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26 October 2012

Ms. Kimberly Colstad
Coastal Technology Corporation
3625 20th Street
Vero Beach, Florida 32960
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Re: Function and Mitigation of Nearshore Hard Bottom in East Florida – Fourth Field Survey

Dear Kimberly:

This report discusses the summer 2012 field survey for the function and mitigation of nearshore hard bottom in east Florida project. During the survey, *in situ* quadrats were sampled and algae, wormrock, and newly settled fish (and microhabitat characteristics) were collected from two artificial reefs; one located just north of Lake Worth Inlet off Singer Island and the other located just south of South Lake Worth Inlet off Ocean Ridge. The two artificial reefs are referred to as Singer Island and Ocean Ridge, respectively. Each artificial reef has a corresponding natural reference location that is sampled in the same way for comparative purposes. At each artificial and natural location, samples were collected from the following depth strata: Stratum 1 (Intertidal [0 to 1 m]), Stratum 2 (Shallow [1 to 2 m]), Stratum 3 (Intermediate [2 to 4 m]), and Stratum 4 (Deep [4 to 6 m]). These locations are depicted in **Figure 1**.

A brief summary of the sampling is provided for each individual study location designated as follows:

- Singer Island Artificial Reef;
- Singer Island Natural Reference location;
- Ocean Ridge Artificial Reef; and
- Ocean Ridge Natural Reference location.

Singer Island Artificial Reef – The survey team first visited this location on 24 August and found sea conditions too rough to sample in the shallow water. During that visit the offshore row of boulders (nominally considered Stratum 4) was completely buried by sand. The team returned one week later following the passage of Tropical Storm Isaac, which dropped considerable amounts of rain in the region and temporarily increased the wave heights in the coastal zone. Although the visibility was poor due to massive discharges of storm-related rainwater through Lake Worth Inlet, sampling was possible. The passing of the storm also caused exposure of the previously buried Stratum 4 boulders. The hard bottom field team sampled 40 quadrats (10 from each Stratum), collected 22 algae samples (2 from Stratum 1 and 10 each from Strata 2 and 3, but none from Stratum 4 because the rock substrate was scoured clean from being buried), and 8 wormrock samples (3 from Stratum 2 and 5 from Stratum 3 [**Table 1**]). Stratum 1 was partially covered by sand and only a few boulders were visible. Microhabitat characteristics were recorded for newly settled fish on Strata 2 and 3. Fishes were in the area; a large school of striped mullet passed over the reef moving southward and blacktip sharks were observed just outside of Stratum 4. Large schools of adult gray snapper were prevalent on the reef structures—these individuals are not usually present in such high abundances at this location and may have been driven inshore during the recent storm. Other species observed were silver porgy, tomtate, black margate, molly miller, blue runner, and inshore lizardfish. Representative photographs of the reef are shown in **Photos 1 to 3**.

Singer Island Natural Reference – The Singer Island Natural Reference strata offshore of Palm Beach were sampled on 26 September (**Figure 1**). Forty quadrats were sampled and 40 algae samples were collected (10 from each of the four stratum; **Table 1**). Five wormrock colonies were present at Stratum 1. Microhabitat characteristics were recorded for five newly settled fish on Strata 3 and 4. Fishes observed on the sampling strata included chain moray, porkfish, sergeant major, glassy sweeper, sailors choice, sand drum, and spadefish. Representative photographs from this location are provided (**Photos 4 to 5**).

Ocean Ridge Artificial Reef – Ocean Ridge Artificial Reef was sampled on 28 September. Visibility was poor due to discharges from the South Lake Worth Inlet, but sampling was possible. As reported during the previous two surveys here, the row of boulders representing Stratum 4 was completely buried by sand. The hard bottom field team sampled the remaining three strata. Thirty quadrats were sampled and 30 algae samples were collected (10 from each remaining three strata). Ten wormrock samples were collected (5 each from Strata 2 and 3). Newly settled fish and microhabitat characteristics were collected along Stratum 2. Fishes that were abundant included porkfish, sergeant major, bluespotted cornetfish, ocean surgeon, bluehead wrasse, silver porgy, and Bermuda chub. Representative photographs of the artificial reef are shown in **Photos 6 to 8**.

Ocean Ridge Natural Reference – This site was sampled on 23 August, visibility and sea conditions were good. Three of the strata were just south of the Singer Island Natural Reference location previously discussed. The intertidal stratum, however, is located farther south, near Phipps Park. All four strata were sampled on 23 August. A total of 40 quadrats were sampled (10 from each stratum). Forty algae samples (10 from each stratum) and 2 wormrock samples (from the intertidal stratum) were collected (**Table 1**). Newly settled fishes and microhabitat characteristics were collected along Strata 2 and 4. The shallow stratum consisted of a raised rock platform with a covering of sand and algae. Fishes observed included porkfish, Gulf flounder, reef croaker, chain moray, French grunt, smallmouth grunt, mahogany snapper, and lane snapper. Representative photographs are shown in **Photos 9 to 12**.

This survey was greatly affected by the continuous discharge of excess rainwater since the passing of Tropical Storm Isaac. Discharges from Lake Worth and South Lake Worth Inlets resulted in generally poor visibility with a few exceptional westward incursions of the Gulf Stream since the last week of August. Nevertheless, all of the reef-based sampling that was possible (i.e., where strata were not buried) was completed. Turtle censusing, which requires ideal visibility and sea conditions, could not be completed despite recent attempts and will be re-scheduled for a later time.

Best regards,



David B. Snyder, CSA International, Inc.
Senior Staff Scientist

Attachment

Ms. Kimberly Colstad
Coastal Technology Corporation

26 October 2012
A-1

ATTACHMENT

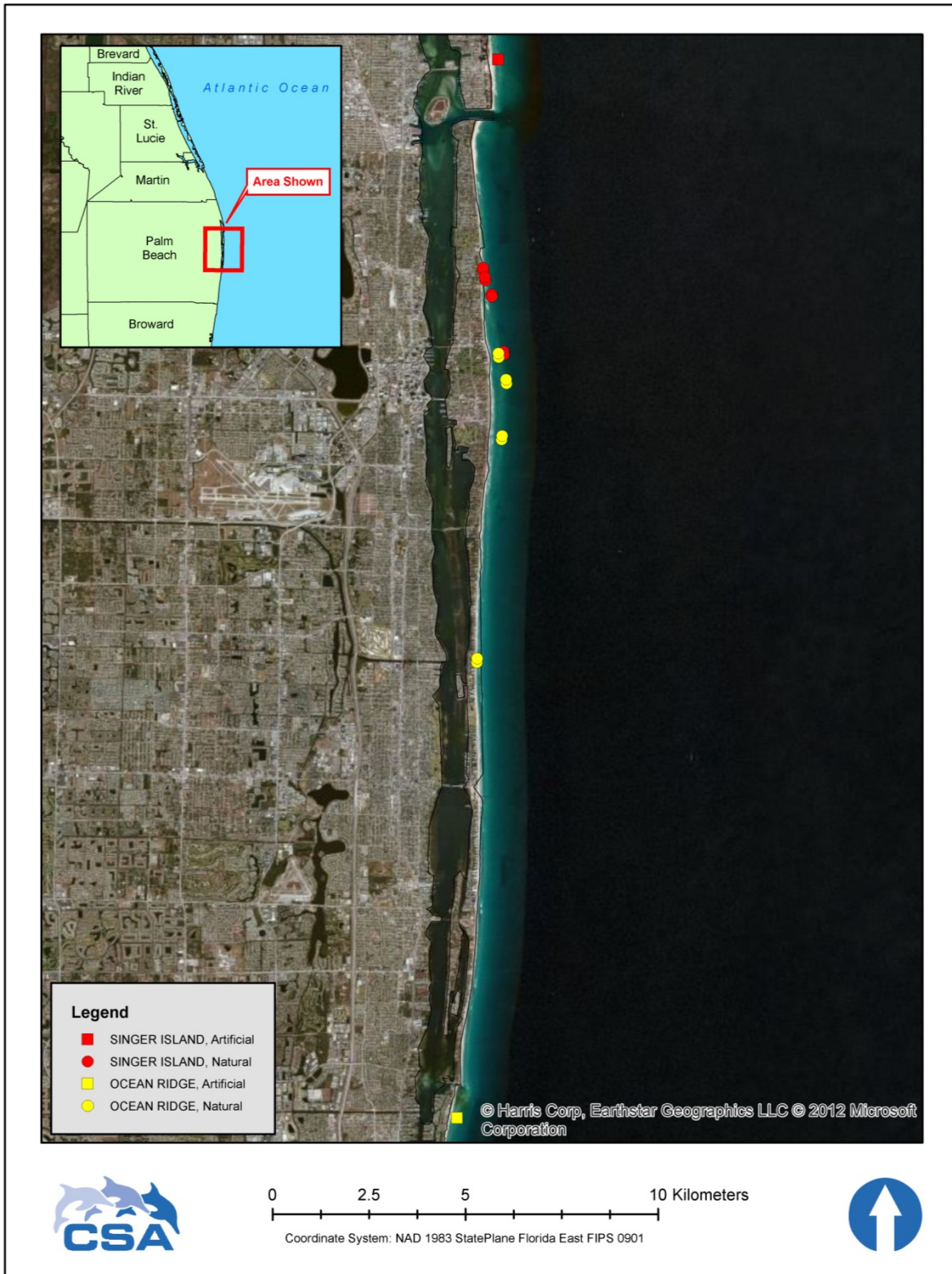


Figure 1. Overview of Singer Island and Ocean Ridge Artificial and Natural Reference locations.

Table 1. Quadrats sampled and samples collected during the summer 2012 field survey at Singer Island and Ocean Ridge Artificial and Natural Reference locations.

Stratum	Biota	Number of Quadrats Sampled or Samples Collected				Total
		Singer Island		Ocean Ridge		
		Artificial	Natural	Artificial	Natural	
1	Algae	2	10	10	10	32
	Fishes	0	0	0	0	0
	Wormrock	0	5	0	2	7
	Quadrats	10	10	10	10	40
2	Algae	10	10	10	10	40
	Fishes	1	0	3	2	6
	Wormrock	3	0	5	0	8
	Quadrats	10	10	10	10	40
3	Algae	10	10	10	10	40
	Fishes	5	0	0	0	5
	Wormrock	5	0	5	0	10
	Quadrats	10	10	10	10	40
4	Algae	*	10	*	10	20
	Fishes	0	0	*	3	3
	Wormrock	0	0	*	0	0
	Quadrats	10	10	*	10	30

* Stratum not available for sampling due to burial.



Photo 1. Stratum 2 at Singer Island Artificial Reef.

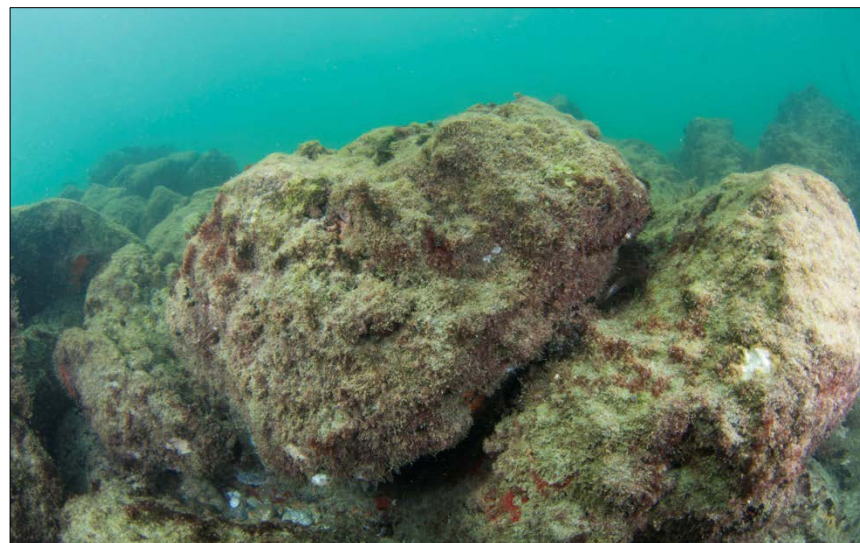


Photo 2. Stratum 3 at Singer Island Artificial Reef.

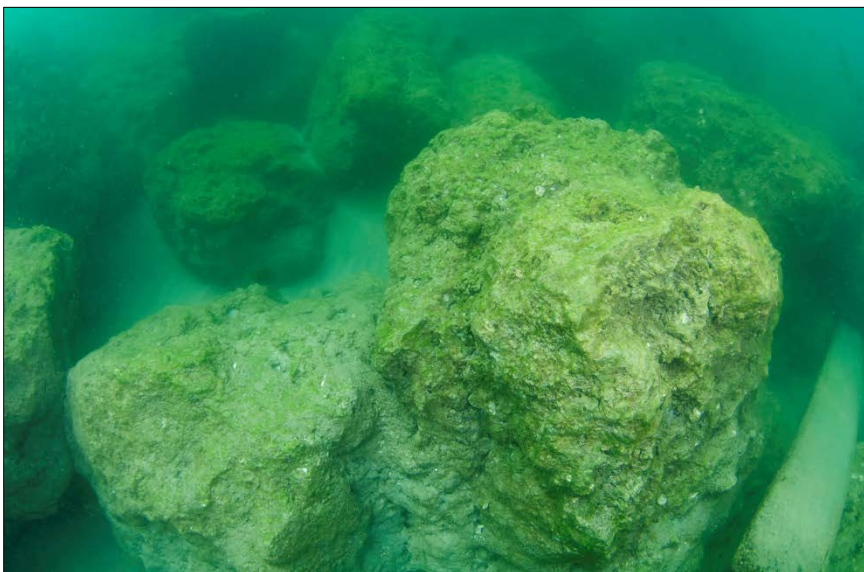


Photo 3. Stratum 4 at Singer Island Artificial Reef scoured because of recent burial by sand.



Photo 4. Stratum 2 at Singer Island Natural Reference location.



Photo 5. Stratum 3 at Singer Island Natural Reference location.

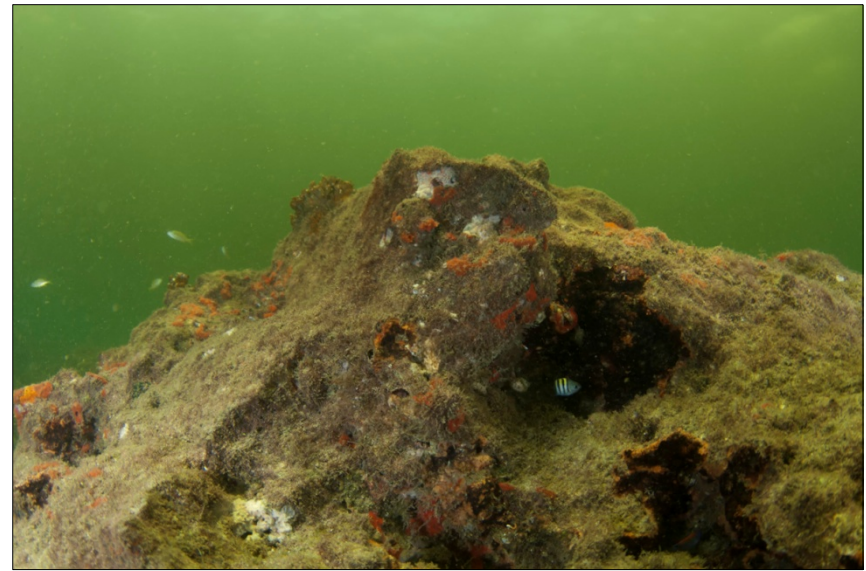


Photo 6. Stratum 2 at Ocean Ridge Artificial Reef.

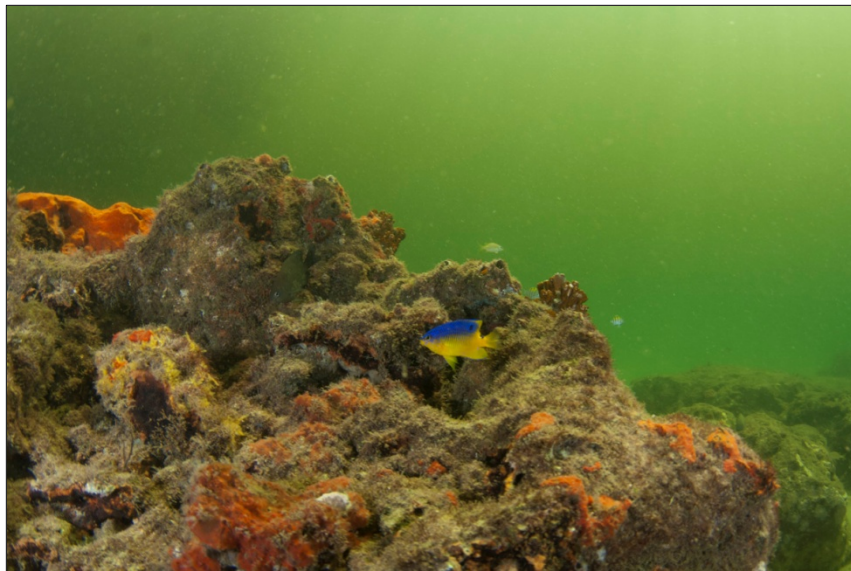


Photo 7. Stratum 3 at Ocean Ridge Artificial Reef.



Photo 8. Collecting wormrock at Ocean Ridge Artificial Reef.



Photo 9. Stratum 1 at Ocean Ridge Natural Reference location.



Photo 10. Stratum 2 at Ocean Ridge Natural Reference location.



Photo 11. Stratum 3 at Ocean Ridge Natural Reference location.



Photo 12. Stratum 4 at Ocean Ridge Natural Reference location.