CAMINADA HEADLAND BEACH BENTHIC ORGANISM SURVEY: YEAR 3

by

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submitted to

Barataria-Terrebonne Estuary Foundation

c/o

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Background

A pre-construction survey of the gulf shoreline benthic community from wet sand (intertidal) and wrack line habitats at four stations along the Caminada Headland Beach (Fourchon, Louisiana) was conducted April 1-2, 2013, as part of a beach and dune restoration project which requires monitoring of wintering piping plovers (*Charadrius melodus*) in that area (McLelland 2013). The 2013 survey showed that the intertidal macrobenthic population was dominated by the polychaete annelid, *Scolelepis squamata* and the amphipod crustacean, *Lepidactylus triarticulatus*. Although the latter was more numerous, the two populations were nearly equal in total biomass. The beach wrack-line invertebrate community at three of the four stations was dominated by large numbers and a rich variety of small insects, but was lower in total biomass than the corresponding intertidal zone fauna.

Year 2 of the survey was conducted April 16-17, 2014, and focused on three aspects: (1) revisiting the same four gulf-side stations to assess changes in the macroinvertebrate population structure resulting from beach renourishment and dune construction (post-construction); (2) survey an additional six gulf-side sites along the Caminada Headland Beach extending eastward from those surveyed in 2013 in order to provide a baseline for further restoration to commence as part of Phase II; and (3) survey the benthic community at three bay-side sites within the Caminada Headland Beach and Dune Restoration project footprint, areas known to provide forage for transient shorebirds. To allow comparison between sampling events, all year 2 samples were collected in the same manner as those of year 1 (McLelland 2014).

Year 3 of the survey, conducted March 30-April 1, 2015, was essentially a repeat of the Year 2 survey with the purpose of continuing observations on the macroinvertebrate assemblages and assessing the impact on the benthic community from further beach renourishment progressing eastward along the headland beach. The same stations from Year 2 were surveyed using the same procedures. The locations of the 10 beach stations and 3 bayside stations sampled in years 2 and 3 appear on the map in Figure 1 (page 3).

Figure 2. Box Core used in intertidal sampling. Photo by J.M. Foster.

Field Procedures.

Intertidal samples were collected at each station near mid-swash zone - that area halfway between the point at which waves break on the beach face and the upper extent of the moving water. A hand-held stainless steel box core, described by Saloman and Naughton (1977), was used for intertidal sampling (Fig. 2). The coring device, six inches (12.5cm) on a side and penetrating to a depth of 18-20cm, was used to collect three replicate quantitative samples at approximately 1 meter apart and representing 0.0156m^2 of substrate. Box Core samples were

Figure 1. Map showing locations of benthic stations at Caminada Headland Beach, Fourchon, Louisiana in Years 2 and 3.

treated with a weak formalin solution to anesthetize motile organisms, then repeatedly elutriated through a 0.5mm mesh sieve. The elutriation technique served to float off soft-bodied infauna (e.g. polychaetes, amphipods) from the samples. The remaining sediment was screened through a 1.0mm sieve to remove possible heavier bodied organisms (e.g., mollusks). Samples were preserved in the field with rose bengal-stained 5% formalin, labeled and returned to the laboratory for analysis. Rose bengal, a protein stain, facilitates the detection of benthic organisms among the sediment and detritus in the samples during the laboratory sorting process.

The wrack line community was sampled following National Water Quality Assessment (NAWQA) Program protocols (Moulton et al, 2002) for the collection of richest-targeted habitat (RTH) samples corresponding to approximately 0.25 square meters of wrack substrate (fine organics, shells, woody debris, drift vegetation, etc.) per sample. Three replicate samples were collected by scooping out about 5 cm of sediment inside a 0.25 square meter quadrant that was placed at about two meter intervals within a 10 meter section of the wrack line (Fig. 3). Large debris particles were removed from the samples by sifting through a coarse screen (4.0 mm) that was dipped in a water bucket to dislodge clinging organisms (spiders, insects, etc.). Samples were then processed and preserved in a similar manner to the box cores using elutriation and screening through a 1.0mm sieve.

Figure 3. 0.25 m quadrant used for sampling beach wrack fauna. Photo by J. McLelland.

One qualitative multi-habitat (QMH) wrack-line sample per station was collected to account for large and rare specimens (i.e. crabs, snails, etc.) occurring among the flotsam and jetsam within the same homogenous wrack-line section used for the collection of RTH sample. The purpose of this sample was to provide an indication of RTH sampling efficiency. QMH sampling, based on NAWQA protocols, was conducted by pushing a wide-mouth kicknet along the 10-meter wrack-line section with the ensuing sediment and debris (e.g., Sargassum weed) being washed by agitation in a sampling bucket. Organisms resulting from this action were placed in a jar, labeled and preserved.

Additional physical data included GPS coordinates, salinity, water and air temperatures, wind speed and direction, and sea state (Table 1). The three bay-side stations were sampled similarly to the beach station wrack-line habitats except that no QMH sample was collected (see Table 2 for station data).

Table 1. Caminada Headland Beach Gulf Side Benthic Field Data – March-April, 2015

	Station 1	Station 2	Station 3	Station 4	Station 5	Station 6	Station 7	Station 8	Station 9	Station 10
Date sampled	3/30/15	3/30/15	4/1/15	4/1/15	3/30/15	4/1/15	4/1/15	4/1/15	4/1/15	3/31/15
Time on Site	1315 - 1435	1450 - 1600	1440 - 1535	1245 - 1335	1705 - 1800	1340 - 1435	1145 - 1225	0935 - 0945	0800 - 0845	1725 - 1820
Latitude	N 29.09067	N 29.11006	N 29.12492	N 29.13925	N 29.11747	N 29.13198	N 29.15350	N 29.16832	N 29.18192	N 29.18827
Longitude	W -90.21364	W -90.17769	W -90.15558	W -90.13197	W -90.16651	W -90.14399	W -90.10953	W -90.86990	W -90.06347	W -90.05154
Station ID no.	ID 334	ID 417	ID 406	ID 421	ID 411	ID 401	ID 526	ID 426	ID 493	ID 490
Intertidal length	3.4m	2.3m	2.7m	4.0m	3.2m	2.0m	2.4m	4.3m	4.0m	4.3m
Wrack to water	1m	1m	3.4m	3.7m	0m	1.3m	2.0m	3.7m	2.6m	2.0m
<u>Sample types:</u>										
box cores	3	3	3	3	3	3	3	3	3	3
wrack semi-quant	3	3	3	3	3	3	3	3	3	3
wrack qualitative	1	1	1	1	1	1	1	1	1	1
<u>Physical data:</u>										
salinity ppt	16	16	15	17	16	16	18	19	18	15
air temp °C	24.7	24.5	22	22.4	23.6	22.3	22	22	21.2	24
water temp °C	22.8	22.8	23.5	23.2	22.6	23.6	22.8	20.8	19.7	23.2
wind speed mph	5	10	5 - 10	15	5	5	10	2	5	20 - 25
wind direction	W	W	ESE	E	SW	ESE	E	ESE	ESE	WSW
% cloud cover	10	20	50	50	0	80	50	70	70	30
sea state ft	3-4	3-4	3	3	3-4	3	2	2	3	3 - 4

Table 2. Caminada Headland Beach Bay-Side Benthic Field Data – for March-April 2015

	BS 1	BS 2	BS 3
Date sampled	4/1/15	4/1/15	3/30/15
Time on Site	1035 - 1100	0845 - 0930	1610 - 1650
Latitude	N 29.17126	N 29.18464	N 29.11860
Longitude	W -90.08729	W -90.06448	W -90.16812
Station ID no.		ID 493	ID 711
Intertidal length	-	-	-
Wrack to water	-	-	-
Sample types:			
box cores	-	-	-
wrack semi-quant	3	3	3
wrack qualitative	-	-	-
Physical data:			
salinity ppt	20	18	25
air temp °C	23.1	22	25
water temp °C	27.6	21.8	29
wind speed mph	10	2	10 - 15
wind direction	E	E	SW
% cloud cover	50	80	10
sea state ft	-	-	-

Laboratory Procedures.

Sorting was conducted under a stereoscopic dissecting microscope to remove all macrobenthic organisms and recognizable fragments. Specimens were counted and identified to the lowest possible taxonomic category with representative reference material being retained and transferred to 70% ethanol for storage. The remaining material was separated into major groups of prey items (e.g, annelids, arthropods, mollusks), preserved in ethanol and set aside for biomass measurement. A numerical database was constructed using Microsoft Access and data was further condensed and organized in spreadsheet format using Microsoft Excel. Numbers counted were converted to numbers per square meter using 64.103 per individual for box core data and 16 per individual for the 0.25 meter quadrant. Metrics of species diversity (H'), equitability (J') and dominance were calculated using formulae incorporated in the Excel spreadsheet.

Species diversity is the number of different species in a particular area (species richness) weighted by some measure of abundance such as number of individuals or biomass. The Shannon-Weiner Diversity Index (H') is the most popular mathematical expression of species richness and evenness in use in ecological investigation, including benthic monitoring studies. According to Pielou (1966), who studied the use of H' in detail, the index is appropriate to use when random samples are drawn from a large community in which the total numbers of species is known. H' is calculated as $-\sum \rho i \text{logn}(\rho i)$, where ρi is the proportion of the total number of specimens *i* expressed as a proportion of the total number of species for all species in the ecosystem. The product of ρilogn (ρi) for each species in the ecosystem is summed and multiplied by −1 to give H'.

The species equitability index (J'), also known as Evenness, is another measure of how well the abundance of individuals is spread among the number of species. It is calculated as H'/H_{max}, where H_{max} is the maximum possible value of H', and equals the log of S, which is the number of species (species richness). The index of dominance, a measure of how a population is dominated by one or a few species, is calculated simply as 1-J'.

Total benthic biomass (by weight) of piping plover prey species was measured following methods described by Versar, Inc. (2002). Samples composed of prey specimen groups (see above), pooled from all replicates, were air dried to a constant weight at 60ºC in a drying oven and then baked for 4 hours at 500ºC in a muffle furnace to determine the ash-free dry weight. Samples were weighed before and after baking using an analytical balance accurate to 0.0001 g. Bivalves and barnacles in the samples were crushed prior to drying to eliminate water trapped in the shells.

Figure 4. Typical Gulf-side beach face.

Results.

General field observations. As in previous years, the typical beach face at most of the Gulf-side stations was flat with little contour (Fig. 4). The substrate consisted of very fine, firmly packed sediment overlaying sparse amounts of shell hash composed of fine flakes at some stations and coarse rubble at others, usually the most recently reconstructed. The sediment was light brown in color due likely to large amounts of fine silt originating from nearby rivers and bays. The newly constructed beach at stations 3-6 contained only a minimal amount of sand and much larger shell particles and rubble originating from dredge material taken from offshore. It was noted that at stations 1 and 2 a deeper layer of sand had accumulated at these construction sites from 2014 allowing the recruitment and colonization of more normal infaunal populations. As in previous years, many of the larger shell pieces at the non-constructed stations still showed evidence of oil contamination with encrusted sand and weathered tar residue. The wrack line at the most recent high-tide mark, similar at all stations, was typified by consistent amounts of recently

Figure 5. Wrack line showing hyacinth debris.

washed up water hyacinth, likely of riverine origin, that appeared to have been deposited within a few weeks prior to our visit (Fig. 5).

Figure 6. Typical Bay-side station behind Caminada Headland Beach.

The three Bay-side stations, open to the bay on the north side, appeared unchanged from the Year 2 study. They were similar in that they were typical exposed mud/sand-flat areas with standing water replenished by tidal inundation, and with varying amounts of fringing vegetation (Fig. 6). The sediment was composed of mud and fine-grained sand topped by a thin algal mat. Quadrant sampling at these stations was conducted at the waterline in sediment either exposed or with about a centimeter of water coverage.

Benthic fauna.

During the Year 3 sampling period, a total of 7,504 organisms were examined from Caminada Headland Beach samples (5926 from the 10 Gulf-side stations and 1578 from the three Bay-side stations) representing 120 nominal taxa from seven phyla. These totals include specimens examined from the qualitative wrack-line (QMH) samples collected at the beach stations (see Appendix I). Numerical, biomass and diversity data for quantitative samples are presented in Tables 3 and 4 for the intertidal and wrack line communities respectively and in Table 5 for the Bay-side benthic community. A complete phylogenetic listing of organisms encountered appears in Appendix II.

Gulf-side Stations

Among the ten Gulf-facing stations, station 8 had by far the largest number of intertidal individuals collected with nearly 32,000 organisms/m^2, largely due to high numbers of the haustoriid amphipod, *Lepidact ylus triarticulatus* and the bivalve *Donax variabilis* (Figs. 7 and 9). These two organisms were also prominent at Station 4, making it the second most populated intertidal site, and also at stations 7, 9 and 10. The highest density of total organisms in the beach wrack-line community occurred at Station 10 (20,144/m^2) with substantial numbers (11,920/m^2) also at station 7. High numbers of *Lepidactylus*, embedded in the upper few cm of sediment in the wrack line, accounted for the density at both of these stations and also at station 4 with 5,056 amphipods/m^2 (Figs. 8 and 10). Species diversity (H') values were overall higher at the easternmost beach stations in both intertidal and wrack-line samples with peaks of 0.659 at station 5 (intertidal) and 1.169 and 1.165 at wrack stations 3 and 5 respectively (Figs. 11 and 12). This directional disproportionality was no doubt due to dominance of embedded amphipod crustaceans in the wrack stations and higher numbers of crustaceans and bivalves in the intertidal core samples.

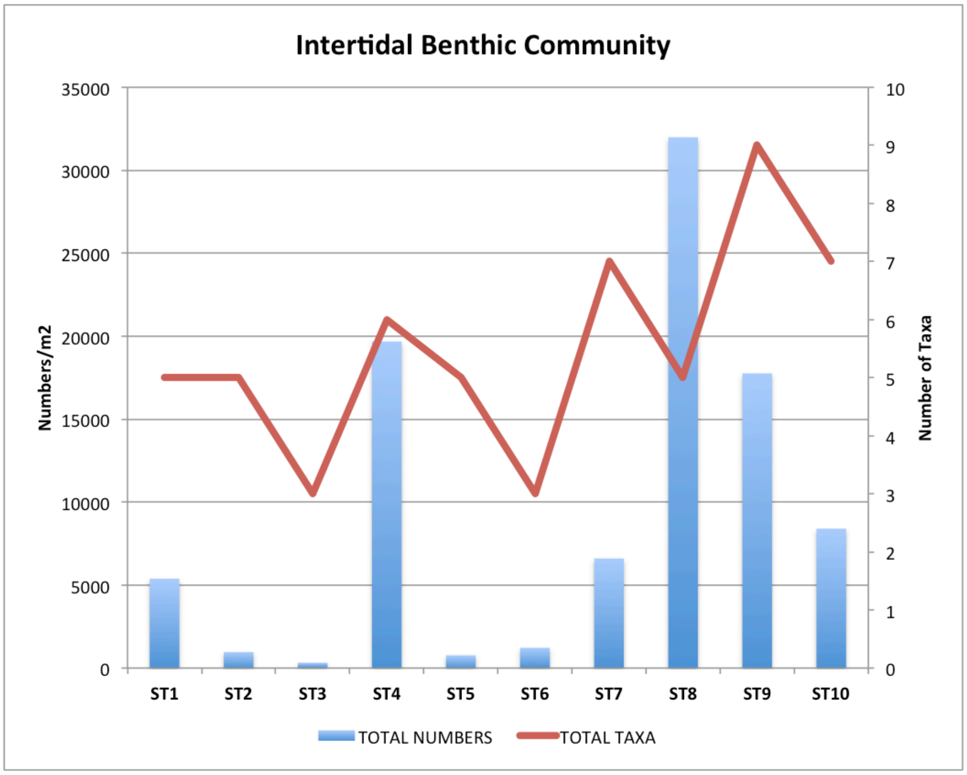

Figure 7. Intertidal total density vs. richness

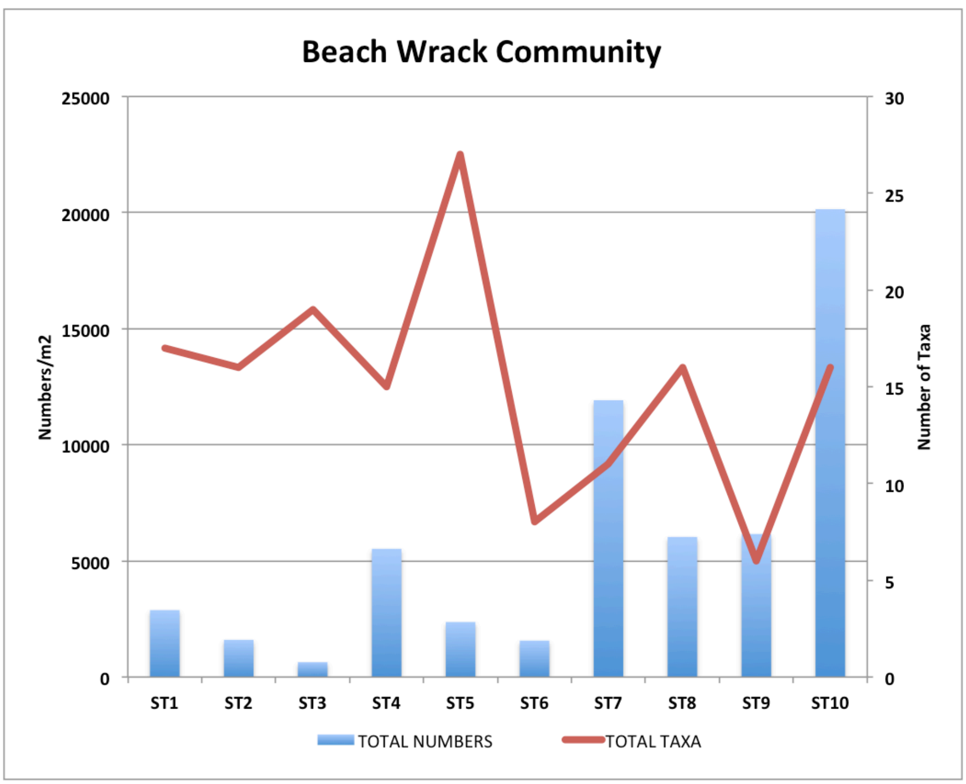

Figure 8. Wrack-line total density vs. richness

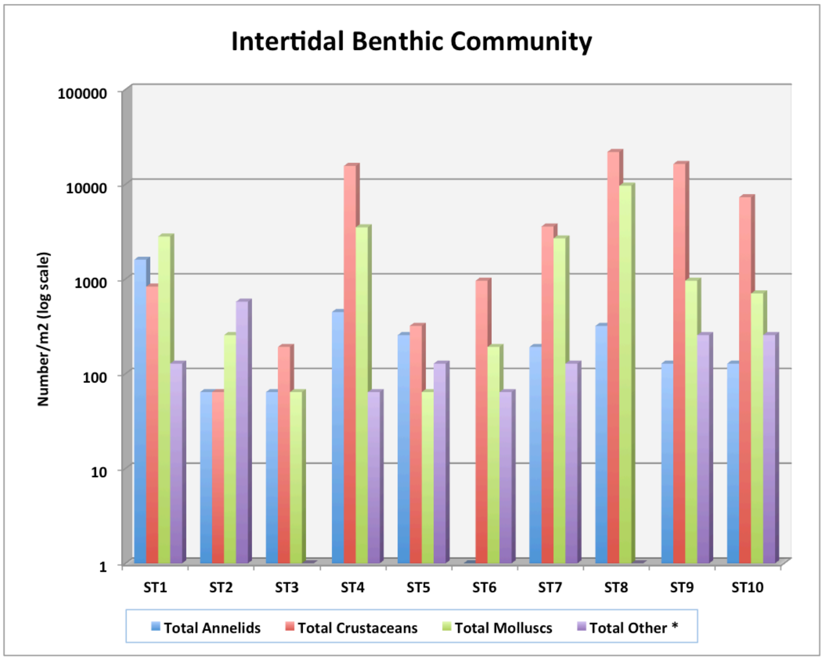

Figure 9. Gulf-side intertidal macrobenthic components.

An important potential food source for foraging shorebirds in the wrack environment was the fauna associated with the freshly washed-up water hyacinths, suspected to be of riverine origin. Numerous insects (28 taxa), and fresh/brackish water gammarid amphipods were found at all stations where hyacinths were abundant. An example of the latter is *Gammarus lecroyae*, a fresh to low salinity amphipod, which was found at nine of the ten beach sites. Another group of organisms found associated with hyacinths at eight stations were large calanoid copepods occurring among the rotted floatation bladders of the plants. These planktonic organisms, by being trapped in the flotsam and washed ashore, likely serve as a source of nutrition for foraging shorebirds.

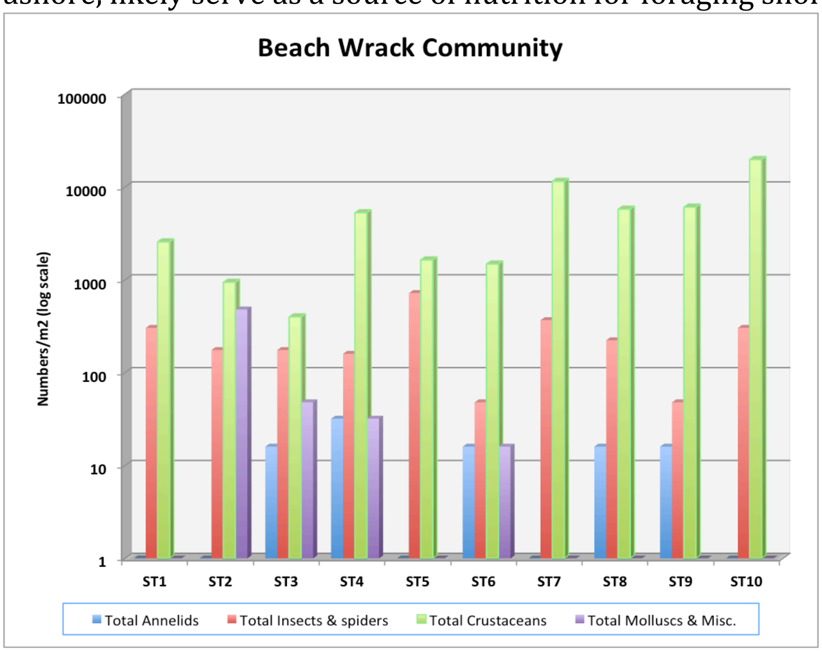

Figure 10. Gulf-side wrack-line macrobenthic components.

In terms of macrofaunal biomass, there was considerably more g /m^2 of available nutrition in the intertidal zone than in the wrack community (see the scales of Figs. 13 and 14) except for Station 3 which had exceptionally low intertidal values. Peaks of intertidal biomass at Stations 8, 1 and 4 were due to large numbers of bivalve molluscs (*Donax variabilis*) (Figs. 9 and 15). In the wrack community, the major player in terms of biomass was the amphipod, *Lepidactylus triariculatus* embedded in the moist sand beneath the wrack line, especially at stations 10 (about 8 g/m2) and 7 (3.8 g/m2) (Figs. 10 and 16). In comparing the biomass totals of all stations (Figs. 17 and 18), molluscs (86%) dominated the intertidal zone, with a sparse representation by crustaceans and annelids (total 13%), while crustaceans (91%) were more prevalent in the wrack community.

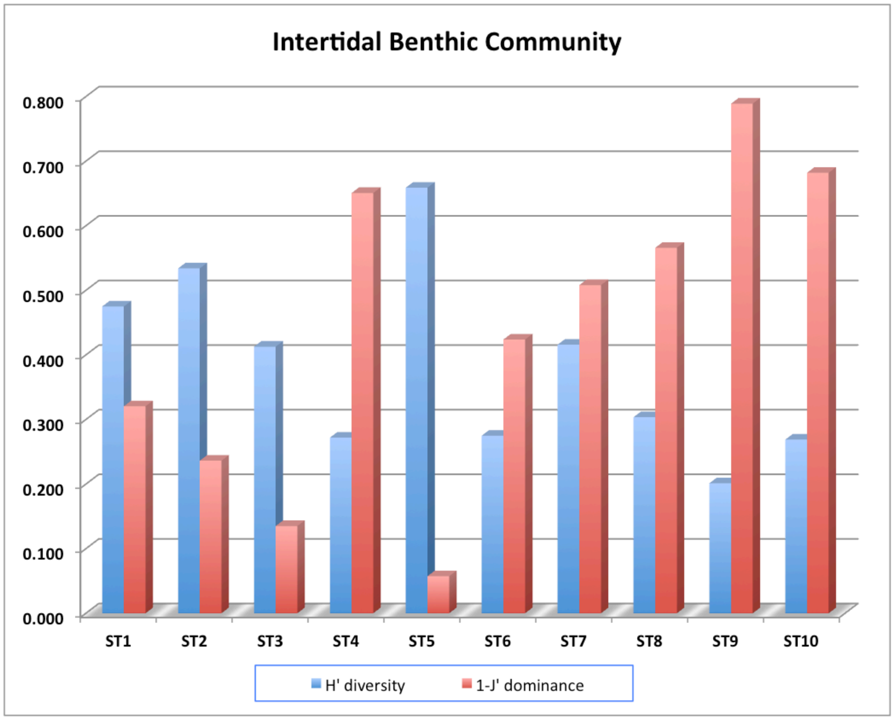

Figure 11. Gulf-side intertidal diversity indices.

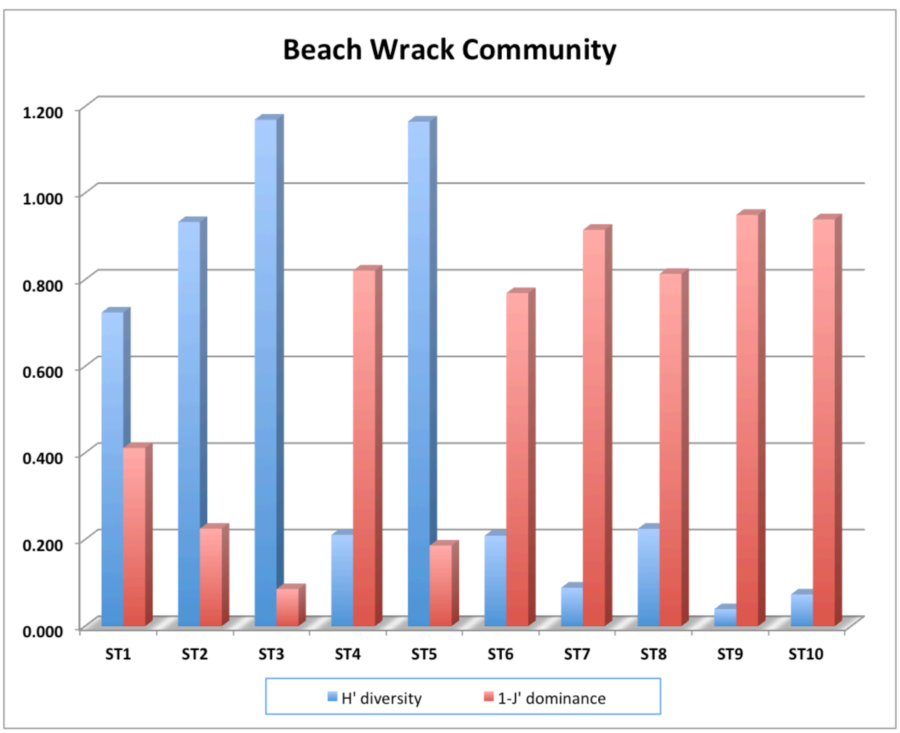

Figure 12. Gulf-side wrack-line diversity indices.

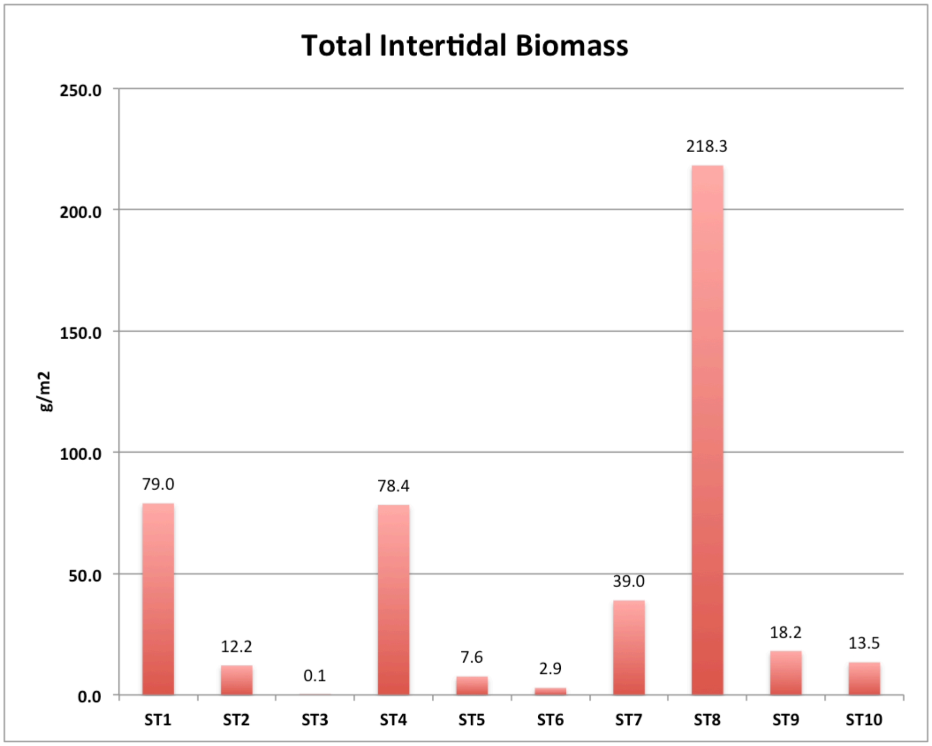

Figure 13. Gulf-side stations total intertidal biomass.

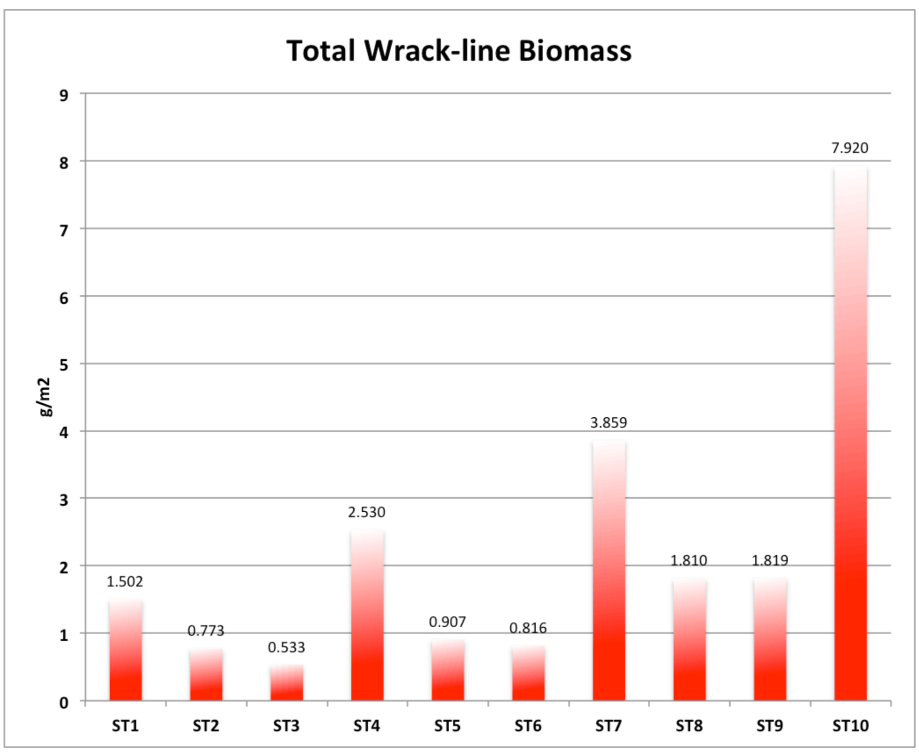

Figure 14. Gulf-side stations total wrack-line biomass.

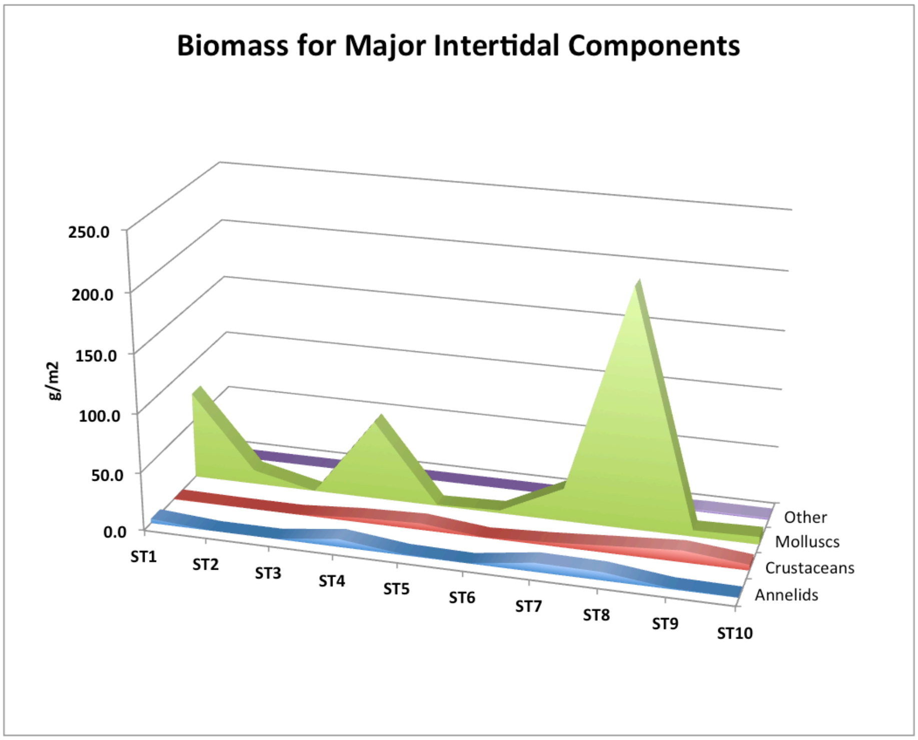

Figure 15. Gulf-side stations intertidal biomass components.

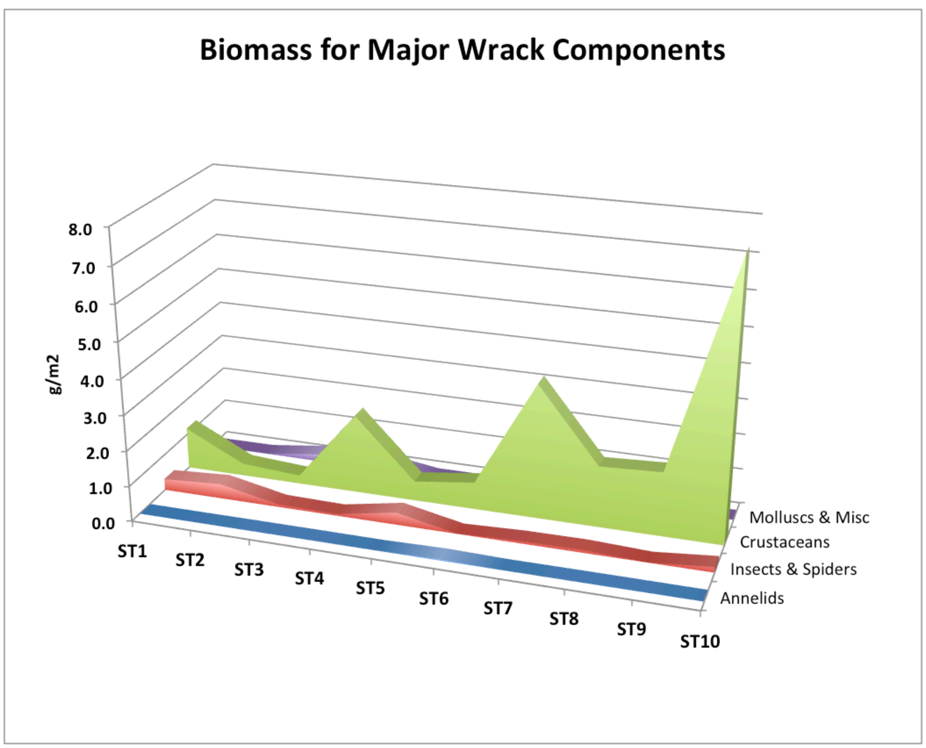

Figure 16. Gulf-side stations wrack-line biomass components.

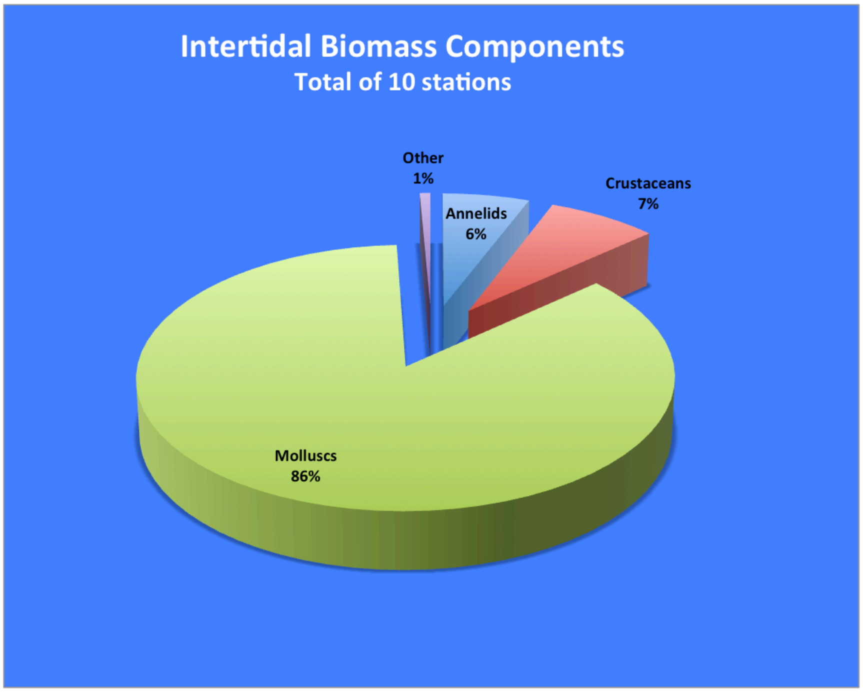

Figure 17. Gulf-side stations combined intertidal biomass components.

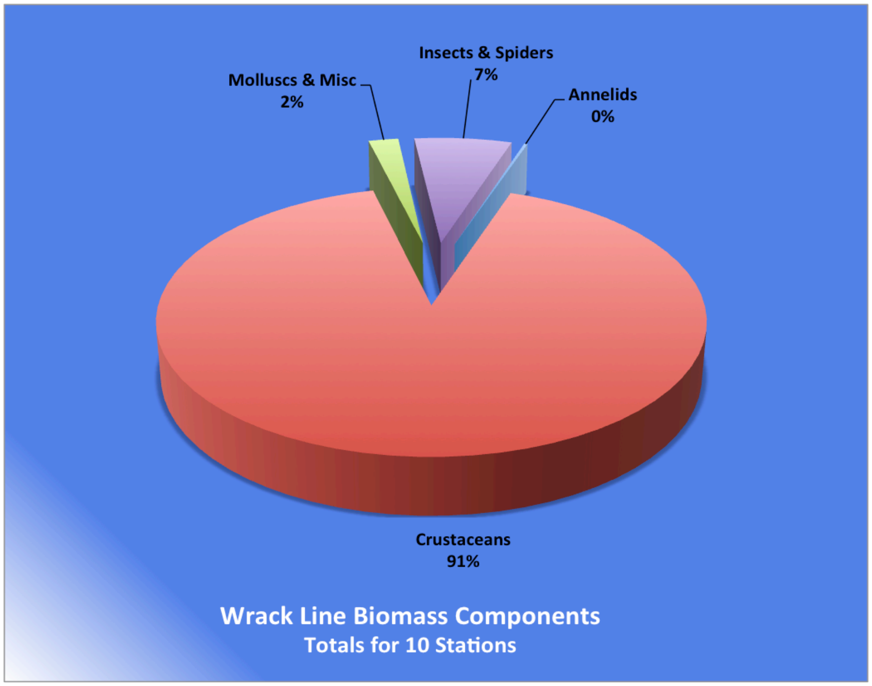

Figure 18. Gulf-side stations combined wrack-line biomass components.

Bay-side Stations

Of the three Bay-side sites, station BS1 had by far the highest density (21,296 organisms/m2) and a larger number of taxa (Fig. 19). While H' diversity values were similar at all three stations (above 0.500), the dominance index was lowest at BS3 (Fig. 20). Polychaete annelids dominated the fauna, especially at BS1 with 21 species present. The small spionid, *Streblospio gynobranchiata* occurred in large numbers (12,592 /m2) at BS1 along with three species of Capitellidae. Crustaceans also prominently occurred at BS1 led by podocopid ostracods and *Ampelisca* spp. (Fig. 21). The fauna at the Bay-side stations was typical of that found in low energy, mesohaline embayments of northern Gulf of Mexico estuaries characterized by low oxygenated, detritus-rich silt bottoms (Heard 1982).

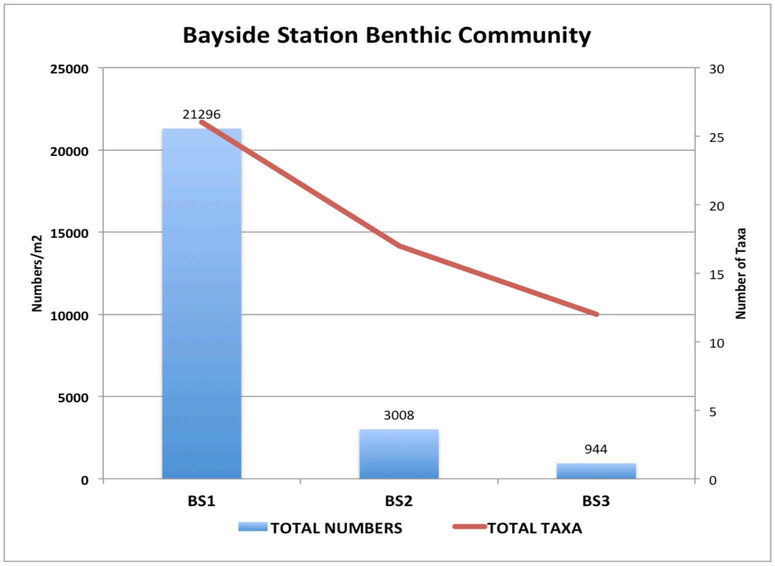

Figure 19. Bayside stations. Total macrobenthic density vs. richness.

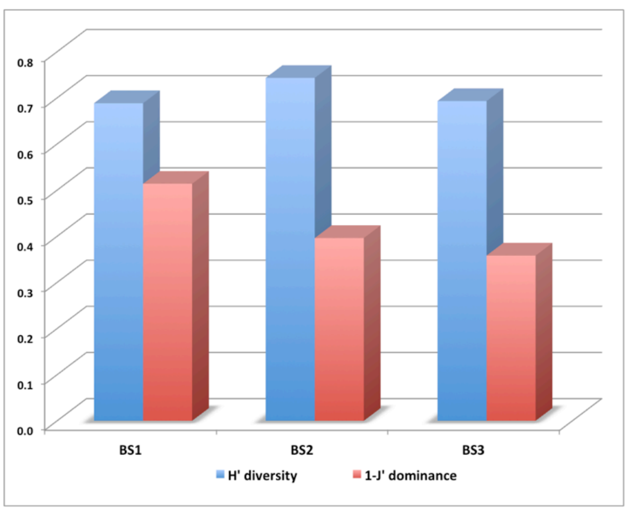

Figure 20. Bayside stations. Diversity indices.

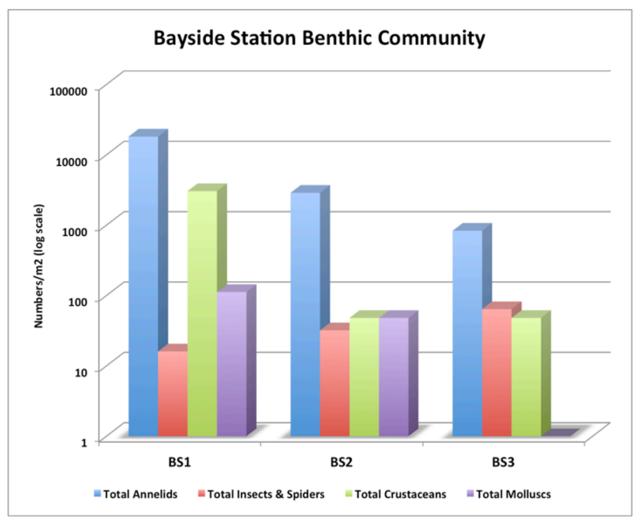

Figure 31. Bayside stations. Macrobenthic components.

Macrobenthic biomass values at the Bayside stations mirrored the trends seen in the density and richness categories at the corresponding stations. The biomass at Station BS1 more than doubled that of BS2, which, in turn, was more than 20 times that of BS3 (Fig. 22). The high density of annelids, including the larger-bodied nereid polychaetes, *Alitta succinea* and *Laeonereis culveri*, and the presence of the large clam, *Macoma mitchelli* at BS1 were responsible for the disparity in biomass values among the three stations. Meanwhile, two larger-bodies snails, *Nassarius vibex* accounted for the spike in mollusc biomass seen at BS2 (Fig. 23). Over all three bayside stations, annelids accounted for 71% of the biomass while molluscs were second at 24% (Fig. 24).

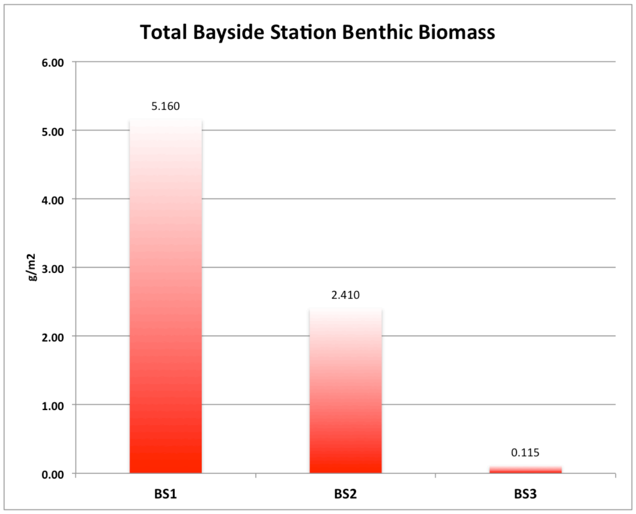

Figure 22. Bayside stations. Macrobenthic biomass.

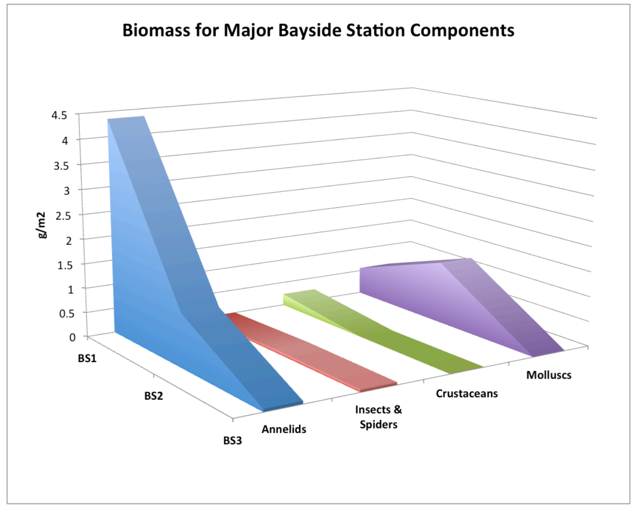

Figure 23. Bayside stations. Macrobenthic components.

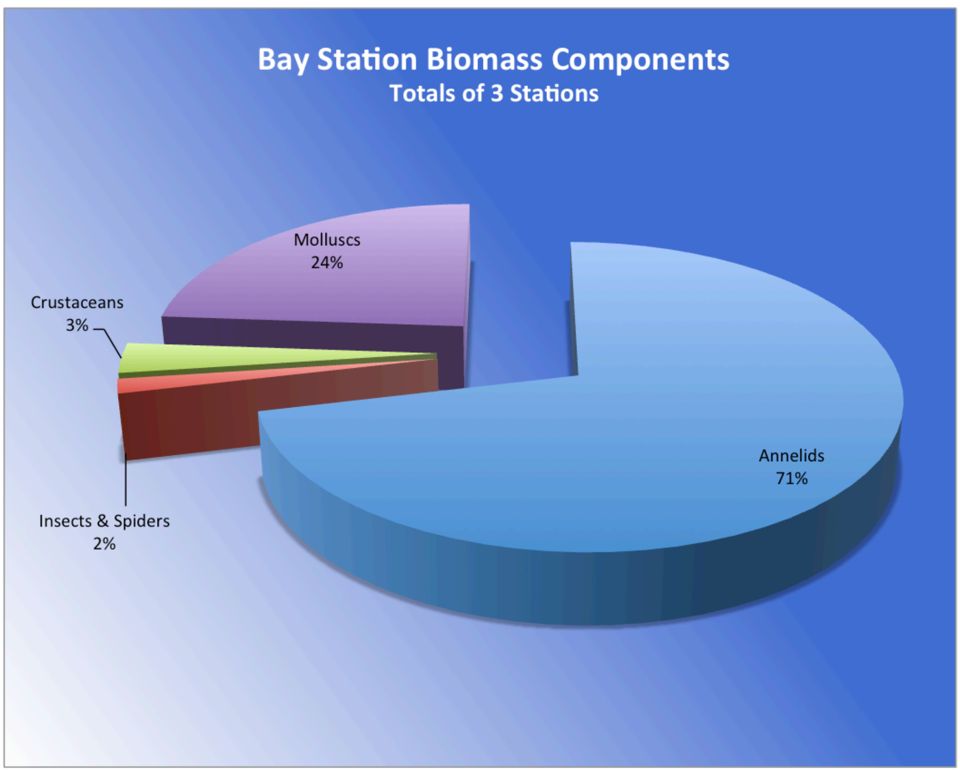

Figure 24. Bayside stations. Combined macrobenthic biomass components.

Comparison with 2013 and 2014 data.

The faunal and physical data at stations 1 through 4 provided the only direct comparison all three years of sampling events; however, a full compliment of 10 Gulf-side and three bayside stations are available for comparison between 2014 and 2015.

Stations 1-4: three year comparisons.

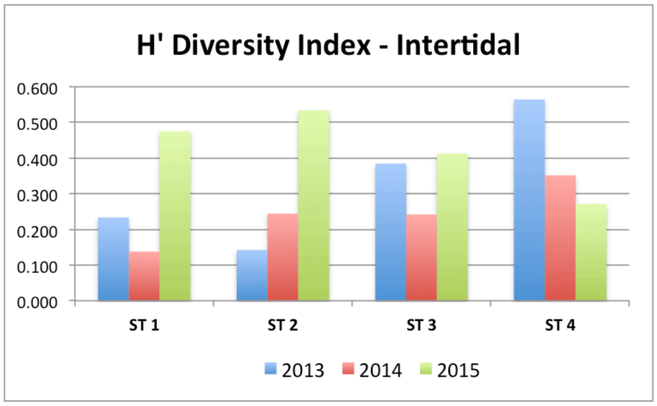

Figure 25. Intertidal diversity – 3 years.

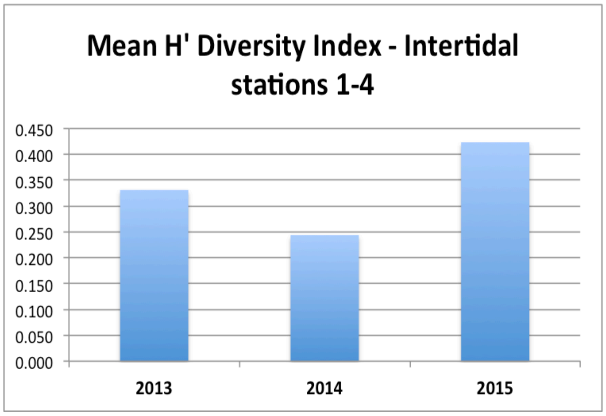

Figure 26. Interidal mean diversity – 3 years.

Intertidal zone. H' species diversity which was higher at stations 3 and 4 than stations 1 and 2 in the first two years of the study had declined in 2015; in fact, station 4 showed the lowest H' value among the four stations for 2015 (Fig. 25). H' values in 2015 showed the highest mean value among the four stations due to increased diversity at stations 1 and 2 (Fig. 26). From a numeric standpoint, the 2015 total macrobenthic density declined at stations 1 and 3 from the previous year, was slightly higher at station 2, but was increased ten fold at station 4 from 2014 levels (Fig. 27), due largely to extreme numbers of intertidal crustaceans and molluscs. The large numbers of crustaceans present at stations 1 and 2 in 2013 had dramatically declined to minimal levels by 2015. The increase in numbers of molluscs at stations 1 and 4 was responsible for peaks of biomass at those stations in 2015 (Fig. 28), since these organisms are larger and heavier than their annelid and crustacean counterparts. In comparing the total biomass components at the four stations over the three-year period it can be seen that the molluscs biomass steadily increases from 16 to 91

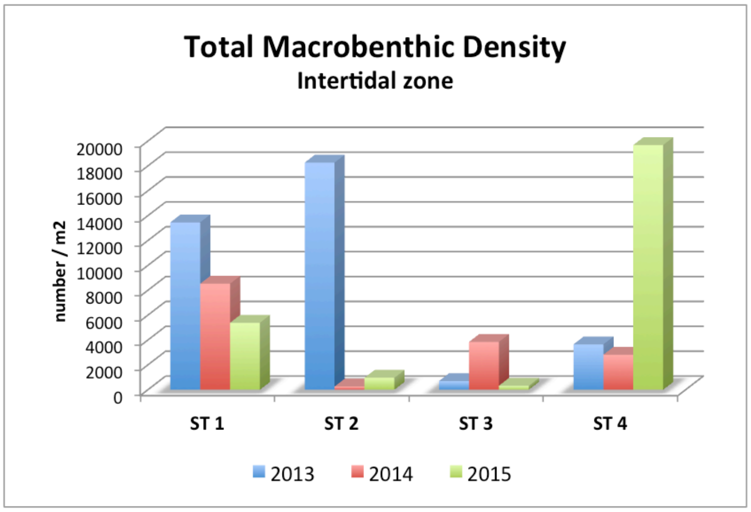

Figure 27. Total macroinvertebrate density - 3 years.

percent while that of annelids and crustacean show corresponding decreases from 42 and 41 percent to 6 and 3 percent respectively (Figs. 29-31).

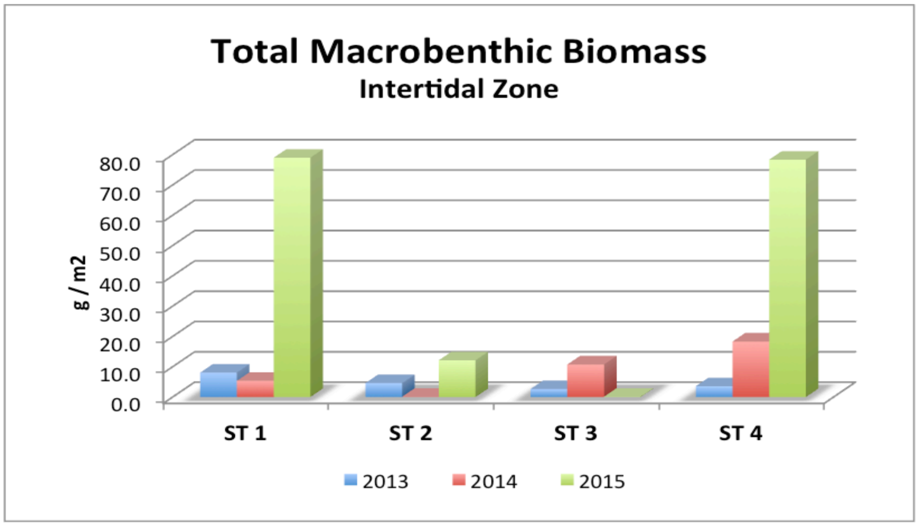

Figure 28. Total macroinvertebrate biomass - 3 years.

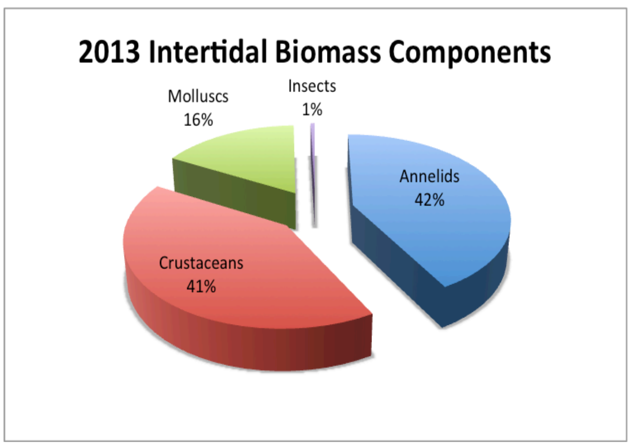

Figure 29. Combined intertidal biomass components for four stations - 2013.

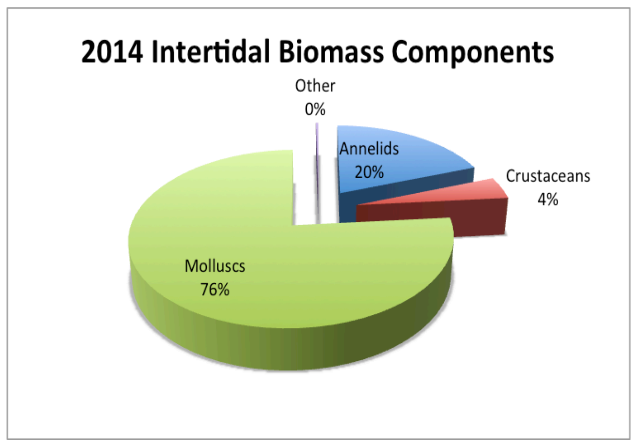

Figure 30. Combined intertidal biomass components for four station – 2014.

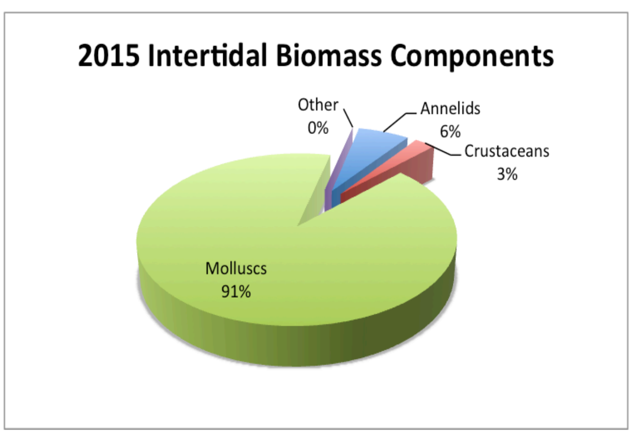

Figure 31. Combined intertidal biomass components for four stations - 2015.

Wrack-line community. In general, the wrack community in 2015 showed a slight rebound in terms of density and species richness from the previous year and an overall mean H' diversity increase from 2013, mainly because of a spike in diversity at station 3 (Figs. 32-34). Insect numbers were again depressed in 2015 but were higher than in 2014 due to those associated with the hyacinth debris. Crustaceans were the dominant organism at all four stations in 2015, both in terms of density and biomass, and showed marked increases from the previous year; in 2015 they showed a decrease from the previous year in percentage of biomass abundance because of the resurgence of the insect fauna (Figs. 35-38).

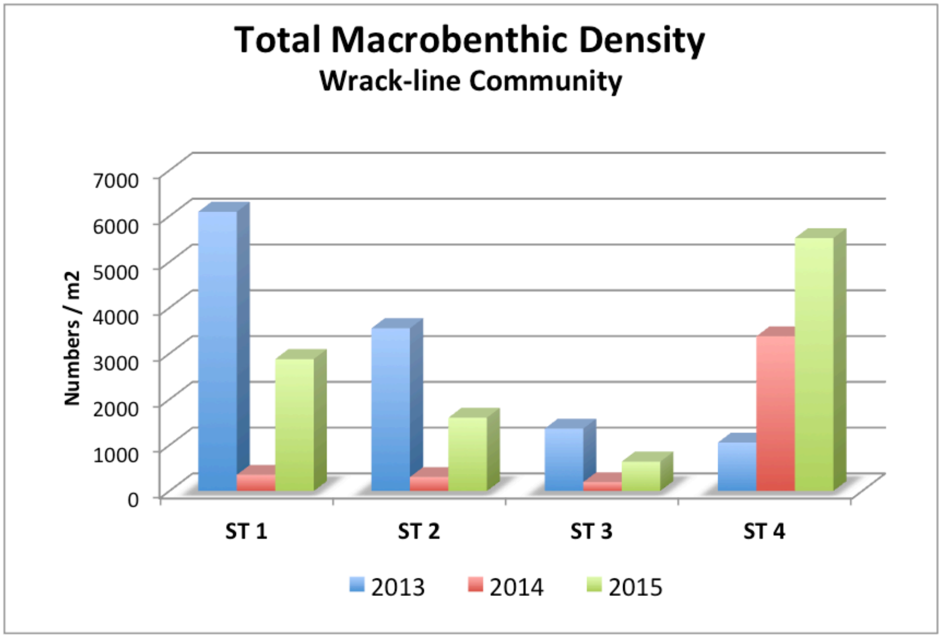

Figure 32. Total macroinvertebrate density - 3 years.

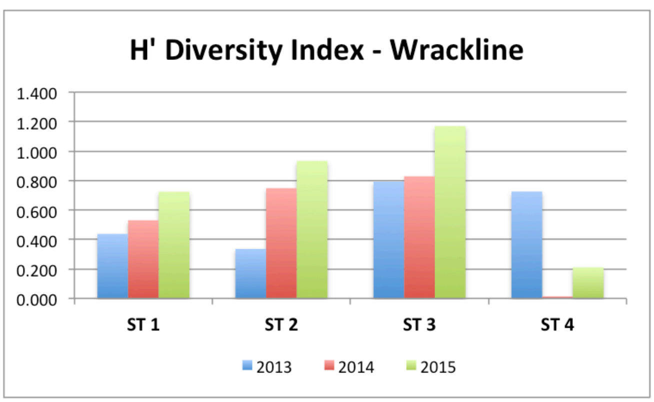

Figure 33. Wrackline species diversity - 3 years.

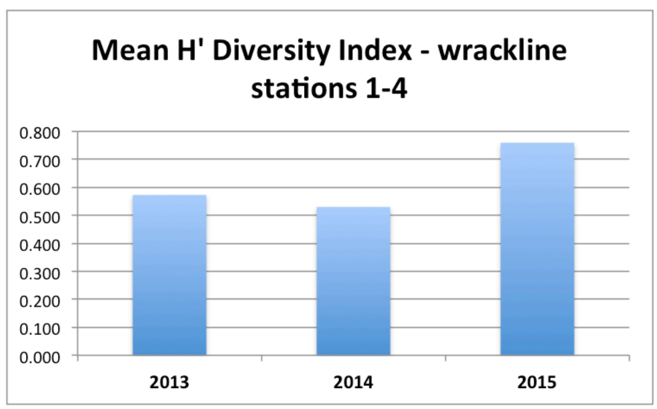

Figure 34. Wrackline mean diversity - 3 years.

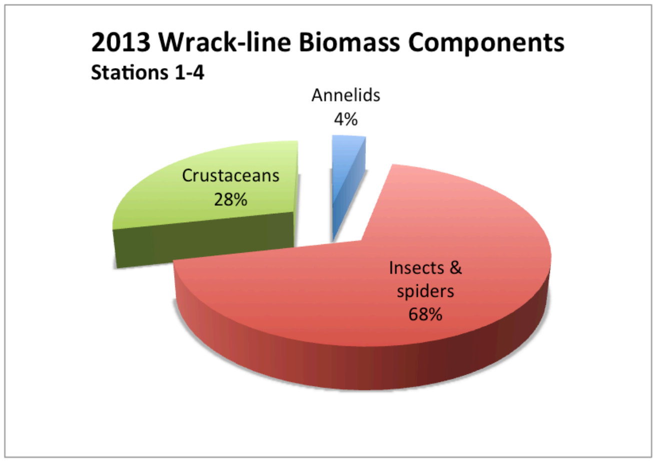

Figure 35. 2013 combined components for 4 stations.

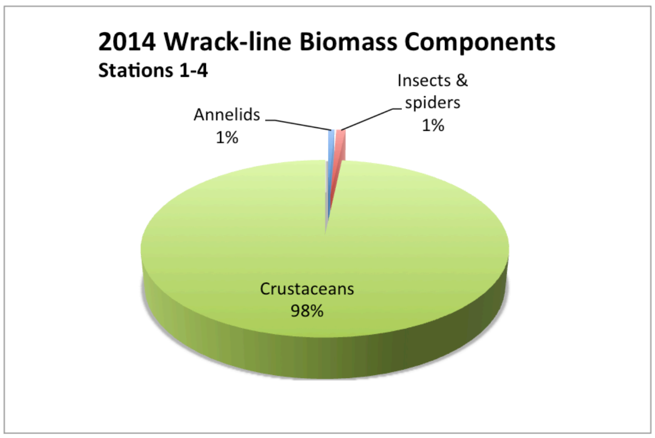

Figure 36. 2014 cominbed components for 4 stations.

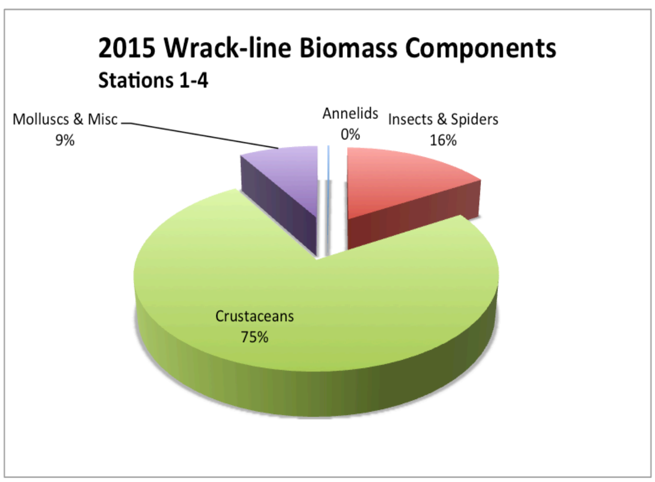

Figure 37. 2015 combined components for 4 stations.

Beach Stations 1-10: Two-year comparisons.

Intertidal zone. In comparing mean intertidal values over all ten stations, macroinvertebrate density was less in 2015 while corresponding values for H' diversity and biomass were higher (Figs. 38-40). The major contributing factor for the large increase in biomass in 2015 was the abundance of molluscs, primarily the coquina clam, *Donax variabilis* at 7 of the ten stations, but especially at station 8 where clams numbered greater than 9,000/m^2 with a corresponding spike in biomass of about 200 g/m^2 (Figs. 41 and 42). The contributions to the overall intertidal biomass from crustaceans and annelids were reduced in 2015 to 7 and 6 percent respectively (Figs. 43 and 44).

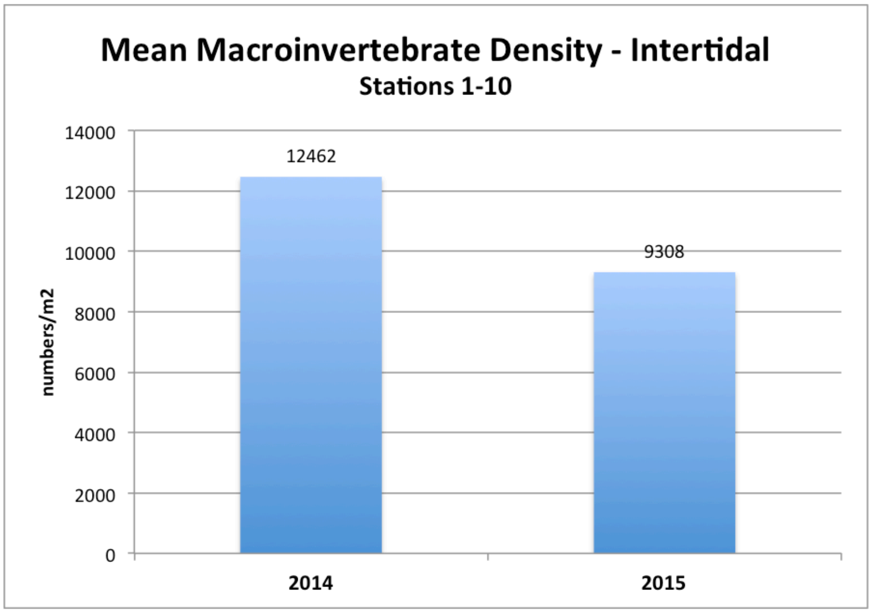

Figure 38. Mean intertidal density over 10 stations - 2 years.

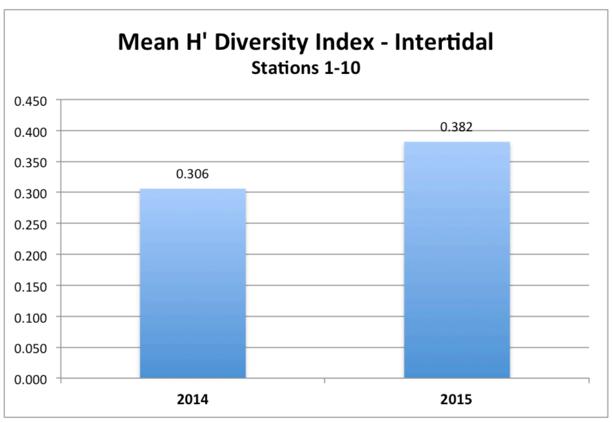

Figure 39. Mean intertidal diversity over 10 stations - 2 years.

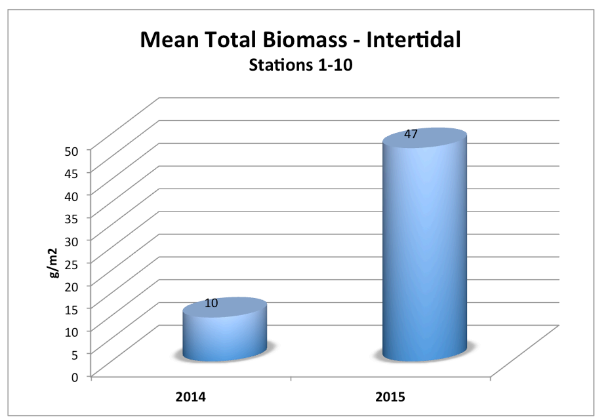

Figure 40. Mean intertidal biomass over 10 stations - 2 years.

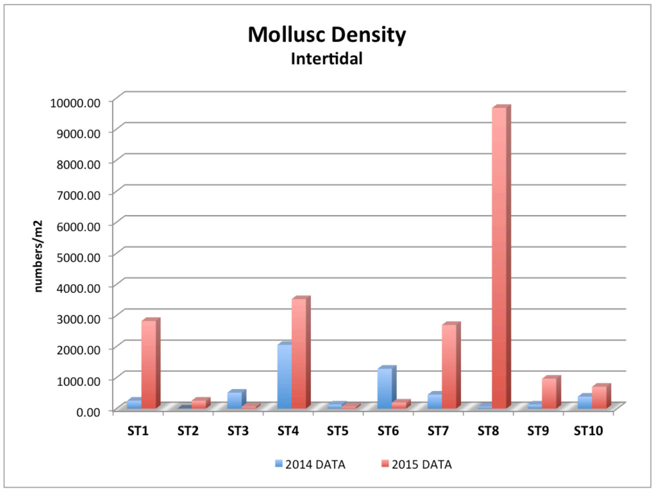

Figure 41. Mollusc density over 10 stations - 2 years.

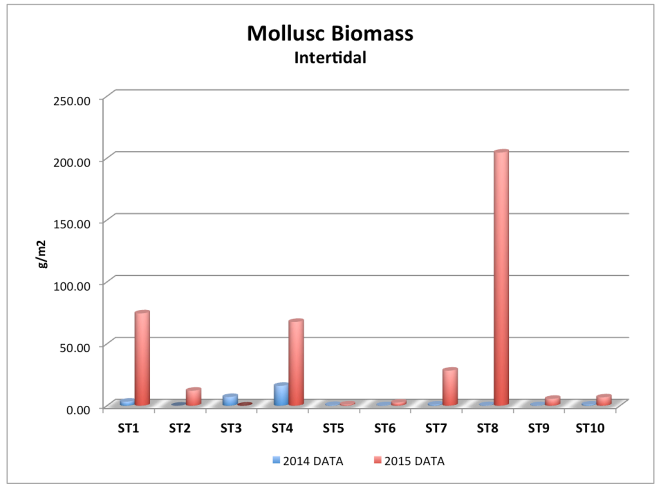

Figure 42. Mollusc biomass over 10 stations - 2 years.

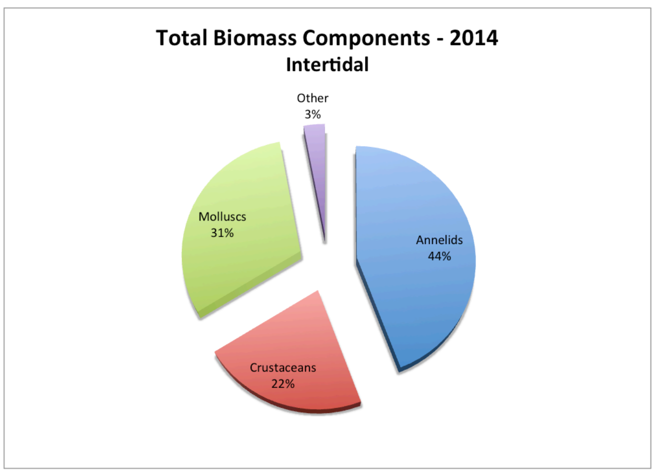

Figure 43. 2014 combined intertidal components for 10 stations.

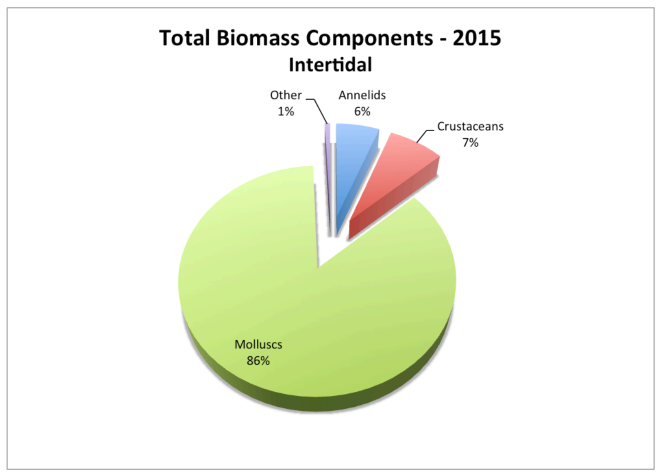

Figure 44. 2015 combined intertidal components for 10 stations.

Wrack-line community. The macroinvertebrate community in the wrack-line showed slight increases in mean density and diversity in 2015 but was about the same for mean biomass among the ten beach stations (Figs. 45-47). The two major components of the beach wrack community, insect/spider and crustaceans, showed major increases in 2015 in density and biomass; insects and spiders for all ten stations and crustaceans at 8 stations (Figs. 48-51). In comparing the composite biomass for all ten stations (Figs. 52 and 53), crustaceans increased from 64 to

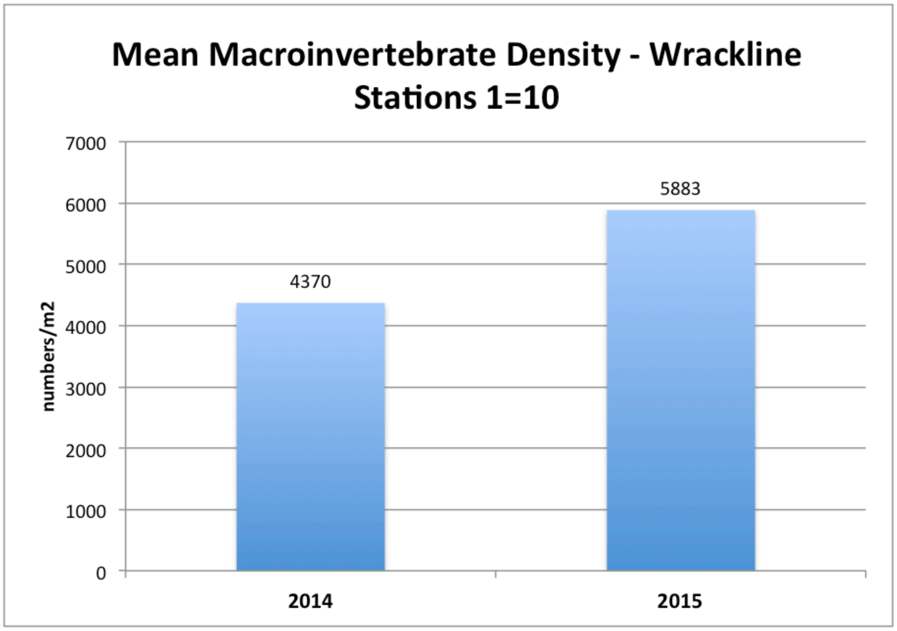

Figure 45. Mean wrackline density over 10 stations - 2 years.

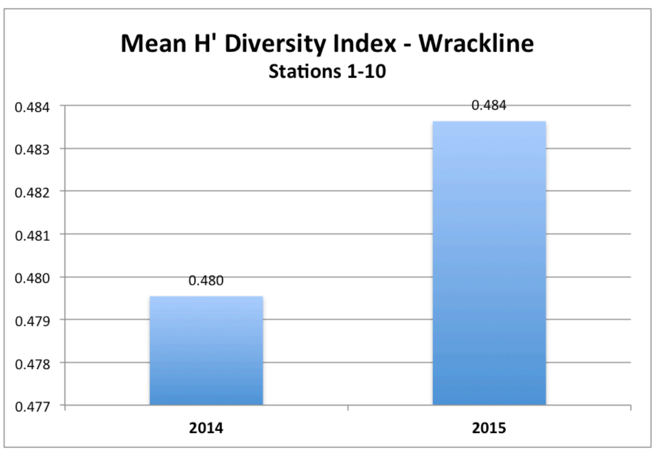

Figure 46. Mean wrackline diversity over 10 stations - 2 years.

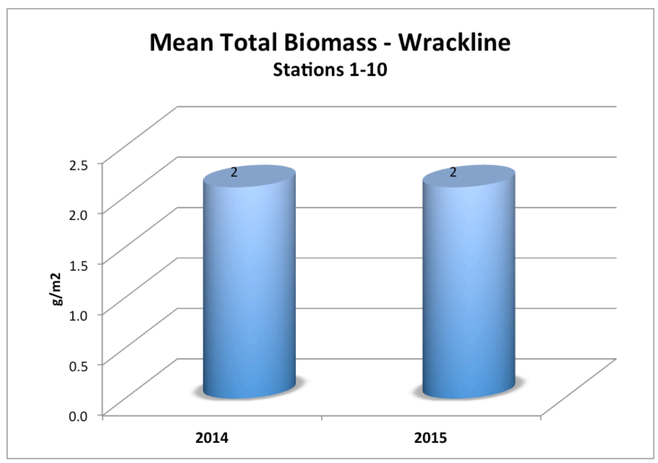

Figure 47. Mean wrackline biomass over 10 stations - 2 years.

91%, mostly because of large numbers of embedded haustoriid amphipods in the moist sand beneath the wrack debris at stations 4,7, and 10; meanwhile insect and spider numbers also showed a modest increase from about 1% of the biomass in 2014 to 7% in 2015.

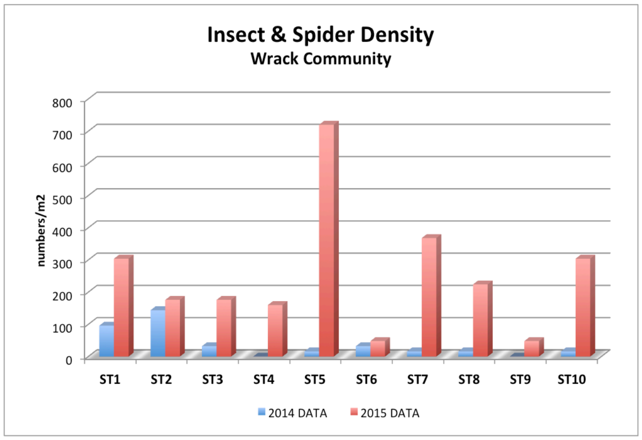

Figure 48. Insect & spider wrackline density over 10 stations - 2 years.

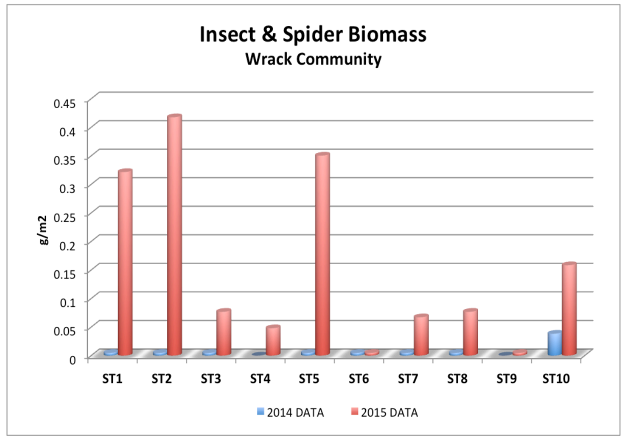

Figure 49. Insect & spider wrackline biomass over 10 stations - 2 years.

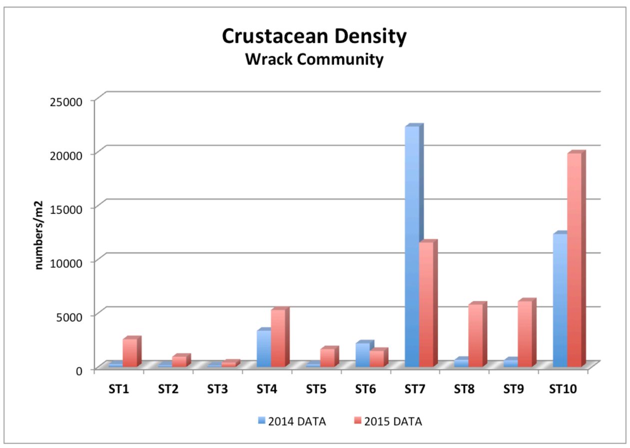

Figure 50. Crustacean wrackline density over 10 stations - 2 years.

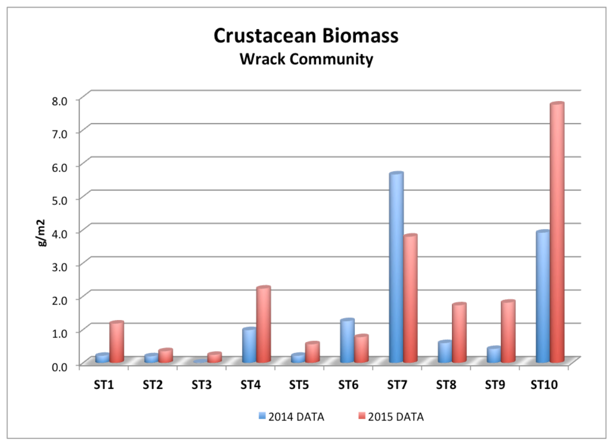

Figure 51. Crustacean wrackline biomass over 10 stations - 2 years.

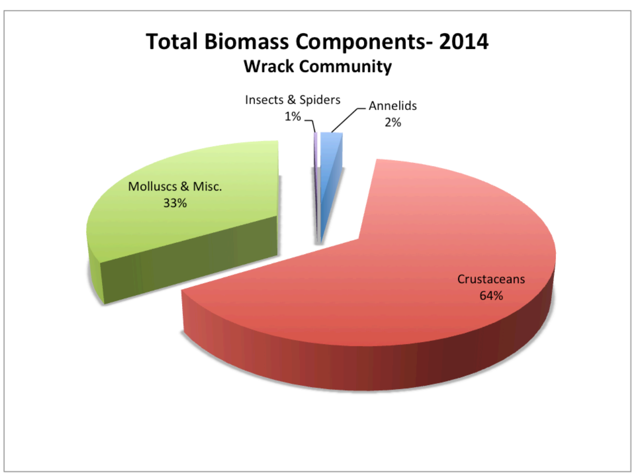

Figure 52. 2014 combined wrackline components over 10 stations.

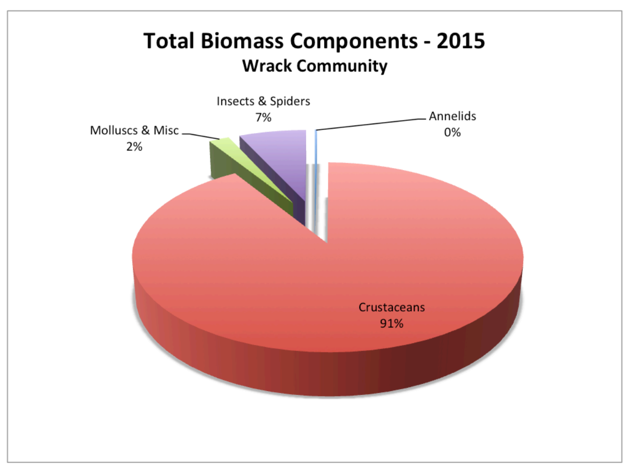

Figure 53. 2015 combined wrackline components over 10 stations.

Bayside Stations: Two-year comparisons.

Values for mean density, diversity and biomass all showed increases in 2015 (Figs. 54-56). Total Macrobenthic biomass increased at all stations but especially so at stations BS1 and BS2 due to higher density of annelids and crustaceans at those stations and more occurrences of larger-bodied molluscs, (*Macoma mitchelli* and *Nassarius vibex*, especially at station BS2 (Fig. 57). The density of insects and spiders was much reduced in 2015 at all three stations (Fig. 58). A comparison of composite biomass components reveals

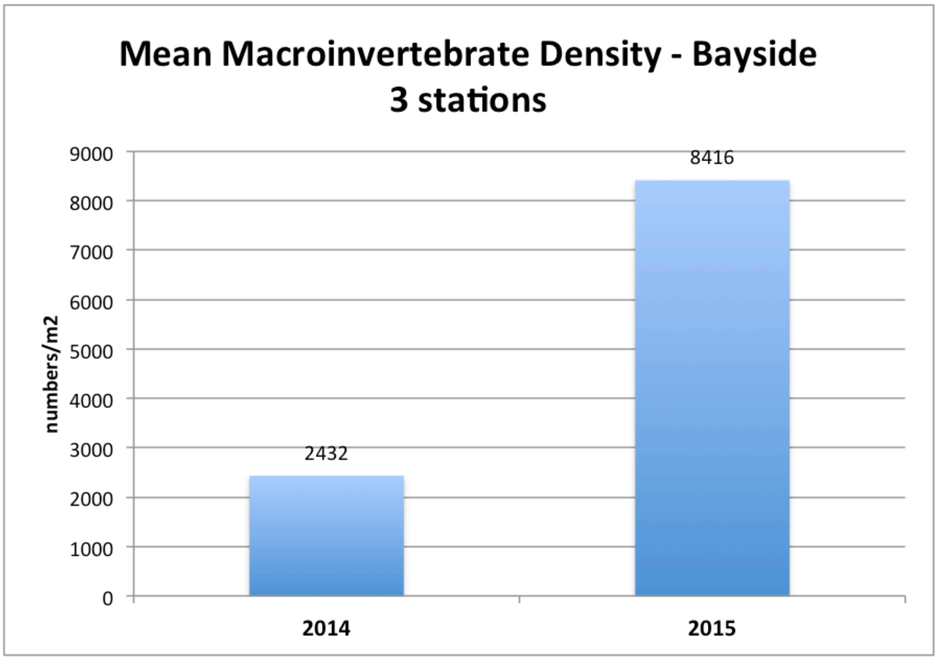

Figure 54. Mean bayside density over three stations - 2 years.

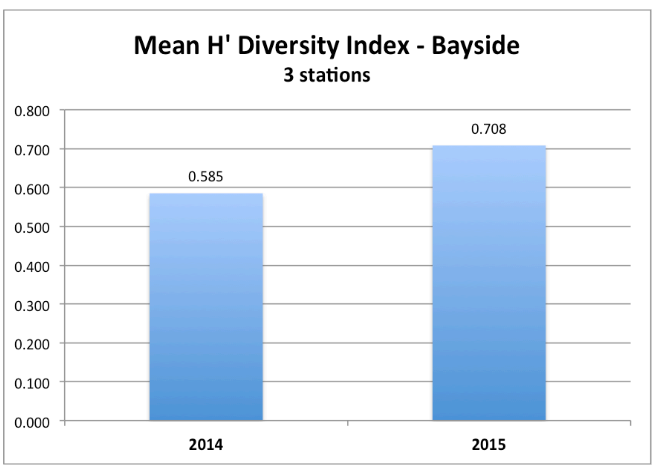

Figure 55. Mean bayside H' diversity over three stations - 2 years.

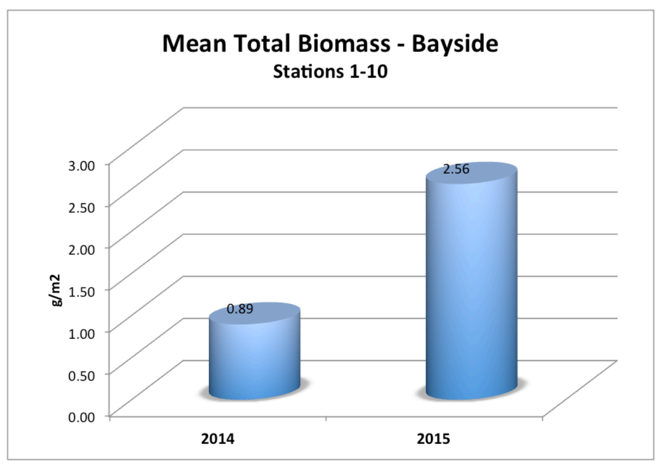

Figure 56. Mean bayside biomass over three stations - 2 years.

a slight increase in annelids, a substantial increase in molluscs (5 to 24%) and a marked decline in insects from 30% in 2014 to 2% in 2015 (Figs. 59 and 60).

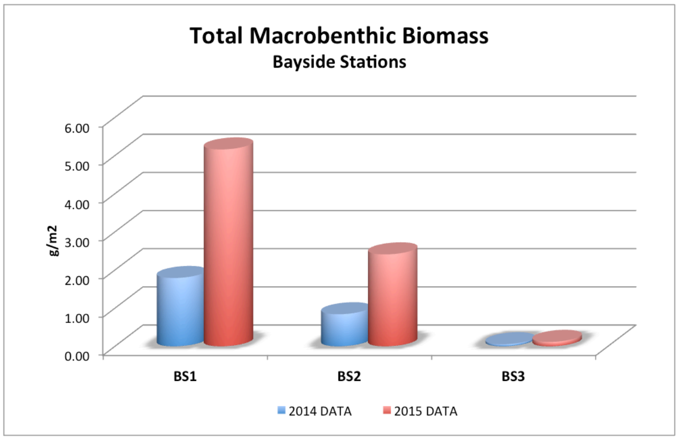

Figure 57. Total bayside biomass over three stations - 2 years.

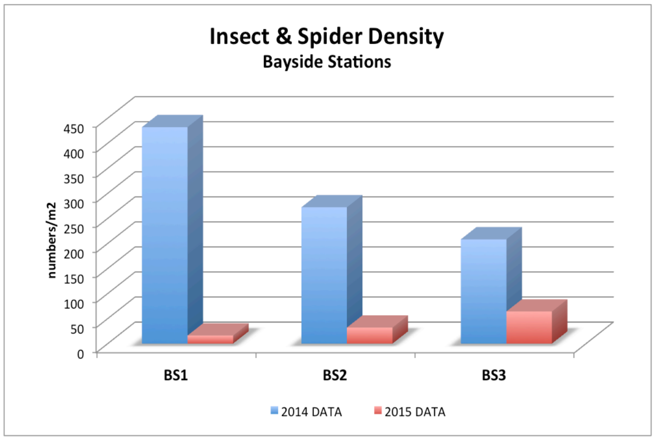

Figure 58. Bayside insect and spider density over three stations - 2 years.

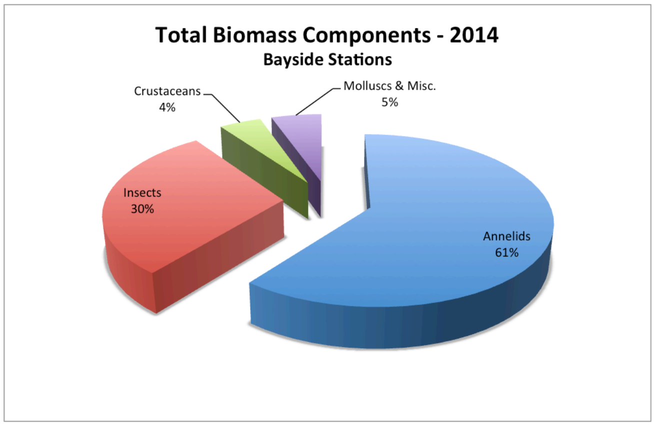

Figure 59. 2024 combined bayside biomass components over three stations.

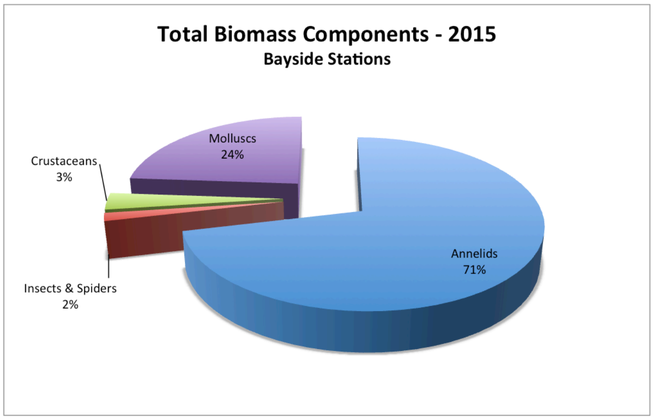

Figure 60. 2015 combined bayside biomass components over three stations.

Summary and Conclusions

The key components in the Macrobenthic community from the 2013 and 2014 studies were again present along the Caminada Headland Beach in 2015. The polychaete, *Scolelepis squamata*, the amphipod, *Lepidactylus triarticulatus* and the bivalve mollusc, *Donax variablilis* accounted for most of the Macrobenthic density and biomass in the intertidal zone at the ten beach stations, while insects and low-salinity crusaceans associated with the recently deposited clumps of riverine water hyacinths added to the nutritional value and potential shore-bird forage in the wrack-line community all stations. The above-mentioned intertidal species are commonly occurring inhabitants of intertidal and near-shore benthic habitats from the barrier island and mainland beaches from the Florida panhandle area to Texas (Rakocinski et al. 1991, 1993; McLelland and Heard 1991; Mikkelsen and Bieler 2008; Tunnel et al. 2010).

The three bayside stations on the backside of Caminada Headland Beach varied from very little biomass at BS3 to a healthy population of annelids and crustaceans. In terms of density and biomass, the key players in these calmer waters were the polychaetes, *Streblospio gynobranchiata*, *Aphelochaeta* sp., three species of Capitellidae, and *Laenonereis culveri*, the crustaceans, *Ampelisca* spp, and the bivalve, *Macomma mitchelli*. These mesohaline organisms are common along bays and estuaries of the northern Gulf of Mexico (Heard 1982; LaSalle and Bishop 1987).

The findings of Year 2 of the Caminada Headland Beach benthic survey are summarized thus:

1. 120 nominal taxa from 7 different phyla were represented from the total of 7,504 organism examined. The intertidal organism *Scolelepis squamata, Lepidactylus triarticulatus* and *Donax variabilis* accounted for most of the numeric density and biomass (g/m2) at the 10 beach stations while 21 species of polychaetes led by the spionid, *Streblospio gynobranchiata* and 3 species of capitellids, were important food resources at the three calm-water bayside stations.

2. Among the beach stations, Station 8 had the highest numerical density of organisms and biomass in the intertidal zone owing to the large numbers of annelids and bivalve molluscs (greater than 30,000 / m2) present there. Station 10 featured the highest density of wrack-line organisms (over 20,000 / m2), again due to a healthy population of embedded *L. triarticulatus*, while station 5 had the larger number of taxa (27) among wrack environments sampled.

3. H' diversity in the intertidal zone was greater than 0.500 at only two of the Gulf-side stations, 2 and 5 while in the wrack community, H' diversity values exceeded 0.500 at four stations with the maximum (1.169) occurring at station 3 (19 total taxa).

4. Intertidal macrobenthic biomass at the Gulf-side stations was overall greater than at corresponding wrack-line communities. Intertidal biomass peaks occurred at stations 1, 4 and 8 due to large numbers of crustaceans and bivalve molluscs present. Crustaceans dominated wrack-line biomass at all stations with the peak being at station 10.

5. Although H' diversity values were similar at the bay-side stations, BS1 had the highest density (21,296/m2) and species richness (26) of the three stations followed by BS2 and BS1. Macrobenthic biomass values mirrored the trends seen in the density and richness profiles with the value of BS1 more than doubled that of BS2, which, in turn, was over 20 times that of BS3.

6. Data from Gulf-side stations 1-4 collected in 2013, 2014 and 2015 were compared. In the intertidal zone, H' diversity values were higher in 2015 at all stations except 4 and the mean diversity of all four stations was higher the same year. Total macrobenthic density in 2015 was lower than in previous years except at station 4 where it was higher. The intertidal biomass at stations 1-4 in 2015 was predominantly molluscs (91%); this group steadily increased from 16 to 91 percent over the three-year period while total biomass of annelids and crustacean showed corresponding decreases from 42 and 41 percent to 6 and 3 percent respectively. As in 2014, the wrack-line biomass was dominated by crustaceans (mostly embedded amphipods) while the insect fauna, largely absent in 2014, showed a resurgence in biomass to 16%.

7. Two years of data from 10 Gulf-side and 3 bay-side stations were compared. Mean intertidal values over all ten stations for macroinvertebrate density was less in 2015 while corresponding values for H' diversity and biomass were higher. However, the mean intertidal biomass was much higher in 2015 owing to large numbers of *Donax variabilis* at stations 1, 4 and 8. Mean values for wrack community diversity and density among the ten Gulf-side stations were higher in 2015 while mean biomass was about the same. Similarly, mean diversity and mean density values at the three bay-side stations were higher in 2015 but mean total biomass values were about the same.

Table 3. Summary of Intertidal Box Core Data – condensed by station.
Values in numbers/ m²

TAXA	ST1	ST2	ST3	ST4	ST5	ST6	ST7	ST8	ST9	ST10
ANNELIDA										
Polychaeta										
Family Lumbrineridae										
Scoletoma verrilli				385			128	321	64	
Family Spionidae										
Scolelepis squamata	1603	64	64	64	256		64		64	128
ARTHROPODA										
Arachnida										
Order Araneae										
Family Linyphiidae										
Unid. Linyphiidae							64			
Entognatha										
Order Poduromorpha										
Unid. Collembola									64	
Insecta										
Order Coleoptera										
Family Staphylinidae										
Unid. Staphylinidae						64	64			
Order Diptera										
Family Sciaridae										
Unid. Sciaridae		64							128	
Order Hymenoptera										
Family Formicidae										
Unid. Formicidae	64									
Solenopsis invicta	64									
Malacostraca										
Order Amphipoda										
Family Haustoriidae										
Lepidactylus triarticulatus	833		192	15577	192	962	3526	21987	16026	7180
Family Talitridae										
Platorchestia sp.		64								
Order Decapoda										
Family Hippidae										
Emerita benedicti					128		64			
Family Pinnotheridae										
Austinixa behreae									385	128
Order Isopoda										
Family Sphaeromatidae										

TAXA	ST1	ST2	ST3	ST4	ST5	ST6	ST7	ST8	ST9	ST10
Ancinus depressus				64						
MOLLUSCA										
Bivalvia										
Veneroida										
Family Donacidae										
Donax variabilis	2821	256		3526	64	192	2692	9487	897	641
Family Montacutidae										
Mysella planulata								128		64
Gastropoda										
Littorinimorpha										
Family Tornidae										
Unid. Tornidae			64					64	64	
MISC TAXA										
Cnidaria										
Unid. Anthozoa										64
Nemertea										
Unid. Nemertea		513		64	128				64	
Unid. Palaeonemertea										192
TOTAL NUMBERS	5385	962	321	19680	769	1218	6603	31987	17757	8397
TOTAL TAXA	5	5	3	6	5	3	7	5	9	7
diversity indices										
Hmax'	0.699	0.699	0.477	0.778	0.699	0.477	0.845	0.699	0.954	0.845
H' diversity	0.475	0.534	0.413	0.272	0.659	0.275	0.416	0.304	0.201	0.269
J' evenness (equitability)	0.680	0.764	0.865	0.349	0.943	0.576	0.492	0.434	0.211	0.318
1-J' dominance	0.320	0.236	0.135	0.651	0.057	0.424	0.508	0.566	0.789	0.682

numbers/m2

Total Annelids	1603	64	64	449	256	0	192	321	128	128
Total Crustaceans	833	64	192	15641	321	962	3590	21987	16410	7308
Total Molluscs	2821	256	64	3526	64	192	2692	9680	962	705
Total Other *	128	577	0	64	128	64	128	0	256	256

TAXA	ST1	ST2	ST3	ST4	ST5	ST6	ST7	ST8	ST9	ST10
					AFD biomass - g					
Total Annelids	0.0197	0.0001	0.0004	0.0356	0.0048	0	0.04	0.037	0.0047	0.0011
Total Crustaceans	0.003	0.0001	0.0001	0.0198	0.0298	0.002	0.0153	0.0346	0.0523	0.0258
Total Molluscs	0.3879	0.0629	0.0001	0.352	0.0049	0.0131	0.1472	1.0635	0.0288	0.035
Total Other *	0.0001	0.0001	0	0.0001	0.0001	0.0001	0.0001	0	0.0086	0.0081

					AFD biomass - g/m2					
Total Annelids	3.79	0.02	0.08	6.85	0.92	0.00	7.69	7.12	0.90	0.21
Total Crustaceans	0.58	0.02	0.02	3.81	5.73	0.38	2.94	6.65	10.06	4.96
Total Molluscs	74.60	12.10	0.02	67.69	0.94	2.52	28.31	204.52	5.54	6.73
Total Other *	0.02	0.02	0.00	0.02	0.02	0.02	0.02	0.00	1.65	1.56

* includes insects, spiders, and misc. taxa

Table 4. Summary of Wrackline Quantitative Data – condensed by station.
Values in numbers/m^2

TAXA	ST1	ST2	ST3	ST4	ST5	ST6	ST7	ST8	ST9	ST10
ANNELIDA										
Unid. Annelida			16							
Polychaeta										
Family Nereididae										
Alitta succinea				16						
Family Spionidae										
Scolelepis squamata				16		16		16	16	
ARTHROPODA										
Arachnida										
Order Araneae										
Family Linyphiidae										
Unid. Erigoninae			16					16		
Unid. Linyphiidae									16	
Family Lycosidae										
Unid. Lycosidae							16			
Entognatha										
Order Poduromorpha										
Unid. Collembola					16					
Family Hypogastruridae										
Unid. Hypogastruridae					272		208			16
Insecta										
Order Coleoptera										
Family Carabidae										
Amblygnathus sp.		16			32					
Bembidion sp.			16							
Family Curculionidae										
Unid. Curculionidae	16		32		32			16		
Tanysphyrus sp	32									
Family Dytiscidae										
Unid. Dytiscidae			80	64	48	32	32	16		80
Uvarus sp.	16									
Family Scarabaeidae										
Unid. Scarabaeidae	16									
Family Staphylinidae										
Unid. Staphylinidae	32	48			64					16
Order Diptera										

TAXA	ST1	ST2	ST3	ST4	ST5	ST6	ST7	ST8	ST9	ST10
Unid. Diptera		16		32	16		16	80	16	16
Family Cecidomyiidae										
Unid. Cecidomyiidae								16		
Family Chironomidae										
Endochironomus sp.					16					16
Glyptotendipes sp.	32									
Polypedilum sp.					16					16
Unid. Chironominae							16			
Unid. Orthocladinae	16									
Family Dolichopidae										
Unid. Dolichopidae				16						
Family Phoridae										
Unid. Phoridae					16					
Family Sciaridae										
Unid. Sciaridae					64				16	
Family Stratiomyidae										
Odontomyia sp.	32	64	16	16	48	16	48	32		144
Family Tephritidae										
Unid. Tephritidae								16		
Order Hemiptera										
Unid. Hemiptera					16		16	16		
Family Aphididae										
Unid. Aphididae	64				32					
Family Cercopidae										
Unid. Cercopidae								16		
Family Cicadellidae										
Unid. Cicadellidae	32	16	16	16			16			
Order Hymenoptera										
Family Braconidae										
Unid. Braconidae		16			16					
Family Eulophidae										
Unid. Eulophidae				16						
Family Formicidae										
Aphenogaster sp.	16									
Ponera sp.					16					
Malacostraca										
Order Amphipoda										
Family Ampithoidae										
Ampithoe valida		16								
Family Corophiidae										
Unid. Corophiidae	16	32	80	112	32					32

TAXA	ST1	ST2	ST3	ST4	ST5	ST6	ST7	ST8	ST9	ST10
Monocorophium ascherusicum					64			48		
Family Gammaridae										
Gammarus lecroyae	320	224	64	32	272	16	16	48		32
Gammarus mucronatus			16	16	96					16
Gammarus tigrinus										16
Gammarus sp.		192	96							
Unid. Gammaridae					144					
Unid. Gammaroidea			32		32					32
Family Haustoriidae										
Lepidactylus triarticulatus	1440	32	16	5056	256	1424	11520	5488	6080	19664
Family Hyalellidae										
Hyalella azteca			16							
Family Hyalidae										
Apohyale wakabarae										16
Family Melitidae										
Melita sp.			16							
Family Talitridae										
Platorchestia sp.	336	128			32					
Order Decapoda										
Family Portunidae										
Callinectes sp		16								
Portunidae zoea					16					
Order Isopoda										
Family Munnidae										
Uromunna reynoldsi						16		16	16	
Maxillopoda										
Order Calanoida										
Unid. Calanoid copepod	448	304	48		496	32	16	48		16
Order Sessilia										
Family Balanidae										
Amphibalanus sp.	16		16	80	208			144		16
MOLLUSCA										
Bivalvia										
Order Veneroida										
Family Donacidae										
Donax variabilis				16						
MISC. TAXA										
Chordata										
Demersal fish eggs		32	32							

TAXA	ST1	ST2	ST3	ST4	ST5	ST6	ST7	ST8	ST9	ST10
Unid. Fish Larva						16				
Nemertea										
Unid. Nemertea		448	16							
Platyhelminthes										
Unid. Turbellaria				16						
TOTAL NUMBERS	2880	1600	640	5520	2368	1568	11920	6032	6160	20144
TOTAL TAXA	17	16	19	15	27	8	11	16	6	16
diversity indices										
Hmax'	1.230	1.204	1.279	1.176	1.431	0.903	1.041	1.204	0.778	1.204
H' diversity	0.724	0.933	1.169	0.211	1.165	0.209	0.089	0.225	0.039	0.073
J' evenness (equitability)	0.588	0.775	0.915	0.179	0.814	0.231	0.085	0.187	0.050	0.061
1-J' dominance	0.412	0.225	0.085	0.821	0.186	0.769	0.915	0.813	0.950	0.939
					numbers/m2					
Total Annelids	0	0	16	32	0	16	0	16	16	0
Total Insects & spiders	304	176	176	160	720	48	368	224	48	304
Total Crustaceans	2576	944	400	5296	1648	1488	11552	5792	6096	19840
Total Molluscs & Misc.	0	480	48	32	0	16	0	0	0	0
					AFD biomass - g					
Total Annelids	0	0	0.0001	0.0001	0	0.0007	0	0.0001	0.0001	0
Total Insects & spiders	0.0067	0.0087	0.0016	0.001	0.0073	0.0001	0.0014	0.0016	0.0001	0.0033
Total Crustaceans	0.0246	0.0073	0.005	0.0465	0.0116	0.0161	0.079	0.036	0.0377	0.1617
Total Molluscs & Misc.	0	0.0001	0.0044	0.0051	0	0.0001	0	0	0	0
					AFD biomass - g/m2					
Total Annelids	0.000	0.000	0.005	0.005	0.000	0.034	0.000	0.005	0.005	0.000
Total Insects & spiders	0.322	0.418	0.077	0.048	0.350	0.005	0.067	0.077	0.005	0.158
Total Crustaceans	1.181	0.350	0.240	2.232	0.557	0.773	3.792	1.728	1.810	7.762
Total Molluscs & Misc.	0.000	0.005	0.211	0.245	0.000	0.005	0.000	0.000	0.000	0.000

Table 5. Summary of Bay-side Quantitative Data – condensed by station.
Values in numbers/m^2

TAXA	BS1	BS2	BS3
ANNELIDA			
Clitellata			
Order Haplotaxida			
Family Enchytraeidae			
Unid. Enchytraeidae			16
Family Naididae			
Paranais litoralis			32
Polychaeta			
Family Ampharetidae			
Hobsonia florida	64		
Melinna maculata	144		
Family Arenicolidae			
Arenicola cristata	32		
Family Capitellidae			
Capitella capitata complex	1888	272	400
Heteromastus filiformis	160	64	
Mediomastus ambiseta	1632	560	16
Family Chaetopteridae			
Spiochaetopterus costarum	16		
Family Cirratulidae			
Aphelochaeta sp.	1040		
Family Goniadidae			
Glycinde multidens	16		
Family Hesionidae			
Microphthalmus sczelkowii	96		
Family Nereididae			
Alitta succinea	16	240	32
Laeonereis culveri	224		
Family Orbiniidae			
Leitoscoloplos fragilis	48		
Leitoscoloplos sp.	16	32	
Family Phyllodocidae			
Eteone heteropoda	64	112	
Unid. Phyllodocidae		16	
Family Sabellidae			
Dialychone perkinsi		48	
Unid. Sabellidae		16	
Family Spionidae			
Dipolydora socialis	80		

TAXA	BS1	BS2	BS3
Polydora cornuta		32	320
Streblospio gynobranchiata	12592	1488	16
ARTHROPODA			
Arachnida			
Order Araneae			
Family Araneidae			
Araneus sp.		16	
Insecta			
Unid. Insect pupa			48
Order Diptera			
Family Chironomidae			
Unid. Chironomidae	16		
Family Dolichopidae			
Unid. Dolichopidae			16
Family Sciaridae			
Unid. Sciaridae		16	
Malacostraca			
Order Amphipoda			
Family Ampeliscidae			
Ampelisca abdita	208		
Ampelisca sp.	128		
Family Corophiidae			
Unid. Corophiidae	16		
Family Haustoriidae			
Lepidactylus triarticulatus		16	
Unid. Haustoriidae	16		
Order Isopoda			
Family Idoteidae			
Edotea triloba	80		
Maxillopoda			
Order Harpacticoida			
Unid. Harpacticoida	768	32	16
Sessilia			
Family Balanidae			
Amphibalanus sp.			16
Ostracoda			
Order Podocopida			
Unid. Podocopida	1824		16
MOLLUSCA			

TAXA	BS1	BS2	BS3
Bivalvia			
Order Veneroida			
Family Tellinidae			
Macoma mitchelli	112		
Gastropoda			
Order Heterostropha			
Family Pyramidellidae			
Eulimastoma weberi		16	
Order Neogastropoda			
Family Nassariidae			
Nassarius vibex		32	
TOTAL NUMBERS	21296	3008	944
TOTAL TAXA	26	17	12

diversity indices			
Hmax'	1.415	1.230	1.079
H' diversity	0.688	0.743	0.693
J' evenness (equitability)	0.486	0.604	0.642
1-J' dominance	0.514	0.396	0.358

		numbers/m2	
Total Annelids	18128	2880	832
Total Insects & Spiders	16	32	64
Total Crustaceans	3040	48	48
Total Molluscs	112	48	0

		AFD biomass - g	
Total Annelids	0.0907	0.0223	0.0012
Total Insects & Spiders	0.0001	0.0013	0.0011
Total Crustaceans	0.005	0.0001	0.0001
Total Molluscs	0.0117	0.0265	0

		AFD biomass - g/m2	
Total Annelids	4.354	1.070	0.058
Total Insects & Spiders	0.005	0.062	0.053
Total Crustaceans	0.240	0.005	0.005
Total Molluscs	0.562	1.272	0.000

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***Appendices*.**

Appendix I. Qualitative beach wrack-line data (QMH). Numbers represent specimens observed in samples.

TAXA	ST1	ST2	ST3	ST4	ST5	ST6	ST7	ST8	ST9	ST10
ANNELIDA										
Clitellata										
Family Naididae										
Paranais litoralis	1									
Polychaeta										
Family Nereididae										
Alitta succinea				1						
Family Spionidae										
Scolelepis squamata	1		1	1		1	2			
ARTHROPODA										
Arachnida										
Order Araneae										
Unid. Araneae	1									
Family Linyphiidae										
Unid. Erigoninae	2							1		4
Unid. Linyphiidae	1			1					1	
Family Lycosidae										
Unid. Lycosidae	1		1							
Entognatha										
Order Poduromorpha										
Unid. Collembola			1							
Family Hypogastruridae				5						
Unid. Hypogastruridae					12		12			
Insecta										
Order Coleoptera										
Family Carabidae										
Amblygnathus sp.						2				
Unid. Carabidae	1				1					
Unid. Carabidae larva					1					
Family Curculionidae										
Unid. Curculionidae	1	1	1		2	2				
Family Dytiscidae										
Unid. Dytiscidae	3	1	5		4	1	2	4	3	5
Family Haliplidae										
Unid. Haliplidae					1					

TAXA	ST1	ST2	ST3	ST4	ST5	ST6	ST7	ST8	ST9	ST10
Family Hydrophilidae										
Unid. Hydrophilidae					1					
Family Nitidulidae										
Unid. Nitidulidae			1							1
Family Scarabaeidae										
Aphodius sp.										1
Family Staphylinidae										
Unid. Staphylinidae		1	1		4	1	1			1
Order Diptera										
Unid. Diptera										1
Family Chironomidae										
Endochironomus sp.									1	
Polypedilum sp.									1	1
Unid. Chironomidae					1			1		
Unid. Orthocladinae		1								
Family Dolichopidae										
Unid. Dolichopidae				1						
Family Mycetophilidae										
Unid. Mycetophilidae	1								1	
Family Sciaridae										
Unid. Sciaridae			1						1	
Family Sciomyzidae										
Unid. Sciomyzidae									1	
Family Stratiomyidae										
Odontomyia sp.	1	2	4	1		4		11	9	3
Order Hemiptera										
Family Aphididae										
Unid. Aphididae	1				3					
Family Cicadellidae										
Unid. Cicadellidae			3				1			
Family Miridae										
Unid. Miridae		2	1				1			
Family Naucoridae										
Pelocoris sp.										1
Malacostraca										
Order Amphipoda										
Family Ampithoidae										
Unid. Ampithoidae								1		
Family Corophiidae										
Unid. Corophiidae	4	1	1		5	2	3			3

TAXA	ST1	ST2	ST3	ST4	ST5	ST6	ST7	ST8	ST9	ST10
Monocorophium ascherusicum				1				1	8	
Family Gammaridae										
Gammarus lecroyae	10	1	9		6			2		1
Gammarus mucronatus	9						2	2	3	2
Gammarus tigrinus										1
Gammarus sp.	31	10		2	2	5				
Unid. Gammaroidea					6			1		
Family Haustoriidae										
Lepidactylus triarticulatus	12		1	27	4	7	60	111	92	71
Family Hyalellidae										
Hyalella azteca		2								
Hyalella sp.					1					
Family Hyalidae										
Apohyale wakabarae		1								
Family Melitidae										
Melita sp.		1								
Family Stenothoidae										
Stenothoe minuta									1	
Family Talitridae										
Platorchestia sp.	10	5		7	1		2			1
Order Decapoda										
Family Portunidae										
Portunidae megalops						1				
Order Isopoda										
Family Asellidae										
Lirceus sp.								3		
Family Idoteidae										
Edotea triloba						1				
Family Sphaeromatidae										
Ancinus depressus					1	1				
Maxillopoda										
Order Calanoida										
Unid. Calanoid copepod	7	7		1	17	1	1		1	
Order Sessilia										
Family Balanidae										
Amphibalanus sp.	2		2				1	3		12
MOLLUSCA										
Bivalvia										
Unid. Bivalvia										1

TAXA	ST1	ST2	ST3	ST4	ST5	ST6	ST7	ST8	ST9	ST10
Order Veneroida										
Family Donacidae										
Donax variabilis				1				1		1
MISC. TAXA										
Chordata										
Demersal fish eggs		9			2					
Unid. Fish Larva					2					
TOTAL NUMBERS	100	45	33	49	77	29	88	142	123	111
TOTAL TAXA	20	15	15	12	21	13	12	13	13	18

Appendix II. Phylogenetic listing of taxa.

Phylum	Class	Subclass	Order	Suborder	Family	Taxon	Authority
Annelida						Unid. Annelida	
	Clitellata	Oligochaeta	Haplotaxida	Tubificina	Enchytraeidae	Unid. Enchytraeidae	
					Naididae	Paranais litoralis	(Muller, 1784)
	Polychaeta	Aciculata	Eunicida		Lumbrineridae	Scoletoma verrilli	(Perkins, 1979)
			Phyllodocida	Glyceriformia	Goniadidae	Glycinde multidens	F. Muller, 1858
				Nereidiformia	Hesionidae	Microphthalmus sczelkowii	Mecznikow, 1865
					Nereididae	Alitta succinea	(Leukart, 1847)
						Laeonereis culveri	(Webster, 1880)
				Phyllodociformia	Phyllodocidae	Eteone heteropoda	Hartman, 1951
						Unid. Phyllodocidae	
		Canalipalpata	Sabellida		Sabellidae	Dialychone perkinsi	(Tovar-Hernandez, 2005)
						Unid. Sabellidae	
			Spionida	Spioniformia	Spionidae	Dipolydora socialis	(Schmarda, 1861)
				Spioniformia	Spionidae	Polydora cornuta	Bosc, 1802
				Spioniformia	Spionidae	Scolelepis squamata	(Muller, 1806)
				Spioniformia	Spionidae	Streblospio gynobranchiata	Rice & Levin, 1998
					Chaetopteridae	Spiochaetopterus costarum	(Claparede, 1870)
			Terebellida	Cirratuliformia	Cirratulidae	Aphelochaeta sp.	
				Terebellomorpha	Ampharetidae	Hobsonia florida	Hartman, 1951
						Melinna maculata	Webster, 1879
		Scolecida			Arenicolidae	Arenicola cristata	Stimpson, 1856
					Capitellidae	Capitella capitata complex	(Fabricius, 1780)
						Heteromastus filiformis	(Claparede, 1864)
						Mediomastus ambiseta	(Hartman, 1947)
					Orbiniidae	Leitoscoloplos fragilis	(Verril, 1873)
						Leitoscoloplos sp.	
Arthropoda	Arachnida		Araneae		Araneidae	Araneus sp.	
					Linyphiidae	Unid. Erigoninae	
						Unid. Linyphiidae	
					Lycosidae	Unid. Lycosidae	
						Unid. Araneae	
	Entognatha	Collembola	Poduromorpha		Hypogastruridae	Unid. Hypogastruridae	
						Unid. Collembola	
	Insecta	Pterygota	Coleoptera	Adephaga	Carabidae	Amblygnathus sp.	
						Bembidion sp.	
						Unid. Carabidae	
						Unid. Carabidae larva	
					Haliplidae	Unid. Haliplidae	

Phylum	Class	Subclass	Order	Suborder	Family	Taxon	Authority
					Curculionidae	Tanysphyrus sp	
						Unid. Curculionidae	
					Nitidulidae	Unid. Nitidulidae	
					Scarabaeidae	Aphodius sp.	
						Unid. Scarabaeidae	
				Polyphaga	Staphylinidae	Unid. Staphylinidae	
					Dytiscidae	Unid. Dytiscidae	
						Uvarus sp.	
					Hydrophilidae	Unid. Hydrophilidae	
			Diptera	Brachycera	Sciomyzidae	Unid. Sciomyzidae	
					Stratiomyidae	Odontomyia sp.	
				Nematocera	Cecidomyiidae	Unid. Cecidomyiidae	
					Chironomidae	Endochironomus sp.	
						Glyptotendipes sp.	
						Polypedilum sp.	Keiffer, 1912
						Unid. Chironomidae	
						Unid. Chironominae	
						Unid. Orthocladinae	
					Mycetophilidae	Unid. Mycetophilidae	
					Dolichopidae	Unid. Dolichopidae	
					Phoridae	Unid. Phoridae	
					Sciaridae	Unid. Sciaridae	
					Tephritidae	Unid. Tephritidae	
						Unid. Diptera	
			Hemiptera	Auchenorrhyncha	Cercopidae	Unid. Cercopidae	
				Heteroptera	Miridae	Unid. Miridae	
					Naucoridae	Pelocoris sp.	
				Sternorrhyncha	Aphididae	Unid. Aphididae	
					Cicadellidae	Unid. Cicadellidae	
						Unid. Hemiptera	
			Hymenoptera	Apocrita	Eulophidae	Unid. Eulophidae	
					Braconidae	Unid. Braconidae	
					Formicidae	Aphenogaster sp.	
						Ponera sp.	
						Solenopsis invicta	Buren, 1972
						Unid. Formicidae	
	Insecta					Unid. Insect pupa	
	Malacostraca	Eumalacostraca	Amphipoda	Gammaridea	Ampeliscidae	Ampelisca abdita	Mills, 1964
						Ampelisca sp.	
					Ampithoidae	Ampithoe valida	Smith, 1873

Phylum	Class	Subclass	Order	Suborder	Family	Taxon	Authority
						Unid. Ampithoidae	
					Corophiidae	Monocorophium ascherusicum	(Costa, 1857)
						Unid. Corophiidae	
					Gammaridae	Gammarus lecroyae	Thoma & Heard, 2009
						Gammarus mucronatus	Say, 1818
						Gammarus sp.	
						Gammarus tigrinus	Sexton, 1939
						Unid. Gammaridae	
					Haustoriidae	Lepidactylus triarticulatus	Robertson & Shelton, 1980
						Unid. Haustoriidae	
					Hyalellidae	Hyalella azteca	Saussure, 1857
						Hyalella sp.	
					Hyalidae	Apohyale wakabarae	(Serejo, 1999)
					Melitidae	Melita sp.	
					Stenothoidae	Stenothoe minuta	Holmes, 1905
					Talitridae	Platorchestia sp.	
				Senticaudata		Unid. Gammaroidea	
			Decapoda	Pleocyemata	Pinnotheridae	Austinixa behreae	(Manning & Felder, 1989)
					Portunidae	Callinectes sp	
						Portunidae megalops	
						Portunidae zoea	
					Hippidae	Emerita benedicti	Schmitt, 1935
			Isopoda	Asellota	Asellidae	Lirceus sp.	
					Munnidae	Uromunna reynoldsi	Frankenberg & Menzies, 1966
				Flabellifera	Sphaeromatidae	Ancinus depressus	(Say, 1818)
				Valvifera	Idoteidae	Edotea triloba	(Say, 1818)
	Maxillopoda	Copepoda	Calanoida			Unid. Calanoid copepod	
			Harpacticoida			Unid. Harpacticoida	
		Theocostraca	Sessilia	Balanomorpha	Balanidae	Amphibalanus sp.	
	Ostracoda	Podocopa	Podocopida			Unid. Podocopida	
Chordata	Actinopterygii					Demersal fish eggs	
						Unid. Fish Larva	
Cnidaria	Anthozoa					Unid. Anthozoa	
Mollusca	Bivalvia	Heterodonta	Veneroida		Donacidae	Donax variabilis	Say, 1822
					Montacutidae	Mysella planulata	(Stimpson, 1857)
					Tellinidae	Macoma mitchelli	Dall, 1895
						Unid. Bivalvia	
	Gastropoda	Caenogastropoda	Littorinimorpha		Tornidae	Unid. Tornidae	
		Prosobranchia	Neogastropoda		Nassariidae	Nassarius vibex	(Say, 1822)
			Heterostropha		Pyramidellidae	Eulimastoma weberi	(Morrison, 1965)

Phylum	Class	Subclass	Order	Suborder	Family	Taxon	Authority
Nemertea	Palaeonemertea					Unid. Palaeonemertea	
						Unid. Nemertea	
Platyhelminthes	Turbellaria					Unid. Turbellaria	