



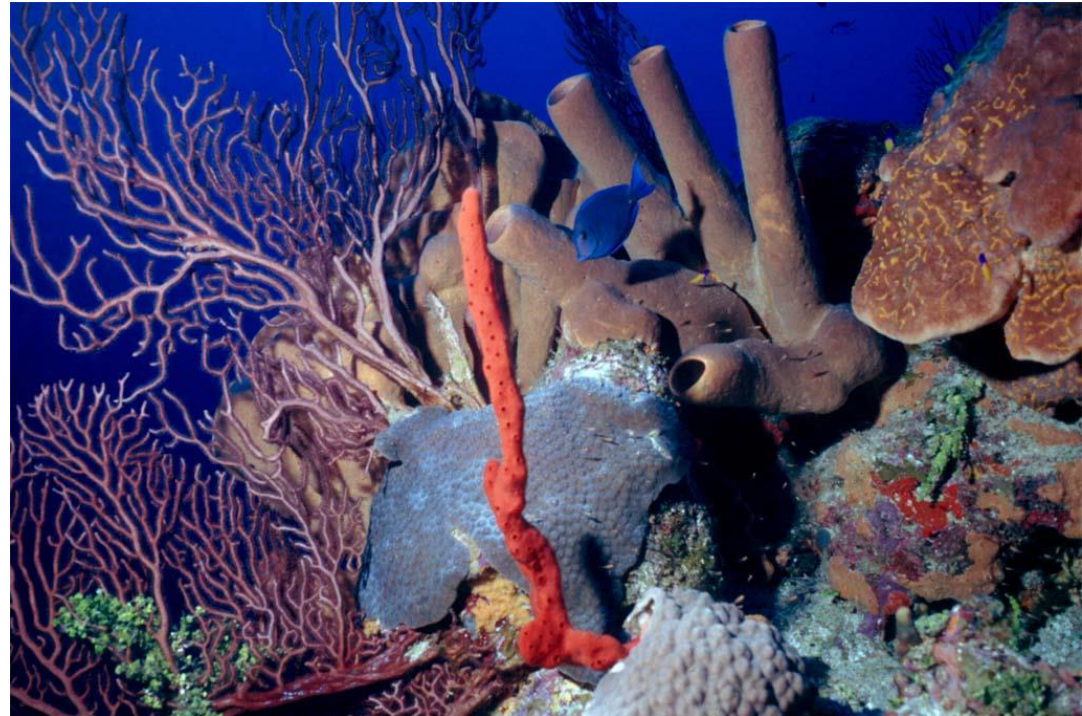
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CORAL REEF
CONSERVATION PROGRAM

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The Coral Reef Conservation Program's National Coral Reef Monitoring Plan





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Presentation Outline

- NCRMP Genesis & Framework
- Monitoring Components
- Expected NCRMP Outcomes/Outputs





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What is NCRMP?

- National Coral Ref Monitoring Plan
- A Plan to bring the NOAA Coral Program's core monitoring efforts under one umbrella
- Aimed at status and trends information
 - How are our reefs doing over time?

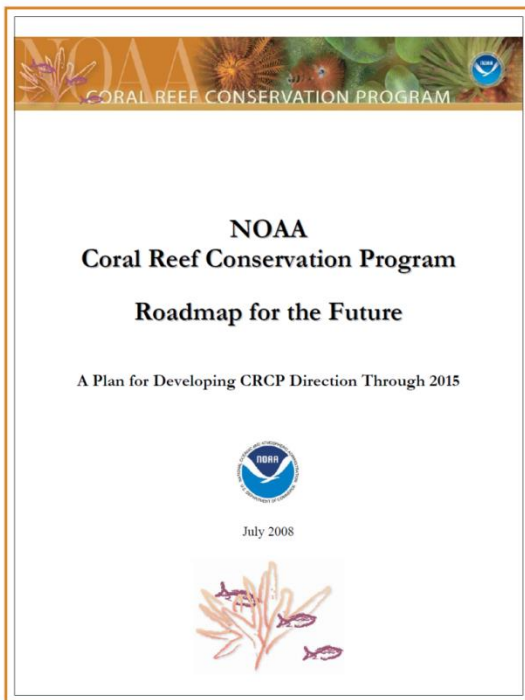




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Genesis of NCRMP

- CRCP External Program Review 2007
- CRCP Roadmap Process (2008-2010)
- CR Ecosystem Integrated Observing System Workshops – CREIOS (2008/2009)
- The Boreman Report (2009)
- CRCP monitoring was inconsistent spatially and temporally, unbalanced, and expensive





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NCRMP Framework

- “Core”, Permanent CRCP program
- 4 Themes (benthic, fish, climate, human dimensions)
- NCRMP Working Group (est. 2010) – 16 member team
- 15% of CRCP budget ~ \$4M - \$4.5M
- Align with CRCP Geographic Priorities
- 0-30m depth
- Encourages Partnerships
- “In development”: 2013-2015



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NCRMP Goals

- Collect biological, climate, and socioeconomic data in U.S. coral reef areas
- Consistent and comparable methods and standard operating procedures (SOPs)
- Develop and maintain strong partnerships
- Deliver high-quality data, data products, and tools
- Provide context for interpreting results of localized monitoring
- Provide periodic assessments of the status and trends of the nation's coral reef ecosystems



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Core NCRMP Elements

	Tier 1 - Critical	Tier 2 - Important	Tier 3 - Informative
Benthos/ Coral	<ul style="list-style-type: none"> • Percent cover of benthic organisms/substrate • Coral condition (<i>e.g.</i>, bleaching, disease) • Abundance and size structure • Rugosity • Benthic diversity • Key species 	<ul style="list-style-type: none"> • Growth rate • Bioerosion rates 	<ul style="list-style-type: none"> • Reproduction • Recruitment • Mortality • Metabolic performance • Microbial communities • Non-indigenous species • Protected species
Fish	<ul style="list-style-type: none"> • Abundance and size structure • Diversity • Key species 		<ul style="list-style-type: none"> • Reproduction • Population fecundity • Recruitment • Distribution • Trophic structure • Non-indigenous species • Protected species
Climate	<ul style="list-style-type: none"> • Temperature/thermal stress • Vertical thermal structure • Carbonate chemistry 	<ul style="list-style-type: none"> • Insolation • Wave energy • Hydrodynamics 	<ul style="list-style-type: none"> • Nutrients/productivity • Meteorology • Impacts of global change
People	<ul style="list-style-type: none"> • Participation in coral reef activities • Knowledge, attitudes, and perceptions of coral reefs and management strategies • Population changes and distribution • Economic dependence on coral reefs 	<ul style="list-style-type: none"> • Land use • Land cover 	<ul style="list-style-type: none"> • Economic value



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Socio-Economic Monitoring

1. Participation in reef activities
2. Perceived resource condition
3. Attitudes toward coral reef management strategies and enforcement
4. Awareness and knowledge of reefs
5. Human population changes near coral reefs
6. Economic impact of coral reef fishing to jurisdiction
7. Economic impact of dive/snorkel tourism to jurisdiction
8. Community well-being
9. Cultural importance of reefs
10. Participation in behaviors that may improve coral reef health
11. Physical infrastructure
12. Awareness of coral reef rules and regulations
13. Governance





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Socio-economic Monitoring

- Led by CRCP HQ and Hollings Marine Lab
- Jurisdictional Knowledge/Attitude/Perception Surveys every 3-4 years
 - Florida, U.S. Virgin Islands, Puerto Rico, Hawai'i, American Sāmoa, Guam, and CNMI
 - Participation in reef activities (including snorkeling, diving, fishing, harvesting)
 - Perceived resource condition
 - Attitudes toward coral reef management strategies and enforcement
 - Awareness and knowledge of coral reefs
 - Cultural importance of reefs
 - Participation in behaviors that may improve coral reef health
- Population and Economic Dependence (US Census/Gov't info)
 - Economic impact of coral reef fishing to jurisdiction
 - Economic impact of dive/snorkel tourism to jurisdiction
 - Awareness of coral reef rules and regulations
 - Governance



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Climate Monitoring

- What are the spatial and temporal trends in temperature and ocean acidification on coral reefs?
- Led by AOML/CRED/CRW
- Joint with NOAA's OA Program & other collaborating partners
- Complex nested monitoring design - high spatial/low temporal resolution to low spatial/high temporal resolution

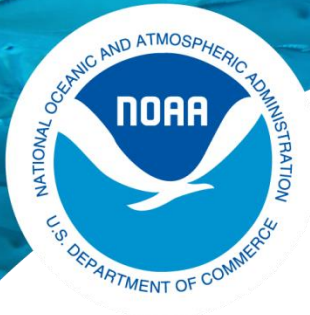




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Climate Modeling Approach

- Thermal Stress
 - Satellite SST measures, Degree Heating Weeks, thermal stratification
- Ocean Acidification
 - Class 0 (random) – bottle samples
 - TCO₂ & Total Alkalinity
 - Class I (fixed) – Subsurface Temperature Recorders (STRs) - Thermal Stratification
 - Class II (fixed) - Automatic Water Samplers (RAS) – Diurnal variation
 - 48 hour sampling TCO₂ & TA



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Climate Modeling Approach

Class III (fixed) “Sentinel” Sites

- MAP CO2 Buoy
- Calcification Accretion Units (CAUs), Autonomous Reef Monitoring Structures (ARMS), and Bioerosion Monitoring Units (BMUs)
- Assessments of benthic cover, coral growth, macroinvertebrates, fish assemblages etc.
- CO2 time-series AND Ecosystem Response
- Atlantic: Flower Garden Banks (2014/2015), Florida Keys (Cheeca Rocks 12/11), Puerto Rico (La Parguera 1/09)
- Highly leveraged sites

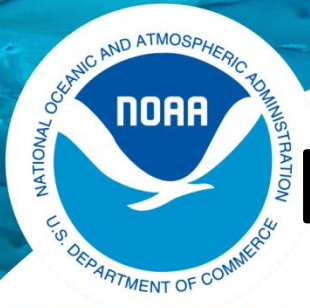


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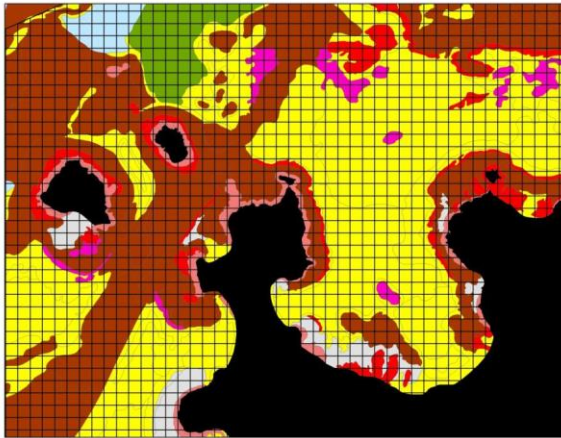
Biological Monitoring



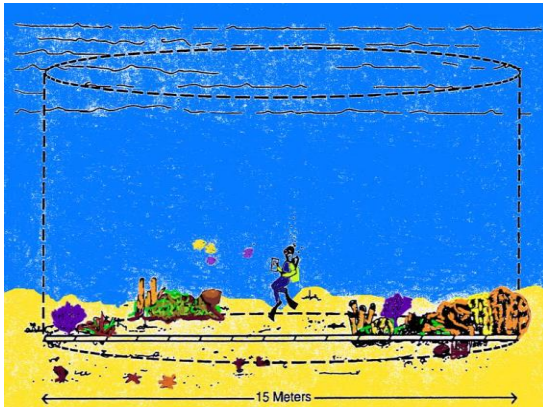
- Co-Led by NCCOS/Biogen & NMFS SEFSC
- Biennial diver surveys in Atlantic Jurisdictions (Florida, USVI, Puerto Rico, Flower Gardens)
- Benthic Organisms (focus on coral) & coral reef fishes
- “Wide but thin” approach



Biological Monitoring Approach



- Grid-Based Stratified Random Probability Driven Design
- Benthics/Corals
 - Line Point Intercept protocol for % Cover
 - Demographic belt transect protocol for coral size/abundance
 - “Key Species” belt transect – conch, diadema, spiny lobster
- Fish
 - Bohnsack/Bannerot Stationary Point Counts (RVC)
 - NOS Biogeography 25x4 Belt Transect
- Other
 - Assist with carbonate water quality (Class 0)

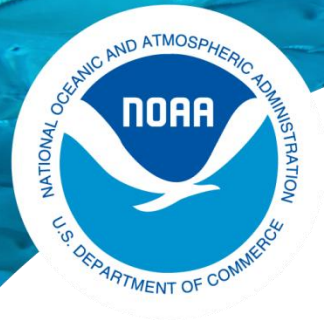




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Benefits of NCRMP

- Consistent, long term and stable
- Scalable
- Complementary to local/jurisdictional monitoring
- Standard protocols & training
- Sharing of platforms and divers
- Full Access to All NCRMP data
 - Data
 - Data Products
 - Protocols and Survey Designs
 - Monitoring Reports
 - “State of the Reefs” quadrennial reports
- NOAA takes care of data management



NCRMP is not Everything

- “Wide but Thin Approach” provides backbone, coarse, jurisdiction level monitoring
- Complementary: Puts local/regional monitoring in context
- Doesn’t replace State/Jurisdiction monitoring
- Won’t capture short/mid-term trends (hurricanes, disease/bleaching outbreaks etc)
- Won’t capture: cryptic species, juvenile corals, rare species/events, spawning aggregations, marine debris etc.



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SEFSC/AOML Collaboration

- SEFSC/AOML – leadership in Atlantic/Caribbean monitoring
- Opportunities for cross-training, co-staffing
- Opportunities for sharing platforms & gear
- Joint Analysis Opportunities
 - Reef Permanence
 - Habitat Structure
 - Coral Recruitment/Settlement
 - Net impacts of temperature, OA, grazing (diadema/parrotfish)



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THANK YOU

For More Information:

- Overall/Data Management
 - Jessica Morgan - CRCP
- Biological Monitoring
 - Jennifer Schull – NMFS
 - Randy Clark – NOS/Biogeo
- Socioeconomics
 - Peter Edwards – CRCP
- Climate
 - Derek Manzello & Ian Enochs – AOML

