

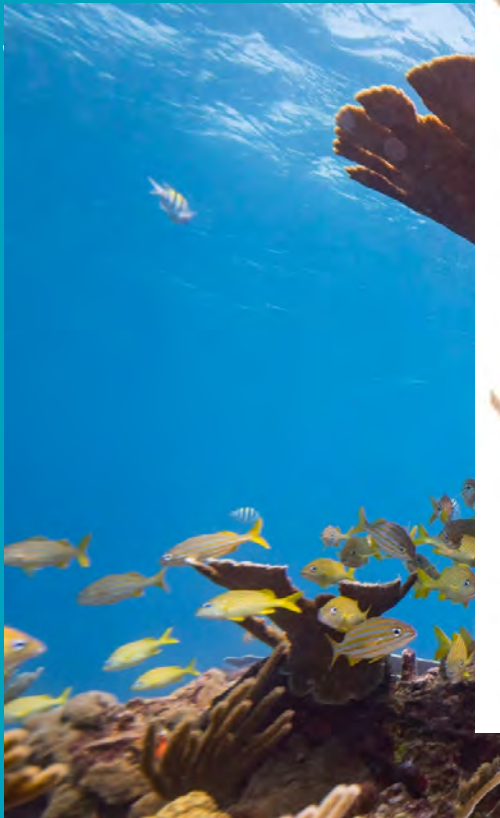
Gardening Corals for Reef Restoration



By: Dr. Katie Lohr

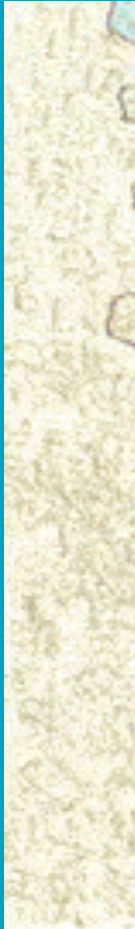
Coral Reef Ecosystems

- Habitat



research

0 min



Acroporid corals

- ~180 species of *Acropora*...
- ...but only 2 in the Caribbean!
- Historically spatial dominants
- Fast growth rate
- Complexity

Staghorn coral (*Acropora cervicornis*)



Elkhorn coral (*Acropora palmata*)



Carysfort Reef 1975



Discovery Bay,
Jamaica
1975



Carysfort Reef 2014



Discovery Bay,
Jamaica
2013

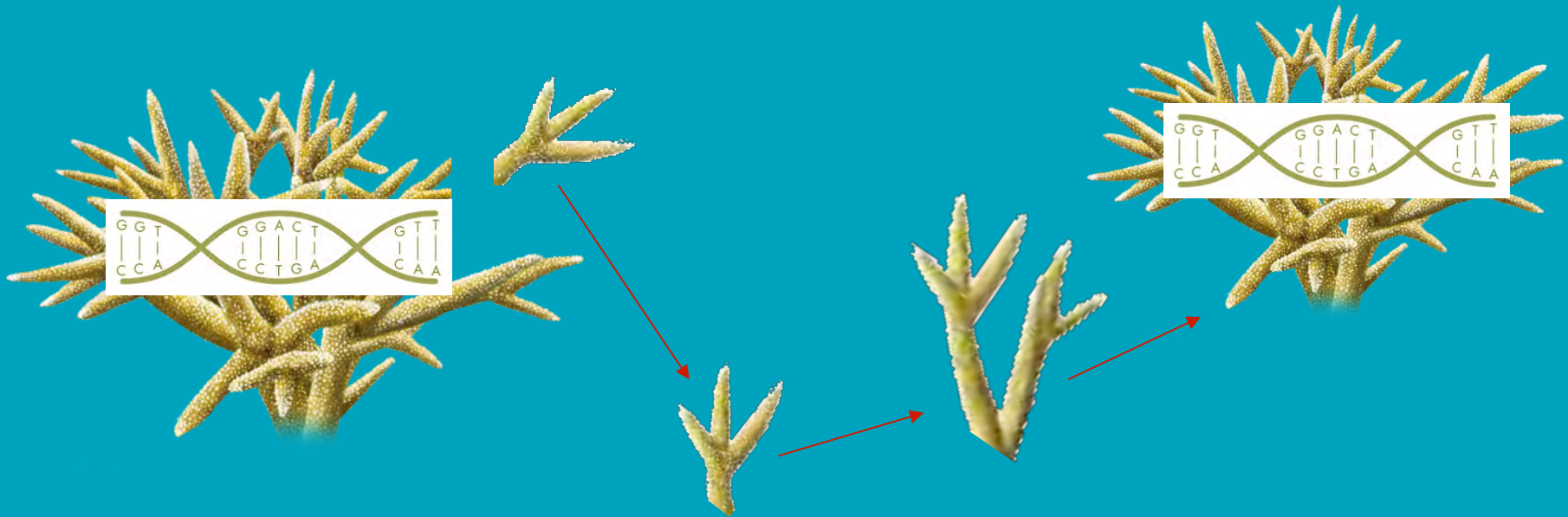


Coral Restoration

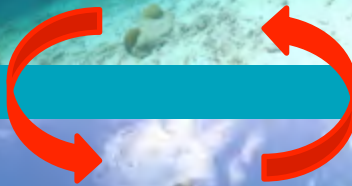
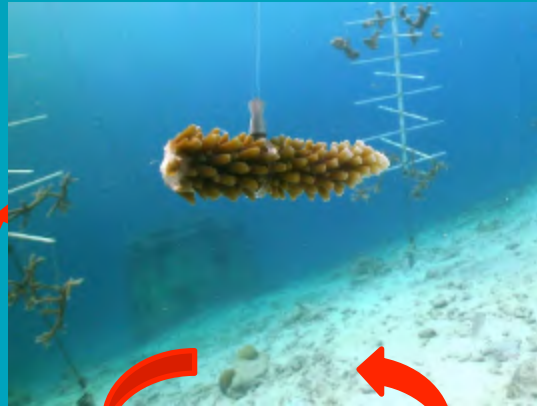


Using Natural Reproduction to Restore Reefs

- Asexual reproduction: Fragmentation



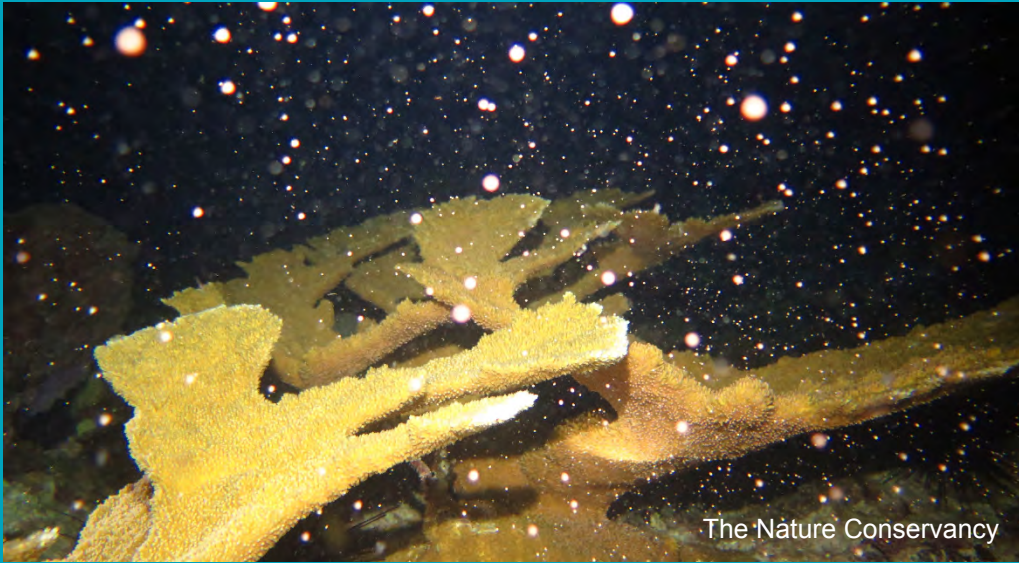
“Coral gardening”



Using Natural Reproduction to Restore Reefs

- Sexual reproduction: Spawning





The Nature Conservancy



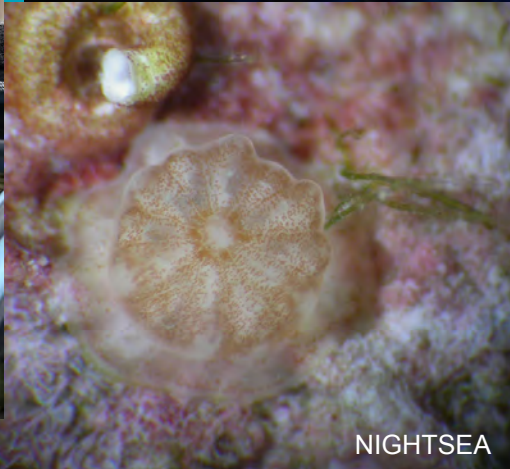
reefresilience.org



The Florida Aquarium



SECORE

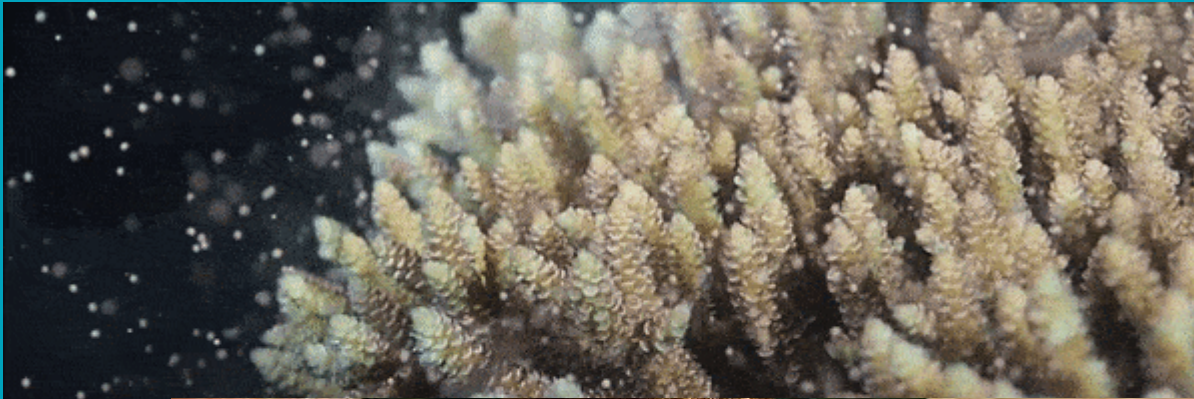


NIGHTSEA

Current Topics in Coral Restoration

- Cryopreservation and assisted gene flow
- Coral Rescue
- Restoration site selection
- Mission: Iconic Reefs

Coral Cryopreservation

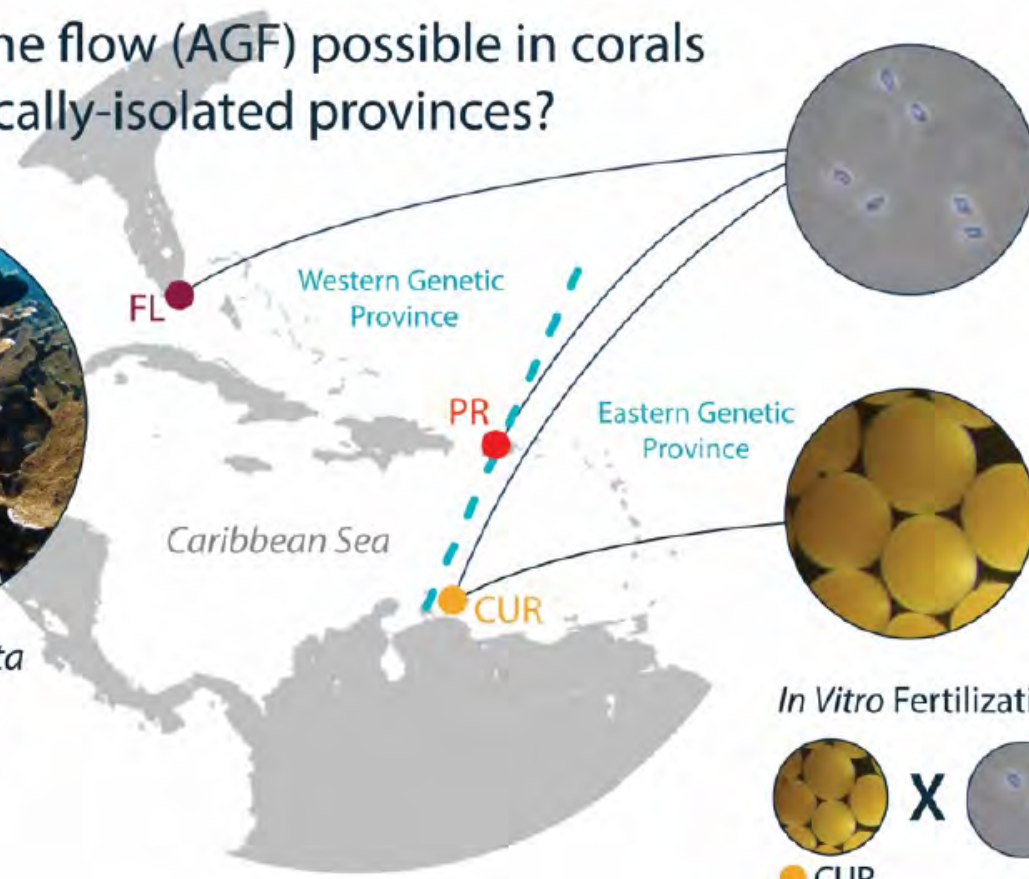


Assisted Gene Flow

Is assisted gene flow (AGF) possible in corals across genetically-isolated provinces?



Acropora palmata
Elkhorn coral
(threatened)



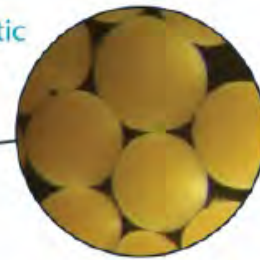
Coral sperm collected

- Florida 2016
 - Puerto Rico 2008
 - Curaçao 2018
 - Curaçao 2018
- } cryo-preserved



Coral eggs collected

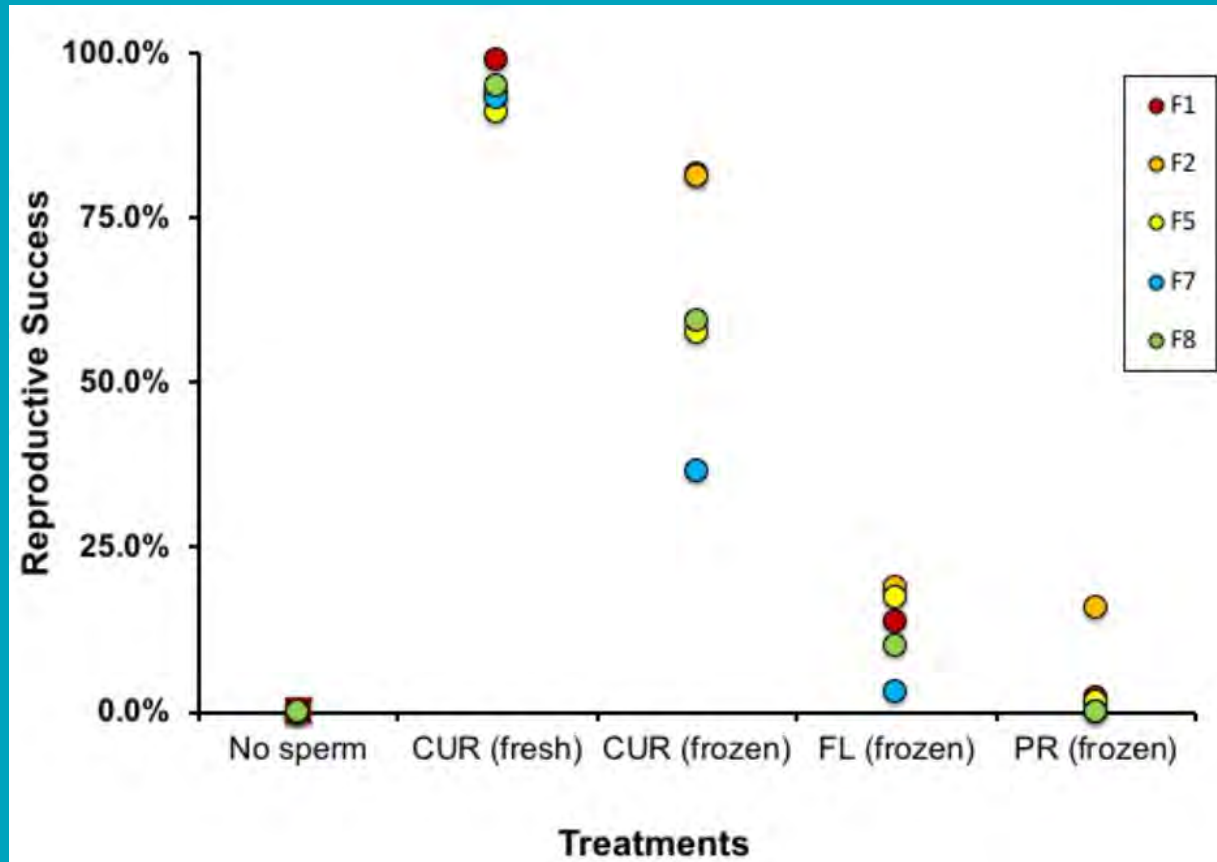
- Curaçao 2018



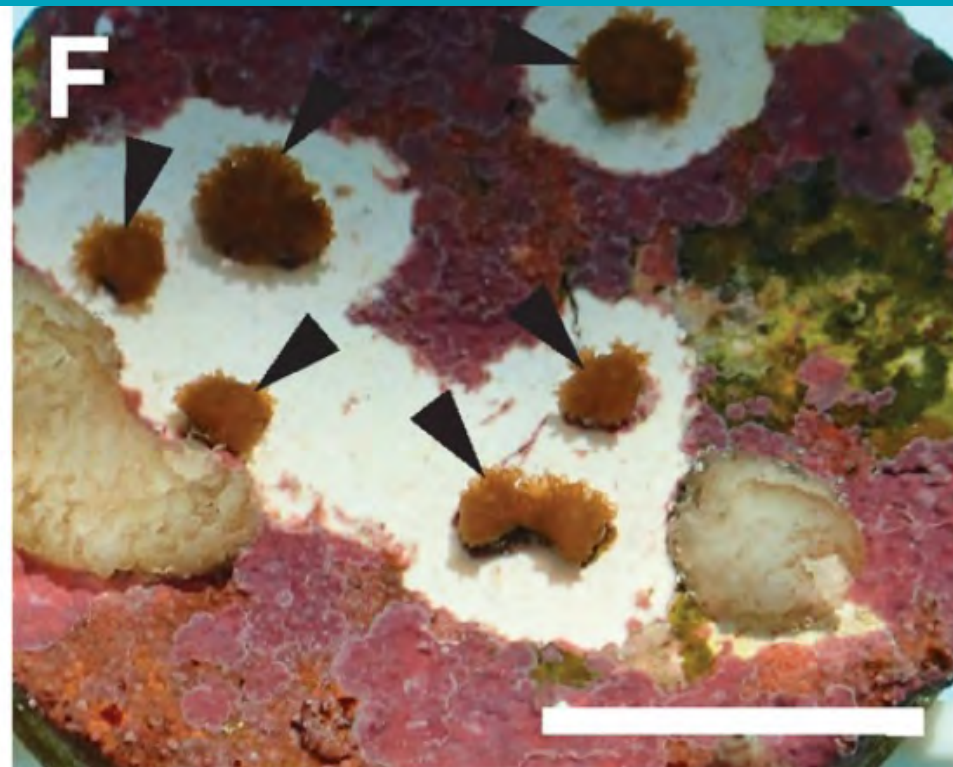
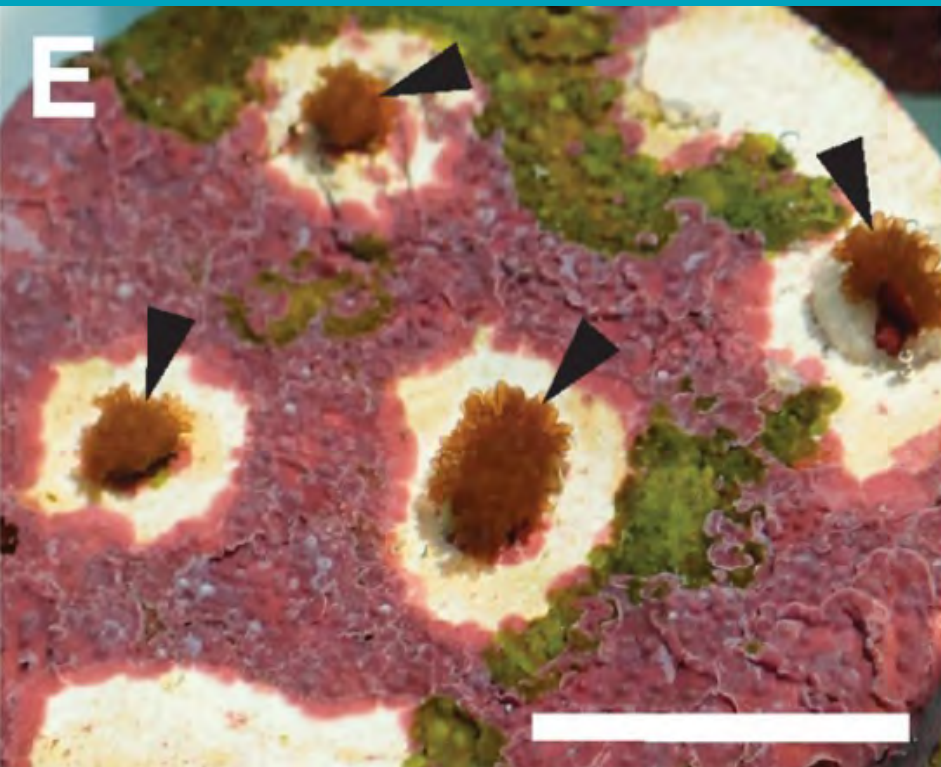
In Vitro Fertilization Crosses:

- | | | | |
|---|----------|---|------------------------------|
|  | X |  | ● FL Cryo Western Province |
| | |  | ● PR Cryo Mixed Zone |
| | |  | ● CUR Cryo Eastern Province |
| ● CUR | |  | ● CUR Fresh Eastern Province |

Assisted Gene Flow



Assisted Gene Flow



Stony Coral Tissue Loss Disease (SCTLD)

Jan 5, 2017
~5% dead



Jan 19, 2017
~20% dead



Feb 1, 2017
~60% dead



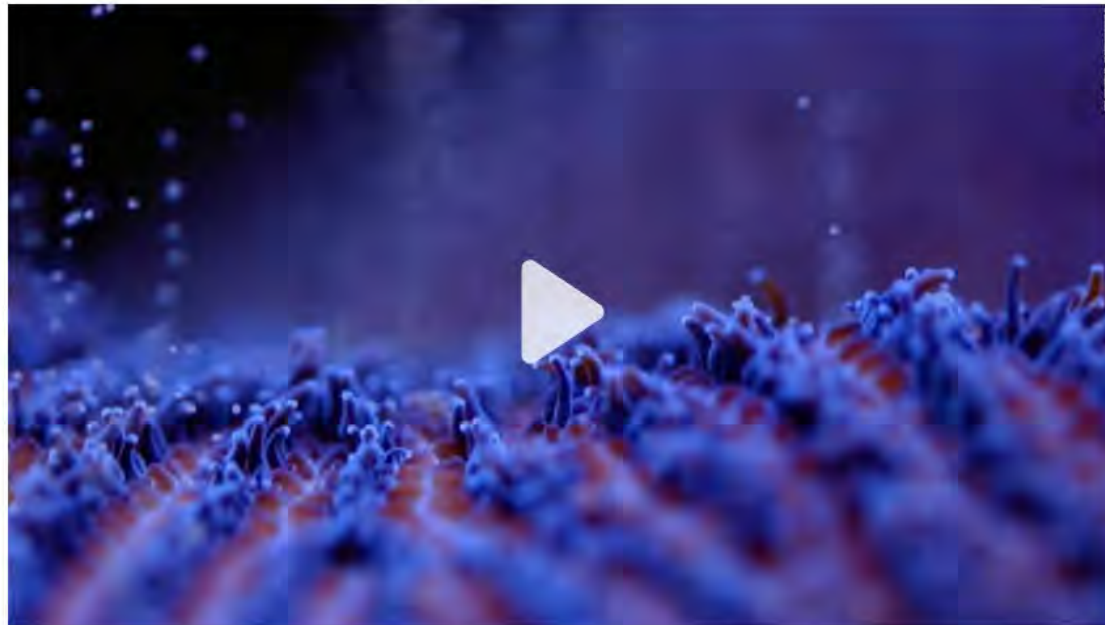
Photo: Brian Reckenbeil, FWC

Coral Rescue

The Florida Aquarium just made a breakthrough that will help save the third largest coral reef in the world

By Alaa Elassar, CNN

Updated 7:43 AM ET, Wed April 22, 2020



How scientists could save coral from brink of extinction 02:13

(CNN) — The Florida Aquarium has made a breakthrough that will help save "America's Great Barrier Reef," the third largest coral reef in the world.

For the first time in world history, the aquarium in Tampa, Florida has successfully reproduced ridged cactus coral in human care.

More from CNN



The toilet paper hack that you need to know about

CNN Underscored



17 sanitizing products that are still available online

CNN Underscored

DRAFT-A-THON

Make a difference this Draft.
Let's unite in support of COVID-19 relief

DONATE NOW

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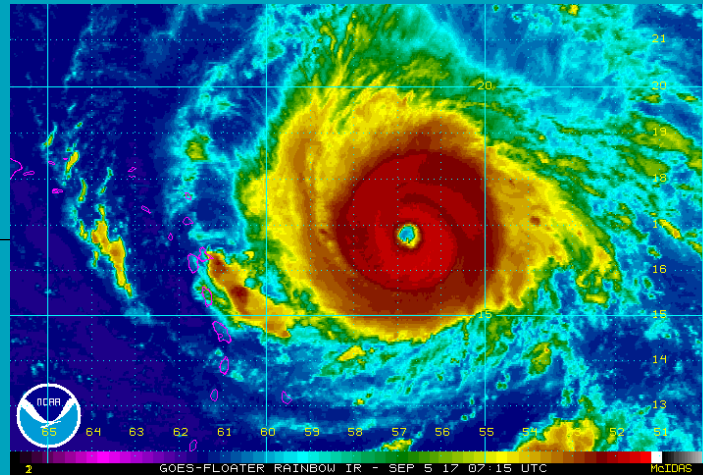
Photo: Miami Herald

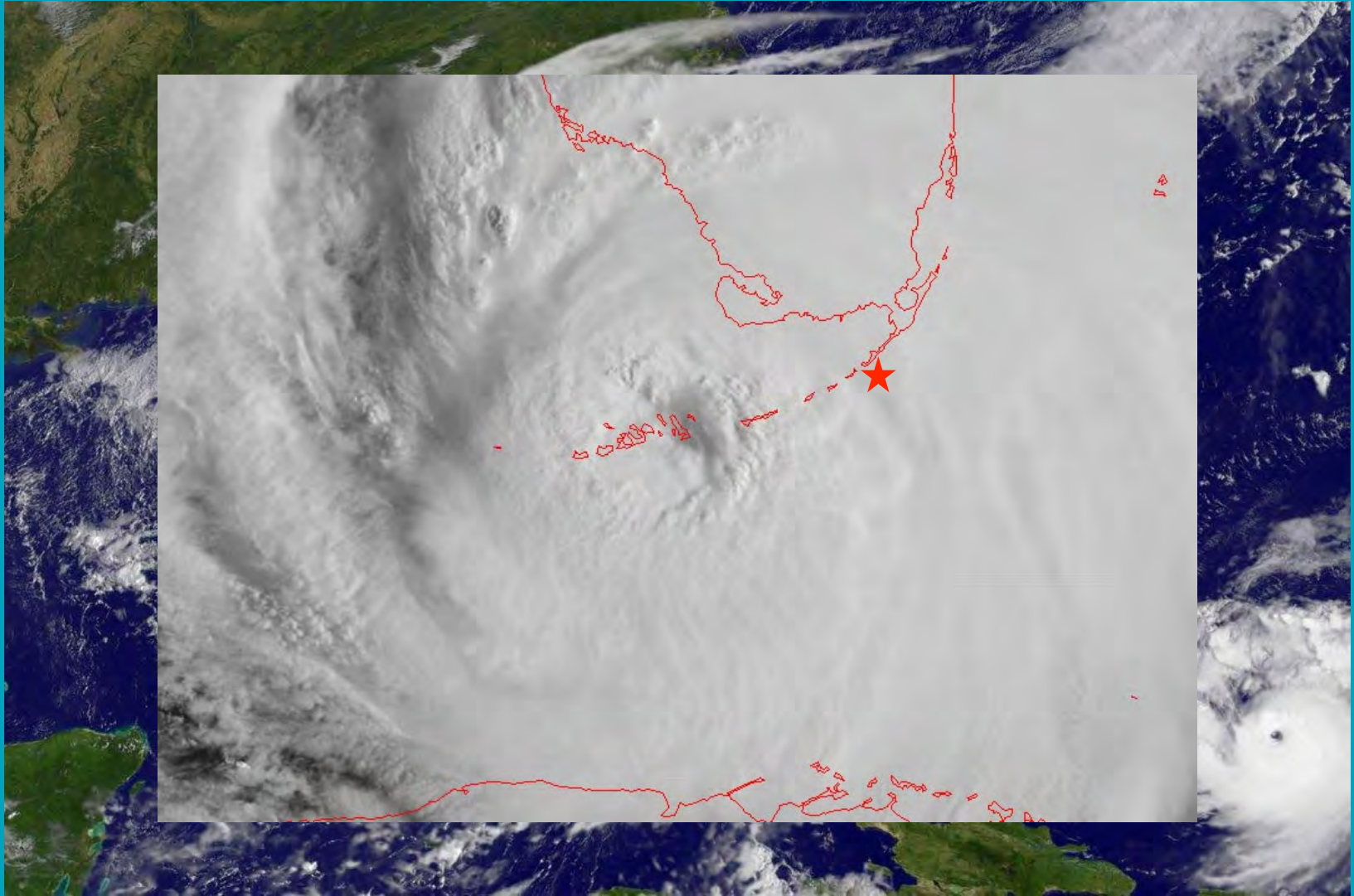
Restoration Site Selection



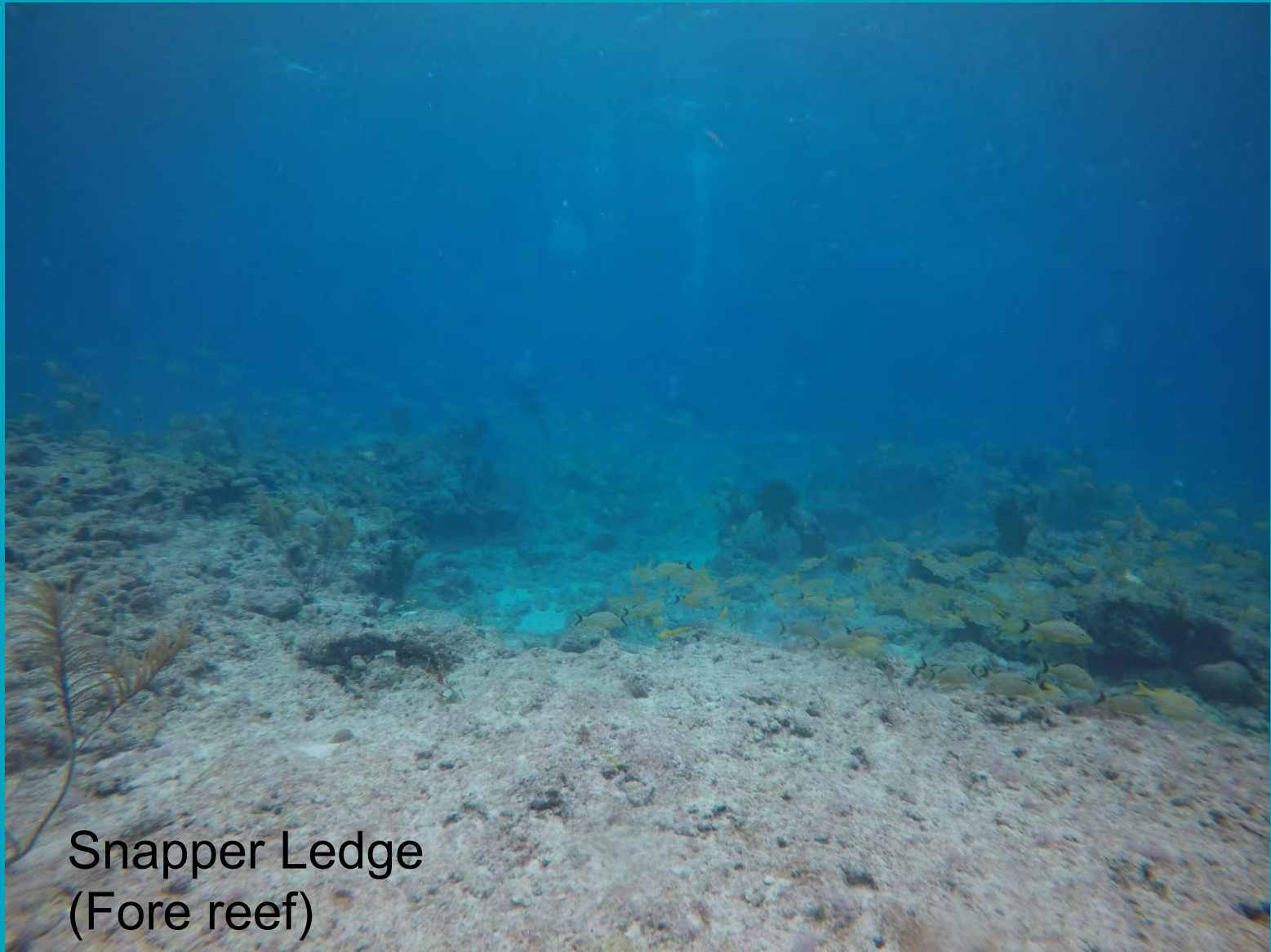
Restoration Site Selection

$t = 0$	$t = 51$	$t = 248$	$t = 365$
May 2017	June 2017	January 2018	May 2018



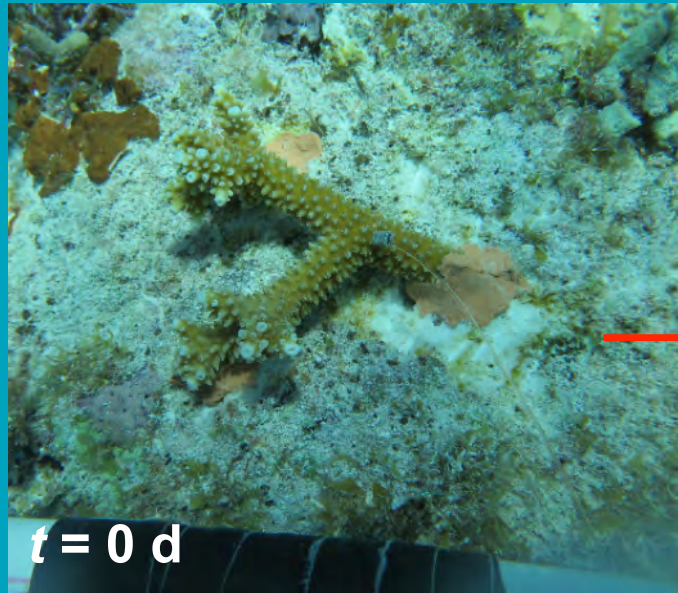


Results



Snapper Ledge
(Fore reef)

Results



Additional Dataset

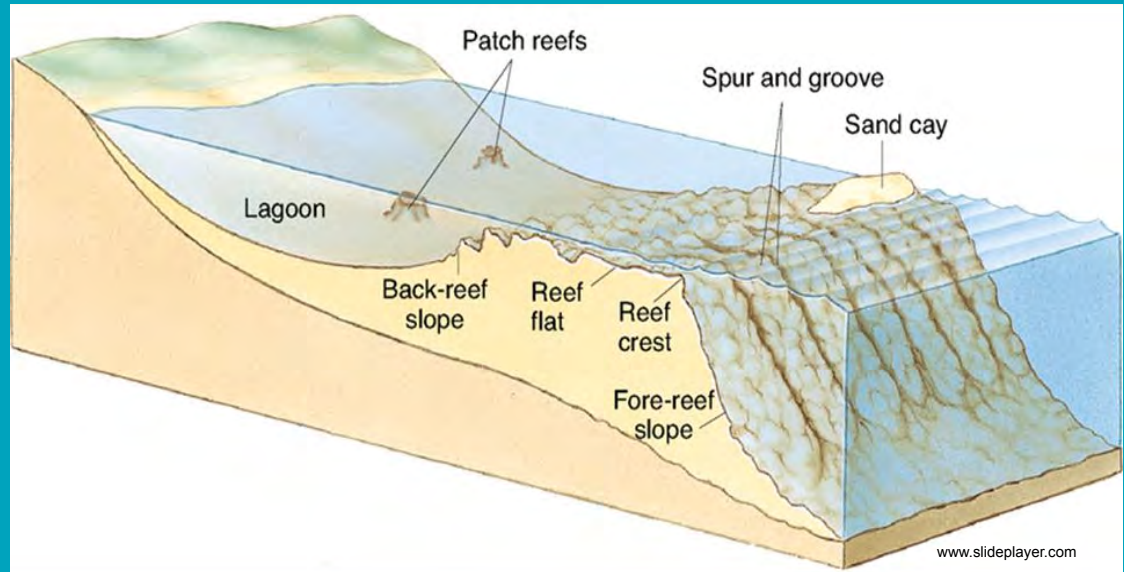
- CRF pre- and post-Irma monitoring records (+6 sites)
- Higher post-hurricane survival at CRF patch vs. fore reef sites ($X^2 = 159.61$, $p < 0.000001$)

CORAL
RESTORATION
FOUNDATION



Discussion

- 86% of wave energy dissipated by reef crest (Ferrario et al. 2014)



- Thickets historically facilitated retention of broken fragments (Highsmith 1982)



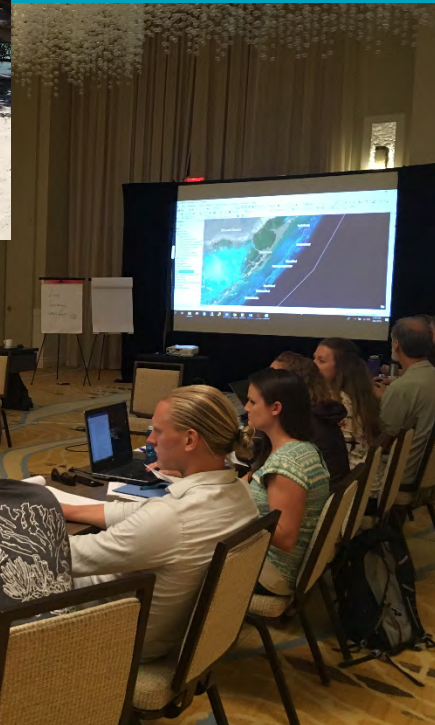
What's next?



What's next?



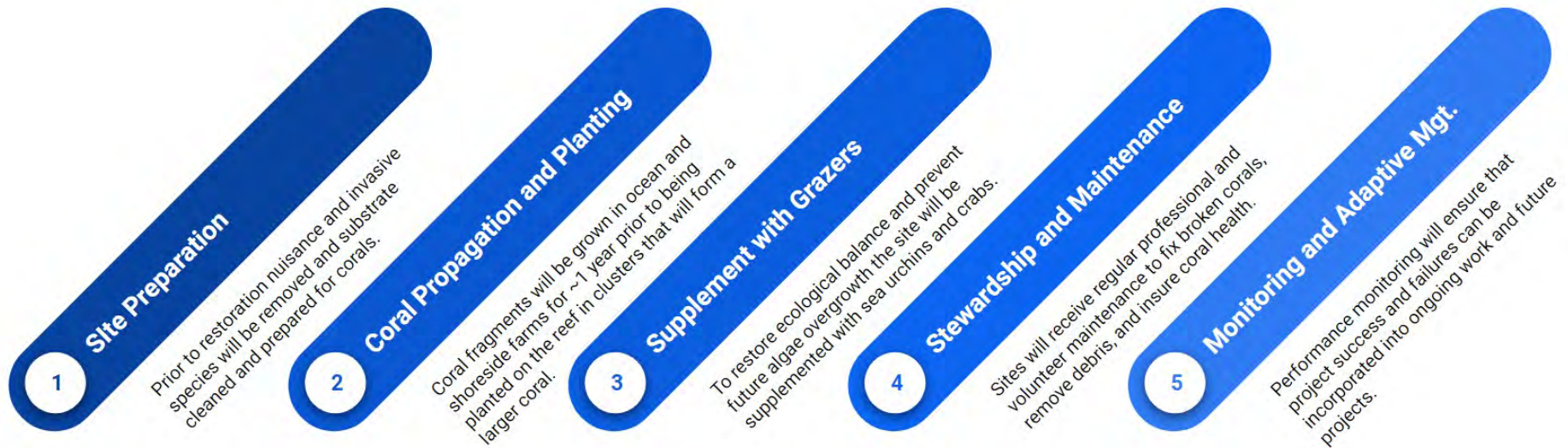
Mission: Iconic Reefs



Mission: Iconic Reefs

Zone	3 - Looe Key - Spur and Groove - Top								
Restorable Area (sq mi)	20,294	Coral Restoration Component							
	Completion Target	Phase 1 (10 Years)				Phase 2 (20 Years)			
Target % Cover	20.25%	13.60%	Area of Restored Coral (sq m)	Restoration Requirement (clusters/heads)	Method	6.65%	Area of Restored Coral (sq m)	Restoration Requirement (clusters/heads)	Method
Elkhorn Coral	10.00%	8.00%	1,623	7,587	Combination asexual outplanting & sexual propagation	2.00%	406	1,592	Combination asexual outplanting & sexual propagation
Star Coral	2.00%	1.00%	203	7,128	Reskinning substrate	1.00%	203	5,494	Reskinning substrate
Brain Coral	1.00%	0.50%	101	3,564	Reskinning substrate	0.50%	101	2,747	Reskinning substrate
Pillar Coral	0.25%	0.10%	20	607	Asexual outplanting	0.15%	30	634	Asexual outplanting
Staghorn Coral	6.00%	4.00%	812	3,929		2.00%	406	1,592	
Other Small Stony Coral	1.00%	0.00%	0	0	Reskinning substrates	1.00%	203	8,585	Reskinning substrates
Other	0.00%	0.00%	0			0.00%	0		

Mission: Iconic Reefs



A PLAN TO RESTORE 7 ICONIC REEFS OF THE FLORIDA KEYS

AUGUST 2019

VERSION 1.1



GRAND TOTALS

AREA RESTORED: 440,000 SQ M

CORALS PLANTED: ~750,000

Mission: Iconic Reefs



Photo: XL Catlin Seaview Survey



CORAL
RESTORATION
FOUNDATION




Reef Renewal



National
Marine Sanctuary
Foundation

UF | IFAS
UNIVERSITY of FLORIDA



The Nature
Conservancy 

Thank you!





NATIONAL
MARINE
SANCTUARY
FOUNDATION



Katie Lohr

NOAA Office of National Marine Sanctuaries

Email: Kathryn.Lohr@noaa.gov

<http://sanctuaries.noaa.gov>