USCRTF CC Working Group/ Florida Reef Resilience Program

August 9, 2017

Fort Lauderdale

Florida Reef Resilience Program

3-Party M.O.A. in 2004

MEMORANDUM OF AGREEMENT

BETWEEN THE

U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL OCEAN SERVICE

AND THE

STATE OF FLORIDA
DEPARTMENT OF ENVIRONMENTAL PROTECTION

AND THE

GREAT BARRIER REEF MARINE PARK AUTHORITY
AUSTRALIA

NOS Agreement Code: MOA-2004-161/1252

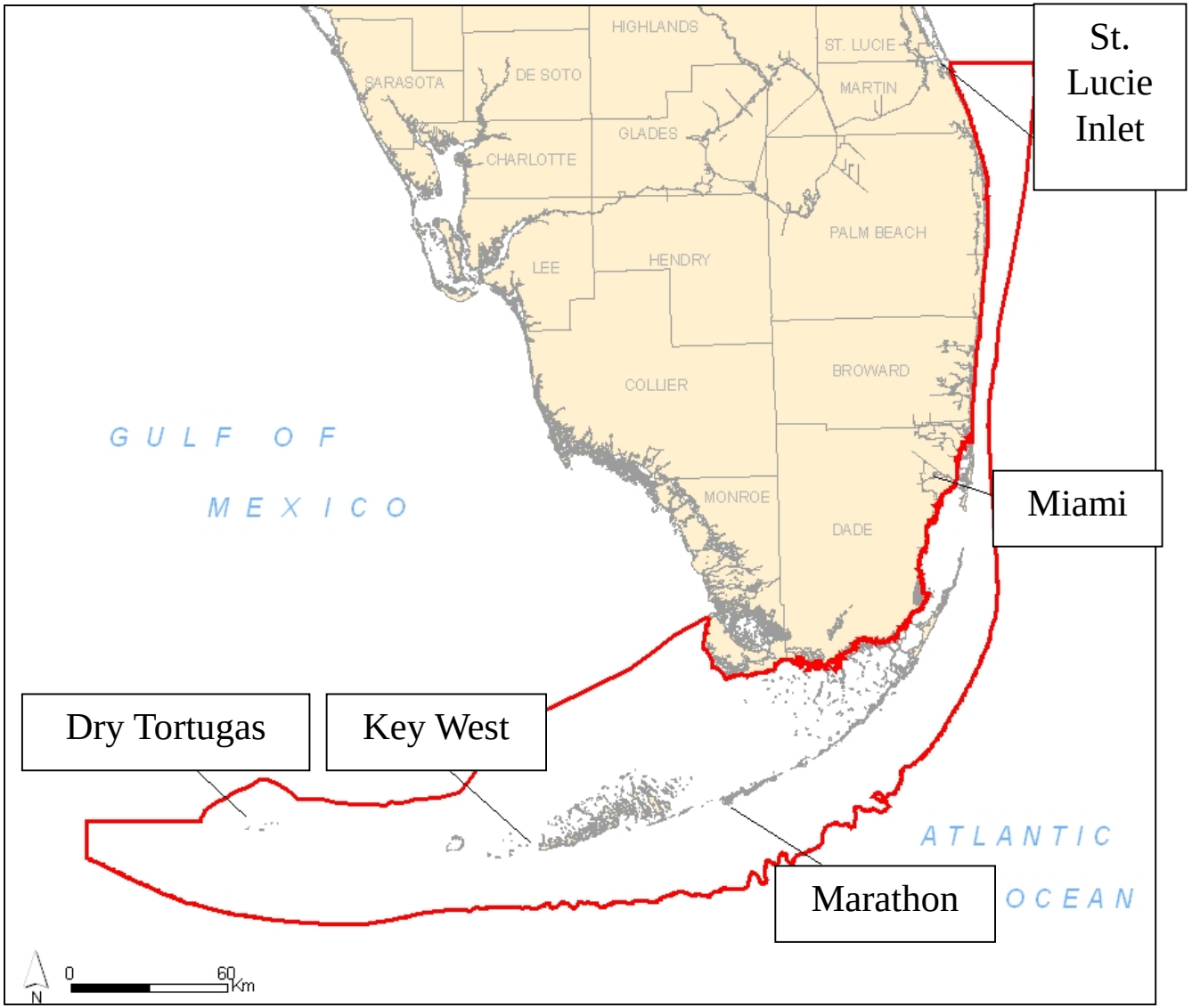
Australian Government
Great Barrier Reef
Marine Park Authority

The purpose of this Agreement is to establish a partnership between the Parties that will benefit the FKNMS and GBRMPA marine protected areas to better facilitate the exchange of information between the organizations and within their respective regions. We agree to partner in our efforts to achieve a shared goal of improving coral reef resilience to ensure the long-term sustainability of coral reefs. We share many of the same challenges in managing and studying barrier coral reef environments.

FRRP Partnerships

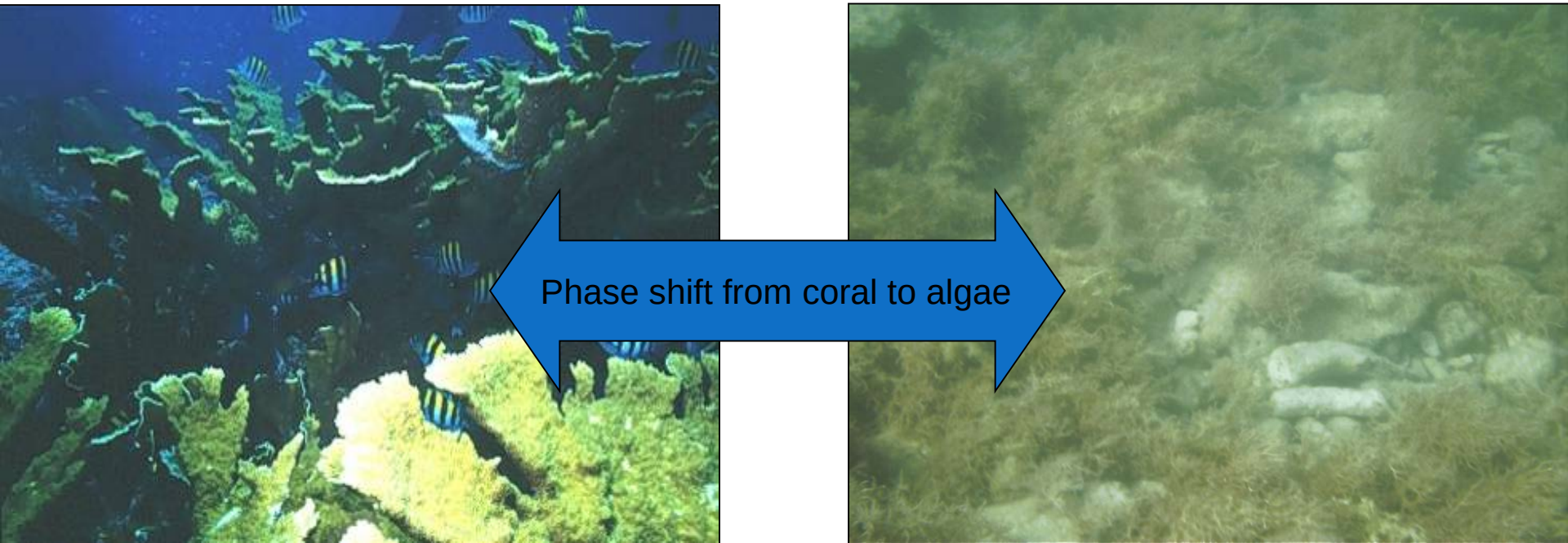
The FRRP Region

The FRRP spans the shallow coral reef system from St. Lucie Inlet to the Dry Tortugas



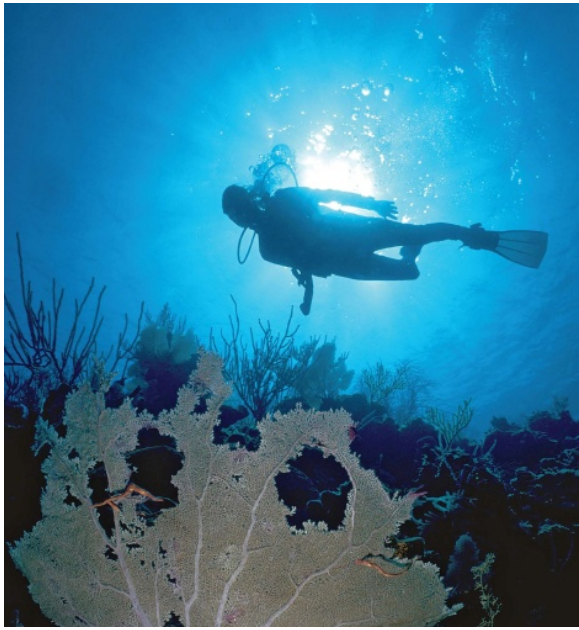
Defining “Resilience”

- The FRRP defines resilience as the ability of systems to absorb disturbances, to resist phase shifts, and to regenerate and reorganize in order to maintain key functions and processes in a time span relevant to resource use and management activities.



Driving Questions

- Under a global climate change scenario, are there reef areas/coral populations destined to become the '*winners*'[1] and others destined to become the '*losers*?'
- If so, what are some of the driving factors influencing this pattern?
- If so, how will people be affected (i.e. fishing, dive tourism, etc.)?
- Are there management strategies that can enhance resistance/tolerance/ recovery of South Florida's coral reefs?



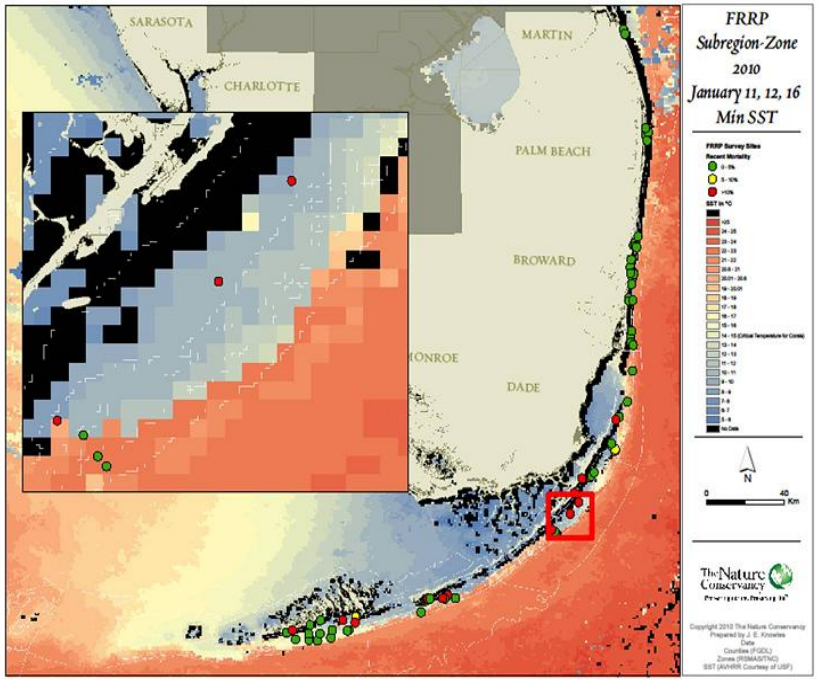
1. Loya Y, Sakai K, Yamazato K, Nakano Y, Sambali H, Van Woesik R (2001) ***Ecology Letters* 4: 122-131**

The FRRP's Vision

- Marine resource managers and reef users have new tools that enhance their ability to identify and map the condition of coral reefs, understand the factors that create and maintain resilience, and recognize the economic and cultural values associated with reefs. Empowered with this knowledge, managers and users jointly develop, implement, and support strategies that improve ecological conditions and economic sustainability over time.

Biophysical Science

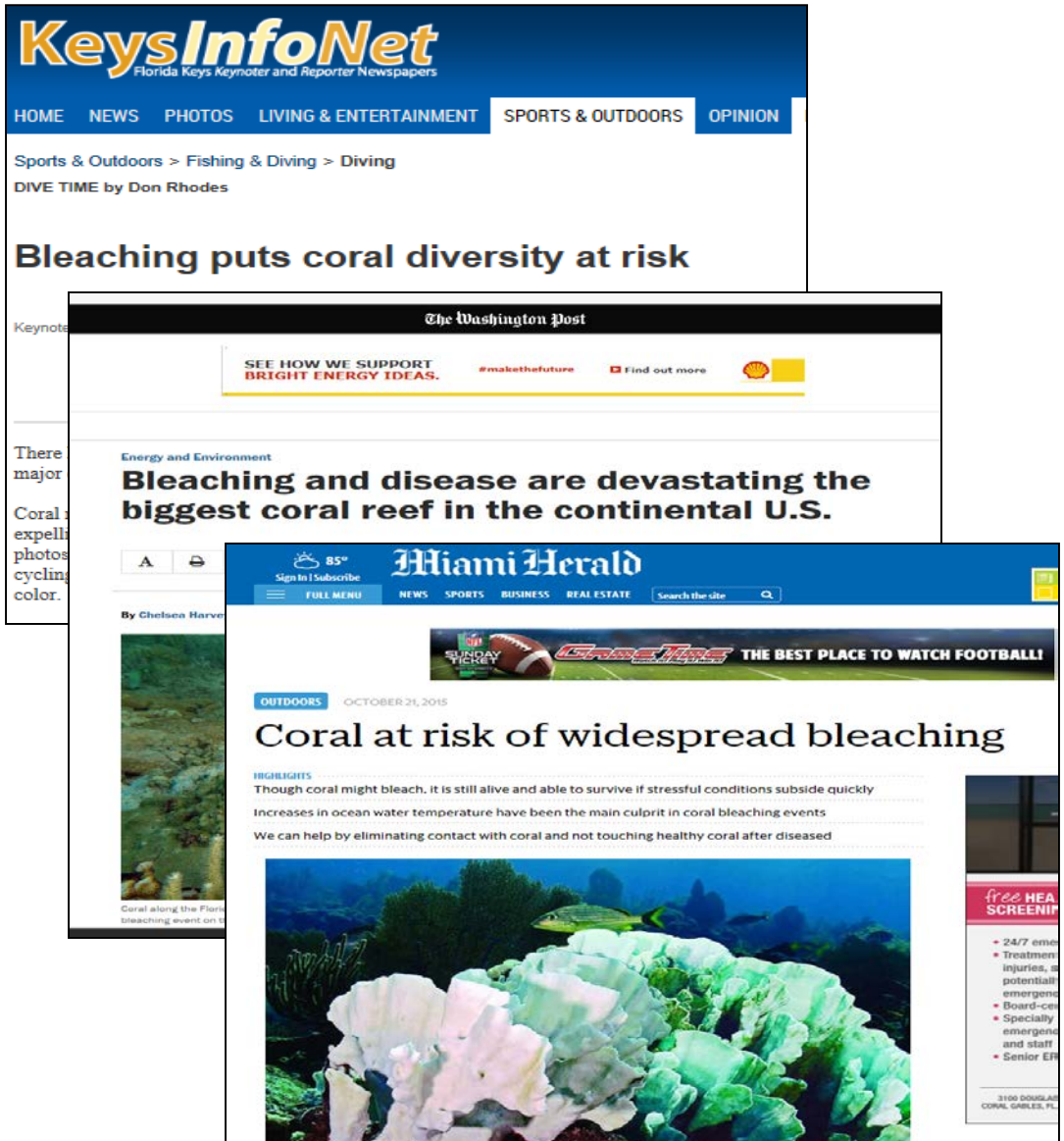
- "Disturbance Response Monitoring" focused on coral bleaching and diseases
- Relationships of stressors (e.g. sea temperature and water quality) to coral condition and bleaching resistance
- Remote sensing
- Data sharing



Human Dimensions Science

- Understanding Coral Reef Use: Snorkeling, SCUBA Diving and Recreational Fishing in the Florida Keys by Residents and Non-Residents During 2006-2007
- Linking the Economy and Environment of the Florida Keys 2007-08
- SEFL Coral Reef Initiative Project 10 on historical reef use, current trends and stakeholder perceptions
- An Economic Analysis of the South Florida Reef Tract: Developing an Annual Assessment Tool

Communications



- Media
- Meetings
- Workshops
- Conferences
- Website -

www.frrp.org

Bleaching Response Plan

Chapter 1: Early Warning System

Chapter 2: Impact Assessment (Disturbance Response Monitoring)

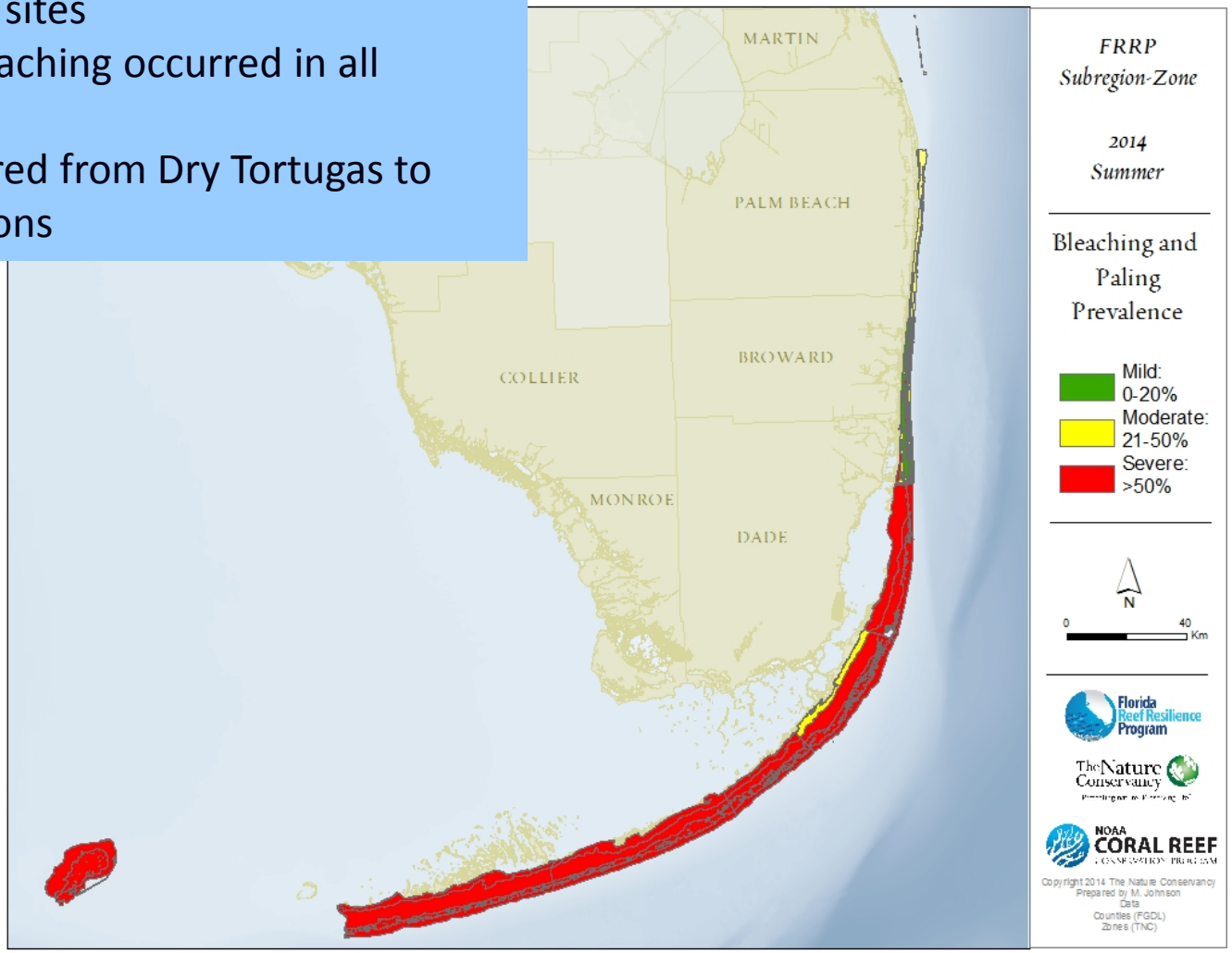
Chapter 3: Communications

Chapter 4: Management Actions

2014 Summer Bleaching Results

- For 2014, 172 surveyed sites
- Moderate to severe bleaching occurred in all regions
- Severe bleaching occurred from Dry Tortugas to Broward-Miami sub-regions

Each year, a "Quick-Look Report" is produced based on the survey results. These may be found online at *www.frrp.org*.



2014 Summer Bleaching Results

Sub-Region	Zone	% Paling Prevalence	% Bleaching and Paling Prevalence	# of Sites
Dry Tortugas	Lagoon	19.55	70.20	11
Dry Tortugas	Forereef	20.41	55.38	17
Lower Keys	Inshore	33.52	77.18	3
Lower Keys	Mid-Channel	6.09	71.42	6
Lower Keys	Offshore Patch	15.86	80.22	9
Lower Keys	Forereef	18.98	79.83	24
Middle Keys	Inshore	32.65	52.42	2
Middle Keys	Mid-Channel	18.73	68.86	2
Middle Keys	Offshore Patch	24.73	77.66	5
Middle Keys	Forereef	29.79	59.06	8
Upper Keys	Inshore	16.67	50.00	2
Upper Keys	Mid-Channel	54.04	72.78	9
Upper Keys	Offshore Patch	12.66	90.37	2
Upper Keys	Forereef	17.18	77.98	11
Biscayne	Inshore	27.05	89.26	3
Biscayne	Mid-Channel	4.35	65.22	1
Biscayne	Forereef	10.75	61.38	15
Broward- Miami	Undetermined	11.54	42.31	1
Broward-Miami	Inshore	16.16	61.56	10
Broward-Miami	Deepwater	7.84	15.69	1
Broward-Miami	Inner Reef	18.95	54.41	8
Broward-Miami	Middle Reef	7.22	28.20	8
Broward-Miami	Outer Reef	13.75	29.90	5
Deerfield	Inshore	5.56	22.22	1
South Palm Beach	Inshore	9.38	25.00	2
South Palm Beach	Outer Reef	1.96	5.88	2
North Palm Beach	Inshore	28.57	28.57	2
Martin	Inshore	1.91	29.39	2

2014 Summer Disease Results

Sub-Region	Zone	% Disease Prevalence	# of Sites
Tortugas--Dry Tortugas NP	Forereef	0.00	17
Tortugas--Dry Tortugas NP	Lagoon	0.00	11
Lower Keys	Forereef	0.00	24
Lower Keys	Inshore	2.27	3
Lower Keys	Mid Channel	0.00	6
Lower Keys	Offshore Patch Reef	0.00	9
Middle Keys	Forereef	0.85	8
Middle Keys	Inshore	0.00	2
Middle Keys	Mid Channel	0.00	2
Middle Keys	Offshore Patch Reef	1.99	5
Upper Keys	Forereef	0.69	11
Upper Keys	Inshore	0.00	2
Upper Keys	Mid Channel	14.64	9
Upper Keys	Offshore Patch Reef	0.85	2
Biscayne	Forereef	0.00	15
Biscayne	Inshore	0.00	3
Biscayne	Mid Channel	0.00	1
Broward-Miami	Deepwater	0.00	1
Broward-Miami	Inner Reef	0.00	8
Broward-Miami	Inshore	0.71	10
Broward-Miami	Middle Reef	0.00	8
Broward-Miami	Outer Reef	0.00	5
Broward-Miami	Undetermined	3.70	1
Deerfield	Inshore	5.56	1
North Palm Beach	Inshore	0.00	2
South Palm Beach	Inshore	0.00	2
South Palm Beach	Outer Reef	0.00	2
Martin	Inshore	0.00	2

CLIMATE CHANGE ACTION PLAN

FOR THE

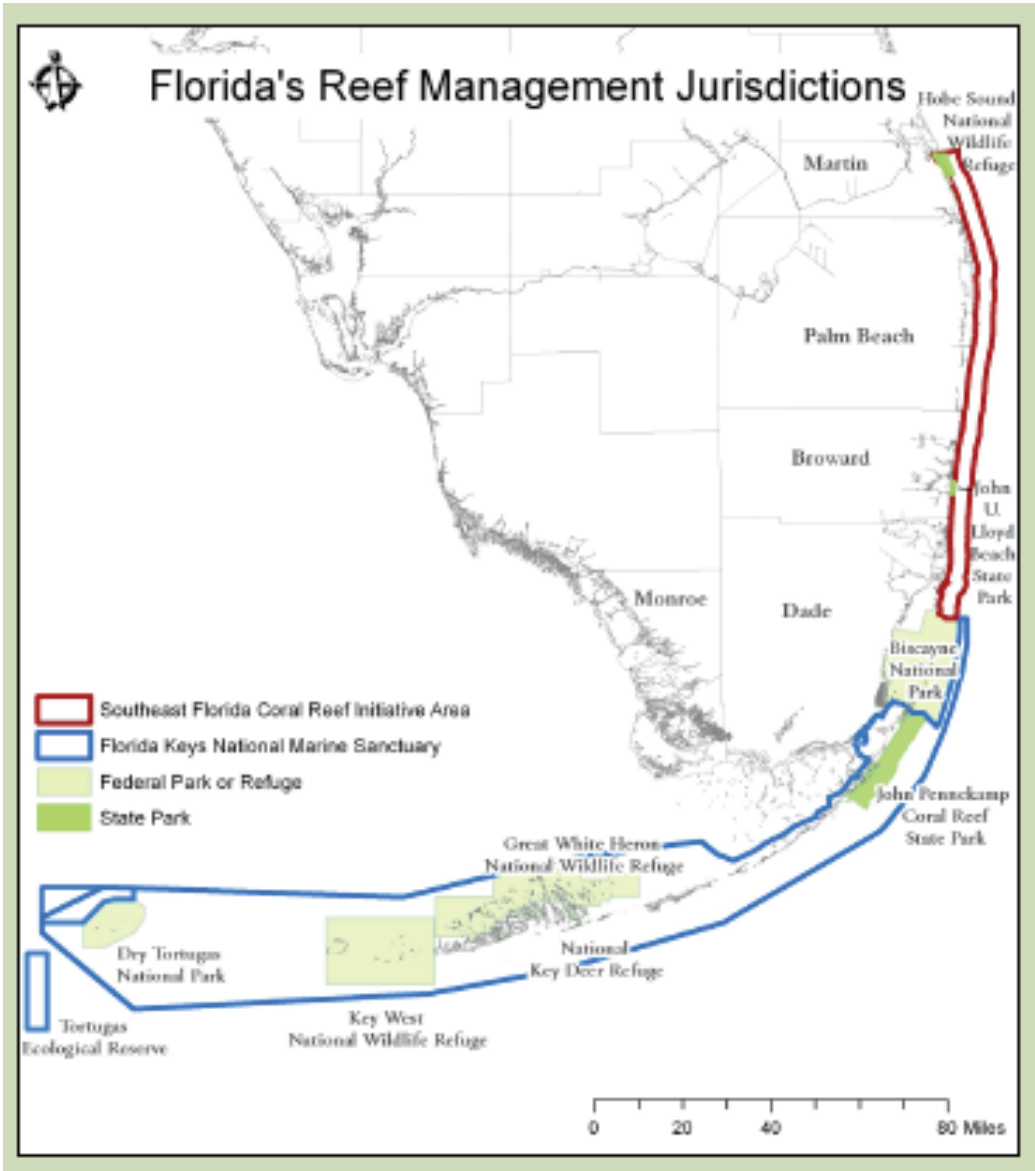
Florida Reef System

2010-2015

Global threats make local actions more important than ever.

Climate Change Action Plan for the Florida Reef System 2010-2015

Recognizes the need to reduce local impacts to increase resilience and offers a framework of adaptable actions throughout the entire 300 nm of the FL Reef System to comprehensively address the complex factors associated with climate change.



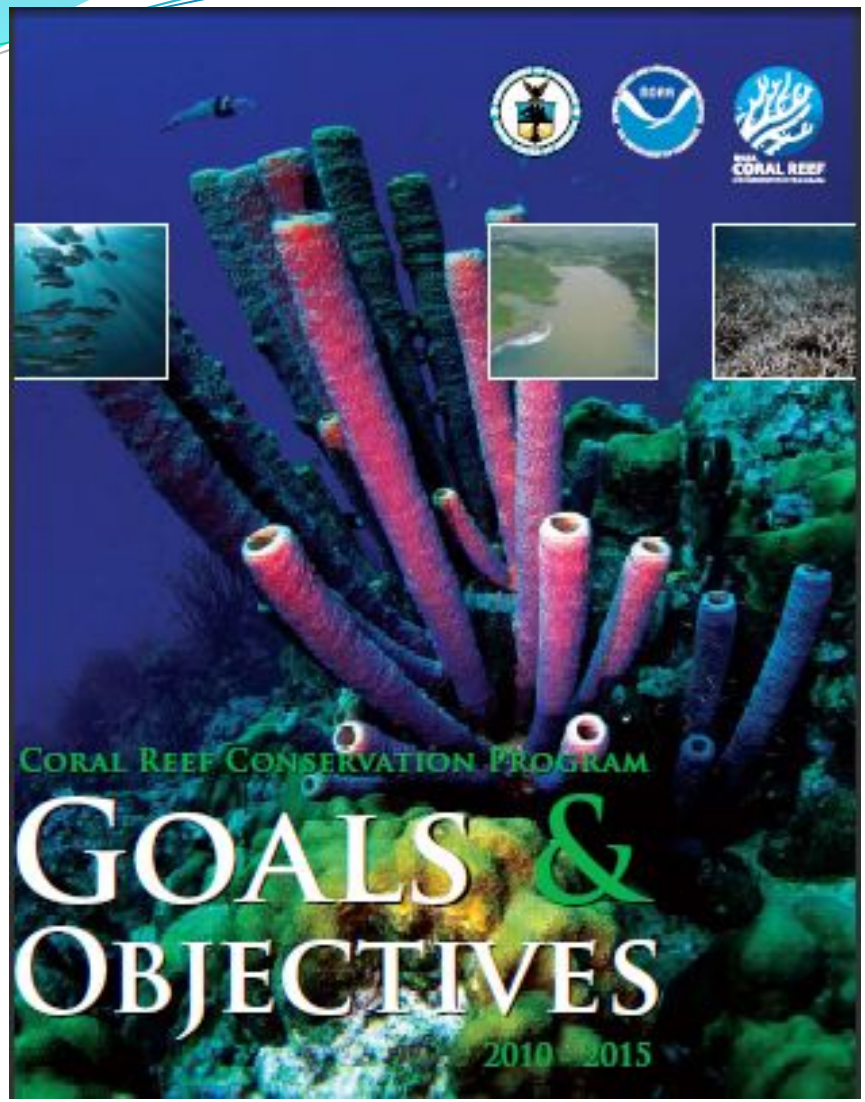
Action Plan Goals

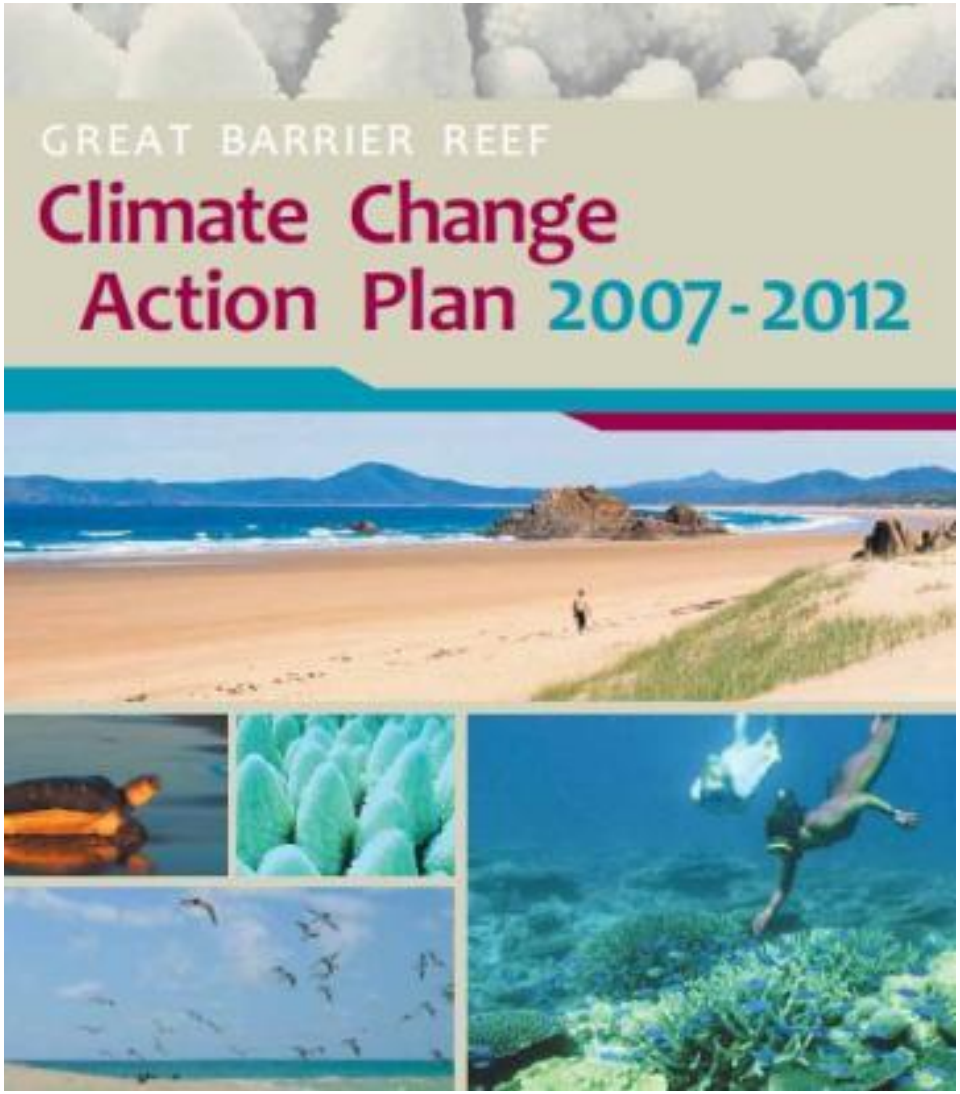
- **Goal 1: Management** - Increase coral reef resilience to climate change and ocean acidification through effective management strategies and actions.

- **Goal 2: Public Engagement** - Identify, understand, and communicate risks and vulnerability of Florida's coral reef ecosystems, ecosystem services, and dependent human communities to climate change and ocean acidification.

- **Goal 3: Science** - Enhance strategic management of Florida's coral reef ecosystems through improved and applied understanding, forecasts, and projections of climate change and ocean acidification impacts.

Draws heavily from…





…and numerous other sources

Actions derived from:

- Great Barrier Reef Climate Change Action Plan 2007 – 2012
- NOAA Coral Reef Conservation Program Goals & Objectives 2010-2015
- The FRRP "Coping with Climate Change" Conference 2008
- The Florida Governor's Action Team on Energy and Climate Change
- Miami-Dade County CC Advisory Task Force
- Florida Coastal and Ocean Coalition
- The Florida Oceans and Coastal Council
- Report by the Environmental Defense Fund -Corals and Climate Change: Florida's Natural Treasures at Risk
- Report by Tufts University -Florida and Climate Change – The Costs of Inaction.,
- Florida Fish and Wildlife Conservation Commission (FWCC)-Florida's Wildlife on the Frontline of Climate Change – Climate Change Summit Report, 2008
- US Coral Reef Task Force
- Draft Priority Coral Reef Management Goals and Objectives for Florida 2009,
- "A Call to Action for Coral Reefs." Dodge et al. Science Vol 322 10 October 2008
- The Honolulu Declaration on Ocean Acidification and Reef Management 2008
- Florida's Resilient Coasts: A State Policy Framework for Adaptation to Climate Change 2008
- Fourth Assessment Report of the Intergovernmental Panel on Climate Change

- 40 Specific Actions
  - 22 Management
  - 10 Engagement
  - 8 Science
- 6 Overarching Enabling Conditions

Enabling Conditions

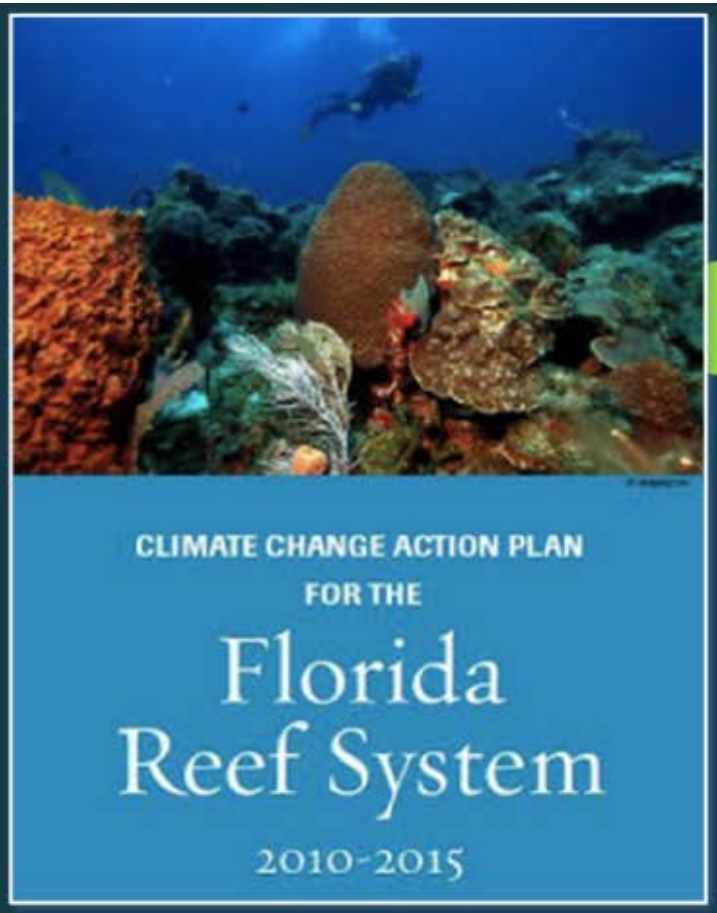
1. Global greenhouse gas reductions
2. Completion of Everglades Restoration
3. Clean-up of the Mississippi River Watershed
4. Marine Spatial Planning at regional scale
5. Regionwide management and connectivity with Gulf of Mexico and Caribbean Sea
6. Actions of this plan need to be incorporated into regional and local government comprehensive plans

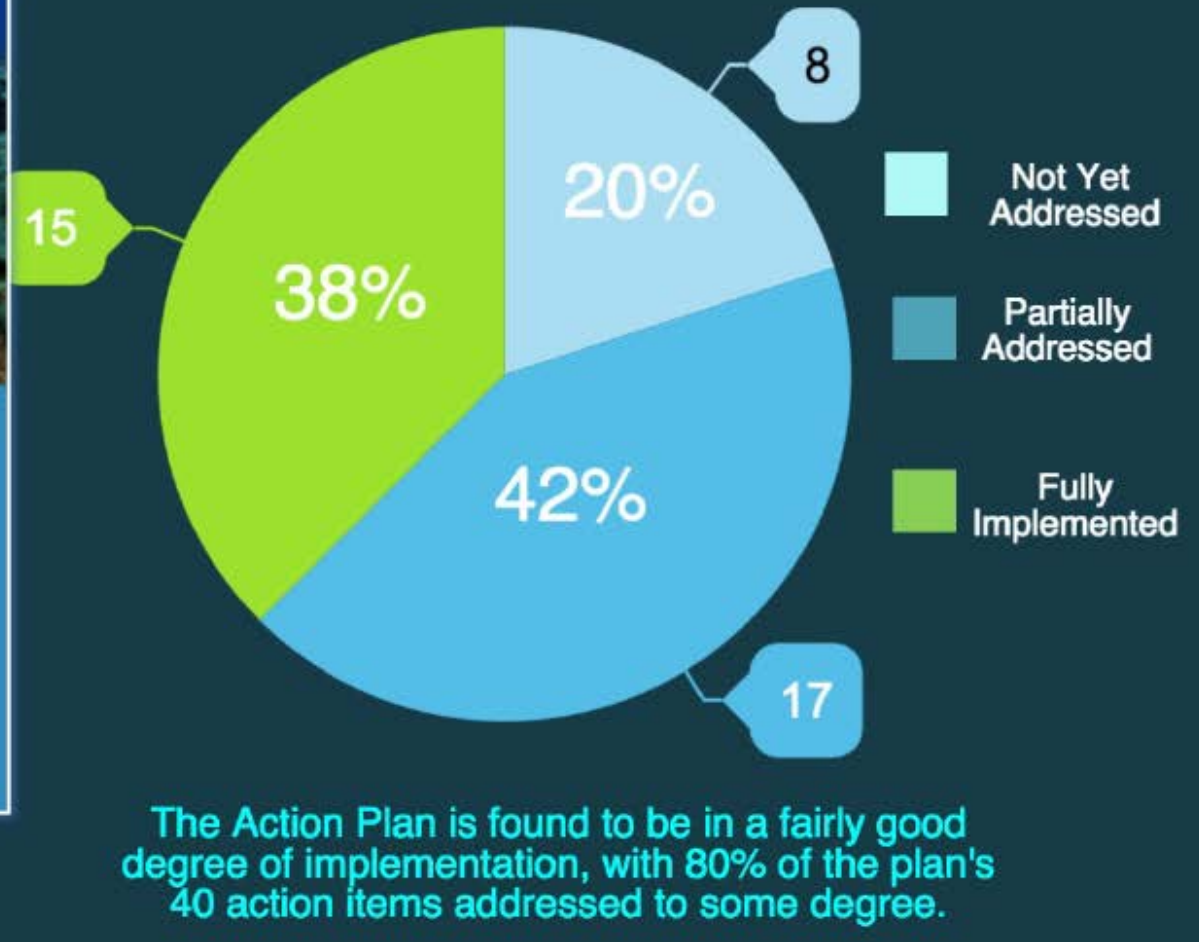
Climate Change Action Plan for the Florida Reef System 2010-2015 SCORECARD

Mallory Morgan
Scripps Institute of Oceanography
2015
with support from EcoAdapt

Scores were developed using an online survey, in-person and phone interviews, and independent internet research.

Overall Status in 2015





Degree of Implementation

Action Item	Confidence
1.1.1 Continue and expand FRRP DRM and BleachWatch programs	***
1.1.2 Integrate entire reef system into bleaching response management plans	**
1.2.4 Protect vulnerable species and habitats from non-climate pressures	**
1.2.5 Include vulnerability in threatened and endangered species assessments	**
1.3.1 Require mitigation and adaptation in County & Municipality plans	*
1.4.1 Revise existing programs and strategies to optimize resilience	**
1.5.1 Provide climate change tools and training for Florida's reef managers	**
2.2.1 Develop scientifically based climate change fact sheets	**
2.2.2 Involve community members in coral reef research and monitoring efforts	***
2.2.4 Develop a Greater Everglades Ecosystem education program	***
2.3.2 Communicate findings of climate change reports and risk assessments	**
2.3.3 Implement regional marine and coastal accreditation programs	*
3.1.2 Examine relationships between reef fish-stony coral populations-condition	***
3.1.4 Translate climate forecasts into a relevant, useful product for managers	*
3.2.1 Determine and map areas of high and low resilience to climate change	***
1.2.2 Develop a marine zoning plan to protect against non-climate stressors	***
1.2.3 Identify and protect transition/alternative refugia habitats for range shifts	***
1.3.2 Include sea level rise adaptation into County and City c	***
1.3.3 Limit certain kind of development that is at risk from se	
1.4.4 Work through a formal council to minimize water quali	
1.4.5 Evaluate resource protection legislation for climate cha	
1.4.6 Place mainland corals under authority of principal man	
1.6.3 Promote minimum impact reef use activities/avoidance	
1.6.4 Create a boating license similar to a driver's license	
2.1.1 Identify & forecast socio-economic effects of vulnerable	
2.2.3 Incorporate reef impact information into school science	
2.3.1 Create business adaptation plans and create new oppor	
2.3.4 Identify and support "climate smart" coastal and marine organizations	**
3.1.1 Revise regulations on coastal development and beach nourishment projects	**
3.1.3 Examine calcium carbonate saturation state and calcification rates	***
3.2.2 Identify thresholds by which climate change causes irreversible damage	**
3.2.3 Define and model the transition of one habitat to another	**
1.2.1 Integrate climate change-induced crisis response strategies into plans	**
1.2.6 Prohibit new dredging	***
1.4.2 Evaluate risks of climate change into fisheries management	***
1.4.3 Create a formal Florida Reef System Management Council	***
1.6.1 Increase law enforcement presence and regulatory compliance	***
1.6.2 Fully implement the State's lobster trap reduction plan, reduce ghost fishing	***
2.2.5 Create community feedback mechanisms for adaptive management	***
3.3.1 Support field research of novel intervention measures	**

Scoring:

Fully Addressed

Partially Addressed

Not Yet Addressed

Confidence Ranking

*Low Confidence, **Intermediate Confidence *** High Confidence

Reflects: Amount of information + Level of agreement amongst participants for each action item

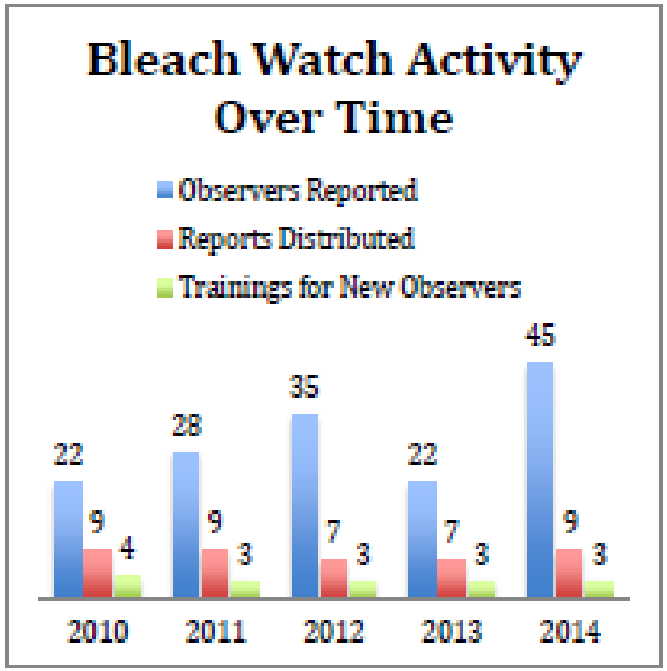
Example of Details in Report

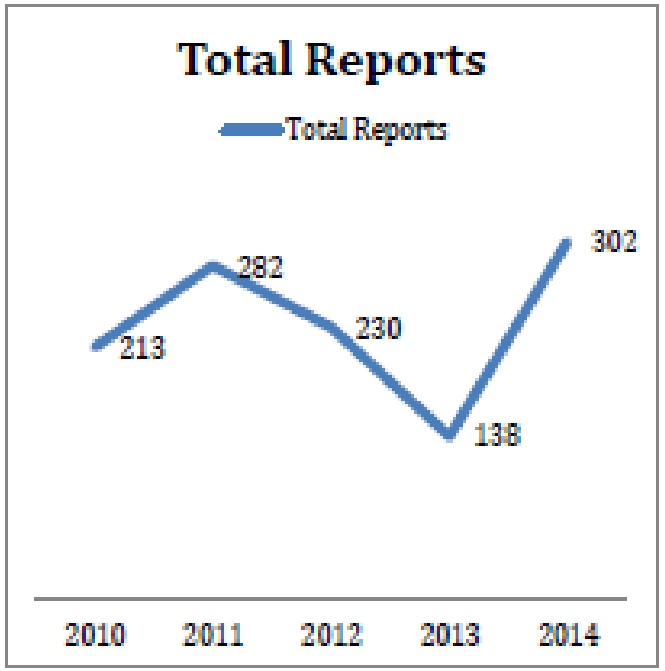
ACTION 1.1.1

Continue and expand the FRRP disturbance response monitoring (DRM) and Mote Marine Laboratory's Bleach Watch activities throughout the entire five-county (Monroe, Miami-Dade, Broward, Palm Beach and Martin) Florida Reef System.

IMPLEMENTATION:

Both programs now monitor the entire five-county reef tract. BleachWatch has expanded into SeaFan for the SEFCRI region. These programs consistently integrate new partners and train new observers, as well as work to improve monitoring strategies. The DRM program is now in the preliminary phases of expanding into the greater Caribbean area including the British Virgin Islands and Puerto Rico.
The Disturbance Response Monitoring Program completed 164 surveys in 2014 alone. The "Quick Look" reports produced from the DRM program are an important education and outreach component in the region. The Florida reef tract is one of, if not the most, surveyed reefs in the entire world thanks to the surveying efforts of these programs.





STATUS OF INDIVIDUAL OUTCOMES

Management Strategies

Comprises 55% of the plan

Vulnerable Community & Industry Awareness

Comprises 25% of the plan

Scientific Research

Comprises 20% of the plan

SUCCESSES

Through several programs, community members are empowered to be actively engaged in reef monitoring and influence management decisions.

The region heavily monitors and responds to coral bleaching events through the success of the Disturbance Response Monitoring Program and Bleach Watch.

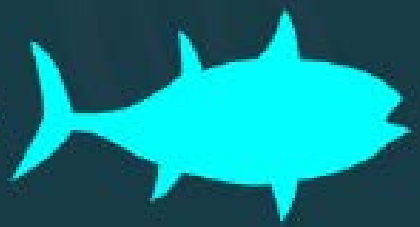
Broward, Miami-Dade, Palm Beach, and Monroe Counties have updated their comprehensive plans to mitigate and adapt to the impacts of climate change.

SOUTHEAST FLORIDA REGIONAL COMPACT CLIMATE CHANGE

OPPORTUNITIES

Ghost fishing of derelict lobster traps continues to negatively impact the reef.

Integrating climate change research into fisheries management is still needed at the state level.



Increased law enforcement presence on the water is needed to ensure regulatory compliance.

Summary of Top Ten Actions

1. Work with Florida's coral reef management jurisdictions to improve regulations and management that facilitate adaptation to climate change and ocean acidification. Evaluate and revise existing programs and strategies to optimize their effectiveness and make them more robust in the context of creating resilience to climate change.

Partly Addressed

2. Develop and implement a marine zoning plan that incorporates resilience-based concepts to provide maximum protection from non-climate stresses for all reef types and associated habitats in the Florida Reef System. This plan must also ensure connectivity between reefs and their associated nursery habitats.

Partly Addressed

3. Integrate climate change predictions and uncertainties into Florida's comprehensive planning laws and procedures, particularly in coastal areas. Include sea level rise adaptation and mitigation planning in county and municipal comprehensive plans.

Fully Addressed

4. Continue and expand the Florida Reef Resilience Program's "Disturbance Response Monitoring" and Mote Marine Laboratory's "Bleach Watch" activities throughout the five-county area.

Fully Addressed

5. Decrease the likelihood of negative fishing, diving, and other reef use impacts to key habitats and important functional groups of plants and animals (e.g. herbivores) by increasing law enforcement presence and regulatory compliance.

Not Addressed

6. Develop scientific climate change fact sheets tailored for reef users, community members, visitors, elected officials, businesses and industries to increase understanding of and support for actions to increase resilience. Use multiple outlets (e.g. news media, radio, brochures, community meetings, social networks, blogs and website to communicate facts.

Fully Addressed

7. Forecast the potential social and economic effects of climate change on reef-dependent industries and communities to measure their vulnerability and resilience and determine cost-to-benefit ratios of any proposed climate change mitigation/adaptation measures. Support the creation of industry-specific business adaptation plans for diving, fishing and tourism industries.

Partly Addressed

8. Increase awareness and appreciation of the Florida Reef System and encourage a sense of urgency for its sound management and protection.

Partly Addressed

9. Ensure long term, question-driven monitoring of environmental variables linked to coral bleaching and other climate change impacts throughout the Florida Reef System. Integrate monitoring results into a coastal observing network that informs the evolving questions underlying protection and management of marine resources.

Partly Addressed

10. Develop scientific models of the Florida Reef System to help predict its responses to physical, chemical, and socio-economic shifts associated with climate change and ocean acidification, and the interactions of these global processes with local stressors (e.g. pollution, over-fishing, etc.). Determine and map areas of high and low resilience to climate change in order to prioritize management efforts.

Fully Addressed

Version 2.0

CLIMATE CHANGE ACTION PLAN

FOR THE

Florida Reef System

2010-2015

General Approach to v2.0

- Add a bit about the genesis and purpose of FRRP
- Add a “vision” to help put goals and actions in context
- Format action items so the main idea is more apparent
- Describe progress and next steps on top 10
- Revisit top 10 (or however many) priorities to highlight
- Add recommendations for reef users and others to implement in addition to reef managers

General Approach to v2.0

- Increase emphasis on management actions in addition to policy, planning, study, and communication
- Remove sea level rise items
- Reduce impression that FRRP will lead all actions as opposed to convening and connecting others who are taking action
- Reduce number of actions by lumping many detailed actions under topical headers (e.g. “resilience-based management,” and “communications”)

Actions for Reef Users and Other Individuals

- Minimize marine debris from litter and gear
- Engage in accreditation programs (e.g. Blue Star)
- Practice minimum impact anchoring
- Avoid bleached and diseased corals
- Practice low impact fishing including catch and release
- Maintain buoyancy control while diving
- Report bleaching, disease, and other problems
- Model good behavior/call out bad behavior

Resilience-Based Management

- More emphasis on LBSP/non-point reduction
- More emphasis on invasive species prevention, early detection, and rapid response
- More ecosystem restoration effort (coral, seagrass, sponges, urchins)
- Id./protect transition habitats for range shifts
- Reduce trophic and gear impacts of fishing
- No-dredging during stress or spawning events

Communication/Education/Outreach

- More frequent opportunities for science/ technical information exchange and public engagement with experts (live and online)
- Emphasize role of reefs in fish production
- Target fishers and divers
- Target policy decision makers
- Incorporate CC info into school curricula
- Showcase climate smart coastal and marine organizations/businesses

Potential New Directions

- Examine role of artificial habitat for replacing ecosystem services lost from reefs
- Species and genotype translocations + banking
- Reduce OA from land-based sources
- Develop coral disease interventions
- Develop bleaching interventions

Florida Reef Resilience Program