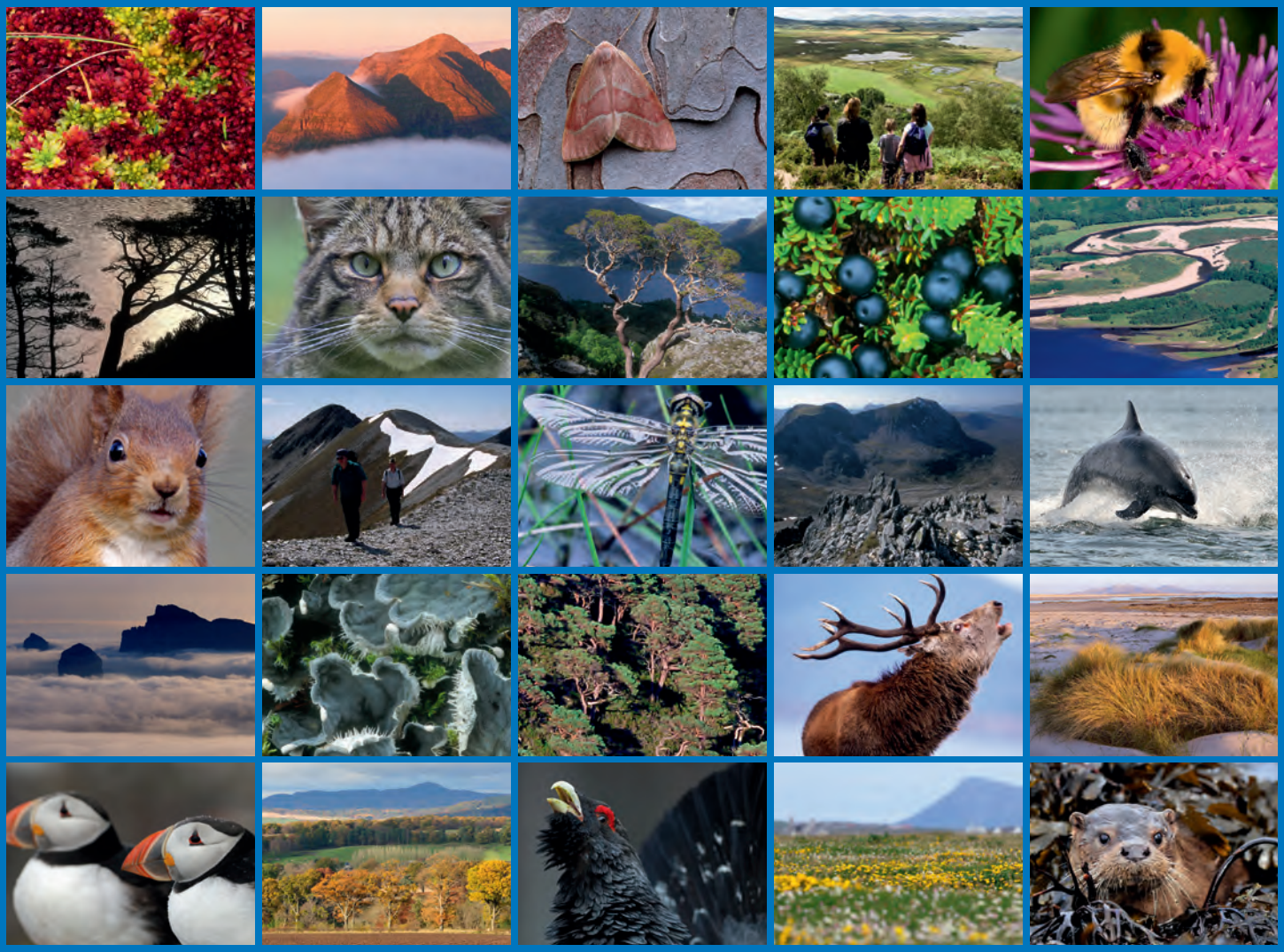
Scottish Natural Heritage
Commissioned Report No. 946

Infaunal and PSA analyses of benthic samples collected from South Arran MPA, Lochs Duich, Long and Alsh MPA and Southern Trench MPA proposal



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COMMISSIONED REPORT

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Infaunal and PSA analyses of benthic samples collected from South Arran MPA, Lochs Duich, Long and Alsh MPA and Southern Trench MPA proposal

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COMMISSIONED REPORT

Summary

Infaunal and PSA analyses of benthic samples collected from South Arran MPA, Lochs Duich, Long and Alsh MPA and Southern Trench MPA proposal

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Keywords

Marine survey; MPA; South Arran; Lochs Duich Long Alsh; protected features; seabed habitats; infauna; PSA.

Background

On the 7 August 2014, 30 Nature Conservation Marine Protected Areas (NC MPAs) were designated in the seas around Scotland, 17 in territorial waters under the Marine (Scotland) Act 2010 and 13 in offshore waters under the Marine and Coastal Access Act 2009. Scottish Natural Heritage (SNH) submitted formal advice to the Scottish Government in July 2014 on the case for designating a further four NC MPAs in territorial waters.

In September 2015 a survey was carried out by SNH to assess the condition of seabed habitats within South Arran NC MPA and Lochs Duich, Long and Alsh SAC / NC MPA. Sixty-nine grab samples were collected during the survey. Seven additional grab samples were collected within the Southern Trench MPA proposal by Cefas in December 2015.

Seastar Survey Ltd. was contracted by SNH to undertake the infaunal analysis of the grab samples, including identifying all the faunal components within the grab samples, sediment particle size analysis (PSA), and assigning a biotope to each sample. This report presents the results from these analyses, and a brief interpretation of the data.

Main findings

- A total of 76 grab samples were collected and analysed for both PSA and macrobenthic invertebrates; 54 samples were from Arran, 15 from Loch Alsh and 7 from the Southern Trench.

- Of the South Arran samples, those from stations D4 and D6 were generally coarser (sandy gravel and gravelly sand) than those at stations T2, T3 and T4, which were predominantly muddy sand and sandy mud.

- The most dominant taxa recorded in the South Arran samples were Annelida (51.9 %) followed by Mollusca (22.5%) and Echinodermata (12.9 %). The most abundant species included *Amphiura filiformis*, *Owenia fusiformis* and *Abra alba*.

- D4 and D6 samples were generally classified as the biotope **SS.SSa.OSa.OfusAfil**. Three biotopes / biotope complexes were identified for the 'T' samples; T4 samples were all classified as **SS.SMu.CSaMu** while the remaining samples were designated as either **SS.SMu.CSaMu.AfilMysAnit** or **SS.SSa.CMuSa.AalbNuc**.

- The 15 samples from Loch Alsh were found to be predominantly mixed sediment (either gravelly muddy sand or muddy sandy gravel) with samples from stations LA1 and LA2 being coarser than at station LA4.

- The most dominant taxa recorded in the Loch Alsh samples were Annelida (51.6 %) followed by Mollusca (18.2 %). The third most abundant group was Desmoscolecidae, a family in the Nematoda phylum.

- The flame shell *Limaria hians* was recorded in all samples from stations LA1 and LA2; in total 62 *L. hians* were identified ranging in size from 0.3 to 4.2 cm maximum shell length. This size distribution suggests active recruitment in the area.

- In addition, the horse mussel *Modiolus modiolus* was identified in four of the five samples from stations LA1 and LA2.

- The biotope **SS.SMx.IMx.Lim** was assigned to all five of these samples. Conversely, no *L. hians* or *M. modiolus* were identified at LA4.

- The ocean quahog *Arctica islandica* (a Priority Marine Feature in Scottish waters and an OSPAR T&D species) was found in samples LA4_G01 and LA4_G02.

- Species diversity was found to be highest in one of the samples in which *L. hians* was present, although species evenness was high in all of the Loch Alsh samples.

- Samples from Southern Trench MPA proposal showed an increase in sediment size from west to east, with samples closest to shore classified as sandy mud or muddy sand, and those further offshore classed as gravelly sand.

- Numbers of individuals and diversity for the Southern Trench samples was fairly low, however, evenness was high.

- The most dominant taxa recorded in the Southern Trench samples were Annelida (51.6 %) followed by Echinoderms (26.9 %) and Crustacea (12.0 %). The most common species included *Prionospio steenstrupi, A. filiformis* and *A. chiajei*.

- The OSPAR T&D species *Sabellaria spinulosa* was recorded at station STTR04. Multiple small 'blocks' of *S. spinulosa* tubes were found in the sample, potentially indicating the presence of biogenic reefs at this station.

- Due to the low numbers of individuals in the Southern Trench samples, samples were designated at the biotope complex level, with offshore muds (**SS.SMu.OMu**) and offshore sands (**SS.SSa.OSa**) recorded.

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Thanks to Joanna Murray and the *Endeavour* crew at Cefas for collecting the Southern Trench samples.

1. INTRODUCTION

1.1 Background and objectives

On the 7 August 2014, 30 Nature Conservation Marine Protected Areas (NC MPAs) were designated in the seas around Scotland, 17 in territorial waters under the Marine (Scotland) Act 2010 and 13 in offshore waters under the Marine and Coastal Access Act 2009. Scottish Natural Heritage (SNH) submitted formal advice to the Scottish Government in July 2014 on the case for designating a further four NC MPAs in territorial waters. Scottish Ministers are currently considering this advice.

The primary aim of the 2015 surveys in these sites was to establish the condition / status of a range of the features present against which future change may be determined. Management measures for South Arran NC MPA and Loch Alsh NC MPA/SAC came into effect on 8 February 2016 (Marine Scotland, 2016).

The protected features of the South Arran NC MPA are burrowed mud, kelp and seaweed communities on sublittoral sediments, maerl beds, maerl or coarse shell gravel with burrowing sea cucumbers, ocean quahog aggregations, seagrass beds and shallow tide-swept coarse sands with burrowing bivalves. Lochs Duich, Long and Alsh NC MPA was designated for burrowed mud and flame shell (*Limaria hians*) beds. Biogenic habitats formed by horse mussels (*Modiolus modiolus*) are also protected as 'reefs' in the Lochs Duich, Long and Alsh Special Area of Conservation (SAC). The proposed protected features of the Southern Trench MPA are burrowed mud, minke whale, fronts and shelf deeps.

A survey was carried out by SNH between 14 - 30 September 2015 on board the MRV *Alba na Mara* with the aim of assessing the condition of seabed habitats within South Arran NC MPA and the Lochs Duich, Long and Alsh SAC / NC MPA. Sixty-nine infaunal grab samples and PSA samples were successfully collected during the survey. Seven additional grab and PSA samples were collected within the Southern Trench MPA proposal by Cefas on the RV *Endeavour* on 5 - 7 December 2015.

Seastar Survey Ltd. (Seastar) was contracted by SNH to undertake the infaunal analysis of the grab samples taken during this survey, including identifying all the faunal components within the grab samples, sediment particle size analysis (PSA). Biotopes were assigned to each sample and the presence of Priority Marine Features (PMFs) highlighted (Tyler-Walters *et al*. 2016). This report presents the results from these analyses, and a brief interpretation of the data.

1.2 Survey locations

The sampled areas are shown in Figure 1.1. The sampling locations in South Arran NC MPA and Lochs Duich, Long and Alsh NC MPA / SAC are displayed in Figures 1.2 and 1.3. The sampling locations surveyed by Cefas in the Southern Trench NC MPA proposal are illustrated in Figure 1.4. The full details of each sampling location are provided in Appendix I.

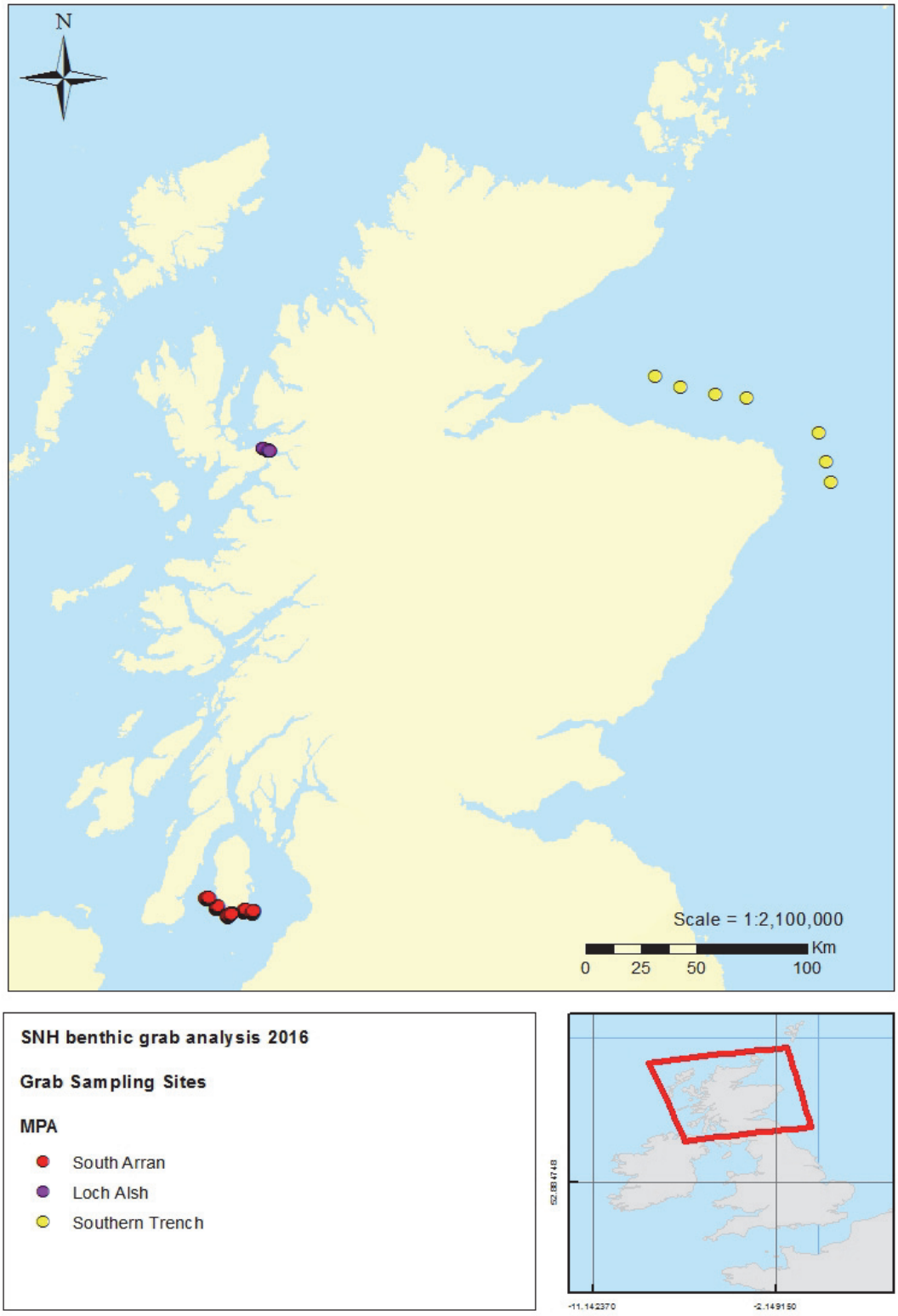

Figure 1.1: Location of the benthic grab sampling locations surveyed in 2015. South Arran and Loch Alsh locations surveyed in September 2015; Southern Trench surveyed by Cefas in December 2015.

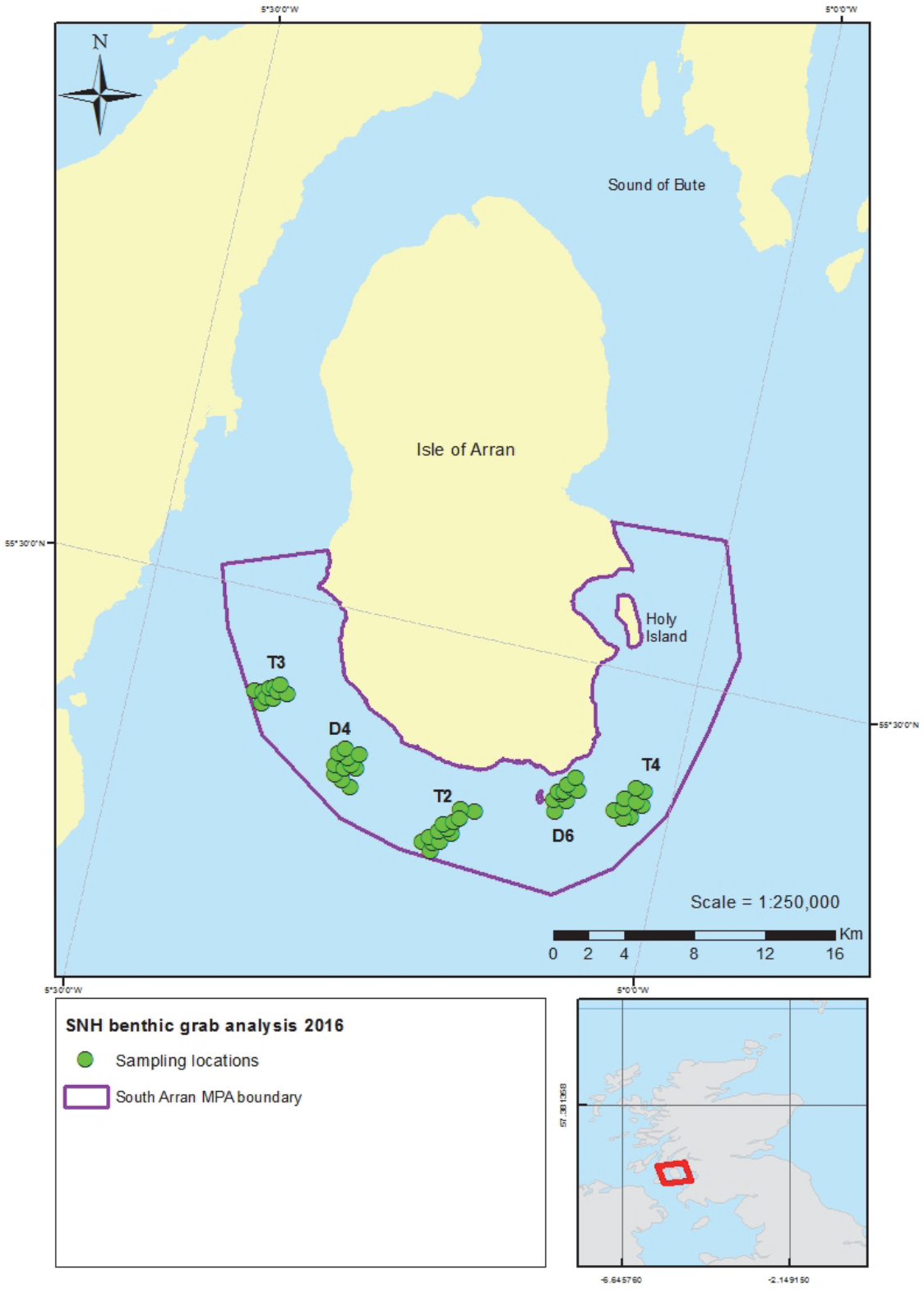

Figure 1.2: 2015 benthic grab sampling locations within South Arran NC MPA.

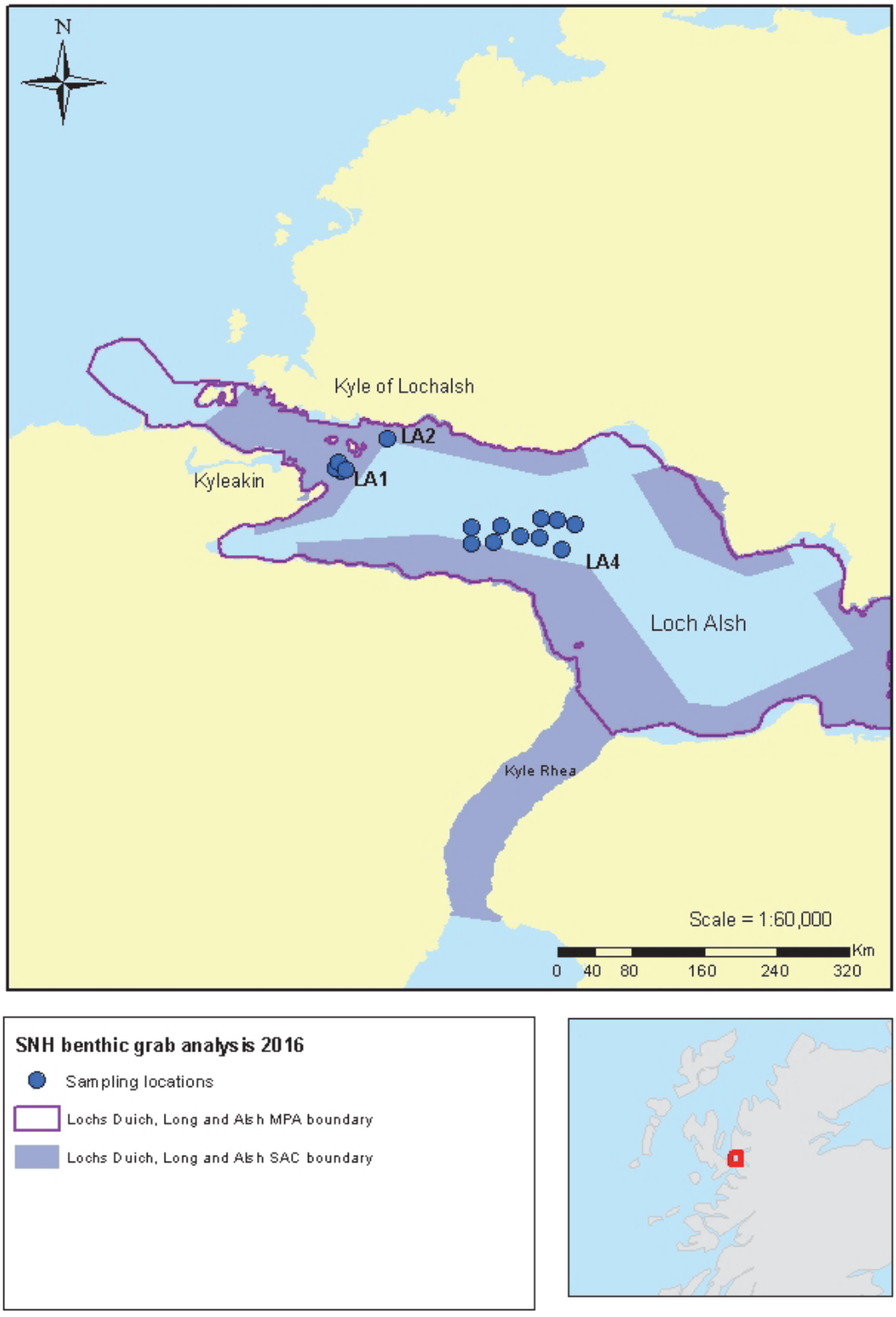

Figure 1.3: 2015 *benthic grab sampling locations in Loch Alsh (part of Lochs Duich, Long and Alsh SAC / NC MPA).*

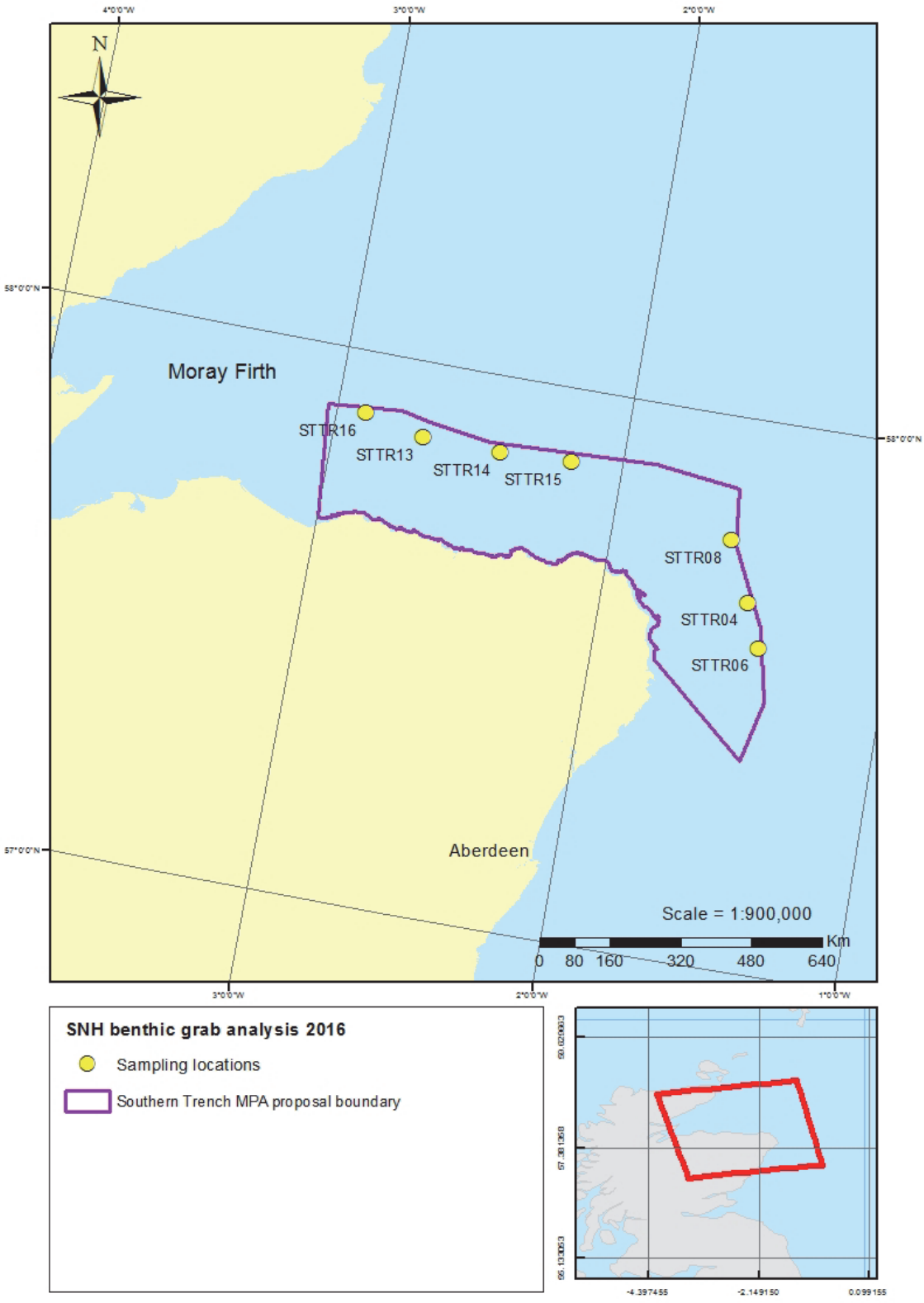

Figure 1.4: 2015 benthic grab sampling locations within Southern Trench MPA proposal.

2. METHODOLOGY

2.1 Infaunal sample collection

Infaunal samples were collected from South Arran MPA and Lochs Duich Long and Alsh MPA/SAC using a 0.1 m^2 Day grab on board the MRV *Alba na Mara*. Stations around Arran were haphazardly selected within five 'survey boxes' with similar depths to reduce variability within habitats. Depths ranged from 21 - 56 m (bcd) for most of the stations, although one box was located deeper at approximately 116 m.

Sampling locations in Loch Alsh were selected to target the *Limaria hians* bed (30 - 42 m bcd) and the burrowed mud habitat (78 - 115 m bcd), although some stations were relocated due to the presence of creels. At three additional stations (not shown on Figure 1.3), grab samples were taken solely to ascertain the presence or absence of *L. hians* and to ground-truth the video footage collected over the same area, so that the boundary of the flame shell bed could be defined more accurately. These samples were discarded after assessment and no further analysis was conducted. For all other grab samples, a small sub-sample was removed from the grab with a spoon for separate particle size analysis (PSA) and stored in a plastic bag before being frozen. The remainder of the grab sample was then passed through a 1 mm mesh sieve and the infaunal sieve residue retained and fixed with borax buffered formalin.

Samples from the Southern Trench MPA proposal were also collected using a Day grab and depths ranged from 74 - 93 m (bcd). Sampling stations were located throughout the MPA proposal to fill data gaps.

2.2 Sediment sample analysis

2.2.1 Particle Size Analysis

Sediment PSA was undertaken using both wet and dry sieving and laser diffraction. Wet and dry sieving was carried out at Seastar's laboratory using sieves at 0.5 phi intervals as per standard protocols.

For each sample, the sediment was dried at 100 - 105 °C. The dry weight of the sediment sample was determined using a calibrated balance, accurate to 5 d.p.. The sample was then wet sieved on a 63 µm mesh to remove fines and dried a second time. The remaining sample was re-weighed to establish the weight percentage of the <63 µm fraction before being dry sieved using nested sieves from -4 to 4 Phi at 0.5 phi intervals to yield weight percentage data for particle size fractions at 0.5 phi intervals.

A sub-sample of the original sediment sample was used for analysis by laser diffraction using a Mastersizer 2000 laser granulometer, which can analyse particles in the size range of 0.04 µm - 2000 µm. Sediment statistics were calculated using Gradistat v.8.0 (Blott and Pye, 2001).

The phi (ϕ) grain size measure is based on the Wentworth sediment class divisions but using $\log_2$ rather than $\log_{10}$ (see Leeder, 1982), thus $\phi = -\log_2$ mm. The Wentworth grain size (sieve mesh size) series of 8 mm, 4 mm, 2 mm, 1 mm, 0.5 mm, 0.25 mm and 0.125 mm are therefore calculated as 2^3, 2^2, 2^1, 2^0, 2^{-1}, 2^{-2} and 2^{-3}; giving ϕ units of -3, -2, -1, 0, 1, 2 and 3.

2.2.2 Macrofaunal processing and analysis

Prior to species identification each infaunal grab sample was washed through nested sieves (1 mm and 5 mm) in order to remove the preservative and partition the sample to aid sorting by separating larger fauna or particularly coarse sediment residue. Residues from sieves were then transferred to trays with water and the contents agitated. Immediately following

agitation, the water was poured off over a 1 mm sieve. This was repeated as necessary to remove the majority of fauna present. The 'light' fraction was then transferred to petri dishes which were sorted by experienced personnel using low magnification microscopes. The remaining residues were sorted by hand using hand magnifiers. The picked fauna were split by phyla and stored in glass vials in 80 % industrial methylated spirit (IMS) ready for identification.

The fauna were subsequently identified to the lowest practical taxonomic level with reference to WoRMS (WoRMS Editorial Board, 2016) for species nomenclature, and assigned an MCS alphanumeric biocode according to Howson and Picton (1997) where applicable. Epifauna was identified and recorded when clearly attached to substrata. As requested by SNH, the maximum shell size of any individuals of *Limaria hians* was also measured. A full list of taxa encountered and abundances per sample were recorded on a standard species / sample matrix.

The invertebrate specimens collected were separated by species and station, preserved in 80 % IMS and stored in glass sample vials with polyethylene closures to facilitate their incorporation into the collections of The National Museums of Scotland.

The macrofaunal sediment data have been provided as number of individuals 0.1 m^{-2}. The data analyses comprised both univariate and multivariate analyses all of which were calculated using Primer (Plymouth Routines in Multivariate Ecological Research) v 6 (Clarke and Warwick, 2001). The following standard parameters were calculated; total number of individuals (N), total number of species (S), species diversity where the Shannon-Wiener (H'), Pielou's (J), Margalef's (d) diversity and Simpson's Dominance indices (see e.g. Fowler and Cohen, 1992; Clarke and Warwick, 2001) were used with the natural log (log_e) being the chosen parameter in the case of the Shannon-Wiener diversity index.

The multivariate analysis was carried out using cluster analysis and ordination (non-metric multi-dimensional scaling, MDS). The Arran samples were generally in areas of coarse sediment (stations labelled 'D') or fine sediment (stations labelled 'T'); community analysis was therefore carried out separately for the two groups. For all samples, the data were square root transformed to down-weigh the importance of common types of macrofauna in relation to rarer types. The transformed data were then analysed using the Bray-Curtis similarity coefficient (using Primer v.6) followed by a cluster analysis where the sites were group averaged and the resultant dendrogram plotted. Non-metric multi-dimensional scaling (MDS) was then carried out to further assess the presence of any similarities between sites (Clarke and Warwick, 2001). The SIMPER routine in PRIMER was subsequently used to assess the difference in characteristic species / taxa in the sample clusters. This information was then used to inform assignment of a biotope to each sample.

2.2.3 Assignment of biotopes

A biotope was assigned to each grab station according to the Marine Biotope Classification for Britain and Ireland (Connor *et al*., 2004). The sediment type derived from the PSA results and the characteristic species identified from each sample were used to categorize the biotope for each sample. Where insufficient fauna (i.e. characterising fauna) were collected to adequately categorise a biotope, then the sediment type from the PSA was primarily used.

3. RESULTS

3.1 South Arran

3.1.1 PSA

The results from the PSA of the South Arran samples are given in Table 3.1 and displayed on a modified Folk triangle (Folk, 1954) in Figure 3.2. Full results of the PSA, including results of the laser diffraction analysis, are provided in Appendix II.

The samples from stations D4 and D6 were generally found to be composed of coarser sediment than at stations T2, T3 and T4 (Figure 3.2). Of the 54 samples collected from South Arran NC MPA, 43 had a low gravel component (0 - 5 % by weight), with nine samples composed of 8 - 25 % gravel and the remaining two samples with 34 and 56 % gravel. The samples composed of greater than 5 % gravel by weight were all from stations D4 and D6. Nine samples were composed of >90 % sand; again, all of these were from stations D4 and D6. Thirty-seven samples were found to be composed of at least 50 % sand, while the remaining samples had sand fractions of 18 - 42 %. Mud fractions varied from 1 - 80 %, with the muddiest samples (60 - 80 % mud) being found at stations T2, T3 and T4.

In total, seven samples were classified as sandy mud and 22 samples were classified as muddy sand. With two exceptions (D4_G01 and D4_G03) all of these fine sediment samples were sampled from stations T2, T3 and T4 (see Figure 3.2). Two samples were classified as sandy gravel (D4_G11 and D6_G04), nine samples were classified as gravelly sand and seven as sand. All of these coarse sediment samples were from stations D4 and D6 (see Figure 3.2). The remaining seven samples were classified as mixed sediment, specifically (slightly) gravelly muddy sand.

In general, the sediment samples were either very poorly or poorly sorted, however, samples classed as >90 % sand were found to be either moderately well or well sorted. Samples from shallower depth tended to have higher gravel fractions, although no linear trend was detected.

Table 3.1: Summary of the Particle Size Analysis (sediment weight by percentage) from grab samples collected from South Arran NC MPA in 2015. Mud, sand and gravel refer to all size fractions within each category.

Sample	% Gravel	% Sand	% Mud	Depth (m)	Classification (Folk system adapted by BSG)	Sorting Index
D4_G01	0.001	0.896	0.102	-39.8	Muddy Sand	Poorly Sorted
D4_G02	0.167	0.739	0.094	-35.8	Gravelly Muddy Sand	Very Poorly Sorted
D4_G03	0.001	0.883	0.116	-39.3	Muddy Sand	Poorly Sorted
D4_G04	0.005	0.972	0.023	-32.1	Sand	Moderately Well Sorted
D4_G05	0.002	0.977	0.021	-32.7	Sand	Well Sorted
D4_G06	0.003	0.952	0.046	-32.9	Sand	Moderately Well Sorted
D4_G07	0.005	0.961	0.034	-34.7	Sand	Moderately Well Sorted
D4_G08	0.083	0.889	0.028	-32.0	Gravelly Sand	Poorly Sorted
D4_G09	0.188	0.801	0.012	-30.9	Gravelly Sand	Poorly Sorted
D4_G10	0.240	0.721	0.039	-30.9	Gravelly Sand	Very Poorly Sorted

Sample	% Gravel	% Sand	% Mud	Depth (m)	Classification (Folk system adapted by BSG)	Sorting Index
D4_G11	0.555	0.413	0.032	-28.9	Sandy Gravel	Very Poorly Sorted
D4_G12	0.147	0.809	0.043	-28.5	Gravelly Sand	Poorly Sorted
D6_G01	0.099	0.813	0.088	-51.8	Gravelly Sand	Very Poorly Sorted
D6_G02	0.050	0.921	0.028	-37.1	Gravelly Sand	Poorly Sorted
D6_G03	0.001	0.978	0.021	-49.1	Sand	Well Sorted
D6_G04	0.346	0.636	0.018	-33.7	Sandy Gravel	Very Poorly Sorted
D6_G05	0.030	0.929	0.041	-35.8	Slightly Gravelly Sand	Poorly Sorted
D6_G06	0.089	0.877	0.034	-36.4	Gravelly Sand	Poorly Sorted
D6_G07	0.002	0.940	0.058	-45.5	Sand	Moderately Well Sorted
D6_G08	0.009	0.950	0.042	-49.0	Sand	Well Sorted
D6_G09	0.184	0.775	0.041	-34.9	Gravelly Sand	Very Poorly Sorted
D6_G10	0.192	0.667	0.141	-38.6	Gravelly Muddy Sand	Very Poorly Sorted
T2_G01	0.001	0.299	0.700	-61.7	Sandy Mud	Poorly Sorted
T2_G02	0.001	0.223	0.776	-61.7	Sandy Mud	Poorly Sorted
T2_G03	0.004	0.386	0.610	-61.9	Sandy Mud	Poorly Sorted
T2_G04	0.000	0.341	0.659	-62.0	Sandy Mud	Poorly Sorted
T2_G05	0.042	0.352	0.606	-62.8	Slightly Gravelly Sandy Mud	Very Poorly Sorted
T2_G06	0.001	0.567	0.433	-61.3	Muddy Sand	Poorly Sorted
T2_G07	0.002	0.702	0.296	-61.8	Muddy Sand	Poorly Sorted
T2_G08	0.016	0.669	0.315	-60.8	Slightly Gravelly Muddy Sand	Poorly Sorted
T2_G09	0.000	0.689	0.310	-62.0	Muddy Sand	Poorly Sorted
T2_G10	0.001	0.727	0.272	-60.6	Muddy Sand	Poorly Sorted
T2_G11	0.000	0.878	0.122	-52.9	Muddy Sand	Moderately Sorted
T2_G12	0.003	0.827	0.169	-53.7	Muddy Sand	Poorly Sorted
T2_G13	0.005	0.800	0.196	-56.8	Muddy Sand	Poorly Sorted
T3_G01	0.000	0.513	0.486	-53.5	Muddy Sand	Poorly Sorted
T3_G02	0.000	0.205	0.795	-52.1	Sandy Mud	Poorly Sorted
T3_G03	0.002	0.727	0.271	-59.6	Muddy Sand	Poorly Sorted
T3_G04	0.000	0.521	0.479	-59.5	Muddy Sand	Poorly Sorted
T3_G05	0.000	0.587	0.413	-59.5	Muddy Sand	Poorly Sorted
T3_G06	0.011	0.820	0.169	-52.0	Slightly Gravelly Muddy Sand	Poorly Sorted
T3_G07	0.008	0.808	0.183	-54.5	Muddy Sand	Poorly Sorted
T3_G08	0.013	0.826	0.162	-54.9	Slightly Gravelly Muddy Sand	Poorly Sorted
T3_G09	0.005	0.888	0.107	-47.5	Muddy Sand	Poorly Sorted
T3_G10	0.010	0.819	0.171	-52.0	Muddy Sand	Poorly Sorted
T4_G01	0.003	0.610	0.387	-121.7	Muddy Sand	Very Poorly Sorted
T4_G02	0.005	0.820	0.174	-118.5	Muddy Sand	Poorly Sorted
T4_G03	0.010	0.684	0.305	-123.9	Slightly Gravelly Muddy Sand	Poorly Sorted
T4_G04	0.018	0.753	0.229	-130.0	Slightly Gravelly Muddy Sand	Poorly Sorted
T4_G05	0.002	0.678	0.320	-113.4	Muddy Sand	Very Poorly Sorted
T4_G06	0.001	0.676	0.323	-122.2	Muddy Sand	Poorly Sorted
T4_G07	0.002	0.560	0.438	-134.3	Muddy Sand	Poorly Sorted

Sample	% Gravel	% Sand	% Mud	Depth (m)	Classification (Folk system adapted by BSG)	Sorting Index
T4_G08	0.009	0.184	0.807	-129.4	Sandy Mud	Poorly Sorted
T4_G09	0.007	0.734	0.259	-131.4	Muddy Sand	Poorly Sorted

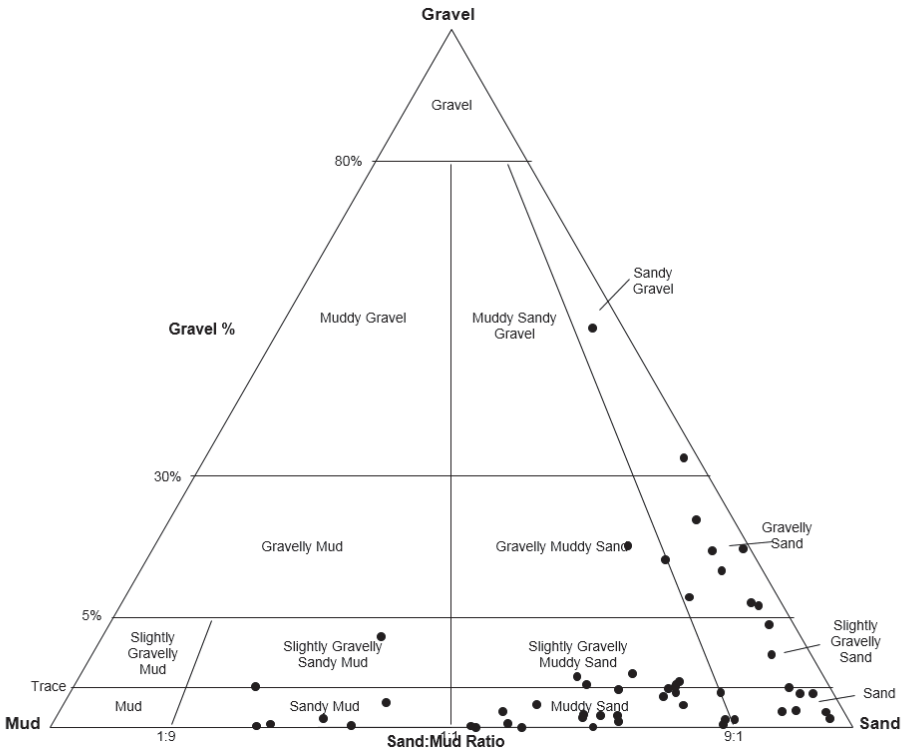

Figure 3.1: Modified Folk triangle showing classification of the South Arran sediment samples (c.f. Table 3.1).

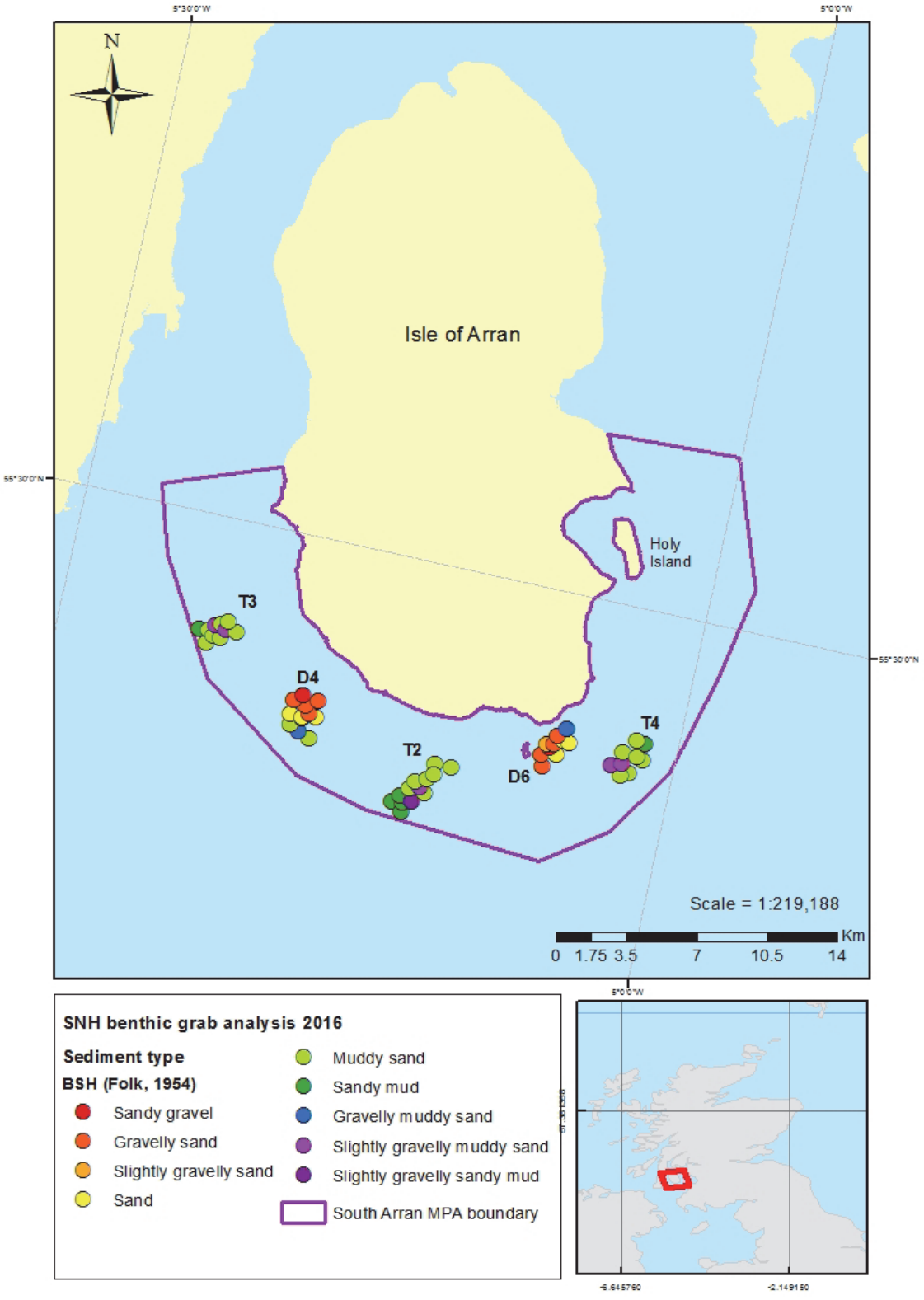

Figure 3.2: Broadscale habitat (BSH) types resulting from the particle size analysis of sediment samples collected from South Arran NC MPA in 2015.

3.1.2 Macrofaunal analysis

The macrofaunal analysis revealed a total of 4835 individuals and 261 taxa (see Appendix III) in the South Arran grab samples (excluding unquantifiable meiofauna and epi-fauna). Overall the macrofauna was dominated by Annelida (51.9 %) followed by Mollusca (22.5 %) and Echinoderms (12.9 %). The Crustacea contributed 7.5 %, Anthozoa 1.9 %, Nemertea 1.0 % and Phoronida 1.0 % with the remaining groups (Porifera, Turbellaria, Sipuncula, Ascidiacea and Pycnogonida) contributing the final 1.2 %.

Of particular note was the presence of *Arctica islandica*, a protected feature of the MPA and a Priority Marine Feature (PMF) as well as the relatively high abundance of *Dasybranchus* sp. within the Capitellidae family.

3.1.2.1 Macrofaunal abundance

The abundance of the identified macrofauna (excluding unquantifiable meiofauna and epifauna) are given in Appendix III with a summary of the most abundant taxa overall given in Table 3.2. Unlike the overall data, where Annelida were the most abundant taxa, the echinoderm *Amphiura filiformis* was found to be the most abundant taxon in the South Arran samples, though *Owenia fusiformis* and *Abra alba* were also relatively abundant.

Table 3.2: Total abundance of the main macrofaunal taxa identified in the samples collected from the South Arran NC MPA in 2015. MCS refers to species alphanumeric biocodes according to Howson and Picton (1997).

MCS A	MCS N	Taxon	Abundance (total in all South Arran samples)
ZB	154	*Amphiura filiformis*	452
P	1098	*Owenia fusiformis*	406
W	2059	*Abra alba*	278
P	1027	*Scalibregma inflatum*	151
P	796	*Spiophanes kroyeri*	114
W	1906	*Kurtiella bidentata*	111
P	834	*Chaetozone setosa*	92
D	764	*Edwardsia* sp.	88
P	501	*Nephtys incisa*	87
P	-	*Lumbrineris cingulata*	84
P	913	*Dasybranchus*	74
W	1577	*Ennucula tenuis*	69
W	2058	*Abra* sp.	69
S	552	*Photis longicaudata*	65
P	502	*Nephtys kersivalensis*	64
P	1093	*Galathowenia oculata*	64
P	569	Lumbrineridae	63
W	1569	*Nucula nitidosa*	63
P	920	*Notomastus* sp.	61
ZB	148	Amphiuridae	59
W	2104	*Timoclea ovata*	58

3.1.2.2 Diversity

The results for the species diversity analyses are given in Table 3.3. The total number of individuals at each station range from 12 to 297 individuals per sample with the total number of taxa ranging from 5 to 66 taxa per sample indicating that there some differences between the samples, and potentially between the stations within the South Arran MPA.

The species diversity (Shannon-Wiener diversity index) ranged from 1.35 to 3.77 with the highest values overall found at stations from areas within D rather than T. However, the pattern was not apparent across all stations and the differences between D and T were relatively small. The species richness results largely followed the pattern of the Shannon-Wiener index results.

The equitability (J) results suggest an equal distribution between species at most of the South Arran stations. Most values are above 0.85 with the lowest equitability found at station D6_G05, indicating a relatively higher dominance by a smaller number of different species. There was no apparent difference in evenness between areas D and T.

Table 3.3: Total number of individuals (N), number of species (S), Margalef's species richness (d), Pielou's equitability index (J), Shannon-Wiener diversity index (H') and Simpson's Dominance Index calculated for the infaunal samples collected from the South Arran NC MPA in 2015.

Sample	S	N	d	J'	H' (loge)	Simpson's
D4_G01	42	121	8.55	0.75	2.80	0.85
D4_G02	59	127	11.97	0.91	3.73	0.97
D4_G03	49	128	9.89	0.78	3.02	0.87
D4_G04	40	58	9.61	0.95	3.52	0.98
D4_G05	27	39	7.10	0.94	3.11	0.97
D4_G06	31	82	6.81	0.86	2.96	0.93
D4_G07	29	75	6.49	0.89	2.99	0.94
D4_G08	50	108	10.47	0.91	3.56	0.97
D4_G09	31	85	6.75	0.92	3.15	0.96
D4_G10	48	105	10.10	0.91	3.51	0.97
D4_G11	53	114	10.98	0.92	3.67	0.97
D4_G12	52	117	10.71	0.91	3.59	0.97
D6_G01	63	191	11.80	0.85	3.54	0.95
D6_G02	42	120	8.56	0.81	3.01	0.91
D6_G03	27	42	6.96	0.94	3.11	0.97
D6_G04	52	125	10.56	0.90	3.55	0.96
D6_G05	59	217	10.78	0.71	2.90	0.83
D6_G06	66	215	12.10	0.90	3.77	0.97
D6_G07	40	102	8.43	0.89	3.29	0.96
D6_G08	29	65	6.71	0.82	2.75	0.88
D6_G09	54	203	9.98	0.85	3.40	0.94
D6_G10	54	164	10.39	0.86	3.43	0.94
T2_G01	5	12	1.61	0.84	1.35	0.76
T2_G02	9	16	2.89	0.88	1.92	0.87
T2_G03	5	13	1.56	0.88	1.42	0.77
T2_G04	8	16	2.53	0.91	1.89	0.88

Sample	S	N	d	J'	H' (loge)	Simpson's
T2_G05	12	17	3.88	0.98	2.43	0.96
T2_G06	13	29	3.56	0.89	2.28	0.90
T2_G07	20	55	4.74	0.82	2.45	0.88
T2_G08	10	33	2.57	0.85	1.96	0.85
T2_G09	33	91	7.09	0.90	3.13	0.95
T2_G10	43	123	8.73	0.80	3.02	0.90
T2_G11	59	297	10.19	0.75	3.06	0.89
T2_G12	51	161	9.84	0.71	2.81	0.82
T2_G13	45	126	9.10	0.88	3.34	0.94
T3_G01	20	55	4.74	0.88	2.64	0.92
T3_G02	7	12	2.42	0.87	1.70	0.83
T3_G03	19	42	4.82	0.80	2.36	0.86
T3_G04	8	30	2.06	0.81	1.69	0.80
T3_G05	19	30	5.29	0.94	2.76	0.95
T3_G06	45	113	9.31	0.89	3.38	0.95
T3_G07	41	102	8.65	0.77	2.87	0.86
T3_G08	32	73	7.23	0.90	3.11	0.95
T3_G09	37	128	7.42	0.75	2.71	0.85
T3_G10	32	66	7.40	0.85	2.95	0.91
T4_G01	19	55	4.49	0.82	2.40	0.86
T4_G02	29	80	6.39	0.90	3.04	0.95
T4_G03	30	102	6.27	0.87	2.96	0.94
T4_G04	27	109	5.54	0.82	2.71	0.91
T4_G05	21	57	4.95	0.86	2.61	0.91
T4_G06	22	65	5.03	0.84	2.58	0.91
T4_G07	17	39	4.37	0.92	2.62	0.94
T4_G08	13	19	4.08	0.96	2.45	0.95
T4_G09	19	53	4.53	0.83	2.44	0.87

3.1.2.3 Macrofaunal composition

The results from the cluster analysis of all the macrobenthic invertebrate samples collected from South Arran NC MPA are shown in Figure 3.3. It was found that, with the exception of samples T2_G11 and T3_G09, there was a split between the ‘D’ and ‘T’ stations with the two groups exhibiting approximately 85 % dissimilarity. Due both to this and to the difference in sediment type between the two groups (with ‘T’ stations overall more coarse than ‘D’ stations) the two groups were examined in more depth separately.

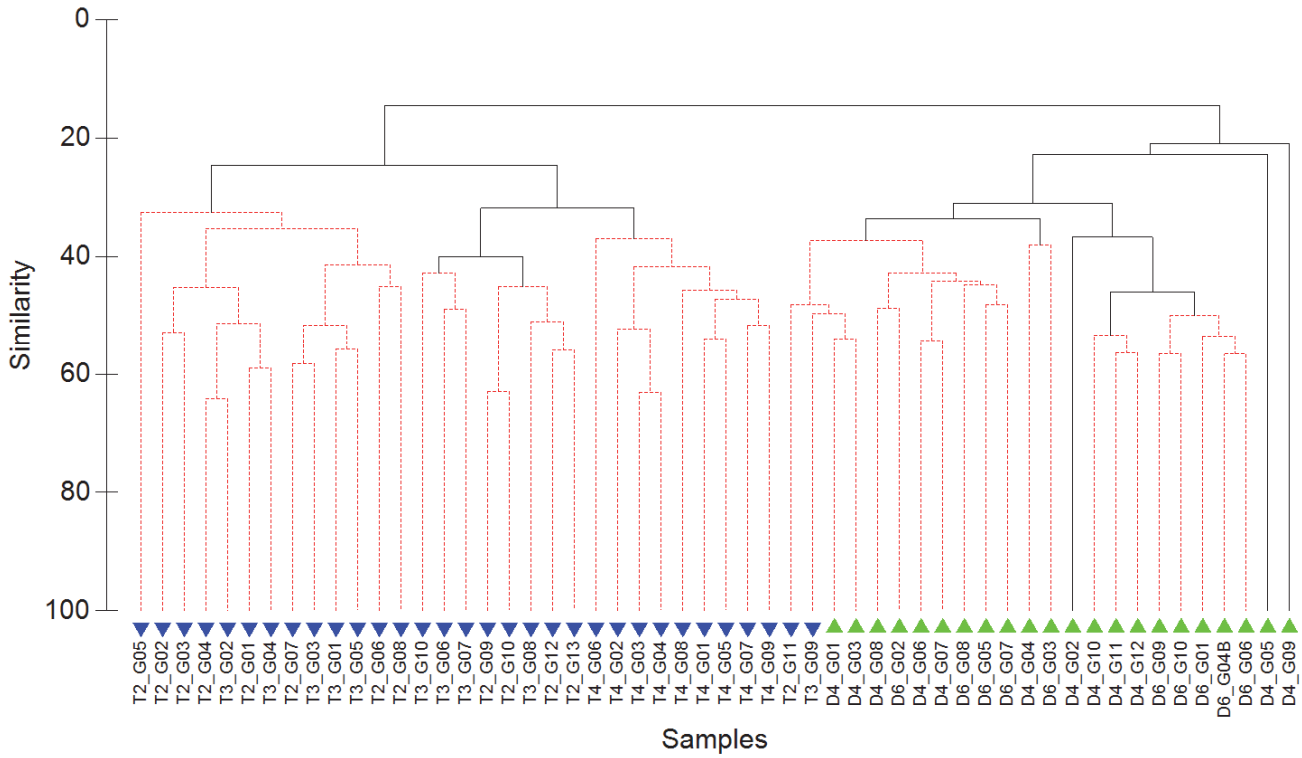

Figure 3.3: Cluster analysis of the 2015 South Arran NC MPA macrobenthic invertebrate sample data. Symbols indicate station code; T (blue) and D (green). Red dotted lines indicate significant results of SIMPROF analysis at 5 %.

The results of the cluster and ordination analyses for stations D4 and D6 are given in Figures 3.4 and 3.5. SIMPROF analysis indicated the presence of three clusters, together with three 'outliers', however, subsequent ordination analysis and SIMPER analysis (see Table 3.4), as well as expert interpretation of the raw data, suggested that these clusters were separated based primarily on relative abundances of the dominant taxa, rather than differences in the species present. The relatively high degree of similarity between all but two of the samples (approximately 30 %) supports this analysis.

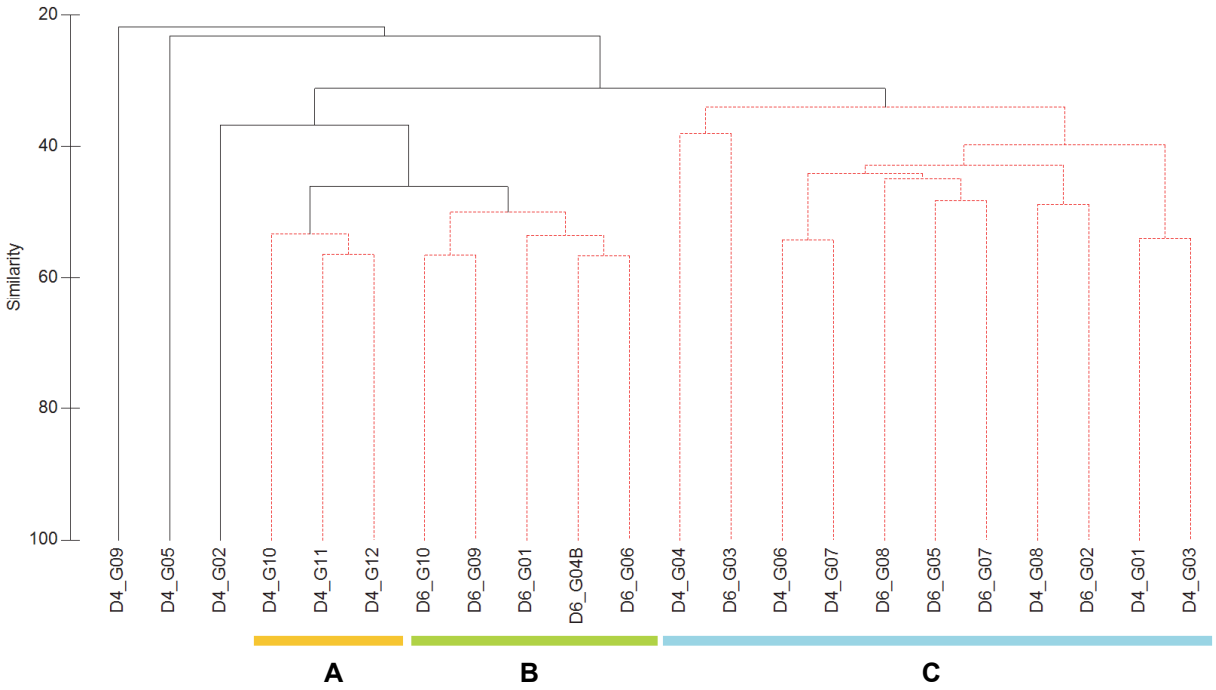

Figure 3.4: Cluster analysis of the macrobenthic invertebrate sample data from stations D4 and D6 collected from South Arran NC MPA in 2015. Red dotted lines indicate significant results of SIMPROF analysis at 5 %.

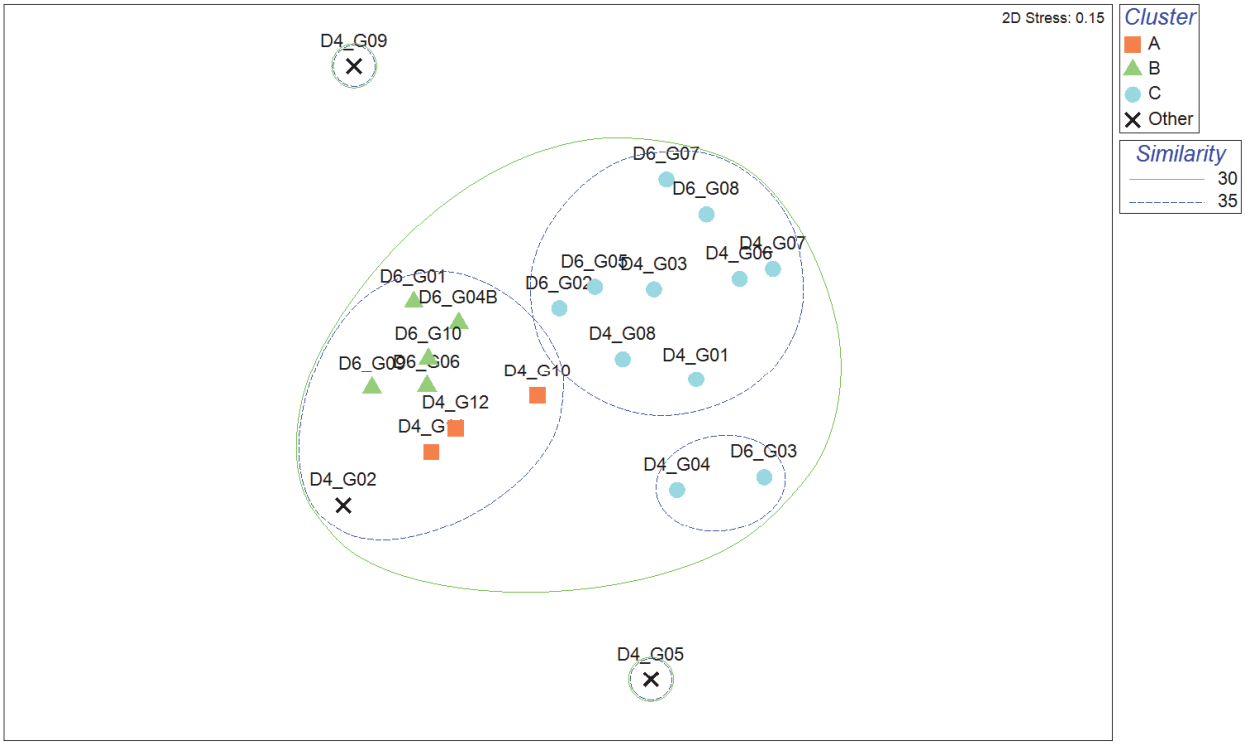

Figure 3.5: Ordination analysis of the macrobenthic invertebrate sample data from stations D4 and D6 collected from South Arran NC MPA in 2015.

Table 3.4: SIMPER analysis of the macrobenthic invertebrate sample data from stations D4 and D6 collected in South Arran NC MPA in 2015.

Cluster	Species	Av.Abund	Av.Sim	Contrib%
	Owenia fusiformis	3.43	4.37	8.05
	Ampelisca sp.	2.43	3.08	5.67
	Lumbrineris cingulata	2.34	2.9	5.34
	Edwardsia sp.	2.08	2.86	5.27
	Photis longicaudata	2.14	2.72	5.01
A	Trichobranchidae	1.99	2.61	4.8
	Leptochiton asellus	1.63	2.18	4.01
	Lumbrineridae	1.61	2.03	3.73
	Amphiura filiformis	2.14	2.03	3.73
	Nereimyra punctata	1.9	2	3.69
	Atylus vedlomensis	1.49	1.79	3.29
	Owenia fusiformis	5.05	4.93	9.47
	Amphiura filiformis	2.9	2.63	5.07
	Ampelisca sp.	2.62	2.26	4.34
	Lumbrineris cingulata	2.18	2.25	4.33
	Lumbrineris sp.	1.98	1.98	3.81
B	Lumbrineridae	1.98	1.97	3.79
	Photis longicaudata	2.4	1.76	3.38
	Amphiuridae	2.03	1.7	3.27
	Glycera lapidum	1.79	1.64	3.16
	Sosane sulcata	1.93	1.64	3.15
	Edwardsia sp.	1.84	1.57	3.01
	Owenia fusiformis	3.82	4.85	12.14
	Amphiura filiformis	2.9	2.71	6.8
	Ampelisca sp.	1.66	2.48	6.21
	Nephtys kersivalensis	1.38	1.92	4.81
	Spiophanes kroyeri	1.36	1.68	4.2
C	*Edwardsia* sp.	1.45	1.6	4
	Abra alba	1.28	1.48	3.7
	Galathowenia oculata	1.49	1.44	3.62
	Spisula solida	1.35	1.43	3.58
	Diplocirrus glaucus	0.93	1.31	3.28
	Chaetozone setosa	1.06	1.23	3.09

The results of the cluster and ordination analyses for stations T2, T3 and T4 are given in Figures 3.6 and 3.7. SIMPROF analysis indicated the presence of five clusters, with three of those (B, C and D) closely related at approximately 40 % similarity.

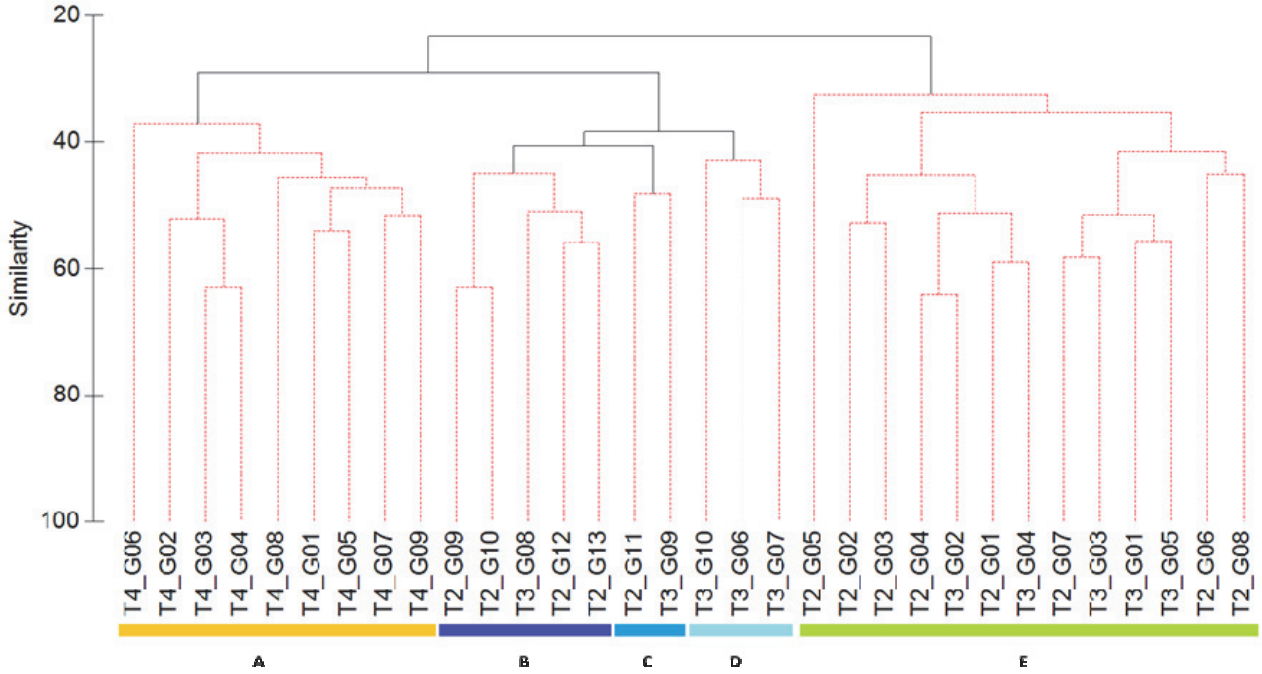

Figure 3.6: Cluster analysis of the macrobenthic invertebrate sample data from stations T2, T3 and T4 collected from South Arran NC MPA in 2015. Red dotted lines indicate significant results of SIMPROF analysis at 5 %.

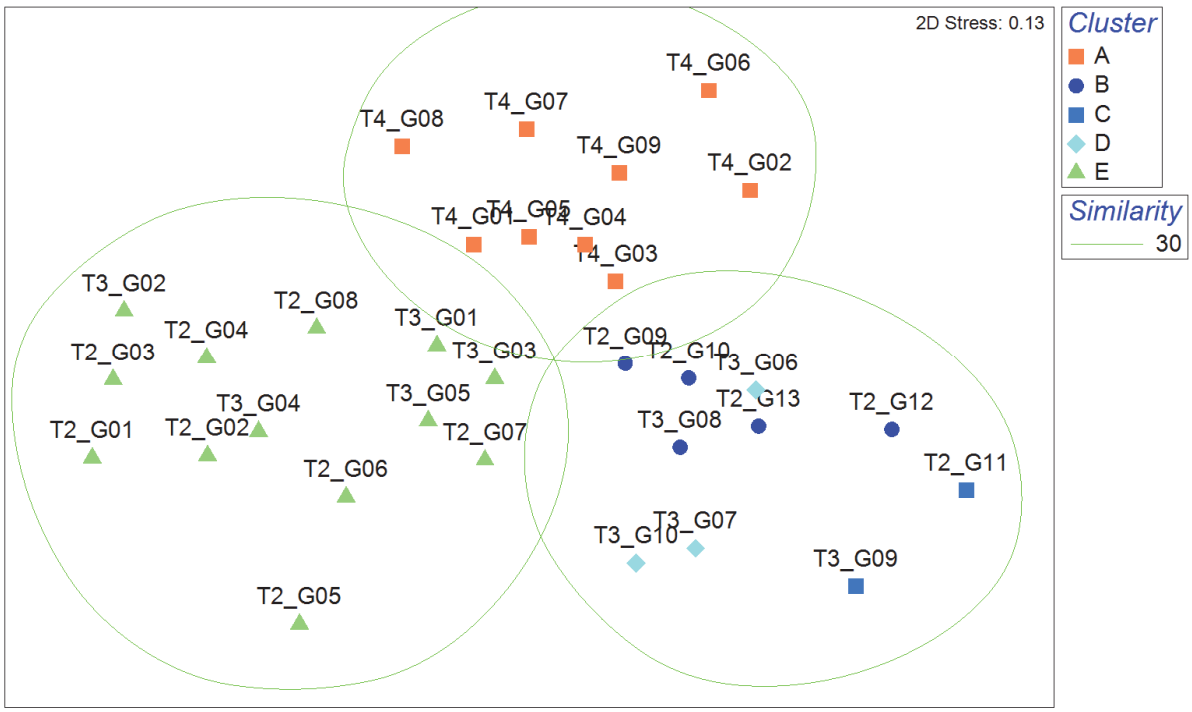

Figure 3.7: Ordination analysis of the macrobenthic invertebrate sample data from stations T2, T3 and T4 collected from South Arran NC MPA in 2015.

SIMPER analysis of the 'T' samples was performed on the five identified clusters in order to identify faunal trends in each group and to determine whether clusters B, C and D were similar enough to be grouped together. The results of this analysis are given in Table 3.5.

Table 3.5: SIMPER analysis of the macrobenthic invertebrate sample data from stations T2, T3 and T4 collected in South Arran NC MPA in 2015.

Cluster	Species	Av.Abund	Av.Sim	Contrib%
A	*Abra alba*	2.54	5.57	12.79
	Spiophanes kroyeri	1.72	3.63	8.34
	Dasybranchus sp.	1.77	3	6.89
	Mediomastus fragilis	1.47	2.94	6.74
	Chaetozone setosa	1.88	2.89	6.64
	Scalibregma inflatum	1.79	2.82	6.48
	Ennucula tenuis	1.76	2.75	6.31
	Glycera unicornis	1.14	2.73	6.27
	Calocaris macandreae	1.05	2.6	5.96
	Notomastus sp.	1.36	2.53	5.82
B	*Kurtiella bidentata*	2.69	3.69	7.51
	Abra alba	2.43	3.36	6.83
	Amphiura filiformis	3.76	3.29	6.69
	Diplocirrus glaucus	1.77	2.71	5.51
	Abra sp.	1.63	2.31	4.7
	Praxillella affinis	1.52	2.26	4.6
	Dasybranchus sp.	1.62	2.25	4.58
	Spiophanes kroyeri	1.38	1.93	3.93
	Mediomastus fragilis	1.41	1.92	3.9
	Nemertea	1.23	1.77	3.59
	Amphiura chiajei	1.08	1.7	3.46
	Chaetozone setosa	1.47	1.55	3.15
C	*Amphiura filiformis*	7.96	8.53	17.71
	Amphiuridae	3.07	3.48	7.23
	Kurtiella bidentata	4.64	3.26	6.76
	Abra alba	2.64	3.02	6.26
	Diplocirrus glaucus	1.87	2.13	4.43
	Owenia fusiformis	2.19	2.13	4.43
	Spisula solida	2.19	2.13	4.43
	Nephtys kersivalensis	1.83	1.74	3.62
	Spiophanes kroyeri	2.12	1.74	3.62
	Galathowenia oculata	1.41	1.74	3.62
	Trichobranchidae	1.71	1.74	3.62
	Chaetoderma nitidulum	1.93	1.74	3.62
D	*Abra alba*	5.01	8.33	18.57
	Nucula nitidosa	1.97	3.26	7.27
	Spiophanes kroyeri	1.99	2.84	6.33
	Abra sp.	1.61	2.66	5.93
	Nemertea	1.58	2.29	5.11
	Dasybranchus sp.	1.47	2.14	4.78
	Lumbrineris cingulata	1	1.88	4.2

Cluster	Species	Av.Abund	Av.Sim	Contrib%
	Praxillella affinis	1	1.88	4.2
	Trichobranchidae	1.24	1.88	4.2
	Nephtys kersivalensis	1.32	1.2	2.68
	Polydora ciliata	1.14	0.89	1.98
	Owenia fusiformis	1.05	0.89	1.98
	Amphiura filiformis	0.94	0.89	1.98
	Nephtys incisa	2.13	12.01	30.17
	Abra alba	1.97	9.09	22.84
	Abra sp.	1.47	5.64	14.17
	Notomastus sp.	0.84	2.73	6.87
E	*Scalibregma inflatum*	1.27	2.28	5.74
	Nucula nitidosa	0.83	1.93	4.85
	Polycirrinae	0.38	1.02	2.56
	Chaetozone zetlandica	0.42	0.82	2.06
	Glycera unicornis	0.38	0.71	1.79

3.1.3 Designation of biotopes

The biotopes assigned to each sample, together with a summary of the biotic and abiotic features, is given in Appendix IV.

With the exception of samples D4_G05 and D4_G09, all samples at stations D4 and D6 were assigned the biotope **SS.SSa.OSa.OfusAfil** (*Owenia fusiformis* and *Amphiura filiformis* in offshore circalittoral sand or muddy sand) due both to the sediment types observed (sand, gravelly sand and muddy sand) and to the dominance of *O. fusiformis* and the brittlestar *A. filiformis* in all of the samples. While the dominance of *A. filiformis* may have also suggested that the circalittoral biotope **SS.SMu.CSaMu.AfilMysAnit** (*Amphiura filiformis*, *Mysella bidentata* and *Abra nitida* in circalittoral sandy mud) was a possible good fit for the samples, the other characteristic species, specifically *Abra nitida* and *Kurtiella bidentata*, were only observed in low numbers (<5 per sample) in comparatively few samples; *K. bidentata* was only present in six of the samples, while *A. nitida* was identified in five. Therefore, despite the fact that .OfusAfil is an 'offshore' biotope, the dominance of *O. fusiformis* compared to the other taxa present, combined with the coarser sediment type (sands and gravels rather than the sandy mud of .AfilMysAnit) was deemed sufficient to justify the assignment of this biotope as a best fit for these samples.

The remaining, 'outlier' samples were classified as **SS.SSa** (sublittoral sands and muddy sands) due to the lack of any dominant fauna.

Samples at station T4 were taken at greater depths than those at stations T2 and T3 (>100 m) and were all found to be significantly different from the other samples, being assigned as a separate cluster (A) in the cluster and ordination analyses. These samples were characterised by muddy sand, however, the fauna present were more representative of muddy biotopes; the biotope complex **SS.SMu.CSaMu** (circalittoral sandy mud) was therefore assigned.

Samples in clusters B and C, which in the analysis were found to be approximately 40 % similar, were found to be characterised by similar fauna, with the bivalves *Kurtiella bidentata* and *Abra alba* and the brittlestar *A. filiformis* contributing most to similarity within both groups. The biotope **SS.SMu.CSaMu.AfilMysAnit** (*Amphiura filiformis*, *Mysella bidentata* and *Abra nitida* in circalittoral sandy mud) was therefore assigned to samples within both

clusters. The likely reason for the separation of these clusters by the SIMPROF analysis is the relative abundances of the dominant fauna, with average abundances of *A. filiformis* and *K. bidentata* among the main contributors to dissimilarity between the groups.

Samples within cluster D were typified by the presence of the bivalves *A. alba* and *Nucula nitidosa* and were therefore assigned the biotope **SS.SSa.CMuSa.AalbNuc** (*Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment). While the samples in cluster D were found to be ~40 % similar to those in clusters B and C, the relative importance of the characteristic species is sufficient to justify assignment of different biotopes. The biotope classification notes that "the biotope .AalbNuc may grade into .AfilMysAnit in muddier sediments"; indeed, the results of the sediment analysis indicate that the samples in cluster D were more mixed (i.e. with a higher gravel fraction) than those in clusters B and C, which were largely classified as muddy sand.

While the taxa present in samples in cluster E were broadly similar to those observed in other samples, in particular those in cluster D (e.g. *A. alba*, *N. nitidosa*, *Nephtys* spp.), the number of both species and individuals present were far lower. For this reason, these samples were assigned as **SS.SSa.CMuSa(.AalbNuc)** – a tentative assignment due to the relatively low abundance of the characterising species.

The distribution of the biotopes assigned to the South Arran NC MPA samples is shown in Figure 3.8.

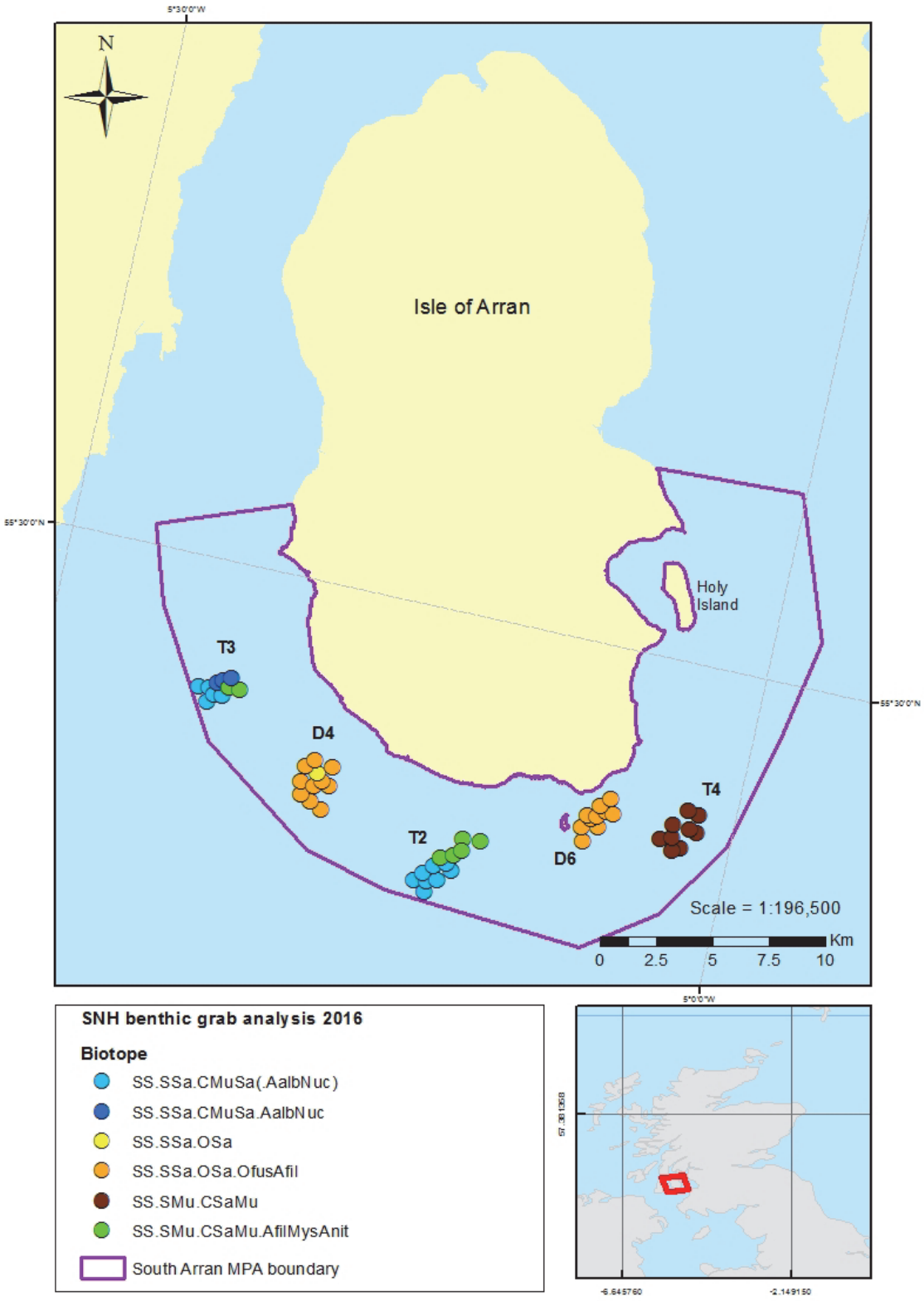

Figure 3.8: Biotopes (Connor et al.*, 2004) assigned to grab samples collected from South Arran NC MPA in 2015.*

3.2 Loch Alsh

3.2.1 PSA

The results from the PSA of the Loch Alsh samples are given in Table 3.6 and displayed on a modified Folk triangle (Folk, 1954) in Figure 3.9. Full results of the PSA, including results of the laser diffraction analysis, are provided in Appendix II.

Samples from stations LA1 and LA2 were found to be composed of coarse, slightly muddy mixed sediments. These samples had either moderate (5 - 30 % by weight) or high (40 - 50 %) proportions of gravel, and mud fractions were highly variable (9 - 35 %). Samples at stations LA4 were generally composed primarily of sand with minor (< 5 %) fractions of gravel, although three of the LA4 samples were found to possess high proportions of mud (~55 - 65 %). All of the sediment samples were either very poorly or poorly sorted. Samples from shallower depth tended to have higher gravel fractions, although no linear trend was detected.

The distribution of sediment types assigned to the Loch Alsh samples is shown in Figure 3.10. Samples from LA1 and LA2 were classified as either muddy sandy gravel or gravelly muddy sand, while six of the nine LA4 samples were found to be composed of finer sediment, either muddy sand or sandy mud. The remaining samples, including LA4_G07, which had a higher gravel fraction (6.2 %) than the other LA4 samples, were classified as (slightly) gravelly muddy sand.

Table 3.6: Summary of the Particle Size Analysis (sediment weight by percentage) from grab samples collected from Loch Alsh (part of Lochs Duich, Long and Alsh SAC / NC MPA) in 2015. Mud, sand and gravel refer to all size fractions within each category.

Sample	% Gravel	% Sand	% Mud	Depth (m)	Classification (Folk system adapted by BSG)	Sorting Index
LA1_G01	0.241	0.587	0.173	-39.8	Gravelly Muddy Sand	Very Poorly Sorted
LA1_G02	0.416	0.405	0.179	-41.8	Muddy Sandy Gravel	Very Poorly Sorted
LA1_G03	0.479	0.423	0.098	-42.5	Muddy Sandy Gravel	Very Poorly Sorted
LA1_G04	0.405	0.483	0.111	-52.6	Muddy Sandy Gravel	Very Poorly Sorted
LA2_G03	0.130	0.780	0.089	-41.9	Gravelly Muddy Sand	Poorly Sorted
LA4_G01	0.013	0.756	0.231	-122.8	Slightly Gravelly Muddy Sand	Poorly Sorted
LA4_G02	0.015	0.727	0.258	-125.4	Slightly Gravelly Muddy Sand	Poorly Sorted
LA4_G03	0.015	0.592	0.393	-118.0	Slightly Gravelly Muddy Sand	Very Poorly Sorted
LA4_G04	0.005	0.358	0.638	-110.8	Sandy Mud	Very Poorly Sorted
LA4_G05	0.041	0.396	0.563	-106.7	Slightly Gravelly Sandy Mud	Very Poorly Sorted
LA4_G06	0.008	0.448	0.544	-101.6	Sandy Mud	Very Poorly Sorted
LA4_G07	0.062	0.590	0.348	-89.1	Gravelly Muddy Sand	Very Poorly Sorted
LA4_G08	0.003	0.547	0.451	-91.8	Muddy Sand	Very Poorly Sorted
LA4_G09	0.002	0.538	0.460	-87.0	Muddy Sand	Very Poorly Sorted
LA4_G10	0.009	0.586	0.405	-87.2	Muddy Sand	Very Poorly Sorted

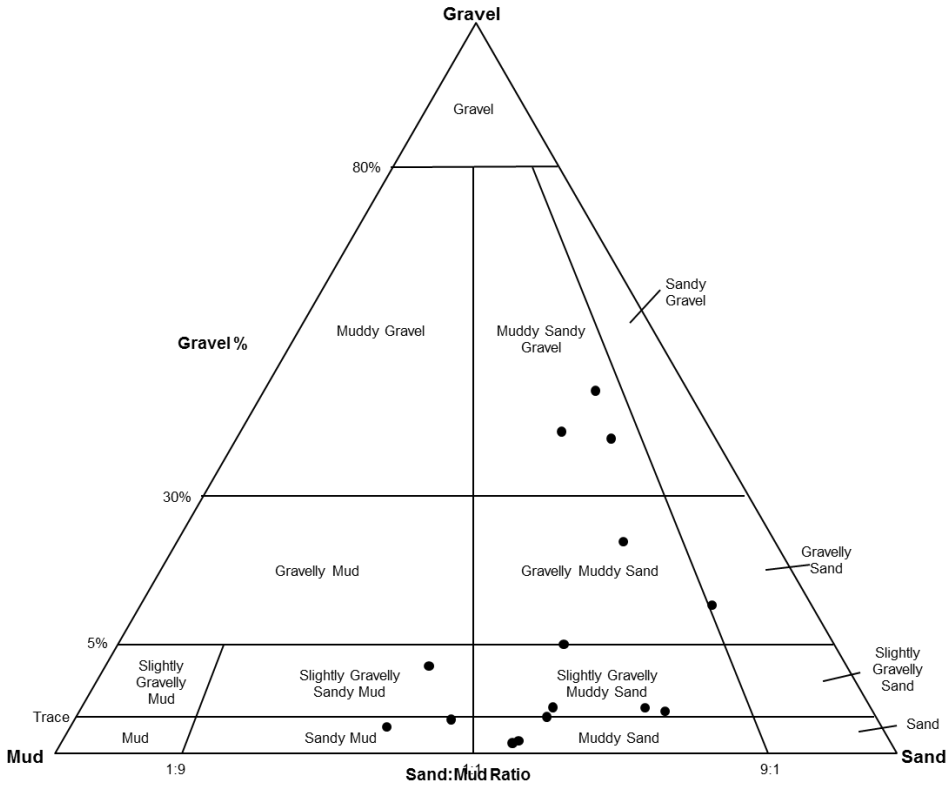

Figure 3.9: Modified Folk triangle showing classification of the Loch Alsh sediment samples (c.f. Table 3.6).

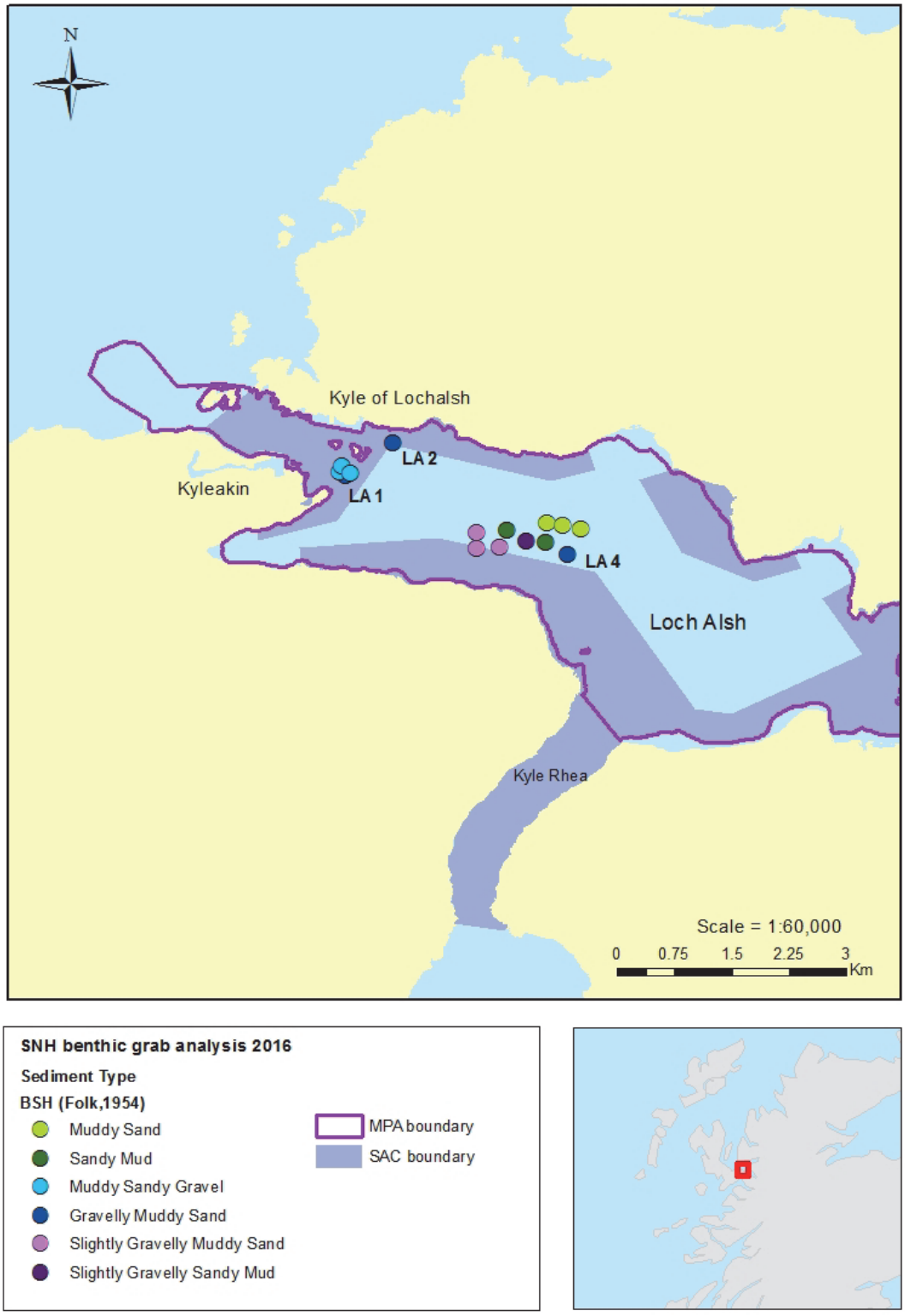

Figure 3.10: Broadscale habitat (BSH) types resulting from the particle size analysis of sediment samples collected from Loch Alsh (part of Lochs Duich, Long and Alsh SAC / NC MPA) in 2015.

3.2.2 Macrofaunal analysis

The macrofaunal analysis revealed a total of 3664 individuals and 208 taxa (see Appendix V) in the Loch Alsh grab samples (excluding unquantifiable meiofauna and epifauna). Overall the macrofauna was dominated by Annelida (51.6 %) followed by Mollusca (18.2 %). The third most abundant group was Desmoscolecidae, a family in the Nematoda Phylum. The Echinoderms contributed 7.6 % and the Crustacea 5.9 % of the macrofauna, followed by Nemertea (1.9 %) and Sipuncula (1.0 %). The remaining groups (Porifera, Turbellaria, Anthozoa and Echiura) contributed to the remaining 0.2 %.

Of particular note was the presence of *Limaria hians*, *Modiolus modiolus* (both habitat forming species) and *Arctica islandica* (a PMF), but also the large abundance of individuals in the Nematode family Desmoscolecidae at some of the stations.

3.2.2.1 Macrofaunal abundance

The abundance of the identified macrofauna (excluding unquantifiable meiofauna and epi-fauna) are given in Appendix V with a summary of the most abundant taxa overall given in Table 3.7. Unlike the overall data, where Annelida were the most abundant, the Desmoscolecidae was the most abundant taxon in the samples from Loch Alsh but the spionids *Prionospio fallax* and *P. cirrifera* as well as the hesionid *Nereimyra punctata* were also relatively abundant. However, of most significant note is the presence of *L. hians* and *M. modiolus* at relatively high abundances. Thirteen individuals of *L. hians* were recorded at station LA1_G01, five individuals at LA1_G02, 11 individuals at LA1_G03, seven individuals at LA1_G04 and 26 individuals at LA2_G03 with maximum shell sizes ranging from 0.3 to 4.2 cm (detailed data given in Appendix IX).

Table 3.7: Total abundance of the main macrofaunal taxa identified in the samples collected from Loch Alsh (part of Lochs Duich, Long and Alsh SAC / NC MPA) in 2015. Species of interest are highlighted in bold. MCS refers to species alphanumeric biocodes according to Howson and Picton (1997).

MCS A	MCS N	Taxon	Abundance (total in all Loch Alsh samples)
HD	480	Desmoscolecidae	516
P	765	*Prionospio fallax*	223
P	747	*Prionospio cirrifera*	204
P	310	*Nereimyra punctata*	149
P	91	*Pholoe baltica*	109
ZB	124	*Ophiothrix fragilis*	105
P	919	*Mediomastus fragilis*	95
P	763	*Prionospio* sp.	82
W	2059	*Abra alba*	82
P	305	*Psamathe fusca*	69
P	878	*Diplocirrus glaucus*	64
W	1741	***Limaria hians***	62
ZB	152	*Amphiura chiajei*	56
P	796	*Spiophanes kroyeri*	49
W	1708	*Modiolula phaseolina*	48
P	92	*Pholoe inornata*	47
S	519	*Othomaera othonis*	47
W	1570	*Nucula nucleus*	47

MCS A	MCS N	Taxon	Abundance (total in all Loch Alsh samples)
P	834	*Chaetozone setosa*	46
W	53	*Leptochiton asellus*	46
W	2061	*Abra nitida*	43
W	270	*Turritella communis*	42
G	1	Nemertea	40
P	971	*Praxillella affinis*	38
P	1027	*Scalibregma inflatum*	38
W	1702	***Modiolus modiolus***	38

3.2.2.2 Diversity

The results for the species diversity analyses from the Loch Alsh grab samples are given in Table 3.8. The total number of individuals at each station range from 125 to 500 individuals per sample with the total number of taxa ranging from 31 to 104 taxa per sample, indicating that there were some differences between the samples, and potentially between the stations.

The species diversity (Shannon-Wiener diversity index) ranged between 2.72 and 4.11 suggesting similar levels of species diversity across the different stations. Note, however, that species diversity and species richness were generally slightly higher at stations where *Limaria hians* was recorded (LA1 and LA2) compared to stations (LA4) where this taxon was not recorded.

The equitability (J) results suggest an equal distribution between species at most of the stations. Most values are higher than 0.85 with the lowest equitability found at station LA4_G04, indicating a relatively higher dominance by a smaller number of different species.

Table 3.8: Total number of individuals (N), number of species (S), Margalef's species richness (d), Pielou's equitability index (J), Shannon-Wiener diversity index (H') and Simpson's Dominance Index calculated for the infaunal samples collected from Loch Alsh (part of Lochs Duich, Long and Alsh SAC / NC MPA) in 2015.

Sample	S	N	d	J'	H' (loge)	Simpson's
LA1_G01	54	247	9.62	0.86	3.43	0.95
LA1_G02	64	278	11.19	0.87	3.61	0.96
LA1_G03	51	224	9.24	0.88	3.46	0.96
LA1_G04	63	296	10.90	0.86	3.58	0.96
LA2_G03	104	500	16.57	0.88	4.11	0.98
LA4_G01	53	139	10.54	0.90	3.59	0.97
LA4_G02	46	128	9.27	0.89	3.41	0.96
LA4_G03	44	167	8.40	0.87	3.28	0.94
LA4_G04	41	186	7.65	0.77	2.87	0.87
LA4_G05	31	125	6.21	0.79	2.72	0.89
LA4_G06	40	189	7.44	0.84	3.09	0.93
LA4_G07	51	167	9.77	0.83	3.26	0.94
LA4_G08	32	160	6.11	0.81	2.80	0.90
LA4_G09	38	159	7.30	0.79	2.87	0.91
LA4_G10	49	158	9.48	0.86	3.35	0.95

3.2.2.3 Macrofaunal composition

The results of the cluster and ordination analyses for the macrobenthic invertebrate samples collected from Loch Alsh are given in Figures 3.11 and 3.12. SIMPROF analysis indicated the presence of two very distinct clusters, separated at approximately 20 % similarity, with one of these groups split into two further significant clusters at approximately 50 % similarity. The MDS ordination demonstrated that the first split was indeed significant, however, the second was not, and in fact, did not appear at all. It is therefore likely that clusters B and C are highly similar in terms of their communities. In order to determine whether these two groups were indeed significantly different in terms of their communities, SIMPER analysis was run on all three clusters identified in the SIMPROF analysis. The results of the SIMPER analysis are given in Table 3.9.

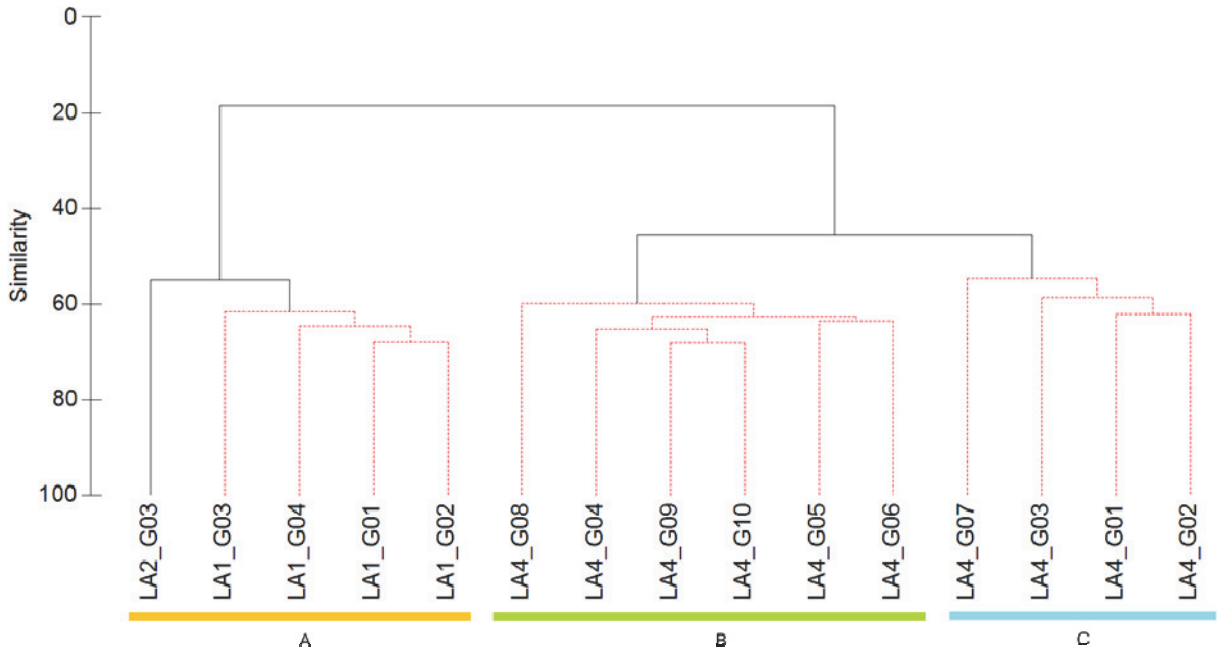

Figure 3.11: Cluster analysis of the macrobenthic invertebrate sample data collected from Loch Alsh (part of Lochs Duich, Long and Alsh SAC / NC MPA) in 2015. Red dotted lines indicate significant results of SIMPROF analysis at 5 %.

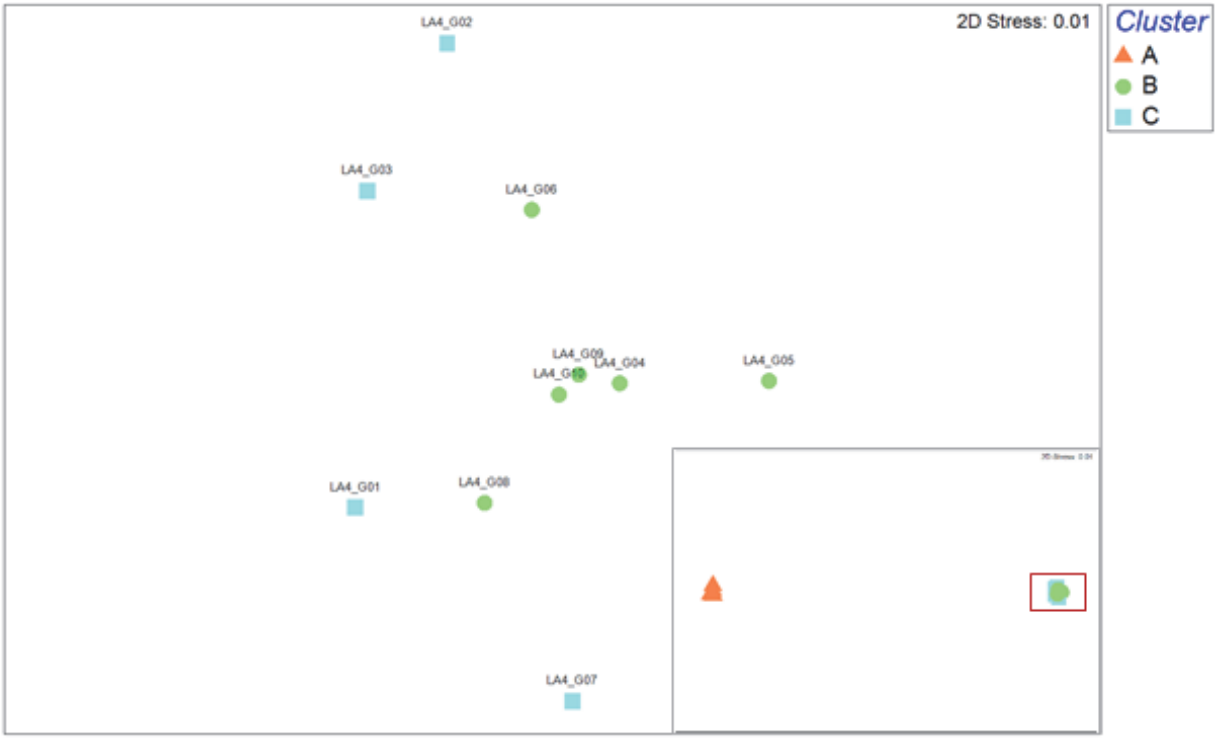

Figure 3.12: Zoomed in ordination analysis of the macrobenthic invertebrate sample data collected from Loch Alsh (part of Lochs Duich, Long and Alsh SAC / NC MPA) in 2015 (full MDS plot in inset).

Table 3.9: SIMPER analysis of the macrobenthic invertebrate sample data collected from Loch Alsh (part of Lochs Duich, Long and Alsh SAC / NC MPA) in 2015.

Cluster	Species	Av.Abund	Av.Sim	Contrib%
A	*Nereimyra punctata*	5.35	3.75	6.24
	Ophiothrix fragilis	4.55	3.45	5.73
	Psamathe fusca	3.47	2.49	4.14
	Pholoe baltica	3.33	2.39	3.97
	Limaria hians	3.38	2.22	3.68
	Trichobranchidae	2.88	2.2	3.66
	Othomaera othonis	2.99	2.1	3.49
	Mediomastus fragilis	3.53	2.07	3.43
	Nucula nucleus	2.76	2.06	3.42
	Pholoe inornata	2.96	2.03	3.38
	Leptochiton asellus	2.95	2.02	3.36
	Ophiocomina nigra	2.67	1.83	3.05
	Modiolula phaseolina	2.93	1.82	3.02
	Aonides oxycephala	2.22	1.7	2.82
	Eumida bahusiensis	2.37	1.66	2.76
	Urothoe elegans	1.98	1.5	2.49
	Prionospio cirrifera	2.4	1.49	2.47
	Flabelligera affinis	2.33	1.47	2.45
	Acanthocardia echinata	1.9	1.31	2.18
	Modiolus modiolus	2.45	1.28	2.13

	Prionospio cirrifera	4.7	6.03	9.65
	Prionospio fallax	5.15	5.93	9.49
	Prionospio sp.	3.07	4	6.39
	Abra alba	3.13	3.73	5.98
	Spiophanes kroyeri	2.29	2.91	4.66
	Thyasiral sp.	2.05	2.48	3.97
	Nemertea	1.83	2.41	3.86
	Diplocirrus glaucus	2.31	2.35	3.77
	Chaetozone setosa	1.78	2.25	3.61
B	*Abra nitida*	2.28	2.06	3.3
	Pholoe baltica	1.69	2.02	3.23
	Chaetoderma nitidulum	1.81	1.81	2.89
	Mediomastus fragilis	1.62	1.8	2.87
	Abra sp.	1.68	1.77	2.84
	Praxillella affinis	1.74	1.71	2.73
	Praxillella praetermissa	1.36	1.64	2.63
	Prionospio multibranchiata	1.68	1.62	2.59
	Scalibregma inflatum	1.7	1.53	2.44
	Ancistrosyllis groenlandica	1.07	1.5	2.4
	Amphiura chiajei	1.28	1.43	2.28
	Pholoe baltica	2.85	3.42	5.97
	Amphiura chiajei	3.15	3.35	5.85
	Amphiura filiformis	2.68	3.02	5.27
	Prionospio fallax	2.96	2.81	4.9
	Kurtiella bidentata	2.22	2.7	4.72
	Diplocirrus glaucus	2.34	2.45	4.28
	Praxillella affinis	1.93	2.36	4.11
	Myrtea spinifera	2.33	2.18	3.81
	Ampelisca sp.	2.04	2.15	3.75
C	*Prionospio cirrifera*	2.5	2.11	3.68
	Prionospio sp.	1.88	2.09	3.64
	Spiophanes kroyeri	1.7	1.94	3.39
	Amphictene auricoma	1.41	1.87	3.27
	Dasybranchus sp.	1.93	1.85	3.24
	Nemertea	1.66	1.73	3.02
	Owenia fusiformis	1.62	1.6	2.8
	Cerebratulus sp.	1.06	0.95	1.66
	Pista cristata	1.31	0.9	1.57
	Turritella communis	2.27	0.82	1.44

3.2.3 Designation of biotopes

The biotopes assigned to each sample, together with a summary of the biotic and abiotic features, is given in Appendix VI.

The five samples in which the flame shell *L. hians* were recorded were all part of cluster A and were assigned the biotope **SS.SMx.IMx.Lim** (*Limaria hians* beds in tide-swept sublittoral muddy mixed sediment). The horse mussel *M. modiolus* was also observed in four of these five samples, which are the primary feature of several biotopes within the **SS.SBR.SMus**

(sublittoral mussel beds on sublittoral sediment) biotope complex and also a PMF. However the *L. hians* biotope was preferentially assigned due to the apparent greater abundance of *L. hians* (including the bysuss threads, which impact local seabed ecology due to the binding effect of the 'nests' on the sediment which leads to increased diversity, see Tyler-Walters, 2008). Furthermore, the biotope description includes reference to *M. modiolus*, which 'sometimes occur at the same sites lying over the top of the *Limaria* bed' whereas the *M. modiolus* biotopes do not include mention of *L. hians*. It is, however, important to note that these samples potentially represent two different PMF habitats.

Cluster groups B and C were found to be generally characterised by mixed muddy sand and were fairly similar in terms of the dominant fauna, although relative abundances varied between samples. The presence of the bivalves *Kurtiella bidentata*, *Thyasira* spp. and *Abra alba*, together with high numbers of the worms *Prionospio* spp. and *Chaetozone setosa* and the brittlestar *Amphiura* spp. meant that the biotope **SS.SMx.CMx.MysThyMx** (*Mysella bidentata* and *Thyasira* spp. in circalittoral muddy mixed sediment) was assigned to all samples, although the abundance of the characterising bivalves was perhaps lower than normally recorded for this biotope.

The distribution of the biotopes assigned to the Loch Alsh samples is shown in Figure 3.13.

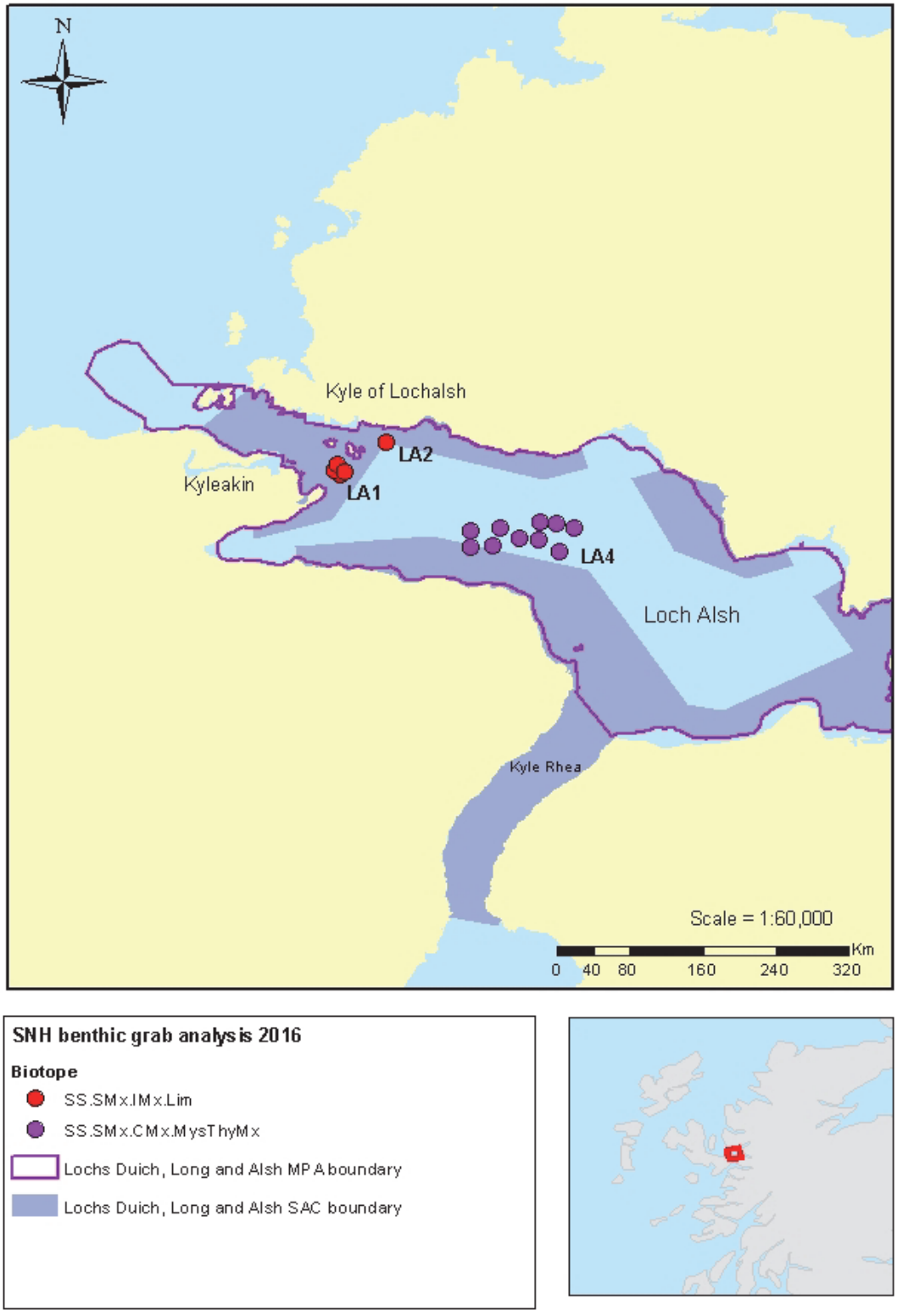

Figure 3.13: Biotopes (Connor et al.*, 2004) assigned to grab samples collected from Loch Alsh (part of Lochs Duich, Long and Alsh SAC / NC MPA) in 2015.*

3.3 Southern Trench

3.3.1 PSA

The results from the PSA of the Southern Trench samples are given in Table 3.10 and displayed on a modified Folk triangle (Folk, 1954) in Figure 3.14. Full results of the PSA, including results of the laser diffraction analysis, are provided in Appendix II.

Samples collected from Southern Trench MPA were found to fall into two distinct groups; STTR 04, 06 and 08, which were taken from further offshore (see Figure 3.15) were characterised by high (> 85 %) proportions of sand with minor (5 – 12 %) gravel fractions, and were classified as gravelly sand. By contrast, samples STTR 13 – 16 had no gravel, instead being characterised by varying proportions of sand and mud. STTR 14 and 15 were both approximately 70 % sand and 30 % mud, while STTR 13 and 16 were found to have 62 and 70 % mud respectively. STTR 14 and 15 were classified as muddy sand, while STTR 13 and 16 were classified as sandy mud. All of the sediment samples were either very poorly or poorly sorted.

Table 3.10: Summary of the Particle Size Analysis (sediment weight by percentage) from grab samples collected from Southern Trench MPA proposal in 2015. Mud, sand and gravel refer to all size fractions within each category.

Sample	% Gravel	% Sand	% Mud	Depth (m)	Classification (Folk system adapted by BSG)	Sorting Index
STTR04	0.053	0.918	0.029	-81.2	Gravelly Sand	Moderately Sorted
STTR06	0.119	0.850	0.031	-89.5	Gravelly Sand	Poorly Sorted
STTR08	0.117	0.863	0.020	-78.1	Gravelly Sand	Poorly Sorted
STTR13	0.000	0.382	0.618	-98.7	Sandy Mud	Poorly Sorted
STTR14	0.000	0.732	0.268	-93.8	Muddy Sand	Poorly Sorted
STTR15	0.000	0.707	0.293	-85.8	Muddy Sand	Very Poorly Sorted
STTR16	0.000	0.295	0.705	-98.2	Sandy Mud	Poorly Sorted

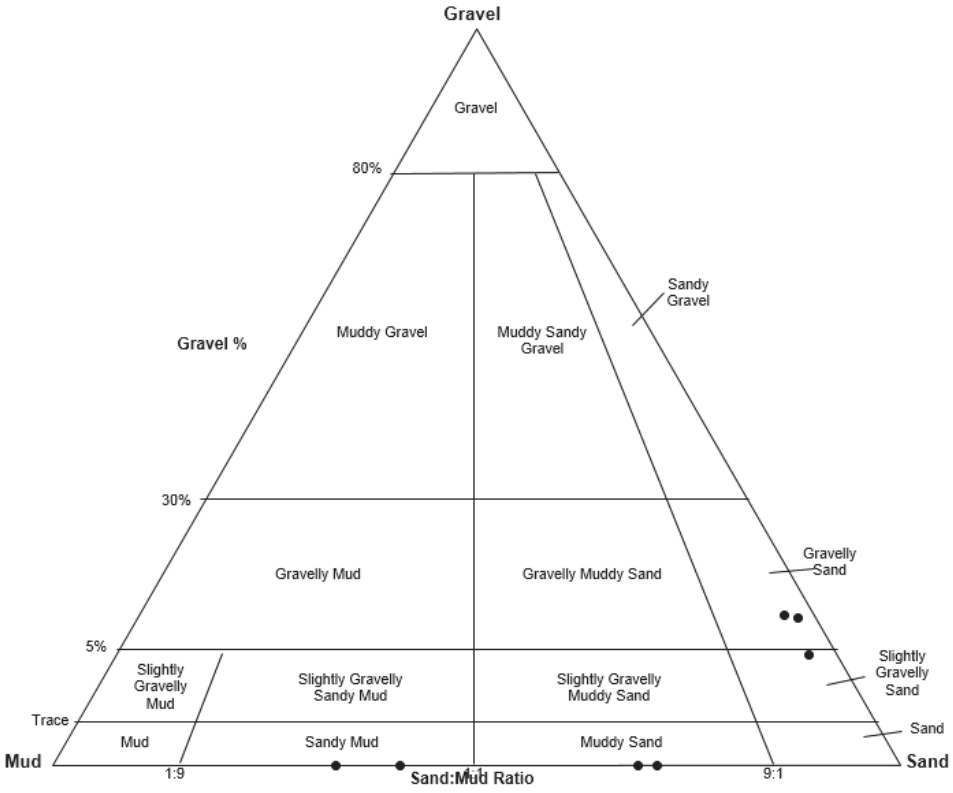

Figure 3.14: Modified Folk triangle showing classification of the 2015 Southern Trench MPA proposal sediment samples (c.f. Table 3.10).

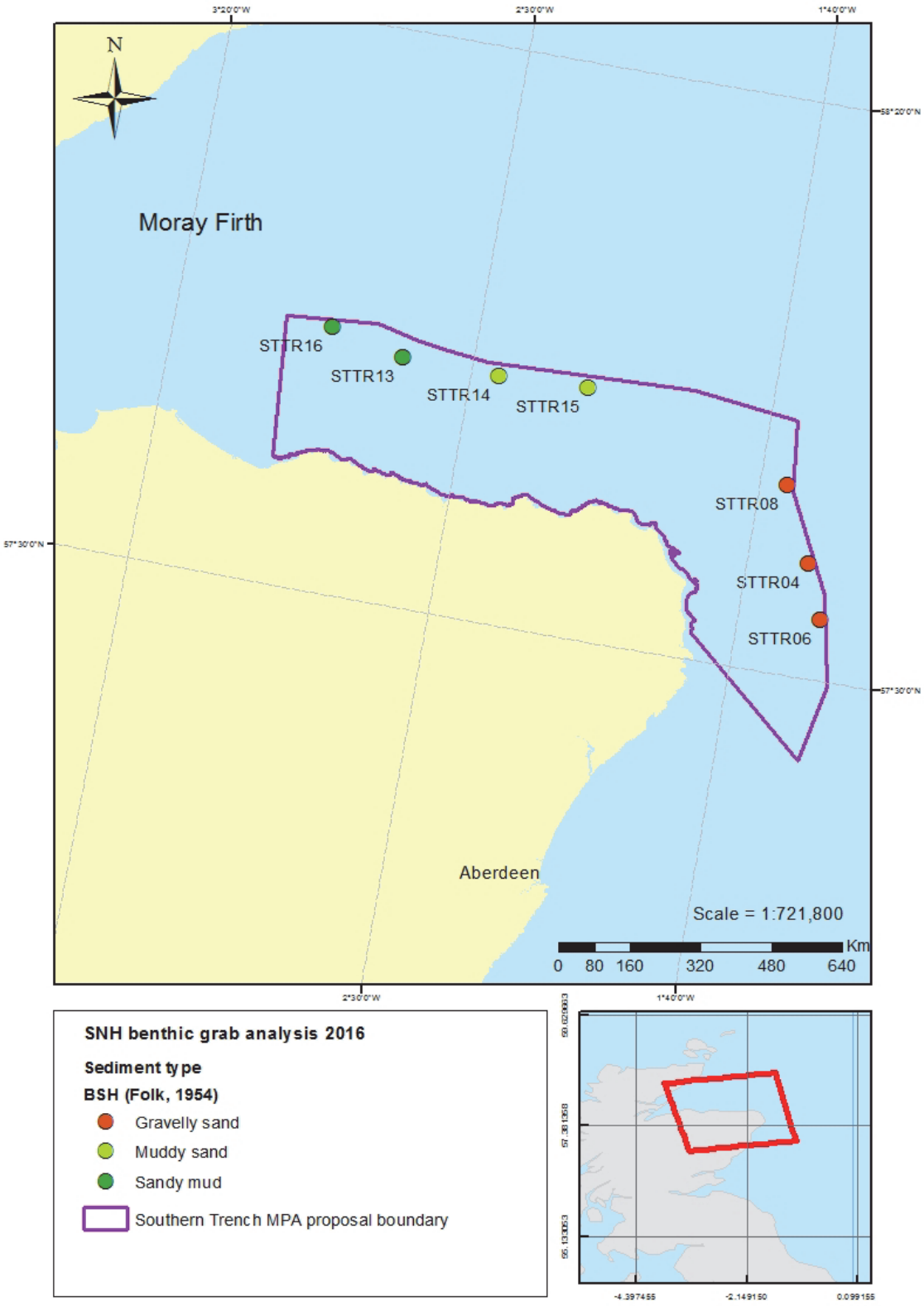

Figure 3.15: Broadscale habitat (BSH) types resulting from the particle size analysis of sediment samples collected from Southern Trench MPA proposal in 2015.

3.3.2 Macrofaunal analysis

The macrofaunal analysis revealed a total of 581 individuals and 122 taxa (see Appendix VII) in the Southern Trench grab samples (excluding unquantifiable meiofauna and epifauna). Overall the macrofauna was dominated by Annelida (51.6 %) followed by Echinoderms (26.9 %) and Crustacea (12.0 %). The Mollusca contributed 6.7 % and the Nemertea 1.9 %. Phoronida and Sipuncula constituted the remaining groups contributing the final 0.8 %.

Of particular note was the presence of *Sabellaria spinulosa* at station STTR04. Individuals as well as multiple small 'blocks' of *S. spinulosa* tubes were recorded potentially indicating the presence of biogenic reefs (an Annex I habitat) at this station.

3.3.2.1 Macrofaunal abundance

The abundance of the identified macrofauna (excluding unquantifiable meiofauna and epifauna) are given in Appendix VII with a summary of the most abundant taxa in the Southern Trench samples given in Table 3.11. The annelid *Prionospio steenstrupi* was the most abundant taxon overall but the echinoderms *Amphiura filiformis*, *A. chiajei* and *Echinocyamus pusillus* were also relatively abundant.

Table 3.11: Total abundance of the main macrofaunal taxa identified in the samples collected by Cefas from Southern Trench MPA proposal in 2015. MCS refers to species alphanumeric biocodes according to Howson and Picton (1997).

MCS A	MCS N	Taxon	Abundance (total no. in all Southern Trench samples)
P	768	*Prionospio steenstrupi*	49
ZB	154	*Amphiura filiformis*	46
ZB	152	*Amphiura chiajei*	42
ZB	212	*Echinocyamus pusillus*	37
P	834	*Chaetozone setosa*	31
P	1093	*Galathowenia oculata*	18
ZB	148	Amphiuridae	18
P	796	*Spiophanes kroyeri*	17
P	1117	*Sabellaria spinulosa*	16
W	9	*Chaetoderma nitidulum*	16
P	919	*Mediomastus fragilis*	14
G	1	Nemertea	11
P	93	*Pholoe pallida*	8
W	2059	*Abra alba*	8
P	723	*Aonides paucibranchiata*	7
P	733	*Laonice bahusiensis*	7
P	1098	*Owenia fusiformis*	7
S	248	*Urothoe elegans*	7
ZB	167	*Ophiocten affinis*	7
P	878	*Diplocirrus glaucus*	6
P	1090	Oweniidae	6
P	1107	*Lagis koreni*	6
P	260	*Glycera lapidum*	5

3.3.2.2 Diversity

The results for the species diversity analyses are given in Table 3.12. The total number of individuals at each station range from 25 to 148 individuals per sample with the total number of taxa ranging from 16 to 47 taxa per sample, indicating that there some differences between stations.

The species diversity (Shannon-Wiener diversity index) was similar across the STTR stations but it was highest at station STTR04, at which *S. spinulosa* was identified. The lowest species diversity value is found at stations STTR16 and STTR08.

The equitability (J) results suggest an equal distribution between species at most of the stations. The values range between 0.79 – 0.94 with the lowest equitability found at station STTR15, indicating a relatively higher dominance by a smaller number of different species.

Table 3.12: Total number of individuals (N), number of species (S), Margalef's species richness (d), Pielou's equitability index (J), Shannon-Wiener diversity index (H') and Simpson's Dominance Index calculated for the infaunal samples collected by Cefas from Southern Trench MPA proposal in 2015.

Sample	S	N	d	J'	H' (loge)	Simpson's
STTR04	47	88	10.27	0.90	3.45	0.96
STTR06	33	53	8.06	0.94	3.28	0.97
STTR08	16	25	4.66	0.94	2.60	0.95
STTR13	39	148	7.60	0.82	3.02	0.92
STTR14	29	58	6.90	0.88	2.97	0.93
STTR15	34	122	6.87	0.79	2.79	0.90
STTR16	24	87	5.15	0.82	2.62	0.89

3.3.2.3 Macrofaunal composition

The results of the cluster and ordination analyses for stations D4 and D6 are given in Figures 3.16 and 3.17. SIMPROF analysis indicated the presence of three significant clusters, following the trend identified in the sediment analysis (i.e. increasing sediment size with increasing distance from shore). SIMPER analysis was then run on the identified clusters. The results of the SIMPER analysis are given in Table 3.13.

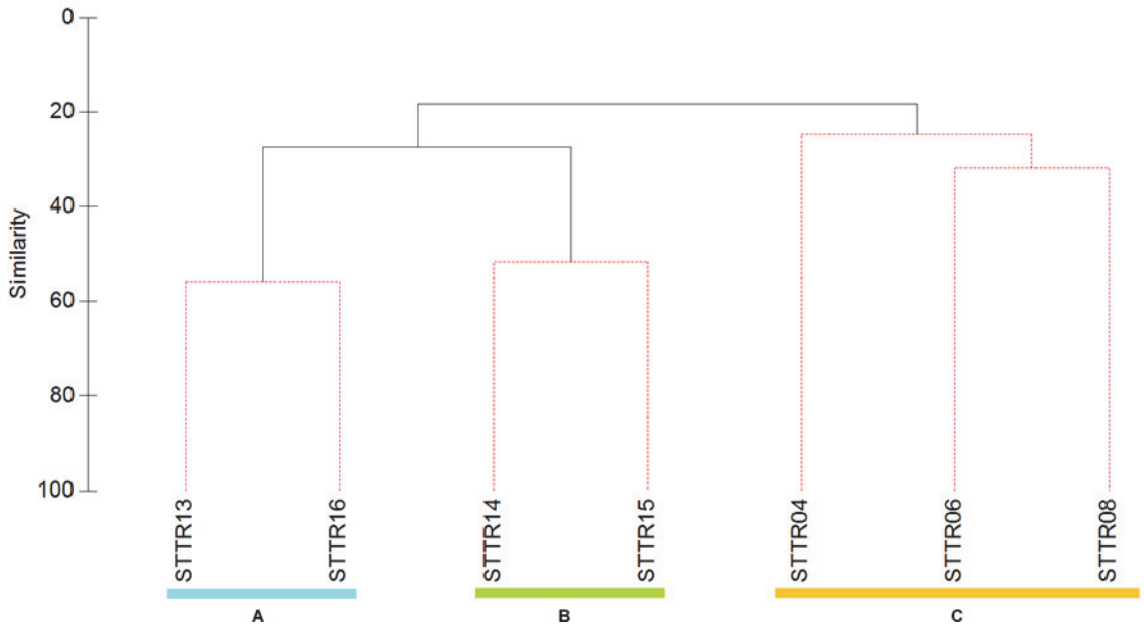

Figure 3.16: Cluster analysis of the macrobenthic invertebrate sample data collected from Southern Trench MPA proposal in 2015. Red dotted lines indicate significant results of SIMPROF analysis at 5 %.

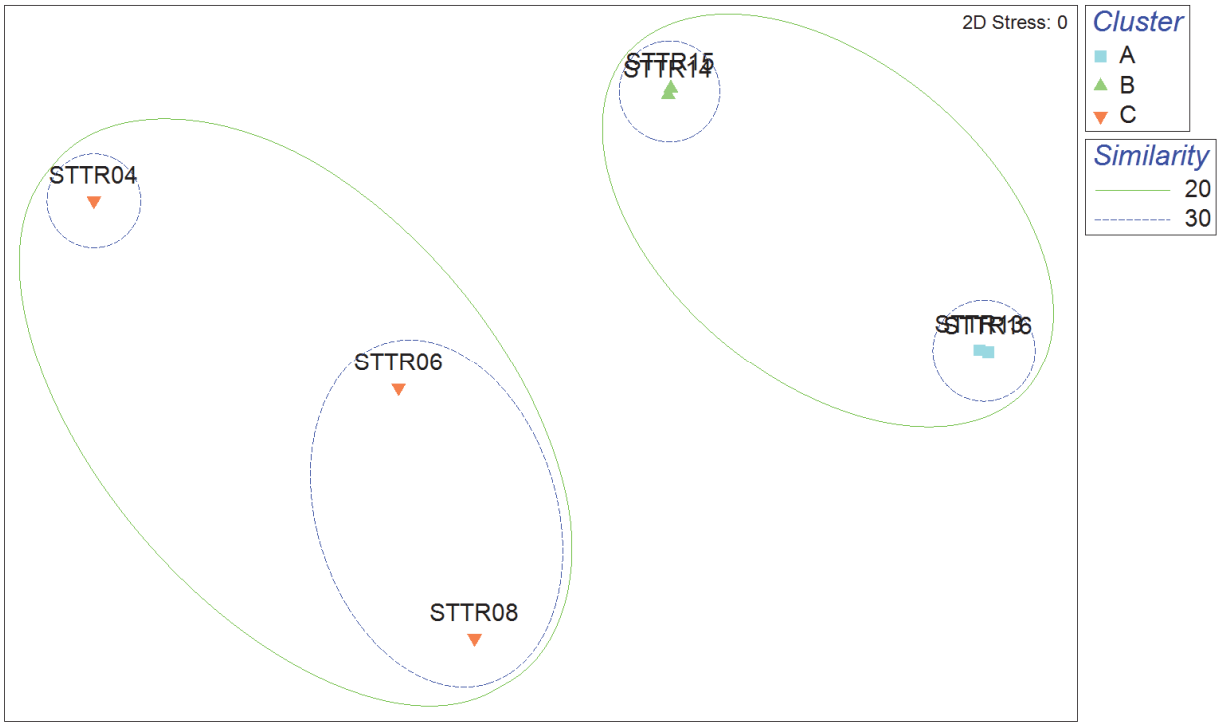

Figure 3.17: Ordination analysis of the macrobenthic invertebrate sample data collected from Southern Trench MPA proposal in 2015.

Table 3.13: SIMPER analysis of the macrobenthic invertebrate sample data collected from Southern Trench MPA proposal in 2015.

Cluster	Species	Av.Abund	Av.Sim	Contrib%
A	*Amphiura chiajei*	4.49	7.37	13.21
	Prionospio steenstrupi	4.28	5.71	10.23
	Chaetoderma nitidulum	2.55	4.66	8.36
	Spiophanes kroyeri	2.53	4.26	7.63
	Mediomastus fragilis	2.5	3.81	6.82
	Nemertea	1.98	3.3	5.91
	Pholoe pallida	1.98	3.3	5.91
	Chaetozone setosa	2.93	3.3	5.91
	Galathowenia oculata	1.87	3.3	5.91
	Laonice bahusiensis	1.57	2.69	4.82
	Nucula nucleus	1.41	2.69	4.82
	Glycera unicornis	1.37	1.9	3.41
	Oweniidae	1.21	1.9	3.41
	Harpinia antennaria	1.21	1.9	3.41
	Eudorella emarginata	1	1.9	3.41
B	*Amphiura filiformis*	4.47	8.18	15.78
	Echinocyamus pusillus	3.29	4.37	8.43
	Chaetozone setosa	1.73	3.79	7.3
	Lagis koreni	1.71	3.09	5.96
	Ampelisca sp.	1.57	3.09	5.96
	Ophiocten affinis	1.57	3.09	5.96
	Goniada maculata	1.21	2.19	4.22
	Nephtys sp.	1	2.19	4.22
	Prionospio steenstrupi	1.91	2.19	4.22
	Diplocirrus glaucus	1	2.19	4.22
	Oweniidae	1	2.19	4.22
	Galathowenia oculata	2.08	2.19	4.22
	Owenia fusiformis	1.21	2.19	4.22
	Ampharetinae	1	2.19	4.22
	Trichobranchidae	1.5	2.19	4.22
	Kurtiella bidentata	1	2.19	4.22
C	*Echinocyamus pusillus*	1.89	3.75	13.79
	Nemertea	1	2.65	9.75
	Glycera lapidum	1.14	2.65	9.75
	Notomastus sp.	1.14	2.65	9.75
	Timoclea ovata	1	2.65	9.75
	Amphiura filiformis	1.14	2.65	9.75
	Aonides paucibranchiata	1.08	1.13	4.15
	Chaetozone setosa	1	1.13	4.15
	Amphiuridae	0.67	1.13	4.15
	Lumbrineris cingulata	0.94	0.95	3.5
	Owenia fusiformis	0.94	0.95	3.5
	Spisula elliptica	0.67	0.85	3.13
	Golfingia (Golfingia) elongata	0.8	0.67	2.48
	Spiophanes kroyeri	0.8	0.67	2.48

3.3.3 Designation of biotopes

The biotopes assigned to each sample, together with a summary of the biotic and abiotic features, is given in Appendix VIII.

The numbers of individuals and taxa in the Southern Trench samples were low compared to the other 2015 survey areas, and evenness very high, with no apparent dominant fauna in any of the samples. This made assignment of biotopes more challenging.

Cluster A (samples STTR13 and 16) both had relatively high numbers of the brittlestar *Amphiura chiajei* and the worm *Prionospio* spp., indicating an offshore mud biotope, however, no exact match could be determined at the biotope level. The biotope complex **SS.SMu.OMu** (Offshore circalittoral mud) was therefore assigned.

Samples STTR14 and 15 formed cluster B; while these samples were found to have a base level of similarity of approximately 20 % with cluster A, they differed in both sediment type (muddy sand rather than sandy mud), and in the brittlestar species present (*Amphiura filiformis* rather than *A. chiajei*). The presence of *A. filiformis*, together with *Owenia fusiformis* and *Galathowenia oculata*, suggests that the closest biotope match is **SS.SSa.OSa.OfusAfil** (*Owenia fusiformis* and *Amphiura filiformis* in offshore circalittoral sand or muddy sand), however, given the low numbers of individuals (particularly of *O. fusiformis*) the biotope was only tentatively assigned.

Cluster C comprised the three samples furthest from shore (STTR04, 06 and 08) which were all found to be gravelly sand. Numbers of individuals were lower for this cluster than for groups A and B, with very high evenness (> 0.9). STTR04 was found to have several species of amphipods, as well as being the only station at which *S. spinulosa* was recorded, however, as numbers were very low, these samples were assigned at the biotope complex level based primarily on sediment type and location / depth; **SS.SSa.OSa** (offshore circalittoral sand).

The distribution of the biotopes assigned to the Southern Trench MPA proposal samples is shown in Figure 3.18.

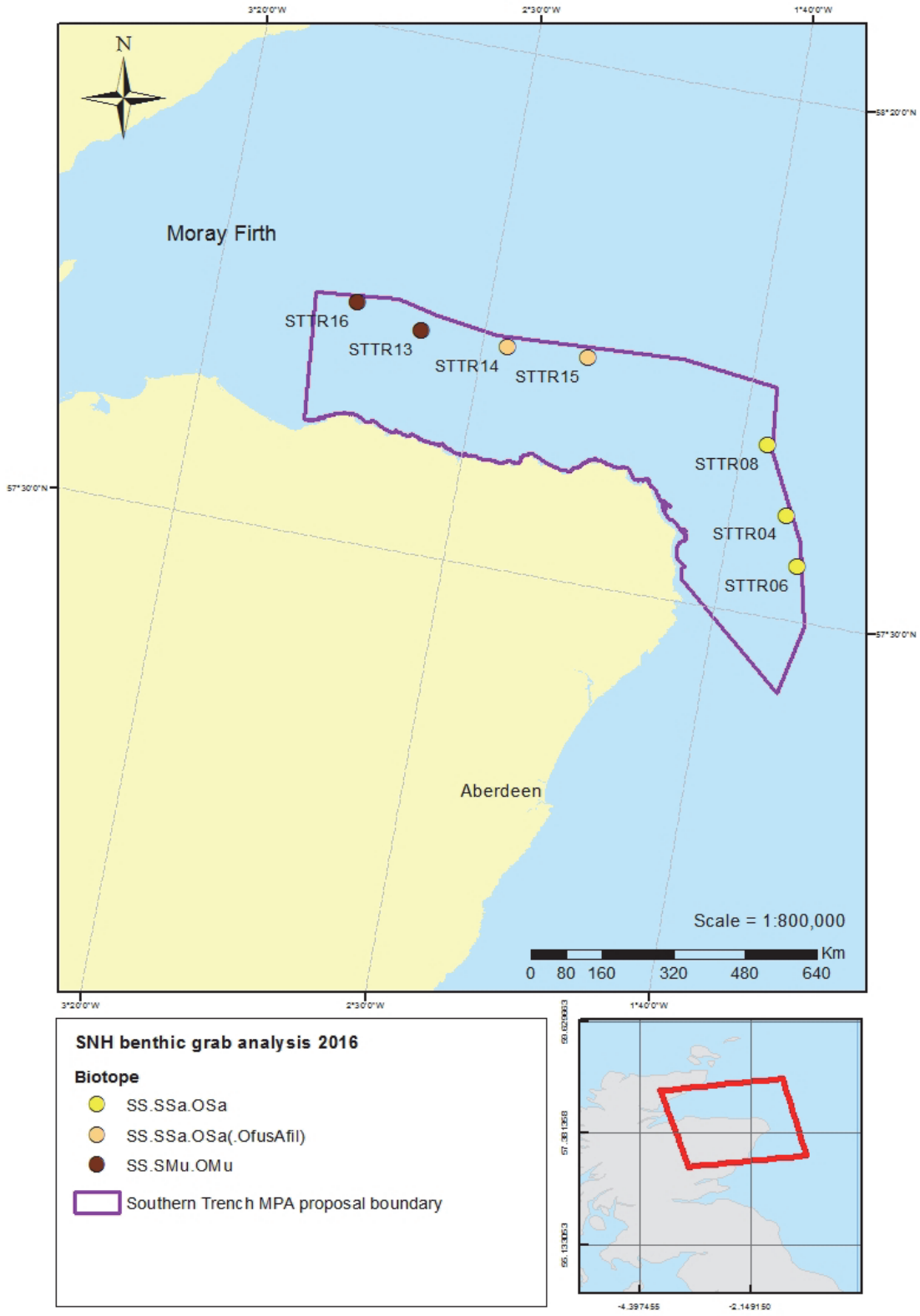

Figure 3.18: Biotopes (Connor et al.*, 2004) assigned to grab samples collected by Cefas from Southern Trench MPA proposal in 2015.*

4. DISCUSSION

4.1 South Arran

There have been numerous recent studies in the Clyde Sea area and around Arran (e.g. Allen *et al.*, 2013; Allen, 2014a; Axelsson *et al.*, 2009, 2010; Howson and Steel, 2014) but relatively few using sediment grab sampling, particularly along the south coast of Arran. Only one recent study (Allen, 2014a) has been found where similar sampling methodologies to those of 2015 have been used. Unfortunately, none of the stations from Allen (2014) appear to be exactly at the same position and only a few of the sampling locations are in close proximity (at T3, D4, D6 and T4 but not at T2) to the 2015 stations (Figure 4.1). Some caution is therefore needed when comparing the two sets of data. However, when comparing the biotopes recorded in close proximity in the 2014 study to those in 2015 there appear to be some differences (Figure 4.1).

Detailed descriptions of the reasoning behind the 2015 designations have been provided in the results section, but the main differences between the 2014 and 2015 surveys underlying the designations were the sediment grain size and faunal composition.

In 2015 most of the biotopes at D4 and D6 were classified as **SS.SSa.OSa.OfusAfil** whilst the 2014 study recorded **SS.SCS.ICS**, **SS.SCS.ICS.MoeVen** or **SS.SCS.CCS.MedLumVen** in the same wider area. The dominant and characterising fauna in the 2015 samples at these locations were *Owenia fusiformis* and *Amphiura filiformis*, species not contributing significantly to the biotopes recorded in 2014. It is unlikely that such changes have occurred over the year between the two studies; therefore the differences are more likely to be due to high spatial variability. This has implications for future studies and sample sizes required to detect changes over time.

Sampling did not take place in the vicinity of T2 in 2014. However, one 2014 sample was collected at area T3 (2015). The 2015 samples were classified as **SS.SSa.CMuSa.AalbNuc**, **SS.SSa.CMuSa(.AalbNuc)** and **SS.SMu.CSaMu.AfilMysAnit** whilst the 2014 survey recorded **SS.SMu.CSaMu**, illustrating similarities in sediment grain size, faunal composition and depth at least in part of the T3 sample area between 2014 and 2015.

All of the 2015 samples in area T4 were assigned to the **SS.SMu.CSaMu** biotope which is the same as those recorded in the 2014 survey. The 2015 **SS.SMu.CSaMu** designations were largely based on the sediment and faunal characteristics (including *Calocaris macandreae, Mediomastus fragilis, Nephtys incisa* and species in the *Prionospio/Minuspio* complex). Of note, however, is that the 2015 stations could potentially have been classified within **SS.SMu.OMu** as all the stations were located in depths in excess of 100 m. However, considering the fauna present, assigning these stations as **SS.SMu.CSaMu** was deemed more appropriate.

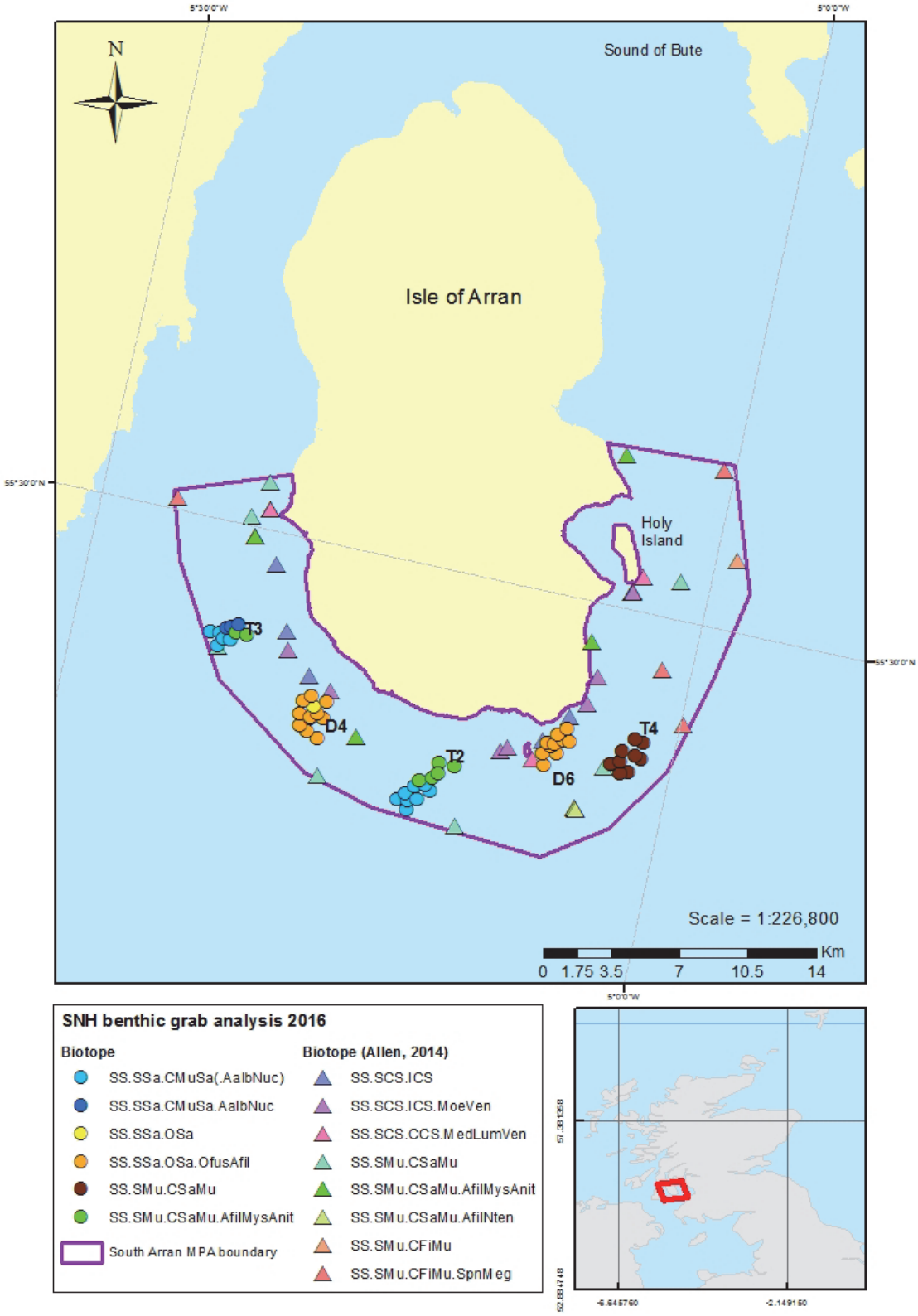

Figure 4.1: Biotopes at grab survey stations around Arran from Allen (2014) and the current (2015) surveys.

4.2 Loch Alsh

The known extent of the flame shell bed in Loch Alsh prior to the 2015 survey is illustrated in Figure 4.2. This flame shell bed is reported to be the largest known bed in Scottish waters with an estimated cover of 93 ha (SNH, 2014a). Fieldwork in 2014 (Allen, 2014b; Moore, 2015) expanded the original estimate of 75 ha (Moore *et al*., 2013). The current grab survey data confirm the presence of *L. hians* at stations LA1 and LA2 with a total of 62 individuals being identified. Based on historical data provided by SNH (see Figure 4.2), these records are from positions immediately outside (up to 100 m) the currently recorded inner edge of the *L. hians* beds within Loch Alsh, suggesting a need for a review of all the available data from the region (outside the scope of the current study) to refine the boundary of the bed. The size of the *L. hians* individuals identified in this study ranged from 0.3 to 4.2 cm (maximum length) from five different stations (see Appendix IX) with juveniles (< 1 cm; as defined by Trigg and Moore, 2009, Moore *et al.*, 2011) recorded at four of the five stations (see Appendix IX). This suggests recruitment of *L. hians* in this area, especially at LA2_G03 with 12 out of 26 *L. hians* shells being <1 cm long.

It has been suggested that species diversity is particularly high among *L. hians* beds (e.g. Hall-Spencer and Moore, 2000; Trigg *et al.*, 2011) but neither the Shannon-Wiener nor the species richness indices suggested a particularly high species diversity among the *L. hians* samples collected in 2015. It is possible that patchiness, the cryptic lifestyle or different types of sampling methodology (e.g. sediment grab sampling or dive core sampling) could explain some of these differences but other factors could also influence the results (e.g. difficulties during sample processing, identification of algal and epifaunal species). Careful assessments of both the methodologies used (e.g. sampling, processing and analysis) and the different types of species records may result in equally high species diversity records for *L. hians* nests (allowing for differences in sediment grain size and geographical location).

Historical studies have reported the presence of *Modiolus modiolus* in Loch Alsh (see e.g. Moore *et al*., 2013). This taxon has not only been found within and around *L. hians* beds (see e.g. Connor *et al*., 2004; Lancaster *et al.*, 2014) but also recorded separately in Loch Alsh under a number of different biotopes (see Moore *et al*., 2013). It has been suggested that *L. hians* and *M. modiolus* are competing for the same resources and space. Furthermore, it has been suggested that dense populations of *L. hians,* often together with *Ophiothrix fragilis,* outcompete *M. modiolus,* degrading *M. modiolus* recruitment success and respiratory functions (Moore *et al*., 2013). The 2015 survey revealed *M. modiolus* (and *O. fragilis*) present at stations among the *L. hians* beds in LA1 and LA2 sampling areas but whether these species are actively competing for space remains unknown. Although the theory of *L. hians* outcompeting *M. modiolus* may hold true, there is no apparent evidence of this in the current study. Additional data from Loch Alsh would be required to assess this further.

The high abundances of Desmoscolecidae were only recorded at stations where *L. hians* and *M. modiolus* were also recorded. Knowledge regarding the ecology of *L. hians* 'nests' is still relatively limited and future studies may record this group of nematodes at other locations. The Desmoscolecidae in this study were characterised by conspicuous transverse rings (desmen) but no other obvious features (e.g. chaeta). Little other information is available about this group of marine nematodes. Trigg (2009) mentioned the high abundance of nematodes in a detailed study of *L. hians* nests, but there was no further classification or identification of these individuals. Nematodes may be more important within the *L. hians* beds than is currently understood.

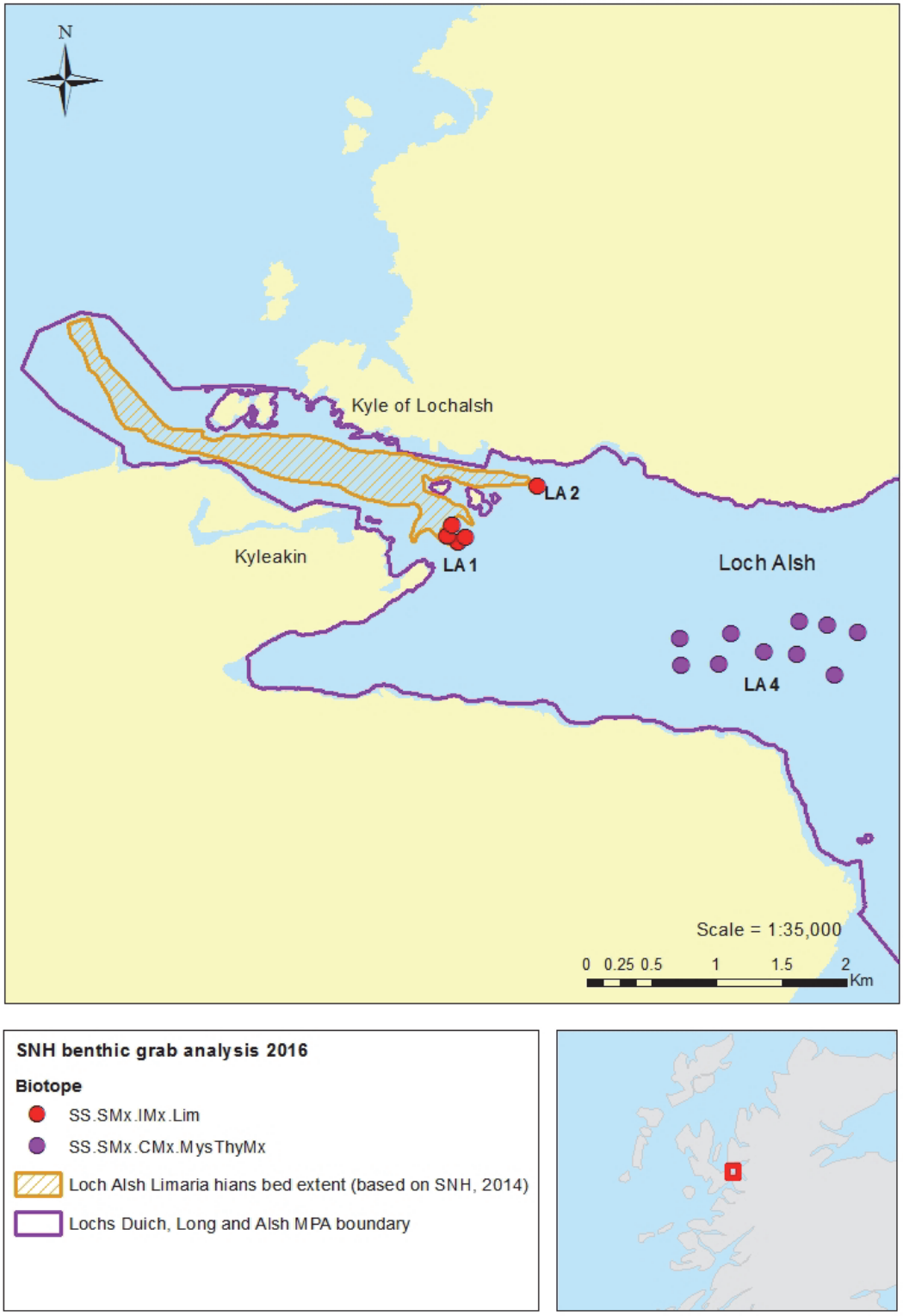

Figure 4.2: The distribution of the Limaria hians *bed in Loch Alsh (from SNH, 2014a).*

4.3 Southern Trench

There are few historical commissioned sediment grab sampling and biotope studies (e.g. Foster-Smith *et al.*, 2009; Moore, 2015) from the Moray Firth but one in particular (Hirst *et al.,* 2012) focused on the Southern Trench area. This study and the Southern Trench MPA proposal (SNH, 2014b) highlight, among other habitats, the presence of the MPA search feature 'burrowed mud' within the Southern Trench. The component biotope (**SS.SMu.CFiMu.SpnMeg**) was recorded at several locations in Hirst *et al.* (2012) but all of these locations were south of those sampled in 2015 and this biotope was not assigned to any of the 2015 samples. However, two stations from 2015 were classified as **SS.SMu.OMu** (Offshore circalittoral mud).

The 2015 stations STTR14 and 15 were tentatively classified as **SS.SSa.OSa(.OfusAfil)** largely as a result of the sediment grain size distribution and the component species. However, as a result of the latter being found only in low abundances, the designation of the full biotope could not be justified. There were no 2012 sample locations in the immediate vicinity of STTR 14 and STTR15 (see Hirst *et al.,* 2012) but the nearest (G18) was classified as **SS.SSa.CMuSa**, a biotope similar in sediment characteristics but with differences in component faunal characteristics.

Stations STTR04, 06 and 08 were located in the eastern sector of the Southern Trench survey area, stations all found to be characterised by gravelly sand. These stations were assigned the **SS.SSa.OSa** biotope. None of the 2012 sample stations were in close proximity to the 2015 stations, therefore direct comparisons were not possible. However, as 16 individuals of *Sabellaria spinulosa* were recorded at STTR04 and this species was recorded at stations G7 and G17 in the 2012 study (see Hirst *et al.,* 2012), it is possible that this species may have a wider distribution in the area than is currently known. This species occurs along all coasts in the British Isles as individuals (Jackson & Hiscock, 2008) and may be gregarious in favourable conditions, with long lived, stable biogenic structures which are protected as 'reefs' under the Habitats Directive (Hendrick and Foster-Smith, 2006). In the present study multiple small 'blocks' of *S. spinulosa* tubes were found in at STTR04, however, due to a lack of commonly associated species and low densities of *S. spinulosa* in the blocks found, this sample was not considered part of a biogenic reef formation. Further analysis of video footage in the area may determine the presence of *S. spinulosa* reefs in the area.

4.4 Limitations

4.4.1 Macrofaunal identification

The identification of the macrofauna was challenging in some instances as some individuals were damaged resulting in genus or even family level identification. In some cases chaeta, elytra and body parts were missing and the shell of molluscs (e.g. *Abra* spp.) were almost entirely dissolved leaving only the muscular tissue in the sample residue. The damage to animals could, for example, have occurred during the sampling activities or as a result of the sample processing but also potentially during the transport. The dissolved mollusc shells are most likely a result of high formaldehyde concentrations in the sampling buckets or as a result of the lack of a buffer.

Over the last few years there have been several changes in nomenclature but also in a number of new keys used for identification. In particular, the introduction of the San Martin (2003) and the subsequent San Martin & Worsfold (2015) paper have resulted in a number of new species as well as changes in the identification of others. Care should therefore be taken in the interpretation of the results in terms of some of the fauna present and the associated ecology.

4.4.2 Epifaunal identification

The process of identifying epifauna is a challenging task, particularly as a result of the uncertainty of the origin of the material unless it was attached to substrata (i.e. pebbles, gravel) and some material may have been brought in with currents or other physical processes. Unless the biota was attached, the epifauna were not identified.

5. REFERENCES

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APPENDIX I: INFAUNAL SAMPLE METADATA

Station ID	Date	Area	Time	Lat	Long	Depth BCD
D4_G01	17/09/2015	Arran	16:10:55	55.41145	-5.28798	-32.2
D4_G02	17/09/2015	Arran	16:18:20	55.41348	-5.29711	-28.3
D4_G03	17/09/2015	Arran	16:25:40	55.41554	-5.30438	-31.8
D4_G04	17/09/2015	Arran	16:31:48	55.42034	-5.30598	-24.7
D4_G05	17/09/2015	Arran	16:40:53	55.41958	-5.29674	-25.4
D4_G06	17/09/2015	Arran	16:50:34	55.41978	-5.29711	-25.7
D4_G07	17/09/2015	Arran	16:55:43	55.42106	-5.28629	-27.5
D4_G08	17/09/2015	Arran	17:02:13	55.42218	-5.29166	-24.9
D4_G09	17/09/2015	Arran	17:09:31	55.42521	-5.296	-23.9
D4_G10	17/09/2015	Arran	17:16:53	55.42662	-5.30557	-23.9
D4_G11	17/09/2015	Arran	17:24:36	55.4296	-5.29956	-22
D4_G12	17/09/2015	Arran	17:32:45	55.4286	-5.28671	-21.7
D6_G01	20/09/2015	Arran	11:54:04	55.42164	-5.10357	-44.9
D6_G02	20/09/2015	Arran	12:02:04	55.42692	-5.10674	-30.2
D6_G03	20/09/2015	Arran	12:14:22	55.42811	-5.09529	-42.1
D6_G04	20/09/2015	Arran	12:27:24	55.43058	-5.10135	-26.6
D6_G05	20/09/2015	Arran	12:37:47	55.43178	-5.10421	-28.7
D6_G06	20/09/2015	Arran	12:45:19	55.43227	-5.0984	-29.3
D6_G07	20/09/2015	Arran	12:54:12	55.43492	-5.0919	-38.3
D6_G08	20/09/2015	Arran	13:05:25	55.43456	-5.08669	-41.8
D6_G09	20/09/2015	Arran	13:15:33	55.43649	-5.09716	-27.6
D6_G10	20/09/2015	Arran	13:24:04	55.44039	-5.09094	-31.3
LA1_G01	28/09/2015	Loch Alsh	16:21:16	57.27355	-5.70812	-30.2
LA1_G02	28/09/2015	Loch Alsh	16:29:55	57.2738	-5.70959	-32
LA1_G03	28/09/2015	Loch Alsh	16:32:25	57.27459	-5.70936	-32.7
LA1_G04	28/09/2015	Loch Alsh	16:39:59	57.27396	-5.70729	-42.5
LA2_G03	29/09/2015	Loch Alsh	14:20:43	57.27849	-5.69981	-35.8
LA4_G01	26/09/2015	Loch Alsh	16:03:51	57.26864	-5.67663	-112.3
LA4_G02	26/09/2015	Loch Alsh	16:30:17	57.27048	-5.67753	-114.5
LA4_G03	26/09/2015	Loch Alsh	16:42:47	57.26937	-5.67187	-107.1
LA4_G04	26/09/2015	Loch Alsh	16:50:00	57.27157	-5.67123	-99.8
LA4_G05	26/09/2015	Loch Alsh	17:02:12	57.27088	-5.66667	-95.7
LA4_G06	26/09/2015	Loch Alsh	17:09:52	57.27118	-5.66244	-90.5
LA4_G07	26/09/2015	Loch Alsh	17:20:46	57.27039	-5.65714	-78
LA4_G08	26/09/2015	Loch Alsh	17:33:25	57.27341	-5.66307	-80.7
LA4_G09	27/09/2015	Loch Alsh	14:37:46	57.27359	-5.65949	-78.7
LA4_G10	27/09/2015	Loch Alsh	14:56:20	57.2736	-5.65541	-78.5
STTR04	06/12/2015	Southern Trench	00:31:15	57.66745	-1.50143	-77.9
STTR06	07/12/2015	Southern Trench	00:03:12	57.58871	-1.44252	-85.8
STTR08	05/12/2015	Southern Trench	22:39:48	57.7744	-1.59292	-74
STTR13	05/12/2015	Southern Trench	06:11:02	57.86116	-2.69682	-93
STTR14	05/12/2015	Southern Trench	08:31:25	57.85875	-2.4272	-88.4
STTR15	05/12/2015	Southern Trench	10:04:44	57.86536	-2.17967	-81
STTR16	05/12/2015	Southern Trench	05:09:51	57.88603	-2.90403	-92.6

Station ID	Date	Area	Time	Lat	Long	Depth BCD
T2_G01	20/09/2015	Arran	09:05:23	55.39216	-5.21363	-55.7
T2_G02	20/09/2015	Arran	09:15:26	55.38845	-5.20465	-55.7
T2_G03	20/09/2015	Arran	09:21:34	55.3927	-5.20486	-55.9
T2_G04	20/09/2015	Arran	09:27:12	55.39532	-5.20843	-55.9
T2_G05	20/09/2015	Arran	09:36:52	55.39402	-5.19826	-56.7
T2_G06	20/09/2015	Arran	09:43:58	55.3992	-5.20236	-55.2
T2_G07	20/09/2015	Arran	09:53:26	55.39907	-5.18956	-55.7
T2_G08	20/09/2015	Arran	09:58:51	55.40096	-5.19383	-54.6
T2_G09	20/09/2015	Arran	10:05:40	55.40275	-5.19912	-55.8
T2_G10	20/09/2015	Arran	10:14:48	55.40498	-5.19009	-54.3
T2_G11	20/09/2015	Arran	11:05:05	55.4126	-5.17379	-46.2
T2_G12	20/09/2015	Arran	11:14:33	55.41228	-5.1867	-47
T2_G13	20/09/2015	Arran	11:25:52	55.40768	-5.18544	-50
T3_G01	20/09/2015	Arran	06:52:51	55.44295	-5.38299	-46.6
T3_G02	20/09/2015	Arran	07:02:24	55.44827	-5.39111	-45.3
T3_G03	20/09/2015	Arran	07:14:14	55.44885	-5.38342	-52.9
T3_G04	20/09/2015	Arran	07:21:23	55.44646	-5.37933	-52.8
T3_G05	20/09/2015	Arran	07:29:13	55.4466	-5.37359	-52.9
T3_G06	20/09/2015	Arran	07:36:33	55.4513	-5.37871	-45.4
T3_G07	20/09/2015	Arran	07:43:50	55.45262	-5.37511	-48
T3_G08	20/09/2015	Arran	07:50:18	55.45062	-5.37026	-48.4
T3_G09	20/09/2015	Arran	07:58:13	55.45057	-5.3621	-41
T3_G10	20/09/2015	Arran	08:05:42	55.45443	-5.36999	-45.6
T4_G01	18/09/2015	Arran	16:04:00	55.4269	-5.03564	-114
T4_G02	18/09/2015	Arran	16:12:43	55.42533	-5.0416	-110.9
T4_G03	18/09/2015	Arran	16:26:27	55.42882	-5.0507	-116.3
T4_G04	18/09/2015	Arran	16:34:49	55.4306	-5.04321	-122.6
T4_G05	18/09/2015	Arran	16:51:00	55.43406	-5.02705	-106.2
T4_G06	18/09/2015	Arran	17:28:44	55.43568	-5.044	-115.4
T4_G07	20/09/2015	Arran	13:57:55	55.43508	-5.03269	-126.9
T4_G08	20/09/2015	Arran	14:39:50	55.44116	-5.02828	-121.8
T4_G09	20/09/2015	Arran	14:52:34	55.44203	-5.03572	-123.8

APPENDIX II: PARTICLE SIZE ANALYSIS RESULTS

South Arran NC MPA samples - wet and dry sieving results (stations D4 and D6):

Values by weight (g)

	Sieve Mesh Size (µm)																						
Sample	**90000**	**63000**	**45000**	**31500**	**22400**	**16000**	**11200**	**8000**	**5600**	**4000**	**2800**	**2000**	**1400**	**1000**	**710**	**500**	**355**	**250**	**180**	**125**	**90**	**63**	**<63**
D4-G01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.07	0.13	0.25	0.54	1.15	3.19	12.39	34.44	45.95	21.84	2.56	14.00
D4-G02	0.00	0.00	0.00	0.00	0.00	0.00	2.42	3.12	4.12	2.58	2.82	2.33	2.97	5.33	5.05	4.90	6.73	10.96	13.47	21.37	5.24	1.02	9.78
D4-G03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.05	0.04	0.12	0.32	0.88	2.64	10.30	29.33	45.93	28.99	2.61	16.00
D4-G04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.07	0.07	0.14	0.28	0.49	1.01	3.11	14.62	10.80	3.89	0.60	0.05	0.83
D4-G05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.10	0.12	0.27	0.50	1.33	7.60	41.23	15.14	2.72	0.44	0.03	1.48
D4-G06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.05	0.04	0.13	0.37	1.06	4.87	13.07	18.54	5.20	0.34	2.10
D4-G07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.16	0.07	0.11	0.13	0.28	0.84	2.87	11.76	26.46	24.03	3.83	0.27	2.53
D4-G08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.47	1.50	0.55	0.56	0.83	0.69	0.96	1.43	3.04	5.06	13.23	23.97	12.27	2.18	0.20	2.00
D4-G09	0.00	0.00	0.00	0.00	0.00	0.00	3.71	3.02	4.99	2.94	4.24	6.13	9.11	15.57	21.10	22.73	17.87	11.56	6.32	2.16	0.27	0.05	1.55
D4-G10	0.00	0.00	0.00	0.00	0.00	0.00	3.48	11.45	4.75	1.96	2.62	3.03	2.38	2.52	2.28	3.66	4.40	6.66	19.30	35.11	5.04	0.57	4.43
D4-G11	0.00	0.00	0.00	0.00	0.00	0.00	4.57	21.65	16.90	5.05	5.20	3.59	2.49	2.68	1.52	1.28	1.44	3.81	11.88	13.69	3.09	0.54	3.26
D4-G12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.88	4.07	3.29	4.05	5.22	4.94	6.10	5.81	5.23	5.47	9.86	35.10	43.26	6.98	1.04	6.62
D6-G01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.26	0.98	0.67	1.80	2.92	5.12	8.06	7.69	8.31	6.72	5.62	5.72	7.16	5.87	2.20	6.78
D6-G02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.97	0.75	0.99	0.78	0.74	1.06	1.28	1.76	3.54	9.98	19.34	19.12	6.35	0.96	1.98
D6-G03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.02	0.07	0.14	0.22	0.43	0.98	3.20	29.62	33.84	5.20	0.58	1.57
D6-G04B	0.00	0.00	0.00	0.00	0.00	16.31	0.00	0.00	2.10	1.40	2.51	4.45	4.96	4.66	3.19	3.37	4.35	6.82	8.07	9.18	3.85	0.75	1.37
D6-G05A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.25	0.91	0.63	0.60	0.59	1.21	2.75	5.85	10.28	15.26	16.54	27.78	19.81	3.45	4.59
D6-G06	0.00	0.00	0.00	0.00	0.00	0.00	0.86	0.00	0.67	1.39	1.62	1.99	2.48	3.72	4.05	5.47	8.31	12.78	12.76	9.40	4.11	0.93	2.46
D6-G07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.10	0.09	0.24	0.24	0.41	0.49	1.41	6.80	31.52	27.06	5.01	4.54
D6-G08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.54	0.00	0.09	0.01	0.02	0.14	0.13	0.14	0.14	0.52	3.13	34.10	28.04	3.33	3.06
D6-G09	0.00	0.00	0.00	0.00	0.00	3.48	0.00	3.19	0.00	1.43	1.80	2.89	3.93	2.94	3.77	3.76	4.87	8.80	9.54	8.05	6.28	1.94	2.86
D6-G10	0.00	0.00	0.00	0.00	0.00	0.00	2.01	1.59	3.38	4.85	7.70	6.28	4.63	3.98	3.04	3.03	2.94	3.44	6.23	17.70	31.84	12.83	19.05

South Arran NC MPA samples - wet and dry sieving results (stations T2, T3 and T4):

Values by weight (g)

	Sieve Mesh Size (µm)																					
Sample	**90000**	**63000**	**45000**	**31500**	**22400**	**16000**	**11200**	**8000**	**5600**	**4000**	**2800**	**2000**	**1400**	**1000**	**710**	**500**	**355**	**250**	**180**	**125**	**90**	**63**	**<63**
T2-G01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.01	0.65	0.73	1.63	2.05	1.85	2.07	2.93	2.64	6.74	13.32	81.69
T2-G02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.03	0.05	0.18	0.42	0.74	0.75	1.30	2.02	2.32	5.54	9.17	78.86
T2-G03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.20	0.31	0.48	0.68	1.10	1.10	1.50	2.21	3.02	7.41	10.92	45.60
T2-G04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.00	0.01	0.04	0.81	1.72	1.20	1.00	1.19	1.66	2.51	13.64	19.85	84.70
T2-G05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.19	1.80	0.35	0.32	0.04	0.24	0.61	0.51	0.52	0.59	0.73	1.83	3.38	14.19	16.53	67.79
T2-G06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.04	0.16	0.47	0.72	0.92	1.13	1.68	3.75	6.99	30.51	23.92	53.86
T2-G07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.13	0.08	0.23	0.48	0.32	0.48	0.74	1.60	4.83	15.94	48.30	15.92	37.59
T2-G08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.02	0.00	0.00	0.00	0.06	0.02	0.15	0.19	0.32	0.66	2.22	6.19	14.17	46.52	17.82	41.73
T2-G09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.04	0.29	0.34	0.49	0.80	2.34	6.44	12.74	47.36	24.95	43.27
T2-G10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.06	0.10	0.18	0.27	0.45	0.80	2.68	7.19	17.82	48.05	21.38	37.12
T2-G11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.01	0.01	0.02	0.09	0.19	0.54	1.27	4.50	13.07	39.00	31.01	5.59	13.27
T2-G12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.03	0.15	0.10	0.05	0.09	0.26	0.56	1.49	5.61	15.06	31.18	53.05	16.59	25.43
T2-G13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.44	0.11	0.11	0.35	0.84	0.99	1.30	1.92	6.23	16.69	35.74	42.24	11.18	28.79
T3-G01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.03	0.13	0.29	0.67	1.31	3.50	7.80	12.84	14.44	13.76	52.09
T3-G02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.04	0.07	0.51	0.93	0.64	1.12	1.78	1.43	3.84	12.97	91.22
T3-G03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.07	0.17	0.98	2.46	4.84	9.81	19.90	30.34	22.63	9.77	6.28	40.08
T3-G04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.33	0.49	0.90	2.56	7.25	17.25	21.90	17.50	63.00
T3-G05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.44	0.53	0.88	3.22	9.54	24.44	25.97	17.60	58.40
T3-G06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.82	0.38	0.01	0.17	0.12	0.17	0.51	1.19	3.21	7.89	20.99	41.33	29.53	6.71	3.27	23.75
T3-G07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.76	0.34	0.10	0.00	0.08	0.08	0.23	0.36	0.83	2.27	9.58	26.72	48.02	27.61	6.76	27.83
T3-G08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.73	0.00	0.05	0.04	0.16	0.98	1.46	1.98	3.94	10.58	25.09	36.89	27.37	8.50	22.94
T3-G09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.62	0.00	0.03	0.05	0.03	0.19	0.43	0.99	2.59	9.97	27.80	42.41	27.50	6.63	14.29
T3-G10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.26	0.00	0.06	0.08	0.08	0.17	0.36	0.64	1.21	2.93	10.27	26.16	41.47	32.72	10.56	26.54
T4-G01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.16	0.49	0.99	1.86	1.88	1.76	2.41	3.29	8.03	16.41	7.60	28.50
T4-G02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.42	0.00	0.09	0.15	0.12	0.23	0.42	0.78	1.40	2.63	10.16	28.86	37.48	25.71	9.99	25.09
T4-G03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.89	0.17	0.13	0.07	0.12	0.04	0.17	0.90	0.72	0.89	1.30	3.65	14.85	54.96	12.64	40.29
T4-G04	0.00	0.00	0.00	0.00	0.00	0.00	2.30	0.00	0.10	0.00	0.06	0.00	0.07	0.20	0.49	1.25	2.40	5.31	15.95	36.76	31.36	9.15	31.36
T4-G05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.16	0.22	0.57	1.21	2.75	6.41	17.47	26.91	20.22	6.47	3.50	40.55
T4-G06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.05	0.12	0.12	0.14	0.18	0.40	0.69	0.92	3.25	14.83	56.07	14.19	43.50
T4-G07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.04	0.09	0.29	0.57	1.38	1.75	3.89	8.71	16.33	20.52	11.06	50.65
T4-G08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.46	0.47	0.38	0.84	0.82	0.94	0.88	0.96	1.20	1.81	5.64	6.09	86.63
T4-G09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.80	0.00	0.08	0.09	0.11	0.09	0.26	0.38	0.73	1.71	4.92	10.21	21.83	47.25	19.17	37.66

Loch Alsh (part of Lochs Duich, Long and Alsh SAC / NC MPA) samples - wet and dry sieving results:

Values by weight (g)

	Sieve Mesh Size (µm)																						
Sample	**90000**	**63000**	**45000**	**31500**	**22400**	**16000**	**11200**	**8000**	**5600**	**4000**	**2800**	**2000**	**1400**	**1000**	**710**	**500**	**355**	**250**	**180**	**125**	**90**	**63**	**<63**
LA1-G02	0.00	0.00	0.00	0.00	0.00	4.44	1.69	2.97	3.11	2.15	1.67	1.84	2.22	5.11	4.40	4.65	4.48	4.97	6.28	6.32	3.24	1.88	12.84
LA1-G03	0.00	0.00	0.00	0.00	0.00	7.79	0.59	4.83	7.43	3.62	2.84	2.17	2.04	3.66	2.60	2.82	2.82	3.18	3.78	3.88	2.28	1.38	12.57
LA1-G04	0.00	0.00	0.00	0.00	0.00	4.15	4.08	5.06	5.39	3.87	3.06	2.43	2.60	3.18	2.12	1.88	1.90	2.99	3.90	3.23	1.78	1.17	5.74
LA1-GO1	0.00	0.00	0.00	0.00	0.00	4.23	1.34	4.03	5.59	7.17	7.21	4.51	3.96	5.79	4.61	4.57	4.29	4.81	4.93	4.24	2.12	1.29	9.36
LA2-G03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.19	1.19	0.97	2.49	4.62	7.56	13.08	13.46	10.33	6.92	4.86	3.09	1.76	0.88	0.63	7.18
LA4-G01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67	0.12	0.25	0.48	0.75	1.49	1.42	1.94	2.59	4.64	12.01	25.59	25.71	13.65	27.55
LA4-G01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.03	0.00	0.18	0.12	0.49	0.56	1.24	1.41	2.15	3.61	6.20	13.51	22.31	24.62	12.75	31.50
LA4-G03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.11	0.26	0.49	0.65	0.87	1.12	1.57	1.91	2.76	4.52	6.92	9.72	9.21	26.10
LA4-G04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.25	0.36	0.52	0.56	1.04	1.96	2.81	3.51	4.27	5.18	6.74	48.29
LA4-G05	0.00	0.00	0.00	0.00	0.00	0.00	1.10	0.31	0.00	0.54	0.99	0.65	1.00	1.23	1.28	2.02	1.90	3.78	4.32	5.34	6.03	7.63	49.35
LA4-G06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.16	0.49	0.51	1.10	1.13	2.06	3.11	5.32	6.28	7.66	8.38	10.10	55.74
LA4-G07	0.00	0.00	0.00	0.00	0.00	0.95	1.52	0.27	0.53	1.09	1.28	1.35	1.02	2.17	2.02	2.81	3.85	5.19	7.40	12.05	16.45	13.15	39.04
LA4-G08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.03	0.05	0.41	1.43	1.68	3.09	3.58	4.73	4.85	5.03	5.38	6.12	30.04
LA4-G09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.02	0.14	0.15	1.19	2.86	3.72	4.04	4.82	6.08	6.92	10.11	8.47	41.46
LA4-G10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.39	0.24	0.38	0.70	1.55	2.08	3.53	4.77	7.15	9.99	12.36	12.55	38.20

Southern Trench MPA proposal samples - wet and dry sieving results:

Values by weight (g)

	Sieve Mesh Size (µm)																					
Sample	**90000**	**63000**	**45000**	**31500**	**22400**	**16000**	**11200**	**8000**	**5600**	**4000**	**2800**	**2000**	**1400**	**1000**	**710**	**500**	**355**	**250**	**180**	**125**	**90**	**63**	**<63**
STTR04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.89	0.00	0.29	0.85	0.59	0.62	0.63	0.53	0.70	2.47	15.92	20.81	3.04	0.76	0.38	1.47
STTR06	0.00	0.00	0.00	0.00	0.00	0.00	4.48	0.00	0.00	0.00	0.67	0.35	0.22	0.51	0.51	0.76	3.05	18.47	12.04	2.59	0.63	0.39	1.42
STTR08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.98	0.66	0.57	1.23	1.56	1.45	1.52	1.97	3.90	8.53	20.04	6.01	0.68	0.26	0.15	1.05
STTR13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.05	7.85	13.40	14.79	61.91
STTR14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	3.33	9.20	14.98	18.74	16.90	9.98	26.84
STTR15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	3.76	9.71	14.85	16.13	13.28	8.39	4.24	29.38
STTR16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	4.40	10.77	14.20	70.63

South Arran NC MPA samples - laser diffraction results (stations D4 and D6):

Values by % volume

	Aperture size (µm)																											
Sample	**2000**	**1414**	**1000**	**707**	**500**	**354**	**250**	**177**	**125**	**88**	**63**	**44**	**31**	**22**	**16**	**11**	**8**	**6**	**4**	**3**	**2**	**1.3**	**1**	**0.7**	**0.5**	**0.35**	**0.24**	**0.17**	**0.12**
D4-G01	0.00	0.00	0.00	0.00	0.04	4.90	14.59	22.85	21.56	11.35	2.47	0.07	0.68	1.96	2.48	3.33	3.10	2.86	3.67	1.99	1.64	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D4-G02	0.00	0.00	0.00	0.12	3.14	7.32	10.15	10.37	8.23	5.24	3.31	3.49	4.00	4.34	4.42	6.08	6.06	5.90	7.92	4.50	3.95	1.37	0.06	0.00	0.00	0.00	0.00	0.00	0.00
D4-G03	0.00	0.00	0.00	0.00	0.00	3.27	12.93	22.05	22.17	12.41	3.00	0.14	0.54	2.08	2.93	4.04	3.69	3.29	3.93	1.92	1.35	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D4-G04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.09	0.47	1.54	3.45	5.52	7.81	9.64	14.09	13.40	12.10	14.96	7.96	6.67	2.18	0.09	0.00	0.00	0.00	0.00	0.00	0.00
D4-G05	0.00	0.00	0.00	0.15	7.26	30.39	38.35	16.09	1.51	0.00	0.00	0.45	0.85	0.55	0.35	0.61	0.79	0.81	1.00	0.49	0.35	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D4-G06	0.00	0.00	0.00	0.00	0.04	5.70	19.23	29.26	23.31	8.58	0.76	0.00	0.26	1.43	1.71	2.02	1.76	1.63	2.11	1.13	0.90	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D4-G07	0.00	0.00	0.00	0.00	0.54	8.05	23.39	30.75	19.67	4.74	0.09	0.00	0.54	1.49	1.54	1.82	1.67	1.57	2.03	1.08	0.85	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D4-G08	0.00	0.00	0.00	0.00	2.56	12.93	23.78	24.59	14.83	4.17	0.12	0.03	1.07	1.75	1.84	2.44	2.35	2.19	2.71	1.38	1.06	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D4-G09	0.00	0.00	0.06	5.48	17.09	25.07	23.49	13.98	4.82	0.49	0.00	0.47	0.88	0.84	0.78	1.16	1.23	1.19	1.49	0.77	0.60	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D4-G10	0.00	0.04	0.08	0.21	1.51	7.73	18.96	25.87	20.08	7.62	0.68	0.00	0.42	1.63	1.94	2.48	2.41	2.36	3.07	1.57	1.12	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D4-G11	0.00	0.00	0.01	0.44	3.74	11.19	19.17	21.67	16.21	7.21	1.39	0.18	1.00	1.71	1.86	2.47	2.45	2.39	3.20	1.78	1.49	0.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D4-G12	0.00	0.08	0.30	1.07	4.19	12.07	22.46	25.61	17.47	5.81	0.29	0.00	0.50	1.34	1.29	1.42	1.29	1.26	1.70	0.94	0.76	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D6-G01	0.00	0.00	0.29	3.93	8.12	10.61	11.39	11.15	10.25	7.90	4.53	2.52	1.78	2.19	2.76	4.16	4.09	3.81	4.87	2.66	2.25	0.73	0.03	0.00	0.00	0.00	0.00	0.00	0.00
D6-G02	0.00	0.00	0.12	1.27	5.87	14.32	22.68	23.22	15.30	5.57	0.61	0.01	0.64	1.28	1.31	1.56	1.42	1.33	1.72	0.92	0.73	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D6-G03	0.00	0.00	0.00	0.00	0.61	7.96	21.64	29.54	21.33	6.89	0.42	0.00	0.52	1.59	1.60	1.68	1.38	1.28	1.70	0.94	0.77	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D6-G04B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.22	2.50	5.81	9.80	11.29	11.09	9.99	11.64	9.72	8.20	9.61	4.88	3.91	1.24	0.10	0.00	0.00	0.00	0.00	0.00	0.00
D6-G05A	0.00	0.00	0.00	1.08	5.36	10.47	15.96	19.43	18.25	11.78	4.20	0.46	0.14	1.11	1.76	2.32	1.95	1.67	2.02	1.04	0.81	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D6-G06	0.00	0.00	0.00	2.28	9.58	16.49	20.41	18.93	13.58	7.11	2.48	0.90	0.87	1.14	1.11	1.21	0.95	0.81	1.01	0.55	0.47	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D6-G07	0.00	0.00	0.00	0.00	0.00	0.69	9.27	23.37	29.36	18.72	4.91	0.23	0.01	1.04	2.00	2.56	1.99	1.63	1.99	1.09	0.93	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D6-G08	0.00	0.00	0.00	0.00	0.00	0.05	5.02	23.24	36.31	19.62	2.88	0.02	0.01	1.14	2.04	2.43	1.81	1.48	1.86	1.04	0.88	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D6-G09	0.00	0.00	0.65	4.10	8.76	12.87	15.08	14.45	11.71	7.58	3.63	1.80	1.40	1.77	2.05	2.78	2.57	2.35	3.00	1.65	1.40	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00
D6-G10	0.00	0.00	0.01	0.35	2.11	4.30	7.79	13.01	17.29	16.35	9.99	4.53	1.56	1.56	2.23	3.38	3.21	2.99	3.98	2.33	2.15	0.83	0.05	0.00	0.00	0.00	0.00	0.00	0.00

South Arran NC MPA samples - laser diffraction results (stations T2, T3 and T4):

Values by % volume

	Aperture size (µm)																											
Sample	**2000**	**1414**	**1000**	**707**	**500**	**354**	**250**	**177**	**125**	**88**	**63**	**44**	**31**	**22**	**16**	**11**	**8**	**6**	**4**	**3**	**2**	**1.3**	**1**	**0.7**	**0.5**	**0.35**	**0.24**	**0.17**	**0.12**
T2-G01	0.00	0.00	0.00	0.00	0.09	0.20	0.22	0.55	1.96	4.54	6.87	9.21	9.29	8.47	7.54	9.43	8.86	8.35	10.93	6.12	5.35	1.92	0.09	0.00	0.00	0.00	0.00	0.00	0.00
T2-G02	0.00	0.00	0.00	0.00	0.10	0.50	0.33	0.38	1.64	4.39	7.04	9.59	9.62	8.66	7.68	9.71	9.22	8.64	10.96	5.75	4.49	1.25	0.04	0.00	0.00	0.00	0.00	0.00	0.00
T2-G03	0.00	0.00	0.00	0.00	0.24	0.91	0.91	2.17	5.71	9.79	11.15	11.25	8.80	6.75	5.61	6.98	6.55	6.11	7.83	4.29	3.65	1.24	0.06	0.00	0.00	0.00	0.00	0.00	0.00
T2-G04	0.00	0.00	0.00	0.00	0.09	0.57	0.49	1.27	4.04	7.86	9.73	10.50	8.77	7.13	6.19	8.00	7.80	7.45	9.63	5.14	4.09	1.19	0.05	0.00	0.00	0.00	0.00	0.00	0.00
T2-G05	0.00	0.00	0.00	0.00	0.03	0.40	0.46	1.77	5.60	10.06	11.28	10.83	8.14	6.29	5.49	7.24	7.11	6.78	8.75	4.71	3.84	1.18	0.05	0.00	0.00	0.00	0.00	0.00	0.00
T2-G07	0.00	0.00	0.00	0.00	0.08	0.44	3.05	9.66	16.49	18.06	12.49	6.90	3.29	2.84	3.21	4.43	4.11	3.79	4.97	2.83	2.50	0.83	0.03	0.00	0.00	0.00	0.00	0.00	0.00
T2-G08	0.00	0.00	0.00	0.00	0.00	0.00	0.49	4.85	9.67	12.27	10.63	8.54	6.09	5.12	4.90	6.63	6.47	6.19	8.18	4.60	3.99	1.34	0.06	0.00	0.00	0.00	0.00	0.00	0.00
T2-G09	0.00	0.00	0.00	0.05	0.13	0.15	1.70	6.49	12.57	15.79	12.84	8.65	4.72	3.60	3.80	5.47	5.27	4.87	6.25	3.46	3.03	1.09	0.06	0.00	0.00	0.00	0.00	0.00	0.00
T2-G10	0.00	0.00	0.00	0.00	0.00	0.04	4.02	12.35	19.72	20.33	12.95	5.90	1.84	1.69	2.46	3.67	3.35	3.01	3.86	2.18	1.94	0.67	0.03	0.00	0.00	0.00	0.00	0.00	0.00
T2-G11	0.00	0.00	0.00	0.00	0.00	2.36	9.91	17.15	19.69	14.61	6.23	1.66	1.03	2.23	3.00	4.18	3.90	3.64	4.76	2.67	2.29	0.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T2-G12	0.00	0.00	0.00	0.00	0.00	1.67	9.71	17.98	22.58	18.96	9.55	2.85	0.43	1.12	1.93	2.72	2.37	2.09	2.70	1.54	1.36	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T2-G13	0.00	0.00	0.00	0.00	0.00	0.00	2.91	9.84	14.98	14.40	8.82	4.60	2.75	3.20	3.93	5.77	5.73	5.55	7.54	4.40	4.00	1.49	0.08	0.00	0.00	0.00	0.00	0.00	0.00
T3-G01	0.00	0.00	0.00	0.00	0.00	0.00	3.26	9.44	12.86	13.72	11.72	9.57	6.16	4.11	3.43	4.63	4.58	4.31	5.54	3.03	2.62	0.96	0.06	0.00	0.00	0.00	0.00	0.00	0.00
T3-G02	0.00	0.00	0.00	0.00	0.09	0.23	0.18	0.52	2.68	6.80	10.08	12.08	10.08	7.45	5.91	7.55	7.52	7.29	9.64	5.40	4.70	1.70	0.10	0.00	0.00	0.00	0.00	0.00	0.00
T3-G03	0.00	0.00	0.00	0.00	2.06	7.37	11.22	11.54	9.30	6.79	5.41	5.69	5.18	4.34	3.68	4.71	4.67	4.56	6.07	3.41	2.94	1.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00
T3-G04	0.00	0.00	0.00	0.00	0.32	1.74	3.34	5.99	9.39	11.69	10.98	9.63	6.67	4.76	4.06	5.48	5.45	5.22	6.85	3.83	3.35	1.19	0.06	0.00	0.00	0.00	0.00	0.00	0.00
T3-G05	0.00	0.00	0.00	0.00	0.00	0.21	4.27	9.02	13.33	14.67	11.83	8.82	5.32	3.61	3.18	4.40	4.41	4.24	5.60	3.16	2.80	1.05	0.06	0.00	0.00	0.00	0.00	0.00	0.00
T3-G06	0.00	0.00	0.00	0.00	0.62	6.85	13.85	16.47	13.10	7.07	3.03	2.48	2.91	3.19	3.25	4.58	4.67	4.57	6.07	3.38	2.90	0.97	0.04	0.00	0.00	0.00	0.00	0.00	0.00
T3-G07	0.00	0.00	0.00	0.00	0.01	3.94	12.26	18.54	18.80	12.93	5.94	2.81	2.14	2.45	2.55	3.32	3.12	2.93	3.82	2.11	1.78	0.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T3-G08	0.00	0.00	0.00	0.00	0.95	7.32	14.31	18.35	17.32	11.75	5.49	2.56	1.81	2.05	2.20	2.96	2.83	2.67	3.48	1.91	1.59	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T3-G09	0.00	0.00	0.00	0.00	0.02	4.14	11.96	18.21	18.86	13.08	5.62	1.97	1.36	2.08	2.60	3.75	3.65	3.42	4.39	2.37	1.95	0.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00
T3-G10	0.00	0.00	0.00	0.00	0.00	0.31	5.39	11.25	15.31	14.49	9.66	6.10	3.77	3.20	3.25	4.60	4.62	4.49	6.01	3.42	3.01	1.06	0.05	0.00	0.00	0.00	0.00	0.00	0.00
T4-G01	0.00	0.00	0.00	0.00	0.00	0.00	1.86	6.20	10.31	11.51	8.72	6.26	4.73	4.91	5.41	7.52	7.12	6.56	8.43	4.68	4.12	1.53	0.14	0.00	0.00	0.00	0.00	0.00	0.00
T4-G02	0.00	0.00	0.00	0.00	0.00	0.70	4.90	9.27	11.70	10.41	6.65	4.52	3.81	4.38	5.01	7.14	6.90	6.43	8.25	4.55	3.94	1.39	0.07	0.00	0.00	0.00	0.00	0.00	0.00
T4-G03	0.00	0.00	0.00	0.00	0.00	0.00	1.44	8.66	15.49	16.88	11.21	5.67	2.63	2.93	3.89	5.76	5.46	5.04	6.56	3.73	3.35	1.25	0.07	0.00	0.00	0.00	0.00	0.00	0.00
T4-G04	0.00	0.00	0.00	0.00	0.00	0.02	2.75	7.90	10.53	9.28	5.79	4.11	4.07	5.10	5.88	8.29	7.94	7.38	9.48	5.23	4.53	1.62	0.08	0.00	0.00	0.00	0.00	0.00	0.00
T4-G05	0.00	0.00	0.00	0.00	0.82	5.50	9.00	9.31	7.13	4.41	3.02	3.72	4.66	5.38	5.68	7.74	7.39	6.87	8.80	4.83	4.18	1.49	0.08	0.00	0.00	0.00	0.00	0.00	0.00
T4-G06	0.00	0.00	0.00	0.00	0.00	0.00	1.16	7.75	13.33	14.06	9.50	5.46	3.31	3.72	4.64	6.87	6.63	6.14	7.88	4.36	3.79	1.34	0.07	0.00	0.00	0.00	0.00	0.00	0.00
T4-G07	0.00	0.00	0.00	0.00	0.13	1.22	2.85	4.79	6.42	6.53	5.24	5.02	5.20	5.91	6.53	9.32	9.19	8.67	11.04	5.84	4.66	1.38	0.07	0.00	0.00	0.00	0.00	0.00	0.00
T4-G08	0.00	0.00	0.00	0.00	0.10	0.52	0.49	0.93	2.31	4.04	5.02	6.21	6.65	7.17	7.62	10.61	10.27	9.63	12.53	7.03	6.26	2.37	0.22	0.00	0.00	0.00	0.00	0.00	0.00
T4-G09	0.00	0.00	0.00	0.00	0.15	1.56	8.04	15.51	21.08	19.18	10.52	3.63	0.74	1.32	2.22	3.21	2.82	2.50	3.24	1.87	1.71	0.64	0.03	0.00	0.00	0.00	0.00	0.00	0.00
T6-G06	0.00	0.00	0.00	0.00	0.00	0.00	0.12	4.11	10.02	14.12	12.95	10.10	6.21	4.49	4.20	5.80	5.70	5.46	7.29	4.19	3.78	1.40	0.07	0.00	0.00	0.00	0.00	0.00	0.00

Loch Alsh (part of Lochs Duich, Long and Alsh SAC / NC MPA) samples - laser diffraction results:

Values by % volume

	Aperture size (µm)																											
Sample	**2000**	**1414**	**1000**	**707**	**500**	**354**	**250**	**177**	**125**	**88**	**63**	**44**	**31**	**22**	**16**	**11**	**8**	**6**	**4**	**3**	**2**	**1.3**	**1**	**0.7**	**0.5**	**0.35**	**0.24**	**0.17**	**0.12**
LA1-G02	0.00	0.00	0.00	0.12	1.97	3.93	4.46	4.25	3.92	3.61	3.58	4.68	5.56	6.26	6.64	9.24	9.04	8.57	11.14	6.12	5.16	1.68	0.07	0.00	0.00	0.00	0.00	0.00	0.00
LA1-G03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.56	3.95	8.41	11.48	12.46	11.41	12.66	9.98	8.23	9.73	5.12	4.33	1.51	0.16	0.00	0.00	0.00	0.00	0.00	0.00
LA1-G04	0.00	0.00	0.00	0.00	0.00	0.35	2.63	5.22	5.87	5.03	3.95	4.21	4.84	5.89	6.77	9.76	9.61	9.14	12.01	6.74	5.87	2.05	0.07	0.00	0.00	0.00	0.00	0.00	0.00
LA1-GO1	0.00	0.16	0.61	1.66	3.25	4.78	6.23	7.08	6.92	5.73	4.30	4.28	4.64	5.29	5.69	7.78	7.38	6.79	8.50	4.44	3.48	0.98	0.04	0.00	0.00	0.00	0.00	0.00	0.00
LA2-G03	0.00	0.02	2.00	7.55	12.06	12.42	9.16	5.21	3.09	2.58	2.44	2.63	2.72	3.18	3.76	5.62	5.59	5.26	6.76	3.70	3.15	1.06	0.05	0.00	0.00	0.00	0.00	0.00	0.00
LA4-G01	0.00	0.00	0.00	0.07	1.19	3.50	6.24	9.27	11.32	10.65	7.50	5.44	4.30	4.46	4.77	6.40	5.88	5.29	6.57	3.49	2.85	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00
LA4-G01	0.00	0.00	0.00	0.00	0.16	2.66	5.95	9.45	12.00	11.64	8.29	5.75	4.10	4.13	4.56	6.28	5.81	5.23	6.53	3.52	2.97	0.95	0.03	0.00	0.00	0.00	0.00	0.00	0.00
LA4-G03	0.00	0.00	0.00	0.13	0.91	1.86	2.83	4.94	8.09	10.13	9.07	7.66	5.91	5.51	5.67	7.66	7.10	6.39	7.86	4.09	3.24	0.92	0.03	0.00	0.00	0.00	0.00	0.00	0.00
LA4-G04	0.00	0.00	0.00	0.00	0.41	1.39	2.60	4.30	6.51	8.26	8.18	8.12	7.11	6.62	6.38	8.27	7.59	6.84	8.46	4.42	3.52	0.99	0.03	0.00	0.00	0.00	0.00	0.00	0.00
LA4-G05	0.00	0.00	0.00	0.00	0.31	1.08	2.05	3.47	5.34	7.00	7.37	7.94	7.45	7.17	6.99	9.05	8.23	7.35	9.08	4.82	3.99	1.24	0.04	0.00	0.00	0.00	0.00	0.00	0.00
LA4-G06	0.00	0.00	0.00	0.16	1.06	1.92	2.37	3.51	5.82	8.02	8.17	8.07	7.05	6.69	6.59	8.57	7.78	6.93	8.45	4.37	3.45	0.98	0.03	0.00	0.00	0.00	0.00	0.00	0.00
LA4-G07	0.00	0.00	0.00	0.00	0.00	0.00	1.14	5.24	7.73	7.92	6.45	5.77	5.31	5.77	6.47	9.40	9.27	8.64	10.70	5.38	3.90	0.91	0.02	0.00	0.00	0.00	0.00	0.00	0.00
LA4-G08	0.00	0.00	0.00	0.03	0.78	2.07	3.26	4.97	7.39	9.20	8.73	8.13	6.73	6.17	6.01	7.82	7.11	6.31	7.64	3.88	2.97	0.78	0.02	0.00	0.00	0.00	0.00	0.00	0.00
LA4-G09	0.00	0.00	0.00	0.04	0.90	2.02	2.93	4.50	7.06	9.22	8.97	8.32	6.74	6.11	6.00	7.92	7.25	6.43	7.74	3.94	3.05	0.84	0.03	0.00	0.00	0.00	0.00	0.00	0.00
LA4-G10	0.00	0.00	0.00	0.07	1.64	3.47	4.84	6.54	8.75	10.03	8.86	7.60	5.82	5.16	5.04	6.60	6.01	5.36	6.64	3.56	3.00	0.98	0.04	0.00	0.00	0.00	0.00	0.00	0.00

Southern Trench MPA proposal samples - laser diffraction results:

Values by % volume

	Aperture size (µm)																											
Sample	**2000**	**1414**	**1000**	**707**	**500**	**354**	**250**	**177**	**125**	**88**	**63**	**44**	**31**	**22**	**16**	**11**	**8**	**6**	**4**	**3**	**2**	**1.3**	**1**	**0.7**	**0.5**	**0.35**	**0.24**	**0.17**	**0.12**
STTR04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	1.96	4.69	7.82	9.54	10.58	10.77	13.47	11.32	9.29	10.41	5.04	3.86	1.14	0.07	0.00	0.00	0.00	0.00	0.00	0.00
STTR06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	2.51	5.90	9.51	10.61	10.67	10.20	12.44	10.44	8.62	9.72	4.70	3.55	1.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00
STTR08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	1.96	4.51	7.69	9.70	10.88	10.91	13.27	10.95	9.01	10.32	5.18	4.13	1.30	0.16	0.00	0.00	0.00	0.00	0.00	0.00
STTR13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.05	7.85	13.40	14.79	13.53	8.98	6.12	5.23	6.73	5.92	4.91	5.42	2.56	1.91	0.57	0.03	0.00	0.00	0.00	0.00	0.00	0.00
STTR14	0.00	0.00	0.00	0.00	0.02	3.33	9.20	14.98	18.74	16.90	9.98	4.43	1.76	2.22	3.16	4.35	3.45	2.57	2.60	1.17	0.88	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00
STTR15	0.00	0.00	0.00	0.27	3.76	9.71	14.85	16.13	13.28	8.39	4.24	2.70	2.39	2.81	3.18	4.34	3.85	3.23	3.61	1.71	1.25	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00
STTR16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	4.40	10.77	14.20	14.87	11.06	7.92	6.41	7.65	6.46	5.27	5.75	2.67	1.97	0.57	0.03	0.00	0.00	0.00	0.00	0.00	0.00

APPENDIX III: SOUTH ARRAN NC MPA INFAUNAL ANALYSIS ABUNDANCE DATA

NB 'Dam' = damaged' 'Juv.' = Juvenile; P = Present but not enumerated

Station D4

Taxon	Qualifier	D4_G01	D4_G02	D4_G03	D4_G04	D4_G05	D4_G06	D4_G07	D4_G08	D4_G09	D4_G10	D4_G11	D4_G12
Sycon ciliatum			1										1
Actiniaria						1						2	
Edwardsia		7	1	5	3	1	1		3		4	4	5
Turbellaria													
Nemertea		1		1	3	1							
Cerebratulus					1		1					1	
Sipuncula						1							1
Golfingia (Golfingia) elongata				1								1	
Phascolion (Phascolion) strombus									1				
Aphrodita aculeata								1					
Polynoidae	Dam.	1	1		1					1	1		
Gattyana cirrhosa			1									1	
Harmothoe		1			1		1		1		2	2	
Malmgrenia arenicolae										1			
Malmgrenia mcintoshi													
Lepidonotus squamatus			1										
Pholoe	Dam.											1	1
Pholoe assimilis			1										
Pholoe baltica		1	3	1	1						1	1	
Pholoe inornata											1	1	1
Sthenelais	Dam./Juv.												
Sthenelais limicola				1		3		3	4				
Phyllodocidae	Juv.												
Hypereteone foliosa									1				
Phyllodoce mucosa													
Phyllodoce rosea				1									
Eulalia													1
Eulalia mustela										2			
Eulalia ornata											1		

Taxon	Qualifier	D4_G01	D4_G02	D4_G03	D4_G04	D4_G05	D4_G06	D4_G07	D4_G08	D4_G09	D4_G10	D4_G11	D4_G12
Eulalia viridis													1
Eumida													
Eumida bahusiensis													
Glyceridae	Dam./Juv.				1								
Glycera	Dam./Juv.		2		1					4	2	1	1
Glycera alba			1										
Glycera celtica										1			1
Glycera lapidum			2		1	1				6			1
Glycera unicornis			1										2
Glycinde nordmanni			1										
Goniada maculata		1	1									1	2
Hesionidae	Dam.											1	
Psamathe fusca										7			
Nereimyra punctata			1								1	5	6
Syllinae													
Syllis garciai													
Syllis parapari						1							
Exogone verugera													
Aglaophamus agilis										3			
Nephtys	Dam.	1	1	1				2	2		1	1	1
Nephtys cirrosa			1				1						
Nephtys hombergii				2	1		2		3		1		1
Nephtys kersivalensis		4			1		2	2	2		6	2	1
Aponuphis bilineata						6				1		1	3
Nothria conchylega													
Eunice pennata											1		
Lysidice unicornis										2			
Lumbrineridae	Dam./Juv.		4	1	2	1			1		2	2	4
Lumbrineris	Juv.			2					2				
Lumbrineris cingulata		1	18	1		1			1		3	7	7
Orbiniidae	Dam./Juv.												
Orbinia sertulata												1	
Scoloplos (Scoloplos) armiger						3		1	4		1	1	4
Paradoneis lyra													
SPIONIDAE										1	1		
Poecilochaetus serpens		1				1					1		
Aonides oxycephala			4								1	2	3
Aonides paucibranchiata						1						1	
Laonice										1	2		
Laonice bahusiensis			1	1						4			

Taxon	Qualifier	D4_G01	D4_G02	D4_G03	D4_G04	D4_G05	D4_G06	D4_G07	D4_G08	D4_G09	D4_G10	D4_G11	D4_G12
Prionospio cirrifera				1			1				1		1
Polydora	Juv.									1			
Polydora ciliata													
Pseudopolydora pulchra									1				
Scolelepis (Scolelepis) foliosa						1							
Spio											1		
Paraspio decorata		1			1	1		1			1		
Spiophanes bombyx		1											
Spiophanes kroyeri		5	5		2	1	1		3		2	1	
Magelona	Dam.			2					1		1		1
Magelona alleni		1		1							1	1	1
Cirratulidae												1	1
Chaetozone zetlandica			2	2									
Chaetozone gibber			1									1	
Chaetozone setosa		1	3	3	1		2		1				1
Cirratulus									1				
Monticellina dorsobranchialis			2										1
Diplocirrus glaucus			1	2	1	1	1	2	1		1		1
Flabelligera affinis													
Capitellidae										1			
Dasybranchus		1	1										
Mediomastus fragilis			3						1			1	
Notomastus				1						5			
Maldanidae	Dam.			2									
Clymenella cincta		1										1	
Clymenura													
Euclymene				1								2	
Euclymene oerstedi													
Praxillella affinis												2	
Praxillella praetermissa		4		2									
Ophelina acuminata													
Oweniidae		1		5				2			1		1
Galathowenia oculata			1	2			3	5	1		1		
Galathowenia fragilis								2					
Owenia fusiformis		4	2	7	2	1	15	13	9	4	9	10	17
Terebellida	Dam.		1										
Amphictene auricoma		1	3				1					2	2
Lagis koreni		1		1					1		1		
Sabellaria spinulosa			1										
Ampharetidae	Dam./Juv.		2								2		1

Taxon	Qualifier	D4_G01	D4_G02	D4_G03	D4_G04	D4_G05	D4_G06	D4_G07	D4_G08	D4_G09	D4_G10	D4_G11	D4_G12
Melinna palmata				1									
Ampharetinae	Dam./Juv.			1					1			1	
Ampharete lindstroemi				1									
Amphicteis gunneri													
Anobothrus gracilis													
Sosane sulcata												1	2
Trichobranchidae													
Trichobranchus	Dam./Juv.		1	1									1
Trichobranchus glacialis											1	1	
Trichobranchus roseus		1	4										1
Terebellides stroemii			3						1		4	3	1
Lanice conchilega													
Pista cristata			1			1						2	
Polycirrinae	Dam.	2	1		1				1	1		2	
Lysilla loveni		1											
Sabellidae	Dam.		2										
Paradialychone filicaudata										4			
Euchone rubrocincta									1				
Pseudopotamilla reniformis			1										
Serpulidae	Dam.		1						1		3		2
Hydroides norvegica			2		1								1
Spirobranchus triqueter			1									1	
Anoplodactylus	Dam.		2										
Anoplodactylus petiolatus							1						
Deflexilodes tuberculatus													
Leucothoe lilljeborgi										2			
Urothoe elegans					1				2		2		3
Harpinia antennaria							2	2					
Lysianassidae	Dam.												
Hippomedon denticulatus					1								
Lysianassa plumosa												*3*	1
Orchomenella nana													
Scopelocheirus hopei													
Atylus vedlomensis						1				2	3	1	3
Ampelisca	Dam.			1	3		1		2	1	1	2	1
Ampelisca brevicornis					3			3		3			
Ampelisca diadema			2						1				
Ampelisca spinipes													
Ampelisca tenuicornis		3		3							5	6	3
Abludomelita obtusata													

Taxon	Qualifier	D4_G01	D4_G02	D4_G03	D4_G04	D4_G05	D4_G06	D4_G07	D4_G08	D4_G09	D4_G10	D4_G11	D4_G12
Othomaera othonis													
Photis longicaudata									1		5	6	3
Pariambus typicus													
Pseudoprotella phasma			3										
Gnathiidae									5				
Astacilla dilatata							1	1			1		
Astacilla longicornis													
Diastylis rathkei					2				1				
Processa					1								
Processa canaliculata							1					1	
Paguridae			1										
Anapagurus hyndmanni													
Galathea									1				
Pisidia longicornis				1					2				
Ebalia tuberosa			2										
Hyas			1										
Liocarcinus	Juv./Dam.									1	2	2	
Chaetoderma nitidulum		2		1	1		1						
Leptochiton asellus			1						2		3	2	3
Capulus ungaricus			1										
Euspira nitida			3										
Onchidoris													
Antalis entalis													
Nucula nitidosa				1		1			1		1	2	
Nucula nucleus			3										
Ennucula tenuis				1	1		1	2	1				
Modiolula phaseolina													
Musculus discors													
Pecten maximus			1										
Aequipecten opercularis					1								
Talochlamys pusio													
Thyasira		1					1						
Thyasira flexuosa				1			2	1	1				
Diplodonta rotundata													
Kurtiella bidentata		2		4			4						
Astarte sulcata			2										
Parvicardium scabrum													
Spisula elliptica													
Spisula solida		7		2	1		9	8	1				
Acanthocardia echinata		1	5						1				

Taxon	Qualifier	D4_G01	D4_G02	D4_G03	D4_G04	D4_G05	D4_G06	D4_G07	D4_G08	D4_G09	D4_G10	D4_G11	D4_G12
Phaxas pellucidus				2	1								1
Arcopagia crassa										1			
Moerella donacina												2	1
Gari fervensis		1		1	1			1	1				
Azorinus chamasolen													
Abra	Shell disolved												
Abra alba		1		1	1	1	5	3	4				
Abra nitida		2		1				1	1				
Abra prismatica						1		1					1
Gouldia minima												6	
Venus casina										4		1	
Clausinella fasciata					1		2	5	1	3		1	
Timoclea ovata					2	1		1	5	11	1	1	1
Dosinia lupinus		3		1			4	1	9	1	1		
Corbula gibba		1			2						1	1	
Hiatella arctica			1	1									1
Saxicavella jeffreysi		1						1					
Cochlodesma praetenue						2	2	1	2				2
Phoronis		1		3	1						1	2	2
Phoronis muelleri		2		1									
Asteroidea	Juv.												1
Asterias rubens					1								
Amphiuridae	Juv.		1			1	1		1		1		
Amphiura filiformis		46	3	45			11	7	11	1	13	2	2
Amphipholis squamata					4								
Ophiuridae	Juv.				1	2	1						
Ophiocten affinis				1	1			1		1	1		
Echinoidea	Dam./Juv.		2			2							1
Psammechinus miliaris													
Echinocyamus pusillus			1						1	4		3	4
Echinocardium cordatum		1	2	2				1					
Holothuroidea	Dam.	1											
Ascidiacea					1								
Sertulariidae					P								
Verruca stroemia	Tubes												P
Balanus balanus			P										
Balanus crenatus							P		P		P		
Copepoda	parasitic												P
Turritella communis	Shell only			P									
Ascophora												P	

Station D6

Taxon	Qualifier	D6_G01	D6_G02	D6_G03	D6_G04 B	D6_G05	D6_G06	D6_G07	D6_G08	D6_G09	D6_G10
Sycon ciliatum											
Actiniaria				1							1
Edwardsia		1	4	1	3	7	2		1	8	5
Turbellaria						1	1				
Nemertea		1				1				2	
Cerebratulus							1				
Sipuncula							1				
Golfingia (Golfingia) elongata											
Phascolion (Phascolion) strombus						1		1	1		
Aphrodita aculeata											
Polynoidae	Dam.						2			1	
Gattyana cirrhosa											
Harmothoe		1	1		1	1				1	1
Malmgrenia arenicolae		1									
Malmgrenia mcintoshi											2
Lepidonotus squamatus											
Pholoe	Dam.	1					2			2	1
Pholoe assimilis											
Pholoe baltica		6			1	1	1			3	2
Pholoe inornata		1			1		2			4	1
Sthenelais	Dam./Juv.					1		1			
Sthenelais limicola								2	1		
Phyllodocidae	Juv.						1				
Hypereteone foliosa					1						
Phyllodoce mucosa			1								
Phyllodoce rosea											
Eulalia											
Eulalia mustela											
Eulalia ornata											
Eulalia viridis											
Eumida			1								
Eumida bahusiensis					1					1	2
Glyceridae	Dam./Juv.										
Glycera	Dam./Juv.	2			1		1			1	1

Taxon	Qualifier	D6_G01	D6_G02	D6_G03	D6_G04 B	D6_G05	D6_G06	D6_G07	D6_G08	D6_G09	D6_G10
Glycera alba											1
Glycera celtica		1			1	2	1				
Glycera lapidum		3	1		3		5			5	1
Glycera unicornis					1					1	1
Glycinde nordmanni										1	1
Goniada maculata					1		3			3	2
Hesionidae	Dam.						1				
Psamathe fusca											
Nereimyra punctata							4			2	6
Syllinae											1
Syllis garciai		1								2	
Syllis parapari											
Exogone verugera					1		1			1	
Aglaophamus agilis					1						
Nephtys	Dam.			1		3		4	3		
Nephtys cirrosa									1		
Nephtys hombergii			2			4					1
Nephtys kersivalensis			1	2		5		5	1		
Aponuphis bilineata		4			4	1	4				2
Nothria conchylega		1									
Eunice pennata											
Lysidice unicornis										2	2
Lumbrineridae	Dam./Juv.	5		1	2	1	5			4	4
Lumbrineris	Juv.	3	1		3		5			3	6
Lumbrineris cingulata		7	2		4	1	4		1	5	4
Orbiniidae	Dam./Juv.						2				
Orbinia sertulata		1									
Scoloplos (Scoloplos) armiger			2		3		2				
Paradoneis lyra						1					
SPIONIDAE			1	1					1		
Poecilochaetus serpens											
Aonides oxycephala					1		2			17	3
Aonides paucibranchiata											
Laonice		1								1	2
Laonice bahusiensis		4			2			1		4	
Prionospio cirrifera					2	1		3		2	
Polydora	Juv.	1									
Polydora ciliata										1	
Pseudopolydora pulchra											
Scolelepis (Scolelepis) foliosa											

Taxon	Qualifier	D6_G01	D6_G02	D6_G03	D6_G04 B	D6_G05	D6_G06	D6_G07	D6_G08	D6_G09	D6_G10
Spio						1					
Paraspio decorata						1				2	
Spiophanes bombyx											
Spiophanes kroyeri		3	2	3		5	3	1	5	2	2
Magelona	Dam.										
Magelona alleni		1									3
Cirratulidae										1	1
Chaetozone zetlandica		1					5	1			
Chaetozone gibber		1	1	1			1			6	
Chaetozone setosa			1		1	3	2	3	1		
Cirratulus											
Monticellina dorsobranchialis		1									
Diplocirrus glaucus				1		1		1	2	5	
Flabelligera affinis								1			
Capitellidae						1					
Dasybranchus											
Mediomastus fragilis					1					1	
Notomastus		1									
Maldanidae	Dam.		1					1			
Clymenella cincta											
Clymenura			1					1			
Euclymene				1							
Euclymene oerstedi									1	1	
Praxillella affinis										1	
Praxillella praetermissa									1		
Ophelina acuminata		1									
Oweniidae				1		3	1	4	2	3	1
Galathowenia oculata		2	10		2	4	1	10	3	5	2
Galathowenia fragilis						1		1			
Owenia fusiformis		19	32	4	17	88	19	14	22	41	36
Terebellida	Dam.										1
Amphictene auricoma		6				1	3			3	6
Lagis koreni								1			
Sabellaria spinulosa											
Ampharetidae	Dam./Juv.									1	
Melinna palmata		2									
Ampharetinae	Dam./Juv.	1			2	2	4	1			1
Ampharete lindstroemi									1		
Amphicteis gunneri											2
Anobothrus gracilis		2				1					1

Taxon	Qualifier	D6_G01	D6_G02	D6_G03	D6_G04 B	D6_G05	D6_G06	D6_G07	D6_G08	D6_G09	D6_G10
Sosane sulcata		1			3		3			10	4
Trichobranchidae					1						
Trichobranchus	Dam./Juv.						1			1	
Trichobranchus glacialis											
Trichobranchus roseus											2
Terebellides stroemii							7			2	3
Lanice conchilega				1		1					
Pista cristata			1								
Polycirrinae	Dam.			1			3				
Lysilla loveni											
Sabellidae	Dam.	1				1					
Paradialychone filicaudata					1	1		1			
Euchone rubrocincta					2					3	
Pseudopotamilla reniformis											
Serpulidae	Dam.	2					2		1		
Hydroides norvegica		2		1		1		1	1		1
Spirobranchus triqueter					1		1				2
Anoplodactylus	Dam.										
Anoplodactylus petiolatus			1			1					
Deflexilodes tuberculatus			1	1							
Leucothoe lilljeborgi											
Urothoe elegans			1								
Harpinia antennaria											
Lysianassidae	Dam.				1						
Hippomedon denticulatus					1						
Lysianassa plumosa										1	
Orchomenella nana										*2*	
Scopelocheirus hopei		*2*									
Atylus vedlomensis		28	3		5	3	3	1			4
Ampelisca	Dam.	2	2	1	1	1	4				3
Ampelisca brevicornis		2	1	2		4			2	1	1
Ampelisca diadema											
Ampelisca spinipes					2						3
Ampelisca tenuicornis		1			3	1	12		1	1	2
Abludomelita obtusata					1	4	3			1	
Othomaera othonis		2									4
Photis longicaudata		1	5		10	1	16	6	2	8	1
Pariambus typicus			1		1						
Pseudoprotella phasma											
Gnathiidae											

Taxon	Qualifier	D6_G01	D6_G02	D6_G03	D6_G04 B	D6_G05	D6_G06	D6_G07	D6_G08	D6_G09	D6_G10
Astacilla dilatata											
Astacilla longicornis		4									
Diastylis rathkei											1
Processa											
Processa canaliculata											
Paguridae											
Anapagurus hyndmanni								1			
Galathea							2				
Pisidia longicornis											
Ebalia tuberosa										1	
Hyas											
Liocarcinus	Juv./Dam.		1			1	1			2	
Chaetoderma nitidulum		1	1			1		1	1	3	4
Leptochiton asellus		2					5			1	1
Capulus ungaricus											
Euspira nitida		1	1				1				
Onchidoris		2	2		1						
Antalis entalis		1		5	1	1		3			
Nucula nitidosa			2	2				1			
Nucula nucleus											
Ennucula tenuis						2	2	1			1
Modiolula phaseolina		2			1	1					
Musculus discors							1				
Pecten maximus											
Aequipecten opercularis						1	1				
Talochlamys pusio		1					1				
Thyasira								2			
Thyasira flexuosa								7	1		1
Diplodonta rotundata				1							
Kurtiella bidentata						2	1		1		
Astarte sulcata											
Parvicardium scabrum		1									
Spisula elliptica				1							
Spisula solida			1	1		1					
Acanthocardia echinata							1				
Phaxas pellucidus						3		1			
Arcopagia crassa											
Moerella donacina										1	
Gari fervensis		4	1	1	1		2			2	
Azorinus chamasolen						1					

Taxon	Qualifier	D6_G01	D6_G02	D6_G03	D6_G04 B	D6_G05	D6_G06	D6_G07	D6_G08	D6_G09	D6_G10
Abra	Shell disolved								1		
Abra alba						5		2	2		
Abra nitida									1		
Abra prismatica				1		2					
Gouldia minima		1					1				
Venus casina											
Clausinella fasciata		1	4		3	7		5	1		2
Timoclea ovata		9	6	3	7	7	2				1
Dosinia lupinus		2	1		1	6	6				6
Corbula gibba											
Hiatella arctica		1			1	1	2				
Saxicavella jeffreysi											
Cochlodesma praetenue					1	1	2				
Phoronis		1	1	1	2	1	1	1			1
Phoronis muelleri		1	2		1	1	2				2
Asteroidea	Juv.										1
Asterias rubens											
Amphiuridae	Juv.	2	1	1	2		13	2		4	3
Amphiura filiformis		18	13	1	6	8	7	3		10	4
Amphipholis squamata											
Ophiuridae	Juv.				3		4				
Ophiocten affinis		2	1		1	1	4	4	2		
Echinoidea	Dam./Juv.						1				
Psammechinus miliaris							1				
Echinocyamus pusillus		3	1				4	1			
Echinocardium cordatum							1				
Holothuroidea	Dam.							1			
Ascidiacea											
Sertulariidae											
Verruca stroemia	Tubes	P									P
Balanus balanus			P	P			P				P
Balanus crenatus			P							P	P
Copepoda	parasitic										
Turritella communis	Shell only										
Ascophora											

Stations T2 and T3:

Taxon	Qualifier	T2_G01	T2_G02	T2_G03	T2_G04	T2_G05	T2_G06	T2_G07	T2_G08	T2_G09	T2_G10	T2_G11	T2_G12	T2_G13	T3_G01	T3_G02	T3_G03
Edwardsia											1	18	1				
Turbellaria												3	1				
Nemertea			1				1	3	1	1	2	1	1	3			
Cerebratulus																	
Sipuncula													1				
Golfingia																	
Golfingia (Golfingia) elongata							3							3			
Nephasoma							1										
Polynoidae	Dam.					2								1	1		1
Gattyana cirrhosa													1				
Harmothoe												1					
Malmgrenia arenicolae											1	1					
Malmgrenia marphysae			1														
Pholoe baltica							2					1	4				
Phyllodocidae	Juv.											1					
Eteone longa												1					
Mysta picta								1									
Eumida bahusiensis											1						
Glyceridae	Dam./Juv.																
Glycera	Dam./Juv.													1			
Glycera celtica																	
Glycera unicornis			1						1	1	1			2	1		
Glycinde nordmanni																	
Goniada maculata								1				3	1				1
Oxydromus flexuosus										1			1	1			
Podarkeopsis capensis									1								
Ancistrosyllis groenlandica								1									
Glyphohesione klatti															1		
Syllis garciai																	
Eunereis longissima											1						
Nephtys	Dam.									1	1	3			1		
Nephtys hombergii								2					1	1	2	2	
Nephtys incisa		5	4	6	5	2	8	2	9	5	2			1	8	5	1
Nephtys kersivalensis								1				5	3				
Lumbrineridae	Dam./Juv.				1					2	1	2	1				1
Abyssoninoe hibernica																	
Lumbrineris	Juv.									1		3					
Lumbrineris cingulata						1		1			1		2	3	1		
Orbinia sertulata																	

Taxon	Qualifier	T2_G01	T2_G02	T2_G03	T2_G04	T2_G05	T2_G06	T2_G07	T2_G08	T2_G09	T2_G10	T2_G11	T2_G12	T2_G13	T3_G01	T3_G02	T3_G03
Scoloplos (Scoloplos) armiger											1	1					
Levinsenia gracilis										1							
SPIONIDAE																	
Aonides paucibranchiata																	
Laonice bahusiensis												1					
Prionospio cirrifera						1				1	2	1	3				
Polydora ciliata																	
Prionospio	Dam./Juv.									1							
Pseudopolydora pulchra																	
Scolelepis (Scolelepis) foliosa																	
Spiophanes bombyx												2					
Spiophanes kroyeri							1			1	2	8	3	3			1
Magelona alleni												1		5			
Cirratulidae																	
Aphelochaeta								1					1				
Chaetozone zetlandica		1			1										2		1
Chaetozone setosa											3	4	6	2	1		
Cirratulus															1		
Monticellina dorsobranchialis													1	1			
Diplocirrus glaucus										5	3	4	3	3			
Capitellidae																	
Dasybranchus								1		3	5	1	3	2	2		2
Mediomastus fragilis										1	5	2	1	2	7		
Notomastus			1	2		1	1	3	2	7	7			1	1		1
Maldanidae	Dam.											2	2				
Praxillura longissima																	
Clymenura												2					
Microclymene tricirrata												1					
Euclymene												4	1	2			
Euclymene oerstedi												7		3			
Praxillella affinis										1	2	2	3	3			
Praxillella gracilis																	
Praxillella praetermissa																	
Rhodine gracilior														2			
Ophelina acuminata														1			
Lipobranchius jeffreysii						1											
Scalibregma inflatum					2			12	7	14	37			1	4	1	14
Oweniidae													1	1			
Galathowenia oculata										2	1	2		3			
Galathowenia fragilis												2	2				

Taxon	Qualifier	T2_G01	T2_G02	T2_G03	T2_G04	T2_G05	T2_G06	T2_G07	T2_G08	T2_G09	T2_G10	T2_G11	T2_G12	T2_G13	T3_G01	T3_G02	T3_G03
Owenia fusiformis											1	7	1	3			
Terebellida	Dam.				1											1	
Pectinariidae	Dam./Juv.										1	2					
Amphictene auricoma										2	1		2	4			
Lagis koreni										2	1		1	1			
Ampharetidae	Dam./Juv.																1
Melinna palmata												1					
Ampharetinae	Dam./Juv.																
Ampharete lindstroemi											1	2					
Amphicteis gunneri																	
Anobothrus gracilis														1			
Trichobranchus	Dam./Juv.											2	1				
Trichobranchus roseus														1			
Terebellides stroemii													1				
Eupolymnia nebulosa			1														
Lanice conchilega														1			
Pista cristata													1	1			
Polycirrinae	Dam.		1	1	1	1						2					
Lysilla loveni													2				
Sabellidae	Dam.											1					
Anoplodactylus petiolatus											1		1				
Urothoe elegans																	
Harpinia antennaria																	
Ampelisca	Dam.											1					
Ampelisca brevicornis		1															
Ampelisca diadema												1					
Ampelisca tenuicornis												1					
Abludomelita obtusata										2	1	2	2	2			
Diastylis rathkei													2				
Hippolytidae	Dam.																
Processa						2	1	1					1				
Processa canaliculata																	
Nephrops norvegicus						2								1			
Calocaris macandreae																	
Paguridae																	
Portunidae	Juv./Dam.														1		
Liocarcinus	Juv./Dam.														2		
Chaetoderma nitidulum											2	6	2	1			
Euspira nitida																	
Cylichna cylindracea									1	1		1	2				

Taxon	Qualifier	T2_G01	T2_G02	T2_G03	T2_G04	T2_G05	T2_G06	T2_G07	T2_G08	T2_G09	T2_G10	T2_G11	T2_G12	T2_G13	T3_G01	T3_G02	T3_G03
Philine														1			
Retusa umbilicata											3						
Nucula nitidosa						1	1	1	5	4	3	2			3		1
Nucula nucleus																	
Ennucula tenuis								2		4			1	2	1		1
Nuculana minuta																	
Aequipecten opercularis											1						
Thyasira										2		1	1				
Thyasira flexuosa										2	4	1				1	
Tellimya ferruginosa										5	1						
Kurtiella bidentata								1		4	4	44	12	14			1
Parvicardium scabrum																	
Spisula solida												3	1				
Acanthocardia echinata																	
Phaxas pellucidus													1				
Abra	Shell disolved	4	5		2		3	5		1	2		3	4	6	1	2
Abra alba		1	1	2	3	2	4	14	5	9	10	6	1	4	9	1	8
Abra nitida				2													
Arctica islandica	Very damaged												1				
Gouldia minima																	
Clausinella fasciata												1					
Dosinia lupinus														3			
Corbula gibba																	
Hiatella arctica											1	1					
Thracia phaseolina																	1
Phoronis							1			1		3	1	4			
Phoronis muelleri																	
Amphiuridae	Juv.							1			1	11	1	2			1
Amphiura chiajei							2			1	1		2	1			2
Amphiura filiformis										2	1	81	67	24			1
Ophiuridae	Juv.					1		1				2					
Echinoidea	Dam./Juv.																
Echinocardium cordatum												1					
Holothuroidea	Dam.										1	2					
Leptopentacta elongata												1	1				
Leptosynapta	Dam.								1				1				
Labidoplax buskii											1	2					
Pelonaia corrugata												16					
Sertulariidae							P	P		P				P			
Balanus balanus												P					
Balanus crenatus									P								
Copepoda	parasitic																
Crustacea	larvae				1	1							1				
Escharella immersa											P						

Stations T3 and T4:

Taxon	Qualifier	T3_G04	T3_G05	T3_G06	T3_G07	T3_G08	T3_G09	T3_G10	T4_G01	T4_G02	T4_G03	T4_G04	T4_G05	T4_G06	T4_G07	T4_G08	T4_G09
Edwardsia						1	1										
Turbellaria				1													
Nemertea			1	3	4	1	2	1			2		2	3			1
Cerebratulus					1												
Sipuncula						1											
Golfingia					1												
Golfingia (Golfingia) elongata					3			1									
Nephasoma																	
Polynoidae	Dam.	1	1	1							1	1	1				
Gattyana cirrhosa					1												
Harmothoe																	
Malmgrenia arenicolae																	
Malmgrenia marphysae																	
Pholoe baltica							2										
Phyllodocidae	Juv.					1				1		1					
Eteone longa																	
Mysta picta																	
Eumida bahusiensis																	
Glyceridae	Dam./Juv.																1
Glycera	Dam./Juv.																
Glycera celtica							1	1			1			1			
Glycera unicornis		1	1	3	1	2			1		2	4	1	1	2	1	2
Glycinde nordmanni							1	1									
Goniada maculata					1			1									
Oxydromus flexuosus						1											
Podarkeopsis capensis																	
Ancistrosyllis groenlandica									1					1			
Glyphohesione klatti			1														
Syllis garciai					1												
Eunereis longissima																	
Nephtys	Dam.				2		1		1			2	1				
Nephtys hombergii			1		3	2	1	1									
Nephtys incisa		9	1			1			4		2	2	2		1	2	
Nephtys kersivalensis					5	5	2	3		4			1			1	
Lumbrineridae	Dam./Juv.			2	1		1		5		2		2	1			2
Abyssoninoe hibernica														1			
Lumbrineris	Juv.																
Lumbrineris cingulata			1	1	1	1		1			3						
Orbinia sertulata					1												
Scoloplos (Scoloplos) armiger																	

Taxon	Qualifier	T3_G04	T3_G05	T3_G06	T3_G07	T3_G08	T3_G09	T3_G10	T4_G01	T4_G02	T4_G03	T4_G04	T4_G05	T4_G06	T4_G07	T4_G08	T4_G09
Levinsenia gracilis																	
SPIONIDAE		1						1		2		1					
Aonides paucibranchiata									1		1						
Laonice bahusiensis																	
Prionospio cirrifera						2				3	7	1		2	1		
Polydora ciliata				4		1		2		4							1
Prionospio	Dam./Juv.														2		
Pseudopolydora pulchra				1	4		2										
Scolelepis (Scolelepis) foliosa											1			1			
Spiophanes bombyx																	
Spiophanes kroyeri				8	3	1	2	2	1	4	4	5		8	4	1	6
Magelona alleni				1			1	1									
Cirratulidae															1		
Aphelochaeta								1		1	1	1			1		
Chaetozone zetlandica		1										1					
Chaetozone setosa				3	1	3			2	6	10	9	1	12			6
Cirratulus																	
Monticellina dorsobranchialis										2	3	1	3	1		1	
Diplocirrus glaucus						2	3			1	1	1		4			
Capitellidae													1				2
Dasybranchus			1	4	1	1		2		1	1	6	9		7	3	17
Mediomastus fragilis				2		2			3	11	5		2		2	3	2
Notomastus			2	1				1	1	8	7	3	1	1		1	1
Maldanidae	Dam.			1						1	1	1					
Praxillura longissima			1					2									
Clymenura																	
Microclymene tricirrata																	
Euclymene				1	1												
Euclymene oerstedi						1											
Praxillella affinis				1	1	3		1				1					1
Praxillella gracilis				1													
Praxillella praetermissa				1							2	1					
Rhodine gracilior																	
Ophelina acuminata			1						1						2		1
Lipobranchius jeffreysii					1												
Scalibregma inflatum			5	7	1				5	1	1	22	12	1	3		1
Oweniidae				1			1							1			
Galathowenia oculata				1	1		2										
Galathowenia fragilis															1		
Owenia fusiformis				2		1	3	3									
Terebellida	Dam.				1											1	

Taxon	Qualifier	T3_G04	T3_G05	T3_G06	T3_G07	T3_G08	T3_G09	T3_G10	T4_G01	T4_G02	T4_G03	T4_G04	T4_G05	T4_G06	T4_G07	T4_G08	T4_G09
Pectinariidae	Dam./Juv.				1												
Amphictene auricoma				1						3	1		1				
Lagis koreni											1						
Ampharetidae	Dam./Juv.					1	1			1							
Melinna palmata																	
Ampharetinae	Dam./Juv.						1										
Ampharete lindstroemi																	
Amphicteis gunneri				1													
Anobothrus gracilis										3		1					
Trichobranchus	Dam./Juv.																
Trichobranchus roseus					1		3	1									
Terebellides stroemii				3		1	1			2	1						
Eupolymnia nebulosa																	
Lanice conchilega			1		3												
Pista cristata																	
Polycirrinae	Dam.		1	1		1	1	1				1					
Lysilla loveni																	
Sabellidae	Dam.																
Anoplodactylus petiolatus																	
Urothoe elegans							1										
Harpinia antennaria					1		1			1							
Ampelisca	Dam.			1													
Ampelisca brevicornis				3	1					1							
Ampelisca diadema																	
Ampelisca tenuicornis							1										
Abludomelita obtusata				1	1												
Diastylis rathkei																	
Hippolytidae	Dam.							1									
Processa					1												
Processa canaliculata						1											
Nephrops norvegicus																1	
Calocaris macandreae									1		1	3	1	1	3	1	1
Paguridae				1													
Portunidae	Juv./Dam.																
Liocarcinus	Juv./Dam.																
Chaetoderma nitidulum						3	2	1						1			
Euspira nitida							1										
Cylichna cylindracea																	
Philine																	
Retusa umbilicata							2	1									
Nucula nitidosa		2	2	3	6	1	1	3		1	4	6	1		1		

Taxon	Qualifier	T3_G04	T3_G05	T3_G06	T3_G07	T3_G08	T3_G09	T3_G10	T4_G01	T4_G02	T4_G03	T4_G04	T4_G05	T4_G06	T4_G07	T4_G08	T4_G09
Nucula nucleus													5	7			
Ennucula tenuis					1			1	3	2	17	13			5	1	3
Nuculana minuta										1				12			
Aequipecten opercularis																	
Thyasira																	
Thyasira flexuosa					1	2		3									
Tellimya ferruginosa				1			3	1									
Kurtiella bidentata			1	4		5	7										
Parvicardium scabrum				2	1												
Spisula solida							7										
Acanthocardia echinata				1						1							
Phaxas pellucidus				2	1												
Abra	Shell disolved	7	4	2	2	4		4	2		4						1
Abra alba		8	2	21	37	9	8	19	19	6	12	16	7	3	2	2	2
Abra nitida									1	1	3	4	2				
Arctica islandica	Very damaged																
Gouldia minima								1									
Clausinella fasciata				1													
Dosinia lupinus				4	1												
Corbula gibba									2	6				1			
Hiatella arctica																	
Thracia phaseolina																	
Phoronis				3	1		1										
Phoronis muelleri				2	1												
Amphiuridae	Juv.			1			8										
Amphiura chiajei			2			1	2		1	1		1	1	1	1		
Amphiura filiformis				2		11	48	2									2
Ophiuridae	Juv.						1										
Echinoidea	Dam./Juv.			1													
Echinocardium cordatum							1	1									
Holothuroidea	Dam.																
Leptopentacta elongata																	
Leptosynapta	Dam.																
Labidoplax buskii																	
Pelonaia corrugata																	
Sertulariidae																	
Balanus balanus																	
Balanus crenatus					P												
Copepoda	parasitic									P							
Crustacea	larvae	P					P										
Escharella immersa																	

APPENDIX IV: SUMMARY OF THE ABIOTIC CHARACTERISTICS, BIOTOPES AND FEATURES OF THE SAMPLES COLLECTED IN SOUTH ARRAN NC MPA IN 2015

Sample no.	Depth (m)	Gravel (%)	Sand (%)	Mud (%)	Sediment description	Biotope classification	Site-Specific Protected Features
D4_G01	-39.8	0.12	89.65	10.23	Muddy Sand	SS.SSa.OSa.OfusAfil	
D4_G02	-35.8	16.69	73.95	9.36	Gravelly Muddy Sand	SS.SSa.OSa.OfusAfil	
D4_G03	-39.3	0.12	88.25	11.63	Muddy Sand	SS.SSa.OSa.OfusAfil	
D4_G04	-32.1	0.51	97.18	2.31	Sand	SS.SSa.OSa.OfusAfil	
D4_G05	-32.7	0.23	97.69	2.08	Sand	SS.SSa.OSa	
D4_G06	-32.9	0.25	95.18	4.57	Sand	SS.SSa.OSa.OfusAfil	
D4_G07	-34.7	0.50	96.07	3.43	Sand	SS.SSa.OSa.OfusAfil	
D4_G08	-32.0	8.33	88.85	2.81	Gravelly Sand	SS.SSa.OSa.OfusAfil	
D4_G09	-30.9	18.77	80.07	1.16	Gravelly Sand	SS.SSa.OSa	
D4_G10	-30.9	24.01	72.10	3.89	Gravelly Sand	SS.SSa.OSa.OfusAfil	
D4_G11	-28.9	55.50	41.34	3.17	Sandy Gravel	SS.SSa.OSa.OfusAfil	
D4_G12	-28.5	14.73	80.95	4.32	Gravelly Sand	SS.SSa.OSa.OfusAfil	
D6_G01	-51.8	9.92	81.28	8.80	Gravelly Sand	SS.SSa.OSa.OfusAfil	
D6_G02	-37.1	5.01	92.15	2.84	Gravelly Sand	SS.SSa.OSa.OfusAfil	
D6_G03	-49.1	0.13	97.81	2.06	Sand	SS.SSa.OSa.OfusAfil	
D6_G04	-33.7	34.62	63.62	1.76	Sandy Gravel	SS.SSa.OSa.OfusAfil	
D6_G05	-35.8	3.04	92.85	4.11	Slightly Gravelly Sand	SS.SSa.OSa.OfusAfil	
D6_G06	-36.4	8.94	87.70	3.36	Gravelly Sand	SS.SSa.OSa.OfusAfil	
D6_G07	-45.5	0.23	93.96	5.81	Sand	SS.SSa.OSa.OfusAfil	
D6_G08	-49.0	0.88	94.96	4.16	Sand	SS.SSa.OSa.OfusAfil	
D6_G09	-34.9	18.39	77.51	4.11	Gravelly Sand	SS.SSa.OSa.OfusAfil	
D6_G10	-38.6	19.18	66.68	14.13	Gravelly Muddy Sand	SS.SSa.OSa.OfusAfil	
T2_G01	-61.7	0.13	29.86	70.01	Sandy Mud	SS.SSa.CMuSa(.AalbNuc)	
T2_G02	-61.7	0.06	22.34	77.60	Sandy Mud	SS.SSa.CMuSa(.AalbNuc)	
T2_G03	-61.9	0.36	38.63	61.00	Sandy Mud	SS.SSa.CMuSa(.AalbNuc)	
T2_G04	-62.0	0.04	34.11	65.85	Sandy Mud	SS.SSa.CMuSa(.AalbNuc)	
T2_G05	-62.8	4.21	35.18	60.61	Slightly Gravelly Sandy Mud	SS.SSa.CMuSa(.AalbNuc)	

Sample no.	Depth (m)	Gravel (%)	Sand (%)	Mud (%)	Sediment description	Biotope classification	Site-Specific Protected Features
T2_G06	-61.3	0.06	56.66	43.28	Muddy Sand	SS.SSa.CMuSa(.AalbNuc)	
T2_G07	-61.8	0.17	70.21	29.62	Muddy Sand	SS.SSa.CMuSa(.AalbNuc)	
T2_G08	-60.8	1.58	66.88	31.54	Slightly Gravelly Muddy Sand	SS.SSa.CMuSa(.AalbNuc)	
T2_G09	-62.0	0.01	68.94	31.05	Muddy Sand	SS.SMu.CSaMu.AfilMysAnit	
T2_G10	-60.6	0.09	72.70	27.21	Muddy Sand	SS.SMu.CSaMu.AfilMysAnit	
T2_G11	-52.9	0.05	87.76	12.20	Muddy Sand	SS.SMu.CSaMu.AfilMysAnit	
T2_G12	-53.7	0.33	82.73	16.94	Muddy Sand	SS.SMu.CSaMu.AfilMysAnit	Ocean quahog aggregations
T2_G13	-56.8	0.45	79.99	19.56	Muddy Sand	SS.SMu.CSaMu.AfilMysAnit	
T3_G01	-53.5	0.03	51.32	48.65	Muddy Sand	SS.SSa.CMuSa(.AalbNuc)	
T3_G02	-52.1	0.03	20.51	79.47	Sandy Mud	SS.SSa.CMuSa(.AalbNuc)	
T3_G03	-59.6	0.18	72.71	27.12	Muddy Sand	SS.SSa.CMuSa(.AalbNuc)	
T3_G04	-59.5	0.00	52.10	47.90	Muddy Sand	SS.SSa.CMuSa(.AalbNuc)	
T3_G05	-59.5	0.00	58.71	41.29	Muddy Sand	SS.SSa.CMuSa(.AalbNuc)	
T3_G06	-52.0	1.07	82.00	16.93	Slightly Gravelly Muddy Sand	SS.SSa.CMuSa.AalbNuc	
T3_G07	-54.5	0.84	80.84	18.33	Muddy Sand	SS.SSa.CMuSa.AalbNuc	
T3_G08	-54.9	1.28	82.56	16.16	Slightly Gravelly Muddy Sand	SS.SMu.CSaMu.AfilMysAnit	
T3_G09	-47.5	0.53	88.79	10.68	Muddy Sand	SS.SMu.CSaMu.AfilMysAnit	
T3_G10	-52.0	0.96	81.90	17.14	Muddy Sand	SS.SSa.CMuSa.AalbNuc	
T4_G01	-121.7	0.34	60.95	38.71	Muddy Sand	SS.SMu.CSaMu	
T4_G02	-118.5	0.54	82.01	17.45	Muddy Sand	SS.SMu.CSaMu	
T4_G03	-123.9	1.05	68.44	30.51	Slightly Gravelly Muddy Sand	SS.SMu.CSaMu	
T4_G04	-130.0	1.80	75.32	22.88	Slightly Gravelly Muddy Sand	SS.SMu.CSaMu	
T4_G05	-113.4	0.19	67.82	31.99	Muddy Sand	SS.SMu.CSaMu	
T4_G06	-122.2	0.15	67.57	32.28	Muddy Sand	SS.SMu.CSaMu	
T4_G07	-134.3	0.24	56.00	43.77	Muddy Sand	SS.SMu.CSaMu	
T4_G08	-129.4	0.93	18.40	80.67	Sandy Mud	SS.SMu.CSaMu	
T4_G09	-131.4	0.75	73.39	25.87	Muddy Sand	SS.SMu.CSaMu	

APPENDIX V: LOCH ALSH (PART OF LOCHS DUICH, LONG AND ALSH SAC / NC MPA) INFAUNAL ANALYSIS ABUNDANCE DATA

NB 'Dam' = damaged' 'Juv.' = Juvenile; P = Present but not enumerated

Taxon	Qualifier	LA1_G01	LA1_G02	LA1_G03	LA1_G04	LA2_G03	LA4_G01	LA4_G02	LA4_G03	LA4_G04	LA4_G05	LA4_G06	LA4_G07	LA4_G08	LA4_G09	LA4_G10
Sycon ciliatum				1												
Actiniaria							1									
Edwardsia									2							
Turbellaria							2							1		
Nemertea			1	3	1	2	4	2	5	2	4	6	1	3	4	2
Cerebratulus			1					2	2				2			
Tubulanus		1		1	1	1										
Desmoscolecidae		110	83	62	121	140										
Sipuncula			2	1	2	2		1					1			1
Golfingia		2	2		3	4										
Golfingia (Golfingia) elongata			4	5		1	1									
Golfingia (Golfingia) vulgaris		1	1		3	1										
Thalassema thalassemum					2											
Aphrodita aculeata																1
Polynoidae	Dam.	2	2		2	3		1								1
Subadyte pellucida						1										
Eunoe oerstedi		2	1													
Harmothoe		1	3	1	2	6		1				1				1
Harmothoe impar		1														
Malmgrenia arenicolae						1										
Malmgrenia mcintoshi				1												
Lepidonotus squamatus			2	4	3	5										
Pholoe	Dam.			1												
Pholoe baltica		14	14	6	8	15	7	12	6	6	2	2	8	6	1	2
Pholoe inornata		3	8	13	10	12		1								
Sthenelais	Dam./Juv.				1											
Sthenelais boa			3			1										
Phyllodocidae	Juv.					1				1						
Eteone longa						1										
Eulalia									1	1						
Eulalia bilineata					1	1										
Eumida						1										
Eumida bahusiensis		3	4	6	9	7										
Paranaitis kosteriensis															1	
Glycera	Dam./Juv.							1		2	1		1	1		1
Glycera celtica							1	1	1	1		1				1
Glycera lapidum				1							1	1				
Glycera unicornis						1	2	1			1	2	1		1	4
Goniada maculata				1												

Taxon	Qualifier	LA1_G01	LA1_G02	LA1_G03	LA1_G04	LA2_G03	LA4_G01	LA4_G02	LA4_G03	LA4_G04	LA4_G05	LA4_G06	LA4_G07	LA4_G08	LA4_G09	LA4_G10
Sphaerodorum gracilis		4	1	2		1		1					1			
Hesionidae	Dam.		2		2	2						1	1			
Psamathe fusca		10	9	8	16	19	2		3	1			1			
Nereimyra punctata		37	12	25	31	44										
Oxydromus flexuosus							2	4		2	2	3			2	
Podarkeopsis capensis											1					
Ancistrosyllis groenlandica										2	1	1		1	1	1
Syllis armillaris			2	2	4	1										
Syllis columbretensis						2										
Trypanosyllis (Trypanosyllis) coeliaca					1	1										
Odontosyllis fulgurans						1										
Exogoninae							1	1	1							
Exogone dispar										1						
Proceraea cornuta						1										
Eunereis longissima		1														
Nephtys	Dam.	1			1	1										
Nephtys hombergii		2	2		1			1								
Nephtys incisa										1		1	1	1	1	2
Nephtys kersivalensis		1	4													
Aponuphis bilineata						1										
Lysidice unicornis		3				5										
Lumbrineridae	Dam./Juv.		1				1		1			2	2	1	1	
Abyssoninoe hibernica							1	1			1	3	4	3	3	1
Lumbrineris	Juv.	1	1			6										
Lumbrineris cingulata			3			4	1									
Schistomeringos rudolphi						1										
Orbiniidae	Dam./Juv.	1														
Orbinia sertulata			1													
Cirrophorus branchiatus						2							1			
Paradoneis lyra													1			
SPIONIDAE												1				
Aonides oxycephala		7	4	5	4	5										
Aonides paucibranchiata				1	1						1					
Laonice					1	1										
Prionospio multibranchiata						1	1	3		2	1	18		2	1	1
Prionospio cirrifera		1	4	8	9	10	2	13	16	12	33	16	1	44	19	16
Polydora ciliata							2	1	6			3				
Prionospio	Dam./Juv.	2			1	5	3	3	7	6	8	18	2	13	8	6
Prionospio fallax		1				2	5	5	29	63	22	34	4	7	38	13
Scolelepis (Scolelepis) foliosa							2		2	1		2		2	1	1

Taxon	Qualifier	LA1_G01	LA1_G02	LA1_G03	LA1_G04	LA2_G03	LA4_G01	LA4_G02	LA4_G03	LA4_G04	LA4_G05	LA4_G06	LA4_G07	LA4_G08	LA4_G09	LA4_G10
Spiophanes bombyx			1													
Spiophanes kroyeri		2	2				2	2	5	7	5	6	3	2	4	9
Magelona minuta															1	1
Cirratulidae				2		1	1							1	1	
Aphelochaeta						3									1	
Caulleriella alata					1											
Chaetozone setosa		1	1	5	1		2		15	6	2	5	1	2	2	3
Chaetozone christiei													1			
Cirratulus cirratus				1												
Monticellina dorsobranchialis			1				1		2	2	2	1				
Diplocirrus glaucus							3	3	6	9	7	3	12		9	12
Flabelligera affinis		2	9	2	8	9										1
Pherusa plumosa				2		1										
Capitellidae			1													
Dasybranchus							4	1	3		4		9	3		1
Mediomastus fragilis		7	31	3	22	9	2	1	1	1	2	10		3	2	1
Notomastus					1	5	1	1	2		1	1				3
Maldanidae	Dam.						1			1			1			3
Clymenella cincta													1			
Euclymene lombricoides														3		
Praxillella affinis							3	5	3	2	6	8	4		3	4
Praxillella gracilis															1	1
Praxillella praetermissa								1		4	1	2		1	1	3
Rhodine loveni										1		1		1	1	1
Scalibregma celticum		2	1	1	1	2										
Scalibregma inflatum		3	4		1	2		1	2	4		8	2	7	3	1
Oweniidae								2								
Galathowenia oculata								1								1
Owenia fusiformis							5	5	1				1			1
Terebellida	Dam.			1		1	1						1			
Amphictene auricoma							2	2	2				2			
Lagis koreni							2	1	4	1						
Ampharetidae	Dam./Juv.		1			1			1				1			
Ampharetinae	Dam./Juv.						1						1			
Amphicteis gunneri													1		1	
Anobothrus gracilis							1									
Sosane sulcata									1							
Trichobranchus	Dam./Juv.	3	2	2	2	3										
Trichobranchus glacialis		3	2	3	5	3										
Trichobranchus roseus			1													

Taxon	Qualifier	LA1_G01	LA1_G02	LA1_G03	LA1_G04	LA2_G03	LA4_G01	LA4_G02	LA4_G03	LA4_G04	LA4_G05	LA4_G06	LA4_G07	LA4_G08	LA4_G09	LA4_G10
Terebellides stroemii		1	7	2	2	1	1		1			1	1			
Amphitritinae													1			
Amphitrite cirrata							2	2					1			
Eupolymnia nebulosa															1	
Eupolymnia nesidensis						2										
Pista cristata					1	5	1	5	4	5						2
Polycirrinae	Dam.			2		3						2				1
Sabellidae	Dam.		1	2	3	5										
Euchone rubrocincta						1										
Jasmineira elegans						17										
Pseudopotamilla reniformis						1										
Serpulidae	Dam.					1										
Hydroides norvegica			1		1											
Spirobranchus lamarcki					2	3										
Spirobranchus triqueter		1	6	1	7	3										
Tubificoides amplivasatus			2			2										
Leucothoe lilljeborgi										2			1			
Urothoe elegans		3	6	4	4	3										
Harpinia antennaria					1		1		1						1	
Lysianassidae	Dam.			1		1										
Ampelisca	Dam.		1				1						2			
Ampelisca spinipes		1				7										
Ampelisca tenuicornis							1	4	3	1	1	1	7		2	1
Othomaera othonis		8	12	12	3	12										
Gammaropsis maculata						18										
Photis longicaudata			1	1	1		2						1			
Phtisica marina						7										
Pseudoprotella phasma						12										
Gnathiidae					1	2										
Anthura gracilis					1											
Janira maculosa						11										
Munna						10										
Munna kroyeri						2										
Uromunna petiti						2										
Tanaopsis graciloides					3	1										
Leucon (Leucon) nasica		1														
Cumella (Cumella) pygmaea				1												
Eualus pusiolus		2	1	2	1	5										
Calocaris macandreae								1	1							
Galathea					1											

Taxon	Qualifier	LA1_G01	LA1_G02	LA1_G03	LA1_G04	LA2_G03	LA4_G01	LA4_G02	LA4_G03	LA4_G04	LA4_G05	LA4_G06	LA4_G07	LA4_G08	LA4_G09	LA4_G10
Galathea intermedia			1	1												
Galathea nexa		1			4	1										
Munida rugosa						2										
Hyas						2										
Hyas araneus						2										
Eurynome		1														
Chaetoderma nitidulum							1	2	1	5	3			6	2	9
Leptochiton asellus		14	12	3	9	8										
Emarginula fissura					2	5										
Turritella communis							15						27			
Velutina velutina						2										
Cylichna cylindracea								1		2						
Retusa umbilicata											1					
Nucula nitidosa		2	3											1		
Nucula nucleus		10	4	9	9	7		1					1		3	3
Ennucula tenuis							1		2			1	2	1		
Modiolus modiolus		8	7		13	10										
Modiolula phaseolina		3	3	11	15	16										
Limaria hians		13	5	11	7	26										
Aequipecten opercularis						2										
Palliolum tigerinum						1										
Monia squama		2	2	1	4	2										
Myrtea spinifera							9	1	4	1			11			
Thyasira			2			1			5	6	1	6		7	3	4
Tellimya ferruginosa					1											
Kurtiella bidentata		1				1	7	5	4	2	1		4	3		
Acanthocardia echinata		6	5	2	2	4										
Gari depressa						1										
Azorinus chamasolen							1									1
Abra	Shell disolved									3	3	5	1	7		3
Abra alba		4	2	5	1	3			2	9	3	5	1	15	13	19
Abra nitida									1	4		3	1	10	17	7
Arctica islandica	Very damaged						1	1					1			
Gouldia minima						2										
Timoclea ovata		1	2	1		2										
Dosinia lupinus			1				2	2								1
Corbula gibba							1								1	1
Hiatella arctica		5	4	2	1	11										
Thracia				2	2											
Thracia phaseolina						4	1		1				1			

Taxon	Qualifier	LA1_G01	LA1_G02	LA1_G03	LA1_G04	LA2_G03	LA4_G01	LA4_G02	LA4_G03	LA4_G04	LA4_G05	LA4_G06	LA4_G07	LA4_G08	LA4_G09	LA4_G10
Cochlodesma praetenue																1
Ophiothrix fragilis		23	29	17	22	14										
Ophiocomina nigra		4	10	14	6	4										
Ophiopholis aculeata		4			10	7										
Amphiuridae	Juv.	4		1	3	5	1		1	1				1	1	1
Amphiura chiajei						1	11	11	3	2	3	2	18		3	2
Amphiura filiformis			2				7	10	3	1		1	10	1		1
Psammechinus miliaris			1													
Echinocardium cordatum												1	1			
Sertulariidae											P					P
Verruca stroemia	Tubes		P													
Balanus crenatus			P	P												
Disporella hispida			P	P	P	P										
Electra pilosa			P													
Ascidiacea		P			P	P										
Rhodophyta			P	P												
Corallinaceae		P				P										
CHROMOPHYCOTA			P													

APPENDIX VI: SUMMARY OF THE ABIOTIC CHARACTERISTICS, BIOTOPES AND FEATURES OF THE SAMPLES COLLECTED FROM LOCH ALSH (PART OF LOCHS DUICH, LONG AND ALSH SAC / NC MPA) IN 2015

Note that flagged PMFs include species listed as PMFs as well as the biotopes the species were recorded in.

Sample no.	Depth (m)	Gravel (%)	Sand (%)	Mud (%)	Sediment description	Biotope classification	Site-Specific Protected Features	Priority Marine Features (PMFs)
LA1_G01	-39.8	24.07	58.68	17.25	Gravelly Muddy Sand	SS.SMx.IMx.Lim	Flame shell beds	Flame shell beds
LA1_G02	-41.8	41.64	40.51	17.85	Muddy Sandy Gravel	SS.SMx.IMx.Lim	Flame shell beds	Flame shell beds
LA1_G03	-42.5	47.92	42.30	9.78	Muddy Sandy Gravel	SS.SMx.IMx.Lim	Flame shell beds	Flame shell beds
LA1_G04	-52.6	40.54	48.34	11.12	Muddy Sandy Gravel	SS.SMx.IMx.Lim	Flame shell beds	Flame shell beds
LA2_G03	-41.9	13.04	78.02	8.94	Gravelly Muddy Sand	SS.SMx.IMx.Lim	Flame shell beds	Flame shell beds
LA4_G01	-122.8	1.29	75.58	23.13	Slightly Gravelly Muddy Sand	SS.SMx.CMx.MysThyMx		*Arctica islandica*
LA4_G02	-125.4	1.51	72.65	25.84	Slightly Gravelly Muddy Sand	SS.SMx.CMx.MysThyMx		*Arctica islandica*
LA4_G03	-118.0	1.52	59.22	39.26	Slightly Gravelly Muddy Sand	SS.SMx.CMx.MysThyMx		
LA4_G04	-110.8	0.46	35.77	63.77	Sandy Mud	SS.SMx.CMx.MysThyMx		
LA4_G05	-106.7	4.10	39.58	56.31	Slightly Gravelly Sandy Mud	SS.SMx.CMx.MysThyMx		
LA4_G06	-101.6	0.76	44.79	54.45	Sandy Mud	SS.SMx.CMx.MysThyMx		
LA4_G07	-89.1	6.23	59.01	34.75	Gravelly Muddy Sand	SS.SMx.CMx.MysThyMx		*Arctica islandica*
LA4_G08	-91.8	0.27	54.67	45.07	Muddy Sand	SS.SMx.CMx.MysThyMx		
LA4_G09	-87.0	0.24	53.80	45.96	Muddy Sand	SS.SMx.CMx.MysThyMx		
LA4_G10	-87.2	0.92	58.58	40.50	Muddy Sand	SS.SMx.CMx.MysThyMx		

APPENDIX VII: SOUTHERN TRENCH MPA PROPOSAL INFAUNAL ANALYSIS ABUNDANCE DATA

NB 'Dam' = damaged' 'Juv.' = Juvenile; P = Present but not enumerated

Taxon	Qualifier	STTR04	STTR06	STTR08	STTR13	STTR14	STTR15	STTR16
Nemertea		1	1	1	3			5
Golfingia (Golfingia) elongata		1	2					
Pisione remota				2				
Polynoidae	Dam.	1						
Harmothoe		1						
Malmgrenia arenicolae							1	
Pholoe	Dam.				1			
Pholoe baltica		1						
Pholoe pallida					3			5
Sthenelais	Dam./Juv.						1	
Sthenelais jeffreysi	sensu Barnich, 2011					1		
Sthenelais limicola						1		
Phyllodocidae	Juv.	1						
Eteone longa			2					
Hypereteone foliosa							1	
Glycera celtica			1		1		1	
Glycera lapidum		1	2	1	1			
Glycera unicornis					3			1
Glycinde nordmanni		1						
Goniada maculata			1		1	1	2	
Psamathe fusca			1					
Oxydromus flexuosus					1			
Glyphohesione klatti		1						
Syllis parapari		1						
Exogone dispar			1					
Nephtys	Dam.			1		1	1	
Nephtys longosetosa		1				1		
Lumbrineridae	Dam./Juv.	1			1			
Abyssoninoe hibernica					3			
Lumbrineris	Juv.		1					
Lumbrineris cingulata		2	2					
Orbiniidae	Dam./Juv.				1			
Orbinia sertulata					1			
Scoloplos (Scoloplos) armiger			1			1		
Aricidea (Acmira) simonae			1		1			
Paradoneis lyra							1	
Poecilochaetus serpens			1					
Aonides paucibranchiata			1	5	1			
Laonice bahusiensis					2		2	3

Taxon	Qualifier	STTR04	STTR06	STTR08	STTR13	STTR14	STTR15	STTR16
Prionospio cirrifera		1						
Prionospio	Dam./Juv.				3			
Prionospio fallax					3			
Prionospio steenstrupi					31	1	8	9
Scolelepis (Scolelepis) foliosa								1
Spio			1					
Spiophanes bombyx			3				1	
Spiophanes kroyeri		2	1		8	1		5
Magelona alleni							1	
Chaetozone zetlandica			1					
Chaetozone setosa			4	1	17	3	3	3
Chaetozone christiei			1					
Diplocirrus glaucus					4	1	1	
Flabelligera affinis		1						
Capitellidae		1					1	1
Dasybranchus					1			
Mediomastus fragilis				1	9			4
Notomastus		1	2	1				
Maldanidae	Dam.				1			
Euclymene droebachiensis		1						
Praxillella affinis		1						
Praxillella praetermissa					3			
Ophelia borealis			2					
Ophelina acuminata							1	
Asclerocheilus intermedius			1					
Scalibregma inflatum								1
Oweniidae				1	1	1	1	2
Galathowenia oculata					4	1	10	3
Owenia fusiformis		2	2			1	2	
Amphictene auricoma		1						
Lagis koreni						4	2	
Sabellaria spinulosa		16						
Ampharetinae	Dam./Juv.					1	1	
Trichobranchus	Dam./Juv.					1		
Trichobranchus roseus							3	
Terebellides stroemii							1	
Polycirrinae	Dam.	1	1					
Serpulidae	Dam.	1						
Hydroides norvegica		1						
Westwoodilla caecula					1	2		

Taxon	Qualifier	STTR04	STTR06	STTR08	STTR13	STTR14	STTR15	STTR16
Urothoe elegans		6			1			
Harpinia antennaria					2		2	1
Atylus vedlomensis		1	1					
Ampelisca	Dam.	1						
Ampelisca spinipes		4						
Ampelisca tenuicornis						2	3	
Othomaera othonis		4						
Gammaropsis maculata		2						
Phtisica marina		2						
Pseudoprotella phasma		3						
Gnathiidae		2						
Eudorella emarginata					1			1
Leucon (Leucon) nasica								3
Calocaris macandreae					1			1
Callianassa subterranea								1
Galathea		1						
Galathea intermedia		4						
Liocarcinus	Juv./Dam.	1						
Chaetoderma nitidulum					7	3		6
Trivia arctica		1						
Euspira montagui				1				
Euspira nitida		1	1				1	
Antalis entalis		3				2		
Nucula nucleus					2			2
Thyasira						1		
Kurtiella bidentata						1	1	
Spisula elliptica		1		1				
Acanthocardia echinata			2				1	
Phaxas pellucidus		1						
Moerella donacina				3				
Abra	Shell disolved				1		1	
Abra alba					5	3		
Timoclea ovata		1	1	1				
Phoronis						1	1	
Asterias rubens		1						
Ophiocomina nigra								1
Amphiuridae	Juv.		1	1	2	1	12	1
Amphiura chiajei					15	1		26
Amphiura filiformis		1	1	2	1	14	27	
Ophiocten affinis		1	1			2	3	

Taxon	Qualifier	STTR04	STTR06	STTR08	STTR13	STTR14	STTR15	STTR16
Echinocyamus pusillus		2	8	2		4	21	
Echinocardium cordatum							2	1
Labidoplax buskii							1	
Sabellaria spinulosa	Tubes present	P	P					
Disporella hispida				P				
Flustra foliacea	Unattached?	P						
Ascidiacea		P						

APPENDIX VIII: SUMMARY OF THE ABIOTIC CHARACTERISTICS, BIOTOPES AND FEATURES OF THE SAMPLES COLLECTED FROM SOUTHERN TRENCH MPA PROPOSAL IN 2015

No MPA specific proposed protected features could be identified from the grab samples alone.

Sample no.	Depth (m)	Gravel (%)	Sand (%)	Mud (%)	Sediment description	Biotope classification	Priority Marine Features (PMFs)
STTR04	-81.2	5.25	91.81	2.93	Gravelly Sand	SS.SSa.OSa	
STTR06	-89.5	11.93	84.99	3.08	Gravelly Sand	SS.SSa.OSa	
STTR08	-78.1	11.65	86.32	2.03	Gravelly Sand	SS.SSa.OSa	
STTR13	-98.7	0.00	38.21	61.79	Sandy Mud	SS.SMu.OMu	
STTR14	-93.8	0.00	73.21	26.79	Muddy Sand	SS.SSa.OSa(.OfusAfil)	
STTR15	-85.8	0.00	70.68	29.32	Muddy Sand	SS.SSa.OSa(.OfusAfil)	
STTR16	-98.2	0.00	29.51	70.49	Sandy Mud	SS.SMu.OMu	

APPENDIX IX: MAXIMUM SHELL SIZE (CM) OF *LIMARIA HIANS* AT STATIONS WITHIN LOCH ALSH IN 2015

Station	Shell	Size (cm)	Station	Shell	Size (cm)	Station	Shell	Size (cm)	Station	Shell	Size (cm)	Station	Shell	Size (cm)
LA1_G01	1	0.3	LA1_G02	1	0.6	LA1_G03	1	0.4	LA1_G04	1	1.0	LA2_G03	1	0.3
	2	0.3		2	1.5		2	0.5		2	1.1		2	0.5
	3	0.8		3	2.0		3	0.6		3	3.6		3	0.5
	4	1.0		4	3.7		4	0.9		4	3.6		4	0.6
	5	1.0		5	3.8		5	1.0		5	3.8		5	0.6
	6	1.2					6	1.2		6	4.0		6	0.7
	7	1.2					7	1.3		7	4.2		7	0.7
	8	1.4					8	1.4					8	0.7
	9	2.1					9	1.5					9	0.8
	10	2.7					10	1.7					10	0.8
	11	2.8					11	3.5					11	0.9
	12	3.6											12	0.9
	13	3.9											13	1.0
													14	1.0
													15	1.3
													16	1.8
													17	1.9
													18	2.1
													19	3.5
													20	3.7
													21	3.7
													22	3.8
													23	3.8
													24	3.9
													25	4.0
													26	4.0

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