Kahoʻolawe Island Reserve: ʻIli O Kealaikahiki

Photo by KIRC

Conservation Action Plan January 2014

Vision: *The kino (physical manifestation) of Kanaloa is restored. Forests and shrub lands of native plants and other biota clothe its slopes and valleys. Pristine ocean waters and healthy reef ecosystems are the foundation that support and surround the island.*

Nā poʻe Hawaiʻi (the people of Hawaiʻi) care for the land in a manner which recognizes the island and ocean of Kanaloa as a living spiritual entity. Kanaloa is a puʻuhonua and wahipana (a place of refuge, a sacred place) where Native Hawaiian cultural practices flourish.

The piko (the navel, the center) of Kanaloa is the crossroads of past and future generations from which the Hawaiian lifestyle is spread throughout the islands.

Kahoʻolawe Island Reserve

Hawaii Division of Aquatic Resources

The Nature Conservancy
Protecting nature. Preserving life.™

NOAA CORAL REEF CONSERVATION PROGRAM


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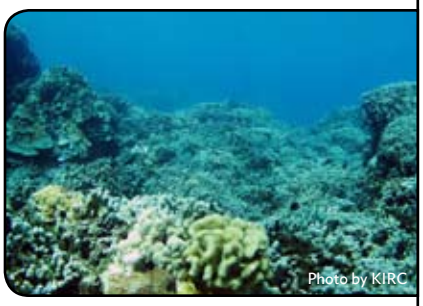
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Acronyms
CAP: Conservation Action Plan • **CPUE**: Catch Per Unit Effort
KIRC: Kahoʻolawe Island Reserve Commission
NOAA: National Oceanic and Atmospheric Administration
ORM: Ocean Resources Management Plan • **PKO**: Protect Kahoʻolawe ʻOhana
TNC: The Nature Conservancy • **UXO**: Unexploded Ordnance

Planning Process

This plan was developed by a multidisciplinary project team who convened at four workshops from 2011-2013 as part of a peer planning and learning process with two other marine sites (Wahikuli-Honokowai Coastal Area and Molokini Shoal Marine Life Conservation District). The Nature Conservancy (TNC) hosted and facilitated the workshops in collaboration with the National Oceanic Atmospheric Administration's (NOAA) Coral Reef Conservation Program, to increase effective management of Hawai'i's marine protected areas. The teams built their plans simultaneously, providing each other with constructive feedback and peer review at every step utilizing Conservation Action Planning (CAP).

CAP is a powerful process to guide conservation teams to develop focused strategies and measures of success. It has been utilized by hundreds of diverse projects at multiple scales throughout the world and is supported by a network of trained professionals that make up the Conservation Coaches Network; CAP is part of the Open Standards for the Practice of Conservation.

Applying CAP in a shared format provides practitioners a common approach and language for conservation planning and the opportunity for candid exchange and peer review. This plan will enable project staff to responsively adaptat their actions, to improve strategy effectiveness and achieve a greater conservation impact.

Kahoʻolawe CAP Team members include KIRC staff: Dean Tokishi, Jen Vander Veur, Mike Nahoʻopiʻi, Paul Higashino, Kui Gapero, Jaime Bruch, and Lyman Abbott; former KIRC staff: Kahale Saito, Cheryl King, and former Kaho'olawe Island Reserve Commissioner Kaʻiulani Murphy; Mākena resident Eddie Chang, and TNC staff Kanekoa Kukea-Shultz.

Figure 1. Group photo of the Kahoʻolawe CAP team in 2012.

Project Background

Site Description

Kahoʻolawe is part of the island of Maui, *moku* (district) of Honuaʻula. Kahoʻolawe has nine ʻili (land divisions): Pāpākā, Hakioawa, Kanapou, Kūnaka/Nāʻālapa, Kealaikahiki, Honokoʻa, Ahupū, and Kūheia/Kaulana and Lua Makika. This plan focuses on the southwestern *ʻili o Kealaikahiki*, the land division of Kealaikahiki, which means "the pathway to Tahiti."

Kealaikahiki's shoreline has both rugged basalt shoreline and sand beaches. The nearshore reef consists of boulders with low coral cover but a high cover of coralline algae (Friedlander, 2010). This ʻili consists of about 4,000 acres of land, about 6 miles of coastline, and 1,210 acres of coral reef (Field, 2011).

Kahoʻolawe has no standing source of fresh water and groundwater is severely limited. A rain catchment system was constructed at the island's highest point, Puʻu Moaʻulanui, which collects about 500,000 gallons of water each year for native plant restoration. Once established, plants and groundcover help retain moisture and soil, reducing sediment run off to the shoreline and coral reefs.

History of Marine Protection

Kahoʻolawe is of tremendous significance to Native Hawaiians, and a treasure and resource for all of Hawaiʻi's people. In recognition of the special cultural and historical status of Kahoʻolawe, the island and the waters within two nautical miles of its shores have been designated by the State of Hawaiʻi as the Kahoʻolawe Island Reserve (Reserve). The Reserve was established for the preservation of Kahoʻolawe's archaeological, historical and environmental resources, rehabilitation, re-vegetation, and habitat restoration and education.

The Kahoʻolawe Island Reserve Commission (KIRC) was established to manage Kahoʻolawe, its land, waters, and resources in trust for the general public and for the future Native Hawaiian sovereign entity. To guide fulfillment of this responsibility, the KIRC developed the Kahoʻolawe Ocean Resources Management Plan in 1997. The vision

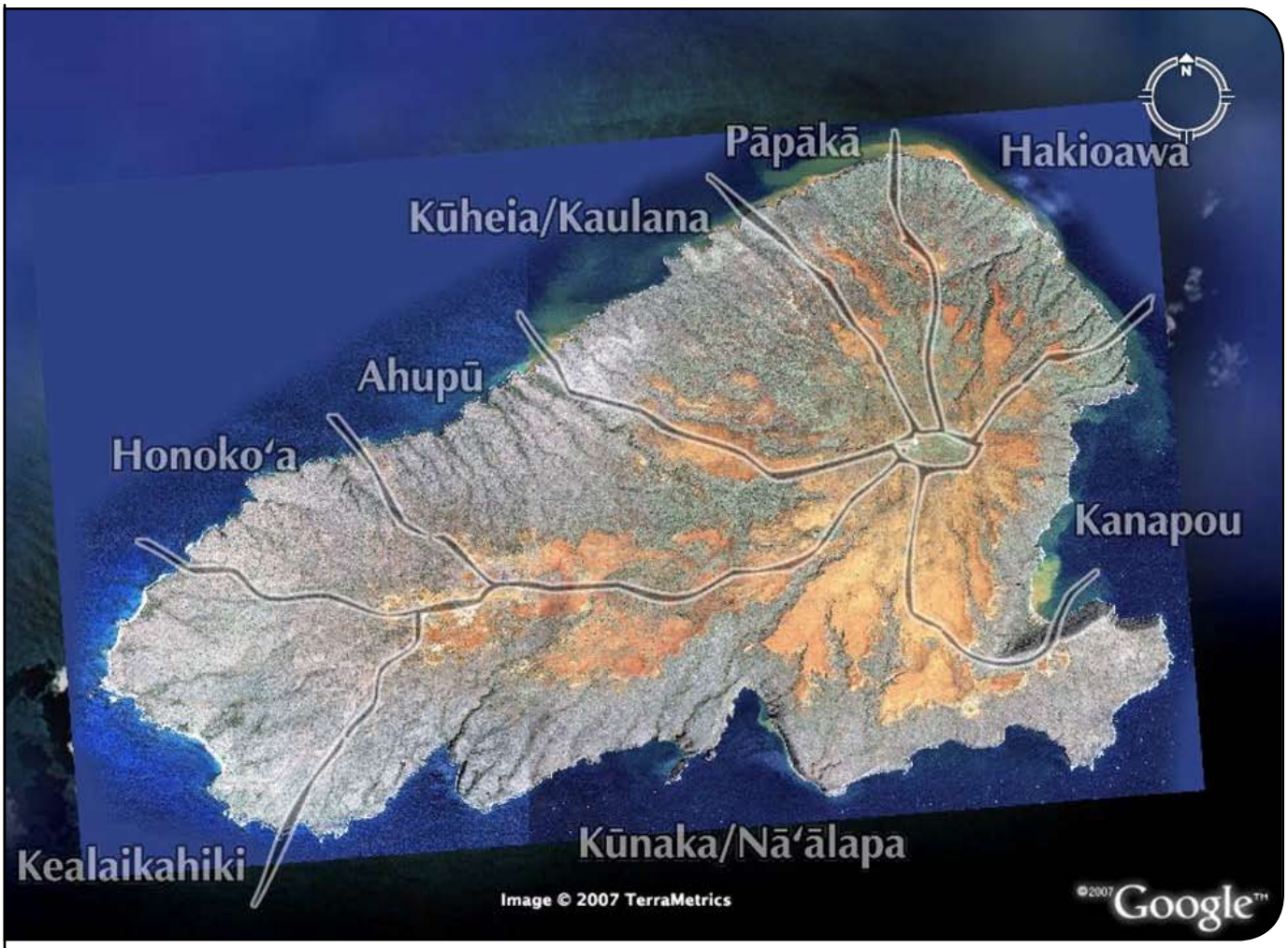


Figure 2. Map of the island of Kahoʻolwe, displaying the nine ʻili (land divisions).

of this plan is that through careful and cooperative stewardship, Kahoʻolawe will be the crossroads of past and future generations of Hawaiʻi's people, and that the traditional Hawaiian values of resources management may again take root throughout Hawaiʻi.

Commercial use of Kahoʻolawe and its resources is strictly prohibited. During the military bombing era, fishing was off-limits. Today, within two nautical miles of the island, limited take is permitted for cultural, spiritual, and subsistence purposes. In the Reserve today, limited take is permitted for cultural, spiritual, and subsistence purposes.

Under the Hawaiʻi Administrative Rules (HAR 13-261), permitted trolling is allowed during two designated weekends a month in waters greater than 30 fathoms. Prior to entry, all vessels are required to register ($25 for a calendar year permit) with the KIRC. Registered vessels are required to file monthly catch report with the KIRC regardless if entry is made into the Reserve or not. Access to the Reserve is highly restricted because of the continued presence of unexploded ordnance (UXO), and for the protection of marine resources. All other fishing (including bottom fishing), ocean recreation, commercial and/or any other activities are strictly prohibited in the Reserve.

Why We Are Concerned

It is essential that the resources of the Reserve are not just protected, but managed for the current and future benefit of the people of Hawaiʻi. Kealaikahiki is a remarkable place, but without management of historical and current threats and uses, the gains provided by protection could easily be lost. In many areas of the island, sediment from the eroded landscape

Timeline of Significant Events

1858
Hawaiian Government leases Kahoʻolawe as ranch lands

1910-1918
Governor Walter F. Frear declares Kahoʻolawe as forest reserve under the control of the Board of Agriculture and Forestry

1918-1933
Kahoʻolawe leased as a ranch

1941-1945
U.S. Army signs sublease with ranch acquiring bombing rights; Kahoʻolawe used as a training ground and bombing target after Pearl Harbor attack

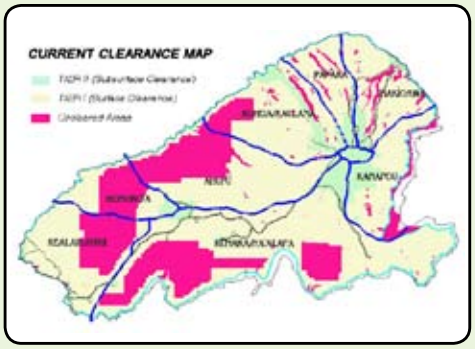
1953
Kahoʻolawe reserved for the use of the U.S. for naval purposes; stipulating that the Navy, when it no longer needed Kahoʻolawe, would return it in a condition "reasonably safe for human habitation, without cost to the Territory"

1976
First Protect Kahoʻolawe ʻOhana (PKO) landing to protest the Navy's continued use of the island as a bombing target; they filed a federal lawsuit charging the U.S. Navy with violating laws pertaining to the environment, historic preservation and religious freedom

1990
President Bush issues memorandum temporarily halting the bombing

1992
Healing ceremony; military votes to end military use of the island and authorizes $400 million to clear the island of ordnance; the state designates Kahoʻolawe as a natural and cultural reserve "to be used exclusively for the preservation and practice of all rights customarily and traditionally exercised by Native Hawaiians for cultural, spiritual, and subsistence purposes"; KIRC is created to plan for the island's future

1994
Title to Kahoʻolawe officially transferred from U.S. military to the State of Hawaiʻi.



is the primary threat, and in others, marine debris is the challenge. At Kealaikahiki, where most of the human access and use occurs, the biggest management challenges are associated with resource extraction, existing and potential introductions of invasive species and pollutants, the continual use of traditional practices, and ensuring safe habitat for the many native species that utilize the sandy bays, beaches and dunes.

What We Are Protecting

Kahoʻolawe is made up of diverse, natural and cultural assets and values that require management and protection to ensure they thrive for present and future generations. Within the project scope, we identified five conservation targets. Conservation targets are the features of the area that we plan to maintain and are the primary focus of management. They are Coral Reef & Nearshore Ecosystem, Cultural Landscape, Offshore Ecosystem, Shoreline Habitat, and Significant Species per ʻili.

Coral Reef &Nearshore Ecosystem

This conservation target extends from the high water mark to 30 fathoms in depth, and includes tidepools, the rocky intertidal zone, coral reefs, and sandy bays. The nested targets include: harvested nearshore fish (aholehole, moi, manini, papio), schooling fish (akule and ʻopelu), and reef fish.

The large 1,200 acre reef system at Kealaikahiki has not yet been surveyed, however, a few coastal locations in

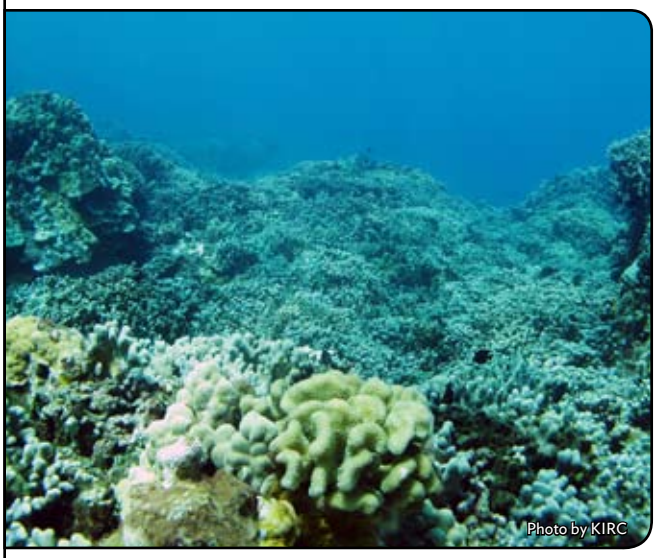
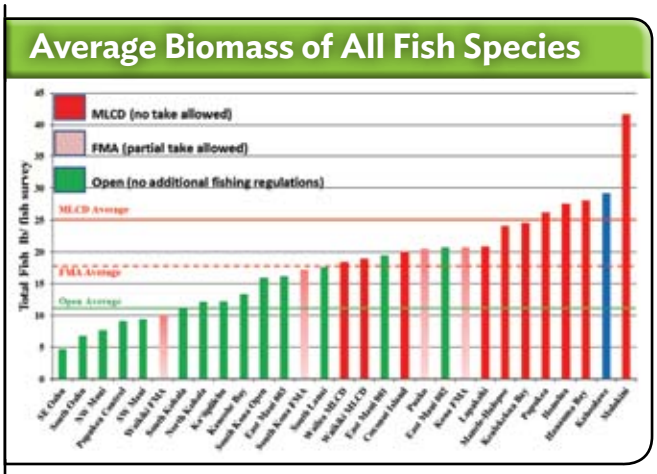
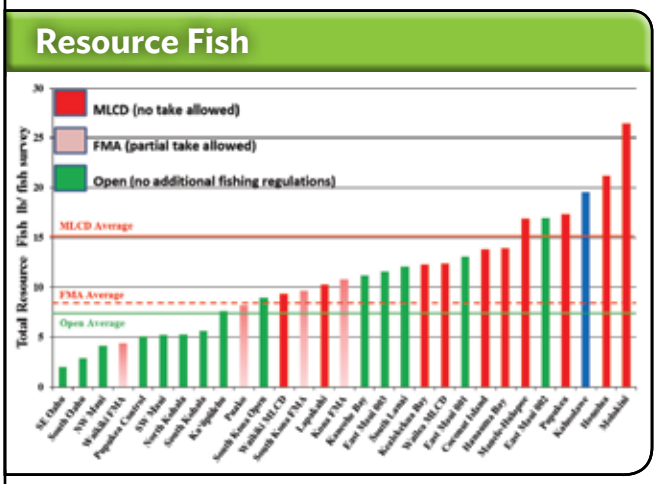


Figure 3. Coral reef structure in Kealaikahiki.





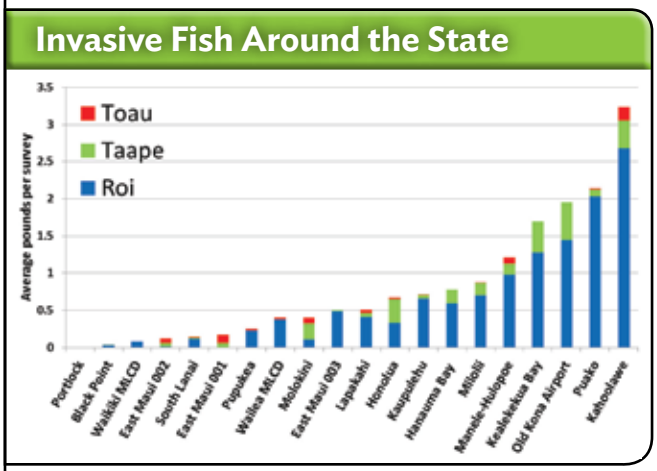


Figure 4. Statewide comparison of average biomass of all fish species, resource fish, and invasive fish.

the ʻili were surveyed in the 2009 dives of the fringing reefs around the entire island. According to the report from that survey, Kealaikahiki has the lowest coral cover at 15%, and the highest turf algae cover at 81% (Friedlander, 2010). Target fisheries species biomass (pālukaluka, ʻōmilu, uku, ʻaʻawa and mū) was highest in the ʻilis most distant from Maui (i.e. Kealaikahiki) and may reflect a fishing gradient due to illegal harvest in the ʻilis nearest to Maui. In windward ʻili, the blackfin chromis was the dominant planktivore (plankton eater), and the brown surgeonfish or *māʻiʻiʻi*, was the dominant herbivore (algae eater) (Friedlander, 2010).

For Kahoʻolawe island as a whole, coral cover is improving over time due possibly to reduced sediment load. The coral species that are present are either robust (*Porites lobata, Pocillopora meandrina*) or in an encrusting growth form (*Montipora capitata*). The trophic biomass composition around the entire island is 33% herbivores, 27% invertivores, 21% planktivores, and 19% apex predators, which is considered a well-balanced trophic assemblage (Friedlander, 2010). In comparison with other fully or mostly protected areas in Hawaiʻi, Kahoʻolawe has some of the highest average biomass of all fish species, resource fish, and invasive fish (Friedlander and TNC published and unpublished data) (Figure 4).

Cultural Landscape

The cultural landscape includes cultural sites, natural resources, navigational sites and viewplanes, cultural uses, place names, knowledge of place and Kinolau O Kanaloa (the earthly forms and manifestations of the Hawaiian god Kanaloa). The island of Kahoʻolawe is on the National Registry of Historic Places and has over 3,000 archaeological sites and features. Although the physical features of the island are very well documented, history and oral traditions are limited. Caring for and perpetuating the cultural landscape helps ensure history,

Figure 5. Cultural shrine to gather rain clouds.

culture and oral traditions are perpetuated.

Offshore Ecosystem

The offshore ecosystem, defined as Zone B in the KIRC Ocean Program Management Plan, extends from >30 fathoms in depth (180ft) to 2 miles off the island. The nested targets are offshore pelagic fish (mahimahi, ahi, ono, akule) and bottom fish (deep 7: opakapaka, onaga, ehu, gindai, hapuʻu, lehi, kalikali). Where the substrate

Figure 6. *Hapuʻu or Grouper caught off the island.*

is topographically complex and provides adequate shelter, bottom fish and invertebrate communities are usually well developed.

Shoreline Habitat

The shoreline habitat is the area above the high water line, and includes beaches, dunes, and wetlands. The nested targets include: seabirds, monk seals, and sea turtles. Suitable habitat for Hawaiian seabirds,

Figure 7. *The sandy shoreline of Kealaikahiki.*

monk seals and sea turtles is on an overall decline in the State of Hawaiʻi, including the Northwestern Hawaiian islands, due to climate change, rising sea levels and urban expansion. Kahoʻolawe presents an unprecedented opportunity for enhancement and restoration of Hawaiian shoreline habitat and special ecological areas. The remoteness of Kahoʻolawe, lack of human development and minimal light disturbance make the Reserve an ideal place to implement conservation actions such as removal of non-native predators, habitat enhancement and rare animal translocations and reintroductions.

Significant Species per ʻili

Spinner Dolphins or naiʻa frequent Honokonaiʻa Bay and are a significant species in this ʻili. Spinner Dolphins are protected under the Federal Marine Mammal Protection Act and under federal law may not be approached, harassed, injured or killed. Aside from the ecological importance of this species within Kealaikahiki there is a cultural connection that is just as important. The place name Honokanai'a, which means "the bay of the dolphin," provides insight and connection to generations previous to ours as to what resources they observed.

Figure 8. *Spinner Dolphins off of Kealaikahiki.*

Status of Our Conservation Targets

The status of each conservation target was assessed according to the key ecological attributes essential to their long-term viability. We assessed viability by assigning values along a four-part scale from poor to very good. Each target is assigned a current status and

a desired status. This plan focuses on how to move the target from its current state to a preferred future state. Refer to the *Appendix* for more details on the target viability rankings.

Threats to Our Targets

The conservation targets are impacted by threats. Individual and or multiple threats combined can put pressure on the system and significantly alter target health. Fourteen direct threats were evaluated by the CAP team and ranked using scope, severity, and magnitude as criteria (see *Appendix* for "Threat Ranking Table").

The highest ranked threats were used to help identify priorities for conservation strategies. These threats have direct impacts on coastal and marine ecosystems. The top five threats are walking on sensitive coastal resources, potential alien species introduction, coastal vegetation that is inappropriate for seabird nesting, erosion & sedimentation, and feral cats. These threats affect three targets: *Coral Reef & Nearshore Ecosystem, Shoreline Habitat, and Cultural Landscape.*

Human tramping largely affects seabird nesting habitat and cultural sites. It is prohibited to stand in the submerged area as it is not clear of UXO. Corals are an integral part of the reef and are especially vulnerable to human activities.

Table 1. Status of Conservation Targets

Conservation Target	Nested Target	Current Status	Desired Status
Coral Reef & Nearshore Ecosystem	• harvested nearshore fish (aholehole, moi, manini, papio) • schooling fish (akule and ʻopelu) • reef fish	Fair	Good
Cultural Landscape	• cultural resources and sites • view planes • kinolau o Kanaloa	Good	Very Good
Offshore Ecosystem	• offshore pelagic fish (mahimahi, ahi, ono, akule) • bottom fish (deep 7: opakapaka, onaga, ehu, gindai, hapuʻu, lehi, kalikali)	Fair	Good
Shoreline Habitat	• seabirds • monk seals • sea turtles	Poor	Good
Significant Species per ʻili	• spinner dolphins	Good	Very Good

Current/Desired Status Scale Definitions

Very Good: The factor is functioning at an ecologically desirable status, and requires little human intervention.
Good: The factor is functioning within its range of acceptable variation; it may require some human intervention.
Fair: The factor lies outside of its range of acceptable variation and requires human intervention. If unchecked, the target will be vulnerable to serious degradation.
Poor: Allowing the factor to remain in this condition for an extended period will make restoration or preventing extirpation practically impossible.

Table 2: Top Ranked Threats to Targets

	Resource Extraction • Over harvesting • Illegal harvesting
	Introduced Species • Additional alien species introduction • Feral cats • Rodents • Invasive fish species • Inappropriate vegetation
	Human Impacts • Walking on coastal habitat • Potential fuel spill & vessel grounding • Erosion & sedimentation

Potential alien species introduction via vessel or helicopter affects both the *Coral Reef and Nearshore Ecosystem* and the *Shoreline Habitat*. Alien species are a high priority threat to Kaho'olawe. As KIRC controls access, anyone who enters the Reserve is mandated to attend an orientation that describes the protocol to prevent alien species introduction.

Inappropriate non-native vegetation affects the *Shoreline Habitat* by growing over cultural sites and seabird nesting habitat. Native coastal species are the preferred vegetation. Once native plant species are in abundance, they will create a "seed bank" that will sustain a native plant community. Part of this process is the removal of invasive and alien plant species.

Erosion and sedimentation affect the *Coral Reef and Nearshore Ecosystem* target and the *Shoreline Habitat* target. An estimated 1.9 million tons of soil is deposited into the ocean surrounding Kaho'olawe each year through runoff. Kaho'olawe is being planted with native species of trees, shrubs, vines, grasses, and herbs. Restoration is targeted for 4,300 acres. The remaining land is barren hardpan, soil compacted so severely by erosion that it cannot readily absorb water.

The KIRC's Pu'u Moa'ulanui restoration project focuses on reducing sediment flow in stream channels before it reaches the sea by promoting growth of vegetation in those areas. Many of the erosion control techniques have involved the use of native pili grass grown by the Natural Resources Conservation Service on Moloka'i.

Non-native feral cats prey on nesting seabirds and their young in the Shoreline Habitat. KIRC is committed to the removal of feral cats in its efforts to restore native coastal habitats and wildlife.

Objectives and Strategies

Five objectives and associated strategic actions were created to achieve the overall goal, to restore the coastal and marine resources, knowledge, habitats, and native species of 'ili o Kealaikahiki. The plan focuses on improving the status of the conservation targets and reducing the impacts of priority threats.

Objective 1	Manage marine ecosystems so that targeted fish populations, wildlife, and coral reef health status is increased and/or maintained at good levels by 2018.
Objective 2	Prevent human impacts to marine wildlife and introduction of new alien species, disease and pathogens from vessel and aircraft landing at Kealaikahiki by 2015.
Objective 3	Perpetuate traditional Hawaiian fishing practices, and environmental knowledge and understanding within the Reserve, annually through 2017.
Objective 4	One hundred pairs of Wedge-Tailed Shearwaters (ua'u kani) are nesting in the shoreline areas of Kealaikahiki by 2020.
Objective 5	Solidify enduring political support for KIRC policies and annual budget of $3.5 mil by July 2014.

Objective 1: Manage marine ecosystems so that targeted fish populations, wildlife, and coral reef health status is increased and/or maintained at good levels by 2018.

Strategic Actions

1.1. Increase the percentage of fishing catch reports submitted from permitted trollers and on-island users to good levels.

a. Reach out to trollers and on-island fishers through one or more in-person meetings per year and explain their important role in resource management, and how they can help by submitting timely and consistent catch reports. Educate users on why state rules are in place and how breaking the rules affect resource populations. Emphasize Hawaiian cultural sustainable fishing practices, and the use of catch report information in developing a Kahoʻolawe specific seasonal and moon calendar. Encourage compliance with KIRC and state rules.
b. Create incentives and user-friendly systems for submitting timely monthly catch reports.

1.2. Increase compliance with allowed entry dates, zones, and types of fishing.

a. Increase penalties for non-compliance with rules.
b. Create communication materials and outreach to fishers with information on how to report non-compliant activities.
c. Adjust KIRC presence on island to coincide with in-Reserve ocean use. Increase and randomize KIRC presence (days/times).
d. Have the equipment and skills to engage with and educate boaters from Kealaikahiki.

1.3. Adjust fisheries management based on accumulated information.

a. Determine if internal kapu or if state rules, regulations, and statutes need to be modified. Identify people to "champion" changes to existing regulations.
b. Provide standardized method of informing Commission and fishers if a management action needs to be initiated due to resource changes (e.g., harvesting method, size limit, bag limit, area closures, species kapu, and seasonality).
c. Fill fisheries information gaps with fisheries independent data.

1.4. Establish five-year closure at Honokanaiʻa to replenish declining fish populations.

a. Develop purpose, position and time-frame for closure.
b. Review with PKO.
c. Provide outreach to stakeholders and the public.
d. Conduct before and after reef and reef fish surveys.

1.5 By 2017, assess the status of the 1200-acre Kealaikahiki coral reef.

a. Seek out expert advice on what is required to carry out study.
b. Inquire with USGS about information gathered from ground truthing surveys completed with Ann Gibbs including in-water tow video.

1.6 Reduce existing introduced species (roi, toʻau, taʻape) by 25% by 2017 on selected Honokanaiʻa reefs.

a. Involve volunteers in fish surveys, fish removal, and gut analysis.

1.7 Document and track habitat use by protected marine species and educate volunteers about the unique refuge that Kealaikahiki provides for Spinner dolphins, Hawaiian monk seals, and Hawaiian green sea turtles.

a. Provide access, education and service opportunities within the living classroom and refuge of Kahoʻolawe.

Objective 2: Prevent human impacts to marine wildlife and introduction of new alien species, disease and pathogens from vessel and aircraft landing at Kealaikahiki by 2015.

Strategic Actions

2.1 Prevent fuel spills and boat groundings at Honokanaiʻa.

a. Research and define best management practices.
b. Define procedures and conduct training.
c. Improve mooring with longer chain and larger buoy.

2.2 Develop state-of-the-art biosecurity plan to prevent additional alien species introductions.

a. Consult with Papahānaumokuākea on their protocols and strategies to deal with mice, rooted plants, hitch-hikers on tabbies, aquatic alien species via boat transport (hull fouling), and marine debris.
b. Implement plan, including inspecting KIRC hulls after annual scrubbing, and surveying marine debris.

Objective 3: Perpetuate traditional Hawaiian fishing practices, environmental knowledge and understanding within the Reserve, annually through 2017.

Strategic Actions

3.1 Gather and consult with poʻo lawaiʻa from 1993-1995 kaʻapuni to conduct a follow-up kaʻapuni with younger lawaiʻa to pass on cultural knowledge of place and practices, and to reflect on current resource status compared to 20 years ago.

3.2 Five known fishing koʻa and associated biological resources and cultural practices are understood, one site per year, from 2013 -2017.

a. Beginning with Kahoʻolawe site 270 in 2013, generate a historical understanding of the mapped

ko'a in Kealaikahiki.
b. Examine the relationship between the ko'a and the adjacent submerged resources.
c. Perpetuate use and knowledge of the ko'a and associated submerged resources.

Objective 4: One hundred pairs of Wedge-Tailed Shearwaters (ua'u kani) are nesting in the shoreline areas of Kealaikahiki by 2020.

Strategic Actions
4.1 Remove all feral cats by 2016 and all rodents by 2020 island-wide.
a. Form expert working group, develop removal plan, seek funding/approvals, and implement plan.
b. Assess baseline predator abundance and impacts, and implement monitoring.
c. Seek funding and collaborate with Division of Forestry and Wildlife, Maui Invasive Species Committee, TNC, National Park Service, PKO, National Fish and Wildlife Foundation, Audubon Society, and Island Conservation.

4.2. Enhance habitat for nesting in parallel with predator removal.
a. Select appropriate sites for nesting.
b. Assess vegetation for site restoration.
c. Implement habitat restoration.
d. Limit human disturbance in colonies.
e. Conduct localized predator control as needed.
f. Implement biosecurity plan to prevent new introductions (see *Objective 3*).

4.3. Strategically reintroduce Wedge-tailed shearwaters.
a. Develop and implement attraction plan for natural reintroduction.
b. Conduct monitoring and banding to track effectiveness of efforts.

Objective 5: Solidify enduring political support for KIRC policies and annual budget of $3.5 mil by July 2014.

5.1 Develop and implement a segmented communication plan for target audiences for coastal and marine resources management funding.
a. Develop key messages and delivery with input from key constituents.

5.2 Build the case for funding by Office of Hawaiian Affairs and other private and public sources.
a. Build sustainable finance scenarios and communicate value to key audiences.

Measuring Our Success

For this project, this monitoring plan answers two basic interrelated questions:

Resource Status
How are key targets, threats, and other factors at the project site changing over time? (see *Table 3*)

Strategy Effectiveness
Are the conservation actions we are taking achieving their desired results? (see T*able 4*)

To answer these questions, the CAP team and its partners are collecting data on a number of indicators that gauge either the status of a target, change in a threat, or progress towards an objective. These indicators inform us of our progress towards accomplishing our objectives, and ultimately all of the goals of the project.

Coral Reef Monitoring
In addition to staff-led monitoring described in *Table 3*, KIRC partnered with the University of Hawai'i and TNC to characterize and assess the status of the coral reefs surrounding the entire island. Alan Friedlander published the results of the 2009 surveys in 2010, including information on key indicators for coral and algae, fish, apex predators, and large invertebrates (Friedlander 2010). KIRC will work with partners on a larger scale coral reef survey in the next few years.

Figure 9. Dean Tokishi (KIRC) and Kydd Pollock (TNC) conducting a reef fish survey in 2009.

Fish Tagging and Replenishment Study
Protected areas act in two ways to replenish adjacent areas, through larval transport, and spillover of adult fish.

Accomplishments

During the development of the CAP, these strategic actions have since been accomplished in 2012:

1.1. Increase the percentage of fishing catch reports submitted from permitted trollers and on-island users to good levels.

- Conducted targeted outreach to permitted fishers and doubled the percentage of fishing reports submitted monthly. In November 2012, began targeted outreach with local fishermen about the process of registering for permitted trolling and why compliance with all rules (including catch reporting) is important.
- Introduced an incentive to fishermen who submit all monthly catch reports on time, receive a 20% reduction in permit fees the following year.

1.3. Adjust fisheries management based on accumulated information.

- Initiated fish tagging project to track nearshore targeted fish growth rates and home ranges.

4.1. Remove all feral cats by 2016 and all rodents by 2020 island-wide.

- Secured a Federal grant from the National Fish and Wildlife Foundation to implement the early stages of this project. Created a Working Group, and business plan outlining the financial, social, and biological issues associated with an invasive vertebrate eradication for the entire island of Kahoʻolawe.

Table 3: How is Resource Status Changing Over Time?

Coral Reef & Nearshore Ecosystem Status Indicators	Current KIRC Monitoring	Frequency
Percent coral cover	Two Honokanaiʻa nearshore reefs, on established transects	Annually
Reef fish abundance biomass and size class	Two Honokanaiʻa nearshore reefs, directional timed swims for resource fish	Quarterly
Biomass of non-native fish	Two Honokanaiʻa nearshore reefs, directional timed swims for resource fish in association with roi removal	Quarterly
Alien algae presence/absence	Visual surveys intertidal and nearshore areas	Monthly
Catch per unit effort of pelagic fish	Permitted trolling monthly catch reports	Monthly
Percentage of permittees submitting catch reports, and their catch per unit effort	Tracking and analysis of monthly catch reports	Monthly
Growth rate and home range of shoreline fish	Fish caught by pole and line, and tagged and released using spaghetti tags. Information is collected if fish is caught again and reported	Monthly
ʻOpihi abundance, biomass and diversity	Standardized ʻopihi monitoring protocol, with ʻOpihi Partnership and Chris Bird of Texas A&M	Annually
Abundance and location of key species	Aerial surveys coastal changes; marine debris; illegal access; seabird activity; monk seal resting and pupping, sea turtle abundance and size class; location and size of akule schools; location of jacks and sharks	Monthly
Abundance, identification and location of monk seals	Coastal walks	Monthly

As the largest marine area in the main Hawaiian Islands under protection and management, and with relatively high fish biomass, Kahoʻolawe is likely serving as a source of reef fish to other islands. To fully understand the impact of fish movement and growth rates, the KIRC is monitoring fish habitat, growth rates and, through fish tagging, their travel outside the Reserve.

Figure 10. Aholehole tagged for fish tagging study.

Monitoring by Sea and Air

As a Reserve, Kahoʻolawe is rich with marine life that includes manō, naiʻa, hāhālua, and koholā. ʻIlioholoikauaua, honu, seabirds such as ʻiwa and koaʻeʻula also utilize the Reserve's coastal habitats. The KIRC conducts island-wide inventory of these species (visual counts by foot, boat, and helicopter) to establish a distribution and abundance baseline that will help determine change over time as a result of management actions and their protection within the Reserve.

Figure 11. Monk seal and honu in the Reserve.

Permitted Trolling Catch Report Data

The pelagic waters around Kahoʻolawe have been utilized by permitted trollers for the past 19 years. The KIRC permitting system has been in effect since 2007. While submitting catch reports is a condition of the permit, on average, less than 20% of permitted trollers submitted catch reports. To address this problem, the KIRC changed the catch report forms to make them easier for the trollers, created an online fillable version, conducted education and outreach 'talk story sessions' and changed the reporting requirement to a monthly submission of catch reports. Due to these changes, submission of catch reports has more than doubled, with an all-time high percentage of permitted trollers submitting catch reports.

Another component of permitted trolling management includes an analysis of the information submitted in the catch reports. The latest report focused on the permitted trolling conducted from 2010-2012 (see *Figure 10*). Data showed that the CPUE increased from 0.316 (in the 2007-2009 report) to 0.337 fish/hour (in the 2010-2012 report). Data also showed that CPUE increased in three of the six trolling zones, while declining in the other three. This may indicate a shift in fishing pressure around the Reserve or may be due to a more complete picture from the increase in catch reporting.

The Ocean Program also investigates how the catch rates correlate to the Hawaiian moon calendar. Permitted trolling only occurs two weekends a month and due to this there is an uneven number of data points across the moon phases, with some phases having multiple trolling days and others having none. Due to the skewed number of samples per moon phase, it is difficult to draw a clear correlation to the moon phase and catch rates, however our preliminary data show higher catch rates and more biomass removed around the favorable moon phases with some of the highest catch rates around the Kanaloa moons. This last correlation is especially intriguing as Kahoʻolawe is deeply tied to the Hawaiian God of the ocean, Kanaloa.

While the removal of pelagic fish does occur around the island, the Reserve also offers some safe haven for these species and the continued management, and monitoring of these resources is a critical aspect of maintaining the health of the Reserve.

Community Involvement

In the healing process for Kaho'olawe, the KIRC relies on volunteers to get the job done. Through our Restoration, Ocean, and Cultural programs and the supporting Operations program, there are many varied volunteer opportunities that the public can participate in. These include reforestation and erosion control projects, fish monitoring and species surveys, historical site restoration and protocol assistance, infrastructure improvements, and a myriad of other projects.

Removal of non-native fish
The Ocean Program will be looking to the community for assistance in monitoring and regulating non-native fish populations in in Honokanai'a Bay. This opportunity is funded by a Hawai'i Community Foundation grant in 2013. Through this grant, community members will learn and participate in fish identification and in-water survey techniques. Their skills will also be utilized in the removal of the 500 pounds of non-native fish. Following all removal efforts, gut analysis will be conducted to determine what impact the non-native fish are having upon the native fish communities.

Kanapou marine debris removal
Through grants obtained from NOAA's Marine Debris Program and Fisheries Habitat Conservation Office and Keep The Hawaiian Islands Beautiful, the KIRC has been conducting coastal debris clean ups at three different locations around Kaho'olawe. Utilizing the KIRC's strong volunteer base, more than 40 tons of debris will be removed from the shoreline through these grants.

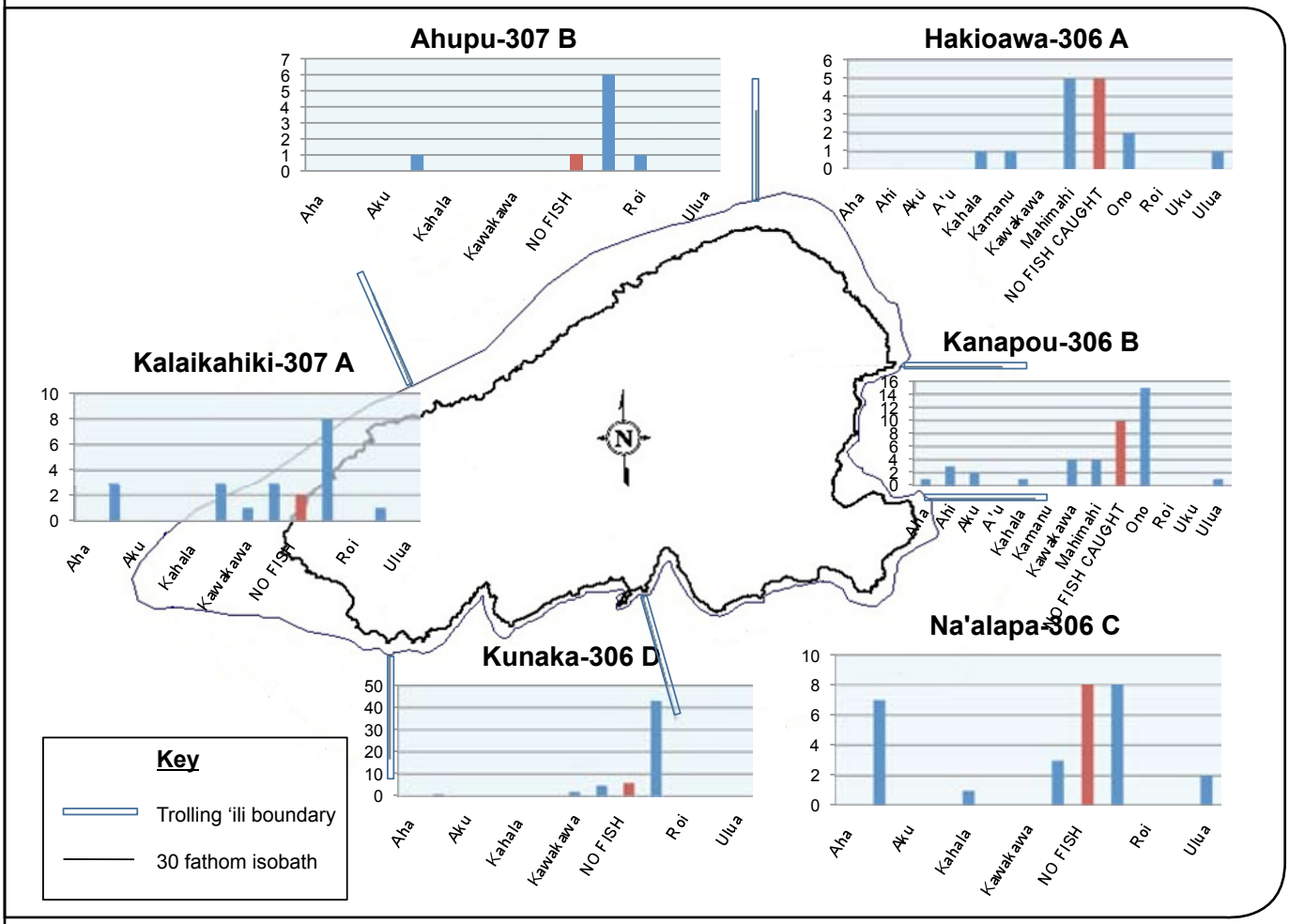


Figure 10: Trolling total fish caught per zone from 2010 to 2012.

Figure 13. Before and after pictures of marine debris clean-up effort at Kanapou.

Restoration
A $1.5 million grant from the State Department of Health will enable about 1,800 volunteers to participate in restoration activities on Kahoʻolawe over the next three years. Volunteer trips typically focus on watershed restoration and re-vegetation activities. The program also includes talk-story sessions on ancient and contemporary history, current events, and future use of Kahoʻolawe. Volunteers visit significant Hawaiian cultural sites, listen to historical stories, learn chants, and practice cultural protocols as part of the KIRC Culture and Education Program.

Contact Information

Ocean Program Manager
Dean Tokishi (dtokishi@kirc.hawaii.gov)

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NOAA's Coral Reef Conservation Program

Table 4: Are Our Actions Having the Desired Effect?

Objective	What we want to see (2013-2018)	How we will measure
1. Manage marine ecosystems	Permitted trolling catch report submission increase to 51-75% on-time reports. Honokanaiʻa reef fish biomass increase and invasive fish decrease. The spill-over effect of Kahoʻolawe reef fish on nearby Hawaiian islands is understood, large reef is characterized, increasing public support for Reserve management.	Catch report analysis, reef fish surveys, fish tagging study, number of positive Hawaiʻi press reports on spill-over effect and large reef.
2. Prevent human impacts	Fuel spill and vessel grounding plan and best practices in use and no spills or groundings have occurred. Bio-security plan written with expert review, and no new introductions or re-introductions have occurred.	Number of incidents, introductions, or reintroductions. Supportive peer-review and positive press.
3. Perpetuate traditional fishing practices	Poʻo lawaiʻa from 1993-1995 kaʻapuni conduct follow-up kaʻapuni with younger lawaiʻa to pass on cultural knowledge of place and practices, and reflect on resource status compared to 20 years ago. One fishing koʻa researched per year.	Kaʻapuni conducted, koʻa researched, information shared with key audiences.
4. Increase wedge-tailed shearwater nesting	Predators removed from the island. Selected habitat restored. 100 pairs of wedge-tailed shearwaters nesting annually by 2020.	Predator and bird population assessments.
5. Support for KIRC budget	Key messages from this plan and other KIRC programs are communicated to funders. Stable annual funding increased.	Level of annual funding increases.

Appendix A: Threat Ranking Across Targets

Threats to Targets	Coral Reef & Nearshore Ecosystem	Offshore Ecosystem	Shoreline Habitat	Cultural Landscape	Significant Species per 'ili	Summary Threat Rating
Human trampling	Medium		Very High	Low		High
Potential alien species introduction via vessel or helicopter	High		High			High
Inappropriate vegetation	Low		Very High	Low		High
Erosion & sedimentation	High		High	Medium		High
Feral cats			Very High			High
Lack of knowledge of or presence of resources	Medium	Low	Medium	Medium		Medium
Historical changes in land use and lack of language use				High		Medium
Fuel spill & vessel grounding	High				Medium	Medium
Increased human access	Medium		High	Low		Medium
Overharvesting	Medium	Medium				Medium
Rodents			High			Medium
Aquatic disease and pathogens	Low					Low
Illegal poaching	Low	Medium				Low
Introduced fish species	Medium					Low
Summary Target Ratings:	High	Medium	Very High	Medium	Low	Very High

Threat Ranking: The known impact of each threat was evaluated for each target. The ranking was based on the stresses leading to the degradation of the target and on the source of the stress. The stress is rated in terms of the severity (the level of damage the resource could reasonably expect within 10 years under the current circumstance), and the scope (very widespread to very localized that would be expected within 10 years under the current circumstance). The source of the stress was rated in terms of contribution (is the source acting alone to cause the stress or is it a low contributor to the particular stress?), and irreversibility (the degree to which the effects of a source of stress can be restored). Each of the criteria (severity, scope, contribution, and irreversibility) was ranked on a four point scale (low, medium, high, and very high) for each target.

Appendix B. Target Viability Ranking, Key Ecological Attributes, and Indicators

Targets by Indicator	Status	Poor	Fair	Good	Very Good
Coral Reef &Nearshore Ecosystem	Fair				
Abundance and biomass of targeted fish spp.	Fair				
Abundance and biomass of moi, aholehole	Good	>50% decreased abundance & biomass from 2010 levels	25%-49% decreased abundance and biomass from 2010 levels	equivalent to current (2010) levels of abundance and biomass	>25% increase over current levels
Abundance, biomass and diversity of 'opihispp	Fair	>50% decreased abundance, biomass & diversity from 2010 levels	=2010 abundance, biomass & diversity	25-49% increase of 2010 abundance, biomass & diversity	>50% increase of 2010 abundance, biomass & diversity
Abundance, biomass of reef fish including jacks and manini	Fair	>50% decrease of abundance, biomass of reef fish	average biomass= 29 lbs per survey; average biomass of resource fish= 19 lbs per survey; prime spawner =16 lbs per survey		
Abundance, biomass of akule	Poor	no sightings over a year		akule school sighted 6 month of the year in Honokanai'a, est. school size 1.5-2 tons	5 tons
Species Diversity	Good				
Fish Trophic Structure	Good	almost no apex predators; dominated by small herbivores		25% apex predators	50% apex; 25% herbivores; 25% secondary
Diversity of Invertebrate Species	Good	single family present	multiple families present	multiple families present; multiple genera present	multiple families present; multiple genera present; multiple species present
Benthic Composition	Fair				
Composition of Limu and Coral Species	Fair	coral reef area dominated by macroalgae and/or turf <10% coral cover and/or >50% coral cover dominated by macroalgae	= 13-23% coral cover	50% living coral cover (low macroalgae, low to moderate turf cover)	
Coral Size Structure	Fair	lacking large, mature colonies and recruits		full range of coral colony sizes (recruits, mature colonies)	
Condition of the water column	Good				
Turbidity	Good	poor visibility; darker than light brown; visibility <3ft; suspension persists up to 2-3 weeks; 6-12inches of sedimentation on bottom	visibility up to 25-30ft; suspension persists for up to 1 week; 1-6 inches of sedimentation at bottom	crystal clear water, up to 50ft horizontal visibility; no sedimentation at bottom	>100 ft horizontal visibility; no sedimentation at bottom
Cultural Landscape	Good				
Mo'olelo and traditional placenames	Fair				
Use of traditional names	Fair	traditional names are not preserved or used		Staff consistently uses and teaches a set of traditional placenames in all areas frequently visited	
Cultural resources and sites	Fair				

Legend

Key Ecological Attribute

Indicator

Targets by Indicator	Status	Poor	Fair	Good	Very Good
Ko'a and other cultural sites	Fair	No ko'a or cultural sites are intact & being utilized		Majority of known ko'a and cultural sites are maintained understood, practiced, and applied by multiple practitioners and are transmitted	All ko'a and cultural sites are maintained understood, practiced, and applied by multiple practitioners and are self perpetuating; the island is thriving
Viewplanes	Very Good				
Viewplanes are clear from shoreline to summit, neighbor islands, horizon, heavens	Very Good	Viewplanes obstructed by structures			No obstructions; view is all natural
Traditional navigation learning/teaching	Good				
	Good	not visiting Kuhikehe	visiting Kuhikehe with little explanation	visiting Kuhikehe with an explanation	application of learned knowledge at Kuhikehe
Offshore Ecosystem	Fair				
Abundance of offshore Pelagic	Fair				
Catch per Unit Effort	Fair	more than 60% of catch reports are zero catch reports	CPUE range from 0-0.5 fish per hour	CPUE range from 0.51-1.0 fish per hour	CPUE of greater than 1.0 fish per hour
Percentage of Permitees Submitting Catch Reports	Fair	0-25% of permitees submitting catch reports	26-50% of permitees submitting catch reports	51-75% of permitees submitting catch reports	76-100% of permitees submitting catch reports
Bottom fish stocks status	Good				
Biomass and species diversity of deep 7	Good	>50% decrease from baseline	>25% decrease from baseline	=baseline	>50% increase from baseline
Bottomfish movement (in/out) of Reserve	Good	No movement occurring		=baseline study conducted w/kelly&zieman ('05?)	
Shoreline Habitat	Poor				
Turtle Nesting	Poor				
Presence of nesting turtles	Poor	no nesting		one returning turtle species; 10 nesting turtles per season laying multiple nests	multiple returning turtle species; 100 nesting turtles per season laying multiple nests
Survival of hatchlings	Poor	no hatchlings produced per nest		50% hatchling success per nest	
Intact dunes and functioning wetlands	Fair				
Presence/absence of non-native and native vegetation	Fair	Absence of dune and wetland vegetation; no freshwater retention		Presence of dune and wetland indicator vegetation species; freshwater retained in the area	
Seabird presence	Poor				
Wedge-tailed shearwater nesting success	Poor	predators present; no breeding pairs present; no successful nesting occurring.		predator free; constant, if not increasing number of breeding pairs; sustained nesting colony of greater than one hundred of nesting pairs_	
Seabird Species Diversity	Poor	predators present; no	multiple species present	nesting and guano	nesting of multiple

Legend

Key Ecological Attribute

Indicator

Targets by Indicator	Status	Poor	Fair	Good	Very Good
		nesting; low # of observations; low species diversity		present	species; no predators; frequent sightings of multiple species
Monk seals utilizing the reserve	Good				
Presence/absence, size, behavior, physical condition	Good	no monk seals		one birth a year; consistent 4-7 sightings per ocean program access	increased number of births and seals sighted
Significant Species per 'ili	Good				
Size of spinner dolphin pod resting at Honokanai'a	Good				
Size of pod and duration of time spent in bay	Good	a decreased frequency of sighting over time; decreased duration of time spent in bay(per sighting),		stable or increasing over time; stable or increasing amount of time....baseline will be created from already existing data	
Level of human & vessel activity in Honokanai'a Bay	Good				
Level of human & vessel activity in Honokanai'a Bay	Good	double the level of vessel and human activity over good levels		average 3 round trips to the bay with the vessel Ohua per week *no swimmers	

Legend

Key Ecological Attribute

Indicator

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Kahoʻolawe Island Reserve

Hawaii Division of Aquatic Resources

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