

Assessment and Restoration of the Pillar Coral *Dendrogyra cylindrus* on the Florida Reef Tract

FINAL REPORT



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Final Report. NOAA-CRCP Award NA18NOS4820206. 11 pp.

Background

The pillar coral *Dendrogyra cylindrus* is a taxonomically and structurally unique Caribbean coral listed as vulnerable under the IUCN Red List (Aronson et al. 2008) and Threatened under the US Endangered Species Act (USFWS 2014). The species is uncommon but conspicuous throughout its range, but population structure, stressors, and trajectories have been poorly studied. Baseline surveys of the Florida Reef Tract (FRT) population were initiated in 2013/2014. Surveys measured demographic parameters, genotyping was conducted in collaboration with the Baums lab (Penn State University), and long-term fate tracking was established to assess changes in health. From the baseline surveys through 2015, disease and consecutive hyperthermal bleaching events resulted in a precipitous population decline. As a result, a rescue project was initiated in late 2015 to bring fragments of colonies into land-based facilities and offshore nurseries to protect genetic diversity and promote growth of new material. Additionally, assisted reproduction during spawning events was initiated by collecting gametes from in situ as well as ex situ colonies for fertilization, larval rearing, and settlement of new genotypes.

The initiation of this NOAA-CRCP grant in September 2018 set forward with the goals of:

1. Continuing to assess *D. cylindrus* colonies in the wild to monitor population status and impacts of stressors.
2. Continuing to collect fragments from wild colonies and distributing them among multiple nurseries for growout.
3. Collecting gametes during the 2019 spawning event to create new genotypes.

Permitting

Permitting to conduct *D. cylindrus* monitoring and spawning collections during the grant period occurred under permits FKNMS-2016-062 and FKNMS-2019-176. Collections for *D. cylindrus* genetic rescue occurred under FKNMS-2015-156. Movement of onshore *D. cylindrus* holdings to offshore nurseries was authorized under SAL-19-2142-SCRCP.

Goal 1: Assessment of wild *D. cylindrus* colonies

During the course of this grant, 445 observations of *D. cylindrus* colonies were conducted over 30 field days. These observations included wrapping up fall 2018 assessments as well as conducting full population assessments during spring 2019, fall 2019, and spring 2020. In addition to the 756 colonies known before September 2019, an additional 59 colonies were identified over the course of the grant period and were incorporated into regular assessments.

At each assessed colony, measurements of maximum length, width, and height of each colony were taken using a 50 cm measuring stick. Additionally, the percent of each colony covered with live tissue, old mortality, and recent mortality (classified as bare white skeleton with defined polyp structure) was recorded. When recent mortality was observed, the cause(s) were determined and recorded to the extent possible. If multiple stressors had caused mortality, the percent attributable to each was differentiated. Bleaching/paling was also recorded categorically as “paling,” “partial bleaching,” and “bleaching.”

Colony locations were overlaid on the Disturbance Response Monitoring zone map (FRRP 2015) to analyze inshore to offshore reef distribution. Colony locations were also overlaid on the Florida Unified Reef Map (FWRI 2014) to identify distribution among habitats. Nearest neighbor analyses were used to identify distance between genotypes.

Colony locations, genetic sampling, and demographic data highlighted the following results:

- Of the 815 known FRT colonies, 11 were within Dry Tortugas National Park, 709 were within the Florida Keys National Marine Sanctuary, 27 were within Biscayne National Park, and 68 were in the Southeast Florida region north of Biscayne.
- Of the 815 colonies, 144 were within no-take marine protected areas, 36 were within zones limited to catch-and-release trolling, and 635 were within fishable waters

- Within the Southeast Florida region, the majority of colonies were found on the inner reef and inshore zones. Within the Florida Keys, the majority of colonies are found on the forereef. Colonies were found on spur and groove reef, low-relief reef/pavement, patch reefs, and ridges (Figure 1).
- By using known genotypes (Chan et al. 2019) and predicting clonality among non-genotyped colonies within 70m of each other, the number of genotypes on the FRT was estimated at 188.
- The majority of colonies (77%) on the FRT were asexually produced; more than 50% of colonies were represented by only five genotypes.
- The average distance between genotypes was 1070 (\pm 1367 SD) meters. Only four genotypes were within 10m of their nearest neighbor.
- Average colony size was 1.7 m in diameter and 1.2 m in height. Only one juvenile (< 20 cm) was identified in this survey; this colony measured 7 cm and died within a year of first siting. Juveniles have also not been found by other monitoring or recruitment projects (CREMP pers comm; Miller (2000-2011)). *D. cylindrus* on the FRT has likely been reproductively extinct for decades.

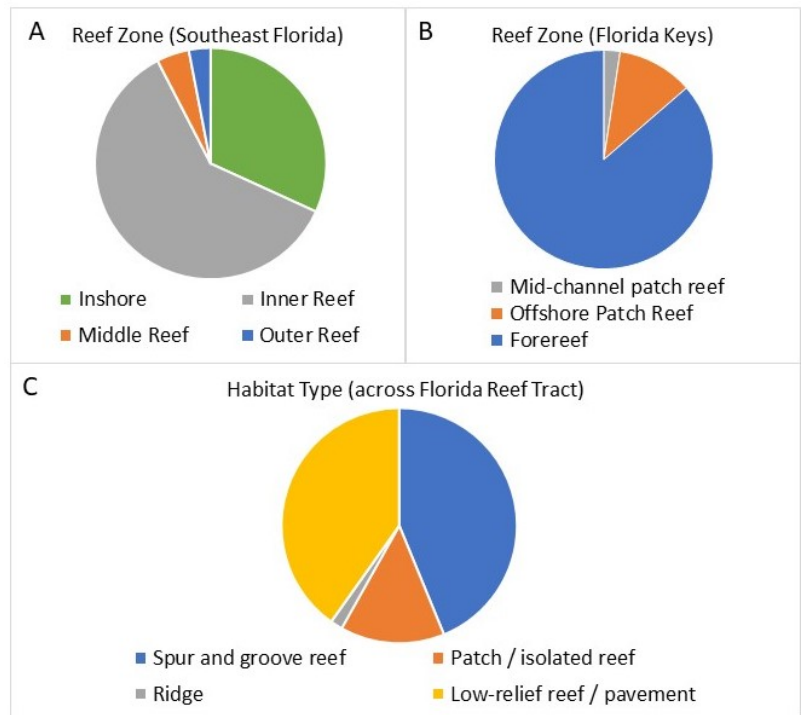


Figure 1. *Dendrogyra cylindrus* zone and habitat distribution. Maps from the Disturbance Monitoring Program identified reef zone distribution of colonies within southeast Florida (A) and the Florida Keys (B). The Florida Unified Reef Map identified the nearest habitat type across the whole of the Florida Reef Tract (C).

Sources of mortality across all surveys (2013 – present) were analyzed for prevalence, severity, and seasonality (Table 1). Minor stressors (less than 1% prevalence and 2% recent mortality on affected colonies) include damselfish nests/gardens, competition with other benthic colonizers, predation by the corallivorous snail *Coralliophila abbreviata*, abrasion/sedimentation, and an unknown yellow-band disease seen on Upper Keys colonies during winter 2014/15. More prevalent and severe stressors included bleaching-related mortality following hyperthermal events in 2014 and 2015, black band disease which was uncommon but deleterious to infected colonies, white plague, and stony coral tissue loss disease (SCTLD). The bleaching resulting from the 2014 and 2015 hyperthermal events is further reported on in Lewis et al. (2019). Further information on black band disease in *D. cylindrus* is available in Lewis et al. (2017).

	% of Observations	% Recent Mortality (Avg)	Seasonality
Damselfish	< 1%	0.6%	Year-round, spring peak
Competition	< 1%	0.7%	Year-round
Predation	< 1%	1.1%	Year-round, fall peak
Abrasion/ Sedimentation	< 1%	1.4%	Year-round
Bleaching	3%	7.2%	Warm water
Unk. yellow-band disease	< 1 %	0.8%	Cold water
Black band disease	< 1 %	4.6%	Warm water
White plague	12%	6.3%	Warm water
SCTLD	13% **	17.5%	Year-round

Table 1. Summary of stressors resulting in some mortality on *D. cylindrus* colonies across 3056 observations between 2013-2020. While stressors are observable only during snapshot monitoring events, the percent of colonies affected and the percent of recent mortality due to SCTLD (**) presented here are particularly conservative as rapid mortality resulted in many colonies dying between monitoring events.

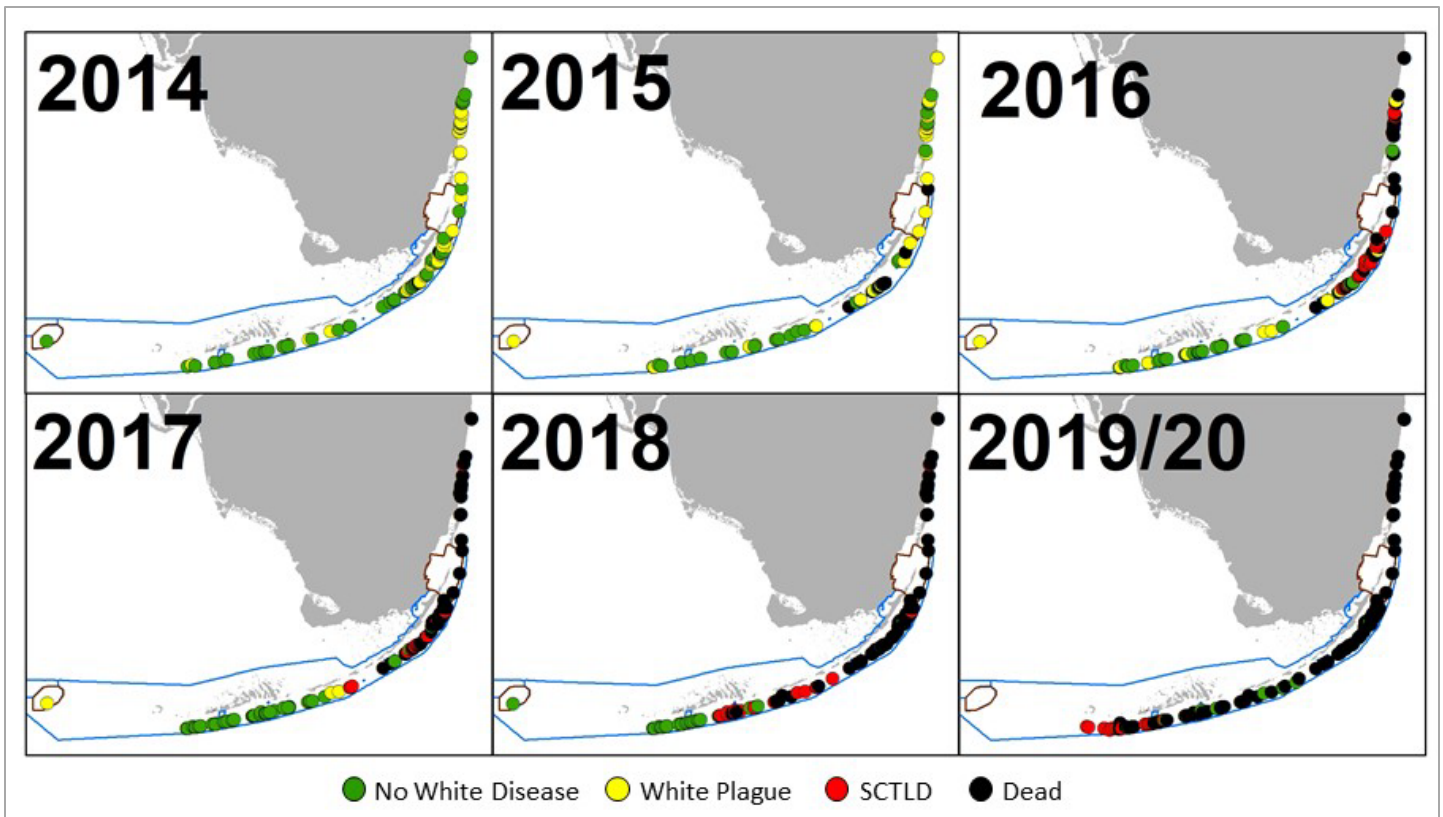
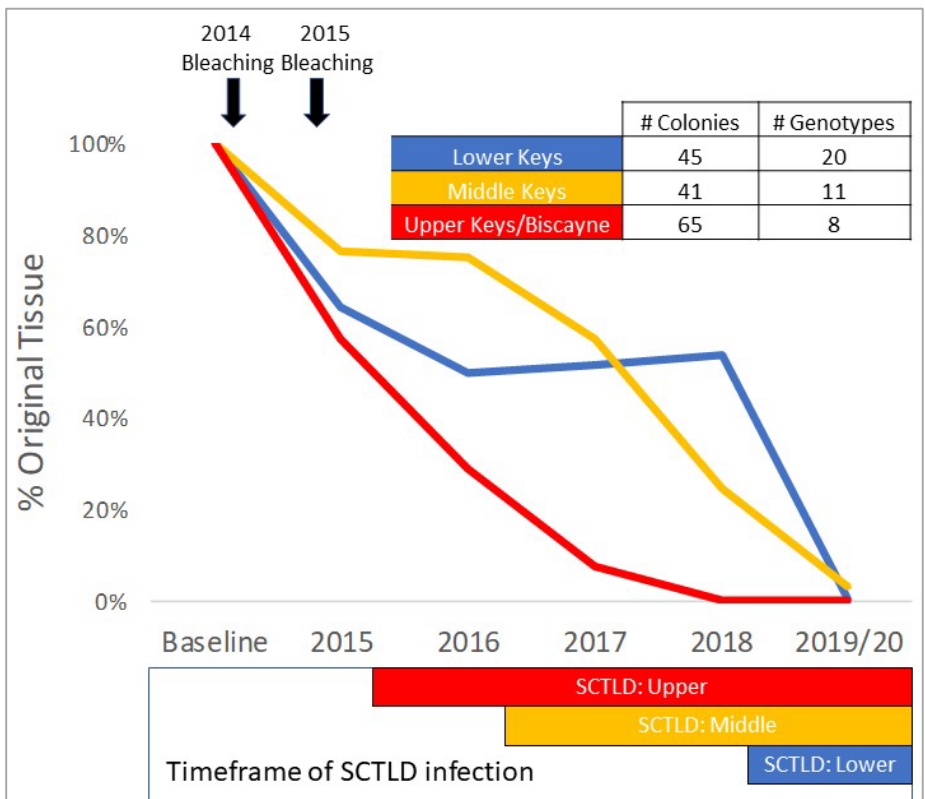


Figure 2. Status of *Dendrogyra cylindrus* colonies from 2014 through March 2020. At sites with multiple observations within a calendar year, the most recent is indicated. For sites with multiple colonies, disease on any colony (white plague or SCTLD) resulted in the site being classified as diseased. Stony coral tissue loss disease radiated from a site just north of Biscayne National Park and in most cases resulted in complete mortality. SCTLD was not identified until 2016, and so some observations of white plague in 2015 in southeast Florida and the Upper Keys may be SCTLD.

Figure 3. Percent of original tissue on a subset of well-monitored *Dendrogyra cylindrus* colonies from 2013/14 through 2019. Total tissue surface area (cm²) is calculated from size measurements and percent live coral. Amount of tissue each year on the selected colonies within each region was summed and compared to baseline surveys. The timing of the 2014 and 2015 bleaching events is highlighted (top), as is the presence of Stony Coral Tissue Loss Disease within each region (bottom).



Most stressors caused loss of *D. cylindrus* tissue, but rarely resulted in mortality to whole colonies or genotypes. A notable exception was SCTLD, which originated near Virginia Key (Precht et al. 2016) and radiated throughout the Florida Reef Tract from 2015 – 2020. Impacts to over 20 coral species have significantly impacted coral densities and diversity (Walton et al. 2018) and the ongoing spread has decimated the *D. cylindrus* population. Assessments during the time period of this grant documented the continued progression of SCTLD through the Lower Keys and into the Marquesas region (Figure 2). Analyses of tissue loss among a frequently-monitored subset of colonies showed that losses in tissue from the 2014 and 2015 bleaching and white plague events in the Middle and Lower Keys had stabilized and began recovering before the arrival of SCTLD in each region caused near extinction (Figure 3).

The status of the *D. cylindrus* population at the conclusion of this grant period (March 2020) is:

- From baseline surveys to March 2020, 91% of *D. cylindrus* tissue died, 88% of colonies died, and 73% of genotypes are now extinct in the wild.
- Of the 50 remaining in situ genotypes in March 2020, 25 had active SCTLD lesions, 5 had been treated with antibiotics to arrest SCTLD, and 10 had declined to less than 2% coral cover since the baseline surveys.

Further details regarding the analyses, results, and conclusions have been submitted to Coral Reefs for publication. A pre-print is available at <https://biorxiv.org/cgi/content/short/2020.05.09.085886v1> and is included as an additional document submitted with this final report.

Goal 2: Collection of *D. cylindrus* fragments for genetic rescue

During the grant period, a total of 230 fragments representing 53 previously uncollected genotypes were added to the genetic bank. As of March 2020, a total of 527 fragments representing a presumed 145 genotypes were maintained in protective care. These included 24 sexually produced juveniles as well as a number of asexually produced gemmae (dropped skeletal/tissue masses from growing colonies). Nearly 84% of the ex situ genotypes are maintained by multiple nurseries (Table 2). The twenty genotypes currently held at only one nursery represent single isolates currently too small for fragmentation.

	Sep 2018	Mar 2020
# of fragments	383	527
# of genotypes	77	145
% at > 1 facility	29%	84%

Table 2. Status of *Dendrogyra cylindrus* fragments within the genetic bank and the start and conclusion of the grant period

The importance of these holdings in preserving the genetic diversity of the FRT population has increased as the number of wild genotypes continues to decrease. In March 2020, 97% of genetically banked fragments were from genotypes that were extinct or nearly extinct in the wild (Figure 4)

Through the time frame of the grant period, the majority of fragments were moved out of Mote Marine Lab, with the exception of three juveniles resulting from field spawning efforts in 2016. However, two new partners were established:

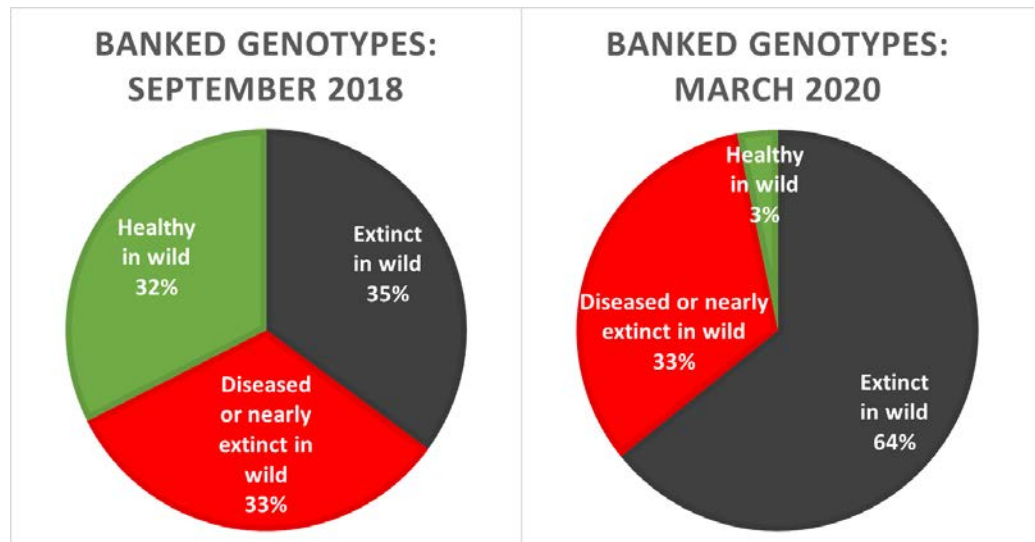


Figure 4. In situ status of the genotypes held in genetic banks at the start (September 2018) and conclusion (March 2020) of the grant period.

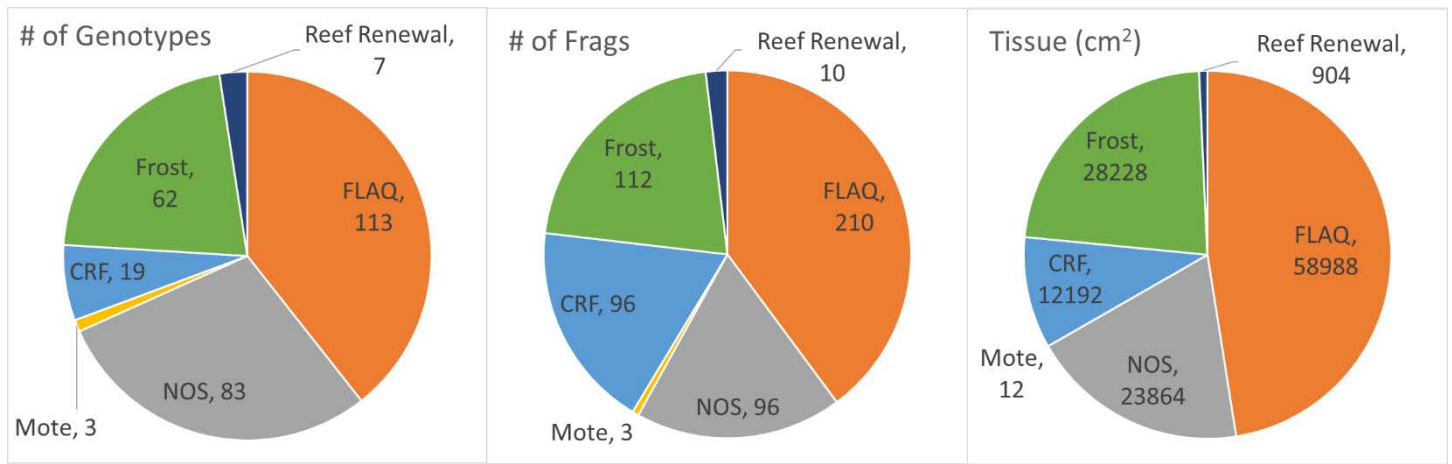


Figure 5. March 2020 holdings of *Dendrogyra cylindrus* by collaborating facilities (CRF: Coral Restoration Foundation, NOS: NOAA National Ocean Service Charleston, FLAQ: Florida Aquarium Center for Conservation).

Phillip and Patricia Frost Museum of Science (Miami) and Reef Renewal (Florida Keys). Florida Aquarium’s Center for Conservation, NOAA-NOS Charleston, and Coral Restoration Foundation all continued their collaborative efforts throughout the grant period. In March 2020, *D. cylindrus* fragments were distributed amongst these partners as identified in Figure 5.

Lessons learned and best practices on *D. cylindrus* fragment collection, transport, processing, husbandry, and monitoring were compiled from the partners into a report distributed to management agencies, practitioners, and other coral rescue facilities (Neely et al. 2020). This document is also included as an additional file with this final grant report.

Early collections were focused on pillars of opportunity and healthy colonies. However, as SCTLD progressed through the reef tract, some collections were of diseased fragments that required urgent and often heroic care. The protocols developed to treat SCTLD-affected *D. cylindrus* proved pivotal in developing the veterinary products used on other coral species also affected by SCTLD both ex situ and in situ. This included the development of an antibiotic dental paste for use in aquaria as well as the partnership with CoreRx/Ocean Alchemists that led to the development of a field-based application formula (Miller et al. 2018; Neely 2018; O’Neil et al. 2018).

Goal 3: Collection of gametes during coral spawning (2019)

Spawning efforts during 2019 focused on both in situ and ex situ colonies. In situ observations and collections were conducted by collaborative teams at Western Dry Rocks, the last remaining region of high genotype diversity. Spawning times and genders were recorded, and gametes were fertilized at sea and transferred to Florida Aquarium staff for rearing. Details were provided to local management agencies and are attached as a Quick Look report here (Neely 2019).

Simultaneously, a subset of genetic bank fragments held at Florida Aquarium’s Center for Conservation were placed into indoor aquarium systems that mimicked natural light and temperature conditions; corals underwent full gametogenesis and produced large numbers of larvae and settlers. This effort marks the first time an Atlantic coral species has undergone controlled spawning under artificial light regimes.

The functional extinction of wild *D. cylindrus* colonies in Florida means that the capacity for sexual reproduction now lies entirely with rescued fragments. The ability to manipulate light cycles to successfully induce spawning, with the potential to do so multiple times a year, facilitates a more predictable larval supply in the future. Since the first attempts at larval rearing and settlement in 2016, the number of settlers and juveniles has continued to increase; in 2016 there were 3

surviving settlers, in 2018 there were 6, and in 2019 there were 19. Early juvenile survival remains the bottleneck to larger-scale production, but the Florida Aquarium has committed to continuing to overcome this obstacle.

Observations of spawning over many years noted significant differences in spawn time between wild corals and those held onshore in outdoor facilities (Figure 6). In particular:

- Corals held onshore in outdoor facilities spawned on average 50 minutes later than those in the wild.
- Corals held onshore in outdoor facilities spawned on later dates and on a wider range of dates than those in the wild.

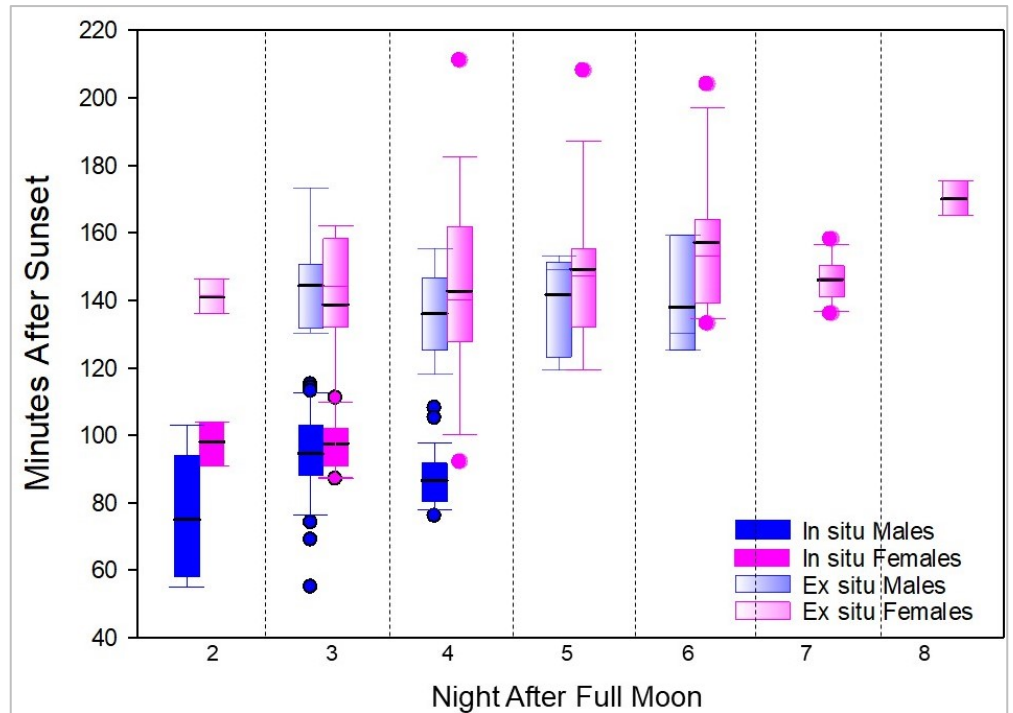


Figure 6. Comparison of in situ and ex situ spawn times of male and female *Dendrogyra cylindrus*. Boxes represent the quartiles with means, whiskers encompass the 10th-90th percentiles. Dots are outliers.

We propose that these delayed spawn times are due to the presence of artificial light, and we propose that artificial lights impact not only onshore spawning times but also wild colonies with close proximity to shore. These results and discussion are in final review by *Frontiers in Marine Science*.

Products/Outputs

The following products / outputs were outlined for the work conducted under this grant; current status is provided.

Product	Type/Format	Status
Population status report	Report to State of Florida, FKNMS, BISC, DRTO, NOAA Protected Resources, CRCP. Peer-reviewed publication.	Population status publication in review by Coral Reefs. Preprint available. Information on bleaching published in Lewis et al. (2019). Information on holobionts during disease and bleaching published in Lewis (2018). Permit reports provided to relevant management agencies. Extensive presentations to relevant management agencies.
Genetic banks	Fragments of <i>D. cylindrus</i> housed in controlled facilities for long term protection and genetic banking	527 fragments representing 145 genotypes held across 6 genetic banks; 84% of genotypes held in more than one facility.
Husbandry report	Report compiled by practitioners from the three facilities, distributed to managers and available to the public upon request	Report submitted to management agencies, practitioners, and AZA facilities participating in coral rescue projects on additional Florida species.
New juvenile <i>D. cylindrus</i>	Potentially hundreds of genetically unique juveniles for eventual experimentation/ outplanting	Juveniles from 2016, 2018, and 2019 held in onshore facilities. Florida Aquarium plans to continue production of juveniles.

Spawning/ settlement report	Written report provided to State of Florida, FKNMS, NOAA Protected Resources, CRCP.	Quick Look report provided to relevant management agencies. Publication in final review by <i>Frontiers in Marine Science</i> .
Final Report	Report to State of Florida, FKNMS, BISC, DRTO, NOAA Protected Resources, CRCP	Presented here.

Outreach / Education

Presentations:

- Lewis CL, KL Neely, M Rodriguez-Lanetty. “Cryptic *Symbiodinium* may be key to survival in changing climate where recurrent hyperthermal events are affecting Florida’s pillar coral.” European Coral Reef Symposium, Oxford UK. December 15, 2017
- Neely KL. “Preliminary Disease Intervention Results” Southeast Florida Coral Reef Initiative Technical Advisory Committee, Dania Beach FL. April 3, 2018
- Neely KL. “Coral Disease Treatments.” Water Quality Protection Program, Marathon FL. May 22, 2018
- Neely KL. “Coral Disease Treatments.” Florida Keys National Marine Sanctuary Advisory Council, Marathon FL. June 18, 2018
- Lewis, CL. “Florida’s pillar coral (*Dendrogyra cylindrus*): the roles of the holobiont partners in bleaching recovery and disease process.” Florida International University, Miami FL. December 3, 2018
- Neely KL and CL Lewis. “Coral Disease Treatments.” Florida Disease Workshop, Key Largo FL. July 10, 2018
- Neely KL, K O’Neil, CL Lewis, IB Baums, A Chan. “Breeding Baby Unicorns: Assisted Reproduction of Pillar Coral in Florida.” Association of Marine Labs of the Caribbean, Dominican Republic. May 21, 2019
- Neely, KL and CL Lewis. Q&A Panel for Changing Seas “Corals in Crisis” screenings. June 8, 2019: John Pennekamp State Park, Key Largo FL (Neely and Lewis). June 25, 2019: Nova Southeastern University, Dania Beach FL (Neely)
- Neely, KL and K O’Neil. “Husbandry and treatment of ex situ pillar coral.” Coral Health Management Advisory Group. July 22, 2019
- Neely, KL and K O’Neil. “Husbandry and treatment of ex situ pillar coral.” AZA Coral Husbandry Working Group. August 15, 2019
- Lewis, CL and KL Neely. “Chasing the Last Unicorns: Rescue of *D. cylindrus*.” FWC-FWRI Seminar, Marathon FL. September 6, 2019
- Neely KL. “Cradle to Grave: Active Responses to Florida’s Coral Crisis.” Presented at Nova Southeastern University Symposium, Dania Beach FL. November 19, 2019

Popular Press:

Date Published	Story Title	Outlet	Author	Link to content
5/13/2018	Coral scientists create gene bank for endangered pillar coral	Sarasota Herald Tribune	Earle Kimel	https://www.heraldtribune.com/news/20180513/coral-scientists-create-gene-bank-for-endangered-pillar-coral
5/13/2018	Coral scientists create gene bank for endangered pillar coral	Florida Times-Union	Earle Kimel	http://www.jacksonville.com/news/20180513/coral-scientists-create-gene-bank-for-endangered-pillar-coral
Fall 2018	The Last Unicorns: Florida’s Disappearing Pillar Coral	Alert Diver	Karen Neely	http://www.alertdiver.com/pillar-coral?fbclid=IwAR3WYQmeIL9mL_JLw3WjwTeMB8ntPpl4Sxdaars6oBgZAfz_M3DE7IYss8

12/5/2018	Pillars of Hope	The Coral Chronicles: Talking Science	Coral Restoration Foundation	https://www.coralrestoration.org/
1/10/2019	As disease ravages coral reefs, scientists scramble for solutions	Yale Environment 360	Ret Talbot	https://e360.yale.edu/features/as-disease-ravages-coral-reefs-scientists-scramble-for-solutions
2/12/2019	Coral Reef Restoration and Conservation Efforts: Pillar Coral	Florida Aquarium	Triton Productions	https://www.youtube.com/watch?reload=9&time_continue=5&v=RPah3vWo0U&fbclid=IwAR21-sxBrDyMwnCK_DeRZCdPvz-ev-SQQvMzq2EU37xwFhjcJWRibasG3XI
6/12/2019	Scientists are putting antibiotics into the ocean—on purpose. And it's our only hope.	Popular Science	Amelia Urry	https://www.popsoci.com/coral-antibiotics-science/
6/26/2019	Changing Seas: Corals in Crisis	PBS	PBS	https://www.youtube.com/watch?v=H-WIs4J2oW8&t=7s
Summer 2019	Society and climate change in Latin America and the Caribbean: coral reefs under threat	Hemisphere	Cindy Lewis and Mauricio Rodriguez-Lannetty	https://digitalcommons.fiu.edu/lacc_hemisphere/vol28/iss1/1
8/22/2019	Scientific breakthrough at Florida Aquarium could save America's 'Great Barrier Reef'	FOX 4 Southwest Florida	CNN	https://www.fox4now.com/news/protecting-paradise/scientific-breakthrough-at-florida-aquarium-could-save-americas-great-barrier-reef
8/22/2019	A scientific breakthrough at the Florida Aquarium could save 'America's Great Barrier Reef'	NBC 2 Southwest Florida	CNN	https://www.nbc-2.com/story/40951305/a-scientific-breakthrough-at-the-florida-aquarium-could-save-americas-great-barrier-reef
8/23/2019	Coral disease hunt calls for community participation	Virgin Islands Daily News	Daily News Staff	http://www.virginislandsdailynews.com/arts_and_entertainment/coral-disease-hunt-calls-for-community-participation/article_cb104c57-ecb4-56ee-9134-2946da6e9b6e.html
8/23/2019	In breakthrough that could aid depleted reefs, Florida scientists induce spawning of Atlantic coral in lab	Japan Times	Reuters	https://www.japantimes.co.jp/news/2019/08/23/world/science-health-world/breakthrough-aid-depleted-reefs-florida-scientists-induce-spawning-atlantic-coral-lab/#.XXIJzDZKjmY
8/23/2019	This Scientific Breakthrough at the Florida Aquarium Could Save Coral Reefs	EcoWatch	Jordan Davidson	https://www.ecowatch.com/florida-aquarium-coral-reefs-2639990687.html
8/24/2019	A scientific breakthrough at a Florida Aquarium could save 'America's Great Barrier Reef'	CBS 12 WPEC	Lauren M. Johnson / CNN	https://cbs12.com/news/local/a-scientific-breakthrough-at-a-florida-aquarium-could-save-americas-great-barrier-reef
8/24/2019	Florida scientists induce spawning of Atlantic coral in lab for first time	Daily Times		https://dailytimes.com.pk/453196/florida-scientists-induce-spawning-of-atlantic-coral-in-lab-for-first-time/

8/24/2019	Florida Scientists Induce Spawning Of Atlantic Coral In Lab For First Time	South Florida Reporter	Reuters	https://southfloridareporter.com/florida-scientists-induce-spawning-of-atlantic-coral-in-lab-for-first-time-video/
8/24/2019	Spawning of Atlantic Coral at the Florida Aquarium Could Help Repopulate America's Coral Reef	News Conduct	John Bacon	http://newsconduct.com/2019/08/24/spawning-of-atlantic-coral-at-the-florida-aquarium-could-help-repopulate-americas-coral-reef/
8/26/2019	Lab-grown coral 'breakthrough' could save America's reefs	New York Post	Hannah Sparks	https://nypost.com/2019/08/26/lab-grown-coral-breakthrough-could-save-americas-reefs/
8/26/2019	Scientists Induce Spawning of Atlantic Coral in Florida Lab for the First Time	Firstpost	Reuters	https://www.firstpost.com/tech/science/scientists-induce-spawning-of-atlantic-coral-in-florida-lab-for-the-first-time-7226231.html
8/26/2019	Spawning Season: Baby Unicorns	The Coral Chronicles: Talking Science	Samantha Simpson	https://www.coralrestoration.org/post/talking-science-in-august-2019-with-the-coral-chronicles-1
8/27/2019	Lab-grown coral could save endangered reefs	FOX News	Chris Ciaccia	https://www.foxnews.com/science/lab-grown-coral-save-endangered-reefs
8/28/2019	Lab breakthrough could help Keys reef	Keys News	Kevin Wadlow	https://keysnews.com/article/story/lab-breakthrough-could-help-keys-reef/
8/28/2019	Scientists reproduced Atlantic coral in a laboratory for the first time. Aquarium-grown coral could save America's 'Great Barrier Reef.'	Business Insider	Morgan McFall-Johnsen	https://www.businessinsider.com/atlantic-coral-reproduced-florida-laboratory-first-time-2019-8
8/28/2019	Florida Scientists Prompt Spawning of Atlantic Coral in Artificial Setting for First Time	The Boulder Gazette	Eden Dunce	http://bouldergazette.com/florida-scientists-prompt-spawning-of-atlantic-coral-in-artificial-setting-for-first-time/305/
8/29/2019	This scientific breakthrough could save 'America's Great Barrier Reef'	Lonely Planet Travel News	Sasha Brady	https://www.lonelyplanet.com/articles/florida-scientists-lab-coral-reef
9/24/2019	Florida Aquarium scientists in Tampa, Apollo Beach fight to save endangered coral reefs	83 Degrees Media	William March	https://www.83degreesmedia.com/features/saving-endangered-coral-at-Florida-Aquarium-092419.aspx
9/26/2019	Disaster under the waves: the race to save the coral of the Caribbean	Reuters	Lucas Jackson	https://www.reuters.com/article/us-environment-corals-scientists-widerim/disaster-under-the-waves-the-race-to-save-the-coral-of-the-caribbean-idUSKBN1WB24O
9/27/2019	Scientists racing to save Caribbean coral reefs	New York Post	Reuters	https://nypost.com/2019/09/27/scientists-racing-to-save-caribbean-coral-reefs/
10/13/2019	A 'fertility clinic' for coral sparks hope to save our dying reefs	Today	Bianca Seidman	https://www.today.com/news/induced-spawning-hope-save-coral-reefs-dying-worldwide-t164502
10/28/2019	The Fate of This Coral Species Rests in a Dark Room in Tampa	National Resources Defense Council	Jason Bittel	https://www.nrdc.org/onearth/fate-coral-species-rests-dark-room-tampa

3/4/2020	Lights, Camera, Action!: a pillar coral update	The Coral Chronicles: Talking Science	Coral Restoration Foundation	https://www.coralrestoration.org/post/talking-science-in-march-2020-with-the-coral-chronicles
4/1/2020	Welcome to the family: new pillar corals at CRF	The Coral Chronicles: Talking Science	Coral Restoration Foundation	https://www.coralrestoration.org/post/talking-science-in-april-2020-with-the-coral-chronicles

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