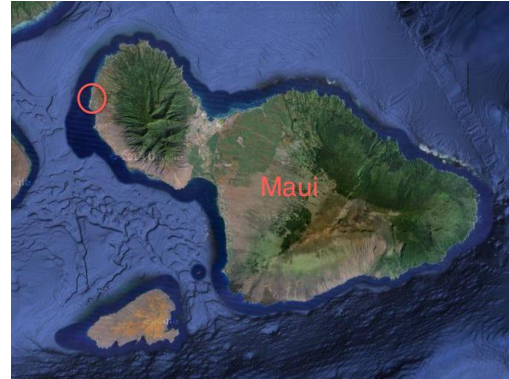


**Managing Fisheries for Reef Resilience: Kahekili Herbivore Fisheries Management Area  
North Kā'anapali, West Maui, Hawai'i**

**The Challenge**

Long term monitoring of coral reefs along the leeward coast of the Island of Maui began in 1999 by the State of Hawai'i's Division of Aquatic Resources (DAR) and the University of Hawai'i's (UH) Institute of Marine Biology's Coral Reef Monitoring Assessment Program. Many of these coral reef survey locations were established at previous study sites, providing managers with a longer term picture of the changes on these reef systems. Assessments have shown that of the nine reefs monitored, many sites experienced a significant decrease in live coral cover as reefs became overrun by invasive algae. At Kahekili in north Kā'anapali, reef monitoring sites indicated a decrease in coral cover from 55% to 33% between 1994 and 2006.



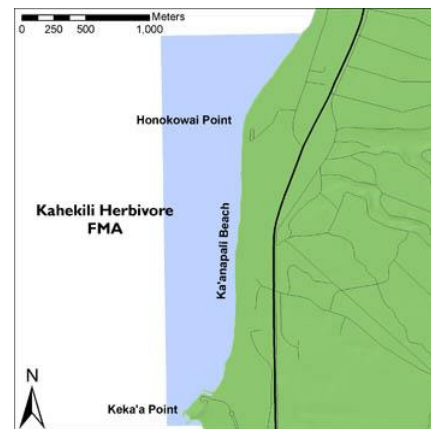
Location of North Kā'anapali, West Maui, Hawai'i

The significant increases of invasive algae were seen as a major threat to West Maui's coral reefs. At Kā'anapali, specifically, red algal blooms of *Acanthophora spicifera* had become much more abundant, which was suggested by UH research to be a result of elevated nutrients from wastewater and fertilizers. Despite the sources of land-based pollution, the increasing abundance of algae was exacerbated by the fact that there was a decrease in abundance of reef grazing herbivores, which fish surveys at the same sites confirmed.

**Actions Taken**

A cooperative "Fish Habitat Utilization Study" by DAR and the National Oceanic and Atmospheric Administration (NOAA) revealed clear evidence of the relationship between grazing fish and the abundance of invasive algae; the more herbivorous fishes present, the less algae on the reefs.

Therefore, in July of 2009, the State of Hawai'i designated the Kahekili Herbivore Fisheries Management Area (KHFMA) in order to control the overabundance of marine algae on coral reefs and restore the marine ecosystem back to a healthy balance. The killing, injuring, or harming of sea urchins and certain herbivorous fishes, including sea chubs, parrotfish, and surgeonfish is prohibited in order to increase the local abundance of these beneficial fishes and sea urchins in the area. Feeding of these fishes is also prohibited in order to promote grazing. The onshore boundaries extend from Honokōwai Beach Park (and offshore for a distance of 1,292 yards) south approximately 2 miles to Hanaka'ō'ō Beach (and offshore for a distance of 335 yards) (Hawai'i Revised Statues, Chapter 13-60.7).



Boundaries of the KHFMA along the Kā'anapali Coast, West Maui © Hawai'i DLNR

### How Successful Has it Been?

Although some fishermen and cultural practitioners opposed fishing rules, the majority of the community was in strong support of the KHfMA. Many of the local fishermen understood the poor conditions of the reef, and realized the benefits of fisheries management. The overwhelming support for the KHfMA has led to more education within the area as well as compliance with the rules.

Since the establishment of the KHfMA in 2009, DAR, in partnership with UH and NOAA's Pacific Islands Fisheries Science Center (PIFSC), has continued monitoring the reefs at Kahekili. According to the PIFSC Interim Monitoring Report from February 2013, results thus far indicate the following:



Beneficial herbivorous fishes now fully protected within the KHfMA © Hawai'i DLNR

- Consistent upward trend in biomass of parrotfishes, which more than doubled between 2009 and 2012
- Increases in parrotfish biomass have not been distributed evenly across the KHfMA, and, in particular, there has been little or no recovery of parrotfish biomass in the shallow, nearshore reef areas adjacent to Kahekili Beach Park;
- Strong positive relationship between total parrotfish biomass and total crustose coralline algae (CCA) cover. CCA is a benign algae that is important for coral settlement, and studies show that increases in parrotfish biomass leads to increased CCA cover
- No clear overall trend in biomass of surgeonfishes

A possible reason for the lack of change in biomass of surgeonfish could be linked to their lifespan; they can live up to 40+ years, so with three years of data, it is not surprising that biomass has not changed.

The steady increase in biomass of parrotfishes since the establishment of the FMA has potentially significant indications for reef resilience. The larger the fish, the deeper the excavating bites, which is important because this removes algae from the substrate, exposes bare rock and opens up new sites for coral recruitment.

### Lessons Learned and Recommendations

- In addition to increasing stocks of herbivorous fishes on the reefs to control invasive algae, management must also include reducing sources of land-based pollution that is resulting in high levels of nutrients (nitrogen and phosphorus) found in nearshore waters, which is likely driving the algal blooms.
- Poor habitat quality resulting from invasive algae and subsequent degradation of reefs will also have lower economic (commercial and recreational) and cultural value.
- Studies have shown that reef deterioration in the monitored sites occurred rapidly; therefore, resource managers must take steps to not only restore reefs back to their healthy conditions, but also prevent any further threats from degrading Maui's reefs.
- Public awareness about coral reef health and the negative impacts of land-based pollution on reef ecosystems has increased since the designation of the KHfMA. With the community's support, West Maui reefs have since been designated as a priority site under the Hawai'i Coral Reef Strategy, have been chosen for a Ridge to Reef cooperative watershed management

project by the state and the U.S. Army Corps of Engineers, and have been designated as a priority site in the Pacific by the U.S. Coral Reef Task Force.

- Reef recovery takes time – although three years of data indicates an increase in biomass of parrotfishes, slow-growing corals will need long-term protection to fully recover.
- Making a genuine effort to provide data and have a dialogue with the local community at the beginning of the planning process is essential to the success of the project. Community members will gain more trust, offer input, and be part of the problem solving process.
- Data that is specific, real time, and applicable is vital to having a supportive, knowledgeable community.
- Identifying and engaging key stakeholders and fishers from the area can provide a wealth of local knowledge, as well as buy-in and compliance later on.

### **Funding Summary**

The process to establish the KHFMA was funded and staffed by the State of Hawai'i's Department of Land and Natural Resources (DLNR) as part of the agency's mission and core responsibilities. Monitoring efforts have been funded primarily through a Sports Fish Restoration Program grant administered by the U.S. Fish and Wildlife Service. The islands of Maui and O'ahu receive roughly \$300,000/year (US) from the program, of which Maui spends about \$200,000 (US) for monitoring staff and other associated costs. Other funding partners include:

NOAA Coral Reef Ecosystem Division, Pacific Islands Fisheries Science Center  
NOAA Coral Reef Conservation Program  
University of Hawai'i  
Graduate students with funding

### **Lead Organization**

Hawai'i Division of Aquatic Resources, Department of Land and Natural Resources  
<http://state.hi.us/dlnr/dar/>

### **Partners**

Hawai'i Coral Reef Initiative Research Program  
<http://www.hcri.ssri.Hawaii.edu/>

NOAA Coral Reef Conservation Program  
<http://coralreef.noaa.gov/>

NOAA Pacific Islands Fisheries Science Center, Coral Reef Ecosystem Division  
<http://www.pifsc.noaa.gov/cred/>

The Nature Conservancy  
<http://www.tnc.org>

UH, Hawai'i Institute of Marine Biology  
<http://www.Hawaii.edu/himb/>

UH Manoa, Department of Botany  
<http://www.botany.Hawaii.edu/directory.htm>

**Resources**

Hawai'i Coral Reef Strategy: Priorities for Management in the Main Hawai'ian Islands 2010-2020, State of Hawai'i

Kahekili Herbivore Fishery Management Area – Interim Monitoring Results, National Oceanic and Atmospheric Administration, Pacific Islands Fisheries Science Center

Kahekili Herbivore Fisheries Management Area Rules

[http://state.hi.us/dlnr/dar/regulated\\_areas\\_mau.html#kahekili](http://state.hi.us/dlnr/dar/regulated_areas_mau.html#kahekili)

Regulated Fishing Areas in Maui County, Hawai'i Division of Aquatic Resources

[http://Hawaii.gov/dlnr/dar/regulated\\_areas\\_mau.html](http://Hawaii.gov/dlnr/dar/regulated_areas_mau.html)

Status and Trends of Maui's Coral Reefs, Hawai'i Division of Aquatic Resources