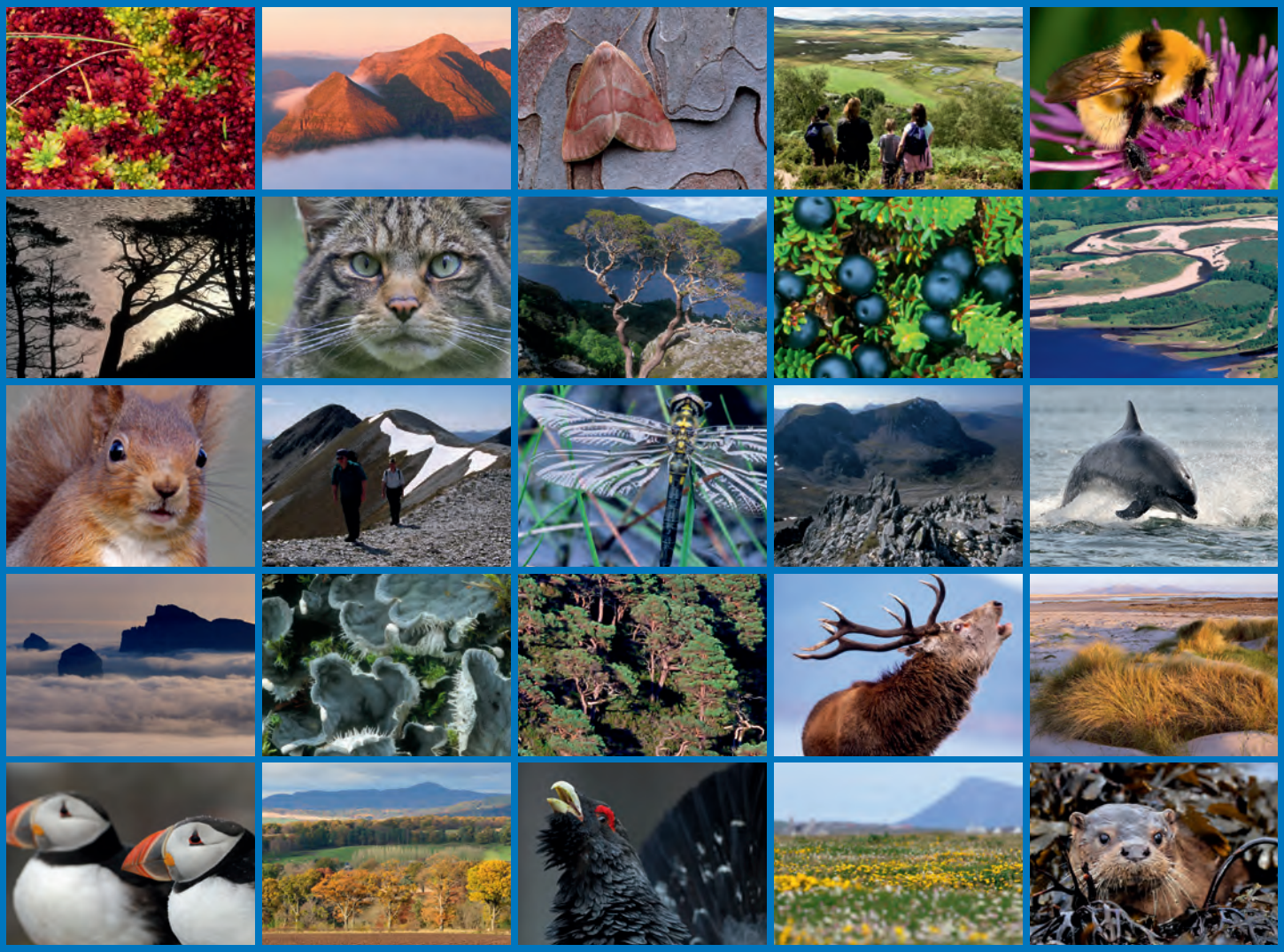
Scottish Natural Heritage
Commissioned Report No. 539

Infaunal analysis of grab samples collected from the Clyde Sea, in March 2012



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COMMISSIONED REPORT

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Infaunal analysis of grab samples collected from the Clyde Sea, in March 2012

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COMMISSIONED REPORT

Summary

Infaunal analysis of grab samples collected from the Clyde Sea, in March 2012

Commissioned Report No.: 539
Project no: 013913
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Background

In 2012 a survey was undertaken by Scottish Natural Heritage (SNH) and the Scottish Environment Protection Agency (SEPA) within the Clyde Sea region to gather biological data to help inform our understanding of the benthic community structure and diversity present, as well as to identify the presence of Priority Marine Features and MPA search features within the area. Twenty-eight stations were surveyed within the Clyde Sea from Upper Loch Fyne to the Clyde Sill using a 0.1 m^2 Day grab. Precision Marine Survey Ltd were commissioned to undertake faunal analysis and particle size analysis (PSA) of the infaunal samples and produce a brief interpretative report to characterise the benthic communities and biotopes.

Main findings

- PSA of the infauna samples collected showed sediments including sandy mud, muddy sand, sand and mixed gravelly sand or mud.
- Species diversity was highly variable (3 to 77 species per 0.1 m^2) but generally moderate to high and over 250 species were recorded in total.
- The most abundant species included *Amphiura filiformis, Owenia fusiformis, Kurtiella bidentata, Sabellaria spinulosa, Nematoda* spp., and *Lumbrineris cingulata/gracilis* with a wide variety of other polychaetes, bivalves and crustacea.
- A number of biotopes were recorded which included **SS.SMu.CFiMu.SpnMeg** and **SS.SMu.CFiMu.MegMax** (PMF/MPA search features) in addition to **SS.SCS.CCS.MedLumVen** and **SS.SMu.CSaMu.AfilMysAnit**. A number of more transitional biotopes were also recorded including those resembling offshore biotopes such as **SS.SSa.OSa.OfusAfil** (an MPA search feature) and other rather poorly defined coarser gravelly or mixed sediment communities e.g. **SS.SCS.OCS.**
- The PMF/ MPA search feature *Arctica islandica* was also observed at six stations.

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1. INTRODUCTION

In March 2012 SNH undertook a benthic survey within the Clyde Sea area on board SEPA's vessel the RV *Sir John Murray* to gather information on the benthic invertebrate communities present. The survey work was funded by Marine Scotland. This survey also aimed to identify the presence of habitats and species of importance in Scottish waters known as Priority Marine Features[1] (PMFs). A list of PMFs was developed by Scottish Natural Heritage (SNH) and the Joint Nature Conservation Committee (JNCC) in order to target action under the three pillars of The Marine (Scotland) Act 2010 which aim to implement conservation measures at the wider-seas level, at specific targeted species, or delivered at key locations e.g. through the identification of new Marine Protected Areas (MPAs).

Precision Marine Limited were contracted by SNH to undertake the infaunal analysis of the 28 grab samples collected during the 2012 fieldwork within the Clyde Sea. Analysis included infaunal identification, particle size analysis (PSA) and assigning of a biotope to each sample. This report presents the results from this analysis and a brief interpretation of the data.

[1] See - http://www.snh.gov.uk/protecting-scotlands-nature/safeguarding-biodiversity/priority-marine-features/

2. METHODS

2.1 Infaunal Sample Collection

The survey was undertaken from the 12th to the 18th of March 2012 on board the SEPA vessel *RV Sir John Murray* and covered areas within Loch Fyne, the Clyde Sill and around Arran in water depths ranging from 18 m to 177 m (Figure 1). A total of 28 infaunal samples were collected during the survey. In addition to the collection of grab samples drop down video data were also collected during the survey which have been analysed as part of a separate report (Moore and Atkinson, 2012). During the 2012 Clyde Sea survey a single grab sample was collected at each station using a 0.1 m^2 Day grab. Once on board each infaunal sample was passed through a 1 mm mesh sieve and the infaunal sieve residue retained and fixed with buffered formalin. A small sub-sample of each grab was then removed for separate particle size analysis (PSA) and stored in plastic bags before being frozen. The samples were then collected by Precision Marine Survey Ltd for processing. A summary of the sampling details for the survey is provided in Table 1 and a map showing the layout of the sampling stations is given in Figure 1.

Table 1: Sampling details from the 2012 Clyde Sea survey.

Station	Date	Location	Time	Latitude	Longitude	Depth (m)
G01	12/03/2012	Arran	15:48	55.455383	-5.060000	65
G02	12/03/2012	Arran	16:40	55.410725	-5.180793	47
G03	12/03/2012	Arran	17:36	55.437851	-5.285824	18
G04	13/03/2012	Clyde Sill	11:53	55.202648	-5.483525	76
G05	13/03/2012	Clyde Sill	13:34	55.061531	-5.430124	106
G06	13/03/2012	Clyde Sill	15:13	55.073711	-5.188776	47
G07	14/03/2012	Clyde Sill	11:21	55.222874	-5.548429	91
G08	14/03/2012	Clyde Sill	12:00	55.196907	-5.599582	114
G09	14/03/2012	Clyde Sill	12:42	55.149872	-5.532145	114
G10	14/03/2012	Clyde Sill	14:04	55.093781	-5.398314	?
G11	15/03/2012	Clyde Sill	08:10	55.320420	-5.474057	53
G13	15/03/2012	Clyde Sill	11:03	55.241363	-5.346759	46
G14	15/03/2012	Arran	13:26	55.466682	-5.387033	59
G16	15/03/2012	Lower Loch Fyne	17:40	55.814796	-5.316782	55
G17	16/03/2012	Loch Fyne	08:33	56.038326	-5.315614	45
G18	16/03/2012	Loch Fyne	11:25	56.224983	-5.055037	115
G19	16/03/2012	Loch Fyne	11:48	56.238655	-5.054130	46
G20	16/03/2012	Loch Fyne	14:54	55.975258	-5.372279	117
G21	16/03/2012	Loch Fyne	15:20	55.984592	-5.421405	37
G22	16/03/2012	Loch Fyne	16:58	55.855987	-5.342482	177
G23	17/03/2012	Loch Fyne	07:59	55.826643	-5.278001	155
G24	17/03/2012	Loch Fyne	09:40	55.774040	-5.238621	163
G25	17/03/2012	Loch Fyne	10:23	55.771404	-5.193005	77
G26	17/03/2012	Inchmarnock	11:37	55.785576	-5.136519	28
G27	17/03/2012	West Cumbrae	15:55	55.760254	-4.985360	101
G28	18/03/2012	Arran South	10:02	55.544895	-5.002504	119
G29	18/03/2012	Arran South	11:28	55.406219	-5.072257	111
G30	18/03/2012	Arran South	11:54	55.383716	-5.091307	79

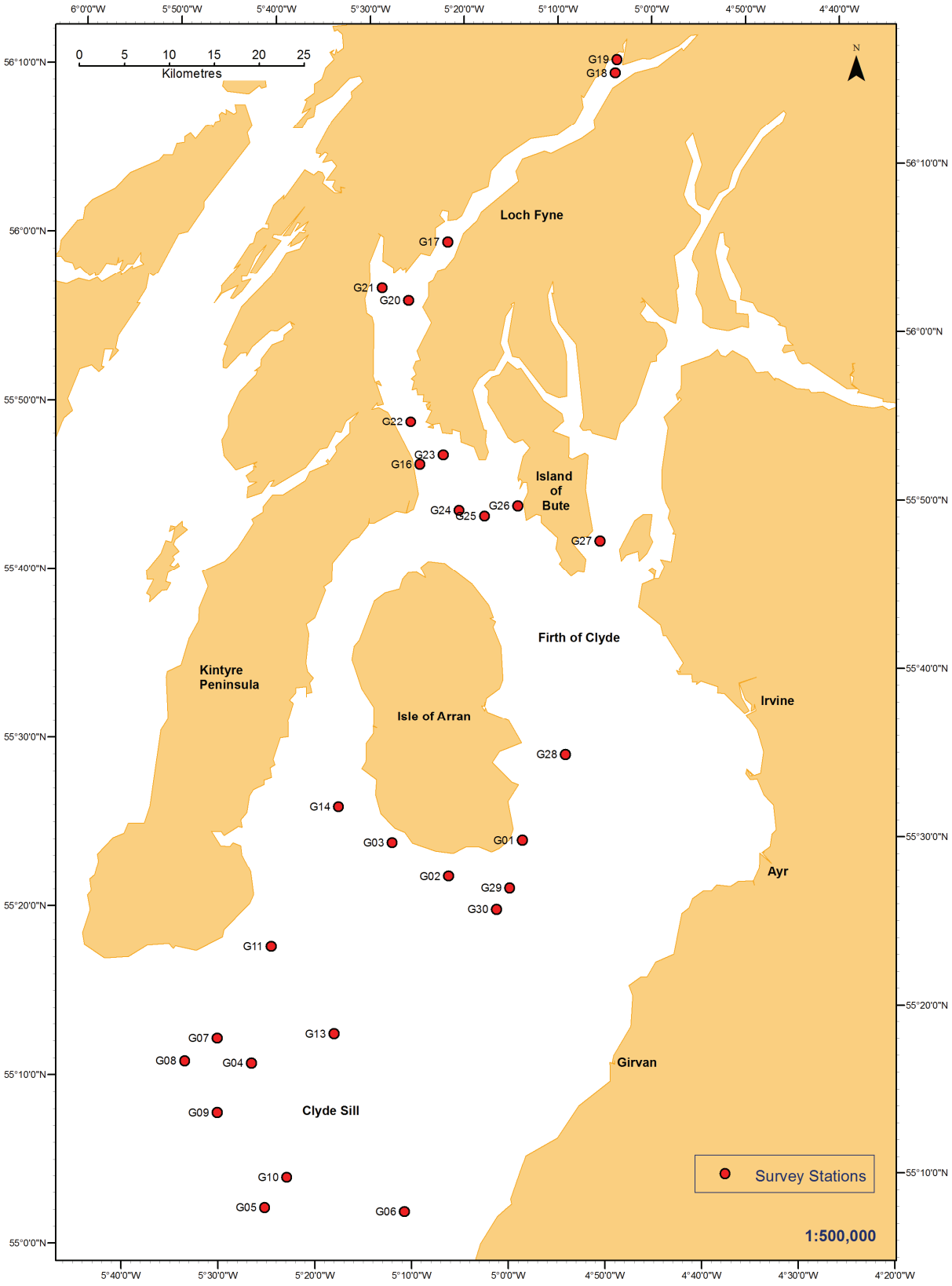

Figure 1. Map of 2012 infaunal sample stations collected within the Clyde Sea. © Crown copyright and database right 2013. All rights reserved. Ordnance Survey Licence number 100017908.

2.2 Laboratory Processing

All laboratory methodologies were based on best practice (Marine Monitoring Handbook procedural guideline 3-9; Rees *et al.,* 1990; Rees, 1999; Cooper & Rees, 2002; Worsfold *&* Hall 2010; Ware & Kenny 2011). In addition Precision Marine Survey Limited are members of the National Marine Biological and Analytical Quality Control scheme (NMBAQC). Two experienced members of staff 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.

Prior to species identification each sample was washed through a nest of sieves to remove the preservative and partition the sample for ease of sorting. The smallest mesh aperture was 1 mm and larger sieves (5 mm or 10 mm) were also used as required to separate larger animals or coarser sediment residue. The residue from each sieve was then gently washed into separate 100 mm petri dishes for subsequent identification. For larger samples the sieve residue was put into a separate bucket or white tray with water and the contents agitated. Immediately after agitation, the light fraction was decanted to another container. The light fraction was then decanted into petri dishes and the remaining residue put into a separate container.

The sample containers/petri dishes were marked with the appropriate sample code (relating to the client, date, specific station, sample and replicate no.). All fractions were then decanted into separate 100 mm petri dishes and examined under a stereoscopic microscope. The fauna derived was then split by phyla and placed in glass vials with 70% industrial methylated spirit (IMS) and stored ready for identification. Each petri dish was then checked for a final time by another member of staff.

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 were 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.

The taxonomic literature used was that as detailed in Rees *et al.* (1990) which includes the most recent updates in the scientific literature and newer keys provided by groups such as the NMBAQC and species reporting nomenclature used WoRMS standards (Appletans *et al*., 2011).

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 and all biomass data are recorded in grams or fractions thereof.

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 2000. 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 2000 and the >1mm fraction discarded. The second sub-sample 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 were analysed separately but for visualisation purposes the finer fractions were also merged wtth 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 were then used to derive statistics including 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.

Total organic carbon was determined by loss on ignition (LOI) at 480ºC. Each sample was oven dried at 105ºC until the weight stabilised (± 0.001g). The weight of the sample was recorded and the sample was then placed into a kiln at 600ºC for four hours. Once the sample had cooled it was re-weighed and the difference between the two weights expressed as the percentage loss on ignition.

2.3 Analysis of Biological Data

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

- The total number of species at each station (S)
- The total abundance of individuals at each station (A)
- The total biomass (in grams wet weight) at each station (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.

The PRIMER package developed by Primer-E (Clarke and Gorley, 2006) was used to derive Abundance Biomass Comparison (ABC) plots (Warwick, 1986) for each station. 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 intersect the biomass curves or is elevated above it as the community is characterised by numerous small-bodied opportunist species. The ABC plots produced by PRIMER give 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 undisturbed communities and negative values for potentially disturbed communities) and this was subsequently used as an additional biological parameter.

Multivariate analysis of the abundance data was carried out in order to describe the main patterns and assemblages within the area following standard methodologies (Clarke and Warwick, 2001). 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. Cluster analysis is used to display graphically the similarity between stations based upon their species composition whereby the similarity between stations is calculated (in this case using the Bray-Curtis similarity coefficient) to produce a similarity matrix showing the percent similarity of stations (0% indicating no species in common and 100% indicating an identical community). These values are then used to plot a dendrogram or tree diagram in which stations are linked at their respective similarity to other stations and consequently it is possible to define groups of stations with similar species composition at a predefined level of similarity.

Non-metric MDS graphically displays the (rank) similarity between stations as a 2 dimensional plot in which the distances between stations indicates the level of similarity between them. The stress value associated with an MDS plot indicates how faithful the plot is in representing the similarity between stations 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. Station groupings were derived using the similarity profile test (SIMPROF) within the PRIMER package. Characteristic taxa within each group were assessed using calculations of mean abundance and the % of stations at which the species occurred and by using the SIMPER routine within PRIMER. Correlations between species data and sediment parameters was undertaken using the BEST routine within PRIMER which derives a non-parametric Spearman correlation between the similarity matrices derived from the biological and environmental data. The results of this procedure give the statistic r which gives an indication of the strength of the relationships between the environmental parameters and community structure with higher values (approaching 1) indicating a strong positive correlation. This technique also derives a subset of the best combination of environmental parameters which give the highest correlation in similarity.

3. RESULTS

3.1 Sedimentary Parameters

A summary of sediment parameters at each station is provided in Table 2 and the full details of particle size analysis, including cumulative distribution plots, are provided in Appendix 2. A wide range of sediments were recorded during the survey including sands at stations G10 and G13, muddy-sand at stations G02 and G17 and sandy-mud at stations G23 and G24 along with a variety of mixed gravelly sediments (gravely-sand, gravely-mud, slightly gravelly muddy-sand or sandy-mud) recorded at the remaining stations. Gravel content was variable but typically less than 3% with the exception of stations G03, G07, G08, G09 and G26 which had an increased gravel content ranging from 12% to 45%. Mud content was also highly variable with less than 10% mud recorded at stations G03, G04, G09, G10, G11 and G13 whilst the remaining stations exhibited a much higher mud fraction often in excess of 50%. The variability in sediment types is also reflected in the sorting of the sediments which were generally poorly or very poorly sorted with the exception of stations G10 and G11 (well sorted or moderately sorted). Sediment skewness was also variable ranging from very finely skewed to symmetrical or coarse skewed sediment distribution.

The spatial distribution of sediment types is illustrated in Figure 2 and the variation in mud, sand and gravel content at the stations is also shown in a sediment trigon (Figure 3). As might be expected the muddier stations were those in less exposed areas, such as within Loch Fyne, whilst offshore stations in the Clyde Sill area (e.g. stations G03, G04, G09, G10 and G11) exhibited sandier or slightly gravelly sediments.

Table 2. Summary of sedimentary parameters.

Station	Sediment type	Median phi	Mean phi	Sorting		Gravel	Sand	Mud	LOI
G01	Slightly Gravelly Muddy Sand	3.12	3.66	1.72	Poorly Sorted	0.90	77.50	21.60	0.31
G02	Muddy Sand	3.27	4.02	2.04	Very Poorly Sorted	0.00	64.74	35.26	0.78
G03	Sandy Gravel	-0.84	-0.54	1.65	Poorly Sorted	44.58	53.93	1.50	1.68
G04	Slightly Gravelly Sand	1.64	1.63	1.14	Poorly Sorted	2.87	91.63	5.50	0.54
G05	Slightly Gravelly Muddy Sand	2.28	3.15	2.03	Very Poorly Sorted	0.11	77.08	22.81	0.52
G06	Slightly Gravelly Muddy Sand	3.98	4.53	1.98	Poorly Sorted	0.02	50.46	49.51	0.91
G07	Gravelly Muddy Sand	1.07	1.42	2.70	Very Poorly Sorted	16.77	66.28	16.96	1.22
G08	Gravelly Mud	3.32	2.70	3.81	Very Poorly Sorted	27.86	28.89	43.25	3.36
G09	Gravelly Sand	1.19	0.95	1.39	Poorly Sorted	11.95	84.21	3.84	1.11
G10	Sand	1.75	1.75	0.48	Well Sorted	0.00	100.0	0.00	0.26
G11	Slightly Gravelly Sand	1.84	1.81	0.87	Moderately Sorted	1.54	95.52	2.94	1.02
G13	Sand	2.69	2.72	1.04	Poorly Sorted	0.00	91.99	8.01	0.54

Table 2 continued.

Station	Sediment type	Median phi	Mean phi		Sorting	Gravel	Sand	Mud	LOI
G14	Slightly Gravelly Sandy Mud	4.36	4.54	2.22	Very Poorly Sorted	0.01	43.64	56.35	1.76
G16	Slightly Gravelly Muddy Sand	3.27	3.86	1.91	Poorly Sorted	0.01	67.14	32.85	1.03
G17	Muddy Sand	3.70	3.97	1.39	Poorly Sorted	0.00	62.28	37.72	1.57
G18	Slightly Gravelly Sandy Mud	4.60	4.57	1.84	Poorly Sorted	0.04	38.55	61.40	10.00
G19	Slightly Gravelly Sandy Mud	4.68	4.79	1.49	Poorly Sorted	0.03	30.83	69.14	7.73
G20	Slightly Gravelly Sandy Mud	5.17	5.29	1.95	Poorly Sorted	0.13	30.09	69.79	5.05
G21	Slightly Gravelly Sandy Mud	4.20	4.64	1.64	Poorly Sorted	0.14	43.36	56.50	1.81
G22	Slightly Gravelly Sandy Mud	4.75	4.91	2.36	Very Poorly Sorted	2.95	39.90	57.15	5.42
G23	Sandy Mud	4.72	4.78	2.25	Very Poorly Sorted	0.00	42.52	57.48	7.04
G24	Sandy Mud	4.80	4.79	2.26	Very Poorly Sorted	0.00	42.36	57.64	6.65
G25	Slightly Gravelly Sandy Mud	5.38	5.52	1.88	Poorly Sorted	0.02	24.03	75.95	3.52
G26	Muddy Sandy Gravel	2.85	1.80	4.27	Extremely Poorly Sorted	30.54	35.74	33.72	1.48
G27	Slightly Gravelly Sandy Mud	4.75	4.87	2.21	Very Poorly Sorted	0.99	38.54	60.47	5.86
G28	Slightly Gravelly Sandy Mud	5.04	4.84	2.29	Very Poorly Sorted	0.05	38.14	61.81	4.88
G29	Slightly Gravelly Muddy Sand	2.93	3.69	1.98	Poorly Sorted	0.13	73.70	26.17	0.68
G30	Slightly Gravelly Muddy Sand	2.66	3.44	2.06	Very Poorly Sorted	0.05	76.75	23.20	0.97

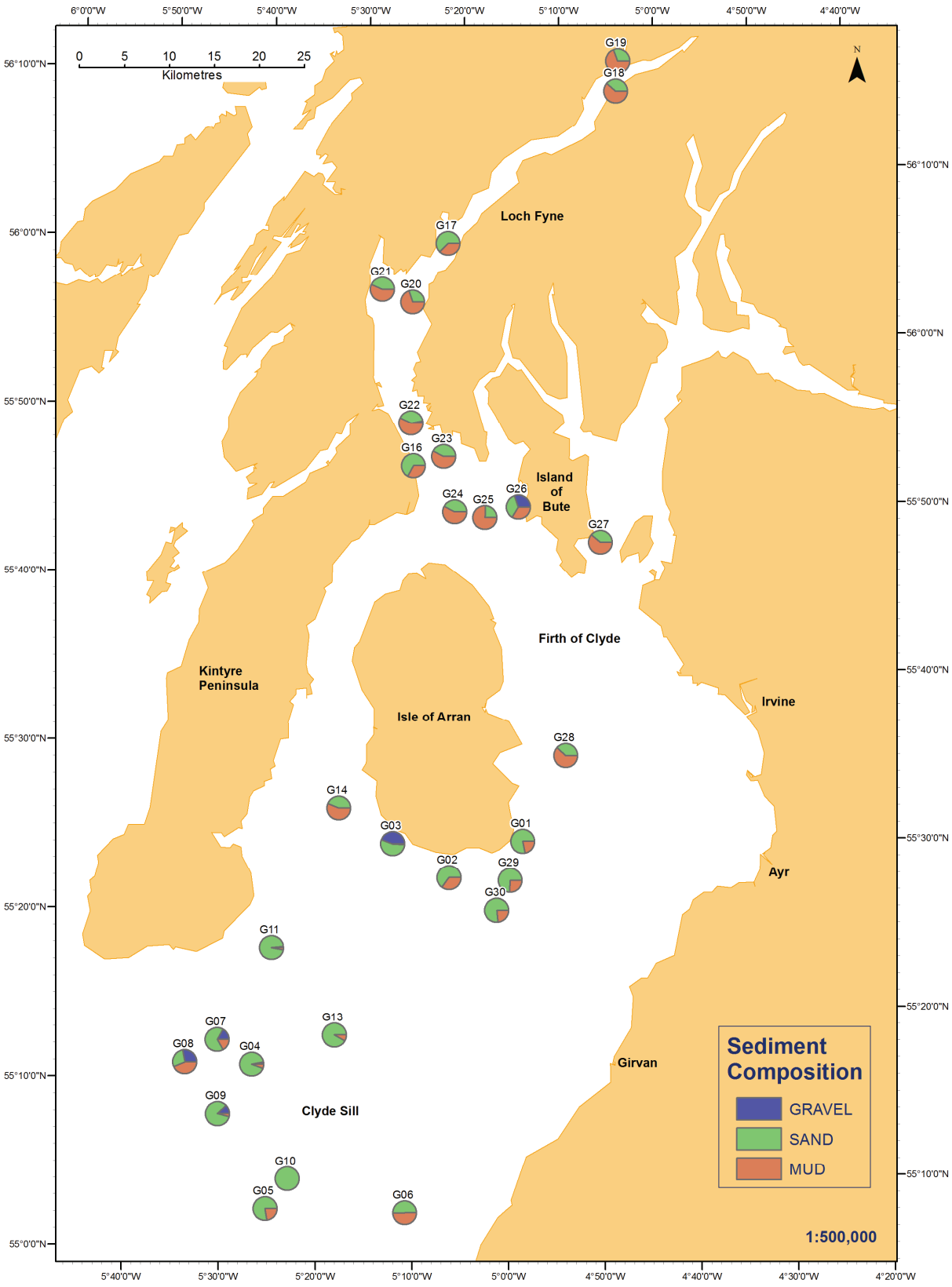

Figure 2. Sediment composition of infaunal samples collected within the Clyde Sea. © Crown copyright and database right 2013. All rights reserved. Ordnance Survey Licence number 100017908.

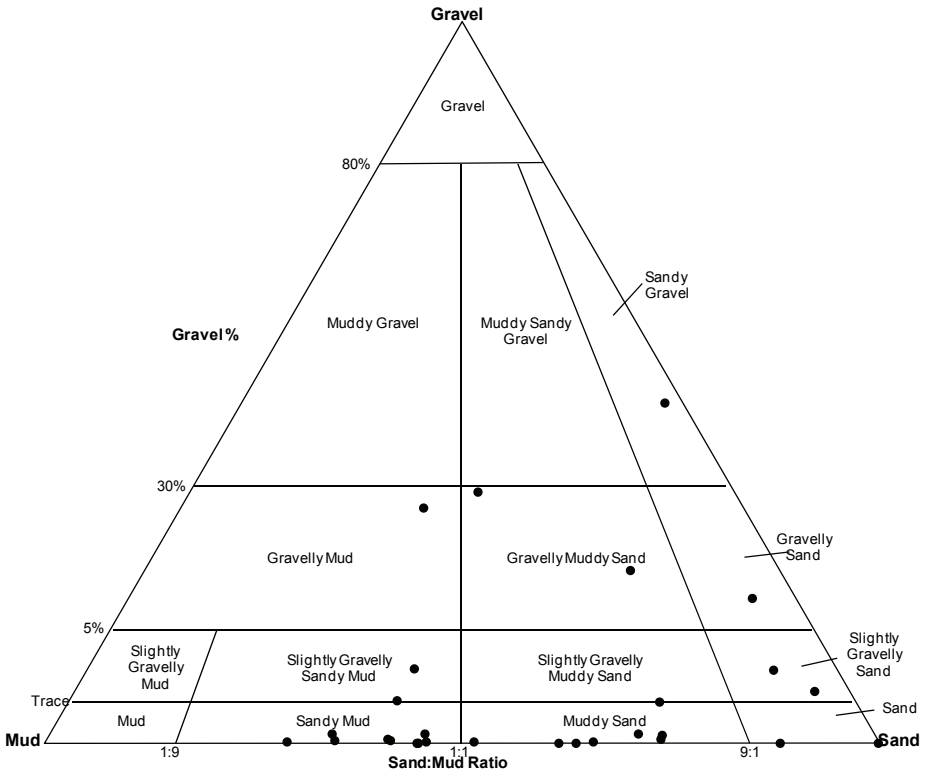

Figure 3. Sediment trigon for the Clyde Sea samples.

3.2 Primary and Derived Biological Parameters

The Clyde Sea infaunal samples exhibited a high level of variability in terms of biological parameters as illustrated in Table 3 (which provides details of parameters at each station) and Figures 4 to 7 which show the spatial distribution of the total numbers of species, total abundance, total biomass and Shannon's diversity. The number of taxa per 0.1m^2 sample ranged from less than 10 taxa at stations G06, G14, G20, G23, G24, G25 and G28 to much higher numbers of taxa (>50 per 0.1m^2) at stations G04 and G09 with the remaining stations having moderate numbers of taxa (10 – 50 per 0.1m^2). Higher numbers of species were generally recorded in the more offshore areas (Clyde Sill or off Arran) with low to moderate numbers of taxa stations to the north in Loch Fyne. However, within the Clyde Sill area low numbers of taxa were also recorded at a few stations in outer areas or to the west of Arran. Abundances were also variable with numbers ranging from three individuals per 0.1m^2 (at station G24) to over 200 per 0.1m^2 at stations G02 to G05 and abundance values showed no clear spatial distribution over the survey area. Total biomass was particularly high at stations G02 and G29 (153g and 134g per 0.1m^2 respectively) to the south of Arran and stations G16, G17 and G21 (100g to 205g per 0.1m^2) in Loch Fyne which related to the presence of large specimens of the bivalve *Arctica islandica*. Diversity indices were also variable with moderate to high levels of diversity and evenness and in general higher diversities were recorded in outer offshore areas, although some stations within Loch Fyne (stations G17 and G26) were also relatively diverse.

Table 3. Primary and derived biological parameters.

Station	No. of Species	Abundance (A)	Biomass (B)	Margalef's d	Pielou's Evenness J	Shannon's Diversity H'	ABC w Statistic
G01	27	49	5.5435	6.68	0.93	4.41	0.59
G02	39	330	153.6434	6.55	0.65	3.43	0.20
G03	41	281	5.9176	5.14	0.76	3.72	0.26
G04	77	263	19.0368	10.23	0.74	4.33	0.34
G05	37	231	12.6298	6.06	0.57	2.91	0.15
G06	3	10	0.59	0.43	0.47	0.47	0.16
G07	32	46	0.6758	6.27	0.90	4.16	0.48
G08	24	47	33.2792	5.19	0.88	3.85	0.55
G09	53	76	0.9319	9.70	0.90	4.89	0.40
G10	13	24	12.9504	3.78	0.93	3.43	0.61
G11	30	51	15.0613	5.60	0.85	3.85	0.51
G13	25	50	0.6377	5.62	0.91	4.10	0.47
G14	6	9	0.2876	2.28	0.94	2.42	0.34
G16	32	153	195.9043	6.16	0.67	3.34	0.29
G17	33	97	205.0895	6.99	0.88	4.42	0.51
G18	9	34	10.8731	2.27	0.75	2.36	0.33
G19	13	46	5.5837	3.13	0.66	2.43	0.27
G20	8	17	6.9153	2.47	0.84	2.53	0.24
G21	24	61	100.2363	5.59	0.78	3.57	0.45
G22	10	30	5.3423	2.35	0.80	2.53	0.37
G23	7	17	3.004	2.12	0.90	2.54	0.52
G24	3	3	1.715	1.82	1.00	1.58	0.97
G25	8	19	6.0007	2.38	0.92	2.76	0.32
G26	42	78	2.025	7.80	0.91	4.69	0.41
G27	14	30	5.7175	3.82	0.91	3.45	0.46
G28	6	7	0.3974	2.57	0.98	2.52	0.77
G29	30	63	134.18	7.00	0.91	4.47	0.60
G30	39	127	2.2539	7.84	0.88	4.64	0.24

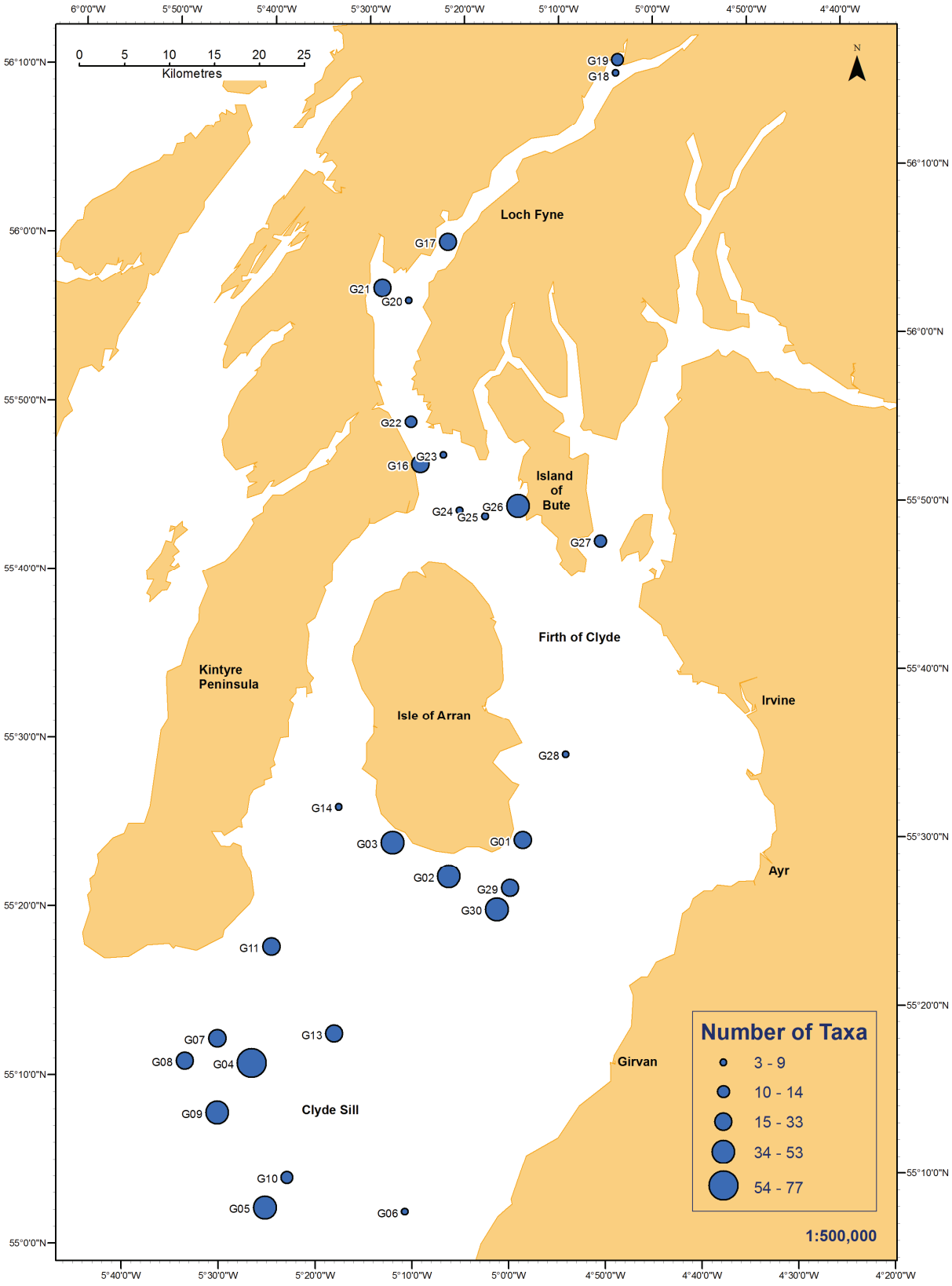

Figure 4. Total numbers of taxa (including qualitative species) collected within the Clyde Sea. © Crown copyright and database right 2013. All rights reserved. Ordnance Survey Licence number 100017908.

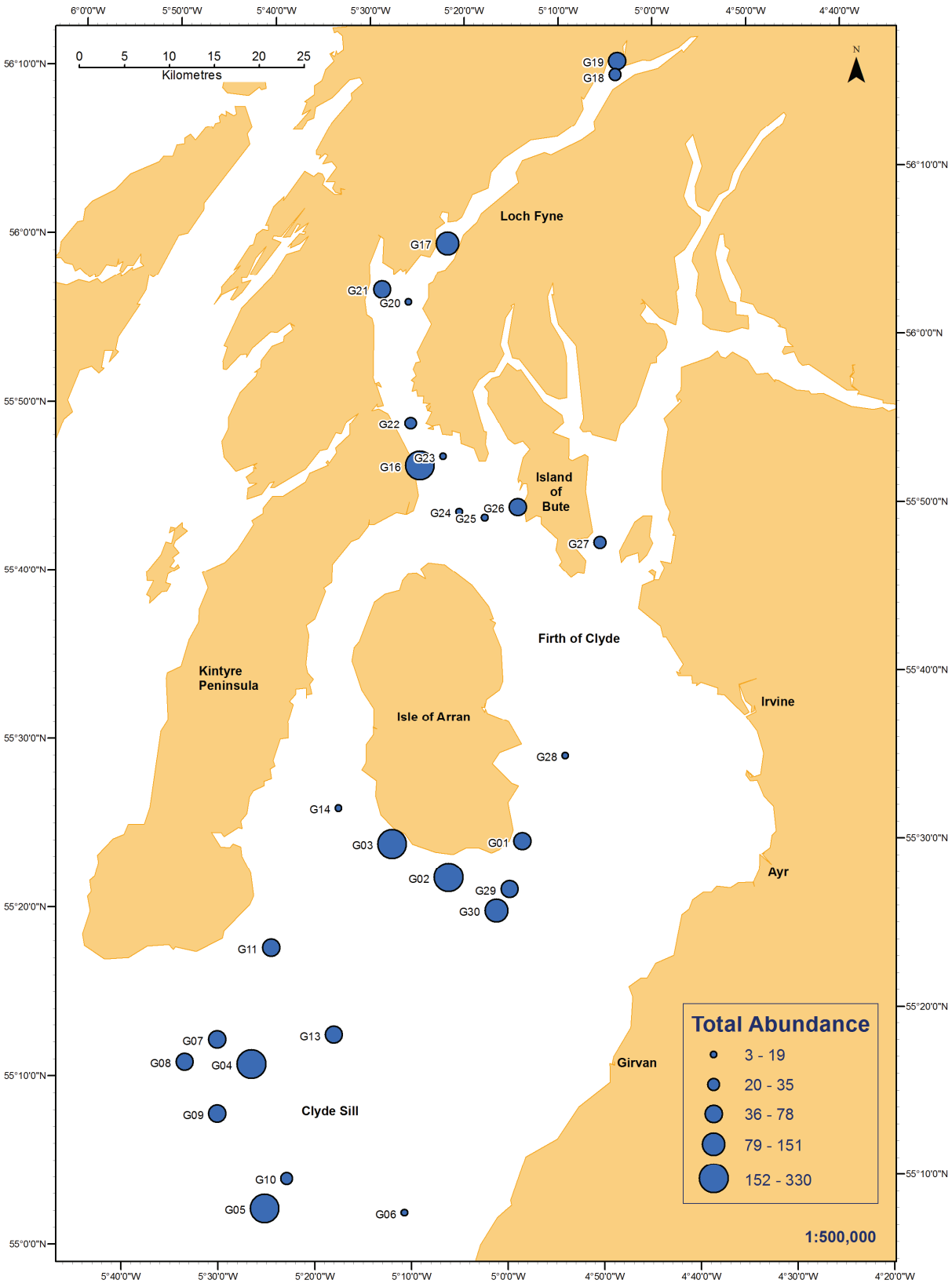

Figure 5. Total abundance (numbers of individuals) within infauna samples collected within the Clyde Sea. © Crown copyright and database right 2013. All rights reserved. Ordnance Survey Licence number 100017908.

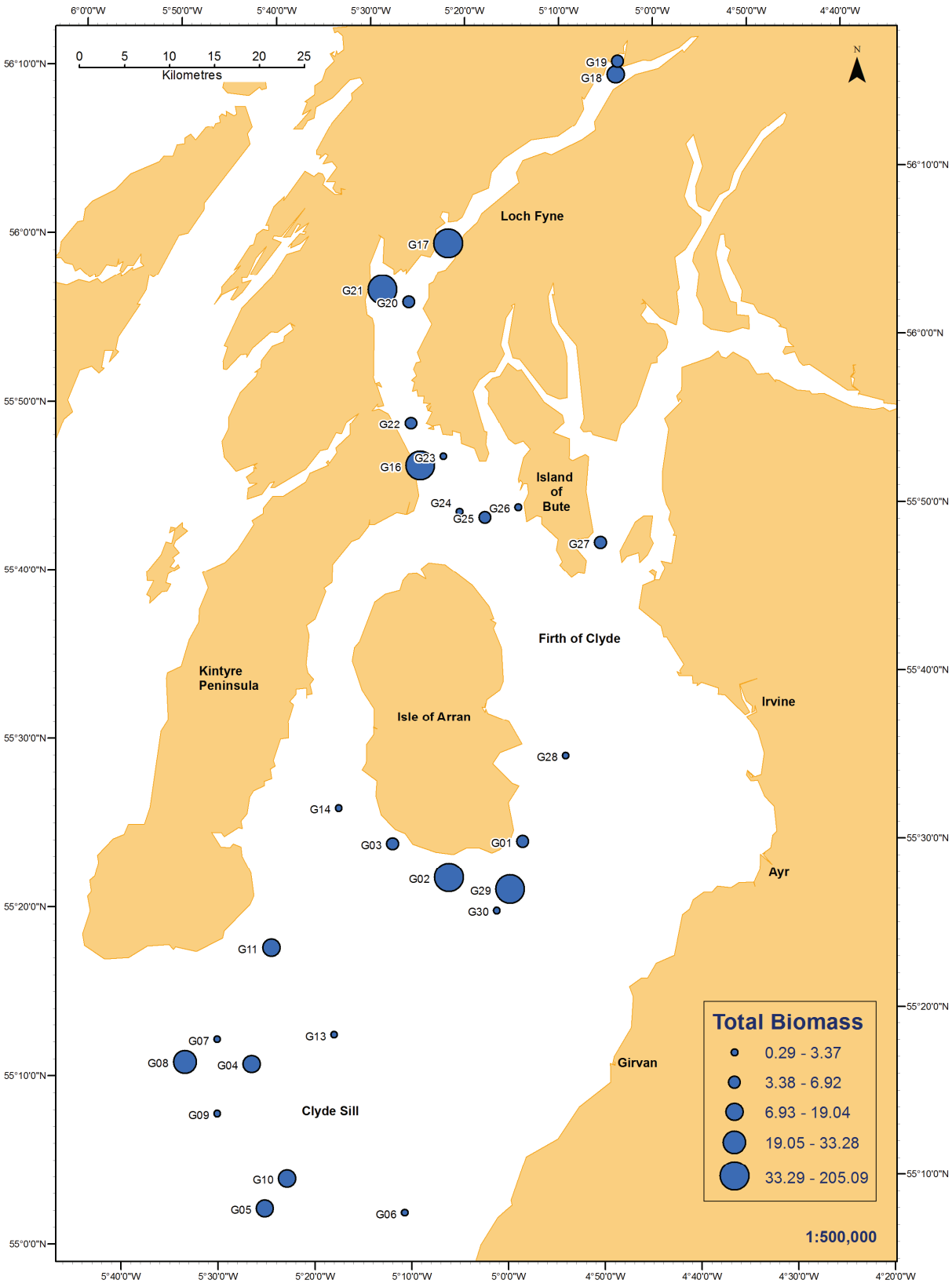

Figure 6. Total biomass (g wet weight) of infaunal samples collected within the Clyde Sea. © Crown copyright and database right 2013. All rights reserved. Ordnance Survey Licence number 100017908.

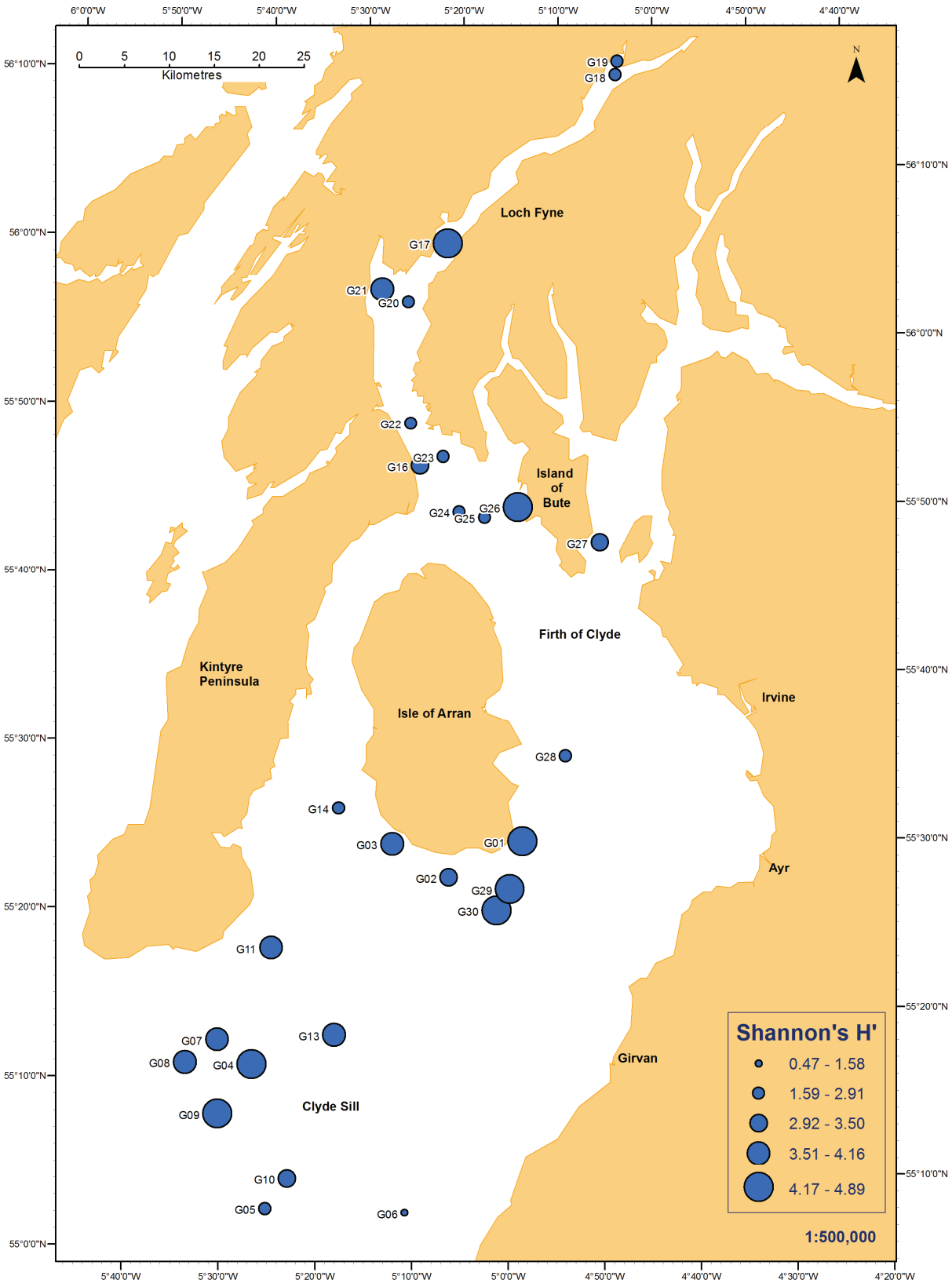

Figure 7. Shannon's diversity (H') of the infauna sample collected within the Clyde Sea. © Crown copyright and database right 2013. All rights reserved. Ordnance Survey Licence number 100017908.

3.3 Abundance Biomass Comparison (ABC) curves

Values of the ABC w statistic were all relatively high and no negative values were recorded. As illustrated in Figure 8, the majority of stations exhibited ABC plots with biomass curves well elevated above the abundance curve and these results would usually indicate relatively unstressed communities. A few stations exhibited ABC plots in which the biomass and abundance curves are quite close together (e.g. stations G05, G09, G014 and G30) whilst at station G20 the biomass and abundance curves intersected which sometimes indicates moderate disturbance. However, these stations are not characterised by species particularly indicative of anthropogenic disturbance (such as capitellid polychaetes) and the ABC curves do not appear to exhibit signs of significant stress to the benthic communities which may be directly attributable to human impacts.

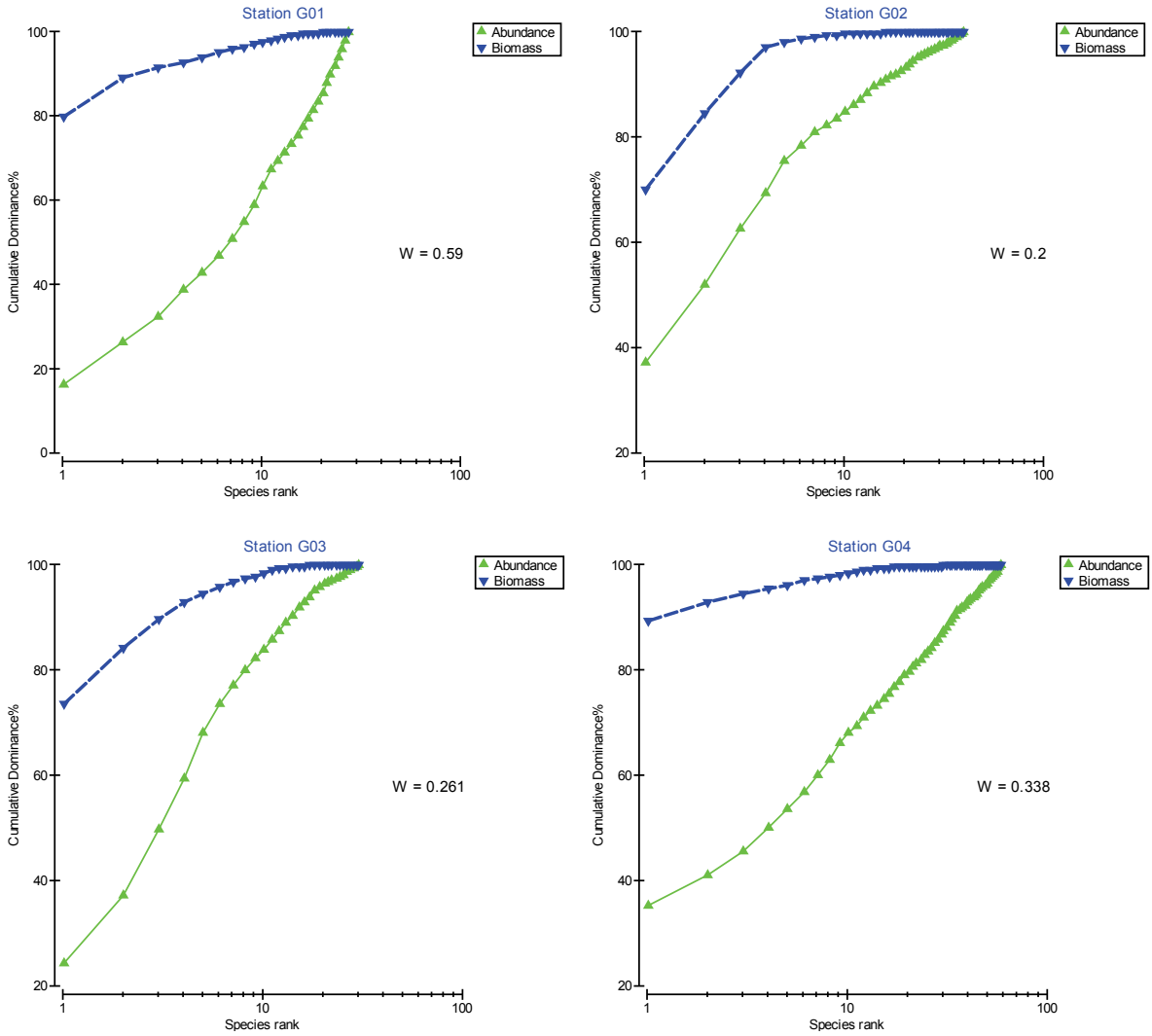

Figure 8. ABC plots for infaunal samples collected within the Clyde Sea.

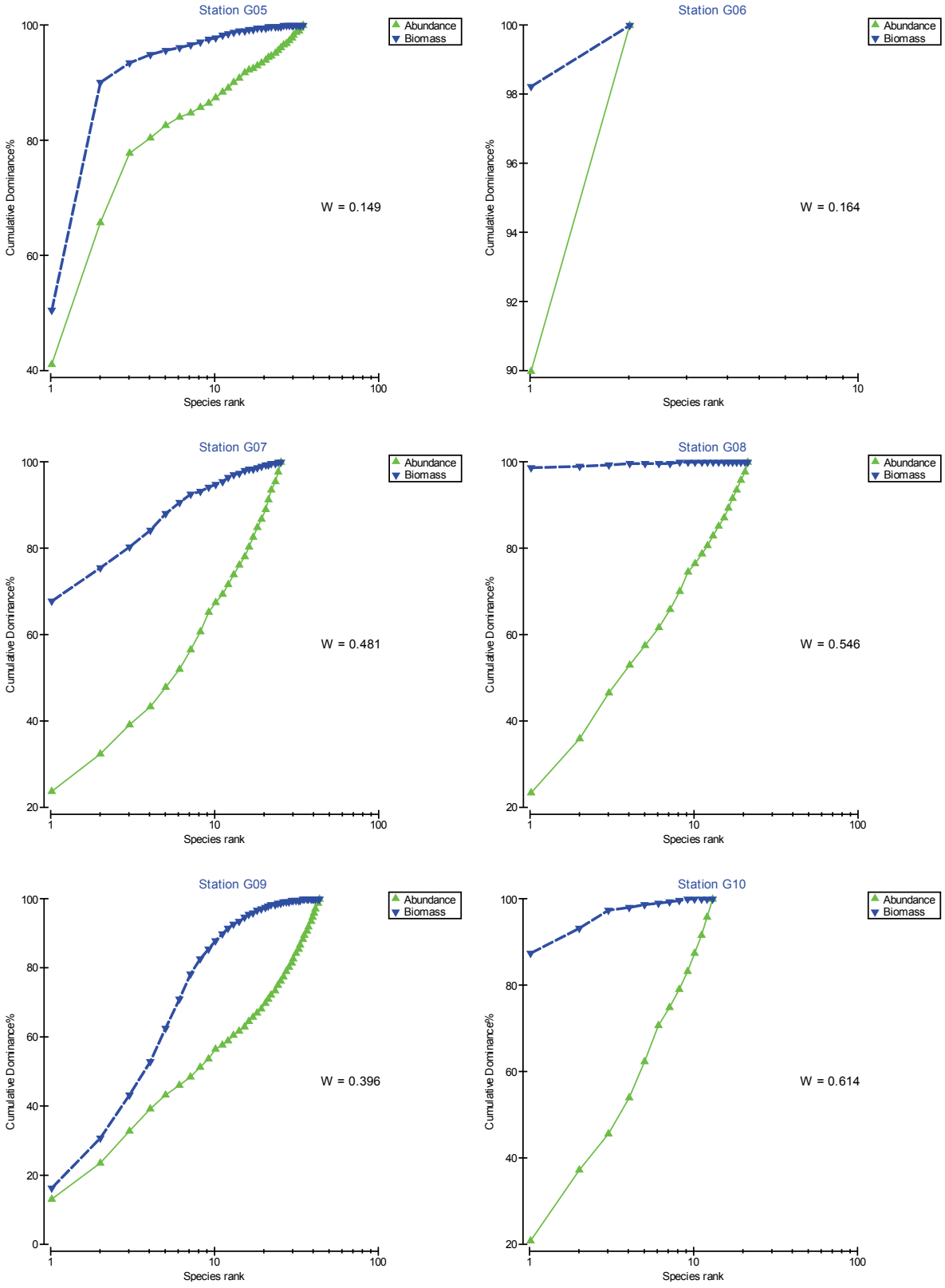

Figure 8 (cont.). ABC plots for infaunal samples collected within the Clyde Sea

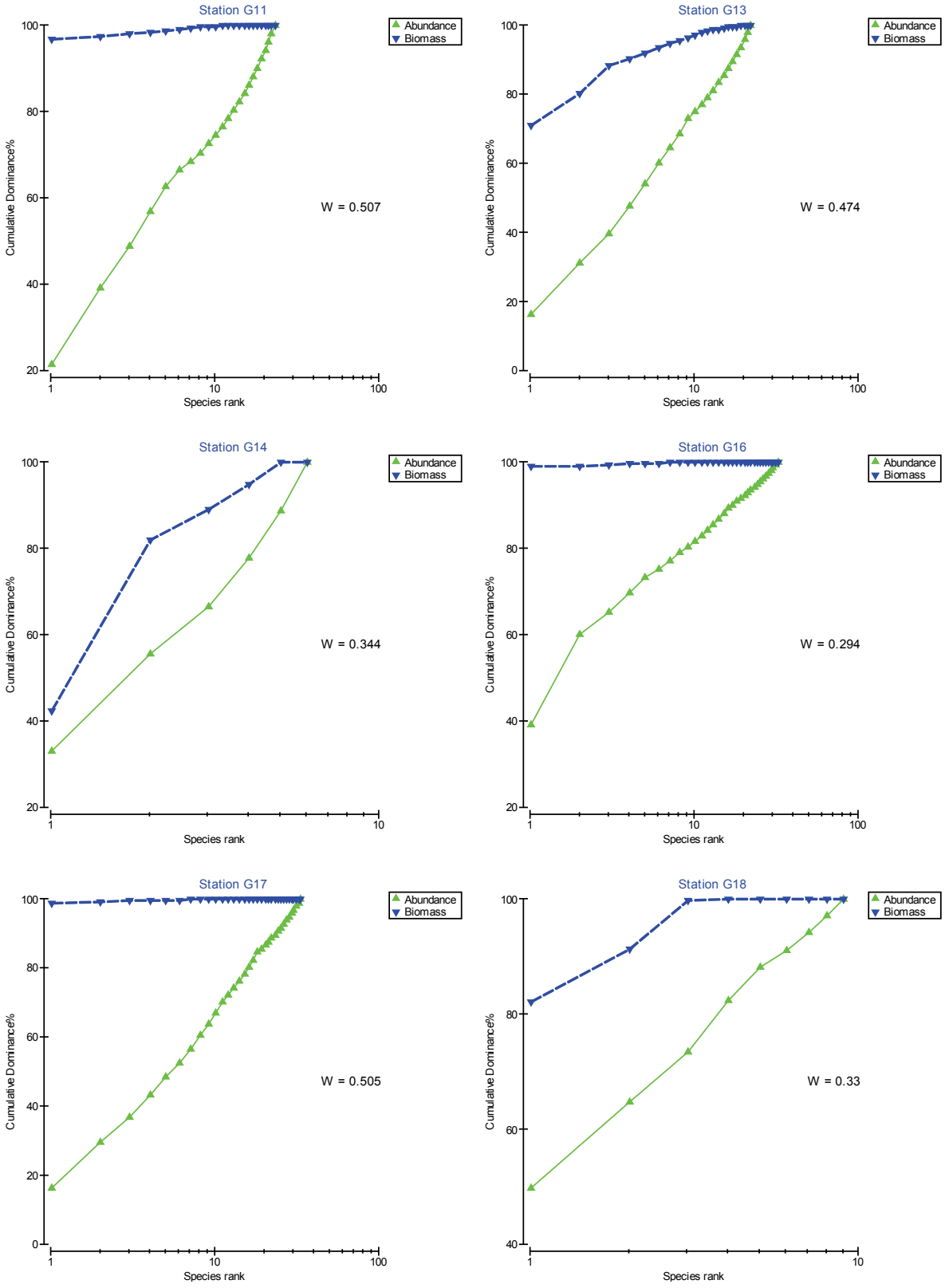

Figure 8 (cont.). ABC plots for infaunal samples collected within the Clyde Sea.

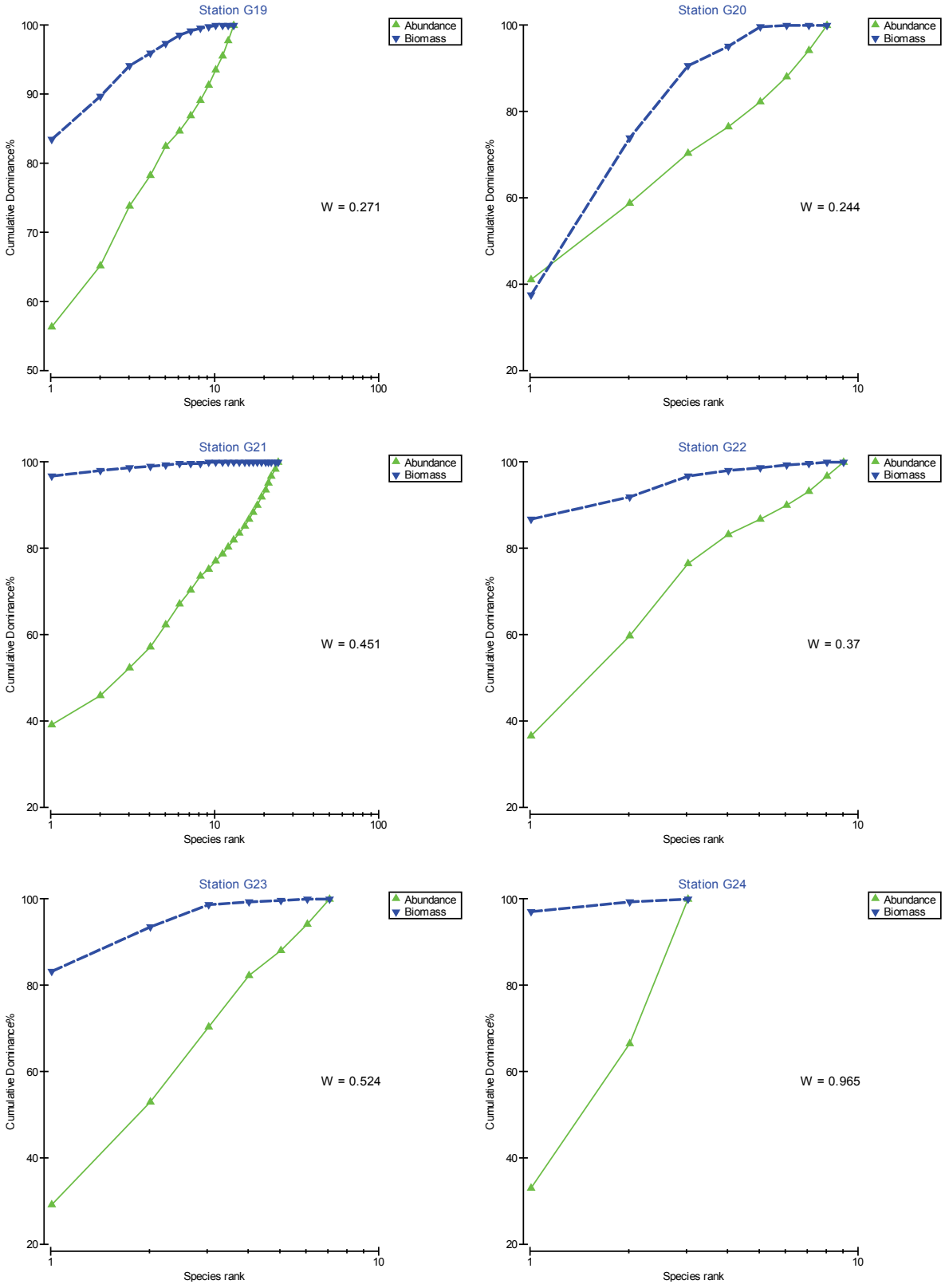

Figure 8 (cont.). ABC plots for infaunal samples collected within the Clyde Sea.

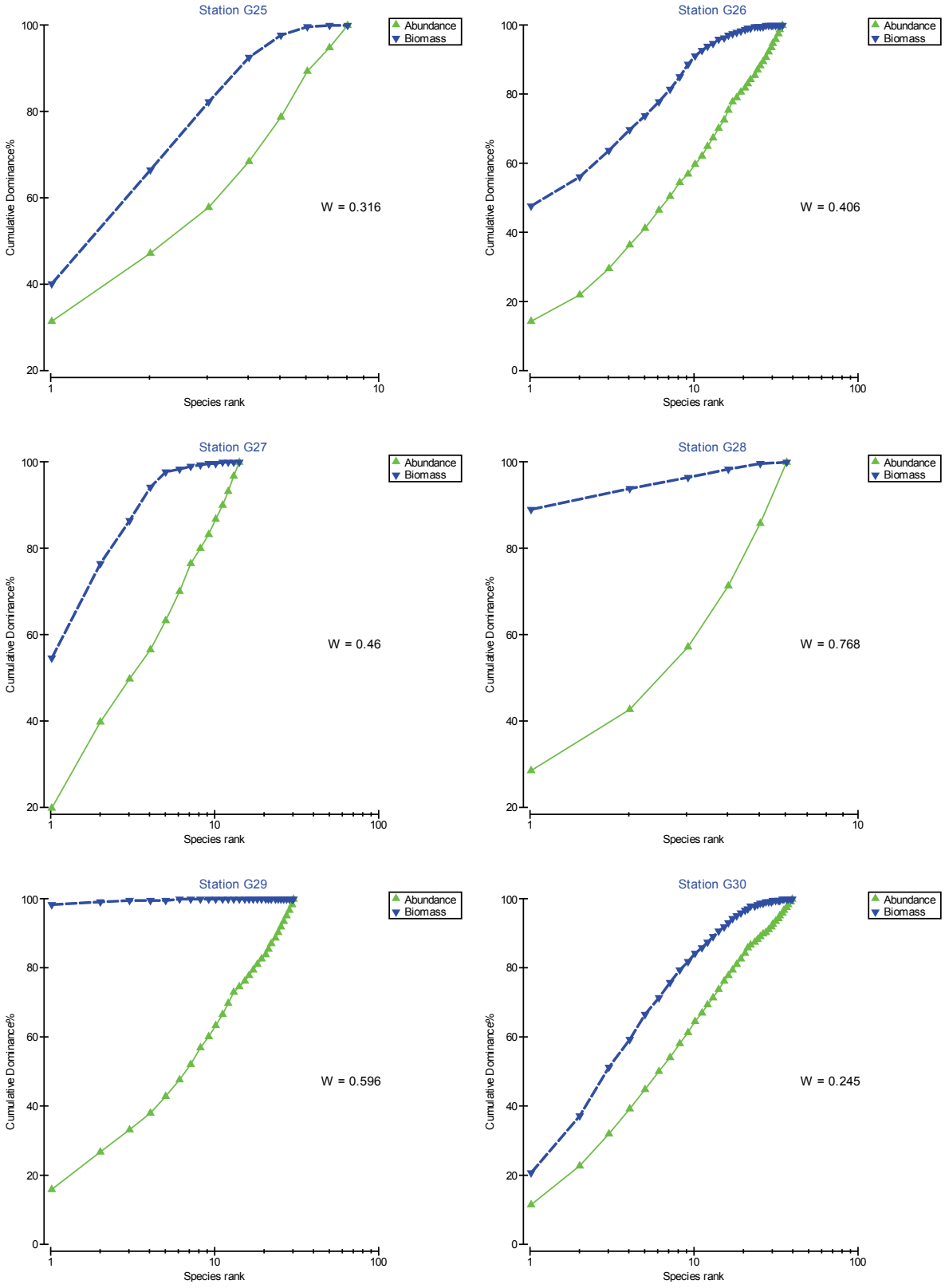

Figure 8 (cont.). ABC plots for infaunal samples collected within the Clyde Sea.

3.4 Species Composition

In total over 250 species were recorded from the survey including a wide variety of polychaetes, crustacea (notably amphipods), molluscs and echinoderms along with a variety of epifaunal/encrusting or colonial taxa such as hydroids, bryozoans and occasional sponges, anemones or ascidians. Table 4 and Table 5 show the most dominant taxa recorded over the survey area in terms of abundance and biomass. In terms of abundance, the echinoderm *Amphiura filiformis* was the most commonly observed species along with other polychaete or mollusc taxa such as *Owenia fusiformis, Kurtiella bidentata, Sabellaria spinulosa*, Nematoda spp., *Lumbrineris cingulata/gracilis*, *Spiophanes kroyeri* and *Turritella communis* which together accounted for over 40% of the total abundance.

In terms of biomass the ocean quahog, *Arctica islandica* (a PMF species) accounted for the majority of the biomass (>70%) although this species was only recorded at six stations. Other taxa with relatively high biomass included *Echinocardium flavescens, Glycymeris glycymeris, Turritella communis, Amphiura filiformis, Colus gracilis* and *Echinocardium cordatum* although with the exception of *Amphiura filiformis* these were recorded at relatively few stations. The most common taxa present included *Crisia* spp., recorded at 21% of sampling stations, and Porifera sp., recorded at 18% (Table 6). A variety of other taxa were also present including *Crisidia cornuta*, *Amphiblestrum auritum*, *Escharella ventricosa*, *Balanus crenatus*, Campanulariidae sp. and *Electra pilosa* whilst one station (G03 the shallowest station) included some algal species on maerl gravel along with some fragments of live maerl.

Table 4. Dominant taxa (by abundance) recorded at the Clyde Sea survey stations.

Taxa	Total Abundance	% of Total Abundance	No. of Stations
Amphiura filiformis	269	12	11
Owenia fusiformis	196	21	12
Kurtiella bidentata	145	27	10
Sabellaria spinulosa	102	32	3
NEMATODA spp.	90	36	5
Lumbrineris cingulata/gracilis	47	38	12
Spiophanes kroyeri	45	40	13
Turritella communis	44	42	3
Dosinia sp. juv.	39	43	3
Galathowenia oculata	38	45	7
Amphiura chiajei	38	47	7
Abra alba	37	49	7
Clausinella fasciata	36	50	1
Nephtys incisa	33	52	9
Modiolus sp. juv.	33	53	2
Euclymene oerstedii	32	54	3
Thracia sp. juv.	29	56	2
NEMERTEA spp.	28	57	12
Ennucula tenuis	28	58	12
Aonides paucibranchiata	28	60	4

Table 5. Dominant taxa (by biomass) recorded at the Clyde Sea survey stations.

Taxa	Total Biomass	% of Total Biomass	No. of Stations
Arctica islandica	732.6275	77	6
Echinocardium flavescens	33.3275	81	3
Glycymeris glycymeris	32.8802	84	1
Turritella communis	27.132	87	3
Amphiura filiformis	18.0779	89	11
Colus gracilis	14.5852	91	1
Echinocardium cordatum	12.002	92	1
Abra alba	11.0685	93	7
Dosinia exoleta	9.4661	94	2
Amphiura chiajei	7.4077	95	7
Ennucula tenuis	4.8756	95	12
Clausinella fasciata	4.3523	96	1
Calocaris macandreae	4.2573	96	3
Glycera rouxii	4.1106	97	10
Notomastus sp	3.7063	97	10
Owenia fusiformis	2.0306	97	12
Nephtys incisa	1.8847	98	9
Nucula nitidosa	1.7741	98	13
Lipobranchus jeffreysi	1.667	98	1
Pelonaia corrugata	1.5949	98	1

Table 6. Dominant taxa recorded at the Clyde Sea survey stations.

Qualitative Taxa	No. of Stations	% of Stations	Qualitative Taxa	No. of Stations	% of Stations
Crisia spp.	6	21	*Vesicularia spinosa*	1	4
Porifera sp.	5	18	*Flustra foliacea*	1	4
Crisidia cornuta	5	18	*Bugula* sp.	1	4
Amphiblestrum auritum	4	14	*Scrupocellaria scruposa*	1	4
Escharella ventricosa	4	14	*Hippothoa flagellum*	1	4
Balanus crenatus	3	11	*Hippoporina pertusa*	1	4
Campanulariidae sp.	3	11	*Phylactella labrosa*	1	4
Electra pilosa	3	11	*Schizomavella* sp.	1	4
Verruca stroemi	2	7	*Microporella ciliata*	1	4
Halecium sp.	2	7	*Cellepora pumicosa*	1	4
Hydrallmania falcata	2	7	Polyclinidae sp.	1	4
Tubulipora sp.	2	7	Didemnidae sp.	1	4
Disporella hispida	2	7	*Polycarpa* sp.	1	4
Eucratea loricata	2	7	Rhodophyta sp.	1	4
Cellaria sp.	2	7	Corallinaceae sp.	1	4
Diphasia sp.	1	4	Maerl spp.	1	4
Sertularella sp.	1	4	*Plocamium cartilagineum*	1	4
Bicrisia abyssicola	1	4	*Heterosiphonia plumosa*	1	4

3.5 Multivariate Analysis

The results of cluster analysis and MDS are given in Figure 9 which highlights the presence of four main groups of stations (groups a, b, d and f) in addition there are two outlier groups consisting of individual stations (group c – station g10 and group e – station G13). Similarities between stations were variable and ranged from below 10% to around 60% and overall the similarities between samples and within groups were often relatively low indicating a relatively high level of variation in species composition. The characteristic taxa derived from SIMPER and a summary of sediment type and water depth within these groups is provided in Table 7 whilst the spatial distribution of groups is provided in Figure 10.

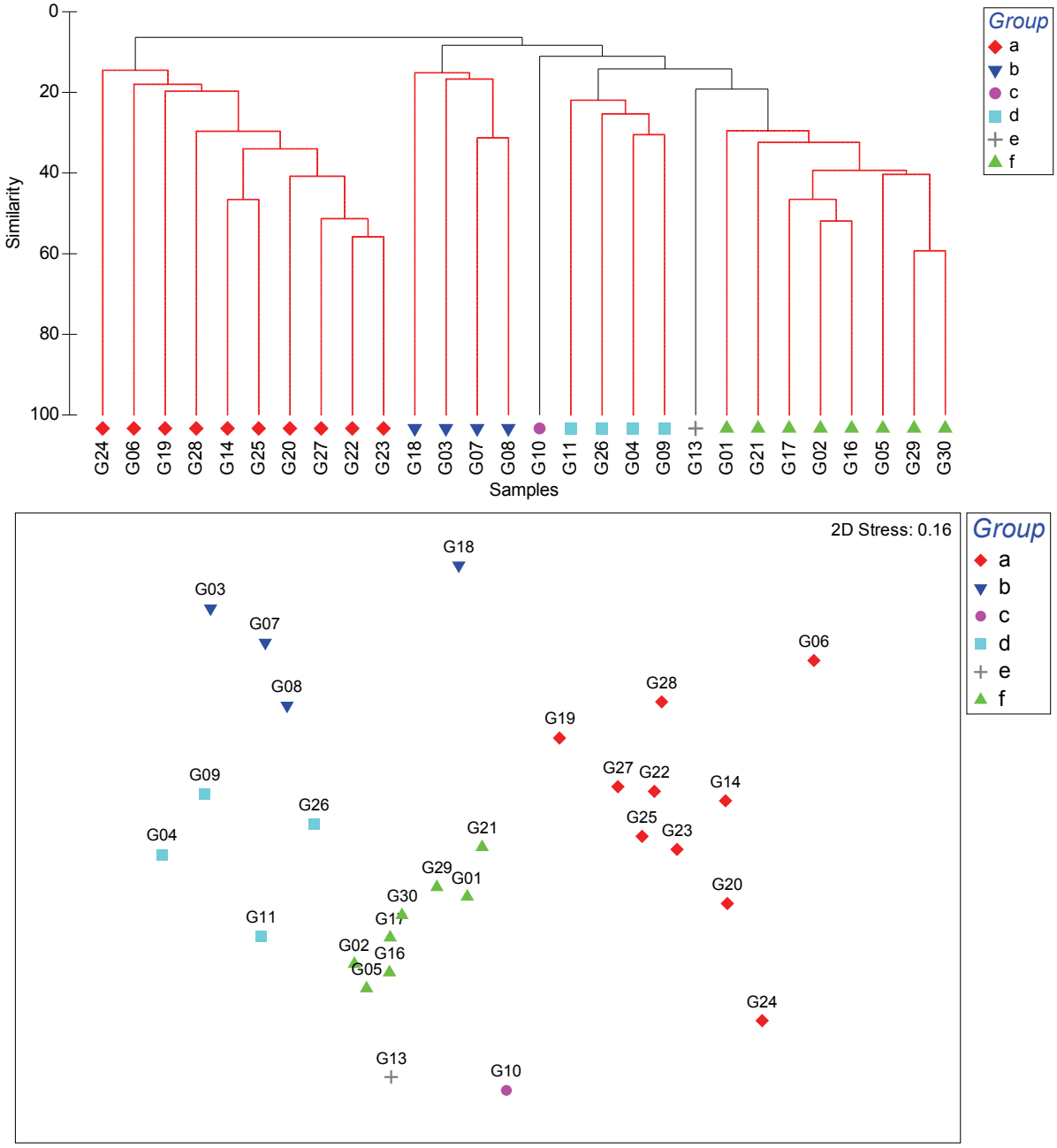

Figure 9. Results of cluster analysis and MDS.

Group A consisted primarily of stations within Loch Fyne (G19, G20, G22, G23, G24 and G25) and a few stations in the outer Clyde Sill (G06), off Arran (G14 and G28) or in the mouth of the Clyde (G27). These stations are characterised by circalittoral or deep (offshore) slightly gravelly sandy-mud or sandy-mud with species such as *Nephtys incisa, Abra alba, Nucula nitidosa, Ennucula tenuis, Glycera rouxii* and *Amphiura chiajei*. This group of stations is separated from the remaining stations at approximately 10% similarity. Group B comprises four loosely associated stations including G07 and G08 in the Clyde Sill area, a station off Arran (G03) and station G18 located at the top end of Loch Fyne. These samples are characterised by variable sediments including sandy gravels and gravelly muddy-sand or gravelly mud with moderate abundances of species such as *Mediomastus fragilis*, Nematoda spp., *Spiophanes kroyeri*, *Aonides paucibranchiata,* Nemertea spp., *Pholoe baltica, Nematonereis unicornis, Cirrophorus branchiatus, Laonice bahusiensis* and *Timoclea ovata*. This group is relatively variable with a variety of other taxa present at individual stations. For example, the shallowest station (G03 off Arran with a water depth of 18m) is characterised by a variety of bivalves such as *Clausinella fasciata, Dosinia* sp. juv., *Thracia* sp. juv., *Modiolus* sp. juv. and *Gari tellinella* and sediments at this station comprised maerl gravel (with some fragments of live maerl) with some algal taxa attached to larger maerl debris or stones.

Group C comprises of a single station (G10) in the outer Clyde Sill area characterised by circalittoral/deep sandy habitats with taxa such as *Tellimya ferruginosa, Scoloplos armiger, Pholoe baltica, Nucula nitidosa, Amphiura filiformis* and *Echinocardium flavescens.* Group D includes a number of stations in the outer Clyde sill area (G04, G09, G11) and a station in the outer area of Loch Fyne (G26). These stations are relatively diverse and situated in areas of gravelly sand or muddy sandy gravel and are characterised by species such as *Lumbrineris cingulata/gracilis, Owenia fusiformis, Paradoneis lyra, Amphiuridae* sp. (juv.), *Echinocyamus pusillus, Timoclea ovata, Eumida sanguinea,* Nemertea spp., *Leptochiton asellus, Nereimyra punctata* and *Sabellaria spinulosa*.

Group E comprises a single station (G13) in circalittoral/deep sand in the outer Clyde Sill area and is characterised by *Kurtiella bidentata*, Edwardsiidae sp., *Chamelea striatula*, Amphiu*ra filiformis, Diplocirrus glaucus, Musculus tumida, Spiophanes bombyx, Harpinia antennaria, Dosinia* sp. juv. and Ascidiidae sp.

Group F comprises a variety of stations to the south of Arran (stations G01, G02, G29 and G30), in Loch Fyne (G16, G17 and G21) and one station in the Clyde Sill area (G05). These stations were characterised by deep or circalittoral muddy sand or slightly gravelly muddy sand with taxa such as *Amphiura filiformis* and *Owenia fusiformis* along with *Spiophanes kroyeri, Nephtys kersivalensis, Galathowenia oculata, Kurtiella bidentata, Euclymene* spp., *Diplocirrus glaucus,* the PMF species *Arctica islandica* and also *Cylichna cylindracea*.

The BEST routine within PRIMER has been used to correlate sedimentary parameters and water depth to the patterns in community structure. This indicated that sediment parameters such as mean and median grain size and mud content had the highest correlations to patterns in community structure (correlations of 0.562, 0.529 and 0.486 respectively) with the remaining sediment parameters having correlations between 0.11 and 0.299. Water depth had a relatively low correlation to the patterns in community structure in comparison to sedimentary parameters. The combination of mean and median phi grain size, mud content and organic content (% LOI) gave the best combined correlation to sample similarity with a correlation of 0.606.

Table 7. Characteristic taxa within groups derived from cluster analysis.

Group A (Average similarity: 26.39%)					
Station	**Sediment Type**	**% Gravel**	**% Sand**	**% Mud**	**Depth (m)**
G06	Slightly Gravelly Muddy Sand	0.02	50.46	49.51	47
G14	Slightly Gravelly Sandy Mud	0.01	43.64	56.35	59
G19	Slightly Gravelly Sandy Mud	0.03	30.83	69.14	46
G20	Slightly Gravelly Sandy Mud	0.13	30.09	69.79	117
G22	Slightly Gravelly Sandy Mud	2.95	39.90	57.15	177
G23	Sandy Mud	0.00	42.52	57.48	155
G24	Sandy Mud	0.00	42.36	57.64	163
G25	Slightly Gravelly Sandy Mud	0.02	24.03	75.95	77
G27	Slightly Gravelly Sandy Mud	0.99	38.54	60.47	101
G28	Slightly Gravelly Sandy Mud	0.05	38.14	61.81	119
	Taxa	**Av.Abund**	**% of Stations**	**Contrib%**	**Cum.%**
	Nephtys incisa	3	80	30.93	30.93
	Abra alba	3.7	70	25.1	56.03
	Nucula nitidosa	0.8	60	13.73	69.76
	Ennucula tenuis	1.6	60	11.98	81.73
	Glycera rouxii	0.7	50	6.44	88.17
	Amphiura chiajei	3.1	30	2.29	90.46

Group B (Average similarity: 18.30%)					
Station	**Sediment Type**	**% Gravel**	**% Sand**	**% Mud**	**Depth (m)**
G03	Sandy Gravel	44.58	53.93	1.50	18
G07	Gravelly Muddy Sand	16.77	66.28	16.96	91
G08	Gravelly Mud	27.86	28.89	43.25	114
G18	Slightly Gravelly Muddy Sand	0.01	67.14	32.85	55
	Taxa	**Av.Abund**	**% of Stations**	**Contrib%**	**Cum.%**
	Mediomastus fragilis	5.75	100	32.72	32.72
	NEMATODA spp.	21.75	75	14.38	47.11
	Spiophanes kroyeri	1	75	11.05	58.16
	Aonides paucibranchiata	6.75	75	10.55	68.71
	NEMERTEA spp.	1	50	4.27	72.98
	Pholoe baltica	1	50	3.02	76
	Nematonereis unicornis	0.75	50	3.02	79.02
	Cirrophorus branchiatus	0.75	50	3.02	82.04
	Laonice bahusiensis	0.5	50	3.02	85.06
	Timoclea ovata	2.25	50	3	88.06
	Notomastus sp.	1.5	50	2.45	90.51

Table 7 (cont.). Characteristic taxa within groups derived from cluster analysis.

Group C					
Station	**Sediment Type**	**% Gravel**	**% Sand**	**% Mud**	**Depth (m)**
G10	Sand	0	100	0	-
	Taxa	**Abundance**			
	Tellimya ferruginosa	5			
	Scoloplos armiger	4			
	Pholoe baltica	2			
	Nucula nitidosa	2			
	Amphiura filiformis	2			
	Echinocardium flavescens	2			
	Nephtys assimilis	1			
	Lumbrineris cingulata/gracilis	1			
	Euspira pulchella	1			
	Kurtiella bidentata	1			
	Abra prismatica	1			
	Dosinia exoleta	1			
	SPATANGOIDA sp. juv.	1			

Group D (Average similarity: 24.44%)					
Station	**Sediment Type**	**% Gravel**	**% Sand**	**% Mud**	**Depth (m)**
G04	Slightly Gravelly Sand	2.87	91.63	5.50	76
G09	Gravelly Sand	11.95	84.21	3.84	114
G11	Slightly Gravelly Sand	1.54	95.52	2.94	53
G26	Muddy Sandy Gravel	30.54	35.74	33.72	28
	Taxa	**Av.Abund**	**% of Stations**	**Contrib%**	**Cum.%**
	Lumbrineris cingulata/gracilis	7.5	100	18.11	18.11
	Owenia fusiformis	8	100	16.78	34.89
	Paradoneis lyra	4.25	100	8.92	43.81
	Amphiuridae sp. (juv.)	2.5	100	8.25	52.07
	Echinocyamus pusillus	3	75	6.46	58.52
	Timoclea ovata	3.75	75	4.02	62.54
	Eumida sanguinea	1	75	3.59	66.13
	NEMERTEA spp.	2.75	75	3.55	69.68
	Leptochiton asellus	1.5	75	3.55	73.24
	Nereimyra punctata	1	75	3.17	76.41
	Sabellaria spinulosa	25.25	50	2.54	78.95
	Hiatella arctica	1.75	50	1.6	80.55
	Urothoe elegans	2.75	50	1.49	82.04
	Laonice bahusiensis	0.5	50	1.35	83.39
	Notomastus sp.	0.75	50	1.35	84.73
	Hydroides norvegicus	0.75	50	1.35	86.08
	Syllis armillaris	4.25	50	1.27	87.35
	Nematonereis unicornis	1	50	1.27	88.62
	Aglaophamus agilis	1	50	1.05	89.68
	Spiophanes bombyx	1.25	50	1.05	90.73

Table 7 (cont.). Characteristic taxa within groups derived from cluster analysis.

Group E					
Station	**Sediment Type**	**% Gravel**	**% Sand**	**% Mud**	**Depth (m)**
G13	Sand	0.00	91.99	8.01	46
	Top 10 Taxa	**Abundance**			
	Kurtiella bidentata	8			
	Edwardsiidae sp.	7			
	Chamelea striatula	4			
	Amphiura filiformis	4			
	Diplocirrus glaucus	3			
	Musculus tumida	3			
	Spiophanes bombyx	2			
	Harpinia antennaria	2			
	Dosinia sp. juv.	2			
	Ascidiidae sp.	2			

Group F (Average similarity: 37.09%)					
Station	**Sediment Type**	**% Gravel**	**% Sand**	**% Mud**	**Depth (m)**
G01	Slightly Gravelly Muddy Sand	0.90	77.50	21.60	65
G02	Muddy Sand	0.00	64.74	35.26	47
G05	Slightly Gravelly Muddy Sand	0.11	77.08	22.81	106
G16	Slightly Gravelly Muddy Sand	0.01	67.14	32.85	55
G17	Muddy Sand	0.00	62.28	37.72	45
G21	Slightly Gravelly Sandy Mud	0.14	43.36	56.50	37
G29	Slightly Gravelly Muddy Sand	0.13	73.70	26.17	111
G30	Slightly Gravelly Muddy Sand	0.05	76.75	23.20	79
	Taxa	**Av.Abund**	**% of Stations**	**Contrib%**	**Cum.%**
	Amphiura filiformis	32.50	88	12.55	12.55
	Owenia fusiformis	20.38	88	9.54	22.09
	Spiophanes kroyeri	4.88	100	7.53	29.62
	Nephtys kersivalensis	1.50	100	5.55	35.17
	Galathowenia oculata	4.63	75	5.01	40.18
	Kurtiella bidentata	16.75	75	4.17	44.35
	Euclymene spp.	2.38	75	3.65	47.99
	Diplocirrus glaucus	2.13	75	3.19	51.19
	Arctica islandica	1.38	75	3.03	54.21
	Cylichna cylindracea	1.38	75	2.82	57.03
	Ennucula tenuis	1.38	63	2.59	59.62
	Terebellides stroemi	1.75	63	2.49	62.11
	NEMERTEA spp.	1.38	63	2.13	64.23
	Anobothrus gracilis	1.50	63	2.08	66.31
	Nephtys sp. juv.	0.88	63	2.04	68.35
	Phoronis muelleri	1.25	63	1.93	70.28
	Goniada maculata	1.13	63	1.85	72.13
	Abra nitida	1.13	50	1.72	73.85
	Lumbrineris cingulata/gracilis	1.25	63	1.71	75.56
	Amphiuridae sp. (juv.)	1.00	50	1.45	77.01
	Nucula nitidosa	1.75	50	1.44	78.44
	Glycera rouxii	0.88	50	1.36	79.8
	Nephtys hombergii	0.75	50	1.27	81.08

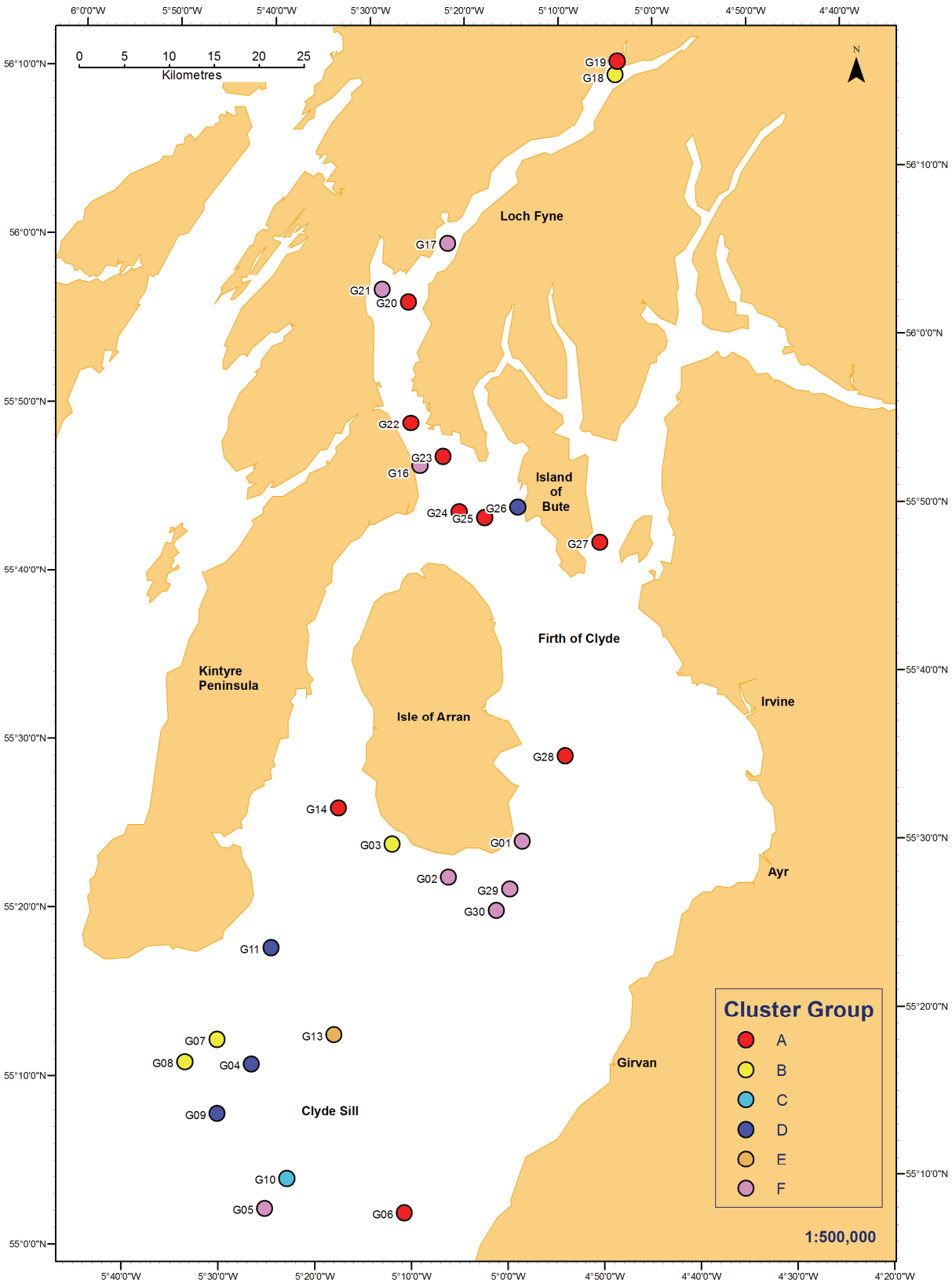

Figure 10. Groups derived from cluster analysis. © Crown copyright and database right 2013. All rights reserved. Ordnance Survey Licence number 100017908.

4. BIOTOPE COMPOSITION

Biotopes were assigned to each station initially on the basis of species composition at each station, sedimentary parameters, water depth and the results of multivariate analysis. It was noted that many of the stations exhibited transitional infaunal communities or those which do not correspond directly to one particular biotope. In many cases the results of infaunal analysis were then correlated to the results of drop down video reported in Moore and Atkinson, 2012 as this provided additional information on key taxa which may assist in biotope classification (e.g. burrowing megafauna) which are not present in the infaunal samples.

A summary of biotope codes for the stations is provided in Table 8 and a breakdown of biotopes for stations in each of the groups derived by cluster analysis with sediment descriptions and characteristic taxa is provided in Table 9. Biotopes listed in brackets indicate additional biotopes to which the station resembled where the primary classification was uncertain or where additional biotopes were recorded during video survey. The spatial distribution of biotopes is provided in Figure 11.

Table 8. Biotopes at each station.

Station	Biotope	Station	Biotope
G01	SS.SMu.CFiMu.SpnMeg	G17	SS.SMu.CSaMu.AfilMysAnit / (SS.SMu.CSaMu.VirOphPmax)
G02	SS.SMu.CSaMu.AfilMysAnit (SS.SSa.OSa.OfusAfil?)	G18	SS.SMu.CFiMu.MegMax
G03	SS.SCS.CCS.MedLumVen	G19	SS.SMu.CFiMu.MegMax
G04	SS.SCS.CCS (SS.SBR.PoR.SspiMx)	G20	SS.SMu.CFiMu.SpnMeg
G05	SS.SMu.CSaMu.AfilMysAnit (SS.SSa.OSa.OfusAfil?)	G21	SS.SMu.CFiMu.SpnMeg
G06	SS.SMu.CFiMu.SpnMeg	G22	SS.SMu.CFiMu.SpnMeg
G07	SS.SCS.CCS.MedLumVen	G23	SS.SMu.CFiMu.SpnMeg
G08	SS.SCS.CCS.MedLumVen / SS.SMx.CMx.FluHyd	G24	SS.SMu.CFiMu.SpnMeg
G09	SS.SCS.CCS / OCS	G25	SS.SMu.CFiMu.SpnMeg
G10	SS.SSa.OSa?	G26	SS.SMx.CMX
G11	SS.SCS.CCS/SS.SSa.CFiSa	G27	SS.SMu.CFiMu.SpnMeg
G13	SS.SMu.CSaMu.AfilMysAnit?	G28	SS.SMu.CFiMu.SpnMeg
G14	SS.SMu.CFiMu.SpnMeg	G29	SS.SMu.CFiMu.SpnMeg
G16	SS.SMu.CSaMu.AfilMysAnit	G30	SS.SMu.CFiMu.SpnMeg

Group A included stations G19, G20, G22, G23, G24 and G25 in Loch Fyne, station G27 in the Clyde Firth, station G06 (Clyde Sill) and stations G14 and G28 off Arran. These stations were characterised by sandy-mud or slightly gravelly sandy-mud or muddy-sand and have a relatively poorly defined infaunal community in terms of the biotope classification but generally fall into the **SS.SMu.CFiMu** or **SS.SMu.CSaMu** biotope complex. Characteristic taxa such as *Nephtys incisa, Abra alba, Nucula nitidosa, Ennucula tenuis, Glycera rouxii* and *Amphiura chiajei* are characteristic of a number of biotopes within these broader biotope complex groups. Some stations (e.g. G19 and G23) included both *Thyasira flexuosa* and *Ennucula tenuis* within the infaunal communities which show some resemblance to biotopes such as **SS.SMu.CSaMu.ThyNten** (*Thyasira* spp. and *Nuculoma tenuis* in circalittoral sandy mud) although this correlation was not particularly convincing. A few stations within this group include burrowing megafaunal species such as *Calocaris macandreae* (G20 and G27) which indicates the biotope **SS.SMu.CFiMu.SpnMeg**. However, infaunal grabs tend to

under-sample such taxa so a correlation of these stations to the drop down video reported in Moore and Atkinson (2012) was undertaken. These results indicated that all stations within group A were moderately to densely burrowed by *Nephrops norvegicus* and/or *Calocaris macandreae,* and occasionally *Jaxea nocturna* with *Virgularia mirabilis* also recorded occasionally. As such the stations within group A have been designated as **SS.SMu.CFiMu.SpnMeg** (Seapens and burrowing megafauna in circalittoral fine mud).

Group B included a number of mixed gravelly stations in the Clyde Sill area (G07 and G08), station G03 inshore south of Arran and one station in the upper reaches of Loch Fyne (G18). These stations tended to be somewhat variable but with stations G07 and G08 characterised by taxa such as *Mediomastus fragilis* often with occasional robust venerid bivalves such as *Goodallia triangularis* which correlates to deep water variants of the biotope **SS.SCS.CCS.MedLumVen** (*Mediomastus fragilis*, *Lumbrineris* spp. and venerid bivalves in circalittoral coarse sand or gravel). Video data from Moore and Atkinson (2012) indicated a level of colonisation by hydroids and bryozoans such as *Flustra foliacea* at station G08 so the station could be transitional with the biotope **SS.SMx.CMx.FluHyd** (*Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment). Station G03 off Arran was located in shallower water with a number of robust bivalves such as *Clausinella fasciata* along with *Mediomastus fragilis* and *Lumbrineris* spp. so is likely to be a shallower variant of **SS.SCS.CCS.MedLumVen**. However, this station also includes *Dosinia* sp. and *Timoclea ovata* along with interstitial polychaetes such as *Polygordius* sp. and *Pisione remota* and other taxa characteristic of **SS.SCS.ICS.MoeVen** (Moerella spp. with venerid bivalves in infralittoral gravelly sand) although the key species *Moerella* is not present. Further grab samples would need to be collected to confirm the assigned biotope. Station G18 is found in slightly gravelly sandy mud in Loch Fyne and whilst also characterised by *Mediomastus fragilis* it also includes *Amphiura chiajei* and video data from Moore and Atkinson (2012) indicated that the area was densely burrowed by *Calocaris macandreae* with *Nephrops norvegicus*, *Jaxea nocturna* and *Callianassa subterranea* burrows and also *Maxmuelleria lankesteri* mounds. As such this station has been classified as **SS.SMu.CFiMu.MegMax** (Burrowing megafauna and *Maxmuelleria lankesteri* in circalittoral mud).

Station G10 in Group C in the Clyde Sill area is characterised by sand in deep water but the dominant species (*Tellimya ferruginosa*, *Scoloplos armiger*, *Pholoe baltica*, *Nucula nitidosa* and *Amphiura filiformis*) are not particularly characteristic of any given biotope so have been classified as **SS.SSa.OSa** (Offshore circalittoral sand).

Group D includes a number of stations in gravelly sand or gravel in deeper waters in the Clyde Sill area (G04, G09, G11) or muddy sands off the Island of Bute (G26). These stations had somewhat variable taxa which were generally indicative of slightly coarser sands or gravelly sand but generally did not clearly correspond to a particular biotope and have been classified as variants of **SS.SCS.CCS**, **SS.SCS.OCS** or **SS.SSa.CFiSa**. Station G04 was somewhat unusual as having relatively high numbers of the polychaete *Sabellaria spinulosa* (although these were within the sediment as opposed to forming reef structures) so are similar to a deeper variant of **SS.SBR.PoR.SspiMx** (*Sabellaria spinulosa* on stable circalittoral mixed sediment). Station G26 is in shallower water in muddier gravel and has been classified as **SS.SMx.CMX**.

Station G13 (group E) was located in deeper (slightly muddy) sand and characterised by *Kurtiella bidentata*, Edwardsiidae sp., *Chamelea striatula, Amphiura filiformis* and *Diplocirrus glaucus* and has been tentatively assigned the biotope **SS.SMu.CSaMu.AfilMysAnit** (*Amphiura filiformis, Mysella bidentata* and *Abra nitida* in circalittoral sandy mud).

Stations in Group F included a station in the Clyde Sill (G05), stations off Arran (G01, G02, G29 and G30) and stations within Loch Fyne (G16, G17 and G21). These stations were generally in deeper muddy sand or sandy mud often with some gravel content. Stations

G02, G05, G16 and G17 were characterised by *Amphiura filiformis* and *Kurtiella bidentata* so are likely to be **SS.SMu.CSaMu.AfilMysAnit** (*Amphiura filiformis, Mysella bidentata* and *Abra nitida* in circalittoral sandy mud) although station G02 and in particular G05 in deeper water also had high numbers of *Owenia fusiformis* so bore some similarity to the offshore biotope **SS.SSa.OSa.OfusAfil** (*Owenia fusiformis* and *Amphiura filiformis* in offshore circalittoral sand or muddy sand) and are possibly transitional between the two. Video evidence in Moore and Atkinson (2012) indicated that at G17 some areas with occasional *Virgularia mirabilis* were present to which they had assigned the biotope **SS.SMu.CSaMu.VirOphPmax** (*Virgularia mirabilis* and *Ophiura* spp. with *Pecten maximus* on circalittoral sandy or shelly mud). The remaining stations in this group had less clearly defined infaunal communities which bore some resemblance to the biotope **SS.SMu.CSaMu.AfilNten** (*Amphiura filiformis* and *Nuculoma tenuis* in circalittoral and offshore sandy mud) and to a lesser extent **SS.SSa.OSa.OfusAfil** although biotopes for these stations were not particularly well defined based on infuanal data. However, video data reported in Moore and Atkinson (2012) indicated moderate to light burrowing by megafauna such as *Nephrops norvegicus* and sometimes *Calocaris macandreae* (which was also in the infaunal sample G21) and as such these have been classified as **SS.SMu.CFiMu.SpnMeg** (Seapens and burrowing megafauna in circalittoral fine mud).

Table 9. Biotopes, sediment descriptions and dominant taxa within cluster groups.

Group	Station	Biotope	Sediment Type	Depth (m)	Dominant Taxa
A	G06	SS.SMu.CFiMu.SpnMeg	Slightly Gravelly Muddy Sand	47	*Nephtys incisa, Ampelisca brevicornis*, Amphiuridae sp. (juv.)
	G14	SS.SMu.CFiMu.SpnMeg	Slightly Gravelly Sandy Mud	59	Copepoda sp., *Nephtys incisa, Abyssoninoe hibernica, Notomastus* sp., *Nucula nitidosa*
	G19	SS.SMu.CFiMu.MegMax	Slightly Gravelly Sandy Mud	46	*Amphiura chiajei, Diplocirrus glaucus, Thyasira flexuosa, Glycera rouxii, Chaetozone setosa*
	G20	SS.SMu.CFiMu.SpnMeg	Slightly Gravelly Sandy Mud	117	*Abra alba, Nucula sulcata, Calocaris macandreae, Glycera rouxii, Ancistrosyllis groenlandica*
	G22	SS.SMu.CFiMu.SpnMeg	Slightly Gravelly Sandy Mud	177	*Abra alba, Ennucula tenuis, Nephtys incisa, Goniada maculata, Glycera alba*
	G23	SS.SMu.CFiMu.SpnMeg	Sandy Mud	155	*Abra alba, Nephtys incisa, Ennucula tenuis, Nucula nitidosa, Glyphohesione klatti*
	G24	SS.SMu.CFiMu.SpnMeg	Sandy Mud	163	*Lipobranchus jeffreysi, Nucula nitidosa, Ennucula tenuis*, ,
	G25	SS.SMu.CFiMu.SpnMeg	Slightly Gravelly Sandy Mud	77	*Abra alba, Amphiura chiajei, Nephtys incisa, Notomastus* sp., *Nucula nitidosa*
	G27	SS.SMu.CFiMu.SpnMeg	Slightly Gravelly Sandy Mud	101	*Nephtys incisa, Abra alba, Ennucula tenuis, Glycera rouxii, Calocaris macandreae*
	G28	SS.SMu.CFiMu.SpnMeg	Slightly Gravelly Sandy Mud	119	*Chaetoderma nitidulum*, Nemertea spp., *Glycera rouxii, Nephtys incisa, Monticellina* sp.
B	G03	SS.SCS.CCS.MedLumVen	Sandy Gravel	18	Nematoda spp., *Clausinella fasciata*, *Dosinia* sp. juv., *Thracia* sp. juv., *Modiolus* sp. juv.
	G07	SS.SCS.CCS.MedLumVen	Gravelly Muddy Sand	91	*Aonides paucibranchiata, Mediomastus fragilis, Timoclea ovata*, Nemertea spp., *Nematonereis unicornis*
	G08	SS.SCS.CCS.MedLumVen / SS.SMx.CMx.FluHyd	Gravelly Mud	114	*Mediomastus fragilis*, *Scalibregma inflatum, Lumbrineris cingulata/gracilis, Pholoe baltica*, Nemertea spp.
	G18	SS.SMu.CFiMu.MegMax	Slightly Gravelly Sandy Mud	115	Nematoda spp., *Mediomastus fragilis, Mendicula ferruginea, Amphiura chiajei, Dosinia exoleta*
C	G10	SS.SSa.OSa?	Sand	-	*Tellimya ferruginosa, Scoloplos armiger, Pholoe baltica, Nucula nitidosa, Amphiura filiformis*

Table 9 continued.

Group	Station	Biotope	Sediment Type	Depth (m)	Dominant Taxa
D	G04	SS.SCS.CCS (SS.SBR.PoR.SspiMx)	Slightly Gravelly Sand	76	*Sabellaria spinulosa, Syllis armillaris, Nephasoma minutum, Timoclea ovata, Lumbrineris cingulata/gracilis*
	G09	SS.SCS.CCS / OCS	Gravelly Sand	114	*Lumbrineris cingulata/gracilis, Sabellaria spinulosa*, Spirorbidae sp., *Echinocyamus pusillus*, *Polycirrus* sp.
	G11	SS.SCS.CCS/SS.SSa.CFiSa	Slightly Gravelly Sand	53	*Owenia fusiformis, Urothoe elegans, Lumbrineris cingulata/gracilis, Spiophanes bombyx, Echinocyamus pusillus*
	G26	SS.SMx.CMX	Muddy Sandy Gravel	28	*Owenia fusiformis, Lumbrineris cingulata/gracilis, Paradoneis lyra*, Amphiuridae sp. (juv.), *Gnathia oxyuraea*
E	G13	SS.SMu.CSaMu.AfilMysAnit?	Sand	46	*Kurtiella bidentata*, Edwardsiidae sp., *Chamelea striatula, Amphiura filiformis, Diplocirrus glaucus*
F	G01	SS.SMu.CFiMu.SpnMeg	Slightly Gravelly Muddy Sand	65	*Turritella communis, Galathowenia oculata*, Maldanidae sp., *Nucula nitidosa, Nephtys hombergii*
	G02	SS.SMu.CSaMu.AfilMysAnit (SS.SSa.OSa.OfusAfil?)	Muddy Sand	47	*Amphiura filiformis, Owenia fusiformis, Turritella communis, Kurtiella bidentata, Euclymene oerstedii*
	G05	SS.SMu.CSaMu.AfilMysAnit (SS.SSa.OSa.OfusAfil?)	Slightly Gravelly Muddy Sand	106	*Kurtiella bidentata, Amphiura filiformis, Owenia fusiformis, Nucula nitidosa, Spiophanes kroyeri*
	G16	SS.SMu.CSaMu.AfilMysAnit	Slightly Gravelly Muddy Sand	55	*Owenia fusiformis, Amphiura filiformis, Euclymene oerstedii, Galathowenia oculata*, Amphiuridae sp. (juv.)
	G17	SS.SMu.CSaMu.AfilMysAnit / SS.SMu.CSaMu.VirOphPmax	Muddy Sand	45	*Amphiura filiformis, Kurtiella bidentata, Praxillella gracilis, Owenia fusiformis, Galathowenia oculata*
	G21	SS.SMu.CFiMu.SpnMeg	Slightly Gravelly Sandy Mud	37	*Amphiura filiformis, Abyssoninoe hibernica, Notomastus* sp., *Nephtys incisa, Euclymene* spp.
	G29	SS.SMu.CFiMu.SpnMeg	Slightly Gravelly Muddy Sand	111	*Spiophanes kroyeri, Owenia fusiformis, Harpinia antennaria, Glycera rouxii, Nephtys kersivalensis*
	G30	SS.SMu.CFiMu.SpnMeg	Slightly Gravelly Muddy Sand	79	*Spiophanes kroyeri, Galathowenia oculata, Owenia fusiformis*, *Euclymene* spp., *Terebellides stroemi*

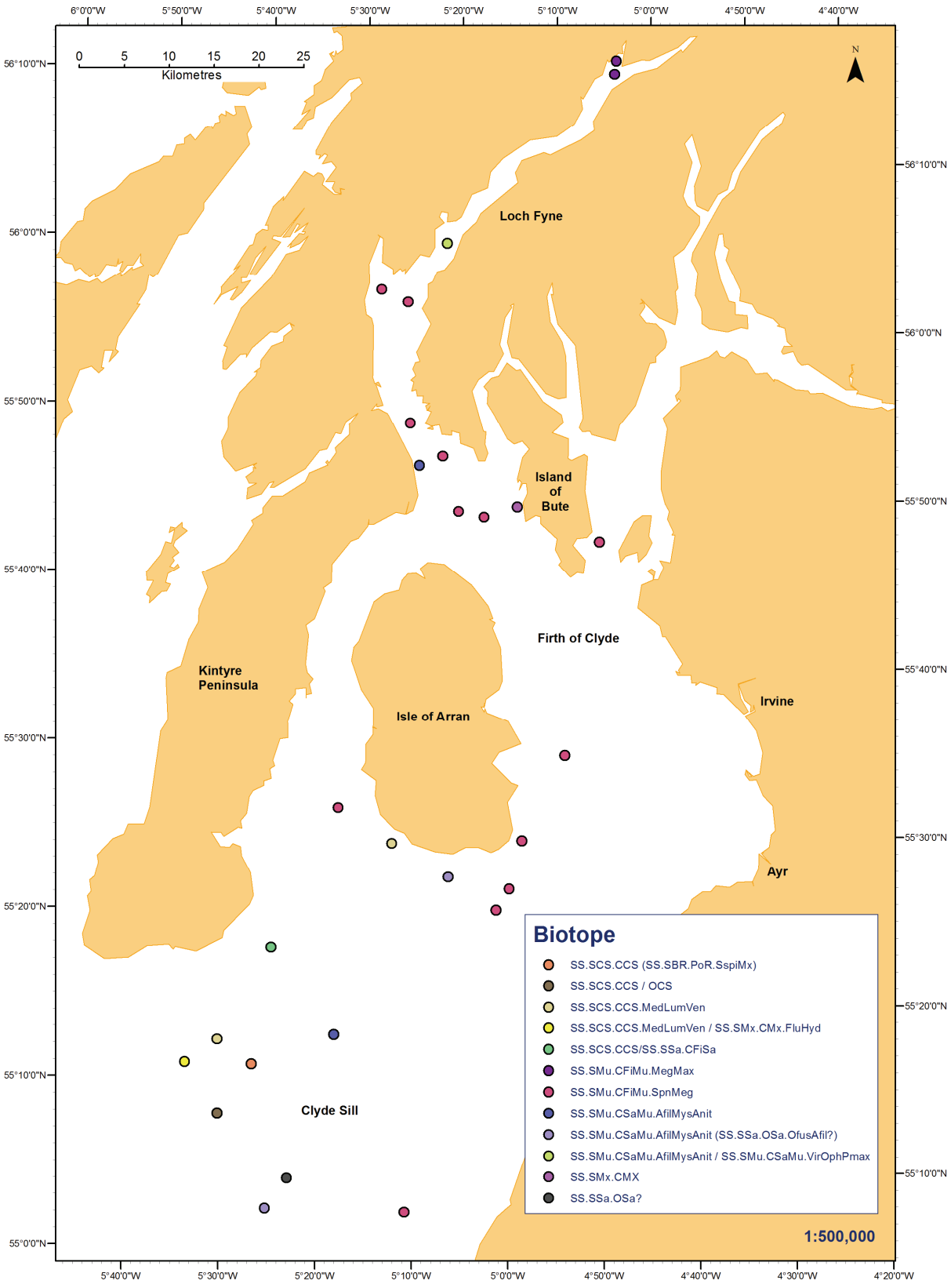

Figure 11. Biotope codes assigned to Infaunal sampling stations within the Clyde . © Crown copyright and database right 2013. All rights reserved. Ordnance Survey Licence number 100017908.

5. CONCLUSIONS

The sampling stations surveyed in the Clyde Sea area covered a relatively wide range of water depths (18 m – 177 m) ranging from shallower infralittoral areas to circalittoral and deep (offshore) habitats with a variety of sediments including sands, muddy-sands and sandy muds and mixed gravelly sands or slightly gravelly muddy sand/sandy mud. A large number of taxa were recorded from the survey with over 250 taxa identified with polychaete worms being particularly common along with amphipod crustacea, molluscs (primarily bivalves) and echinoderms. A number of colonial or encrusting taxa such as hydroids, bryozoans, sponges, anemones and ascidians were also occasionally recorded. The most abundant taxa included species such as *Amphiura filiformis, Owenia fusiformis, Kurtiella bidentata, Sabellaria spinulosa*, Nematoda spp., *Lumbrineris cingulata/gracilis, Spiophanes kroyeri, Turritella communis, Dosinia* sp. and *Galathowenia oculata* although some of these taxa were recorded at relatively few stations. In general the abundance of individual taxa was moderate to low and no species were recorded in exceptionally high numbers. The most widespread taxa included *Amphiura filiformis*, *Owenia fusiformis*, *Kurtiella bidentata*, *Lumbrineris cingulata/gracilis*, *Spiophanes kroyeri*, Nemertea spp. and *Ennucula tenuis* which were recorded at around 40% of the stations.

Four main groups of stations were derived from multivariate analysis in addition to a few outlier stations, although the similarities between stations were often relatively low. An assessment of the main communities in relation to the UK biotope classification (Connor *et al*., 2004) indicated the presence of a number of biotopes including variants of circalittoral sandy mud (**SS.SMu.CSaMu**) in Loch Fyne and some stations in the Clyde Firth or Clyde Sill area which video evidence from Moore and Atkinson (2012) indicated were **SS.SMu.CFiMu.SpnMeg** (Seapens and burrowing megafauna in circalittoral fine mud) or in some cases **SS.SMu.CFiMu.MegMax** (Burrowing megafauna and *Maxmuelleria lankesteri* in circalittoral mud). These biotopes are of note as they are Priority Marine Features and MPA search features. Stations classified as these biotopes tended to have somewhat variable infaunal communities which were difficult to directly correlate to biotope level (although certain stations such as G20, G21 and G27 contained burrowing megafauna such as *Calocaris macandreae* within the infaunal samples) and this highlights the importance of gathering video data in such areas.

Other circalittoral muddy-sand habitats (often with some gravel content) in Loch Fyne and off Arran were also classified as **SS.SMu.CFiMu.SpnMeg** whilst others had communities indicative of biotopes such as **SS.SMu.CSaMu.AfilMysAnit** (*Amphiura filiformis*, *Mysella bidentata* and *Abra nitida* in circalittoral sandy-mud) and those in more offshore areas (Clyde Sill) also bore some resemblance to offshore biotopes such as **SS.SSa.OSa.OfusAfil** (*Owenia fusiformis* and *Amphiura filiformis* in offshore circalittoral sand or muddy sand). It is possible that these offshore areas were transitional in nature and habitats further offshore may include better examples of **SS.SSa.OSa.OfusAfil.** This biotope is of interest as it is an offshore PMF and MPA search feature although additional survey work in offshore areas would be required to confirm this. Video data from these circalittoral muddy-sand habitats also highlighted the potential presence of **SS.SMu.CSaMu.VirOphPmax** (*Virgularia mirabilis* and *Ophiura* spp. with *Pecten maximus* on circalittoral sandy or shelly mud). Other stations in muddy habitats in this area also included some species characteristic of **SS.SMu.CSaMu.AfilNten** (*Amphiura filiformis* and *Nuculoma tenuis* in circalittoral and offshore sandy mud) but were not clearly defined and again may represent transitional habitats.

Other areas in deeper waters off Arran or in the Clyde sill were characterised by more mixed gravelly sands which included variants of **SS.SCS.CCS.MedLumVen** (*Mediomastus fragilis, Lumbrineris* spp. and venerid bivalves in circalittoral coarse sand or gravel) or poorly defined circalittoral or offshore coarse/mixed sediment biotopes (**SS.SCS.OCS** or **SS.SCS.CCS**).

One station (G04), located in the Clyde Sill area with a water depth of 76 m, also had relatively high numbers of the polychaete *Sabellaria spinulosa* which is usually found in somewhat shallower waters and could be a transitional deeper variant of **SS.SBR.PoR.SspiMx** (*Sabellaria spinulosa* on stable circalittoral mixed sediment). Additional grab samples would need to be collected to confirm this biotope. Station G03 also included coarser sediments characterised by maerl gravel with some evidence of occasional live maerl fragments present within the maerl debris. However, insufficient live maerl was recorded for this station to be classified as a maerl biotope which may be attributed to the lack of replicate grab samples collected. A number of other stations in the outer areas (off Arran or in the Clyde Sill) included less well defined examples circalittoral or offshore coarse or sand biotopes **SS.SCS.OCS** or **SS.SSa.OSa.**

Overall the stations sampled appear to be representative of deeper sealoch or offshore sandy-muds and mixed/gravelly habitats off the west Scottish coast and the majority of species recorded were typical for circalittoral muddy-sands, sandy-muds or gravelly mixed sediments. In addition to containing examples of PMF/MPA search features such as **SS.SMu.CFiMu.SpnMeg** and **SS.SMu.CFiMu.MegMax** the survey area also included six stations with the PMF species *Arctica islandica* (stations G02, G16, G17, G21, G29 and G30). Species richness and diversity was variable and total abundances tended to be moderate to low but overall the area was moderately diverse. Certain stations (G09 and in particular G04) in the outer Clyde sill area were particularly diverse with station G04 having 77 species. The more diverse areas tended to correspond to coarser mixed sediments which is a section of the biotope classification that (along with offshore biotopes) is currently less well defined (and subject to an ongoing review by JNCC). As such the offshore habitats of the Clyde Sea area with examples of transitional coarser or sand/muddy sand biotopes (**SS.SCS.OCS** or **SS.SSa.OSa**) would benefit from additional data to improve the knowledge base of such communities in this region.

Less diverse areas (less than 10 taxa recorded) were primarily muddy stations in Loch Fyne (stations G18, G20, G22, G23, G24, G25 and G28) and a few stations off Arran (G14 and G28) or in the Clyde Sill (G06). Stations G06 and G24 were particularly low in infaunal species with only three taxa recorded. ABC curves did not indicate particularly stressed communities at these stations and without access to historical data it is difficult to assess whether the observed diversities are typical for these areas. As such the reason for these relatively impoverished communities is uncertain but may be due to the lack of replicate samples being collected. Alternatively this may relate to a variety of factors (e.g. sediment disturbance, variation in water quality) which may be of natural or anthropogenic origin. However, a few stations (G23, G25, G27 and G28) were observed from video survey to have a degree of trawl scarring and it is possible that this may have had some impact on communities although further research would be required to assess this. This could include further video/benthic sampling in conjunction with multibeam bathymetric or sidescan studies to detect intensity of trawl scars in conjunction with an assessment of local fishing effort to assess the overall size of area most affected by trawling. However, it should be noted that a number of the more impoverished stations had a variety of megafauna or other epifaunal taxa not included in the infaunal dataset (based on video data from Moore and Atkinson 2012) so it is possible that the recorded infaunal diversities were underestimates. In such areas additional or replicate sampling would improve the statistic rigour of the dataset for any future surveys.

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ANNEX 1: GRAB PHOTOGRAPHS


Station G01


Station G02


Station G03


Station G04

Station G05

Station G06

Station G07

Station G08

Station G09

Station G10

Station G11

Station G13


Station G14


Station G16


Station G17


Station G18

Station G19

Station G20

Station G21

Station G22

Station G23

Station G24

Station G25

Station G26

Station G27

Station G28

Station G29

Station G30

ANNEX 2: SEDIMENT DISTRIBUTION DATA

SAMPLE	PARAMETER	G01	G02	G03	G04	G05	G06	G07
SAMPLE TYPE:		Unimodal, Poorly Sorted	Bimodal, Very Poorly Sorted	Bimodal, Poorly Sorted	Unimodal, Poorly Sorted	Unimodal, Very Poorly Sorted	Bimodal, Poorly Sorted	Trimodal, Very Poorly Sorted
TEXTURAL GROUP:		Slightly Gravelly Muddy Sand	Muddy Sand	Sandy Gravel	Slightly Gravelly Sand	Slightly Gravelly Muddy Sand	Slightly Gravelly Muddy Sand	Gravelly Muddy Sand
SEDIMENT NAME:		Slightly Medium Gravelly Medium Silty Fine Sand	Medium Silty Fine Sand	Sandy Very Fine Gravel	Slightly Very Fine Gravelly Medium Sand	Slightly Very Fine Gravelly Medium Silty Fine Sand	Slightly Very Fine Gravelly Very Coarse Silty Very Fine Sand	Very Fine Gravelly Very Coarse Silty Medium Sand
FOLK AND WARD METHOD (μm)	MEDIAN GRAIN SIZE D_{50} (μm)	115.1	103.9	1787.4	319.8	205.6	63.33	475.6
	MEAN GRAIN SIZE (μm)	78.99	61.50	1458.0	322.2	112.8	43.25	374.7
	SORTING	3.297	4.120	3.134	2.199	4.096	3.950	6.478
	SKEWNESS	-0.516	-0.507	-0.243	-0.118	-0.619	-0.378	-0.270
	KURTOSIS	1.830	0.835	0.952	1.569	1.665	0.833	1.211
FOLK AND WARD METHOD (ϕ)	MEDIAN GRAIN SIZE D_{50} (ϕ):	3.119	3.267	-0.838	1.645	2.282	3.981	1.072
	MEAN GRAIN SIZE (ϕ):	3.662	4.023	-0.544	1.634	3.148	4.531	1.416
	SORTING	1.721	2.043	1.648	1.137	2.034	1.982	2.696
	SKEWNESS	0.516	0.507	0.243	0.118	0.619	0.378	0.270
	KURTOSIS	1.830	0.835	0.952	1.569	1.665	0.833	1.211
FOLK AND WARD METHOD (Description)	MEAN:	Very Fine Sand	Very Coarse Silt	Very Coarse Sand	Medium Sand	Very Fine Sand	Very Coarse Silt	Medium Sand
	SORTING:	Poorly Sorted	Very Poorly Sorted	Poorly Sorted	Poorly Sorted	Very Poorly Sorted	Poorly Sorted	Very Poorly Sorted
	SKEWNESS:	Very Fine Skewed	Very Fine Skewed	Fine Skewed	Fine Skewed	Very Fine Skewed	Very Fine Skewed	Fine Skewed
	KURTOSIS:	Very Leptokurtic	Platykurtic	Mesokurtic	Very Leptokurtic	Very Leptokurtic	Platykurtic	Leptokurtic
BULK GRAIN SIZE	% GRAVEL:	0.90	0.00	44.58	2.87	0.11	0.02	16.77
	% SAND:	77.50	64.74	53.93	91.63	77.08	50.46	66.28
	% MUD:	21.60	35.26	1.50	5.50	22.81	49.51	16.96
	% V COARSE GRAVEL:	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	% COARSE GRAVEL:	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	% MEDIUM GRAVEL:	0.49	0.00	3.51	0.18	0.00	0.00	0.00
	% FINE GRAVEL:	0.40	0.00	14.76	1.00	0.00	0.00	3.79
	% V FINE GRAVEL:	0.01	0.00	26.30	1.69	0.11	0.02	12.98
	% V COARSE SAND:	0.01	0.04	26.61	2.26	0.18	0.02	14.67
	% COARSE SAND:	0.00	0.30	8.96	17.51	3.46	0.48	17.02
	% MEDIUM SAND:	6.85	9.39	11.80	43.75	34.14	3.76	19.51
	% FINE SAND:	37.29	32.48	6.15	25.63	34.61	19.15	9.93
	% V FINE SAND:	33.35	22.54	0.42	2.48	4.71	27.06	5.14
	% V COARSE SILT:	4.42	5.90	0.29	1.29	3.04	15.00	3.92
	% COARSE SILT:	2.92	7.89	0.39	1.34	5.59	8.98	3.60
	% MEDIUM SILT:	5.86	9.21	0.31	1.23	6.09	10.35	3.83
	% FINE SILT:	5.02	7.59	0.32	1.12	5.25	9.29	3.36
	% V FINE SILT:	2.84	3.98	0.18	0.53	2.51	4.97	1.88
	% CLAY:	0.54	0.68	0.00	0.00	0.33	0.93	0.37
% LOI (ORGANIC CARBON)		0.31	0.78	1.68	0.54	0.52	0.91	1.22

SAMPLE	PARAMETER	G08	G09	G10	G11	G13	G14	G16
SAMPLE TYPE:		Trimodal, Very Poorly Sorted	Bimodal, Poorly Sorted	Unimodal, Well Sorted	Unimodal, Moderately Sorted	Unimodal, Poorly Sorted	Bimodal, Very Poorly Sorted	Bimodal, Poorly Sorted
TEXTURAL GROUP:		Gravelly Mud	Gravelly Sand	Sand	Slightly Gravelly Sand	Sand	Slightly Gravelly Sandy Mud	Slightly Gravelly Muddy Sand
SEDIMENT NAME:		Fine Gravelly Medium Silt	Very Fine Gravelly Medium Sand	Well Sorted Medium Sand	Slightly Very Fine Gravelly Medium Sand	Poorly Sorted Fine Sand	Slightly Very Fine Gravelly Very Fine Sandy Very Coarse Silt	Slightly Very Fine Gravelly Very Coarse Silty Fine Sand
FOLK AND WARD METHOD (μm)	MEDIAN GRAIN SIZE D_{50} (μm)	99.93	437.5	296.4	279.6	155.1	48.58	103.7
	MEAN GRAIN SIZE (μm)	153.9	517.6	296.7	285.3	151.7	42.99	69.08
	SORTING	14.07	2.627	1.391	1.823	2.063	4.666	3.764
	SKEWNESS	0.157	0.277	0.006	0.138	-0.318	-0.117	-0.448
	KURTOSIS	0.604	1.293	0.911	1.226	2.114	0.826	1.076
FOLK AND WARD METHOD (ϕ)	MEDIAN GRAIN SIZE D_{50} (ϕ):	3.323	1.192	1.754	1.839	2.688	4.364	3.270
	MEAN GRAIN SIZE (ϕ):	2.700	0.950	1.753	1.810	2.721	4.540	3.856
	SORTING	3.815	1.393	0.476	0.866	1.045	2.222	1.912
	SKEWNESS	-0.157	-0.277	-0.006	-0.138	0.318	0.117	0.448
	KURTOSIS	0.604	1.293	0.911	1.226	2.114	0.826	1.076
FOLK AND WARD METHOD (Description)	MEAN:	Fine Sand	Coarse Sand	Medium Sand	Medium Sand	Fine Sand	Very Coarse Silt	Very Fine Sand
	SORTING:	Very Poorly Sorted	Poorly Sorted	Well Sorted	Moderately Sorted	Poorly Sorted	Very Poorly Sorted	Poorly Sorted
	SKEWNESS:	Coarse Skewed	Coarse Skewed	Symmetrical	Coarse Skewed	Very Fine Skewed	Fine Skewed	Very Fine Skewed
	KURTOSIS:	Very Platykurtic	Leptokurtic	Mesokurtic	Leptokurtic	Very Leptokurtic	Platykurtic	Mesokurtic
BULK GRAIN SIZE	% GRAVEL:	27.86	11.95	0.00	1.54	0.00	0.01	0.01
	% SAND:	28.89	84.21	100.00	95.52	91.99	43.64	67.14
	% MUD:	43.25	3.84	0.00	2.94	8.01	56.35	32.85
	% V COARSE GRAVEL:	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	% COARSE GRAVEL:	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	% MEDIUM GRAVEL:	1.09	1.99	0.00	0.00	0.00	0.00	0.00
	% FINE GRAVEL:	15.58	2.10	0.00	0.14	0.00	0.00	0.00
	% V FINE GRAVEL:	11.18	7.86	0.00	1.40	0.00	0.01	0.01
	% V COARSE SAND:	7.38	7.73	0.50	3.91	0.06	0.07	0.02
	% COARSE SAND:	1.64	22.79	3.64	9.74	0.01	1.71	0.21
	% MEDIUM SAND:	3.18	37.83	66.60	43.20	12.15	10.57	11.22
	% FINE SAND:	6.84	15.41	29.27	36.24	57.06	15.00	30.54
	% V FINE SAND:	9.86	0.45	0.00	2.43	22.71	16.29	25.16
	% V COARSE SILT:	9.52	1.14	0.00	0.57	0.10	16.60	9.23
	% COARSE SILT:	9.56	0.79	0.00	0.98	1.94	12.31	6.55
	% MEDIUM SILT:	10.14	0.80	0.00	0.44	2.43	11.30	7.80
	% FINE SILT:	8.59	0.78	0.00	0.68	1.98	9.93	5.93
	% V FINE SILT:	4.60	0.33	0.00	0.28	1.40	5.26	2.82
	% CLAY:	0.84	0.00	0.00	0.00	0.16	0.95	0.51
% LOI (ORGANIC CARBON)		3.36	1.11	0.26	1.02	0.54	1.76	1.03

SAMPLE	PARAMETER	G17	G18	G19	G20	G21	G22	G23
SAMPLE TYPE:		Bimodal, Poorly Sorted	Unimodal, Poorly Sorted	Unimodal, Poorly Sorted	Bimodal, Poorly Sorted	Bimodal, Poorly Sorted	Bimodal, Very Poorly Sorted	Bimodal, Very Poorly Sorted
TEXTURAL GROUP:		Muddy Sand	Slightly Gravelly Sandy Mud	Slightly Gravelly Sandy Mud	Slightly Gravelly Sandy Mud	Slightly Gravelly Sandy Mud	Slightly Gravelly Sandy Mud	Sandy Mud
SEDIMENT NAME:		Very Coarse Silty Very Fine Sand	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	Slightly Very Fine Gravelly Very Fine Sandy Very Coarse Silt	Slightly Very Fine Gravelly Very Fine Sandy Medium Silt	Fine Sandy Medium Silt
FOLK AND WARD METHOD (μm)	MEDIAN GRAIN SIZE D_{50} (μm)	76.98	41.23	38.94	27.74	54.56	37.19	37.82
	MEAN GRAIN SIZE (μm)	63.75	42.06	36.15	25.55	40.16	33.24	36.41
	SORTING	2.616	3.573	2.808	3.867	3.110	5.116	4.741
	SKEWNESS	-0.381	-0.003	-0.125	-0.087	-0.405	-0.059	-0.048
	KURTOSIS	1.466	0.907	1.023	0.789	1.173	0.753	0.722
FOLK AND WARD METHOD (ϕ)	MEDIAN GRAIN SIZE D_{50} (ϕ):	3.699	4.600	4.682	5.172	4.196	4.749	4.725
	MEAN GRAIN SIZE (ϕ):	3.971	4.571	4.790	5.290	4.638	4.911	4.779
	SORTING	1.387	1.837	1.489	1.951	1.637	2.355	2.245
	SKEWNESS	0.381	0.003	0.125	0.087	0.405	0.059	0.048
	KURTOSIS	1.466	0.907	1.023	0.789	1.173	0.753	0.722
FOLK AND WARD METHOD (Description)	MEAN:	Very Fine Sand	Very Coarse Silt	Very Coarse Silt	Coarse Silt	Very Coarse Silt	Very Coarse Silt	Very Coarse Silt
	SORTING:	Poorly Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted	Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted
	SKEWNESS:	Very Fine Skewed	Symmetrical	Fine Skewed	Symmetrical	Very Fine Skewed	Symmetrical	Symmetrical
	KURTOSIS:	Leptokurtic	Mesokurtic	Mesokurtic	Platykurtic	Leptokurtic	Platykurtic	Platykurtic
BULK GRAIN SIZE	% GRAVEL:	0.00	0.04	0.03	0.13	0.14	2.95	0.00
	% SAND:	62.28	38.55	30.83	30.09	43.36	39.90	42.52
	% MUD:	37.72	61.40	69.14	69.79	56.50	57.15	57.48
	% V COARSE GRAVEL:	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	% COARSE GRAVEL:	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	% MEDIUM GRAVEL:	0.00	0.00	0.00	0.00	0.00	0.30	0.00
	% FINE GRAVEL:	0.00	0.00	0.00	0.00	0.00	1.22	0.00
	% V FINE GRAVEL:	0.00	0.04	0.03	0.13	0.14	1.43	0.00
	% V COARSE SAND:	0.07	0.08	0.11	0.10	0.12	0.92	0.05
	% COARSE SAND:	0.42	0.69	0.66	0.04	1.16	0.47	0.72
	% MEDIUM SAND:	0.83	6.30	1.50	1.79	0.19	5.28	9.39
	% FINE SAND:	19.62	14.12	7.14	9.41	8.67	15.93	17.61
	% V FINE SAND:	41.34	17.36	21.42	18.74	33.22	17.29	14.76
	% V COARSE SILT:	19.59	19.40	27.82	17.28	27.36	9.14	10.24
	% COARSE SILT:	5.35	19.24	20.91	14.61	9.34	9.89	12.44
	% MEDIUM SILT:	6.51	13.14	11.86	15.41	7.71	14.46	15.10
	% FINE SILT:	4.23	6.60	5.88	13.58	7.46	14.18	12.51
	% V FINE SILT:	1.67	2.61	2.29	7.49	3.84	8.02	6.17
	% CLAY:	0.37	0.41	0.38	1.43	0.79	1.46	1.02
% LOI (ORGANIC CARBON)		1.57	10.00	7.73	5.05	1.81	5.42	7.04

SAMPLE	PARAMETER	G24	G25	G26	G27	G28	G29	G30
SAMPLE TYPE:		Bimodal, Very Poorly Sorted	Bimodal, Poorly Sorted	Polymodal, Extremely Poorly Sorted	Bimodal, Very Poorly Sorted	Bimodal, Very Poorly Sorted	Bimodal, Poorly Sorted	Bimodal, Very Poorly Sorted
TEXTURAL GROUP:		Sandy Mud	Slightly Gravelly Sandy Mud	Muddy Sandy Gravel	Slightly Gravelly Sandy Mud	Slightly Gravelly Sandy Mud	Slightly Gravelly Muddy Sand	Slightly Gravelly Muddy Sand
SEDIMENT NAME:		Fine Sandy Medium Silt	Slightly Very Fine Gravelly Very Fine Sandy Very Coarse Silt	Very Coarse Silty Sandy Coarse Gravel	Slightly Very Fine Gravelly Very Fine Sandy Medium Silt	Slightly Very Fine Gravelly Fine Sandy Medium Silt	Slightly Very Fine Gravelly Medium Silty Fine Sand	Slightly Very Fine Gravelly Medium Silty Fine Sand
FOLK AND WARD METHOD (μm)	MEDIAN GRAIN SIZE D_{50} (μm)	35.91	24.00	138.9	37.10	30.45	131.5	158.2
	MEAN GRAIN SIZE (μm)	36.12	21.73	287.7	34.20	34.87	77.22	92.12
	SORTING	4.795	3.688	19.34	4.627	4.899	3.938	4.156
	SKEWNESS	-0.015	-0.098	0.252	-0.066	0.090	-0.553	-0.555
	KURTOSIS	0.713	0.799	0.739	0.795	0.737	1.255	1.505
FOLK AND WARD METHOD (ϕ)	MEDIAN GRAIN SIZE D_{50} (ϕ):	4.800	5.381	2.848	4.752	5.037	2.926	2.660
	MEAN GRAIN SIZE (ϕ):	4.791	5.524	1.797	4.870	4.842	3.695	3.440
	SORTING	2.262	1.883	4.274	2.210	2.293	1.977	2.055
	SKEWNESS	0.015	0.098	-0.252	0.066	-0.090	0.553	0.555
	KURTOSIS	0.713	0.799	0.739	0.795	0.737	1.255	1.505
FOLK AND WARD METHOD (Description)	MEAN:	Very Coarse Silt	Coarse Silt	Medium Sand	Very Coarse Silt	Very Coarse Silt	Very Fine Sand	Very Fine Sand
	SORTING:	Very Poorly Sorted	Poorly Sorted	Extremely Poorly Sorted	Very Poorly Sorted	Very Poorly Sorted	Poorly Sorted	Very Poorly Sorted
	SKEWNESS:	Symmetrical	Symmetrical	Coarse Skewed	Symmetrical	Symmetrical	Very Fine Skewed	Very Fine Skewed
	KURTOSIS:	Platykurtic	Platykurtic	Platykurtic	Platykurtic	Platykurtic	Leptokurtic	Very Leptokurtic
BULK GRAIN SIZE	% GRAVEL:	0.00	0.02	30.54	0.99	0.05	0.13	0.05
	% SAND:	42.36	24.03	35.74	38.54	38.14	73.70	76.75
	% MUD:	57.64	75.95	33.72	60.47	61.81	26.17	23.20
	% V COARSE GRAVEL:	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	% COARSE GRAVEL:	0.00	0.00	10.74	0.00	0.00	0.00	0.00
	% MEDIUM GRAVEL:	0.00	0.00	8.23	0.00	0.00	0.00	0.00
	% FINE GRAVEL:	0.00	0.00	3.92	0.22	0.00	0.03	0.00
	% V FINE GRAVEL:	0.00	0.02	7.66	0.77	0.05	0.10	0.05
	% V COARSE SAND:	0.08	0.05	6.79	0.80	0.09	0.19	0.07
	% COARSE SAND:	0.92	0.01	1.60	0.82	1.59	0.43	1.67
	% MEDIUM SAND:	9.67	0.99	3.27	6.01	10.72	14.74	23.06
	% FINE SAND:	18.11	6.08	9.58	14.32	14.57	37.38	36.97
	% V FINE SAND:	13.59	16.91	14.49	16.60	11.17	20.95	14.99
	% V COARSE SILT:	9.59	19.80	9.52	13.72	11.30	3.21	2.83
	% COARSE SILT:	12.83	15.51	6.87	13.13	14.63	5.88	4.64
	% MEDIUM SILT:	15.44	15.40	7.52	13.85	16.26	7.40	6.09
	% FINE SILT:	12.56	14.69	6.14	11.98	12.74	6.02	5.85
	% V FINE SILT:	6.19	8.71	3.11	6.57	5.96	3.12	3.24
	% CLAY:	1.04	1.86	0.56	1.22	0.92	0.53	0.56
% LOI (ORGANIC CARBON)		6.65	3.52	1.48	5.86	4.88	0.68	0.97

ANNEX 3: SPECIES DATA

Taxa	G01	G02	G03	G04	G05	G06	G07	G08	G09	G10	G11	G13	G14	G16	G17	G18	G19	G20	G21	G22	G23	G24	G25	G26	G27	G28	G29	G30
Porifera sp.			P	P			P		P															P				
Halecium sp.											P	P																
Diphasia sp.									P																			
Hydrallmania falcata				P					P																			
Sertularella sp.											P																	
Campanulariidae sp.				P							P													P				
Cerianthus lloydii																								2				
Edwardsiidae sp.												7		1	1													
TURBELLARIA spp.											1																	
NEMERTEA spp.	1	2		8	3		2	2	1						2									2	1	1		3
NEMATODA spp.			69	2				1	1							17												
Golfingia sp. juv.					1				1																			
Golfingia vulgaris															1									1				
Nephasoma minutum				12																								
Thysanocardia procera	1	1																										
Phascolion strombus	1																											
ECHIURA sp.									1																			
Pisione remota			1																									
Aphrodita aculeata juv.				1																				1				1
Polynoidae sp.				2			1												1									
Harmothoe spp.														1														
Malmgreniella marphysae								1																				
Malmgreniella mcintoshi									1																			
Lepidonotus squamatus				1																								
Panthalis oerstedi																1												
Pholoe inornata				1																								
Pholoe baltica	1	2			1		1	3		2																		
Sthenelais limicola									1			1																
Eulalia bilineata				2																								
Eulalia expusilla				1																								
Eulalia mustela juv.									2																			
Eumida sanguinea				1					2		1																	
Glycera alba	1										1						1			1					1		1	
Glycera lapidum agg.			5		1			1	1																			
Glycera rouxii	1	2															2	1	1	1				3	2	1	3	
Goniada maculata		1			1									2	4		1		1	2								
Nereimyra punctata				2					1															1				
Ophiodromus flexuosus																	1		1				1					
Podarkeopsis capensis			1						1																			
Ancistrosyllis groenlandica																		1		P								
Glyphohesione klatti																					1							
Syllis cornuta									1																			
Syllis armillaris				15					2																			
Syllis variegata				2																								
Sphaerosyllis sp.			5																									
Sphaerosyllis bulbosa			2																									
Nereididae sp juv.				1																								
Eunereis longissima							1																					

Taxa	G01	G02	G03	G04	G05	G06	G07	G08	G09	G10	G11	G13	G14	G16	G17	G18	G19	G20	G21	G22	G23	G24	G25	G26	G27	G28	G29	G30
Nereis zonata				3								1																
Aglaophamus agilis				3							1																	
Nephtys sp. juv.	1				1										2												1	2
Nephtys assimilis										1																		
Nephtys hombergii	2				2						1																1	1
Nephtys incisa						9							2				1		3	5	4		2		6	1		
Nephtys kersivalensis	1	2			1									1	1				1								3	2
Eunice sp. juv.																								1				
Nematonereis unicornis				2			2	1	2																			
Lumbrineris cingulata/gracilis		5	1	9	1			5	10	1	5				1									6			1	2
Abyssoninoe hibernica													1	1					4	1					1		1	1
Notocirrus scoticus					1																							
Scoloplos armiger					1				1	4																		
Cirrophorus branchiatus							1	2	1																			
Levinsenia gracilis																1	1											1
Paradoneis lyra				9					1		1								1					6				
Aonides oxycephala																								3				
Aonides paucibranchiata			15				11	1			1																	
Laonice bahusiensis							1	1	1															1				
Minuspio cf. *multibranchiata*																	1											
Polydora ciliata				2			1																					1
Prionospio fallax	1																											1
Pseudopolydora antennata				1											3													
Pseudopolydora pulchra				1																								
Spiophanes bombyx				1							4	2																
Spiophanes kroyeri	2	2			5		1	2						2	2	1			1	1	1						10	15
Magelona filiformis												1																
Aphelochaeta sp.					2																						1	
Caulleriella alata								1																				
Caulleriella zetlandica				1																				1				
Chaetozone gibber					2																							
Chaetozone setosa					2										1		2										1	2
Chaetozone christiei											1																	
Cirratulus cirratus				2																								
Monticellina sp.				1	1											1									1	1	1	1
Diplocirrus glaucus	1	8		1								3		3	2		4										1	2
Pherusa flabellata				1																								
Mediomastus fragilis			3				4	11								5												
Notomastus sp			4				2		1				1	1	2				4				2	2				1
Maldanidae sp.	3				1							P											1					
Praxillura longissima					2									2	1													
Clymenura sp. juv.											1			1														
Microclymene tricirrata																												2
Euclymene spp.					1									2	1				3								3	9
Euclymene lombricoides	1	1																										
Euclymene oerstedii		20												8	4													
Heteroclymene robusta					1																							
Praxillella affinis	2	10		1					1																			1
Praxillella gracilis															7													
Praxillella praetermissa															2													

Taxa	G01	G02	G03	G04	G05	G06	G07	G08	G09	G10	G11	G13	G14	G16	G17	G18	G19	G20	G21	G22	G23	G24	G25	G26	G27	G28	G29	G30
Rhodine gracilior		4																										
Ophelina acuminata					2														1									1
Lipobranchus jeffreysi																						1						
Scalibregma inflatum								6																	1			
Polygordius sp.			2																									
Galathowenia oculata	5	4			2									7	5									1				14
Owenia fusiformis	1	49		8	28				2		11	1		60	6									11			7	12
Amphictene auricoma		1												1													2	3
Pectinaria belgica																	1											
Sabellaria spinulosa				93			1		8																			
Ampharetidae sp. juv.									1																			
Melinna palmata																								1				
Ampharete lindstroemi	1				1																							1
Ampharete acutifrons																								1				
Ampharete octocirrata																								1				
Amphicteis gunneri																								2				
Anobothrus gracilis		1			2									2													2	5
Sosane sulcata																								1				
Terebellides stroemi	2	2		3				2	1										2								1	7
Trichobranchus roseus		2												3	1												1	
Amphitrite cirrata																			1									
Eupolymnia nesidensis							1																	2				
Lanassa venusta							1																					
Pista cristata		1																										
Amaeana trilobata									1																			
Polycirrus sp.				1					3						1										1			
Polycirrus medusa		1	4											1													1	1
Paradialychone filicaudata							1																	1				
Pseudopotamilla reniformis				2																								
Hydroides norvegicus			5						1															2				
Spirobranchus triqueter			1						1																			
Spirorbidae sp.									7																			
Limnodriloides sp.									1																			
Grania sp.			1																									
Anoplodactylus petiolatus		1																										
Verruca stroemi			P																					P				
Balanus crenatus				P					P															P				
COPEPODA sp.													3															
Perioculodes longimanus			1																									
Westwoodilla caecula		1												1														
Urothoe elegans				2							9																	
Harpinia antennaria					2							2															4	4
Metaphoxus fultoni			3																									
Lysianassidae sp. juv.			1																									
Acidostoma obesum															1													
Tmetonyx similis									1																			
Nototropis falcatus				1																								
Atylus vedlomensis							1																					
Ampelisca sp.																								1				
Ampelisca brevicornis		1				1																						

Taxa	G01	G02	G03	G04	G05	G06	G07	G08	G09	G10	G11	G13	G14	G16	G17	G18	G19	G20	G21	G22	G23	G24	G25	G26	G27	G28	G29	G30
Ampelisca diadema														1														
Ampelisca tenuicornis														1														
Abludomelita obtusata	2	1																										
Cheirocratus sp.									1																			
Maerella tenuimana							2																					
Aoridae sp.				1				2																				
Leptocheirus hirsutimanus			3				1																					
Megamphopus cornutus									1																			
Unciola planipes							2																					
Gnathia sp.				1																				2				
Gnathia oxyuraea				1																				4				
Eurydice pulchra									1																			
Astacilla longicornis												1																
Diastylis rugosa												1																
Calocaris macandreae																		2	1						2			
CAUDOFOVEATA sp.									1																			
Chaetoderma nitidulum	1													1				1						1		2	1	
Leptochiton asellus				3			1		1															2				
Leptochiton cancellatus			4																									
Turritella communis	8	35												1														
Alvania punctata				5							1																	
Onoba semicostata				3																								
Euspira pulchella					1					1														2				
Vitreolina philippi		1																										
Colus gracilis											1																	
Turbonilla rufescens												1																
Acteon tornatilis juv.																												1
Cylichna cylindracea		4			1							1			3				1								1	1
Onchidoridae sp. juv.															1													
Antalis entalis		2																									1	
Nucula nitidosa	3	1			6					2	1	1	1					1			2	1	2		1			4
Nucula nucleus				2	1																							
Nucula sulcata																		3										
Ennucula tenuis	2													2	1		1	1		7	3	1		1	3		3	3
Glycymeris glycymeris								1																				
Modiolus sp. juv.			25	8																								
Musculus tumida												3																
Anomiidae sp. juv.				1																								
Thyasira flexuosa	2											1			1		4		1		1			1				
Mendicula ferruginea																3												
Kellia suborbicularis				1																								
Montacuta substriata				2																								
Tellimya ferruginosa										5																		
Kurtiella bidentata		22			95			1		1	1	8		1	13				2									1
Astarte sulcata juv.								1	1																			
Goodallia triangularis				2			1																					
Parvicardium minimum																												7
Phaxas pellucidus		1																										1
Arcopagia crassa juv.			1																									
Gari sp. juv.											1																	

Taxa	G01	G02	G03	G04	G05	G06	G07	G08	G09	G10	G11	G13	G14	G16	G17	G18	G19	G20	G21	G22	G23	G24	G25	G26	G27	G28	G29	G30
Gari tellinella			10																									
Abra alba													1					7		11	5		6		6	1		
Abra nitida	1																		3	1							2	3
Abra prismatica										1																		
Arctica islandica		1												2	4				1								2	1
Chamelea striatula			36									4																
Clausinella fasciata			6	12			3		1		2																	
Timoclea ovata			1																						2			
Tapes sp. juv.			35	2								2																
Dosinia sp. juv.										1						2												
Dosinia exoleta											1																	
Mya truncata															1													1
Corbula gibba				3								1												4				
Hiatella arctica								1																				
Zirfaea crispata			27				2																					
Thracia sp. juv.				P	P		P		P		P																	
Crisidia cornuta								P																				
Bicrisia abyssicola				P	P			P	P		P													P				
Crisia spp.			P				P																					
Tubulipora sp.			P				P																					
Disporella hispida				P																								
Vesicularia spinosa				P					P																			
Eucratea loricata				P	P						P																	
Electra pilosa				P																								
Flustra foliacea				P					P		P													P				
Amphiblestrum auritum				P																								
Bugula sp.			P																									
Scrupocellaria scruposa				P				P																				
Cellaria sp.							P																					
Hippothoa flagellum				P			P		P															P				
Escharella ventricosa				P																								
Hippoporina pertusa							P																					
Phylactella labrosa				P																								
Schizomavella sp.			P																									
Microporella ciliata			P																									
Cellepora pumicosa		2		2										1	3									1			1	3
Phoronis muelleri				2																								
Ophiothrix fragilis																												
Amphiuridae sp. (juv.)	1		8	3		P			1		1	1		5					1					5			1	
Amphiura chiajei															1	3	26		1				3		2		2	
Amphiura filiformis		123			57					2	1	4		32	16				24				2				3	5
Amphiura securigera								1																				
Ophiuridae sp. juv.									1					1														
Echinocyamus pusillus			1	4			1		5		3																	
SPATANGOIDA sp. juv.				1						1		1																
Echinocardium cordatum		1																										
Echinocardium flavescens				1	1					2																		
Leptosynapta bergensis		4			1				1					3					1									
Labidoplax sp.				4																								
Labidoplax buski		4												2	2													

Taxa	G01	G02	G03	G04	G05	G06	G07	G08	G09	G10	G11	G13	G14	G16	G17	G18	G19	G20	G21	G22	G23	G24	G25	G26	G27	G28	G29	G30
Polyclinidae sp.				P																								
Didemnidae sp.									P																			
Ascidiidae sp.												2																
Pelonaia corrugata		4																										
Polycarpa sp.				P																								
Dendrodoa grossularia				P																				1				
Rhodophyta sp.			P																									
Corallinaceae sp.			P																									
Maerl spp.			P																									
Heterosiphonia plumosa			P																									

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