Osborne Tire Reef Coral Removal, Relocation, and Monitoring

Summary Report Draft 2

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January 2023

Task: Colony Collection

This report includes summary information on the 514 colonies collected during eight collection days. Table 1 lists the collection dates, the tire reef locations, and the number of colonies collected. These colonies include 14 species (Tables 2 and 3). Four species (*Montastraea cavernosa*, *Porites astreoides*, *Siderastrea siderea*, and *Stephanocoenia intersepta*) represented 78% of the collected colonies (Table 3). We bin collected colonies into 5 cm diameter size classes for colonies up to 20 cm diameter and 10 cm classes for colonies > 21 cm (<5 cm, 5-10 cm, 11-15 cm, 16-20, 21-30, etc.). Nearly 70% of the colonies were in the 5-10 cm and 11-15 cm diameter size classes. Colony diameter ranged from 2 cm to over 50 cm. Eleven of the 14 species were represented in the < 15 cm diameter size classes while only five species were represented in the > 30 cm diameter size classes (Table 2). These 514 colonies have only been collected from two tire reef area target sites (sites 6 and 7) (Tables 1 and 4) (Figure 1).

Task: Colony Relocation

Collected colonies have been outplanted, kept in the NSU offshore nursery, or transferred to other institutions (Table 5). Colonies have been outplanted to four locations (Tables 1 and 4). Colonies in the North and South Spawning hubs and the Clipper Lasco grounding site were assigned to the monitored population. These three locations include 203 of the 334 colonies outplanted. The remaining 131 colonies were outplanted to a nearshore habitat offshore Hollywood, Florida (HC1).

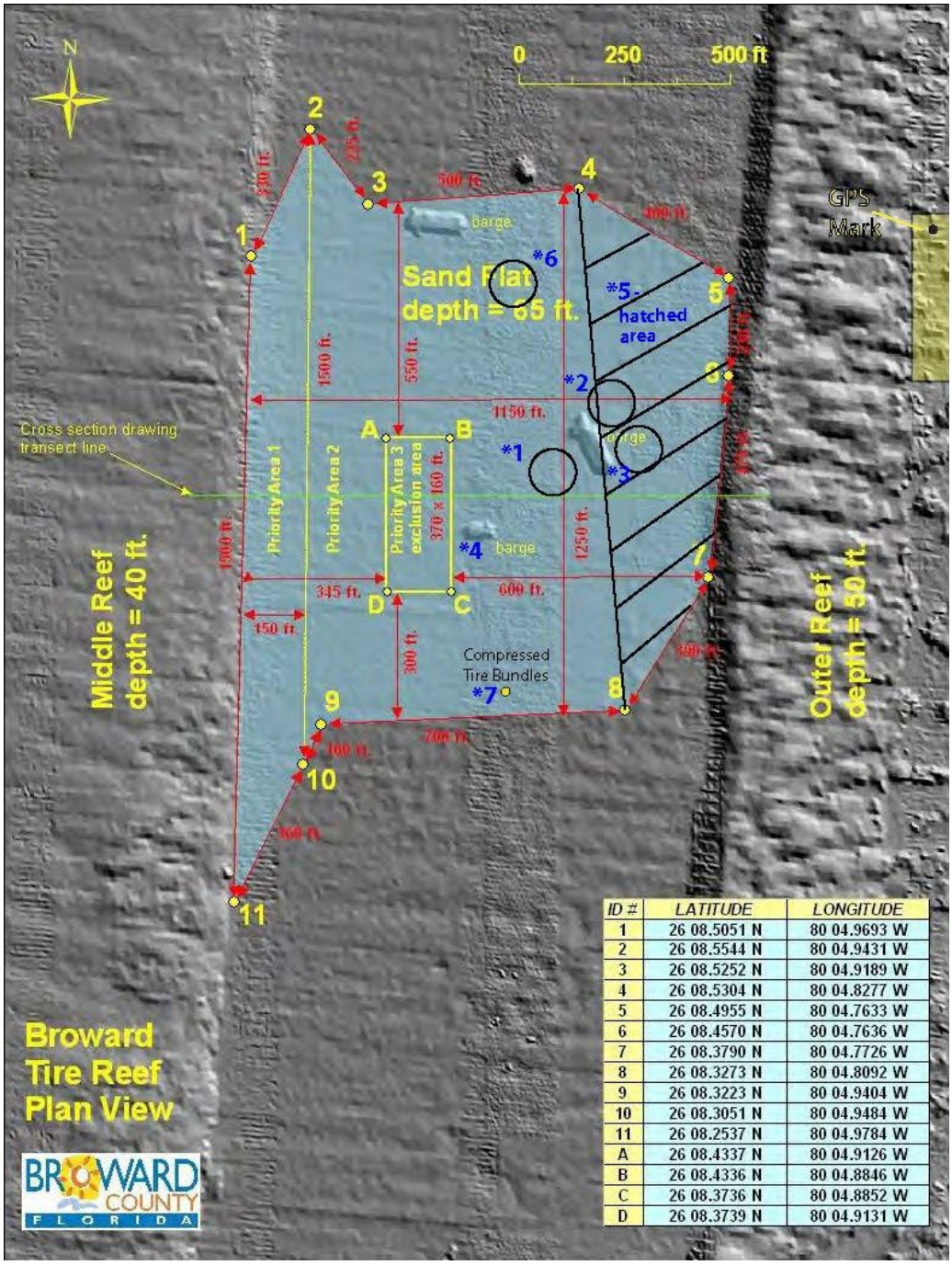
Seventy-five colonies remain in the NSU offshore nursery (Table 5). These colonies include all 39 colonies <5 cm diameter and 36 colonies <10 cm diameter. These smaller colonies in the nursery have been deployed on tree structures and modules. We are taking advantage of these corals of opportunity to gain information on small colony survival and changes in health condition on each of the two structures. We will also compare survival and health of the juvenile colonies to stony coral microfragments and sexual recruits deployed in the nursery. Twenty-six of the colonies remaining in the nursery were lost following the passing of Hurricane Nicole on 9 November 2022. The nursery experienced some damage from wave and surge energy associated with the hurricane. Several nursery trees were lost, and a nursery table was damaged. Colonies still held in the nursery will be outplanted in the future or offered to other institutions. Seventy-nine colonies were transferred to Dr. Diego Lirman of the University of Miami (https://marine-biology-ecology.rsmas.miami.edu/research-themes/centers-and-labs/benthic-ecology-coral-restoration-lab/index.html) (Tables 1 and 5). Dr. Lirman will incorporate these colonies into his restoration program.

Table 1. Summary of activities by task, date, and location. The number of corals involved in each task by date is also included.

Task	Date	Location	Number of Corals
Collection	8/22/2022	Tire 6	57
	8/26/2022	Tire 6	48
	9/6/2022	Tire 7	77
	9/7/2022	Tire 7	92
	9/16/2022	Tire 7	48
	10/24/2022	Tire 7	84
	10/25/2022	Tire 7	37
	11/3/2022	Tire 6	71
Outplanting	8/30/2022	North Hub	14
	8/31/2022	South Hub	13
	9/9/2022	North Hub (18)/South Hub (20)	38
	9/12/2022	HC1	75
	9/20/2022	South Hub	2
	10/18/2022	North Hub (15)/South Hub (18)	33
	10/19/2022	HC1	56
	10/31/2022	Clipper Lasco	66
	11/1/2022	South Hub	1
	11/30/2022	Clipper Lasco (34)/South Hub (2)	36
Monitoring	9/20/2022	South Hub	33
	10/12/2022	North Hub	32
	11/23/2022	North Hub (47)/South Hub (54)	101
	11/30/2022	Clipper Lasco	66
Coral Transfer	10/19/2022	Diego Lirman Lab (UM)	9
	11/2/2022	Diego Lirman Lab (UM)	70

Table 2. Stony coral species names and 4-letter codes.

Scientific Name	4-Letter code	Scientific Name	4-Letter code
Agaricia agaricites	AAGA	*Porites astreoides*	PAST
Colpophyllia natans	CNAT	*Porites porites*	PPOR
Dichocoenia stokesii	DSTO	*Pseudodiploria strigosa*	PSTR
Montastraea cavernosa	MCAV	*Solenastrea bournoni*	SBOU
Madracis decactis	MDEC	*Scolymia cubensis*	SCUB
Meandrina meandrites	MMEA	*Stephanocoenia intersepta*	SINT
Mycetophyllia aliciae	MYAL	*Siderastrea siderea*	SSID



ID #	LATITUDE	LONGITUDE
1	26 08.5051 N	80 04.9693 W
2	26 08.5544 N	80 04.9431 W
3	26 08.5252 N	80 04.9189 W
4	26 08.5304 N	80 04.8277 W
5	26 08.4955 N	80 04.7633 W
6	26 08.4570 N	80 04.7636 W
7	26 08.3790 N	80 04.7726 W
8	26 08.3273 N	80 04.8092 W
9	26 08.3223 N	80 04.9404 W
10	26 08.3051 N	80 04.9484 W
11	26 08.2537 N	80 04.9784 W
A	26 08.4337 N	80 04.9126 W
B	26 08.4336 N	80 04.8846 W
C	26 08.3736 N	80 04.8852 W
D	26 08.3739 N	80 04.9131 W

Figure 1. Map showing the Osborne Tire Reef area and the seven target groups (lables *1-*7) for the stony coral assessment (black circles and lables *1-*7). Figure provided by IDC and DEP.

Table 3. Summary information on the number of colonies of each species collected by size (cm diameter) class (see Table 2 for species codes).

Species	< 5 cm	5-10 cm	11-15 cm	16-20 cm	21-30 cm	31-40 cm	>40 cm	Total
AAGA	4	37	16	2	0	0	0	**59**
CNAT	0	0	0	0	1	1	0	**2**
DSTO	0	1	0	0	0	0	0	**1**
MCAV	9	41	19	9	14	4	1	**97**
MDEC	0	4	5	0	0	0	0	**9**
MMEA	4	2	1	0	0	0	0	**7**
MYAL	0	0	0	0	3	0	0	**3**
PAST	0	31	51	21	16	5	1	**125**
PPOR	0	1	2	1	0	0	0	**4**
PSTR	3	2	1	1	6	0	1	**14**
SBOU	0	0	0	0	4	0	0	**4**
SCUB	10	0	0	0	0	0	0	**10**
SINT	1	24	37	16	3	0	0	**81**
SSID	8	53	26	8	2	1	0	**98**
Total	**39**	**196**	**158**	**58**	**49**	**11**	**3**	**514**

Table 4. Location information for all locations involved in the effort (Tire Reef Collection Sites 6 and 7 coordinates slightly differ from coordinates shown in Figure 1. Table 4 represents actual field collected coordinates).

	GPS Coordinates	
Site	**Latitude**	**Longitude**
Tire Reef Collection Site 6	26 08.490 N	80 04.858 W
Tire Reef Collection Site 7	26 08.336 N	80 04.863 W
Nursery	26 07.472 N	80 05.795 W
North Hub Outplant Site	26 08.653 N	80 05.388 W
South Hub Outplant Site	25 58.609 N	80 06.000 W
Clipper Lasco Outplant Site	26 07.093 N	80 05.578 W
HC1 Outplant Site	26 00.738 N	80 06.379 W

Task: Colony Monitoring

The Statement of Work (SOW) requires a minimum of 25% of the outplanted colonies to be monitored 1-month, 3-months, and 6-months post-outplanting. We have modified this approach by monitoring all colonies at three sites (North and South spawning Hubs and the Clipper Lasco grounding site) which currently represents 60% of the outplanted colonies. These 203 colonies in the monitoring population also represent 39% of the 514 colonies collected. We will monitor these colonies according to the SOW.

Table 5. Summary information on destination of all collected colonies.

Colony Relocation	**# Colonies**
Outplanted and monitored (North and South Hubs and Clipper Lasco)	203
Outplanted and portion surveyed at 6-months (site HC1)	131
Nursery	75
Lost from Nursery	26
Transferred to UM	79
Total	**514**

Additionally, we will survey survival of the colonies outplanted at HC1 6-months post-outplanting. We modified the approach to provide more information on the colonies outplanted to the grounding site and to efficiently monitor a larger proportion of the outplanted colonies (visit more colonies at fewer sites).

Of the 514 colonies collected, 203 have been included in the monitoring effort (Tables 5 and 6), and these colonies represent 13 of the 14 collected species (Tables 7 - 9). All collected *S. cubensis* colonies were < 5 cm diameter and remain in the nursery. The 1-month monitoring event has not been completed for 36 colonies because these colonies were outplanted in late November (Table 6). The 1-month event was completed for 167 colonies (Tables 6 - 9) and survival was 100%. The 3-month event has been completed for 65 colonies (Tables 6- 9) and survival was 98%. One *A. agaricites* colony was noted as missing after Hurricane Nicole during the 3-month event at the North Spawning Hub (Table 7).

Partial colony recent mortality on the monitored corals was identified on 25 colonies representing four species during the 1-month monitoring event, and one colony (*P. astreoides*) during the 3-month event (Table 10). Mortality was caused by predation (24 colonies) or an unknown cause (2 colonies). Colony partial bleaching was identified on 31 colonies (8 species) during the 1-month event and 13 colonies (3 species) during the 3-month event (Table 10).

Table 6. Colony monitoring summary information (Time 0 refers to colonies that have not had a 1-month event).

Site	**Total**	**Time 0**	**1-Month**	**3-Month**
South Hub	55	1	54	33
North Hub	47	0	47	32
Clipper Lasco	101	35	66	0
Total	203	36	167	65

Table 7. Summary information for the monitored colonies outplanted to the North Spawning Hub site. Only colony diameter size classes represented at this site are included (# C = number of colonies and # A = number of colonies alive).

		Size Class (cm)					
		5-10		11-15		16-20	
Event	**Species**	**# C**	**# A**	**# C**	**# A**	**# C**	**# A**
1-Month	**AAGA**	5	5	1	1	0	
3-Month	**AAGA**	3	2	0		0	
1-Month	**MCAV**	2	2	4	4	0	
3-Month	**MCAV**	0		3	3	0	
1-Month	**MDEC**	1	1	0		0	
3-Month	**MDEC**	0		0		0	
1-Month	**PAST**	5	5	8	8	1	1
3-Month	**PAST**	3	3	8	8	1	1
1-Month	**SINT**	3	3	4	4	1	1
3-Month	**SINT**	2	2	4	4	0	
1-Month	**SSID**	10	10	2	2	0	
3-Month	**SSID**	6	6	2	2	0	

Table 8. Summary information for the monitored colonies outplanted to the South Spawning Hub site. Only colony diameter size classes represented at this site are included (# C = number of colonies and # A = number of colonies alive).

		Size class (cm)									
		5-10		11-15		16-20		21-30		31-40	
Event	Species	# C	# A	# C	# A	# C	# A	# C	# A	# C	# A
1-Month	AAGA	1	1	2	2	0		0		0	
3-Month	AAGA	1	1	2	2	0		0		0	
1-Month	CNAT	0		0		0		1	1	1	1
3-Month	CNAT	0		0		0		0		1	1
1-Month	DSTO	1	1	0		0		0		0	
3-Month	DSTO	0		0		0		0		0	
1-Month	MCAV	5	5	0		1	1	2	2	1	1
3-Month	MCAV	0		0		1	1	2	2	1	1
1-Month	MDEC	0		1	1	0		0		0	
3-Month	MDEC	0		1	1	0		0		0	
1-Month	PAST	0		4	4	4	4	6	6	0	
3-Month	PAST	0		4	4	3	3	3	3	0	
1-Month	PPOR	0		3	3	0		3	3	0	
3-Month	PPOR	0		1	1	0		1	1	0	
1-Month	PSTR	0		1	1	0		0		0	
3-Month	PSTR	0		0		0		0		0	
1-Month	SBOU	0		0		0		0		1	1
3-Month	SBOU	0		0		0		0		0	
1-Month	SINT	0		5	5	0		2	2	0	
3-Month	SINT	0		4	4	0		1	1	0	
1-Month	SSID	1	1	5	5	2	2	1	1	0	
3-Month	SSID	1	1	5	5	2	2	0		0	

Table 9. Summary information for the monitored colonies outplanted to the Clipper Lasco site. Only colony diameter size classes represented at this site are included (# C = number of colonies and # A = number of colonies alive).

		Size class (cm)							
		5-10		11-15		16-20		21-30	
Event	Species	# C	# A	# C	# A	# C	# A	# C	# A
1-Month	AAGA	7	7	1	1	1	1	0	
3-Month	AAGA	0		0		0		0	
1-Month	MCAV	5	5	3	3	0		3	3
3-Month	MCAV	0		0		0		0	
1-Month	MDEC	4	4	0		0		0	
3-Month	MDEC	0		0		0		0	
1-Month	MMEA	2	2	0		0		0	
3-Month	MMEA	0		0		0		0	
1-Month	MYAL	0		0		0		1	1
3-Month	MYAL	0		0		0		0	
1-Month	PAST	7	7	4	4	1	1	4	4
3-Month	PAST	0		0		0		0	
1-Month	PPOR	0		0		0		0	
3-Month	PPOR	0		0		0		0	
1-Month	PSTR	2	2	0		2	2	0	
3-Month	PSTR	0		0		0		0	
1-Month	SBOU	0		0		0		1	1
3-Month	SBOU	0		0		0		0	
1-Month	SINT	6	6	1	1	1	1	0	
3-Month	SINT	0		0		0		0	
1-Month	SSID	7	7	1	1	2	2	0	
3-Month	SSID	0		0		0		0	

Table 10. Summary of colony health conditions for the monitored colonies by monitoring event and species (all sites pooled).

Event	Condition	AAGA	DSTO	MCAV	MDEC	PAST	PSTR	SINT	SSID
1-Month	Predation	1	0	0	0	14	2	0	6
1-Month	Partial Bleaching	1	1	6	2	1	2	11	7
1-Month	Unknown	1	0	0	0	1	0	0	0
3-Month	Predation	0	0	0	0	1	0	0	0
3-Month	Partial Bleaching	0	0	2	0	0	0	6	5