

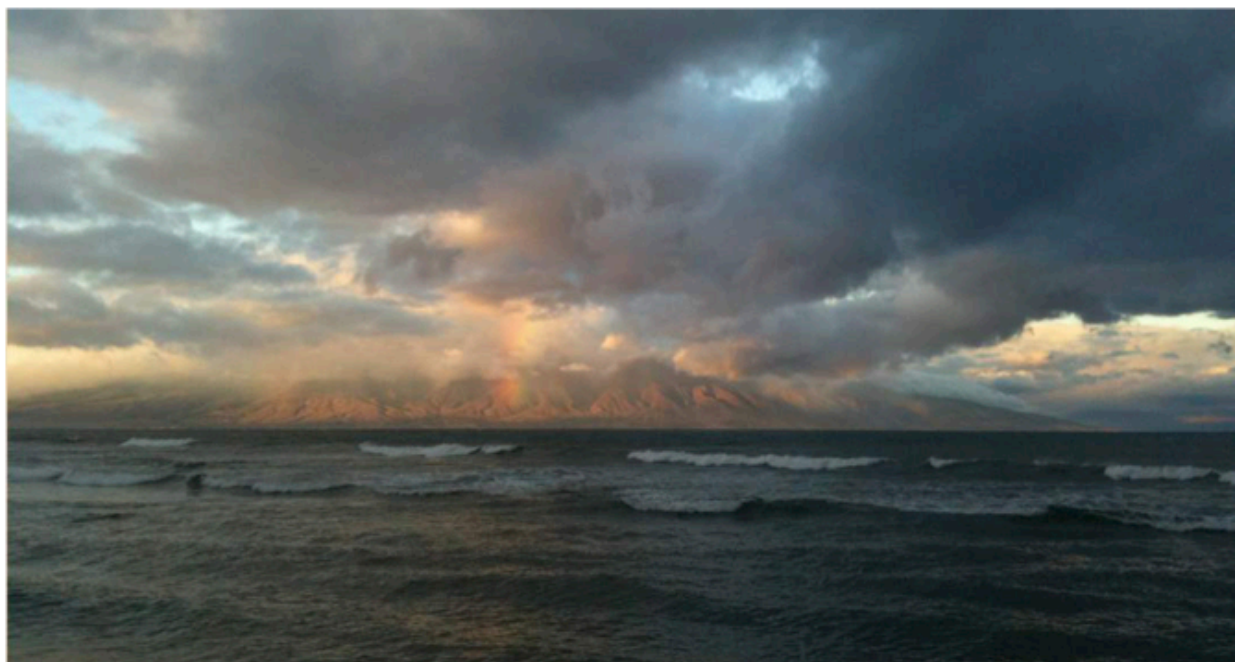
Lāna‘i Island

≈ Makai ≈

Draft Community Action Plan



2016



Born was Lāna‘i, an island

Lāna‘i is recognized in this *mele ko‘ihonua* (genealogical chant) as the fourth of the Hawaiian Islands. According to Hawaiian tradition, the islands were born from the unions of Wākea, often referred to in other cultures as Sky Father, and Papahānaumoku, Earth Mother (Malo, 1898).

‘O Wākea noho ia Papahānaumoku,
Hānau ‘o Hawai‘i, he moku,
Hānau ‘o Maui, he moku.
Ho‘i hou ‘o Wākea noho iā
Ho‘ohōkūkalani.
Hānau ‘o Moloka‘i, he moku,
Hānau ‘o Lāna‘i ka ‘ula, he moku.
Lili ‘ōpū punalua ‘o Papa iā
Ho‘ohōkūkalani.
Ho‘i hou ‘o Papa noho iā Wākea.
Hānau ‘o O‘ahu, he moku,
Hānau ‘o Kaua‘i, he moku,
Hānau ‘o Ni‘ihau, he moku,
He ‘ula a ‘o Kaho‘olawe.

Wākea lived with Papa, begetter of islands,
Born was Hawai‘i, an island,
Born was Maui, an island.
Wākea made a new departure and lived
Ho‘ohōkūkalani.
Born was Moloka‘i, an island,
Born was red Lāna‘i, an island.
The womb of Papa became jealous at its
partnership with Ho‘ohōkūkalani.
Papa returned and lived with Wākea.
Born was O‘ahu, an island,
Born was Kaua‘i, an island,
Born was Ni‘ihau, an island,
A red rock was Kaho‘olawe.

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This page: Sol Kaho‘ohalahala

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Executive Summary

The natural resources of Lānaʻi have sustained Native Hawaiian and local resident families for generations. Despite its importance, the marine life of Lānaʻi is endangered by a number of unmanaged threats both in the water and from land. By creating and committing to this Community Action Plan (CAP) the Lānaʻi community joins a wave of conservation-minded groups around the world working to buffer their natural resources against climate change and other global and local threats. This plan aims to protect not only natural resources, but also ancestral knowledge and values that live *through* these resources.

This CAP was written by, and for, the residents of Lānaʻi and those who care for the island. We, the community, believe Native Hawaiian wisdom and practices are essential to the sustainable management of the natural resources and our way of life, and also invite collaboration among groups with a stake in the resources to be a part of this management conversation.

This CAP targets marine and coastal resources along the entire coastline of Lānaʻi that are vulnerable to threats existing *mauka* to *makai*. The six priority targets that we would like to see return to health and abundance include coral reef and reef fish assemblages, jacks and nearshore pelagic fishes, shoreline habitat and fisheries, rocky intertidal fisheries, cultural landscapes, and the Lānaʻi way of life. The threats that challenge these resources include erosion and sedimentation, climate change, unsustainable harvest, ocean user conflict, marine debris and coastal waste, coastal development, and the changing culture and lifestyle of Lānaʻi.

Our goals are for healthy coastal and marine ecosystems, community involvement in perpetuating the Lānaʻi way of life, and the establishment of a Lānaʻi-specific ocean management framework. These goals embody our island culture and address needs that resonate across Maui Nui. Our aim is to restore and maintain the vital components of our island environment and community. This is an opportunity to create an ocean management framework that recognizes and values local subsistence fishing, tourism, economic growth, Hawaiian culture, and the marine ecosystem of Lānaʻi.

Acknowledgements

This CAP acknowledges how the people of Lānaʻi care for and envision our island future. It represents our involvement, respect, and responsibility for place, and in turn, our hope that Lānaʻi will be rejuvenated to provide for us. This CAP was generated by the community in hopes that it can help to unite everyone around caring for our island home.

Why We Need This Plan

Native Hawaiian and local resident families have thrived off of the natural resources of Lānaʻi for generations. Today, marine resources, including coral reefs and near-shore fisheries, remain central to island life. Despite its importance, the marine life of Lānaʻi is endangered by a number of unmanaged threats both in the water and from land including sedimentation, climate change, and overharvest.

In Hawaiʻi, the environment is the foundation for traditions and cultural identity. It is important to note that this plan aims to protect not only natural resources, but also ancestral knowledge and values that live *through* these resources. The *moʻolelo* (history) of Lānaʻi describes the resourcefulness, patience, and ingenuity of our Hawaiian ancestors and reminds us of the values that instill meaning and connection to the environment. For example, this intimate knowledge of Lānaʻi enabled the Hawaiian people to survive in the most extreme drought conditions by sourcing water from droplets found on blades of grass and ʻilima blossoms. Perpetuating the island's oral traditions by continuing to share these types of stories and values teaches our community to take better care of ourselves, our environment, and each other.

By creating and committing to this Community Action Plan (CAP) the Lānaʻi community joins a wave of conservation-minded groups around the world working to buffer their natural resources against climate change and other global and local threats. In order to restore and maintain resource abundance, this plan identifies some of the species and ecosystems that need *mālama* (care), threats that are cause for concern, and a sustainable way forward to manage and improve the future of Lānaʻi.

Who We Are

This document was written by and for residents of Lānaʻi and those who care for our island. We are a group of parents, grandparents, fishers, hunters, farmers, Native Hawaiians, students, conservation professionals and scientists who came together with a shared goal: to develop a CAP to restore the health and abundance of the coral reefs, near-shore fisheries, coastal ecosystems, and cultural landscape of Lānaʻi.

We believe Native Hawaiian wisdom and practices are essential to the sustainable management of natural resources and our way of life. We believe that success will be achieved through collaboration among groups with a stake in the resources, and that the community of Lānaʻi is at the center of this process since we and our descendants have a responsibility to actively care for our home.

Our vision: We accept our *kuleana* (privilege and responsibility) as stewards of Lānaʻi, from *mauka* (toward the mountains) to *makai* (toward the sea), to perpetuate the knowledge of *nā kūpuna* (our elders) as the foundation to restore our marine resources and to build a self-sustaining island ecosystem through an empowered and unified community.

We are inspired by and embody traditional values:

- **Pono** - *Do what is right*
- **Kuleana** - *Responsibility to people and place*
- **Laulima** - *Work together*
- **Kōkua** - *Commitment to helping others*
- **Hoʻomanaʻo** - *Remember the past*

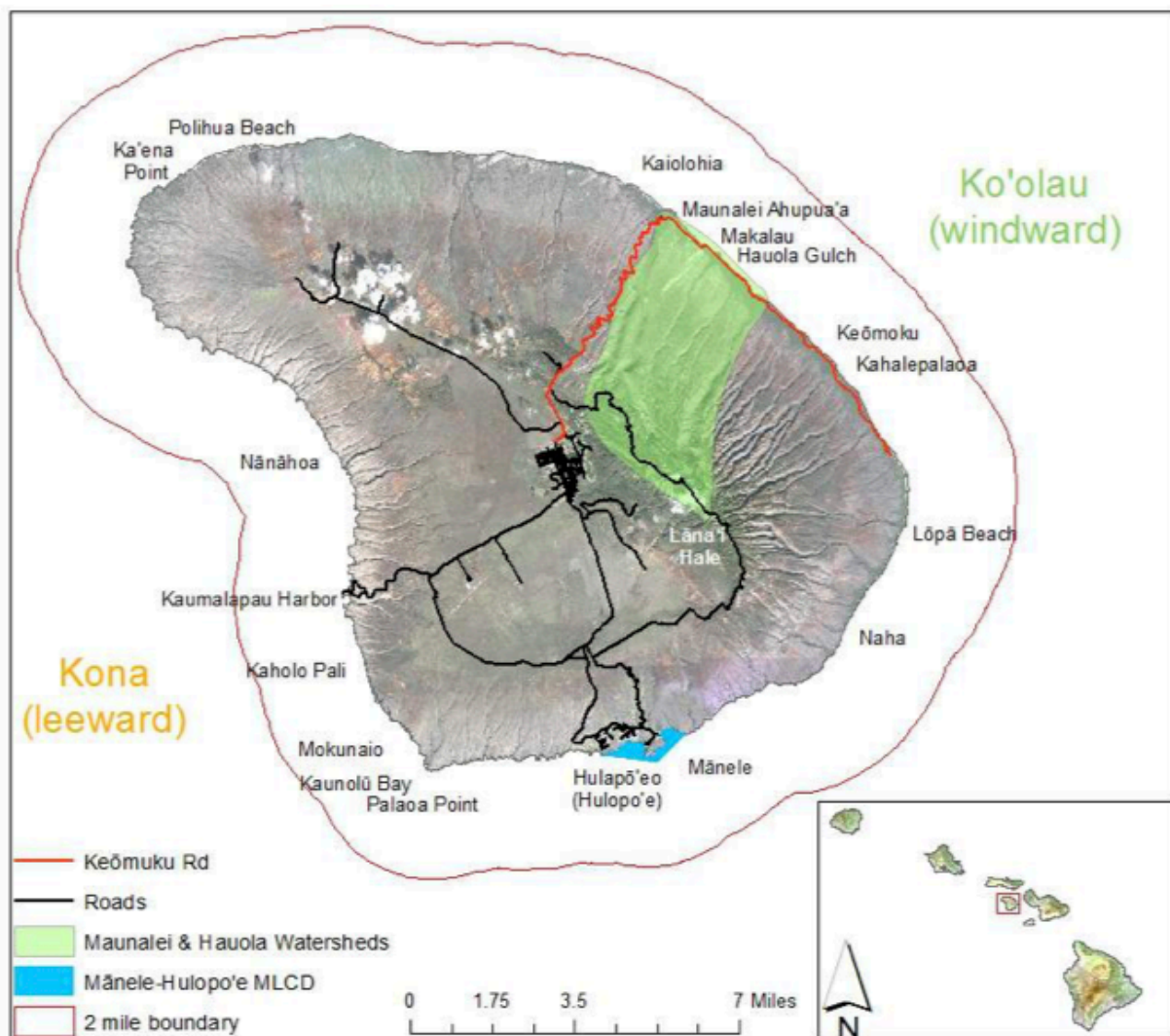


Attendees at the February, 2015 Lānaʻi CAP Meeting.
Photo: The Nature Conservancy

Process and Project Scope

Our planning team met three times during two- and three- day workshops in February, May and August 2015 to develop this community action plan (CAP). The CAP was developed using Open Standards for the Practice of Conservation and The Nature Conservancy's simple, science-based approach for planning, implementing, and measuring success of management activities. The Nature Conservancy Maui Marine Program facilitated the process. (See **Appendix 2** for a list of CAP participants and facilitators).

Initially our group came together to develop a CAP for the *ahupua'a* (land division) of Maunalei on the north shore of Lāna'i. As we mapped out priority natural and cultural resources, our project scope expanded to include all the *makai* areas of the island. Just as *makai* areas are connected to *mauka* areas in traditional *ahupua'a* management, we saw that *makai* areas are also inherently connected to one another and must be managed together to properly care for our natural resources and harvesting practices used all around the island. We broadened our focus to address management needs for coral reefs, subsistence fisheries species, cultural sites and traditional Hawaiian practices existing *mauka* to *makai* and along the entire coastline of Lāna'i from the shoreline out to two miles. Lāna'i is the only island completely encompassed within the Hawaiian Island Humpback Whale National Marine Sanctuary boundary.



Prepared by Roxie Sylva 2/2017

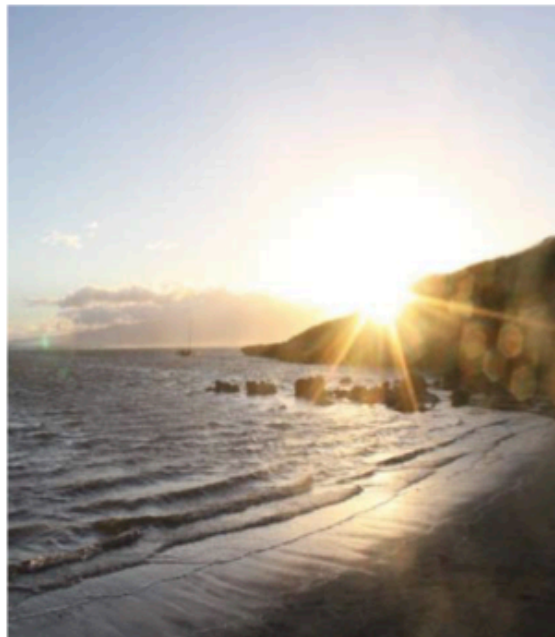
Figure 1. Map of Lāna'i place names and kona/ko'olau locations.

Note: "Hulapō'eo" is the name used by Lāna'i kūpuna for the place commonly referred to as "Hulopoe."

Context

Lānaʻi is a single, gently sloping volcano that formed between 1.2 and 1.46 million years ago. Until the last ice age (about 12,000 years ago) Lānaʻi was part of a larger island called Maui Nui, now separated into the islands of Maui, Lānaʻi, Molokaʻi and Kahoʻolawe. Today they remain connected through their proximity, shallow waters, and currents. Coral reefs and fish populations are linked by larval dispersal, with currents transporting larvae between islands and helping reseed reefs (Kobayashi, 2008; U.S.G.S., 2003).

Lānaʻi has 47 miles (76 km) of coastline that are protected from the north and northeast swells by the islands of Maui and Molokaʻi. The climate is typically dry with stream activity only during large rain events. Rainfall at the summit averages around 26-34 inches (66-84 cm) per year plus moisture attained through fog-drip while the coasts receive 15 inches (38 cm) per year (Giambelluca et al., 2013, based on weather station records from 1724-2016).



Sunrise at Maunalei, Lānaʻi. Photo: Manuel Mejia

Lānaʻi is comprised of thirteen *ahupuaʻa*, three of which are unique in that they extend across the island from the *kona* to *koʻolau* regions. This speaks to the connectivity between the two sides of the island and how its inhabitants traveled to different parts of the island in order to harvest various resources.

Lānaʻi Koʻolau

The *koʻolau* or windward side of the island is exposed to the trade winds and is characterized by sandy beaches and coral reefs. Along the northern coast, windy conditions have formed a series of beaches and low sand dunes, buffered by a narrow fringing reef. The ocean here receives sediment from both the island's windswept northeastern mountains and from the soil built up in shallow gulches during rainstorms. Polihua, the longest beach on Lānaʻi, extends across 1.5 mi (2.4 km) of the northwest corner of the island. At Maunalei and Hauola, deltas form at the base of large erosional gulches along this coast, where flowing streams deposit large amounts of sediment during massive rain events. Near Kahalepalaoa, the coast turns to face northeast and is out of direct exposure to Kona storm waves, allowing the fringing reef to widen. Along the southeastern coast near Naha and Lōpā is a thin, low-lying coastal terrace fronted by a narrow and continuous fringing reef (Fletcher, 2013).

Lānaʻi Kona

The *kona* or leeward side of the island is protected from the trade winds and the coastline is largely basalt rock. Between Polihua and Nānāhoa, the coast is rocky and wave-eroded with small offshore coral patches and no sand. Offshore of Nānāhoa lies a beautiful assembly of sea stacks isolated by the retreating coast. Between Nānāhoa and Kaumalapau Harbor the sea cliffs reach heights of 344 ft (105 m). South of Kaumalapau Harbor the sea cliffs rise up to 984 ft (300 m) above the ocean along the Kaholo Pali, extending to Mokunaio at the southwest corner of the island near Palaoa Pt. The sea cliffs reduce to 98 ft (30 m) in height as they approach the southwest corner of Lānaʻi at Kaunolū Bay. The Mānele-Hulopoʻe Marine Life Conservation District lies along the central south shore where the low-lying bays at Hulapōeo (traditional name for Hulopoʻe) and Mānele interrupt a sea cliff coast (Fletcher, 2013).

One of the earliest traditional accounts of Lāna'i is the story of Kaululā'au, a young chief from Lāhaina who is said to have freed the island from evil spirits in the 1400s, making Lāna'i habitable. Once the island was settled, fish, mollusks, and *limu* (algae) formed a major part of the diet for Lāna'i inhabitants.

In modern times, the land and people of Lāna'i have experienced multiple economic and land-use changes, evolving from a village lifestyle to a ranching livelihood (with the introduction of several species of ungulates), then to pineapple production, and now to a resort economy. (See **Appendix 5** for a timeline of Lāna'i's ungulate and land-use history).

Kaululā'au was a mischievous boy known to pull up breadfruit trees. This was done so often that the trees became scarce in Lele, a district in Lāhaina. After much consideration, his father and chief of Maui, Kaka'alaneo, banished Kaululā'au to Lāna'i, where ghosts were plentiful. Kaululā'au is famed for defeating the numerous ghosts on Lāna'i with his wit and skill, and made it a place fit to be inhabited by people as it is now.

The cave in which Kaululā'au found shelter was at Ka Lae Hi, which lies close to Makalau, meaning 'four-hundred eyes'. This is a *wahi pana* (storied place) that has reference to the eyes of the multitude of searching ghosts who intended to devour Kaululā'au. However, Kaululā'au entrapped the ghosts and sealed their eyes with breadfruit gum upon the mountain, Lāna'i Hale (As told by Abraham Kauila and Nami Ka'ōpū'iki Makahanaloa).

Targets	Nested Targets
Coral Reef & Reef Fish Assemblage	Reef Flat, Coral Reef, Estuaries, Limu, He'e, Moi, Enenue, Uhu, Manini, Ulua
Protected Species	Monk Seal, Na'i'a, Koholā, Honu, Honu 'Ea
Nearshore Pelagic Fisheries	Ahi, Kawakawa, Aku, Mahimahi, Ono, Marlin, Bottomfish
Shoreline Habitat & Fisheries	Sand Dunes & Beaches, Native Coastal Vegetation, Kūpe'e, 'Ōhiki
Rocky Intertidal Fisheries	'Opihi, 'A'ama, Limu
Cultural Landscape	Storied Places Cultural Sites Fishponds Respect Access
Lāna'i Way of Life	Subsistence Gathering, Slow Driving, Courtesy

Figure 2. CAP Targets and Nested Targets

What We Care About

Lāna'i Targets and Nested Targets

There are seven priority targets that we would like to see return to health and abundance and are the basis for the goals identified in this CAP. These targets are meant to represent the full biological and cultural diversity of Lāna'i. Nested targets are the particularly important species and community values encompassed with the targets addressed. We care deeply about these species, ecosystems, and cultural landscapes and want to ensure they remain for future generations to enjoy. (See **Appendix 1** for a list of definitions for Hawaiian words).

Coral Reef & Reef Fish Assemblage

This assemblage includes corals, algae, fish, and invertebrates that comprise a healthy nearshore reef ecosystem. Coral reef ecosystems provide valuable habitat for resource fishes and *limu* harvested for sustenance. Northeast Lāna'i is home to one of the largest coral reefs (2.8 mi², 1801 acres) in Maui County and in the state (Field, 2011). In the same area, from Maunalei to Kahalepalaoa, there are also extensive shallow reef flats, favored habitat for species like *he'e* (day octopus). Close to shore, subsurface fresh water flow creates estuarine habitat for juvenile reef fish species and edible *limu* species.

Protected Species

This target includes whales, dolphins and seals protected by the Marine Mammal Protection Act of 1972, and sea turtles, humpback whales, and monk seals further protected by the Endangered Species Act of 1973 and Hawai'i State Law. *Koholā* received addition protection within the Hawaiian Islands Humpback Whale National Marine Sanctuary of 1992.



Reef fish and corals at Mānele-Hulapōeo MLCD.
Photo: Karin Osuga.



Lithified sand dunes at Ka Lae Hi on the northeast shore of Lānaʻi. Photo: Sol Kahoʻohalahala



Kauno'a is often gathered for use in lei making.
Photo: Sol Kahoʻohalahala

Kauno'a and *pōhūehue* grow together on coastal stretches of sand, *pōhūehue* being the first to develop. *Kauno'a*, known as *kaunao'a* elsewhere in Hawai'i, then grows over the *pōhūehue* and uses it for nutrients. Due to overgrazing by ungulates, their interaction has rarely been witnessed over the past 30 years on Lānaʻi, and *kauno'a*, the "flower" of Lānaʻi, has been more difficult to collect for lei making. Their scarcity is a call for *mālama*.

Nearshore Pelagic Fisheries

This target includes pelagic fish caught by trolling such as *ahi*, *kawakawa*, *aku*, *mahimahi*, *ono*, marlin and other highly mobile fish and bottomfish species associated with deep nearshore waters. These fish are prized by shoreline fishers and trollers. Fishing grounds and habitats include fish aggregation areas such as certain rocky drops offs, currents, and artificial fish aggregation devices.

Shoreline Habitats & Fisheries

On the *kona* side of Lānaʻi, the shoreline is primarily basalt boulder beach, shelves, and cliffs, with species like *'opihi*, *'a'ama*, *pūpū*, and *hā'uke'uke* and many valued *limu* living between the high and low tide marks. Intertidal zones provide a unique habitat for many invertebrate species, valuable nursery areas for many fish species, and important local harvesting areas. On the *ko'olau* side, the shoreline is primarily sand beach and lithified sand dunes where species like sand crabs thrive. There are also coastal wetlands of varying salinity with subsurface connections to the ocean. Most, if not all, of the native coastal vegetation like *poehuehue*, *kauno'a* (also known as *kaunao'a*), and *naupaka* has been replaced by *kiawe* and other non-native plants.

Rocky Intertidal Fisheries

These fisheries include species harvested from the rocky shoreline area between high and low tide marks, primarily *limu* and invertebrate species including *'a'ama* crabs, *'opihi* and *hā'uke'uke* urchins.

Cultural Landscape

This target includes the stories and names of places, traditions, values and resources that are the foundation of the Hawaiian cultural landscape and identity. For instance, the relationship between native plant species *kauno'a* and *pōhūehue* teaches the people of Lānaʻi to work together – a lesson that can only be taught if these organisms and their story live on. This irreplaceable *'ike* (knowledge) enriches all the people and landscapes of Lānaʻi and Hawai'i.

Lānaʻi Way of Life

The culture unique to Lānaʻi is a result of many diverse values, backgrounds, and traditions. For instance, only one road on Lānaʻi is paved, so when driving on the many dirt roads, it is common courtesy to kindly share the road with oncoming cars and to slow down so as not to kick up dust. Subsistence practices such as fishing and hunting are important supplements to local income and diet.

What The Challenges Are

Lāna‘i Threats and Definitions

These are the seven priority threats that we would like to address in order to restore our target resources.

Erosion & Sedimentation

The primary cause of changes in vegetation and the soil profile has been the introduction of ungulates (hooved animals). The isolated native ecosystems of Hawai‘i evolved without the need to protect themselves against grazing and browsing ungulates, which were introduced to Lāna‘i in the early 1800s. At various points in time, goats, axis deer, pigs, pronghorn antelope, and mouflon sheep have reduced native plant and animal populations, contributing to staggering statistics: only 2% of the dryland native forest and 30% of the native cloud forest on the island remain due to years of land degradation (U.S. Fish and Wildlife Service, 2012). (See **Appendix 5** for a timeline of ungulate presence and land-use history for Lāna‘i). In addition to overgrazing by ungulates (currently from axis deer (*Axis axis*) and mouflon sheep (*Ovis gmelini musimon*)), widespread deforestation on Lāna‘i has led to a decline in native habitat that has never fully recovered (Macdonald et al., 1986; Fletcher, 2013).



Lack of vegetation leads to exposed soils and sedimentation in the nearshore marine environment.
Photo: Sol Kaho'ohalahala



A brown water event at Maunalei after a big rain.
Photo: Sol Kaho'ohalahala

The extensive loss of vegetation on Lāna‘i has drastically diminished soil stability, exposing loose, denuded soils that wash down gulches into nearshore waters following heavy rains. This leads to brown water events on both the *kona* and *ko‘olau* sides of the island, reducing water visibility and light available to coral and algae, inhibiting photosynthesis and the ability of the reef to grow and repair damage. Once soil settles on the bottom of the ocean it is considered sediment and smothers and erodes nearshore habitats including sand beaches and coral reefs that house invertebrates, algae, and fish, rendering them inhospitable to their usual constituents. Sediment resuspension during tidal changes and strong winds perpetuates this cycle over the long-term. The *Status of Coral Reefs of the World* (2004 and 2008) deems sediment run-off as one of the most serious stressors affecting coral reef health and sustainability in Hawai‘i (Field et al., 2008; Friedlander et al., 2004; Friedlander et al., 2008; Friedlander et al., 2008).

Climate Change Impacts

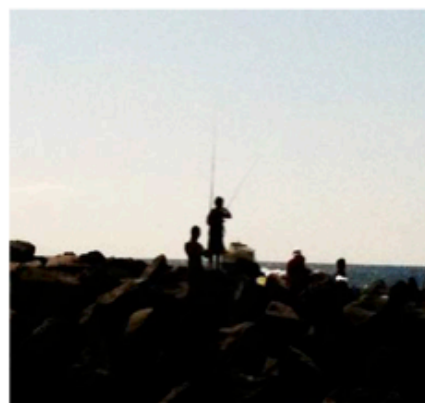
Climate change is one of the most significant long-term threats facing the nearshore reefs of Lāna‘i. Hawai‘i experienced its most severe coral bleaching event ever in the fall of 2015 due to rising sea temperatures, where over 14,000 surveyed coral colonies in West Hawai‘i were 38-92% partially or fully bleached (The Nature Conservancy, 2015). Presently, the most noticeable effects of climate change to the coastal and nearshore system are increased intensity of storms, altered seasonal variations in temperature and rainfall with documented impacts including seawater intrusion into coastal areas from rising sea level (Rotzoll & Fletcher, 2013), and increased and prolonged thermal and pH stress on corals, algae and other susceptible organisms (Gattuso et al., 2015). While our community cannot control the weather, we can control local impacts that affect the reef’s ability to withstand climate change. Management actions that reduce sediment and pollution, protect herbivores such as *uhu* that create habitat for corals, and ensure fisheries are sustainably managed would increase the resilience and recovery of the island’s reefs.

Unsustainable Harvest

Statewide decreases in nearshore fisheries have been recorded for more than 100 years, in part due to harvesting marine species faster than they can reproduce (Smith, 1993; Friedlander & DeMartini, 2002; Longenecker et al., 2014; Friedlander et al., 2015). On Lānaʻi, there is recreational, subsistence and commercial fishing for species that inhabit the shoreline, coral reef and nearshore deep water habitats. Fishers include full-time and part-time Lānaʻi residents and people from neighbor islands who access fishing grounds from shore and by boat. Recently, fishing effort has increased alongside a boom in contracted construction work on Lānaʻi and after new strict bag and size limits for parrotfish and goatfish were implemented on Maui. Unsustainable harvest and declines in fisheries will make it more difficult for residents to continue harvesting what they need. There is also the concern that Native Hawaiian customary practices would be extinguished if resources within subsistence areas are overharvested. Maui county is one of the fastest growing counties in the United States (Magin, 2015), thus foreseeably exacerbating the issue of unsustainable harvest if no preventative management action is taken.

Ocean User Conflicts

There are several ocean user conflict hotspots on Lānaʻi, primarily between ocean operators, on-island divers, and pole fishers. In 2011, off of Kaunalapau Harbor, a whale watching zodiac tour operator out of Lāhaina Harbor tragically killed a Lānaʻi resident diving off shore. At Kaʻena point, a local diver with flag and float was nearly hit by an ocean operator driving fast close to shore. At Kaunolū, local shoreline fishers compete with snorkel operators for space and use. With projected population and visitor growth on Lānaʻi and Maui, there will be more potential users and conflicts.



Fishing is an important subsistence, practice. Photo: Sol Kahoʻohalahala

Marine Debris & Coastal Waste

With prevailing trade winds and currents, the north shore of Lānaʻi is perfectly oriented to intercept large amounts of marine debris along its coastline. (See **Appendix 3** for a map of marine debris distribution around Lānaʻi). Marine debris consists of plastics and microplastics from human consumption that deliberately or accidentally enter the ocean, often from far across the Pacific Ocean. Marine debris and the associated microplastics are harmful when ingested by marine organisms such as fish, sea turtles and monk seals, where it bioaccumulates and poses a human health risk. Coastal waste from human use, excrement and toilet paper due to the lack of public facilities can occur at popular coastal areas, posing a health risk and an eyesore that can inhibit tourists and other community members from visiting the area.



Manini and uhu on the reef. Photo: Sol Kahoʻohalahala

Potential Coastal Development

Through the Maui county community planning process for the island of Lānaʻi, the County Council voted not to allow coastal development at Kahalepalaoa. This addressed our concern that coastal development at Kahalepalaoa would likely disrupt cultural practices such as local subsistence and recreational fishing practices, and access and use patterns. Additionally, development could have negative effects on the nearshore environment by increasing nutrient pollution through waste water treatment facilities or processes, leaching and run off from fertilizers and pesticides used in landscaping, and storm water runoff from hardened surfaces while potentially compounding the existing sedimentation issue from construction grading (Potters, 2013).

Changing Culture & Lifestyle of Lāna‘i

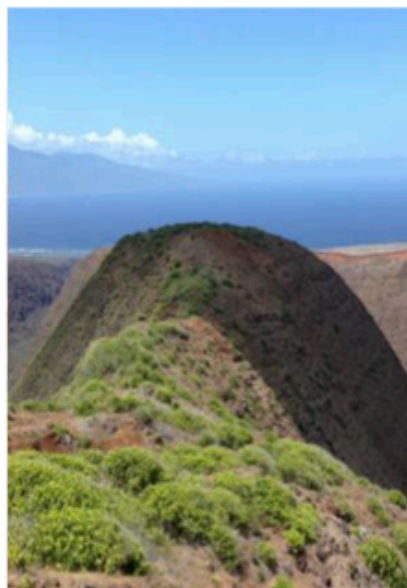
Case studies from around the world highlight the serious compromising impacts tourism can have on the environment, culture, and society of a place, where often times the same qualities that attracted visitors can also be destroyed by them through unmanaged access to cultural sites, traditional practices, and natural resources (UNESCO, 1995; Sharpley, 1999; Oliveira, 2003). While existing literature of tourism impacts on Lāna‘i is slim, lessons can be learned from global and statewide findings. In 2010, the Hawai‘i Tourism Authority conducted a study that found 60% of Native Hawaiians felt the tourism industry in Hawai‘i is inauthentic and does not preserve Hawaiian language and culture (Sample, 2010), likely due to the lack of social responsibility by the industry towards the local environment and culture (Darowski et al., 2007). “As long as the industry continues to put the visitor first, it will continue to sacrifice the well-being of Hawai‘i’s people and environment for the comfort of the tourist.” (Bauckham, 2004).

The local economy of Lāna‘i, once rooted in agriculture, is now based in tourism. With just over 3,000 full-time residents, nearly 60,000 people visited Lāna‘i in 2015; a year when most hotel rooms were closed for renovation (Hawai‘i Tourism Authority, 2015). In 2014 alone, visitor revenue totaled \$74.8 million (KHON2, 2015). The unique, slow-paced Lāna‘i way of life is grounded in *pono* interactions. Divergences with this lifestyle have been seen in ocean user conflicts at Kaunolū, unlawful interaction with *nai‘a* at Mānele Bay, and on the dirt roadways where fast-moving cars kick up dust for other users. Thus a challenge and an opportunity remains to embrace the positive aspects of tourism, which can boost the economy, job creation, the sales of local products and services, and friendships across nations, while preserving the cherished and irreplaceable culture, natural areas, and *aloha* of Lāna‘i and Hawai‘i.

Towards Solutions

Lāna‘i Coastal and Marine Strategies

There are three overarching goals in this plan. Each goal has several objectives and strategic actions, providing a starting point for our community to take action. These goals represent a coming together of many experts, initiating formal discussions about Lāna‘i’s coastal and marine resource future, and encouraging more collaboration and conversation.



A view of the ocean from mauka Lāna‘i.
Photo: Sol Kaho’ohalahala

Effective management of our coastal resources needs to address multiple issues and objectives in order to achieve sustainability and resilience against climate change and other threats. The strategies in this plan aim to protect a range of habitats home to numerous marine species by addressing the three big threats to the marine environment of Hawai‘i: climate change, sedimentation, and overharvest.

Goal 1: Healthy Coastal and Marine Ecosystems

Create a healthy and resilient nearshore reef environment that supports an abundance of fish.

Goal 2: Ocean Management Framework

Develop a Lāna‘i-specific ocean management framework and gain broad-based support for it.

Goal 3: Community of Practice

Build and expand upon community involvement and *kuleana* to perpetuate the self-sufficient and independent Lāna‘i way of life.

GOAL 1: HEALTHY COASTAL AND MARINE ECOSYSTEMS		
Create a healthy and resilient nearshore reef environment that supports an abundance of fish.		
Objective 1.1		
Reduce sediment inputs to the reef by 50% at the top 2 priority watersheds, Maunalei and Hauola immediately.		
Strategic Actions	Targets Addressed	Threats Addressed
a. Communicate and collaborate with Pūlama Lāna'i and the local and statewide community about the sense of urgency and the need to proactively reduce sedimentation to restore coastal and marine health island-wide, beginning with the Maunalei and Hauola <i>ahupua'a</i> . (See pg. 11, <i>Why Maunalei & Hauola</i>). b. Work with Pūlama Lāna'i and <i>kuleana</i> landowners to actively engage community in <i>mauka to makai</i> management, including replanting native plants, fencing, management of ungulates, implementing appropriate sediment control, restoring and maintaining <i>kahawai</i> (streams) and creating water capture areas to increase filtration.	Coral Reef & Reef Fish Assemblage	• Erosion & Sedimentation
	Nearshore Pelagic Species	
	Shoreline Habitat & Fisheries	
	Cultural Landscape	
	Lāna'i Way of Life	
Objective 1.2		
Assess and significantly increase the biomass of target reef fish island-wide in 5 years.		
Strategic Actions	Targets Addressed	Threats Addressed
a. Conduct scientific assessment of reef and reef fish around the island of Lāna'i and compare to past assessments to understand current fish biomass and overall resource status. b. Conduct an assessment of traditional and local ecological knowledge along with the above scientific studies to inform the creation a Lāna'i Ocean Management Framework (Goal 2). c. Seek enhanced enforcement for DAR fishing rules.	Coral Reef & Reef Fish Assemblage	• Unsustainable Harvest
	Nearshore Pelagic Species	
	Shoreline Habitat & Fisheries	
	Cultural Landscape	
	Lāna'i Way of Life	
Objective 1.3		
Double the 'opihi and 'a'ama at Kaunolū in 5 years.		
Strategic Actions	Targets Addressed	Threats Addressed
a. Develop and conduct community-based 'a'ama and 'opihi monitoring programs at Kaunolū, which include data collection and sustainable harvest protocols. (See pg. 11, <i>Why Kaunolū</i>). b. Using baseline data, establish a management and restoration project for the rocky intertidal fishery.	Shoreline Habitat & Fisheries	• Unsustainable Harvest • Ocean User Conflicts
	Cultural Landscape	
	Lāna'i Way of Life	

Figure 3. Goal 1: Healthy Coastal and Marine Ecosystems



The Lāna'i community surveying shallow-water habitat. Photo: Sol Kaho'ohalahala

Why Maunalei & Hauola?

Maunalei and Hauola are the largest of the major gulches on the *ko'olau* side of Lāna'i and were identified as priority watersheds for this plan. Compared to other watersheds, these gulches contribute the most sediment and have the greatest effect on nearshore ecosystems and local fishing, which continues to be a very important livelihood for practitioners in this area.

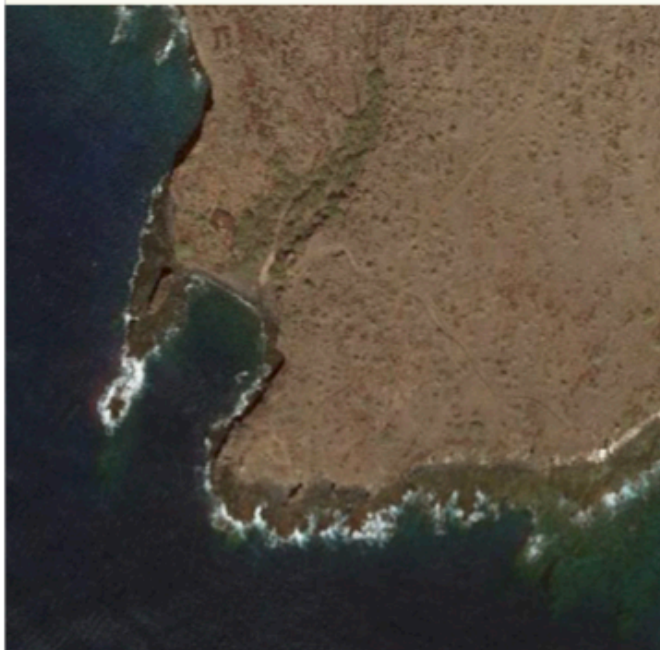
Today, during massive rain events large amounts of sediment get washed down the gulch and out onto the reef where it turns the ocean brown and smothers the corals and *limu*. Efforts by local community group Maunalei Ahupua'a Community Managed Makai Area supported by Conservation International to build gabions (small dams of *kiawe* branches) on *kuleana* lands at the base of the watershed have demonstrated that it is possible to slow the water during these flood events. During the 2014 rainy season, nearly 40,000 lbs (20 tons) or the equivalent of 2.5 dump trucks of sediment were kept off the reef by this project (Teneva, 2015).

Another ongoing community effort is the Maunalei Limu Restoration Project, which is working to cultivate native *limu* that was once plentiful here, but has had its habitat smothered by sedimentation (Lāna'i Culture and Heritage Center, 2013; Lāna'i Culture and Heritage Center, 2016).



Why Kaunolū?

Kaunolū is the site of an ancient fishing village and Halulu Heiau. Kaunolū Village is the largest surviving ruin of a Hawaiian village in the islands, sitting high on the southern sea cliffs overlooking Kaunolū Bay, which provided a sheltered landing spot for fishing canoes. The area is very arid and the stream in the gulch is seasonal and prone to flash floods. However, the offshore waters are extremely rich fishing grounds and have been fished for centuries.



Halulu Heiau was rebuilt by Kamehameha I after he captured the Island of Lāna'i in the early 1800's. It also had an associated *pu'uhonua* (place of refuge), the only one on the island of Lāna'i. At the top of the hill behind the heiau is Kahekili's Leap, a 63-foot cliff edge where *lele kawa* (cliff jumping) was practiced by Kahekili, Chief of Maui (mid-1700s) and his warriors.

Today, Kaunolū is listed as a National Historic Landmark and attracts many visitors and snorkel tours. This causes a conflict with the subsistence fishermen as they have to move out of their fishing grounds to accommodate inundation by commercial tours and visitors. It is also a popular location for off-island fishers, leading to concerns of overharvest. Kaunolū has been proposed as a demonstration project location for intertidal fisheries in this CAP (*'opihi* and *'a'ama* crabs) because of its cultural and historical importance and because it is accessible and visible to resource users (Nation Park Service, n.d.).

GOAL 2: OCEAN MANAGEMENT FRAMEWORK		
Develop a Lānaʻi-specific ocean management framework and gain broad-based support for it.		
Objective 2.1		
Effectively communicate the CAP process to build support for a Lānaʻi Ocean Management Framework.		
Strategic Actions	Targets Addressed	Threats Addressed
a. Conduct outreach to island stakeholders and hold community meetings to explain the CAP process and intended outcomes and to seek input and support. b. Modify the CAP according to community feedback and engage agencies to further develop and implement a Lānaʻi ocean management framework. c. Seek broad-based support on Lānaʻi, across the state, and from agencies for an ocean management framework.	Reef & Reef Fish Assemblages	<ul style="list-style-type: none"> • Unsustainable Harvest • Ocean User Conflicts • Marine Debris & Coastal Waste • Changing Culture & Lifestyle of Lānaʻi
	Protected Species	
	Nearshore Pelagic Species	
	Shoreline Habitat & Fisheries	
	Rocky Intertidal Fisheries	
	Cultural Landscape	
	Lānaʻi Way of Life	
Objective 2.2		
Develop a Lānaʻi Ocean Management Framework.		
Strategic Actions	Targets Addressed	Threats Addressed
a. Develop island-wide fishing rules. b. Design fishery replenishment areas (refugia or no-take areas). c. Establish Special Management Areas (e.g. Kaunolū, Polihua, and Maunalei). d. Propose a Lānaʻi Island-Based Fisheries and Ocean Use Management Council.	Reef & Reef Fish Assemblages	<ul style="list-style-type: none"> • Unsustainable Harvest • Ocean User Conflicts • Marine Debris & Coastal Waste • Changing Culture & Lifestyle of Lānaʻi
	Protected Species	
	Nearshore Pelagic Species	
	Shoreline Habitat & Fisheries	
	Rocky Intertidal Fisheries	
	Cultural Landscape	
	Lānaʻi Way of Life	

Figure 4. Goal 2: Ocean Management Framework. See Appendix 4 for Reef Resilience Principles that guided the creation of Goal 2.

Ocean Management Framework

Here are some area-based designations for marine management that are in use across the state that may help us achieve and inform our goals, specifically Objective 2.2 which seeks to develop a Lānaʻi Ocean Management Framework – a four-part, proactive framework to return nearshore fisheries and coral reefs to abundance, and address ocean safety concerns. Island-Based Fisheries Rules (Hawaiʻi Administrative Rule 33-95.1) allow for rules to be developed island by island, considering the specific needs of the people and place.

1. Island-based fishing rules – Division of Aquatic Resources (DAR): Specific fishing rules, like bag and size limits and seasonal closures to protect spawning seasons, can be instituted to address and island's needs and issues, also utilizing place-based and traditional knowledge.
2. Fishery Replenishment Area (FRA)/Fishery Management Area (FMA) – (DAR): Fishery replenishment areas (refugia or no-take areas) from the shore to beyond the reef are strategically designed to manage, preserve, protect, conserve or propagate fisheries and marine life.
3. Marine Life Conservation District (MLCD) – (DAR): Special Management Areas at Kaunolū, Polihua, and Maunalei designed to conserve and replenish marine resources to address issues of user conflict and habitat degradation. Allow only limited fishing and other consumptive uses, or prohibit such uses entirely.
4. Ocean Management Area – Division of Boating and Ocean Recreation (DOBOR): A Lānaʻi Regional Fisheries and Ocean Use Management Council designed to reduce conflicts among ocean water users, especially in areas of high activity.

GOAL 3: COMMUNITY OF PRACTICE Build and expand upon community involvement and responsibility to perpetuate the self-sufficient Lāna'i and Independent way of life.		
Objective 3.1 Reinvigorate sustainable subsistence fishing practices, and increase sustainability of fishing.		
Strategic Actions	Targets Addressed	Threats Addressed
a. Develop a <i>pono</i> fishing and harvesting code of conduct for on- and off-island fishers (including picking up and packing out your trash), based on traditional knowledge and best available science. b. Develop a Lāna'i moon and fishing calendar. c. Work with landowners to maintain traditional fishing trails and access to fishing grounds. d. Conduct <i>lawai'a</i> camps to educate youth, engage families and elders in passing on <i>pono</i> fishing 'ike. e. Seek enhanced enforcement for DOBOR rules to ensure the safety of fishers and other ocean users.	Reef & Reef Fish Assemblages	<ul style="list-style-type: none"> • Unsustainable Harvest • Marine Debris & Coastal Waste • Ocean User Conflicts • Changing Culture & Lifestyle of Lāna'i
	Protected Species	
	Nearshore Pelagic Species	
	Shoreline Habitat & Fisheries	
	Rocky Intertidal Fisheries	
	Cultural Landscape	
	Lāna'i Way of Life	
Objective 3.2 Increase community and youth involvement in place-based restoration.		
Strategic Actions	Targets Addressed	Threats Addressed
f. Establish community engagement projects at Kaunolū (see Objective 1.3) and at Maunalei (see Objective 1.1) for erosion and <i>limu</i> restoration. g. Develop projects with Lāna'i Elementary and High School to integrate place-based restoration projects into curriculum and increase awareness of Lāna'i reefs and the proposed solutions. h. Work with partners to engage community and youth in marine debris clean-ups. (See Appendix 3). i. At Polihua, address vehicle use on the beach by working with Pūlama Lāna'i, stakeholders, and government agencies to ensure safe habitat for monk seal birthing, <i>honu</i> and <i>honu</i> 'ea nesting, and for other sandy beach ecosystem inhabitants. (See pg. 11, Why Polihua). j. Work with DLNR DAR to include community participation in the development of a management plan for Manele-Hulopo'e MLCD. (See pg. 11, Why Mānele-Hulopo'e MLCD).	Reef & Reef Fish Assemblages	<ul style="list-style-type: none"> • Unsustainable Harvest • Ocean User Conflicts • Changing Culture & Lifestyle of Lāna'i
	Protected Species	
	Nearshore Pelagic Species	
	Shoreline Habitat & Fisheries	
	Rocky Intertidal Fisheries	
	Cultural Landscape	
	Lāna'i Way of Life	
Objective 3.3 Provide learning opportunities for visitors, workers and new residents about the Lāna'i way of life.		
Strategic Actions	Targets Addressed	Threats Addressed
a. Develop a code of conduct to provide Lāna'i visitors information on the unique Lāna'i way of life. b. Collaborate with Lāna'i visitor industry to promote the code of conduct through outreach materials. c. Given the high volume of visitor traffic on Keomoku Road, consider a ranger-type program to help guide visitors toward <i>pono</i> conduct and cultural norms (e.g. slow driving).	Cultural Landscape	<ul style="list-style-type: none"> • Unsustainable Harvest • Ocean User Conflicts • Marine Debris & Coastal Waste • Changing Culture & Lifestyle of Lāna'i
	Lāna'i Way of Life	

Figure 5. Goal 3: Community of Practice



Why Mānele-Hulopo'e MLCD?

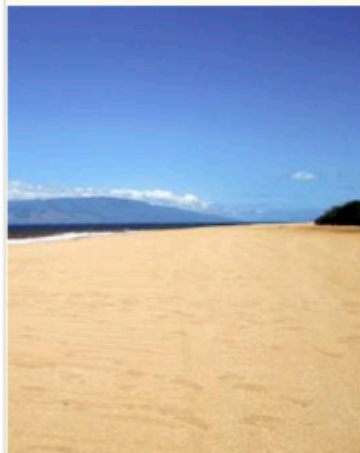
The Mānele-Hulopo'e Marine Life Conservation District (MLCD) is a 309 acre protected area encompassing the two bays of Mānele and Hulapō'eo (the name used by Lāna'i *kūpuna* for the place commonly referred to as Hulopo'e). By limiting or prohibiting boat traffic, fishing, and other consumptive uses within this area, the MLCD provides marine life with a protected area in which to grow and reproduce, thus replenishing marine resources and providing people with a safe place to swim. This MLCD is a popular snorkel spot and recent concerns have surfaced about continual human interactions with *nai'a*, which rest in the bay before hunting offshore at night. Scientists have observed altered *nai'a* behavior in areas with repeat encounters with humans, and according to recent studies, some *nai'a* are not getting enough rest (NOAA, n.d.). Hulapō'eo also is a gathering place for schools of akule, including halalu (juvenile akule). Akule are an important food source that support subsistence practices. While the MLCD was created by the state in 1976, at the request of the Lāna'i community and in consultation with them, a management plan for this area has never been produced. When the state does conduct a planning process for the MLCD, we offer community involvement in the process.

Spinner dolphin mom and calf and Hawaiian green sea turtle at Mānele-Hulopo'e MLCD. Photos: Alana Yurkanin

Why Polihua?

Polihua is one of the most beautiful white beaches on Lāna'i. Frequented by fishermen and visitors, it is said to be a historical nesting site for *honu 'ea* (hawksbill sea turtles). In the early 1900s, Polihua beach was a popular location to harvest nesting females (Balazs, 1973) but today nesting there is nonexistent (Kittinger, 2013).

Upon reaching the northwestern islands of the Hawaiian chain, Pele, her family, and traveling companions began seeking out a home in which Pele could keep her fires dry. At Lehua, Ka'ula, Ni'ihau, Kaua'i, and on down the island chain, no place was suitable. Continuing the journey, Pele visited O'ahu and then traveled to Moloka'i. At none of those islands, was she able to find a satisfactory home. Pele and her family then traveled to Lāna'i, where the goddess rested on the shores of Ka'ā at Polihua. A *mele* tells us that Pele found particular pleasure in eating the turtles that frequented Polihua, literally translated as "cove-of-eggs," commemorating the nesting practices of the turtles on Lāna'i. The following is interpreted from Pele and Hi'iaka: A Myth From Hawai'i (Emerson, 1915):



... A Nāna'i Kaulahea
A Mauna-lei kui ka lei
Lei Pele i ka 'ie'ie la
Wai hinu po'o o Hi'iaka
Hōlapu 'ili o Haumea
'Ua 'ono o Pele i kāna i'a
O ka honu o Polihua
Honu iki 'ā'ī no'uno'u
Kua pāpa'i o ka moana
Ke 'ea nui kua wakawaka
Ho'olike i ka 'ai na Pele

I nā 'oaoaka 'oaka i ka lani la
Elieli kau mai. . .

It was on Nāna'i of Kaulahea
At Mauna-lei that the wreath was made
Pele wore the 'ie'ie as her adornment
And Hi'iaka's head glistened with water
Haumea's skin was burned
And now Pele desires to eat her fish
The turtle of Polihua
A small turtle with a thick neck
Crab backed turtle of the deep sea
The great hawksbill turtle with its razor like back
Made into food for Pele

As lightning flashes sky ward
Awe possesses me. . .

Polihua Beach overlooking the island of Maui. Photo: Alana Yurkanin



Lāna'i community meeting. Photo: Sol Kaho'ohalahala

Invitation to Participate in Next Steps

A lot of effort has gone into developing this CAP as a first step to creating a foundation for Lāna'i residents, Pūlama Lāna'i, and stakeholders to contribute planning ideas to a Lāna'i *makai* resource future. Next steps include communicating and collaborating on these management goals on Lāna'i by soliciting and embracing feedback and suggestions from the community. This is an opportunity to build support for Pūlama Lāna'i to control sediment that leads to the sea, strategize for a future of sustainable fishing, create an Ocean Management Framework that recognizes and values local subsistence fishing, tourism, economic growth, Hawaiian culture, and Lāna'i's marine ecosystem, and actively engage community and youth in these important efforts.

Contact Information

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Our Supporters & Friends

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Lāna'i's coral reef seascape. Photo: Karin Osuga

References

- Balazs, G. H. (1973). Status of marine turtles in the Hawaiian Islands. *Elepaio* 33: 127–132 p.
- Bauckham, W. K. (2004). Opportunities and risks of establishing an ecotourism certification program in Hawai'i. University of Hawai'i master's thesis. Accessed February 28, 2017 from <http://www2.hawaii.edu/~wbauckha/Thesis/start.htm>.
- Darowski, L., Strilchuk, J., Sorochnikov, J., & Provost, C. (2007). Negative Impact of Tourism on Hawai'i Natives and Environment. *Lethbridge Undergraduate Research Journal*, 1 (2).
- Emerson, N. B. (Trans.). (1915). *Pele and Hi'iaka: A Myth From Hawai'i*. Honolulu, HI: Honolulu.
- Field, M. E. (2011). Future Reefs: Which Hawaiian Coral Reefs are the Best Candidates for Long-Term Survival? U.S. Geological Survey [USGS] Pacific Science Center, Santa Cruz, CA.
- Field, M. E., Cochran, S. A., Logan, J. B., & Storlazzi, C. D. (2008). The Moloka'i Coral Reef Today, and Alternatives for the Future. 167–170 p. In: Field, M. E., Cochran, S. A., Logan, J. B., and Storlazzi, C. D. (eds.). (2008). *The Coral Reef of South Moloka'i, Hawai'i; Portrait of a Sediment-Threatened Fringing Reef*. U.S. Geological Survey Scientific Investigations Report, 2007–5101.
- Fletcher, C. (2013). Coastal Geology Group: Lāna'i. Retrieved June 16, 2016, from University of Hawai'i, Mānoa, School of Ocean and Earth Science and Technology (SOEST), <http://www.soest.hawaii.edu/coasts/publications/hawaiiCoastline/lanai.html>
- Friedlander, A. M., Aeby, G., Brainard, R., Brown, E., Chaston, K., Clark, A., McGowan, P., Montgomery, T., Walsh, W., Williams, I., & Wiltse, W. (2008). The State of Coral Reef Ecosystems of the Main Hawaiian Islands. 158–199 p. In: Waddell, J. E., & Clarke, A. M. (eds.). (2008). *The State of Coral Reef Ecosystems of the United States and Pacific Freely Associated States: 2008*. NOAA Technical Memorandum NOS NCCOS 73. NOAA/NCCOS Center for Coastal Monitoring and Assessment's Biogeography Team. Silver Spring, MD. 569 p.
- Friedlander, A. M., Aeby, G., Brainard, R., Brown, E., Clark, A., Coles, S., DeMartini, E., Dollar, S., Godwin, S., Hunter, C., Jokiel, P., Kenyon, J., Kosaki, R., Maragos, J., Vroom, P., Walsh, B., Williams, I., & Wiltse, W. (2004). Status of Coral Reefs in the Hawaiian Archipelago. In: Wilkinson, C. (ed.). (2004). *Status of Coral Reefs of the World: 2004*. Australian Institute of Marine Science, Cape Ferguson, Queensland, and Dampier, Western Australia, 411–430 p.
- Friedlander, A. M. & DeMartini, E. E. (2002). Contrasts in density, size, and biomass of reef fishes between the Northwestern and the main Hawaiian Islands: the effects of fishing down apex predators. *Mar. Ecol. Prog. Ser.* 230, 253–264 p.
- Friedlander, A. M., Maragos, J., Brainard, R., Clark, A., Aeby, G., Bowen, B., Brown, E., Chaston, C., Kenyon, J., Meyer, C., McGowan, P., Miller, J., Montgomery, T., Schroeder, R., Smith, C., Vroom, P., Walsh, W., Williams, I., Wiltse, W., & Zamzow, J. (2008). Status of Coral Reefs in Hawaii and the United States Pacific Remote Island Areas (Baker, Howland, Palmyra, Kingman, Jarvis, Johnston, Wake) in 2008. In: Wilkinson, C. (ed.). (2008). *Status of Coral Reefs of the World: 2008*. Global Coral Reef Monitoring Network and Reef and Rainforest Research Centre, Townsville, Australia, 213–224 p.

- Friedlander A. M., Nowlis, J., & Koike, H. (2015). Stock assessments using reference points and historical data: stock status and catch limits. 91–118 p. In: Kittinger, J. N., McClenachan, L. E., Gedan, K., & Blight, L. K. (eds.). *Applying Marine Historical Ecology to Conservation and Management: Using the Past to Manage for the Future*. University of California Press.
- Gattuso, J. P., Magnan, A., Billé, R., Cheung, W. W. L., Howes, E. L., Joos, F., Allemand, D., Bopp, L., Cooley, S. R., Eakin, C. M., Hoegh-Guldberg, O., Kelly, R. O., Pörtner, H. O., Rogers, A. D., Baxter, J. M., Laffoley, D., Osborn, D., Rankovic, A., Rochette, J., Sumaila, U. R., Treyer, S., & Turley, C. (2015). Contrasting futures for ocean and society from different anthropogenic CO₂ emissions scenarios. *Science*, 2015, 349 (6249), doi: 10.1126/science.aac4722
- Giambelluca, T.W., Chen, Q., Frazier, A.G., Price, J.P., Chen, Y.-L., Chu, P.-S., Eischeid, J.K., & Delparte, D.M. (2013). Online Rainfall Atlas of Hawai‘i. *Bull. Amer. Meteor. Soc.* 94, 313–316 p., doi: 10.1175/BAMS-D-11-00228.1.
- Hawai‘i Tourism Authority. (2015). Hawai‘i Tourism Authority 2015 Annual Visitor Research Report. 24 p. Retrieved February 16, 2017, from <http://files.hawaii.gov/dbedt/visitor/visitor-research/2015-annual-visitor.pdf>
- Hobdy, R. (1993). Lāna‘i - A Case Study: The Loss of Biodiversity on a Small Hawaiian Island. *Pacific Science*, 1993, 47(3), 201–210 p.
- National Park Service. (n.d.). Kaunolū Village Site, Island of Lāna‘i, Hawai‘i. Retrieved July 19, 2016, from National Park Service, U.S. Department of the Interior. https://www.nps.gov/nr/travel/asian_american_and_pacific_islander_heritage/Kaunolu-Village-Site.htm
- KHON2. (2015, July 7). Visit Lanai for the day to help struggling island economy. Retrieved August 16, 2016, from KHON2, <http://khon2.com/2015/07/07/visit-lanai-for-the-day-to-help-struggling-island-economy/>
- Kittinger, J. N., Houtan, K. S. V., McClenachan, L. E., & Lawrence, A. L. (2013). Using historical data to assess the biogeography of population recovery. *Ecography*, 36(8), 868–872 p. doi:10.1111/j.1600-0587.2013.00245.x
- Kobayashi, D. R. (2008). Larval retention versus larval reception: Marine connectivity patterns within and around the Hawaiian Archipelago. Unpublished manuscript, 1–47 p.
- Lāna‘i Culture and Heritage Center. (2016). Maunalei, Keomoku and the Kahalepalaoa Vicinity. Retrieved August 17, 2016, from Lāna‘i Culture and Heritage Center, <https://www.lanaichc.org/maunalei-kahalepalaoa-region.html>
- Lāna‘i Culture and Heritage Center. (2013). What’s Happening at Maunalei? Retrieved July 19, 2016, from Lāna‘i Culture and Heritage Center, <https://www.lanaichc.org/maunalei.html>
- Longenecker, K., Chan, Y., Toonen, R., Carlon, D., Hunt, T., Friedlander, A., & DeMartini, E. (2014). How far has our baseline shifted? Archaeological evidence that pristine reefs are good proxy targets for modern fish populations. *Conservation Biology* 28. 1322–1330 p. doi: 10.1111/cobi.12287.
- MacDonald, G. A., Abbott, A. T., & Peterson, F. L. (1986). *Volcanoes in the sea: The geology of Hawaii* (2nd ed.). Honolulu: University of Hawaii Press, The.

- Malo, D. (1898). *Hawaiian Antiquities (Mo'olelo Hawai'i)*. (2nd ed.). Honolulu: Bishop Museum Press.
- Magin, J. L. (2015, September 18). Maui, Hawaii counties among fastest-growing in U.S., Census data confirms. *Pacific Business News*. Retrieved February 2, 2017, from <http://www.bizjournals.com/pacific/news/2015/09/18/maui-hawaii-counties-among-fastest-growing-in-u-s.html>
- NOAA Fisheries Pacific Islands Regional Office. (n.d.). Reducing Human Disturbance to Wild Dolphins [PDF]. Retrieved March 2, 2017, from <http://www.fpir.noaa.gov/Library/PRD/Spinner%20Dolphin/Reducing-human-disturbance-to-wild-dolphins-revFNL.pdf>
- Oliveira, J. A. (2003). Governmental responses to tourism development: three Brazilian case studies. *Tourism Management*, 24(1), 97-110. doi:10.1016/s0261-5177(02)00046-8
- Piniak, G. A., & Storlazzi, C. D. (2008). Diurnal variability in turbidity and coral fluorescence on a fringing reef flat: Southern Molokai, Hawaii. *Estuarine, Coastal and Shelf Science*, 77(1), 56-64 p. doi:10.1016/j.ecss.2007.08.023
- Potters, G., Dr. (2013). *Marine Pollution* (1st ed.). Retrieved February 28, 2017, from https://s3-ap-southeast-1.amazonaws.com/mylekha-ebook/Natural_science/environmental_science/marine-pollution.pdf. ISBN 978-87-403-0540-1
- Rotzoll, K. & Fletcher, C.H. (2013). Assessment of groundwater inundation as a consequence of sea-level rise. *Nature Climate Change* 3, 477-481 p.
- Sample, H. A. (2010, February 15). Native Hawaiians say tourism industry distorts their culture. Retrieved February 28, 2017, from http://usatoday30.usatoday.com/travel/destinations/2010-02-15-hawaii-tourism-survey_n.htm
- Sharpley, R. (1999). *Tourism, tourists and society*, Huntingdon: ELM Publications.
- Smith, M. K. (1993). An ecological perspective on inshore fisheries in the main Hawaiian Islands. *Mar Fish Rev.* (55). 34-49 p.
- Teneva, L. (2015, April 10). Ridge-to-reef conservation takes hold on Hawaiian island of Lāna'i. Retrieved October 19, 2016, from Humanature: Conservation International Blog, <http://blog.conservation.org/2015/04/ridge-to-reef-conservation-takes-hold-on-hawaiian-island-of-lanai/>
- The Nature Conservancy. (2015). Summary of Findings, 2015 Coral Bleaching Surveys: South Kohala, North Kona. 2 p.
- UNESCO Principal Regional Office for Asia and the Pacific. Pandey, R. N., Chettri, P., Kunwar, R. R., and Ghimire, G. (1995). Case study on the effects of tourism on culture and the environment: Nepal; Chitwan-Sauraha and Pokhara-Ghandruk. Bangkok, UNESCO. 51 p. (RACAP Series on Culture and Tourism in Asia 4).
- U.S. Fish and Wildlife Service. (2012, September 20). The Lāna'i plant cluster recovery plan. Retrieved August 5, 2016, from Pacific Islands Fish and Wildlife Office, <https://www.fws.gov/pacificislands/flora/lanaiplantcluster.html>
- USGS. (2003). Island-hopping Coral Larvae in Hawai'i. Retrieved August 16, 2016, from <https://walrus.wr.usgs.gov/posters/images/CRDriftPageSize.pdf>

Hawaiian Words

- ‘A‘ama:** Saltwater shore crab (*Grapsus tenuicrustatus*) (p. 5, 6, 10, 11)
- Ahi:** Yellowfin tuna (*Thunnus albacares*), Bigeye tuna (*Thunnus obesus*) (p. 5, 6)
- Ahupua‘a:** Land division usually extending from the uplands to the sea (p. 3, 4, 10)
- Akule:** Bigeye scad (*Selar crumenophthalmus*) (p. 14)
- Aloha:** Greetings, farewell, and an expression of love (p. 9)
- Enenue:** Chub, also called *nenue* (*Kyphosus bigibbus*, *Kyphosus vaigiensis*) (p. 5)
- Halalu:** Juvenile bigeye scad (*Selar crumenophthalmus*) (p. 14)
- Hā‘uke‘uke:** Armored/shingles urchin (*Colobocentrotus amasa*) (p. 6)
- He‘e:** Day octopus (*Octopus cyanea*) (p. 5)
- ‘Ike:** Understand, knowledge, recognize (p. 6, 13, 15)
- ‘Ilima:** Native Hawaiian flowering shrub (*Sida fallax*) (p. 2)
- Honu:** Hawaiian green sea turtle (*Chelonia mydas*) (p. 5, 13, 14)
- Honu ‘ea:** Hawksbill sea turtle (*Eretmochelys imbricata*) (p. 5, 13, 14)
- Kahawai:** River, stream (p. 10)
- Kauno‘a/Kauna‘oa:** Endemic coastal plant, dodder (*Cuscuta sandwichiana*) (p. 6)
- Kawakawa:** Mackerel tuna (*Euthynnus affinis*) (p. 5, 6)
- Kiawe:** Mesquite tree (*Prosopis pallida*) (p. 6, 11)
- Koholā:** Humpback whale (*Megaptera novaeangliae*) (p. 5)
- Kona:** Leeward side (p. 3, 4, 6, 7)
- Ko‘olau:** Windward side (p. 3, 4, 6, 7, 11)
- Kuleana:** Responsibility, right, privilege (p. 2, 9, 10, 11)
- Kūpe‘e:** Marine snail (*Nerita polita*) (p. 5)
- Kūpuna:** Elders (p. 2, 3, 14)
- Lawai‘a:** Fisherman (p. 13)
- Lele kawa:** Cliff jumping (p. 11)
- Limu:** Algae (*Gracillaria* spp.) (p. 5, 6, 11, 13)
- Makai:** Seaward, toward the sea (p. 1, 2, 3, 10, 15)
- Mālama:** To take care of; tend, preserve, protect, maintain (p. 2, 6)
- Mahalo nui:** Many thanks (p. 15)
- Mahimahi:** Dolphinfish (*Coryphaena hippurus*) (p. 5, 6)
- Mauka:** Inland, upland, towards the mountain (p. 1, 2, 3, 9, 10)
- Mele:** Song (p. 14)
- Mele ko‘ihonua:** Genealogical chant (p. inside cover)
- Moi:** Pacific threadfin (*Polydactylus sexfilis*) (p. 5)
- Mo‘olelo:** History, tale, tradition, legend (p. 2)
- Nā kūpuna:** Our grandparents, ancestors, elders (p. 2)
- Nai‘a:** Spinner dolphin (*Stenella longirostris*) (p. 5, 9, 14)
- Naupaka:** Native flowering beach shrub (*Scaevola sericea*) (p. 6)
- ‘Ōhiki:** Sand crab (*Ocypode ceratophthalma*, *Ocypode laevis*) (p. 5)
- ‘Opīhi:** Saltwater limpet (genus *Cellana*) (p. 5, 6, 10, 11)
- Ono:** Wahoo (*Acanthocybium solandri*) (p. 5, 6)
- Pōhuehue:** Native flowering vine, beach morning glory (*Ipomoea pes-caprae*) (p. 6)
- Pono:** Goodness, uprightness (p. 2, 9, 13)
- Pūpū:** Sea snail (order Gastropoda, order Bivalvia) (p. 6)
- Pu‘uhonua:** Place of refuge (p. 11)
- Uhu:** Parrotfish (family Scaridae) (p. 5, 7, 8)
- Ulua:** Trevallies (various species within family Carangidae) (p. 5)
- Wahi pana:** Legendary place; significant place to those that live there (p. 5)

Lānaʻi Community Action Planning Participants and Facilitators

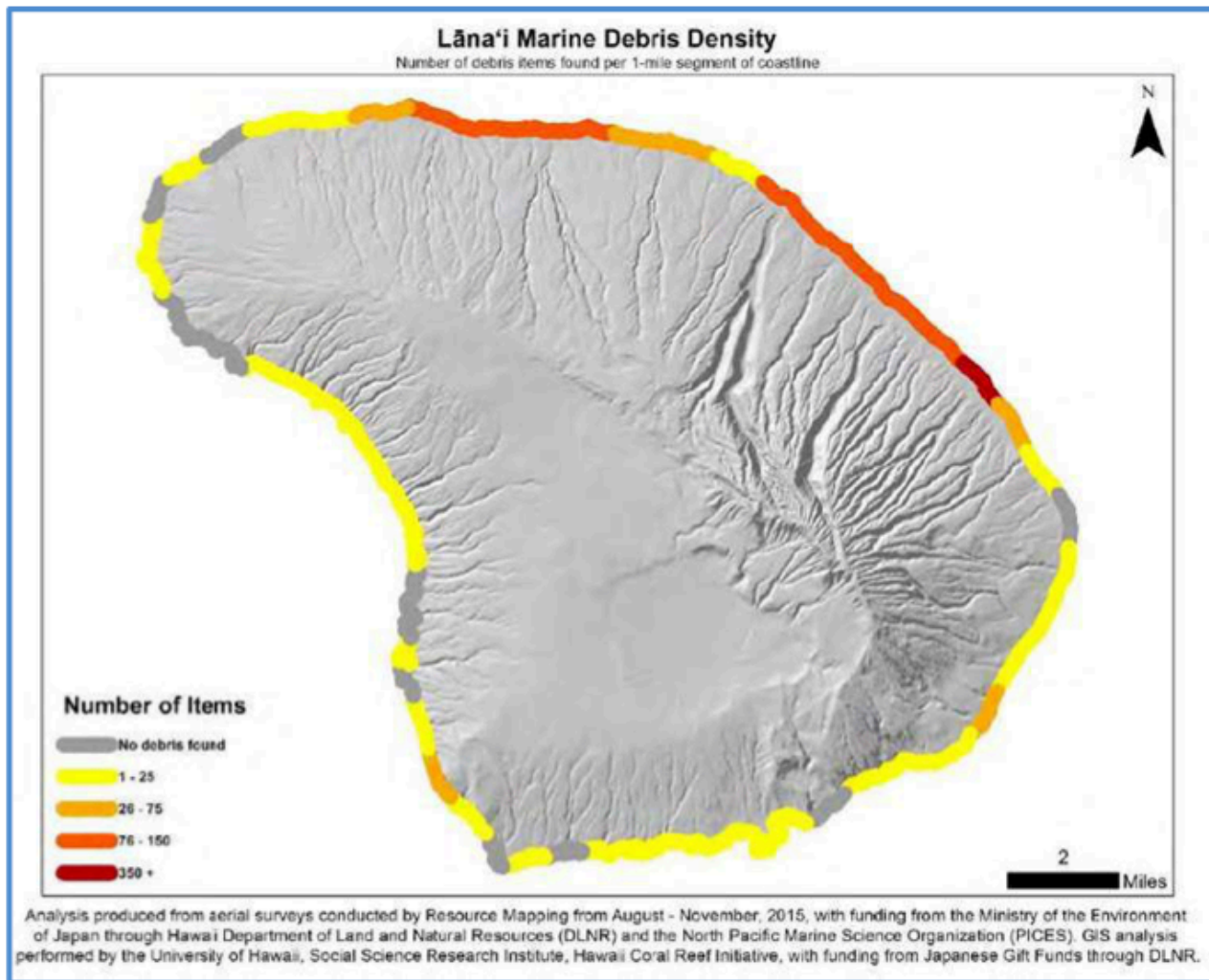
The people who attended CAP meetings that resulted in this document consisted of Lānaʻi residents, fishermen, ocean users, Native Hawaiians, scientists, ocean resources managers, non-profit organizations, and state and federal agency representatives:

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Lānaʻi Marine Debris Density Map

Marine debris consists of plastics and microplastics from human consumption that deliberately or accidentally enter the ocean, often from far across the Pacific Ocean. The following map depicts the distribution of marine debris density around Lānaʻi, which collects primarily on the island's north coast where prevailing trade winds and currents deposit debris:



Reef Resilience Principles

The following Reef Resilience Principles and State of Hawaii management tools were utilized in developing the Lānaʻi CAP strategies:

Reef Resilience Principles

Principle 1: Representation and Replication of resilient species and habitats that are well represented and replicated throughout a marine reserve network can decrease risk of catastrophic events, like bleaching, from destroying entire reef ecosystems.

- Represent 20-40% of each habitat within marine reserves
- Replicate protection of habitats within marine reserves
- Ensure marine reserves are in place for the long-term, preferable permanently
- Create a multiple use marine protected areas that is as large as possible
- Include resilient sites in marine reserves

Principle 2: Critical Areas are vital to survival and sustainability of marine habitats. These are areas that provide secure and essential sources of larvae, spawning aggregations and nursery habitats, and protect endangered species.

- Ensure marine reserves include critical habitats
- Include an additional 15% of key habitats in shorter-term marine reserves
- Have marine reserves in more square and circular shapes
- Include special or unique sites in marine reserves

Principle 3: Connectivity influences the design of marine protected area networks. Preserving connectivity among reefs ensures replenishment of fish stocks from nearby healthy reefs.

- Apply minimum and variable sizes to marine reserves
- Locate MPA boundaries both within habitats and at habitat edges
- Locate more protection upcurrent

Principle 4: Effective Management is essential to meeting goals and objectives, and ultimately keeping reefs vibrant and healthy. Reducing threats is the foundation for successful conservation along with investments in measuring the effects of actions, human capacity and long-term financing. Actions include:

- Prohibit destructive activities throughout the management area.
- Minimize existing and prevent new local threats