NYSDEC/SoMAS MOU AM11315

Impacts of Ocean Sewage Treatment Plant Outfalls

Final Report

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Introduction

The MOU for the Ocean Outfall Project was officially approved in August 2017. Following this approval, the group of investigators began planning for the first research cruise, with an initial meeting to determine individual needs and opportunities for coordination between groups. In this meeting, it was determined that a cruise would be planned for November 2017, during which, four separate tasks would be carried out:

- deployment of a moored ADCP and three to four SeaCats (set at one location to capture a profile),
- water sample collection for quantification and characterization of the plankton community,
- CTD profiles (collecting salinity, turbidity, DO, temperature, etc.) taken at gridded stations to characterize the water column and attempt to identify the plume and any interaction of the plumes between the two outfalls, and
- collection of multibeam data covering the area surrounding each outfall.

Following this meeting, LANDSAT imagery was obtained to see if a plume was visible due to turbidity or algal blooms that would thrive in nitrogen-rich effluent. This information could inform the design of the sampling plan for both the water quality and plankton sampling plans. Upon scrutiny, the satellite imagery did not prove useful in this manner. Literature searches were carried out in order to inform the sampling plans. In the literature searches, other ocean outfall sites with similar effluent volumes and/or oceanographic qualities were targeted. Much of the peer-reviewed literature focuses on near-field ocean outfall characterization (within 1km of the ocean outfall), which is not the focus of this study, and were of limited use. The sampling plan is generally gridded and encompasses the area around the two outfalls and the span of water between them. The plankton sampling plan is designed to take samples at a subset of the CTD sampling stations, with the caveat that more samples may be taken at stations where an effluent plume is identified.

The ADCP, SeaCat CTDs, acoustic releases, and the mooring equipment were ordered in August 2017. Unfortunately, this equipment did not all arrive in time for our November cruise date and the cruise had to be delayed to January 2018 when all of the same tasks will be carried out with the exception of the multibeam data.

Methods: Sampling and outreach.

Cruise I: January 2018 (Deploy moorings). During 24 to 26 January 2018, the bottom-mounted ADCP (Figure 1) was set at 40.5750º; 73.7382º in 50 feet of water. A mooring with four SeaCat CTD's (Figure 2) was set at 40.5750º; 73.4046º in 53 feet of water.

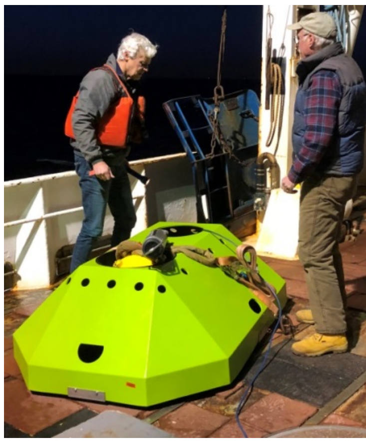

Figure 1. ADCP

Figure 2 SeaCat deployment

CTD measurements were made at 29 locations and eight stations were sampled for the analysis of the planktonic communities (Figure 3). Seawater samples were collected using Niskin bottles and Salinity, DO and temperature were measured by CTD.

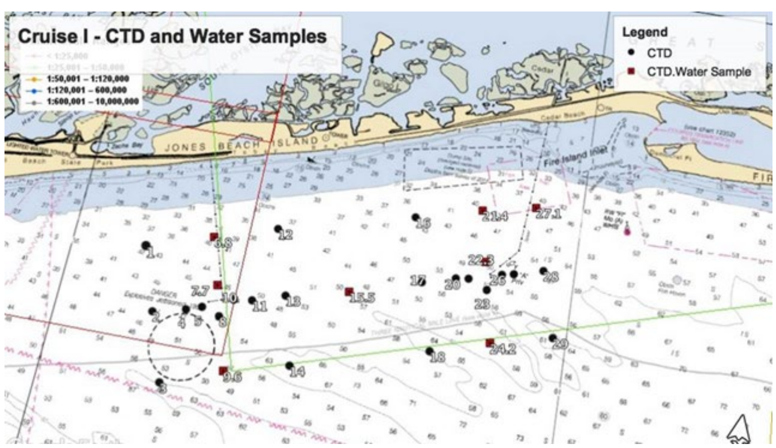

Figure 3. CTD and water samples January 2018

Cruise II: April 2018 Retrieve ADCP and the SeaCat moorings that were placed on 25 January were retrieved on 2 April, 2018 after 66 days. CTD stations were sampled (Figure 4).

A single transect of eight water samples was taken near the boil in April 2018 at the Cedar Creek outfall from a depth of about 1.5 meters (Figure 4). Eight (non-duplicated) samples also were taken for LOI.

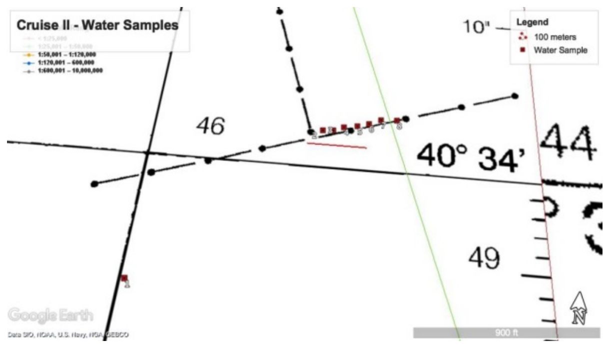

Figure 4. CTD and water samples April 2018.

Cruise III: May 2018 (Multibeam survey). Mutibeam backscatter surveys were interpreted to represent 17 substrate types. In light of the potentially strong longshore current, two plankton-sampling stations were added further east and west. Seawater samples were taken using Niskin bottles at nine stations (plus an additional station in the boil previously identified) at a depth of about 1.5 meters and five triplicate samples were taken for LOI. Salinity, DO and temperature were measured by CTD. Twenty-three CTD stations were done (Figure 5 and Table 1).

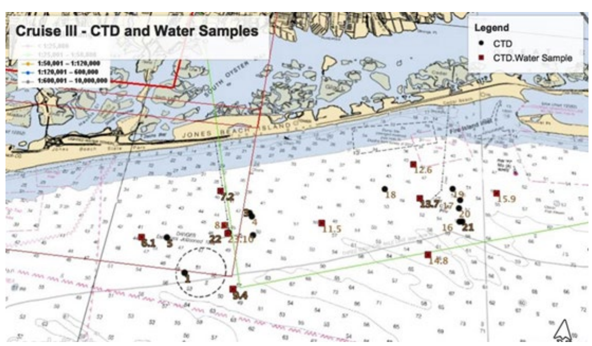

Figure 5. Stations occupied for CTD casts and water sampling.

Table 1. Station Locations for Water samples

Sample	Latitude	Longitude	Sample depth(m)
1	40.5623	-73.48444	1.5
2	40.58204	-73.45374	1.5
3	40.56976	-73.44898	1.5
4	40.54876	-73.44062	1.5
5	40.57454	-73.406	1.5
6	40.60064	-73.36576	1.5
7	40.58774	-73.3624	1.5
8	40.56776	-73.3583	1.5
9	40.59292	-73.32707	1.5

Cruise IV : 14-17 August 2018

Nine water samples were taken using Niskin bottles for plankton assessment at a depth of about 1.5 meters and 29 CTD stations were done (Figure 6). Salinity, DO and temperature were measured by CTD. Subsequent analysis of the planktonic composition is described in Appendix A.

Sixty bottom samples for fauna and sediments were collected using a modified van Veen grab (0.04 m^2). Six samples were collected in each of 10 substrate types identified after Cruise III (Figure 6 see also Figures 20, 21 and 22).

Subsamples of sediments for grain size were drawn from each grab sample. The remaining sediment was washed through a 0.5 mm sieve for fauna. All material left on the sieve was preserved in 10% buffered formalin and stained with rose bengal. Faunal samples were rewashed in the lab and transferred to 70% ethanol before sorting and identification. Individual organisms were identified to species level whenever possible and the total for each taxon enumerated. Unless otherwise noted, all abundances in this report are expressed as the number of individuals per sample (i.e., per 0.04 m2).

Sediment grain size analysis following methodology in Folk (1974) was used to estimate percent composition by weight of major size-fractions (gravel, sand, silt-clay). Samples were initially partitioned into three size-fractions by adding 50 ml of a 1% Calgon solution to the sample, mixing to disaggregate the particles in the sample, and wet sieving with distilled water through a combination of 2 mm and 63 micron sieves. The >2 mm (gravel) and 2 mm-63 micron (sand) fractions were placed in a drying oven at 60o C for at least 48 hours to obtain dry weights. Water containing the <63 micron fraction (silt-clay or mud) was brought up to 1000 ml total volume by adding distilled water in a graduated cylinder, mixed thoroughly, and subsampled with a 20 ml pipette at a depth of 20 cm, 20 seconds after mixing to obtain an estimate of silt-clay. These pipette samples were placed in a drying oven at 60o C for at least 48 hours to obtain dry weight estimates. Weight estimates included a correction for the amount of Calgon introduced to the samples. Because sand dominated the sample, the sand fraction was further analyzed in a settling column to obtain a more detailed grain size distribution.

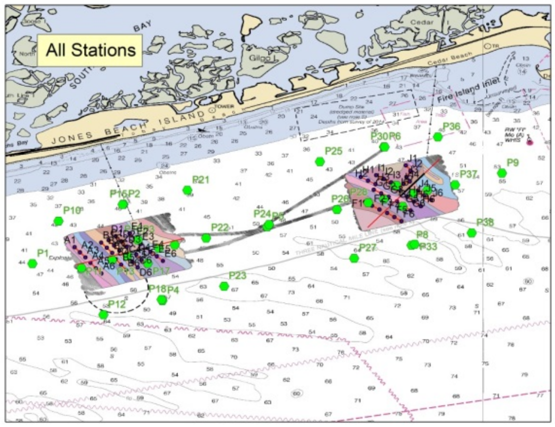

Figure 6. Locations of 30 bottom samples, 29 CTD stations, 9 Water Samples and 5 LOI triplicate samples.

C**ruise VI: 9 October, 2018.** Deployment of the ADCP and Sea Cat moorings.

Cruise V: 29 October, 2018. Water samples were collected for plankton analyses using Van Dorn bottles. Salinity, DO and temperature were measured with a Pro 2030 YSI. Nitrite/nitrate, ammonium, total nitrogen and dissolved organic carbon were analyzed at the Stony Brook School of Marine and Atmospheric Sciences (SoMAS) Analytical Laboratory, an approved Environmental Laboratory in conformance with the National Laboratory Accreditation Conference Standards (2003) for the category Environmental Analyses Non Potable Water (N.Y. Lab ID no. 12075).

Cruise VI: 17 January, 2019. Recovery of SeaCat Mooring after 100 days.

Cruise VII: 10 February, 2019. Water samples collected for plankton analysis using Van Dorn bottles, Salinity, DO and temperature were measured with a Pro 2030 YSI.. Nitrite/nitrate, ammonium, total nitrogen and dissolved organic carbon were analyzed at the Stony Brook School of Marine and Atmospheric Sciences (SoMAS) Analytical Laboratory, an approved Environmental Laboratory in conformance with the National Laboratory Accreditation Conference Standards (2003) for the category Environmental Analyses Non Potable Water (N.Y. Lab ID no. 12075).

Cruise VIII: 8 March, 2019. Water samples collected for plankton analysis using Van Dorn bottles. Salinity, DO and temperature were measured with a Pro 2030 YSI. Nitrite/nitrate, ammonium, total nitrogen and dissolved organic carbon were analyzed at the Stony Brook School of Marine and Atmospheric Sciences (SoMAS) Analytical Laboratory, an approved Environmental Laboratory in conformance with the National Laboratory Accreditation Conference Standards (2003) for the category Environmental Analyses Non Potable Water (N.Y. Lab ID no. 12075).

Cruise IX: 18 March, 2019. Recovery of ADCP after 160 days.

Cruise X: 10 April, 2019. Water samples collected for plankton analysis using Van Dorn bottles. Salinity, DO and temperature were measured with a Pro 2030 YSI. Nitrite/nitrate, ammonium, total nitrogen and dissolved organic carbon were analyzed at the Stony Brook School of Marine and Atmospheric Sciences (SoMAS) Analytical Laboratory, an approved Environmental Laboratory in conformance with the National Laboratory Accreditation Conference Standards (2003) for the category Environmental Analyses Non Potable Water (N.Y. Lab ID no. 12075).

Cruise XI: 15 May 2019. Water samples collected for plankton analysis using Van Dorn bottles. Salinity, DO and temperature were measured with a Pro 2030 YSI. Nitrite/nitrate, ammonium, total nitrogen and dissolved organic carbon were analyzed at the Stony Brook School of Marine and Atmospheric Sciences (SoMAS) Analytical Laboratory, an approved Environmental Laboratory in conformance with the National Laboratory Accreditation Conference Standards (2003) for the category Environmental Analyses Non Potable Water (N.Y. Lab ID no. 12075).

CRUISE XII: 12 June, 2019. Water samples collected for plankton analysis using Van Dorn bottles. Salinity, DO and temperature were measured with a Pro 2030 YSI. Nitrite/nitrate, ammonium, total nitrogen and dissolved organic carbon were analyzed at the Stony Brook School of Marine and Atmospheric Sciences (SoMAS) Analytical Laboratory, an approved Environmental Laboratory in conformance with the National Laboratory Accreditation Conference Standards (2003) for the category Environmental Analyses Non Potable Water (N.Y. Lab ID no. 12075).

CRUISE XIII: 9 July, 2019. Water samples collected for plankton analysis using Van Dorn bottles . Salinity, DO and temperature were measured with a Pro 2030 YSI. Nitrite/nitrate, ammonium, total nitrogen and dissolved organic carbon were analyzed at the Stony Brook School of Marine and Atmospheric Sciences (SoMAS) Analytical Laboratory, an approved Environmental Laboratory in conformance with the National Laboratory Accreditation Conference Standards (2003) for the category Environmental Analyses Non Potable Water (N.Y. Lab ID no. 12075).

CRUISE XIV: 14 August, 2019. Water samples collected for plankton analysis using Van Dorn bottles. Salinity, DO and temperature were measured with a Pro 2030 YSI. Nitrite/nitrate, ammonium, total nitrogen and dissolved organic carbon were analyzed at the Stony Brook School of Marine and Atmospheric Sciences (SoMAS) Analytical Laboratory, an approved Environmental Laboratory in conformance with the National Laboratory Accreditation Conference Standards (2003) for the category Environmental Analyses Non Potable Water (N.Y. Lab ID no. 12075).

CRUISE XV: 9 September 2019. Water samples collected for plankton analysis using Van Dorn bottles. Salinity, DO and temperature were measured with a Pro 2030 YSI. Nitrite/nitrate, ammonium, total nitrogen and dissolved organic carbon were analyzed at the Stony Brook School of Marine and Atmospheric Sciences (SoMAS) Analytical Laboratory, an approved Environmental Laboratory in conformance with the National Laboratory Accreditation

Conference Standards (2003) for the category Environmental Analyses Non Potable Water (N.Y. Lab ID no. 12075).

CRUISE XVI: 15 October 2019. Deployment of the ADCP and Sea Cat moorings.

CRUISE XVII: 21 December 2019. Recovery of ADCP after 67 days

Outreach. A poster presentation (Appendix B) was given at the Long Island Natural History Conference (March 22-23, 2019; http://longislandnature.org/). A presentation (Appendix C) was also made at a public forum ("Save the Western Bays") hosted by the Citizens Campaign for the Environment, Operation Splash and The Nature Conservancy on 2 April 2019.

Results

Summary. Evidence of an effluent plume has been detected in the nearshore ocean waters near the vicinity of two ocean outfalls. The presence of the outfall structures seemed to disrupt the natural migration of sand ridges in the area modifying the sediment composition. Benthic sediment habitat is influenced by the outfalls as they alter the migration of sand ridges thus changing the substrate. Impacts in the water column were found, as depressions of salinity, mostly within a mile of the discharge point and a "boil" was a persistent feature over the Cedar Creek discharge. Nutrient concentrations in the boil were constantly elevated and organisms characteristic of wastewater (nematodes) were occasionally found. In addition, acoustic imaging showed a distinct plume. The junction box appeared to be damaged frustrating the diffusers; this was later confirmed by County divers. The study of plankton in the area near the outfalls has been completed (Schweitzer, K., 2019). At current discharge rates, the negative impact of these outfalls local and is limited because the wastewater effluents diffuse quickly into the seawater. Overall, the compositional seasonal changes of microplanktonic species reflect the common pattern found in the natural population.

Currents and Waves: Deployments of the RDI Teledyne ADCP and SeaBird SeaCat CTDOs have captured characteristics of the regional circulation, wind waves and swell and water column stratification in both winter (unstratified conditions) and during summer (stratified conditions). Current observations indicate weak semidiurnal tidal currents, a weak westward drift, and very strong synoptic period (2 – 7 days) wind driven fluctuations. Tidal currents are weakly sheared; the M_2 current ellipse (Figure 7) is oriented along the coast with a semi-major axis of 13 cm/s at the surface. Tidal excursions are approximately 1.5 km. Non-tidal currents, such as those for deployment 4 in Figure 8, exhibit strong low frequency alongshore fluctuations with magnitudes exceeding 40 cm/s. Alongshore currents are weakly sheared and correlated with alongshore winds. Cross-shore fluctuations are weak (5 cm/s) and highly sheared vertically. They do exhibit an upwelling response to alongshore winds with onshore flow at depth and offshore flow in the upper water column, but because of the relatively shallow water column depths, they are also responsive to cross-shore winds. Offshore winds can drive surface waters offshore and deeper waters onshore. Figure 8 also emphasizes that there can be a coupled dynamic response between the wind forced alongshore and cross-shore fluctuations.

These observations from these moored instruments were complemented by extensive shipborne CTD observations near the outfall. MOU AM08782 had as an objective consideration of the extent of impacts associated with an increase in discharge at the Cedar Creek outfall if augmented by wastewater from Bay Park. Work proposed here would quantify the impact on concentration fields associated with an augmented discharge at Cedar Creek for the observed flow fields using our existing FVCOM model. We had been contacted about our regional modeling capabilities by Boomi Environmental LLC in connection with their environmental impact analysis. Additionally, our bottom ADCP mooring showed evidence of extensive sand movement during storms indicating high bottom stresses. Observations of wave period and significant wave height from the ADCP indicate that wave induced currents make an important contribution to near bottom currents and bottom stress. We propose here an evaluation of bottom stress using both our ADCP observations and FVCOM model and the impact on sand movement in vicinity of the outfall.

Figure 9 shows progressive vector diagrams for deployments 1 through 4 giving an overview of long term drift patterns over the duration of the deployments associated with near surface, mid-depth and near bottom currents. The early spring deployment from 1/26/2018 to 4/2/2018 is associated with a long-term westerly drift and onshore flow at depth associated with upwelling during the passage of multiple northeasters (Figure 10) which also lead to significant wave activity (Figure 11). Mid-winter winds during Deployment 2 from 10/12/2018 to 1/27/2019 (Figure 10) were markedly different from those during Deployment 1, both in intensity and direction. The northwesterly winds produced offshore flow in the surface layers and significant onshore flow at depth. The interior of the water column exhibited an easterly drift (Figure 9). Currents again were highly responsive to local winds. This deployment was associated with very heavy long-period surface wave activity (Figure 11) from the south southeast, so these were not local sea waves. Judging by the impact on our mooring, the increased wave and current activity during Deployment 2 was associated with significantly greater sand movement than occurred during Deployment 1. Deployment 3 from 5/8/2019 to 8/2/2019 was associated with summer winds from the southwest. This more stratified period was characterized by surface drift towards the southeast, a westerly drift at mid-depth and

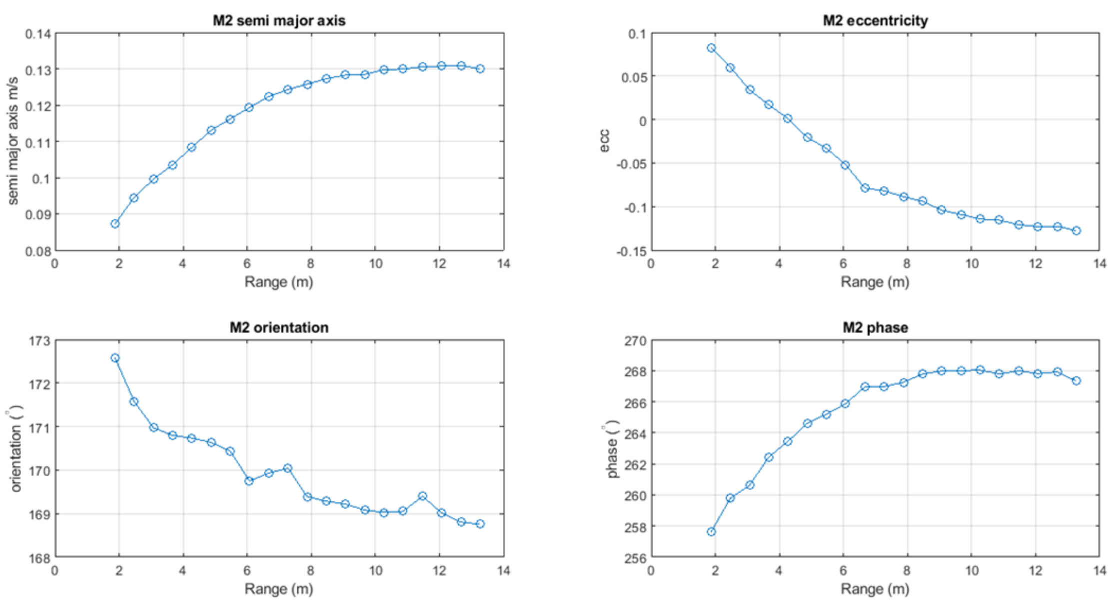

Figure 7. M2 tidal current ellipse properties.

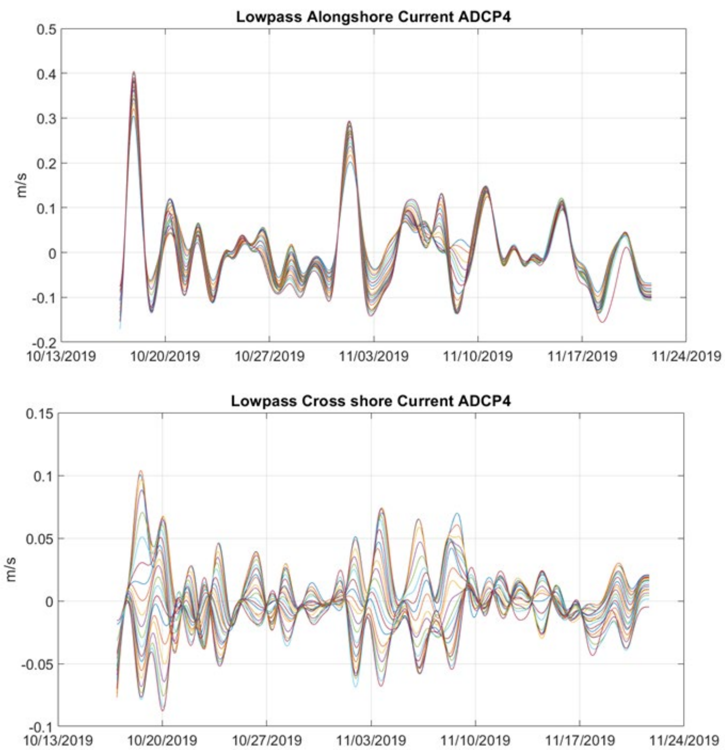

Figure 8. Alongshore and cross shore lowpass filtered currents during Deployment 4.

onshore flow at depth and relatively weak surface wave activity. Deployment 4 in late fall from 10/15/2019 to 11/21/2019 was associated with very strong northeasters and strong surface wave activity. This was a shorter deployment characterized by a persistent offshore surface drift towards the south and onshore flow at depth.

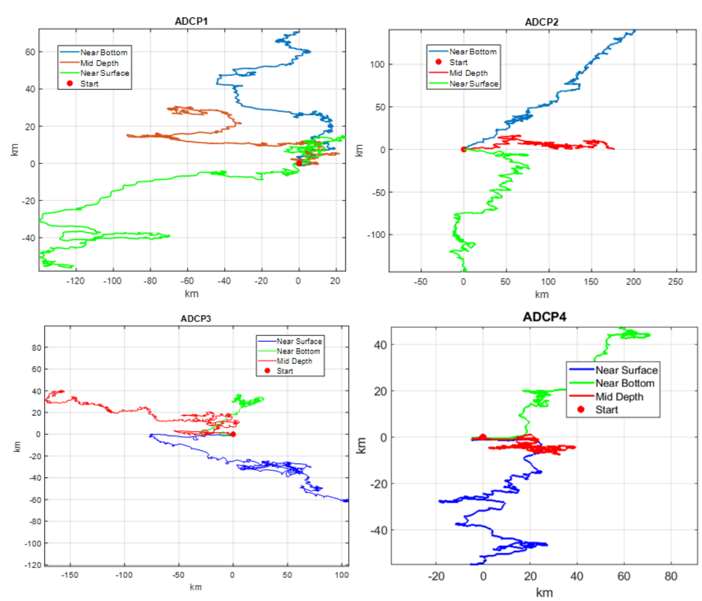

Figure 9. ADCP current progressive vectors for Deployments 1 through 4 (N.B. scale change).

Winds in mid-winter from 10/12/2018 to 1/27/2019 (Figure 8) were markedly different from those during Deployment 1, both in intensity and direction. The northwesterly winds produced offshore flow in the surface layers and significant onshore flow at depth (Figure 7). The interior of the water column exhibited an easterly drift. Currents again were highly responsive to local winds.

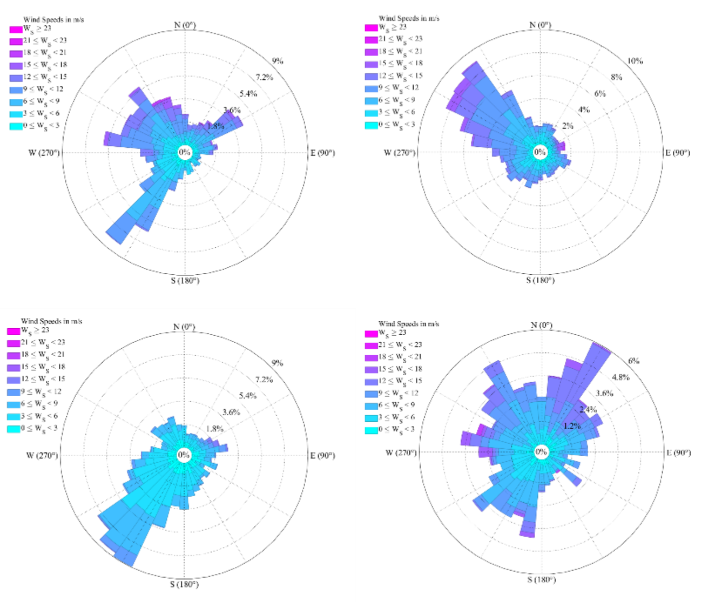

Figure 10. Wind roses for Deployments 1 through 4 from NDBC 44025.

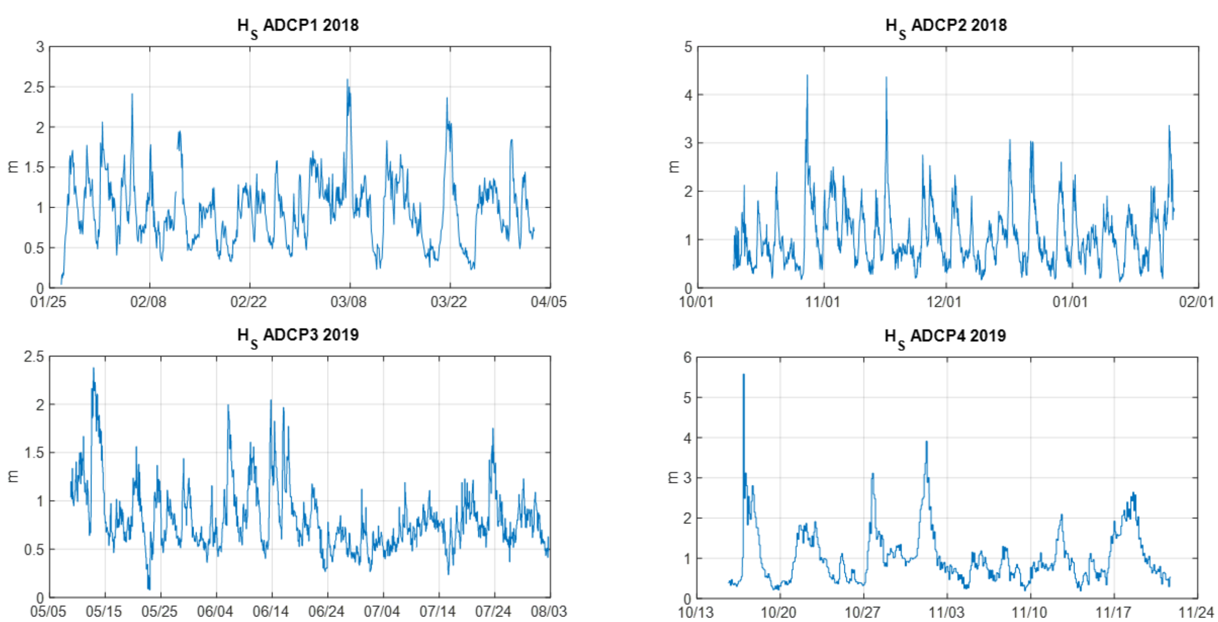

Figure 11. ADCP significant wave heights for Deployments 1 through 4 (N.B. scale change).

Temperature, Salinity, Density and Dissolved Oxygen

During Deployment 1 from 1/26/2018 to 4/2/2018 temperature time series (Figure 12) showed clear evidence of seasonal warming but no evidence of an onset of thermal stratification. Salinity time series showed evidence of weak haline stratification and synoptic period variability associated with alongshore and across shore wind induced currents. It was difficult to identify influence of the outfall. Dissolved oxygen time series showed some stratification but both depths are near saturation.

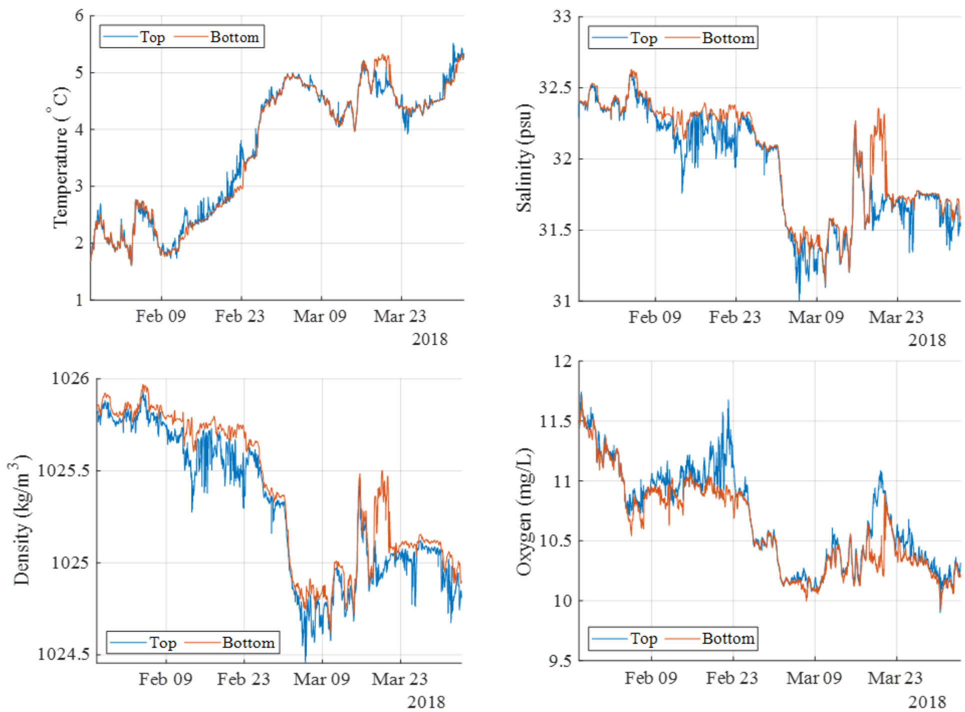

Figure 12. Time series for near bottom and near surface temperature, salinity, density and dissolved oxygen from the SeaCat mooring for Deployment 1.

During Deployment 3 5/8/2019 to 8/2/2018 temperature time series (Figure 13) showed clear evidence of seasonal warming and an onset of thermal stratification. Salinity time series showed evidence of haline stratification and synoptic period events associated with very strong haline stratification. Time series for bottom dissolved oxygen shows the clear impact of the suppression of vertical mixing by the evolving density stratification. Figure 14 emphasizes the importance of haline stratification events during the early summer, and persistent thermal stratification later in the summer. It also emphasizes the importance of these haline stratification events to rapid decline in oxygen in bottom waters. Analyses of current fluctuations show clearly that haline stratification events are associated with eastwardly directed surface currents advecting low salinity surface waters from the west.

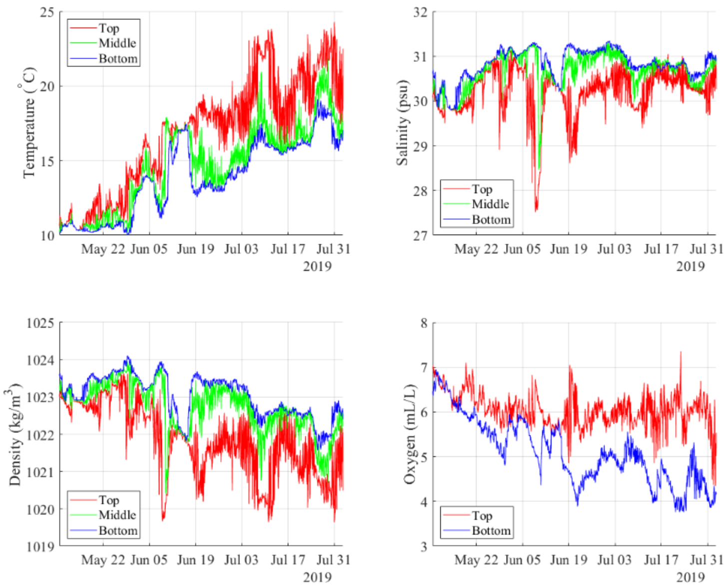

Figure 13. Time series for near bottom, mid-depth and near surface temperature, salinity, density and dissolved oxygen from the SeaCat mooring for Deployment 3.

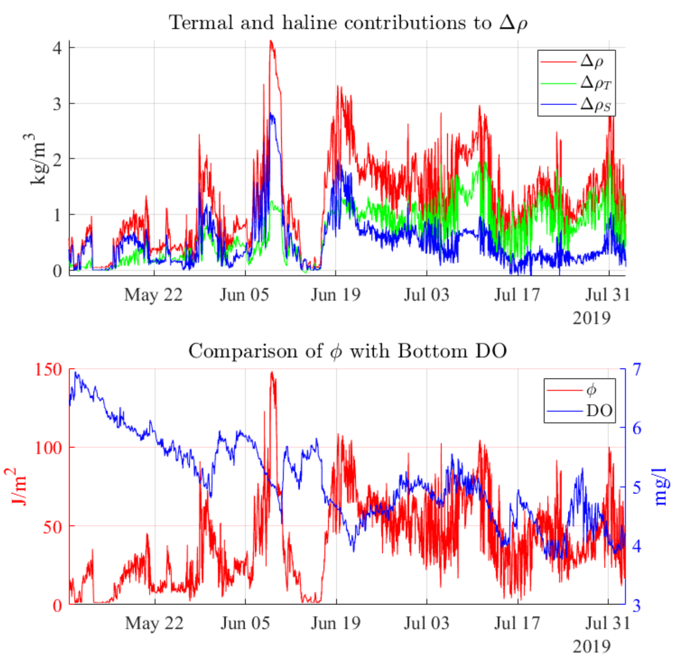

Figure 14. Thermal and haline contributions to density stratification during Deployment 3, and impact of density stratification on bottom dissolved oxygen.

Very little vertical salinity structure was seen in the winter, as expected, although higher salinity was seen at the sea floor on the winter survey, rather than any evidence dilution by fresh (sewage) water. There was a small but detectable low-salinity signal in the warmer surface water in the vicinity of the surface boil observed at the Cedar Creek outfall during the multibeam survey in May, 2018 (Figure 15) and in the cooler bottom water at the SWSD outfall (Figure 16).

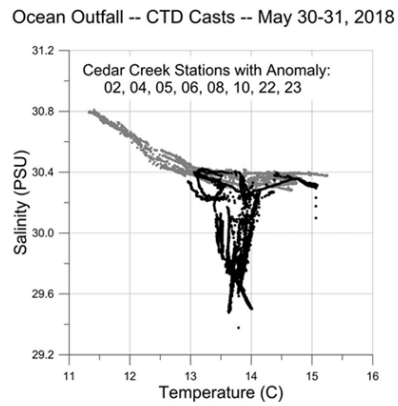

Figure 15. CTD casts taken during the multibeam surveys at the Cedar Creek outfall. Lower salinities were found at the surface.

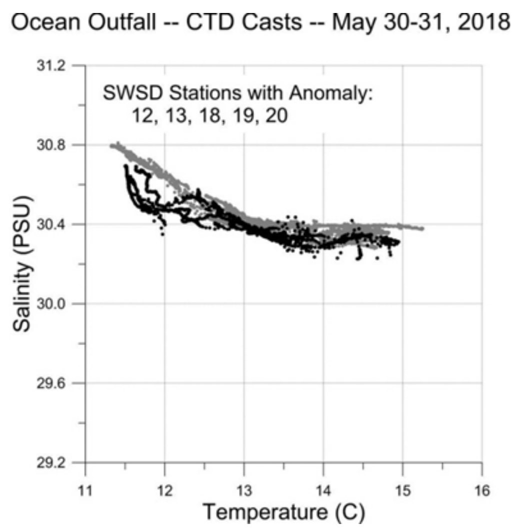

Figure 16. CTD casts taken during the multibeam surveys at the SWSD outfall outfall. Lower salinities were found near the bottom.

Evidence of a lower-salinity lower-temperature plume was found at a depth of about six meters on the eastern edge of the diffusers at the Cedar Creek Outfall in August 2018 (Station 10; Figure 17). (The combination of cooler temperature and lower salinity make the plume water slightly denser than the water above it).

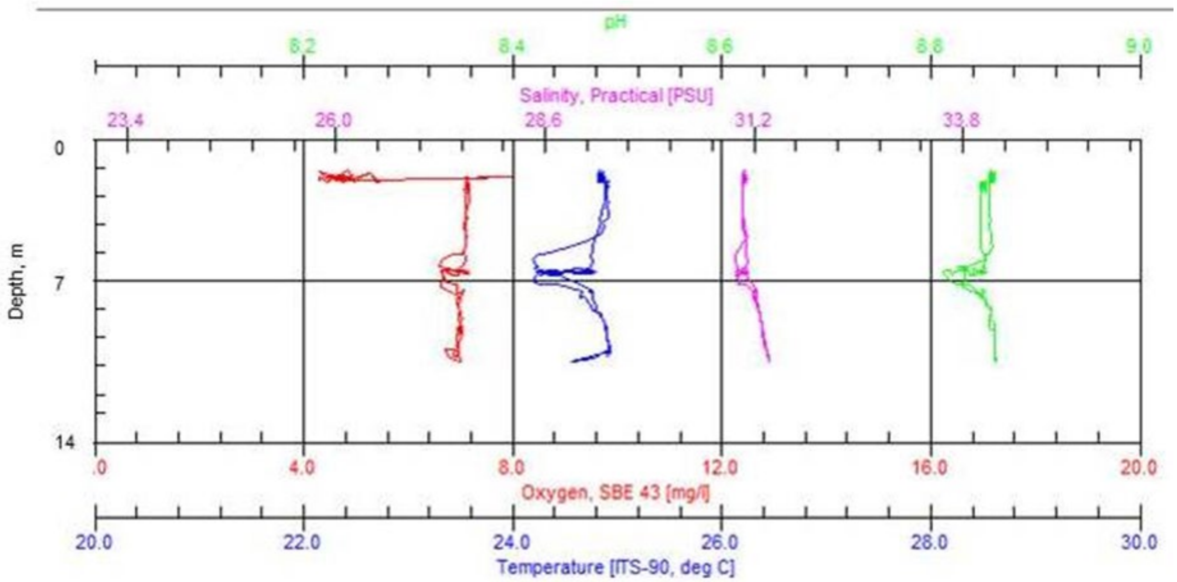

Figure 17. Evidence of a subsurface plume at station 10, located on the eastern edge of the Cedar Creek Outfall. (August 15 at 14:43 EDT).

The surface plume of decreased salinity and dissolved oxygen was detected south of the SWSD outfall in January 2018 (Figure 18) and a subsurface plume was identified by minima in salinity, temperature DO and pH between three and six meters depth at the eastern edge of the Cedar Creek outfall in August, 2018 (Figure 19).

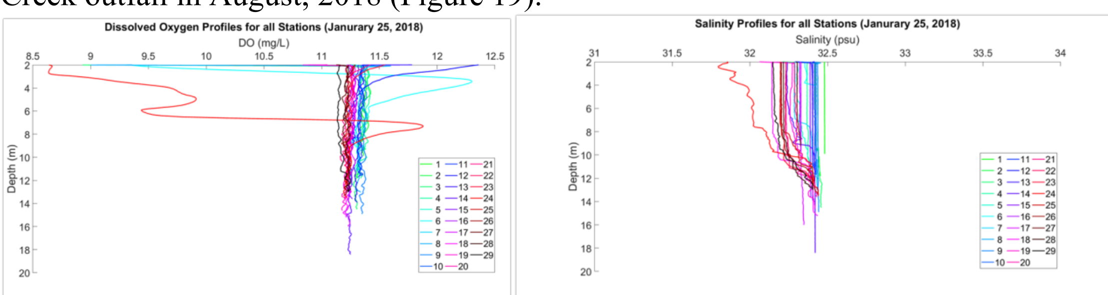

Figure 18. Signs of the Plume at Station 24 (south of SWSD outfall) 1/25/2018.

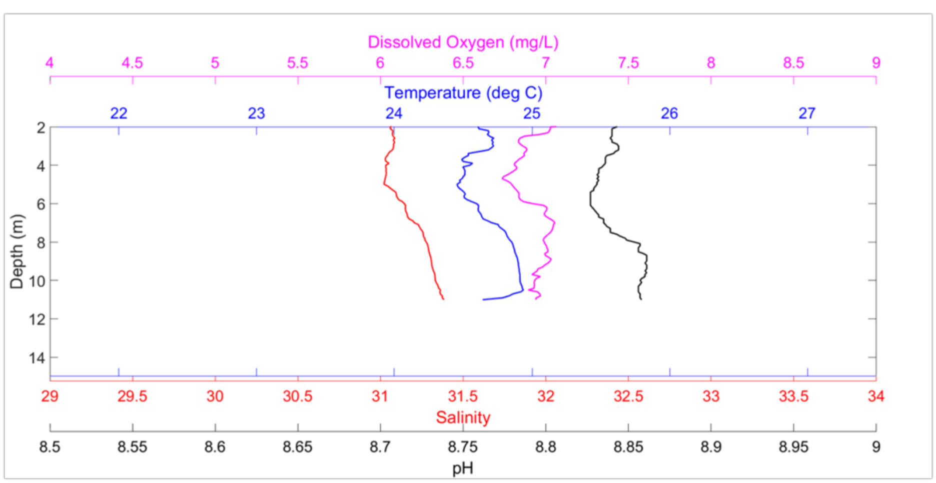

Figure 19. Evidence of subsurface plume at station 10, located at the eastern edge of Cedar Creek Outfall 8/2018.

Sediments and benthic communities. Sediments and benthic communities. The presence of the outfall seem to disrupt the natural migration of sand ridges in the area modifying the sediment composition. The sea floor near the outfalls is an active one in terms of sediment transport. Low relief ridges of sand, or sand waves, are known to migrate on the shelf most likely driven by longshore currents in storms (Trowbridge 1995, Calvete et al. 2001). The relief of these features near the outfall is low, less than a meter, but the bedform is defined by changes in the acoustic backscatter, which we used to delineate benthic habitats. These features are "sorted bedforms" which have been observed at these water depths both east and west of the study area where they were found to migrate at rates of several metes per year to the west (Liu et al. 2018). In one deployment of the ADCP, the device was buried in migrating sand to a depth of about 10 cm. In addition, although the sea floor is comprised of uniform fine sand, there is a large settling flux of suspended particulates to the sea floor. Only a small fraction is incorporated into the bottom sediment but even low-relief bed forms can trap some particulate in the sediment enhancing the backscatter discrimination of the sorted bedforms. Any open enclosures on the ADCP deployed for this study tended to trap and retain fine-grained sediment. In the case of the outfall diffusers, the presence of the physical structures modifies the natural sediment transport leading to variations in substrate consequently manifest in the benthic community structure. This impact seems to extend for at last one kilometer from the structures.

The grain sizes ranged from 0.02 mm (2.15 phi) to 0.3 mm (1.65 phi) and only 8 % of the samples had a fine-grained fraction greater than 3%, and none greater than 6.3%. The coarser sediment, however, were found in the impacted zone both north and south of the outfall, while finer sediment tended to be found in the "control" zone to the west.

Benthic sediment habitat is influenced by the outfalls as they alter the migration of sand ridges thus changing the substrate. The benthic samples showed evidence of a sediment impact with generally coarser sediments south of the outfalls. It appears that the outfall structures modify the migration of sand waves through the region. On the Long Island shelf, sand waves are oriented obliquely to the shoreline and seem to migrate slowly to the west. Finer sediment spears in the troughs and coarser sand is found on the crests. These differences in grain-size alter the benthic community with differences in the benthic community composition being larger between the crests and troughs than they are across the region. The outfall diffusers seem to cause scour of sand waves intersecting them.

Stratification of the areas into bottom type provinces in two areas associated with the Cedar Creek and Southwest Sewer District (SWSD) outfalls (Figure 20) was conducted by visual examination of preliminary 300 kHz multibeam backscatter data (Figures 21 and 22). In this process, acoustic backscatter was taken as a proxy for bottom type. Areas with high backscatter (light grey) tend to be coarser grained than areas with low backscatter (dark grey), although the presence of surficial material such as shells, sediment texture, and fine scale topography also affect backscatter. Visual examination of the backscatter maps suggested the presence of sand waves oriented approximately northwest-southeast. The presence of the outfall seemed to disrupt the natural migration of sand waves in the area modifying the sediment composition.

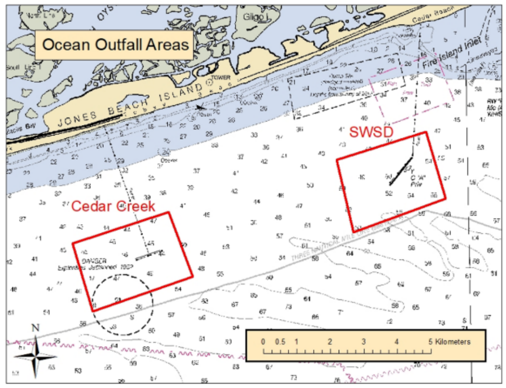

Figure 20. Ocean outfalls study area.

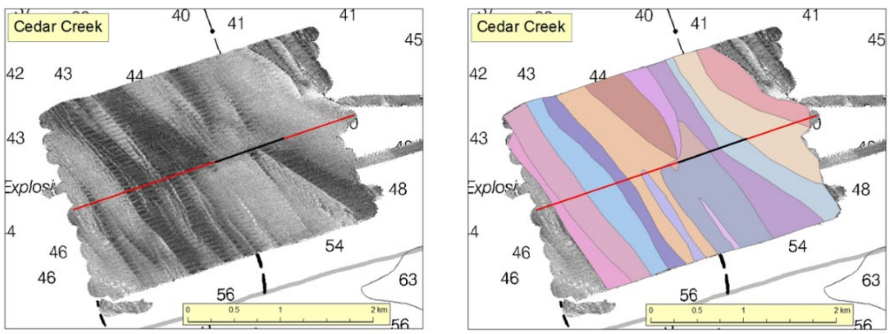

Figure 21. Cedar Creek backscatter (left) and bottom provinces (right). The outfall diffuser is represented as a black line. The red line bisects the study area into north and south regions and is oriented in the same direction as the outfall.

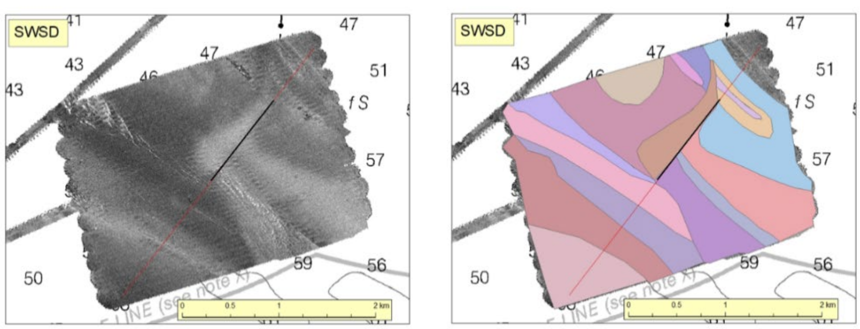

Figure 22. SWSD backscatter (left) and bottom provinces (right). The outfall diffuser is represented as a black line. The red line bisects the study area into north and south regions and is oriented in the same direction as the outfall.

Ten sand wave oriented bottom provinces were targeted for bottom sampling. These areas were assigned a letter code from A-J in a west to east direction (Figure 23). Six benthic samples were located within each province with three samples to the north and three to the south of the line oriented in the direction of the outfalls that bisected each study area. The rationale for the target position of each sampling location was that stations were approximately 250m apart, at least 100m from a bottom province boundary, and at least 150m from the outfall diffuser. Flanagan et al. (2018) determined that no evidence of spatial autocorrelation in benthic community structure remained at distances of 250m after accounting for the effect of bottom province. These sampling stations were, therefore, assumed to be independent in later statistical analysis of the data. Vessel drift during sampling added random positioning to the locations.

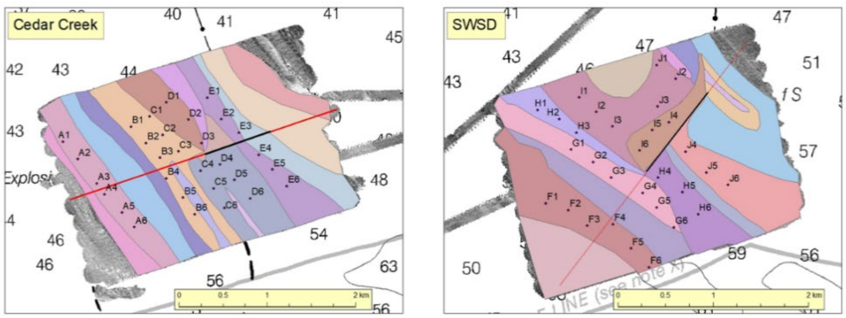

Figure 23. The locations of benthic grab samples to be taken on Cruise 4 were chosen among them. The black line in the maps represent the approximate location of the outfall diffusers. The red lines bisect the study areas into north and south regions and is oriented in the same direction as the outfall diffusers.

Data were entered into Microsoft Excel spreadsheets, and faunal data were summarized by using PC-ORD (MJM Software Design, Gleneden Beach, OR). This summary and subsequent data analyses required assigning a unique 4-character code for each species. This was created in most cases by using the first 2 characters in both the genus and species name. Faunal data at each sampling station were summarized by calculating the abundance (total number of individuals per grab), species richness S (number of species per grab), Shannon diversity ($H' = -\sum p_i ln p_i$) where p_i is the proportion of individuals of each species, and equitability ($E = H'/lnS$). Equitability ranges from 0 to 1 and measures how evenly individuals are distributed among the S species present. A geodatabase of the data and GIS maps displaying selected data were created in ArcGIS version 10.7.1 (ESRI, Redlands CA). All data were imported into the GIS directly from the Excel spreadsheets.

Data were analyzed by redundancy analysis (RDA), a multivariate direct gradient technique that explicitly incorporates environmental variables in the analysis of the faunal data. RDA, first suggested by Rao (1964), is a technique that combines ordination of sample sites based on species abundance data with regression on the environmental data in order to examine the relationship between community structure and environmental variables (Jongman *et al.*, 1995). By examining the environmental and biological data simultaneously, this analysis depicts the trends in the species data that are related to the selected environmental data. RDA is based on Euclidean distance, which is not the most appropriate resemblance measure for species data, since it incorrectly interprets shared species absences between samples as similarities. In order to circumvent this shortcoming, abundance data were Hellinger transformed by taking the square root of relative abundances of each species in a sample (Legendre and Gallagher, 2001). This transformation focuses the analysis on compositional differences, reduces the influence of the most abundant species, and combined with Euclidean distance, has been shown to produce good representations of ecological data (Legendre and Gallagher, 2001). RDA analyses were conducted in Canoco 4.5 (Microcomputer Power, Ithaca, NY, USA).

To examine the effect of the outfall diffusers on benthic community structure, Hellinger transformed species data were analyzed using RDA to carry out a multivariate nonparametric analysis of variance. Two categorical factors were defined. Bottom type provinces were designated as control (A, B, F, G) or impacted (C, D, E, H, I, J) based on their location relative to the outfall diffusers. Since the sonar backscatter data suggested that the diffusers disrupted sand waves and potentially influenced bottom type to the north and south, the second categorical factor distinguished whether a sampling station was located north or south of the line oriented on the outfalls that bisected the study areas (Figure 21). Stations within a province were, therefore, designated as north (e.g., A1, A2, A3) or south (e.g., A4, A5, A6). The only exception to this north-south designation was for stations I4-6; these stations were included as south to balance the experimental design.

Data were analyzed as a hierarchical split-plot experiment. Provinces were whole-plots and stations within provinces were split-plots. The interaction between the two categorical factors was examined first by explicitly defining each interaction term as an explanatory variable (N*Control, S*Control, N*Outfall, S*Outfall). Figure 23 identifies the bottom type provinces and stations for each interaction term. As with any analysis of variance, an F-ratio statistic was calculated that expresses how strongly the species assemblage data are explained by the explanatory variables (ter Braak and Smilauer, 2002). The size of this F statistic was assessed by permutation test. Bottom provinces and stations within provinces were permuted 1000 times, with provinces freely exchanged between control and impacted and with stations freely exchanged between north and south but always remaining within their province. If an interaction model was not justified from this analysis, the effect of each categorical factor would next be considered separately in an additive model.

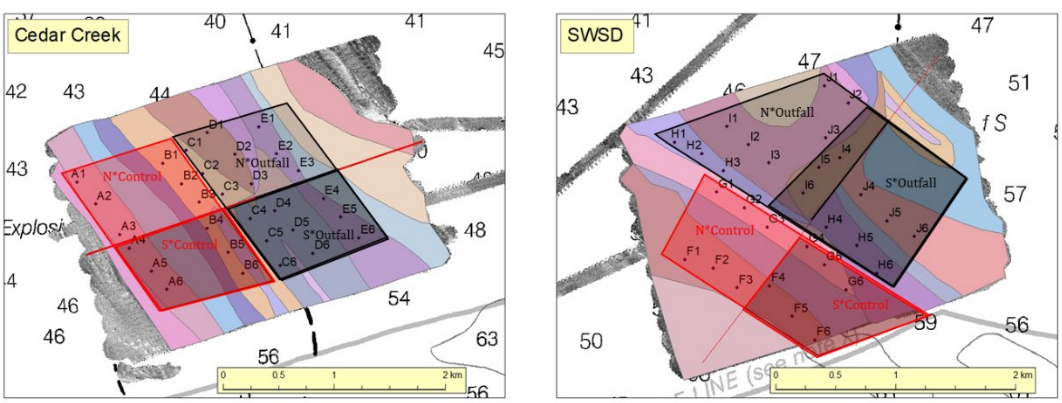

Figure 24. Split-plot experimental design used in the RDA analysis to test the impact of the diffusers on benthic fauna community structure.

A total of 43,965 animals representing 88 taxa were collected in the 60 samples. Average abundance in the 60 samples was 733 individuals per sample (18,320 per m^2) and average species richness was 25 species per sample. Of the 88 taxa, 45% were polychaetes, 17% were molluscs, 31% were crustaceans, and the remainder (7%) was distributed among six other groups (Table 2). Numerical dominants included the amphipod *Pseudunciola obliquua* (average abundance = 491 individuals per sample), the polychaete *Polygordius* spp (60 per sample), the amphipod *Ampelisca* spp (25 per sample), the polychaete *Prionospio pygmaeus* (23 per sample), the amphipod *Protohaustorius wigleyi* (20 per sample), the amphipod *Acanthohaustorius millsi* (18 per sample), the amphipod *Rhepoxynuis epistomus* (16 per sample), oligochaetes (12 per sample), the polychaete *Caulleriella venefica* (10 per sample), and the bivalve *Spisula solidissima* (5 per sample). These 10 taxa represented about 93% of the total number of individuals collected, and no other taxon had an average abundance greater than 5 per sample. Faunal data listed by sample are tabulated in Appendix E. As examples of dominant species spatial distributions, abundance (individuals per sample) maps for *Pseudunciola obliquua*, *Polygordius* spp, *Ampelisca* spp, and *Spisula solidissima* are given in Figures 27-28, respectively. Abundance and species richness maps are provided in Figures 29 and 30. Abundance, species richness, and diversity measures are listed in Table 3.

Table 2. Benthic fauna species list, average abundance, frequency of occurrence, and percent frequency of occurrence.

	Average Abundance	Frequency of Occurrence	Percent Frequency of Occurrence
ACTINIARIA			
Ceriantheopsis americana	0.1	4	6.7
CRUSTACEA			
Amphipoda			
Acanthohaustorius millsi	18.1	41	68.3
Ampelisca spp (*vadorum, verrilli*)	25.2	16	26.7
Corophium tuberculatum	1.5	16	26.7
Grandidierella sp	0.6	15	25.0
Microdeutopus sp	0.0	1	1.7
Protohaustorius wigleyi	19.8	48	80.0
Pseudunciola obliquua	491.5	51	85.0
Rhepoxynuis epistomus	16.2	49	81.7
Synchelidium americanum	0.4	19	31.7
Unciola irrorata	3.5	46	76.7
Cumacea			
Oxyurostylis smithii	0.2	7	11.7
Pseudoleptocuma minor	0.4	21	35.0
Decapoda			
Cancer irroratus (Atlantic rock crab)	0.0	2	3.3

Crab megalopa	0.2	11	18.3
Crangon septemspinosa (sand shrimp)	0.0	1	1.7
Dissodactylus mellitae (sand dollar pea crab)	0.0	2	3.3
Ovalipes ocellatus (lady crab)	0.0	1	1.7
Pagurus annulipes (banded dwarf hermit crab)	0.1	3	5.0
Pagurus longicarpus (long wrist hermit crab)	0.3	7	11.7
Pagurus pollicaris (flat claw hermit crab)	0.0	1	1.7
Isopoda			
Ancinus depressus	0.2	7	11.7
Chiridotea tuftsi	2.1	41	68.3
Edotea triloba	0.5	21	35.0
Ptilanthura tenuis	1.0	30	50.0
Mysidacea			
Mysidopsis bigelowi	0.0	1	1.7
Neomysis americana	0.1	2	3.3
Tanaidacea			
Tanaissus psammophilus	0.2	9	15.0
ECHINODERMATA			
Echinoidea			
Echinarachnius parma (sand dollar)	3.0	50	83.3
Holothuroidea			
Leptosynapta tenuis	0.1	2	3.3
MOLLUSCA			
Bivalvia			
Anadara transversa (transverse ark)	0.0	1	1.7
Ensis directus (common razor clam)	0.2	12	20.0
Lyonsia arenosa (sand lyonsia)	0.2	8	13.3
Mulinia lateralis (little surf clam)	0.0	1	1.7
Nucula proxima (near nut shell)	0.3	13	21.7
Nucula tenuis (thin nut shell)	0.0	1	1.7
Siliqua costata (ribbed pod)	0.0	1	1.7
Spisula solidissima (surf clam)	5.0	54	90.0
Tellina agilis (Northern dwarf tellin)	2.1	46	76.7
Gastropoda			
Crepidula spp (juveniles) (slipper snail)	1.0	12	20.0
Epitonium multistriatum (wentletrap)	0.0	1	1.7
Euspira heros (Northern moonsnail)	0.0	1	1.7

Euspira immaculate (immaculate moonsnail)	0.0	2	3.3
Ilyanassa trivittata (New England dog whelk)	0.2	10	16.7
Neverita duplicata (lobed moonsnail)	0.0	1	1.7
POLYCHAETA			
Aricidea catherinae	0.9	24	40.0
Aricidea wassi	2.2	26	43.3
Asabellides oculata	2.8	46	76.7
Capitella sp	0.2	8	13.3
Caulleriella venefica	9.7	50	83.3
Clymenella torquata	0.0	1	1.7
Diopatra cuprea	0.2	8	13.3
Dipolydora socialis	0.1	2	3.3
Dispio uncinata	0.1	4	6.7
Drilonereis longa	0.1	8	13.3
Euclymene zonalis	0.2	9	15.0
Exogone dispar	3.6	38	63.3
Glycera americana	0.2	8	13.3
Harmothoe extenuata	0.1	3	5.0
Heteromastus filiformis	0.0	1	1.7
Kirkegaardia baptisteae	2.0	41	68.3
Leitoscoloplos robustus	0.2	9	15.0
Megalona sp	0.3	15	25.0
Neanthes arenaceodentata	0.3	7	11.7
Nepthys picta	2.3	45	75.0
Notocirrus spiniferus	0.6	10	16.7
Notomastus sp	4.2	38	63.3
Onuphis eremita	1.1	33	55.0
Orbinia swani	0.0	1	1.7
Paraonis fulgens	0.1	6	10.0
Paranaitis speciosa	0.1	3	5.0
Parougia caeca	0.8	20	33.3
Phyllodoce arenae	0.3	12	20.0
Phyllodoce mucosa	0.0	1	1.7
Polydora cornuta	0.4	6	10.0
Polygordius spp	59.8	59	98.3
Prionospio pygmaeus	23.5	23	38.3
Sabellaria vulgaris	0.0	1	1.7
Sigalion arenicola	0.5	23	38.3

Sigambra tentaculata	0.0	1	1.7
Spiochaetopterus oculatus	2.4	47	78.3
Spiophanes bombyx	4.5	53	88.3
Streptosyllis varians	0.0	1	1.7
Syllides setosa	1.5	20	33.3
Travisia carnea	1.0	27	45.0
OTHER			
Nemertinea spp	0.5	17	28.3
Oligochaeta spp	11.9	48	80.0
Turbellaria sp	0.2	8	13.3

Table 3. Faunal station summary results.

Station	Sample	Abundance	Species Richness	Evenness	Shannon Diversity	Simpsons Diversity
A1	133	1063	22	0.305	0.944	0.3637
A2	132	962	22	0.24	0.74	0.2852
A3	131	638	16	0.448	1.242	0.5942
A4	134	877	27	0.356	1.172	0.452
A5	135	1178	20	0.214	0.642	0.2466
A6	136	1303	23	0.357	1.119	0.4852
B1	142	233	31	0.784	2.693	0.8968
B2	141	214	21	0.809	2.464	0.8946
B3	140	275	25	0.654	2.105	0.8041
B4	139	117	19	0.841	2.477	0.8911
B5	138	506	30	0.487	1.655	0.6121
B6	137	269	30	0.624	2.121	0.7452
C1	145	534	24	0.562	1.786	0.7195
C2	144	186	26	0.77	2.508	0.8821
C3	143	434	25	0.649	2.088	0.7811
C4	160	1721	22	0.281	0.87	0.3622
C5	159	1258	23	0.336	1.053	0.4761
C6	158	1507	20	0.175	0.524	0.1975
D1	149	1342	26	0.279	0.908	0.3828
D2	150	1001	20	0.223	0.667	0.2595
D3	151	1226	27	0.299	0.985	0.4065
D4	157	1261	27	0.281	0.927	0.3217
D5	156	1098	21	0.287	0.875	0.3311

D6	155	1362	32	0.245	0.848	0.2936
E1	146	706	18	0.434	1.254	0.5876
E2	147	848	17	0.306	0.866	0.3498
E3	148	839	22	0.207	0.64	0.2201
E4	154	920	27	0.303	0.999	0.3786
E5	153	1992	31	0.186	0.639	0.2048
E6	152	1460	30	0.302	1.026	0.3568
F1	104	288	17	0.461	1.306	0.621
F2	105	524	26	0.624	2.034	0.8104
F3	106	490	20	0.491	1.47	0.6272
F4	103	481	19	0.403	1.187	0.5671
F5	102	1233	26	0.394	1.285	0.6151
F6	101	129	16	0.74	2.052	0.8078
G1	112	106	25	0.835	2.687	0.8831
G2	111	154	31	0.809	2.779	0.9018
G3	110	154	25	0.728	2.343	0.7979
G4	107	202	32	0.846	2.933	0.923
G5	108	157	26	0.817	2.66	0.8882
G6	109	135	25	0.873	2.809	0.9246
H1	113	174	25	0.627	2.019	0.7247
H2	114	234	28	0.705	2.35	0.8497
H3	115	189	28	0.638	2.126	0.7524
H4	127	1029	26	0.22	0.716	0.2522
H5	126	491	30	0.412	1.401	0.494
H6	125	1184	30	0.193	0.655	0.2064
I1	118	129	24	0.706	2.245	0.7966
I2	117	77	25	0.91	2.929	0.933
I3	116	215	30	0.802	2.727	0.8977
I4	128	1631	31	0.212	0.726	0.237
I5	129	1344	24	0.231	0.733	0.2645
I6	130	1729	31	0.132	0.455	0.1429
J1	119	240	24	0.735	2.335	0.8534
J2	120	266	22	0.679	2.099	0.8129
J3	121	379	29	0.48	1.618	0.5921
J4	124	1285	26	0.345	1.123	0.5321
J5	123	753	28	0.292	0.973	0.3682
J6	122	1233	27	0.212	0.699	0.2533

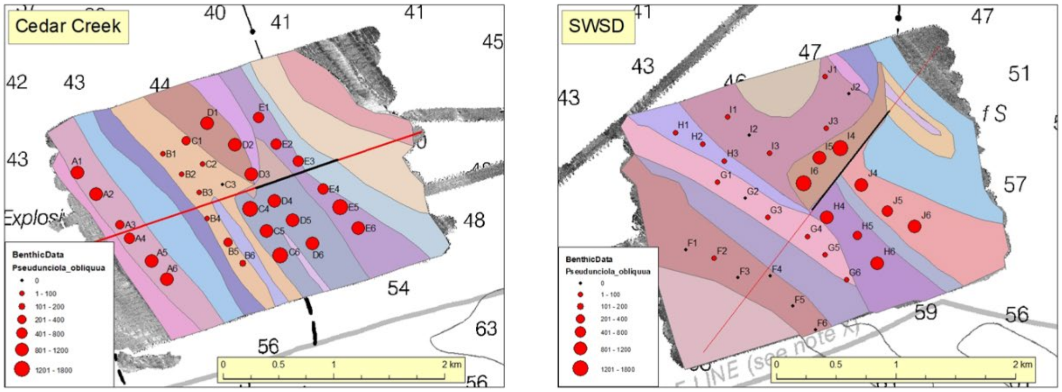

Figure 25. Abundance (number of individuals per sample) of the amphipod *Pseudunciola obliquua*.

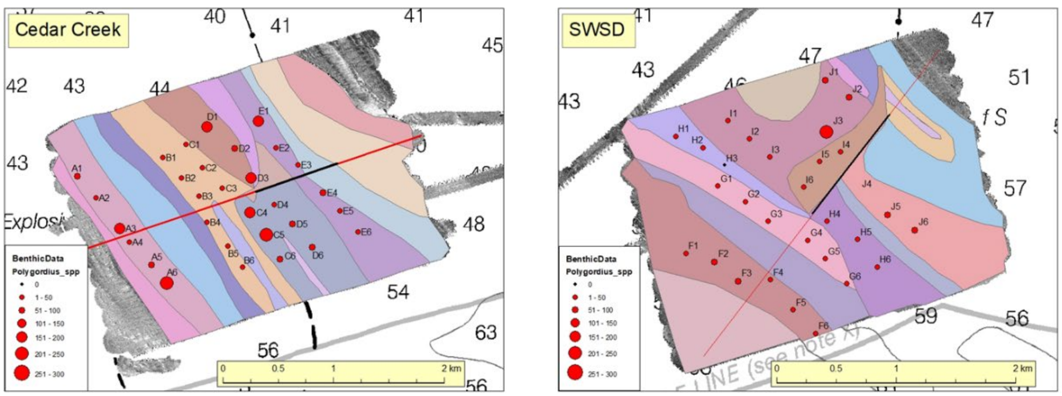

Figure 26. Abundance (number of individuals per sample) of the polychaete *Polygordius* spp.

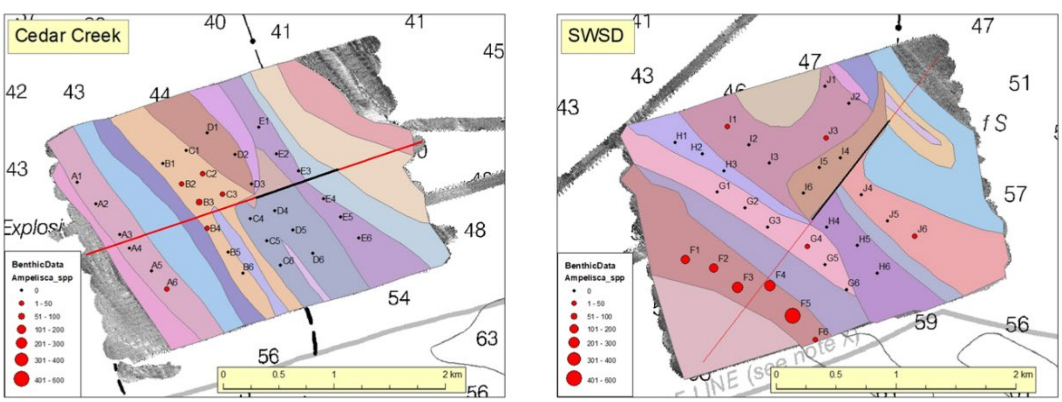

Figure 27. Abundance (number of individuals per sample) of the amphipod Ampelisca **spp. This taxa is a mixture of *A. ampelisca* and *A. vadorum*.**

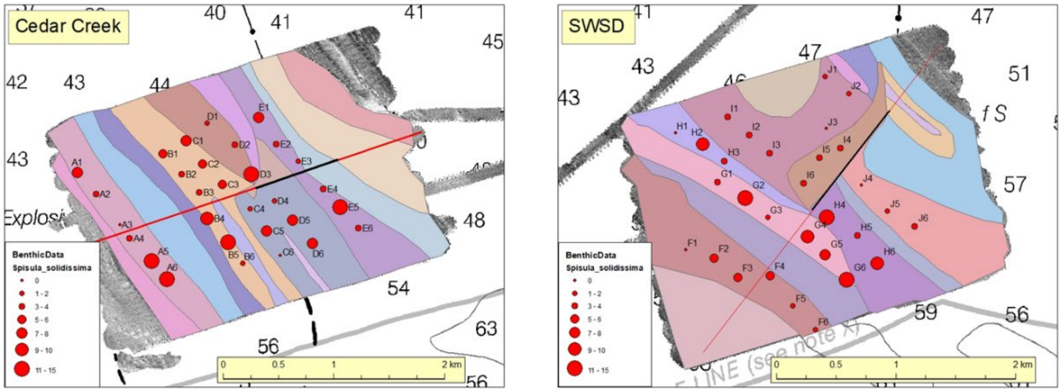

Figure 28. Abundance (number per sample) of newly post-set surf clams *Spisula solidissima*, a commercially important species.

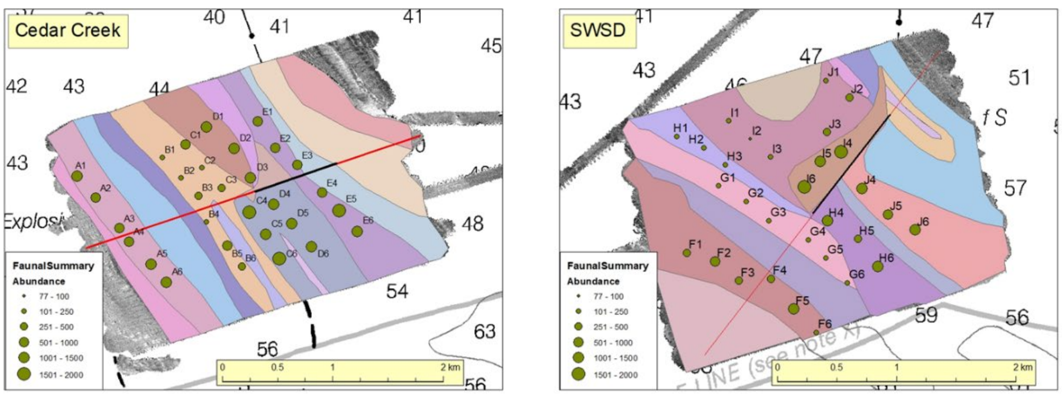

Figure 29. Abundance (number per sample) for each station.

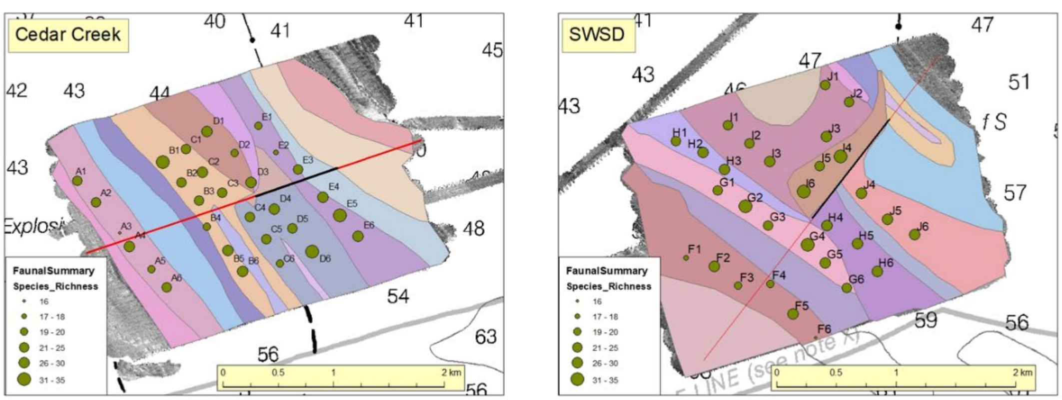

Figure 30. Species richness (number of taxa per sample) for each station.

The RDA ordination triplot in Figure 31 displays the relationship between benthic faunal community structure, the categorical explanatory variables (Control/Outfall and N/S), and species abundances. In this ordination diagram, points represent the community structure at each sampling station; those that plot close to one another have similar species composition while points far apart are dissimilar. The larger red triangles represent the categorical explanatory variables and are located at the centroid of the stations belonging to that categorical variable (e.g., the red triangle labeled N*Control is the centroid of the samples in the designated regions indicated in Figure 24. The black arrows represent the direction of steepest increase for selected species whose variances are well explained by the RDA analysis. The origin is the mean abundance of the species and decreasing values extend through the origin in the direction opposite the head of the arrow. Station points can be orthogonally projected onto the arrow of a species (i.e., the direction of the projected point is perpendicular to the arrow); this projection approximately orders the samples from the largest to the smallest value for that species.

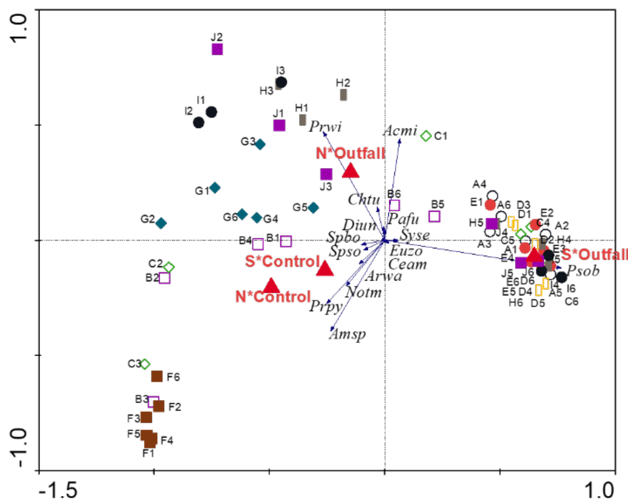

Figure 31. RDA ordination triplot for the benthic fauna. Species codes are in Table 2.

Permutation tests indicated that the interaction between N/S and Control/Outfall was significant for both the first canonical axis (F-ratio = 13.55, p=0.011) and for all canonical axes combined (F-ratio=5.92, p=0.001). The four categorical interaction variables (N*Control, S*Control, N*Outfall, S*Outfall) explained 24.1% of the total variability in community structure. The N*Control and S*Control centroids plotted close together in the ordination diagram indicating that their community structure was the most similar of the four station groups. In contrast, N*Outfall and S*Outfall had distinctly separated centroids, indicating distinct differences in community structure north and south of the outfalls. The outfall centroids were also distinctly separated from the control centroids along both canonical axes. It should be noted that heterogeneity of variances probably also contributed to the significant permutation test outcome. Control province points (e.g., F1-F6) more tightly grouped together while impacted province points (e.g., I1-I6) were more scattered in the ordination diagram.

The observed gradient in benthic faunal community structure can be attributed at least in part to variation in sediment grain size within the study areas. In Figure 32, a contour plot, generated from a locally weighted linear regression (loess) between mean grain size in phi units and sample scores, was overlaid on the ordination diagram. The coarsest sediments were associated with South*Outfall stations, North*Outfall stations in provinces D and E, and those of province A. The amphipod *Pseudunciola obliquua* was dominant at these stations (Figure 25). This species is an infaunal, tube building, motile, surface deposit feeder. Its preferred substrate is medium to course sand (Diaz et al. 2004) and is a dominant species on dynamic sandy bottoms (Morgan and Woodhead 1984). In contrast, the amphipod *Ampelisca* spp (*A. ampelisca* & *A. vadorum*) is also an infaunal, tube building, motile, surface deposit feeder, and its preferred substrate is fine sand to muddy sediments (Cerrato 2006). *Ampelisca* spp was a dominant only in the fine sands of province F (Figure 26, 32).

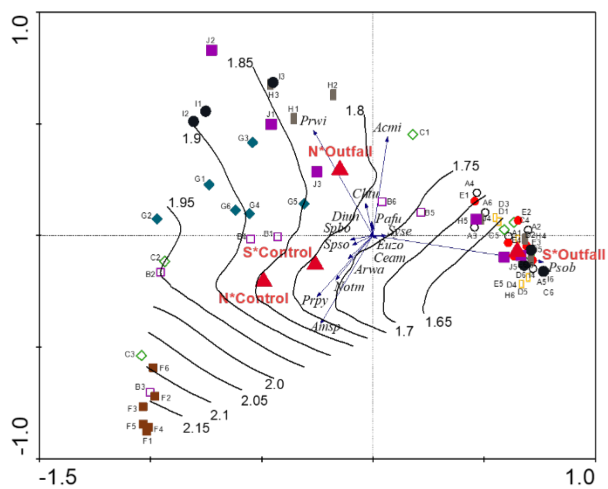

Figure 32. A contour-based attribute plot of mean grain size in phi units overlaid on the RDA ordination triplot for the benthic fauna. The contour plot was generated from a locally weighted linear regression (loess) between mean grain size and sample scores. Species codes are in Table 2.

Plankton. The study of plankton in the area near the outfalls has been completed (Schweitzer 2019). The plankton results show a regular diatom/dinoflagellate cycle. Overall, the compositional seasonal changes of microplanktonic species reflect the common pattern found in the natural population. No new species were found that had not been recorded in earlier studies, although some became more dominant. In the winter, the plankton samples were dominated by diatoms (Table 3) and by large forms (greater than 20 μm), but, except for differences near the Fire Island Inlet, there seemed to be little variation in the planktonic community structure around the outfalls. Small-form dinoflagellates dominated the plankton population in May 2018 (Table 4). These were about 300μm to 1000μm in size. The general patterns of planktonic coastal succession we observed were like those seen before the outfalls were in place, with Spring and Fall diatom blooms and dinoflagellates dominating in the summer (Environmental Protection Agency, 1972. Environmental Impact Statement on Wastewater Treatment Facilities Construction Grants for Nassau and Suffolk Counties, New York).

Table 4. Preliminary planktonic community composition.

Preliminary planktonic community composition (Dominant species in bold)

Cruise I	Cruise II	Cruise III	Cruise IV
Diatoms Thalassiosira, Rhizosolenia, Cerataulina	**Diatom** *Pseudo-nitzschia*	**Dinoflagellates** *Gyrodinium* ***Ciliates*** *Mesodinium rubrum*	**Ciliates** *Strombidium* **Diatoms** *Rhizosolena* **Dinoflagellates**
Dinoflagellates	Diatom *Rhizosolenia,* *Cerataulina,* *guinardi*	Dinoflagellates *Scrippsiella,* *Dinophysis, Polykrikos,* *Alexandrium,* *Prorocentrum,* *Ceratium*	Dinoflagellates *Scrippsiella,* *Alexandrium,* *Prorocentrum,* *Ceratium,* *Gymnodinium*
Ciliates	Dinoflagellates *Scrippsiella*, *Alexandium*	Ciliates *Laboea strobilam,* *Strombidium*	Diatom *Navicula*
Diatoms	Ciliates *Strombidium,* *Pseudotontoni a Myronecta*		Tunicate Larvae
	Rotifer		

Preliminary planktonic community composition (Dominant species in bold)			
Cruise V	Cruise VI	Cruise VII	Cruise VIII
Diatoms *Leptocylindrus sp.* **Ciliates** *Strombidium sp.*	**Diatoms** *Thalassiosira sp.* **Ciliates** *Strombidium sp.*	**Other-** Raphidophyceae: Hetersigma akashiwo Chattonella Prymnesiophyte: Phaeocystis **Ciliates** *Strombidium sp.*	*Analyses pending*
Diatoms *Thalassiosira sp.* *Cheatoceros sp.*	Diatoms *Thalassiosira sp.* *Cheatoceros sp.* *Stephanopyxis sp.* *Cyclotella sp.*	Diatoms *Leptocylindrus sp.* *cylindrotheca sp.*	
Dinoflagellates *Gyrodinium sp.*	Dinoflagellates *Gyrodinium sp.* *Oxytoxum sp.*	Dinoflagellates *Gyrodinium sp.*	.
Ciliates *Mesodinium rubrum*	Ciliates *Mesodinium rubrum*	Ciliates *Mesodinium rubrum*	
Other Unknown rotifer species			

The "Boil. Impacts in the water column were found, as depressions of salinity, mostly within a mile of the discharge point and a "boil" was a persistent feature over the Cedar Creek discharge (Figure 33). Nutrient concentrations in the boil were constantly elevated and organisms characteristic of wastewater (nematodes) were occasionally found. The extent of the boil was limited (estimated to cover an area of about 400 square feet, or less than 40 square meters).

Figure 33. "Boil" seen in the vicinity of the Cedar Creek Outfall in January 2018.

The chief operator of Cedar Creek STP, Dan Ryan, reported that no outfall pipe backpressure issues were noted at the STP and about five years ago the diffuser risers were repaired following net entanglement, sand was also cleared. Fisherpeople apparently reported having seen typically more than one boil visible spread out over the length of the diffuser area. However, acoustic imaging showed a distinct plume. The junction box appeared to be damaged frustrating the diffusers; this was later confirmed by County divers. At current discharge rates, the negative impact of these outfalls local and is limited because the wastewater effluents diffuse quickly into the seawater.

Along a transect of eight water samples was taken in the vicinity of the boil in April, 2018 at a depth of about 1.5 meters, the plankton community was dominated by Pseudo-nitzschia (Table 4) and by large forms (greater than 20 µm).

In the boil samples of Cruise III (May 29 2018) and Cruise VII (March 8 2019), the population of the marine ciliate *Laboea strobili*, a planktonic mixotrophic oligotrich ciliate that requires algae for food, was more than five times larger than that found at the other samples. In the sample taken north of the outfall in May 2018, unidentified (inorganic?) flakes were found (Figure 34). These were about 300µm to 1000µm in size. It may be that this species was at higher abundance at depth and brought to the surface in the buoyant plume from the outfall diffuser.

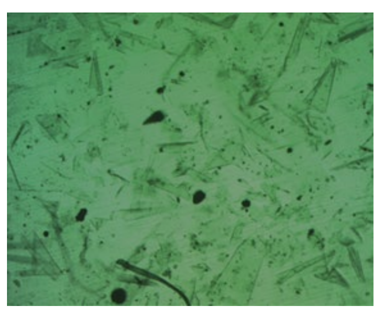

Figure 34. Unidentified flakes seen in the sample was taken north of the SWSD outfall. The field of view (10x) is about 2000 µm.

Conclusions and Recommendations

At current discharge rates, any negative impact of these outfalls is local and limited because the wastewater effluents diffuse quickly into the seawater. However, modeling of both the nearfield and farfield dispersion should be done to guide monitoring impacts on concentration fields, especially if the discharge is increased or new outfall sites are established. Observations of the "boil" at the Cedar Creek site demonstrate that elevated discharge conditions can raise surface nutrient concentrations as well as vector organisms that are characteristic of wastewater (nematodes) to the surface.

The combination of cooler temperature and lower salinity make the plume water slightly denser than the water above it. As a result, monitoring for any water column impacts of the discharge should be especially sensitive to the drift of bottom water. The currents were found to be highly responsive to local winds. Upwelling should be expected in response to both cross-shore and alongshore winds with onshore flow at depth and offshore flow in the upper water column. The northwesterly winds produced offshore flow in the surface layers and significant onshore flow at depth. Southwest winds, prevalent in the summer, stratified period, produce surface drift towards the southeast, a westerly drift at mid-depth and onshore flow at depth. Haline stratification occurs during the early summer, and persistent thermal stratification later in the summer leads to rapid decline in oxygen in bottom waters. Haline stratification events are associated with eastwardly directed surface currents advecting low salinity surface waters from the west. Very little vertical salinity structure was seen in the winter, as expected, although higher salinity was seen at the sea floor on the winter survey, rather than any evidence dilution by fresh (sewage) water.

Benthic sediment habitat appear to be influenced by the outfalls as they alter the migration of sand ridges thus changing the substrate, rather than by the effluent of the discharge points themselves. Although there is a large settling flux of suspended particulates to the sea floor, which would include particulates in the sewage effluent, only a small fraction is incorporated into the bottom sediment. The sea floor is comprised of uniform fine sand with active sediment transport. Wave-induced sediment transport seem to cause scour of sand waves intersecting the diffusers. This disruption the natural migration of sand modifies the substrate and, consequently manifest in the benthic community structure. Gradient in benthic faunal community structure can be attributed at least in part to variation in sediment grain size within the study areas. This impact seems to extend for at last one kilometer from the structures. The activity of the sea floor should be expected at other sites on the Long Island shelf; the distribution of bottom stress due to waves and currents of sediment transport should be widely explored in the context of site selection for any offshore structures.

The compositional seasonal changes of microplanktonic species reflect the common pattern found in the natural population. Except for differences near to, and attributed to, Fire Island Inlet, there seemed to be little variation in the planktonic community structure around the outfalls. The general patterns of planktonic coastal succession we observed were like those seen before the outfalls were in place, In monitoring, Pervasive changes in community structure should not be expected, but the appearance of the a organisms characteristic of wastewater (nematodes) would, of course, signal a direct impact of the discharge.

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Appendix A: Plankton analysis

Three methods were used to determine the plankton community structure and diversity: inverted microscopy, total and size-fractionated chlorophyll a fluorescence and flow cytometry. For microscopy, seawater was collected in 250-ml amber glass bottles, preserved with Lugol's iodine (10% concentration) and kept in the dark. The Utermöhl settling chamber technique was used for quantitative phytoplankton analysis (Edler & Elbrächter, 2010). The settling chamber is constructed with an upper cylinder and a bottom plate with a thin glass. Seventy-five milliliters of sample were aliquoted into the upper chamber and allowed to settle for 24 hours. An Olympus CK2 inverted microscope equipped with an Amscope Microscope Eyepiece Camera Model MU1400 was used to observe the samples. Using a 10x objective, organisms larger than 25 µm were identified and counted to the lowest practical level.

The measurement of total and size-fractionated chlorophyll a were used as a proxy for the biomass of phytoplankton. Filtration of seawater was followed by acetone extraction of chlorophyll and spectrophotometric determination of wavelengths. Seventy and a half milliliters of seawater were aliquoted from a one-liter brown plastic Nalgene bottle and filtered through 25 mm diameter filters of three different pore size (n=3 for each): Whatman Glass Microfiber GF/F, Whatman Nuclepore Track-Etch 3 µm, and Millipore Net Filter 20 µm. Sample filters were kept frozen and stored in a -20° C refrigerator until processing. For processing, 7 mL of 10% acetone was added to each sample and returned to the -20° C freezer for 24 hours. Samples were then removed from the freezer and kept in the dark for one hour. Each sample was analyzed for chlorophyll a content using a Turner Designs Model 10-AU-005-CE Digital Fluorometer. A reading was recorded before acidification (Fo) and after acidification with a few drops of 10% HCL (Fa). Measurements were then used to calculate the chlorophyll a content in µg chl a L-1 as (Fo-Fa)*7 ml/70.5 ml. The chlorophyll a size fraction between 3 µm and 20 µm was calculated by subtracting 20 µm filter concentrations from the 3 µm filter concentration and the fraction greater than 3 µm was calculated by subtracting 3 µm filter concentration from GF/F (0.7 µm) filter concentrations.

A Fluid Imaging Portable FlowCam® was used to analyze seawater samples for particles less than 25 µm. Lens selection was based on manufacturer recommendations. Using a 300 µm flow cell and 4x objective at 0.53 ml minute-1, sample seawater was run using FlowCam Autoimage mode. The minimum detectable particle size was 2 µm. To count particles between 2 µm and 7 µm, each sample was run for 5 minutes with no size cut-off. About 10 ml was then run for 35 minutes (Blanco, 1994) to image particles larger than 7 µm. The concentration of particles (number mL-1) and other parameters were calculated by FlowCam by magnification, flow cell depth, and other context settings.

For comparison with the seawater samples, wastewater effluent from Cedar Creek and Southwest Sewer District Treatment plants were collected in brown Nalgene one-liter bottles. The effluent had been chlorinated and was taken at the last point of collection before entering the pipes leading to the outfall.

The effects of the environmental variables on the phytoplankton community were investigated with redundancy analysis (RDA) using Canoco 4.5. Species abundances were Hellinger transformed, recommended for ordination of species abundance data (Legendre & Gallagher, 2001). The environmental variables used were salinity, dissolved oxygen, temperature, nitrate/nitrite, total nitrogen, ammonia, total organic carbon, latitude (to demarcate distance from shore) and longitude (to demarcate east and west). Forward selection was used to choose the best explanatory variable at each step from a set of candidate predictors. A permutation test was used to test significance of each variable. A minimum value of the small sample, bias adjusted version of the Akaike Information Criterion (AICc) was used to stop the selection process (Akaike, 1973; Banks & Joyner, 2017). Akaike weights were used to account for the variation and uncertainly in the models (Wagenmakers & Farrell, 2004). In all ordination plots, stations are represented by red squares, the environmental variables by red vectors, and species by black vectors. On a vector, the arrowhead represents high, the origin average, and when extended through the origin, the tail of the vector represents low values for that variable. The plot is centered on the average and the direction the arrow points is the maximum direction of increase in that characteristic or species abundance. The closer two stations, the more alike they are in terms of species abundance Shannon diversity (H') was used evaluate the diversity of the plankton species present in the samples. Indices were calculated using the package vegan (Oksanen, 2013) within the R statistical framework (Team, 2018). Shannon Diversity Index (H') is a commonly used index to
characterize the species diversity in a population. It is calculated as

$$H' = -\sum_{i=1}^{S} p_i \ln p_i$$

where pi is the proportion of individuals of each species observed (i=1,…S).

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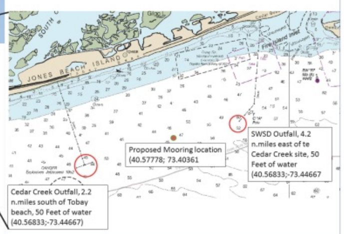
Appendix B

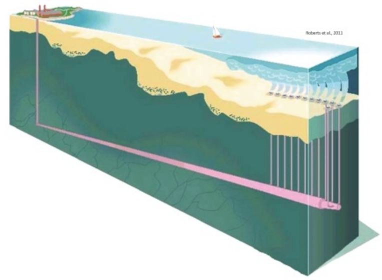
Phytoplankton abundance and composition near wastewater outfalls on Long Island’s coast

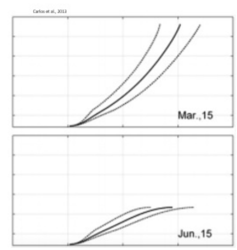
Karin Schweitzer, School of Marine and Atmospheric Sciences, Stony Brook University

To determine the effects of the sewage outfall on the phytoplankton community, composition, and succession

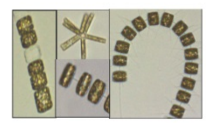


Effluent is less dense than seawater and will be positively buoyant. However, seasonal stratification and strong currents complicate effluent movement.

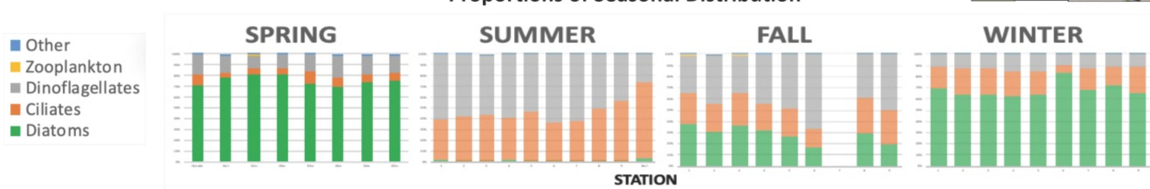




Water samples taken at and around the outfalls over two years to capture seasonal data. The species composition and seasonal succession were similar to those documented before the outfalls were installed and consistent with a North Atlantic coastal annual succession. A diatom bloom was observed in the spring and again in the fall/winter, with dinoflagellates dominating the summer months.

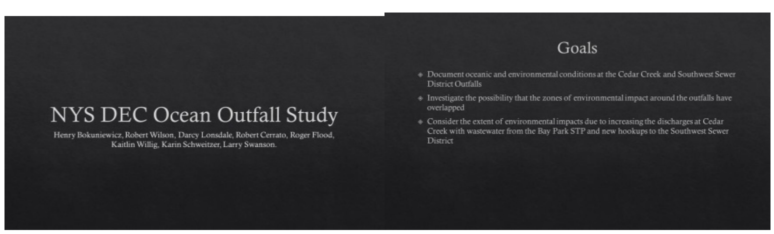


Proportions of Seasonal Distribution



Next Steps: statistical analysis to more fully evaluate planktonic community structure relative to geographical position from the outfall and seasonal succession of dominant planktonic species as well as redundancy analysis with environmental variables such as nutrients.

Appendix C




Approaches
Seasonal ADCP deployments to ascertain the shifting behavior of littoral currents
Seasonal deployments of four SeaCats to document the vertical structure of the water column
Seasonal CTD deployments to determine water column structure outfall plume dynamics
Multibeam surveys at outfall locations to document changes in bathymetry and sediment distribution patterns
Sediment sampling to determine grain size,, benthic community structure, and geochemistry
Phytoplankton surveys to compare with historic surveys prior to construction of the outfalls
Existing Ocean Outfalls
Cedar Creek
Volume discharged 59 MGD
Depth of outfall ~50 ft
Distance from shore 2.2 nm
Treatment level Secondary
Proposed increase in volume due to Bay Park STP 50 MGD
Southwest Sewer District
Volume discharged 27 MGD
Depth of outfall ~50 ft
Distance from shore 2.3 nm
Treatment level Secondary
Proposed increase in volume due to increased sewering 10 MGD
Study Area
Proposed Mooring location (40.57778; 73.40361
SWSD Outfall, 4.2 n.miles east of te Cedar Creek site, 50 Feet of water (40.56833;-73.44667
Cedar Creek Outfall, 2.2 n.miles south of Tobay beach, 50 Feet of water (40.56833;-73.44667)
Deployment of ADCP and SeaCat
Deployment location: 40.5750° N, 73.7382° W
Deployment location: 40.5750° N, 73.4046° W
Signs of the Plume at Station 24 (south of SWSD outfall) 1/25/2018
CTD Profile Station Locations- January, 2018
Cruise I - CTD and Water Samples
Evidence of subsurface plume at station 10, located at the eastern edge of Cedar Creek Outfall 8/2018
CTD and Water Samples taken on Cruise III
Cruise III - CTD and Water Samples
Unidentified flakes seen in the water sample taken at Station 7 above the outfall. Field of view is about 2000 μg
Plankton Communities from first 4 Cruises
No changes in community dynamics 1970's surveys
Multibeam Backscatter Map around Cedar Creek Outfall
3.1x1.6 km area covered
Interpreted to represent 17 bottom types
Locations of benthic samples to be taken on Cruise 4 were chosen to include these bottom types
CTD Casts taken during Multibeam Survey
CTD Casts near each outfall
(bathymetric survey stations)
Cedar Creek Outfall
SWSD Outfall
Lower salinities were found at the surface
Lower salinities were found near the bottom
Station Locations for All Sampling- August 2018
Green- CTD profile stations
Black – sediment sample locations
Sediment sampling locations chosen based on bathymetric survey
All Stations
What's left in Year 1?
Monthly phytoplankton surveys
Second deployment of ADCP and SeaCats
Final CTD profile survey for Year 1
Research Plan for Year 2
4 one-month ADCP and SeaCat deployments
4 CTD surveys
Sediment Sampling
Phytoplankton surveys monthly from February to September
Thank you to our Funding Agency
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
NEW YORK STATE
Questions?

Appendix D Grain-size Data

StatID	Latitude	Longitude	Sample	Depth (ft)	%Sand	%Gravel	%Fines	Mean, Phi	median,Phi	skewness, Phi
A1	40.5676	-73.4701	133	44	99.24%	0.30%	0.46%	1.4983	1.5280	-0.0932
A2	40.5658	-73.4682	132	44	99.86%	0.01%	0.13%	1.4920	1.5120	-0.0649
A3	40.5633	-73.4657	131	44	99.54%	0.27%	0.20%	1.5037	1.5400	-0.1080
A4	40.5622	-73.4647	134	45	99.31%	0.01%	0.68%	1.7507	1.8010	-0.1442
A5	40.5603	-73.4624	135	44	98.99%	0.01%	1.00%	1.5130	1.4340	0.1928
A6	40.5588	-73.4608	136	46	97.53%	2.25%	0.22%	1.5567	1.5880	-0.1080
B1	40.5690	-73.4610	142	45	99.16%	0.10%	0.75%	2.0583	2.0930	-0.1104
B2	40.5673	-73.4590	141	44	98.50%	0.02%	1.48%	1.8963	1.9160	-0.0568
B3	40.5658	-73.4572	140	46	98.35%	0.12%	1.52%	1.8700	1.8820	-0.0332
B4	40.5637	-73.4564	139	47	98.64%	0.22%	1.14%	1.6507	1.6930	-0.1234
B5	40.5617	-73.4542	138	47	99.25%	0.00%	0.75%	1.9230	1.9900	-0.2251
B6	40.5600	-73.4527	137	48	98.80%	0.12%	1.08%	1.8007	1.8550	-0.1648
C1	40.5700	-73.4585	145	43	99.19%	0.00%	0.81%	1.8577	1.8480	0.0345
C2	40.5681	-73.4568	144	46	99.63%	0.05%	0.32%	2.0627	2.1040	-0.1300
C3	40.5664	-73.4547	143	45	98.76%	0.01%	1.23%	1.9480	1.9070	0.1224
C4	40.5644	-73.4518	160	44	99.17%	0.16%	0.67%	1.6500	1.6700	-0.0815
C5	40.5626	-73.4501	159	43	99.44%	0.02%	0.54%	1.6760	1.6940	-0.0787
C6	40.5606	-73.4487	158	44	99.45%	0.00%	0.55%	1.6943	1.7210	-0.0973
D1	40.5714	-73.4562	149	45	99.27%	0.03%	0.70%	1.8747	1.9120	-0.1470
D2	40.5696	-73.4533	150	45	99.12%	0.00%	0.88%	1.6083	1.5810	0.0870
D3	40.5672	-73.4516	151	44	99.06%	0.00%	0.94%	2.1027	2.1410	-0.1276
D4	40.5650	-73.4492	157	44	98.82%	0.19%	0.99%	1.8390	1.8960	-0.1271
D5	40.5634	-73.4473	156	45	99.57%	0.03%	0.40%	1.4750	1.4950	-0.0862
D6	40.5615	-73.4452	155	45	98.37%	0.31%	1.32%	1.4230	1.4610	-0.1161
E1	40.5718	-73.4507	146	43	99.00%	0.00%	0.90%	1.6453	1.6590	-0.0387
E2	40.5696	-73.4489	147	44	99.10%	0.00%	0.90%	1.7627	1.7950	-0.1345
E3	40.5682	-73.4466	148	45	99.42%	0.04%	0.54%	2.2393	2.2910	-0.1640
E4	40.5659	-73.4440	154	47	98.82%	0.22%	0.96%	1.5467	1.4980	0.1490
E5	40.5644	-73.4422	153	45	97.36%	1.71%	0.93%	1.7190	1.7090	0.0286
E6	40.5627	-73.4403	152	44	99.92%	0.00%	0.08%	1.3900	1.3640	0.0763
F1	40.5819	-73.3735	104	51	96.00%	0.37%	3.63%	2.2867	2.3990	-0.2883
F2	40.5812	-73.3707	105	55	92.43%	1.28%	6.29%	2.3227	2.4590	-0.3929
F3	40.5797	-73.3684	106	56	97.43%	0.56%	2.02%	2.1480	2.1930	-0.1268
F4	40.5798	-73.3652	103	55	97.12%	0.13%	2.75%	2.1780	2.2410	-0.1748
F5	40.5775	-73.3630	102	56	96.25%	0.72%	3.03%	2.2417	2.3480	-0.2836
F6	40.5757	-73.3608	101	59	99.71%	0.07%	0.22%	1.4410	1.3810	0.1633
G1	40.5869	-73.3702	112	46	99.07%	0.78%	0.15%	1.9583	1.9760	-0.0545
G2	40.5857	-73.3675	111	46	99.81%	0.19%	0.00%	1.9367	1.9510	-0.0433
G3	40.5842	-73.3653	110	51	98.53%	0.23%	1.24%	1.9790	1.9950	-0.0535
G4	40.5827	-73.3614	107	51	99.55%	0.08%	0.36%	1.8160	1.8850	-0.2076
G5	40.5813	-73.3597	108	54	97.73%	0.12%	2.16%	1.9623	2.0040	-0.1328
G6	40.5794	-73.3576	109	54	98.62%	1.23%	0.15%	1.9833	2.0500	-0.1745
H1	40.5907	-73.3743	113	39	99.82%	0.00%	0.17%	1.8920	1.9230	-0.1209
H2	40.5898	-73.3716	114	42	98.99%	0.31%	0.70%	1.8533	1.8590	-0.0158
H3	40.5885	-73.3695	115	44	99.61%	0.25%	0.14%	1.8513	1.9130	-0.1841
H4	40.5841	-73.3595	127	46	99.70%	0.15%	0.15%	1.6230	1.6840	-0.2273
H5	40.5827	-73.3565	126	46	99.17%	0.06%	0.77%	1.6940	1.7190	-0.0863
H6	40.5806	-73.3546	125	48	98.91%	0.07%	1.02%	1.6127	1.6560	-0.1340
I1	40.5918	-73.3691	118	44	99.74%	0.05%	0.22%	1.9520	1.9760	-0.1434
I2	40.5904	-73.3670	117	42	98.17%	0.36%	1.47%	1.6897	1.7370	-0.1835
I3	40.5890	-73.3650	116	44	98.62%	0.07%	1.31%	1.8597	1.8420	0.0797
I4	40.5893	-73.3580	128	45	99.10%	0.07%	0.83%	1.3293	1.3580	-0.0995
I5	40.5886	-73.3601	129	45	99.52%	0.03%	0.45%	1.4810	1.4730	0.0299
I6	40.5867	-73.3617	130	45	99.15%	0.25%	0.60%	1.5840	1.6330	-0.1765
J1	40.5947	-73.3594	119	45	99.05%	0.38%	0.57%	1.2587	1.2470	0.0362
J2	40.5934	-73.3571	120	43	99.34%	0.12%	0.54%	1.3077	1.3300	-0.0775
J3	40.5908	-73.3594	121	43	98.27%	0.06%	1.67%	1.4407	1.4850	-0.1762
J4	40.5865	-73.3560	124	45	99.15%	0.03%	0.81%	1.4667	1.5070	-0.1545
J5	40.5845	-73.3535	123	48	99.71%	0.00%	0.29%	1.7223	1.7150	0.0323
J6	40.5833	-73.3508	122	48	99.97%	0.03%	0.00%	1.8003	1.7760	0.0705

Appendix E.
Benthic Faunal Data by Sample. Number per 0.04 m^2 van Veen grab sample.

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PC-ORD, 6.08
 4 Apr 2020, 16:05:35

Matrix contents:    60 sites
             by     88 species

DataSummaryBySample
SPECIES COUNTS FOR EACH SAMPLE UNIT


DataSummaryBySample
Sample unit: A1

Acmi     Acanthohaustorius_millsi         35.000
Asoc     Asabellides_oculata               1.000
Casp     Capitella_sp                      1.000
Cave     Caulleriella_venefica            11.000
Chtu     Chiridotea_tuftsi                 2.000
Ecpa     Echinarachnius_parma              1.000
Exdi     Exogone_dispar                   11.000
Grsp     Grandidierella_sp                 1.000
Notm     Notomastus_sp                     2.000
Olsp     Oligochaeta_spp                  16.000
Paca     Parougia_caeca                    1.000
Posp     Polygordius_spp                  87.000
Prwi     Protohaustorius_wigleyi           5.000
Psob     Pseudunciola_obliquua           842.000
Ptte     Ptilanthura_tenuis                3.000
Rhep     Rhepoxynuis_epistomus            25.000
Spbo     Spiophanes_bombyx                 7.000
Spoc     Spiochaetopterus_oculatus         1.000
Spso     Spisula_solidissima               7.000
Teag     Tellina_agilis                    2.000
Trca     Travisia_carnea                   1.000
Unir     Unciola_irrorata                  1.000


DataSummaryBySample
Sample unit: A2

Acmi     Acanthohaustorius_millsi         56.000
Arca     Aricidea_catherinae               1.000
Asoc     Asabellides_oculata               2.000
Chtu     Chiridotea_tuftsi                 2.000
Ecpa     Echinarachnius_parma              1.000
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Exdi	Exogone_dispar	1.000
Kiba	Kirkegaardia_baptisteae	4.000
Nepi	Nepthys_picta	1.000
Olsp	Oligochaeta_spp	1.000
Oner	Onuphis_eremita	1.000
Posp	Polygordius_spp	22.000
Prwi	Protohaustorius_wigleyi	3.000
Psmi	Pseudoleptocuma_minor	1.000
Psob	Pseudunciola_obliquua	810.000
Rhep	Rhepoxynuis_epistomus	41.000
Spbo	Spiophanes_bombyx	4.000
Spoc	Spiochaetopterus_oculatus	2.000
Spso	Spisula_solidissima	4.000
Syse	Syllides_setosa	1.000
Syam	Synchelidium_americanum	1.000
Teag	Tellina_agilis	1.000
Unir	Unciola_irrorata	2.000

DataSummaryBySample
Sample unit: A3

Acmi	Acanthohaustorius_millsi	5.000
Cave	Caulleriella_venefica	25.000
Chtu	Chiridotea_tuftsi	2.000
Ecpa	Echinarachnius_parma	1.000
Exdi	Exogone_dispar	2.000
Iltr	Ilyanassa_trivittata	1.000
Nupr	Nucula_proxima	1.000
Olsp	Oligochaeta_spp	14.000
Oner	Onuphis_eremita	1.000
Paca	Parougia_caeca	1.000
Posp	Polygordius_spp	171.000
Psob	Pseudunciola_obliquua	365.000
Rhep	Rhepoxynuis_epistomus	43.000
Spoc	Spiochaetopterus_oculatus	1.000
Trca	Travisia_carnea	1.000
Unir	Unciola_irrorata	4.000

DataSummaryBySample
Sample unit: A4

Acmi	Acanthohaustorius_millsi	55.000
Casp	Capitella_sp	2.000
Cave	Caulleriella_venefica	3.000
Chtu	Chiridotea_tuftsi	2.000
Ecpa	Echinarachnius_parma	4.000
Edtr	Edotea_triloba	1.000
Kiba	Kirkegaardia_baptisteae	6.000
Lete	Leptosynapta_tenuis	2.000

Mesp	Megalona_sp	1.000
Nesp	Nemertinea_spp	2.000
Notm	Notomastus_sp	3.000
Olsp	Oligochaeta_spp	5.000
Oner	Onuphis_eremita	4.000
Ovoc	Ovalipes_ocellatus	1.000
Paca	Parougia_caeca	1.000
Posp	Polygordius_spp	20.000
Prpy	Prionospio_pygmaeus	1.000
Prwi	Protohaustorius_wigleyi	80.000
Psob	Pseudunciola_obliquua	641.000
Rhep	Rhepoxynuis_epistomus	24.000
Siar	Sigalion_arenicola	2.000
Spbo	Spiophanes_bombyx	1.000
Spoc	Spiochaetopterus_oculatus	5.000
Spso	Spisula_solidissima	4.000
Syse	Syllides_setosa	1.000
Syam	Synchelidium_americanum	1.000
Teag	Tellina_agilis	5.000

DataSummaryBySample
Sample unit: A5

Acmi	Acanthohaustorius_millsi	7.000
Arca	Aricidea_catherinae	1.000
Asoc	Asabellides_oculata	1.000
Cave	Caulleriella_venefica	14.000
Euzo	Euclymene_zonalis	1.000
Exdi	Exogone_dispar	4.000
Kiba	Kirkegaardia_baptisteae	1.000
Nupr	Nucula_proxima	2.000
Olsp	Oligochaeta_spp	2.000
Paca	Parougia_caeca	1.000
Posp	Polygordius_spp	78.000
Psob	Pseudunciola_obliquua	1019.000
Rhep	Rhepoxynuis_epistomus	26.000
Spbo	Spiophanes_bombyx	1.000
Spoc	Spiochaetopterus_oculatus	2.000
Spso	Spisula_solidissima	11.000
Syse	Syllides_setosa	2.000
Syam	Synchelidium_americanum	1.000
Tusp	Turbellaria_sp	1.000
Unir	Unciola_irrorata	3.000

DataSummaryBySample
Sample unit: A6

Acmi	Acanthohaustorius_millsi	66.000
Amsp	Ampelisca_spp	1.000

Asoc	Asabellides_oculata	2.000
Cave	Caulleriella_venefica	9.000
Chtu	Chiridotea_tuftsi	2.000
Ecpa	Echinarachnius_parma	4.000
Endi	Ensis_directus	1.000
Exdi	Exogone_dispar	1.000
Kiba	Kirkegaardia_baptisteae	1.000
Nepi	Nepthys_picta	1.000
Notm	Notomastus_sp	1.000
Olsp	Oligochaeta_spp	14.000
Oner	Onuphis_eremita	1.000
Posp	Polygordius_spp	205.000
Prwi	Protohaustorius_wigleyi	16.000
Psmi	Pseudoleptocuma_minor	2.000
Psob	Pseudunciola_obliquua	908.000
Rhep	Rhepoxynuis_epistomus	49.000
Siar	Sigalion_arenicola	1.000
Spbo	Spiophanes_bombyx	5.000
Spoc	Spiochaetopterus_oculatus	1.000
Spso	Spisula_solidissima	11.000
Teag	Tellina_agilis	1.000

DataSummaryBySample
Sample unit: B1

Arwa	Aricidea_wassi	7.000
Asoc	Asabellides_oculata	15.000
Casp	Capitella_sp	1.000
Cave	Caulleriella_venefica	28.000
Chtu	Chiridotea_tuftsi	1.000
Ecpa	Echinarachnius_parma	5.000
Glam	Glycera_americana	1.000
Grsp	Grandidierella_sp	3.000
Kiba	Kirkegaardia_baptisteae	2.000
Mesp	Megalona_sp	1.000
Nesp	Nemertinea_spp	3.000
Nepi	Nepthys_picta	2.000
Nedu	Neverita_duplicata	1.000
Notm	Notomastus_sp	16.000
Olsp	Oligochaeta_spp	11.000
Oner	Onuphis_eremita	4.000
Orsw	Orbinia_swani	1.000
Posp	Polygordius_spp	5.000
Prpy	Prionospio_pygmaeus	2.000
Prwi	Protohaustorius_wigleyi	43.000
Psmi	Pseudoleptocuma_minor	1.000
Psob	Pseudunciola_obliquua	44.000
Ptte	Ptilanthura_tenuis	2.000
Siar	Sigalion_arenicola	1.000
Sico	Siliqua_costata	1.000

Spbo	Spiophanes_bombyx	14.000
Spoc	Spiochaetopterus_oculatus	3.000
Spso	Spisula_solidissima	6.000
Syam	Synchelidium_americanum	1.000
Teag	Tellina_agilis	3.000
Trca	Travisia_carnea	5.000

DataSummaryBySample
Sample unit: B2

Amsp	Ampelisca_spp	3.000
Arwa	Aricidea_wassi	15.000
Asoc	Asabellides_oculata	1.000
Cave	Caulleriella_venefica	26.000
Chtu	Chiridotea_tuftsi	2.000
Ecpa	Echinarachnius_parma	6.000
Lyar	Lyonsia_arenosa	1.000
Nepi	Nepthys_picta	2.000
Notm	Notomastus_sp	17.000
Notc	Notocirrus_spiniferus	1.000
Olsp	Oligochaeta_spp	27.000
Posp	Polygordius_spp	36.000
Prpy	Prionospio_pygmaeus	30.000
Prwi	Protohaustorius_wigleyi	20.000
Psob	Pseudunciola_obliquua	2.000
Ptte	Ptilanthura_tenuis	1.000
Siar	Sigalion_arenicola	1.000
Spbo	Spiophanes_bombyx	15.000
Spso	Spisula_solidissima	4.000
Syam	Synchelidium_americanum	1.000
Teag	Tellina_agilis	3.000

DataSummaryBySample
Sample unit: B3

Amsp	Ampelisca_spp	83.000
Arwa	Aricidea_wassi	11.000
Asoc	Asabellides_oculata	1.000
Cave	Caulleriella_venefica	10.000
Drlo	Drilonereis_longa	1.000
Ecpa	Echinarachnius_parma	3.000
Glam	Glycera_americana	1.000
Grsp	Grandidierella_sp	2.000
Kiba	Kirkegaardia_baptisteae	6.000
Mesp	Megalona_sp	1.000
Nesp	Nemertinea_spp	1.000
Nepi	Nepthys_picta	2.000
Notm	Notomastus_sp	10.000
Notc	Notocirrus_spiniferus	1.000

Oner	Onuphis_eremita	2.000
Phar	Phyllodoce_arenae	3.000
Posp	Polygordius_spp	36.000
Prpy	Prionospio_pygmaeus	78.000
Prwi	Protohaustorius_wigleyi	1.000
Psob	Pseudunciola_obliquua	2.000
Siar	Sigalion_arenicola	1.000
Spbo	Spiophanes_bombyx	11.000
Spoc	Spiochaetopterus_oculatus	2.000
Spso	Spisula_solidissima	4.000
Syam	Synchelidium_americanum	2.000

DataSummaryBySample
Sample unit: B4

Amsp	Ampelisca_spp	1.000
Arwa	Aricidea_wassi	2.000
Cave	Caulleriella_venefica	6.000
Exdi	Exogone_dispar	1.000
Glam	Glycera_americana	1.000
Kiba	Kirkegaardia_baptisteae	2.000
Nesp	Nemertinea_spp	1.000
Nepi	Nepthys_picta	5.000
Notm	Notomastus_sp	18.000
Olsp	Oligochaeta_spp	3.000
Oner	Onuphis_eremita	3.000
Posp	Polygordius_spp	20.000
Prwi	Protohaustorius_wigleyi	19.000
Psob	Pseudunciola_obliquua	13.000
Ptte	Ptilanthura_tenuis	2.000
Spbo	Spiophanes_bombyx	1.000
Spoc	Spiochaetopterus_oculatus	4.000
Spso	Spisula_solidissima	10.000
Unir	Unciola_irrorata	5.000

DataSummaryBySample
Sample unit: B5

Acmi	Acanthohaustorius_millsi	3.000
Arwa	Aricidea_wassi	5.000
Asoc	Asabellides_oculata	3.000
Cave	Caulleriella_venefica	9.000
Chtu	Chiridotea_tuftsi	8.000
Crme	Crab_megalopa	1.000
Ecpa	Echinarachnius_parma	4.000
Edtr	Edotea_triloba	1.000
Exdi	Exogone_dispar	2.000
Grsp	Grandidierella_sp	2.000
Kiba	Kirkegaardia_baptisteae	6.000

Mesp	Megalona_sp	1.000
Nepi	Nepthys_picta	1.000
Notm	Notomastus_sp	9.000
Olsp	Oligochaeta_spp	5.000
Oner	Onuphis_eremita	2.000
Oxsm	Oxyurostylis_smithii	1.000
Paca	Parougia_caeca	2.000
Posp	Polygordius_spp	45.000
Prpy	Prionospio_pygmaeus	1.000
Prwi	Protohaustorius_wigleyi	61.000
Psob	Pseudunciola_obliquua	305.000
Ptte	Ptilanthura_tenuis	2.000
Rhep	Rhepoxynuis_epistomus	5.000
Siar	Sigalion_arenicola	2.000
Spbo	Spiophanes_bombyx	2.000
Spoc	Spiochaetopterus_oculatus	2.000
Spso	Spisula_solidissima	11.000
Teag	Tellina_agilis	4.000
Unir	Unciola_irrorata	1.000

DataSummaryBySample
Sample unit: B6

Acmi	Acanthohaustorius_millsi	4.000
Arwa	Aricidea_wassi	5.000
Asoc	Asabellides_oculata	1.000
Cair	Cancer_irroratus	1.000
Cave	Caulleriella_venefica	11.000
Drlo	Drilonereis_longa	1.000
Ecpa	Echinarachnius_parma	5.000
Euhe	Euspira_heros	1.000
Exdi	Exogone_dispar	2.000
Grsp	Grandidierella_sp	2.000
Kiba	Kirkegaardia_baptisteae	3.000
Lero	Leitoscoloplos_robustus	1.000
Mesp	Megalona_sp	3.000
Nesp	Nemertinea_spp	1.000
Nepi	Nepthys_picta	4.000
Notm	Notomastus_sp	9.000
Oner	Onuphis_eremita	4.000
Oxsm	Oxyurostylis_smithii	1.000
Posp	Polygordius_spp	11.000
Prpy	Prionospio_pygmaeus	1.000
Prwi	Protohaustorius_wigleyi	44.000
Psob	Pseudunciola_obliquua	126.000
Ptte	Ptilanthura_tenuis	1.000
Rhep	Rhepoxynuis_epistomus	10.000
Spbo	Spiophanes_bombyx	4.000
Spoc	Spiochaetopterus_oculatus	6.000
Spso	Spisula_solidissima	2.000

Syam	Synchelidium_americanum	1.000
Teag	Tellina_agilis	3.000
Unir	Unciola_irrorata	1.000

DataSummaryBySample
Sample unit: C1

Acmi	Acanthohaustorius_millsi	50.000
Arca	Aricidea_catherinae	1.000
Arwa	Aricidea_wassi	1.000
Cave	Caulleriella_venefica	2.000
Chtu	Chiridotea_tuftsi	7.000
Ecpa	Echinarachnius_parma	4.000
Grsp	Grandidierella_sp	2.000
Mesp	Megalona_sp	1.000
Nepi	Nepthys_picta	1.000
Notm	Notomastus_sp	1.000
Olsp	Oligochaeta_spp	7.000
Posp	Polygordius_spp	25.000
Prpy	Prionospio_pygmaeus	1.000
Prwi	Protohaustorius_wigleyi	85.000
Psob	Pseudunciola_obliquua	257.000
Rhep	Rhepoxynuis_epistomus	57.000
Siar	Sigalion_arenicola	1.000
Spbo	Spiophanes_bombyx	10.000
Spoc	Spiochaetopterus_oculatus	2.000
Spso	Spisula_solidissima	7.000
Syam	Synchelidium_americanum	1.000
Teag	Tellina_agilis	4.000
Trca	Travisia_carnea	6.000
Tusp	Turbellaria_sp	1.000

DataSummaryBySample
Sample unit: C2

Amsp	Ampelisca_spp	1.000
Arwa	Aricidea_wassi	8.000
Asoc	Asabellides_oculata	2.000
Cave	Caulleriella_venefica	23.000
Chtu	Chiridotea_tuftsi	1.000
Drlo	Drilonereis_longa	1.000
Ecpa	Echinarachnius_parma	1.000
Endi	Ensis_directus	1.000
Kiba	Kirkegaardia_baptisteae	7.000
Mesp	Megalona_sp	1.000
Nesp	Nemertinea_spp	2.000
Nepi	Nepthys_picta	2.000
Notm	Notomastus_sp	9.000
Olsp	Oligochaeta_spp	29.000

Oner	Onuphis_eremita	1.000
Posp	Polygordius_spp	43.000
Prpy	Prionospio_pygmaeus	19.000
Prwi	Protohaustorius_wigleyi	9.000
Psob	Pseudunciola_obliquua	1.000
Ptte	Ptilanthura_tenuis	1.000
Siar	Sigalion_arenicola	1.000
Spbo	Spiophanes_bombyx	13.000
Spoc	Spiochaetopterus_oculatus	2.000
Spso	Spisula_solidissima	5.000
Trca	Travisia_carnea	1.000
Unir	Unciola_irrorata	2.000

DataSummaryBySample
Sample unit: C3

Amsp	Ampelisca_spp	50.000
Arwa	Aricidea_wassi	11.000
Asoc	Asabellides_oculata	5.000
Cave	Caulleriella_venefica	45.000
Ecpa	Echinarachnius_parma	1.000
Exdi	Exogone_dispar	2.000
Glam	Glycera_americana	2.000
Grsp	Grandidierella_sp	1.000
Kiba	Kirkegaardia_baptisteae	4.000
Lero	Leitoscoloplos_robustus	1.000
Nepi	Nepthys_picta	9.000
Notc	Notocirrus_spiniferus	19.000
Olsp	Oligochaeta_spp	16.000
Oner	Onuphis_eremita	3.000
Phar	Phyllodoce_arenae	1.000
Posp	Polygordius_spp	50.000
Prpy	Prionospio_pygmaeus	182.000
Prwi	Protohaustorius_wigleyi	2.000
Ptte	Ptilanthura_tenuis	1.000
Spbo	Spiophanes_bombyx	2.000
Spoc	Spiochaetopterus_oculatus	10.000
Spso	Spisula_solidissima	5.000
Syam	Synchelidium_americanum	1.000
Teag	Tellina_agilis	3.000
Unir	Unciola_irrorata	8.000

DataSummaryBySample
Sample unit: C4

Acmi	Acanthohaustorius_millsi	66.000
Cave	Caulleriella_venefica	14.000
Chtu	Chiridotea_tuftsi	4.000
Crme	Crab_megalopa	2.000

Ecpa	Echinarachnius_parma	1.000
Exdi	Exogone_dispar	8.000
Iltr	Ilyanassa_trivittata	2.000
Kiba	Kirkegaardia_baptisteae	1.000
Nepi	Nepthys_picta	1.000
Notm	Notomastus_sp	1.000
Palo	Pagurus_longicarpus	6.000
Posp	Polygordius_spp	180.000
Prwi	Protohaustorius_wigleyi	20.000
Psmi	Pseudoleptocuma_minor	3.000
Psob	Pseudunciola_obliquua	1360.000
Ptte	Ptilanthura_tenuis	1.000
Rhep	Rhepoxynuis_epistomus	43.000
Siar	Sigalion_arenicola	1.000
Spbo	Spiophanes_bombyx	2.000
Spso	Spisula_solidissima	2.000
Syse	Syllides_setosa	2.000
Unir	Unciola_irrorata	1.000

DataSummaryBySample
Sample unit: C5

Acmi	Acanthohaustorius_millsi	53.000
Arca	Aricidea_catherinae	3.000
Casp	Capitella_sp	1.000
Cave	Caulleriella_venefica	3.000
Ceam	Ceriantheopsis_americana	1.000
Crme	Crab_megalopa	1.000
Dicu	Diopatra_cuprea	1.000
Ecpa	Echinarachnius_parma	1.000
Exdi	Exogone_dispar	7.000
Glam	Glycera_americana	1.000
Grsp	Grandidierella_sp	1.000
Lyar	Lyonsia_arenosa	2.000
Notm	Notomastus_sp	1.000
Olsp	Oligochaeta_spp	4.000
Palo	Pagurus_longicarpus	2.000
Posp	Polygordius_spp	220.000
Psmi	Pseudoleptocuma_minor	1.000
Psob	Pseudunciola_obliquua	880.000
Rhep	Rhepoxynuis_epistomus	58.000
Spbo	Spiophanes_bombyx	4.000
Spso	Spisula_solidissima	8.000
Teag	Tellina_agilis	2.000
Unir	Unciola_irrorata	3.000

DataSummaryBySample
Sample unit: C6

Acmi	Acanthohaustorius_millsi	17.000
Arwa	Aricidea_wassi	1.000
Cave	Caulleriella_venefica	6.000
Chtu	Chiridotea_tuftsi	2.000
Ecpa	Echinarachnius_parma	2.000
Edtr	Edotea_triloba	1.000
Kiba	Kirkegaardia_baptisteae	1.000
Nepi	Nepthys_picta	2.000
Oner	Onuphis_eremita	1.000
Posp	Polygordius_spp	85.000
Prpy	Prionospio_pygmaeus	1.000
Prwi	Protohaustorius_wigleyi	6.000
Psob	Pseudunciola_obliquua	1347.000
Ptte	Ptilanthura_tenuis	2.000
Rhep	Rhepoxynuis_epistomus	22.000
Spbo	Spiophanes_bombyx	5.000
Spoc	Spiochaetopterus_oculatus	1.000
Syse	Syllides_setosa	2.000
Teag	Tellina_agilis	2.000
Unir	Unciola_irrorata	1.000

DataSummaryBySample
Sample unit: D1

Acmi	Acanthohaustorius_millsi	40.000
Cave	Caulleriella_venefica	4.000
Ecpa	Echinarachnius_parma	3.000
Edtr	Edotea_triloba	3.000
Exdi	Exogone_dispar	2.000
Mesp	Megalona_sp	1.000
Nepi	Nepthys_picta	1.000
Notm	Notomastus_sp	1.000
Olsp	Oligochaeta_spp	4.000
Oner	Onuphis_eremita	2.000
Paca	Parougia_caeca	1.000
Pafu	Paraonis_fulgens	1.000
Posp	Polygordius_spp	177.000
Prwi	Protohaustorius_wigleyi	27.000
Psmi	Pseudoleptocuma_minor	2.000
Psob	Pseudunciola_obliquua	1038.000
Ptte	Ptilanthura_tenuis	1.000
Rhep	Rhepoxynuis_epistomus	17.000
Spbo	Spiophanes_bombyx	5.000
Spoc	Spiochaetopterus_oculatus	2.000
Spso	Spisula_solidissima	2.000
Taps	Tanaissus_psammophilus	1.000
Teag	Tellina_agilis	2.000
Trca	Travisia_carnea	2.000
Tusp	Turbellaria_sp	1.000
Unir	Unciola_irrorata	2.000

DataSummaryBySample
Sample unit: D2

Acmi	Acanthohaustorius_millsi	24.000
Cave	Caulleriella_venefica	4.000
Chtu	Chiridotea_tuftsi	1.000
Kiba	Kirkegaardia_baptisteae	2.000
Notm	Notomastus_sp	1.000
Olsp	Oligochaeta_spp	1.000
Paca	Parougia_caeca	1.000
Posp	Polygordius_spp	70.000
Prpy	Prionospio_pygmaeus	1.000
Prwi	Protohaustorius_wigleyi	14.000
Psmi	Pseudoleptocuma_minor	1.000
Psob	Pseudunciola_obliquua	858.000
Ptte	Ptilanthura_tenuis	1.000
Rhep	Rhepoxynuis_epistomus	11.000
Siar	Sigalion_arenicola	1.000
Spso	Spisula_solidissima	3.000
Teag	Tellina_agilis	4.000
Trca	Travisia_carnea	1.000
Tusp	Turbellaria_sp	1.000
Unir	Unciola_irrorata	1.000

DataSummaryBySample
Sample unit: D3

Acmi	Acanthohaustorius_millsi	44.000
Arca	Aricidea_catherinae	1.000
Arwa	Aricidea_wassi	1.000
Asoc	Asabellides_oculata	2.000
Cave	Caulleriella_venefica	4.000
Chtu	Chiridotea_tuftsi	1.000
Diun	Dispio_uncinata	2.000
Edtr	Edotea_triloba	1.000
Exdi	Exogone_dispar	1.000
Lyar	Lyonsia_arenosa	1.000
Mesp	Megalona_sp	1.000
Nepi	Nepthys_picta	1.000
Notm	Notomastus_sp	1.000
Notc	Notocirrus_spiniferus	1.000
Oxsm	Oxyurostylis_smithii	1.000
Posp	Polygordius_spp	154.000
Prwi	Protohaustorius_wigleyi	31.000
Psmi	Pseudoleptocuma_minor	1.000
Psob	Pseudunciola_obliquua	930.000
Ptte	Ptilanthura_tenuis	5.000
Rhep	Rhepoxynuis_epistomus	17.000

Siar	Sigalion_arenicola	1.000
Spbo	Spiophanes_bombyx	4.000
Spoc	Spiochaetopterus_oculatus	3.000
Spso	Spisula_solidissima	11.000
Teag	Tellina_agilis	3.000
Trca	Travisia_carnea	3.000

DataSummaryBySample
Sample unit: D4

Acmi	Acanthohaustorius_millsi	7.000
Arca	Aricidea_catherinae	3.000
Asoc	Asabellides_oculata	10.000
Cave	Caulleriella_venefica	39.000
Cotu	Corophium_tuberculatum	36.000
Crju	Crepidula_juvspp	18.000
Dicu	Diopatra_cuprea	1.000
Endi	Ensis_directus	1.000
Euzo	Euclymene_zonalis	3.000
Exdi	Exogone_dispar	20.000
Grsp	Grandidierella_sp	1.000
Haex	Harmothoe_extenuata	1.000
Kiba	Kirkegaardia_baptisteae	2.000
Lyar	Lyonsia_arenosa	1.000
Olsp	Oligochaeta_spp	27.000
Paca	Parougia_caeca	2.000
Posp	Polygordius_spp	25.000
Psob	Pseudunciola_obliquua	1036.000
Ptte	Ptilanthura_tenuis	1.000
Rhep	Rhepoxynuis_epistomus	6.000
Siar	Sigalion_arenicola	2.000
Spbo	Spiophanes_bombyx	3.000
Spoc	Spiochaetopterus_oculatus	1.000
Spso	Spisula_solidissima	1.000
Syse	Syllides_setosa	10.000
Teag	Tellina_agilis	3.000
Unir	Unciola_irrorata	1.000

DataSummaryBySample
Sample unit: D5

Asoc	Asabellides_oculata	2.000
Cave	Caulleriella_venefica	32.000
Chtu	Chiridotea_tuftsi	1.000
Ecpa	Echinarachnius_parma	2.000
Endi	Ensis_directus	1.000
Euzo	Euclymene_zonalis	2.000
Exdi	Exogone_dispar	54.000
Nepi	Nepthys_picta	1.000

Notm	Notomastus_sp	1.000
Nupr	Nucula_proxima	3.000
Olsp	Oligochaeta_spp	7.000
Paca	Parougia_caeca	4.000
Posp	Polygordius_spp	52.000
Prwi	Protohaustorius_wigleyi	1.000
Psob	Pseudunciola_obliquua	894.000
Rhep	Rhepoxynuis_epistomus	9.000
Spoc	Spiochaetopterus_oculatus	1.000
Spso	Spisula_solidissima	8.000
Syse	Syllides_setosa	17.000
Taps	Tanaissus_psammophilus	1.000
Teag	Tellina_agilis	5.000

DataSummaryBySample
Sample unit: D6

Acmi	Acanthohaustorius_millsi	11.000
Arca	Aricidea_catherinae	2.000
Arwa	Aricidea_wassi	1.000
Asoc	Asabellides_oculata	2.000
Cave	Caulleriella_venefica	14.000
Ceam	Ceriantheopsis_americana	1.000
Chtu	Chiridotea_tuftsi	1.000
Cotu	Corophium_tuberculatum	1.000
Crju	Crepidula_juvspp	1.000
Dicu	Diopatra_cuprea	1.000
Ecpa	Echinarachnius_parma	3.000
Endi	Ensis_directus	1.000
Euzo	Euclymene_zonalis	1.000
Exdi	Exogone_dispar	24.000
Iltr	Ilyanassa_trivittata	1.000
Kiba	Kirkegaardia_baptisteae	1.000
Olsp	Oligochaeta_spp	28.000
Oner	Onuphis_eremita	2.000
Oxsm	Oxyurostylis_smithii	2.000
Palo	Pagurus_longicarpus	1.000
Posp	Polygordius_spp	60.000
Prwi	Protohaustorius_wigleyi	4.000
Psmi	Pseudoleptocuma_minor	1.000
Psob	Pseudunciola_obliquua	1142.000
Rhep	Rhepoxynuis_epistomus	28.000
Spbo	Spiophanes_bombyx	3.000
Spoc	Spiochaetopterus_oculatus	1.000
Spso	Spisula_solidissima	7.000
Syse	Syllides_setosa	11.000
Syam	Synchelidium_americanum	1.000
Teag	Tellina_agilis	3.000
Unir	Unciola_irrorata	2.000

DataSummaryBySample
Sample unit: E1

Acmi	Acanthohaustorius_millsi	39.000
Asoc	Asabellides_oculata	1.000
Cave	Caulleriella_venefica	3.000
Chtu	Chiridotea_tuftsi	4.000
Crme	Crab_megalopa	1.000
Exdi	Exogone_dispar	2.000
Nepi	Nepthys_picta	1.000
Palo	Pagurus_longicarpus	1.000
Posp	Polygordius_spp	178.000
Prwi	Protohaustorius_wigleyi	2.000
Psob	Pseudunciola_obliquua	413.000
Ptte	Ptilanthura_tenuis	1.000
Rhep	Rhepoxynuis_epistomus	40.000
Spbo	Spiophanes_bombyx	8.000
Spso	Spisula_solidissima	7.000
Teag	Tellina_agilis	3.000
Trca	Travisia_carnea	1.000
Unir	Unciola_irrorata	1.000

DataSummaryBySample
Sample unit: E2

Acmi	Acanthohaustorius_millsi	60.000
Asoc	Asabellides_oculata	1.000
Cave	Caulleriella_venefica	7.000
Chtu	Chiridotea_tuftsi	2.000
Exdi	Exogone_dispar	3.000
Kiba	Kirkegaardia_baptisteae	1.000
Lyar	Lyonsia_arenosa	1.000
Posp	Polygordius_spp	29.000
Prpy	Prionospio_pygmaeus	1.000
Prwi	Protohaustorius_wigleyi	6.000
Psob	Pseudunciola_obliquua	679.000
Ptte	Ptilanthura_tenuis	1.000
Rhep	Rhepoxynuis_epistomus	44.000
Siar	Sigalion_arenicola	1.000
Spbo	Spiophanes_bombyx	6.000
Spso	Spisula_solidissima	3.000
Unir	Unciola_irrorata	3.000

DataSummaryBySample
Sample unit: E3

Acmi	Acanthohaustorius_millsi	20.000
Asoc	Asabellides_oculata	2.000

Ecpa	Echinarachnius_parma	1.000
Endi	Ensis_directus	1.000
Exdi	Exogone_dispar	2.000
Kiba	Kirkegaardia_baptisteae	1.000
Nepi	Nepthys_picta	1.000
Notm	Notomastus_sp	1.000
Pafu	Paraonis_fulgens	1.000
Phar	Phyllodoce_arenae	1.000
Posp	Polygordius_spp	24.000
Prwi	Protohaustorius_wigleyi	8.000
Psmi	Pseudoleptocuma_minor	2.000
Psob	Pseudunciola_obliquua	740.000
Rhep	Rhepoxynuis_epistomus	15.000
Siar	Sigalion_arenicola	1.000
Spbo	Spiophanes_bombyx	5.000
Spoc	Spiochaetopterus_oculatus	2.000
Spso	Spisula_solidissima	1.000
Syse	Syllides_setosa	1.000
Teag	Tellina_agilis	7.000
Trca	Travisia_carnea	2.000

DataSummaryBySample
Sample unit: E4

Acmi	Acanthohaustorius_millsi	22.000
Asoc	Asabellides_oculata	3.000
Casp	Capitella_sp	1.000
Cave	Caulleriella_venefica	11.000
Chtu	Chiridotea_tuftsi	2.000
Cotu	Corophium_tuberculatum	1.000
Crme	Crab_megalopa	1.000
Ecpa	Echinarachnius_parma	1.000
Edtr	Edotea_triloba	1.000
Exdi	Exogone_dispar	2.000
Nepi	Nepthys_picta	2.000
Olsp	Oligochaeta_spp	13.000
Oner	Onuphis_eremita	4.000
Phar	Phyllodoce_arenae	2.000
Posp	Polygordius_spp	87.000
Prwi	Protohaustorius_wigleyi	1.000
Psob	Pseudunciola_obliquua	719.000
Ptte	Ptilanthura_tenuis	1.000
Rhep	Rhepoxynuis_epistomus	23.000
Spbo	Spiophanes_bombyx	5.000
Spoc	Spiochaetopterus_oculatus	2.000
Spso	Spisula_solidissima	3.000
Syse	Syllides_setosa	3.000
Syam	Synchelidium_americanum	1.000
Taps	Tanaissus_psammophilus	1.000
Teag	Tellina_agilis	3.000

Unir	Unciola_irrorata	5.000

DataSummaryBySample
Sample unit: E5

Acmi	Acanthohaustorius_millsi	26.000
Arca	Aricidea_catherinae	4.000
Asoc	Asabellides_oculata	3.000
Cave	Caulleriella_venefica	24.000
Chtu	Chiridotea_tuftsi	4.000
Crme	Crab_megalopa	1.000
Ecpa	Echinarachnius_parma	1.000
Edtr	Edotea_triloba	1.000
Endi	Ensis_directus	1.000
Euzo	Euclymene_zonalis	1.000
Exdi	Exogone_dispar	10.000
Kiba	Kirkegaardia_baptisteae	6.000
Lyar	Lyonsia_arenosa	1.000
Nepi	Nepthys_picta	3.000
Nupr	Nucula_proxima	1.000
Olsp	Oligochaeta_spp	17.000
Paca	Parougia_caeca	4.000
Posp	Polygordius_spp	45.000
Prwi	Protohaustorius_wigleyi	4.000
Psmi	Pseudoleptocuma_minor	1.000
Psob	Pseudunciola_obliquua	1775.000
Rhep	Rhepoxynuis_epistomus	23.000
Spbo	Spiophanes_bombyx	3.000
Spoc	Spiochaetopterus_oculatus	2.000
Spso	Spisula_solidissima	12.000
Syse	Syllides_setosa	8.000
Syam	Synchelidium_americanum	1.000
Taps	Tanaissus_psammophilus	1.000
Teag	Tellina_agilis	7.000
Trca	Travisia_carnea	1.000
Unir	Unciola_irrorata	1.000

DataSummaryBySample
Sample unit: E6

Acmi	Acanthohaustorius_millsi	4.000
Antr	Anadara_transversa	1.000
Arca	Aricidea_catherinae	1.000
Asoc	Asabellides_oculata	4.000
Casp	Capitella_sp	1.000
Cave	Caulleriella_venefica	24.000
Ceam	Ceriantheopsis_americana	1.000
Cotu	Corophium_tuberculatum	24.000
Crju	Crepidula_juvspp	10.000

Ecpa	Echinarachnius_parma	4.000
Epmu	Epitonium_multistriatum	1.000
Euzo	Euclymene_zonalis	1.000
Exdi	Exogone_dispar	17.000
Haex	Harmothoe_extenuata	1.000
Iltr	Ilyanassa_trivittata	2.000
Kiba	Kirkegaardia_baptisteae	6.000
Near	Neanthes_arenaceodentata	6.000
Nesp	Nemertinea_spp	1.000
Olsp	Oligochaeta_spp	58.000
Paca	Parougia_caeca	3.000
Posp	Polygordius_spp	47.000
Prwi	Protohaustorius_wigleyi	9.000
Psob	Pseudunciola_obliquua	1167.000
Ptte	Ptilanthura_tenuis	1.000
Rhep	Rhepoxynuis_epistomus	39.000
Spbo	Spiophanes_bombyx	6.000
Spoc	Spiochaetopterus_oculatus	1.000
Spso	Spisula_solidissima	3.000
Syse	Syllides_setosa	13.000
Teag	Tellina_agilis	4.000

DataSummaryBySample
Sample unit: F1

Amsp	Ampelisca_spp	127.000
Asoc	Asabellides_oculata	2.000
Crme	Crab_megalopa	1.000
Drlo	Drilonereis_longa	1.000
Iltr	Ilyanassa_trivittata	1.000
Lero	Leitoscoloplos_robustus	3.000
Nepi	Nepthys_picta	4.000
Notm	Notomastus_sp	1.000
Phar	Phyllodoce_arenae	1.000
Poco	Polydora_cornuta	1.000
Posp	Polygordius_spp	2.000
Prpy	Prionospio_pygmaeus	123.000
Psmi	Pseudoleptocuma_minor	1.000
Spbo	Spiophanes_bombyx	9.000
Spoc	Spiochaetopterus_oculatus	2.000
Teag	Tellina_agilis	2.000
Unir	Unciola_irrorata	7.000

DataSummaryBySample
Sample unit: F2

Amsp	Ampelisca_spp	154.000
Asoc	Asabellides_oculata	2.000
Clto	Clymenella_torquata	1.000

Cotu	Corophium_tuberculatum	1.000
Crme	Crab_megalopa	1.000
Crju	Crepidula_juvspp	1.000
Dicu	Diopatra_cuprea	2.000
Glam	Glycera_americana	1.000
Iltr	Ilyanassa_trivittata	1.000
Kiba	Kirkegaardia_baptisteae	1.000
Lero	Leitoscoloplos_robustus	1.000
Notm	Notomastus_sp	23.000
Olsp	Oligochaeta_spp	48.000
Paan	Pagurus_annulipes	3.000
Papo	Pagurus_pollicaris	1.000
Phar	Phyllodoce_arenae	1.000
Poco	Polydora_cornuta	18.000
Posp	Polygordius_spp	60.000
Prpy	Prionospio_pygmaeus	142.000
Psob	Pseudunciola_obliquua	1.000
Savu	Sabellaria_vulgaris	2.000
Spbo	Spiophanes_bombyx	16.000
Spoc	Spiochaetopterus_oculatus	2.000
Spso	Spisula_solidissima	5.000
Teag	Tellina_agilis	3.000
Unir	Unciola_irrorata	33.000

DataSummaryBySample
Sample unit: F3

Amsp	Ampelisca_spp	276.000
Arwa	Aricidea_wassi	7.000
Crju	Crepidula_juvspp	2.000
Ecpa	Echinarachnius_parma	7.000
Iltr	Ilyanassa_trivittata	2.000
Kiba	Kirkegaardia_baptisteae	6.000
Nesp	Nemertinea_spp	1.000
Nepi	Nepthys_picta	8.000
Notm	Notomastus_sp	3.000
Notc	Notocirrus_spiniferus	2.000
Olsp	Oligochaeta_spp	2.000
Paca	Parougia_caeca	1.000
Phar	Phyllodoce_arenae	1.000
Posp	Polygordius_spp	51.000
Prpy	Prionospio_pygmaeus	102.000
Siar	Sigalion_arenicola	2.000
Spbo	Spiophanes_bombyx	5.000
Spso	Spisula_solidissima	5.000
Syam	Synchelidium_americanum	1.000
Unir	Unciola_irrorata	6.000

DataSummaryBySample

Sample unit: F4

Amsp	Ampelisca_spp	279.000
Arwa	Aricidea_wassi	3.000
Asoc	Asabellides_oculata	1.000
Cotu	Corophium_tuberculatum	2.000
Dicu	Diopatra_cuprea	1.000
Drlo	Drilonereis_longa	1.000
Ecpa	Echinarachnius_parma	2.000
Iltr	Ilyanassa_trivittata	1.000
Misp	Microdeutopus_sp	1.000
Nepi	Nepthys_picta	3.000
Phar	Phyllodoce_arenae	1.000
Poco	Polydora_cornuta	1.000
Posp	Polygordius_spp	2.000
Prpy	Prionospio_pygmaeus	148.000
Rhep	Rhepoxynuis_epistomus	1.000
Spbo	Spiophanes_bombyx	11.000
Spoc	Spiochaetopterus_oculatus	3.000
Spso	Spisula_solidissima	5.000
Unir	Unciola_irrorata	15.000

DataSummaryBySample
Sample unit: F5

Amsp	Ampelisca_spp	518.000
Asoc	Asabellides_oculata	2.000
Cotu	Corophium_tuberculatum	2.000
Crju	Crepidula_juvspp	1.000
Dicu	Diopatra_cuprea	1.000
Ecpa	Echinarachnius_parma	1.000
Glam	Glycera_americana	2.000
Kiba	Kirkegaardia_baptisteae	1.000
Lero	Leitoscoloplos_robustus	1.000
Mula	Mulinia_lateralis	1.000
Near	Neanthes_arenaceodentata	1.000
Notm	Notomastus_sp	12.000
Notc	Notocirrus_spiniferus	6.000
Olsp	Oligochaeta_spp	24.000
Oner	Onuphis_eremita	1.000
Paan	Pagurus_annulipes	2.000
Phar	Phyllodoce_arenae	2.000
Poco	Polydora_cornuta	2.000
Posp	Polygordius_spp	40.000
Prpy	Prionospio_pygmaeus	560.000
Siar	Sigalion_arenicola	4.000
Spbo	Spiophanes_bombyx	16.000
Spoc	Spiochaetopterus_oculatus	5.000
Spso	Spisula_solidissima	2.000
Teag	Tellina_agilis	2.000

Unir	Unciola_irrorata	24.000

DataSummaryBySample
Sample unit: F6

Amsp	Ampelisca_spp	15.000
Asoc	Asabellides_oculata	7.000
Crse	Crangon_septemspinosa	1.000
Edtr	Edotea_triloba	1.000
Glam	Glycera_americana	1.000
Lero	Leitoscoloplos_robustus	1.000
Nepi	Nepthys_picta	4.000
Notm	Notomastus_sp	45.000
Notc	Notocirrus_spiniferus	2.000
Olsp	Oligochaeta_spp	3.000
Posp	Polygordius_spp	27.000
Prpy	Prionospio_pygmaeus	9.000
Spbo	Spiophanes_bombyx	4.000
Spso	Spisula_solidissima	2.000
Teag	Tellina_agilis	1.000
Unir	Unciola_irrorata	6.000

DataSummaryBySample
Sample unit: G1

Ande	Ancinus_depressus	1.000
Asoc	Asabellides_oculata	8.000
Cave	Caulleriella_venefica	6.000
Chtu	Chiridotea_tuftsi	1.000
Cotu	Corophium_tuberculatum	1.000
Crme	Crab_megalopa	2.000
Ecpa	Echinarachnius_parma	3.000
Edtr	Edotea_triloba	2.000
Exdi	Exogone_dispar	1.000
Grsp	Grandidierella_sp	3.000
Near	Neanthes_arenaceodentata	3.000
Nepi	Nepthys_picta	7.000
Notm	Notomastus_sp	7.000
Olsp	Oligochaeta_spp	2.000
Oner	Onuphis_eremita	2.000
Posp	Polygordius_spp	7.000
Prpy	Prionospio_pygmaeus	1.000
Prwi	Protohaustorius_wigleyi	31.000
Psmi	Pseudoleptocuma_minor	1.000
Psob	Pseudunciola_obliquua	4.000
Rhep	Rhepoxynuis_epistomus	1.000
Spbo	Spiophanes_bombyx	2.000
Spso	Spisula_solidissima	4.000
Teag	Tellina_agilis	4.000

Unir	Unciola_irrorata	2.000

DataSummaryBySample
Sample unit: G2

Arca	Aricidea_catherinae	1.000
Arwa	Aricidea_wassi	13.000
Asoc	Asabellides_oculata	4.000
Cave	Caulleriella_venefica	7.000
Drlo	Drilonereis_longa	1.000
Ecpa	Echinarachnius_parma	4.000
Edtr	Edotea_triloba	1.000
Exdi	Exogone_dispar	1.000
Mesp	Megalona_sp	1.000
Mybi	Mysidopsis_bigelowi	2.000
Nesp	Nemertinea_spp	1.000
Nepi	Nepthys_picta	2.000
Notm	Notomastus_sp	6.000
Nupr	Nucula_proxima	1.000
Olsp	Oligochaeta_spp	11.000
Oner	Onuphis_eremita	4.000
Paca	Parougia_caeca	9.000
Phar	Phyllodoce_arenae	1.000
Posp	Polygordius_spp	36.000
Prpy	Prionospio_pygmaeus	2.000
Prwi	Protohaustorius_wigleyi	18.000
Ptte	Ptilanthura_tenuis	4.000
Rhep	Rhepoxynuis_epistomus	1.000
Siar	Sigalion_arenicola	1.000
Spbo	Spiophanes_bombyx	3.000
Spoc	Spiochaetopterus_oculatus	1.000
Spso	Spisula_solidissima	12.000
Syam	Synchelidium_americanum	1.000
Teag	Tellina_agilis	1.000
Trca	Travisia_carnea	1.000
Unir	Unciola_irrorata	3.000

DataSummaryBySample
Sample unit: G3

Arca	Aricidea_catherinae	2.000
Arwa	Aricidea_wassi	5.000
Asoc	Asabellides_oculata	4.000
Cave	Caulleriella_venefica	5.000
Chtu	Chiridotea_tuftsi	2.000
Ecpa	Echinarachnius_parma	7.000
Endi	Ensis_directus	1.000
Exdi	Exogone_dispar	1.000
Mesp	Megalona_sp	2.000

Nesp	Nemertinea_spp	2.000
Nepi	Nepthys_picta	4.000
Olsp	Oligochaeta_spp	9.000
Oner	Onuphis_eremita	3.000
Posp	Polygordius_spp	1.000
Prwi	Protohaustorius_wigleyi	65.000
Psob	Pseudunciola_obliquua	13.000
Ptte	Ptilanthura_tenuis	1.000
Rhep	Rhepoxynuis_epistomus	6.000
Siar	Sigalion_arenicola	1.000
Spoc	Spiochaetopterus_oculatus	10.000
Spso	Spisula_solidissima	2.000
Teag	Tellina_agilis	2.000
Trca	Travisia_carnea	2.000
Tusp	Turbellaria_sp	2.000
Unir	Unciola_irrorata	2.000

DataSummaryBySample
Sample unit: G4

Amsp	Ampelisca_spp	2.000
Arwa	Aricidea_wassi	3.000
Asoc	Asabellides_oculata	2.000
Chtu	Chiridotea_tuftsi	3.000
Cotu	Corophium_tuberculatum	6.000
Crju	Crepidula_juvspp	9.000
Dicu	Diopatra_cuprea	1.000
Ecpa	Echinarachnius_parma	7.000
Edtr	Edotea_triloba	4.000
Endi	Ensis_directus	2.000
Exdi	Exogone_dispar	1.000
Kiba	Kirkegaardia_baptisteae	4.000
Lero	Leitoscoloplos_robustus	1.000
Nesp	Nemertinea_spp	3.000
Nepi	Nepthys_picta	7.000
Notm	Notomastus_sp	30.000
Olsp	Oligochaeta_spp	7.000
Oner	Onuphis_eremita	3.000
Posp	Polygordius_spp	11.000
Prpy	Prionospio_pygmaeus	1.000
Prwi	Protohaustorius_wigleyi	30.000
Psmi	Pseudoleptocuma_minor	1.000
Psob	Pseudunciola_obliquua	23.000
Rhep	Rhepoxynuis_epistomus	14.000
Spbo	Spiophanes_bombyx	3.000
Spoc	Spiochaetopterus_oculatus	5.000
Spso	Spisula_solidissima	9.000
Syam	Synchelidium_americanum	2.000
Teag	Tellina_agilis	1.000
Trca	Travisia_carnea	5.000

Tusp	Turbellaria_sp	1.000
Unir	Unciola_irrorata	1.000

DataSummaryBySample
Sample unit: G5

Ande	Ancinus_depressus	1.000
Arwa	Aricidea_wassi	7.000
Asoc	Asabellides_oculata	4.000
Chtu	Chiridotea_tuftsi	2.000
Dime	Dissodactylus_mellitae	1.000
Ecpa	Echinarachnius_parma	2.000
Edtr	Edotea_triloba	2.000
Euim	Euspira_immaculata	1.000
Exdi	Exogone_dispar	5.000
Kiba	Kirkegaardia_baptisteae	3.000
Nesp	Nemertinea_spp	3.000
Nepi	Nepthys_picta	1.000
Notm	Notomastus_sp	2.000
Olsp	Oligochaeta_spp	11.000
Oner	Onuphis_eremita	4.000
Posp	Polygordius_spp	4.000
Prwi	Protohaustorius_wigleyi	33.000
Psmi	Pseudoleptocuma_minor	1.000
Psob	Pseudunciola_obliquua	34.000
Rhep	Rhepoxynuis_epistomus	1.000
Spbo	Spiophanes_bombyx	6.000
Spoc	Spiochaetopterus_oculatus	7.000
Spso	Spisula_solidissima	8.000
Syam	Synchelidium_americanum	2.000
Teag	Tellina_agilis	5.000
Trca	Travisia_carnea	7.000

DataSummaryBySample
Sample unit: G6

Ande	Ancinus_depressus	1.000
Arwa	Aricidea_wassi	13.000
Asoc	Asabellides_oculata	8.000
Cave	Caulleriella_venefica	13.000
Chtu	Chiridotea_tuftsi	3.000
Dime	Dissodactylus_mellitae	1.000
Ecpa	Echinarachnius_parma	4.000
Nesp	Nemertinea_spp	2.000
Neam	Neomysis_americana	1.000
Nepi	Nepthys_picta	6.000
Notm	Notomastus_sp	2.000
Nupr	Nucula_proxima	1.000
Olsp	Oligochaeta_spp	19.000

Oner	Onuphis_eremita	1.000
Paca	Parougia_caeca	2.000
Posp	Polygordius_spp	7.000
Prwi	Protohaustorius_wigleyi	9.000
Psob	Pseudunciola_obliquua	6.000
Rhep	Rhepoxynuis_epistomus	10.000
Spbo	Spiophanes_bombyx	1.000
Spoc	Spiochaetopterus_oculatus	6.000
Spso	Spisula_solidissima	15.000
Teag	Tellina_agilis	2.000
Trca	Travisia_carnea	1.000
Unir	Unciola_irrorata	1.000

DataSummaryBySample
Sample unit: H1

Acmi	Acanthohaustorius_millsi	4.000
Arwa	Aricidea_wassi	2.000
Cave	Caulleriella_venefica	1.000
Chtu	Chiridotea_tuftsi	1.000
Diun	Dispio_uncinata	2.000
Drlo	Drilonereis_longa	1.000
Ecpa	Echinarachnius_parma	6.000
Exdi	Exogone_dispar	5.000
Kiba	Kirkegaardia_baptisteae	2.000
Mesp	Megalona_sp	1.000
Nesp	Nemertinea_spp	2.000
Nepi	Nepthys_picta	6.000
Notm	Notomastus_sp	4.000
Olsp	Oligochaeta_spp	4.000
Oner	Onuphis_eremita	1.000
Posp	Polygordius_spp	2.000
Prwi	Protohaustorius_wigleyi	85.000
Psmi	Pseudoleptocuma_minor	1.000
Psob	Pseudunciola_obliquua	30.000
Rhep	Rhepoxynuis_epistomus	4.000
Spbo	Spiophanes_bombyx	2.000
Spoc	Spiochaetopterus_oculatus	3.000
Taps	Tanaissus_psammophilus	1.000
Teag	Tellina_agilis	1.000
Trca	Travisia_carnea	3.000

DataSummaryBySample
Sample unit: H2

Acmi	Acanthohaustorius_millsi	30.000
Ande	Ancinus_depressus	1.000
Cave	Caulleriella_venefica	4.000
Chtu	Chiridotea_tuftsi	10.000

Diun	Dispio_uncinata	2.000
Ecpa	Echinarachnius_parma	4.000
Edtr	Edotea_triloba	1.000
Kiba	Kirkegaardia_baptisteae	1.000
Mesp	Megalona_sp	3.000
Near	Neanthes_arenaceodentata	1.000
Nesp	Nemertinea_spp	1.000
Nepi	Nepthys_picta	2.000
Nute	Nucula_tenuis	1.000
Olsp	Oligochaeta_spp	28.000
Oxsm	Oxyurostylis_smithii	1.000
Posp	Polygordius_spp	5.000
Prwi	Protohaustorius_wigleyi	64.000
Psmi	Pseudoleptocuma_minor	1.000
Psob	Pseudunciola_obliquua	46.000
Ptte	Ptilanthura_tenuis	6.000
Rhep	Rhepoxynuis_epistomus	4.000
Spso	Spisula_solidissima	9.000
Syse	Syllides_setosa	1.000
Syam	Synchelidium_americanum	1.000
Taps	Tanaissus_psammophilus	3.000
Trca	Travisia_carnea	2.000
Tusp	Turbellaria_sp	1.000
Unir	Unciola_irrorata	1.000

DataSummaryBySample
Sample unit: H3

Acmi	Acanthohaustorius_millsi	21.000
Ande	Ancinus_depressus	1.000
Arca	Aricidea_catherinae	1.000
Arwa	Aricidea_wassi	2.000
Cave	Caulleriella_venefica	3.000
Chtu	Chiridotea_tuftsi	9.000
Cotu	Corophium_tuberculatum	1.000
Diun	Dispio_uncinata	2.000
Ecpa	Echinarachnius_parma	7.000
Edtr	Edotea_triloba	1.000
Kiba	Kirkegaardia_baptisteae	2.000
Nesp	Nemertinea_spp	1.000
Nepi	Nepthys_picta	1.000
Notm	Notomastus_sp	1.000
Olsp	Oligochaeta_spp	2.000
Oner	Onuphis_eremita	1.000
Paca	Parougia_caeca	1.000
Prpy	Prionospio_pygmaeus	1.000
Prwi	Protohaustorius_wigleyi	88.000
Psob	Pseudunciola_obliquua	20.000
Rhep	Rhepoxynuis_epistomus	7.000
Spbo	Spiophanes_bombyx	4.000

Spoc	Spiochaetopterus_oculatus	2.000
Spso	Spisula_solidissima	4.000
Taps	Tanaissus_psammophilus	1.000
Teag	Tellina_agilis	2.000
Trca	Travisia_carnea	1.000
Unir	Unciola_irrorata	2.000

DataSummaryBySample
Sample unit: H4

Acmi	Acanthohaustorius_millsi	43.000
Ande	Ancinus_depressus	1.000
Arca	Aricidea_catherinae	3.000
Asoc	Asabellides_oculata	3.000
Casp	Capitella_sp	1.000
Cave	Caulleriella_venefica	3.000
Chtu	Chiridotea_tuftsi	3.000
Ecpa	Echinarachnius_parma	4.000
Nepi	Nepthys_picta	1.000
Notm	Notomastus_sp	1.000
Nupr	Nucula_proxima	1.000
Olsp	Oligochaeta_spp	1.000
Oner	Onuphis_eremita	1.000
Paca	Parougia_caeca	1.000
Posp	Polygordius_spp	29.000
Prwi	Protohaustorius_wigleyi	7.000
Psmi	Pseudoleptocuma_minor	1.000
Psob	Pseudunciola_obliquua	888.000
Ptte	Ptilanthura_tenuis	1.000
Rhep	Rhepoxynuis_epistomus	17.000
Siar	Sigalion_arenicola	1.000
Spoc	Spiochaetopterus_oculatus	2.000
Spso	Spisula_solidissima	12.000
Syse	Syllides_setosa	2.000
Trca	Travisia_carnea	1.000
Unir	Unciola_irrorata	1.000

DataSummaryBySample
Sample unit: H5

Acmi	Acanthohaustorius_millsi	33.000
Arca	Aricidea_catherinae	3.000
Arwa	Aricidea_wassi	1.000
Asoc	Asabellides_oculata	8.000
Cave	Caulleriella_venefica	5.000
Chtu	Chiridotea_tuftsi	1.000
Ecpa	Echinarachnius_parma	2.000
Edtr	Edotea_triloba	2.000
Euzo	Euclymene_zonalis	1.000

Exdi	Exogone_dispar	4.000
Iltr	Ilyanassa_trivittata	1.000
Kiba	Kirkegaardia_baptisteae	1.000
Lero	Leitoscoloplos_robustus	1.000
Mesp	Megalona_sp	1.000
Nepi	Nepthys_picta	1.000
Notm	Notomastus_sp	1.000
Olsp	Oligochaeta_spp	14.000
Oner	Onuphis_eremita	1.000
Paan	Pagurus_annulipes	1.000
Posp	Polygordius_spp	25.000
Prwi	Protohaustorius_wigleyi	9.000
Psmi	Pseudoleptocuma_minor	1.000
Psob	Pseudunciola_obliquua	346.000
Ptte	Ptilanthura_tenuis	6.000
Rhep	Rhepoxynuis_epistomus	7.000
Spbo	Spiophanes_bombyx	5.000
Spoc	Spiochaetopterus_oculatus	3.000
Spso	Spisula_solidissima	4.000
Teag	Tellina_agilis	2.000
Trca	Travisia_carnea	1.000

DataSummaryBySample
Sample unit: H6

Acmi	Acanthohaustorius_millsi	27.000
Arca	Aricidea_catherinae	2.000
Arwa	Aricidea_wassi	2.000
Asoc	Asabellides_oculata	16.000
Cair	Cancer_irroratus	1.000
Cave	Caulleriella_venefica	8.000
Chtu	Chiridotea_tuftsi	3.000
Cotu	Corophium_tuberculatum	1.000
Crju	Crepidula_juvspp	4.000
Dicu	Diopatra_cuprea	2.000
Ecpa	Echinarachnius_parma	4.000
Endi	Ensis_directus	1.000
Exdi	Exogone_dispar	1.000
Haex	Harmothoe_extenuata	1.000
Kiba	Kirkegaardia_baptisteae	1.000
Mesp	Megalona_sp	1.000
Near	Neanthes_arenaceodentata	2.000
Nepi	Nepthys_picta	2.000
Nupr	Nucula_proxima	2.000
Posp	Polygordius_spp	12.000
Prwi	Protohaustorius_wigleyi	2.000
Psmi	Pseudoleptocuma_minor	1.000
Psob	Pseudunciola_obliquua	1054.000
Rhep	Rhepoxynuis_epistomus	12.000
Spbo	Spiophanes_bombyx	2.000

Spoc	Spiochaetopterus_oculatus	4.000
Spso	Spisula_solidissima	9.000
Taps	Tanaissus_psammophilus	2.000
Teag	Tellina_agilis	3.000
Unir	Unciola_irrorata	2.000

DataSummaryBySample
Sample unit: I1

Acmi	Acanthohaustorius_millsi	4.000
Amsp	Ampelisca_spp	1.000
Arca	Aricidea_catherinae	2.000
Asoc	Asabellides_oculata	2.000
Cave	Caulleriella_venefica	1.000
Chtu	Chiridotea_tuftsi	2.000
Drlo	Drilonereis_longa	1.000
Ecpa	Echinarachnius_parma	9.000
Edtr	Edotea_triloba	1.000
Nepi	Nepthys_picta	21.000
Nupr	Nucula_proxima	1.000
Olsp	Oligochaeta_spp	1.000
Pasp	Paranaitis_speciosa	1.000
Posp	Polygordius_spp	4.000
Prpy	Prionospio_pygmaeus	1.000
Prwi	Protohaustorius_wigleyi	52.000
Psob	Pseudunciola_obliquua	3.000
Rhep	Rhepoxynuis_epistomus	5.000
Spbo	Spiophanes_bombyx	3.000
Spoc	Spiochaetopterus_oculatus	7.000
Spso	Spisula_solidissima	3.000
Trca	Travisia_carnea	1.000
Tusp	Turbellaria_sp	1.000
Unir	Unciola_irrorata	2.000

DataSummaryBySample
Sample unit: I2

Acmi	Acanthohaustorius_millsi	2.000
Asoc	Asabellides_oculata	1.000
Cave	Caulleriella_venefica	1.000
Cotu	Corophium_tuberculatum	5.000
Crme	Crab_megalopa	1.000
Crju	Crepidula_juvspp	6.000
Diso	Dipolydora_socialis	2.000
Ecpa	Echinarachnius_parma	7.000
Edtr	Edotea_triloba	3.000
Grsp	Grandidierella_sp	3.000
Kiba	Kirkegaardia_baptisteae	1.000
Neam	Neomysis_americana	2.000

Nepi	Nepthys_picta	1.000
Notm	Notomastus_sp	1.000
Nupr	Nucula_proxima	1.000
Olsp	Oligochaeta_spp	2.000
Oner	Onuphis_eremita	1.000
Posp	Polygordius_spp	1.000
Prwi	Protohaustorius_wigleyi	10.000
Rhep	Rhepoxynuis_epistomus	9.000
Spbo	Spiophanes_bombyx	2.000
Spoc	Spiochaetopterus_oculatus	3.000
Spso	Spisula_solidissima	4.000
Teag	Tellina_agilis	3.000
Unir	Unciola_irrorata	5.000

DataSummaryBySample
Sample unit: I3

Acmi	Acanthohaustorius_millsi	33.000
Arca	Aricidea_catherinae	1.000
Arwa	Aricidea_wassi	1.000
Asoc	Asabellides_oculata	1.000
Cave	Caulleriella_venefica	2.000
Chtu	Chiridotea_tuftsi	4.000
Cotu	Corophium_tuberculatum	3.000
Crju	Crepidula_juvspp	3.000
Ecpa	Echinarachnius_parma	8.000
Edtr	Edotea_triloba	1.000
Endi	Ensis_directus	1.000
Grsp	Grandidierella_sp	11.000
Kiba	Kirkegaardia_baptisteae	4.000
Notm	Notomastus_sp	5.000
Olsp	Oligochaeta_spp	8.000
Oner	Onuphis_eremita	2.000
Pafu	Paraonis_fulgens	1.000
Poco	Polydora_cornuta	2.000
Posp	Polygordius_spp	20.000
Prwi	Protohaustorius_wigleyi	48.000
Psob	Pseudunciola_obliquua	19.000
Ptte	Ptilanthura_tenuis	1.000
Rhep	Rhepoxynuis_epistomus	11.000
Siar	Sigalion_arenicola	1.000
Spbo	Spiophanes_bombyx	5.000
Spoc	Spiochaetopterus_oculatus	6.000
Spso	Spisula_solidissima	4.000
Teag	Tellina_agilis	4.000
Trca	Travisia_carnea	4.000
Unir	Unciola_irrorata	1.000

DataSummaryBySample

Sample unit: I4

Acmi	Acanthohaustorius_millsi	9.000
Arca	Aricidea_catherinae	4.000
Asoc	Asabellides_oculata	7.000
Cave	Caulleriella_venefica	18.000
Ceam	Ceriantheopsis_americana	1.000
Chtu	Chiridotea_tuftsi	2.000
Cotu	Corophium_tuberculatum	5.000
Ecpa	Echinarachnius_parma	5.000
Euzo	Euclymene_zonalis	1.000
Euim	Euspira_immaculata	1.000
Exdi	Exogone_dispar	9.000
Grsp	Grandidierella_sp	1.000
Kiba	Kirkegaardia_baptisteae	2.000
Lero	Leitoscoloplos_robustus	1.000
Lyar	Lyonsia_arenosa	2.000
Nepi	Nepthys_picta	2.000
Notm	Notomastus_sp	1.000
Olsp	Oligochaeta_spp	54.000
Palo	Pagurus_longicarpus	1.000
Paca	Parougia_caeca	6.000
Pafu	Paraonis_fulgens	2.000
Posp	Polygordius_spp	17.000
Prwi	Protohaustorius_wigleyi	8.000
Psob	Pseudunciola_obliquua	1423.000
Rhep	Rhepoxynuis_epistomus	25.000
Spbo	Spiophanes_bombyx	2.000
Spso	Spisula_solidissima	3.000
Syse	Syllides_setosa	3.000
Syam	Synchelidium_americanum	1.000
Teag	Tellina_agilis	2.000
Unir	Unciola_irrorata	13.000

DataSummaryBySample
Sample unit: I5

Acmi	Acanthohaustorius_millsi	53.000
Arca	Aricidea_catherinae	1.000
Asoc	Asabellides_oculata	1.000
Cave	Caulleriella_venefica	13.000
Diso	Dipolydora_socialis	1.000
Ecpa	Echinarachnius_parma	2.000
Exdi	Exogone_dispar	1.000
Kiba	Kirkegaardia_baptisteae	1.000
Nepi	Nepthys_picta	1.000
Olsp	Oligochaeta_spp	17.000
Oner	Onuphis_eremita	3.000
Oxsm	Oxyurostylis_smithii	2.000
Pasp	Paranaitis_speciosa	1.000

Posp	Polygordius_spp	37.000
Psob	Pseudunciola_obliquua	1150.000
Ptte	Ptilanthura_tenuis	2.000
Rhep	Rhepoxynuis_epistomus	36.000
Siar	Sigalion_arenicola	1.000
Spbo	Spiophanes_bombyx	5.000
Spoc	Spiochaetopterus_oculatus	3.000
Spso	Spisula_solidissima	3.000
Syse	Syllides_setosa	1.000
Teag	Tellina_agilis	2.000
Unir	Unciola_irrorata	7.000

DataSummaryBySample
Sample unit: I6

Acmi	Acanthohaustorius_millsi	22.000
Arca	Aricidea_catherinae	2.000
Asoc	Asabellides_oculata	2.000
Casp	Capitella_sp	1.000
Cave	Caulleriella_venefica	7.000
Chtu	Chiridotea_tuftsi	2.000
Ecpa	Echinarachnius_parma	1.000
Edtr	Edotea_triloba	2.000
Endi	Ensis_directus	1.000
Exdi	Exogone_dispar	1.000
Kiba	Kirkegaardia_baptisteae	1.000
Nepi	Nepthys_picta	2.000
Notm	Notomastus_sp	1.000
Notc	Notocirrus_spiniferus	1.000
Oner	Onuphis_eremita	1.000
Oxsm	Oxyurostylis_smithii	1.000
Palo	Pagurus_longicarpus	3.000
Paca	Parougia_caeca	2.000
Phmu	Phyllodoce_mucosa	1.000
Posp	Polygordius_spp	26.000
Psob	Pseudunciola_obliquua	1600.000
Ptte	Ptilanthura_tenuis	2.000
Rhep	Rhepoxynuis_epistomus	31.000
Spbo	Spiophanes_bombyx	2.000
Spoc	Spiochaetopterus_oculatus	4.000
Spso	Spisula_solidissima	4.000
Stva	Streptosyllis_varians	1.000
Syam	Synchelidium_americanum	1.000
Teag	Tellina_agilis	1.000
Trca	Travisia_carnea	2.000
Unir	Unciola_irrorata	1.000

DataSummaryBySample
Sample unit: J1

Acmi	Acanthohaustorius_millsi	9.000
Ande	Ancinus_depressus	4.000
Arca	Aricidea_catherinae	3.000
Arwa	Aricidea_wassi	2.000
Cave	Caulleriella_venefica	19.000
Chtu	Chiridotea_tuftsi	4.000
Ecpa	Echinarachnius_parma	3.000
Exdi	Exogone_dispar	3.000
Kiba	Kirkegaardia_baptisteae	10.000
Notm	Notomastus_sp	1.000
Nupr	Nucula_proxima	1.000
Olsp	Oligochaeta_spp	52.000
Paca	Parougia_caeca	1.000
Pafu	Paraonis_fulgens	1.000
Posp	Polygordius_spp	60.000
Prwi	Protohaustorius_wigleyi	36.000
Psob	Pseudunciola_obliquua	13.000
Rhep	Rhepoxynuis_epistomus	4.000
Spbo	Spiophanes_bombyx	2.000
Spso	Spisula_solidissima	1.000
Syse	Syllides_setosa	6.000
Teag	Tellina_agilis	2.000
Trca	Travisia_carnea	1.000
Unir	Unciola_irrorata	2.000

DataSummaryBySample
Sample unit: J2

Acmi	Acanthohaustorius_millsi	31.000
Asoc	Asabellides_oculata	5.000
Cave	Caulleriella_venefica	9.000
Chtu	Chiridotea_tuftsi	10.000
Cotu	Corophium_tuberculatum	1.000
Crju	Crepidula_juvspp	2.000
Ecpa	Echinarachnius_parma	5.000
Grsp	Grandidierella_sp	3.000
Kiba	Kirkegaardia_baptisteae	1.000
Nepi	Nepthys_picta	1.000
Olsp	Oligochaeta_spp	7.000
Palo	Pagurus_longicarpus	1.000
Pafu	Paraonis_fulgens	2.000
Posp	Polygordius_spp	91.000
Prwi	Protohaustorius_wigleyi	47.000
Rhep	Rhepoxynuis_epistomus	38.000
Site	Sigambra_tentaculata	1.000
Spbo	Spiophanes_bombyx	2.000
Spso	Spisula_solidissima	1.000
Teag	Tellina_agilis	1.000
Trca	Travisia_carnea	1.000

Unir	Unciola_irrorata	6.000

DataSummaryBySample
Sample unit: J3

Acmi	Acanthohaustorius_millsi	2.000
Amsp	Ampelisca_spp	1.000
Asoc	Asabellides_oculata	8.000
Cave	Caulleriella_venefica	6.000
Chtu	Chiridotea_tuftsi	4.000
Cotu	Corophium_tuberculatum	1.000
Crme	Crab_megalopa	1.000
Crju	Crepidula_juvspp	4.000
Ecpa	Echinarachnius_parma	4.000
Edtr	Edotea_triloba	1.000
Exdi	Exogone_dispar	1.000
Grsp	Grandidierella_sp	1.000
Kiba	Kirkegaardia_baptisteae	4.000
Lyar	Lyonsia_arenosa	1.000
Nepi	Nepthys_picta	3.000
Notm	Notomastus_sp	1.000
Nupr	Nucula_proxima	2.000
Olsp	Oligochaeta_spp	2.000
Phar	Phyllodoce_arenae	1.000
Poco	Polydora_cornuta	1.000
Posp	Polygordius_spp	236.000
Prwi	Protohaustorius_wigleyi	10.000
Psob	Pseudunciola_obliquua	44.000
Ptte	Ptilanthura_tenuis	1.000
Rhep	Rhepoxynuis_epistomus	23.000
Siar	Sigalion_arenicola	2.000
Spoc	Spiochaetopterus_oculatus	1.000
Teag	Tellina_agilis	2.000
Unir	Unciola_irrorata	11.000

DataSummaryBySample
Sample unit: J4

Acmi	Acanthohaustorius_millsi	27.000
Arca	Aricidea_catherinae	2.000
Asoc	Asabellides_oculata	2.000
Cave	Caulleriella_venefica	20.000
Chtu	Chiridotea_tuftsi	1.000
Ecpa	Echinarachnius_parma	3.000
Edtr	Edotea_triloba	1.000
Exdi	Exogone_dispar	1.000
Iltr	Ilyanassa_trivittata	1.000
Kiba	Kirkegaardia_baptisteae	2.000
Near	Neanthes_arenaceodentata	1.000

Notc	Notocirrus_spiniferus	1.000
Nupr	Nucula_proxima	1.000
Olsp	Oligochaeta_spp	16.000
Oner	Onuphis_eremita	1.000
Posp	Polygordius_spp	357.000
Prwi	Protohaustorius_wigleyi	9.000
Psmi	Pseudoleptocuma_minor	1.000
Psob	Pseudunciola_obliquua	802.000
Ptte	Ptilanthura_tenuis	2.000
Rhep	Rhepoxynuis_epistomus	18.000
Siar	Sigalion_arenicola	2.000
Spbo	Spiophanes_bombyx	5.000
Spoc	Spiochaetopterus_oculatus	2.000
Syse	Syllides_setosa	2.000
Unir	Unciola_irrorata	5.000

DataSummaryBySample
Sample unit: J5

Acmi	Acanthohaustorius_millsi	3.000
Arca	Aricidea_catherinae	3.000
Asoc	Asabellides_oculata	2.000
Cave	Caulleriella_venefica	9.000
Chtu	Chiridotea_tuftsi	4.000
Ecpa	Echinarachnius_parma	3.000
Exdi	Exogone_dispar	2.000
Kiba	Kirkegaardia_baptisteae	1.000
Lete	Leptosynapta_tenuis	1.000
Nesp	Nemertinea_spp	1.000
Nepi	Nepthys_picta	3.000
Notc	Notocirrus_spiniferus	1.000
Olsp	Oligochaeta_spp	51.000
Oner	Onuphis_eremita	1.000
Paca	Parougia_caeca	1.000
Pasp	Paranaitis_speciosa	1.000
Posp	Polygordius_spp	51.000
Prwi	Protohaustorius_wigleyi	3.000
Psob	Pseudunciola_obliquua	594.000
Ptte	Ptilanthura_tenuis	2.000
Rhep	Rhepoxynuis_epistomus	3.000
Spbo	Spiophanes_bombyx	1.000
Spoc	Spiochaetopterus_oculatus	1.000
Spso	Spisula_solidissima	2.000
Syse	Syllides_setosa	5.000
Taps	Tanaissus_psammophilus	1.000
Trca	Travisia_carnea	2.000
Unir	Unciola_irrorata	1.000

DataSummaryBySample

Sample unit: J6

Acmi	Acanthohaustorius_millsi	20.000
Amsp	Ampelisca_spp	1.000
Arca	Aricidea_catherinae	4.000
Arwa	Aricidea_wassi	2.000
Asoc	Asabellides_oculata	1.000
Cave	Caulleriella_venefica	9.000
Chtu	Chiridotea_tuftsi	1.000
Ecpa	Echinarachnius_parma	4.000
Euzo	Euclymene_zonalis	1.000
Exdi	Exogone_dispar	2.000
Hefi	Heteromastus_filiformis	2.000
Kiba	Kirkegaardia_baptisteae	6.000
Near	Neanthes_arenaceodentata	1.000
Nepi	Nepthys_picta	1.000
Olsp	Oligochaeta_spp	7.000
Oner	Onuphis_eremita	1.000
Phar	Phyllodoce_arenae	1.000
Posp	Polygordius_spp	81.000
Prwi	Protohaustorius_wigleyi	5.000
Psob	Pseudunciola_obliquua	1062.000
Ptte	Ptilanthura_tenuis	2.000
Rhep	Rhepoxynuis_epistomus	10.000
Spbo	Spiophanes_bombyx	2.000
Spoc	Spiochaetopterus_oculatus	2.000
Spso	Spisula_solidissima	3.000
Syse	Syllides_setosa	1.000
Teag	Tellina_agilis	1.000

******** Lists completed. Normal exit. **********************
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Outfall Progress Report APRIL2019