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APPENDIX 12-B SUBTIDAL BENTHIC ECOLOGICAL CHARACTERISATION SURVEY

Centre for Marine and Coastal Studies Ltd

Nigg Bay

Subtidal Survey Report

Technical Report

CMACS Ref: J3262 (Nigg Bay Subtidal Survey Report) v2

Prepared for: Fugro-Emu Ltd

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Cover Image: Looking south across Nigg Bay

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1. Introduction

Aberdeen Harbour Board have proposed the design and construction of a new harbour facility at Nigg Bay immediately South of the existing harbour. The purpose of the new facility is to complement and expand the capabilities of the existing harbour, accommodate larger vessels, retain existing custom, and attract increased numbers of vessels and vessel types to Aberdeen.

The new harbour development shall include but is not limited to:

- Dredging the existing bay to accommodate vessels up to 9m draft with additional dredge depth of 10.5m to the east quay and entrance channel;
- Construction of new north and south breakwaters to form the harbour;
- Provision of approximately 1500m of new quays and associated support infrastructure. The quay will be constructed with solid quay wall construction and suspended decks over open revetment;
- Construction of areas for development by others to facilitate the provision of fuel, bulk commodities and potable water;
- Land reclamation principally through using materials recovered from dredging operations and local sources, where possible;
- Provision of ancillary accommodation for the facility;
- Off-site highway works to the extent necessary to access the facility and to satisfy statutory obligations;
- Diversions and enabling works necessary to permit the development.

Fugro EMU Limited (Fugro EMU), with support from the Waterman Group has been appointed by Aberdeen Harbour Board to undertake a full Environmental Impact Assessment and prepare an Environmental Statement in relation to the proposed construction of a new harbour facility in Nigg Bay, to the south of the existing harbour.

As part of this process, CMACS Ltd was commissioned by Fugro EMU to carry out a baseline survey of the subtidal area of Nigg Bay and adjacent areas (Figure 1). An intertidal biotope survey of Nigg Bay between Girdle Ness in the North and Greg Ness in the south was carried out in October 2014 (CMACS Ltd 2015).

Prior to survey, background information was prepared from available published, unpublished and on-line information.

The survey involved the use of drop down camera (video and still images), grab samples for sediment and macrofauna, and 2m scientific beam trawls, to identify, map and describe the subtidal sediments, fauna and biotopes (including information on the main substrates), and to determine the concentration of a suite of chemical contaminants in the sediments within Nigg Bay. A brief description of the sensitivities of the biotopes to the main anticipated impacts of the development was also prepared.

Any potentially important or protected species or habitats, including potential Annex 1 habitat or Annex II species as defined by the Habitats Directive, or Priority Marine Features as recently listed by Marine Scotland (JNCC 2014) were noted and described.

The survey was carried out from 14th - 22nd March 2015 inclusive.

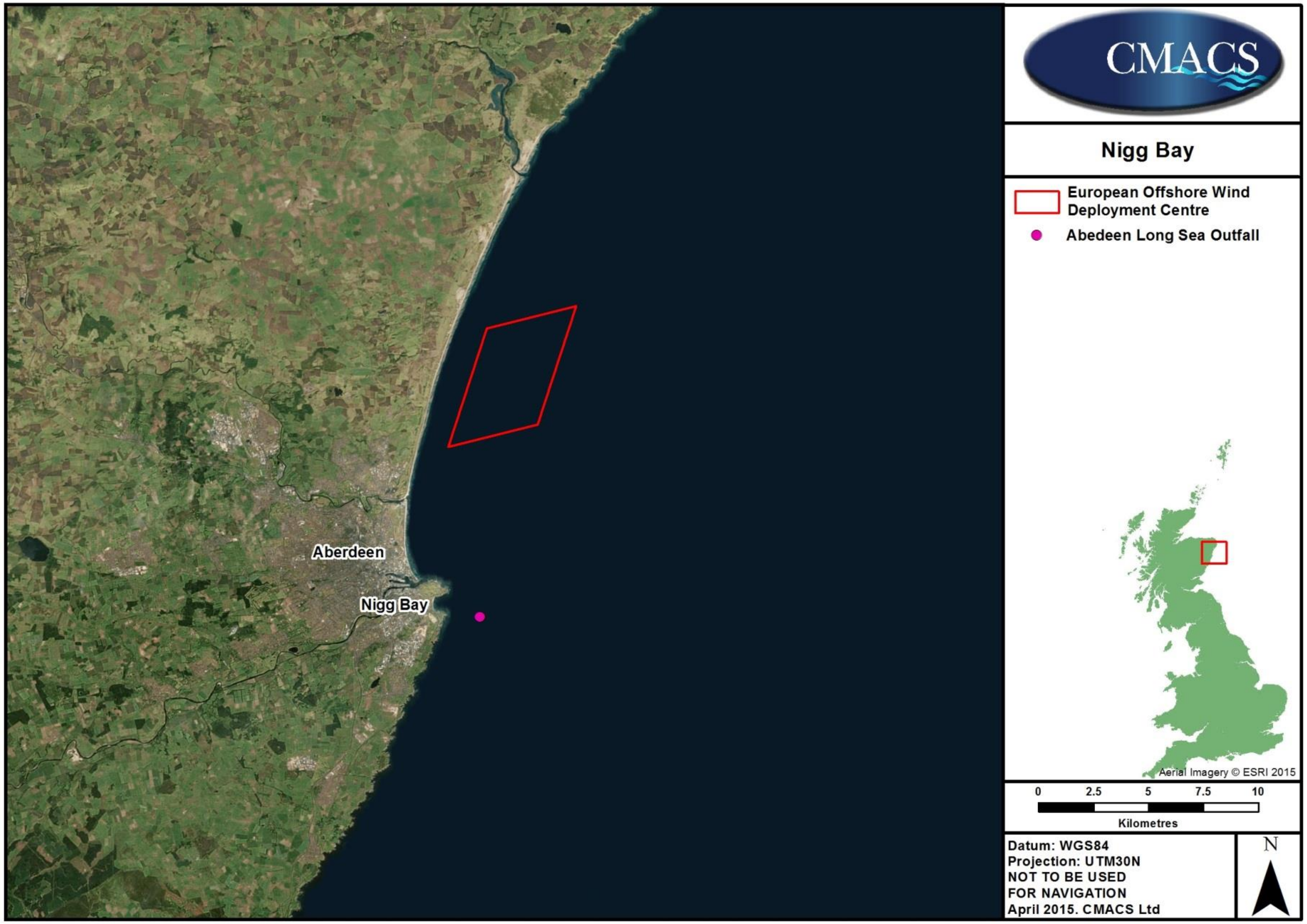

Figure 1. Location of Nigg Bay in Relation to Aberdeen and the European Offshore Wind Deployment Centre (Aberdeen OWF).

2. Existing information

There is no detailed published information on the benthic communities of Nigg Bay, but predicted habitat according to the EmodNet website (http://www.emodnet.eu/) suggests the presence of extensive areas of sand or muddy sand inshore along much of this coast (Figure 2); specifically "A5.23 Infralittoral fine sand or A24 Infralittoral muddy sand" close inshore (this being broader to the north of Aberdeen than to the South, including Nigg Bay). Further offshore predicted habitat becomes A5.25 Circalittoral fine sand or A26 Circalittoral muddy sand. Further offshore still (beyond roughly 10km or so) this in turn is largely replaced by A27 Deep circalittoral sand, although areas of both coarser (A44 Circalittoral mixed sediments and A45 Deep circalittoral mixed sediments) and finer (A35 Circalittoral sandy mud or A36 Circalittoral fine mud) are also predicted. Clearly the presence of moderate or high energy infralittoral rock (A3.1 and A3.2) along with a number of additional rocky habitats is also predicted coastally in the area although the precision in this regard is particularly poor.

Slightly offshore from Nigg Bay, Day grab surveys in support of the Nigg Bay long sea sewage outfall (Figure 1) have been carried out in 1988, 1991, 1995 and 2002 (Cranmer, 1989; Cunningham, 1991; Cunningham & Bell, 1996; SEPA, 2002). Locations surveyed around the outfall have varied slightly over the years, but in the main have used two or three 0.1m^2 replicate Day grab samples sieved over a 1mm mesh, from each of a number of stations close to the sewage outfall, and extending several km up and down current. In addition a number of stations were located inshore and offshore of the outfall, with a few of the stations inshore of the outfall being at a similar distance offshore to the most offshore stations used in this current survey. The depths at the stations surveyed were typically around 25 - 35 m. The sediments were found to be primarily very well sorted fine to medium (and sometimes coarse), sands with very low gravel and mud content, and with a low total organic content (almost always less than 2% as determined by loss on ignition). The taxa found were generally typical of sandy sediments in the area, and comprised mainly annelid worms, molluscs and amphipods. Of the polychaetes, *Nephtys* spp., *Ophelia borealis* and *Glycera* spp. were all present at all the stations. Several very small species of polychaete (*Pisione remota*, *Exogone* spp., *Hesionura elongata*) were also recorded in moderate numbers at many of the stations, but were reduced or absent at the most offshore stations. The most common taxon was the oligochaete worm *Grania* sp. The reef forming polychaete *Sabellaria spinulosa* was recorded at a few stations, scattered throughout the survey area, although they were never present in large numbers. Crustacea were not generally very abundant in the area, with only the burrowing amphipods *Bathyporeia guilliamsoniana* and *Atylus falcatus* being recorded with any frequency. These are again common taxa for clean sandy substrates, which do not usually support large numbers of crustacea. The most common mollusc was the tellin bivalve *Moerella pygmaea*; other common bivalves included *Crenella decussata* and *Abra prismatica*. In 2002 the number of taxa and individuals per station (based on three replicates pooled in each case) were 14-95 (but mostly 24-54) and 58-1355 respectively. It was concluded after the 2002 survey that the survey series had not shown any detrimental effect of the outfall, with the possible exception of a slight increase in numbers of small polychaetes close to the outfall (but no measurable associated enrichment of the sediment that would account for this).

Sidescan sonar and swathe bathymetry images of Nigg Bay and adjacent seabed from a geophysical survey carried out in August 2012 (Caledonia Geotech 2012) were available, and these were used by Fugro-EMU to plan the surveys, and in this report to aid in interpreting the results. Both of these sources suggest the majority of the seabed was likely to be sandy but with a fringe of subtidal rock, somewhat variable in extent, representing an extension of the intertidal bedrock and boulder habitats (see also CMACS 2015). In some places the rock/sand boundary appeared to be very sharp, but in others (e.g. to the east of Girdle Ness at the northern end of Nigg Bay) it was much less so. Three surface sediment samples (see Figure 4) taken with a Van Veen grab showed the sediment to be well sorted medium, or fine to medium, sands with 0.1% to 4.2% mud content and almost no gravel content. The sediment, which according to borehole information consists of a mixture of sand silt gravel and cobbles, overlies rock and is up to 30m thick in the centre of the Bay.

In 2014 video tows and sediment samples were taken by Marine Scotland at a variety of locations, including just offshore from Nigg Bay, in order to provide habitat information for potential developers (Mike Robertson, Marine Scotland; pers. comm.), but the samples were still being worked up and hence no information was available at the time of preparation of this report.

The site of the proposed European Offshore Wind Deployment Centre is located to the north of Aberdeen some 8 to 14 km or so from Nigg Bay. Here in 2010, surveys some 1-5km offshore in depths ranging from 5m to around 40m found that the sediments were predominantly sands, with less than 2% mud content inshore, but increasing up to c. 14% mud offshore. Low numbers of species and abundance were found in the infaunal community of the very sandy inshore shallower stations, where the polychaetes *Nephtys cirrosa* and amphipods dominated, matching the biotope SS.SSA.IFiSa.NcirBat *Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand. The majority of stations were further offshore, where higher numbers of species and abundance were present with the polychaetes *Notomastus latericeus*, the bivalves *Nucula nitidosa* and *Tellina fabula*[1] and brittle stars *Ophiura* spp. dominating, and matching the biotope SS.SSA.CMuSa.AalbNu *Abra alba* and *Nucula nitidosa* in circalittoral muddy sand or slightly mixed sediment). The invertebrate epifaunal community was sparse, consisting mainly of brittle stars, brown shrimp (*Crangon crangon*) and swimming crab (*Liocarcinus holsatus*). Dab (*Limanda limanda*) and plaice (*Pleuronectes platessa*) were abundant, especially as juveniles at shallower inshore stations suggesting the possible presence of nursery grounds in the area. Other common fish species in the area were whiting (*Merlangius merlangus*) and hooknose (*Agonus cataphractus*), which were found slightly further offshore.

[1] Previously called *Fabulina fabula* and more recently accepted as *Angulus fabula*

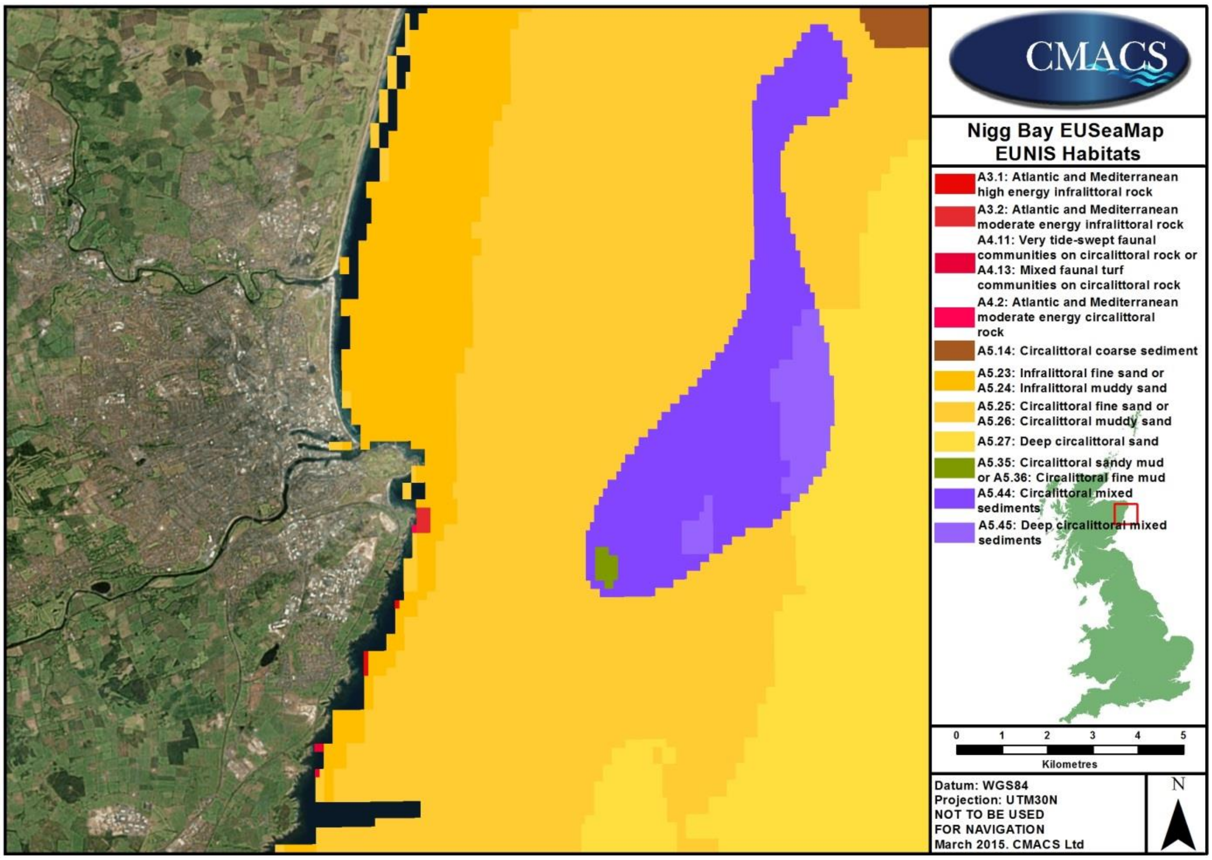

Figure 2. Main benthic habitats in the vicinity of Nigg Bay (downloaded from EModNet).

3. Methodology

3.1 Field sampling

3.1.1 Survey strategy

The survey methods and locations were agreed with the relevant authorities prior to survey. The overall survey plan, which was created with the aid of existing detailed bathymetric and sidescan sonar survey images, involved the use of:

- drop down video plus grab sampling for sediment and macrofaunal analysis at 30 proposed stations (although on the understanding that grabbing may not be possible at some of the inshore stations where hard substrate was expected)
- additional sediment sampling at ten of the stations for analysis of possible chemical contaminants
- 2m scientific beam trawl survey at five locations, primarily for additional information on benthic epifauna to supplement macrofaunal analysis

The survey plan is shown in Figure 2. In practise, minor changes to planned 2m beam trawl locations were required in the field due to the presence of anchored Metocean equipment in Nigg Bay.

Dispensation was received from MS-LOT for the use of the 2m scientific beam trawl, and appropriate notices to mariners were issued.

Survey locations were prepared using the available bathymetric and sidescan sonar information in order ensure sampling of a variety of seabed types.

Camera survey was carried out before grab sampling, in order to prevent grab sampling from taking place on unsuitable substrates such as large boulders, where damage to the grab might be likely, and also to avoid grabbing on sensitive habitats such as Annex 1 features where damage to the feature might have occurred.

The survey was carried out from 14th - 22nd March 2015 inclusive.

3.1.2 Survey vessel

Surveys were carried out using the Aquadynamic (Figure 3), operating on a 12hr day basis out of Aberdeen harbour. Aquadynamic is able to stay on position using dynamic positioning (DP) and differential Global Positioning System (DGPS), providing sub-metre accuracy for vessel position and typically ±1m accuracy for deployment of benthic equipment in shallow water.

Figure 3. Survey Vessel Aquadynamic.

3.1.3 Camera survey

A digital camera with clearwater housing (sometimes erroneously termed a ‘freshwater lens’ system) was used to maximise the quality of images obtained given the anticipated poor visibility due to high levels of suspended sediments. In such a system, the camera is mounted in an enclosed housing which is filled with freshwater and sealed with clear Perspex at the base. The system is deployed with the camera pointing vertically down on a sled to give 20cm clearance from a flat seabed so that the Perspex does not rest directly on the seabed. This system thereby minimises the path distance through turbid water between the camera and seabed target.

The camera was deployed to the seabed while the vessel was held stationary over the target using DGPS and a marine biologist monitored a live video feed as the camera descended. The biologist was responsible for still image capture as well as recording position, depth, noting visible epifauna and describing sediment characteristics.

A minimum of five minutes of survey, with five still images of the seabed, were obtained at each station. Camera survey was lengthened where complex habitat was encountered in order to help to identify and map the extent of these habitats. Notes were taken of the main habitats or species of interest during the survey.

3.1.4 Grab survey

All grab sampling was carried out using a standard stainless steel 0.1m^2 Day grab.

Grab samples for macrofauna were proposed at 30 stations (Figure 4). These stations were also to be first surveyed as camera stations, and it was anticipated that there would be some stations where the camera drops would indicate that the seabed substrate was too coarse or rocky for grab sampling to be attempted.

Sampling protocols required that samples be rejected where washout of sediment during retrieval was suspected (typically because the grab is not completely closed, due for example to stones or shell trapped in the jaws). Samples of less than 5 litres would also generally be rejected. In these situations the grab would be re-deployed up to two further occasions. If no acceptable sample was obtained after three attempts, and in the opinion of the biologist this was due to ground conditions, the vessel would move 50m down-tide and three further attempts made before any station was abandoned. Great care is required before abandoning a station, especially if previous camera survey suggests that grab sampling should be possible.

Once on deck, the contents of the grab were released into a container, and a photograph taken (with a numbered label visible to display station reference and sample ID). For sediment particle size analysis a representative sub-sample amounting to approximately ten times the volume of the largest particle, or 10% of the sample, was removed using a clean (seawater washed) trowel or spoon for sediment particle size and total organic carbon analysis. This sub-sample was stored in a labelled foil container in a cool location and frozen as soon as possible.

For faunal samples (single sample from all stations) the remaining grab contents were gently washed through a 1mm sieve using a low pressure seawater hose. The sieved material was then back-washed into containers labelled on the exterior and with an internal plastic tag, and preserved by addition of a 10% solution of buffered saline formalin to a final concentration of approximately 4%.

Chemical samples were taken from a separate grab sample at ten of the stations. Sampling procedures followed Marine Scotland (2011) guidance. Notably, samples for metal analysis were collected with a clean plastic spoon and those for organic analyses with a clean metal scoop, and the samples were placed in clean acid washed containers supplied by the analytical laboratory. Samples were taken from the surface layer of sediment from the Day grab, and the grab was carefully washed out between samples. All samples for chemical analysis were stored cooled and were delivered to the analysis laboratory as soon as possible in insulated cool boxes.

3.1.5 2m Beam trawl survey

500m tows were carried out using a 2m scientific beam trawl equipped with a 5mm mesh cod end and chain mat. Tows were carried out at an approximate speed of 2 knots over-ground with sufficient warp, typically three to five times water depth, to ensure that the gear sampled the bottom properly. The position of two of the tows had to be adjusted slightly during the survey due to the presence of moored metocean equipment (see Figure 5). All samples were analysed on board the vessel. Invertebrate species were identified and, where appropriate, counted or weighed, and all commercial fish species were measured and the sex of any elasmobranchs was recorded.

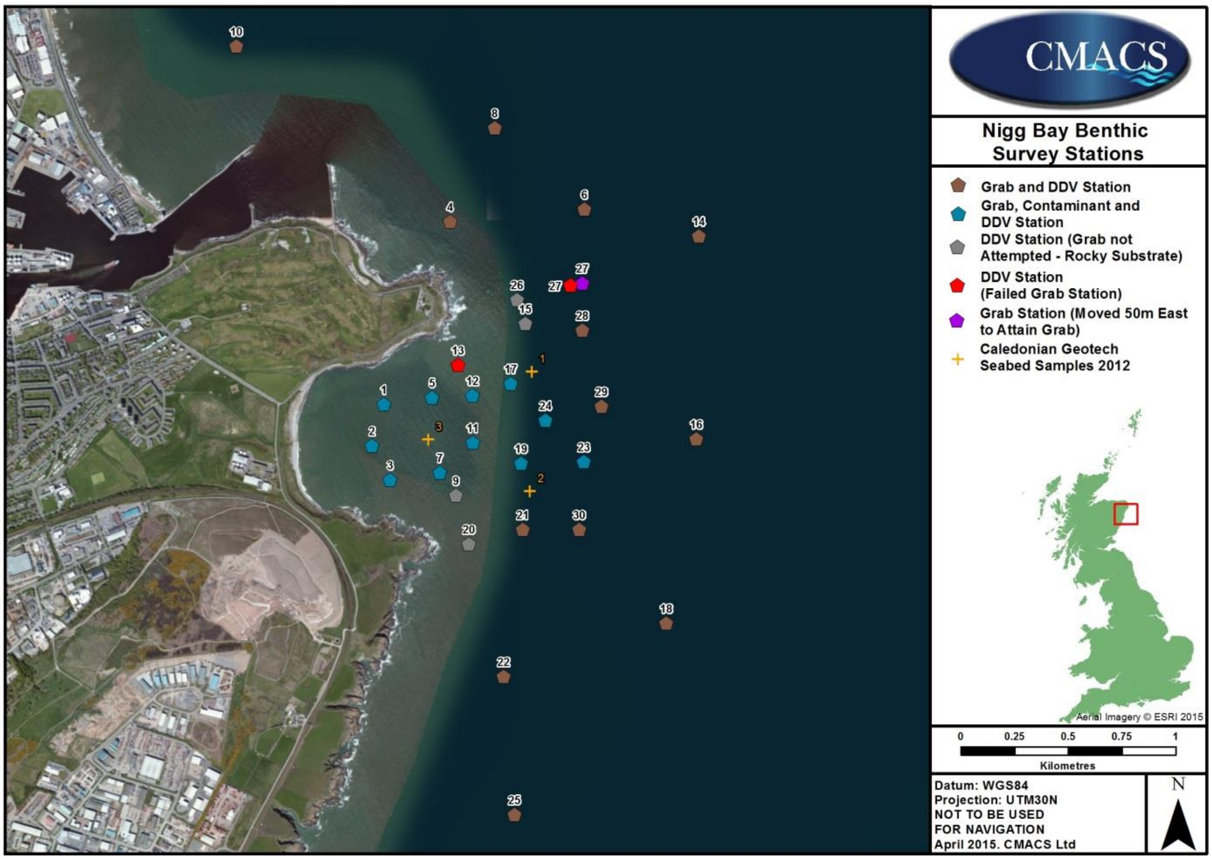

Figure 4. Grab and camera sampling stations. Positions of three sediment samples taken during the 2012 Geotechnical Survey (Caledonia Geotech 2012) are also shown.

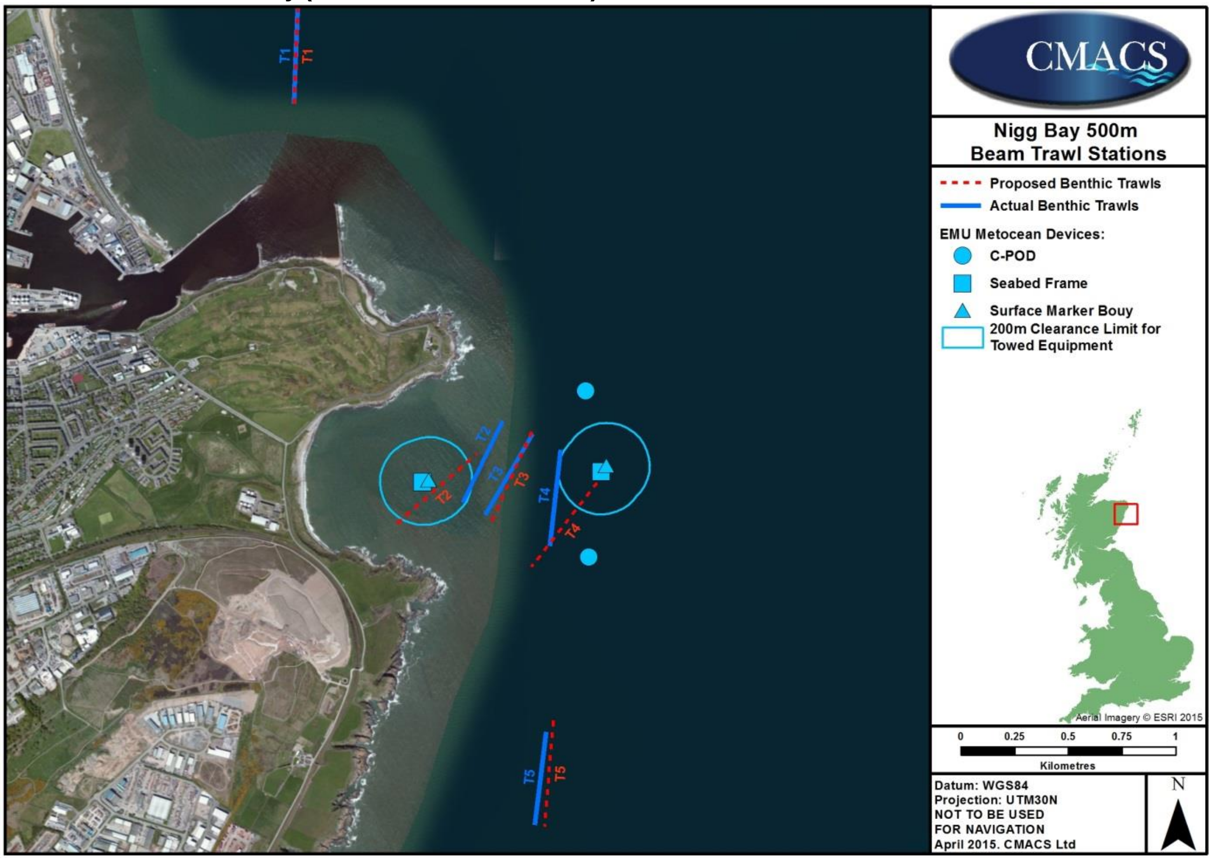

Figure 5. Beam trawl survey locations. Tows T2 & T4 were adjusted from those proposed due to the presence of metocean devices with a requirement for c200m avoidance by towed gear.

3.2 Laboratory methods & data analysis

3.2.1 Camera survey

Data from stills images were analysed by estimating abundance of all taxa (as far as possible) using the SACFOR abundance scale from JNCC 2006 (Table 1), taking into account the known field of view where necessary. Notes of video recordings concentrated on the main features and taxa seen and noting apparent boundaries between differing communities or habitats where these were seen.

Table 1. SACFOR abundance scale, from JNCC (2006).

S = Superabundant, A = Abundant, C = Common, F = Frequent, O = Occasional, R = Rare

GROWTH FORM			SIZE OF INDIVIDUALS / COLONIES					
% COVER	**CRUST / MEADOW**	**MASSIVE / TURF**	**< 1 cm**	**1-3 cm**	**3-15 cm**	**> 15 cm**	**DENSITY**	
> 80%	S		S				> 1 / 0.001 m^2 (1x1 cm)	> 10,000 / m^2
40-79%	A	S	A	S			1-9 / 0.001 m^2	1000-9999 / m^2
20-39%	C	A	C	A	S		1-9 / 0.01 m^2 (10 x 10 cm)	100-999 / m^2
10-19%	F	C	F	C	A	S	1-9 / 0.1 m^2	10-99 / m^2
5-9%	O	F	O	F	C	A	1-9 / m^2	
1-5% or density	R	O	R	O	F	C	1-9 / 10 m^2 3.16 x 3.16 m)	
< 1% or density		R		R	O	F	1-9 / 100 m^2 (10 x 10 m)	
					R	O	1-9 / 1000 m^2 (31.6 x 31.6 m)	
						R	>1 / 10,000 m^2 (100x100 m)	<1 / 1000 m^2
PORIFERA	Crusts *Halichondria*	Massive spp. *Pachymatisma*		Sml solitary *Grantia*	Lge solitary *Stelligera*			
HYDROZOA		Turf species *Tubularia* *Abietinaria*		Small clumps *Sarsia* *Aglaophenia*	Solitary *Corymorpha* *Nemertesia*			
ANTHOZOA	*Corynactis*	*Alcyonium*		Sml solitary *Epizoanthus* *Caryophyllia*	Med. solitary *Virgularia* *Cerianthus* *Urticina*	Large solitary *Eunicella* *Funiculina* *Pachycerianthus*		
ANNELIDA	*Sabellaria spinulosa*	*Sabellaria alveolata*	*Spirorbis*	Scale worms *Nephtys* *Pomatoceros*	*Chaetopterus* *Arenicola* *Sabella*			
CRUSTACEA	Barnacles Tube-dwelling amphipods		*Semibalanus* Amphipods	*B. balanus* *Anapagurus* *Pisidia*	*Pagurus* *Galathea* Small crabs	*Homarus* *Nephrops* *Hyas araneus*		

MOLLUSCA	*Mytilus* *Modiolus*		Sml gastropod *L. neritoides* Sml bivalves *Nucula*	Chitons Med. gastropods *L. littorea* *Turritella* Med. bivalves *Mytilus* *Pododesmus*	Lge gastropod *Patella* *Buccinum* Lge bivalves *Mya Pecten* *Arctica*		Examples of groups or species for each category
BRACHIOPODA				*Neocrania*			
BRYOZOA	Crusts	*Pentapora* *Bugula* *Flustra*			*Alcyonidium* *Porella*		
ECHINODERMATA				*Echinocyamus* *Ocnus*	*Antedon* Sml starfish Brittlestars *Echinocardium* *Aslia Thyone*	Large starfish *Echinus* *Holothuria*	
ASCIDIACEA	Colonial *Dendrodoa*			Sml solitary *Dendrodoa*	Lge solitary *Ascidia* *Ciona*	*Diazona*	
PISCES					Gobies Blennies	Dogfish Wrasse	
PLANTS	Crusts Maerl *Audouinella* Fucoids/ Kelp *Desmarestia*	Foliose Filamentous			*Zostera*	Kelp *Halidrys* *Chorda* *Himanthalia*	

Notes were also made on the main substrates observed and on the quality of each image.

3.2.2 PSA and TOC

The sediment samples were dried until constant weight in an oven at 80°C for a minimum of 24 hours, until a constant sample weight was achieved. Dry sieving was carried out on a half phi series (Table 2) of Endecott BS 410 test sieves using a Retsch AS200 sieve shaker. The amount retained on each sieve was expressed as a percentage of the total dry weight of the sample. Some laser sizing was required where the amount of fines in a samples exceeded 5% on dry sieving, in which case the <2mm fraction were taken to the University of Liverpool for analysis with a Coulter Laser Sizer.

Total organic carbon (TOC) was carried out on a subsample of the sediment from the <2mm fraction by the University of Liverpool on a Carlo Erba NC2500 Elemental Analyser after acid-vapour de-carbonation, and was expressed as % dry weight.

Table 2. Mesh sizes for the half phi series of sieves used for particle size analysis.

31.5 mm	22 mm	16 mm	11 mm	8 mm	5.6 mm	4 mm	2.8 mm	2 mm	1.4 mm
1 mm	710 µm	500 µm	355 µm	250 µm	180 µm	125 µm	90 µm	63 µm.	

Table 3. Classification used for defining sediment type (adapted from Buchanan et al, 1984).

Wentworth Scale (mm)	Phi units	Sediment types
>256 mm	<-8	Boulders
64 - 256 mm	-8 to -6	Cobble
4 - 64 mm	-6 to -2	Pebble
2 - 4 mm	-2 to -1	Granule (gravel)
1 - 2 mm	-1 to 0	Very coarse sand
0.5 - 1 mm	0 - 1	Coarse sand
250 - 500 µm	1 - 2	Medium sand
125 - 250 µm	2 - 3	Fine sand
63 - 125 µm	3 - 4	Very fine sand
<63 µm	>4	Silt

Table 4. Classification used to define the degree of sediment sorting (from Buchanan et al, 1984).

Standard Deviation of mean Phi	Classification
<0.35	Very well sorted
0.35 - 0.5	Well sorted
0.5 - 0.71	Moderately well sorted
0.71 - 1	Moderately sorted
1 - 2	Poorly sorted
2 - 4	Very poorly sorted
>4	Extremely poorly sorted

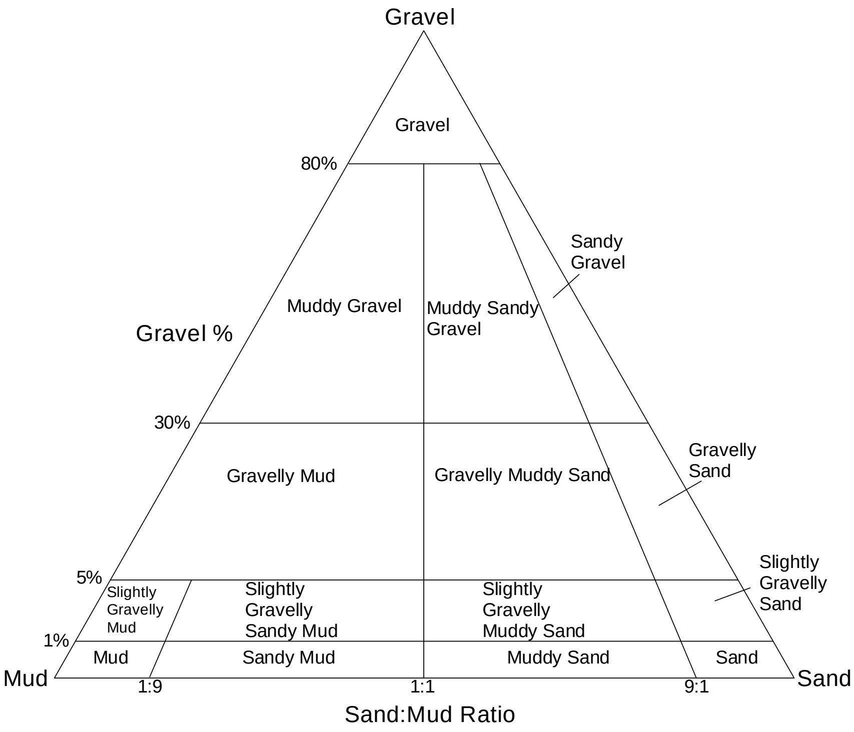

Figure 6. Sediment classification after Folk (1954) as also used by the BGS (Long, 2006). "Gravel" is all components greater than 2 mm and "mud" is less than 63 µm.

Summary statistics for each sediment sample were produced using the software package Gradistat V7.0 from Pye Associates.

3.2.3 Contaminants

Contaminant analysis was carried out using a UKAS accredited laboratory that also takes part in the QUASIMEME (Quality Assurance of Information for Marine Environmental Monitoring in Europe) scheme, on the range of metals (including Tributyl Tin, TBT) Polychlorinated Biphenyls (PCBs) and Polycyclic Aromatic Hydrocarbons (PAHs) listed in Table 5.

Table 5. Suite of determinands used for analysis of chemical contaminants in sediments.

Metals	PCBs	PAHs
As (Arsenic)	PCB congener 28	chrysene
Hg (Mercury)	PCB congener 52	acenaphthene
Cd (Cadmium)	PCB congener 101	acenaphthylene
Cr (Chromium)	PCB congener 118	fluorene
Cu (Copper)	PCB congener 138	naphthalene
Ni (Nickel)	PCB congener 153	phenanthrene
Pb (Lead)	PCB congener 180	benzo(a)anthracene
Zn (Zinc)		benzo(b)fluoranthene

Metals	PCBs	PAHs
TBT		benzo(k)fluoranthene
		benzo(a)pyrene
		benzo(g,h,i)perylene
		dibenzo(a,h)anthracene
		chrysene
		fluoranthene
		pyrene
		indeno(1,2,3-c,d)pyrene

3.2.4 Macrofauna

Grab samples for faunal analysis were rewashed in the laboratory over a 1 mm mesh. All fauna were then picked from the sediment and placed in in 70% alcohol in major taxonomic groups. Wherever possible, all macrofauna from the grab samples were identified to species level and counted. Colonial animals were recorded as present or absent.

The following quality control procedures were used for specimen sorting and identification:

- Experienced operatives carried out all sorting with low power microscopes available for use.
- A proportion of samples (minimum 10%; typically one sample randomly selected from each batch of ten recently sorted samples) was re-sorted by an experienced sorter other than the original. Under this protocol, if the number of animals found in the original sorting is less than 95% of the total found (sorting plus re-sorting) all of the other samples in the appropriate batch sorted by that person must be re-sorted.
- An experienced marine invertebrate taxonomist carried out all identification using relevant up to date identification guides and papers, and an appropriate range of stereo and monocular microscopes.

The laboratory participates in the National Marine Biological Analytical Quality Control (NMBAQC) Scheme.

Biomass determination was carried out following the protocols described in the National Marine Monitoring Plan (NMMP) “Green Book” (Anon, 2001). Biomass to major group (Polychaeta, Oligochaeta, Crustacea, Mollusca, Echinodermata and “Others”) was determined by first obtaining wet weights, which were subsequently converted to Ash Free Dry Weight (AFDW) using published conversion factors. Wet weighing was carried out to the nearest 0.1mg after carefully blotting the animals first. Whilst shelled animals such as molluscs were wet-weighed in their shells, the conversion to ash-free dry weight figures effectively removes the shell element from the final values.

Conversion factors from the measured wet weight to ash free dry weight were based on the published values in Riccardi & Bourget (1998).

Fish were largely ignored for biomass purposes as they are not invertebrates, and are potentially very large animals that probably only occur sporadically in grab samples and would strongly skew the data.

The majority of data analysis was carried out using the software package Primer-e V6. Juveniles, where in large quantities and likely to skew results, were to be excluded from the analysis. Fish were also generally excluded from the statistical analysis, as were any epifauna, although in both cases their presence and ecological importance were discussed where relevant.

A Water Framework Directive (WFD) assessment of sublittoral macrofaunal data from the grab samples was carried out using the most recent available version of the Infaunal Quality Index (IQI) tool from the United Kingdom Technical Advisory Group (UKTAG) website (IQI Workbook UKTAG v01 20140311.xlsm, downloaded from UKTAG 2014). Using this tool (which also uses associated PSA, plus at least an indication of salinity regime), an AMBI IQI value, designed to quantify the degree of environmental stress likely to have been suffered by a benthic community, was determined for each sample and compared to reference values. This is reported as an Ecological Quality Ratio (EQR) for each sample. An EQR with a value of one represents reference conditions and a value of zero represents a severe impact, and the EQR is divided into five ecological status classes (High, Good, Moderate, Poor and Bad) that are thus defined by the changes in the biological community in response to disturbance (Table 6). Once the EQR score and ecological status class have been calculated an assessment should, if possible, be made to consider the certainty of the classification (i.e. confidence in the assigned class) which is based on an interpretation of the standard error of the EQR values calculated, but this is not possible for all datasets. Further information on WFD assessments and the IQI tool is given in WFDUK.org (2014).

Table 6. Ecological status descriptions and boundaries based on EQR values.

Status	Disturbance	EQR values
High	No *or* Very Minor	>0.75
Good	Slight	>0.64
Moderate	Moderate	>0.44
Poor	Major	>0.24
Bad	Severe	≤0.24

Communities were matched to biotope descriptions given in Connor *et al.* (2004) using information on sediments as well as fauna. Additional information from camera surveys and beam trawl surveys was also taken into account in developing biotope descriptions and distributions.

3.2.5 Statistical analysis

Multivariate analysis was carried out using the Primer v6.0 statistical program.

Square root transformations were undertaken prior to the generation of a Bray-Curtis similarity matrix with the similarity matrix used to generate dendrograms (cluster analysis) and multi-dimensional scaling plots (MDS). Cluster analysis and MDS were used in an investigative manner, including use of the SimProf routine to establish groupings of similar communities, which were then followed up with Simper analysis to establish the main contributing species to those communities and how they differ.

MDS plots were also overlaid with bubbles with size relative to percentage of mud and gravel in the sediment as well as depth as an initial investigation into whether or not these factors could be considered as a causative effect on the community present at each station.

4. Results

The survey was successfully completed between 14th and 22nd March inclusive. Field notes for the camera, grab and beam trawl elements are given in Appendices 1-3.

4.1 Camera survey

Visibility was exceptionally low during the survey, notably at the inshore locations but also elsewhere, especially Station 8. Inshore rocky areas were almost always very rough, producing difficulty in getting the camera sufficiently close to the seabed to obtain clear images, and the plexiglass plate that encloses the freshwater between the lens and the seabed was badly scratched early in the survey. Despite these difficulties sufficient information was obtained to identify or clarify the main biotopes and their locations.

At the majority of the locations (all those except for 9, 15, 20, 26, 27 and 28) the images predominantly showed sand with little or no coarse component (e.g. gravel, stones, shell or boulders), and very few fauna. Full results are given in Appendix 4 and representative images are shown in Appendix 5. Burrows indicative of large burrowing organisms were absent. Sandeels were observed at many of these stations (sandeels are discussed further in 4.4 below). At Station 16 one of the five images showed some bare cobble amongst the sand, where a single example of the dahlia anemone *Urticina felina* occurred, whilst three of the images showed some tubes formed from sand grains that were thought to have possibly been formed by the ross worm *Sabellaria spinulosa*, but these were not consolidated and appeared to be small, broken empty tubes (see images in Appendix 5). The presence of very small numbers of *Sabellaria spinulosa* juveniles, along with large numbers of small broken, empty tubes, was confirmed in the grab sample from Station 16. As there was no indication of likely *Sabellaria* reef, grabbing was allowed to proceed at this Station.

At the locations where harder seabed habitats were anticipated, based on sidescan and bathymetry images (stations 9, 13, 15, 20, 26, 27 and 28) the substrate was with only one exception a mixture of boulders/rock and sand, with extensive continuous bedrock always absent (the exception being at Station 13 which was extremely turbid but appeared to be solely composed of sand) (Table 8). The ratio of boulders/rock to sand appeared to vary greatly over distances of only a few meters at all of these stations. At Station 26, where the bathymetric images from 2012 suggest the likely presence of bedrock, there was less sand than elsewhere, but nevertheless considerable amounts of sand were present, and the rock (which may have been large boulders or very rough bedrock, or a mixture of both) were covered in large amounts of sandy sediments. In all cases, including Station 26, the boulders/rock were only sparsely colonised by a small number of organisms. The most conspicuous organisms were the colonial soft coral Dead Man's Fingers *Alcyonium digitatum*, though even these were not ubiquitous and were nowhere abundant, and a small number of the plumose anemone *Metridium senile* at Station 20, while the only other regularly observed large fauna was the common starfish *Asterias rubens.* Very sparse examples of short faunal turf formed by hydroids and/or bryozoans were seen at stations 9, 15 and 27, and occasional sparse examples of more solitary hydroids that were probably *Tubularia* or possibly *Sarsia* sp were seen. Encrusting organisms were mainly limited to a sparse patchy covering of thin orange material that may have been either tunicate (or possibly sponge) at a couple of stations along with very limited amounts of yellow encrusting sponge. Barnacle shells were often seen, sometimes in quite high densities, but virtually all appeared to be dead shells. There were tiny amounts of pink encrusting material that was probably encrusting coralline algae at Station 9 (image 43) and Station 26 (image 60); however, at clearly under 1% cover in each case the SACFOR scale curiously categorises these amounts as essentially absent (Table 1). No other algae were observed at any of the locations apart from a small piece of wrack (*Fucus* sp) at Station 20 that is presumably unattached material that has drifted from the adjacent intertidal area.

Although there are a number of sublittoral biotopes that are characterised by heavy scouring due to sand gravel or cobble, none of them match particularly well the suite of fauna found at this location. The horn wrack *Flustra foliacea*, widespread in the UK on some sand scoured biotopes, was completely absent from the camera images. Whilst it would be expected that this species might be reduced in abundance following winter storms, and re-establish to some extent over the summer, it's complete absence suggests it is never likely to have been abundant, especially as only small amounts were found in the beam trawl survey. The best biotope match appears to be with the biotope complex **Cr.MCR.EcCr Echinoderms and crustose communities**, due largely to the dominance of dead man's fingers *Alcyonium digitatum* and the common starfish *Asterias rubens*, together with the general sparse appearance, although the encrusting pink coralline algae (lithothamnia) and bryozoans that are widespread in this biotope complex were largely absent. There is no clear match with any of the main biotopes described within this biotope complex (Connor *et al* 2004), although there is a greater superficial similarity to **CR.MCR.EcCr.FaAlCr.Adig *Alcyonium digitatum*, *Pomatoceros triqueter*, algal and bryozoan crusts on wave-exposed circalittoral rock** than to any of the alternatives due simply to the presence of *A. digitatum*; however, the relatively low density of *A. digitatum* and lack of the encrusting keelworm *P. triqueter*[2], algal crusts and bryozoan crusts at Nigg Bay means that the match is very poor, and so the area is best simply described as a sparse example of the Cr.MCR.EcCr biotope complex.

Due to the conditions on site during the survey, with consistent onshore swell and a rough rocky seabed (and noting that the geophysical survey vessel was reported to have grounded during the 2012 surveys) it was not possible to elucidate the boundary between the observed echinoderms and crustose communities biotopes and the low-shore *Laminaria digitata* biotope, but it is apparent from the bathymetric information, in combination with aerial imagery available on-line, that the low shore *Laminaria digitata* biotope probably extends a short distance beyond that observed during low tide surveys in autumn of 2014, notably on the northern shoreline. The sidescan and bathymetry images show less match with the camera images than might be expected at stations 9, 13, 15, 20, 26, 27 and 28, in that the camera images revealed more sand and less hard substrate than was suggested by the bathymetric and sidescan images. It is possible that the sand, which is clearly highly mobile in the vicinity of Nigg Bay, may vary noticeably in depth, and hence the degree to which it covers or exposes the areas of boulders, with time. Thus it also seems plausible that there was more sand in these locations during March 2015 than during the geophysical survey on which the acoustic images are based, which was carried out in 2012. Given also the highly variable (over short distances) cover of boulders and sand, it is clear that the boundaries are likely in reality to be somewhat indicative. Despite this, the position of the boundaries between the boulder/rocky Cr.MCR.EcCr biotope and the adjacent sandy infaunal biotopes (the latter described in 4.3 below) seem unlikely to have moved any great distance and so these, and also the boundary with the *Laminaria digitata* biotope, can be inferred with sufficient precision to reliably inform the environmental assessment (see 4.5). Biotope distributions are summarised in 4.5.

Although the areas of rock and boulders arguably form a geogenic reef habitat that matches European Habitats Directive Annex 1 reef definitions, the associated community is very sparse and species poor, being dominated by common starfish *Asteria rubens* and small amounts of dead man's fingers *Alcyonium digitatum*, both of which can be expected to be very widespread and abundant in Scottish waters, and do not match any of the Scottish Priority Marine Features.

Using the definitions presented by Irving (2009) (Table 7), the main areas of reef can be regarded as of medium reefiness based on their elevation (definitely more than 64mm but not more than 5m) and degree to which they are "clast supported" as opposed to matrix supported, which is likely mostly to lie between 40 and 95%; those parts where there are a higher proportion of sands are likely to be of low to medium reefiness.

[2] Now known as *Spirobranchus triqueter*

Table 7. Factors to be considered in defining reefiness of stony reefs (from Irving 2009).

Characteristic	Not a 'stony reef'	'Resemblance' to being a 'stony reef'		
		Low[2]	Medium	High
Composition:	<10%	10-40% Matrix supported	40-95%	>95% Clast supported
Notes: Diameter of cobbles / boulders being greater than 64mm. Percentage cover relates to a minimum area of 25m^2. This 'composition' characteristic also includes 'patchiness'.				
Elevation:	Flat seabed	<64mm	64mm-5m	>5m
Notes: Minimum height (64mm) relates to minimum size of constituent cobbles. This characteristic could also include 'distinctness' from the surrounding seabed. Note that two units (mm and m) are used here.				
Extent:	<25m^2	← >25m^2 →		
Biota:	Dominated by infaunal species			>80% of species present composed of epifaunal species

Table 8. Faunal observations (SACFOR scale) from those Stations where harder (i.e. not sandy) substrates were anticipated based on acoustic observations.

Station	**9**	**9**	**9**	**9**	**13**	**13**	**13**	**13**	**13**	**15**	**15**	**15**	**15**	**15**	**20**	**20**	**20**	**20**	**26**	**26**	**26**	**26**	**26**	**27**	**27**	**27**	**27**	**27**	**28**	**28**	**28**	**28**	**28**
Image no.	**43**	**44**	**45**	**46**	**63**	**64**	**65**	**66**	**67**	**52**	**53**	**54**	**55**	**56**	**39**	**40**	**41**	**42**	**58**	**59**	**60**	**61**	**62**	**51**	**52**	**53**	**54**	**55**	**41**	**42**	**43**	**44**	**45**
Quality	**M**	**P**	**P**	**P**	**M**	**P**	**M**	**P**	**P**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**G**	**P**	**G**	**M**	**M**	**M**	**P**	**P**	**M**	**M**	**M**	**M**	**P**	**P**	**P**
Substratum	**B**	**B**			**S,S hfr**	**S**	**S**	**S**	**S**	**B**	**B**	**S,S hfr**	**S,S hfr**	**B**	**B**	**R,S**	**B**	**B,S, Shf r**	**B**		**B**	**B**	**R,S**	**S**					**R**	**R**		**S**	**S**
Hydroid and/or Bryozoan turf		O								O				C		S	S											S					
Alcyonium digitatum	O														F						R			A			O	F	F	C	O		
Barnacle sp																					R												
Yellow encrusting sponge	R																																
Asterias rubens										A	A			S	A	S	S	S	S		A	S						S					
Orange encrusting ascidian/sponge?										F	R			C					C		F												
Seaweed (fucoid, prob drift)																		R															
Metridium senile															A																		
Sagartia sp?																					A												
Pink encrusting coralline algae	*																				*												
Solitary hydroids *Tubularia* or *Sarsia*																					C												

Substratum: B boulders S Sand Shfr Shell fragments R rock

SACFOR scale S Superabundant A Abundant C Common F Frequent O occasional R Rare

* pink encrusting coralline algae present at less than 1% but this equates to absent on the SACFORscale for this taxon

4.2 Sediments

4.2.1 Particle size analysis and TOC

Results of PSA analysis by dry sieving are given in full in Appendix 6. Summary results are given in Table 9 and Figure 7.

Three of the samples also required laser sizing according to the specified analytical protocol (by virtue of the <63um fraction representing more than 5% of the whole sample upon dry sieving). These were from stations 1, 5 and 10 (5.2%, 6.3% and 5.7% fines after dry sieving respectively). The <2mm fraction (which was virtually all of the sample in each case) was therefore laser sized and the results are given in Appendix 7. These results were provided to the clients consultants for possible use in coastal process modelling. The laser-derived results differed slightly from the dry sieving results for the same samples, with the predominant size fractions being apparently slightly larger. This is not unusual, since laser sizing uses a mean estimate of the particle size based on an estimate of volume (hence influenced by both maximum and minimum particle dimensions), whilst dry sieving, being based on the ability of particles to pass through a mesh, is much less influenced by the longest dimension of the particles.

Considering that several other samples had fine fractions (according to dry sieving) of very close to 5% (but not subjected to laser sizing), along with the disparity in results using the two different methods, only the dry sieving results are discussed in any detail below, since they are likely to be consistent across the survey and are more than adequate for the purpose of attributing and describing the associated biotopes.

The samples were virtually all sand, with the dominant fractions almost always being fine sand, though medium sands were also well represented and were dominant at stations 14, 16, 18, 25 and 30. Coarse sands contributed 20% or more at stations 14, 18 and 30, and were marginally the dominant fraction at Station 18. The sediments were mostly moderately well, well or very well sorted, with only seven stations being moderately sorted (2, 5, 7, 10, 14, 16 & 28). Only station 27 off Girdle Ness was poorly sorted, this station retaining more coarse material than others, with a total of 9.4% gravel. Elsewhere gravel content was consistently very low, with the highest values of around 1.5% - 2.9% being found at relatively offshore stations mostly off Girdle Ness and Nigg Bay (6, 14, 16 & 18). Much of the gravel content appeared to consist of relatively fine shell fragments.

Mud content was also low, with the muddier stations being close inshore within Nigg Bay (1, 2, 5 & 7) and to the North of Aberdeen harbour (Station 10), but even at these locations mud contributed only 4.7 to 6.3% of each sample and sands strongly dominated. Elsewhere mud content was almost always less than 1%.

TOC values are consistently low, ranging from 0.08 to 0.25%, reflecting the low mud contents of the sediments.

The 2012 geotechnical survey found very similar results at the three locations where sediment samples were analysed (Figure 4) with well sorted fine to medium sands with low mud and gravel contents. Surveys from 1988 to 2002 slightly further offshore also found consistently well sorted sandy sediments dominated mostly by fine and mediums sands with low gravel and mud content and low Total Organic Content (as estimated using loss on ignition LOI) (SEPA, 2002).

The PSA analysis supports the observations from the camera survey, where sand predominated at the same stations, with very little observed gravel, most of which was small shell fragments, and no obvious mud.

4.2.2 Contaminants

The results of testing of sediments from ten stations for a comprehensive range of potential contaminant metals (including TBT), PCBs and PAHs are shown in Table 10 (full results in Appendix 8). Relevant Action Levels from Marine Scotland and Cefas are also shown. Contaminant concentrations below action level one are thought to be of no danger to the environment if disposed of at sea, whilst levels above action level two are considered unsuitable for disposal at sea.

The levels of all potential contaminants were found to be consistently well below the Marine Scotland Action 1 levels at all stations.

Table 9. Summary results of particle size analysis and TOC analysis on sediment samples. Continued below.

Results from meshes coarser than 16000µm not shown as nothing was retained Dominant mesh fractions highlighted

Station	% retained on relevant Mesh size (µm)																	
						Gravel		Very coarse sand		Coarse sand		Medium sand		Fine sand		Very fine sand		Mud
	16000	11200	8000	5600	4000	2800	2000	1400	1000	710	500	355	250	180	125	90	63	<63
1				<0.1	<0.1	<0.1	0.3	0.3	0.3	0.4	0.7	1.8	12.4	60.3	5.7	5.6	6.9	5.3
2			0.1			0.1	0.3	0.4	0.5	0.9	3.2	7.3	26.2	44.1	2.7	3.9	5.4	5.0
3					0.1	0.1	0.3	0.6	1.2	2.4	3.8	5.8	25.2	50.8	1.3	4.7	2.2	1.5
4				<0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.6	1.2	9.4	76.6	8.4	1.3	0.8	0.6
5						<0.1	0.1	0.3	0.4	0.6	1.5	3.8	15.6	56.3	5.4	3.3	6.5	6.3
6			0.5		0.3	0.2	0.5	1.0	1.9	3.3	5.4	5.7	18.8	57.3	3.9	0.5	0.4	0.4
7			0.1			<0.1	0.3	0.6	0.9	1.2	1.7	3.2	22.7	49.5	4.7	5.3	5.3	4.7
8						<0.1	0.2	0.3	0.3	0.4	0.7	1.5	14.5	76.0	3.9	0.8	0.8	0.7
10					0.1	0.1	0.4	0.4	0.4	0.5	0.8	1.2	13.1	61.5	2.1	6.4	7.3	5.7
11						0.1	0.3	0.3	0.3	0.6	1.3	2.8	18.4	65.9	4.2	2.3	2.7	0.9
12					<0.1	<0.1	0.2	0.4	0.5	0.6	1.3	2.6	15.8	60.8	4.4	6.5	4.1	2.8
14			0.2	0.5	0.3	0.4	0.8	1.7	4.1	9.1	22.4	24.3	19.0	15.5	0.7	0.3	0.4	0.3
16			0.1	0.2	1.4	0.3	0.9	2.3	4.2	7.5	13.3	20.4	22.2	21.9	2.7	1.0	1.0	0.5
17					<0.1	0.1	0.2	0.3	0.6	0.9	1.2	1.7	12.0	74.6	5.3	1.5	0.7	0.9
18						<0.1	0.1	0.3	1.7	11.9	36.7	37.3	9.3	2.1	0.1	0.1	0.2	0.1
19					<0.1	<0.1	<0.1	0.1	0.1	0.1	0.3	1.4	20.1	75.1	2.0	0.4	0.3	0.2
21						<0.1	<0.1	0.1	0.2	0.3	0.6	1.8	19.8	74.6	1.9	0.4	0.2	0.1
22							<0.1	0.1	0.2	0.3	0.5	3.8	42.7	50.3	1.6	0.1	0.1	<0.1
23						<0.1	<0.1	<0.1	<0.1	0.1	0.8	3.6	32.4	59.6	2.6	0.3	0.3	0.2
24						<0.1	<0.1	<0.1	0.1	0.3	0.5	1.1	14.1	77.3	5.9	0.5	0.1	0.1
25			0.1	<0.1	<0.1	<0.1	0.1	0.2	0.2	0.4	1.4	11.4	47.7	35.5	2.5	0.2	0.2	0.1
27	0.7		0.2	0.5	1.2	2.5	4.4	4.8	5.0	4.7	4.1	3.7	11.5	50.7	5.2	0.3	0.3	0.2
28				0.1	0.5	0.6	1.1	2.0	4.6	5.0	2.9	3.4	14.8	58.3	5.5	0.5	0.5	0.4
29					0.1	0.1	0.2	0.2	0.4	0.7	1.8	3.6	23.7	64.7	3.1	0.3	0.5	0.5
30						<0.1	<0.1	0.1	0.2	1.5	19.9	16.6	26.1	33.6	1.6	0.1	0.1	0.1

Table 9. Continued.

Station	Folk description after Long (2006)	Mean size (µm)	Sorting	Description based on mean size value	% gravel	% sand	% mud	TOC %
1	Sand	181	Moderately Well Sorted	Fine Sand	0.4	94.4	5.2	0.14
2	Sand	231	Moderately Sorted	Fine Sand	0.4	94.6	5.0	0.20
3	Sand	247	Moderately Well Sorted	Fine Sand	0.5	98.0	1.5	0.16
4	Sand	213	Very Well Sorted	Fine Sand	0.3	99.1	0.6	0.12
5	Sand	196	Moderately Sorted	Fine Sand	0.2	93.6	6.3	0.13
6	Slightly Gravelly Sand	265	Moderately Well Sorted	Medium Sand	1.5	98.1	0.4	0.10
7	Sand	209	Moderately Sorted	Fine Sand	0.3	95.0	4.7	0.11
8	Sand	220	Very Well Sorted	Fine Sand	0.2	99.1	0.7	0.09
10	Sand	178	Moderately Sorted	Fine Sand	0.6	93.7	5.7	0.11
11	Sand	228	Well Sorted	Fine Sand	0.4	98.7	0.9	0.18
12	Sand	211	Moderately Well Sorted	Fine Sand	0.2	97.0	2.8	0.18
14	Slightly Gravelly Sand	427	Moderately Sorted	Medium Sand	2.3	97.5	0.3	0.24
16	Slightly Gravelly Sand	383	Moderately Sorted	Medium Sand	2.9	96.6	0.5	0.25
17	Sand	218	Very Well Sorted	Fine Sand	0.2	98.8	0.9	0.14
18	Sand	506	Well Sorted	Coarse Sand	0.1	99.8	0.1	0.10
19	Sand	227	Very Well Sorted	Fine Sand	<0.1	99.8	0.2	0.13
21	Sand	229	Very Well Sorted	Fine Sand	<0.1	99.9	0.1	0.12
22	Sand	251	Very Well Sorted	Medium Sand	<0.1	99.9	0.0	0.08
23	Sand	241	Very Well Sorted	Fine Sand	<0.1	99.8	0.2	0.10
24	Sand	217	Very Well Sorted	Fine Sand	<0.1	99.9	0.1	0.12
25	Sand	268	Well Sorted	Medium Sand	0.2	99.7	0.1	0.10
27	Gravelly Sand	385	Poorly Sorted	Medium Sand	9.4	90.3	0.2	0.14
28	Slightly Gravelly Sand	287	Moderately Sorted	Medium Sand	2.2	97.4	0.4	0.18
29	Sand	238	Well Sorted	Fine Sand	0.3	99.1	0.5	0.13
30	Sand	326	Moderately Well Sorted	Medium Sand	0.1	99.9	0.1	0.11

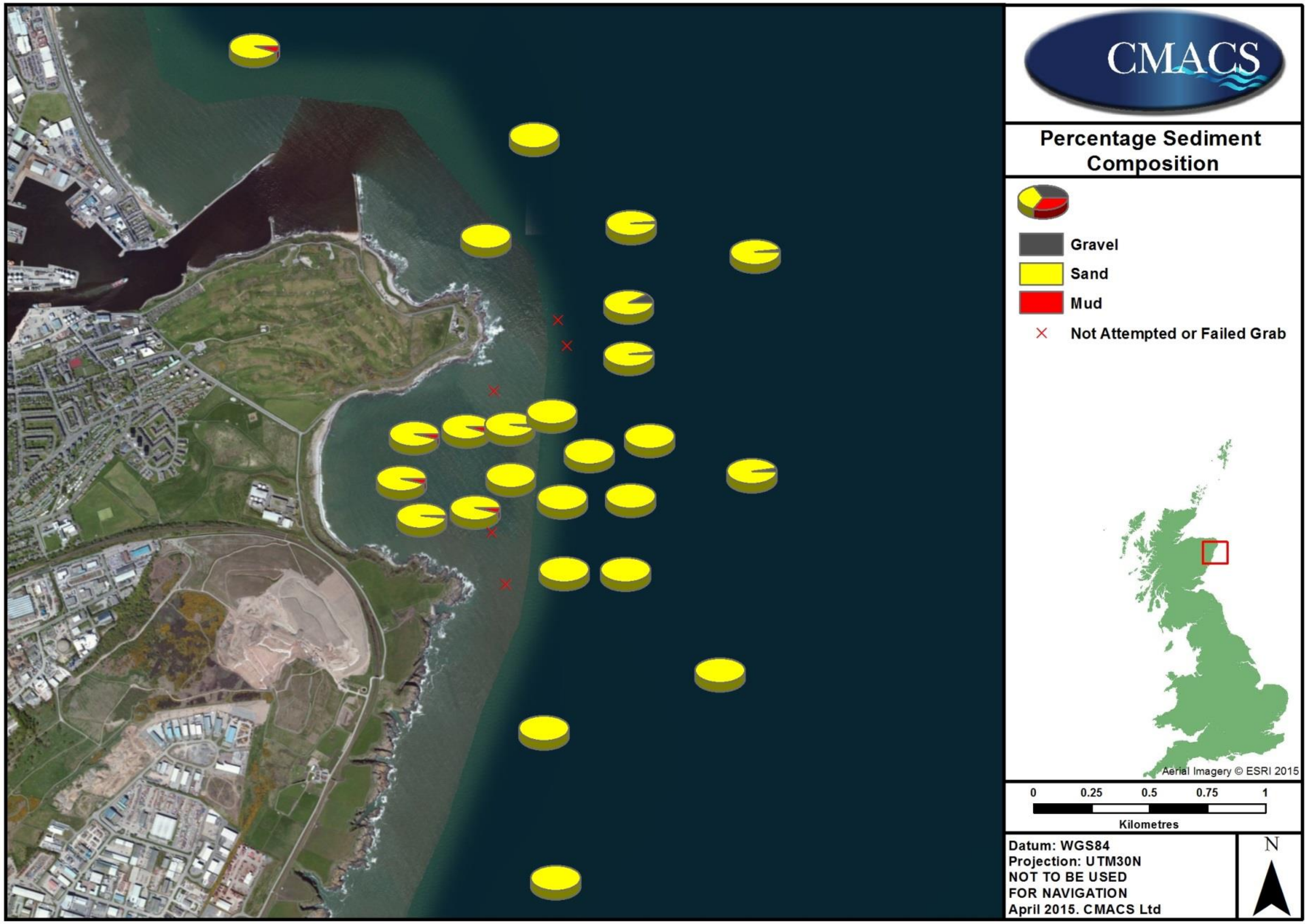

Figure 7. Mud-sand-gravel fractions in sediments from Nigg bay, Aberdeen.

Table 10. Results of testing for a range of potential contaminants in from the <2mm fraction of sediments from ten grab sample stations, along with relevant Action Levels from Marine Scotland and Cefas.

Contaminant	Cefas		Marine Scotland		Nigg Station No									
	Action Level 1	Action Level 2	Action Level 1	Action Level 2	1	2	3	5	7	11	17	19	23	24
Metals, TBT (mg/kg dry weight; PPM)														
As (Arsenic)	20	100	20	70	6.19	5.98	6.12	5.92	6.00	6.65	7.34	7.68	8.79	6.99
Hg (Mercury)	0.3	3	0.25	1.5	0.01	0.02	0.02	0.02	0.01	0.01	0.03	< 0.01	< 0.01	< 0.01
Cd (Cadmium)	0.4	5	0.4	4	< 0.10	< 0.10	0.11	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.16
Cr (Chromium)	40	400	50	370	19.0	24.2	22.1	19.9	22.3	27.3	25.3	22.4	17.8	18.3
Cu (Copper)	40	400	30	300	3.03	3.66	2.96	2.53	2.60	2.48	2.20	2.16	1.70	1.83
Ni (Nickel)	20	200	30	150	5.88	8.11	6.15	5.99	5.79	7.09	5.99	5.66	4.76	4.56
Pb (Lead)	50	500	50	400	17.9	19.5	19.9	17.2	19.5	18.0	17.5	17.9	21.0	18.3
Zn (Zinc)	130	800	130	600	25.0	29.7	25.1	21.8	23.5	24.3	24.8	22.8	18.8	20.3
TBT	0.1	1	0.1	0.5	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
PCBs (mg/kg dry weight; PPM)														
PCB congener 28			0.02	0.18	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
PCB congener 52			0.02	0.18	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
PCB congener 101			0.02	0.18	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
PCB congener 118			0.02	0.18	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
PCB congener 138			0.02	0.18	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
PCB congener 153			0.02	0.18	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
PCB congener 180			0.02	0.18	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
PAHs (µg/kg dry weight; PPB)														
chrysene			100		1.33	3.23	1.46	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	0.812
acenaphthene			100		0.266	1.75	0.531	<0.100	<0.100	0.620	0.132	<0.100	<0.100	0.541
acenaphthylene			100		0.133	0.135	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
fluorene			100		4.25	1.89	0.531	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	0.541
naphthalene			100		<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
phenanthrene			100		3.05	11.3	3.85	0.802	0.794	0.620	0.132	0.270	<0.100	3.25

Contaminant	Cefas		Marine Scotland		Nigg Station No									
	Action Level 1	Action Level 2	Action Level 1	Action Level 2	1	2	3	5	7	11	17	19	23	24
benzo(a)anthracene			100		1.99	4.58	2.13	<0.100	0.132	0.155	<0.100	0.135	<0.100	1.22
benzo(b)fluoranthene			100		2.39	5.25	2.79	0.134	0.529	0.155	0.397	<0.100	<0.100	1.08
benzo(k)fluoranthene			100		0.797	1.75	0.930	0.134	0.265	0.155	0.265	<0.100	<0.100	0.406
benzo(a)pyrene			100		2.13	4.85	2.66	0.267	0.661	0.310	0.662	0.135	<0.100	1.35
benzo(g,h,i)perylene			100		1.33	3.23	1.73	0.134	0.529	0.155	0.397	<0.100	<0.100	0.677
dibenzo(a,h)anthracene			10		0.398	0.808	0.398	<0.100	0.132	<0.100	<0.100	<0.100	<0.100	0.135
chrysene			100		1.20	4.85	1.20	<0.100	<0.100	<0.100	3.31	<0.100	<0.100	0.677
fluoranthene			100		0.797	9.56	4.52	<0.100	<0.100	0.155	0.397	<0.100	<0.100	3.11
pyrene			100		3.85	11.2	4.91	0.267	0.132	<0.100	0.530	<0.100	0.674	3.38
indeno(1,2,3-c,d)pyrene			100		1.20	2.29	1.46	0.134	0.397	0.155	0.265	<0.100	<0.100	0.406

Table 11. Summary of the main fauna found in grab samples (all taxa with a total abundance for the survey of ten or more).

Name	1	2	3	4	5	6	7	8	10	11	12	14	16	17	18	19	21	22	23	24	25	27	28	29	30	Total
Nephtys cirrosa	4	14	12	5	13	7	9	4	12	3	2	2		9	3	5	2	2	2	2	2	2	1	2	2	**121**
Angulus fabula	2	6	4	4	3		6	3	12	8	31			2	1	1	1									**84**
Ophelia borealis						1						39							1		7	4	6	3		**61**
Glycera lapidum												2	31									4	5			**42**
Nemertea spp.			2				2			1	2	1	10									4				**22**
Nephtys sp. Juv.	1				2	1	2	2	1	2	1			1		1		2	2	1			1	1		**21**
Scoloplos armiger						1						10	1	1	1						1		5	1		**21**
Nephtys longosetosa			1	2		1						1		1		1	3	1		1	2		1	4	1	**20**
Spio martinensis				2	1					1	11			4			1									**20**
Magelona johnstoni				1	1			5	3	2	2			1												**15**
Nephtys hombergii					2		2	1			6															**11**
Sabellaria spinulosa													9									2				**11**
Ammodytes sp. *						1				1						8		1								**11**
Notomastus latericeus										1			7									2				**10**

* sandeels *Ammodytes* spp. are fish rather than invertebrates and hence omitted from all statistical analyses of macrofauna

4.3 Macrofauna

Selected faunal abundance data and associated univariate indices from the grab sampling programme are shown in Table 11 and Table 12, and in Figure 8 to Figure 13. Full raw data are presented in Appendix 9.

The fauna was species poor, with a total of only 81 invertebrate taxa for the survey as a whole, and the number of taxa per 0.1m^2 grab varied from 4 to 18, and exceeded 12 at only two stations (16 and 12). Likewise, the number of individuals was also low, being in the range of 4 to 76 individuals per 0.1m^2 grab, and exceeding 28 only at stations 10, 14 and 16 (station 10 being north of Aberdeen harbour, and having a little more mud content than most stations, and Stations 14 and 16 being the deepest, most offshore stations in the survey area). The stations to the south of the survey area were particularly sparsely inhabited (Figure 8) although distribution of number of taxa was rather different, with a tendency for there to be fewer taxa in inshore stations (Figure 9). Station 16 had both the most taxa and the most individuals. A variety of polychaete worms strongly dominate the fauna, notably the catworm *Nephtys cirrosa*, along with *Ophelia borealis* and *Glycera lapidum*; all of these are typical of highly mobile, well sorted sands and typically occur in relatively sparse faunal assemblages, as do several of the other of the other worm species present. NcirBat is widely distributed in the survey area, unlike *O. borealis*, *G. lapidum* and to a lesser degree *Angulus fabula,* which have more restricted distributions (Figure 11 to Figure 13). Of the thirteen invertebrate taxa where a total of more than ten individuals occurred in the survey, all were polychaete worms except for the ribbon worm Nemertea spp. and the small bivalve *A. fabula*. Both of these are commonly encountered in mobile sands but *A. fabula* especially tend to be more abundant with a slightly increased mud content. In the main indicators of diversity and taxon richness are on the low side (Table 12), with the widely used Shannon – Wiener diversity index being mostly less than 2 and with a maximum of 2.3.

Possible communities represented by this data were investigated by means of multivariate statistics, including the Multidimensional Scaling (MDS) plot and associated dendrogram shown in Figure 14. The likely influence of the main available environmental parameters can be seen in Figure 15 where these parameters have been superimposed on the MDS plot. Not unsurprisingly, depth and sediment type, including mud and gravel content, can be seen to vary with the faunal community, and are likely to be strongly influencing factors on the community.

The SimProf routine from Primer V6 was used to identify the main distinguishable faunal groupings as shown in in Figure 14. The distribution of these SimProf derived groups is shown in Figure 16, and the results of Simper analysis to describe the main distinguishing characteristics of the communities are given in Appendix 11.

The majority of the stations in SimProf group d are best described by the biotope **SS.SSa.IFiSa.NcirBat *Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand**, although it is noticeable that the abundance of burrowing amphipods *Bathyporeia* spp. is lower than is usual for this biotope. In some places, notably Station 12, and to a lesser extent stations 2, 3 4, 7, 10 and 12 fauna that favour slightly muddier sediments, notably the bivalve *Angulus fabula* but also some of the polychaetes such as *Nephtys hombergii, and Magelona* spp. are more apparent, whilst at Station 12 single individuals of the bivalves *Abra alba* and *Nucula nitidosa* (again tending to favour slightly muddier sediments) also occur. On balance it was felt that station 12 was a sufficiently better match to the biotope (**SS.SSa.IMuSa.FfabMag *Fabulina fabula*[3] and *Magelona mirabilis* with venerid bivalves and amphipods in infralittoral compacted fine muddy sand**) as to justify assigning this biotope at this station, whilst a number of nearby stations (2, 3 &7) along with Stations 4 & 10 further north, had a fauna that also showed some affinity with this biotope, primarily due again to the presence of some *Angulus fabula*, but are a slightly better match overall for the NcirBat biotope. Note that other inshore stations in Nigg Bay, Stations 1 & 5, had relatively elevated mud content of over 5%, but this was not noticeably reflected in the fauna. However,

[3] *Fabulina fabula* is now better known as *Angulus fabula* or alternatively *Tellina fabula*

Connor *et al.* (2004) notes that the typically rather richer FfabMag biotope often grades into the more species poor NcirBat biotope with increasing stability, and hence mud content, and many taxa are common to both. It is possible that the fauna in and around Nigg bay may vary in the degree to which it matches these two biotope descriptions from year to year.

Groups a, b, and c have relatively impoverished fauna though slightly richer in both taxa and individuals than most of the other stations and not an obvious match to either of the above infaunal biotopes. Station 18 (the sole representative in “group” c) consists largely of coarse and medium sands in contrast to the fine and medium sands that are more dominant elsewhere, and is relatively deep at over 25m, but again had a surprisingly sparse fauna. However, despite having only nine invertebrate taxa it is one of the more diverse communities by virtue of not being heavily dominated by one abundant taxa, and is strongly distinguished from other groups by virtue mostly of the presence of the robust bivalve *Goodallia triangularis* at relatively high density (five individuals) along with an absence of several polychaete worm species such as *Ophelia borealis, Glycera lapidum* and Nemertea spp. It is noticeable that four of the nine taxa at this station were bivalve molluscs, which again distinguishes the community from others in the survey, and suggests a slightly more stable faunal community. These bivalves included single examples of *Moerella pygmaea* and *Crenella decussata*, both of which become more abundant further offshore according to historical surveys by SEPA in the area of the Nigg sewage outfall. The best match for this community is probably the **SS.SCS.ICS Infralittoral Coarse Sediments** biotope complex, although it is deeper and less coarse than is typical for this complex, and relatively sparsely inhabited, with no clear match to any of the constituent biotopes.

Simper groups a and b show a high overall dissimilarity from each other at around 79% dissimilarity but are distinguished from each other by relatively modest differences in a broad range of taxa rather than large differences in any one taxon (Appendix 11). The three taxa contributing the most to differences between these groups were the worms *Ophelia borealis*, *Glycera lapidum* and ribbon worms Nemertea spp., but all three were present in the majority of samples within both groups. *Ophelia borealis* and to a lesser degree *Nemertea* are widespread in sandy sediments and not characteristic of any particular biotope, and there were no distinguishing fauna, or indeed sediment, characteristics, to suggest that the two groups represent different biotopes. The best match for both groups was considered to be the biotope **SS.SCS.ICS.Glap *Glycera lapidum* in impoverished infralittoral mobile gravel and sand** as many of the typical constituent fauna, which are largely worms, are present in one or both groups, including *Glycera lapidum*, *Ophelia borealis*, and *Nephtys cirrosa*.

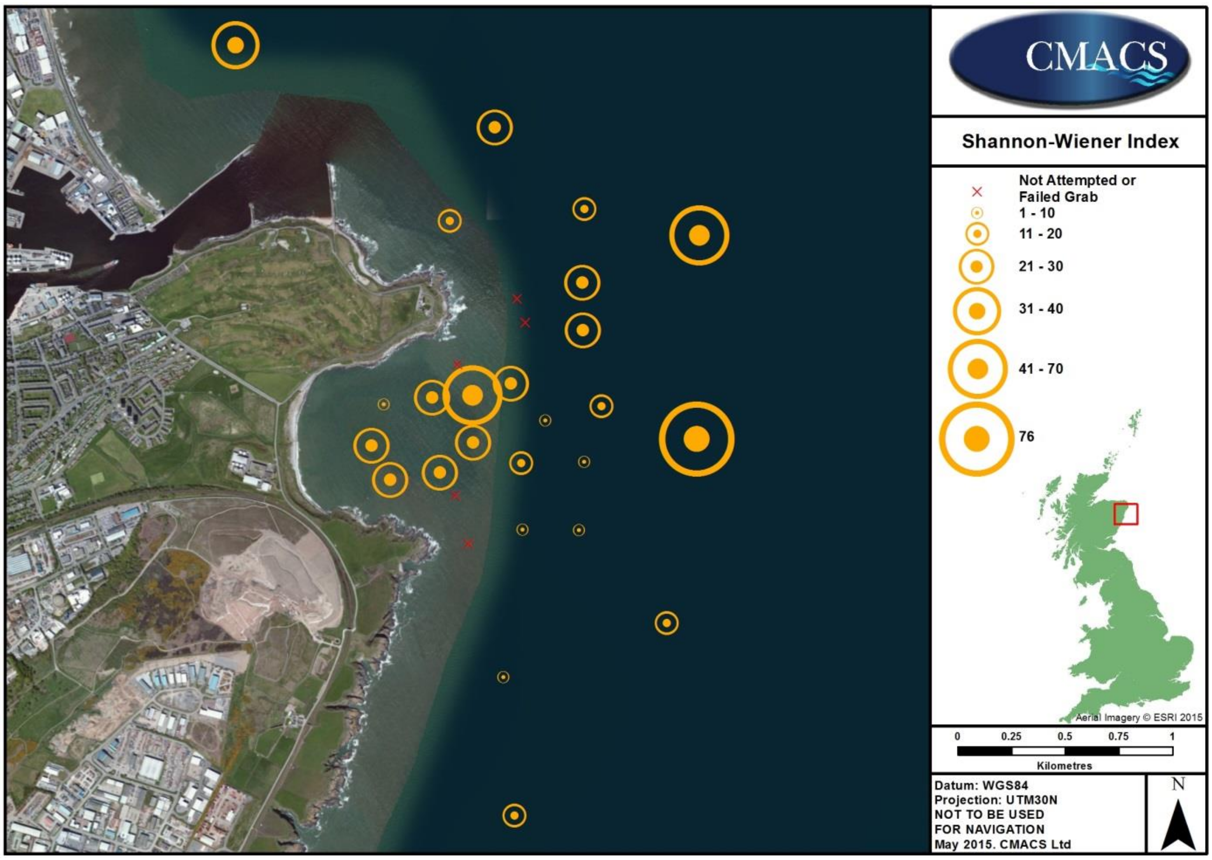

Figure 8. Distribution of number of individuals in grab samples.

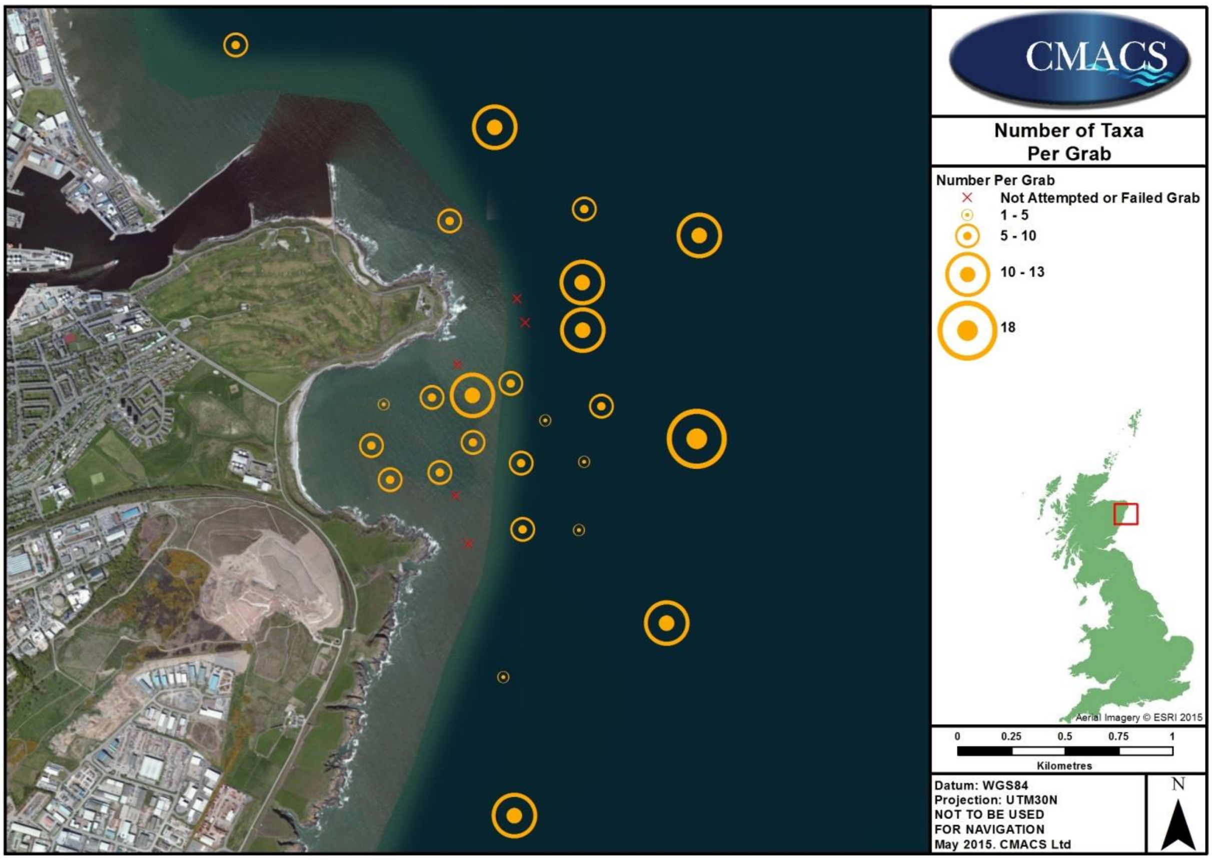

Figure 9. Distribution of number of taxa in grab samples.

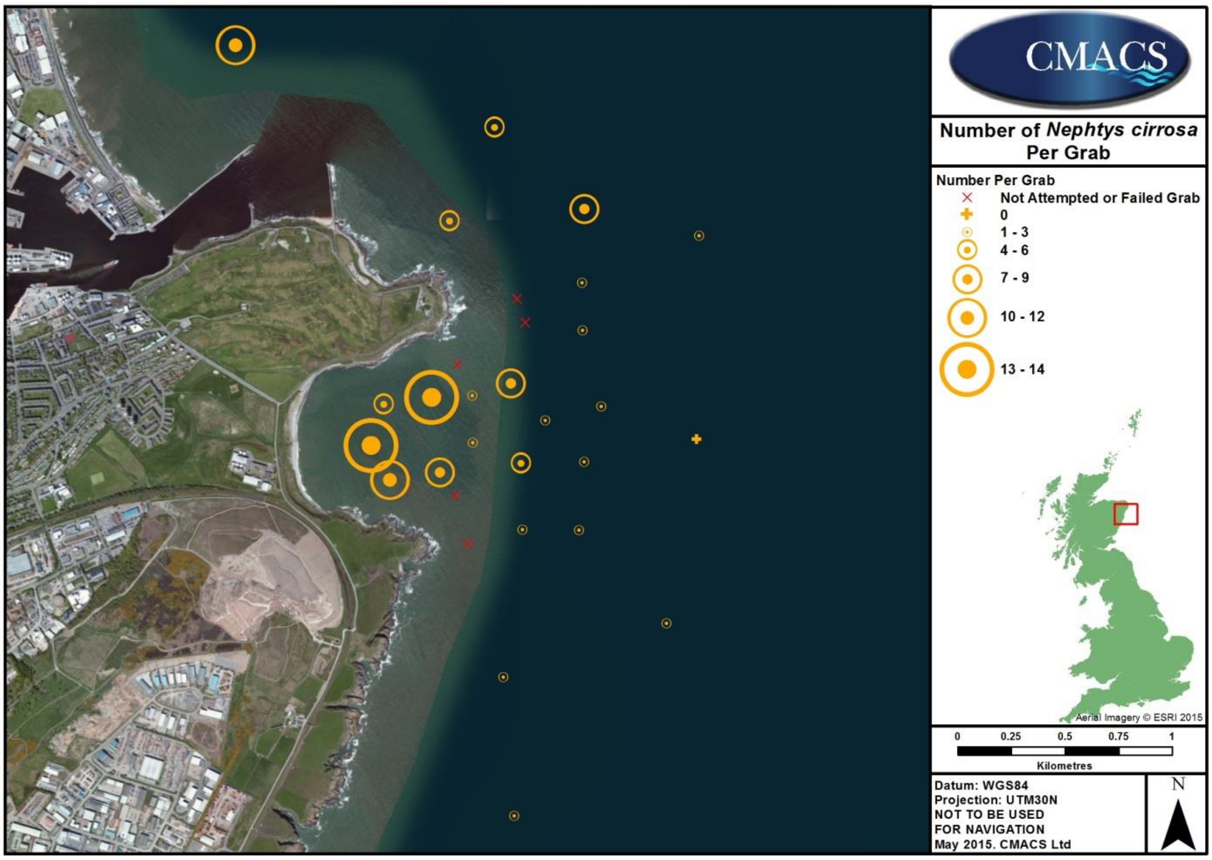

Figure 10. Distribution of number of catworm *Nephtys cirrosa* in grab samples.

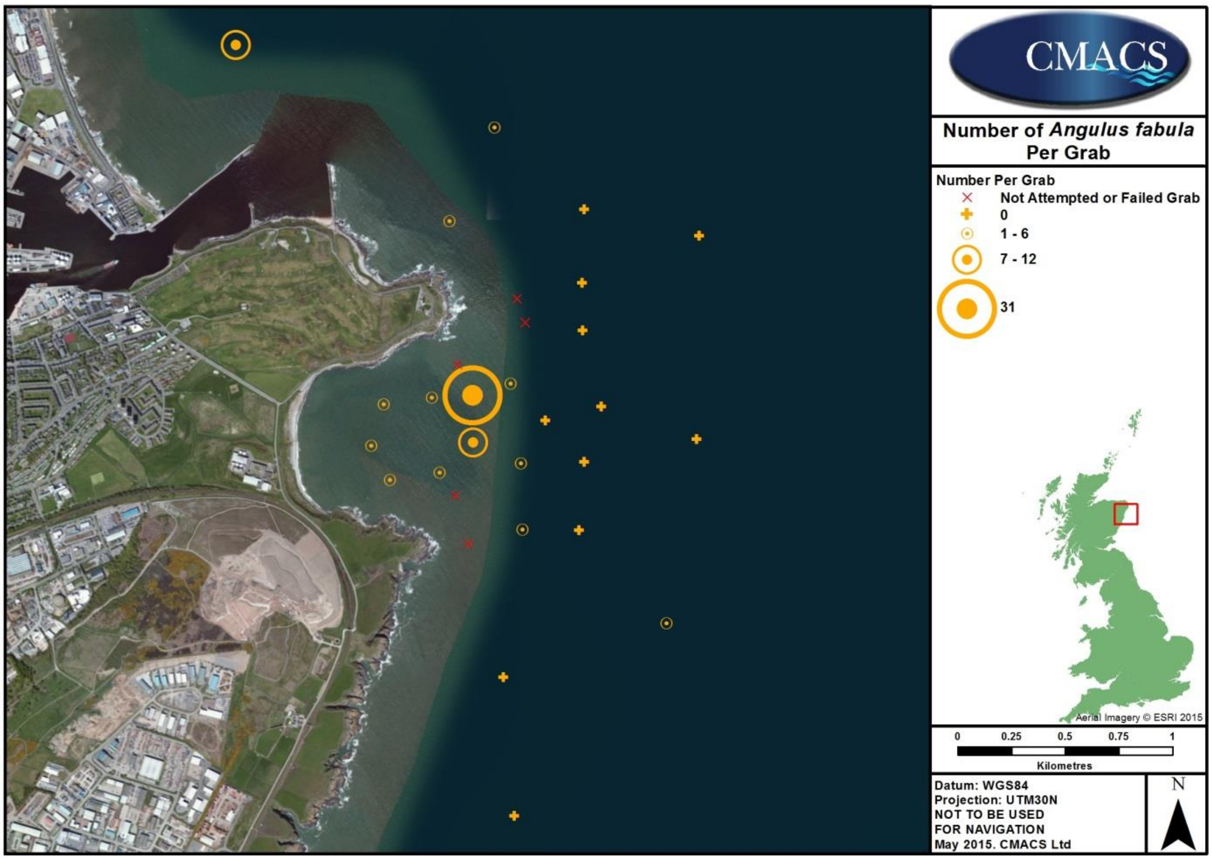

Figure 11. Distribution of number of bivalve *Angulus fabula* in grab samples.

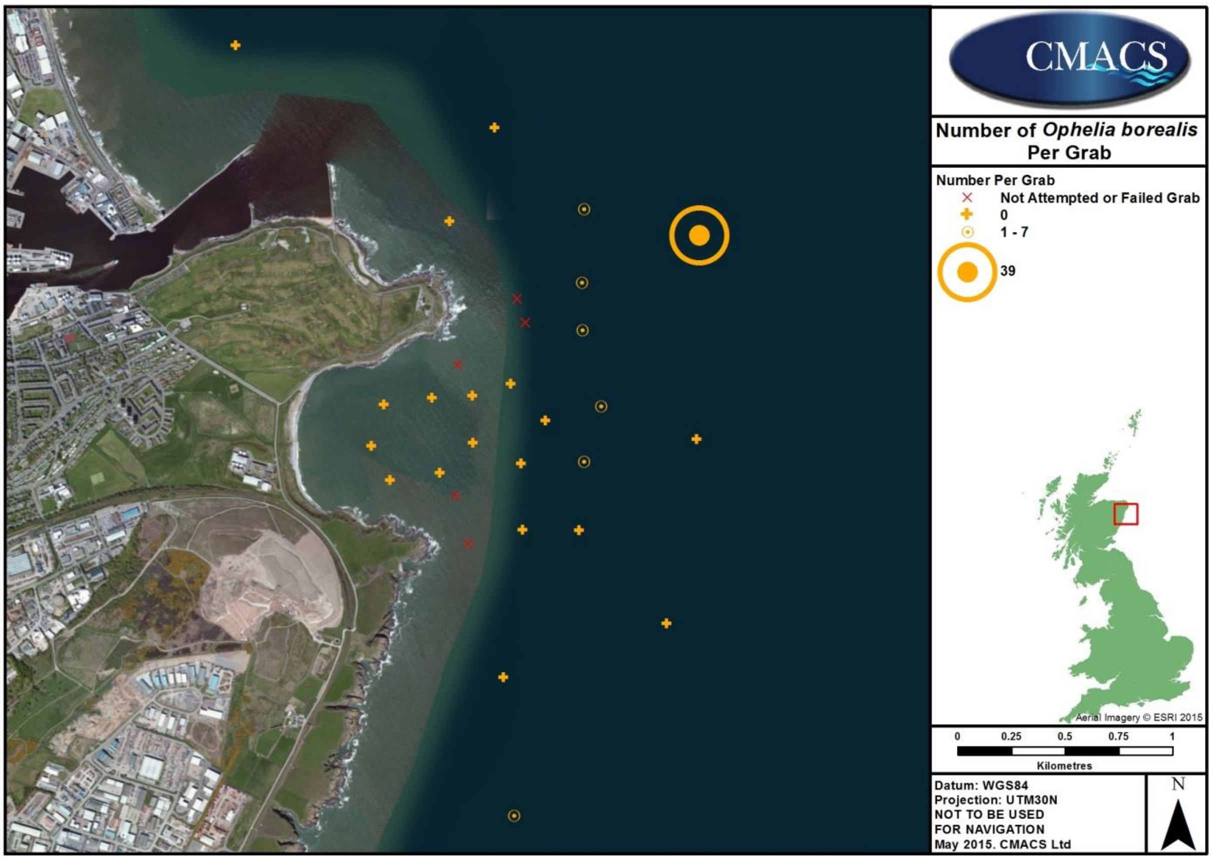

Figure 12. Distribution of number of polychaete worm *Ophelia borealis* in grab samples.

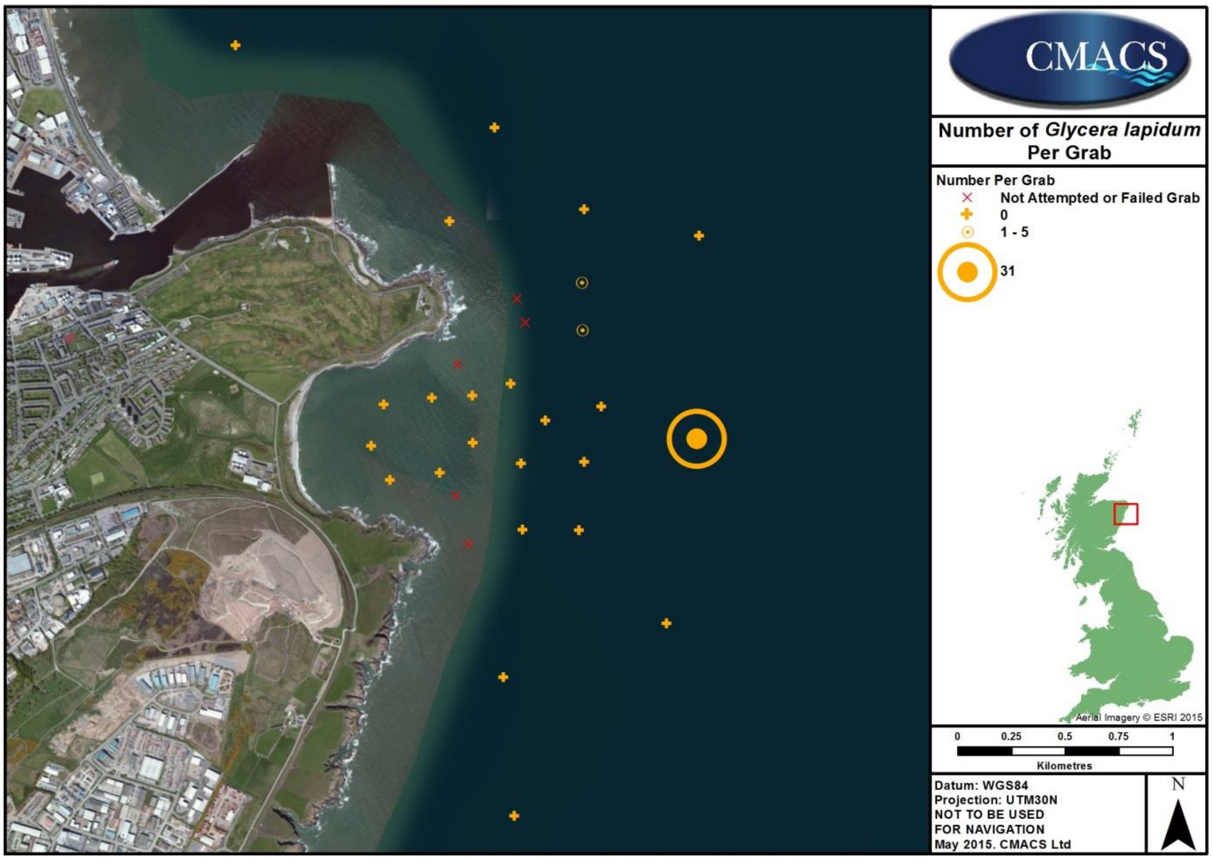

Figure 13. Distribution of number of polychaete worm *Glycera lapidum* in grab samples.

Table 12. Summary of univariate indices for the Nigg Bay grab samples, including the group assigned to each sample via the SimProf routine as shown in Figure 14.

Station	No of taxa S	No of individ. N	Margalef richness d	Pielou's evenness J'	S-W div index H'(log10)	SImpson's index 1-Lambda'	SimProf group
1	5	9	1.82	0.89	1.43	0.81	d
2	8	27	2.12	0.71	1.48	0.70	d
3	6	21	1.64	0.72	1.29	0.65	d
4	10	19	3.06	0.90	2.08	0.89	d
5	7	23	1.91	0.73	1.42	0.67	d
6	9	15	2.95	0.82	1.80	0.80	d
7	7	23	1.91	0.84	1.63	0.79	d
8	12	24	3.46	0.93	2.30	0.92	d
10	10	35	2.53	0.75	1.72	0.77	d
11	10	22	2.91	0.87	2.00	0.85	d
12	13	62	2.91	0.67	1.72	0.71	d
14	12	64	2.64	0.58	1.44	0.61	b
16	18	76	3.93	0.72	2.09	0.80	a
17	9	21	2.63	0.81	1.77	0.80	d
18	11	17	3.53	0.90	2.17	0.90	c
19	8	13	2.73	0.88	1.84	0.86	d
21	6	9	2.28	0.94	1.68	0.89	d
22	5	7	2.06	0.96	1.55	0.90	d
23	4	6	1.67	0.96	1.33	0.87	d
24	3	4	1.44	0.95	1.04	0.83	d
25	11	20	3.34	0.88	2.11	0.87	b
27	12	28	3.30	0.93	2.30	0.92	a
28	12	27	3.34	0.88	2.18	0.89	b
29	6	12	2.01	0.91	1.63	0.85	d
30	4	5	1.86	0.96	1.33	0.90	d

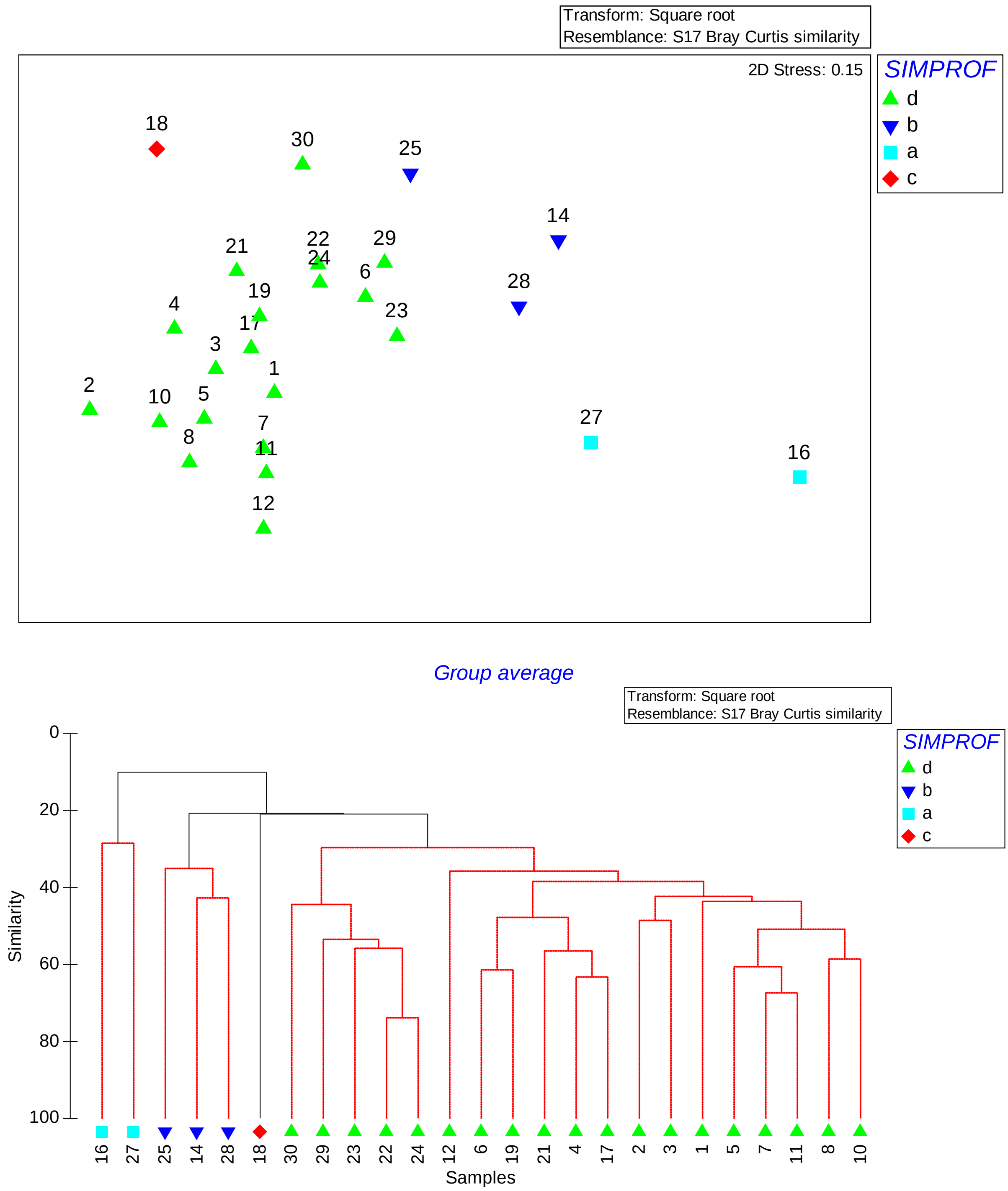

Figure 14. MDS and associated dendrogram from faunal grab sample results, with groupings according to the SimProf routine superimposed.

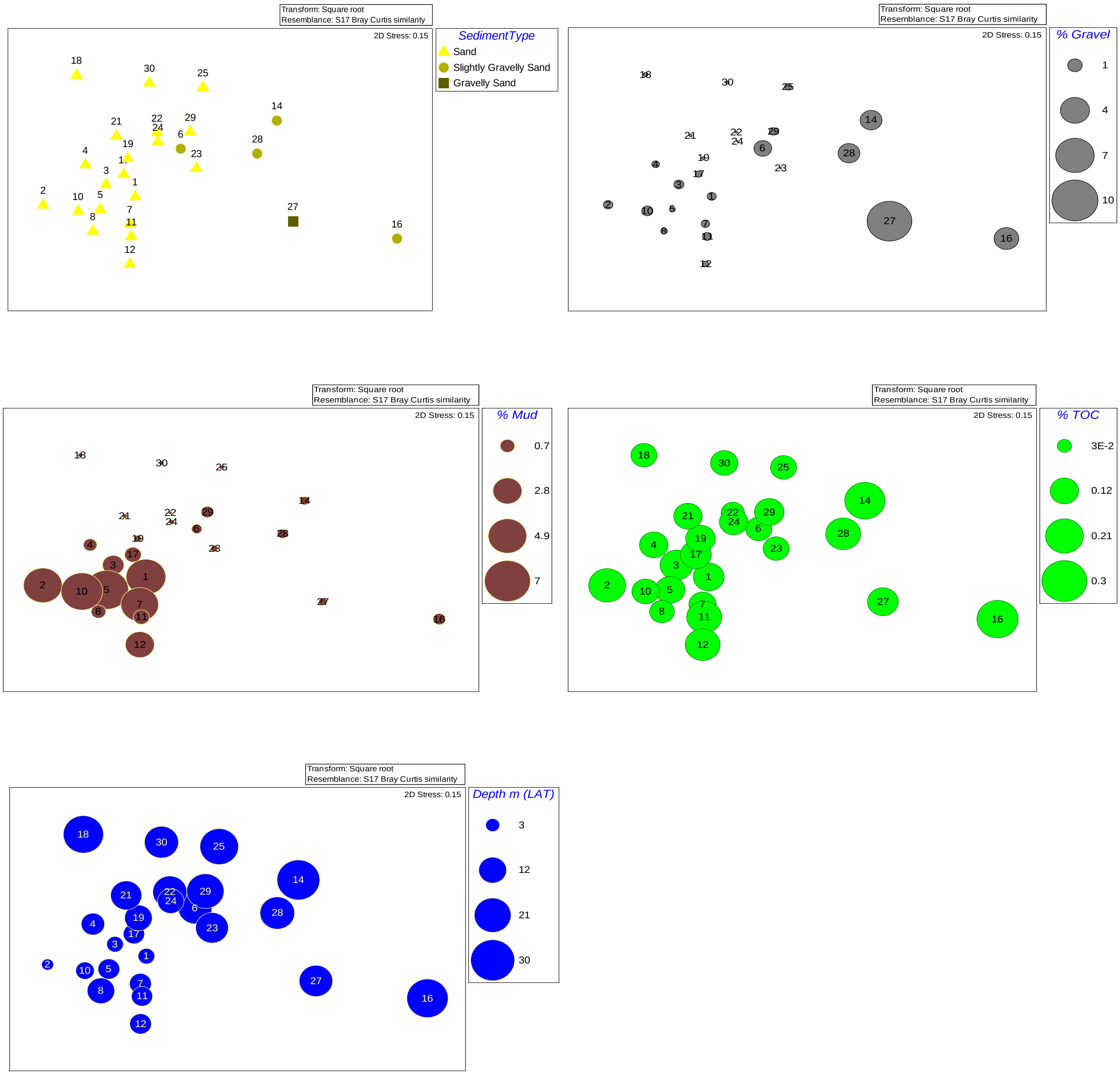

Figure 15. MDS based on grab faunal data as shown in Figure 14, with main environmental variables superimposed.

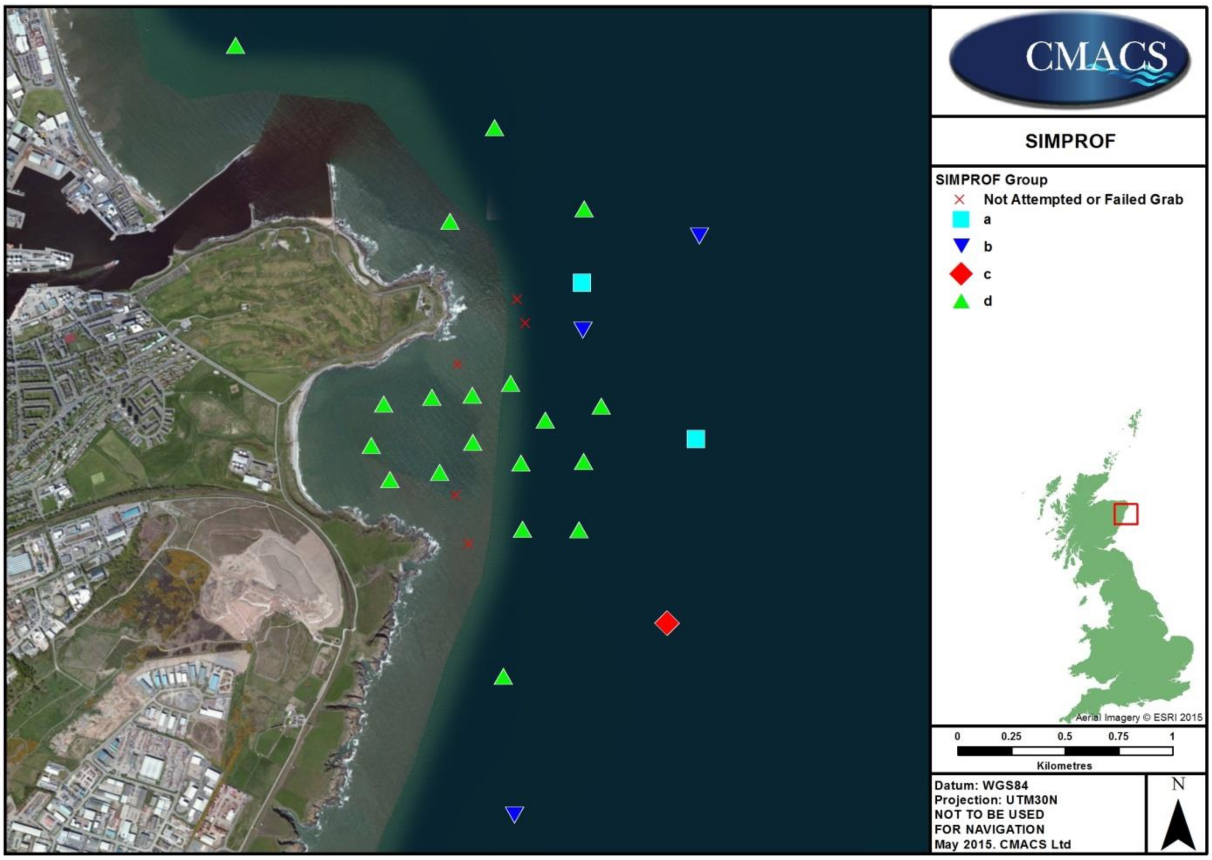

Figure 16. Distribution of SimProf groups as determined according to Primer (see Figure 14).

<u>Biomass</u>

Biomass values in the form of AFDW figures are shown in Table 13. Full raw data, including wet weight values and conversion factors used, are given in Appendix 10. The great majority (almost 88%) of the AFDW biomass was attributable to polychaete worms, which dominated the biomass of every sample except that from Station 27. Another 7.8% of the total biomass was attributable to molluscs, although these were absent from many samples and hence their contribution to total sample biomass was quite variable between stations. Echinoderms, crustacean and “others” contributed only very small amounts to the biomass of the area. The values for all stations were quite low, which is to be expected from relatively impoverished, disturbed sandy sediments; the highest value of 412.5 mg/0.1m^2 was at station 11 in the mouth of Nigg Bay, which was one of the least rich stations in terms of numbers of specimens. The relatively high biomass here was due almost entirely to the presence of two large adult specimens of the catworm *Nephtys assimilis*. The mean AFDW biomass was 66 mg per /0.1m^2 ; in contrast, similar 1mm mesh grab samples from the Moray Firth taken in support of the rather deeper Beatrice Offshore Wind Farm, itself not a particularly rich area for infauna, had a mean AFDW biomass of 298 mg per 0.1m^2, with a somewhat more even contribution from molluscs, echinoderms and polychaetes (BOWL 2012).

Note that sandeels were not included in AFDW estimates (because they are fish and therefore not benthic infauna), but it is worth noting that the specimens were clearly all quite small since they did not contribute to a particularly high wet weight biomass (Appendix 10).

Table 13. Ash free dry weight (AFDW) biomass estimates for faunal gab samples. Oligochaete values were all zero and so are not reproduced here.

Station	Polychaeta		Crustacea		Mollusca		Echinodermata		Others		Total
	AFDW (mg)	%	AFDW (mg)	%	AFDW (mg)	%	AFDW (mg)	%	AFDW (mg)	%	AFDW (mg)
1	8.2	74%	0.0	0%	3.0	26%	0.0	0%	0.0	0%	**11.2**
2	13.6	68%	0.1	0%	6.3	31%	0.0	0%	0.0	0%	**19.9**
3	27.0	88%	0.2	1%	0.9	3%	0.0	0%	2.5	8%	**30.6**
4	102.2	69%	0.1	0%	44.8	30%	0.0	0%	0.0	0%	**147.1**
5	69.6	99%	0.0	0%	1.0	1%	0.0	0%	0.0	0%	**70.6**
6	76.4	100%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	**76.4**
7	72.8	83%	0.1	0%	4.6	5%	0.0	0%	10.0	11%	**87.4**
8	95.4	94%	1.6	2%	4.1	4%	0.0	0%	0.0	0%	**101.1**
10	20.7	59%	0.3	1%	13.9	40%	0.0	0%	0.0	0%	**34.9**
11	397.1	96%	0.0	0%	13.8	3%	0.0	0%	1.6	0%	**412.5**
12	40.8	61%	0.0	0%	23.4	35%	0.0	0%	2.8	4%	**67.0**
14	140.7	98%	2.5	2%	0.0	0%	0.0	0%	0.4	0%	**143.6**
16	66.2	74%	0.0	0%	4.6	5%	6.4	7%	12.0	13%	**89.2**
17	25.0	97%	0.4	2%	0.4	1%	0.0	0%	0.0	0%	**25.8**
18	12.6	88%	0.0	0%	1.7	12%	0.0	0%	0.0	0%	**14.3**
19	37.5	97%	0.5	1%	0.5	1%	0.0	0%	0.0	0%	**38.5**
21	37.4	98%	0.0	0%	0.7	2%	0.0	0%	0.0	0%	**38.1**
22	4.7	85%	0.8	14%	0.0	0%	0.0	1%	0.0	0%	**5.5**
23	6.3	100%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	**6.3**
24	12.2	100%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	**12.2**
25	33.5	86%	0.1	0%	5.4	14%	0.0	0%	0.0	0%	**38.9**
27	10.0	26%	28.1	73%	0.0	0%	0.0	0%	0.3	1%	**38.4**
28	47.9	100%	0.2	0%	0.0	0%	0.0	0%	0.0	0%	**48.1**
29	85.3	100%	0.0	0%	0.1	0%	0.0	0%	0.0	0%	**85.4**
30	6.2	100%	0.0	0%	0.0	0%	0.0	0%	0.0	0%	**6.2**
TOTAL	**1449.02**	**87.9%**	**35.0**	**2.1%**	**128.9**	**7.8%**	**6.4**	**0.4%**	**29.5**	**1.8%**	**1649.0**

WFD analysis

A Water Framework Directive (WFD) biological assessment was carried out on the macrofaunal grab data, following WFDUk.Org (2014) guidance and the results are given in Table 14. All stations were of "Moderate" (13 stations) or "Good" (11 stations) EQR, except for Station 18 which was "High". The IQI workbook outputs report a mean value for the survey of "Good" (i.e. representing "slight" disturbance) based on a mean IQR value of 0.643.

Those stations of high or good quality seem to be predominantly outside Nigg Bay itself, with those five stations most closely inshore within the bay itself all being of moderate quality (Figure 17). It is not known what factors might be influencing the WFD descriptions. There is no reason to suspect any influence of the Nigg bay effluent outfall, since this is situated offshore of station18, the only station of "High" ecological status. Although the shallower sediments within the bay seem likely to be highly disturbed in a physical sense, due to the apparent exposure to frequent wave action, this is an entirely natural form of disturbance that is to be expected in this area, and the fauna seem to be generally consistent with those naturally found in such environments. Furthermore, the slight tendency for increased mud content within the bay suggests in any case that the stations further offshore may be at least as mobile if not more so.

However, the IQI workbook reports that the standard error of EQR, which is used to determine the confidence in the assessment, cannot be computed for this particular set of samples (but does not give the reason). Thus it is unknown how much confidence can be placed in this assessment.

Table 14. Ecological quality ratio values and resulting Ecological Status for the Nigg Bay grab samples.

Sample	EQR value	Disturbance	Ecological Status
NIGG 1	**0.60**	Moderate	**MODERATE**
NIGG 2	**0.58**	Moderate	**MODERATE**
NIGG 3	**0.58**	Moderate	**MODERATE**
NIGG 4	**0.69**	Slight	**GOOD**
NIGG 5	**0.61**	Moderate	**MODERATE**
NIGG 6	**0.64**	Moderate	**MODERATE**
NIGG 7	**0.60**	Moderate	**MODERATE**
NIGG 8	**0.74**	Slight	**GOOD**
NIGG 10	**0.67**	Slight	**GOOD**
NIGG 11	**0.68**	Slight	**GOOD**
NIGG 12	**0.67**	Slight	**GOOD**
NIGG 14	**0.72**	Slight	**GOOD**
NIGG 16	**0.67**	Slight	**GOOD**
NIGG 17	**0.65**	Slight	**GOOD**
NIGG 18	**0.76**	No *or* Very Minor	**HIGH**
NIGG 19	**0.66**	Slight	**GOOD**
NIGG 21	**0.61**	Moderate	**MODERATE**
NIGG 22	**0.61**	Moderate	**MODERATE**
NIGG 23	**0.57**	Moderate	**MODERATE**
NIGG 24	**0.59**	Moderate	**MODERATE**
NIGG 25	**0.65**	Slight	**GOOD**
NIGG 27	**0.63**	Moderate	**MODERATE**
NIGG 28	**0.67**	Slight	**GOOD**
NIGG 29	**0.61**	Moderate	**MODERATE**
NIGG 30	**0.63**	Moderate	**MODERATE**
Survey Mean	**0.643**	Slight	**GOOD**

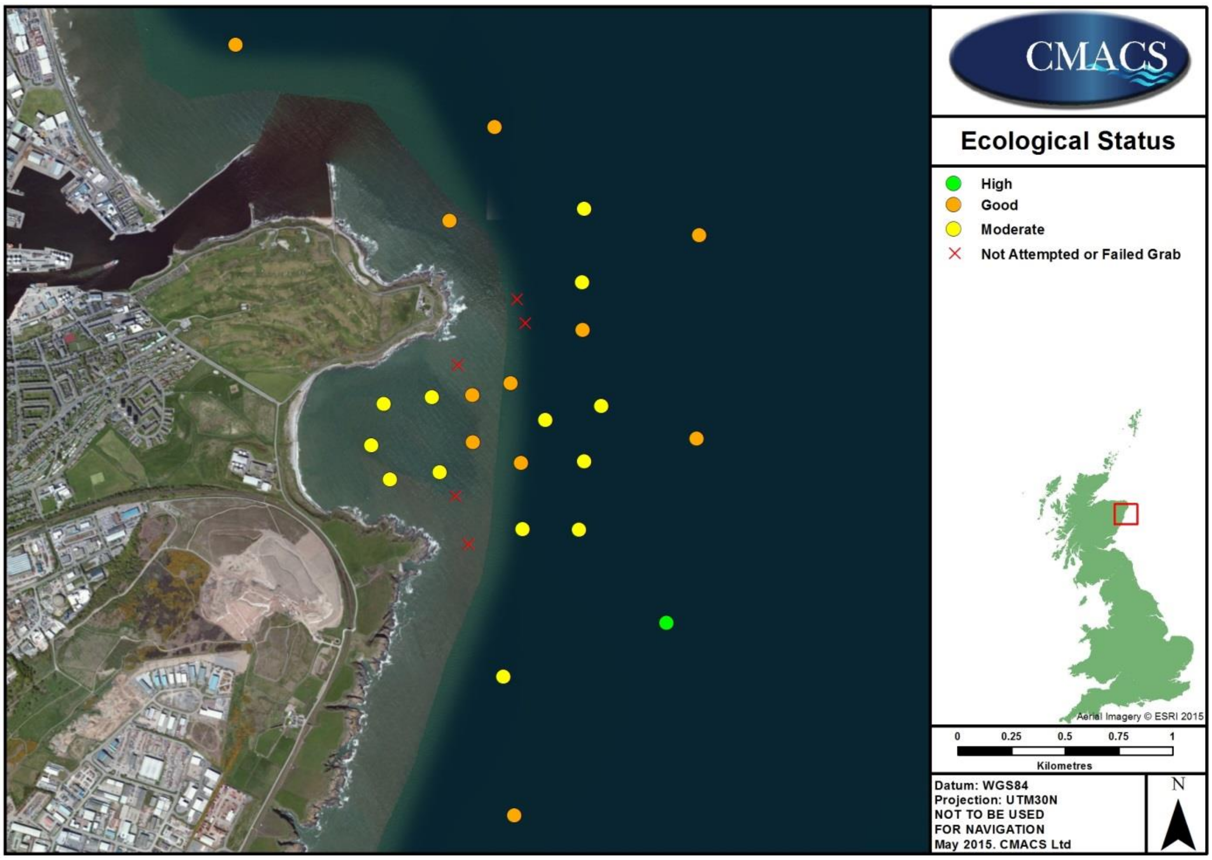

Figure 17. WFD quality classification at grab locations.

4.4 Beam trawl survey

A total of 664 individual fish from ten taxa were caught and 1,123 invertebrates (excluding colonials) from five epifaunal taxa (eight if colonial taxa are included) from the five trawl stations sampled during this 2m scientific beam trawl survey (see Appendix 3 for full raw data).

Fish

In general, fish abundance (Figure 18) and species richness (as estimated using number of taxa; Figure 19) were highest at the northern reference station in the mouth of the harbour (Station T1) and the two most westerly stations (furthest inshore) within Nigg Bay itself (stations T2 & T3), were lowest at the most easterly (offshore) station within the bay (Station 4) and intermediate at the southern reference location (Station T5).

Three fish were particularly numerous compared to other species; the flat fish plaice (*Pleuronectes platessa)* and dab (*Limanda limanda*) and the round fish, whiting (*Merlangius merlangus*) (Table 15; Figure 20, Figure 21 & Figure 22). Sand eels (*Ammodytes* sp.) and sand gobies (*Pomatoschistus minutus*) were also well represented (Table 15; Figure 23 & Figure 24), as well as greater pipefish (*Syngnathus acus*), sprat (*Sprattus sprattus*) and hooknose (*Agonus cataphractus*) (Table 15). No elasmobranchs were recorded.

Table 15. Total ranked numbers of all fish recorded during the 2015 Nigg Bay 2m scientific beam trawl survey.

Common name	Species name	Total number caught
Plaice	*Pleuronectes platessa*	246
Dab	*Limanda limanda*	167
Whiting	*Merlangius merlangus*	121
Sand eel	*Ammodytes* sp.	37
Sand goby	*Pomatoschistus minutus*	28
Greater pipefish	*Syngnathus acus*	24
Sprat	*Sprattus sprattus*	21
Hooknose	*Agonus cataphractus*	17
Cod	*Gadus morhua*	2
Three-bearded rockling	*Gaidropsarus vulgaris*	1

Plaice inhabit similar water depths as dab but prefer a wider range of sediment types, often being found on muddier sea beds and their main food sources are polychaetes and thin shelled bivalves (Ruiz 2007). Dab are a common species around the UK coastline, usually found from shallow waters (a few metres depth) to about 100m water depth, they prefer sandy habitat and prey upon a wide variety of benthic organisms including brittlestars, urchins, fish, worms, crustaceans and molluscs (Ruiz 2008). Whiting are common throughout the Northeast Atlantic, being more commonly found from 30 to 100m. They tend to inhabit a wide range of muddy and gravel bottoms but are also known to be found over sandy and rocky sea beds and their primary food sources consist of small crustaceans, molluscs and polychaetes (Barnes 2008).

The commercially-targeted fish species recorded were generally reasonably small. The two cod (one each at T2 and T3) measured 105 and 131mm, which are well below the minimum legal landing size (MLS) of 350mm (DEFRA 2015). The 121 whiting averaged 122.7 ± 11.6mm standard deviation (SD) (MLS = 270mm), the 246 plaice averaged 100.8 ± 25.9mm SD and the 167 dab averaged 109.0 ± 44.5mm SD; while there is no minimum landing size for the latter, they are generally discarded if less than 250mm (which approximately equates to average size at maturity; Fishbase 2015).

Whilst 2m beam trawl gears are not designed to sample larger fish (which are often able to swim out of the net; Wardle, 1993), the fact that so many small, immature fish were recorded does, however, suggest that Nigg Bay may be an important nursery area, which is supported by mapping produced using accumulated evidence by CEFAS that illustrates nursery areas for a number of species in the vicinity (Ellis *et al*. 2012). Commercially targeted marine fauna are listed under a grouped species biodiversity action plan (www.ukbap.org.uk). The priority species listed under this action plan are those for which the International Council for the Exploration of the Seas (ICES) scientists' assessment have identified as being below Safe Biological Limits (SBL). These include species recorded during the Nigg Bay survey such as plaice, whiting and cod. The latter two species are also both Scottish Priority Marine Features. These fish taxa are protected under the Regulations underpinning the Common Fisheries Policy.

Sand eels of the genus *Ammodytes* are also Scottish Priority Marine Species. Furthermore, lesser sand eel (*A. tobianus*) which is highly likely to be the main species encountered here is also a UK BAP priority species owing to population declines. The industrial fishery for sand eels off eastern Scotland and north east England has been closed since 2000, although they are taken as bycatch. They are an important food source for birds, including terns (Sternidae), kittiwakes (*Rissa tridactyla*) and auks (Alcidae), in addition to other fish (e.g. pollock and mackerel) and certain marine mammals (e.g. seals and porpoises). Sandeels were recorded at all five stations, although other than at Station 4, were only present in low numbers (Figure 23). The majority recorded during this survey were very small (<60mm), although two larger specimens just over 200mm were recorded at stations T2 & T3.

Note that sandeels are clearly quite widespread in the deeper parts of the survey area, having also been seen during video surveys at stations 4, 11, 13, 14, 15, 16, 18, 19, 21, 22, 25, 28, 29 (especially frequent at 14 and 29) and in the grab samples from stations 6, 11, 19 and 22 (eight individuals at Station 11). None were seen in the shallower parts of Nigg Bay during this survey, where some of the stations were slightly more muddy, but groups of small individuals were seen at low water in the centre of Nigg Bay during the intertidal survey in September 2014 (CMACS 2015).

Sand gobies, which were present at stations T1, T2 & T3 (albeit not in large numbers), are protected and legislated for under Appendix III (Protected Fauna Species) of the Bern Convention owing to their trophic position and importance, and are also a Scottish Priority Marine Feature. However, the species is ubiquitous and abundant in shallow, sandy UK habitats.

Invertebrates

Invertebrate abundance mirrored those of fish in that it was highest at the northern reference location (Station T1) and the two most westerly (inshore) stations within Nigg Bay itself (stations T2 & T3) (Figure 25). Species richness (again, as estimated by number of taxa) did not vary greatly, and was very low throughout the survey area (Figure 26).

Crustaceans strongly dominated the hauls and one species, in particular, brown shrimp (*Crangon crangon*), was by far the most abundant invertebrate recorded, with over twenty five times as many as the next most abundant species, flying crab (*Liocarcinus holsatus*; Table 16). The few other species recorded were only present in very low numbers. Colonial invertebrates were not common; the few small records of which consisted of the soft coral, dead man's finger (*Alcyonium digitatum*), the bryozoan, horn wrack (*Flustra foliacea*) and hydroids (Sertulariidae).

Table 16. Total ranked numbers of countable invertebrates recorded during the 2015 Nigg Bay 2m scientific beam trawl survey.

Common name	Species name	Total number caught
Brown shrimp	*Crangon crangon*	1,066
Flying crab	*Liocarcinus holsatus*	42
Harbour crab	*Liocarcinus depurator*	7
Shore crab	*Carcinus maenas*	6
Pink shrimp	*Pandalus montagui*	1
King rag worm	*Alitta virens*	1

Brown shrimp are common throughout British waters, tending to live in shallow coastal regions upon sandy and/or muddy substratum and feed on a variety of benthic organisms including polychaetes, fish, molluscs and small arthropods (Neal 2008). The species was very abundant at the two inshore stations within Nigg Bay, but also moderately so at the northern reference location (Figure 27).

None of the invertebrates recorded during this survey are Scottish Priority Marine Features or protected under other legislation, although brown shrimp are an important commercially-targeted species.

Overview

The fish and invertebrate assemblage recorded during this survey is fairly typical of shallow sandy coastlines of the North Sea, and noticeably similar to those recorded recently at Aberdeen Offshore Wind Farm (CMACS 2011). The catch was predominantly small fish, which were dominated by juvenile flatfish (especially dabs and plaice). There were also numerous whiting in several trawls, along with smaller numbers of sandeels, hooknose, and sand gobies. No elasmobranchs were recorded. Very few invertebrate fauna were found, those occurring being mainly brown shrimp *Crangon crangon* and a few crabs, notably sand crabs *Liocarcinus holsatus*. All fauna found were typical of the sandy biotopes identified by the infaunal sampling and accompanying PSA analysis within the bay.

The Nigg Bay assemblage is not particularly diverse and dominated by just a few species, but this might be expected in such particularly shallow, sandy waters. The communities recorded at the northern reference location and two westerly (inshore) stations within Nigg Bay were relatively similar to each other both in terms of species assemblage and abundances. A similar assemblage, but somewhat less numerous, was recorded at the southern reference location. Station T4, the most easterly (offshore) tow within the Bay, was, however, noticeably more sparse.

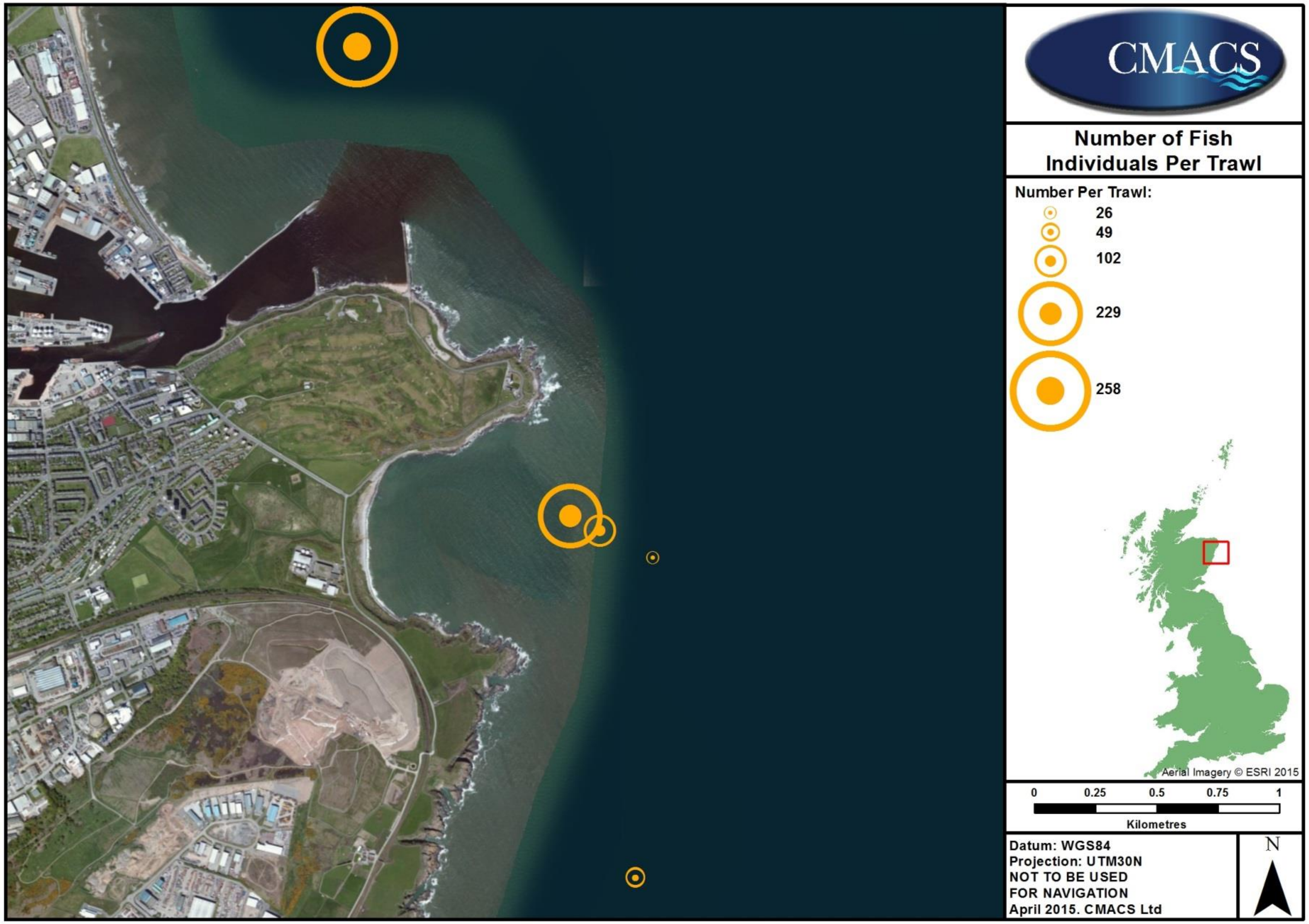

Figure 18. Number of fish individuals caught during beam trawl surveys of Nigg Bay.

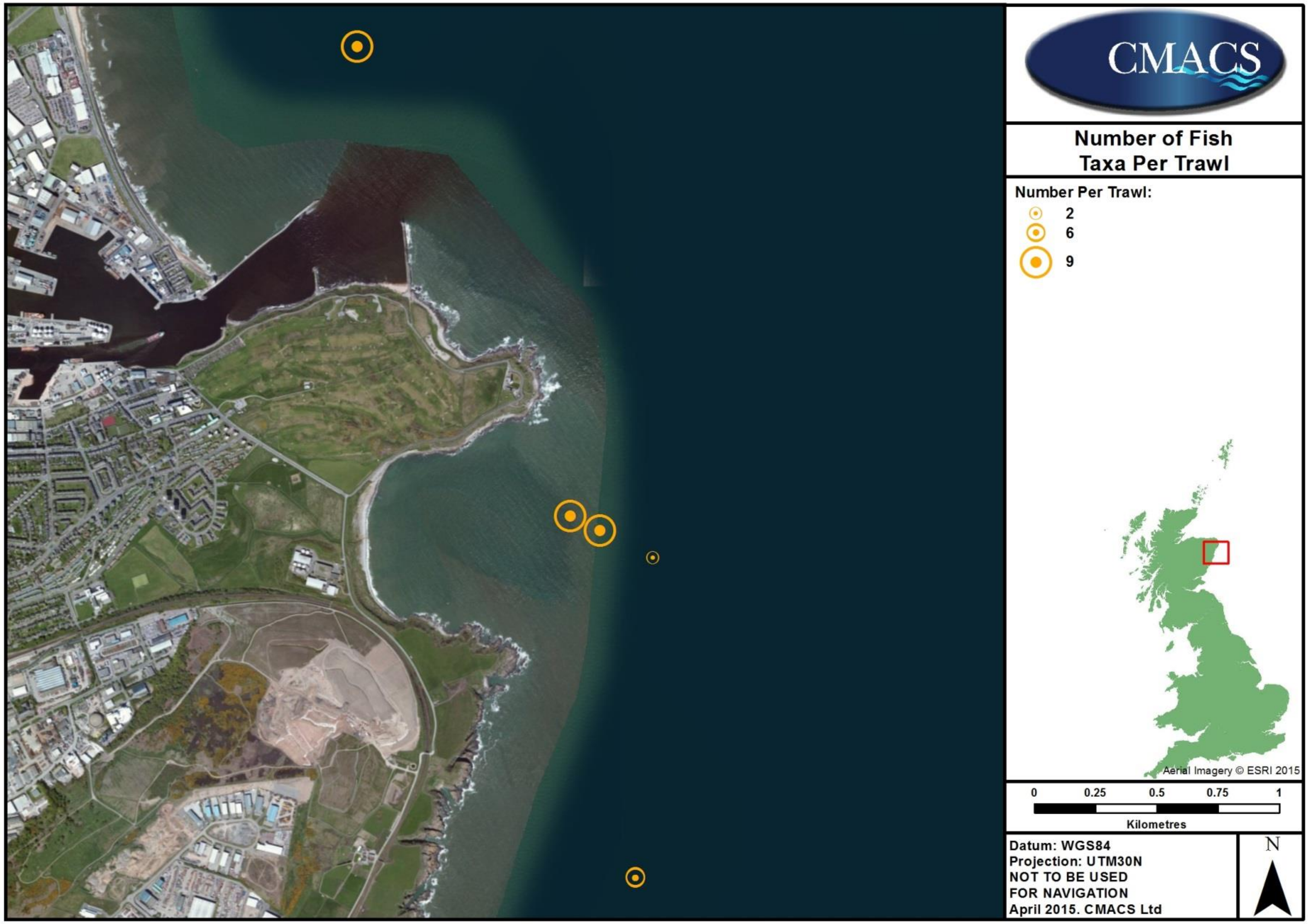

Figure 19. Number of fish taxa caught during beam trawl surveys of Nigg Bay.

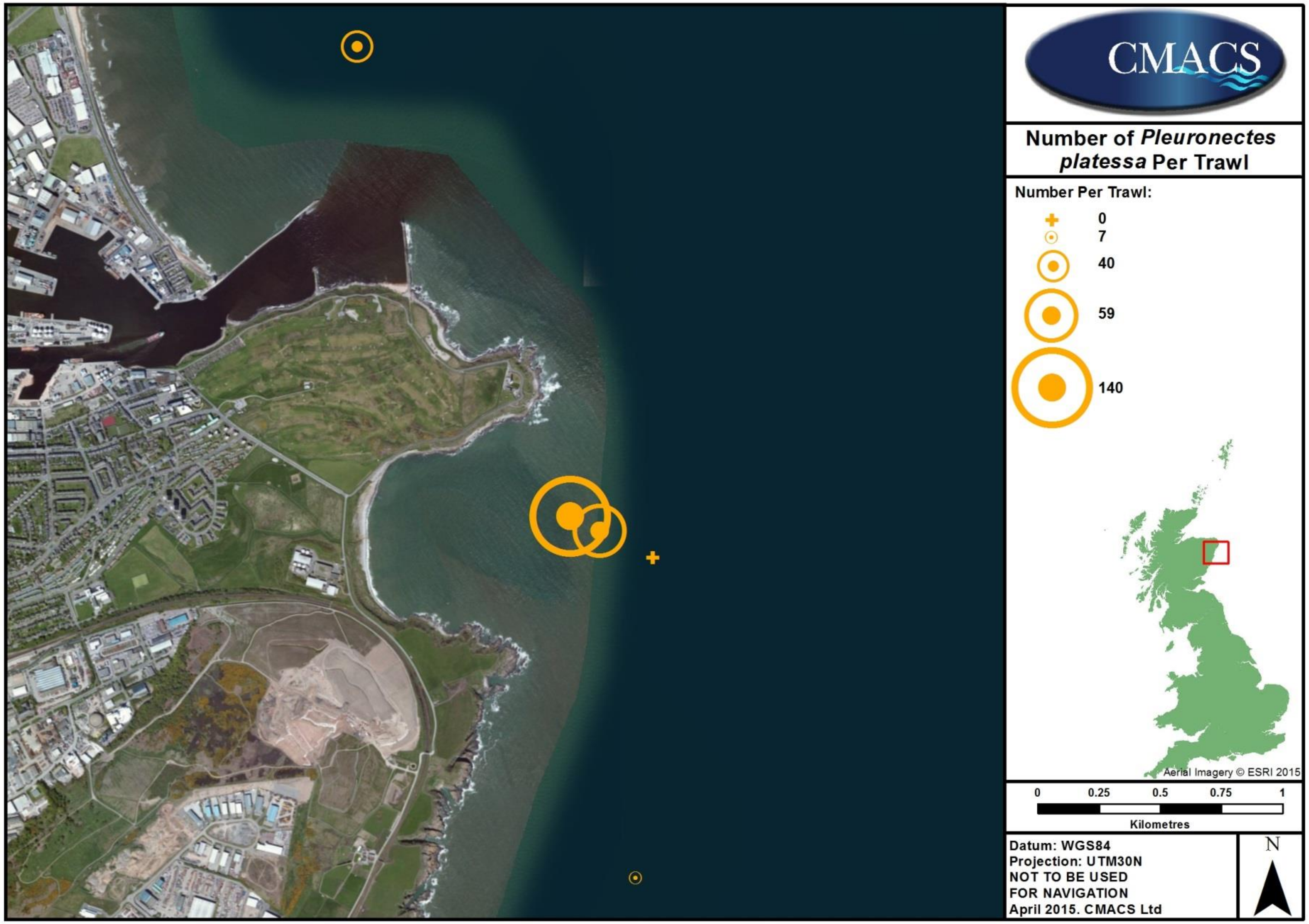

Figure 20. Number of plaice *Pleuronectes platessa* caught during beam trawl surveys of Nigg Bay.

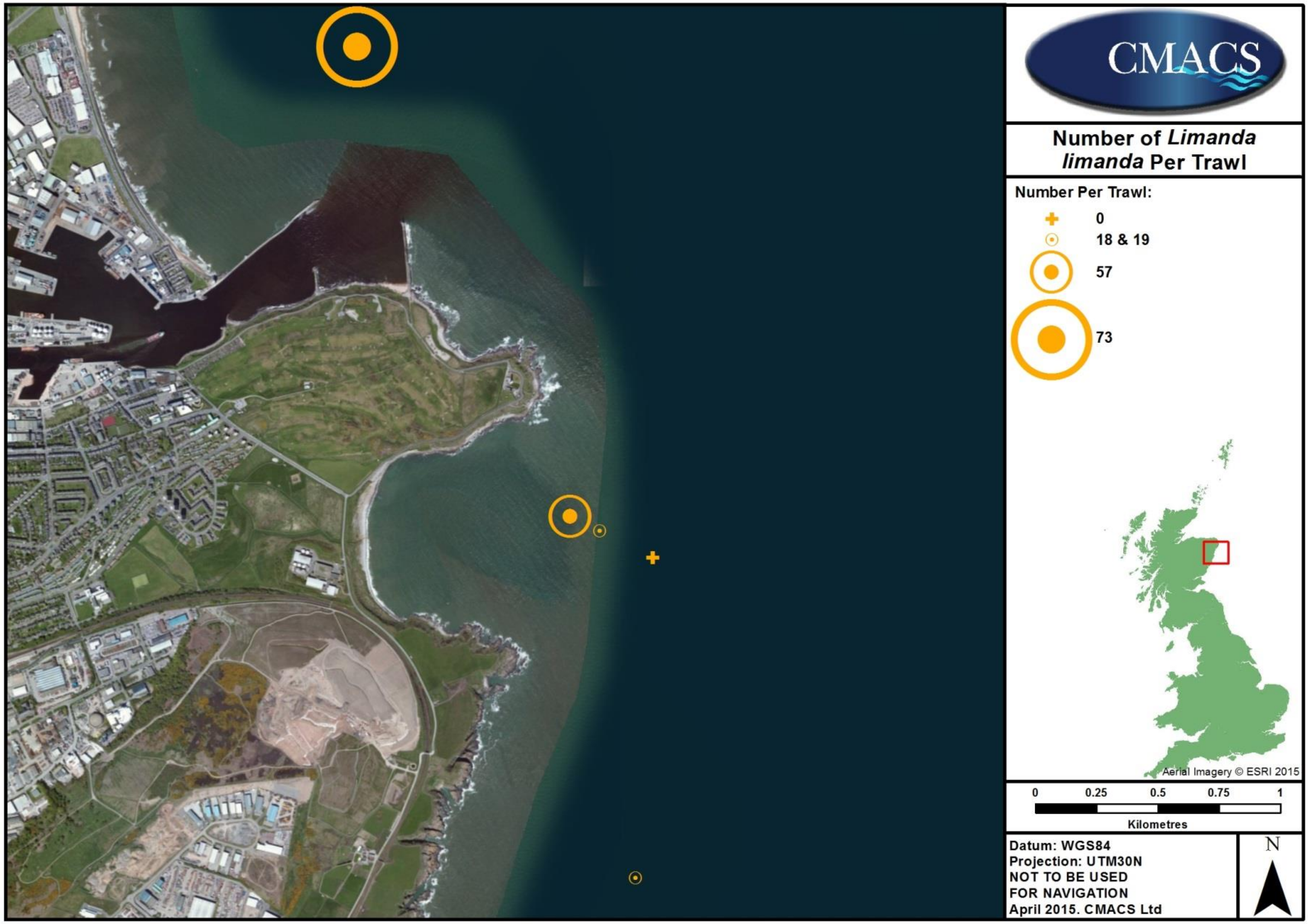

Figure 21. Number of dab *Limanda limanda* caught during beam trawl surveys of Nigg Bay.

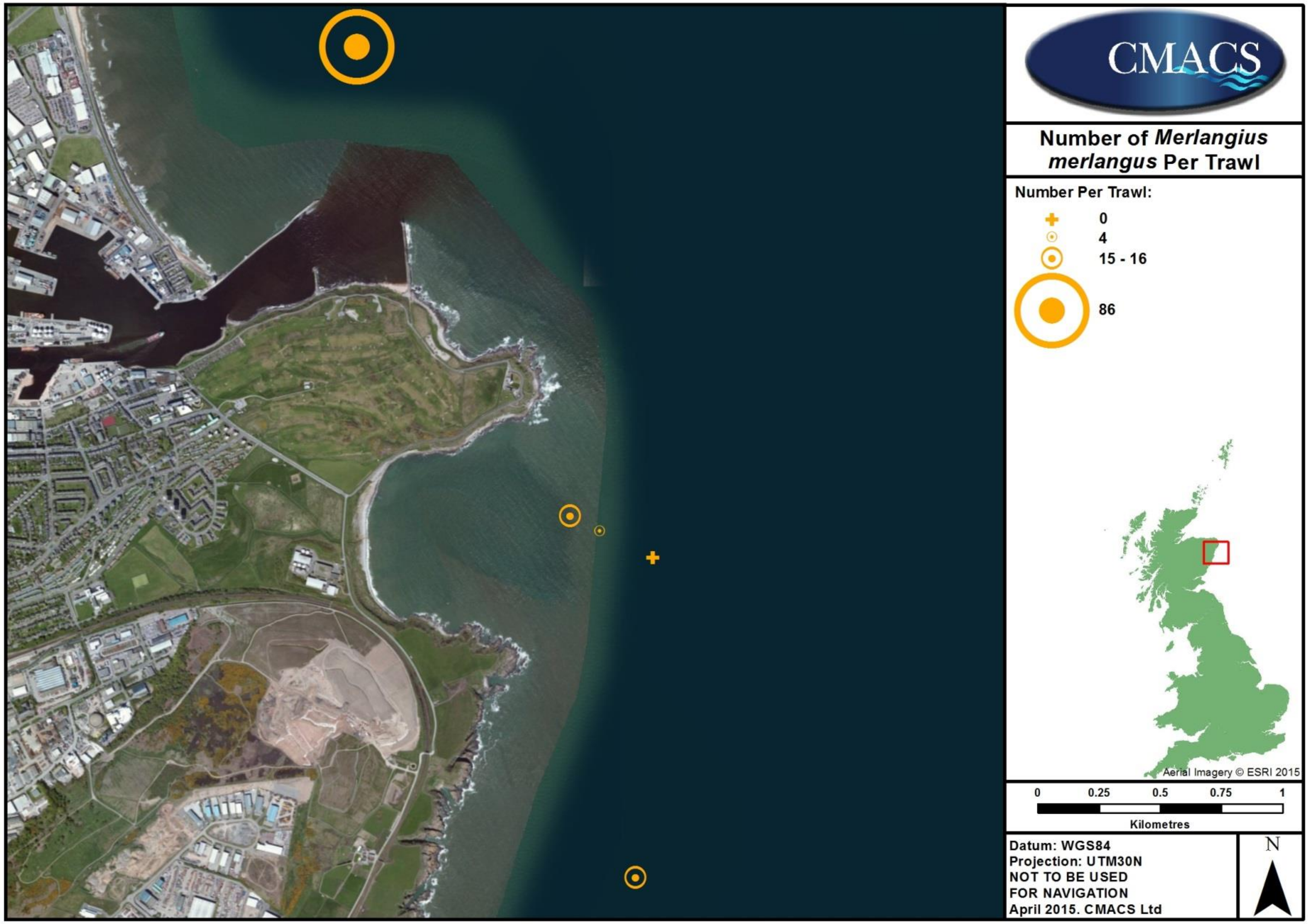

Figure 22. Number of whiting *Merlangius merlangus* caught during beam trawl surveys of Nigg Bay.

Figure 23. Number of sandeel *Ammodytes* sp caught during beam trawl surveys of Nigg Bay.

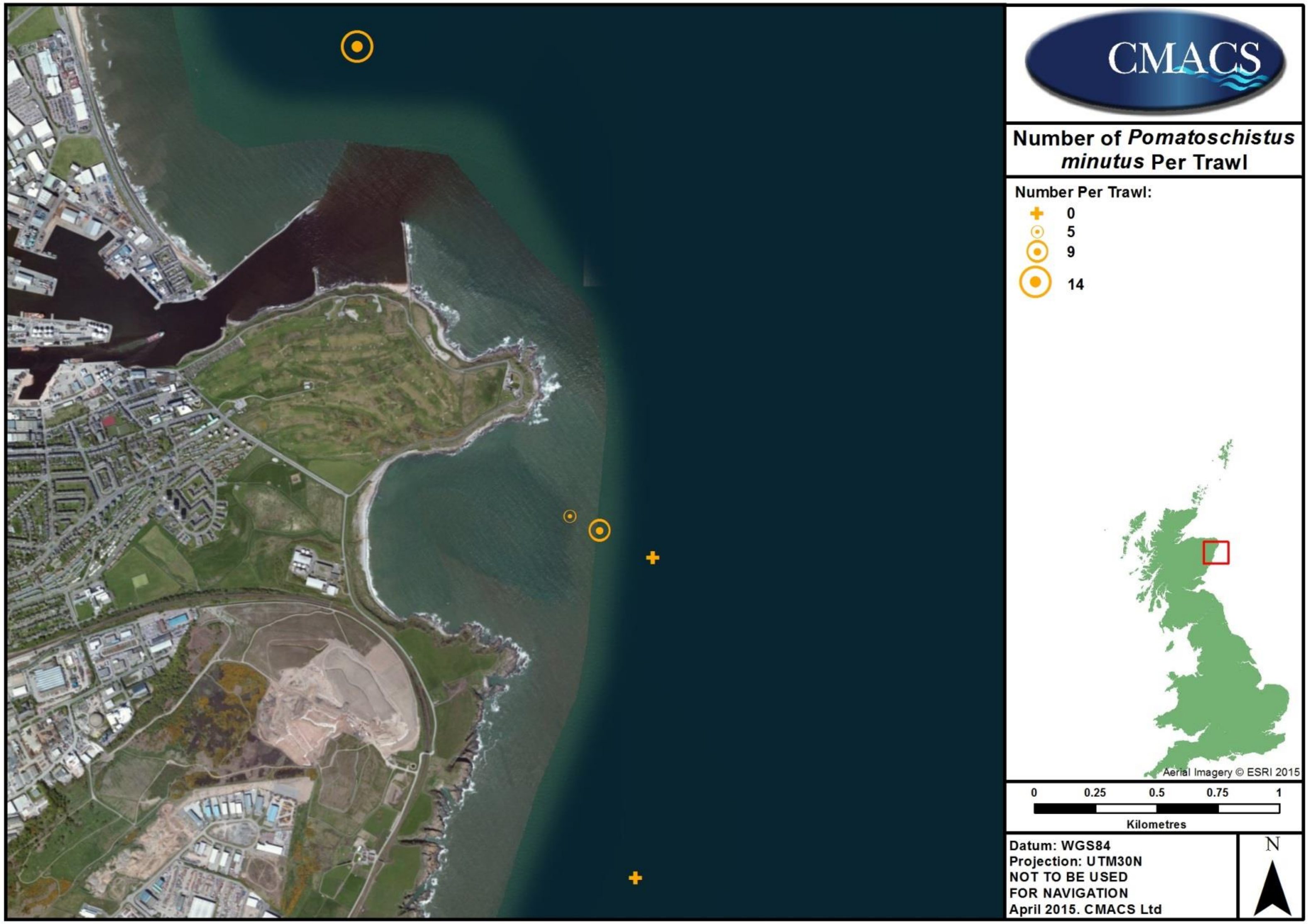

Figure 24. Number of sand goby *Pomatoschistus minutus* caught during beam trawl surveys of Nigg Bay.

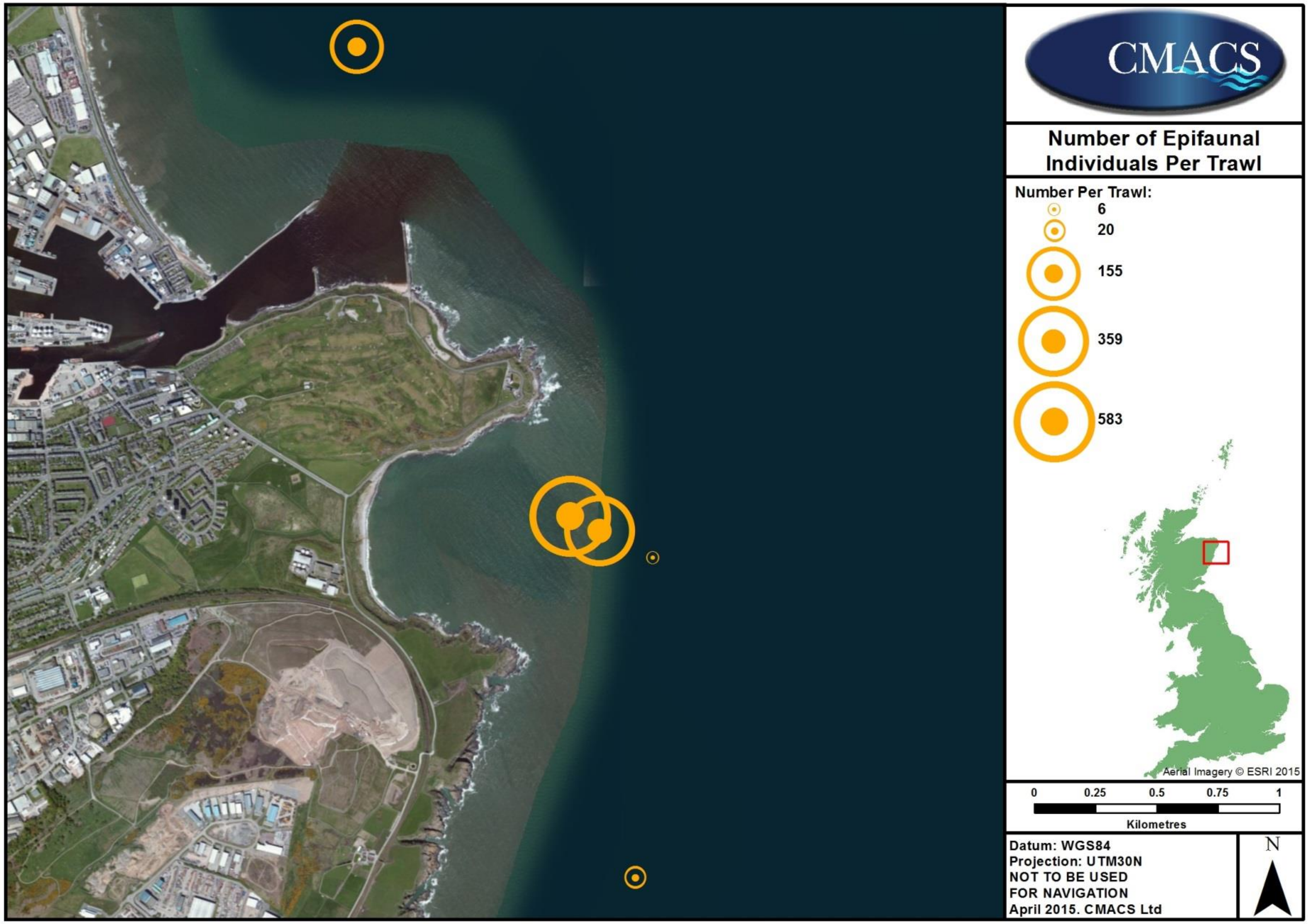

Figure 25. Number of invertebrate individuals caught during beam trawl surveys of Nigg Bay.

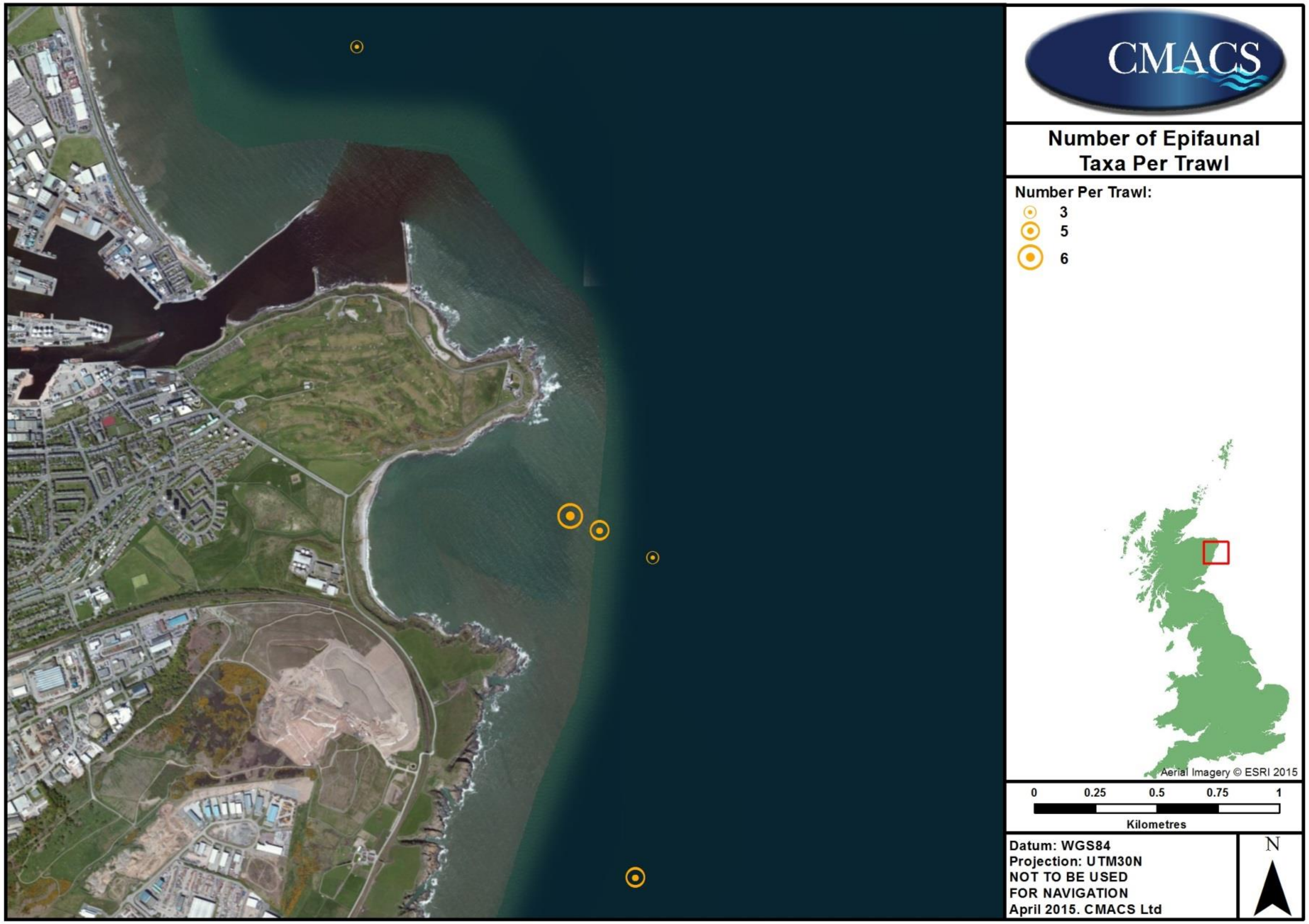

Figure 26. Number of invertebrate taxa caught during beam trawl surveys of Nigg Bay.

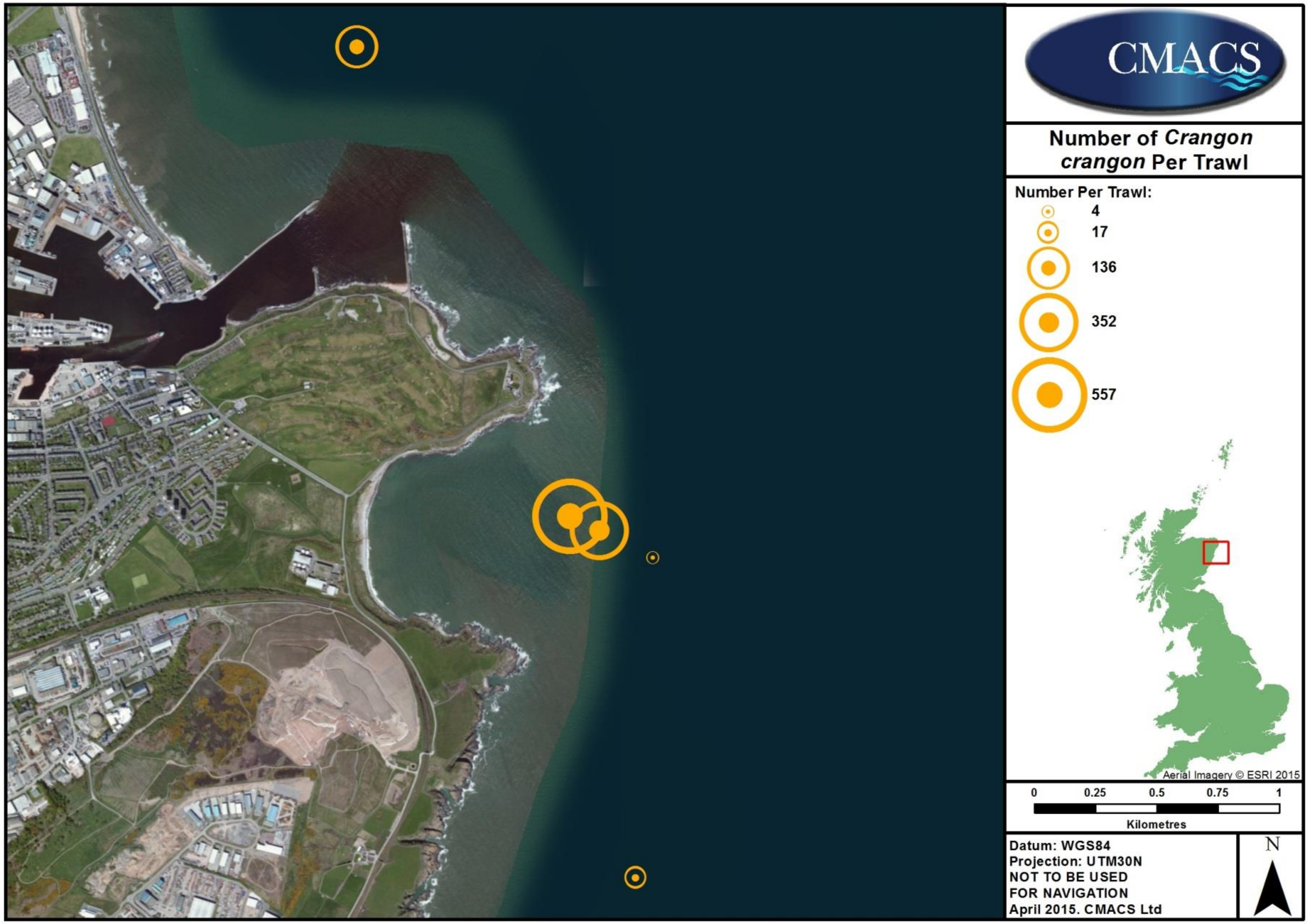

Figure 27. Number of brown shrimp *Crangon crangon* caught during beam trawl surveys of Nigg Bay.

4.5 Biotope distribution

Biotopes as described in the previous sections have been mapped in Figure 28. Note that, due to the availability of sublittoral bathymetric images that were not available for the intertidal survey (CMACS 2015), the distribution of the low shore/shallow sublittoral *Laminaria digitata* biotopes at the bottom of the shore has been revised downwards in some places, especially along the Northern shore; the updated *Laminaria digitata* biotope is shown in Figure 28 but has otherwise been considered in more detail in the intertidal survey (CMACS 2015) and is not considered further here.

Sedimentary biotopes have been mapped contiguously in the more central parts of the survey area where bathymetric images show conclusively the presence of sand or infaunal sampling was relatively dense, but only as discrete dots where the sampling was more widespread and bathymetry images were lacking. Although beam trawl data support the existence of essentially mobile sandy biotopes with little invertebrate epifauna in those areas, they could not be used to aid biotope mapping.

In much of the rocky/boulder area where the predominant biotope was described as Cr.MCR.EcCr biotope complex there were also patches of sand, and where these were most extensive the areas have been mapped as a mosaic of the EcCr biotope with sediment biotopes (Glap or NcirBat). At stations 27 and 28 off Girdle Ness at the Northern end of the Bay the sediment was successfully sampled by grab (although with some difficulty at Station 27, where the location was moved 50m after three failed attempts) and so there is good confidence that the sedimentary element is the *Glycera* dominated Glap biotope as determined by the grab samples. At station 15, and on the south shore around Greg Ness, sediment samples could not be obtained and so there is less confidence in the assignment of the sedimentary element of the mosaic, but it seems highly likely to be similar to the adjacent sedimentary biotopes (Glap in the case of Station 15 and NcirBat in the case of stations 9 and 20).

Although biotopes were not described in the somewhat richer samples taken generally further offshore during historical investigations of the Nigg bay sewage outfall by SEPA, there were some general similarities in the communities in that polychaetes, including many typical of mobile sands such as *Ophelia borealis* and *Glycera* spp. were dominant, whilst crustacea were quite sparse. Differences included the act that the oligochaete worm *Grania* sp was the most abundant organisms, whilst the most abundant bivalve was *Moerella pygmaea* (of which only a single individual was encountered from the 25 samples in this survey), and *Angulus fabula*, the most abundant bivalve in this survey, was not abundant in the SEPA surveys.

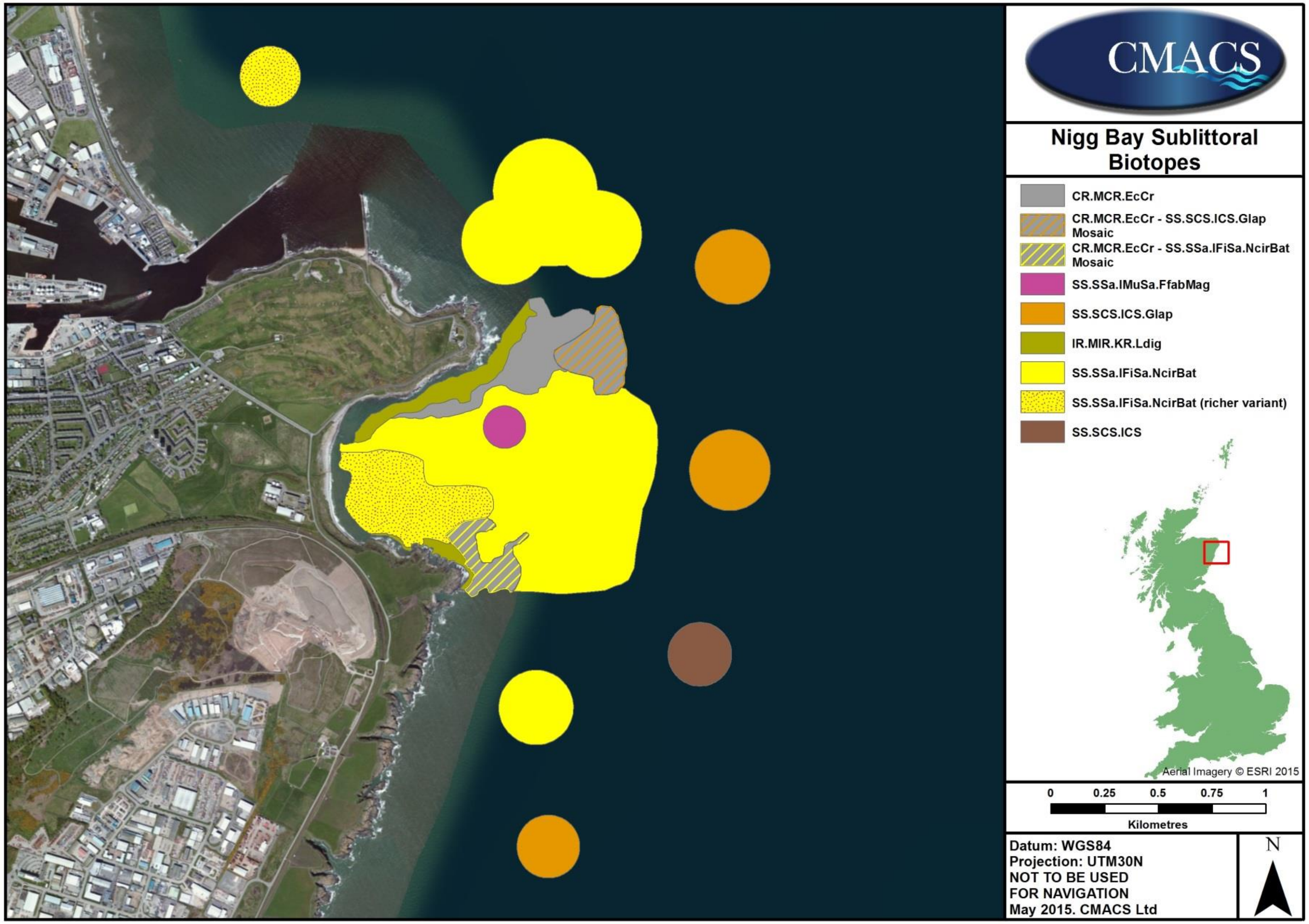

Figure 28. Biotope map of the sublittoral areas of Nigg Bay. The intertidal *Laminaria digitata* biotope is shown since the lower extent of this has been refined, although these areas were described in detail in the intertidal survey report (CMACS 2015).

5. Sensitivity

All biotopes can be considered highly sensitive to complete loss of habitat due to the placement of hard structures over the existing areas, or to removal of habitat, and this element of “sensitivity” is not considered further here. Other impacts that might be expected include disturbance due to the impacts of machinery, anchors etc., increased turbidity during construction, possible deposition of sediments, and changes to the nature of the sediments due to changes in hydrography. Note that description and sensitivities of the *Laminaria digitata* biotopes have already been described in the intertidal survey report (CMACS 2015).

All of the sublittoral fauna and biotopes found, both on rocks/boulders and in sediments, are sparsely populated and consistent with relatively disturbed or scoured habitat. They would all be expected to be tolerant of increased levels of suspended sediments in the water.

In terms of the sedimentary biotopes, one small patch of FfabMag biotope within the bay appears to have a slightly more muddy sediment and may represent a slightly more stable community than in most of the survey locations, but this station was less rich in fauna than is typical for FfabMag. To a lesser degree this also applies to some adjacent stations that represented a slighty muddier and richer variant of the NepcirBat biotope. At Station 18, somewhat offshore of Nigg Bay to the Southwest, a relatively sparse SS.SCS.ICS community on coarse sand that included a small number of longer lived bivalves such as *Goodallia triangularis* is also likely to be slightly more stable. The majority of the sandy areas are dominated by NcirBat and Glap biotopes, however. All of these communities are dominated largely by fauna that can largely be expected to be tolerant to physical disturbance, particularly the dominant polychaetes such as *Nephtys cirrosa*, *Ophelia borealis* and *Glycera lapidum*, Likewise these communities would be expected to recover well from severe disturbance or deposition of sediments, though the FfabMag biotope would be expected to show a slightly slower recovery from severe effects. Even in the FfabMag biotope, however, the majority of the fauna are capable of rapid upward movement if rapidly buried by several cm of sand, and are relatively short lived species that should rapidly recolonize provided that suitable sediments remain available. The NcirBat and Glap biotopes that dominate the majority of the area would be expected to be highly tolerant of disturbance and to recover rapidly, probably over a period of months to a year, even to high levels of disturbance.

The dominant and most characteristic fauna of the rocky biotopes, dead man’s fingers *A. digitatum*, would be expected to show an intermediate intolerance to physical impacts, but has a high ability to recover, so that it’s overall sensitivity is low (Budd 2008). Many of the other associated fauna in these areas would be expected to show low overall sensitivity to physical abrasion. Intolerance to smothering by high levels of sediment deposition is likely to be somewhat higher, since most of the fauna are immobile, but due to the roughness of the topography this is unlikely to occur for any length of time over most of the habitat, since sediments would naturally disperse into the spaces between boulders and rocks. However, assuming that deposition is not permanent, Budd (2008) again notes that *A. digitatum* shows a high recoverability from smothering events (defined as “All of the population of a species or an area of a biotope is smothered by sediment to a depth of 5 cm above the substratum for one month”) although noting that very small colonies are more likely to be killed.

All of the sublittoral fauna and biotopes found, both on rocks/boulders and in sediments, are sparsely populated and consistent with relatively disturbed or scoured habitat. They would be expected to be highly tolerant of increased levels of suspended sediments.

The effects of possible changes in seabed sediments due to changes in hydrography cannot be considered in any detail here due to lack of information on possible changes. However, should the development cause an increase in shelter, and hence an increased mud content, then it is likely that the sediment community would become somewhat richer, and probably resemble more the FfabMag community which is presently poorly represented; this could be at the expense of the sandeels, but these were in any case mostly associated with the more mobile sandy habitats with lower mud content in the outer parts of Nigg Bay and the more offshore stations where such changes are presumably much less likely to occur.

6. Summary

The sediments encountered were virtually all sand, with the dominant fractions almost always being fine sand, though medium sands were also well represented and were dominant in a few places Coarse sands contributed 20% or more at stations 14, 18 and 30, and were marginally the dominant fraction at Station 18. The sediments were almost always moderately well, well or very well sorted. Only station 27 off Girdle Ness was poorly sorted, this station having a total of 9.4% gravel. Elsewhere gravel content was consistently very low, and generally appeared to consist of relatively fine shell fragments. Mud content was also low, with the muddier stations being close inshore within Nigg Bay (1, 2, 5 & 7) and to the North of Aberdeen harbour (Station 10), but even at these stations mud was only 4.7 to 6.3% of each sample and sands strongly dominated.

The levels of all potential contaminants analysed (a range of metals ,Tributyl Tin, TBT; Polychlorinated Biphenyls (PCBs) and Polycyclic Aromatic Hydrocarbons (PAHs)) were found to be consistently well below the Marine Scotland Action 1 levels at all stations.

Hard substrates were mostly found off Girdle Ness to the north, and extending in a narrow band into the Bay, and in smaller areas of Greg ness to the south. These appeared to be largely composed of boulders, though areas of bedrock also occurred off Girdle Ness.

The rocky sublittoral biotopes of the Nigg Bay area were largely sparse examples of the Cr.MCR.EcCr Echinoderms and crustose communities biotope complex, but within these there were also patches of sand, and where these were most extensive the areas have been mapped as a mosaic of the EcCr biotope with sediment biotopes (Glap or NcirBat). In the sediments SS.SSa.IFiSa.NcirBat *Nephtys cirrosa* and *Bathyporeia* spp. in infralittoral sand was the dominant biotope, with other slightly richer infaunal biotopes both close inshore within Nigg Bay (FfabMag) and further offshore (mostly Glap). The EcCr biotope probably changes rather gradually into the lower shore *Laminaria digitata* biotope as depths become shallower although no evidence of algal dominated biotopes was seen in any of the camera images.

The EcCr Echinoderm and crusts biotope on the boulders and rock and comprised a sparse and species poor turf fauna dominated by small amounts of dead man's fingers *Alcyonium digitatum*, occasional hydroids and bryozoans forming a sparse, short turf, and with considerable numbers of common starfish *Asterias rubens* throughout, whilst large numbers of dead barnacle shells were seen in many places, though very few live individuals were seen. Other fauna seen in small amounts included unidentified small patches of encrusting material that may have been colonial ascidian or sponge, small scraps of yellow sponge, occasional solitary hydroid polyps (possibly *Tubularia* sp or *Sarsia* sp) two plumose anemones *Metridium senile*, two individuals of *Sagartia* sp, and occasional small prawns. The lack of fauna appears likely to be heavily influenced by the large amounts of mobile sand, and it is suspected that the amount and depth of sand might be variable from year to year. Using the definitions presented by Irving (2009) the main areas of reef can be regarded as being of medium reefiness, whilst those parts where there are a higher proportion of sands are likely to be of low to medium reefiness.

The widespread biotope NcirBat biotope, which is typical of mobile inshore sands, was poor in both species and numbers of individuals (and biomass was also low throughout). This biotope was dominated by the catworm *Nephtys cirrosa*, and other polychaete worms. Smaller amounts of other sedimentary biotopes were present in a few places; these were again species poor and with a low biomass, and largely dominated by worms, representing the Glap biotope, but the bivalve *Angulus fabula* was moderately abundant in parts of the NcirBat biotope, especially close inshore in Nigg bay, especially at Station 12 in Nigg Bay where the biotope best matched FfabMag, (albeit not as faunistically rich as this biotope usually is). Slightly richer biotopes with larger numbers of both individuals and taxa occur slightly further offshore, as shown by historical surveys associated with the Nigg sewage outfall, and a similar pattern was also observed just north of Aberdeen in the vicinity of the European Offshore Wind Deployment Centre.

A Water Framework Directive (WFD) biological assessment was carried out on the macrofaunal grab data. All stations were of “Moderate” (13 stations) or “Good” (11 stations) EQR, except for Station 18 which was “High”. Those stations of high or good quality seem to be predominantly outside Nigg Bay itself, with the five stations most closely inshore within the bay itself all being of moderate quality. It is not known what factors might be influencing the WFD descriptions, however.

There was no indication of any habitats representing likely Priority Marine Features. Although *Sabellaria spinulosa* was present at two stations, this was in the form of light aggregations of loose small empty/broken tubes at a single location (station 16) where only nine small live individuals were found, and two live individuals in the grab sample from Station 27. There was no indication of any reef like *Sabellaria* aggregations. Although the areas of rock and boulders arguably form a geogenic reef habitat that matches European Habitats Directive Annex 1 reef definitions, the associated community is very sparse and species poor, being dominated by common starfish *Asteria rubens* and small amounts of dead man’s fingers *Alcyonium digitatum*, both of which can be expected to be very widespread and abundant in Scottish waters, and do not match any of the Priority Marine Features. However, three mobile fish species that are considered as PMFs were encountered; these were whiting and sand gobies in the trawls, and sandeels which were frequently encountered throughout (in grabs, camera images, and beam trawls, as well as during the intertidal surveys of 2014), along with a number of commercial fish species, notably plaice, that were also seen in the trawls.

Sensitivity of the biotopes to some of the main kinds of impacts that might be envisaged from the development are briefly discussed in section 5.

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APPENDICES TO THE J3262 NIGG BAY SUBTIDAL SURVEY

CMACS

Appendix 1: Field notes from Camera survey

Site	Date	Time (GMT)	Depth (m)	Fix	Ref	Description & notes
1	19/03/15	11:56:50	7.4	135	68	Sand
		11:57:55	7.7	136	69	Sand
		11:58:44	7.6	137	70	Sand
		11:59:56	7.5	138	71	Sand
		12:01:05	7.9	139	72	Sand
2	19/03/15	12:06:30	7.7	140	73	Sand, low visibility, suspended sediment not clearing
		12:07:29	7.6	141	74	Sand, low visibility, suspended sediment not clearing
		12:08:25	7.4	142	75	Sand, low visibility
		12:09:30	7.6	143	76	Sand, low visibility
		12:10:48	7.7	144	77	Sand
3	19/03/15	12:18:50	8	145	78	Sand
		12:19:49	7.8	146	79	Sand
		12:20:28	8.1	147	80	Sand
		12:21:30	8.2	148	81	Sand
		12:22:21	8.5	149	82	Sand
4	19/03/15	08:54:48	10.7	70	4	Sand
		08:55:59	11	71	5	Sand
		08:57:25	10.7	72	6	Sand
		08:58:10	10.8	73	7	Sand
		08:59:51	10.7	74	8	Sand
5	19/03/15	09:30:54	9	86	19	Sand
		09:31:20	9	87	20	Sand, suspended sediments caused by swell (previous days)
		09:32:52	9	88	21	Sand, very low visibility
		09:33:53	8.5	89	22	Sand, very low visibility
		09:34:57	8.8	90	23	Sand, very low visibility
6	18/03/15	13:43:06	21.5	52	46	Sand
		13:44:17	21.7	53	47	Sand
		13:45:07	21.6	54	48	Sand
		13:45:59	21.9	55	49	Sand
		13:47:27	21.2	56	50	Sand
7	19/03/15	10:49:48	10.2	115	47	Sand, low visibility
		10:50:38	10.4	116	48	Sand, low visibility
		10:52:13	10.2	117	49	Sand, low visibility
		10:53:06	10.0	118	50	Sand, low visibility
		10:53:56	10.6	119	51	Sand, low visibility

Site	Date	Time (GMT)	Depth (m)	Fix	Ref	Description & notes
8	18/03/15	08:02:08	13.8	9	3	Low visibility, fine sand
9	19/03/15	10:37:27	9.2	111	43	Boulders *Alcyonium digitatum*, barnacles, hydroid and/or bryozoan turf
		10:38:38	9.3	112	44	Sand, patchy rocks, suspended sediment
		10:40:18	11.3	113	45	Sand, very low visibility
		10:41:39	10.4	114	46	Sand, very low visibility
						Camera umbilical caught on rock – recording stopped
10	18/03/15	14:19:23	8.6	62	56	Sand
		14:20:14	8.2	63	57	Sand
		14:20:48	8.4	64	58	Sand
		14:21:53	8.2	65	59	Sand
		14:22:51	8.5	66	60	Sand
11	19/03/15	12:28:49	11.9	150	83	Sand, low visibility
		12:30:34	12.1	151	84	Sand, low visibility
		12:31:21	12.2	152	85	Sand
		12:32:00	12.4	153	86	Sand
		12:32:41	12.5	154	87	Sand
12	19/03/15	09:22:56	10.3	81	14	Sand, low visibility – suspended sediments
		09:23:34	10.3	82	15	Sand, low visibility – suspended sediments
		09:24:04	10.3	83	16	Sand, low visibility – suspended sediments
		09:25:24	10.4	84	17	Sand, low visibility – suspended sediments
		09:26:03	10.3	85	18	Sand, low visibility – suspended sediments
13	19/03/15	11:42:55	10.4	130	63	Sand, low visibility
		11:43:42	10.3	131	64	Sand, high amount of suspended sediment
		11:44:51	10.8	132	65	Sand
		11:45:34	10.8	133	66	Sand
		11:46:24	10.6	134	67	Sand, low visibility
14	14/03/15	11:39:45	30.9	2	2	Sand, shell and sand eels
		11:41:51	31.3	3	3	Sand, shell and sand eels
		11:45:39	30.8	4	4	Sand, shell and sand eels
		11:48:32	31.1	5	5	Sand, shell and sand eels
		11:50:05	31.4	6	6	Sand, shell and sand eels

Site	Date	Time (GMT)	Depth (m)	Fix	Ref	Description & notes
15	19/03/15	11:09:03	12.9	120	52	Large boulders, starfish
		11:10:43	11.2	121	53	Large boulders, starfish
		11:13:20	13.8	122	54	Sand, starfish
		11:14:36	13.9	123	55	Sand
		11:15:48	13.5	124	56	Large boulders
16	18/03/15	08:21:03	31.9	11	5	Sand, cobble, starfish
		08:22:02	31.4	12	6	Flat sand, shell fragments
		08:22:56	31.8	13	7	Sand
		08:23:55	31.6	14	8	Sand, Sand eel
		08:24:46	31.9	15	9	Sand, shell fragments
17	19/03/15	09:08:53	11.7	75	9	Sand
		09:09:54	11.7	76	10	Sand
		09:11:13	11.6	77/78	11	Sand
		09:12:42	11.5	79	12	Sand
		09:13:35	11.7	80	13	Sand
18	18/03/15	08:35:09	28.2	16	10	Sand, shell fragments
		08:35:46	29.2	17	11	Sand, shell fragments
		08:36:22	28.3	18	12	Sand, shell fragments
		08:37:41	28.4	19	13	Sand, shell fragments
		08:38:36	28.7	20	14	Sand, shell fragments
19	19/03/15	09:55:02	14.9	96	29	Sand, low visibility
		09:55:49	14.9	97	30	Sand, low visibility
		09:57:01	14.7	98	31	Sand, low visibility
		09:58:04	14.9	99	32	Sand, sand eel
		09:59:53	15.1	100	33	Sand, suspended sediment
20	19/03/15					Only video taken – Boulders, *Alcyonium digitatum*, starfish
		10:23:57	15.6	106	39	Boulder, *Alcyonium digitatum*
		10:25:26	16.3	108	40	Rocks, sand, suspended sediment
		10:26:29	16.2	109	41	Very larger boulder, very little epi-fauna, hydroid and bryozoan turf
		10:28:17	16.2	110	42	Rocks, patchy sand
21	19/03/15	10:07:02	18.4	101	34	Stable sand, no suspended sediment
		10:08:33	18.3	102	35	Sand, suspended sediment
		10:10:25	18.2	103	36	Sand, sand eels, suspended sediment
		10:11:53	18.7	104	37	Sand, low visibility
		10:13:32	18.5	105	38	Sand, fish, low visibility

Site	Date	Time (GMT)	Depth (m)	Fix	Ref	Description & notes
22	18/03/15	09:04:44	20.6	26	20	Sand, shell fragments
		09:05:38	20.8	27	21	Sand, shell fragments
		09:06:44	20.6	28	22	Sand, shell fragments
		09:07:55	21.0	29	23	Sand, shell fragments, *Flustra foliacea*
		09:08:46	20.9	30	24	Sand, shell fragments, Sand eel
23	18/03/15	09:40:05	20.7	36	31	Sand
		09:41:18	20.6	37	32	Sand
		09:42:43	20.2	38	33	Sand
		09:44:02	20.7	39	34	Sand
		09:44:44	20.7	40	35	Sand
24	19/03/15	09:41:12	14.2	91	24	Sand, low visibility – strong tides
		09:42:03	14.0	92	25	Sand, low visibility
		09:43:35	14.6	93	26	Sand, low visibility
		09:45:08	14.3	94	27	Sand, low visibility
		09:46:36	14.3	95	28	Sand, low visibility
25	18/03/15	08:51:43	26.4	21	15	Sand, shell fragments
		08:52:39	26.5	22	16	Sand, shell fragments
		08:53:44	26.2	23	17	Sand, shell fragments
		08:54:41	25.9	24	18	Sand, shell fragments
		08:55:57	25.8	25	19	Sand, shell fragments
26	19/03/15	11:22:14	11.3	125	57	Large boulders
		11:24:22	10.7	126	58	Boulders, starfish
		11:26:40	11.3	127	59/60	Camera moved – image blurred / boulders starfish
		11:28:20	10.0	128	61	Boulders starfish
		11:30:16	10.3	129	62	Very large boulders
27	18/03/15	13:54:35	19.4	57	51	Rock, *Alcyonium digitatum*
		13:56:39	19.2	58	52	Sand
		13:57:55	19.0	59	53	Sand
		13:58:36	18.9	60	54	Sand, stone, *Alcyonium digitatum*
		13:59:51	19.3	61	55	Sand, stone, *Alcyonium digitatum*
28	18/03/15	10:27:50	22.7	46	41	Cobble, sea squirts, *Alcyonium digitatum*
		10:29:20	22.9	47	42	Cobble, sand
		10:30:43	23.7	48	43	Sand, low visibility
		10:32:19	23.5	49	44	Sand, sand eel
		10:33:12	23.4	50	45	Sand, sand eel
29	18/03/15	10:13:18	24.3	41	36	Sand
		10:14:47	24.9	42	37	Sand
		10:16:20	24.5	43	38	Sand

Site	Date	Time (GMT)	Depth (m)	Fix	Ref	Description & notes
		10:17:02	25.0	44	39	Sand
		10:17:47	24.7	45	40	Sand
30	18/03/15	09:24:27	22.7	31	25	Sand, shell fragments
		09:25:22	22.7	32	26	Sand, shell fragments
		09:26:19	22.8	33	27/28	Sand, shell fragments
		09:27:19	22.9	34	29	Sand, shell fragments
		09:28:34	22.3	35	30	Sand

Appendix 2: Field notes from Grab survey

Site	Date	Time (GMT)	Rep	Depth (m)	Fix	Vol. (l)	Description & notes
1	20/03/2015	10:03:22	A	6.1	32	6	Sand
		10:08:22	Cont.	6.1	33	5	Sand
2	20/03/2015	09:52:56	A	5.8	30	6	Sand
		09:56:36	Cont.	5.9	31	7	Sand
3	20/03/2015	09:11:59	A	5.4	28	7	Sand
		09:15:18	Cont.	5.6	29	6	Sand
4	19/03/2015	16:32:04	A	10	0	7	Sand
5	20/03/2015	10:13:13	A	8.7	34	7	Sand, shell fragments
		10:16:33	Cont.	9	35	6	Sand
6	19/03/2015	18:20:54	A	18.3	12	10	Fine sand, shell fragments
7	20/03/2015	09:01:12	A	8.2	26	6	Sand
		09:05:33	Cont.	8.3	27	7	Sand
8	19/03/2015	18:29:40	A	11.5	13	10	Fine sand, shell fragments
10	19/03/2015	18:39:28	A	6.2	14	7	Sand
11	20/03/2015	08:54:35	A	9.4	24	6	Sand
		08:57:56	Cont.	9.3	25	6	Sand

Site	Date	Time (GMT)	Rep	Depth (m)	Fix	Vol. (l)	Description & notes
12	20/03/2015	08:46:41	A	9	22	6	Sand
		08:48:19	Cont.	9.2	23	6	Sand
13	20/03/2015	11:02:32	A	11.1	36		After several unsuccessful grab attempts including after moving 50m away from target, the site was abandoned.
14	19/03/2015	16:43:59	A	30.7	1	10	Sand, sand eel
16	19/03/2015	16:53:20	A	30.7	2	10	Sand, thin layer of *Sabellaria tubes*
17	20/03/2015	08:39:00	A	10.3	20	8	Sand
		08:45:13	Cont.	10.4	21	9	Sand
18	19/03/2015	17:04:52	A	26.9	3	10	Sand
19	19/03/2015 / 20/03/2015	17:58:04	A	12.4	10	9	Fine sand, sand eels
		08:33:00	Cont.	13	19	9	Sand
21	19/03/2015	18:08:28	A	15.7	11	8	Fine sand, shell fragments
22	19/03/2015	17:22:34	A	18.7	5	10	Fine sand
23	19/03/2015 / 20/03/2015	17:36:46	A	17.7	7	10	Fine sand
		08:28:14	Cont.	18.5	18	10	Sand

Site	Date	Time (GMT)	Rep	Depth (m)	Fix	Vol. (l)	Description & notes
24	19/03/2015 / 20/03/2015	17:50:00	A	11.8	9	10	Fine sand, shell fragments
		08:22:20	Cont.	12.2	17	9	Sand
25	19/03/2015	17:15:37	A	23.8	4	8	Fine sand
27	20/03/2015	08:03:51	A	19.7	15	8	Sand, shell fragments (Failed to get a grab at the original location so the vessel moved 50 m offshore before getting a successful grab)
28	20/03/2015	08:11:44	A	20.3	16	8	Sand, shell fragments
29	19/03/2015	17:44:06	A	21.4	8	9	Fine sand
30	19/03/2015	17:30:31	A	19.9	6	10	Fine sand

Appendix 3: Field notes including data from Trawl survey

Trawl 1	Date: 22/03/15	Start time: 10:20	End time: 10:28	Direction: N	
Commercial Species:	Plaice	Dab	Whiting	Sprat	
Total number:	40	73	86	16	
Lengths (mm):	76 88	60 70 62	110 128 135		
	83 71	68 126 59	131 116 116		
	90 140	72 105 55	120 120 121		
	88 88	83 89 70	116 125 125		
	76 91	61 70 99	141 125 115		
	76 83	55 65 66	112 120 126		
	100 133	66 65 66	116 120 119		
	121 97	35 67 64	110 107 119		
	91 90	140 60 69	124 129 115		
	166 69	147 70 170	134 125 111		
	229 95	168 80 160	116 124 128		
	135 83	160 52 51	139 109 131		
	81 88	192 157 53	118 118 112		
	89 72	151 92 61	114 120 129		
	85 77	153 135 55	129 135 120		
	130 90	124 124 61	117 102 117		
	86 91	146 101 61	119 122 120		
	103 73	118 136 60	130 125 115		
	145 55	111 167 70	129 109 130		
	119 62	70 63 64	116 113 125		
		61 63 56	148 131 123		
		63 66 54	111 111 115		
		56 68 61	120 115 105		
		55 165 50	115 112 101		
		68	111 115 145		
			123 126 112		
			115 114 119		
			135 124 123		
			116 130		
Non-commercial species:	**Total number**				
Sand Goby	14				
Sand eel (*Ammodytes tobianus*)	3				
Rockling (3 bearded)	1				
Hook nose	13				
Great Pipe fish (*Syngnathus acus*)	12				
Brown shrimp (*Crangon crangon*)	136				

Trawl 1	Date: 22/03/15	Start time: 10:20	End time: 10:28	Direction: N	
Shore crab (*Carcinus maenas*)	2				
Flying crab (*Liocarcinus holstatus*)	17				

Trawl: 2	Date: 22/03/15				Start time: 11:38		End time: 11:47		Direction: SW
Commercial Species:	Plaice				Dab		Whiting	Sprat	Cod
Total number:	140				57		16	3	1
Lengths (mm):	96	85	94	90	71	61	120		105
	102	91	83	107	70	136	105		
	91	88	82	90	60	189	111		
	75	160	93	121	126	129	131		
	87	107	71	107	121	170	137		
	79	164	95	76	115	169	125		
	78	105	105	81	84	119	92		
	83	104	91	70	82	80	128		
	75	110	107	75	70	110	126		
	102	93	112	100	123	171	122		
	90	91	75	105	60	75	125		
	82	95	121	124	117	139	110		
	90	75	99	125	190	137	105		
	85	85	96	99	170	109	116		
	85	78	98	106	118	162	104		
	85	114	104	84	132	131	125		
	84	90	68	87	124	205			
	60	89	96	98	104	105			
	94	93	89	102	132	113			
	79	112	85	112	126	60			
	106	73	99	103	205	128			
	205	65	98	72	172	119			
	101	99	78	100	12	129			
	205	100	96	104	5	120			
	89	122	111	80	126	75			
	112	129	142	107	122	103			
	86	104	77	87	94	124			
	108	103	110	85	112	71			
	100	107	107	102	130	72			
	102	90	93						
	90	100	112						
	99	86	107						
	141	72	107						
	95	100	100						
	80	98	83						
	89	95	98						
	74	78	86						
Non-commercial species:	**Total number**								
Sand Goby	4								

Trawl: 2	Date: 22/03/15	Start time: 11:38	End time: 11:47		Direction: SW
Greater Sand eel (*Hyperoplus lanceolatus*)	1 (205)				
Hook nose	3				
Great Pipe fish (*Syngnathus acus*)	3				
Brown shrimp (*Crangon crangon*)	557				
Shore crab (*Carcinus maenas*)	1				
Pink Shrimp	1				
Flying crab (*Liocarcinus holstatus*)	18				
Harbour crab (*Liocarcinus depurator*)	6				
Hydroid and/or Bryozoan turf	Occasional				

Trawl: 3	Date: 22/03/15			Start time: 12:50	End time: 12:58		Direction: SW
Commercial Species:	Plaice			Dab	Whiting	Sprat	Cod
Total number:	59			18	4	1	1
Lengths (mm):	146	118	95	125	125		131
	146	127	95	130	145		
	117	91	88	194	123		
	150	92	87	133	142		
	194	77	88	170			
	87	117	80	148			
	111	104	108	154			
	130	110	84	166			
	127	105	83	138			
	94	81	92	74			
	115	95	80	173			
	92	84	103	130			
	138	109	95	64			
	128	125	122	148			
	195	96	83	145			
	99	110	87	116			
	92	113	86	72			
	114	121	108	53			
	110	91	45				
	113	94					
Non-commercial species:	**Total number**						
Sand Goby	9						
Greater Sand eel (*Hyperoplus lanceolatus*)	5 (203mm, 4 less than 100mm)						
Hook nose	1						
Great Pipe fish (*Syngnathus acus*)	4						

Trawl: 3	Date: 22/03/15	Start time: 12:50	End time: 12:58		Direction: SW
Brown shrimp (*Crangon crangon*)	352				
Shore crab (*Carcinus maenas*)	2				
Flying crab (*Liocarcinus holstatus*)	5				
Hydroid and/or Bryozoan turf	Occasional				
Alcyonium digitatum	Rare				

Trawl: 4	Date: 22/03/15	Start time: 14:00	End time: 14:15		Direction: N
Species:	**Total number**				
Lesser Sand eel (*Ammodytes tobianus*)	24 (<100mm, ~60mm)				
Great Pipe fish (*Syngnathus acus*)	2				
Brown shrimp (*Crangon crangon*)	4				
Shore crab (*Carcinus maenas*)	1				
Flying crab (*Liocarcinus holstatus*)	1				

Trawl: 5	Date: 22/03/15	Start time: 14:49		End time: 14:57	Direction:
Commercial Species:	Plaice	Dab		Whiting	Sprat
Total number:	7	19		15	1
Lengths (mm):	195 148 160 160 136 142 92	178 225 212 220 198 116 136 164 169 125	112 97 58 105 99 120 166 56 91	155 135 142 159 132 128 145 140 124 140 120 134 141 108 146	
Non-commercial species:	**Total number**				
Lesser Sand eel (*Ammodytes tobianus*)	4				
Sea gooseberry sp.	2				

Trawl: 5	Date: 22/03/15	Start time: 14:49	End time: 14:57	Direction:
Great Pipe fish (*Syngnathus acus*)	3			
Brown shrimp (*Crangon crangon*)	17			
Harbour crab (*Liocarcinus depurator*)	1 (berried)			
Flying crab (*Liocarcinus holstatus*)	1			
Hydroid and/or Bryozoan turf	Rare			
Flustra foliacea	Rare			
King Ragworm (*Alitta virens*)	1			

Appendix 4: Camera image analysis

Station number	Image number	Image quality	Substrata	Taxa																	Video analysis
				Hydroid and/or Bryozoan turf	Sand eel sp.	*Alcyonium digitatum*	Barnacle sp.	Yellow Encrusting sponge	*Asterias rubens*	Orange encrusting (Ascidiacea sp? possible sponge?)	*Ascidiacea sp.*	Worm tubes (formed from sand grains, broken)	Worm tubes (infauna, membranous, possible parchment worm)	Seaweed (fucoid, probably drift)	*Metridium senile*	Prawn sp.	*Sagartia* sp	*Urticina felina*	Pink encrusting *Coralline* algae	Solitary hydroids(e.g. *Sarsia, Tubularia*)	
1	68	P	Sand/shell fragments (rare)																		Sand with shell fragments (very little amount)
1	69	P	Sand/shell fragments (rare)																		
1	70	M	Sand/shell fragments (rare)																		
1	71	M	Sand/shell fragments (rare)																		
1	72	M	Sand/shell fragments (rare)																		
2	73	P	Sand/shell fragments (occasional)																		Sand
2	74	P	Sand/shell fragments (occasional)																		
2	75	P	Sand/shell fragments (occasional)																		
2	76	P	Sand/shell fragments (occasional)																		

Station number	Image number	Image quality	Substrata	Taxa																	Video analys is
				Hydroid and/or Bryozoan turf	Sand eel sp.	*Alcyonium digitatum*	Barnacle sp.	Yellow Encrusting sponge	*Asterias rubens*	Orange encrusting (Ascidiacea sp? possible sponge?)	*Ascidiacea sp.*	Worm tubes (formed from sand grains, broken)	Worm tubes (infauna, membranous, possible parchment worm)	Seaweed (fucoid, probably drift)	*Metridium senile*	Prawn sp.	*Sagartia* sp	*Urticina felina*	Pink encrusting *Coralline* algae	Solitary hydroids(e.g. *Sarsia, Tubularia*)	
2	77	P	Sand/shell fragments (occasional)																		
3	78	G	Sand/shell fragments (abundant)																		Sand with shell fragments (abundant in some images)
3	79	G	Sand/shell fragments (abundant)																		
3	80	G	Sand/shell fragments (abundant)																		
3	81	G	Sand/shell fragments (abundant)																		
3	82	G	Sand/shell fragments (abundant)																		
4	4	M	Sand/shell fragments (frequent)																		Sand with shell fragments (abundant)
4	5	G	Sand/shells/shel l fragments (abundant)																		
4	6	M	Sand/shells/shel l fragments (abundant)																		

Station number	Image number	Image quality	Substrata	Taxa																	Video analysis
				Hydroid and/or Bryozoan turf	Sand eel sp.	*Alcyonium digitatum*	Barnacle sp.	Yellow Encrusting sponge	*Asterias rubens*	Orange encrusting (Ascidiacea sp? possible sponge?)	*Ascidiacea sp.*	Worm tubes (formed from sand grains, broken)	Worm tubes (infauna, membranous, possible parchment worm)	Seaweed (fucoid, probably drift)	*Metridium senile*	Prawn sp.	*Sagartia* sp	*Urticina felina*	Pink encrusting *Coralline* algae	Solitary hydroids(e.g. *Sarsia, Tubularia*)	
4	7	M	Sand/shells/shell fragments (abundant)																		
4	8	G	Sand/shells/shell fragments (abundant)		C																
5	19	P	Sand																		Sand. Poor visibility
5	20	P																			
5	21	P																			
5	22	P																			
5	23	P																			
6	46	G	Sand/shell fragments (abundant)																		Sand with shell fragments (abundant).
6	47	G	Sand/shell fragments (abundant)																		
6	48	G	Sand/shell fragments (abundant)																		
6	49	G	Sand/shell fragments																		

Station number	Image number	Image quality	Substrata	Taxa																	Video analys is
				Hydroid and/or Bryozoan turf	Sand eel sp.	*Alcyonium digitatum*	Barnacle sp.	Yellow Encrusting sponge	*Asterias rubens*	Orange encrusting (Ascidiacea sp? possible sponge?)	*Ascidiacea sp.*	Worm tubes (formed from sand grains, broken)	Worm tubes (infauna, membranous, possible parchment worm)	Seaweed (fucoid, probably drift)	*Metridium senile*	Prawn sp.	*Sagartia* sp	*Urticina felina*	Pink encrusting *Coralline* algae	Solitary hydroids(e.g. *Sarsia, Tubularia*)	
			(abundant)																		
6	50	G	Sand/shell fragments (abundant)																		
7	47	P	Sand																		Sand. High amount of suspended sediment
7	48	P	Sand																		
7	49	P																			
7	50	P																			
7	51	P	Sand																		
8	3	P																			High amount of suspended sediment. Unable to get a clear view of the seabed Boulders with *Alcyonium*
9	43	P	Boulder			O		R											<1 %		
9	44	P	Boulder	O																	
9	45	P																			
9	46	P																			

Station number	Image number	Image quality	Substrata	Taxa																	Video analysis
				Hydroid and/or Bryozoan turf	Sand eel sp.	*Alcyonium digitatum*	Barnacle sp.	Yellow Encrusting sponge	*Asterias rubens*	Orange encrusting (Ascidiacea sp? possible sponge?)	*Ascidiacea sp.*	Worm tubes (formed from sand grains, broken)	Worm tubes (infauna, membranous, possible parchment worm)	Seaweed (fucoid, probably drift)	*Metridium senile*	Prawn sp.	*Sagartia* sp	*Urticina felina*	Pink encrusting *Coralline* algae	Solitary hydroids(e.g. *Sarsia, Tubularia*)	
																					digitatum. Areas with just sand. High amount of suspended sediment
10	56	P																			Sand and shell fragments (frequent)). High amount of suspended sediment
10	57	P																			
10	58	P	Sand																		
10	59	M	Sand/shell fragments (frequent)																		
10	60	P	Sand																		
11	83	P																			Sand. Poor visibility. Sand eels observed at fix 154 (image 86)
11	84	P																			
11	85	P																			
11	86	P	Sand																		

Station number	Image number	Image quality	Substrata	Taxa																	Video analysis
				Hydroid and/or Bryozoan turf	Sand eel sp.	*Alcyonium digitatum*	Barnacle sp.	Yellow Encrusting sponge	*Asterias rubens*	Orange encrusting (Ascidiacea sp? possible sponge?)	*Ascidiacea sp.*	Worm tubes (formed from sand grains, broken)	Worm tubes (infauna, membranous, possible parchment worm)	Seaweed (fucoid, probably drift)	*Metridium senile*	Prawn sp.	*Sagartia* sp	*Urticina felina*	Pink encrusting *Coralline* algae	Solitary hydroids(e.g. *Sarsia, Tubularia*)	
11	87	P	Sand																		
12	14	P																			Sand. Poor visibility
12	15	P																			
12	16	P	Sand																		
12	17	P																			
12	18	M	Sand/shell fragments																		
13	63	M	Sand/shell fragments (occasional)																		Sand. Poor visibility. Sand eels observed at fix 132 (image 65)
13	64	P	Sand																		
13	65	M	Sand																		
13	66	P	Sand																		
13	67	P	Sand																		
14	2	G	Sand/shell fragments (abundant)																		Sand with shell fragments

Station number	Image number	Image quality	Substrata	Taxa																	Video analysis
				Hydroid and/or Bryozoan turf	Sand eel sp.	*Alcyonium digitatum*	Barnacle sp.	Yellow Encrusting sponge	*Asterias rubens*	Orange encrusting (Ascidiacea sp? possible sponge?)	*Ascidiacea sp.*	Worm tubes (formed from sand grains, broken)	Worm tubes (infauna, membranous, possible parchment worm)	Seaweed (fucoid, probably drift)	*Metridium senile*	Prawn sp.	*Sagartia* sp	*Urticina felina*	Pink encrusting *Coralline* algae	Solitary hydroids(e.g. *Sarsia, Tubularia*)	
14	3	G	Sand/shell fragments (abundant)																		(abundant). Lot's of Sand eels swimming in and out of picture
14	4	G	Sand/shell fragments (abundant)																		
14	5	G	Sand/shell fragments (abundant)																		
14	6	M	Sand/shell fragments (abundant)																		
14	7	G	Sand/shell fragments (abundant)																		
15	52	G	Boulders	O					A		F										Boulders (very little faunal turf). Areas of sand with shell fragments (abundant). Starfish and sand eels
15	53	G	Boulders						A	R											
15	54	G	Sand/shell fragments (abundant)																		
15	55	G	Sand/shell fragments (abundant)																		
15	56	G	Boulder	C					S		C										

Station number	Image number	Image quality	Substrata	Taxa																	Video analysis
				Hydroid and/or Bryozoan turf	Sand eel sp.	*Alcyonium digitatum*	Barnacle sp.	Yellow Encrusting sponge	*Asterias rubens*	Orange encrusting (Ascidiacea sp? possible sponge?)	*Ascidiacea sp.*	Worm tubes (formed from sand grains, broken)	Worm tubes (infauna, membranous, possible parchment worm)	Seaweed (fucoid, probably drift)	*Metridium senile*	Prawn sp.	*Sagartia* sp	*Urticina felina*	Pink encrusting *Coralline* algae	Solitary hydroids(e.g. *Sarsia, Tubularia*)	
																					present
16	5	G	Rocks/sand/shell fragments (frequent)	O					S			O				C		C			Rocks with coarse sand, shell fragments (abundant). Asteria rubens and sand eels recorded
16	6	G	Sand/shell fragments (abundant)																		
16	7	G	Sand/shell fragments (abundant)									R									
16	8	G	Sand/shell fragments (abundant)									R									
17	9	G	Sand/shell fragments (frequent)																		Sand with shell fragments (frequent)
17	10	G	Sand/shell fragments (frequent)																		
17	11	G	Sand/shell fragments (frequent)																		
17	12	G	Sand/shell fragments (frequent)																		

Station number	Image number	Image quality	Substrata	Taxa																	Video analysis
				Hydroid and/or Bryozoan turf	Sand eel sp.	*Alcyonium digitatum*	Barnacle sp.	Yellow Encrusting sponge	*Asterias rubens*	Orange encrusting (Ascidiacea sp? possible sponge?)	*Ascidiacea sp.*	Worm tubes (formed from sand grains, broken)	Worm tubes (infauna, membranous, possible parchment worm)	Seaweed (fucoid, probably drift)	*Metridium senile*	Prawn sp.	*Sagartia* sp	*Urticina felina*	Pink encrusting *Coralline* algae	Solitary hydroids(e.g. *Sarsia, Tubularia*)	
17	13	G	Sand/shell fragments (frequent)																		
18	10	G	Sand/shell fragments (abundant)																		Sand with shell fragments (abundant). Sand eels observed at fix 19 and 20 (image 13 and 14)
18	11	G	Sand/shell fragments (abundant)																		
18	12	G	Sand/shell fragments (abundant)																		
18	13	G	Sand/shell fragments (abundant)																		
18	14	G	Sand/shell fragments (abundant)																		
19	29	G	Sand/shell fragments (abundant)																		Sand with shell fragments (abundant). Sand eels observed at fix 99 (image 32)
19	30	G	Sand/shell fragments (abundant)																		
19	31	G	Sand/shell fragments (abundant)																		

Station number	Image number	Image quality	Substrata	Taxa																	Video analysis
				Hydroid and/or Bryozoan turf	Sand eel sp.	*Alcyonium digitatum*	Barnacle sp.	Yellow Encrusting sponge	*Asterias rubens*	Orange encrusting (Asciciacea sp? possible sponge?)	*Ascidiacea sp.*	Worm tubes (formed from sand grains, broken)	Worm tubes (infauna, membranous, possible parchment worm)	Seaweed (fucoid, probably drift)	*Metridium senile*	Prawn sp.	*Sagartia* sp	*Urticina felina*	Pink encrusting *Coralline* algae	Solitary hydroids(e.g. *Sarsia, Tubularia*)	
19	32	G	Sand/shell fragments (abundant)																		
19	33	G	Sand/shell fragments (abundant)																		
20	39	G	Boulders			F			A						A						Boulder with dense faunal turf, Anemone sp, A. digitatum, Asterias rubens, interspersed with areas of sand
20	40	G	Rock, sand	S					S												
20	41	G	Boulder/sand	S					S												
20	42	G	Boulder/sand/shell fragments (frequent)						S					R							
21	34	G	Sand/shell fragments (abundant)																		Sand with shell fragments (abundant). Sand eels
21	35	G	Sand/shell fragments (abundant)																		

				Taxa																	
Station number	**Image number**	**Image quality**	**Substrata**	Hydroid and/or Bryozoan turf	Sand eel sp.	*Alcyonium digitatum*	Barnacle sp.	Yellow Encrusting sponge	*Asterias rubens*	Orange encrusting (Ascidiacea sp? possible sponge?)	*Ascidiacea sp.*	Worm tubes (formed from sand grains, broken)	Worm tubes (infauna, membranous, possible parchment worm)	Seaweed (fucoid, probably drift)	*Metridium senile*	Prawn sp.	*Sagartia* sp	*Urticina felina*	Pink encrusting *Coralline* algae	Solitary hydroids(e.g. *Sarsia, Tubularia*)	**Video analysis**
21	36	G	Sand/shell fragments (abundant)									C									observed at fix 103 (image 35)
21	37	G	Sand/shell fragments (abundant)																		
21	38	M	Sand/shell fragments (abundant)																		
22	20	G	Sand/shell fragments (frequent)																		Sand with shell fragments (abundant). Sand eels observed at fix 29 and 30 (images 22 and 23)
22	21	G	Sand/shell fragments (frequent)																		
22	22	G	Sand/shell fragments (abundant)																		
22	23	G	Sand/shell fragments (abundant)																		
22	24	G	Sand/shell fragments (abundant)																		
23	31	G	Sand/shell fragments (abundant)																		Sand and shell fragments

Station number	Image number	Image quality	Substrata	Taxa: Hydroid and/or Bryozoan turf	Sand eel sp.	*Alcyonium digitatum*	Barnacle sp.	Yellow Encrusting sponge	*Asterias rubens*	Orange encrusting (Ascidiacea sp? possible sponge?)	*Ascidiacea sp.*	Worm tubes (formed from sand grains, broken)	Worm tubes (infauna, membranous, possible parchment worm)	Seaweed (fucoid, probably drift)	*Metridium senile*	Prawn sp.	*Sagartia* sp	*Urticina felina*	Pink encrusting *Coralline* algae	Solitary hydroids(e.g. *Sarsia, Tubularia*)	Video analysis
23	32	G	Sand/shell fragments (abundant)																		(abundant)
23	33	G	Sand/shell fragments (abundant)																		
23	34	G	Sand/shell fragments (abundant)																		
23	35	G	Sand/shell fragments (abundant)																		
24	24	M	Sand/shell fragments (abundant)																		Sand and shell fragments (abundant)
24	25	M	Sand/shell fragments (abundant)																		
24	26	G	Sand/shell fragments (abundant)																		
24	27	M	Sand/shell fragments (abundant)																		
24	28	M	Sand/shell fragments (abundant)																		

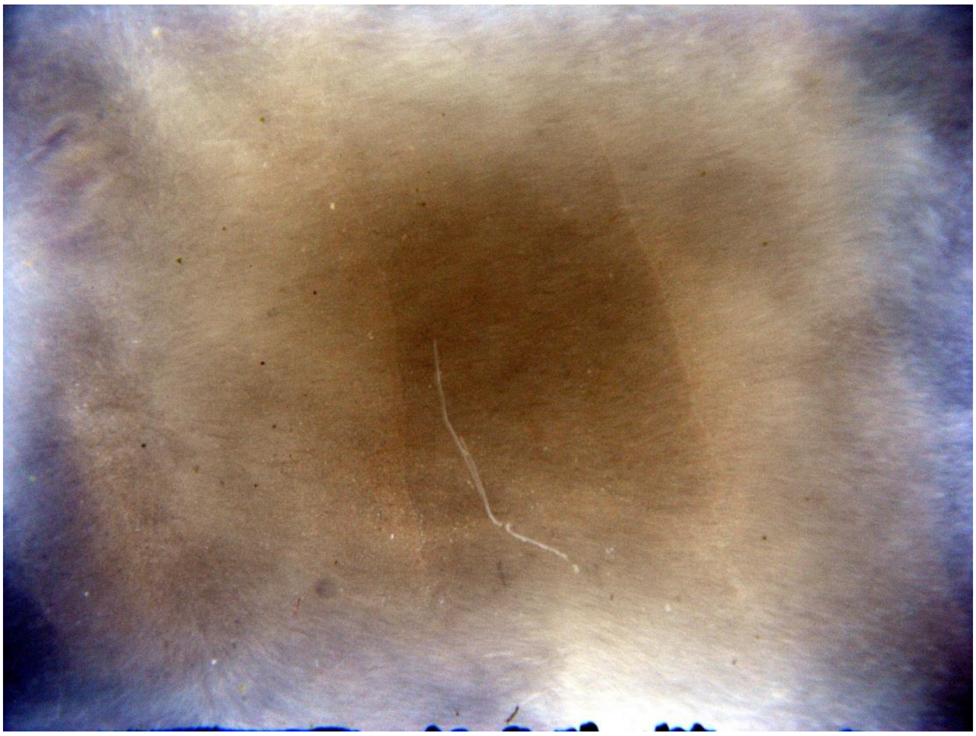
Station number	Image number	Image quality	Substrata	Taxa																	Video analysis
				Hydroid and/or Bryozoan turf	Sand eel sp.	*Alcyonium digitatum*	Barnacle sp.	Yellow Encrusting sponge	*Asterias rubens*	Orange encrusting (Ascidiacea sp? possible sponge?)	*Ascidiacea sp.*	Worm tubes (formed from sand grains, broken)	Worm tubes (infauna, membranous, possible parchment worm)	Seaweed (fucoid, probably drift)	*Metridium senile*	Prawn sp.	*Sagartia* sp	*Urticina felina*	Pink encrusting *Coralline* algae	Solitary hydroids(e.g. *Sarsia, Tubularia*)	
25	15	G	Sand/shell fragments (abundant)																		Sand with shell fragments (abundant). Sand eels observed at fix 25 (image 19)
25	16	G	Sand/shell fragments (abundant)																		
25	17	G	Sand/shell fragments (abundant)																		
25	18	G	Sand/shell fragments (abundant)		C																
25	19	G	Sand/shell fragments (abundant)		C																
26	58	G	Boulders						S	C											Boulders (very little faunal turf), Starfish
26	59	P																			
26	60	G	Boulders			R	R		A	F							A		<1 %	C	
26	61	M	Boulders						S												
26	62	M	Rock, sand																		

Station number	Image number	Image quality	Substrata	Taxa																	Video analysis
				Hydroid and/or Bryozoan turf	Sand eel sp.	*Alcyonium digitatum*	Barnacle sp.	Yellow Encrusting sponge	*Asterias rubens*	Orange encrusting (Ascidiacea sp? possible sponge?)	*Ascidiacea sp.*	Worm tubes (formed from sand grains, broken)	Worm tubes (infauna, membranous, possible parchment worm)	Seaweed (fucoid, probably drift)	*Metridium senile*	Prawn sp.	*Sagartia* sp	*Urticina felina*	Pink encrusting *Coralline* algae	Solitary hydroids(e.g. *Sarsia, Tubularia*)	
27	51	M	Sand			A															Areas of sand intersperred with boulders with Alcyonium digitatum attached and starfish
27	52	P																			
27	53	P																			
27	54	M				O															
27	55	M	Sand	S		F			S												
28	41	M	Rocks			F															Sand, rocks with Alcyonium digitatum. Sand eels observed at fix 49 (image 43)
28	42	M	Rocks			C															
28	43	P				O															
28	44	P	Sand																		
28	45	P	Sand																		
29	36	G	Sand, shell fragments (abundant)																		Sand with shell fragments (abundant). Sand eels
29	37	G	Sand, shell fragments (abundant)																		

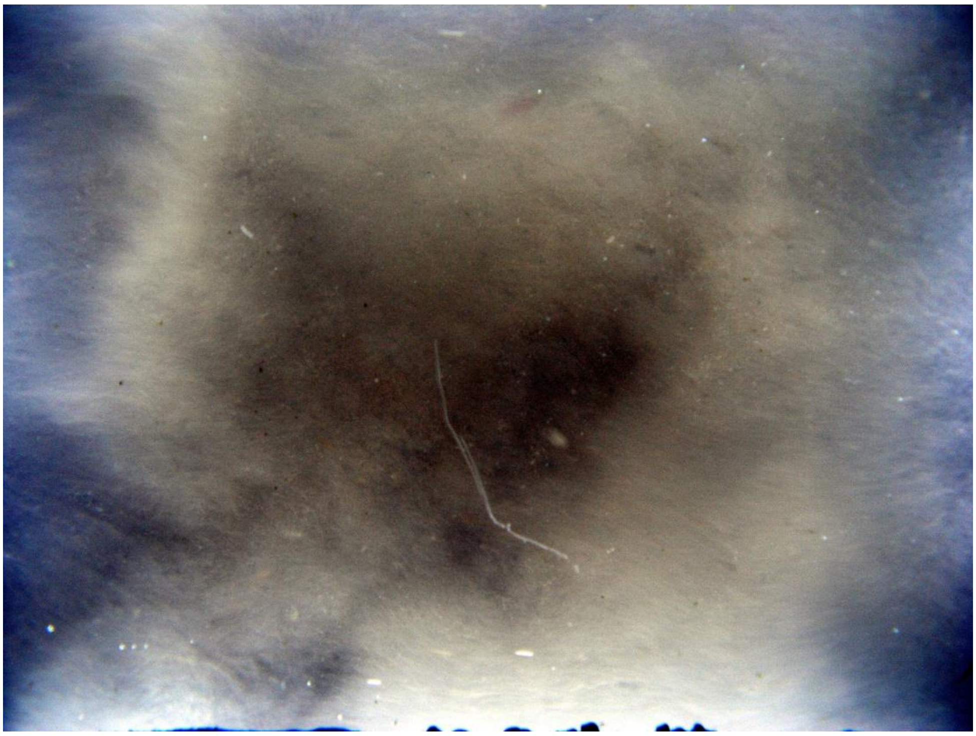
Station number	**Image number**	**Image quality**	**Substrata**	**Taxa**																	**Video analysis**
				Hydroid and/or Bryozoan turf	Sand eel sp.	*Alcyonium digitatum*	Barnacle sp.	Yellow Encrusting sponge	*Asterias rubens*	Orange encrusting (Ascidiacea sp? possible sponge?)	*Ascidiacea sp.*	Worm tubes (formed from sand grains, broken)	Worm tubes (infauna, membranous, possible parchment worm)	Seaweed (fucoid, probably drift)	*Metridium senile*	Prawn sp.	*Sagartia* sp	*Urticina felina*	Pink encrusting *Coralline* algae	Solitary hydroids(e.g. *Sarsia, Tubularia*)	
29	38	G	Sand, shell fragments (abundant)																		observed at all camera drops
29	39	G	Sand, shell fragments (abundant)																		
29	40	G	Sand, shell fragments (abundant)																		
30	25	G	Sand, shell fragments (abundant)																		Sand with shell fragments (abundant)
30	26	G	Sand, shell fragments (abundant)																		
30	27	G	Sand, shell fragments (abundant)																		
30	28	G	Sand, shell fragments (abundant)																		
30	29	G	Sand, shell fragments (abundant)																		

Appendix 5. Example camera images from each location.

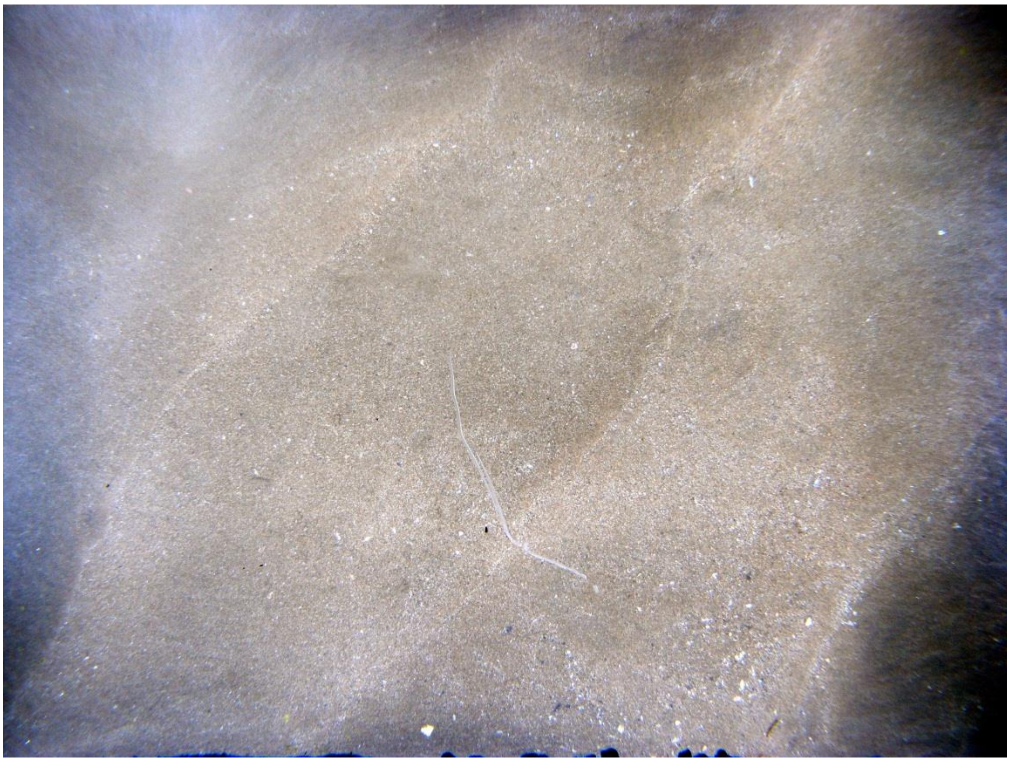
Station 1



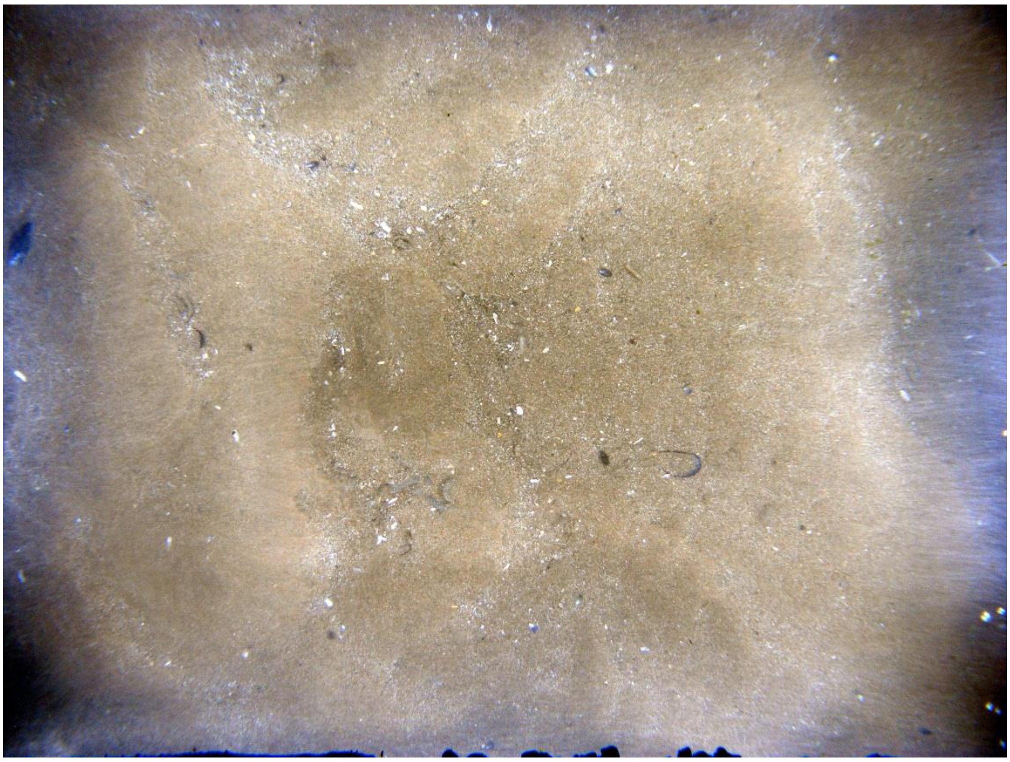
Station 2



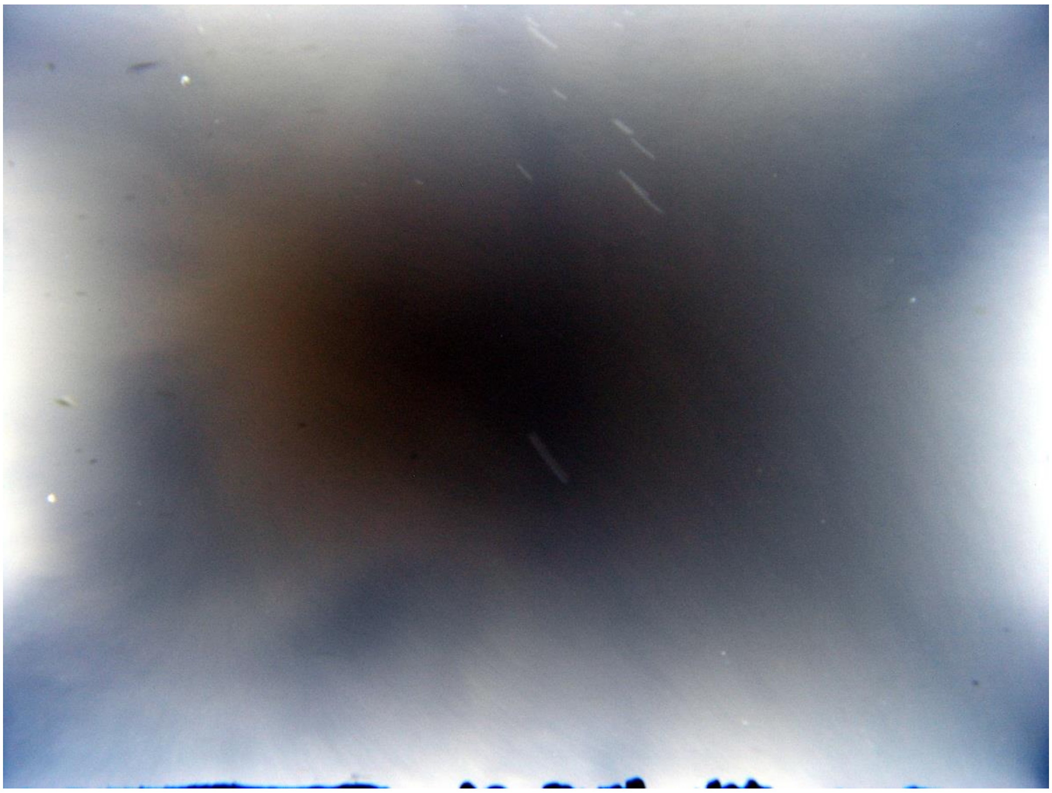
Station 3



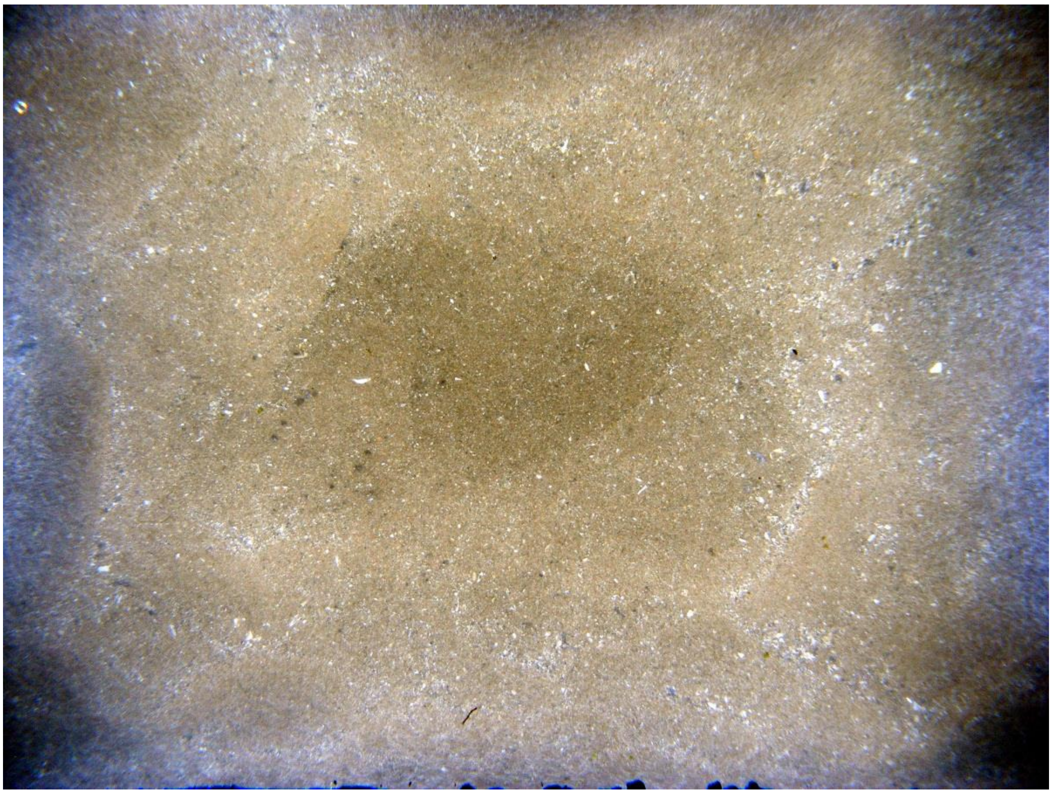
Station 4



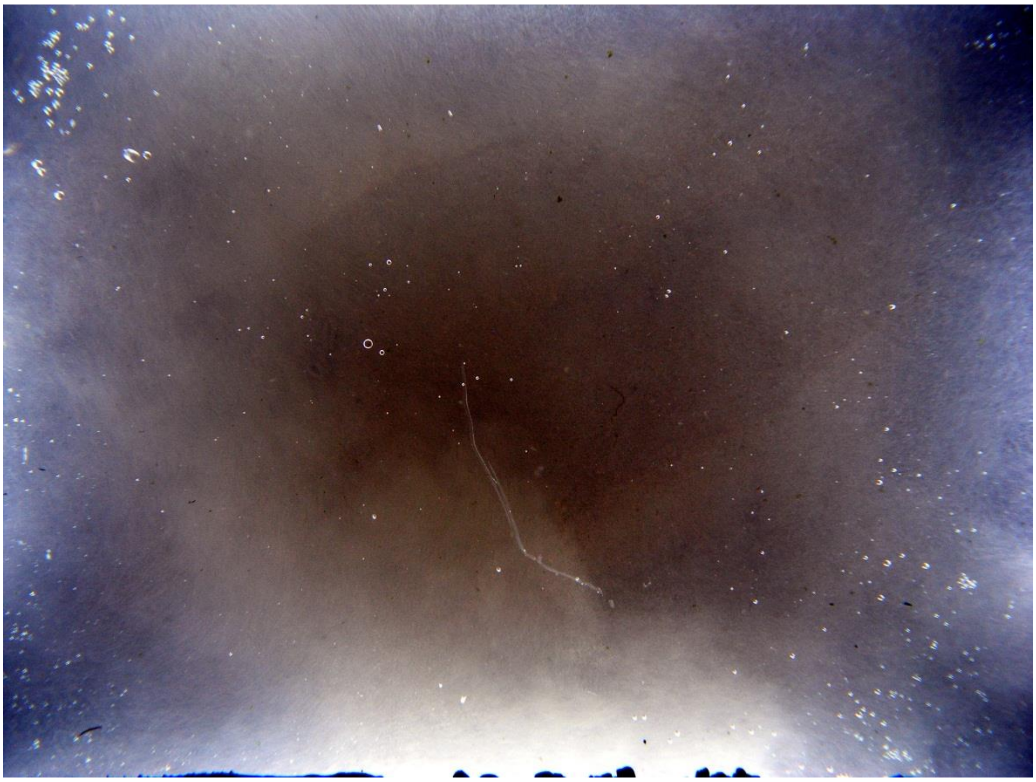
Station 5



Station 6



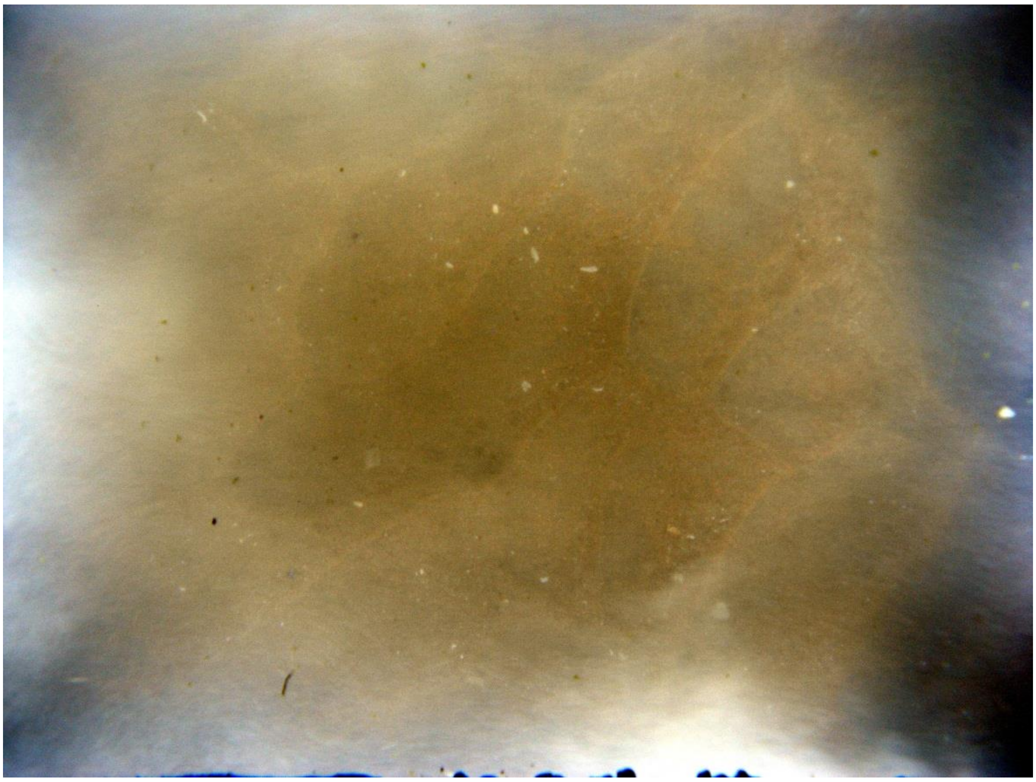
Station 7



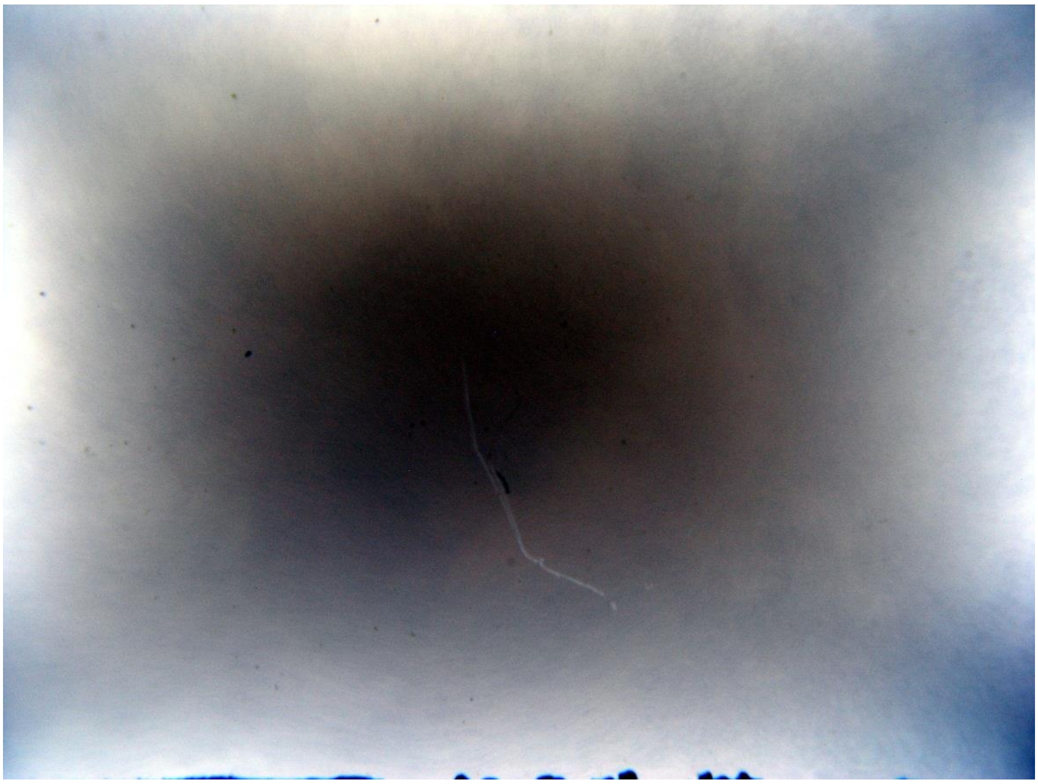
Station 8

Station 9

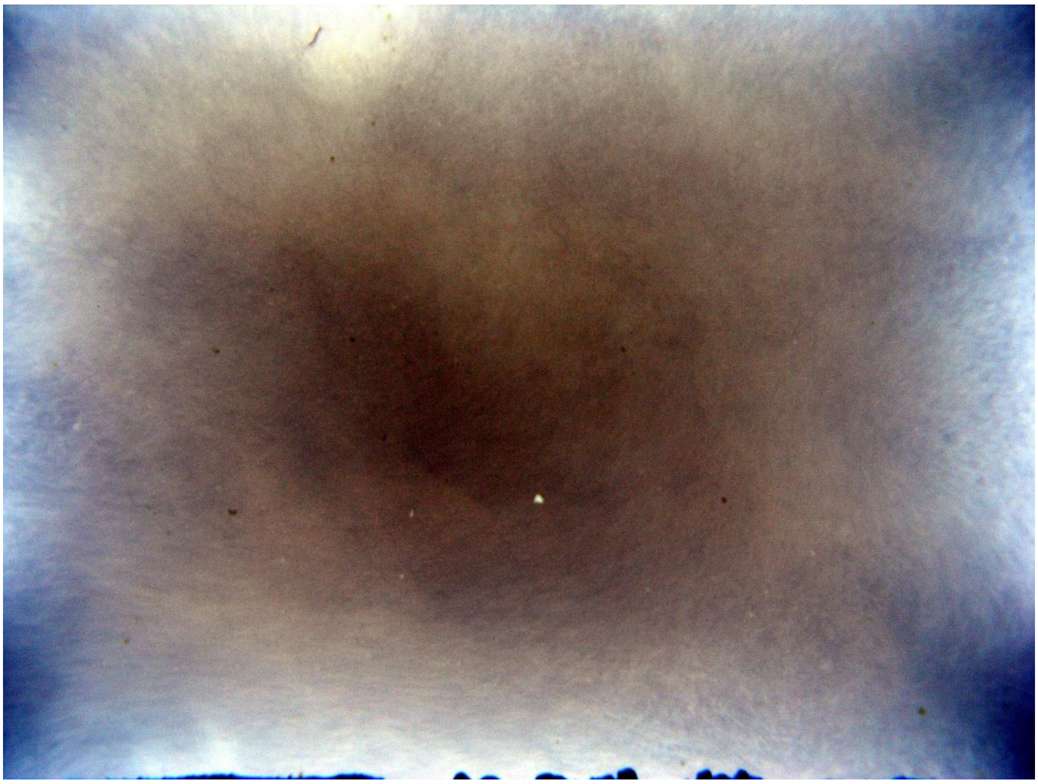
Station 10



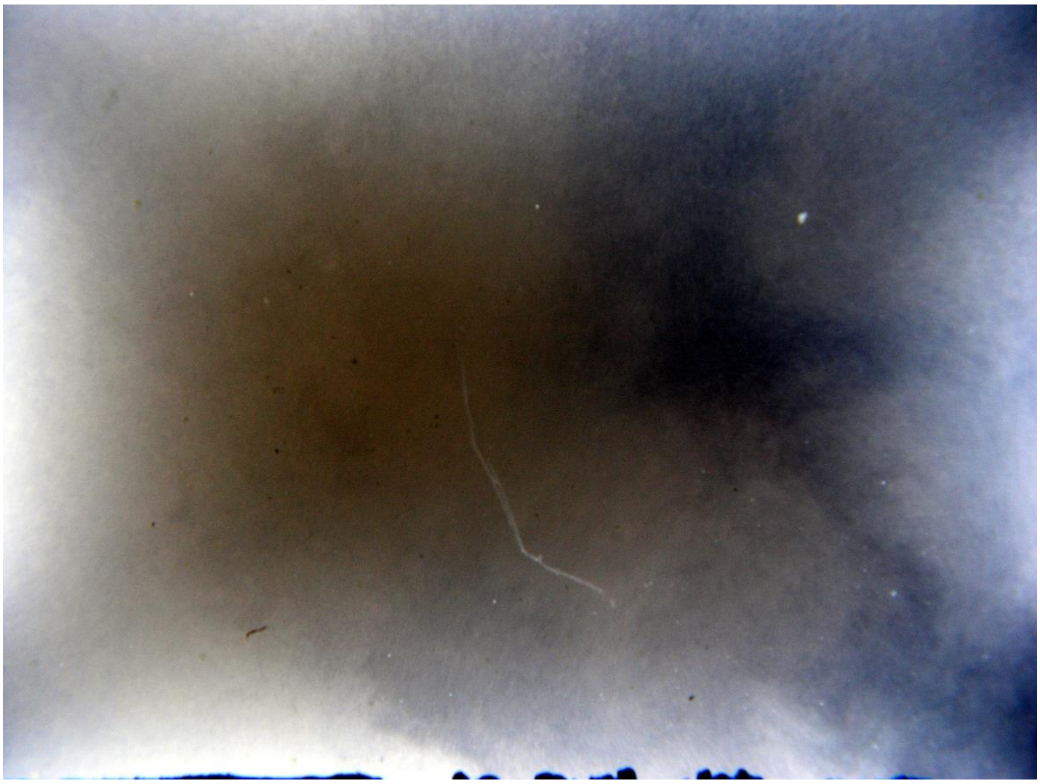
Station 11



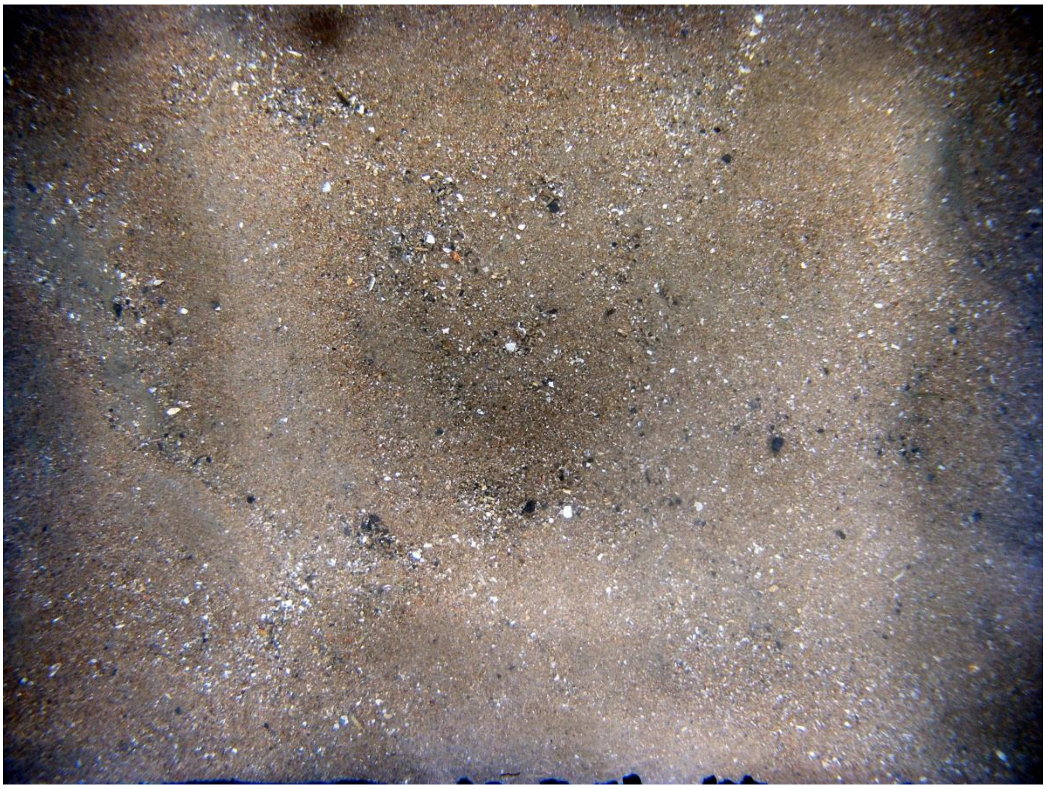
Station 12



Station 13

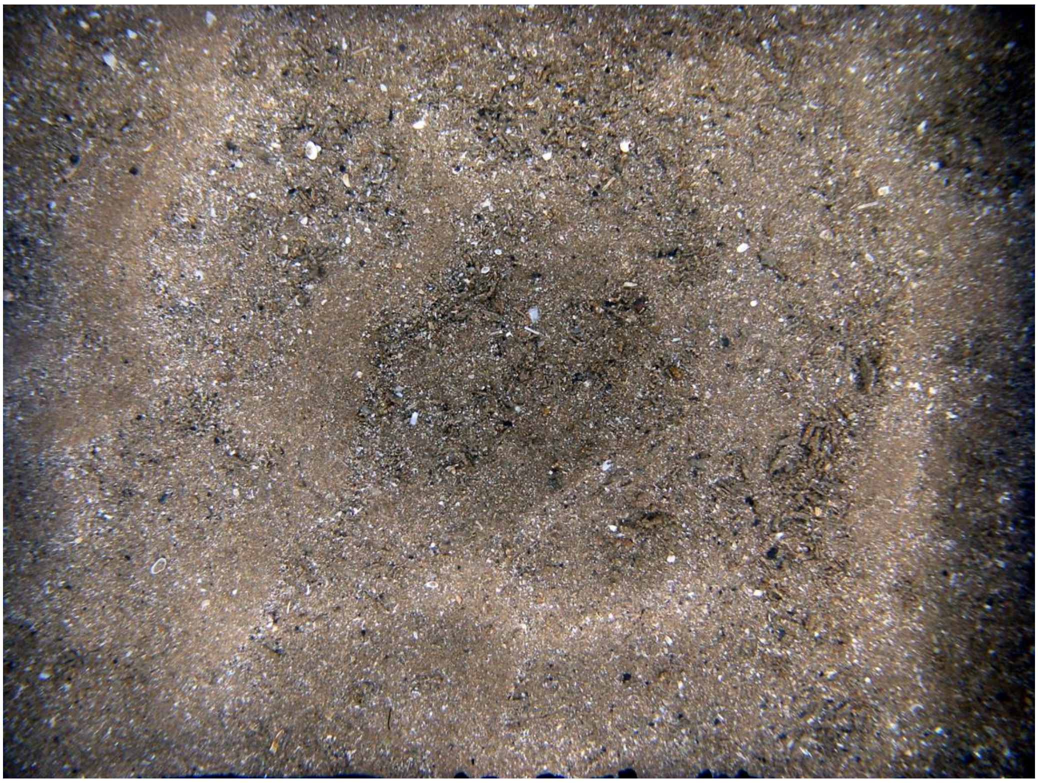


Station 14

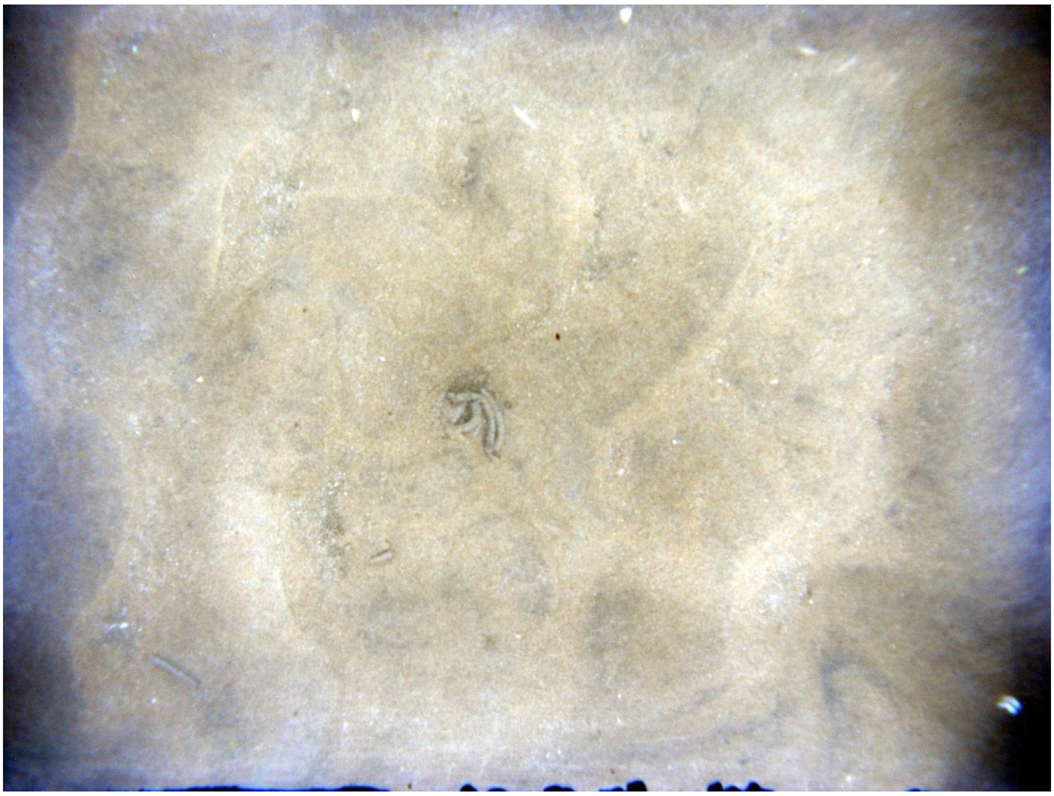


Station 15

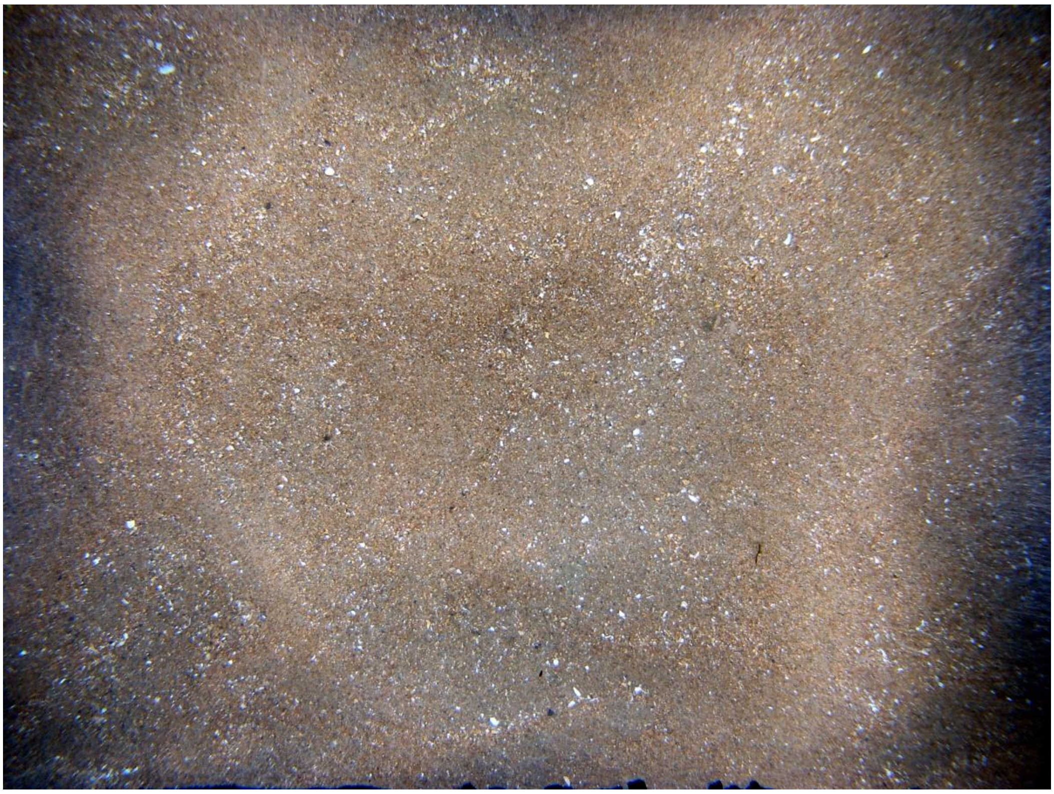
Station 16



Station 17



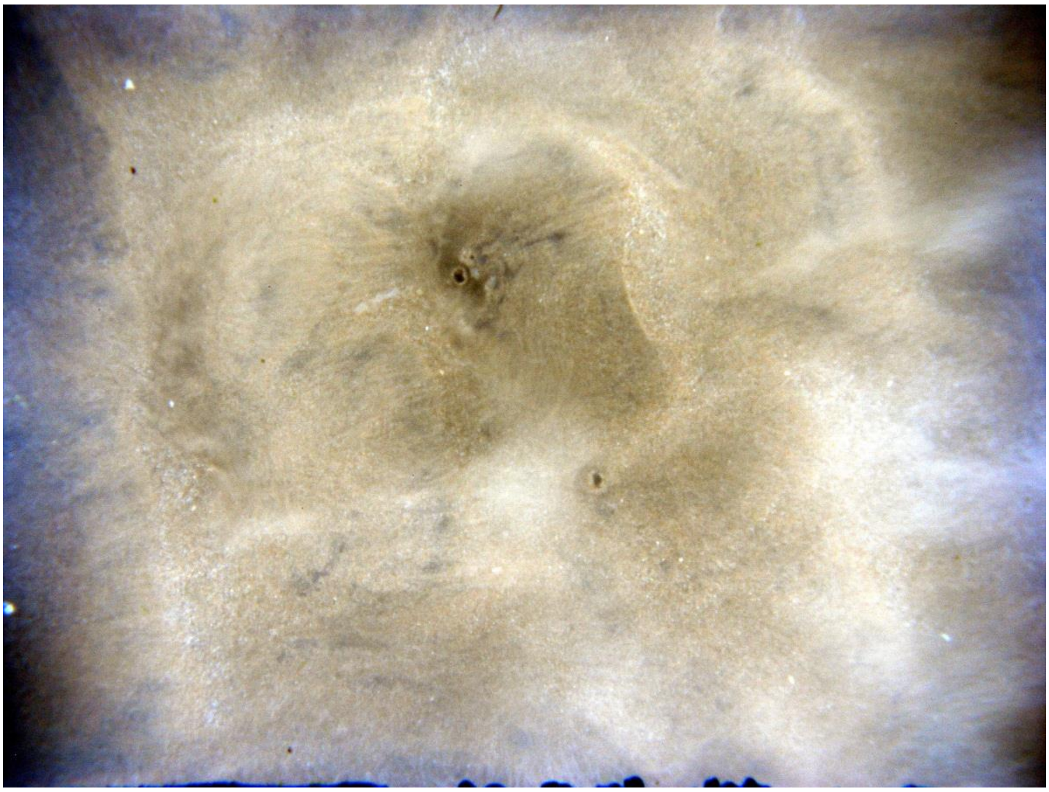
Station 18



Station 19

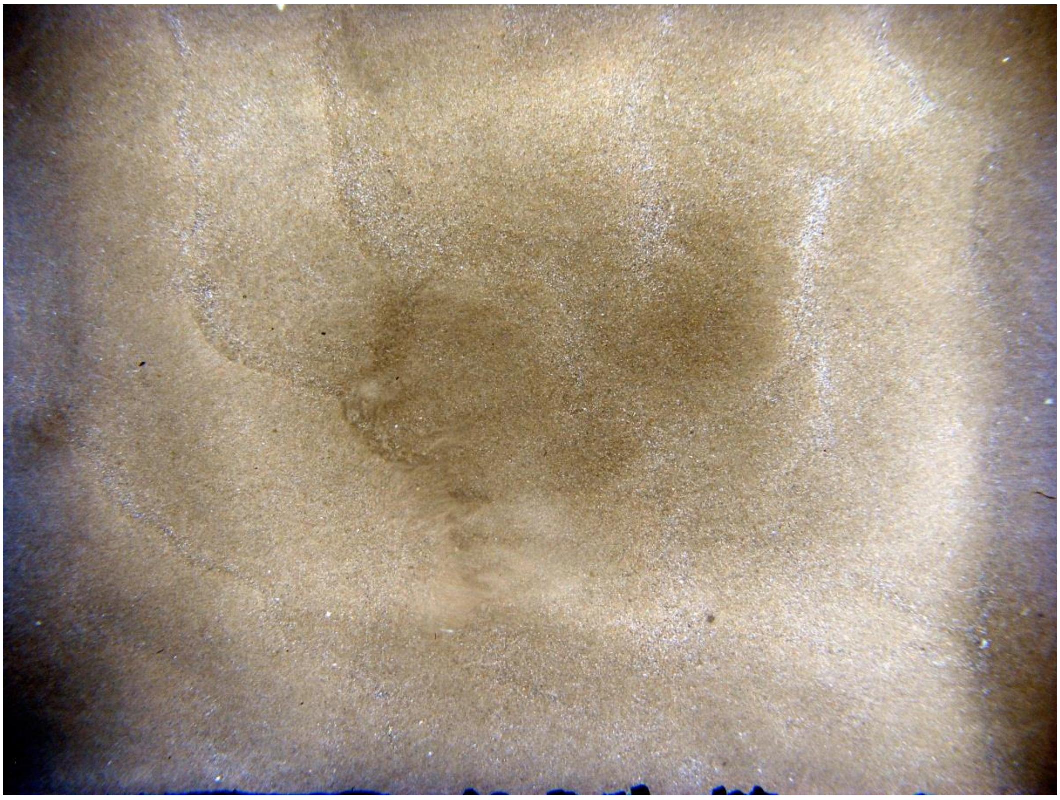
Station 20

Station 21



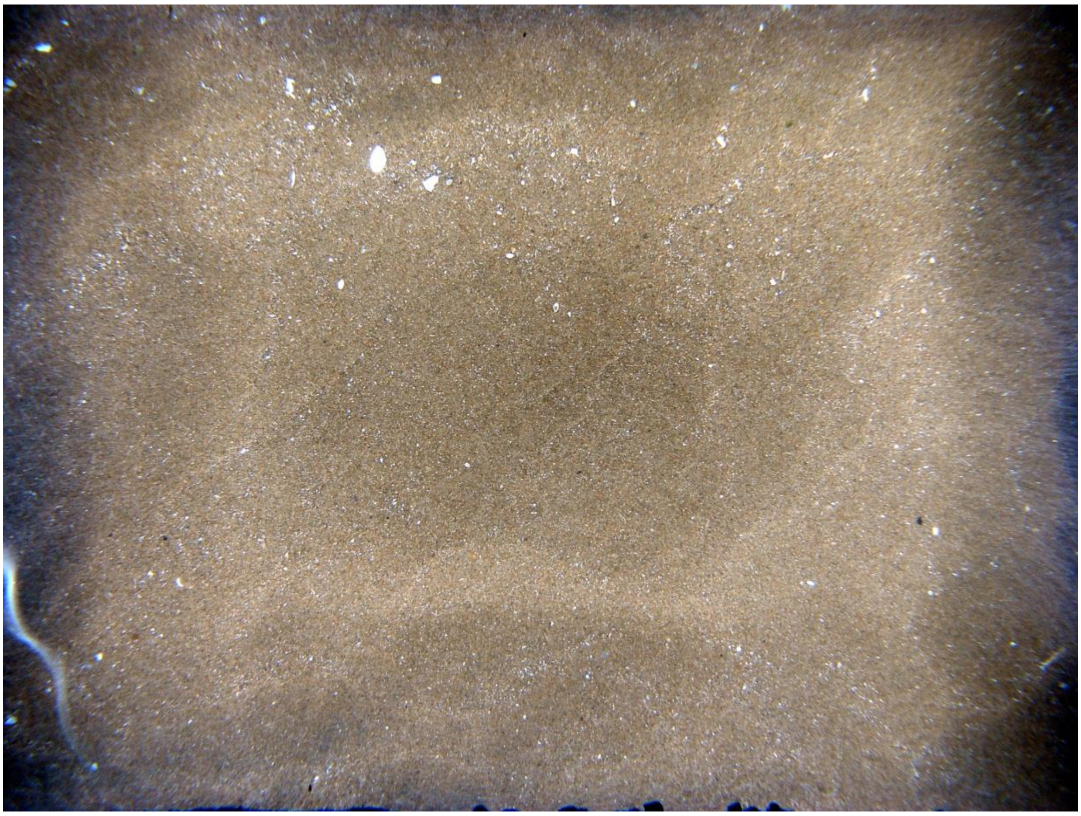
Station 22

Station 23

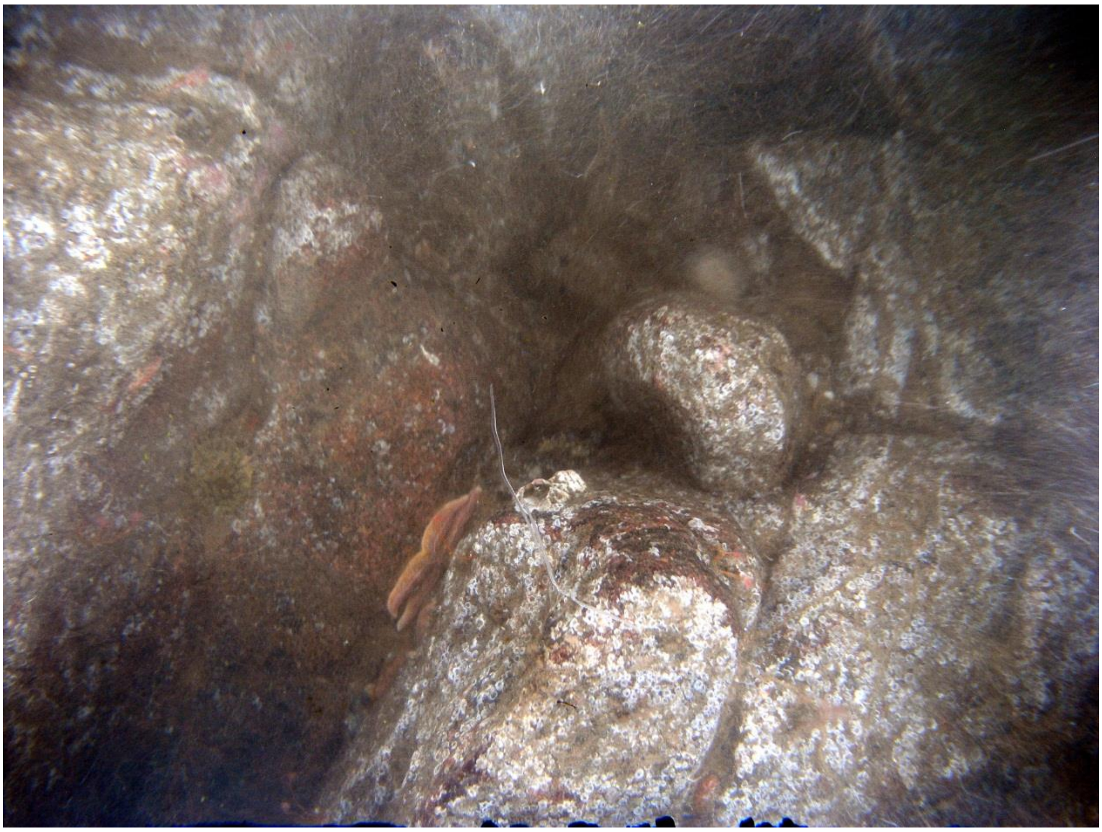


Station 24

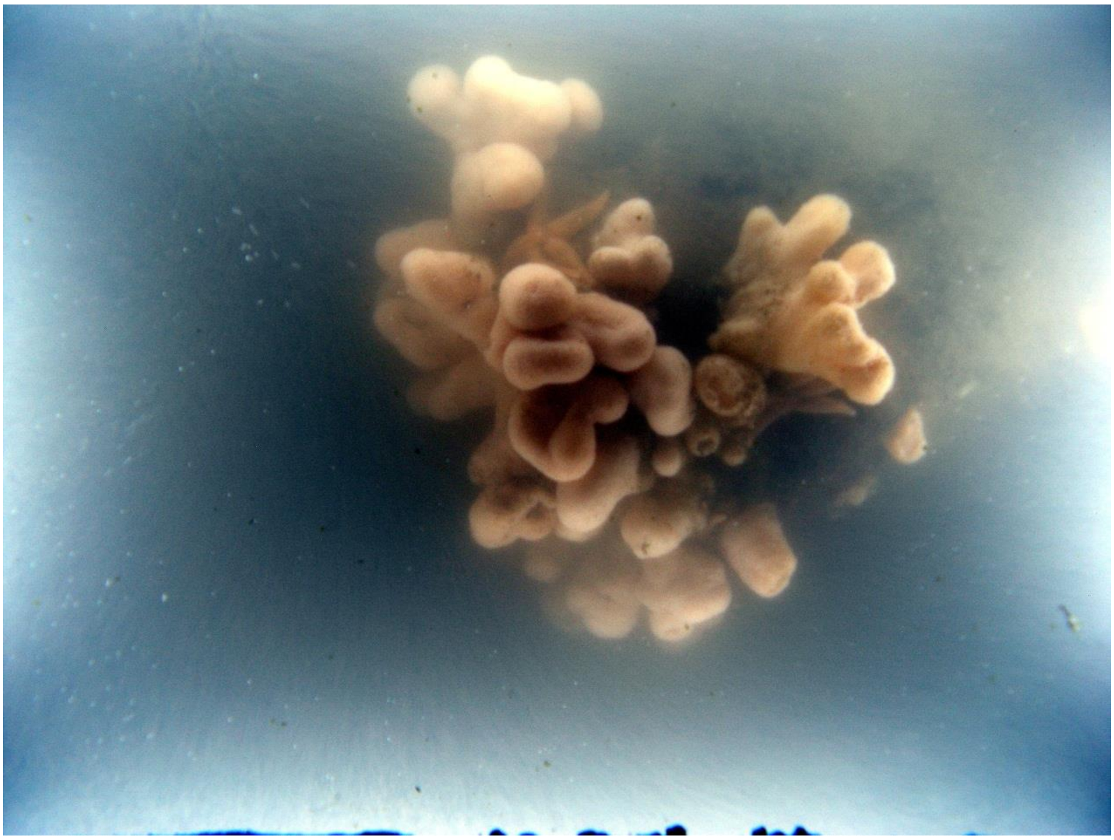
Station 25



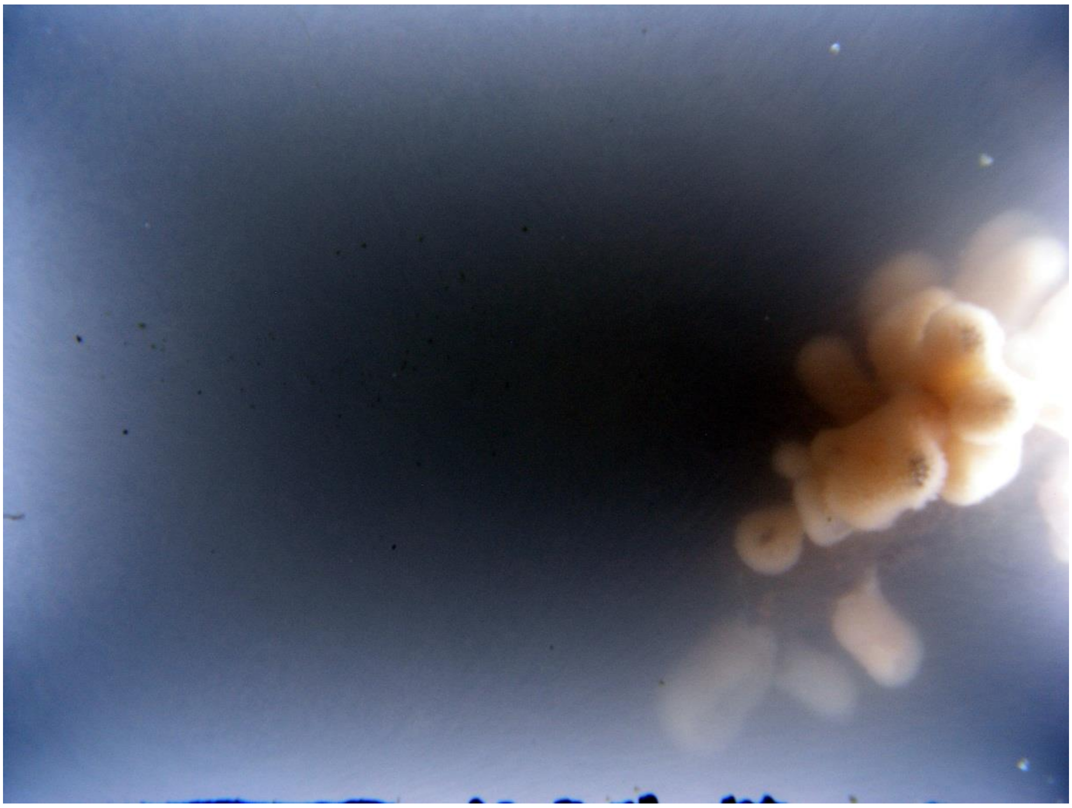
Station 26



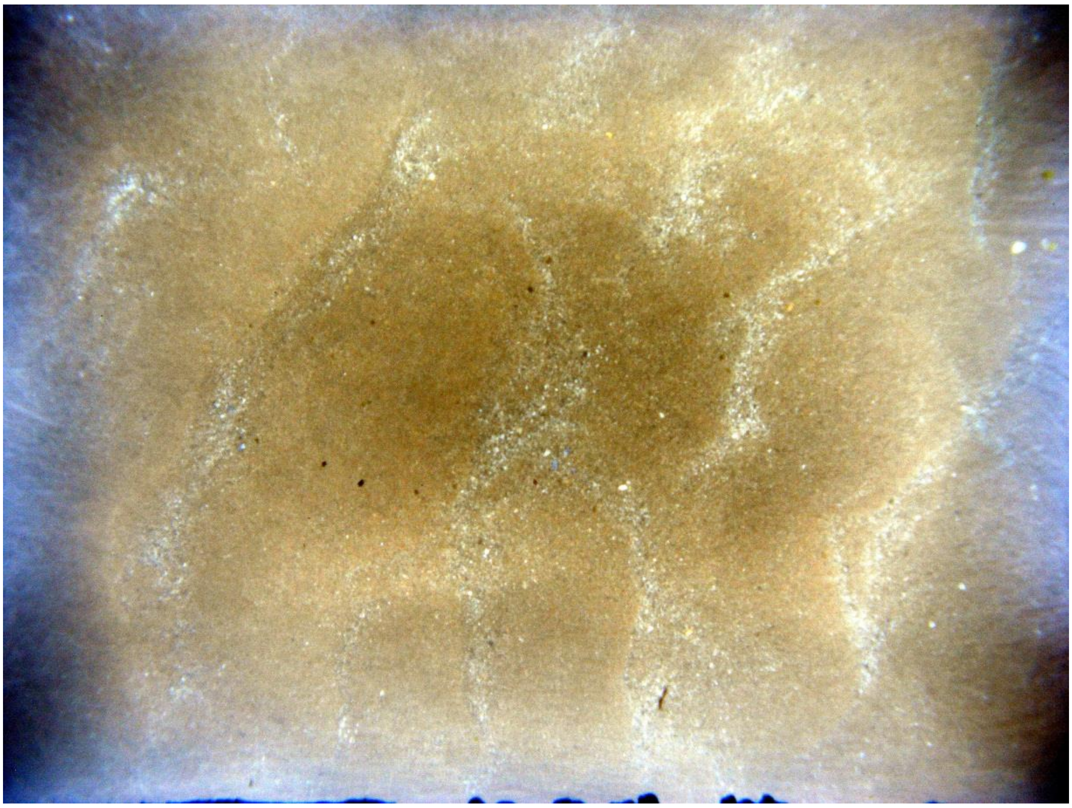
Station 27



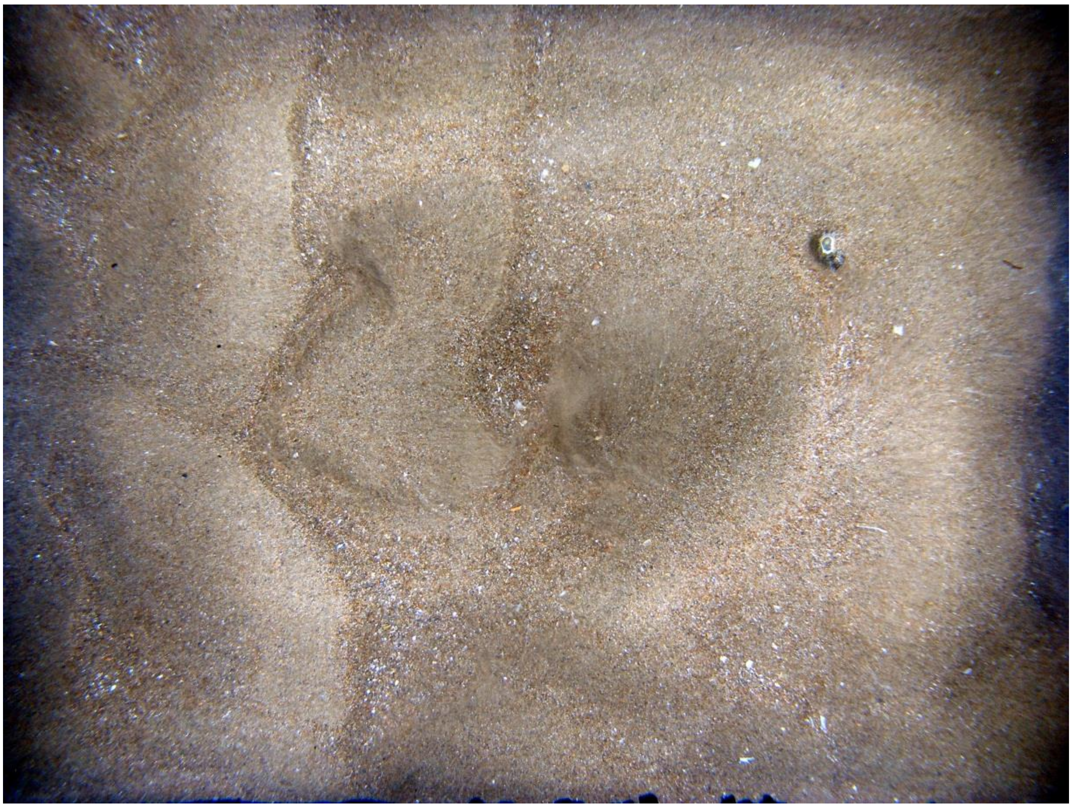
Station 28



Station 29



Station 30



Appendix 6. Sediment PSA Data

		Raw PSA Data (contribution to each size class %)																					
Site	% TOC	63 mm	45 mm	31.5 mm	22.4 mm	16 mm	11.2 mm	8 mm	5.6 mm	4 mm	2.8 mm	2 mm	1.4 mm	1 mm	0.71 mm	0.5 mm	0.355 mm	0.25 mm	0.18 mm	0.125 mm	0.09 mm	0.063 mm	>0.063 mm
1	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.04	0.31	0.33	0.31	0.38	0.70	1.80	12.3	60.28	5.70	5.63	6.89	5.25
2	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.07	0.25	0.42	0.45	0.94	3.16	7.25	26.2	44.13	2.72	3.90	5.40	4.97
3	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.07	0.35	0.63	1.15	2.39	3.81	5.77	25.1	50.78	1.31	4.74	2.23	1.53
4	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.07	0.05	0.15	0.24	0.24	0.33	0.58	1.22	9.37	76.61	8.45	1.31	0.76	0.61
5	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.14	0.25	0.36	0.56	1.46	3.82	15.5	56.32	5.42	3.25	6.54	6.29
6	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.48	0.00	0.31	0.24	0.46	1.01	1.86	3.28	5.36	5.66	18.8	57.34	3.91	0.49	0.43	0.36
7	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.03	0.26	0.57	0.88	1.16	1.71	3.21	22.7	49.50	4.68	5.25	5.27	4.71
8	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.19	0.30	0.34	0.35	0.69	1.46	14.5	76.00	3.87	0.76	0.79	0.71
10	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.14	0.38	0.40	0.42	0.52	0.85	1.22	13.0	61.48	2.06	6.39	7.28	5.75
11	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.33	0.26	0.34	0.61	1.32	2.78	18.3	65.94	4.16	2.26	2.74	0.86
12	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.19	0.38	0.50	0.62	1.28	2.63	15.8	60.79	4.38	6.48	4.12	2.79
14	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.49	0.28	0.43	0.82	1.70	4.08	9.14	22.3	24.2	19.0	15.53	0.71	0.28	0.37	0.28
16	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.16	1.39	0.35	0.93	2.32	4.24	7.48	13.3	20.3	22.2	21.94	2.69	1.01	1.00	0.52
17	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.06	0.16	0.34	0.64	0.85	1.21	1.68	12.0	74.58	5.26	1.52	0.75	0.92
18	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.07	0.35	1.74	11.9	36.7	37.3	9.26	2.08	0.12	0.14	0.17	0.07
19	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.02	0.08	0.05	0.07	0.32	1.42	20.0	75.07	2.01	0.41	0.28	0.18
21	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.13	0.19	0.30	0.58	1.81	19.8	74.64	1.86	0.37	0.19	0.08
22	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.09	0.24	0.34	0.55	3.80	42.6	50.35	1.61	0.14	0.14	0.04
23	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.04	0.11	0.80	3.59	32.3	59.63	2.64	0.30	0.30	0.16
24	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.11	0.26	0.45	1.12	14.0	77.32	5.95	0.45	0.13	0.09
25	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.02	0.02	0.03	0.10	0.18	0.24	0.40	1.39	11.3	47.7	35.49	2.51	0.21	0.17	0.07
27	0.14	0.00	0.00	0.00	0.00	0.67	0.00	0.21	0.55	1.19	2.46	4.36	4.79	5.00	4.72	4.09	3.74	11.5	50.72	5.17	0.30	0.27	0.22
28	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.45	0.61	1.09	1.95	4.55	5.01	2.88	3.44	14.7	58.29	5.46	0.53	0.49	0.36
29	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.07	0.18	0.25	0.44	0.74	1.77	3.62	23.7	64.68	3.06	0.31	0.51	0.53
30	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.01	0.08	0.23	1.53	19.8	16.5	26.1	33.63	1.65	0.11	0.10	0.07

PSA Summary Statistics and Descriptors										
Site	Mean phi	Mean µm	1 std	skewness	kurtosis	Classification after Buchanan	Folk Triangles after BGS	% Gravel	% Sand	% Mud
1	2.468	180.7	0.690	0.487	2.755	Moderately Well Sorted Fine Sand	Sand	0.4%	94.4%	5.2%
2	2.114	231.0	0.739	0.104	1.907	Moderately Sorted Fine Sand	Sand	0.4%	94.6%	5.0%
3	2.015	247.4	0.647	-0.197	1.853	Moderately Well Sorted Fine Sand	Sand	0.5%	98.0%	1.5%
4	2.233	212.7	0.294	-0.002	1.653	Very Well Sorted Fine Sand	Sand	0.3%	99.1%	0.6%
5	2.348	196.4	0.838	0.372	3.437	Moderately Sorted Fine Sand	Sand	0.2%	93.6%	6.3%
6	1.917	264.8	0.645	-0.585	1.526	Moderately Well Sorted Medium Sand	Slightly Gravelly Sand	1.5%	98.1%	0.4%
7	2.258	209.0	0.750	0.197	2.169	Moderately Sorted Fine Sand	Sand	0.3%	95.0%	4.7%
8	2.183	220.3	0.282	-0.159	1.413	Very Well Sorted Fine Sand	Sand	0.2%	99.1%	0.7%
10	2.489	178.1	0.774	0.530	3.165	Moderately Sorted Fine Sand	Sand	0.6%	93.7%	5.7%
11	2.132	228.2	0.437	-0.077	2.062	Well Sorted Fine Sand	Sand	0.4%	98.7%	0.9%
12	2.245	210.9	0.569	0.178	2.454	Moderately Well Sorted Fine Sand	Sand	0.2%	97.0%	2.8%
14	1.226	427.4	0.815	-0.064	1.000	Moderately Sorted Medium Sand	Slightly Gravelly Sand	2.3%	97.5%	0.3%
16	1.385	383.0	0.914	-0.238	1.003	Moderately Sorted Medium Sand	Slightly Gravelly Sand	2.9%	96.6%	0.5%
17	2.198	217.9	0.317	-0.077	1.706	Very Well Sorted Fine Sand	Sand	0.2%	98.8%	0.9%
18	0.983	506.1	0.495	-0.008	1.062	Well Sorted Coarse Sand	Sand	0.1%	99.8%	0.1%
19	2.138	227.2	0.271	-0.286	1.156	Very Well Sorted Fine Sand	Sand	0.0%	99.8%	0.2%
21	2.128	228.7	0.279	-0.304	1.180	Very Well Sorted Fine Sand	Sand	0.0%	99.9%	0.1%
22	1.996	250.8	0.324	-0.110	0.744	Very Well Sorted Medium Sand	Sand	0.0%	99.9%	0.0%
23	2.050	241.5	0.321	-0.242	0.805	Very Well Sorted Fine Sand	Sand	0.0%	99.8%	0.2%
24	2.207	216.5	0.259	-0.099	1.358	Very Well Sorted Fine Sand	Sand	0.0%	99.9%	0.1%
25	1.898	268.3	0.398	-0.035	0.965	Well Sorted Medium Sand	Sand	0.2%	99.7%	0.1%
27	1.376	385.2	1.290	-0.757	0.998	Poorly Sorted Medium Sand	GravellySand	9.4%	90.3%	0.2%
28	1.803	286.5	0.840	-0.644	1.883	Moderately Sorted Medium Sand	Slightly Gravelly Sand	2.2%	97.4%	0.4%
29	2.070	238.1	0.369	-0.388	1.160	Well Sorted Fine Sand	Sand	0.3%	99.1%	0.5%
30	1.616	326.2	0.637	-0.227	0.723	Moderately Well Sorted Medium Sand	Sand	0.1%	99.9%	0.1%

Appendix 7. Sediment Laser Size Data

	Raw Laser Size Data (contribution to each size class %)																					
Site	1822 µm	1660 µm	1512 µm	1377 µm	1255 µm	1143 µm	1041 µm	948.3 µm	863.9 µm	786.9 µm	716.8 µm	653 µm	594.9 µm	541.9 µm	493.6 µm	449.7 µm	409.6 µm	373.1 µm	339.9 µm	309.6 µm	282.1 µm	256.9 µm
1	0	0	0	0	0.00	0.07	0.23	0.33	0.31	0.26	0.24	0.27	0.38	0.58	0.86	1.25	1.87	2.85	4.24	5.92	7.6	8.87
5	0	0	0.00	0.01	0.08	0.2	0.37	0.48	0.5	0.5	0.55	0.66	0.87	1.16	1.52	1.97	2.6	3.55	4.84	6.37	7.86	8.92
10	0.34	0.29	0.26	0.25	0.25	0.27	0.3	0.31	0.27	0.23	0.25	0.33	0.43	0.53	0.64	0.84	1.29	2.16	3.56	5.38	7.32	8.92

	Raw Laser Size Data (contribution to each size class %)																					
Site	234.1 µm	213.2 µm	194.2 µm	176.9 µm	161.2 µm	146.8 µm	133.7 µm	121.8 µm	111 µm	101.1 µm	92.09 µm	83.89 µm	76.42 µm	69.61 µm	63.41 µm	57.77 µm	52.62 µm	47.94 µm	43.67 µm	39.78 µm	36.24 µm	33.01 µm
1	9.33	8.8	7.4	5.58	3.87	2.65	2	1.79	1.81	1.88	1.94	1.97	1.95	1.86	1.69	1.47	1.23	1	0.8	0.63	0.5	0.4
5	9.21	8.56	7.12	5.3	3.57	2.3	1.58	1.31	1.33	1.45	1.57	1.62	1.59	1.5	1.35	1.19	1.02	0.86	0.7	0.56	0.44	0.34
10	9.71	9.42	8.12	6.2	4.23	2.69	1.77	1.43	1.47	1.7	1.96	2.15	2.2	2.13	1.95	1.7	1.42	1.13	0.86	0.64	0.46	0.32

	Raw Laser Size Data (contribution to each size class %)																					
Site	30.07 µm	27.39 µm	24.95 µm	22.73 µm	20.7 µm	18.86 µm	17.18 µm	15.65 µm	14.26 µm	12.99 µm	11.83 µm	10.78 µm	9.817 µm	8.943 µm	8.147 µm	7.421 µm	6.76 µm	6.158 µm	5.61 µm	5.11 µm	4.655 µm	4.24 µm
1	0.31	0.25	0.20	0.17	0.14	0.12	0.11	0.10	0.09	0.08	0.07	0.06	0.06	0.06	0.05	0.05	0.05	0.058	0.058	0.058	0.058	0.057
5	0.25	0.19	0.15	0.12	0.09	0.08	0.07	0.06	0.06	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.042	0.042	0.043	0.043	0.043
10	0.23	0.16	0.12	0.09	0.07	0.06	0.06	0.05	0.05	0.04	0.04	0.03	0.03	0.03	0.03	0.03	0.02	0.029	0.029	0.028	0.028	0.027

Site	Raw Laser Size Data (contribution to each size class %)																					
	3.863 µm	3.519 µm	3.205 µm	2.92 µm	2.66 µm	2.423 µm	2.207 µm	2.011 µm	1.832 µm	1.668 µm	1.52 µm	1.385 µm	1.261 µm	1.149 µm	1.047 µm	0.953 µm	0.868 µm	0.791 µm	0.721 µm	0.656 µm	0.598 µm	0.545 µm
1	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.04	0.04	0.04	0.036	0.029	0.021	0.013	0.004
5	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.032	0.026	0.019	0.012	0.004
10	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.026	0.022	0.016	0.010	0.003

Site	Raw Laser Size Data (contribution to each size class %)						
	0.496 µm	0.452 µm	0.412 µm	0.375 µm			
1	0.0003	0.00	0.00	0.00			
5	0.0003	0.00	0.00	0.00			
10	0.0002	0.00	0.00	0.00			

Laser Size Summary Statistics and Descriptors										
Site	Mean phi	Mean µm	1 std	skewness	kurtosis	Classification after Buchanan	Folk Triangles after BGS	% Gravel	% Sand	% Mud
1	2.423	186.5	0.975	0.408	1.278	Moderately Sorted Fine Sand	Sand	0.0%	90.9%	9.1%
5	2.249	210.4	0.972	0.304	1.580	Moderately Sorted Fine Sand	Sand	0.0%	92.6%	7.4%
10	2.438	184.6	0.960	0.356	1.380	Moderately Sorted Fine Sand	Sand	0.0%	91.8%	8.2%

Appendix 8: Sediment contaminants full results

Table 1. Dry Weights, Total Organic Carbon and Organotins.

Customer Sample No					**Certified Reference Material**		**NIGG 1**	**NIGG 2**	**NIGG 3**	**NIGG 5**	**NIGG 7**	**NIGG 11**	**NIGG 17**	**NIGG 19**	**NIGG 23**	**NIGG 24**
Customer Sample ID																
RPS Sample No							266086	266087	266088	266089	266090	266091	266092	266093	266094	266095
Sample Type					**SEDIMENT**		**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
Sample Location																
Sample Depth (m)																
Sampling Date					**CRM-646**		20/03/15	20/03/15	20/03/15	20/03/15	20/03/15	20/03/15	20/03/15	20/03/15	20/03/15	20/03/15
Sampling Time																
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**Result**	**Recovery %**										
dry solids (at 105°C)			In house	%	n/a	n/a	75.3	74.2	75.3	74.8	75.6	64.5	75.5	74.0	74.2	73.9
total organic carbon*		S		%	n/a	n/a	0.06	0.10	0.19	0.10	0.08	0.10	0.07	0.06	0.06	0.06
tributyltin (TBT)	56573-85-4		In house	mg/kg	0.42	89.4	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002

Tributyltin results have been dry weight corrected

Table 2. Metals.

Customer Sample No						Standard Reference Material		NIGG 1	NIGG 2	NIGG 3	NIGG 5	NIGG 7	NIGG 11	NIGG 17	NIGG 19	NIGG 23	NIGG 24
Customer Sample ID																	
RPS Sample No								266086	266087	266088	266089	266090	266091	266092	266093	266094	266095
Sample Type						SEDIMENT		SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT
Sample Location																	
Sample Depth (m)																	
Sampling Date						SRM-2702		20/03/15	20/03/15	20/03/15	20/03/15	20/03/15	20/03/15	20/03/15	20/03/15	20/03/15	20/03/15
Sampling Time																	
Determinand	**CAS No**	**Codes**	**SOP**	**Mass**	**Units**	**Result**	**Recovery %**										
arsenic*	7440-38-2	SI	ICP-MS	75	mg/kg	42.4	93.6	6.19	5.98	6.12	5.92	6.00	6.65	7.34	7.68	8.79	6.99
cadmium*	7440-43-9	SI	ICP-MS	111	mg/kg	0.93	113.8	< 0.10	< 0.10	0.11	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.16
chromium*	7440-47-3	SI	ICP-MS	52	mg/kg	307.9	87.5	19.0	24.2	22.1	19.9	22.3	27.3	25.3	22.4	17.8	18.3
copper*	7440-50-8	SI	ICP-MS	65	mg/kg	Not certified	n/a	3.03	3.66	2.96	2.53	2.60	2.48	2.20	2.16	1.70	1.83
lead*	7439-92-1	SI	ICP-MS	208	mg/kg	134	100.9	17.9	19.5	19.9	17.2	19.5	18.0	17.5	17.9	21.0	18.3
mercury*	7439-97-6	SI	AFS	202	mg/kg	0.42	93.9	0.01	0.02	0.02	0.02	0.01	0.01	0.03	< 0.01	< 0.01	< 0.01
nickel*	7440-02-0	SI	ICP-MS	60	mg/kg	61.1	81	5.88	8.11	6.15	5.99	5.79	7.09	5.99	5.66	4.76	4.56
zinc*	7440-66-6	SI	ICP-MS	65	mg/kg	462.5	95.3	25.0	29.7	25.1	21.8	23.5	24.3	24.8	22.8	18.8	20.3

Metals results have been dry weight corrected

Table 3. Polycyclic Aromatic Hydrocarbons (EPA 16 PAHs).

Customer Sample No						**Certified Reference Material**		**NIGG 1**	**NIGG 2**	**NIGG 3**	**NIGG 5**	**NIGG 7**	**NIGG 11**	**NIGG 17**	**NIGG 19**	**NIGG 23**	**NIGG 24**
Customer Sample ID																	
RPS Sample No								266086	266087	266088	266089	266090	266091	266092	266093	266094	266095
Sample Type						**SEDIMENT**		**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**	**SEDIMENT**
Sample Location																	
Sample Depth (m)																	
Sampling Date						**NIST-1944**		20/03/15	20/03/15	20/03/15	20/03/15	20/03/15	20/03/15	20/03/15	20/03/15	20/03/15	20/03/15
Sampling Time																	
Determinand	**CAS No**	**Codes**	**SOP**	**Mass**	**Units**	**Result**	**Recovery %**										
naphthalene	91-20-3		304	128	ug/kg	Not certified	n/a	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100
acenaphthylene	208-96-8		304	152	ug/kg	Not certified	n/a	0.133	0.135	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100
acenaphthene	83-32-9		304	154	ug/kg	Not certified	n/a	0.266	1.75	0.531	< 0.100	< 0.100	0.620	0.132	< 0.100	< 0.100	0.541
fluorene	86-73-7		304	166	ug/kg	Not certified	n/a	4.25	1.89	0.531	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100	0.541
phenanthrene	85-01-8		304	178	ug/kg	4471.2	84.8	3.05	11.3	3.85	0.802	0.794	0.620	0.132	0.270	< 0.100	3.25
anthracene	120-12-7		304	178	ug/kg	Not certified	n/a	1.33	3.23	1.46	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100	< 0.100	0.812
fluoranthene	206-44-0		304	202	ug/kg	7223.4	81.0	0.797	9.56	4.52	< 0.100	< 0.100	0.155	0.397	< 0.100	< 0.100	3.11
pyrene	129-00-0		304	202	ug/kg	7310	75.4	3.85	11.2	4.91	0.267	0.132	< 0.100	0.530	< 0.100	0.674	3.38
benzo(a)anthracene	56-55-3		304	228	ug/kg	3290.6	69.7	1.99	4.58	2.13	< 0.100	0.132	0.155	< 0.100	0.135	< 0.100	1.22
chrysene	218-01-9		304	228	ug/kg	3932.4	80.9	1.20	4.85	1.20	< 0.100	< 0.100	< 0.100	3.31	< 0.100	< 0.100	0.677
benzo(b)fluoranthene	205-99-2		304	252	ug/kg	5211.4	87.1	2.39	5.25	2.79	0.134	0.529	0.155	0.397	< 0.100	< 0.100	1.08
benzo(k)fluoranthene	207-08-9		304	252	ug/kg	1598.2	69.5	0.797	1.75	0.930	0.134	0.265	0.155	0.265	< 0.100	< 0.100	0.406
benzo(a)pyrene	50-32-8		304	252	ug/kg	2997.8	69.7	2.13	4.85	2.66	0.267	0.661	0.310	0.662	0.135	< 0.100	1.35
indeno(1,2,3-c,d)pyrene	193-39-5		304	276	ug/kg	850.2	112.0	1.20	2.29	1.46	0.134	0.397	0.155	0.265	< 0.100	< 0.100	0.406
dibenzo(a,h)anthracene	53-70-3		304	278	ug/kg	2138.2	76.9	0.398	0.808	0.398	< 0.100	0.132	< 0.100	< 0.100	< 0.100	< 0.100	0.135
benzo(g,h,i)perylene	191-24-2		304	276	ug/kg	2544.8	89.6	1.33	3.23	1.73	0.134	0.529	0.155	0.397	< 0.100	< 0.100	0.677

PAH results have been dry weight corrected

Table 4. Polychlorinated Biphenyls (ICES 7).

							NIGG 1	NIGG 2	NIGG 3	NIGG 5	NIGG 7	NIGG 11	NIGG 17	NIGG 19	NIGG 23	NIGG 24
				Customer Sample No	Certified Reference Material											
				Customer Sample ID												
				RPS Sample No			266086	266087	266088	266089	266090	266091	266092	266093	266094	266095
				Sample Type	SEDIMENT		SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT	SEDIMENT
				Sample Location												
				Sample Depth (m)												
				Sampling Date	NIST-1944		20/03/15	20/03/15	20/03/15	20/03/15	20/03/15	20/03/15	20/03/15	20/03/15	20/03/15	20/03/15
				Sampling Time												
Determinand	**CAS No**	**Codes**	**SOP**	**Units**	**Result**	**Recovery %**										
2,4,4'-trichlorobiphenyl (PCB congener 28)	7012-37-5		319	ug/kg	91.0	112.6	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
2,2',5,5'-tetrachlorobiphenyl (PCB congener 52)	35693-99-3		319	ug/kg	101.3	127.6	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
2,2',4,5,5'-pentachlorobiphenyl (PCB congener 101)	37680-73-2		319	ug/kg	81.7	111.3	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
2,3',4,4',5-pentachlorobiphenyl (PCB congener 118)	31508-00-6		319	ug/kg	65.6	113.0	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
2,2',3,4,4',5-hexachlorobiphenyl (PCB 138)	35065-28-2		319	ug/kg	97.4	156.8	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
2,2',4,4',5,5'-hexachlorobiphenyl (PCB 153)	35065-27-1		319	ug/kg	83.8	113.2	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
2,2',3,4,4',5,5'-heptachlorobiphenyl (PCB 180)	35065-29-3		319	ug/kg	60.8	137.2	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10

PCB results have been dry weight corrected.

Appendix 9: Grab faunal abundance data

Name	1	2	3	4	5	6	7	8	10	11	12	14	16	17	18	19	21	22	23	24	25	27	28	29	30
Ciliophora																									
Lagotia viridis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Cnidaria																									
Cerianthus lloydii	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Actiniaria spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-
Nemertea																									
Nemertea spp.	-	-	2	-	-	-	2	-	-	1	2	1	10	-	-	-	-	-	-	-	-	4	-	-	-
Nematoda																									
Nematoda spp.	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Entoprocta																									
Pedicellina spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Sipunicula																									
Phascolion strombus	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-
Annelida																									
Pisione remota	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Malmgrenia sp.	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Sigalion mathildae	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sthenelais limicola	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eteone longa/flava (agg.)	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	5	-	-	-
Hesionura elongata	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Hypereteone foliosa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Phyllodoce groenlandica	-	-	-	1	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Eulalia mustela	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Glycera lapidum	-	-	-	-	-	-	-	-	-	-	-	2	31	-	-	-	-	-	-	-	-	4	5	-	-
Glycera oxycephala	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Goniada maculata	-	-	-	1	-	1	-	-	1	-	1	-	-	1	-	2	1	-	-	-	1	-	-	-	-
Goniadella gracilis	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Microphthalmus similis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Syllis pontxioi	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Nephtys sp. Juv.	1	-	-	-	2	1	2	2	1	2	1	-	-	1	-	1	-	2	2	1	-	-	1	1	-
Nephtys sp. Damaged	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Nephtys assimilis	-	-	-	-	-	-	1	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Name	1	2	3	4	5	6	7	8	10	11	12	14	16	17	18	19	21	22	23	24	25	27	28	29	30
Nephtys cirrosa	4	14	12	5	13	7	9	4	12	3	2	2	-	9	3	5	2	2	2	2	2	2	1	2	2
Nephtys hombergii	-	-	-	-	2	-	2	1	-	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nephtys longosetosa	-	-	1	2	-	1	-	-	-	-	-	1	-	1	-	1	3	1	-	1	2	-	1	4	1
Lumbrineris cf. cingulata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Orbinia (Orbinia) sertulata	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Scoloplos (scoloplos) armiger	-	-	-	-	-	1	-	-	-	-	-	10	1	1	1	-	-	-	-	-	1	-	5	1	-
Aonides paucibranchiata	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	-	-
Laonice bahusiensis	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Malacoceros fuliginosus	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Scolelepis bonnieri	-	-	-	-	-	-	-	1	2	-	-	-	-	-	-	-	1	-	-	-	1	-	-	-	-
Scolelepis foliosa	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-
Paraspio decorata	-	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spio martinensis	-	-	-	2	1	-	-	-	-	1	11	-	-	4	-	-	1	-	-	-	-	-	-	-	-
Spiophanes bombyx	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
Magelona mirabilis	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
Magelona johnstoni	-	-	-	1	1	-	-	5	3	2	2	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Chaetozone christiei	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	-	-	-	-	-	-
Capitella capitata complex	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Mediomastus fragilis	-	-	-	-	-	1	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-
Notomastus spp.	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Notomastus latericeus	-	-	-	-	-	-	-	-	-	1	-	-	7	-	-	-	-	-	-	-	-	2	-	-	-
Ophelia borealis	-	-	-	-	-	1	-	-	-	-	-	39	-	-	-	-	-	-	1	-	7	4	6	3	-
Travisia forbesii	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Sabellaria spinulosa	-	-	-	-	-	-	-	-	-	-	-	-	9	-	-	-	-	-	-	-	-	2	-	-	-
Polycirrus spp.	-	-	-	-	-	-	-	-	-	-	-	4	3	-	-	-	-	-	-	-	-	-	-	-	-
Spirobranchus lamarcki	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Chelicerata																									
Acarina sp.	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Crustacea																									
Cirripedia damaged	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pontocrates altamarinus	-	-	1	-	-	-	-	1	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Pontocrates arenarius	-	-	-	-	-	-	1	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Leucothoe incisa	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nototropis falcatus	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-

Name	1	2	3	4	5	6	7	8	10	11	12	14	16	17	18	19	21	22	23	24	25	27	28	29	30
Bathyporeia elegans	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
Bathyporeia guilliamsoniana	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-
Iphinoe trispinosa	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diastylis sp. manca	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diastylis bradyi	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Diastylis laevis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Liocarcinus holsatus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Mollusca																									
Euspira nitida	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Nucula sp. Juv.	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nucula nitidosa	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mytilus edulis Juv.	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Crenella decussata	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Tellimya ferruginosa	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-
Goodallia triangularis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-	-	-	-	-	-
Mactra stultorum	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Angulus fabula	2	6	4	4	3	-	6	3	12	8	31	-	-	2	1	1	1	-	-	-	-	-	-	-	-
Moerella pygmaea	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Abra alba	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Veneridae sp. Juv.	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chamelea striatula juv.	-	-	-	-	-	-	-	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bryozoa																									
Conopeum reticulum	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
Echinodermata																									
Ophiuridae sp. Juv.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Ophiura sp. Juv.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Ophiura albida	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-

Data not used for statistical analysis

Name	1	2	3	4	5	6	7	8	10	11	12	14	16	17	18	19	21	22	23	24	25	27	28	29	30
Pisces																									
Ammodytes sp	-	-	-	-	-	1	-	-	-	1	-	-	-	-	18	-	-	1	-	-	1	-	-	-	-

Appendix 10: Macrofaunal biomass data

Table 1. Conversion factors used to calculate ash-free dry weight (AFDW) biomass (from Ricciardi & Bourget, 1998).

Group	Factor	Notes
Polychaetes	0.160	based on value for "all polychaetes"
Oligochaetes	n/a	
Crustacea	0.160	based on value for "amphipods"
Mollusca	0.580	based on value for "bivalvia"
Echinodermata	0.740	based on value for "ophiuroidea"
Others	0.164	based on value for "nemertea" as the dominant weighable "others"
Fish	n/a	

Table 2. Faunal biomass data (wet weight (g) per grab).

Wet weight (g)									Wet weight percentage contribution to sample						
Station	**Polychaeta**	**Oligochaeta**	**Crustacea**	**Mollusca**	**Echinodermata**	**Other**	**Fish**	**Total**	**Polychaeta**	**Oligochaeta**	**Crustacea**	**Mollusca**	**Echinodermata**	**Other**	**Fish**
Nigg 01	0.0515	0.0000	0.0000	0.0508	0.0000	0.0000	0.0000	0.1023	50%	0%	0%	50%	0%	0%	n/a
Nigg 02	0.0849	0.0000	0.0003	0.1079	0.0000	0.0000	0.0000	0.1931	44%	0%	0%	56%	0%	0%	n/a
Nigg 03	0.1689	0.0000	0.0010	0.0153	0.0000	0.0153	0.0000	0.2005	84%	0%	0%	8%	0%	8%	n/a
Nigg 04	0.6388	0.0000	0.0007	0.7725	0.0000	0.0000	0.0000	1.4120	45%	0%	0%	55%	0%	0%	n/a
Nigg 05	0.4352	0.0000	0.0000	0.0170	0.0000	0.0000	0.0000	0.4522	96%	0%	0%	4%	0%	0%	n/a
Nigg 06	0.4773	0.0000	0.0000	0.0000	0.0000	0.0000	0.2296	0.4773	100%	0%	0%	0%	0%	0%	n/a
Nigg 07	0.4548	0.0000	0.0003	0.0799	0.0000	0.0609	0.0000	0.5959	76%	0%	0%	13%	0%	10%	n/a
Nigg 08	0.5961	0.0000	0.0100	0.0708	0.0000	0.0000	0.0000	0.6769	88%	0%	1%	10%	0%	0%	n/a
Nigg 10	0.1292	0.0000	0.0021	0.2388	0.0000	0.0000	0.0000	0.3701	35%	0%	1%	65%	0%	0%	n/a
Nigg 11	2.4819	0.0000	0.0002	0.2378	0.0000	0.0095	0.0913	2.7294	91%	0%	0%	9%	0%	0%	n/a
Nigg 12	0.2551	0.0000	0.0000	0.4032	0.0000	0.0173	0.0000	0.6756	38%	0%	0%	60%	0%	3%	n/a
Nigg 14	0.8792	0.0000	0.0159	0.0000	0.0000	0.0023	0.0000	0.8974	98%	0%	2%	0%	0%	0%	n/a
Nigg 16	0.4140	0.0000	0.0000	0.0790	0.0859	0.0730	0.0000	0.6519	64%	0%	0%	12%	13%	11%	n/a
Nigg 17	0.1560	0.0000	0.0027	0.0066	0.0000	0.0000	0.0000	0.1653	94%	0%	2%	4%	0%	0%	n/a
Nigg 18	0.0785	0.0000	0.0000	0.0293	0.0000	0.0000	0.0000	0.1078	73%	0%	0%	27%	0%	0%	n/a
Nigg 19	0.2345	0.0000	0.0032	0.0080	0.0000	0.0000	2.2872	0.2457	95%	0%	1%	3%	0%	0%	n/a
Nigg 21	0.2337	0.0000	0.0000	0.0122	0.0000	0.0000	0.0000	0.2459	95%	0%	0%	5%	0%	0%	n/a
Nigg 22	0.0291	0.0000	0.0049	0.0000	0.0004	0.0000	0.1935	0.0344	85%	0%	14%	0%	1%	0%	n/a
Nigg 23	0.0394	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0394	100%	0%	0%	0%	0%	0%	n/a
Nigg 24	0.0765	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0765	100%	0%	0%	0%	0%	0%	n/a
Nigg 25	0.2091	0.0000	0.0003	0.0922	0.0000	0.0000	0.0000	0.3016	69%	0%	0%	31%	0%	0%	n/a
Nigg 27	0.0625	0.0000	0.1705	0.0000	0.0000	0.0018	0.0000	0.2348	27%	0%	73%	0%	0%	1%	n/a
Nigg 28	0.2993	0.0000	0.0011	0.0000	0.0000	0.0000	0.0000	0.3004	100%	0%	0%	0%	0%	0%	n/a
Nigg 29	0.5334	0.0000	0.0000	0.0011	0.0000	0.0000	0.0000	0.5345	100%	0%	0%	0%	0%	0%	n/a
Nigg 30	0.0387	0.0000	0.0000	0.0000	0.0003	0.0000	0.0000	0.0390	99%	0%	0%	0%	1%	0%	n/a
Total	**9.0576**	**0.0000**	**0.2132**	**2.2224**	**0.0866**	**0.1801**	**2.8016**	**11.7599**	**77%**	**0%**	**2%**	**19%**	**1%**	**2%**	n/a

Table 3. Faunal biomass data (ash free dry weight (mg) per grab).

	AFDW (mg)								AFDW percentage contribution to sample						
Station	Polychaeta	Oligochaeta	Crustacea	Mollusca	Echinodermata	Others	Fish	Total	Polychaeta	Oligochaeta	Crustacea	Mollusca	Echinodermata	Others	Fish
1	8.24	0.0000	0.0000	2.95	0.0000	0.0000	n/a	11.1900	73.6%	0.0%	0.0%	26.4%	0.0%	0.0%	n/a
2	13.58	0.0000	0.05	6.26	0.0000	0.0000	n/a	19.8900	68.3%	0.0%	0.3%	31.5%	0.0%	0.0%	n/a
3	27.02	0.0000	0.16	0.89	0.0000	2.5092	n/a	30.5792	88.4%	0.0%	0.5%	2.9%	0.0%	8.2%	n/a
4	102.21	0.0000	0.11	44.81	0.0000	0.0000	n/a	147.1300	69.5%	0.0%	0.1%	30.5%	0.0%	0.0%	n/a
5	69.63	0.0000	0.0000	0.99	0.0000	0.0000	n/a	70.6200	98.6%	0.0%	0.0%	1.4%	0.0%	0.0%	n/a
6	76.37	0.0000	0.0000	0.0000	0.0000	0.0000	n/a	76.3700	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	n/a
7	72.77	0.0000	0.05	4.63	0.0000	9.9876	n/a	87.4376	83.2%	0.0%	0.1%	5.3%	0.0%	11.4%	n/a
8	95.38	0.0000	1.6	4.11	0.0000	0.0000	n/a	101.0900	94.4%	0.0%	1.6%	4.1%	0.0%	0.0%	n/a
10	20.67	0.0000	0.34	13.85	0.0000	0.0000	n/a	34.8600	59.3%	0.0%	1.0%	39.7%	0.0%	0.0%	n/a
11	397.1	0.0000	0.03	13.79	0.0000	1.558	n/a	412.4780	96.3%	0.0%	0.0%	3.3%	0.0%	0.4%	n/a
12	40.82	0.0000	0.0000	23.39	0.0000	2.8372	n/a	67.0472	60.9%	0.0%	0.0%	34.9%	0.0%	4.2%	n/a
14	140.67	0.0000	2.54	0.0000	0.0000	0.3772	n/a	143.5872	98.0%	0.0%	1.8%	0.0%	0.0%	0.3%	n/a
16	66.24	0.0000	0.0000	4.58	6.36	11.972	n/a	89.1520	74.3%	0.0%	0.0%	5.1%	7.1%	13.4%	n/a
17	24.96	0.0000	0.43	0.38	0.0000	0.0000	n/a	25.7700	96.9%	0.0%	1.7%	1.5%	0.0%	0.0%	n/a
18	12.56	0.0000	0.0000	1.7	0.0000	0.0000	n/a	14.2600	88.1%	0.0%	0.0%	11.9%	0.0%	0.0%	n/a
19	37.52	0.0000	0.51	0.46	0.0000	0.0000	n/a	38.4900	97.5%	0.0%	1.3%	1.2%	0.0%	0.0%	n/a
21	37.39	0.0000	0.0000	0.71	0.0000	0.0000	n/a	38.1000	98.1%	0.0%	0.0%	1.9%	0.0%	0.0%	n/a
22	4.66	0.0000	0.78	0.0000	0.03	0.0000	n/a	5.4700	85.2%	0.0%	14.3%	0.0%	0.5%	0.0%	n/a
23	6.3	0.0000	0.0000	0.0000	0.0000	0.0000	n/a	6.3000	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	n/a
24	12.24	0.0000	0.0000	0.0000	0.0000	0.0000	n/a	12.2400	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	n/a
25	33.46	0.0000	0.05	5.35	0.0000	0.0000	n/a	38.8600	86.1%	0.0%	0.1%	13.8%	0.0%	0.0%	n/a
27	10	0.0000	28.13	0.0000	0.0000	0.2952	n/a	38.4252	26.0%	0.0%	73.2%	0.0%	0.0%	0.8%	n/a
28	47.89	0.0000	0.18	0.0000	0.0000	0.0000	n/a	48.0700	99.6%	0.0%	0.4%	0.0%	0.0%	0.0%	n/a
29	85.34	0.0000	0.0000	0.06	0.0000	0.0000	n/a	85.4000	99.9%	0.0%	0.0%	0.1%	0.0%	0.0%	n/a
30	6.19	0.0000	0.0000	0.0000	0.02	0.0000	n/a	6.2100	99.7%	0.0%	0.0%	0.0%	0.3%	0.0%	n/a
Total	**1449.2100**	**0.0000**	**34.9600**	**128.9100**	**6.4100**	**29.5364**	**n/a**	**1649.02640**	**87.9%**	**0.0%**	**2.1%**	**7.8%**	**0.4%**	**1.8%**	**n/a**
mean:	**57.9684**	**0.0%**	**139.8%**	**515.6%**	**25.6%**	**118.1%**	**n/a**	**65.9611**	**85.7%**	**0.0%**	**3.8%**	**8.6%**	**0.3%**	**1.5%**	**n/a**

Appendix 11: Outputs from SIMPER analysis

Similarity Percentages - species contributions

One-Way Analysis

Data worksheet
Name: Sqrt transform
Data type: Abundance
Sample selection: All
Variable selection: All

Parameters
Resemblance: S17 Bray Curtis similarity
Cut off for low contributions: 90.00%

Factor Groups

Sample	SIMPROF
1	d
2	d
3	d
4	d
5	d
6	d
7	d
8	d
10	d
11	d
12	d
17	d
19	d
21	d
22	d
23	d
24	d
29	d
30	d
14	b
25	b
28	b
16	a
27	a
18	c

Group d
Average similarity: 37.78

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Nephtys cirrosa	2.26	17.90	3.07	47.39	47.39
Angulus fabula	1.53	5.82	0.86	15.40	62.79
Nephtys sp. Juv.	0.87	5.79	0.93	15.33	78.12
Nephtys longosetosa	0.64	3.44	0.56	9.10	87.21
Goniada maculata	0.39	0.99	0.36	2.61	89.83
Magelona johnstoni	0.52	0.93	0.37	2.46	92.29

Group b
Average similarity: 37.65

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Ophelia borealis	3.78	14.68	9.23	38.99	38.99
Scoloplos (scoloplos) armiger	2.13	8.02	2.42	21.29	60.28
Nephtys cirrosa	1.28	6.63	4.77	17.60	77.88
Nephtys longosetosa	1.14	5.84	9.02	15.51	93.39

Group a
Average similarity: 28.55

Species	Av.Abund	Av.Sim	Sim/SD	Contrib%	Cum.%
Nemertea spp.	2.58	8.36	#######	29.29	29.29
Glycera lapidum	3.78	8.36	#######	29.29	58.58
Notomastus latericeus	2.03	5.91	#######	20.71	79.29
Sabellaria spinulosa	2.21	5.91	#######	20.71	100.00

Group c
Less than 2 samples in group

Groups d & b
Average dissimilarity = 79.02

Species	**Group d Av. Abund**	**Group b Av. Abund**	**Av. Diss**	**Diss/SD**	**Contrib %**	**Cum %**
Ophelia borealis	0.20	3.78	12.72	2.32	16.10	16.10
Scoloplos (scoloplos) armiger	0.16	2.13	7.04	2.21	8.91	25.01
Angulus fabula	1.53	0.00	4.99	1.20	6.31	31.31
Glycera lapidum	0.00	1.22	4.33	1.20	5.49	36.80
Nephtys cirrosa	2.26	1.28	3.47	1.14	4.39	41.19
Nephtys sp. Juv.	0.87	0.33	2.64	1.21	3.34	44.53
Nephtys longosetosa	0.64	1.14	2.48	1.28	3.13	47.67
Actiniaria spp.	0.00	0.58	2.18	0.69	2.76	50.43
Polycirrus spp.	0.00	0.67	2.14	0.69	2.71	53.14
Tellimya ferruginosa	0.00	0.47	2.00	0.68	2.53	55.67
Goniada maculata	0.39	0.33	1.81	0.88	2.30	57.97
Spio martinensis	0.51	0.00	1.62	0.62	2.05	60.02
Scolelepis bonnieri	0.18	0.33	1.62	0.78	2.04	62.06
Magelona johnstoni	0.52	0.00	1.60	0.71	2.02	64.09
Nemertea spp.	0.28	0.33	1.57	0.82	1.98	66.07
Acarina sp.	0.05	0.33	1.45	0.70	1.83	67.91
Pontocrates arenarius	0.16	0.33	1.43	0.77	1.81	69.71
Lagotia viridis	0.00	0.33	1.41	0.68	1.79	71.5
Pedicellina spp.	0.00	0.33	1.41	0.68	1.79	73.29
Bathyporeia elegans	0.00	0.33	1.41	0.68	1.79	75.08
Malacoceros fuliginosus	0.05	0.33	1.32	0.71	1.67	76.75
Lumbrineris cf. cingulata	0.00	0.33	1.26	0.69	1.60	78.34
Aonides paucibranchiata	0.00	0.33	1.26	0.69	1.60	79.94
Diastylis laevis	0.00	0.33	1.26	0.69	1.60	81.54
Chaetozone christiei	0.05	0.33	1.18	0.71	1.49	83.03
Orbinia (Orbinia) sertulata	0.00	0.33	1.07	0.69	1.36	84.38
Scolelepis foliosa	0.00	0.33	1.07	0.69	1.36	85.74
Nototropis falcatus	0.00	0.33	1.07	0.69	1.36	87.09
Diastylis bradyi	0.00	0.33	1.07	0.69	1.36	88.45
Nephtys hombergii	0.33	0.00	1.01	0.49	1.27	89.72
Pontocrates altamarinus	0.21	0.00	0.69	0.51	0.88	90.60

Groups d & a
Average dissimilarity = 91.38

Species	Group d Av. Abund	Group a Av. Abund	Av. Diss	Diss/SD	Contrib %	Cum %
Glycera lapidum	0.00	3.78	10.56	2.97	11.56	11.56
Nemertea spp.	0.28	2.58	6.83	3.14	7.48	19.03
Sabellaria spinulosa	0.00	2.21	6.31	4.46	6.90	25.93
Notomastus latericeus	0.05	2.03	5.72	4.36	6.26	32.20
Nephtys cirrosa	2.26	0.71	4.20	1.51	4.60	36.80
Angulus fabula	1.53	0.00	4.18	1.15	4.57	41.37
Eteone longa/flava (agg.)	0.11	1.12	4.04	0.99	4.43	45.80
Ophelia borealis	0.20	1.00	3.53	1.01	3.87	49.66
Nephtys sp. Juv.	0.87	0.00	2.64	1.42	2.89	52.55
Polycirrus spp.	0.00	0.87	2.14	0.97	2.35	54.90
Nephtys longosetosa	0.64	0.00	2.07	0.92	2.27	57.17
Microphthalmus similis	0.00	0.50	1.83	0.96	2.01	59.17
Capitella capitata complex	0.00	0.50	1.83	0.96	2.01	61.18
Spirobranchus lamarcki	0.00	0.50	1.83	0.96	2.01	63.19
Liocarcinus holsatus	0.00	0.50	1.83	0.96	2.01	65.19
Conopeum reticulum	0.00	0.50	1.83	0.96	2.01	67.20
Mediomastus fragilis	0.05	0.71	1.78	1.00	1.95	69.15
Phascolion strombus	0.00	0.71	1.75	0.97	1.92	71.06
Ophiura albida	0.00	0.71	1.75	0.97	1.92	72.98
Spio martinensis	0.51	0.00	1.36	0.60	1.49	74.47
Magelona johnstoni	0.52	0.00	1.35	0.70	1.48	75.95
Scoloplos (scoloplos) armiger	0.16	0.50	1.33	0.95	1.45	77.40
Cerianthus lloydii	0.00	0.50	1.24	0.97	1.35	78.76
Malmgrenia sp.	0.00	0.50	1.24	0.97	1.35	80.11
Hesionura elongata	0.00	0.50	1.24	0.97	1.35	81.47
Eulalia mustela	0.00	0.50	1.24	0.97	1.35	82.82
Goniadella gracilis	0.00	0.50	1.24	0.97	1.35	84.18
Syllis pontxioi	0.00	0.50	1.24	0.97	1.35	85.53
Aonides paucibranchiata	0.00	0.50	1.24	0.97	1.35	86.89
Laonice bahusiensis	0.00	0.50	1.24	0.97	1.35	88.24
Euspira nitida	0.00	0.50	1.24	0.97	1.35	89.60
Goniada maculata	0.39	0.00	1.11	0.71	1.22	90.81

Groups b & a
Average dissimilarity = 79.39

Species	Group b Av. Abund	Group a Av. Abund	Av. Diss	Diss/SD	Contrib %	Cum %
Ophelia borealis	3.78	1.00	6.27	1.41	7.90	7.90
Glycera lapidum	1.22	3.78	6.05	1.37	7.62	15.52
Nemertea spp.	0.33	2.58	5.48	3.13	6.90	22.43
Sabellaria spinulosa	0.00	2.21	5.21	4.06	6.57	29.00
Notomastus latericeus	0.00	2.03	4.84	5.40	6.10	35.09
Scoloplos (scoloplos) armiger	2.13	0.50	4.12	1.42	5.19	40.28
Eteone longa/flava (agg.)	0.00	1.12	3.24	0.91	4.08	44.37
Nephtys longosetosa	1.14	0.00	2.88	3.11	3.63	48.00
Polycirrus spp.	0.67	0.87	2.21	0.96	2.79	50.79
Nephtys cirrosa	1.28	0.71	1.55	1.13	1.95	52.74
Phascolion strombus	0.00	0.71	1.49	0.91	1.88	54.61
Mediomastus fragilis	0.00	0.71	1.49	0.91	1.88	56.49
Ophiura albida	0.00	0.71	1.49	0.91	1.88	58.37
Actiniaria spp.	0.58	0.00	1.46	0.63	1.84	60.21
Microphthalmus similis	0.00	0.50	1.45	0.91	1.83	62.04
Capitella capitata complex	0.00	0.50	1.45	0.91	1.83	63.86

Spirobranchus lamarcki	0.00	0.50	1.45	0.91	1.83	65.69
Liocarcinus holsatus	0.00	0.50	1.45	0.91	1.83	67.52
Conopeum reticulum	0.00	0.50	1.45	0.91	1.83	69.34
Tellimya ferruginosa	0.47	0.00	1.28	0.63	1.62	70.96
Aonides paucibranchiata	0.33	0.50	1.19	0.89	1.50	72.46
Cerianthus lloydii	0.00	0.50	1.05	0.91	1.33	73.78
Malmgrenia sp.	0.00	0.50	1.05	0.91	1.33	75.11
Hesionura elongata	0.00	0.50	1.05	0.91	1.33	76.44
Eulalia mustela	0.00	0.50	1.05	0.91	1.33	77.77
Goniadella gracilis	0.00	0.50	1.05	0.91	1.33	79.10
Syllis pontxioi	0.00	0.50	1.05	0.91	1.33	80.43
Laonice bahusiensis	0.00	0.50	1.05	0.91	1.33	81.75
Euspira nitida	0.00	0.50	1.05	0.91	1.33	83.08
Lagotia viridis	0.33	0.00	0.91	0.63	1.14	84.23
Pedicellina spp.	0.33	0.00	0.91	0.63	1.14	85.37
Goniada maculata	0.33	0.00	0.91	0.63	1.14	86.51
Scolelepis bonnieri	0.33	0.00	0.91	0.63	1.14	87.66
Acarina sp.	0.33	0.00	0.91	0.63	1.14	88.80
Bathyporeia elegans	0.33	0.00	0.91	0.63	1.14	89.95
Nephtys sp. Juv.	0.33	0.00	0.84	0.63	1.06	91.01

Groups d & c
Average dissimilarity = 79.02

Species	**Group d Av. Abund**	**Group c Av. Abund**	**Av. Diss**	**Diss/SD**	**Contrib %**	**Cum %**
Goodallia triangularis	0.00	2.24	9.88	5.02	12.51	12.51
Angulus fabula	1.53	1.00	4.68	1.58	5.92	18.43
Pisione remota	0.00	1.00	4.42	5.02	5.59	24.02
Hypereteone foliosa	0.00	1.00	4.42	5.02	5.59	29.61
Glycera oxycephala	0.00	1.00	4.42	5.02	5.59	35.21
Scolelepis foliosa	0.00	1.00	4.42	5.02	5.59	40.80
Travisia forbesii	0.00	1.00	4.42	5.02	5.59	46.39
Crenella decussata	0.00	1.00	4.42	5.02	5.59	51.99
Moerella pygmaea	0.00	1.00	4.42	5.02	5.59	57.58
Nephtys sp. Juv.	0.87	0.00	3.79	1.44	4.80	62.38
Scoloplos (scoloplos) armiger	0.16	1.00	3.74	1.99	4.73	67.11
Nephtys cirrosa	2.26	1.73	3.20	1.26	4.05	71.16
Nephtys longosetosa	0.64	0.00	3.04	0.94	3.84	75.00
Spio martinensis	0.51	0.00	1.86	0.61	2.36	77.36
Magelona johnstoni	0.52	0.00	1.83	0.70	2.32	79.68
Goniada maculata	0.39	0.00	1.55	0.71	1.96	81.64
Nephtys hombergii	0.33	0.00	1.15	0.49	1.45	83.09
Nemertea spp.	0.28	0.00	1.03	0.49	1.31	84.40
Ophelia borealis	0.20	0.00	0.95	0.40	1.20	85.60
Pontocrates altamarinus	0.21	0.00	0.80	0.50	1.01	86.61
Scolelepis bonnieri	0.18	0.00	0.70	0.42	0.88	87.50
Bathyporeia guilliamsoniana	0.16	0.00	0.69	0.41	0.88	88.37
Abra alba	0.16	0.00	0.60	0.41	0.76	89.13
Pontocrates arenarius	0.16	0.00	0.59	0.42	0.75	89.88
Nephtys assimilis	0.13	0.00	0.49	0.33	0.62	90.50

Groups b & c
Average dissimilarity = 82.85

Species	Group b Av. Abund	Group c Av. Abund	Av. Diss	Diss/SD	Contrib %	Cum %
Ophelia borealis	3.78	0.00	12.13	2.26	14.64	14.64
Goodallia triangularis	0.00	2.24	7.47	8.33	9.02	23.65
Glycera lapidum	1.22	0.00	3.89	1.03	4.70	28.35
Nephtys longosetosa	1.14	0.00	3.86	3.10	4.65	33.01
Scoloplos (scoloplos) armiger	2.13	1.00	3.50	1.09	4.22	37.23
Pisione remota	0.00	1.00	3.34	8.33	4.03	41.26
Hypereteone foliosa	0.00	1.00	3.34	8.33	4.03	45.29
Glycera oxycephala	0.00	1.00	3.34	8.33	4.03	49.33
Travisia forbesii	0.00	1.00	3.34	8.33	4.03	53.36
Crenella decussata	0.00	1.00	3.34	8.33	4.03	57.39
Angulus fabula	0.00	1.00	3.34	8.33	4.03	61.42
Moerella pygmaea	0.00	1.00	3.34	8.33	4.03	65.46
Scolelepis foliosa	0.33	1.00	2.37	1.15	2.86	68.31
Polycirrus spp.	0.67	0.00	1.95	0.58	2.35	70.67
Actiniaria spp.	0.58	0.00	1.95	0.58	2.35	73.02
Tellimya ferruginosa	0.47	0.00	1.76	0.58	2.12	75.14
Nephtys cirrosa	1.28	1.73	1.53	1.85	1.84	76.98
Lagotia viridis	0.33	0.00	1.24	0.58	1.50	78.48
Pedicellina spp.	0.33	0.00	1.24	0.58	1.50	79.98
Goniada maculata	0.33	0.00	1.24	0.58	1.50	81.48
Scolelepis bonnieri	0.33	0.00	1.24	0.58	1.50	82.97
Acarina sp.	0.33	0.00	1.24	0.58	1.50	84.47
Bathyporeia elegans	0.33	0.00	1.24	0.58	1.50	85.97
Nephtys sp. Juv.	0.33	0.00	1.13	0.58	1.36	87.33
Lumbrineris cf. cingulata	0.33	0.00	1.13	0.58	1.36	88.69
Aonides paucibranchiata	0.33	0.00	1.13	0.58	1.36	90.04

Groups a & c
Average dissimilarity = 93.05

Species	Group a Av. Abund	Group c Av. Abund	Av. Diss	Diss/SD	Contrib %	Cum %
Glycera lapidum	3.78	0.00	9.71	2.19	10.44	10.44
Nemertea spp.	2.58	0.00	6.93	13.41	7.45	17.89
Goodallia triangularis	0.00	2.24	6.25	4.05	6.72	24.61
Sabellaria spinulosa	2.21	0.00	5.79	3.59	6.22	30.83
Notomastus latericeus	2.03	0.00	5.38	5.20	5.78	36.61
Eteone longa/flava (agg.)	1.12	0.00	3.67	0.71	3.95	40.55
Ophelia borealis	1.00	0.00	3.28	0.71	3.53	44.08
Pisione remota	0.00	1.00	2.80	4.05	3.01	47.09
Hypereteone foliosa	0.00	1.00	2.80	4.05	3.01	50.09
Glycera oxycephala	0.00	1.00	2.80	4.05	3.01	53.10
Scolelepis foliosa	0.00	1.00	2.80	4.05	3.01	56.10
Travisia forbesii	0.00	1.00	2.80	4.05	3.01	59.11
Crenella decussata	0.00	1.00	2.80	4.05	3.01	62.11
Angulus fabula	0.00	1.00	2.80	4.05	3.01	65.12
Moerella pygmaea	0.00	1.00	2.80	4.05	3.01	68.12
Nephtys cirrosa	0.71	1.73	2.52	1.21	2.71	70.83
Polycirrus spp.	0.87	0.00	2.00	0.71	2.15	72.98
Microphthalmus similis	0.50	0.00	1.64	0.71	1.76	74.75
Scoloplos (scoloplos) armiger	0.50	1.00	1.64	0.71	1.76	76.51
Capitella capitata complex	0.50	0.00	1.64	0.71	1.76	78.28
Spirobranchus lamarcki	0.50	0.00	1.64	0.71	1.76	80.04
Liocarcinus holsatus	0.50	0.00	1.64	0.71	1.76	81.81
Conopeum reticulum	0.50	0.00	1.64	0.71	1.76	83.57
Phascolion strombus	0.71	0.00	1.63	0.71	1.75	85.33

Species	Group a Av. Abund	Group c Av. Abund	Av. Diss	Diss/SD	Contrib %	Cum %
Mediomastus fragilis	0.71	0.00	1.63	0.71	1.75	87.08
Ophiura albida	0.71	0.00	1.63	0.71	1.75	88.84
Cerianthus lloydii	0.50	0.00	1.15	0.71	1.24	90.08