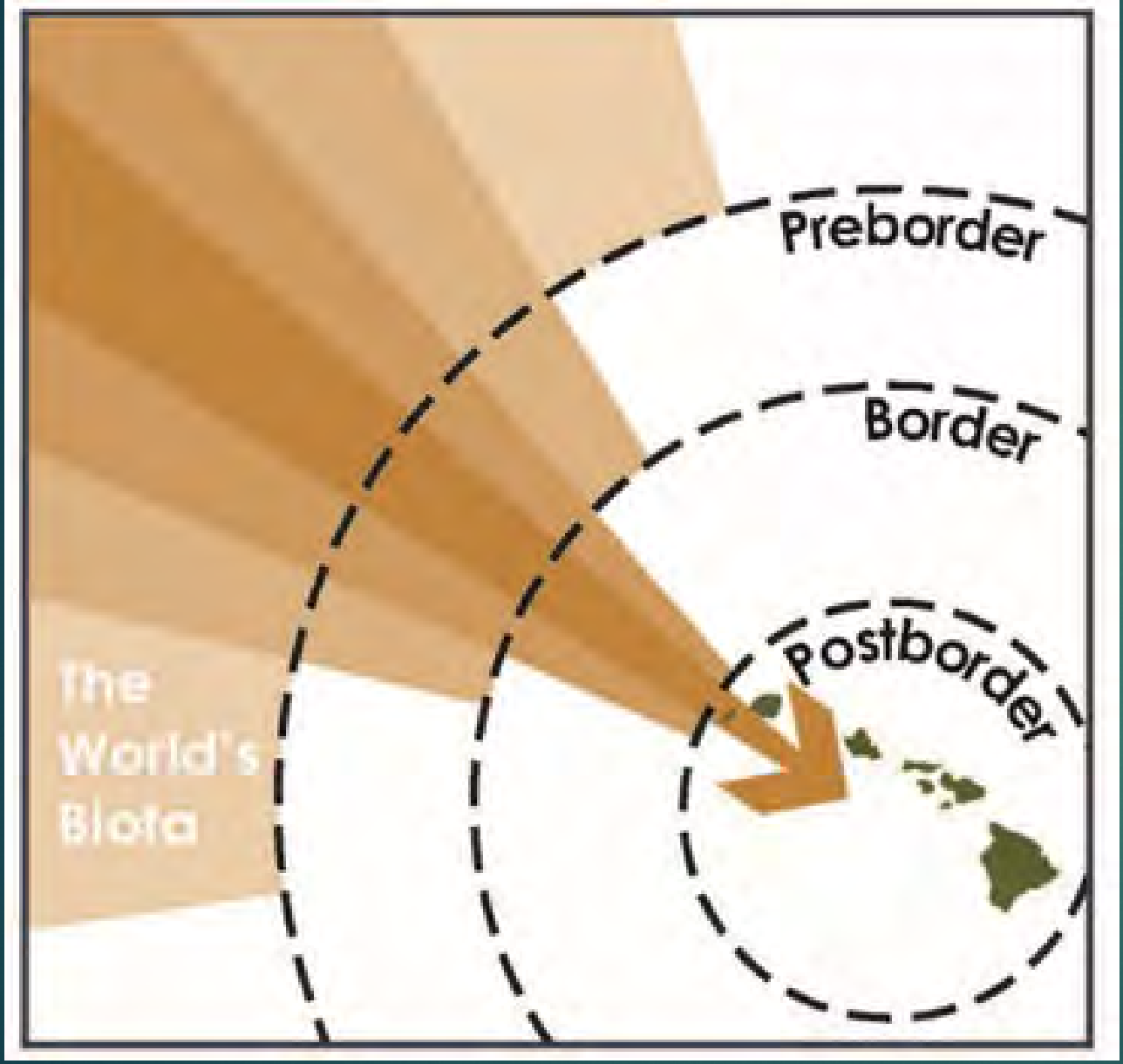
Invasive algae management in the State of Hawaii

KIMBERLY FULLER- DLNR:DAR

Hawaii Division of Aquatic Resources



2017 Interagency Biosecurity Plan

State of Hawaii AIS Management Pillars

- Pre-Border Protection (Prevention)
- Border Protection (Early Detection & Rapid Response)
- Post-Border Management (Monitoring & Control)
- Community Outreach and Support

Kāneʻohe Bay

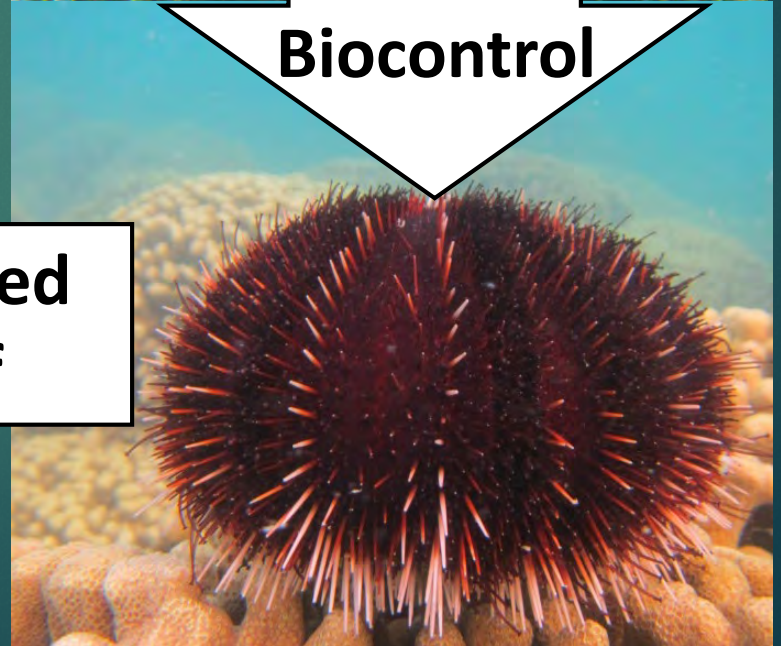
Kappaphycus/Euchuma spp.

- Common name: Smothering Seaweed
- Introduced as aquaculture candidates to Kaneohe Bay in 1974
- Over grows and smothers Hawaiian corals
- Only found in Kaneohe Bay

Invasive Algae Management

Mechanical Removal

Biocontrol

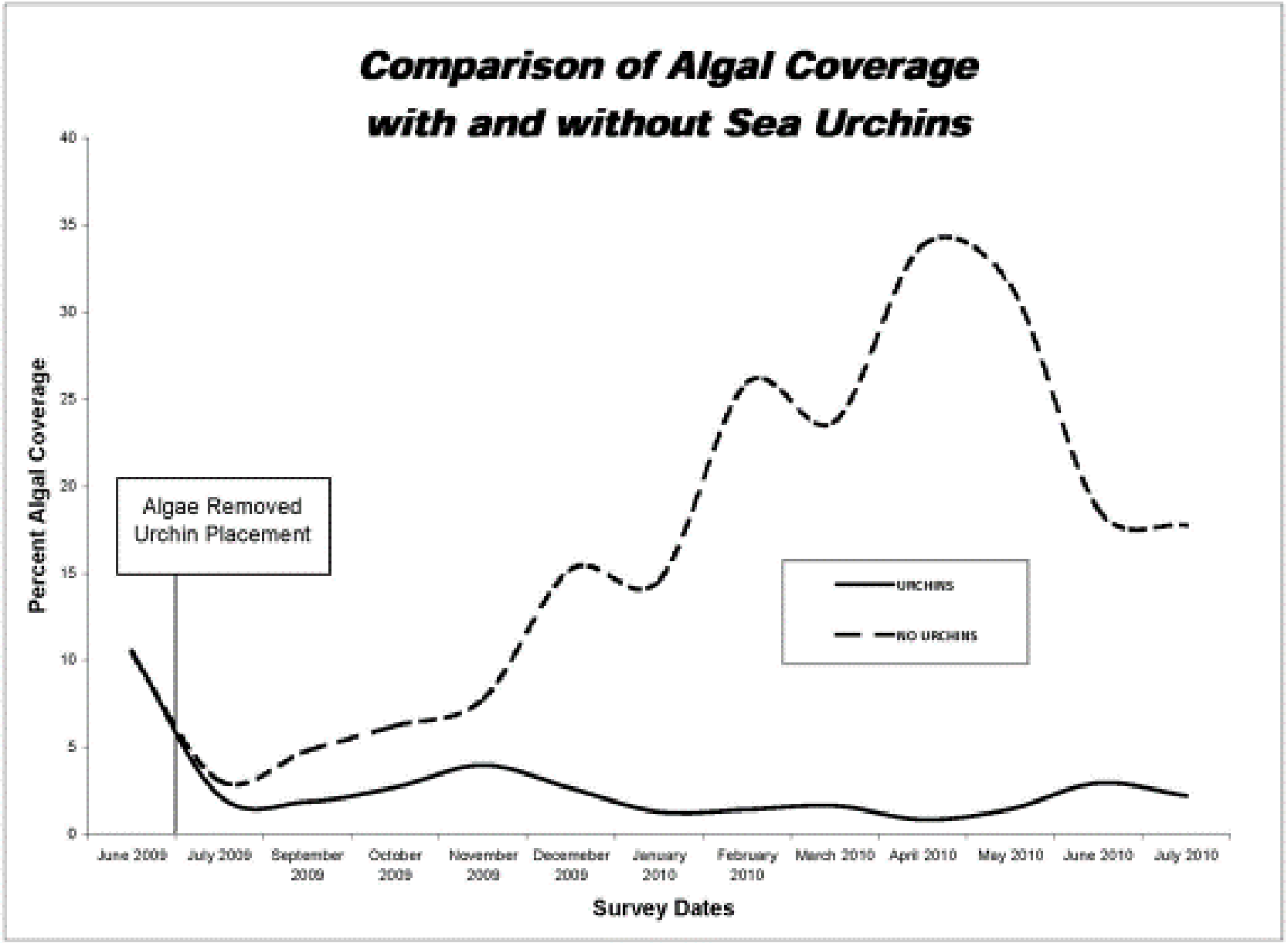


Restored Reef

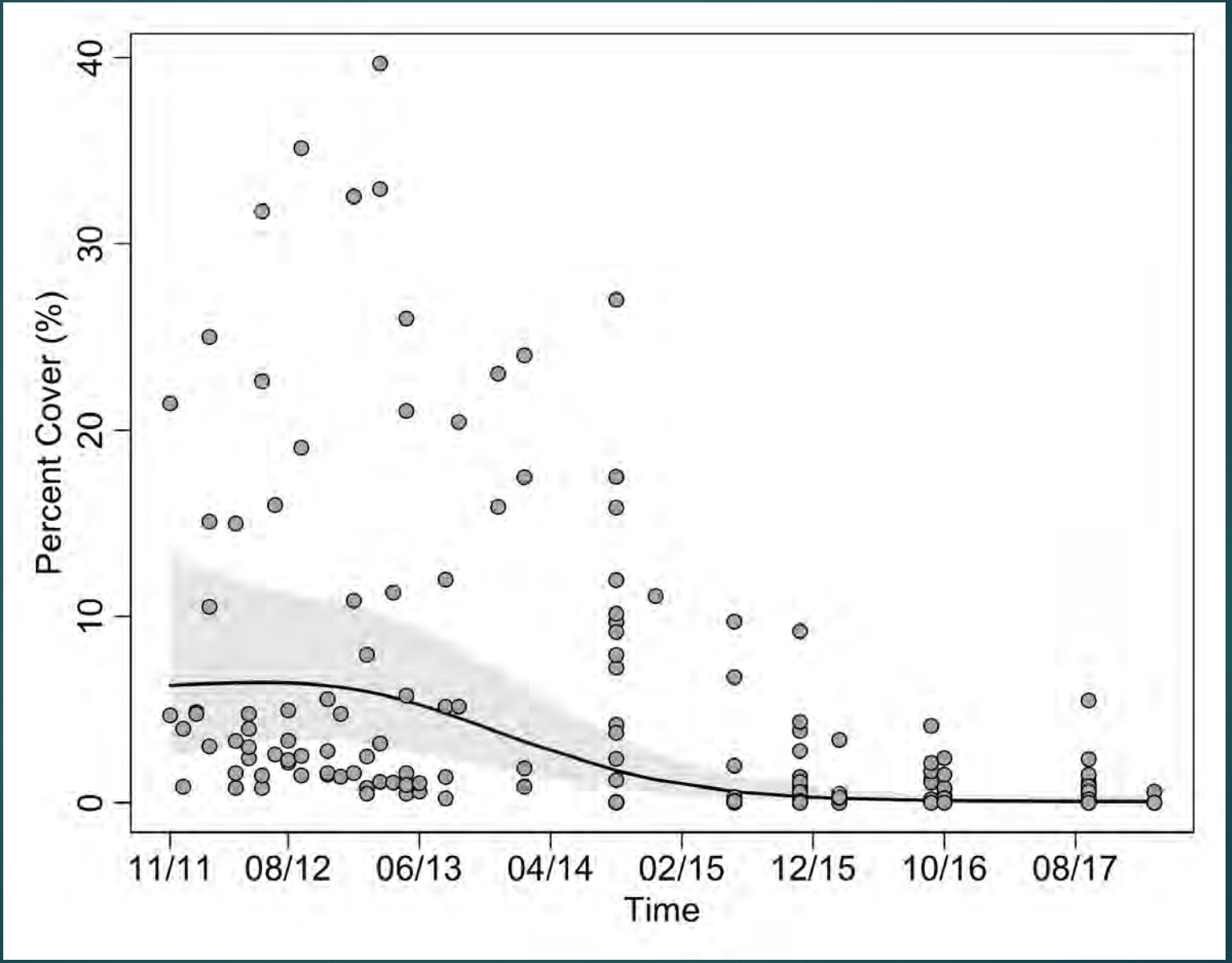
Me

Why *Tripneustes gratilla*?

- ✓ Native species
- ✓ Consumes invasive algae
- ✓ Low market value
- ✓ Easy to handle
- ✓ Will not harm coral
- ✓ Low vagility
- ✓ Can be cultured

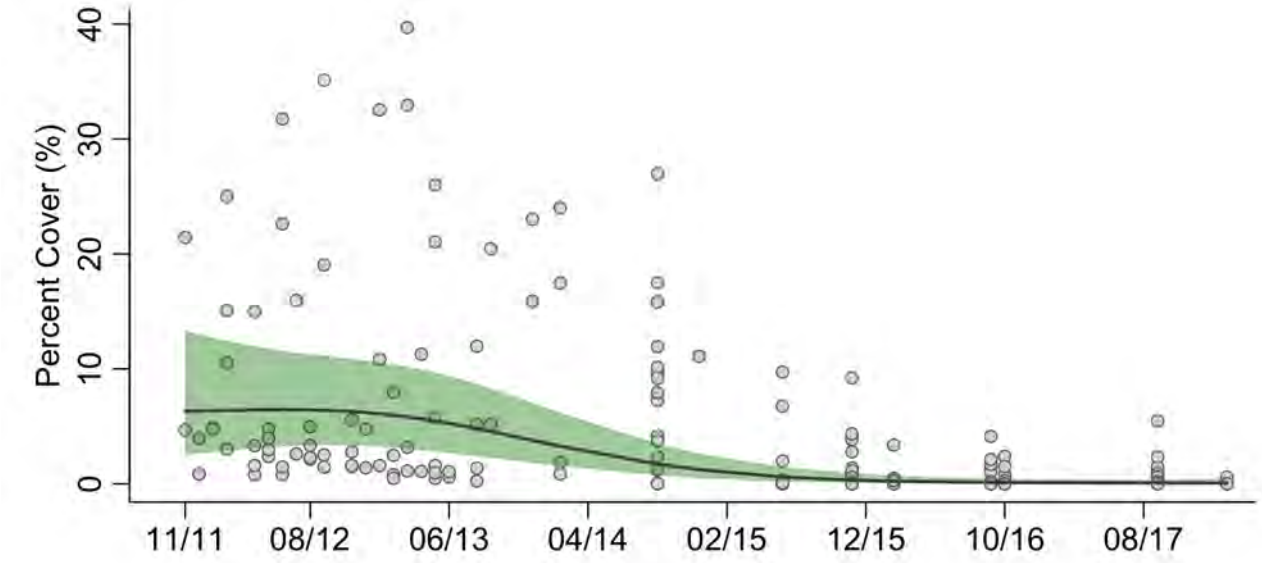

Comparison of Algal Coverage
with and without Sea Urchins
Percent Algal Coverage
40
35
30
25
20
15
10
5
0
Algae Removed
Urchin Placement
URCHINS
NO URCHINS
June 2009
July 2009
September 2009
October 2009
November 2009
Decemeber 2009
January 2010
February 2010
March 2010
April 2010
May 2010
June 2010
July 2010
Survey Dates

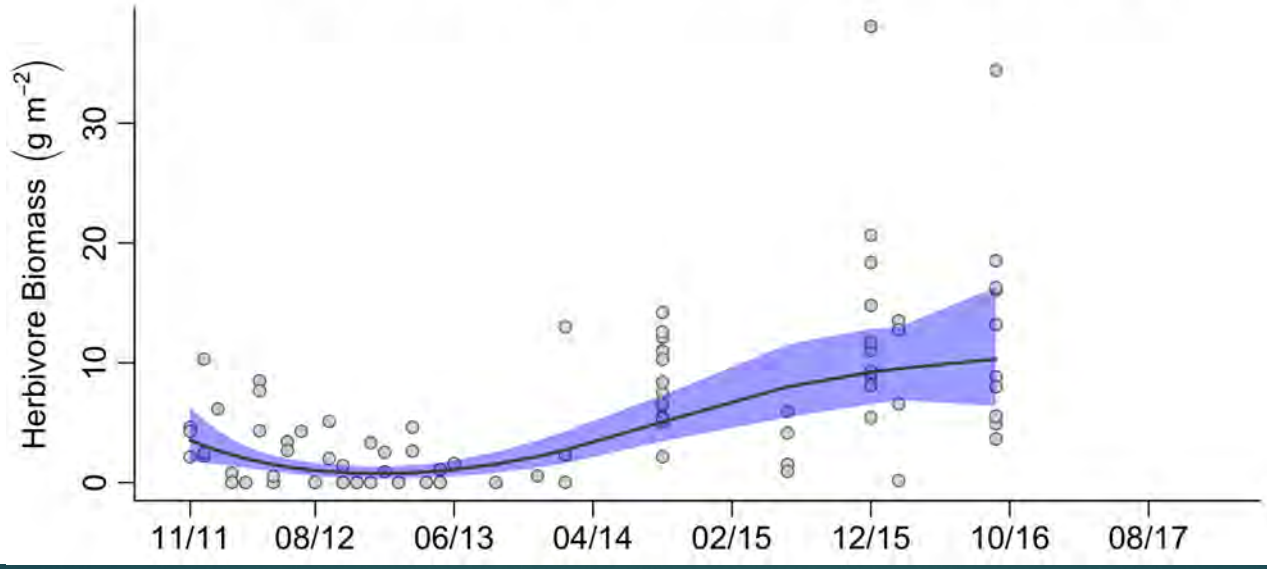
Temporal Patterns



Neilson et al. 2018

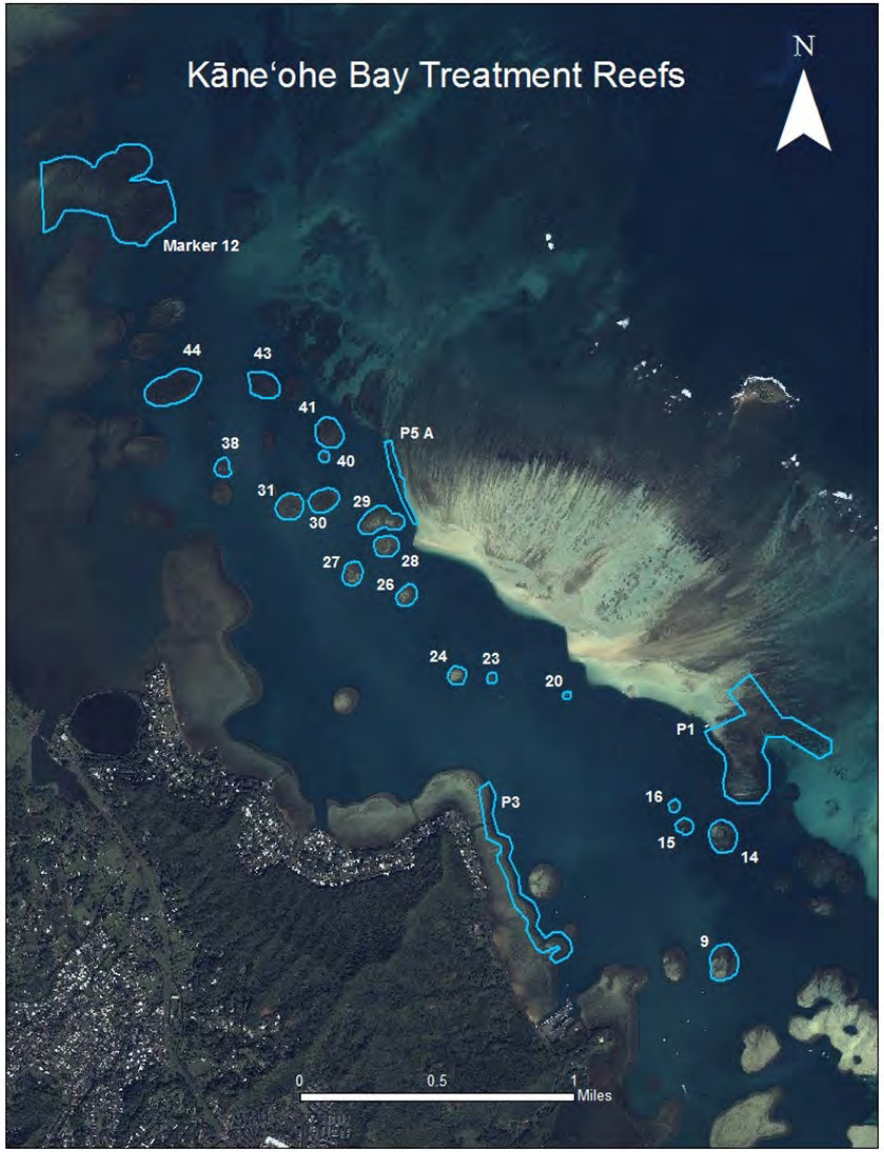
Herbivory





Neilson et al. 2018

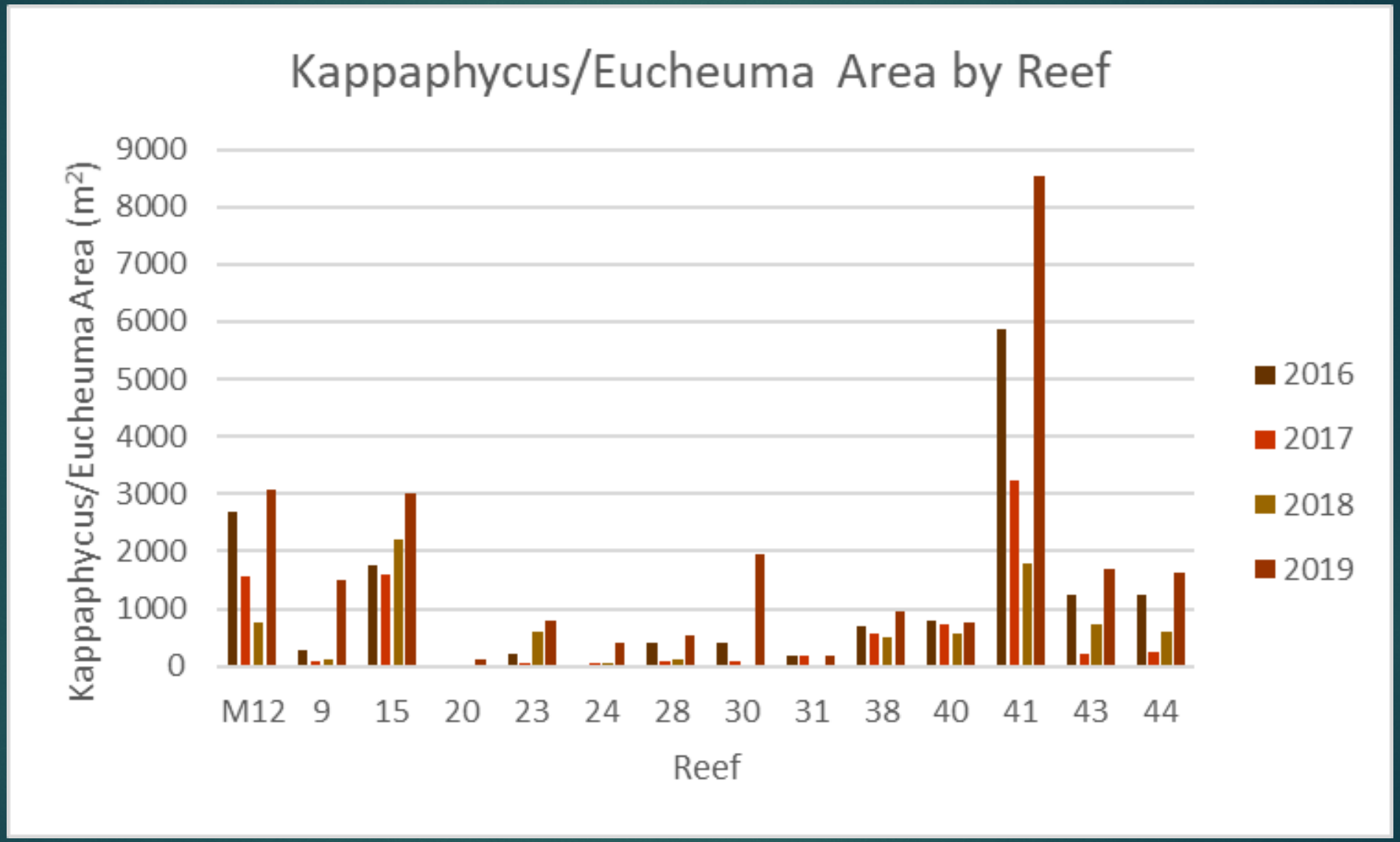
Restoration Progress in Kāne‘ohe Bay



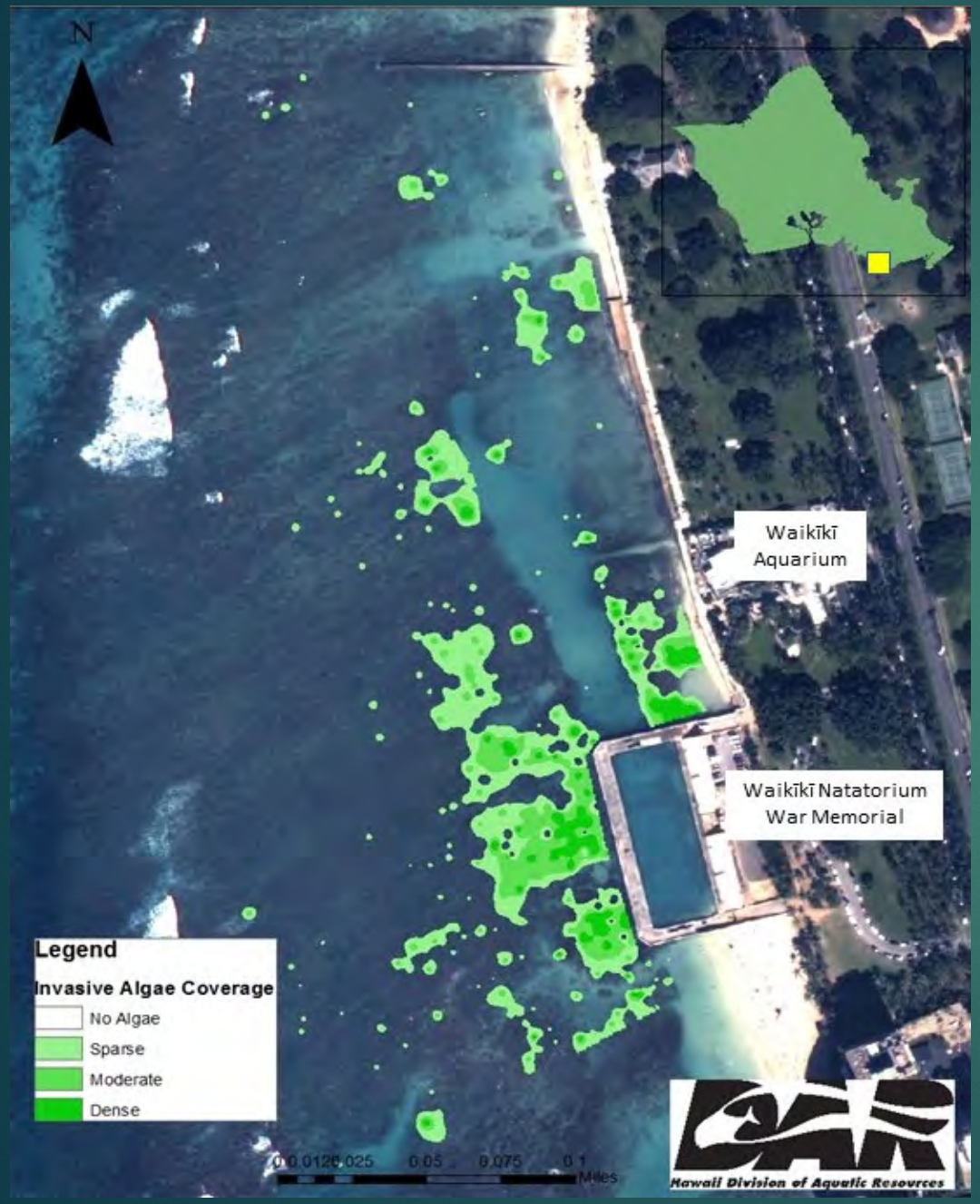
TOTAL Urchins Outplanted: 527,979
Area Treated: 951,132 m^2 (~235 acres)

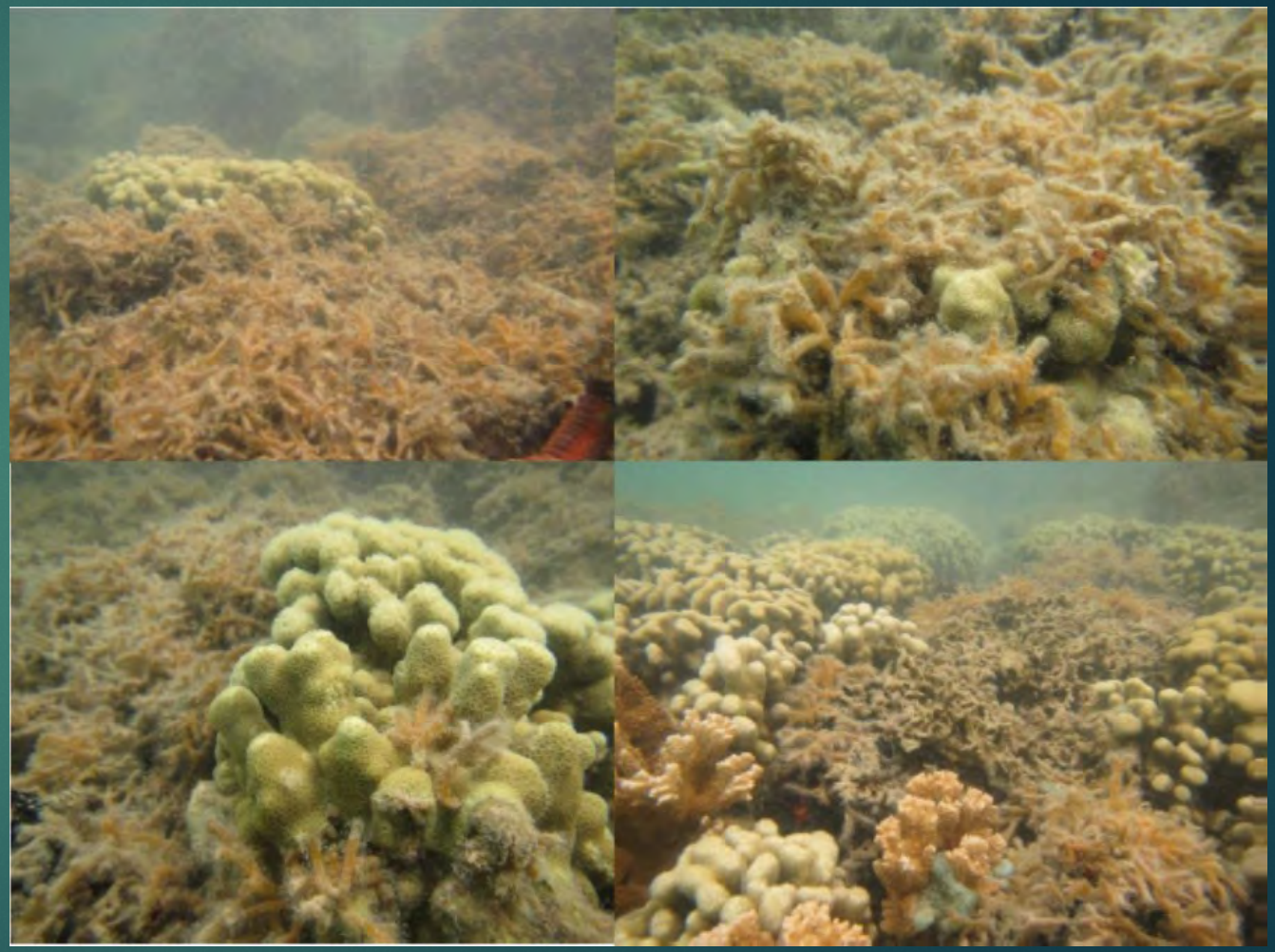
Marker 12 : 65,640
Reef 44 : 11,033
Reef 43 : 6,100
Reef 41 : 30,300
Reef 40 : 3,980
Reef 38 : 3,400
Reef 31 : 650
Reef 30 : 5,100
Reef 29: 133,186
Reef 28 : 4,774
Reef 27: 56,535
Reef 26: 55,027

Reef 24 : 4,400
Reef 23: 4,000
Reef 20 : 3,407
Reef 19: 7,685
Reef 16 : 4,195
Reef 15: 13,629
Reef 14: 30,154
Reef 10: 40,084
Reef 9: 2,350
P5: 14,750
P3: 600
P1: 27,000


Kappaphycus/Eucheuma Area by Reef
Kappaphycus/Eucheuma Area (m²)
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
M12
9
15
20
23
24
28
30
31
38
40
41
43
44
Reef
2016
2017
2018
2019

Waikiki


N
Waikīkī
Aquarium
Waikīkī Natatorium
War Memorial
Legend
Invasive Algae Coverage
No Algae
Sparse
Moderate
Dense
0 0.0125 0.025 0.05 0.075 0.1
Miles
DAR
Hawaii Division of Aquatic Resources



Sea Urchin Initiative

In June 2018, DLNR-DAR and MM launched the project to determine the efficacy of the native collector urchin as a bio-control mechanism to curb the growth of IAA at our Pāiko Restoration Area. After nearly six months of monitoring urchin health and IAA biomass, we are pleased to announce that urchins survived the relocation from deeper water to the nearshore reef flat and they appear to be eating all algae in the Bay, including mudweed. We quickly learned that urchins are very mobile! Each week, a team of interns monitor urchin health, IAA biomass, and herd the urchins back to the center of the designated plots.

mālama maunalua

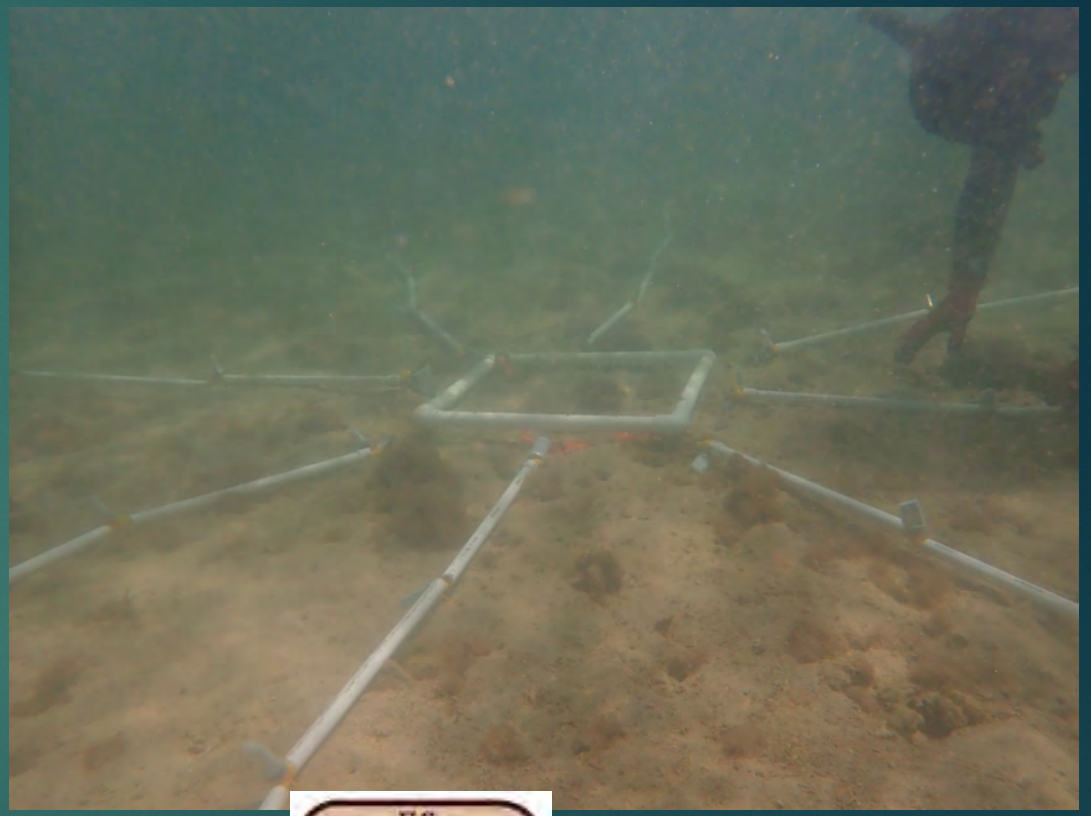
Mālama Maunalua Algae Vacuum

mālama maunalua

Hawaii Division of Aquatic Resources

Manualua Bay Hot Water Control

- 1m x1m Plots- 10 minutes to treat
- Started with 80% cover, 8 days after treatment had 20% cover



USGS science for a changing world

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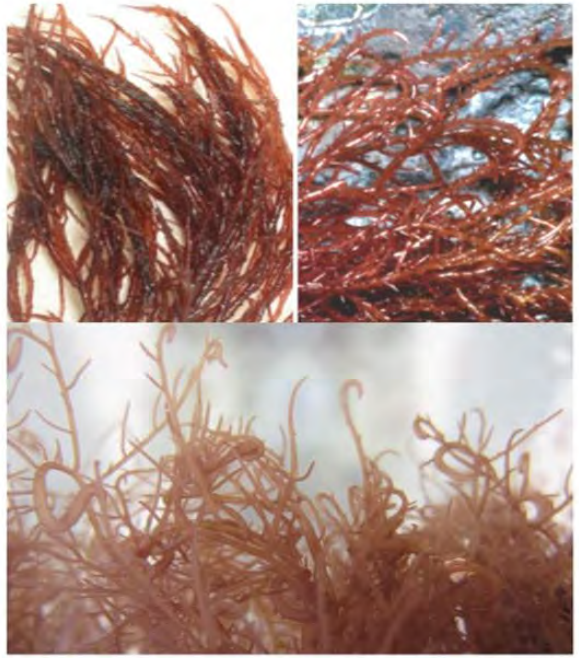
South Shore Molokaʻi Project

Gorilla Ogo
Gracilaria salicornia

Prickly Seaweed
Acanthophora spicifera

Hookweed
Hypnea musciformis



Department of Land and Natural Resources
State of Hawaii

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KUA'ĀINA ULU 'AUAMO

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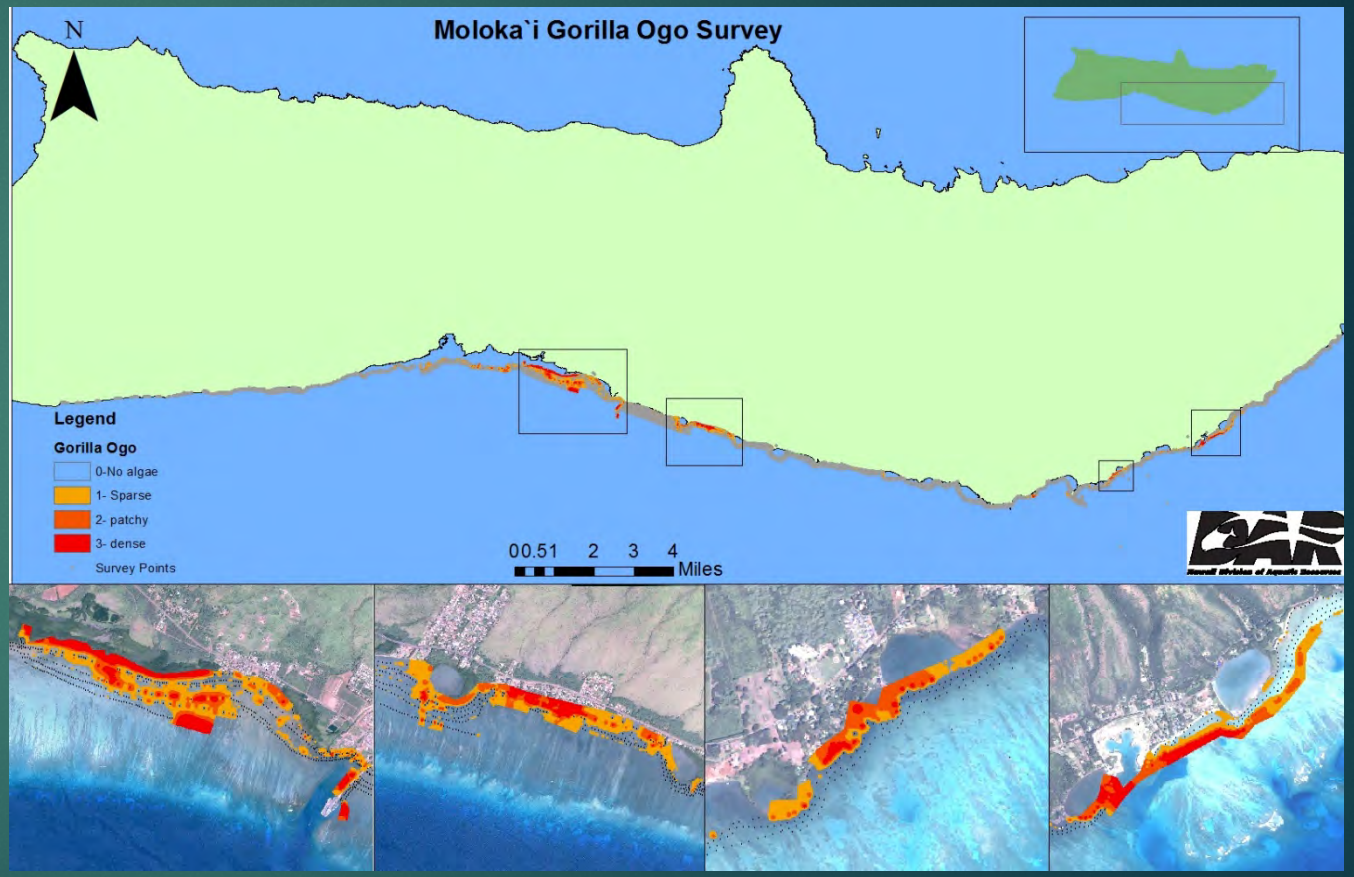
What was accomplished

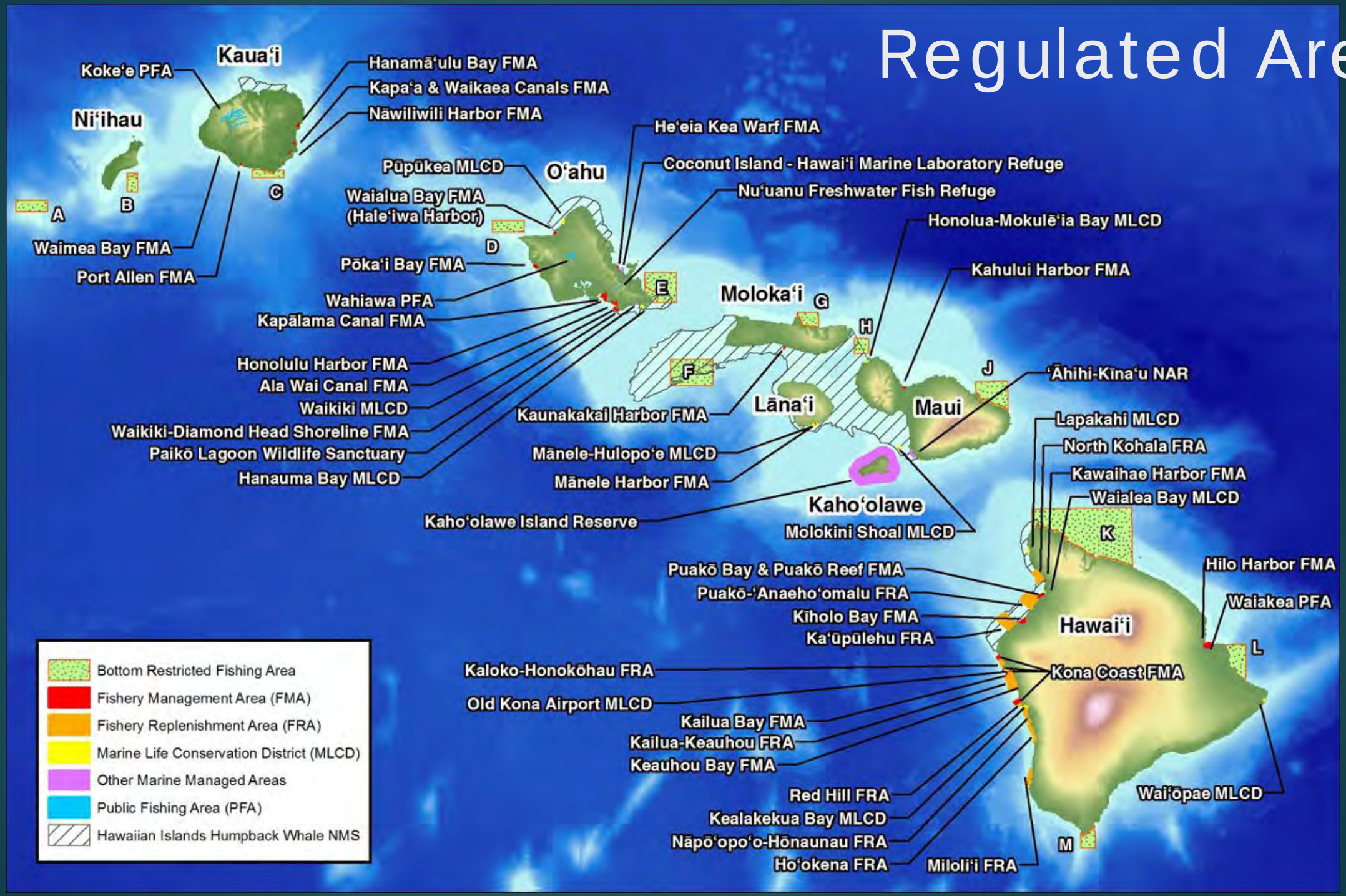
- Over 40 community members participated
- 33 miles of coastline surveyed
- 2,800 acres of reef flat characterized with invasive algae abundance
- Outreach events for school groups and Molokaʻi Earth Day
- Kamehameha School Group in 2018



Continuing efforts

- Management plan
  - Strategic hand removal of invasive algae
  - Continued community work days
  - Potential bio control with native urchins
  - Grant applications for full time project funds

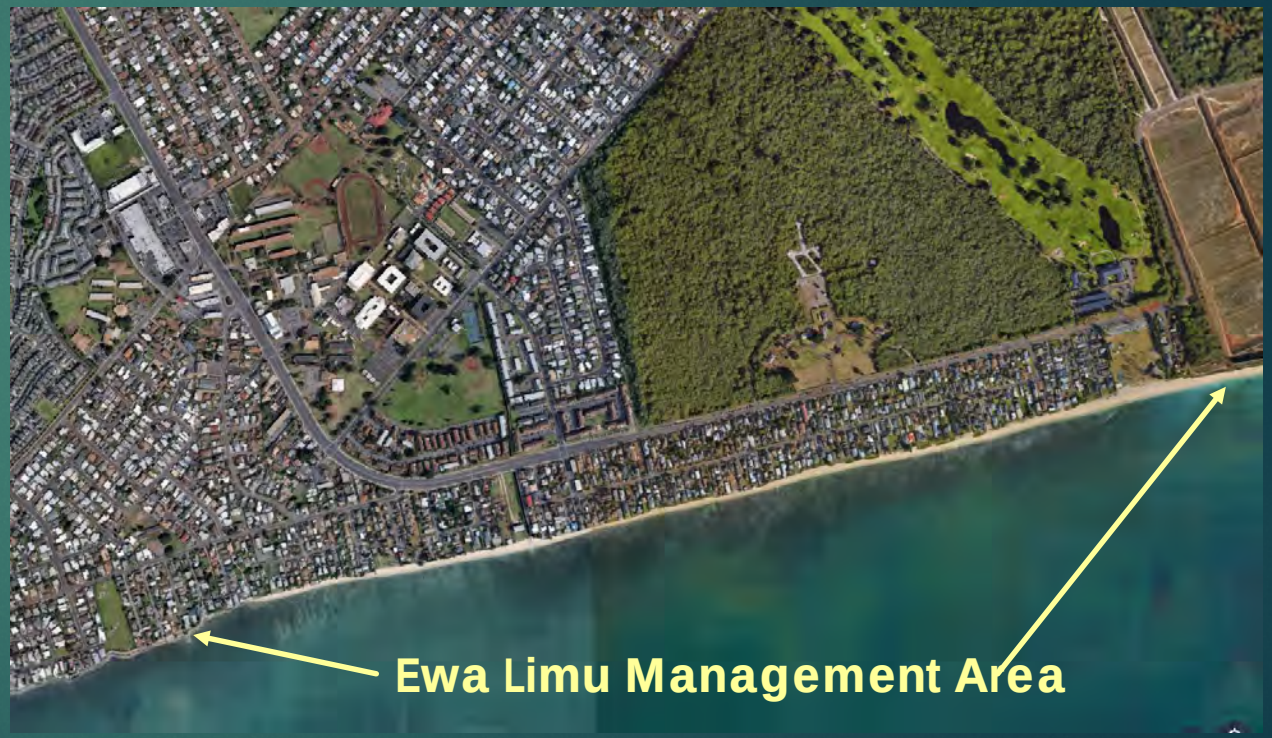
Regulated Areas



Kahekili Herbivore Fisheries Management Area (KHFMA)

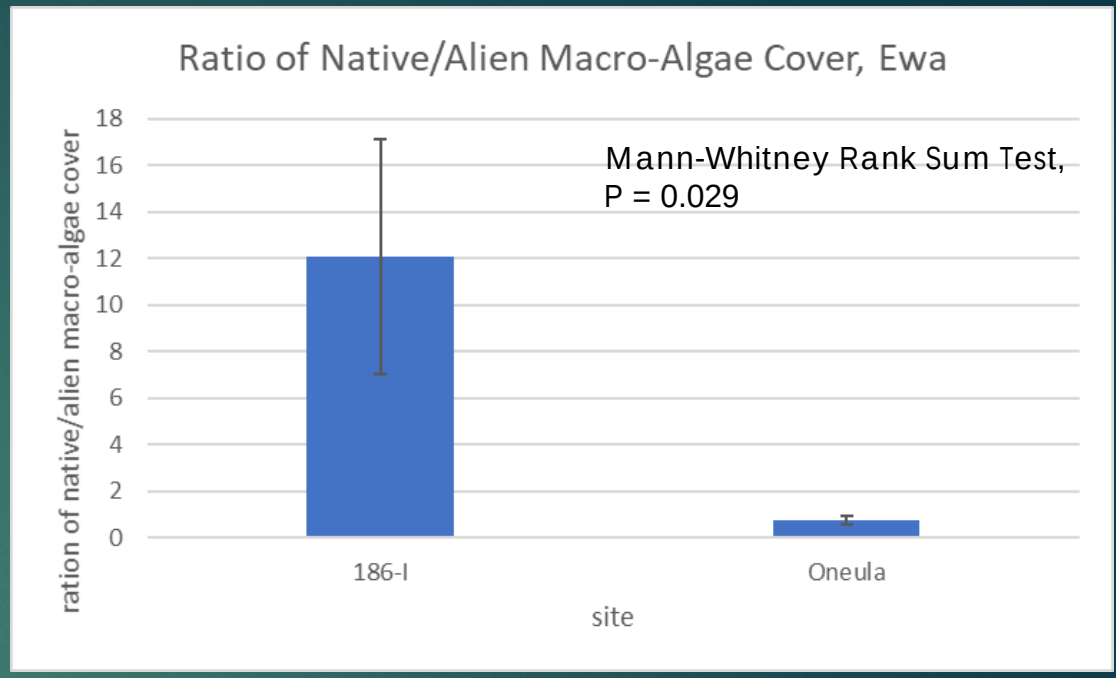
ESTABLISHED IN 2009 TO CONTROL OVERABUNDANCE OF MARINE ALGAE IN CORAL REEF HABITAT (ACANTHOPHORA)

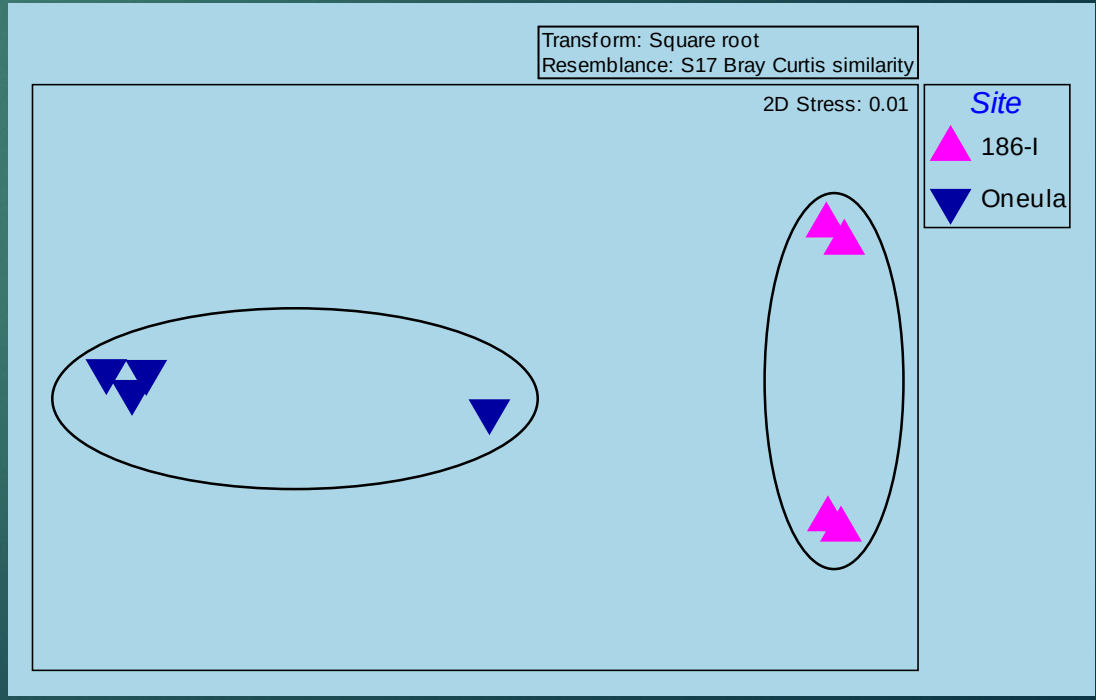
Ewa Limu Management Area



Ewa Limu Management Area

- Two sites
- Four 10m transect
- Culturally significant species present
- Ecological analysis
- Site - 186-I
  - Inside
  - *Padina* 40%
  - Alien cover 11% (*Avrainvillea*)
- Site – Oneula
  - Outside
  - *Centroceras* 53%
  - Alien cover 16% (*Acanthophora*)





R Okano 2019


HAWAII PACIFIC UNIVERSITY
HOLOMUA ME KA OIAIO


HAWAI'I INSTITUTE OF MARINE BIOLOGY
MOKU O LO'E KĀNE'OHE, O'AHU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'A'ohe Limu'ē
No Alien Algae


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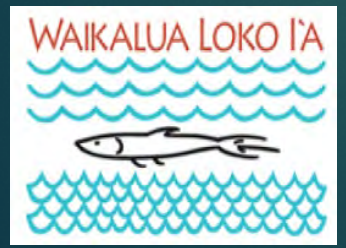
EYES OF THE REEF


WAIKALUA LOKO I'A


Paepae o He'eia
He'eia Fishpond, He'eia O'ahu


mālama maunalua

Community members play a critical role in the fight against invasive species

Summary of Management Options

- Prevention
- Early Detection and Rapid Response
- Monitoring
- Control
  - Physical Removal: by hand, “super sucker”
  - Herbivore Control:
    - Outplanting Urchins
    - Marine Regulated Areas
    - Turtles?
  - Heat? Other Novel Techniques?
  - Addressing Drivers via Regulation