Port Miami Deep Dredge Project: Diving Beneath the Murky Headlines

William F. Precht

DIAL CORDY AND ASSOCIATES INC
Environmental Consultants

The "Murky" Headlines

Activists sue to stop Government Cut dredge and protect coral

BY JENNY STALETOVICH - JSTALETOVICH@MIAMIHERALD.COM
10/01/2014 7:22 PM | Updated: 10/01/2014 7:22 PM

Voices: A fragile environment pays the price for Miami's growth spurt

Alan Farnet, USA TODAY

Bay activists warn Corps to clean up dredge

BY JENNY STALETOVICH
07/17/2014 7:52 PM | Updated: 07/17/2014 8:20 PM

Miami-Dade County

Miami Herald

Biscayne Bay coral at risk from sloppy dredge work

BY JENNY STALETOVICH - JSTALETOVICH@MIAMIHERALD.COM
02/05/2015 4:50 PM | Updated: 02/05/2015 6:24 PM

The New York Times

Despite Protections, Miami Port Project Smothers Coral Reef in Silt

By LIZETTE ALVAREZ

CBS NEWS

Bay dredging project threatens vital Miami reefs

Environmentalists ready to sue over Miami port's deep dredge

Miami's Choice: Bigger Ships or Coral Reefs?

Dredging in Biscayne Bay inflicts heavy damage on North America's only coral reef tract.

By Scott Wyland
for National Geographic

INTERNATIONAL BUSINESS TIMES

Twitter Rumor: 1D Fans Supposed!

Massive PortMiami Dredge Project 'Wiping Out' Vast Coral Field

Local

NOAA Says Port Miami Dredge Disaster For Reef

August 18, 2015 4:40 PM

Miami port dredging damaging sea life, state inspectors say

BY JENNY STALETOVICH
08/19/2014 6:36 PM | Updated: 08/19/2014 8:54 PM

NOAA Warns of "Rapid Deterioration" of Endangered Corals Due to Deep Dredge Sludge

By Michael E. Miller Thu., Sep. 18 2014 at 7:00 AM 8 Comments

Environment AUGUST 17, 2015

PortMiami dredge damages more coral than feds expected

Florida – Deep Dredge Critics File Emergency Demand to Stop "Destruction of Endangered Species"

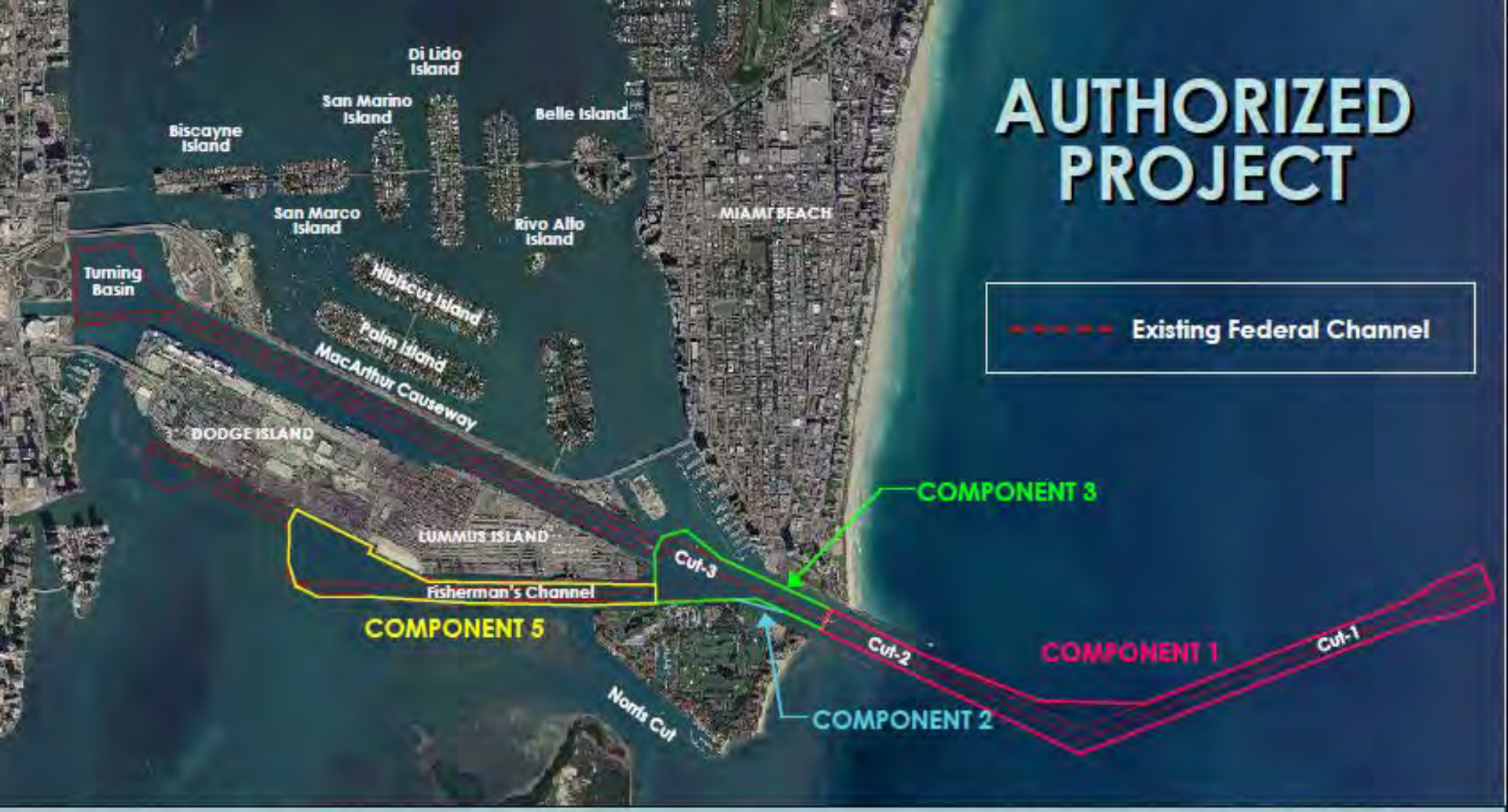
LETTERS TO THE EDITOR MARCH 17, 2016 8:31 PM

Dredging sediment killed our port coral

The Hits Just Keep on Coming!

THE DREDGING OF PORTMIAMI KILLED HALF A MILLION CORALS, ACCORDING TO A STUDY BY MIAMI WATERKEEPER

Science



Component 1:	Component 2:	Component 3:	Component 5:
Widen seaward portion of Cut-1 from 500 to 800 feet; deepen Cut-1 and Cut-2 from 44 to 52 feet	Add turn widener at the southern intersection of Cut-3 with Fisherman's Channel and deepen to 50 feet	Increase Fisher Island turning basin from 1200 to 1500 feet; truncate NE section of the turning basin to minimize seagrass impacts; deepen from 42 to 50 feet	Expand berthing area by 60 feet and widen southern edge of Fisherman's Channel 40 ft; reduce Lummus Island turning basin to a 1500 ft dia.; deepen from 42 to 50 ft

It's important to understand what happened in earlier similar projects!

Proceedings of the Fourth International Coral Reef Symposium, Manila, 1981, Vol. 1

IMPACT OF DREDGING ON A SUBTROPICAL REEF COMMUNITY, SOUTHEAST FLORIDA, U.S.A.

Donald S. Marszalek
Rosenstiel School of Marine and Atmospheric Science, University of Miami,
4600 Rickenbacker Causeway, Miami, Florida 33149 U.S.A.

Many of the small colonies of *D. stokesii*, *M. cavernosa* and other hemispherical forms showed a band of dead tissue adjacent to the substrate, buried beneath the layer of silt which covered the reef surface.

The stony corals at Miami Beach are near the northern limit of their ranges as evidenced by their relatively small size, low abundances, and rapid decrease in abundance north of Dade Country; thus the corals at Miami Beach are probably already under natural stresses, especially temperature and sediment reworking during the winter months. That corals are capable of surviving severe periods of stress can be seen from the numerous scars and overgrown areas on many coral colonies, and in the fact that most corals show no evidence of stress even at the most severely impacted sites. Their

Scleractinian corals appeared to be the most impacted of the reef macrofauna. Although mass mortality of corals has not occurred, the number of corals exhibiting stress symptoms has increased during the course of the dredging project. All species present in the study area showed a similar tolerance to dredging. In 1978, after two dredging seasons, about 5% of the corals near the dredge showed a partial loss of zooxanthellae (pale spots); after the 1980 dredging season, as many as 32.3% of scleractinian corals along a transect adjacent to the dredge exhibited pale spots or loss of tissue near the base of

CASE HISTORY OF A TYPICAL DREDGE-FILL PROJECT IN THE NORTHERN FLORIDA KEYS — EFFECTS ON WATER CLARITY, SEDIMENTATION RATES AND BIOTA

by
George M. Griffin
Harbor Branch Foundation, Inc.
Route 1 — Box 196
Ft. Pierce, Florida 33450

December 1974

- The area of relatively intense plume, turbidity greater than 40 mg/1, rarely extended more than 100-200 m from the dredge.

- Concentration vs . distance plots show that the plume suspensate settles normally, with surface concentration declining in a logarithmetic manner and gradually fading into the background turbidity. In general, the area of plume influence rarely exceeds the limits of an area extending about 500 m down-current from the active dredge.

- Natural turbidity varied moderately in time and space. These natural variations are related to wind stress, resulting in higher turbidity especially during the winter and spring.

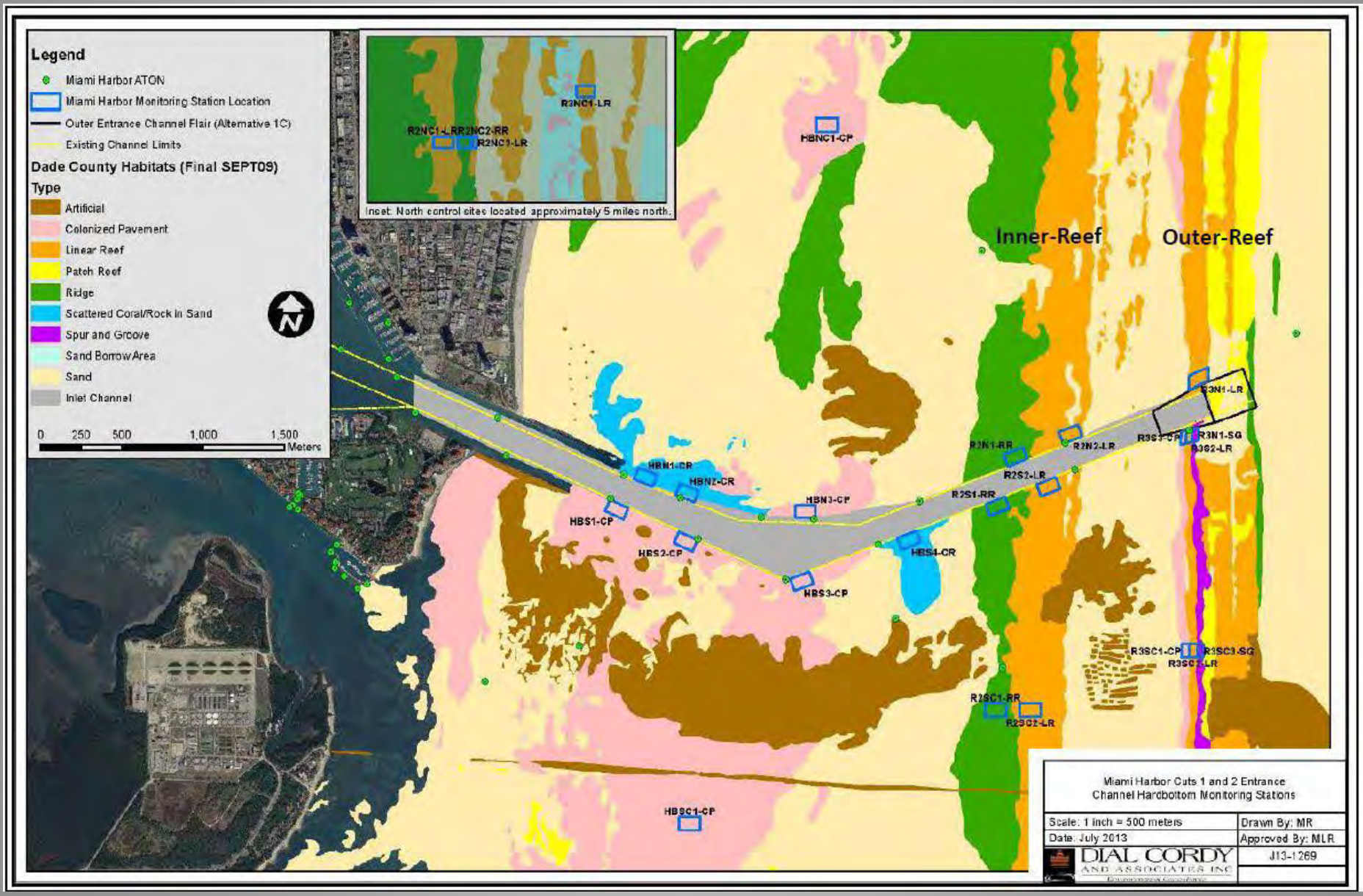
- Waves and currents wafted nearly all of the fine grained dredge effluent out of the project area within a few months following cessation of dredge operations.

- Considering the natural turbidity level and the measured spread of effluent from the dredge, it seems that the patch reef was too distant to have been affected by the dredging . In other words, a reef situated at least one-half mile from a dredge project in the Keys is not likely to be affected . This conclusion coincides with the results of the biological team . They monitored the health of the patch reef at the initiation of the project (November 1972) and after its termination (November 1973) . Based on a quantitative quadrant survey, they reported that no detectable changes had occurred and that the percentages of live and dead coral were identical before and after.

Mandated FDEP Phase III Environmental Monitoring

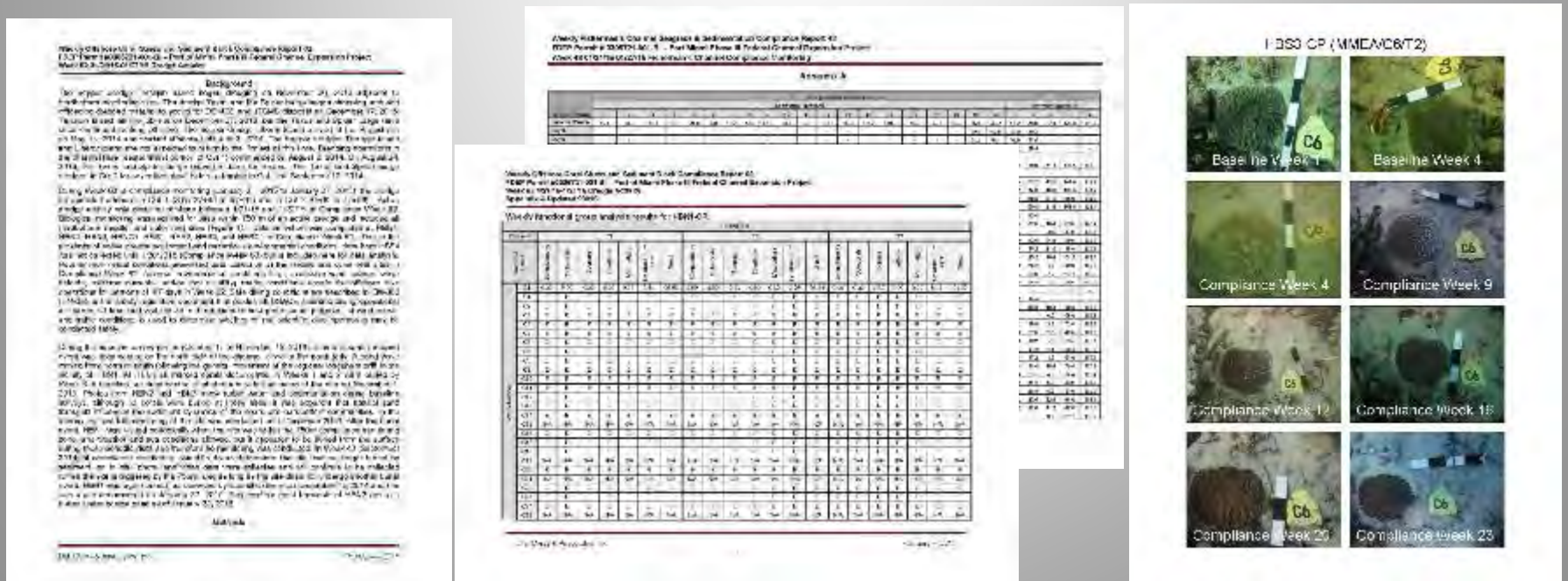
- Cut 1 and Cut 2 hardbottom, middle, and outer reef monitoring at 26 channel side and reference sites, surveying habitat along 78 transects (three transects at each site), with up to ten (10) tagged stony corals per transect.

FDEP Mandated Monitoring Sites



Phase III Environmental Monitoring

- Agency Reporting – weekly data collection, analysis, interpretation, and reporting for offshore and seagrass data.
- Data Management including raw data, spreadsheets, photos, video



Scientific Diving

The Key to Obtaining Scientifically Credible Data in a Safe and Efficient Manner

Organizational Member of AAUS

Project Issues

- **Strong and Variable Currents**
- **Often Poor Visibility**
- **High Boat Traffic**
- **Active Working Port**

EM 385-1-1

Our Team Members Have Been Trained By and Operate Under the Most Stringent Scientific Diving Standards and Protocols!

The NOAA Diving Program

Diving for Science and Technology

Port*M*iami Environmental Monitoring

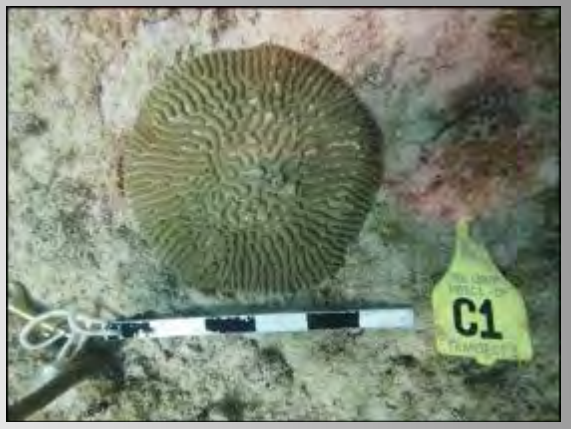
- Scientific Dive Team has safely completed 10,865 project related dives and more than 1,000 snorkels since Sept 2013

- 2017 548 dives
- 2016 704 dives
- 2015* 3,857 dives
- 2014* 4,991 dives
- 2013 765 dives

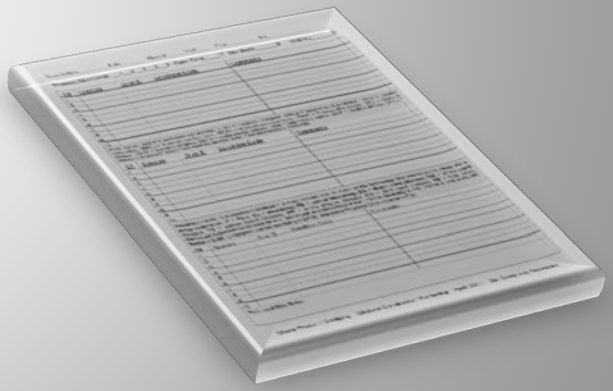
* Performed most scientific dives by an AAUS Organizational Member in 2014 and 2015.

Coral Condition Monitoring
Data Collection, Analysis & Presentation

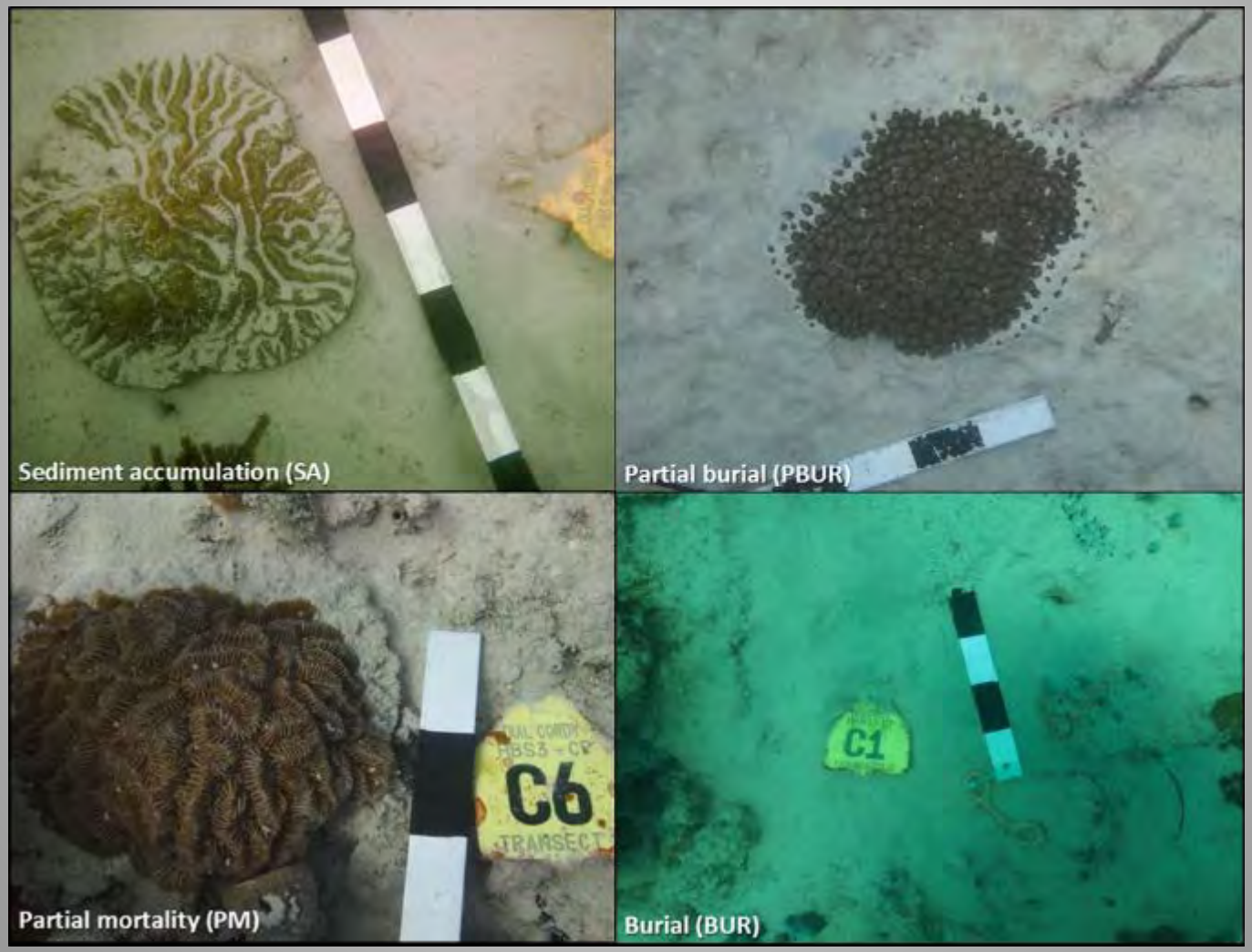
- Weekly data collection process



  - *in situ* condition assessment of marked corals by qualified personnel
  - Conditions are indicators of stress, modified from FRRP methods
  - Proportion of corals by site with “condition”
  - One way t-test, comparing the proportion of corals with condition between reference and channel-side sites
  - Report $p \leq 0.05$ weekly



Photographs of sedimentation indicators documented during compliance and post-construction surveys.



Partial Colony Mortality

Baseline (Oct. 2013)

Recent Partial Mortality in Compliance Week 20 (April 2014)

Partial Burial in Compliance Week 16 (March 2014)

Partial Burial in Compliance Week 30 (Jun. 2014)


15 cm
5 cm
Rim of crustose coralline algae revealing area of partial mortality

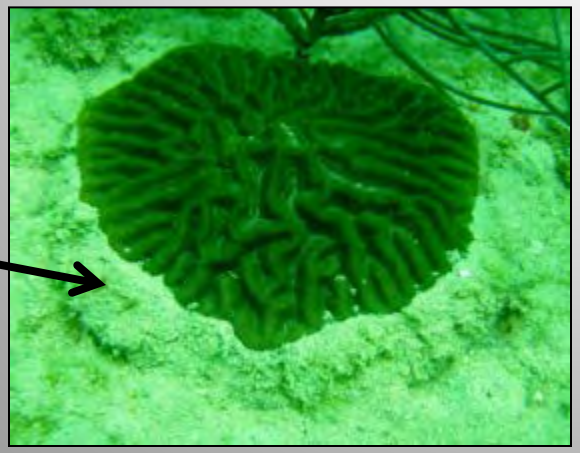
Project Related Sediment Impacts

Partial Colony Mortality

Survey Zone	Area	Site	Partial Mortality Related to Sediment Stress							
			All Corals				Without Dead Corals			
			#PM	N	Prop.	SD	#PM	N	Prop.	SD
Middle Reef	North	R2N1-RR	28	30	0.93	0.25	17	18	0.94	0.24
		R2N2-LR	15	24	0.63	0.49	12	20	0.60	0.50
		R2NC1-LR	2	28	0.07	0.25	2	24	0.08	0.27
		R2NC2-RR	2	30	0.07	0.25	2	28	0.07	0.26
	South	R2S1-RR	17	27	0.63	0.49	14	20	0.70	0.47
		R2S2-LR	15	24	0.63	0.49	6	12	0.50	0.52
		R2SC1-RR	9	30	0.30	0.47	8	21	0.38	0.50
		R2SC2-LR	2	25	0.08	0.28	1	11	0.10	0.32
Outer Reef	North	R3N1-LR	15	21	0.71	0.46	14	18	0.78	0.43
		R3NC1-LR	7	24	0.29	0.46	5	18	0.28	0.46
		R3S1-CP	8	19	0.42	0.51	7	13	0.54	0.52
	South	R3S2-LR	1	25	0.04	0.20	0	20	0.00	0.00
		R3S3-SG	9	25	0.36	0.49	7	19	0.37	0.50
		R3SC1-CP	4	24	0.17	0.38	3	20	0.15	0.37
		R3SC2-LR	0	20	0.00	0.00	0	12	0.00	0.00
		R3SC3-SG	3	24	0.13	0.34	2	15	0.13	0.35
Total			137	400			100	289		

8.4% Tissue loss

58%



Partial Coral Mortality In CNAT

Whole Colony Mortality

Table Total Scleractinan mortality from baseline through the Middle and Outer reef impact assessment as measured at each compliance monitoring site. Mortality has been broken into categories based on cause of coral mortality and include: sediment, disease and bleaching (white plague not included), and white plague disease. The white plague disease category includes colonies photographed with definitive signs of white plague disease and those consistent with white plague due to the resulting mortality patterns, timing, location, and species involved. Corals showing active white plague have also been included.

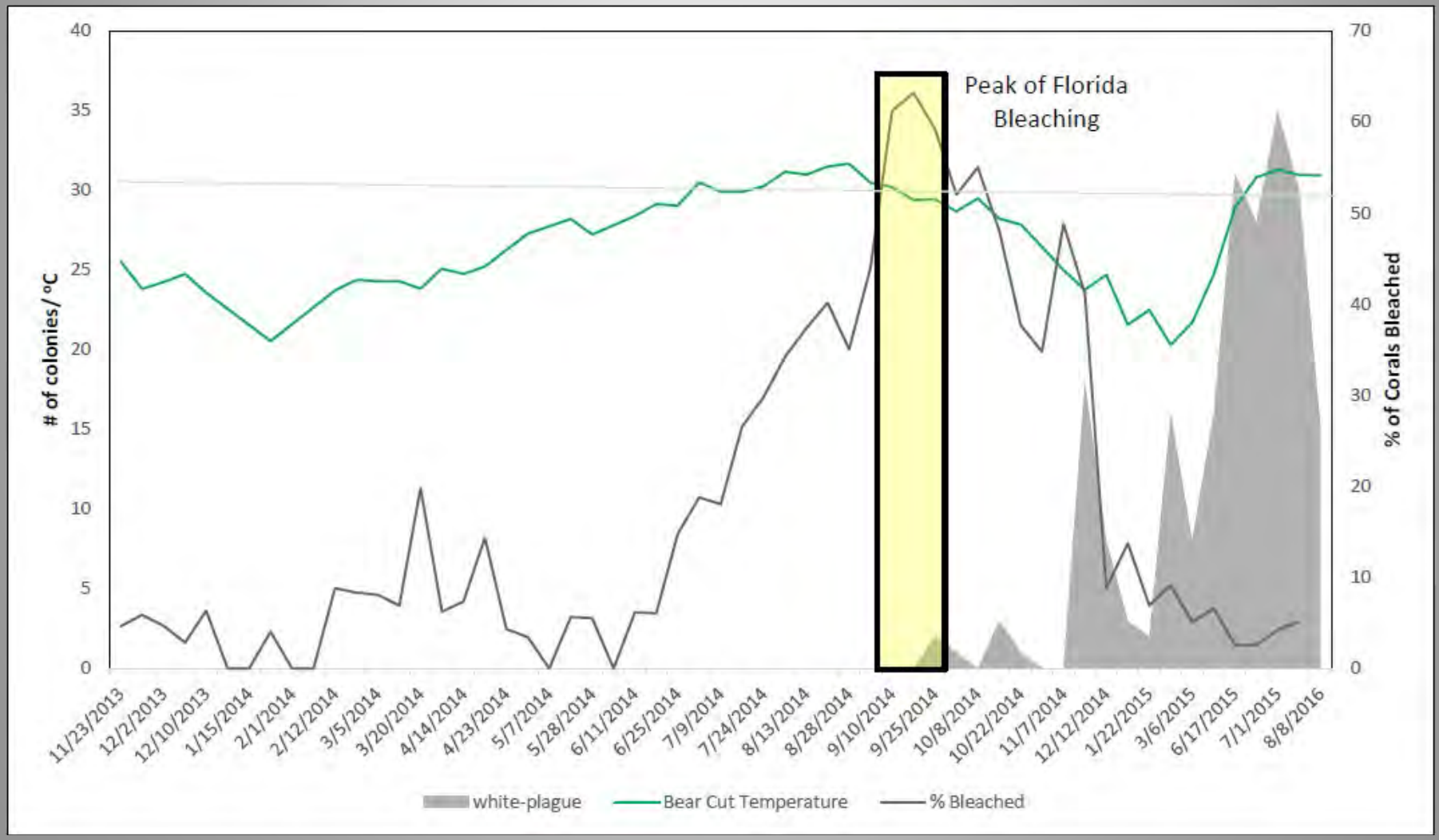
Survey Zone	Area	Site	Scleractinian Mortality (Baseline through Middle and Outer Reef Impact Assessment)								
			N	Sediment	Bleaching / Disease	WP Mortality	WP Active	% Sediment Mortality	% WP Mortality	Total Mortality	% of Tagged Dead
Middle Reef	South	R2S1	27	0	0	7	0	0.00	25.93	7	25.93
		R2SC1	30	0	1	6	4	0.00	20.00	7	23.33
		R2S2	24	0	0	9	4	0.00	37.50	9	37.50
		R2SC2	25	0	2	11	0	0.00	44.00	13	52.00
	North	R2N1	30	0	0	12	0	0.00	40.00	12	40.00
		R2NC2	30	0	0	0	2	0.00	0.00	0	0.00
		R2N2	24	2	0	2	1	8.33	8.33	4	16.67
		R2NC1	28	0	0	0	1	0.00	0.00	0	0.00
Outer Reef	South	R3S1	19	1	0	0	0	5.26	0.00	1	5.26
		R3SC1	24	0	2	2	0	0.00	8.33	4	16.67
		R3S2	25	0	1	3	0	0.00	12.00	4	16.00
		R3SC2	20	0	0	7	2	0.00	35.00	7	35.00
		R3S3	25	0	0	4	4	0.00	16.00	4	16.00
		R3SC3	24	0	0	6	2	0.00	25.00	6	25.00
	North	R3N1	21	2	0	0	0	9.52	0.00	2	9.52
		R3NC1	24	0	0	4	1	0.00	16.67	4	16.67
Totals			400	5	6	73	21	1.25	18.25	84	21.00

<2.7% total tagged Channel-side corals

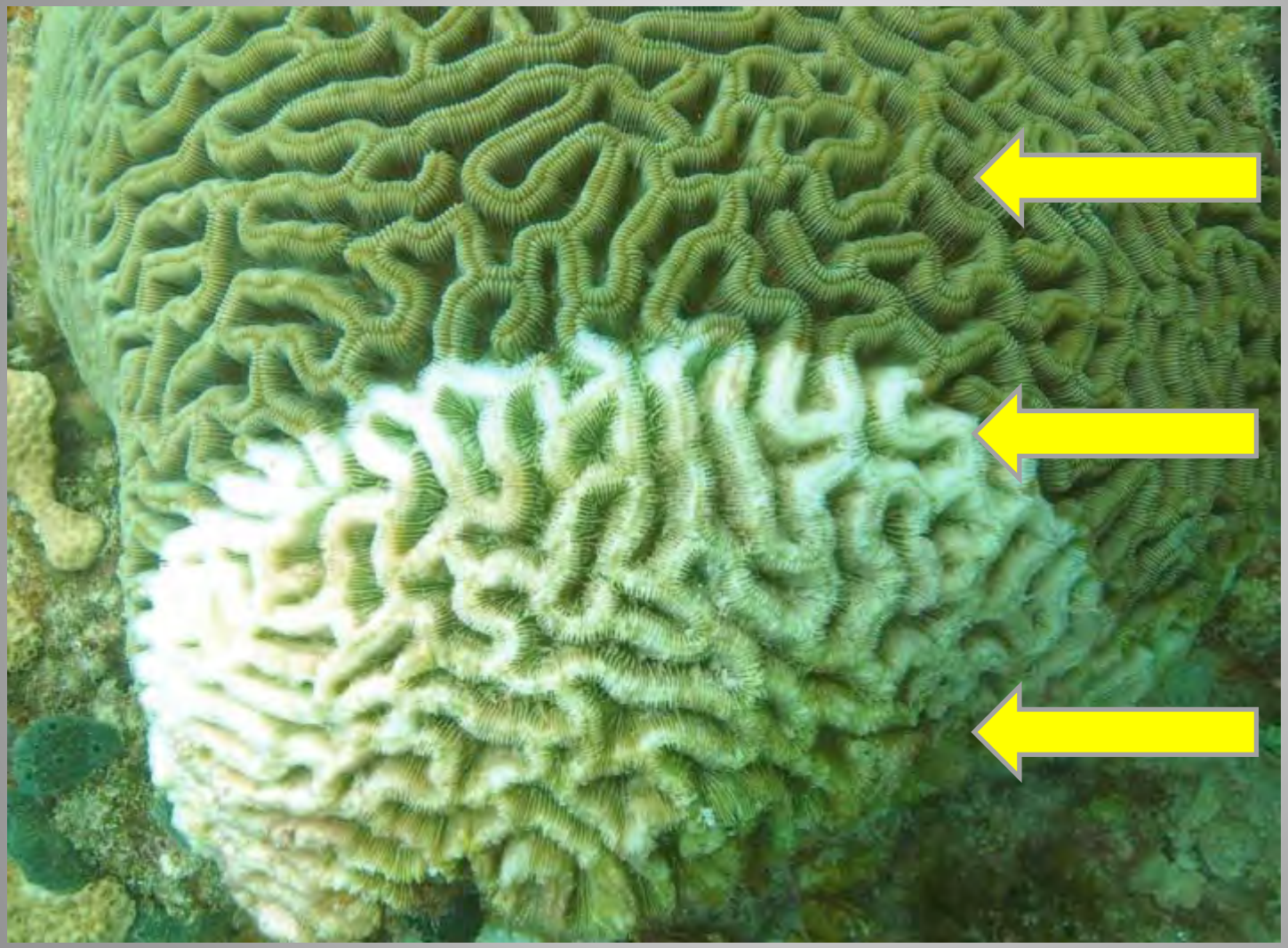
Over the course of project monitoring, seven-tagged channel-side scleractinian corals were buried and died as a direct result of sediment accumulation during dredging.

Partial mortality associated with sediment affected 58% of corals at channel-side sites and 19% of corals at control sites. The difference of 39% in sediment related partial mortality at the channel-side sites can thus be attributed to the dredging project.

Proportion of corals with white-plague disease increases following bleaching



Crandon Reef – August 18, 2015



Advancing front of White-Plague Disease on *Colpophyllia natans*

SCIENTIFIC REPORTS

OPEN

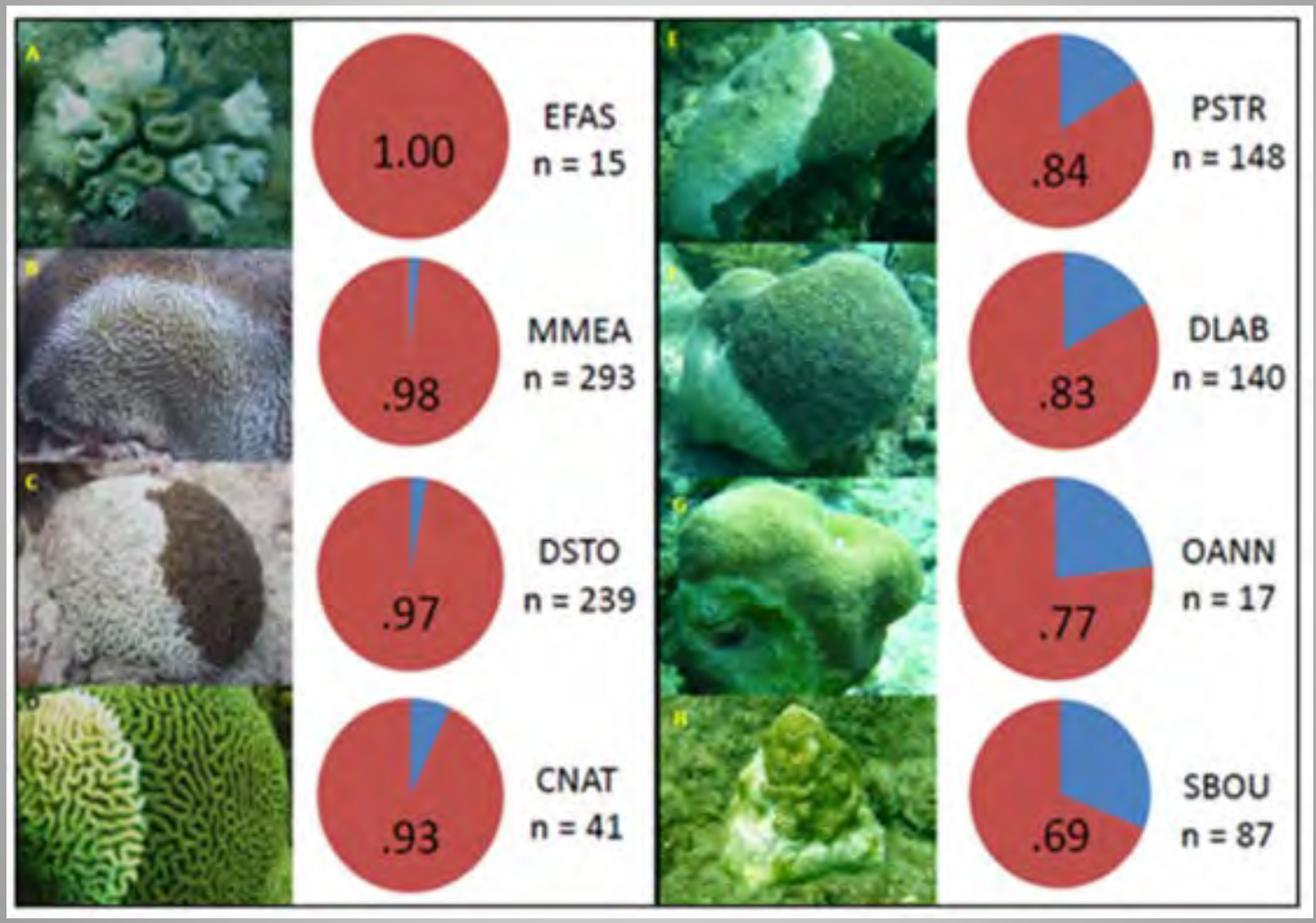
Unprecedented Disease-Related Coral Mortality in Southeastern Florida

Received: 07 January 2016
Accepted: 12 July 2016
Published: 10 August 2016

William F. Precht[1], Brooke E. Gintert[1,2], Martha L. Robbart[1], Ryan Fura[1] & Robert van Woesik[3]

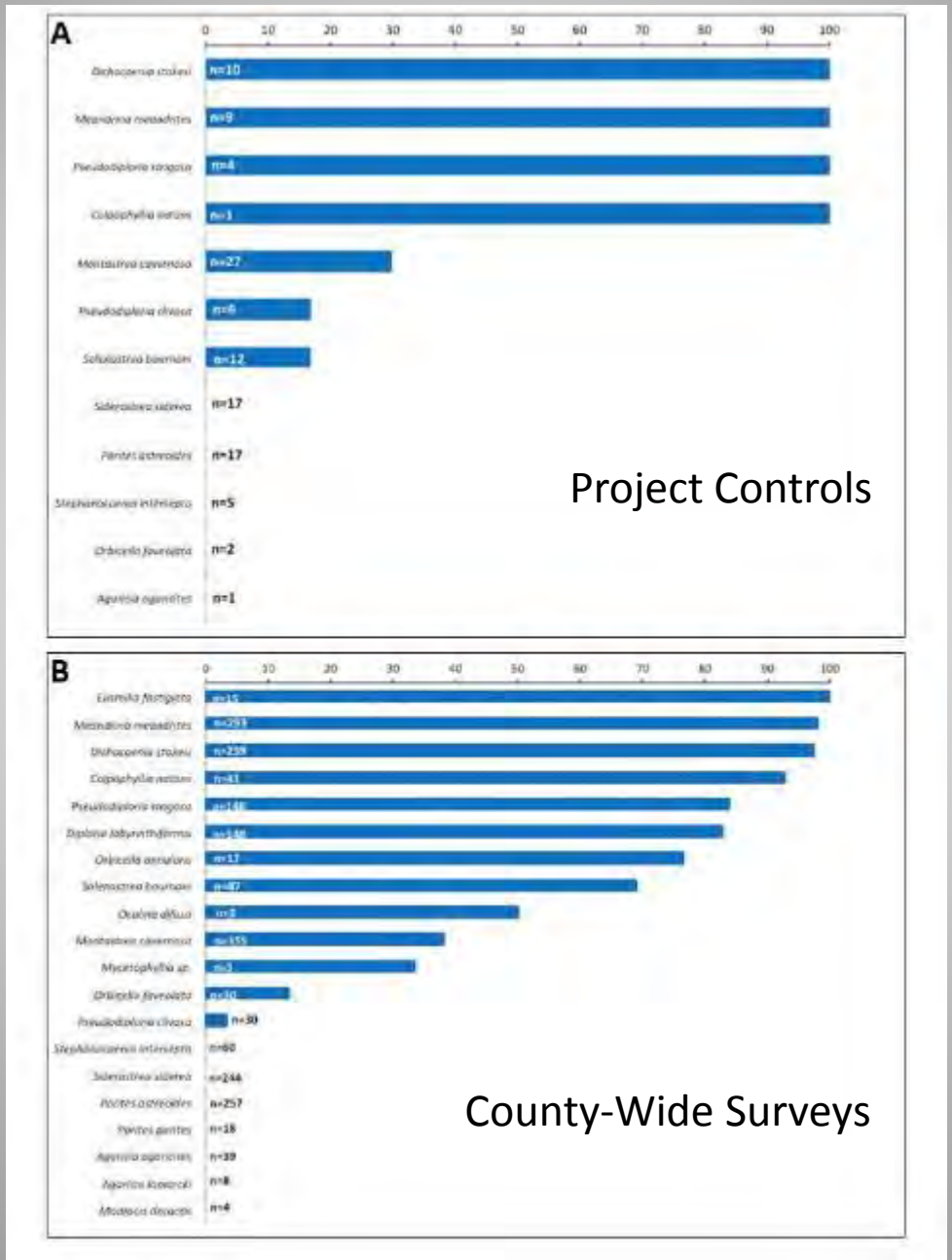
Anomalously high water temperatures, associated with climate change, are increasing the global prevalence of coral bleaching, coral diseases, and coral-mortality events. Coral bleaching and disease outbreaks are often inter-related phenomena, since many coral diseases are a consequence of opportunistic pathogens that further compromise thermally stressed colonies. Yet, most coral diseases have low prevalence (<5%), and are not considered contagious. By contrast, we document the impact of an extremely high-prevalence outbreak (61%) of white-plague disease at 14 sites off southeastern Florida. White-plague disease was observed near Virginia Key, Florida, in September 2014, and after 12 months had spread 100 km north and 30 km south. The disease outbreak directly followed a high temperature coral-bleaching event and affected at least 13 coral species. *Eusmilia fastigiata*, *Meandrina meandrites*, and *Dichocoenia stokesi* were the most heavily impacted coral species, and were reduced to <3% of their initial population densities. A number of other coral species, including *Colpophyllia natans*, *Pseudodiploria strigosa*, *Diploria labyrinthiformis*, and *Orbicella annularis* were reduced to <25% of their initial densities. The high prevalence of disease, the number of susceptible species, and the high mortality of corals affected suggests this disease outbreak is arguably one of the most lethal ever recorded on a contemporary coral reef.

It's important to understand what happened regionally.



2014-2015 were bad years for corals in southeast Florida due to thermal stress (bleaching) and disease.

Mortality due to White-Plague Disease



The Washington Post

Energy and Environment

Bleaching and disease are devastating the biggest coral reef in the continental U.S.

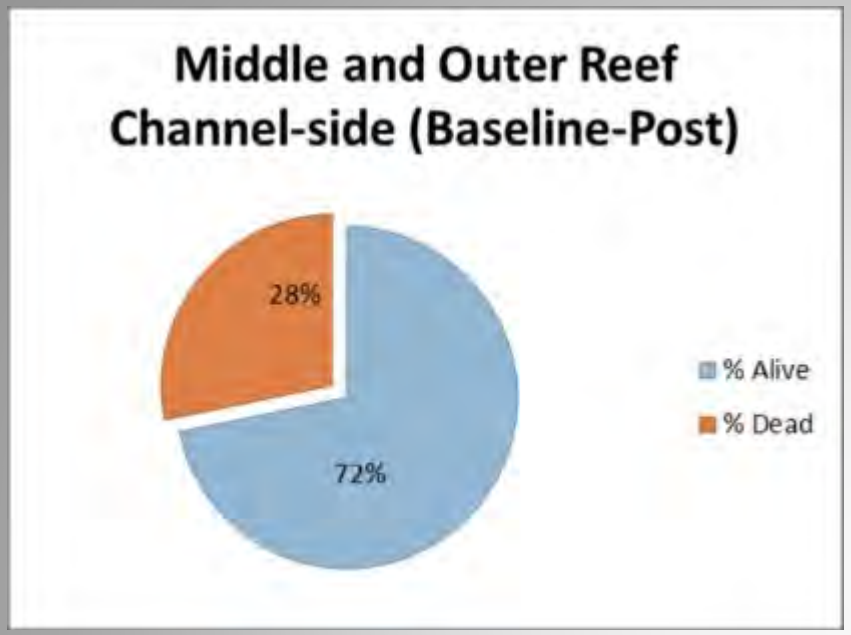
By Chelsea Harvey October 26

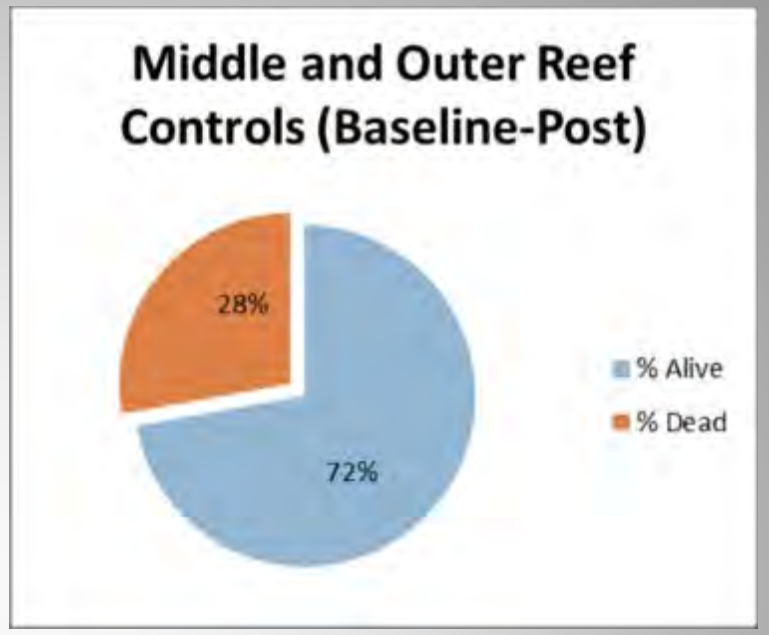
The disease outbreaks have been especially severe in the area off the coast of Miami, where bleaching was particularly heavy, Morton said. While several different types of coral disease have been observed, a disease known as “white plague” has been the most prevalent.

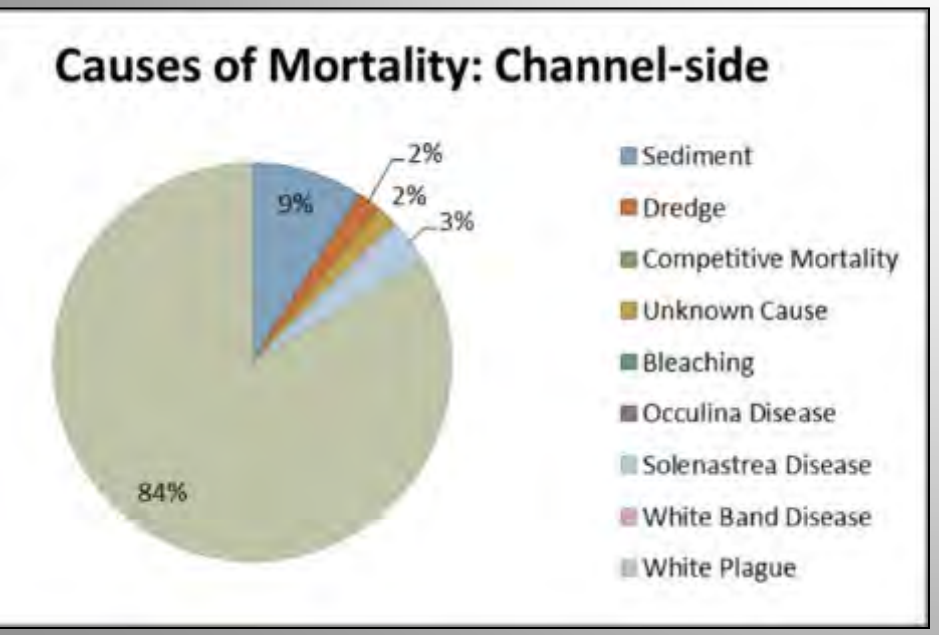
Local News

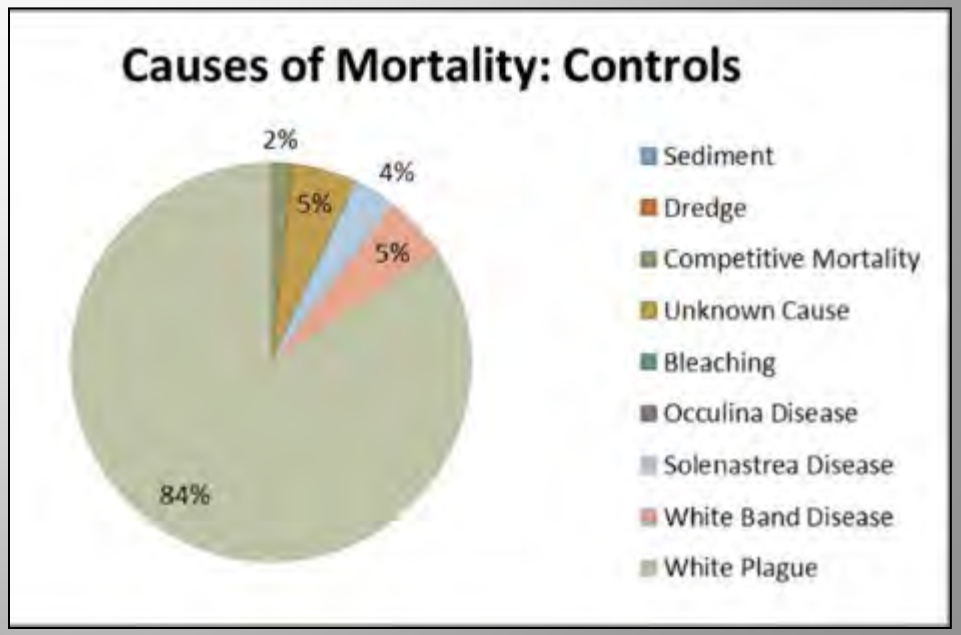
South Florida corals dying in "unprecedented" bleaching and disease

What does the data say?

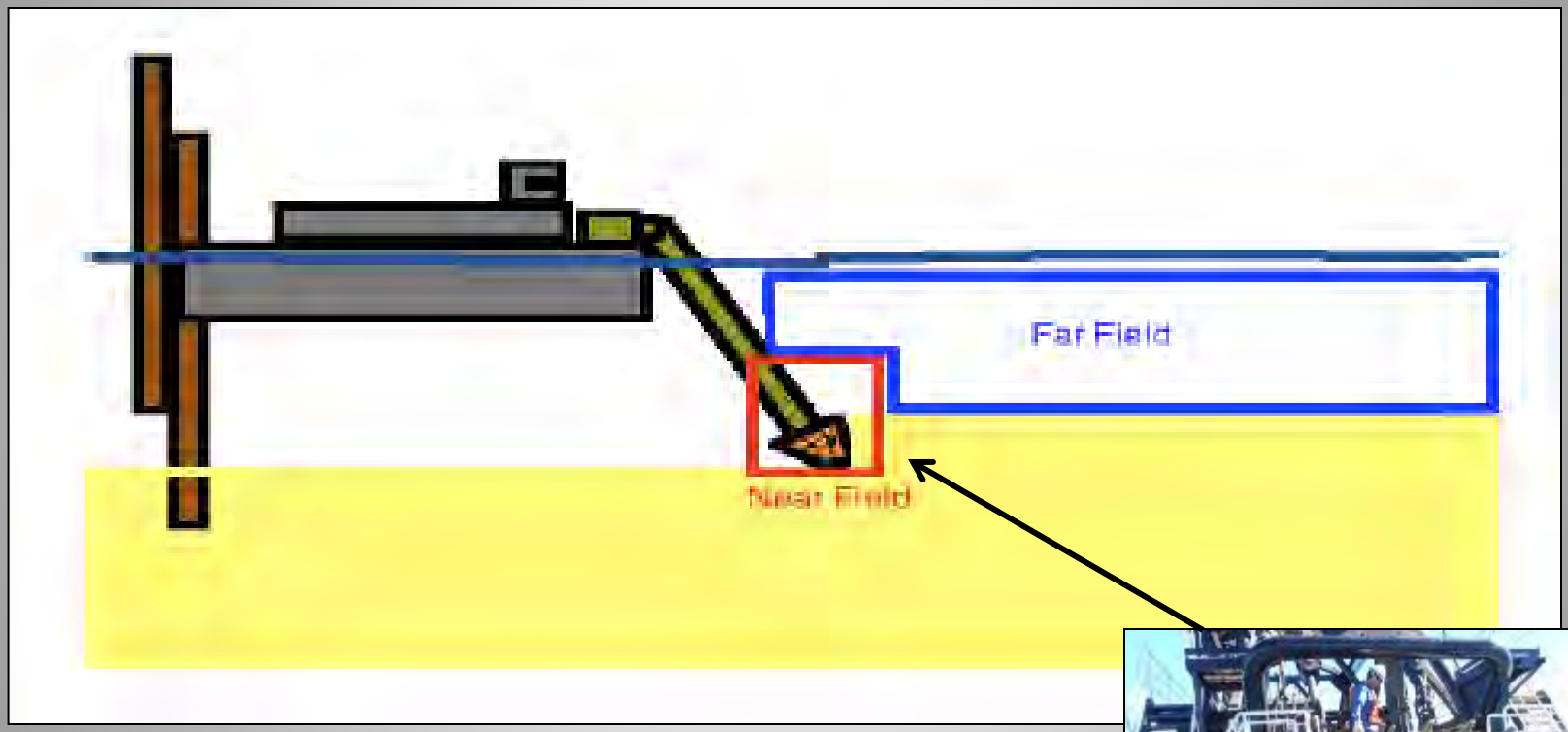




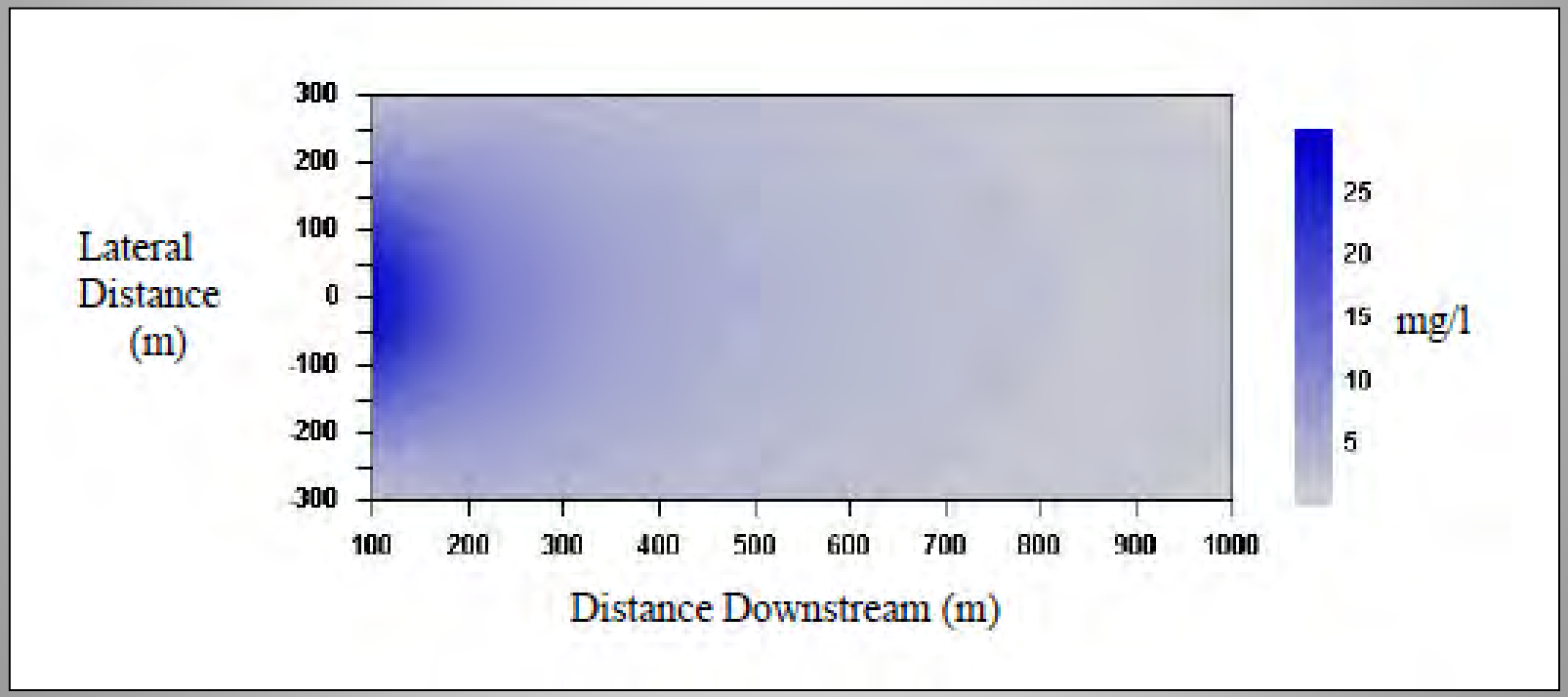




Potential Sediment Effects from Cutter-Head Dredge

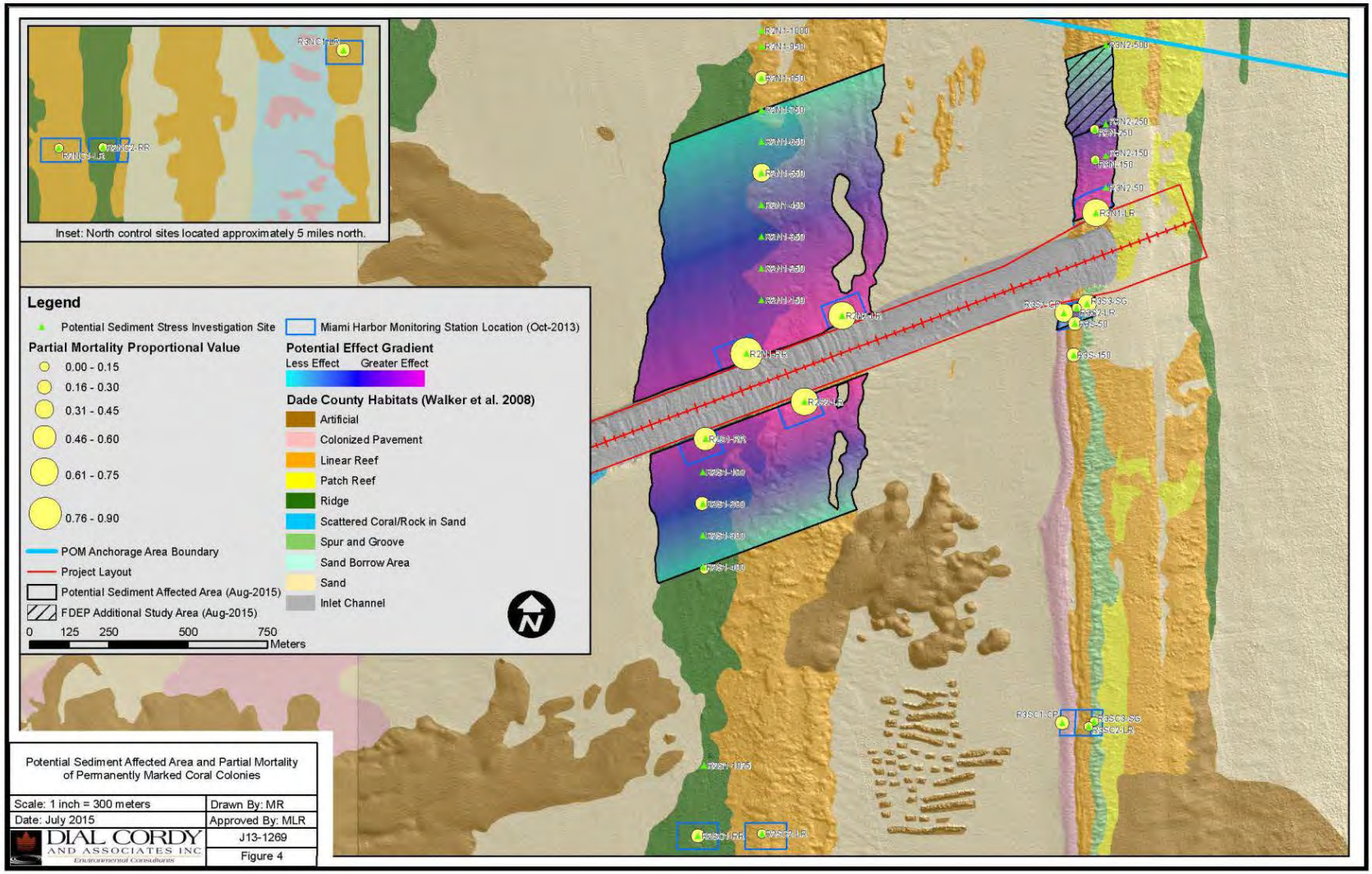


Model Projections of Far-Field Turbidity from Cutter-Head Dredge Operations



Henriksen P.T.L. (2009) Near-field Sediment Resuspension Measurement and Modeling for Cutter Suction Dredging Operations. PhD Dissertation, Texas A&M, College Station, TX

Sediment Impacts Observed at End of Dredging



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Marine Pollution Bulletin

journal homepage: www.elsevier.com/locate/marpolbul

Extensive coral mortality and critical habitat loss following dredging and their association with remotely-sensed sediment plumes

Ross Cunning[a,b,*], Rachel N. Silverstein[c,*], Brian B. Barnes[d], Andrew C. Baker[a]

[a] Department of Marine Biology and Ecology, Rosenstiel School of Marine and Atmospheric Science, University of Miami, 4600 Rickenbacker Causeway, Miami, FL 33149, USA

[b] Daniel P. Haerther Center for Conservation and Research, John G. Shedd Aquarium, 1200 South Lake Shore Drive, Chicago, IL 60605, USA

[c] Miami Waterkeeper, 2103 Coral Way, 2nd Floor, Miami, FL 33145, USA

[d] College of Marine Science, University of South Florida, 140 7th Avenue South, MSL119, St. Petersburg, FL 33701, USA

Natural vs. Project Related Sediment Impacts

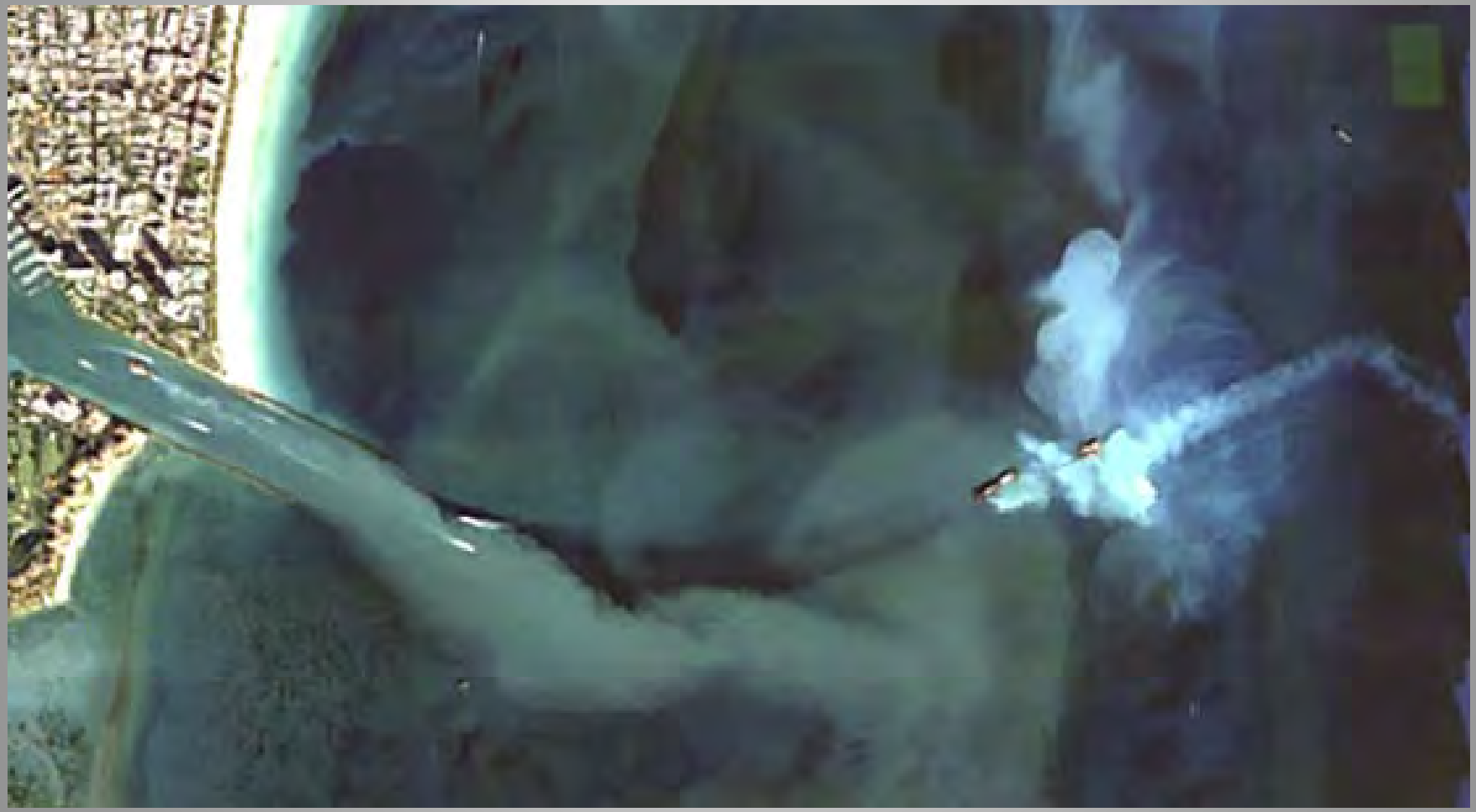
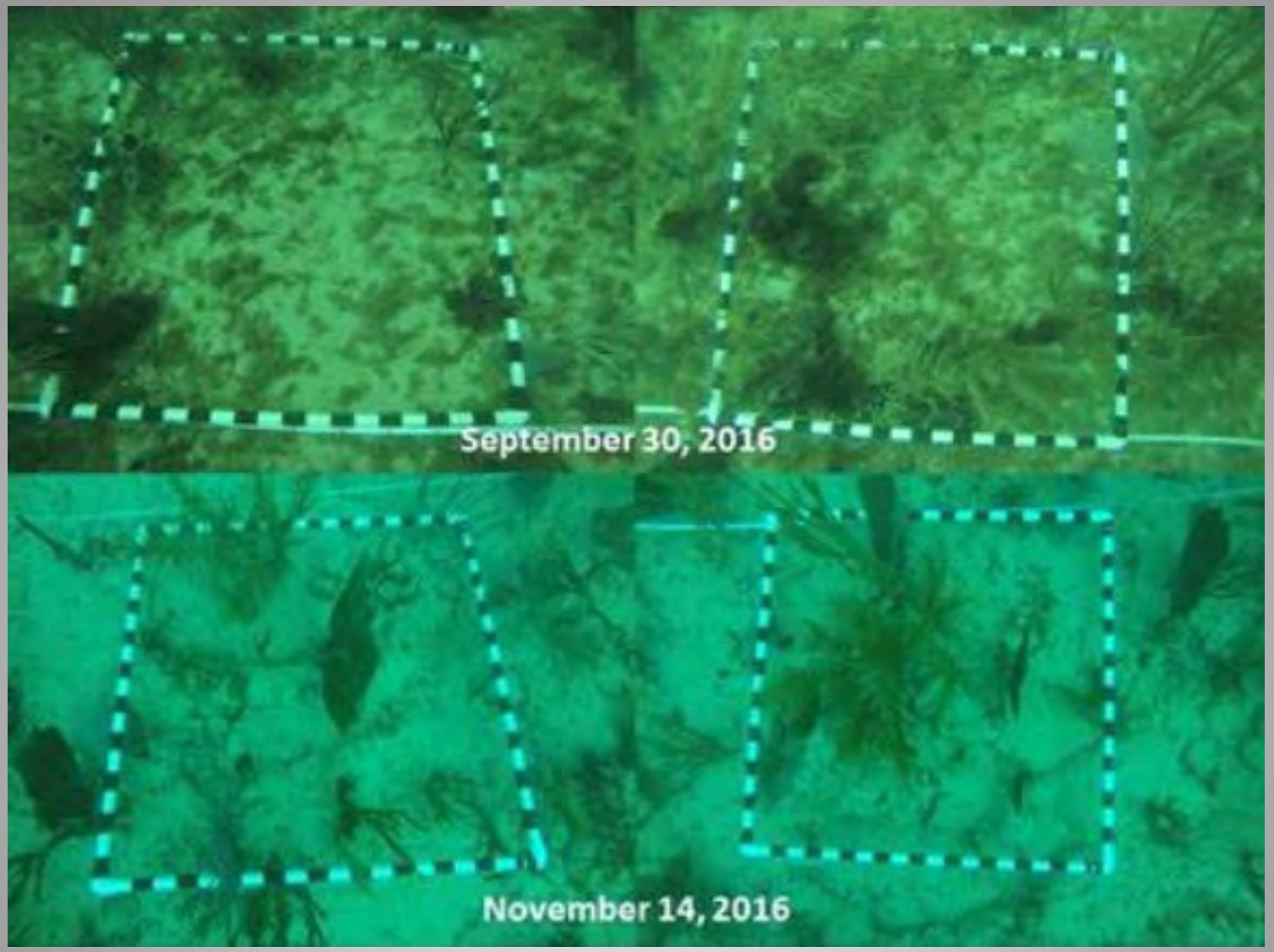


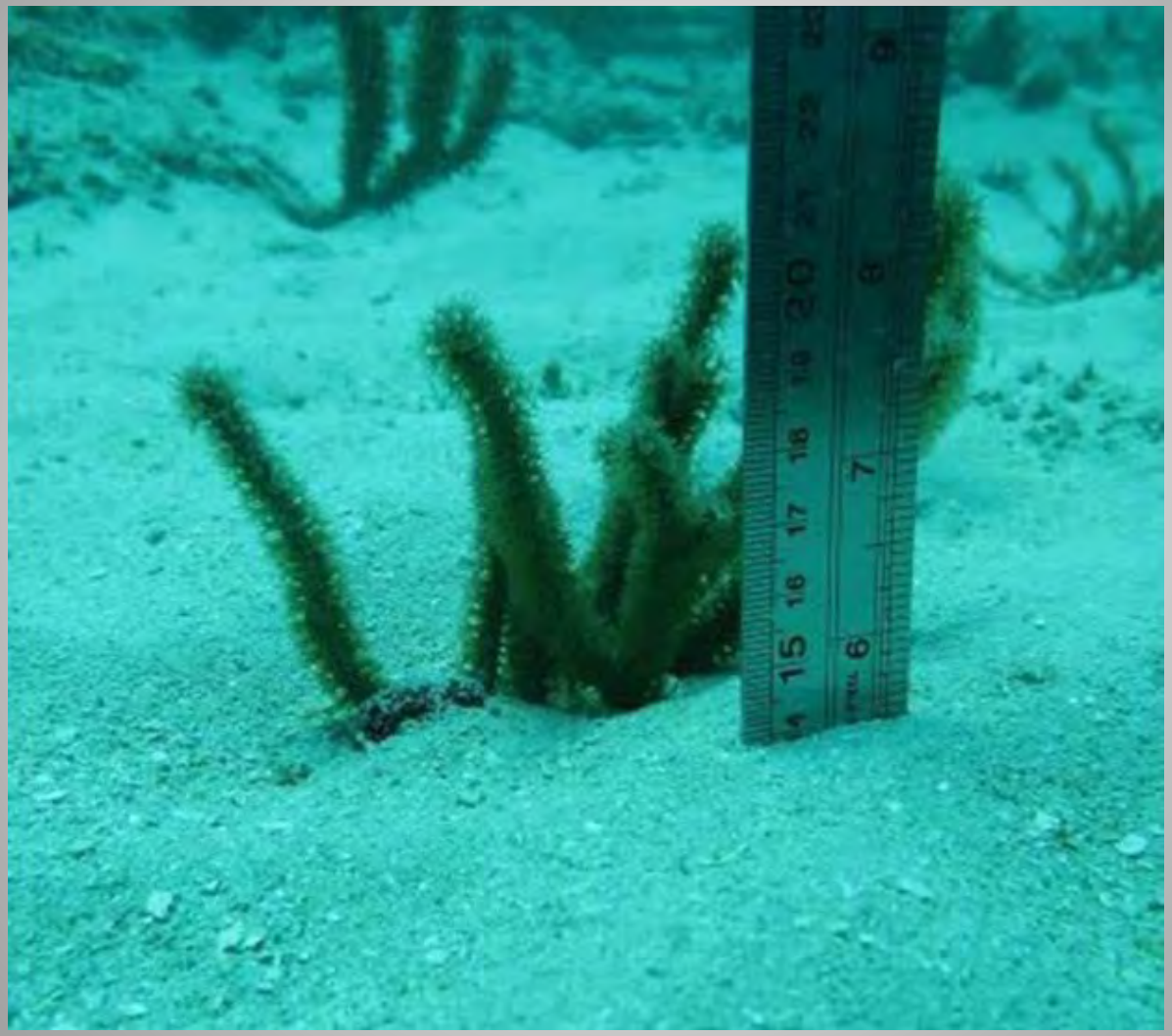
Figure 47. Photograph of permanent site R2N2-LR taken during the first week of middle reef baseline surveys (11/20/2013). Maintenance dredging began in the hardbottom habitat on 11/20/2013, more than 750 m away, as allowed by permit. The sediment pictured accumulated prior to dredge operations.

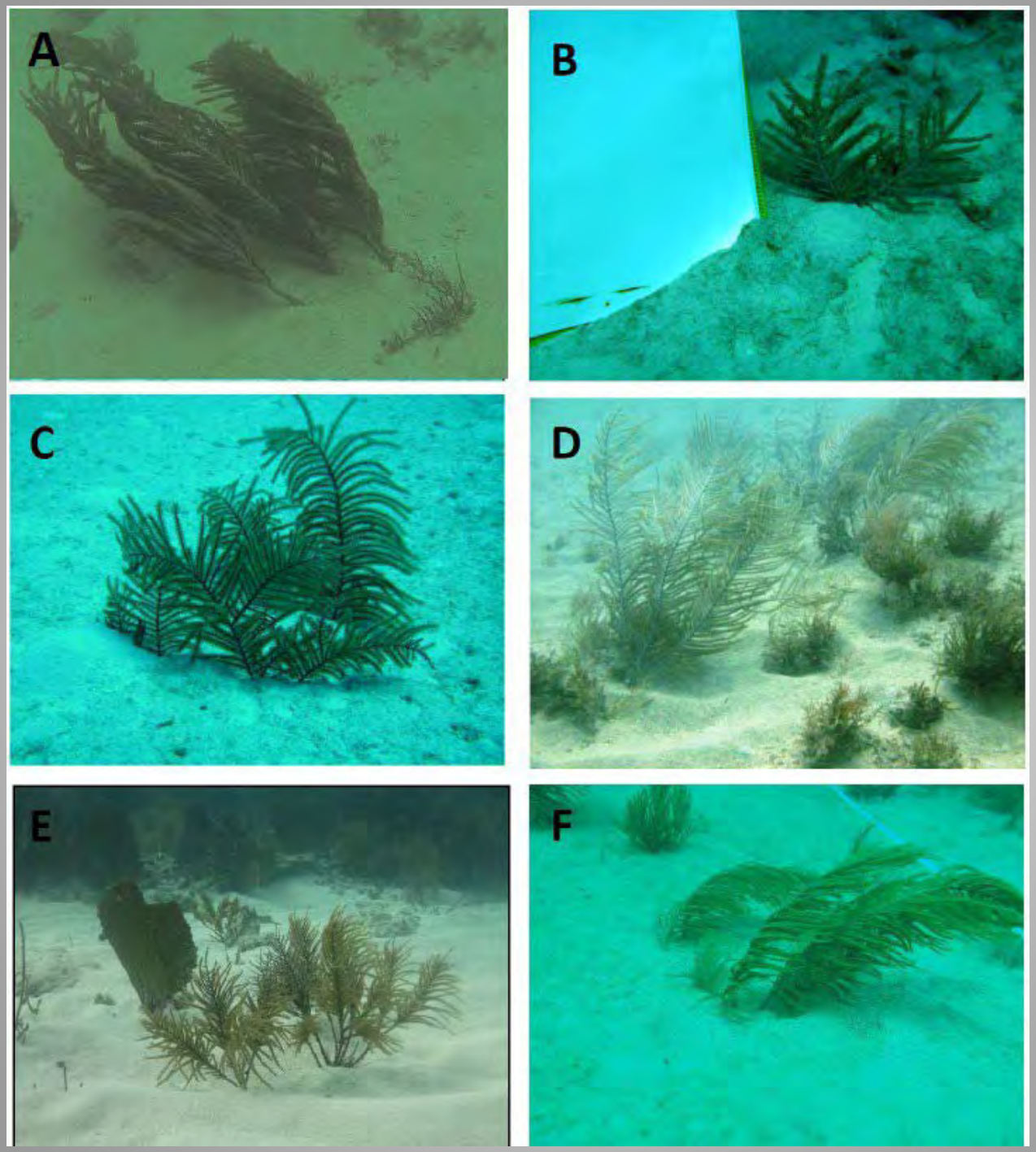
Hurricane Matthew 2016



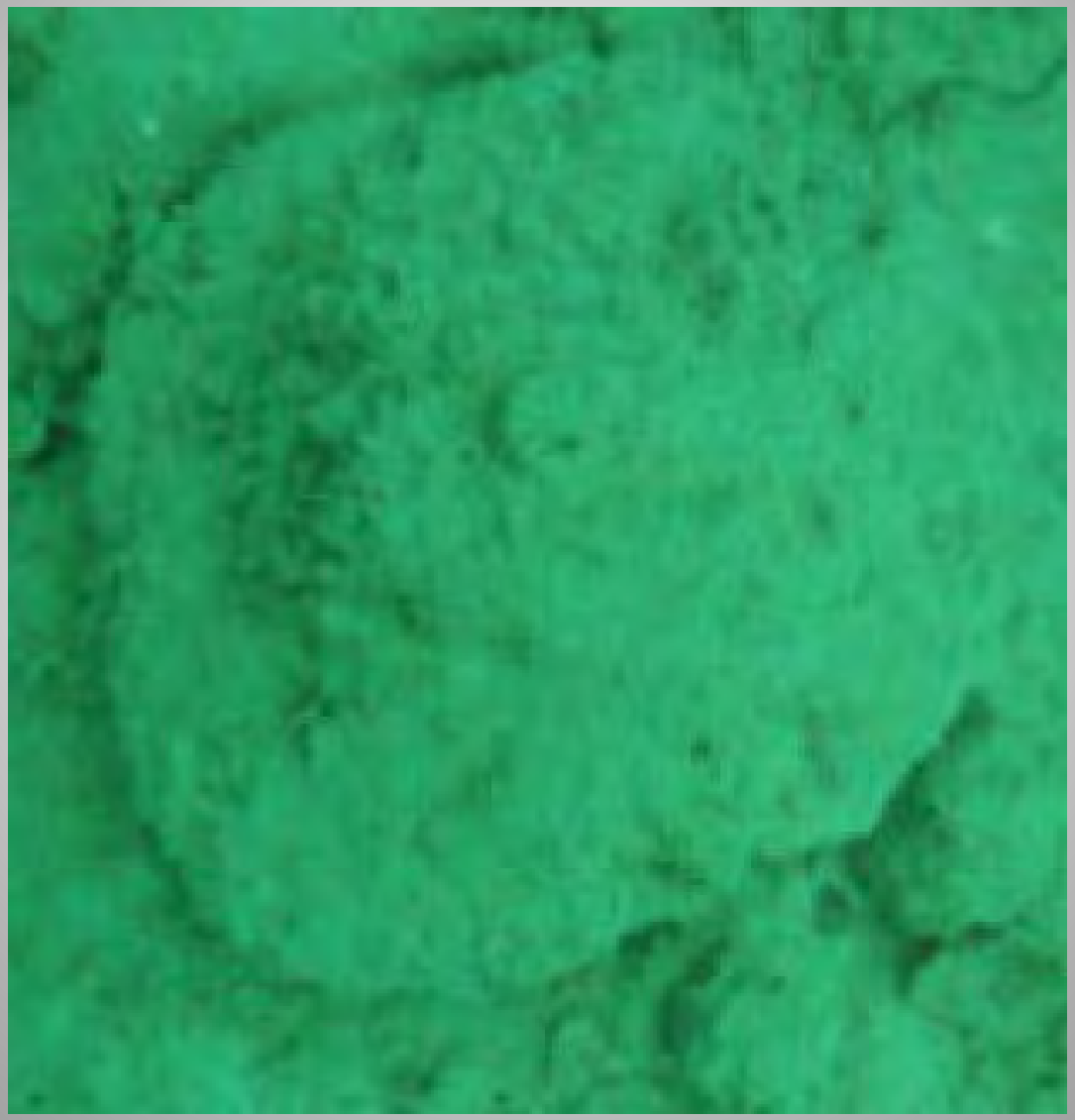
BEFORE AND AFTER HURRICANE MATTHEW QUADRAT PHOTOS COLLECTED AT R2N-75-RR ON SEPTEMBER 30, 2016 (BEFORE) AND NOVEMBER 14, 2016 (AFTER), NOTICE MACROALGAE COVER IN BEFORE PHOTO AND LACK OF MACROALGAE IN AFTER PHOTOS AS WELL AS PRESENCE OF FINE WHITE SEDIMENT OVER THE BOTTOM.

NMFS Report Photo

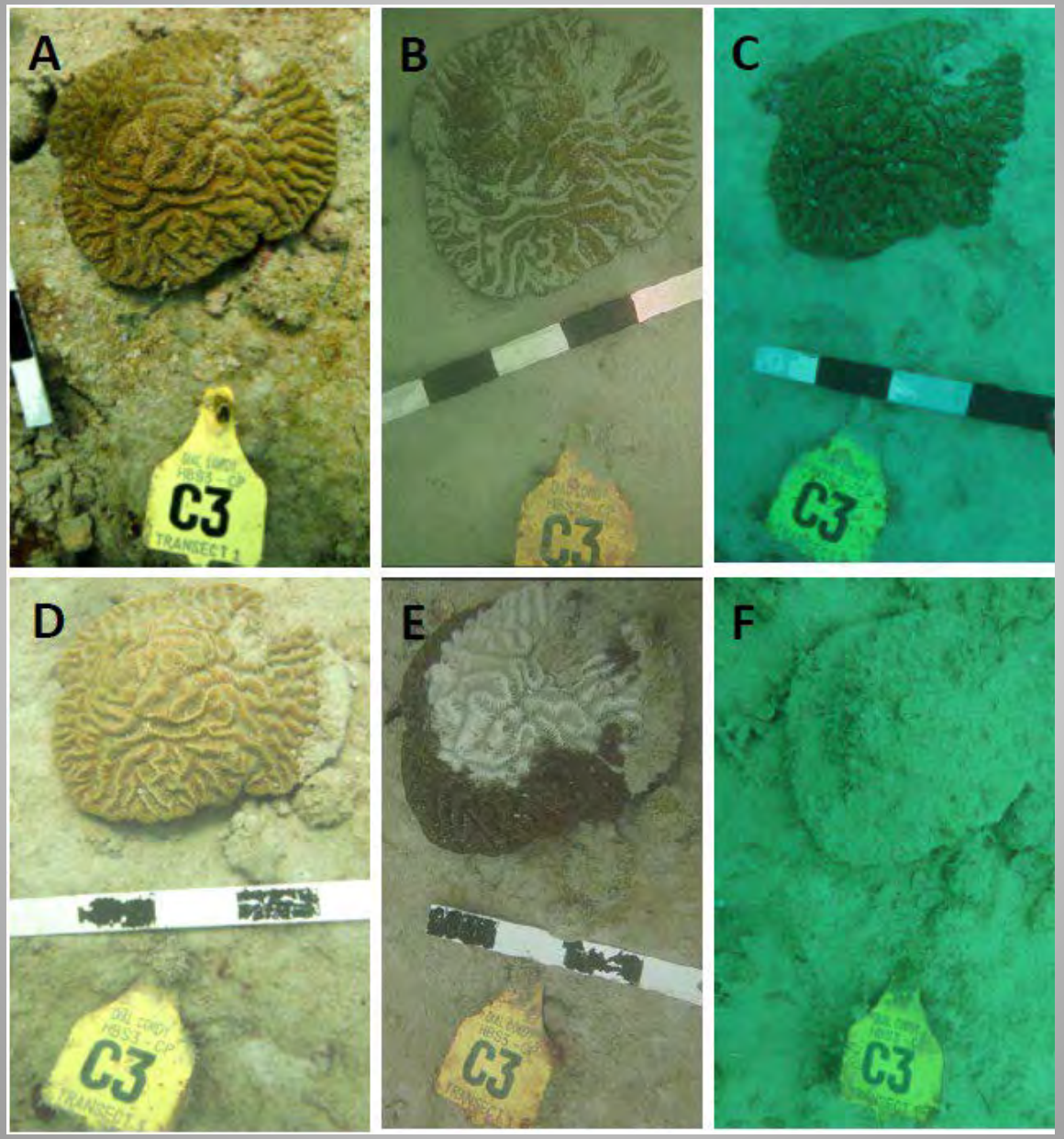



A
B
C
D
E
F

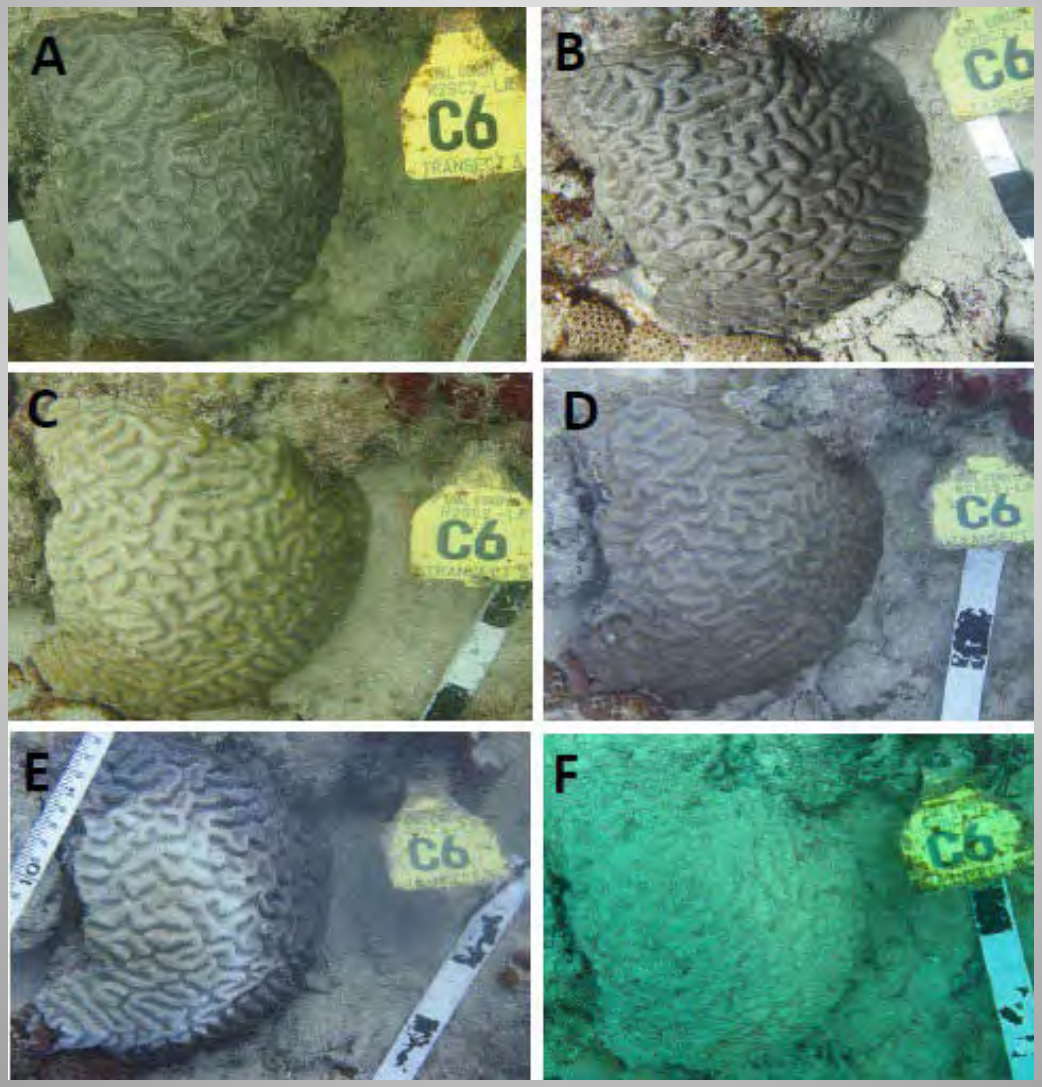
How would you know how this coral died ?



Unless you had this!



Same Sequence at Control Sites



A closely spaced repeated measure sampling design (as was mandated by the FDEP permit) reduces the chances of drawing invalid conclusions leading from the logical fallacy that correlation implies causation.

Between October 19, 2013 and July 13, 2015 each tagged coral, at each site, was monitored and photographed at least 40 times. In the laboratory, these **~25,000** individual observations of in situ coral condition were compared to paired photographs. In cases where corals had died, we were generally able to discern the exact cause of mortality by carefully evaluating the sequence of events recorded (and photographed), prior to death.

Conclusions

The regular monitoring of tagged corals at control and near project sites provided the detailed information needed to assign the correct cause of mortality to corals in the project area as opposed to the undocumented assertions of project opponents who conducted one-off surveys.

The actual monitoring results from the project emphasize the requirement for implementing scientifically-based, not ideologically-based management of natural systems to best understand and protect our fragile coral resources.

CASE HISTORY OF A TYPICAL DREDGE-FILL PROJECT IN THE NORTHERN FLORIDA KEYS — EFFECTS ON WATER CLARITY, SEDIMENTATION RATES AND BIOTA

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- The problem mentioned most often in newspaper and magazine accounts was a supposed relationship between excess siltation produced by dredging and the decline in health of the coral reefs. It appeared from these popular accounts, that the only living coral reefs in the continental United States were in imminent danger of extinction.

- Although the news stories concerning the decline of the reefs have been shown in our research to be more fictional than factual, they did serve the useful purpose of kindling scientific interest into the problems posed by dredging.