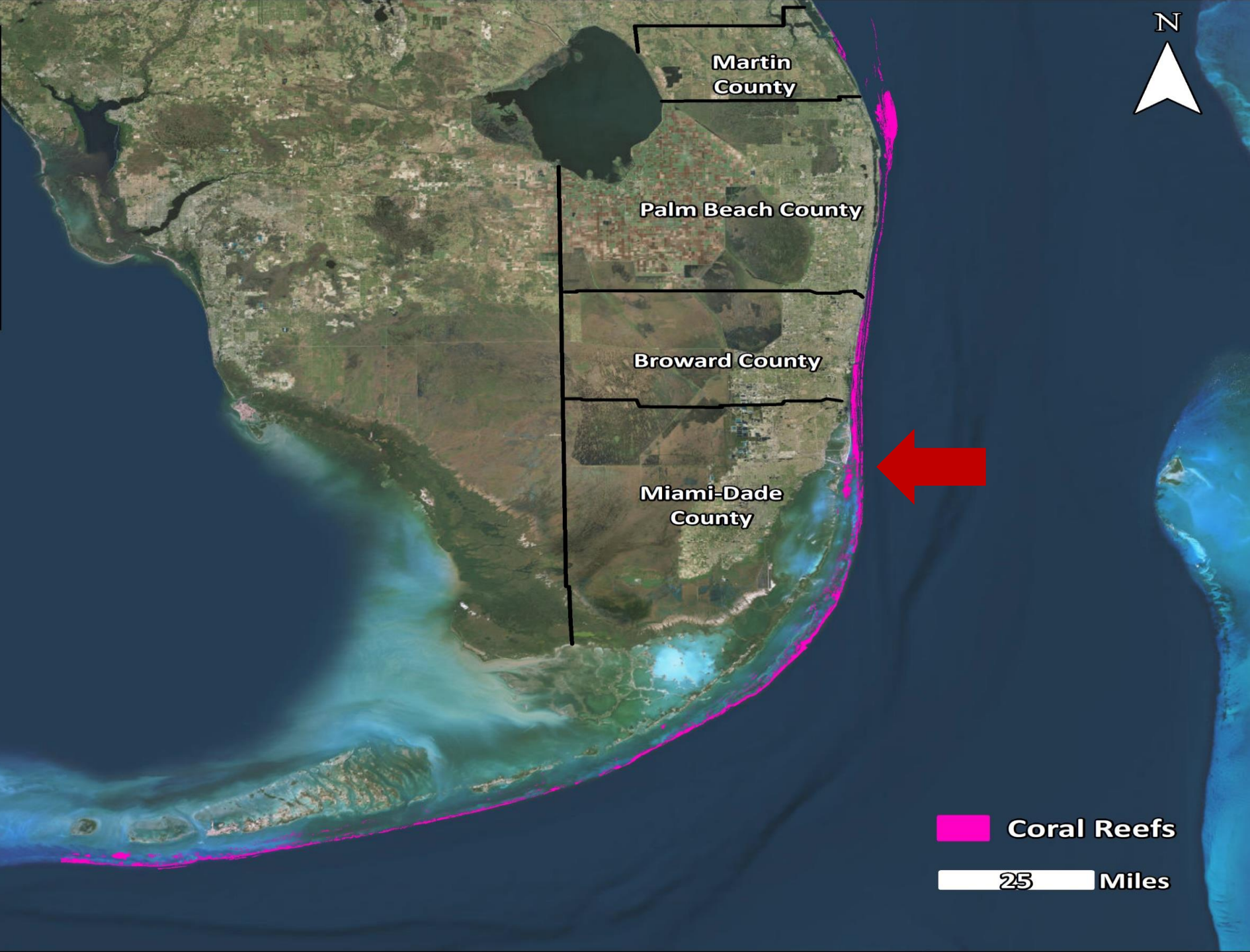


The background of the slide is an underwater photograph of a coral reef. It features various types of coral, including tall, thin, orange-colored stony corals and a large, flat, brain-like coral in the foreground. The water is clear and blue, with some light rays visible. The text is overlaid on this background.

Overview on Stony Coral Tissue Loss Disease and Response to it in Florida

Rob Ruzicka
Coral Program Manager
Fish & Wildlife Research Institute

This presentation was adapted from other talks prepared by Maurizio Martinelli,
Florida's Coral Disease Response Coordinator, and The Coral Rescue Team



First signs of trouble in 2014 in SE FL



Diploria labyrinthiformis



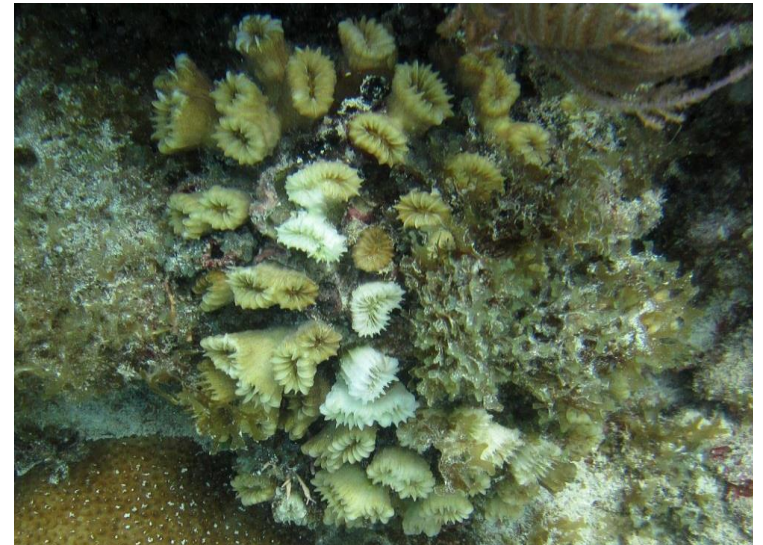
Pseudodiploria strigosa



Dichocoenia stokesii

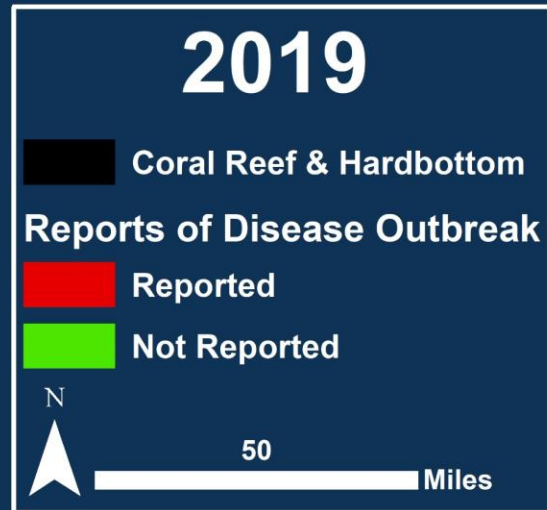


Meandrina Meandrites



Eusmilia fastigiata

Stony Coral Tissue Loss Disease Occurrence Across the Florida Reef Tract



Dry Tortugas
National Park

Lower Keys

Middle Keys

Upper Keys



Martin County

Palm Beach County

Southeast Florida

Broward County

Miami

Miami-Dade
County

Monroe
County

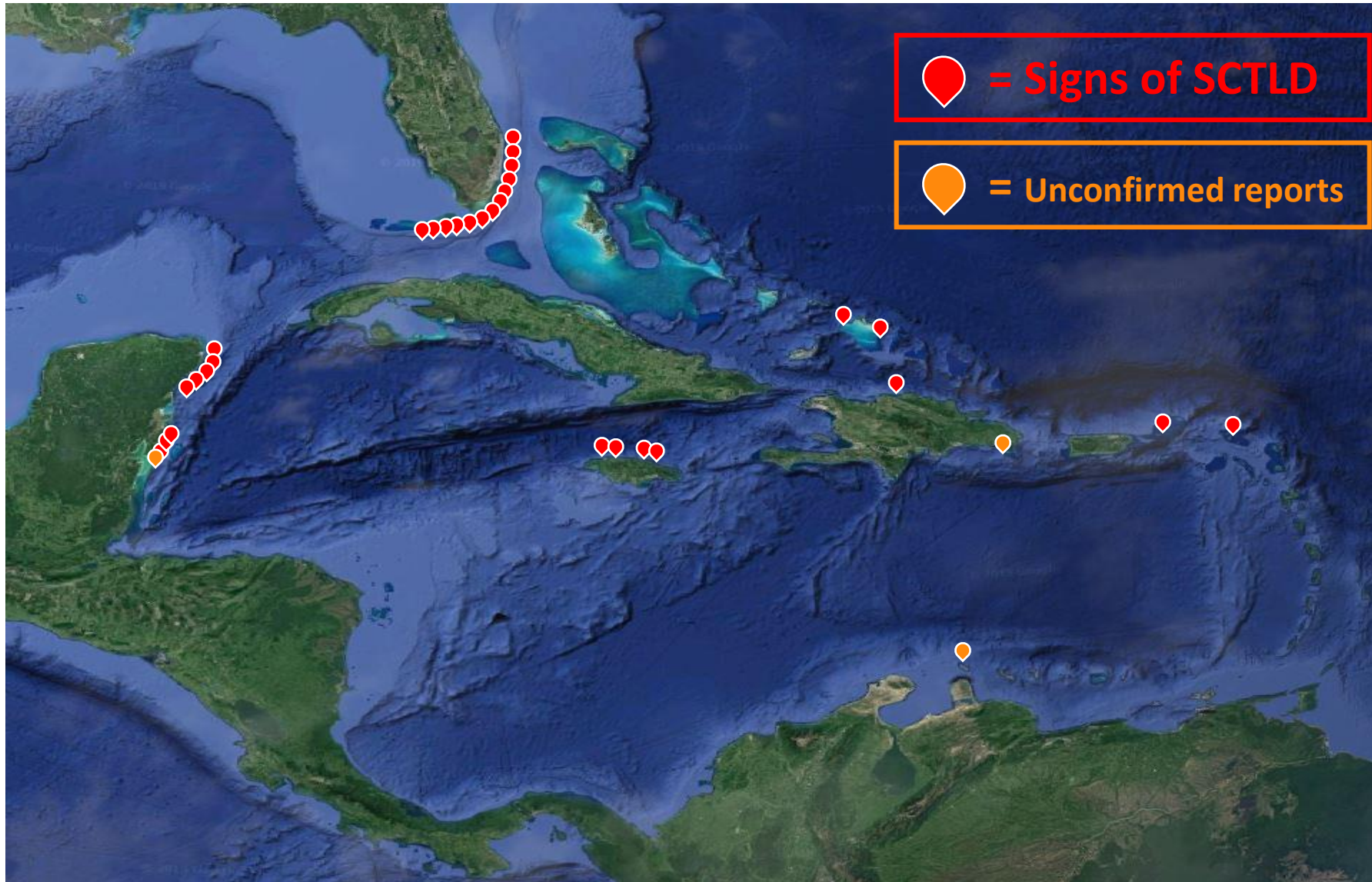
Biscayne
National
Park

Key Largo

Marathon

Key West

Wider Caribbean

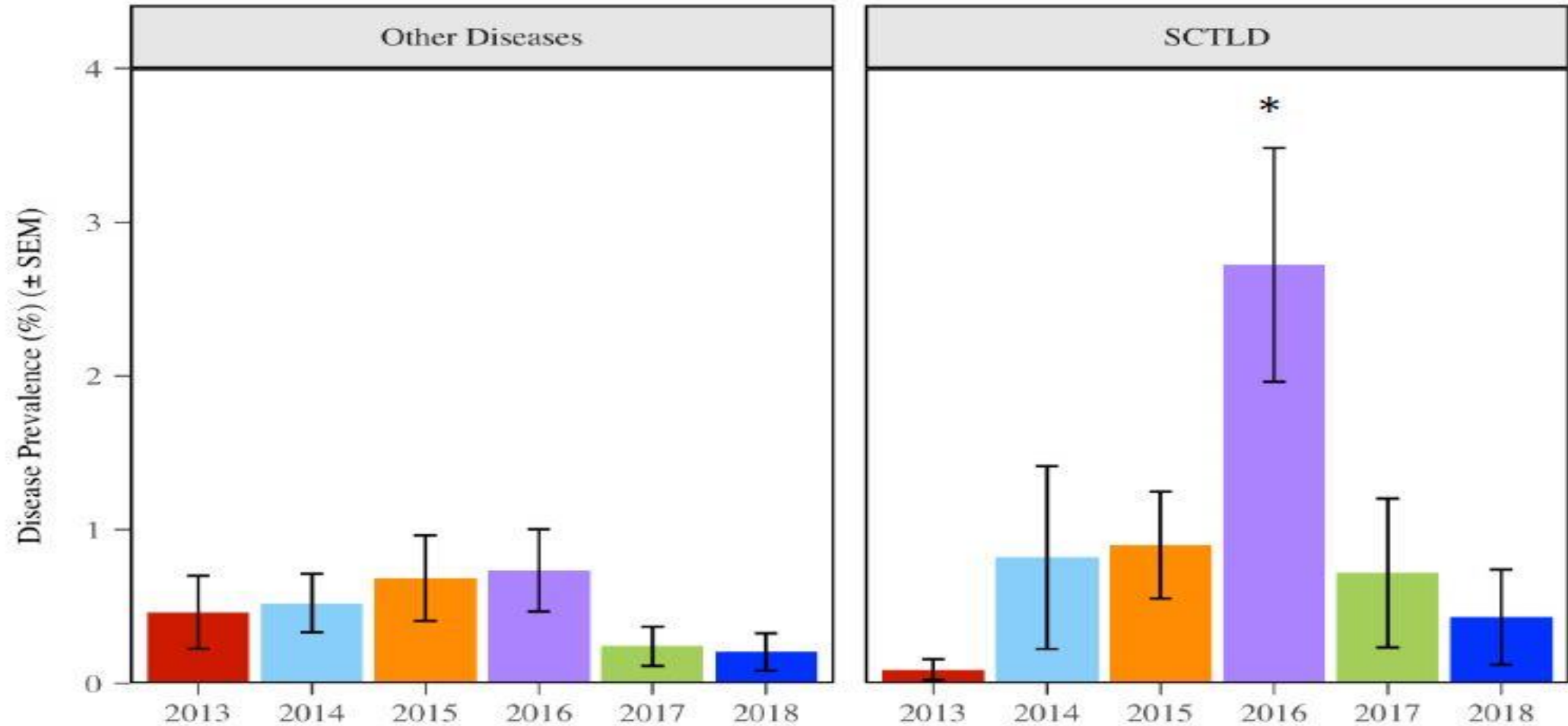


SCTLD Occurrence in the Caribbean



SCTLD Statistics & Consequences

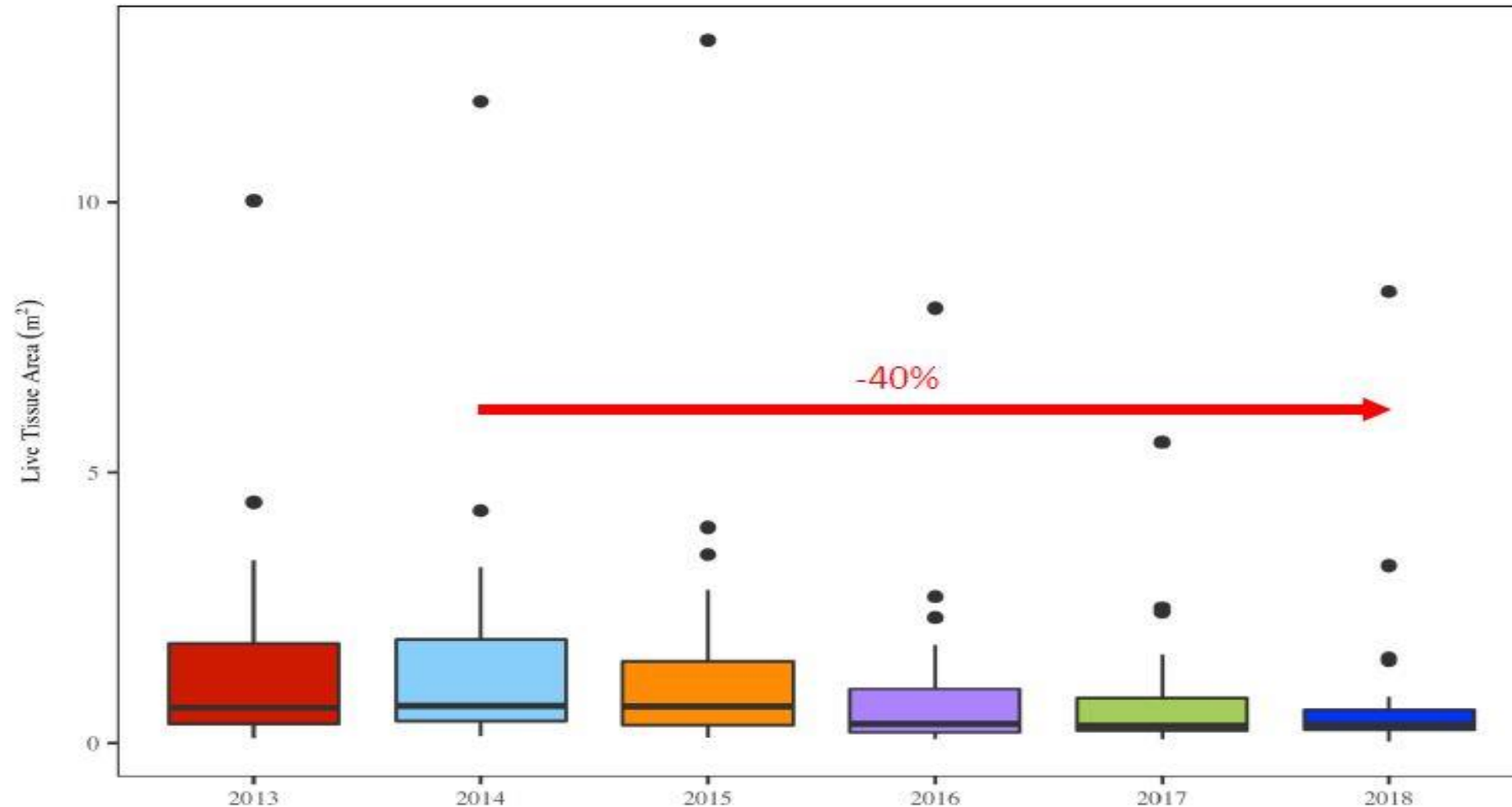
Regional disease prevalence



Source: Walton et al. 2018; SECREMP 2018; Hayes et al. In prep; SECREMP 2019 In prep

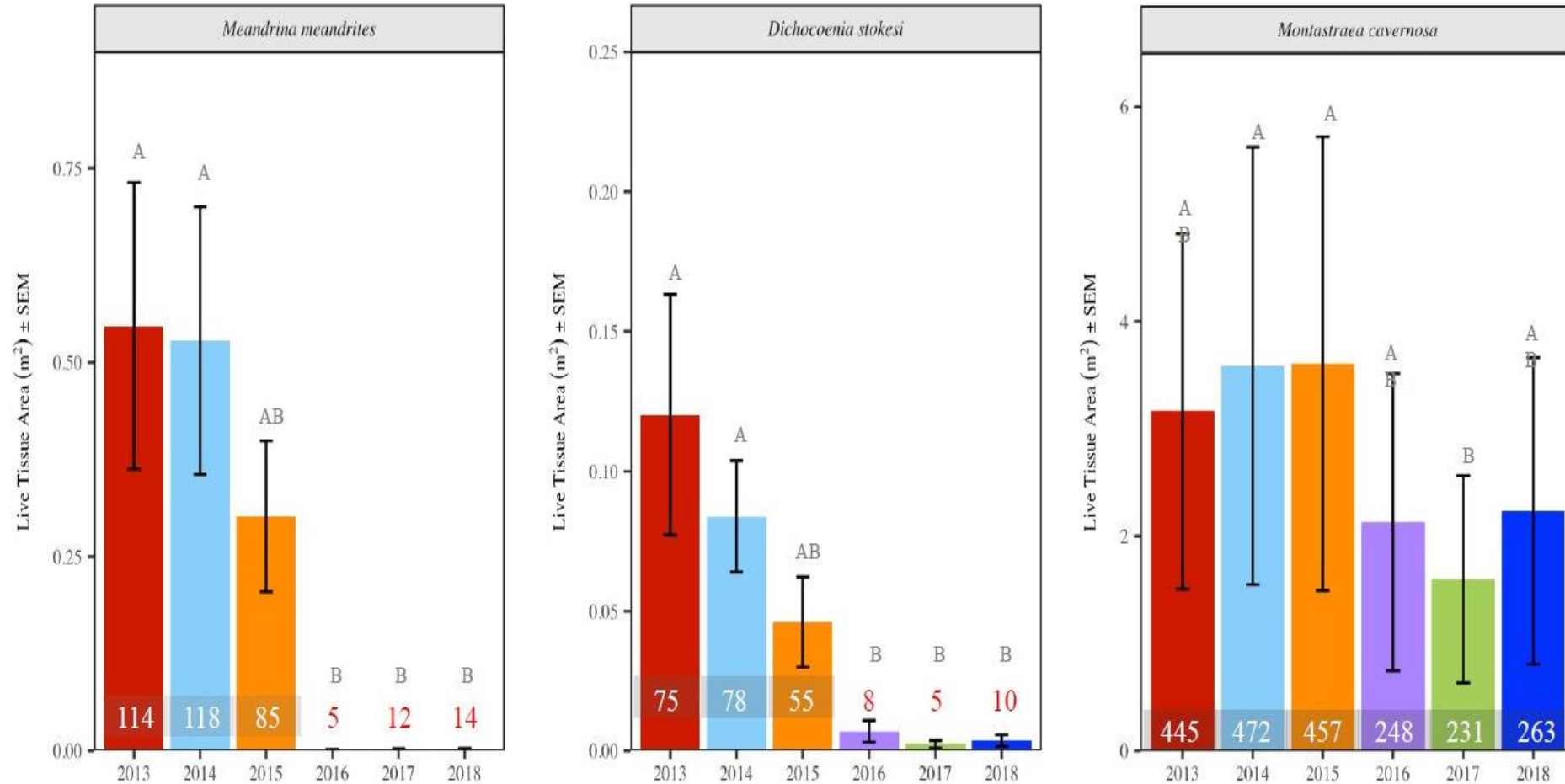
SCTLD Statistics & Consequences

Loss of Regional live tissue area











SCTLD Statistics & Consequences

Species-specific live tissue area and abundance



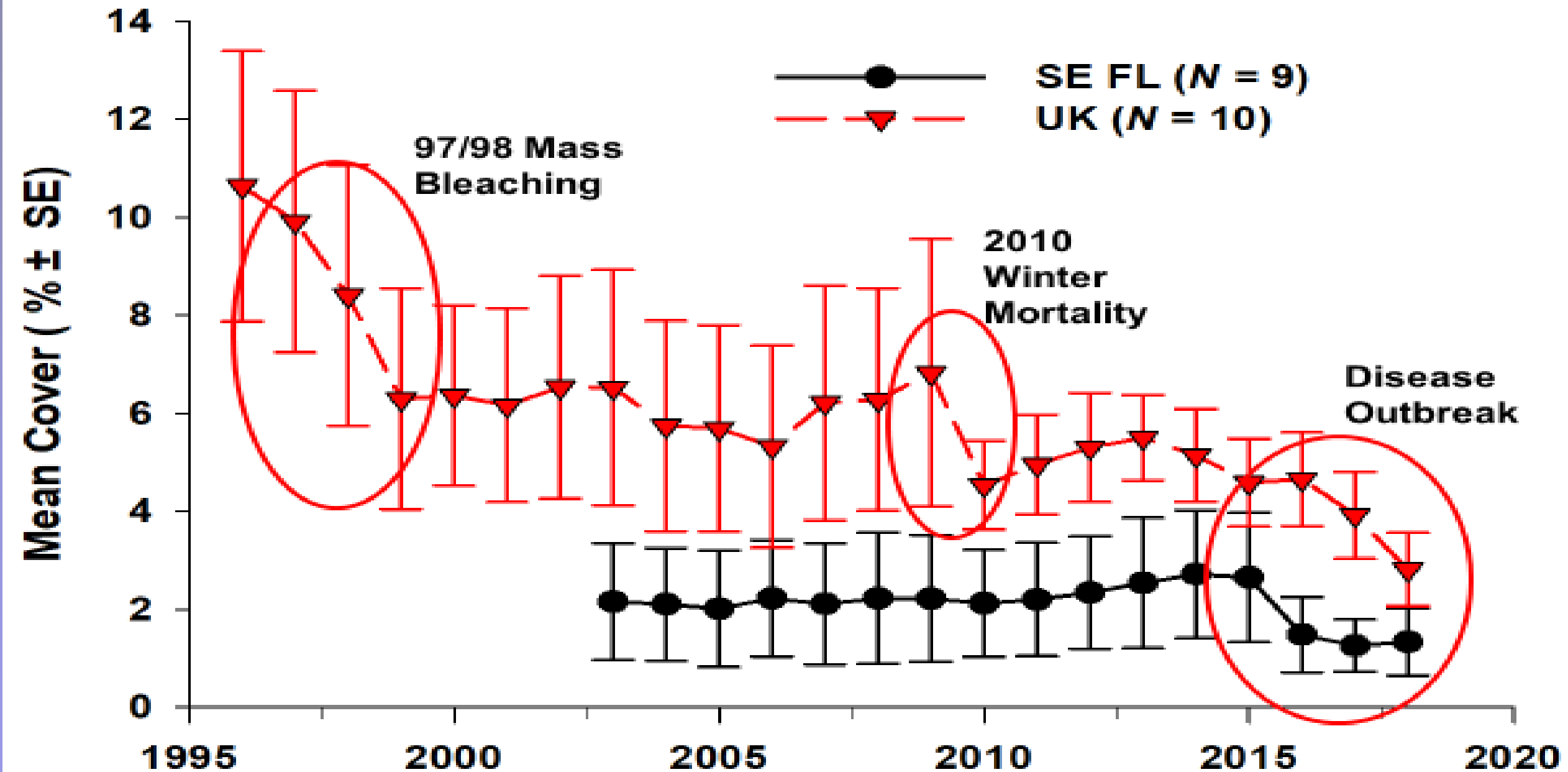
Source: Walton et al. 2018; SECREMP 2018; Hayes et al. In prep; SECREMP 2019 In prep

CREMP Changes in Abundance in the Upper Keys Due to Stony Coral Tissue Loss Disease

Year	CNAT	DLAB	DSTO	MCAV	MMEA	PSTR	SSID	ORBI	Total
									
2014	15	11	31	66	10	12	652	70	2343
2015	13	11	33	72	11	15	682	81	2293
2016	7	13	29	83	11	14	773	69	2349
2017	11	14	11	40	0	6	689	70	2098
2018	0	1	5	35	0	3	649	60	1934

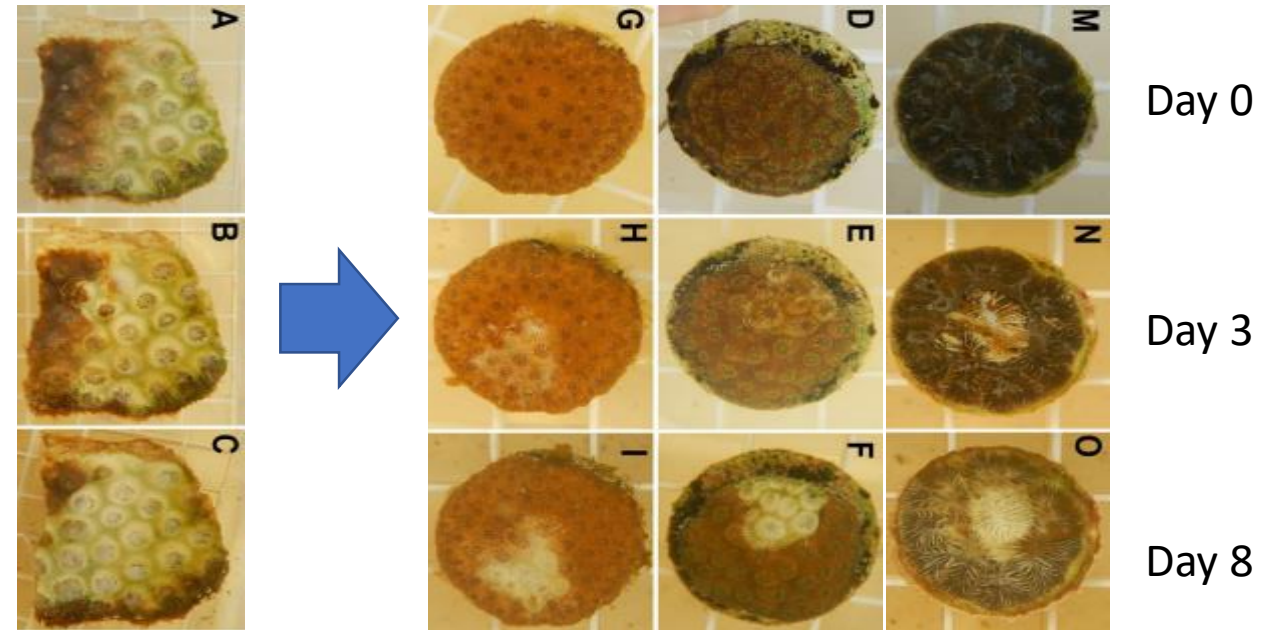
- $N = 14$ sites in the Upper Keys;
- Totals pooled for sites
- Lesions still active on several species

CREMP & SECREMP Coral Cover



Stony Coral Tissue Loss Disease factors

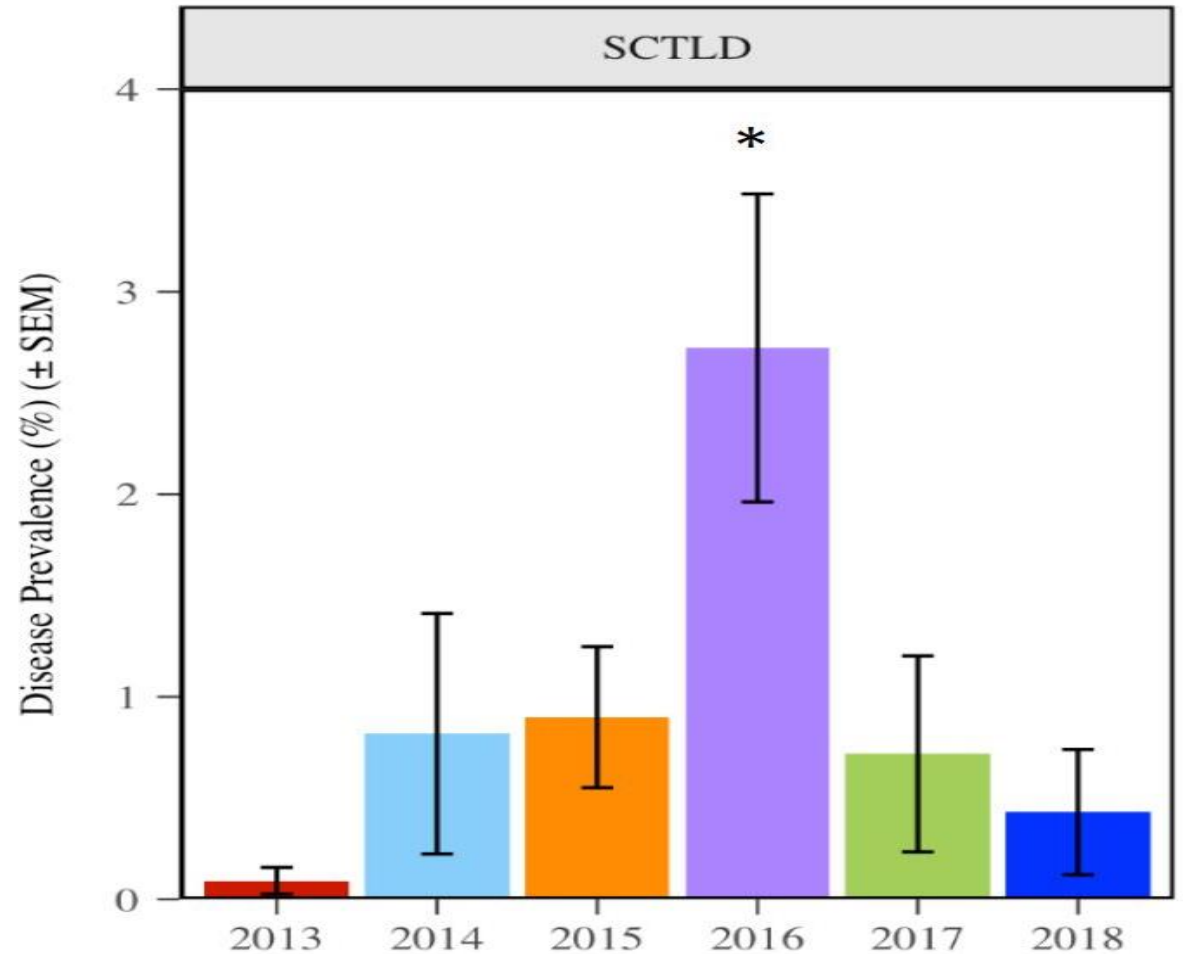
Infectious, waterborne disease



Stony Coral Tissue Loss Disease factors

Infectious, waterborne disease

Persistence of pathogen(s)



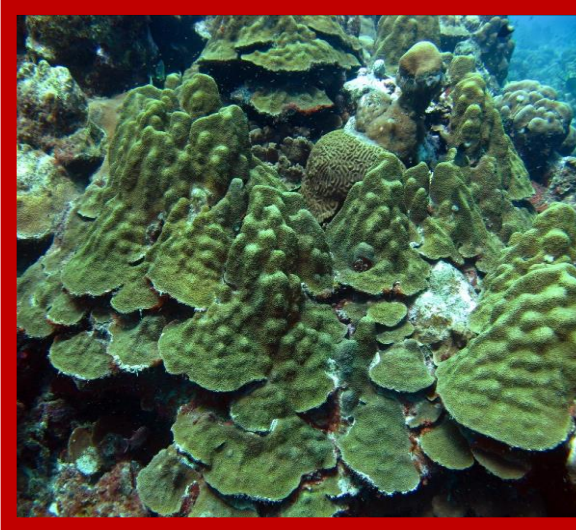
Source: Walton et al. 2018; Hayes et al. (in prep)

Stony Coral Tissue Loss Disease factors

Infectious, waterborne disease

Persistence of pathogen(s)

Impacts ~50% of stony coral species



Susceptible species (★ = ESA listed species) (◻ = major framework builders)

Highly susceptible

Colpophyllia natans (Boulder brain coral)
Dendrogyra cylindrus (Pillar coral) ★
Dichocoenia stokesii (Elliptical star coral)
Diploria labyrinthiformis (Grooved brain coral)
Eusmilia fastigiata (Smooth flower coral)
Meandrina meandrites (Maze coral)
Pseudodiploria strigosa (Symmetrical brain coral)
Pseudodiploria clivosa (Knobby brain coral)

Intermediately susceptible

Montastraea cavernosa (Great star coral)
Orbicella annularis (Lobed star coral) ★
Orbicella faveolata (Mountainous star coral) ★
Orbicella franksi (Boulder star coral) ★
Siderastrea radians (Lesser Starlet coral)
Siderastrea siderea (Massive starlet coral)
Solenastrea bournoni (Smooth star coral)
Stephanocoenia intersepta (Blushing star coral)

Unknown susceptibility

<i>Agaricia agaricites</i> (Lettuce coral)	<i>Helioseris cucullata</i> (Sunray lettuce)	<i>Mussa angulosa</i> (Spiny flower coral)
<i>Agaricia fragilis</i> (Fragile saucer coral)	<i>Isophyllia rigida</i> (Rough star coral)	<i>Mycetophyllia</i> spp. (Cactus corals) ★
<i>Favia fragum</i> (Golfball coral)	<i>Isophyllia sinuosa</i> (Sinuous cactus)	<i>Scolymia</i> spp. (Disk corals)
	<i>Madracis arenterna</i> (Pencil coral)	

Stony Coral Tissue Loss Disease factors

Infectious, waterborne disease

Persistence of pathogen(s)

Impacts ~50% of stony coral species

High prevalence rates (66-100%)



Stony Coral Tissue Loss Disease factors

Infectious, waterborne disease

Persistence of pathogen(s)

Impacts ~50% of stony coral species

Very high prevalence rates (66-100%)

Complete tissue loss on nearly 100% of infected colonies

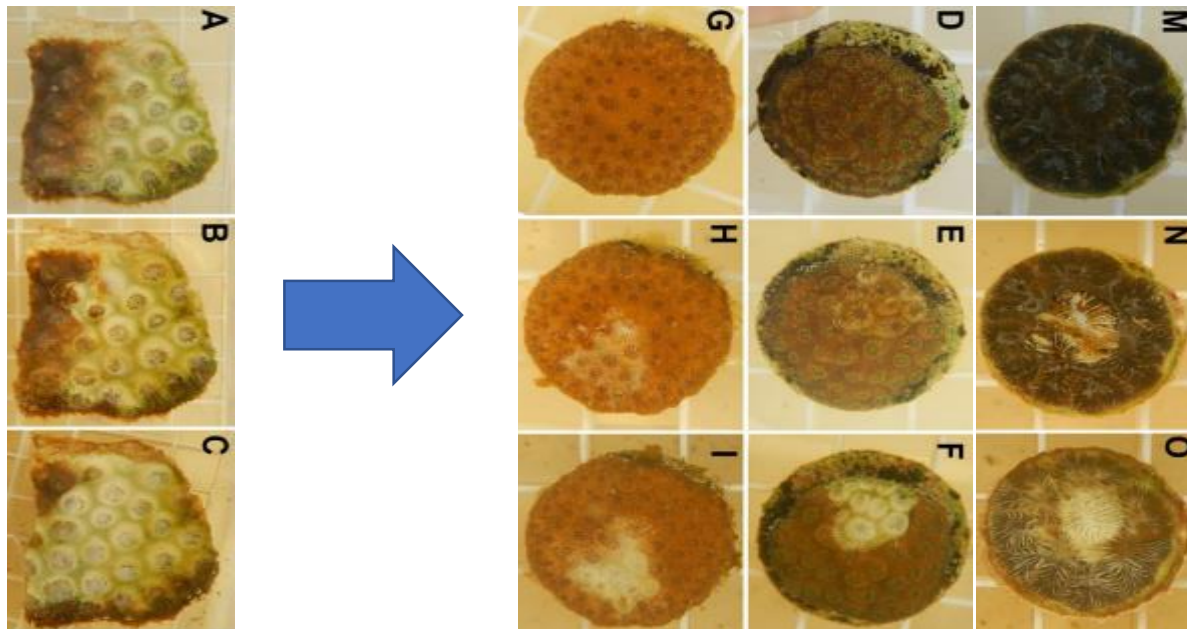


Key research findings

Transmission experiments demonstrate this is infectious

Therapeutic diagnoses suggest bacterial pathogen(s) are involved

Microbiome & pathogenicity experimentation has identified prevalent taxa



Day 0

Day 3

Day 8

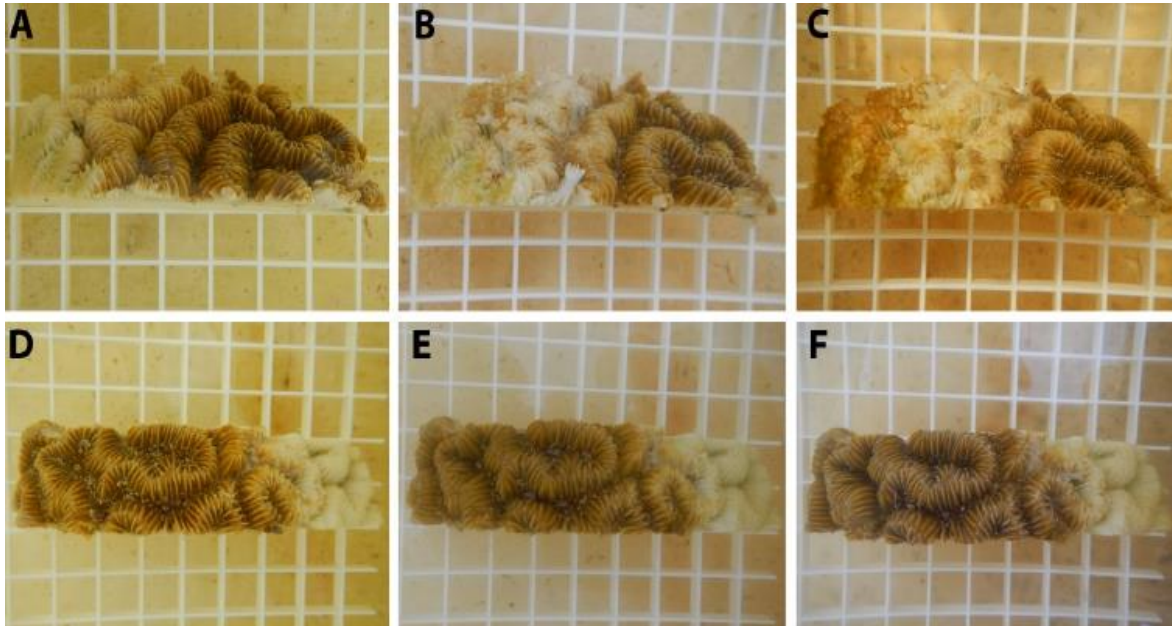
Transmission via
direct contact and
through sterile seawater

Source: Ushijima & Paul, Smithsonian. Unpublished.

Key research findings

Transmission experiments demonstrate this is infectious

Therapeutic diagnoses suggest bacterial pathogen(s) are involved



No treatment

Treated w/ amoxicillin &
kanamycin

Source: Ushijima & Paul, Smithsonian. Unpublished.

Key research findings

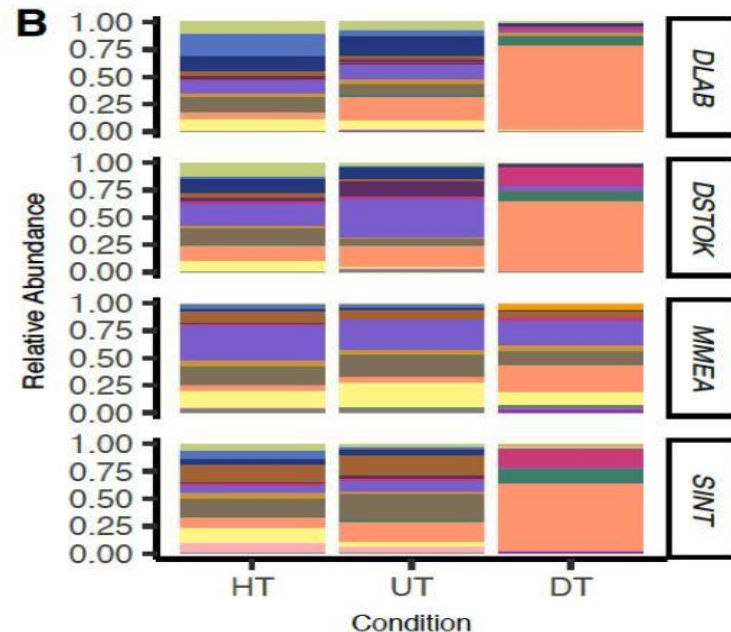
Transmission experiments demonstrate this is infectious

Therapeutic diagnoses suggest bacterial pathogen(s) are involved

Microbiome & pathogenicity experimentation has identified prevalent taxa



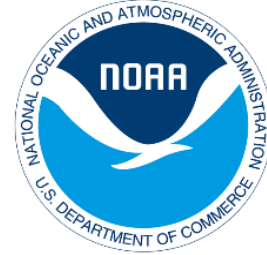
Credit: Florida Department of Environmental Protection



D_3__Rhodobacterales

Source: Rosales et al., NOAA/AOML. Unpublished.

Response Partners



US Army Corps
of Engineers®



OFFICE FOR COASTAL MANAGEMENT
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION



Callaway Marine
Technologies, Inc.



The Nature
Conservancy



ASSOCIATION
OF ZOOS &
AQUARIUMS



NSU | NOVA SOUTHEASTERN
UNIVERSITY
Florida

UNIVERSITY OF MIAMI
ROSENSTIEL
SCHOOL of MARINE &
ATMOSPHERIC SCIENCE

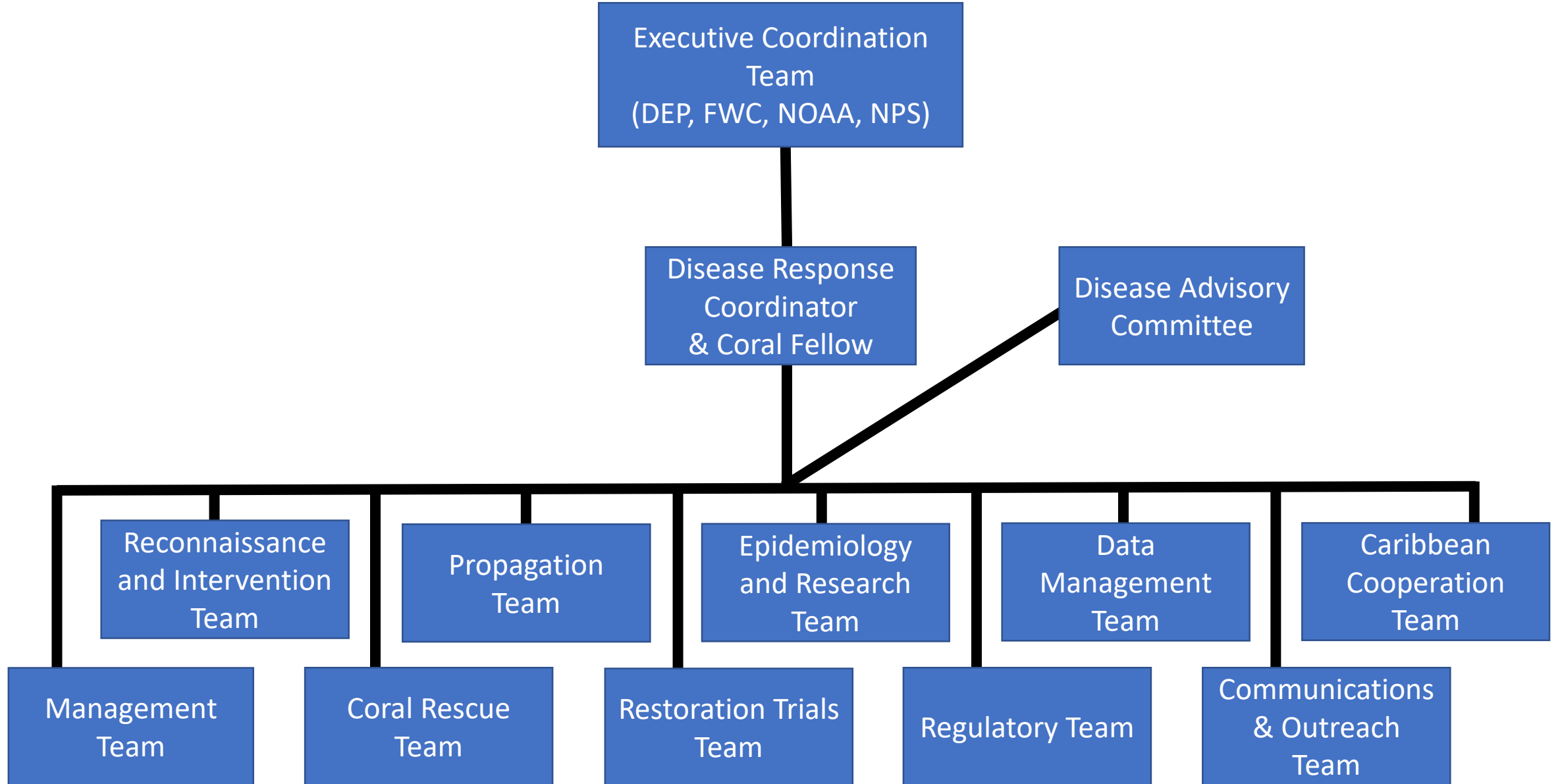


OSU
Oregon State
UNIVERSITY

FIU | FLORIDA
INTERNATIONAL
UNIVERSITY



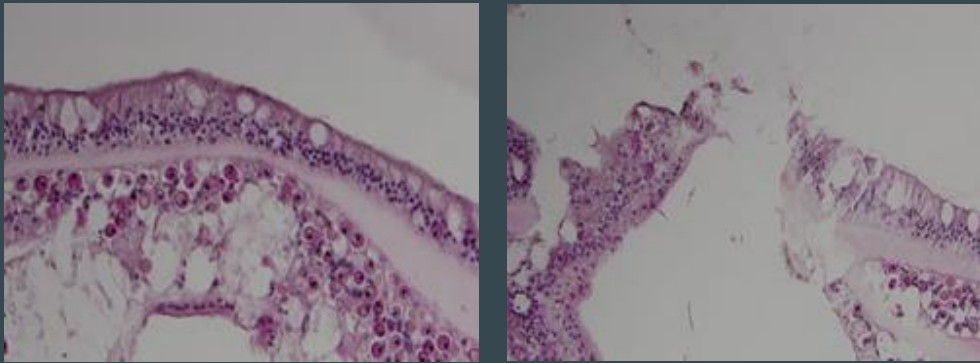
Response Structure



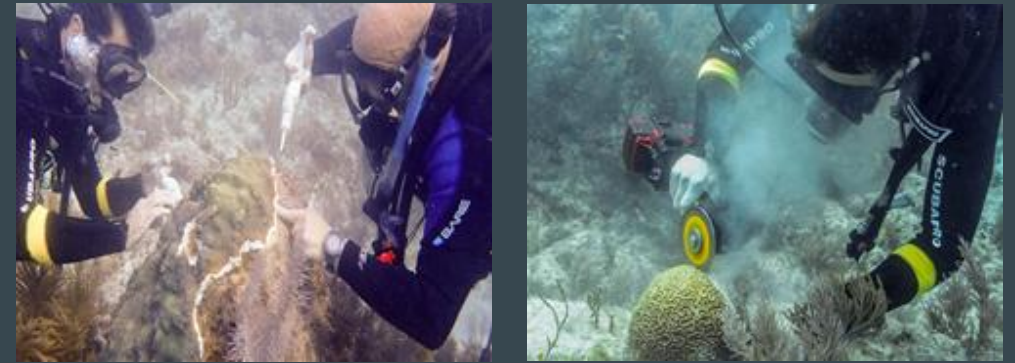
Florida Response Teams

Ten 'Response Teams' that address priority topic areas

Research & Epidemiology



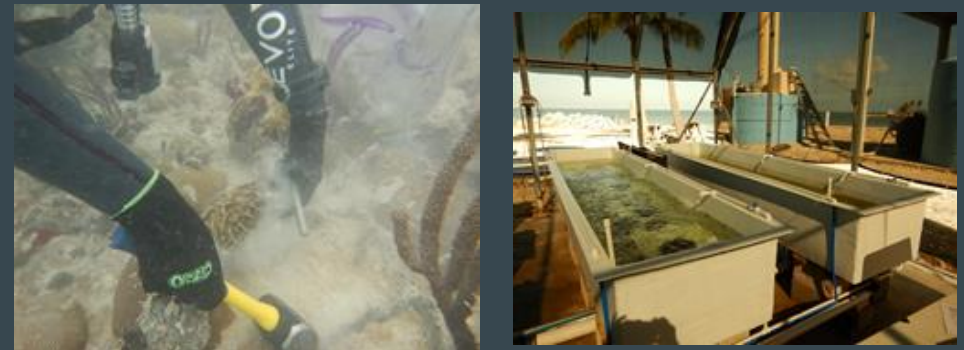
Reconnaissance & Intervention



Caribbean Cooperation



Coral Rescue



Coral Rescue Goals

“Rescue” (collect and gene bank) healthy corals from ahead of the disease boundary

Hold rescued corals in land-based facilities to **prevent** them from becoming infected, to **preserve** genetic diversity, and to **propagate** for future restoration



Coral Rescue Plan

Coral Collection Plan

Species Prioritization – High, Medium, Low

- Disease susceptibility
- Speed of disease progression
- Whole colony mortality
- Reef building contribution
- Spatial distribution declines and current abundance
- Reproductive strategy
- Conservation status (ESA-listed)

22 species:

16 high and 6 medium

Genetic Management Plan

Genetic diversity thresholds and targets

- 50 unique genets = 200 colonies/species

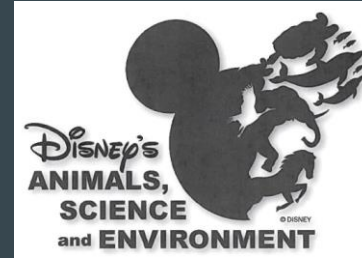
Develop and apply genetic markers

Genet registry

Genetic connectivity studies for brooders

AZA Florida Reef Tract Rescue Project

AZA “Florida Four”



AZA National Participating Facilities

- 16 Primary Holders (including Florida Four)
- 7 Secondary Holders
- 43 Project Friends

...and recruitment is ongoing...

**ASSOCIATION
OF ZOOS &
AQUARIUMS**

Phase 1: Pilot Collections

Who: 12 High Priority Species

What: 8 colonies/species in 2 size classes: <10 cm and 10-30 cm
Total of 180 corals

When: Fall 2018

Where: 7 disease-free sites in Lower Keys

Then Where: Temporary Holding @ KML
Intermediate Holding @ FL Aquarium (Apollo Beach), Mote Aquarium (Sarasota),
University of Miami, Nova Southeastern University (Dania Beach)

CNAT

DLAB

DSTO

EFAS

MMEA

MCAV

OANN

OFAV

PSTR

DCYL

MALI

MANG

MAUR

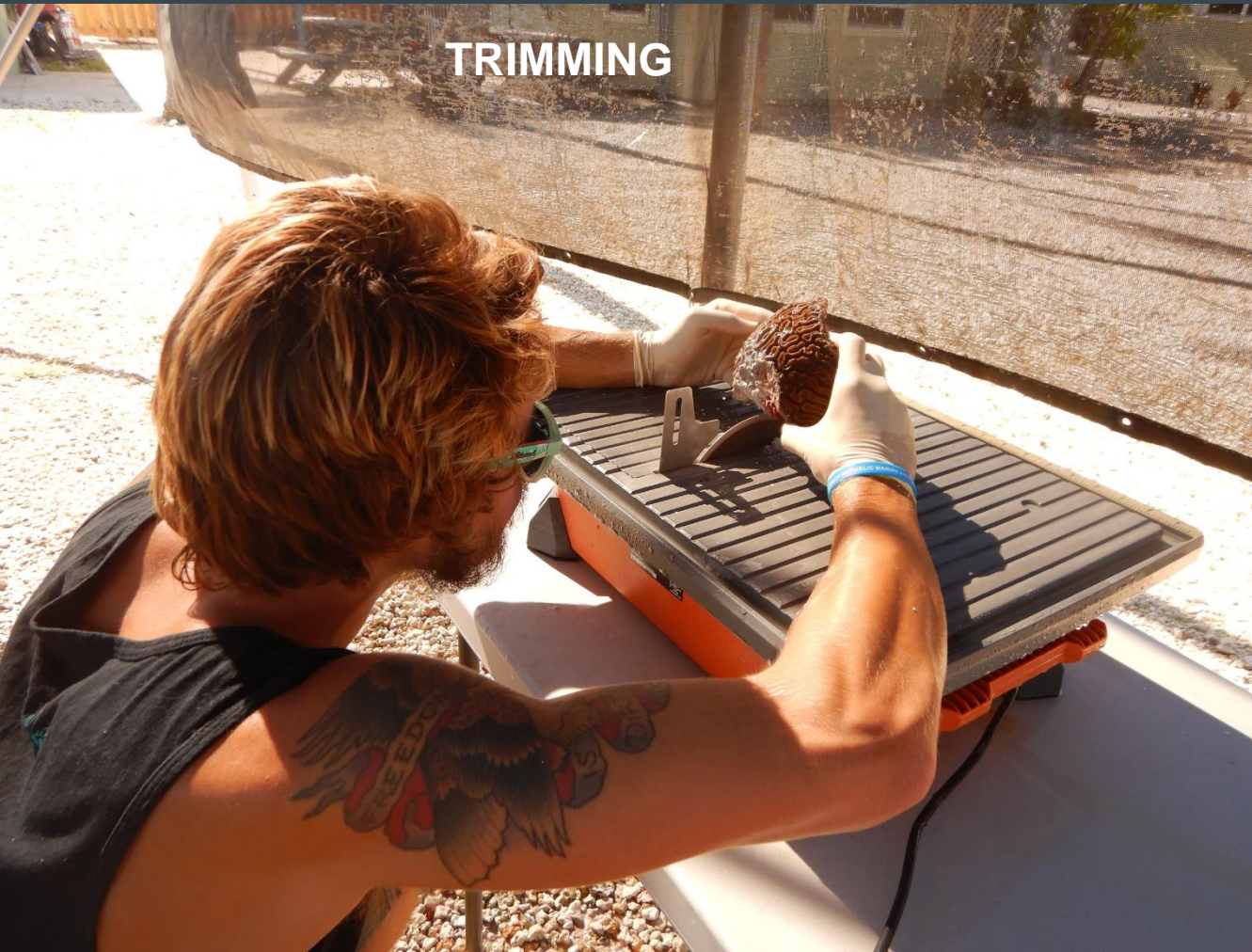
MFER

MLAM

PCLI

Coral Care

TRIMMING



MOUNTING



Phase 2: High Priority Collections



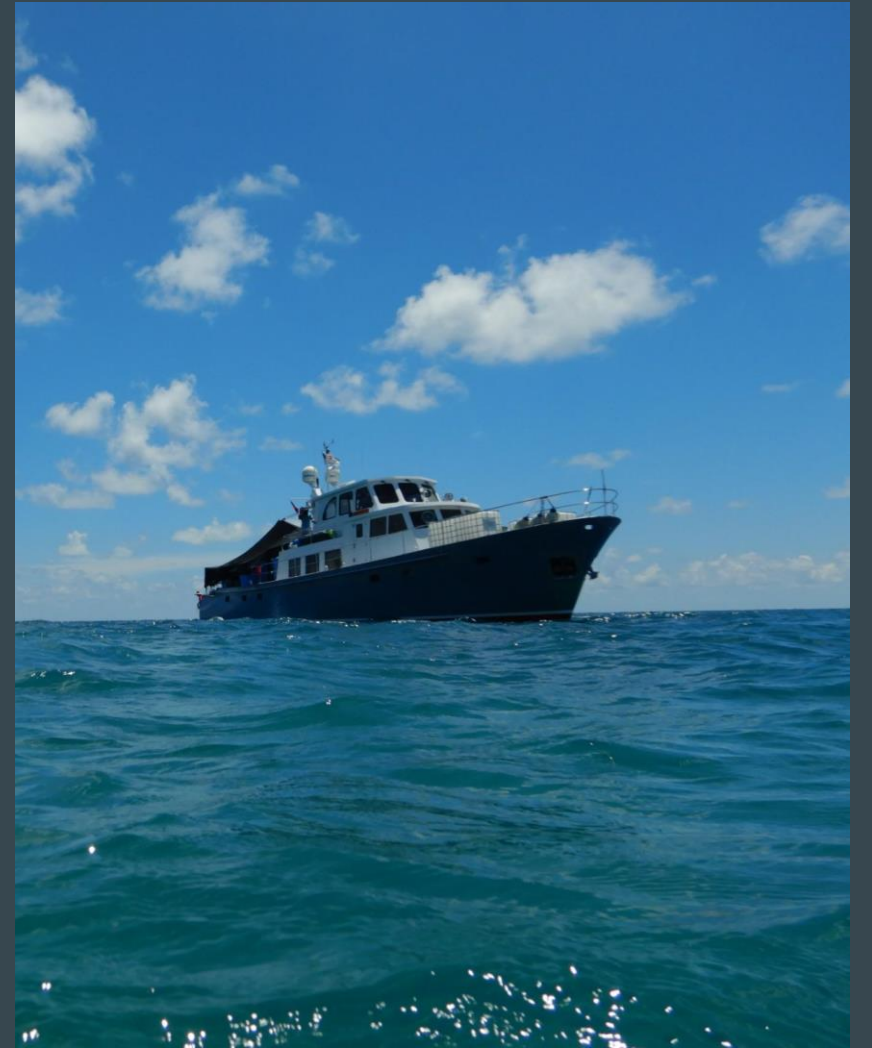
Who: 15 High Priority Species

What: 200 colonies(ramets) per species
Total of 3,000 corals (includes pilot collections)

When: Summer and Fall 2019

Where: Marquesas and Dry Tortugas

Then Where: Intermediate Holding @ UMiami, Nova SE University
Longer-term Holding @ AZA facilities nationwide





Genetic Sampling



Mounting and Tagging



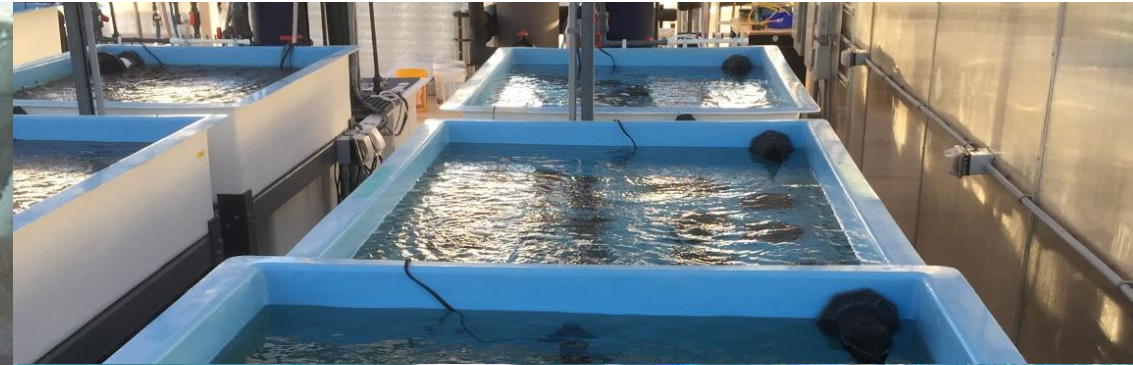
Intermediate Housing



THE FLORIDA
AQUARIUM



ROSENSTIEL
SCHOOL of MARINE &
ATMOSPHERIC SCIENCE



Ship
to
AZA





Behind the Scenes Coral Tours

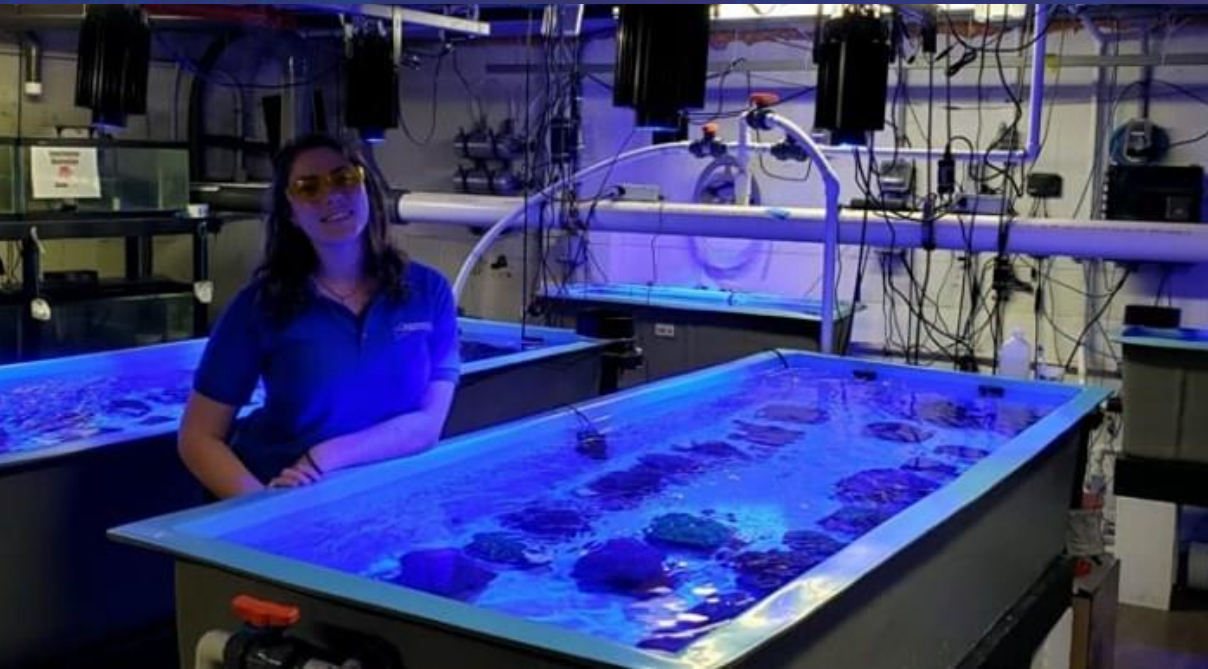
July 22, 26, 29 | August 2, 16, 26 | September 6
2:00-2:30PM

\$19 per adult (includes admission)

\$14 per senior (65&up, includes admission)

\$13 per child (ages 10-12 years, includes admission)

Learn how Jenkinson's is helping save corals from a disease affecting
of the coral species found in Florida. Come join one of our Aquarists for a 30 minute
behind the scenes tour of our coral holding area.
Registration is suggested due to the size of the tours (max 8 people per tour) Call 732.899.1659 or stop by the front desk to sign up



AZA "Reefugees"



Total Rescue Sites

📍 **34**

Colonies Under Care

🪸 **1,487**

Most Recent Rescue

7/3/2019

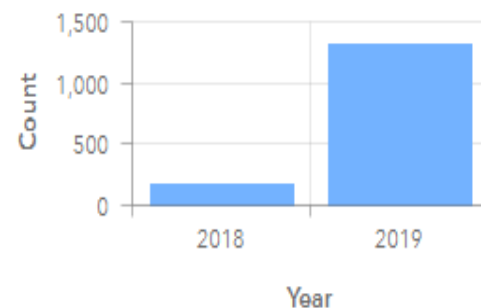
Total Tissue Area

104,325 cm²

Latest Data Update

8/15/2019

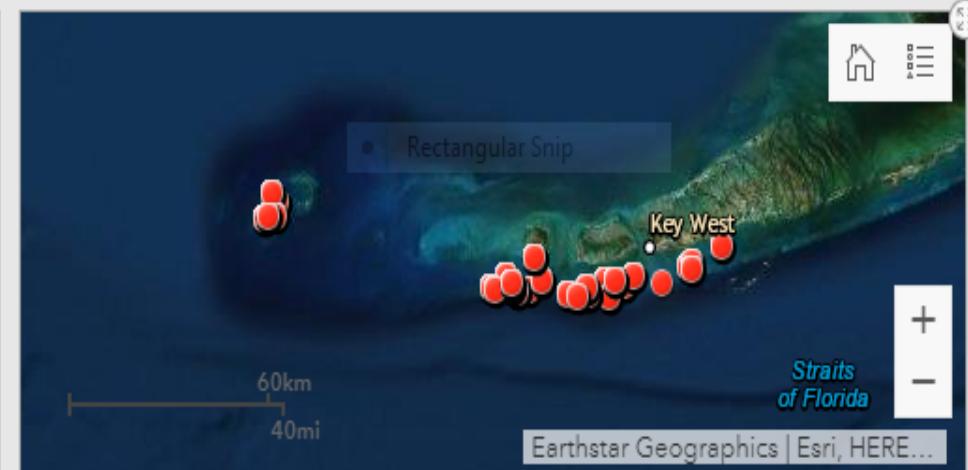
Corals Rescued



Year

Genotype

Coral Codes



Map

Glossary

Current Housing Facility

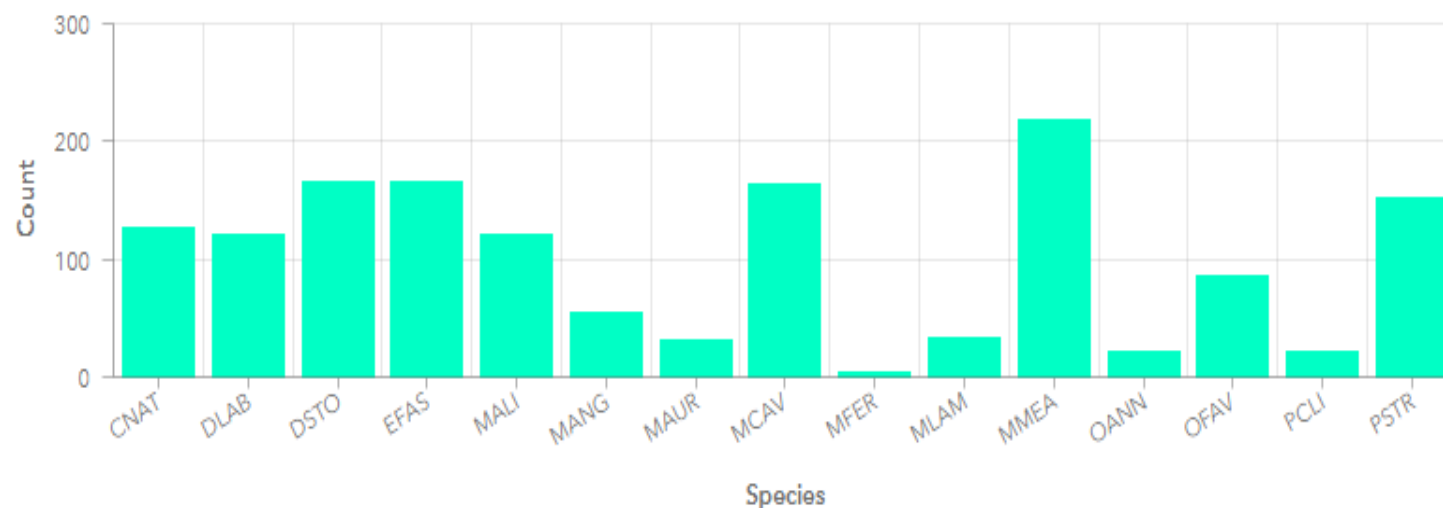
(Click pie chart to filter data)



- Florida Museum of Natural History Aquarium*
- Nova Southeastern University 293
- Omaha's Henry Doorly Zoo* 89
- Riverbanks Zoo & Gardens* 36
- Texas State Aquarium* 30
- University of Miami 461

*Denotes Association of Zoos and Aquariums (AZA) accredited facilities. **Number of corals may change over time as colonies are added, removed, or re-distributed across holding facilities.

High Priority Species Rescued



Species

Facility

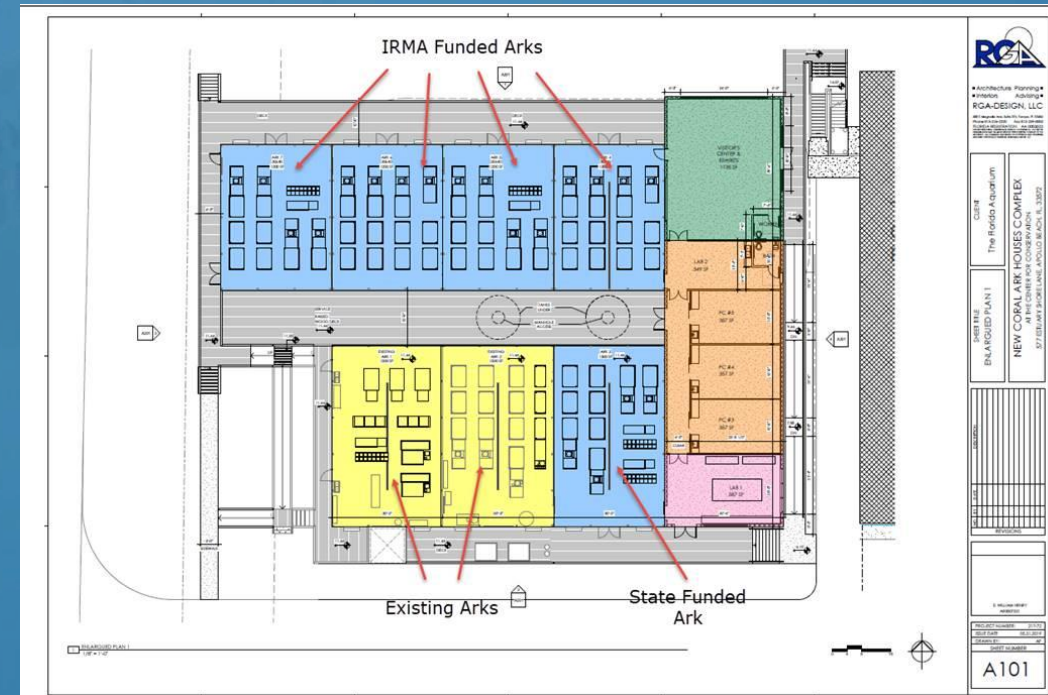
Diameter

Tissue

VISION: Phase 4

Phase 4 – Propagation

- Form Coral Propagation Team
- Activities and needs assessment
- Develop Coral Propagation Plan
- Build out of on-land propagation facilities
 - Florida Aquarium - 4 greenhouses
- Transfer from AZA Facilities to on-land propagation facilities
- Collections from endemic zone
- Expansion of in-water nurseries for grow-out



Propagation Team

- Brand new!
- Develop a Coral Propagation Plan (including sexual, asexual, and sexual-to-asexual), to include collections of corals/gametes from the endemic zone.
- Develop an infrastructure expansion plan.
- Develop and maintain species-specific propagation genetic management plans
- Serve as the coordinating hub for funding, communication, logistics, etc.



Website Resources for SCTLD!

Florida Focused

FKNMS SCTLD Web Portal (general information)

<https://floridakeys.noaa.gov/coral-disease/>

DEP Disease Site (technical information)

<https://floridadep.gov/rcp/coraldisease>

Caribbean Wide

AGRRA webpage (reporting & general information)

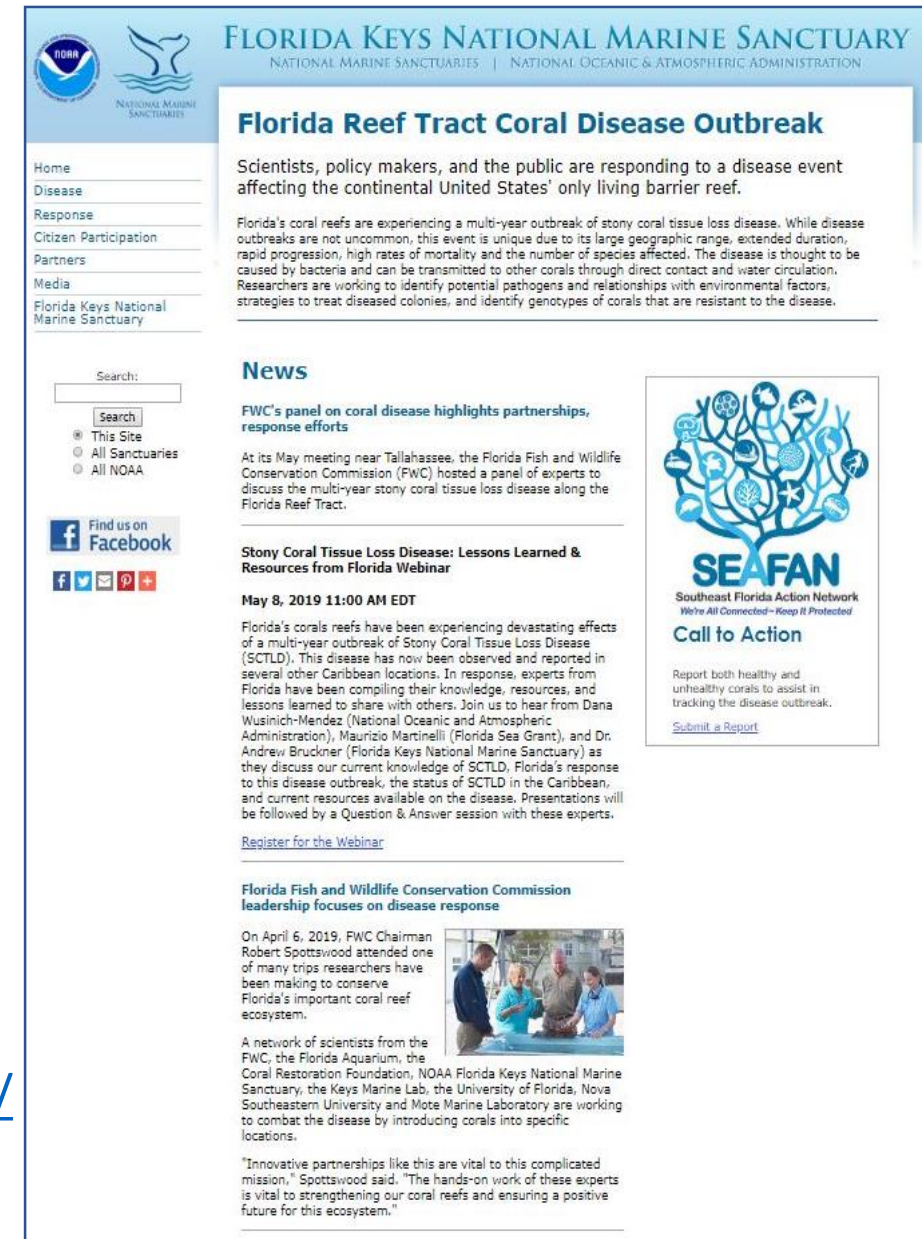
<http://www.agrra.org/coral-disease-outbreak/>

GCFI website (awareness raising)

<https://www.gcfi.org/emerging-issues-florida-coral-disease-outbreak/>

TNC Reef Resilience Network SCTLD page

<http://reefresilience.org/managing-for-disturbance/managing-coral-disease/stony-coral-tissue-loss-disease/>



The screenshot shows the Florida Keys National Marine Sanctuary website. The header includes the NOAA logo, the sanctuary's name, and the National Oceanic & Atmospheric Administration logo. A navigation menu on the left lists: Home, Disease, Response, Citizen Participation, Partners, Media, and Florida Keys National Marine Sanctuary. A search bar is located below the menu. The main content area features a large article titled "Florida Reef Tract Coral Disease Outbreak" with a sub-header "Scientists, policy makers, and the public are responding to a disease event affecting the continental United States' only living barrier reef." The article text describes a multi-year outbreak of stony coral tissue loss disease. Below the article is a "News" section with two items: "FWC's panel on coral disease highlights partnerships, response efforts" and "Stony Coral Tissue Loss Disease: Lessons Learned & Resources from Florida Webinar" dated May 8, 2019. A sidebar on the right contains a "SEAFAN" logo and a "Call to Action" section with a "Submit a Report" link. At the bottom, there is a photo of a group of people and text about a network of scientists working to combat the disease.

Florida Keys National Marine Sanctuary
NATIONAL MARINE SANCTUARIES | NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION

Florida Reef Tract Coral Disease Outbreak

Scientists, policy makers, and the public are responding to a disease event affecting the continental United States' only living barrier reef.

Florida's coral reefs are experiencing a multi-year outbreak of stony coral tissue loss disease. While disease outbreaks are not uncommon, this event is unique due to its large geographic range, extended duration, rapid progression, high rates of mortality and the number of species affected. The disease is thought to be caused by bacteria and can be transmitted to other corals through direct contact and water circulation. Researchers are working to identify potential pathogens and relationships with environmental factors, strategies to treat diseased colonies, and identify genotypes of corals that are resistant to the disease.

News

FWC's panel on coral disease highlights partnerships, response efforts

At its May meeting near Tallahassee, the Florida Fish and Wildlife Conservation Commission (FWC) hosted a panel of experts to discuss the multi-year stony coral tissue loss disease along the Florida Reef Tract.

Stony Coral Tissue Loss Disease: Lessons Learned & Resources from Florida Webinar

May 8, 2019 11:00 AM EDT

Florida's coral reefs have been experiencing devastating effects of a multi-year outbreak of Stony Coral Tissue Loss Disease (SCTLD). This disease has now been observed and reported in several other Caribbean locations. In response, experts from Florida have been compiling their knowledge, resources, and lessons learned to share with others. Join us to hear from Dana Wusinich-Mendez (National Oceanic and Atmospheric Administration), Maurizio Martinelli (Florida Sea Grant), and Dr. Andrew Bruckner (Florida Keys National Marine Sanctuary) as they discuss our current knowledge of SCTLD, Florida's response to this disease outbreak, the status of SCTLD in the Caribbean, and current resources available on the disease. Presentations will be followed by a Question & Answer session with these experts.

[Register for the Webinar](#)

Florida Fish and Wildlife Conservation Commission leadership focuses on disease response

On April 6, 2019, FWC Chairman Robert Spottswood attended one of many trips researchers have been making to conserve Florida's important coral reef ecosystem.

A network of scientists from the FWC, the Florida Aquarium, the Coral Restoration Foundation, NOAA Florida Keys National Marine Sanctuary, the Keys Marine Lab, the University of Florida, Nova Southeastern University and Mote Marine Laboratory are working to combat the disease by introducing corals into specific locations.

"Innovative partnerships like this are vital to this complicated mission," Spottswood said. "The hands-on work of these experts is vital to strengthening our coral reefs and ensuring a positive future for this ecosystem."

SEAFAN
Southeast Florida Action Network
We're All Connected - Keep It Protected
Call to Action
Report both healthy and unhealthy corals to assist in tracking the disease outbreak.
[Submit a Report](#)

Questions?

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(e) mmartinelli1@ufl.edu