

# NOAA/NOS Integrative Mapping, Monitoring & Assessment of U.S. Coral Reef Ecosystems:

A Partnership Effort Led by the National Centers for Coastal Ocean Science

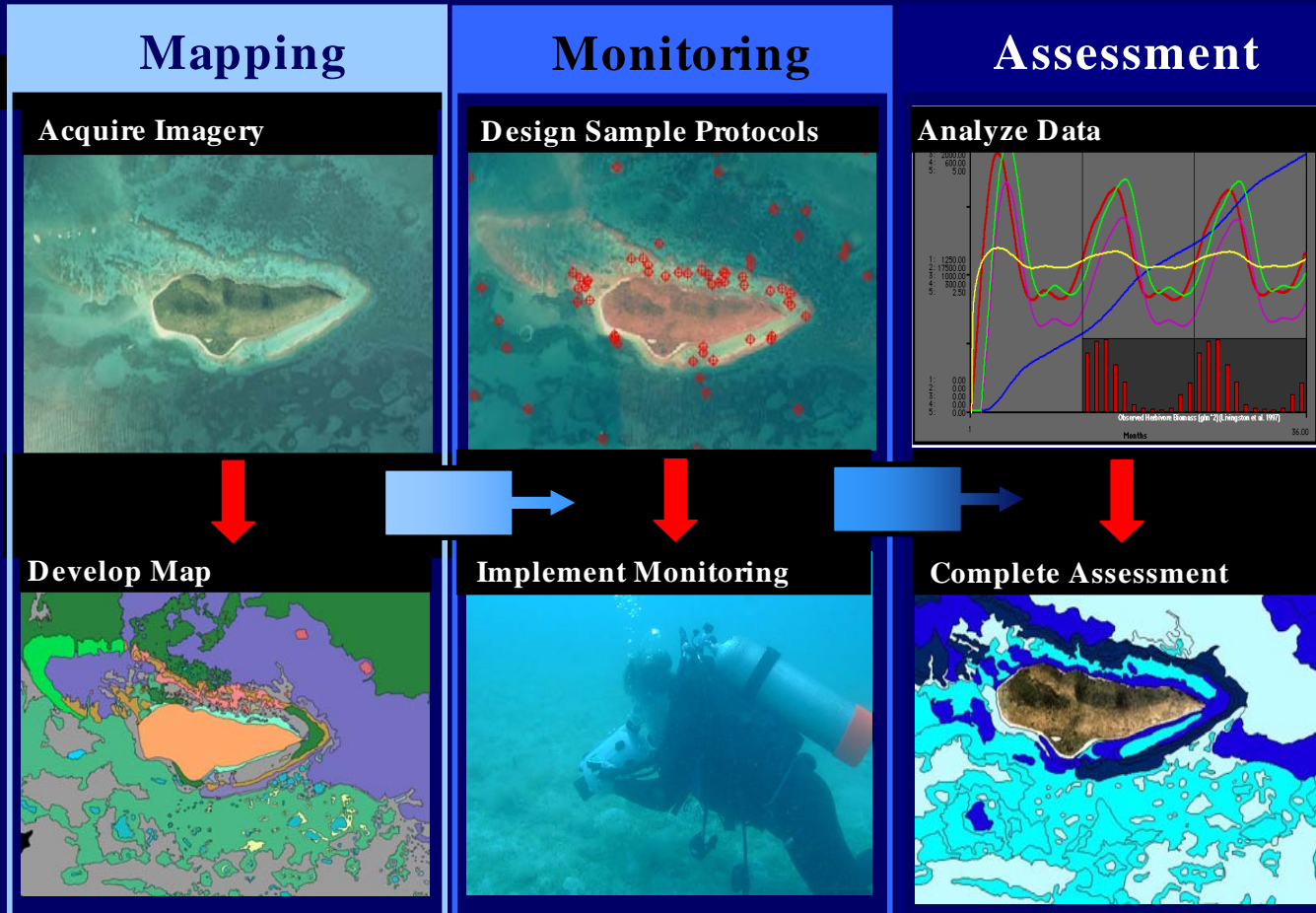


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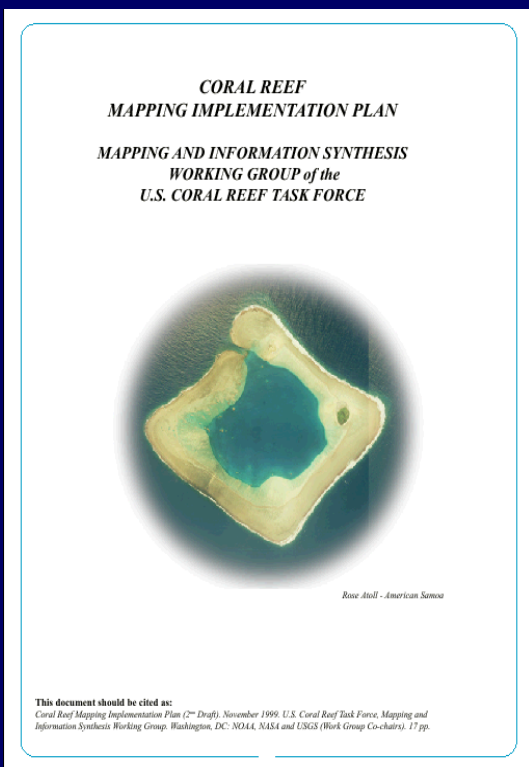
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# Integrated Mapping, Monitoring and Assessment

## National Coral Reef Ecosystem Assessment Process



# Coral Reef Mapping Implementation Plan for the U.S.

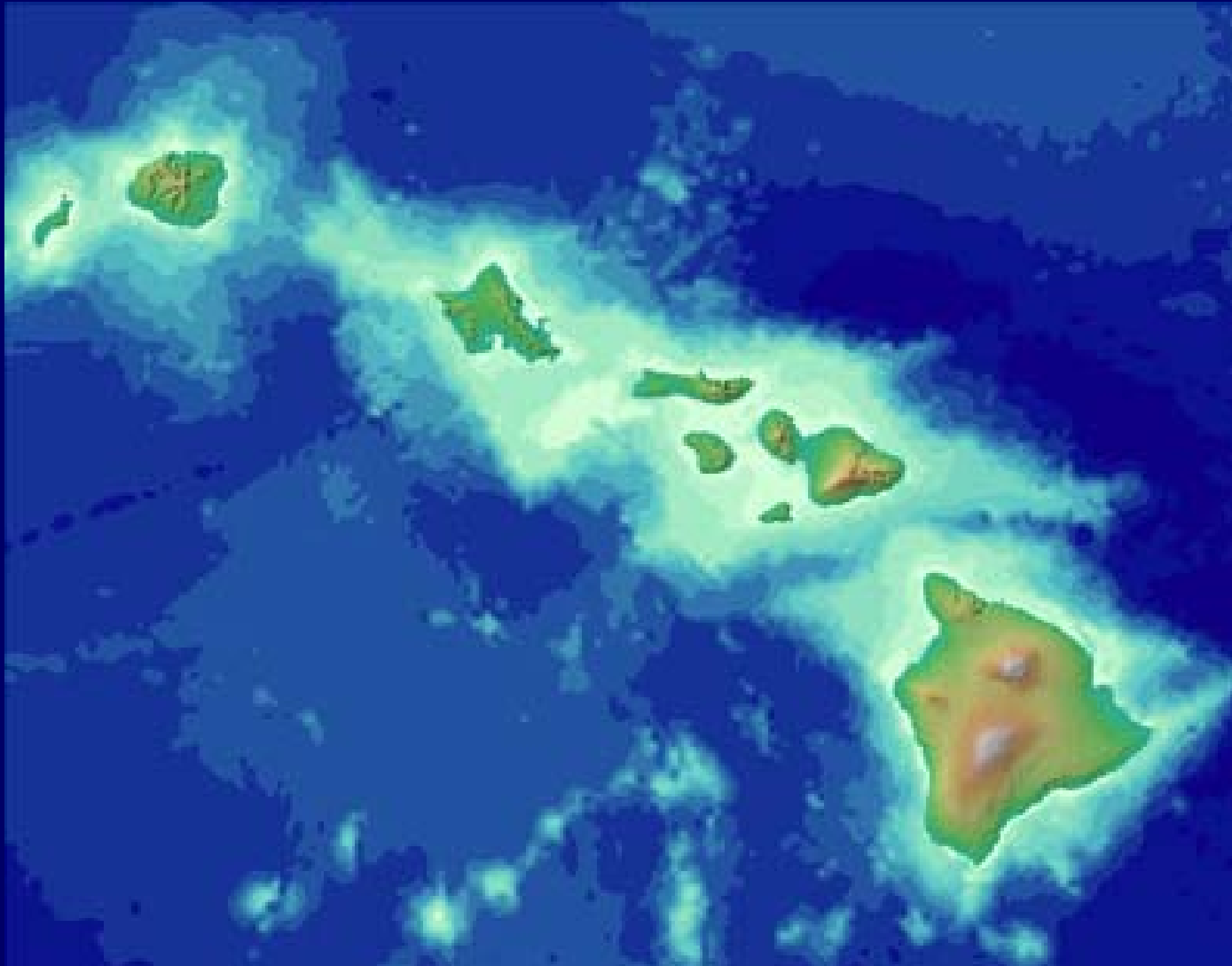


- Digital high resolution maps of coral reef ecosystem habitats
- Delineate benthic habitats using hierarchical classification system
- Map all U.S. States, Territories, Commonwealths & the FAS by 2007
- Integrate maps with research & monitoring activities for use by researchers and managers





# NOS/HI DLNR Mapping of Benthic Habitats in the Main Eight Hawaiian Islands



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# Comparison of Remote Sensing Technologies

IKONOS – true-color; 4 m pixel



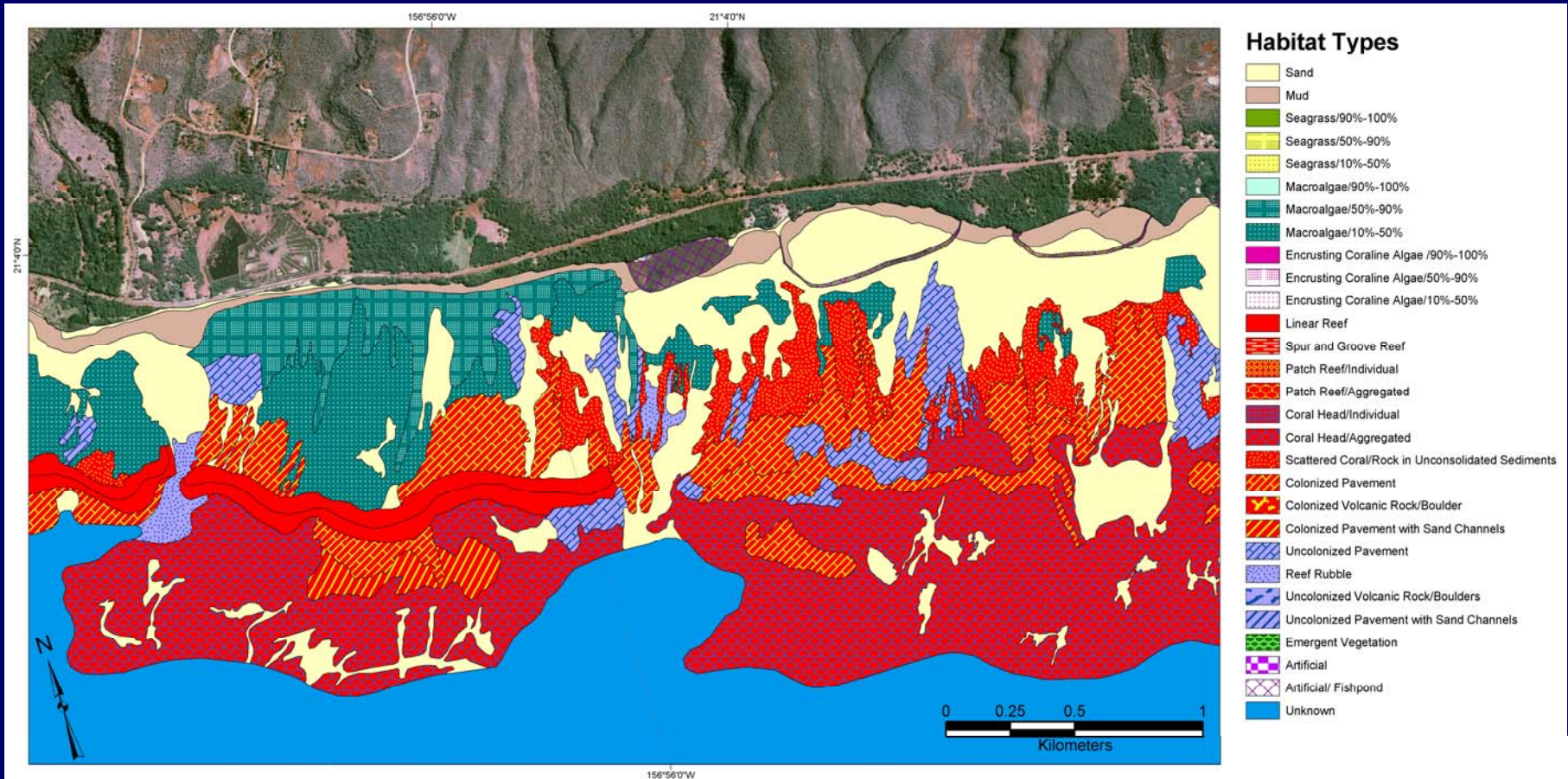
AERIAL PHOTOGRAPHY – true-color; 1.2 m pixel



HYPERSENSPECTRAL – 72 bands between 350 and 1000 nm; 3 m pixel



# Mapping Coral Reef Ecosystems



An example habitat map for a portion of the south shore of Molokai.

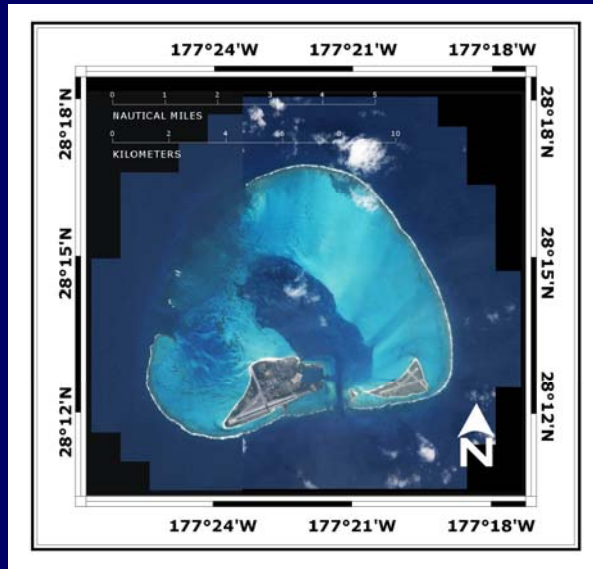


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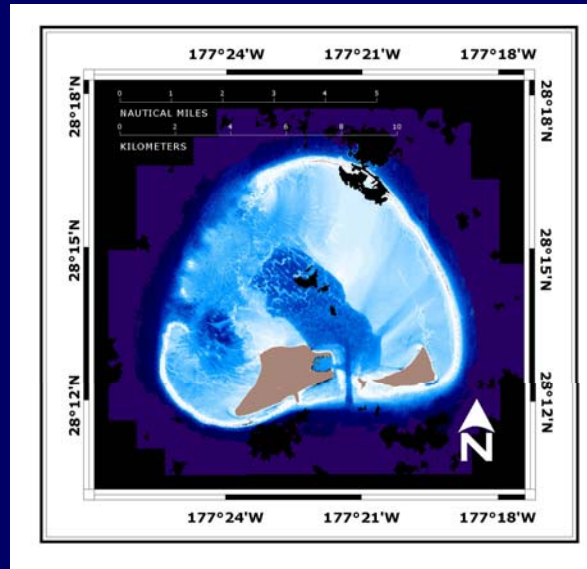
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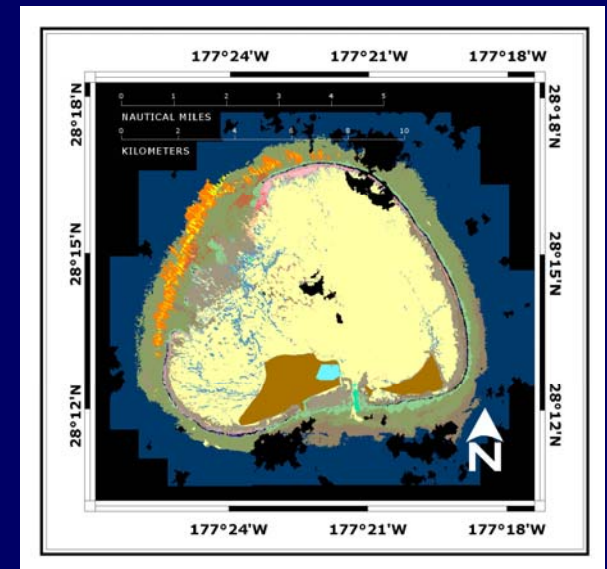
# Developing Mapping Capabilities



IKONOS Imagery of  
Midway Atoll



Derived bathymetry  
layer used to estimate  
light attenuation in the  
water column.



Draft habitat map  
based on 'normalized'  
bottom feature  
reflectance.





# NOS/ NMFS/ Islands U.S. Pacific Coral Reef Ecosystem Mapping



Rota, CNMI

Imagery copyright Space Imaging; processed by NOS



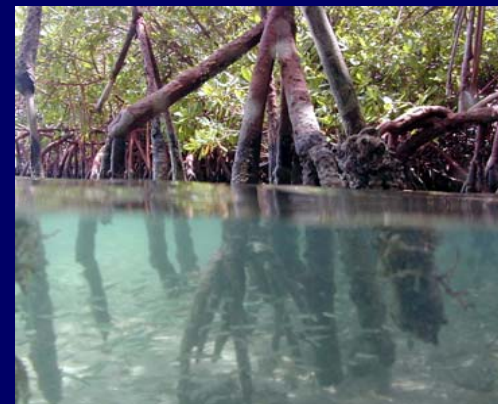
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# Mapping Coral Reef Ecosystems

## Example Uses of NOAA/Partners' Benthic Habitat Maps in the Caribbean, Florida, and Pacific:

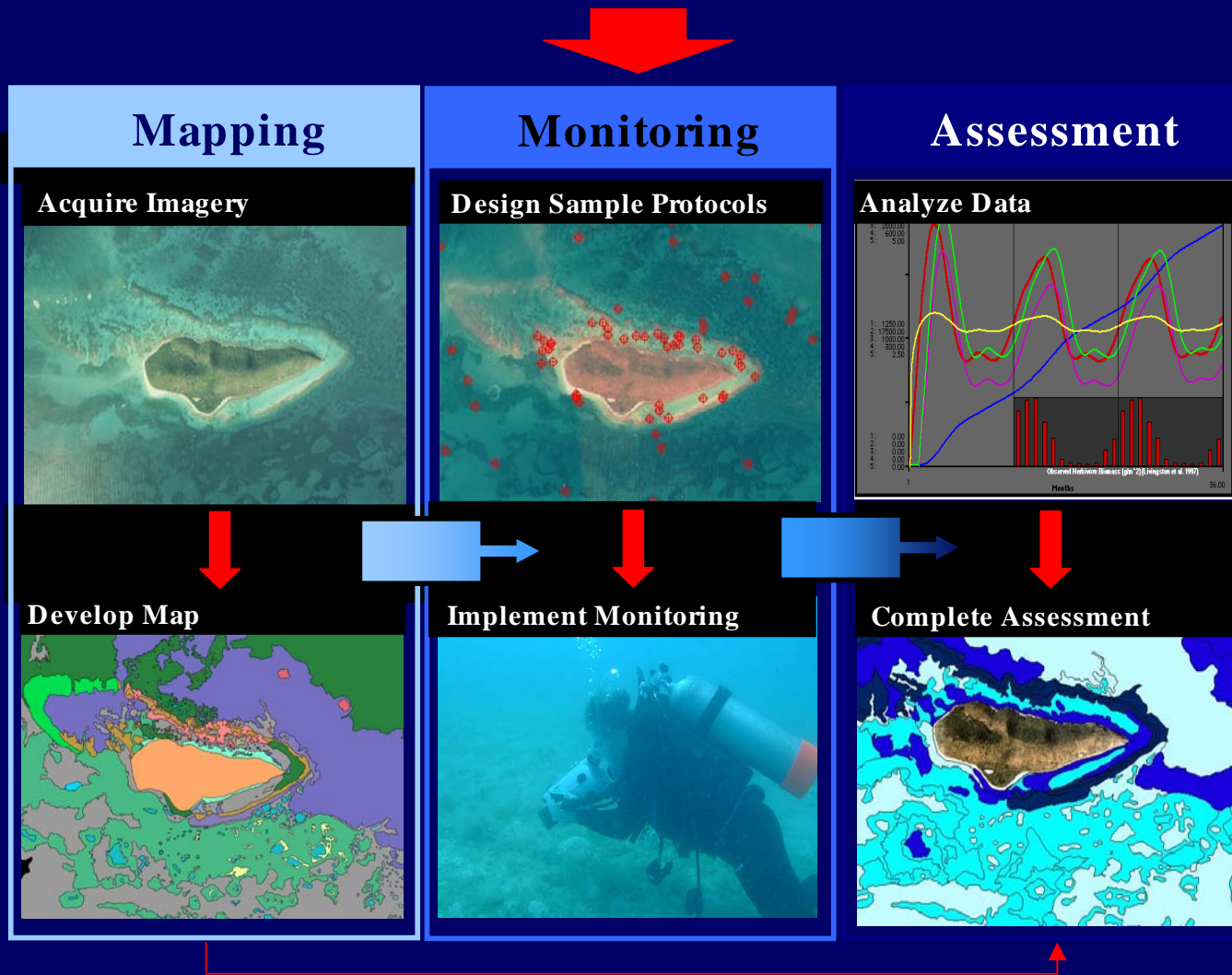
- 1) MPA delineation and assessments (HIDLNR/OI; PRDNER; NPS/USVI;CZM; HI Marine Gap)
  - evaluation of MPAs and ID gaps in protection
  - site selection, boundary delineation
- 2) Research applications (Univ Miami/NMFS; Univ USVI/USVI CZM; NOS/OI; Univ FL/USGS, NPS)
  - implement stratified random sampling; where to sample and level of effort
  - statistical power and sensitivity to detect change
  - seascape ecology of reef fish
- 3) Support fisheries management (FL Mar Res Inst; Car Fish Mgt Council; NMFS, Grays Reef NMS)
  - delineation of essential fish habitats
  - species habitat suitability modeling
- 4) Support management of coral reef ecosystems ( NMSP; NMFS; NPS;)
  - management by depth intervals and important habitats
  - delineation of anchoring zones to minimize impacts on habitats
- 5) Baseline accounting of extent of coral reef ecosystems and transition to finer scale map resolution and increased complexity of habitat classification (STI/UH; NPS/Buck Island;TNC, HI Marine Gap)
  - monitor changes, in extent and characteristics of habitats
  - mapping very fine scale habitats – coral heads
- 6) Support natural disaster planning and assessment activities (NPS/USVI; FEMA)
  - assessment of impacts of hurricanes and typhoons
  - ID storm surge sensitive areas
- 7) Delineation of pilot areas for aqua-culture (PRDNER/Private Sector) and education (Univ)
  - mutton snapper at-sea pen placement
  - classroom tool and education of public





# Integrating Mapping, Monitoring and Assessment

## National Coral Reef Ecosystem Assessment Process





# National Coral Reef Ecosystem Monitoring Program

- **Build a national database & information system for incorporating disparate data sets.**
- **Provide grants where needed to fill data gaps and sustain monitoring efforts.**
- **Integrate monitoring and habitat mapping to provide spatial framework for assessments.**



# National Coral Reef Ecosystem Monitoring Program

Cooperative Monitoring Studies—  
Meeting Local Management Needs & National Program Requirements

## Objectives:

- 1) Provide leadership in the development and implementation of a **national monitoring program** for US coral reef ecosystems.
- 2) Develop a “semi-coordinated” **national network of monitoring sites**,
- 3) Facilitate **sharing of monitoring information** among partners, and
- 4) **Fill gaps** in local monitoring coverage.

A coordinated coral reef ecosystem monitoring program provides a national assessment capability to track the status and trends of coral reef health, community structure, and condition of US coral reef ecosystems.



# 2004 National Coral Reef Ecosystem Monitoring Program

## Current Program Partners

**Puerto Rico**

**US Virgin Islands**

**Florida**

**Hawaii**

**Guam**

**American Samoa**

**Commonwealth of the Northern Mariana Islands**

**Freely-Associated States**

- Palau
- Kosrae (Federated States of Micronesia)

**NOAA Complementary Monitoring and Assessment Studies**



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# National Coral Reef Ecosystem Monitoring Program

## Monitoring Themes and Sample Metrics

### Benthic Parameters



- Cover (live, dead, etc.)
- Abundance
- Condition
- Size class distribution
- Indicator species
- Diversity\*

### Water Quality Parameters



- Nutrients
- Suspended solids
- Chlorophyll
- Turbidity
- Temperature
- PAR

### Fishery Parameters



- Abundance & distribution
- Size class distribution
- Indicator species
- Diversity\*
- Richness
- Evenness



# Using Maps to Support Field Activities

## Random stratified design

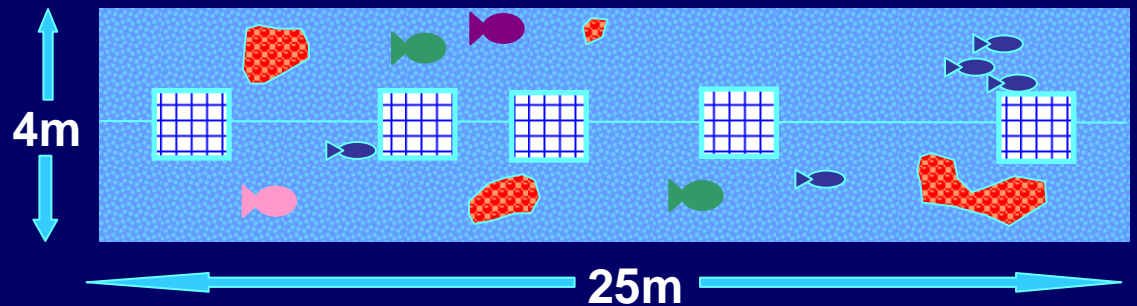
- inside vs. outside MPAs
- hard vs. soft bottom

## Fish Censuses

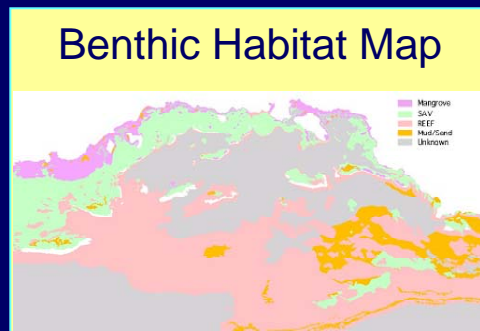
- 25m\*4m transects
- point counts

## Corresponding habitat metrics

- biotic cover
- abiotic cover

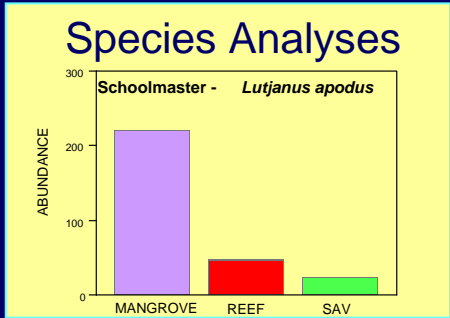


# Coupling of Maps & Species Habitat Utilization Patterns

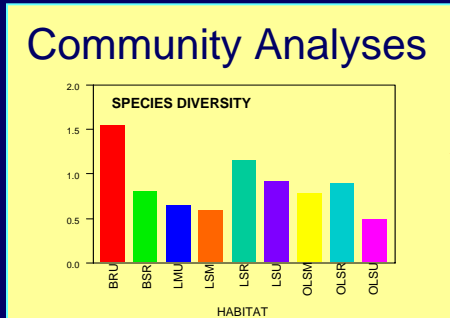
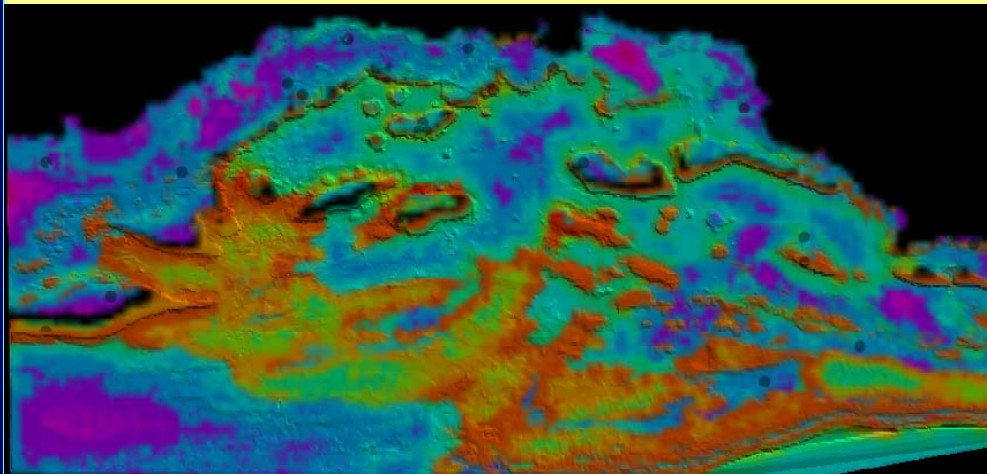


Random Stratified Sampling

Organism Census by Habitat Type



**Biological Relevant Boundaries for MPA's and EFH**





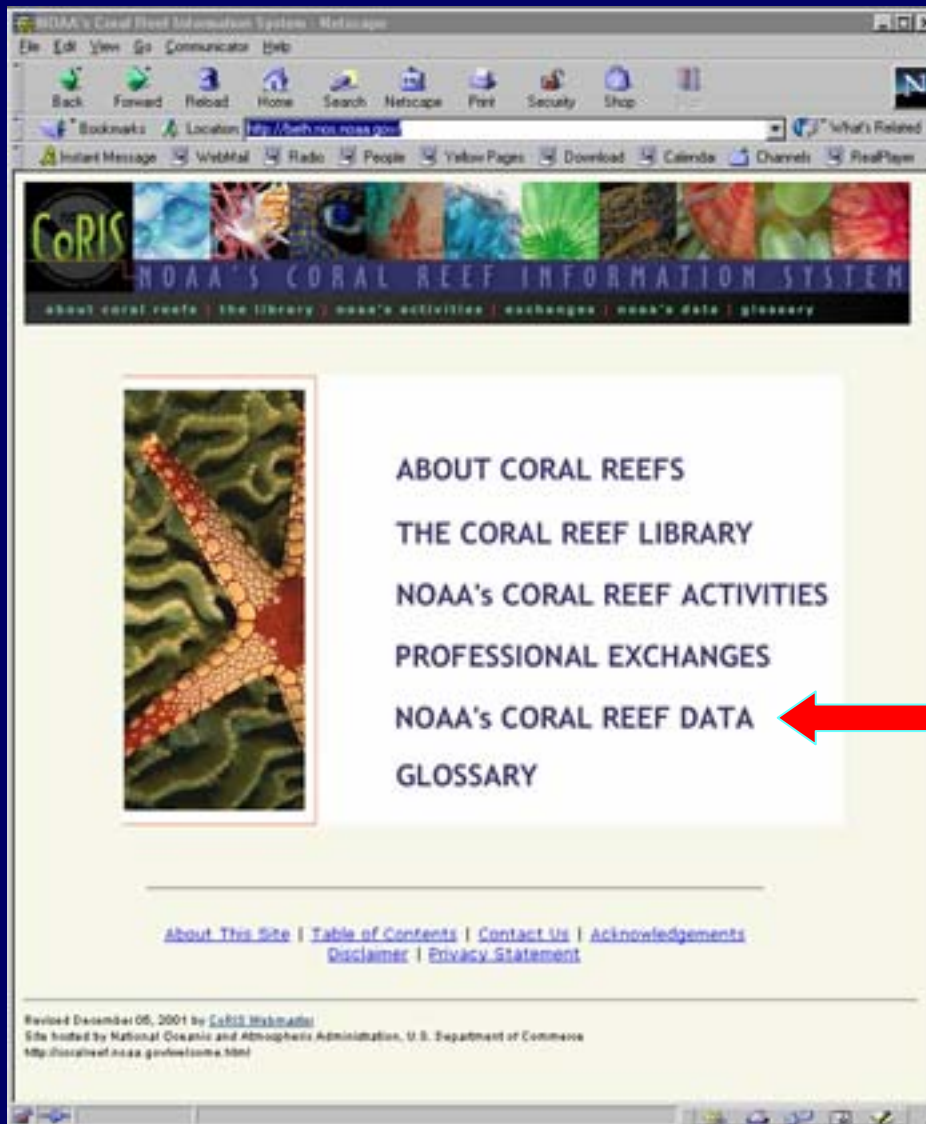
# National Coral Reef Ecosystem Monitoring Program

## CoRIS: NOAA's Coral Reef Information System

All data must be transferred in a timely manner to NOAA funding programs.

Funding eligibility is contingent upon agreement to provide monitoring data within several months after project completion (exact timing under review).

Data will be made available to the general public through this US coral reef data clearinghouse.

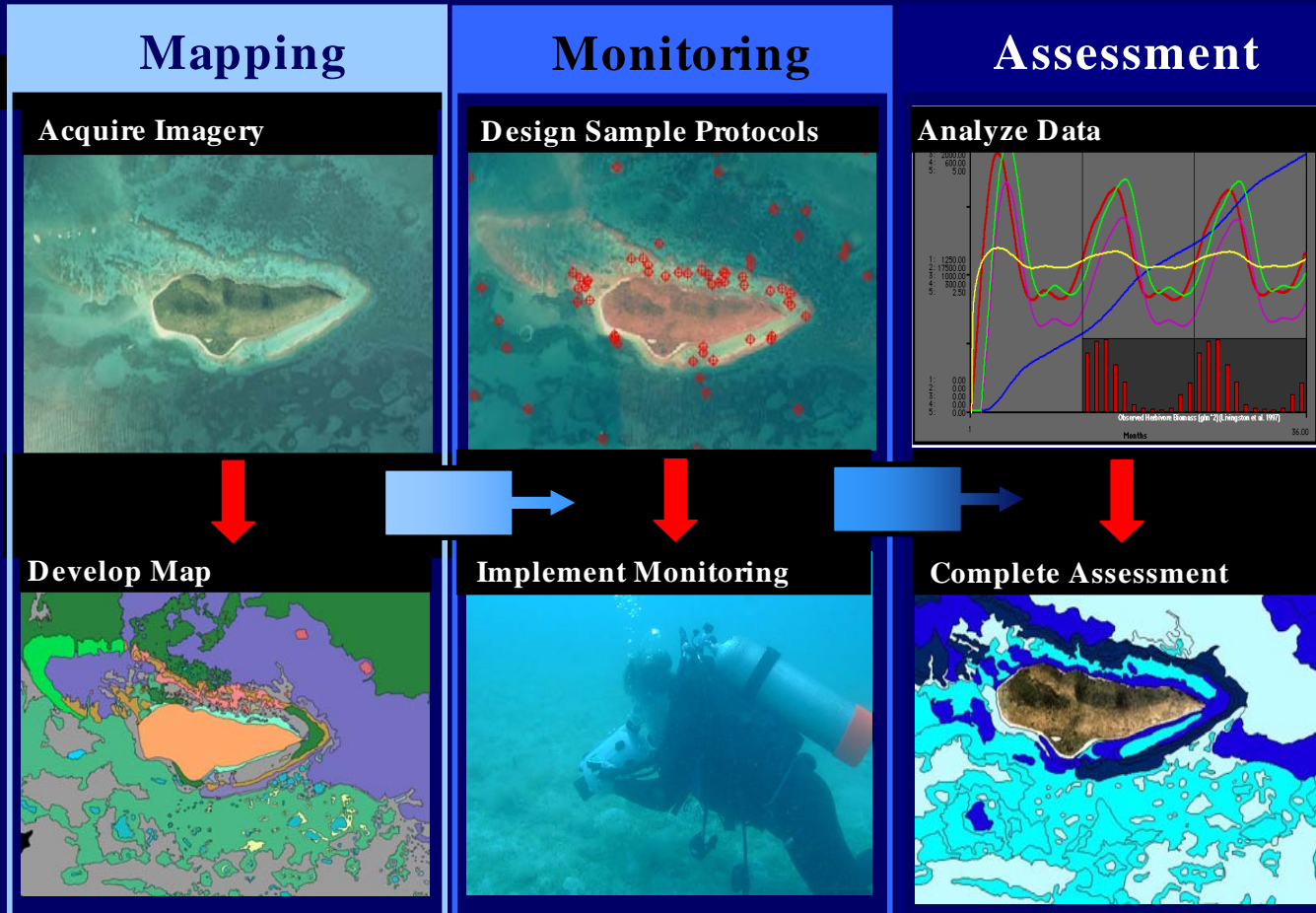
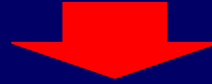


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# Integrating Mapping, Monitoring and Assessment

## National Coral Reef Ecosystem Assessment Process

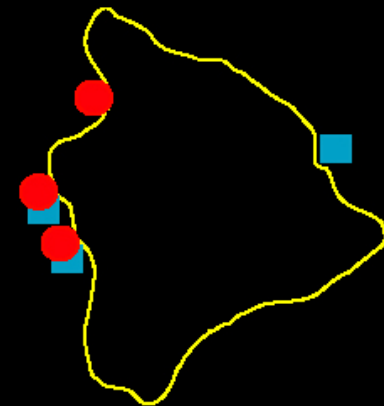
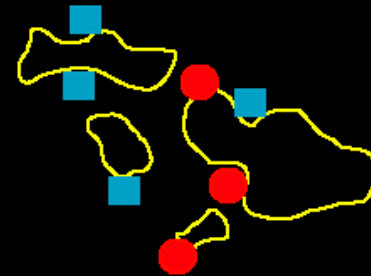
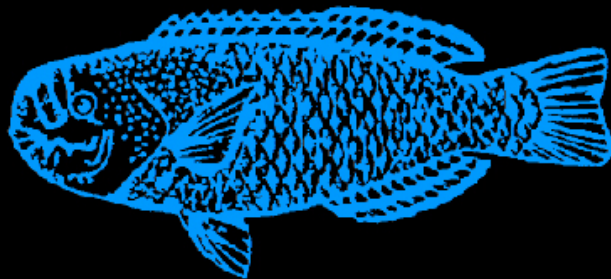




# Main Hawaiian Islands

## Regulated Fishing Areas

- No fishing area
- Fishing activities restricted





# Waikiki Study Area



Photo: Richard Sullivan



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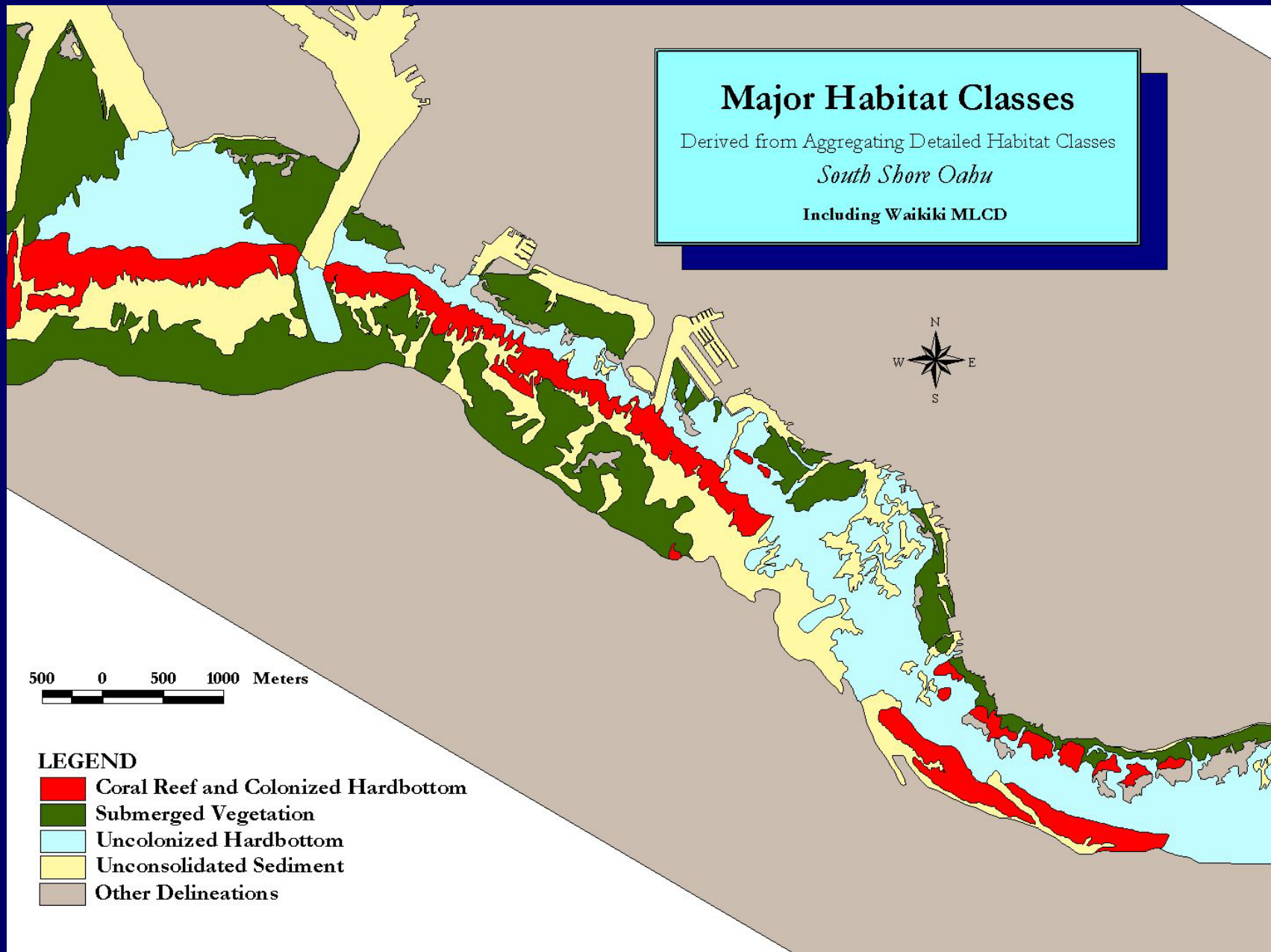


## Major Habitat Classes

Derived from Aggregating Detailed Habitat Classes

*South Shore Oahu*

Including Waikiki MLCD



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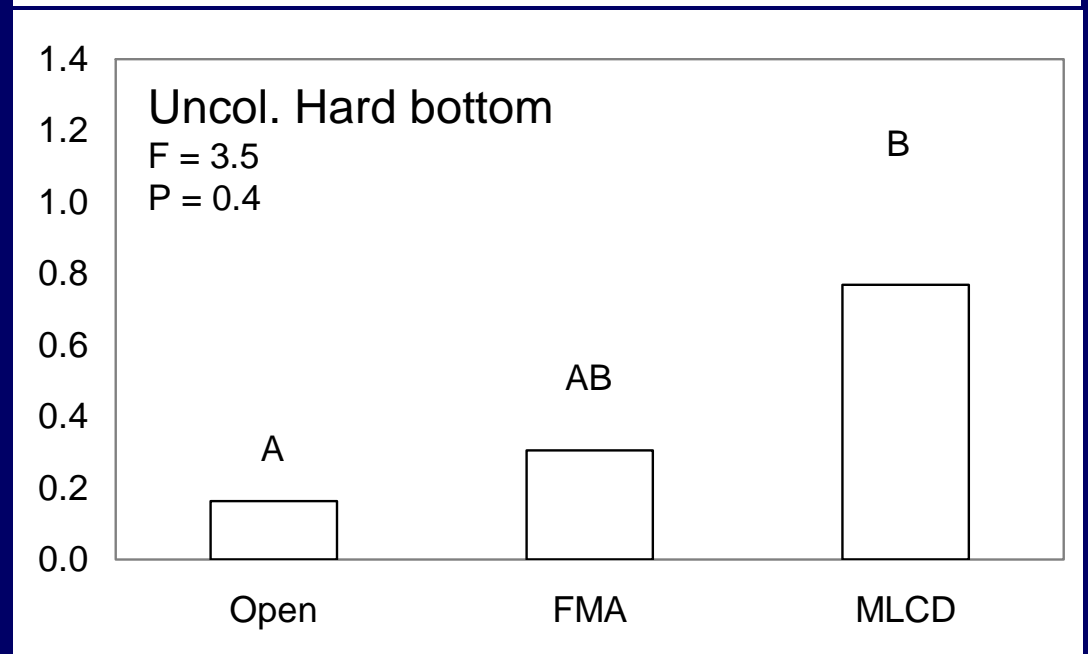
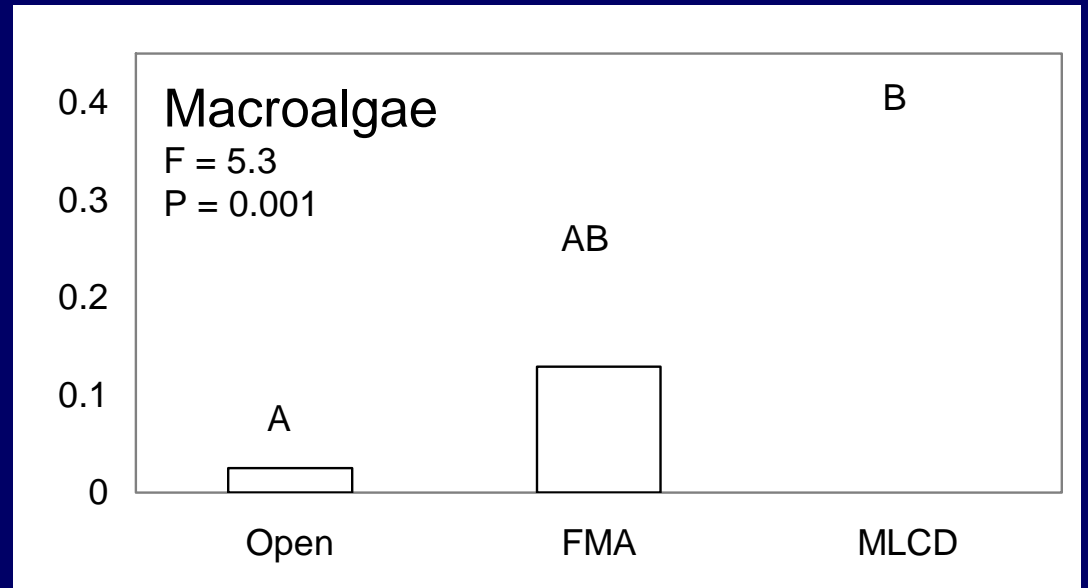
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# Waikiki Study Area

Comparison of fish biomass under various management regimes

Biomass (t/ha)

Biomass (t/ha)



# West Maui Study Area



## Honolua/Mokulei MLCD



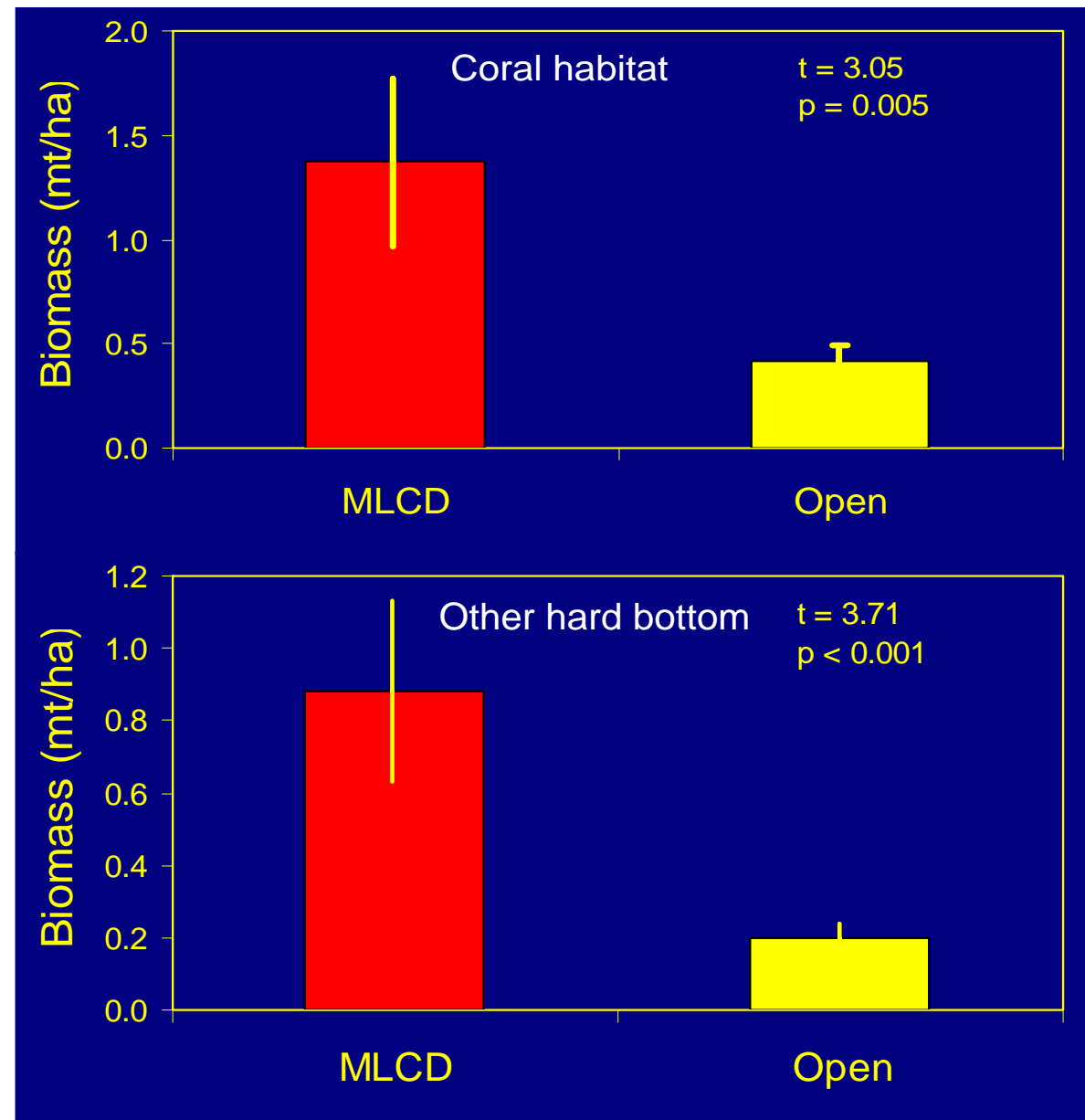
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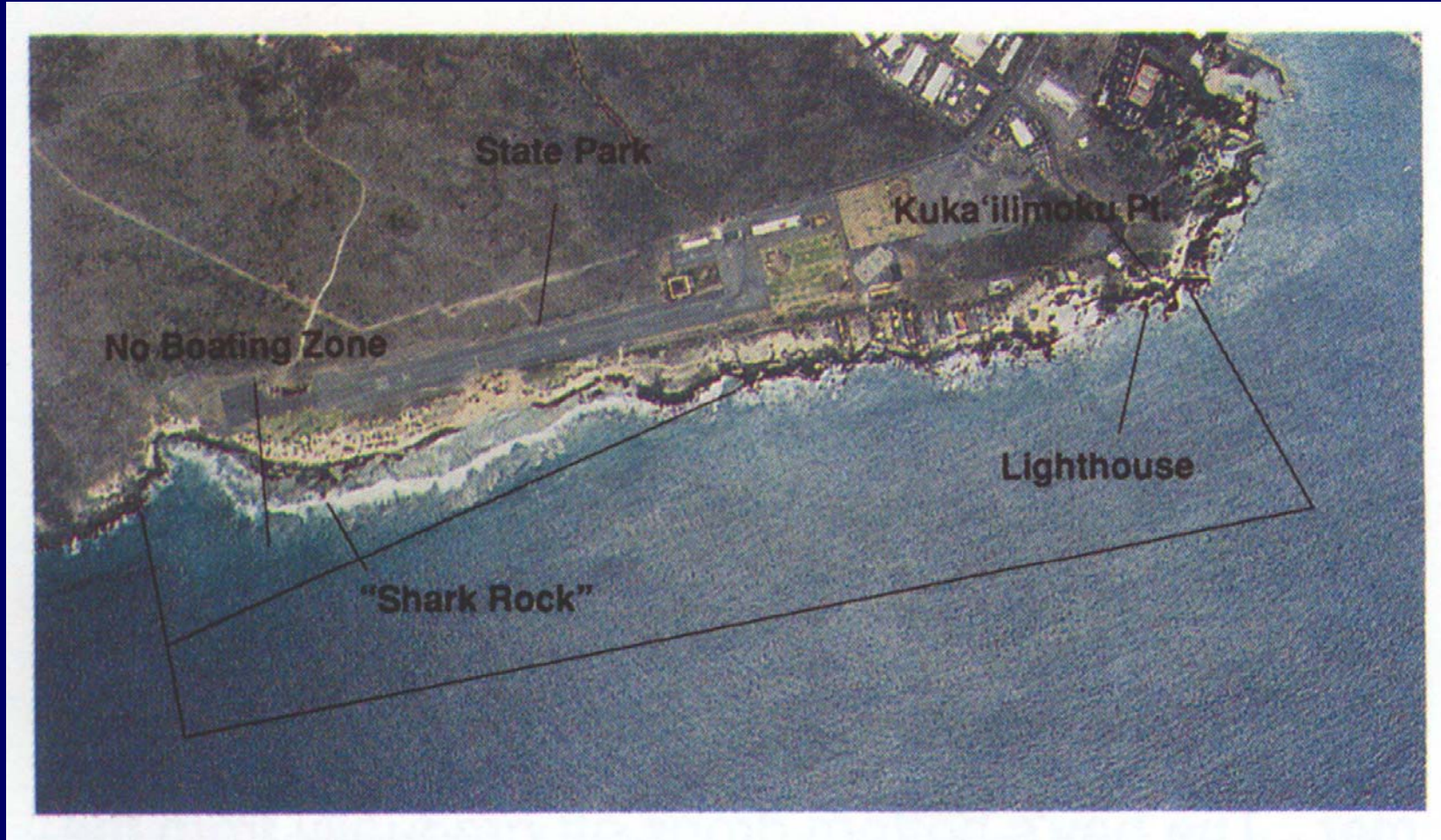


# Honolua-Mokule'ia MLCD

Comparison of fish biomass between Honolua-Mokule'ia MLCD and areas open to fishing.



# West Hawaii Study Area



Old Kona Airport MLCD -- 217 Acres, Established 1992

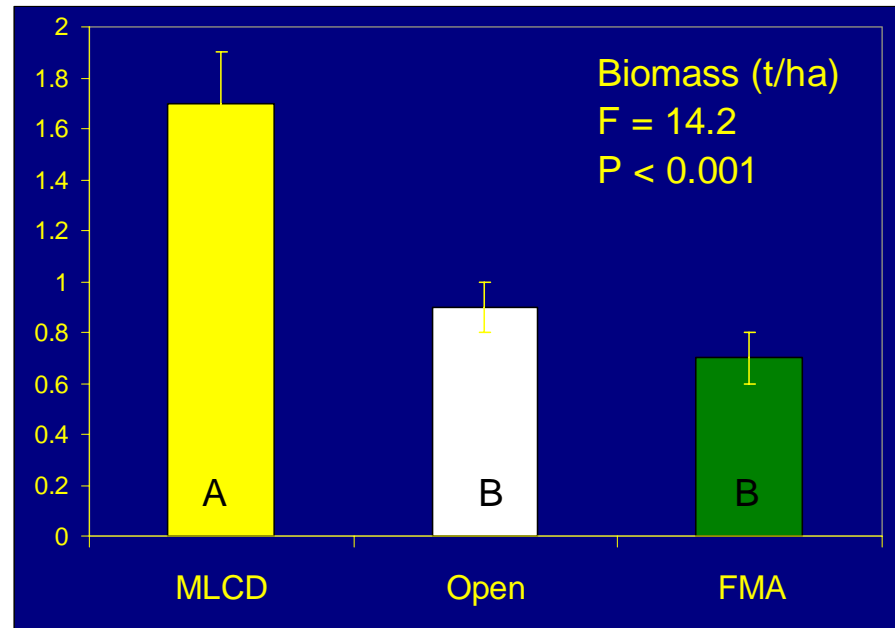
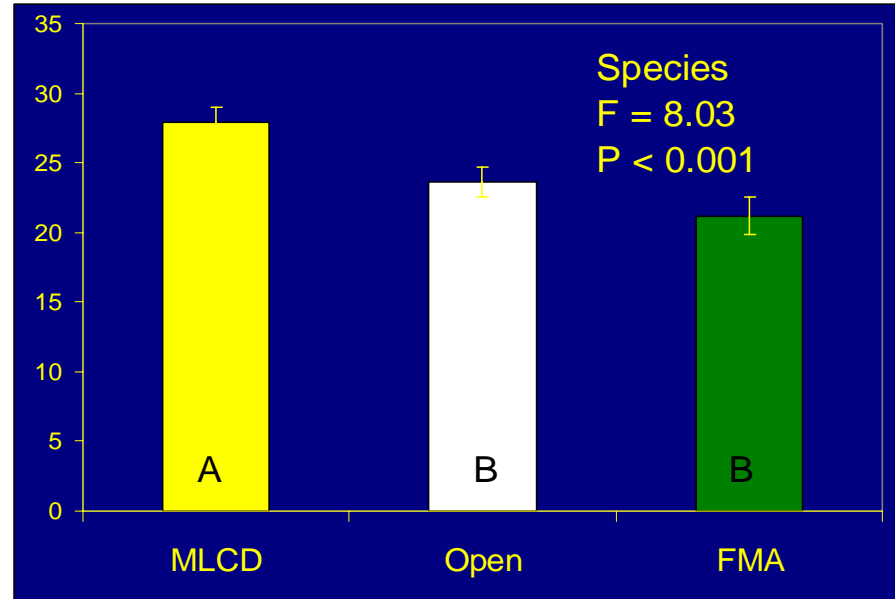


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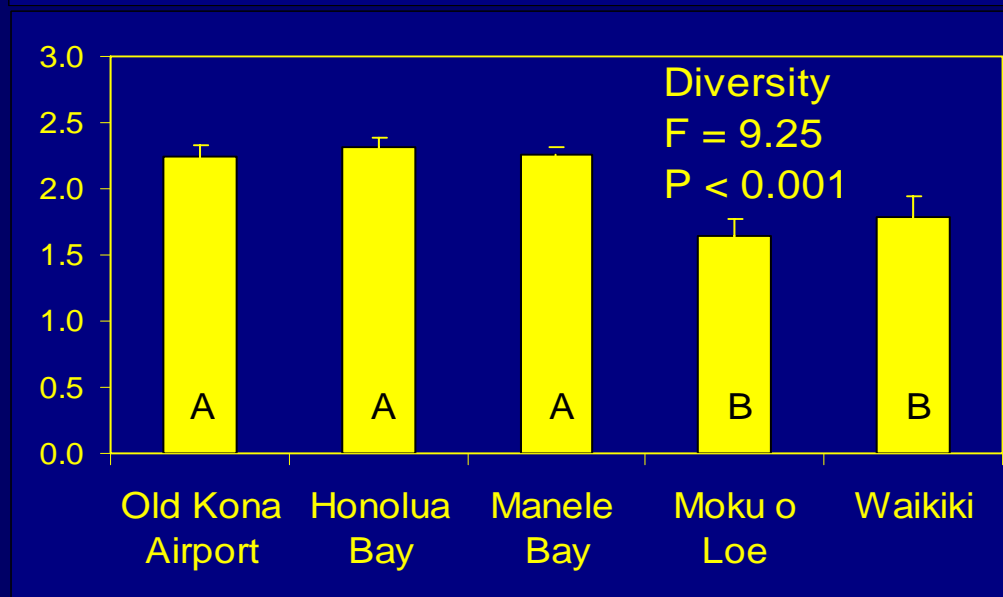
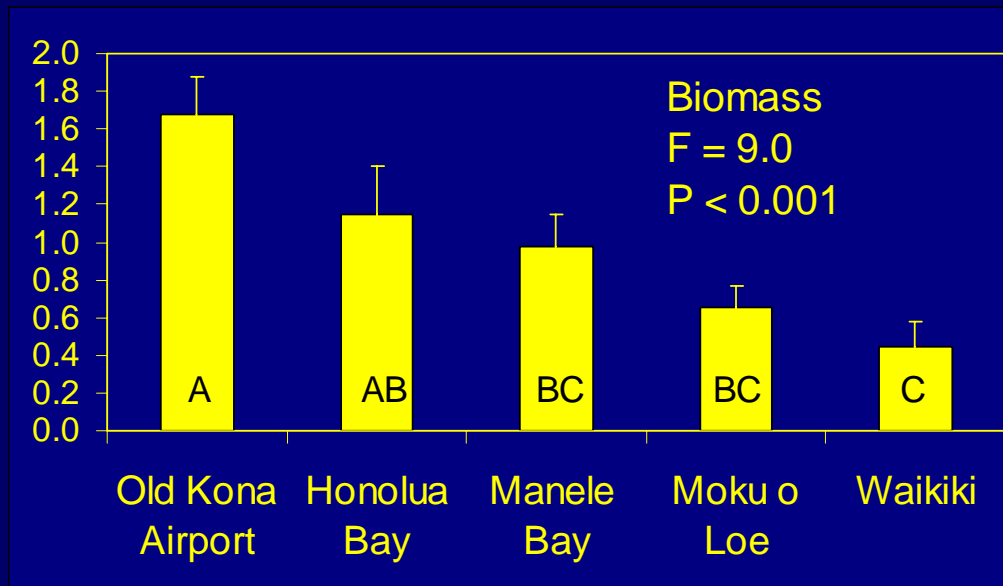
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# Old Kona Airport MLCD

Comparison of fish assemblage characteristics in hardbottom habitats among various management regimes.



# Biomass and Diversity in Protected Areas on Hardbottom Habitats





# Foster Mission

## NPS and NCCOS partners:

- USVI Territorial Government
- NOAA's Office of Coast Survey
- NOAA's Marine Operations Center
- NOAA's Center for Operational Oceanographic Products & Services
- Triton Elics International.



## Mission Objectives:

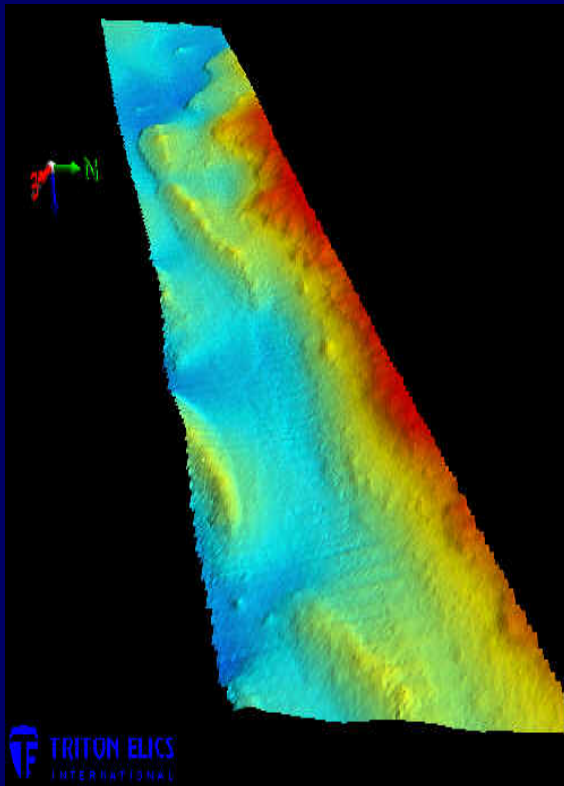
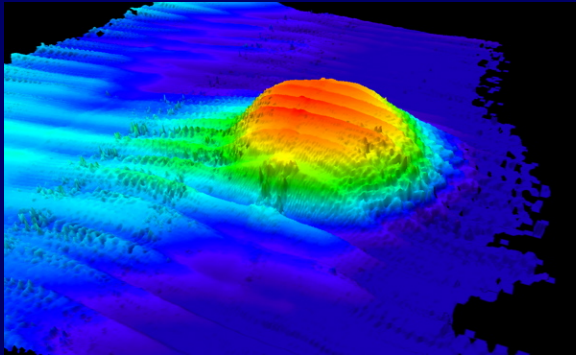
1. Conduct swath bathymetry and acoustical backscatter at three high priority mapping locations.
2. Conduct towed video transects and exploratory surveys – side-scan, drop camera, and towed operated vehicle (TOV: Minibat).
3. To utilize multiple methodologies to conduct an inventory of deep water (>70ft) fishes and associated habitats.



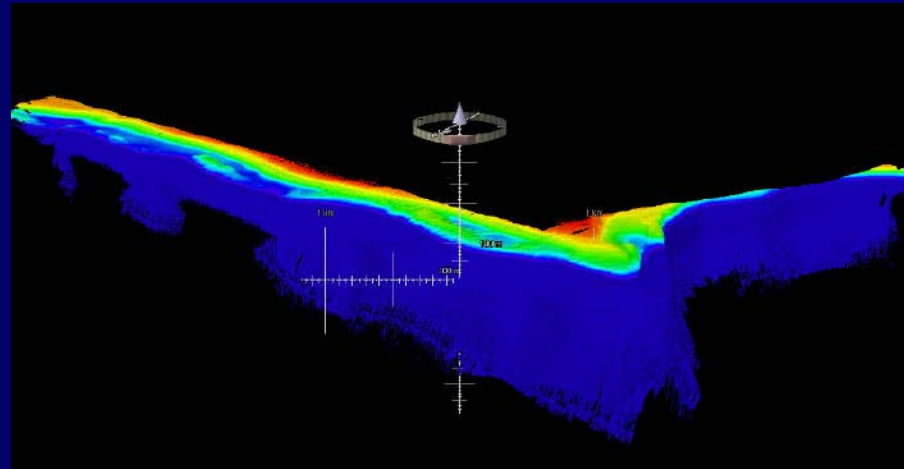
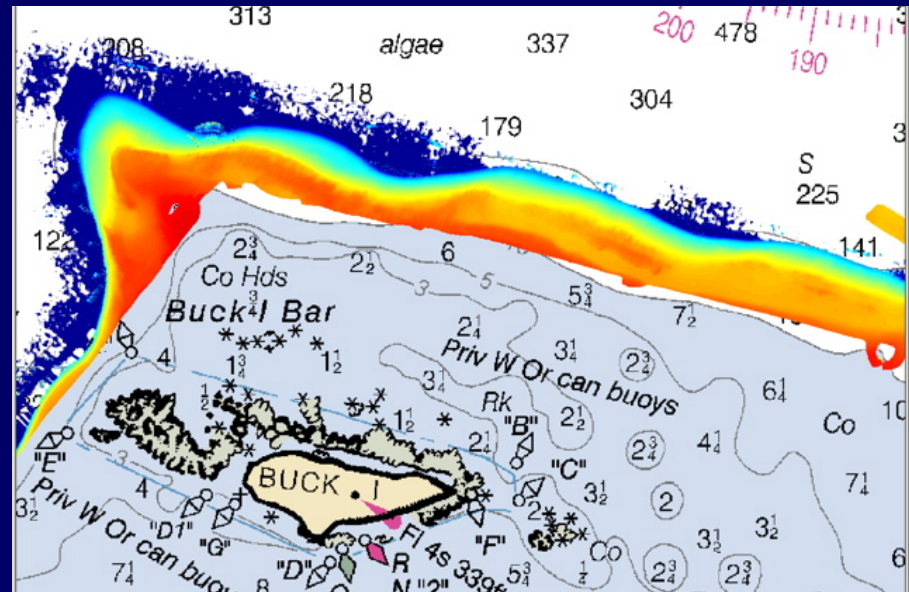
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# Deep-water Multibeam Mapping in the USVI



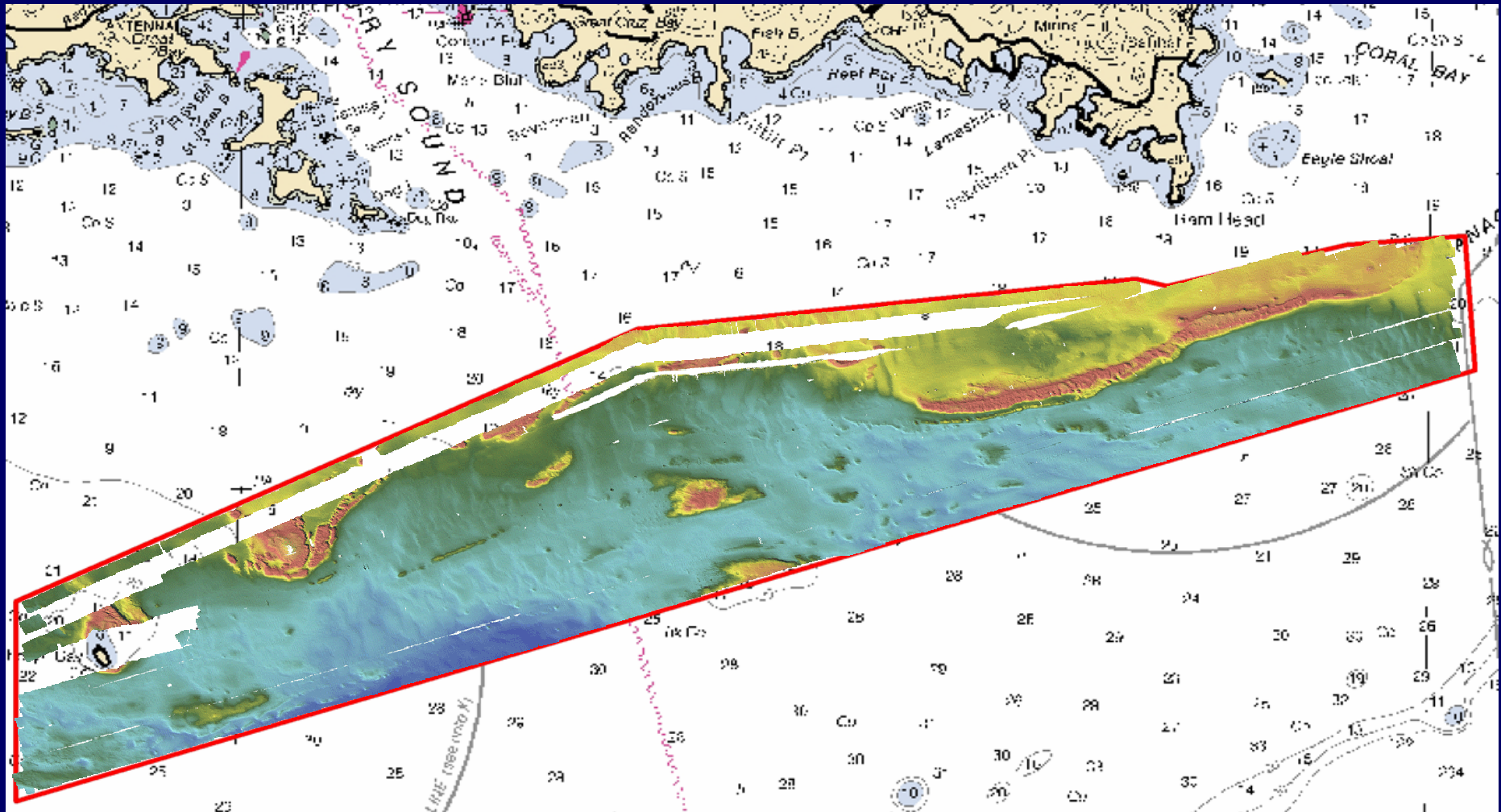
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# Multi-Beam Mapping of St. John's Mid-shelf Reef (MSR)

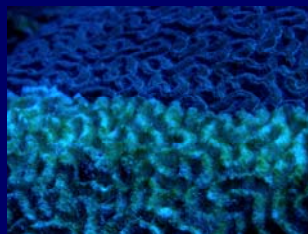


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# Foster Mission - Initial Biological Characterization for St. John



Modified diver surveys for deep water conditions.

- 38 dives completed,
- 128 species encountered

Trapping surveys designed to determine status of commercially exploited species.

- 24 traps set/ recovered,
- 43 fish captured

