# CHANGE AND RECOVERY OF PHYSICAL AND BIOLOGICAL CHARACTERISTICS AT BEACH AND BORROW AREAS IMPACTED BY THE 2005 FOLLY BEACH RENOURISHMENT PROJECT


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# EXECUTIVE SUMMARY

The response and recovery of subtidal sediment borrow areas and beach ecosystems to nourishment activities remain poorly understood. Folly Beach, SC, was nourished between April and October 2005 using sediment from a nearshore subtidal borrow area. The South Carolina Department of Natural Resources monitored both the borrow area and the beach to determine the impacts associated with these activities and to determine whether these systems showed evidence of recovering over a one year period following the impacts.

Benthic sediment samples were collected from the dredged borrow area and a nearby non-dredged reference area prior to dredging and at multiple time points following dredging in order to compare temporal changes in sediment characteristics and benthic infaunal community composition. Sediments within the borrow area became increasingly fine (more silt/clay, larger sand phi size, less calcium carbonate) following dredging and showed little evidence of recovery one year after completion of dredging. The biological community also changed following dredging and continued to diverge from the reference area over the next year, likely in response to changing sediment characteristics. The refilling of the borrow area with fine (muddy) material is probably due to dredging to 3 meters below grade and the proximity of the borrow area to Charleston Harbor, a source of terrigenous sediments. The current accumulation of muddy sediments could prevent this area from being used in future nourishment projects. We recommend that, whenever possible, borrow areas in South Carolina be dredged to less than 3 meters below grade and located at the southern ends of barrier islands where beach-compatible sands tend to accumulate.

Shore-perpendicular transects in nourished areas and non-nourished reference areas of Folly Beach were monitored prior to dredging and during multiple time points following dredging to evaluate temporal changes in sediment characteristics and densities of burrowing macro-invertebrates, specifically the ghost crab *Ocypode quadrata* and the ghost shrimp *Callichirus major*. Subaerial beach width increased substantially following nourishment but decreased to less than half of the post-nourishment width within one year. Sediment characteristics did not change following nourishment. Burrowing macro-invertebrates showed little evidence of nourishment impact. The only exceptions were a tendency of 1) densities of ghost crabs within the dunes to decrease along a gradient of increasing beach width and 2) ghost shrimp to increase following nourishment. Differences in ghost crab densities between nourished and reference areas prior to nourishment, perhaps as a result of differences in development and pedestrian traffic, may have interfered with the ability to detect impacts from nourishment activities. We recommend that careful matching of beach sands and well-replicated and designed monitoring studies continue as part of future nourishment projects to ensure nourishment activities have minimal impact on South Carolina's beach ecosystems.

## BACKGROUND

Nourishment currently represents the most widely used strategy for countering beach erosion in the eastern United States. In most cases, beach nourishment involves dredging sediments from a nearshore subtidal source, such as a sandflat, and placing that sediment onto the shoreface, in essence replacing the sand that had eroded. As a result, this process has the potential to directly impact the physical characteristics and biological communities of two distinct systems: the beach/dune complex where the sand is placed and subtidal sandflats where the sand is dredged (borrow area). Despite the widespread use of nourishment to combat erosion, the level of impact to these systems and the time needed for the systems to recover from the disturbance remain uncertain.

Past studies have shown that beach ecosystems respond quite variably to nourishment (Nelson 1993; NRC 1995; Valverde et al. 1999; Nordstrom 2005; Spreybroek et al. 2006). In most cases, efforts are made to match borrow site sediment characteristics with the beach upon which they are to be deposited. However, some studies have shown significantly elevated levels of fine-grained sediments and shell material on the beach following nourishment (Peterson et al. 2000, 2006) or the apparent transport of fine material in the beach fill offshore (Rakocinski et al. 1996). In South Carolina, the sediment match historically has been good, with post-nourishment sediment characteristics matching pre-nourishment characteristics within six months (Van Dolah et al. 1994; Jutte et al. 1999a). Poor sediment match affects both the functioning of a beach ecosystem as well as its recreational value.

The biological responses to beach nourishment vary widely amongst different taxa and nourishment projects. Infaunal invertebrates, the base of the consumer food web in the intertidal zone, decline immediately following nourishment, but they typically recover within six months (Van Dolah et al. 1994; Rakocinski et al. 1996; Jutte et al. 1999a). In some cases where the sediment match is very poor, several particularly important infaunal prey taxa (such as *Donax* spp. and *Emerita* spp.) decline sharply and remain suppressed for several weeks (Peterson et al. 2006). Burrowing beach macroinvertebrates such as ghost crabs and ghost shrimp (in South Carolina, *Ocypode quadrata* and *Callichirus major*, respectively) fill important roles in processing and aerating sediments, scavenging beach detritus and serving as prey for shorebirds. Numerous studies indicate these invertebrates are severely impacted by nourishment (Peterson et al. 2000; Bilodeau and Bourgeois 2004; Dixon 2007), but the time required for these species to recover remains unknown. Nourishment activities do not seem to affect longer-term responses by fish, but the turbidity plume created by beach filling activities can induce behavioral changes in some species (Wilber et al. 2003). Birds may respond negatively to nourishment activities if sediment characteristics and prey abundances are dramatically altered (Peterson et al. 2006). Sea turtles may benefit from nourishment through the creation of new nesting habitat, but poor sediment matches and/or severely altered beach profile (particularly the formation of vertical scarps) can reduce sea turtle nesting success (Grain et al. 1995).

Much less is known about the changes in subtidal physical characteristics and biological communities following dredging at the borrow site. Sediment characteristics often change dramatically in the pit left by the dredging operation. In some cases, dredging uncovers shell material or carbonate rubble, and, in most cases, silts and clays settle into the pit (Van Dolah et al. 1992; Van Dolah et al. 1994; Jutte et al. 2001a).

While some borrow pits refill quickly with beach-compatible material, others refill with silt and clay that is then covered by sand or do not refill at all (Van Dolah et al. 1998). The latter two situations prevent future use of those areas as sources of beach fill and tend to be associated with borrow pits deeper than 3m below grade and/or those located in close proximity to sources of terriginous fine material such as tidal inlets and rivers. Not surprisingly, dredging reduces benthic invertebrate density and diversity in the short term (Van Dolah et al. 1994; Jutte et al. 1999b). Longer-term recovery rates vary significantly, with longer recovery times associated with borrow pits that were dredged further below grade and those that accumulated substantial amounts of silt and clay (Jutte et al. 2002).

Sediment composition (sand, mud and shell) represents one of the most important characteristics for determining the composition and density of benthic invertebrate communities (McLachlan 1996; Defeo and McLachlan 2005). In both systems (beach and subtidal borrow), invertebrates form the base of the consumer food web, serving as prey for larger invertebrates and vertebrates. As a result, we focused monitoring efforts on these potentially important indicators of ecosystem response and recovery. Specifically, the purposes of this study were: 1) to determine the impact on and recovery of sediment characteristics and invertebrate communities following dredging in the borrow area, and 2) to determine the impact on and recovery of sediment characteristics and burrowing invertebrates following placement of fill on the shoreface of Folly Beach, SC. The project described here utilized a Before-After Control-Impact (BACI) design in order to document the changes in the impact areas (borrow area and nourished beach) relative to un-impacted control (reference) areas. Both impact and reference areas were sampled multiple times following impact in order to assess the longer-term recovery (one year) of these resources.

## MATERIALS AND METHODS

### *Study Site and Study Design*

#### *General*

Folly Island, a barrier island within Charleston County, South Carolina, includes approximately 8.4 km of Atlantic shoreface (Fig 1). The island supports a population of about 2,000 residents and a healthy tourist industry largely dependent upon beach access. Due to erosion, the Atlantic shoreface of Folly Island was nourished in 1991 using material dredged from the Folly River. Ongoing erosion, combined with an active hurricane season in 2004, resulted in another renourishment effort in 2005. The 2005 renourishment project included the placement of approximately two million cubic yards of fill on approximately 8.0 km of Folly Beach extending from the former U.S Coast Guard base on the northeast end through the Charleston County Park on the southwest end (Fig. 1).

#### *Borrow Area*

The borrow area was located approximately 5.3 km offshore (Figure 1). SCDNR performed an early reconnaissance and located a reference area similar to the borrow area based upon gross sediment characteristics. Arc-GIS was used to randomly select ten sampling stations in the borrow area and the reference area prior to dredging (Appendix 1). Previous studies have indicated that ten samples per sampling area and date are sufficient to characterize the dominant benthic taxa (e.g., Van Dolah et al. 1994; Jutte et al. 1999a). Because dredging occurred within only a portion of the borrow area, those stations falling outside of the actual dredged pit were relocated to random locations within the dredged pit for all post-dredging time frames. The stations at the borrow and reference areas were sampled immediately prior to dredging (Pre), immediately following dredging (Post), six months after (6-mo Post) and one year after (12-mo Post) corresponding to April 10, 2005, November 4, 2005, May 5, 2006, and November 1, 2006, respectively.

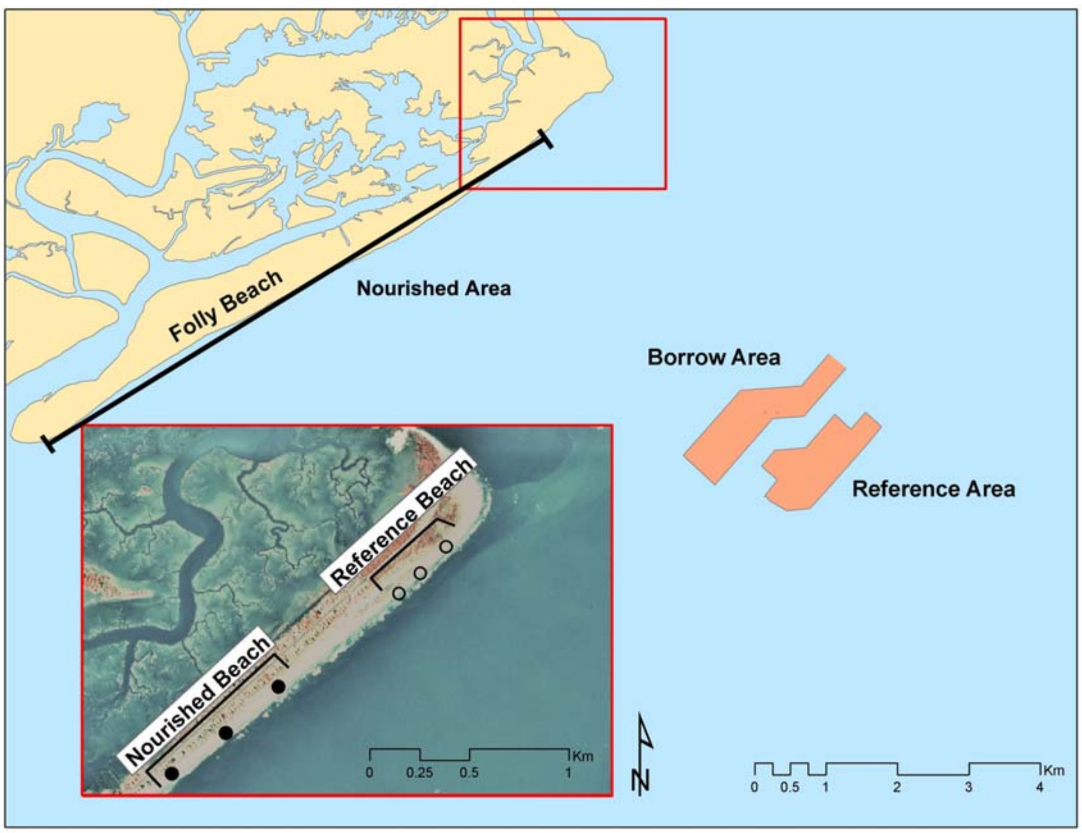


*Figure 1. Map of Folly Beach, SC showing locations of borrow area and reference area and the location of the monitored beach (red box). Inset shows locations of study sites on monitored beach. Closed circles -- study sites in nourished area, Open circles – study sites in reference area.*

*Beach*

Although most of the length of the beach was nourished, monitoring efforts were focused on the northeast portion of the island (Figure 1 inset) since this portion of the island also had a substantial stretch of beach that was not nourished. The non-nourished area was used as the reference site and compared to a portion of the nearby nourished area to minimize the effect of alongshore environmental variation that might confound the comparison of nourished and not nourished areas. Three sampling sites were identified in each of the impact and reference areas. These sites were sampled one time immediately prior to dredging (Pre) and four times following dredging, immediately after (Post), three months after (3-mo Post), six months after (6-mo Post) and one year after (12-mo Post), corresponding to April 5, 2005, June 8, 2005, September 15, 2005, January 3, 2006 and May 24, 2006, respectively.

## Field and Laboratory Methods

*Borrow Area*

Randomly-selected station positions were located using a global positioning system (GPS). A 0.043 $m^2$ Young grab was deployed from a boat and a single sample collected at each of the ten sites within the borrow area and the reference area. Any sample in which the grab did not penetrate evenly to at least 8.0 cm depth (80% of the total depth of the grab) was discarded and re-collected. Each sample was sub-sampled for analysis of sediment characteristics (percent sand, silt, clay, $CaCO_3$, organic matter content, and sand grain size distribution) using a 3.5 cm diameter plastic tube inserted through the top of each grab to the bottom of the sample. The remainder of the grab sample, representing approximately 0.04 $m^2$ of the bottom surface area, was washed through a 0.5 mm-mesh sieve. Organisms and sediment retained on the sieve were preserved in a buffered solution of 10% formalin/seawater with rose bengal stain.

Sediment composition subsamples were analyzed for percentages (by weight) of sand, silt, clay, and calcium carbonate ($CaCO_3$) using procedures described by Folk (1980) and Pequegnat et al. (1981). Sand fractions were dry-sieved using a Ro-tap mechanical shaker, and grain size was determined by using fourteen 0.5 phi-interval screens, where phi = $-\log_2$ (grain diameter in mm) according to the Udden-Wentworth Phi classification (Brown and McLachlan 1990). Measurements of total organic matter (TOM) were obtained by weighing a dried portion of the subsample, ashing it at 550° C in a muffle furnace for two hours, and re-weighing it as described by Plumb (1981).

Benthic organisms were sorted from retained material under a magnifying lens, identified to the lowest possible taxonomic level, and enumerated by experienced taxonomists. A voucher collection was created for the project and maintained by the Environmental Research Section at MRRI.

*Beach*

At each of the six sampling sites, five randomly located, shore-perpendicular 4.0 m wide transects were established along a 100m stretch of beach (Figure 2). Each transect extended 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 (*Ocypode quadrata*) burrows, identified by tracks around the opening of the burrow (Wolcott 1978), and callianassid shrimp (*Callichirus major*) burrows were counted within each 5.0 m (20 $m^2$), section of the transects. This stratification was meant to allow the investigation of changes in ghost crab and shrimp populations along the beach profile. Sampling started approximately 2 hours prior to low tide and continued until slack low tide. Along each transect a composite set of three 3.5 cm diameter push cores was collected for sediment composition and grain size analysis. These three cores were collected in each of the three most seaward 5.0 m sections of each transect where most beach fauna would be found. All sediment samples were treated as described above for borrow study site sediments. The locations of the dune crest and wrack line were noted along each transect in order to allow the transect sections, or distances down the beach profile, to be roughly inter-calibrated amongst transects and stations (Figure 2).

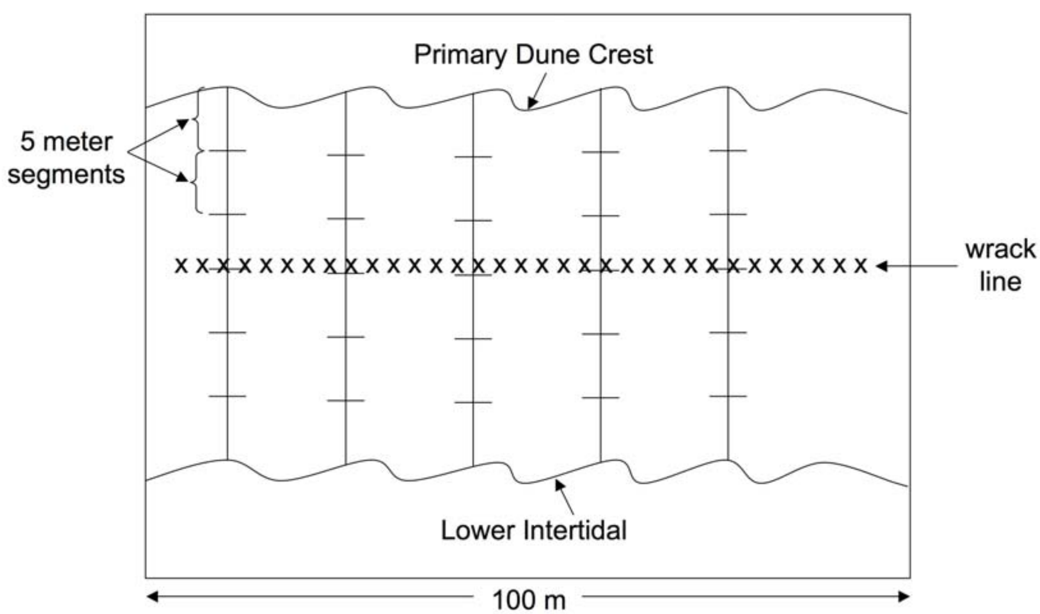


*Figure 2. Layout of transects at each beach site extending from the dune crest to the lower intertidal zone. Transects were randomly located along a 100m stretch of beach within each site.*

## Data Management and Analysis

*Database Development*

A project database was constructed using Microsoft Access. The database included project data such as beach and borrow area locations, time of sampling, type of sampling site (impact and reference), sediment composition data, borrow site infaunal data and beach burrowing macrofauna data. This was constructed to act as a template for all future monitoring projects so that individual databases can be integrated into a comprehensive state-wide beach nourishment database.

*Statistical Analyses*

Borrow and reference area data were first analyzed to detect the impact of dredging activities on sediment characteristics and infaunal communities. For this analysis, pre-dredge and immediate post dredge time frames from the borrow and reference areas were compared using a two-way ANOVA with Time Frame (Pre and Post) and Area (borrow and reference) as factors, with the interaction term in this model (Area X Time Frame) indicating whether a significant change had occurred at the borrow area relative to the reference area. To examine the change in and recovery of sediment characteristics and infaunal communities following dredging, two analyses were performed. First a two-way ANOVA with Time Frame (Post, 6-mo Post, and 12-mo Post) and Area (borrow and reference) as factors was used to examine whether the two areas overall changed similarly through time. Second, to examine the recovery of the borrow area, the following a-priori contrasts of the differences between borrow and reference responses were performed using t-tests:

| | Pre | Post |
|---|---|---|
| 6-mo Post | A | C |
| 12-mo Post | B | D |

Significant differences in contrasts A and/or B indicate that the difference between the borrow and reference areas at a time point had not returned to its pre-dredge condition, hence recovery had not occurred. Significant differences in C and/or D indicate that the differences had changed since the impact occurred. In more complex situations, for example, where all contrasts were significant, more in-depth examination can show whether the difference was intermediate to Pre and Post conditions (recovering but not fully recovered) or had changed to a more extreme condition (response was degrading in absence of continued impact). Multivariate ordination of borrow and reference area communities was performed using canonical correspondence analysis (CCA) in PC-Ord (MjM Software Design) to examine successional vectors in community response and recovery. The analyses were performed on individual station communities (80 total: 2 areas X 4 time frames X 10 stations) and on area-time communities (8 total: 2 areas X 4 time frames). The species matrix consisted of all species that represented at least 0.5% of all individuals collected in the study (27 total species), and the environmental matrix consisted of the sediment characteristics (sand phi size, silt/clay content, calcium carbonate content and total organic matter) and an indicator variable for sampling season (spring or fall). Both matrices were log-transformed to improve normality. Bray-Curtis similarities (S) were calculated for each pair of area-time communities using Primer 6 software (Primer-E Ltd, 2007).

The calculation of beach macrofauna densities was approached in several ways. First, the number of individuals per square meter (areal density) reflects the response of these fauna to overall available beach habitat (are the fauna filling the available habitat to pre-nourishment densities?), and number per linear meter (linear density) reflects the impact of nourishment on the total number of crabs and shrimp using any given unit of beach length (has the overall number of individuals increased or decreased in response to nourishment activities?) Because portions of the beach represent unlikely habitat for one or both of the target taxa, the same densities above were calculated for specific habitats. For ghost crabs, dune densities were calculated based on burrow counts within 10 m of the dune crest, and tide line densities were calculated based on burrow counts within 5 m of the lower wrack line (approximate high tide limit). If these habitats overlapped on a particular transect, the data from that transect was not included in any analyses. For shrimp, intertidal densities were calculated from the number of burrows seaward of the lower wrack line.

Beach macrofauna densities were analyzed with a nested repeated measures ANOVA with Area (Nourished or Reference) and Time Frame as factors. In this analysis, transects were nested within sites (5 transects per study site), and sites were nested within areas (three sites per area). Due to a change in the beach nourishment schedule, one of the nourished sites ("Nourished A") could not be sampled during the immediate Post time frame. This resulted in an unbalanced statistical design that required analysis of the beach data in a piecemeal manner. Because the primary question was whether the physical and biological characteristics of the nourished and reference areas were more or less different during the post-nourishment time frames (Post, 3-mo, 6-mo, and 12-mo Post) than they were in the Pre nourishment time frame, four nested repeated measures ANOVA's were performed. A significant Area X Time Frame interaction term would indicate whether the two areas were behaving differently relative to each other during post nourishment time frames than during the pre nourishment time frame.

## RESULTS

### *Borrow Area*

#### *Sediment Characteristics*

Of the four primary sediment characteristics examined (silt and clay content, calcium carbonate content, sand phi size, and total organic matter), silt and clay content and calcium carbonate content showed a significant change at the borrow area relative to the reference area (Table 1). Silt and clay content was not significantly different between borrow and reference areas during the Pre time frame, but was significantly higher at the borrow area than the pre-dredging values and the post-dredging reference area value during the Post time frame (Figure 3A). Post-dredging, silt and clay content of the borrow area sediments was 3.4X higher than the borrow area pre-dredging, while silt clay content of the reference area decreased slightly. Calcium carbonate content was not significantly different between borrow and reference areas during the Pre time frame, but was significantly lower at the borrow area than the pre-dredging values and the post-dredging reference area value during the Post time frame (Figure 3B). Calcium carbonate content of the borrow area post-dredging was one-sixth of that at the borrow area pre-dredging, while calcium carbonate content of the reference area decreased only slightly. Phi size increased (sands became finer) during the Post time frame at borrow and

*Table 1. Results of two-way ANOVAs testing for the differential response of sediment characteristics at borrow and reference areas during Pre and Post time frames. Significant interaction terms ("Area X Time Frame") indicate that borrow and reference areas responded in a significantly different manner before and after dredging activities.*

| Parameter | Source | df | MS | F | p |
|---|---|---|---|---|---|
| *Silt/Clay* | | | | | |
| | Area | 1 | 0.5707 | 9.98 | 0.003 |
| | Time Frame | 1 | 0.0635 | 1.11 | 0.299 |
| | Area X Time Frame | 1 | 0.4581 | 8.01 | 0.008 |
| | Error | 36 | | | |
| | Total | 39 | | | |
| *Calcium Carbonate* | | | | | |
| | Area | 1 | 0.3186 | 10.17 | 0.003 |
| | Time Frame | 1 | 0.3686 | 10.96 | 0.002 |
| | Area X Time Frame | 1 | 0.2324 | 6.91 | 0.013 |
| | Error | 36 | | | |
| | Total | 39 | | | |
| *Phi Size* | | | | | |
| | Area | 1 | 14.62 | 70.28 | <0.001 |
| | Time Frame | 1 | 3.78 | 18.16 | <0.001 |
| | Area X Time Frame | 1 | 0.54 | 2.58 | 0.117 |
| | Error | 36 | | | |
| | Total | 39 | | | |
| *TOM* | | | | | |
| | Area | 1 | 0.4797 | 3.43 | 0.072 |
| | Time Frame | 1 | 0.0501 | 0.36 | 0.553 |
| | Area X Time Frame | 1 | 0.0956 | 0.68 | 0.414 |
| | Error | 36 | | | |
| | Total | 39 | | | |

reference areas, but the increase in phi size at the borrow area was significant and over twice the increase observed at the reference area (Figure 3C). Total organic matter (TOM) remained constant between Pre and Post time frames at the reference area, but increased three-fold (although not significantly) at the borrow area (Figure 3D).

The differences between borrow and reference area sediment characteristics (borrow characteristic sample *i* at time t – mean reference characteristic at time t) varied through time (Pre, Post, 6-mo Post, 12-mo Post) during the 15.5 months of the study.

This difference in temporal response was significant for silt and clay content ($F_{3,36} = 3.51$, $p = 0.025$), calcium carbonate content ($F_{3,36} = 7.49$, $p = 0.001$), and sand phi size ($F_{3,36} = 9.45$, $p < 0.001$), but not for total organic matter ($F_{3,36} = 0.73$, $p = 0.541$). The difference in silt and clay content between the areas increased post-dredging and remained significantly elevated even 12 months after the cessation of dredging operations (Figure 4A). The difference in calcium carbonate content decreased significantly following dredging, appeared to have recovered to a content intermediate to Pre and Post values at 6-mo Post, but then at 12-mo Post remained at a significantly lower content than Pre values (Figure 4B). The difference in sand phi size increased significantly post-

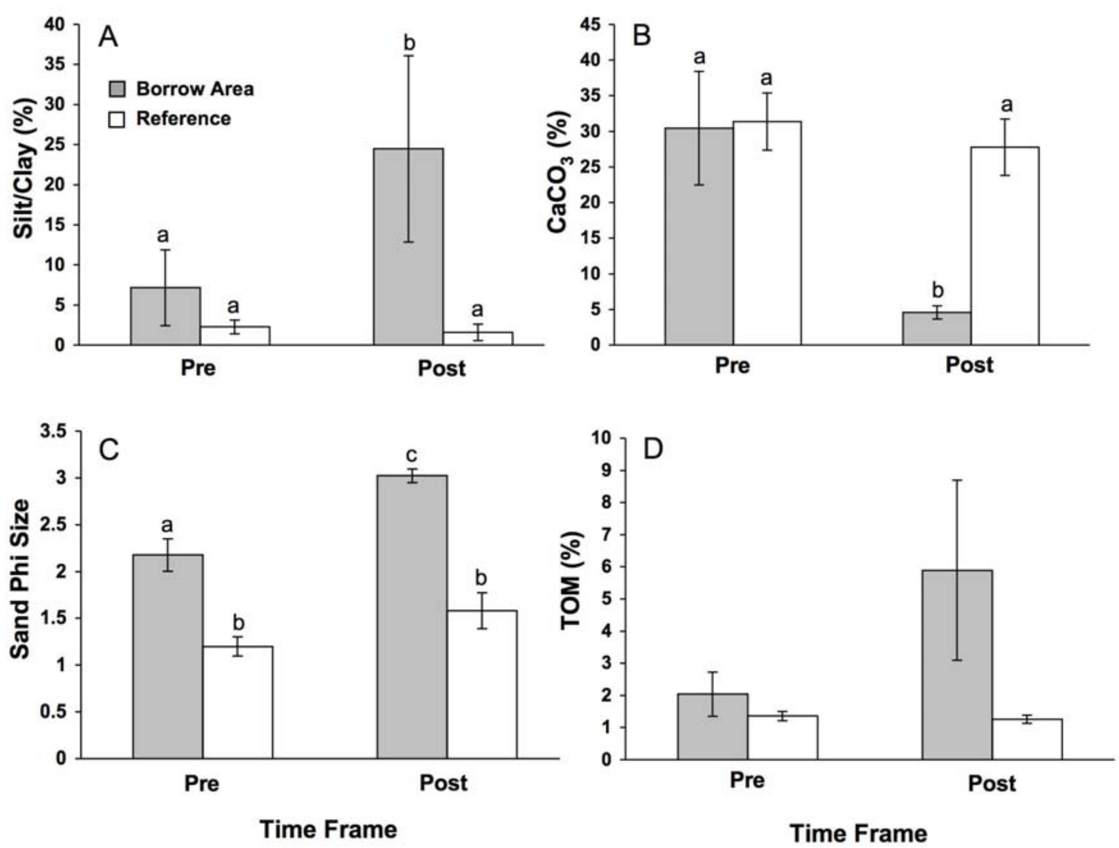


*Figure 3. Mean (+/-SE) sediment characteristics at borrow and reference areas during Pre- and Post-dredging time frames. Different letters indicate significant differences using Tukey's t-tests.*

dredging, continued rising through 6-mo Post and remained significantly elevated 12-months after the completion of dredging (Figure 4C). Total organic matter increased following dredging and remained at least somewhat elevated through 12-mo Post, but the post-dredging values were not significantly different than pre-dredge values (Figure 4D).

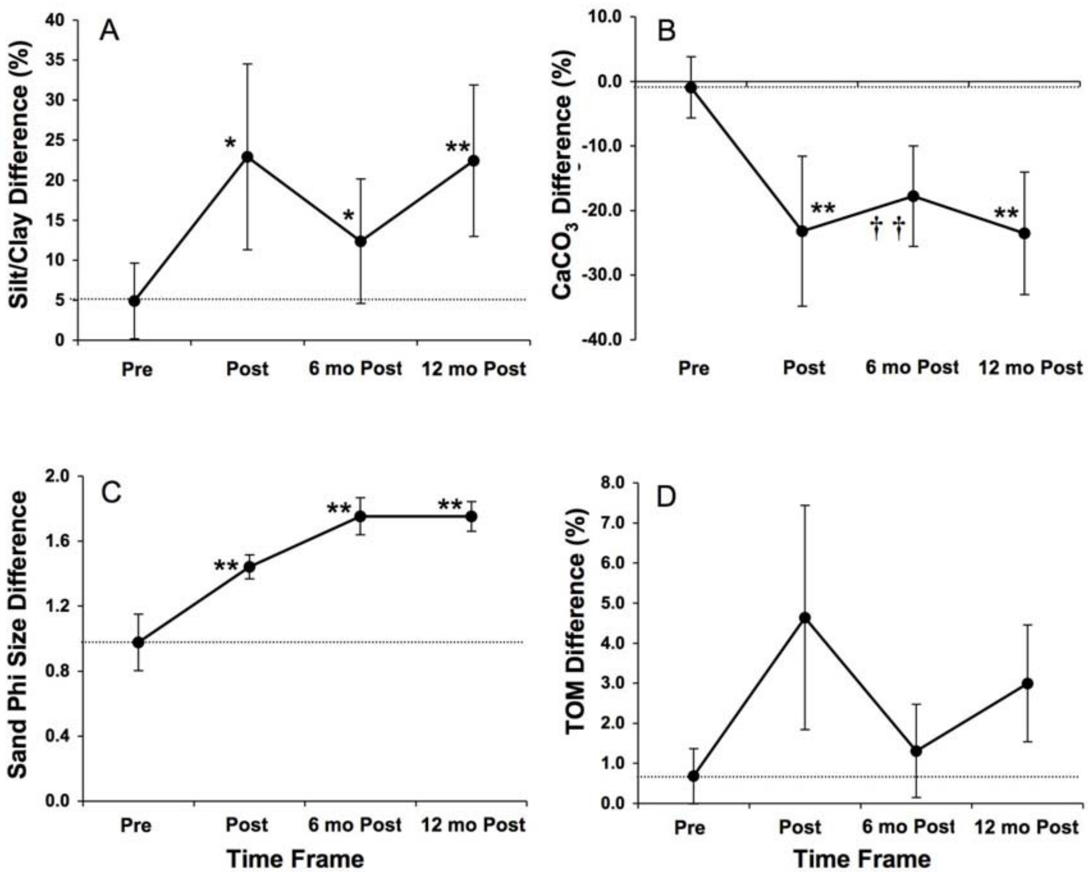


*Figure 4. Mean differences (+/-SE) between reference and borrow area sediment characteristics during Pre-, Post-, 6 mo Post-, and 12 mo Post-dredging time frames. Dotted line indicates difference between two areas before dredging occurred. *--significantly different than Pre time frame with $p < 0.05$, **--significantly different than Pre time frame after correction for multiple comparisons using Tukey's t-test, †--significantly different than Post time frame with $p < 0.05$, ††--significantly different than Post time frame after correction for multiple comparisons using Tukey's t-test.*

*Biological Communities*

Total infaunal density responded significantly at the borrow area relative to the reference area (Table 2), but the changes in species richness, evenness (Jaccard's index) and diversity (Shannon-Wiener diversity index) of the benthic community at the borrow area were not significantly different than at the reference area (Table 2). Between pre-dredging and post-dredging time frames, infaunal density decreased 84% at the borrow area but only decreased 31% at the reference area (Figure 5A). Although not statistically

*Table 2. Results of two-way ANOVAs testing for the differential change of general biological community characteristics at borrow and reference areas during Pre and Post time frames. Significant interaction terms ("Area X Time Frame") indicate that borrow and reference areas changed in a significantly different manner between pre- and post-dredging time frames.*

| Parameter | Source | df | MS | F | p |
|---|---|---|---|---|---|
| *Total Fauna Abundance* | | | | | |
| | Area | 1 | 0.324 | 1.62 | 0.532 |
| | Time Frame | 1 | 2.912 | 14.55 | 0.001 |
| | Area X Time Frame | 1 | 1.049 | 5.24 | 0.028 |
| | Error | 36 | 0.200 | | |
| | Total | 39 | | | |
| *Species Richness (No. of Species)* | | | | | |
| | Area | 1 | 2.058 | 1.69 | 0.202 |
| | Time Frame | 1 | 9.674 | 7.93 | 0.008 |
| | Area X Time Frame | 1 | 4.602 | 3.77 | 0.060 |
| | Error | 36 | 1.219 | | |
| | Total | 39 | | | |
| *Species Evenness (J')* | | | | | |
| | Area | 1 | 0.001 | 0.06 | 0.813 |
| | Time Frame | 1 | 0.044 | 3.34 | 0.076 |
| | Area X Time Frame | 1 | 0.022 | 1.65 | 0.208 |
| | Error | 35 | 0.013 | | |
| | Total | 38 | | | |
| *Species Diversity (H')* | | | | | |
| | Area | 1 | 11.552 | 2.27 | 0.141 |
| | Time Frame | 1 | 9.580 | 1.88 | 0.179 |
| | Area X Time Frame | 1 | 3.554 | 0.70 | 0.409 |
| | Error | 36 | 5.097 | | |
| | Total | 39 | | | |

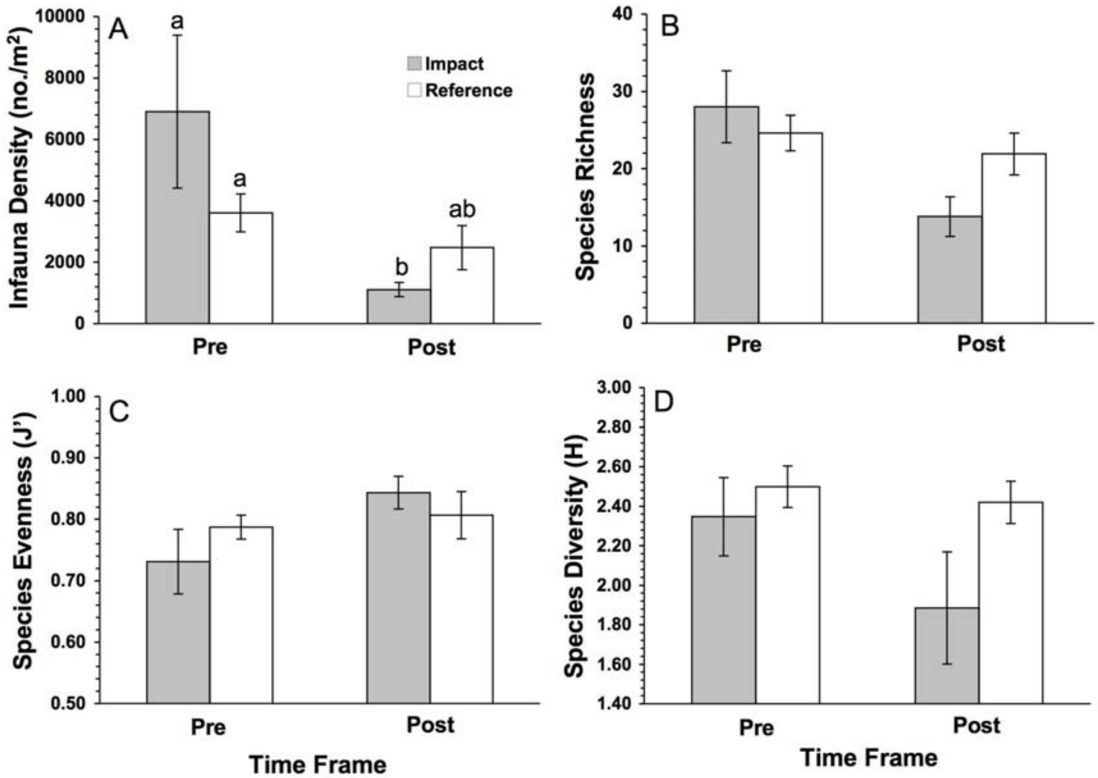


*Figure 5. Mean (+/-SE) benthic community characteristics at borrow and reference areas during Pre- and Post-dredging time frames. Different letters indicate significant differences using Tukey's t-tests.*

significant, species richness declined by approximately 50% at the borrow area, but decreased only slightly at the reference area between the pre- and post-dredging time frames (Figure 5B). Species evenness increased and species diversity decreased at the borrow area following dredging while very little change occurred at the reference area, but these differences were not significant (Figure 5C,D).

In examining recovery of the community, the differences in general community characteristics between the borrow and reference area (borrow characteristic sample *i* at time t – mean reference characteristic at time t) varied through time (Pre, Post, 6-mo Post, 12-mo Post) during the 15.5 months of the study. This difference in temporal response was significant for total infaunal abundance ($F_{3,36} = 18.85$, $p < 0.001$), species richness ($F_{3,36} = 6.34$, $p = 0.001$), and species evenness ($F_{3,35} = 8.62$, $p < 0.001$), but not for species diversity ($F_{3,36} = 1.12$, $p = 0.353$). The total infaunal abundance at the borrow area decreased substantially relative to the reference area immediately following dredging, remained relatively low six months later, and decreased even further twelve months post-dredging (Figure 6A). Similarly, species richness at the borrow area

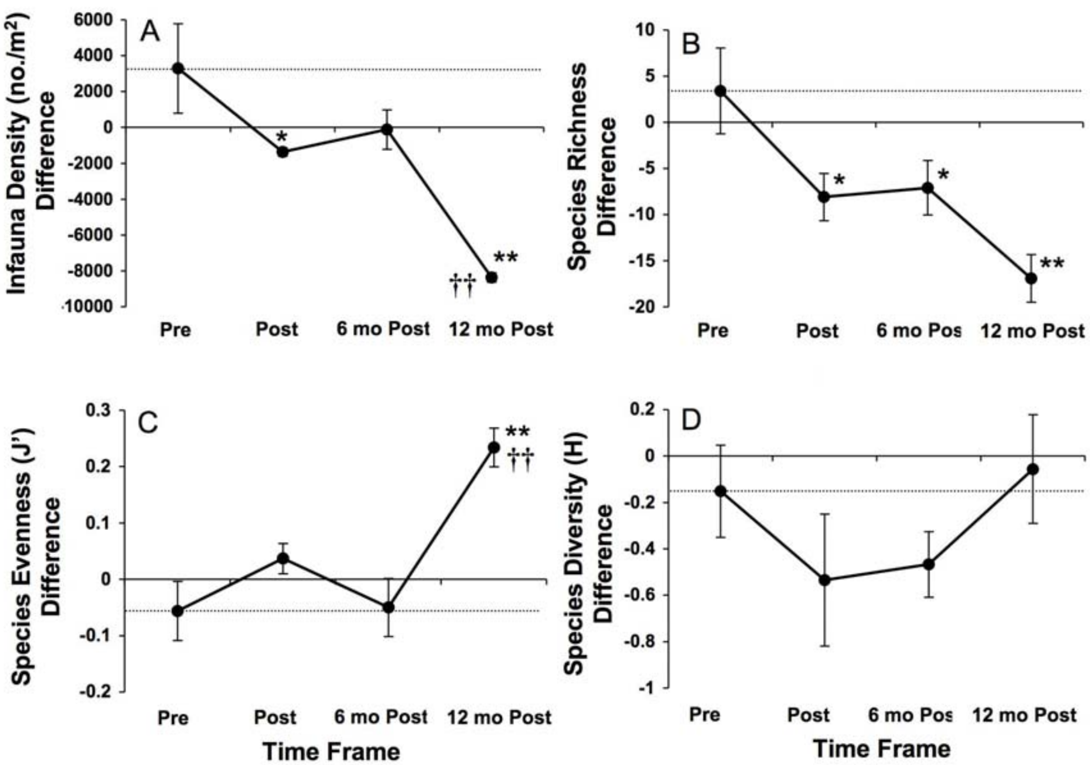


*Figure 6. Mean differences (+/-SE) between reference and borrow area benthic community characteristics during Pre-, Post-, 6 mo Post-, and 12 mo Post-dredging time frames. Dotted line indicates difference between two areas before dredging occurred. *--significantly different than Pre time frame with p < 0.05, **--significantly different than Pre time frame after correction for multiple comparisons using Tukey's t-test, †--significantly different than Post time frame with p < 0.05, ††--significantly different than Post time frame after correction for multiple comparisons using Tukey's t-test.*

declined relative to the reference area immediately following dredging, remained depressed six months later, and decreased even further twelve months post-dredging (Figure 6B). Species evenness remained similar at the borrow and reference areas through the six month post-dredging time frame, but then increased significantly at the borrow area relative to the reference area twelve months post-dredging (Figure 6C). Species diversity declined at the borrow area relative to the reference area post-dredging and then by twelve months post-dredging returned to pre-dredging values, however, none of the changes in species diversity were significant (Figure 6D).

Of the five higher taxa groups examined (amphipods, mollusks, polychaetes, other taxa, and other crustaceans), only the "other taxa" group changed significantly at the borrow area relative to the reference area immediately following dredging (Figure 7). The numbers of individuals within the "other taxa" group (primarily nematodes, ectoprocts, and cumaceans) were not significantly different between borrow and reference areas during the Pre time frame, but were significantly lower at the borrow area post dredging than at either area pre-dredging or at the reference area following dredging (Figure 7D). Post-dredging, the number of "other taxa" at the borrow area decreased 92% from pre-dredging, while the number of "other taxa" at the reference area decreased 33% percent. The number of mollusks decreased 80-90%, a significant decrease, during the Post time frame at both borrow and reference areas (Figure 7B). Substantial decreases in number of amphipods, polychaetes, and other crustaceans were observed at the borrow area during the Post time frame (Figure 7C,D,E). Modest decreases in abundance of polychaetes and other crustaceans were noted at the reference area between

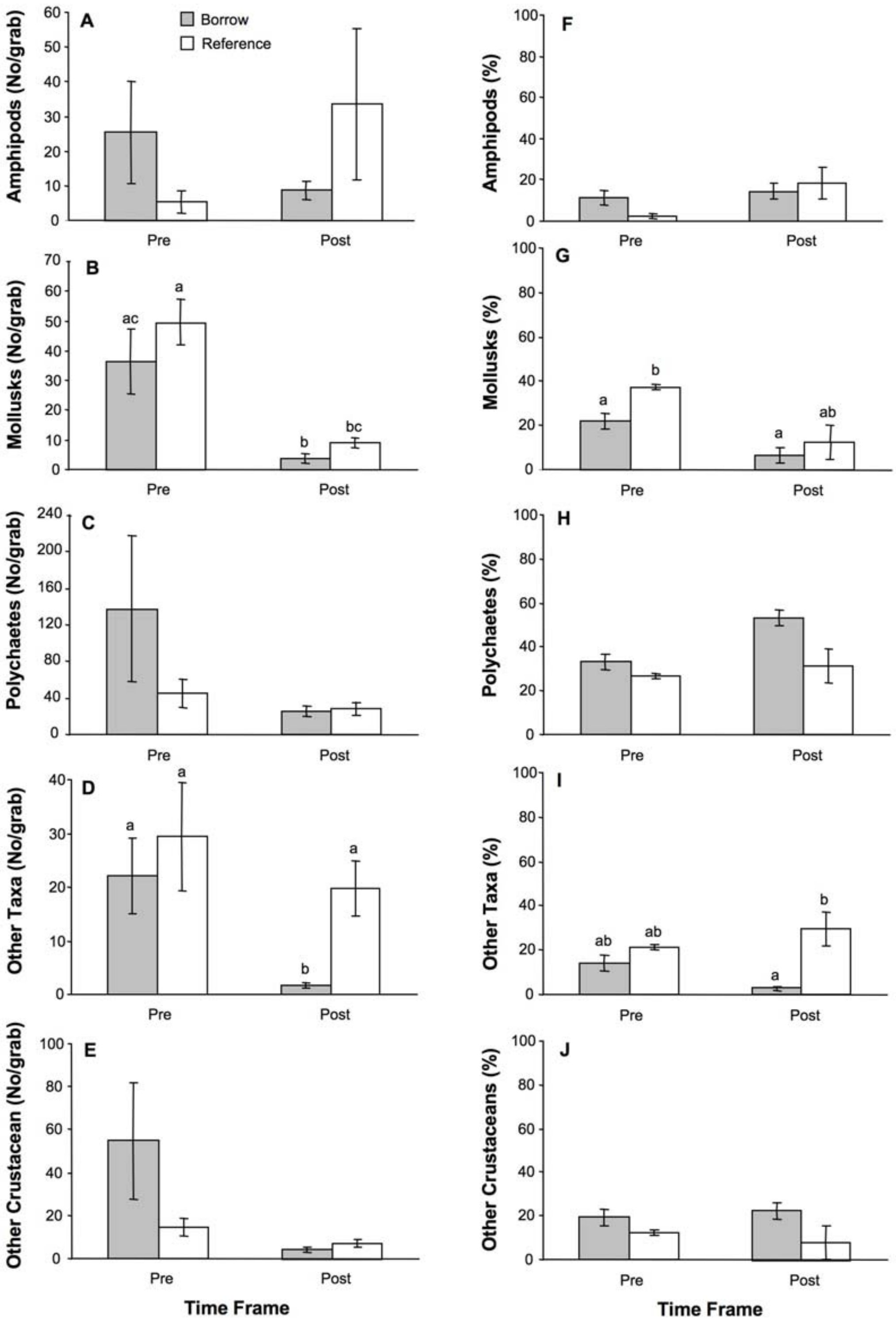


*Figure 7. Mean (+/-SE) number of organisms in higher taxa groups (A-E) and percent of organisms in higher taxa groups (F-J) at borrow and reference areas during Pre- and Post-dredging time frames. Different letters indicate significant differences using Tukey's t-tests.*

the Pre and Post time frames, while the number of amphipods increased six-fold (although not significantly) at the reference area.

The percent abundance of each of the taxonomic groups varied between Pre and Post time frames (Figure 7), however, only the percentage of organisms in the "other taxa" group changed significantly at the borrow area relative to the reference area following dredging (Figure 7I). The percentage of "other taxa" was the same at the two areas during the Pre time frame, but was significantly higher at the reference area than the borrow area during the Post time frame. This change in "other taxa" was driven by a non-significant increase at the reference area and a non significant decrease in the borrow area following dredging. The percentage of mollusks at the reference area during the Pre time frame was significantly higher than those at the borrow area during the Pre and Post time frames (Figure 7G). At the borrow area, polychaetes represented the greatest fraction of the macrofaunal community during both the Pre and Post time frames, and the proportion increased 20% in the borrow area post dredging while comprising a similar percent of reference communities both pre and post (Figure 7H). Coincident with the increase in percent polychaetes in the borrow area, there were substantial decreases in the percentage of mollusks and "other taxa". The community at the reference area was dominated by mollusks during the Pre time frame and by polychaetes in the Post time frame. The percentage of mollusks decreased 25% and other crustaceans decreased 4% at the reference area post dredging, while the percentage of amphipods increased 16% and other taxa increased 9%, although these changes were not statistically significant (Figure 7F-J).

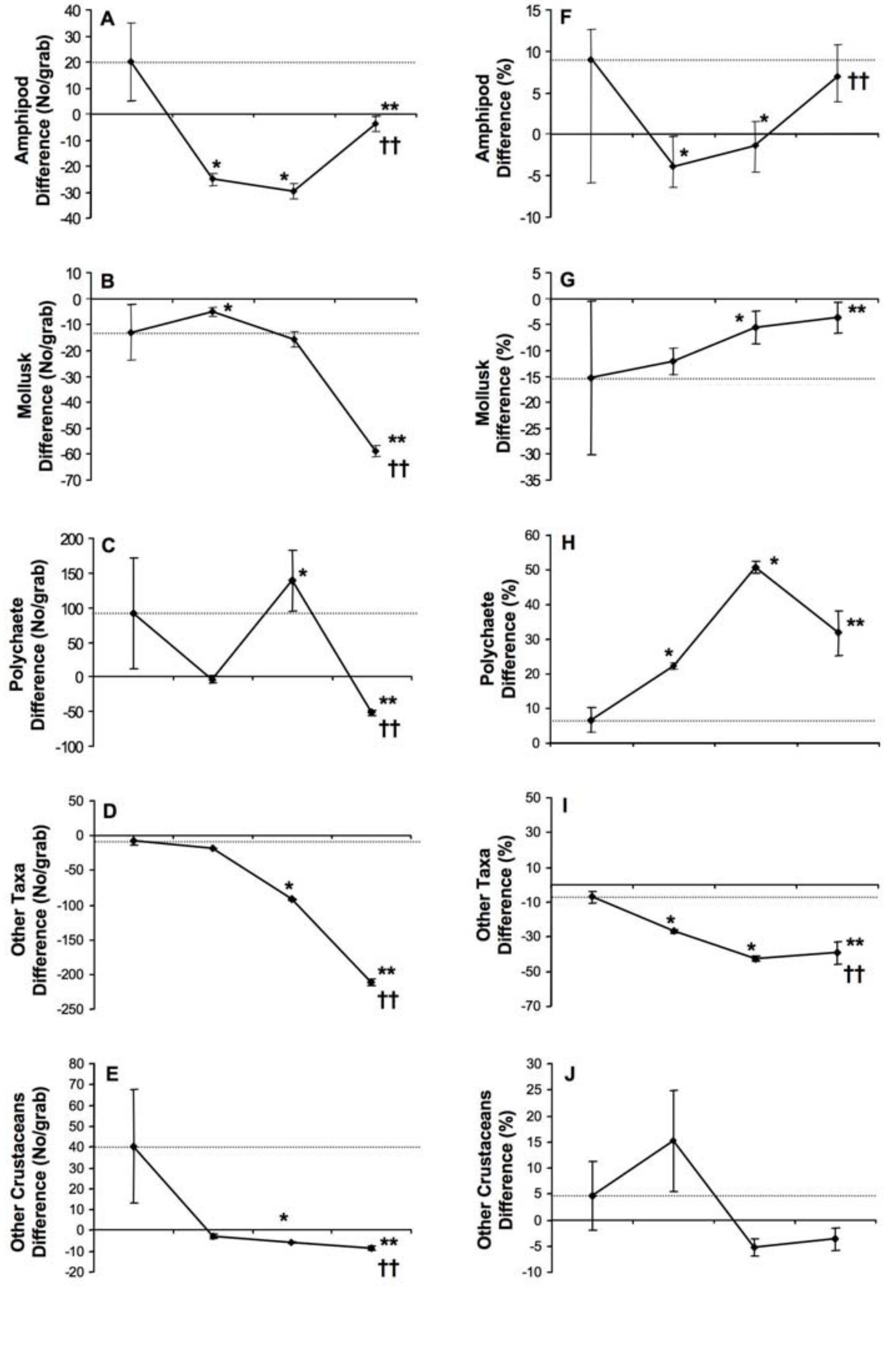


*Figure 8. Mean differences (+/-SE) between reference and borrow area abundances of organisms in higher taxa groups (no/0.04m$^2$ grab; A-E) or percent organisms in higher taxa groups (F-J) during Pre-, Post-, 6 mo Post-, and 12 mo Post-dredging time frames. *--significantly different than Pre time frame with $p < 0.05$, **--significantly different than Pre time frame after correction for multiple comparisons using Tukey's t-test, †--significantly different than Post time frame with $p < 0.05$, ††--significantly different than Post time frame after correction for multiple comparisons using Tukey's t-test.*

The difference between abundance of organisms in the higher taxa groups at the borrow and reference areas varied throughout the four sampling periods of this study. This difference in temporal response was significant for all groups which included amphipods ($F_{3,35} = 33.67$, $p < 0.001$), mollusks ($F_{3,36} = 18.26$, $p < 0.001$), polychaetes ($F_{3,36} = 19.73$, $p < 0.001$), "other taxa" ($F_{3,36} = 33.67$, $p < 0.001$), and other crustaceans ($F_{3,36} = 6.77$, $p = 0.001$). Amphipod abundance at the borrow area decreased significantly relative to the reference area immediately post-dredging, remained low six months later, but then increased significantly during the 12-mo Post time frame (Figure 8A). Mollusk abundance remained similar at borrow and reference areas through the 6-mo Post time frame, but then decreased significantly at the borrow area relative to the reference area twelve months post-dredging (Figure 8B). Polychaete abundance at the borrow area declined relative to the reference area immediately following dredging, increased significantly six months later, then decreased again twelve months post-dredging (Figure 8C). Abundance of other taxa organisms decreased steadily from the Pre time frame to the 12-mo Post time frame, while relative abundance of other crustaceans declined at the borrow area during the Post time frame, remained depressed six months later, and significantly decreased even further by twelve months post-dredging (Figure 8D,E).

The difference in temporal response of the percentages of higher taxa groups between borrow and reference areas was significant for percent amphipods ($F_{3,36} = 3.13$, $p = 0.041$), percent mollusks ($F_{3,36} = 2.79$, $p = 0.051$), percent polychaetes ($F_{3,36} = 7.75$, $p < 0.001$), and percent "other taxa" ($F_{3,36} = 22.32$, $p < 0.001$), but not for other crustaceans ($F_{3,36} = 1.23$, $p = 0.341$). The percentage of amphipods decreased significantly at the borrow area relative to the reference area post-dredging, remained low six months post dredging, and increased significantly relative to post-dredging values twelve months post-dredging (Figure 8F). The percent abundance of mollusks increased at the borrow area relative to the reference area from the Pre to the Post time frame, then continued to increase through the 12-mo Post time frame (Figure 8G). The percent of polychaetes increased significantly at the borrow area relative to the reference area through the 6-mo Post time frame, then decreased significantly during the 12-mo Post time frame but still remained elevated relative to the Pre time frame (Figure 8H). The percentage of organisms in the "other taxa" group showed a steady and significant decline in abundance at the borrow area through six month post-dredging, then increased relative to Post time frame values during the 12-mo Post time frame (Figure 8I). The percentage of other crustacean taxa increased at the borrow area relative to the reference area post-dredging and then decreased six months post-dredging and remained low twelve months post-dredging, however, none of these changes were significant (Figure 8J).

Canonical correspondence analysis (CCA) was used to further examine the infaunal community structure at the borrow and reference areas. The first two axes generated by the CCA of individual station communities explained only 19.4% and 7.2% of the variability in infaunal community structure in the borrow and reference areas (Table 3). The first two axes for averaged area-time communities explained 44.4% and 19.7% of the variability in infaunal community structure at borrow and reference areas (Table 3). The first axis of both analyses was primarily associated with differences in sediment characteristics, with sand phi size, silt/clay content, and total organic matter increasing and calcium carbonate content decreasing towards the left of the CCA bi-plot

*Table 3. Results of canonical correspondence analysis on borrow and reference area station communities and area-time communities. p-values of each axis were derived using 500 Monte-Carlo simulations.*

| | **Axis 1** | **Axis 2** | **Axis 3** |
|---|---|---|---|
| *Station Communities* | | | |
| Eigenvalue | 0.446 | 0.167 | 0.034 |
| % Variance Explained | 19.4 | 7.2 | 1.5 |
| Cumulative % Variance Explained | 19.4 | 26.6 | 28.1 |
| p-value | 0.0020 | 0.0020 | 0.0260 |
| *Area-Time Communities* | | | |
| Eigenvalue | 0.301 | 0.134 | 0.058 |
| % Variance Explained | 44.4 | 19.7 | 8.6 |
| Cumulative % Variance Explained | 44.4 | 64.1 | 72.7 |
| p-value | 0.0160 | 0.2100 | 0.0640 |

(Figure 9). The second axis was primarily associated with the season during which sampling occurred with spring in one direction and fall in the opposite direction (Figure 9). Reference and borrow area communities generally clustered together pre-dredging, but diverged sharply post-dredging. Reference communities oscillated along Axis 2 as seasons changed, but did not shift substantially along Axis 1 (Figure 9B). Following dredging the borrow area communities shifted left along Axis 1, oscillated seasonally along Axis 2 and never returned to pre-dredging conditions along Axis 1 (Figure 9B).

The similarities amongst the Area-Time communities were further examined using Bray-Curtis similarities. The most similar communities were the borrow and reference during the Pre time frame ($S = 80$; Table 4). Through 12 month post-dredging, the community in the reference area remained fairly similar to the Pre time frame reference community ($S \geq 67$), and the Pre time frame borrow community ($S \geq 62$). However, the communities in the borrow area following dredging were much less similar to the Pre time frame at either the reference ($S \leq 42$) or borrow area ($S \leq 54$) or the post-dredging time frames at the reference area ($S \leq 49$).

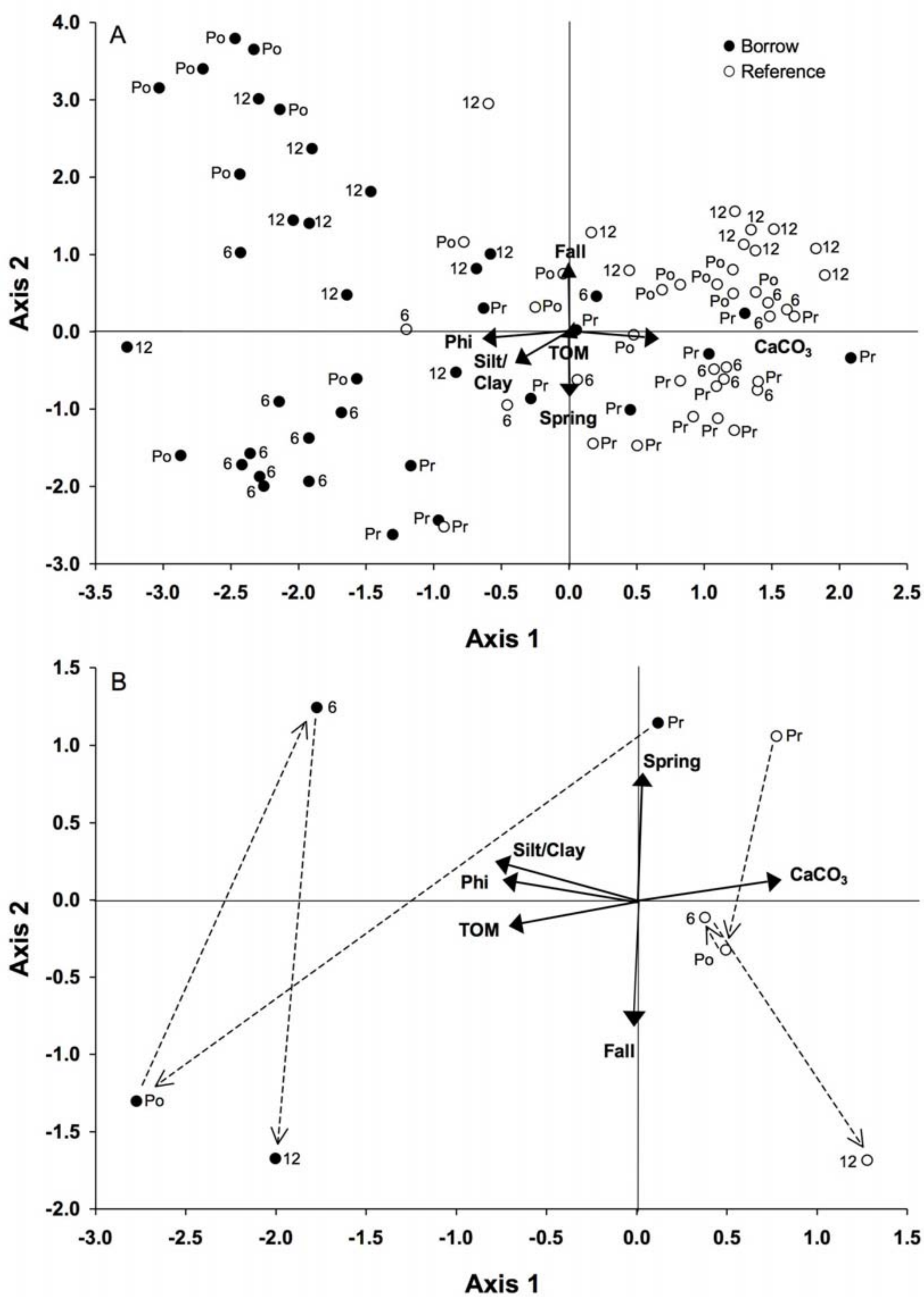


*Figure 9. Bi-plot of A) individual station communities and B) area-time communities using Canonical Correspondence Analysis (CCA). Solid arrows indicate direction of increasing environmental characteristics. Dashed arrows indicate temporal change sequence in each area. Open circles—reference, closed circles—borrow. Pr = Pre, Po = Post, 6 = 6-month Post and 12 = 12-mo Post time frames.*

*Table 4. Bray-Curtis similarities amongst each pair of Area-Time communities.*

| | | **Reference** | | | | **Borrow** | | |
|---|---|---|---|---|---|---|---|---|
| | | **Pre** | **Post** | **6-mo Post** | **12-mo Post** | **Pre** | **Post** | **6-mo Post** |
| **Reference** | **Post** | 68 | | | | | | |
| | **6-mo Post** | 73 | 73 | | | | | |
| | **12-mo Post** | 67 | 69 | 74 | | | | |
| **Borrow** | **Pre** | 79 | 70 | 73 | 62 | | | |
| | **Post** | 28 | 42 | 42 | 28 | 39 | | |
| | **6-mo Post** | 42 | 44 | 48 | 26 | 54 | 55 | |
| | **12-mo Post** | 31 | 49 | 42 | 31 | 36 | 71 | 49 |

The composition of the more abundant taxa (representing 60-70% of all fauna collected) changed substantially at the borrow area relative to the reference area between Pre and Post time frames (Table 5). The reference and borrow areas shared five of their ten most abundant (dominant) taxa (*Ensis directus, Crassinella martinicensis, Oxyurostylis smithi, Clymenella torquata* and the Nematoda) prior to dredging, but did not share any dominant taxa post-dredging. Most of the dominant taxa shared by the borrow and reference areas during the Pre time frame were no longer amongst the dominant taxa during the Post time frame (Table 5). Four of the dominant taxa at the reference area during the Pre time frame (*Crassinella lunulata, Bhawania heteroseta, Cyathura burbancki* and Nematoda) remained among the dominant taxa during the Post time frame, whereas only two of the dominant taxa at the borrow area during the Pre time frame (*Spiophanes bombyx* and *Mediomastus* sp.) were also amongst the dominant taxa during the Post time frame. Those dominant taxa present at the reference area during both the Pre and Post time frames were found in most samples collected (60-90%), suggesting they were widely distributed. In the borrow area, however, the two

*Table 5. Ten most abundant benthic taxa (dominant taxa) collected at the reference and borrow area during pre-nourishment (Pre), immediate Post nourisment (Post), 6 months post nourishment (6 mo Post), and 12 months post nourishment (12 mo Post) sampling. Abundance values represent the total number of individuals collected in ten samples (0.04m$^2$ per sample). Higher taxa codes are P = Polychaete, A = Amphipod, M = Mollusk, and O = Other taxa.*

**Reference Area**

| SpeciesName | Category | Total Abundance | Percent Abundance | Percent of stations where present |
|---|---|---|---|---|
| **Pre** | | | | |
| *Ensis directus* | M | 159 | 11.01 | 90 |
| *Crassinella martinicensis* | M | 134 | 9.28 | 80 |
| *Crassinella lunulata* | M | 124 | 8.59 | 80 |
| Nematoda | O | 119 | 8.24 | 90 |
| *Oxyurostylis smithi* | O | 89 | 6.16 | 100 |
| Actiniaria | O | 85 | 5.89 | 20 |
| *Clymenella torquata* | P | 68 | 4.71 | 30 |
| *Bhawania heteroseta* | P | 60 | 4.16 | 90 |
| *Cyathura burbancki* | O | 39 | 2.70 | 60 |
| *Travisia parva* | P | 37 | 2.56 | 50 |
| ***Total of all other species*** | | ***530*** | ***36.70*** | |
| **Post** | | | | |
| *Batea catharinensis* | A | 274 | 27.68 | 70 |
| Nematoda | O | 93 | 9.39 | 90 |
| *Branchiostoma* sp. | O | 74 | 7.47 | 70 |
| *Bhawania heteroseta* | P | 58 | 5.86 | 80 |
| *Crassinella lunulata* | M | 43 | 4.34 | 90 |
| *Sabellaria vulgaris vulgaris* | P | 31 | 3.13 | 20 |
| *Cyathura burbancki* | O | 27 | 2.73 | 60 |
| *Elasmopus levis* | A | 20 | 2.02 | 30 |
| *Pleuromeris tridentata* | M | 20 | 2.02 | 50 |
| *Glycera americana* | P | 19 | 1.92 | 90 |
| ***Total of all other species*** | | ***331*** | ***33.43*** | |
| **6 mo Post** | | | | |
| Nematoda | O | 427 | 19.60 | 100 |
| *Cupuladria doma* | O | 388 | 17.81 | 70 |
| *Batea catharinensis* | A | 344 | 15.79 | 50 |
| *Pleuromeris tridentata* | M | 141 | 6.47 | 70 |
| *Travisia parva* | P | 110 | 5.05 | 80 |
| *Crassinella martinicensis* | M | 63 | 2.89 | 80 |
| *Bhawania heteroseta* | P | 53 | 2.43 | 80 |
| *Hemipodus roseus* | P | 52 | 2.39 | 90 |
| *Crassinella lunulata* | M | 36 | 1.65 | 80 |
| *Spiophanes bombyx* | P | 31 | 1.42 | 50 |
| ***Total of all other species*** | | ***534*** | ***24.51*** | |
| **12 mo Post** | | | | |
| *Cupuladria doma* | O | 1097 | 28.85 | 70 |
| Nematoda | O | 937 | 24.64 | 100 |
| Veneridae | M | 284 | 7.47 | 40 |
| *Pleuromeris tridentata* | M | 133 | 3.50 | 40 |
| *Caulleriella* sp. | P | 92 | 2.42 | 40 |
| *Bhawania heteroseta* | P | 86 | 2.26 | 80 |
| *Crassinella martinicensis* | M | 86 | 2.26 | 40 |
| *Branchiostoma* sp. | O | 82 | 2.16 | 80 |
| *Crassinella lunulata* | M | 73 | 1.92 | 60 |
| Copepoda | O | 65 | 1.71 | 80 |
| ***Total of all other species*** | | ***868*** | ***22.82*** | |

**Borrow Area**

| SpeciesName | Category | Total Abundance | Percent Abundance | Percent of stations where present |
|---|---|---|---|---|
| **Pre** | | | | |
| *Spiophanes bombyx* | P | 544 | 19.70 | 70 |
| *Oxyurostylis smithi* | O | 497 | 18.00 | 90 |
| *Clymenella torquata* | P | 230 | 8.33 | 40 |
| *Ensis directus* | M | 127 | 4.60 | 70 |
| Nematoda | O | 108 | 3.91 | 80 |
| *Batea catharinensis* | A | 103 | 3.73 | 50 |
| *Crassinella martinicensis* | M | 77 | 2.79 | 60 |
| *Mediomastus* sp. | P | 67 | 2.43 | 40 |
| *Pleuromeris tridentata* | M | 67 | 2.43 | 40 |
| *Amastigos caperatus* | P | 61 | 2.21 | 40 |
| ***Total of all other species*** | | ***880*** | ***31.87*** | |
| **Post** | | | | |
| *Prionospio dayi* | P | 108 | 24.38 | 60 |
| *Magelona* sp. | P | 34 | 7.67 | 70 |
| *Eudevenopus honduranus* | A | 29 | 6.55 | 60 |
| *Rhepoxynius epistomus* | A | 27 | 6.09 | 50 |
| *Armandia agilis* | P | 22 | 4.97 | 40 |
| *Paraprionospio pinnata* | P | 21 | 4.74 | 40 |
| *Mediomastus* sp. | P | 17 | 3.84 | 60 |
| Copepoda | O | 15 | 3.39 | 60 |
| *Spiophanes bombyx* | P | 11 | 2.48 | 40 |
| *Mulinia lateralis* | M | 10 | 2.26 | 20 |
| ***Total of all other species*** | | ***149*** | ***33.63*** | |
| **6 mo Post** | | | | |
| *Spiophanes bombyx* | P | 945 | 44.37 | 90 |
| *Mediomastus* sp. | P | 426 | 20.00 | 70 |
| *Magelona* sp. | P | 124 | 5.82 | 90 |
| *Tellina agilis* | M | 110 | 5.16 | 90 |
| *Nephtys picta* | P | 55 | 2.58 | 90 |
| *Prionospio* sp. | P | 49 | 2.30 | 70 |
| *Notomastus latericeus* | P | 39 | 1.83 | 80 |
| *Batea catharinensis* | A | 31 | 1.46 | 50 |
| *Phyllodoce arenae* | P | 29 | 1.36 | 70 |
| *Protohaustorius deichmannae* | A | 29 | 1.36 | 20 |
| ***Total of all other species*** | | ***293*** | ***13.76*** | |
| **12 mo Post** | | | | |
| Nematoda | O | 88 | 19.17 | 70 |
| *Ophelina acuminata* | P | 29 | 6.32 | 40 |
| *Magelona* sp. | P | 23 | 5.01 | 70 |
| *Eudevenopus honduranus* | A | 21 | 4.58 | 30 |
| Tellinidae | M | 21 | 4.58 | 20 |
| *Tellina* sp. | M | 19 | 4.14 | 40 |
| Pelecypoda | M | 15 | 3.27 | 30 |
| *Prionospio cirrifera* | P | 15 | 3.27 | 20 |
| Copepoda | O | 14 | 3.05 | 60 |
| *Prionospio dayi* | P | 11 | 2.40 | 10 |
| ***Total of all other species*** | | ***203*** | ***44.23*** | |

dominant taxa present in both Pre and Post time frames were less widely distributed, occurring in only 40-70% of the samples collected.

The reference and borrow areas shared only two dominant taxa during the 6-mo (*S. bombyx* and *Batea catharinensis*) and 12-mo Post (Nematoda and Copepoda) time frames (Table 5). Five of the dominant taxa at the reference area pre-dredging (*C. martinicensis, C. lunulata, B. heteroseta*, *Travisia parva*, and the Nematoda) were also among the dominant taxa six months post-dredging, while at the borrow area, three of the dominant taxa pre-dredging (*S. bombyx*, *B. catharinensis*, and *Mediomastus* sp.) were among the dominant taxa six months post-dredging. Four of the dominant taxa at the reference area pre-dredging (*C. martinicensis, C. lunulata, B. heteroseta*, and the Nematoda) were also among the dominant taxa twelve months post-dredging, while at the borrow area only one of the dominant taxa pre-dredging (Nematoda) were among the dominant taxa twelve months post-dredging. In general, the reference area also hosted more persistent taxa than did the borrow area. Amongst the dominant taxa of the reference area, three (*C. lunulata*, *B. heteroseta*, and the Nematoda) were present during all four time frames, while at the borrow area, no species were amongst the dominants during all four time frames.

The mollusks *Ensis directus* (11%), *Crassinella martinicensis* (9%), and *Crassinella lunulata* (9%) dominated the total faunal abundance at the reference area during the Pre time frame (Table 5; Appendix 5.5). Nematodes, representing 8% of the total faunal abundance, were also common at this area. *Ensis directus* disappeared completely from the reference area post-dredging, and several other taxa, which were common in the pre time frame, were substantially less abundant (Appendix 4).

Immediately post-dredging, the reference area contained mostly the amphipod, *Batea catharinensis*, which comprised 28% of the total abundance. By comparison, at the borrow area, four species accounted for more than 50% of the total faunal abundance during the Pre time frame (Table 5). The most abundant species were the spionid polychaete, *Spiophanes bombyx*, and a cumacean, *Oxyurostylis smithi*. During the Post time frame, polychaetes and amphipods dominated the faunal abundance, with the spionid polychaete, *Prionospio dayi*, accounting for almost 25% of the population. *Spiophanes bombyx* decreased in abundance by greater than 98% post-dredging. However, although *S. bombyx* was found in 70% of the borrow stations pre-dredging, 467 of the 544 individuals collected were found in one of the ten samples.

At the reference area, nematodes, the ectoproct *Cupuladria doma* and the amphipod *B. catherinensis* accounted for more than 50% of the total faunal abundance six months post-dredging (Table 5; Appendix 5.5). The mollusk, *E. directus*, which was the dominant species at the reference area pre-dredging, was only present in one of the six month post-dredging samples, and was completely absent from the area twelve months post-dredging (Table 5; Appendix 5.3, 5.4). *Crassinella martinicensis* and *C. lunulata*, which were also common in the Pre time frame, were substantially less abundant at the reference area twelve months post-dredging (Appendix 5). At the borrow area, three species of polychaete, *S. bombyx*, *Mediomastus sp*., and *Magelona sp*., accounted for more than 70% of the total faunal abundance six months post-dredging (Table 5; Appendix 5). The spionid polychaete, *S. bombyx*, which was the most abundant organism at the borrow area pre-dredging, and six months post-dredging, was much less abundant twelve months post-dredging. Examination of the number of individuals twelve months post-dredging indicated a reduction in the total number of organisms present at the borrow area with a higher number of uncommon species.

***Beach***

*Physical Characteristics*

Nourishment succeeded in increasing beach width substantially between the Pre and Post time frames. The distance from the primary dune crest to the upper intertidal line (identified by the wrack line) increased from approximately 15 m Pre-nourishment to

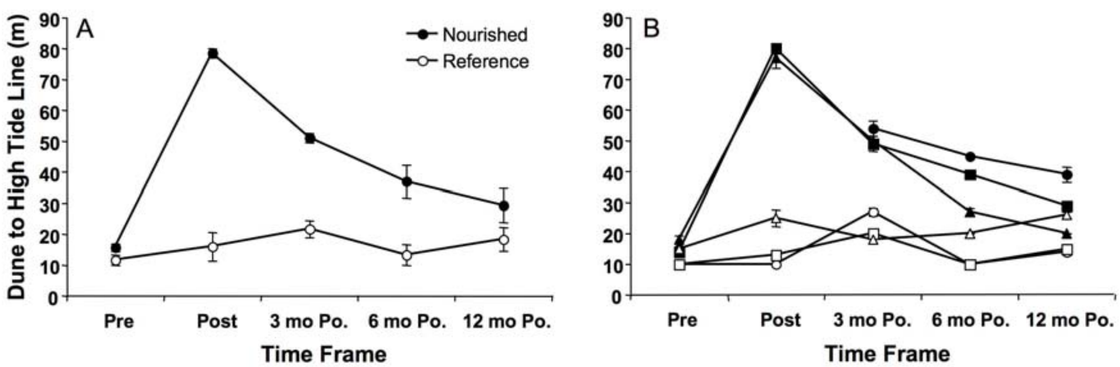


*Figure 10. Mean (+/-SE) distance from the dune crest to the wrack (high tine) line at nourished and reference A) areas and B) sites through time. Closed symbols-nourished stations/areas, open symbols—non-nourished stations/areas*

almost 80 m Post-nourishment within the nourished area (Figure 10A), with two of the three monitored sites responding very similarly (Figure 10B). Beach width in the nourished area decreased to 50 - 55 m by the 3-mo Post time frame and continued to decrease with the individual sites falling to between 20 m and 40 m width by the 12-mo Post time frame. The non-nourished reference sites of the beach fluctuated between 10 m and 25 m in width, but showed little evidence of longer-term change.

Some surficial sediment characteristics showed an apparent response to nourishment of the beach. In particular, sand phi size increased (became finer) in the reference areas but decreased (became courser) in the nourished areas (Figure 11A,E), a difference that was significant during the Post and 3 mo Post time frames (Table 6). By 6-mo Post, sand phi size was similar at reference and nourished areas (Figure 11A,E). Silt and clay content and calcium carbonate ($CaCO_3$) content changed similarly at the reference and nourished areas between the Pre and all post-nourishment time frames (Figure 11B,C,F,G; Table 6). Sediment total organic matter (TOM) was significantly different at reference and nourished areas between the Pre and Post time frames (Figure 11D,H; Table 6). Both reference and nourished areas decreased in TOM during this time, and the significant difference detected was likely due to the strikingly small amount of variance within reference and nourished areas during any given time frame. By the 3-mo Post time frame, TOM content was very similar between the nourished and reference areas despite having differed during the Pre time frame (Figure 11D,H).

*Table 6: Results of repeated measures ANOVA comparing sediment characteristics in nourished and reference areas between Pre and post nourishment (Post, 3 mo Post, 6 mo Post, 12 mo Post) time frames. Shown are degrees of freedom, F values and p-values for the Area X Time interaction terms which, if significant, would indicate nourished and reference areas were changing differently through time.*

| **Compared Time Frames** | **df** | **Phi** | | **Silt/Clay** | | **CaCO3** | | **TOM** | |
|---|---|---|---|---|---|---|---|---|---|
| | | **F** | **p** | **F** | **p** | **F** | **p** | **F** | **p** |
| **Pre vs Post** | 1,3 | 47.19 | **0.006** | 0.59 | 0.498 | 1.77 | 0.275 | 38.14 | **0.009** |
| **Pre vs 3 mo Post** | 1,4 | 32.59 | **0.005** | 0.19 | 0.689 | 2.26 | 0.207 | 4.06 | 0.114 |
| **Pre vs 6 mo Post** | 1,4 | 0.14 | 0.726 | 1.12 | 0.333 | 0.20 | 0.679 | 1.66 | 0.267 |
| **Pre vs 12 mo Post** | 1,4 | 1.33 | 0.313 | 1.40 | 0.302 | 0.10 | 0.768 | 4.69 | 0.096 |

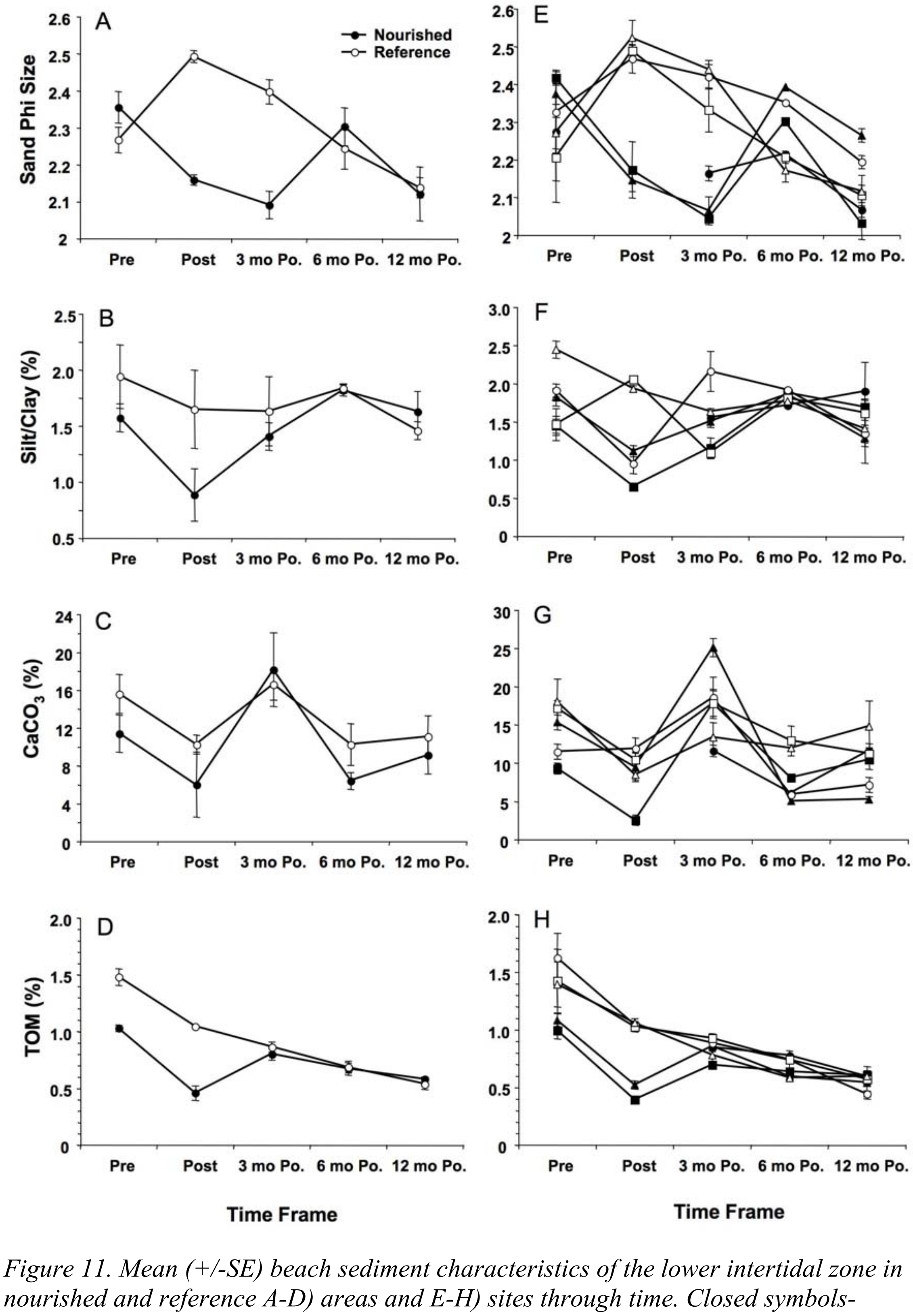


*Figure 11. Mean (+/-SE) beach sediment characteristics of the lower intertidal zone in nourished and reference A-D) areas and E-H) sites through time. Closed symbols-nourished sites/areas, open symbols—non-nourished sites/areas*

*Ghost Crab (Ocypode quadrata) Populations*

Of the four measures of ghost crab density, only areal density (number of crab burrows per square meter) showed a significantly different temporal pattern in the nourished area as compared to the reference area (Table 7; Figure 12B,F). The Area X Time Frame interaction term was significant during the Post time frame, weakened but remained significant in the 3-mo Post time frame, and further weakened and became non-significant in the 6-mo Post and 12-mo Post time frames (Table 7). The areal densities of ghost crabs increased during the Post and 3-mo Post time frames in the reference area but remained relatively stable in the nourished area (Fig 12B). Sites within reference and nourished areas were significantly different through time during the 3-mo Post, 6-mo Post, and 12-mo Post time frames (Table 7; significant Site X Time Frame interactions). The linear densities, dune densities (within 10 m of the dune crest) and tideline densities (within 5 m of the wrack line) did not show evidence of changing significantly in the nourished area relative to the reference area (Table 7). As with areal density, changes in linear density in the nourished area tracked those observed in the reference area, with a peak density at 3-mo Post, a decline 6-mo Post, and a second peak 12-mo Post (Figure 12A,E). Dune ghost crab densities varied substantially, with peak densities occurring on a site- specific basis in the reference area with no such fluctuations (most notably the peak at 3 mo Post) occurring in the nourished area (Fig 12C,G).

With the exception of tideline densities, ghost crab densities were significantly different in the reference and control areas (Table 7; Source = Area). The reference area generally started with greater ghost crab densities during the Pre time frame and maintained that difference through the 12-mo Post time frame (Figure 12A-D). The

*Table 7: Results of repeated measures ANOVA comparing burrowing macrofauna densities in nourished and reference areas between Pre and post nourishment (Post, 3 mo Post, 6 mo Post, 12 mo Post) time frames.*

| | **Pre vs Post** | | | **Pre vs 3 mo Post** | | | **Pre vs 6 mo Post** | | | **Pre vs 12 mo Post** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Source** | **df** | **F** | **p** | **df** | **F** | **p** | **df** | **F** | **p** | **df** | **F** | **p** |
| *Ocypode quadrata* | | | | | | | | | | | | |
| *Linear Density* | | | | | | | | | | | | |
| Area | 1 | 12.51 | **0.038** | 1 | 10.43 | **0.032** | 1 | 19.16 | **0.012** | 1 | 20.63 | **0.010** |
| Site(Area) | 3 | 0.92 | 0.528 | 4 | 0.61 | 0.681 | 4 | 0.86 | 0.557 | 4 | 0.37 | 0.820 |
| Time Frame | 1 | 0.18 | **0.018** | 1 | 22.35 | **0.009** | 1 | 0.13 | 0.736 | 1 | 19.08 | **0.012** |
| Area *Time Frame | 1 | 0.58 | 0.575 | 1 | 1.22 | 0.332 | 1 | 4.43 | 0.103 | 1 | 1.33 | 0.313 |
| Site*Time Frame | 3 | 0.22 | 0.219 | 4 | 5.40 | **0.001** | 4 | 2.81 | **0.036** | 4 | 5.59 | **0.001** |
| Error | 40 | | | 48 | | | 48 | | | 48 | | |
| *Ocypode quadrata* | | | | | | | | | | | | |
| *Areal Density* | | | | | | | | | | | | |
| Area | 1 | 40.64 | **0.008** | 1 | 64.12 | **0.001** | 1 | 13.09 | **0.022** | 1 | 14.43 | **0.019** |
| Site(Area) | 3 | 1.40 | 0.393 | 4 | 0.38 | 0.813 | 4 | 1.24 | 0.419 | 4 | 0.65 | 0.655 |
| Time Frame | 1 | 4.17 | 0.134 | 1 | 15.01 | **0.018** | 1 | 0.04 | 0.847 | 1 | 6.04 | 0.070 |
| Area *Time Frame | 1 | 15.96 | **0.029** | 1 | 8.63 | **0.042** | 1 | 4.76 | 0.095 | 1 | 2.63 | 0.180 |
| Site*Time Frame | 3 | 1.75 | 0.172 | 4 | 4.52 | **0.004** | 4 | 4.69 | **0.003** | 4 | 8.73 | **<0.001** |
| Error | 40 | | | 48 | | | 48 | | | 48 | | |
| *Ocypode quadrata* | | | | | | | | | | | | |
| *Dune Density* | | | | | | | | | | | | |
| Area | 1 | 38.28 | **0.009** | 1 | 18.02 | **0.013** | 1 | 13.37 | **0.022** | 1 | 15.29 | **0.017** |
| Site(Area) | 3 | 0.37 | 0.781 | 4 | 1.92 | 0.271 | 4 | 0.79 | 0.586 | 4 | 0.69 | 0.635 |
| Time Frame | 1 | 13.51 | **0.036** | 1 | 17.04 | **0.014** | 1 | 1.04 | 0.365 | 1 | 3.09 | 0.154 |
| Area *Time Frame | 1 | 5.56 | 0.101 | 1 | 6.60 | 0.062 | 1 | 3.42 | 0.138 | 1 | 4.48 | 0.102 |
| Site*Time Frame | 3 | 1.54 | 0.220 | 4 | 1.75 | 0.154 | 4 | 3.87 | **0.009** | 4 | 7.04 | **<0.001** |
| Error | 40 | | | 48 | | | 48 | | | 48 | | |

*Table 7 cont.*

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Ocypode quadrata* | | | | | | | | | | | | |
| *Tideline Density* | | | | | | | | | | | | |
| Area | 1 | 2.24 | 0.231 | 1 | 7.91 | **0.048** | 1 | 3.64 | 0.129 | 1 | 2.93 | 0.162 |
| Site(Area) | 3 | 8.87 | 0.053 | 4 | 0.29 | 0.868 | 4 | 2.39 | 0.210 | 4 | 0.48 | 0.751 |
| Time Frame | 1 | 0.72 | 0.459 | 1 | 6.61 | 0.062 | 1 | 1.41 | 0.301 | 1 | 10.21 | **0.003** |
| Area *Time Frame | 1 | 0.93 | 0.405 | 1 | 0.54 | 0.503 | 1 | 1.57 | 0.278 | 1 | 0.13 | 0.741 |
| Site*Time Frame | 3 | 1.29 | 0.290 | 4 | 6.81 | **<0.001** | 4 | 2.21 | 0.082 | 4 | 7.59 | **<0.001** |
| Error | 40 | | | 48 | | | 48 | | | 48 | | |
| | | | | | | | | | | | | |
| *Callichirus major* | | | | | | | | | | | | |
| *Linear Density* | | | | | | | | | | | | |
| Area | 1 | 12.51 | **0.038** | 1 | 10.43 | **0.032** | 1 | 19.16 | **0.012** | 1 | 20.63 | **0.010** |
| Site(Area) | 3 | 0.92 | 0.528 | 4 | 0.61 | 0.681 | 4 | 0.86 | 0.557 | 4 | 0.37 | 0.820 |
| Time Frame | 1 | 0.18 | **0.018** | 1 | 22.35 | **0.009** | 1 | 0.13 | 0.736 | 1 | 19.08 | **0.012** |
| Area *Time Frame | 1 | 0.58 | 0.575 | 1 | 1.22 | 0.332 | 1 | 4.43 | 0.103 | 1 | 1.33 | 0.313 |
| Site*Time Frame | 3 | 0.22 | 0.219 | 4 | 5.40 | **0.001** | 4 | 2.81 | **0.036** | 4 | 5.59 | **0.001** |
| Error | 40 | | | 48 | | | 48 | | | 48 | | |

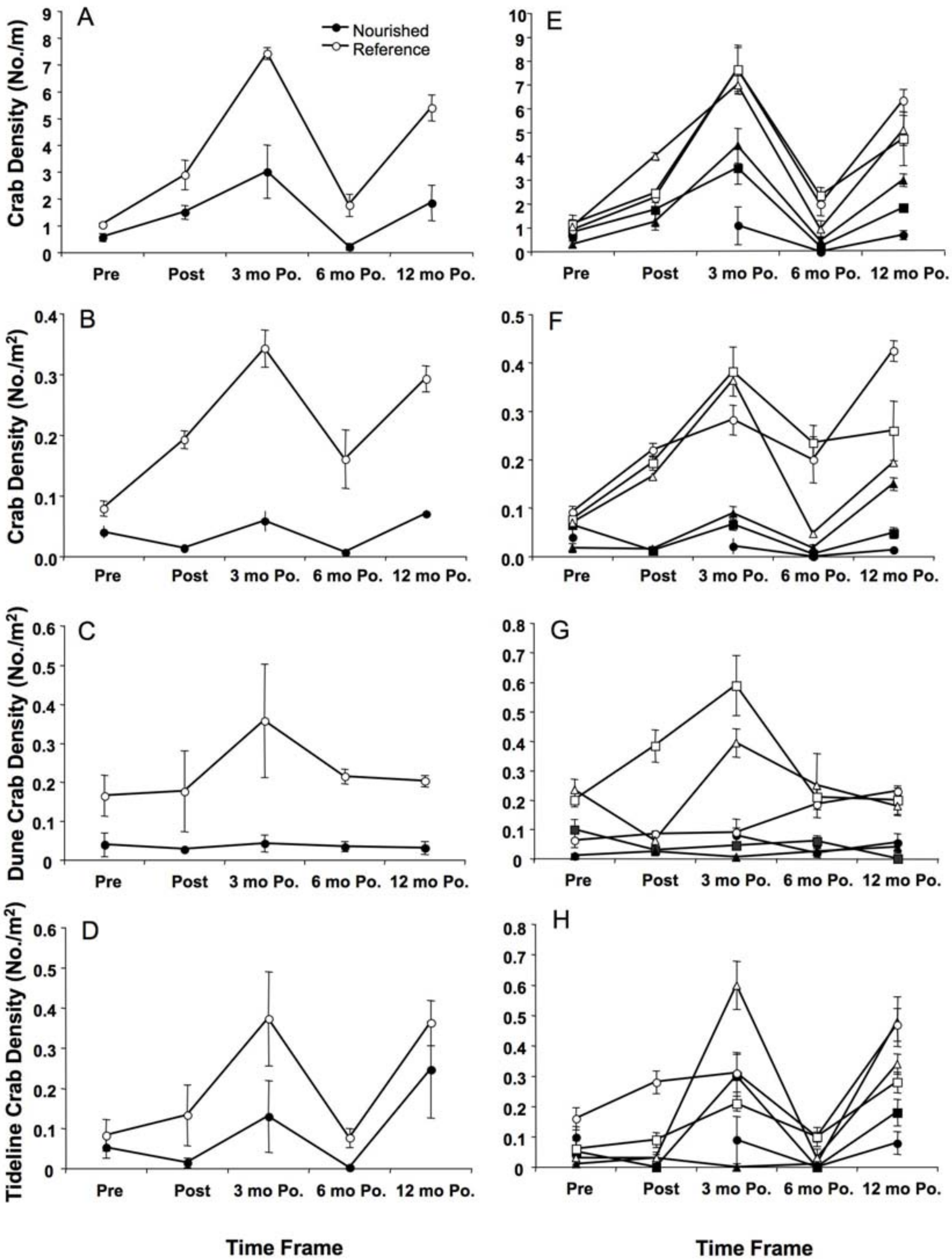


*Figure 12. Mean (+/-SE) ghost crab, Ocypode quadrata, densities on nourished and reference A-D) areas and E-H) sites through time. Dune crab densities are those within 10 m of the primary dune crest, and tide line crab densities are those within 5m of the high tide line. Closed symbols-nourished stations/areas, open symbols—non-nourished stations/areas*

individual sites reflected this general pattern (Figure 12E-H). In most cases, the sites within an area changed in a significantly different manner through time, with most of the differences occurring during later time frames (Table 7).

Dune ghost crab densities tended to show a negative relationship with beach width during all but Post time frames (Figure 13A; Table 8). Because this relationship likely reflects the widening of the beach in areas where ghost crab densities were already lower, the change in dune ghost crab densities was examined as a function of change in beach width during each time frame. Although none of the regression lines describing

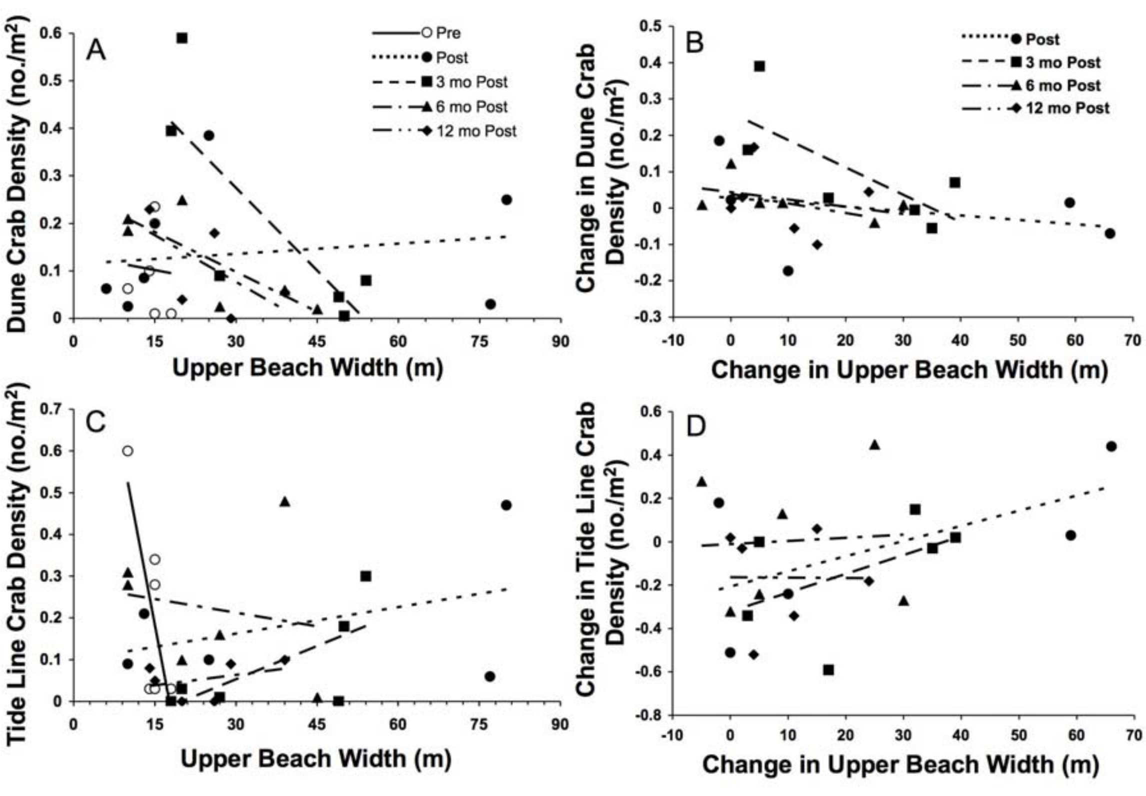


*Figure 13. Relationships between A) dune crab densities and beach width, B) change in dune crab densities and change in beach width prior to and following dredging, C) tide line crab densities and beach width, D) change in tide line crab densities and change in beach width prior to and following dredging.*

these relationships were significant ($p > 0.05$), they all possessed negative slopes, indicating that densities tended to decrease more over pre-nourishment conditions as beach width increased (Figure 13B; Table 8). By contrast, tideline densities showed no consistent relationship with beach width (Figure 13C), and changes in tideline ghost crab densities tended to have positive (and non-significant) relationships with changes in beach width (Figure 13D; Table 8).

*Table 8. Slope, coefficient of variation ($R^2$), and p-value for regression lines describing the relationship between change in beach width and the change in ghost crab dune and tideline densities during each of four sampling time frames.*

| **Change Between** | **Dune Density** | | | **Tideline Density** | | |
|---|---|---|---|---|---|---|
| **Time Frames** | **Slope** | **$R^2$** | **p** | **Slope** | **$R^2$** | **p** |
| Post - Pre | - | 0.00 | 0.620 | + | 0.19 | 0.256 |
| 3 mo Post - Pre | - | 0.43 | 0.095 | + | 0.05 | 0.320 |
| 6 mo Post - Pre | - | 0.09 | 0.287 | + | 0.00 | 0.980 |
| 12 mo Post - Pre | - | 0.00 | 0.615 | - | 0.00 | 0.991 |

*Ghost Shrimp (Callichirus major) Populations*

Observations suggest that the ghost shrimp, *Callichirus major*, occurred on Folly Beach primarily in the lowest portions of the intertidal zone and became increasingly abundant in the shallow subtidal. As a result, the surveys here captured only the uppermost edge of the distribution of this species. Ghost shrimp linear densities were not significantly different at the nourished area than at the reference area (Table 7); however, there was a clear increase in linear densities of ghost shrimp in the nourished area during the Post and 3-mo Post time frames that was not reflected in the reference area (Figure 14). In later time frames, linear densities decreased sharply in the nourished area and began increasing in some reference sites.

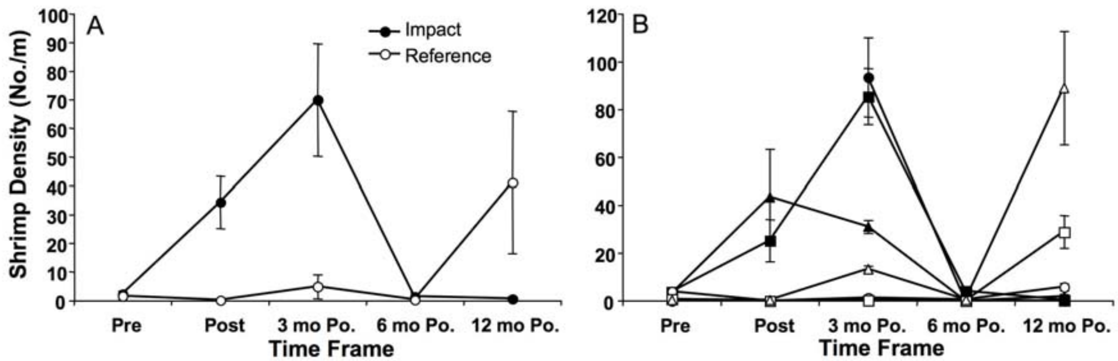

*Figure 14. Mean (+/-SE) ghost shrimp, Callichirus major, densities on nourished and reference A) areas and B) sites through time. Closed symbols-nourished stations/areas, open symbols—non-nourished stations/areas*

## DISCUSSION

### *Borrow Area*

Dredging at the borrow area caused marked changes in both the sediment characteristics and benthic biological communities of the area. Short-term changes were expected due to the complete removal of sediment to depths up to 3.5 m below the existing seafloor and the resulting exposure of deeper sediment layers possessing different characteristics. The preferred post-dredging scenario is one of rapid recovery to pre-dredging conditions, characterized by refilling of the borrow pit with sands similar to those dredged and subsequent colonization by communities typical of those sediments. However, in the borrow area, neither the sediment characteristics nor the biological community recovered to pre-dredge conditions within the first 12-months following dredging.

The seafloor within the borrow pit shifted toward finer grained sediments post-dredging. Silt/clay content increased, $CaCO_3$ (typically shell material and carbonate rock rubble) decreased and sand phi size increased (became finer) following dredging and showed no evidence of recovering twelve months later. Refilling of borrow pits with finer sediments has been documented in other monitoring studies. In the dredged area used to nourish Folly Beach in 1993, silt and clay increased from 3% to 10% and sand phi size increased following dredging (Van Dolah et al. 1994). In the Joiner Banks borrow area used to nourish Hilton Head Island in 1990, sand content declined 31%, and sand phi size and silt and clay content increased following dredging (Van Dolah et al. 1992; Jutte and Van Dolah 2000). In all of these studies, fine sediments remained elevated in the borrow areas for at least one year following dredging.

Some studies have documented recovery of normal sediments in borrow pits, sometimes within several months (Bowan and Marsh 1988; Jutte and Van Dolah 2000; Jutte et al. 2001b). Jutte et al. (2001b), comparing the relative performance of two borrow pits used to renourish Myrtle Beach, SC, USA, observed that a pit located centrally along the coastline and created with a hydraulic pipeline dredge had persistent modified sediment characteristics for more than two years post-dredging, but that a pit located at the southern end of the beach and created using a hopper dredge had no change in sediment characteristics post-dredging. Combined with previous studies (Jutte et al. 1999b, 2002), this indicated that borrow pit depth played an important role in determining whether pits refilled with beach-compatible material. The two borrow areas examined by Jutte et al. (2001a,b) also refilled at very different rates. The centrally located pit with persistent modified sediment characteristics was refilling slowly with rates estimated at 0-16% after two years, and the southern pit with unmodified sediment characteristics was refilling rapidly with rates estimated at 47-100% after two years. Van Dolah et al. (1998) suggested that, in South Carolina, borrow pits located in depositional shoals at the southern ends of barrier islands would represent more sustainable locations than those located more centrally or at the northern ends of barrier islands due to the southerly direction of the dominant alongshore currents. Considering these past findings, the refilling of the Folly Beach borrow pit with fine materials is consistent with it having been dredged up to 3.0 m deep using a hydraulic dredge and its location at the north end of the island near a source of terrigenous material (Charleston Harbor inlet).

Van Dolah et al. (1998) found that most borrow pits created as a result of beach nourishment in South Carolina required between 5.5 and 11.8 years to completely refill, and that several years following dredging, surficial sediments consisted primarily of clean sands. However, two of the borrow pits examined in that study had first filled with fine-grained silts and clays before being covered by beach-compatible sand (Van Dolah et al. 1994; Jutte and Van Dolah 2000). The resulting lens of mud beneath the surficial sand makes those areas unsuitable for future nourishment projects, requiring dredging in new, previously undisturbed areas. Like those two borrow areas, the Folly Beach borrow area is refilling with fine material, suggesting this area will be unsuitable for future nourishment projects on Folly Beach. This area should be monitored closely to determine whether surficial conditions return to the pre-dredging state and whether the fines now being deposited within the pit persist beneath the surficial sediments.

The biological community in the borrow area changed substantially following dredging and failed to recover over the subsequent 12 months. Although borrow and reference area communities were very similar during the Pre time frame, they sharply diverged during all post-dredging time frames. These changes were apparent from the broadest levels of community organization, such as measures of similarity and biodiversity, to fine scales of species abundances. Because dredging necessarily removes the entire benthic community, the change in the borrow area was expected in the Post time frame; however, the lack of recovery over the following 12 months suggests that the borrow area had changed to such an extent that it was no longer capable of supporting a typical benthic community.

Overall community structure shifted substantially at the borrow area post-dredging, independent of any seasonal cycles. As compared to the reference area, total faunal abundance, species richness, and species diversity at the borrow area increased six months post-dredging, then density and richness declined significantly twelve months post-dredging, while diversity returned to pre-dredging levels. The increase in evenness likely reflects the loss of rare species from the borrow area as suggested by the decrease in species richness. The apparent recovery of diversity is due to the opposing effects of increasing species evenness and decreasing species richness within the borrow area. In this case, diversity provided a poor metric of community response and recovery as it hid the changes occurring within the community.

The severe decrease in total faunal density at the borrow area relative to the reference area through twelve months post-dredging was primarily driven by decreases in mollusks, polychaetes, and organisms in the "other taxa" category. Major shifts in abundances of higher taxonomic groups post-dredging have been documented in other studies. For example, in borrow pits associated with the nourishment of Myrtle Beach, SC, Jutte et al. (1999b, 2001a) found mollusks and "other taxa" failed to recover 12-18 months post-dredging at one borrow area, and that most higher taxonomic groups required approximately 19-28 months to recover at a second borrow area. The trend of declining mollusk abundances observed here and in other studies (Jutte et al. 1999b, Blake et al.1996) following dredging may be attributable to seasonal reproductive patterns and limited recruitment in this taxon (Simon and Dauer, 1977).

Dredging also appeared to have affected community composition at the species level. The dissimilarities of the borrow area communities during the post-dredging time frames do not appear to be a temporal cycle because both the reference and borrow area shared common species between the Pre and Post time frames. Several studies in South Carolina have addressed shifts in abundance of particular species in response to dredging (Jutte et al. 1999a, 2001a, 2001b; Van Dolah et al. 1994). Some species, such as the polychaetes *Spiophanes bombyx* and *Prionospio dayi*, and the mollusks *Ensis directus* and *Crassinella martinicensis,* commonly occur in South Carolina and exhibit changes in abundances following dredging activities. Mollusk recolonize slowly after dredging (Jutte et al. 1999a; Simon and Dauer, 1977), while certain polychaetes, such as the spionids *Prionospio dayi* (Table 4) and *P. cristata* tend to increase in abundance quickly at borrow sites post-dredging (Jutte et al. 2001a,b). Changes in *Ensis directus* abundances likely reflect sporadic seasonal trends (Jutte et al. 1999a, 2001b), but other species may be responding to dredging-related changes in sediment characteristics, food sources, or the overall physical disturbance. The shifts in species composition seen in the Folly Beach borrow pit monitored here are consistent with previously-documented slow mollusk recovery and dominance by certain polychaetes (such as *P. dayi*) in severely disturbed benthic areas.

The difference in dominant species found at reference and borrow areas may be in part linked to variation in sediment characteristics even during the Pre time frame. Low variance in sediment characteristics at the reference area, relative to the borrow area, suggests the reference area was a more homogenous environment. The CCA plot of individual station-communities suggests that, pre-dredging, many of the borrow area stations were similar in species and environmental characteristics to the reference area stations, but with a few borrow area stations having communities consistent with finer grained sediments. Post-dredging, all borrow area station-communities shifted towards those associated with finer sediments.

Response and recovery of the biological community is likely closely related to the depth below grade and location of the borrow pit. The borrow areas used to nourish Hilton Head in 1990 and 1999 and the borrow area used to nourish Folly Beach in 1993 were dredged to 3+ m below grade, and all were located either adjacent to or within a tidal inlet. These areas accumulated significant fine material, suffered major changes in benthic community structure, and failed to recover within at least one year (Van Dolah et al. 1992; Van Dolah et al. 1994; Jutte and Van Dolah 2000). Other studies have found that impacts on faunal diversity did not persist for a significant period of time following dredging, and recovery of communities to pre-dredging conditions have been documented within 6-9 months after dredging occurred (Jutte et al. 1999b, 2001; Van Dolah et al. 1994). Two borrow areas examined by Jutte et al. (1999b, 2001a,b) exhibited rapid recovery of faunal abundances to pre-dredge conditions. Both of these areas were dredged to only about one meter below grade using a hopper dredge. This dredging method creats shallower depressions in the seafloor that provide less opportunity for the settling of fines and produce long furrows separated by undisturbed bottom ridges (Taylor 1990). These ridges can provide a local source of fauna allowing the rapid recolonization of the adjacent furrows by similar fauna (Jutte et al. 2001b).

The analyses performed here suggest that higher order taxonomic groups provide limited utility in detecting the impact of dredging on benthic communities. Higher order taxonomic groups responded to dredging, but not in a consistent and strong manner. Organisms in the "other taxa" group responded significantly to dredging at the borrow pit post-dredging, while amphipods, mollusks, polychaetes, and other crustaceans showed evidence of changing differently but not significantly at borrow and reference areas during the pre and post time frame. First, the lack of change in most higher taxonomic groups masks the underlying changes occurring in individual species both seasonally and in apparent response to dredging. Second, variability in abundances of higher taxonomic groups may have reduced the power of statistical tests, making it difficult to detect differences. This suggests that previously-documented higher order taxonomic group recovery in some studies (Jutte *et al.* 1999b, 2001a,b) should be interpreted with care as the species composition of those communities may still be very different. This also suggests that larger sample sizes and identifications to lower taxonomic levels (at least lower than the higher taxonomic groups examined here) are necessary to fully document impacts from dredging. However, both of these needs can significantly increase cost, so for impact assessments to be both economically feasible and ecologically sound there is a need to balance higher taxonomic resolution and the ability to detect impacts. Studies in other systems have shown that family and genus level identifications can provide a good representation of species at a fraction of the cost of identifying samples to the species level (James et al. 1995, Balmford et al. 1996, Sanchez et al. 2006). If this is also true in subtidal sand flats used for borrow areas, statistical power could be improved by identifying organisms at a coarser taxonomic resolution in more samples without a substantial increase in cost. This should be further investigated as a potential cost-savings tool.

***Beach***

The width of the subaerial beach within the monitored nourishment area, as measured from the primary dune crest to the high tide line, increased four-fold following the placement of fill material on the shoreface. Following placement, beach width decreased sharply within just three months and continued decreasing such that by twelve months post-nourishment, beach width was 25-50% of the immediate post-construction width. This was likely due at least in part to the expected equilibration of the beach profile as sediments were carried into the intertidal and subtidal zones. However, strong storms during the winter of 2006 likely also played a role in the rapid reduction in beach width, leading to a second emergency nourishment of this beach in winter/spring 2007.

In general, sediment characteristics did not change substantially on the nourished beach and the changes that did occur (sand phi size and TOM) were no longer apparent within 6 months. Recovery of beach sediment characteristics following nourishment has historically been rapid in South Carolina, occurring within one to six months (Van Dolah, et al. 1992; Van Dolah et al. 1994; Jutte et al. 1999b). In these past studies, recovery of benthic invertebrate communities (the base of the consumer food web on beaches) was likewise rapid and sometimes even occurred faster than the full recovery of native sediment characteristics. However, in some cases, changes in sediment characteristics persisted. For example, Jutte et al. (1999b) found that materials dredged from a shallow lens of sand overlying hardbottom and placed on Myrtle Beach contained more carbonate rubble and coarser sands than the native beach sediments.  These conditions persisted for at least six months post-dredging.

Nourishment did not have a clear and consistent impact on ghost crab abundances on Folly Beach.  Areal ghost crab density (individuals per $m^2$) decreased in the nourished area while it increased in the reference area post-nourishment.  However, this response likely reflects a substantial increase in beach width following nourishment rather than a decline in ghost crab abundances.  In fact, linear density (individuals per meter of beach) increased in both areas up to at least three months post nourishment, indicating that ghost crab population sizes at any given point along the shoreface were increasing independent of any effect of nourishment.  The finding here of minimal impact on ghost crab linear densities is consistent with other studies on this species (Peterson et al. 2006; Dixon 2007).

Ghost crab densities within two habitats, dunes and near the tide line, also showed no significant response to nourishment activities. While not significant, there was some evidence of dune ghost crab densities decreasing with increased beach width within each time period.  Ghost crabs forage primarily in the intertidal zone where they prey upon infaunal invertebrates such as surf clams (*Donax* spp) and mole crabs (*Emerita* spp) (Wolcott 1978) and in some cases deposit feed (Robertson and Pfeiffer 1982). Additionally, ovigerous females incubate their eggs within or near their burrows but must release them into the water (Haley 1972, 1973; Negreiros-Fransozo et al. 2002).  Thus, although ghost crabs can create borrows within the supralittoral zone and well into the dune system, they ultimately rely upon access to the intertidal zone for feeding and reproduction.  Greater distances between the primary dunes and the high tide line caused by the addition of beach fill may have acted to fragment the ghost crab habitat by reducing access to water and forage and increasing the risk of predator exposure.

Ghost crab densities near the high tide line behaved almost identically in the nourished and reference areas. While densities decreased immediately following nourishment, likely due to burial of the existing individuals living near the tide line, densities increased markedly 3 months later at all but one site. *Ocypode* spp. tend to show size related habitat differentiation with smaller individuals occupying habitats lower on the beach and larger individuals occupying areas higher on the beach (Strachan et al.1999; Turra et al. 2005). Dixon (2007) found similar size-specific patterns in the ghost crab populations of Folly Beach with juveniles occurring lower on the beach and adults nearer the dunes. That tide line population densities did not show any long-term negative response to nourishment or relationship with increasing beach width is consistent with this habitat being maintained by an influx of new juvenile recruits. Interestingly, this input of juveniles into the nourished areas did not result in the colonization of new habitat created by the addition of beach fill. The lack of colonization is suggested by stagnant dune ghost crab densities in nourished areas and the lack of a substantial increase in linear densities in the nourished area relative to the reference area.

Reference sites always hosted more crabs than nourished sites even prior to nourishment activities. Within the nourished area, houses were located directly behind the primary dune, while the reference area at the far end of Folly Beach was adjacent to undeveloped property. As a result, the nourished area likely sees more pedestrian traffic than the reference area. The numbers of *Ocypode* spp. burrows have been shown to act as a strong indicator of anthropogenic impact on beaches (Barros 2001). More specifically, Neves and Bemvenuti (2006) showed that ghost crab densities were lower on beaches with greater pedestrian and vehicular traffic. In addition to direct impact by trampling of habitat, the difference between nourished and reference areas may reflect the availability of habitat behind the primary dune crest. In the reference area, crab populations landward of the primary dune crest may be acting as a refuge population from which the primary dunes and upper beach may be colonized when smaller scale impacts do occur. However, very little is known about the size or composition of these landward hind-dune populations.

Overall, this pre-existing difference between nourished and reference population densities may have confounded our ability to detect impacts in this study. First, this clearly illustrates the importance of ensuring that beach nourishment monitoring studies follow the Before-After Control-Impact (BACI) design. In a study of nourishment impacts at Bogue Banks, North Carolina, Peterson et al. (2000) reported ghost crab densities on a nourished beach 86-99% lower than on nearby reference beaches. This suggested a very strong reaction to nourishment, but because the authors did not evaluate ghost crab abundances in the same areas prior to nourishment, it is not known whether the two areas supported different abundances prior to nourishment. If the pre-nourishment data were unavailable in the current study, we might have concluded that nourishment had a strong and persistent impact on the ghost crab populations. Second, because the nourished and reference areas began with different densities, density-dependent population growth could result in population sizes changing differently through time even in the absence of nourishment activities. Our current understanding of population dynamics in this species is insufficient to determine whether the changes observed here were due to nourishment impacts or to natural population growth and decline.

Ghost shrimp densities showed no significant relationship to nourishment activities. A sharp but non-significant increase in ghost shrimp densities immediately following and 3 months following nourishment suggest that beach filling may have increased the value of the lower intertidal zone for this species, perhaps by reducing slope and increasing the total amount of habitat available within the swash zone. Bilodeau and Bourgeois (2004) observed that a related ghost shrimp, *Callichirus islagrande*, was generally absent following the nourishment of two beaches in Louisiana, USA, while the shrimp was present at those same beaches prior to nourishment. This pattern was not apparent on Folly Beach.

In general, intertidal counts of ghost shrimp burrows were highly dependent upon the stage of the tide at the time the surveys were performed. Burrows were increasingly abundant closer to the water's edge during low tide and were most dense within the shallow subtidal zone where consistent counts were extremely difficult. Small differences in tidal fluctuations between sampling time frames, even between the two days necessary to perform the surveys, could greatly impact burrow counts. As a result, intertidal burrow counts likely do not provide a consistent and accurate measure of the abundance of this species.

Site-to-site variation was significant and substantial in all biological responses. This variation likely reduced the power of the statistical analyses performed and illustrates the importance of developing well-replicated study designs that represent a broad spatial scale. By sampling multiple sites within the nourished and reference areas, the current monitoring study reduced the chances of drawing erroneous conclusions regarding differences between those areas. Because nourishment proceeded from north to south along Folly Island, the concentration of study sites at the north end of the beach reduced the chances of error introduced by differences in the date on which the impact occurred. However, that same sampling scheme also limited the generalities that could be drawn from the study. Hurlbert (1984) emphasized the importance of properly replicated studies that avoid pseudoreplication (re-sampling of the same experimental units) and of interspersion of treatment effects to avoid spatial autocorrelation. Peterson and Bishop (2005) identified pseudoreplication and interspersion, as well as difficulties with finding truly independent areas to monitor (nourishment of one area of beach may in fact affect adjacent non-nourished beach areas) as major design problems with beach nourishment studies. As with all large scale monitoring programs, these study design issues were balanced against other sources of error. The Folly Beach nourishment project added beach fill to a single continuous band, thus the opportunity to intersperse reference and nourished areas was very limited. While the reference and nourished areas were pseudoreplicated in the strictest sense, there was a need to reduce temporal effects of impact occurring along the beach at different times by localizing sampling at one end of the island. The conditions at each monitoring site were likely dependent, to some extent, upon the conditions at adjacent monitoring sites, but the sampling sites within each area were spread out as much as possible to improve independence. In most projects of this scale, completely removing the effects of pseudoreplication, lack of interspersion, and lack of independence of reference and nourished areas is unlikely within any single study, but the broader interpretation of nourishment impacts on beach systems is possible if studies continue on future nourishment projects.

Several potentially important responses of beach systems to nourishment remain under-investigated including but not limited to local and regional population dynamics, food web structure, energy transfer and storage, nutrient cycling, and ecosystem connectivity. As an example, Dixon (2007) performed a more detailed analysis of ghost crab population size structure in nourished and reference areas of Folly Beach and showed very clear impacts on local population structure. Specifically, entire cohorts were eliminated from populations experiencing beach fill, an impact likely to affect future reproductive output of the local populations. Peterson and Bishop (2005) argued that the longer-term and broader-scale impacts of these kinds of changes should be addressed with a focused effort that includes a modeling component. Future studies should address these unresolved issues and involve experimental components aimed at elucidating driving mechanisms. Only by teasing out the multiple simultaneous mechanisms driving the changes observed in response to nourishment can we begin to make sound management decisions that improve project design parameters and minimize ecological impacts.

## CONCLUSIONS

Dredging resulted in significant and persistent changes in sediment characteristics and biological communities in the borrow area. Sediment composition shifted toward fines and showed little if any evidence of recovery even twelve months post-dredging. These results were consistent with findings in other dredge pits deeper than 1.0 m and located close to a sources of terrigenous sediments such as tidal rivers. The accumulation of fines is likely to make this area unsuitable for future renourishment projects on Folly Beach. Characteristics of the benthic invertebrate community, from broad community indices to species composition, changed in response to dredging and continued to diverge from previous conditions even one year after the cessation of dredging activity. The failure of the community to recover is likely linked to the lack of recovery of native sediment characteristics.

Nourishment had little effect on surficial sediment characteristics and burrowing macroinvertebrates on the beach. Beach width increased post-nourishment as expected, but within 6-12 months had decreased to 25-50% of its post-nourishment width. Overall ghost crab population size did not respond substantially, but the density of ghost crabs near the primary dune showed evidence of being negatively impacted by increasing beach width. Although the nourishment did not affect the density of presumably recently recruited ghost crabs near the high tide line, these individuals did not appear to colonize new beach habitat created by nourishment. Reference and nourished areas on the beach had different ghost crab densities even prior to nourishment occurring, likely reflecting differences in human pedestrian traffic in the two areas. This difference may have confounded our ability to detect the effects of nourishment. Ghost shrimp densities increased at the nourishment area post-nourishment, perhaps due to reduced beach slope and increased habitat availability in the swash zone.  However, determination of ghost shrimp densities within the intertidal zone was highly tide dependent, suggesting this species is not a reliable indicator of beach nourishment impacts.

## RECOMMENDATIONS

1) Minimize the depth of borrow pits, particularly near sources of terrigenous sediment such as tidal rivers and inlets.

Consistent with several other previous studies in which borrow pits were greater than 1.0 m deep and located on the north end of a barrier island near a tidal inlet, silt and clay readily settled into the borrow pit used in this nourishment project. As this pit continues to fill, the underlying lens of fine material deposited within it will prevent this area from being used in future projects. Shallower pits in these areas may prevent the accumulation of fine sediments, and deeper pits should be restricted to those areas in which beach-compatible sand is actively depositing.

2) Perform hydrologic and sediment transport modeling studies prior to borrow pit dredging to ensure sustainable use of borrow areas.

Detailed models could be used to determine what borrow pit depth would minimize the accumulation of fine sediments at various distances from sources of terrigenous sediment. For example, along Folly Beach, shallower pits may be necessary closer to the Charleston Harbor while deeper pits may be possible further south. The goal should be to dredge only to the depth where beach compatible sands re-accumulate for later nourishment projects.

3) Maintain the careful matching of borrow sediments to the beach upon which they will be placed.

This project very effectively matched sediment characteristics within the monitored section of beach. Such close matching has allowed South Carolina's beach ecosystems to recover rapidly from nourishment activities. This practice should be maintained in all future nourishment projects in the State with proper monitoring of dredging operations to ensure incompatible materials are placed on the beach.

4) Require that physical and biological monitoring activities of future nourishment projects meet minimal sampling design criteria.

A Before-After Control-Impact design is critical to controlling for both spatial and temporal variability. Preferably, both impact and reference sites should be monitored at multiple time points both prior to and following dredging or nourishment. As a minimum, pre-impact monitoring should occur immediately prior to the impact and preferably include one or more monitoring events scheduled at six month intervals pre-impact. The post-impact monitoring should occur immediately following the impact as well as at six and twleve months post-impact. Borrow area monitoring should also include a 24-month post-impact sampling event. When possible, multiple interspersed reference and impact areas should be monitored as well.

## LITERATURE CITED

Balmford, A., A.H.M. Jayasuriya, M.J.B. Green. 1996. *Proceeding of the Royal Society of London B* 263:1571-1573.

Barros, F. 2001. Ghost crabs as tools for rapid assessment of human impacts on exposed sandy beaches. *Biological Conservation* 97:399-404.

Bilodeau, A.L., and R.P. Bourgeois. 2004. Impact of beach restoration on the deep-burrowing ghost shrimp, *Callichirus islagrande*. *Journal of Coastal Research* 20: 931-936.

Blake, N.J., L.J. Doyle, and J.J. Culter. 1996. Impacts and direct effects of sand dredging for beach nourishment on the benthic organisms and geology of the West Florida Shelf. Final Report. OCS Report MMS 95-0005. U.S. Department of the Interior, Minerals Management Service, Office of International Activities and Marine Minerals, Herndon, VA. 109pp.

Bowan, P.R., and G.A. Marsh. 1988. Benthic faunal colonization of an offshore borrow pit in southeastern Florida. Miscellaneous Paper D_88-5, US Army Corps of Engineers, Waterways Experiment Station, Vicksburg, MS. 43pp.

Brown, A.C. and A. McLachlan. 1990. Ecology of sandy shores. Elsevier Science Publishing Company, Inc., New York, NY. 328 pp.

Defeo, O., and A. McLachlan. 2005. Patterns, processes and regulatory mechanisms in sand beach macrofauna: a multi-scale analysis. *Marine Ecology Progress Series* 295: 1-20.

Dixon, C.E. 2007. The effects of summer beach nourishment to the Atlantic ghost crab populations on Folly Beach, SC. Masters Thesis, The Graduate School of the College of Charleston. Charleston, SC.

Folk, R.L. 1980. Petrology of sedimentary rocks. Hemphill Publishing Company, Austin, Texas. 185 pp.

Grain, D.A., A.B. Bolten, and K.A. Bjorndal. 1995. Effects of beach nourishment on sea turtles: review and research initiatives. *Restoration Ecology* 3:95-104.

Haley, S.R. 1972. Reproductive cycling in the ghost crab *Ocypode quadrata* (Fabr.) (Brachyura, Ocypodidae). *Crustaceana* 23:1-11.

Haley, S.R. 1973. On the use of morphologic data as a guide to reproductive maturity in the ghost crab *Ocypode ceratophthalmus* (Pallas) (Brachyura, Ocypodidae). *Pacific Science* 27:350-362.

James, R.L., M.P. Lincoln Smith, P.G. Fairweather. 1995. Sieve mesh size and taxonomic resolution to describe natural spatioal variation of marine macrofauna. *Marine Ecology Progress Series* 118:187-198.

Jutte, P.C., R.F. Van Dolah, and M.V. Levisen. 1999a. An environmental monitoring study of the Myrtle Beach renourishment project: intertidal benthic community assessment, Phase II—Myrtle Beach. Final Report, prepared by the South Carolina Marine Resources Research Institute, South Carolina Marine Resources Division, Charleston, SC for the US Army Corps of Engineers, Charleston District. 38pp.

Jutte, P.C., R.F. Van Dolah, and M.V Levisen. 1999b. An environmental monitoring study of the Myrtle Beach renourishment project: physical and biological assessment of offshore sand borrow site, Phase I—Cherry Grove borrow area.

Final Report, prepared by the South Carolina Marine Resources Research Institute, South Carolina Marine Resources Division, Charleston, SC for the US Army Corps of Engineers, Charleston District. 79pp.

Jutte, P.C. and R.F. Van Dolah. 2000. An assessment of benthic infaunal assemblages and sediments in the Joiner Bank and Gaskin Banks borrow areas for the Hilton Head beach renourishment project. Final Report, Marine Resources Research Institute, South Carolina Department of Natural Resources, submitted to Olsen Associates, Inc. and the Town of Hilton Head Island. 34 pp + appendices.

Jutte, P.C., R.F. Van Dolah, G.Y. Ojeda, and P.T. Gayes. 2001a. An environmental monitoring study of the Myrtle Beach renourishment project: physical and biological assessment of the offshore sand borrow site, Phase II—Cane South borrow area. Final Report, prepared by the South Carolina Marine Resources Research Institute, South Carolina Marine Resources Division, Charleston, SC for the US Army Corps of Engineers, Charleston District. 70pp.

Jutte, P.C., L.E. Zimmerman, R.F. Van Dolah, G.Y. Ojeda, and P.T. Gayes. 2001b. An environmental monitoring study of the Myrtle Beach renourishment project: physical and biological assessment of offshore sand borrow sites, Phase III—Surfside borrow area. Final Report, prepared by the South Carolina Marine Resources Research Institute, South Carolina Marine Resources Division, Charleston, SC for the US Army Corps of Engineers, Charleston District. 80pp.

Jutte, P.C., R.F. Van Dolah, and P.T. Gayes. 2002. Recovery of benthic communities following offshore dredging, Myrtle Beach, South Carolina. *Shore and Beach* 70: 25-30.

McLachlan, A. 1996. Physical factors in benthic ecology: effects of changing sand particle size on beach fauna. *Marine Ecology Progress Series* 131: 205-217.

Negreiros-Fransozo, M.L., A. Fransozo, and G. Bertini. 2002. Reproductive cycle and recruitment period of *Ocypode quadrata* (Decapoda, Ocypodidae) at a sandy beach in southeastern Brazil. *Journal of Crustacean Biology* 22:157-161.

Nelson, WG. 1993. Beach restoration in the southeastern US: Environmental effects and biological monitoring. *Ocean and Coastal Management* 19:157-182.

Neves, F.M. and C.E. Bemvenuti. 2006. The ghost crab *Ocypode quadrata* (Fabricus, 1787) as a potential indicator of anthropogenic impact along the Rio Grande do Sul coast, Brazil. *Biological Conservation* 133:431-435.

Nordstrom, KF. 2005. Beach nourishment and coastal habitats: research needs to improve compatibility. *Restoration Ecology* 13:215-222.

NRC (National Research Council). 1995. Beach Nourishment and Protection. National Academy Press, Washington DC. 334pp.

Pequegnat, W.E., L/H. Pequegnat, B.M. James, E.A. Kennedy. R.R. Fay, and A.D. Fredericks. 1981. Procedural guide for designation surveys of ocean dredged material disposal sites. Final Report prepared by TerEce Corp. for U.S. Army Engineer Waterways Experiment Station, Technical Report EL-81-1, 286 pp.

Peterson, C.H., D.H.M. Hickerson, and G.G. Johnson. 2000. Short-term consequences of nourishment and bulldozing on the dominant large invertebrates of a sandy beach. *Journal of Coastal Research* 16: 368-378.

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

Peterson, C.H., M.J. Bishop, G.A. Johnson, L.M. D'Anna, and L.M. Manning. 2006. Exploiting beach filling as an unaffordable experiment: benthic intertidal impacts propagating upwards to shorebirds. *Journal of Experimental Marine Biology and Ecology* 338: 205-221.

Plumb, R.H., Jr. 1981. Procedures for handling and chemical analysis of sediment and water samples, Technical Report EPA ICE-81-1, prepared by Great Lakes Laboratory, State University College at Buffalo, NY, for the U.S. Environmental Protection Agency/Corps of Engineers Technical Committee on Criteria for Dredge and Fill Material. Published by the U.S. Army Corps of Engineers Waterway Experiment Station, Vicksburg, Miussissippi.

Rakocinski, C.F., R.W. Heard, S.E. LeCroy, L.A. McLelland, and T. Simons. 1996. Responses by macrobenthic assemblages to extensive beach restoration at Perdido Key, Florida, USA. *Journal of Coastal Research* 12: 326-353.

Robertson, J.R., W.J. Pfeiffer. 1982. Deposit-feeding by the ghost crab *Ocypode quadrata* (Fabricus). *Journal of Experimental Marine Biology and Ecology* 56:165-177.

Sanchez-Moyano, J.E., D.A. Fa, F.J. Estacio, J.C. Garcia-Gomez. 2006. Monitoring of marine benthic communities and taxonomic resolution: an approach through diverse habitats and substrates along the southern Iberian coastline. *Helgoland Marine Research* 60:243-255.

Simon, J.L. and D.M. Dauer. 1977. Reestablishment of a benthic community following natural defaunation. In: Coull, B. (Ed.) Ecology of Marine Benthos. University of South Carolina Press, Columbia.

Spreybroeck, J. et al. 2006. Beach nourishment: an ecologically sound coastal defence alternative? A review. *Aquatic Conservation: Marine and Freshwater Ecosystems* 16:419-435.

Strachan, P.H., R.C. Smith, D.A.B Hamilton, A.C Taylor, and R.J.A. Atkinson. 1999. Studies on the ecology and behavior of the ghost crab, *Ocypode cursor* (L.) in northern Cyprus. *Scientia Marina* 63:51-60.

Turra, A., M.A.O. Gonçalves, and M.R. Denadai. 2005. Spatial distribution of the ghost crab *Ocypode quadrata* in low-energy tide-dominated sandy beaches. *Journal of Natural History* 39:2163-2177.

Valverde, HR, AC Trembanis, OH Pilkey. 1999. Summary of beach nourishment episodes on the US east coast barrier islands. *Journal of Coastal Research* 15:1100-1118.

Van Dolah, R.F., P.H. Wendt, R.M. Martore, M.V. Levisen, and W.A. Roumillat. 1992. A physical and biological monitoring study of the Hilton Head Beach nourishment project. Final Report, prepared by the South Carolina Marine Resources Research Institute, SC Marine Resources Division for the Town of Hilton Head Island and the South Carolina Coastal Council. 159 pp.

Van Dolah, R.F., R.M. Martore, A.E. Lynch, M.V. Levisen, P.H. Wendt, D.J. Whitaker, and W.D. Anderson. 1994. Environmental Evaluation of the Folly Beach Nourishment Project. Final Report. Prepared by the Marine Resources Division, South Carolina Department of Natural Resources, Charleston, SC for the US Army Corps of Engineers, Charleston District. 155 pp.

Van Dolah, R.F., B.J. Digre, P.T. Gayes, P. Donovan-Ealy, and M.W. Dowd. 1998. An evaluation of physical recovery rates in sand borrow sites used for beach nourishment projects in South Carolina. Final Report. Prepared for The South Carolina Task Force on Offshore Resources and the Minerals Management Service, Office of International activities and Marine Minerals. 76pp.

Wilber, D.H., D.G. Clarke, G.L. Ray, and M. Burlas. 2003. Response of surf zone fish to beach nourishment operations on the northern coast of New Jersey, USA. *Marine Ecology Progress Series* 250: 231-246.

Wolcott, T.G. 1978. Ecological role of ghost crabs, *Ocypode quadrata* (Fabricus) on an ocean beach: scavengers or predators? *Journal of Experimental Marine Biology and Ecology* 31:67-82

Appendix 1. List of station locations and depths for sites sampled at the Folly Beach Borrow (FA) and Reference (FR) areas. Depth is reported in meters. Latitude and longitude are reported in decimal degrees.

| Station | Collection # | Date | Depth | Latitude | Longitude |
|---|---|---|---|---|---|
| FA01 | 50003 | 4/12/2005 | 11.3 | 32.63591 | 79.86961 |
| FA02 | 50004 | 4/12/2005 | 8.5 | 32.64164 | 79.86869 |
| FA03 | 50005 | 4/12/2005 | 8.2 | 32.64181 | 79.86796 |
| FA04 | 50006 | 4/12/2005 | 11.0 | 32.64398 | 79.85493 |
| FA05 | 50007 | 4/12/2005 | 10.4 | 32.63527 | 79.86930 |
| FA06 | 50008 | 4/12/2005 | 9.4 | 32.64209 | 79.86026 |
| FA07 | 50009 | 4/12/2005 | 8.8 | 32.64149 | 79.86456 |
| FA08 | 50010 | 4/12/2005 | 8.5 | 32.64299 | 79.86333 |
| FA09 | 50011 | 4/12/2005 | 9.4 | 32.64367 | 79.86605 |
| FA10 | 50012 | 4/12/2005 | 9.1 | 32.64402 | 79.86196 |
| FR01 | 50027 | 4/12/2005 | 11.3 | 32.63350 | 79.85354 |
| FR02 | 50028 | 4/12/2005 | 12.2 | 32.63769 | 79.85635 |
| FR03 | 50029 | 4/12/2005 | 11.2 | 32.63348 | 79.85390 |
| FR04 | 50030 | 4/12/2005 | 10.1 | 32.63041 | 79.85568 |
| FR05 | 50031 | 4/12/2005 | 11.6 | 32.63787 | 79.85294 |
| FR06 | 50032 | 4/12/2005 | 10.7 | 32.63179 | 79.85635 |
| FR07 | 50033 | 4/12/2005 | 11.6 | 32.63573 | 79.85059 |
| FR08 | 50034 | 4/12/2005 | 11.7 | 32.63293 | 79.86002 |
| FR09 | 50035 | 4/12/2005 | 12.5 | 32.63961 | 79.84787 |
| FR10 | 50036 | 4/12/2005 | 11.9 | 32.63888 | 79.84807 |
| FA02 | 50129 | 11/4/2005 | 12.2 | 32.38500 | 79.52107 |
| FA03 | 50130 | 11/4/2005 | 11.3 | 32.39509 | 79.52067 |
| FA04 | 50131 | 11/4/2005 | 12.2 | 32.38644 | 79.51323 |
| FA06 | 50132 | 11/4/2005 | 11.0 | 32.38520 | 79.51607 |
| FA07 | 50133 | 11/4/2005 | 11.0 | 32.38487 | 79.51878 |
| FA08 | 50134 | 11/4/2005 | 11.6 | 32.38572 | 79.51774 |
| FA10 | 50135 | 11/4/2005 | 12.5 | 32.38634 | 79.51696 |
| FA11 | 50136 | 11/4/2005 | 11.3 | 32.38662 | 79.51444 |
| FA13 | 50137 | 11/4/2005 | 11.9 | 32.38451 | 79.52032 |
| FA14 | 50138 | 11/4/2005 | 10.4 | 32.38570 | 79.51799 |
| FR01 | 50141 | 11/4/2005 | 10.1 | 32.37995 | 79.51200 |
| FR02 | 50142 | 11/4/2005 | 11.3 | 32.38250 | 79.51377 |
| FR03 | 50143 | 11/4/2005 | 10.4 | 32.38001 | 79.51212 |
| FR04 | 50144 | 11/4/2005 | 9.2 | 32.37818 | 79.51322 |
| FR05 | 50145 | 11/4/2005 | 11.6 | 32.38259 | 79.51163 |
| FR06 | 50146 | 11/4/2005 | 9.5 | 32.37896 | 79.51382 |
| FR07 | 50147 | 11/4/2005 | 10.4 | 32.38144 | 79.51023 |
| FR08 | 50148 | 11/4/2005 | 10.4 | 32.37969 | 79.51593 |
| FR09 | 50149 | 11/4/2005 | 11.6 | 32.38374 | 79.50864 |
| FR10 | 50150 | 11/4/2005 | 10.7 | 32.38336 | 79.50877 |
| FA04 | 60183 | 5/4/2006 | 10.4 | 32.64404 | 79.85490 |
| FA06 | 60184 | 5/4/2006 | 10.7 | 32.64206 | 79.86025 |
| FA07 | 60185 | 5/4/2006 | 9.8 | 32.64137 | 79.86469 |
| FA08 | 60186 | 5/4/2006 | 11.0 | 32.64293 | 79.86311 |
| FA10 | 60187 | 5/4/2006 | 11.9 | 32.64386 | 79.86202 |
| FA11 | 60188 | 5/4/2006 | 10.7 | 32.64419 | 79.85728 |

Appendix 1. List of station locations and depths for sites sampled at the Folly Beach Borrow (FA) and Reference (FR) areas. Depth is reported in meters. Latitude and longitude are reported in decimal degrees.

| Station | Collection # | Date | Depth | Latitude | Longitude |
|---|---|---|---|---|---|
| FA13 | 60189 | 5/4/2006 | 11 | 32.64095 | 79.86737 |
| FA14 | 60190 | 5/4/2006 | 10.7 | 32.64285 | 79.86355 |
| FA02 | 60191 | 5/4/2006 | 11.3 | 32.64173 | 79.86862 |
| FA03 | 60192 | 5/4/2006 | 10.7 | 32.64190 | 79.86469 |
| FR01 | 60195 | 5/4/2006 | 10.4 | 32.63350 | 79.85352 |
| FR02 | 60196 | 5/4/2006 | 11.6 | 32.63571 | 79.85632 |
| FR03 | 60197 | 5/4/2006 | 10.7 | 32.63342 | 79.85355 |
| FR04 | 60198 | 5/4/2006 | 10.1 | 32.63024 | 79.85508 |
| FR05 | 60199 | 5/4/2006 | 11.6 | 32.83758 | 79.85313 |
| FR06 | 60200 | 5/4/2006 | 10.1 | 32.63173 | 79.85621 |
| FR07 | 60201 | 5/4/2006 | 11.0 | 32.63575 | 79.85075 |
| FR08 | 60202 | 5/4/2006 | 10.4 | 32.63274 | 79.86021 |
| FR09 | 60203 | 5/4/2006 | 11.6 | 32.63964 | 79.84830 |
| FR10 | 60204 | 5/4/2006 | 11.6 | 32.63890 | 79.84796 |
| FA02 | 60237 | 11/1/2006 | 9.8 | 32.64187 | 79.86977 |
| FA03 | 60238 | 11/1/2006 | 10.7 | 32.64193 | 79.86800 |
| FA04 | 60239 | 11/1/2006 | 10.1 | 32.64334 | 79.85512 |
| FA06 | 60240 | 11/1/2006 | 10.1 | 32.64186 | 79.86033 |
| FA07 | 60241 | 11/1/2006 | 9.8 | 32.64194 | 79.86464 |
| FA08 | 60242 | 11/1/2006 | 10.1 | 32.64281 | 79.86325 |
| FA10 | 60243 | 11/1/2006 | 11.3 | 32.64390 | 79.86183 |
| FA11 | 60244 | 11/1/2006 | 10.4 | 32.64425 | 79.85736 |
| FA13 | 60245 | 11/1/2006 | 10.4 | 32.64087 | 79.86742 |
| FA14 | 60246 | 11/1/2006 | 10.1 | 32.64293 | 79.85429 |
| FR01 | 60249 | 11/1/2006 | 8.8 | 32.63337 | 79.82349 |
| FR02 | 60250 | 11/1/2006 | 9.1 | 32.63753 | 79.85626 |
| FR03 | 60251 | 11/1/2006 | 9.4 | 32.63353 | 79.85361 |
| FR04 | 60252 | 11/1/2006 | 8.8 | 32.63028 | 79.85544 |
| FR05 | 60253 | 11/1/2006 | 10.7 | 32.63773 | 79.85257 |
| FR06 | 60254 | 11/1/2006 | 9.1 | 32.63176 | 79.82635 |
| FR07 | 60255 | 11/1/2006 | 10.4 | 32.63568 | 79.85048 |
| FR08 | 60256 | 11/1/2006 | 9.8 | 32.63280 | 79.86008 |
| FR09 | 60257 | 11/1/2006 | 10.7 | 32.63857 | 79.84889 |
| FR10 | 60258 | 11/1/2006 | 10.4 | 32.63887 | 79.84803 |

Appendix 2. Characteristics of surficial sediment cores collected from grab samples taken at Folly Borrow Area (FA) and Reference Area (FR) from April 2005 through November 2006. VF = very fine sand, F = fine sand, M = medium sand, C = coarse sand. MW = medium well, W = well, P = poor, M = medium. SD = standard deviation. Organic matter content reported as percent.

| Station | Percent Sand | Percent Silt/Clay | Percent $CaCO_3$ | Organic Matter | $\bar{X}$ | Size Class | SD | Sorting Descr. | Mode |
|---|---|---|---|---|---|---|---|---|---|
| **April 12, 2005 pre nourishment sampling** | | | | | | | | | |
| FA01 | 85.0 | 6.1 | 8.9 | 1.4 | 2.9 | F | 0.748 | M | 3.5 |
| FA02 | 20.6 | 2.4 | 77.0 | 1.9 | 1.4 | M | 0.731 | M | 1.5 |
| FA03 | 39.2 | 2.2 | 58.6 | 1.9 | 1.6 | M | 0.787 | M | 1.5 |
| FA04 | 47.0 | 49.5 | 3.5 | 8.1 | 2.6 | F | 0.737 | M | 3.0 |
| FA05 | 91.1 | 1.0 | 7.9 | 0.9 | 2.6 | F | 0.625 | MW | 3.0 |
| FA06 | 82.9 | 1.6 | 15.5 | 0.8 | 2.3 | F | 0.544 | MW | 2.5 |
| FA07 | 88.3 | 2.5 | 9.3 | 0.9 | 2.8 | F | 0.532 | MW | 3.0 |
| FA08 | 50.6 | 1.9 | 47.6 | 1.5 | 1.6 | M | 0.775 | M | 1.5 |
| FA09 | 61.1 | 0.8 | 38.1 | 1.7 | 1.7 | M | 0.737 | M | 1.5 |
| FA10 | 58.4 | 3.7 | 37.9 | 1.4 | 2.2 | F | 0.914 | M | 3.0 |
| **Mean** | **62.4** | **7.2** | **30.4** | **2.0** | **2.2** | | | | |
| **April 12, 2005 pre nourishment sampling** | | | | | | | | | |
| FR01 | 62.1 | 1.3 | 36.6 | 1.4 | 1.4 | M | 0.811 | M | 1.5 |
| FR02 | 65.4 | 5.0 | 29.6 | 1.6 | 1.6 | M | 1.434 | P | 1.0 |
| FR03 | 48.9 | 1.9 | 49.3 | 1.9 | 0.7 | C | 0.819 | M | 1.0 |
| FR04 | 62.0 | 2.3 | 35.7 | 1.6 | 1.1 | M | 0.673 | MW | 1.0 |
| FR05 | 77.0 | 2.0 | 21.0 | 0.8 | 0.9 | C | 0.771 | M | 1.0 |
| FR06 | 54.9 | 1.6 | 43.5 | 1.7 | 1.3 | M | 0.853 | M | 1.5 |
| FR07 | 63.0 | 1.4 | 35.6 | 1.7 | 1.0 | M | 0.890 | M | 1.5 |
| FR08 | 57.7 | 4.2 | 38.1 | 1.4 | 1.6 | M | 0.836 | M | 1.5 |
| FR09 | 82.4 | 1.7 | 15.9 | 0.9 | 1.5 | M | 1.016 | P | 3.0 |
| FR10 | 90.3 | 1.3 | 8.3 | 0.5 | 0.8 | C | 0.625 | MW | 1.0 |
| **Mean** | **66.4** | **2.3** | **31.4** | **1.4** | **1.2** | | | | |
| **November 4, 2005 immediate post nourishment sampling** | | | | | | | | | |
| FA02 | 84.1 | 4.6 | 11.3 | 1.5 | 3.1 | VF | 0.464 | W | 3.5 |
| FA03 | 9.3 | 88.2 | 2.5 | 20.0 | 3.4 | VF | 0.552 | MW | 4.0 |
| FA04 | 71.7 | 26.2 | 2.1 | 3.4 | 3.0 | VF | 0.467 | W | 3.0 |
| FA06 | 93.6 | 2.4 | 4.0 | 1.1 | 2.8 | F | 0.447 | W | 3.0 |
| FA07 | 92.2 | 3.2 | 4.6 | 1.5 | 3.2 | VF | 0.363 | W | 3.5 |
| FA08 | 93.8 | 3.2 | 3.0 | 1.3 | 2.7 | F | 0.477 | W | 3.0 |
| FA10 | 1.2 | 96.8 | 1.9 | 24.9 | 3.2 | VF | 0.942 | M | 4.0 |
| FA11 | 78.0 | 14.9 | 7.0 | 3.2 | 3.1 | VF | 0.516 | MW | 3.5 |
| FA13 | 91.6 | 2.5 | 5.9 | 1.2 | 3.0 | VF | 0.405 | W | 3.0 |
| FA14 | 93.9 | 2.6 | 3.5 | 0.9 | 2.7 | F | 0.481 | W | **3.0** |
| **Mean** | **70.9** | **24.5** | **4.6** | **5.9** | **3.0** | | | | |
| **November 4, 2005 immediate post nourishment sampling** | | | | | | | | | |
| FR01 | 65.3 | 1.5 | 33.2 | 1.5 | 1.7 | M | 0.796 | M | 1.5 |
| FR02 | 86.2 | 2.2 | 11.7 | 1.1 | 2.5 | F | 0.993 | M | 3.0 |
| FR03 | 56.9 | 1.9 | 41.2 | 1.8 | 1.6 | M | 1.021 | P | 1.5 |
| FR04 | 50.5 | 1.4 | 48.1 | 1.8 | 2.1 | F | 0.704 | MW | 2.0 |
| FR05 | 78.7 | 1.7 | 19.6 | 0.7 | 0.9 | C | 0.771 | M | 1.0 |
| FR06 | 62.4 | 1.1 | 36.6 | 1.4 | 1.2 | M | 0.789 | M | 1.5 |
| FR07 | 66.8 | 1.1 | 32.1 | 1.5 | 0.9 | C | 0.759 | M | 1.0 |
| FR08 | 82.9 | 1.3 | 15.8 | 0.9 | 2.4 | F | 0.725 | M | 3.0 |
| FR09 | 71.1 | 1.9 | 27.0 | 1.2 | 1.8 | M | 1.068 | P | 3.0 |
| FR10 | 85.9 | 1.6 | 12.5 | 0.7 | 0.8 | C | 0.870 | M | 1.0 |
| **Mean** | **70.7** | **1.6** | **27.8** | **1.3** | **1.6** | | | | |

Appendix 2. Characteristics of surficial sediment cores collected from grab samples taken at Folly Borrow Area(FA) and Reference Area (FR) from April 2005 through November 2006. VF = very fine sand, F = fine sand, M = medium sand, C = coarse sand. MW = medium well, W = well, P = poor, M = medium. SD = standard deviation. Organic matter content reported as percent.

| Station | Percent Sand | Percent Silt/Clay | Percent $CaCO_3$ | Organic Matter | $\bar{X}$ | Size Class | SD | Sorting Descr. | Mode |
|---|---|---|---|---|---|---|---|---|---|
| **May 4, 2006 6 months post nourishment sampling** | | | | | | | | | |
| FA02 | 84.4 | 7.5 | 8.1 | 1.5 | 3.2 | VF | 0.412 | W | 3.5 |
| FA03 | 78.1 | 13.6 | 8.3 | 1.6 | 3.2 | VF | 0.455 | W | 3.5 |
| FA04 | 82.2 | 9.6 | 8.2 | 0.6 | 3.7 | VF | 1.898 | P | 3.0 |
| FA06 | 86.9 | 8.2 | 4.9 | 1.0 | 2.7 | F | 0.519 | MW | 3.0 |
| FA07 | 83.9 | 9.6 | 6.5 | 0.9 | 3.2 | VF | 0.413 | W | 3.5 |
| FA08 | 90.5 | 4.6 | 5.0 | 1.0 | 2.9 | F | 0.433 | W | 3.0 |
| FA10 | 1.1 | 85.1 | 13.8 | 12.7 | 3.6 | VF | 0.425 | W | 4.0 |
| FA11 | 88.2 | 4.2 | 7.7 | 1.0 | 2.6 | F | 0.629 | MW | 3.0 |
| FA13 | 69.4 | 21.5 | 9.1 | 3.1 | 3.3 | VF | 0.418 | W | 3.5 |
| FA14 | 91.8 | 3.7 | 4.5 | 0.7 | 2.9 | F | 0.428 | W | 3.0 |
| **Mean** | **75.6** | **16.8** | **7.6** | **2.4** | **3.1** | | | | |
| **May 4, 2006 6 months post nourishment sampling** | | | | | | | | | |
| FR01 | 55.5 | 1.3 | 43.2 | 1.8 | 1.6 | M | 0.879 | M | 1.5 |
| FR02 | 72.9 | 13.2 | 13.9 | 1.3 | 1.3 | M | 1.338 | P | 1 |
| FR03 | 60.0 | 5.8 | 34.2 | 1.4 | 1.5 | M | 0.935 | M | 1.5 |
| FR04 | 68.6 | 2.2 | 29.2 | 1.4 | 1.6 | M | 0.706 | MW | 1.5 |
| FR05 | 74.2 | 0.2 | 25.6 | 0.7 | 1.0 | C | 0.825 | M | 1.0 |
| FR06 | 58.0 | 9.0 | 33.0 | 1.2 | 1.5 | M | 0.911 | M | 1.5 |
| FR07 | 64.1 | 7.4 | 28.6 | 1.2 | 1.6 | M | 0.812 | M | 1.5 |
| FR08 | 81.9 | 1.4 | 16.7 | 0.8 | 2.3 | F | 0.638 | MW | 3.0 |
| FR09 | 85.0 | 1.6 | 13.5 | 0.8 | 0.8 | C | 0.779 | M | 1.0 |
| FR10 | 82.4 | 1.8 | 15.8 | 0.6 | 0.8 | C | 0.806 | M | 1.0 |
| **Mean** | **70.3** | **4.4** | **25.4** | **1.1** | **1.4** | | | | |
| **November 1, 2006 12 months post nourishment sampling** | | | | | | | | | |
| FA02 | 30.1 | 63.1 | 6.8 | 8.5 | 3.4 | VF | 0.417 | W | 4.0 |
| FA03 | 32.0 | 60.1 | 7.9 | 10.2 | 3.4 | VF | 0.461 | W | 4.0 |
| FA04 | 92.1 | 2.1 | 5.8 | 1.1 | 2.7 | F | 0.583 | MW | 3.0 |
| FA06 | 92.3 | 2.2 | 5.5 | 1.5 | 2.8 | F | 0.468 | W | 3.0 |
| FA07 | 89.2 | 4.8 | 6.0 | 1.6 | 3.1 | VF | 0.392 | W | 3.5 |
| FA08 | 20.8 | 75.3 | 3.9 | 1.5 | 3.0 | F | 1.097 | P | 3.5 |
| FA10 | 91.2 | 2.8 | 6.1 | 13.8 | 2.9 | F | 0.436 | W | 3.0 |
| FA11 | 78.0 | 6.1 | 15.9 | 1.6 | 2.7 | F | 0.608 | MW | 3.0 |
| FA13 | 72.9 | 16.6 | 10.5 | 1.1 | 3.3 | VF | 0.435 | W | 3.5 |
| FA14 | 91.1 | 2.5 | 6.5 | 4.0 | 2.7 | F | 0.509 | MW | 3.0 |
| **Mean** | **69.0** | **23.5** | **7.5** | **4.5** | **3.0** | | | | |
| **November 1, 2006 12 months post nourishment sampling** | | | | | | | | | |
| FR01 | 48.2 | 1.0 | 50.8 | 2.1 | 1.2 | M | 0.954 | M | 1.5 |
| FR02 | 74.8 | 0.7 | 24.5 | 0.7 | 1.7 | M | 1.043 | P | 1.0 |
| FR04 | 80.7 | 5.6 | 13.6 | 1.7 | 0.8 | C | 0.752 | M | 1.5 |
| FR05 | 57.6 | 0.8 | 41.6 | 1.6 | 1.3 | M | 1.035 | P | 1.0 |
| FR06 | 67.5 | 0.5 | 32.0 | 1.6 | 1.2 | M | 0.824 | M | 1.5 |
| FR07 | 47.1 | 0.1 | 52.8 | 2.1 | 1.2 | M | 0.904 | M | 1.5 |
| FR08 | 78.9 | 0.1 | 21.0 | 1.0 | 2.4 | F | 0.569 | MW | 1.5 |
| FR09 | 78.9 | 0.5 | 20.6 | 1.6 | 0.5 | C | 0.695 | MW | 3.0 |
| FR10 | 81.7 | 0.3 | 18.1 | 0.9 | 0.6 | C | 0.698 | MW | 1.0 |
| **Mean** | **68.4** | **1.1** | **30.6** | **1.5** | **1.2** | | | | |

Appendix 3. Characteristics of composite sediment cores collected from Folly Beach at Nourished beach sites (FN) and control beach sites (FC) from April 2005 through May 2006. VF = very fine sand, F = fine sand, M = medium sand, C = coarse sand. MW = medium well, W = well, P = poor, M = medium. SD = standard deviation. Organic matter content reported as percent.

| Station | Percent Sand | Percent Silt/Clay | Percent $CaCO_3$ | Organic Matter | $\bar{X}$ | Size Class | SD | Sorting Descr. | Mode |
|---|---|---|---|---|---|---|---|---|---|
| **April 5, 2005 pre nourishment sampling** | | | | | | | | | |
| FN01 | 88.2 | 1.6 | 10.2 | 0.9 | 1.8 | M | 0.530 | MW | 2.0 |
| FN01 | 89.7 | 1.5 | 8.7 | 1.1 | 2.3 | F | 0.596 | MW | 3.0 |
| FN01 | 88.0 | 1.1 | 10.9 | 1.2 | 2.3 | F | 0.547 | MW | 2.5 |
| FN01 | 89.4 | 1.4 | 9.2 | 1.1 | 2.5 | F | 0.552 | MW | 3.0 |
| FN01 | 89.5 | 1.6 | 8.9 | 0.7 | 2.5 | F | 0.549 | MW | 3.0 |
| FN02 | 89.5 | 1.7 | 8.8 | 0.8 | 2.4 | F | 0.567 | MW | 2.5 |
| FN02 | 90.3 | 1.5 | 8.2 | 0.9 | 2.5 | F | 0.634 | MW | 3.0 |
| FN02 | 86.8 | 1.7 | 11.5 | 1.0 | 2.4 | F | 0.551 | MW | 3.0 |
| FN02 | 88.7 | 1.0 | 10.3 | 1.1 | 2.5 | F | 0.576 | MW | 3.0 |
| FN02 | 90.8 | 1.4 | 7.8 | 1.1 | 2.4 | F | 0.531 | MW | 2.5 |
| FN03 | 81.2 | 1.4 | 17.4 | 0.9 | 2.3 | F | 0.691 | MW | 3.0 |
| FN03 | 83.1 | 1.9 | 15.0 | 1.2 | 2.3 | F | 0.592 | MW | 2.5 |
| FN03 | 82.6 | 2.0 | 15.4 | 1.2 | 2.4 | F | 0.604 | MW | 3.0 |
| FN03 | 86.2 | 1.8 | 12.0 | 1.0 | 2.4 | F | 0.568 | MW | 3.0 |
| FN03 | 81.1 | 2.1 | 16.8 | 1.2 | 2.4 | F | 0.570 | MW | 3.0 |
| **Mean** | **87.0** | **1.6** | **11.4** | **1.0** | **2.4** | | | | |
| **April 5, 2005 pre nourishment sampling** | | | | | | | | | |
| FC01 | 89.4 | 1.8 | 8.7 | 2.3 | 2.5 | F | 0.548 | MW | 3.0 |
| FC01 | 85.7 | 1.8 | 12.5 | 1.6 | 1.9 | M | 0.588 | MW | 2.0 |
| FC01 | 88.4 | 1.8 | 9.8 | 0.9 | 2.5 | F | 0.544 | MW | 3.0 |
| FC01 | 84.7 | 2.2 | 13.1 | 1.6 | 2.4 | F | 0.557 | MW | 2.5 |
| FC01 | 84.5 | 1.9 | 13.6 | 1.7 | 2.4 | F | 0.593 | MW | 2.5 |
| FC02 | 82.5 | 0.8 | 16.7 | 0.9 | 2.4 | F | 0.594 | MW | 3.0 |
| FC02 | 79.7 | 2.0 | 18.3 | 1.1 | 1.7 | M | 0.625 | MW | 2.0 |
| FC02 | 81.6 | 1.7 | 16.6 | 1.0 | 2.3 | F | 0.678 | MW | 3.0 |
| FC02 | 84.0 | 1.6 | 14.4 | 2.3 | 2.4 | F | 0.614 | MW | 3.0 |
| FC02 | 78.6 | 1.2 | 20.2 | 1.8 | 2.2 | F | 0.707 | MW | 2.5 |
| FC03 | 82.3 | 2.8 | 15.0 | 1.0 | 2.2 | F | 0.622 | MW | 2.5 |
| FC03 | 80.6 | 2.1 | 17.3 | 2.1 | 2.2 | F | 0.608 | MW | 2.5 |
| FC03 | 68.0 | 2.3 | 29.7 | 1.4 | 2.2 | F | 0.658 | MW | 2.5 |
| FC03 | 83.7 | 2.5 | 13.8 | 1.3 | 2.3 | F | 0.566 | MW | 2.5 |
| FC03 | 82.8 | 2.6 | 14.6 | 1.1 | 2.4 | F | 0.611 | MW | 3.0 |
| **Mean** | **82.4** | **1.9** | **15.6** | **1.5** | **2.3** | | | | |
| **June 8, 2005 immediate post nourishment sampling** | | | | | | | | | |
| FN02 | 94.3 | 0.6 | 5.1 | 0.4 | 2.2 | F | 0.603 | MW | 2.5 |
| FN02 | 96.6 | 0.7 | 2.6 | 0.4 | 2.2 | F | 0.502 | MW | 2.5 |
| FN02 | 97.8 | 0.6 | 1.6 | 0.4 | 1.9 | M | 0.567 | MW | 2.0 |
| FN02 | 97.4 | 0.8 | 1.8 | 0.4 | 2.3 | F | 0.479 | W | 2.5 |
| FN02 | 97.7 | 0.6 | 1.7 | 0.4 | 2.3 | F | 0.510 | MW | 2.5 |
| FN03 | 91.8 | 1.1 | 7.1 | 0.5 | 2.1 | F | 0.739 | M | 2.5 |
| FN03 | 93.3 | 1.4 | 5.3 | 0.4 | no data | no data | no data | no data | no data |
| FN03 | 91.8 | 1.2 | 7.0 | 0.5 | 2.3 | F | 0.814 | M | 3.0 |
| FN03 | 85.5 | 0.9 | 13.6 | 0.6 | 2.1 | F | 0.736 | M | 2.5 |
| FN03 | 84.6 | 1.0 | 14.4 | 0.6 | 2.1 | F | 0.766 | M | 2.5 |
| **Mean** | **93.1** | **0.9** | **6.0** | **0.5** | **2.2** | | | | |

Appendix 3. Characteristics of composite sediment cores collected from Folly Beach at Nourished beach sites (FN) and control beach sites (FC) from April 2005 through May 2006. VF = very fine sand, F = fine sand, M = medium sand, C = coarse sand. MW = medium well, W = well, P = poor, M = medium. SD = standard deviation. Organic matter content reported as percent.

| Station | Percent Sand | Percent Silt/Clay | Percent $CaCO_3$ | Organic Matter | $\bar{X}$ | Size Class | SD | Sorting Descr. | Mode |
|---|---|---|---|---|---|---|---|---|---|
| **June 9, 2005 immediate post nourishment sampling** | | | | | | | | | |
| FC01 | 87.5 | 0.7 | 11.8 | 1.06148 | 2.5 | F | 0.600 | MW | 3.0 |
| FC01 | 81.7 | 1.4 | 16.9 | 1.0 | 2.3 | F | 0.777 | M | 3.0 |
| FC01 | 86.9 | 0.7 | 12.3 | 1.0 | 2.5 | F | 0.612 | MW | 3.0 |
| FC01 | 89.1 | 1.1 | 9.8 | 1.2 | 2.5 | F | 0.539 | MW | 3.0 |
| FC01 | 90.4 | 0.8 | 8.8 | 1.0 | 2.5 | F | 0.496 | W | 3.0 |
| FC02 | 84.7 | 2.0 | 13.2 | 0.9 | 2.5 | F | 0.531 | MW | 3.0 |
| FC02 | 88.9 | 2.2 | 8.9 | 1.0 | 2.5 | F | 0.548 | MW | 3.0 |
| FC02 | 86.0 | 2.0 | 12.0 | 1.2 | 2.4 | F | 0.543 | MW | 2.5 |
| FC02 | 87.4 | 2.1 | 10.5 | 1.0 | 2.5 | F | 0.609 | MW | 3.0 |
| FC02 | 90.5 | 1.9 | 7.5 | 1.1 | 2.5 | F | 0.497 | W | 3.0 |
| FC03 | 90.2 | 1.9 | 7.8 | 1.0 | 2.5 | F | 0.562 | MW | 3.0 |
| FC03 | 91.0 | 1.8 | 7.2 | 1.0 | 2.5 | F | 0.539 | MW | 3.0 |
| FC03 | 88.0 | 2.0 | 10.0 | 1.1 | 2.4 | F | 0.552 | MW | 3.0 |
| FC03 | 87.7 | 2.0 | 10.3 | 1.2 | 2.5 | F | 0.558 | MW | 3.0 |
| FC03 | 90.8 | 2.0 | 7.2 | 1.0 | 2.7 | F | 0.592 | MW | 3.0 |
| **Mean** | **88.1** | **1.6** | **10.3** | **1.0** | **2.5** | | | | |
| | | | | | | | | | |
| **September 15, 2005 3 months post nourishment sampling** | | | | | | | | | |
| FN01 | 86.7 | 1.6 | 11.7 | 0.9 | 2.2 | F | 0.698 | MW | 2.5 |
| FN01 | 89.4 | 1.6 | 9.0 | 0.8 | 2.2 | F | 0.716 | M | 2.5 |
| FN01 | 87.2 | 1.5 | 11.3 | 0.9 | 2.2 | F | 0.708 | MW | 2.5 |
| FN01 | 85.3 | 1.6 | 13.1 | 0.8 | 2.2 | F | 0.759 | M | 2.5 |
| FN01 | 85.5 | 1.5 | 13.0 | 0.9 | 2.1 | F | 0.718 | M | 2.5 |
| FN02 | 76.7 | 1.3 | 22.1 | 0.8 | 2.0 | F | 0.873 | M | 2.5 |
| FN02 | 77.4 | 1.2 | 21.5 | 0.7 | 2.0 | F | 0.826 | M | 2.5 |
| FN02 | 83.4 | 1.6 | 15.0 | 0.6 | 2.1 | F | 0.912 | M | 3.0 |
| FN02 | 82.4 | 1.0 | 16.6 | 0.7 | 2.1 | F | 0.920 | M | 2.5 |
| FN02 | 85.3 | 0.8 | 13.9 | 0.7 | 2.1 | F | 0.801 | M | 2.5 |
| FN03 | 72.8 | 1.6 | 25.7 | 0.7 | 2.1 | F | 0.836 | M | 2.5 |
| FN03 | 71.1 | 1.3 | 27.5 | 1.0 | 2.1 | F | 0.879 | M | 3.0 |
| FN03 | 75.4 | 1.8 | 22.8 | 0.9 | 2.2 | F | 0.781 | M | 2.5 |
| FN03 | 70.8 | 1.5 | 27.7 | 0.8 | 1.9 | M | 0.905 | M | 2.5 |
| FN03 | 76.6 | 1.4 | 22.0 | 0.9 | 2.1 | F | 0.836 | M | 2.5 |
| **Mean** | **80.4** | **1.4** | **18.2** | **0.8** | **2.1** | | | | |
| | | | | | | | | | |
| **September 15, 2005 3 months post nourishment sampling** | | | | | | | | | |
| FC01 | 80.5 | 2.1 | 17.3 | 0.9 | 2.3 | F | 0.747 | M | 3.0 |
| FC01 | 76.8 | 3.2 | 20.0 | 1.0 | 2.5 | F | 0.751 | M | 3.0 |
| FC01 | 85.9 | 1.9 | 12.3 | 0.9 | 2.4 | F | 0.715 | M | 3.0 |
| FC01 | 82.8 | 2.1 | 15.2 | 0.9 | 2.5 | F | 0.621 | MW | 3.0 |
| FC01 | 70.3 | 1.6 | 28.1 | 0.7 | 2.4 | F | 0.670 | MW | 3.0 |
| FC02 | 84.6 | 0.9 | 14.5 | 0.9 | 2.4 | F | 0.630 | MW | 2.5 |
| FC02 | 80.5 | 1.0 | 18.5 | 0.9 | 2.3 | F | 0.693 | MW | 3.0 |
| FC02 | 75.7 | 1.2 | 23.1 | 1.0 | 2.2 | F | 0.791 | M | 3.0 |
| FC02 | 85.9 | 1.0 | 13.1 | 0.8 | 2.2 | F | 0.665 | MW | 2.5 |
| FC02 | 78.7 | 1.3 | 20.0 | 1.0 | 2.5 | F | 0.656 | MW | 3.0 |
| FC03 | 79.9 | 1.7 | 18.4 | 0.8 | 2.4 | F | 0.693 | MW | 3.0 |
| FC03 | 88.1 | 1.7 | 10.3 | 0.9 | 2.5 | F | 0.582 | MW | 3.0 |
| FC03 | 84.1 | 1.5 | 14.4 | 0.8 | 2.4 | F | 0.685 | MW | 3.0 |
| FC03 | 90.4 | 1.7 | 7.9 | 0.9 | 2.4 | F | 0.538 | MW | 2.5 |
| FC03 | 82.3 | 1.6 | 16.0 | 0.5 | 2.5 | F | 0.593 | MW | 3.0 |
| **Mean** | **81.8** | **1.6** | **16.6** | **0.9** | **2.4** | | | | |

Appendix 3. Characteristics of composite sediment cores collected from Folly Beach at Nourished beach sites (FN) and control beach sites (FC) from April 2005 through May 2006. VF = very fine sand, F = fine sand, M = medium sand, C = coarse sand. MW = medium well, W = well, P = poor, M = medium. SD = standard deviation. Organic matter content reported as percent.

| Station | Percent Sand | Percent Silt/Clay | Percent $CaCO_3$ | Organic Matter | $\bar{X}$ | Size Class | SD | Sorting Descr. | Mode |
|---|---|---|---|---|---|---|---|---|---|
| **January 3, 2006 6 months post nourishment sampling** | | | | | | | | | |
| FN01 | 92.0 | 1.8 | 6.2 | 0.6 | 2.2 | F | 0.563 | MW | 2.5 |
| FN01 | 94.7 | 1.7 | 3.6 | 0.6 | 2.3 | F | 0.520 | MW | 3.0 |
| FN01 | 92.7 | 1.6 | 5.7 | 1.5 | 2.1 | F | 0.528 | MW | 2.5 |
| FN01 | 90.6 | 1.7 | 7.7 | 0.6 | 2.2 | F | 0.627 | MW | 3.0 |
| FN01 | 91.1 | 1.8 | 7.2 | 0.6 | 2.2 | F | 0.536 | MW | 3.0 |
| FN02 | 89.8 | 1.7 | 8.5 | 0.6 | 2.4 | F | 0.631 | MW | 3.0 |
| FN02 | 93.8 | 1.7 | 4.5 | 0.6 | 2.3 | F | 0.512 | MW | 2.5 |
| FN02 | 89.6 | 2.0 | 8.4 | 0.6 | 2.2 | F | 0.689 | MW | 3.0 |
| FN02 | 90.4 | 2.0 | 7.7 | 0.7 | 2.2 | F | 0.582 | MW | 3.0 |
| FN02 | 86.5 | 2.0 | 11.5 | 0.7 | 2.3 | F | 0.688 | MW | 3.0 |
| FN03 | 93.5 | 1.7 | 4.8 | 0.6 | 2.4 | F | 0.477 | W | 2.5 |
| FN03 | 93.4 | 2.0 | 4.6 | 0.6 | 2.5 | F | 0.574 | MW | 2.5 |
| FN03 | 92.8 | 2.0 | 5.2 | 0.6 | 2.5 | F | 0.531 | MW | 3.0 |
| FN03 | 93.2 | 1.6 | 5.2 | 0.6 | 2.3 | F | 0.574 | MW | 2.5 |
| FN03 | 92.4 | 2.0 | 5.6 | 0.6 | 2.3 | F | 0.625 | MW | 2.5 |
| **Mean** | **91.8** | **1.8** | **6.4** | **0.7** | **2.3** | | | | |
| **January 4, 2006 6 months post nourishment sampling** | | | | | | | | | |
| FC01 | 93.1 | 1.8 | 5.2 | 0.7 | 2.4 | F | 0.497 | W | 3 |
| FC01 | 93.5 | 1.9 | 4.6 | 0.9 | 2.3 | F | 0.438 | W | 2.5 |
| FC01 | 91.8 | 1.9 | 6.2 | 0.5 | 2.4 | F | 0.529 | MW | 2.5 |
| FC01 | 91.3 | 2.0 | 6.7 | 1.0 | 2.3 | F | 0.501 | MW | 2.5 |
| FC01 | 91.1 | 2.0 | 6.9 | 0.6 | 2.3 | F | 0.579 | MW | 2.5 |
| FC02 | 78.8 | 1.6 | 19.7 | 0.6 | 2.2 | F | 0.554 | MW | 2.5 |
| FC02 | 88.6 | 1.9 | 9.4 | 1.0 | 2.2 | F | 0.587 | MW | 2.5 |
| FC02 | 88.9 | 1.7 | 9.4 | 0.6 | 2.2 | F | 0.540 | MW | 2.5 |
| FC02 | 84.2 | 1.8 | 14.0 | 0.7 | 2.2 | F | 0.656 | MW | 2.5 |
| FC02 | 85.5 | 2.1 | 12.4 | 0.7 | 2.3 | F | 0.525 | MW | 2.5 |
| FC03 | 84.0 | 1.7 | 14.4 | 0.6 | 2.1 | F | 0.625 | MW | 2.5 |
| FC03 | 87.0 | 1.9 | 11.1 | 0.6 | 2.2 | F | 0.591 | MW | 2.5 |
| FC03 | 87.8 | 1.8 | 10.4 | 0.6 | 2.1 | F | 0.616 | MW | 2.5 |
| FC03 | 88.5 | 1.8 | 9.7 | 0.6 | 2.2 | F | 0.496 | W | 2.5 |
| FC03 | 83.8 | 1.8 | 14.4 | 0.6 | 2.2 | F | 0.672 | MW | 2.5 |
| **Mean** | **87.9** | **1.8** | **10.3** | **0.7** | **2.2** | | | | |
| **May 24, 2006 12 months post nourishment sampling** | | | | | | | | | |
| FN01 | 84.3 | 2.2 | 13.5 | 0.6 | 2.1 | F | 0.674 | MW | 2.5 |
| FN01 | 84.8 | 1.7 | 13.4 | 0.6 | 2.0 | F | 0.639 | MW | 2.5 |
| FN01 | 84.8 | 2.9 | 12.3 | 0.7 | 2.0 | F | 0.710 | M | 2.5 |
| FN01 | 88.7 | 2.1 | 9.2 | 0.5 | 2.1 | F | 0.676 | MW | 2.5 |
| FN01 | 89.6 | 0.6 | 9.8 | 0.6 | 2.1 | F | 0.635 | MW | 2.5 |
| FN02 | 90.0 | 1.6 | 8.4 | 0.5 | 2.2 | F | 0.699 | MW | 3.0 |
| FN02 | 85.9 | 1.6 | 12.5 | 0.6 | 2.0 | M | 0.678 | MW | 2.5 |
| FN02 | 89.3 | 1.5 | 9.2 | 0.7 | 2.0 | F | 0.681 | MW | 2.5 |
| FN02 | 90.5 | 1.8 | 7.7 | 0.7 | 2.1 | F | 0.621 | MW | 2.5 |
| FN02 | 83.5 | 2.0 | 14.5 | 0.6 | 1.9 | M | 0.788 | M | 3.0 |
| FN03 | 92.9 | 1.7 | 5.4 | 0.6 | 2.3 | F | 0.512 | MW | 2.5 |
| FN03 | 92.5 | 1.4 | 6.1 | 0.4 | 2.3 | F | 0.593 | MW | 3.0 |
| FN03 | 95.5 | 0.0 | 4.4 | 0.2 | 2.3 | F | 0.499 | W | 2.5 |
| FN03 | 94.4 | 1.3 | 4.3 | 0.5 | 2.2 | F | 0.576 | MW | 2.5 |
| FN03 | 91.9 | 1.9 | 6.1 | 1.0 | 2.2 | F | 0.514 | MW | 2.5 |
| | **89.2** | **1.6** | **9.1** | **0.6** | **2.1** | | | | |

Appendix 3. Characteristics of composite sediment cores collected from Folly Beach at Nourished beach sites (FN) and control beach sites (FC) from April 2005 through May 2006. VF = very fine sand, F = fine sand, M = medium sand, C = coarse sand. MW = medium well, W = well, P = poor, M = medium. SD = standard deviation. Organic matter content reported as percent.

| Station | Percent Sand | Percent Silt/Clay | Percent $CaCO_3$ | Organic Matter | $\bar{X}$ | Size Class | SD | Sorting Descr. | Mode |
|---|---|---|---|---|---|---|---|---|---|
| **May 25-26, 2006 12 months post nourishment sampling** | | | | | | | | | |
| FC01 | 92.7 | 1.1 | 6.2 | 0.4 | 2.2 | F | 0.581 | MW | 2.5 |
| FC01 | 93.3 | 1.1 | 5.6 | 0.4 | 2.2 | F | 0.565 | MW | 2.5 |
| FC01 | 87.4 | 1.7 | 10.9 | 0.5 | 2.2 | F | 0.614 | MW | 2.5 |
| FC01 | 91.7 | 1.3 | 7.0 | 0.5 | 2.2 | F | 0.612 | MW | 2.5 |
| FC01 | 92.3 | 1.5 | 6.2 | 0.4 | 2.2 | F | 0.581 | MW | 2.5 |
| FC02 | 86.7 | 1.8 | 11.4 | 0.5 | 2.1 | F | 0.634 | MW | 2.5 |
| FC02 | 84.4 | 1.4 | 14.3 | 0.7 | 2.1 | F | 0.652 | MW | 2.5 |
| FC02 | 87.2 | 2.0 | 10.8 | 0.6 | 2.1 | F | 0.645 | MW | 2.5 |
| FC02 | 88.2 | 1.9 | 9.9 | 0.4 | 2.2 | F | 0.593 | MW | 2.5 |
| FC02 | 89.1 | 1.0 | 9.9 | 0.6 | 2.0 | F | 0.665 | MW | 2.5 |
| FC03 | 89.7 | 1.0 | 9.3 | 0.6 | 2.1 | F | 0.671 | MW | 3.0 |
| FC03 | 78.9 | 2.2 | 18.9 | 0.5 | 2.1 | F | 0.654 | MW | 2.5 |
| FC03 | 84.0 | 1.8 | 14.2 | 0.8 | 2.2 | F | 0.739 | M | 3.0 |
| FC03 | 92.2 | 1.1 | 6.7 | 0.5 | 2.2 | F | 0.571 | MW | 2.5 |
| FC03 | 73.8 | 1.1 | 25.1 | 0.6 | 2.0 | M | 0.733 | M | 2.5 |
| | **87.4** | **1.5** | **11.1** | **0.5** | **2.1** | | | | |

Appendix 4. Summary of benthic macrofauna in the Folly Reference and Borrow Areas. All values represent the total number of individuals in 10 grab samples. The higher taxa group of each species is indicated next to the species name (M=mollusc, A=amphipod, P=Polychaete, O=other taxa).

| Species Name | Category | Reference Pre | Reference Post | Reference 6 month Post | Reference 12 month Post | Impact Pre | Impact Post | Impact 6 month Post | Impact 12 month Post |
|---|---|---|---|---|---|---|---|---|---|
| *Abra aequalis* | M | 8 | 4 | 13 | 0 | 0 | 2 | 3 | 0 |
| *Acanthohaustorius intermedius* | A | 0 | 0 | 0 | 4 | 5 | 0 | 4 | 0 |
| *Acanthohaustorius millsi* | A | 0 | 0 | 9 | 0 | 0 | 1 | 0 | 0 |
| *Accalathura crenulata* | O | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 |
| *Acetes americanus* | O | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Acteocina candei* | M | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| Actiniaria | O | 85 | 1 | 0 | 0 | 0 | 0 | 1 | 0 |
| *Aglaophamus verrilli* | P | 0 | 0 | 0 | 2 | 0 | 1 | 2 | 1 |
| *Aligena elevata* | M | 0 | 0 | 0 | 0 | 0 | 2 | 7 | 0 |
| *Amastigos caperatus* | P | 0 | 0 | 0 | 0 | 61 | 0 | 0 | 0 |
| *Americamysis bahia* | O | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Ampelisca abdita* | A | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 |
| *Ampelisca* sp. | A | 3 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Ampharetidae | P | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| *Amphicteis gunneri* | P | 11 | 0 | 2 | 0 | 38 | 0 | 0 | 0 |
| Amphinomidae | P | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Amphipoda | A | 4 | 0 | 0 | 1 | 1 | 0 | 0 | 1 |
| Amphiuridae | O | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Anadara transversa* | M | 3 | 0 | 1 | 0 | 5 | 0 | 0 | 0 |
| *Ancistrosyllis hartmanae* | P | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 0 |
| *Ancistrosyllis* sp. | P | 0 | 0 | 28 | 6 | 1 | 0 | 0 | 0 |
| Aoridae | A | 0 | 0 | 0 | 23 | 0 | 0 | 0 | 0 |
| *Apanthura magnifica* | O | 0 | 2 | 0 | 0 | 2 | 0 | 0 | 0 |
| *Aphelochaeta* sp. | P | 7 | 0 | 0 | 8 | 0 | 0 | 0 | 0 |
| *Arabella mutans* | P | 8 | 4 | 6 | 0 | 4 | 1 | 0 | 1 |
| *Arabella* sp. | P | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| Arabellidae | P | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 |
| Arcidae | M | 1 | 0 | 0 | 3 | 2 | 0 | 0 | 0 |
| *Aricidea* sp. | P | 0 | 0 | 1 | 9 | 0 | 0 | 0 | 1 |
| *Aricidea wassi* | P | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| *Armandia agilis* | P | 0 | 4 | 0 | 17 | 0 | 22 | 8 | 8 |
| *Armandia maculata* | P | 1 | 0 | 1 | 32 | 1 | 0 | 1 | 0 |
| Ascidiacea | O | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| *Autolytus* sp. | P | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Barbatia* sp. | M | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Batea catharinensis* | A | 24 | 274 | 344 | 3 | 103 | 0 | 31 | 0 |
| *Bathyporeia parkeri* | A | 0 | 0 | 1 | 0 | 0 | 2 | 2 | 0 |
| *Bhawania heteroseta* | P | 60 | 58 | 53 | 86 | 52 | 0 | 1 | 0 |
| *Biffarius biformis* | O | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Bowmaniella floridana* | O | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 |
| *Branchiostoma* sp. | O | 19 | 74 | 22 | 82 | 42 | 0 | 0 | 0 |
| *Brania* sp. | P | 2 | 0 | 1 | 5 | 0 | 0 | 0 | 0 |
| *Brania wellfleetensis* | P | 1 | 0 | 1 | 8 | 0 | 0 | 0 | 0 |
| *Caecum pulchellum* | M | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| *Caecum* sp. | M | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Calappidae | O | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 |
| *Calyptraea centralis* | M | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| *Cancer irroratus* | O | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Capitellidae | P | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| Carditidae | M | 0 | 0 | 0 | 29 | 0 | 0 | 0 | 0 |
| *Carinomella lactea* | O | 1 | 1 | 0 | 0 | 4 | 2 | 0 | 8 |
| *Caulleriella* sp. | P | 0 | 7 | 2 | 92 | 0 | 0 | 0 | 1 |

Appendix 4 cont. Summary of benthic macrofauna in the Folly Reference and Borrow Areas. All values represent the total number of individuals in 10 grab samples. The higher taxa group of each species is indicated next to the species name (M=mollusc, A=amphipod, P=Polychaete, O=other taxa).

| Species Name | Category | Reference Pre | Reference Post | Reference 6 month Post | Reference 12 month Post | Impact Pre | Impact Post | Impact 6 month Post | Impact 12 month Post |
|---|---|---|---|---|---|---|---|---|---|
| *Ceratonereis* sp. | P | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 |
| Chaetognatha | O | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| *Chaetopleura apiculata* | M | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Chione cancellata* | M | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Chrysopetalidae | P | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 |
| *Cirolana polita* | O | 3 | 2 | 5 | 0 | 0 | 0 | 0 | 0 |
| Cirratulidae | P | 3 | 6 | 6 | 13 | 5 | 3 | 0 | 2 |
| *Cirriformia* sp. | P | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 |
| *Cirrophorus* sp. | P | 2 | 2 | 3 | 0 | 0 | 0 | 0 | 0 |
| *Cistenides gouldii* | P | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 |
| *Clymenella torquata* | P | 68 | 0 | 0 | 0 | 230 | 0 | 25 | 0 |
| Copepoda | O | 4 | 17 | 17 | 65 | 25 | 15 | 0 | 14 |
| *Corbula contracta* | M | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| Corophiidae | A | 1 | 0 | 1 | 8 | 0 | 0 | 1 | 0 |
| *Corophium* sp. | A | 11 | 7 | 5 | 0 | 1 | 0 | 0 | 0 |
| *Corophium tuberculatum* | A | 0 | 0 | 0 | 0 | 14 | 0 | 0 | 1 |
| *Costoanachis avara* | M | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| *Crassinella lunulata* | M | 124 | 43 | 36 | 73 | 52 | 0 | 0 | 0 |
| *Crassinella martinicensis* | M | 134 | 11 | 63 | 86 | 77 | 0 | 0 | 0 |
| *Crepidula fornicata* | M | 0 | 2 | 1 | 0 | 1 | 0 | 1 | 0 |
| *Crepidula plana* | M | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 |
| Cumacea | O | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 3 |
| *Cupuladria doma* | O | 23 | 0 | 388 | 1097 | 0 | 0 | 0 | 0 |
| *Cyathura burbancki* | O | 39 | 27 | 13 | 20 | 7 | 0 | 2 | 0 |
| *Cyclaspis pustulata* | O | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Cyclaspis varians* | O | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 |
| Decapoda | O | 0 | 3 | 4 | 2 | 1 | 2 | 0 | 3 |
| *Dentatisyllis carolinae* | P | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Diopatra cuprea* | P | 18 | 4 | 3 | 5 | 6 | 0 | 1 | 0 |
| *Discoporella umbellata* | O | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Dissodactylus mellitae* | O | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Dorvilleidae | P | 1 | 4 | 2 | 14 | 6 | 1 | 1 | 0 |
| *Drilonereis longa* | P | 3 | 0 | 0 | 0 | 2 | 1 | 1 | 0 |
| *Dulichiella appendiculata* | A | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Edotia* sp. | P | 1 | 2 | 0 | 2 | 0 | 0 | 0 | 0 |
| *Edotia triloba* | O | 1 | 1 | 1 | 0 | 8 | 1 | 3 | 0 |
| *Elasmopus levis* | A | 0 | 20 | 11 | 0 | 30 | 0 | 0 | 0 |
| *Elasmopus* sp. | A | 0 | 0 | 0 | 13 | 0 | 0 | 0 | 0 |
| *Emerita benedicti* | O | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Emerita talpoida* | O | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Enchytraeidae | O | 0 | 0 | 19 | 0 | 0 | 0 | 0 | 0 |
| *Ensis directus* | M | 159 | 0 | 12 | 0 | 127 | 2 | 4 | 0 |
| *Eobrolgus spinosus* | A | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 |
| *Epitomapta roseola* | O | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 |
| *Ericthonius brasiliensis* | A | 3 | 10 | 7 | 5 | 1 | 0 | 0 | 0 |
| *Ervilia concentrica* | M | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| *Eteone heteropoda* | P | 8 | 0 | 0 | 0 | 1 | 0 | 1 | 0 |
| *Euceramus praelongus* | O | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Eudevenopus honduranus* | A | 0 | 1 | 1 | 1 | 5 | 29 | 5 | 21 |
| *Eupleura caudata* | M | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |

Appendix 4 cont. Summary of benthic macrofauna in the Folly Reference and Borrow Areas. All values represent the total number of individuals in 10 grab samples. The higher taxa group of each species is indicated next to the species name (M=mollusc, A=amphipod, P=Polychaete, O=other taxa).

| Species Name | Category | Reference Pre | Reference Post | Reference 6 month Post | Reference 12 month Post | Impact Pre | Impact Post | Impact 6 month Post | Impact 12 month Post |
|---|---|---|---|---|---|---|---|---|---|
| *Eurydice piperata* | O | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| *Eurythoe* sp. | P | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| *Eusyllis* sp. | P | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| *Exogone dispar* | P | 0 | 0 | 0 | 3 | 2 | 0 | 0 | 0 |
| *Exogone* sp. | P | 16 | 8 | 3 | 1 | 9 | 0 | 3 | 0 |
| Gammaridea | A | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 |
| Gastropoda | M | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| *Glottidia pyramidata* | O | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Glycera americana* | P | 15 | 19 | 3 | 0 | 2 | 2 | 24 | 1 |
| *Glycera asymmetrica* | P | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| *Glycera dibranchiata* | P | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 0 |
| *Glycera oxycephala* | P | 0 | 0 | 0 | 13 | 24 | 0 | 0 | 0 |
| *Glycera papillosa* | P | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| *Glycera* sp. | P | 10 | 4 | 5 | 4 | 6 | 2 | 0 | 0 |
| *Glycinde solitaria* | P | 13 | 6 | 0 | 1 | 0 | 4 | 2 | 0 |
| *Glycinde* sp. | P | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 |
| *Goniada littorea* | P | 0 | 6 | 0 | 1 | 0 | 8 | 1 | 8 |
| *Goniadides carolinae* | P | 5 | 5 | 9 | 7 | 15 | 0 | 0 | 0 |
| *Haminoea solitaria* | M | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 |
| Haustoriidae | A | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| *Hemipholis elongata* | O | 5 | 0 | 1 | 0 | 2 | 0 | 0 | 0 |
| *Hemipodus roseus* | P | 5 | 0 | 52 | 27 | 0 | 0 | 0 | 1 |
| Hesionidae | P | 1 | 0 | 0 | 14 | 9 | 0 | 0 | 0 |
| *Heteropodarke heteromorpha* | P | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 0 |
| Hirudinea | O | 0 | 0 | 0 | 12 | 0 | 0 | 0 | 0 |
| *Hydroides dianthus* | P | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Hypoconcha arcuata* | O | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Insecta | O | 1 | 1 | 4 | 0 | 3 | 0 | 0 | 2 |
| *Isolda pulchella* | P | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 |
| Isopoda | O | 1 | 0 | 0 | 6 | 0 | 0 | 0 | 0 |
| *Kinbergonuphis* sp. | P | 0 | 0 | 3 | 0 | 2 | 0 | 5 | 0 |
| *Laonice cirrata* | P | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Latreutes parvulus* | O | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Leitoscoloplos fragilis* | P | 1 | 0 | 0 | 0 | 3 | 1 | 10 | 0 |
| *Leitoscoloplos robustus* | P | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Leitoscoloplos* sp. | P | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| *Lembos smithi* | A | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 |
| *Lepidonotus sublevis* | P | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| *Leptocheirus plumulosus* | A | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| *Leptochela serratorbita* | O | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 |
| *Leptochela* sp. | O | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 |
| *Leptognathia caeca* | O | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 0 |
| *Leptonacea* sp. | M | 2 | 0 | 0 | 0 | 3 | 0 | 7 | 0 |
| *Leptosynapta tenuis* | O | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 |
| *Leucon americanus* | O | 0 | 0 | 2 | 0 | 0 | 0 | 2 | 0 |
| *Listriella barnardi* | A | 0 | 0 | 0 | 0 | 1 | 9 | 9 | 2 |
| *Listriella clymenellae* | A | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| *Lucifer faxoni* | O | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |

Appendix 4 cont. Summary of benthic macrofauna in the Folly Reference and Borrow Areas. All values represent the total number of individuals in 10 grab samples. The higher taxa group of each species is indicated next to the species name (M=mollusc, A=amphipod, P=Polychaete, O=other taxa).

| Species Name | Category | Reference Pre | Reference Post | Reference 6 month Post | Reference 12 month Post | Impact Pre | Impact Post | Impact 6 month Post | Impact 12 month Post |
|---|---|---|---|---|---|---|---|---|---|
| Lucinidae | M | 0 | 1 | 0 | 17 | 0 | 0 | 0 | 0 |
| Lumbrineridae | P | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Lumbrinerides* sp. | P | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Lumbrineris coccinea* | P | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| *Lumbrineris* sp. | P | 1 | 0 | 4 | 16 | 0 | 0 | 0 | 0 |
| *Lyonsia hyalina* | M | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| *Maera* sp. | A | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 |
| *Magelona papillicornis* | P | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 3 |
| *Magelona pettiboneae* | P | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| *Magelona phyllisae* | P | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| *Magelona rosea* | P | 0 | 0 | 0 | 5 | 12 | 0 | 0 | 0 |
| *Magelona* sp. | P | 0 | 4 | 16 | 0 | 11 | 34 | 124 | 23 |
| Magelonidae | P | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 |
| Maldanidae | P | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| *Marginella* sp. | M | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| Marginellidae | M | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| *Mediomastus ambiseta* | P | 1 | 0 | 0 | 0 | 5 | 0 | 1 | 4 |
| *Mediomastus californiensis* | P | 0 | 0 | 0 | 3 | 24 | 0 | 0 | 0 |
| *Mediomastus* sp. | P | 19 | 11 | 8 | 17 | 67 | 17 | 426 | 0 |
| Melanellidae | M | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Melita nitida* | A | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Melita* sp. | A | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| Melitidae | A | 0 | 0 | 0 | 19 | 5 | 0 | 0 | 0 |
| *Mellita* sp. | O | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| *Metharpinia floridana* | A | 0 | 0 | 0 | 2 | 0 | 0 | 2 | 10 |
| *Microphthalmus* sp. | P | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Microprotopus raneyi* | A | 0 | 0 | 8 | 0 | 21 | 0 | 9 | 0 |
| *Molgula manhattensis* | O | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| *Molgula* sp. | O | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 |
| *Monticellina* sp. | P | 12 | 2 | 1 | 2 | 0 | 0 | 0 | 0 |
| *Mooreonuphis nebulosa* | P | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 |
| *Mooreonuphis pallidula* | P | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Mulinia lateralis* | M | 0 | 1 | 0 | 0 | 0 | 10 | 0 | 0 |
| Mysida | O | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| *Natica pusilla* | M | 1 | 0 | 2 | 0 | 1 | 3 | 4 | 5 |
| Naticidae | M | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Nematoda | O | 119 | 93 | 427 | 937 | 108 | 9 | 15 | 88 |
| Nemertea | O | 21 | 16 | 17 | 21 | 20 | 6 | 10 | 6 |
| *Neopanope sayi* | O | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Nephtyidae | P | 0 | 0 | 1 | 0 | 15 | 0 | 0 | 0 |
| *Nephtys bucera* | P | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Nephtys picta* | P | 8 | 9 | 6 | 3 | 4 | 0 | 55 | 9 |
| *Nephtys simoni* | P | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 |
| *Nephtys* sp. | P | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 |
| Nereididae | P | 0 | 11 | 2 | 1 | 2 | 1 | 0 | 0 |
| *Nereis riisei* | P | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 |
| *Nereis* sp. | P | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 |
| *Nereis succinea* | P | 18 | 8 | 4 | 14 | 54 | 0 | 0 | 0 |
| *Notomastus latericeus* | P | 0 | 0 | 0 | 0 | 0 | 0 | 39 | 1 |
| *Nucula proxima* | M | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| *Nucula* sp. | M | 0 | 1 | 1 | 0 | 2 | 0 | 1 | 0 |
| *Odontosyllis enopla* | P | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| *Ogyrides alphaerostris* | O | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| Oligochaeta | O | 1 | 3 | 0 | 22 | 0 | 0 | 0 | 0 |

Appendix 4 cont. Summary of benthic macrofauna in the Folly Reference and Borrow Areas. All values represent the total number of individuals in 10 grab samples. The higher taxa group of each species is indicated next to the species name (M=mollusc, A=amphipod, P=Polychaete, O=other taxa).

| Species Name | Category | Reference Pre | Reference Post | Reference 6 month Post | Reference 12 month Post | Impact Pre | Impact Post | Impact 6 month Post | Impact 12 month Post |
|---|---|---|---|---|---|---|---|---|---|
| *Olivella mutica* | M | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 3 |
| *Ophelia denticulata* | P | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 |
| Opheliidae | P | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| *Ophelina acuminata* | P | 0 | 0 | 0 | 10 | 1 | 0 | 3 | 29 |
| *Ophelina cylindricaudata* | P | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 1 |
| *Ophelina* sp. | P | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| Ophiuroidea | O | 13 | 5 | 2 | 5 | 13 | 0 | 1 | 0 |
| Orbiniidae | P | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 |
| Ostracoda | O | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| *Owenia fusiformis* | P | 0 | 0 | 0 | 1 | 3 | 0 | 11 | 1 |
| *Owenia* sp. | P | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Oxyurostylis smithi* | O | 89 | 7 | 12 | 6 | 497 | 6 | 10 | 9 |
| Paguridae | O | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Pagurus longicarpus* | O | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| *Pagurus* sp. | O | 1 | 5 | 2 | 1 | 0 | 0 | 0 | 0 |
| *Pananthura formosa* | O | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Panopeus herbstii* | O | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Paracaprella tenuis* | A | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Parametopella cypris* | A | 0 | 0 | 4 | 0 | 1 | 0 | 0 | 0 |
| *Paramphinome* sp. | P | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Paraonidae | P | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| *Paraonis fulgens* | P | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| *Parapionosyllis* sp. | P | 0 | 0 | 1 | 0 | 15 | 0 | 0 | 0 |
| *Paraprionospio pinnata* | P | 0 | 0 | 0 | 1 | 0 | 21 | 18 | 4 |
| Pelecypoda | M | 1 | 0 | 0 | 6 | 2 | 0 | 1 | 15 |
| Penaeoidea | O | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 |
| *Periclimenes* sp. | O | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| Phoronida | O | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| Phoxocephalidae | A | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 1 |
| *Phyllangia americana* | O | 0 | 0 | 8 | 3 | 0 | 0 | 0 | 0 |
| *Phyllodoce arenae* | P | 2 | 0 | 3 | 0 | 1 | 1 | 29 | 0 |
| *Phyllodoce groenlandica* | P | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Phyllodoce madeirensis* | P | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 |
| *Phyllodoce mucosa* | P | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 |
| Phyllodocidae | P | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 |
| Pilargidae | P | 1 | 3 | 0 | 0 | 1 | 0 | 0 | 0 |
| *Pinnixa* sp. | O | 0 | 0 | 0 | 2 | 2 | 1 | 0 | 0 |
| *Pinnotheres* sp. | O | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| *Pionosyllis gesae* | P | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Pisione remota* | P | 8 | 6 | 11 | 11 | 3 | 0 | 0 | 0 |
| *Pista* sp. | P | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Platyhelminthes | O | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| *Pleuromeris tridentata* | M | 37 | 20 | 141 | 133 | 67 | 1 | 0 | 0 |
| *Podarke* sp. | P | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Podarkeopsis levifuscina* | P | 5 | 2 | 0 | 2 | 0 | 0 | 0 | 0 |
| *Podocerus* sp. | A | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| *Poecilochaetus johnsoni* | P | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| *Polinices duplicatus* | M | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| *Polinices* sp. | M | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| Polychaeta | P | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 1 |
| *Polycirrus* sp. | P | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Polydora socialis* | P | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Polyodontes lupina* | P | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Prionospio cirrifera* | P | 7 | 5 | 0 | 12 | 1 | 0 | 0 | 15 |

Appendix 4 cont. Summary of benthic macrofauna in the Folly Reference and Borrow Areas. All values represent the total number of individuals in 10 grab samples. The higher taxa group of each species is indicated next to the species name (M=mollusc, A=amphipod, P=Polychaete, O=other taxa).

| Species Name | Category | Reference Pre | Reference Post | Reference 6 month Post | Reference 12 month Post | Impact Pre | Impact Post | Impact 6 month Post | Impact 12 month Post |
|---|---|---|---|---|---|---|---|---|---|
| *Prionospio cristata* | P | 0 | 2 | 10 | 38 | 0 | 0 | 0 | 0 |
| *Prionospio dayi* | P | 0 | 0 | 0 | 0 | 0 | 108 | 3 | 11 |
| *Prionospio* sp. | P | 0 | 3 | 19 | 1 | 0 | 5 | 49 | 3 |
| *Progoniada regularis* | P | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| *Protohaustorius deichmannae* | A | 0 | 0 | 2 | 0 | 17 | 8 | 29 | 4 |
| *Protohaustorius* sp. | A | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| *Pseudeurythoe ambigua* | P | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| *Pyura vittata* | O | 1 | 0 | 25 | 27 | 0 | 0 | 0 | 0 |
| *Rhepoxynius epistomus* | A | 1 | 14 | 2 | 8 | 7 | 27 | 3 | 2 |
| *Rhepoxynius hudsoni* | A | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| *Rhepoxynius* sp. | A | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 6 |
| *Sabellaria floridensis* | P | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Sabellaria vulgaris* | P | 7 | 31 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Schistomeringos* sp. | P | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Scolelepis* sp. | P | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| *Scolelepis squamata* | P | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 5 |
| *Scolelepis texana* | P | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 |
| *Scoletoma tenuis* | P | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| Serpulidae | P | 0 | 0 | 0 | 0 | 57 | 0 | 0 | 0 |
| *Sigalion arenicola* | P | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Sigalionidae | P | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Sigambra bassi* | P | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| *Sigambra* sp. | P | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Sigambra tentaculata* | P | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 7 |
| *Sigambra wassi* | P | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 1 |
| Sipuncula | O | 0 | 4 | 5 | 0 | 1 | 0 | 1 | 0 |
| *Solen viridis* | M | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Solenidae | M | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Sphaerosyllis glandulata* | P | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 |
| *Sphaerosyllis longicauda* | P | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| *Sphaerosyllis* sp. | P | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 |
| *Sphenia antillensis* | M | 12 | 2 | 0 | 0 | 4 | 0 | 0 | 0 |
| *Spiochaetopterus costarum oculatus* | P | 0 | 2 | 0 | 0 | 0 | 2 | 2 | 2 |
| Spionidae | P | 0 | 1 | 1 | 24 | 9 | 0 | 1 | 4 |
| *Spiophanes bombyx* | P | 24 | 6 | 31 | 2 | 544 | 11 | 945 | 10 |
| *Spiophanes missionensis* | P | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| *Spiophanes* sp. | P | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| *Spiophanes wigleyi* | P | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| *Spisula solidissima* | M | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| *Sthenelais boa* | P | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| *Streblospio benedicti* | P | 1 | 0 | 0 | 0 | 1 | 0 | 11 | 0 |
| *Streptosyllis* sp. | P | 0 | 3 | 0 | 0 | 0 | 0 | 1 | 0 |
| *Strigilla mirabilis* | M | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 1 |
| Syllidae | P | 3 | 4 | 3 | 39 | 0 | 0 | 0 | 0 |

Appendix 4 cont. Summary of benthic macrofauna in the Folly Reference and Borrow Areas. All values represent the total number of individuals in 10 grab samples. The higher taxa group of each species is indicated next to the species name (M=mollusc, A=amphipod, P=Polychaete, O=other taxa).

| Species Name | Category | Reference Pre | Reference Post | Reference 6 month Post | Reference 12 month Post | Impact Pre | Impact Post | Impact 6 month Post | Impact 12 month Post |
|---|---|---|---|---|---|---|---|---|---|
| *Syllis* sp. | P | 2 | 0 | 4 | 0 | 1 | 0 | 0 | 0 |
| *Synchelidium americanum* | A | 1 | 1 | 0 | 0 | 5 | 9 | 0 | 6 |
| *Synelmis ewingi* | P | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Synelmis* sp. | P | 0 | 0 | 1 | 20 | 0 | 0 | 0 | 0 |
| Tanaidacea | O | 4 | 5 | 2 | 0 | 0 | 0 | 0 | 0 |
| *Tellina agilis* | M | 0 | 0 | 20 | 0 | 5 | 10 | 110 | 1 |
| *Tellina alternata* | M | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| *Tellina* sp. | M | 1 | 0 | 1 | 8 | 0 | 6 | 0 | 19 |
| Tellinidae | M | 1 | 1 | 2 | 1 | 0 | 0 | 1 | 21 |
| *Terebra concava* | M | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| *Tharyx* sp. | P | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| *Tiron* sp. | A | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Tiron triocellatus* | A | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 |
| *Tiron tropakis* | A | 6 | 0 | 8 | 1 | 12 | 0 | 3 | 0 |
| *Trachycardium muricatum* | M | 0 | 0 | 0 | 7 | 1 | 0 | 0 | 0 |
| *Travisia parva* | P | 37 | 0 | 110 | 6 | 10 | 0 | 0 | 0 |
| *Travisia* sp. | P | 8 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| *Trypanosyllis* sp. | P | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| Tubificidae | O | 4 | 0 | 2 | 4 | 1 | 0 | 0 | 0 |
| Tubificidae sp. b | O | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| *Tubificoides brownae* | O | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 |
| *Tubificoides wasselli* | O | 0 | 0 | 19 | 0 | 14 | 0 | 0 | 0 |
| Turbellaria | O | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Turbonilla* sp. | M | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 |
| *Unciola serrata* | A | 0 | 0 | 1 | 0 | 12 | 0 | 2 | 0 |
| *Unciola* sp. | A | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| Veneridae | M | 0 | 0 | 0 | 284 | 0 | 0 | 0 | 0 |
| *Websterinereis tridentata* | P | 0 | 0 | 0 | 24 | 0 | 0 | 0 | 0 |
| Xanthidae | O | 0 | 0 | 0 | 3 | 3 | 0 | 0 | 0 |

Appendix 5.1. Abundance of benthic species collected at the Folly Borrow Area during Pre-nourishment sampling. Abundance values represent the number of individuals per grab ($0.04m^2$). Density represents the number of individuals/$m^2$. Higher taxa codes are P = polychaete, A = amphipod, M = mollusc, and O = other taxa.

| SpeciesName | Category | Total Abundance (# /$0.04m^2$) | Percent Abundance | Percent of Stations Where Present | FA01 | FA02 | FA03 | FA04 | FA05 | FA06 | FA07 | FA08 | FA09 | FA10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Spiophanes bombyx* | P | 544 | 19.70 | 70 | 467 | 0 | 0 | 27 | 37 | 7 | 2 | 0 | 2 | 2 |
| *Oxyurostylis smithi* | O | 497 | 18.00 | 90 | 169 | 0 | 15 | 246 | 1 | 8 | 15 | 24 | 7 | 12 |
| *Clymenella torquata* | P | 230 | 8.33 | 40 | 217 | 0 | 0 | 6 | 6 | 0 | 0 | 0 | 0 | 1 |
| *Ensis directus* | M | 127 | 4.60 | 70 | 50 | 1 | 1 | 0 | 66 | 0 | 0 | 4 | 4 | 1 |
| Nematoda | O | 108 | 3.91 | 80 | 2 | 0 | 50 | 0 | 11 | 11 | 9 | 16 | 5 | 4 |
| *Batea catharinensis* | A | 103 | 3.73 | 50 | 0 | 0 | 0 | 5 | 2 | 0 | 2 | 4 | 0 | 90 |
| *Crassinella martinicensis* | M | 77 | 2.79 | 60 | 0 | 47 | 19 | 0 | 0 | 2 | 1 | 7 | 1 | 0 |
| *Mediomastus* sp. | P | 67 | 2.43 | 40 | 5 | 0 | 0 | 2 | 0 | 0 | 0 | 3 | 0 | 57 |
| *Pleuromeris tridentata* | M | 67 | 2.43 | 40 | 0 | 26 | 29 | 0 | 0 | 0 | 1 | 11 | 0 | 0 |
| *Amastigos caperatus* | P | 61 | 2.21 | 40 | 32 | 0 | 0 | 22 | 6 | 0 | 1 | 0 | 0 | 0 |
| Serpulidae | P | 57 | 2.06 | 20 | 0 | 0 | 55 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| *Nereis succinea* | P | 54 | 1.96 | 40 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 4 | 48 |
| *Bhawania heteroseta* | P | 52 | 1.88 | 60 | 0 | 2 | 8 | 4 | 0 | 0 | 0 | 15 | 2 | 21 |
| *Crassinella lunulata* | M | 52 | 1.88 | 60 | 0 | 23 | 11 | 0 | 0 | 0 | 5 | 10 | 2 | 1 |
| *Branchiostoma* sp. | O | 42 | 1.52 | 30 | 0 | 7 | 14 | 0 | 0 | 0 | 0 | 21 | 0 | 0 |
| *Amphicteis gunneri* | P | 38 | 1.38 | 40 | 34 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 2 |
| *Elasmopus levis* | A | 30 | 1.09 | 20 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 29 |
| Copepoda | O | 25 | 0.91 | 70 | 0 | 0 | 12 | 0 | 1 | 3 | 1 | 3 | 4 | 1 |
| *Glycera oxycephala* | P | 24 | 0.87 | 50 | 11 | 0 | 7 | 0 | 0 | 3 | 0 | 2 | 1 | 0 |
| *Mediomastus californiensis* | P | 24 | 0.87 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24 |
| *Microprotopus raneyi* | A | 21 | 0.76 | 30 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 8 | 0 |
| Nemertea | O | 20 | 0.72 | 60 | 4 | 0 | 0 | 0 | 2 | 1 | 1 | 3 | 0 | 9 |
| *Protohaustorius deichmannae* | A | 17 | 0.62 | 20 | 0 | 0 | 0 | 0 | 12 | 0 | 5 | 0 | 0 | 0 |
| *Goniadides carolinae* | P | 15 | 0.54 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 3 | 0 |
| Nephtyidae | P | 15 | 0.54 | 70 | 5 | 0 | 0 | 1 | 2 | 2 | 2 | 2 | 1 | 0 |
| *Parapionosyllis* sp. | P | 15 | 0.54 | 10 | 0 | 0 | 0 | 15 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Corophium tuberculatum* | A | 14 | 0.51 | 30 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 10 |
| *Tubificoides wasselli* | O | 14 | 0.51 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 13 |
| Ophiuroidea | O | 13 | 0.47 | 50 | 0 | 0 | 3 | 0 | 0 | 2 | 0 | 4 | 1 | 3 |
| *Magelona rosea* | P | 12 | 0.43 | 30 | 10 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| *Tiron tropakis* | A | 12 | 0.43 | 60 | 2 | 0 | 0 | 0 | 1 | 2 | 0 | 1 | 3 | 3 |
| *Unciola serrata* | A | 12 | 0.43 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| *Magelona* sp. | P | 11 | 0.40 | 20 | 10 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Travisia parva* | P | 10 | 0.36 | 30 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 2 | 2 | 0 |

Appendix 5.1. Abundance of benthic species collected at the Folly Borrow Area during Pre-nourishment sampling. Abundance values represent the number of individuals per grab ($0.04m^2$). Density represents the number of individuals/$m^2$. Higher taxa codes are P = polychaete, A = amphipod, M = mollusc, and O = other taxa.

| SpeciesName | Category | Total Abundance/(# per grab ($0.04m^2$) | % Abundance | % stations where present | FA01 | FA02 | FA03 | FA04 | FA05 | FA06 | FA07 | FA08 | FA09 | FA10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Exogone* sp. | P | 9 | 0.33 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| Hesionidae | P | 9 | 0.33 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| *Magelona papillicornis* | P | 9 | 0.33 | 10 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 |
| Spionidae | P | 9 | 0.33 | 10 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Ceratonereis* sp. | P | 8 | 0.29 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| *Edotia triloba* | O | 8 | 0.29 | 20 | 6 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Rhepoxynius epistomus* | A | 7 | 0.25 | 20 | 0 | 0 | 0 | 0 | 0 | 5 | 2 | 0 | 0 | 0 |
| *Cyathura burbancki* | O | 7 | 0.25 | 30 | 1 | 4 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| *Diopatra cuprea* | P | 6 | 0.22 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| Dorvilleidae | P | 6 | 0.22 | 30 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 2 | 1 | 0 |
| *Glycera* sp. | P | 6 | 0.22 | 40 | 0 | 0 | 0 | 1 | 3 | 0 | 1 | 0 | 0 | 1 |
| *Nereis* sp. | P | 6 | 0.22 | 20 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 5 |
| *Molgula* sp. | O | 6 | 0.22 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 |
| *Acanthohaustorius intermedius* | A | 5 | 0.18 | 20 | 0 | 0 | 0 | 0 | 2 | 3 | 0 | 0 | 0 | 0 |
| *Anadara transversa* | M | 5 | 0.18 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| Cirratulidae | P | 5 | 0.18 | 30 | 3 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| *Eudevenopus honduranus* | A | 5 | 0.18 | 20 | 0 | 0 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 0 |
| *Mediomastus ambiseta* | P | 5 | 0.18 | 20 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Melitidae | A | 5 | 0.18 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 4 |
| *Phyllodoce madeirensis* | P | 5 | 0.18 | 10 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Synchelidium americanum* | A | 5 | 0.18 | 20 | 3 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| *Tellina agilis* | M | 5 | 0.18 | 10 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 |
| *Leptosynapta tenuis* | O | 5 | 0.18 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 |
| *Arabella mutans* | P | 4 | 0.14 | 20 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 3 |
| *Lembos smithi* | A | 4 | 0.14 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| *Nephtys picta* | P | 4 | 0.14 | 20 | 3 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| *Sphenia antillensis* | M | 4 | 0.14 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 3 |
| *Carinomella lactea* | O | 4 | 0.14 | 10 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Ampelisca abdita* | A | 3 | 0.11 | 20 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Ancistrosyllis hartmanae* | P | 3 | 0.11 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 |
| *Eobrolgus spinosus* | A | 3 | 0.11 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| *Isolda pulchella* | P | 3 | 0.11 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| *Leitoscoloplos fragilis* | P | 3 | 0.11 | 20 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Leptonacea* sp. | M | 3 | 0.11 | 30 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |

Appendix 5.1. Abundance of benthic species collected at the Folly Borrow Area during Pre-nourishment sampling. Abundance values represent the number of individuals per grab ($0.04m^2$). Density represents the number of individuals/$m^2$. Higher taxa codes are P = polychaete, A = amphipod, M = mollusc, and O = other taxa.

| SpeciesName | Category | Total Abundance/(# per grab ($0.04m^2$) | % Abundance | % stations where present | FA01 | FA02 | FA03 | FA04 | FA05 | FA06 | FA07 | FA08 | FA09 | FA10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Owenia fusiformis* | P | 3 | 0.11 | 10 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Phyllodoce mucosa* | P | 3 | 0.11 | 10 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Phyllodocidae | P | 3 | 0.11 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 |
| *Pisione remota* | P | 3 | 0.11 | 20 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| Insecta | O | 3 | 0.11 | 20 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 |
| Xanthidae | O | 3 | 0.11 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| *Acteocina candei* | M | 2 | 0.07 | 10 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Arcidae | M | 2 | 0.07 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| *Costoanachis avara* | M | 2 | 0.07 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| *Drilonereis longa* | P | 2 | 0.07 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| *Exogone dispar* | P | 2 | 0.07 | 20 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| *Glycera americana* | P | 2 | 0.07 | 10 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Kinbergonuphis* sp. | P | 2 | 0.07 | 10 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Magelona phyllisae* | P | 2 | 0.07 | 10 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nereididae | P | 2 | 0.07 | 20 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| *Nucula* sp. | M | 2 | 0.07 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| Pelecypoda | M | 2 | 0.07 | 20 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| *Pseudeurythoe ambigua* | P | 2 | 0.07 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| *Unciola* sp. | A | 2 | 0.07 | 10 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Apanthura magnifica* | O | 2 | 0.07 | 10 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Hemipholis elongata* | O | 2 | 0.07 | 20 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| *Pinnixa* sp. | O | 2 | 0.07 | 20 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Amphipoda | A | 1 | 0.04 | 10 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Ancistrosyllis* sp. | P | 1 | 0.04 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| *Armandia maculata* | P | 1 | 0.04 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Cistenides gouldii* | P | 1 | 0.04 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Corbula contracta* | M | 1 | 0.04 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Corophium sp.* | A | 1 | 0.04 | 10 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Crepidula fornicata* | M | 1 | 0.04 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Ericthonius brasiliensis* | A | 1 | 0.04 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Cancer irroratus* | O | 1 | 0.04 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Chaetognatha | O | 1 | 0.04 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Decapoda | O | 1 | 0.04 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| *Leptochela serratorbita* | O | 1 | 0.04 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Appendix 5.1. Abundance of benthic species collected at the Folly Borrow Area during Pre-nourishment sampling. Abundance values represent the number of individuals per grab ($0.04m^2$). Density represents the number of individuals/$m^2$. Higher taxa codes are P = polychaete, A = amphipod, M = mollusc, and O = other taxa.

| SpeciesName | Category | Total Abundance/(# per grab ($0.04m^2$) | % Abundance | % stations where present | FA01 | FA02 | FA03 | FA04 | FA05 | FA06 | FA07 | FA08 | FA09 | FA10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Neopanope sayi* | O | 1 | 0.04 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Pinnotheres* sp. | O | 1 | 0.04 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sipuncula | O | 1 | 0.04 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Tubificidae | O | 1 | 0.04 | 10 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tubificidae sp. b | O | 1 | 0.04 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Ervilia concentrica* | M | 1 | 0.04 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Eteone heteropoda* | P | 1 | 0.04 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Eupleura caudata* | M | 1 | 0.04 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Gastropoda | M | 1 | 0.04 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Lepidonotus sublevis* | P | 1 | 0.04 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Leptocheirus plumulosus* | A | 1 | 0.04 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Listriella barnardi* | A | 1 | 0.04 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Marginella* sp. | M | 1 | 0.04 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| Marginellidae | M | 1 | 0.04 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Natica pusilla* | M | 1 | 0.04 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Naticidae | M | 1 | 0.04 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Nephtys simoni* | P | 1 | 0.04 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Nephtys* sp. | P | 1 | 0.04 | 10 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| *Odontosyllis enopla* | P | 1 | 0.04 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Olivella mutica* | M | 1 | 0.04 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| *Ophelina acuminata* | P | 1 | 0.04 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Parametopella cypris* | A | 1 | 0.04 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Phyllodoce arenae* | P | 1 | 0.04 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pilargidae | P | 1 | 0.04 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Pista* sp. | P | 1 | 0.04 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Prionospio cirrifera* | P | 1 | 0.04 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Sigambra bassi* | P | 1 | 0.04 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Sthenelais boa* | P | 1 | 0.04 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Streblospio benedicti* | P | 1 | 0.04 | 10 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Strigilla mirabilis* | M | 1 | 0.04 | 10 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Syllis* sp. | P | 1 | 0.04 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Terebra concava* | M | 1 | 0.04 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Trachycardium muricatum* | M | 1 | 0.04 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Travisia* sp. | P | 1 | 0.04 | 10 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| *Turbonilla* sp. | M | 1 | 0.04 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Mean total abundance (#/$0.04m^2$)** | | | | | **1099** | **113** | **236** | **343** | **179** | **63** | **54** | **176** | **61** | **437** |
| **Mean density (#/$m^2$)** | | | | | **27475** | **2825** | **5900** | **8575** | **4475** | **1575** | **1350** | **4400** | **1525** | **10925** |
| **Species Richness (#/$0.04m^2$)** | | | | | **47** | **10** | **19** | **20** | **26** | **20** | **19** | **36** | **25** | **58** |
| **Species Diversity** | | | | | **1.97** | **1.56** | **2.31** | **1.22** | **2.23** | **2.68** | **2.44** | **3.04** | **2.97** | **3.05** |
| **Evenness** | | | | | **0.51** | **0.68** | **0.78** | **0.41** | **0.68** | **0.89** | **0.83** | **0.85** | **0.92** | **0.75** |

Appendix 5.2. Abundance of benthic species collected at the Folly Borrow Area post nourishment (Post) sampling. Abundance values represent the number of individuals per grab ($0.04m^2$). Density represents the number of individuals/$m^2$. Higher taxa codes are P = polychaete, A = amphipod, M = mollusc, and O = other taxa.

| Species Name | Category | Total Abundance (# /$0.04m^2$) | Percent Abundance | Percent of Stations Where Present | FA02 | FA03 | FA04 | FA06 | FA07 | FA08 | FA10 | FA11 | FA13 | FA14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Prionospio dayi* | P | 108 | 24.38 | 60 | 0 | 0 | 0 | 33 | 25 | 9 | 0 | 7 | 10 | 24 |
| *Magelona* sp. | P | 34 | 7.67 | 70 | 1 | 0 | 7 | 1 | 1 | 3 | 0 | 19 | 0 | 2 |
| *Eudevenopus honduranus* | A | 29 | 6.55 | 60 | 0 | 0 | 0 | 8 | 5 | 1 | 0 | 3 | 10 | 2 |
| *Rhepoxynius epistomus* | A | 27 | 6.09 | 50 | 0 | 0 | 0 | 12 | 4 | 3 | 0 | 0 | 4 | 4 |
| *Armandia agilis* | P | 22 | 4.97 | 40 | 0 | 0 | 0 | 3 | 14 | 3 | 0 | 0 | 2 | 0 |
| *Paraprionospio pinnata* | P | 21 | 4.74 | 40 | 0 | 0 | 17 | 0 | 2 | 0 | 0 | 0 | 1 | 1 |
| *Mediomastus* sp. | P | 17 | 3.84 | 60 | 0 | 0 | 8 | 0 | 2 | 2 | 0 | 1 | 2 | 2 |
| Copepoda | O | 15 | 3.39 | 60 | 0 | 0 | 1 | 5 | 3 | 2 | 0 | 2 | 2 | 0 |
| *Spiophanes bombyx* | P | 11 | 2.48 | 40 | 2 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 1 | 2 |
| *Mulinia lateralis* | M | 10 | 2.26 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 1 |
| *Tellina agilis* | M | 10 | 2.26 | 30 | 0 | 0 | 0 | 7 | 2 | 1 | 0 | 0 | 0 | 0 |
| *Listriella barnardi* | A | 9 | 2.03 | 20 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 8 | 0 | 0 |
| *Synchelidium americanum* | A | 9 | 2.03 | 30 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 4 | 0 | 1 |
| Nematoda | O | 9 | 2.03 | 40 | 0 | 0 | 1 | 3 | 0 | 3 | 0 | 0 | 2 | 0 |
| *Goniada littorea* | P | 8 | 1.81 | 40 | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 3 | 1 | 0 |
| *Protohaustorius deichmannae* | A | 8 | 1.81 | 40 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 2 | 3 |
| *Tellina* sp. | M | 6 | 1.35 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 3 |
| *Nemertea* | O | 6 | 1.35 | 50 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 2 | 1 | 1 |
| *Oxyurostylis smithi* | O | 6 | 1.35 | 40 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 2 | 0 | 1 |
| *Prionospio* sp. | P | 5 | 1.13 | 10 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Bowmaniella floridana* | O | 5 | 1.13 | 30 | 0 | 0 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 2 |
| *Glycinde solitaria* | P | 4 | 0.90 | 30 | 1 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| *Mooreonuphis nebulosa* | P | 4 | 0.90 | 10 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 |
| *Cyclaspis varians* | O | 4 | 0.90 | 20 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 0 | 0 |
| Cirratulidae | P | 3 | 0.68 | 30 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 |
| *Natica pusilla* | M | 3 | 0.68 | 20 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 |
| *Sigambra wassi* | P | 3 | 0.68 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 |
| Penaeoidea | O | 3 | 0.68 | 10 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Abra aequalis* | M | 2 | 0.45 | 20 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| *Aligena elevata* | M | 2 | 0.45 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |

Appendix 5.2. Abundance of benthic species collected at the Folly Borrow Area post nourishment (Post) sampling. Abundance values represent the number of individuals per grab (0.04$m^2$). Density represents the number of individuals/$m^2$. Higher taxa codes are P = polychaete, A = amphipod, M = mollusc, and O = other taxa.

| SpeciesName | Category | Total Abundance/(# per grab (0.04$m^2$) | % Abundance | % stations where present | FA02 | FA03 | FA04 | FA06 | FA07 | FA08 | FA10 | FA11 | FA13 | FA14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Bathyporeia parkeri* | A | 2 | 0.45 | 20 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| *Ensis directus* | M | 2 | 0.45 | 20 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| *Glycera americana* | P | 2 | 0.45 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| *Glycera* sp. | P | 2 | 0.45 | 20 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Haustoriidae | A | 2 | 0.45 | 20 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Spiochaetopterus costarum oculatus* | P | 2 | 0.45 | 20 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Strigilla mirabilis* | M | 2 | 0.45 | 10 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| *Carinomella lactea* | O | 2 | 0.45 | 20 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| Decapoda | O | 2 | 0.45 | 10 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Lucifer faxoni* | O | 2 | 0.45 | 20 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| *Acanthohaustorius millsi* | A | 1 | 0.23 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Aglaophamus verrilli* | P | 1 | 0.23 | 10 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| *Arabella mutans* | P | 1 | 0.23 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| Dorvilleidae | P | 1 | 0.23 | 10 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Drilonereis longa* | P | 1 | 0.23 | 10 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Hydroides dianthus* | P | 1 | 0.23 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Leitoscoloplos fragilis* | P | 1 | 0.23 | 10 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Nereididae | P | 1 | 0.23 | 10 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Phyllodoce arenae* | P | 1 | 0.23 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Pleuromeris tridentata* | M | 1 | 0.23 | 10 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| *Acetes americanus* | O | 1 | 0.23 | 10 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Americamysis bahia* | O | 1 | 0.23 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Biffarius biformis* | O | 1 | 0.23 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Cumacea | O | 1 | 0.23 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Edotia triloba* | O | 1 | 0.23 | 10 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Leptochela serratorbita* | O | 1 | 0.23 | 10 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Mysida | O | 1 | 0.23 | 10 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Ogyrides alphaerostris* | O | 1 | 0.23 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Periclimenes* sp. | O | 1 | 0.23 | 10 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Pinnixa* sp. | O | 1 | 0.23 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| **Mean total abundance (#/0.04$m^2$)** | | | | | **11** | **2** | **49** | **83** | **76** | **49** | **1** | **62** | **55** | **55** |
| **Mean density (#/$m^2$)** | | | | | **275** | **50** | **1225** | **2075** | **1900** | **1225** | **25** | **1550** | **1375** | **1375** |
| **Species Richness (#/0.04$m^2$)** | | | | | **6** | **2** | **17** | **12** | **22** | **23** | **1** | **17** | **18** | **20** |
| **Species Diversity** | | | | | **1.54** | **0.69** | **2.20** | **1.97** | **2.40** | **2.91** | **0.00** | **2.38** | **2.50** | **2.27** |
| **Evenness** | | | | | **0.86** | **1.00** | **0.78** | **0.79** | **0.78** | **0.93** | **N/A** | **0.84** | **0.86** | **0.76** |

Appendix 5.3. Abundance of benthic species collected at the Folly Borrow Area during 6 month post (6 mo Post) nourishment sampling. Abundance values represent the number of individuals per grab ($0.04m^2$). Density represents the number of individuals/$m^2$. Higher taxa codes are P = polychaete, A = amphipod, M = mollusc, and O = other taxa.

| SpeciesName | Category | Total Abundance (# /$0.04m^2$) | Percent Abundance | Percent of Stations Where Present | FA02 | FA03 | FA04 | FA06 | FA07 | FA08 | FA10 | FA11 | FA13 | FA14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Spiophanes bombyx* | P | 945 | 44.37 | 90 | 250 | 150 | 16 | 109 | 62 | 39 | 0 | 160 | 106 | 53 |
| *Mediomastus* sp. | P | 426 | 20.00 | 70 | 49 | 101 | 0 | 2 | 9 | 6 | 0 | 7 | 252 | 0 |
| *Magelona* sp. | P | 124 | 5.82 | 90 | 8 | 23 | 8 | 26 | 2 | 14 | 0 | 22 | 8 | 13 |
| *Tellina agilis* | M | 110 | 5.16 | 90 | 5 | 8 | 2 | 16 | 15 | 17 | 0 | 11 | 8 | 28 |
| *Nephtys picta* | P | 55 | 2.58 | 90 | 12 | 10 | 2 | 9 | 3 | 7 | 0 | 10 | 1 | 1 |
| *Prionospio* sp. | P | 49 | 2.30 | 70 | 1 | 2 | 0 | 3 | 16 | 6 | 0 | 17 | 0 | 4 |
| *Notomastus latericeus* | P | 39 | 1.83 | 80 | 5 | 3 | 0 | 4 | 3 | 4 | 0 | 1 | 18 | 1 |
| *Batea catharinensis* | A | 31 | 1.46 | 50 | 0 | 0 | 0 | 25 | 2 | 1 | 2 | 1 | 0 | 0 |
| *Phyllodoce arenae* | P | 29 | 1.36 | 70 | 4 | 1 | 0 | 6 | 0 | 2 | 0 | 6 | 4 | 6 |
| *Protohaustorius deichmannae* | A | 29 | 1.36 | 20 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 28 |
| *Clymenella torquata* | P | 25 | 1.17 | 40 | 0 | 2 | 0 | 13 | 0 | 3 | 0 | 7 | 0 | 0 |
| *Glycera americana* | P | 24 | 1.13 | 90 | 7 | 5 | 1 | 3 | 1 | 1 | 0 | 1 | 2 | 3 |
| *Paraprionospio pinnata* | P | 18 | 0.85 | 70 | 1 | 3 | 0 | 1 | 0 | 1 | 5 | 1 | 6 | 0 |
| Nematoda | O | 15 | 0.70 | 70 | 3 | 0 | 3 | 3 | 1 | 0 | 2 | 0 | 2 | 1 |
| *Owenia fusiformis* | P | 11 | 0.52 | 50 | 1 | 1 | 0 | 2 | 2 | 0 | 0 | 5 | 0 | 0 |
| *Streblospio benedicti* | P | 11 | 0.52 | 10 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Leitoscoloplos fragilis* | P | 10 | 0.47 | 50 | 1 | 4 | 0 | 3 | 1 | 1 | 0 | 0 | 0 | 0 |
| Nemertea | O | 10 | 0.47 | 60 | 3 | 0 | 1 | 3 | 1 | 1 | 0 | 1 | 0 | 0 |
| *Oxyurostylis smithi* | O | 10 | 0.47 | 60 | 1 | 1 | 1 | 0 | 2 | 0 | 0 | 4 | 0 | 1 |
| *Listriella barnardi* | A | 9 | 0.42 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 4 | 0 |
| *Microprotopus raneyi* | A | 9 | 0.42 | 20 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 |
| *Armandia agilis* | P | 8 | 0.38 | 30 | 0 | 0 | 0 | 4 | 3 | 1 | 0 | 0 | 0 | 0 |
| *Aligena elevata* | M | 7 | 0.33 | 40 | 0 | 1 | 0 | 1 | 0 | 4 | 0 | 1 | 0 | 0 |
| *Leptonacea* sp. | M | 7 | 0.33 | 30 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 1 |
| Gammaridea | A | 6 | 0.28 | 10 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 |
| *Eudevenopus honduranus* | A | 5 | 0.23 | 20 | 0 | 0 | 4 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| *Haminoea solitaria* | M | 5 | 0.23 | 30 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 3 | 0 | 0 |
| *Kinbergonuphis* sp. | P | 5 | 0.23 | 40 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 2 | 0 | 0 |
| *Acanthohaustorius intermedius* | A | 4 | 0.19 | 10 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Ensis directus* | M | 4 | 0.19 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 |

Appendix 5.3. Abundance of benthic species collected at the Folly Borrow Area during 6 month post (6 mo Post) nourishment sampling. Abundance values represent the number of individuals per grab ($0.04m^2$). Density represents the number of individuals/$m^2$. Higher taxa codes are P = polychaete, A = amphipod, M = mollusc, and O = other taxa.

| **SpeciesName** | **Category** | **Total Abundance (# /$0.04m^2$)** | **Percent Abundance** | **Percent of Stations Where Present** | **FA02** | **FA03** | **FA04** | **FA06** | **FA07** | **FA08** | **FA10** | **FA11** | **FA13** | **FA14** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Natica pusilla* | M | 4 | 0.19 | 30 | 1 | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 |
| Orbiniidae | P | 4 | 0.19 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 2 |
| *Abra aequalis* | M | 3 | 0.14 | 30 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Exogone* sp. | P | 3 | 0.14 | 30 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 |
| *Ophelina acuminata* | P | 3 | 0.14 | 10 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Prionospio dayi* | P | 3 | 0.14 | 10 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Rhepoxynius epistomus* | A | 3 | 0.14 | 10 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Scolelepis squamata* | P | 3 | 0.14 | 20 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 |
| *Scolelepis texana* | P | 3 | 0.14 | 10 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Tiron tropakis* | A | 3 | 0.14 | 20 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| *Edotia triloba* | O | 3 | 0.14 | 20 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Aglaophamus verrilli* | P | 2 | 0.09 | 20 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Aricidea wassi* | P | 2 | 0.09 | 10 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Bathyporeia parkeri* | A | 2 | 0.09 | 10 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Glycera dibranchiata* | P | 2 | 0.09 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| *Glycinde solitaria* | P | 2 | 0.09 | 20 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| *Metharpinia floridana* | A | 2 | 0.09 | 20 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Sigambra tentaculata* | P | 2 | 0.09 | 20 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| *Spiochaetopterus costarum oculatus* | P | 2 | 0.09 | 20 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Unciola serrata* | A | 2 | 0.09 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| *Cyathura burbancki* | O | 2 | 0.09 | 10 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Leucon americanus* | O | 2 | 0.09 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| Phoronida | O | 2 | 0.09 | 20 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| *Ampelisca* sp. | A | 1 | 0.05 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| *Armandia maculata* | P | 1 | 0.05 | 10 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Bhawania heteroseta* | P | 1 | 0.05 | 10 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Capitellidae | P | 1 | 0.05 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Cistenides gouldii* | P | 1 | 0.05 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Corophiidae | A | 1 | 0.05 | 10 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Crepidula fornicata* | M | 1 | 0.05 | 10 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |

Appendix 5.3. Abundance of benthic species collected at the Folly Borrow Area during 6 month post (6 mo Post) nourishment sampling. Abundance values represent the number of individuals per grab ($0.04 m^2$). Density represents the number of individuals/$m^2$. Higher taxa codes are P = polychaete, A = amphipod, M = mollusc, and O = other taxa.

| SpeciesName | Category | Total Abundance (# /$0.04m^2$) | Percent Abundance | Percent of Stations Where Present | FA02 | FA03 | FA04 | FA06 | FA07 | FA08 | FA10 | FA11 | FA13 | FA14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Diopatra cuprea* | P | 1 | 0.05 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| Dorvilleidae | P | 1 | 0.05 | 10 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Drilonereis longa* | P | 1 | 0.05 | 10 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Eteone heteropoda* | P | 1 | 0.05 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Goniada littorea* | P | 1 | 0.05 | 10 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Mediomastus ambiseta* | P | 1 | 0.05 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Nephtys simoni* | P | 1 | 0.05 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Nucula proxima* | M | 1 | 0.05 | 10 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Nucula* sp. | M | 1 | 0.05 | 10 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Paraonis fulgens* | P | 1 | 0.05 | 10 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Pelecypoda | M | 1 | 0.05 | 10 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Polinices duplicatus* | M | 1 | 0.05 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| *Progoniada regularis* | P | 1 | 0.05 | 10 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spionidae | P | 1 | 0.05 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Streptosyllis* sp. | P | 1 | 0.05 | 10 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tellinidae | M | 1 | 0.05 | 10 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Tiron triocellatus* | A | 1 | 0.05 | 10 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Turbonilla* sp. | M | 1 | 0.05 | 10 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Actiniaria | O | 1 | 0.05 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| Cumacea | O | 1 | 0.05 | 10 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Ophiuroidea | O | 1 | 0.05 | 10 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Ostracoda | O | 1 | 0.05 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Platyhelminthes* | O | 1 | 0.05 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sipuncula | O | 1 | 0.05 | 10 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Mean total abundance (#/$0.04m^2$)** | | | | | **373** | **326** | **53** | **258** | **134** | **120** | **11** | **288** | **421** | **146** |
| **Mean density (#/$m^2$)** | | | | | **9325** | **8150** | **1325** | **6450** | **3350** | **3000** | **275** | **7200** | **10525** | **3650** |
| **Species Richness (#/$0.04m^2$)** | | | | | **27** | **24** | **16** | **38** | **20** | **28** | **4** | **28** | **17** | **16** |
| **Species Diversity** | | | | | **1.40** | **1.63** | **2.35** | **2.36** | **2.00** | **2.46** | **1.29** | **1.95** | **1.28** | **1.88** |
| **Evenness** | | | | | **0.43** | **0.51** | **0.85** | **0.65** | **0.67** | **0.74** | **0.93** | **0.58** | **0.45** | **0.68** |

Appendix 5.4. Abundance of benthic species collected at the Folly Borrow Area during 12 month post (12mo Post) nourishment sampling. Abundance values represent the number of individuals per grab ($0.04 m^2$). Density represents the number of individuals/$m^2$. Higher taxa codes are P = Polychaete, A = Amphipod, M = Mollusc, and O = Other taxa.

| SpeciesName | Category | Total Abundance (# /$0.04m^2$) | Percent Abundance | Percent of Stations Where Present | FA02 | FA03 | FA04 | FA06 | FA07 | FA08 | FA10 | FA11 | FA13 | FA14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nematoda | O | 88 | 19.17 | 70 | 0 | 2 | 2 | 4 | 0 | 10 | 0 | 53 | 1 | 16 |
| *Ophelina acuminata* | P | 29 | 6.32 | 40 | 0 | 0 | 0 | 6 | 3 | 3 | 0 | 17 | 0 | 0 |
| *Magelona* sp. | P | 23 | 5.01 | 70 | 4 | 4 | 0 | 0 | 4 | 2 | 1 | 5 | 3 | 0 |
| *Eudevenopus honduranus* | A | 21 | 4.58 | 30 | 0 | 0 | 3 | 13 | 0 | 5 | 0 | 0 | 0 | 0 |
| Tellinidae | M | 21 | 4.58 | 20 | 0 | 0 | 0 | 12 | 0 | 9 | 0 | 0 | 0 | 0 |
| *Tellina* sp. | M | 19 | 4.14 | 40 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 6 | 1 | 8 |
| Pelecypoda | M | 15 | 3.27 | 30 | 0 | 0 | 0 | 9 | 0 | 2 | 0 | 0 | 4 | 0 |
| *Prionospio cirrifera* | P | 15 | 3.27 | 20 | 0 | 0 | 0 | 0 | 0 | 13 | 2 | 0 | 0 | 0 |
| Copepoda | O | 14 | 3.05 | 60 | 2 | 1 | 3 | 0 | 5 | 1 | 0 | 0 | 0 | 2 |
| *Prionospio dayi* | P | 11 | 2.40 | 10 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Metharpinia floridana* | A | 10 | 2.18 | 20 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 9 |
| *Spiophanes bombyx* | P | 10 | 2.18 | 30 | 0 | 0 | 5 | 2 | 0 | 0 | 0 | 0 | 0 | 3 |
| *Nephtys picta* | P | 9 | 1.96 | 40 | 0 | 0 | 1 | 3 | 4 | 0 | 0 | 1 | 0 | 0 |
| *Oxyurostylis smithi* | O | 9 | 1.96 | 40 | 0 | 0 | 0 | 1 | 0 | 5 | 0 | 0 | 2 | 1 |
| *Armandia agilis* | P | 8 | 1.74 | 30 | 0 | 0 | 1 | 0 | 4 | 3 | 0 | 0 | 0 | 0 |
| *Goniada littorea* | P | 8 | 1.74 | 50 | 0 | 0 | 0 | 1 | 2 | 1 | 0 | 3 | 0 | 1 |
| *Rhepoxynius hudsoni* | A | 8 | 1.74 | 20 | 0 | 0 | 0 | 7 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Carinomella lactea* | O | 8 | 1.74 | 20 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Maldanidae | P | 7 | 1.53 | 20 | 0 | 0 | 0 | 5 | 2 | 0 | 0 | 0 | 0 | 0 |
| *Sigambra tentaculata* | P | 7 | 1.53 | 30 | 0 | 0 | 0 | 0 | 4 | 1 | 0 | 0 | 2 | 0 |
| *Rhepoxynius* sp. | A | 6 | 1.31 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| *Synchelidium americanum* | A | 6 | 1.31 | 30 | 0 | 0 | 0 | 1 | 3 | 2 | 0 | 0 | 0 | 0 |
| Nemertea | O | 6 | 1.31 | 30 | 0 | 0 | 1 | 1 | 0 | 4 | 0 | 0 | 0 | 0 |
| Aharetidae | P | 5 | 1.09 | 10 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 |
| *Natica pusilla* | M | 5 | 1.09 | 50 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 |
| *Scolelepis squamata* | P | 5 | 1.09 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| *Magelona pettiboneae* | P | 4 | 0.87 | 20 | 0 | 0 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 |
| *Mediomastus ambiseta* | P | 4 | 0.87 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 1 |
| *Paraprionospio pinnata* | P | 4 | 0.87 | 20 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Protohaustorius deichmannae* | A | 4 | 0.87 | 20 | 0 | 0 | 1 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |

Appendix 5.4. Abundance of benthic species collected at the Folly Borrow Area during 12 month post (12mo Post) nourishment sampling. Abundance values represent the number of individuals per grab ($0.04m^2$). Density represents the number of individuals/$m^2$. Higher taxa codes are P = Polychaete, A = Amphipod, M = Mollusc, and O = Other taxa.

| SpeciesName | Category | Total Abundance (# /$0.04m^2$) | Percent Abundance | Percent of Stations Where Present | FA02 | FA03 | FA04 | FA06 | FA07 | FA08 | FA10 | FA11 | FA13 | FA14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Spionidae | P | 4 | 0.87 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| *Listriella clymenellae* | A | 3 | 0.65 | 20 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 2 | 0 |
| *Magelona papillicornis* | P | 3 | 0.65 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| *Olivella mutica* | M | 3 | 0.65 | 10 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Prionospio* sp. | P | 3 | 0.65 | 10 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 |
| *Protohaustorius* sp. | A | 3 | 0.65 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| Cumacea | O | 3 | 0.65 | 10 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 |
| Decapoda | O | 3 | 0.65 | 30 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| Cirratulidae | P | 2 | 0.44 | 10 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| *Listriella barnardi* | A | 2 | 0.44 | 10 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Rhepoxynius epistomus* | A | 2 | 0.44 | 20 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| *Spiochaetopterus costarum oculatus* | P | 2 | 0.44 | 10 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Spiophanes missionensis* | P | 2 | 0.44 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| *Spiophanes* sp. | P | 2 | 0.44 | 20 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| *Spiophanes wigleyi* | P | 2 | 0.44 | 10 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| Insecta | O | 2 | 0.44 | 20 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| *Leptochela sp.* | O | 2 | 0.44 | 10 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| *Aglaophamus verrilli* | P | 1 | 0.22 | 10 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ahipoda | A | 1 | 0.22 | 10 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Arabella mutans* | P | 1 | 0.22 | 10 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Aricidea* sp. | P | 1 | 0.22 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Capitellidae | P | 1 | 0.22 | 10 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| *Caulleriella* sp. | P | 1 | 0.22 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Corophium tuberculatum* | A | 1 | 0.22 | 10 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Glycera americana* | P | 1 | 0.22 | 10 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Hemipodus roseus* | P | 1 | 0.22 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| *Leitoscoloplos robustus* | P | 1 | 0.22 | 10 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Lumbrinerides* sp. | P | 1 | 0.22 | 10 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| *Notomastus latericeus* | P | 1 | 0.22 | 10 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Opheliidae | P | 1 | 0.22 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |

Appendix 5.4. Abundance of benthic species collected at the Folly Borrow Area during 12 month post (12mo Post) nourishment sampling. Abundance values represent the number of individuals per grab ($0.04m^2$). Density represents the number of individuals/$m^2$. Higher taxa codes are P = Polychaete, A = Amphipod, M = Mollusc, and O = Other taxa.

| SpeciesName | Category | Total Abundance (# /$0.04m^2$) | Percent Abundance | Percent of Stations Where Present | FA02 | FA03 | FA04 | FA06 | FA07 | FA08 | FA10 | FA11 | FA13 | FA14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Ophelina cylindricaudata* | P | 1 | 0.22 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Ophelina* sp. | P | 1 | 0.22 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Owenia fusiformis* | P | 1 | 0.22 | 10 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *ParAhinome sp.* | P | 1 | 0.22 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| Phoxocephalidae | A | 1 | 0.22 | 10 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Phyllodoce groenlandica* | P | 1 | 0.22 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Polinices* sp. | M | 1 | 0.22 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Polychaeta | P | 1 | 0.22 | 10 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Podontes lupina* | P | 1 | 0.22 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Sigambra wassi* | P | 1 | 0.22 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Strigilla mirabilis* | M | 1 | 0.22 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Tellina agilis* | M | 1 | 0.22 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Leptochela serratorbita* | O | 1 | 0.22 | 10 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Ogyrides alphaerostris* | O | 1 | 0.22 | 10 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| **Mean total abundance (#/$0.04m^2$)** | | | | | **14** | **14** | **37** | **78** | **46** | **85** | **3** | **90** | **21** | **71** |
| **Mean density (#/$m^2$)** | | | | | **350** | **350** | **925** | **1950** | **1150** | **2125** | **75** | **2250** | **525** | **1775** |
| **Species Richness (#/$0.04m^2$)** | | | | | **6** | **6** | **16** | **21** | **20** | **27** | **2** | **11** | **11** | **21** |
| **Species Diversity** | | | | | **1.65** | **1.65** | **2.38** | **2.65** | **2.82** | **2.94** | **0.64** | **1.38** | **2.27** | **2.60** |
| **Evenness** | | | | | **0.92** | **0.92** | **0.86** | **0.87** | **0.94** | **0.89** | **0.92** | **0.58** | **0.95** | **0.86** |

Appendix 5.5. Abundance of benthic species collected at the Folly Reference Area during pre (Pre) nourishment sampling. Abundance values represent the number of individuals per grab ($0.04m^2$). Density represents the number of individuals/$m^2$. Higher taxa codes are P = polychaete, A = amphipod, M = mollusc, and O = other taxa.

| SpeciesName | Category | Total Abundance (# /$0.04m^2$) | Percent Abundance | Percent of Stations Where Present | FR01 | FR02 | FR03 | FR04 | FR05 | FR06 | FR07 | FR08 | FR09 | FR10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Ensis directus* | M | 159 | 11.01 | 90 | 0 | 46 | 5 | 7 | 10 | 1 | 3 | 44 | 23 | 20 |
| *Crassinella martinicensis* | M | 134 | 9.28 | 80 | 0 | 0 | 39 | 1 | 8 | 33 | 27 | 10 | 2 | 14 |
| *Crassinella lunulata* | M | 124 | 8.59 | 80 | 24 | 0 | 9 | 0 | 11 | 3 | 9 | 42 | 11 | 15 |
| Nematoda | O | 119 | 8.24 | 90 | 34 | 0 | 6 | 4 | 10 | 2 | 18 | 16 | 1 | 28 |
| *Oxyurostylis smithi* | O | 89 | 6.16 | 100 | 1 | 4 | 4 | 6 | 25 | 2 | 15 | 6 | 24 | 2 |
| Actiniaria | O | 85 | 5.89 | 20 | 0 | 0 | 0 | 7 | 0 | 0 | 78 | 0 | 0 | 0 |
| *Clymenella torquata* | P | 68 | 4.71 | 30 | 0 | 47 | 0 | 0 | 0 | 0 | 2 | 19 | 0 | 0 |
| *Bhawania heteroseta* | P | 60 | 4.16 | 90 | 2 | 4 | 5 | 0 | 5 | 1 | 8 | 20 | 2 | 13 |
| *Cyathura burbancki* | O | 39 | 2.70 | 60 | 4 | 0 | 8 | 0 | 9 | 0 | 10 | 0 | 7 | 1 |
| *Travisia parva* | P | 37 | 2.56 | 50 | 15 | 0 | 10 | 3 | 3 | 6 | 0 | 0 | 0 | 0 |
| *Pleuromeris tridentata* | M | 37 | 2.56 | 70 | 2 | 0 | 13 | 0 | 2 | 10 | 7 | 2 | 0 | 1 |
| *Spiophanes bombyx* | P | 24 | 1.66 | 40 | 0 | 14 | 0 | 0 | 0 | 0 | 2 | 7 | 0 | 1 |
| *Batea catharinensis* | A | 24 | 1.66 | 30 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 17 | 1 | 0 |
| *Cupuladria doma* | O | 23 | 1.59 | 10 | 23 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nemertea | O | 21 | 1.45 | 70 | 1 | 2 | 0 | 5 | 0 | 1 | 8 | 3 | 0 | 1 |
| *Mediomastus* sp. | P | 19 | 1.32 | 30 | 0 | 11 | 0 | 0 | 2 | 0 | 0 | 6 | 0 | 0 |
| *Branchiostoma* sp. | O | 19 | 1.32 | 70 | 1 | 0 | 6 | 1 | 1 | 0 | 2 | 0 | 5 | 3 |
| *Nereis succinea* | P | 18 | 1.25 | 40 | 2 | 14 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Diopatra cuprea* | P | 18 | 1.25 | 30 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 1 |
| *Exogone* sp. | P | 16 | 1.11 | 30 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 13 | 2 | 0 |
| *Glycera americana* | P | 15 | 1.04 | 40 | 0 | 0 | 6 | 0 | 1 | 3 | 0 | 5 | 0 | 0 |
| Ophiuroidea | O | 13 | 0.90 | 40 | 2 | 8 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| *Glycinde solitaria* | P | 13 | 0.90 | 40 | 0 | 0 | 0 | 0 | 5 | 0 | 3 | 0 | 2 | 3 |
| *Sphenia antillensis* | M | 12 | 0.83 | 30 | 0 | 0 | 1 | 0 | 6 | 0 | 5 | 0 | 0 | 0 |
| *Monticellina* sp. | P | 12 | 0.83 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 10 | 0 | 0 |
| *Synelmis ewingi* | P | 11 | 0.76 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 0 |
| *Corophium* sp. | A | 11 | 0.76 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 0 |
| *Amphicteis gunneri* | P | 11 | 0.76 | 10 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Pionosyllis gesae* | P | 10 | 0.69 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 0 |
| *Glycera* sp. | P | 10 | 0.69 | 50 | 0 | 1 | 6 | 1 | 1 | 0 | 1 | 0 | 0 | 0 |

Appendix 5.5. Abundance of benthic species collected at the Folly Reference Area during pre (Pre) nourishment sampling. Abundance values represent the number of individuals per grab ($0.04m^2$). Density represents the number of individuals/$m^2$. Higher taxa codes are P = polychaete, A = amphipod, M = mollusc, and O = other taxa.

| SpeciesName | Category | Total Abundance (# /$0.04m^2$) | Percent Abundance | Percent of Stations Where Present | FR01 | FR02 | FR03 | FR04 | FR05 | FR06 | FR07 | FR08 | FR09 | FR10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Travisia* sp. | P | 8 | 0.55 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 7 | 0 |
| *Pisione remota* | P | 8 | 0.55 | 30 | 0 | 3 | 0 | 0 | 0 | 1 | 4 | 0 | 0 | 0 |
| *Nephtys picta* | P | 8 | 0.55 | 60 | 0 | 1 | 0 | 1 | 2 | 1 | 2 | 0 | 0 | 1 |
| *Eteone heteropoda* | P | 8 | 0.55 | 20 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 6 | 0 | 0 |
| *Arabella mutans* | P | 8 | 0.55 | 20 | 0 | 7 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Abra aequalis* | M | 8 | 0.55 | 50 | 0 | 0 | 1 | 2 | 0 | 0 | 1 | 3 | 0 | 1 |
| Solenidae | M | 7 | 0.48 | 10 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Sabellaria vulgaris vulgaris* | P | 7 | 0.48 | 30 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 0 |
| *Prionospio cirrifera* | P | 7 | 0.48 | 20 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 |
| *Aphelochaeta* sp. | P | 7 | 0.48 | 30 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 5 | 0 | 0 |
| *Tiron tropakis* | A | 6 | 0.42 | 20 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 3 | 0 | 0 |
| *Podarkeopsis levifuscina* | P | 5 | 0.35 | 10 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Hemipodus roseus* | P | 5 | 0.35 | 10 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Hemipholis elongata* | O | 5 | 0.35 | 20 | 0 | 4 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Goniadides carolinae* | P | 5 | 0.35 | 30 | 0 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tubificidae | O | 4 | 0.28 | 20 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 2 | 0 | 0 |
| Tanaidacea | O | 4 | 0.28 | 30 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |
| Copepoda | O | 4 | 0.28 | 30 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| Amphipoda | A | 4 | 0.28 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 2 | 0 |
| Syllidae | P | 3 | 0.21 | 20 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| *Ericthonius brasiliensis* | A | 3 | 0.21 | 30 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Drilonereis longa* | P | 3 | 0.21 | 20 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 0 |
| Cirratulidae | P | 3 | 0.21 | 30 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| *Cirolana polita* | O | 3 | 0.21 | 30 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| *Anadara transversa* | M | 3 | 0.21 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 |
| *Ampelisca* sp. | A | 3 | 0.21 | 10 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Syllis* sp. | P | 2 | 0.14 | 10 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| *Progoniada regularis* | P | 2 | 0.14 | 10 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Phyllodoce arenae* | P | 2 | 0.14 | 10 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Paguridae | O | 2 | 0.14 | 10 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Appendix 5.5. Abundance of benthic species collected at the Folly Reference Area during pre (Pre) nourishment sampling. Abundance values represent the number of individuals per grab ($0.04m^2$). Density represents the number of individuals/$m^2$. Higher taxa codes are P = polychaete, A = amphipod, M = mollusc, and O = other taxa.

| SpeciesName | Category | Total Abundance (# /$0.04m^2$) | Percent Abundance | Percent of Stations Where Present | FR01 | FR02 | FR03 | FR04 | FR05 | FR06 | FR07 | FR08 | FR09 | FR10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Leptonacea* sp. | M | 2 | 0.14 | 10 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| Gastropoda | M | 2 | 0.14 | 10 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| *Cirrophorus* sp. | P | 2 | 0.14 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| *Brania* sp. | P | 2 | 0.14 | 10 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Turbellaria | O | 1 | 0.07 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| Tellinidae | M | 1 | 0.07 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Tellina* sp. | M | 1 | 0.07 | 10 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Synchelidium americanum* | A | 1 | 0.07 | 10 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| *Streblospio benedicti* | P | 1 | 0.07 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| Sigalionidae | P | 1 | 0.07 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Rhepoxynius epistomus* | A | 1 | 0.07 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Pyura vittata* | O | 1 | 0.07 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pilargidae | P | 1 | 0.07 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| Pelecypoda | M | 1 | 0.07 | 10 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Pagurus* sp. | O | 1 | 0.07 | 10 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Oligochaeta | O | 1 | 0.07 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Odontosyllis enopla* | P | 1 | 0.07 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Natica pusilla* | M | 1 | 0.07 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Microphthalmus* sp. | P | 1 | 0.07 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Mediomastus ambiseta* | P | 1 | 0.07 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| Maldanidae | P | 1 | 0.07 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| *Lumbrineris* sp. | P | 1 | 0.07 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Lumbrineridae | P | 1 | 0.07 | 10 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| *Leitoscoloplos* sp. | P | 1 | 0.07 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Leitoscoloplos fragilis* | P | 1 | 0.07 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| Isopoda | O | 1 | 0.07 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Insecta | O | 1 | 0.07 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Hypoconcha arcuata* | O | 1 | 0.07 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Hesionidae | P | 1 | 0.07 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| *Glottidia pyramidata* | O | 1 | 0.07 | 10 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |

Appendix 5.5. Abundance of benthic species collected at the Folly Reference Area during pre (Pre) nourishment sampling. Abundance values represent the number of individuals per grab ($0.04m^2$). Density represents the number of individuals/$m^2$. Higher taxa codes are P = polychaete, A = amphipod, M = mollusc, and O = other taxa.

| SpeciesName | Category | Total Abundance (# /$0.04m^2$) | Percent Abundance | Percent of Stations Where Present | FR01 | FR02 | FR03 | FR04 | FR05 | FR06 | FR07 | FR08 | FR09 | FR10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Euceramus praelongus* | O | 1 | 0.07 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Edotia triloba* | O | 1 | 0.07 | 10 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Edotia* sp. | P | 1 | 0.07 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Dorvilleidae | P | 1 | 0.07 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cumacea | O | 1 | 0.07 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| Corophiidae | A | 1 | 0.07 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| *Corbula contracta* | M | 1 | 0.07 | 10 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Chione cancellata* | M | 1 | 0.07 | 10 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Carinomella lactea* | O | 1 | 0.07 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Brania wellfleetensis* | P | 1 | 0.07 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| *Armandia maculata* | P | 1 | 0.07 | 10 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Arcidae | M | 1 | 0.07 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| **Mean total abundance (#/$0.04m^2$)** | | | | | **133** | **220** | **129** | **48** | **118** | **70** | **217** | **302** | **99** | **108** |
| **Mean density (#/$m^2$)** | | | | | **3325** | **5500** | **3225** | **1200** | **2950** | **1750** | **5425** | **7550** | **2475** | **2700** |
| **Species Richness (#/$0.04m^2$)** | | | | | **22** | **32** | **21** | **20** | **28** | **17** | **28** | **40** | **20** | **18** |
| **Species Diversity** | | | | | **2.30** | **2.70** | **2.50** | **2.67** | **2.81** | **1.96** | **2.43** | **3.10** | **2.35** | **2.16** |
| **Evenness** | | | | | **0.74** | **0.78** | **0.82** | **0.89** | **0.84** | **0.69** | **0.73** | **0.84** | **0.78** | **0.75** |

Appendix 5.6. Abundance of benthic species collected at the Folly Reference Area during immediate post (Post) nourishment sampling. Abundance values represent the number of individuals per grab ($0.04m^2$). Density represents the number of individuals/$m^2$. Higher taxa codes are P = polychaete, A = amphipod, M = mollusc, and O = other taxa.

| SpeciesName | Category | Total Abundance (# /$0.04m^2$) | Percent Abundance | Percent of Stations Where Present | FR01 | FR02 | FR03 | FR04 | FR05 | FR06 | FR07 | FR08 | FR09 | FR10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Batea catharinensis* | A | 274 | 27.68 | 70 | 15 | 208 | 1 | 0 | 1 | 1 | 0 | 28 | 20 | 0 |
| Nematoda | O | 93 | 9.39 | 90 | 3 | 7 | 5 | 5 | 13 | 6 | 4 | 0 | 3 | 47 |
| *Branchiostoma* sp. | O | 74 | 7.47 | 70 | 12 | 0 | 16 | 5 | 6 | 10 | 11 | 0 | 0 | 14 |
| *Bhawania heteroseta* | P | 58 | 5.86 | 80 | 5 | 0 | 11 | 0 | 1 | 1 | 3 | 10 | 19 | 8 |
| *Crassinella lunulata* | M | 43 | 4.34 | 90 | 4 | 0 | 6 | 1 | 2 | 2 | 7 | 5 | 11 | 5 |
| *Sabellaria vulgaris vulgaris* | P | 31 | 3.13 | 20 | 0 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| *Cyathura burbancki* | O | 27 | 2.73 | 60 | 3 | 0 | 0 | 0 | 4 | 1 | 8 | 0 | 5 | 6 |
| *Elasmopus levis* | A | 20 | 2.02 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 12 | 1 |
| *Pleuromeris tridentata* | M | 20 | 2.02 | 50 | 0 | 0 | 4 | 2 | 0 | 8 | 2 | 0 | 0 | 4 |
| *Glycera americana* | P | 19 | 1.92 | 90 | 3 | 3 | 1 | 1 | 1 | 6 | 0 | 2 | 1 | 1 |
| Copepoda | O | 17 | 1.72 | 30 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 1 | 8 | 0 |
| Nemertea | O | 16 | 1.62 | 80 | 1 | 1 | 0 | 4 | 0 | 4 | 1 | 1 | 3 | 1 |
| *Rhepoxynius epistomus* | A | 14 | 1.41 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 8 | 2 |
| *Crassinella martinicensis* | M | 11 | 1.11 | 50 | 0 | 0 | 0 | 1 | 0 | 3 | 1 | 1 | 0 | 5 |
| *Dentatisyllis carolinae* | P | 11 | 1.11 | 10 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Mediomastus* sp. | P | 11 | 1.11 | 50 | 0 | 0 | 0 | 0 | 1 | 5 | 0 | 1 | 2 | 2 |
| Nereididae | P | 11 | 1.11 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 8 | 0 |
| *Sigambra* sp. | P | 11 | 1.11 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 9 | 0 |
| *Ericthonius brasiliensis* | A | 10 | 1.01 | 10 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Nephtys picta* | P | 9 | 0.91 | 40 | 0 | 0 | 0 | 0 | 1 | 0 | 2 | 5 | 1 | 0 |
| *Exogone sp.* | P | 8 | 0.81 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 6 | 0 |
| *Nereis succinea* | P | 8 | 0.81 | 20 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 |
| *Caulleriella* sp. | P | 7 | 0.71 | 10 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Corophium* sp. | A | 7 | 0.71 | 20 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 |
| *Oxyurostylis smithi* | O | 7 | 0.71 | 50 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 2 | 2 |
| Cirratulidae | P | 6 | 0.61 | 30 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 1 |
| *Glycinde solitaria* | P | 6 | 0.61 | 20 | 3 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Goniada littorea* | P | 6 | 0.61 | 20 | 0 | 0 | 0 | 0 | 3 | 0 | 3 | 0 | 0 | 0 |
| *Pisione remota* | P | 6 | 0.61 | 40 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 3 |
| *Spiophanes bombyx* | P | 6 | 0.61 | 50 | 0 | 0 | 2 | 0 | 1 | 1 | 0 | 1 | 1 | 0 |

Appendix 5.6. Abundance of benthic species collected at the Folly Reference Area during immediate post (Post) nourishment sampling. Abundance values represent the number of individuals per grab ($0.04m^2$). Density represents the number of individuals/$m^2$. Higher taxa codes are P = polychaete, A = amphipod, M = mollusc, and O = other taxa.

| SpeciesName | Category | Total Abundance (# /$0.04m^2$) | Percent Abundance | Percent of Stations Where Present | FR01 | FR02 | FR03 | FR04 | FR05 | FR06 | FR07 | FR08 | FR09 | FR10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Barbatia* sp. | M | 5 | 0.51 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 | 0 |
| *Goniadides carolinae* | P | 5 | 0.51 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 2 |
| *Prionospio cirrifera* | P | 5 | 0.51 | 50 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Scoletoma tenuis* | P | 5 | 0.51 | 20 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 3 | 0 |
| Ophiuroidea | O | 5 | 0.51 | 20 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| *Pagurus* sp. | O | 5 | 0.51 | 30 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 2 | 0 |
| Tanaidacea | O | 5 | 0.51 | 40 | 0 | 0 | 0 | 1 | 1 | 2 | 0 | 0 | 0 | 1 |
| *Abra aequalis* | M | 4 | 0.40 | 10 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Arabella mutans* | P | 4 | 0.40 | 20 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| *Armandia agilis* | P | 4 | 0.40 | 10 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Diopatra cuprea* | P | 4 | 0.40 | 20 | 0 | 3 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Dorvilleidae | P | 4 | 0.40 | 30 | 0 | 2 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Glycera* sp. | P | 4 | 0.40 | 20 | 0 | 0 | 0 | 0 | 1 | 0 | 3 | 0 | 0 | 0 |
| *Magelona* sp. | P | 4 | 0.40 | 30 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 1 | 0 |
| Syllidae | P | 4 | 0.40 | 30 | 0 | 1 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 |
| Sipuncula | O | 4 | 0.40 | 30 | 2 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Melita nitida* | A | 3 | 0.30 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 |
| Pilargidae | P | 3 | 0.30 | 10 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 |
| *Prionospio* sp. | P | 3 | 0.30 | 10 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Rhepoxynius* sp. | A | 3 | 0.30 | 10 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Streptosyllis* sp. | P | 3 | 0.30 | 20 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Decapoda | O | 3 | 0.30 | 30 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| Oligochaeta | O | 3 | 0.30 | 20 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Autolytus* sp. | P | 2 | 0.20 | 10 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Cirrophorus* sp. | P | 2 | 0.20 | 10 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| *Crepidula fornicata* | M | 2 | 0.20 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| *Dulichiella appendiculata* | A | 2 | 0.20 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| *Edotia* sp. | P | 2 | 0.20 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| *Monticellina* sp. | P | 2 | 0.20 | 10 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Podarkeopsis levifuscina* | P | 2 | 0.20 | 20 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| *Prionospio cristata* | P | 2 | 0.20 | 10 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| *Sphenia antillensis* | M | 2 | 0.20 | 10 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

Appendix 5.6. Abundance of benthic species collected at the Folly Reference Area during immediate post (Post) nourishment sampling. Abundance values represent the number of individuals per grab ($0.04m^2$). Density represents the number of individuals/$m^2$. Higher taxa codes are P = polychaete, A = amphipod, M = mollusc, and O = other taxa.

| SpeciesName | Category | Total Abundance (# /$0.04m^2$) | Percent Abundance | Percent of Stations Where Present | FR01 | FR02 | FR03 | FR04 | FR05 | FR06 | FR07 | FR08 | FR09 | FR10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Spiochaetopterus costarum oculatus* | P | 2 | 0.20 | 10 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Apanthura magnifica* | O | 2 | 0.20 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| *Cirolana polita* | O | 2 | 0.20 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| *Panopeus herbstii* | O | 2 | 0.20 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 |
| *Eudevenopus honduranus* | A | 1 | 0.10 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lucinidae | M | 1 | 0.10 | 10 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Mulinia lateralis* | M | 1 | 0.10 | 10 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Nucula* sp. | M | 1 | 0.10 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Odontosyllis enopla* | P | 1 | 0.10 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Paracaprella tenuis* | A | 1 | 0.10 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Podarke* sp. | P | 1 | 0.10 | 10 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Polycirrus* sp. | P | 1 | 0.10 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Polydora socialis* | P | 1 | 0.10 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Schistomeringos* sp. | P | 1 | 0.10 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spionidae | P | 1 | 0.10 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Synchelidium americanum* | A | 1 | 0.10 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Tellinidae | M | 1 | 0.10 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| *Travisia* sp. | P | 1 | 0.10 | 10 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| *Trypanosyllis* sp. | P | 1 | 0.10 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Turbonilla* sp. | M | 1 | 0.10 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Actiniaria | O | 1 | 0.10 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| *Carinomella lactea* | O | 1 | 0.10 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Edotia triloba* | O | 1 | 0.10 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Emerita benedicti* | O | 1 | 0.10 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Emerita talpoida* | O | 1 | 0.10 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Insecta | O | 1 | 0.10 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| *Latreutes parvulus* | O | 1 | 0.10 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Leptochela serratorbita* | O | 1 | 0.10 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Leptochela* sp. | O | 1 | 0.10 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| **Mean total abundance (#/$0.04m^2$)** | | | | | **57** | **335** | **64** | **30** | **46** | **58** | **53** | **83** | **155** | **109** |
| **Mean density (#/$m^2$)** | | | | | **1425** | **8375** | **1600** | **750** | **1150** | **1450** | **1325** | **2075** | **3875** | **2725** |
| **Species Richness (#/$0.04m^2$)** | | | | | **16** | **39** | **15** | **14** | **19** | **20** | **18** | **22** | **36** | **20** |
| **Species Diversity** | | | | | **2.31** | **1.84** | **2.22** | **2.43** | **2.52** | **2.64** | **2.53** | **2.45** | **3.11** | **2.15** |
| **Evenness** | | | | | **0.83** | **0.50** | **0.82** | **0.92** | **0.85** | **0.88** | **0.88** | **0.79** | **0.87** | **0.72** |

Appendix 5.7. Abundance of benthic species collected at the Folly Reference Area during 6 month post (6 mo Post) nourishment sampling. Abundance values represent the number of individuals per grab ($0.04m^2$). Density represents the number of individuals/$m^2$. Higher taxa codes are P = polychaete, A = amphipod, M = mollusc, and O = other taxa.

| SpeciesName | Category | Total Abundance (# /0.04m2) | Percent Abundance | Percent of Stations Where Present | FR01 | FR02 | FR03 | FR04 | FR05 | FR06 | FR07 | FR08 | FR09 | FR10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nematoda | O | 427 | 19.60 | 100 | 30 | 57 | 71 | 44 | 22 | 5 | 37 | 18 | 71 | 72 |
| *Cupuladria doma* | O | 388 | 17.81 | 70 | 179 | 0 | 6 | 17 | 0 | 39 | 97 | 0 | 2 | 48 |
| *Batea catharinensis* | A | 344 | 15.79 | 50 | 0 | 0 | 328 | 4 | 0 | 0 | 1 | 7 | 4 | 0 |
| *Pleuromeris tridentata* | M | 141 | 6.47 | 70 | 23 | 0 | 66 | 9 | 0 | 20 | 16 | 0 | 1 | 6 |
| *Travisia parva* | P | 110 | 5.05 | 80 | 28 | 0 | 12 | 9 | 14 | 8 | 13 | 0 | 20 | 6 |
| *Crassinella martinicensis* | M | 63 | 2.89 | 80 | 12 | 0 | 10 | 8 | 1 | 24 | 1 | 0 | 2 | 5 |
| *Bhawania heteroseta* | P | 53 | 2.43 | 80 | 13 | 5 | 6 | 0 | 1 | 3 | 7 | 0 | 9 | 9 |
| *Hemipodus roseus* | P | 52 | 2.39 | 90 | 9 | 0 | 13 | 3 | 4 | 2 | 2 | 2 | 8 | 9 |
| *Crassinella lunulata* | M | 36 | 1.65 | 80 | 5 | 2 | 9 | 1 | 0 | 1 | 12 | 1 | 0 | 5 |
| *Spiophanes bombyx* | P | 31 | 1.42 | 50 | 2 | 22 | 0 | 0 | 0 | 0 | 0 | 5 | 1 | 1 |
| *Ancistrosyllis* sp. | P | 28 | 1.28 | 20 | 0 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 |
| *Pyura vittata* | O | 25 | 1.15 | 50 | 0 | 0 | 0 | 3 | 0 | 7 | 8 | 0 | 1 | 6 |
| *Branchiostoma* sp. | O | 22 | 1.01 | 40 | 4 | 0 | 0 | 0 | 1 | 0 | 8 | 0 | 0 | 9 |
| *Tellina agilis* | M | 20 | 0.92 | 70 | 0 | 0 | 1 | 9 | 1 | 5 | 0 | 2 | 1 | 1 |
| *Leptognathia caeca* | O | 20 | 0.92 | 40 | 1 | 0 | 7 | 8 | 0 | 4 | 0 | 0 | 0 | 0 |
| *Prionospio* sp. | P | 19 | 0.87 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 18 | 0 |
| Enchytraeidae | O | 19 | 0.87 | 50 | 2 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 12 | 3 |
| *Tubificoides wasselli* | O | 19 | 0.87 | 30 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 2 |
| Copepoda | O | 17 | 0.78 | 30 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 |
| Nemertea | O | 17 | 0.78 | 50 | 4 | 0 | 4 | 0 | 0 | 0 | 4 | 3 | 2 | 0 |
| *Magelona* sp. | P | 16 | 0.73 | 30 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 6 | 7 | 0 |
| *Abra aequalis* | M | 13 | 0.60 | 60 | 1 | 2 | 1 | 0 | 0 | 1 | 5 | 3 | 0 | 0 |
| *Cyathura burbancki* | O | 13 | 0.60 | 70 | 2 | 0 | 4 | 0 | 1 | 1 | 2 | 0 | 1 | 2 |
| *Ensis directus* | M | 12 | 0.55 | 60 | 2 | 4 | 2 | 0 | 0 | 1 | 0 | 0 | 2 | 1 |
| *Oxyurostylis smithi* | O | 12 | 0.55 | 50 | 0 | 3 | 2 | 0 | 0 | 3 | 3 | 1 | 0 | 0 |
| *Elasmopus levis* | A | 11 | 0.50 | 10 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Pisione remota* | P | 11 | 0.50 | 70 | 3 | 3 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 |
| *Prionospio cristata* | P | 10 | 0.46 | 10 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Acanthohaustorius millsi* | A | 9 | 0.41 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 |
| *Goniadides carolinae* | P | 9 | 0.41 | 30 | 2 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 5 | 0 |
| *Mediomastus* sp. | P | 8 | 0.37 | 40 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 1 | 4 | 0 |
| *Microprotopus raneyi* | A | 8 | 0.37 | 30 | 2 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 1 |
| *Tiron tropakis* | A | 8 | 0.37 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 3 | 1 |

Appendix 5.7. Abundance of benthic species collected at the Folly Reference Area during 6 month post (6 mo Post) nourishment sampling. Abundance values represent the number of individuals per grab ($0.04m^2$). Density represents the number of individuals/$m^2$. Higher taxa codes are P = polychaete, A = amphipod, M = mollusc, and O = other taxa.

| SpeciesName | Category | Total Abundance (# /0.04m2) | Percent Abundance | Percent of Stations Where Present | FR01 | FR02 | FR03 | FR04 | FR05 | FR06 | FR07 | FR08 | FR09 | FR10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Phyllangia americana* | O | 8 | 0.37 | 30 | 1 | 0 | 0 | 1 | 0 | 6 | 0 | 0 | 0 | 0 |
| *Tubificoides brownae* | O | 8 | 0.37 | 20 | 4 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Ericthonius brasiliensis* | A | 7 | 0.32 | 20 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 3 | 0 | 0 |
| *Arabella mutans* | P | 6 | 0.28 | 30 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 3 |
| Cirratulidae | P | 6 | 0.28 | 10 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Nephtys picta* | P | 6 | 0.28 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 1 | 0 |
| *Corophium* sp. | A | 5 | 0.23 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 |
| *Glycera* sp. | P | 5 | 0.23 | 20 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| *Cirolana polita* | O | 5 | 0.23 | 40 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 |
| Sipuncula | O | 5 | 0.23 | 20 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Lumbrineris* sp. | P | 4 | 0.18 | 40 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 |
| *Nereis succinea* | P | 4 | 0.18 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 |
| *Parametopella cypris* | A | 4 | 0.18 | 10 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Syllis* sp. | P | 4 | 0.18 | 30 | 0 | 0 | 2 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| Decapoda | O | 4 | 0.18 | 30 | 0 | 0 | 2 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| Insecta | O | 4 | 0.18 | 40 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| *Cirrophorus* sp. | P | 3 | 0.14 | 20 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Diopatra cuprea* | P | 3 | 0.14 | 30 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| *Exogone* sp. | P | 3 | 0.14 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| *Glycera americana* | P | 3 | 0.14 | 10 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Kinbergonuphis* sp. | P | 3 | 0.14 | 20 | 0 | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| *Phyllodoce arenae* | P | 3 | 0.14 | 30 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 | 0 |
| *Sphaerosyllis* sp. | P | 3 | 0.14 | 20 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| Syllidae | P | 3 | 0.14 | 20 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Amphicteis gunneri* | P | 2 | 0.09 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| *Caulleriella* sp. | P | 2 | 0.09 | 10 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dorvilleidae | P | 2 | 0.09 | 20 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| *Glycera papillosa* | P | 2 | 0.09 | 10 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Lyonsia hyalina* | M | 2 | 0.09 | 20 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| *Melita* sp. | A | 2 | 0.09 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| *Natica pusilla* | M | 2 | 0.09 | 20 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| *Nephtys* sp. | P | 2 | 0.09 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| Nereididae | P | 2 | 0.09 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 |

Appendix 5.7. Abundance of benthic species collected at the Folly Reference Area during 6 month post (6 mo Post) nourishment sampling. Abundance values represent the number of individuals per grab ($0.04m^2$). Density represents the number of individuals/$m^2$. Higher taxa codes are P = polychaete, A = amphipod, M = mollusc, and O = other taxa.

| SpeciesName | Category | Total Abundance (# /0.04m2) | Percent Abundance | Percent of Stations Where Present | FR01 | FR02 | FR03 | FR04 | FR05 | FR06 | FR07 | FR08 | FR09 | FR10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Ophelia denticulata* | P | 2 | 0.09 | 20 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| *Protohaustorius deichmannae* | A | 2 | 0.09 | 10 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| *Rhepoxynius epistomus* | A | 2 | 0.09 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| *Spisula solidissima* | M | 2 | 0.09 | 20 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| *Tellina alternata* | M | 2 | 0.09 | 20 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| Tellinidae | M | 2 | 0.09 | 10 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| Ascidiacea | O | 2 | 0.09 | 10 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| *Leucon americanus* | O | 2 | 0.09 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 |
| *Molgula manhattensis* | O | 2 | 0.09 | 10 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ophiuroidea | O | 2 | 0.09 | 20 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Pagurus longicarpus* | O | 2 | 0.09 | 20 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Pagurus* sp. | O | 2 | 0.09 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| Tanaidacea | O | 2 | 0.09 | 10 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tubificidae | O | 2 | 0.09 | 20 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 |
| *Anadara transversa* | M | 1 | 0.05 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Aricidea* sp. | P | 1 | 0.05 | 10 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Armandia maculata* | P | 1 | 0.05 | 10 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Bathyporeia parkeri* | A | 1 | 0.05 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Brania* sp. | P | 1 | 0.05 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Brania wellfleetensis* | P | 1 | 0.05 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Caecum pulchellum* | M | 1 | 0.05 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Caecum* sp. | M | 1 | 0.05 | 10 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Corbula contracta* | M | 1 | 0.05 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Corophiidae | A | 1 | 0.05 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Crepidula fornicata* | M | 1 | 0.05 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Eudevenopus honduranus* | A | 1 | 0.05 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| Gastropoda | M | 1 | 0.05 | 10 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| *Leitoscoloplos* sp. | P | 1 | 0.05 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Marginella* sp. | M | 1 | 0.05 | 10 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Monticellina* sp. | P | 1 | 0.05 | 10 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Nephtyidae | P | 1 | 0.05 | 10 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Nucula* sp. | M | 1 | 0.05 | 10 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Paraonidae | P | 1 | 0.05 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |

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| SpeciesName | Category | Total Abundance (# /0.04m2) | Percent Abundance | Percent of Stations Where Present | FR01 | FR02 | FR03 | FR04 | FR05 | FR06 | FR07 | FR08 | FR09 | FR10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Paraonis fulgens* | P | 1 | 0.05 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Parapionosyllis* sp. | P | 1 | 0.05 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Poecilochaetus johnsoni* | P | 1 | 0.05 | 10 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Polychaeta | P | 1 | 0.05 | 10 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Scolelepis* sp. | P | 1 | 0.05 | 10 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Sigalion arenicola* | P | 1 | 0.05 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spionidae | P | 1 | 0.05 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Synelmis* sp. | P | 1 | 0.05 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Tellina* sp. | M | 1 | 0.05 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Tharyx* sp. | P | 1 | 0.05 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| *Unciola serrata* | A | 1 | 0.05 | 10 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Edotia triloba* | O | 1 | 0.05 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Hemipholis elongata* | O | 1 | 0.05 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| *Mellita* sp. | O | 1 | 0.05 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| **Mean total abundance (#/0.04m$^2$)** | | | | | **361** | **158** | **583** | **131** | **53** | **140** | **239** | **99** | **214** | **201** |
| **Mean density (#/m$^2$)** | | | | | **9025** | **3950** | **14575** | **3275** | **1325** | **3500** | **5975** | **2475** | **5350** | **5025** |
| **Species Richness (#/0.04m$^2$)** | | | | | **33** | **28** | **35** | **25** | **15** | **24** | **29** | **35** | **38** | **27** |
| **Species Diversity** | | | | | **2.12** | **2.41** | **1.77** | **2.42** | **1.86** | **2.42** | **2.26** | **3.13** | **2.65** | **2.24** |
| **Evenness** | | | | | **0.61** | **0.72** | **0.50** | **0.75** | **0.69** | **0.76** | **0.67** | **0.88** | **0.73** | **0.68** |

Appendix 5.8. Abundance of benthic species collected at the Folly Reference Area during 12 month post (12 mo Post) nourishment sampling. Abundance values represent the number of individuals per grab ($0.04 m^2$). Density represents the number of individuals/$m^2$. Higher taxa codes are P = polychaete, A = amphipod, M = mollusc, and O = other taxa.

| **SpeciesName** | **Category** | **Total Abundance (# /$0.04m^2$)** | **Percent Abundance** | **Percent of Stations Where Present** | **FR01** | **FR02** | **FR03** | **FR04** | **FR05** | **FR06** | **FR07** | **FR08** | **FR09** | **FR10** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Cupuladria doma* | O | 1097 | 28.85 | 70 | 130 | 0 | 278 | 38 | 0 | 210 | 233 | 0 | 120 | 88 |
| Nematoda | O | 937 | 24.64 | 100 | 29 | 107 | 50 | 38 | 122 | 91 | 248 | 63 | 113 | 76 |
| Veneridae | M | 284 | 7.47 | 40 | 0 | 0 | 39 | 0 | 122 | 100 | 109 | 0 | 0 | 36 |
| *Pleuromeris tridentata* | M | 133 | 3.50 | 40 | 0 | 0 | 33 | 0 | 122 | 41 | 45 | 0 | 0 | 14 |
| *Caulleriella* sp. | P | 92 | 2.42 | 40 | 0 | 17 | 2 | 0 | 122 | 18 | 55 | 0 | 0 | 0 |
| *Bhawania heteroseta* | P | 86 | 2.26 | 80 | 7 | 3 | 26 | 1 | 122 | 2 | 20 | 0 | 15 | 0 |
| *Crassinella martinicensis* | M | 86 | 2.26 | 40 | 36 | 0 | 0 | 38 | 122 | 0 | 0 | 0 | 8 | 0 |
| *Branchiostoma* sp. | O | 82 | 2.16 | 80 | 18 | 0 | 27 | 3 | 122 | 11 | 10 | 0 | 3 | 8 |
| *Crassinella lunulata* | M | 73 | 1.92 | 60 | 0 | 0 | 17 | 2 | 122 | 23 | 23 | 0 | 0 | 3 |
| Copepoda | O | 65 | 1.71 | 80 | 3 | 2 | 4 | 0 | 122 | 1 | 36 | 10 | 3 | 6 |
| Syllidae | P | 39 | 1.03 | 80 | 5 | 4 | 1 | 1 | 122 | 3 | 1 | 0 | 7 | 0 |
| *Prionospio cristata* | P | 38 | 1.00 | 20 | 1 | 0 | 37 | 0 | 122 | 0 | 0 | 0 | 0 | 0 |
| *Armandia maculata* | P | 32 | 0.84 | 50 | 2 | 1 | 14 | 0 | 122 | 2 | 13 | 0 | 0 | 0 |
| Carditidae | M | 29 | 0.76 | 20 | 14 | 0 | 0 | 15 | 122 | 0 | 0 | 0 | 0 | 0 |
| *Hemipodus roseus* | P | 27 | 0.71 | 70 | 12 | 4 | 2 | 0 | 122 | 1 | 4 | 0 | 3 | 1 |
| *Pyura vittata* | O | 27 | 0.71 | 50 | 0 | 0 | 3 | 6 | 122 | 8 | 6 | 0 | 0 | 4 |
| Spionidae | P | 24 | 0.63 | 40 | 13 | 0 | 1 | 3 | 122 | 0 | 0 | 0 | 7 | 0 |
| *Websterinereis tridentata* | P | 24 | 0.63 | 20 | 0 | 0 | 0 | 0 | 122 | 0 | 0 | 0 | 6 | 0 |
| Aoridae | A | 23 | 0.60 | 20 | 0 | 0 | 0 | 0 | 122 | 0 | 0 | 0 | 3 | 0 |
| Oligochaeta | O | 22 | 0.58 | 40 | 0 | 0 | 0 | 0 | 122 | 0 | 1 | 2 | 0 | 2 |
| Nemertea | O | 21 | 0.55 | 50 | 0 | 1 | 5 | 0 | 122 | 7 | 4 | 0 | 0 | 4 |
| *Synelmis* sp. | P | 20 | 0.53 | 20 | 0 | 0 | 11 | 0 | 122 | 0 | 9 | 0 | 0 | 0 |
| *Cyathura burbancki* | O | 20 | 0.53 | 60 | 3 | 0 | 6 | 3 | 122 | 0 | 2 | 0 | 4 | 2 |
| Melitidae | A | 19 | 0.50 | 10 | 0 | 0 | 0 | 0 | 122 | 0 | 0 | 0 | 0 | 0 |
| *Armandia agilis* | P | 17 | 0.45 | 70 | 0 | 1 | 2 | 0 | 122 | 3 | 2 | 1 | 2 | 0 |
| Lucinidae | M | 17 | 0.45 | 40 | 0 | 0 | 3 | 0 | 122 | 8 | 3 | 0 | 0 | 3 |
| *Mediomastus* sp. | P | 17 | 0.45 | 10 | 0 | 0 | 0 | 0 | 122 | 0 | 0 | 0 | 0 | 0 |
| *Lumbrineris* sp. | P | 16 | 0.42 | 40 | 0 | 0 | 0 | 0 | 122 | 1 | 0 | 0 | 7 | 1 |
| Dorvilleidae | P | 14 | 0.37 | 60 | 3 | 3 | 2 | 0 | 122 | 1 | 1 | 0 | 0 | 0 |
| Hesionidae | P | 14 | 0.37 | 30 | 1 | 1 | 0 | 0 | 122 | 0 | 0 | 0 | 0 | 0 |
| *Nereis succinea* | P | 14 | 0.37 | 10 | 0 | 14 | 0 | 0 | 122 | 0 | 0 | 0 | 0 | 0 |
| Cirratulidae | P | 13 | 0.34 | 30 | 0 | 0 | 0 | 0 | 122 | 0 | 1 | 0 | 0 | 2 |

Appendix 5.8. Abundance of benthic species collected at the Folly Reference Area during 12 month post (12 mo Post) nourishment sampling. Abundance values represent the number of individuals per grab ($0.04m^2$). Density represents the number of individuals/$m^2$. Higher taxa codes are P = polychaete, A = amphipod, M = mollusc, and O = other taxa.

| SpeciesName | Category | Total Abundance (# /$0.04m^2$) | Percent Abundance | Percent of Stations Where Present | FR01 | FR02 | FR03 | FR04 | FR05 | FR06 | FR07 | FR08 | FR09 | FR10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Elasmopus* sp. | A | 13 | 0.34 | 30 | 0 | 0 | 0 | 0 | 8 | 0 | 2 | 0 | 3 | 0 |
| *Glycera oxycephala* | P | 13 | 0.34 | 40 | 0 | 0 | 5 | 0 | 0 | 3 | 2 | 0 | 0 | 3 |
| *Prionospio cirrifera* | P | 12 | 0.32 | 10 | 0 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Hirudinea | O | 12 | 0.32 | 30 | 0 | 0 | 0 | 0 | 0 | 3 | 5 | 0 | 0 | 4 |
| *Pisione remota* | P | 11 | 0.29 | 30 | 4 | 0 | 4 | 0 | 3 | 0 | 0 | 0 | 0 | 0 |
| *Maera* sp. | A | 10 | 0.26 | 10 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 |
| *Ophelina acuminata* | P | 10 | 0.26 | 20 | 0 | 9 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Aricidea* sp. | P | 9 | 0.24 | 10 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 |
| *Aphelochaeta* sp. | P | 8 | 0.21 | 20 | 0 | 0 | 0 | 1 | 7 | 0 | 0 | 0 | 0 | 0 |
| *Brania wellfleetensis* | P | 8 | 0.21 | 30 | 0 | 0 | 2 | 0 | 0 | 0 | 2 | 0 | 0 | 4 |
| Corophiidae | A | 8 | 0.21 | 10 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 |
| *Heteropodarke heteromorpha* | P | 8 | 0.21 | 30 | 0 | 0 | 0 | 1 | 0 | 3 | 4 | 0 | 0 | 0 |
| *Ophelina cylindricaudata* | P | 8 | 0.21 | 20 | 0 | 0 | 0 | 0 | 0 | 1 | 7 | 0 | 0 | 0 |
| *Rhepoxynius epistomus* | A | 8 | 0.21 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 2 | 0 |
| *Tellina* sp. | M | 8 | 0.21 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 1 | 0 |
| Arabellidae | P | 7 | 0.18 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 |
| *Chrysopetalidae* | P | 7 | 0.18 | 20 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| *Cirriformia* sp. | P | 7 | 0.18 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 0 |
| *Goniadides carolinae* | P | 7 | 0.18 | 30 | 0 | 0 | 5 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| *Nereis riisei* | P | 7 | 0.18 | 10 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 |
| *Trachycardium muricatum* | M | 7 | 0.18 | 20 | 0 | 0 | 3 | 0 | 0 | 4 | 0 | 0 | 0 | 0 |
| *Ancistrosyllis* sp. | P | 6 | 0.16 | 30 | 0 | 2 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| Pelecypoda | M | 6 | 0.16 | 20 | 0 | 5 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Travisia parva* | P | 6 | 0.16 | 40 | 0 | 0 | 3 | 0 | 0 | 1 | 1 | 0 | 0 | 1 |
| Isopoda | O | 6 | 0.16 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 1 |
| *Oxyurostylis smithi* | O | 6 | 0.16 | 40 | 0 | 3 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 |
| *Brania* sp. | P | 5 | 0.13 | 40 | 1 | 2 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| *Diopatra cuprea* | P | 5 | 0.13 | 20 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 2 | 0 |
| *Ericthonius brasiliensis* | A | 5 | 0.13 | 10 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 |
| *Magelona rosea* | P | 5 | 0.13 | 20 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 1 | 0 |
| Ophiuroidea | O | 5 | 0.13 | 20 | 0 | 0 | 1 | 0 | 4 | 0 | 0 | 0 | 0 | 0 |
| *Acanthohaustorius intermedius* | A | 4 | 0.11 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 |

Appendix 5.8. Abundance of benthic species collected at the Folly Reference Area during 12 month post (12 mo Post) nourishment sampling. Abundance values represent the number of individuals per grab ($0.04m^2$). Density represents the number of individuals/$m^2$. Higher taxa codes are P = polychaete, A = amphipod, M = mollusc, and O = other taxa.

| SpeciesName | Category | Total Abundance (# /$0.04m^2$) | Percent Abundance | Percent of Stations Where Present | FR01 | FR02 | FR03 | FR04 | FR05 | FR06 | FR07 | FR08 | FR09 | FR10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Glycera* sp. | P | 4 | 0.11 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 |
| Magelonidae | P | 4 | 0.11 | 30 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 2 |
| Calappidae | O | 4 | 0.11 | 10 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Tubificidae | O | 4 | 0.11 | 10 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Arcidae | M | 3 | 0.08 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 |
| *Batea catharinensis* | A | 3 | 0.08 | 10 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 |
| *Crepidula plana* | M | 3 | 0.08 | 10 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 |
| *Exogone dispar* | P | 3 | 0.08 | 20 | 0 | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 0 | 0 |
| *Glycinde* sp. | P | 3 | 0.08 | 20 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Mediomastus californiensis* | P | 3 | 0.08 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 |
| *Nephtys picta* | P | 3 | 0.08 | 20 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| Phoxocephalidae | A | 3 | 0.08 | 20 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 1 |
| *Sphaerosyllis glandulata* | P | 3 | 0.08 | 10 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 |
| *Accalathura crenulata* | O | 3 | 0.08 | 20 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Epitomapta roseola* | O | 3 | 0.08 | 10 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Phyllangia americana* | O | 3 | 0.08 | 30 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| Xanthidae | O | 3 | 0.08 | 10 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 |
| *Aglaophamus verrilli* | P | 2 | 0.05 | 10 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Arabella* sp. | P | 2 | 0.05 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| *Calyptraea centralis* | M | 2 | 0.05 | 10 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Edotia* sp. | P | 2 | 0.05 | 10 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Eurythoe* sp. | P | 2 | 0.05 | 20 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Eusyllis* sp. | P | 2 | 0.05 | 10 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Glycera asymmetrica* | P | 2 | 0.05 | 20 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 |
| *Lumbrineris coccinea* | P | 2 | 0.05 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| *Metharpinia floridana* | A | 2 | 0.05 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| *Monticellina* sp. | P | 2 | 0.05 | 10 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Podarkeopsis levifuscina* | P | 2 | 0.05 | 10 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Podocerus* sp. | A | 2 | 0.05 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 |
| Polychaeta | P | 2 | 0.05 | 20 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Sphaerosyllis longicauda* | P | 2 | 0.05 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 |
| *Spiophanes bombyx* | P | 2 | 0.05 | 20 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |

Appendix 5.8. Abundance of benthic species collected at the Folly Reference Area during 12 month post (12 mo Post) nourishment sampling. Abundance values represent the number of individuals per grab ($0.04m^2$). Density represents the number of individuals/$m^2$. Higher taxa codes are P = polychaete, A = amphipod, M = mollusc, and O = other taxa.

| SpeciesName | Category | Total Abundance (# /$0.04m^2$) | Percent Abundance | Percent of Stations Where Present | FR01 | FR02 | FR03 | FR04 | FR05 | FR06 | FR07 | FR08 | FR09 | FR10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Tiron triocellatus* | A | 2 | 0.05 | 20 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Decapoda | O | 2 | 0.05 | 20 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Eurydice piperata* | O | 2 | 0.05 | 20 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 |
| *Pinnixa* sp. | O | 2 | 0.05 | 10 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Amphinomidae | P | 1 | 0.03 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Amphipoda | A | 1 | 0.03 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Ancistrosyllis hartmanae* | P | 1 | 0.03 | 10 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Chaetopleura apiculata* | M | 1 | 0.03 | 10 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| *Dulichiella appendiculata* | A | 1 | 0.03 | 10 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| *Eudevenopus honduranus* | A | 1 | 0.03 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Exogone* sp. | P | 1 | 0.03 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Glycera dibranchiata* | P | 1 | 0.03 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Glycinde solitaria* | P | 1 | 0.03 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Goniada littorea* | P | 1 | 0.03 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Laonice cirrata* | P | 1 | 0.03 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Melanellidae | M | 1 | 0.03 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Mooreonuphis pallidula* | P | 1 | 0.03 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| *Nephtys bucera* | P | 1 | 0.03 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Nephtys simoni* | P | 1 | 0.03 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Nereididae | P | 1 | 0.03 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Ophelia denticulata* | P | 1 | 0.03 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Opheliidae | P | 1 | 0.03 | 10 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Ophelina* sp. | P | 1 | 0.03 | 10 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Owenia fusiformis* | P | 1 | 0.03 | 10 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Owenia* sp. | P | 1 | 0.03 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| *Paraprionospio pinnata* | P | 1 | 0.03 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Polinices* sp. | M | 1 | 0.03 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Prionospio* sp. | P | 1 | 0.03 | 10 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Sabellaria floridensis* | P | 1 | 0.03 | 10 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Sabellaria vulgaris* | P | 1 | 0.03 | 10 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Sigalionidae | P | 1 | 0.03 | 10 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| *Solen viridis* | M | 1 | 0.03 | 10 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |

Appendix 5.8. Abundance of benthic species collected at the Folly Reference Area during 12 month post (12 mo Post) nourishment sampling. Abundance values represent the number of individuals per grab (0.04m$^2$). Density represents the number of individuals/m$^2$. Higher taxa codes are P = polychaete, A = amphipod, M = mollusc, and O = other taxa.

| SpeciesName | Category | Total Abundance (# /0.04m$^2$) | Percent Abundance | Percent of Stations Where Present | FR01 | FR02 | FR03 | FR04 | FR05 | FR06 | FR07 | FR08 | FR09 | FR10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tellinidae | M | 1 | 0.03 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| *Tiron* sp. | A | 1 | 0.03 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| *Tiron tropakis* | A | 1 | 0.03 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Trypanosyllis* sp. | P | 1 | 0.03 | 10 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Amphiuridae | O | 1 | 0.03 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Cyclaspis pustulata* | O | 1 | 0.03 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Discoporella umbellata* | O | 1 | 0.03 | 10 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| *Dissodactylus mellitae* | O | 1 | 0.03 | 10 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Leptochela serratorbita* | O | 1 | 0.03 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mysida | O | 1 | 0.03 | 10 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Ostracoda | O | 1 | 0.03 | 10 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *Pagurus* sp. | O | 1 | 0.03 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *Pananthura formosa* | O | 1 | 0.03 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| **Mean total abundance (#/0.04m$^2$)** | | | | | **296** | **205** | **615** | **162** | **375** | **562** | **876** | **105** | **327** | **280** |
| **Mean density (#/m$^2$)** | | | | | **7400** | **5125** | **15375** | **4050** | **9375** | **14050** | **21900** | **2625** | **8175** | **7000** |
| **Species Richness (#/0.04m$^2$)** | | | | | **26** | **36** | **43** | **22** | **35** | **37** | **41** | **14** | **27** | **29** |
| **Species Diversity** | | | | | **2.11** | **2.16** | **2.30** | **2.11** | **2.82** | **2.11** | **2.25** | **1.57** | **1.93** | **2.18** |
| **Evenness** | | | | | **0.65** | **0.60** | **0.61** | **0.68** | **0.79** | **0.58** | **0.61** | **0.60** | **0.59** | **0.65** |

Appendix 6. Summary of *Ocypode quadrata* and *Callichirus major* counted at the Folly Beach reference and nourished areas. All values represent the total number of individuals counted on a transect.

| Time Frame | Area | Site | Transect | Number of 5m segments | Number of *Ocypode quadrata* | Number of *Callichirus major* |
|---|---|---|---|---|---|---|
| Pre | Nourished | FN01 | 1 | 16 | 1 | 0 |
| Pre | Nourished | FN01 | 2 | 17 | 3 | 0 |
| Pre | Nourished | FN01 | 3 | 17 | 1 | 0 |
| Pre | Nourished | FN01 | 4 | 17 | 3 | 0 |
| Pre | Nourished | FN01 | 5 | 17 | 4 | 0 |
| Pre | Nourished | FN02 | 1 | 17 | 2 | 0 |
| Pre | Nourished | FN02 | 2 | 17 | 1 | 0 |
| Pre | Nourished | FN02 | 3 | 17 | 3 | 5 |
| Pre | Nourished | FN02 | 4 | 17 | 7 | 5 |
| Pre | Nourished | FN02 | 5 | 17 | 3 | 8 |
| Pre | Nourished | FN03 | 1 | 18 | 2 | 8 |
| Pre | Nourished | FN03 | 2 | 18 | 0 | 3 |
| Pre | Nourished | FN03 | 3 | 18 | 1 | 0 |
| Pre | Nourished | FN03 | 4 | 18 | 0 | 3 |
| Pre | Nourished | FN03 | 5 | 18 | 3 | 1 |
| Pre | Reference | FC01 | 1 | 16 | 2 | 5 |
| Pre | Reference | FC01 | 2 | 16 | 5 | 1 |
| Pre | Reference | FC01 | 3 | 15 | 2 | 8 |
| Pre | Reference | FC01 | 4 | 17 | 5 | 2 |
| Pre | Reference | FC01 | 5 | 16 | 4 | 3 |
| Pre | Reference | FC02 | 1 | 16 | 6 | 0 |
| Pre | Reference | FC02 | 2 | 16 | 3 | 1 |
| Pre | Reference | FC02 | 3 | 16 | 4 | 2 |
| Pre | Reference | FC02 | 4 | 16 | 3 | 0 |
| Pre | Reference | FC02 | 5 | 15 | 7 | 0 |
| Pre | Reference | FC03 | 1 | 16 | 9 | 0 |
| Pre | Reference | FC03 | 2 | 17 | 1 | 0 |
| Pre | Reference | FC03 | 3 | 18 | 1 | 1 |
| Pre | Reference | FC03 | 4 | 18 | 9 | 0 |
| Pre | Reference | FC03 | 5 | 18 | 1 | 1 |
| Post | Nourished | FN02 | 1 | 21 | 8 | 27 |
| Post | Nourished | FN02 | 2 | 22 | 4 | 16 |
| Post | Nourished | FN02 | 3 | 21 | 17 | 0 |
| Post | Nourished | FN02 | 4 | 22 | 1 | 30 |
| Post | Nourished | FN02 | 5 | 22 | 5 | 53 |
| Post | Nourished | FN03 | 1 | 25 | 1 | 113 |
| Post | Nourished | FN03 | 2 | 25 | 4 | 64 |
| Post | Nourished | FN03 | 3 | 23 | 9 | 16 |
| Post | Nourished | FN03 | 4 | 22 | 7 | 14 |
| Post | Nourished | FN03 | 5 | 22 | 4 | 10 |
| Post | Reference | FC01 | 1 | 13 | 10 | 0 |
| Post | Reference | FC01 | 2 | 13 | 9 | 0 |
| Post | Reference | FC01 | 3 | 13 | 7 | 0 |
| Post | Reference | FC01 | 4 | 13 | 11 | 0 |
| Post | Reference | FC01 | 5 | 13 | 8 | 0 |
| Post | Reference | FC02 | 1 | 13 | 9 | 0 |
| Post | Reference | FC02 | 2 | 13 | 12 | 0 |
| Post | Reference | FC02 | 3 | 13 | 10 | 0 |
| Post | Reference | FC02 | 4 | 13 | 9 | 0 |
| Post | Reference | FC02 | 5 | 13 | 9 | 0 |
| Post | Reference | FC03 | 1 | 16 | 18 | 0 |
| Post | Reference | FC03 | 2 | 15 | 17 | 0 |
| Post | Reference | FC03 | 3 | 15 | 15 | 0 |

Appendix 6 cont. Summary of *Ocypode quadrata* and *Callichirus major* counted at the Folly Beach reference and nourished areas. All values represent the total number of individuals counted on a transect.

| Time Frame | Area | Site | Transect | Number of 5m segments | Number of *Ocypode quadrata* | Number of *Callichirus major* |
|---|---|---|---|---|---|---|
| Post | Reference | FC03 | 4 | 13 | 15 | 1 |
| Post | Reference | FC03 | 5 | 15 | 15 | 0 |
| 3mo Post | Nourished | FN01 | 1 | 23 | 17 | 124 |
| 3mo Post | Nourished | FN01 | 2 | 22 | 2 | 103 |
| 3mo Post | Nourished | FN01 | 3 | 25 | 1 | 77 |
| 3mo Post | Nourished | FN01 | 4 | 25 | 2 | 126 |
| 3mo Post | Nourished | FN01 | 5 | 25 | 0 | 37 |
| 3mo Post | Nourished | FN02 | 1 | 22 | 22 | 120 |
| 3mo Post | Nourished | FN02 | 2 | 23 | 18 | 73 |
| 3mo Post | Nourished | FN02 | 3 | 22 | 7 | 81 |
| 3mo Post | Nourished | FN02 | 4 | 22 | 11 | 52 |
| 3mo Post | Nourished | FN02 | 5 | 25 | 12 | 101 |
| 3mo Post | Nourished | FN03 | 1 | 24 | 7 | 37 |
| 3mo Post | Nourished | FN03 | 2 | 24 | 19 | 31 |
| 3mo Post | Nourished | FN03 | 3 | 24 | 18 | 21 |
| 3mo Post | Nourished | FN03 | 4 | 24 | 24 | 35 |
| 3mo Post | Nourished | FN03 | 5 | 24 | 21 | 31 |
| 3mo Post | Reference | FC01 | 1 | 15 | 40 | 0 |
| 3mo Post | Reference | FC01 | 2 | 15 | 31 | 2 |
| 3mo Post | Reference | FC01 | 3 | 14 | 37 | 2 |
| 3mo Post | Reference | FC01 | 4 | 14 | 25 | 2 |
| 3mo Post | Reference | FC01 | 5 | 14 | 20 | 0 |
| 3mo Post | Reference | FC02 | 1 | 13 | 35 | 0 |
| 3mo Post | Reference | FC02 | 2 | 13 | 41 | 1 |
| 3mo Post | Reference | FC02 | 3 | 13 | 34 | 0 |
| 3mo Post | Reference | FC02 | 4 | 13 | 25 | 0 |
| 3mo Post | Reference | FC02 | 5 | 14 | 18 | 0 |
| 3mo Post | Reference | FC03 | 1 | 17 | 25 | 14 |
| 3mo Post | Reference | FC03 | 2 | 16 | 27 | 18 |
| 3mo Post | Reference | FC03 | 3 | 16 | 27 | 11 |
| 3mo Post | Reference | FC03 | 4 | 15 | 27 | 12 |
| 3mo Post | Reference | FC03 | 5 | 16 | 34 | 11 |
| 6mo Post | Nourished | FN01 | 1 | 23 | 0 | 0 |
| 6mo Post | Nourished | FN01 | 2 | 22 | 0 | 0 |
| 6mo Post | Nourished | FN01 | 3 | 22 | 0 | 0 |
| 6mo Post | Nourished | FN01 | 4 | 22 | 0 | 0 |
| 6mo Post | Nourished | FN01 | 5 | 23 | 0 | 0 |
| 6mo Post | Nourished | FN02 | 1 | 21 | 2 | 9 |
| 6mo Post | Nourished | FN02 | 2 | 23 | 0 | 8 |
| 6mo Post | Nourished | FN02 | 3 | 23 | 0 | 1 |
| 6mo Post | Nourished | FN02 | 4 | 23 | 1 | 1 |
| 6mo Post | Nourished | FN02 | 5 | 23 | 1 | 1 |
| 6mo Post | Nourished | FN03 | 1 | 16 | 0 | 0 |
| 6mo Post | Nourished | FN03 | 2 | 15 | 4 | 0 |
| 6mo Post | Nourished | FN03 | 3 | 16 | 1 | 0 |
| 6mo Post | Nourished | FN03 | 4 | 16 | 3 | 0 |
| 6mo Post | Nourished | FN03 | 5 | 17 | 1 | 0 |
| 6mo Post | Reference | FC01 | 1 | 13 | 4 | 2 |
| 6mo Post | Reference | FC01 | 2 | 13 | 4 | 0 |
| 6mo Post | Reference | FC01 | 3 | 13 | 7 | 0 |
| 6mo Post | Reference | FC01 | 4 | 13 | 12 | 0 |
| 6mo Post | Reference | FC01 | 5 | 13 | 13 | 0 |
| 6mo Post | Reference | FC02 | 1 | 12 | 9 | 0 |

Appendix 6 cont. Summary of *Ocypode quadrata* and *Callichirus major* counted at the Folly Beach reference and nourished areas. All values represent the total number of individuals counted on a transect.

| Time Frame | Area | Site | Transect | Number of 5m segments | Number of *Ocypode quadrata* | Number of *Callichirus major* |
|---|---|---|---|---|---|---|
| 6mo Post | Reference | FC02 | 2 | 12 | 7 | 0 |
| 6mo Post | Reference | FC02 | 3 | 12 | 11 | 0 |
| 6mo Post | Reference | FC02 | 4 | 12 | 14 | 0 |
| 6mo Post | Reference | FC02 | 5 | 12 | 6 | 0 |
| 6mo Post | Reference | FC03 | 1 | 15 | 8 | 0 |
| 6mo Post | Reference | FC03 | 2 | 16 | 6 | 1 |
| 6mo Post | Reference | FC03 | 3 | 16 | 0 | 0 |
| 6mo Post | Reference | FC03 | 4 | 15 | 2 | 1 |
| 6mo Post | Reference | FC03 | 5 | 16 | 3 | 0 |
| 12mo Post | Nourished | FN01 | 1 | 19 | 4 | 0 |
| 12mo Post | Nourished | FN01 | 2 | 19 | 0 | 0 |
| 12mo Post | Nourished | FN01 | 3 | 19 | 3 | 0 |
| 12mo Post | Nourished | FN01 | 4 | 18 | 4 | 0 |
| 12mo Post | Nourished | FN01 | 5 | 18 | 3 | 0 |
| 12mo Post | Nourished | FN02 | 1 | 17 | 6 | 0 |
| 12mo Post | Nourished | FN02 | 2 | 18 | 8 | 0 |
| 12mo Post | Nourished | FN02 | 3 | 18 | 9 | 0 |
| 12mo Post | Nourished | FN02 | 4 | 19 | 6 | 0 |
| 12mo Post | Nourished | FN02 | 5 | 19 | 8 | 1 |
| 12mo Post | Nourished | FN03 | 1 | 17 | 10 | 2 |
| 12mo Post | Nourished | FN03 | 2 | 17 | 10 | 2 |
| 12mo Post | Nourished | FN03 | 3 | 17 | 14 | 0 |
| 12mo Post | Nourished | FN03 | 4 | 17 | 15 | 0 |
| 12mo Post | Nourished | FN03 | 5 | 17 | 11 | 5 |
| 12mo Post | Reference | FC01 | 1 | 15 | 28 | 4 |
| 12mo Post | Reference | FC01 | 2 | 15 | 30 | 5 |
| 12mo Post | Reference | FC01 | 3 | 16 | 21 | 12 |
| 12mo Post | Reference | FC01 | 4 | 16 | 27 | 4 |
| 12mo Post | Reference | FC01 | 5 | 15 | 21 | 4 |
| 12mo Post | Reference | FC02 | 1 | 17 | 16 | 10 |
| 12mo Post | Reference | FC02 | 2 | 16 | 14 | 18 |
| 12mo Post | Reference | FC02 | 3 | 17 | 13 | 30 |
| 12mo Post | Reference | FC02 | 4 | 17 | 15 | 48 |
| 12mo Post | Reference | FC02 | 5 | 17 | 37 | 38 |
| 12mo Post | Reference | FC03 | 1 | 21 | 29 | 142 |
| 12mo Post | Reference | FC03 | 2 | 20 | 16 | 146 |
| 12mo Post | Reference | FC03 | 3 | 20 | 18 | 46 |
| 12mo Post | Reference | FC03 | 4 | 19 | 16 | 31 |
| 12mo Post | Reference | FC03 | 5 | 19 | 23 | 80 |