

# Essential Fish Habitat Classification and Age & Growth of Deepwater Snappers in Puerto Rico Using Remote Video Camera's Tethered to Deep Drop Fishing Gear

## EFP F/SER28:SS Final Report



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## Introduction

The Caribbean Fishery Management Council (CFMC) has ranked investigations into Puerto Rico's valuable, but poorly studied deepwater snapper-grouper complex fishery, particularly the habitat it targets, at the highest priority level for deepwater research in their region. This project utilized commercial fishing vessels and accompanying fishery observers to conduct field work in Puerto Rico from 2018 through 2020, from water depths of 100-500 m. During this two year project, remote video cameras and LED lights were fixed to the fishermen's deep-drop fishing gear and deployed to record imagery of fish assemblages and benthic habitats in the west, southeast and northeast regions of Puerto Rico. Additionally, a vertical fishing line with twelve baited hooks was deployed prior to the remote video camera line to document the presence of fish that are wary of the LED light, and for the collection of biological samples. Biological samples (otoliths and gonads) and basic demographic data were collected from queen snapper (*Etelis oculatus*) and blackfin snapper (*Lutjanus buccanella*) for use in age and growth and age validation studies, and to verify reproductive studies.

## Objectives

The primary objectives of this survey were as follows:

- (1) Deploy camera and hook and line gear at a minimum of 450 survey stations over two years;
- (2) Provide groundtruthing for multibeam mapping efforts via habitat classification from video;
- (3) Develop the percentage of seafloor covered by specific biotic and abiotic organisms and features;
- (4) Develop species richness and a diversity index for both video and catch data;
- (5) Estimate factors affecting queen snapper distributions and abundance;
- (6) Compute validated age composition estimates and size distributions for US Caribbean queen snapper.

## Methods

Field sampling was conducted following a stratified random statistical survey design. Each year, 75 sampling sites were selected for each of the three targeted regions, stratified by depth and rugosity scores as defined by University of Miami Rosenstiel Marine and Atmospheric Science (RSMAS) and National Centers for Coastal Ocean Science (NCCOS) multibeam backscatter and bathymetry data (Figure 1). The selected sites were center points of 500 x 500 m boxes in a grid system.

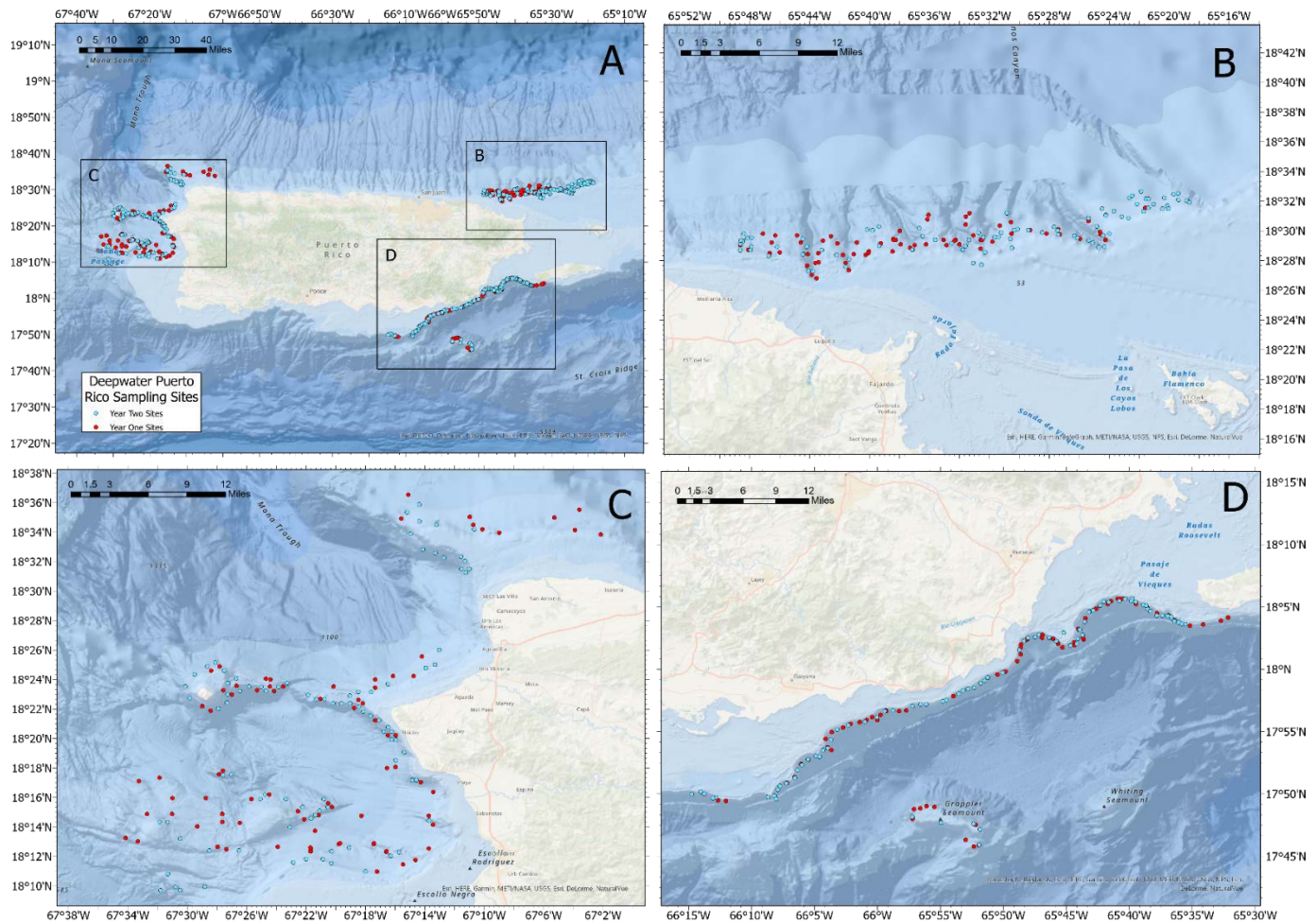


Figure 1. A) Maps of all survey sites sampled in two years with remote video camera and hook and line fishing along the (B) western, (C) northeastern, and (D) southeastern regions of Puerto Rico.

Fishing equipment was standardized throughout all three regions, including hook type and size, number of hooks per line, bait types, and soak time (Table 1). The sampling of any individual site consisted of the deployment of one vertical hook and line, with twelve baited hooks, and soaked for twenty minutes, followed directly by the deployment of the remote video camera, three baited hooks, and soaked for five minutes. The remote video camera is comprised of a GoPro (HERO4, GoPro, Inc., San Mateo, CA) in a small, pressure tested housing (GG HousingGoPro4 300 Extended, Golem Gear, Inc., Brooksville FL), and an LED video light (Lumen Subsea Light, Blue Robotics, Inc., Torrance, CA; EBL1200D, Sartek Industries, Inc., Setauket, NY), both secured to a small plastic panel attached to the fishing line with two gangions. On average, five sites were completed per day. All fish caught on hook and line were identified to the lowest taxonomic level possible, and the observer recorded length measurements. Biological samples (otoliths and gonads) were taken from queen snapper and blackfin snapper by the observer once a trip was completed, in addition to sex, length measurements, and weight.

Table 1. Standardized fishing method followed by commercial fishermen in the west, northeast and southeast region of Puerto Rico for the duration of this project.

Category	Item	Specification
<b>Gear</b>	Type	Vertical Hook-Line, Electric Reel
	Number of Lines Per Site	2
	Number of Hooks per Line	Fishing Line: 12 Camera Line: 3
	Hook Type, Size	Circle, #9
	Length of Leader Line Attaching Hook to Main Line	6"
	Spacing between Leaders/Hooks Along Main Line	12"
	Camera Distance from Weight	3'
	Weights, Attached to End of Main Line	5 – 10 lbs
	Bait	California Squid (Loligo)
<b>Fishing Sample</b>	Site Coordinates	decimal degrees
	Fishing Time Within Grid Cell	20 min. bottom time for fishing line; 5 min. bottom time for camera line
<b>Daily Trip</b>	Trip Duration, Dock-to-Dock	10-12 hrs
	Maximum Distance from Port	20 nautical miles
	Estimated Average Samples per Trip Day	5-8

Videos and field datasheets were downloaded at the end of each field day and backed-up onto the provided harddrive for review by principal investigator K. Overly. Videos were reviewed and fish and invertebrate species were identified to the lowest taxonomic level possible on a high-resolution video monitor. Minimum counts (maximum number observed in a single frame) of fish were recorded for each species, in addition to species occurrence (presence/absence). The general habitat was classified (i.e. sand, mud, rock, epifauna, etc.) for each video. Detailed habitat characteristics will be classified according to Coastal and Marine Ecological Classification Standards (CMECS), which was created with the intention of unifying classification efforts for integration and comparisons of data among organizations and surveys. Additionally, the percentage of bottom covered by benthic biota and abiotic features will be estimated for one still screenshot taken from each video sample with Coral Point Count with Excel extensions (CPCe) software.

### Preliminary Results

Biological samples collected from queen snapper (n=114) and blackfin snapper (n=10) were processed by the observer and delivered to the Puerto Rico DNER Fisheries Research Lab for shipment to University of South Carolina Aiken for further processing in ongoing age, growth and reproductive studies. Otolith samples have been sectioned and are currently undergoing age estimation. Otolith cores have been processed and we are

awaiting results for bomb radiocarbon chronometer age validation. All gonad samples have been shipped to the University of South Carolina Aiken to contribute to ongoing reproductive studies on both target species.

A total of 471 survey sites were sampled under the Exempted Fishing Permit timeframe. All survey sites and their associated general habitat classification are listed in the Appendix, alongside their corresponding region, depth and coordinates. No fish were harvested within the exempted area of Bajo de Sico. Minimal fish were caught during seasonal closures in 2018 and 2019, with eleven silk snapper, and three vermilion snapper caught in 2018, and 23 silk snapper, two vermilion snapper, and six blackfin snapper in 2019 (Figure 2A, Figure 2B). Silk, vermilion, and blackfin snapper caught during seasonal closures were quickly measured and released promptly.

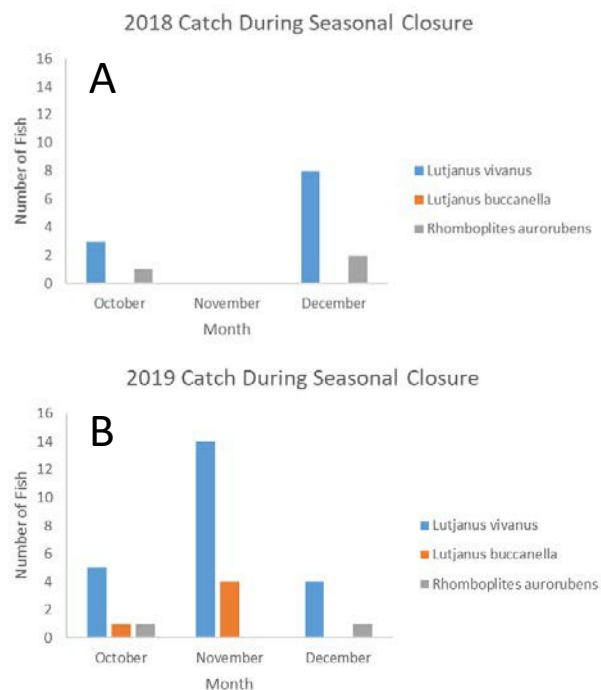


Figure 2: Number of silk snapper (*Lutjanus vivanus*), blackfin snapper (*Lutjanus buccanella*), and vermilion snapper (*Rhomboplites aurorubens*) caught during seasonal closure (October-December) over: (A) year one sampling in 2018, and (B) year two sampling in 2019.

No fishing gear was lost, although fishermen noted several fish throughout the project timeframe that were depredated on the fishing line. Bycatch species outside of the deepwater snapper grouper complex that have been identified include: jacks (*Caranx lugubris*, *Seriola dumerili*), Atlantic scombrops (*Scombrops oculatus*), tilefishes (*Caulolatilus williamsi*, *C. sp.*), lionfish (*Pterois volitans*), beardfishes (*Polymixia lowei*, *P. nobilis*), Tattler (*Serranus phoebe*), King snake eels (*Ophichthus rex*), New Granada drum (*Protosciaena trewavasae*), Three-spine bass (*Synagrops trispinosus*), and several shark species (*Squalus cubensis*, *S. clarkae*, *Mustelus canis*). Shark species caught as bycatch in this project were utilized in DNA barcoding to describe the diversity of sharks caught in Puerto Rico, a project conducted by G. Franqui at the Department of Marine Sciences, University of Puerto Rico, Mayagüez. Pictures were taken of the shark species for preliminary identification at sea, and a DNA sample was collected for processing, prior to release of the fish. Any unknown bycatch species were photographed and identified following capture and release.

Total catch and average size for all species caught on hook and line gear in year one and year two of sampling is summarized in Table 2A and Table 2B, respectively. Within the snapper grouper complex, species caught starting with the highest frequency across both sampling years included: cardinal snapper (n=287), silk snapper (n=162), queen snapper (n=114), vermilion snapper (n=36), wenchmen snapper (n=36), blackfin snapper (n=10) and red hind (n=1). Catch per month of each species for year one and year two of sampling is summarized in Table 3A and Table 3B, respectively.

Video processing is complete, with 471 videos downloaded and read for fish and invertebrate identification, species presence/absence, and habitat classification. CPCe analysis is currently underway and has been completed for year one sampling sites. Preliminary results from coral identification show that the west coast appears to have the highest abundance and diversity of invertebrates, however more detailed analysis is being conducted to describe habitat utilization and linkages between fish assemblages, specifically queen snapper, and deepwater coral communities.

Data collected in this study is providing critical information on queen snapper life history and habitat associations to improve management and conservation of this deepwater fisheries resource. Analyzing habitat utilization and the distribution of queen snapper will not only add to our limited knowledge regarding queen snapper habitat preference, but results could also be incorporated into spatial planning under ecosystem-based fisheries management (EBFM).

Table 2A: Quantity and average length in millimeters of all species obtained from hook in line sampling during year one (2018-2019) for all three regions.

Sampling Year One (2018-2019)			
Species	Count	Average FL (mm)	Average Max TL (mm)
<i>Caranx lugubris</i>	1	460	540
<i>Caulolatilus williamsi</i>	2	285	275
<i>Epinephelus guttatus</i>	1	NA	383
<i>Etelis oculatus</i>	48	364	429
<i>Lutjanus buccanella</i>	3	343	373
<i>Lutjanus vivanus</i>	81	340	370
<i>Ophichthus rex</i>	1	3000	3000
<i>Polymixia nobilis</i>	2	NA	NA
<i>Pristipomoides aquilonaris</i>	17	210	228
<i>Pristipomoides macrophthalmus</i>	120	297	334
<i>Scombrops oculatus</i>	1	290	320
<i>Serranus phoebe</i>	1	NA	383
<i>Synagrops trispinosus</i>	1	310	330
<i>Rhomboplites aurorubens</i>	5	243	275
<i>Squalus cubensis</i>	24	490	502
<i>Caulolatilus sp.</i>	1	390	390
<i>Protosciaena trewavasae</i>	2	255	255

Table 2B: Quantity and average length in millimeters of all species obtained from hook and line sampling during year two (2019-2020) for all three regions.

Sampling Year Two (2019-2020)			
Species	Count	Average FL (mm)	Average Max TL (mm)
<i>Caulolatilus williamsi</i>	1	350	360
<i>Etelis oculatus</i>	66	349	422
<i>Lutjanus buccanella</i>	7	280	301
<i>Lutjanus vivanus</i>	81	307	342
<i>Mustelus canis</i>	1	730	800
<i>Ophichthus rex</i>	1	NA	NA
<i>Polymixia lowei</i>	5	210	242
<i>Pristipomoides aquilonaris</i>	19	222	248
<i>Pristipomoides macrophthalmus</i>	167	300	334
<i>Pterois volitans</i>	1	NA	NA
<i>Rhomboplites aurorubens</i>	31	245	210
<i>Seriola dumerili</i>	2	395	485
<i>Squalus clarkae</i>	12	540	563
<i>Squalus cubensis</i>	5	454	517

Table 3A: Quantity of fish caught per month obtained from hook and line sampling in year one (2018-2019) across all three regions.

Year One (2018-2019)											
Species	September	October	November	December	January	February	March	June	July	August	Total
<i>Caulolatilus williamsi</i>					1						1
<i>Etelis oculatus</i>	24	7		10	2	3	14	1		5	66
<i>Lutjanus buccanella</i>		1	4							2	7
<i>Lutjanus vivanus</i>	7	5	14	4	14	10	14	1		12	81
<i>Mustelus canis</i>										1	1
<i>Ophichthus rex</i>		1									1
<i>Polymixia lowei</i>						3	2				5
<i>Pristipomoides aquilonaris</i>	7	5		3	2		1		1		19
<i>Pristipomoides macrophthalmus</i>	44	10	2		2	28	43	11	5	22	167
<i>Pterois volitans</i>			1								1
<i>Rhomboplites aurorubens</i>	21	1		1	3	3		1		1	31
<i>Seriola dumerili</i>	2										2
<i>Squalus clarkae</i>	1	2	7	2							12
<i>Squalus cubensis</i>	4		1								5
<b>Total Per Month</b>	<b>110</b>	<b>32</b>	<b>29</b>	<b>20</b>	<b>24</b>	<b>47</b>	<b>74</b>	<b>14</b>	<b>6</b>	<b>43</b>	<b>399</b>

Table 3B: Quantity of fish caught per month obtained from hook and line sampling in year two (2019-2020)  
across all three regions.

Year Two (2019-2020)									
Species	October	November	December	February	May	June	July	August	Total
<i>Caranx lugubris</i>					1				1
<i>Caulolatilus williamsi</i>			1	1					2
<i>Epinephelus guttatus</i>	1								1
<i>Etelis oculatus</i>	2	1	3	5	17	18		2	48
<i>Lutjanus buccanella</i>					2	1			3
<i>Lutjanus vivanus</i>	3		8	2	27	33	2	6	81
<i>Ophichthus rex</i>						1			1
<i>Polymixia nobilis</i>					2				2
<i>Pristipomoides aquilonaris</i>			1	3	2	3	7	1	17
<i>Pristipomoides macrophthalmus</i>		2	8	4	27	58	4	17	120
<i>Scombrops oculatus</i>								1	1
<i>Serranus phoebe</i>	1								1
<i>Synagrops trispinosus</i>						1			1
<i>Rhomboplites aurorubens</i>	1		2			2			5
<i>Squalus cubensis</i>		1	21	1	1				24
<i>Caulolatilus sp.</i>				1					1
<i>Protosciaena trewavasae</i>					2				2
<b>Total Per Month</b>	<b>8</b>		<b>44</b>	<b>17</b>	<b>81</b>	<b>117</b>	<b>13</b>	<b>27</b>	<b>311</b>

### Appendix:

Table 4: All survey sites (n=471) sampled across all three regions in Puerto Rico. Listed in each row is the associated region, sampling year, latitude and longitude in decimal degrees, recorded depth in meters, and the general habitat classification.

Site	Region	Year	Latitude	Longitude	Depth (m)	General Habitat
4251	West	1	18.38	-67.31	225.0	Rock and Epifauna
4870	West	1	18.19	-67.26	118.9	Rock and Epifauna
4909	West	1	18.20	-67.24	125.7	Epifauna
4850	West	1	18.21	-67.23	133.2	Epifauna
4817	West	1	18.25	-67.23	142.5	Epifauna
4581	West	1	18.27	-67.22	184.7	Sand
4895	West	1	18.28	-67.24	106.1	Epifauna
4827	West	1	18.40	-67.25	131.3	Epifauna
2732	West	1	18.40	-67.29	336.5	Epifauna
4356	West	1	18.39	-67.29	206.7	Epifauna
4251	West	1	18.38	-67.31	225.0	Rock and Epifauna
4833	West	1	18.37	-67.30	141.0	Rock and Epifauna
4790	West	1	18.61	-67.25	100.0	Rock and Epifauna
4785	West	1	18.34	-67.27	104.3	Rock and Epifauna
4982	West	1	18.56	-67.04	101.1	Rock and Epifauna
2937	West	1	18.59	-67.06	325.6	Epifauna
4824	West	1	18.57	-67.06	131.1	Rock and Epifauna
3994	West	1	18.58	-67.09	239.6	Epifauna
4797	West	1	18.57	-67.15	122.7	Rock and Epifauna
4584	West	1	18.57	-67.17	208.5	Sand
4042	West	1	18.57	-67.18	235.9	Epifauna
3320	West	1	18.58	-67.18	292.6	Sand
4063	West	1	18.21	-67.47	232.3	Rock and Epifauna

5040	West	1	18.24	-67.44	365.8	Rock
1593	West	1	18.26	-67.43	400.6	Epifauna and Small Sand Mounds
2065	West	1	18.27	-67.41	374.9	Epifauna
3792	West	1	18.25	-67.38	252.4	Epifauna
3140	West	1	18.24	-67.37	342.2	Rock and Epifauna
4114	West	1	18.21	-67.36	232.3	Sand
2443	West	1	18.21	-67.33	349.3	Sand
3821	West	1	18.21	-67.36	250.6	Sand
2820	West	1	18.21	-67.29	325.6	Epifauna
3625	West	1	18.21	-67.28	257.9	Rock
1558	West	1	18.26	-67.34	426.2	Epifauna
1775	West	1	18.26	-67.34	385.9	Rock and Epifauna
1174	West	1	18.25	-67.35	406.0	Epifauna and Sand Dunes
2195	West	1	18.23	-67.36	376.8	Sand
756	West	1	18.25	-67.30	453.6	Sand
2042	West	1	18.25	-67.46	380.4	Rock and Epifauna
3357	West	1	18.23	-67.49	285.3	Rock and Epifauna
2958	West	1	18.24	-67.46	320.1	Rock and Epifauna
3784	West	1	18.21	-67.46	259.7	Epifauna
3849	West	1	18.21	-67.40	250.6	Epifauna
3741	West	1	18.41	-67.46	257.9	Rock
4168	West	1	18.41	-67.47	215.8	Epifauna
4693	West	1	18.39	-67.46	166.4	Epifauna
905	West	1	18.38	-67.45	437.1	Epifauna
4203	West	1	18.39	-67.44	203.0	Rock and Epifauna
1596	West	1	18.28	-67.55	411.5	Sand

867	West	1	18.29	-67.53	449.9	Epifauna
2804	West	1	18.27	-67.52	332.9	Epifauna
1699	West	1	18.27	-67.48	404.2	Epifauna
2388	West	1	18.29	-67.46	345.7	Rock and Epifauna
2279	West	1	18.30	-67.46	354.8	Rock and Epifauna
1265	West	1	18.39	-67.42	391.4	Epifauna
3168	West	1	18.40	-67.41	318.2	Epifauna
2934	West	1	18.40	-67.41	334.7	Sand
4551	West	1	18.39	-67.41	197.5	Rock and Epifauna
2849	West	1	18.39	-67.40	316.4	Rock and Epifauna
1851	West	1	18.39	-67.39	347.5	Rock and Epifauna
2487	West	1	18.38	-67.35	323.7	Rock and Epifauna
2321	West	1	18.39	-67.34	384.1	Epifauna
2412	West	1	18.40	-67.27	360.3	Epifauna
1887	West	1	18.43	-67.24	385.9	Sand
4361	West	1	18.22	-67.57	197.5	Rock and Epifauna
4535	West	1	18.22	-67.56	188.4	Epifauna
4417	West	1	18.25	-67.55	204.8	Rock and Epifauna
3391	West	1	18.25	-67.52	285.3	Epifauna
3519	West	1	18.37	-67.48	225.0	Rock and Epifauna
1553	West	1	18.37	-67.47	391.4	Epifauna
2444	West	1	18.37	-67.31	353.0	Sand
3577	West	1	18.35	-67.29	219.5	Rock and Epifauna
2820	West	1	18.22	-67.29	373.1	Rock and Epifauna
4475	West	1	18.24	-67.22	195.7	Sand
1755	West	1	18.30	-67.27	395.1	Epifauna

1318	West	1	18.34	-67.27	347.5	Epifauna
4114	West	1	18.21	-67.36	232.3	Sand
3821	West	1	18.21	-67.36	252.4	Sand
2443	West	1	18.21	-67.33	356.7	Epifauna
3625	West	1	18.21	-67.28	257.9	Rock and Epifauna
20	Southeast	1	17.83	-66.21	281.7	Epifauna
19	Southeast	1	17.82	-66.20	303.6	Epifauna
17	Southeast	1	17.85	-66.12	281.7	Sand
6	Southeast	1	17.86	-66.11	235.9	Rock and Epifauna
34	Southeast	1	17.87	-66.10	384.1	Epifauna
33	Southeast	1	17.88	-66.09	411.5	Epifauna
32	Southeast	1	17.89	-66.06	473.7	Rock and Epifauna
7	Southeast	1	17.92	-66.06	208.5	Epifauna
5	Southeast	1	17.93	-66.04	214.0	Epifauna
16	Southeast	1	17.93	-66.02	254.2	Epifauna
12	Southeast	1	17.94	-66.01	234.1	Rock and Epifauna
31	Southeast	1	17.93	-66.00	424.3	Epifauna
3	Southeast	1	17.82	-65.92	117.1	Rock and Epifauna
27	Southeast	1	17.82	-65.94	69.5	Rock and Epifauna
8	Southeast	1	17.81	-65.94	69.5	Rock and Epifauna
29	Southeast	1	17.81	-65.95	345.7	Epifauna
28	Southeast	1	17.80	-65.95	345.7	Sand
13	Southeast	1	17.76	-65.87	283.5	Rock and Epifauna
21	Southeast	1	17.77	-65.87	270.7	Epifauna
30	Southeast	1	17.77	-65.88	404.2	Sand
22	Southeast	1	17.70	-65.90	292.6	Epifauna

4	Southeast	1	17.79	-65.87	274.4	Sand
5797	Southeast	1	18.04	-65.81	270.7	Epifauna
5924	Southeast	1	18.03	-65.81	237.8	Rock and Epifauna
6052	Southeast	1	18.03	-65.81	283.5	Epifauna
5684	Southeast	1	18.04	-65.73	243.3	Sand
5811	Southeast	1	18.04	-65.74	203.0	Rock and Epifauna
5939	Southeast	1	18.03	-65.74	309.1	Epifauna
5938	Southeast	1	18.03	-65.74	223.1	Rock and Epifauna
5686	Southeast	1	18.04	-65.73	365.8	Epifauna
36	Southeast	1	18.03	-65.76	312.8	Sand
4830	Southeast	1	18.07	-65.54	100.6	Sand
4956	Southeast	1	18.06	-65.55	327.4	Epifauna and Small Sand Mounds
5079	Southeast	1	18.06	-65.57	76.8	Rock and Epifauna
5203	Southeast	1	18.06	-65.59	290.8	Small Sand Mounds
18	Southeast	1	18.07	-65.61	89.6	Epifauna and Small Sand Mounds
9	Southeast	1	18.07	-65.61	54.9	Rock and Epifauna
4813	Southeast	1	18.07	-65.61	329.2	Rock and Epifauna
4682	Southeast	1	18.08	-65.63	173.8	Epifauna and Small Sand Mounds
45511	Southeast	1	18.08	-65.64	329.2	Sand
4420	Southeast	1	18.09	-65.66	314.6	Epifauna
4161	Southeast	1	18.09	-65.67	212.2	Rock and Epifauna
4160	Southeast	1	18.09	-65.68	259.7	Sand
4159	Southeast	1	18.09	-65.68	254.2	Epifauna
4285	Southeast	1	18.09	-65.69	329.2	Epifauna
4412	Southeast	1	18.09	-65.70	402.4	Sand
4410	Southeast	1	18.09	-65.71	318.2	Sand

4537	Southeast	1	18.08	-65.71	314.6	Epifauna
4663	Southeast	1	18.08	-65.72	182.9	Epifauna
4918	Southeast	1	18.07	-65.72	365.8	Sand
5301	Southeast	1	18.05	-65.73	217.7	Epifauna
5300	Southeast	1	18.05	-65.73	241.4	Rock and Epifauna
5686	Southeast	1	18.04	-65.73	292.6	Epifauna
5934	Southeast	1	18.03	-65.76	310.9	Epifauna
5677	Southeast	1	18.04	-65.77	259.7	Rock and Epifauna
25	Southeast	1	18.04	-65.77	268.9	Epifauna
5546	Southeast	1	18.05	-65.78	250.6	Sand
5674	Southeast	1	18.04	-65.78	395.1	Sand
5669	Southeast	1	18.04	-65.80	320.1	Sand
6944	Southeast	1	18.00	-65.83	259.7	Rock and Epifauna
37	Southeast	1	17.99	-65.84	281.7	Epifauna
26	Southeast	1	17.94	-65.97	342.0	Rock and Epifauna
2	Southeast	1	17.95	-65.96	292.6	Epifauna
15	Southeast	1	17.94	-65.99	268.9	Sand
24	Southeast	1	17.94	-65.99	281.7	Epifauna
1	Southeast	1	17.96	-65.90	283.5	Rock and Epifauna
40	Southeast	1	17.90	-66.07	345.7	Epifauna and Small Sand Mounds
46	Southeast	1	17.91	-66.07	208.5	Epifauna
41	Southeast	1	17.92	-66.05	274.4	Epifauna
42	Southeast	1	17.93	-66.01	285.3	Epifauna
43	Southeast	1	17.94	-66.00	384.1	Epifauna
3306	Northeast	1	18.48	-65.57	287.1	Sand
3177	Northeast	1	18.49	-65.57	352.9	Sand

2667	Northeast	1	18.51	-65.56	342.0	Epifauna
2411	Northeast	1	18.52	-65.56	405.4	Sand
3174	Northeast	1	18.49	-65.58	303.9	Sand
3046	Northeast	1	18.49	-65.55	362.7	Sand
2402	Northeast	1	18.52	-65.60	383.7	Sand
3162	Northeast	1	18.49	-65.64	306.3	Sand
2530	Northeast	1	18.51	-65.60	366.7	Sand
3439	Northeast	1	18.48	-65.54	269.1	Sand
4695	Northeast	1	18.49	-65.54	310.0	Sand
3185	Northeast	1	18.49	-65.53	325.2	Sand
2284	Northeast	1	18.52	-65.56	402.6	Sand
2934	Northeast	1	18.50	-65.51	239.9	Sand
2550	Northeast	1	18.51	-65.51	395.6	Sand
2675	Northeast	1	18.51	-65.52	328.6	Sand
2810	Northeast	1	18.50	-65.49	259.7	Sand
2942	Northeast	1	18.50	-65.47	201.2	Epifauna
9195	Northeast	1	18.50	-65.46	168.2	Sand
3546	Northeast	1	18.48	-65.64	168.2	Rock and Coral
3162	Northeast	1	18.49	-65.64	295.3	Epifauna
2904	Northeast	1	18.50	-65.63	356.0	Sand
3287	Northeast	1	18.49	-65.65	254.2	Sand
3540	Northeast	1	18.48	-65.67	214.3	Sand
3669	Northeast	1	18.48	-65.67	199.3	Sand
3668	Northeast	1	18.47	-65.67	186.2	Sand
3282	Northeast	1	18.49	-65.68	354.2	Sand
3277	Northeast	1	18.49	-65.70	346.5	Epifauna

3665	Northeast	1	18.47	-65.68	312.4	Sand
9263	Northeast	1	18.49	-65.43	330.1	Sand
8949	Northeast	1	18.51	-65.42	359.0	Sand
8891	Northeast	1	18.52	-65.40	221.0	Sand
9132	Northeast	1	18.50	-65.46	285.3	Sand
3183	Northeast	1	18.49	-65.54	333.4	Rock
3920	Northeast	1	18.46	-65.69	333.7	Sand
3919	Northeast	1	18.46	-65.69	242.0	Sand
3662	Northeast	1	18.47	-65.70	277.7	Sand
2891	Northeast	1	18.49	-65.71	364.5	Sand
3145	Northeast	1	18.49	-65.72	339.8	Sand
3268	Northeast	1	18.49	-65.74	321.9	Sand
2884	Northeast	1	18.49	-65.75	358.4	Sand
3648	Northeast	1	18.48	-65.77	185.9	Sand
3645	Northeast	1	18.47	-65.78	194.1	Sand
3653	Northeast	1	18.47	-65.74	270.3	Sand
3654	Northeast	1	18.47	-65.74	332.2	Sand
3302	Northeast	1	18.48	-65.58	210.6	Epifauna
3040	Northeast	1	18.49	-65.60	337.1	Sand
3295	Northeast	1	18.48	-65.62	361.2	Sand
3422	Northeast	1	18.48	-65.62	197.2	Epifauna
3292	Northeast	1	18.49	-65.63	250.2	Sand
3162	Northeast	1	18.49	-65.64	294.4	Sand
3551	Northeast	1	18.48	-65.62	183.5	Epifauna
3528	Northeast	1	18.45	-65.73	183.5	Sand
3912	Northeast	1	18.45	-65.73	235.3	Sand

3913	Northeast	1	18.46	-65.74	200.9	Sand
4038	Northeast	1	18.46	-65.73	308.1	Sand
4295	Northeast	1	18.46	-65.72	243.2	Epifauna
4424	Northeast	1	18.48	-65.72	329.2	Sand
3003	Northeast	1	18.50	-65.77	362.7	Sand
3006	Northeast	1	18.49	-65.78	306.3	Sand
3261	Northeast	1	18.50	-65.79	349.0	Sand
3382	Northeast	1	18.48	-65.80	207.9	Sand
3512	Northeast	1	18.48	-65.81	248.4	Sand
3177	Northeast	1	18.53	-65.36	246.6	Sand
8774	Northeast	1	18.50	-65.41	271.3	Epifauna
9142	Northeast	1	18.50	-65.41	343.8	Sand
9204	Northeast	1	18.49	-65.40	247.8	Sand
9269	Northeast	1	18.49	-65.57	339.8	Sand
1883	West	2	18.27	-67.41	385.9	Sand
1897	West	2	18.29	-67.45	384.0	Sand
2110	West	2	18.27	-67.42	376.7	Sand
2211	West	2	18.27	-67.39	365.8	Sand
2878	West	2	18.29	-67.46	320.0	Sand
2691	West	2	18.38	-67.45	354.8	Sand
1230	West	2	18.37	-67.46	396.8	Rock and Epifauna
991	West	2	18.39	-67.44	417.0	Rock and Epifauna
3612	West	2	18.40	-67.45	272.5	Rock and Epifauna
2451	West	2	18.39	-67.50	329.2	Sand
2968	West	2	18.38	-67.50	292.6	Sand
3123	West	2	18.41	-67.49	338.3	Rock and Epifauna

2101	West	2	18.42	-67.47	367.6	Epifauna
4743	West	2	18.41	-67.46	166.4	Epifauna
4651	West	2	18.40	-67.45	173.7	Epifauna
4410	West	2	18.37	-67.33	184.7	Rock and Epifauna
4074	West	2	18.37	-67.34	228.6	Rock and Epifauna
4144	West	2	18.37	-67.32	212.1	Rock and Epifauna
3153	West	2	18.36	-67.30	256.0	Sand
2898	West	2	18.37	-67.31	274.3	Rock and Epifauna
4106	West	2	18.36	-67.29	215.8	Rock
4856	West	2	18.35	-67.28	126.2	Rock
2431	West	2	18.52	-67.19	309.1	Sand
4949	West	2	18.54	-67.19	82.3	Rock and Epifauna
4963	West	2	18.53	-67.19	100.6	Rock and Epifauna
4609	West	2	18.52	-67.18	182.9	Epifauna
4690	West	2	18.57	-67.22	146.3	Rock and Epifauna
4443	West	2	18.57	-67.18	208.5	Epifauna
4853	West	2	18.41	-67.23	140.8	Rock and Epifauna
1209	West	2	18.60	-67.24	424.3	Sand
1638	West	2	18.59	-67.25	398.7	Sand
3317	West	2	18.58	-67.24	283.5	Epifauna
2662	West	2	18.57	-67.25	371.2	Epifauna
2480	West	2	18.55	-67.24	369.4	Epifauna
3501	West	2	18.54	-67.22	369.4	Sand
2454	West	2	18.54	-67.21	374.9	Sand
1395	West	2	18.53	-67.19	391.4	Sand
1068	West	2	18.34	-67.28	369.4	Sand

4981	West	2	18.35	-67.27	60.4	Epifauna
4783	West	2	18.34	-67.27	124.4	Rock and Epifauna
1471	West	2	18.33	-67.27	406.0	Sand
3372	West	2	18.33	-67.27	294.4	Sand
4275	West	2	18.32	-67.26	193.9	Epifauna
1078	West	2	18.26	-67.35	438.9	Sand
1709	West	2	18.26	-67.34	418.8	Sand
2236	West	2	18.25	-67.35	373.1	Sand
2567	West	2	18.25	-67.36	338.3	Epifauna
2077	West	2	18.24	-67.36	384.0	Sand
2813	West	2	18.26	-67.37	329.2	Epifauna
3323	West	2	18.23	-67.38	274.3	Epifauna
4930	West	2	18.19	-67.38	109.7	Rock and Epifauna
4911	West	2	18.20	-67.37	124.4	Rock and Epifauna
4684	West	2	18.20	-67.35	179.2	Sand
4884	West	2	18.19	-67.34	120.7	Rock and Epifauna
3232	West	2	18.21	-67.34	301.8	Sand
2763	West	2	18.21	-67.32	332.8	Rock and Epifauna
8530	Northeast	2	18.54	-65.32	365.2	Sand
8592	Northeast	2	18.54	-65.33	331.6	Sand
8656	Northeast	2	18.53	-65.32	233.8	Sand
8720	Northeast	2	18.53	-65.31	283.5	Sand
8784	Northeast	2	18.53	-65.31	315.5	Sand
8780	Northeast	2	18.53	-65.34	286.5	Rock and Epifauna
20	Northeast	2	18.54	-65.36	32.9	Sand
22	Northeast	2	18.54	-65.36	355.7	Epifauna

8775	Northeast	2	18.53	-65.36	189.0	Epifauna and Sand Dunes
8837	Northeast	2	18.52	-65.36	128.6	Sand
8707	Northeast	2	18.53	-65.37	300.2	Sand
8518	Northeast	2	18.54	-65.38	423.4	Sand
29	Northeast	2	18.50	-65.52	298.7	Sand
3059	Northeast	2	18.49	-65.52	308.8	Sand
3058b	Northeast	2	18.49	-65.53	374.0	Sand
3314	Northeast	2	18.65	-65.53	212.8	Sand
3568	Northeast	2	18.48	-65.54	137.2	Sand
7	Northeast	2	18.46	-65.54	197.8	Sand
3178	Northeast	2	18.49	-65.59	271.3	Epifauna
3041	Northeast	2	18.49	-65.61	423.7	Sand
2784	Northeast	2	18.50	-65.61	369.1	Sand
3551	Northeast	2	18.48	-65.62	187.1	Epifauna
3304	Northeast	2	18.49	-65.58	247.5	Epifauna
6	Northeast	2	18.48	-65.56	225.6	Sand
3437	Northeast	2	18.46	-65.55	313.6	Epifauna
6	Northeast	2	18.48	-65.56	255.1	Sand
3307	Northeast	2	18.48	-65.56	345.9	Sand
2926	Northeast	2	18.50	-65.55	317.0	Sand
3055	Northeast	2	18.49	-65.54	362.4	Sand
3414	Northeast	2	18.48	-65.66	234.4	Sand
2775	Northeast	2	18.50	-65.66	393.2	Sand
2901	Northeast	2	18.50	-65.66	386.5	Sand
5	Northeast	2	18.50	-65.67	384.7	Sand
3792	Northeast	2	18.47	-65.69	384.7	Sand

4047	Northeast	2	18.46	-65.69	136.2	Rock and Epifauna
3425	Northeast	2	18.48	-65.51	71.3	Rock and Epifauna
9	Northeast	2	18.49	-65.51	111.9	Epifauna
2807	Northeast	2	18.50	-65.51	313.6	Sand
2808	Northeast	2	18.50	-65.50	312.4	Sand
10	Northeast	2	18.50	-65.49	188.1	Sand
21	Northeast	2	18.52	-65.51	98.8	Epifauna and Sand Dunes
25	Northeast	2	18.53	-65.34	341.7	Sand
8780	Northeast	2	18.53	-65.33	98.1	Rock and Epifauna
8653	Northeast	2	18.54	-65.34	364.5	Sand
24	Northeast	2	18.53	-65.35	384.7	Sand
2879	West	2	18.18	-67.52	332.8	Rock and Epifauna
3316	West	2	18.17	-67.51	307.2	Rock and Epifauna
1148	West	2	18.16	-67.53	453.5	Rock and Epifauna
2116	West	2	18.16	-67.51	398.7	Rock
2801	West	2	18.17	-67.48	378.6	Rock
3559	West	2	18.39	-67.43	250.5	Rock and Epifauna
4701	West	2	18.39	-67.42	153.6	Rock and Epifauna
4000	West	2	18.39	-67.41	237.7	Rock and Epifauna
3540	West	2	18.39	-67.40	250.5	Rock and Epifauna
1601	West	2	18.40	-67.39	427.9	Rock and Epifauna
1916	West	2	18.31	-67.27	385.9	Sand
4152	West	2	18.29	-67.25	206.7	Sand
4706	West	2	18.29	-67.24	142.6	Epifauna
1601	West	2	18.40	-67.39	422.5	Rock and Epifauna
1633	West	2	18.38	-67.36	404.2	Rock and Epifauna

2257	West	2	18.38	-67.36	367.6	Rock and Epifauna
3440	West	2	18.38	-67.35	278.0	Rock and Epifauna
3439	West	2	18.38	-67.32	287.1	Rock and Epifauna
4866	West	2	18.18	-67.30	142.6	Sand
4330	West	2	18.20	-67.27	208.5	Sand
4217	West	2	18.20	-67.26	210.3	Sand
4769	West	2	18.24	-67.23	126.2	Epifauna
4152	West	2	18.29	-67.25	214.0	Sand
4897	West	2	18.24	-67.53	120.7	Rock and Epifauna
4573	West	2	18.24	-67.52	177.4	Rock and Epifauna
4421	West	2	18.22	-67.51	204.8	Rock and Epifauna
4220	West	2	18.21	-67.48	219.5	Rock and Epifauna
3761	West	2	18.21	-67.44	263.3	Sand
3922	West	2	18.39	-67.31	254.2	Epifauna
4686	West	2	18.39	-67.29	157.3	Epifauna
4150	West	2	18.39	-67.27	230.4	Sand
2288	West	2	18.43	-67.22	365.8	Sand
4798	West	2	18.42	-67.22	137.2	Rock and Epifauna
55	Southeast	2	17.99	-65.85	283.5	Sand
19	Southeast	2	18.00	-65.83	329.2	Mud
20	Southeast	2	17.97	-65.88	246.9	Rock and Epifauna
21	Southeast	2	17.97	-65.89	226.8	Rock and Epifauna
54	Southeast	2	17.96	-65.91	257.9	Rock and Epifauna
23	Southeast	2	17.95	-65.94	254.2	Rock and Epifauna
53	Southeast	2	17.95	-65.98	270.7	Sand
22	Southeast	2	17.94	-65.99	301.8	Sand

80	Southeast	2	17.94	-66.00	373.1	Artificial
24	Southeast	2	17.93	-66.02	307.2	Sand
16	Southeast	2	18.04	-65.77	283.5	Sand
58	Southeast	2	18.04	-65.76	303.6	Rock and Epifauna
57	Southeast	2	18.05	-65.79	256.0	Sand
17	Southeast	2	18.04	-65.79	426.1	Sand
56	Southeast	2	18.04	-65.80	314.6	Sand
18	Southeast	2	18.04	-65.81	241.4	Sand
25	Southeast	2	17.93	-66.04	283.5	Epifauna
76	Southeast	2	17.92	-66.05	206.7	Rock and Epifauna
62	Southeast	2	17.91	-66.06	398.7	Epifauna
26	Southeast	2	17.89	-66.07	393.2	Sand
27	Southeast	2	17.89	-66.07	329.2	Sand
15	Southeast	2	18.05	-65.75	164.6	Rock and Epifauna
59	Southeast	2	18.03	-65.74	263.3	Rock and Epifauna
14	Southeast	2	18.03	-65.74	303.6	Sand
60	Southeast	2	18.04	-65.73	239.6	Sand
82	Southeast	2	18.05	-65.73	332.8	Epifauna
12	Southeast	2	18.05	-65.73	287.1	Rock and Epifauna
65	Southeast	2	18.06	-65.73	437.1	Sand
64	Southeast	2	18.09	-65.69	332.8	Rock and Epifauna
11	Southeast	2	18.09	-65.70	261.5	Sand
13	Southeast	2	18.09	-65.71	353.0	Sand
75	Southeast	2	18.08	-65.71	237.7	Sand
61	Southeast	2	18.08	-65.72	157.3	Rock and Epifauna
78	Southeast	2	17.85	-66.11	274.3	Rock and Epifauna

30	Southeast	2	17.87	-66.11	283.5	Rock and Epifauna
29	Southeast	2	17.87	-66.10	385.9	Epifauna
28	Southeast	2	17.88	-66.09	417.0	Rock and Epifauna
72	Southeast	2	17.88	-66.08	331.0	Rock and Epifauna
77	Southeast	2	17.88	-66.08	294.4	Rock and Epifauna
35	Southeast	2	17.83	-66.14	263.3	Rock and Epifauna
33	Southeast	2	17.83	-66.14	210.3	Rock and Epifauna
34	Southeast	2	17.83	-66.13	173.7	Rock and Epifauna
79	Southeast	2	17.84	-66.13	387.7	Epifauna
32	Southeast	2	17.84	-66.13	256.0	Rock and Epifauna
31	Southeast	2	17.85	-66.12	314.6	Sand
37	Southeast	2	17.83	-66.21	259.7	Rock and Epifauna
39	Southeast	2	17.83	-66.22	369.4	Sand
40	Southeast	2	17.83	-66.23	312.7	Epifauna
38	Southeast	2	17.84	-66.23	182.9	Rock and Epifauna
86	Southeast	2	17.83	-66.25	363.9	Rock
13	Northeast	2	18.50	-65.40	137.5	Rock and Epifauna
14	Northeast	2	18.49	-65.41	138.7	Sand
9078	Northeast	2	18.51	-65.41	164.6	Rock and Epifauna
15	Northeast	2	18.52	-65.40	211.8	Sand
8949	Northeast	2	18.51	-65.42	323.7	Epifauna
19	Northeast	2	18.51	-65.38	120.4	Rock and Epifauna
18	Northeast	2	18.52	-65.39	171.9	Sand
23	Northeast	2	18.54	-65.36	391.4	Sand
8518	Northeast	2	18.54	-65.37	378.6	Sand
17	Northeast	2	18.52	-65.39	246.6	Sand

16	Northeast	2	18.53	-65.41	271.9	Epifauna
9119	Northeast	2	18.49	-65.44	378.0	Sand
9195	Northeast	2	18.50	-65.46	163.7	Rock and Epifauna
9132	Northeast	2	18.50	-65.46	240.8	Sand
2688	Northeast	2	18.50	-65.46	331.6	Sand
8	Northeast	2	18.50	-65.47	232.0	Epifauna
12	Northeast	2	18.48	-65.41	287.1	Epifauna
9331	Northeast	2	18.48	-65.41	310.9	Sand
9329	Northeast	2	18.49	-65.42	286.5	Sand
9265	Northeast	2	18.49	-65.42	374.3	Sand Dunes
11	Northeast	2	18.49	-65.44	329.2	Sand
3661	Northeast	2	18.47	-65.70	194.8	Epifauna
30	Northeast	2	18.48	-65.72	296.3	Sand
3270	Northeast	2	18.48	-65.74	370.9	Epifauna
3269	Northeast	2	18.49	-65.74	353.9	Epifauna
3653	Northeast	2	18.47	-65.74	254.5	Sand
4167	Northeast	2	18.45	-65.73	306.9	Epifauna
4	Northeast	2	18.46	-65.73	158.5	Sand
31	Northeast	2	18.48	-65.77	249.0	Rock
3	Northeast	2	18.47	-65.78	78.6	Sand
1	Northeast	2	18.48	-65.80	199.3	Sand
32	Northeast	2	18.48	-65.80	246.3	Sand
3129	Northeast	2	18.49	-65.80	335.9	Epifauna
3128	Northeast	2	18.49	-65.80	306.0	Epifauna
3255	Northeast	2	18.49	-65.81	295.4	Epifauna
3254	Northeast	2	18.49	-65.81	301.8	Sand

33	Northeast	2	18.48	-65.81	165.2	Sand
2999	Northeast	2	18.49	-65.81	266.7	Sand
3254	Northeast	2	18.49	-65.81	307.8	Sand
3382	Northeast	2	18.50	-65.81	365.5	Sand
7575	Southeast	2	17.98	-65.87	265.2	Rock
7449	Southeast	2	17.98	-65.86	289.0	Sand
7322	Southeast	2	17.98	-65.86	362.1	Rock and Epifauna
7195	Southeast	2	17.99	-65.85	173.7	Rock and Epifauna
81	Southeast	2	18.03	-65.81	281.6	Sand
5806	Southeast	2	18.04	-65.76	320.0	Epifauna
6	Southeast	2	18.09	-65.65	274.3	Epifauna
9	Southeast	2	18.09	-65.66	124.4	Rock and Epifauna
69	Southeast	2	18.09	-65.66	173.7	Sand
8	Southeast	2	18.09	-65.66	256.0	Sand
10	Southeast	2	18.09	-65.67	228.6	Sand
92	Southeast	2	18.09	-65.68	365.8	Sand
1	Southeast	2	18.07	-65.62	371.2	Sand
63	Southeast	2	18.07	-65.62	354.8	Sand
67	Southeast	2	18.07	-65.63	380.4	Sand
4	Southeast	2	18.08	-65.64	329.2	Sand
7	Southeast	2	18.08	-65.64	363.9	Sand
68	Southeast	2	18.09	-65.64	204.8	Sand
74	Southeast	2	18.06	-65.59	246.9	Epifauna
5	Southeast	2	18.06	-65.60	347.5	Epifauna
71	Southeast	2	18.06	-65.60	239.6	Epifauna
70	Southeast	2	18.06	-65.61	276.1	Rock and Epifauna

2	Southeast	2	18.07	-65.61	274.3	Epifauna
3	Southeast	2	18.07	-65.61	237.7	Epifauna
46	Southeast	2	17.80	-65.95	374.9	Sand
44	Southeast	2	17.79	-65.92	210.3	Epifauna
45	Southeast	2	17.81	-65.91	164.6	Epifauna
42	Southeast	2	17.79	-65.87	201.2	Epifauna
43	Southeast	2	17.79	-65.86	164.6	Rock and Epifauna
47	Southeast	2	17.77	-65.86	274.3	Epifauna
52	Southeast	2	17.95	-65.95	259.7	Rock
91	Southeast	2	17.95	-65.94	237.7	Rock
90	Southeast	2	17.96	-65.91	283.5	Rock and Epifauna
7700	Southeast	2	17.97	-65.89	210.3	Epifauna and Small Sand Mounds