

# 2018 Coral Propagation in Puerto Rico Report

NOAA, Sea Ventures, HJR Reefscaping

## Nursery Information

Table 1: Coordinates, number and types of configurations in each nursery.

Region	Location	Latitude	Longitude	FUCAs	Trees	Trees w/Tiles	BUCAs	Tables
La Parguera	Margarita West	17.91966	-67.12831	8	10	2		
	Margarita East	17.92437	-67.09991		10	2		1
	Atravesado	17.94225	-67.08495		10	1		
	San Cristobal	17.94420	-67.07890				18	
Guanica	Cayo Coral BUCAs	17.93873	-66.88703				9	
	Cayo Coral Trees	17.93799	-66.87126		20	4		
	Andrea	17.90246	-66.91671	9				
Guayanilla	Margara	17.95240	-66.73058	36	5			
Ponce	Berberia Bank	17.90216	-66.45297		2			
	Cayo Berberia East	17.92484	-66.44734	5				
	Cayo Berberia West	17.91871	-66.46042		2			
NE Reserve	Lobos	18.37454	-65.57039		20	4		
	Sea Bass	18.35510	-65.57329	4	10	4		
	Palominito	18.33835	-65.56378	7	11	4		
North	Shacks	18.51525	-67.10183				1	
	Penon de Mera	18.48887	-66.67713				1	

Appendix I has maps showing the location of the various configurations in each nursery

## Outplanting

2,368 corals were outplanted from the coral nurseries to 13 different sites in 2018. This includes 1,821 *Acropora cervicornis*, 467 *Acropora palmata*, 35 *Dendrogyra cylindrus* and 10 *Xestospongia muta* (Table 2). Appendix II has information on the size classes of outplanted corals.

**Table 2: Corals outplanted from Puerto Rico Nurseries during 2018.**

Region	Source of Outplants	Outplanting Site	Coordinates		Dates	Species	# of Outplants	Tagged Colonies
NE Reserve	Palomino Nursery	Sand Slide North	18.33835	-65.56378	8/1/2018	Apal	250	25
						Acer	32	
						Dcyl	18	15
	Sea Bass	Sea Bass	18.35510	-65.57329	8/3/2018	Acer	298	
Ponce	Berberia Bank Nursery	Berberia West	17.91871	-66.46042	9/5/2018	Apal	88	
	Berberia West Nursery					Apal	42	
	Berberia East Nursery	Berberia East	17.92484	-66.44734	9/5/2018	Acer	94	
Guayanilla	Margara Nursery	Wemist	17.94356	-66.70659	9/6/2018	Acer	165	
						Dcyl	20	20
						Xmuta	10	10
	Margara Nursery	Tirala	17.94330	-66.70573	9/7/2018	Acer	210	
	Margara Nursery	The Middle	17.95059	-66.73040	9/9/2018	Acer	200	
	Margara Nursery	Site 115	17.95240	-66.73058	9/10/2018	Acer	393	
Margara Nursery	Site 115	17.95240	-66.73058	10/5/2018	Acer	37		
Guanica	Andrea Nursery	Andrea	17.90246	-66.91671	9/8/2018	Acer	192	
La Parguera	San Cristobal Nursery	Atravesado	17.94225	-67.08495	8/27/2018	Apal	87	25
	Margarita West Nursery	Margarita West	17.91966	-67.12831	8/27/2018	Acer	124	
	Margarita East	Margarita East Shallow	17.92437	-67.09991	9/11/2018	Acer	44	44
	Margarita East	Margarita East Deep	17.92437	-67.09993	9/11/2018	Acer	32	32
						Total	<b>2,368</b>	<b>191</b>

## Seeding and fragging conducted

Total number of corals in the nurseries increased from approximately 5,400 in 2017 to approximately 8,417 corals in 2018. (Table 3). *A. palmata* had the largest increase from 1,930 to 4,229 corals. *D. cylindrus* production doubled from 350 to 737. *A. cervicornis* capacity increased slightly from 3,120 to 3,371 corals. *Meandrina meandrites* capacity was increased from just a few experimental corals to 90 corals in two different nurseries. There are a few other species represented by just a few experimental corals including *Orbicella* spp and *Porites* spp. Work was conducted during August through December of 2018.

**Table 3: Changes in the number of corals growing in nurseries during 2018.**

Nursery		# of Corals in 2017 (prior to Hurricanes Irma & Maria)				# of Corals at the end 2018				
Region	Location	Acer	Apal	Dcyl	Total	Acer	Apal	Dcyl	Mmea	Total
La Parguera	Margarita west	400			400	302	496	106		904
	Margarita East	100	150		250	80	450	123	40	693
	Atravesado		100		100		480			480
	San Cristobal		250		250		243			243
Guanica	Cayo Coral BUCAs		140		140		123			123
	Cayo Coral Trees		250		250	100	914	86		1,100
	Andrea	500			500	352				352
Guayanilla	Guayanilla	1,000		150	1,150	1,368		50	40	1,458
Ponce	Berberia Bank		120		120		100			100
	Cayo Berberia East	200	10		210	195				195
	CBW		120		120		95			95
NE Reserve	Diablo	160		50	210	100	2			102
	Lobos		540		540		841	44		885
	Sea Bass	460		100	560	594		172		766
	Palominito	300	250	50	600	280	300	200		780
North	Shacks						33			
	Penon de Mera						36			
<b>Totals</b>		<b>3,120</b>	<b>1,930</b>	<b>350</b>	<b>5,400</b>	<b>3,371</b>	<b>4,229</b>	<b>737</b>	<b>80</b>	<b>8,417</b>

## Monitoring Results

**Table 4: Monitoring results for *A. palmata* outplants.**

<b>Location</b>	<b>Treatment</b>	<b>Outplant or Transplant Dates</b>	<b>Date of Last Monitoring</b>	<b>% Survival</b>	<b>Growth (cm/yr)</b>	<b>% Disease, Bleaching, other</b>
<b>Atravesado</b>	Nursery Outplant	Feb 2017	Aug 2018	100%	1 - 2	0%
<b>Atravesado</b>	Storm frag; Cement	Feb 2017	Aug 2018	100%	-2 - 0	0%
<b>Cayo Coral</b>	Nursery Outplant	2015	Oct 2018	100%	8 - 15	31% disease (spots)
<b>Cayo Coral</b>	Nursery Outplant	Feb 2017	Aug 2018	95%	4 - 7	0%
<b>Cayo Coral</b>	Storm frag; Cement	Nov 2016	Aug 2018	91%	5.1	0%
<b>Cayo Coral</b>	Storm frag; No Cement	Nov 2016	Aug 2018	62%	1.4	0%
<b>Dakity</b>	Noemi Transplant; fragged	2017	Oct 2018	100%	7	0%
<b>Dakity</b>	Noemi Transplant; not fragged	2017	Oct 2018	100%	-1	0%
<b>Lobos</b>	Noemi Transplant	2017	Oct 2018	77%	N/A	0%
<b>San Cristobal</b>	Nursery; BUCAs	Feb 2017	Aug 2018	67%	5 - 7	3% disease
<b>Vega Baja</b>	Storm frag; No Cement	2008	Nov 2016	83%	4	0%

Additional monitoring data (percent tissue mortality, percent stable, etc.) can be found in Appendix III.

Cause(s) of coral mortality at the nursery: Hurricanes Irma and Maria (See Problems sections)

## ***Dendrogyra cylindrus***

**Table 4: Monitoring results for *Dendrogyra cylindrus*.**

<b>Location</b>	<b>Nursery or Outplant</b>	<b>Depth (m)</b>	<b>Dates of 1st Monitoring</b>	<b>Date of Last Monitoring</b>	<b>Percent Survival</b>	<b>Growth (cm/yr)</b>	<b>% Disease, Bleaching, other</b>
<b>Margara</b>	Nursery	15	2015	Aug 2018	70%	1	0%
<b>West Cay, STT</b>	Nursery	5	2015	June 2018	73 - 98%	2 - 3	0%
<b>West Cay, STT</b>	Outplant	5	April 2016	Oct 2018	100%	1	0%
<b>Great St. James, STT</b>	Outplant	5	April 2015	April 2016	89%	1 - 3	0%

When properly maintained (quarterly cleaning and outplanting when ready), survival and growth rates are higher in the nursery.

## ***Meandrina meandrina***

Over the last few years, we have had success growing *M. meandrina* by hanging them from trees and FUCAs using monofilament and thermostat cables (Figure 1). We did not have any luck growing them on tiles. Growth rates are 1.2 - 2.0 cm/yr. Based on these results, during September, 2018 we increased *M. meandrina* production in two of the nurseries (Margara and Margarita East). There are currently 100 fragments in the nurseries (Figure 2). If it goes well this year, we may be able to scale it up even more next year.

## **Genetic sampling**

Tissue samples were collected from *A. cervicornis* and *A. palmata* colonies from the nurseries for genetic analyses. 400 samples have been collected so far. 73 samples have been analyzed so far by Iliana Baums lab for genetic analyses. The results show that we have 41 different

genotypes in the nurseries in La Parguera and Guanica. The rest of the samples will be processed in the spring of 2019.

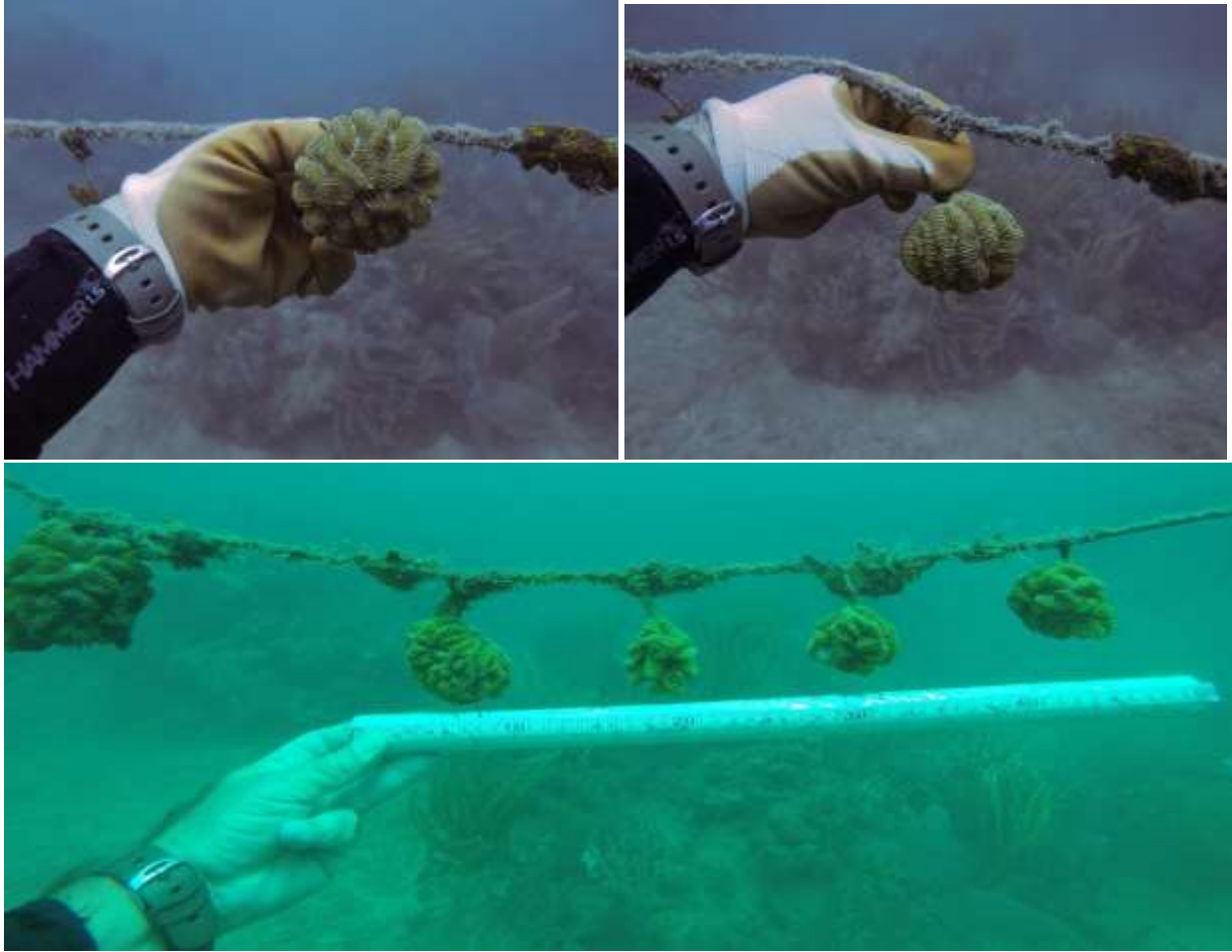


Figure 1: *M. meandrina* hanging from line nursery with thermostat cable.



Figure 2: *M. meandrina* after fragmentation hanging from tree with monofilament.

**Problems:**

Hurricanes Irma and Maria affected several of the nurseries in Puerto Rico, Florida and the USVI during September, 2017. Damages ranged from minor to catastrophic depending on exposure to the storms, nursery depths and configurations used. Wide-spread post-hurricane logistical challenges made it difficult to assess the nurseries in a timely manner or even conduct any required maintenance. Tables 5 summarize the damages to nurseries and outplants in PR and the USVI.

**Table 5: Level of hurricane impact to nurseries and earliest chance for assessment.**

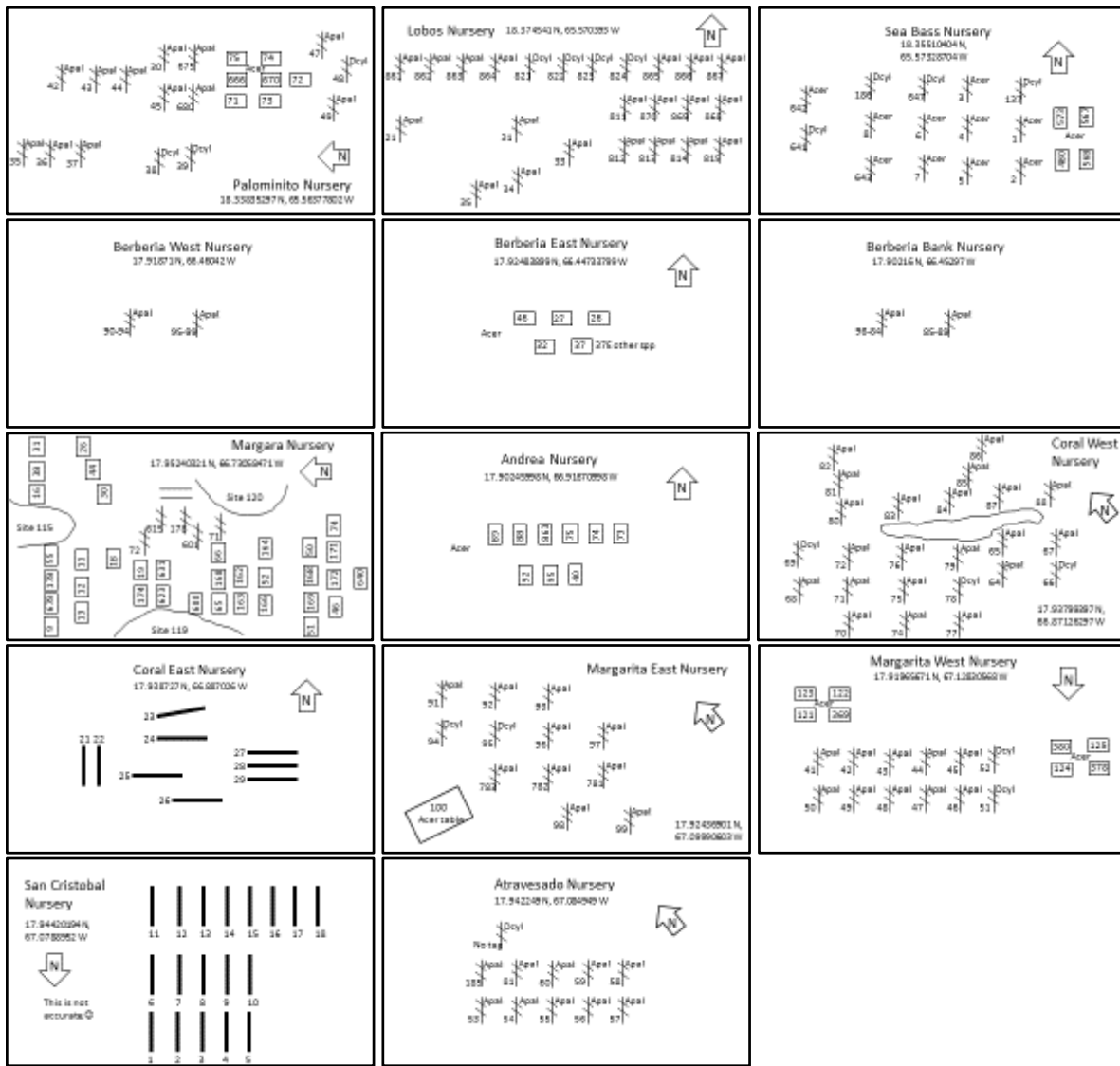
Nursery		Impacts	
Region	Location	(Low-Med-High)	Earliest Post Hurricane Check
La Parguera	Margarita west	Low	October
	Margarita East	Low	October
	Atravesado	Low	October
	San Cristobal	Low	October
Guanica	Cayo Coral Bucas	Low	October
	Cayo Coral Trees	Low	October
	Andrea	Low	October
Guayanilla	Guayanilla	Medium	November
Ponce	Berberia Bank	Low	November
	Cayo Berberia East	Medium	November
	CBW	Low	November
NE Reserve	Diablo	Medium	September

	Lobos	Low	September
	Sea Bass	Low	September
	Palominito	Low	September
<b>Culebra</b>	Tamarindo	High	September
	Tamarindo Chico	High	September
	Punta Soldado	High	September
<b>St. Thomas</b>	West Cay	High	December
	Flat Cat	Medium	December



# Appendix I

## Maps with the locations of coral configurations in each nursery



## Appendix II

### Size classes of corals outplanted from the nurseries during 2018.

Region	Source Nursery	Outplanting Site	# of Outplants							
			Species	0 - 10 cm	10 - 20 cm	20 - 30 cm	30 - 40 cm	40 - 50 cm	50 - 60 cm	Total
NE Reserve	Palomino	Sand Slide North	Apal	250						250
			Acer				16	16		32
			Dcyl	18						
	Sea Bass	Sea Bass	Acer		198	100				298
			Dcyl	32						32
Ponce	Berberia Bank	Berberia West	Apal	88						88
	Berberia West		Apal	42						42
	Berberia East	Berberia East	Acer			47	47			94
Guayanilla	Margara	Wemist	Acer			20	60	60	25	165
			Dcyl	20						20
			Xmuta	10						
		Tirala	Acer		21	84	84	21		210
		The Middle	Acer				102	98		200
		Site 115	Acer				200	193		393
Site 115	Acer					10	25	2	37	
Guanica	Andrea	Andrea	Acer			11	81	77	23	192
La Parguera	San Cristobal	Atravesado	Apal	20	48	14	5			87
	Margarita West	Margarita West	Acer			64	60			124
	Margarita East	Margarita East Shallow	Acer				44			44
		Margarita East Deep	Acer				32			32
			<b>Total</b>	480	345	585	674	490	50	<b>2,368</b>

**Appendix III**

**Additional Monitoring Data**

<b>Location</b>	<b>Treatment</b>	<b>% Survival</b>	<b>% Tissue Mortality</b>	<b>% Present</b>	<b>% Stable</b>	<b>% Fusion</b>
<b>Atravesado</b>	Nursery Outplant	100%	5%	100%	100%	91%
<b>Atravesado</b>	Storm frag; Cement	100%	17%	90%	100%	67%
<b>Cayo Coral</b>	2015 Nursery Outplant	100%	2%	100%	100%	100%
<b>Cayo Coral</b>	2017 Nursery Outplant	95%	7%	100%	100%	95%
<b>Cayo Coral</b>	Storm frag; Cement	91%	10%	98%	100%	90%
<b>Cayo Coral</b>	Storm frag; No Cement	62%	42%	57%	63%	50%
<b>Dakity</b>	Grounding transplant; cement; fragged	100%	1%	92%	100%	100%
<b>Dakity</b>	Grounding transplant; cement; not fragged	100%	10%	100%	100%	100%
<b>Lobos</b>	Grounding Transplant; cement	77%	14%	100%	100%	90%
<b>San Cristobal</b>	Nursery; BUCAs	67%	10%	96%	100%	94%
<b>Vega Baja</b>	Storm frag; No Cement	83%	57%	93%	96%	91%