

NOAA Coral Reef Conservation Program Ecosystem Science Evaluation

National Coral Reef Monitoring Program

Topical Area: Foundational Efforts

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CRCP/NCCOS: Peter Edwards, Maria Dillard, Arielle Levine, Jarrod Loerzel

National Coral Reef Monitoring Program

Background

NCRMP formed as a result of strategic planning efforts – brought together monitoring efforts under one umbrella

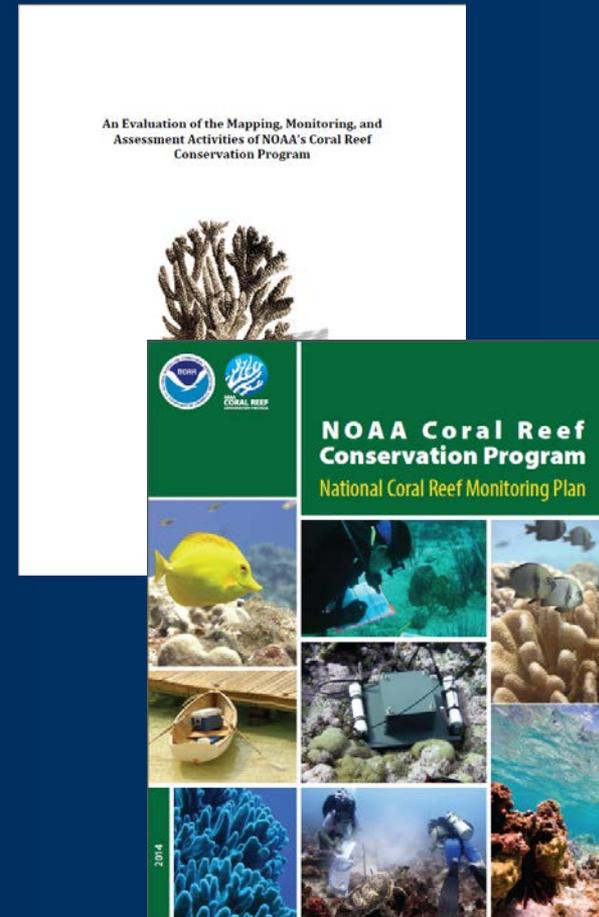
Filled gaps:

- Lack of standardized methods and objectives
- Integrated ecosystem approach
- Ability to report to Congress/NOAA leadership/public

2013 was first implementation year – currently in fourth field season (many efforts have been ongoing in similar forms since early 2000s)

Funding Support

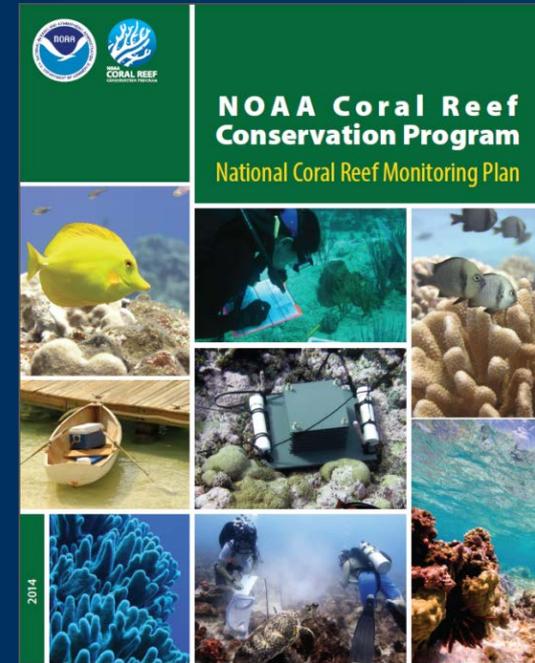
\$4.5M CRCP investment, with \$350K support from NOAA Ocean Acidification Program (OAP) through climate partnership



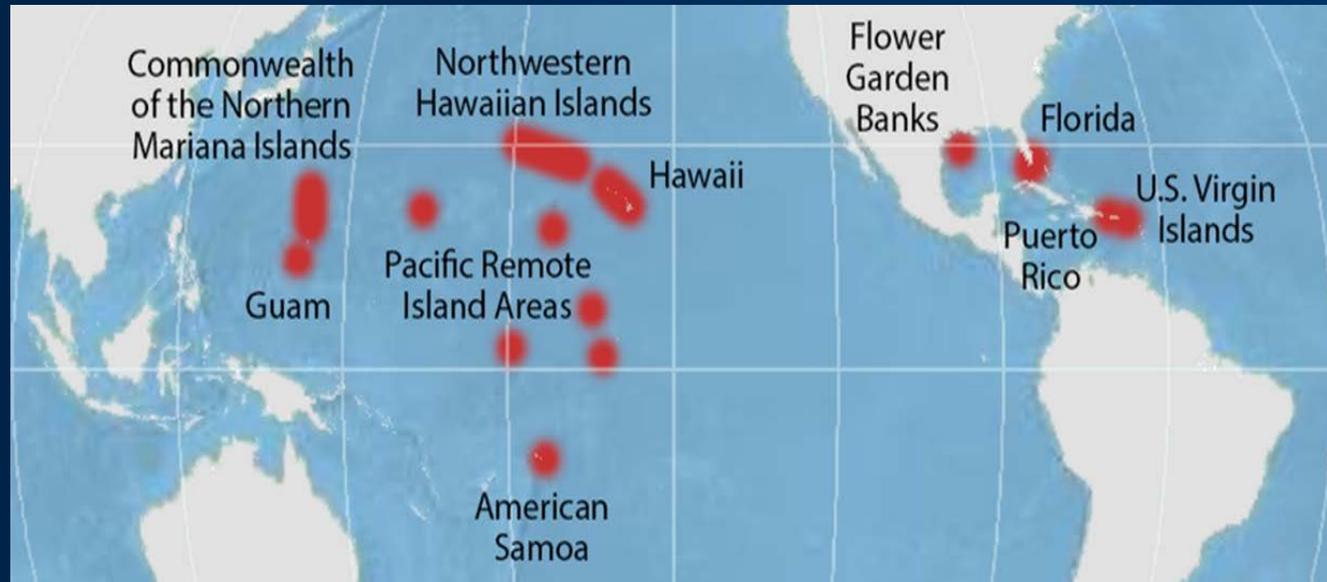
NCRMP Theme	Funding
Biological	\$2.6M
Climate	\$1.5M (+ \$350K OAP)
Socioeconomic	\$400K

Goals

- 1. Collect scientifically sound, geographically comprehensive data** (biological, climate, and socioeconomic) in the U.S. coral reef areas
- 2. Develop consistent and comparable methods and standard operating protocols**
- 3. Deliver data, data products, and tools** to the coral reef conservation community
- 4. Provide periodic assessments** of the status and trends of the nation's coral reef ecosystems
- 5. Develop and maintain strong partnerships** with federal, state/territory, and academic partners
- 6. Provide context** for interpreting localized monitoring



Overview



- Six NOAA teams implement NCRMP biological, climate and socioeconomic data collection across 10 priority locations
- Biological cycle: 3 years in Pacific, 2 years in Atlantic
- Socioeconomic cycle: 5 years (7 inhabited jurisdictions)

Overview

Focus on four monitoring themes:

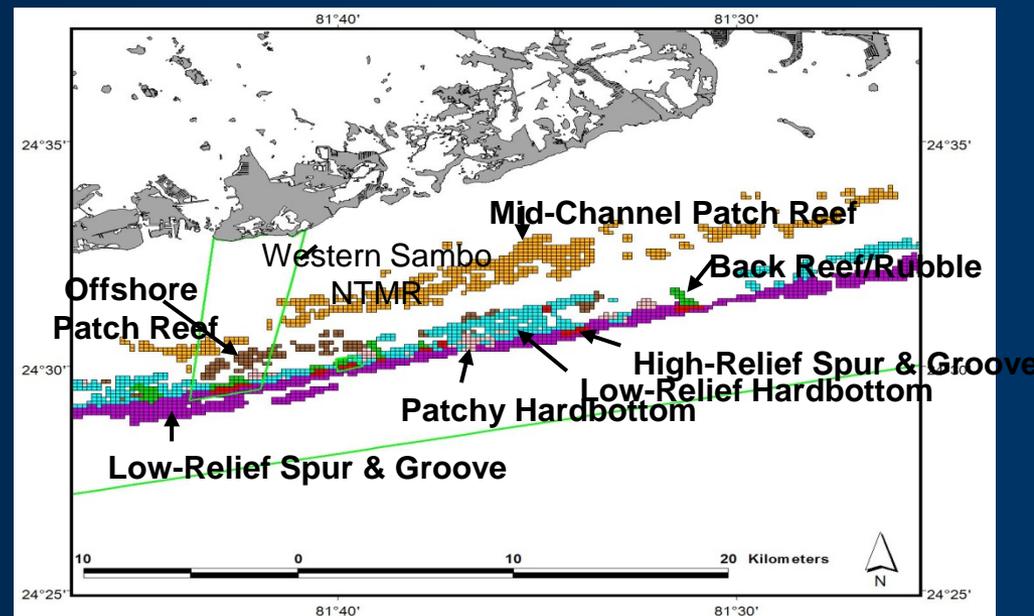
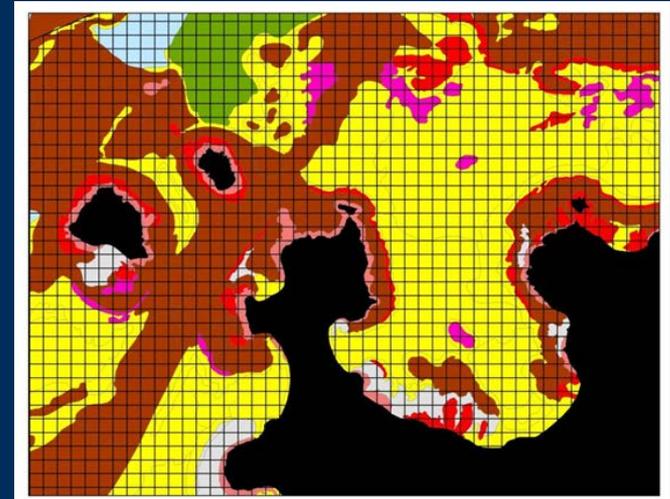
- Benthic community structure
- Fish community structure
- Climate impacts
- Socioeconomic condition

Monitoring Themes	Tier 1 (Critical) Indicators
Biological	
• Coral and Benthos	<ul style="list-style-type: none">• Coral abundance and size structure• Coral condition (bleaching and disease incidence, mortality)• Benthic percent cover• Benthic key species• Rugosity
• Reef Fish	<ul style="list-style-type: none">• Fish abundance and size structure• Fish diversity• Fish key species
Climate	
• Thermal Stress	<ul style="list-style-type: none">• Temperature/thermal stress• Vertical thermal structure
• Ocean Acidification	<ul style="list-style-type: none">• Carbonate chemistry
• Ecological Impacts*	<ul style="list-style-type: none">• Coral growth rate*• Bioerosion rate*• Community structure* (cryptofauna diversity)
Socioeconomics	<ul style="list-style-type: none">• Knowledge, attitudes, and perceptions of coral reefs and management strategies• Participation in coral reef activities• Population changes and distribution• Economic dependence on coral reefs

Stratified random sampling design

Strata:

- Region (can include management zones)
- Habitat type
- Depth zones
 - * 0-30 m hard bottom areas
- Site allocation is statistically driven and iterative process – better maps will improve precision and optimize sampling
- Island/region, sub-region and strata scale, rather than providing site specific information – ‘wide but thin’
- Distinct from permanent site-based monitoring approach

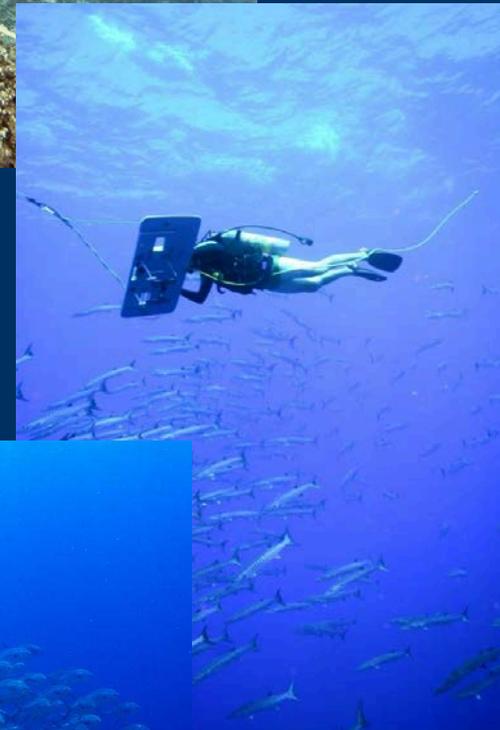


Sample Grid at 100 x 100 m

Benthic and fish data

Benthic Transects

- Demographic metrics: Adult (and juvenile) abundance & size, species/genus, partial mortality, condition, rugosity
- Benthic cover: Photo-quadrats (Pacific), Line-point intercept (Atlantic)
- Benthic key species (Atlantic)



Fish Stationary Point Counts

- Fish abundance, size, species

Towed-diver (Pacific)

- Key benthic and fish species



Key contributions – Benthic data

- Benthic community structure and coral populations data across multiple spatial scales provides the essential foundation of data to support applied management and other projects:
 - Spatial & MPA planning and assessment
 - Spatial predictive models -> coral species habitat utilization
 - Prioritize potential coral restoration areas
 - Reef resilience assessments
 - ESA corals: 1) Spatial predictive models
2) larval connectivity model
3) population assessments
 - Evaluation of the effects of bleaching events and disease outbreaks
 - Identify areas for research projects



~24 strata (4 MPAs)

Key contributions – Benthic data

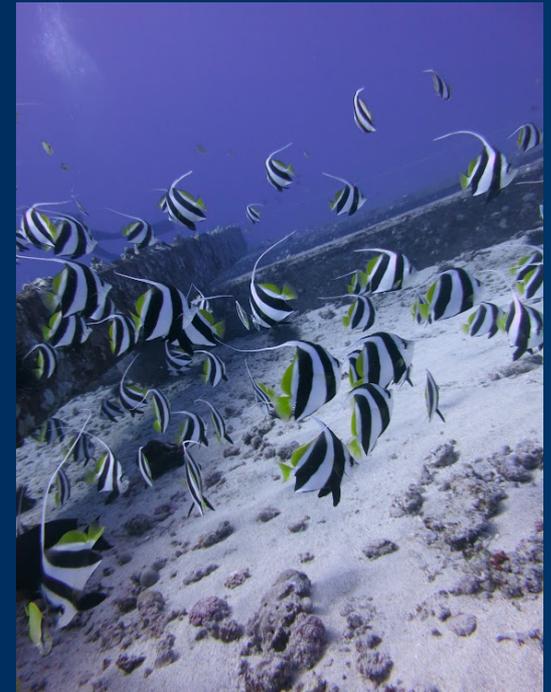
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~24 strata (4 MPAs)

Key contributions – Fish data

- Island-wide estimates of fish species richness, abundance and size provide biogeographic patterns -> spatial & MPA planning and assessment
- Fishery-independent size structured data useful for fisheries management needs – direct link to Regional Fishery Management Councils
- ESA reviews
- Highly leveraged partnerships – partners benefit from a monitoring program that is larger than their jurisdiction
- Broader conservation and management science
 - Data spans wide gradients of human impact, oceanography and management
 - Understanding of what “natural” coral reef fish assemblages are like and how they vary – essential for understanding human impacts and setting management targets



Climate data



NOAA OCEAN ACIDIFICATION PROGRAM

Tiered climate approach to characterizing OA and thermal impacts across spatial and temporal scales

Class III: M_{Ap}CO₂ buoys (PR, FL, HI, *AS)

Class II: Diurnal subsurface carbonate chemistry

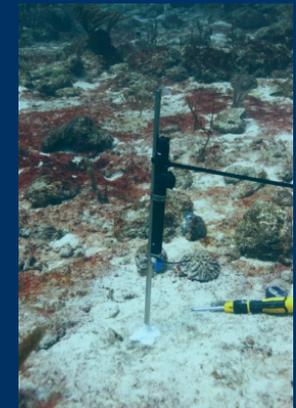
Class I: Vertical thermal structure

Class 0: Discrete carbonate chemistry water sampling

Ecological impacts: coral growth & calcification, bioerosion, community structure (Class II & III)

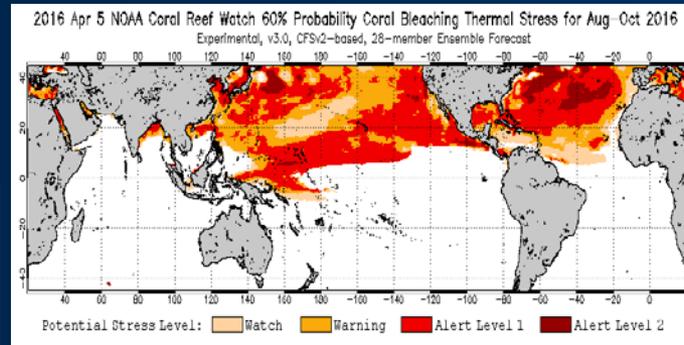
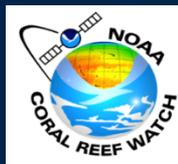


Cheeca Rocks M_{Ap}CO₂



Class I
Lang Bank, St Croix

Satellite-derived SST:



Class I sites on Florida Reef Tract

Key contributions – Climate data

- Tracking exposure and response to global climate drivers:
 - Exposure: tracking reef exposure to warming and ocean acidification *in-situ*
 - Response: Tracking realized carbonate accretion/erosion, benthic shifts, and biodiversity impacts
- These datasets allow a firm foundation for modeling both vulnerability and future reef states
- Satellite data provides managers current reef environmental conditions to quickly identify areas at risk



Overview – Socioeconomic data

Primary data collection

- Resident surveys take place in each jurisdiction
- One set of core questions as well as selected jurisdictional specific questions relevant to local management needs

Secondary data collection

- Focused on indicators such as population change, economic impacts and community well-being
- Relies on public sources like US Census Bureau, jurisdiction governments, federal agencies

Participation in reef activities

Perceived resource condition

Attitudes towards coral reef management strategies and enforcement

Awareness and knowledge of coral reefs

Human population changes near coral reefs

Economic impact of coral reef fishing to jurisdiction

Economic impact of dive/snorkel tourism to jurisdiction

Community well-being

Cultural importance of reefs

Participation in behaviors that may improve coral reef health

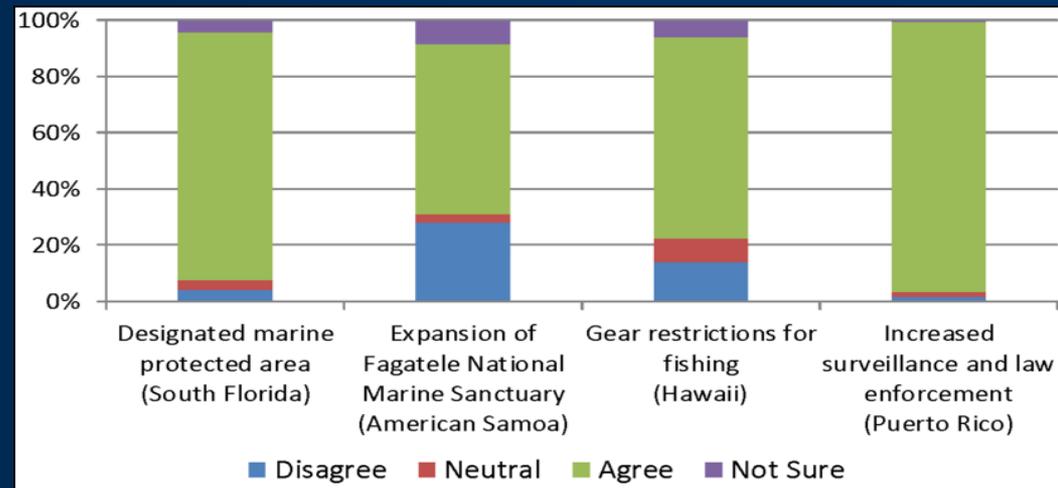
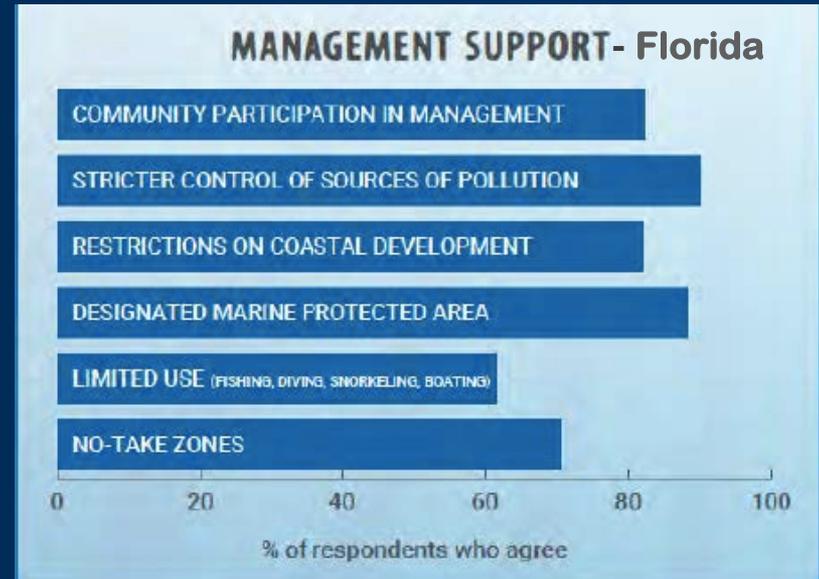
Physical infrastructure

Awareness of coral reef rules and regulations

Governance

Key contributions – Socioeconomic data

- Data collected from representative sample of the entire population (rather than special interest groups)
- Findings to date show that support for management measures is relatively high
- Provides data that decision-makers care about (e.g. what the public thinks)



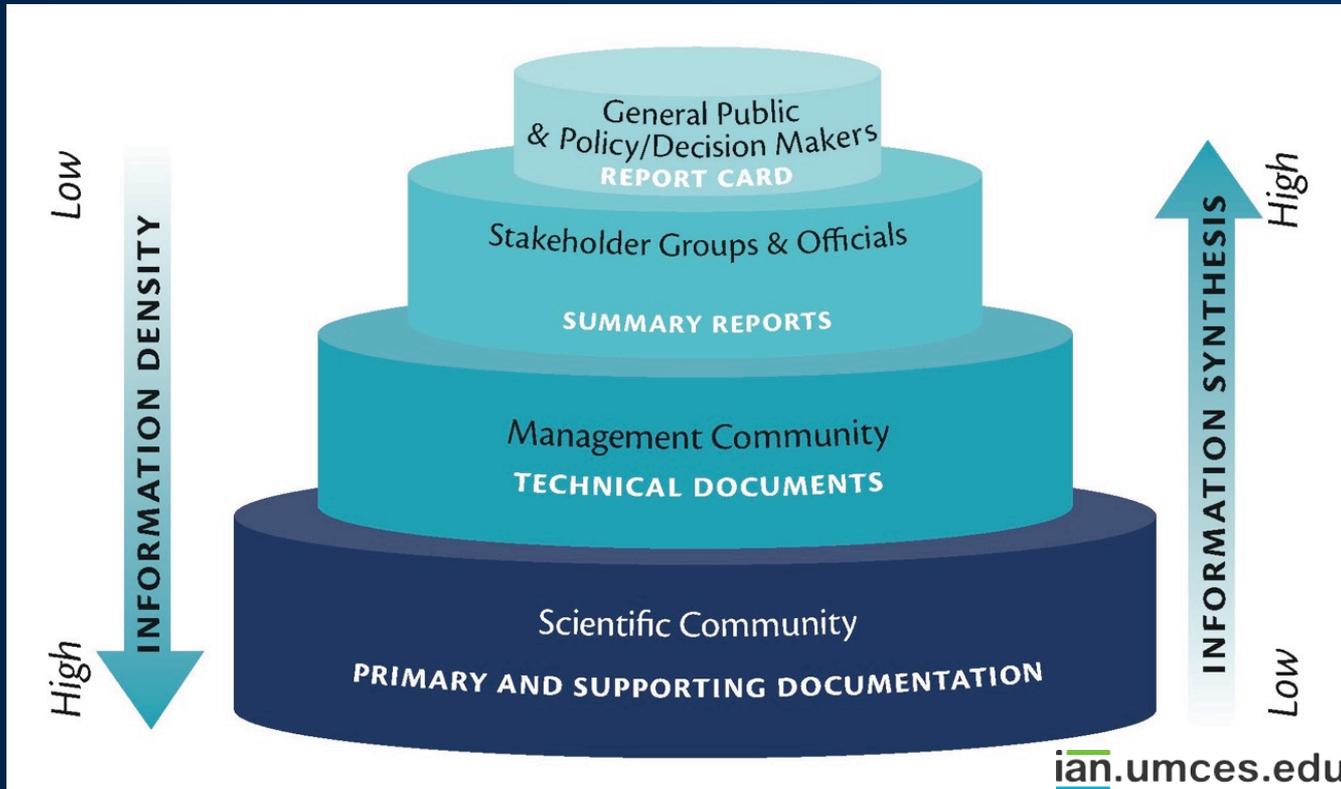
Key contributions and strengths

Geographically comprehensive, long-term characterization of U.S. coral reef benthic, fish, climate and socioeconomic conditions

- Data supports ecosystem approach to management planning and assessment
- Provides context for site-based management and data
- Advances fundamental understanding within and across themes
- Provides ability to report to Congress/NOAA leadership/public

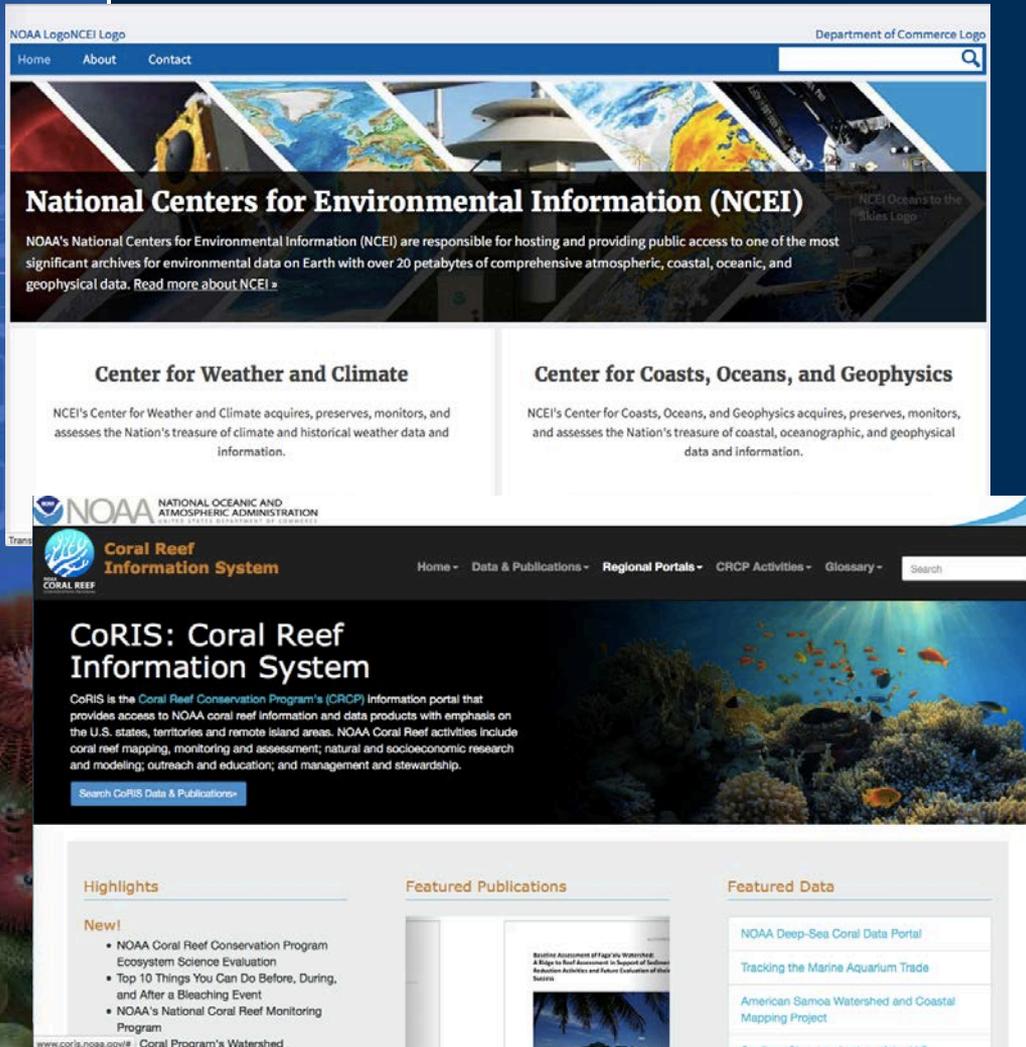


Information dissemination



Information dissemination

- Data



The screenshot shows the NOAA National Centers for Environmental Information (NCEI) website. At the top, there is a navigation bar with 'Home', 'About', and 'Contact' links, and a search box. The main header features a collage of environmental images and the text: 'National Centers for Environmental Information (NCEI)'. Below this, a paragraph states: 'NOAA's National Centers for Environmental Information (NCEI) are responsible for hosting and providing public access to one of the most significant archives for environmental data on Earth with over 20 petabytes of comprehensive atmospheric, coastal, oceanic, and geophysical data. Read more about NCEI »'. The page is divided into two columns. The left column is titled 'Center for Weather and Climate' and describes its role in acquiring, preserving, monitoring, and assessing climate and historical weather data. The right column is titled 'Center for Coasts, Oceans, and Geophysics' and describes its role in acquiring, preserving, monitoring, and assessing coastal, oceanographic, and geophysical data. Below these columns is the NOAA logo and the text 'NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION U.S. DEPARTMENT OF COMMERCE'. The bottom section of the screenshot shows the 'Coral Reef Information System' (CoRIS) website. It has a navigation bar with 'Home', 'Data & Publications', 'Regional Portals', 'CRCP Activities', and 'Glossary' links, and a search box. The main header features a coral reef image and the text: 'CoRIS: Coral Reef Information System'. Below this, a paragraph states: 'CoRIS is the Coral Reef Conservation Program's (CRCP) information portal that provides access to NOAA coral reef information and data products with emphasis on the U.S. states, territories and remote island areas. NOAA Coral Reef activities include coral reef mapping, monitoring and assessment; natural and socioeconomic research and modeling; outreach and education; and management and stewardship.' There is a search box labeled 'Search CoRIS Data & Publications'. The bottom section of the CoRIS website is divided into three columns: 'Highlights', 'Featured Publications', and 'Featured Data'. The 'Highlights' column lists 'New!' items: 'NOAA Coral Reef Conservation Program Ecosystem Science Evaluation', 'Top 10 Things You Can Do Before, During, and After a Bleaching Event', and 'NOAA's National Coral Reef Monitoring Program'. The 'Featured Publications' column shows a book cover titled 'Baseline Assessment of the Watershed: A Bridge to Reef Assessment in Support of Sustainable Resource Activities and Future Evaluation of Reef Success'. The 'Featured Data' column lists 'NOAA Deep-Sea Coral Data Portal', 'Tracking the Marine Aquarium Trade', and 'American Samoa Watershed and Coastal Mapping Project'.

Data repositories

- Public Access to Research and Results (PARR) requires – documentation, archived and accessible
- NCEI (NOAA) – National Centers for Environmental Information
- CoRIS (NOAA) – Coral Reef Information System

Information dissemination

- Data

NOAA Logo NCEI Logo Department of Commerce Logo

Home About Contact

NOAA NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Coral Reef Information System Home - Data & Publications - Regional Portals - CRCP Activities - Glossary - Search

HOME > NOAA'S NATIONAL CORAL REEF MONITORING PROGRAM

NOAA's National Coral Reef Monitoring Program

Coral reefs are among the most valuable ecosystems on earth, providing people with goods and services that include food, storm protection, and recreational opportunities. Despite their importance, coral reef ecosystems are in decline from a myriad of man-made and natural threats.

Search the CoRIS collection for NCRMP materials:

Search Clear

NCRMP Activities

- Tracking Biological Trends
- Monitoring Climate-Driven Impacts
- Understanding Socioeconomic Connections

In response, the NOAA Coral Reef Conservation Program established an integrated and focused monitoring effort with partners across the U.S.—the National Coral Reef Monitoring Program (NCRMP).

The goals of NCRMP monitoring are to:

U.S. DEPARTMENT OF COMMERCE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION Login Help About Feedback

Data repositories

- Public Access to Research and Results (PARR) requires – documentation, archived and accessible
- NCEI (NOAA) – National Centers for Environmental Information
- CoRIS (NOAA) – Coral Reef Information System

CORIS SITE HOME SEARCH BROWSE SEARCH TIPS

Search

Use capital letters for boolean operators (AND, OR, NOT)

 Search Clear All

Additional Options

Records shown from: This Site
Click here to select different site or configure search.

WHEN
Click here to enter content date criteria.

Intersecting Fully within

Start Date: (yyyy-mm-dd)

End Date: (yyyy-mm-dd)

WHERE
Click here to enter location criteria.

Anywhere Intersecting Fully within

Select A Region

Results 1-25 of 178 record(s) 1 2 3 4 5 6 Last

Expand results

- NOAA Coral Reef Conservation Program. U.S. National Coral Reef Monitoring Program (NCRMP): Overview
- National Coral Reef Monitoring Program (NCRMP): Who, what, where, when
- National Coral Reef Monitoring Program: Assessment of coral reef communities in Puerto Rico using the Coral Demographics method
- National Coral Reef Monitoring Program: Assessment of coral reef communities in Flower Garden Banks National Marine Sanctuary using the Coral Demographics method
- National Coral Reef Monitoring Program: Assessment of coral reef communities in Puerto Rico using the Line Point-Intercept (LPI) method
- National Coral Reef Monitoring Program: Assessment of coral reef communities in U.S. Virgin Islands (USVI) using the Belt Transect fish census method
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Transferring data from data.nodc.noaa.gov...

Information dissemination

- Data and peer-reviewed pubs, technical reports

NATIONAL CORAL REEF MONITORING PROGRAM Biological Monitoring Atlantic/Caribbean

St. John and St. Thomas U.S. Virgin Islands



Mission Data Report

December 2015

NOAA NOS
National Centers for Coastal Ocean Science



Summary Report of Baseline Surveys and Installations Conducted in 2015 in the National Marine Sanctuary of American Samoa¹

Prepared by: Coral Reef Ecosystem Program
NOAA Pacific Islands Fisheries Science Center

Submitted to: National Marine Sanctuary of American Samoa

SUMMARY

This report describes baseline survey data from the National Marine Sanctuary of American Samoa (NMSAS) and the National Marine Sanctuary of Hawaii (NMSH) in March 2015. CRMEP implements the Pacific Coral Reef Ecosystem Program (PCREP) ecosystem-scale interdisciplinary coral reef monitoring program. Collectively, these resulting data provide a baseline for future monitoring. Furthermore, since the survey methods used are directly comparable to those used in other PCREP sites, we can continue this work periodically so that we can track coral reef health over time and in comparison to other sites.

STRUCTURE OF THIS REPORT

The report is divided into three sections. The first section reports population and adult (> 5 cm) coral colony density, partial mortality as measured by the percent of coral condition meter causing diseases combined, and bleaching reported for total scleractinians, gen...

The ocean and climate change section reports on sea level rise, sea level rise, and carbonate accretion rate (g aragonite saturation state and carbon). The fish section reports the site-level *Acanthurus lineatus* (alone). In addition, benthic substrate ratio (ratio of sum of macroalgae and turf cover) at pool site-level data up to the island...

¹ NOAA Pacific Islands Fisheries Science Center Data Report DR-16-007
Issued 26 April 2016

doi:10.7279/5N9114K



NOAA Coral Reef Watch

2015 Annual Summaries of Thermal Conditions Related to Coral Bleaching for NCRMP Jurisdictions

Executive Summary

2015 was the warmest year ever recorded on land and in the ocean. On October 2, 2015 NOAA's Coral Reef Watch (CRW) declared the third confirmed global coral bleaching event (after the 1997-1999 and 2010 global events) was underway, as anomalously warm ocean temperatures were causing widespread coral bleaching in Hawaii and the Caribbean. This global event began in the North Pacific Ocean in the summer of 2014 and expanded to the South Pacific Ocean, Indian Ocean, and Atlantic Ocean in 2015. The event has been closely associated with an extensive warm "blob" in the northeastern Pacific Ocean lasting from late 2013 through late 2015, a partially formed 2014-15 El Niño, and a record-strength El Niño event that developed in mid-2015 and peaked in late 2015. This bleaching event is still ongoing in 2016 and will likely persist into 2017.

U.S. coral reefs have been hit disproportionately hard. For two years in a row, U.S. coral reefs experienced bleaching on a large spatial scale, including record bleaching events in the Hawaiian Islands, American Samoa, the Commonwealth of the Northern Mariana Islands (CNMI), and Florida. Data analysis based on CRW's daily global 5-km satellite monitoring shows that during the two-year period of 2014-2015, 100% of the U.S. coral reef areas experienced some levels of bleaching thermal stress, with Alert Level 2 thermal stress (typically associated with widespread coral bleaching and mortality) experienced by 41% of the U.S. coral reef areas and Alert Level 1 thermal stress (typically associated with significant bleaching) by 39% of the U.S. coral reef areas. Meanwhile, globally 99% of coral reef areas (including U.S. reef areas) experienced some levels of bleaching thermal stress, with only 9% for Alert Level 2 and 22% for Alert Level 1.

While CRW's heritage, operational twice weekly global 50-km satellite coral bleaching thermal stress monitoring products (Liu et al., 2013) continues to alert coral reef communities to the development of thermal stress, in February 2015, CRW initiated an enhancement of its next-generation daily global 5-km satellite coral bleaching thermal stress monitoring products (Liu et al., 2014) that are now featured on the CRW website as core products of CRW's management decision support system. The 5-km global products include Sea Surface Temperature (SST), SST Anomaly, Coral Bleaching HotSpot, Degree Heating Week (DHW), a 7-day maximum Bleaching Alert Area, and a 7-day SST Trend product. The 3-km products provide much higher spatial and temporal resolution, and more data per pixel, and use new climate data records and climatology, which allow them to monitor thermal conditions globally at or near reef scales.

February 2015 also saw the release of CRW's new Regional Virtual Stations Bleaching Thermal Stress Gauges, based on this 3-km product suite and CRW's Coral Bleaching Thermal Stress Outlook. CRW's both 5-km Regional Virtual Stations and heritage 50-km Virtual Stations provide detailed coral bleaching thermal stress information for select global and U.S. reef locations based on CRW's near real-time satellite monitoring products, but the 3-km Regional Virtual Stations are much more comprehensive than the 50-km Virtual Stations they replace. The configuration of the 3-km

NOAA Technical Memorandum CRCP 24

National Coral Reef Monitoring Program Socioeconomic Monitoring Component

Summary Findings for American Samoa, 2014



NOAA Coral Reef Conservation Program
Silver Spring, MD

March 2016



U.S. Department of the Interior
National Oceanic and Atmospheric Administration
National Ocean Service

S. Prizker

Dr. Kathryn Sullivan
Administrator

Dr. W. Russell Collier
Assistant Administrator

PIFSC Data Report DR-15-008

Issued 2 April 2015



Pacific Reef Assessment and Monitoring Program Fish monitoring brief: American Samoa 2015

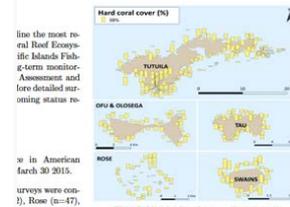


Figure 2. Mean hard coral cover at sites surveyed.

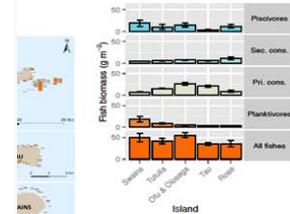


Figure 3. Mean consumer group fish biomass (± standard error). Primary consumers are herbivores and detritivores, and secondary consumers are piscivores and invertebrates.

Information dissemination

- Data and peer-reviewed pubs, technical reports, outreach/education/tools

NATION
Biologic
Mission
December
NOAA NOS
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The Commonwealth of the Northern Mariana Islands



NOAA FISHERIES

Pacific Islands Fisheries Science Center

The Pacific Islands Fisheries Science Center (PIFSC) in Honolulu, Hawaii is one of six NOAA Fisheries National Marine Fisheries Service science centers nationally.

PIFSC is responsible for research on marine fisheries, protected species (U.S. and the endangered Hawaiian monk seal and other marine mammals and sea turtles), and ecosystems in the entire western and central Pacific Ocean, including coral reefs, seagrass (near island) habitats and prairie (open ocean) environments, and the human communities that rely on these natural marine ecosystems.

Annual Report of Baseline Surveys and Installations in 2015 in the National Marine Sanctuary of American Samoa!

Reef Ecosystem Program
A Pacific Islands Fisheries Science Center

baseline survey of the National Marine Sanctuary of American Samoa! implements the P... disciplinary co... mpling work... ulating data pro... e survey metho... y comparable... ristically so th... 1 in comparison

REPORT

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2015 Annual Summaries
Coral Bleaching

Executive Summary

2015 was the warmest year ever recorded in the Coral Reef Watch (CRW) dataset for the 1999 and 2010 global events was underway causing widespread coral bleaching in Hawaii, North Pacific Ocean in the summer of 2014, and the Indian Ocean in 2015. The event "Bleob" in the southeast Pacific Ocean formed 2014-15 El Niño, and a tropical storm peaked in late 2015. This bleaching event is... U.S. coral reefs have been hit disproportionately... experienced bleaching on a large spatial scale... Islands, American Samoa, the Commonwealth of Florida. Data analysis based on CRW's data... two-year period of 2014-2015, 100% of the... bleaching thermal stress, with Alert Level 2... coral bleaching and mortality) experienced at... thermal stress (typically associated with age... bleaching, globally 96% of coral reef area

Measuring coral reef fishes by taking humans out of the picture

THE CONVERSATION

April 17, 2016 6:13am EDT

Authors

Adrian Pearson
Hawaii Inshore, National Oceanic and Atmospheric Administration

Heidi D. Williams
National Oceanic and Atmospheric Administration



Coral reefs and associated fisheries are of vital social, cultural and economic importance. Fish... Fisheries, public outreach

We are living in the Anthropocene, a period where humans are the dominant force on Earth's natural systems. Coral reef ecosystems are no exception.

Widely known for their striking beauty and diversity, coral reefs also have great social, cultural and economic importance. At human-populated islands, small-scale and... are often vital sources of protein and income.

... that even relatively low levels of fishing can have large... measure the status and therefore sustainability of coral... could think that an isolated reef ecosystem situated from... provide an ideal benchmark against which other coral... as sources of fish - can be compared. But in a recent c... that simple.

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CONNECTIONS BETWEEN CORAL REEFS & COASTAL COMMUNITIES

TAKEAWAYS FROM HAWAII

NOAA's Coral Reef Conservation Program monitors the biological, socioeconomic, and climate conditions of US coral reef areas and communities. This includes collection of socioeconomic variables including demographics, human use of coral reef resources, as well as knowledge, attitudes, and perceptions of coral reefs and coral reef management through the use of surveys and existing data. The takeaways below are based on the survey results for Hawaii.

MANAGEMENT SUPPORT
The majority of people support management strategies to improve protection.

USES OF RESOURCES
Swimming 82%, Fishing 81%, Beach Recreation 85%

TEMPERATURE & RESILIENCY
Years of residence impacts perceptions of marine resource conditions. Residents who have lived in Hawaii for over 10 years are more likely to have a more negative opinion concerning the condition of marine resources.

PERCEPTIONS
PARTICIPANTS WERE ASKED HOW THE AMOUNT OF CORAL AND CONDITION OF OCEAN WATER QUALITY HAS CHANGED IN THE PAST 10 YEARS.

VALUES & AWARENESS
1. Hawaiian residents who agreed that "coral reefs are important to Hawaii's culture" were more likely to rely more heavily on coral reefs and be more familiar with the various threats faced by coral reefs.
2. Hawaiian residents who agreed that "coral reefs protect Hawaii from erosion and natural disasters" were more likely to respond more favorably to management options and believe that the threat level to coral reefs is "high" or "extreme."

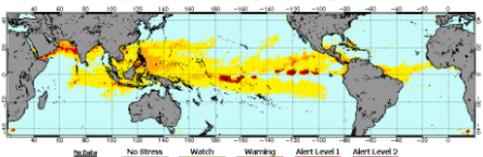
THREAT FAMILIARITY
How familiar are you with these potential threats facing coral reefs?
Climate change 68%, Coral Bleaching 38%, Pollution 44%, Ocean acidification 44%, Beach erosion/galvanizing 72%

CORAL REEF INFO SOURCES & DEGREE OF TRUST TO PROVIDE ACCURATE INFO
TOP SOURCES: 1) Newspapers/Print, 2) TV, 3) Internet
TRUST: 1) Trust, 2) Don't Trust, 3) Neither

Coral Reef Watch Satellite Monitoring

Click on buttons below image to change parameter; click on image to navigate to parameter's web page.

NOAA Coral Reef Watch Daily 5-km Geo-Polar Blended Night-Only Bleaching Alert Area 74 Max 13 Jun 2018



Switch to 50-km products

Alerts HotSpot DHW SST Anomaly SST Trend Outlook Doldrums Virtual Stations

El Niño bleaching patterns web page

CO2 ↑407.70

Information dissemination

- Data and peer-reviewed pubs, technical reports, outreach/education/tools
- Additionally: conference presentations, presentations to managers, direct relationships, team/region specific web portals, working directly with NCRMP team members

NATION
Biologic

NOAA Fisheries

Mission

December

NOAA NOS
National C

The Commonwealth of the Northern Mariana Islands

Pacific Islands Fisheries Science Center (PIFSC): Coral Reef Ecosystem Division (CRED)

PIFSC's Coral Reef Ecosystem Division (CRED) conducts research and provides information products on the condition and trends of the coral reef ecosystems in the U.S. Pacific Islands region. Domestic and international scientists, managers, and decision makers routinely use our scientific data, models, and tools to address the myriad of threats that face these unique and valuable resources.

Ecosystem Monitoring: An Integrated Approach

To inform ecosystem-based management and conservation strategies, CRED leads programs of coral reef ecosystem assessment and long-term monitoring, benthic habitat mapping, marine debris surveys and removal, oceanographic and water quality studies, and applied research. With an interdisciplinary, integrated approach to research, CRED collects data about fishes, corals, algae, invertebrates, and microbes and the physical structure and chemical properties of their environments. This information is critical to expanding our knowledge of the biodiversity of coral reef ecosystems and to assessing the effects of major threats to coral reefs.

Pacific-wide data sets of ecological and oceanographic variables around populated and unpopulated islands allow us to link island-scale results to remote ecological reference areas. Data modeling efforts allow for the evaluation and forecasting of changes in ecosystem conditions at large spatial scales on coral reefs.

Annual Report of Baseline Surveys and Installations in 2015 in the National Marine Sanctuary of American Samoa!

NOAA Pacific Islands Fisheries Science Center

baseline survey of the National Marine Sanctuary of American Samoa

2015 Annual Summaries Coral Bleaching

2015 was the warmest year ever recorded in the Coral Reef Watch (CRW) dataset for the 1999 and 2010 global events was underway causing widespread coral bleaching in Hawaii, North Pacific Ocean in the summer of 2014, and the Atlantic Ocean in 2015. The event "Bleeb" in the southeast Pacific Ocean formed 2014-15 El Niño, and a tropical storm peaked in late 2015. This bleaching event is U.S. coral reefs have been hit disproportionately experienced coral bleaching on a large scale in the Pacific Islands, American Samoa, the Commonwealth of the Northern Mariana Islands, and Florida. Data analysis based on CRW's data from two years of 2014-2015, 100% of the bleaching thermal stress, with Alert Level 2 coral bleaching and mortality experienced if thermal stress (typically associated with age 15 months, globally 96% of coral reef area

Measuring coral reef fishes by taking humans out of the picture

THE CONVERSATION

April 17, 2016 @ 1:08pm EDT

Authors: Adam Pearson, Heather Williams

We are living in the Anthropocene, a period where humans are the dominant force on Earth's natural systems. Coral reef ecosystems are no exception. Widely known for their striking beauty and diversity, coral reefs also have great social, cultural and economic importance. At human-populated islands, small-scale and less often vital sources of protein and income. Even relatively low levels of fishing can have large impacts on coral reef ecosystems. To measure the status and therefore sustainability of coral reefs, an ideal benchmark against which other coral reef systems can be compared. But in a recent study, we found that many coral reef managers are not using the same simple

CONNECTIONS BETWEEN CORAL REEFS & COASTAL COMMUNITIES

TAKEAWAYS FROM HAWAII

NOAA's Coral Reef Conservation Program monitors the biological, socioeconomic, and climate conditions of US coral reef areas and communities. This includes collection of socioeconomic variables including demographics, human use of coral reef resources, as well as knowledge, attitudes, and perceptions of coral reefs and coral reef management through the use of surveys and existing data. The takeaways below are based on the survey results for Hawaii.

MANAGEMENT SUPPORT

The majority of people support management strategies to improve protection.

Conservation/Restrictions to Development	82%
Education, Outreach/Outreach to Stakeholders	81%
Restoration/Recreation/Recreation	78%
Enforcement/Regulation/Control	75%

USES OF RESOURCES

Swimming	82%
Fishing	81%
Beach Recreation	80%

TEMPURE & CONDITION

Years of residence impacts perceptions of marine resource conditions. Residents who have lived in Hawaii for over 10 years are more likely to have a more negative opinion concerning the condition of marine resources.

PERCEPTIONS

PARTICIPANTS WERE ASKED HOW THE AMOUNT OF CORAL AND CONDITION OF OCEAN WATER QUALITY HAS CHANGED IN THE PAST 10 YEARS.

Better	5%
Worse	44%
No Change	31%
Not Sure	19%

VALUES & AWARENESS

1. Hawaiian residents who agreed that "coral reefs are important to Hawaii's culture" were more likely to rely more heavily on coral reefs and be more familiar with the various threats faced by coral reefs.

2. Hawaiian residents who agreed that "coral reefs protect Hawaii from erosion and natural disasters" were more likely to respond more favorably to management options and believe that the threat level to coral reefs is "high" or "extreme."

THREAT FAMILIARITY

How familiar are you with these potential threats facing coral reefs?

Climate Change	68%
Coral Bleaching	38%
Pollution	44%
Overfishing	44%
Sea Level Rise	72%

CORAL REEF INFO SOURCES & DEGREE OF TRUST TO PROVIDE ACCURATE INFO

TOP SOURCES

- 1) Newspapers/Print
- 2) TV
- 3) Internet

TRUST

Trust	1
Don't Trust	2
Neither	3

Coral Reef Watch Satellite Monitoring

Click on buttons below image to change parameter; click on image to navigate to parameter's web page.

NOAA Coral Reef Watch Daily 5-km Geo-Polar Blended Night-Only Bleaching Alert Area 74 Max 13 Jun 2016

Switch to 50-km products

CO2 +497.70

Alerts HotSpot DHW SST Anomaly SST Trend Outlook Doldrums Virtual Stations

[El Niño bleaching patterns web page](#)

New product: Status and trends report cards

Benthic indicators:

- Benthic cover (coral, macroalgae, CCA)
- Key adult populations
- Key juvenile populations
- Partial mortality
- Diversity
- Herbivory

Fish indicators:

- Reef fish biomass
- Sharks and piscivores
- Sustainability
- Diversity

Climate indicators:

- Thermal stress
- Ocean acidification
- Reef material growth

Socio indicators:

- Management in place
- Awareness of coral reefs
- Pro-environmental behavior
- Support for management

Each indicator requires baseline and thresholds for scoring



Challenges

- Site scale monitoring needs— compatibility between national and jurisdictional programs
- Field fatigue – Understaffed, lack of time and/or funding for non-standard analysis and thought
- NOAA ship time and boats – remote locations, few options, long advance planning, unreliable supply
- Level funding does not take into account cost of doing business increases (something has to give)



Future directions

- Better integration across socio and biophysical
- Refine survey design – increase sampling allocation efficiency (need better maps!)
- Plan to compare localized monitoring efforts (e.g. Territorial Coral Reef Monitoring Program (TCRMP)) with NCRMP to assess comparability
- Water quality – gap in ecosystem approach, but not compatible with NCRMP scales (and funding!)
- Continue to refine and target reporting products and data, including data accessibility and visualization

