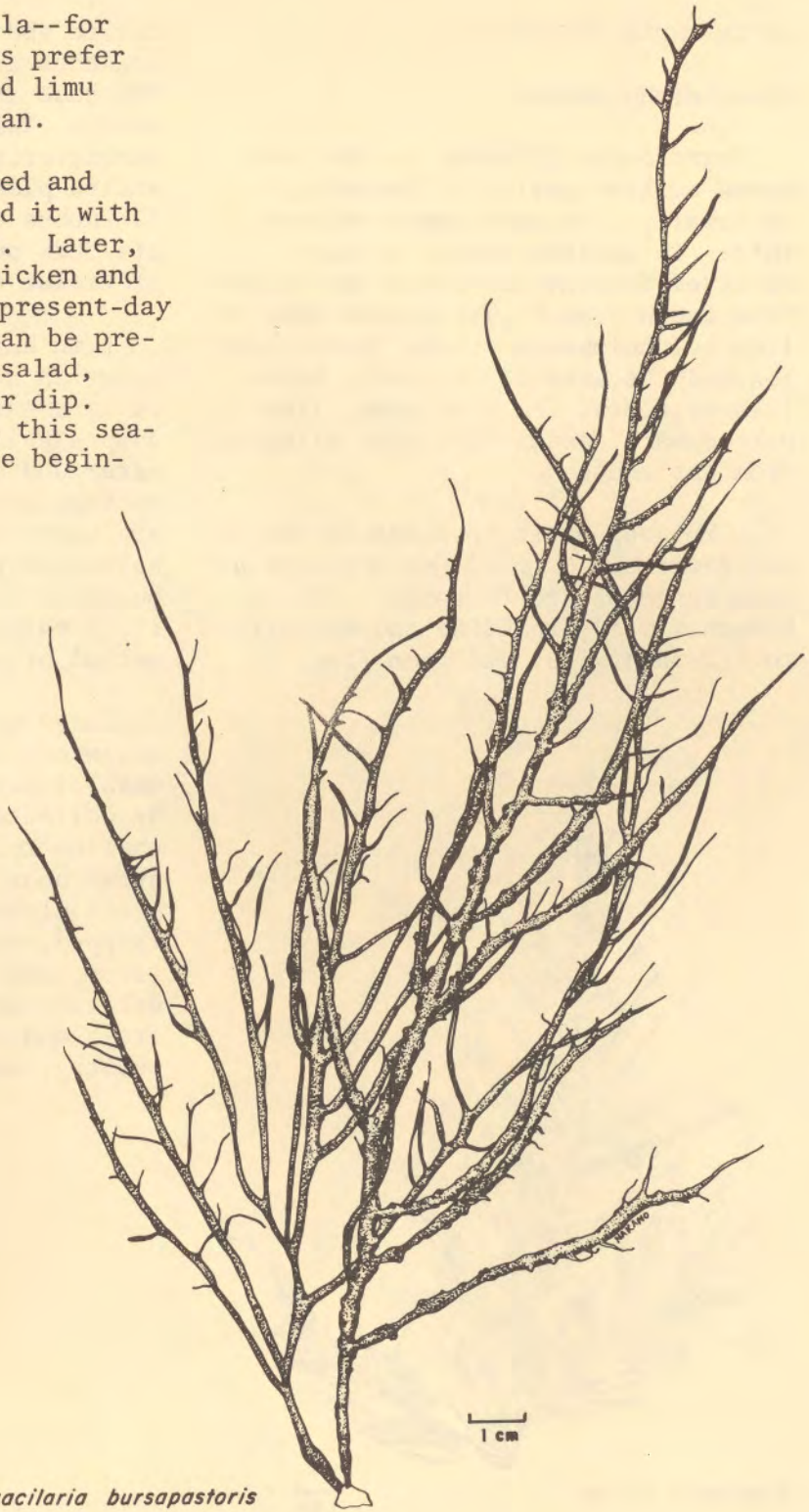
Most of the commercial supply is collected from shallow reefs by divers who cut the main branches above the holdfast. Considerable quantities wash up in the shore drift of several beaches. It is very



Gracilaria coronopifolia

tedious to remove the 'ōpala--for this reason, most islanders prefer to collect the beach-washed limu which has been scoured clean.

The old Hawaiians chopped and salted the limu, then mixed it with other limu or fish or meat. Later, they used it to thicken chicken and pork stews. The range of present-day uses is far greater--ogo can be prepared as a candy, pickle, salad, tempura, soup vegetable, or dip. Because of its mild taste, this seaweed is recommended for the beginning limu eater.



Gracilaria bursapastoris

Grateloupia filicina

Limu huluhuluwaena

Grateloupia filicina is the best known edible species of *Grateloupia* in Hawaii. Its many names reflect this. In ancient Hawaii it was reserved for the ali'i and was called "the queen limu." Its common name is limu huluhuluwaena or the "pubic hair seaweed" because of its dark, hair-like branches. Another name, limu pakeleawa'a, means "the limu slipping from the canoe."

Like many other seaweeds in the red division, *G. filicina* displays a wide range of growth forms. Its main branches vary from fine and hair-like to 1/2-inch wide, and from flat to curled and twisted. Its side branches are always flattened near the base and grow out in a single plane. This is a distinguishing characteristic of the genus. The entire plant grows to a height of 12 inches and can be quite bushy. Its dark purple color turns to shades of violet and green in the sun.

Grateloupia filicina 1 cm

Limu huluhuluwaena usually grows in an intertidal habitat, often on wave-washed lava boulders. It adapts well to slightly brackish water and often grows near stream mouths and springs. Along the southern coast of the Maui isthmus the hair-like plant appears on intertidal boulders bordering Maalaea Bay where it is called "chop-chop"--after the method of preparation.

Large quantities of limu huluhuluwaena can be found in the shore wash of several Oahu beaches. It can be collected from the intertidal and shallow rocks by cutting the main stems near the base. Traditionally it is cleaned, rinsed in salt water, chopped, and added to 'opihi, raw liver, and other limu. It has a delicate but distinctive flavor when fresh and combines well with fish, poultry, and dairy products.

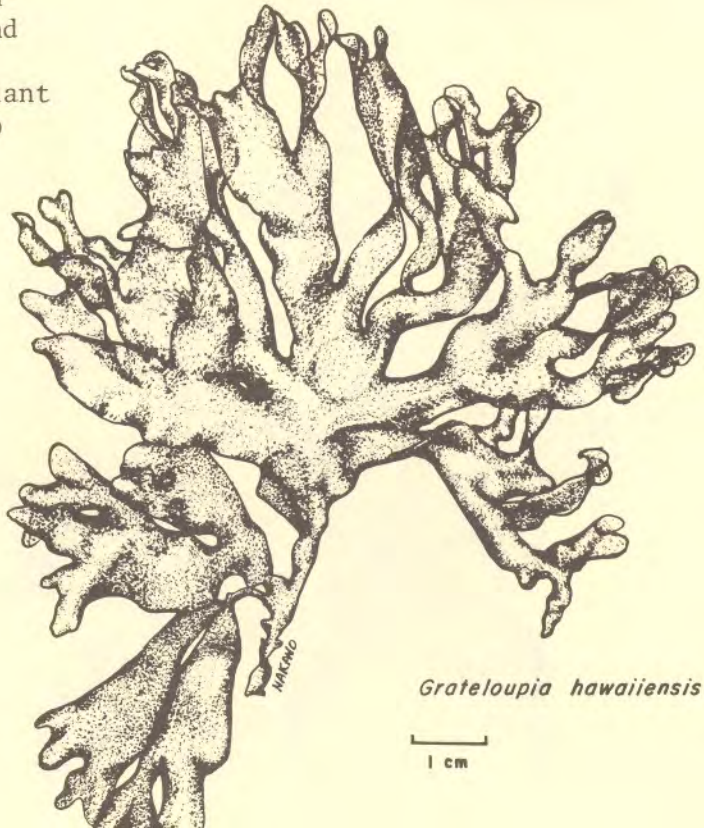
Grateloupia hawaiiensis

This limu lacks a Hawaiian or common name; in fact, it is not mentioned anywhere as an edible limu. The absence of a Hawaiian name and established uses is a reflection of its limited availability, for it is infrequently collected on only a few islands.

Grateloupia hawaiiensis usually grows on intertidal boulders and in tide pools among other seaweed, often with *Ahnfeltia concinna* (limu 'aki'aki). Its subtidal form reaches a maximum length of 6 inches in contrast to the more typical intertidal form which grows from 1 to 3 inches. Like so many red algae, *G. hawaiiensis* displays a wide variability in form--from deeply lobed, broad, and flattened to narrow, twisted, and wiry. The texture of the fresh plant is rubbery and the color is a deep and shiny reddish-purple.

It is most abundant on the Maui isthmus where it washes up on Maalaea, Kihei, and Kahului beaches. The collector need only to pick up fresh specimens from the shore or water. These are clean or just slightly sandy and require only a simple rinse.

Like the other edible species of *Grateloupia*, *G. hawaiiensis* has a pleasant taste reminiscent of the ocean and combines well in a vinegar dressing or pickling sauce. The blades can be pressed together and shredded or sliced, then eaten fresh in a salad or cooked in a soup or tsukudani.



Grateloupia hawaiiensis

Halymenia formosa

Limu lepe 'ula'ula

Limu lepe 'ula'ula, the cock's comb limu, is one of the most attractive of Hawaii's seaweed. *H. formosa* is large; the thallus measures as much as 3 feet in circumference. From a single, rounded holdfast arise soft, dark-magenta blades. They are always toothed or lobed at the margins, which explains the cock's comb name. In the water *H. formosa* stands upright and sways slowly with the water motion. Its gelatinous "leaves" fall limp when removed from the water.

H. formosa is uncommon and grows in depths of 3 to 20 feet, often in slightly turbid conditions. It frequently washes up onto the leeward shores of all the islands, where limu pickers collect it.

Limu lepe 'ula'ula is typically free of epiphytes and 'ōpala and needs only to be rinsed in salt water. If exposed to heat or fresh water this seaweed rapidly turns orangish and appears to melt. It keeps well if dried rapidly in the sun and stored in a jar; it rehydrates quickly in salt water. It does not freeze well. Unless dried, this vegetable should be used the same day as it is collected. It was considered by the old Hawaiians to be a "one-day limu."

The classical method of preparation was as a thickener in a stew or soup. The tasty dried fronds can be served as a snack, somewhat like potato chips.

Halymenia formosa

Hypnea spp.

Limu huna

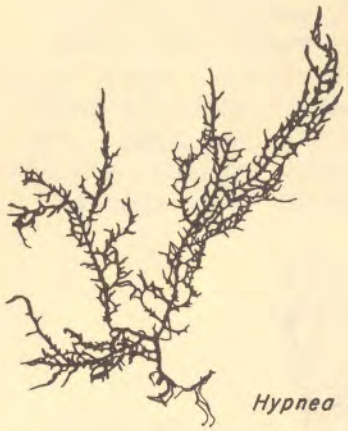
Hypnea is the dark horse of edible limu. It has many species on most of the islands, yet is uncommonly used as a sea vegetable. Local people today do not recognize it as a food, although there are tales that the old Hawaiians used to eat it with squid or mixed with a tiny mollusc.

There are two common edible species, *H. cervicornis* and *H. chordacea*. The former is called limu huna. "Huna" translates to "hidden" or "concealed," referring to its growth in crevices and under ledges of shallow reefs.

Limu huna is often epiphytic on other limu and grows dense and entangled at its base, then separates to narrow strands up to 12 inches long. The color varies from green to yellow to red to brown; a single thallus will often exhibit several of these shades. Limu huna is a close relative of *Gracilaria* and could pass for a fine, delicate version of the long ogo. It grows in abundance in shallow reefs and is easily collected by breaking off the long, single strands.

H. chordacea grows exposed on the low intertidal sections of lava or limestone flats. It is small, less than 6 inches in height, and branches tightly around a main stem. It looks like a forest of tall and narrow pine trees that have lost their needles. The color, a dark greyish-green, is not common of other limu in the intertidal zone, although it sometimes lightens to shades of red or green. It is collected by pinching off the upright sections, then is pounded and rubbed to remove the 'ōpala.

The taste of both species is extremely mild and the texture delicate. They can be prepared fresh or cooked by methods closely following those for ogo. Both can be used to make tempura, or to thicken a soup or stew. In addition, both can be used fresh in a limu salad.



Hypnea cervicornis

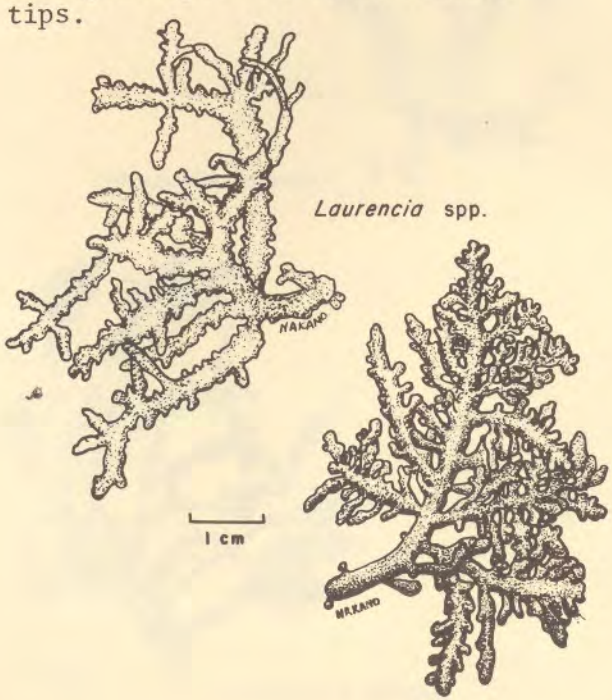
Hypnea chordacea

Laurencia spp.

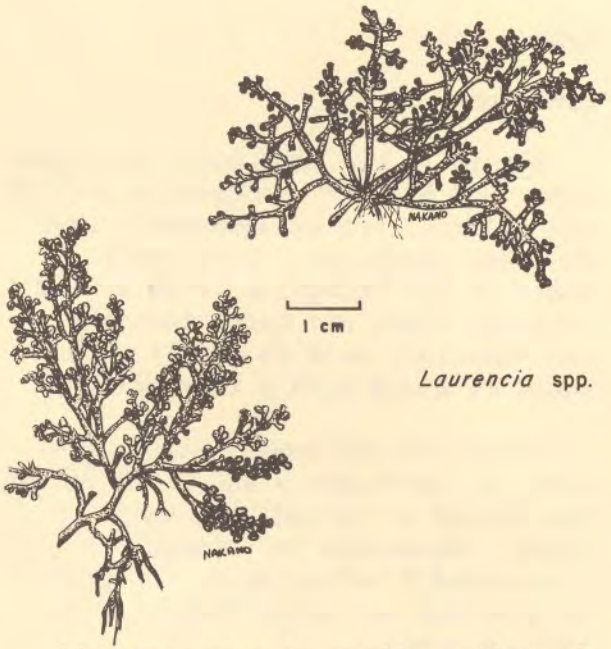
Limu pe'epe'e, limu maneoneo

Laurencia is a genus of small red seaweeds of uncertain taxonomy in Hawaii. There are many species of these shallow water or intertidal seaweeds, most without specific names.

In general the species can be divided into the two major food categories--vegetable and spice. The spice *Laurencia*, collectively known as limu maneoneo, are peppery, almost hot to the taste. They are also called "chili pepper limu" and "mustard limu." They are small, usually red or pinkish, grow in shallow waters on coral reefs, and often wash up onto beaches. Clumped at the base, limu maneoneo grows in small "bushes" up to 8 inches high. The many short, knobby branches all have an "apical pit" at their rounded tips.



Laurencia spp.



Laurencia spp.

Limu maneoneo is easily collected from the shore drift inside reefs. It can also be picked fresh from the sand-coral substrate although here it is typically entangled with seaweed and coral pieces. Its spicy flavor combines well with raw fish. It should only be eaten fresh.

The vegetable *Laurencia*, known as "limu pe'epe'e" or "flower limu," have a sweet, penetrating flavor. They are usually yellowish-green and often grow intertidally. The name flower limu describes its pattern of growth on lava rocks, while the name "limu pe'epe'e," or "the hidden seaweed," refers to its growth in crevices and holes. The plants are small and thick with many large knobs over their entire length. The main branches are somewhat flattened.

Limu pe'epe'e can be collected by pinching or cutting the upright branches, followed by a rinse in salt water. It is usually eaten fresh in a salad, or combined with raw fish.

Porphyra spp.

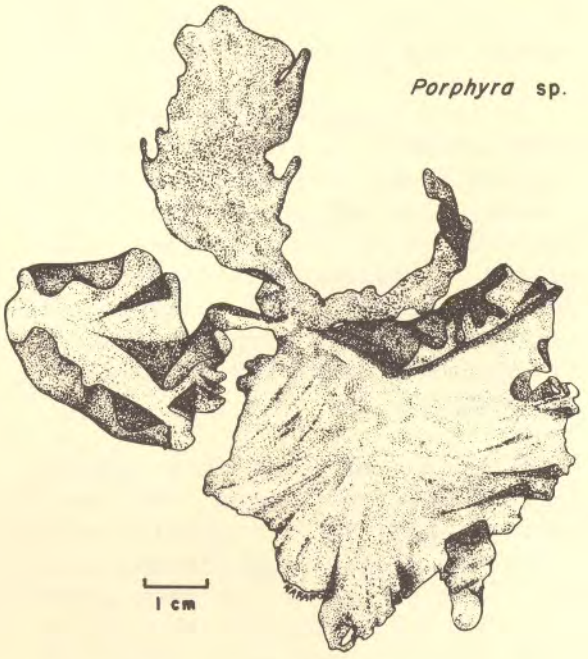
Limu pahe'e, Nori

Porphyra is a genus of seaweed that is common and well-known as a food in Europe and Asia, but it seldom occurs in the tropics. The local species is small and uncommon, consequently it is not well known. But the "nori" seaweed is immediately familiar as an island food, although it is a product of a cultivated and prepared species from Japan.

The local name for *Porphyra* is limu pahe'e; pahe'e means "slippery" or "satiny" in Hawaiian, describing the smooth, flat blades which mold against exposed lava rock. Another name, limu lū'au, means "the seaweed that looks like young taro tops." The deep purple color lightens to a grey-violet shade in the sun. The fronds are small--only 3 to 4 inches long and less than 2 inches wide.

Limu pahe'e appears only during the winter or early spring, following periods of high surf, and grows in distinct patches at high levels on intertidal lava rocks and cliffs. Its seasonality is the most pronounced of those of the Hawaiian seaweeds.

Along the Kona coast, it appears in abundance at certain sites following winter storms. Unfortunately, this is a short-lived appearance. It rarely lasts for more than a few weeks and finding it depends on being at the right place at the right time. The only way to collect it is to scrape it off the rock, while avoiding the wave and surge.



In old Hawaii, limu pahe'e was considered a delicacy, so much so that it was reserved for use by the royalty. Sometimes it was soaked in fresh water, then added to 'opihi, or salted and added to raw fish. The uses for it have expanded greatly as a result of the local enthusiasm for nori. The imported nori sheets are available year-round in Hawaii. The rehydrated nori can be used as a substitute for limu pahe'e in any of the given recipes. Nori is a versatile limu and can be used as a seasoning salt, or as a wrapper for sushi, cooked in a soup or tsukudani, or used fresh in a salad.

Sargassum echinocarpum

Limu kala

Sargassum is a genus of classical fame. Mariners have long avoided the Sargasso Sea in the central Atlantic. Sea myths tell of the creatures living in this permanently floating colony of seaweed, which impedes the passage of ships.

It is a conspicuous seaweed, and often exhibits a floating habit, forming "seas" elsewhere in tropical oceans, although none so large or renowned as the Sargasso Sea. *Sargassum* is worldwide in distribution, but it is on tropical volcanic islands that this genus displays its greatest diversity of species and forms.

There are at least four species in the Hawaiian Islands, and one, *S. echinocarpum*, is of special interest to the limu eater and ethnobotanist. It is a plant common to wave-washed lava benches, although its habitat range extends from warm, calm tide pools to depths greater than 10 feet. It forms thick stands and reaches lengths up to 3 feet in channels between intertidal lava rocks which are subject to constant wave action.

The dark-brown stem arises from a thick, enlarged base. Occasional branches, all of which have holly-like "leaves," give the growing plant a bushy appearance. The stems are markedly flattened and the margins of the leaves are toothed to smooth. At the base of the leaves are small air-filled floats, or bladders, with pointed apexes. The leaves are typically golden-brown and often speckled, with a distinctive midrib. The variable leaf size was noted by the old Hawaiians and their language includes names for both the large-leaved (kala-launui) and small-leaved (kala-lauli'i) forms.

Ethnobotanical lore of old Hawaii is rich with uses for limu kala--its name "kala," meaning "to loosen," was derived from one of its ceremonial uses. In addition, *Sargassum* was important for several other ceremonial and medicinal purposes. When used as food by the Hawaiians the leaves were broken, soaked in fresh water until they turned dark, and used as a stuffing for baked fish, or chopped with fish heads and salt. The limu was also eaten fresh at the beach with raw fish or octopus.

The name "kala" may have been derived from the surgeonfish "kala" which eats this limu.

Sargassum can be collected from both the shore drift of many beaches or gathered from deeper levels by diving. The upper sections of the plant and the large, clean leaves are preferred. Any crusts of coralline algae should be removed.

Since limu kala has a thick, leathery consistency its food uses are limited. The upper sections can be sun-dried and eaten like potato chips. The finely chopped leaves which have a salty tang can be added to a fresh salad. The leaves can also be deep-fried in a tempura batter.

Sargassum echinocarpum

Ulva spp.

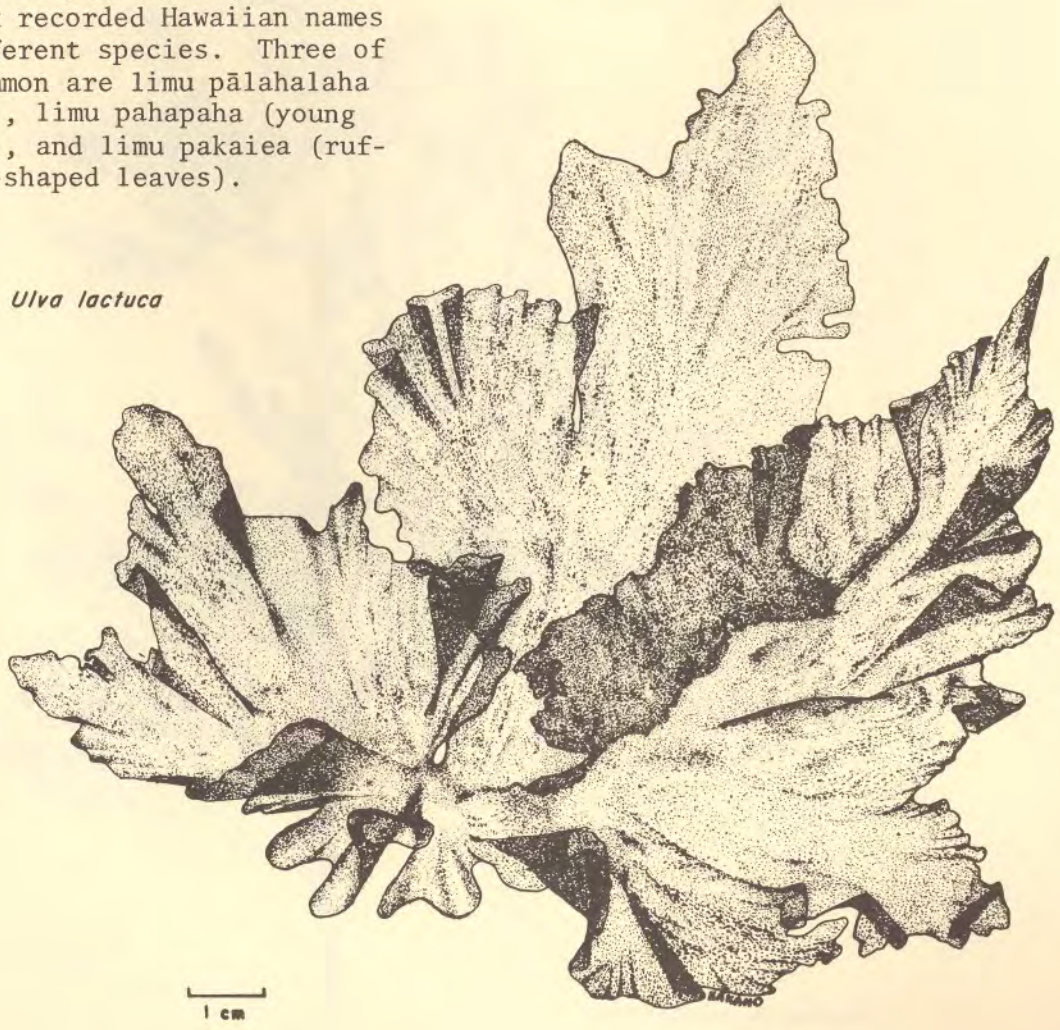
Sea lettuce, limu pālahalaha

The species of *Ulva* are green, flattened blades which, in water, resemble a head of loosely arranged leaf lettuce. They are occasionally used as a salad vegetable.

In Hawaii there are two major species: *U. lactuca*, the typical broad-bladed sea lettuce; and *U. fasciata*, the narrower-bladed limu popular with the Hawaiians. Some botanists classify both as *U. fasciata*. There are at least six recorded Hawaiian names for the different species. Three of the most common are limu pālahalaha (spread out), limu pahapaha (young taro leaves), and limu pakaiea (ruffled, heart-shaped leaves).

The cosmopolitan *Ulva* has long been used for food along both temperate and tropical coasts in the Atlantic and Pacific. There are many uses for the North American variety; the Scots eat it in a soup or salad; and in Japan it is made into a meat garnish. The ancient Hawaiians used to chop it with other limu into a palu (fish-head relish) and mix the tender tips with salt and a small mollusc.

Ulva lactuca



Despite its widespread use as food, the attitude towards the rough and leathery texture of *Ulva* has been one of scorn and distaste. Modern Hawaiians often call it "turtle limu" saying it is fit only as food for turtles. Upon eating *Ulva* prepared in a salad a French phycologist commented, "It was leathery and waxy in taste, and in spite of good digestion I thought I would be ill" (Sauvageau, 1920).

Ulva has been wrongly maligned, for, when properly prepared, it is a palatable, even tasty sea vegetable. When finely chopped it is a good substitute for parsley; it combines well with other limu in a pickle or salad; and it can be dried and powdered into a seasoning salt. The "leaves" can be boiled, stir-fried, or deep-fried.

Ulva fasciata

U. fasciata, the ribbon sea lettuce, has blades which vary in length from 1 inch to 3 or more feet and in width from 1/2 to 6 inches. The fronds arising from a single holdfast can be single and narrow, or broad and deeply cleft, but are usually tapered towards the tip. The margins vary from straight and flat to wavy or ruffled. It grows intertidally, and subtidally to depths of 5 feet or more on coral reefs.

U. lactuca grows in arctic, temperate, and tropical waters. Its Hawaiian varieties measure up to 18 inches in diameter. The margins grow smooth, but become torn and lobed with age, and are often a paler green than the base. *U. lactuca* is common in calm, shallow water although its habitat range overlaps that of *U. fasciata*. It grows well in tide pools as well as in slightly brackish waters.

Often considered an indicator of pollution, *Ulva* grows well in nutrient-rich waters, but unless the water is contaminated or has an oil film there is little reason to bypass it. The only precaution needed is a thorough washing.

Sea lettuce is very common on all islands. Following a kona storm or rough water, plants often wash ashore forming extended mounds. The limu can be easily collected from these masses, although the fresh, dark-green, intertidal forms are more desirable. Intertidal "leaves" are typically free of 'ōpala, although in warm, calm, and shallow water small black snails are sometimes found growing on the surface.

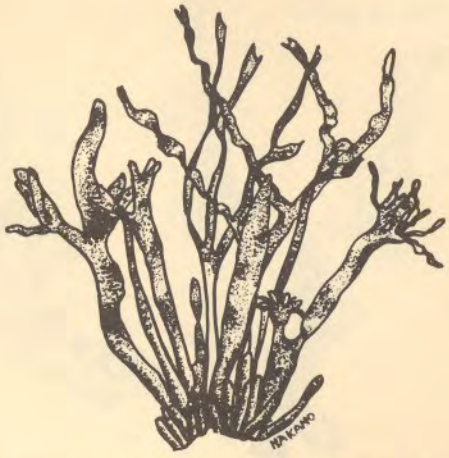
'Opihi limu

This assemblage of intertidal limu is without a definite scientific identity; it includes several genera of limu of similar habitat and size. It includes species of *Grateloupia*, *Polyopes*, and *Gymnogrongus*, but the definition as well as the identification of 'opihi limu varies with locale and island. One explanation for the name is that they share an intertidal habitat with the 'opihi, sometimes growing on the shell. Other reasons are that they taste like the 'opihi, or that they are commonly prepared with the raw 'opihi meat, or that the tiny limpets eat them.

Whatever the reason for the definition, 'opihi limu are small, usually intertidal seaweeds found on every island--usually on lava benches and boulders subject to mild surge. The thallus of one common 'opihi limu, *Grateloupia phuquocensis*, is typically short, from 1/2 inch to 5 inches. The flattened, narrow blade, which is round at the holdfast, branches once or twice in the upper portion. It usually grows clumped, and occasionally spreads to cover an entire section of rock.

The young, tender plants which are less than 2 inches in length are preferred. The longer plants can be used if they are first tenderized in hot water. Usually, the limu is cut from the rock with a pair of scissors or a knife. Some people scrape the plants off with a blunt blade, but this can damage the holdfast and hinder regrowth. The encrusting coralline algae should be cleaned off before using.

Literature does not mention this limu in Hawaiian ethnobotany, although it was probably used as an accompaniment to fish or as a relish. The flavor is mild and the texture crunchy. 'Opihi limu goes well in a mixed-limu salad, or chopped with 'opihi in lemon juice.



Grateloupia phuquocensis

Limu Ethnobotany

When a limu becomes a legend

The ancient Polynesians in Hawaii had a consummate subsistence society. Their culture was rich in ethnobotanical knowledge and lore. On an island of limited foodstuffs nothing edible escaped their searches. The basic starchy land foods of taro, banana, sweet potato, yam, and breadfruit were combined with protein from the ocean--fish, shellfish, and other invertebrates. The monotony of this limited diet was broken by the flavor and color of the seaweeds, collectively called limu, which were used as spice, relish, and salad in old Hawaii. Seaweeds also had a place in medicine, ceremony, legend, and fishing.

The history of Hawaiian use of limu has filtered down in legend, use, and occasional literature, but much of the former knowledge has been lost. It is estimated that there were 30 to 70 types of limu used as food, as medicine, or in ceremony. What remains is a mere remnant of this heritage.

The Hawaiians lived not only under the imperative of a subsistence economy, but also under the regulations of a kapu system. The kapu, imposed by the ruling chiefs for personal as well as common advantage, forbade some people to eat certain foods. It also established closed seasons for the capture of certain types of fish during parts of the year. It was an effective system through the wise management of available resources. The women were particularly affected by the kapu. Until the intervention of Queen Kaahumanu in 1819, they were not allowed to eat pork, bananas, coconut, turtle, and such fish as ulua and kūmū. So women turned to marine invertebrates and seaweeds for food and protein. The versatility of limu as food was developed largely as a result of this kapu.

Early methods of preparing seaweed as food were never sophisticated: limu was used fresh, dried, or preserved with salt. There were some limu that could not be preserved; these perishable and delicate ones acquired the name of one-day limu, to be picked and eaten within a few hours. Among these were limu pe'epe'e, limu lepe 'ula'ula, and limu pahe'e. Others, such as limu kohu and limu lipoa were salted in a process called "pa'akai,"

or "made with salt." They were stored for long periods. Other seaweeds were allowed to partially ferment in a ripening process. When limu 'ele'ele and limu wāwae'iole had developed a rich flavor through fermentation, they were said to be "miko" and ready to eat. Both are prepared in the same way today.

Cooking was done in an imu, a stone-lined underground barbecue pit. Taro, pigs, sweet potatoes, and occasionally limu, were baked by this underground heat. Hawaiians also made soups by dropping hot stones into a calabash. Limu manauea and limu 'aki'aki were added to these soups for flavor and thickening.

The old Hawaiians used limu in different combinations--limu huna was mixed with octopus, limu pālahalaha with a small mollusc, limu 'ele'ele with poi and fish, and limu huluhuluwaena with ake (raw liver). Sometimes the seaweeds such as limu wāwae'iole and limu pe'epe'e were combined together in a mixture called ho'ohui. The spice seaweeds--limu kohu, limu lipoa, and limu 'ele'ele--had very distinct flavors and were not mixed with other limu.

Freshwater limu in the inland streams were also eaten as food. Following the ripening method used for limu 'ele'ele, the long, green strands of limu palawai were prepared and used as seasoning when the seaweeds were in short supply.

Limu palawai, as well as the marine limu, were important in the unwritten pharmacopeia of the old Hawaiians. Many of the medicinal uses were recorded by the Territorial Board of Health in the early 1900s. Limu kala was chopped or chewed and applied as a poultice to coral cuts, a use that persists today. As a medicine, it was given to small children to treat body weakness.

Limu 'ele'ele was used to remove white blotches from the skin in a complex preparation described by Kaahumanu and Akina (1922):

> *Take a quartful of the weed; the bark of eight Waltheria americana* (hialoa) *roots; the bark of eight "popolo" roots; two pieces of the mountain apple bark; two segments of white sugarcane and a quartful of water. The different pieces of bark and the sugarcane segments are then thoroughly pounded together and then mixed with the water and the weed. These are then cooked with six red-hot stones; and, after being cooked, the liquid from the mixture is separated and strained with the fine fibers of the Cyperus laevigata* (a small sedge grass). *The patient takes a mouthful of this liquid for a single dose. This is repeated twice a day for five consecutive days. Salty foods must be avoided. Laxatives should be taken after the treatments are over and the Bidens* (koko'olau) *tea should regularly be used.*

Other limu were used for medicinal purposes in similarly intricate preparations. Limu manauea was used to treat miscarriage, limu lipoa for mouth sores in children, limu huna for a disorder of the alimentary canal. Limu pālahalaha, the sea let-

tuce, was dried with other plants and then smoked for nine consecutive days as a recommended treatment for asthma. Limu pahe'e was wrapped in ti leaves with other plants, baked, then eaten for five days to alleviate chest pains. Limu kohu had a number of medicinal uses. A poultice of the limu and leaves of limu pahe'e were used to heal a sprain, relieve a stomachache, and treat a backache, and also to remove white splotches on the skin (Kaahumanu and Akina, 1922).

Other limu were important in ceremony and legend. The lore of limu kala is particularly rich. One definition of kala is "to loosen." Hawaiians believed that sickness was caused by evil spirits within the body, and that a person could not be free of an illness until these spirits left. A lei of limu kala worn around the neck represented these spirits. A sick person would wear this lei and swim out to sea. When the lei floated away, it loosened the hold of the evil spirits and allowed the person to recover from his illness. The lei of limu kala was worn on the head (lei o ka po'o) by dancers in the hula hoe, the dance celebrating canoe paddling (Abbott and Williamson, 1974).

A maiden wearing a braided lei of limu kala on her head. (Photo by Conrad Schaefer.)

Another definition of kala means "to forgive." The leaves of limu kala were used in a family ritual called ho'oponopono to bring about peace and forgiveness in the family. During a ho'oponopono the 'ohana (family) assembled in a circle to hear and handle grievances, to discuss problems, to say prayers, and to seek forgiveness. Following the ceremony, the family members ate the young leaves of limu kala.

Limu kala was also used in the purification ceremony. When someone died, his relatives observed a ritual period of watching the body and mourning. After the burial the kahuna pule heiau (temple priest) brought out a dish which contained seawater, limu kala, and tumeric. He would stand before the mourners and pray for their purification (hui kala). Then he would sprinkle them with water (Malo, 1903).

The sea lettuce, limu pālahalaha, was also used in the hulas and has special significance to those whose 'aumakua or family god is the shark. The legend relates that an early ancestor of the shark was wrapped in the leaves of the sea lettuce and then put out to sea. To this day this limu is thought to be sacred to the shark god and is kapu to those whose 'aumakua is the shark.

Limu kohu also had a place in legend. One tale tells of a woman who was out looking for limu one day. Sitting on a flat section of rock, she felt along the shore for

the treasured limu kohu. But she didn't find any. Suddenly, she started moving and realized that she had been seated on the back of an enormous turtle, her 'aumakua or family god. The turtle swam with her on its back to a section of the coast which abounded with the dark and fragrant limu kohu. Here the woman filled her basket with the limu, then returned home to tell her friends how her 'aumakua had rewarded her (Stone, 1978).

Legend also tells of one limu used in a love potion. A young woman, skilled in the ways of love and magic, would give her chosen victim a piece of freshwater limu to make him adore her forever. Legendary or not, another seaweed, limu ko'ele'ele (*Gymnogrongus* sp.) was said to have aphrodisiac properties when eaten, but only when accompanied by a certain chant.

The Hawaiians valued their limu highly and took measures to insure their availability. Limu kohu was transplanted from Kauai to a "limu garden" on Oahu for Queen Liliuokalani at her Diamond Head residence. At Moloaa on Kauai, the source of much of the present commercial supply, this seaweed was carefully tended and the 'ōpala removed. Forms of aquaculture were also attempted with limu pahe'e and limu huluhuluwaena. The huluhuluwaena in Kaneohe Bay was supposedly transported there by a chief from the island of Hawaii.

The ancient islanders lived on an island of very limited plants and foodstuffs. But what they lacked in variety they made up in versatility.

* * *

During the latter part of World War II, Flora Lee Simpson noticed a decline in limu-picking along the Waikiki shoreline and expressed her sentiments in *Paradise of the Pacific*. The methods of picking limu have since changed but the love--the aloha--held by the Hawaiian people for this part of their heritage has not. Ms. Simpson evokes this aloha in her writing, and shares the knowledge of limu as it was once shared with her.

(Alonzo Gartley, Bishop Museum, ca 1900-1910.)

Where are the older women who used to frequent the shallow waters back of Halekulani, equipped with squid boxes and wearing holokus or plain Mother Hubbards, which, shining wet, flattened their percale fullness against the ample curves of the wearer? Once in a while I see one in the early morning...pale ghost, I'm sure, of a once happy group. The manauea is thick and red and beckons with long, stemmy fingers as the waves surge over and drift back, but few answer.

(Bishop Museum)

Where are the old women who would sit on the beach, surrounded by small children and infants, endlessly picking over the limu, removing each grain of sand, each coarsened stem, each lichen discolored leaf, while the older children and papa swam in and out bringing more and more of the littoral harvest to their commodius laps?

Where is the maiden who, magic wise, made of the limu kalawai, a love potion that her lover may be true and adore her forever? Gone with the ill one who made of the limu kala a lei which he placed around his neck out in the sea, ate of it, then threw it into the sea, with a prayer that his sickness would pass. All things, they say, pass. But with the limu knocking at the shore of all Hawaii, let us at least taste of it.

The limu served at luaus is minute in quantity and semi-dried by normal process of evaporation in waiting for the liquor to be drunk and the feast to begin. Limu is at its best fresh off the reef, eaten while treading water or standing if the depth permits. The next best is that collected just before breakfast and served with bacon and eggs. These opinions are not necessarily unanimous. I have heard tell that some people like the limu "ripened;" in the interests of a fuller and better life, I tried it and the answer is "NO."

Limu is not just one kind of seaweed. The epicure likes three or four kinds chopped together. Wāwae'iole, the foot of the rat; lipoa, reddish and iridescent; manauea, red stems grouped; these three you can get makai of the Royal Hawaiian and the Halekulani. The wāwae'iole grows on old coral on the bottom and is hard to see unless you pretend you are looking for a

wormout dirty dishrag caught on a rock. It is, under the sediment and clinging coral chips, a rich dark green network of thickened stems which become more and more attractive as you rub it back and forth between your palms while sloshing it up and down in the ocean.

One morning I met a weather-beaten, blue-eyed, grizzled man of sixty-odd years who picks manauea and lipoa by touch. He says that you don't make so many mistakes that way because you can always tell what you've got by the feel whereas many non-edible and edible types look alike. (Non-edible is used here in the sense of unpalatable or non-nutritious; I have not heard of any poisonous limus.) He likes his limu chopped with a threadlike limu, the limu 'ele'ele which only grows where fresh and salt water meet. So he gets on a bus and goes to Waialae Stream and after he gets as much limu 'ele'ele as he wants, he transfers back along Kalakaua to the Royal where he wades along the wall feeling for lipoa and a short-stemmed firm peppery limu which he says is not true lipehu although very similar. I took my diving mask and got some wāwae'iole for him and he gave me of the limu 'ele'ele which came from Waialae Stream.

He puts it [limu] in a jar and keeps it in the refrigerator. He says that it keeps for a week or two but is better without a lid. I tried that. The butter tasted of low tide, the milk tasted like a John Masefield poem, which poems, as everyone knows, were written to be read--not eaten, and when the door of the refrigerator was opened, Conrad's ghost stalked the room.

We talked of limu...its taste ...its goodness...and of the things of the sea and from the sea. He said the wāwae'iole is better when you find it floating loose and washing in the slack water between the breaker and sand because the action of the waves has cleansed it rather thoroughly and you don't have so much pilikia getting the rubbish out of it.

After a Kona storm the beach is littered with seaweeds; colors of reds and ochres and greens; in shapes stemmy, leafy, grassy, and of such oddness as not to be of this world.

If you are inspired to hunt yourself a mass of limu be guided by these golden rules; clean it as you pick it. Seawater only should be used for washing. If you want to give it another washing at home, take home a pail of seawater. Try chopping a little chili pepper in with it. There is nothing wrong with the storm-loosened edible limu in the slack water at the edge of the beach but some there are who insist it's not fit to eat unless plucked from its native heath with your own loving hands. That's as may be. I've had batches of both and

they taste not a whit different. The waves wash it clean when bringing it in and you'll save work if you don't belong to the latter school of thought

If you don't know what to pick, ask whomever is there before you.

People who are picking limu are, if they think you're really interested and not just trying to be gregarious and funny, most informative and eager to share their knowledge--and the crop--with you. I know. I'm one of them now.

Ocean Harvest

When a seaweed becomes a sea vegetable

"Weed vs Vegetable"

According to a recent checklist of marine algae in Hawaii (Hunt, 1976), there are over 350 species in the green, brown, and red divisions. With the exception of the hard and stony coralline algae there are approximately 300 potentially edible species. The distinction between edible and palatable narrows this number significantly, however. All seaweeds are edible, but not all are palatable. The term edible is used here to indicate good flavor and texture. The 25 species described earlier are by no means the only edible ones. Many other marine algae are good to eat, but are scarce or seasonal, or too small to be of concern.

The best and simplest way to test a seaweed for edibility is to taste it. Some may be bitter, gritty, or sour, but the reward of finding a tasty sea vegetable far surpasses this disadvantage. There is no risk involved for there are no poisonous seaweeds in the red, brown, or green divisions, only those of disagreeable texture or taste. There is a caveat, however. This method should not be used in polluted waters. The seaweed taken from these nutrient-rich waters should be thoroughly washed and cleaned to remove the small animals and plants adhering to the surface before tasting.

Researchers at the University of Hawaii investigating the chemical constituents of edible Hawaiian species have isolated some potentially toxic compounds. However, the concentration of these is negligible in amounts normally consumed. The genera which have been tested are *Asparagopsis* and *Dictyopteris* (Burreson, Moore, and Roller, 1976; Moore, 1977). Both have a strong fragrance and are used sparingly as spices.

Collection, Cleaning, and Conservation

It is not as easy to collect limu as it was earlier in the century. Limu pickers now compete with other limu pickers for the biggest collection; and the lion's share goes to the commercial collector who sells his limu in the store. The limu can

In the early 1900s, women waded out at low tide to gather limu on the coral flats off Aina Haina. (Frank Davey, Bishop Museum, ca 1897-1903.)

(Ray Jerome Baker, Bishop Museum, ca 1920.)

be found, but collecting requires more craft and skill than it used to.

Limu picking is an exercise in patience, discretion, and conservation--patience because a particular seaweed is not always available, discretion because the edible seaweed may be masked or hidden by others, and conservation to insure future supplies. Although most limu are available year-round, some appear at irregular times or in unexpected places. Sand and other 'ōpala sometimes disguise seaweed; it takes a learned eye to recognize a silted-over limu wāwae'iole.

Some Hawaiians advocate the old-style method of picking limu by touch. They wade out into water--up to waist deep--and reach along the bottom and feel for the texture of the desired plant.

There are three other styles of collection: diving with mask and snorkel, sorting through beach wash, and picking from exposed intertidal rocks. It will take some practice for the diver to identify the edible plant among the epiphytes, sand, and animals that often mask it. Beachwashed seaweeds are typically clean, and fellow collectors are usually willing to identify those that are edible. To the intertidal collector, a knife and agility are essential, especially when the water is rough or high. Veteran limu pickers in the Kohala area refer to calm, gentler surf as "women's waves," reserving for themselves the danger, and attendant glory of picking 'opihi and limu kohu in the rugged, surf-washed regions. It requires skill and daring to pick from these intertidal zones, and each year there are one or two pickers who are swept off the rocks and lost to sea in the violent winter surf.

Wavewashed intertidal zone at Keaau, Hawaii. (Photo by Dr. E. Alison Kay.)

Like other commodities, the supply of limu is limited; conservation practiced by collectors insures the future availability of the supply. Beachwashed limu poses no problem to conservation, only to the poor limu picker who arrives late at the shore. The old Hawaiians realized that only the upper section of the plants should be removed, leaving the lower portion to regrow. This practice should be closely followed today, especially for "creeping" limu such as limu kohu and ararucip. In any case, it is important to leave the holdfast--the bottom portion joining plant to substrate--so the plant can produce another "crop."

There is another reason--an ecological one--for removing only the upper section of the plant. Many times collectors compete with fish and invertebrate herbivores for the limu, and there is no guarantee that the plants can withstand this pressure. A wise collector leaves enough for the next person and the next fish.

After collection comes cleaning, an unavoidable part of limu cookery. The most efficient way to clean limu is to pick clean. Bypass the "dirtied" limu for cleaner forms, or pick only the "clean" branches. Often, the limu washed up on a beach has been scoured by the waves and the cleaning chore has been minimized. But it is not always possible to find clean limu, and there is no way around the tedium of removing 'ōpala. There is one method, however, that works well for *Codium*, *Grateloupia*, and *Gracilaria* species which often sport loosely adhering objects. A hard spray of water from a garden hose easily removes the 'ōpala

without damaging the limu itself. But this is equivalent to a fresh-water rinse, so the limu should be prepared immediately.

A limu picker sorts through the piles of beachwashed seaweed at Ewa Beach, a popular collecting site.

The agitation of a washing machine is also an effective means of cleaning limu. The seaweed can be put in a large nylon mesh bag and run through the rinse cycle. The water motion scours the seaweed much like waves and surge. The result is remarkably clean limu with very little work.

Storing the Sea Vegetables

Methods of storing and preserving land vegetables work equally well for sea vegetables. Most of the tropical seaweeds can be stored by freezing, drying, or salting.

Freezing

Of the three processes, freezing is preferred. The sea vegetables should be thoroughly cleaned, rinsed in salt water, drained well, and packed into small to medium containers. One word of warning: the odor of some limu will permeate the freezer so packaging must be secure. Almost all of the edible seaweeds freeze well, wilt slightly when thawed, and retain fresh color and flavor.

Drying

Drying is a less preferred method--the color fades, and the taste and texture changes. Only three limu are well-suited to drying: *Halymenia*, *Ahnfeltia*, and *Porphyra*. Sun dry these on a rack or screen. Fortunately, limu do not attract flies and other insects and can be left unprotected until dry. They can also be dehydrated in a warm oven. Dried limu should be stored in air-tight containers and rehydrated only with salt water.

Salting

The old Hawaiians used salting almost exclusively to preserve limu, and salting is essential to develop the taste of the "spice" seaweeds--limu kohu, limu 'ele'ele, and limu lipoa. Each of these is carefully rinsed and cleaned, then combined with Hawaiian salt and allowed to stand until "miko," or until a strong flavor develops. This degree of ripeness is highly variable. The seaweeds are then refrigerated. Other seaweeds can be salted, but results in considerable changes in texture.

The preservation method for some types of sea vegetables follows.

Sea Vegetable	Preservation Method
Ahnfeltia	Dried or frozen, almost indestructible
Asparagopsis	Salted first Can be frozen
Caulerpa	Cannot be preserved
Codium	Sometimes salted, but wilts Cannot be dried or frozen
Dictyopteris	Salted first Can be frozen
Enteromorpha	Salted first Can be frozen
Eucheuma	Frozen, but very limp when thawed
Gracilaria	Frozen, but wilted when thawed
Grateloupia	Frozen
Halymenia	Dried, but shrinks considerably although flavor improves Cannot be frozen
Laurencia	Cannot be preserved
Porphyra	Dried
Sargassum	Frozen, but slightly tenderized when thawed
Ulva	Frozen

Wilting the Sea Vegetables

Many island cooks wilt the ogo and other sea vegetables with hot water before using them in a pickle or salad. There are advantages and disadvantages to this. Wilting does tenderize the seaweeds, but the usual marinade of vinegar and shoyu also has the same effect. The tougher sea lettuce and limu kala which would most benefit from tenderizing are unaffected by the hot water process.

Most of the recipes for kim chee and namasu call for wilting, but it is optional whether or not to follow these instructions. The resulting taste and texture will be the same.

Wilting is a simple process. Immerse the clean seaweed in hot, but

not boiling, water until the seaweed turns green. It may take a few seconds to more than a minute. Rinse immediately with cold water. Use the seaweed as directed. Delaying the cold water rinse causes the seaweed to over-tenderize into a soft gel.

Commercial Sources of Limu

Local fish and supermarkets stock a variety of Hawaii's sea vegetables year-round. A visit to these stores is an excellent way for the limu eater to become familiar with the common edible limu.

Of the more than 200 species of Hawaiian sea vegetables, 10 are available locally in either fishmarkets or large grocery stores. The source of this supply is wholly from independent collectors, and the supply is subject to the vagaries of weather and season. Although there are some experimental plots, sea vegetables are not yet grown commercially.

The most popular of the marketed limu are limu kohu (*Asparagopsis* sp.) and limu 'ele'ele (*Enteromorpha* spp.); they can be found in the meat or fish departments of almost all island supermarkets. *Gracilaria* (limu manauea) and *Codium* (limu wāwae'iole), each with two marketed species, are frequently available in one-pound plastic bags. Both ararucip (*Caulerpa racemosa*) and limu lipoa (*Dictyopteris* spp.) are rarely seen in markets on Oahu. Limu manauea (ogo) is available in a variety of preparations: pickled as a kim chee, combined in a raw fish poke, or dressed in a namasu (vinegar sauce).

Wholesale dealers are knowledgable about supply and quality, and, in purchasing, prefer limu of high quality. Much of the supply for limu 'ele'ele is from the Hilo area. Maui is the preferred source for the short ogo (*G. coronopifolia*) and Honolulu for the long ogo (*G. bursapastoris*), while Kauai supplies the dark limu kohu. For the rat's feet limu, the erect *C. reediae* is favored over *C. edule*. A survey of markets on the four major islands showed that prices vary from island to island according to the weather and season and the supply and demand (Fortner, 1975). The prices which represent the range in retail markets on Oahu and Hawaii during 1976, 1977, and 1978 follow.

Limu	How Sold	Price
Limu kohu (*Asparagopsis taxiformis*)	Salted, in containers	$4.50 to $9.00/lb
	Packed into small balls	$ .40 to $1.50/ea
Limu wāwae'iole (*Codium* spp.)	Fresh, in open bins or in plastic bags	$ .79 to $1.29/lb
	Salted and wilted, in containers	$2.00 to $3.00/lb
Limu 'ele'ele (*Enteromorpha* spp.)	Salted, in small plastic containers	$2.09 to $3.59/lb
Limu manauea--ogo (*Gracilaria* spp.)	Fresh, in open bins or packaged in plastic bags	$1.10 to 1.59/lb
	Salted and chopped in small container, for addition to poke	$1.50 to $2.70/lb
	Prepared kim chee	$1.99/lb
	Prepared namasu	$1.59 to $1.99/lb
Ararucip (*Caulerpa racemosa*)	Fresh, in open bins	$ .89 to $1.19/lb
Limu lipoa (*Dictyopteris* spp.)	Salted, packed in jars	$3.79 to $4.75/lb
Tambalang--guso (*Eucheuma spinosum*)*	Fresh, in open bins	$ .79 to $ .99/lb
Limu huluhuluwaena (*Grateloupia filicina*)	Salted, in small plastic containers	$2.00 to $3.00/lb
Sea lettuce--Limu lepe 'ula'ula (*Halymenia formosa*)	Fresh, in open bins	$1.25/lb

*1976 data; not available at present

In island markets, limu is sold chopped, salted, pickled, mixed with other seafoods, or fresh by the pound. (Photos by Conrad Schaefer.)

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Appetizers

The versatility of limu is demonstrated in this section. Recipes include the very popular Hawaiian poke and lomi salmon, as well as the oriental limu kim and tsukudani.

POKE--RAW FISH

1 lb. raw fish fillet ('ahi or aku is best)
2 t Hawaiian salt
1 small ball limu kohu (about 3 T) or 1 C salted limu manauea (ogo), chopped
1 Hawaiian chili pepper with seeds removed
1/8 t 'inamona (salted, roasted kukui nuts)

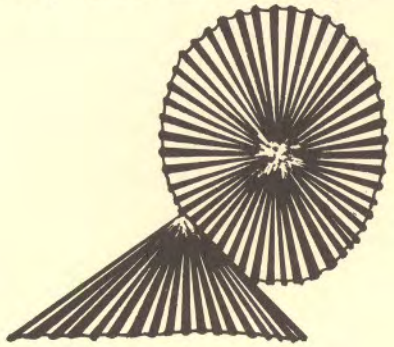
Cut the fish into bite-sized cubes and toss with the salt. Add the remaining ingredients; toss thoroughly. Refrigerate for 12 hours before serving. Serve as appetizer or side dish.

'OPIHI IN ESCARGOT SAUCE

Although 'opihi are traditionally served raw, they are also excellent cooked in an escargot garlic-butter sauce. Chopped sea lettuce adds flavor and color.

'Opihi in the shell, preferably freshly picked
Butter to cover a pan to 1/4 inch
Garlic, finely minced and mashed
Sea lettuce, finely chopped
Salt and pepper to taste

In a large saucepan melt the butter over low heat; add the garlic, sea lettuce, and seasonings; mix well. Set the 'opihi, foot down, in the hot butter and cook until 'opihi loosen from shell--about 2 minutes. Remove from heat, serve immediately.



I'A MAKA--RAW LOMI FISH

Lomi is the Hawaiian word for "massage." In this recipe for raw fish massaging is used not only to soften the flesh, but also to allow the flavor or the seasonings to be blended into the fish.

1/2 lb. whole raw fish ('ō'io or bonefish)
1 T Hawaiian or rock salt
1 C ice water
3 T green onion, finely chopped
1-1/2 t 'inamona (salted, roasted kukui nuts)
6 T limu kohu, or limu lipoa, or limu pe'epe'e

Scale the fish and remove the entrails. Cut the fish crosswise into several pieces and sprinkle with salt. Then refrigerate the fish for several hours.

After refrigeration, rinse the fish, taking off the excess salt. Do not wash thoroughly. Cut the fish into small pieces and remove bones and skin. Mash the fish with your fingers and add water gradually. Add the other ingredients and mix thoroughly. Serve immediately. May be served with chili pepper water or hot pepper sauce.

LOMI SALMON WITH OGO

1 lb. salted salmon
3 medium tomatoes
2 Maui onions
2 stalks green onions
2 C ogo (limu manauea)
Ice for chilling

Wash the salt off the surface of the salmon, then soak in fresh water for several hours. Drain. Cut the salmon into bite-sized pieces, set aside. Chop the tomatoes and onions. Wilt the ogo, then rinse, drain, and chop into 1/2-inch sections. Combine tomatoes, onions, and ogo with the fish, add salt to taste. Chill the mixture by placing ice on the surface. Remove leftover ice before serving as a side dish or appetizer.

'OPIHI AND LIMU

Raw 'opihi are a versatile mixer with many sea vegetables. 'Opihi limu, limu huluhuluwaena, or limu pe'epe'e may be used in this mixture; limu huluhuluwaena is preferred by Hawaiians.

Limu
'Opihi
Salt

Chop the limu and mix into the cleaned raw 'opihi, salt lightly. Serve chilled.

AKE AND LIMU HULUHULUWAENA

This is an old Hawaiian method of preparing raw liver.

1/2 C limu huluhuluwaena, salted and chopped
5 lbs. ake (raw beef liver)
Flour
Hawaiian salt
1 T 'inamona (salted, roasted kukui nuts)
3 red peppers, minced (optional)

Remove membrane and veins from liver, chop into bite-sized pieces. Roll in flour, lomi-lomi (massage) the blood out, then wash thoroughly. Repeat the process three times until the blood is drained and the flour is almost white. Then add salt and let sit for 1 day in the refrigerator. Rinse with water and drain well. Add the 'inamona and limu to taste, mix well. Serve chilled as an appetizer.

LIMU DIP

This simple dip is excellent with crisp and fresh limu wāwae'iole.

2 t Dijon mustard
1 C mayonnaise
Juice of 1/2 lemon
1/2 C green onion, chopped
Salt and pepper to taste

Combine ingredients well, refrigerate. Serve with chilled limu. Makes 1 cup.

OGO GUACAMOLE

1 C ogo (limu manauea), chopped
2 large ripe avocados
Juice of 1/2 lemon
1 medium tomato, chopped
1 small Maui onion, chopped
Salt and pepper to taste
Hot pepper sauce or minced chili peppers to taste

Cut the avocados in half, remove the seeds, and scoop out the pulp with a spoon. Mash coarsely with a fork, blending in the lemon juice. Add the tomato, onion, and ogo. Season with salt, pepper, and hot pepper sauce or chili peppers. Serve with corn chips.

OGO KIM CHEE DIP

A hot ogo kim chee--such as Korean Kim Chee--lends itself well to a cream cheese dip. This recipe is highly recommended.

2 T ogo kim chee liquid
1 8-oz. pkg. cream cheese
1/2 C ogo kim chee
Green onions, chopped (optional)

Combine the liquid and cheese to desired consistency. Finely chop the ogo kim chee, add to the mixture with the onions, and blend well. Chill. Serve with crackers, vegetables, or limu kala chips.

LAVER BREAD OR FRIED LIMU PAHE'E

Laver bread, made from the English species of Porphyra, is a popular food in the British Isles. This slightly greasy "bread" was a staple food in the high-fat diet of whaling boat crews.

Limu pahe'e
Oatmeal
Salt
Bacon

Wash the limu in fresh water, then boil for 10 to 15 minutes in a heavy saucepan until tender. Add enough water to make a thick jelly. Transfer with a tablespoon into dry oatmeal and salt mixture; coat thoroughly. Fry with bacon until crisp. Serve with potatoes and butter.

This is the classical laver "bread," but it can be modified. Dip each tablespoon of boiled limu into a bowl containing a beaten egg, then roll in flour and seasoning mixture. Deep fry until crisp. Serve as a side dish.

LAVER TOAST SPREAD

2 C wet Porphyra (nori or limu pahe'e)
1/4 C lemon juice
Olive oil
Salt and pepper to taste

Wash the limu well, then boil until tender--about 10 minutes. Do not overcook. Remove from heat, drain the pulp. Add lemon juice, a few drops of olive oil, mix well. Add salt and pepper to taste. Serve chilled on toast.

HOT ENGLISH LAVER

Serve this laver with roast beef.

2 C wet Porphyra (nori or limu pahe'e)
2 T butter
1/4 C roast beef gravy
2 T lemon juice
Pepper to taste

Wash the laver well, then boil until tender--about 10 minutes. Add the remaining ingredients and heat again. Serve hot.

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.

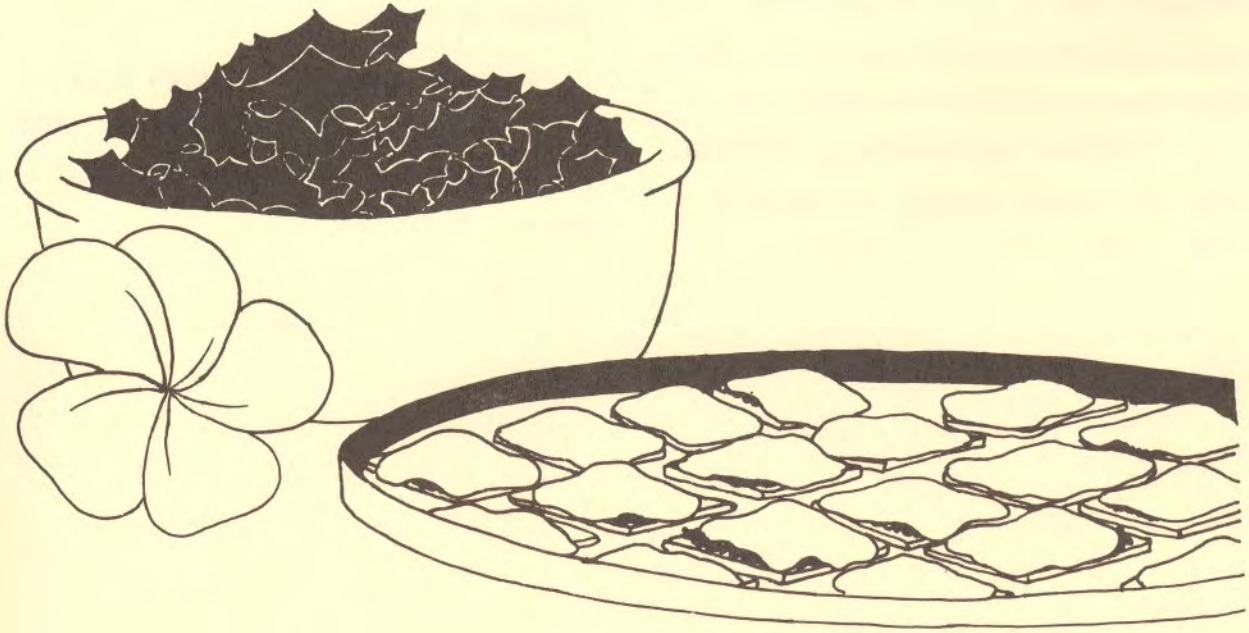
Limu kala
Fat for deep frying
Salt

Cut the clean leaves from the 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.

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.



Pickles, Relishes, and Kim Chee

The most popular sea vegetable recipe in Hawaii is for pickled ogo. There are as many variations of it as there are cooks. The names--kim chee, namasu, sunomono, sanbaizuke--reflect an Eastern origin.

Essentially all recipes in this category include shoyu, vinegar, and spices in varying amounts. Many recipes for ogo are also used for other sea vegetables. The hot Korean kim chee and ogo namasu are highly recommended.

TRADITIONAL OGO KIM CHEE

2 lbs. ogo (limu manauea)
4 C water
2 t red peppers, minced, seeds removed
2 t garlic cloves, minced
1/2 t paprika
1/2 t ginger root, minced
1/4 t MSG (optional)

Clean and wilt the ogo. Drain, then chop into 2 to 3-inch pieces. Combine the remaining ingredients, and mix with the ogo. Pack tightly into large-mouthed jars, seal, and refrigerate. Allow flavor to develop for a few days before eating.

QUICK OGO KIM CHEE

Homemade kim chee is a simple process with the packaged kim chee mix usually used for won bok or turnips.

2 lbs. ogo (limu manauea)
1 pkg. kim chee mix
1/2 C water
3 T cider vinegar

Clean, wilt, and drain the ogo. Cut into 2-inch pieces. In a separate pan, combine contents of the package mix with water and vinegar. Pour over the ogo and mix well. Press into quart jars. Allow to stand 1 day to develop full flavor, then refrigerate.

KOREAN SEAWEED

2 lbs. limu manauea (ogo)
3-4 chili peppers, chopped, seeds removed
1/4 C dark sesame oil
2 C shoyu

Wash and clean the ogo. Wilt if necessary, then drain and cut into 2 to 3-inch lengths. Combine the remaining ingredients and pour over the ogo. Mix well and refrigerate before serving.

OGO KIM CHEE--HOT

1 lb. ogo (limu manauea)
12 dried shrimps
1 T dark sesame oil

Sauce

1/4 C sesame seeds, roasted and ground
2 T brown sugar
1 clove garlic, minced
2 chili peppers, chopped
1 C green onion, chopped
1 t salt
1/2 t MSG (optional)
1/4 C cider vinegar (optional)

Wash and clean the ogo. Drain, cut into 2-inch pieces. Soak the shrimp in water for an hour, drain, mince, then fry in a skillet until crisp. Combine all of the sauce ingredients; pour over the limu. Marinate overnight. Serve chilled.

KOREAN OGO KIM CHEE

2 lbs. ogo (limu manauea)
1/2 C green onion, chopped
1 Maui onion, chopped

Sauce

1 C cider vinegar
1/2 C shoyu
1/2 C sugar
1 T kochu chang
1 chili pepper, minced, seeds removed
Grated fresh ginger and garlic to taste
Dried shrimp, fried and chopped
1/4 t MSG (optional)

Clean and wilt the ogo, drain well. Chop into 3-inch sections. Mix with onions. Combine the sauce ingredients, stir until sugar dissolves. Season to taste. Pour the sauce over the limu and onions, mix well. Pack into jars and refrigerate.

KOREAN-STYLE KIM CHEE

1 lb. limu manauea (ogo)
1/2 C shoyu
1/4 C cider vinegar
1 T mirin
2 t chili powder
1 clove garlic, minced
Ginger to taste, grated
1/2 t MSG (optional)

Clean the ogo, and wilt in hot water. Chop to desired length. Mix remaining ingredients and add to the ogo. Refrigerate.

PICKLED OGO

2 lbs. ogo (limu manauea)
1 t dark sesame oil
1 t sesame seeds
2 cloves garlic, minced
1/2 round onion, sliced
1/2 chili pepper, minced
2 T cider vinegar
3/4 C shoyu
1 T sugar
1/4 t black pepper
1/2 t MSG (optional)

Wilt the seaweed if desired. Drain well, chop into 4-inch sections. Combine the remaining ingredients and pour over the prepared limu, mixing well. Pack tightly into glass jars and refrigerate for at least a day.

LIMU SUNOMONO

Sunomono is a Japanese vinegar sauce. Like the kim chee sauce, there are as many versions of the sauce as there are cooks.

I

1 T sugar
1/2 t salt
1/2 C cider vinegar
1/2 t MSG (optional)

II

2 T sugar
1/2 t salt
1/4 C lime or lemon juice
1/4 t MSG (optional)

III

1/4 C cider vinegar
1 t shoyu
1 T sugar
1/2 t salt

IV

1/4 C miso
2 T cider vinegar
2 T sugar
1/2 t MSG (optional)

Mix the ingredients together until the sugar and salt are dissolved. Pour over a quart of prepared (wilted) limu and let stand a day before serving.

OGO SANBAIZUKE

2 lbs. ogo (limu manauea)

Sauce

1/2 C sugar
1/2 C vinegar, distilled
1/2 C shoyu
1/2 C green onion, chopped
1 t fresh ginger, grated
3 t sesame seeds, roasted
Chili pepper to taste
MSG (optional)

Clean, wash, and wilt the ogo. Rinse and drain, then chop to desired size. Combine sauce ingredients; stir until sugar dissolves. Pour sauce over the ogo and pack into jars. Refrigerate for at least a week before serving.

LIMU MANAUEA--HAWAIIAN STYLE

4 C limu manauea (ogo)
1 thumb-sized piece fresh ginger
1/2 C cider vinegar
1/2 C water
1/2 chili pepper, minced, seeds removed
1 t Hawaiian salt (optional)

Thoroughly clean and wash the limu. Wilt if desired, then rinse in cold water and drain. Smash the ginger and place in the bottom of a quart jar. Put the limu into a jar, then add the vinegar, water, chili pepper, and salt. Cover, shake to mix and, store in the refrigerator for at least 2 days. Serve as a relish with Hawaiian food.

'OPIHI LIMU PICKLE

4 C 'opihi limu
1/3 C cider vinegar
2/3 C shoyu
1 Maui onion, chopped
1 chili pepper, chopped, seeds removed
3 cloves garlic, minced
1 thumb-sized piece ginger, minced

Wash and clean the limu thoroughly. Chop into 1-inch sections and wilt with hot water. Drain well. Combine the remaining ingredients in a bowl. Add the limu and mix well. Marinate overnight in the refrigerator.

LIMU 'ELE'ELE RELISH

1/2 lb. fresh limu 'ele'ele
2 T sesame seeds
Few drops of sesame seed oil
1 clove garlic, minced
Small piece of ginger, minced
1 chili pepper, chopped
Salt to taste

Wash and drain the limu, cut into 6-inch sections. Combine the remaining ingredients and work into the limu, mixing well. Serve chilled.

OGO NAMASU

1 lb. ogo (limu manauea)
1 tomato
1/2 Maui onion
1 cucumber

Marinade

1/4 C vegetable oil
1/4 C cider vinegar
3 T shoyu
2 t salt
1 T sugar
1/4 t fresh ginger, minced
Pinch pepper
Dash hot pepper sauce
1 t MSG (optional)

Wilt the seaweed, then drain and cut into 3-inch sections. Combine the ingredients for the marinade, set aside. Cut the tomato, onion, and cucumber into strips, add the limu, and combine with the marinade. Let stand at least 2 hours before serving. 'Opihis are optional.

CUCUMBER-SEAWEED NAMASU

1 lb. limu manauea (ogo)
3 medium cucumbers
Salt
1/2 of 1 lb. can of abalone
1/2 can of abalone juice
1/2 C sugar
1/2 t salt
1/2 t MSG
1/2 C Japanese vinegar
2 T shoyu
1 t fresh ginger, chopped

Prepare the ogo by washing thoroughly, then break into small pieces. Wilt with hot water, drain. Peel the cucumbers if desired, then cut into thin strips. Sprinkle with some salt, let stand for 20 minutes or until limp. Drain off the excess water. Cut abalone into slivers and set aside. Mix the sugar, the 1/2 t salt, MSG, vinegar, shoyu, ginger, and abalone juice; stir until the sugar dissolves. Add the abalone, limu, and cucumbers. Toss well and chill. Serve as a salad or vegetable dish.

VEGETABLE-OGO NAMASU

1/2 lb. ogo (limu manauea)
1 medium cucumber
1/4 C dried shrimp
1/2 C cider vinegar
1 medium carrot
1/2 C sugar
Salt to taste
MSG (optional)

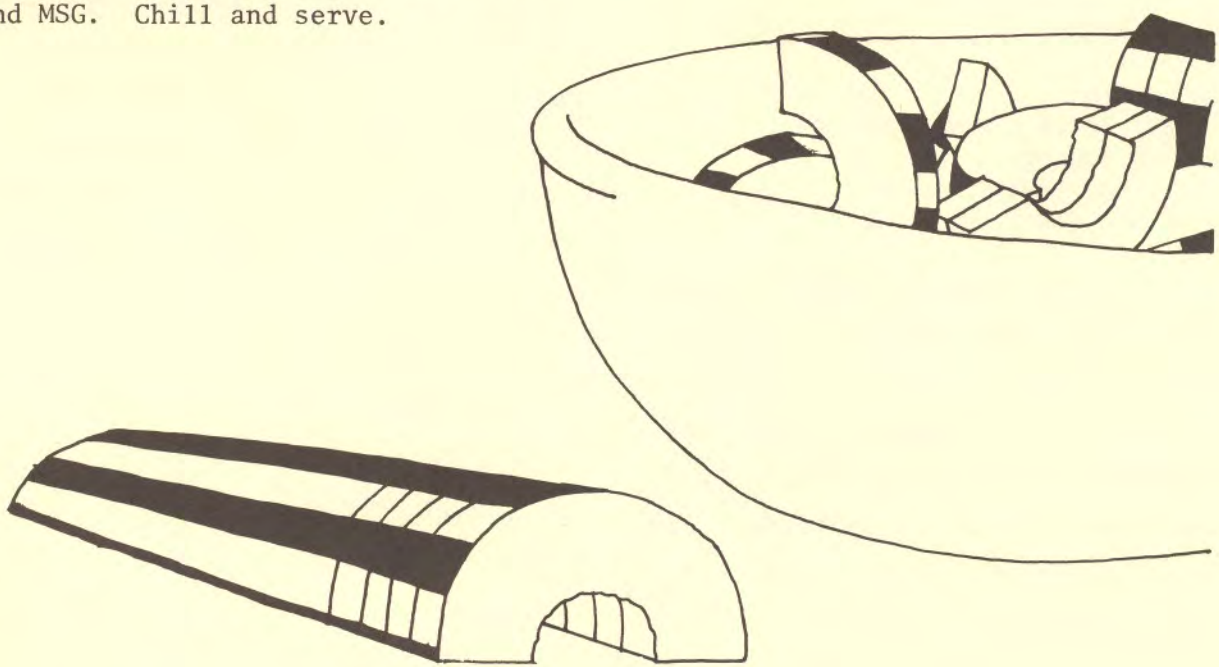
Wash and chop the ogo. Peel the cucumber and cut into strips. Sprinkle with salt and set aside for an hour. Soak the shrimp in the vinegar. Cut the carrot into strips. Then rinse the salt from the cucumber slices. Remove the shrimp from the vinegar and chop fine. Combine the vegetables and shrimp, then make a sauce of the vinegar and sugar and pour over the vegetables. Add salt and MSG. Chill and serve.

TAMBALANG RELISH

This relish, made from the Eucheuma imported from the Philippines, is a good accompaniment to meat and poultry dishes.

1 C tambalang, grated
1/4 C red wine vinegar
4 T sugar
1/8 t salt
1/4 onion, chopped fine
4 slices fresh ginger, minced

After grating, blanch the tambalang with 2 C of boiling water for 2 to 3 minutes, rinse, and drain. Combine the remaining ingredients in a saucepan, simmer for 10 minutes. Pour the hot solution over the tambalang, mixing well. Let cool, then refrigerate.



NUOC MAM SAUCE

This Vietnamese sauce is an interesting change from the usual kim chee dressing. It may be served over limu manauea (ogo), limu wāwae'iole, and other "salad" limu.

3/4-inch piece fresh, hot chili pepper
1 clove garlic
1 t sugar
1/2 lime
1 T cider vinegar
1 T water
4 T fish sauce

Seed the chili pepper, and peel the garlic clove. Crush them together in a mortar with a pestle, adding the sugar. Peel and seed the lime and mash the pulp in the mortar with the garlic and chili pepper. Add vinegar and water to the pulp and mix well. Add the fish sauce last. Serve over cleaned and chopped limu.

GAMET (PICKLED NORI)

Gamet is the Filipino name for limu pahe'e, or nori, and this method of preparation has been imported from the Philippine Islands. The fermented fish sauce, bagoong, makes this a very odoriferous combination and calls for an acquired taste.

Gamet (nori or fresh limu pahe'e)
Tomatoes
Cider vinegar
Bagoong

After washing the limu, hold the pieces tightly together and slice into thin sections. Chop the tomatoes, add to the limu. Make a mixture of one part vinegar to three parts bagoong and combine with the vegetables. Serve chilled as a salad or pickle.

LIMU-ONION RELISH

1 lb. limu manauea (ogo) or limu wāwae'iole
1 Maui onion, chopped

Marinade

1/2 C sugar
1/2 t salt
1/2 C Japanese vinegar
1/2 t MSG (optional)

Break the ogo into small pieces, then wilt with hot water. Do not wilt limu wāwae'iole. Mix with onion. Combine the marinade ingredients, and pour over the onions and seaweed. Serve chilled.

PICKLED SEA LETTUCE

Pickled Ulva is somewhat tough and must be chewed well. It is best served with other Hawaiian dishes such as poi and broiled fish.

1/2 lb. sea lettuce

Sauce

1/4 C shoyu
4 T lemon juice
1 T sugar
1 piece ginger, minced
1/4 t MSG (optional)

Wash and clean the sea lettuce, chop into fine strips. Combine the sauce ingredients and mix with the sea lettuce. Marinate for at least half an hour. Serve as a salad garnish with sliced tomatoes and onions.

TERIYAKI-STYLE LIMU WĀWAE'IOLE

1/2 lb. limu wāwae'iole
3/4 C prepared teriyaki sauce
1-1/2 T sesame seeds
1/2 C green onion, chopped

Wash and clean the limu in fresh water, drain well. Chop into 2-inch lengths. Mix with teriyaki sauce, sesame seeds, and green onion. Serve immediately.

Salads and Salad Dressings

Most limu are excellent salad vegetables. The following recipes for hot, cold, and gelled salads use ten different kinds of limu. The first three recipes are particularly good.

OGO-CUCUMBER SALAD

1 lb. ogo (limu manauea)
1 C Hawaiian rock salt
2 medium cucumbers, peeled and thinly sliced
1 small Maui onion, sliced in rings
8 C water
1/4 C cider or tarragon vinegar
1 pint dairy sour cream
1 T shoyu
Salt and pepper to taste

Cut the ogo into 6-inch pieces. In a large mixing bowl make a very concentrated saltwater solution with the rock salt, then add the cucumbers, onions, and ogo. Let stand for 4 hours. Drain and gently squeeze the water out, then place the vegetables in another bowl. Mix the other ingredients and pour over the wilted vegetables. Combine well. Chill and serve.

Sliced fresh mushrooms and bean sprouts may be substituted.

POKPOKLO SALAD

4 C pokpoklo (limu wāwae'iole)
1/2 Maui onion, sliced
1 medium tomato, sliced

Dressing

1/4 C shoyu
2 t wine vinegar
2 t sugar
1/4 C sherry or other wine
1 t black pepper
MSG (optional)

Wash the limu well, rinse in fresh water. Chop only if serving immediately (the cut sections wilt faster than the whole pieces). Combine with onions in a bowl. Pour the dressing over the limu and onions, toss. Arrange tomato slices on top. Chill and serve.

LIMU PAHE'E-ONION SALAD

2 C fresh limu pahe'e
1 medium Maui onion, chopped
Italian salad dressing

Wash and drain the limu, salt lightly. Toss with the onion. Serve chilled with an Italian salad dressing.

FOUR LIMU SALAD

2 C limu wāwae'iole
1 C limu huluhuluwaena
2 C limu manauea (ogo)
1/2 C limu pe'epe'e
1/2 C cider vinegar
3 T shoyu
1 t sugar
1/2 t salt
1 clove garlic, minced
1/2 t ginger, finely grated

Clean and wash the limu, wilt if desired. Drain well, then chop to a uniform size--about 1 inch. Transfer the limu to a mixing bowl. Combine the remaining ingredients and pour over the limu. Marinate for a few hours before serving. If you prefer crisp limu wāwae'iole, chop and add to the marinating salad just before serving (if allowed to sit it will become limp). This salad may be served with fish and poi.

ONION-'ELE'ELE-GARBANZO SALAD

1 C dry garbanzo beans
1 C limu 'ele'ele, finely chopped
1 medium Maui onion, chopped

Marinade

1/2 C olive or salad oil
1/3 C cider vinegar
3/4 t pepper
1/2 t salt

Cook the garbanzo beans as directed on package. Drain, cool. Combine with limu and onions. Prepare the marinade and pour over the beans, onion, and limu. Toss thoroughly, breaking up the mats of limu 'ele'ele. Serve chilled as a main salad.

ARARUCIP SALAD

This is a typical Filipino-style salad using ararucip, (Caulerpa racemosa).

1 quart ararucip
2 medium tomatoes, chopped
1 round onion, sliced
1/2 C cider vinegar
1/2 t paprika
Salt and pepper to taste

Clean the ararucip well, removing the small grains of sand that persist in the fine "roots." Rinse and drain. Chop into 2-inch sections. Add the tomatoes and onion, toss with the vinegar and seasonings. Serve chilled.

MISO-LIMU SALAD

Miso, fermented soybean paste, is a Japanese food that is popular with islanders. It combines well with both land and sea vegetables.

2 C limu manauea (ogo) or limu huluhuluwaena

Miso Sauce

1 T sesame seeds, roasted and ground
3 T sugar
3 T miso
3 T shoyu
Dash of MSG (optional)

Prepare the limu by wilting with hot water. Cut into 2-inch sections, drain well, and place in medium sized bowl. Combine the remaining ingredients and mix with the limu. Serve chilled. Combinations of cooked vegetables such as spinach, string beans, carrots, or bean sprouts can be substituted for the limu.

LIMU MANEONEO SALAD

Several species of Laurencia has earned the name of "chili pepper limu" because of their distinct peppery flavor. Although most often used sparingly as a spice, this limu also makes a very spicy salad topped with miso sauce.

2 C cleaned limu maneoneo
1/2 C miso sauce

Break the limu into small pieces. Top with miso sauce (see "Miso-Limu Salad" recipe). Serve chilled.

LIMU HULUHULUWAENA SALAD

2 C fresh limu huluhuluwaena
1 large tomato, chopped
1 large Maui onion, chopped
1/8 C shoyu
1/4 C cider vinegar
Salad oil
Salt and pepper to taste

Soak the limu overnight, clean, and chop into 2-inch sections. Mix the tomato and onion together with the limu. Mix the shoyu and vinegar and toss with the salad. Add a little salad oil. Season.

LIMU DELIGHT (OGO)

Fresh limu manauea (ogo)
6 radishes, grated
1 lb. creamed cottage cheese
4 tomatoes (or ripe mangoes), sliced
Green onions, chopped
Salt and pepper to taste
Mayonnaise (optional)

Clean the fresh limu thoroughly, chop very fine, salt to taste. Mix radishes with creamed cottage cheese. Form into round balls. Place chopped limu on platter as you would lettuce. Place cottage cheese balls on top of the limu, lay slices of fresh tomatoes around, and garnish with green onions. Add salt and pepper, and mayonnaise if desired.

GULAMON SALAD

In the Philippine Islands ogo is called gulamon. This recipe is in simple Filipino style.

3 C gulamon (ogo)
3 C boiling water
4 egg tomatoes
1 t salt

Clean and wash the gulamon, then wilt with hot water until it turns green. Rinse immediately with cold water. Drain well, then chop to desired size. Mash the tomatoes and combine with gulamon and salt. Serve chilled.

LIMU HULUHULUWAENA-GRAPEFRUIT SALAD

1 C fresh limu huluhuluwaena
1 grapefruit, peeled, sectioned, and seeded
3 T cider vinegar
1/2 t salt
1 t sugar

Wash and chop the limu into 2 to 3-inch sections. Cut the grapefruit into bite-sized pieces, and mix with the limu. Combine vinegar, salt, and sugar; add to limu and grapefruit and stir. Serve chilled.

LIMU PE'EPE'E SALAD

Limu pe'epe'e has a distinctive taste which forgoes the need for spices or seasonings in the dressing. Because its aroma is very strong, this salad should be kept in a tightly capped jar.

2 C limu pe'epe'e
Juice of 2 lemons
1/4 t MSG (optional)

Clean the limu well, discarding all sections covered with coralline algae and 'ōpala. Wash with fresh water, then wilt with hot water. Drain well, patting dry with paper towel. Combine the remaining ingredients and toss with the limu. Salt to taste. Serve chilled as a salad or appetizer.

PHILIPPINE-STYLE LIMU PE'EPE'E SALAD

1 C limu pe'epe'e
1 large ripe tomato
Salt and pepper to taste

Clean the limu well, wash with fresh water. Pour hot--not boiling--water over the limu to soften the stiff pieces, then rinse and drain. Chop the tomato and remove the liquid. Transfer the drained tomato to a bowl, add the limu, and mash together. Add seasoning. Serve chilled as a salad or side dish.

WILTED SEA LETTUCE SALAD

2 C (packed) limu pālahalaha
2 slices bacon
1/2 C wine vinegar
Salt and pepper to taste

Clean and wash the limu, chop into bite-sized pieces, and set aside to drain. Fry the bacon in a large skillet, remove the crisp pieces. Add the limu and stir-fry in the bacon grease until the color changes. Gently toss the salad with the vinegar, then crush the bacon and sprinkle on top. Season and serve hot.

LIMU APPETIZER (OGO)

Serve this combination of cottage cheese, vegetables, and limu as a salad or appetizer.

1-1/2 lbs. fresh limu manauea (ogo)
1 lb. large curd cottage cheese
1/2 C daikon or red radish, finely grated
2 T scallions or green onions, minced
2 t shoyu
Salt and freshly ground pepper to taste
Ripe mango slices

Rinse the limu several times with tepid water and drain. Chop into fine shreds with a very sharp knife and salt lightly. Combine thoroughly with the cottage cheese, daikon, scallions, shoyu, and seasonings. Form into compact walnut-sized balls and chill for 1 hour. Serve on a chilled plate surrounded by mango slices. Yield: 4 to 6 servings.

TOMATO VEGETABLE LIMU ASPIC

An aspic is a salad mold usually made with a reduced chicken or veal stock, or with fruit or vegetable juice. Common gelling agents are naturally found in the meat stock, prepared gelatin; or agar flakes. This vegetable aspic depends on the carrageenan gel extracted from limu 'aki'aki (Ahnfeltia sp.). Although the extraction is usually done chemically in a laboratory, this limu produces a high quality gel by a simple cooking process. In addition to the carrageenan, the limu imparts an interesting ocean flavor to this tomato-based salad.

Extracting the gel

Take 1 pound fresh limu 'aki'aki, rinse with fresh water, place in a large saucepan, and cover with water. Bring to a boil, stirring occasionally to prevent sticking. Lower the heat and simmer for 30 to 45 minutes. The limu will soften and begin to break into short, mushy pieces. The sauce should have the consistency of a thick, velvety paste. Strain the sauce to remove remaining pieces of limu. A large tea strainer or fine-sieved collander works well. Set aside 1 cup of this gel. Store the remainder in the refrigerator.

Salad

3 medium tomatoes, chopped
1 C limu gel (method given above)
1/2 t salt
1 small piece bay leaf
1 whole clove
1 t celery salt
1/2 t black pepper
2 chicken bouillon cubes
1 Maui onion, minced
1 cucumber, diced small
2 stalks celery, diced
1 bell pepper, minced
3 T fresh lemon juice
1 T shoyu
1 C limu manauea (ogo) or limu huluhuluwaena, chopped and salted

Blend or mash the tomatoes as finely as possible. (You may substitute 2 cups of tomato juice for the fresh tomatoes.) Combine the juice with the limu gel in a small saucepan, mix well, then add the salt, bay leaf, clove, celery salt, black pepper, and the bouillon cubes. Simmer gently for 20 minutes, then remove from heat. Pour the tomato mixture into a 1-1/2 quart bowl or gelatin mold. Add the vegetables, lemon juice, and shoyu. Mix well. Chill for at least 2 hours. Remove from mold and serve on a bed of ogo. Garnish with parsley. Yield: 6 servings.

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.

FOUR BEAN VEGETABLE-LIMU SALAD

1 medium can yellow wax beans
1 medium can lima beans
1 medium can green beans
1 can garbanzo beans
3-4 carrots, coarsely shredded
2 stalks celery, chopped
1 large onion, chopped fine
1 pkg. limu manauea (ogo), or
  2 C limu huluhuluwaena, cut into 2-inch pieces or
  3 C limu wāwae'iole
1 medium bell pepper, chopped (optional)

Dressing

1 C cider vinegar
1 C salad oil
2 t dry mustard
2 T parsley or limu pālahalaha, chopped
3/4 C sugar
1 t salt
1 t pepper
1 t tarragon, crumbled

After draining, combine the beans in a large bowl with the rest of the vegetables. Make the dressing, shake well, and pour over the salad. Refrigerate for at least 12 hours

Soups

Sea vegetables are excellent in soups; they add both flavor to and thicken a broth. Limu pahe'e, or nori, is particularly good in a pork or chicken soup.

CHICKEN SOUP WITH OGO

1/2 lb. ogo (limu manauea)
1 C chicken meat
4 C chicken stock
2 dried mushrooms or
6 large fresh mushrooms, sliced
1 thumb-sized piece ginger root, thinly sliced
1 t salt
1 C green onion, chopped
1 squash, cubed
1/2 t MSG (optional)

Clean and wash the ogo, cut into 4 to 5-inch sections. Place in serving bowls and set aside. In a medium saucepan, boil the chicken in the stock for 5 minutes, then add the mushrooms, ginger, squash, and spices. Simmer for 10 minutes. To serve, pour the very hot soup over the ogo. Garnish with green onions. This soup may be made with ground pork instead of chicken.

LIMU PAHE'E PORK SOUP

1/2 C fresh limu pahe'e or
4 sheets musubi nori
6 C water
1/2 lb. pork belly, sliced
1 can water chestnuts
1 lb. pork hash
1 thumb-sized piece ginger, minced
1 small pkg. sin choy (salted mustard cabbage), sliced
Salt and pepper to taste

Bring the water to a boil in a 2-quart saucepan. Add the pork belly and simmer for 15 minutes. Slice the water chestnuts and add to the water. Form the pork hash into small, tight balls, and add to the soup stock. Add the ginger and sin choy. Simmer for another 15 minutes. If using nori, tear the sheets into small pieces and add to the soup 5 minutes before serving. Season. Serve hot with rice.

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.

MISO SOUP WITH LIMU

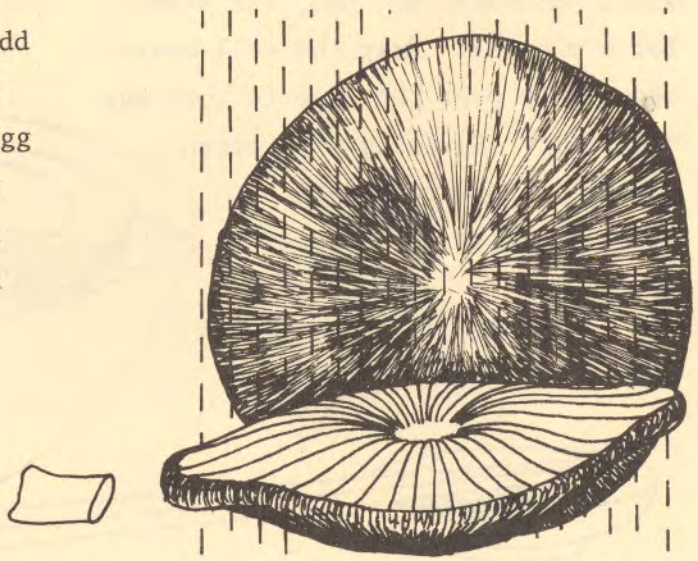
1/4 C limu 'ele'ele or
2 T limu kohu or limu lipoa
1/4 C dried shrimp
5 C water
1/4 C miso, dissolved in 2 T water
1 egg, beaten
Green onions

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.

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 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 PAHE'E SOUP

This is one version of an oriental-style soup. Limu pahe'e is available only during rough water in the winter; at other times the Japanese nori is an acceptable substitute.

1/2 C fresh limu pahe'e, washed and chopped or 4 sheets musubi nori
1/2 lb. fresh ground pork
1/4 C water chestnuts, chopped
1 egg, beaten
1 green onion, chopped
1/2 t MSG (optional)

Brown the ground pork and drain the fat. Transfer to a medium-sized saucepan, cover with water, and simmer for 15 to 20 minutes, then add 3 to 4 cups water and bring to a boil. Reduce heat and simmer. Add the limu pahe'e. If using nori, fry or fan lightly over an open flame to dry, and crumble into soup. Add the water chestnuts and MSG, and simmer for 5 minutes. Drip the well-beaten egg slowly over the soup to form egg "flowers." Sprinkle with green onions. Spoon out immediately. Yield: 6 servings.

SAIMIN WITH LIMU

Saimin, a simple oriental noodle soup, becomes a complete meal with the addition of garnishes--chopped green onions, sliced fish cake, char siu, cooked shrimp, hard-boiled egg slices, etc. A more flavorful combination can be achieved with the addition of a variety of limu.

Package of saimin

Prepare the saimin according to directions on package. Top with one or more of the following:

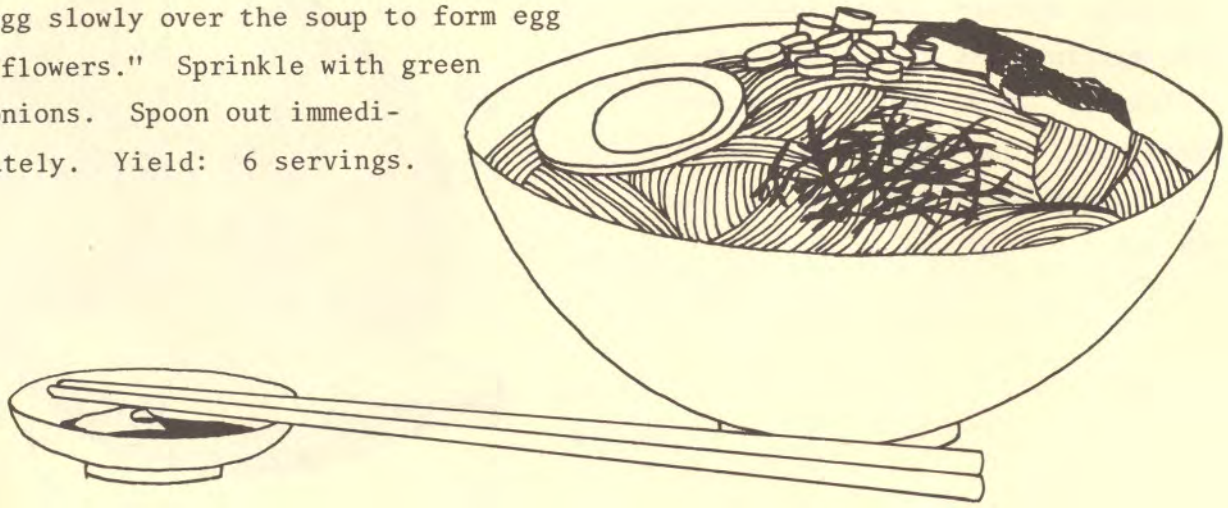
Salted prepared limu kohu

Chopped salted ogo

Salted limu pālahalaha (Ulva) cut into thin strips

Salted prepared limu lipoa

Prepared limu 'ele'ele



SEAWEED SOUP
(NORI OR LIMU PAHE'E)

This clear soup--suimono--calls for dashi as the stock. You can either make your own with the recipe below or use small packages of dehydrated dashi-no-moto sold in the oriental food section of supermarkets.

Konbu (Laminaria japonica), a Japanese kelp, is an essential ingredient in this culinary stock. The other vital ingredient is katsuobushi, oven-dried bonito fish which has been allowed to develop a greenish mildew to increase its flavor prior to shredding.

Dashi

1 sq. inch piece dried konbu
5 C water
1/2 C shredded katsuobushi
1/8 t MSG (optional)

In a saucepan, bring the konbu and water to a boil. Remove konbu. Add the shredded katsuobushi to the water and bring to a boil again. Add the MSG, remove the saucepan from the heat, and strain at once using the liquid as the dashi stock.

Soup

1-1/2 C limu pahe'e or
1 pkg. (10 sheets) sushi nori
5 C dashi
1/3 C canned abalone, thinly sliced
1 t shoyu
1/2 t MSG
1 T green onions, minced

Rinse the fresh limu 2 or 3 times in tepid water, to remove the grit, sand, and 'ōpala. Squeeze out the water, then slice into thin strips or slivers. If using the dried nori, cut the sheets into narrow strips or tear into small pieces. Heat the dashi in a saucepan over a high flame, add the abalone, and boil for 2 minutes, then add the seaweed. Continue to boil for 5 minutes more, then stir in the shoyu and MSG. Garnish with green onions. Serve at once. Yield: 4 servings.

Main Dishes

Limu combines well with meat, fish, and eggs in the following recipes. In these main dishes the limu is used not so much as a major ingredient as it is used for flavor, color, and texture.

TUNA-TOFU-LIMU PATTIES

1 C prepared limu huluhuluwaena or limu manauea (ogo), chopped and salted
1/2 C dried or fresh mushrooms, chopped
1 block tofu
1/2 C green or round onion, chopped
4 eggs, beaten
2 cans tuna
1 t salt
3 T shoyu
1/2 t MSG (optional)
1 carrot, grated (optional)

If using dried mushrooms, soak in water, drain, and chop fine. Squeeze the excess water from the tofu and crumble into a large mixing bowl. Add the remaining ingredients and mix thoroughly. Form into patties or drop by small spoonfuls into a well-greased frying pan. Fry until golden brown, turn, and fry the other side. Keep in a warm oven until ready to serve. Yield: 8 to 12 patties.

CRISPY LIMU-TUNA BALLS

1/4 C limu kohu or
1/2 C limu 'ele'ele or
1/2 C limu maneoneo or
1 C limu manauea (ogo), chopped
2 cans tuna, drained
1/2 C condensed chicken consommé
1 egg, beaten
1 small onion, chopped fine
1 C dry bread crumbs
1/4 C parsley or sea lettuce, chopped
1 t poultry seasoning
1 t salt
1 T prepared mustard
Corn flake crumbs
Oil or shortening for deep frying

Combine all ingredients except the corn flake crumbs and oil in a medium-sized bowl, mix well. Shape into small balls and roll in corn flake crumbs. Fry in hot deep fat (375°F) until golden brown--about 5 minutes. Drain on paper towels.

Or, to bake, place in a shallow pan and add approximately 1/2 t oil to each pattie. Bake in a very hot oven (450°F) for 10 minutes or until golden brown.

LIMU-WRAPPED BAKED FISH

Originally ti leaves were used to wrap fish to retain moisture. Here sea lettuce "leaves" keep the fish moist and can be eaten, too.

Fish
Onion juice
Lemon juice
Butter
Large, roundish leaves of limu pālahalaha (about 6 per fish)

Use any fish or piece of fish large enough for baking. If using a whole fish, clean, gut, and scale it. Make a mixture of the onion juice, lemon juice, and butter. Spread liberally over the fish, inside and out. Wrap the fish securely in layers of the limu and tie securely. Place in a baking pan with just a little water and bake at 375°F for 45 minutes or more--until the fish turns white and flakes easily. To serve, place on a platter and gently unfold the limu wrapping, discarding browned or burned sections. Eat the limu dipped in shoyu or lemon juice.

LIMU-STUFFED BAKED FISH

A piece of limu lipoa cooked inside a fish adds a sweet flavor to the meat. Use the wrapping method described in the "Limu-Wrapped Baked Fish" recipe.

6 medium-sized reef fish or 6 fish filets
1/3 C shoyu
6 slices bacon
3 C limu manauea (ogo)
3 t limu lipoa
1 round onion, diced
Large fronds of limu pālahalapa (approximately 6 per fish)

Clean and scale the fish, then coat inside and out with shoyu. Inside of each fish or folded filet, place 1 strip of bacon, 1/2 C of limu manauea, chopped to 3-inch lengths, and 1/2 t of limu lipoa. Sprinkle with diced onion and shoyu. Close the fish, wrapping tightly with the sheets of limu pālahalaha. Tie securely. Bake at 350°F for 30 minutes, or 45 minutes over charcoal. Serve open on a platter with shoyu.

MEAT STEW AND LIMU

The most popular use for limu 'ele'ele is with a meat stew. Islanders like to place a bit of the salted limu on top of a bowl of stew and rice.

Prepared limu 'ele'ele
Cooking oil
1 clove garlic, minced
1 lb. stew beef cut in 1-inch chunks
6 C water
1 can tomato paste
1 bay leaf
3 stalks celery
2 large onions
3 carrots
3 boiling potatoes or 1 taro
Salt and pepper to taste

Heat the oil in a heavy frying pan or Dutch oven. Add the garlic and stew beef. Brown the meat. Mix the water and tomato paste and add with bay leaf to the meat. Cut the celery, onion, carrots, and potatoes or taro to stew size; add to pan, and simmer for 45 to 55 minutes. Season with salt and pepper. Place a tablespoon of prepared limu 'ele'ele on top of individual servings.

MEAT STEW AND LIMU LEPE 'ULA'ULA

When cooked, limu lepe 'ula'ula releases a gelatin that thickens a soup or broth. Add it to a meat stew in the last few moments of cooking instead of customary thickeners such as flour or cornstarch. The limu adds an interesting flavor to the meat. Any stew recipe may be used.

LIMU OMELET

Sea vegetables add a new dimension to omelets. One or more of the following fillings can be added to the eggs during the last few moments of cooking.

I

Sour cream
Maui onion, chopped
Limu 'ele'ele

II

Pickled ogo
Onion, chopped and sauteed briefly

III

Limu pahe'e, fried with bacon

IV

Limu kohu
Grated cheddar cheese

LIMU MEATBALLS

1 C ogo, finely chopped
2 eggs, slightly beaten
1 C milk
1/2 C dry bread crumbs
3 T butter
1/2 C onion, finely chopped
1 lb. ground chuck
1/4 lb. ground pork
1-3/4 t salt
3/4 t dill weed
1/4 t allspice
1/8 t nutmeg
1/8 t cardamon
3 T flour
1/8 t pepper
1 10-1/2 oz. can beef broth
1/2 C light cream

In a large bowl, combine the eggs, milk, and dry bread crumbs. In a large skillet, heat 1 T of the butter. Sauté onions until soft (5 minutes), lift out with slotted spoon. Add to bread crumb mixture, along with ogo, ground chuck, ground pork, 1-1/2 t of the salt, 1/4 t of the dill weed, allspice, nutmeg, and cardamon. With a wooden spoon or your hands, mix well to combine. Cover and refrigerate for 1 hour.

Shape meat mixture into meatballs, each about 1 inch in diameter. In remaining 2 T of hot butter, sauté meatballs in a skillet, about half at a time, until browned all over. Remove the meatballs and place in a 2-quart casserole dish.

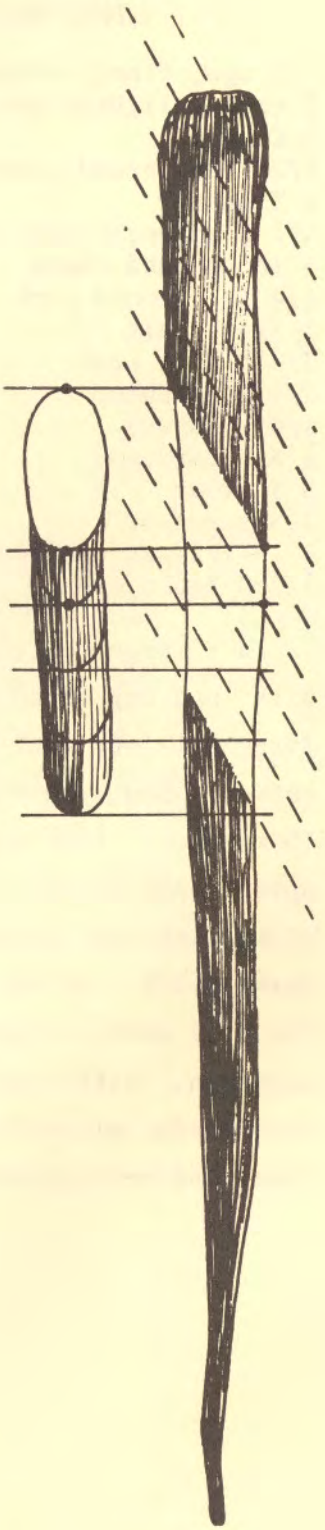
Remove skillet from the heat and pour out the drippings. Measure 2 T drippings, adding more butter if necessary and pour back into skillet. Add flour, the remaining 1/4 t salt, and the pepper, stirring until smooth. Gradually stir in beef broth and bring mixture to a boil, stirring constantly. Add remaining 1/2 t dill weed and the cream. Pour over meatballs in the casserole dish. Cover and bake for 30 minutes in 325°F oven. Garnish top of meatballs with fresh dill sprigs if desired.

LIMU NIKU GOBO

1 lb. ogo
1/2 lb. gobo (about 2 roots)
1 lemon, sliced
4 C water
3 T cooking oil
1 lb. top sirloin, thinly sliced or teriyaki meat, sliced
1 T ginger, minced
1 T sugar
1 t salt
1/3 C shoyu
1 t MSG (optional)

Clean and drain the ogo; do not cut. Set aside. Scrape the gobo skin and cut into slanted ovals 1/8-inch thick. Parboil the gobo and lemon slices in 4 C of water in a saucepan for 10 minutes. Drain and remove the lemon slices.

Heat the cooking oil in a large, heavy skillet. When hot, add the meat and gobo and sauté for 5 minutes. In a separate bowl combine the ginger, sugar, salt, shoyu, and MSG, then slowly add to the meat and gobo, stirring well. Cover the skillet, reduce the heat, and simmer for 15 minutes until the flavors are well blended. Add the ogo, tossing gently until the limu wilts and turns green. Remove from heat and let stand for a few moments before serving.



LIMU TOFU TEMPURA

1 C limu, finely chopped (use salad type limu)
1 block tofu
2 T sesame seeds, toasted
1/2 C carrots, finely chopped
1/3 C green beans, finely chopped
3 shrimps, cooked and chopped
2 t salt
3 eggs, beaten
4 t brown sugar
Oil for deep frying
1/4 C green onion (optional)
1/4 C limu 'ele'ele, chopped (optional--for color and flavor)
Ogo (optional)

Place the tofu in a muslin cloth and squeeze to remove excess water. Grind the sesame seeds, then add the tofu and the remaining ingredients except the oil; mix well. The consistency should be of a thick paste. Heat the oil to 375°F and drop the tofu mixture by teaspoonfuls into the deep fryer, cooking until golden brown. Remove, drain on paper towels. Place hot atop a bed of chopped ogo. Serve with a mustard-shoyu dip.

STUFFED LAVER FRONDS

The late Euell Gibbons created this recipe for the laver or Porphyra of the temperate Pacific coast. Our local Porphyra species, limu pahe'e, is much too small to be used in this manner, but the dried sheets of Japanese nori are well suited as wrappers for this rice-meat filling.

Dried Porphyra (nori) sheets
2 C cooked rice
1/4 lb. ground beef
1/4 lb. fresh mushrooms, chopped
1 medium onion, chopped
Shoyu to taste
1 t MSG (optional)

Combine all ingredients except the limu. Season to taste. Moisten the seaweed sheets, placing about 3 T of the filling on each sheet. Roll tightly, place in steamer with sufficient water. Steam for 50 minutes. Serve as an appetizer or with sauce as a main dish.

Miscellaneous

Recipes for seasoning salts, drinks, and candy are given in this section. Oriental side dishes--fried rice, tempura, and sushi--are also included.

LIMU TEMPURA

Many different kinds of limu can be cooked in this style, including limu manauea (ogo), limu huna, limu huluhuluwaena, 'opihi limu, limu kala, and sea lettuce.

1 lb. limu
1 C flour
1/2 t sugar
1 t salt
1 T shoyu
1 egg
3/4 C milk
Dash of MSG
Oil for deep frying

Clean the limu and drain well. Mix the other ingredients except the oil into a thin batter. With a fork or salad tongs, pick a suitable piece of limu, dip into the batter and coat thoroughly. Transfer to the hot oil (approximately 375°F) and deep fry until golden brown. Drain excess oil on paper towels. Serve hot as an appetizer or side dish with shoyu and Chinese mustard.

SEA LETTUCE SEASONING SALT

The Ulva lactuca of temperate coasts is often dried and powdered as a seasoning salt. Our tropical representative works equally well prepared in this manner.

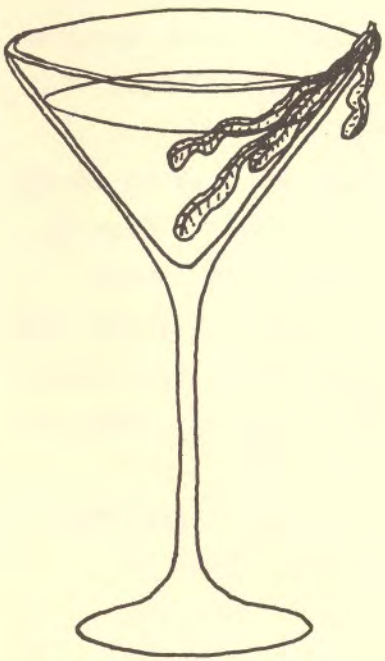
Sea lettuce (limu pālahalaha)

Wash the plants, pat dry with towel and arrange in single layers on cookie sheets. Dry in sun or in (150°F) oven. This usually takes the whole day. The sea lettuce shrinks, darkens, and becomes brittle when completely dry. Crush to a fine powder with a rolling pin or grind in a food mill. The powder resembles fine black pepper. Store in a dry place. Serve on salads, fish, and soup.

CANDIED OGO

2 C brown sugar
1 C water
1/2 C sesame seeds
1/4 t sesame seed oil
1 t vanilla extract
4 C ogo, chopped into 4-inch pieces

Boil the sugar, water, sesame seeds, and oil until it forms a thick syrup. Continue cooking at 270° to 290°F until it reaches the soft-crack stage. Remove from heat. Add the vanilla and ogo, stirring constantly. Pour onto a greased, shallow baking pan and spread in a thin layer. Let cool, then set in sun to dry for a few hours. Cut into one-inch squares and store in freezer.



OGO-VEGETABLE SMOOTHIE

Water
1 small carrot, sliced for blending
1 small cucumber
2 small tomatoes
1 C fresh ogo, chopped
1/2 t salt
Dash of pepper
Juice of 1/2 lemon
4 T vinegar
1 T sugar
1/2 t hot pepper sauce (optional)

Blend or osterize the vegetables and ogo in as little water as possible. Add the remaining ingredients, blend well. Season to taste. Serve chilled. Yield: 2 servings.

MARTINI WITH LIMU "OLIVE"

Gin
Vermouth
Prepared limu lipoa

In a martini pitcher pour in one ounce of vermouth, then fill with gin and crushed ice. Shake well, pour into glasses. Garnish with a piece of limu lipoa in place of the usual olive.

NORI MAKI SUSHI

Sushi is a Japanese food consisting of cooked rice combined with prepared seafood and vegetables. Sushi maki is the rice and fillings rolled in sheets of the nori (seaweed).

The nori sheets used to make sushi rolls are made from a seaweed cultivated in Japan. It is easy to make your own sushi sheets, however, with either limu 'ele'ele or limu pahe'e.

The following explains how to prepare the rice and fillings and how to roll the sushi.

Sushi meshi (vinegar rice)--enough for 10 sushi rolls

4 C rice (pearl or short-grain)
4 C water
6-inch piece of dashi konbu (Japanese dried kelp)
1/3 C rice vinegar
6 T sugar
1 T salt
2 t MSG (optional)

Wash the rice well. Wipe the dried salt off the konbu and add to 4 C of water in a saucepan. Bring to a boil. After 3 minutes remove the konbu and add the rice. Mix well, cover, and bring to a boil. Reduce the heat and let steam for 20 minutes. Remove from heat and let stand for 10 minutes. Transfer rice to a large pan.

Heat the rest of the ingredients until the salt and sugar have dissolved. Cool, then carefully fold into the rice, keeping the rice grains whole. The rice should be somewhat sticky.

Gu (sushi fillings)

1 pkg. nori (10 sheets)
1 2-oz. pkg. kanpyo (dried gourd)
1 2-oz. pkg. shiitake (dried mushroom)
2 medium carrots
10 stalks watercress
1 can unagi (broiled eel) or Hawaiian tuna
Hana ebi (colored powdered shrimp)
1/2 C pickled ogo
1/4 C limu 'ele'ele, chopped and salted
1/4 C tsukudani

Kanpyo. Wash and cook in water until soft. Add enough stock to cover and cook until tender. Drain. Add 4 T sugar, 3 T shoyu, 2 t salt, and 1 t MSG (optional), and continue cooking for another 10 minutes. Cut into 8-inch lengths.

Shiitake. Wash and soak in enough water to cover until soft. Cook in the same water until very tender. Drain. Add 3 T sugar, 4 T shoyu, and 1/2 t MSG (optional), and cook until the sauce is well absorbed. Cut into 1/4-inch strips.

Carrots. Cut carrots lengthwise into 1/4-inch strips. Cook in 1 C water for 7 to 10 minutes.

Drain. Add 2 T sugar, 1 t salt, and 1/2 t MSG (optional), and cook for 5 minutes.

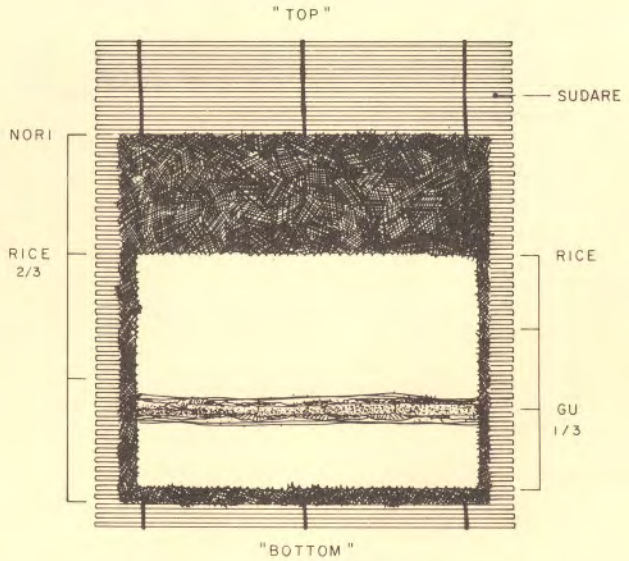
Watercress. Clean and boil for 2 minutes in salted water. Drain and squeeze out water. Cut into 8-inch lengths.

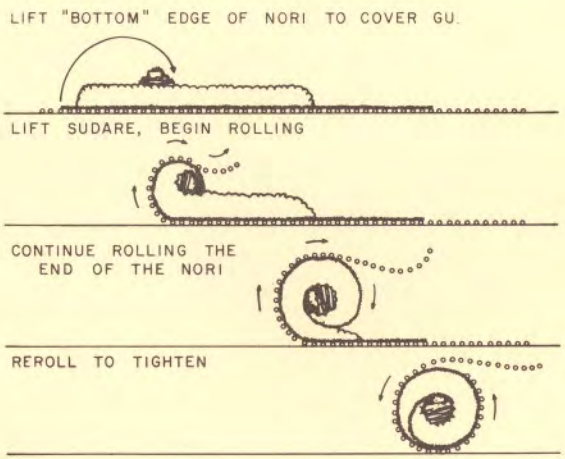
Hawaiian tuna. Cook in saucepan with 3 T sugar and 4 T shoyu until sauce is dissolved.

Method of rolling sushi

Place a sheet of nori on the bamboo mat (sudare) about 3/4 to 1 inch from the bottom edge. Spread a layer of sushi rice over the bottom 2/3 of the nori to a desired thickness (about 1/2-inch). Arrange combinations of the filling on the rice about 1/3 inside from the front edge (some people prefer to place the fillings in the middle of the rice layer). Lift the bottom edge of the mat, keeping ingredients in place with your fingers. When the edge of the sudare touches the rice, lift the sudare and finish rolling while applying slight pressure. Roll to the end of the mat. Reroll sushi with the sudare using slight pressure to tighten the roll, then, with fingers, press in loose rice at each end of the roll.

To serve, cut in half and then into quarters. Arrange on a plate, cut side up.



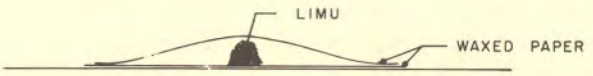


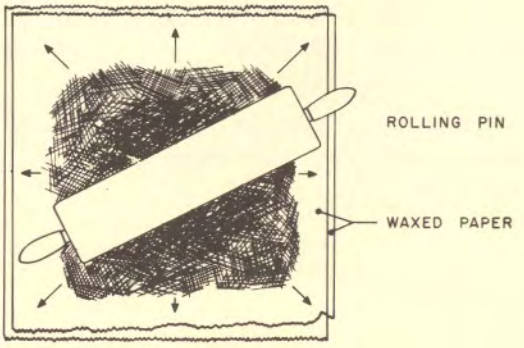
DRIED LIMU SHEETS

It is possible to make thin sheets of dried seaweed much like the commercial nori used for sushi rolls and rice balls. Three Hawaiian seaweeds can be used, either individually or mixed: limu 'ele'ele, sea lettuce, and the local nori--limu pahe'e. The three can be mixed in any combination, although the sea lettuce, if used exclusively, is slightly tough and bitter. Because making nori sheets is a tedious and time-consuming process, it is worthwhile only if a pound or more of seaweed is available.

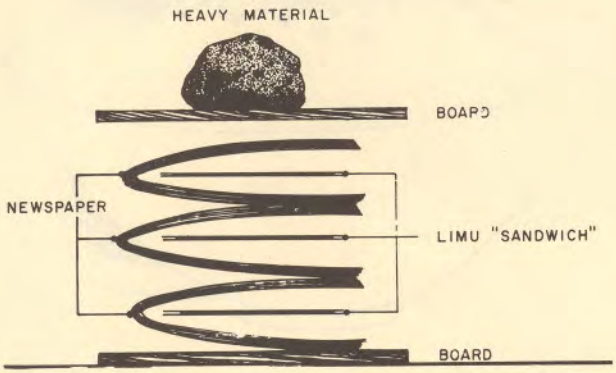
Fresh or frozen limu (mixed or single varieties)

Clean and rinse the limu. In half-pound increments, put into blender, cover with water, and blend at medium speed until fine. Strain the mixture through muslin and squeeze out all excess water. If desired, season lightly with shoyu or salt, mixing well. Then remove a golf ball-sized piece of the limu, placing it between two large pieces of waxed paper. With a rolling pin, roll out very thin sheets. Work the limu around to create and even sheet without holes. If a piece of sand or 'ōpala appears, remove it and rework the thickness. Take this limu "sandwich" and set it between newspapers--at least 20 pages on each side. Repeat the process with the rest of the limu.





Stack these units, place a flat board on the top and bottom, and place a heavy weight on top. Set in a warm, dry place. Change the papers daily. In about 5 days the limu should be completely dry. Extract the waxed paper layers from the stack and lay on a flat surface. Very carefully, peel off the top layer of waxed paper. Then slowly remove the limu sheet from the bottom waxed paper. A spatula helps to prevent tearing. Trim the sheet to sushi nori size (8" x 8") and store in a dry place. The trimmed edges can be shredded, salted, and mixed with sesame seeds to make a Hawaiian version of furikake nori, or rice condiment. Use the limu sheet as you would the sushi nori.



CHINESE FRIED RICE

1 C limu manauea (ogo) or
1 C limu huluhuluwaena or
1/4 C limu kohu or
1/4 C limu 'ele'ele, chopped
1/2 lb. ground pork
1 small piece ginger, sliced
1 clove garlic, minced
2 medium carrots
1/4 lb. green beans
2 stalks celery
1/2 C green onions, chopped
4 C cooked rice
1/4 C shoyu
1 egg
Salt and pepper to taste

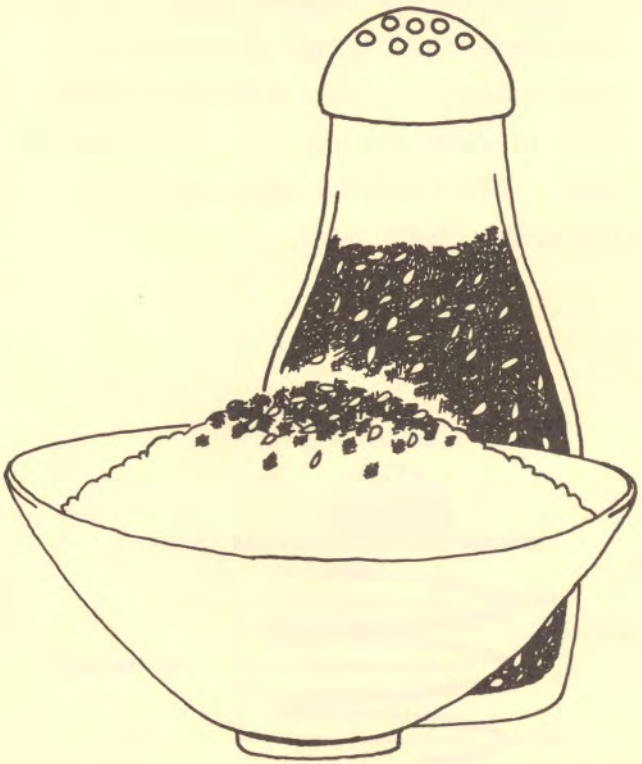
In a large skillet fry the pork with the ginger and garlic. Slice all vegetables Chinese style--thin and long--then add to the pork. Stir-fry until cooked but still crispy. Add the limu and rice, mix thoroughly in pan with vegetables. Cook for 5 to 10 minutes over low heat. Sprinkle with shoyu. Just before,serving, scramble the egg in a cup and pour over the rice, tossing until the egg is cooked. Season with salt and pepper.

LIMU 'ELE'ELE SEASONING SALT

The Japanese have a rice condiment called "awo-nori" or "ohasi-nori," which is made from dried Enteromorpha. Small jars of these are sold in the Japanese food section of supermarkets. The local species of Enteromorpha, limu 'ele'ele, combined with sesame seeds and salt, can be used to create a similar condiment. The limu shrinks tremendously when it dries, however; one packed quart of the fresh limu yields only about one-third cup of the powder.

Fresh limu 'ele'ele (at least 1 quart)
Salt to taste
Sesame seeds

Wash and clean the limu well. Spread on a screen or pan and dry in full sun for about 3 to 4 hours. Complete the drying in a warm oven (150°F). When completely dried, it should be brittle and very dark. Powder the limu by crushing, or grinding in a food mill. Add salt and combine it with an equal amount of white sesame seeds. Dried and shredded nori can also be added. Serve sprinkled over hot rice.



Appendices

Appendix A. Nomenclature

Both Hawaiian and scientific languages have a binomial, or two-word, system of naming seaweed. The scientific nomenclature consists of a genus and species--distinct taxonomic divisions based on phylogeny, or relationships developed through ancestral history. This scientific nomenclature is eminently useful because it assigns one name to one plant. It has the added advantage of grouping related plants together. The genus, a noun which is capitalized, is followed by a specific, usually descriptive, name in lower case, which distinguishes it from all others of the same genus. This is useful in distinguishing two different types of limu having the same common name, and occasionally it identifies an edible plant by a specific epithet such as "edule" or "deliciosa."

"Limu" is the Hawaiian name analogous to the scientific genus. It is the Hawaiian word for all plants growing in both fresh and salt water, and in the proper sense it includes all algae, mosses, and liverworts (Pukui and Elbert, 1957). Popular use, however, has limited the word to mean just the edible seaweeds. In Hawaiian nomenclature, "limu" is followed by an adjective descriptive of the particular seaweed. The word limu can be contracted to lī- and followed by the proper name. Hence, limu pahapaha and līpahapaha both refer to the seaweed that looks like young taro leaves, or *Ulva*, the sea lettuce.

In contrast with definite scientific nomenclature, the Hawaiian style of naming is ambiguous and repetitious. The Hawaiian practice of naming limu unique to only one or very few localities is an example. One species of limu may have four or more Hawaiian names on each island, and a variation in growth form may add yet another name. Identification is further complicated by the addition of Japanese and Filipino names to the local seaweed species.

The following table gives the scientific, Hawaiian, and other names of some of the limu found in Hawaii. Also included are the meanings for the Hawaiian names.

Scientific Name	Hawaiian Name	Meaning	Other Names
Ahnfeltia concinna	LIMU 'AKI'AKI Limu 'eleau (Maui)	To nibble as a fish; bite, bite --	Pig limu; sea nibbles --
Asparagopsis taxiformis	LIMU KOHU Limu koko (Kauai) Limu lipehe (Kauai) Limu pa'akai	Supreme Dark-red Light-colored Stored with salt	Supreme limu -- -- --
Caulerpa racemosa	None	--	ARARUCIP (Philippines) Sea grapes
Codium edule and *Codium reediae*	LIMU WĀWAE'IOLE Limu 'a'ala'ula Limu 'ala'ula	Rat's feet Red fragrance Red fragrance	Reindeer limu (Hawaii) Frog legs (Maui) POKPOKLO (Philippines) Miru (Japan)
Dictyopteris australis and *Dictyopteris plagiogramma*	LIMU LIPOA	Gathered from the deep	--
Enteromorpha spp.	LIMU 'ELE'ELE Limu huluhulu'īlio Limu pipi-lani (Maui)	Black or dark Dog's hair --	Dark green nori -- --
Eucheuma spinosum	None	--	Guso (Philippines) TAMBALANG (Philippines)
Gracilaria bursapastoris and *Gracilaria coronopifolia*	LIMU MANAUEA	--	OGO (Japan) Gulamon (Philippines)
Grateloupia filicina	LIMU HULUHULUWAENA Limu pakeleawa'a	Pubic hair Slipping from the canoe	Queen limu Chop-chop (Maui)
Grateloupia hawaiiensis	None	--	--
Grateloupia spp., *Polyopes* sp., *Gymnogrongus* sp.	'OPIHI LIMU	--	--
Halymenia formosa	Limu lepeahina LIMU LEPE 'ULA'ULA	Fringe of Hina Red cock's comb	Pele's hair Red sea lettuce Pele's tongue
Hypnea cervicornis	Limu huna	Hidden, concealed	--
Laurencia	LIMU PE'EPE'E LIMU MANEONEO	Hidden --	Tartariptio (Philippines) Layalaya (Philippines) Flower limu Mustard limu Chili pepper limu
Porphyra spp.	LIMU PAHE'E Limu lū'au Limu pahe'ehe'e	Slippery, satiny Young taro tops --	NORI (Japan) Gamet (Philippines) Laver (England)
Sargassum echinocarpum	LIMU KALA Limu honu	To loosen; to forgive Turtle	Holly limu --
Ulva spp.	LIMU PĀLAHALAHA Limu pahapaha Limu pakaiea	Spread out, flattened, broad Young taro leaves Ruffled, heart-shaped leaves	SEA LETTUCE; turtle limu -- --

Note: CAPS indicate the common name(s).
Names in parentheses indicate place of word origin.

Appendix B. Limu and Nutrition

There are many advantages to eating sea vegetables: taste, economy, versatility, and nutrition. Nutrition alone, however, would be a poor reason to include seaweeds in one's diet. The nutritional status of seaweeds in general has been misinterpreted, and too often seaweeds are regarded as a complete health food.

In food value, sea vegetables are as variable as garden vegetables and provide similar food components. The nutritional value of each sea vegetable is as different as its land relatives; one cannot generalize that seaweeds are high in any one component. Their value arises primarily from the mineral salts they provide in available organic form and from a number of important vitamins and trace elements. Most sea vegetables are high in carbohydrates, but it is largely of an indigestible form, similar to the cellulose in celery. Many sea vegetables show a high concentration of Vitamins A and E. Also noteworthy are the elements, such as iodine, iron, magnesium, calcium, phosphorus, zinc, silicon, potassium, and sodium, which seaweeds provide in varying degrees.

Among Hawaiian limu *Porphyra* are very high in protein, while others, such as *Asparagopsis*, *Sargassum*, and *Ulva*, are notably high in iodine. *Codium* provides much iron, and *Gracilaria* has concentrations of manganese and zinc. The nutritional analyses of seaweeds vary with season, sex, and maturity of the plant, and nutrients present in the water.

The following chart is a compilation of nutritional analyses for genera of tropical seaweeds; some are Hawaiian species, some are not. The great variability in nutrient composition is evident here, especially for protein and Vitamin A.

Seaweed	Weight (g)	Calories	Protein (g)	Fat (g)	Carbohydrate (g)	Fiber (g)	Ash (g)	Calcium (mg)	Phosphorus (mg)	Iron (mg)
Ahnfeltia concinna	100	--	5.6	0.07	56.6	--	--	--	--	--
Caulerpa racemosa (raw)	100	8	0.1	0.1	2.1	--	--	29	160	18
Codium tenne (raw)	100	11	1	1.8	1.8	0.1	3.9	63	8	2.1
Codium tonue (raw)	100	11	1.2	0.2	1.8	0.7	0.6	62	8	2.1
Gracilaria confervoidex (raw)	100	48	1.8	0.2	11.5	0.5	2.5	510	1.2	--
Gracilaria verrucosa (dried)	100	--	28.78	--	--	--	--	--	240	40
Laurencia seticulosa (raw)	100	27	0.6	0.6	5.6	0.7	3	351	10	--
Porphyra sp. (dried)	100	235	22.2	1.1	44.3	4.7	15	434	350	28.3
Porphyra tenera (dried)	100	--	35.6	0.7	44.3	--	--	--	--	--
Sargassum siliquastrum (dried)	100	190	15.5	3.6	31.4	1	27.8	320	152	--
Ulva lactuca	100	230	19	0.6	46.7	4.6	13.7	730	230	--
Gracilaria sp. (pickled)	100	11	2.3	0.2	11.5	--	--	510	--	56

*trace elements

Sodium (mg)	Potassium (mg)	Vitamin A (iu)	Thiamine (mcg)	Riboflavin (mcg)	Niacin (mg)	Ascorbic acid (mg)	Source
--	--	--	--	--	--	--	Reed, 1907
--	--	465	10	10	0.2	20	FNRC, 1968
--	--	--	0.01	tr*	0.1	tr	FAO, 1972
--	--	285	0.01	tr	0.1	tr	FNRC, 1968
--	--	--	0	0.03	0.5	0	FAO, 1972
--	--	--	--	--	--	--	Johnston, 1972
--	--	--	tr	0.02	0.1	tr	FAO, 1972
1,294	3,503	--	0.24	1.34	5.5	14	FAO, 1972
--	--	44,500	250	0.24	10	20	Committee on Food Composition, 1960
--	488	--	0.21	0.17	6.5	4	FAO, 1972
--	--	--	0.04	0.52	--	10	FAO, 1972
--	--	260	--	30	0.5	--	School of Public Health, University of Hawaii, 1968

Appendix C. Collecting Sites

The following edible limu can be collected at various sites in Hawaii. The limu are by no means restricted to these given locations nor are they always available.

Ahnfeltia concinna--on almost any lava coastline subject to heavy surf; common everywhere on Maui and Hawaii; uncommon on Oahu and Kauai

Asparagopsis taxiformis--in intertidal and subtidal zones on all islands: Waikiki, Waimanalo, and Hauula on Oahu; Kohala and Kalapana on Hawaii; and Moloaa on Kauai

Caulerpa racemosa--in tide pools or calm water, especially at Sandy Beach and Kaneohe Bay on Oahu

Codium edule--very common on all islands: Waikiki and Diamond Head on Oahu, and Hilo Bay on Hawaii

Codium reediae--in shallow waters off Diamond Head, Waikiki, Mokuleia, and Waimea; washed up at Barbers Point and Ewa Beach on Oahu; in shallow waters off Kihei on Maui

Dictyopteris spp.--in waters off Waikiki, Diamond Head, Waimanalo, Kahuku, Kawela Bay; washed up on Kailua Bay on Oahu and Kihei on Maui

Enteromorpha spp.--common near freshwater intrusions: Kahala and Hauula on Oahu; Kihei on Maui; Hilo Bay, Wailoa Pond (Hilo), Kawaihae, and Ho'okena on Hawaii; Hanapepe and Hanalei on Kauai

Gracilaria coronopifolia--in waters off Kaneohe and Laie; washed up at Ewa Beach and Barbers Point on Oahu and Kihei on Maui

Gracilaria bursapastoris--in waters off Kaneohe and Sand Island on Oahu

Grateloupia filicina--washed up at Ewa Beach, Kailua, and Kaneohe Bay on Oahu; Hilo Bay on Hawaii; Maalaea and Kihei on Maui

Grateloupia hawaiiensis--washed up at Kihei, Maalaea, and Kahului on Maui; in the intertidal zone at Sand Island on Oahu

Halymenia formosa--uncommon on all islands: washed up at Ewa Beach, Barbers Point, Castle Beach, and Kailua on Oahu; Kahului on Maui; Hilo Bay and Kawaihae on Hawaii

Laurencia spp.--common in the intertidal and subtidal zones at Haleiwa, Kaneohe Bay, Kualoa, and Diamond Head on Oahu; Kawaihae and Hilo Bay on Hawaii; Hana on Maui

'Opihi limu--on lava coasts subject to surf: Waimea Bay and Haleiwa on Oahu; Kohala, Keaau, and Ho'okena on Hawaii; Hanapepe on Kauai

Porphyra spp.--rare in the intertidal zone on lava during winter: Kawaihae to Kona, Ho'okena and Keaau on Hawaii; Hana on Maui; Waimea and Maili on Oahu; Papa'a Bay on Kauai

Sargassum echinocarpum--common everywhere, especially at the rocky intertidal zones: in shallow water off Waikiki; in the intertidal zone at Barbers Point on Oahu

Ulva spp.--common on all islands: in the intertidal zone off Waikiki and Diamond Head; washed up at Barbers Point and Ewa Beach on Oahu

Glossary

agar. A gel produced from cell wall of certain red algae, see carrageenan.

'ahi (Hawaiian). Yellowfin tuna. Currently the fish most used for sashimi in Hawaii and one of the more important food fishes for ancient Hawaiians. Can be dried and salted to last for long voyages and stored as long as four years in dry areas. Available fresh or frozen, whole or in portions in most island markets.

ajinomoto (Japanese). Monosodium glutamate (MSG). A highly refined crystalline chemical flavor enhancer made by hydrolysis of petroleum, molasses, or starch with hydrochloric acid. Repeated or heavy ingestion may cause "Chinese restaurant syndrome," burning sensation, headaches, pressure in chest or other discomfort. Use with discretion.

ake (Hawaiian). Raw liver. Often served poke style: chopped raw with onions and seaweed.

aku (Hawaiian). Bonito or skipjack of the tuna family. An important food item of the ancient Hawaiians, used today for sashimi. Available fresh or frozen, whole or in portions in most island markets.

'alae salt (Hawaiian). Rock or sea salt in large crystals, colored orange-red with water-soluble ocherous earth. Found in 1/2 lb. packages in most island markets. Used for salting fish or as table condiment for Hawaiian food. Crushed rock or ice cream salt may be substituted.

ali'i (Hawaiian). Chief, chiefess, king, queen; the royalty in old Hawaii.

apex. The tip or end of a structure.

'aumakua (Hawaiian). Family or personal god whose spirit may rest in an object such as a tree or rock.

benthic. Living or growing on the sea bottom.

calabash. A circular vessel like a deep bowl for food or water or treasures. Made of wood or gourd, usually narrower at the mouth than sides. Sometimes made to hang in a net.

carrageenan. A gel derived from cell wall of certain red algae. Used as a thickening and stabilizing agent in ice cream, jelly, chocolate milk, instant soup, lotions, and medicines. One of the food additives judged safe by most recent studies.

coralline algae. Calcareous red algae, often resembling coral, which plays a large part in building up coral reefs. Often form crusts on surface of other algae.

daikon (Japanese). Mild, white radish, 4 inches in diameter, 18 to 24 inches long. Often pickled (takuwan), or shredded. Available in most island markets.

dashi (Japanese). Basic soup stock or broth made from vegetables or kombu. With dried fish flakes added, dashi becomes a base for other soups including saimin.

dashi-no-moto (Japanese). Instant powdered dashi or basic soup stock. A bouillon cube may be substituted.

diatom. Single-celled or colonial algae in the Chrysophyta or yellow-green division. Usually planktonic or benthic, but also encrusting on subtidal seaweeds. Shell of two overlapping silica plates which form sediments called diatomaceous earth.

ginger. The tuberous root of a ginger plant. Used fresh, sliced, or crushed in many island dishes. Available in most island markets. Dry, powdered ginger may be substituted, but the flavor is more subdued.

gobo (Japanese). Burdock. A long, dark brown tapering root vegetable, 1/2 to one inch in diameter, 18 to 24 inches long. Used boiled, pickled, and slivered in maki sushi and various hekka or "chop suey" type recipes.

goma (Japanese). Sesame seed.

gu (Japanese). Filling for maki sushi.

hana ebi (Japanese). Ebi is shrimp; hana ebi is dried shrimp powder usually dyed red or green. Used in maki sushi. Available in most island markets.

holdfast. The attachment or anchoring of an alga, often rootlike or discoidal in appearance.

holoku (Hawaiian). A loose-seamed dress with a train based on the missionary "mother hubbard."

ho'oponopono (Hawaiian). To correct or rectify, to put to rights; mental cleansing; the old Hawaiian ritual of clearing the air among family members by discussion, examination, and prayer.

i'a maka (Hawaiian). I'a: any food eaten as a relish with a staple including meat, fish, vegetable, or even salt. Limu in various combinations was often eaten as a relish. Maka: raw, as fish; uncooked. I'a maka: raw-fish accompaniment to a meal.

i'a palu (Hawaiian). A relish or appetizer made of the head or stomach of fish along with a kukui relish, garlic, and chili peppers. The term also applies to fish bait made of fish head or stomach often used in chumming.

imu (Hawaiian). An underground oven, usually 3 to 4 feet deep. Used to cook an entire pig by heat from porous stones overlying hot coals. Kālua describes food cooked in this manner; e.g., kālua pig.

'ina (Hawaiian). Young of the sea urchin (wana).

'ina'i (Hawaiian). Accompaniment to poi, usually meat, fish, or vegetable. To serve something as an 'ina'i. Also called i'a as in i'a maka.

'inamona (Hawaiian). Dry relish made of the cooked kukui (candlenut) nut ground with salt and sometimes chili pepper. Also called 'akimona.

intertidal. Lying between the high and low tide levels at the ocean's edge exposed to air for a certain part of each day.

kai choy (Chinese). Mustard cabbage. Choy is the general word for different types of cabbage. "Kai" type is dark green topped with celery-like stems and is often used in pickled form, or sin choy.

kapu (Hawaiian). Taboo, tapu, prohibition.

katsuobushi (Japanese). Dry, flaked tuna pared from large dry slabs. Used as a base in soups and sauces.

kim chee (Korean). Vegetable relish, a regular part of every Korean meal. Usually made with Chinese cabbage, salt, garlic, chili pepper, vinegar, and sugar. Soaked overnight, usually weeks, sometimes years. Other vegetables used are cucumber and daikon. Available in most island markets.

kochu chang, also kojugon, ko choo jung (Korean). Hot red bean paste, often added to soups or sauces, made into a pungent dip by adding vinegar, shoyu, and sugar. Miso may be substituted if recipe calls for bean paste. Both are available in most Honolulu markets.

kōko'olau or ko'oko'olau (Hawaiian). Species of *Bidens*. Small composite plants both native and introduced. Often called beggartick. Dried leaves and flowers used as a tonic in tea by Hawaiians. Available in many island markets.

konbu, also kombu (Japanese). *Laminaria* spp., a sea vegetable sold in leathery olive brown sheets 3 to 6 inches wide and 2-1/2 to 6 feet long. The base for many soups, especially dashi kombu. Available dry in most island markets.

kona storm. Weather condition in Hawaii when the northeast trade winds are absent or are replaced by winds from the south. Air is warm or humid, synonymous with bad weather. Kona means leeward; the kona winds blow from the south or leeward side of the islands.

kukui (Hawaiian). Candlenut. State tree of Hawaii with pale green, maple-shaped leaves. Nuts contain white oily kernels formerly used for light; either burned whole or as pressed oil. The meat is still used for a relish ('inamona). The soft wood was used for canoes, bark gum for painting tapa, nut coats and roots for black dye, leaves and small white flowers for lei representing Moloka'i, polished nut shells in beige, brown, or ebony for leis.

kūmū (Hawaiian). A goatfish. Very popular food fish, prized for delicious white flesh. Eaten broiled, raw, cooked in ti leaves, or salted and cooked. Used extensively by Hawaiians as offering to gods.

limu (Hawaiian). Traditionally, the name for all plants growing in or around the water, both fresh and salt. Includes mosses, lichens, liverworts, water and sea grasses, slimes, and seaweeds. In contemporary use usually applies to edible or useful seaweed.

lomi (Hawaiian). To rub, press, squeeze, crush, mash fine, massage, rub out. Lomi salmon (kamano lomi) is raw, salted salmon worked with the fingers and mixed with onions and tomatoes, usually served with poi and other Hawaiian foods. Other types of fish fixed this way are called i'a lomi--mashed or worked food that can be eaten with the staple.

lū'au (Hawaiian). Feast named for the young taro tops (lū'au) which are always served. Other foods include kālua pig, baked taro and sweet potato, 'opihi, kulolo, haupia, laulau, and breadfruit.

margin. The outer edge or periphery of an alga blade.

Maui onion. Flat, white onion, particularly noted for its sweet flavor and lack of after-bite. Grown mostly on the upland slopes of east Maui. Used extensively for salads and pickles. Any sweet onion may be substituted.

miso (Japanese). Fermented soy bean paste. An all-purpose, high-protein base for many dishes, especially the stomach-soothing, nutritious miso soup. One cup of miso broth with tofu chunks provides 1/6 of adult daily protein requirement. Miso can be purchased at many island markets.

mirin (Japanese). Sweet sake, tastes like slightly alcoholic sugar water. May be simmered with shoyu and kombu to make a rice relish or tempura dip. If mirin is unavailable, substitute for each tablespoon 1/2 teaspoon honey and 2 teaspoons sake, pale dry sherry, or water.

musubi (Japanese). Rice balls, more usually wedges or triangles of boiled rice, sometimes wrapped with a strip of nori, sometimes contain a salted plum (umeboshi). Musubi are the most common element in a bento or box lunch--as expected as a sandwich in an American lunch. Available fresh daily along with sushi at any okazuya (plate lunch delicatessen).

namasu (Japanese). Cold, crisp vegetables soaked in a rice vinegar dressing. Usually some combination of cucumber, carrot, daikon, gingerroot, or seaweed.

niku gobo (Japanese). Niku is any chopped or sliced meat; hence, gobo and meat.

nori (Japanese). *Porphyra* seaweed usually sold in tissue-thin purplish black sheets of about 8 inches square, packed in bundles of 10. Used for covering for roll sushi and rice balls, and in soups. Same as limu pahe'e in Hawaii, laver in England.

'ō'io (Hawaiian). Bonefish. Important food fish for the Hawaiians who had four different names for its different stages of growth.

'ōpae (Hawaiian). General name for shrimp with different modifiers for ocean, fresh water, red, etc., e.g., 'ōpae ula = red shrimp. In recipes, refers to dried packaged shrimp.

'ōpala (Hawaiian). Trash, rubbish, refuse, litter, garbage.

'opihi (Hawaiian). Much-relished intertidal limpet. Eaten raw and alive or chopped with onions. Increasingly scarce and expensive but still available at fishmarkets.

pa'akai (Hawaiian). Salt; can refer to seaweeds prepared with salt.

pilikia (Hawaiian). Trouble of any kind, bother, nuisance, distress.

poi (Hawaiian). The main staple of the ancient Hawaiian diet made from cooked taro, occasionally breadfruit, pounded to a paste and thinned water then eaten with one, two, or three fingers depending on the consistency.

poke (Hawaiian). To slice, cut crosswise into pieces, as fish or wood. Poke he'e: a cut portion of squid. Food made that way as aku poke.

pōpolo (Hawaiian). The black nightshade, a herbaceous plant in the tomato family with tiny white flowers and small, black, edible berries.

saimin (Cosmopolitan). Fish or chicken broth with spaghetti-sized noodles served hot, usually garnished with green onion and kamaboko (fishcake) slices or sliced char siu (Chinese red-dyed sweet roast pork). Sold fresh at most lunch counters, coffee shops, benefit carnivals, and fast food outlets.

sanbaizuke (Japanese). A sauce of shoyu, vinegar, and sugar for pickling vegetables.

sashimi (Japanese). Raw fish sliced for eating as appetizer usually with shoyu and hot mustard. Red meat fish like the 'ahi is preferred though white meat fish like swordfish may also be used. The major factor is freshness--usually less than a day from the sea.

sesame oil (Japanese). Sesame seed oil, dark sesame oil. The dark, strong-smelling oil with a slightly burnt flavor extracted from cooked sesame seeds. Not to be confused with the light-colored sesame oil used in salads. Used by many oriental cooks: Schechuan, Thai, Korean, Japanese, and Chinese. Peanut oil plus liquid smoke may approximate the taste.

shiitake (Japanese). Largest of well-used Japanese mushrooms, 2 to 5 inches in diameter, dark brown, usually sold dried then reconstituted with water or in soups. Fairly expensive in Hawaii. Found in clear packages in the oriental sections of most island markets.

shiragoma (Japanese). White sesame seed.

shoyu (Japanese). Soy sauce. Dark brown salty liquid used for seasoning many oriental dishes. Natural shoyu is 6.9 percent protein and 18 percent salt. Made by 12 to 18 month fermentation of whole soybeans, natural salt, and roasted cracked wheat. Synthetic or chemical soy sauce sold under various Chinese names is prepared using hydrochloric acid, additives, and preservatives, which may be harmful to your system.

stipe. The thickened stem-like part of an alga.

subtidal. Below the lowest low-tide level; never exposed to the air.

sudare (Japanese). The split bamboo mat (like "matchstick" curtains) used to roll the maki sushi.

suimono (Japanese). Clear soup served as an appetizer or first course of a meal.

sunomono (Japanese). Vegetables soaked in rice vinegar sauce. One of the basic group of aemono or "dressed things," usually made with thin cucumber slices, salt, vinegar, miso, sugar, and ginger. Served in small portions as an appetizer.

sushi (Japanese). Rice vinegar-flavored boiled rice shaped around or under vegetables, mushrooms, egg, or various seafood, raw or cooked. Some types wrapped in nori or stuffed in age (fried tofu).

sushi meshi (Japanese). Vinegar-flavored rice for sushi.

taro (Tahitian), kalo (Hawaiian). A large perennial herb in the arum family, with heart-shaped leaves rising from underground tubers or corms. Most varieties grown in a pond or paddy kept moist by canals and terraces. Major staple of the Hawaiians still used today. All eaten parts must be cooked to break down the oxalic acid crystals or a burning or itching sensation of the mouth and throat will occur. The starchy root is boiled or baked and eaten like a potato. The leaves are eaten as cooked greens called lū'au often with squid or chicken or wrapped around pork and butterfish and steamed in ti leaves for laulau. Available in some island markets.

tempura (Japanese). The way of cooking foods by deep frying, usually with a batter which makes a crispy coating. Also foods cooked in this manner, i.e., shrimp, eggplant, onion, carrot, green beans, or yam. The boxed, dry batter is now sold in most US markets.

teriyaki (Japanese). A sauce or marinade for various cuts of meat or fish cooked by broiling, pan frying, or grilling. Most cooks use shoyu, sugar, ginger, and garlic in the marinade.

thallus. The entire plant body of an alga.

ti (Tahitian), ki (Hawaiian). A plant of the lily family having a slender, woody stem ending in a cluster of long, narrow leaves one to two feet long. Formerly much used for house thatch, food wrappers, hula skirts, and sandals. The thick, sweet roots were baked for food or distilled for okolehao (brandy). Now mainly seen as garden ornamentals, but still used for wrapping fish or laulau for steaming.

tofu (Japanese). Soy bean curd. Custard-like, bland, white or russet, cholesterol-free squares sold fresh in most island markets. Takes on the flavors cooked with it, i.e., pork tofu. Higher in protein than meat. Delicious when cooked with stir-fried vegetables. Will keep covered with water for 2 to 3 days. Also used in some Korean and Chinese dishes.

tsukudani (Japanese). Simmered sauce of shoyu, sugar, seaweed, and sometimes fish. Used as dip for tempura or with rice.

ulua (Hawaiian). Species of jack or crevalle; deepwater predatory fish. Prized gamefish known for speed and tenacity. Grows to 5 feet in length, over 100 pounds. Widely used food fish, eaten raw, baked, or broiled.

wana (Hawaiian). The general name for sea urchin, also anything sharp, pointed, or in long spikes or rays. The sweet, orange roe (young eggs) of several varieties is highly prized as a delicacy by both the Hawaiians and the Japanese who use it on one of the Tokyo-style sushi.

water chestnut (Cosmopolitan). Crunchy, white, root bulb used extensively in stir-fried dishes. Available fresh with the dark hairy skins on in some vegetable markets, but widely available peeled in cans.

won bok (Chinese). Also called bok choy or Chinese cabbage. Size and shape of heavy romaine, color of head cabbage, with milder flavor and white stem. Widely used in Chinese and Korean cooking, especially in the peppery, pickled condiment, kim chee.

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