CS.12-67

NASSAU COUNTY - SAISSA
Task Order Memorandum
Contract CM1852-05

To:	Olsen Associates, Inc. 2618 Herschel St. Jacksonville, FL 32204	**Date:** **Contract:** **Request Made By:** **Request Received By:** **Task Order No:**	23 October 2012 Coastal Engineering Bill Moore, SAISSA Rep. Erik J. Olsen, P.E. 2013-05

Task Order: Year-2 Biological Monitoring of Beach Macrofauna and Borrow Site Benthic Recovery 2011 Renourishment: South Amelia Island Shore Stabilization Project

Consultant, through the use of a qualified environmental subconsultant, shall complete the permit-required 2012/2013 biological monitoring of the recovery of beach macrofauna species and borrow site benthic species associated with the 2011 renourishment of the South Amelia Island Shore Stabilization Project. This monitoring program began in 2010, prior to construction. Exhibit A of Task Order 2012-02 contains a copy of the approved Monitoring Plan.

Work under this Task Order will include the November 2012 data collection along the beach as well as the spring sampling at both the beach and the borrow site and the second report of results comparing the pre-construction to Year 1 and 2 post-construction results. Deliverables shall include a detailed Year-2 monitoring report. Ten (10) hardcopies of the report shall be delivered to SAISSA along with an electronic *.PDF copy on CD-ROM disc. Consultant shall make all required submittals for this work to the appropriate regulatory agencies. All work shall be performed on a Lump Sum basis.

Fee: $ 58,000.00 (Lump Sum)

Requested Completion Date: December 31, 2013.

Olsen Associates, Inc.

Erik J. Olsen, P.E.

Date:
23 October 2012

SAISSA

Mr. Bob Martin
SAISSA President

Date: 11-16-12

Nassau County,
Board of County Commissioners

Daniel B. Leeper
Its: Chair

Date: 11-19-12

Attest To Chair
Signature

John A. Crawford
Its: Ex-Officio Clerk

MES 11.20.12

Approved As To Form and Legal Sufficiency:

David A. Hallman

NASSAU COUNTY - SAISSA
Task Order Memorandum
Contract CM1852

To:	Olsen Associates, Inc. 2618 Herschel St. Jacksonville, FL 32204	**Date:** **Contract:** **Request Made By:** **Request Received By:** **Task Order No:**	02 April 2012 Coastal Engineering Bill Moore, SAISSA Rep. Albert E. Browder, Ph.D., P.E. 2012-02

Task Order: Year-1 Biological Monitoring of Beach Macrofauna and Borrow Site Benthic Recovery 2011 Renourishment: South Amelia Island Shore Stabilization Project

Consultant, through the use of a qualified environmental subconsultant, shall complete the permit-required 2012 biological monitoring of the recovery of beach macrofauna species and borrow site benthic species associated with the 2011 renourishment of the South Amelia Island Shore Stabilization Project. This monitoring program, required by the National Marine Fisheries Services as part of the USACE permit, began in 2010, prior to construction. Exhibit A contains a copy of the approved Monitoring Plan.

Work under this Task Order will include the Spring 2012 data collection along the beach and at the borrow site, the first report of results comparing the pre-construction to 1-Yr post-construction results, and the Fall 2012 data collection efforts. Deliverables shall include a detailed 1-Yr monitoring report. Ten (10) hardcopies of the report shall be delivered to SAISSA along with an electronic *.PDF copy on CD-ROM disc. Consultant shall make all required submittals for this work to the appropriate regulatory agencies. All work shall be performed on a Lump Sum basis.

Fee: $ 56,000.00 (Lump Sum)

Requested Completion Date: November 2012 (completion of the Fall 2012 sampling).

Olsen Associates, Inc.

Albert E. Browder, Ph.D., P.E., V.P.

Date:
02 April 2012

SAISSA

Mrs. Mary Brannen
SAISSA President

Date:
4-3-12

Nassau County,
Board of County Commissioners

STACY T. JOHNSON
Its: Chair

Date: 4-18-12

ATTEST TO CHAIR SIGNATURE:

JOHN A. CRAWFORD
Its: Ex-Officio Clerk

Approved as to form and legal sufficiency:

DAVID A. HALLMAN

EXHIBIT A

USACE Permit Application #SAJ-2001-3870
FDEP JCP File # 0187721-010-JC

South Amelia Island Shore Stabilization Project
Beach Renourishment
Nassau County, FL

Monitoring Plan for Borrow Site Benthic Communities & Beach Fill Site Macrofauna

Prepared for:

South Amelia Island Shore Stabilization Association (SAISSA)
&
Florida Park Service

Prepared By:

Olsen Associates, Inc.
2618 Herschel St.
Jacksonville, FL 32204
904-387-6114

In conjunction with
Coastal Eco-Group Inc.
810 SE 8th Ave Suite C
Deerfield Beach, FL 33441

Rev. 11 November 2010

This document describes the monitoring plan for the assessment of offshore softbottom benthic communities in and around the borrow site for the proposed South Amelia Island Shore Stabilization Project in Nassau County, FL. The document likewise includes a monitoring plan for the evaluation of potential project-related impacts to key beach-habitat macrofauna along the project fill shoreline. This monitoring plan is provided in response to project review comments received from the National Marine Fisheries Service – Habitat Conservation Division, dated 14 May 2010 and provided to the U.S. Army Corps of Engineers for permit application SAJ-2001-3870 (SP-PRJ).

1.0 PROPOSED ACTIVITY

The purpose of the present maintenance work for the South Amelia Island Shore Stabilization Project is to perform the routine renourishment of the Atlantic Ocean shoreline from R-59.5 southward to R-78, Nassau County, FL. The present project proposes the placement of up to approximately 2.0 million cubic yards (1,529,000 m^3) of beach-quality sand along

17,900 ft (5.5 km) of the project shoreline from R-59.5 southward to R-78, approximately 900 ft north of the existing rock terminal groin (**Figure 1**).

Work is proposed for Spring/Summer 2011 and is anticipated to require four to five months to complete. Due to the nature of the meteorological climate of the area, work is proposed to commence on 1 May 2011 (approx.). It is noted that both of the previous beach nourishment projects at this site (1994, 2002) were constructed during this time of year, as was the recently constructed Nassau County, FL, Shore Protection Project in Fernandina Beach, FL, north of the site. The project was last renourished in 2002, after which two rock structures were constructed fronting the Atlantic Ocean along the project length.

Sand for the project would be excavated from a 141-acre (57.1-hectare) borrow site located directly offshore of the project limits along the margin of the Nassau Sound ebb shoal. Ambient seabed elevations at the borrow site range from between -16.1 ft to -27.1 ft (-4.9 m to -8.3 m) NAVD88. The expected excavation depth ranges from between -29.2 to -35.2 ft (-8.9 m to -10.7m) NAVD88. The proposed borrow site contains approximately 2.23 million cubic yards (1.705 million m^3) of sand above the design excavation depth.

2.0 AFFECTED AREAS

Figure 1 depicts the Amelia Island shoreline, the project area and the extended affected areas around Nassau Sound. The affected area includes the Amelia Island shoreline and nearshore area from the Lewis Street access near FDEP monument R-57 southward into the beach fill placement area beginning at R-59.5 just south of Burney Park. The fill placement limits extend for 17,900 ft along the southern Amelia Island shoreline southward into the Amelia Island State Park property, terminating at R-78. AISP is managed by the DEP-Division of Recreation and Parks (DRP).

The affected area also extends into the ebb shoal at Nassau Sound. The proposed project borrow site lies roughly due east of the rock breakwater along the NE margin of the ebb shoal. The previous utilized 2002 borrow site lies immediately to the southeast of the proposed site.

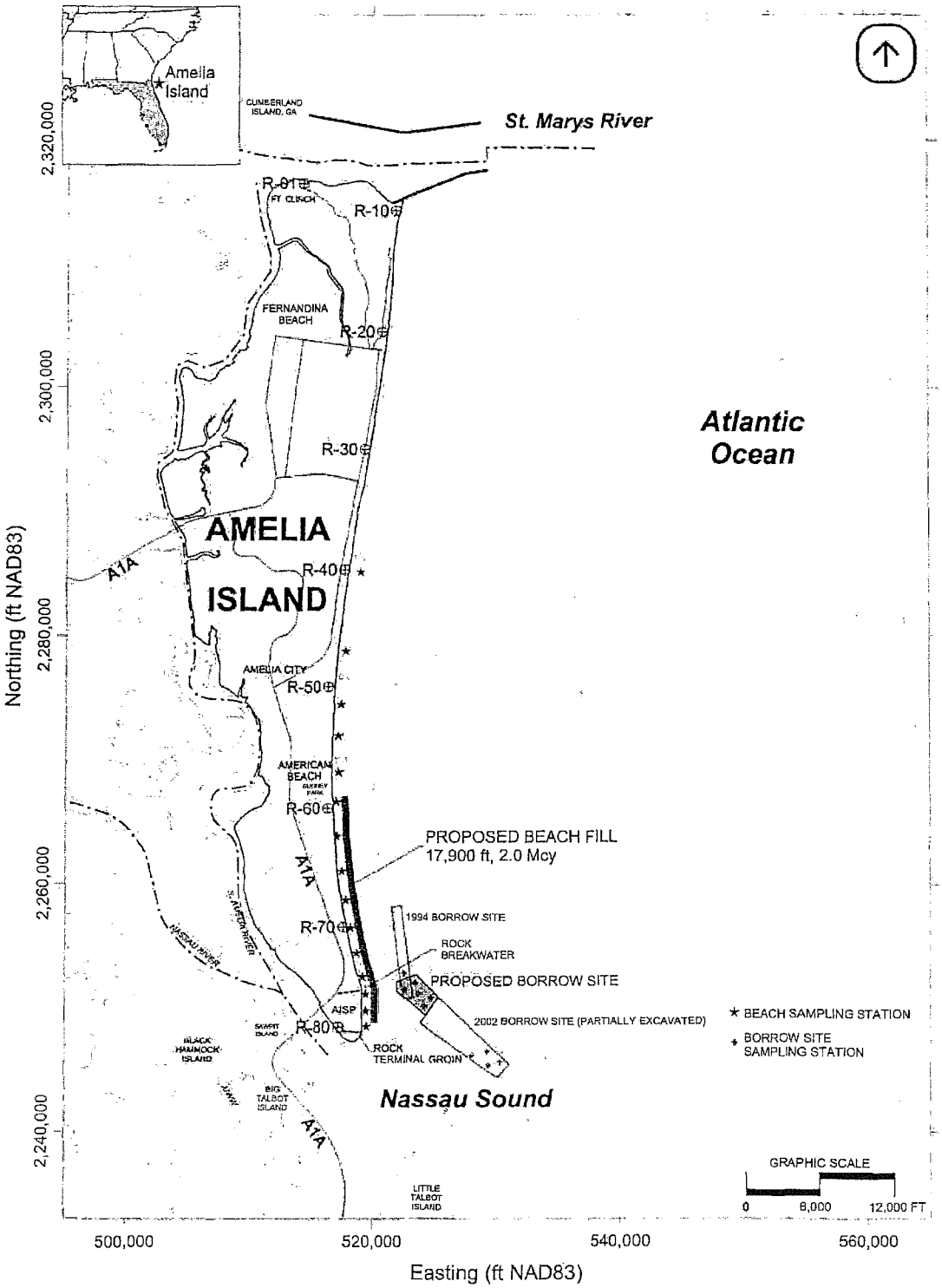

Figure 1. Location Map: South Amelia Island Shore Stabilization Project. Approximate locations of beach and offshore borrow site sampling stations are shown.

3.0 BORROW SITE BENTHIC ASSEMBLAGE SAMPLING

Ten (10) offshore stations (5 control stations and 5 borrow site impact stations) will be sampled following a Before-After-Control-Impact study design (BACI) to characterize species richness and abundance of the offshore macroinvertebrate/infaunal community and evaluate the effects of dredging on these softbottom communities. **Figure 1** provides the approximate locations of the ten offshore sampling sites. DGPS positioning will be collected at each location at the time of sample collection. Water temperature, salinity, pH, dissolved oxygen and turbidity will be measured at the seabed at each sampling location.

The five (5) impact stations shall be randomly distributed across the proposed borrow site. Four of the control stations shall be randomly distributed across the undredged portion of the 2002 borrow site located immediately adjacent to the excavated portion of the 2002 borrow site. The remaining control site shall be located at the south end of the 1994 borrow site.

3.1 Sampling Schedule

Pre-construction sampling shall occur in the late Spring of 2011 (immediate pre-construction). The post-construction monitoring program shall consist of three annual monitoring events during the late spring/early summer months. Because the proposed project extends into late September 2011, the immediate post-construction sampling event is proposed for late spring/early summer 2012 to provide a similar seasonal comparison to the pre-construction baseline dataset and remove the effects of seasonality on invertebrate populations. Due to the delay in the immediate post-construction survey (7 to 8 month post-construction), two additional years of sampling are proposed.

Pre-construction baseline sampling:

- Late spring/early summer 2011

Immediate post-construction sampling (7 to 8 months post-construction):

- Late spring/early summer 2012

Year 1 sampling event, if needed (19 to 20 months post-construction):

- Late spring/early summer 2013

Year 2 sampling event, if needed (31 to 32 months post-construction):

- Late spring/early summer 2014

If the immediate post-construction (7 to 8 months) or Year 1 post-construction (19 to 20 months) sampling results indicate recovery of benthic communities to pre-construction baseline conditions, a request to discontinue monitoring shall be submitted to the NMFS with submittal of the annual monitoring report. Recovery of benthic communities shall be defined as recovery of abundance and diversity parameters at the impact sites to pre-construction baseline conditions,

and changes in species richness, evenness, and diversity at the borrow site shall not be significantly different from the control sites.

Given its location and orientation, it is expected that the proposed borrow site will experience infilling rates and infilled sediment characteristics similar to those of the 2002 site (OAI, 2008). If the mean grain size does not change significantly within the borrow site following excavation (i.e. borrow site does not infill with fine sediments) and sediment characteristics return to approximately baseline conditions, species biomass, abundance and richness should recover to pre-dredging levels within a period of one to two years post-construction.

3.2 Sampling Protocol

Three replicate grab samples will be collected from each of the ten sampling locations using a 0.05 m^2 weighted Ponar grab. A grab will be classified as successful if a minimum of 80% of the sampler volume is retained. All unsuccessful grabs will be discarded.

Grab samples will be carefully rinsed in a stainless steel sieve bucket with saltwater and screened through a 0.5 mm mesh. The remaining sediment and organisms will placed in labeled, double-Ziploc plastic bags and initially preserved in a 10% buffered formalin solution with Rose Bengal stain. Organisms will be allowed to harden for 48 hours and were then transferred to 70% ethanol.

During the sorting process, organisms and remaining sediment will be placed in sorting trays and submersed in diluted, de-ionized water to minimize any volatile alcohol vapor. Benthic samples will be sorted, identified to species level of the lowest taxonomic level possible, and enumerated. Sampling, sorting, and identification of the grab samples will be performed by a trained marine biology laboratory (preliminarily identified to be the Marine Sciences Department at Jacksonville University).

Concurrent with the benthic infauna sampling, sediment samples will be collected for analysis of grain size distribution, shell content (visual estimate), carbonate content, and percent silts/fines. Each station will have two replicate samples collected using a 3.5cm x 10 cm core subsample from the Ponar grab sample. The sediment samples will be placed in labeled double-Ziploc plastic bags following visual inspection.

3.3 Data Analyses

Sediment samples will be analyzed using standard ASTM procedures for grain size distribution and percent fines. Sediment data will be presented as grain size distribution curves, tabularized shell visual estimate and silt/clay percentage for each sample site.

Benthic data from the borrow site and adjacent control sites will be statistically compared to evaluate changes in faunal abundance and species richness among sites. Offshore borrow site and control data will be analyzed to detect the impact of dredging activities on sediment characteristics and infaunal communities using ANOVA and paired t-tests.

Multivariate analyses will be performed using the PRIMER software package (Clarke and Warwick, 2001; Clarke and Gorley, 2006). Bray-Curtis similarity coefficients will be determined from the species site matrix after log(X+1) transformation and multi-dimensional scaling (MDS) plots are constructed to represent similarities of infaunal communities over time (Clark and Warwick, 2001). Analysis of similarity (ANOSIM) will be performed to examine the significant differences between benthic communities at each offshore control and borrow site station between sampling events. Similarity percentages (SIMPER) will be performed to identify species that primarily account for Bray-Curtis similarities observed between samples (Clarke and Gorley, 2006).

Since the health of an ecosystem is indicated by the diversity of its component organisms, various measures of diversity have been used for environmental assessments. The simplest method to determine the diversity of an ecosystem is richness or the total number of species/taxa. A popular diversity measure has been the Shannon Diversity Index (H'), which accounts for both abundance and evenness of the species present in a sample, although it is frequently criticized as being an inadequate measure of biodiversity (Peterson and Bishop, 2005). This may be due to the Index being strongly reliant on sampling effort; however, Shannon's Diversity Index can be compared when similar sampling regimes are utilized and assemblages include over 100 species (Lambshead et al., 1983). Simpson's Index (1-lambda) measures both the evenness and richness of the community. Pielou's Index (J') also measures diversity with an emphasis on evenness.

These diversity indices will be calculated for each area (borrow site versus control) and interpreted as a whole for trends in community diversity. Diversity indices will be performed on non-transformed data.

4.0 BEACH FILL SITE MACROFAUNA SAMPLING

Patchy distribution and abundance of infauna are a result of spatial, temporal, and physical factors (James and Fairweather, 1996; McLachlan, 1983). Key physical factors that define structure are wave energy, tidal range, and sand particle size (McLachlan, 1996). Important considerations when evaluating potential impacts to the benthic community include the ability of the community to recolonize the area after a disturbance; restoration of some measure of community parameters (*e.g.*, species richness and diversity); and the functional property of the community to higher trophic levels (*i.e.*, resident and migratory fish and shorebirds). However, the spatial and temporal variability (i.e. patchiness) of benthic macroinvertebrate/infaunal populations presents substantial challenges for accurate impact assessment derived from benthic infaunal sampling programs. Cost-effective sampling programs are often inadequate in their sampling design due to high natural variability (Underwood, 1992).

The Florida Fish and Wildlife Conservation Commission recently completed a study of beach nourishment impacts in Florida using three key beach-habitat indicator species: mole crab (*Emerita talpoida*), ghost crab (*Ocypode quadrata*) and coquina clams (*Donax* spp.) (Irlandi and Arnold, 2008). All three species are considered indicator species for beach habitat in Florida's Comprehensive Wildlife Conservation Strategy. Coquina clams (*Donax* spp.) and mole crabs (*Emerita talpoida*) are a significant portion of the prey base for ecologically and economically important coastal birds and fish (Peterson et al., 2000); therefore, evaluation of recovery of these species will provide data to infer potential impacts to higher surf zone trophic levels.

A monitoring program based upon these three beach-habitat indicator species is proposed to evaluate the potential project-related effects on beach macrofaunal populations at Amelia Island. A sampling protocol which focuses on these three indicator species rather than infaunal core analyses will provide a more robust dataset by allowing for two sampling events during each year (late spring and late fall to capture peak recruitment periods) and a higher density of sampling locations (both impact and control) in comparison to infaunal core sampling. Although the field time is greater with the proposed indicator sampling protocol, laboratory analysis time and associated costs for core processing and taxonomic identification are significantly reduced. A sediment sampling program will be implemented in conjunction with the macrofaunal monitoring program to evaluate sediment compatibility with the existing beach and predict recovery of infaunal populations at the beach fill site.

4.1 Sampling Locations/Protocol

Using a BACI (Before-After-Control-Impact) approach, ten (10) locations will be sampled within the beach project fill area and five (5) control locations will be sampled to the north of the proposed beach fill area (**Figure 1**). A higher density of impact locations will be

sampled at the south end of the project area within Amelia Island State Park in important shorebird foraging habitat. It is noted that much of the Amelia Island shoreline has been nourished through time, including the 2008 Nassau County Shore Protection Project, which extended from the south jetty at the St. Marys Entrance southward beyond Sadler Rd. to R-34.5.

At each sampling location, a 100 m tape will be stretched along the dune line. Five randomly-located, shore-perpendicular transects, 4-m in width, will be established along this 100-m stretch of beach. Each transect will extend from the primary dune crest at the landward end to the lower intertidal zone at the seaward end. Starting at the dune crest, the numbers of active ghost crab burrows, identified by tracks around the opening of the burrows, will be counted within each 5-m (20 m^2) section of the transect. Sampling will be performed as close to low tide as possible.

Within each 100-m sampling location, five transects will be randomly selected to quantify *Emerita talpoida* and *Donax* spp. Based on the results of the east coast sampling from the FWC study (Irlandi and Arnold, 2008), which indicated very few *Emerita* and/or *Donax* from the lower swash zone, only the upper and mid swash zones will be sampled at each of the five locations within each 100-m wide station. Samples will be collected using a wire basket with a 1 mm mesh (ca. 23 cm x 13 cm x 20 cm) attached to a ca. 1.5 m long handle. This will sample a constant volume of sediment (Irlandi and Arnold, 2008). Samples will be placed in plastic bags and transferred to container with 10% buffered formalin and rose Bengal. In the laboratory, fauna will be sorted by rinsing samples through a 1 mm mesh sieve. All sorted organisms will be stored in 70% alcohol for enumeration and measurements. Shell length and carapace length for *Donax* and *Emerita* will be measured. If sample size is excessively large (greater than 30 individuals), subsamples will be processed for size measurements.

Beach sediment samples will be obtained annually to correlate beach recovery rate with the placed material. Sediment cores (5 cm x 10 cm depth) will be collected from the middle of the upper beach, mid lower beach and mid swash zone along one transect at each of the 15 100-m wide beach sampling locations (fill impact and control). Sample locations at each station correspond approximately to the +3.0 ft, 0.0 ft, and -3.0 ft contours referenced to NAVD88. Sediment samples will be placed in labeled double-Ziploc plastic bags after visual inspection. Sediment samples will be analyzed for sediment grain size distribution, shell content (visual estimate), carbonate content, and percent silts/fines.

4.2 Sampling Schedule:

Pre-construction sampling shall occur in:

- Late November/early December 2010 and
- Late April/early May 2011.

Immediate post-construction sampling shall occur in

- Late November/early December 2011 (2-3 months post-construction).

Year 1 Post-Construction sampling shall occur in:

- Late April/early May 2012 (7-8 months post-construction) and
- Late November/early December 2012 (14-15 months post-construction).

If the Year 1 post-construction results indicate recovery of the three beach-habitat indicator species, all or portions of the monitoring protocol may be discontinued in consultation with the NMFS. If recovery of only one or two species occurs at the 14-15 month (Year 1) Post-Construction survey, a Year 2 sampling program will be implemented based upon the species which did not recover to the baseline condition in Year 1. If recovery does not occur within two years, additional monitoring may be required at less frequent intervals to document long-term recovery rates. This long-term monitoring protocol will be coordinated in consultation with the NMFS.

4.3 Data Analyses

Data analyses will mirror those procedures and data products described in Section 3.3 following the BACI study design.

5.0 REFERENCES

Clarke, K.R. and Gorley, R.N., 2006. PRIMER-E® (v6): User Manual/Tutorial. PRIMER-E Ltd, Plymouth, UK.

Clarke, K.R. and Warwick, R.M., 2001. Change in marine communities: An approach to statistical analysis and interpretation, 2nd edition. PRIMER-E Ltd, Plymouth, UK.

Irlandi, E. and B. Arnold. 2008. Assessment of nourishment impacts to beach indicator species. Florida Fish and Wildlife Conservation Commission Grant Agreement No. 05042.

James, R.J. and P.G. Fairweather. 1996. Spatial Variation of Intertidal Macrofauna on a Sandy Ocean Beach in Australia. *Estuarine, Coastal, and Shelf Science* 43: 81-107.

Lambshead, P.J.D., Platt, H.M., and K.M. Shaw. 1983. The detection of differences among assemblages of marine benthic species based on as assessment of dominance and diversity. *Journal of Natural History* 17: 859-874.

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Olsen Associates, Inc. (OAI) 2007, "South Amelia Island 2007 Sand Search," Technical Report prepared for the FL Park Service – FDEP and the South Amelia Island Shore Stabilization Association, Olsen Associates, Inc., Jacksonville, FL.

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Peterson, C.H. and Bishop, M.J., 2005. Assessing the environmental impacts of beach nourishment. *BioScience* 55: 887-896.

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Underwood, A. J. 1992. Beyond BACI: The detection of environmental impacts on populations in the real, but variable, world. Journal of Experimental Marine Biology and Ecology 161:145–178.