

Evaluating Effectiveness of Coral Reef Management



CSCOR Coral Reef Projects PI Meeting

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Ruth Kelty
NOAA/NOS/National Centers for Coastal Ocean Science



Overview

- Benefits of evaluation
- Types of evaluation
- Writing objectives, performance measures
- Impact evaluation for the Coral Conservation Program
 - Context
 - Program theory
 - Criteria for success
 - Program implementation



Benefits of Evaluation

- Accountability
 - Meets requirements of funders
 - Provides information to stakeholders
- Decision Making
 - Guides program direction – setting and reviewing goals and priorities
 - Guides resource allocation by determining value of program
 - Improves program design, implementation, cost-effectiveness
 - Supports effective management practices



Benefits of Evaluation

- Increases understanding
 - existing/potential needs
 - programming that addresses those needs
- Social change
 - shape public opinion (through education)
 - promote, defend, or oppose specific methods, approaches, or programs
- Cohesion & collaboration
 - consistency
 - communication



Types of Evaluation

1. Program theory evaluation

Does your plan make sense?

2. Implementation evaluation

Did you do what you said you'd do?

3. Outcome/impact evaluation

Did it have the intended impact?



1. Program Theory

- What are we trying to accomplish & how?
 - Plan of operation.
 - Logic connecting activities to intended outcomes.
 - Rational for why it does what it does.

1st step is to articulate the program theory in explicit and detailed written/graphic form.



2. Implementation Evaluation

- *Is the program being implemented as intended?*
- *Is the program operating up to its established standards?*



3. Implementation Evaluation

- Provides a way for program managers to ensure that daily operations are appropriate and efficient.
- Powerful tool for:
 - documenting operational effectiveness of the program
 - justifying the way resources are deployed
 - defending program's performance.



2. Implementation Evaluation

- Diagnostic value for impact evaluation
 - If a program is found not to have the desired impact, evaluation can indicate whether this result occurred because of theory or implementation failure.
 - When program effects are found, evaluation helps confirm that they resulted from program activities rather than spurious sources.
- Identifies aspects of the program most instrumental to producing the effects so managers know where to concentrate efforts



3. Impact Evaluation

- Gauges the extent to which a program produces the intended improvements.
 - *Were the desired outcomes attained?*
 - *Was the program effective in producing change in the environmental conditions targeted?*
 - *Were there unintended side effects?*
- Assumes you know the objectives and criteria of success.



3. Impact Evaluation

- Methods must distinguish between
 - Changes that are a function of the intervention, and
 - Changes influenced by other processes.
- Emphasis on estimating the status of the reefs had their not been an intervention.



Program Objectives

1. Identify the specific changes the project is designed to accomplish.
2. Ensure these changes are measurable.

What are we trying to change?

- Knowledge
- Attitudes
- Skills
- Behavior
- Environmental condition



Program Objectives

- Objective vs. activity
- Project will create a GIS database showing marine resource distribution and use
 - Creating database is an activity
 - Objective of this activity is to increase knowledge of resource distribution and use.



Program Objectives

Objective should include:

- The date by which the change will occur
- The specific change desired (use action verb)
- A measure (# or %)
- The target group/species/population
- The location.



Program Objectives

- By 2010, the status of 80% of exploited fish species in Hawaii will be documented in the State of the Reefs Report.
- By 2006 a diagnostic indicator of coral bleaching stress will provide managers in the FKNMS warning one month before all coral bleaching events.



Performance Measures

- What changes should be expected from doing the project work?
 - Qualified by specific measures (# or %)
 - Linked directly to project goals and objectives
- Performance measures should:
 - Be results focused
 - Be challenging but feasible
 - Involve a meaningful comparison



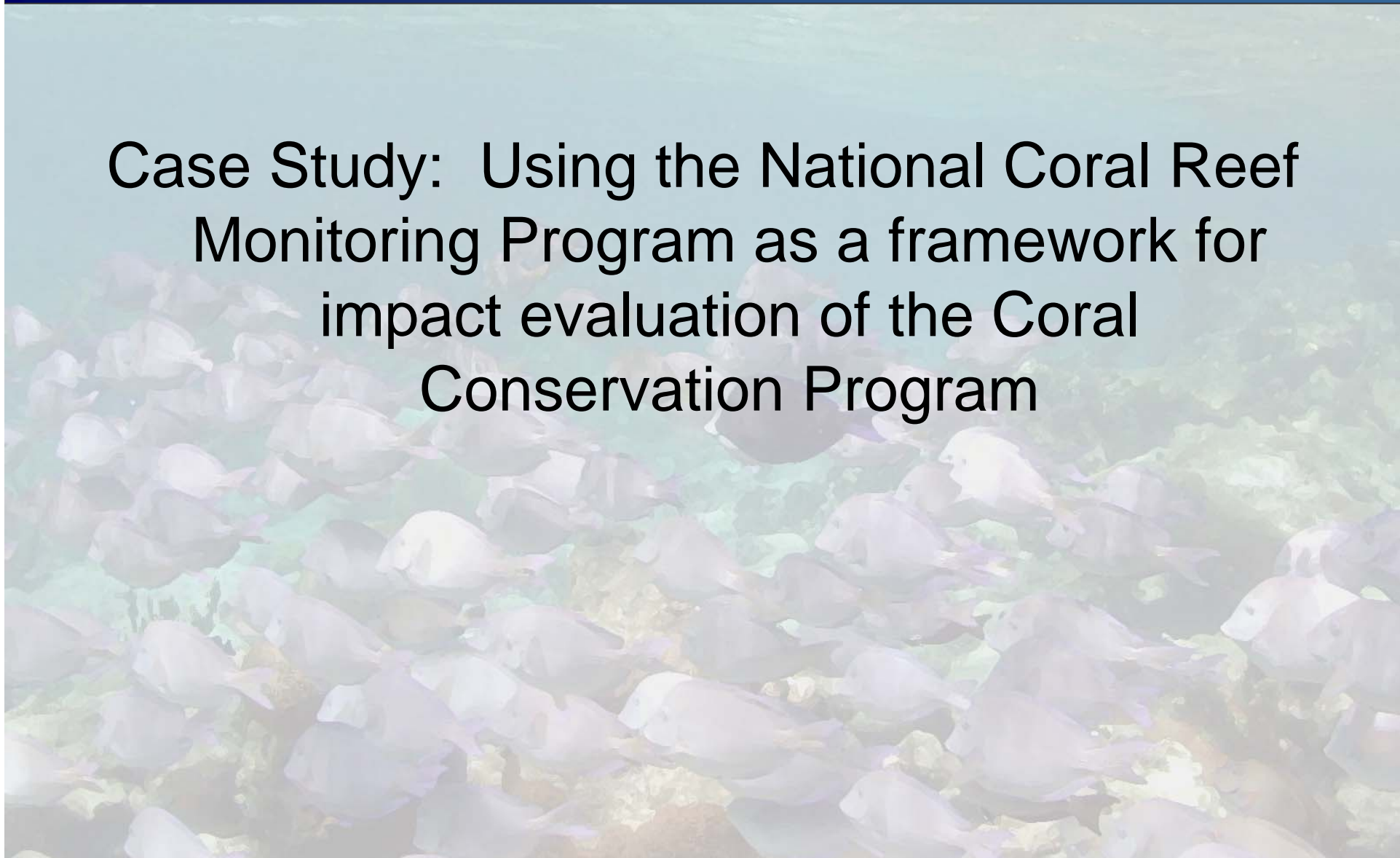
Performance Measures

Continued...

- Performance measures should:
 - Be measurable (quantitative or qualitative)
 - Refer to a result or outcome that can be reasonably attributed to the project activity
 - Be valid and reliable (repeatable)
 - Selective – limited to and focused on key areas of concern



Case Study: Using the National Coral Reef Monitoring Program as a framework for impact evaluation of the Coral Conservation Program





Framework for Impact Evaluation of CCP

Organizational context

Problem statement

What we did (program theory)

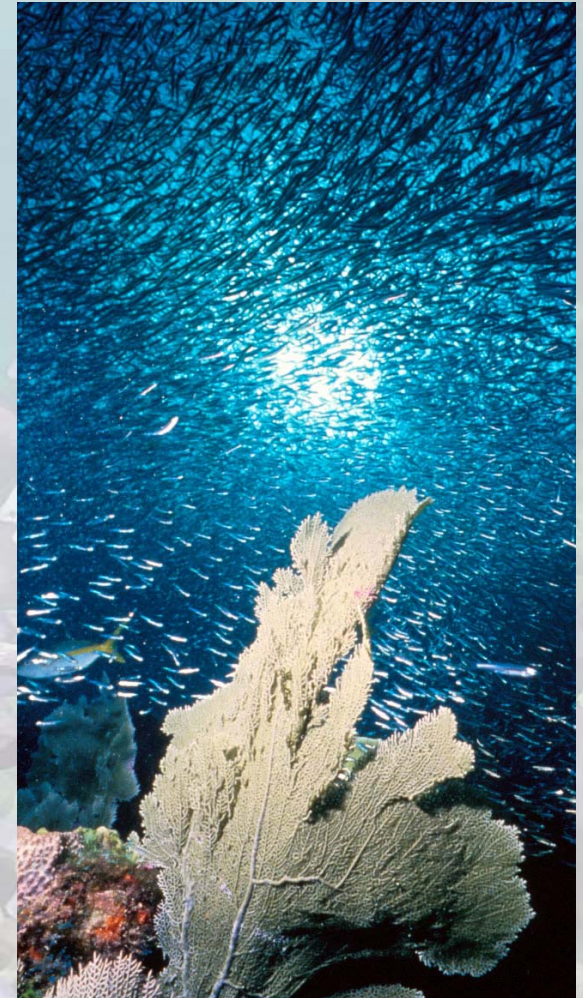
What we're doing (program implementation)

- Questions central to evaluating state of the reef ecosystem

- Criteria for success

Applied monitoring – an example

Monitoring for socioeconomic





Organizational Context

- Reefs in decline.
- 1998 – E.O. 13089 directed the Federal government to strengthen its stewardship of the nation's and world's coral reef ecosystems and established the CRTF to lead and coordinate U.S. efforts to address the coral reef crisis.
- 2000 - CRTF completed *The National Action Plan to Conserve Coral Reefs* which guides Federal, State, Territorial and local action to reverse the worldwide decline and loss of coral reefs.
- 2000 - Coral Reef Conservation Act provides NOAA with the authority to preserve, sustain, and restore the condition of coral reef ecosystems.



Organizational Context

- Congress appropriated ~\$71M between FY2001 and 2003 to support CCP activities.
- \$5M over the past four years on coral reef mapping to learn where our reefs are.
- \$1.1M in grants to states and territories for improved assessment and monitoring.
- \$3M supported extramural restoration, education, research, and monitoring.



Organizational Context

Has our money been well spent?

What areas need the most improvement?

What initiatives produce the biggest bang for our bucks?



Impact Evaluation

Problem Statement: Need to evaluate the impact of the CCP.

- Has CCP produced change in the environmental and socioeconomic conditions targeted?***
- Are there unintended side effects?***

Solution: National Coral Reef Monitoring Program & State of the Reefs Reports



National Coral Reef Ecosystem Monitoring Program

Program Goal: *to build a scientific basis and state and territory capacity to monitor the status and trends in the condition and function of US coral reef ecosystems, and to use the state of the reef to evaluate the effectiveness of management.*

Program Audience: Agencies responsible for managing coral reef ecosystems and their use.



National Coral Reef Ecosystem Monitoring Program

What would a successful
program look like?



Ideal Program

- What is the geographic extent & distribution of CREs?
- What proportion of these resources are declining or improving? Where, at what rate?
- What factors are contributing to observed changes? What stressors/responses are associated with poor conditions? Is management associated with improving conditions?



Ideal Program

- What are ecological and human risks associated with decline?
- What actions are being taken by the CRTF agencies to improve the condition of CREs?
Are those actions having the desired effects?



Threat-based Approach

- **Stresses vary regionally in intensity and impact**
 - **Atlantic: disease, coastal development and runoff, pollution, fishing, and trade in coral and live reef species**
 - **Pacific: coastal development and runoff, pollution, recreational use, fishing, trade in coral and live species, and invasives**



National vs. Regional

- **Program needs to function at two levels: national and site-specific.**
- **National program:**
 - **standard suite of parameters**
 - **comparable reef ecosystem components & habitats through time**
 - **share quality assured data**



Criteria for Success

- Data collected for each ecosystem should contain a "core" set of data for needed effective planning and management at both the regional and national level.
- Additional non-core parameters and elements of program design (i.e. sampling protocols) should address regional threats.
- Regional sampling designs and site selection should provide for long-term monitoring that allows for assessment of the condition of the ecosystems and evaluation of management effectiveness.



Criteria for Success

- Data for all regions should be collected and maintained in accordance with clearly defined protocols and quality-assurance standards.
- Data should be compatible for synthesis at ecosystem and other broad levels.
- Data should be available within a time scale useful to managers and should feed directly into the production of State of the Reefs reports.



Ideal Program

Plan comprehensively and for the future, but start with the highest priorities and with what existing capacity and available resources will allow.



National Coral Reef Ecosystem Monitoring Program

Program Reality: Filled Gaps

- Hosted >60 managers and scientists
- Goal: Design a multi-agency program to link state, territorial, national, and international monitoring efforts into a comprehensive monitoring network.
- NCCOS identified and GIS-mapped 350 nationwide coral reef monitoring, assessment, and research projects
- Awarded grants to fill identified gaps in Hawaii, Am. Samoa, Guam, CNMI, Puerto Rico, and the USVI.



Core Parameters


Benthic habitat characterization (depth, habitat delineation, % live/dead cover [e.g., corals, submerged aquatic vegetation, macroalgae, sponges], rugosity, diversity)

Associated biological community structure including fish condition (abundance, density, size, diversity, disease, harvest trends) and large motile and sessile invertebrates condition (abundance, density, size, diversity, disease, harvest trends)

Water/substrate quality (temperature, nutrient enrichment, toxic chemicals, turbidity).

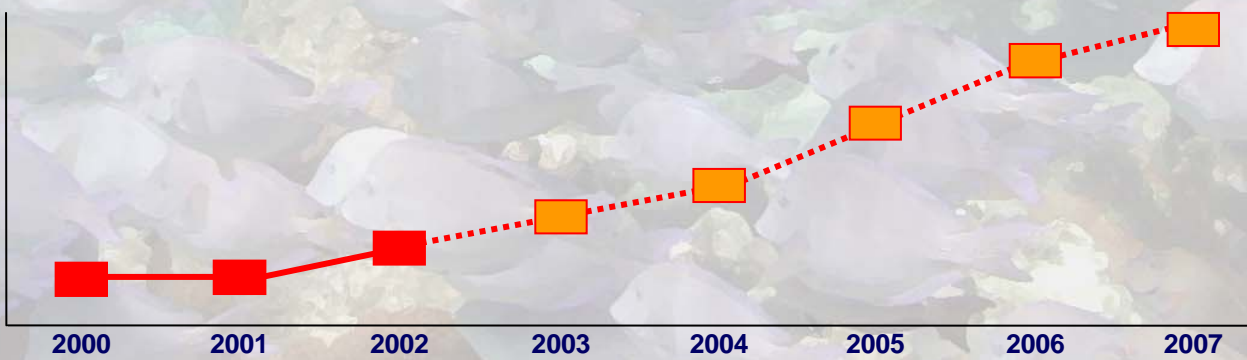


National Coral Reef Ecosystem Monitoring Program

	2000			2001			2002			2003			2004			2005			2006			2007					
	Water Quality	Habitat	Biological	Water Quality	Habitat	Biological	Water Quality	Habitat	Biological	Water Quality	Habitat	Biological	Water Quality	Habitat	Biological	Water Quality	Habitat	Biological	Water Quality	Habitat	Biological	Water Quality	Habitat	Biological			
American Samoa						●		●	●										●	●	●						
CNMI			●		●	●		●	●										●	●	●						
Guam	●			●			●	●											●	●	●						
Hawai'i		●	●		●	●		●	●										●	●	●						
Freely Associated States									●										●	●	●						
Florida								●	●										●	●	●						
Puerto Rico		●	●		●	●		●	●										●	●	●						
USVI		●	●		●	●		●	●										●	●	●						
TOTAL FUNDS				\$444,000			\$560,790			\$790,000			\$1.5M			\$2M			\$2.5M			\$3.5M			\$4M		

Total Actual Funds/Year (FY00-02) and Projected (FY03-07) Funds/Year Required to Meet FY2007 Goals

\$ 4 M
\$ 3.5 M
\$ 3 M
\$ 2.5 M
\$ 2 M
\$ 1.5 M
\$ 1 M
\$ 0.5 M
\$ 0 M





NOS Coral Ecosystem Monitoring Program

FY02 Accomplishments Summary: Internal

Biogeography Program's Integrated Mapping & Monitoring Activities

Total FY02 Budget - \$235K (100K – CoRIS DBM, 100K - Contract Labor, 35K Travel)

To Date a Total of 1300 Sites have been Surveyed (appx. 350 during FY02) to Develop a Comprehensive Baseline Characterization of Coral Reefs and Associated Biological Communities in and around St. John, St. Croix, and Southwestern Puerto Rico

simultaneous collections

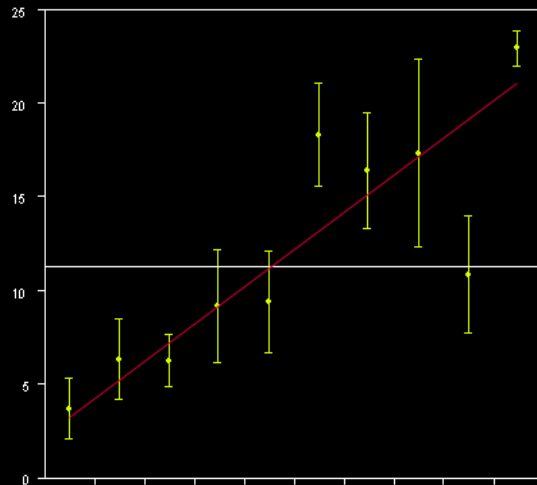
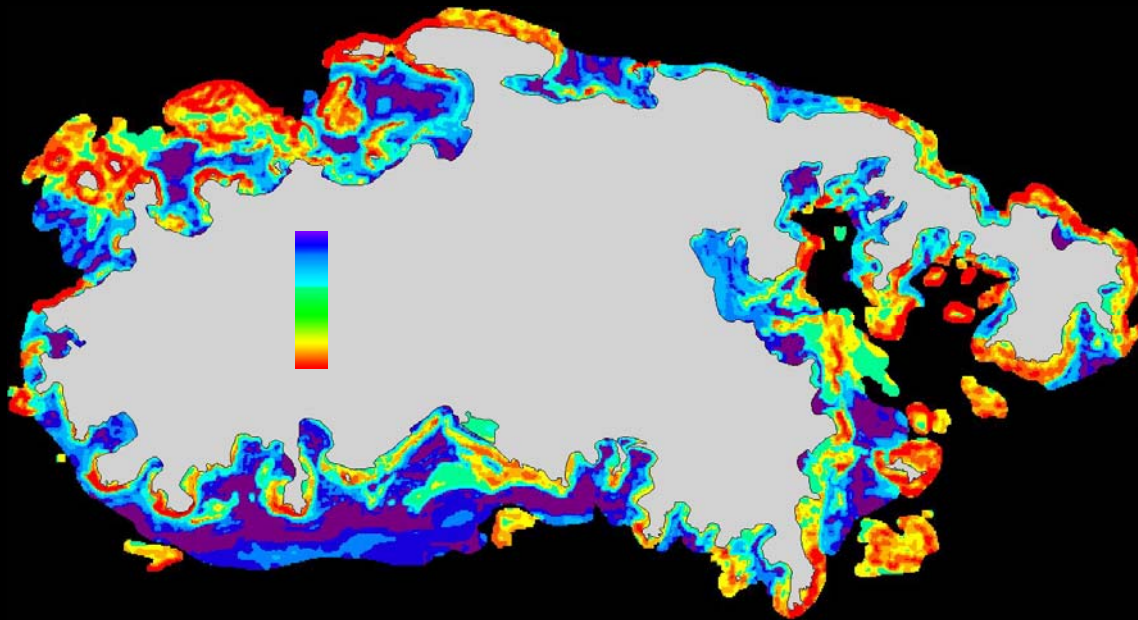
Fish Data Collected

- Abundance and Distribution
- Size Structure
- Trophic Dynamics (Gut Content Analysis)
- Habitat Utilization Patterns
- Community Structure (Diversity, Richness, etc.)

Fine-scale Habitat Characterization Data

- Coral Cover and Taxonomy
- Algal Cover and Taxonomy
- Seagrass Cover and Taxonomy
- Physiography
- Disease





NCCOS Scientists Have Been Asked by the US National Park Service (NPS) to help in the Development of Reef Fish Monitoring Protocols for the Buck Island Reef National Monument, and the Virgin Islands National Park.

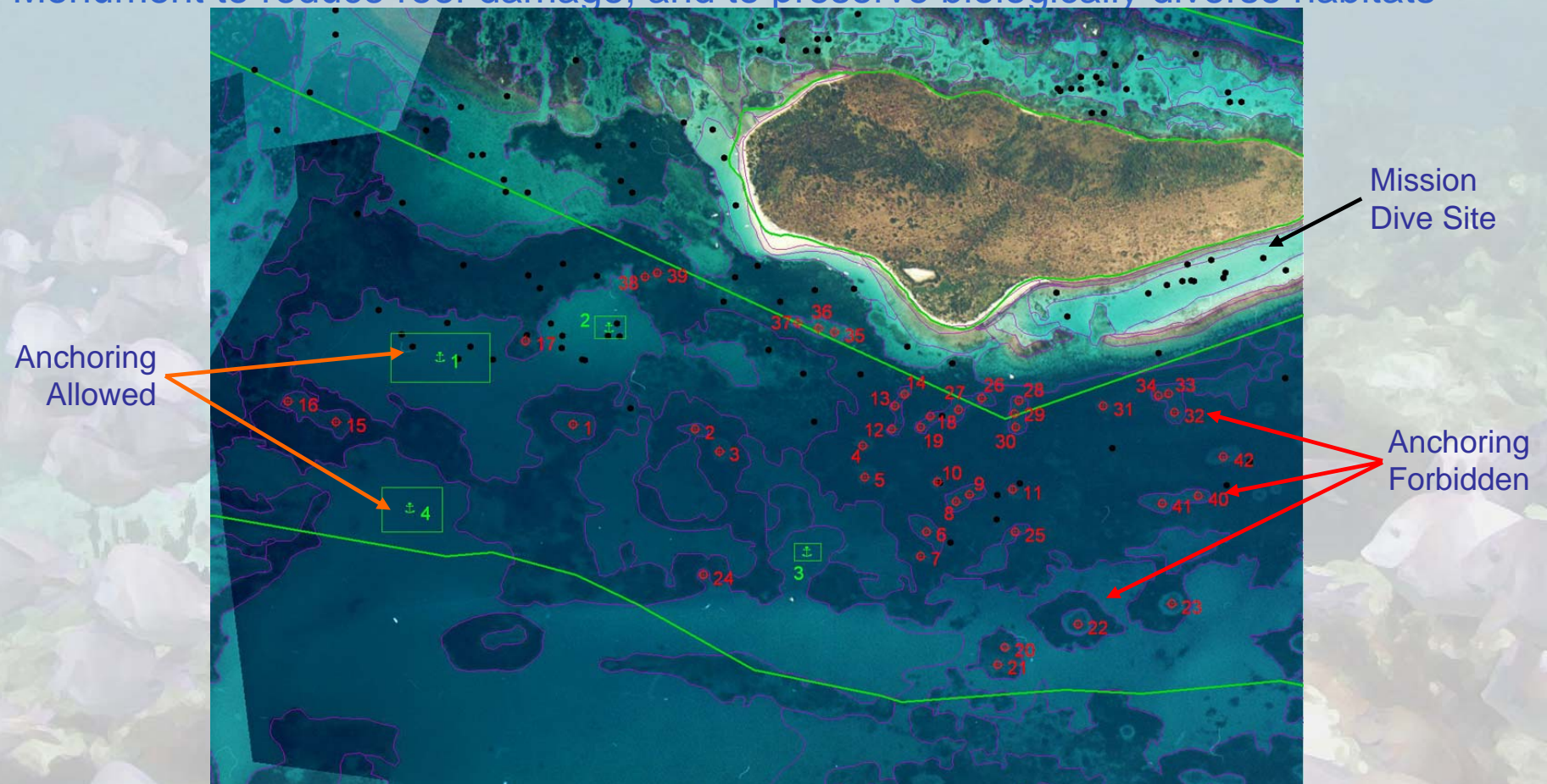
Furthermore, All data are Being Shared with NPS, and are being Analyzed by NOS Monitoring Program Personnel to test for Post Closure Results on Fish Abundance, Distribution, and Diversity.

In this Example (Presented at AFS02) Monitoring Data were Used to Develop Spatially-explicit Models of Predicted Fish Diversity. NPS and NCCOS Scientist will Track Changes In these Patterns over Time to Evaluate Park Management.



NOS Coral Ecosystem Monitoring Program

Monitoring data and habitat maps, were used by the National Park Service to change existing vessel anchoring regulations within the Buck Island Reef National Monument to reduce reef damage, and to preserve biologically diverse habitats





NOS Coral Ecosystem Monitoring Program

FY02 Accomplishments Summary: Internal

http://biogeo.nos.noaa.gov/products/data/reef_fish/

Department of Commerce | National Oceanic and Atmospheric Administration | National Ocean Service
National Centers for Coastal Ocean Science | Center for Coastal Monitoring and Assessment

NOAA'S BIOGEOGRAPHY PROGRAM

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Reef Fish Query Engine

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Reef Fish Navigation Console

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Welcome to the Biogeography Program Reef fish census data clearinghouse. This data query tool was developed for you to browse our online inventory of reef fish census data collected from locations throughout the US Caribbean, including St. Croix, St. John, and Puerto Rico. Use this tool to explore our data and download the information you desire to use. If you prefer to access the raw data files (as the online query returns only a subset of the available data), please use the following [LINK](#). Be sure to follow the "read data dictionary" link below for a brief description of the codes you see in the query selection boxes. This will help you better understand the data being returned.

These census data were explicitly collected to be integrated and analyzed within the construct of the Biogeography Program's high resolution coral reef and benthic habitats mapping information (GIS data available at the following [LINK](#)). This spatially-explicit sample design provides a valuable mechanism to explore the distribution and habitat requirements and/or preferences of fishes in the US Caribbean. Follow this [LINK](#) for a more detailed description of Biogeography Program reef fish censusing protocols.

We'd like to take this opportunity to thank you for stopping by, and hope to see you here again very soon.

Mark E. Monaco, Ph.D.
 NOAA/National Ocean Service
 Biogeography Program Chief

SELECT FISH CENSUS ATTRIBUTES

Date	Survey Type	Size Class	Zone	Structure	Type
All 2-9-01 2-12-01 2-13-01	All Point Trans	All > 35cm < 5 cm 5-10 cm	All B/S LAG	All HB UNC VEG	All CB CP CPSC

Select your Species:

Sort By:

[Read Data Dictionary/Code Key](#)

All 'Internal' Data Have Been Made Accessible

- Reef Fish
- Benthic Characterizations

http://biogeo.nos.noaa.gov/mon_web/

Welcome to Adobe GoLive 4 - Netscape

NOAA's Ocean Service | home

Coral Reef Ecosystem Monitoring Program

INFORMATION KIOSK
 Program Description
 Frequent Questions
 Data & Analyses
 Publications

FUNDED PROJECTS
 American Samoa
 CNMI (Saipan)
 FAS (Palau)
 Florida
 Guam
 Hawaii
 Puerto Rico
 US Virgin Islands

PROGRAM ADMIN
 Application Forms
 Member Login

NOAA | Ocean Service | National Centers for Coastal Ocean Science
 Center for Coastal Monitoring & Assessment | Biogeography Program

[REEF](#) [Bio-Geography PROGRAM](#) [REEFBASE](#) [ICRU](#) [ICRAN](#)

List of Other Useful Coral Reef Links (from NOAA's CHAMP website)

Project Information for
 'External' Monitoring Activities
 has Been Made Accessible

- Budgets
- Project Descriptions
- Data
- Reports



National Coral Reef Ecosystem Monitoring Program

Social Science to inform and evaluate coral reef management.

- **Coral reef ecosystems provide annual benefits of \$30 billion in goods and services to world economies (Cesar and Burke 2003).**
- **Value to Hawaii is ~\$10 billion, with annual economic benefits of \$360 million (Cesar 2003).**
- **Reef uses include commercial and recreational fisheries, marine transportation, tourism, receiving waters for biological and chemical wastes.**
- **High and competing demands → resource conflicts and pressure the natural environment.**
- **Maintaining healthy CREs requires a balance not only between **ecological functions and human use needs**, but also between the **human uses** commonly found in those ecosystems.**



National Coral Reef Ecosystem Monitoring Program

Determine the health of CREs based on society's stated or desired uses by:

- 1. Quantifying the human uses of coral reef ecosystems;**
- 2. Gauging the relationships between uses and a series of environmental metrics such as those used in the State of the Reefs report;**
- 3. Assessing the interactions between various human use activities in coral reef ecosystems; and**
- 4. Developing forecasts to help managers accomplish society's uses of coral reef ecosystems in an economically and environmentally sustainable manner with the fewest resource conflicts.**



National Coral Reef Ecosystem Monitoring Program

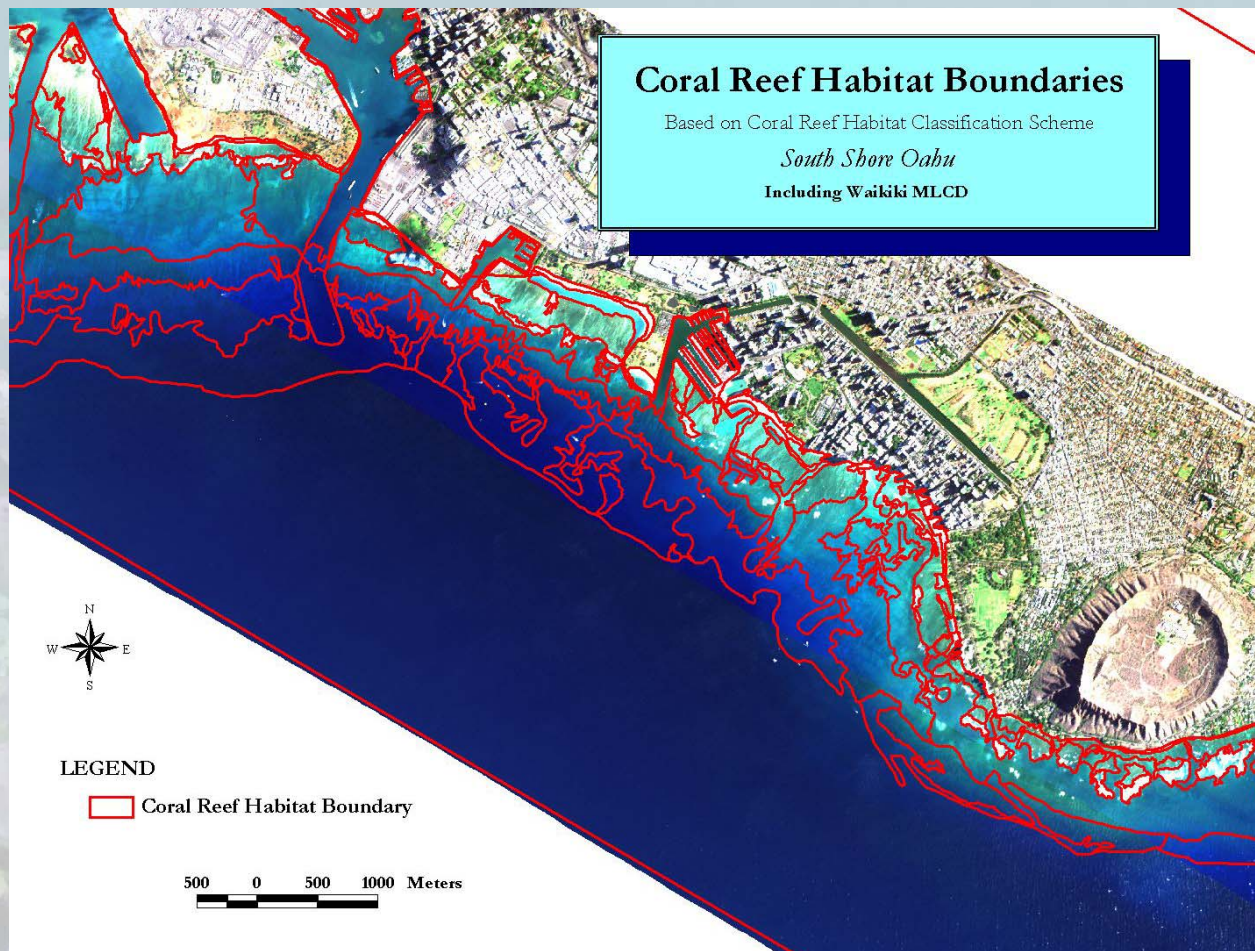




NOS Coral Ecosystem Monitoring Program

Biogeography Program's Integrated Mapping & Monitoring Activities

Reef Fishes, MPA Design, MLCD Function & Efficacy





5 Key Evaluation Questions

- ***What?*** Did we do what we said we'd do?
- ***Why?*** What did we learn about what worked and what didn't work?
- ***So what?*** What difference did it make that we did this work?
- ***Now what?*** What could we do differently?
- ***Then what?*** How do we plan to use evaluation findings?



Evaluating Effectiveness of Coral Reef Management

Ideal program: Criteria for success

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