APPENDIX L
BENTHIC SURVEY REPORT

A Characterization of Benthic Macroinfaunal Resources Within the Proposed Bluewater SPM Pipeline Corridor Located on the Texas Coast, 2019

SUBMITTED TO:

Lloyd Engineering, Inc.
6565 West Loop South, Suite 708
Bellaire, Texas 77401

PREPARED BY:

Barry A. Vittor & Associates, Inc.
8060 Cottage Hill Rd.
Mobile, Alabama 36695
(251) 633-6100
www.bvaenviro.com

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INTRODUCTION

Lloyd Engineering, Inc. conducted a field survey in 2019 of benthic macroinfaunal assemblages within a potential pipeline corridor located on the Texas Coast for the Bluewater SPM Project (BWSPM). The collection of the benthic macroinvertebrate samples was made by Lloyd Engineering personnel and laboratory and data analysis was performed by Barry A. Vittor & Associates, Inc. (BVA).

METHODS

Sample Collection and Handling

A sleeve within a standard box core (area = 0.06 m^2) was used to collect bottom samples at each of nine station locations along the BWSPM transect (see Appendix I for sampling locations). Half of each bottom sample (0.03m^2) was designated for macroinfauna taxonomic analysis. Samples were sieved in the field through 0.5 mm mesh sieves and fixed in 10% buffered formalin with Rose Bengal stain. Due to sea conditions during the initial sampling effort, some benthic samples were preserved in the field and then sieved at a land base. The preserved samples were transported to BVA's laboratory in Mobile, Alabama.

Macroinfaunal Sample Analysis

In BVA's laboratory, benthic samples were inventoried, rinsed gently through a 0.5 mm mesh sieve to remove preservatives and sediment, and stored in 70% isopropanol solution until processing. Sample material (i.e., sediment, detritus, organisms) was placed in white enamel trays for sorting under Wild M-5A dissecting microscopes. All macroinvertebrates were carefully removed with forceps and placed in labeled (inside and outside: sample number, collection date, taxa, number of individuals) glass vials

containing 70% isopropanol. Each vial represented a major Phylum (e.g. Annelida, Mollusca, Arthropoda). All sorted macroinvertebrates were identified to the lowest practical identification level (LPIL), which in most cases was to species level unless the specimen was a juvenile, damaged, or otherwise unidentifiable. The number of individuals of each taxon, excluding fragments, was recorded. A voucher collection was prepared and was composed of representative individuals of each taxon.

Each sample was analyzed for wet-weight biomass (g) for the major taxonomic groups identified. After identification, each taxonomic group was kept in separate vials and preserved in 70% isopropanol. A biomass technician removed the organisms from a vial, placed them on a filter paper pad, gently blotted them with a paper towel to remove moisture, placed them in a tared weighing pan, and weighed the pan to the nearest 0.1 mg using a Mettler Model AG-104 balance

DATA ANALYSIS

All data generated as a result of laboratory analysis of macroinfauna samples were first coded on data sheets. Enumeration data were entered for each species according to station and replicate. These data were reduced to a data summary report for each station, which included a taxonomic species list and benthic community parameters information. Archive data files of species identification and enumeration were prepared.

Assemblage Analyses

Several numerical indices were chosen for analysis and interpretation of the macroinfaunal data. Infaunal abundance is reported as the total number of individuals per station and the total number of individuals per square meter (= density). Taxa richness is reported as the number of taxa represented in a given station collection.

Taxa diversity, which is often related to the ecological stability and environmental "quality" of the benthos, was estimated by Shannon's Index (Pielou, 1966). Taxa diversity within a given community is dependent upon the number of taxa present (taxa richness) and the distribution of all individuals among those taxa (equitability or evenness). In order to quantify and compare the equitability in the fauna to the taxa diversity for a given area, Pielou's Index J' was calculated (Pielou, 1966).

BENTHIC COMMUNITY CHARACTERIZATION

Faunal Composition, Abundance, and Community Structure

Microsoft ™ Excel spreadsheets are being provided separately which include: raw data on taxa abundance and density by station, a major taxa table with overall taxa abundance, and an assemblage parameter table including data on number of taxa, density, taxa diversity and taxa evenness by station.

A total of 267 individuals were identified from the 9 BWSPM stations (Appendix II). The dominant taxa collected included the polychaetes, *Mediomastus* (LPIL), *Streblospio benedicti* and *Magelona uebelackerae*, the amphipod, *Ampelisca agassizi*, and the tellinid bivalve, *Angulus versicolor*.

Station taxa richness and abundance data are summarized for the 9 stations in Table 1 and Figure 1. Taxa richness at each station ranged from 0 at Station BWSPM-18-01 to 26 at Station BWSPM-18-18. Station densities ranged from 0 organisms·m^2 at Station BWSPM-18-01 to 4633.3 organisms·m^2 at Station BWSPM-18-18.

Taxa diversity and evenness for the 9 BWSPM stations are given in Table 1 and Figure 2. Taxa diversity (H´) ranged from 0 at BWSPM-18-01 to 2.69 at BWSPM-18-15. Taxa evenness (J´) ranged from 0 at BWSPM-18-01 to 1.00 at BWSPM-18-02.

Wet-weigh biomass data for the 9 BWSPM stations is given in Table 2 and Figure 3. Total station wet-weight biomass ranged from 0 g/station at Station BWSPM-18-01 to 1.1934 g/station at Station BWSPM-18-10.

SUMMARY

In 2019, the macroinfauna taxa dominating the benthic assemblages at the BWSPM stations were typically opportunistic polychaetes adapted to a dynamic benthic environment (e.g. fluctuating salinity regime, changes in benthic sediments) and are typical of those found in estuarine and shallow water benthic habitats (Felder and Kemp, 2009). The shallow water habitats of these opportunistic taxa are much more susceptible to short- and long-term climatic variability (e.g. tropical disturbances) that assemblages found in deeper waters. While there was localized variability in macroinfaunal assemblage between stations, this variability is typical of subtropical estuarine habitats.

LITERATURE CITED

Felder, D.L and D.K Kemp. 2009. Gulf of Mexico Origin, Waters, and Biota. Volume 1, Biodiversity. Texas A&M Press, College Station, Texas.

Pielou, E.C. 1966. The measurement of diversity in different types of biological collections. Journal of Theoretical Biology 13:131-144.

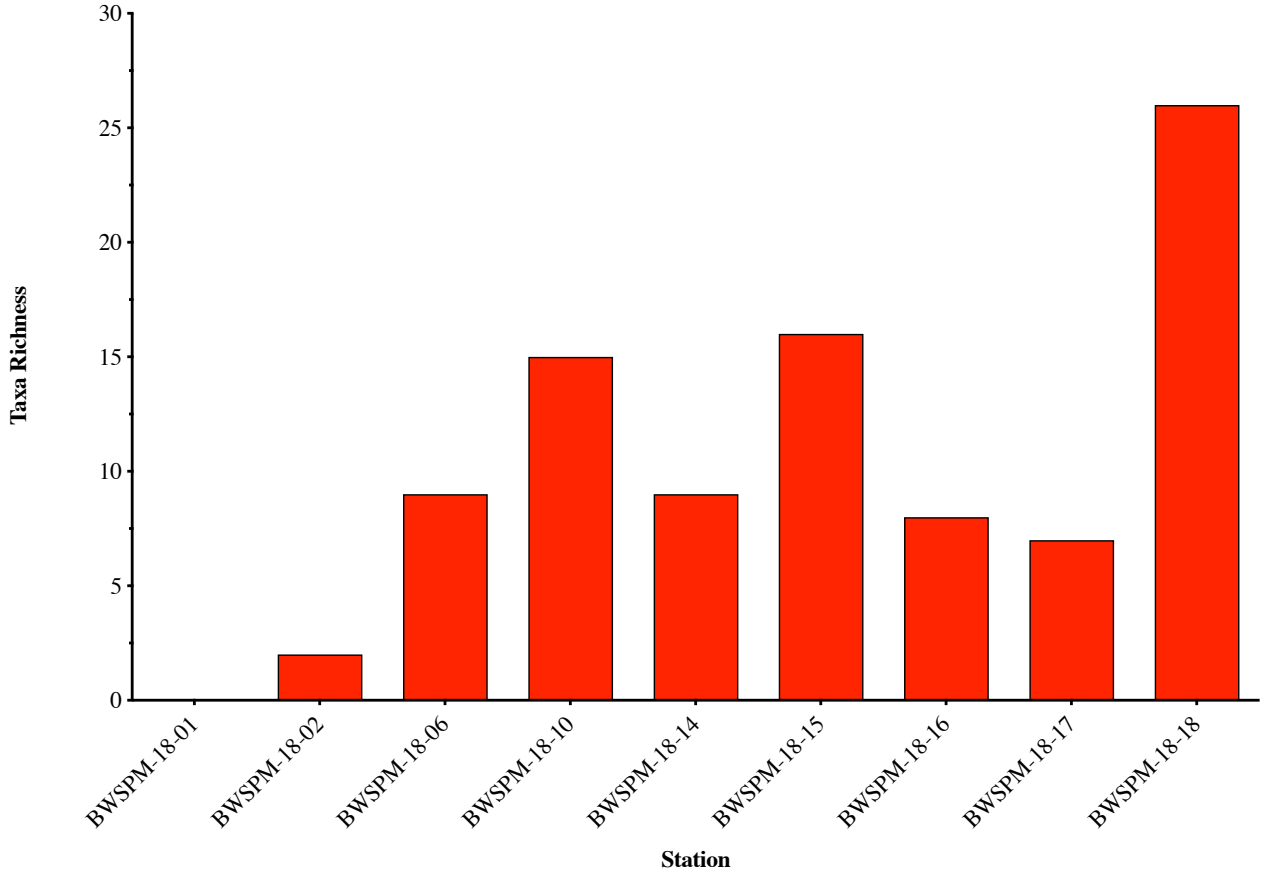
Table 1. Summary of macrobenthic community parameters for the Bluewater SPM stations, 2019.

Station Name	Density nos/m2	No. of Individuals	Taxa Richness	Diversity H'	Evenness J'
BWSPM-18-01	0.0	0	0	–	–
BWSPM-18-02	66.7	2	2	0.69	1.00
BWSPM-18-06	800.0	24	9	1.79	0.82
BWSPM-18-10	633.3	19	15	2.63	0.97
BWSPM-18-14	600.0	18	9	1.78	0.81
BWSPM-18-15	700.0	21	16	2.69	0.97
BWSPM-18-16	800.0	24	8	1.54	0.74
BWSPM-18-17	666.7	20	7	1.68	0.86
BWSPM-18-18	4633.3	139	26	1.92	0.59

Table 2. Wet-weight biomass data for the Bluewater SPM stations, 2019.

Sample ID	Annelida g/station	Mollusca g/station	Arthropoda g/station	Echinodermata g/station	Other Taxa g/station	Sample Total g/station
BWSPM-18-01	–	–	–	–	–	–
BWSPM-18-02	0.0077	0.0000	0.0021	0.0000	0.0000	0.0098
BWSPM-18-06	0.1426	0.0000	0.0247	0.0000	0.0000	0.1673
BWSPM-18-10	0.4727	0.1602	0.4073	0.1432	0.0000	1.1834
BWSPM-18-14	0.0506	0.0138	0.0020	0.4129	0.0145	0.4938
BWSPM-18-15	0.0097	0.0376	0.0113	0.0130	0.0000	0.0716
BWSPM-18-16	0.0073	0.0039	0.0020	0.0000	0.0067	0.0199
BWSPM-18-17	0.0037	0.0409	0.0144	0.0000	0.0050	0.0640
BWSPM-18-18	0.0880	0.0512	0.3744	0.0000	0.0408	0.5544

Figure 1. Taxa richness and density data for the Bluewater SPM stations, 2019.



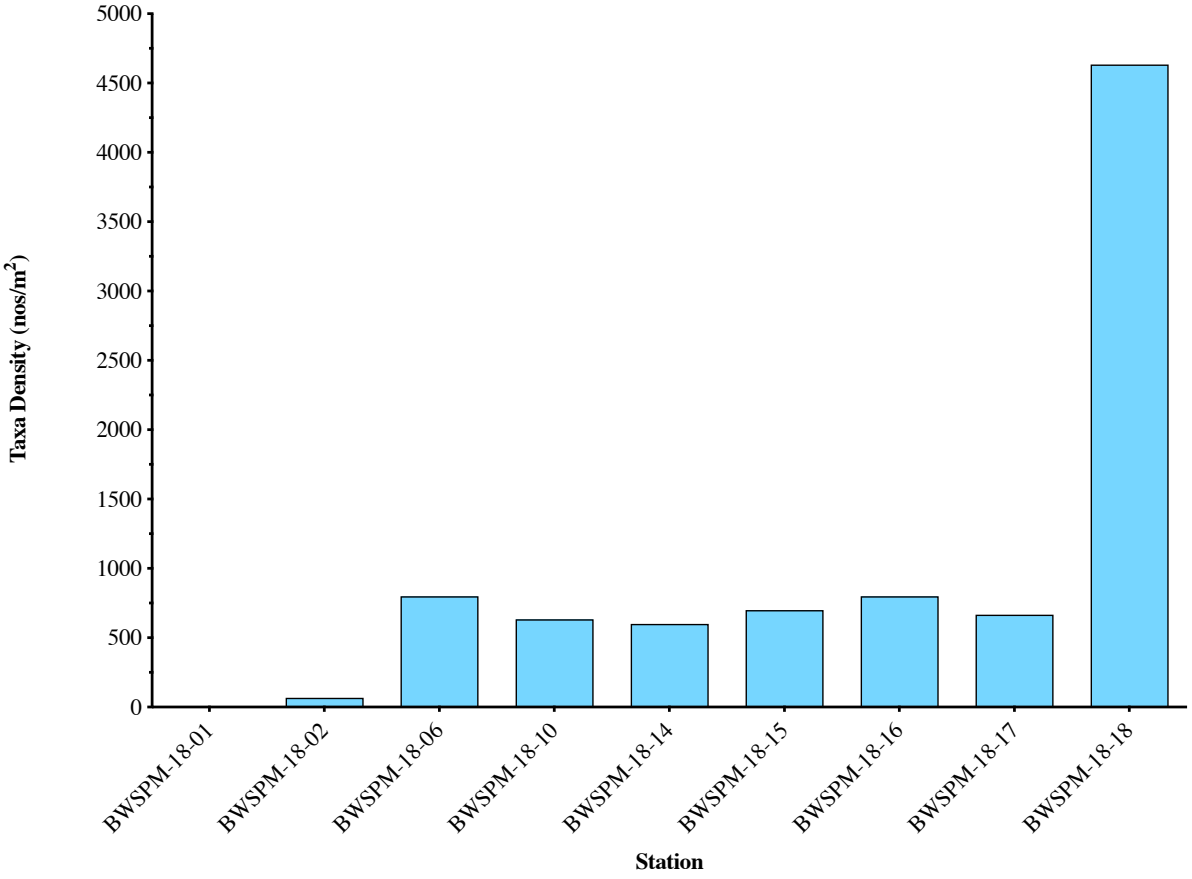
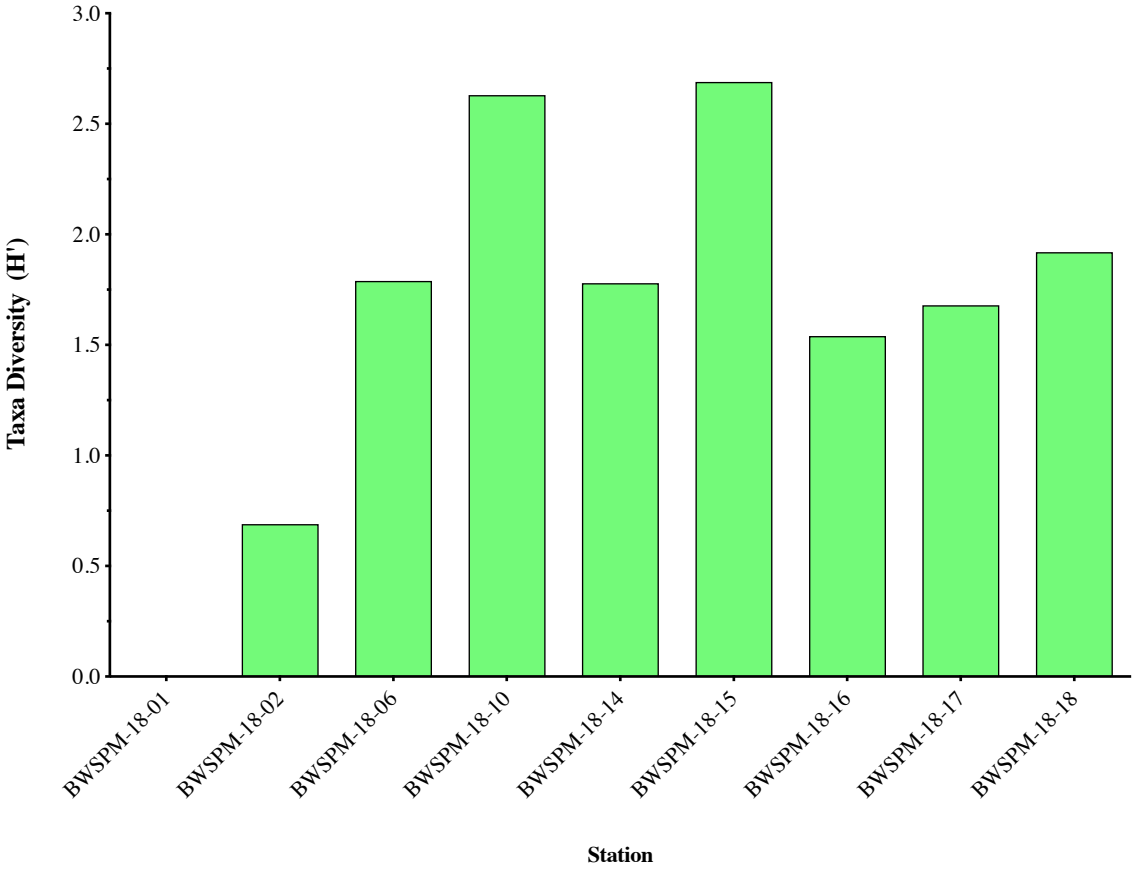


Figure 2. Taxa diversity (H') and evenness (J') data for the Bluewater SPM stations, 2019.



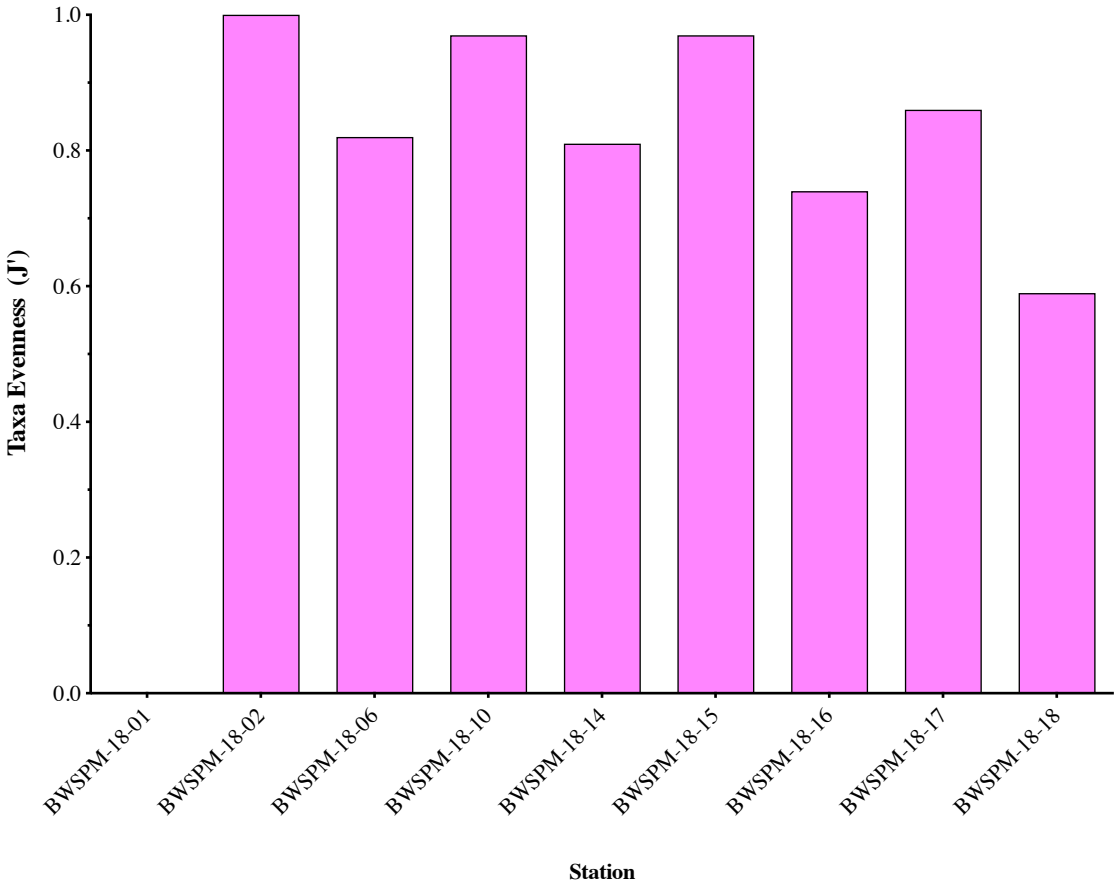
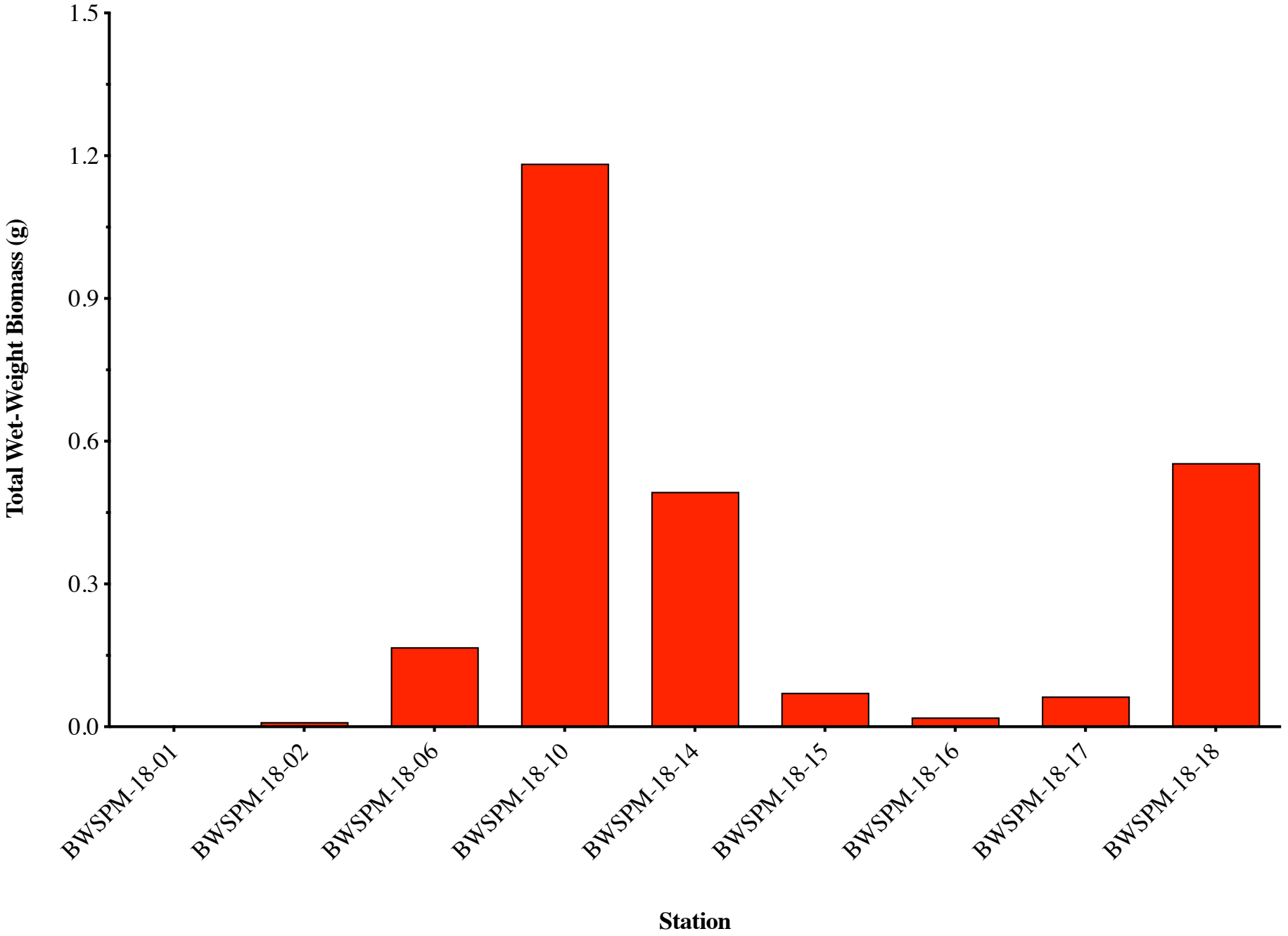
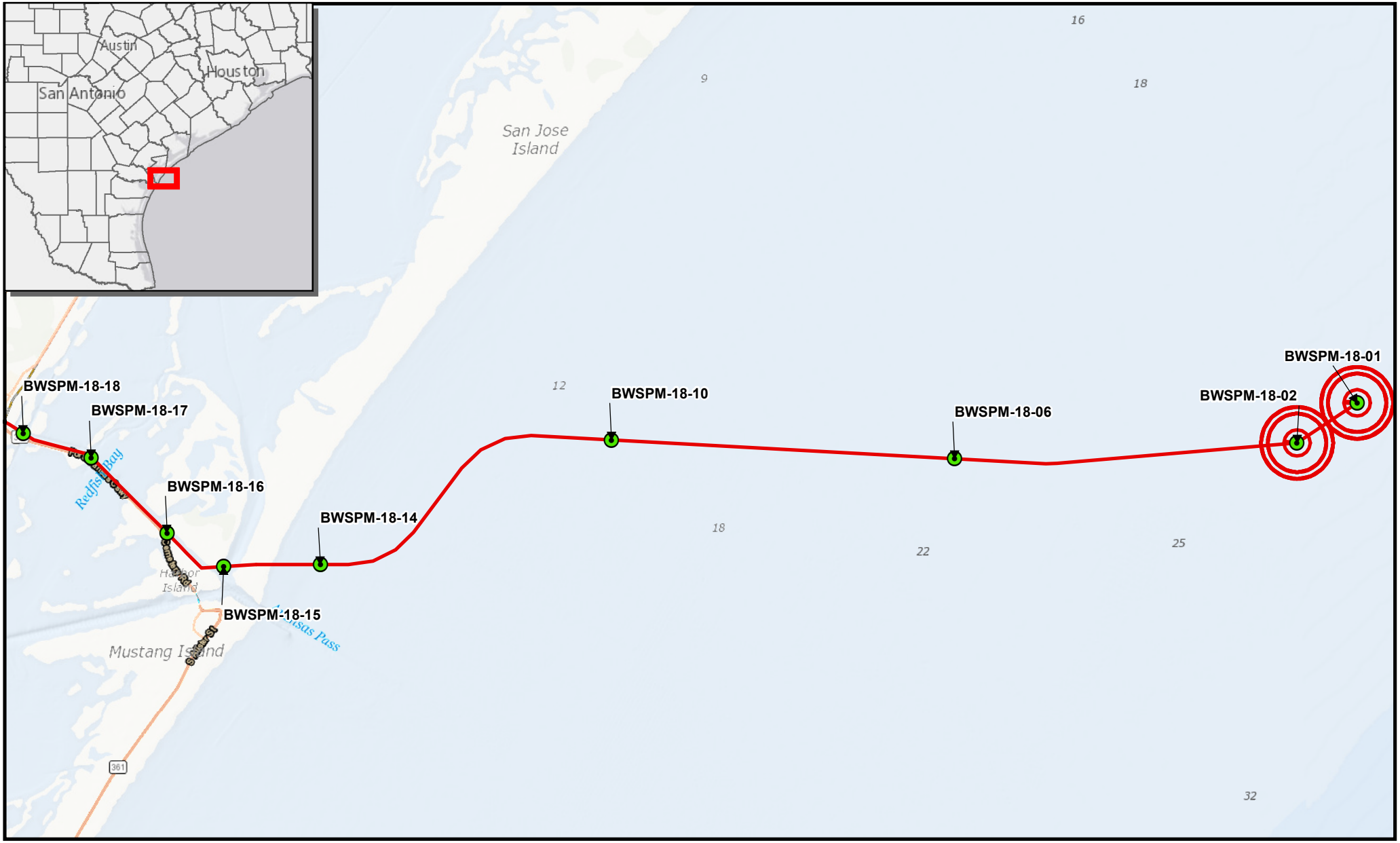


Figure 3. Station total wet-weight biomass data for the Bluewater SPM stations, 2019.



APPENDIX I
Bluewater SPM Benthic Sampling Station Map



Map Details

- Benthic Sample Location
- Proposed Project

1 inch = 16,000 feet

0 8,000 16,000 Feet

N

Coordinate System: NAD 1983 2011 StatePlane Texas South FIPS 4205 Ft US
Projection: Lambert Conformal Conic
Datum: NAD 1983 2011
Units: Foot US

LOYD ENGINEERING, INC.

Benthic Sampling Location Map

Bluewater SPM Project
Aransas County, TX

SHEET 1 of 1 Date: Apr 05, 2019

APPENDIX II
Raw Data File

Appendix II. BWSPM raw data file.

Station Name	Phylum	Class	Order	Family	Taxa	Abundance
BWSPM-18-01					No Organisms Found	0
BWSPM-18-02	Annelida	Polychaeta	Phyllodocida	Nephtyidae	Nephtys incisa	1
BWSPM-18-02	Arthropoda	Malacostraca	Cumacea	Leuconidae	Eudorella monodon	1
BWSPM-18-06	Annelida	Polychaeta	Eunicida	Onuphidae	Diopatra cuprea	1
BWSPM-18-06	Annelida	Polychaeta	Spionida	Magelonidae	Magelona uebelackerae	4
BWSPM-18-06	Annelida	Polychaeta	Scolecida	Capitellidae	Mediomastus (LPIL)	3
BWSPM-18-06	Annelida	Polychaeta	Eunicida	Lumbrineridae	Scoletoma verrilli	2
BWSPM-18-06	Annelida	Polychaeta	Terebellida	Cirratulidae	Monticellina dorsobranchialis	1
BWSPM-18-06	Annelida	Polychaeta	Scolecida	Paraonidae	Levinsenia gracilis	1
BWSPM-18-06	Annelida	Polychaeta	Spionida	Spionidae	Polydora cornuta	1
BWSPM-18-06	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	Ampelisca agassizi	10
BWSPM-18-06	Arthropoda	Malacostraca	Cumacea	Leuconidae	Eudorella (LPIL)	1
BWSPM-18-10	Annelida	Polychaeta	Eunicida	Lumbrineridae	Scoletoma verrilli	2
BWSPM-18-10	Annelida	Polychaeta	Scolecida	Paraonidae	Levinsenia gracilis	2
BWSPM-18-10	Annelida	Polychaeta	Phyllodocida	Goniadidae	Glycinde solitaria	1
BWSPM-18-10	Annelida	Polychaeta	Terebellida	Pectinariidae	Pectinaria gouldi	1
BWSPM-18-10	Annelida	Polychaeta	Phyllodocida	Nephtyidae	Nephtys incisa	1
BWSPM-18-10	Annelida	Polychaeta	Scolecida	Maldanidae	Maldanidae (LPIL)	1
BWSPM-18-10	Annelida	Polychaeta	Phyllodocida	Polynoidae	Malmgreniella taylori	1
BWSPM-18-10	Annelida	Polychaeta	Scolecida	Capitellidae	Notomastus (LPIL)	1
BWSPM-18-10	Echinodermata				Echinodermata (LPIL)	1
BWSPM-18-10	Mollusca	Gastropoda	Neritopsina	Neritidae	Neritina usnea	1
BWSPM-18-10	Mollusca	Bivalvia	Myoida	Corbulidae	Caryocorbula (LPIL)	1
BWSPM-18-10	Mollusca	Bivalvia	Veneroida	Tellinidae	Angulus versicolor	1
BWSPM-18-10	Mollusca	Bivalvia	Veneroida	Ungulinidae	Diplodonta punctata	3
BWSPM-18-10	Arthropoda	Malacostraca	Cumacea	Leuconidae	Eudorella (LPIL)	1
BWSPM-18-10	Arthropoda	Malacostraca	Decapoda	Xanthidae	Rhithropanopeus harrisii	1
BWSPM-18-14	Annelida	Polychaeta	Phyllodocida	Hesionidae	Podarke obscura	1
BWSPM-18-14	Annelida	Polychaeta	Scolecida	Capitellidae	Mediomastus (LPIL)	1
BWSPM-18-14	Annelida	Polychaeta	Spionida	Magelonidae	Magelona uebelackerae	8
BWSPM-18-14	Annelida	Polychaeta	Spionida	Spionidae	Paraprionospio pinnata	1
BWSPM-18-14	Annelida	Polychaeta	Cossurida	Cossuridae	Cossura soyeri	1
BWSPM-18-14	Cnidaria	Anthozoa	Actiniaria		Actiniaria (LPIL)	1
BWSPM-18-14	Mollusca	Bivalvia	Veneroida	Tellinidae	Angulus versicolor	1
BWSPM-18-14	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	Ampelisca vadorum	3
BWSPM-18-14	Echinodermata	Holothuroidea	Apodida	Synaptidae	Leptosynapta tenuis	1
BWSPM-18-15	Annelida	Polychaeta	Oweniida	Oweniidae	Owenia fusiformis	1
BWSPM-18-15	Annelida	Polychaeta	Scolecida	Capitellidae	Mediomastus (LPIL)	1
BWSPM-18-15	Annelida	Polychaeta	Eunicida	Onuphidae	Onuphidae (LPIL)	1
BWSPM-18-15	Annelida	Polychaeta	Spionida	Spionidae	Streblospio benedicti	1
BWSPM-18-15	Annelida	Polychaeta	Spionida	Chaetopteridae	Spiochaetopterus oculatus	1
BWSPM-18-15	Annelida	Polychaeta	Spionida	Spionidae	Dipolydora socialis	1
BWSPM-18-15	Arthropoda	Malacostraca	Decapoda	Paguridae	Pagurus (LPIL)	1
BWSPM-18-15	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	Ampelisca vadorum	2
BWSPM-18-15	Arthropoda	Malacostraca	Isopoda	Hyssuridae	Xenanthura brevitelson	2
BWSPM-18-15	Arthropoda	Malacostraca	Amphipoda	Haustoriidae	Protohaustorius bousfieldi	1

BWSPM-18-15	Echinodermata				Echinodermata (LPIL)	1
BWSPM-18-15	Mollusca	Bivalvia	Veneroida	Ungulinidae	Diplodonta punctata	1
BWSPM-18-15	Mollusca	Bivalvia	Veneroida	Tellinidae	Macoma tenta	2
BWSPM-18-15	Mollusca	Bivalvia	Arcoida	Arcidae	Anadara floridana	1
BWSPM-18-15	Mollusca	Gastropoda	Neogastropoda	Nassariidae	Nassarius acutus	1
BWSPM-18-15	Mollusca	Bivalvia	Veneroida	Semelidae	Abra aequalis	3
BWSPM-18-16	Annelida	Polychaeta	Scolecida	Capitellidae	Mediomastus (LPIL)	12
BWSPM-18-16	Annelida	Polychaeta	Spionida	Spionidae	Paraprionospio pinnata	2
BWSPM-18-16	Annelida	Polychaeta	Phyllodocida	Syllidae	Sphaerosyllis taylori	1
BWSPM-18-16	Annelida	Polychaeta	Spionida	Spionidae	Streblospio benedicti	5
BWSPM-18-16	Annelida	Polychaeta	Scolecida	Maldanidae	Maldanidae (LPIL)	1
BWSPM-18-16	Hemichordata	Enteropneusta		Ptychoderidae	Balanoglossus (LPIL)	1
BWSPM-18-16	Mollusca	Bivalvia	Veneroida	Tellinidae	Angulus versicolor	1
BWSPM-18-16	Arthropoda	Malacostraca	Cumacea	Diastylidae	Oxyurostylis (LPIL)	1
BWSPM-18-17	Annelida	Polychaeta	Spionida	Spionidae	Streblospio benedicti	5
BWSPM-18-17	Annelida	Polychaeta	Terebellida	Ampharetidae	Melinna maculata	1
BWSPM-18-17	Nemertea	Anopla	Paleonemertea	Tubulanidae	Tubulanus sp. A	1
BWSPM-18-17	Mollusca	Bivalvia	Veneroida	Semelidae	Abra aequalis	3
BWSPM-18-17	Mollusca	Bivalvia	Veneroida	Mactridae	Mulinia lateralis	2
BWSPM-18-17	Mollusca	Bivalvia	Pholadomyoida	Lyonsiidae	Lyonsia floridana	1
BWSPM-18-17	Arthropoda	Malacostraca	Amphipoda	Ampeliscidae	Ampelisca vadorum	7
BWSPM-18-18	Annelida	Polychaeta	Scolecida	Capitellidae	Mediomastus (LPIL)	77
BWSPM-18-18	Annelida	Polychaeta	Phyllodocida	Glyceridae	Glycera americana	1
BWSPM-18-18	Annelida	Polychaeta	Spionida	Spionidae	Streblospio benedicti	11
BWSPM-18-18	Annelida	Polychaeta	Spionida	Spionidae	Prionospio (LPIL)	1
BWSPM-18-18	Annelida	Polychaeta	Terebellida	Cirratulidae	Caulleriella cf. alata	1
BWSPM-18-18	Annelida	Polychaeta	Terebellida	Cirratulidae	Cirratulidae (LPIL)	7
BWSPM-18-18	Annelida	Polychaeta	Spionida	Chaetopteridae	Spiochaetopterus oculatus	2
BWSPM-18-18	Annelida	Polychaeta	Spionida	Spionidae	Paraprionospio pinnata	1
BWSPM-18-18	Annelida	Polychaeta	Scolecida	Paraonidae	Levinsenia gracilis	1
BWSPM-18-18	Annelida	Polychaeta	Terebellida	Cirratulidae	Tharyx acutus	2
BWSPM-18-18	Annelida	Polychaeta	Spionida	Spionidae	Apoprionospio pygmaea	2
BWSPM-18-18	Annelida	Polychaeta	Spionida	Spionidae	Spiophanes bombyx	2
BWSPM-18-18	Annelida	Polychaeta	Scolecida	Capitellidae	Capitella capitata	1
BWSPM-18-18	Chordata	Leptocardii	Amphioxiformes	Branchiostomatidae	Branchiostoma (LPIL)	2
BWSPM-18-18	Nemertea	Anopla	Paleonemertea	Tubulanidae	Tubulanus sp. A	3
BWSPM-18-18	Cnidaria	Anthozoa	Actiniaria		Actiniaria (LPIL)	1
BWSPM-18-18	Phoronida			Phoronidae	Phoronis (LPIL)	1
BWSPM-18-18	Platyhelminthes				Platyhelminthes (LPIL)	1
BWSPM-18-18	Mollusca	Bivalvia	Veneroida	Tellinidae	Macoma tenta	1
BWSPM-18-18	Mollusca	Bivalvia	Veneroida	Tellinidae	Angulus versicolor	12
BWSPM-18-18	Mollusca	Bivalvia	Veneroida	Semelidae	Abra aequalis	2
BWSPM-18-18	Mollusca	Gastropoda	Neotaenioglossa	Naticidae	Neverita delessertiana	3
BWSPM-18-18	Arthropoda	Malacostraca	Isopoda	Hyssuridae	Xenanthura brevitelson	1
BWSPM-18-18	Arthropoda	Malacostraca	Cumacea	Diastylidae	Oxyurostylis (LPIL)	1
BWSPM-18-18	Arthropoda	Malacostraca	Cumacea	Bodotriidae	Cyclaspis sp. N	1
BWSPM-18-18	Arthropoda	Malacostraca	Decapoda	Diogenidae	Clibanarius vittatus	1
						267