



MO'OMOMI, WEST MOLOKA'I: A COASTAL TREASURE

by Hannah Will Johnstone

with assistance from Raymond S. Tabata, UH Sea Grant,
in cooperation with the Moloka'i Historical Society

University of Hawai'i at Mānoa
Sea Grant Extension Service
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Preface

This book was prepared to provide quick access to information about Mo'omomi, Moloka'i, its plants and other points of interest. I hope that individuals taking this nature walk may now derive pleasure in identifying the various native and introduced species of plants growing at Mo'omomi.

Mo'omomi beach and dunes are unique, as they are probably the best example of a coastal vegetated ecosystem remaining in the main Hawaiian Islands. In this relatively undisturbed area grow rare coastal plants once found throughout Hawai'i.

The plant descriptions found in this guide are written for easy identification. Photographs of the plants and natural features of Mo'omomi were taken by the author on numerous field trips.

Please walk with care at Mo'omomi and stay on established trails. Heightened interest and increased numbers of visitors make it even more important to protect the delicate environment of the area. Leave the environment as you found it. Make your collections with your camera only.

Dedication

This book is dedicated to my parents, George Alexander Will and Bernice Kealohapau'ole Bush Will, for life and boundless love; and to Princess Bernice Pauahi Bishop, founder of the Kamehameha Schools for children of Hawaiian ancestry. Princess Pauahi's wisdom and generosity offered me an education and opportunities not available from any other source.

Mahalo Nui Loa—Acknowledgments

My sincerest thanks and aloha to Joan Aidem. Although I am *hapa haole* (part-Hawaiian), and was raised on Moloka'i from the time I was an infant and was familiar with Mo'omomi, West Moloka'i, it took a *malihini haole* (newcomer), Joan, to open my eyes to the special plants that grew at my feet and the uniqueness of Mo'omomi. I thank her for the many times she drove me to Mo'omomi, and for the use of her invaluable reference publications and books. I thank her, too, for suggesting key people to contact for all phases of the manuscript.

For "first" words praising the value of the project and long walks to take more photographs, to measure one more flower, reading, suggesting, correcting and proofreading the manuscript, I thank, Will, my husband. Thanks also to my daughter, Diane Cobb-Adams, for listening and encouraging me to complete the manuscript.

Very special thanks to Ray Tabata for reading the first draft, for technical and sound advice in various phases of the manuscript, and for his diligent assistance with the design and final production. Thanks to: the Bishop Museum Press for allowing liberal references to the *Manual of Flowering Plants of Hawai'i*, Vol 1 & 2; Storrs L. Olson and Helen F. James for allowing references to their publications; and Dr. Everett Wingert, UH Geography, for providing EPS files for the illustrations on page 6.

Mahalo nui loa to: Samuel Gon, III, Carol Fox, Alan Holt, and Ed Misaki of The Nature Conservancy of Hawai'i, for reviewing the manuscript and offering suggestions; and Jill Ladwig Hamm, formerly with UH Sea Grant Communications, for editing early manuscripts. To Candy Irvine, former co-worker and friend, mahalo nui loa for reading, correcting, and making suggestions for a better manuscript. Thanks to Ian Hurst, manager, Moloka'i Ranch, for permission to pass over ranch property in gathering photographs. To Richard Butterworth and Robert Bowie, of Dornoch, Scotland, my deep appreciation for their kindness in providing computers for my use in Scotland. To George Balazs, Zoologist/Leader, Marine Turtle Research, National Marine Fisheries Service, grateful thanks for prompt suggestions toward an accurate article on Hawaiian Sea Turtles. Mahalo nui loa to Laura Thompson for kōkua and aloha, and for providing transportation in Honolulu. My thanks also to the following people: Steve Montgomery, Marguerite Ashford-Hirano, Fred and Patricia Strible, Herb and the late Marian Much, Sue and Bob Muirhead, Kenneth and Darlene Fiske, Betty Carl, William B. Johnstone, III, and Sarah Sykes.

The Nature Conservancy of Hawai'i

Mo'omomi Preserve:

A Refuge for Hawaiian Plants

The Nature Conservancy of Hawai'i established the 921-acre Mo'omomi Preserve in 1988. The creation of this Preserve was made possible by a challenge grant from the Kresge Foundation and by contributions from thousands of individuals.

Mo'omomi is the last stronghold of a major Hawaiian coastal ecosystem—a holdover from an ancient era. Conservancy staff and volunteers help protect the vast communities of native grasses and shrubs, and also many Hawaiian coastal plant species found nowhere else on Earth. Mo'omomi's secluded beaches are important for the threatened green sea turtle, and also offer shelter to visiting rare Hawaiian monk seals.

The Nature Conservancy is a private, non-profit, international organization devoted to the protection of natural areas that best preserve the diversity of life on Earth. The Conservancy's Hawai'i Field Office manages eleven such natural areas throughout the state. The Conservancy relies on the generous support of individuals, corporations, and foundations to accomplish its mission. Membership in The Nature Conservancy will help to protect Hawai'i's natural lands and wildlife for future generations.

For more information about the Nature Conservancy of Hawai'i, write to 1116 Smith Street, Suite 201, Honolulu, HI 96817.

Foreword

There are few areas in Hawai'i where native coastal plants still flourish. Places such as Ka'ena on O'ahu, and Kalaupapa or Mo'omomi on Moloka'i are among the few places remaining where sizeable and diverse populations of representative native species abound.

Hannah Johnstone's perseverance and dedication has resulted in a useful guide to the unique natural history of the Mo'omomi area. We generally lack natural history guides for specific parts of our Hawai'i Nei, particularly outside of our world-class national parks. Hannah's contribution to this and future generations is a handy compendium of information, written in a friendly style, that will help residents and visitors better appreciate the many fascinating facets of one of our islands' outstanding jewels.

The Sea Grant Extension Service, a public outreach unit of the University of Hawai'i and part of a national network of Sea Grant programs, aims to promote the wise use of our coastal resources. By supporting the production and distribution of this publication, we hope that more people will gain an appreciation of Hawai'i's unique flora and fauna. With appreciation comes stewardship of the resources for generations yet to come.

Raymond S. Tabata, Extension Agent
Coastal Recreation and Tourism
University of Hawai'i at Manoa
Sea Grant Extension Service
Honolulu, Hawai'i

INTRODUCTION

Taking a walk along Mo'omomi Beach can be a marvelous experience. This is especially so if you have a friend like Joan Aidem. Joan is an ardent amateur naturalist. She is willing to share the wealth of knowledge she has gathered over more than a decade of work and study in the Mo'omomi area. Perhaps Joan is best known for her discovery of fossil bones of the flightless Hawaiian goose-like duck at Mo'omomi in the 1970s.

For those not fortunate enough to have an informed and enthusiastic personal guide, I hope that this book proves interesting and useful. The contents offer researched information with colorful photographs of the native plants growing in the area, and maps and directions to the Mo'omomi area of West Moloka'i. To further enhance and supplement the walk, highlights are included of ancient sites, fossil bird bones and land snail shells, ancient plant molds of sandstone, human relics, Hawaiian sea turtles and fishing floats.

Be prepared to experience the incredible beauty that surrounds you. The coral sand beaches, endless blue sky, and the fresh smell of seaweed and salty sea spray will arouse your senses. For me, childhood memories of family picnics and camping trips return. The call of adventure captivates and pulls one along, to look for that special treasure: that rare plant, that shell or glass fishing float, a piece of driftwood, a rock for adze (ancient hewing tool) making.

Notice each plant that has survived yet another season in the harsh, salty, windy and dry climate of West Moloka'i. Contemplate the sweeping view from the high ridges looking back across Kawa'aloa Bay. All are treasures. Enjoy the moment of discovery! Come along then, and let your senses soar at the beauty of Mo'omomi.

Getting to Mo'omomi



From Kaunakakai: Take Route 460 (Maunaloa Highway), west from Kaunakakai toward the airport, turn right (north) at Route 480 (Pu'upe'elua (*also properly known as Pu'ukape'elua*) Avenue). Continue for approximately 1.2 miles until you reach Farrington Avenue.

Turn left (west) onto Farrington Avenue and follow it for approximately 3 miles to the end of the paved portion of the road. Continue on Mo'omomi Road, a dirt road, for about 2.1 miles until you come to a fork in the road. The **left fork** is for vehicle entry through Moloka'i Ranch to **The Nature Conservancy (TNC) Mo'omomi Preserve**. The **right fork** (key not required) continues for another half mile to the beach through Hawaiian Homes Commission lands.

The left fork leads to the TNC Mo'omomi Preserve. Vehicle entrance requires a permit and key (\$25 key deposit refundable upon return). Permits are issued by TNC's Moloka'i office on a limited, first-come first-served basis. The Nature Conservancy office can provide you with a visitor's map that will guide you through the Moloka'i Ranch lands and into the Mo'omomi Preserve. Monthly hikes are organized for members and interested individuals. For information and access, contact The Nature Conservancy of Hawai'i, Moloka'i Preserves, P.O. Box 220, Kualapu'u, Hawai'i, 96757.

The Nature Conservancy Mo'omomi Preserve

There is a parking area within the Preserve at Kaiehu Point, Kawa'aloa Bay. The entire trip through the Preserve, following directional arrows, can take from three to four hours. Examples of plants near Kaiehu Point can make even a short walk almost as exciting as the full trip. The magnificent view of the coastline, the fragrance and sound of the sea, the colors of the ocean and the sky, all blend together in a special setting for an unforgettable day of exploring and enjoyment.

In the distance, the Moloka'i Ranch beach pavilion overlooks Kawa'aloa Bay with its wide sandy beach, crashing surf, and very strong sea currents. Words of warning: *Do not swim at Kawa'aloa Bay; or anywhere else in this area where ocean conditions are generally dangerous.*

Here at the west end of Kawa'aloa Bay there is a ledge that provides an overhang. This area was once used as a shelter by ancient Hawaiians. To reach the shelter, climb down the rocks, keeping left to reach the floor of the shelter. At the site there are remains of opihi shells (edible limpet) and fish bones excavated some years ago by the Bernice P. Bishop Museum in a field exploration of the area.

Returning to the top of the ledge, take a minute to look back across Kawa'aloa Bay. Enjoy the sweeping view of the green mountains in the distance, search the horizon for Kalaupapa Lighthouse, and listen to the wild surf crashing on the yellow sandy beach. Drink in the smell of the seaweed that grows on the coral reefs of the bay and feeds the native green turtles. Feel the warmth of the sun and the power of the wind on your body. Let yourself experience the magic of Mo'omomi.

Your adventure unfolds as you encounter each plant, identify it, and contemplate its environment. Following a rainy period, the tiniest of plants, the delicate nama, can be found growing on this ledge, as well as the pa'ū-o-Hi'i-aka, 'ilima, hinahina-kū-kahakai and pōpolo, to name just a few.

Precautions

A word about road conditions: The existing dirt road, under dry conditions, is rough and deeply rutted. Negotiate the road with care. If it

has rained recently, the road will be slippery and dangerous. A four-wheel drive vehicle or a high clearance truck is almost essential. If you don't have access to such a vehicle, it might be better to try visiting Mo'omomi beach on a dry day or park at the end of the pavement and walk 2.6 miles to the beach.

Ideally, the best days to walk Mo'omomi beach are those without rain or wind. However, you can generally expect **hot** sun beating down, and mild breezes to strong fierce winds at times. It is best to be prepared. Be wise and *take precautions to protect yourself* from the sun, glare of sand and sea, wind-whipped sand, and sharp sandstone.

- Bring along a visor or tight-fitting hat.
- Use sunscreen lotion and sunglasses.
- Wear medium length to long cotton trousers and light hiking boots or athletic shoes.
- A canteen of water is essential.
- A backpack, though not necessary, can carry the canteen of water, beverages, lunch or snacks, binoculars, camera, extra film and batteries.
- Take a plastic bag to protect delicate equipment from corrosive sea spray or a sudden shower.

Help Protect the Environment of Mo'omomi

Visitors and hikers are requested to keep to the obvious trail to minimize the effect of foot traffic in the Mo'omomi area. Additional care must be taken not to cause unintentional harm. Pay particular attention while walking through vegetated dune areas, crossing the sandstone ledge, and traversing the outcroppings of lithified sandstone plant casts.

Littering is prohibited. Please carry your refuse out of the preserve to be disposed of properly. Your help in collecting and removing beach debris is gratefully accepted. Please try to leave the area cleaner than you found it.

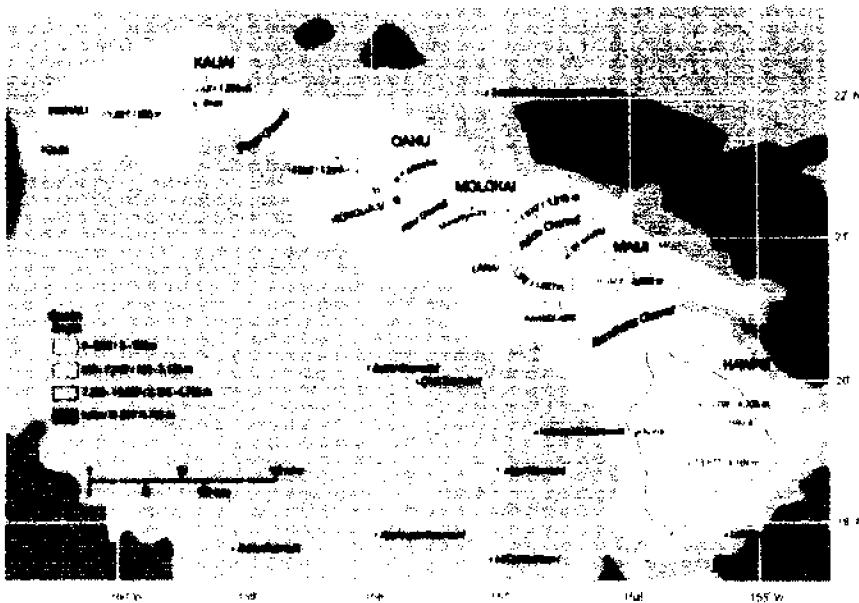
Visitors to the Mo'omomi Preserve are reminded not to pick or collect rare plants; and that digging, collecting, or tampering with relics and cultural artifacts is strictly prohibited. Do not make any collection exposures with your camera.

GEOGRAPHY AND SETTING

The Hawaiian archipelago is a chain of volcanoes rising from the middle of the Northern Pacific Ocean. It is the most remote island chain in the world. North America, the nearest continent, is 2,375 miles away. The closest high islands are the Marquesas Islands, nearly the same distance to the south.

More than 100 islands, reefs, and shoals make up the archipelago, which extends over 1,531 miles from the still growing Island of Hawai'i in the south to Kure Atoll in the Northwestern Hawaiian Islands.

The main Hawaiian chain, containing eight larger islands, comprises the southeastern portion of the archipelago. These eight islands represent over 90 percent of the land area of the archipelago. The western islands of Kaua'i and Ni'ihau are the oldest, and Hawai'i, with its two active volcanoes, is the youngest.



Nearly five million years ago the main Hawaiian islands began forming when the volcano under the island that is now Kaua'i emerged from the sea. New volcanic mountains appeared at a rate of slightly more than one per million years for the first three million years.

In the succeeding million years, six volcanoes formed beginning with West Moloka'i about two million years ago followed by East Moloka'i, West Maui, Lāna'i, Kaho'olawe, and Haleakalā. These six volcanos were so close together that the lava flows formed a single mass below sea level. It is thought that some or all of these central main islands may have been joined and separated at least twice in the past as the level of the ocean fluctuated. At present sea level, the six volcanos form four islands: Moloka'i (East and West Moloka'i), Maui (West Maui and Haleakalā), Lāna'i, and Kaho'olawe.

Climate

The climate of Hawai'i is dominated by its tropical setting and by being surrounded by ocean. Patterns of air circulating in the Pacific Ocean and individual island topography further influence the climate.

Temperatures at sea level are usually mild and constant, averaging a high of around 83°F and a low of about 68°F, with not much seasonal variation. In contrast, rainfall in Hawai'i can vary greatly. To illustrate, Mount Wai'ale'ale on Kaua'i is one of the wettest areas on earth, while on leeward island coasts, dry, desert-like areas exist.

From May to September, northeasterly tradewinds blow almost without interruption and bring frequent showers to the windward slopes of the islands while the leeward lowlands are virtually without rain.

From October to April, the tradewinds are apt to be interrupted by either southerly "Kona" winds or cold fronts from the north. It is each island's unique topography, wind patterns, and distribution of tradewind rains that create the particular climatic differences in the eight major islands.

Flora and Fauna

The vegetation of the Hawaiian Islands is as varied as the climate. Climatic conditions influence the array of plants. They vary from those plants growing on the summits of mountains that rise over 10,000 feet, to those growing in lowland areas able to support human settlement and agriculture, and to dry coastal slopes and dunes much like Mo'omomi. Each is different.

Before the arrival of man there were only a few native mammals in Hawai'i. The Hawaiian monk seal, *Monachus schauinslandi*, is the only endemic species of littoral mammal in Hawai'i; and the Hawaiian hoary bat, *Lasiurus cinereus semotus*, is an endemic subspecies that was isolated from its mainland relatives but is closely related to them. Prehistoric fossil bat bones have been discovered on several of the Hawaiian islands, and they are presently being studied by scientists.

Native Hawaiian ecosystems have suffered most from the activities of man in the lowlands. The first humans to reach the Hawaiian Islands arrived sometime around the eighth century A.D. from the South Pacific. These migrating Polynesians brought with them an assortment of exotic plants and animals, and made active and intensive use of the lowlands. They brought about significant changes that greatly affected the native lowland ecosystems.

In 1778, Captain James Cook, the British explorer, heralded the arrival of western man to the Hawaiian Islands. Thus began the further introduction of exotic plants, animals, birds, and insects, both accidental and deliberate. By 1880, the island landscapes below the 1,500 ft. elevation had already suffered change through the Hawaiians' use of fire.

Today the encroachment on native ecosystems by modern civilization continues. What remains of the native ecosystems is generally restricted to the mountainous regions of the islands. There are precious few lowland areas in Hawai'i where native ecosystems still remain to study and enjoy. Our knowledge of its uncommon flora and fauna will continue to be enhanced by respecting and preserving the native lowland ecosystems of the Mo'omomi area and The Nature Conservancy of Hawai'i Mo'omomi Preserve.

The Island of Moloka'i

Several Hawaiian legends describe the origin of the Island of Moloka'i. My favorite is quoted from the Bishop Museum publication, *Moloka'i: A Site Survey*, by C.C. Summers, 1971.

"According to Paku'i, who was an historian in the time of Kamehameha I, the islands of the Hawaiian group were born of Wakea and his wives. After Wakea's first wife, Papa, had given birth to Hawaii, Maui and Kahoolawe, she returned to Tahiti.

Wakea then took Kaulawahine as his wife and she bore Lanai.
Again he took another wife...."

*Hoi ae o Wakea loa Hina,
Loa Hina he wahine moe na Wakea,
Hapai Hina ia Molokai, he moku,
O Molokai a Hina he keiki moku*

Then Wakea turned around and found Hina,
Hina was found as a wife for Wakea,
Hina conceived Molokai, an island;
Hina's Molokai is an island child.

(Fornander, 1916–1917:12,13)

Moloka'i lies approximately 25 miles southeast of O'ahu, 8.5 miles northwest of Maui, and 9 miles north of Lāna'i. In the Hawaiian group of islands, Moloka'i is the fifth largest. It is 38 miles long and 10 miles wide, with an area of 260 square miles, and 100 miles of coastline.

About two million years ago two major volcanoes emerged from the Pacific Ocean to become the West Moloka'i and East Moloka'i Mountains. A plain between these mountains joins the two principal parts of Moloka'i.

East Moloka'i is the larger of the two volcanic mountains, with its highest peak, Kamakou, soaring to 4,970 feet. On East Moloka'i's northern coast, abundant rainfall causes stream erosion, which has created large, deep valleys. On the island's southern coast, the valleys are smaller and narrower with a plain down to the sea. During a period of minor renewal of volcanism on East Moloka'i, the Kalaupapa Peninsula was formed.

On the south side of West Moloka'i, the sloping mountain, Maunaloa, reaches 1,380 feet. The existence of gulches, rather than valleys, indicate less rainfall here. The northern coast ends on a high cliff. By comparison, West Moloka'i is considerably drier than East Moloka'i.

In ancient times, the entire western portion of the island was called the Kona District (leeward), and represented nearly three-quarters of the island. This district was distinguished by the shoal waters off its

southern coast, where numerous fishponds were built for continuous supplies of fish.

The other district of Moloka'i, formerly called the Ko'olau District (windward), included the ahupua'a of Hālawā, Wailāu, Pelekunu, Waikolu, Kalawāo, Mākanalua, and Kalaupapa. An ahupua'a is a land division usually extending from the uplands to the sea. In ancient times it was not uncommon for a king or chief to bestow upon a favored individual an ahupua'a, thus assuring a food supply from both the mountains and the sea.

These ahupua'a represented approximately one-quarter of the island. The first four ahupua'a were the most populated, due to their large and cultivatable valleys. In these valleys the heiau, places of Pre-Christian worship, were constructed of stone platforms. They were located away from the bottom lands maximizing the use of the land for cultivation. Dwellings were placed along the beach and up the valleys close to the slopes. Because of high cliffs, these valleys were almost isolated from each other.

Mo'omomi, Kaluako'i, West Moloka'i



Some people think the name, Mo'omomi, is linked to the legend told of the ancient Hawaiians' quest for a special, stony sponge that they used medicinally. This special sponge is described as being found in a submerged cave at Mo'omomi. The location of the cave was a carefully protected secret. To gather the medicinal sponge was particularly

dangerous and extremely difficult because the cave entrance was guarded by a supernatural *mo'ō*, a lizard or serpent. Today, the origin of the name, Mo'omomi, still remains a mystery.

West Moloka'i is part of the extinct volcano, Maunaloa, one of two primary volcanoes of Moloka'i. The results of volcanic activity is evident in the number of cone-shaped cinder hills, spatter cones, and a bed of fine-grained basalt. Basalt is the common lava of Hawai'i, and is a dark heavy lava rock. It is rich in iron and magnesium, and is comparatively poor in silicon. Kaluako'i, West Moloka'i, was known in ancient Hawai'i as an excellent source of basalt material to make stone implements.

The Mo'omomi preserve is located southwest of Mo'omomi Bay. It extends about two miles along the seashore of West Moloka'i and inland a mile or two. The terrain of Mo'omomi is mostly coral sand and sand dunes. The sand is formed of fragments of coral, coralline (like coral) algae, and mollusk shells. Two distinct types of sand dunes occur here, those consolidated or lithified (turned to stone or petrified), and those composed of unconsolidated or loose coral sand. Each supports plants distinctive to the type of dune.

The area of Mo'omomi we are concerned with was named the "Desert Strip" by the geologist Chester K. Wentworth and later renamed the "Dune Strip." It includes those sand dunes that stretch from the windward beach inland for some distance in a southwesterly direction. This is the area where so many of the native plants and grasses described in this book grow.

It is the persistent drifting of coral sand over the west upland, fed by very strong northeast tradewinds carrying sand from the beach at Mo'omomi, which gives the upland its desert appearance.

The velocity of the prevailing winds at Mo'omomi ranges from less than 10-miles-per-hour (mph) to 50 mph or more. This "Desert Strip" is aptly named *Keonelele* by the Hawaiians, "the flying sand." Those who have crossed the dunes in strong winds can attest to the pain and discomfort of flying particles of sand. The ancient Hawaiians called the wind of Mo'omomi, *Kuapā*, meaning dashing or slashing, as waves on a shore. (Pukui and Elbert, 1965).

The Mo'omomi area was used by ancient Hawaiians for fishing and for quarrying stone for adzes. Many burial sites have been found in the sandy areas, and it is said to have been "the place for the dead."

The publication, *Moloka'i: A Site Survey*, by C.C. Summers (1971), reported the following: "In 1895, C. M. Hyde¹ wrote of his observations that the people of Pelekunu Valley at certain times of the year came to Mo'omomi to catch their fish using the area as a temporary fishing station. Their water was obtained from a spring beneath tide level located '...at the northern end of the fissure...' between the lands of Kaluako'i and Pala'au."

Moloka'i Ranch Manager and early pioneer, George P. Cooke (1949), reported in his book *Mo'olelo O Molokai*, "...that he had observed Ti plants growing in ruins of rock enclosures and was puzzled by their presence. Mrs. Jennie Wilson², explained to him that she was born in Pelekunu Valley and the people of Pelekunu would paddle by canoe to Kalawao and carry their pa'i'ai (semi-hard poi) and other belongings up the pali and overland down the western slope to Mo'omomi. Here they caught and dried fish to be carried back to their valley homes at Pelekunu. The migration of the inhabitants of Pelekunu explains their need for ti leaf and its protection. Ti leaf being important in native cooking, for bundling preserved fish and for the hukilau (community fishing)."

Mr. Cooke, also relates "Bella Munro's³ report by an old Hawaiian fisherman who found two caves in nearby ridges at Mo'omomi; one had been walled up and contained a number of human bones. The other cave, also walled up contained baskets of lauhala full of salt. Supposedly the salt was stored for use (with grass) for preserving bodies, as was the custom, and may also have been used to preserve dried fish."

Notes:

¹Reverend Charles McEwen Hyde, of Haverhill, Massachusetts, arrived in Honolulu in 1877. He organized The Social Science Association of Honolulu.

²Wife of John H. Wilson, mayor of Honolulu for six unconservative terms, 1920 to 1952.

³Wife of James Munro, former superintendent of Hawaiian Homes Commission, Moloka'i, and rancher at Kainalu, Moloka'i.

FOSSILS, ADZES, AND TRACES OF THE PAST

Fossils are remains, impressions, or traces of plants and animals of past geological ages that have been preserved in the earth's crust. Most living things never become fossilized for a number of reasons. Fossils are important to us because they are an unwritten record of life on earth. Through the examination and study of fossils much can be learned of what life might have been like many years ago.

Fossil Bird Bones of Mo'omomi, West Moloka'i

Finding a fossil can be the beginning of a puzzle. It was the discovery of extensive fossil bird bones at Mo'omomi and 'Ilio Point, West Moloka'i, by Joan Aidem in 1971, that made a significant contribution and major advance in the study of past life in Hawai'i. As a result, a new chapter was opened in the study of birds in Hawai'i. This was an exciting time because prior to 1971, very few bird fossils had been discovered in Hawai'i. The wealth of fossil bird bones found at Mo'omomi was the first hint of a Hawaiian bird population larger and more complex than previously conceived.



Aidem collected quantities of fossil bird bones and systematically labeled them according to their collection sites. These fossils were then shipped to the Bishop Museum for cataloguing, prior to shipment to the Smithsonian Institution for study. Something new was discovered with each additional bag of fossil bones delivered to the Bishop Museum by Aidem. The known number of species of endemic land birds from the Hawaiian Islands was doubled after these discoveries were enumerated.

Though Aidem found many fossil bird bones at Mo'omomi, the most important discovery was the fossil remains of the flightless Hawaiian goose. This was an important and exceptional find, in that it was preserved as a nearly complete skeleton in a weakly cemented sand

dune. The majority of bird remains discovered at Mo'omomi were scattered bones found in loose sand among the dunes.

This flightless goose was named *Thambetothen chauliodous*, (astonishing goose with prominent teeth). It is the second fossil bird discovered in the Hawaiian Islands. In 1926 the first fossil bird bones, *Geochen rhuax*, were discovered during the digging of a water tunnel in volcanic ash in Kohala on the Island of Hawai'i.

The geologist Harold T. Stearns drew the conclusion, based on the carbon age of fossil land snail shells found at Mo'omomi, (B.P. Bishop Museum—Occasional Papers XXIV,10, 1973), that the fossil goose skeleton was about 25,000 years old. It was probably deposited in the dune when the sea was lower than at present during the late Wisconsinan or last glacial period. It is not known how long the species had inhabited Moloka'i before it became flightless.

The Flightless Hawaiian "Goose"

A brief account, as told to me by Joan Aidem, relates the fascinating story of the discovery of fossil bird bones, the flightless Hawaiian goose, at Mo'omomi. When Joan lived in San Diego, California, she would explore the sea cliffs along the shoreline looking for fossilized shark teeth and whale bones. In 1970 Joan moved to Moloka'i, and it was natural that she would be drawn to the shoreline and sand dunes of Mo'omomi, West Moloka'i.

On her numerous beachcombing trips to Mo'omomi to explore and to hunt for glass fishing floats, she would often see scattered bird bones lying in the sand among the dunes. Inquiries on the island as to the origin of these bones were fruitless. Little interest or information could be generated about these bird bones. However, the mystery of the identity of these bird bones continued to puzzle Joan. Some time passed with no information or clues forthcoming.

On a day trip to Mo'omomi, while walking along the shoreline, Joan saw a bird beak protruding from a sand dune. Against proper training, she unceremoniously pulled the beak from the dune. She took it home for examination and study. Later, with proper equipment, she returned to the site to locate and retrieve the skull. It was Joan's friend, Paul Breese, former Director of the Honolulu Zoo, who suggested and prompted her

to take the beak and skull to the Bernice P. Bishop Museum for identification.

At the museum, Dr. Alan Ziegler, a vertebrate zoologist, was particularly interested in the fossil bird beak because the mandible (upper or lower part of a bird's beak) was serrated, or almost toothed. There was nothing like it in the museum collection and this discovery appeared to be of some significant value.

Because the beak and skull were retrieved on different occasions, there was a good possibility that more of the bird might be contained within the dune. When it was discovered that more of the fossil bird did in fact remain in the dune, there was great excitement! But removal of the fossilized bird remains was to be delayed until an experienced paleontologist passed through Hawai'i. This eventually proved to be unfeasible.

Nearly a year passed. Dr. Ziegler removed the remainder of the fossilized bird from the Mo'omomi dune. The fossil bones, contained within a jacketed ball of sand and plaster, were sent for examination and identification to Dr. Alexander Wetmore, Dean of Avian Paleontology at the Smithsonian Institution. Dr. Wetmore was the first to describe the only fossil bird known from the islands in 1926.

Dr. Storrs L. Olson, also with the Smithsonian Institution, and Dr. Alexander Wetmore, named the flightless Hawaiian goose, *Thambetochea chauliodous* in 1976. They described it, "...as being a large, flightless goose with an extremely reduced wing, keelless sternum, very robust hind limb, and a heavily ossified [changed into bone] bill having bony toothlike projections on the rostrum (beak) and mandible." Further study by Olson and Helen F. James (1991), an ornithologist, of the *Thambetochea chauliodous* indicates that it is more of an extinct flightless goose-like duck, than a goose.

More Surprises to Come?

What about all the other fossil bird bones that were collected at Mo'omomi? Contemplate the arrival of each bird on the shores of Moloka'i. Consider the location of the Hawaiian Islands in the Pacific Ocean, far from other major land masses. How, when, and from where did they arrive?

There were some startling surprises to be discovered in the fossil bird bones found at Mo'omomi. Species of birds, that, prior to 1971, were unknown in Hawai'i were found to have existed in prehistoric times: *Thambetochen chauliodous*, an extinct flightless goose-like duck; *Apteribis glenos*, an extinct flightless ibis; *Grallistrix geleches*, an extinct small long-legged Moloka'i owl; *Porzana menehune*, the world's smallest extinct flightless rail; *Circus dosseus*, a small extinct harrier; and *Corvus viriosus*, an extinct slender-billed crow...to name just a few.

More than twenty years have passed since these fossil bird bones were discovered by Joan Aidem, and substantial work has been accomplished by the late Alexander Wetmore, Storrs L. Olson, and Helen F. James in identifying and describing these fossil bird bones. Yet, these are preliminary steps in the research of prehistoric Hawaiian birds leading to further study in subjects such as evolution, extinction, biogeography, and ecology.

Olson and James support the theory that these birds began to disappear during the 1,500 years or so between the arrival of the Polynesians in the Hawaiian Islands and the first appearance of Europeans in 1778. These prehistoric extinctions were probably caused indirectly by habitat change, expanding populations of pre-contact Hawaiians, predation by early humans, and the introduction of non-native animals.

Joan Aidem has been deservedly honored for discovering the fossil bird bones of Mo'omomi, and for continued interest and work in collecting Hawaiian bird fossils. For this occasion a new group of extinct gaping birds were named: *Aidemia*, with three new species, one in particular being the Moloka'i *Aidemia lutetiae*.

Ancient Plant Molds of Sandstone

High above the beach, and located in front of the sand dunes, is a shelf or outcropping of weathered sandstone. This is the area of the Mo'omomi dunes scoured bare by the wind. Here lie the remains of rhizoliths — sandstone molds or casts of plant stems and roots of an ancient forest. These plant molds are grayish-white in color and brittle and crunchy in texture. The remaining standing plant casts, with additional broken parts strewn over the surface of the terrain, give an other-worldly appearance in sharp contrast to the sandy beach and blue skies. The plant molds bear a strong resemblance to the stems of the

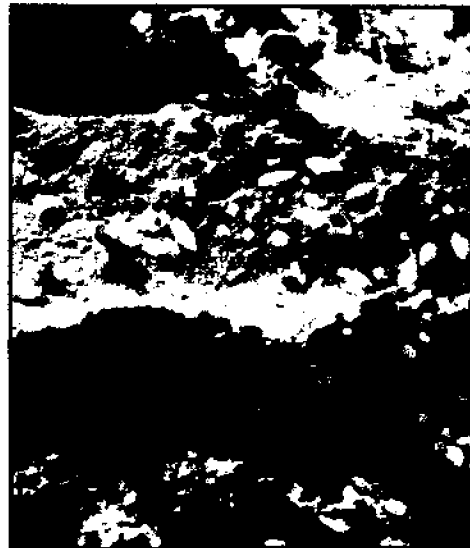
naupaka, *Scaevola sericea*, which today grows abundantly along Hawaiian shorelines.

Chester K. Wentworth (1925), geologist, offers an explanation for these plant casts. He said that as the plants were covered by the drifting sand, water and chemicals passing downward to the stems and roots cemented the sand. There are other areas of sandstone and plant molds similar to those found at Mo'omomi. These can be found at 'Ilio Point, Moloka'i, and at Makawehi Dunes, Kaua'i.



Fossil Land Snail Shells

Near Kalani Point, West Moloka'i, there are dunes of lightly cemented sandstone (sand that is lithified, or turned into stone). The sandstone is interspersed with layers of hardened red volcanic soil and remnants of prehistoric sandstone plant stems and root molds or forms. Along the beach, this layer of reddish sediment thickens to approximately three feet in depth, and is abundant with fossil land snail shells. Over the years, wind and waves have exposed these treasures from the past.



The fossil land snail shells have been identified from three different groups of shells. *Amastra*, the right-handed shells, *Partulina*, the plump left-handed shells, and *Newcombia*, the thin left-handed shells. Handedness is determined by holding the shell with the point upward

and the opening toward oneself. If the opening is to the right, the shell is right-handed and vice versa for a left-handed-shell.

It is speculated that many years ago there must have been a massive die-off of land snails that lived at higher elevations in the ancient forest of West Moloka'i. In time, the snails were washed down or deposited at the shoreline. Harold T. Stearns reported in a Bishop Museum paper published in 1973 that the soil in which they are found can be traced in one place below sea level and, in another place, at least 100 feet above sea level. This indicates that there may have been a great change in the climatic and environmental conditions in the islands.

The fossil snail shells individually collected by Aidem and Stearns were determined to be more than 27,000 years old by two different laboratories. In recent years, there has been further consideration and study on the subject of establishing the age of the Mo'omomi fossil land snail shells. It is thought that as a result of dead carbon in the snail shells previously tested, they may have appeared to be older than they actually are. It is conceivable, then, that the fossil snail shells could possibly be younger than previously thought.

HUMAN RELICS AT MO'OMOMI

Stone Adzes

Ancient Hawaiians were skillful workers of stone. The most common stone implement of the ancient Hawaiians was the adze, a cutting tool. Adze makers, known as *po'e ka ko'i*, were a highly esteemed group. The adzes were made of fine-grained rock which were chipped and rubbed until the proper shape was achieved; they ranged in size from a foot long, weighing 10 to 12 pounds, to a delicate one inch in length. These adzes were rectangular in shape notably different from the triangular or rounded adze forms of other Pacific island groups.

At Mo'omomi, stone adzes, adze blanks, and other relics were found strewn over small areas located near the base of low sand mounds. The stone to make these implements was thought to be from the Kaluako'i quarry, located just south of the road leading from Mo'omomi to Keonelele Beach, at an elevation of 300 feet.

Most stone adzes were hafted (tied onto) on a curved, L-shaped handle of hau, *Hibiscus tiliaceus*, or suitable wood, padded with a bit of kapa, lauhala, or banana leaf between the stone and the wood. Then the stone and wood were firmly lashed together with sennit (coconut fiber) braid or olonā cord. The various types and sizes of the stone adzes were adapted to the different kinds of woodwork for which they were used—from felling huge trees to fine carving of intricate patterns on tapa beaters.

Pebbles, Cobbles, and Tools

Abundant quantities of smoothing pebbles were discovered at various sites at Mo'omomi. These pebbles are small, smooth rock that is probably of beach origin. It is possible that these stones were used as smoothing stones in rubbing and polishing articles of wood. It is thought that some of these stones were also used in cooking small birds.

Large beach cobbles (a naturally rounded stone larger than a pebble and smaller than a boulder), in a somewhat elongated form, also were found. These stones were rather symmetrical, and were possibly used as anvils and for hammering.

Rough coral fragments, shaped to triangular wedge forms, were also found at Mo'omomi. These coral fragments were probably used as files in sharpening fish hooks and in cutting away other material.

Marine Shells

Near the other artifact materials found at Mo'omomi by C. K. Wentworth were various marine shells. It was thought that the meat within the marine shells was used for food, but cowrie shells were often used in octopus fishing as well. Cowrie shells could be used as a lure to catch octopus by fastening them above a grooved stone of similar shape that permitted the insertion of a stick bearing a bone or wooden point to form a hook. The octopus would attach itself to the cowrie shell, and when the lure was drawn to the surface, the hook prevented the octopus from sliding off the lure. Both the humpback cowry, *Cypraea mauritiana*, and Tiger Cowry, *Cypraea tigris*, were used in this activity.

Glass Fishing Floats

Mo'omomi is a beach of beautiful yellow sand and sandstone outcroppings, the latter appearing and disappearing with the seasons of the year. In the past, the shoreline was relatively free of debris with only an occasional storm sending mountain trash coursing down the swollen streams into the sea. Unfortunately, today we find unsightly and potentially dangerous human refuse of assorted plastic implements, fish nets, fish lines, floats, hooks, hypodermic needles, boxes from fast-food outlets, sake and whiskey bottles, and much more—all washed upon our shores.

Organized volunteers make annual trips to Mo'omomi to try to keep the area clean. There never seems to be enough workers to keep up with this impossible task. Be a thoughtful visitor or explorer who has shared the beauty of Mo'omomi, and help keep this precious area clean by taking all your refuse away for proper disposal in a rubbish bin.

What about the long treasured Japanese glass fishing floats, once found at Mo'omomi and other island beaches? Where do they come from? How do they reach our shores? The Hawaiian Islands are located approximately 600 miles north of the westbound North Equatorial Current. Very little adrift in the Pacific Ocean current makes its way to

this archipelago. Because the islands experience normal northeast trade winds most of the year, only an occasional fishing float arrives on the seas affected by these "trades." It is the Kona storms of winter that bring in most of the Japanese glass fishing floats sought by beachcombers today.

These treasures originate with the high demand for fish in the diet of the people of Japan. In response to that demand, Japanese fishermen have developed an impressive array of fishing gear and methods. Working in international waters, they use gill nets, trawlers and purse seiners, and all require the use of fishing floats.

The largest floats (those with greatest bouyancy) are used for tuna long-line fishing; medium-sized floats are needed for tangle-net operations, and the smaller and most commonly found floats are used in salmon gillnet fishing. Records indicate that the Japanese fishing fleet loses half its floats each year as the floats tear free of the nets in heavy seas. New floats are produced continuously to make up for those losses. In all likelihood, the average fishing float found on Hawai'i's beaches could be 10 or more years old.

At one time, Mo'omomi treasure hunters often found beautiful glass fish floats. Today they are rare indeed. In their place, one finds metal or plastic floats. But the very rarity of the glass floats makes them much more valuable. Scan the shoreline and water's edge. Perhaps you may find a glass fishing float to carry home.

HAWAIIAN SEA TURTLES

The west shores and coastal dunes of Mo'omomi, Moloka'i, are known as a place of cultural and scientific importance in Hawai'i. Mo'omomi is also a breeding and nesting area for a small number of female green turtles that inhabit the waters of Hawai'i.

Three species of sea turtles are native to Hawai'i: the green turtle, the hawksbill turtle, and the leatherback turtle. The most common sea turtle to inhabit the waters of Hawai'i is the green turtle, *Chelonia mydas*, belonging to the turtle family Cheloniidae. The carapace, or upper shell, of the adult green turtle is dark brown with olive or gold flecks. The bottom shell or plastron is yellow to orangish in color. Green turtles receive their name from the color of their body fat. They can be distinguished from other sea turtles by the single pair of scales on the front of their heads.

Hawaiians call the green turtle *honu*. The green turtle can weigh up to 400 pounds and is primarily a vegetarian. Its life span is unknown. Yet, scientists believe that as the green turtle matures sexually at approximately 25 years, an assumption could be made that its lifespan is 50 to 100 years. The Hawaiian green turtle is listed as a threatened species under the United States Endangered Species Act.

The green turtle has no teeth but its jaws are modified to provide crushing, biting, and tearing surfaces. They eat algae or limu (seaweed) that grows underwater on coral reefs and on rocks near the shore. They have a preference to live near these "grazing plots or pastures" of limu that are located in nearshore waters. By eating, and recropping the young limu in the "grazing plots," the green turtle is able to increase the percentage of protein in its diet. The green turtle, like cows, depends on the bacteria in its large intestine for digestion of its food.

Hawai'i's green turtle can migrate up to 800 miles from its feeding grounds. When the green turtle is active, it must swim to the surface to breathe every few minutes, but while it is resting it is able to remain underwater for as long as two and a half hours without breathing. The green turtle's growth seems to be slow in the wild, given the long time it takes to reach sexual maturity. Both the male and female green turtle look alike until maturity. At maturity the male green turtle develops a long claw on each flipper; and a long tail, capable of grasping, tipped

with a heavy flattened nail which is utilized during mating. The female's claw's and tail are much smaller.

Both male and female turtles travel long distances from their feeding grounds to the nesting beach where in the nearby waters of the nesting beach, the male and female turtles mate. Scientists believe that the nesting female turtle returns to the same beach where it was born. How the female turtle recognizes her particular nesting beach remains a mystery. Estimates suggest that only 100 to 500 female green turtles nest each year in Hawai'i. The majority of these female turtles nest principally in the French Frigate Shoals of the northwestern Hawaiian Islands.

The female green turtle that returns to Mo'omomi Beach to excavate a nest and lay eggs in the sand has a difficult task. She must arrive at the nesting beach at night, and the beach must be deserted because lights and movement will disturb the female and frighten her away. Normally graceful, swift, and buoyant in the water, the pregnant female green turtle is heavy and vulnerable on land.

The green turtle sheds large sticky tears all the time. However, while on land the female green turtle's tears are visible and help keep her eyes free of sand and prevent drying. She ascends the beach by hauling her heavy body forward and then digs a deep body pit for her nest well above the high tide line. After 60 to 100 eggs are deposited in the nest, the female turtle covers them with sand. An attempt to conceal her nest is made prior to returning to the sea, but a depression in the sand or pit and tracks remain to identify the nest of the female green turtle. The whole process requires tremendous effort by the female green turtle, and can take from one to three hours to complete.

The eggs lying unprotected within their warm sand nest will incubate for two months. After the two-months period has ended, the hatchlings prepare to leave their nest. How the hatchling green turtles sense that proper conditions exist outside the nest for emergence is an interesting puzzle. Studies suggest that the temperature of the sand is the determining factor. Hatchlings usually emerge from the nest during the night when the sand is cooler, so the hatchlings are less visible to waiting predators such as crabs, birds, and carnivorous fish.

After the one-ounce turtles hatch, they must work together as a group in order to emerge from their nest. A single hatchling is not capable of emerging from the nest by itself. It may take the hatchlings days to reach

the beach surface of the nest. Newly hatched turtles thrash about triggering the movement of other hatchlings. The group movement causes the ceiling and walls of the nest chamber to collapse, raising the nest floor toward the surface of the beach. The topmost hatchlings cease their activity if the surface sand is hot. If the sand is cool, suggesting an overcast day or nighttime, the hatchlings will emerge explosively from their nest and head for the ocean. The hatchlings must race swiftly to the ocean to stave off possible attacks by predators.

How hatchlings find the ocean has been studied extensively, but it is still not completely understood. By discriminating between light intensities and selecting the brightest and most open horizon, hatchlings can find the ocean even if the surf is not in view. Moving down a slope, as well as the interaction of cues, may also help the hatchling locate the water. At the water's edge the hatchlings must negotiate the surf, and once in the water they must replace the crawling stroke with a swimming stroke. They dive at the approach of a wave to avoid being thrown back onto the beach. The hatchlings then swim constantly for the next 36 to 48 hours. Ocean currents carry the hatchlings far from land where they continue to grow for several years before joining adult and juvenile turtles at coastal feeding grounds.

Ancient Hawaiians used sea turtles for food, and as the demand for turtle meat increased so did turtle hunting. As a result, the population of sea turtles declined sharply. This is not the only reason why the turtle population in Hawai'i is threatened. The dramatic decline of the Hawaiian green turtle population can be attributed directly to (1) slaughtering of sea turtles for food and for various commercial uses, and (2) urban development.

Scientists find it difficult to estimate the population of the other two native species of sea turtles, the hawksbills and leatherbacks. The hawksbills do not nest in groups and the leatherbacks do not nest in Hawai'i at all. Both species are considered endangered worldwide. In past centuries worldwide sea turtle numbers were of sufficient proportion that no consideration was given toward exploitation and possible extinction. Today, poor and wealthy countries alike are either producers or consumers of sea turtle products, decimating turtle numbers for meat, eggs, shell, oil, leather and decorative objects. International awareness and cooperation among individuals and nations are urgently needed to protect these vanishing animals. Otherwise, the sea turtles will ultimately disappear from the seas they have inhabited for millions of years.

COASTAL PLANTS OF MO'OMOMI

New life arriving in the Hawaiian Islands in ancient times came by three means: ocean, wind, or birds. Ocean currents containing floating debris acted as host to various insects. Plant spores and smaller insects rode strong winds from all parts of the world to land by chance on a Hawaiian island. Birds blown off course by the same strong winds and storms played their part, bringing seeds in their digestive systems or attached to their feathered bodies.

The few plants and animals that successfully arrived in Hawai'i evolved into new forms to fit the varied habitats, and flourished. Each individual island provided further isolation, creating an environment contributing to the enhancement of each new species.

Today more rare and endangered plant species grow in Hawai'i than in any other state of the United States, except for California. Yet, Hawai'i, much smaller than California, has the highest concentration of rare and endangered plants in the United States. Among the unique plants that grow at Mo'omomi are four native plant species that are considered globally imperilled.

In this guidebook, the descriptions for each plant species growing at Mo'omomi will show its origin relative to Hawai'i and its distributional status. The categories used throughout the book— "endemic", "indigenous" and "naturalized"—are described in the *Manual of Flowering Plants of Hawai'i, Volume 1*. Each designation is placed next to the scientific name of the plant within parenthesis. The designations are as follows:

Endemic (end): Plants occurring only in the Hawaiian Archipelago, but not necessarily on a single island within the archipelago.

Indigenous (ind): Plants that occur naturally in the archipelago but that also have a wider distribution outside Hawai'i.

Naturalized (nat): Plants that apparently have been introduced to the archipelago directly or indirectly by man. These plants are thoroughly established and spreading.

Both common names and scientific names of plants are used in the text. Scientific names of plants are from the *Manual of the Flowering Plants of*

Hawai'i, Volumes 1 and 2, by Warren L. Wagner, Derral R. Herbst and S. H. Sohmer (1990). Each plant description provides page references to the *Manual of the Flowering Plants of Hawai'i, Volumes 1 and 2*. Categories indicating degrees of threat to native plant species are also given for each plant as adapted by the *Manual of Flowering Plants of Hawai'i, Volumes 1 and 2*. The four categories indicating the degrees of threat are as follows:

1. **Extinct (Ex):** This category is used for species for which we have evidence that they no longer exist. Because many Hawaiian plants are restricted in their distribution, some species presently placed in this category may be rediscovered.
2. **Endangered (E):** These are plants in danger of becoming extinct throughout all or a significant portion of their range, unless the threats jeopardizing their survival are alleviated.
3. **Vulnerable (V):** This category includes plants likely to become endangered in the near future unless the threats to their survival are removed or reduced. In Hawai'i, most species in this category are threatened by extensive habitat destruction or modification, or by other environmental disturbances.
4. **Rare (R):** Many Hawaiian plants have small, localized populations. Species not believed to be endangered or vulnerable at present, but that could be considered at risk, are included in this category.



'AKI'AKI

Sporobolus virginicus (L.)

Poaceae (Grass family) (Vol. 2, Pg. 1597)

'Aki'aki is a common tropical grass growing along island coasts near the high-tide line and within the reach of ocean spray. This grass is indigenous to Hawai'i and occurs on many other islands in the tropics. The Hawaiian name *'aki'aki* alludes to the power of this grass to exorcise spirits. In fact, it was used in ancient exorcism ceremonies.

Description. The flowers and seeds are borne on spikes above the blades of grass. This grass is able to tolerate hot sun and salt air. The plant helps to stabilize the wind-swept sand at Mo'omomi as it grows along the shore and amongst the dunes. The scientific name, *Sporobolus virginicus*, is derived from the Greek *sporos* (seed) and *ballein* (to throw), referring to the unusual action of the fruit that swells and bursts on soaking, pushing out the seed of the plant.



'AKOKO, KOKO

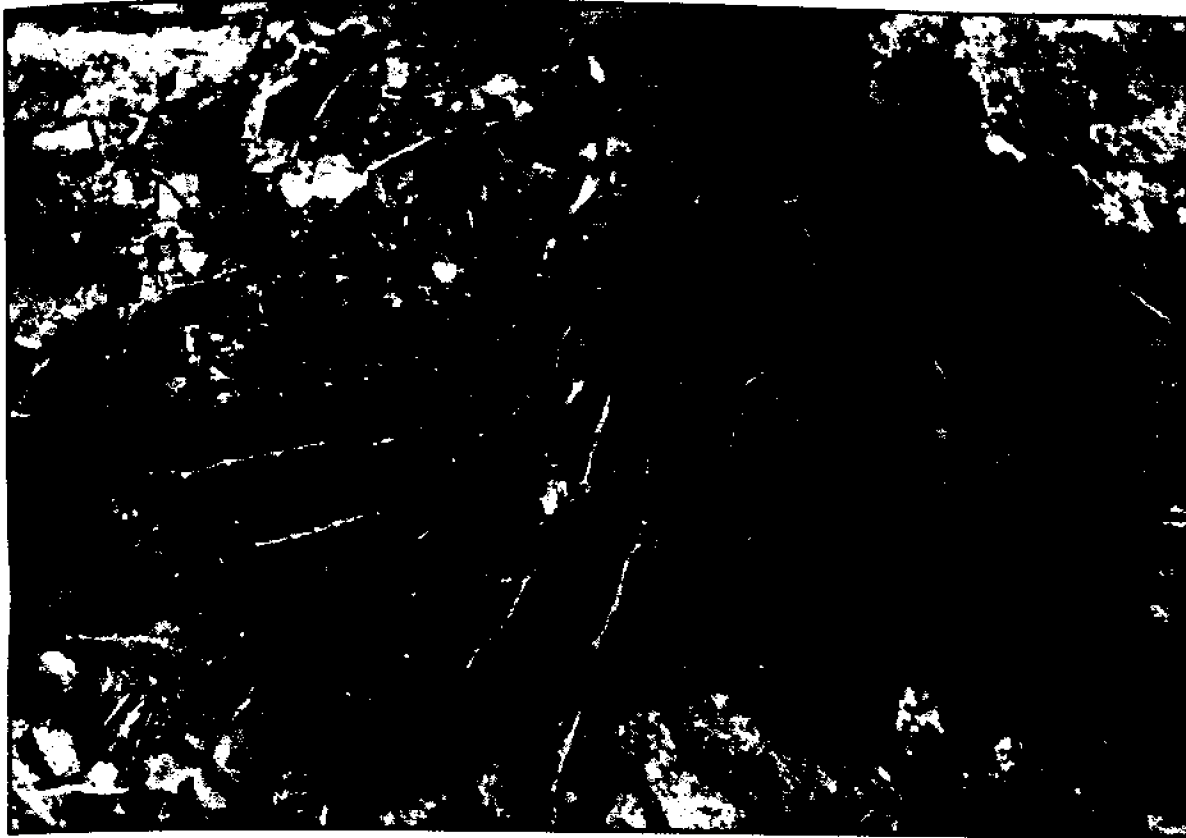
Chamaesyce degeneri (end)

Euphorbiaceae (Spurge family) (Vol. 1, Pg. 607)

The 'akoko lies close to the ground in its growth, mat-like, and is one of several Hawaiian *Chamaesyce* species. The plant grows on sand dunes and along drier coastlines. This plant grows throughout Hawai'i except on the islands of Lāna'i and Kaho'olawe. This 'akoko is endemic to Hawai'i.

Chamaesyce degeneri was named to honor Dr. Otto Degener (1899–1988). He was an early leader in conservation, saving Hawaiian plants, and in dramatizing the plight of the flora of the Hawaiian Islands. His contribution is immense because many of the plants Degener collected are now extinct. The Hawaiians used the bark of 'akoko, together with other herbs, in the preparation of a rather strong purgative that was to be administered with great care.

Description. The bluish-green leaves are succulent, somewhat circular in shape, and grow on a stem opposing each other. On different branches, variations may occur in leaf color from bluish-green to a rusty red. The leaves average $\frac{1}{2}$ to one inch in length. The pale yellow flowers are tiny and inconspicuous, and form close to the base of each leaf where it joins the stem.



'AKOKO

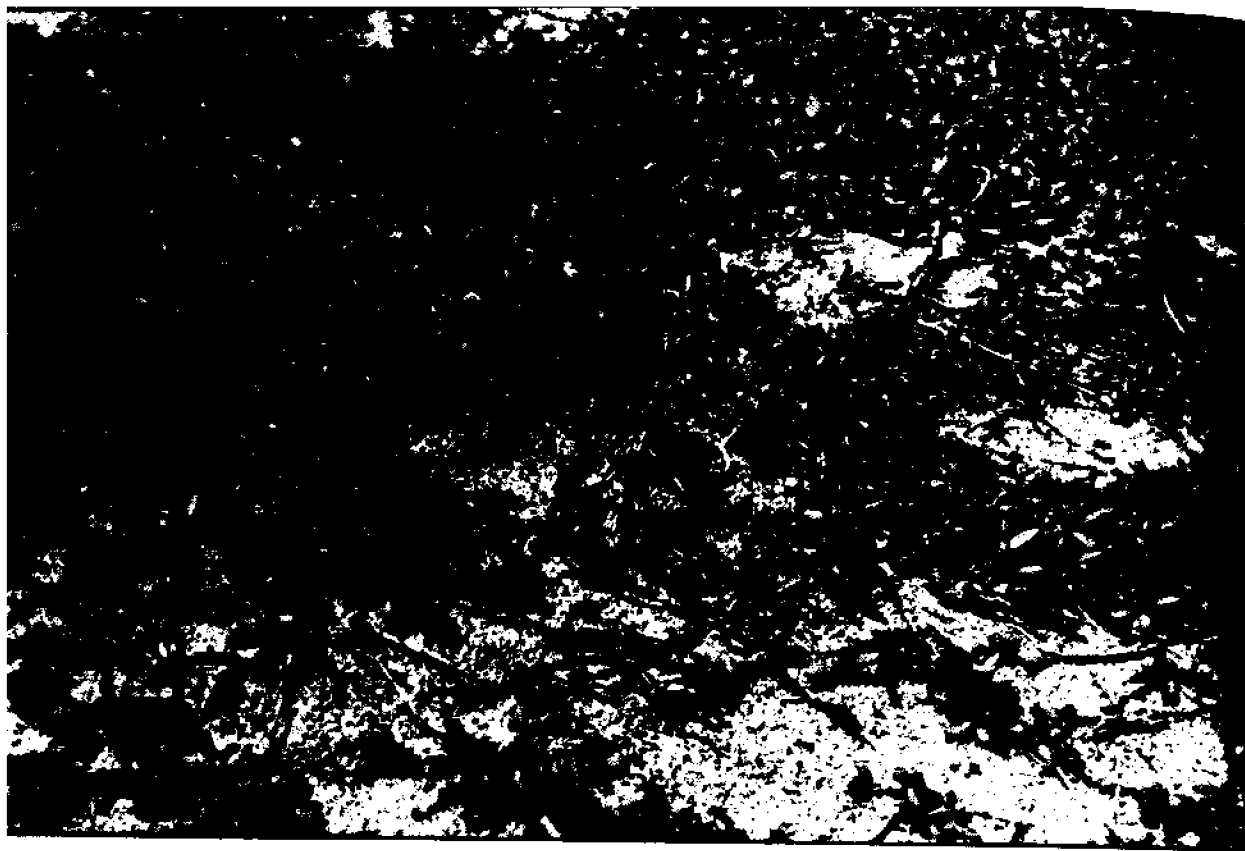
Chamaesyce skottsbergii (end.. E)

Euphorbiaceae (Spurge family) (Vol 1, Pg. 614)

This attractive plant grows in the shallow sand, and on the sandstone ledges, in back of the sand dunes at Mo'omomi. This 'akoko is endemic to Hawai'i and can be found on southwestern O'ahu and West Moloka'i.

Chamaesyce skottsbergii is a low, mat-forming plant, and has a lacy appearance as it lies upon the ground. Each plant measures approximately six to ten inches or more across. A thick, deep tap root enables this plant to survive in the hot, arid area of Mo'omomi.

Description. Slender branchlets of the plant support the bluish-green leaves that grow opposite each other. The shape of the small leaves are oblong to nearly round, and are approximately $\frac{1}{4}$ -inch wide and $\frac{1}{2}$ -inch long. The veins of the leaves are yellow. Tiny yellow flowers grow at the base of each leaf, and appear as yellow dots along the branches.



'ĀKULIKULI

Sesuvium portulacastrum (Ind)

Aizoaceae (Fig-marigold family) (Vol. 1, Pg. 176)

This succulent plant with trailing branches and fleshy stems is a prostrate herb. It is salt-tolerant and is found near the beach, and up amongst the rocks along the shoreline.

'Ākulikuli is a common beach plant, and can be found elsewhere in most tropical regions. It is widely used in the South Pacific as a salad plant, and is very salty in taste. The 'ākulikuli is indigenous to the islands of Hawai'i. It also grows in South Africa, Australia, Pearl and Hermes Atoll, Lisianski, Laysan, and Necker Islands.

Description. The leaves of the 'ākulikuli are narrow and rounded, and are about $\frac{1}{4}$ inch to $1\frac{1}{2}$ -inch long. Flowers: The flowers are borne at the leaf where the leaves join the branches, are white to magenta in color, and have five pointed petals.



ALENA

Boerhavia repens (ind)

Nyctaginaceae (Four-o'clock family) (Vol. 1, Pg. 981)

The alena is a perennial plant that trails along the ground, and grows primarily in coastal areas. This plant is also found throughout the tropical islands of the Pacific Ocean, as well as Africa.

The Hawaiians used the roots of the alena plant medicinally to relieve toothaches, and as a diuretic.

Description. The leaves are spade-shaped, and are an inch to 1½-inch in length. Each set of leaflets grows opposite each other. The tiny clusters of tubular flowers, white to pinkish in color, are supported on a thin stalk an inch or two above the plant. The sticky seeds of the alena clings to sea and shore birds, and this aids in the dispersal of the seeds.



'ENA'ENA

Gnaphalium sandwicense var. *molokaiense* (end., V)
Asteraceae (Sunflower family) (Vol. 1, Pg. 321)

The 'ena'ena is a small plant that is densely covered with white, soft, fine hairs. The name *Gnaphalium* is taken from the Greek *gnophalon* (lock of wool) which describes the woolly appearance of these plants. It is approximately six inches in height, having one central stalk and up to five branching stalks that grow outwardly away from the main stalk. The 'ena'ena plant is endemic to Hawai'i. This variety of 'ena'ena is found only in West Moloka'i. It is designated as being vulnerable due to potential development of coastal areas in Hawai'i.

The ancient Hawaiians used the 'ena'ena as insect repellent when storing feathered *kāhili*, a staff mounted with circles of featherwork at the top. The *kahili* was a symbol of royalty and authority in ancient Hawai'i.

Description. The leaves are a thick, narrow, spatula shape, and are covered with a mat of dense fine hairs. These fine hairs are soft and fuzzy to touch; and give the plant a bright white appearance. The leaf measures approximately $1\frac{3}{4}$ -inches in length, and $\frac{1}{4}$ - to $\frac{1}{2}$ -inch in width. The flower heads are in tight clusters, and are borne at the end of thick stalks. The tiny individual flowers, within the cluster, are dark mustard yellow.



HINAHINA, HINAHINA-KŪ-KAHAKAI

Heliotropium anomalum, var. *argenteum* (end)

Boraginaceae (Borage family) (Vol. 1, Pg. 395)

This beautiful perennial plant grows close to the ground in a sprawling fashion. It is found along coastal bluffs in dry, sandy areas and helps to stabilize the sandy slopes at Mo'omomi. The scientific name for the plant's genus, *Heliotropium*, is from the Greek *helios* (sun) and *trope* (turning), referring to the erroneous belief that the flowers turn to face the sun. Leaves and flowers that follow the sun are called heliotropic. The leaves and flowers are highly prized for lei making. This is strongly discouraged, however, because the plants are slow-growing, and are vulnerable to over-collection. The *hinahina* is the official flower of the Island of Kaho'olawe. The *Heliotropium anomalum*, var. *argenteum*, is endemic to Hawai'i. The plants also grow on Ni'ihau, Kaua'i and O'ahu, but are rarely found on Maui and Hawai'i. It is thought that at one time, the *hinahina* may have grown on the islands of Lāna'i and Kaho'olawe.

Description. The leaves are arranged in whorls. Each slender leaf is approximately $\frac{1}{2}$ to 1-inch in length and shape, and green-grayish in color. The leaves are covered with fine hairs that give them a silvery appearance that helps to reflect the heat from the sun. The tiny white flowers have five waxy petals and a yellow center, and are borne in a cluster supported on a stalk above the leaves of the plant. The flowers have a sweet, delicate fragrance.



'IHI

Portulaca lutea (ind)

Portulacaceae (Purslane family) (Vol. 2, Pg. 1071)

The *'ihi* is a low-lying perennial herb. This plant is commonly found growing along the coastlines of Pacific Islands and on most of the islands of Hawai'i. It does not grow in great abundance at Mo'omomi.

Description. The leaves are about an inch long, spatula-to-round in shape and succulent. They are supported on thick, fleshy branches that are reddish-green to brown. The *'ihi* blossom is bright yellow with five petals, and approximately $\frac{1}{2}$ -inch in diameter. The seeds are very small, shiny, and black.



'ILIMA

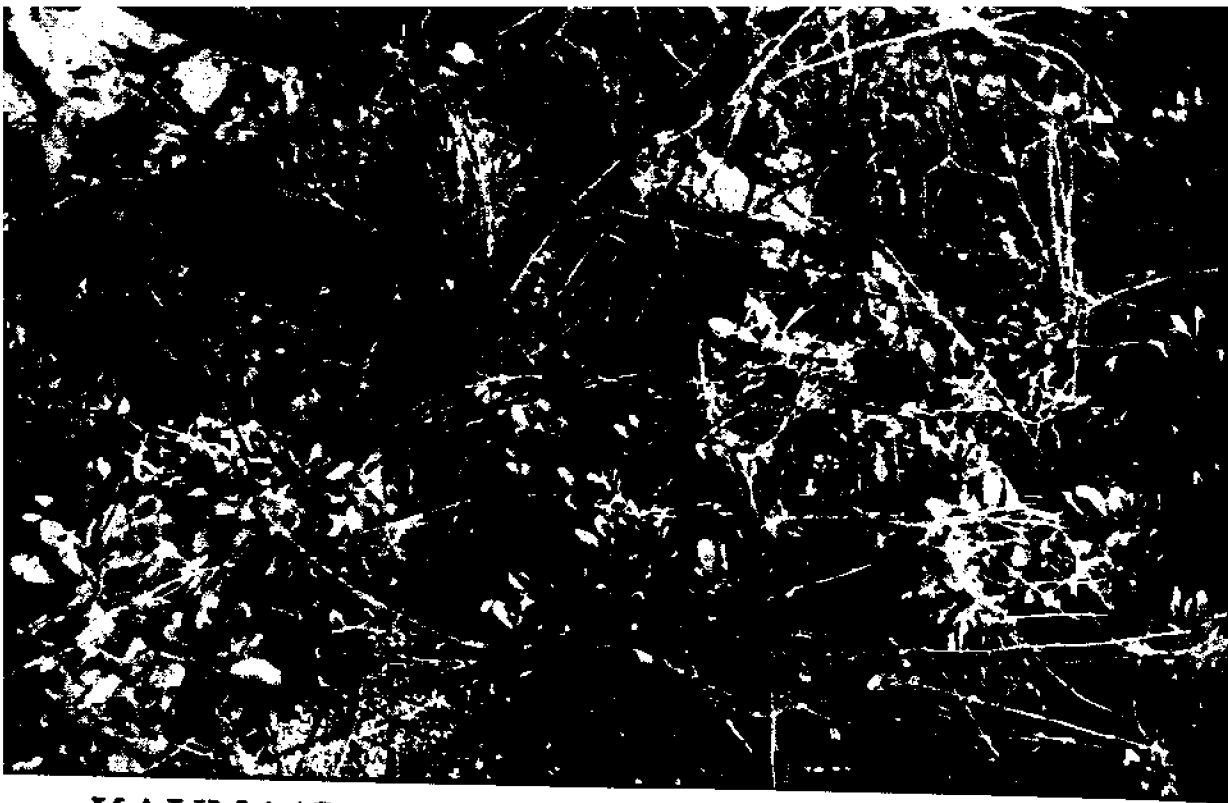
Sida fallax (ind)

Malvaceae (Mallow family) (Vol. 1, Pg. 897)

The common 'ilima grows along the coastline and dunes of Mo'omomi. It is a low-lying plant with branches that sprawl across the ground. This plant can be found growing on all the main Hawaiian Islands including Nihoa and Midway Atoll, and is widespread throughout the Pacific islands to China.

The 'ilima's fragile blossoms are highly prized when strung into a lei. It can take more than 500 blossoms to make one strand of the 'ilima lei. Several strands of 'ilima are often entwined with the shiny fragrant leaves of the maile, *Alyxia oliviformis*, for presentation at special events. 'Ilima blossoms were used by Hawaiians to cure general debility. In ancient times, the flowers, young shoots and bark, together with certain other plants, were combined and used in the treatment of asthma. Also, sometimes pregnant women ate the flowers until the time of childbirth for an easier birth. The 'ilima is the official flower of O'ahu.

Description. The leaves have serrated or sawtooth-like edges, and are oblong, and somewhat heart-shaped. They are approximately 1 to 1½-inch in length. The color of the leaves is light green, and they have a velvety appearance that helps withstand the hot sun of Mo'omomi. The delicate, paper-thin, five-petaled flowers are yellow-orange in color. They measure about ½ to one inch in diameter. The seeds are black and small, larger than grains of sand.



KAUNA'OA

Cuscuta sandwichtana (end)

Cuscutaceae (Dodder family) (Vol. 1, Pg. 582)

The fragile *kauna'oa* vine grows in coastal areas, but does not grow in great abundance at Mo'omomi. The stems of this leafless plant are light yellow to orange, and string-like in appearance. This parasitic plant absorbs nourishment from a host plant. The photograph shows the *kauna'oa*, with orange, thread-like twining vines, growing over its host-plants, the 'aki'aki grass and the silvery-bluish green *hinalina-kū-kahakai*.

There is a Hawaiian proverb that says: "*Hihi kauna'oa, hihi Mana, aloha wale ia la'au kumu 'ole* (tangled parasite vine, tangled Mana, pity for this vine without a trunk—said of parasites or helpless folk) (Pukui and Elbert, 1965). The scientific name for its genus, *Cuscuta*, was taken from the Arabic, *kuskut* (a tangled twist of hair), alluding to the appearance of the plant's twining stems. The *kauna'oa* is the official flower of the Island of Lāna'i and grows on all the main Hawaiian Islands except Kaua'i and Kaho'olawe. It is endemic to Hawai'i.

Description. Tiny, tubular flowers grow in tight clusters on the thin, slender stems of the plant. The minuscule seeds are round, and dark reddish-brown.



KIAWE, ALGAROBA

Prosopis pallida (nat)

Fabaceae (Pea Family) (Vol. 1, Pg. 692)

The *kiawe* trees that grow at Mo'omomi beach are stunted and flat in growth due to extremely windy conditions. They hug the rocks and sandy bluffs in their struggle to survive. In friendlier, dry forest areas, the *kiawe* can grow upwards of 50 feet, and utilizes a deep root to tap scarce ground water. In past years, the Moloka'i Ranch used the yellow bean pods as a food supply for its cattle. This contributed greatly to the *kiawe's* wide distribution on the island. Excellent honey has been made from the *kiawe* blossoms. Beginning in 1910, honey was produced with great success by Moloka'i Ranch, but in 1937 a bee disease destroyed the industry. The wood of the *kiawe* is hard, and can be used for fence posts. It is also an excellent charcoal source because of its aroma that leaves a rich flavor. The *kiawe*, also called mesquite outside of Hawai'i, was introduced to Hawai'i in the early 1800s. It is native to Peru, Colombia and Ecuador, South America. Seedlings spring up after each rain and it is now considered a pest. Native dryland and coastal plants at Mo'omomi have been effectively displaced by this plant.

Description. The leaves are compound, comprising many tiny leaflets, which give a lacy appearance. Sharp thorns grow close to the junction of the leaves on the branches. A puncture from one of these nasty thorns can be very painful. Miniature yellow florets are borne on a spike that gives a cylindrical appearance to the flower cluster. The small, flat seeds are contained in a yellow bean pod. The bean pod is stiff and waxy, measuring approximately four to seven inches in length. The fruit matures in the summer.



MAU'U

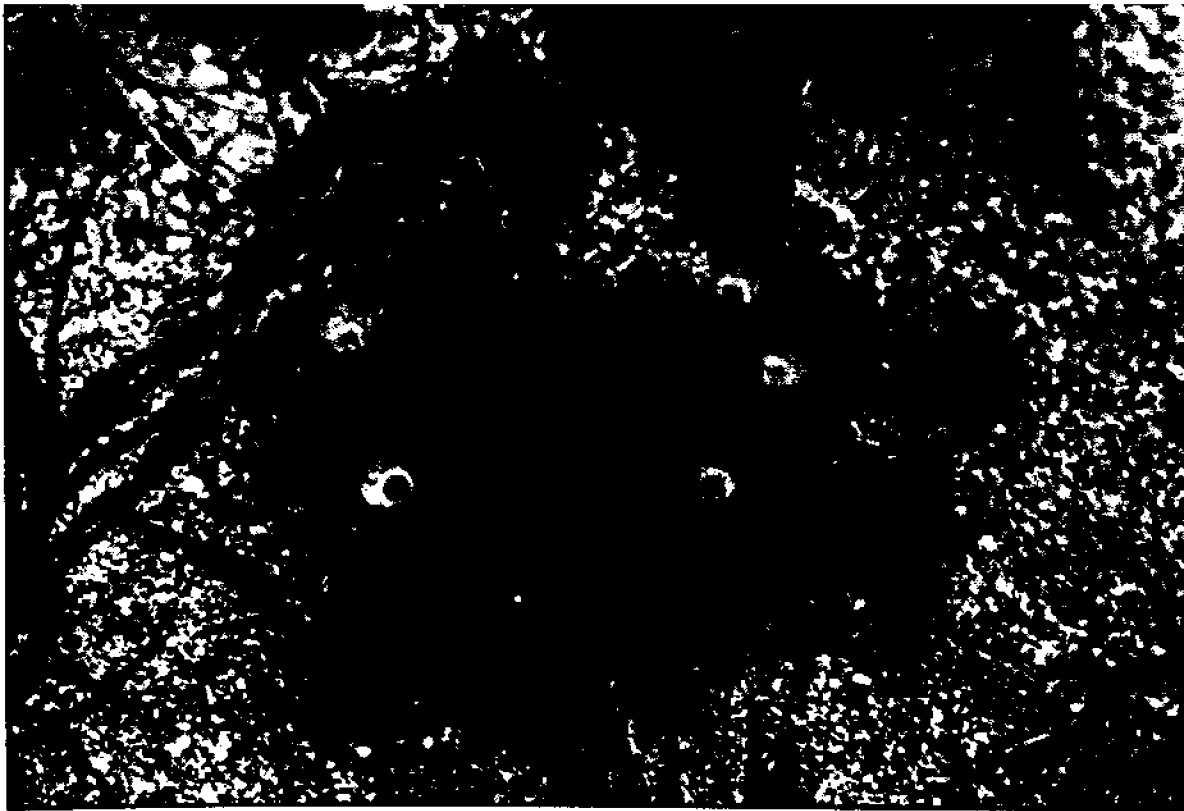
Fimbristylis cymosa (trd)

Cyperaceae (Sedge family) (Vol. 2, Pg. 1404)

The *mau'u* grows in grass-like clumps, and at Mo'omomi, it is common to the rocky sandstone areas above Kawa'aloa Bay. It is also found growing in shallow sand, among the cracks of the sandstone ledges at the shoreline, and behind the sand dunes.

Fimbristylis cymosa is found growing on all the main islands of Hawai'i except on Kaho'olawe, and it also grows on Kure and Midway Atolls, Laysan, and the French Frigate Shoals. It also grows in coastal areas across the Pacific Basin including Australia, Western Malesia, and the Neotropics.

Description. The leaves are stiff narrow blades, and are a deep brownish-green. The small flowers and seeds are borne on long stalks above the clump of leaves.



NAMA

Nama sandwicensis (end. V)

Hydrophyllaceae (Waterleaf family) (Vol. 1, Pg. 795)

The nama is a lovely little plant. It is an annual or possibly short-lived perennial herb. It grows on limestone ledges at Kaiehu Point, and among the sand dunes at Mo'omomi. The nama grows in a small mat-form, two to three inches in diameter, and it reaches $\frac{1}{2}$ -inch to an inch in height. This delightful plant is not easily spotted, because it is so small and lies so close to the ground. Following a rainy period, the nama is usually plentiful, and at other times it completely disappears.

Nama is the Greek word for spring. The nama grows on all the main islands of Hawai'i, except Kaho'olawe, and also grows on Lisianski and Laysan. *Nama sandwicensis* is endemic to Hawai'i.

Description. The leaves are slightly cupped, succulent in appearance, hairy, and grow close to the stem of the plant. The leaves are a deep green to a yellowish green, depending on soil conditions. The nama has small, tubular flowers with five pale bluish-purple petals, a white throat, and a yellowish ribbed center. The very small seeds are yellowish brown.

Scaevola sericea (ind)

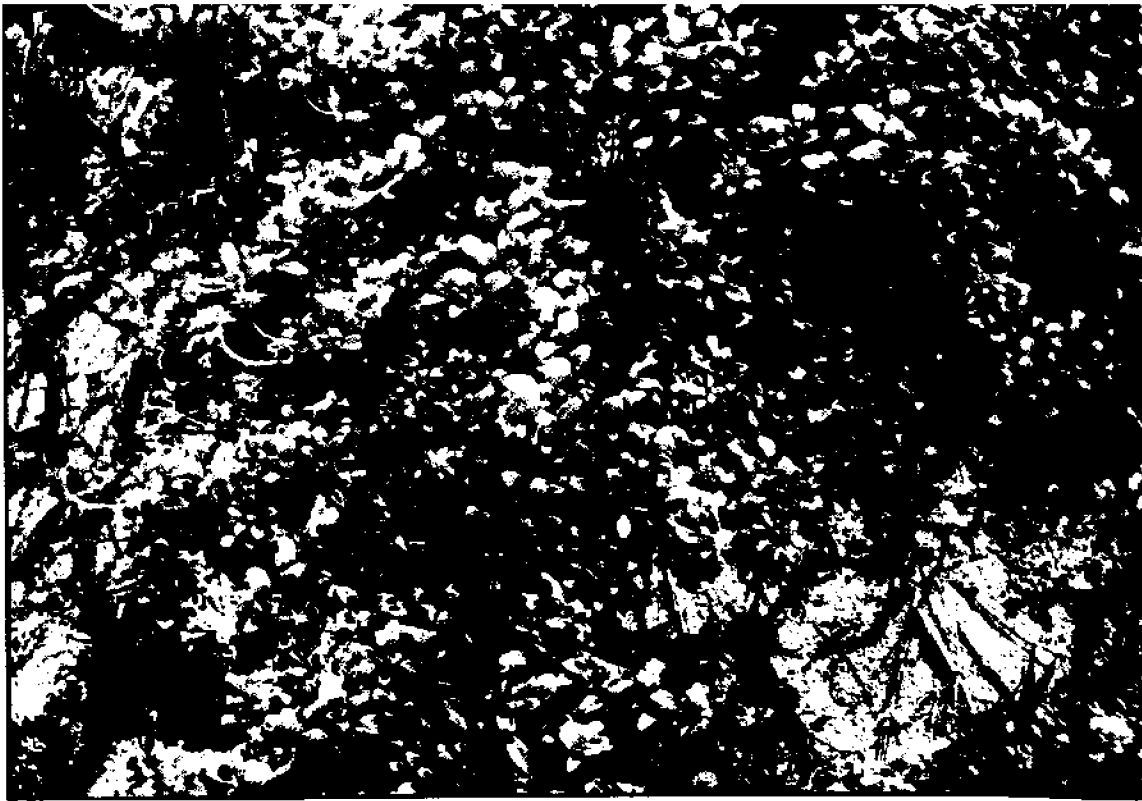
Goodeniaceae (Goodenia family) (Vol. 1, Pg. 788)



This shrub is bushy and densely branched. Windy conditions at Mo'omomi cause the *naupaka* to grow close to the ground, limiting its growth to two to three feet in height. In a less hostile environment, the *naupaka* can grow up to 8-10 feet in height. The *naupaka* is found growing throughout the Hawaiian Archipelago, but not on Gardner Pinnacles, Necker and Nihoa.

There are various versions of the not-so-ancient legend for the *naupaka*. This is the story that was told to me: There was a Hawaiian Chief who had a lovely daughter, and they lived near the ocean. His daughter was in the habit of walking along the shore in the early morning. On one of these walks she met a handsome young man who was fishing. They met many times by the sea, and soon fell in love. When they told her father of their wish to marry, the Chief forbade it because the young man was a commoner. The lovers were unhappy, but continued to meet secretly. At one of these meetings, they were discovered by the Chief, and he, in anger, cast a spell upon the lovers. He turned them into the white *naupaka* flower, and he tore it in half, decreeing that the *naupaka* plant that grows in the mountains would bear only one-half of the flower. The other half of the flower would be borne by the *naupaka* plant growing at the shore. This separated the lovers for eternity, and this was their punishment for disobeying their Chief.

Description. The bright green leaves are leathery in texture, and reach two to four inches in length. The small, whitish flowers, with soft yellow centers, appear to be a "half" flower, a semi-circle with five petals. The seeds are white waxy berries, approximately $\frac{1}{2}$ -inch across, with a fleshy cover that makes them buoyant in the ocean. The seeds are easily moved with the currents and tides, helping them disperse across the islands. The ancient Hawaiians used the bark of the *naupaka* root, pounded together with salt, to treat cuts and skin disorders.



NEHE

Lipochaeta integrifolia (end)

Asteraceae (Sunflower family) (Vol. 1, Pg. 336)

This is a low-lying, perennial plant with mat-like growth. At Mo'omori it grows a few inches above the ground. In other parts of Hawai'i, this plant may attain a foot or more in height.

There are many species of *Lipochaeta* that grow along the coasts of the main Hawaiian Islands in a variety of environments, including dry leeward mountains and lava flows. The Nehe is also found growing on the coasts of Kure Atoll and Laysan.

Description. The leaves are whitish-green, thick, oblong to spatula-like in shape, and approximately an inch long in length. They usually grow opposite each other on the stems. The stems lie close to the ground with roots along the lower surface. The pretty yellow flowers are borne on a stalk, and average a $\frac{1}{2}$ -inch in diameter. The head of the flower is composed of many tiny florets that are raised and tightly compacted in a disk shape, and surrounded by ray or daisy-like petals.



NOHU

Tribulus cistoides (Ind)

Zygophyllaceae (Creosote bush family) (Vol. 2, Pg. 1343)

The nohu, also known as the Puncture Vine, is a perennial herb that grows close to the ground with stems or branchlets that are usually less than three feet long. Both stems and leaves are covered with many tiny, soft hairs that give protection from the sun and heat.

The ancient Hawaiians used the seeds of the *nohu* in the treatment of bladder diseases. Another use was to make tea from the root of the plant in the treatment of thrush ('*ea*—a disease of the mouth marked by whitish fungus especially affecting children). The *nohu* grows on all of the Northwestern Hawaiian Islands, except Gardner Pinnacles and Necker. It is now considered a pantropical weed.

Description. The leaves are composed of approximately six pairs of leaflets opposing each other on one main stem. Each leaflet is approximately $\frac{1}{2}$ -inch long. The bright yellow flowers have five petals. Each blossom measures approximately one inch in diameter. The seed has three to five lobes, and several sharp hard spines that are painful when stepped upon with a bare foot. The seed is about $\frac{1}{3}$ -inch in diameter. The word *Tribulus* means a 4-pointed weapon or war club.



'OHAI

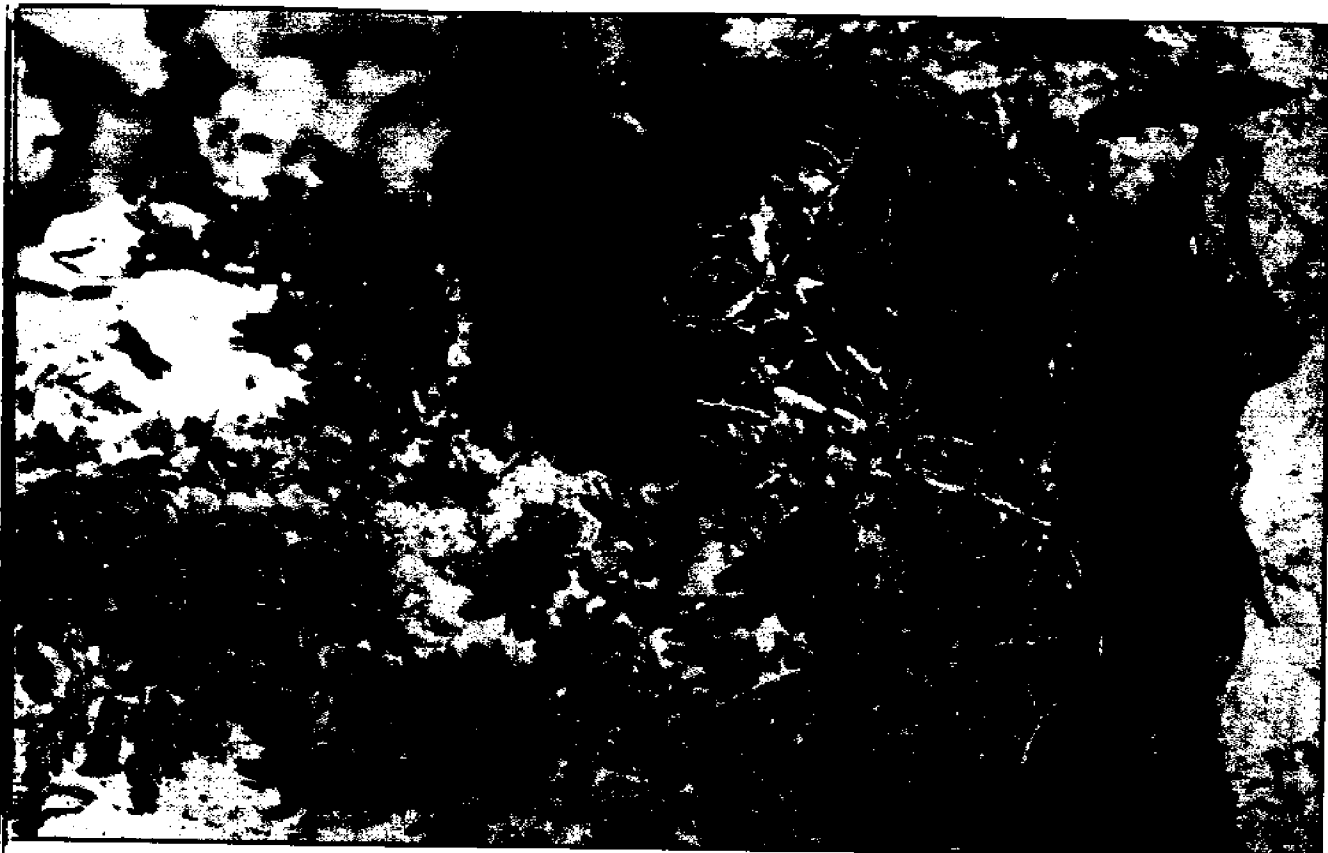
Sesbania tomentosa (end. V)

Fabaceae (Pea family) (Vol. 2, Pg. 1257)

This dense, spreading shrub sprawls on the ground with stems or branchlets that often root themselves. At Mo'omomi, an 'ohai plant can cover an area of five feet in diameter, and grow from six to eight inches in height above the ground.

The 'ohai is a plant that is becoming increasingly rare, and without care it could be eliminated from Moloka'i and Hawai'i. This plant has been designated as vulnerable to extinction due to loss of lowland habitats.

Description. The leaves are composed of approximately 12 to 20 leaflets opposing each other on the stem. Each leaflet is dark green with a whitish cast, and is approximately one inch in length. The branches, stems and leaves are covered with fine, soft hairs resulting in a velvety appearance that gives protection from the sun and heat. The beautiful red 'ohai flowers that bloom at Mo'omomi are similar in appearance to pea flowers, and are approximately $\frac{1}{2}$ -inch in length. The underside of the petals are pale yellow-green. The seeds are contained in bean pods that appear to be slightly flattened. They are pale green to dark brown.



'ŌHELO-KAI, 'AE'AE

Lycium sandwicense (ind)

Solanaceae (Nightshade family) (Vol. 2, Pg. 1257)

The 'ōhelo-kai is a low spreading shrub that grows along the shoreline. This salt-tolerant plant grows on all the main islands of Hawai'i. It also grows on Rapa, Tonga, and Juan Fernandez Islands.

Description. The leaves on the stems appear in an alternating pattern. Each leaf is about one inch long, green, pointed, and succulent. The branches of the plant that lie upon the ground often take root. The pale lavender flowers are tubular in shape with four petals, and appear where the leaf joins the stem of the plant. The flower measures approximately $\frac{1}{4}$ -inch in length. The fruit is a round red berry that has an edible juicy pulp, and it contains numerous flattish seeds.



PA'Ū-O-HI'IAKA

Jacquemontia ovalifolia, subspecies *sandwicensis* (end)
Convolvulaceae (Morning glory family) (Vol. 1, Pg. 562)

This plant is endemic to Hawai'i, and grows on all the main islands of Hawai'i. Different subspecies grow in Mexico, the West Indies and Africa.

The ancient Hawaiians used the leaves and stems of the plant medicinally as a cathartic, and for treating babies with thrush. This attractive perennial vine lies flat as it sprawls upon the ground.

Hawaiian legend records that this plant was given its name by Pele, the Fire Goddess of the Volcanoes. As the story is told, Pele returned from a lengthy morning of fishing, and found her baby sister, Hi'iaka, on the beach covered by the trailing stems of this plant. The child had been protected from the strong rays of the sun by this plant, and so Pele named the plant, *pa'ū-o-Hi'iaka* or skirt-of-Hi'iaka.

Description. The leaves are thick in texture, 1-1½-inch in length, and alternate on the main branches of the plant. The pale blue to whitish flowers are cup-shaped, and are approximately an inch in diameter. Flower stems are attached at the base of the leaves, and the flower heads rise above the foliage of the plant. Blossoms appear throughout the year, but primarily from December to July.



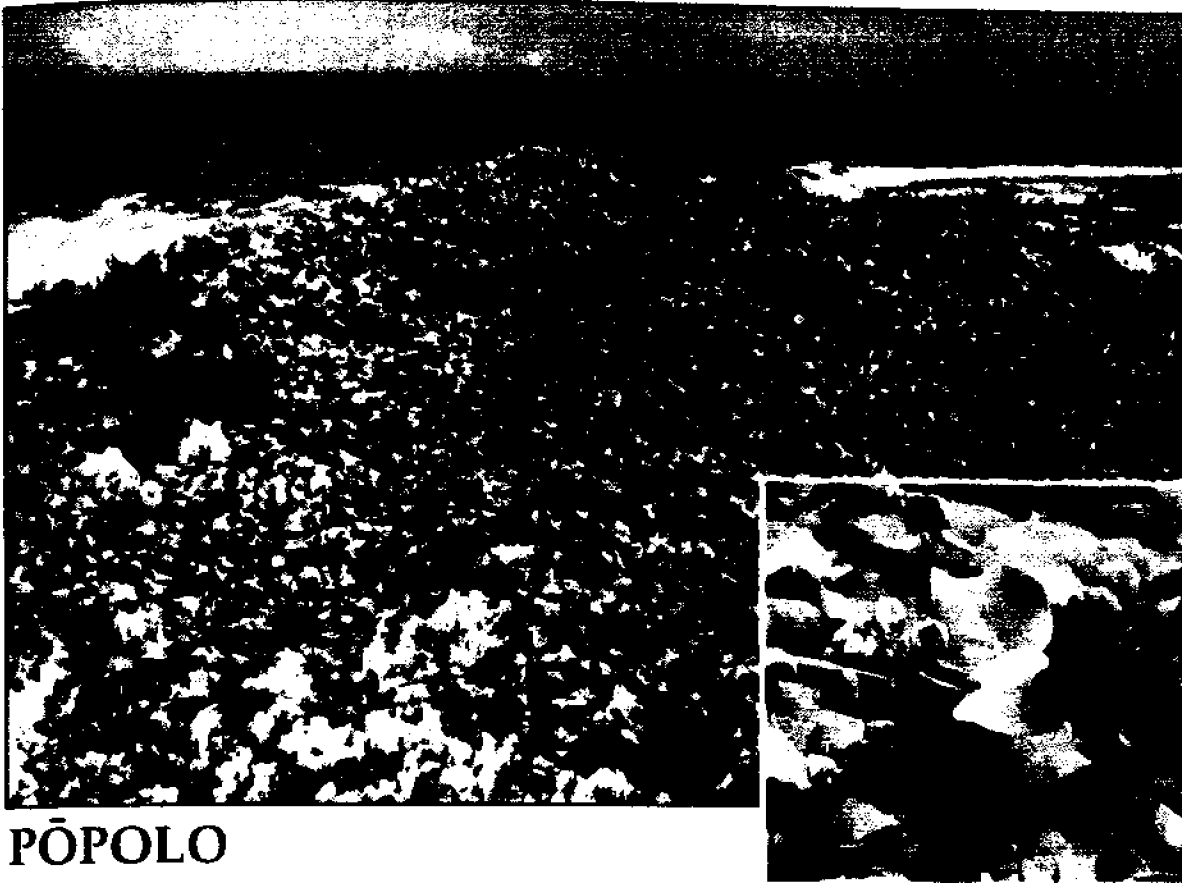
PŌHUEHUE

Ipomoea pes-caprae, subspecies *brasiliensis* (ind)
Convolvulaceae (Morning glory family) (Vol. 1, Pg. 559)

The *pōhuehue* is a perennial vine that grows at the high-water line along island sea shores. This vine is a common beach plant, though it does not grow in great abundance at Mo'omomi. The *pōhuehue* grows on all the main islands of Hawai'i. It is also found on beaches and occasionally inland on Midway Atoll, Lisianski, Laysan, French Frigate Shoals, and Nihoa.

This plant's name *Ipomoea* is taken from the Greek *ips* (worm) and *homios* (comparable to), meaning worm-like, in describing the twining habit of the plant. The vines of the *pōhuehue* were utilized in the making of temporary twined fish traps and baskets, as cords in house construction, in medicines, and as famine food by the ancient Hawaiians. Sometimes, the vines of the *pōhuehue* were used by ancient Hawaiian surfers to evoke improved surf conditions by slapping the ocean surface with the vines and chanting special chants.

Description. The leaves are smooth and thick, heart-shaped, and are two to three inches in length. The pinkish lavender flowers are funnel-shaped with a ribbed throat in a deeper shade of lavender. Usually, four seeds are contained in a small capsule. The seeds are brown or black, and are capable of floating on sea currents for months.



PŌPOLO

Solanum nelsonii (end)

Solanaceae (Nightshade family) (Vol. 2, Pg. 1273)

Solanum nelsonii was first collected in 1778 by David Nelson, and the plant was named in his honor. Nelson discovered many plants on Captain James Cook's voyages. This plant is found on Ni'ihau, Kaua'i, O'ahu, Maui, and Hawai'i, as well as on Kure, Midway, Pearl, and Hermes Atolls, Laysan, and Nihoa.

This plant is a trailing vine-like shrub, lying close to the ground. Its branches are covered with very fine, soft golden hairs that cast a brownish hue to the plant. It is a member of the tomato family.

Description. When the plant is well established, and seasonal rains have been plentiful, the foliage is thick and dense. The leaves are heart-shaped, thick, and have edges that are smooth, wavy, or slightly curved. They can grow from one to two inches in length and width, depending on the season. The leaves are grayish-green when the brown hairs are rubbed off. A stem supports one to two bell-like blossoms together with one or more buds. Each blossom is approximately $\frac{1}{2}$ -inch in diameter, cup-shaped, and has five petals that are light lavender with a dark purple center. The fruit, when ripe, are black and resemble miniature tomatoes.



TETRAMOLOPIUM ROCKII

Tetramolopium rockii (end. V)

Asteraceae (Sunflower family) (Vol. 1, Pg. 368)

Tetramolopium rockii is known to be found only at and near Mo'omomi, West Moloka'i, Hawai'i. It grows on the sandstone ledges behind the first line of sand dunes at the west end of Mo'omomi, and near Mo'omomi Bay. The plants form compact mats, three inches or more in diameter, and reach a height of two to three inches.

Description. The stems of this plant are intricately branched at the base. The yellowish-green leaves are blade-like and spatula shaped, and $\frac{5}{8}$ " to one inch in length. The leaves are covered with fine soft short hairs that provide protection from the sun and heat at Mo'omomi. The daisy-like blossom has a yellow center and a white to pinkish skirt of petals borne upon a stalk.

HA'INA 'IA MAI ANA KA PUANA

Thus ends my story. As a child, it was always a joyful event to accompany my father, George A. Will, in his work-related inspection trips to the west end of Moloka'i for the Moloka'i Ranch and later with the Hawaiian Homes Commission. Weekends spent at Mo'omomi and evening tales told around a campfire are fond memories of my past.

Through this book, it has been my hope that all visitors to Mo'omomi, particularly young children, may recognize Mo'omomi's cultural significance, and gain new respect and appreciation for this place which I cherish. Mo'omomi has always been a place of beauty, curiosity and mystery ...and should remain that way.

With your help, care and protection,
Mo'omomi will be preserved for future generations to share.

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