APPENDIX UES10-4

MARINE SURVEYS AT NORTH KILLINGHOLME AND CHERRY COBB SANDS (SPRING 2016)

ABLE MARINE ENERGY PARK
(Material Change 2 – TR030006)

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Marine Surveys at North Killingholme and Cherry Cobb Sands (Spring 2016).

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1. Introduction

The proposed development of the Able Marine Energy Park (AMEP) east of North Killingholme on the Lincolnshire Coast will partly affect the Humber Estuary Special Area of Conservation (SAC) and the Special Protection Area (SPA) / Ramsar site. Consequently, a series of measures have been derived to both compensate and mitigate for the effects of the AMEP on the habitats and species within this area of the Humber estuary and these will be implemented as part of any future development. As part of this process a Marine Environmental Management and Monitoring Plan (MEMMP) was produced in April 2013 following close consultation with stakeholders and in addition to other components included requirements for the monitoring of intertidal and subtidal benthic invertebrate and fish communities in the vicinity of the proposed development at North Killingholme (NKM) and the compensation site at Cherry Cobb Sands (CCS). The current report summarises the results of the 2016 intertidal and subtidal benthic invertebrate surveys at North Killingholme and Cherry Cobb Sands undertaken in June and July 2016.

2. Methods

2.1 Intertidal Benthic Survey

The methods and survey design employed for the survey follow those outlined in the MEMMP and utilised a survey design which aimed to allow detection of possible impacts on intertidal benthic infauna by comparison of impact monitoring with baseline data and wider comparison with data collected during the previous characterisation survey (May 2010) to highlight natural temporal variability in benthic assemblages in the area (comparisons to the May 2010 data are provided in an additional technical note). The survey design and methods outlined in the MEMMP are based on existing guidelines and methodologies followed Procedural Guideline No. 3-6: Quantitative sampling of intertidal sediment species using cores (from the Marine Monitoring Handbook - Davies et al, 2001).

The survey design utilised a beyond BACI (Before-After Control-Impact) gradient design to take into account the existence of different zones of impact (primary impact, under the direct footprint of the quay development, and secondary impact) and also control areas subject to no impact. The survey design also takes into account shore level (upper, middle and lower shore strata) to account for the variability of communities that occur at different shore levels. The proposed survey design outlined in the MEMMP including sampling along a series of 12 transects running from the seawall or lower extent of the saltmarsh to approximately mean low water (tides permitting) which cover the impact zones and a control area to the north. At representative sites on the upper, mid and low shore three replicate 0.01m^2 cores were taken from the sediment using a handheld corer (0.01 m^2) and placed into sealable plastic bags, each carrying a unique code for the station. For the NKM survey sites were positioned (where possible) in close proximity to sample sites utilised for the 2010 characterisation survey. Cores were taken to a depth no less than 15cm to ensure adequate recovery of burrowing invertebrates and an additional sample at each sampling station was collected for Particle Size Analysis.

A summary of the survey design for the NKM and CCS surveys is provided below and the positions of the samples provided is in Figure 1 in Section 3. The CCS site differs in terms of general topography from the NKM site as this area has a much wider intertidal area with increasingly sandy sediments on the low shore. There is also extensive encroachment of saltmarsh (*Spartina*) with dense creek systems on the upper shore in the region of the northern control sites which made much of the upper shore area inaccessible – for transects CN1 and CN2 the upper shore site was taken from the fringe of Stone Creek which runs parallel to the shore in this area.

North Killingholme (NKM)				**Number of replicate benthic cores by shore level stations**		
Survey areas		**Area code**	**Transect**	**Upper**	**Mid**	**Lower**
Impact	Under direct footprint of quay development	**DI**	DI1	3	3	3
			DI2	3	3	3
			DI3	3	3	3
	Under the area of indirect impact north of the quay development	**IN**	IN1	3	3	3
			IN2	3	3	3
			IN3	3	3	3
	Under the area of indirect impact south of the quay development	**IS**	IS1	3	3	3
			IS2	3	3	3
			IS3	3	3	3
Control	Control area north of NKM	**CN**	CN1	3	3	3
			CN2	3	3	3
			CN3	3	3	3

12 transects
3 sites x transect = 36 sites
3 replicates per site = 108 samples

Cherry Cobb Sands (CCS)				**Number of replicate benthic cores by shore level stations**		
Survey areas	**Area location**	**Area code**	**Transect**	**Upper**	**Mid**	**Lower**
Impact	Under direct footprint	**I**	I1	3	3	3
			I2	3	3	3
			I3	3	3	3
Control	North	**CN**	CN1	3	3	3
			CN2	3	3	3
			CN3	3	3	3
	South	**CS**	CS1	3	3	3
			CS2	3	3	3
			CS3	3	3	3

9 transects
3 sites per transect = 27 sites
3 replicates per site = 81 samples

The samples collected were kept cool until laboratory processing which took place the following day in which samples were sieved through a 0.5mm mesh sieve and stored in 4% buffered saline formalin solution. Due to the nature of the sediments in the area (soft mud) sampling was undertaken using a hovercraft platform and sample positions were logged using

a Magellan Promark 3 GPS logger. The intertidal survey was undertaken on the 19th June and the 3rd and 23rd July 2016 for the NKM survey and hovercraft survey for the CCS site was undertaken on the 4th and 5th June 2016.

2.2 Subtidal Benthic Survey

As outlined in the MEMMP a subtidal benthic was required to assess the benthic invertebrate communities in the vicinity of the proposed development and adjacent habitats. A total of 30 sample sites were surveyed eight sites in the area of direct impact, eight sites in adjacent seabed habitats (secondary or indirect impact) and seven sites to the upstream to the north and downstream to the south respectively as controls. The positioning of the sites follows those outlined in the MEMMP and three replicate samples were taken at each site. Methodologies for grab sampling followed Marine Monitoring Handbook procedural guideline 3-9 and other best practice guidelines (Ware & Kenny, 2011; Worsfold & Hall, 2010).

Survey was undertaken using the survey vessel 'Precision 1' which was deployed from Hull Marina and utilised a 0.1m^2 day grab as this is the standard technique employed by the Environment Agency in the Humber. At each pre-determined station position, the 0.1m^2 Day grab was lowered to the seabed and the resulting sample recovered. To ensure adequate material is retained for analysis, sample volumes were checked prior to the grab sample being accepted with the sediment sample measured by depth of sample. Small samples (<7cm depth) or those with material such as stones caught in the jaws of the grab were discarded. When samples were within the prescribed limits, each sample was photographed and sub-sampled for subsequent Particle Size Analysis (PSA) and Loss On Ignition determination (LOI). Sites located in areas of harder ground (e.g. coarser sediments or firm clay) or those with repeated failures were repositioned slightly as required to obtain an adequate and representative sample but within 20m of the original location.

A full survey log was maintained throughout the survey detailing time of sampling, DGPS position, number of attempts required, station number, water depth, physical characteristics of the sample and presence of any other relevant features. Sample processing was undertaken utilising a 0.5mm sieve with a nested sieving technique (0.5mm and 1mm) employed if required to reduce the potential for small and delicate invertebrates being damaged by cobble and gravel. Each acceptable sample was removed from the day grab and gently washed through the sieve in order to separate the sediment from the infauna. The sieved residue was then back-washed into sealable containers and borax buffered 4% formo-saline solution is added as a fixative. The survey was undertaken between the 7th and 16th of June 2016 and the results from the survey and locations of sampling sites are provide in Section 4.

2.3 Laboratory Analysis

All laboratory methodologies were based on best practice and followed tried and tested method statements widely acknowledged within the industry (Ware & Kenny, 2011; Worsfold & Hall, 2010; Cooper & Rees 2002; Rees, 1999; Barnett, 1993; Rees et al, 1990). PMSL are members of the National Marine Biological and Analytical Quality Control scheme (NMBAQC).

Two experienced members of PMSL undertook the sample sorting, conducting all the sieving, sorting work and sample description with a further member of staff carrying out standard sorting quality control. Experienced taxonomists carried out the identification of the sorted fauna, with an additional member of staff carrying out quality control for faunal identification. A standard sample tracking procedure was followed throughout the analysis period.

2.4 Sorting of Invertebrate Samples

Each sample was sieved in freshwater water and then rinsed with running tap water through a 0.5mm stainless steel sieve with a nest of 20cm diameter 5mm and 1mm sieves used as required for any coarser material. The sieve contents were backwashed over a white tray to catch any potential spillage, into pre-labelled plastic storage buckets. A borax buffered 4% saline formalin solution was then added to the samples. The samples were then well mixed and stored for at least 48 hours to ensure adequate preservation and shaken once during the period.

Prior to identification each sample was washed through a nest of sieves, with the smallest mesh aperture of 0.5mm, to remove the preservative and partition the sample for ease of sorting. The residue from each sieve was then gently washed into separate white trays. Water was added to the trays and the contents agitated. Immediately after agitation, the light fraction was decanted to another tray. This procedure was repeated up to 3 times, and each tray of light fractions examined as a sub-sample of the heavy fraction. The trays were marked with the appropriate sample code (relating to the client, date, specific site, sample and replicate number). All fractions were then decanted into separate 100mm Petri dishes and examined under a stereoscopic microscope with 20x eyepieces giving a maximum magnification of up to 80x. The fauna derived was added to the retained containers, preserved and stored ready for identification. Each petri dish was checked for a final time by another member of staff.

2.5 Taxonomic Identification

Identification was carried out using Olympus SZ40 zoom microscopes with 10x and 20x eyepieces, giving a maximum magnification of up to 80x. An additional 2x objective was occasionally used to increase the potential magnification to 160x. Olympus BX41 compound microscopes were used for further magnification, up to 800x.

Identification of infaunal samples was to the lowest possible taxonomic level (i.e. species), and during identification, all individuals were initially separated into families, with part animals being assigned to families where possible. The macrofaunal specimens were identified to species level using standard taxonomic keys, low and high power stereoscopic

microscopes and dissection when necessary, for identification. Incomplete animals without anterior ends are not recorded as individuals to be included in the quantitative dataset. However, they were identified where possible and recorded as present. Similarly, motile and colonial sessile epibenthic taxa and meiofauna were only recorded as present and not included within the infaunal quantitative data set.

Fish species collected were identified using Wheeler, (1969) and Whitehead *et al.* (1989) and length frequency analysis of key species undertaken as required.

As part of the standard quality assessment (QA) procedure, regular cross-reference identification was carried out. Each sample residue was described textually with the residue retained for possible further analysis and Analytical Quality Control (AQC). All fauna will be retained under the standard codes for 2 years or returned to the clients representative for further analysis and AQC should this be required.

The taxonomic literature used is essentially as given in Rees et al (1990) and reporting nomenclature was based on that of the Species Directory of the Marine Fauna and Flora of the British Isles and Surrounding Seas (Howson & Picton, 1997), with updated nomenclature as required following WoRMS standards (Appletans *et al*., 2010).

2.6 Biomass of Invertebrates

Biomass analysis was performed by wet weight (tissue blotted) and carried out for individual species in each sample. Each taxa was placed on blotting paper for 30 seconds to allow absorption of preservative into the blotting paper. Following this time period the individuals were placed on the microbalance and the reading taken. The macrofaunal organisms were then placed back in their respective pots and stored. Biomass calculations include all identifiable fragments and calculated to ± 0.0001g, all biomass data was recorded in grams or fractions thereof. Following collation of wet weight biomass data conversions to Ash Free Dry Weight Biomass were undertaken using coefficients derived from Rumohr et al. (1987) and Ricciardi and Bourget (1998) for comparison with targets. Following analysis each specimen was returned to its sample pot and stored in 70% IMS (Industrial Methylated Spirits).

2.7 Particle Size Analysis (PSA)

The particle size analysis was carried out by a combination of dry sieving and laser particle size analysis (for the fraction <1mm) using a Malvern Mastersizer 3000. Prior to analysis, photographs were taken of all samples. The sediment samples were then split with one sub-sample being passed through a 1mm sieve to remove the larger size classes of sediment if required. The <1mm fraction of the sample was then analysed using the Malvern Mastersizer 3000 and the >1mm fraction discarded. The second sub-sample of coarser material (if present) was passed through a nest of sieves at 0.5 phi intervals. Each fraction, including the <1mm fraction, was then oven dried at 85°C for 24 hours and weighed. Data generated from these methods was analysed separately but for visualisation purposes the finer fractions were also merged to the coarse fraction (if present) to provide an overall grain size distribution for each sample – although it is acknowledged that merging of such datasets can be problematic due to differing techniques. The data derived from PSA was then used to derive statistics

such as mean grain size, bulk sediment classes (% silt, sand & gravel), skewness and sorting coefficient using the program Gradistat. These methods are consistent with the procedures identified at the NMBAQC PSA workshop on laboratory methods, which was held at the Cefas Lowestoft laboratory in July 2009.

Estimates of total organic carbon were determined by loss on ignition. Each sample was oven dried at 105ºC until the weight stabilises (± 0.01g). The weight of the sample was recorded and the sample was then placed into a kiln at 480ºC for six hours. Once the sample had cooled the sample was then re-weighed and the difference between the two weights expressed as the percentage loss on ignition (% LOI).

3. Intertidal Benthic Survey Results

As described in Section 2 In total 108 samples were collected from 36 sites on 12 transects at North Killingholme whilst 81 samples were collected from Cherry Cobb Sands at 28 sites on 9 transects. The location of sampling sites surveyed during the intertidal survey is provided in Figure 1.

3.1 Sedimentary Parameters

3.1.1 North Killingholme

A summary of sedimentary parameters from survey sites at North Killingholme are provided in Table 1 with the full data provided in Appendix 1. Maps showing sediment composition, sediment type and median phi grain size are given in Figures 2 to 4. Sediments at North Killingholme were relatively uniform and almost entirely comprised of sandy mud with the exception of sites DI3L, IN3M, IS1L, IS1M and IS3M which were classified as slightly gravelly sandy mud whilst site IN3Lwas classified as gravelly mud. Mud content ranged from 54.98% (at IN3L) to 86.86% (at DI2U) with the majority of sites having greater than 75% mud. Certain sites, particularly those within the Southern Indirect Impact area had a somewhat lower mud content (and conversely higher sand content). All sites were characterised by sediments which were poorly or very poorly sorted whilst skewness was highly variable and ranged from very coarse skewed to fine skewed. Levels of organic content (% LOI) were low to moderate with values ranging from 4.02% to 10.66% with higher values often recorded at upper shore sites and particularly those adjacent to saltmarsh.

3.1.2 Cherry Cobb Sands

A summary of sedimentary parameters from survey sites at Cherry Cobb Sands are provided in Table 2 with the full data provided in Appendix 2. Maps showing sediment composition, sediment type and median phi grain size are given in Figures 2 to 4. Sediments at Cherry Cobb Sands were quite heterogeneous and exhibited much more variability than at North Killingholme with sediments including sands, muddy sands, sandy mud and slightly gravelly sandy mud or slightly gravelly muddy sand. Mud content ranged from 4.37% (site CS2L) to 86.51% (site CCN2U) and the majority of sites had mud contents in excess of 50% (sandy mud). However, a number of sites primarily on the low or mid shore (such as sites CS1L, I1L, I3L, CS3M, I2L, CS2M, CCN1L and CCN3L) exhibited a reduced mud fraction ranging from 20% to 50% mud (muddy sand). Two sites on the low shore within the southern control area had a very low mud content (<10%) with predominantly sandy sediments (sites CS2L and CS3L). Several sites also had a slight gravel fraction although gravel content was very low (<0.5%). The majority of sites exhibited poorly sorted sediments with the exception of those with characterised by sands (or muddy sands) which were moderately sorted. Skewness was variable with sediments ranging from very fine skewed to coarse skewed. Levels of organic matter in the sediment as expressed by % LOI were similar to those recorded at North Killingholme but usually slightly lower (particularly at sandy sites) with values ranging from 1.19% to 9.75%. As at North Killingholme higher levels of organic matter tended to be recorded at the muddier areas particularly on the mid to upper shore with lowest LOI values in sandier lowshore habitats.

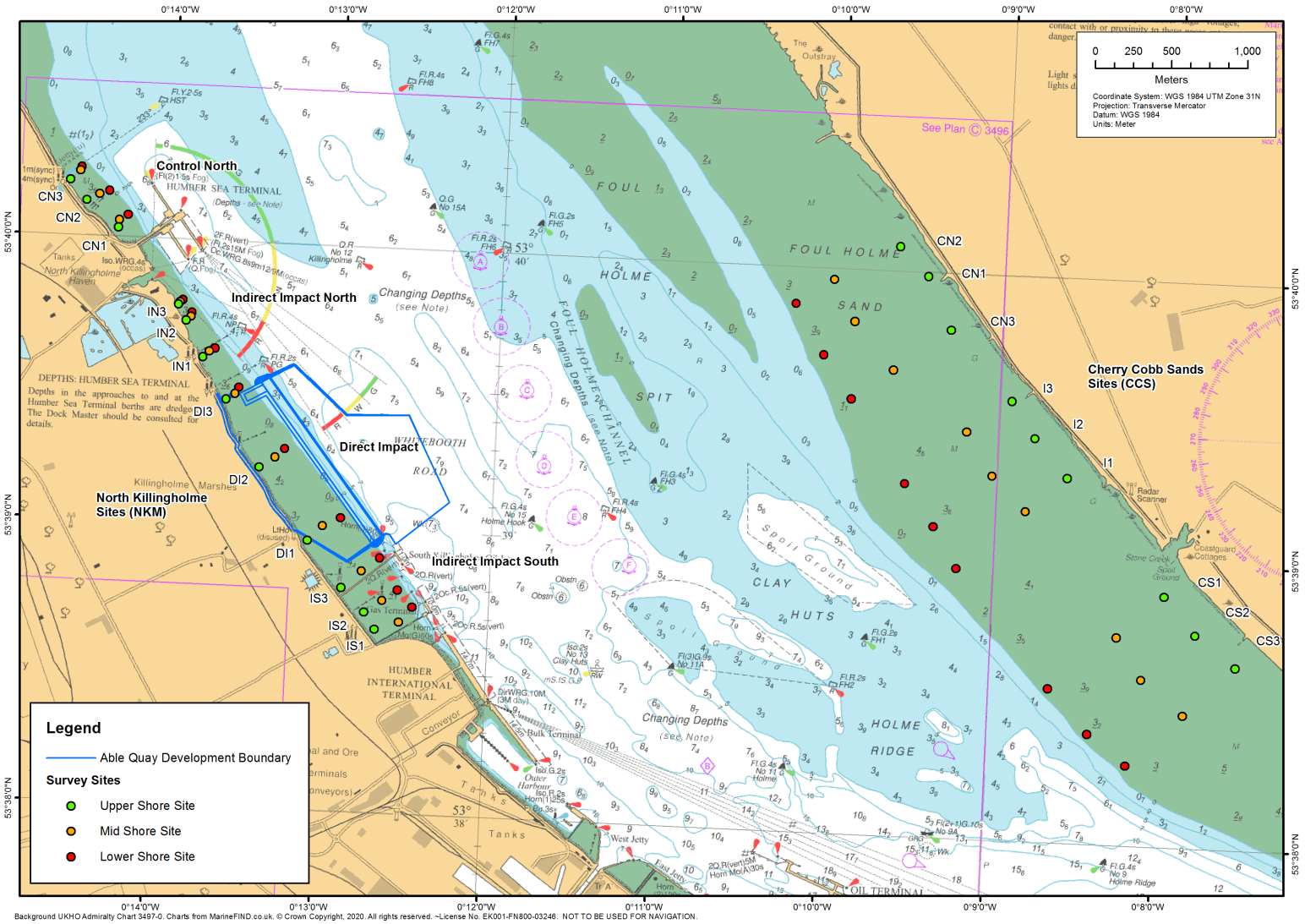


Figure 1. Location of survey sites at North Killingholme (NKM) and Cherry Cobb Sands (CCS).

Table 1. Summary of sedimentary parameters at North Killingholme.

Area	Site	Sediment Type	Median Grain Size (phi)	Mean Grain Size (phi)	Sorting (phi)		Skewness (phi)		% Gravel	% Sand	% Mud	% LOI
Control North	CN1L	Sandy Mud	5.31	5.33	2.12	Very Poorly Sorted	-0.04	Symmetrical	0.00	26.62	73.38	6.13
	CN1M	Sandy Mud	4.99	5.35	1.71	Poorly Sorted	0.28	Fine Skewed	0.00	22.95	77.05	5.31
	CN1U	Sandy Mud	5.63	5.80	1.76	Poorly Sorted	0.11	Fine Skewed	0.00	15.60	84.40	5.46
	CN2L	Sandy Mud	4.81	4.78	2.02	Very Poorly Sorted	-0.02	Symmetrical	0.00	33.64	66.36	8.32
	CN2M	Sandy Mud	4.85	5.10	1.76	Poorly Sorted	0.17	Fine Skewed	0.00	27.45	72.55	5.17
	CN2U	Sandy Mud	6.30	6.12	1.98	Poorly Sorted	-0.20	Coarse Skewed	0.00	15.20	84.80	9.06
	CN3L	Sandy Mud	4.97	5.07	2.01	Very Poorly Sorted	0.02	Symmetrical	0.00	28.73	71.27	6.32
	CN3M	Sandy Mud	5.10	5.32	1.73	Poorly Sorted	0.15	Fine Skewed	0.00	21.87	78.13	5.92
	CN3U	Sandy Mud	6.00	5.97	1.86	Poorly Sorted	-0.10	Symmetrical	0.00	14.52	85.48	7.47
Direct Impact	DI1L	Sandy Mud	5.29	5.32	2.15	Very Poorly Sorted	-0.04	Symmetrical	0.00	27.12	72.88	5.98
	DI1M	Sandy Mud	5.23	5.37	1.98	Poorly Sorted	0.04	Symmetrical	0.00	24.72	75.28	6.93
	DI1U	Sandy Mud	6.17	6.08	1.88	Poorly Sorted	-0.13	Coarse Skewed	0.00	13.86	86.14	9.37
	DI2L	Sandy Mud	4.69	4.87	1.95	Poorly Sorted	0.11	Fine Skewed	0.00	34.63	65.37	7.30
	DI2M	Sandy Mud	4.77	5.09	1.94	Poorly Sorted	0.19	Fine Skewed	0.00	30.89	69.11	5.62
	DI2U	Sandy Mud	6.19	6.12	1.83	Poorly Sorted	-0.11	Coarse Skewed	0.00	13.14	86.86	7.57
	DI3L	Slightly Gravelly Sandy Mud	5.26	5.44	1.96	Poorly Sorted	0.08	Symmetrical	0.01	23.60	76.39	5.24
	DI3M	Sandy Mud	5.35	5.56	1.82	Poorly Sorted	0.14	Fine Skewed	0.00	20.33	79.67	5.77
	DI3U	Sandy Mud	5.35	5.27	2.20	Very Poorly Sorted	-0.10	Coarse Skewed	0.00	25.96	74.04	7.08
Indirect Impact North	IN1L	Sandy Mud	4.86	5.20	1.80	Poorly Sorted	0.24	Fine Skewed	0.00	26.91	73.09	4.02
	IN1M	Sandy Mud	4.95	5.27	1.82	Poorly Sorted	0.21	Fine Skewed	0.00	25.95	74.05	4.79
	IN1U	Sandy Mud	5.77	5.70	1.98	Poorly Sorted	-0.11	Coarse Skewed	0.00	19.58	80.42	7.90
	IN2L	Sandy Mud	5.04	5.16	1.91	Poorly Sorted	0.04	Symmetrical	0.00	27.84	72.16	6.82
	IN2M	Sandy Mud	4.76	4.92	1.95	Poorly Sorted	0.06	Symmetrical	0.00	32.22	67.78	5.40
	IN2U	Sandy Mud	5.40	5.39	2.00	Very Poorly Sorted	-0.06	Symmetrical	0.00	23.89	76.11	6.86
	IN3L	Gravelly Mud	4.34	2.51	4.52	Extremely Poorly Sorted	-0.46	Very Coarse Skewed	24.44	20.58	54.98	5.46
	IN3M	Slightly Gravelly Sandy Mud	5.40	5.33	2.06	Very Poorly Sorted	-0.11	Coarse Skewed	0.03	24.33	75.64	7.71
	IN3U	Sandy Mud	5.43	5.27	2.09	Very Poorly Sorted	-0.16	Coarse Skewed	0.00	25.16	74.84	7.79
Indirect Impact South	IS1L	Slightly Gravelly Sandy Mud	4.42	4.69	1.86	Poorly Sorted	0.19	Fine Skewed	0.02	39.58	60.41	6.06
	IS1M	Slightly Gravelly Sandy Mud	4.94	5.00	2.06	Very Poorly Sorted	0.01	Symmetrical	0.04	31.59	68.37	8.27
	IS1U	Sandy Mud	5.14	4.65	2.64	Very Poorly Sorted	-0.22	Coarse Skewed	0.00	35.61	64.39	10.66
	IS2L	Sandy Mud	4.44	4.76	1.83	Poorly Sorted	0.20	Fine Skewed	0.00	37.97	62.03	4.50
	IS2M	Sandy Mud	5.05	5.08	2.09	Very Poorly Sorted	-0.02	Symmetrical	0.00	29.72	70.28	8.23
	IS2U	Sandy Mud	5.83	5.58	2.24	Very Poorly Sorted	-0.21	Coarse Skewed	0.00	23.31	76.69	9.48
	IS3L	Sandy Mud	4.87	4.97	2.05	Very Poorly Sorted	0.03	Symmetrical	0.00	32.81	67.19	5.82
	IS3M	Slightly Gravelly Sandy Mud	5.07	5.31	1.86	Poorly Sorted	0.14	Fine Skewed	0.01	24.52	75.47	6.01
	IS3U	Sandy Mud	6.05	5.86	2.04	Very Poorly Sorted	-0.17	Coarse Skewed	0.00	18.65	81.35	8.95

Table 2. Summary of sedimentary parameters at Cherry Cobb Sands.

Area	Site	Sediment Type	Median Grain Size (phi)	Mean Grain Size (phi)	Sorting (phi)		Skewness (phi)		% Gravel	% Sand	% Mud	% LOI
Control North	CCN1L	Slightly Gravelly Muddy Sand	3.83	4.47	1.84	Poorly Sorted	0.48	Very Fine Skewed	0.04	55.68	44.28	3.52
	CCN1M	Sandy Mud	5.22	5.51	1.81	Poorly Sorted	0.20	Fine Skewed	0.00	20.54	79.46	6.89
	CCN1U	Slightly Gravelly Sandy Mud	5.70	5.73	1.93	Poorly Sorted	-0.01	Symmetrical	0.06	19.58	80.37	6.89
	CCN2L	Slightly Gravelly Sandy Mud	4.34	4.81	1.95	Poorly Sorted	0.31	Very Fine Skewed	0.04	43.65	56.31	3.57
	CCN2M	Slightly Gravelly Sandy Mud	5.21	5.38	1.98	Poorly Sorted	0.06	Symmetrical	0.07	24.87	75.06	8.51
	CCN2U	Sandy Mud	6.31	6.16	1.84	Poorly Sorted	-0.16	Coarse Skewed	0.00	13.49	86.51	7.98
	CCN3L	Muddy Sand	3.85	4.48	1.87	Poorly Sorted	0.45	Very Fine Skewed	0.00	54.93	45.07	4.76
	CCN3M	Sandy Mud	5.05	5.30	1.90	Poorly Sorted	0.12	Fine Skewed	0.00	25.15	74.85	7.32
	CCN3U	Sandy Mud	5.78	5.72	2.06	Very Poorly Sorted	-0.12	Coarse Skewed	0.00	19.32	80.68	9.75
Control South	CS1L	Muddy Sand	3.39	3.40	0.76	Moderately Sorted	0.04	Symmetrical	0.00	80.18	19.82	2.34
	CS1M	Slightly Gravelly Sandy Mud	4.53	4.95	1.73	Poorly Sorted	0.33	Very Fine Skewed	0.06	32.59	67.35	5.08
	CS1U	Slightly Gravelly Sandy Mud	4.68	5.04	1.64	Poorly Sorted	0.32	Very Fine Skewed	0.04	28.45	71.50	4.33
	CS2L	Sand	2.61	2.64	0.66	Moderately Well Sorted	0.12	Fine Skewed	0.00	95.63	4.37	1.19
	CS2M	Slightly Gravelly Muddy Sand	3.84	3.94	1.11	Poorly Sorted	0.30	Fine Skewed	0.25	57.32	42.43	2.72
	CS2U	Slightly Gravelly Sandy Mud	5.01	5.34	1.74	Poorly Sorted	0.25	Fine Skewed	0.35	22.42	77.24	5.11
	CS3L	Sand	2.65	2.69	0.71	Moderately Sorted	0.12	Fine Skewed	0.00	94.82	5.18	1.84
	CS3M	Muddy Sand	3.67	3.73	0.99	Moderately Sorted	0.27	Fine Skewed	0.00	66.54	33.46	2.78
	CS3U	Slightly Gravelly Sandy Mud	4.25	4.58	1.50	Poorly Sorted	0.37	Very Fine Skewed	0.44	40.38	59.18	3.42
Impact	I1L	Muddy Sand	3.46	3.50	0.89	Moderately Sorted	0.26	Fine Skewed	0.00	78.35	21.65	1.60
	I1M	Slightly Gravelly Sandy Mud	4.95	5.28	1.85	Poorly Sorted	0.20	Fine Skewed	0.19	25.26	74.55	5.55
	I1U	Sandy Mud	4.92	5.20	1.76	Poorly Sorted	0.19	Fine Skewed	0.00	24.71	75.29	5.75
	I2L	Muddy Sand	3.65	3.79	1.20	Poorly Sorted	0.36	Very Fine Skewed	0.00	66.30	33.70	2.71
	I2M	Slightly Gravelly Sandy Mud	4.88	5.14	1.85	Poorly Sorted	0.14	Fine Skewed	0.07	27.02	72.92	6.12
	I2U	Sandy Mud	4.99	5.10	1.95	Poorly Sorted	0.04	Symmetrical	0.00	28.27	71.73	8.10
	I3L	Slightly Gravelly Muddy Sand	3.62	3.78	1.22	Poorly Sorted	0.39	Very Fine Skewed	0.07	67.70	32.23	2.73
	I3M	Slightly Gravelly Sandy Mud	4.95	5.16	1.87	Poorly Sorted	0.11	Fine Skewed	0.06	27.18	72.76	7.74
	I3U	Sandy Mud	5.57	5.68	1.87	Poorly Sorted	0.02	Symmetrical	0.00	17.65	82.35	8.00

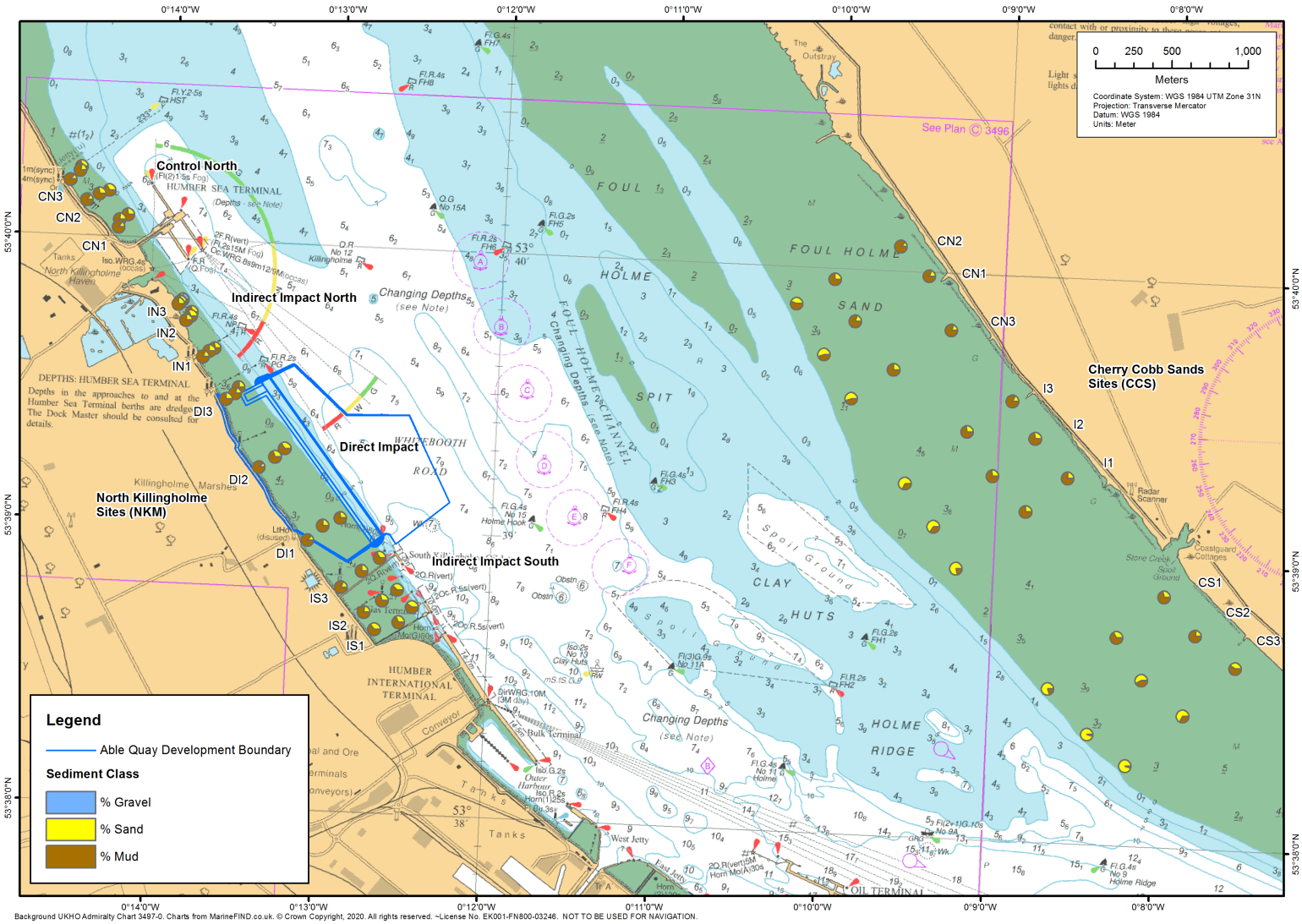


Figure 2. Sediment composition at survey sites.

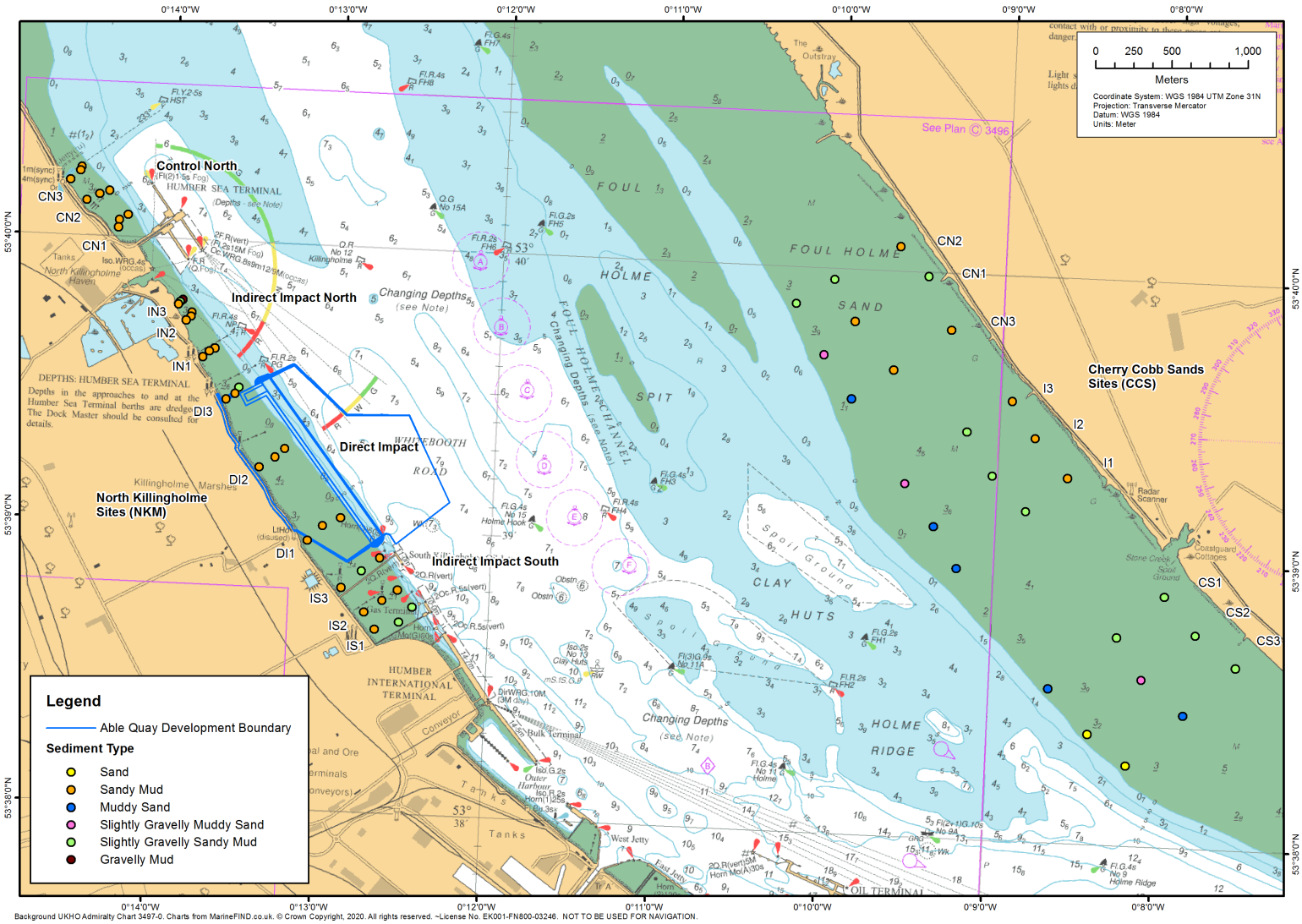


Figure 3. Sediment type at survey sites.

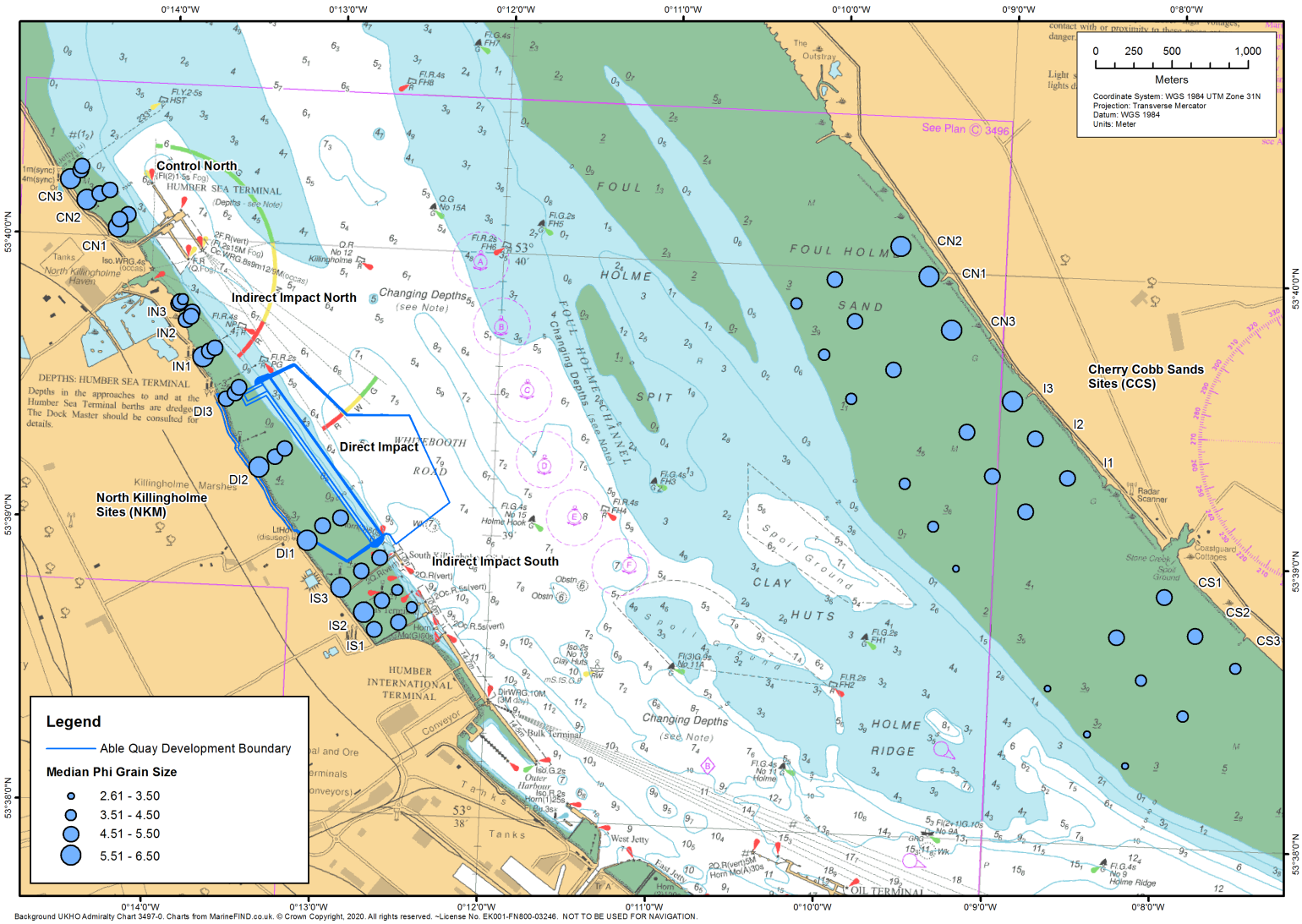


Figure 4. Median phi grain size at survey sites.

3.2 Biological Parameters

A number of primary and derived biological parameters values were calculated from the species data tabulated and input into GIS. Standard biological parameters utilised for benthic analysis include the following:

- The total number of taxa at each site/replicate (S)
- The total number of individuals (abundance) at each site/replicate (N)
- The total biomass (in grams AFDW) at each site/replicate (B).
- Margalef's index of species richness (d)
- Shannon's diversity index (H')

This index is a univariate measure of diversity which incorporates both the number of species and the distribution or equitability of individuals between species. High values of H' indicate a more diverse community whilst low values indicate low diversity.

- Pielou's evenness (J)

This index is a univariate measure of evenness or equitability which describes the distribution of individuals between species. High values of J (approaching 1) indicate that the abundance of animals are evenly spread between species whilst low values of J (approaching 0) indicate that the majority of animals are comprised of a few species, a situation which often occurs in low diversity areas subject to disturbance or organic enrichment.

In addition, the PRIMER package developed by Primer-E (Clarke and Gorley, 2006) was used to derive Abundance Biomass Comparison (ABC) plots (Warwick, 1986) for each replicate and per site. These show the cumulative % dominance of abundance and biomass per species rank and have been used to detect stress in benthic communities. In healthy communities the biomass curve is usually elevated above the abundance curve whilst in transitional or disturbed communities the abundance curves intersects the biomass curves or is elevated above it as the community is characterised by numerous small-bodied opportunist species. In naturally stressed environments such as estuaries some communities naturally exhibit curves indicative of chronic levels of disturbance e.g. due to salinity fluctuations or sediment disturbance although the curves still provide a useful graphical description of community structure and the contribution of larger bodied animals which may for example be an important food source for other groups of animals such as birds/fish. The ABC plots produced by PRIMER also provide the w statistic, which is a univariate descriptor of the ABC plots and measures the extent to which the biomass curve lies above the abundance curve (positive values for relatively undisturbed communities and negative values for potentially disturbed communities) and this was subsequently used as an additional biological parameter.

A summary of the biological parameters at each site is provided in Tables 3 and 4 which gives average values per 0.01m^2 for North Killingholme and Cherry Cobb Sands respectively whilst the values of biological parameters from the individual replicates are provided in Appendices

3 and 4. Replicate samples have also been combined to provide summaries of overall ABC structure per site and these are provided in Appendices 5 and 6. A series of summary graphs showing average values (and standard error) for each zone/shore level have also been derived from the replicate data for each area to provide mean biological parameters per 0.01m^2 (Figures 5 and 6) and the spatial variation in these parameters is highlighted in Figures 7 to 13.

3.2.1 North Killingholme

Values of biological parameters appear to be typical for mid estuary muddy intertidal habitats and generally correspond to values recorded elsewhere in the middle reaches of the Humber estuary. Total numbers of taxa tend to be relatively low with mean numbers of taxa ranging from around 2 to 8 animals per 0.01m^2. The mean numbers of individuals was extremely variable with very low mean numbers (<10 animals per 0.01m^2) in some areas (predominantly at lower shore sites) and mean numbers of individuals ranged from 6 to 265 individuals per 0.01m^2. Biomass was similarly variable with average AFDW biomass values ranging from 0.0001g to 0.045g per core. Average abundances and biomass scaled up to values per metre square range from 600 to 26500 animals per m^2 and 0.0129g to 4.5g AFDW biomass per m^2.

Some spatial patterns in biological patterns were evident (Figures 2 to 9) largely in relation to position on the shore. Numbers of taxa were relatively similar across the survey area with slightly higher numbers of taxa recorded at midshore areas. Numbers of individuals and biomass tended to show more distinct patterns in relation to shore position with generally lower values on the lower shore and increased numbers of individuals or biomass on the midshore (or occasionally upper shore). Biomass and numbers of individuals were relatively variable with occasional sites exhibiting particularly high or low values occurring throughout the survey area. Values for diversity indices such as Margalef's d and Shannon's H tended to be moderate to low (as is commonly the case in estuarine habitats) with mean Shannon's H' diversity varying from 0.33 to 2.29 and values of Pielou's evenness J were moderate to low ranging from 0.35 to 0.96. Relatively few obvious spatial patterns in these parameters were evident.

The mean values of the ABC w statistic in Table 3 and ABC plots per site provided in Appendix 5 indicated that the majority of sites had biomass curves elevated above the abundance curve indicating normal communities, although a few sites exhibited plots in which the curves intersected with mean w statistics of close to or just below zero. However, such values are typical in naturally stressed estuarine habitats and in these areas the lower w values tend to reflect due to increased dominance by taxa such as *Corophium volutator* (or oligochaete taxa) and no communities particularly indicative of organic enrichment or anthropogenic disturbance were observed. No obvious spatial pattern was evident in terms of ABC curves or the resultant w statistics and each survey area had examples of high and low values. However, a slightly higher number of sites with intersecting ABC plots and negative w values were located within the northern control area.

3.2.2 Cherry Cobb Sands

The mean biological parameters derived from Cherry Cobb Sands dataset are shown in Table 4 whilst the replicate data is given in Appendix 4 and graphs showing mean values per 0.01m^2 for each survey area and shore level with error bars are given in Figure 6. The spatial distribution of mean biological parameters per site are provided in Figures 7 to 13. The results of the CCS survey indicate that numbers of taxa were broadly similar to NKM with mean values per site ranging from 1 to 13 taxa per 0.01m^2 with lower numbers of taxa often recorded at the lower shore sites particularly in sandier habitats. The mean numbers of individuals at CCS were also broadly similar to the NKM sites (ranging from 1.33 to 460 per 0.01m^2) whilst mean AFDW biomass ranged from 0.00002g to 0.1842g per 0.01m^2. Total abundances and biomass scaled up to values per metre square ranged from 133 to 46000 animals per m^2 and 0.0022g to 18.42g AFDW biomass per m^2 and generally correspond to other surveys in the middle Humber. Lower faunal densities (and biomass) tended to be present in low shore areas which presumably reflects a more dynamic sedimentary environment on the low shore. Diversity parameters were variable with mean Shannon's H' diversity varying from 0.31 to 2.6 and mean Pielou's evenness ranging from 0.54 to 1.00. Overall, the sites at CCS generally exhibited somewhat low to moderate levels of diversity and aside from impoverished low shore sandy habitats were often slightly more diverse than corresponding habitats at NKM. ABC plots per replicate indicated that the majority of sites exhibited curves with biomass curves above abundance curves (higher w values) although occasional sites (usually on upper or mid shore muddy habitats) had intersecting curves with w values around or just below zero.

An assessment of spatial variability in terms of biological parameters indicates relatively few differences between NKM and CCS in terms of the numbers of taxa although a higher total number of taxa were recorded at CCS which presumably reflects the wider range of sediment types in this area. Numbers of individuals and biomass were highly variable throughout the survey area although CCS sites tended to exhibit lower values than NKM on the low shore (particularly in more mobile sandy habitats). Diversity parameters were similarly variable and typically low to moderate with lowest diversity values at NKM typically recorded on the upper shore (or occasionally on the lower shore) whilst at CCS lowest diversities were usually recorded in sandier sediments on the low shore The remainder of the upper and mid shore CCS sites however tended to have somewhat higher total numbers of individuals and biomass than recorded at the NKM sites.

Table 3. Mean values of biological parameters for each site (0.01m²) at North Killingholme.

Area	Shore	Site	Mean Numbers of Taxa	Mean Numbers of Individuals		Mean Biomass (AFDW g)		Mean Margalef's d	Mean Pielou's J	Mean Shannon's H'	Mean AFDW ABC w stat
				per 0.01m²	per 1m²	per 0.01m²	per 1m²				
Control North	Low	CN1L	4.33	19.33	1933	0.0017	0.1710	1.12	0.77	1.57	0.23
	Mid	CN1M	6.33	117.00	11700	0.0303	3.0332	1.12	0.51	1.34	0.01
	Upper	CN1U	6.00	111.33	11133	0.0283	2.8261	1.09	0.60	1.54	0.06
	Low	CN2L	5.00	13.00	1300	0.0039	0.3936	1.38	0.90	1.79	0.27
	Mid	CN2M	5.33	106.67	10667	0.0257	2.5654	0.84	0.58	1.27	-0.10
	Upper	CN2U	2.67	27.67	2767	0.0017	0.1686	0.53	0.48	0.66	-0.31
	Low	CN3L	5.33	78.33	7833	0.0170	1.7043	0.92	0.35	0.82	-0.04
	Mid	CN3M	5.33	107.33	10733	0.0384	3.8425	0.92	0.55	1.31	-0.02
	Upper	CN3U	6.33	125.00	12500	0.0314	3.1375	1.18	0.78	2.03	0.35
Direct Impact	Low	DI1L	4.00	16.33	1633	0.0012	0.1187	1.11	0.80	1.60	0.08
	Mid	DI1M	7.33	265.00	26500	0.0362	3.6154	1.21	0.45	1.23	0.00
	Upper	DI1U	2.33	58.33	5833	0.0044	0.4425	0.32	0.37	0.42	0.05
	Low	DI2L	4.67	69.00	6900	0.0060	0.6041	0.86	0.53	1.17	-0.10
	Mid	DI2M	4.33	57.33	5733	0.0184	1.8434	0.86	0.82	1.72	0.37
	Upper	DI2U	2.67	7.00	700	0.0001	0.0129	0.63	0.59	0.93	0.16
	Low	DI3L	3.33	9.67	967	0.0005	0.0471	1.04	0.72	1.24	0.19
	Mid	DI3M	4.67	49.67	4967	0.0091	0.9078	0.79	0.59	1.17	-0.21
	Upper	DI3U	7.00	137.67	13767	0.0371	3.7150	1.23	0.58	1.63	0.02
Indirect Impact North	Low	IN1L	4.67	203.67	20367	0.0343	3.4323	0.62	0.16	0.33	0.04
	Mid	IN1M	3.33	63.00	6300	0.0087	0.8747	0.55	0.69	1.06	0.20
	Upper	IN1U	8.33	117.33	11733	0.0450	4.5000	1.51	0.61	1.83	0.18
	Low	IN2L	4.33	18.67	1867	0.0033	0.3299	1.13	0.77	1.62	0.30
	Mid	IN2M	4.00	43.67	4367	0.0071	0.7101	0.81	0.70	1.36	0.01
	Upper	IN2U	4.33	72.67	7267	0.0192	1.9161	0.80	0.34	0.70	-0.14
	Low	IN3L	3.67	8.67	867	0.0047	0.4661	1.42	0.96	1.74	0.79
	Mid	IN3M	5.67	31.33	3133	0.0182	1.8240	1.57	0.86	2.14	0.50
	Upper	IN3U	5.33	34.33	3433	0.0034	0.3373	1.13	0.59	1.38	0.05
Indirect Impact South	Low	IS1L	3.00	6.00	600	0.0055	0.5458	1.11	0.91	1.28	0.73
	Mid	IS1M	4.00	23.67	2367	0.0399	3.9878	1.06	0.74	1.45	0.19
	Upper	IS1U	5.00	46.00	4600	0.0159	1.5928	1.20	0.64	1.45	0.12
	Low	IS2L	3.33	9.00	900	0.0079	0.7908	0.97	0.94	1.44	0.69
	Mid	IS2M	6.33	57.00	5700	0.0337	3.3661	1.32	0.87	2.23	0.50
	Upper	IS2U	6.00	76.33	7633	0.0425	4.2483	1.33	0.69	1.60	0.45
	Low	IS3L	6.33	11.33	1133	0.0130	1.3036	2.04	0.92	2.29	0.53
	Mid	IS3M	6.00	218.33	21833	0.0371	3.7118	0.94	0.53	1.34	-0.15
	Upper	IS3U	3.00	18.67	1867	0.0008	0.0754	0.42	0.53	0.56	-0.01

Table 4. Mean values of biological parameters for each site (0.01m²) at Cherry Cobb Sands.

Area	Shore	Site	Mean Numbers of Taxa	Mean Numbers of Individuals		Mean Biomass (AFDW g)		Mean Margalef's d	Mean Pielou's J	Mean Shannon's H'	Mean AFDW ABC w stat
				per 0.01m²	per 1m²	per 0.01m²	per 1m²				
Control North	Low	CCN1L	3.00	7.00	700	0.0033	0.3253	1.08	0.84	1.33	0.37
	Mid	CCN1M	6.33	460.00	46000	0.0920	9.1970	0.75	0.61	1.28	0.16
	Upper	CCN1U	5.00	33.67	3367	0.0650	6.4981	1.12	0.77	1.67	0.45
	Low	CCN2L	5.67	101.33	10133	0.0066	0.6622	1.47	0.89	1.76	0.62
	Mid	CCN2M	3.00	21.33	2133	0.0008	0.0765	0.71	0.67	1.03	-0.20
	Upper	CCN2U	7.33	133.33	13333	0.0755	7.5487	1.38	0.60	1.66	0.22
	Low	CCN3L	3.33	8.67	867	0.0143	1.4303	1.11	0.81	1.42	0.53
	Mid	CCN3M	7.33	422.67	42267	0.0314	3.1389	1.08	0.54	1.45	-0.02
	Upper	CCN3U	1.67	1.67	167	0.0000	0.0022	0.91	0.92	0.31	-0.06
Control South	Low	CS1L	3.00	3.00	300	0.0207	2.0680	1.39	0.94	0.95	0.39
	Mid	CS1M	11.67	197.00	19700	0.1177	11.7692	2.05	0.73	2.60	0.17
	Upper	CS1U	12.67	227.33	22733	0.1842	18.4202	2.12	0.68	2.44	0.14
	Low	CS2L	2.00	2.33	233	0.0121	1.2050	0.82	0.86	0.58	0.07
	Mid	CS2M	8.33	50.33	5033	0.1167	11.6730	1.87	0.61	1.84	0.24
	Upper	CS2U	11.33	135.67	13567	0.1655	16.5508	1.99	0.71	2.36	0.24
	Low	CS3L	2.33	2.33	233	0.0021	0.2116	1.37	0.96	0.83	0.54
	Mid	CS3M	4.33	21.33	2133	0.1165	11.6522	1.09	0.61	1.28	0.26
	Upper	CS3U	11.00	213.67	21367	0.1367	13.6748	1.88	0.68	2.37	0.20
Impact	Low	I1L	1.33	1.33	133	0.0021	0.2079	1.44	1.00	0.33	0.24
	Mid	I1M	11.67	284.33	28433	0.1106	11.0633	1.93	0.72	2.52	0.19
	Upper	I1U	10.00	104.00	10400	0.0723	7.2320	1.89	0.67	2.03	0.23
	Low	I2L	2.33	10.67	1067	0.0194	1.9376	0.56	0.75	0.90	0.51
	Mid	I2M	11.00	203.00	20300	0.1427	14.2697	1.89	0.69	2.38	0.20
	Upper	I2U	8.00	118.00	11800	0.0449	4.4902	1.49	0.86	2.32	0.24
	Low	I3l	4.33	7.00	700	0.0126	1.2587	1.23	0.96	1.46	0.43
	Mid	I3M	10.67	261.67	26167	0.0682	6.8151	1.81	0.72	2.38	0.17
	Upper	I3U	3.33	14.67	1467	0.0006	0.0613	0.63	0.79	0.85	0.13

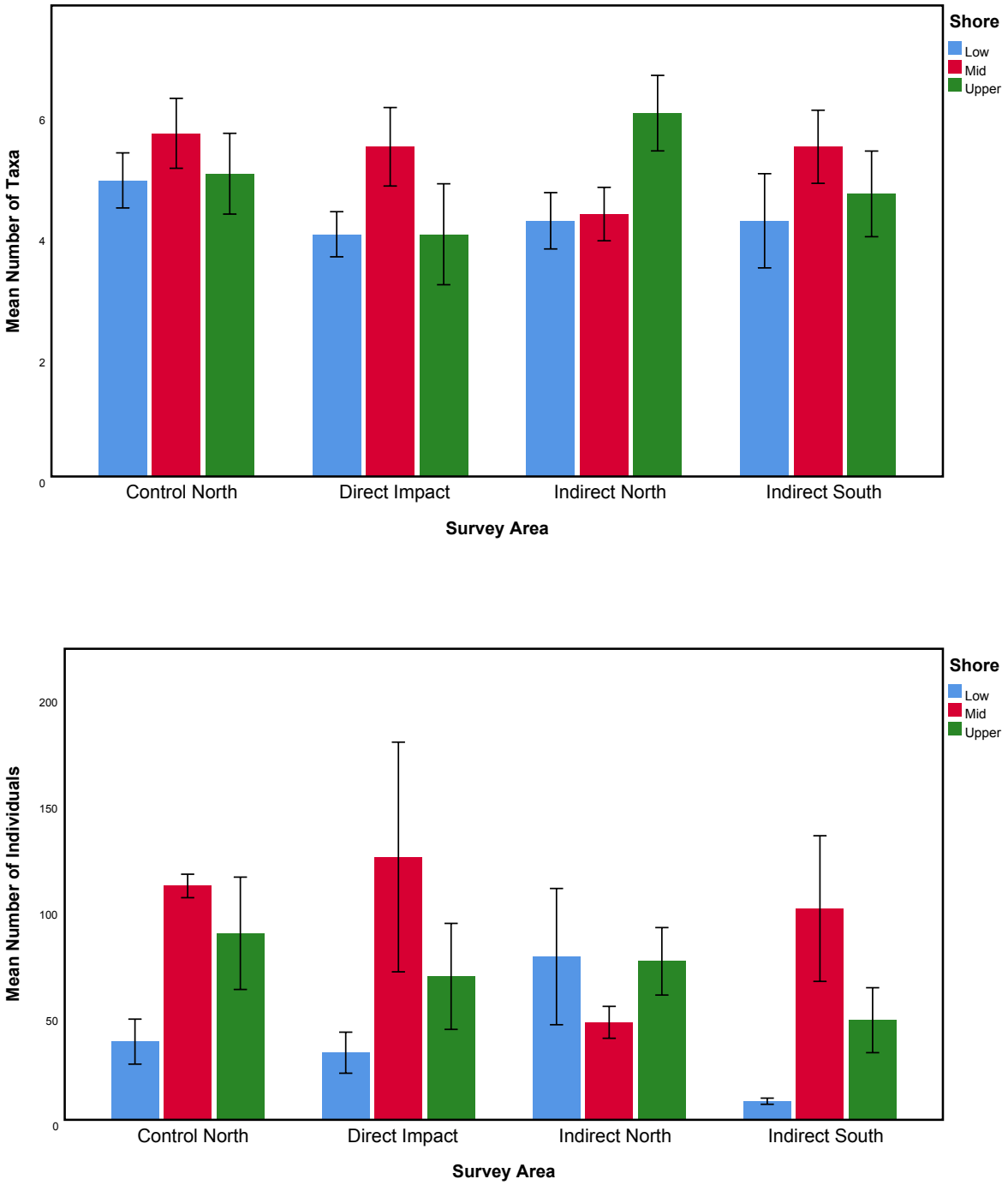
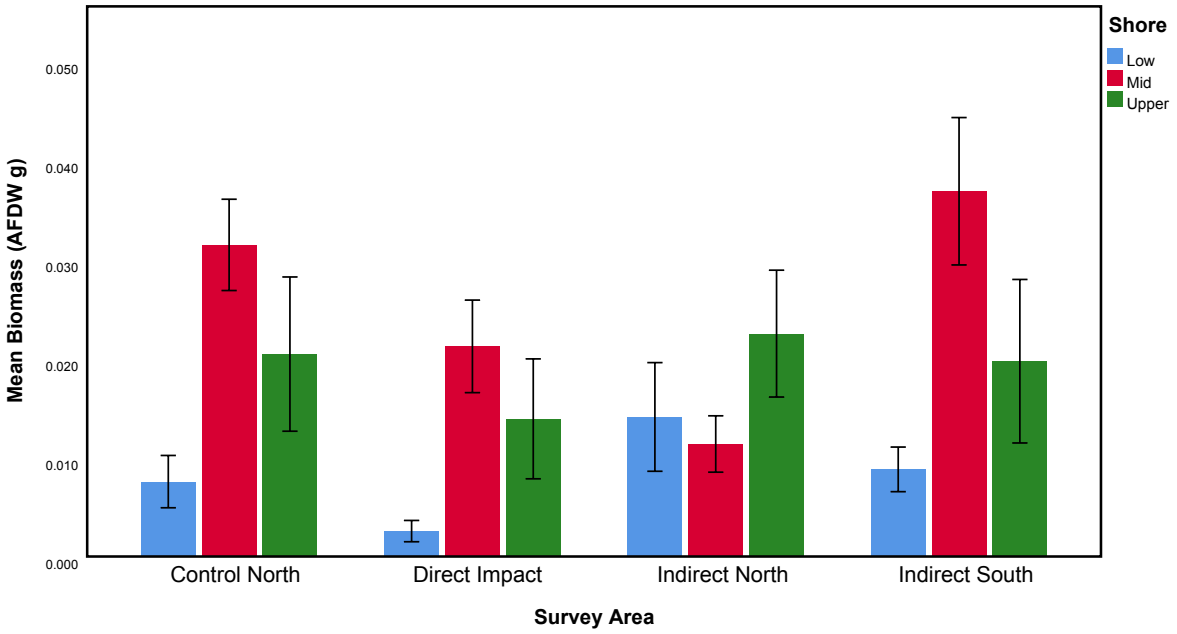


Figure 5. Average values (with standard error) of biological parameters (per 0.01m^2) for each survey area at North Killingholme.



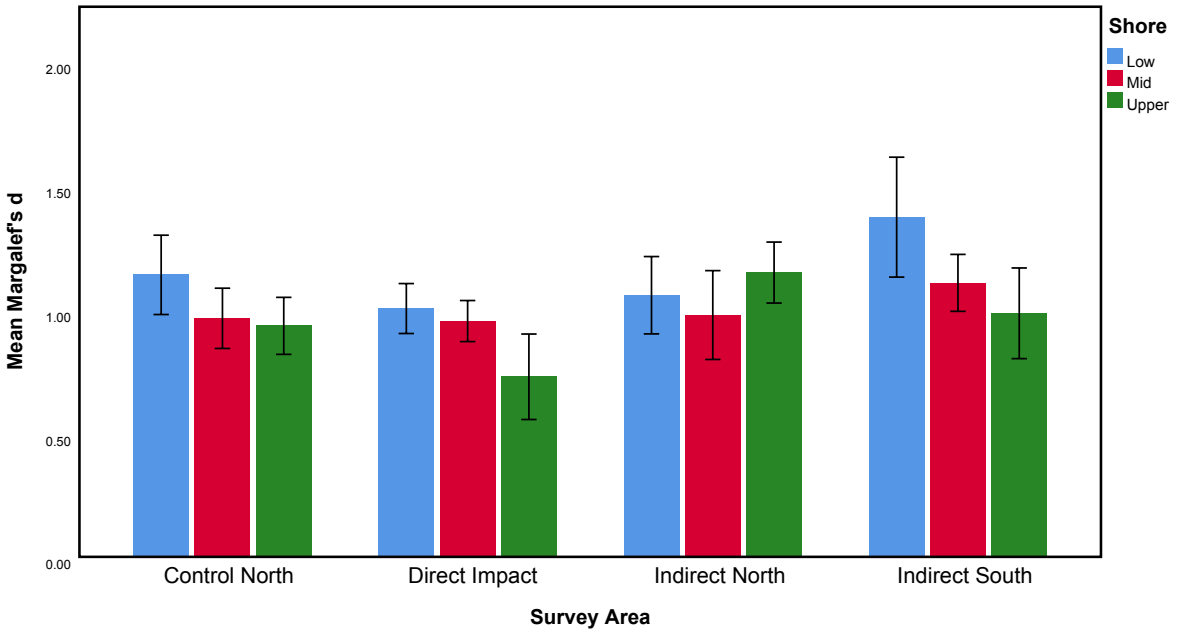
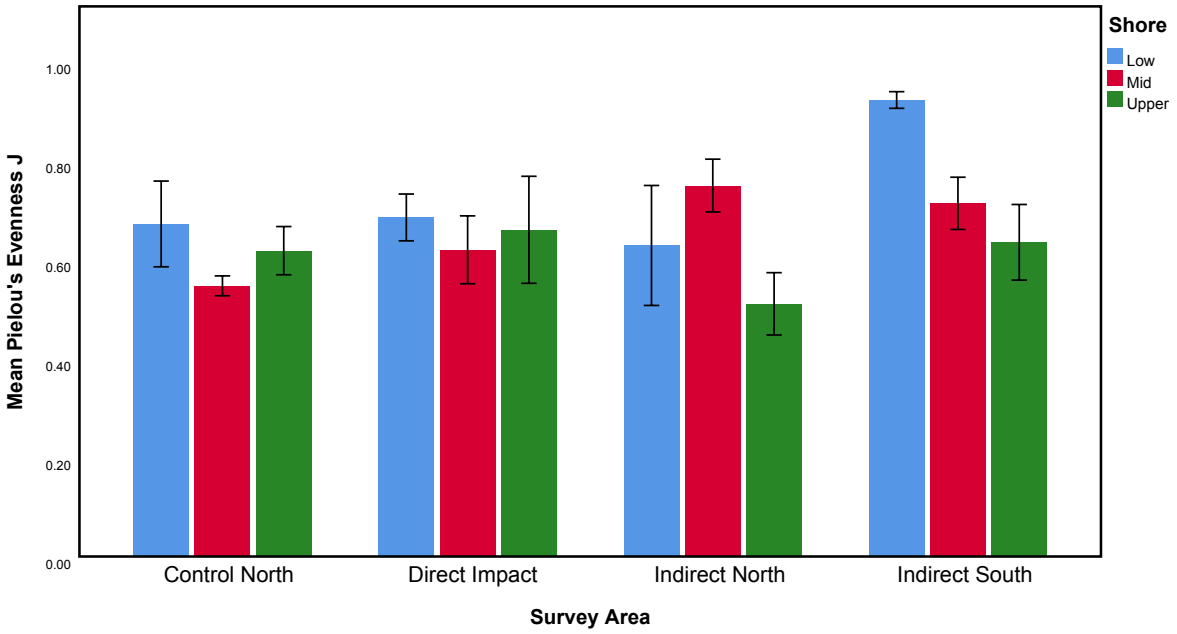


Figure 5 (cont.). Average values (with standard error) of biological parameters (per 0.01m^2) for each survey area at North Killingholme.



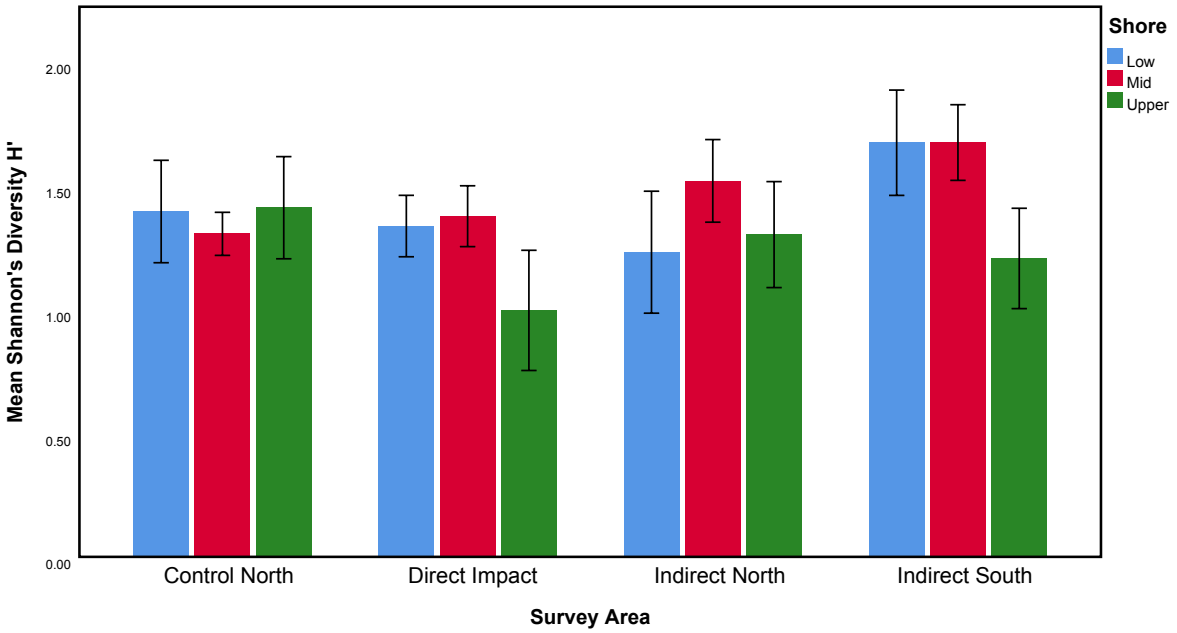


Figure 5 (cont.). Average values (with standard error) of biological parameters (per 0.01m^2) for each survey area at North Killingholme.

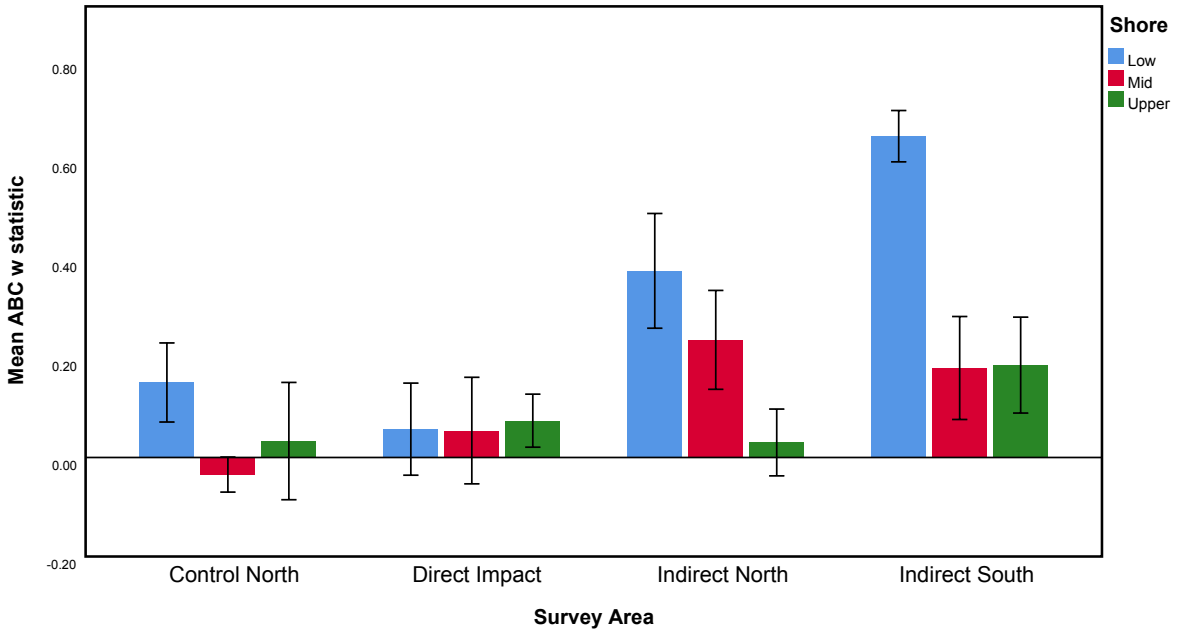


Figure 5 (cont.). Average values (with standard error) of biological parameters (per 0.01m^2) for each survey area at North Killingholme.

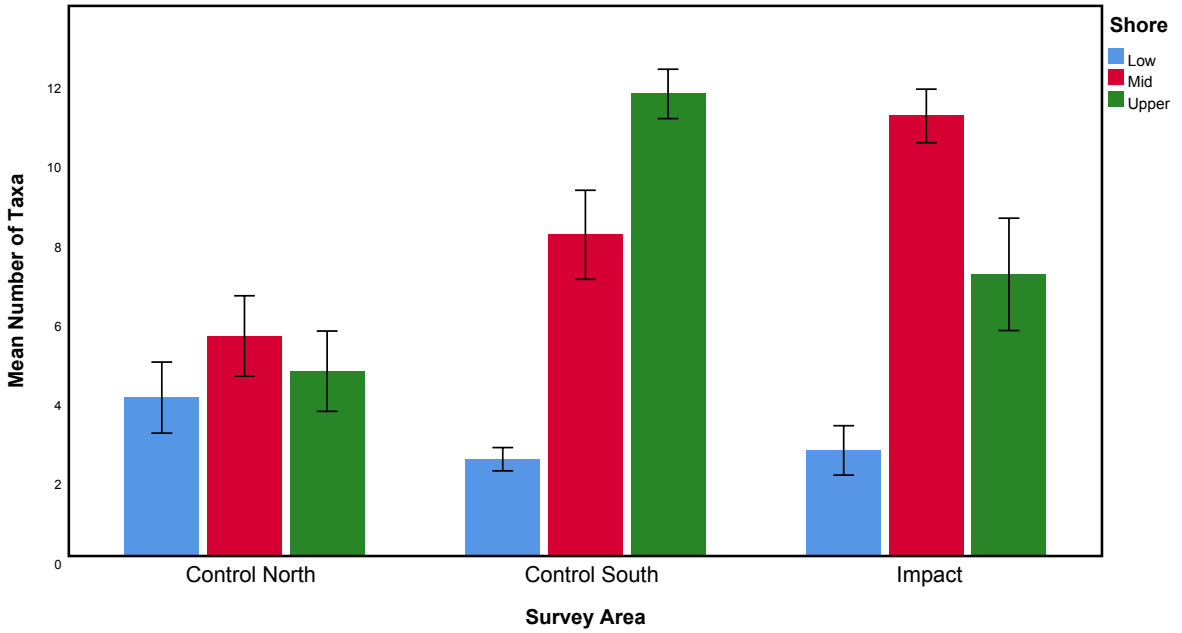
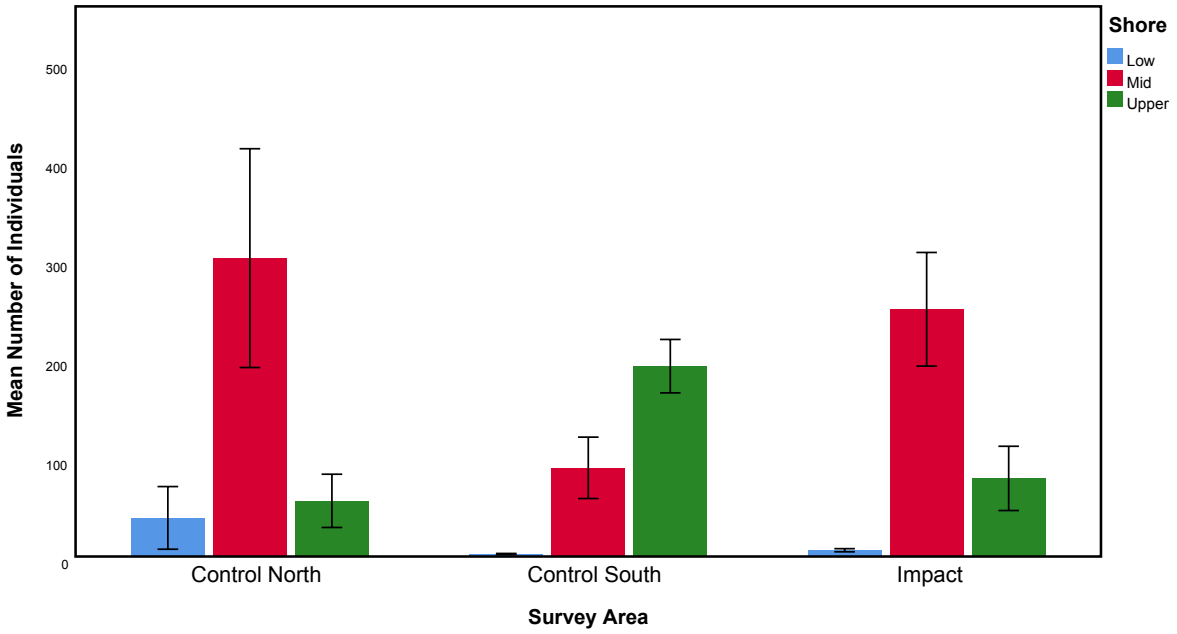


Figure 6. Average values (with standard error) of biological parameters (per 0.01m^2) for each survey area at Cherry Cobb Sands.



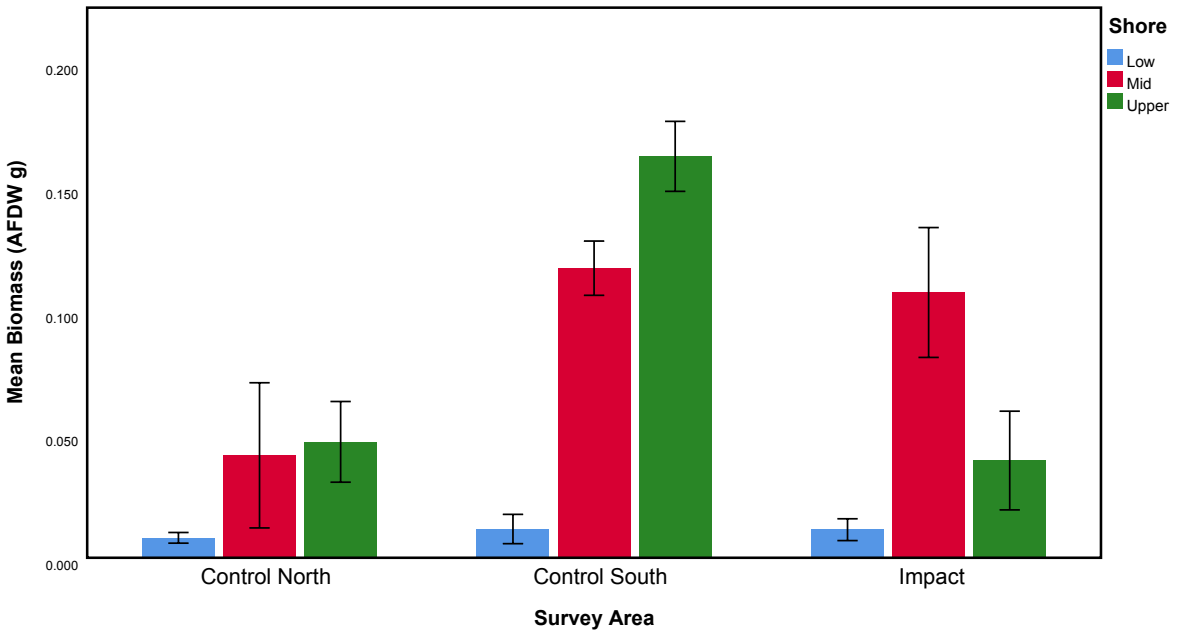
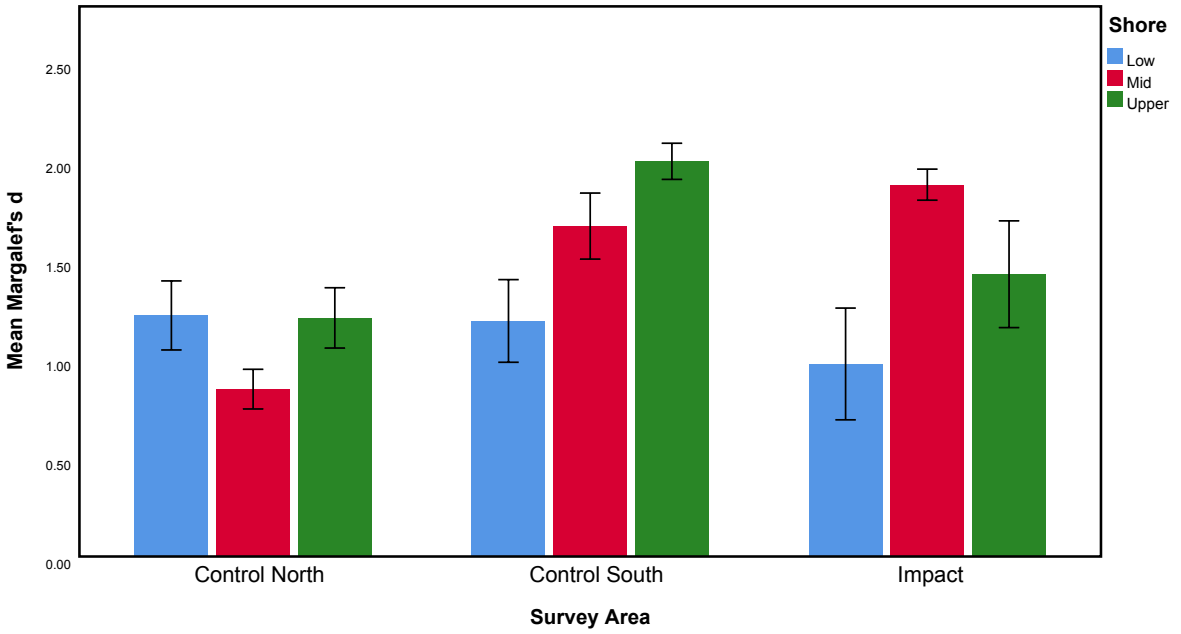


Figure 6 (cont.). Average values (with standard error) of biological parameters (per 0.01m^2) for each survey area at Cherry Cobb Sands.



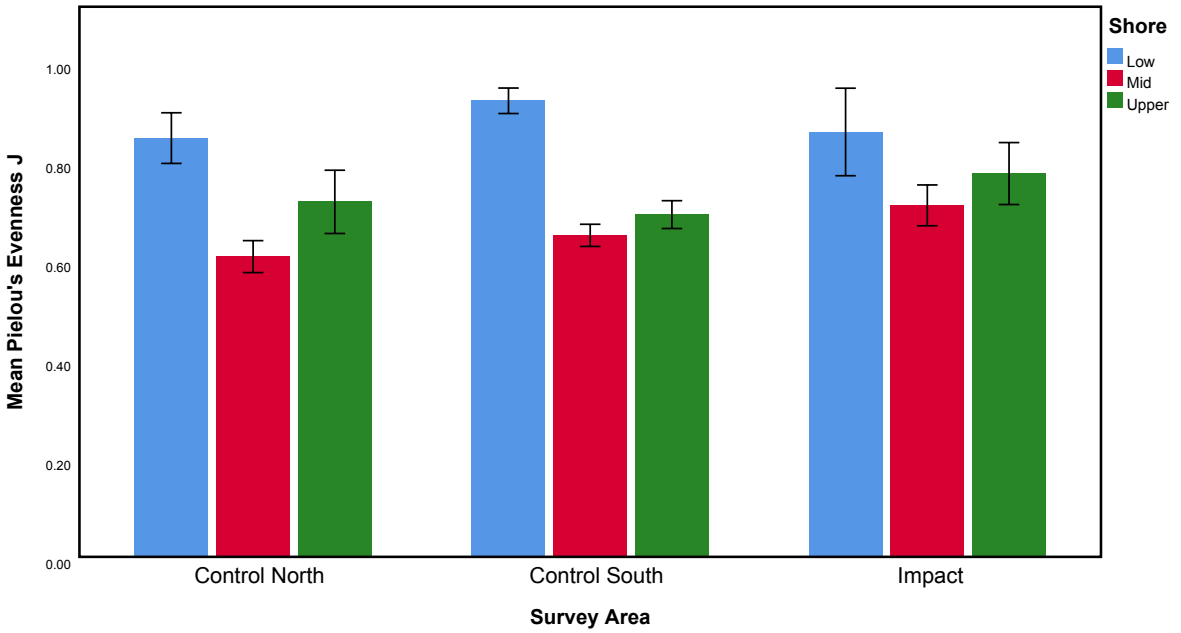


Figure 6 (cont.). Average values (with standard error) of biological parameters (per 0.01m^2) for each survey area at Cherry Cobb Sands.

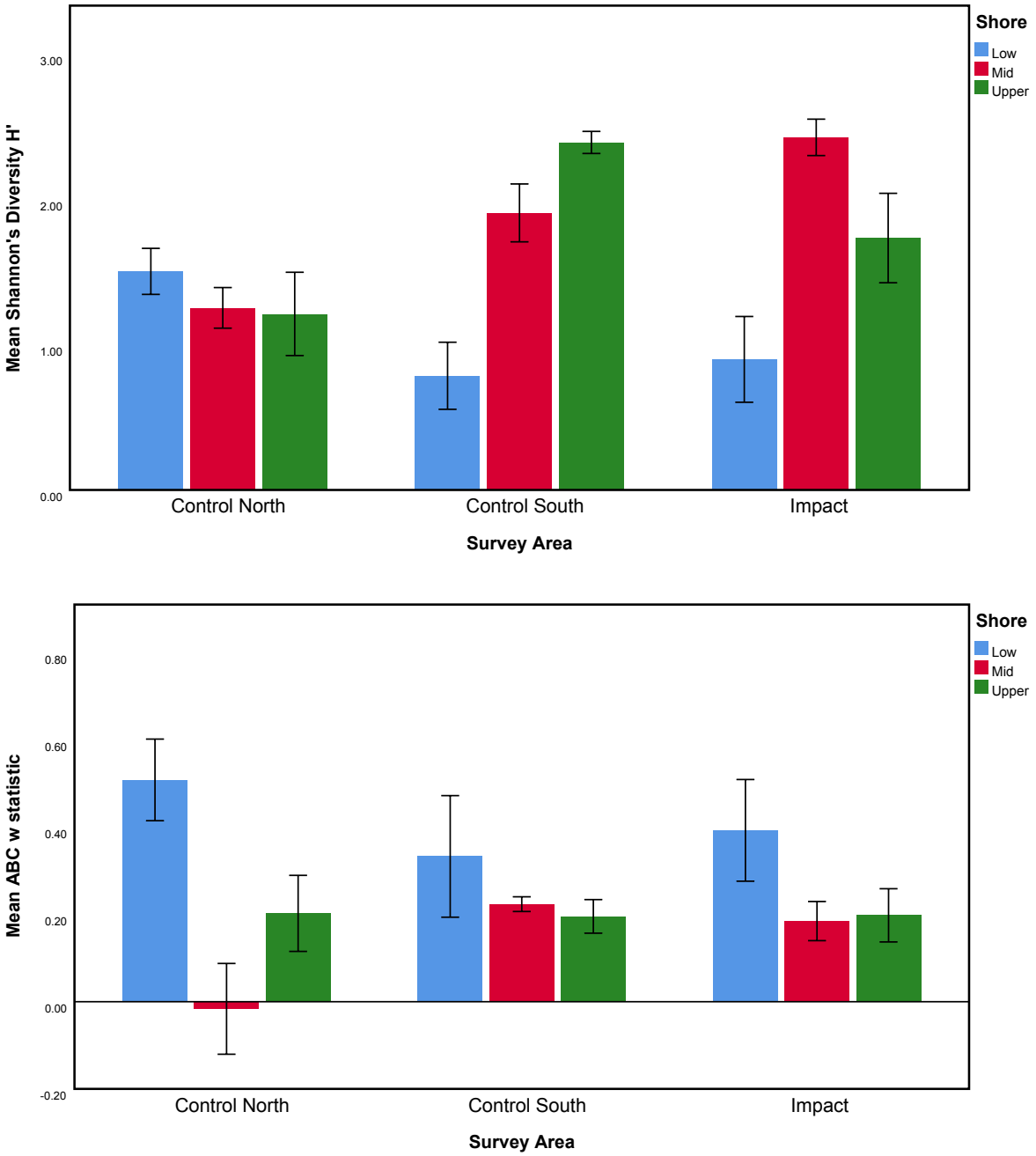


Figure 6 (cont.). Average values (with standard error) of biological parameters (per 0.01m^2) for each survey area at Cherry Cobb Sands.

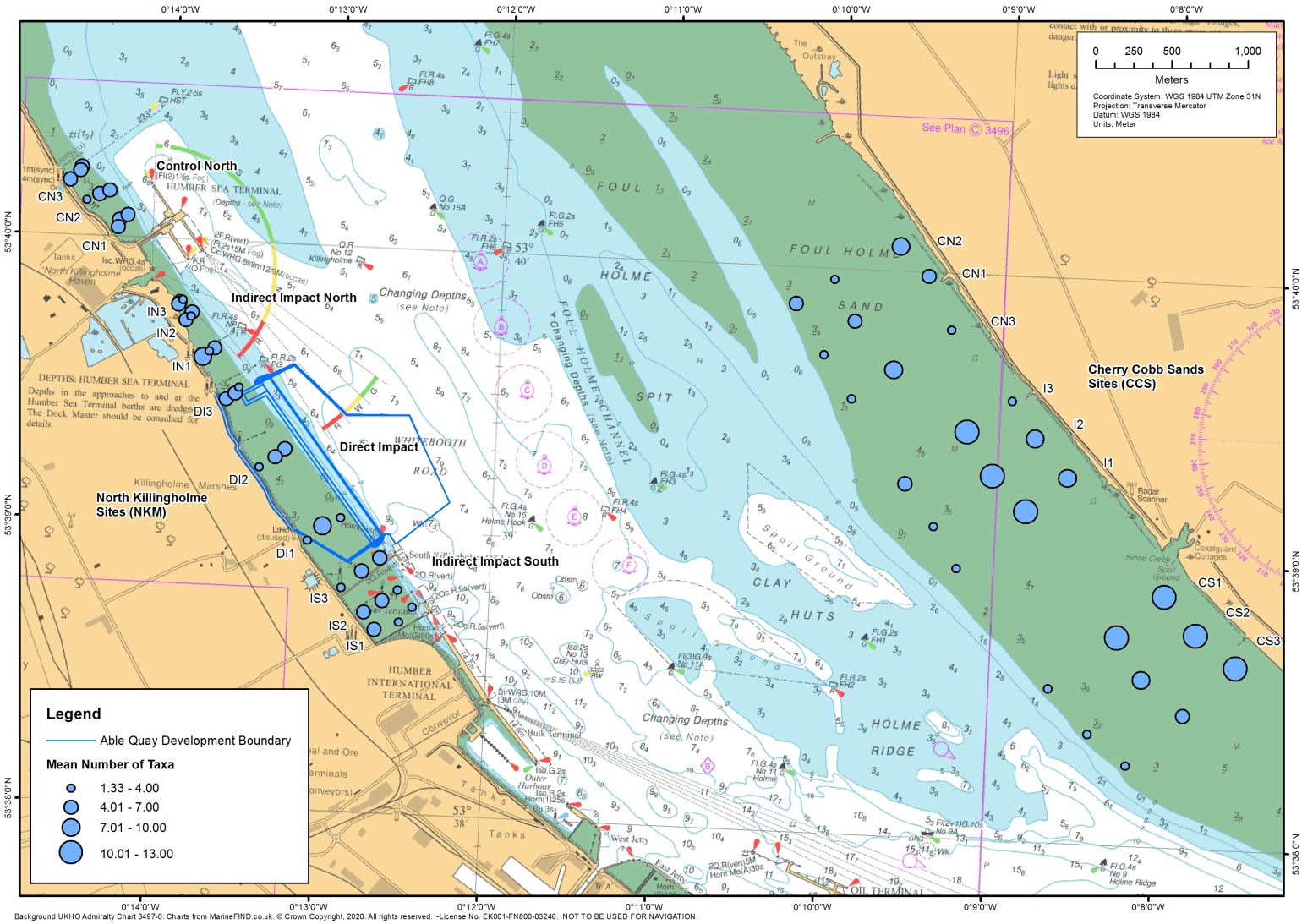


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Figure 7. Number of taxa per 0.01m² at the survey sites.

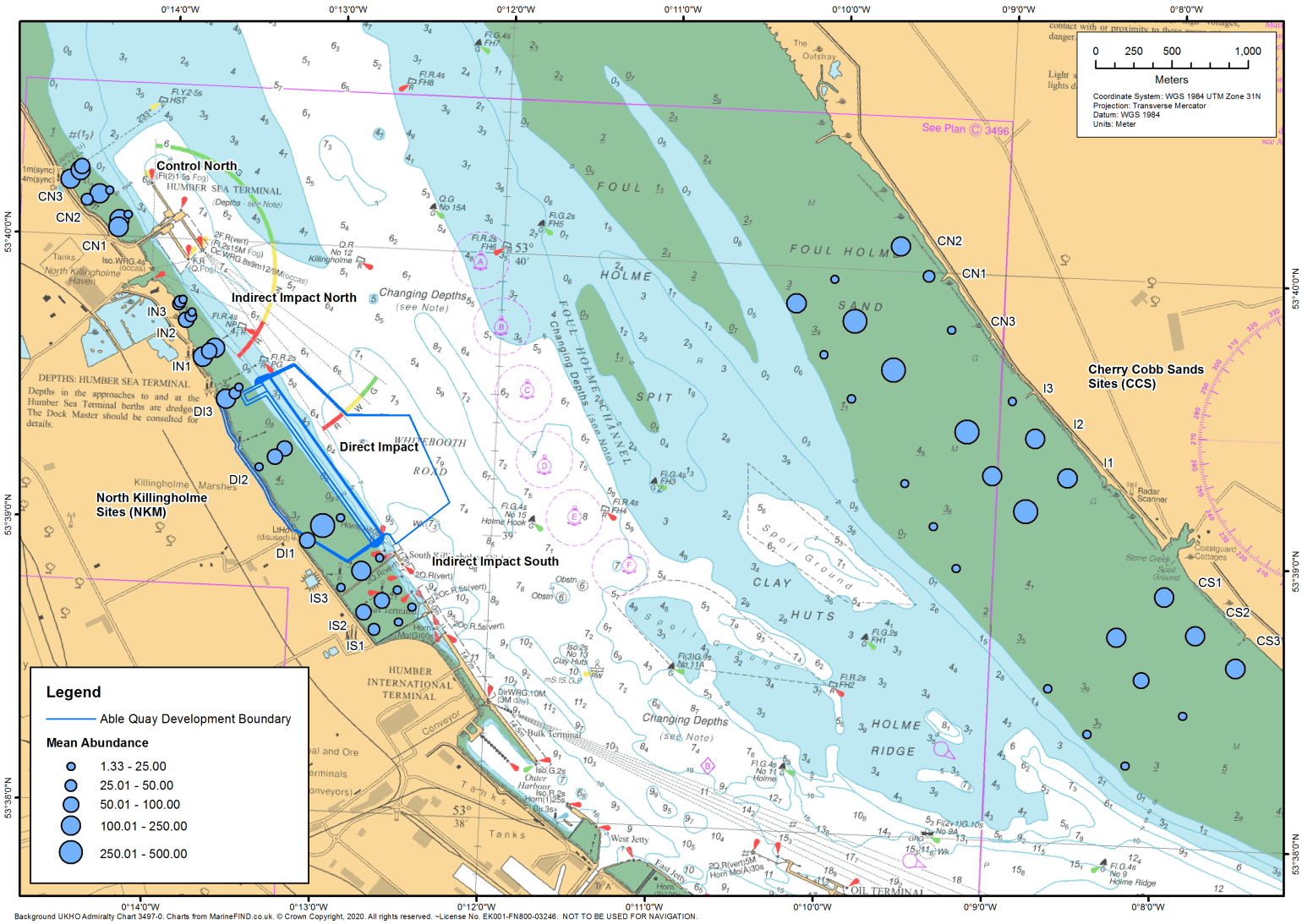

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Figure 8. Numbers of individuals per 0.01m^2 at the survey sites.

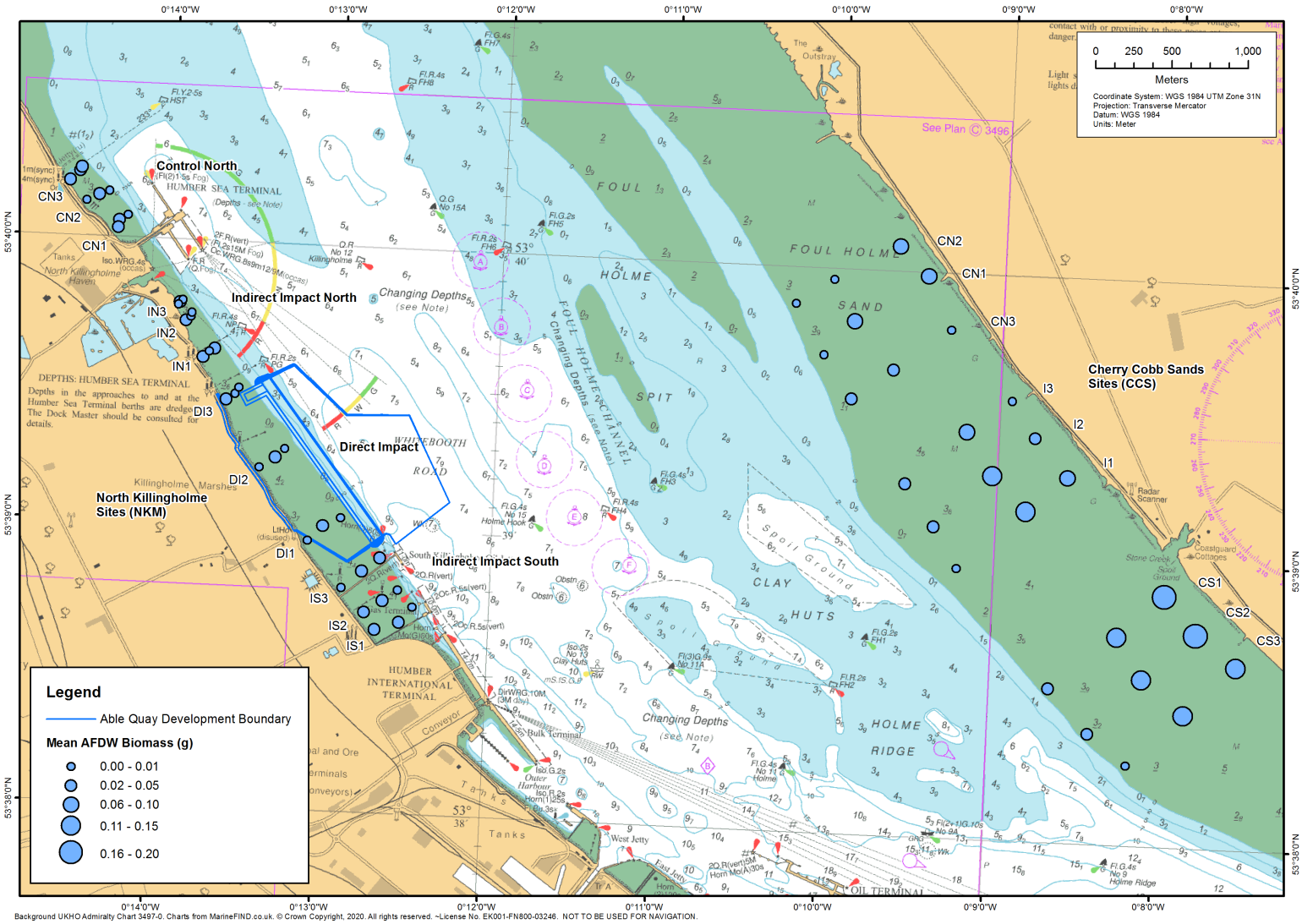


Figure 9. AFDW Biomass (g per 0.01m^2) at the survey sites.

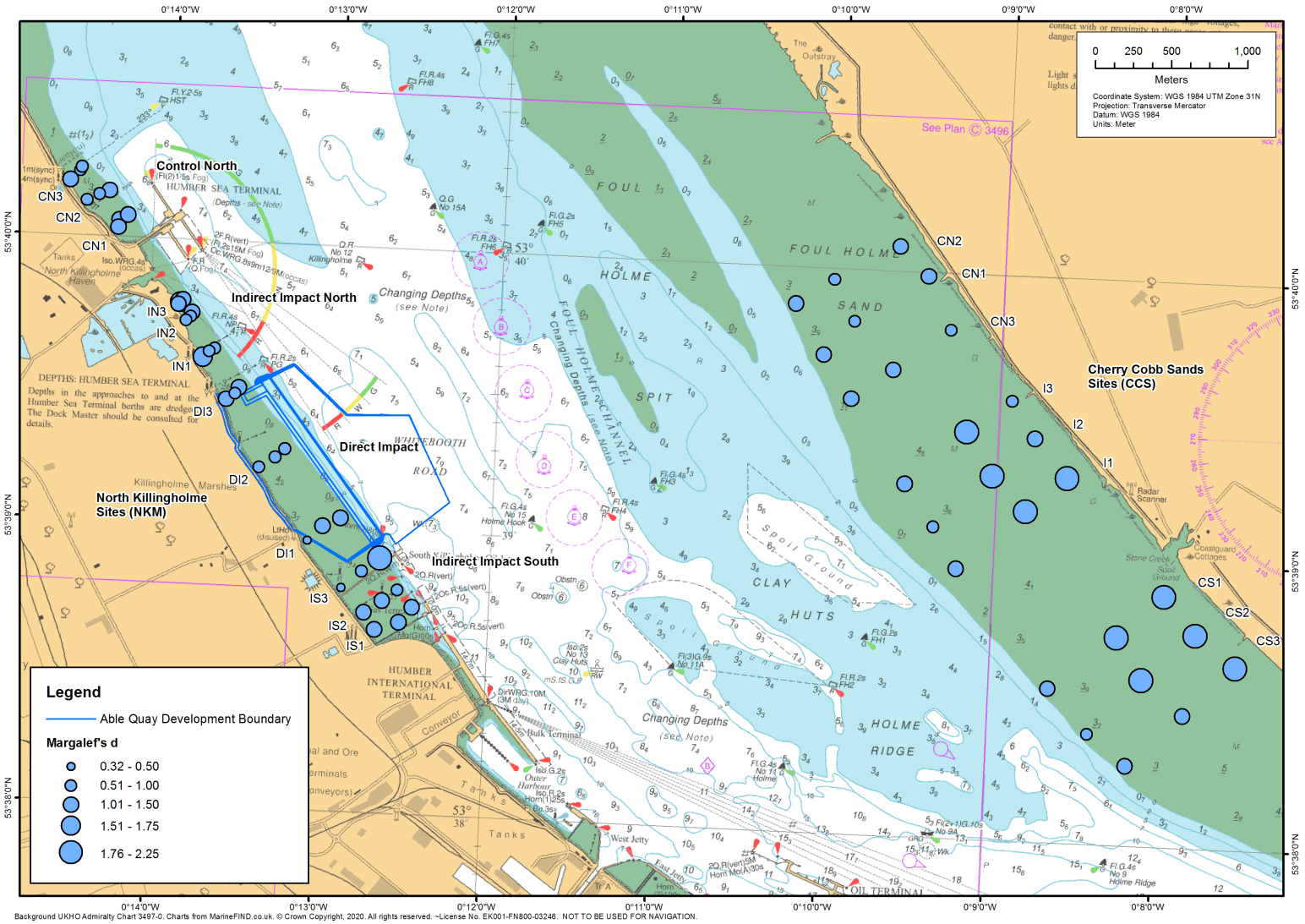
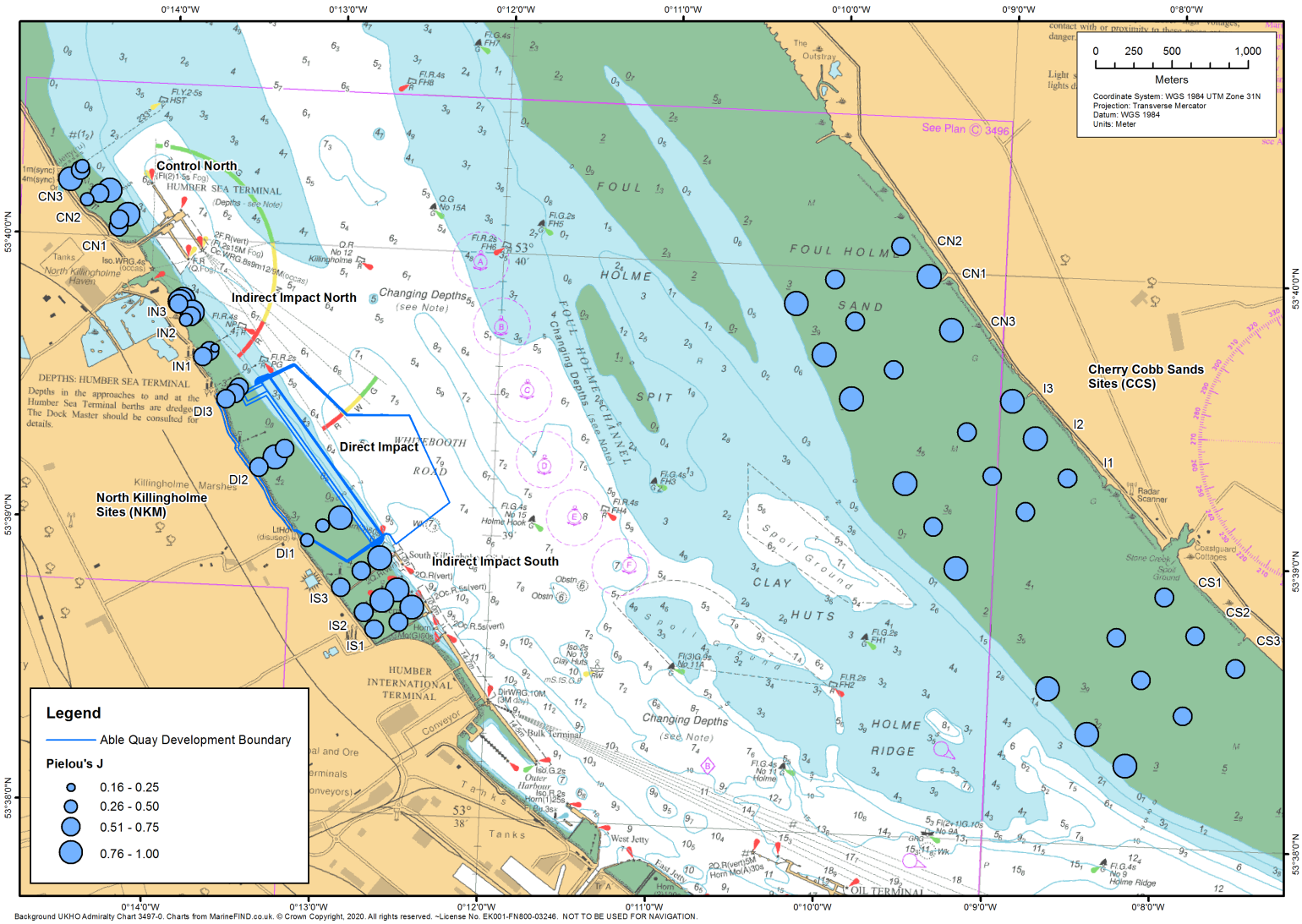


Figure 10. Margalef's d at the survey sites (per 0.01m^2).



Background UKHO Admiralty Chart 3497-0. Charts from MarineFIND.co.uk. © Crown Copyright, 2020. All rights reserved. ~License No. EK001-FN800-03246. NOT TO BE USED FOR NAVIGATION.

Figure 11. Pielou's evenness J at the survey sites (per 0.01m^2).

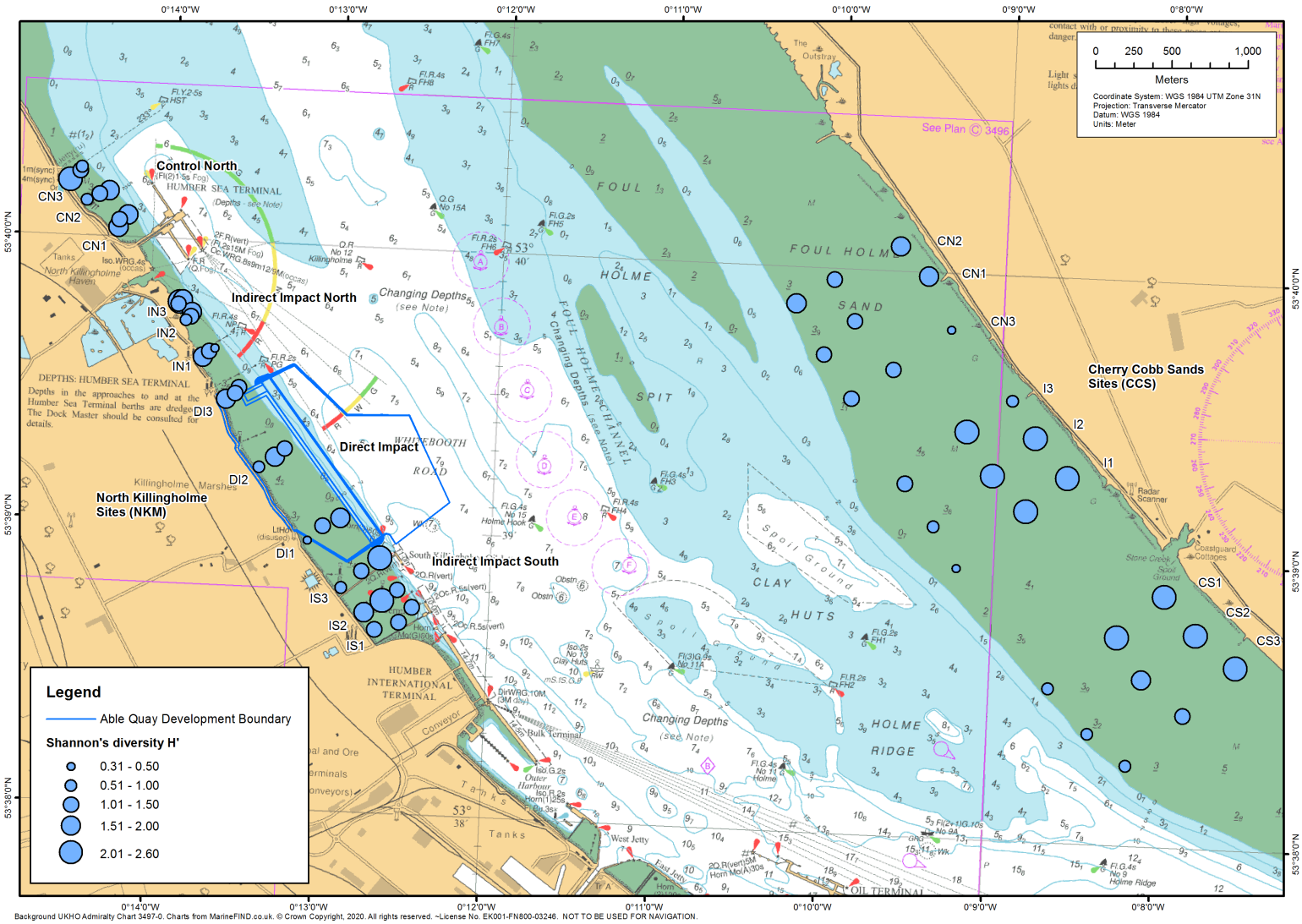


Figure 12. Shannon's diversity H' at the survey sites (per 0.01m^2).

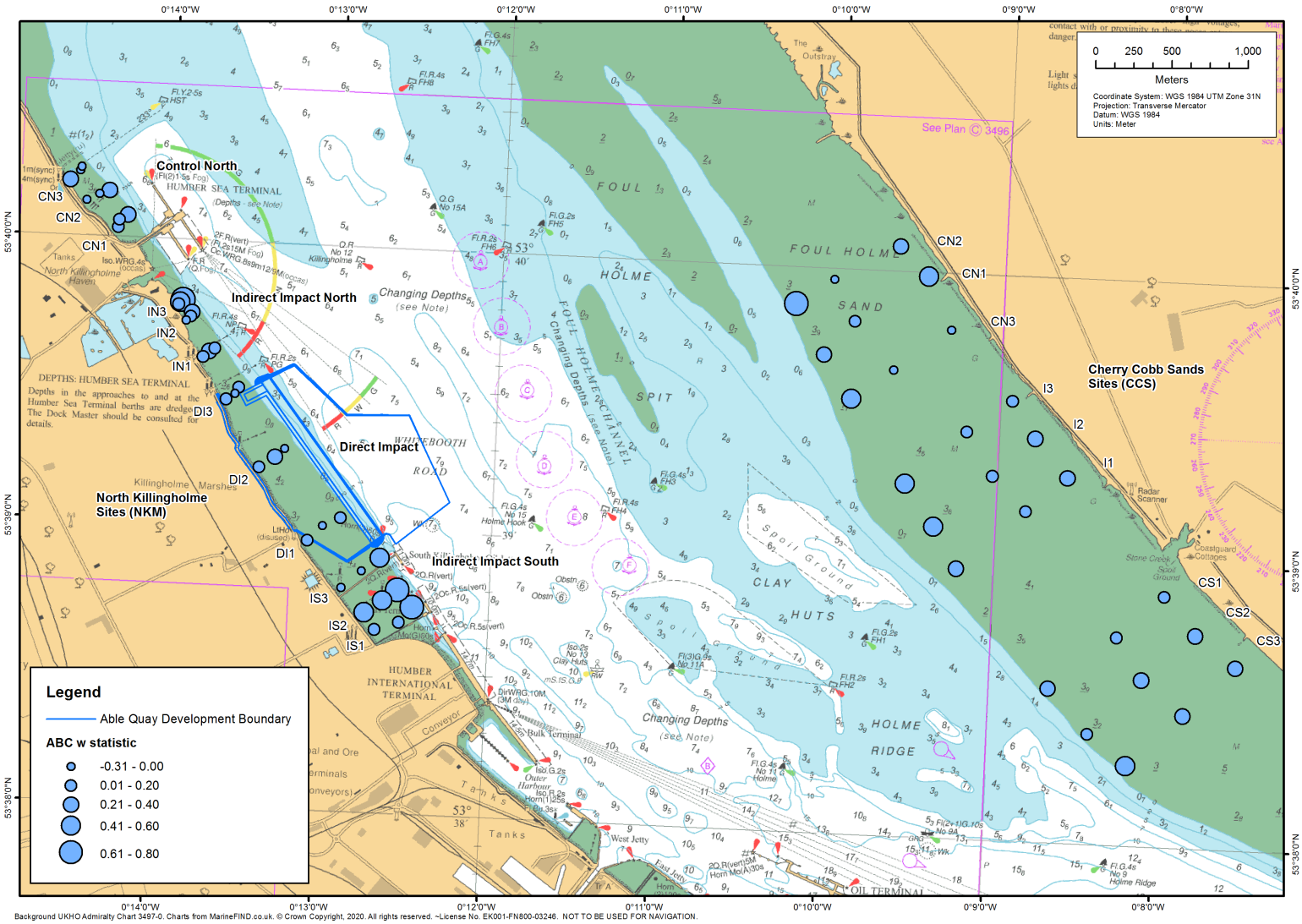


Figure 13. ABC w statistic at the survey sites (per 0.01m^2).

3.3 Species composition at the survey areas

3.3.1 North Killingholme

A summary of the dominant taxa by abundance and biomass has been provided based on average data at each site. The average abundances and AFDW biomass per site have been scaled up to numbers and weights per m^2 across the entire survey area and these are provided in Table 5. In total 33 taxa were recorded during the survey including a number of terrestrial (insect) taxa which have been included as they were particularly indicative of upper shore areas adjacent to saltmarsh. In terms of total abundance, the most dominant taxa were *Corophium volutator* and *Tubificoides benedii* which accounted for over 70% of the total abundance and were recorded at the majority of sites (74% and 75% respectively). Moderate numbers of other oligochaetes (*Tubificoides* species, *Baltidrilus costatus* and Enchytraeidae sp.) were also recorded in moderately to high abundances at a lower number of sites. *Streblospio shrubsolii* and *Limicola balthica* were also recorded in moderate numbers at 43% and 58% of sites respectively whilst *Hediste diversicolor* was also quite common but only recorded in 27% of samples compared with 2013 when it was present in over 60% of samples. In terms of biomass, larger species such as *Corophium volutator, Hediste diversicolor,* and *Limicola balthica* accounted for the majority of the biomass (88% of total).

Table 5. Ranked average abundance and biomass for the full survey area at North Killingholme (per m^2).

Taxa	Mean Abundance per m^2	% of samples	% of Total	Taxa	Mean AFDW Biomass (g) per m^2	% of samples	% of Total
Corophium volutator	2958.33	74.07	43.73	Corophium volutator	0.55264	74	31.50
Tubificoides benedii	1838.89	75.00	70.91	Hediste diversicolor	0.55152	27	62.93
Baltidrilus costatus	567.59	27.78	79.30	Limecola balthica	0.44704	58	88.41
Nematoda	518.52	60.19	86.97	Tubificoides benedii	0.10903	75	94.63
Enchytraeidae spp.	275.00	17.59	91.03	Scrobicularia plana	0.03376	1	96.55
Streblospio shrubsolii	177.78	43.52	93.66	Baltidrilus costatus	0.02348	28	97.89
Limecola balthica	152.78	58.33	95.92	Nephtys hombergii	0.01735	3	98.88
Hediste diversicolor	82.41	26.85	97.14	Streblospio shrubsolii	0.00573	44	99.20
Manayunkia aestuarina	42.59	5.56	97.77	Eteone flava/longa agg.	0.00346	21	99.40
Eteone flava/longa agg.	31.48	21.30	98.23	Diptera spp. larvae	0.00269	6	99.56
Nereididae spp. juvenile	23.15	12.96	98.58	Nematoda	0.00213	60	99.68
Collembola sp.	22.22	12.96	98.91	Nereididae spp. juvenile	0.00199	13	99.79
Pygospio elegans	16.67	10.19	99.15	Cyathura carinata	0.00137	2	99.87
Diptera spp. larvae	14.81	6.48	99.37	Enchytraeidae spp.	0.00076	18	99.91
Tubificoides swirencoides	11.11	2.78	99.53	Gastropoda spp.	0.00042	4	99.94
Acari spp.	7.41	4.63	99.64	Manayunkia aestuarina	0.00024	6	99.95
Tubificoides galiciensis	4.63	0.93	99.71	Peringia ulvae	0.00019	1	99.96
Nephtys hombergii	3.70	2.78	99.77	Collembola sp.	0.00018	13	99.97
Cyathura carinata	2.78	1.85	99.81	Pygospio elegans	0.00011	10	99.98
Tellinoidea sp.	2.78	0.93	99.85	Tubificoides swirencoides	0.00008	3	99.98
Gastropoda spp.	1.85	3.70	99.88	Aphelochaeta marioni	0.00007	1	99.99
Jaera (Jaera) albifrons	1.85	1.85	99.90	Acari spp.	0.00006	5	99.99
Aphelochaeta marioni	0.93	0.93	99.92	Tubificoides galiciensis	0.00003	1	99.99
Aphelochaeta/Tharyx sp.	0.93	0.93	99.93	Mysida sp.	0.00003	0.92593	99.99
Bivalvia sp.	0.93	0.93	99.95	Jaera (Jaera) albifrons	0.00003	1.85185	99.99
Peringia ulvae	0.93	0.93	99.96	Platyhelminthes sp.	0.00002	0.92593	100.00
Platyhelminthes sp.	0.93	0.93	99.97	Caridea sp.	0.00002	0.92593	100.00
Scrobicularia plana	0.93	0.93	99.99	Aphelochaeta/Tharyx sp.	0.00001	0.92593	100.00
Tharyx killariensis	0.93	0.93	100.00	Spionidae sp.	0.00001	0.92593	100.00
Caridea sp.	P	0.93	100.00	Tharyx killariensis	0.00001	0.92593	100.00
Mysida sp.	P	0.93	100.00	Tellinoidea sp.	0.00001	0.92593	100.00
Spionidae sp.	P	0.93	100.00	Bivalvia sp.	0.00001	0.92593	100.00
Tubificoides sp.	P	0.93	100.00	Tubificoides sp.	0.00000	0.92593	100.00

3.3.2 Cherry Cobb Sands

The dominant taxa across the CCS survey area (mean abundance and AFDW biomass per m^2) are provided in Table 6. A similar range of taxa were recorded at CCS in comparison to NKM with the exception of *Corophium volutator* which was largely absent at CCS. The total number of taxa recorded (37 taxa) is greater than at NKM which presumably reflects wider range of habitats present at CCS. The dominant taxa at CCS (in terms of numbers of individuals) were Nematoda spp., Enchytraeidae spp., *Tubificoides benedii,* Collembola spp., *Limicola balthica, Pygospio elegans* and *Manayunkia aestuarina* which account for 83% of the total abundance of which the most widespread were Nematoda, *Tubificoides benedii* and *Limicola balthica* which were recorded in over 60% of samples. In terms of biomass, *Limecola balthica, Scrobicularia plana and Hediste diversicolor* account for 87% of the total biomass although with the exception of *Limicola balthica* these taxa were recorded in fewer than 30% of the samples.

Table 6. Ranked average abundance and biomass for the full survey area at Cherry Cobb Sands (per m^2).

Taxa	Mean Abundance per m^2	% of sites	% of Total	Taxa	Mean AFDW Biomass (g) per m^2	% of sites	% of Total
Nematoda spp.	2758.02	62.96	24.44	Limecola balthica	2.6835	61.73	44.33
Enchytraeidae spp.	2041.98	23.46	42.53	Scrobicularia plana	1.7598	20.99	73.40
Tubificoides benedii	1809.88	67.90	58.56	Hediste diversicolor	0.8331	28.40	87.16
Collembola spp.	837.04	13.58	65.98	Abra tenuis	0.1466	29.63	89.59
Limecola balthica	743.21	61.73	72.57	Tubificoides benedii	0.1342	67.90	91.80
Pygospio elegans	704.94	45.68	78.81	Peringia ulvae	0.1063	35.80	93.56
Manayunkia aestuarina	540.74	25.93	83.60	Nephtys hombergii	0.0792	16.05	94.87
Peringia ulvae	343.21	35.80	86.64	Arenicola sp.	0.0578	1.23	95.82
Baltidrilus costatus	338.27	6.17	89.64	Nereididae spp. (juvenile/damaged	0.0575	30.86	96.77
Nereididae spp. (juvenile/damaged	256.79	30.86	91.92	Diptera sp. larvae	0.0326	20.99	97.31
Abra tenuis	255.56	29.63	94.18	Pygospio elegans	0.0271	45.68	97.76
Hediste diversicolor	100.00	28.40	95.07	Eteone flava/longa agg.	0.0249	35.80	98.17
Paranais litoralis	87.65	2.47	95.84	Bivalvia sp. (juvenile/damaged)	0.0221	13.58	98.54
Eteone flava/longa agg.	77.78	35.80	96.53	Nematoda spp.	0.0176	62.96	98.83
Cyathura carinata	64.20	18.52	97.10	Nephtys cirrosa	0.0158	1.23	99.09
Platyhelminthes (Dalyellidae) sp.	50.62	20.99	97.55	Cyathura carinata	0.0123	18.52	99.29
Tellinidae sp. (juvenile/damaged)	50.62	3.70	98.00	Baltidrilus costatus	0.0120	6.17	99.49
Streblospio shrubsolii	44.44	9.88	98.39	Enchytraeidae spp.	0.0061	23.46	99.59
Nemertea spp.	37.04	2.47	98.72	Tellinidae sp. (juvenile/damaged)	0.0050	3.70	99.67
Scrobicularia plana	30.86	20.99	98.99	Collembola spp.	0.0046	13.58	99.75
Diptera sp. larvae	29.63	20.99	99.26	Manayunkia aestuarina	0.0031	25.93	99.80
Nephtys hombergii	19.75	16.05	99.43	Scoloplos armiger	0.0024	2.47	99.84
Bivalvia sp. (juvenile/damaged)	19.75	13.58	99.61	Streblospio shrubsolii	0.0024	9.88	99.88
Copepoda spp.	12.35	3.70	99.72	Retusa obtusa	0.0021	3.70	99.91
Acari spp.	11.11	6.17	99.81	Gastropoda spp.	0.0020	11.11	99.95
Gastropoda spp.	6.17	11.11	99.87	Paranais litoralis	0.0007	2.47	99.96
Retusa obtusa	4.94	3.70	99.91	Nephtys caeca	0.0006	1.23	99.97
Corophium volutator	2.47	2.47	99.93	Crangonidae sp.	0.0006	1.23	99.98
Scoloplos armiger	2.47	2.47	99.96	Platyhelminthes (Dalyellidae) sp.	0.0005	20.99	99.99
Mytilidae sp. juvenile	1.23	1.23	99.97	Nemertea spp.	0.0003	2.47	99.99
Nephtys caeca	1.23	1.23	99.98	Copepoda spp.	0.0002	3.70	100.00
Nephtys cirrosa	1.23	1.23	99.99	Acari spp.	0.0001	6.17	100.00
Sphaerodoridium minutum	1.23	1.23	100.00	Corophium volutator	0.0000	2.47	100.00
Arenicola sp.	P	1.23	100.00	Orbiniidae sp.	0.00002	1.23	100.00
Crangonidae sp.	P	1.23	100.00	Sphaerodoridium minutum	0.00002	1.23	100.00
Orbiniidae sp.	P	1.23	100.00	Spionidae sp.	0.00002	1.23	100.00
Spionidae sp.	P	1.23	100.00	Mytilidae sp. juvenile	0.00001	1.23	100.00

3.3.3 Spatial Trends

The summaries of dominant taxa (mean abundance and AFDW biomass per m^2) within the different shore levels in each survey area are provided in Tables 7 to 9 for NKM and 10 to 12 for CCS. The spatial distribution of key taxa (*Hediste diversicolor*, *Macoma balthica*, *Corophium volutator, Streblospio shrubsolii, Pygospio elegans, Manayunkia aestuarina* and oligochaetes) in terms of mean numbers per m^2 at each site are provided in a series of charts in Figures 14 to 20. These results highlight the influence of shore level on the distribution of infauna and any differences between specific survey areas tends to be less pronounced for NKM but more obvious for CCS where a much larger variation in intertidal habitats and sediment type (in conjunction with a much wider foreshore) is reflected in the distribution of infaunal species. At NKM, taxa such as *Corophium volutator* and *Tubificoides benedii* dominated in terms of abundance at all areas whilst other key other species exhibited more variability with regard to position on the shore with *Streblospio shrubsolii* tending to be more prevalent on the low shore whilst *Hediste diversicolor* tended to increase in abundance at upper shore sites. *Limicola balthica* was relatively widespread but tended to exhibit higher numbers on the mid or low shore. The maps shown in Figures 14 to 19 also highlight the widespread coverage by *Corophium volutator*, particularly in the northern indirect impact area and control area whilst *Limicola balthica* is widely distributed in varying densities throughout the area with perhaps a slight increase in numbers on the mid shore and low shore. *Hediste diversicolor* is more prevalent on the upper shore (or mid shore at the southern indirect impact site) and was recorded in lower densities within the direct impact area. As expected *Hediste diversicolor*, *Limicola balthica*, *Corophium volutator* and *Tubificoides* spp. dominate in terms of biomass across all the areas at NKM.

At CCS more pronounced spatial differences were evident reflecting the variation in sedimentary regime with some differences in key taxa between CCS and NKM. Modest numbers of taxa were present at low shore areas (particularly at the southern control area) with *Limicola balthica, Tubifioides benedii* and *Nephtys hombergii* characteristic within the impact site and southern control area. *Limicola balthica* was also commonly recorded at low shore habitats in the northern control area but highest numbers in this area were contributed by *Manayunkia aestuarina* and *Paranais litoralis* (although these taxa occurred in relatively few samples). On the mid shore oligochaetes such as *Tubificoides benedii* or Enchytraeidae spp. and Nematoda spp. tended to dominate along with *Pygospio elegans*. *Limicola balthica* was also very abundant on the midshore in the southern control area and impact site (and was recorded in all samples) but was absent on the midshore in the northern control area. The upper shore was also strongly dominated by Nematoda spp. *and Tubificoides benedii*. (particularly within the impact site and southern control site) whilst *Baltidrilus costatus*, Nereididae spp., Enchytraeidae spp. and *Hediste diversicolor* were more abundant in upper shore habitats in the northern control area. Whilst a similar range of taxa were recorded at CCS and NKM some differences are evident. Figure 16 highlights the relative absence of *Corophium volutator* at CCS whilst it is extremely abundant at NKM. Densities of *Hediste diversicolor* were highly variable at both NKM and CCS whilst the highest densities of *Limicola balthica* tended to be recorded at CCS, particularly at upper and mid shore areas of the southern control and impact transects.

Table 7. Average ranked abundance and biomass (per 1m^2) for the low shore sites at North Killingholme.

Control North Low Shore			Direct Impact Low Shore			Indirect Impact North Low Shore			Indirect Impact South Low Shore		
Taxa	Mean Abundance per m^2	% of samples	Taxa	Mean Abundance per m^2	% of samples	Taxa	Mean Abundance per m^2	% of samples	Taxa	Mean Abundance per m^2	% of samples
Corophium volutator	2677.78	88.89	Tubificoides benedii	2155.56	100.00	Corophium volutator	6666.67	66.67	Limecola balthica	222.22	100.00
Streblospio shrubsolii	411.11	100.00	Corophium volutator	377.78	55.56	Tubificoides benedii	522.22	100.00	Tubificoides benedii	211.11	88.89
Tubificoides benedii	233.33	88.89	Streblospio shrubsolii	322.22	66.67	Streblospio shrubsolii	166.67	77.78	Nematoda	155.56	44.44
Eteone flava/longa agg.	188.89	88.89	Tubificoides swirencoides	122.22	22.22	Limecola balthica	133.33	55.56	Corophium volutator	66.67	33.33
Limecola balthica	100.00	55.56	Limecola balthica	88.89	66.67	Pygospio elegans	100.00	33.33	Streblospio shrubsolii	55.56	22.22
Nematoda	22.22	11.11	Pygospio elegans	44.44	33.33	Enchytraeidae spp.	33.33	11.11	Tubificoides galiciensis	55.56	11.11
Aphelochaeta/Tharyx sp.	11.11	11.11	Eteone flava/longa agg.	33.33	33.33	Jaera (Jaera) albifrons	22.22	22.22	Nephtys hombergii	44.44	33.33
Enchytraeidae spp.	11.11	11.11	Baltidrilus costatus	11.11	11.11	Nematoda	22.22	22.22	Collembola sp.	33.33	22.22
Hediste diversicolor	11.11	11.11	Nematoda	11.11	11.11	Cyathura carinata	22.22	11.11	Pygospio elegans	11.11	11.11
Nereididae spp. juvenile	11.11	11.11				Eteone flava/longa agg.	11.11	11.11	Tharyx killariensis	11.11	11.11
Pygospio elegans	11.11	11.11				Mysida sp.	P	11.11	Tubificoides swirencoides	11.11	11.11
									Baltidrilus costatus	P	11.11
									Nereididae spp. juvenile	P	11.11
									Tubificoides sp.	P	11.11

Control North Low Shore			Direct Impact Low Shore			Indirect Impact North Low Shore			Indirect Impact South Low Shore		
Taxa	Mean AFDW Biomass (g) per m^2	% of samples	Taxa	Mean AFDW Biomass (g) per m^2	% of samples	Taxa	Mean AFDW Biomass (g) per m^2	% of samples	Taxa	Mean AFDW Biomass (g) per m^2	% of samples
Corophium volutator	0.474667	88.89	Limecola balthica	0.137736	66.67	Corophium volutator	1.137067	66.67	Limecola balthica	0.657056	100.00
Limecola balthica	0.245679	55.56	Tubificoides benedii	0.065339	100.00	Limecola balthica	0.244274	55.56	Nephtys hombergii	0.208250	33.33
Eteone flava/longa agg.	0.015413	88.89	Corophium volutator	0.044800	55.56	Tubificoides benedii	0.013535	100.00	Nereididae spp. juvenile	0.006457	11.11
Streblospio shrubsolii	0.013156	100.00	Streblospio shrubsolii	0.006756	66.67	Cyathura carinata	0.011676	11.11	Corophium volutator	0.004089	33.33
Tubificoides benedii	0.005989	88.89	Tubificoides swirencoides	0.000898	22.22	Streblospio shrubsolii	0.001244	77.78	Tubificoides benedii	0.001497	88.89
Hediste diversicolor	0.000662	11.11	Eteone flava/longa agg.	0.000453	33.33	Nematoda	0.000409	22.22	Nematoda	0.000818	44.44
Nematoda	0.000204	11.11	Pygospio elegans	0.000370	33.33	Pygospio elegans	0.000370	33.33	Streblospio shrubsolii	0.000711	22.22
Aphelochaeta/Tharyx sp.	0.000178	11.11	Nematoda	0.000204	11.11	Mysida sp.	0.000344	11.11	Tubificoides galiciensis	0.000419	11.11
Nereididae spp. juvenile	0.000166	11.11	Baltidrilus costatus	0.000060	11.11	Jaera (Jaera) albifrons	0.000316	22.22	Collembola sp.	0.000303	22.22
Pygospio elegans	0.000123	11.11				Eteone flava/longa agg.	0.000151	11.11	Tharyx killariensis	0.000178	11.11
Enchytraeidae spp.	0.000060	11.11				Enchytraeidae spp.	0.000060	11.11	Pygospio elegans	0.000123	11.11
									Baltidrilus costatus	0.000060	11.11
									Tubificoides swirencoides	0.000060	11.11
									Tubificoides sp.	0.000060	11.11

Table 8. Average ranked abundance and biomass (per 1m^2) for the mid shore sites North Killingholme.

Control North Mid Shore			Direct Impact Mid Shore			Indirect Impact North Mid Shore			Indirect Impact South Mid Shore		
Taxa	Mean Abundance per m^2	% of samples	Taxa	Mean Abundance per m^2	% of samples	Taxa	Mean Abundance per m^2	% of samples	Taxa	Mean Abundance per m^2	% of samples
Corophium volutator	7755.56	100.00	Tubificoides benedii	9111.11	100.00	Corophium volutator	2300.00	88.89	Tubificoides benedii	5100.00	66.67
Tubificoides benedii	1533.33	100.00	Corophium volutator	1655.56	100.00	Tubificoides benedii	1655.56	100.00	Corophium volutator	2444.44	100.00
Nematoda	966.67	88.89	Nematoda	1066.67	100.00	Nematoda	222.22	66.67	Nematoda	1111.11	100.00
Limecola balthica	477.78	100.00	Limecola balthica	333.33	100.00	Streblospio shrubsolii	177.78	44.44	Baltidrilus costatus	688.89	55.56
Enchytraeidae spp.	122.22	22.22	Streblospio shrubsolii	111.11	33.33	Limecola balthica	166.67	66.67	Hediste diversicolor	288.89	55.56
Streblospio shrubsolii	55.56	44.44	Eteone flava/longa agg.	33.33	22.22	Hediste diversicolor	22.22	22.22	Limecola balthica	133.33	66.67
Nereididae spp. juvenile	44.44	22.22	Tellinoidea sp.	33.33	11.11	Enchytraeidae spp.	22.22	11.11	Enchytraeidae spp.	88.89	11.11
Eteone flava/longa agg.	33.33	33.33	Acari spp.	11.11	11.11	Bivalvia sp.	11.11	11.11	Collembola sp.	44.44	33.33
Cyathura carinata	11.11	11.11	Aphelochaeta marioni	11.11	11.11	Eteone flava/longa agg.	11.11	11.11	Eteone flava/longa agg.	33.33	22.22
Hediste diversicolor	11.11	11.11	Hediste diversicolor	11.11	11.11	Nereididae spp. juvenile	11.11	11.11	Streblospio shrubsolii	22.22	22.22
Pygospio elegans	11.11	11.11	Platyhelminthes sp.	11.11	11.11				Pygospio elegans	11.11	11.11
Scrobicularia plana	11.11	11.11	Pygospio elegans	11.11	11.11						
Spionidae sp.	P	11.11	Caridea sp.	P	11.11						
			Gastropoda spp.	P	11.11						

Control North Mid Shore			Direct Impact Mid Shore			Indirect Impact North Mid Shore			Indirect Impact South Mid Shore		
Taxa	Mean AFDW Biomass (g) per m^2	% of samples	Taxa	Mean AFDW Biomass (g) per m^2	% of samples	Taxa	Mean AFDW Biomass (g) per m^2	% of samples	Taxa	Mean AFDW Biomass (g) per m^2	% of samples
Corophium volutator	1.327644	100.00	Limecola balthica	0.880633	100.00	Limecola balthica	0.652721	66.67	Hediste diversicolor	1.870778	55.56
Limecola balthica	1.276137	100.00	Tubificoides benedii	0.463360	100.00	Corophium volutator	0.335822	88.89	Corophium volutator	0.695822	100.00
Scrobicularia plana	0.405162	11.11	Corophium volutator	0.424000	100.00	Tubificoides benedii	0.120137	100.00	Limecola balthica	0.672197	66.67
Tubificoides benedii	0.088516	100.00	Hediste diversicolor	0.342700	11.11	Hediste diversicolor	0.016059	22.22	Tubificoides benedii	0.428864	66.67
Hediste diversicolor	0.033608	11.11	Nematoda	0.004518	100.00	Streblospio shrubsolii	0.007289	44.44	Baltidrilus costatus	0.008804	55.56
Eteone flava/longa agg.	0.008160	33.33	Streblospio shrubsolii	0.003556	33.33	Eteone flava/longa agg.	0.002720	11.11	Nematoda	0.006747	100.00
Cyathura carinata	0.004733	11.11	Eteone flava/longa agg.	0.001511	22.22	Nematoda	0.001227	66.67	Eteone flava/longa agg.	0.003627	22.22
Nematoda	0.001636	88.89	Aphelochaeta marioni	0.000889	11.11	Nereididae spp. juvenile	0.000166	11.11	Streblospio shrubsolii	0.000711	22.22
Streblospio shrubsolii	0.000711	44.44	Platyhelminthes sp.	0.000280	11.11	Bivalvia sp.	0.000064	11.11	Collembola sp.	0.000455	33.33
Nereididae spp. juvenile	0.000331	22.22	Caridea sp.	0.000183	11.11	Enchytraeidae spp.	0.000060	11.11	Enchytraeidae spp.	0.000419	11.11
Spionidae sp.	0.000178	11.11	Gastropoda spp.	0.000153	11.11				Pygospio elegans	0.000123	11.11
Pygospio elegans	0.000123	11.11	Acari spp.	0.000152	11.11						
Enchytraeidae spp.	0.000120	22.22	Tellinoidea sp.	0.000129	11.11						
			Pygospio elegans	0.000123	11.11						

Table 9. Average ranked abundance and biomass (per 1m^2) for the upper shore sites North Killingholme.

Control North Upper Shore			Direct Impact Upper Shore			Indirect Impact North Upper Shore			Indirect Impact South Upper Shore		
Taxa	Mean Abundance per m^2	% of samples	Taxa	Mean Abundance per m^2	% of samples	Taxa	Mean Abundance per m^2	% of samples	Taxa	Mean Abundance per m^2	% of samples
Corophium volutator	3388.89	77.78	Corophium volutator	2888.89	66.67	Corophium volutator	5244.44	88.89	Baltidrilus costatus	2522.22	100.00
Enchytraeidae spp.	2266.67	77.78	Baltidrilus costatus	1788.89	44.44	Enchytraeidae spp.	700.00	44.44	Nematoda	1177.78	55.56
Baltidrilus costatus	1722.22	88.89	Tubificoides benedii	1322.22	55.56	Streblospio shrubsolii	566.67	66.67	Manayunkia aestuarina	500.00	55.56
Nematoda	988.89	66.67	Streblospio shrubsolii	233.33	33.33	Nematoda	255.56	100.00	Hediste diversicolor	144.44	44.44
Hediste diversicolor	200.00	55.56	Nematoda	222.22	55.56	Hediste diversicolor	211.11	88.89	Diptera spp. larvae	133.33	44.44
Nereididae spp. juvenile	77.78	22.22	Hediste diversicolor	88.89	22.22	Tubificoides benedii	200.00	77.78	Collembola sp.	111.11	66.67
Diptera spp. larvae	44.44	33.33	Nereididae spp. juvenile	55.56	33.33	Limecola balthica	133.33	55.56	Acari spp.	33.33	22.22
Acari spp.	44.44	22.22	Collembola sp.	55.56	22.22	Nereididae spp. juvenile	77.78	44.44	Corophium volutator	33.33	22.22
Collembola sp.	22.22	11.11	Enchytraeidae spp.	55.56	22.22	Baltidrilus costatus	77.78	22.22	Gastropoda spp.	22.22	33.33
Limecola balthica	11.11	11.11	Limecola balthica	33.33	22.22	Eteone flava/longa agg.	11.11	11.11	Peringia ulvae	11.11	11.11
Manayunkia aestuarina	11.11	11.11	Eteone flava/longa agg.	22.22	22.22				Tubificoides benedii	11.11	11.11
Streblospio shrubsolii	11.11	11.11									
Tubificoides benedii	11.11	11.11									

Control North Upper Shore			Direct Impact Upper Shore			Indirect Impact North Upper Shore			Indirect Impact South Upper Shore		
Taxa	Mean AFDW Biomass (g) per m^2	% of samples	Taxa	Mean AFDW Biomass (g) per m^2	% of samples	Taxa	Mean AFDW Biomass (g) per m^2	% of samples	Taxa	Mean AFDW Biomass (g) per m^2	% of samples
Hediste diversicolor	0.993168	55.56	Corophium volutator	0.590756	66.67	Hediste diversicolor	1.210542	88.89	Hediste diversicolor	1.843296	44.44
Corophium volutator	0.818311	77.78	Hediste diversicolor	0.307437	22.22	Corophium volutator	0.772089	88.89	Baltidrilus costatus	0.086839	100.00
Limecola balthica	0.145185	11.11	Limecola balthica	0.243969	22.22	Limecola balthica	0.208863	55.56	Diptera spp. larvae	0.020627	44.44
Baltidrilus costatus	0.062584	88.89	Baltidrilus costatus	0.121395	44.44	Streblospio shrubsolii	0.026667	66.67	Corophium volutator	0.006578	22.22
Diptera spp. larvae	0.011678	33.33	Tubificoides benedii	0.110914	55.56	Nereididae spp. juvenile	0.013907	44.44	Gastropoda spp.	0.004907	33.33
Enchytraeidae spp.	0.006708	77.78	Streblospio shrubsolii	0.007822	33.33	Tubificoides benedii	0.010061	77.78	Nematoda	0.003680	55.56
Nematoda	0.003271	66.67	Eteone flava/longa agg.	0.005893	22.22	Eteone flava/longa agg.	0.003627	11.11	Manayunkia aestuarina	0.002667	55.56
Nereididae spp. juvenile	0.002318	22.22	Nematoda	0.001022	55.56	Baltidrilus costatus	0.001976	22.22	Peringia ulvae	0.002289	11.11
Acari spp.	0.000303	22.22	Nereididae spp. juvenile	0.000497	33.33	Nematoda	0.001840	100.00	Collembola sp.	0.000910	66.67
Manayunkia aestuarina	0.000178	11.11	Collembola sp.	0.000303	22.22	Enchytraeidae spp.	0.001557	44.44	Acari spp.	0.000303	22.22
Streblospio shrubsolii	0.000178	11.11	Enchytraeidae spp.	0.000120	22.22				Tubificoides benedii	0.000060	11.11
Collembola sp.	0.000152	11.11									
Tubificoides benedii	0.000060	11.11									

Table 10. Average ranked abundance and biomass (per 1m^2) for the low shore sites at Cherry Cobb Sands.

Control North Low Shore			Impact Low Shore			Control South Low Shore		
Taxa	Mean Abundance per m^2	% of samples	Taxa	Mean Abundance per m^2	% of samples	Taxa	Mean Abundance per m^2	% of samples
Manayunkia aestuarina	1222.22	22	Limecola balthica	311.11	67	Tubificoides benedii	100.00	78
Paranais litoralis	755.56	11	Tubificoides benedii	177.78	67	Limecola balthica	88.89	44
Nematoda spp.	655.56	56	Nephtys hombergii	44.44	33	Nephtys hombergii	33.33	33
Enchytraeidae spp.	500.00	11	Pygospio elegans	33.33	22	Pygospio elegans	11.11	22
Limecola balthica	411.11	100	Manayunkia aestuarina	22.22	11	Nephtys cirrosa	11.11	11
Tubificoides benedii	144.44	67	Abra tenuis	11.11	11	Scoloplos armiger	11.11	11
Peringia ulvae	55.56	33	Enchytraeidae spp.	11.11	11	Arenicola sp.	P	11
Nephtys hombergii	44.44	33	Eteone flava/longa agg.	11.11	11	Bivalvia sp.	P	11
Bivalvia sp.	33.33	11	Nematoda spp.	11.11	11	Orbiniidae sp.	P	11
Copepoda spp.	33.33	11	Bivalvia sp.	P	11	Spionidae sp.	P	11
Collembola spp.	11.11	11	Gastropoda spp.	P	11			
Eteone flava/longa agg.	11.11	11						
Nephtys caeca	11.11	11						
Pygospio elegans	11.11	11						

Control North Low Shore			Impact Low Shore			Control South Low Shore		
Taxa	Mean AFDW Biomass (g) per m^2	% of samples	Taxa	Mean AFDW Biomass (g) per m^2	% of samples	Taxa	Mean AFDW Biomass (g) per m^2	% of samples
Limecola balthica	0.590630	100	Limecola balthica	1.004266	67	Arenicola sp.	0.520143	11
Nephtys hombergii	0.174417	33	Nephtys hombergii	0.112972	33	Limecola balthica	0.343181	44
Manayunkia aestuarina	0.009422	22	Tubificoides benedii	0.007127	67	Nephtys hombergii	0.146806	33
Peringia ulvae	0.006410	33	Abra tenuis	0.007011	11	Nephtys cirrosa	0.142139	11
Paranais litoralis	0.006228	11	Eteone flava/longa agg.	0.001813	11	Bivalvia sp.	0.006960	11
Nephtys caeca	0.005833	11	Bivalvia sp.	0.000709	11	Tubificoides benedii	0.001557	78
Tubificoides benedii	0.005570	67	Pygospio elegans	0.000247	22	Pygospio elegans	0.000247	22
Nematoda spp.	0.003680	56	Nematoda spp.	0.000204	11	Orbiniidae sp.	0.000178	11
Copepoda spp.	0.001833	11	Manayunkia aestuarina	0.000178	11	Spionidae sp.	0.000178	11
Enchytraeidae spp.	0.001437	11	Gastropoda spp.	0.000153	11	Scoloplos armiger	0.000124	11
Collembola spp.	0.000152	11	Enchytraeidae spp.	0.000060	11			
Eteone flava/longa agg.	0.000151	11						
Pygospio elegans	0.000123	11						
Bivalvia sp.	0.000064	11						

Table 11. Average ranked abundance and biomass (per 1m^2) for the mid shore sites at Cherry Cobb Sands.

Control North Mid Shore			Impact Mid Shore			Control South Mid Shore		
Taxa	Mean Abundance per m^2	% of samples	Taxa	Mean Abundance per m^2	% of samples	Taxa	Mean Abundance per m^2	% of samples
Enchytraeidae spp.	11711.11	67	Nematoda spp.	7122.22	89	Limecola balthica	2755.56	100
Collembola spp.	7377.78	56	Tubificoides benedii	5488.89	100	Nematoda spp.	1755.56	56
Nematoda spp.	7322.22	89	Enchytraeidae spp.	4711.11	22	Tubificoides benedii	1666.67	78
Manayunkia aestuarina	1911.11	44	Pygospio elegans	2355.56	100	Pygospio elegans	722.22	100
Pygospio elegans	1422.22	33	Peringia ulvae	1355.56	100	Enchytraeidae spp.	577.78	11
Diptera sp. larvae	100.00	67	Abra tenuis	1011.11	100	Manayunkia aestuarina	322.22	11
Acari spp.	100.00	56	Limecola balthica	877.78	100	Cyathura carinata	211.11	33
Bivalvia sp.	77.78	22	Manayunkia aestuarina	622.22	56	Abra tenuis	155.56	44
Hediste diversicolor	66.67	33	Nemertea spp.	322.22	11	Peringia ulvae	122.22	56
Scrobicularia plana	22.22	22	Eteone flava/longa agg.	266.67	89	Collembola spp.	111.11	22
Eteone flava/longa agg.	11.11	11	Cyathura carinata	188.89	44	Nereididae spp.	100.00	22
Tubificoides benedii	11.11	11	Nereididae spp.	144.44	67	Eteone flava/longa agg.	88.89	44
Gastropoda spp.	P	33	Dalyellidae sp.	144.44	56	Streblospio shrubsolii	88.89	22
Nereididae spp.	P	11	Hediste diversicolor	77.78	44	Scrobicularia plana	66.67	44
			Copepoda spp.	77.78	22	Nephtys hombergii	55.56	44
			Scrobicularia plana	66.67	33	Hediste diversicolor	55.56	33
			Streblospio shrubsolii	66.67	22	Dalyellidae sp.	33.33	33
			Paranais litoralis	33.33	11	Retusa obtusa	33.33	22
			Corophium volutator	22.22	22	Diptera sp. larvae	11.11	11
			Diptera sp. larvae	11.11	11	Scoloplos armiger	11.11	11
			Crangonidae sp.	P	11	Sphaerodoridium minutum	11.11	11

Control North Mid Shore			Impact Mid Shore			Control South Mid Shore		
Taxa	Mean AFDW Biomass (g) per m^2	% of samples	Taxa	Mean AFDW Biomass (g) per m^2	% of samples	Taxa	Mean AFDW Biomass (g) per m^2	% of samples
Scrobicularia plana	2.846640	22	Scrobicularia plana	4.169684	33	Limecola balthica	8.800838	100
Hediste diversicolor	0.730266	33	Limecola balthica	3.818092	100	Scrobicularia plana	1.722729	44
Nereididae spp.	0.247837	11	Hediste diversicolor	1.132731	44	Hediste diversicolor	0.479283	33
Diptera sp. larvae	0.128158	67	Abra tenuis	0.508062	100	Nephtys hombergii	0.278639	44
Pygospio elegans	0.048717	33	Tubificoides benedii	0.447610	100	Tubificoides benedii	0.105764	78
Nematoda spp.	0.041911	89	Peringia ulvae	0.358636	100	Peringia ulvae	0.086225	56
Collembola spp.	0.040343	56	Pygospio elegans	0.090773	100	Abra tenuis	0.083008	44
Enchytraeidae spp.	0.032460	67	Nematoda spp.	0.053360	89	Cyathura carinata	0.041811	33
Manayunkia aestuarina	0.012800	44	Cyathura carinata	0.043704	44	Pygospio elegans	0.022200	100
Gastropoda spp.	0.006593	33	Eteone flava/longa agg.	0.042009	89	Scoloplos armiger	0.021653	11
Bivalvia sp.	0.000773	22	Diptera sp. larvae	0.019262	11	Eteone flava/longa agg.	0.018284	44
Acari spp.	0.000758	56	Enchytraeidae spp.	0.017428	22	Nematoda spp.	0.009609	56
Eteone flava/longa agg.	0.000151	11	Crangonidae sp.	0.005775	11	Retusa obtusa	0.008740	22
Tubificoides benedii	0.000060	11	Nemertea spp.	0.002200	11	Diptera sp. larvae	0.007432	11
			Streblospio shrubsolii	0.002133	22	Nereididae spp.	0.005960	22
			Dalyellidae sp.	0.001400	56	Streblospio shrubsolii	0.003022	22
			Manayunkia aestuarina	0.001244	56	Enchytraeidae spp.	0.001437	11
			Nereididae spp.	0.001159	67	Dalyellidae sp.	0.000840	33
			Copepoda spp.	0.000367	22	Collembola spp.	0.000303	22
			Corophium volutator	0.000356	22	Manayunkia aestuarina	0.000178	11
			Paranais litoralis	0.000060	11	Sphaerodoridium minutum	0.000178	11

Table 12. Average ranked abundance and biomass (per 1m^2) for the upper shore sites at Cherry Cobb Sands.

Control North Upper Shore			Impact Upper Shore			Control South Upper Shore		
Taxa	Mean Abundance per m^2	% of samples	Taxa	Mean Abundance per m^2	% of samples	Taxa	Mean Abundance per m^2	% of samples
Baltidrilus costatus	3044.44	56	Nematoda spp.	2322.22	89	Tubificoides benedii	6711.11	100
Nereididae spp.	833.33	56	Tubificoides benedii	1977.78	100	Nematoda spp.	5244.44	100
Enchytraeidae spp.	577.78	33	Nereididae spp.	1111.11	56	Limecola balthica	2155.56	100
Hediste diversicolor	488.89	67	Manayunkia aestuarina	588.89	33	Pygospio elegans	1611.11	89
Nematoda spp.	388.89	78	Peringia ulvae	455.56	33	Peringia ulvae	1100.00	100
Eteone flava/longa agg.	88.89	22	Tellinidae sp.	333.33	22	Abra tenuis	1033.33	89
Diptera sp. larvae	66.67	44	Streblospio shrubsolii	244.44	44	Dalyellidae sp.	233.33	67
Bivalvia sp.	66.67	33	Pygospio elegans	177.78	33	Eteone flava/longa agg.	177.78	100
Collembola spp.	33.33	33	Hediste diversicolor	166.67	33	Cyathura carinata	177.78	89
Manayunkia aestuarina	11.11	11	Enchytraeidae spp.	144.44	33	Manayunkia aestuarina	166.67	44
Nemertea spp.	11.11	11	Limecola balthica	88.89	44	Enchytraeidae spp.	144.44	22
Tubificoides benedii	11.11	11	Abra tenuis	88.89	22	Nereididae spp.	122.22	67
Gastropoda spp.	P	11	Gastropoda spp.	55.56	44	Tellinidae sp.	122.22	11
			Dalyellidae sp.	44.44	33	Scrobicularia plana	100.00	56
			Eteone flava/longa agg.	44.44	33	Diptera sp. larvae	55.56	33
			Scrobicularia plana	22.22	33	Hediste diversicolor	44.44	44
			Diptera sp. larvae	22.22	22	Mytilidae sp. juvenile	11.11	11
						Retusa obtusa	11.11	11
						Bivalvia sp.	P	33

Control North Upper Shore			Impact Upper Shore			Control South Upper Shore		
Taxa	Mean AFDW Biomass (g) per m^2	% of samples	Taxa	Mean AFDW Biomass (g) per m^2	% of samples	Taxa	Mean AFDW Biomass (g) per m^2	% of samples
Hediste diversicolor	4.464868	67	Scrobicularia plana	2.778716	33	Limecola balthica	9.307825	100
Baltidrilus costatus	0.107980	56	Limecola balthica	0.286218	44	Scrobicularia plana	4.320742	56
Nereididae spp.	0.065891	56	Nereididae spp.	0.191548	56	Abra tenuis	0.612666	89
Diptera sp. larvae	0.031547	44	Tubificoides benedii	0.173917	100	Hediste diversicolor	0.548486	44
Eteone flava/longa agg.	0.007404	22	Hediste diversicolor	0.142047	33	Tubificoides benedii	0.466415	100
Enchytraeidae spp.	0.001797	33	Abra tenuis	0.108611	22	Peringia ulvae	0.404267	100
Nematoda spp.	0.001431	78	Peringia ulvae	0.101029	33	Bivalvia sp.	0.189853	33
Bivalvia sp.	0.000967	33	Tellinidae sp.	0.043049	22	Eteone flava/longa agg.	0.131164	100
Collembola spp.	0.000455	33	Diptera sp. larvae	0.023963	22	Diptera sp. larvae	0.083417	33
Nemertea spp.	0.000244	11	Eteone flava/longa agg.	0.022969	33	Pygospio elegans	0.071533	89
Manayunkia aestuarina	0.000178	11	Streblospio shrubsolii	0.016178	44	Nematoda spp.	0.033733	100
Gastropoda spp.	0.000153	11	Nematoda spp.	0.014311	89	Cyathura carinata	0.024771	89
Tubificoides benedii	0.000060	11	Gastropoda spp.	0.010887	44	Retusa obtusa	0.010120	11
			Pygospio elegans	0.009990	33	Nereididae spp.	0.005298	67
			Manayunkia aestuarina	0.003200	33	Tellinidae sp.	0.002384	11
			Dalyellidae sp.	0.000840	33	Dalyellidae sp.	0.001680	67
			Enchytraeidae spp.	0.000359	33	Manayunkia aestuarina	0.000711	44
						Enchytraeidae spp.	0.000120	22
						Mytilidae sp. juvenile	0.000051	11

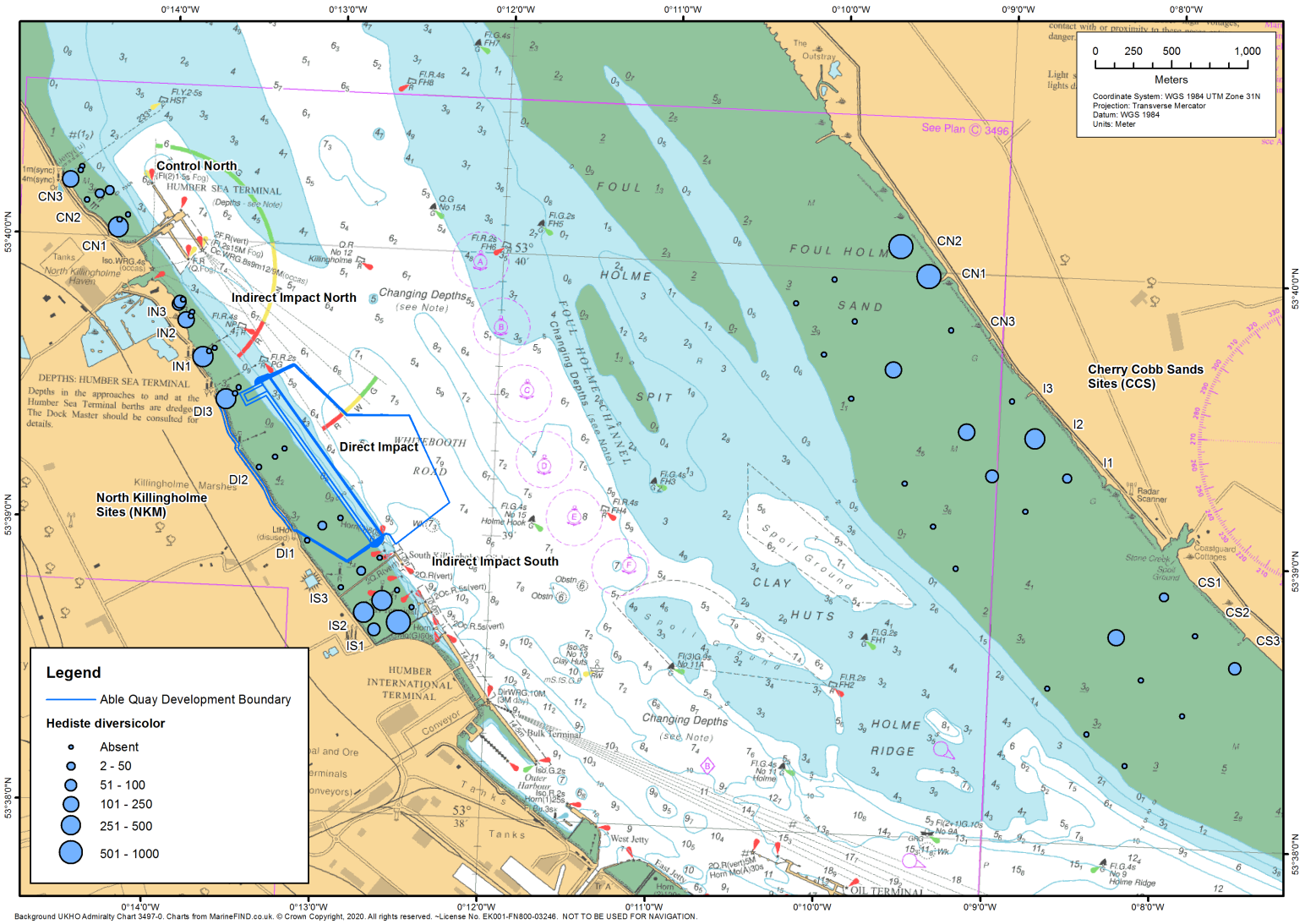


Figure 14. Spatial distribution in numbers of *Hediste diversicolor* (per 1m^2).

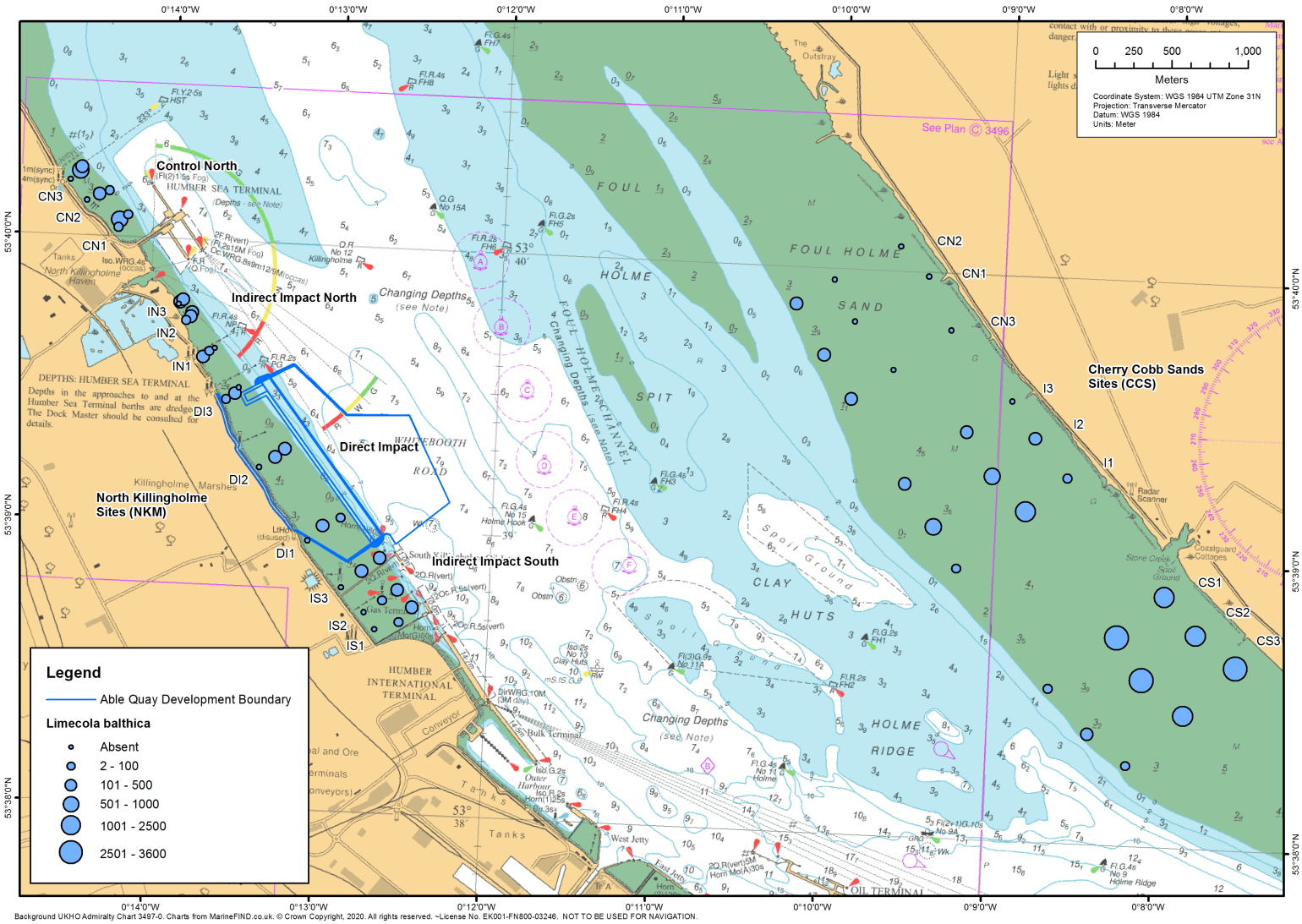


Figure 15. Spatial distribution in numbers of *Limicola balthica* (per 1m^2).

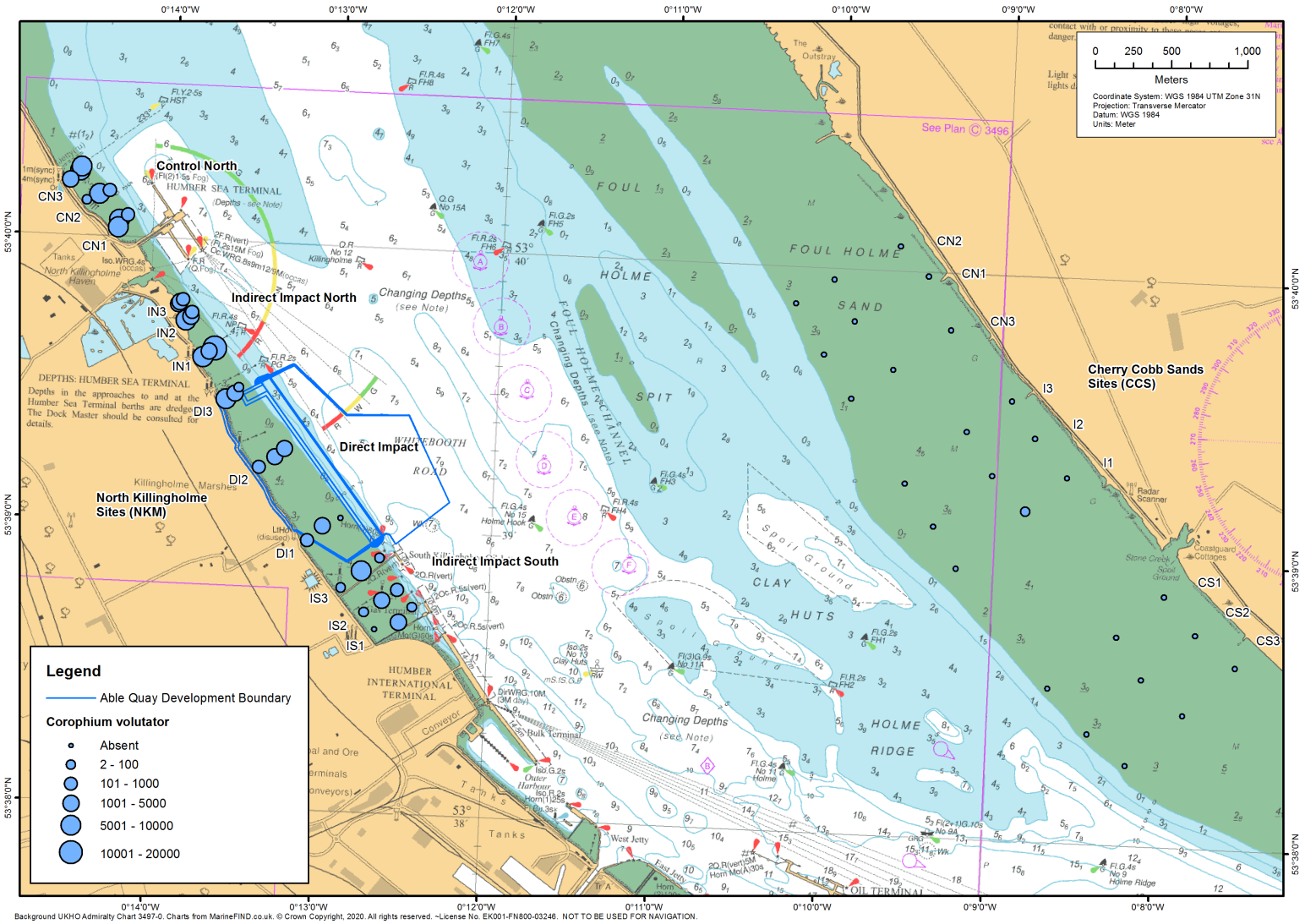


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Figure 16. Spatial distribution in numbers of *Corophium volutator* (per 1m²).

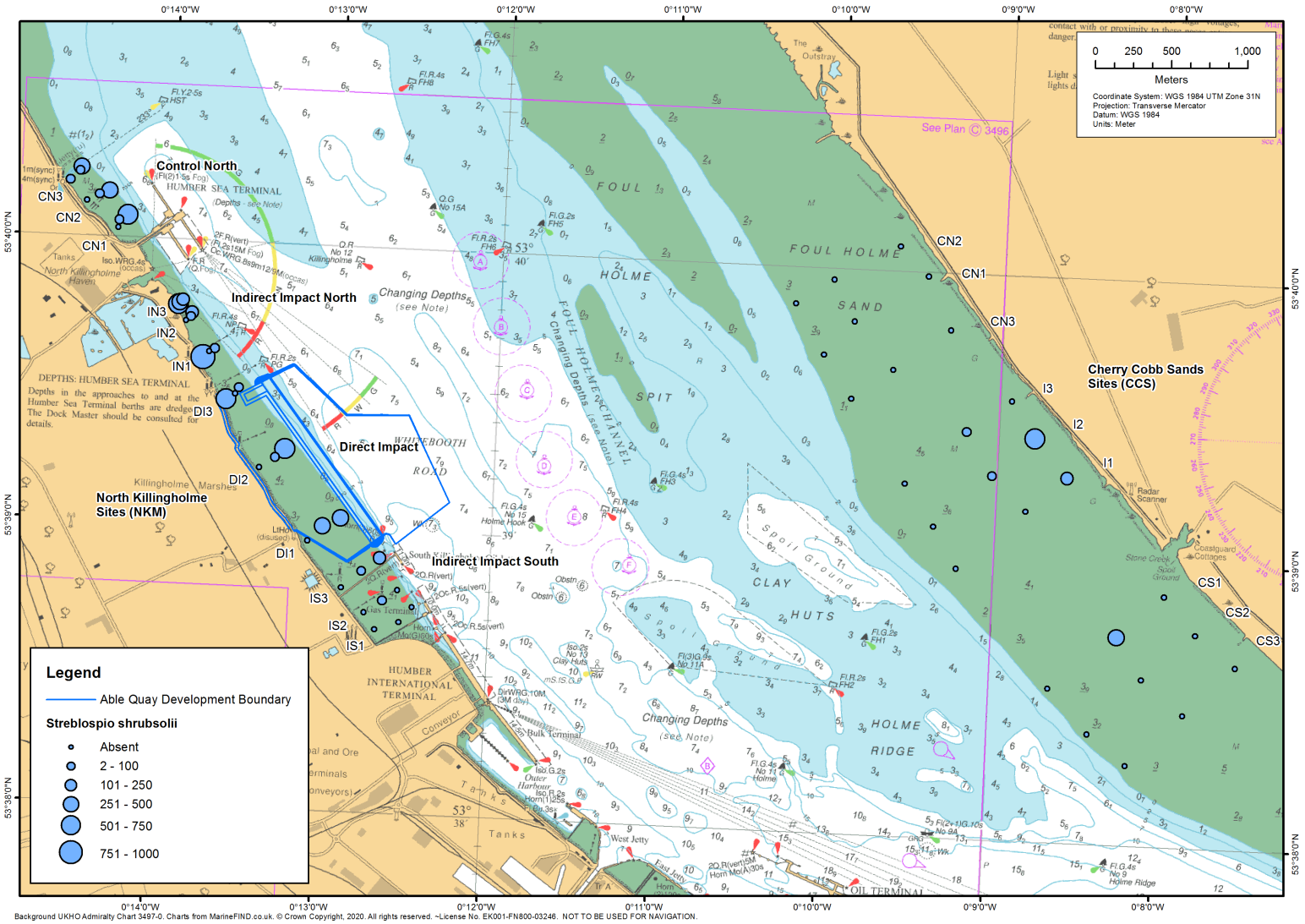

Figure 17. Spatial distribution in numbers of *Streblospio shrubsolii* (per 1m^2).

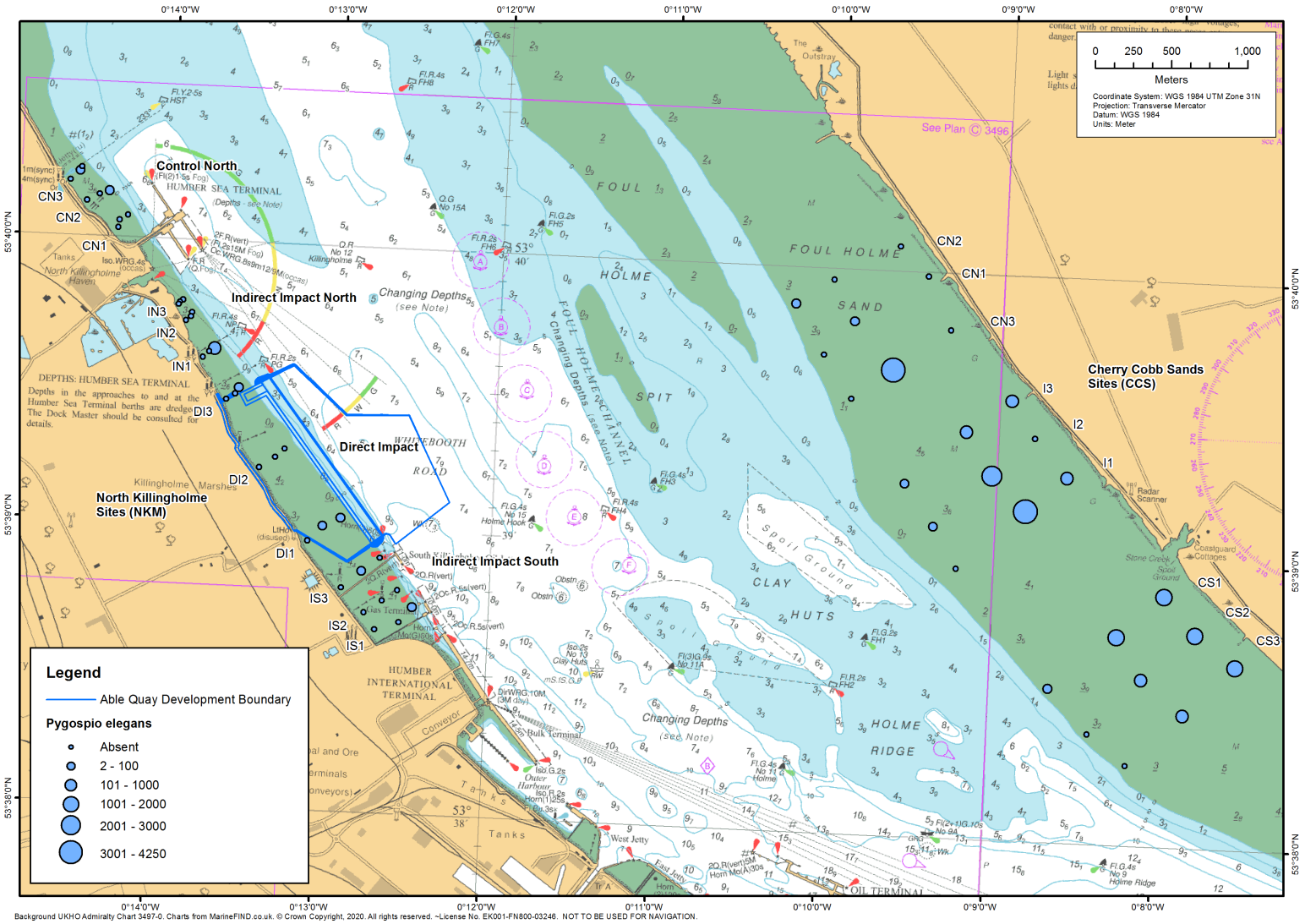

Figure 18. Spatial distribution in numbers of *Pygospio elegans* (per 1m^2).

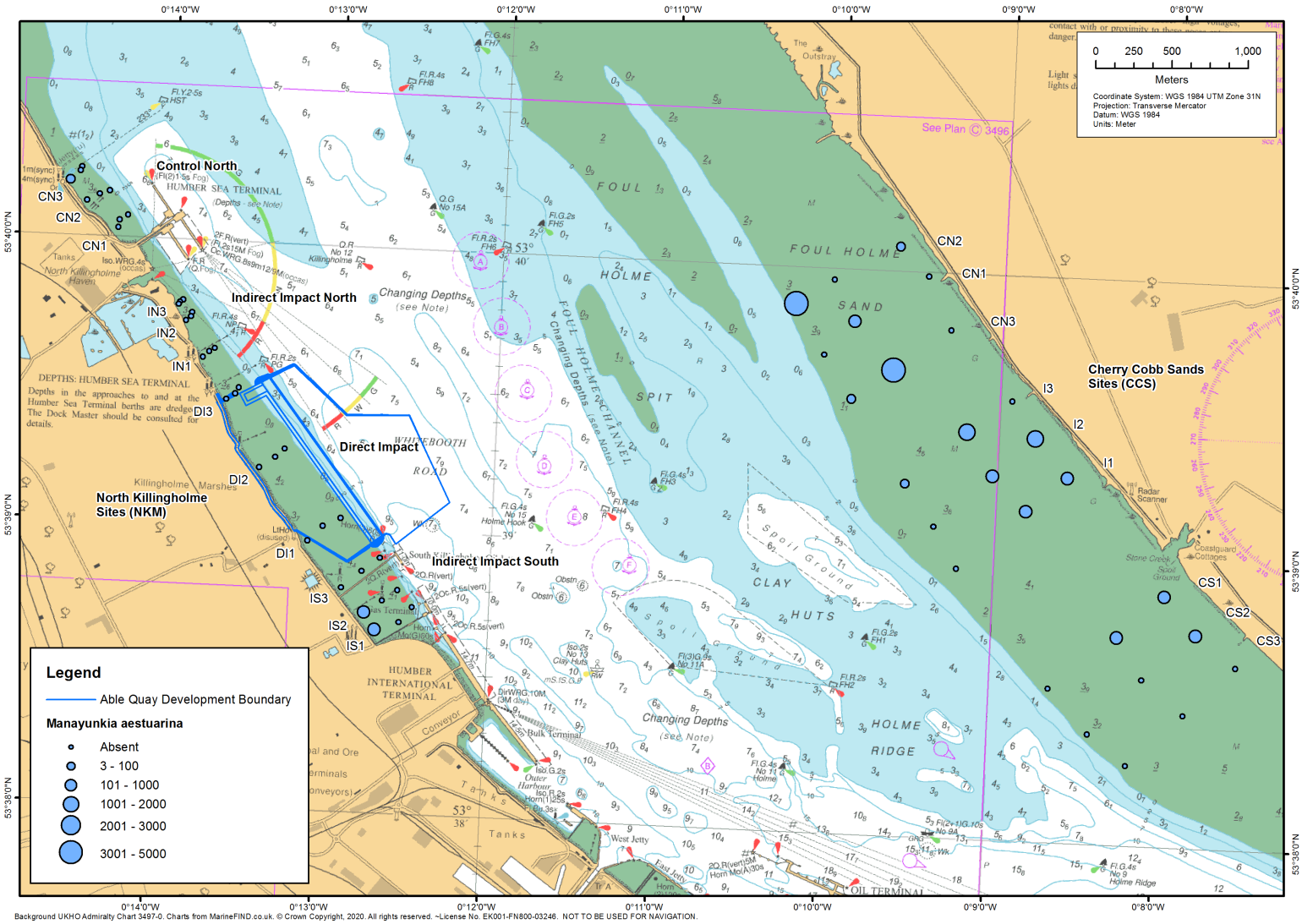

Figure 19. Spatial distribution in numbers of *Manayunkia aestuarina* (per 1m²).

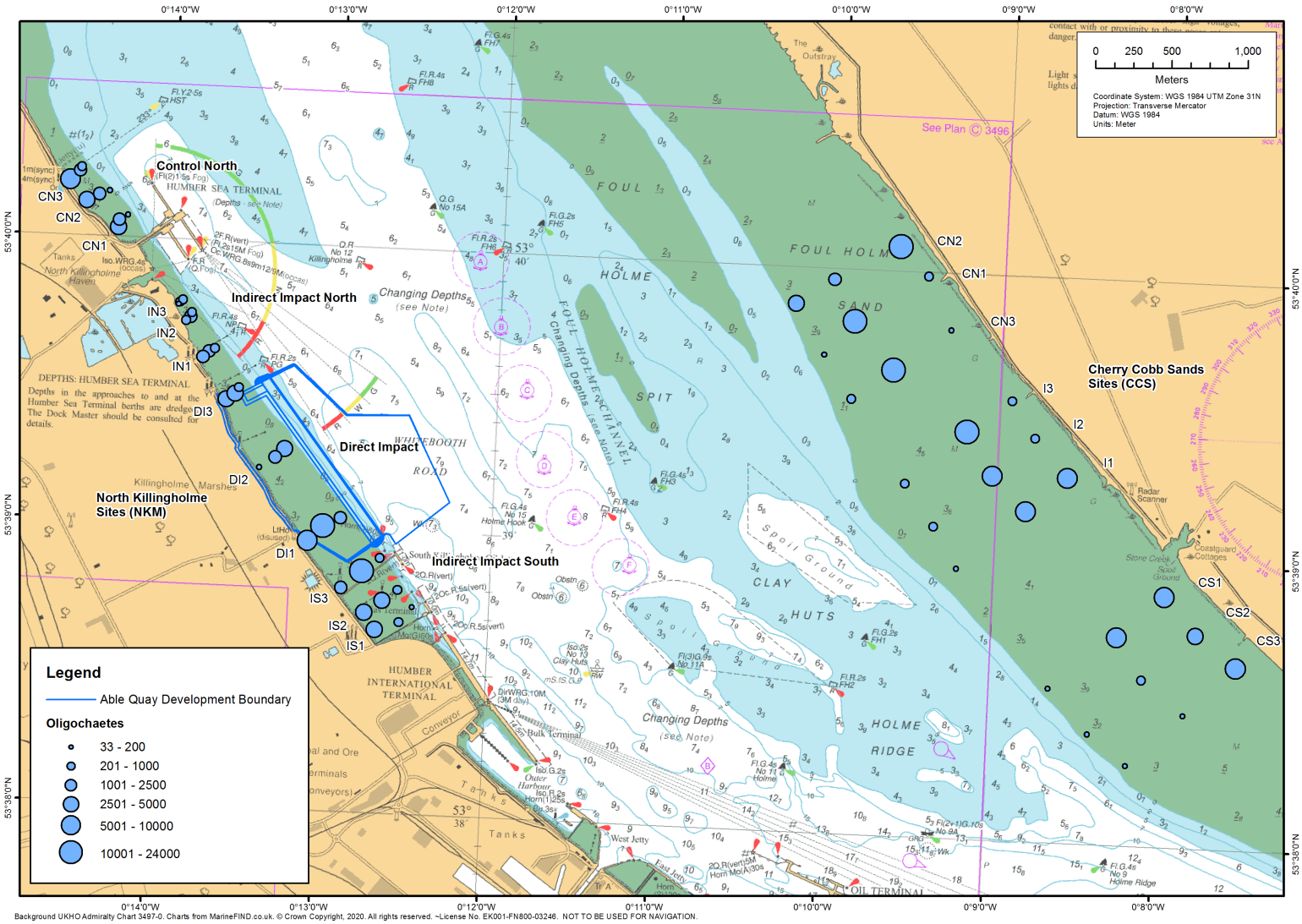

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Figure 20. Spatial distribution in numbers of *oligochaete taxa* (per 1m^2).

3.4 Multivariate Analysis of Community Structure

Multivariate analysis of the abundance data (following fourth root transformation) was carried out in order to describe the main patterns and assemblages within the area. Classification (cluster analysis) of the data was undertaken using the Bray-Curtis similarity coefficient and grouped average (UPGMA) clustering technique followed by a non-metric MDS (multi-dimensional scaling) ordination both using the PRIMER package (Clarke & Warwick, 2001). Cluster analysis is used to display graphically the similarity between sites based upon their species composition whereby the similarity between sites is calculated (in this case using the Bray-Curtis similarity coefficient) to produce a similarity matrix showing the percent similarity of sites (0% indicating no species in common and 100% indicating an identical community).

These values were then used to plot a dendrogram or tree diagram in which sites are linked at their respective similarity to other sites and consequently it is possible to define groups of sites with similar species composition at a predefined level of similarity. Non-metric MDS graphically displays the (rank) similarity between sites as a 2 dimensional plot in which the distances between sites indicates the level of similarity between them. The stress value associated with an MDS plot indicates the how faithful the plot is in representing the similarity between sites with low values (below 0.2) generally indicating a good fit. The station groupings derived from cluster analysis have subsequently been superimposed onto the MDS plots and input into GIS and the dominant species and mean environmental and biological parameters for each group calculated. Site groupings were derived using the similarity profile test (SIMPROF) within the PRIMER package. Characteristic taxa within each group were assessed using the SIMPER routine in PRIMER along with calculations of mean abundance and the % of sites at which the species occurred.

An initial assessment of faunal similarity was carried out using replicate data for both NKM and CCS (appendices 9 and 10) which allows an assessment of variability within a site and also may be used for future statistical analysis. Analysis at a site level (i.e. replicates combined) was then carried out using the combined dataset to analyse both survey areas simultaneously and the results of this analysis are provided here. Analysis at a site level simplifies assessment of spatial patterns in community structure which integrates small scale variability/noise at the sites and is useful in defining biotopes for the survey area as these are defined at a site level and given that individual replicates were sampled directly in close proximity from identical sediments there is no risk of pooling samples from widely differing habitats. Aside from simplifying interpretation of biotopes this also allowed correlations between species data and sedimentary data using the BEST routine within PRIMER.

In general, the results of the replicate analysis defined a broadly similar range of site groups (communities) to those identified using site data (with replicates combined). However, the replicate analysis was often more complex with a higher number of small (outlier) groups comprising of one or two samples often characterised by very low numbers of taxa/individuals (or with no species recorded). The combined analysis of NKM and CCS site data together indicated that the sites from each area were primarily separated into different groups. The site groups from the combined dataset generally matched those derived when

the data from NKM and CCS were analysed separately so to avoid repetition the results discussed here are those based on the combined NKM and CCS dataset.

The results of cluster analysis on the NKM and CCS data are shown in Figures 21 to 23 which show the dendrogram with symbols to show SIMPROF cluster group (Figure 21), survey area (Figure 22) and shore level (Figure 23). The spatial distribution of cluster groups and derived biotopes are provided in Figures 24 and 25 whilst the results of nMDS (with separate plots to highlight group, survey area and shore level) are provided in Figures 26 to 28. A high level of variability between sites is present with similarities between sites varying from around 20% to over 90% and the SIMPROF routine derived 9 site groups. The results of cluster analysis and ordination highlight a degree of separation between survey areas (and particularly between NKM and CCS sites) whilst differences based on shore level were also relatively well defined.

The characteristic taxa at the sites in each group are highlighted in Table 13 which includes contribution to group similarity (from SIMPER analysis) along with mean abundance (per $0.01m^2$ and $1m^2$) and the frequency of occurrence (% of sites) for each species (species which make no contribution to similarity are generally not included in the table). Also provided are the list of sites in each group and a summary of sedimentary parameters.

Group a includes a number of sites from NKM and CCS, primarily on the upper shore, characterised by sandy mud and heavily dominated by the oligochaete *Baltidrilus costatus* along with Nematoda spp. and terrestrial insect taxa including Collembola spp. and Diptera spp. larvae. Enchytraeidae spp., *Corophium volutator* and *Hediste diversicolor* are also present in moderate numbers but only present in a round 50% of samples. Group b includes a number of upper or midshore sites from CCS characterised by slightly gravelly sandy mud and dominated by Nematoda spp., *Tubificoides benedii* and *Limecola balthica* along with *Peringia ulvae*, *Pygospio elegans*, *Abra tenuis*, Nereididae spp. juvenile, *Manayunkia aestuarina*, *Eteone flava/longa* agg., Platyhelminthes (Dalyellidae) sp., Enchytraeidae spp. and *Hediste diversicolor* with the latter recorded at the majority of sites.

Group c includes just three mid shore or low shore sites from the northern control area of CCS characterised by very high densities of Nematoda spp., Enchytraeidae spp., *Manayunkia aestuarina* and *Pygospio elegans* along with other taxa such as Diptera spp. larvae, Bivalvia sp., Collembola spp., *Scrobicularia plana* and *Tubificoides benedii.* Group d includes a variety of low shore sites from CCS (along with occasional mid shore CCS sites) which were characterised by muddy sand or sand and dominated by *Limecola balthica* and *Tubificoides benedii* with lower abundances of *Nephtys hombergii*, *Pygospio elegans* and Nematoda spp.

Group e includes a single upper shore site (I3U) from CCS characterised by relatively few species such as *Limecola balthica*, *Tubificoides benedii*, *Nephtys hombergii*, *Pygospio elegans* and Nematoda spp. whilst group f includes two low shore sites from NKM characterised by sandy mud and dominated by moderate numbers of *Tubificoides benedii* and *Streblospio shrubsolii* along with *Limecola balthica*, *Tubificoides swirencoides*, *Tubificoides galiciensis* and *Nephtys hombergii*. Group g is also characterised by low shore NKM sites in sandy mud or slightly gravelly sandy mud and has a somewhat similar community to group f but is

characterised by *Tubificoides benedii*, *Corophium volutator*, *Pygospio elegans* and *Streblospio shrubsolii*.

Group h includes a number of upper or midshore sites from NKM primarily characterised by sandy mud and dominated by *Corophium volutator*, Nematoda spp., *Hediste diversicolor*, Enchytraeidae spp., *Baltidrilus costatus* and *Limecola balthica*. Group i includes the remainder of sites from NKM which were primarily characterised by sandy muds from the upper, mid and low shore and dominated by *Corophium volutator* and *Tubificoides benedii* along with *Limecola balthica*, Nematoda spp., *Streblospio shrubsolii*, *Eteone flava/longa* agg. and *Hediste diversicolor* although the latter was recorded at only 38% of sites.

Overall, whilst there is a degree of variability in terms of benthic community structure and distribution it is evident that many of the observed differences in invertebrate communities are rather subtle as opposed to distinct changes in assemblage. Aside from differences in relation to shore level, multivariate analysis also highlighted some differences between survey areas and particularly between NKM and CCS. These differences predominantly appear to reflect variation in sediment type, particularly at CCS where there is much greater variability in key sedimentary parameters.

The BEST routine in Primer was used to identify correlations between sediment type and shore level (distance from high water) and the patterns in community structure. The results of the BEST routine indicated that all parameters had some correlation to the species data with the parameters % LOI and median phi grain size exhibiting the highest correlations (0.441 and 0.417 respectively). Mean phi grain size, distance down the shore, mud content and sand content all had correlations between 0.3 and 0.4 with the remaining sediment parameters exhibiting lower correlations. The best combination of parameters to correlate with the patterns in species data were mean and median grain size and % LOI water which collectively exhibited a correlation of 0.467.

Whilst more obvious differences in communities could be identified between site groups which had widely differing sediment types (or shore height) the differences between many of the individual cluster groups were often quite subtle and tended to highlight differences in the relative dominance of similar groups of taxa or reflect the distribution of specific taxa which are present in one area but not another. At a broader (survey) level for example the SIMPER routine highlighted *Corophium volutator, Tubificoides benedii,* Nematoda spp.*, Limecola balthica, Streblospio shrubsolii, Baltidrilus costatus* and *Hediste diversicolor* as the most characteristic taxa for NKM (explaining >90% of similarity) whilst for CCS key taxa which account for >90% of similarity are *Tubificoides benedii,* Nematoda spp.*, Limecola balthica, Pygospio elegans, Enchytraeidae spp., Manayunkia aestuarina, Eteone flava/longa agg., Nephtys hombergii, Peringia ulvae, Abra tenuis,* Nereididae spp. juvenile*,* Diptera spp. larvae *and Hediste diversicolor*.

Key taxa which accounted for differences between the two survey areas included *Corophium volutator,* Nematoda spp., *Tubificoides benedii,* Enchytraeidae spp., *Limecola balthica, Pygospio elegans, Streblospio shrubsolii and Baltidrilus costatus* which accounted for over 50% dissimilarity. These results highlight a degree of overlap between NKM and CCS in terms of infaunal community composition as the majority of these taxa are present in both areas

but with differing abundances. The distribution of certain taxa, notably *Corophium volutator,* highlight more obvious differences between survey areas and this species accounts for the highest proportion of dissimilarity between NMK and CCS and is widespread at NKM but largely absent from CCS.

At a biotope level many of the observed communities appear to be variants of typical estuarine biotopes as classified under the current UK classification (Connor et al. 2004) and a map showing the distribution of main biotopes is provided in Figure 25. Areas of upper shore sandy mud at both NKM and CCS which have greater elevation and often in closer proximity to saltmarsh (e.g. group a) are usually characterised by *oligochaetes* (notably *Baltidrilus costatus*) along with variable densities of insect taxa, Enchytraeidae spp. and *Hediste diversicolor* or *Corophium volutator*. These appear to be mid estuarine, upper shore variants of biotopes more commonly found in upper estuarine areas namely *LS.LMu.Uest (Polychaete/oligochaete-dominated upper estuarine mud shores) or LS.LMu.UEst.Hed (Hediste diversicolor in littoral mud).* In certain upper shore areas at NKM or CCS these may also resemble rather transitional variants of sub-biotopes such as*, LS.LMu.UEst.Hed.Ol (Hediste diversicolor and oligochaetes in littoral mud)* or even *LS.LMu.UEst.Tben (Tubificoides benedii and other oligochaetes in littoral mud)* depending on the level of dominance by oligochaetes or *Hediste diversicolor*.

Poorly defined or impoverished muddy sands or sands on the low shore at CCS (group d) with variable (but generally low) numbers of *Limicola balthica, Tubificoides benedii* and *Nephtys hombergii* have generally been defined as *LS.LSa.MuSa (Polychaete/bivalve-dominated muddy sand shores)* but could also be slightly muddy variants of *LS.LSa (Littoral Sand)* and presumably reflect more dynamic environmental conditions and more mobile sediments. Certain areas of muddy sands on the mid shore at the southern end of CCS within group d have been classified as the biotope *LS.LSa.MuSa.MacAre (Macoma balthica and Arenicola marina in littoral muddy sand)*. Variable populations of *Arenicola marina* were evident in this area from observations of surface casts (usually up to 5 to 10 per m^2) during survey although this taxa was not picked up during core sampling due to their patchy distribution.

Low shore habitats at NKM tended to be much muddier than at CCS and examples of these low shore sandy muds at sites in groups f and g have a fairly poorly defined infaunal community perhaps indicating sediment instability and are classified as *LS.LMu.MEst* but are probably variants of *LS.LMu.MEst.NhomMacStr (Nephtys hombergii, Macoma balthica and Streblospio shrubsolii in littoral sandy mud)*. These habitats tend to be relatively impoverished and characterised by low to moderate numbers of *Streblospio shrubsolii*, and *Tubificoides benedii* and occasional *Macoma balthica*, *Nephtys hombergii* and *Corophium volutator*.

Groups b and c form a series of closely related groups which are clustered together at around 45% similarity and are predominantly mid shore or less elevated upper shore sandy mud sites at CCS. These sites tend to be the most diverse areas with a variety of taxa including varying abundances of taxa such as *Nematoda spp., Tubificoides benedii, Limecola balthica, Peringia ulvae, Pygospio elegans, Abra tenuis,* juvenile Nereididae spp.*, Manayunkia aestuarina and Eteone flava/longa* agg. with varying abundances of *Hediste diversicolor*. The majority of sites in these groups are variants of *LS.LMu.MEst.HedMac (Hediste diversicolor and Macoma balthica in littoral sandy mud*) although the mid shore habitats from CCS in group c tend to

be more impoverished than those recorded in group b with reduced numbers of *Limecola balthica* and *Hediste diversicolor* and have subsequently been classified as *LS.LMu.Mest*.

The remaining sites in groups h & i include the majority of sites from NKM and include samples from all areas of the shore . Sites in group h included high numbers of *Corophium volutator* and moderate densities of *Hediste diversicolor and Limecola balthica* and are likely to be a variant of the biotope *LS.LMu.MEst.HedMac* (albeit less diverse than similar communities recorded at CCS). At many of the sites in group i a transitional and rather uncertain variant of *LS.LMu.MEst.HedMac* appears to be present with moderately high densities of *Limecola balthica* but lower numbers of *Hediste diversicolor* along with high densities of *Corophium volutator*, *Tubificoides benedii* and *Streblospio shrubsolii*. These areas also show some resemblance to upper estuarine biotopes such as *LS.LMu.UEst.Hed.Cvol (Hediste diversicolor and Corophium volutator in littoral mud)* or *LS.LMu.UEst.Hed.Str (Hediste diversicolor and Streblospio shrubsolii in littoral sandy mud)*.

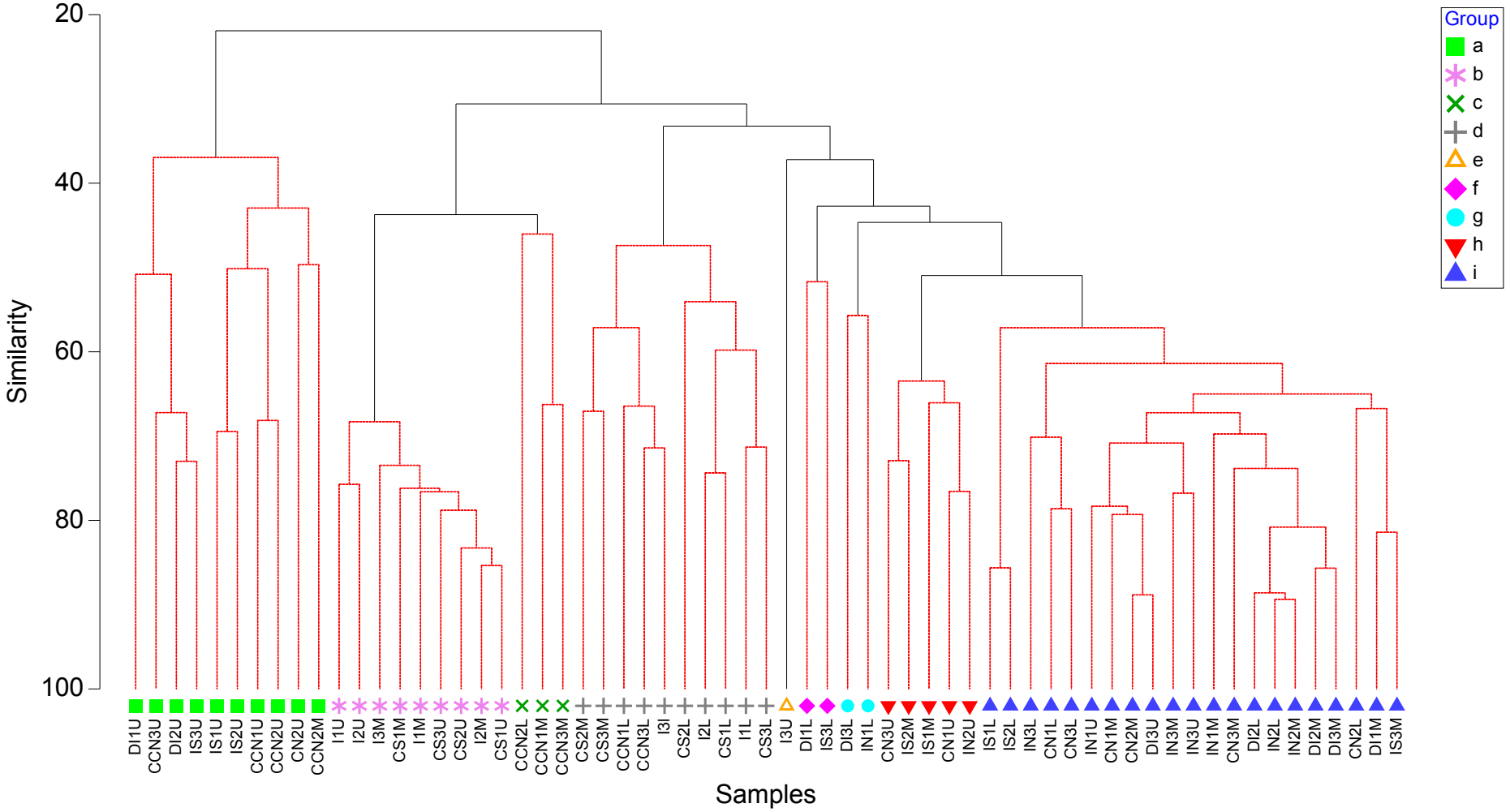


Figure 21. Results of cluster analysis on sites from North Killingholme & Cherry Cobb Sands (samples highlighted by group).

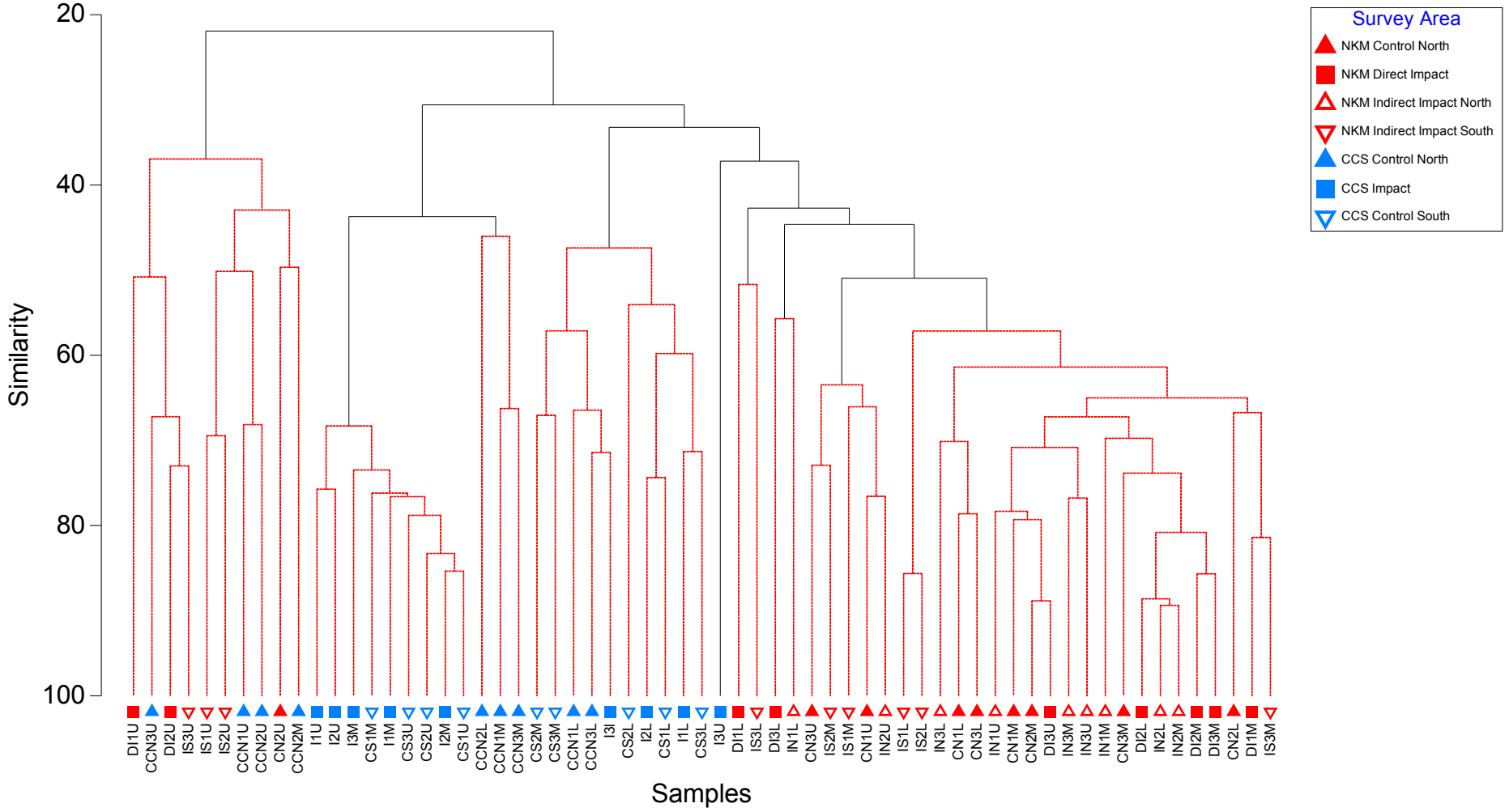


Figure 22. Results of cluster analysis on sites from North Killingholme & Cherry Cobb Sands (samples highlighted by area).

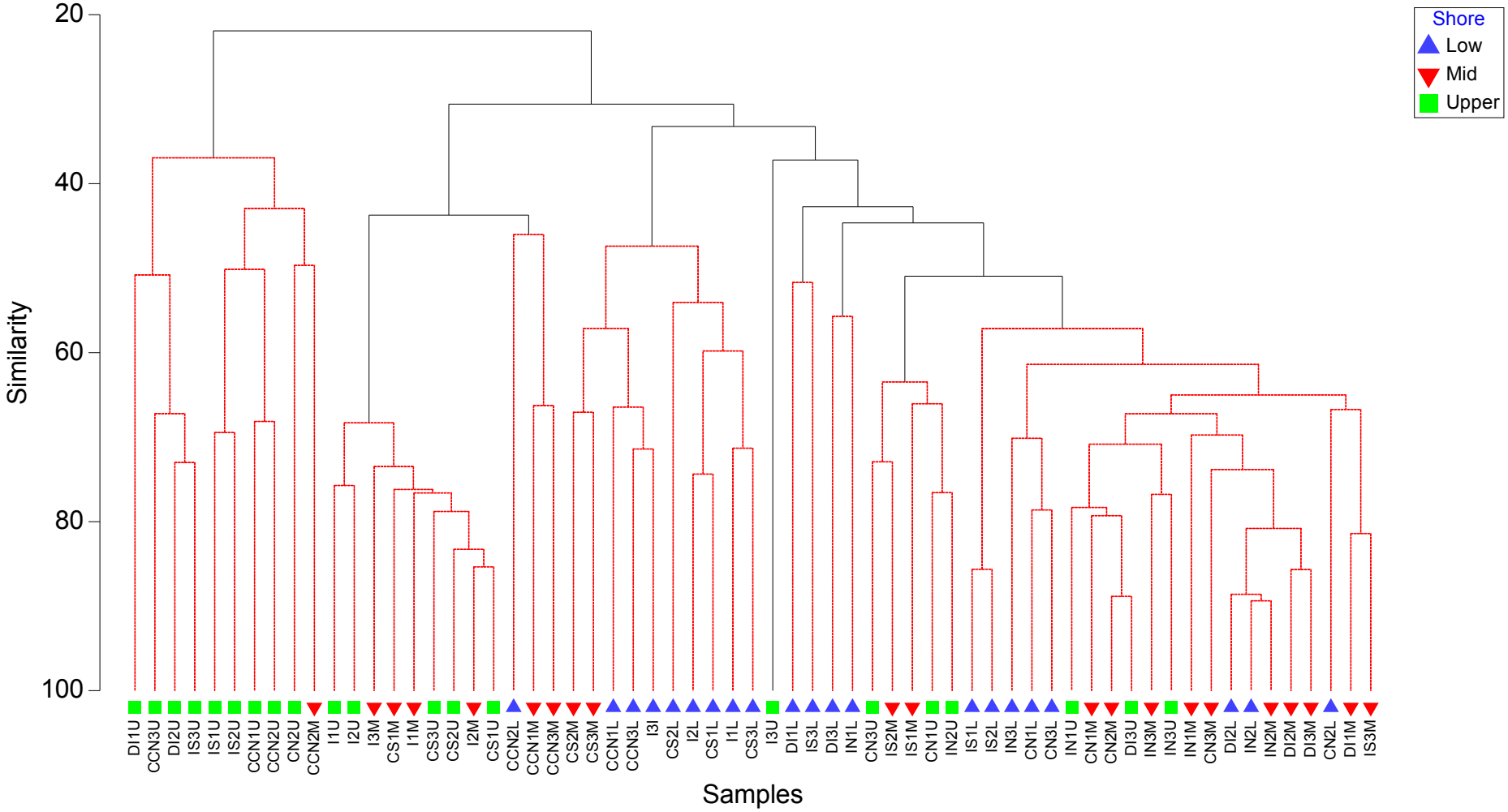


Figure 23. Results of cluster analysis on sites from North Killingholme & Cherry Cobb Sands (samples highlighted by shore).

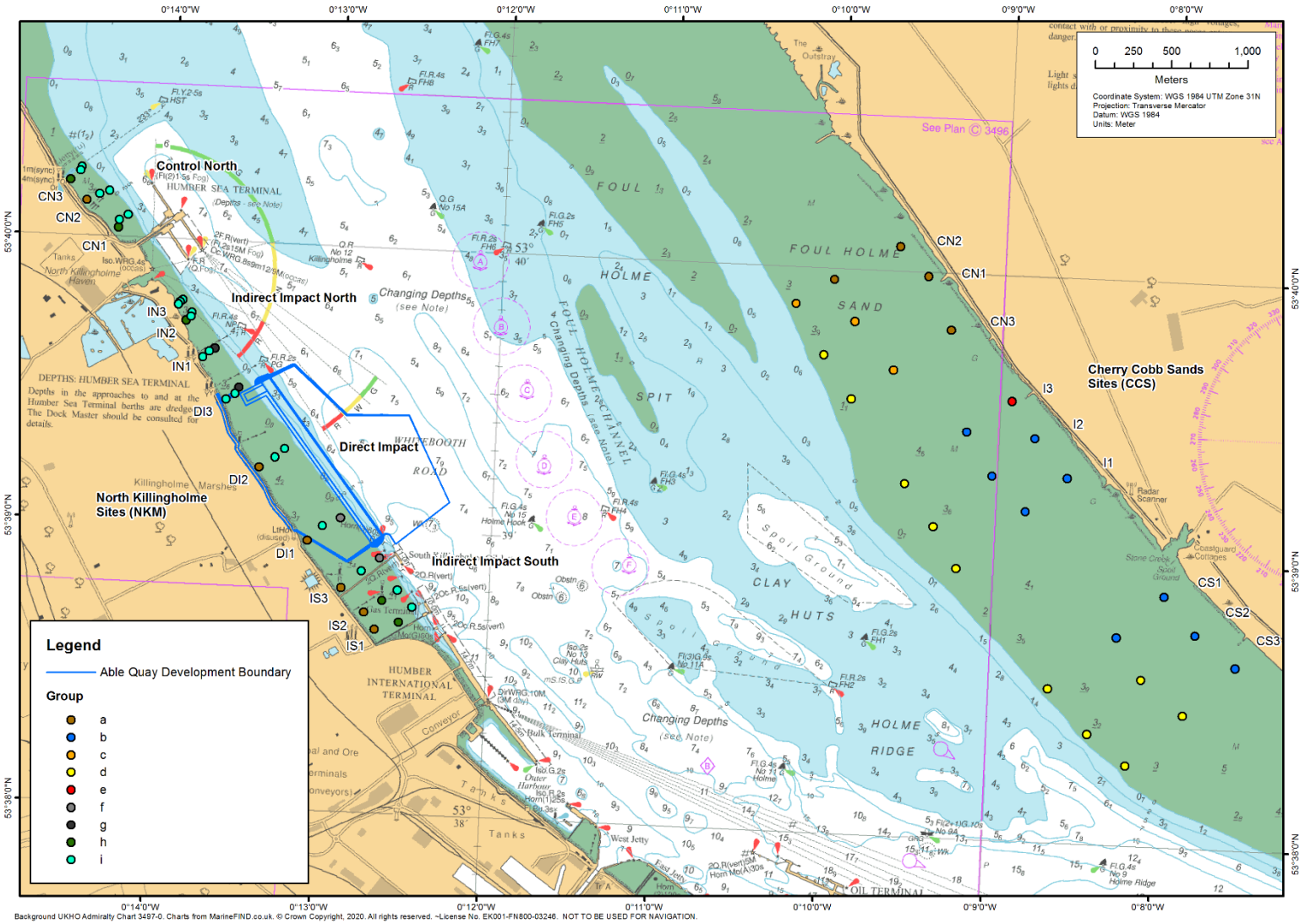


Figure 24. Spatial distribution of site groups from cluster analysis of North Killingholme & Cherry Cobb Sands data.

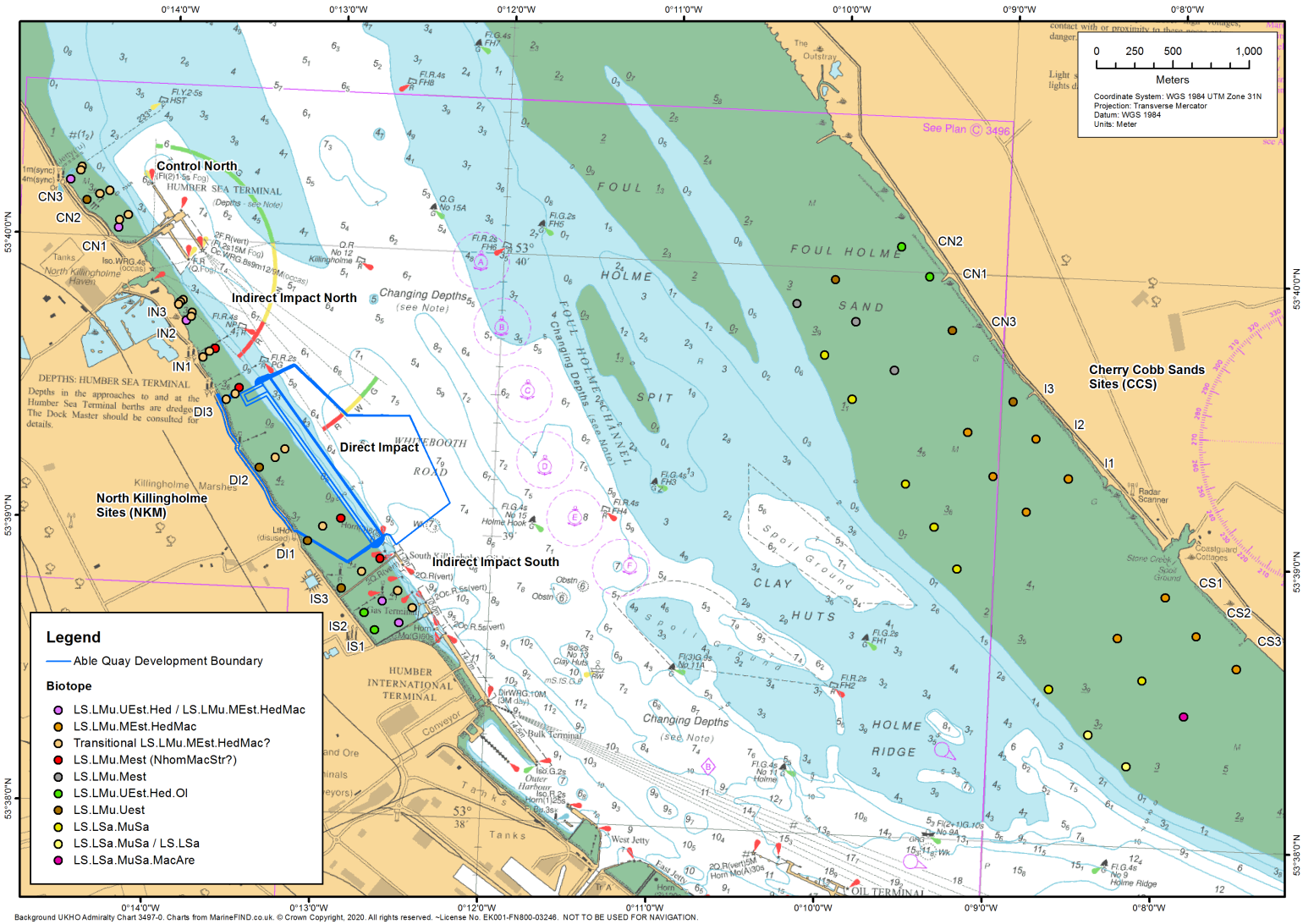


Figure 25. Distribution of biotopes at North Killingholme and Cherry Cobb Sands.

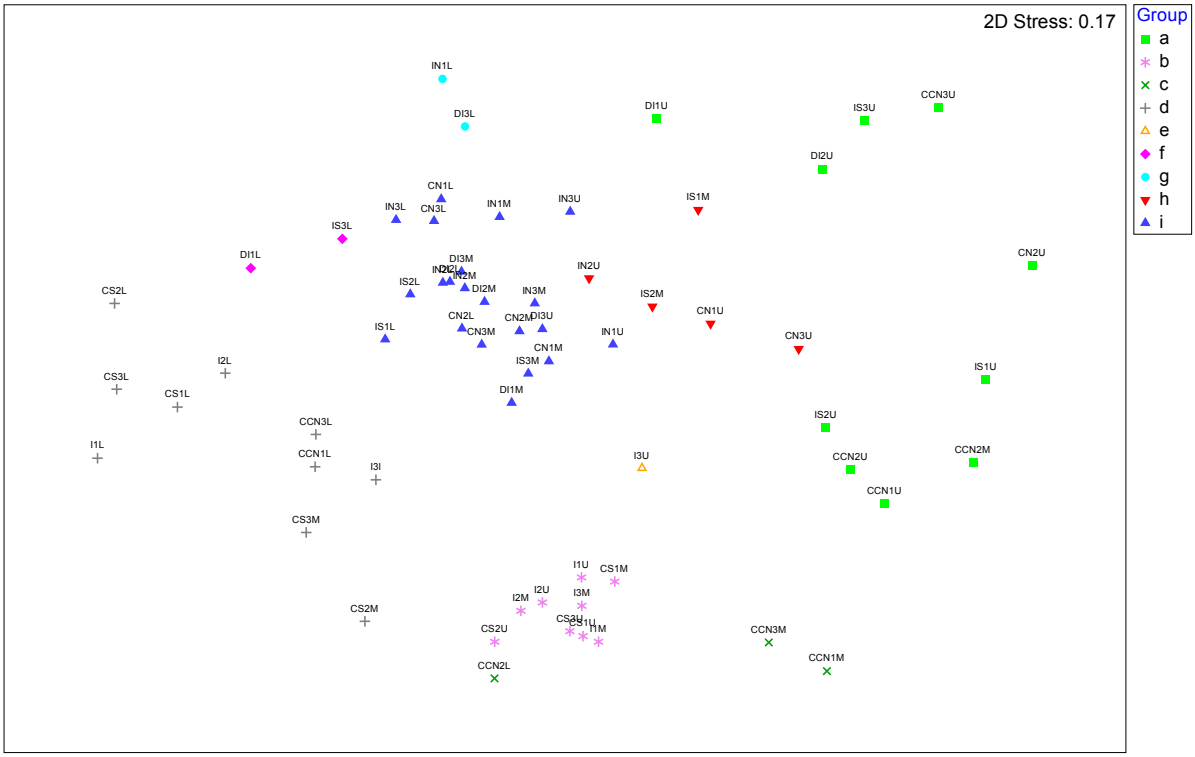


Figure 26. Results of nMDS on site data (North Killingholme & Cherry Cobb Sands) with samples highlighted by cluster group.

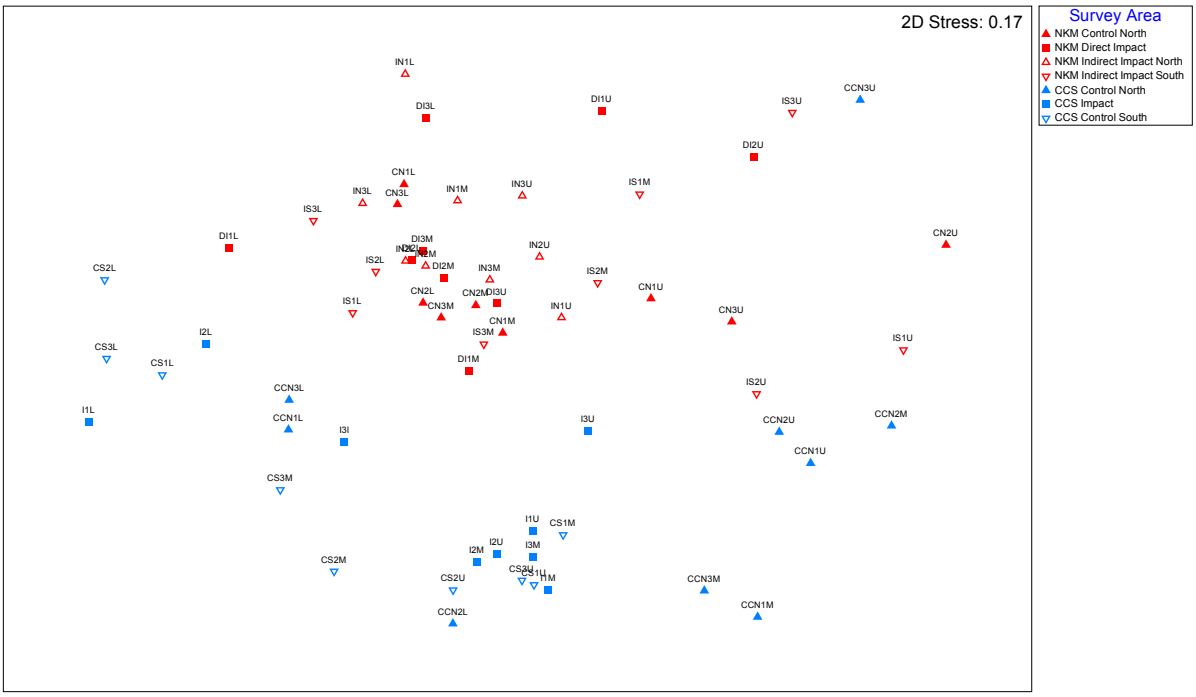


Figure 27. Results of nMDS on site data (North Killingholme & Cherry Cobb Sands) with samples highlighted by survey area.

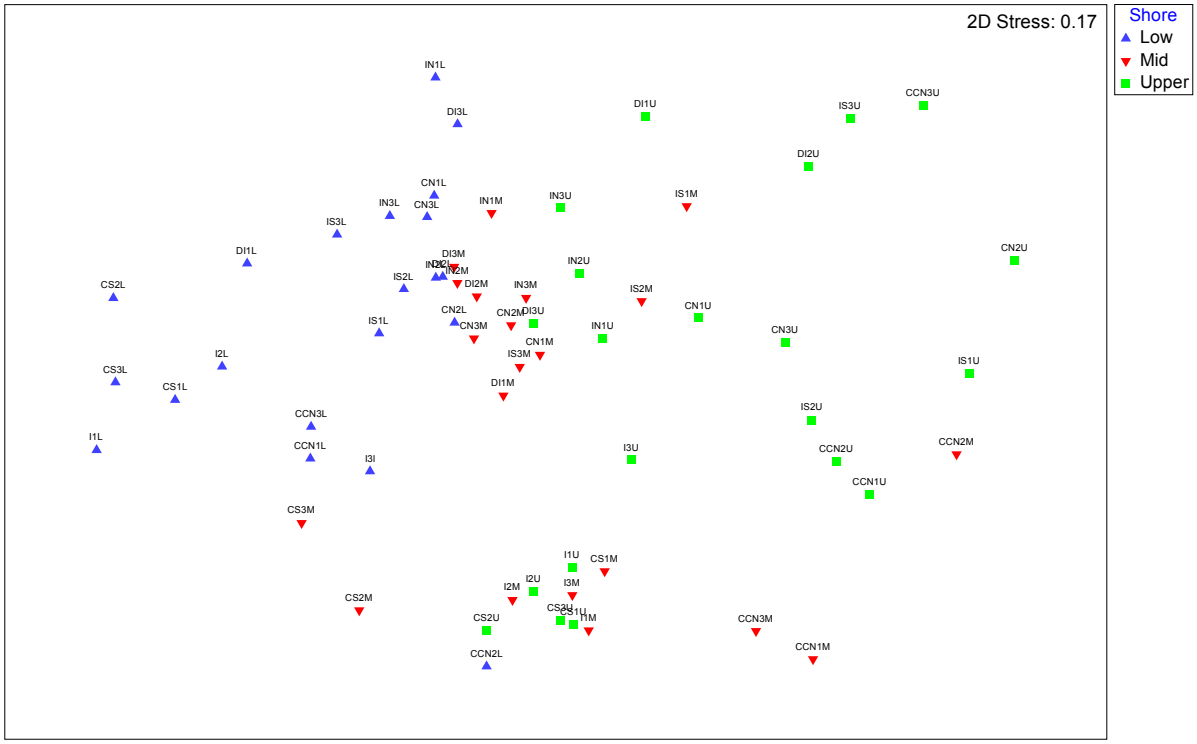


Figure 28. Results of nMDS on site data (North Killingholme & Cherry Cobb Sands) with samples highlighted by shore level.

Table 13. Characteristic taxa from SIMPER analysis of groups derived from cluster analysis for North Killingholme & Cherry Cobb Sands (site data).

Group a (Average similarity: 43.96%)							
Sites	**Area**	**Sediment Type**	**Median Phi**	**% Gravel**	**% Sand**	**% Mud**	**% LOI**
CN2U	NKM	Sandy Mud	6.301	0.00	15.20	84.80	9.06
DI1U	NKM	Sandy Mud	6.169	0.00	13.86	86.14	9.37
DI2U	NKM	Sandy Mud	6.19	0.00	13.14	86.86	7.57
IS1U	NKM	Sandy Mud	5.14	0.00	35.61	64.39	10.66
IS2U	NKM	Sandy Mud	5.83	0.00	23.31	76.69	9.48
IS3U	NKM	Sandy Mud	6.05	0.00	18.65	81.35	8.95
CCN1U	CCS	Slightly Gravelly Sandy Mud	5.70	0.06	19.58	80.37	6.89
CCN2M	CCS	Slightly Gravelly Sandy Mud	5.21	0.07	24.87	75.06	8.51
CCN2U	CCS	Sandy Mud	6.31	0.00	13.49	86.51	7.98
CCN3U	CCS	Sandy Mud	5.78	0.00	19.32	80.68	9.75
		Species	**Mean Abundance (per 0.01m²)**	**Mean Abundance (per 1m²)**	**% of Sites Recorded**	**% Contribution to similarity**	**Cum. % Contribution to Similarity**
		Baltidrilus costatus	24.47	2446.67	90	33.46	33.46
		Nematoda spp.	5.20	520.00	90	23.64	57.1
		Collembola spp.	0.63	63.33	70	13.03	70.13
		Diptera spp. larvae	0.80	80.00	60	7.72	77.85
		Enchytraeidae spp.	3.40	340.00	50	7.08	84.93
		Corophium volutator	0.63	63.33	50	6.55	91.47
		Hediste diversicolor	1.90	190.00	40	2.95	94.43
		Acari spp.	0.43	43.33	30	2.14	96.56
		Manayunkia aestuarina	1.53	153.33	30	1.33	97.89
		Tubificoides benedii	0.30	30.00	30	1.06	98.96
		Nereididae spp. juvenile	2.50	250.00	20	0.74	99.7
		Bivalvia sp.	0.20	20.00	20	0.3	100

Group b (Average similarity: 73.57%)							
Sites	**Area**	**Sediment Type**	**Median Phi**	**% Gravel**	**% Sand**	**% Mud**	**% LOI**
CS1M	CCS	Slightly Gravelly Sandy Mud	4.526	0.06	32.59	67.35	5.08
CS1U	CCS	Slightly Gravelly Sandy Mud	4.678	0.04	28.45	71.50	4.33
CS2U	CCS	Slightly Gravelly Sandy Mud	5.01	0.35	22.42	77.24	5.11
CS3U	CCS	Slightly Gravelly Sandy Mud	4.25	0.44	40.38	59.18	3.42
I1M	CCS	Slightly Gravelly Sandy Mud	4.95	0.19	25.26	74.55	5.55
I1U	CCS	Sandy Mud	4.92	0.00	24.71	75.29	5.75
I2M	CCS	Slightly Gravelly Sandy Mud	4.88	0.07	27.02	72.92	6.12
I2U	CCS	Sandy Mud	4.99	0.00	28.27	71.73	8.10
I3M	CCS	Slightly Gravelly Sandy Mud	4.95	0.06	27.18	72.76	7.74
		Species	**Mean Abundance (per 0.01m²)**	**Mean Abundance (per 1m²)**	**% of Sites Recorded**	**% Contribution to similarity**	**Cum. % Contribution to Similarity**
		Nematoda spp.	53.89	5388.89	100	14.99	14.99
		Tubificoides benedii	52.26	5225.93	100	13.75	28.73
		Limecola balthica	14.33	1433.33	100	8.82	37.55
		Peringia ulvae	9.81	981.48	100	8.68	46.23
		Pygospio elegans	14.93	1492.59	89	7.96	54.18
		Abra tenuis	7.37	737.04	100	7.74	61.92
		Nereididae spp. juvenile	4.93	492.59	100	6.34	68.26
		Manayunkia aestuarina	5.67	566.67	89	5.99	74.25
		Eteone flava/longa agg.	1.78	177.78	100	5.94	80.19
		Platyhelminthes (Dalyellidae) sp.	1.41	140.74	89	4.26	84.45
		Enchytraeidae spp.	18.26	1825.93	67	3.15	87.6
		Hediste diversicolor	1.15	114.81	78	3.07	90.67
		Scrobicularia plana	0.81	81.48	78	3.07	93.74
		Cyathura carinata	1.93	192.59	67	2.4	96.14
		Streblospio shrubsolii	1.33	133.33	56	1.78	97.92
		Diptera spp. larvae	0.33	33.33	56	1.27	99.19
		Copepoda spp.	0.26	25.93	22	0.11	100

Group c (Average similarity: 52.77%)							
Sites	**Area**	**Sediment Type**	**Median Phi**	**% Gravel**	**% Sand**	**% Mud**	**% LOI**
CCN1M	CCS	Sandy Mud	5.216	0.00	20.54	79.46	6.89
CCN2L	CCS	Slightly Gravelly Sandy Mud	4.342	0.04	43.65	56.31	3.57
CCN3M	CCS	Sandy Mud	5.05	0.00	25.15	74.85	7.32
		Species	**Mean Abundance (per 0.01m²)**	**Mean Abundance (per 1m²)**	**% of Sites Recorded**	**% Contribution to similarity**	**Cum. % Contribution to Similarity**
		Nematoda spp.	78.11	7811.11	100	27.02	27.02
		Enchytraeidae spp.	117.56	11755.56	100	26.6	53.62
		Manayunkia aestuarina	31.22	3122.22	100	21.58	75.2
		Pygospio elegans	14.33	1433.33	100	8.53	83.73
		Diptera spp. larvae	0.67	66.67	67	3.68	87.41
		Bivalvia sp.	1.11	111.11	67	3.67	91.08
		Collembola spp.	73.67	7366.67	67	3.33	94.41
		Scrobicularia plana	0.22	22.22	67	2.8	97.21
		Tubificoides benedii	0.56	55.56	67	2.79	100
		Paranais litoralis	7.56	755.56	33	0	100
		Limecola balthica	1.11	111.11	33	0	100
		Hediste diversicolor	0.67	66.67	33	0	100

Group d (Average similarity: 53.43%)							
Sites	**Area**	**Sediment Type**	**Median Phi**	**% Gravel**	**% Sand**	**% Mud**	**% LOI**
CCN1L	CCS	Slightly Gravelly Muddy Sand	3.83	0.04	55.68	44.28	3.52
CCN3L	CCS	Muddy Sand	3.85	0.00	54.93	45.07	4.76
CS1L	CCS	Muddy Sand	3.39	0.00	80.18	19.82	2.34
CS2L	CCS	Sand	2.61	0.00	95.63	4.37	1.19
CS2M	CCS	Slightly Gravelly Muddy Sand	3.84	0.25	57.32	42.43	2.72
CS3L	CCS	Sand	2.65	0.00	94.82	5.18	1.84
CS3M	CCS	Muddy Sand	3.67	0.00	66.54	33.46	2.78
I1L	CCS	Muddy Sand	3.46	0.00	78.35	21.65	1.60
I2L	CCS	Muddy Sand	3.65	0.00	66.30	33.70	2.71
I3l	CCS	Slightly Gravelly Muddy Sand	3.62	0.07	67.70	32.23	2.73

Species	**Mean Abundance (per 0.01m²)**	**Mean Abundance (per 1m²)**	**% of Sites Recorded**	**% Contribution to similarity**	**Cum. % Contribution to Similarity**
Limecola balthica	6.83	683.33	100	36.96	36.96
Tubificoides benedii	1.40	140.00	100	32.99	69.95
Nephtys hombergii	0.50	50.00	80	16.43	86.39
Pygospio elegans	1.10	110.00	50	5.13	91.52
Nematoda spp.	0.23	23.33	50	4.11	95.63
Eteone flava/longa agg.	0.20	20.00	40	2.31	97.93
Scoloplos armiger	0.07	6.67	20	0.55	98.48
Manayunkia aestuarina	0.10	10.00	20	0.48	98.96
Peringia ulvae	0.33	33.33	20	0.38	99.34
Abra tenuis	0.27	26.67	20	0.37	99.71
Platyhelminthes (Dalyellidae) sp.	0.10	10.00	20	0.29	100
Retusa obtusa	0.10	10.00	10	0	100

Group e (site CCS I3U)							
Sites	**Area**	**Sediment Type**	**Median Phi**	**% Gravel**	**% Sand**	**% Mud**	**% LOI**
I3U	CCS	Sandy Mud	5.57	0.00	17.65	82.35	8.00

Species	**Mean Abundance (per 0.01m²)**	**Mean Abundance (per 1m²)**	**Cum. % abundance**
Nematoda spp.	7.33	733.33	50
Enchytraeidae spp.	3.00	300.00	70
Tubificoides benedii	2.33	233.33	86
Pygospio elegans	2.00	200.00	100

Group f (Average similarity: 51.69%)							
Sites	**Area**	**Sediment Type**	**Median Phi**	**% Gravel**	**% Sand**	**% Mud**	**% LOI**
DI1L	NKM	Sandy Mud	5.29	0.00	27.12	72.88	5.98
IS3L	NKM	Sandy Mud	4.87	0.00	32.81	67.19	5.82

Species	**Mean Abundance (per 0.01m²)**	**Mean Abundance (per 1m²)**	**% of Sites Recorded**	**% Contribution to similarity**	**Cum. % Contribution to Similarity**
Tubificoides benedii	5.17	516.67	100	29.91	29.91
Streblospio shrubsolii	2.50	250.00	100	27.5	57.41
Limecola balthica	1.50	150.00	100	24.2	81.61
Tubificoides swirencoides	2.00	200.00	100	18.39	100
Tubificoides galiciensis	0.83	83.33	50	0	100
Nephtys hombergii	0.67	66.67	50	0	100
Collembola spp.	0.50	50.00	50	0	100
Corophium volutator	0.17	16.67	50	0	100
Nematoda spp.	0.17	16.67	50	0	100
Pygospio elegans	0.17	16.67	50	0	100
Tharyx killariensis	0.17	16.67	50	0	100

Group g (Average similarity: 55.70%)							
Sites	**Area**	**Sediment Type**	**Median Phi**	**% Gravel**	**% Sand**	**% Mud**	**% LOI**
DI3L	NKM	Slightly Gravelly Sandy Mud	5.26	0.01	23.60	76.39	5.24
IN1L	NKM	Sandy Mud	4.86	0.00	26.91	73.09	4.02
		Species	**Mean Abundance (per 0.01m²)**	**Mean Abundance (per 1m²)**	**% of Sites Recorded**	**% Contribution to similarity**	**Cum. % Contribution to Similarity**
		Tubificoides benedii	5.50	550.00	100	34.33	34.33
		Corophium volutator	97.67	9766.67	100	23.79	58.13
		Pygospio elegans	2.00	200.00	100	23.79	81.92
		Streblospio shrubsolii	0.50	50.00	100	18.08	100
		Cyathura carinata	0.33	33.33	50	0	100
		Jaera (Jaera) albifrons	0.33	33.33	50	0	100
		Baltidrilus costatus	0.17	16.67	50	0	100
		Eteone flava/longa agg.	0.17	16.67	50	0	100

Group h (Average similarity: 66.24%)							
Sites	**Area**	**Sediment Type**	**Median Phi**	**% Gravel**	**% Sand**	**% Mud**	**% LOI**
CN1U	NKM	Sandy Mud	5.63	0.00	15.60	84.40	5.46
CN3U	NKM	Sandy Mud	6.00	0.00	14.52	85.48	7.47
IN2U	NKM	Sandy Mud	5.40	0.00	23.89	76.11	6.86
IS1M	NKM	Slightly Gravelly Sandy Mud	4.94	0.04	31.59	68.37	8.27
IS2M	NKM	Sandy Mud	5.05	0.00	29.72	70.28	8.23
		Species	**Mean Abundance (per 0.01m²)**	**Mean Abundance (per 1m²)**	**% of Sites Recorded**	**% Contribution to similarity**	**Cum. % Contribution to Similarity**
		Corophium volutator	37.13	3713.33	100	28.46	28.46
		Nematoda spp.	8.67	866.67	100	18.87	47.33
		Hediste diversicolor	3.20	320.00	100	17.3	64.63
		Enchytraeidae spp.	14.93	1493.33	80	11.56	76.19
		Baltidrilus costatus	9.67	966.67	80	11.18	87.37
		Limecola balthica	0.40	40.00	80	7.21	94.58
		Tubificoides benedii	2.80	280.00	60	3.54	98.12
		Collembola spp.	0.33	33.33	40	1.02	99.14
		Streblospio shrubsolii	0.13	13.33	40	0.86	100
		Nereididae spp. juvenile	0.47	46.67	20	0	100
		Acari spp.	0.07	6.67	20	0	100
		Diptera spp. larvae	0.07	6.67	20	0	100
		Manayunkia aestuarina	0.07	6.67	20	0	100

Group i (Average similarity: 65.46%)							
Sites	**Area**	**Sediment Type**	**Median Phi**	**% Gravel**	**% Sand**	**% Mud**	**% LOI**
CN1L	NKM	Sandy Mud	5.31	0.00	26.62	73.38	6.13
CN1M	NKM	Sandy Mud	4.99	0.00	22.95	77.05	5.31
CN2L	NKM	Sandy Mud	4.81	0.00	33.64	66.36	8.32
CN2M	NKM	Sandy Mud	4.85	0.00	27.45	72.55	5.17
CN3L	NKM	Sandy Mud	4.97	0.00	28.73	71.27	6.32
CN3M	NKM	Sandy Mud	5.10	0.00	21.87	78.13	5.92
DI1M	NKM	Sandy Mud	5.23	0.00	24.72	75.28	6.93
DI2L	NKM	Sandy Mud	4.69	0.00	34.63	65.37	7.30
DI2M	NKM	Sandy Mud	4.77	0.00	30.89	69.11	5.62
DI3M	NKM	Sandy Mud	5.35	0.00	20.33	79.67	5.77
DI3U	NKM	Sandy Mud	5.35	0.00	25.96	74.04	7.08
IN1M	NKM	Sandy Mud	4.95	0.00	25.95	74.05	4.79
IN1U	NKM	Sandy Mud	5.77	0.00	19.58	80.42	7.90
IN2L	NKM	Sandy Mud	5.04	0.00	27.84	72.16	6.82
IN2M	NKM	Sandy Mud	4.76	0.00	32.22	67.78	5.40
IN3L	NKM	Gravelly Mud	4.34	24.44	20.58	54.98	5.46
IN3M	NKM	Slightly Gravelly Sandy Mud	5.40	0.03	24.33	75.64	7.71
IN3U	NKM	Sandy Mud	5.43	0.00	25.16	74.84	7.79
IS1L	NKM	Slightly Gravelly Sandy Mud	4.42	0.02	39.58	60.41	6.06
IS2L	NKM	Sandy Mud	4.44	0.00	37.97	62.03	4.50
IS3M	NKM	Slightly Gravelly Sandy Mud	5.07	0.01	24.52	75.47	6.01

Species	**Mean Abundance (per 0.01m²)**	**Mean Abundance (per 1m²)**	**% of Sites Recorded**	**% Contribution to similarity**	**Cum. % Contribution to Similarity**
Corophium volutator	32.25	3225.40	100	27.66	27.66
Tubificoides benedii	29.71	2971.43	100	24.78	52.44
Limecola balthica	2.38	238.10	95	16.61	69.05
Nematoda spp.	5.08	507.94	86	13.03	82.08
Streblospio shrubsolii	2.73	273.02	81	10.36	92.44
Eteone flava/longa agg.	0.52	52.38	57	3.81	96.25
Hediste diversicolor	0.44	44.44	38	1.41	97.66
Nereididae spp. juvenile	0.29	28.57	33	1.13	98.79
Enchytraeidae spp.	1.02	101.59	24	0.68	99.47
Pygospio elegans	0.08	7.94	24	0.53	100
Baltidrilus costatus	0.11	11.11	5	0	100
Tellinoidea sp.	0.05	4.76	5	0	100
Acari spp.	0.02	1.59	5	0	100
Aphelochaeta marioni	0.02	1.59	5	0	100
Aphelochaeta/Tharyx sp.	0.02	1.59	5	0	100
Bivalvia sp.	0.02	1.59	5	0	100
Collembola spp.	0.02	1.59	5	0	100
Cyathura carinata	0.02	1.59	5	0	100
Platyhelminthes sp.	0.02	1.59	5	0	100
Scrobicularia plana	0.02	1.59	5	0	100

4. Subtidal Benthic Survey Results

As outlined in Section 2 the subtidal benthic survey collected 90 samples from thirty sites from four areas (impact area, secondary impact, control north and control south). Details on the benthic sample positions are provided in Appendix 11 with the distribution of sample sites shown in Figure 29.

4.1 Sedimentary Parameters

The results of Particle Size Analysis is provided in Appendix 12 and a summary of key sedimentary parameters and water depths are provided in Table 14 with maps showing the distribution of survey sites, sediment types, sediment composition and median phi grain size shown in Figures 30 to 32. The sediments collected during survey were similar within each site and the data provided here are based on particle size analysis from a single representative sample per site. Sample sites within the survey areas ranged from 1.85m CD to 11.48m CD with upstream areas generally exhibiting slightly shallower depths. A variety of different sediment types were recorded during survey including sands or muddy sands, sandy gravel and sandy mud.

Gravel content ranged from 0% at the majority of sites to 60% at site CS 5 and the southern (downstream) control sites tended to have the highest gravel content. Sand and mud content varied considerably throughout the area with some spatial variability between areas. The northern control site included cleaner sand, muddy sand or sandy mud with a very low gravel content at a few sites (<1%) and mud content ranged from 7.36% to 78.06%. Conversely the southern control area included gravelly mud, gravelly sand, slightly gravelly muddy sand, muddy sandy gravel and gravelly muddy sand or slightly gravelly sandy mud. Gravel content in this area ranged from 0.68% to 60.95% whilst mud content ranged from 5.17% to 58.28%. The direct impact area tended to exhibit muddier sediments with muddy sands or sandy muds sometimes with small quantities (<1%) of gravel (slightly gravelly sandy mud or slightly gravelly muddy sand). The secondary impact area also included muddy habitats including sandy muds or muddy sands (or slightly gravelly muddy sand/sandy muds) but also included two sandier sites (SI4 and SI5). Gravel content in the direct impact area ranged from 0% to 0.91% at the direct impact area and 0% to 0.004% at the secondary impact area whilst mud content in these areas ranged from 26.14% to 85.33% at the direct impact area and 7.11% to 83.65% at the secondary impact area. Aside from the sandier sites in the northern control area and the secondary impact area, the majority of sites exhibited poorly or very poorly sediments which ranged from very fine skewed to coarse skewed whilst % LOI varied from 1.19% to 7.86%.

4.2 Biological Parameters

A range of biological parameters were calculated for the samples as undertaken for the intertidal invertebrate survey. A summary of the biological parameters at each site is provided in Table 15 which gives average values per 0.1m^2 for each site whilst the values of biological parameters from the individual replicates are provided in Appendix 13. Replicate samples have also been combined to provide summaries of overall ABC structure per site (in

Appendix 14). The spatial variation in average values of key biological parameters per site ($0.1m^2$) is highlighted in Figures 33 to 36. Numbers of taxa were generally low with mean numbers per site ranging from one to seven taxa per $0.1m^2$ and the majority of individual samples had less than five taxa with no clear difference between survey areas.

The number of individuals at the sites were also relatively low with the majority of sites having on average fewer than 20 individuals. A few sites had higher numbers of animals including sites SI3 (mean value of 174 individuals per $0.1m^2$) and DI 3 (mean value of 51 individuals per $0.1m^2$). Just under half the sites exhibited mean abundances of under 10 per $0.1m^2$ and whilst there were no major differences between survey areas the lowest number of species and numbers of individuals tended to occur in slightly deeper water in the main channels, particularly downstream of the development area in the secondary impact or southern control areas which presumably reflects increased tidal stress in these areas. AFDW biomass tended to be rather low in comparison to intertidal communities ranging from 0.00012g to 0.10707g. Evenness values were generally moderate to high (>0.75) whilst other diversity metrics tended to exhibit moderately low values with Shannon's H' diversity ranging from 0 to 2.45 and approximately half of the sites had mean H' values of less than 1.

ABC plots generally exhibited curves with biomass curves above abundance plots (and positive w values) although sites which had few taxa could not provide particularly meaningful curves. Calculation of average ABC w statistics based on replicate data indicated that some sites e.g. sites CN3, CS3, CS7, DI8 and SI2 had low average w values at or below zero. Such results are likely to be representative of the relatively dynamic environmental conditions related to tidal stress or sediment disturbance and salinity fluctuations within the estuary rather than indicative of significant anthropogenic impacts.

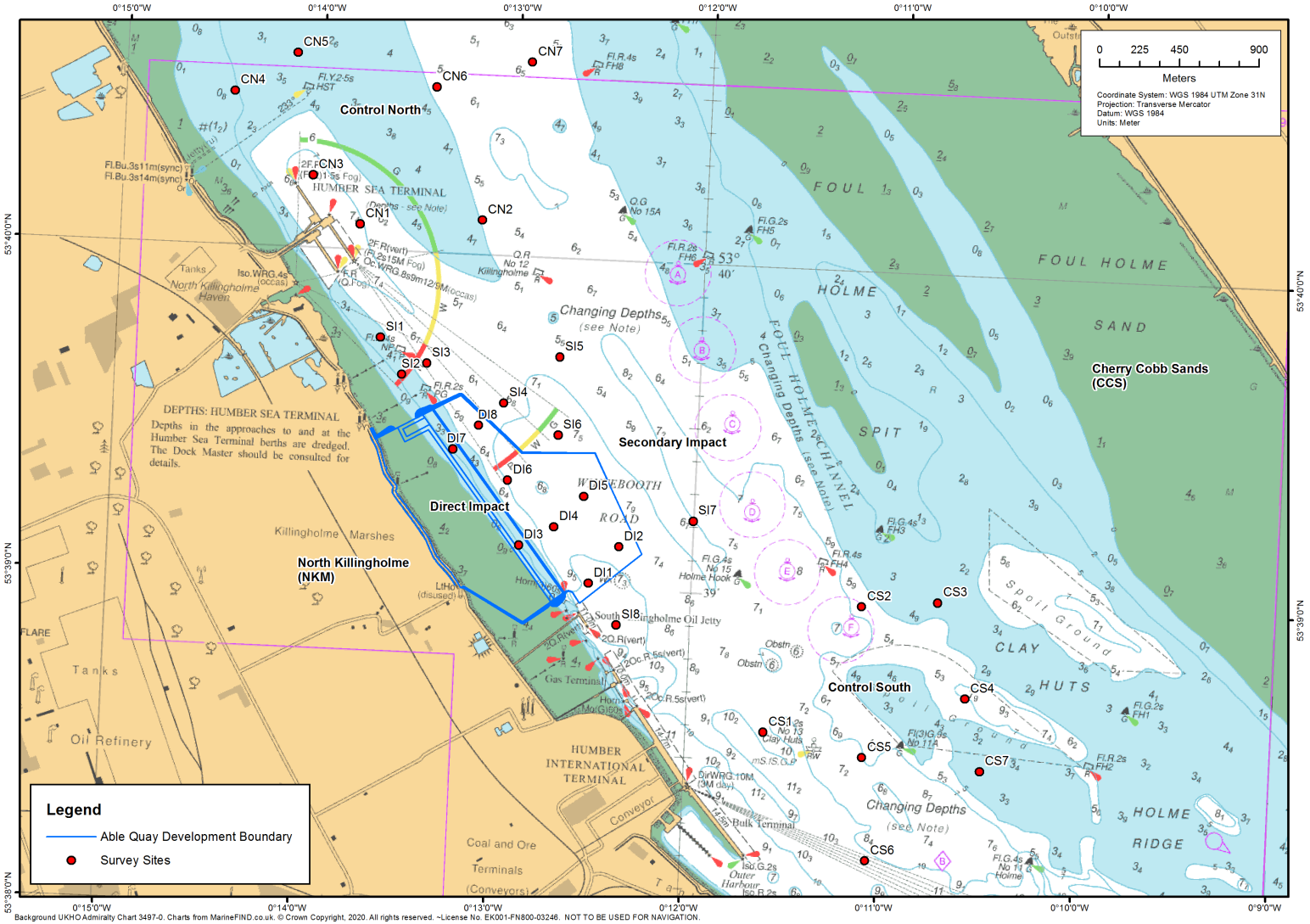


Figure 29. Location of subtidal benthic survey sites.

Table 14. Summary of sedimentary parameters and water depth from the subtidal benthic survey.

Area	Site	Sediment Type	Median Grain Size (phi)	Mean Grain Size (phi)	Sorting (phi)		Skewness (phi)		% Gravel	% Sand	% Mud	% LOI
Control North	CN1	Sandy Mud	5.91	5.64	2.09	Very Poorly Sorted	-0.19	Coarse Skewed	0.000	24.40	75.60	6.24
	CN2	Slightly Gravelly Muddy Sand	3.10	3.88	1.89	Poorly Sorted	0.59	Very Fine Skewed	0.034	71.46	28.51	2.32
	CN3	Sandy Mud	5.31	5.33	2.22	Very Poorly Sorted	-0.04	Symmetrical	0.000	31.99	68.01	7.29
	CN4	Sandy Mud	6.10	5.81	2.10	Very Poorly Sorted	-0.20	Coarse Skewed	0.000	21.94	78.06	6.32
	CN5	Slightly Gravelly Sandy Mud	4.26	4.74	2.16	Very Poorly Sorted	0.29	Fine Skewed	0.033	47.30	52.66	2.78
	CN6	Sand	2.75	2.78	0.95	Moderately Sorted	0.28	Fine Skewed	0.000	92.64	7.36	1.89
	CN7	Slightly Gravelly Muddy Sand	2.81	2.91	1.15	Poorly Sorted	0.41	Very Fine Skewed	0.366	87.13	12.51	1.53
Control South	CS1	Gravelly Mud	4.33	2.93	4.63	Extremely Poorly Sorted	-0.38	Very Coarse Skewed	20.421	26.74	52.84	5.04
	CS2	Gravelly Sand	0.85	0.58	1.48	Poorly Sorted	-0.39	Very Coarse Skewed	13.732	82.91	3.35	6.34
	CS3	Gravelly Mud	4.93	4.72	3.06	Very Poorly Sorted	-0.20	Coarse Skewed	6.049	36.91	57.04	3.31
	CS4	Slightly Gravelly Muddy Sand	2.98	3.77	2.50	Very Poorly Sorted	0.42	Very Fine Skewed	0.681	60.18	39.14	3.39
	CS5	Muddy Sandy Gravel	-2.44	-1.86	2.88	Very Poorly Sorted	0.37	Very Fine Skewed	60.945	33.89	5.17	2.34
	CS6	Gravelly Muddy Sand	1.01	1.74	3.06	Very Poorly Sorted	0.31	Very Fine Skewed	15.472	65.69	18.83	6.80
	CS7	Slightly Gravelly Sandy Mud	4.82	4.60	2.64	Very Poorly Sorted	-0.11	Coarse Skewed	2.726	38.99	58.28	7.86
Direct Impact	DI1	Muddy Sand	2.76	3.67	2.00	Poorly Sorted	0.64	Very Fine Skewed	0.000	73.18	26.82	1.59
	DI2	Slightly Gravelly Sandy Mud	5.33	4.89	2.61	Very Poorly Sorted	-0.19	Coarse Skewed	0.066	36.89	63.04	3.07
	DI3	Slightly Gravelly Sandy Mud	5.93	5.88	1.87	Poorly Sorted	-0.05	Symmetrical	0.004	18.32	81.67	6.26
	DI4	Slightly Gravelly Muddy Sand	2.83	3.72	1.97	Poorly Sorted	0.64	Very Fine Skewed	0.002	73.85	26.14	1.75
	DI5	Slightly Gravelly Muddy Sand	2.76	3.86	2.50	Very Poorly Sorted	0.56	Very Fine Skewed	0.422	55.72	43.86	2.36
	DI6	Sandy Mud	5.82	5.72	1.97	Poorly Sorted	-0.08	Symmetrical	0.000	21.75	78.25	7.01
	DI7	Slightly Gravelly Sandy Mud	6.44	6.20	1.90	Poorly Sorted	-0.21	Coarse Skewed	0.278	14.39	85.33	6.65
	DI8	Slightly Gravelly Sandy Mud	5.98	5.84	2.03	Very Poorly Sorted	-0.12	Coarse Skewed	0.909	20.16	78.93	6.22
Secondary Impact	SI1	Slightly Gravelly Sandy Mud	5.42	5.38	2.19	Very Poorly Sorted	-0.06	Symmetrical	0.004	29.85	70.15	6.14
	SI2	Sandy Mud	6.24	6.06	1.96	Poorly Sorted	-0.17	Coarse Skewed	0.000	16.35	83.65	6.83
	SI3	Sandy Mud	5.32	5.36	2.12	Very Poorly Sorted	0.01	Symmetrical	0.000	30.92	69.08	5.29
	SI4	Sand	2.61	2.66	0.97	Moderately Sorted	0.35	Very Fine Skewed	0.000	91.51	8.49	1.19
	SI5	Sand	2.72	2.75	0.92	Moderately Sorted	0.32	Very Fine Skewed	0.000	92.89	7.11	1.68
	SI6	Muddy Sand	3.16	4.00	2.00	Very Poorly Sorted	0.57	Very Fine Skewed	0.000	66.21	33.79	4.62
	SI7	Muddy Sand	2.75	2.80	1.10	Poorly Sorted	0.36	Very Fine Skewed	0.000	88.99	11.01	1.48
	SI8	Slightly Gravelly Muddy Sand	2.47	3.24	1.78	Poorly Sorted	0.68	Very Fine Skewed	0.003	78.77	21.23	1.88

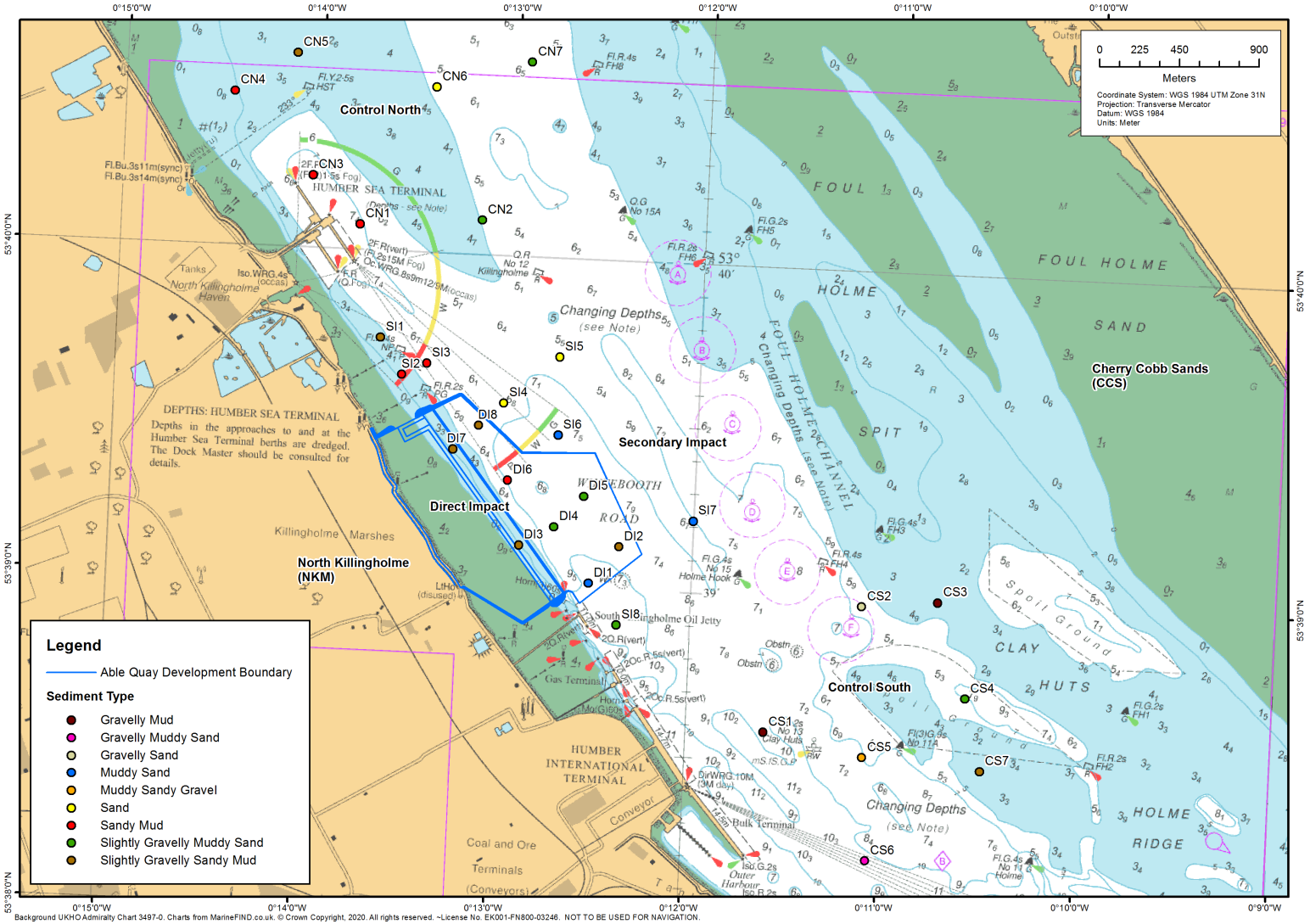


Figure 30. Sediment type at the subtidal benthic survey sites.

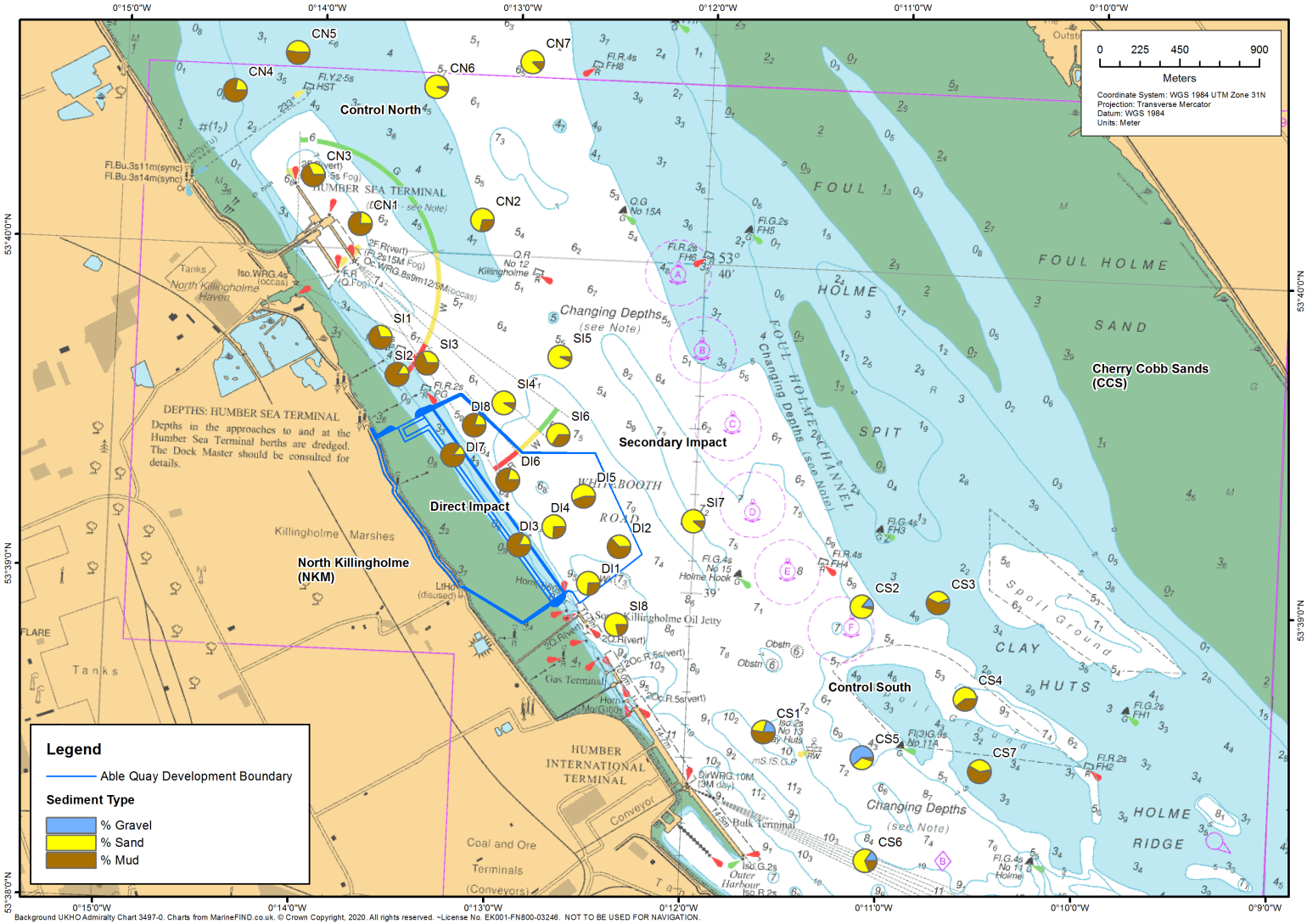


Figure 31. Sediment composition at the subtidal benthic survey sites.

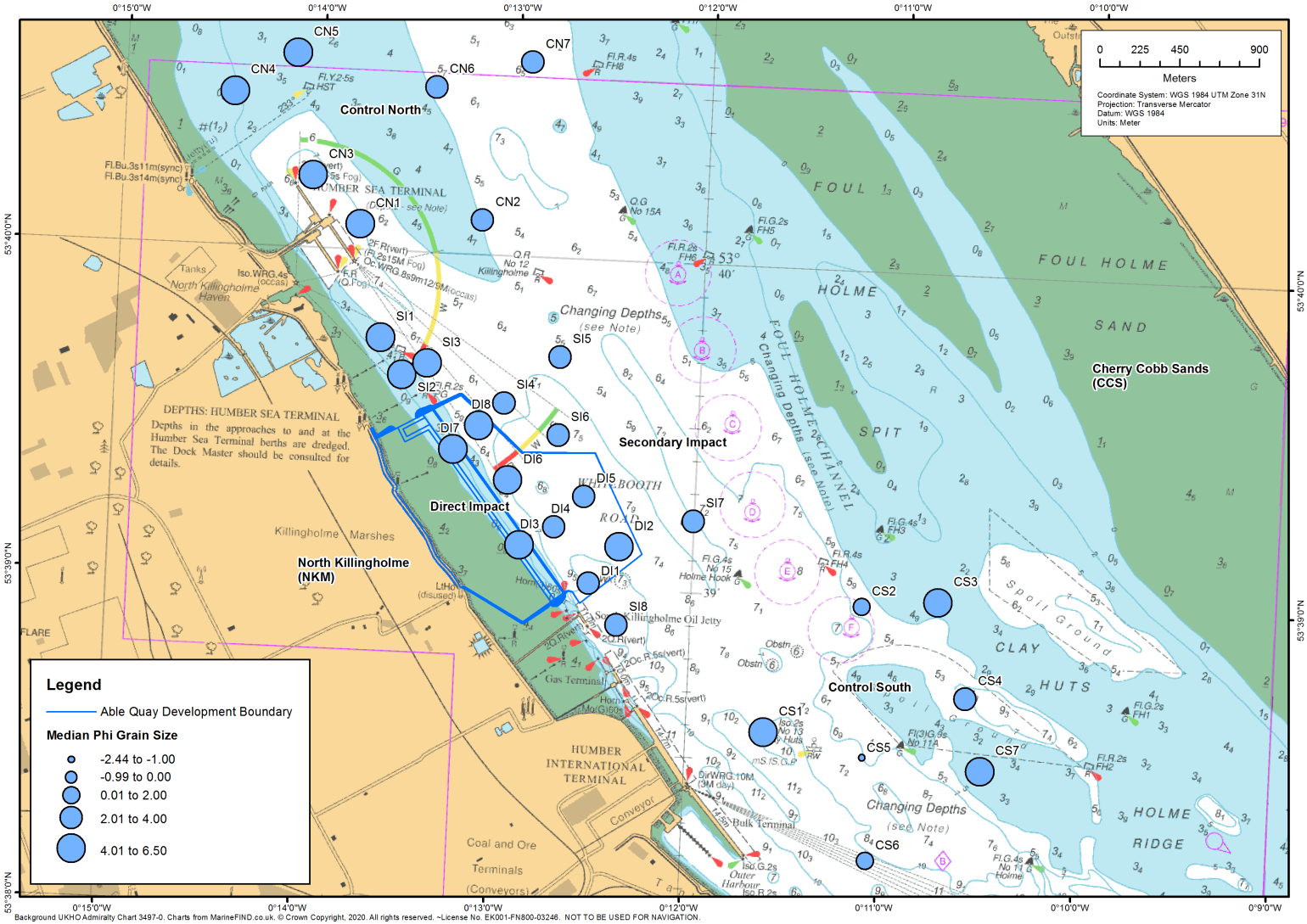


Figure 32. Median phi grain size at the subtidal benthic survey sites.

Table 15. Mean biological parameters at the subtidal benthic survey sites.

Area	Site	Mean Numbers of Taxa	Mean Numbers of Individuals		Biomass (AFDW g)		Mean Margalef's d	Mean Pielou's J	Mean Shannon's H'	Mean AFDW ABC w stat
			per 0.1m2	per 1m2	per 0.1m2	per 1m2				
Control North	CN1	1.00	1.00	10.00	0.0018	0.0177	-	-	0.00	0.00
	CN2	6.67	25.33	253.33	0.0283	0.2827	1.63	0.83	2.14	0.34
	CN3	3.00	11.67	116.67	0.0050	0.0500	0.82	0.79	1.01	-0.08
	CN4	4.00	8.33	83.33	0.0007	0.0066	1.44	0.84	1.44	0.52
	CN5	4.00	10.67	106.67	0.0239	0.2390	0.97	0.78	1.25	0.22
	CN6	3.33	9.00	90.00	0.0033	0.0332	1.27	0.85	1.25	0.24
	CN7	2.33	3.33	33.33	0.0189	0.1892	1.47	0.96	1.01	0.24
Control South	CS1	1.33	7.00	70.00	0.0004	0.0044	0.00	-	0.00	0.00
	CS2	2.33	10.00	100.00	0.0060	0.0602	0.49	0.62	0.62	0.11
	CS3	2.33	5.67	56.67	0.0015	0.0148	0.56	0.61	0.41	-0.09
	CS4	4.33	25.00	250.00	0.0047	0.0471	1.08	0.61	1.17	0.06
	CS5	2.33	10.00	100.00	0.0066	0.0658	0.71	0.69	0.86	0.44
	CS6	3.33	6.33	63.33	0.0049	0.0488	1.09	0.92	1.35	0.35
	CS7	7.33	39.00	390.00	0.0008	0.0082	1.72	0.70	1.95	-0.04
Direct Impact	DI1	6.67	14.00	140.00	0.0031	0.0312	2.06	0.92	2.45	0.42
	DI2	2.67	18.33	183.33	0.0040	0.0399	0.32	0.29	0.26	0.00
	DI3	7.33	51.33	513.33	0.0157	0.1568	1.62	0.67	1.90	0.16
	DI4	5.00	13.67	136.67	0.0044	0.0436	1.51	0.83	1.84	0.31
	DI5	2.67	7.67	76.67	0.0118	0.1176	0.64	0.86	0.67	0.15
	DI6	3.33	13.00	130.00	0.1071	1.0707	0.70	0.68	0.84	0.17
	DI7	4.67	14.67	146.67	0.0022	0.0222	1.34	0.86	1.73	0.45
	DI8	2.67	11.00	110.00	0.0061	0.0612	0.65	0.71	0.75	-0.10
Secondary Impact	SI1	3.33	14.67	146.67	0.0052	0.0520	0.81	0.78	1.19	0.29
	SI2	2.67	2.67	26.67	0.0001	0.0012	0.82	0.86	0.58	-0.27
	SI3	5.67	174.33	1743.33	0.0490	0.4897	0.84	0.22	0.51	0.04
	SI4	1.67	3.67	36.67	0.0019	0.0190	0.69	0.86	0.57	0.30
	SI5	1.67	2.00	20.00	0.0133	0.1328	1.18	0.96	0.64	0.55
	SI6	3.33	5.00	50.00	0.0081	0.0813	1.44	0.93	1.56	0.55
	SI7	1.33	1.33	13.33	0.0010	0.0101	1.44	1.00	0.33	0.33
	SI8	5.33	16.00	160.00	0.0028	0.0281	1.54	0.69	1.50	0.24

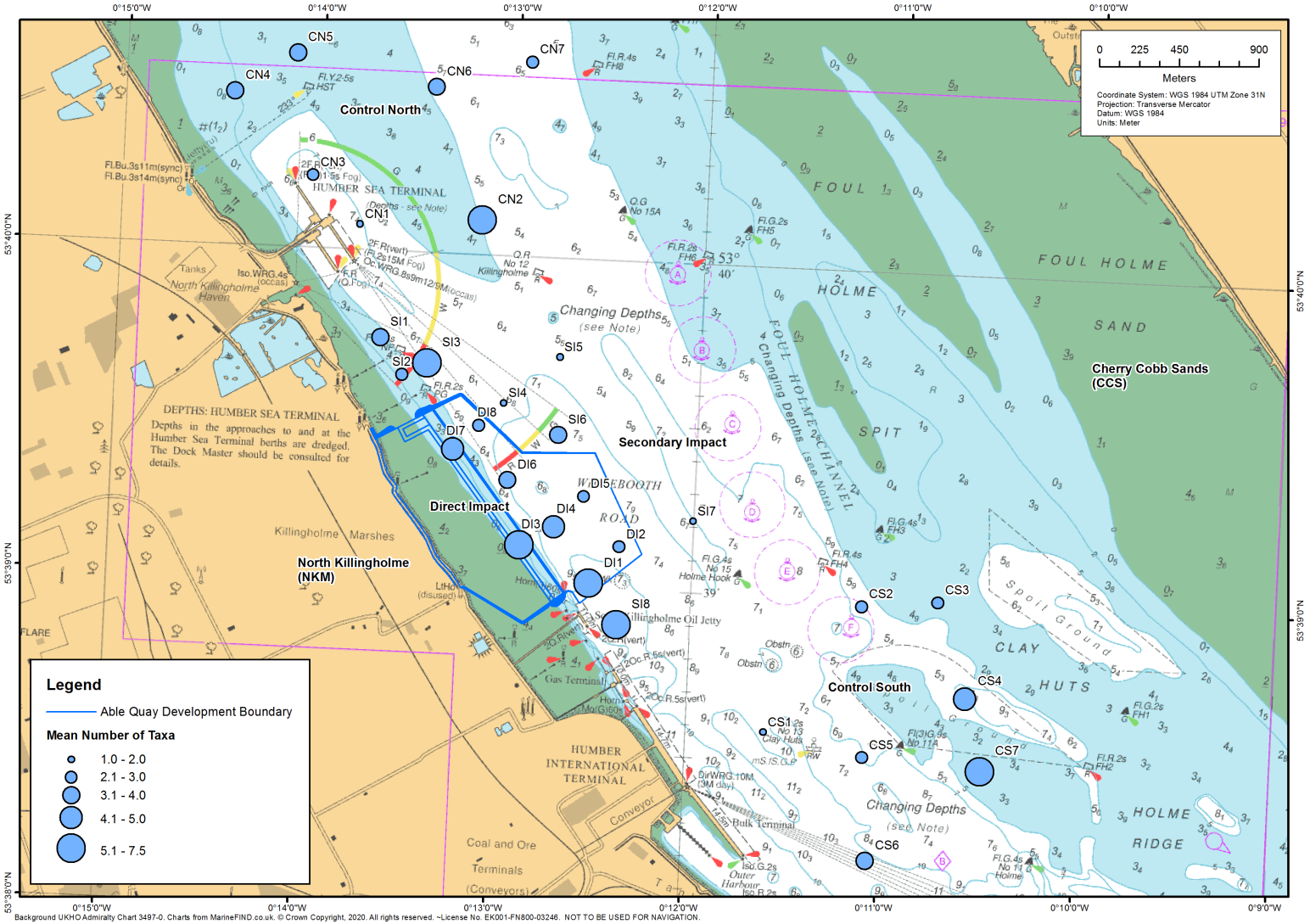


Figure 33. Mean number of taxa per 0.1m² at the subtidal benthic survey sites.

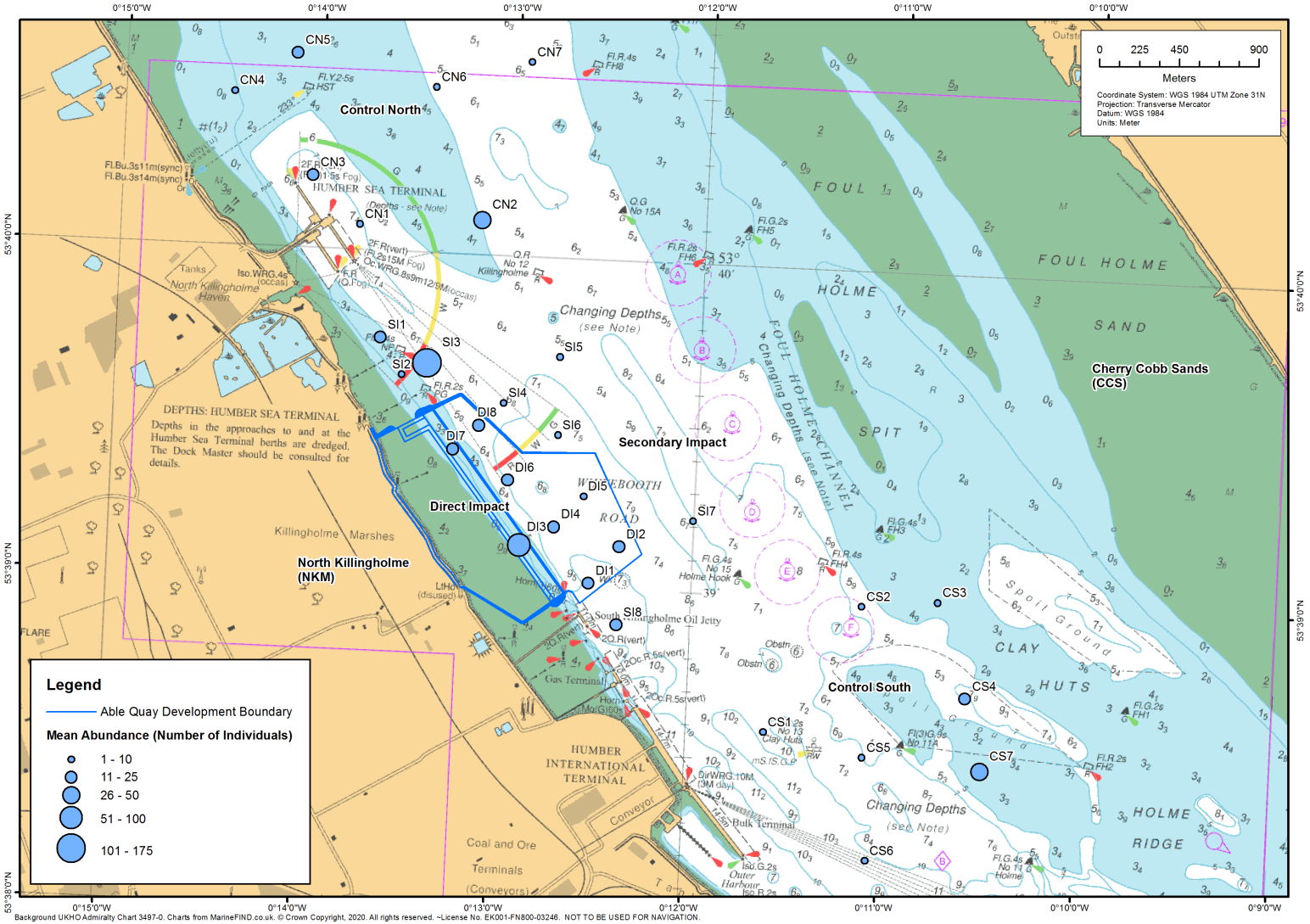
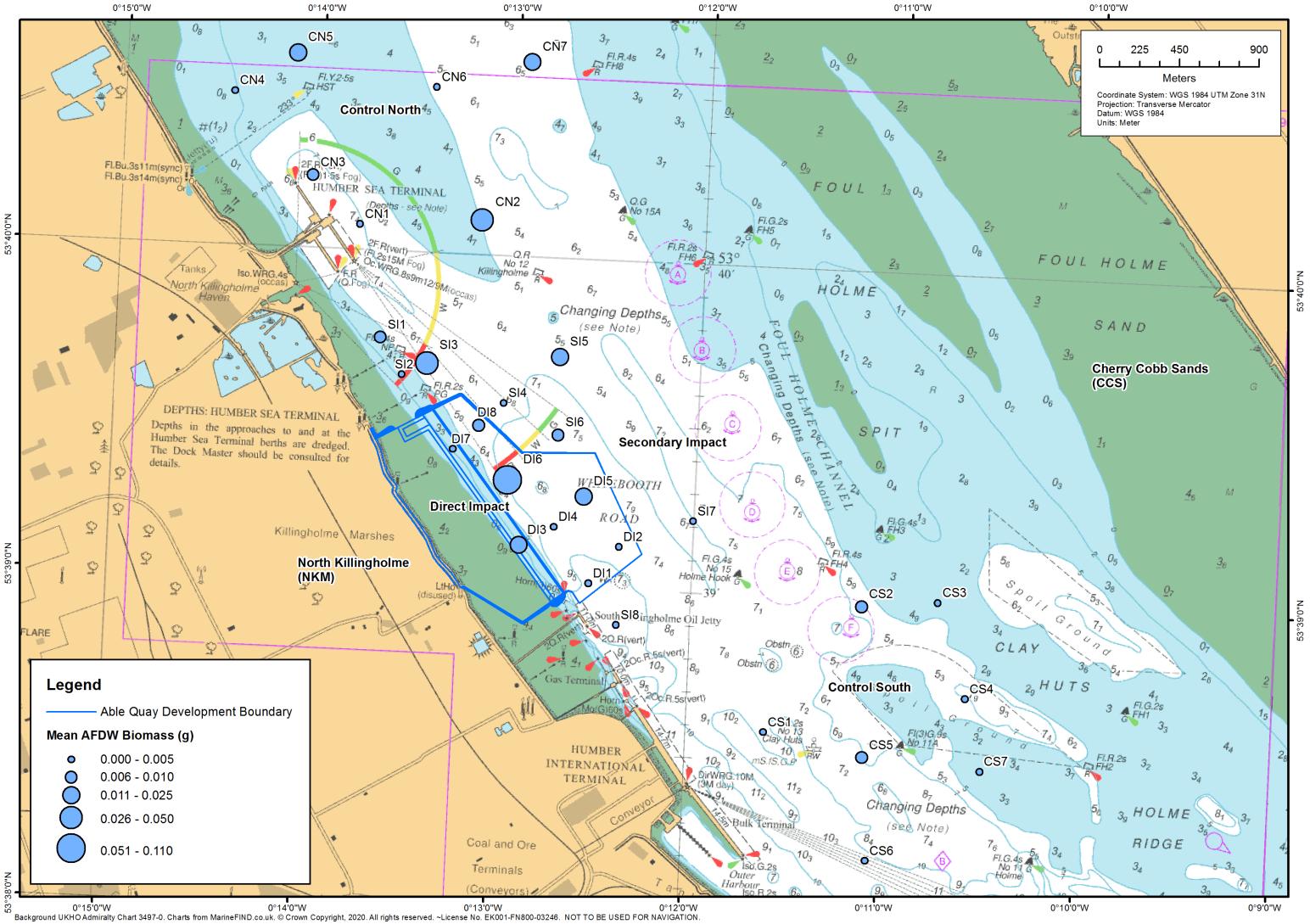


Figure 34. Mean number of individuals per 0.1m² at the subtidal benthic survey sites.



Background UKHO Admiralty Chart 3497-0. Charts from MarineFIND.co.uk. © Crown Copyright, 2020. All rights reserved. ~License No. EK001-FN800-03246. NOT TO BE USED FOR NAVIGATION.

Figure 35. Mean AFDW biomass per 0.1m^2 at the subtidal benthic survey sites.

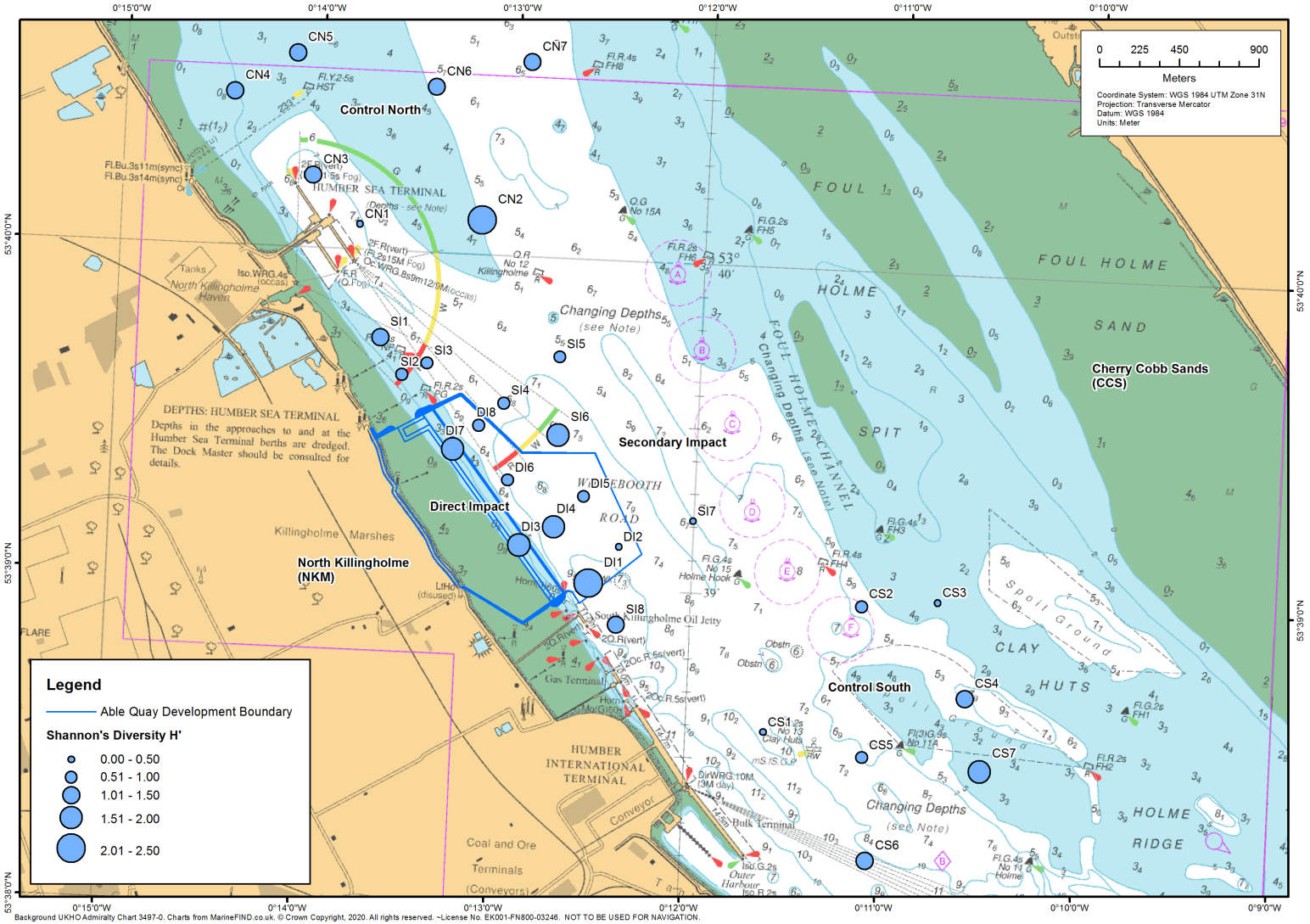


Figure 36. Mean Shannon's diversity H' per 0.1m² at the subtidal benthic survey sites.

4.3 Species Composition

In total 49 taxa were recorded during the subtidal survey although many of these were present in low densities or only recorded occasionally. A summary of species collected during the survey are provided in Tables 16 and 17 which highlight the species collected in each survey area ranked by abundance and biomass respectively and the full species matrix from the survey are provided in Appendices 15 and 16. Sites in the northern control area were characterised by *Capitella* sp., Arenicolidae sp. (*Arenicola marina*) and *Gammarus salinus* although these were only present at around 50% of the sites. Other less frequently recorded taxa in this area included *Streblospio shrubsolii*, *Polydora cornuta*, *Limecola balthica*, *Corophium volutator*, Mysida spp. and *Nephtys hombergii*. In terms of biomass the species *Limecola balthica*, *Crangon crangon*, Arenicolidae sp. (*Arenicola marina*) and *Nephtys hombergii* dominated the northern control area.

The southern control area included a more variable range of species but only *Capitella* sp. and *Eurydice pulchra* were present in over 50% of the sites. Other taxa recorded in lower densities included species such as Nematoda spp., *Pygospio elegans*, Arenicolidae sp. (*Arenicola marina*), *Gastrosaccus spinifer, Polydora cornuta* and *Gammarus salinus.* In terms of biomass *Eurydice pulchra, Capitella sp., Gammarus salinus* and *Gastrosaccus spinifer* accounted for most of the biomass (90%).

The direct impact and secondary impact areas were also characterised by low numbers of *Capitella* sp. but included modest numbers of species such *Corophium volutator* and *Streblospio shrubsolii*. However, many of the taxa present in these areas were recorded at relatively few sites. Other taxa recorded within the direct impact area included *Gammarus salinus*, *Tubificoides benedii*, *Limecola balthica* and *Nephtys hombergii* whilst at the secondary impact area other taxa recorded occasionally included *Polydora cornuta*, Nematoda spp., *Gammarus salinus*, Arenicolidae sp. (*Arenicola marina*), *Limecola balthica* and *Pygospio elegans*. In terms of biomass the direct impact area was dominated by *Carcinus maenas*, *Limecola balthica*, *Corophium volutator*, Arenicolidae sp. (*Arenicola marina*) and *Gammarus salinus* which collectively accounted for over 90% of total biomass although *Carcinus maenas* was only recorded at a single sample. Within the secondary impact area *Corophium volutator*, *Limecola balthica*, *Gammarus salinus* and Arenicolidae sp. (*Arenicola marina*) accounted for 90% of total biomass.

A range of other taxa were also recorded sporadically across the survey area in low numbers along with occasional encrusting or colonial taxa such as hydroids and bryozoa which were usually present as small colonies on pieces of shell or larger stones.

Table 16. Summary of dominant taxa by abundance at the subtidal benthic survey areas.

Control North					Control South				
Taxa	Mean Abundance per 0.1m²	Mean Abundance per 1m²	Cumulative % Abundance	% of Samples	Taxa	Mean Abundance per 0.1m²	Mean Abundance per 1m²	Cumulative % Abundance	% of Samples
Capitella sp.	3.00	30	30.29	48	Capitella sp.	4.95	50	33.66	57
Arenicolidae sp. (Arenicola marina)	1.57	16	46.15	52	Eurydice pulchra	3.00	30	54.05	57
Gammarus salinus	1.19	12	58.17	48	Nematoda spp.	2.81	28	73.14	24
Streblospio shrubsolii	0.67	7	64.90	19	Pygospio elegans	1.43	14	82.85	14
Polydora cornuta	0.67	7	71.63	5	Arenicolidae sp. (Arenicola marina)	0.38	4	85.44	24
Limecola balthica	0.48	5	76.44	33	Gastrosaccus spinifer	0.33	3	87.70	19
Corophium volutator	0.48	5	81.25	10	Polydora cornuta	0.33	3	89.97	10
Mysida spp.	0.38	4	85.10	19	Gammarus salinus	0.19	2	91.26	10
Nephtys hombergii	0.33	3	88.46	24	Mysida spp.	0.19	2	92.56	10
Nematoda spp.	0.33	3	91.83	14	Modiolus modiolus	0.19	2	93.85	5
Copepoda spp.	0.24	2	94.23	19	Nemertea spp.	0.14	1	94.82	14
Eteone flava/longa agg.	0.24	2	96.63	19	Copepoda spp.	0.10	1	95.47	10
Bivalvia sp.	0.10	1	97.60	10	Corophium volutator	0.10	1	96.12	10
Crangon crangon	0.05	0	98.08	5	Platyhelminthes (Dalyellidae) sp.	0.10	1	96.76	10
Gammarus sp.	0.05	0	98.56	5	Anthozoa spp.	0.10	1	97.41	5
Nemertea spp.	0.05	0	99.04	5	Actiniaria sp. juvenile	0.05	0	97.73	5
Pygospio elegans	0.05	0	99.52	5	Balanus balanus	0.05	0	98.06	5
Tubificoides benedii	0.05	0	100.00	5	Bivalvia sp.	0.05	0	98.38	5
Arachnida sp.	P	P		5	Crangon allmanni	0.05	0	98.71	5
					Eteone flava/longa agg.	0.05	0	99.03	5
					Eteone sp. juvenile	0.05	0	99.35	5
					Mytilidae spp. juvenile	0.05	0	99.68	5
					Scoloplos armiger	0.05	0	100.00	5
					Electra monostachys	P	P		10
					Conopeum reticulum	P	P		5
					Sertulariidae sp.	P	P		5

Direct Impact					Secondary Impact				
Taxa	Mean Abundance per 0.1m²	Mean Abundance per 1m²	Cumulative % Abundance	% of Samples	Taxa	Mean Abundance per 0.1m²	Mean Abundance per 1m²	Cumulative % Abundance	% of Samples
Capitella sp.	4.46	45	24.83	54	Corophium volutator	20.29	203	73.90	21
Corophium volutator	3.88	39	46.40	33	Capitella sp.	2.04	20	81.34	38
Streblospio shrubsolii	3.46	35	65.66	38	Streblospio shrubsolii	1.96	20	88.47	42
Gammarus salinus	1.04	10	71.46	17	Polydora cornuta	0.58	6	90.59	13
Tubificoides benedii	1.00	10	77.03	33	Nematoda spp.	0.50	5	92.41	17
Limecola balthica	0.88	9	81.90	46	Gammarus salinus	0.46	5	94.08	21
Nephtys hombergii	0.50	5	84.69	25	Arenicolidae sp. (Arenicola marina)	0.38	4	95.45	29
Arenicolidae sp. (Arenicola marina)	0.33	3	86.54	29	Limecola balthica	0.38	4	96.81	29
Tharyx killariensis	0.33	3	88.40	8	Pygospio elegans	0.17	2	97.42	13
Pygospio elegans	0.25	3	89.79	17	Tubificoides benedii	0.13	1	97.88	8
Corophiidae sp.	0.25	3	91.18	8	Gastrosaccus spinifer	0.08	1	98.18	8
Polydora cornuta	0.21	2	92.34	8	Nemertea spp.	0.08	1	98.48	8
Scoloplos armiger	0.21	2	93.50	8	Nephtys caeca	0.08	1	98.79	8
Nematoda spp.	0.17	2	94.43	17	Nephtys cirrosa	0.08	1	99.09	8
Diastylis rathkei	0.17	2	95.36	13	Bivalvia sp.	0.04	0	99.24	4
Mytilidae spp. juvenile	0.17	2	96.29	13	Gastrosaccus sp. juvenile	0.04	0	99.39	4
Cyathura carinata	0.13	1	96.98	8	Mytilidae spp. juvenile	0.04	0	99.54	4
Eteone flava/longa agg.	0.13	1	97.68	8	Nephtys hombergii	0.04	0	99.70	4
Nemertea spp.	0.13	1	98.38	8	Scoloplos armiger	0.04	0	99.85	4
Spionidae sp.	0.13	1	99.07	4	Tharyx killariensis	0.04	0	100.00	4
Carcinus maenas	0.04	0	99.30	4	Electra monostachys	P	P		8
Eurydice pulchra	0.04	0	99.54	4	Amphipoda sp.	P	P		4
Mysida spp.	0.04	0	99.77	4	Cumacea sp.	P	P		4
Nephtys caeca	0.04	0	100.00	4	Gammarus sp.	P	P		4
Electra pilosa	P	P		8	Mysida spp.	P	P		4
Conopeum reticulum	P	P		4					
Electra monostachys	P	P		4					
Nereididae sp.	P	P		4					
Orbiniidae sp.	P	P		4					

Table 17. Summary of dominant taxa by biomass at the subtidal benthic survey sites.

Control North					Control South				
Taxa	Mean AFDW Biomass (g) per 0.1m^2	Mean AFDW Biomass (g) per 1m^2	Cumulative % AFDW Biomass	% of Samples	Taxa	Mean AFDW Biomass (g) per 0.1m^2	Mean AFDW Biomass (g) per 1m^2	Cumulative % AFDW Biomass	% of Samples
Limecola balthica	0.003607	0.036069	30.85	33	Eurydice pulchra	0.001586	0.015863	44.55	57
Crangon crangon	0.002273	0.022727	50.28	5	Capitella sp.	0.000666	0.006659	63.25	57
Arenicolidae sp. (Arenicola marina)	0.002266	0.022657	69.66	52	Gammarus salinus	0.000540	0.005397	78.40	10
Nephtys hombergii	0.002084	0.020842	87.48	24	Gastrosaccus spinifer	0.000428	0.004276	90.41	19
Gammarus salinus	0.000734	0.007340	93.76	48	Arenicolidae sp. (Arenicola marina)	0.000151	0.001514	94.66	24
Capitella sp.	0.000381	0.003810	97.02	48	Scoloplos armiger	0.000067	0.000672	96.54	5
Corophium volutator	0.000184	0.001836	98.59	10	Crangon allmanni	0.000031	0.000313	97.43	5
Polydora cornuta	0.000086	0.000856	99.32	5	Pygospio elegans	0.000028	0.000280	98.21	14
Mysida spp.	0.000037	0.000369	99.64	19	Mysida spp.	0.000021	0.000214	98.81	10
Streblospio shrubsolii	0.000021	0.000213	99.82	19	Polydora cornuta	0.000014	0.000137	99.20	10
Eteone flava/longa agg.	0.000012	0.000117	99.92	19	Nematoda spp.	0.000012	0.000123	99.54	24
Copepoda spp.	0.000003	0.000031	99.95	19	Modiolus modiolus	0.000005	0.000052	99.69	5
Nematoda spp.	0.000003	0.000026	99.97	14	Nemertea spp.	0.000003	0.000031	99.78	14
Nemertea spp.	0.000001	0.000010	99.98	5	Platyhelminthes (Dalyellidae) sp.	0.000002	0.000024	99.84	10
Gammarus sp.	0.000001	0.000007	99.98	5	Copepoda spp.	0.000002	0.000016	99.89	10
Arachnida sp.	0.000001	0.000007	99.99	5	Corophium volutator	0.000002	0.000015	99.93	10
Bivalvia sp.	0.000001	0.000006	99.99	10	Actiniaria sp. juvenile	0.000001	0.000007	99.95	5
Pygospio elegans	0.000001	0.000005	100.00	5	Eteone flava/longa agg.	0.000001	0.000006	99.97	5
Tubificoides benedii	0.0000003	0.000003	100.00	5	Eteone sp. juvenile	0.000001	0.000006	99.99	5
					Bivalvia sp.	0.0000003	0.000003	99.99	5
					Mytilidae spp. juvenile	0.0000002	0.000002	100.00	5
					Electra monostachys	P	P		10
					Anthozoa spp.	P	P		5
					Balanus balanus	P	P		5
					Conopeum reticulum	P	P		5
					Sertulariidae sp.	P	P		5

Direct Impact					Secondary Impact				
Taxa	Mean AFDW Biomass (g) per 0.1m²	Mean AFDW Biomass (g) per 1m²	Cumulative % AFDW Biomass	% of Samples	Taxa	Mean AFDW Biomass (g) per 0.1m²	Mean AFDW Biomass (g) per 1m²	Cumulative % AFDW Biomass	% of Samples
Carcinus maenas	0.012639	0.126385	65.52	4	Corophium volutator	0.005727	0.057267	56.26	21
Limecola balthica	0.001478	0.014781	73.18	46	Limecola balthica	0.002923	0.029225	84.98	29
Corophium volutator	0.001326	0.013260	80.05	33	Gammarus salinus	0.000452	0.004520	89.42	21
Arenicolidae sp. (Arenicola marina)	0.001272	0.012718	86.65	29	Arenicolidae sp. (Arenicola marina)	0.000379	0.003790	93.14	29
Gammarus salinus	0.001003	0.010025	91.84	17	Nephtys caeca	0.000252	0.002523	95.62	8
Nephtys hombergii	0.000655	0.006548	95.24	25	Nephtys cirrosa	0.000239	0.002392	97.97	8
Capitella sp.	0.000385	0.003847	97.23	54	Capitella sp.	0.000085	0.000853	98.81	38
Streblospio shrubsolii	0.000139	0.001387	97.95	38	Streblospio shrubsolii	0.000037	0.000367	99.17	42
Mysida spp.	0.000112	0.001117	98.53	4	Polydora cornuta	0.000028	0.000283	99.45	13
Diastylis rathkei	0.000051	0.000513	98.80	13	Nemertea spp.	0.000015	0.000147	99.59	8
Corophiidae sp.	0.000047	0.000467	99.04	8	Nephtys hombergii	0.000011	0.000109	99.70	4
Nephtys caeca	0.000046	0.000459	99.28	4	Tubificoides benedii	0.000007	0.000072	99.77	8
Nereididae sp.	0.000031	0.000310	99.44	4	Gastrosaccus spinifer	0.000007	0.000066	99.83	8
Scoloplos armiger	0.000029	0.000294	99.59	8	Scoloplos armiger	0.000007	0.000065	99.90	4
Tubificoides benedii	0.000023	0.000234	99.71	33	Nematoda spp.	0.000003	0.000031	99.93	17
Tharyx killariensis	0.000014	0.000140	99.78	8	Bivalvia sp.	0.000002	0.000024	99.95	4
Eteone flava/longa agg.	0.000012	0.000119	99.84	8	Pygospio elegans	0.000001	0.000014	99.96	13
Orbiniidae sp.	0.000009	0.000093	99.89	4	Amphipoda sp.	0.000001	0.000007	99.97	4
Cyathura carinata	0.000009	0.000089	99.94	8	Tharyx killariensis	0.000001	0.000007	99.98	4
Nematoda spp.	0.000003	0.000031	99.96	17	Mysida spp.	0.000001	0.000006	99.98	4
Mytilidae spp. juvenile	0.000002	0.000023	99.97	13	Gammarus sp.	0.000001	0.000006	99.99	4
Pygospio elegans	0.000002	0.000019	99.98	17	Gastrosaccus sp. juvenile	0.000001	0.000005	100.00	4
Nemertea spp.	0.000002	0.000018	99.99	8	Cumacea sp.	0.0000003	0.000003	100.00	4
Polydora cornuta	0.000001	0.000014	99.99	8	Mytilidae spp. juvenile	0.0000002	0.000002	100.00	4
Spionidae sp.	0.000001	0.000007	100.00	4	Electra monostachys	P	P		8
Eurydice pulchra	0.000001	0.000006	100.00	4					
Electra pilosa	P	P		8					
Conopeum reticulum	P	P		4					
Electra monostachys	P	P		4					

4.4 Multivariate Analysis of Community Structure

Multivariate analysis of the abundance data (following square root transformation) was carried out as described for the intertidal invertebrate surveys in order to describe the main patterns and assemblages within the area. Classification (cluster analysis) of the data was undertaken using the Bray-Curtis similarity coefficient and grouped average (UPGMA) clustering technique followed by a non-metric MDS (multi-dimensional scaling) ordination both using the PRIMER package (Clarke & Warwick, 2001). Analysis was undertaken in a number of permutations as follows. Initially the data was assessed using analysis of replicate data (appendix 17) which allows an assessment of variability within individual sites (and also may be used for subsequent statistical analysis). Analysis at a site level (i.e. replicates combined) was then undertaken as this simplifies assessment of spatial patterns in community structure which integrates small scale variability/noise within each site and particularly where numbers of taxa and individuals were very low. The results from the analysis of site data is reported here and this information is useful in defining biotopes for the survey area and was also used to summarise communities in relation to sedimentary parameters.

The site groups from the combined (site) dataset broadly correlated to those identified from replicate data but provided a less complex summary of the main communities which was less influenced by outliers or samples with very extremely low numbers of taxa or abundances. The results of cluster analysis and nMDS on site data are shown in Figures 37 and 38 which show the dendrogram and nMDS plots with different symbols to highlight SIMPROF group and survey area. The spatial distribution of cluster groups and derived biotopes are provided in Figures 39 and 40. The characteristic taxa at the sites in each group are highlighted in Table 18 which includes contribution to group similarity (from SIMPER analysis) along with mean abundance (per $0.01m^2$ and $1m^2$) and the frequency of occurrence (% of sites) for each species (species which account for no similarity in the larger groups are generally not included in the table). Also provided are the list of sites in each group and a summary of sedimentary parameters.

Similarity between sites ranged from around 10% to 75% similarity and 3 groups of sites were identified from the SIMPROF test. Group a included just three sites within the southern control area (CS2, CS5 and CS7) which were characterised by gravelly sand or mixed sediments (muddy sandy gravel or gravelly muddy sand) with low numbers of taxa such as *Eurydice pulchra* (which was recorded at all sites) and *Capitella* sp., Copepoda spp., *Gastrosaccus spinifer*, Nematoda spp. and *Gammarus salinus*.

Group b included sites from all four survey areas and was characterised by a variety of sediment types including sands, muddy sand or slightly gravelly sandy mud/muddy sand. Only *Capitella* sp. was recorded at all sites within this group whilst other taxa including Arenicolidae sp. (*Arenicola marina*) and *Limecola balthica* were recorded at most sites and a number of other taxa including *Gammarus salinus*, *Eteone flava/longa* agg., *Streblospio shrubsolii* and *Eurydice pulchra* were also present which were recorded less frequently.

Group c included muddier samples from the different survey areas with all samples being characterised by sandy mud (or slightly gravelly sandy mud). This group was dominated by

taxa such as *Streblospio shrubsolii*, *Corophium volutator* and *Gammarus salinus* which were present at most sites along with other less frequently recorded species such as Nematoda spp., *Polydora cornuta*, *Pygospio elegans*, *Tubificoides benedii*, *Nephtys hombergii* and *Limecola balthica*.

The results of BEST analysis indicated that the largest correlation between environmental parameters and community structure was for median and mean phi grain size which had correlations of 0.456 and 0.444 respectively. Other sedimentary parameters such as mud content and % LOI had correlations above 0.3 (0.363 and 0.34 respectively) whilst sand and gravel content and sediment sorting had correlations of 0.241, 0.164 and 0.108 respectively. The other environmental parameters - water depth, skewness and kurtosis had low correlations below 1. The best combination of parameters to correlate with the patterns in species data were mean phi grain size and % LOI which collectively exhibited a correlation of 0.548.

In terms of biotopes (Figure 40) the survey sites appear to cover a range of rather impoverished and often transitional forms of variable salinity biotopes which are typically recorded in the middle Humber. These included *SS.SMx.SMxVS - Sublittoral mixed sediment in variable salinity (estuaries)* and *SS.SCS.SCSVS - Sublittoral coarse sediment in variable salinity (estuaries)* in groups a and b. Some of the samples in group b are likely to be variants of *SS.SSa.SSaVS* biotopes such as *SS.SSa.SSaVS.NintGam (Neomysis integer and Gammarus spp. in fluctuating low salinity infralittoral mobile sand).* However, unlike the 2013 subtidal surveys, no specimens of the mysid *Neomysis integer* were recorded during the 2016 survey although the spatial and temporal distribution of this species can be highly variable. The extent of the biotope *SS.SSa.SSaVS.NintGam* is also known to vary considerably on a temporal basis from upper estuary to mid estuary in the Humber (Allen *et al.* 2003) and may also occur on exposed clay/mud habitats. A number of the samples in group b also exhibited some resemblance to the biotope *SS.SSa.SSaVS.MoSaVS - Infralittoral mobile sand in variable salinity (estuaries).*

The muddier sites in group c were generally classified as rather impoverished forms of *SS.SMu.SMuVS - Sublittoral mud in variable salinity (estuaries)* although a number of sites in this group which included moderate densities of the polychaete *Polydora ciliata* which were classified as the biotope *SS.SMu.SMuVS.PolCvol - Polydora ciliata and Corophium volutator in variable salinity infralittoral firm mud or clay*. Inshore sites with impoverished mud or clay habitats classified as *SS.SMu.SMuVS* may also be transitional with adjacent low shore muddy biotopes recorded during the intertidal invertebrate survey.

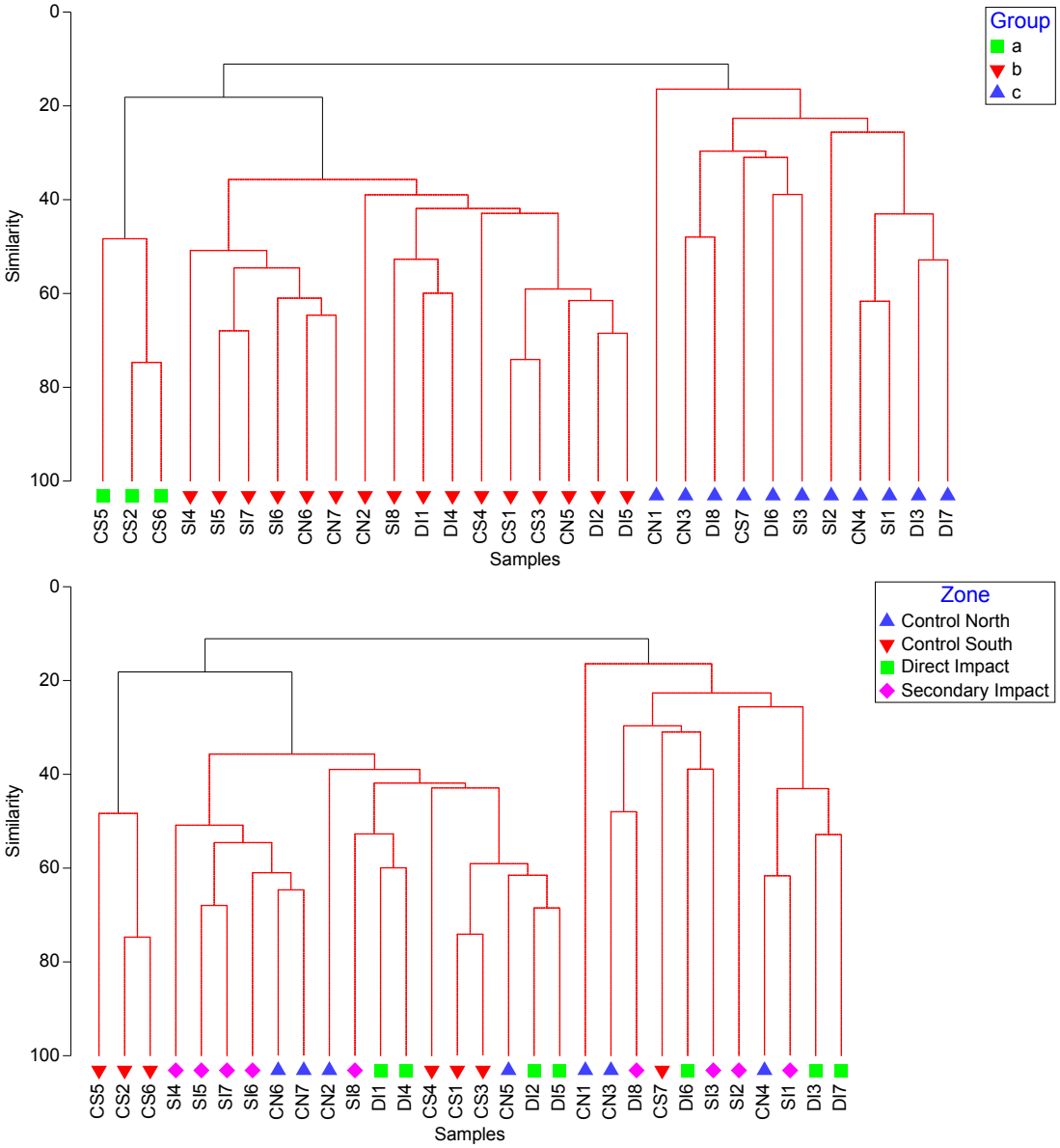


Figure 37. Results of cluster analysis on site data from the subtidal benthic survey with sites highlighted by group (top) and area (bottom).

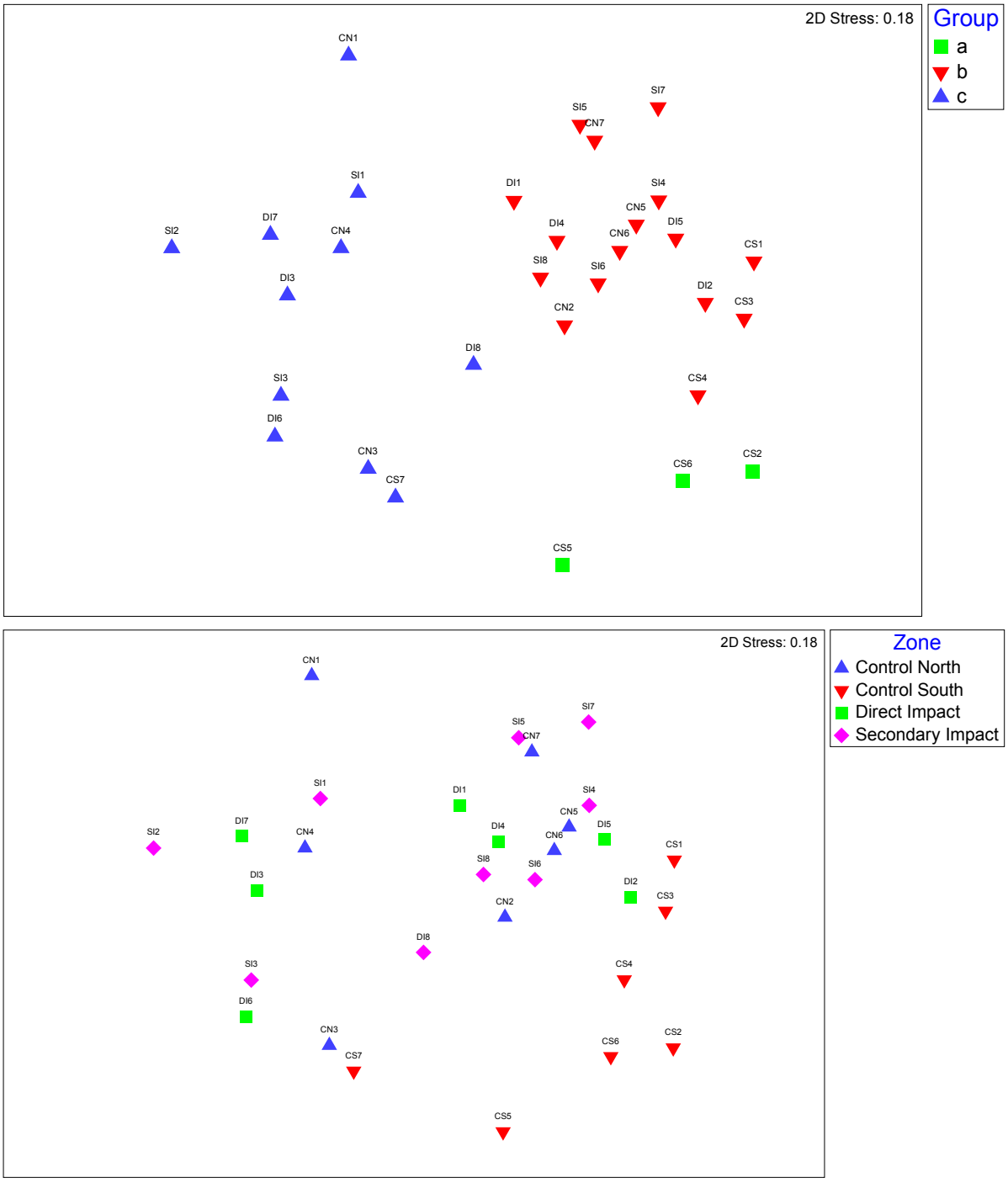


Figure 38. Results of nMDS on site data from the subtidal benthic survey with sites highlighted by group (top) and area (bottom).

Table 18. Characteristic taxa from SIMPER analysis of groups derived from cluster analysis on the subtidal benthic site data.

Group a (Average similarity: 57.12%)							
Sites	**Area**	**Sediment Type**	**% Gravel**	**% Sand**	**% Mud**	**% LOI**	**Depth mCD**
CS2	Control South	Gravelly Sand	13.732	82.91	3.35	6.34	6.30
CS5	Control South	Muddy Sandy Gravel	60.945	33.89	5.17	2.34	7.86
CS6	Control South	Gravelly Muddy Sand	15.47	65.69	18.83	6.80	11.48
		Species	**Mean Abundance (per 0.01m²)**	**Mean Abundance (per 1m²)**	**% of Sites Recorded**	**% Contribution to similarity**	**Cum. % Contribution to Similarity**
		Eurydice pulchra	6.44	64.44	100	70.28	70.28
		Capitella sp.	0.67	6.67	67	10.95	81.24
		Copepoda spp.	0.22	2.22	67	6.32	87.56
		Gastrosaccus spinifer	0.33	3.33	67	6.32	93.88
		Nematoda spp.	0.33	3.33	67	6.12	100
		Gammarus salinus	0.33	3.33	33	0	100

Group b (Average similarity: 42.35%)							
Sites	**Area**	**Sediment Type**	**% Gravel**	**% Sand**	**% Mud**	**% LOI**	**Depth mCD**
CN2	Control North	Slightly Gravelly Muddy Sand	0.034	71.46	28.51	2.32	5.20
CN5	Control North	Slightly Gravelly Sandy Mud	0.033	47.30	52.66	2.78	9.05
CN6	Control North	Sand	0.000	92.64	7.36	1.89	5.66
CN7	Control North	Slightly Gravelly Muddy Sand	0.366	87.13	12.51	1.53	5.93
CS1	Control South	Gravelly Mud	20.421	26.74	52.84	5.04	10.96
CS3	Control South	Gravelly Mud	6.049	36.91	57.04	3.31	6.07
CS4	Control South	Slightly Gravelly Muddy Sand	0.681	60.18	39.14	3.39	7.22
DI1	Direct Impact	Muddy Sand	0.000	73.18	26.82	1.59	9.03
DI2	Direct Impact	Slightly Gravelly Sandy Mud	0.066	36.89	63.04	3.07	9.07
DI4	Direct Impact	Slightly Gravelly Muddy Sand	0.00	73.85	26.14	1.75	8.06
DI5	Direct Impact	Slightly Gravelly Muddy Sand	0.42	55.72	43.86	2.36	8.07
SI4	Secondary Impact	Sand	0.00	91.51	8.49	1.19	6.60
SI5	Secondary Impact	Sand	0.00	92.89	7.11	1.68	6.14
SI6	Secondary Impact	Muddy Sand	0.00	66.21	33.79	4.62	6.98
SI7	Secondary Impact	Muddy Sand	0.00	88.99	11.01	1.48	6.60
SI8	Secondary Impact	Slightly Gravelly Muddy Sand	0.00	78.77	21.23	1.88	9.49
		Species	**Mean Abundance (per 0.01m²)**	**Mean Abundance (per 1m²)**	**% of Sites Recorded**	**% Contribution to similarity**	**Cum. % Contribution to Similarity**
		Capitella sp.	6.52	65.21	100	62.33	62.33
		Arenicolidae sp. (Arenicola marina)	1.04	10.42	69	15.22	77.55
		Limecola balthica	0.67	6.67	75	13.66	91.21
		Gammarus salinus	0.38	3.75	38	3.24	94.45
		Eteone flava/longa agg.	0.13	1.25	25	0.76	95.21
		Streblospio shrubsolii	0.33	3.33	19	0.73	95.95
		Eurydice pulchra	0.13	1.25	19	0.56	96.51
		Nephtys caeca	0.06	0.63	19	0.47	96.98
		Copepoda spp.	0.08	0.83	19	0.45	97.43
		Nemertea spp.	0.06	0.63	19	0.43	97.86
		Gastrosaccus spinifer	0.13	1.25	19	0.41	98.27
		Nephtys hombergii	0.17	1.67	19	0.41	98.68
		Scoloplos armiger	0.15	1.46	19	0.34	99.02
		Mytilidae spp. juvenile	0.04	0.42	13	0.21	99.23
		Nephtys cirrosa	0.04	0.42	13	0.17	99.41
		Nematoda spp.	0.04	0.42	13	0.16	99.56
		Bivalvia sp.	0.04	0.42	13	0.13	99.7
		Tharyx killariensis	0.06	0.63	13	0.11	99.81
		Mysida spp.	0.17	1.67	13	0.1	99.91
		Corophium volutator	0.04	0.42	13	0.09	100

Group c (Average similarity: 52.77%)							
Sites	**Area**	**Sediment Type**	**% Gravel**	**% Sand**	**% Mud**	**% LOI**	**Depth mCD**
CN1	Control North	Sandy Mud	0.00	24.40	75.60	6.24	7.73
CN3	Control North	Sandy Mud	0.00	31.99	68.01	7.29	9.23
CN4	Control North	Sandy Mud	0.00	21.94	78.06	6.32	7.80
CS7	Control South	Slightly Gravelly Sandy Mud	2.73	38.99	58.28	7.86	3.83
DI3	Direct Impact	Slightly Gravelly Sandy Mud	0.00	18.32	81.67	6.26	1.85
DI6	Direct Impact	Sandy Mud	0.00	21.75	78.25	7.01	7.07
DI7	Direct Impact	Slightly Gravelly Sandy Mud	0.28	14.39	85.33	6.65	2.76
DI8	Direct Impact	Slightly Gravelly Sandy Mud	0.91	20.16	78.93	6.22	7.02
SI1	Secondary Impact	Slightly Gravelly Sandy Mud	0.00	29.85	70.15	6.14	4.29
SI2	Secondary Impact	Sandy Mud	0.00	16.35	83.65	6.83	8.34
SI3	Secondary Impact	Sandy Mud	0.00	30.92	69.08	5.29	6.87

Species	**Mean Abundance (per 0.01m²)**	**Mean Abundance (per 1m²)**	**% of Sites Recorded**	**% Contribution to similarity**	**Cum. % Contribution to Similarity**
Streblospio shrubsolii	3.88	38.79	73	28.34	28.34
Corophium volutator	17.88	178.79	73	20.83	49.17
Gammarus salinus	1.33	13.33	64	13.05	62.22
Nematoda spp.	2.33	23.33	64	10.38	72.6
Polydora cornuta	1.21	12.12	45	7.72	80.32
Pygospio elegans	1.21	12.12	55	5.38	85.7
Tubificoides benedii	0.73	7.27	45	3.77	89.47
Nephtys hombergii	0.36	3.64	36	2.88	92.35
Limecola balthica	0.24	2.42	36	2.57	94.92
Nemertea spp.	0.18	1.82	36	1.99	96.91
Mysida spp.	0.15	1.52	27	1.23	98.13
Mytilidae spp. juvenile	0.12	1.21	27	0.75	98.88
Eteone flava/longa agg.	0.09	0.91	18	0.3	99.18
Cyathura carinata	0.09	0.91	18	0.28	99.45
Diastylis rathkei	0.12	1.21	18	0.28	99.73
Bivalvia sp.	0.06	0.61	18	0.27	100
Arenicolidae sp. (Arenicola marina)	0.24	2.42	9	0	100

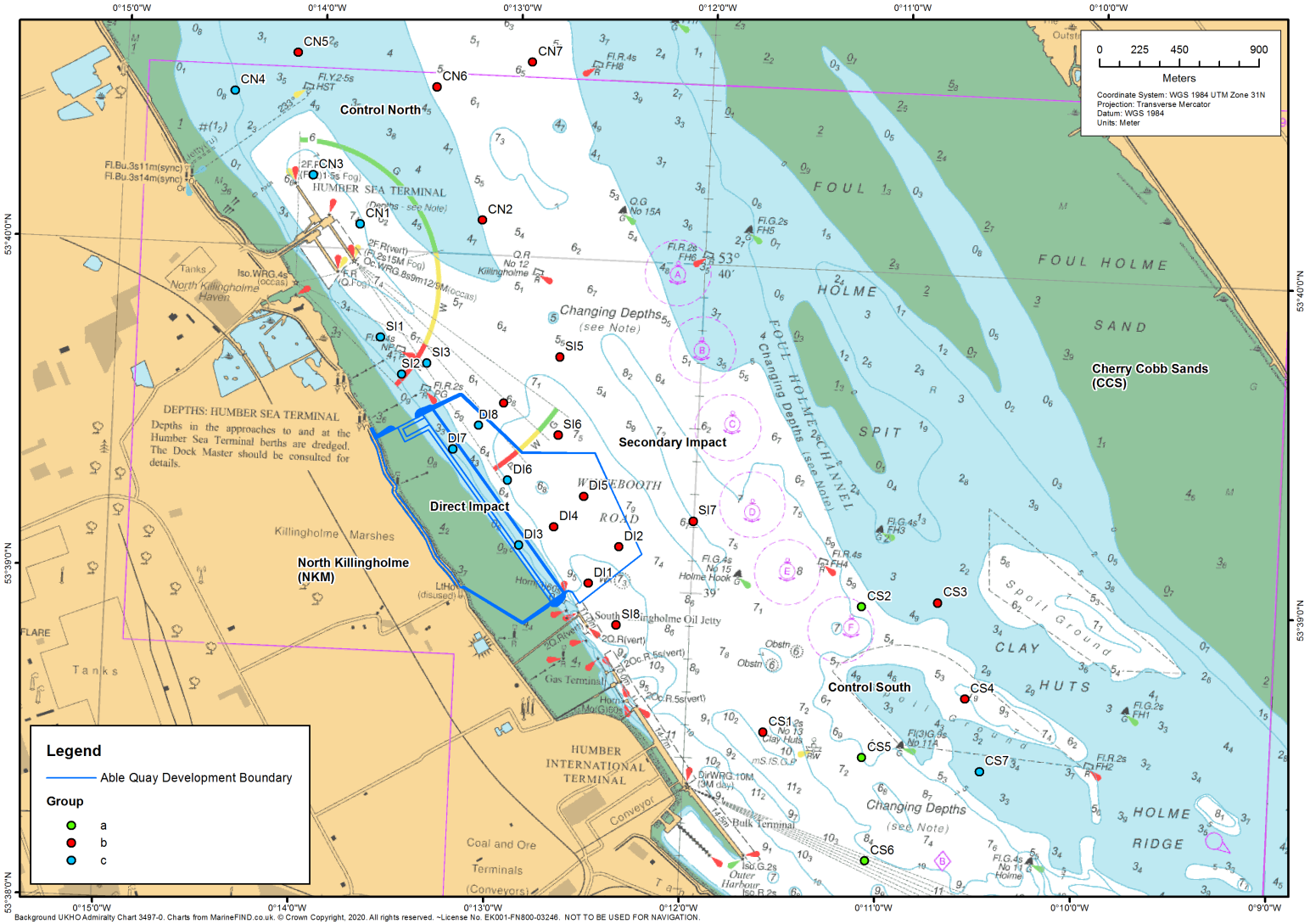


Figure 39. Spatial distribution of SIMPROF groups derived from cluster analysis on subtidal benthic data.

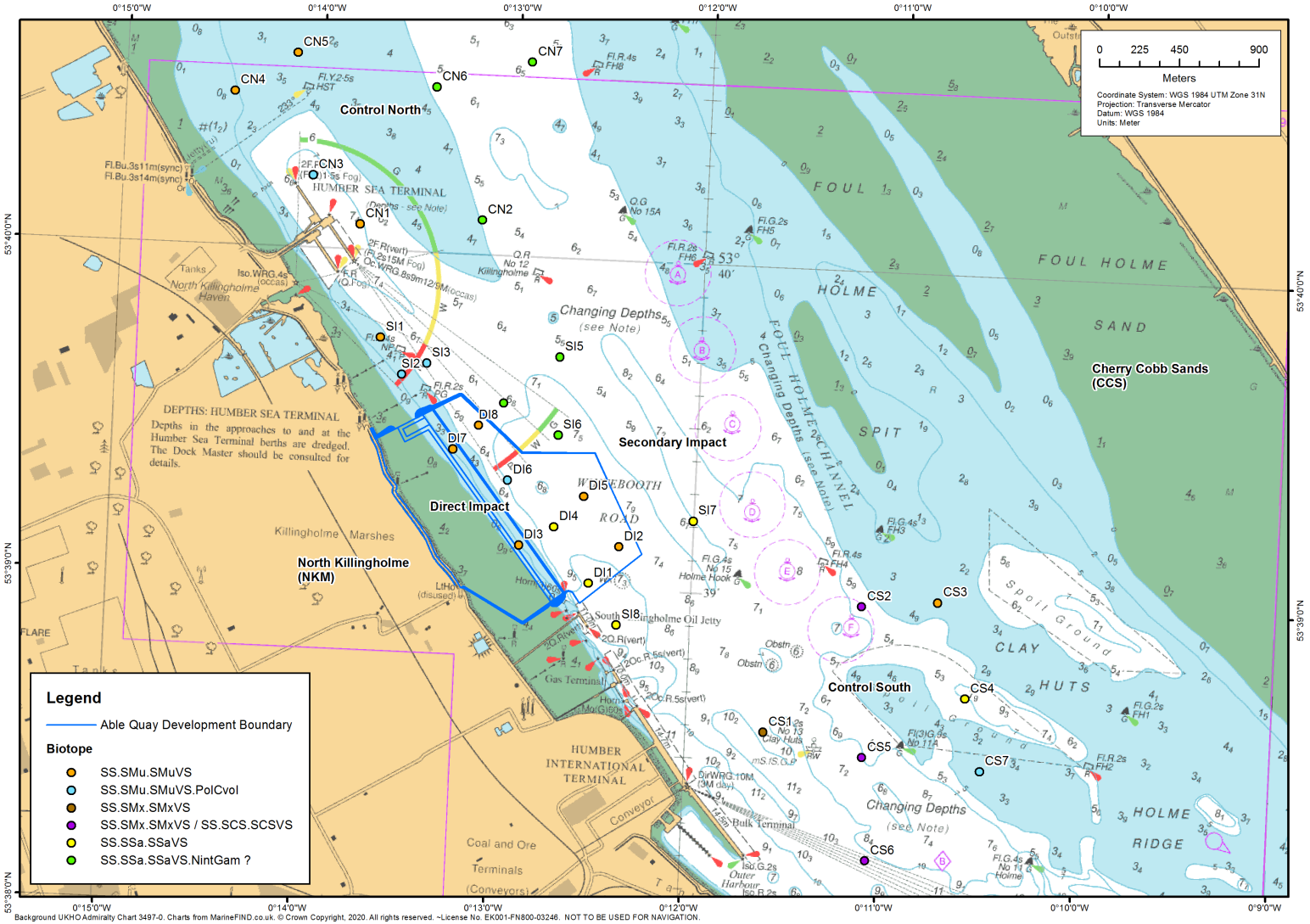


Figure 40. Spatial distribution of biotopes at subtidal benthic survey sites.

5. Conclusions

The results of the 2016 intertidal benthic survey indicate that the North Killingholme mudflats maintain a variety of infaunal invertebrates including good examples of mid estuary mud assemblages. Numbers of species are relatively low as might be expected in a dynamic estuarine environment and the numbers of individuals and biomass also tended to be highly variable across the survey area but generally in the expected range for this area of the Humber. Intertidal habitats were characterised by species such as *Corophium volutator*, *Tubificoides benedii*, *Streblospio shrubsolii*, *Hediste diversicolor*, Nematoda and *Limicola balthica* along with a number of other polychaete and oligochaete taxa which are typical of this section of the Humber.

Some spatial variation was evident in terms of biological parameters and community structure but this is primarily in relation to shore position (which presumably reflects variability of sediment type/stability). Lower shore communities or those on the upper shore adjacent to saltmarsh (with greater elevation) often tended to exhibit more impoverished communities. Other NKM sites on upper and mid (or lower mid) shore tended to be more diverse/productive which a wider range of taxa and often higher densities/biomass. However, as in 2013 the differences between the communities recorded tend to be rather subtle as opposed to significant shifts in community structure. Relatively few spatial trends are evident at NKM and intertidal assemblages outside the proposed development area (e.g. at sites from the control area to the north) are often rather similar to those within the development area. In terms of key species there generally appeared to be no clear spatial variation across the NKM mudflat in 2016 with the exception of *Hediste diversicolor* which exhibited slightly reduced densities/biomass within the development area.

As in 2013, high densities of *Corophium* volutator were recorded throughout the NKM site and this species was largely absent from the CCS area during the 2016 survey. However, populations of this species are known to show high levels of temporal and spatial variability in the Humber with populations exhibiting periods of expansion and reduction in the middle estuary over time (Allen, 2009). At CCS the invertebrate taxa recorded were broadly similar to those recorded at NKM although a greater number of taxa were recorded overall at CCS which presumably reflects the greater variation in sediment type at this area. Some differences between CCS and NKM were also evident in terms of species composition, notably the much larger numbers of *Corophium volutator* and *Streblospio shrubsolii* at NKM and higher numbers of *Pygospio elegans* and *Manayunkia aestuarina* at CCS. Densities of *Hediste diversicolor* were broadly similar at both areas although slightly higher numbers were recorded at some upper shore NKM areas whilst densities of *Limicola balthica* tended to be slightly higher at CCS. Aside from differences in *Corophium* volutator, *Streblospio shrubsolii* and *Pygospio elegans* the majority of taxa recorded were found in both survey areas albeit with varying levels of dominance/abundance.

Whilst the intertidal species and communities recorded in 2016 generally corresponded to those recorded in spring 2013 some differences were evident. For example, it was noted that overall, the abundance of *Hediste diversicolor* and the number of samples in which it was recorded was lower than in 2013 at both NKM and CCS. To a lesser extent the same was true

with regard to *Limicola balthica* which also appears to have reduced in density and distribution in 2016. The oligochaete *Baltidrilus costatus* appears to have increased in abundance and distribution in 2016 whereas *Tubificoides pseudogaster* agg. was absent.

The intertidal habitats at NKM and CCS exhibit a degree of variability but are generally characterised by typical estuarine mud biotopes although in many cases these are somewhat transitional forms and are considered likely to be inherently variable. Typical biotopes include somewhat transitional middle estuary variants of *LS.LMu.MEst.HedMac (Hediste diversicolor and Macoma balthica in littoral sandy mud)* and examples of this biotope at NKM (particularly toward the upper shore) often included very high abundances of both *Corophium volutator* and *Streblospio shrubsolii* with variable densities of *Hediste diversicolor*. As such these transitional *LS.LMu.MEst.HedMac* biotopes also resembled upper estuarine biotopes *(LS.LMu.UEst)* such as *LS.LMu.UEst.Hed.Cvol (Hediste diversicolor and Corophium volutator in littoral mud)* or *LS.LMu.UEst.Hed.Str (Hediste diversicolor and Streblospio shrubsolii in littoral sandy mud)*.

A range of other estuarine biotopes are present at NKM and CCS including poorly defined or transitional variants of *LS.LMu.MEst (Polychaete/bivalve-dominated mid estuarine mud shores)* on the low shore which could include the biotope *LS.LMu.MEst.NhomMacStr (Nephtys hombergii, Macoma balthica and Streblospio shrubsolii in littoral sandy mud)*. Such biotopes could also be lower shore variants of *LS.LMu.MEst.HedMac* which are subject to sediment instability. Various forms of more typically upper estuarine biotopes were also recorded on the upper shore and particularly in areas adjacent to saltmarsh which tended to be variants of *LS.LMu.UEst (Polychaete/oligochaete-dominated upper estuarine mud shores)* and included a number of rather poorly defined oligochaete or polychaete dominated biotopes such as *LS.LMu.UEst.Hed.Ol (Hediste diversicolor and oligochaetes in littoral mud)*. The CCS area also included impoverished and poorly defined sand or muddy sand biotopes on the lower shore e.g. *LS.LSa.MuSa (Polychaete/bivalve-dominated muddy sand shores)* and also some areas of *Arenicola* beds including the biotope *LS.LSa.MuSa.MacAre (Macoma balthica and Arenicola marina in littoral muddy sand)* on the mid shore at the southernmost end of the survey area.

The subtidal benthic survey highlighted a range of sedimentary habitats including muds, sandy muds, sand and sandy gravel or mixed gravelly muddy habitats. These habitats tended to be very impoverished which is typical for the middle Humber and in line with findings from previous surveys (e.g. Burdon et al., 2011). Characteristic taxa from the subtidal survey included species such as *Capitella* sp., Arenicolidae sp. *(Arenicola marina), Eurydice pulchra, Gammarus salinus, Corophium volutator, Nematoda spp., Polydora cornuta, Pygospio elegans, Streblospio shrubsolii* and *Tubificoides benedii.* Typical biotopes recorded were largely variants of biotopes such as *SS.SCS.SCSVS - Sublittoral coarse sediment in variable salinity (estuaries)* or *SS.SSa.SSaVS - Sublittoral sand in variable salinity (estuaries)* which included variants of *SS.SSa.SSaVS.NintGam (Neomysis integer and Gammarus spp. in fluctuating low salinity infralittoral mobile sand)* albeit without the mysid *Neomysis integer.* Such habitats may also include variants of the biotope *SS.SSa.SSaVS.MoSaVS - Infralittoral mobile sand in variable salinity (estuaries).* Other biotopes in muddier habitats included rather impoverished and uncertain examples of *SS.SMu.SMuVS - Sublittoral mud in variable*

salinity (estuaries) including the biotope *SS.SMu.SMuVS.PolCvol - Polydora ciliata and Corophium volutator in variable salinity infralittoral firm mud or clay*. Such communities are commonly recorded in mid to upper estuarine areas although in the current survey they were often rather transitional (or impoverished) and are presumably influenced by strong tidal currents and variable salinity regime.

Overall, It is considered that the intertidal and subtidal biotopes (and associated infaunal densities and biomass) recorded during the 2016 benthic surveys appear to be typical for muddy intertidal sediments and sandy, gravelly or muddy mixed subtidal habitats in the mid to outer Humber and generally correspond to those recorded during the 2013 baseline survey (PMSL, 2014). The benthic communities identified in 2016 also broadly correspond to communities recorded in other surveys within the Humber (Burdon et al., 2011, ABPmer & PMSL, 2010; PMSL, 2010; Allen, 2009; Allen, 2008; Allen, 2007 and Allen et al., 2003). Whilst not particularly diverse, the intertidal invertebrate communities in particular can support quite high densities of benthic infauna which form an important food source for avifaunal and fish communities but are also inherently variable reflecting the dynamic nature of the middle estuary.

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Appendix 1. Results of Particle Size Analysis at North Killingholme

SAMPLE	PARAMETER	CN1L	CN1M	CN1U	CN2L	CN2M	CN2U	CN3L	CN3M	CN3U	DI1L	DI1M	DI1U	DI2L	DI2M	DI2U
SAMPLE TYPE:		Trimodal, Very Poorly Sorted	Bimodal, Poorly Sorted	Bimodal, Poorly Sorted	Unimodal, Very Poorly Sorted	Unimodal, Poorly Sorted	Bimodal, Poorly Sorted	Bimodal, Very Poorly Sorted	Unimodal, Poorly Sorted	Bimodal, Poorly Sorted	Trimodal, Very Poorly Sorted	Bimodal, Poorly Sorted	Trimodal, Poorly Sorted	Unimodal, Poorly Sorted	Bimodal, Poorly Sorted	Bimodal, Poorly Sorted
TEXTURAL GROUP:		Sandy Mud	Sandy Mud	Sandy Mud	Sandy Mud	Sandy Mud	Sandy Mud	Sandy Mud	Sandy Mud	Sandy Mud	Sandy Mud	Sandy Mud	Sandy Mud	Sandy Mud	Sandy Mud	Sandy Mud
SEDIMENT NAME:		Very Fine Sandy Very Coarse Silt	Very Fine Sandy Very Coarse Silt	Very Fine Sandy Very Coarse Silt	Very Fine Sandy Very Coarse Silt	Very Fine Sandy Very Coarse Silt	Very Fine Sandy Fine Silt	Very Fine Sandy Very Coarse Silt	Very Fine Sandy Very Coarse Silt	Very Fine Sandy Coarse Silt	Very Fine Sandy Very Coarse Silt	Very Fine Sandy Very Coarse Silt	Very Fine Sandy Medium Silt	Very Fine Sandy Very Coarse Silt	Very Fine Sandy Very Coarse Silt	Very Fine Sandy Fine Silt
	MEDIAN GRAIN SIZE D $_{50}$ (µm)	25.2	31.4	20.2	35.7	34.6	12.68	31.8	29.19	15.6	25.6	26.639	13.9	38.8	36.7	13.7
FOLK AND	MEAN GRAIN SIZE (µm)	24.92	24.53	17.9	36.3	29.1	14.37	29.8	25.1	15.9	25.1	24.2	14.734	34.174	29.398	14.344
WARD METHOD	SORTING	4.349	3.273	3.389	4.049	3.381	3.936	4.026	3.33	3.634	4.441	3.9	3.674	3.872	3.828	3.565
(µm)	SKEWNESS	0.037	-0.284	-0.112	0.018	-0.170	0.200	-0.016	-0.148	0.100	0.042	-0.042	0.134	-0.108	-0.185	0.105
	KURTOSIS	0.922	0.847	0.814	0.979	1.006	1.001	1.045	0.993	0.987	0.941	0.949	0.991	0.960	0.963	0.924
	MEDIAN GRAIN SIZE D $_{50}$ (phi):	5.310	4.991	5.627	4.808	4.852	6.301	4.973	5.098	6.003	5.286	5.2	6.169	4.687	4.767	6.192
FOLK AND	MEAN GRAIN SIZE (phi):	5.327	5.349	5.802	4.784	5.101	6.121	5.066	5.318	5.971	5.316	5.4	6.085	4.871	5.088	6.123
WARD METHOD	SORTING	2.121	1.711	1.761	2.017	1.757	1.977	2.009	1.734	1.862	2.151	2.0	1.877	1.953	1.937	1.834
(phi)	SKEWNESS	-0.037	0.284	0.112	-0.018	0.170	-0.200	0.016	0.148	-0.100	-0.042	0.042	-0.134	0.108	0.185	-0.105
	KURTOSIS	0.922	0.847	0.814	0.979	1.006	1.001	1.045	0.993	0.987	0.941	0.949	0.991	0.960	0.963	0.924
	MEAN:	Coarse Silt	Coarse Silt	Coarse Silt	Very Coarse Silt	Coarse Silt	Medium Silt	Coarse Silt	Coarse Silt	Coarse Silt	Coarse Silt	Coarse Silt	Medium Silt	Very Coarse Silt	Coarse Silt	Medium Silt
FOLK AND WARD METHOD	SORTING:	Very Poorly Sorted	Poorly Sorted	Poorly Sorted	Very Poorly Sorted	Poorly Sorted	Poorly Sorted	Very Poorly Sorted	Poorly Sorted	Poorly Sorted	Very Poorly Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted
(Description)	SKEWNESS:	Symmetrical	Fine Skewed	Fine Skewed	Symmetrical	Fine Skewed	Coarse Skewed	Symmetrical	Fine Skewed	Symmetrical	Symmetrical	Symmetrical	Coarse Skewed	Fine Skewed	Fine Skewed	Coarse Skewed
	KURTOSIS:	Mesokurtic	Platykurtic	Platykurtic	Mesokurtic	Mesokurtic	Mesokurtic	Mesokurtic	Mesokurtic	Mesokurtic	Mesokurtic	Mesokurtic	Mesokurtic	Mesokurtic	Mesokurtic	Mesokurtic
BULK GRAIN SIZE	% GRAVEL:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	% SAND:	26.623	22.950	15.604	33.642	27.451	15.203	28.728	21.870	14.518	27.124	24.717	13.865	34.632	30.889	13.140
	% MUD:	73.377	77.050	84.396	66.358	72.549	84.797	71.272	78.130	85.482	72.876	75.283	86.135	65.368	69.111	86.860
	% V COARSE GRAVEL:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	% COARSE GRAVEL:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	% MEDIUM GRAVEL:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	% FINE GRAVEL:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	% V FINE GRAVEL:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	% V COARSE SAND:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.016	0.000	0.000	0.000
	% COARSE SAND:	0.990	0.000	0.000	1.171	0.076	1.141	1.751	0.008	0.826	2.225	0.654	0.913	0.330	0.630	0.208
	% MEDIUM SAND:	6.822	0.060	0.714	8.184	2.926	3.410	6.391	2.041	3.160	6.223	4.546	2.994	6.194	4.187	2.327
	% FINE SAND:	6.688	3.841	3.181	9.828	6.884	3.808	6.610	5.570	3.228	6.019	6.274	3.153	9.996	7.051	3.455
	% V FINE SAND:	12.123	19.049	11.710	14.458	17.565	6.844	13.976	14.250	7.304	12.657	13.243	6.788	18.113	19.021	7.150
	% V COARSE SILT:	17.884	27.264	21.696	20.424	26.401	11.887	21.870	25.800	15.231	17.884	20.684	13.564	22.026	24.547	14.445
	% COARSE SILT:	17.025	17.258	19.237	18.730	18.305	17.249	19.018	20.973	20.184	16.737	18.462	19.250	15.867	15.251	18.838
	% MEDIUM SILT:	14.889	12.093	15.167	12.868	11.863	19.227	13.081	13.135	19.324	14.744	14.036	19.636	11.783	10.757	18.766
	% FINE SILT:	14.221	12.287	16.199	9.621	10.301	20.759	10.950	11.443	18.366	14.157	13.337	19.634	10.266	11.125	19.846
	% V FINE SILT:	8.154	7.104	10.309	4.349	5.131	13.300	5.714	6.083	10.735	8.141	7.681	11.966	4.953	6.508	12.681
	% CLAY:	1.204	1.044	1.788	0.366	0.549	2.374	0.639	0.696	1.643	1.212	1.084	2.086	0.474	0.923	2.283
LOI		6.13	5.31	5.46	8.32	5.17	9.06	6.32	5.92	7.47	5.98	6.93	9.37	7.30	5.62	7.57

SAMPLE	PARAMETER	DI3L	DI3M	DI3U	IN1L	IN1M	IN1U	IN2L	IN2M	IN2U	IN3L	IN3M	IN3U	IS1L	IS1M	IS1U
SAMPLE TYPE:		Bimodal, Poorly Sorted	Bimodal, Poorly Sorted	Bimodal, Very Poorly Sorted	Bimodal, Poorly Sorted	Bimodal, Poorly Sorted	Bimodal, Poorly Sorted	Bimodal, Poorly Sorted	Bimodal, Poorly Sorted	Bimodal, Very Poorly Sorted	Trimodal, Extremely Poorly Sorted	Bimodal, Very Poorly Sorted	Bimodal, Very Poorly Sorted	Unimodal, Poorly Sorted	Unimodal, Very Poorly Sorted	Bimodal, Very Poorly Sorted
TEXTURAL GROUP:		Slightly Gravelly Sandy Mud	Sandy Mud	Sandy Mud	Sandy Mud	Sandy Mud	Sandy Mud	Sandy Mud	Sandy Mud	Sandy Mud	Gravelly Mud	Slightly Gravelly Sandy Mud	Sandy Mud	Slightly Gravelly Sandy Mud	Slightly Gravelly Sandy Mud	Sandy Mud
SEDIMENT NAME:		Slightly Very Fine Gravelly Very Fine Sandy Very Coarse Silt	Very Fine Sandy Very Coarse Silt	Very Fine Sandy Coarse Silt	Very Fine Sandy Very Coarse Silt	Very Fine Sandy Very Coarse Silt	Very Fine Sandy Coarse Silt	Very Fine Sandy Very Coarse Silt	Very Fine Sandy Very Coarse Silt	Very Fine Sandy Coarse Silt	Coarse Gravelly Very Coarse Silt	Slightly Very Fine Gravelly Very Fine Sandy Coarse Silt	Very Fine Sandy Coarse Silt	Slightly Very Fine Gravelly Very Fine Sandy Very Coarse Silt	Slightly Fine Gravelly Very Fine Sandy Very Coarse Silt	Coarse Sandy Coarse Silt
	MEDIAN GRAIN SIZE D $_{50}$ (µm)	26.1	24.6	24.5	34.6	32.4	18.29	30.31	36.79	23.70	49.29	23.62	23.1	46.8	32.6	28.3
FOLK AND	MEAN GRAIN SIZE (µm)	22.962	21.174	25.972	27.214	25.947	19.275	27.932	33.069	23.770	176.113	24.837	25.985	38.812	31.263	39.921
WARD METHOD	SORTING	3.882	3.519	4.605	3.494	3.538	3.933	3.751	3.871	4.004	22.892	4.179	4.252	3.635	4.159	6.241
(µm)	SKEWNESS	-0.076	-0.136	0.102	-0.242	-0.209	0.114	-0.036	-0.059	0.063	0.461	0.113	0.159	-0.191	-0.009	0.221
	KURTOSIS	0.922	0.842	0.997	0.963	0.906	0.962	0.968	1.046	0.979	0.740	1.032	1.006	0.992	0.954	0.785
	MEDIAN GRAIN SIZE D $_{50}$ (phi):	5.258	5.347	5.349	4.855	4.947	5.773	5.044	4.765	5.399	4.342	5.404	5.434	4.416	4.938	5.144
FOLK AND	MEAN GRAIN SIZE (phi):	5.445	5.562	5.267	5.200	5.268	5.697	5.162	4.918	5.395	2.505	5.331	5.266	4.687	4.999	4.647
WARD METHOD	SORTING	1.957	1.815	2.203	1.805	1.823	1.976	1.907	1.953	2.001	4.517	2.063	2.088	1.862	2.056	2.642
(phi)	SKEWNESS	0.076	0.136	-0.102	0.242	0.209	-0.114	0.036	0.059	-0.063	-0.461	-0.113	-0.159	0.191	0.009	-0.221
	KURTOSIS	0.922	0.842	0.997	0.963	0.906	0.962	0.968	1.046	0.979	0.740	1.032	1.006	0.992	0.954	0.785
	MEAN:	Coarse Silt	Coarse Silt	Coarse Silt	Coarse Silt	Coarse Silt	Coarse Silt	Coarse Silt	Very Coarse Silt	Coarse Silt	Fine Sand	Coarse Silt	Coarse Silt	Very Coarse Silt	Very Coarse Silt	Very Coarse Silt
FOLK AND WARD METHOD	SORTING:	Poorly Sorted	Poorly Sorted	Very Poorly Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted	Very Poorly Sorted	Extremely Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted	Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted
(Description)	SKEWNESS:	Symmetrical	Fine Skewed	Coarse Skewed	Fine Skewed	Fine Skewed	Coarse Skewed	Symmetrical	Symmetrical	Symmetrical	Very Coarse Skewed	Coarse Skewed	Coarse Skewed	Fine Skewed	Symmetrical	Coarse Skewed
	KURTOSIS:	Mesokurtic	Platykurtic	Mesokurtic	Mesokurtic	Mesokurtic	Mesokurtic	Mesokurtic	Mesokurtic	Mesokurtic	Platykurtic	Mesokurtic	Mesokurtic	Mesokurtic	Mesokurtic	Platykurtic
BULK GRAIN SIZE	% GRAVEL:	0.014	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	24.441	0.033	0.000	0.016	0.042	0.000
	% SAND:	23.598	20.326	25.957	26.906	25.949	19.584	27.841	32.219	23.890	20.581	24.325	25.157	39.577	31.587	35.610
	% MUD:	76.388	79.674	74.043	73.094	74.051	80.416	72.159	67.781	76.110	54.977	75.642	74.843	60.408	68.371	64.390
	% V COARSE GRAVEL:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	% COARSE GRAVEL:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	13.180	0.000	0.000	0.000	0.000	0.000
	% MEDIUM GRAVEL:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5.641	0.000	0.000	0.000	0.000	0.000
	% FINE GRAVEL:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3.040	0.000	0.000	0.000	0.021	0.000
	% V FINE GRAVEL:	0.014	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.581	0.033	0.000	0.016	0.021	0.000
	% V COARSE SAND:	0.029	0.000	0.037	0.000	0.000	0.000	0.000	0.000	0.000	2.326	0.497	0.000	0.000	0.042	0.000
	% COARSE SAND:	0.578	0.013	2.990	0.108	0.279	0.574	0.901	1.935	1.217	0.652	2.190	2.308	0.284	1.569	10.701
	% MEDIUM SAND:	3.795	1.454	7.353	2.320	2.693	4.504	4.833	6.037	5.555	3.750	5.847	7.310	5.356	6.496	9.823
	% FINE SAND:	5.331	4.576	5.740	5.847	5.201	5.255	6.417	7.242	5.701	4.260	5.320	5.869	11.350	8.632	6.350
	% V FINE SAND:	13.865	14.283	9.837	18.630	17.776	9.251	15.689	17.005	11.416	9.594	10.472	9.671	22.587	14.848	8.737
	% V COARSE SILT:	21.294	22.692	17.259	26.862	25.349	15.846	21.310	23.160	18.347	15.133	17.541	16.268	22.735	19.608	12.197
	% COARSE SILT:	18.116	18.328	18.703	16.988	16.694	18.889	18.295	17.315	18.973	14.011	19.774	19.837	14.047	17.596	15.644
	% MEDIUM SILT:	13.623	14.196	15.314	10.817	12.045	18.345	14.719	12.065	16.687	11.100	17.177	18.013	10.422	13.464	15.502
	% FINE SILT:	13.560	14.286	13.880	10.602	12.165	16.991	12.043	10.198	14.373	9.477	14.029	14.457	8.734	11.498	13.681
	% V FINE SILT:	8.391	8.726	7.819	6.601	6.861	9.121	5.349	4.664	7.009	4.748	6.509	5.897	4.075	5.659	6.694
	% CLAY:	1.403	1.447	1.066	1.224	0.937	1.224	0.442	0.380	0.720	0.508	0.612	0.370	0.395	0.545	0.671
LOI		5.24	5.77	7.08	4.02	4.79	7.90	6.82	5.40	6.86	5.46	7.71	7.79	6.06	8.27	10.66

SAMPLE	PARAMETER	IS2L	IS2M	IS2U	IS3L	IS3M	IS3U
SAMPLE TYPE:		Unimodal, Poorly Sorted	Bimodal, Very Poorly Sorted	Bimodal, Very Poorly Sorted	Unimodal, Very Poorly Sorted	Bimodal, Poorly Sorted	Bimodal, Very Poorly Sorted
TEXTURAL GROUP:		Sandy Mud	Sandy Mud	Sandy Mud	Sandy Mud	Slightly Gravelly Sandy Mud	Sandy Mud
SEDIMENT NAME:		Very Fine Sandy Very Coarse Silt	Very Fine Sandy Very Coarse Silt	Very Fine Sandy Fine Silt	Very Fine Sandy Very Coarse Silt	Slightly Very Fine Gravelly Very Fine Sandy Very Coarse Silt	Very Fine Sandy Medium Silt
	MEDIAN GRAIN SIZE D_{50} (µm)	46.1	30.11	17.63	34.16	29.76	15.13
FOLK AND	MEAN GRAIN SIZE (µm)	36.837	29.649	20.894	31.823	25.143	17.161
WARD METHOD	SORTING	3.562	4.243	4.728	4.151	3.619	4.109
(µm)	SKEWNESS	-0.201	0.021	0.209	-0.026	-0.138	0.170
	KURTOSIS	1.040	0.971	0.955	0.968	0.948	0.960
	MEDIAN GRAIN SIZE D_{50} (phi):	4.439	5.054	5.826	4.872	5.070	6.047
FOLK AND	MEAN GRAIN SIZE (phi):	4.763	5.076	5.581	4.974	5.314	5.865
WARD METHOD	SORTING	1.833	2.085	2.241	2.053	1.855	2.039
(phi)	SKEWNESS	0.201	-0.021	-0.209	0.026	0.138	-0.170
	KURTOSIS	1.040	0.971	0.955	0.968	0.948	0.960
	MEAN:	Very Coarse Silt	Coarse Silt	Coarse Silt	Very Coarse Silt	Coarse Silt	Coarse Silt
FOLK AND WARD METHOD	SORTING:	Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted	Poorly Sorted	Very Poorly Sorted
(Description)	SKEWNESS:	Fine Skewed	Symmetrical	Coarse Skewed	Symmetrical	Fine Skewed	Coarse Skewed
	KURTOSIS:	Mesokurtic	Mesokurtic	Mesokurtic	Mesokurtic	Mesokurtic	Mesokurtic
BULK GRAIN SIZE	% GRAVEL:	0.000	0.000	0.000	0.000	0.013	0.000
	% SAND:	37.971	29.723	23.314	32.813	24.518	18.651
	% MUD:	62.029	70.277	76.686	67.187	75.469	81.349
	% V COARSE GRAVEL:	0.000	0.000	0.000	0.000	0.000	0.000
	% COARSE GRAVEL:	0.000	0.000	0.000	0.000	0.000	0.000
	% MEDIUM GRAVEL:	0.000	0.000	0.000	0.000	0.000	0.000
	% FINE GRAVEL:	0.000	0.000	0.000	0.000	0.000	0.000
	% V FINE GRAVEL:	0.000	0.000	0.000	0.000	0.013	0.000
	% V COARSE SAND:	0.000	0.000	0.039	0.012	0.013	0.000
	% COARSE SAND:	1.273	1.824	2.987	2.158	0.238	0.253
	% MEDIUM SAND:	4.643	6.753	6.471	6.272	3.240	4.366
	% FINE SAND:	7.926	7.812	5.247	8.070	5.695	6.127
	% V FINE SAND:	24.129	13.333	8.570	16.301	15.332	7.905
	% V COARSE SILT:	24.197	19.230	13.014	19.683	24.013	12.575
	% COARSE SILT:	13.686	18.352	16.649	16.821	18.458	17.890
	% MEDIUM SILT:	10.874	13.958	17.528	13.458	12.836	18.890
	% FINE SILT:	9.126	11.935	17.844	11.153	12.311	18.607
	% V FINE SILT:	3.868	6.145	10.218	5.479	6.937	11.396
	% CLAY:	0.279	0.657	1.433	0.593	0.916	1.991
LOI		4.50	8.23	9.48	5.82	6.01	8.95

Appendix 2. Results of Particle Size Analysis at Cherry Cobb Sands

SAMPLE	PARAMETER	CCN1L	CCN1M	CCN1U	CCN2L	CCN2M	CCN2U	CCN3L	CCN3M	CCN3U	CS1L	CS1M	CS1U	CS2L	CS2M	CS2U
SAMPLE TYPE:		Bimodal, Poorly Sorted	Bimodal, Poorly Sorted	Bimodal, Poorly Sorted	Bimodal, Poorly Sorted	Bimodal, Poorly Sorted	Unimodal, Poorly Sorted	Bimodal, Poorly Sorted	Trimodal, Poorly Sorted	Bimodal, Very Poorly Sorted	Unimodal, Moderately Sorted	Bimodal, Poorly Sorted	Bimodal, Poorly Sorted	Unimodal, Moderately Well Sorted	Unimodal, Poorly Sorted	Bimodal, Poorly Sorted
TEXTURAL GROUP:		Slightly Gravelly Muddy Sand	Sandy Mud	Slightly Gravelly Sandy Mud	Slightly Gravelly Sandy Mud	Slightly Gravelly Sandy Mud	Sandy Mud	Muddy Sand	Sandy Mud	Sandy Mud	Muddy Sand	Slightly Gravelly Sandy Mud	Slightly Gravelly Sandy Mud	Sand	Slightly Gravelly Muddy Sand	Slightly Gravelly Sandy Mud
SEDIMENT NAME:		Slightly Very Fine Gravelly Very Coarse Silty Very Fine Sand	Very Fine Sandy Very Coarse Silt	Slightly Very Fine Gravelly Very Fine Sandy Very Coarse Silt	Slightly Very Fine Gravelly Very Fine Sandy Very Coarse Silt	Slightly Very Fine Gravelly Very Fine Sandy Very Coarse Silt	Very Fine Sandy Fine Silt	Very Coarse Silty Very Fine Sand	Very Fine Sandy Very Coarse Silt	Very Fine Sandy Coarse Silt	Very Coarse Silty Very Fine Sand	Slightly Very Fine Gravelly Very Fine Sandy Very Coarse Silt	Slightly Fine Gravelly Very Fine Sandy Very Coarse Silt	Moderately Well Sorted Fine Sand	Slightly Fine Gravelly Very Coarse Silty Very Fine Sand	Slightly Fine Gravelly Very Fine Sandy Very Coarse Silt
	MEDIAN GRAIN SIZE D_{50} (µm)	70.5	26.9	19.3	49.3	27.1	12.60	69.5	30.24	18.2	95.3	43.418	39.1	164.2	69.6	31.1
FOLK AND	MEAN GRAIN SIZE (µm)	44.99	21.87	18.8	35.7	24.0	13.98	44.9	25.5	18.9	94.9	32.3	30.368	160.326	65.109	24.623
WARD METHOD	SORTING	3.568	3.511	3.817	3.859	3.954	3.589	3.646	3.73	4.183	1.690	3.3	3.117	1.584	2.157	3.338
(µm)	SKEWNESS	-0.480	-0.202	0.013	-0.311	-0.062	0.163	-0.451	-0.125	0.121	-0.039	-0.333	-0.315	-0.123	-0.298	-0.249
	KURTOSIS	0.844	0.861	0.851	0.795	0.926	0.937	0.857	0.974	1.023	1.053	1.093	1.050	1.100	1.547	0.886
	MEDIAN GRAIN SIZE D_{50} (phi):	3.826	5.216	5.696	4.342	5.206	6.311	3.847	5.047	5.783	3.392	4.5	4.678	2.607	3.845	5.008
FOLK AND	MEAN GRAIN SIZE (phi):	4.474	5.515	5.735	4.809	5.378	6.161	4.478	5.295	5.722	3.398	5.0	5.041	2.641	3.941	5.344
WARD METHOD	SORTING	1.835	1.812	1.932	1.948	1.983	1.844	1.866	1.900	2.065	0.757	1.7	1.640	0.663	1.109	1.739
(phi)	SKEWNESS	0.480	0.202	-0.013	0.311	0.062	-0.163	0.451	0.125	-0.121	0.039	0.333	0.315	0.123	0.298	0.249
	KURTOSIS	0.844	0.861	0.851	0.795	0.926	0.937	0.857	0.974	1.023	1.053	1.093	1.050	1.100	1.547	0.886
	MEAN:	Very Coarse Silt	Coarse Silt	Coarse Silt	Very Coarse Silt	Coarse Silt	Medium Silt	Very Coarse Silt	Coarse Silt	Coarse Silt	Very Fine Sand	Very Coarse Silt	Coarse Silt	Fine Sand	Very Fine Sand	Coarse Silt
FOLK AND WARD METHOD	SORTING:	Poorly Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted	Very Poorly Sorted	Moderately Sorted	Poorly Sorted	Poorly Sorted	Moderately Well Sorted	Poorly Sorted	Poorly Sorted
(Description)	SKEWNESS:	Very Fine Skewed	Fine Skewed	Symmetrical	Very Fine Skewed	Symmetrical	Coarse Skewed	Very Fine Skewed	Fine Skewed	Coarse Skewed	Symmetrical	Very Fine Skewed	Very Fine Skewed	Fine Skewed	Fine Skewed	Fine Skewed
	KURTOSIS:	Platykurtic	Platykurtic	Platykurtic	Platykurtic	Mesokurtic	Mesokurtic	Platykurtic	Mesokurtic	Mesokurtic	Mesokurtic	Mesokurtic	Mesokurtic	Mesokurtic	Very Leptokurtic	Platykurtic
BULK GRAIN SIZE	% GRAVEL:	0.039	0.000	0.055	0.037	0.065	0.000	0.000	0.000	0.000	0.000	0.057	0.045	0.000	0.249	0.345
	% SAND:	55.682	20.535	19.576	43.652	24.875	13.488	54.930	25.150	19.318	80.177	32.593	28.453	95.629	57.324	22.416
	% MUD:	44.280	79.465	80.369	56.311	75.060	86.512	45.070	74.850	80.682	19.823	67.350	71.502	4.371	42.427	77.239
	% V COARSE GRAVEL:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	% COARSE GRAVEL:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	% MEDIUM GRAVEL:	0.000	0.000	0.000	0.012	0.022	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.089
	% FINE GRAVEL:	0.013	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.023	0.022	0.000	0.197	0.141
	% V FINE GRAVEL:	0.026	0.000	0.055	0.025	0.043	0.000	0.000	0.000	0.000	0.000	0.034	0.022	0.000	0.052	0.115
	% V COARSE SAND:	0.026	0.000	0.193	0.198	0.130	0.000	0.000	0.030	0.000	0.000	0.023	0.090	0.000	0.083	0.089
	% COARSE SAND:	0.359	0.000	0.070	0.576	0.543	0.163	1.241	0.575	1.618	0.176	0.211	0.114	0.002	0.003	0.001
	% MEDIUM SAND:	1.524	1.158	2.654	2.647	4.331	2.419	2.070	3.935	5.174	1.774	2.324	1.038	14.603	0.112	0.906
	% FINE SAND:	18.335	4.594	5.031	13.293	6.159	3.706	17.348	5.394	4.404	26.733	5.837	4.832	59.283	12.036	4.285
	% V FINE SAND:	35.438	14.783	11.627	26.939	13.711	7.200	34.271	15.215	8.123	51.494	24.197	22.379	21.742	45.089	17.135
	% V COARSE SILT:	12.680	24.918	18.191	15.117	21.173	13.084	13.161	23.895	15.503	16.621	30.404	30.848	0.926	28.511	27.072
	% COARSE SILT:	7.853	18.532	17.148	11.406	17.237	17.513	7.980	17.973	19.371	0.606	13.524	16.443	1.782	5.069	17.887
	% MEDIUM SILT:	10.166	12.572	15.872	12.326	13.787	19.687	10.216	12.822	17.659	1.440	8.100	9.102	0.763	4.019	12.048
	% FINE SILT:	8.959	12.972	16.970	11.051	13.763	21.210	9.012	12.196	16.501	0.885	9.106	9.203	0.763	3.472	12.193
	% V FINE SILT:	4.235	8.730	10.459	5.732	7.937	12.898	4.289	6.945	9.933	0.270	5.371	5.234	0.137	1.305	7.013
	% CLAY:	0.386	1.741	1.730	0.678	1.164	2.120	0.412	1.019	1.714	0.000	0.845	0.673	0.000	0.050	1.026
LOI		3.52	6.89	6.89	3.57	8.51	7.98	4.76	7.32	9.75	2.34	5.08	4.33	1.19	2.72	5.11

SAMPLE	PARAMETER	CS3L	CS3M	CS3U	I1L	I1M	I1U	I2L	I2M	I2U	I3L	I3M	I3U
SAMPLE TYPE:		Unimodal, Moderately Sorted	Unimodal, Moderately Sorted	Bimodal, Poorly Sorted	Unimodal, Moderately Sorted	Bimodal, Poorly Sorted	Bimodal, Poorly Sorted	Unimodal, Poorly Sorted	Bimodal, Poorly Sorted	Unimodal, Poorly Sorted	Unimodal, Poorly Sorted	Unimodal, Poorly Sorted	Bimodal, Poorly Sorted
TEXTURAL GROUP:		Sand	Muddy Sand	Slightly Gravelly Sandy Mud	Muddy Sand	Slightly Gravelly Sandy Mud	Sandy Mud	Muddy Sand	Slightly Gravelly Sandy Mud	Sandy Mud	Slightly Gravelly Muddy Sand	Slightly Gravelly Sandy Mud	Sandy Mud
SEDIMENT NAME:		Moderately Sorted Fine Sand	Very Coarse Silty Very Fine Sand	Slightly Fine Gravelly Very Fine Sandy Very Coarse Silt	Very Coarse Silty Very Fine Sand	Slightly Fine Gravelly Very Fine Sandy Very Coarse Silt	Very Fine Sandy Very Coarse Silt	Very Coarse Silty Very Fine Sand	Slightly Fine Gravelly Very Fine Sandy Very Coarse Silt	Very Fine Sandy Very Coarse Silt	Slightly Very Fine Gravelly Very Coarse Silty Very Fine Sand	Slightly Fine Gravelly Very Fine Sandy Very Coarse Silt	Very Fine Sandy Coarse Silt
	MEDIAN GRAIN SIZE D_{50} (µm)	159.1	78.4	52.5	90.6	32.3	33.1	79.40	33.89	31.40	81.06	32.35	21.11
FOLK AND	MEAN GRAIN SIZE (µm)	155.457	75.144	41.848	88.675	25.707	27.199	72.116	28.314	29.116	72.919	27.981	19.449
WARD METHOD	SORTING	1.631	1.985	2.831	1.854	3.610	3.394	2.301	3.602	3.871	2.330	3.665	3.643
(µm)	SKEWNESS	-0.122	-0.273	-0.365	-0.260	-0.204	-0.193	-0.356	-0.143	-0.043	-0.387	-0.109	-0.024
	KURTOSIS	1.069	1.477	1.248	1.625	0.940	1.043	1.647	1.045	1.001	1.733	0.992	0.957
	MEDIAN GRAIN SIZE D_{50} (phi):	2.652	3.672	4.252	3.464	4.953	4.917	3.655	4.883	4.993	3.625	4.950	5.566
FOLK AND	MEAN GRAIN SIZE (phi):	2.685	3.734	4.579	3.495	5.282	5.200	3.794	5.142	5.102	3.778	5.159	5.684
WARD METHOD	SORTING	0.706	0.989	1.501	0.890	1.852	1.763	1.202	1.849	1.953	1.220	1.874	1.865
(phi)	SKEWNESS	0.122	0.273	0.365	0.260	0.204	0.193	0.356	0.143	0.043	0.387	0.109	0.024
	KURTOSIS	1.069	1.477	1.248	1.625	0.940	1.043	1.647	1.045	1.001	1.733	0.992	0.957
	MEAN:	Fine Sand	Very Fine Sand	Very Coarse Silt	Very Fine Sand	Coarse Silt	Coarse Silt	Very Fine Sand	Coarse Silt	Coarse Silt	Very Fine Sand	Coarse Silt	Coarse Silt
FOLK AND WARD METHOD	SORTING:	Moderately Sorted	Moderately Sorted	Poorly Sorted	Moderately Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted
(Description)	SKEWNESS:	Fine Skewed	Fine Skewed	Very Fine Skewed	Fine Skewed	Fine Skewed	Fine Skewed	Very Fine Skewed	Fine Skewed	Symmetrical	Very Fine Skewed	Fine Skewed	Symmetrical
	KURTOSIS:	Mesokurtic	Leptokurtic	Leptokurtic	Very Leptokurtic	Mesokurtic	Mesokurtic	Very Leptokurtic	Mesokurtic	Mesokurtic	Very Leptokurtic	Mesokurtic	Mesokurtic
BULK GRAIN SIZE	% GRAVEL:	0.000	0.000	0.441	0.000	0.193	0.000	0.000	0.069	0.000	0.072	0.058	0.000
	% SAND:	94.820	66.536	40.377	78.354	25.260	24.712	66.303	27.016	28.273	67.700	27.184	17.650
	% MUD:	5.180	33.464	59.182	21.646	74.547	75.288	33.697	72.915	71.727	32.228	72.758	82.350
	% V COARSE GRAVEL:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	% COARSE GRAVEL:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	% MEDIUM GRAVEL:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	% FINE GRAVEL:	0.000	0.000	0.355	0.000	0.155	0.000	0.000	0.055	0.000	0.010	0.029	0.000
	% V FINE GRAVEL:	0.000	0.000	0.086	0.000	0.039	0.000	0.000	0.014	0.000	0.061	0.029	0.000
	% V COARSE SAND:	0.000	0.000	0.024	0.000	0.026	0.013	0.000	0.028	0.000	0.020	0.029	0.000
	% COARSE SAND:	0.026	0.000	0.053	0.086	0.188	0.133	0.795	0.704	0.836	0.270	0.681	0.348
	% MEDIUM SAND:	14.434	0.009	0.372	0.365	2.886	2.835	0.759	4.046	5.169	0.236	3.991	3.248
	% FINE SAND:	55.673	16.886	7.559	22.236	5.296	5.548	17.554	5.648	7.851	18.788	6.428	4.251
	% V FINE SAND:	24.687	49.640	32.369	55.666	16.864	16.183	47.196	16.590	14.417	48.385	16.054	9.803
	% V COARSE SILT:	1.518	23.820	30.688	15.424	25.741	27.625	19.334	25.945	21.879	17.782	23.965	19.866
	% COARSE SILT:	1.603	3.258	11.126	1.073	17.309	19.442	3.284	18.248	19.272	2.923	18.391	21.050
	% MEDIUM SILT:	0.961	3.051	6.867	2.896	11.323	10.947	5.263	11.551	12.993	4.937	12.548	15.973
	% FINE SILT:	0.933	2.368	6.770	1.590	11.835	10.516	3.985	10.764	11.161	4.187	11.486	14.996
	% V FINE SILT:	0.165	0.950	3.372	0.659	7.216	5.998	1.711	5.750	5.806	2.185	5.786	9.050
	% CLAY:	0.000	0.017	0.358	0.005	1.123	0.759	0.119	0.657	0.616	0.214	0.582	1.415
LOI		1.84	2.78	3.42	1.60	5.55	5.75	2.71	6.12	8.10	2.73	7.74	8.00

Appendix 3. Biological parameters at North Killingholme (replicate data per 0.01m^2)

Area	Shore	Sample	Quantitative Taxa	Total Taxa	Numbers of Individuals	Biomass (AFDW g)	Margalef's d	Pielou's J	Shannon's H'	AFDW ABC w stat
Control North	Low	CN1L - A	6	6	22	0.001924	1.62	0.71	1.84	0.19
	Low	CN1L - B	4	4	16	0.001363	1.08	0.80	1.59	0.10
	Low	CN1L - C	3	3	20	0.001843	0.67	0.81	1.28	0.39
	Low	CN2L - A	7	7	20	0.010846	2.00	0.86	2.42	0.50
	Low	CN2L - B	2	3	5	0.000035	0.62	0.97	0.97	-0.12
	Low	CN2L - C	5	5	14	0.000926	1.52	0.85	1.99	0.41
	Low	CN3L -A	6	6	83	0.016619	1.13	0.43	1.12	-0.01
	Low	CN3L - B	4	5	67	0.014255	0.71	0.21	0.42	-0.16
	Low	CN3L - C	5	5	85	0.020254	0.90	0.40	0.93	0.05
	Mid	CN1M - A	5	5	132	0.030817	0.82	0.53	1.24	-0.01
	Mid	CN1M - B	8	8	117	0.036492	1.47	0.53	1.60	0.09
	Mid	CN1M - C	6	6	102	0.023688	1.08	0.45	1.17	-0.04
	Mid	CN2M - A	4	5	105	0.020771	0.64	0.67	1.33	-0.04
	Mid	CN2M - B	8	8	134	0.031646	1.43	0.53	1.58	0.00
	Mid	CN2M - C	3	3	81	0.024546	0.46	0.56	0.88	-0.27
	Mid	CN3M - A	7	7	117	0.065306	1.26	0.59	1.65	0.03
	Mid	CN3M - B	5	5	100	0.019863	0.87	0.49	1.14	0.05
	Mid	CN3M - C	4	4	105	0.030107	0.64	0.57	1.14	-0.13
	Upper	CN1U - A	6	6	60	0.014945	1.22	0.62	1.60	0.07
	Upper	CN1U - B	5	5	140	0.021442	0.81	0.60	1.39	0.11
	Upper	CN1U - C	7	7	134	0.048396	1.23	0.58	1.64	0.01
	Upper	CN2U -A	2	2	9	0.000193	0.46	0.50	0.50	-0.77
	Upper	CN2U - B	3	3	51	0.002773	0.51	0.35	0.56	-0.10
	Upper	CN2U - C	3	3	23	0.002092	0.64	0.58	0.91	-0.05
	Upper	CN3U - A	5	5	71	0.008147	0.94	0.83	1.92	0.44
	Upper	CN3U - B	6	6	41	0.017237	1.35	0.80	2.06	0.41
	Upper	CN3U - C	8	8	263	0.068742	1.26	0.71	2.12	0.19
Direct Impact	Low	DI1L - A	3	3	22	0.000250	0.65	0.69	1.09	-0.39
	Low	DI1L - B	5	5	15	0.000157	1.48	0.83	1.93	0.17
	Low	DI1L - C	4	4	12	0.003156	1.21	0.89	1.78	0.47
	Low	DI2L - A	3	3	57	0.005013	0.49	0.44	0.70	-0.19
	Low	DI2L - B	6	6	67	0.009782	1.19	0.59	1.53	0.00
	Low	DI2L - C	5	5	83	0.003327	0.91	0.55	1.27	-0.12
	Low	DI3L - A	4	4	13	0.000437	1.17	0.68	1.35	0.23
	Low	DI3L - B	3	3	7	0.000619	1.03	0.72	1.15	-0.05
	Low	DI3L - C	3	3	9	0.000356	0.91	0.77	1.22	0.38
	Mid	DI1M - A	10	10	531	0.040641	1.43	0.27	0.88	-0.09
	Mid	DI1M - B	6	6	51	0.021073	1.27	0.65	1.69	0.15
	Mid	DI1M - C	6	6	213	0.046747	0.93	0.44	1.13	-0.07
	Mid	DI2M - A	4	4	23	0.021182	0.96	0.97	1.93	0.71
	Mid	DI2M - B	5	5	81	0.022259	0.91	0.76	1.77	0.21
	Mid	DI2M - C	4	4	68	0.011861	0.71	0.73	1.47	0.20
	Mid	DI3M - A	4	4	59	0.011831	0.74	0.47	0.94	-0.44
	Mid	DI3M - B	4	4	29	0.006707	0.89	0.66	1.33	-0.21
	Mid	DI3M - C	4	6	61	0.008698	0.73	0.62	1.25	0.03
	Upper	DI1U - A	2	2	16	0.001744	0.36	0.95	0.95	0.16
	Upper	DI1U - B	4	4	157	0.011391	0.59	0.16	0.31	-0.02
	Upper	DI1U - C	1	1	2	0.000140	0.00		0.00	0.00
	Upper	DI2U - A	3	4	13	0.000344	0.78	0.84	1.33	0.47
	Upper	DI2U - B	3	3	6	0.000024	1.12	0.92	1.46	0.00
	Upper	DI2U - C	1	1	2	0.000018	0.00		0.00	0.00
	Upper	DI3U - A	7	7	183	0.033181	1.15	0.44	1.23	-0.03
	Upper	DI3U - B	7	7	139	0.045536	1.22	0.65	1.82	0.10
	Upper	DI3U - C	7	7	91	0.032732	1.33	0.66	1.85	-0.01

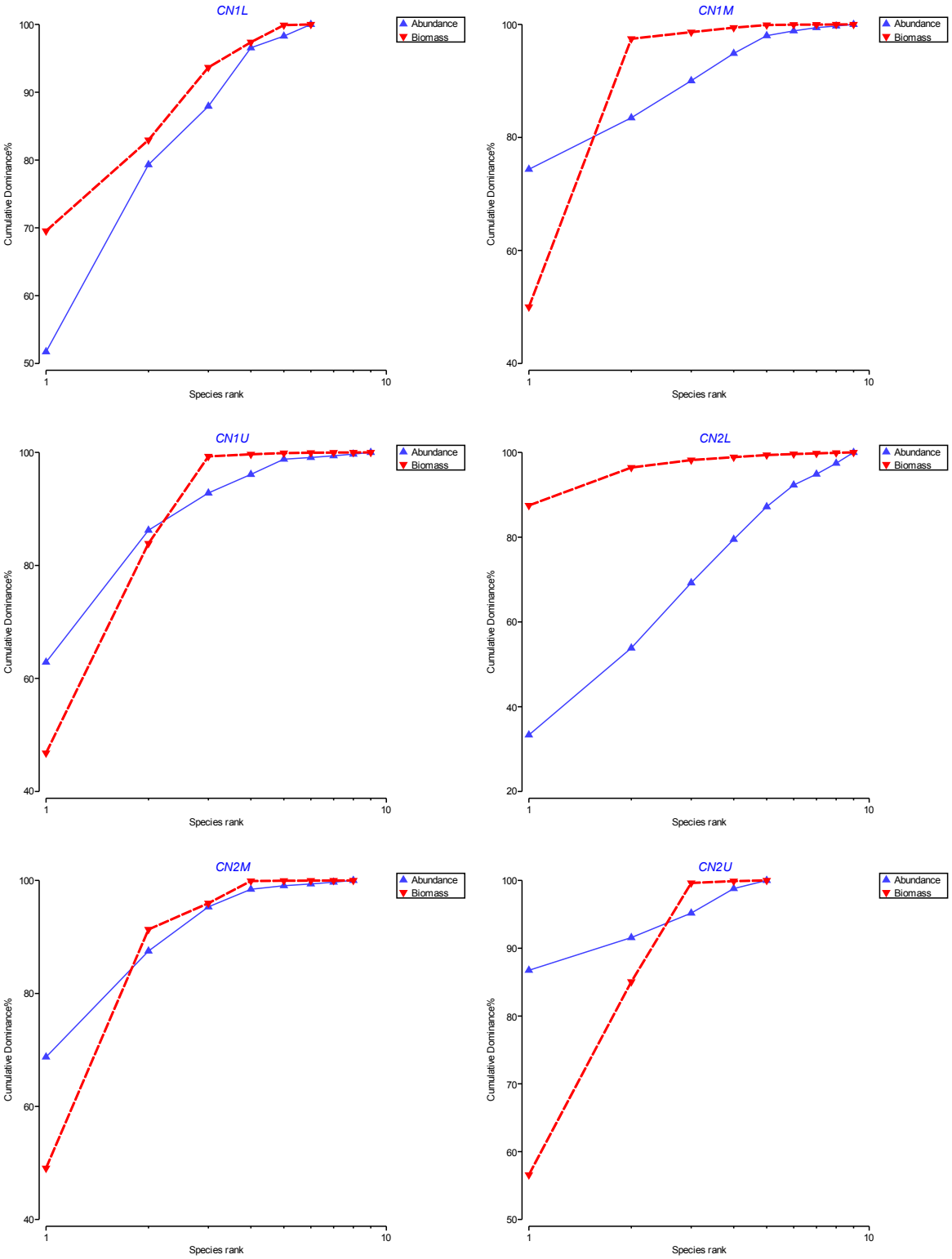
Area	Shore	Sample	Quantitative Taxa	Total Taxa	Numbers of Individuals	Biomass (AFDW g)	Margalef's d	Pielou's J	Shannon's H'	AFDW ABC w stat
Indirect North	Low	IN1L - A	4	4	190	0.030063	0.57	0.17	0.34	0.05
	Low	IN1L - B	6	7	239	0.047348	0.91	0.16	0.42	0.04
	Low	IN1L - C	3	3	182	0.025559	0.38	0.15	0.24	0.04
	Low	IN2L - A	5	5	21	0.001176	1.31	0.81	1.88	0.17
	Low	IN2L - B	5	5	23	0.008200	1.28	0.84	1.95	0.48
	Low	IN2L - C	3	3	12	0.000520	0.80	0.66	1.04	0.25
	Low	IN3L - A	3	3	10	0.008146	0.87	0.96	1.52	0.78
	Low	IN3L - B	5	5	13	0.004322	1.56	0.91	2.10	0.62
	Low	IN3L - C	3	3	3	0.001516	1.82	1.00	1.58	0.96
	Mid	IN1M - A	4	4	72	0.007856	0.70	0.58	1.17	0.06
	Mid	IN1M - B	4	4	82	0.011062	0.68	0.52	1.03	0.04
	Mid	IN1M - C	2	2	35	0.007323	0.28	0.97	0.97	0.51
	Mid	IN2M - A	4	4	60	0.008485	0.73	0.65	1.30	-0.25
	Mid	IN2M - B	3	3	36	0.003529	0.56	0.77	1.22	0.15
	Mid	IN2M - C	5	5	35	0.009290	1.13	0.68	1.57	0.13
	Mid	IN3M - A	5	5	7	0.006129	2.06	0.96	2.24	0.72
	Mid	IN3M - B	6	6	48	0.016598	1.29	0.75	1.94	0.26
	Mid	IN3M - C	6	6	39	0.031992	1.36	0.86	2.23	0.51
	Upper	IN1U - A	9	9	149	0.050933	1.60	0.48	1.51	0.07
	Upper	IN1U - B	7	8	145	0.049662	1.21	0.50	1.39	0.03
	Upper	IN1U - C	8	8	58	0.034406	1.72	0.86	2.57	0.45
	Upper	IN2U - A	4	4	33	0.010821	0.86	0.29	0.58	-0.29
	Upper	IN2U - B	4	4	103	0.019787	0.65	0.42	0.83	0.03
	Upper	IN2U - C	5	5	82	0.026875	0.91	0.30	0.69	-0.16
	Upper	IN3U - A	5	5	38	0.005120	1.10	0.63	1.46	-0.02
	Upper	IN3U - B	6	6	33	0.002070	1.43	0.71	1.83	0.02
	Upper	IN3U - C	4	5	32	0.002928	0.87	0.42	0.84	0.14
Indirect South	Low	IS1L - A	3	3	7	0.003433	1.03	0.91	1.45	0.70
	Low	IS1L - B	2	3	8	0.011568	0.48	0.81	0.81	0.50
	Low	IS1L - C	3	3	3	0.001374	1.82	1.00	1.58	0.98
	Low	IS2L - A	2	2	3	0.012847	0.91	0.92	0.92	0.67
	Low	IS2L - B	4	4	14	0.009343	1.14	0.96	1.92	0.72
	Low	IS2L - C	3	4	10	0.001535	0.87	0.94	1.49	0.67
	Low	IS3L - A	9	10	15	0.005359	2.95	0.92	2.92	0.58
	Low	IS3L - B	4	4	7	0.011286	1.54	0.92	1.84	0.55
	Low	IS3L - C	5	5	12	0.022463	1.61	0.91	2.12	0.46
	Mid	IS1M - A	3	3	10	0.000698	0.87	0.73	1.16	0.04
	Mid	IS1M - B	4	4	10	0.045685	1.30	0.79	1.57	0.28
	Mid	IS1M - C	5	5	51	0.073251	1.02	0.70	1.64	0.26
	Mid	IS2M - A	8	8	51	0.032286	1.78	0.82	2.45	0.33
	Mid	IS2M - B	4	4	41	0.015799	0.81	0.97	1.93	0.75
	Mid	IS2M - C	7	7	79	0.052896	1.37	0.82	2.30	0.43
	Mid	IS3M - A	5	5	265	0.034207	0.72	0.58	1.34	-0.15
	Mid	IS3M - B	5	5	109	0.022085	0.85	0.57	1.32	-0.17
	Mid	IS3M - C	8	8	281	0.055061	1.24	0.45	1.36	-0.13
	Upper	IS1U - A	6	6	57	0.044186	1.24	0.56	1.46	0.24
	Upper	IS1U - B	4	4	8	0.000124	1.44	0.88	1.75	0.09
	Upper	IS1U - C	5	5	73	0.003476	0.93	0.49	1.14	0.02
	Upper	IS2U - A	4	4	10	0.039769	1.30	0.99	1.97	0.85
	Upper	IS2U - B	5	5	147	0.066391	0.80	0.74	1.72	0.37
	Upper	IS2U - C	9	9	72	0.021288	1.87	0.35	1.12	0.13
	Upper	IS3U - A	3	4	20	0.000790	0.67	0.47	0.75	0.14
	Upper	IS3U - B	3	4	28	0.001369	0.60	0.60	0.95	-0.16
	Upper	IS3U -C	1	1	8	0.000102	0.00		0.00	0.00

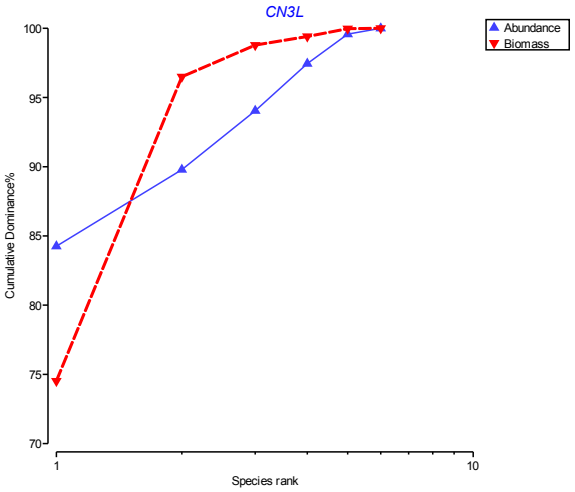
Appendix 4. Biological parameters at Cherry Cobb Sands (replicate data per 0.01m^2)

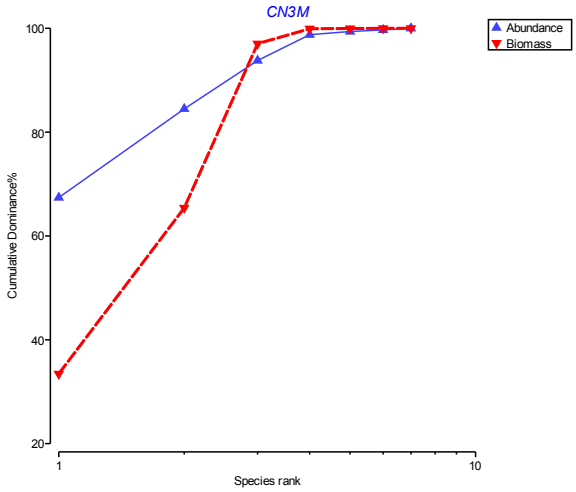
Area	Shore	Sample	Quantitative Taxa	Total Taxa	Numbers of Individuals	Biomass (AFDW g)	Margalef's d	Pielou's J	Shannon's H'	AFDW ABC w stat
Control North	Low	CCN1L- A	3	3	6	0.001011	1.12	0.92	1.46	0.54
	Low	CCN1L- B	3	3	10	0.004110	0.87	0.73	1.16	0.39
	Low	CCN1L- C	3	3	5	0.004639	1.24	0.86	1.37	0.18
	Mid	CCN1M- A	2	2	51	0.000418	0.25	0.75	0.75	0.37
	Mid	CCN1M- B	6	7	575	0.004887	0.79	0.52	1.34	-0.12
	Mid	CCN1M- C	9	10	754	0.270605	1.21	0.55	1.75	0.24
	Upper	CCN1U- A	7	7	62	0.066606	1.45	0.69	1.95	0.32
	Upper	CCN1U- B	6	6	28	0.105968	1.50	0.92	2.37	0.67
	Upper	CCN1U- C	2	2	11	0.022368	0.42	0.68	0.68	0.36
	Low	CCN2L- A	11	11	292	0.014523	1.76	0.66	2.29	0.14
	Low	CCN2L- B	2	2	8	0.003854	0.48	1.00	1.00	0.99
	Low	CCN2L- C	4	4	4	0.001489	2.16	1.00	2.00	0.75
	Mid	CCN2M- A	2	2	5	0.000032	0.62	0.72	0.72	-0.45
	Mid	CCN2M- B	3	3	18	0.000033	0.69	0.60	0.94	-0.47
	Mid	CCN2M- C	4	4	41	0.002229	0.81	0.70	1.41	0.33
	Upper	CCN2U- A	9	9	234	0.063058	1.47	0.44	1.39	0.09
	Upper	CCN2U- B	8	8	143	0.029893	1.41	0.62	1.85	0.16
	Upper	CCN2U- C	5	5	23	0.133510	1.28	0.75	1.74	0.41
	Low	CCN3L- A	3	3	10	0.014887	0.87	0.58	0.92	0.30
	Low	CCN3L- B	3	3	9	0.009710	0.91	0.88	1.39	0.65
	Low	CCN3L- C	4	4	7	0.018312	1.54	0.98	1.95	0.64
	Mid	CCN3M- A	8	9	694	0.008594	1.07	0.58	1.73	-0.17
	Mid	CCN3M- B	8	8	557	0.030055	1.11	0.56	1.68	0.11
	Mid	CCN3M- C	4	5	17	0.055519	1.06	0.48	0.95	0.02
	Upper	CCN3U- A	2	3	3	0.000046	0.91	0.92	0.92	-0.19
	Upper	CCN3U- B	1	1	1	0.000005			0.00	0.00
	Upper	CCN3U- C	1	1	1	0.000014			0.00	0.00
Control South	Low	CS1L - A	4	4	5	0.007219	1.86	0.96	1.92	0.49
	Low	CS1L - B	1	2	1	0.000670			0.00	0.00
	Low	CS1L - C	2	3	3	0.054151	0.91	0.92	0.92	0.67
	Mid	CS1M - A	11	11	147	0.114642	2.00	0.72	2.50	0.15
	Mid	CS1M - B	12	12	145	0.087978	2.21	0.72	2.56	0.14
	Mid	CS1M - C	12	12	299	0.150455	1.93	0.76	2.73	0.21
	Upper	CS1U -A	14	14	267	0.207744	2.33	0.63	2.41	0.15
	Upper	CS1U -B	12	12	299	0.159329	1.93	0.66	2.37	0.02
	Upper	CS1U -C	11	12	116	0.185532	2.10	0.74	2.55	0.26
	Low	CS2L -A	0	1	0	0.000016			0.00	0.00
	Low	CS2L -B	2	2	3	0.024365	0.91	0.92	0.92	-0.28
	Low	CS2L -C	2	3	4	0.011770	0.72	0.81	0.81	0.50
	Mid	CS2M - C	6	6	34	0.058681	1.42	0.58	1.50	0.21
	Mid	CS2M - B	10	10	59	0.150755	2.21	0.62	2.05	0.27
	Mid	CS2M - C	9	9	58	0.140753	1.97	0.62	1.96	0.24
	Upper	CS2U -A	13	14	208	0.215604	2.25	0.64	2.37	0.16
	Upper	CS2U - B	12	12	146	0.191339	2.21	0.66	2.38	0.17
	Upper	CS2U - C	7	8	53	0.089580	1.51	0.83	2.34	0.40
	Low	CS3L -A	3	3	3	0.002607	1.82	1.00	1.58	0.99
	Low	CS3L - B	1	2	1	0.000032			0.00	0.00
	Low	CS3L - C	2	2	3	0.003708	0.91	0.92	0.92	0.63
	Mid	CS3M - A	4	4	23	0.146216	0.96	0.58	1.15	0.26
	Mid	CS3M - B	5	5	20	0.113064	1.34	0.61	1.42	0.29
	Mid	CS3M - C	4	4	21	0.090287	0.99	0.64	1.28	0.23
	Upper	CS3U - A	12	12	246	0.160277	2.00	0.68	2.44	0.20
	Upper	CS3U - B	11	11	148	0.122656	2.00	0.80	2.77	0.31
	Upper	CS3U - C	10	10	247	0.127310	1.63	0.57	1.90	0.09

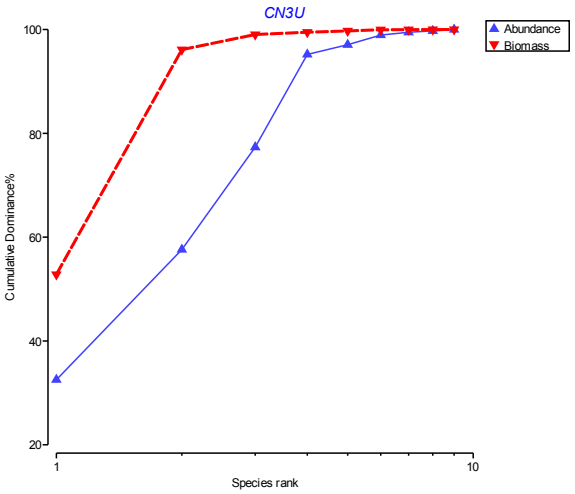
Area	Shore	Sample	Quantitative Taxa	Total Taxa	Numbers of Individuals	Biomass (AFDW g)	Margalef's d	Pielou's J	Shannon's H'	AFDW ABC w stat
	Low	I1L- A	1	1	1	0.000005			0.00	0.00
	Low	I1L- B	2	2	2	0.004395	1.44	1.00	1.00	0.71
	Low	I1L- C	1	1	1	0.001838			0.00	0.00
	Mid	I1M- A	9	9	209	0.238237	1.50	0.78	2.49	0.29
	Mid	I1M- B	15	15	516	0.027194	2.24	0.59	2.32	-0.07
	Mid	I1M- C	11	11	128	0.066469	2.06	0.79	2.74	0.35
	Upper	I1U- A	14	14	232	0.171721	2.39	0.53	2.01	0.13
	Upper	I1U- B	8	10	53	0.042025	1.76	0.58	1.74	0.20
	Upper	I1U- C	6	6	27	0.003212	1.52	0.90	2.34	0.36
	Low	I2L- A	3	3	12	0.013513	0.80	0.81	1.28	0.48
	Low	I2L- B	2	2	11	0.032352	0.42	0.44	0.44	0.18
	Low	I2L- C	2	2	9	0.012262	0.46	0.99	0.99	0.87
	Mid	I2M- A	12	12	178	0.136892	2.12	0.79	2.85	0.30
Impact	Mid	I2M- B	11	11	233	0.070155	1.83	0.64	2.22	0.14
	Mid	I2M- C	10	10	198	0.221045	1.70	0.62	2.07	0.15
	Upper	I2U- A	10	10	48	0.101514	2.32	0.88	2.92	0.39
	Upper	I2U- B	3	3	43	0.002824	0.53	0.95	1.51	0.33
	Upper	I2U- C	10	11	263	0.030368	1.62	0.76	2.53	0.01
	Low	I3l- A	6	7	12	0.033718	2.01	0.95	2.46	0.67
	Low	I3l- B	1	2	3	0.000069	0.00		0.00	0.00
	Low	I3l- C	4	4	6	0.003974	1.67	0.96	1.92	0.63
	Mid	I3M- A	8	8	54	0.019052	1.75	0.82	2.47	0.21
	Mid	I3M- B	11	12	170	0.071551	1.95	0.84	2.91	0.25
	Mid	I3M- C	12	12	561	0.113849	1.74	0.49	1.77	0.04
	Upper	I3U- A	2	3	13	0.000118	0.39	0.62	0.62	-0.04
	Upper	I3U- B	0	2	0	0.000491			0.00	0.00
	Upper	I3U- C	4	5	31	0.001230	0.87	0.97	1.93	0.42

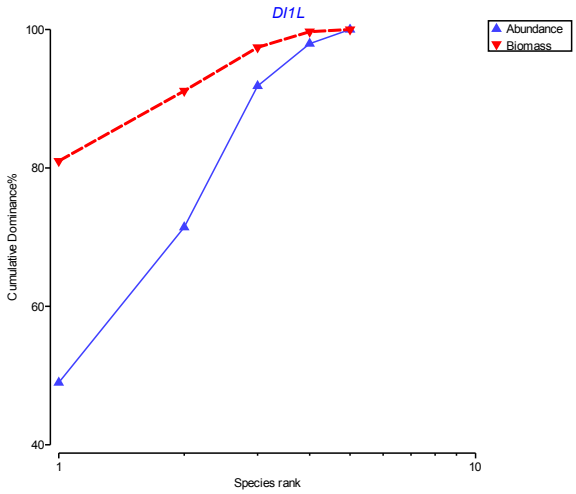
Appendix 5. ABC Curves per site (North Killingholme)

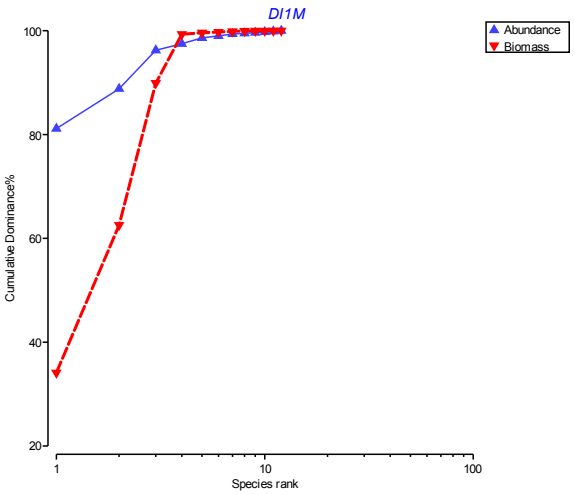


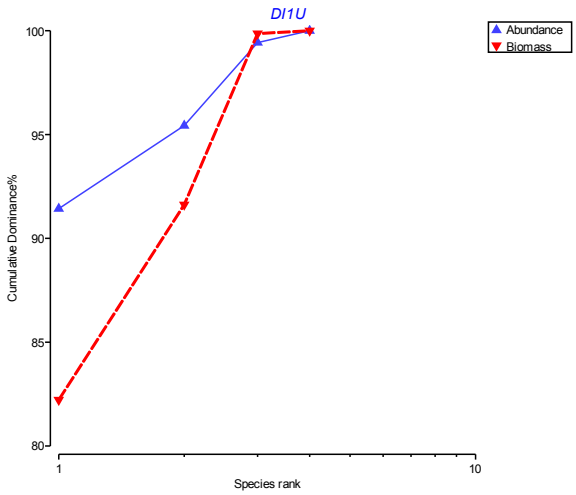

CN3L
Abundance
Biomass
Cumulative Dominance%
Species rank

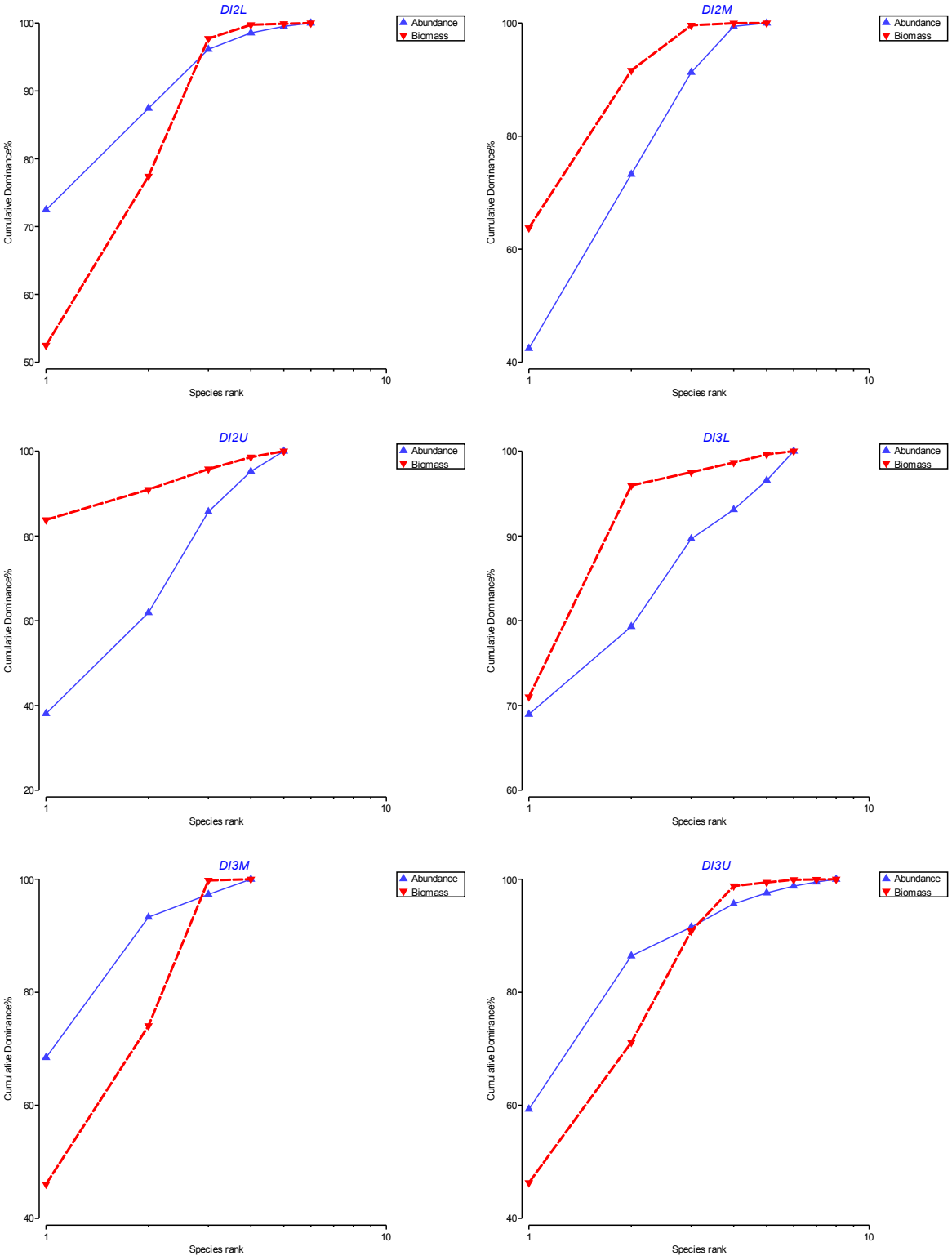

CN3M
Abundance
Biomass
Cumulative Dominance%
Species rank

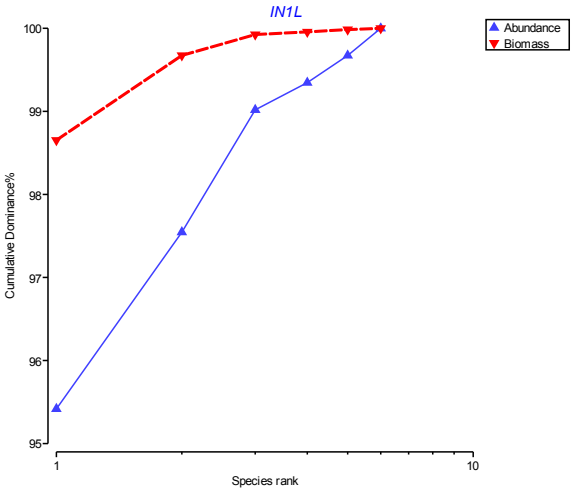

CN3U
Abundance
Biomass
Cumulative Dominance%
Species rank

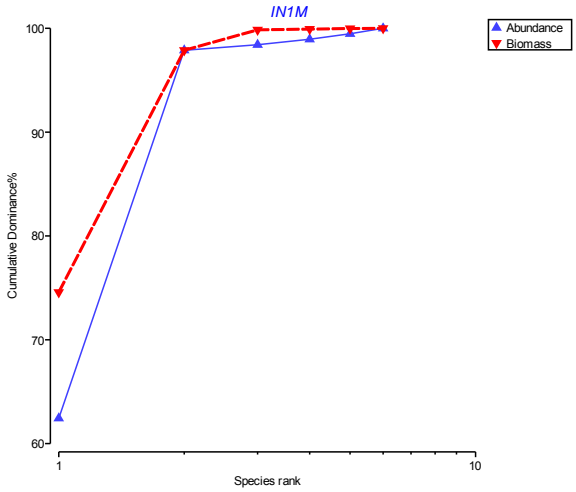

DI1L
Abundance
Biomass
Cumulative Dominance%
Species rank

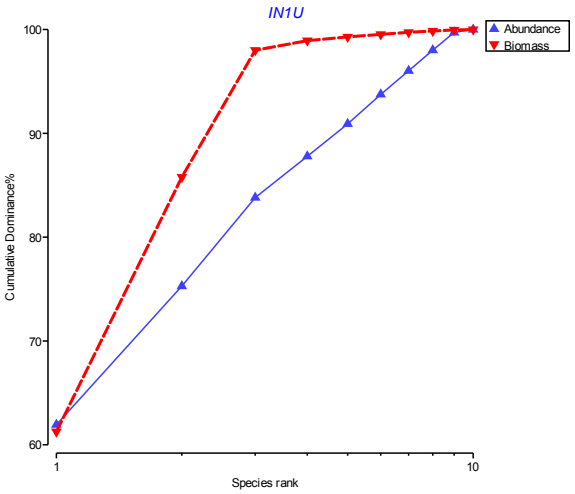

DI1M
Abundance
Biomass
Cumulative Dominance%
Species rank

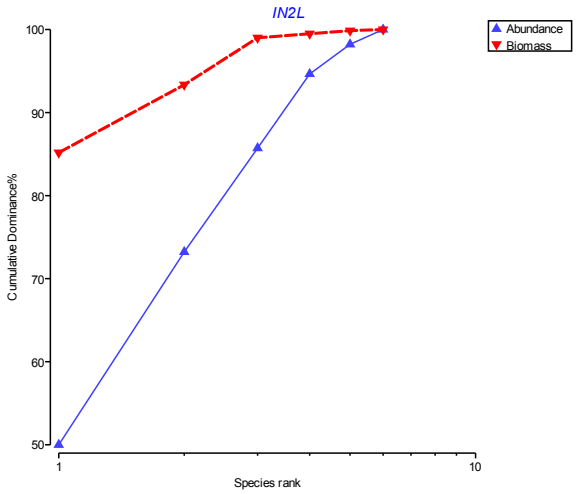

DI1U
Abundance
Biomass
Cumulative Dominance%
Species rank

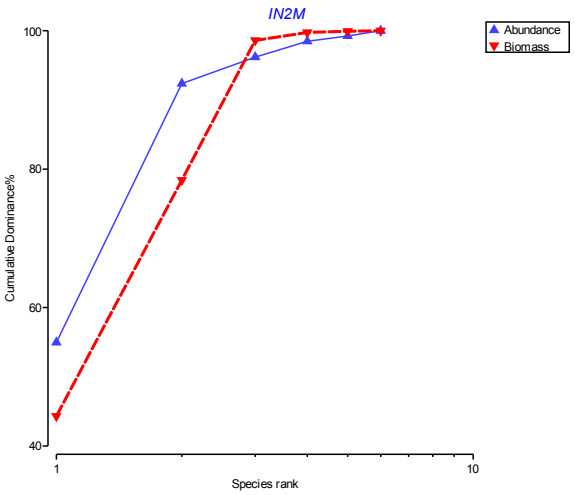

DI2L
DI2M
DI2U
DI3L
DI3M
DI3U
Abundance
Biomass
Cumulative Dominance%
Species rank
1
10

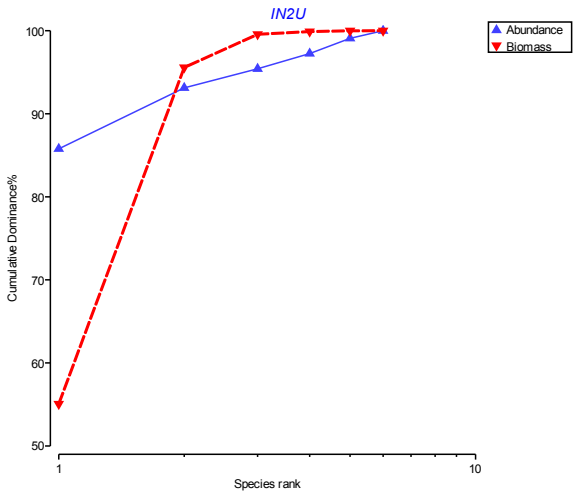

IN1L
Abundance
Biomass
Cumulative Dominance%
100
99
98
97
96
95
1
10
Species rank

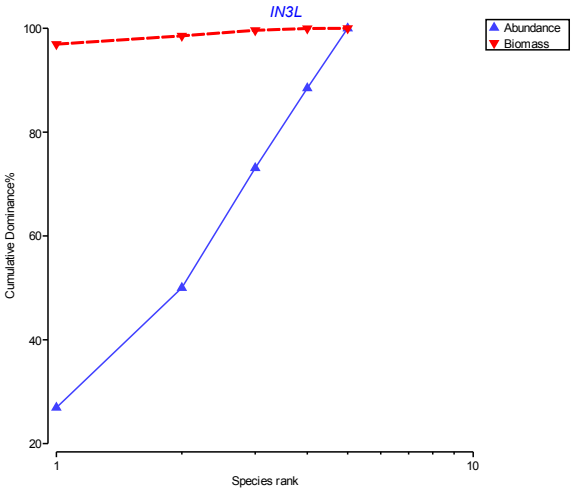

IN1M
Abundance
Biomass
Cumulative Dominance%
100
90
80
70
60
1
10
Species rank

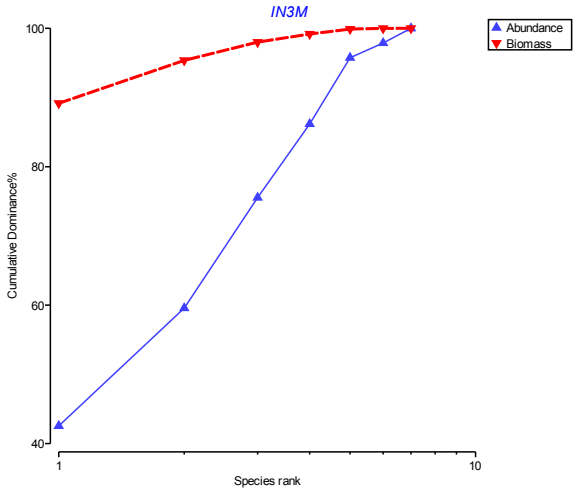

IN1U
Abundance
Biomass
Cumulative Dominance%
100
90
80
70
60
1
10
Species rank

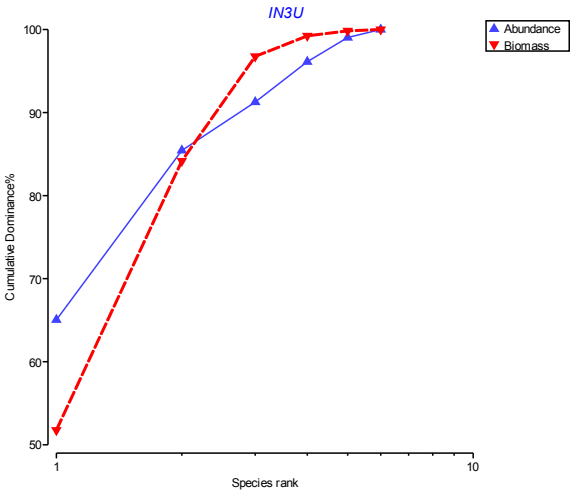

IN2L
Abundance
Biomass
Cumulative Dominance%
100
90
80
70
60
50
1
10
Species rank

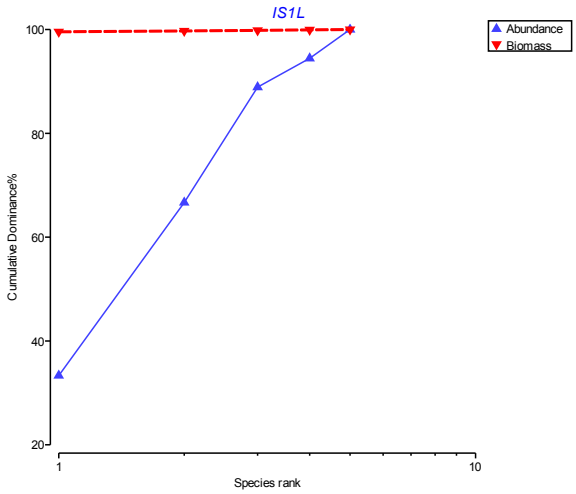

IN2M
Abundance
Biomass
Cumulative Dominance%
100
80
60
40
1
10
Species rank

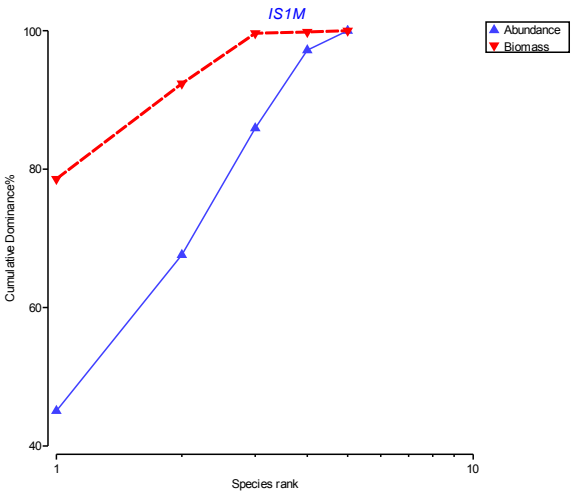

IN2U
Abundance
Biomass
Cumulative Dominance%
100
90
80
70
60
50
1
10
Species rank

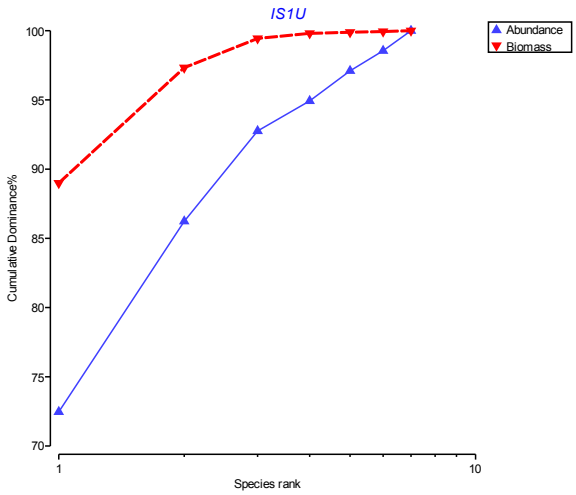

IN3L
Abundance
Biomass
Cumulative Dominance%
Species rank
100
80
60
40
20
1
10

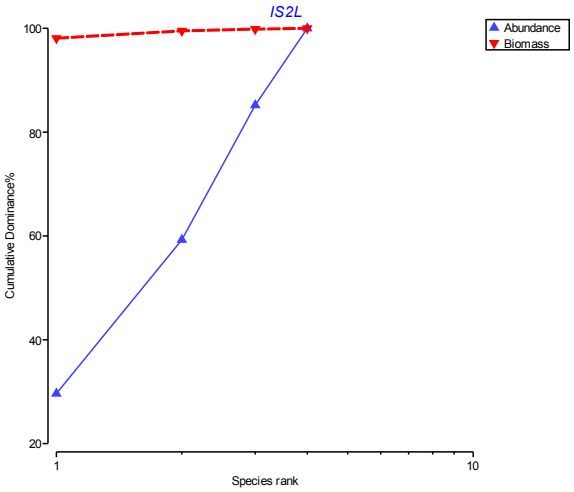

IN3M
Abundance
Biomass
Cumulative Dominance%
Species rank
100
80
60
40
1
10

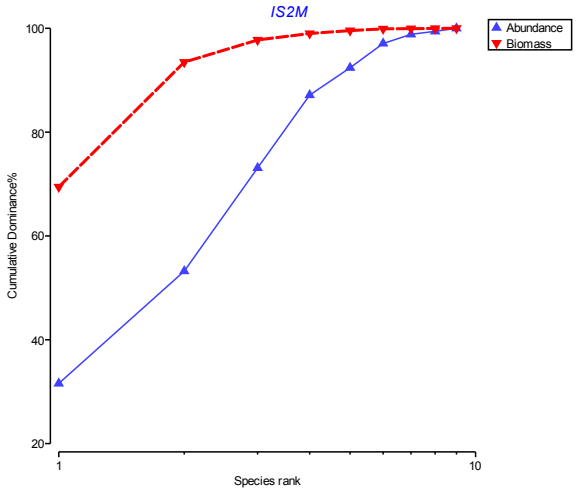

IN3U
Abundance
Biomass
Cumulative Dominance%
Species rank
100
90
80
70
60
50
1
10

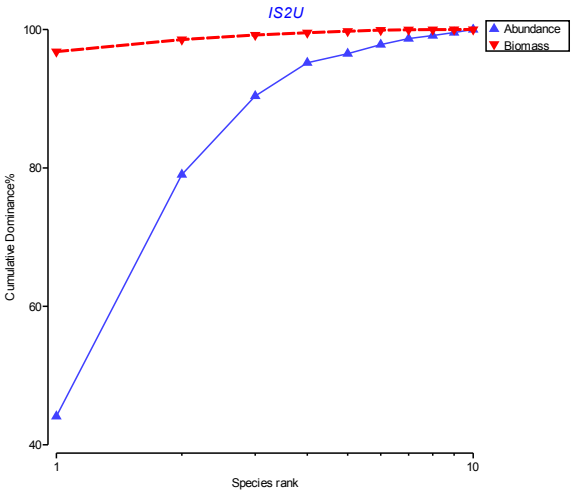

IS1L
Abundance
Biomass
Cumulative Dominance%
Species rank
100
80
60
40
20
1
10

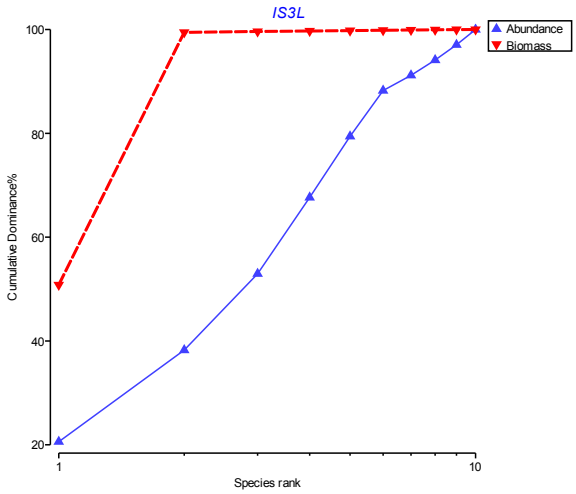

IS1M
Abundance
Biomass
Cumulative Dominance%
Species rank
100
80
60
40
1
10

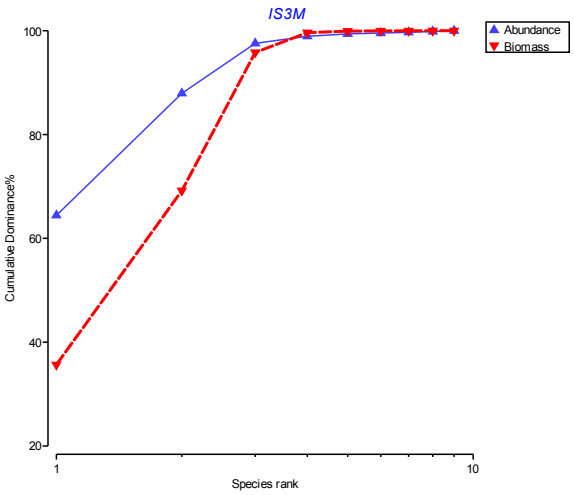

IS1U
Abundance
Biomass
Cumulative Dominance%
Species rank
100
95
90
85
80
75
70
1
10

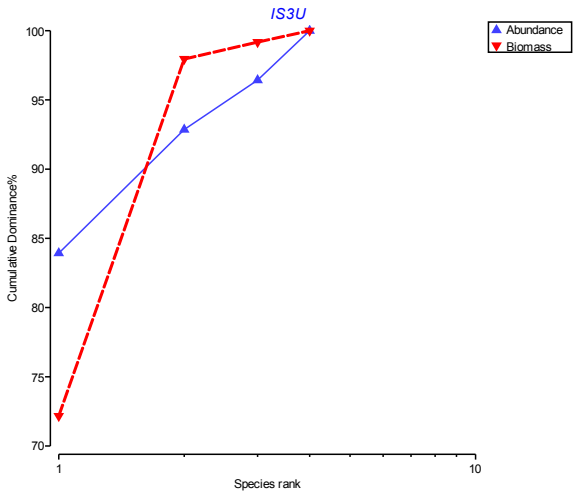

IS2L
Abundance
Biomass
Cumulative Dominance%
Species rank


IS2M
Abundance
Biomass
Cumulative Dominance%
Species rank

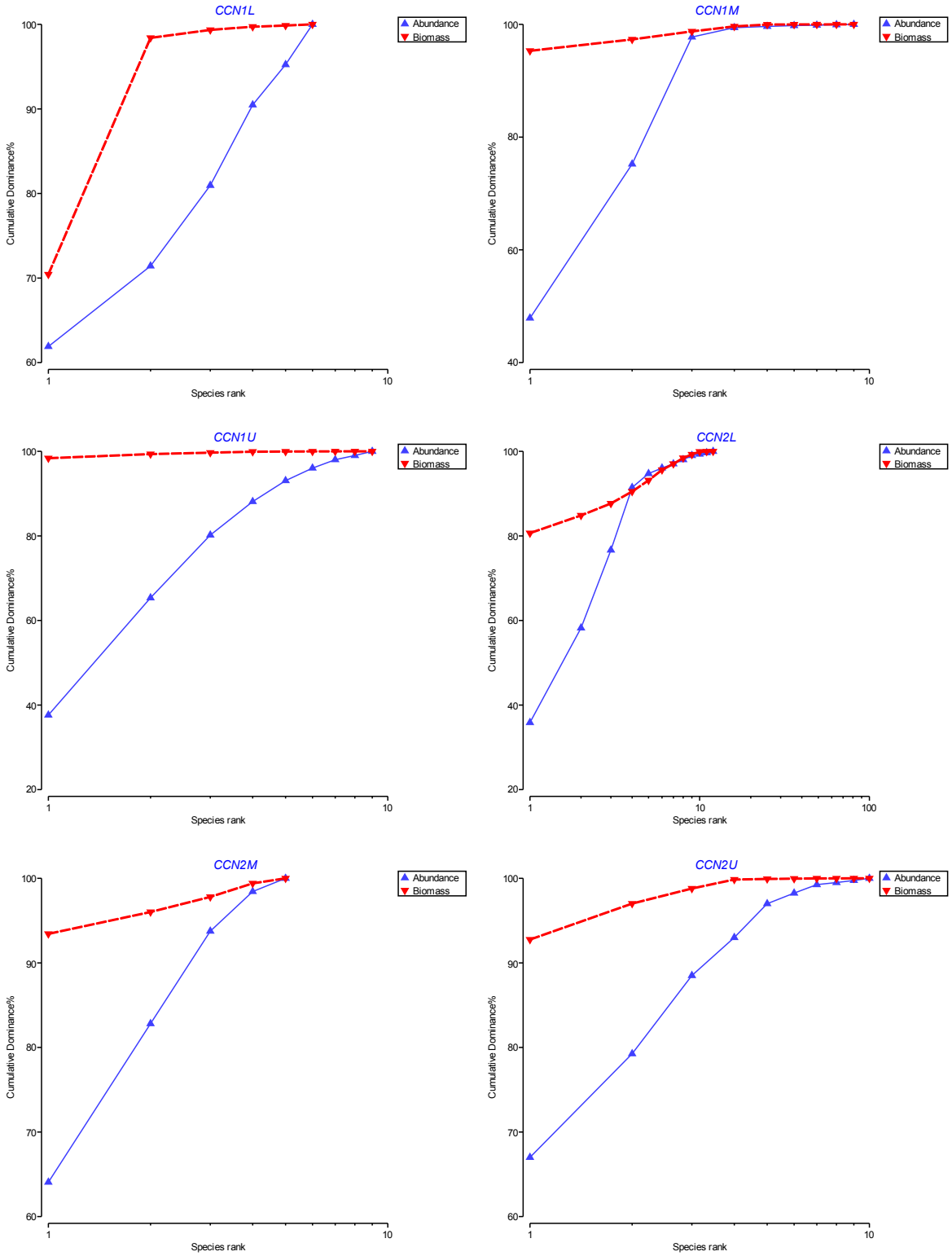

IS2U
Abundance
Biomass
Cumulative Dominance%
Species rank

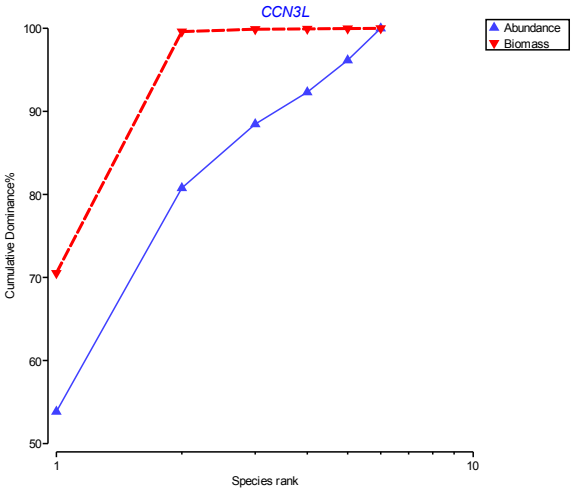

IS3L
Abundance
Biomass
Cumulative Dominance%
Species rank

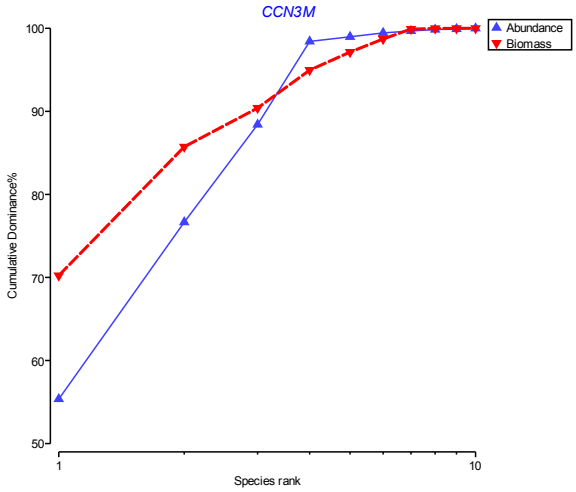

IS3M
Abundance
Biomass
Cumulative Dominance%
Species rank

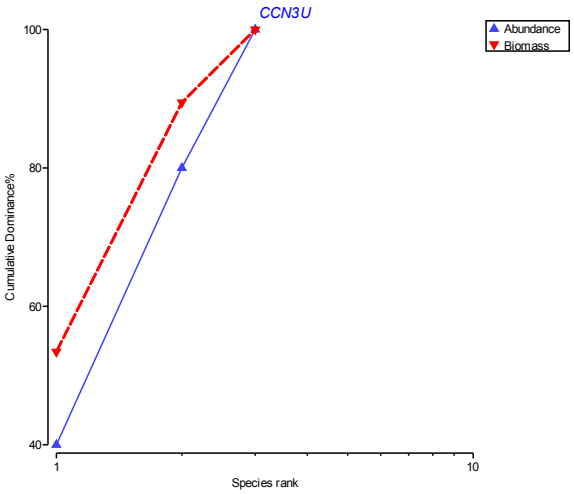

IS3U
Abundance
Biomass
Cumulative Dominance%
Species rank

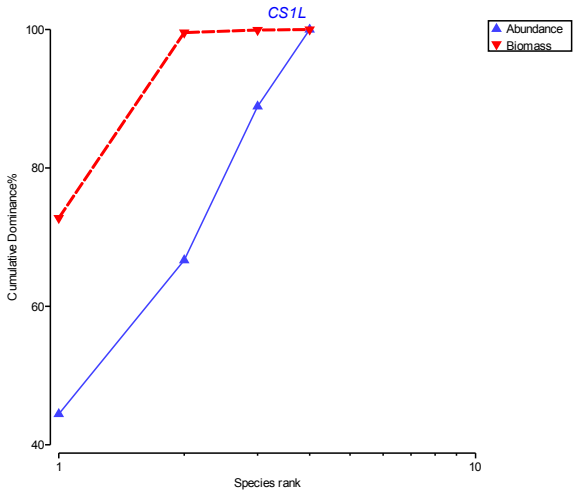
Appendix 6. ABC Curves per site (Cherry Cobb Sands)

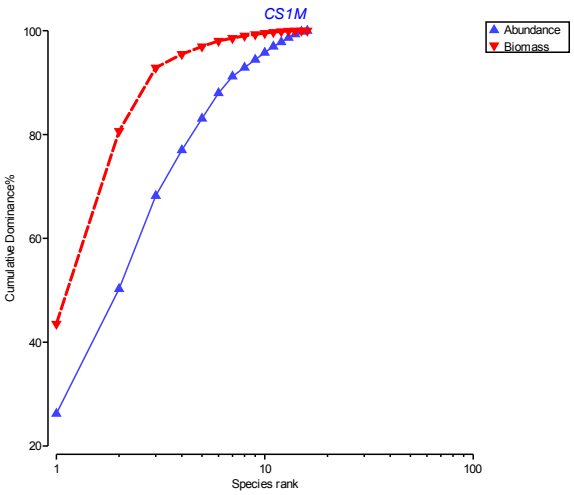


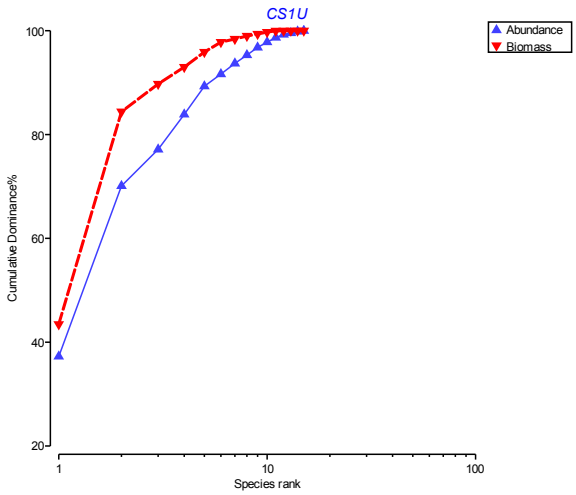

CCN3L
Abundance
Biomass
Cumulative Dominance%
Species rank
100
90
80
70
60
50
1
10

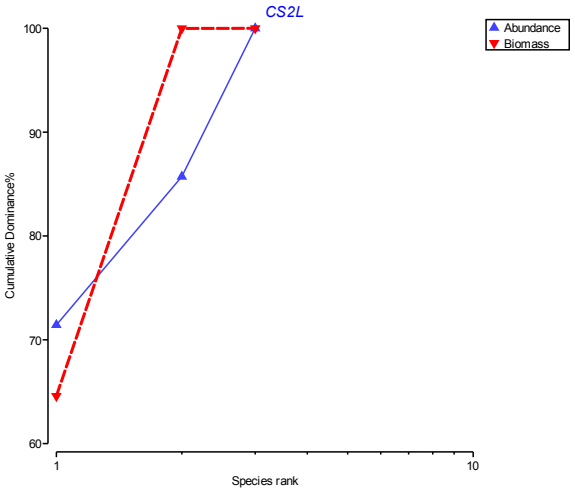

CCN3M
Abundance
Biomass
Cumulative Dominance%
Species rank
100
90
80
70
60
50
1
10

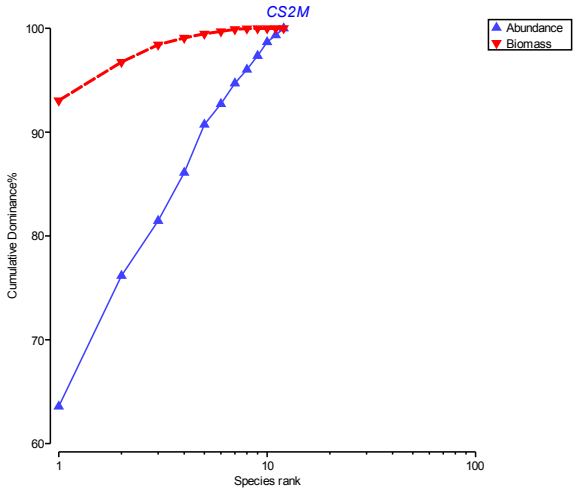

CCN3U
Abundance
Biomass
Cumulative Dominance%
Species rank
100
80
60
40
1
10

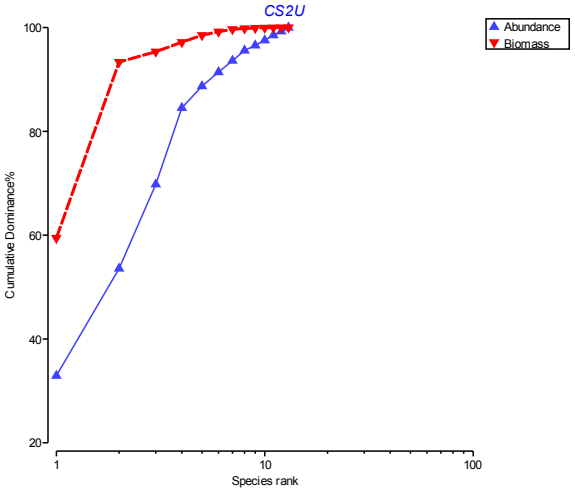

CS1L
Abundance
Biomass
Cumulative Dominance%
Species rank
100
80
60
40
1
10

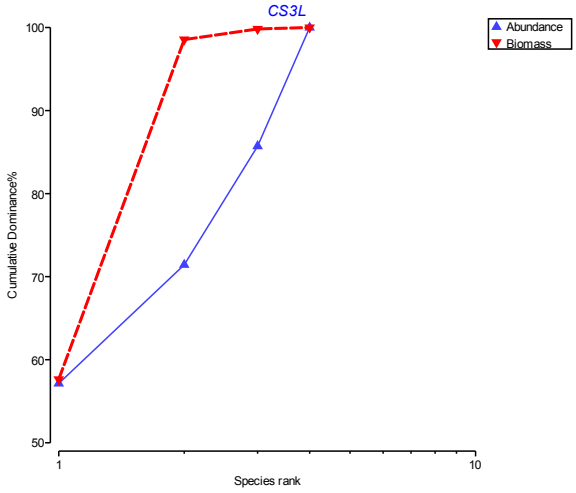

CS1M
Abundance
Biomass
Cumulative Dominance%
Species rank
100
80
60
40
20
1
10
100

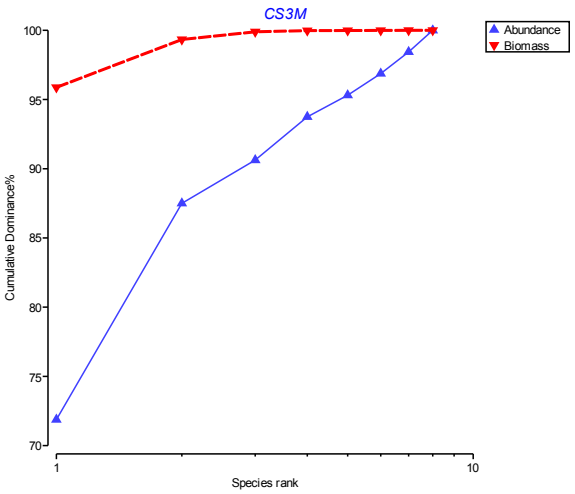

CS1U
Abundance
Biomass
Cumulative Dominance%
Species rank
100
80
60
40
20
1
10
100

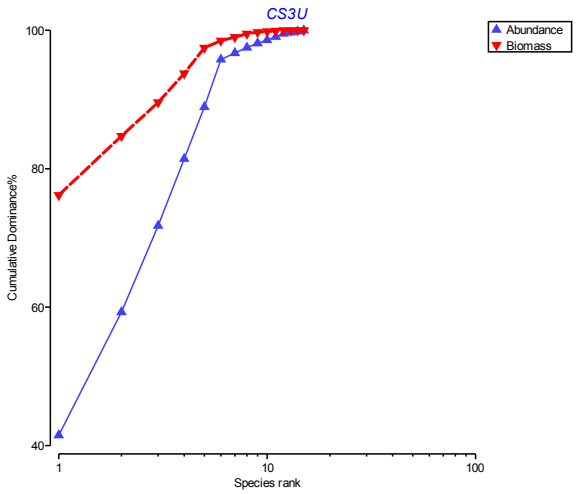

CS2L
Abundance
Biomass
Cumulative Dominance%
Species rank

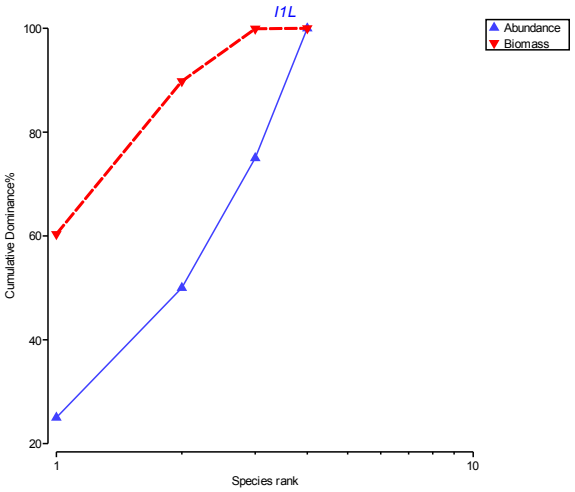

CS2M
Abundance
Biomass
Cumulative Dominance%
Species rank

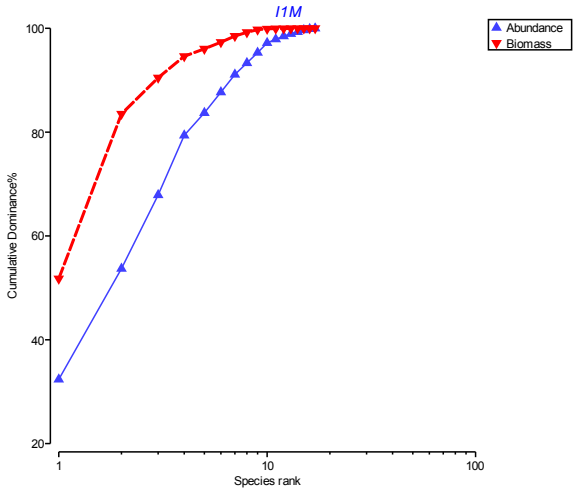

CS2U
Abundance
Biomass
Cumulative Dominance%
Species rank

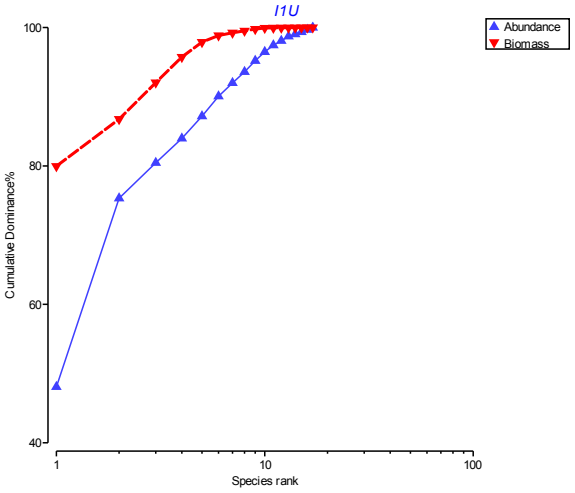

CS3L
Abundance
Biomass
Cumulative Dominance%
Species rank

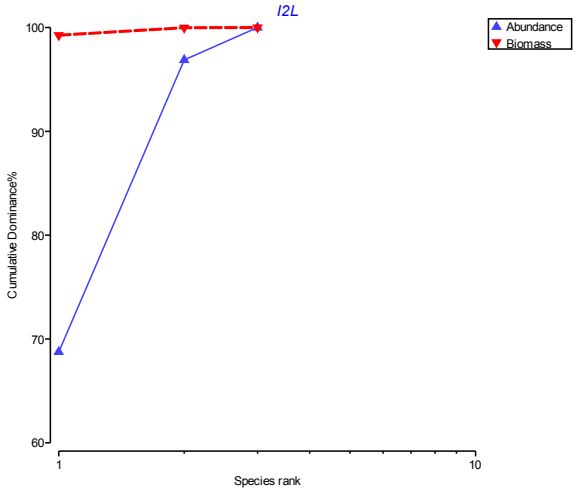

CS3M
Abundance
Biomass
Cumulative Dominance%
Species rank

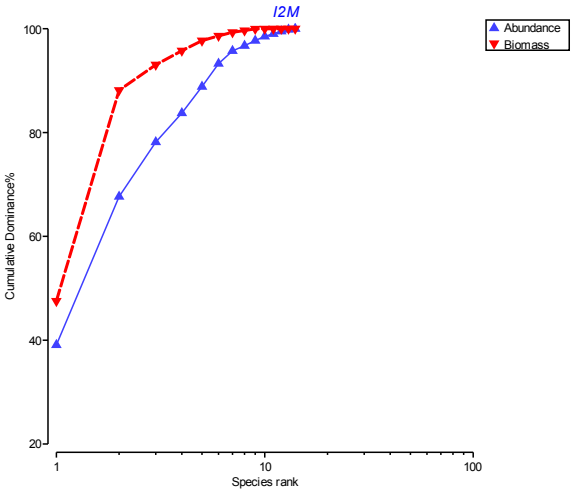

CS3U
Abundance
Biomass
Cumulative Dominance%
Species rank

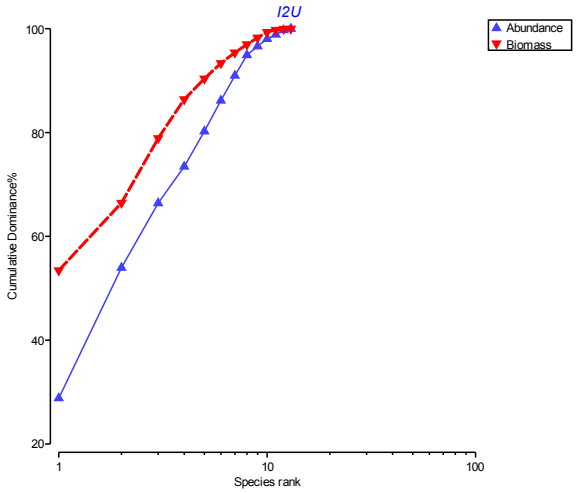

I1L
Abundance
Biomass
Cumulative Dominance%
Species rank

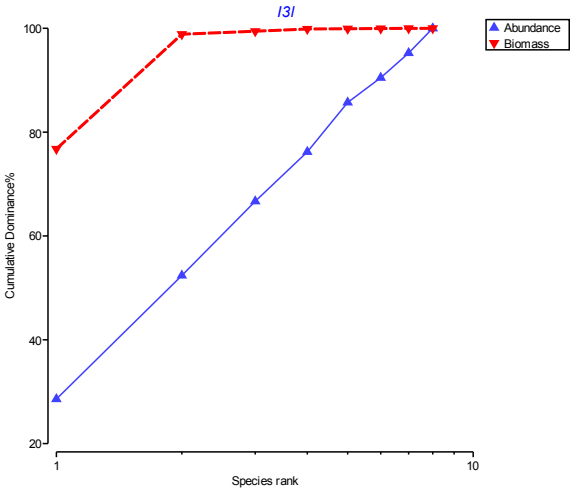

I1M
Abundance
Biomass
Cumulative Dominance%
Species rank

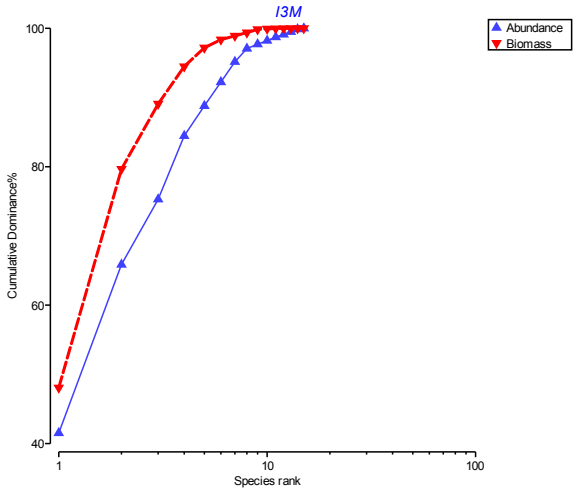

I1U
Abundance
Biomass
Cumulative Dominance%
Species rank

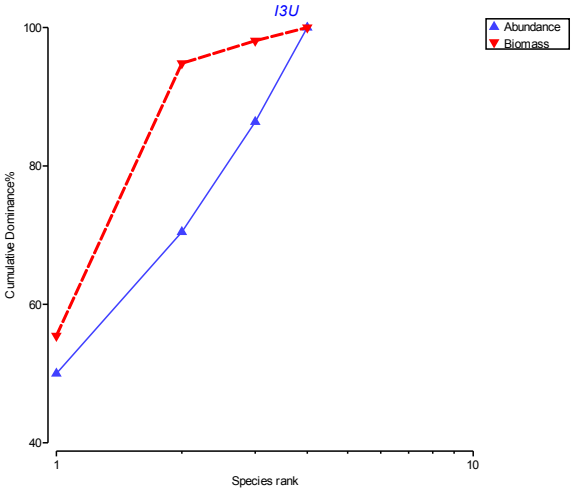

I2L
Abundance
Biomass
Cumulative Dominance%
Species rank


I2M
Abundance
Biomass
Cumulative Dominance%
Species rank


I2U
Abundance
Biomass
Cumulative Dominance%
Species rank


I3I
Abundance
Biomass
Cumulative Dominance%
Species rank
100
80
60
40
20
1
10


I3M
Abundance
Biomass
Cumulative Dominance%
Species rank
100
80
60
40
1
10
100


I3U
Abundance
Biomass
Cumulative Dominance%
Species rank
100
80
60
40
1
10

Appendix 7. Species data from North Killingholme

Abundance per 0.01m ^{2}	Qualifier	NKM CN1L-A	NKM CN1L-B	NKM CN1L-C	NKM CN1M-A	NKM CN1M-B	NKM CN1M-C	NKM CN1U-A	NKM CN1U-B	NKM CN1U-C	NKM CN2L-A	NKM CN2L-B	NKM CN2L-C	NKM CN2M-A	NKM CN2M-B	NKM CN2M-C
Acari spp.								1								
Aphelochaeta marioni																
Aphelochaeta/Tharyx sp.											1					
Bivalvia sp.	damaged															
Caridea sp.	damaged															
Collembola sp.																
Corophium volutator		13	4	13	100	81	80	38	91	81	7		6	69	87	64
Cyathura carinata							1									
Diptera spp. larvae								1								
Enchytraeidae spp.		1			2	9		10	35	33						
Eteone flava/longa agg.		1	1	3		1	1					2	2		1	
Gastropoda spp.	damaged															
Hediste diversicolor								2	3	6	1				1	
Baltidrilus costatus									5	4						
Peringia ulvae																
Jaera (Jaera) albifrons																
Limecola balthica		1			8	4	5			1	3			4	3	3
Manayunkia aestuarina																
Mysida sp.	damaged															
Nematoda					11	14	7	8	6	8	2			7	18	
Nephtys hombergii																
Nereididae spp. juvenile						3									1	
Platyhelminthes sp.																
Pygospio elegans													1			
Scrobicularia plana																
Spionidae sp.														P		
Streblospio shrubsolii		3	9	4		1					1	3	4		2	
Tellinoidea sp.																
Tharyx killariensis																
Tubificoides benedii		3	2		11	4	8			1	5	P	1	25	21	14
Tubificoides galiciensis																
Tubificoides swirencoides																
Tubificoides sp.																

AFDW Biomass (g) per 0.01m ^{2}	Qualifier	NKM CN1L-A	NKM CN1L-B	NKM CN1L-C	NKM CN1M-A	NKM CN1M-B	NKM CN1M-C	NKM CN1U-A	NKM CN1U-B	NKM CN1U-C	NKM CN2L-A	NKM CN2L-B	NKM CN2L-C	NKM CN2M-A	NKM CN2M-B	NKM CN2M-C
Acari spp.								0.000014								
Aphelochaeta marioni																
Aphelochaeta/Tharyx sp.											0.000016					
Bivalvia sp.	damaged															
Caridea sp.	damaged															
Collembola sp.																
Corophium volutator		0.001216	0.000688	0.001664	0.015616	0.014608	0.012960	0.006608	0.015040	0.009792	0.000304		0.000752	0.008640	0.016160	0.012960
Cyathura carinata							0.000426									
Diptera spp. larvae								0.000314								
Enchytraeidae spp.		0.000005			0.000005	0.000005		0.000065	0.000065	0.000054						
Eteone flava/longa agg.		0.000014	0.000014	0.000163		0.000381	0.000340					0.000014	0.000014		0.000014	
Gastropoda spp.	damaged															
Hediste diversicolor								0.007927	0.006303	0.025449	0.000060				0.003025	
Baltidrilus costatus									0.000016	0.000011						
Peringia ulvae																
Jaera (Jaera) albifrons																
Limecola balthica		0.000549			0.014638	0.021309	0.009550			0.013067	0.010325			0.010803	0.011110	0.010594
Manayunkia aestuarina																
Mysida sp.	damaged															
Nematoda					0.000018	0.000018	0.000018	0.000018	0.000018	0.000018	0.000018			0.000018	0.000018	
Nephtys hombergii																
Nereididae spp. juvenile						0.000015									0.000015	
Platyhelminthes sp.																
Pygospio elegans													0.000011			
Scrobicularia plana																
Spionidae sp.														0.000016		
Streblospio shrubsolii		0.000032	0.000640	0.000016		0.000016					0.000048	0.000016	0.000144		0.000016	
Tellinoidea sp.																
Tharyx killariensis																
Tubificoides benedii		0.000108	0.000022		0.000539	0.000140	0.000393			0.000005	0.000075	0.000005	0.000005	0.001294	0.001288	0.000992
Tubificoides galiciensis																
Tubificoides swirencoides																
Tubificoides sp.																

Abundance per 0.01m ^{2}	Qualifier	NKM CN2U-A	NKM CN2U-B	NKM CN2U-C	NKM CN3L-A	NKM CN3L-B	NKM CN3L-C	NKM CN3M-A	NKM CN3M-B	NKM CN3M-C	NKM CN3U-A	NKM CN3U-B	NKM CN3U-C	NKM DI1L-A	NKM DI1L-B	NKM DI1L-C
Acari spp.			3													
Aphelochaeta marioni																
Aphelochaeta/Tharyx sp.																
Bivalvia sp.	damaged															
Caridea sp.	damaged															
Collembola sp.													2			
Corophium volutator				1	65	63	70	65	74	78	8	2	84			
Cyathura carinata																
Diptera spp. larvae		1	2													
Enchytraeidae spp.				4							21	9	92			
Eteone flava/longa agg.					3	1	4									
Gastropoda spp.	damaged															
Hediste diversicolor												3	4			
Baltidrilus costatus		8	46	18							29	20	25			
Peringia ulvae																
Jaera (Jaera) albifrons																
Limecola balthica					2	2	1	6	4	6				1	1	1
Manayunkia aestuarina													1			
Mysida sp.	damaged															
Nematoda								8	19	3	12	5	50			
Nephtys hombergii																
Nereididae spp. juvenile					1							2	5			
Platyhelminthes sp.																
Pygospio elegans								1							1	
Scrobicularia plana								1								
Spionidae sp.																
Streblospio shrubsolii					11	1	1	1	1		1			6	2	2
Tellinoidea sp.																
Tharyx killariensis																
Tubificoides benedii					1	P	9	35	2	18				15	4	5
Tubificoides galiciensis																
Tubificoides swirencoides															7	4
Tubificoides sp.																

AFDW Biomass (g) per 0.01m ^{2}	Qualifier	NKM CN2U-A	NKM CN2U-B	NKM CN2U-C	NKM CN3L-A	NKM CN3L-B	NKM CN3L-C	NKM CN3M-A	NKM CN3M-B	NKM CN3M-C	NKM CN3U-A	NKM CN3U-B	NKM CN3U-C	NKM DI1L-A	NKM DI1L-B	NKM DI1L-C
Acari spp.			0.000014													
Aphelochaeta marioni																
Aphelochaeta/Tharyx sp.																
Bivalvia sp.	damaged															
Caridea sp.	damaged															
Collembola sp.													0.000014			
Corophium volutator				0.001440	0.011360	0.009440	0.017296	0.009120	0.014720	0.014704	0.007024	0.000112	0.033632			
Cyathura carinata																
Diptera spp. larvae		0.000096	0.000642													
Enchytraeidae spp.				0.000005							0.000043	0.000032	0.000340			
Eteone flava/longa agg.					0.000938	0.000014	0.000218									
Gastropoda spp.	damaged															
Hediste diversicolor												0.016107	0.033600			
Baltidrilus costatus		0.000097	0.002118	0.000647							0.001046	0.000889	0.000809			
Peringia ulvae																
Jaera (Jaera) albifrons																
Limecola balthica					0.004044	0.004780	0.002412	0.017913	0.005011	0.013924				0.000110	0.000005	0.002769
Manayunkia aestuarina													0.000016			
Mysida sp.	damaged															
Nematoda								0.000018	0.000018	0.000018	0.000018	0.000037	0.000184			
Nephtys hombergii																
Nereididae spp. juvenile					0.000015							0.000060	0.000149			
Platyhelminthes sp.																
Pygospio elegans								0.000011							0.000011	
Scrobicularia plana								0.036465								
Spionidae sp.																
Streblospio shrubsolii					0.000256	0.000016	0.000016	0.000016	0.000016		0.000016			0.000048	0.000016	0.000160
Tellinoidea sp.																
Tharyx killariensis																
Tubificoides benedii					0.000005	0.000005	0.000313	0.001763	0.000097	0.001461				0.000092	0.000108	0.000162
Tubificoides galiciensis																
Tubificoides swirencoides															0.000016	0.000065
Tubificoides sp.																

Abundance per 0.01m ^{2}	Qualifier	NKM DI1M-A	NKM DI1M-B	NKM DI1M-C	NKM DI1U-A	NKM DI1U-B	NKM DI1U-C	NKM DI2L-A	NKM DI2L-B	NKM DI2L-C	NKM DI2M-A	NKM DI2M-B	NKM DI2M-C	NKM DI2U-A	NKM DI2U-B	NKM DI2U-C
Acari spp.		1														
Aphelochaeta marioni		1														
Aphelochaeta/Tharyx sp.																
Bivalvia sp.	damaged															
Caridea sp.	damaged															
Collembola sp.														2	3	
Corophium volutator		43	3	13	6	1		6	16	9	7	14	32	8		
Cyathura carinata																
Diptera spp. larvae																
Enchytraeidae spp.														3	2	
Eteone flava/longa agg.		2	1						1	1						
Gastropoda spp.	damaged															
Hediste diversicolor				1												
Baltidrilus costatus					10	150								P	1	
Peringia ulvae																
Jaera (Jaera) albifrons																
Limecola balthica		4	4	2				2	2	1	7	6	1			
Manayunkia aestuarina																
Mysida sp.	damaged															
Nematoda		13	12	36		1			1		6	18	7			2
Nephtys hombergii																
Nereididae spp. juvenile																
Platyhelminthes sp.		1														
Pygospio elegans				1												
Scrobicularia plana																
Spionidae sp.																
Streblospio shrubsolii		8	1						5	13		1				
Tellinoidea sp.		3														
Tharyx killariensis																
Tubificoides benedii		455	30	160		5	2	49	42	59	3	42	28			
Tubificoides galiciensis																
Tubificoides swirencoides																
Tubificoides sp.																

AFDW Biomass (g) per 0.01m ^{2}	Qualifier	NKM DI1M-A	NKM DI1M-B	NKM DI1M-C	NKM DI1U-A	NKM DI1U-B	NKM DI1U-C	NKM DI2L-A	NKM DI2L-B	NKM DI2L-C	NKM DI2M-A	NKM DI2M-B	NKM DI2M-C	NKM DI2U-A	NKM DI2U-B	NKM DI2U-C
Acari spp.		0.000014														
Aphelochaeta marioni		0.000080														
Aphelochaeta/Tharyx sp.																
Bivalvia sp.	damaged															
Caridea sp.	damaged															
Collembola sp.														0.000014	0.000014	
Corophium volutator		0.004624	0.001280	0.004320	0.001232	0.000016		0.000512	0.001760	0.001408	0.002672	0.003872	0.008864	0.000320		
Cyathura carinata																
Diptera spp. larvae																
Enchytraeidae spp.														0.000005	0.000005	
Eteone flava/longa agg.		0.000122	0.000014						0.000014	0.000014						
Gastropoda spp.	damaged															
Hediste diversicolor				0.030843												
Baltidrilus costatus					0.000512	0.010403								0.000005	0.000005	
Peringia ulvae																
Jaera (Jaera) albifrons																
Limecola balthica		0.019583	0.014776	0.002638				0.003703	0.005764	0.000044	0.018270	0.015699	0.001291			
Manayunkia aestuarina																
Mysida sp.	damaged															
Nematoda		0.000110	0.000018	0.000020		0.000018			0.000018		0.000018	0.000166	0.000018			0.000018
Nephtys hombergii																
Nereididae spp. juvenile																
Platyhelminthes sp.		0.000025														
Pygospio elegans				0.000011												
Scrobicularia plana																
Spionidae sp.																
Streblospio shrubsolii		0.000288	0.000016						0.000016	0.000352		0.000016				
Tellinoidea sp.		0.000012														
Tharyx killariensis																
Tubificoides benedii		0.015782	0.004970	0.008915		0.000954	0.000140	0.000798	0.002210	0.001509	0.000221	0.002506	0.001687			
Tubificoides galiciensis																
Tubificoides swirencoides																
Tubificoides sp.																

Abundance per 0.01m ^{2}	Qualifier	NKM DI3L-A	NKM DI3L-B	NKM DI3L-C	NKM DI3M-A	NKM DI3M-B	NKM DI3M-C	NKM DI3U-A	NKM DI3U-B	NKM DI3U-C	NKM IN1L-A	NKM IN1L-B	NKM IN1L-C	NKM IN1M-A	NKM IN1M-B	NKM IN1M-C
Acari spp.																
Aphelochaeta marioni																
Aphelochaeta/Tharyx sp.																
Bivalvia sp.	damaged													1		
Caridea sp.	damaged						P									
Collembola sp.																
Corophium volutator		2	1		7	7	23	121	81	43	181	226	176	40	57	21
Cyathura carinata												2				
Diptera spp. larvae																
Enchytraeidae spp.																
Eteone flava/longa agg.			1					1	1							
Gastropoda spp.	damaged						P									
Hediste diversicolor									5	3						
Baltidrilus costatus				1												
Peringia ulvae																
Jaera (Jaera) albifrons											1	1				
Limecola balthica					2	2	2	1		2					1	
Manayunkia aestuarina																
Mysida sp.	damaged											P				
Nematoda					2	1	1	4	11	2					1	
Nephtys hombergii																
Nereididae spp. juvenile								1	2	2				1		
Platyhelminthes sp.																
Pygospio elegans		1		2							4	3	2			
Scrobicularia plana																
Spionidae sp.																
Streblospio shrubsolii		1						2	12	7		2				
Tellinoidea sp.																
Tharyx killariensis																
Tubificoides benedii		9	5	6	48	19	35	53	27	32	4	5	4	30	23	14
Tubificoides galiciensis																
Tubificoides swirencoides																
Tubificoides sp.																

AFDW Biomass (g) per 0.01m ^{2}	Qualifier	NKM DI3L-A	NKM DI3L-B	NKM DI3L-C	NKM DI3M-A	NKM DI3M-B	NKM DI3M-C	NKM DI3U-A	NKM DI3U-B	NKM DI3U-C	NKM IN1L-A	NKM IN1L-B	NKM IN1L-C	NKM IN1M-A	NKM IN1M-B	NKM IN1M-C
Acari spp.																
Aphelochaeta marioni																
Aphelochaeta/Tharyx sp.																
Bivalvia sp.	damaged													0.000006		
Caridea sp.	damaged						0.000017									
Collembola sp.																
Corophium volutator		0.000016	0.000336		0.003920	0.003056	0.005552	0.020096	0.024160	0.007344	0.029984	0.046112	0.025456	0.004752	0.008544	0.006272
Cyathura carinata												0.001051				
Diptera spp. larvae																
Enchytraeidae spp.																
Eteone flava/longa agg.			0.000014					0.000286	0.000245							
Gastropoda spp.	damaged						0.000014									
Hediste diversicolor									0.018461	0.009208						
Baltidrilus costatus				0.000005												
Peringia ulvae																
Jaera (Jaera) albifrons											0.000014	0.000014				
Limecola balthica					0.004313	0.001940	0.000747	0.008352		0.013605					0.000517	
Manayunkia aestuarina																
Mysida sp.	damaged											0.000031				
Nematoda					0.000018	0.000018	0.000018	0.000018	0.000018	0.000018					0.000018	
Nephtys hombergii																
Nereididae spp. juvenile								0.000015	0.000015	0.000015				0.000015		
Platyhelminthes sp.																
Pygospio elegans		0.000011		0.000011							0.000011	0.000011	0.000011			
Scrobicularia plana																
Spionidae sp.																
Streblospio shrubsolii		0.000016						0.000064	0.000400	0.000240		0.000016				
Tellinoidea sp.																
Tharyx killariensis																
Tubificoides benedii		0.000393	0.000270	0.000340	0.003579	0.001692	0.002350	0.004350	0.002237	0.002302	0.000054	0.000113	0.000092	0.003083	0.001984	0.001051
Tubificoides galiciensis																
Tubificoides swirencoides																
Tubificoides sp.																

Abundance per 0.01m²	Qualifier	NKM IN1U-A	NKM IN1U-B	NKM IN1U-C	NKM IN2L-A	NKM IN2L-B	NKM IN2L-C	NKM IN2M-A	NKM IN2M-B	NKM IN2M-C	NKM IN2U-A	NKM IN2U-B	NKM IN2U-C	NKM IN3L-A	NKM IN3L-B	NKM IN3L-C
Acari spp.																
Aphelochaeta marioni																
Aphelochaeta/Tharyx sp.																
Bivalvia sp.	damaged															
Caridea sp.	damaged															
Collembola sp.																
Corophium volutator		108	110		4	9		21	13	15	30	84	73		4	
Cyathura carinata																
Diptera spp. larvae																
Enchytraeidae spp.		16	8	23								16			3	
Eteone flava/longa agg.		1					1	1								
Gastropoda spp.	damaged															
Hediste diversicolor		3	4	4							1	1	3			
Baltidrilus costatus			3	4												
Peringia ulvae																
Jaera (Jaera) albifrons																
Limecola balthica		1	5	4	2	3		3		2	1		1	2	4	1
Manayunkia aestuarina																
Mysida sp.	damaged															
Nematoda		5	5	4	1	1			2	1	1	2	1			
Nephtys hombergii																
Nereididae spp. juvenile		1		5												
Platyhelminthes sp.																
Pygospio elegans																
Scrobicularia plana																
Spionidae sp.																
Streblospio shrubsolii		9	10	11	3	2	2			1				4	1	1
Tellinoidea sp.																
Tharyx killariensis																
Tubificoides benedii		5	P	3	11	8	9	35	21	16			4	4	1	1
Tubificoides galiciensis																
Tubificoides swirencoides																
Tubificoides sp.																

AFDW Biomass (g) per 0.01m²	Qualifier	NKM IN1U-A	NKM IN1U-B	NKM IN1U-C	NKM IN2L-A	NKM IN2L-B	NKM IN2L-C	NKM IN2M-A	NKM IN2M-B	NKM IN2M-C	NKM IN2U-A	NKM IN2U-B	NKM IN2U-C	NKM IN3L-A	NKM IN3L-B	NKM IN3L-C
Acari spp.																
Aphelochaeta marioni																
Aphelochaeta/Tharyx sp.																
Bivalvia sp.	damaged															
Caridea sp.	damaged															
Collembola sp.																
Corophium volutator		0.017104	0.016000		0.000320	0.000240		0.002208	0.002416	0.002640	0.002704	0.016336	0.012608		0.000224	
Cyathura carinata																
Diptera spp. larvae																
Enchytraeidae spp.		0.000005	0.000005	0.000124								0.000005			0.000005	
Eteone flava/longa agg.		0.000326					0.000014	0.000245								
Gastropoda spp.	damaged															
Hediste diversicolor		0.032378	0.027118	0.023199							0.006154	0.003427	0.013708			
Baltidrilus costatus			0.000086	0.000092												
Peringia ulvae																
Jaera (Jaera) albifrons																
Limecola balthica		0.000352	0.006044	0.010105	0.000687	0.007742		0.003703		0.005737	0.001945		0.000352	0.008011	0.004072	0.001473
Manayunkia aestuarina																
Mysida sp.	damaged															
Nematoda		0.000018	0.000018	0.000018	0.000018	0.000018			0.000018	0.000018	0.000018	0.000018	0.000018			
Nephtys hombergii																
Nereididae spp. juvenile		0.000015		0.000253												
Platyhelminthes sp.																
Pygospio elegans																
Scrobicularia plana																
Spionidae sp.																
Streblospio shrubsolii		0.000384	0.000384	0.000480	0.000016	0.000016	0.000016			0.000016				0.000016	0.000016	0.000016
Tellinoidea sp.																
Tharyx killariensis																
Tubificoides benedii		0.000350	0.000005	0.000135	0.000135	0.000183	0.000490	0.002328	0.001094	0.000879			0.000189	0.000119	0.000005	0.000027
Tubificoides galiciensis																
Tubificoides swirencoides																
Tubificoides sp.																

Abundance per 0.01m²	Qualifier	NKM IN3M-A	NKM IN3M-B	NKM IN3M-C	NKM IN3U-A	NKM IN3U-B	NKM IN3U-C	NKM IS1L-A	NKM IS1L-B	NKM IS1L-C	NKM IS1M-A	NKM IS1M-B	NKM IS1M-C	NKM IS1U-A	NKM IS1U-B	NKM IS1U-C
Acari spp.														2		1
Aphelochaeta marioni																
Aphelochaeta/Tharyx sp.																
Bivalvia sp.	damaged															
Caridea sp.	damaged															
Collembola sp.															1	1
Corophium volutator			25	15	23	17	27	1			2	2	28			
Cyathura carinata																
Diptera spp. larvae														2		7
Enchytraeidae spp.				2												
Eteone flava/longa agg.																
Gastropoda spp.	damaged															
Hediste diversicolor		1	1		2	1						6	10	2		
Baltidrilus costatus											7		1	40	4	56
Peringia ulvae																
Jaera (Jaera) albifrons																
Limecola balthica		2	2	5				3	2	1		1	1			
Manayunkia aestuarina														9	2	8
Mysida sp.	damaged															
Nematoda		1	10	5	1	1	3		6		1	1	11	2	1	
Nephtys hombergii																
Nereididae spp. juvenile						1	P									
Platyhelminthes sp.																
Pygospio elegans										1						
Scrobicularia plana																
Spionidae sp.																
Streblospio shrubsolii		1	4	10	11	9	1									
Tellinoidea sp.																
Tharyx killariensis																
Tubificoides benedii		2	6	2	1	4	1	3		1						
Tubificoides galiciensis																
Tubificoides swirencoides																
Tubificoides sp.									P							

AFDW Biomass (g) per 0.01m²	Qualifier	NKM IN3M-A	NKM IN3M-B	NKM IN3M-C	NKM IN3U-A	NKM IN3U-B	NKM IN3U-C	NKM IS1L-A	NKM IS1L-B	NKM IS1L-C	NKM IS1M-A	NKM IS1M-B	NKM IS1M-C	NKM IS1U-A	NKM IS1U-B	NKM IS1U-C
Acari spp.														0.000014		0.000014
Aphelochaeta marioni																
Aphelochaeta/Tharyx sp.																
Bivalvia sp.	damaged															
Caridea sp.	damaged															
Collembola sp.															0.000014	0.000014
Corophium volutator			0.002352	0.001040	0.001664	0.001152	0.001920	0.000016			0.000464	0.000160	0.008080			
Cyathura carinata																
Diptera spp. larvae														0.000137		0.000874
Enchytraeidae spp.				0.000005												
Eteone flava/longa agg.																
Gastropoda spp.	damaged															
Hediste diversicolor		0.000432	0.001013		0.002712	0.000253						0.033287	0.060718	0.042525		
Baltidrilus costatus											0.000216		0.000005	0.001477	0.000075	0.002431
Peringia ulvae																
Jaera (Jaera) albifrons																
Limecola balthica		0.005550	0.012962	0.030276				0.003396	0.011545	0.001357		0.012220	0.004264			
Manayunkia aestuarina														0.000016	0.000016	0.000144
Mysida sp.	damaged															
Nematoda		0.000018	0.000018	0.000018	0.000018	0.000018	0.000018		0.000018		0.000018	0.000018	0.000184	0.000018	0.000018	
Nephtys hombergii																
Nereididae spp. juvenile						0.000015	0.000969									
Platyhelminthes sp.																
Pygospio elegans										0.000011						
Scrobicularia plana																
Spionidae sp.																
Streblospio shrubsolii		0.000016	0.000064	0.000560	0.000720	0.000416	0.000016									
Tellinoidea sp.																
Tharyx killariensis																
Tubificoides benedii		0.000113	0.000189	0.000092	0.000005	0.000216	0.000005	0.000022		0.000005						
Tubificoides galiciensis																
Tubificoides swirencoides																
Tubificoides sp.									0.000005							

Abundance per 0.01m²	Qualifier	NKM IS2L-A	NKM IS2L-B	NKM IS2L-C	NKM IS2M-A	NKM IS2M-B	NKM IS2M-C	NKM IS2U-A	NKM IS2U-B	NKM IS2U-C	NKM IS3L-A	NKM IS3L-B	NKM IS3L-C	NKM IS3M-A	NKM IS3M-B	NKM IS3M-C
Acari spp.																
Aphelochaeta marioni																
Aphelochaeta/Tharyx sp.																
Bivalvia sp.	damaged															
Caridea sp.	damaged															
Collembola sp.					1		2	2		1	1		2			1
Corophium volutator			4		6	12	16			1	1			87	9	58
Cyathura carinata																
Diptera spp. larvae								2		1						
Enchytraeidae spp.					8											
Eteone flava/longa agg.														2		1
Gastropoda spp.	damaged								2							
Hediste diversicolor					2		7	3	7	1					1	
Baltidrilus costatus				P	20	14	20	3	74	3						
Peringia ulvae										1						
Jaera (Jaera) albifrons																
Limecola balthica		2	3	3	1						2	3	1	4	2	3
Manayunkia aestuarina									23	3						
Mysida sp.	damaged															
Nematoda			2	5	9	9	6		41	60	1			14	23	26
Nephtys hombergii											1	1	2			
Nereididae spp. juvenile											P					
Platyhelminthes sp.																
Pygospio elegans																1
Scrobicularia plana																
Spionidae sp.																
Streblospio shrubsolii							1				4	1				1
Tellinoidea sp.																
Tharyx killariensis											1					
Tubificoides benedii		1	5	2	4	6	27			1	3	2	2	158	74	190
Tubificoides galiciensis													5			
Tubificoides swirencoides											1					
Tubificoides sp.																

AFDW Biomass (g) per 0.01m²	Qualifier	NKM IS2L-A	NKM IS2L-B	NKM IS2L-C	NKM IS2M-A	NKM IS2M-B	NKM IS2M-C	NKM IS2U-A	NKM IS2U-B	NKM IS2U-C	NKM IS3L-A	NKM IS3L-B	NKM IS3L-C	NKM IS3M-A	NKM IS3M-B	NKM IS3M-C
Acari spp.																
Aphelochaeta marioni																
Aphelochaeta/Tharyx sp.																
Bivalvia sp.	damaged															
Caridea sp.	damaged															
Collembola sp.					0.000014		0.000014	0.000014		0.000014	0.000014		0.000014			0.000014
Corophium volutator			0.000336		0.005056	0.015392	0.003824			0.000016	0.000016			0.009648	0.001392	0.018608
Cyathura carinata																
Diptera spp. larvae								0.000833		0.000014						
Enchytraeidae spp.					0.000038											
Eteone flava/longa agg.														0.000313		0.000014
Gastropoda spp.	damaged								0.000414							
Hediste diversicolor					0.022618		0.047501	0.038874	0.064010	0.020488					0.004247	
Baltidrilus costatus				0.000005	0.000156	0.000124	0.000291	0.000049	0.001789	0.000383						
Peringia ulvae										0.000206						
Jaera (Jaera) albifrons																
Limecola balthica		0.012841	0.008924	0.001500	0.004319						0.001137	0.009374	0.009061	0.015545	0.005033	0.019116
Manayunkia aestuarina									0.000048	0.000016						
Mysida sp.	damaged															
Nematoda			0.000018	0.000018	0.000037	0.000202	0.000092		0.000129	0.000147	0.000018			0.000018	0.000018	0.000018
Nephtys hombergii											0.003518	0.001890	0.013335			
Nereididae spp. juvenile											0.000581					
Platyhelminthes sp.																
Pygospio elegans																0.000011
Scrobicularia plana																
Spionidae sp.																
Streblospio shrubsolii							0.000048				0.000048	0.000016				0.000016
Tellinoidea sp.																
Tharyx killariensis											0.000016					
Tubificoides benedii		0.000005	0.000065	0.000011	0.000049	0.000081	0.001127			0.000005	0.000005	0.000005	0.000016	0.008683	0.011394	0.017264
Tubificoides galiciensis													0.000038			
Tubificoides swirencoides											0.000005					
Tubificoides sp.																

Abundance per 0.01m²	Qualifier	NKM IS3U-A	NKM IS3U-B	NKM IS3U-C
Acari spp.				
Aphelochaeta marioni				
Aphelochaeta/Tharyx sp.				
Bivalvia sp.	damaged			
Caridea sp.	damaged			
Collembola sp.		1	4	
Corophium volutator			2	
Cyathura carinata				
Diptera spp. larvae				
Enchytraeidae spp.				
Eteone flava/longa agg.				
Gastropoda spp.	damaged	P	P	
Hediste diversicolor				
Baltidrilus costatus		17	22	8
Peringia ulvae				
Jaera (Jaera) albifrons				
Limecola balthica				
Manayunkia aestuarina				
Mysida sp.	damaged			
Nematoda		2		
Nephtys hombergii				
Nereididae spp. juvenile				
Platyhelminthes sp.				
Pygospio elegans				
Scrobicularia plana				
Spionidae sp.				
Streblospio shrubsolii				
Tellinoidea sp.				
Tharyx killariensis				
Tubificoides benedii				
Tubificoides galiciensis				
Tubificoides swirencoides				
Tubificoides sp.				

AFDW Biomass (g) per 0.01m²	Qualifier	NKM IS3U-A	NKM IS3U-B	NKM IS3U-C
Acari spp.				
Aphelochaeta marioni				
Aphelochaeta/Tharyx sp.				
Bivalvia sp.	damaged			
Caridea sp.	damaged			
Collembola sp.		0.000014	0.000014	
Corophium volutator			0.000576	
Cyathura carinata				
Diptera spp. larvae				
Enchytraeidae spp.				
Eteone flava/longa agg.				
Gastropoda spp.	damaged	0.000014	0.000014	
Hediste diversicolor				
Baltidrilus costatus		0.000744	0.000765	0.000102
Peringia ulvae				
Jaera (Jaera) albifrons				
Limecola balthica				
Manayunkia aestuarina				
Mysida sp.	damaged			
Nematoda		0.000018		
Nephtys hombergii				
Nereididae spp. juvenile				
Platyhelminthes sp.				
Pygospio elegans				
Scrobicularia plana				
Spionidae sp.				
Streblospio shrubsolii				
Tellinoidea sp.				
Tharyx killariensis				
Tubificoides benedii				
Tubificoides galiciensis				
Tubificoides swirencoides				
Tubificoides sp.				

Appendix 8. Species data from Cherry Cobb Sands

Abundance per 0.01m²	Qualifier	CCS CCN1L-A	CCS CCN1L-B	CCS CCN1L-C	CCS CCN1M-A	CCS CCN1M-B	CCS CCN1M-C	CCS CCN1U-A	CCS CCN1U-B	CCS CCN1U-C	CCS CCN2L-A	CCS CCN2L-B	CCS CCN2L-C	CCS CCN2M-A	CCS CCN2M-B	CCS CCN2M-C
Abra tenuis																
Acari spp.						1	1							1	3	3
Arenicola sp.																
Bivalvia sp. (juvenile/damaged)	inc. damaged							1			3					
Collembola spp.						11	385	265							1	
Copepoda spp.											3					
Corophium sp.																
Corophium volutator																
Crangonidae sp.																
Cyathura carinata																
Platyhelminthes (Dalyellidae) sp.																
Diptera sp. larvae						1	2	2								3
Enchytraeidae spp.						63	248	3			45				14	27
Eteone flava/longa agg.			1				1	3	5							
Gastropoda spp.	damaged					p										
Hediste diversicolor								10	9	9						
Baltidrilus costatus									5							
Limecola balthica		3	7	3							5	4	1			
Manayunkia aestuarina						11	12				109					
Mytilidae sp. juvenile																
Nematoda spp.		1		1	40	114	223	8	5	2	52	4		4		8
Nemertea spp.									1							
Nephtys caeca													1			
Nephtys cirrosa																
Nephtys hombergii				1							1					
Nereididae spp. (juvenile/damaged)	inc. damaged						P	35	3							
Orbiniidae sp.	damaged															
Paranais litoralis											68					
Peringia ulvae			2								2		1			
Pygospio elegans							1				1					
Retusa obtusa																
Scoloplos armiger																
Scrobicularia plana	inc. damaged						1									
Sphaerodoridium minutum																
Spionidae sp.	damaged															
Streblospio shrubsolii																
Tellinidae sp. (juvenile/damaged)	inc. damaged															
Tubificoides benedii		2									3		1			

AFDW Biomass (g) per 0.01m²	Qualifier	CCS CCN1L-A	CCS CCN1L-B	CCS CCN1L-C	CCS CCN1M-A	CCS CCN1M-B	CCS CCN1M-C	CCS CCN1U-A	CCS CCN1U-B	CCS CCN1U-C	CCS CCN2L-A	CCS CCN2L-B	CCS CCN2L-C	CCS CCN2M-A	CCS CCN2M-B	CCS CCN2M-C
Abra tenuis																
Acari spp.						0.000014	0.000014							0.000014	0.000014	0.000014
Arenicola sp.																
Bivalvia sp. (juvenile/damaged)	inc. damaged							0.000006			0.000006					
Collembola spp.						0.000014	0.002443	0.001147							0.000014	
Copepoda spp.											0.000165					
Corophium sp.																
Corophium volutator																
Crangonidae sp.																
Cyathura carinata																
Platyhelminthes (Dalyellidae) sp.																
Diptera sp. larvae						0.001297	0.003822	0.000437								0.002143
Enchytraeidae spp.						0.000183	0.000647	0.000005			0.000129				0.000005	0.000054
Eteone flava/longa agg.			0.000014				0.000014	0.000014	0.000653							
Gastropoda spp.	damaged					0.000014										
Hediste diversicolor								0.064249	0.105179	0.022350						
Baltidrilus costatus									0.000081							
Limecola balthica		0.000901	0.004083	0.001890							0.011242	0.003835	0.000945			
Manayunkia aestuarina						0.000016	0.000016				0.000832					
Mytilidae sp. juvenile																
Nematoda spp.		0.000018		0.000018	0.000405	0.000920	0.000938	0.000018	0.000018	0.000018	0.000258	0.000018		0.000018		0.000018
Nemertea spp.									0.000022							
Nephtys caeca													0.000525			
Nephtys cirrosa																
Nephtys hombergii				0.002730							0.000490					
Nereididae spp. (juvenile/damaged)	inc. damaged						0.022305	0.001877	0.000015							
Orbiniidae sp.	damaged															
Paranais litoralis											0.000561					
Peringia ulvae			0.000014								0.000549		0.000014			
Pygospio elegans							0.000011				0.000011					
Retusa obtusa																
Scoloplos armiger																
Scrobicularia plana	inc. damaged						0.241692									
Sphaerodoridium minutum																
Spionidae sp.	damaged															
Streblospio shrubsolii																
Tellinidae sp. (juvenile/damaged)	inc. damaged															
Tubificoides benedii		0.000092									0.000280		0.000005			

Abundance per 0.01m ^{2}	Qualifier	CCS CCN2U-A	CCS CCN2U-B	CCS CCN2U-C	CCS CCN3L-A	CCS CCN3L-B	CCS CCN3L-C	CCS CCN3M-A	CCS CCN3M-B	CCS CCN3M-C	CCS CCN3U-A	CCS CCN3U-B	CCS CCN3U-C	CCS I1L-A	CCS I1L-B	CCS I1L-C
Abra tenuis															1	
Acari spp.																
Arenicola sp.																
Bivalvia sp. (juvenile/damaged)	inc. damaged	4	1					6	1							
Collembola spp.			1			1		2			1		1			
Copepoda spp.																
Corophium sp.																
Corophium volutator																
Crangonidae sp.																
Cyathura carinata																
Platyhelminthes (Dalyellidae) sp.																
Diptera sp. larvae		2	1	1				1	1	1						
Enchytraeidae spp.		28	21					392	310							
Eteone flava/longa agg.																
Gastropoda spp.	damaged							p		p	p					
Hediste diversicolor		2	6	8				1	4	1						
Baltidrilus costatus		172	85	11								1				
Limecola balthica					8	4	2								1	
Manayunkia aestuarina		1					1	53	96							
Mytilidae sp. juvenile																
Nematoda spp.		5	12	1	1			137	119	14	2					
Nemertea spp.																
Nephtys caeca																
Nephtys cirrosa																
Nephtys hombergii							2									1
Nereididae spp. (juvenile/damaged)	inc. damaged	19	16	2												
Orbiniidae sp.	damaged															
Paranais litoralis																
Peringia ulvae																
Pygospio elegans								102	25							
Retusa obtusa																
Scoloplos armiger																
Scrobicularia plana	inc. damaged									1						
Sphaerodoridium minutum																
Spionidae sp.	damaged															
Streblospio shrubsolii																
Tellinidae sp. (juvenile/damaged)	inc. damaged															
Tubificoides benedii		1			1	4	2		1					1		

AFDW Biomass (g) per 0.01m ^{2}	Qualifier	CCS CCN2U-A	CCS CCN2U-B	CCS CCN2U-C	CCS CCN3L-A	CCS CCN3L-B	CCS CCN3L-C	CCS CCN3M-A	CCS CCN3M-B	CCS CCN3M-C	CCS CCN3U-A	CCS CCN3U-B	CCS CCN3U-C	CCS I1L-A	CCS I1L-B	CCS I1L-C
Abra tenuis															0.000631	
Acari spp.																
Arenicola sp.																
Bivalvia sp. (juvenile/damaged)	inc. damaged	0.000075	0.000006					0.000064	0.000006							
Collembola spp.			0.000014			0.000014		0.000014			0.000014		0.000014			
Copepoda spp.																
Corophium sp.																
Corophium volutator																
Crangonidae sp.																
Cyathura carinata																
Platyhelminthes (Dalyellidae) sp.																
Diptera sp. larvae		0.000723	0.001351	0.000328				0.000369	0.002020	0.001884						
Enchytraeidae spp.		0.000113	0.000043					0.001224	0.000809							
Eteone flava/longa agg.																
Gastropoda spp.	damaged							0.000566		0.000014	0.000014					
Hediste diversicolor		0.053223	0.023780	0.133057				0.001624	0.025002	0.039098						
Baltidrilus costatus		0.006484	0.003056	0.000092								0.000005				
Limecola balthica					0.014863	0.009583	0.005813								0.003764	
Manayunkia aestuarina		0.000016					0.000016	0.000400	0.000720							
Mytilidae sp. juvenile																
Nematoda spp.		0.000018	0.000018	0.000018	0.000018			0.001049	0.000405	0.000018	0.000018					
Nemertea spp.																
Nephtys caeca																
Nephtys cirrosa																
Nephtys hombergii							0.012478									0.001838
Nereididae spp. (juvenile/damaged)	inc. damaged	0.002399	0.001624	0.000015												
Orbiniidae sp.	damaged															
Paranais litoralis																
Peringia ulvae																
Pygospio elegans								0.003286	0.001088							
Retusa obtusa																
Scoloplos armiger																
Scrobicularia plana	inc. damaged									0.014506						
Sphaerodoridium minutum																
Spionidae sp.	damaged															
Streblospio shrubsolii																
Tellinidae sp. (juvenile/damaged)	inc. damaged															
Tubificoides benedii		0.000005			0.000005	0.000113	0.000005		0.000005					0.000005		

Abundance per 0.01m ^{2}	Qualifier	CCS I1M-A	CCS I1M-B	CCS I1M-C	CCS I1U-A	CCS I1U-B	CCS I1U-C	CCS I2L-A	CCS I2L-B	CCS I2L-C	CCS I2M-A	CCS I2M-B	CCS I2M-C	CCS I2U-A	CCS I2U-B	CCS I2U-C
Abra tenuis		22	3	9	2						11	11	12	6		
Acari spp.																
Arenicola sp.																
Bivalvia sp. (juvenile/damaged)	inc. damaged															
Collembola spp.																
Copepoda spp.			6													
Corophium sp.																
Corophium volutator			1	1												
Crangonidae sp.																
Cyathura carinata		10	1	5									1			
Platyhelminthes (Dalyellidae) sp.			2	2	1							6		1		2
Diptera sp. larvae			1				2									
Enchytraeidae spp.			98			3	1									
Eteone flava/longa agg.		1	2	2	1						12	2	1	2		1
Gastropoda spp.	damaged					P	5									
Hediste diversicolor					1						1	1			14	P
Baltidrilus costatus																
Limecola balthica		15	9	13	2	1		7	10	5	10	9	8	3		2
Manayunkia aestuarina			17		7	2					4	1				44
Mytilidae sp. juvenile																
Nematoda spp.			229	47	41	36	8				49	75	50	6	20	76
Nemertea spp.		29														
Nephtys caeca																
Nephtys cirrosa																
Nephtys hombergii																
Nereididae spp. (juvenile/damaged)	inc. damaged		1	2	2	5	4				2	3	1	14		75
Orbiniidae sp.	damaged															
Paranais litoralis																
Peringia ulvae		5	3	11	16						24	4	3	4		21
Pygospio elegans		47	60	14	9	1		1			17	24	23			
Retusa obtusa																
Scoloplos armiger																
Scrobicularia plana	inc. damaged	3			1	P					1		2	1		
Sphaerodoridium minutum																
Spionidae sp.	damaged															
Streblospio shrubsolii					3	2					3			3		14
Tellinidae sp. (juvenile/damaged)	inc. damaged				6											24
Tubificoides benedii		77	83	22	140	3	7	4	1	4	44	97	97	8	9	4

AFDW Biomass (g) per 0.01m ^{2}	Qualifier	CCS I1M-A	CCS I1M-B	CCS I1M-C	CCS I1U-A	CCS I1U-B	CCS I1U-C	CCS I2L-A	CCS I2L-B	CCS I2L-C	CCS I2M-A	CCS I2M-B	CCS I2M-C	CCS I2U-A	CCS I2U-B	CCS I2U-C
Abra tenuis		0.015522	0.003397	0.004226	0.000006						0.002028	0.004738	0.004795	0.009769		
Acari spp.																
Arenicola sp.																
Bivalvia sp. (juvenile/damaged)	inc. damaged															
Collembola spp.																
Copepoda spp.			0.000017													
Corophium sp.																
Corophium volutator			0.000016	0.000016												
Crangonidae sp.																
Cyathura carinata		0.002783	0.000128	0.001008									0.000014			
Platyhelminthes (Dalyellidae) sp.			0.000025	0.000025	0.000025							0.000025		0.000025		0.000025
Diptera sp. larvae			0.001734				0.001720									
Enchytraeidae spp.			0.000458			0.000005	0.000005									
Eteone flava/longa agg.		0.000014	0.000014	0.000014	0.000014						0.000598	0.000190	0.000571	0.000952		0.001102
Gastropoda spp.	damaged					0.000248	0.000511									
Hediste diversicolor					0.006675						0.000417	0.003502			0.001669	0.004440
Baltidrilus costatus																
Limecola balthica		0.040601	0.008517	0.056234	0.004539	0.005006		0.013270	0.032271	0.012154	0.086582	0.052624	0.034639	0.010462		0.005753
Manayunkia aestuarina			0.000016		0.000016	0.000016					0.000016	0.000016				0.000256
Mytilidae sp. juvenile																
Nematoda spp.			0.002134	0.000258	0.000534	0.000166	0.000018				0.000442	0.000552	0.000478	0.000018	0.000018	0.000497
Nemertea spp.		0.000198														
Nephtys caeca																
Nephtys cirrosa																
Nephtys hombergii																
Nereididae spp. (juvenile/damaged)	inc. damaged		0.000015	0.000015	0.000015	0.000253	0.000015				0.000015	0.000030	0.000015	0.007778		0.009178
Orbiniidae sp.	damaged															
Paranais litoralis																
Peringia ulvae		0.000728	0.001387	0.002637	0.003901						0.006428	0.001113	0.000783	0.001923		0.003269
Pygospio elegans		0.001421	0.002475	0.000355	0.000444	0.000011		0.000011			0.000400	0.001221	0.001332			
Retusa obtusa																
Scoloplos armiger																
Scrobicularia plana	inc. damaged	0.171796			0.144542	0.035943					0.036975		0.166501	0.069600		
Sphaerodoridium minutum																
Spionidae sp.	damaged															
Streblospio shrubsolii					0.000016	0.000016					0.000016			0.000016		0.001408
Tellinidae sp. (juvenile/damaged)	inc. damaged				0.000006											0.003869
Tubificoides benedii		0.005174	0.006861	0.001682	0.010990	0.000361	0.000943	0.000232	0.000081	0.000108	0.002975	0.006145	0.011917	0.000970	0.001137	0.000571

Abundance per 0.01m²	Qualifier	CCS I3I-A	CCS I3I-B	CCS I3I-C	CCS I3M-A	CCS I3M-B	CCS I3M-C	CCS I3U-A	CCS I3U-B	CCS I3U-C	CCS CS1L-A	CCS CS1L-B	CCS CS1L-C	CCS CS1M-A	CCS CS1M-B	CCS CS1M-C
Abra tenuis					7	15	1								1	6
Acari spp.																
Arenicola sp.													p			
Bivalvia sp. (juvenile/damaged)	inc. damaged		p									P				
Collembola spp.														9		1
Copepoda spp.							1									
Corophium sp.																
Corophium volutator																
Crangonidae sp.						p										
Cyathura carinata														7	8	4
Platyhelminthes (Dalyellidae) sp.					1	2										
Diptera sp. larvae									P					1		
Enchytraeidae spp.		1					326			9						52
Eteone flava/longa agg.				1	1		3								4	
Gastropoda spp.	damaged	P						P		P						
Hediste diversicolor						1	4							2	2	1
Baltidrilus costatus																
Limecola balthica		3		2	5	9	1				2			30	30	46
Manayunkia aestuarina		2				23	11									29
Mytilidae sp. juvenile																
Nematoda spp.		1			11	29	151	11		11				57	12	86
Nemertea spp.																
Nephtys caeca																
Nephtys cirrosa																
Nephtys hombergii		2		1							1		1			
Nereididae spp. (juvenile/damaged)	inc. damaged					4								2	7	
Orbiniidae sp.	damaged															
Paranais litoralis							3									
Peringia ulvae					7	42	23							1	2	
Pygospio elegans				2	2	11	14			6	1			9	8	19
Retusa obtusa																
Scoloplos armiger																
Scrobicularia plana	inc. damaged													2	1	2
Sphaerodoridium minutum																
Spionidae sp.	damaged															
Streblospio shrubsolii						3									6	2
Tellinidae sp. (juvenile/damaged)	inc. damaged															
Tubificoides benedii		3	3		20	31	23	2	P	5	1	1	2	27	64	51

AFDW Biomass (g) per 0.01m²	Qualifier	CCS I3I-A	CCS I3I-B	CCS I3I-C	CCS I3M-A	CCS I3M-B	CCS I3M-C	CCS I3U-A	CCS I3U-B	CCS I3U-C	CCS CS1L-A	CCS CS1L-B	CCS CS1L-C	CCS CS1M-A	CCS CS1M-B	CCS CS1M-C
Abra tenuis					0.002028	0.008057	0.000935								0.000648	0.004530
Acari spp.																
Arenicola sp.													0.046813			
Bivalvia sp. (juvenile/damaged)	inc. damaged		0.000064									0.000626				
Collembola spp.														0.000014		0.000014
Copepoda spp.							0.000017									
Corophium sp.																
Corophium volutator																
Crangonidae sp.						0.000520										
Cyathura carinata														0.001335	0.001463	0.000966
Platyhelminthes (Dalyellidae) sp.					0.000025	0.000025										
Diptera sp. larvae									0.000437					0.000669		
Enchytraeidae spp.		0.000005					0.001110			0.000022						0.000129
Eteone flava/longa agg.				0.000163	0.001061		0.001319								0.001605	
Gastropoda spp.	damaged	0.000014						0.000014		0.000207						
Hediste diversicolor						0.022350	0.075677							0.016286	0.009402	0.017448
Baltidrilus costatus																
Limecola balthica		0.028397		0.000528	0.011083	0.026446	0.026903				0.003912			0.046266	0.023792	0.061047
Manayunkia aestuarina		0.000016				0.000048	0.000016									0.000016
Mytilidae sp. juvenile																
Nematoda spp.		0.000018			0.000018	0.000092	0.000828	0.000018		0.000018				0.000442	0.000018	0.000368
Nemertea spp.																
Nephtys caeca																
Nephtys cirrosa																
Nephtys hombergii		0.005058		0.003273							0.003290		0.007333			
Nereididae spp. (juvenile/damaged)	inc. damaged					0.000015								0.000015	0.000522	
Orbiniidae sp.	damaged															
Paranais litoralis							0.000005									
Peringia ulvae					0.002912	0.011785	0.004505							0.000549	0.001360	
Pygospio elegans				0.000011	0.000011	0.000366	0.000588			0.000444	0.000011			0.000278	0.000322	0.000377
Retusa obtusa																
Scoloplos armiger																
Scrobicularia plana	inc. damaged													0.047264	0.044451	0.061938
Sphaerodoridium minutum																
Spionidae sp.	damaged															
Streblospio shrubsolii						0.000176									0.000256	0.000016
Tellinidae sp. (juvenile/damaged)	inc. damaged															
Tubificoides benedii		0.000210	0.000005		0.001913	0.001671	0.001946	0.000086	0.000054	0.000539	0.000005	0.000043	0.000005	0.001525	0.004140	0.003606

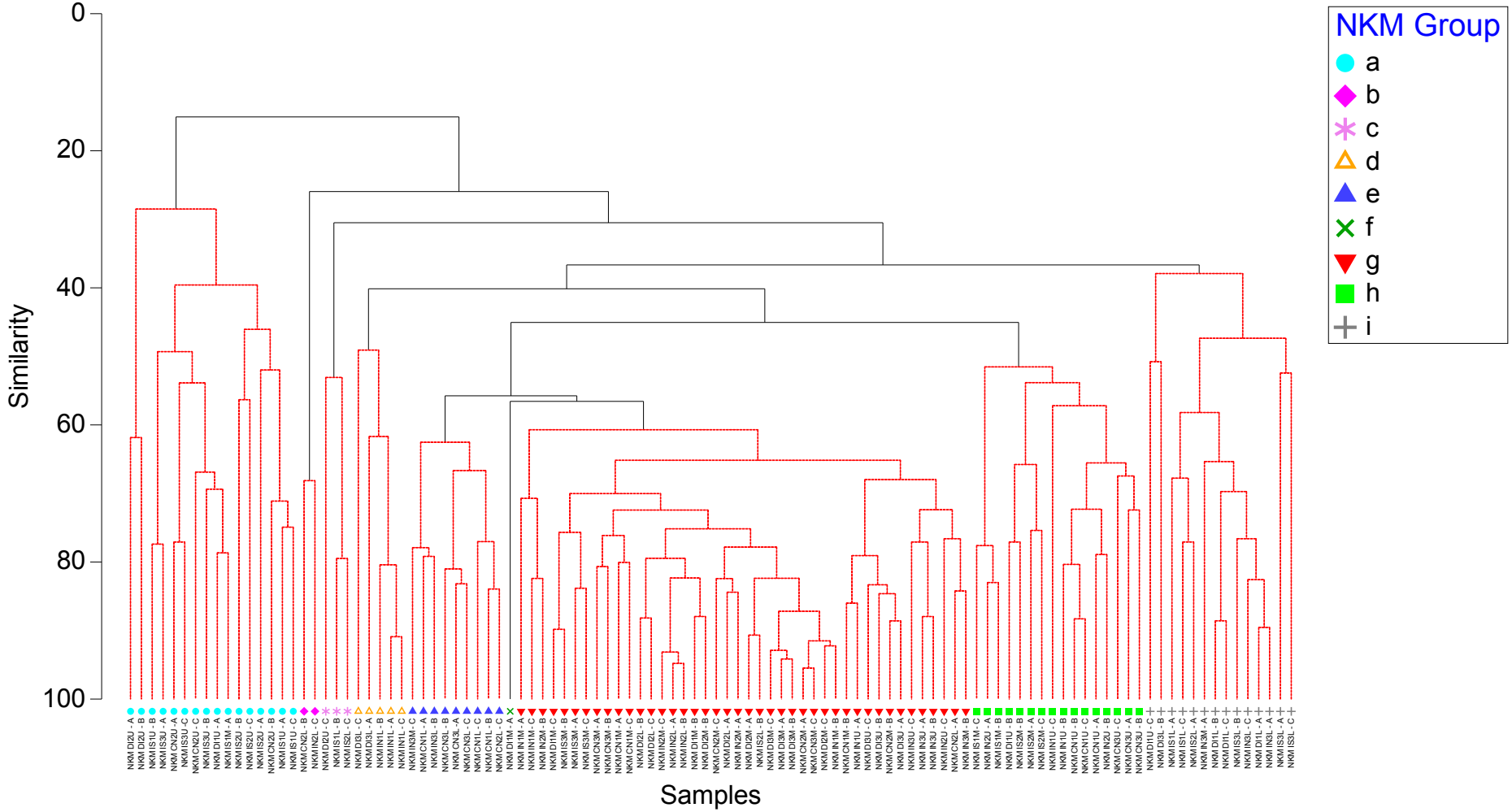
Abundance per 0.01m ^{2}	Qualifier	CCS CS1U-A	CCS CS1U-B	CCS CS1U-C	CCS CS2L-A	CCS CS2L-B	CCS CS2L-C	CCS CS2M-C	CCS CS2M-B	CCS CS2M-C	CCS CS2U-A	CCS CS2U-B	CCS CS2U-C	CCS CS3L-A	CCS CS3L-B	CCS CS3L-C
Abra tenuis		5	9						4	3	5	5	7			
Acari spp.																
Arenicola sp.																
Bivalvia sp. (juvenile/damaged)	inc. damaged			P							P		P			
Collembola spp.																
Copepoda spp.																
Corophium sp.																
Corophium volutator																
Crangonidae sp.																
Cyathura carinata		4	2	4							1	1	1			
Platyhelminthes (Dalyellidae) sp.		4	6	6				1		1	3	1				
Diptera sp. larvae		1		1												
Enchytraeidae spp.		7														
Eteone flava/longa agg.		1	2	1					2		2	2	4			
Gastropoda spp.	damaged															
Hediste diversicolor			1													
Baltidrilus costatus																
Limecola balthica		24	14	10		2	3	24	37	35	27	26	13			1
Manayunkia aestuarina		1	10								2	2				
Mytilidae sp. juvenile																
Nematoda spp.		101	95	28					2		106	10	18			
Nemertea spp.																
Nephtys caeca																
Nephtys cirrosa						1										
Nephtys hombergii								1	1	1				1		
Nereididae spp. (juvenile/damaged)	inc. damaged	1		1							2	2				
Orbiniidae sp.	damaged														p	
Paranais litoralis																
Peringia ulvae		19	17	10				2	3	3	6	2	1			
Pygospio elegans		9	21	7			P	4	5	10	31	29				
Retusa obtusa									1	2						
Scoloplos armiger														1		
Scrobicularia plana	inc. damaged	2	2	2					1		1	2				
Sphaerodoridium minutum										1						
Spionidae sp.	damaged				p											
Streblospio shrubsolii																
Tellinidae sp. (juvenile/damaged)	inc. damaged										11					
Tubificoides benedii		88	120	46			1	2	3	2	11	64	9	1	1	2

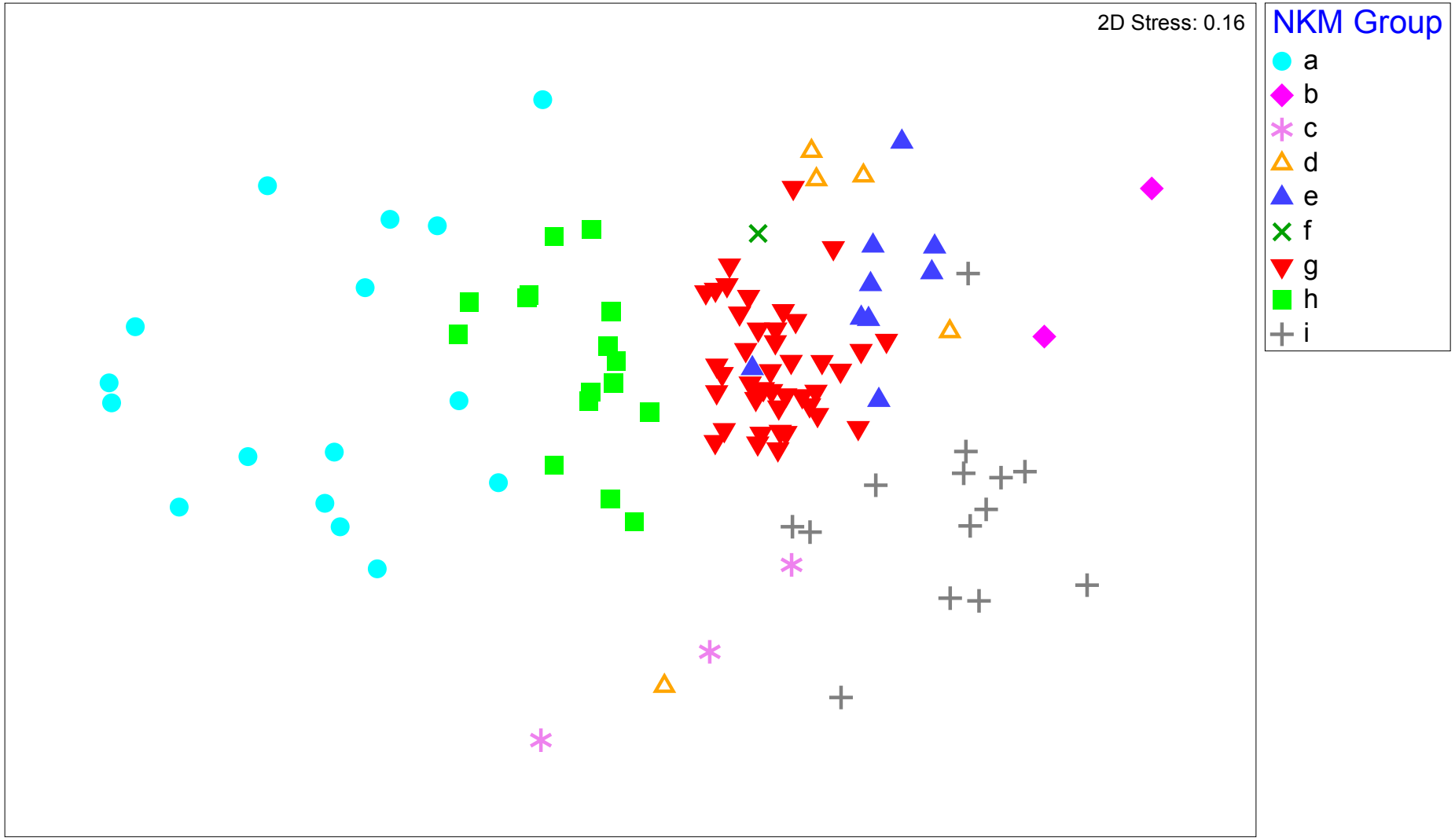
AFDW Biomass (g) per 0.01m ^{2}	Qualifier	CCS CS1U-A	CCS CS1U-B	CCS CS1U-C	CCS CS2L-A	CCS CS2L-B	CCS CS2L-C	CCS CS2M-C	CCS CS2M-B	CCS CS2M-C	CCS CS2U-A	CCS CS2U-B	CCS CS2U-C	CCS CS3L-A	CCS CS3L-B	CCS CS3L-C
Abra tenuis		0.003397	0.007161						0.001375	0.000918	0.001972	0.001442	0.006107			
Acari spp.																
Arenicola sp.																
Bivalvia sp. (juvenile/damaged)	inc. damaged			0.000771							0.001699		0.014616			
Collembola spp.																
Copepoda spp.																
Corophium sp.																
Corophium volutator																
Crangonidae sp.																
Cyathura carinata		0.000426	0.000440	0.000483							0.000014	0.000142	0.000256			
Platyhelminthes (Dalyellidae) sp.		0.000025	0.000025	0.000025				0.000025		0.000025	0.000025	0.000025				
Diptera sp. larvae		0.001474		0.001829												
Enchytraeidae spp.		0.000005														
Eteone flava/longa agg.		0.001061	0.002135	0.000014					0.000014		0.000014	0.002217	0.004230			
Gastropoda spp.	damaged															
Hediste diversicolor			0.029428													
Baltidrilus costatus																
Limecola balthica		0.135222	0.053030	0.051470		0.011572	0.011753	0.051481	0.144184	0.130155	0.112484	0.110413	0.062558			0.003649
Manayunkia aestuarina		0.000016	0.000016								0.000016	0.000016				
Mytilidae sp. juvenile																
Nematoda spp.		0.001030	0.000938	0.000018					0.000018		0.000662	0.000018	0.000018			
Nemertea spp.																
Nephtys caeca																
Nephtys cirrosa						0.012793										
Nephtys hombergii								0.005233	0.001348	0.006405				0.002590		
Nereididae spp. (juvenile/damaged)	inc. damaged	0.000015		0.000015							0.000015	0.000164				
Orbiniidae sp.	damaged														0.000016	
Paranais litoralis																
Peringia ulvae		0.006497	0.006428	0.003049				0.001813	0.001676	0.002362	0.001154	0.001099	0.001003			
Pygospio elegans		0.000533	0.001210	0.000389			0.000011	0.000011	0.000355	0.000355	0.000888	0.001421				
Retusa obtusa									0.000276	0.000511						
Scoloplos armiger														0.000011		
Scrobicularia plana	inc. damaged	0.051893	0.050147	0.123992					0.001392		0.094888	0.067947				
Sphaerodoridium minutum										0.000016						
Spionidae sp.	damaged				0.000016											
Streblospio shrubsolii																
Tellinidae sp. (juvenile/damaged)	inc. damaged										0.000215					
Tubificoides benedii		0.006150	0.008371	0.003477			0.000005	0.000119	0.000119	0.000005	0.001558	0.006436	0.000792	0.000005	0.000016	0.000059

Abundance per 0.01m ^{2}	Qualifier	CCS CS3M-A	CCS CS3M-B	CCS CS3M-C	CCS CS3U-A	CCS CS3U-B	CCS CS3U-C
Abra tenuis					21	25	16
Acari spp.							
Arenicola sp.							
Bivalvia sp. (juvenile/damaged)	inc. damaged						
Collembola spp.							
Copepoda spp.							
Corophium sp.							
Corophium volutator							
Crangonidae sp.							
Cyathura carinata					2	1	
Platyhelminthes (Dalyellidae) sp.				1	1		
Diptera sp. larvae						3	
Enchytraeidae spp.						6	
Eteone flava/longa agg.		1	1		1	1	2
Gastropoda spp.	damaged						
Hediste diversicolor					1	1	1
Baltidrilus costatus							
Limecola balthica		17	14	15	27	22	31
Manayunkia aestuarina							
Mytilidae sp. juvenile					1		
Nematoda spp.			1		54	45	15
Nemertea spp.							
Nephtys caeca							
Nephtys cirrosa							
Nephtys hombergii				2			
Nereididae spp. (juvenile/damaged)	inc. damaged				3		2
Orbiniidae sp.	damaged						
Paranais litoralis							
Peringia ulvae					9	23	12
Pygospio elegans		4	3	3	26	10	12
Retusa obtusa							1
Scoloplos armiger			1				
Scrobicularia plana	inc. damaged						
Sphaerodoridium minutum							
Spionidae sp.	damaged						
Streblospio shrubsolii							
Tellinidae sp. (juvenile/damaged)	inc. damaged						
Tubificoides benedii		1			100	11	155

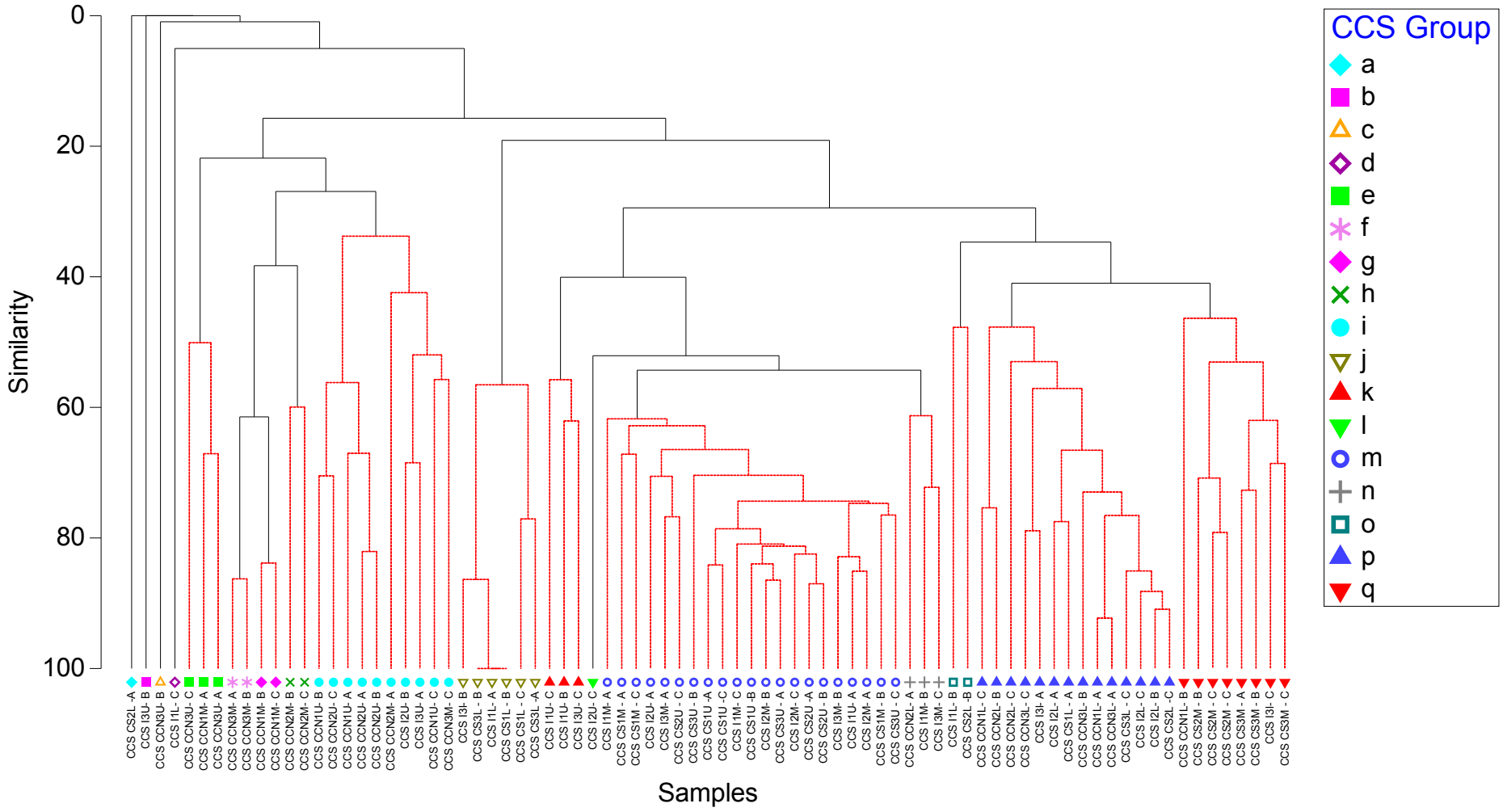
AFDW Biomass (g) per 0.01m ^{2}	Qualifier	CCS CS3M-A	CCS CS3M-B	CCS CS3M-C	CCS CS3U-A	CCS CS3U-B	CCS CS3U-C
Abra tenuis					0.011229	0.016541	0.007290
Acari spp.							
Arenicola sp.							
Bivalvia sp. (juvenile/damaged)	inc. damaged						
Collembola spp.							
Copepoda spp.							
Corophium sp.							
Corophium volutator							
Crangonidae sp.							
Cyathura carinata					0.000426	0.000043	
Platyhelminthes (Dalyellidae) sp.				0.000025	0.000025		
Diptera sp. larvae						0.004204	
Enchytraeidae spp.						0.000005	
Eteone flava/longa agg.		0.000014	0.000014		0.000585	0.001006	0.000544
Gastropoda spp.	damaged						
Hediste diversicolor					0.008135	0.002608	0.009193
Baltidrilus costatus							
Limecola balthica		0.145920	0.111072	0.078158	0.130562	0.088582	0.093384
Manayunkia aestuarina							
Mytilidae sp. juvenile					0.000005		
Nematoda spp.			0.000018		0.000147	0.000184	0.000018
Nemertea spp.							
Nephtys caeca							
Nephtys cirrosa							
Nephtys hombergii				0.012093			
Nereididae spp. (juvenile/damaged)	inc. damaged				0.000253		0.000015
Orbiniidae sp.	damaged						
Paranais litoralis							
Peringia ulvae					0.003640	0.008516	0.005000
Pygospio elegans		0.000278	0.000011	0.000011	0.001077	0.000089	0.000833
Retusa obtusa							0.000911
Scoloplos armiger			0.001949				
Scrobicularia plana	inc. damaged						
Sphaerodoridium minutum							
Spionidae sp.	damaged						
Streblospio shrubsolii							
Tellinidae sp. (juvenile/damaged)	inc. damaged						
Tubificoides benedii		0.000005			0.004193	0.000879	0.010122

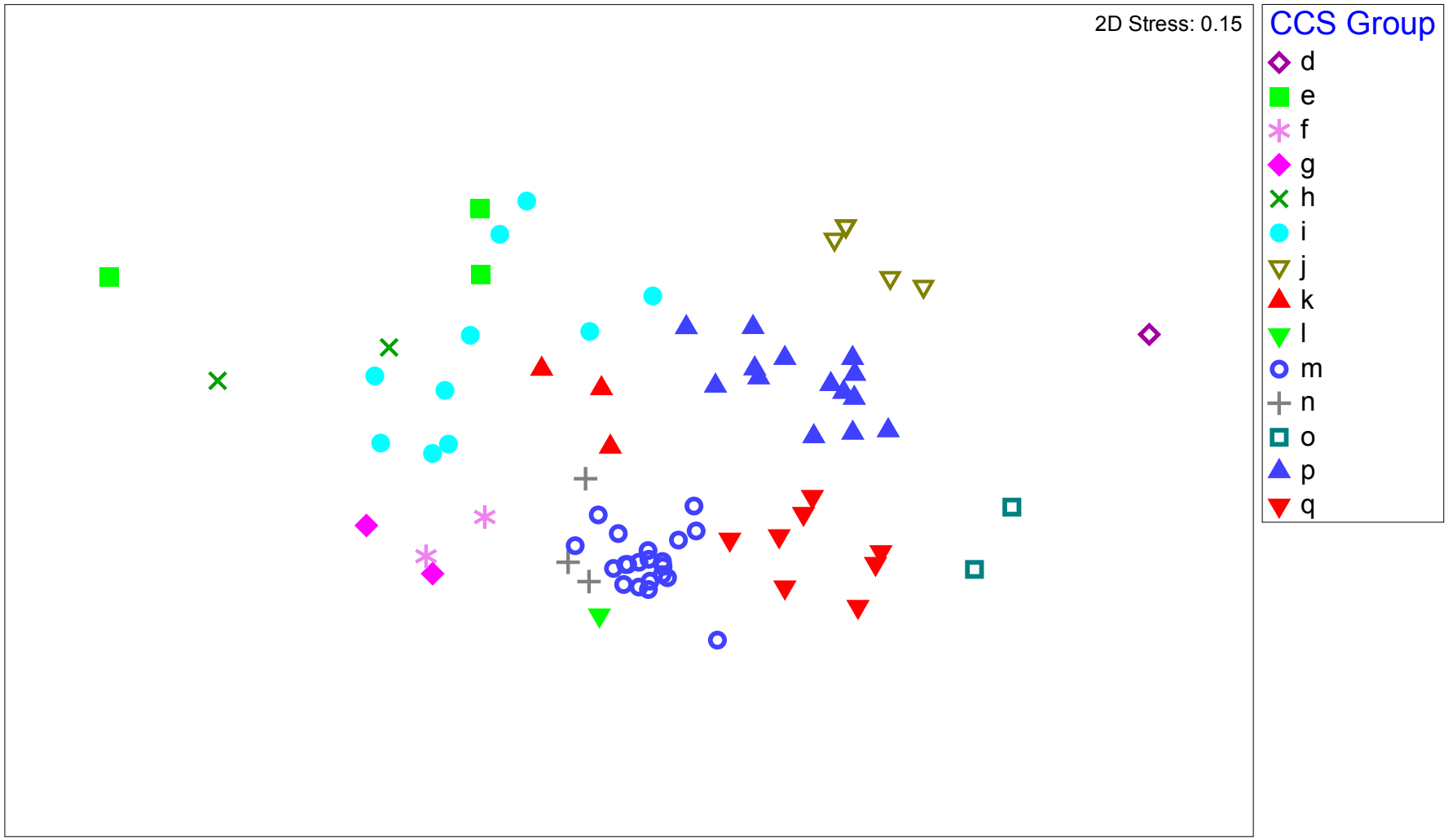
Appendix 9. Multivariate analysis of replicate data from North Killingholme




2D Stress: 0.16
NKM Group
a
b
c
d
e
f
g
h
i

Appendix 10. Multivariate analysis of replicate data from Cherry Cobb Sands





Samples CS2L-A, I3U-B & CCN3U-B omitted

Appendix 11. Sample details for the subtidal benthic survey

Station	Replicate	Date & Time	Latitude	Longitude	Depth (m CD)
CN1	A	07/06/2016 13:16	53° 40' 04.6680" N	0° 13' 46.6200" W	7.73
CN1	B	07/06/2016 13:27	53° 40' 04.6680" N	0° 13' 46.5720" W	7.75
CN1	C	07/06/2016 13:33	53° 40' 04.6440" N	0° 13' 46.6440" W	7.77
CN2	A	07/06/2016 15:36	53° 40' 06.3660" N	0° 13' 09.1920" W	5.20
CN2	B	07/06/2016 15:46	53° 40' 06.2760" N	0° 13' 09.2760" W	5.18
CN2	C	07/06/2016 15:51	53° 40' 06.3540" N	0° 13' 09.2100" W	5.27
CN3	A	07/06/2016 14:29	53° 40' 13.2360" N	0° 14' 01.7340" W	9.23
CN3	B	07/06/2016 14:41	53° 40' 13.2840" N	0° 14' 01.9560" W	9.32
CN3	C	07/06/2016 14:47	53° 40' 13.2000" N	0° 14' 01.8240" W	9.26
CN4	A	07/06/2016 11:13	53° 40' 28.0080" N	0° 14' 26.8740" W	7.80
CN4	B	07/06/2016 11:23	53° 40' 27.9060" N	0° 14' 27.1080" W	7.55
CN4	C	07/06/2016 11:29	53° 40' 28.0260" N	0° 14' 27.0480" W	7.53
CN5	A	07/06/2016 12:15	53° 40' 35.4060" N	0° 14' 08.0880" W	9.05
CN5	B	07/06/2016 12:25	53° 40' 35.3340" N	0° 14' 08.0460" W	8.98
CN5	C	07/06/2016 12:41	53° 40' 35.4060" N	0° 14' 07.9920" W	8.56
CN6	A	07/06/2016 16:12	53° 40' 30.2700" N	0° 13' 25.0080" W	5.66
CN6	B	07/06/2016 16:22	53° 40' 30.0120" N	0° 13' 24.8880" W	5.57
CN6	C	07/06/2016 16:28	53° 40' 30.0900" N	0° 13' 24.9600" W	5.46
CN7	A	07/06/2016 16:53	53° 40' 35.5980" N	0° 12' 55.9320" W	5.93
CN7	B	07/06/2016 17:00	53° 40' 35.4180" N	0° 12' 56.0880" W	5.83
CN7	C	07/06/2016 17:06	53° 40' 35.4600" N	0° 12' 56.0220" W	5.88
CS1	A	16/06/2016 10:09	53° 38' 35.3040" N	0° 11' 35.9040" W	10.96
CS1	C	16/06/2016 10:25	53° 38' 35.2800" N	0° 11' 35.9340" W	10.96
CS1	D	16/06/2016 10:38	53° 38' 35.2500" N	0° 11' 35.9940" W	10.86
CS2	A	09/06/2016 19:08	53° 38' 59.2620" N	0° 11' 07.4640" W	6.17
CS2	B	09/06/2016 19:15	53° 38' 59.1300" N	0° 11' 07.1580" W	6.35
CS2	C	09/06/2016 19:23	53° 38' 58.9560" N	0° 11' 07.4040" W	6.30
CS3	A	09/06/2016 18:21	53° 39' 00.3960" N	0° 10' 43.8960" W	6.03
CS3	B	09/06/2016 18:28	53° 39' 00.2820" N	0° 10' 44.0940" W	6.07
CS3	C	09/06/2016 18:39	53° 39' 00.3360" N	0° 10' 44.0820" W	5.77
CS4	A	16/06/2016 14:37	53° 38' 42.9540" N	0° 10' 34.4820" W	7.22
CS4	B	16/06/2016 14:47	53° 38' 43.0080" N	0° 10' 34.3500" W	7.06
CS4	C	16/06/2016 14:54	53° 38' 42.9360" N	0° 10' 34.5720" W	7.05
CS5	A	16/06/2016 12:37	53° 38' 31.4400" N	0° 11' 05.2920" W	7.86
CS5	B	16/06/2016 12:47	53° 38' 31.4820" N	0° 11' 05.2920" W	7.79
CS5	C	16/06/2016 12:51	53° 38' 31.4520" N	0° 11' 05.2740" W	7.84
CS6	A	16/06/2016 11:38	53° 38' 12.6480" N	0° 11' 03.0240" W	11.46
CS6	B	16/06/2016 11:46	53° 38' 12.6660" N	0° 11' 02.9340" W	11.48
CS6	C	16/06/2016 11:53	53° 38' 12.6000" N	0° 11' 03.0660" W	11.26
CS7	A	16/06/2016 13:29	53° 38' 29.8920" N	0° 10' 29.0040" W	4.04
CS7	B	16/06/2016 13:40	53° 38' 29.8380" N	0° 10' 29.0400" W	3.66
CS7	D	16/06/2016 13:50	53° 38' 29.8500" N	0° 10' 29.0220" W	3.83

Station	Replicate	Date & Time	Latitude	Longitude	Depth (m CD)
DI1	A	12/06/2016 11:59	53° 39' 01.0080" N	0° 12' 31.6440" W	9.03
DI1	B	12/06/2016 12:08	53° 39' 00.8340" N	0° 12' 31.4160" W	9.03
DI1	C	12/06/2016 12:13	53° 39' 01.0320" N	0° 12' 31.6620" W	9.00
DI2	A	12/06/2016 13:14	53° 39' 07.7940" N	0° 12' 22.7880" W	9.24
DI2	B	12/06/2016 13:23	53° 39' 07.9020" N	0° 12' 22.7400" W	9.07
DI2	C	12/06/2016 13:31	53° 39' 07.9740" N	0° 12' 22.6800" W	8.85
DI3	A	10/06/2016 09:05	53° 39' 07.4040" N	0° 12' 53.5080" W	1.85
DI3	B	10/06/2016 09:14	53° 39' 07.6980" N	0° 12' 53.5440" W	2.09
DI3	C	10/06/2016 09:20	53° 39' 07.7160" N	0° 12' 53.6880" W	1.96
DI4	A	12/06/2016 11:16	53° 39' 11.0280" N	0° 12' 42.9960" W	8.06
DI4	B	12/06/2016 11:24	53° 39' 11.0340" N	0° 12' 42.8880" W	8.13
DI4	C	12/06/2016 11:29	53° 39' 11.0640" N	0° 12' 43.1040" W	8.06
DI5	A	12/06/2016 14:11	53° 39' 16.8480" N	0° 12' 34.3140" W	7.92
DI5	B	12/06/2016 14:17	53° 39' 16.9260" N	0° 12' 34.3440" W	8.02
DI5	C	12/06/2016 14:24	53° 39' 16.8120" N	0° 12' 34.2720" W	8.07
DI6	A	12/06/2016 10:22	53° 39' 19.1580" N	0° 12' 57.7920" W	7.07
DI6	B	12/06/2016 10:30	53° 39' 19.1280" N	0° 12' 57.8940" W	7.09
DI6	C	12/06/2016 10:36	53° 39' 19.1820" N	0° 12' 58.0500" W	6.93
DI7	A	10/06/2016 09:55	53° 39' 24.4020" N	0° 13' 15.1200" W	2.76
DI7	B	10/06/2016 10:04	53° 39' 24.3660" N	0° 13' 15.0360" W	2.69
DI7	C	10/06/2016 10:09	53° 39' 24.3600" N	0° 13' 15.1260" W	2.63
DI8	A	09/06/2016 16:51	53° 39' 29.0880" N	0° 13' 07.4640" W	7.02
DI8	B	09/06/2016 16:57	53° 39' 28.9200" N	0° 13' 07.4880" W	7.02
DI8	C	09/06/2016 17:02	53° 39' 28.9620" N	0° 13' 07.5780" W	6.97
SI1	A	09/06/2016 13:23	53° 39' 44.1600" N	0° 13' 38.8860" W	4.29
SI1	B	09/06/2016 13:31	53° 39' 44.0100" N	0° 13' 38.9100" W	4.27
SI1	C	09/06/2016 13:36	53° 39' 43.9380" N	0° 13' 38.8860" W	4.25
SI2	A	09/06/2016 14:16	53° 39' 37.5780" N	0° 13' 31.7340" W	8.34
SI2	B	09/06/2016 14:24	53° 39' 37.5540" N	0° 13' 31.8120" W	8.15
SI2	C	09/06/2016 14:30	53° 39' 37.4820" N	0° 13' 31.8000" W	7.94
SI3	A	09/06/2016 15:21	53° 39' 39.8340" N	0° 13' 24.2580" W	6.87
SI3	B	09/06/2016 15:29	53° 39' 39.7800" N	0° 13' 24.2940" W	6.88
SI3	C	09/06/2016 15:37	53° 39' 39.8220" N	0° 13' 24.6720" W	6.74
SI4	A	10/06/2016 10:53	53° 39' 33.1920" N	0° 13' 00.0540" W	6.60
SI4	B	10/06/2016 11:00	53° 39' 33.0120" N	0° 12' 59.8620" W	6.61
SI4	C	10/06/2016 11:10	53° 39' 33.1920" N	0° 13' 00.2580" W	6.55
SI5	A	16/06/2016 09:20	53° 39' 42.0480" N	0° 12' 43.4820" W	6.14
SI5	B	16/06/2016 09:29	53° 39' 41.9940" N	0° 12' 43.5480" W	6.17
SI5	C	16/06/2016 09:35	53° 39' 41.9580" N	0° 12' 43.5840" W	6.17
SI6	A	10/06/2016 11:38	53° 39' 27.7980" N	0° 12' 42.9360" W	6.98
SI6	B	10/06/2016 11:47	53° 39' 27.5520" N	0° 12' 42.7200" W	6.83
SI6	C	10/06/2016 11:52	53° 39' 27.6840" N	0° 12' 42.7800" W	6.87
SI7	A	10/06/2016 12:17	53° 39' 13.1880" N	0° 12' 00.2940" W	6.60
SI7	B	10/06/2016 12:25	53° 39' 13.3860" N	0° 12' 00.7260" W	7.07
SI7	C	10/06/2016 12:33	53° 39' 13.0320" N	0° 12' 00.4020" W	6.99
SI8	A	12/06/2016 12:37	53° 38' 53.6520" N	0° 12' 22.5420" W	9.49
SI8	B	12/06/2016 12:44	53° 38' 53.6160" N	0° 12' 22.5060" W	9.59
SI8	C	12/06/2016 12:50	53° 38' 53.7060" N	0° 12' 22.6020" W	9.44

Appendix 12. Results of Particle Size Analysis for the subtidal benthic survey

SAMPLE	PARAMETER	CN1	CN2	CN3	CN4	CN5	CN6	CN7	CS1	CS5	CS3	CS4	CS2	CS6	CS7	DI1
SAMPLE TYPE:		Unimodal, Very Poorly Sorted	Bimodal, Poorly Sorted	Trimodal, Very Poorly Sorted	Unimodal, Very Poorly Sorted	Bimodal, Very Poorly Sorted	Unimodal, Moderately Sorted	Unimodal, Poorly Sorted	Polymodal, Extremely Poorly Sorted	Polymodal, Very Poorly Sorted	Bimodal, Very Poorly Sorted	Bimodal, Very Poorly Sorted	Bimodal, Poorly Sorted	Trimodal, Very Poorly Sorted	Bimodal, Very Poorly Sorted	Bimodal, Poorly Sorted
TEXTURAL GROUP:		Sandy Mud	Slightly Gravelly Muddy Sand	Sandy Mud	Sandy Mud	Slightly Gravelly Sandy Mud	Sand	Slightly Gravelly Muddy Sand	Gravelly Mud	Muddy Sandy Gravel	Gravelly Mud	Slightly Gravelly Muddy Sand	Gravelly Sand	Gravelly Muddy Sand	Slightly Gravelly Sandy Mud	Muddy Sand
SEDIMENT NAME:		Very Fine Sandy Fine Silt	Slightly Fine Gravelly Fine Silty Fine Sand	Very Fine Sandy Fine Silt	Very Fine Sandy Fine Silt	Slightly Very Fine Gravelly Fine Sandy Fine Silt	Moderately Sorted Fine Sand	Slightly Fine Gravelly Coarse Silty Fine Sand	Coarse Gravelly Fine Silt	Medium Silty Sandy Coarse Gravel	Medium Gravelly Fine Silt	Slightly Fine Gravelly Fine Silty Medium Sand	Medium Gravelly Medium Sand	Very Fine Gravelly Medium Silty Medium Sand	Slightly Fine Gravelly Fine Sandy Medium Silt	Fine Silty Fine Sand
	MEDIAN GRAIN SIZE D_{50} (µm)	16.6	116.5	25.2	14.6	52.1	148.17	142.3	49.781	5421.8	32.7	126.7	554.77	496.57	35.5	147.7
FOLK AND	MEAN GRAIN SIZE (µm)	20.10	67.95	24.9	17.8	37.5	146.07	133.4	131.3	3630.809	37.820	73.153	670.674	300.300	41.291	78.321
WARD METHOD	SORTING	4.246	3.714	4.671	4.288	4.475	1.933	2.223	24.8	7.383	8.353	5.652	2.794	8.335	6.229	3.992
(µm)	SKEWNESS	0.186	-0.592	0.037	0.201	-0.294	-0.275	-0.405	0.383	-0.372	0.204	-0.418	0.395	-0.308	0.113	-0.643
	KURTOSIS	0.810	1.098	0.806	0.847	0.694	1.850	2.265	0.983	0.718	0.841	0.702	1.687	2.422	0.771	1.040
	MEDIAN GRAIN SIZE D_{50} (phi):	5.910	3.102	5.309	6.100	4.263	2.755	2.813	4.3	-2.439	4.935	2.981	0.850	1.010	4.816	2.759
FOLK AND	MEAN GRAIN SIZE (phi):	5.637	3.879	5.326	5.810	4.735	2.775	2.906	2.9	-1.860	4.725	3.773	0.576	1.736	4.598	3.674
WARD METHOD	SORTING	2.086	1.893	2.224	2.100	2.162	0.951	1.152	4.6	2.884	3.062	2.499	1.482	3.059	2.639	1.997
(phi)	SKEWNESS	-0.186	0.592	-0.037	-0.201	0.294	0.275	0.405	-0.383	0.372	-0.204	0.418	-0.395	0.308	-0.113	0.643
	KURTOSIS	0.810	1.098	0.806	0.847	0.694	1.850	2.265	0.983	0.718	0.841	0.702	1.687	2.422	0.771	1.040
	MEAN:	Coarse Silt	Very Fine Sand	Coarse Silt	Coarse Silt	Very Coarse Silt	Fine Sand	Fine Sand	Fine Sand	Very Fine Gravel	Very Coarse Silt	Very Fine Sand	Coarse Sand	Medium Sand	Very Coarse Silt	Very Fine Sand
FOLK AND WARD METHOD	SORTING:	Very Poorly Sorted	Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted	Moderately Sorted	Poorly Sorted	Extremely Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted	Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted	Poorly Sorted
(Description)	SKEWNESS:	Coarse Skewed	Very Fine Skewed	Symmetrical	Coarse Skewed	Fine Skewed	Fine Skewed	Very Fine Skewed	Very Coarse Skewed	Very Fine Skewed	Coarse Skewed	Very Fine Skewed	Very Coarse Skewed	Very Fine Skewed	Coarse Skewed	Very Fine Skewed
	KURTOSIS:	Platykurtic	Mesokurtic	Platykurtic	Platykurtic	Platykurtic	Very Leptokurtic	Very Leptokurtic	Mesokurtic	Platykurtic	Platykurtic	Platykurtic	Very Leptokurtic	Very Leptokurtic	Platykurtic	Mesokurtic
BULK GRAIN SIZE	% GRAVEL:	0.000	0.034	0.000	0.000	0.033	0.000	0.366	20.421	60.945	6.049	0.681	13.732	15.472	2.726	0.000
	% SAND:	24.399	71.457	31.992	21.939	47.304	92.640	87.128	26.735	33.888	36.914	60.180	82.914	65.693	38.993	73.179
	% MUD:	75.601	28.510	68.008	78.061	52.662	7.360	12.506	52.844	5.166	57.037	39.139	3.354	18.835	58.281	26.821
	% V COARSE GRAVEL:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	% COARSE GRAVEL:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	9.344	27.279	1.015	0.000	0.000	3.300	0.000	0.000
	% MEDIUM GRAVEL:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	7.106	15.241	1.902	0.000	5.874	0.927	0.015	0.000
	% FINE GRAVEL:	0.000	0.030	0.000	0.000	0.002	0.000	0.250	2.782	11.878	1.617	0.388	2.927	4.037	1.574	0.000
	% V FINE GRAVEL:	0.000	0.003	0.000	0.000	0.031	0.000	0.116	1.188	6.548	1.516	0.293	4.931	7.209	1.137	0.000
	% V COARSE SAND:	0.000	0.017	0.000	0.000	0.017	0.000	0.053	0.815	4.482	1.002	0.420	11.528	8.979	0.496	0.000
	% COARSE SAND:	0.080	0.000	2.128	0.124	0.034	0.172	0.000	0.702	10.700	1.245	5.869	31.243	25.135	6.583	0.003
	% MEDIUM SAND:	3.857	6.174	5.344	3.691	4.372	9.606	6.458	9.043	13.387	15.382	25.097	36.160	29.601	10.049	15.069
	% FINE SAND:	9.224	40.209	8.592	7.781	23.188	55.505	54.854	7.533	2.731	13.533	18.223	2.601	1.010	11.488	45.352
	% V FINE SAND:	11.238	25.056	15.928	10.343	19.693	27.357	25.763	8.642	2.588	5.752	10.570	1.382	0.969	10.378	12.755
	% V COARSE SILT:	11.930	4.504	14.186	11.432	9.773	0.688	0.823	8.405	1.051	7.575	6.431	0.931	2.365	10.312	3.429
	% COARSE SILT:	15.123	6.342	12.534	14.879	10.668	2.035	3.491	9.246	0.963	10.243	7.658	0.721	3.906	13.387	5.934
	% MEDIUM SILT:	18.349	6.704	14.391	18.230	11.475	1.970	3.267	11.979	1.337	13.330	9.526	0.828	5.424	13.820	6.370
	% FINE SILT:	18.775	6.962	16.021	19.510	12.393	1.853	3.274	13.565	1.239	15.172	9.660	0.722	5.017	12.698	7.207
	% V FINE SILT:	10.131	3.638	9.448	11.884	7.278	0.807	1.565	8.259	0.552	9.211	5.208	0.151	2.022	7.016	3.554
	% CLAY:	1.293	0.360	1.427	2.126	1.076	0.007	0.086	1.390	0.023	1.505	0.656	0.000	0.101	1.047	0.327
LOI		6.24	2.32	7.29	6.32	2.78	1.89	1.53	5.04	2.34	3.31	3.39	6.34	6.80	7.86	1.59

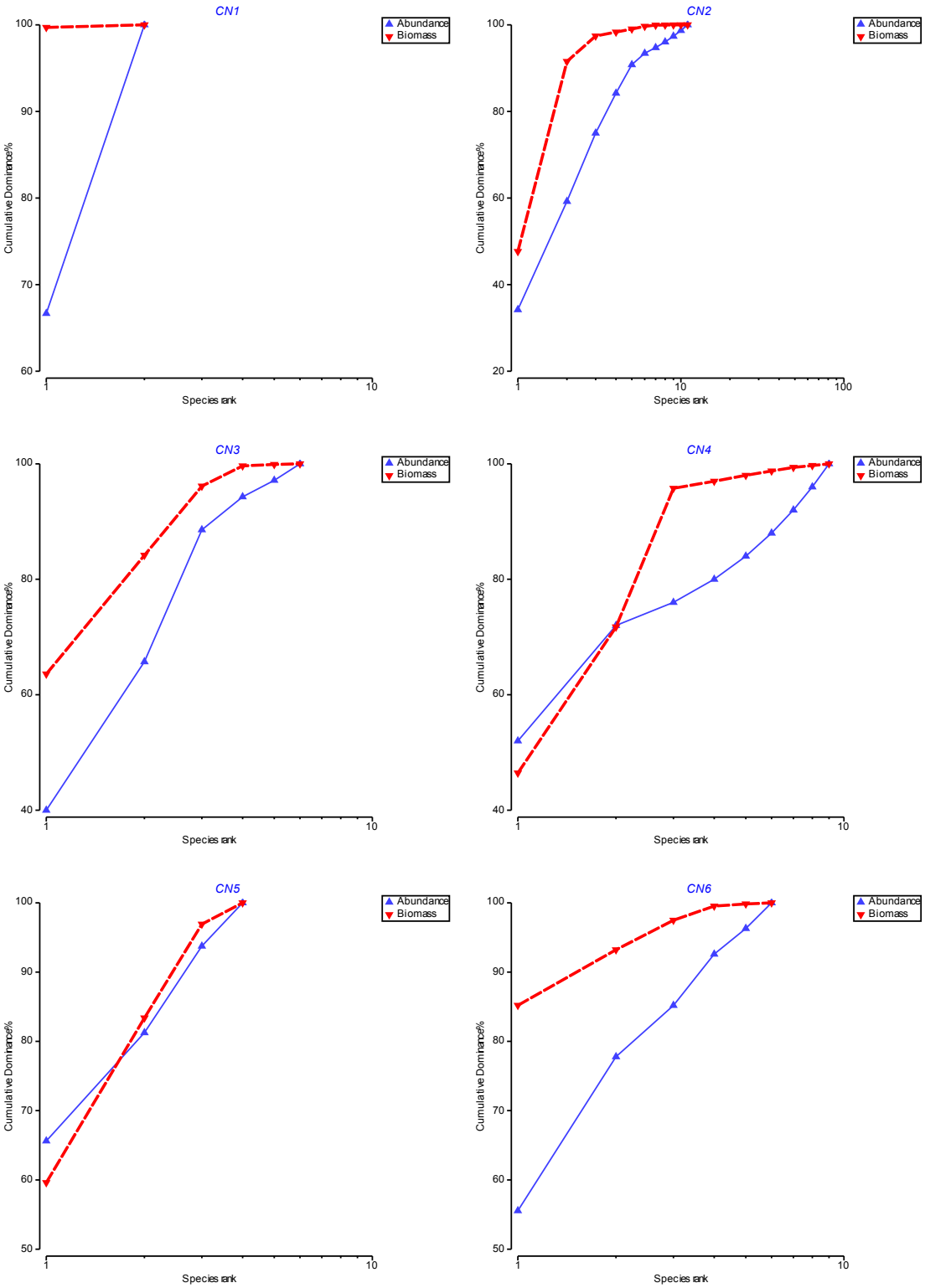
SAMPLE	PARAMETER	DI2	DI3	DI4	DI5	DI6	DI7	DI8	SI1	SI2	SI3	SI4	SI5	SI6	SI7	SI8
SAMPLE TYPE:		Bimodal, Very Poorly Sorted	Bimodal, Poorly Sorted	Bimodal, Poorly Sorted	Bimodal, Very Poorly Sorted	Bimodal, Poorly Sorted	Unimodal, Poorly Sorted	Bimodal, Very Poorly Sorted	Bimodal, Very Poorly Sorted	Bimodal, Poorly Sorted	Bimodal, Very Poorly Sorted	Unimodal, Moderately Sorted	Unimodal, Moderately Sorted	Bimodal, Very Poorly Sorted	Unimodal, Poorly Sorted	Unimodal, Poorly Sorted
TEXTURAL GROUP:		Slightly Gravelly Sandy Mud	Slightly Gravelly Sandy Mud	Slightly Gravelly Muddy Sand	Slightly Gravelly Muddy Sand	Sandy Mud	Slightly Gravelly Sandy Mud	Slightly Gravelly Sandy Mud	Slightly Gravelly Sandy Mud	Sandy Mud	Sandy Mud	Sand	Sand	Muddy Sand	Muddy Sand	Slightly Gravelly Muddy Sand
SEDIMENT NAME:		Slightly Very Fine Gravelly Medium Sandy Fine Silt	Slightly Very Fine Gravelly Very Fine Sandy Fine Silt	Slightly Very Fine Gravelly Fine Silty Fine Sand	Slightly Medium Gravelly Fine Silty Medium Sand	Very Fine Sandy Fine Silt	Slightly Very Fine Gravelly Very Fine Sandy Fine Silt	Slightly Very Fine Gravelly Very Fine Sandy Fine Silt	Slightly Very Fine Gravelly Very Fine Sandy Fine Silt	Very Fine Sandy Fine Silt	Very Fine Sandy Fine Silt	Moderately Sorted Fine Sand	Moderately Sorted Fine Sand	Medium Silty Fine Sand	Coarse Silty Fine Sand	Slightly Very Fine Gravelly Fine Silty Fine Sand
	MEDIAN GRAIN SIZE D_{50} (µm)	24.82	16.35	140.8	147.4	17.69	11.5	15.805	23.3	13.2	25.1	164.2	151.3	112.1	149.1	180.5
FOLK AND	MEAN GRAIN SIZE (µm)	33.684	17.014	76.0	68.7	18.9	13.6	17.5	24.062	15.004	24.340	158.744	148.643	62.608	143.132	105.734
WARD METHOD	SORTING	6.123	3.658	3.914	5.674	3.93	3.736	4.1	4.574	3.885	4.354	1.962	1.895	4.008	2.143	3.431
(µm)	SKEWNESS	0.185	0.051	-0.636	-0.562	0.084	0.208	0.124	0.065	0.171	-0.010	-0.352	-0.315	-0.569	-0.362	-0.677
	KURTOSIS	0.619	0.788	1.112	0.633	0.808	0.891	0.813	0.816	0.901	0.764	2.282	2.079	0.834	2.130	2.156
	MEDIAN GRAIN SIZE D_{50} (phi):	5.332	5.934	2.828	2.762	5.821	6.444	6.0	5.423	6.238	5.315	2.607	2.724	3.157	2.745	2.470
FOLK AND	MEAN GRAIN SIZE (phi):	4.892	5.877	3.719	3.863	5.724	6.201	5.8	5.377	6.059	5.361	2.655	2.750	3.998	2.805	3.241
WARD METHOD	SORTING	2.614	1.871	1.969	2.504	1.974	1.901	2.0	2.194	1.958	2.122	0.972	0.922	2.003	1.100	1.778
(phi)	SKEWNESS	-0.185	-0.051	0.636	0.562	-0.084	-0.208	-0.124	-0.065	-0.171	0.010	0.352	0.315	0.569	0.362	0.677
	KURTOSIS	0.619	0.788	1.112	0.633	0.808	0.891	0.813	0.816	0.901	0.764	2.282	2.079	0.834	2.130	2.156
	MEAN:	Very Coarse Silt	Coarse Silt	Very Fine Sand	Very Fine Sand	Coarse Silt	Medium Silt	Coarse Silt	Coarse Silt	Medium Silt	Coarse Silt	Fine Sand	Fine Sand	Very Fine Sand	Fine Sand	Very Fine Sand
FOLK AND WARD METHOD	SORTING:	Very Poorly Sorted	Poorly Sorted	Poorly Sorted	Very Poorly Sorted	Poorly Sorted	Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted	Poorly Sorted	Very Poorly Sorted	Moderately Sorted	Moderately Sorted	Very Poorly Sorted	Poorly Sorted	Poorly Sorted
(Description)	SKEWNESS:	Coarse Skewed	Symmetrical	Very Fine Skewed	Very Fine Skewed	Symmetrical	Coarse Skewed	Coarse Skewed	Symmetrical	Coarse Skewed	Symmetrical	Very Fine Skewed	Very Fine Skewed	Very Fine Skewed	Very Fine Skewed	Very Fine Skewed
	KURTOSIS:	Very Platykurtic	Platykurtic	Leptokurtic	Very Platykurtic	Platykurtic	Platykurtic	Platykurtic	Platykurtic	Mesokurtic	Platykurtic	Very Leptokurtic	Very Leptokurtic	Platykurtic	Very Leptokurtic	Very Leptokurtic
BULK GRAIN SIZE	% GRAVEL:	0.066	0.004	0.002	0.422	0.000	0.278	0.909	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.003
	% SAND:	36.893	18.322	73.854	55.718	21.751	14.392	20.165	29.846	16.345	30.922	91.511	92.891	66.205	88.986	78.766
	% MUD:	63.042	81.674	26.144	43.860	78.249	85.330	78.926	70.150	83.655	69.078	8.489	7.109	33.795	11.014	21.230
	% V COARSE GRAVEL:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	% COARSE GRAVEL:	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	% MEDIUM GRAVEL:	0.000	0.000	0.000	0.218	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	% FINE GRAVEL:	0.016	0.000	0.000	0.057	0.000	0.127	0.428	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	% V FINE GRAVEL:	0.049	0.004	0.002	0.148	0.000	0.152	0.481	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.003
	% V COARSE SAND:	0.352	0.004	0.003	0.348	0.000	0.059	0.053	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.034
	% COARSE SAND:	3.308	0.029	0.001	1.528	0.001	0.290	0.057	1.614	0.374	0.214	0.000	0.000	0.004	0.000	0.005
	% MEDIUM SAND:	18.651	1.231	12.073	29.294	1.900	1.989	2.174	5.254	3.183	4.246	12.240	7.496	7.670	9.635	20.981
	% FINE SAND:	9.965	4.316	45.833	21.598	7.617	3.683	6.062	8.606	3.999	10.137	63.113	61.818	37.648	55.861	51.816
	% V FINE SAND:	4.617	12.742	15.943	2.950	12.234	8.371	11.818	14.363	8.789	16.324	16.158	23.577	20.884	23.490	5.930
	% V COARSE SILT:	9.191	17.105	2.950	6.533	15.387	12.431	14.809	14.400	13.577	14.935	0.592	0.199	5.299	0.915	3.190
	% COARSE SILT:	12.327	15.577	5.775	7.893	15.646	15.108	14.354	13.790	15.916	13.161	2.716	2.080	7.555	3.245	5.034
	% MEDIUM SILT:	15.031	16.905	6.321	10.433	16.793	18.755	16.243	15.178	18.263	14.327	2.204	2.423	8.559	2.695	5.151
	% FINE SILT:	15.797	18.805	7.343	11.595	18.246	22.241	19.262	15.880	20.480	15.631	2.124	1.784	8.311	2.838	5.421
	% V FINE SILT:	9.228	11.364	3.497	6.501	10.585	14.198	12.189	9.382	12.979	9.479	0.847	0.619	3.785	1.288	2.309
	% CLAY:	1.468	1.919	0.260	0.906	1.592	2.597	2.068	1.519	2.440	1.545	0.007	0.003	0.285	0.033	0.126
LOI		3.07	6.26	1.75	2.36	7.01	6.65	6.22	6.14	6.83	5.29	1.19	1.68	4.62	1.48	1.88

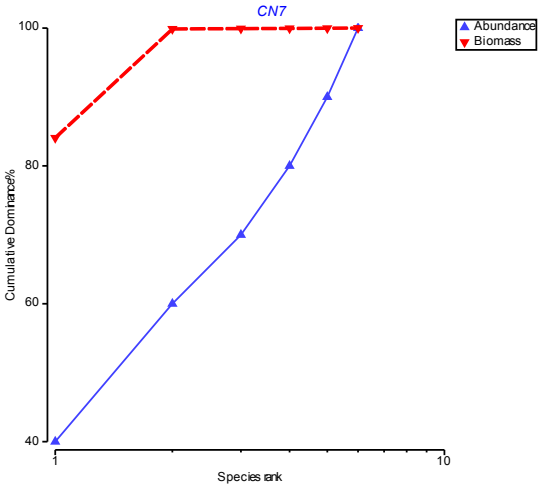
Appendix 13. Biological Parameters at Subtidal Benthic Sites (replicate data per 0.1m^2)

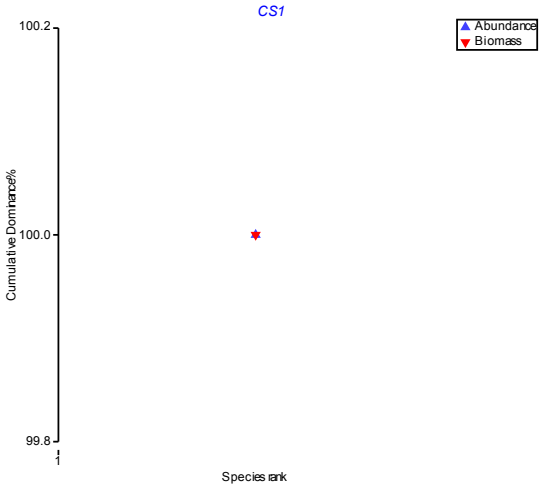
Area	Sample	Quantitative Taxa	Total Taxa	Numbers of Individuals	Biomass (AFDW g)	Margalef's d	Pielou's J	Shannon's H'	AFDW ABC w stat
Control North	CN1 (A)	1	1	1	0.000121			0.00	0.00
	CN1 (B)	1	1	1	0.000016			0.00	0.00
	CN1 (C)	1	1	1	0.005173			0.00	0.00
	CN2 (A)	4	4	17	0.011340	1.06	0.92	1.84	0.55
	CN2 (B)	7	8	28	0.004975	1.80	0.77	2.15	0.16
	CN2 (C)	8	8	31	0.068498	2.04	0.81	2.42	0.29
	CN3 (A)	1	1	3	0.000015	0.00		0.00	0.00
	CN3 (B)	3	3	5	0.000050	1.24	0.86	1.37	-0.34
	CN3 (C)	5	5	27	0.014942	1.21	0.71	1.65	0.09
	CN4 (A)	4	4	9	0.001063	1.37	0.72	1.45	0.27
	CN4 (B)	5	6	14	0.000456	1.52	0.81	1.87	0.35
	CN4 (C)	2	2	2	0.000471	1.44	1.00	1.00	0.93
	CN5 (A)	4	4	15	0.049423	1.11	0.78	1.55	0.15
	CN5 (B)	2	4	6	0.007207	0.56	0.92	0.92	0.47
	CN5 (C)	4	4	11	0.015064	1.25	0.64	1.28	0.04
	CN6 (A)	2	2	4	0.000191	0.72	0.81	0.81	0.34
	CN6 (B)	2	2	2	0.000030	1.44	1.00	1.00	0.08
	CN6 (C)	6	6	21	0.009750	1.64	0.75	1.93	0.31
	CN7 (A)	3	3	3	0.008996	1.82	1.00	1.58	1.00
	CN7 (B)	1	1	1	0.047727			0.00	0.00
	CN7 (C)	3	3	6	0.000046	1.12	0.92	1.46	-0.27
Control South	CS1 (A)	1	2	7	0.000558	0.00		0.00	0.00
	CS1 (C)	1	1	11	0.000640	0.00		0.00	0.00
	CS1 (D)	1	1	3	0.000128	0.00		0.00	0.00
	CS5 (A)	3	3	5	0.011541	1.24	0.86	1.37	0.58
	CS5 (B)	2	2	6	0.001367	0.56	0.92	0.92	0.64
	CS5 (C)	2	2	19	0.006841	0.34	0.30	0.30	0.10
	CS3 (A)	2	2	4	0.002011	0.72	0.81	0.81	-0.42
	CS3 (B)	2	3	12	0.001878	0.40	0.41	0.41	0.16
	CS3 (C)	1	2	1	0.000537			0.00	0.00
	CS4 (A)	4	4	50	0.006674	0.77	0.21	0.42	0.03
	CS4 (B)	3	3	6	0.000592	1.12	0.92	1.46	0.39
	CS4 (C)	5	6	19	0.006879	1.36	0.70	1.63	-0.24
	CS2 (A)	2	2	7	0.006878	0.51	0.59	0.59	-0.52
	CS2 (B)	2	2	5	0.000598	0.62	0.97	0.97	0.75
	CS2 (C)	2	3	18	0.010581	0.35	0.31	0.31	0.11
	CS6 (A)	2	2	4	0.007374	0.72	1.00	1.00	0.19
	CS6 (B)	5	6	7	0.003846	2.06	0.96	2.24	0.75
	CS6 (C)	2	2	8	0.003409	0.48	0.81	0.81	0.12
	CS7 (A)	5	5	20	0.000072	1.34	0.61	1.42	-0.41
	CS7 (B)	7	8	69	0.001180	1.42	0.72	2.02	0.03
	CS7 (D)	9	9	28	0.001197	2.40	0.76	2.42	0.24

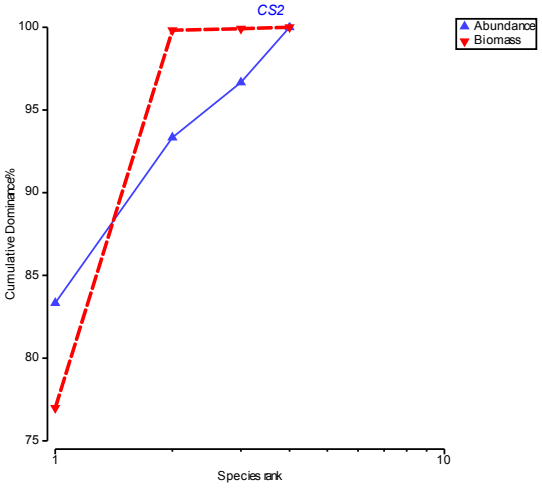
Area	Sample	Quantitative Taxa	Total Taxa	Numbers of Individuals	Biomass (AFDW g)	Margalef's d	Pielou's J	Shannon's H'	AFDW ABC w stat
Direct Impact	DI1 (A)	7	8	20	0.003928	2.00	0.92	2.57	0.22
	DI1 (B)	6	6	10	0.004056	2.17	0.90	2.32	0.49
	DI1 (C)	6	6	12	0.001373	2.01	0.95	2.46	0.56
	DI2 (A)	2	2	21	0.003076	0.33	0.28	0.28	-0.12
	DI2 (B)	3	4	24	0.001763	0.63	0.31	0.50	0.11
	DI2 (C)	1	2	10	0.007137	0.00		0.00	0.00
	DI3 (A)	7	8	87	0.011665	1.34	0.62	1.75	-0.03
	DI3 (B)	6	6	42	0.011594	1.34	0.49	1.26	0.11
	DI3 (C)	8	8	25	0.023770	2.17	0.90	2.69	0.41
	DI4 (A)	5	5	9	0.001757	1.82	0.95	2.20	0.43
	DI4 (B)	5	5	24	0.005140	1.26	0.68	1.58	0.01
	DI4 (C)	4	5	8	0.006185	1.44	0.88	1.75	0.48
	DI5 (A)	1	1	9	0.001200	0.00		0.00	0.00
	DI5 (B)	1	2	6	0.000464	0.00		0.00	0.00
	DI5 (C)	5	5	8	0.033624	1.92	0.86	2.00	0.46
	DI6 (A)	5	5	28	0.016956	1.20	0.50	1.16	-0.03
	DI6 (B)	1	1	2	0.000017	0.00		0.00	0.00
	DI6 (C)	3	4	9	0.304237	0.91	0.85	1.35	0.55
	DI7 (A)	2	2	9	0.001488	0.46	0.92	0.92	0.65
	DI7 (B)	6	6	22	0.003531	1.62	0.76	1.97	0.28
	DI7 (C)	6	6	13	0.001649	1.95	0.90	2.32	0.41
	DI8 (A)	5	5	26	0.012987	1.23	0.62	1.43	0.18
	DI8 (B)	2	2	4	0.000031	0.72	0.81	0.81	-0.47
	DI8 (C)	1	1	3	0.005340	0.00		0.00	0.00
Secondary Impact	SI1 (A)	3	3	24	0.014887	0.63	0.69	1.10	0.34
	SI1 (B)	4	5	16	0.000526	1.08	0.83	1.67	0.19
	SI1 (C)	2	2	4	0.000198	0.72	0.81	0.81	0.34
	SI2 (A)	2	2	4	0.000032	0.72	0.81	0.81	-0.50
	SI2 (B)	2	4	3	0.000057	0.91	0.92	0.92	-0.30
	SI2 (C)	1	2	1	0.000278			0.00	0.00
	SI3 (A)	8	9	168	0.038902	1.37	0.29	0.86	0.02
	SI3 (B)	5	5	216	0.064273	0.74	0.09	0.20	0.02
	SI3 (C)	3	3	139	0.043740	0.41	0.29	0.47	0.09
	SI4 (A)	2	2	2	0.004083	1.44	1.00	1.00	0.85
	SI4 (B)	1	1	4	0.000704	0.00		0.00	0.00
	SI4 (C)	2	2	5	0.000900	0.62	0.72	0.72	0.03
	SI5 (A)	1	1	1	0.002065			0.00	0.00
	SI5 (B)	2	2	3	0.029567	0.91	0.92	0.92	0.67
	SI5 (C)	2	2	2	0.008221	1.44	1.00	1.00	1.00
	SI6 (A)	4	4	5	0.002253	1.86	0.96	1.92	0.49
	SI6 (B)	2	2	3	0.000149	0.91	0.92	0.92	0.50
	SI6 (C)	4	4	7	0.021983	1.54	0.92	1.84	0.66
	SI7 (A)	1	1	1	0.000014			0.00	0.00
	SI7 (B)	1	1	1	0.000032			0.00	0.00
	SI7 (C)	2	2	2	0.002981	1.44	1.00	1.00	0.99
	SI8 (A)	3	3	5	0.002698	1.24	0.86	1.37	0.44
	SI8 (B)	6	7	14	0.001590	1.89	0.80	2.06	0.14
	SI8 (C)	6	6	29	0.004148	1.48	0.41	1.06	0.13

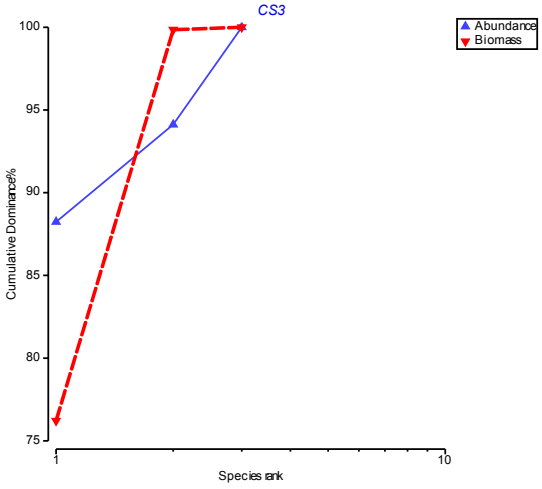
Appendix 14. ABC Curves for Subtidal Benthic Sites

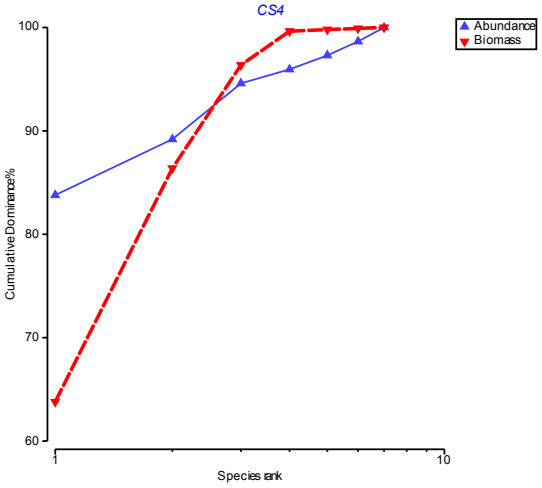


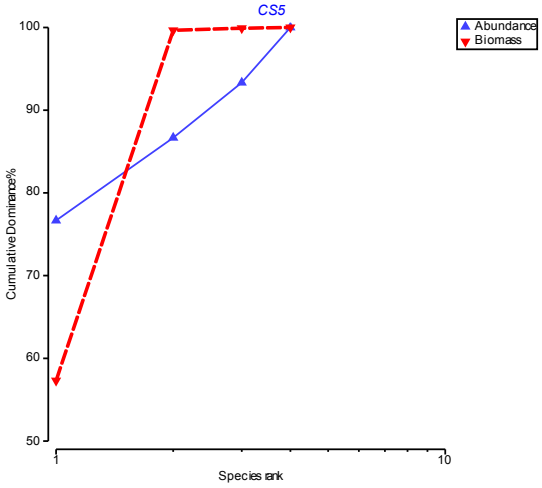

CN7
Abundance
Biomass
Cumulative Dominance%
100
80
60
40
1
10
Species rank

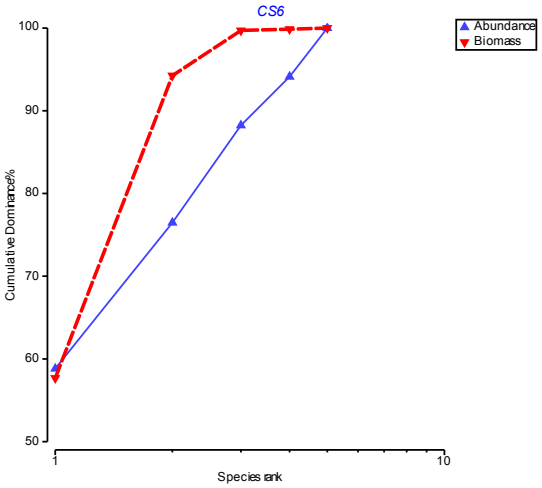

CS1
Abundance
Biomass
Cumulative Dominance%
100.2
100.0
99.8
1
Species rank

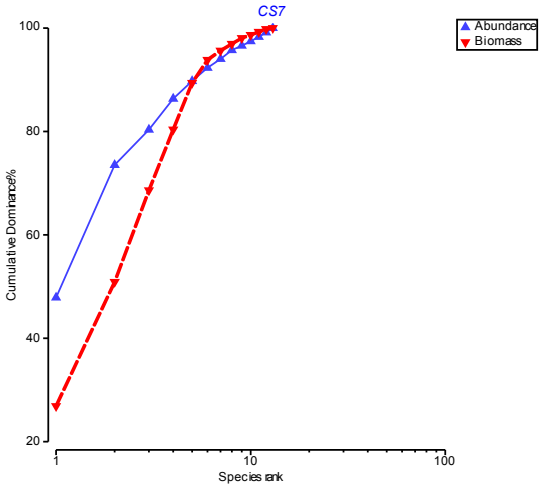

CS2
Abundance
Biomass
Cumulative Dominance%
100
95
90
85
80
75
1
10
Species rank

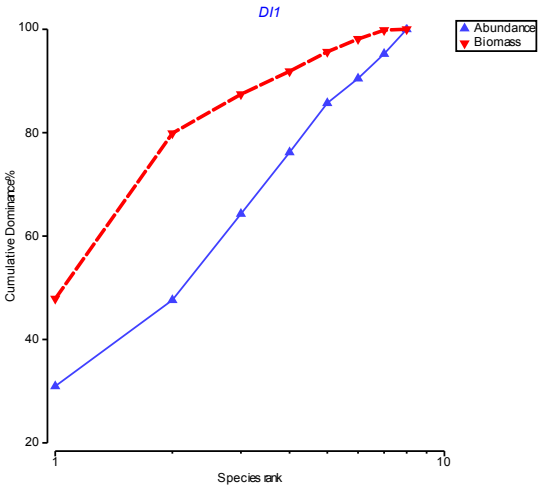

CS3
Abundance
Biomass
Cumulative Dominance%
100
95
90
85
80
75
1
10
Species rank

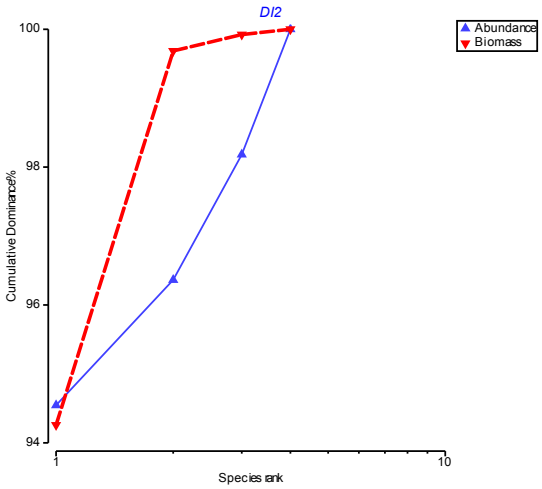

CS4
Abundance
Biomass
Cumulative Dominance%
100
90
80
70
60
1
10
Species rank

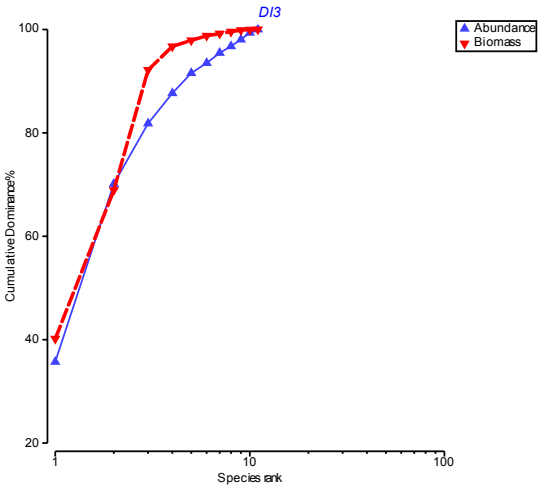

CS5
Abundance
Biomass
Cumulative Dominance%
100
90
80
70
60
50
1
10
Species rank

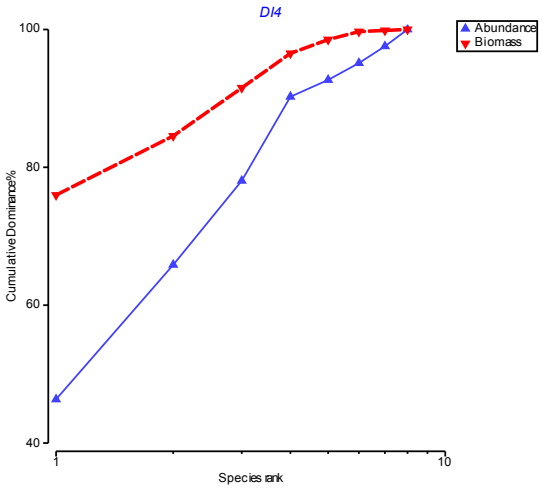

CS6
Abundance
Biomass
Cumulative Dominance%
Species rank

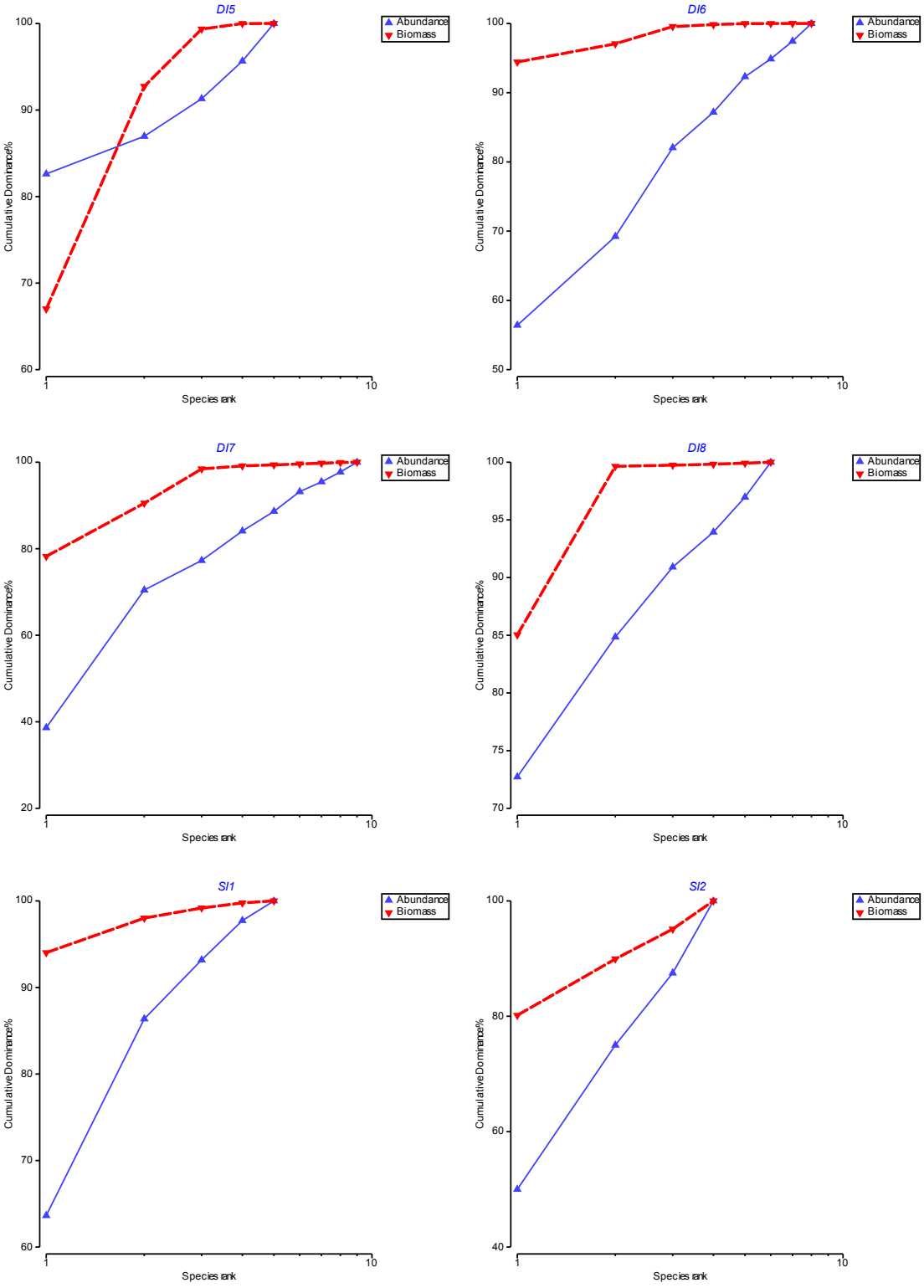

CS7
Abundance
Biomass
Cumulative Dominance%
Species rank

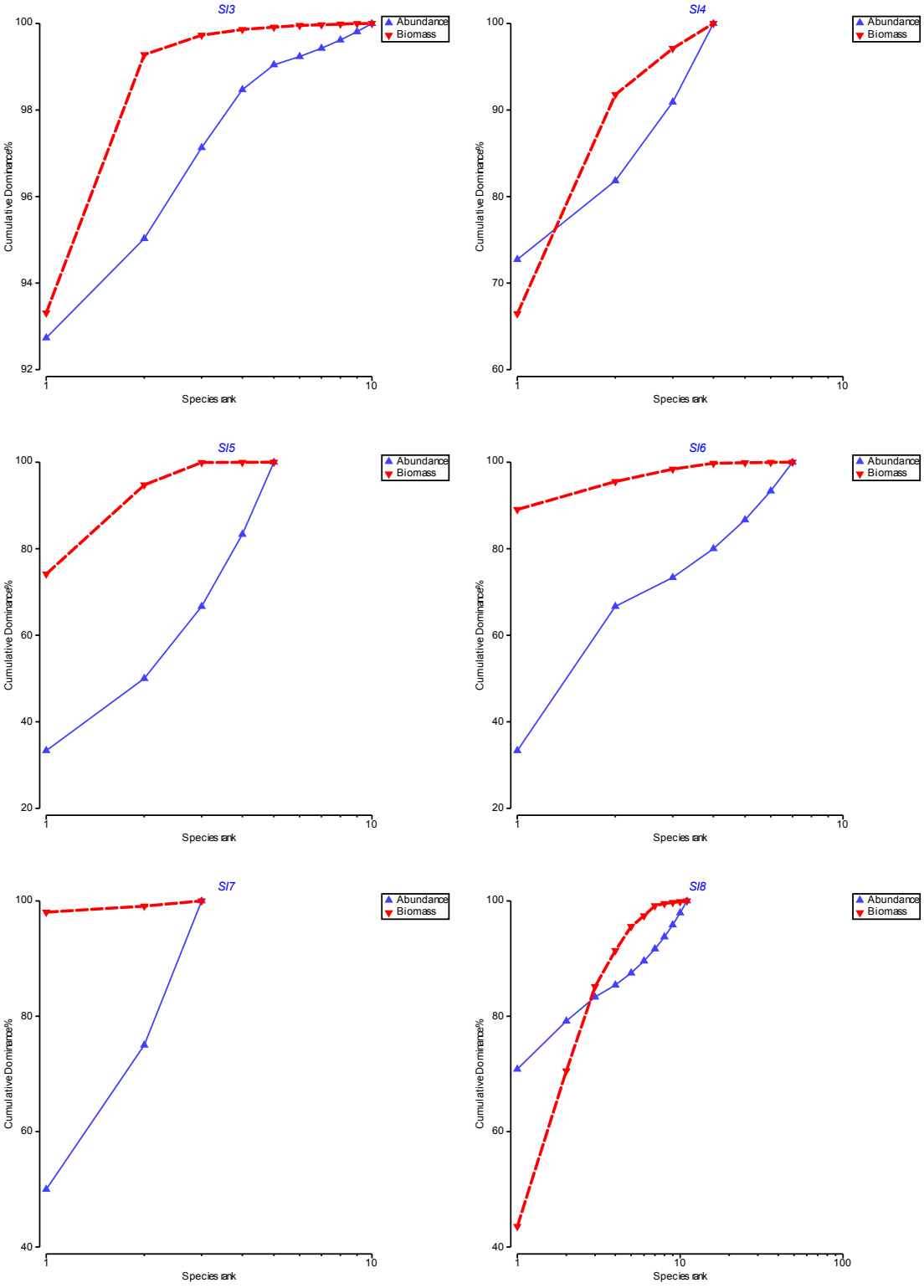

DI1
Abundance
Biomass
Cumulative Dominance%
Species rank


DI2
Abundance
Biomass
Cumulative Dominance%
Species rank


DI3
Abundance
Biomass
Cumulative Dominance%
Species rank


DI4
Abundance
Biomass
Cumulative Dominance%
Species rank


DI5
DI6
DI7
DI8
SI1
SI2
Abundance
Biomass
Cumulative Dominance%
Species rank
1
10


SI3
SI4
SI5
SI6
SI7
SI8
Abundance
Biomass
Cumulative Dominance%
Species rank

Appendix 15. Subtidal Benthic Abundance Data (per 0.1m^2)

Abundance per 0.1m ^{2}	Qualifier	CN1 (A)	CN1 (B)	CN1 (C)	CN2 (A)	CN2 (B)	CN2 (C)	CN3 (A)	CN3 (B)	CN3 (C)	CN4 (A)	CN4 (B)	CN4 (C)	CN5 (A)	CN5 (B)	CN5 (C)
Actiniaria sp. juvenile																
Amphipoda sp.	damaged															
Anthozoa spp.																
Arachnida sp.						P										
Arenicolidae sp. (Arenicola marina)	inc. juvenile				3	7	9					P		3	P	1
Balanus balanus																
Bivalvia sp.	inc. damaged/juvenile					1						1				
Capitella sp.					3	12	11							9	4	8
Carcinus maenas																
Conopeum reticulum																
Copepoda spp.							1		1							
Corophiidae sp.																
Corophium volutator							1			9						
Crangon allmanni																
Crangon crangon																
Cumacea sp.	damaged															
Cyathura carinata																
Platyhelminthes (Dalyellidae) sp.																
Diastylis rathkei																
Electra monostachys																
Electra pilosa																
Eteone flava/longa agg.						1	1				1					
Eteone sp. juvenile																
Eurydice pulchra																
Gammarus sp.	inc. juvenile					1										
Gammarus salinus		1		1	8		4	3	3	2						
Gastrosaccus sp. juvenile																
Gastrosaccus spinifer																
Limecola balthica					3		2				1			1		1
Modiolus modiolus																
Mysida spp.	inc. damaged/juvenile					5	2			1					P	
Mytilidae spp. juvenile																
Nematoda spp.									1	1		5				
Nemertea spp.											1					
Neomysis integer																
Nephtys caeca																
Nephtys cirrosa																
Nephtys hombergii						1							1	2	2	1
Nereididae sp.																
Orbiniidae sp.																
Polydora cornuta										14						
Pygospio elegans												**1**				
Scoloplos armiger																
Sertulariidae sp.																
Sphaerodoridium minutum																
Spionidae sp.	damaged															
Streblospio shrubsolii			1								6	6	1			
Tharyx killariensis																
Tubificoides benedii												1				

Abundance per 0.1m ^{2}	Qualifier	CN6 (A)	CN6 (B)	CN6 (C)	CN7 (A)	CN7 (B)	CN7 (C)	CS1 (A)	CS1 (C)	CS1 (D)	CS2 (A)	CS2 (B)	CS2 (C)	CS3 (A)	CS3 (B)	CS3 (C)
Actiniaria sp. juvenile																
Amphipoda sp.	damaged															
Anthozoa spp.																
Arachnida sp.																
Arenicolidae sp. (Arenicola marina)	inc. juvenile		1	5	1		3	P								P
Balanus balanus																
Bivalvia sp.	inc. damaged/juvenile														1	
Capitella sp.		3	1	11			1	7	11	3		3		3	11	1
Carcinus maenas																
Conopeum reticulum													P			
Copepoda spp.				1			2						1			
Corophiidae sp.																
Corophium volutator																
Crangon allmanni																
Crangon crangon						1										
Cumacea sp.	damaged															
Cyathura carinata																
Platyhelminthes (Dalyellidae) sp.																
Diastylis rathkei																
Electra monostachys															P	
Electra pilosa																
Eteone flava/longa agg.				2												
Eteone sp. juvenile																
Eurydice pulchra											6	2	17	1		
Gammarus sp.	inc. juvenile															
Gammarus salinus		1		1	1											
Gastrosaccus sp. juvenile																
Gastrosaccus spinifer											1					
Limecola balthica				1	1											
Modiolus modiolus																
Mysida spp.	inc. damaged/juvenile															
Mytilidae spp. juvenile																
Nematoda spp.																
Nemertea spp.																
Neomysis integer																
Nephtys caeca																
Nephtys cirrosa																
Nephtys hombergii																
Nereididae sp.																
Orbiniidae sp.																
Polydora cornuta																
Pygospio elegans																
Scoloplos armiger																
Sertulariidae sp.																
Sphaerodoridium minutum																
Spionidae sp.	damaged															
Streblospio shrubsolii																
Tharyx killariensis																
Tubificoides benedii																

Abundance per 0.1m ^{2}	Qualifier	CS4 (A)	CS4 (B)	CS4 (C)	CS5 (A)	CS5 (B)	CS5 (C)	CS6 (A)	CS6 (B)	CS6 (C)	CS7 (A)	CS7 (B)	CS7 (D)	DI1 (A)	DI1 (B)	DI1 (C)
Actiniaria sp. juvenile												1				
Amphipoda sp.	damaged															
Anthozoa spp.									2							
Arachnida sp.																
Arenicolidae sp. (Arenicola marina)	inc. juvenile								P			5	3		1	1
Balanus balanus				1												
Bivalvia sp.	inc. damaged/juvenile															
Capitella sp.		47	3	12					1	2				6	4	3
Carcinus maenas																
Conopeum reticulum																
Copepoda spp.									1							
Corophiidae sp.																
Corophium volutator											1		1			
Crangon allmanni													1			
Crangon crangon																
Cumacea sp.	damaged															
Cyathura carinata																
Platyhelminthes (Dalyellidae) sp.					1		1									
Diastylis rathkei																
Electra monostachys				P												
Electra pilosa														P		
Eteone flava/longa agg.		1														
Eteone sp. juvenile													1			
Eurydice pulchra		1		3	1	4	18	2	2	6						
Gammarus sp.	inc. juvenile															
Gammarus salinus					3								1			
Gastrosaccus sp. juvenile																
Gastrosaccus spinifer			2	2				2								
Limecola balthica														3	2	2
Modiolus modiolus												4				
Mysida spp.	inc. damaged/juvenile	1											3			
Mytilidae spp. juvenile											1					
Nematoda spp.						2			1		14	28	14			
Nemertea spp.			1								1	1				
Neomysis integer																
Nephtys caeca																
Nephtys cirrosa																
Nephtys hombergii														1	1	
Nereididae sp.																
Orbiniidae sp.																
Polydora cornuta												5	2			
Pygospio elegans											3	25	2			
Scoloplos armiger				1										4		1
Sertulariidae sp.												P				
Sphaerodoridium minutum																
Spionidae sp.	damaged															
Streblospio shrubsolii														3	1	3
Tharyx killariensis														2		
Tubificoides benedii														1	1	2

Abundance per 0.1m ^{2}	Qualifier	DI2 (A)	DI2 (B)	DI2 (C)	DI3 (A)	DI3 (B)	DI3 (C)	DI4 (A)	DI4 (B)	DI4 (C)	DI5 (A)	DI5 (B)	DI5 (C)	DI6 (A)	DI6 (B)	DI6 (C)
Actiniaria sp. juvenile																
Amphipoda sp.	damaged															
Anthozoa spp.																
Arachnida sp.																
Arenicolidae sp. (Arenicola marina)	inc. juvenile			P				2	1	2			1			
Balanus balanus																
Bivalvia sp.	inc. damaged/juvenile															
Capitella sp.		20	22	10				3	15	1	9	6	4			
Carcinus maenas																1
Conopeum reticulum			P													
Copepoda spp.																
Corophiidae sp.													1			5
Corophium volutator					14	32	7							22		
Crangon allmanni																
Crangon crangon																
Cumacea sp.	damaged															
Cyathura carinata							2									
Platyhelminthes (Dalyellidae) sp.																
Diastylis rathkei					1											
Electra monostachys																P
Electra pilosa												P				
Eteone flava/longa agg.						2		1								
Eteone sp. juvenile																
Eurydice pulchra			1													
Gammarus sp.	inc. juvenile															
Gammarus salinus														1		
Gastrosaccus sp. juvenile																
Gastrosaccus spinifer																
Limecola balthica		1				1	2	2	2	4			1			
Modiolus modiolus																
Mysida spp.	inc. damaged/juvenile															
Mytilidae spp. juvenile			1										1			
Nematoda spp.						1	1	1								
Nemertea spp.										1				2		
Neomysis integer																
Nephtys caeca									1							
Nephtys cirrosa																
Nephtys hombergii					3	1	5							1		
Nereididae sp.					P											
Orbiniidae sp.										P						
Polydora cornuta															2	3
Pygospio elegans					1		2							2		
Scoloplos armiger																
Sertulariidae sp.																
Sphaerodoridium minutum																
Spionidae sp.	damaged															
Streblospio shrubsolii					54		1		5							
Tharyx killariensis					6											
Tubificoides benedii					8	5	5									

Abundance per 0.1m ^{2}	Qualifier	DI7 (A)	DI7 (B)	DI7 (C)	DI8 (A)	DI8 (B)	DI8 (C)	SI1 (A)	SI1 (B)	SI1 (C)	SI2 (A)	SI2 (B)	SI2 (C)	SI3 (A)	SI3 (B)	SI3 (C)
Actiniaria sp. juvenile																
Amphipoda sp.	damaged											P				
Anthozoa spp.																
Arachnida sp.																
Arenicolidae sp. (Arenicola marina)	inc. juvenile															
Balanus balanus																
Bivalvia sp.	inc. damaged/juvenile													1		
Capitella sp.					4											
Carcinus maenas																
Conopeum reticulum																
Copepoda spp.																
Corophiidae sp.																
Corophium volutator		6	7	4		1					1			146	211	128
Crangon allmanni																
Crangon crangon																
Cumacea sp.	damaged											P				
Cyathura carinata				1												
Platyhelminthes (Dalyellidae) sp.																
Diastylis rathkei			2	1												
Electra monostachys									P							
Electra pilosa																
Eteone flava/longa agg.																
Eteone sp. juvenile																
Eurydice pulchra																
Gammarus sp.	inc. juvenile												P			
Gammarus salinus					18	3	3			1				7		
Gastrosaccus sp. juvenile																
Gastrosaccus spinifer																
Limecola balthica			1					1	2							
Modiolus modiolus																
Mysida spp.	inc. damaged/juvenile				1									P		
Mytilidae spp. juvenile				2											1	
Nematoda spp.					1			7	3					1		
Nemertea spp.														1		
Neomysis integer																
Nephtys caeca																
Nephtys cirrosa																
Nephtys hombergii													1			
Nereididae sp.																
Orbiniidae sp.																
Polydora cornuta												2		4		8
Pygospio elegans			1											1	2	
Scoloplos armiger																
Sertulariidae sp.																
Sphaerodoridium minutum																
Spionidae sp.	damaged	3														
Streblospio shrubsolii			10	4	2			16	9	3	3	1		7	1	3
Tharyx killariensis																
Tubificoides benedii			1	1					2						1	

Abundance per 0.1m ^{2}	Qualifier	SI4 (A)	SI4 (B)	SI4 (C)	SI5 (A)	SI5 (B)	SI5 (C)	SI6 (A)	SI6 (B)	SI6 (C)	SI7 (A)	SI7 (B)	SI7 (C)	SI8 (A)	SI8 (B)	SI8 (C)
Actiniaria sp. juvenile																
Amphipoda sp.	damaged															
Anthozoa spp.																
Arachnida sp.																
Arenicolidae sp. (Arenicola marina)	inc. juvenile			1			1	1	2	2	1		1			
Balanus balanus																
Bivalvia sp.	inc. damaged/juvenile															
Capitella sp.			4	4		1		2		3		1		3	7	24
Carcinus maenas																
Conopeum reticulum																
Copepoda spp.																
Corophiidae sp.																
Corophium volutator															1	
Crangon allmanni																
Crangon crangon																
Cumacea sp.	damaged															
Cyathura carinata																
Platyhelminthes (Dalyellidae) sp.																
Diastylis rathkei																
Electra monostachys															P	
Electra pilosa																
Eteone flava/longa agg.																
Eteone sp. juvenile																
Eurydice pulchra																
Gammarus sp.	inc. juvenile															
Gammarus salinus		1					1	1								
Gastrosaccus sp. juvenile																1
Gastrosaccus spinifer									1						1	
Limecola balthica						2				1			1	1	1	
Modiolus modiolus																
Mysida spp.	inc. damaged/juvenile															
Mytilidae spp. juvenile																
Nematoda spp.										1						
Nemertea spp.								1								
Neomysis integer																
Nephtys caeca		1												1		
Nephtys cirrosa					1											1
Nephtys hombergii																
Nereididae sp.																
Orbiniidae sp.																
Polydora cornuta																
Pygospio elegans															1	
Scoloplos armiger																1
Sertulariidae sp.																
Sphaerodoridium minutum																
Spionidae sp.	damaged															
Streblospio shrubsolii															3	1
Tharyx killariensis																1
Tubificoides benedii																

Appendix 16. Subtidal AFDW Benthic Biomass Data (g per 0.1m^2)

AFDW Biomass (g) per 0.1m ^{2}	Qualifier	CN1 (A)	CN1 (B)	CN1 (C)	CN2 (A)	CN2 (B)	CN2 (C)	CN3 (A)	CN3 (B)	CN3 (C)	CN4 (A)	CN4 (B)	CN4 (C)	CN5 (A)	CN5 (B)	CN5 (C)
Actiniaria sp. juvenile																
Amphipoda sp.	damaged															
Anthozoa spp.																
Arachnida sp.						0.000014										
Arenicolidae sp. (Arenicola marina)	inc. juvenile				0.000767	0.001795	0.034661					0.000192		0.001178	0.000014	0.008521
Balanus balanus																
Bivalvia sp.	inc. damaged/juvenile					0.000006						0.000006				
Capitella sp.					0.000352	0.002320	0.002304							0.000816	0.000720	0.000672
Carcinus maenas																
Conopeum reticulum																
Copepoda spp.							0.000017		0.000017							
Corophiidae sp.																
Corophium volutator							0.000768			0.003088						
Crangon allmanni																
Crangon crangon																
Cumacea sp.	damaged															
Cyathura carinata																
Platyhelminthes (Dalyellidae) sp.																
Diastylis rathkei																
Electra monostachys																
Electra pilosa																
Eteone flava/longa agg.						0.000014	0.000014				0.000014					
Eteone sp. juvenile																
Eurydice pulchra																
Gammarus sp.	inc. juvenile					0.000015										
Gammarus salinus		0.000121		0.005173	0.000379		0.000152	0.000015	0.000015	0.009512						
Gastrosaccus sp. juvenile																
Gastrosaccus spinifer																
Limecola balthica					0.009841		0.030568				0.000835			0.016979		0.000060
Modiolus modiolus																
Mysida spp.	inc. damaged/juvenile					0.000217	0.000016			0.000527					0.000016	
Mytilidae spp. juvenile																
Nematoda spp.									0.000018	0.000018		0.000018				
Nemertea spp.											0.000022					
Neomysis integer																
Nephtys caeca																
Nephtys cirrosa																
Nephtys hombergii						0.000595							0.000455	0.030450	0.006458	0.005810
Nereididae sp.																
Orbiniidae sp.																
Polydora cornuta										0.001797						
Pygospio elegans												0.000011				
Scoloplos armiger																
Sertulariidae sp.																
Sphaerodoridium minutum																
Spionidae sp.	damaged															
Streblospio shrubsolii			0.000016								0.000192	0.000224	0.000016			
Tharyx killariensis																
Tubificoides benedii												0.000005				

AFDW Biomass (g) per 0.1m ^{2}	Qualifier	CN6 (A)	CN6 (B)	CN6 (C)	CN7 (A)	CN7 (B)	CN7 (C)	CS1 (A)	CS1 (C)	CS1 (D)	CS2 (A)	CS2 (B)	CS2 (C)	CS3 (A)	CS3 (B)	CS3 (C)
Actiniaria sp. juvenile																
Amphipoda sp.	damaged															
Anthozoa spp.																
Arachnida sp.																
Arenicolidae sp. (Arenicola marina)	inc. juvenile		0.000014	0.000411	0.000014		0.000014	0.000014								0.000521
Balanus balanus																
Bivalvia sp.	inc. damaged/juvenile														0.000006	
Capitella sp.		0.000176	0.000016	0.000608			0.000016	0.000544	0.000640	0.000128		0.000016		0.001088	0.001872	0.000016
Carcinus maenas																
Conopeum reticulum													P			
Copepoda spp.				0.000017			0.000017						0.000017			
Corophiidae sp.																
Corophium volutator																
Crangon allmanni																
Crangon crangon						0.047727										
Cumacea sp.	damaged															
Cyathura carinata																
Platyhelminthes (Dalyellidae) sp.																
Diastylis rathkei																
Electra monostachys															P	
Electra pilosa																
Eteone flava/longa agg.				0.000204												
Eteone sp. juvenile																
Eurydice pulchra											0.002755	0.000582	0.010565	0.000923		
Gammarus sp.	inc. juvenile															
Gammarus salinus		0.000015		0.000015	0.000015											
Gastrosaccus sp. juvenile																
Gastrosaccus spinifer											0.004124					
Limecola balthica				0.008495	0.008968											
Modiolus modiolus																
Mysida spp.	inc. damaged/juvenile															
Mytilidae spp. juvenile																
Nematoda spp.																
Nemertea spp.																
Neomysis integer																
Nephtys caeca																
Nephtys cirrosa																
Nephtys hombergii																
Nereididae sp.																
Orbiniidae sp.																
Polydora cornuta																
Pygospio elegans																
Scoloplos armiger																
Sertulariidae sp.																
Sphaerodoridium minutum																
Spionidae sp.	damaged															
Streblospio shrubsolii																
Tharyx killariensis																
Tubificoides benedii																

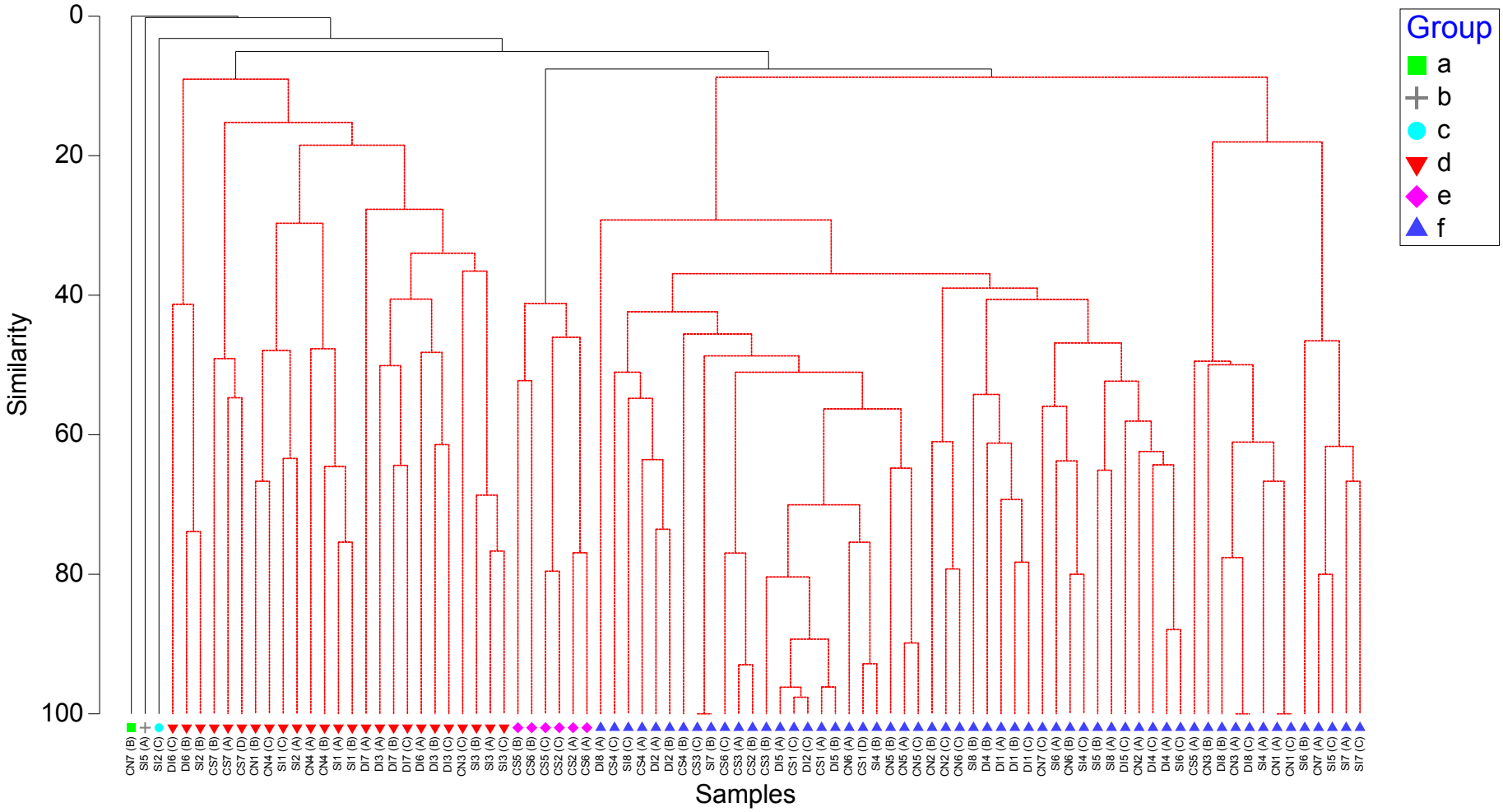
AFDW Biomass (g) per 0.1m ^{2}	Qualifier	CS4 (A)	CS4 (B)	CS4 (C)	CS5 (A)	CS5 (B)	CS5 (C)	CS6 (A)	CS6 (B)	CS6 (C)	CS7 (A)	CS7 (B)	CS7 (D)	DI1 (A)	DI1 (B)	DI1 (C)
Actiniaria sp. juvenile												0.000014				
Amphipoda sp.	damaged															
Anthozoa spp.									P							
Arachnida sp.																
Arenicolidae sp. (Arenicola marina)	inc. juvenile								0.002617			0.000014	0.000014		0.000219	0.000014
Balanus balanus				P												
Bivalvia sp.	inc. damaged/juvenile															
Capitella sp.		0.006176	0.000448	0.002400					0.000016	0.000640				0.000240	0.000096	0.000016
Carcinus maenas																
Conopeum reticulum																
Copepoda spp.									0.000017							
Corophiidae sp.																
Corophium volutator											0.000016		0.000016			
Crangon allmanni													0.000658			
Crangon crangon																
Cumacea sp.	damaged															
Cyathura carinata																
Platyhelminthes (Dalyellidae) sp.					0.000025		0.000025									
Diastylis rathkei																
Electra monostachys				P												
Electra pilosa														P		
Eteone flava/longa agg.		0.000014														
Eteone sp. juvenile													0.000014			
Eurydice pulchra		0.000469		0.002726	0.000199	0.001349	0.006816	0.002982	0.001179	0.002769						
Gammarus sp.	inc. juvenile															
Gammarus salinus					0.011317								0.000015			
Gastrosaccus sp. juvenile																
Gastrosaccus spinifer			0.000122	0.000342				0.004392								
Limecola balthica														0.001286	0.000692	0.001017
Modiolus modiolus												0.000109				
Mysida spp.	inc. damaged/juvenile	0.000016											0.000434			
Mytilidae spp. juvenile											0.000005					
Nematoda spp.						0.000018			0.000018		0.000018	0.000184	0.000018			
Nemertea spp.			0.000022								0.000022	0.000022				
Neomysis integer																
Nephtys caeca																
Nephtys cirrosa																
Nephtys hombergii														0.001453	0.003028	
Nereididae sp.																
Orbiniidae sp.																
Polydora cornuta												0.000271	0.000017			
Pygospio elegans											0.000011	0.000566	0.000011			
Scoloplos armiger				0.001411										0.000560		0.000146
Sertulariidae sp.												P				
Sphaerodoridium minutum																
Spionidae sp.	damaged															
Streblospio shrubsolii														0.000224	0.000016	0.000176
Tharyx killariensis														0.000160		
Tubificoides benedii														0.000005	0.000005	0.000005

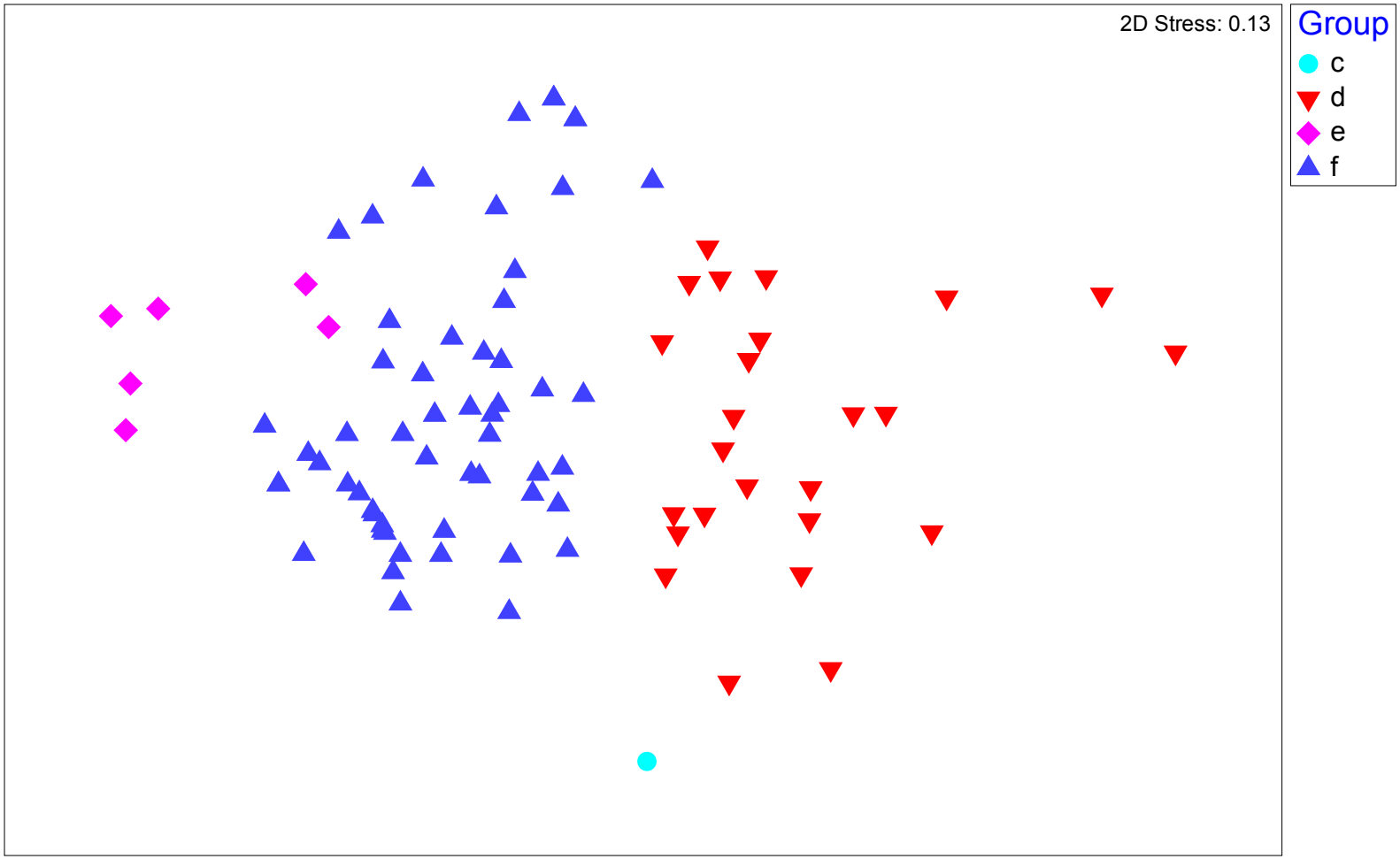
AFDW Biomass (g) per 0.1m ^{2}	Qualifier	DI2 (A)	DI2 (B)	DI2 (C)	DI3 (A)	DI3 (B)	DI3 (C)	DI4 (A)	DI4 (B)	DI4 (C)	DI5 (A)	DI5 (B)	DI5 (C)	DI6 (A)	DI6 (B)	DI6 (C)
Actiniaria sp. juvenile																
Amphipoda sp.	damaged															
Anthozoa spp.																
Arachnida sp.																
Arenicolidae sp. (Arenicola marina)	inc. juvenile			0.006001				0.000110	0.000260	0.000274			0.023646			
Balanus balanus																
Bivalvia sp.	inc. damaged/juvenile															
Capitella sp.		0.002752	0.001744	0.001136				0.000320	0.000224	0.000352	0.001200	0.000464	0.000672			
Carcinus maenas																0.303324
Conopeum reticulum			P													
Copepoda spp.																
Corophiidae sp.													0.000224			0.000896
Corophium volutator					0.005504	0.010144	0.002944							0.008000		
Crangon allmanni																
Crangon crangon																
Cumacea sp.	damaged															
Cyathura carinata							0.000199									
Platyhelminthes (Dalyellidae) sp.																
Diastylis rathkei					0.000410											
Electra monostachys																P
Electra pilosa												P				
Eteone flava/longa agg.						0.000136		0.000150								
Eteone sp. juvenile																
Eurydice pulchra			0.000014													
Gammarus sp.	inc. juvenile															
Gammarus salinus														0.008450		
Gastrosaccus sp. juvenile																
Gastrosaccus spinifer																
Limecola balthica		0.000324				0.000758	0.012545	0.001159	0.003297	0.005313			0.009077			
Modiolus modiolus																
Mysida spp.	inc. damaged/juvenile															
Mytilidae spp. juvenile			0.000005										0.000005			
Nematoda spp.						0.000018	0.000018	0.000018								
Nemertea spp.										0.000022				0.000022		
Neomysis integer																
Nephtys caeca									0.001103							
Nephtys cirrosa																
Nephtys hombergii					0.002485	0.000403	0.007875							0.000473		
Nereididae sp.					0.000745											
Orbiniidae sp.										0.000224						
Polydora cornuta															0.000017	0.000017
Pygospio elegans					0.000011		0.000011							0.000011		
Scoloplos armiger																
Sertulariidae sp.																
Sphaerodoridium minutum																
Spionidae sp.	damaged															
Streblospio shrubsolii					0.002096		0.000016		0.000256							
Tharyx killariensis					0.000176											
Tubificoides benedii					0.000237	0.000135	0.000162									

AFDW Biomass (g) per 0.1m ^{2}	Qualifier	DI7 (A)	DI7 (B)	DI7 (C)	DI8 (A)	DI8 (B)	DI8 (C)	SI1 (A)	SI1 (B)	SI1 (C)	SI2 (A)	SI2 (B)	SI2 (C)	SI3 (A)	SI3 (B)	SI3 (C)
Actiniaria sp. juvenile																
Amphipoda sp.	damaged											0.000016				
Anthozoa spp.																
Arachnida sp.																
Arenicolidae sp. (Arenicola marina)	inc. juvenile															
Balanus balanus																
Bivalvia sp.	inc. damaged/juvenile													0.000058		
Capitella sp.					0.000016											
Carcinus maenas																
Conopeum reticulum																
Copepoda spp.																
Corophiidae sp.																
Corophium volutator		0.001472	0.002608	0.001136		0.000016					0.000016			0.029408	0.064160	0.043504
Crangon allmanni																
Crangon crangon																
Cumacea sp.	damaged											0.000008				
Cyathura carinata				0.000014												
Platyhelminthes (Dalyellidae) sp.																
Diastylis rathkei			0.000661	0.000160												
Electra monostachys									P							
Electra pilosa																
Eteone flava/longa agg.																
Eteone sp. juvenile																
Eurydice pulchra																
Gammarus sp.	inc. juvenile												0.000015			
Gammarus salinus					0.010256	0.000015	0.005340			0.000182				0.008769		
Gastrosaccus sp. juvenile																
Gastrosaccus spinifer																
Limecola balthica			0.000005					0.014325	0.000352							
Modiolus modiolus																
Mysida spp.	inc. damaged/juvenile				0.002682									0.000016		
Mytilidae spp. juvenile				0.000046											0.000005	
Nematoda spp.					0.000018			0.000018	0.000018					0.000018		
Nemertea spp.														0.000022		
Neomysis integer																
Nephtys caeca																
Nephtys cirrosa																
Nephtys hombergii													0.000263			
Nereididae sp.																
Orbiniidae sp.																
Polydora cornuta												0.000017		0.000441		0.000220
Pygospio elegans			0.000011											0.000011	0.000011	
Scoloplos armiger																
Sertulariidae sp.																
Sphaerodoridium minutum																
Spionidae sp.	damaged	0.000016														
Streblospio shrubsolii			0.000240	0.000288	0.000016			0.000544	0.000064	0.000016	0.000016	0.000016		0.000160	0.000016	0.000016
Tharyx killariensis																
Tubificoides benedii			0.000005	0.000005					0.000092						0.000081	

AFDW Biomass (g) per 0.1m ^{2}	Qualifier	SI4 (A)	SI4 (B)	SI4 (C)	SI5 (A)	SI5 (B)	SI5 (C)	SI6 (A)	SI6 (B)	SI6 (C)	SI7 (A)	SI7 (B)	SI7 (C)	SI8 (A)	SI8 (B)	SI8 (C)
Actiniaria sp. juvenile																
Amphipoda sp.	damaged															
Anthozoa spp.																
Arachnida sp.																
Arenicolidae sp. (Arenicola marina)	inc. juvenile			0.000164			0.008206	0.000329	0.000137	0.000233	0.000014		0.000014			
Balanus balanus																
Bivalvia sp.	inc. damaged/juvenile															
Capitella sp.			0.000704	0.000736		0.000016		0.000016		0.000016		0.000032		0.000016	0.000240	0.000272
Carcinus maenas																
Conopeum reticulum																
Copepoda spp.																
Corophiidae sp.																
Corophium volutator															0.000352	
Crangon allmanni																
Crangon crangon																
Cumacea sp.	damaged															
Cyathura carinata																
Platyhelminthes (Dalyellidae) sp.																
Diastylis rathkei																
Electra monostachys															P	
Electra pilosa																
Eteone flava/longa agg.																
Eteone sp. juvenile																
Eurydice pulchra																
Gammarus sp.	inc. juvenile															
Gammarus salinus		0.000303					0.000015	0.001578								
Gastrosaccus sp. juvenile																0.000012
Gastrosaccus spinifer									0.000012						0.000146	
Limecola balthica						0.029551				0.021715			0.002967	0.000407	0.000824	
Modiolus modiolus																
Mysida spp.	inc. damaged/juvenile															
Mytilidae spp. juvenile																
Nematoda spp.										0.000018						
Nemertea spp.								0.000330								
Neomysis integer																
Nephtys caeca		0.003780												0.002275		
Nephtys cirrosa					0.002065											0.003675
Nephtys hombergii																
Nereididae sp.																
Orbiniidae sp.																
Polydora cornuta																
Pygospio elegans															0.000011	
Scoloplos armiger																0.000157
Sertulariidae sp.																
Sphaerodoridium minutum																
Spionidae sp.	damaged															
Streblospio shrubsolii															0.000016	0.000016
Tharyx killariensis																0.000016
Tubificoides benedii																

Appendix 17. Multivariate Analysis of Replicate Data from the Subtidal Benthic Survey





Samples CN7(B) & SI5(A) omitted