North West Irish Sea Mounds: Hard and Soft Substrata Habitats

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Executive Summary

- Since June 2003 a number of acoustic and biological surveys have been conducted in the area of the North Channel north west of the Isle of Man adjacent to the boundary of the NW Irish Sea "mud patch".
- The area has been identified as a potential offshore SAC (Special Area for Conservation) for Annex I reef habitat, principally rocky reef habitat.
- In June 2006 the area was mapped using multi-beam sonar and a number of potential habitat features identified.
- A series of cruises attempting to characterise the primary biological features of the area were undertaken in November 2006 and January/February 2007.
- The report contains the interpretation of both the soft bottom infauna data and epifauna data together with supporting physical descriptors.
- Based on the Natura 2000 Code 1170 definition of reefs/ EC Habitats Directive Interpretation Manual, the report concludes that this site represents Annex I reef habitat.
- A number of important sub-features in the area are also discussed, in particular small pockets of firmer sediment between rock surfaces were often characterised by dense tube worm communities (*Galathowenia oculata* and *Melinna palmata*).
- The main anthropogenic activity in the area is commercial fishing.

Contents

1.0 Introduction

The North West Irish Sea Mounds are a group of bedrock outcrops in a region of the Irish Sea known as the North Channel, which separates Northern Ireland and Scotland (Figure 1). These mounds were originally identified and mapped by the United Kingdom Hydrographic Office (Admiralty Charts) and British Geological Survey (BGS) who described them as bedrock outcrops in an otherwise fairly homogeneous, deep sedimentary region. In 2003 a survey of the area was undertaken as part of the Irish Sea Pilot (Golding *et* al, 2004), which confirmed that a number of the bathymetric peaks were bedrock outcrops, or 'reefs', which are listed under Annex I of the Habitats Directive as being of conservation importance. In-between the reef areas appear to be large expanses of soft sediments, which are bioturbated by megafauna such as *Nephrops norvegicus*.

Figure 1. Location of the North West Irish Sea Mounds in relation to Great Britain and Ireland.

As a first stage in producing a biotope map for the area, which is a pre-requisite to consideration for marine protection, a multibeam echosounder (MBES) survey was undertaken in June 2006. The results of this survey are presented, along with a synthesis of existing data, in the 2006 North West Irish Sea Mounds report (Mitchell *et al*, 2006). Recommendations from the 2006 report were used in the planning of the biological survey for this report.

1.1 Background data

The biological survey was restricted to the south-east corner of the 2006 multibeam survey area in order to constrain the survey effort within offshore waters (>12nm). The biological survey was also extended further to the south-east to cover potential reef areas identified by the BGS (Graham *et al*, 2001) (see Figure 2 below). A previous survey in 2003 identified two significant bathymetric 'highs' (shallowings) from RoxAnn AGDS data, rising from –148m to –55m. The more southerly peak had been examined by underwater video, which revealed a bedrock reef with a veneer of shelly mud of varying thickness with the brittlestars *Ophiothrix fragilis* and *Ophiocomina nigra* abundant, the squat lobster *Munida rugosa* common and patches of hydrozoan turf. Sloping rock walls showed the highest diversity of epifauna, with dense patches of *Alcyonium digitatum*, *Urticina eques* and *Metridium senile* common, and *Echinus esculentus* frequent. Before the current survey, the large bathymetric rise in the centre of the RoxAnn interpolated depth image had not been ground-truthed. Multibeam sonar data from the 2006 survey have provided high resolution bathymetry for the survey site and allowed physical classification of the site into six substrata zones (Mitchell *et al*, 2006). These zones are:

1. Low relief bedrock
2. Homogeneous sedimentary plain (*Nephrops* bioturbated mud?)
3. Deep (>100m) medium-high relief bedrock outcrops (slope > 4°)
4. Shallow (<100m) medium-high relief bedrock outcrops (slope > 4°)
5. Coarse and/or mixed sediment
6. Mixed sediment with boulder or cobble fields (plus possible sediment veneer)

The objectives of the investigation were:

a. to undertake biological characterisation of the physical seabed types identified in the geomorphological survey (Mitchell *et al,* 2006) to highest biotope level.
b. to produce a detailed seabed habitat map, based on the integration of geomorphological (Mitchell *et al,* 2006) and biological data.

1.2 Approach

For the biological mapping of the soft substrata, the clustering and classification of areas particle size samples have been used as the primary tool. The assumption here is that particle size parameters dictate infaunal community characteristics, hence these have been used as the primary unit. All of the particle size data collected in 2003, 2006 and 2007 are classified into groups which should represent biologically meaningful zones. Where particle size points are paired with infaunal data this is used to confirm whether distinct communities are present and what the characterizing species are of that habitat.

For the hard substrata, the video footage from the drop-down camera and epibenthic video sledge was used to directly characterize the physical nature of the seabed and the major taxa present.

2.0 Materials and Methods

2.1 Research cruises

In total, input from four separate research cruises is used in this report. Grab and video sampling throughout the North West Irish Sea Mounds area was undertaken in February 2003 (AFBI Cruise Reports 2003). Additional grabs were collected in November 2006 specifically in the south-eastern area of interest (AFBI Cruise Reports 2006). Within the same area, a new video and grab campaign was also undertaken in January 2007

(22/01/07-23/01/07) from RV Corystes. However, due to poor visibility on the initial cruise a supplementary survey was used to collect additional video footage (25/02/07 RV Corystes).

2.2 Use of Optimal Allocation Analysis to guide ground-truthing effort

As part of the Development of a Framework for Mapping European Seabed Habitats (MESH) project (Interreg IIIB) a number of methods have been investigated into improving survey design. One such method has been the application of Optimal Allocation Analysis (OAA) to the design of ground-truthing surveys. The idea behind this method is to utilise existing broad-scale, full coverage datasets such as acoustic or optical remote sensing to guide ground-truthing for habitat mapping in an objective manner. This rests upon the assumption that the remotely-sensed variables such as bathymetry and backscatter may indicate habitat heterogeneity. The variables can be classified using a number of unsupervised methods (see section 2.3 below) or manually classified into areas of similar characteristics, known as 'ground-types'. The underlying remotely-sensed data for each of the resulting ground-types may be readily extracted through a GIS (using Zonal Statistics in Spatial Analyst Tools) and the statistics of these variables calculated for each ground-type (e.g. mean, variance, sum etc.). The summary statistics can then be used for the OAA which will use these to assess the variance of each ground-type and also consider the area of each ground-type, which when coupled with either a maximum number of potential samples or a set coefficient of variance (CoV; a measure of precision) will calculate the optimal number of samples required for ground-truthing each ground-type. Both the CoV and maximum number of samples for the entire survey area can be readily manipulated depending on the users requirements. The recommended number of samples is provided in the same units as the ground-type areas are provided in (usually m^2, for instance). Where a number of remotely-sensed variables (including those derived from bathymetry) would ideally be considered in such an analysis (for example slope, rugosity, backscatter, aspect), these can all be incorporated into the OAA and the results for each variable inspected, and if applicable the results for each variable can be averaged.

In the case of the North West Irish Sea Mounds site, it was deemed that the variables slope, backscatter and aspect were likely to be most representative of habitat heterogeneity. For JNCC potential offshore SAC designation purposes, the survey area was clipped to include largely the area falling outside the 12nM limit. The summary statistics for each of these variables were extracted for the six substrata zones identified by the Benthic Terrain Modeller for the clipped area, and entered into an Excel spreadsheet containing embedded calculations for OAA. The area of each zone was also added (in m^2). The CoV was set at 5% (i.e. 95% precision) for calculating the optimal sample numbers per ground-type. The results for each variable, and the average scores, are presented in Table 1 below:

Table 1. Sample numbers required for a CoV of 5% for each ground-type ('zone') within the clipped area. Samples are in m^2.

	Slope angle	Backscatter	Aspect	Average
Total samples	**113**	**65**	**127**	**102**
Zone 1	**12**	**7**	**16**	**12**
Zone 2	**18**	**28**	**58**	**35**
Zone 3	**46**	**8**	**12**	**22**
Zone 4	**13**	**2**	**5**	**7**
Zone 5	**18**	**16**	**30**	**21**
Zone 6	**5**	**3**	**6**	**5**

Although the OAA recommends the number of samples for each ground-type, it does not advise where these should be placed within each ground-type or what sampling equipment should be used. In sedimentary regions it is generally accepted that the biology of such areas is dominated by infauna, and therefore an appropriate infaunal sampling tool will be required, such as a Day grab. Such samples cover a very small area, for instance the Day grab bite aperture is $0.1m^2$, and therefore each $1m^2$ sample recommended by the OAA will in reality require ten grab samples to cover such an area. However, conversely, where the ground-type is likely to be reef or cobbles/boulders epifauna will dominate the biological community, and a suitable sampling platform for such communities would be a video/camera system (if visibility is adequate). Video systems can cover a larger area in less time than grab sampling, with the field of view at any one point usually approximating $1m^2$. It is therefore quite simple to cover the recommended sample area with video tows/drops on the bedrock zones but much more time consuming to sample the recommended area in the sedimentary zones.

In order to assess how much sampling, and using what equipment, was required to achieve a precision of 95% for the North West Irish Sea Mounds site for the 2007 surveys, it was first necessary to incorporate the coverage of pre-existing ground-truthing (from 2003 and 2006; see section 1.1 above). Each existing Day grab was considered to represent $0.1m^2$, and the video drops area coverage was calculated by multiplying the tow length (in m, as measured on GIS) by $1m^2$. If any of the footage was of poor quality (e.g. bad visibility or too far off the seafloor) this reduced the area covered that could be used for further analysis, however as long tows were made any loss of usable footage was considered to have a minimal impact on the analysis below. The pre-existing ground-truthing coverage (prior to the 2007 surveys) amongst each ground-type within the clipped area is provided in Table 2 below.

Table 2. Existing coverage of ground-truthing for each ground-type within the clipped area (in m^2).

Ground-type	Video2006	Video2003	Grabs2006	Grabs2003	Total
1. low relief bedrock (sediment veneer?)		125	0.2	0.1	125.3
2. homogeneous sedimentary plain (bioturbated mud?)			0.7		0.7
3. deep (>100m) med-high relief bedrock outcrops			0.1		0.1
4. shallow (<100m) med-high relief bedrock outcrops		168	0.5		168.5
5. coarse / mixed sediment			0.5		0.5
6. mixed sediment / cobble & boulder fields					
TOTAL	0	293	2	0.1	295.1

It was evident that in all but ground-types 1 and 4 (low relief bedrock and shallow med-high relief bedrock outcrops) sampling prior to the 2007 survey was below that recommended by the OAA. In addition, although ground-type 1 (low relief bedrock) had effectively been ‘over-sampled’ according to the OAA, this actually only consisted of one long video transect on one bedrock outcrop and it was noted from examination of this footage that much of this area was covered in a thick sediment veneer and was therefore likely to be characterised by both epifauna and infauna. Only three grab samples had been taken on this ground-type and therefore it was recommended that additional grab samples be taken in order to characterise the infauna as well as analysis of the video for epifauna community analysis/description. Three of the under-sampled ground-types were largely sedimentary and the 2003 footage indicated that the bedrock ground-types may also be covered by a sediment veneer. In order to characterise the infaunal community of such areas it was determined that grab or core samples should be taken, however it was also decided to obtain additional video to provide a ‘landscape’ view of the habitat and detect key epifauna species that could be critical in structuring the sediment, such as *Nephrops norvegicus* and *Thalassinid* shrimps. In addition video may provide an idea of the heterogeneity of the habitat that may relate to a similar spatial scale as that detected by the acoustic remote-sensing. To address these issues, for sedimentary ground-types the total recommended sampling area for the 2007 survey was divided into a third to be sampled by video tows and two-thirds to be sampled by grabs or cores. Some of the grab/core samples were selected to target habitat patches targeted by the video drops/tows. In addition, due to the time at which the OAA was carried out, the distribution of ground-truthing between ground-types from previous surveys did not follow that recommended by the OAA. When considering these points, additional sampling was suggested as provided in Table 3.

Using the above recommendations for additional ground-truthing, a series of locations were selected for the forthcoming sampling program. These are presented in Figure 2.

Table 3. Additional ground-truthing requirements to build upon existing data for biotope mapping in clipped North West Irish Sea Mounds area.

Ground-type	Extra video ground-truthing	Rationale	Extra infaunal sampling	Rationale
1. Low relief bedrock (sediment veneer?)	2x 50m video drops	To cover rock areas/patches that are yet to be sampled		
2. Homogeneous sedimentary plain (bioturbated mud?)	½ of 100m video drop run between ground-types 2 & 5. 3x 50m video drops.	To cover transition area between ground-types 2 & 5, and be co-located with grab samples	2 replicate Day grab samples at 12 sites	$23m^2$ recommended infaunal sample coverage (67% of OAA total for zone 2); due to practicality, 1 sample per m^2 is suggested as compromise
3. Deep (>100m) med-high relief bedrock outcrops *and* 6. mixed sediment / cobble & boulder fields	5x 200m video drops	To cover boundaries between deep bedrock and cobble/boulder areas that exist as small bordering patches		
4. Shallow (<100m) med-high relief bedrock outcrops	2x 100m video drops	To cover rock areas/patches that are yet to be sampled		
5. Coarse / mixed sediment	½ of 100m video drop run between ground-types 2 & 5. 2x 50m video drops.	To cover an area sampled by grabs	2 replicate Day grab samples at 5 sites	$5m^2$ recommended infaunal sample coverage (67% of OAA total for zone 5); due to practicality, 1 sample per m^2 is suggested as compromise
Extra features: Bedrock crevices			2 replicate Day grab samples at 2 sites	To target sediment habitats within large gullies of bedrock outcrop
Extra features: North facing aspects on bedrock	2x 50m video drops	To target potentially more exposed bedrock which may not have sediment veneer		
Extra features: deep-shallow gradients	2x 600m video drops running from deep to shallow	To explore the gradient from deep to shallow (sedimentary areas to bedrock peaks)		
TOTAL:	9x 50m video drops 3x 100m video drops 5x 200m video drops 2x 600m video drops		19 grabs sites, 2 replicates at each site= 38 grabs in total	

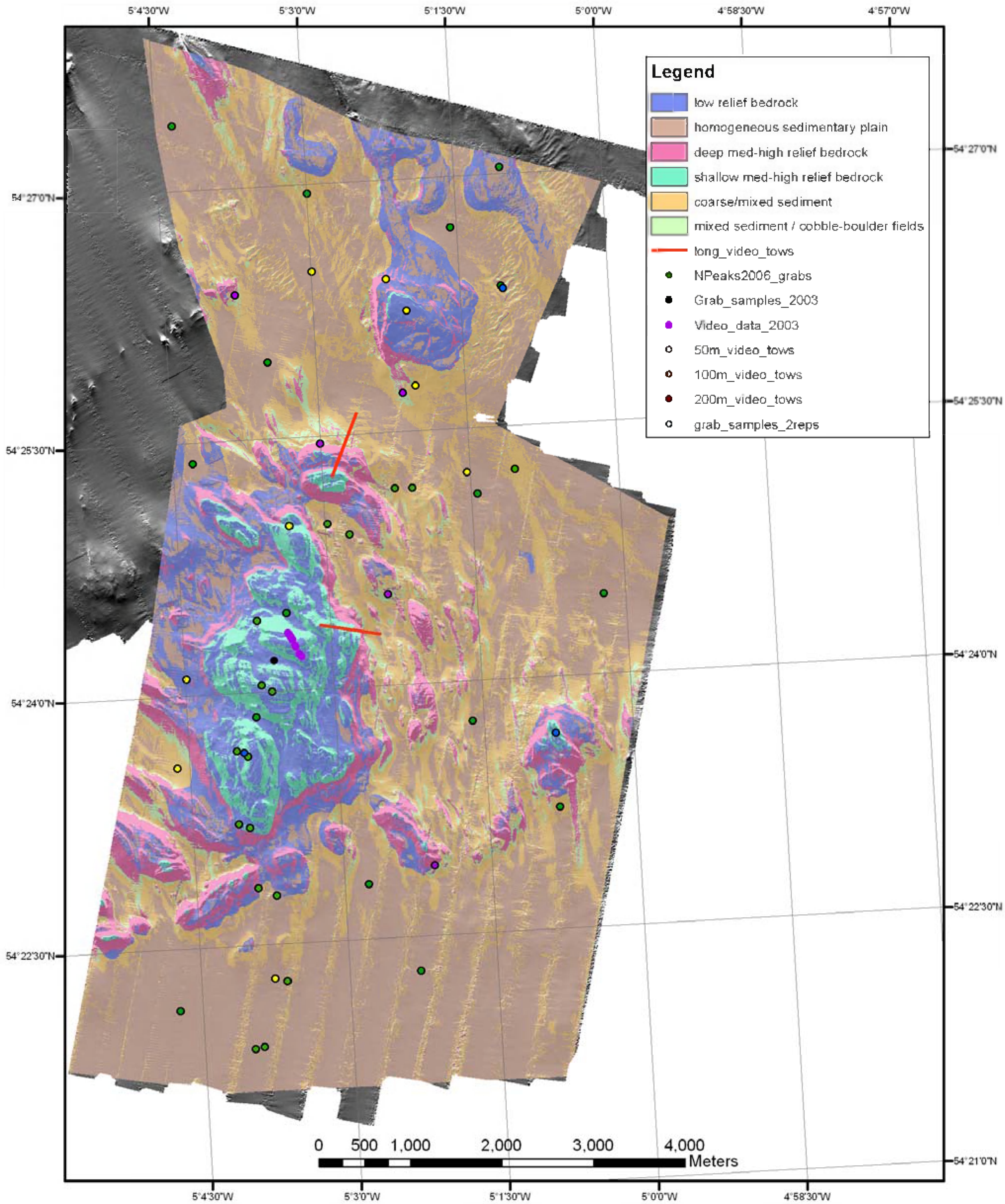


Figure 2. Location of ground truthing sites from the 2003 and 2006 surveys, and planned targets for the 2007 survey, implementing the recommendations from the OAA. (table of positions provided in Annex).

2.3 Field Methods

2.3.1. Infaunal Grabs and Particle Size Sampling

A 0.1 m^2 Day-grab was used to collect sediment for both infaunal analysis and particle size analysis (PSA). All grab samples were sieved using a 1mm mesh immediately after collection before being preserved in 4 % buffered seawater formaldehyde. A sub-sample of each grab was taken for the PSA and placed in a standard sample tube and frozen.

2.3.2. Sediment processing and analysis

Sediment samples from Day grabs were sent for particle analysis using laser sizing (Malvern Long-bed Mastersizer X with wet sample unit MS17, Department of Geographical Sciences, University of Plymouth). The values from this analysis were used to calculate the usual suite of particle size parameters. The organic material was removed from the core sediments with the addition of 6% Hydrogen Peroxide. Dispersion of the particles was achieved with the addition of calgon dispersant (33 g sodium hexametaphosphate and 7 g sodium carbonate per litre of de-ionised water). This shift in overall ionic charge prevents the material flocculating together and allows exact determination of the particle distribution.

2.3.3. Infauna analysis

Infauna analysis was carried out by an NMBAQC accredited contractor (ERT, Edinburgh). Only infauna retained on a 1mm sieve were identified. All species were counted and weighed for total biomass. Infaunal data were filtered and standardised by the exclusion of colonial and epifaunal species, such as hydroids and barnacles, and juvenile fauna unassigned to a species.

2.3.4. Video & Stills image acquisition

Video transects were made using a towed video sledge and drop frame. Both systems had a video camera, stills camera and lights. The video camera was a Kongsberg-Simrad Osprey underwater camera operated by a Simrad video control deck unit recording directly to a Sony DVD recorder. A stills camera system (Photosea 1000A 35 mm cameras and Photosea 1500S strobe) was also fitted to the sledge and operated through the Simrad video control unit. Slide film (Kodak or Fuji 200 ASA) was used, with the resulting stills scanned onto computer using a Nikon CoolScan IV slide scanner. These images were enhanced using Adobe Photoshop (brightness, contrast and colour adjusted), and catalogued with positional information, which was determined as far as possible using the associated video footage and field log notes. Positional information was imprinted on the video records using a dGPS linked to TrakView overlay system.

The majority of the video footage from the North West Irish Sea Mounds was of a fairly poor quality as a result of the reduced visibility. The stills photographs from the first three cruises were also poor, with back-scatter making many of the pictures unusable. Stills collected on the final cruise were significantly better and their higher resolution facilitated the identification of some of the epifaunal species. Both the epibenthic video sledge and the drop-down cameras were fitted with the IPS USBL. An intermittent fault developed with the tracker on some of the video ground truthing surveys. Therefore, all layback corrections have been undertaken with a Pythagoras calculation verified by the USBL.

2.4. Data Analysis

Using the mean particle diameter, sorting, % silt and % clay, all of the sediment samples underwent hierarchical clustering in SPSS. The coefficients presented in the agglomeration schedule were used to find the optimum number of clusters. Having established the membership of each sediment sample, the summary statistics for each cluster were calculated. Where possible, paired infaunal data were assigned to the same clusters identified by the hierarchical analysis. The complete infaunal dataset, with each sample assigned membership to a cluster, was imported into PRIMER (Plymouth Routines in Multivariate Ecological Research). To confirm that each particle size cluster was biologically meaningful and generated distinct communities, the infaunal data were tested with ANOSIM. Following this, the clustered infauna were analyzed with SIMPER to highlight the characteristic species within a grouping and hence dissimilarity between groupings.

Video footage, classified according to substrata type and obvious fauna every 30 seconds, was overlaid onto the predicted physical zones generated in the 2006 report (Mitchell *et al*, 2006). Using Spatial Analyst tools in ArcGIS, the zone type under each video observation was extracted. The results of the predicted zone type and the observed type/biotope were cross tabulated.

Videos were analysed in the laboratory in combination with the field notes and high-resolution stills in order to assist with species identification and sediment categorisation. Video quality was typically not good enough to make species or detailed biotope identification reliable. The footage was paused every 30 seconds and details of the physical substratum made; these classifications were later reclassified to match the physical zones used in the 2006 report. When possible, notes were also made on the communities present, although estimation against the SACFOR abundance scale was not possible.

Biotope selection was performed by identifying characteristic infauna and sediment from each confirmed zone type. Each individual member (a member is one sediment sample and its associated infauna) of a cluster identified by the multivariate analysis had its most abundant ten species selected and pooled. This aggregated data for each cluster was then ranked to provide a reduced ranked species list of the most commonly occurring species within the cluster. This list (for each of the four clusters) was used in combination with the epifauna from the video and stills camera and the sediment analysis to match up to the characteristic biotope in the JNCC Marine Habitat Classification for Britain and Ireland (Connor *et al* 2004).

The biotope selection process was performed by cross matching species lists from each biotope description to the clusters reduced ranked species list from the infauna in a data matrix. This matrix provides a score, which indicates the strongest matches between the infauna and the species lists in the Habitat Classification scheme. This matrix matching procedure was repeated for each cluster identified by the multivariate analysis. The potential biotopes were then reviewed for each example whilst considering the environmental, video/stills and sediment data, allowing a more comprehensive and holistic interpretation of the data. Exclusion of remaining biotope descriptions and the selection of the most likely biotope from the classification scheme were then performed.

3.0 Results

The GIS project “North West Irish Sea Mounds Biology 2007” and the 2006 GIS project “North Channel Peaks 2006” containing all data from survey are contained in the digital appendix.

Nineteen video tows, covering a total distance of 2950 meters, were proposed following the recommendations from the OAA. Nineteen video tows were obtained during the 2007 survey, covering a total distance 10,555 meters. Although nineteen tows were obtained, four of the proposed site were missed. Eighteen grabs sites were also proposed and nineteen were obtained during the survey. Although eighteen tows were obtained four of the proposed sites were missed. The locations of those proposed sites and the sites successfully obtained in the 2007 survey are shown in Figure 3.

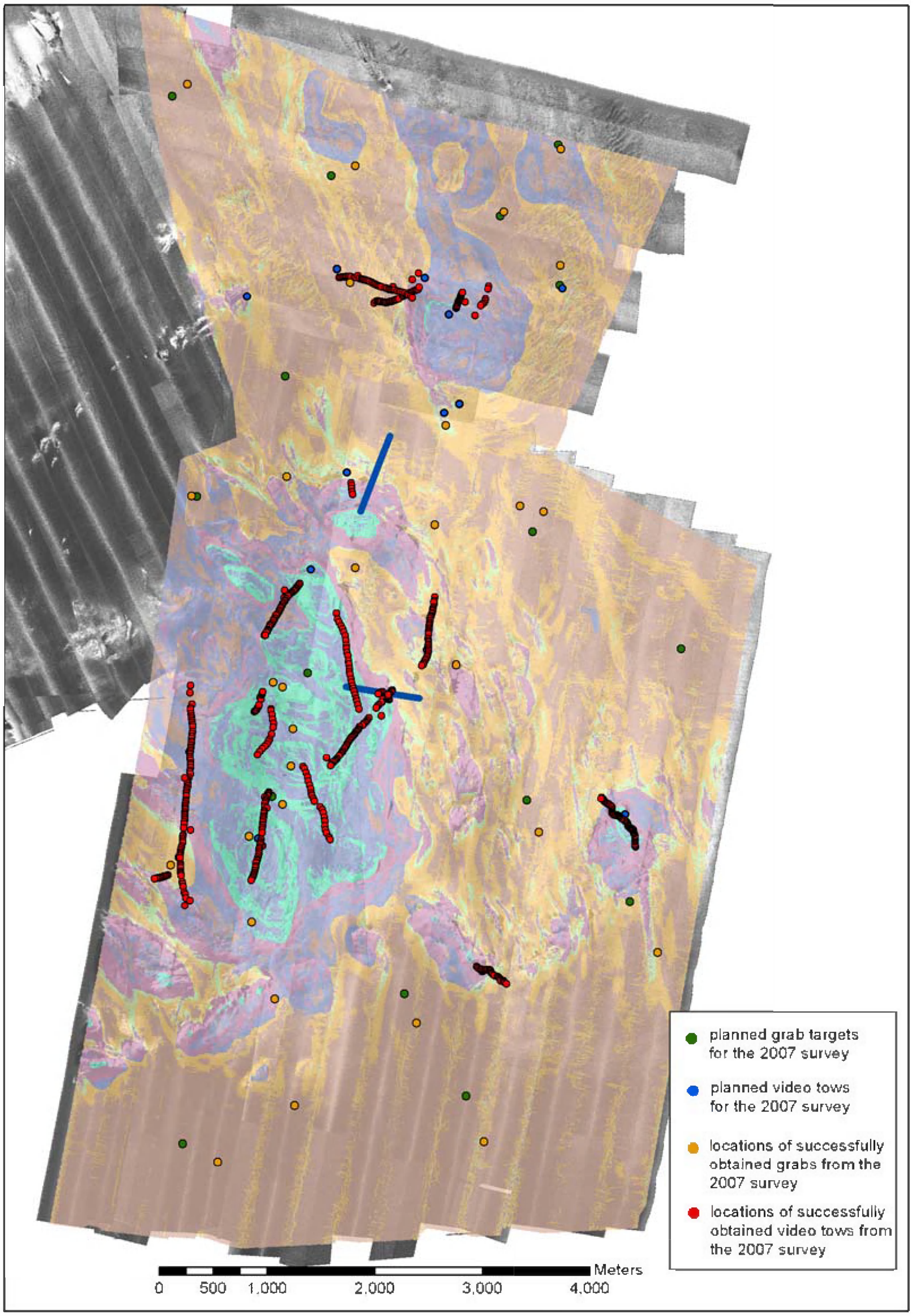


Figure 3. Planned targets for the 2007 survey (implementing the recommendations from the OAA, videos and grab sites) and the locations where ground truthing was successfully obtained during the 2007 survey (video and grab sites).

3.1. Soft Substrata Habitats

Hierarchical classification of the 29 particle size samples suggested the use of 5 clusters. The membership and characteristics of the 5 clusters are shown in Table 4. The clustering separated the particle size samples by silt and clay content, resulting in five classes spread along a gradient of mean particle size. All classes were very poorly sorted, except for cluster 5, which was extremely poor. Going down Table 4 shows that the clusters decreased in particle size (phi) as silt and clay content increased. It is also evident that cluster 5 was very poorly represented by samples with just two particle size samples and one infaunal sample.

Table 4. Membership and characteristics of the sediment samples clustering.

Cluster no.	PSA *n*	Fauna *n*	Mean (phi)	Sorting index	Silt (%)	Clay (%)	Description (Relative clay content)
5	2	1	2.06 1.31	4.28 0.82	30.10 3.07	7.77 0.47	Extremely poorly sorted sand (very low clay content)
2	2	0	3.63 0.09	3.89 0.03	37.83 0.41	9.29 1.61	Very poorly sorted fine sand (low clay content)
4	8	7	4.27 0.58	3.93 0.43	45.75 1.64	9.45 1.64	Very poorly sorted coarse silt (moderate clay content)
1	8	6	5.34 0.18	3.15 0.30	55.00 3.64	10.92 1.50	Very poorly sorted silt (high clay content)
3	9	6	6.61 0.18	2.28 0.36	74.21 3.17	13.41 1.77	Very poorly sorted fine silt (very high clay content)

Table 4 shows that sand samples, i.e. cluster 5, are the most coarse sediment samples. Members of this cluster were predominantly obtained from on the bedrock outcrop, suggesting that this material is typical of the infill between rock associated with the main mound (figure 4, Table 5). This is not surprising considering the greater tidal current velocities experienced at this site as the flow is forced over the main mound and thereby accelerates. Cluster 2 was found to overlay the mixed sediment zone, again representing a good level of agreement between the observed samples and the predicted physical zones from the acoustic data. The coarse silt samples grouped in cluster 4 are fairly well spread between sedimentary, mixed and bedrock physical zones, although more are present in the sedimentary plain zone. The silt and fine silt clusters (1 and 3) show good agreement with the modelled zones and mostly fall into the sedimentary plain zone.

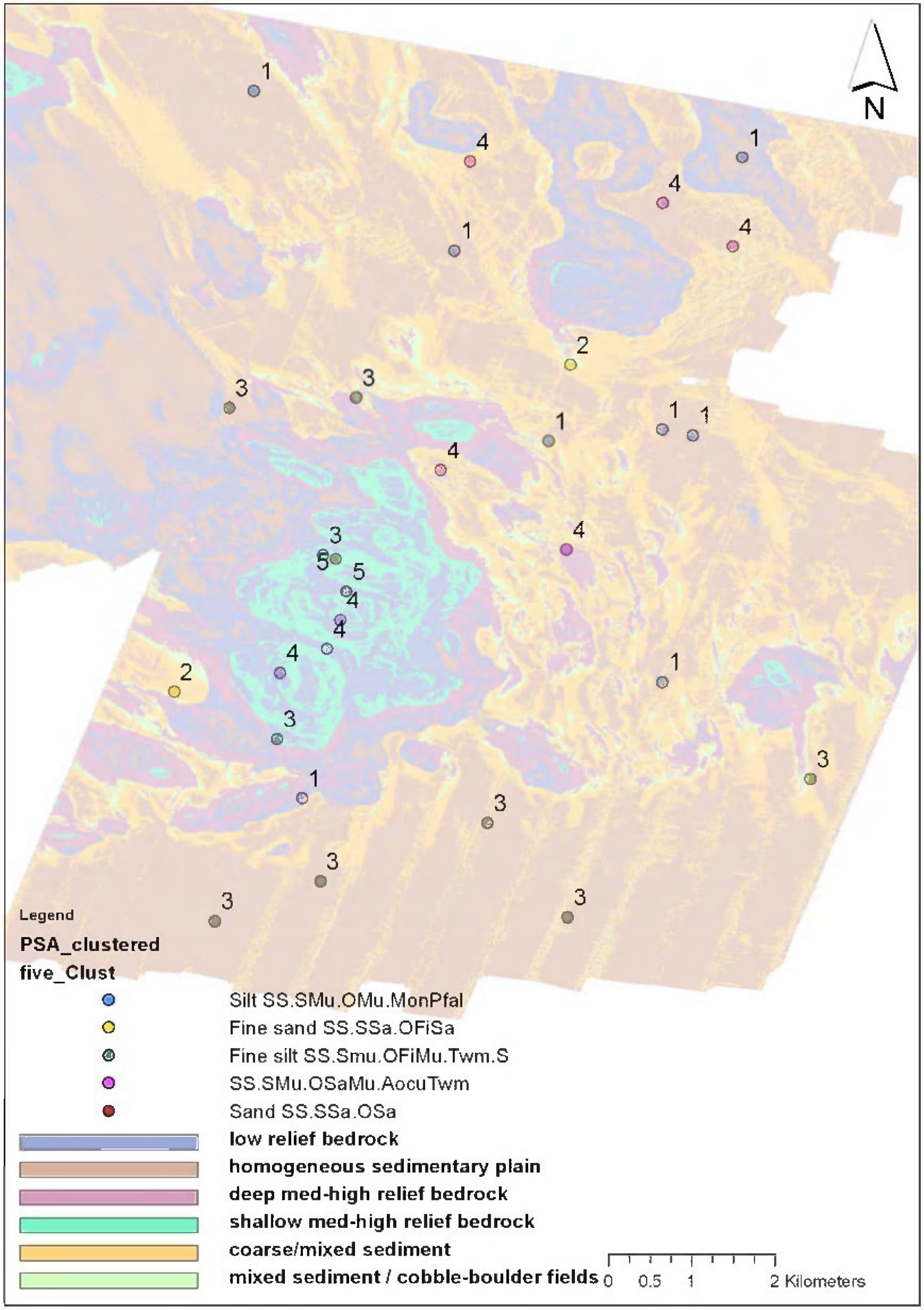


Figure 4. Location of particle size samples at the North West Irish Sea Mounds; labels are the cluster membership for each grab.

Table 5. Cross tabulation of the clustered sediment samples and the predicted physical zone underlying these points.

	Physical zones predicted in the 2006 report				
PSA Cluster	Homogeneous sedimentary plain	Coarse mixed sediment	Bedrock low relief	Deep bedrock mid-high relief	Shallow bedrock mid-high relief
5			1		1
4	3	1	2	1	1
3	5	2	1		1
2		2			
1	6	1		1	

Having clustered the sediment samples and used the cross tabulation to see that they correspond well with the predicted physical zones, the accompanying infaunal data were used to characterise these clusters and zone types. Firstly, ANOSIM was used to determine if the sediment clusters correspond to distinct community types.

Unfortunately, there were no infaunal samples to represent sediment cluster 2. It is apparent that the fauna for sediment clusters 1, 3 and 4 are significantly distinct and hence represent identifiable habitats (Table 6). However, there was only one infaunal sample for cluster 5, hence there is not enough replication to adequately represent this cluster. This has resulted in the infauna from cluster 5 being indistinguishable from those of other clusters.

Table 6. ANOSIM (Analysis of Similarities) for the infaunal samples assigned the same membership as the PSA samples.

Groups	Statistic	Level %	Possible Permutations	Actual Number > = Permutations	Observed
5, 1	1.000	14.3	7	7	1
5, 3	0.378	42.9	7	7	3
5, 4	0.510	25.0	8	8	2
1, 3	0.350	0.4	462	462	2
1, 4	0.598	0.1	1716	999	0
3, 4	0.288	1.4	1716	999	13

Global sample statistic (Global R): 0.424, significance level of sample statistic: 0.1%

Number of permuted statistics greater than or equal to Global R: 0

Cluster 5 infauna has not been included in the SIMPER analysis as there was only 1 sample (Table 8), however the analysis did calculate a very high dissimilarity of this site when compared to the other 3 communities (Table 8). From the SIMPER analysis it is apparent that high abundances of *Monticellina* sp, *Prionospio fallax, Tharyx killariensis* and *Glycera rouxi* are characteristic of cluster 1 and of the medium silt habitat. The coarse silt habitat of cluster 4 is characterised by high abundances of *Galathowenia oculat, Melinna palmata* and *Amphiura chiajei*. The fine silt habitat (Cluster 3) is best characterised by a fairly variable community with low abundances of several species. Figure 5 also indicates that cluster 3 is characterized by low abundance and species presence. By contrast, the coarse silt on cluster 4 is highly diverse and contains almost 10 times more individuals. The medium silt of cluster 1 has less species than that found in cluster 4 but more than clusters 3 and 5.

Table 7. Characteristic infaunal species of the particle size clusters/physical zones as calculated by SIMPER (Similarity Percentages - species contributions). Cluster 2 has not been examined due to an absence of paired infaunal data.

	Average abundance (Contribution to similarity)		
Species	*Cluster 1* Average similarity: 44.53	*Cluster 3* Average similarity: 17.09	*Cluster 4* Average similarity: 32.84
Monticellina sp	45.5 (39.62)	6.67 (21.08)	9.71 (7.87)
Prionospio fallax	24.5 (18.15)	0.33 (> 1.00)	6.64 (> 1.0)
Tharyx killariensis	17.67 (10.55)	1.83 (2.28)	4.36 (> 1.0)
Glycera rouxi	2.17 (1.31)	1.67 (15.44)	1.57 (0.33)
Galathowenia oculata	4.00 (1.39)	14.83 (14.84)	93.57 (45.25)
Tubulanus polymorphus	2.50 (2.12)	0.83 (6.48)	2.57 (0.31)
Terebellides stroemi	1.06 (> 1.0)	2.17 (5.66)	2.14 (0.30)
Melinna palmata	7.00 (> 1.0)	9.17 (> 1.00)	28.14 (14.85)
Amphiura chiajei	1.17 (> 1.0)	1.33 (0.34)	10.29 (5.96)

Table 8. Average dissimilarity between soft substrata clusters based on infaunal data.

	Average dissimilarity between clusters		
	3	4	5
1	82.49	84.19	93.71
3		83.23	90.94
4			90.93

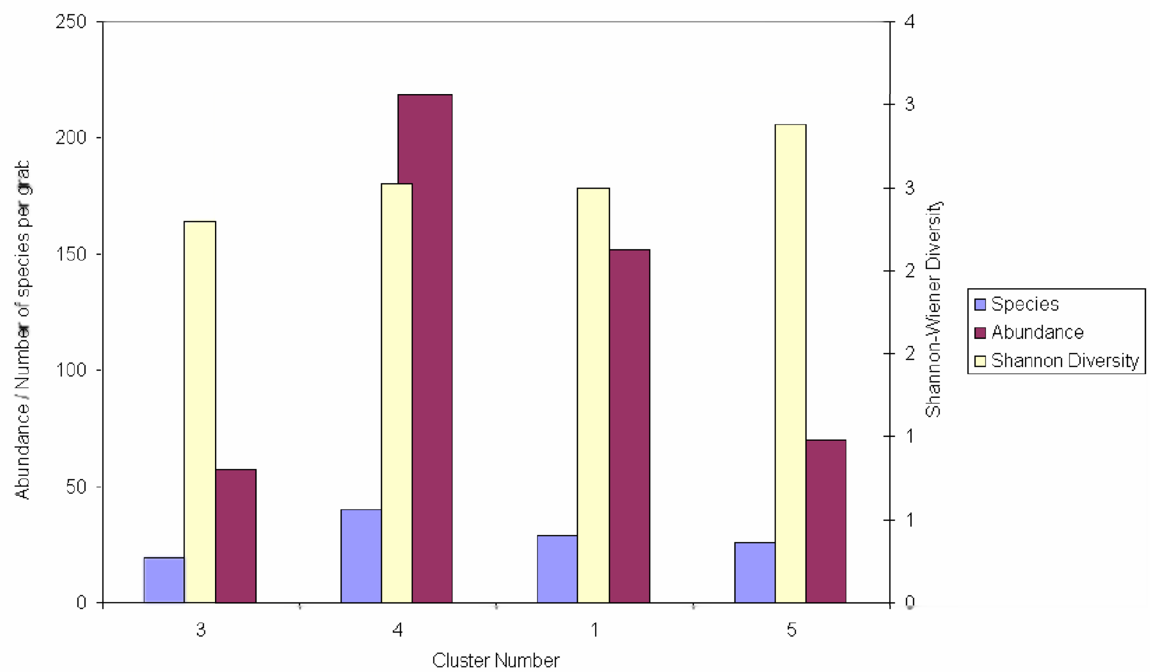


Figure 5. The total number of species, community abundance and Shannon-Wiener Diversity for soft sediment grabs from the North West Irish Sea Mounds sorted by sediment clusters.

The infauna associated with each cluster were then used to determine the biotope represented by each cluster, using the biotope descriptions in Conor *et al* (2006) (Table 9a). It was not always possible to find a good match, and so for clusters 1,2,3 and 4, new biotopes were proposed. Biotope codes were assigned using the same naming structure as for existing biotopes, and these are described in Table 9b.

Table 9a. Biotope code for each sediment cluster with physical description and main fauna present.

Cluster no.	Description (Relative clay content)	Major fauna	Biotope (EUNIS code)
5	Extremely poorly sorted sand (very low clay content)	Not enough replication	SS.SSa.OSa (A5.27)
2	Very poorly sorted fine sand (low clay content)	No faunal samples	SS.SSa.OFiSa (A5.26)
4	Very poorly sorted coarse silt (moderate clay content)	Dense *Galathowenia oculata* *Melinna palmata*	SS.SMu.OSaMu.Gocu Twm (A5.35)
1	Very poorly sorted silt (high clay content)	*Monticellina* sp *Prionospio fallax* *Tharyx killariensis*	SS.SMu.OMu.MonPfal (A5.37)
3	Very poorly sorted fine silt (very high clay content)	Sparse *Galathowenia oculata* *Melinna palmata*	SS.Smu.OFiMu.TwmS (A5.36)

Table 9b. Biotope code description.

Biotope	Description
SS.SSa.OSa	Offshore sands and muddy sands
SS.SSa.OFiSa	Offshore fine sands and muddy sands
SS.SMu.OSaMu.AocuTwm	Offshore sandy mud with *Galathowenia oculata* and other tube worms
SS.SMu.OMu.MonPfal	Offshore mud rich in *Monticellina* sp., *Prionospio fallax* and *Tharyx killariensis*
SS.Smu.OFiMu.Twm.S	Offshore fine mud with sparse tubeworm community. Also heavily bioturbated with small and large burrow apertures apparent.

3.2. Hard Substrata Habitats

Due to the poor visibility, all of the hard physical zone has been classified as CR.MCR.EcCr.UrtSed. Where possible, the existing biotope structure has been used to develop the new code required for this habitat. It follows the existing 'moderate energy circalittoral rock - echinoderms and crustose communities' and finishes with the dominant and characteristic faunal species, *Urticina* spp. (probably *U. eques*). The final suffix code of 'Sed' refers to the fact that the rock surfaces are extensively covered in a layer of silt; in some areas this infill is probably thick and of a coarse, sandy nature. The grabs taken in this rocky biotope suggest that the infill is typically sandy and were classified as either SS.SSa.OSa or SS.SSa.OFiSa. Due to the predominance of the rock surfaces, the soft substrata biotopes have not been used.

Figure 6 shows the location of all of the video tows (both sledge and drop frame) undertaken on the south eastern corner of the North West Irish Sea Mounds with figures 7, 8 and 9 further classifying the tows into broad habitat types. Table 10 illustrates how the the habitat types in figures 6-9 relate to the physical types named in table 11 and the biotope codes featured in figure 10.

Table 10. How the habitat types in figures 6-9 relate to the physical types named in table 11 and the biotope codes featured in figure 10.

Physical Types (table 11)	Habitat Types (Figures, 6-9)	Biotope Code (Figure 10)
Sedimentary plain	1. Soft sediment	SS.SMu
	2. Soft sediment < mixed soft sediment	SS.SMu
	3. Soft sediment = mixed soft sediment	SS.SMu
	4. Soft sediment > mixed soft sediment	SS.SMu
Mixed soft substratum	5. Mixed soft sediment	CR.LCR
	6. Mixed soft sediment < cobble/boulder	CR.LCR
	7. Mixed soft sediment = cobble/boulder	CR.LCR
	8. Mixed soft sediment > cobble/boulder	CR.LCR
Cobble boulder	9. Cobble/Boulder	CR.LCR
	10. Cobble/Boulder = Bedrock	CR.LCR
Low relief bedrock	11. Bedrock LM relief	CR.MCR
Shallow M/H relief bedrock	12. Bedrock H relief	CR.MCR
Deep M/H relief bedrock	12. Bedrock H relief	CR.MCR

(Note A) *Soft sediment < mixed soft sediment* indicates predominantly soft sediment with some mixed sediment, B) *Soft sediment = mixed soft sediment* indicates a balance of soft sediment and mixed sediment C) *Soft sediment > mixed soft sediment* indicates predominantly mixed sediment with some soft sediment.

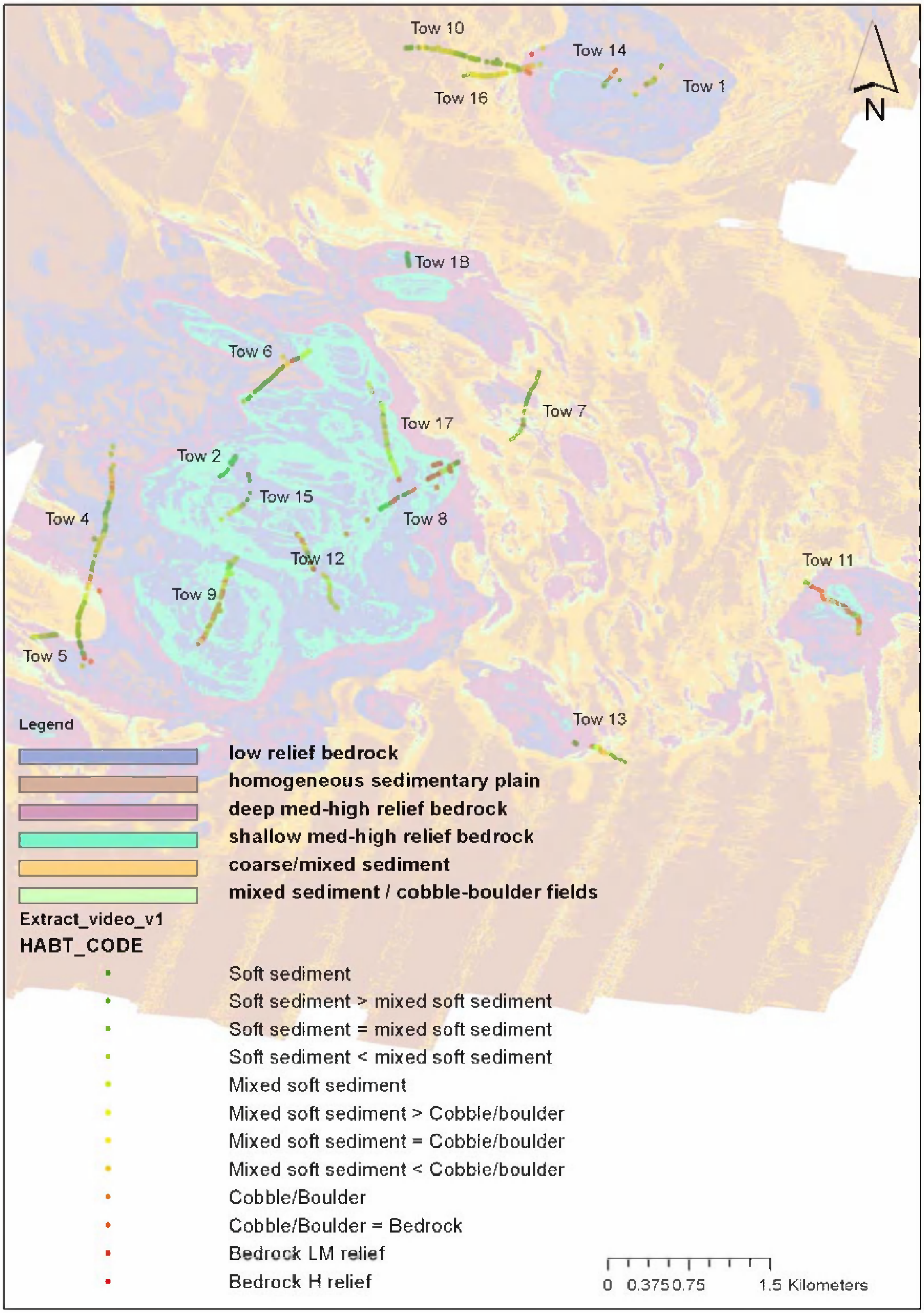


Figure 6. Location of drop frame and epibenthic sledge tows over the south eastern corner of the North West Irish Sea Mounds.

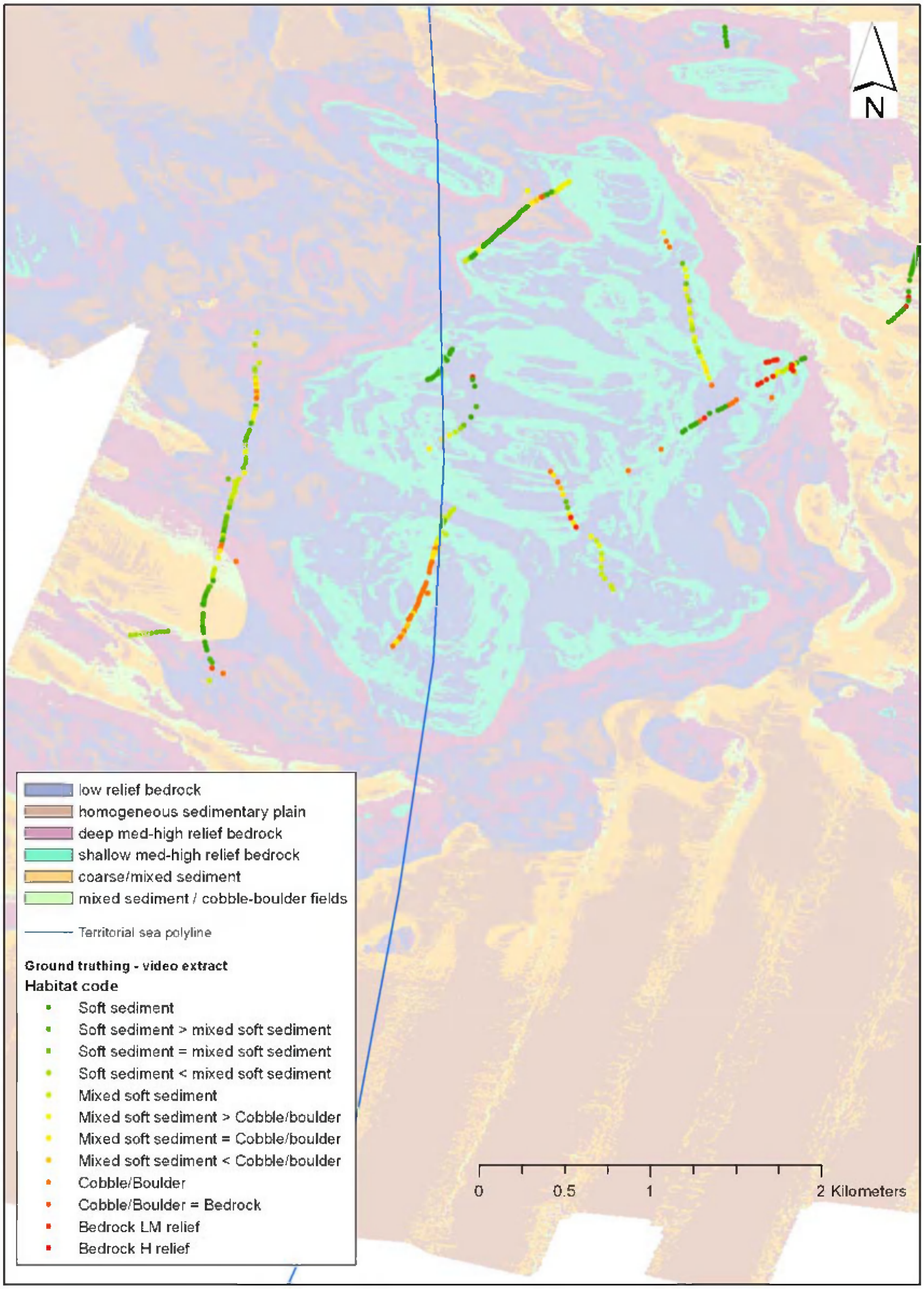


Figure 7. Central survey area with tows classified into broad substrata types. Habitat codes are on a gradient with; 1) soft mud, 2) mixed mud, sand and gravel substratum, 3) cobble and boulder substratum, 4) low relief bedrock and 5) high relief bedrock.

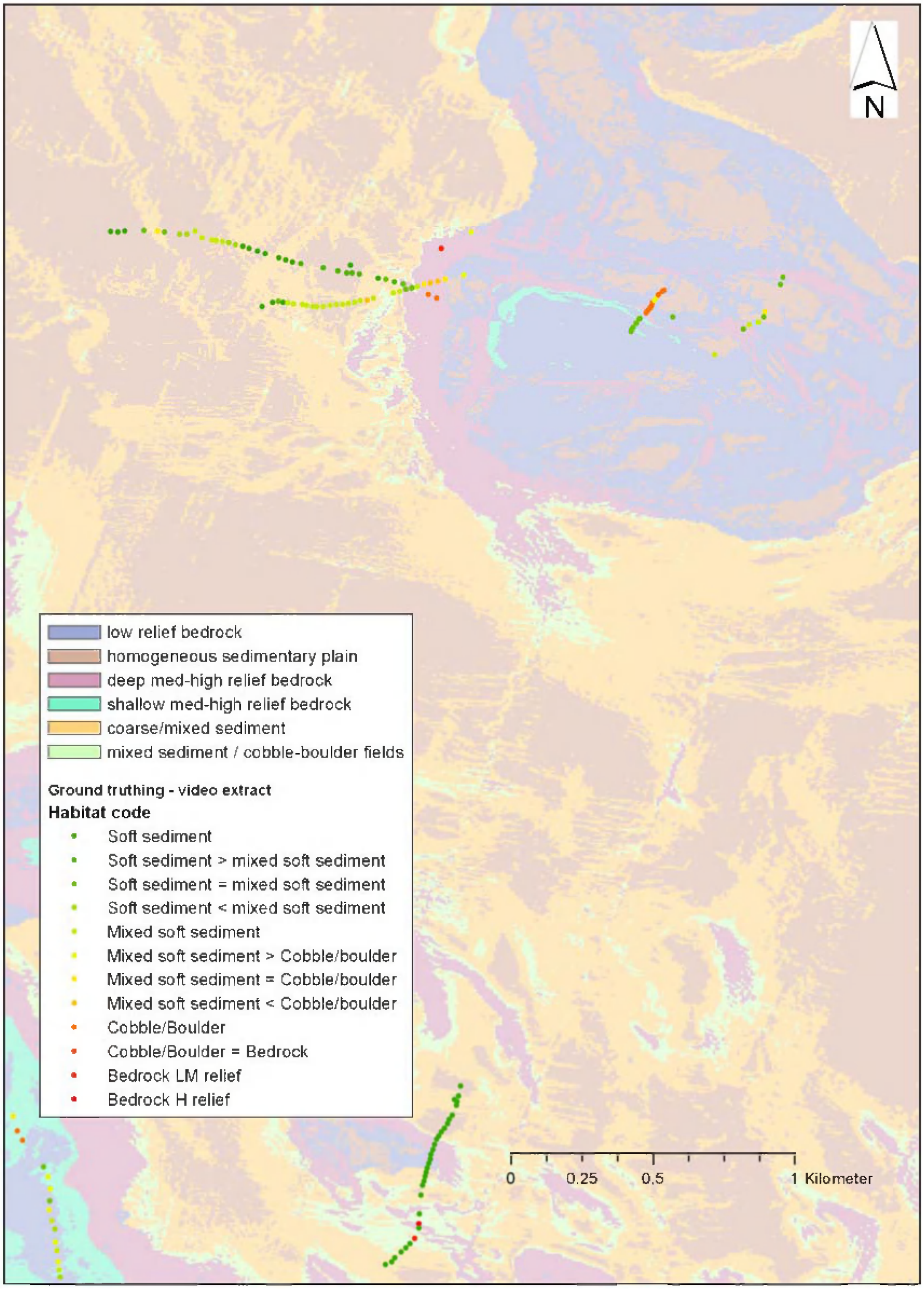


Figure 8. Northern survey area with tows classified into broad substrata types. Habitat codes are on a gradient with; 1) soft mud, 2) mixed mud, sand and gravel substratum, 3) cobble and boulder substratum, 4) low relief bedrock and 5) high relief bedrock.

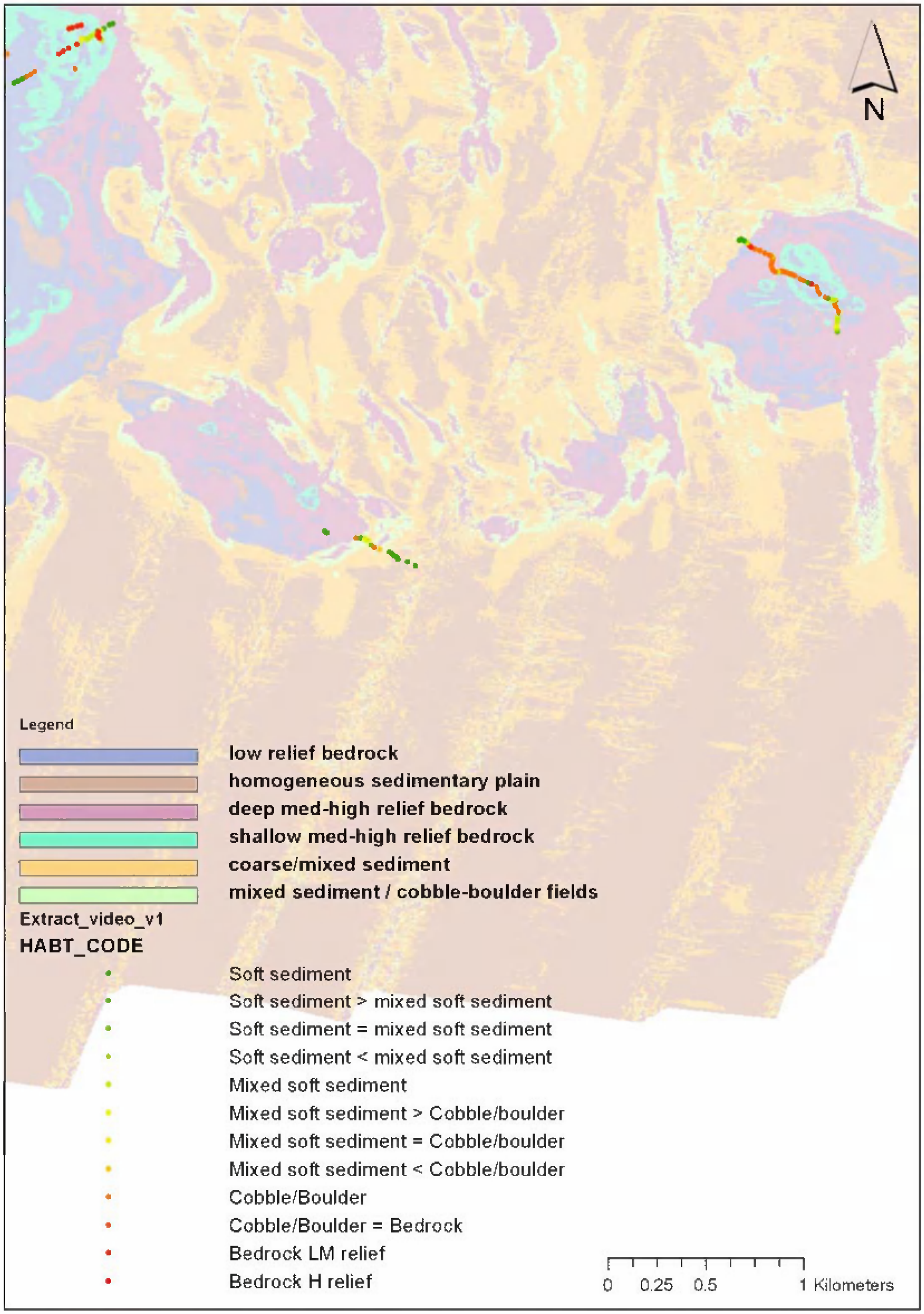


Figure 9. South-eastern survey area with tows classified into broad substrata types. Habitat codes are on a gradient with; 1) soft mud, 2) mixed mud, sand and gravel substratum, 3) cobble and boulder substratum, 4) low relief bedrock and 5) high relief bedrock.

Using tools within ArcGis, the predicted physical zones underlying the actual observed substrata have been extracted. A cross tabulation of the predicted and observed substrata type are shown in Table11. It is apparent that many of the areas predicted to have bedrock appeared on the video to be softer sediments. This apparent discrepancy was probably due to deep sediment overlaying the rock surfaces.

Table 11. Cross tabulation table of the ground truthed substrata classification and the predicted physical zones from the 2006 report.

	Video substrata classifications					
Physical zones	Sedimentary plain (1.0)	Sedimentary plain with some coarser material (1.5)	Mixed soft substratum (2.0)	Mixed substratum with some cobble(2.5)	Cobble boulder (3.0)	Bedrock all (4.0)
Sedimentary plain	8%	9%	9%	12%	2%	0%
Mixed soft substratum	52%	22%	24%	10%	0%	0%
Cobble boulder	8%	11%	16%	0%	13%	12%
Low relief bedrock	0%	0%	0%	0%	0%	0%
Shallow M/H relief bedrock	22%	26%	36%	59%	59%	80%
Deep M/H relief bedrock	11%	31%	15%	20%	26%	8%

Overall, it is apparent from Table 11 that as the modeled zones progress from the soft sedimentary plain to bedrock, the video classification results also changed from predominantly soft/mixed grounds to that of bedrock. It is possible that the modeled zones have in some instances over-classified sedimentary plain areas as mixed soft substratum. It also apparent that areas predicted to be bedrock by Mitchell *et al*, (2006), appeared on the video ground truthing to be dominated by soft sediments. This is probably a product of three things; 1) positional errors, 2) very poor video visibility and, 3) sediment infilling and overlying low relief bedrock. Video classification 3 (cobble/boulder substratum) has also failed to spot predicted cobble boulder areas and has typically fallen on bedrock areas.

The distribution of the cross tabulation would suggest that video was unable to distinguish bedrock relief zones. On the video, there was only one hard biotope that could be distinguished, hence for the habitat map, the three bedrock zones modeled in the 2006 report have been amalgamated into one hard substratum category. In the video footage, it has been very difficult to separate sedimentary plain and mixed soft substrata. Once again, these two categories have been combined into one 'mixed soft substrata'; where possible, the grab results will be used to delineate biotope subdivisions in this area (see section 3.3). The reclassifications suggested above result in a new cross tabulation analysis shown in Table 12.

Table 12. Physical zones reclassified accordingly.

	1	1.5	2	2.5	3	4
Soft substratum	59%	32%	32%	22%	2%	0%
Cobble boulder	8%	11%	17%	0%	13%	12%
All bedrock	33%	57%	51%	78%	85%	88%

Table 12 shows the reclassified physical zones based on the video transect ground truthing. There is a clear gradient of increasing hardness in the video data and a progression from soft to hard substrata of the modeled physical zones. It is unfortunate that only three zones can be distinguished from the video but this will lead to the resulting habitat map having a greater confidence. The unified physical zones are shown in Figure 10.

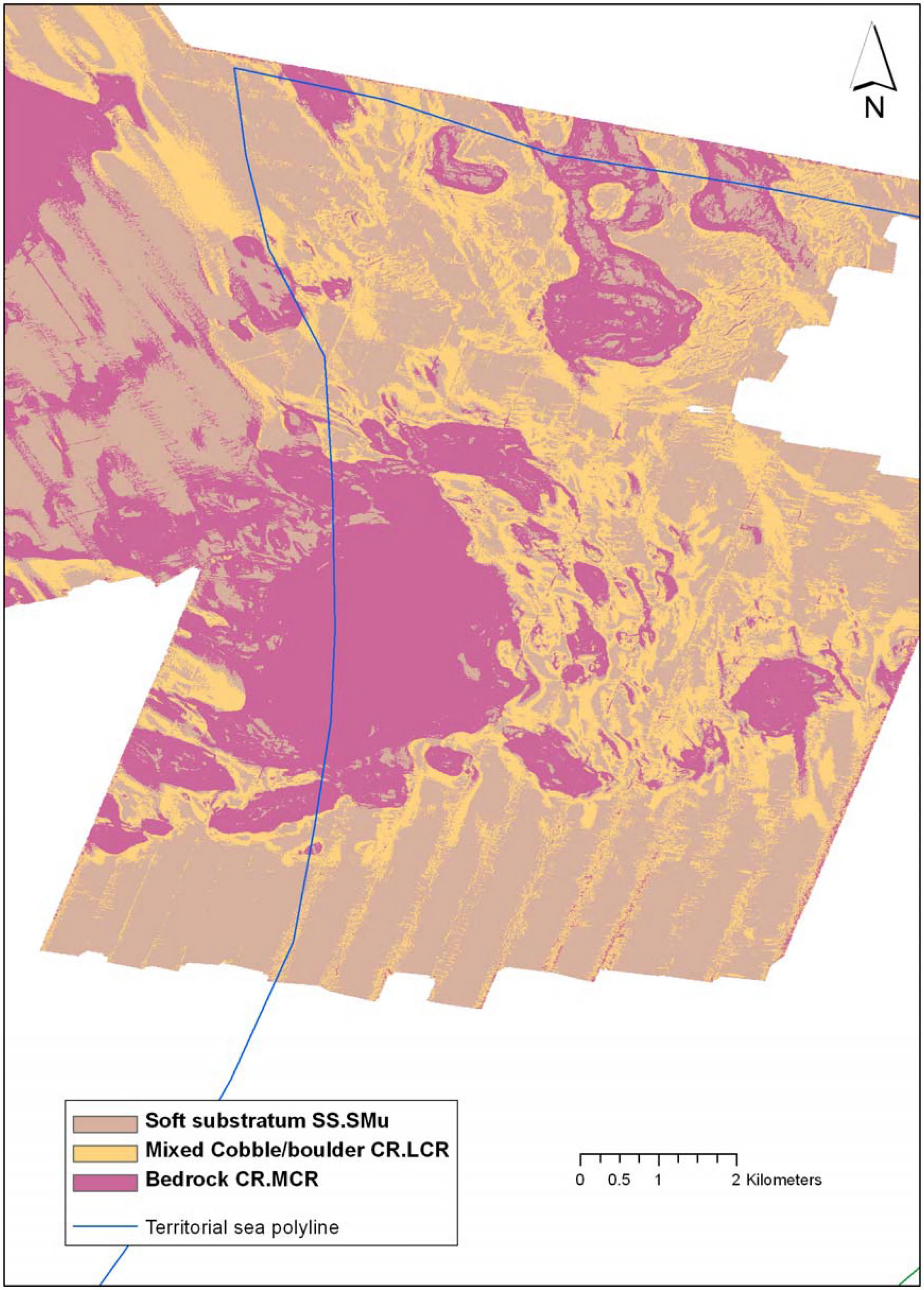


Figure 10. Mapping showing the distribution of level 3 Biotope habitats. Physical habitat map produced by combining the original physical zones (Mitchell *et al*, 2006) following the integration of the video ground truthing.

3.3. Biotope Based Habitat Map

Combining both the video and grab samples has facilitated the production of a biotope-based habitat map (Figure 11). Due to the poor visibility during the video and stills collection, detailed differentiation of the biotopes present has not been possible. The biotope codes for the hard and mixed substrata are listed in Table 13. The predicted area for each habitat type can be found in Table 14.

Table 13. Biotopes used for hard and mixed substrata for the North West Irish Sea Mounds. * Indicates a new biotope proposed for the purposes of this study.

Physical description	Major fauna	Other notes	Biotope (EUNIS code)
Bedrock outcrops with extensive sediment infill and veneers	Abundance *Urticina eques* and brittle stars (probably *Ophiothrix fragilis* and *Ophiocomina nigra*). Short hydroid and bryozoan turf sometimes distinguishable from silt veneer.	Moderate energy circalittoral rock. Echinoderms and crustose communities. All surfaces covered in silt except for those with the most extreme aspect. Some areas are likely to be extensively infilled with course soft sediment. This sedimentation is despite a moderate tidal current that accelerates over the rock surfaces.	* CR.MCR.EcCr.UrtSed (A4.21-)
Mixed / spares cobble and boulder with finer material	Soft sediment with small and large burrows (*Nephrops*). Rocky surfaces with characteristic *Urticina eques*. This habitat also includes areas of firmer, coarser sediment often colonised by tube worms.	Low energy circalittoral mixed sediment. Offshore circalittoral mixed sediment. Cobble boulder on a soft substrata background. Either very soft, bioturbated mud or coarser, firmer material with tubeworms.	* CR.L.SMx.OMx. (A5.45)
All soft substrata	Large and small aperture burrows in softer areas, some Sabellid worms. Occasionally dense tube worms in firmer, coarser areas.	Sublittoral cohesive mud and sandy mud communities. Bioturbated mud and sand. Low tidal currents. Then close to grab samples, this biotope has been sub-divided by fauna.	SS.SMu. (A5.3)

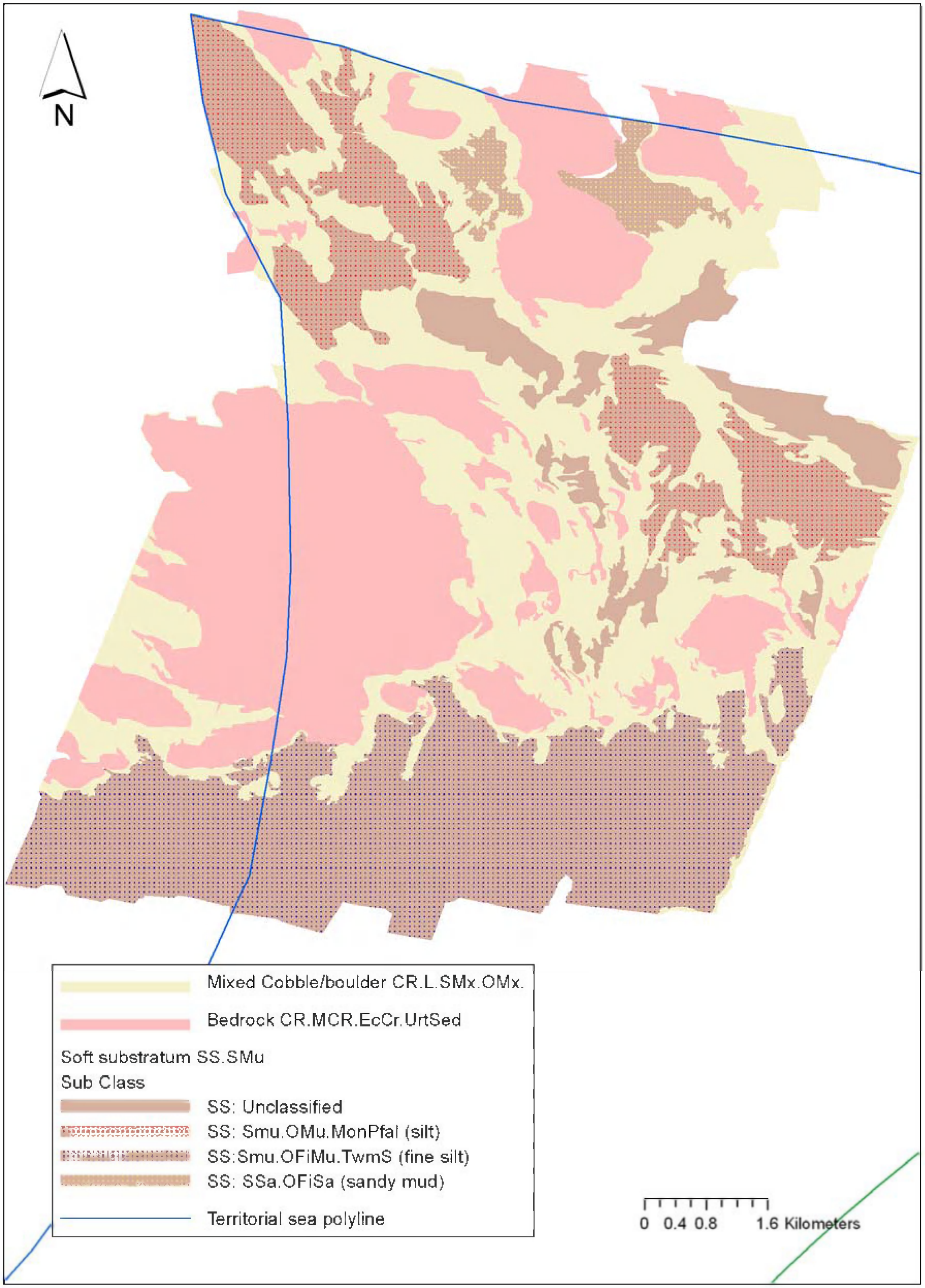


Figure12. Final habitat map for the south-western section of the North West Irish Sea Mounds.

Table 14. Predicted areas for the habitats identified at the North West Irish Sea Mounds.

Habitat	Biotope	Area (km2)
Bedrock outcrops with extensive sediment infill and veneers	CR.MCR.EcCr.UrtSed.	16.0
Mixed / spares cobble and boulder with finer material	CR.L.SMx.OMx.	16.5
All soft substrata	All SS biotopes	21.2
Soft substrata	Unclassified	2.7
Soft substrata	SS.SMu.OMu.MonPfal	5.8
Soft substrata	SS.SMu.OFiMu.TwmS	11.7
Soft substrata	SS.SSa.OFiSa	1.1

Due to the poor video visibility, only the very conspicuous fauna were apparent, i.e. *Urticina* (Figure 13a and 13c). However, on a couple of stills photographs more species could be seen and the nature of the turf observed. Encrusting turf species on rock also included a hydroid/bryozoan turf, brittle stars (probably *Ophiothrix fragilis* and *Ophiocomina nigra*), small sponges, and occasional *Alcyonium* sp.

The habitats with the cobble and boulder content to the sediment were classified with the new biotope code CR.L.SMx.OMx - Low energy circalittoral mixed sediment (Figures 14 a, b and c), offshore circalittoral mixed sediment. Cobble boulder on a soft substrata background. The rock surfaces have a similar but sparser community than that seen on the hard substratum. The soft substrata between cobble and boulder was either sand or bioturbated mud.

Although the grabs were split between five groups based on the physical properties of the sediment, the points for two of these groupings were on predominantly bedrock areas with their own biotope code from the video analysis. The soft substrata were subdivided into three biotope divisions based on the grab ground-truthing – only two have a biological element to the classification. The southern sedimentary plain was characterised by heavily bioturbated fine silt coded SS.Smu.OFiMu.Twm.S (Table 9a and 9b, Figure 16 a, b and c). The soft sediment pockets at the base of the rock to the north and north-east were classified as SS.SMu.OMu.MonPfal (Table 9a and 9b, Figures 15 a, b and c). In the north-eastern corner of the survey area is a patch of coarser sediment classified as offshore fine sand/muddy sand (SS.SSa.OFiSa). Due to the low number of accompanying faunal grabs, there is no information about the species present in this biotope.

3.4. Photographic stills from North West Irish Sea Mounds Survey 2007

a

b

C

Figure 13 a, b and c. Bedrock substratum (CR.MCR.EcCr.UrtSed.) from North West Irish Sea Mounds survey 2007.

a

b

c

Figure 14 a, b and c. Cobble and boulder substratum (CR.L.SMx.OMx.)

a

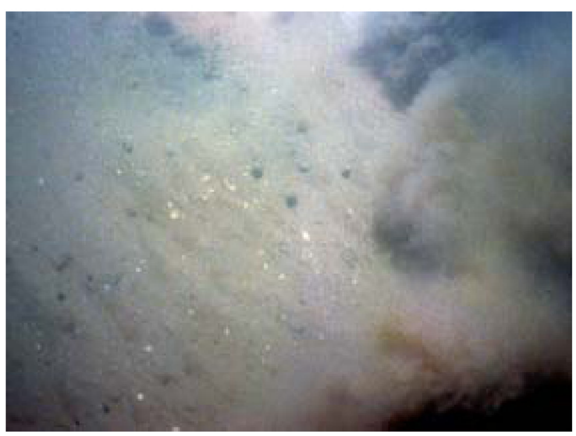
b

c

Figure 15 a, b and c. Mixed and coarse soft substrata (e.g. SS.SSa.OFiSa.)

a

b



c

Figure 16 a, b and c. Mud substratum (SS.SMu.)

4.0 Discussion and Conclusions

The habitat mapping of the North West Irish Sea Mounds was hampered by poor visibility during the video ground-truthing cruises. The resulting habitat map has been maintained at the original spatial resolution of 5 meters. The habitat classification used on the map has been implemented to a fairly low level rather than using more detailed codes with a low confidence. In Mitchell *et al*, (2006), the site of interest was classified into six physical zones which included both hard and soft substrata. However, due to the visibility during the ground truthing, it was not possible to distinguish between all six zones. Based on the seabed features that could be seen on the video footage, three physical zones were confidently identified to the highest biotope level possible and the dominant fauna characterized.

The three main level 3 habitats observed at the North West Irish Sea Mounds were CR.MCR.EcCr.UrtSed, CR.L.SMx.OMx. and SS.SMu. The SS.SMu biotope was further divided into three other soft sediment biotopes based on the particle size clustering; two of these subdivisions were level four codes that included information about the fauna. The exposed rock surfaces (CR.MCR.EcCr.UrtSed) are biologically interesting for several reasons. Firstly, the surfaces had a very high density of *Urticina* spp. (probably *U. eques*), which appeared to be highly characteristic of the hard rock habitats on the North West Irish Sea Mounds. The lack of visibility on the video footage revealed little of the other epibenthic species present. However, the few stills available did provide more detail on the smaller, turf-forming species present, which appeared to suggest that the fauna was fairly rich and worthy of further investigation. Based on the Natura 2000 Code 1170 definition of reefs/ EC Habitats Directive Interpretation Manual, it appears that this site represents Annex I reef habitat. However, only through further investigation of the smaller fauna present on the rock surfaces can the exact biological quality of this site be established.

Although not the original features of interest, the soft sediment areas were varied and biologically diverse. The numerous infills and small pockets of firmer sediment between rock surfaces were often characterised by dense tube worm communities (*Galathowenia oculata* and *Melinna palmate*). The finer areas were extensively bioturbated in places and numerous burrowing megafauna were apparent of the sediment surface. It was only on these soft substrata was there an evidence of anthropogenic activity when trawl marks were observed in the back-scatter images (Mitchell *et al,* 2006). It is known that trawling for *N norvegicus* occurs in some of the some substrates adjacent to this area and this is the likeliest source of these marks. However, semi-pelagic fishing does occur throughout the North Channel and although this gear is designed to avoid the bottom occasional contact may be made. Some of the other outcrops to the north east of the area are known as the "Herring Peaks"; however, this fishery is pelagic and unlikely to directly influence the benthic community structure.
This above does illustrate the wider biological importance of the area.

The location of the area north of the NW Irish Sea Gyre and summer stratified area suggests that water column structure may have a strong influence on the development of benthic communities and it would be a key recommendation that the AFBI oceanographic programme extend its routine survey work to include regular CTD casts in the area.

Further video work at the North West Irish Sea Mounds would greatly improve the resulting habitat maps for this area. The tidal currents at this site mean that there will always be difficulties in sampling but detailed project planning to allow cruise time to be scheduled at Neap tides in the later Spring or Summer months would undoubtedly improve image quality. The strong currents are liable to make use of ROV's in this area difficult although the use of weighted tethers and "garage" systems may make limited use possible. Similarly the visibility will limit the choice of camera system as high backscatter can often adversely affect high definition digital systems. Given the relatively high possibility that any single cruises on this area may suffer from poor conditions. It may have to be recognised that a series of short sampling events targeted at this area when conditions are appropriate, perhaps using passage time on other surveys, may allow for fuller characterisation of the area. This would undoubtedly prove a more cost effective approach as it would minimize wasted ship time, which in most cases makes up the most expensive part of surveys of this type.

Although not overtly undertaken as part of the MESH project, outputs from this project will be lodged with the MESH meta-database. Furthermore, further work arising from the project is liable to contribute to the further testing of MESH protocols.

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6.0 Acknowledgements

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7.0. Appendix

Table 1. Location of PSA grabs from the North West Irish Sea Mounds in 2003-2007.

Date	Code	Decimal latitude	Dec longitude	Descriptor
21/1/2007	NC 31 - 07A	54.4581	-5.0684	shelly mud *Nephrops*
21/1/2007	NC 31 - 07B	54.4573	-5.0697	shelly mud *Nephrops*
21/1/2007	NC 36 - 07A	54.4492	-5.0480	*Dentalium* shlls in mud
21/1/2007	NC 36 - 07B	54.4497	-5.0463	*Dentalium* shlls in mud
21/1/2007	NC 26 - 07A	54.4452	-5.0253	compact shelly mud
21/1/2007	NC 26 - 07B	54.4452	-5.0254	compact shelly mud
21/1/2007	NC 25 - 07A	54.4500	-5.0179	compact mud with stones
21/1/2007	NC 25 - 07B	54.4502	-5.0168	compact mud abundant tubeworms
21/1/2007	NC 23 - 07A	54.4396	-5.0188	shelly sand tubeworms
21/1/2007	NC 23 - 07B	54.4405	-5.0178	grab almost totally tubeworms
21/1/2007	NC 32 - 07A	54.4191	-5.0228	very soft mud
21/1/2007	NC 32 - 07B	54.4200	-5.0222	very soft mud
21/1/2007	NC 29 - 07A	54.4071	-5.0375	
21/1/2007	NC 29 - 07B	54.4077	-5.0359	
21/1/2007	NC 34 - 07A	54.3940	-5.0269	stones in soft mud
21/1/2007	NC 34 - 07B	54.3933	-5.0255	
21/1/2007	NC 22 - 07A	54.3846	-5.0113	mud with stones
21/1/2007	NC 22 - 07B	54.3828	-5.0095	cobble
21/1/2007	NC 28 - 07A	54.3684	-5.0370	mud with *Brissopsis* less shell
21/1/2007	NC 28 - 07B	54.3678	-5.0358	mud with *Brissopsis*
21/1/2007	NC 27 - 07A	54.3799	-5.0461	resembled mud from "mudpatch"
21/1/2007	NC 27 - 07B	54.3780	-5.0444	resembled mud from "mudpatch"
21/1/2007	NC 30 - 07A	54.3687	-5.0767	soft mud
21/1/2007	NC 30 - 07B	54.3674	-5.0739	soft mud
22/1/2007	NC 24 - 07A	54.4316	-5.0583	soft mud
22/1/2007	NC 24 - 07B	54.4241	-5.0586	soft mud
22/1/2007	NC 20 - 07A	54.4265	-5.0329	shelly mud
22/1/2007	NC 20 - 07B	54.4277	-5.0355	shelly mud
22/1/2007	NC 34(100) 07 A	54.4398	-5.0538	shelly mud

22/1/2007	NC 34(100) 07 B	54.4400	-5.0480	shelly mud
22/1/2007	NC 37 - 07A	54.4066	-5.0608	shell in jaws but mud
22/1/2007	NC 37 - 07B	54.4050	-5.0632	shelly mud
22/1/2007	NC 33 - 07A	54.4230	-5.0723	
22/1/2007	NC 33 - 07B	54.4214	-5.0738	
22/1/2007	NC 38 - 07A	54.3969	-5.0618	tubeworms
22/1/2007	NC 38 - 07B	54.3948	-5.0631	tubeworms
22/1/2007	NC 21 - 07A	54.3923	-5.0783	mud with *Maldanid*
22/1/2007	NC 21 - 07B	54.3900	-5.0794	tubeworms

Table 2. The location of the faunal grabs collected from the North West Irish Sea Mounds in 2006.

Station	Date	Decimal latitude	Decimal longitude
1a	12/11/2006	54.4207	-5.0174
1b	12/11/2006	54.4206	-5.0255
2a	12/11/2006	54.4194	-5.0348
2b	12/11/2006	54.4194	-5.0378
3a	12/11/2006	54.4151	-5.0458
3b	12/11/2006	54.4163	-5.0495
4a	12/11/2006	54.4007	-5.0620
4b	12/11/2006	54.4000	-5.0603
5a	12/11/2006	54.3937	-5.0650
5b	12/11/2006	54.3943	-5.0668
6a	12/11/2006	54.3867	-5.0653
6b	12/11/2006	54.3871	-5.0672
7a	12/11/2006	54.3799	-5.0614
7b	12/11/2006	54.3807	-5.0645
8a	12/11/2006	54.3714	-5.0605
8b	12/11/2006	54.3717	-5.0625
9a	12/11/2006	54.3651	-5.0649
9b	12/11/2006	54.3649	-5.0664
10a	12/11/2006	54.4071	-5.0622
10b	12/11/2006	54.4071	-5.0622

Table 3. Particle size parameters for samples collected from the North West Irish Sea Mounds between 2003-2007.

		Folk and Ward (from phi values)				Percentages in category					
	Sample	Mean	Sorting	Skewness	Kurtosis	(Gravel)	Cobbles	Pebbles	Sand	Silt	Clay
2007	NC 100 -07	5.112	3.176	-0.276	0.899	3.23	0	3.23	29.39	59.13	8.26
2007	NC 21 -07	3.694	3.916	0.132	0.618	9.24	0	9.24	42.8	37.54	10.43
2007	NC 22 -07	6.261	2.632	-0.295	1.192	4.57	0	4.57	14.25	70.24	10.94
2007	NC 23 -07	4.562	3.642	-0.252	0.664	7.24	0	7.24	35.66	48.72	8.37
2007	NC 24 -07	6.529	2.27	-0.116	0.871	1.18	0	1.18	13.68	71.41	13.73
2007	NC 25 -07	5.279	3.474	-0.281	0.756	4.19	0	4.19	30.14	52.65	13.02
2007	NC 26 -07	4.577	3.773	-0.148	0.689	6.28	0	6.28	36.57	45.31	11.84
2007	NC 27 -07	6.659	2.157	-0.091	0.84	0	0	0	12.05	73.43	14.52
2007	NC 28 -07	6.767	1.929	-0.055	1.028	0	0	0	7.7	79.98	12.33
2007	NC 29 -07	4.629	3.586	-0.087	0.708	3.95	0	3.95	40.59	44.31	11.15
2007	NC 30 -07	6.807	2.043	-0.028	0.876	0	0	0	7.66	77.11	15.23
2007	NC 31 -07	5.207	2.861	0.076	0.795	2.48	0	2.48	36.03	51.25	10.24
2007	NC 32 -07	5.43	2.919	-0.139	0.74	1.14	0	1.14	34.45	53.79	10.62
2007	NC 33 -07	6.522	2.183	-0.106	0.846	0.14	0	0.14	14.21	72.64	13
2007	NC 34 -07	5.703	2.816	-0.164	0.77	0.17	0	0.17	31.19	56.97	11.67
2007	NC 36 -07	4.766	3.625	-0.071	0.852	8.34	0	8.34	35.44	45.32	10.9
2007	NC 37 -07	1.132	4.854	0.495	0.553	49.19	0	49.19	11.1	32.27	7.44
2007	NC 38 -07	3.361	4.328	-0.18	0.558	28.55	0	28.55	20.77	43.33	7.35
2007	NC STN20	3.572	3.868	0.08	0.768	12.23	0	12.23	41.5	38.12	8.15
2006	NCP 10B	6.498	3.085	-0.327	1.613	7.52	0	7.52	7.57	72.17	12.74
2006	NCP 1B	5.434	3.016	-0.134	0.72	0.54	0	0.54	34.78	52.74	11.93
2006	NCP 2B	5.306	3.279	-0.2	0.777	3.01	0	3.01	32.86	52.27	11.86
2006	NCP 3B	4.495	3.773	-0.144	0.866	10.76	0	10.76	35	45.87	8.37
2006	NCP 4B	3.311	4.818	-0.362	0.576	29.43	0	29.43	15.28	46.97	8.32
2006	NCP 5B	4.455	3.884	-0.242	0.715	11.62	0	11.62	32.93	46.18	9.27
2006	NCP 6B	6.619	2.064	-0.14	0.956	0.06	0	0.06	11.26	76.98	11.71
2006	NCP 7B	5.239	3.659	-0.428	1.106	12.25	0	12.25	16.81	61.16	9.78
2006	NCP 8B	6.831	2.148	-0.059	0.89	0	0	0	9.51	73.96	16.53
2003	NCP2A	2.98	3.7	0.58	0.7	9.19	0	9.19	54.78	27.93	8.1

Table 4. Infaunal species matrix for Day Grabs (0.1 m^2 day-grab with a bite aperture of 0.1m^2) collected at the North West Irish Sea Mounds in 2006.

		1	**1**	**2**	**2**	**3**	**3**	**4**	**4**	**4**	**5**	**5**	**6**	**6**	**7**	**7**	**8**	**8**	**9**	**9**	**10**	**10**
Taxon	**Authority**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**C**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**	**A**	**B**
Opercularella lacerata	(Johnston 1847)									P												
Hydrallmania falcata	Linnaeus 1758									P												
Cerianthus lloydii	Grosse 1859					9	3	2				1										
PLATYHELMINTHES	-		1							1												
NEMERTEA spp	-	7			1	1	1		1		2	2	1								2	5
Tubulanus polymorphus	Reiner 1804	2	3	4	4		2		9		6	1	2	1		2	1				1	
Cerebratulus spp	Renier 1804		1	4			1														1	2
Golfingia spp juv	Lankester 1885							2	3		1											
Golfingia elongata	(Keferstein 1862)							1														
Thysanocardia procera	(Mobius 1875)											1		1								
Aphroditidae spp juv	-							1														
Polynoidae spp juv	-									1		1										
Polynoidae spp indet	-				1				2							1						
Harmothoe antilopes	McIntosh 1876			1							2											
Harmothoe fragilis	Moore 1910	1								3												
Harmothoe impar	(Johnston 1839)																				1	
Lepidonotus squamatus	(Linnaeus 1758)									3												
Pholoe baltica	Örsted 1843			1	1	1	1	1	2		3	2										
Pseudomystides limbata	(Saint-Joseph 1888)																				1	
Eumida sanguinea	(Oersted 1843)									1												
Notophyllum foliosum	(M Sars 1835)									1												
Glycera alba	(Muller 1776)	2	4		2	2	1		2			1			1	1						
Glycera lapidum	Quatrefages 1866		1					1	1													
Glycera rouxi	Audouin & Edwards 1833	3		2	3	4	3	1	2			1	4	3		5	1	1		2		1
Goniada maculata	Oersted 1843	1		1		2		3	3		1										1	
Hesionidae spp juv	-										1		1									
Podarkeopsis capensis	(Day 1963)			1	1		1					2										

Gyptis rosea	(Malm 1874)	2	2		2				1											5		
Ancistrosyllis groenlandica	McIntosh 1879	3	2	6	5																	1
Litocorsa stremma	Pearson 1970	3	3	2	3		1				3		2	1								
Glyphohesione klatti	Friedrich 1950	10	2	10	13		1					2			2	1						1
Ehlersia sp A	-					1		1	6		3	5		1							1	
Exogone hebes	(Webster & Benedict 1884)				1																	
Autolytus spp	Grube 1850									2												
Nephtys spp juv	Cuvier 1817		2										1	1								
Nephtys hystricis	McIntosh 1900										2											
Nephtys incisa	Malmgren 1865		1	2											1	3				1		8
Lumbrineris gracilis	(Ehlers 1868)		2	1		1	2	2	3		3	3										
Lumbrineris hibernica	(McIntosh 1903)	3	1		1	1	3		1		2	5	2	1	7	1		1				1
Driloneris filum	(Claparede 1868)				1		1		1													
Ougia subaequalis	(Oug 1978)					1																
Schistomeringos neglecta	(Fauvel 1923)											2										
Aricidea laubieri	Hartley 1981	1			1	1	2		4		2	1										1
Levinsenia gracilis	(Tauber 1879)	9	1	2	8						1	1				2	2					
Paradoneis lyra	(Southern 1914)								1													1
Paraonis fulgens	(Levinsen 1884)														1	1				1		
Apistobranchus tullbergi	(Theel 1879)				7																	
Laonice bahusiensis	Soderstrom 1920		1		1		1	1	5		2											1
Polydora caeca	(Oersted 1843)								1													
Prionospio fallax	Soderstrom 1920	36	43	22	36		1	1				2			1	9						2
Minuspio cirrifera	(Wiren 1883)							1						1							1	
Minuspio cf multibranchiata	(Berkeley 1927)	6	4	3	3		3					2										1
Scolelepis sp indet	de Blainville 1828															1						
Scolelepis (P) cf gilchristi	(Day 1961)				1																	
Spio martinensis	Mesnil 1896	1																				
Spiophanes kroyeri	Grube 1860				2		2	1				1				1					1	2

Magelona alleni	Wilson 1958					1																1
Magelona minuta	Eliason 1962			4					1						1	2						2
Caulleriella bioculata	(Keferstein 1862)							3														
Caulleriella zetlandica	(McIntosh 1911)						1															
Tharyx killariensis	(Southern 1914)	5	13	22	53	2	1		2			1		3	2	11					1	7
Monticellina sp	(Kirkegaard 1959)	55	38	40	101	17	5	5	13		20	8	13	8	9	30		1	2	8	2	16
Diplocirrus glaucus	(Malmgren 1867)	5	3	3	4			1	2		1		3								2	5
Flabelligera affinis	M Sars 1829									1												
Pherusa falcata	Støp-Bowitz 1948								1													
Mediomastus fragilis	Rasmussen 1973	2	2			3	1	2	21		1		2	2		1				1		
Notomastus latericeus	M Sars 1851	1	1				1	4	2			1										
Asychis biceps	(M Sars 1861)											1										1
Euclymeninae sp A	-						1		1			7										
Euclymene oerstedii	(Claparede 1863)													1								
Praxillella affinis	(M Sars 1872)	6	3		3								1									
Praxillella gracilis	(M Sars 1861)			1																		
Scalibregma inflatum	Rathke 1843			1				1														
Owenia fusiformis	Chiaje 1842							3														
Galathowenia oculata	Zaks 1922	5	2		15	41	59	372	104	1	40	38	3	2	2		1				9	74
Lagis koreni	Malmgren 1866				1																	
Sabellaria spinulosa	Leuckart 1849									1												
Melinna palmata	Grube 1869					19	1	72	22		28	55									1	1
Ampharete falcata	Eliason 1955	3							2													
Ampharete lindstroemi	(Malmgren 1867)				1		3		2		2	1	2			1						3
Amphicteis gunneri	(M Sars 1835)								1		2	4		3	1							
Sabellides octocirrata	(M Sars 1835)							1	3		1	6										2
Terebellides stroemi	M Sars 1835		1	2			1	2	9	2	1		1	2		2					4	6
Streblosoma intestinalis	M Sars 1872								1		1											
Sabellidae spp juv	-												2									
Euchone rubrocincta	(M Sars 1861)								1													
Hydroides norvegica	Gunnerus 1768									1												
Pomatoceros lamarcki	(Quatrefages 1866)									1												

Tubificidae spp	-				2				2													
Grania spp	Southern 1913			1				1	2		1											
Anoplodactylus petiolatus	(Kroyer 1844)							1														
MYSIDACEA sp	-								1													
Parapleustes sp indet	(G O Sars 1882)									4											1	
Amphilochus manudens	Bate 1862										1											
Cressa dubia	(Bate 1857)								1													
Harpinia antennaria	Meinert 1890	1	1		1		1												1			
Harpinia crenulata	(Boeck 1871)				1																	
Harpinia laevis	G O Sars 1891				2																	
Harpinia pectinata	G O Sars 1891			2	1				1		1				1						1	
Ampelisca diadema	(A Costa 1853)										5	6										
Ampelisca macrocephala	Lilljeborg 1852			1																		
Ampelisca spinipes	Boeck 1861					1																
Ampelisca tenuicornis	Lilljeborg 1855								1				1								1	2
Haploops tubicola	Lilljeborg 1855							1	1		3	2	1	4							1	1
Eriopisa elongata	(Bruzelius 1859)											1										
Maera othonis	(H Milne-Edwards 1830)											2										
Photis longicaudata	(Bate & Westwood 1862)					1	1		1			2		3								
Aoridae spp indet (female)	-					1		1			1											
Unciola planipes	Norman 1867						1															
Parvipalpus capillaceus	(Chevreux 1888)																				1	
Phtisica marina	Slabber 1769							1	1	3	1	4	1									
Pseudoprotella phasma	(Montagu 1804)							1	2													
Gnathia spp indet (female)	Leach 1814									3												
Gnathia sp juv	Leach 1814									1												
Janira maculosa	Leach 1813									2												
Eudorella truncatula	(Bate 1856)				1																	

Leucon nasica	(Krøyer 1841)															1						
Diastyloides biplicata	(G O Sars 1865)				1																	
Nephrops norvegicus	(Linnaeus 1758)		2		1										1							
Calocaris macandreae	Bell 1846	3	2	2	1						1	1		2	4	1	3			3		
Galathea strigosa	(Linnaeus 1767)									2												
Pisidia longicornis	(Linnaeus 1767)									5												
Hyas sp juv	Leach 1814									2				1								
Pilumnus hirtellus	(Linnaeus 1761)								2			1										
Falcidens crossotus	Salvini-Plawen 1968			2	5	3	2	1	2		4	4	3	1		3				1		11
Eleutheromenia sierra	(Pruvot 1890)											1										
Leptochiton asellus	(Gmelin 1791)									1												
Mangelia coarcata	(Forbes 1840)												1									
Antalis entalis	(Linnaeus 1758)							1														
Nucula sp juv	Lamarck 1799												1									
Nucula sulcata	Bronn 1831		1												1				1			
Jupiteria minuta	(O F Muller 1776)											1										
Palliolum tigerinum	(O F Muller 1776)											2										
Chlamys sulcata	(Muller 1776)									1												
Pododesmus patelliformis	(Linnaeus 1761)									17												
Thyasira flexuosa	(Montagu 1803)	2		1		1	2	2	4		1	1	1									1
Tellimya ferruginosa	(Montagu 1808)			1																		
Tridonta elliptica	(Brown 1827)							2														
Parvicardium ovale	(G B Sowerby 1840)									1												
Phaxas pellucidus	(Pennant 1777)						1															
Abra spp indet	Lamarck 1818												4									
Abra alba	(W Wood 1802)	1	4	1	5		1	2	2		1	4				5						5
Abra nitida	(O F Muller 1776)				4			2			3		4	1								4
Timoclea ovata	(Pennant 1777)							4	3		3	1		1								
Corbula gibba	(Olivi 1792)					1			1			3	2	2							1	6
Hiatella arctica	(Linnaeus 1767)						1	3		2	1		5									
Cuspidaria cuspidata	(Olivi 1792)																					1
Cuspidaria costellata	(Deshayes 1833)							3	2			1	1									1

Plagioecia patina	(Lamarck 1816)									P												
Bugula spp	Oken 1815									P												
OPHIUROIDEA sp juv	-			1	2						7	3				1						4
Ophiopholis aculeata	(Linnaeus 1767)									10												
Amphiura chiajei	Forbes 1843	3	2	3	6	30	7	7	19		8	1	3	5								
Amphiura filiformis	(O F Muller 1776)		1				1	3														
Amphipholis squamata	(Chiaje 1829)					2						2										
Echinocardium spp juv	J E Gray 1825			1				3														

Table 5. Video log sheet for the 2007 cruises on the North West Irish Sea Mounds.

Decimal Latitude	Decimal Longitude	Time	Substrata	Fauna	Other	Sediment infill?
54.43909	-5.02821	09:56:00	Soft sediment = mixed soft sediment			y
54.43887	-5.02831	09:56:30	Soft sediment = mixed soft sediment			y
54.43801	-5.02880	09:59:01	Mixed soft sediment = Cobble/Boulder			y
54.43783	-5.02883	09:59:30	Soft sediment = mixed soft sediment			y
54.43767	-5.02900	10:00:00	Mixed soft sediment			y
54.43759	-5.02929	10:00:28	Mixed soft sediment			y
54.43746	-5.02947	10:01:00	Soft sediment = mixed soft sediment			y
54.43664	-5.03038	10:03:59	Mixed soft sediment			-
54.42331	-5.04942	10:35:00	Soft sediment		New Tow	
54.42309	-5.04940	10:35:30	Soft sediment			
54.42284	-5.04939	10:36:02	Soft sediment			
54.42258	-5.04934	10:36:33	Soft sediment			
54.42234	-5.04930	10:36:59	Soft sediment			
54.40475	-5.06505	14:18:59	Soft sediment			
54.40477	-5.06498	14:19:30	Soft sediment			
54.40481	-5.06485	14:20:00	Soft sediment			
54.40487	-5.06474	14:20:30	Soft sediment			
54.40502	-5.06458	14:21:00	Soft sediment			
54.40514	-5.06447	14:21:33	Soft sediment			
54.40529	-5.06437	14:20:00	Soft sediment			
54.40590	-5.06417	14:23:00	Soft sediment			
54.40577	-5.06403	14:24:00	Soft sediment			
54.40609	-5.06388	14:25:00	Soft sediment			
54.40619	-5.06386	14:25:30	Soft sediment			
54.40625	-5.06383	14:26:00	Soft sediment			
54.40628	-5.06379	14:26:30	Soft sediment			
54.40634	-5.06375	14:27:00	Soft sediment			
54.39148	-5.07871	16:29:02	Soft sediment = mixed soft sediment		TOW 5 stn 6	y

54.39146	-5.07890		Soft sediment = mixed soft sediment			
54.39145	-5.07909		Soft sediment = mixed soft sediment			
54.39142	-5.07930		Soft sediment = mixed soft sediment	Burrows		
54.39138	-5.07956	16:31:06	Soft sediment = mixed soft sediment			
54.39136	-5.07973		Soft sediment < mixed soft sediment			
54.39134	-5.07992		Soft sediment < mixed soft sediment			
54.39133	-5.08012		Soft sediment < mixed soft sediment			
54.39130	-5.08038		Soft sediment < mixed soft sediment			
54.39126	-5.08067	16:33:30	Soft sediment < mixed soft sediment	Burrows		
54.41514	-5.05764	17:10:30	Mixed soft sediment	Anemone	Stn 8 Tow 6	
54.41506	-5.05776		Mixed soft sediment	Surface material gravelly		
54.41491	-5.05800		Cobble/Boulder	Anemones	Isolated	
54.41484	-5.05809		Cobble/Boulder	Anemones		
54.41472	-5.05823		Mixed soft sediment > Cobble/Boulder			y
54.41463	-5.05837		Mixed soft sediment < Cobble/Boulder			Flat y
54.41455	-5.05852		Mixed soft sediment = Cobble/Boulder			Flat y
54.41449	-5.05874	17:14:00	Cobble/Boulder	Anemones		y
54.41443	-5.05892		Mixed soft sediment = Cobble/Boulder			y
54.41437	-5.05905		Mixed soft sediment = Cobble/Boulder			y
54.41428	-5.05925		Mixed soft sediment = Cobble/Boulder	Burrows		y
54.41418	-5.05937		Mixed soft sediment < Cobble/Boulder	Anemones	Vis average	Flat y
54.41407	-5.05952		Mixed soft sediment = Cobble/Boulder	Anemones		Flat y
54.41397	-5.05966		Mixed soft sediment = Cobble/Boulder	Anemones		Flat y
54.41470	-5.05979		Mixed soft sediment > Cobble/Boulder	None obvious		Flat y
54.41375	-5.05991		Mixed soft sediment = Cobble/Boulder	Some burrows & anemones		Flat y
54.41364	-5.06005	17:18:30	Mixed soft sediment	Small burrows		Flat y
54.41351	-5.06020		Soft sediment < mixed soft sediment	Burrows		Flat y
54.41339	-5.06030		Soft sediment = mixed soft sediment	Burrows - *Nephrops*		Flat y
54.41326	-5.06041		Soft sediment	Burrows		Flat y
54.41316	-5.06055		Soft sediment	Burrows		Flat y

54.41303	-5.06067		Soft sediment	Burrows		Flat y
54.41289	-5.06081		Soft sediment	Burrows		Flat y
54.41276	-5.06097	17:22:30	Soft sediment	Small burrows		Flat y
54.41265	-5.06110		Soft sediment	Small burrows		
54.41252	-5.06126		Soft sediment	Burrows		Flat y
54.41240	-5.06141		Soft sediment			
54.41226	-5.06155		Soft sediment	Burrows small & large		Flat y
54.41212	-5.06170		Soft sediment			Flat y
54.41199	-5.06186		Soft sediment > mixed soft sediment	Small and large burrows		Flat y
54.41186	-5.06202	17:25:30	Soft sediment			Flat y
54.41172	-5.06215		Mixed soft sediment	Encrusting sponge/DMF		Flat y
54.41161	-5.06230		Mixed soft sediment > Cobble/Boulder			Flat y
54.41149	-5.06243		Mixed soft sediment > Cobble/Boulder	Anemones/Burrows rare		Flat y
54.41137	-5.06254		Soft sediment = mixed soft sediment	Burrows		Flat y
54.41128	-5.06262		Soft sediment > mixed soft sediment	Burrows		Flat y
54.41119	-5.06273		Soft sediment > mixed soft sediment	Burrows		Flat y
54.41110	-5.06287		Soft sediment < mixed soft sediment	Rock with Anemones		Flat y
54.41100	-5.06307	17:29:30	Mixed soft sediment			
54.41517	-5.05759	17.103	Mixed soft sediment > Cobble/Boulder	Anemones	New Tow	fy
54.41506	-5.05776	17.11.00	Mixed soft sediment > Cobble/Boulder	Anemones		fy
54.41495	-5.05795	17.11.32	Mixed soft sediment > Cobble/Boulder			fy
54.41483	-5.05809	17.12.00	Mixed soft sediment > Cobble/Boulder			fy
54.41472	-5.05823	17.12 33	Mixed soft sediment > Cobble/Boulder			fy
54.41463	-5.05837	17.12.33	Mixed soft sediment			fy
54.41463	-5.05853	17.12.10	Soft sediment			fy
54.41449	-5.05877	17.13.30	Soft sediment			fy
54.41443	-5.05892	17.14.03	Soft sediment > mixed soft sediment			fy
54.41437	-5.05905	17.14.58	Cobble/Boulder < Bedrock			fy
54.41428	-5.05925	17.15.30	-			fy
54.41418	-5.05937	17.16.00	-			fy

54.41408	-5.05988	17.16.40	-			fy
54.41397	-5.05966	17.17.00	-			fy
54.41386	-5.05980	17.17.32	Soft sediment			fy
54.41376	-5.05990	17.17.59	Soft sediment			fy
54.41366	-5.06003	17.18.25	Soft sediment			fy
54.41353	-5.06020	17.19.02	Soft sediment	Burrows		fy
54.41340	-5.06029	17.19.27	Soft sediment	Burrows		fy
54.41327	-5.06041	17.20.00	Soft sediment	Burrows		fy
54.41317	-5.06052	17.20.28	Soft sediment	Burrows		fy
54.41303	-5.06068	17.21.00	Soft sediment	Burrows		fy
54.41289	-5.06081	17.21.30	Soft sediment			fy
54.41276	-5.06098	17.22.00	Soft sediment			fy
54.41265	-5.06110	17.22.31	Soft sediment			fy
54.41261	-5.06128	17.22.59	Soft sediment			fy
54.41240	-5.06142	17.23.30	Soft sediment	Burrows		fy
54.41226	-5.06156	17.24.00	Soft sediment	Burrows small		fy
54.41212	-5.06171	17.24.30	Soft sediment	Small & some large burrows		fy
54.41198	-5.06185	17.24.59	Soft sediment			fy
54.41185	-5.06204	17.25.30	Soft sediment			fy
54.41174	-5.06215	17.26.00	Soft sediment			fy
54.41162	-5.06229	17.27.30	-			
54.41148	-5.06246	17.27.30	-			
54.41138	-5.06255	17.28.00	Soft sediment			
54.41128	-5.06262	17.28.30	Soft sediment	Burrows		
54.41119	-5.06273	17.29.00	Soft sediment			
54.41100	-5.06288	17.29.30	-	Anemones		
54.41345	-5.03843	8.27.00	Soft sediment			Fy
54.41314	-5.03849	8.28.00	Soft sediment			Fy
54.41295	-5.03854	8.28.56	Soft sediment			Fy
54.41284	-5.03857	8.29.00	Soft sediment			Fy

54.41301	-5.03863	8.29.30	Soft sediment			Fy
54.41253	-5.03869	8.30.00	Soft sediment			Fy
54.41239	-5.03879	8.30.31	Soft sediment			Fy
54.41225	-5.03885	8.31.10	Soft sediment			Fy
54.41211	-5.03894	8.31.31	Soft sediment			Fy
54.41199	-5.03904	8.31.59	Soft sediment			Fy
54.41185	-5.03913	8.32.30	Soft sediment			Fy
54.41175	-5.03920	8.33.00	Soft sediment			Fy
54.41160	-5.03926	8.33.30	Soft sediment			Fy
54.41144	-5.03930	8.34.00	Soft sediment	No obs., poor vis		Fy
54.41129	-5.03937	8.34.34	Soft sediment			Fy
54.41113	-5.03939	8.35.00	Soft sediment			Fy
54.41101	-5.03945	8.35.36	Soft sediment			Fy
54.41084	-5.03949	8.36.00	Soft sediment			Fy
54.41072	-5.03952	8.36.30	Soft sediment			Fy
54.41058	-5.03956	8.37.00	Soft sediment			Fy
54.41044	-5.03959	8.37.30	Soft sediment			Fy
54.41030	-5.03963	8.38.00	Soft sediment			Fy
54.38333	-5.03967	8.38.30	-	*Sabella*		Fy
54.40999	-5.03969	8.39.00	Soft sediment	Burrows		Fy
54.40981	-5.03967	8.39.00	-			Fy
54.40967	-5.03969	8.39.59	-			Fy
54.40950	-5.03971	8.40.30	-			Fy
54.40939	-5.03974	8.41.00	Soft sediment			Fy
54.40925	-5.03975	8.41.30	-			Fy
54.40907	-5.03975	8.42.01	Bedrock	Anemones		xx
54.40893	-5.03976	8.42.30	Soft sediment			Fy
54.40876	-5.03982	8.43.01	-			Fy
54.40860	-5.03989	8.43.30	Bedrock			Fy
54.40844	-5.04003	8.44.00	Soft sediment			Fy

54.40830	-5.04016	8.44.32	Soft sediment			Fy
54.40817	-5.04032	8.45.02	Soft sediment			Fy
54.40799	-5.04051	8.46.30	Soft sediment			Fy
54.40786	-5.04062	8.46.01	Soft sediment			Fy
54.40777	-5.04082	8.46.30	Soft sediment			Fy
54.40587	-5.04522	8.57.30	Soft sediment			Fy
54.40582	-5.04537	8.58.00	Soft sediment			Fy
54.40573	-5.04536	8.58.30	-			Fy
54.40563	-5.04563	8.58.19	Soft sediment > mixed soft sediment			Fy
54.40554	-5.04577	8.59.30	Mixed soft sediment = Cobble/Boulder			Fy
54.53333	-5.04592	9.00.00	Soft sediment > mixed soft sediment			Fy
54.40537	-5.04606	9.00.30	Mixed soft sediment	*Sabella*		Fy
54.40529	-5.04622	9.01.00	Mixed soft sediment	*Sabella*		Fy
54.40516	-5.04636	9.01.30	Mixed soft sediment	*Sabella*		Fy
	-5.04647	9.01.59	Mixed soft sediment	*Sabella*		Fy
	-5.04664	9.02.30	Mixed soft sediment > Cobble/Boulder			Fy
54.40494	-5.04677	9.02.58	Mixed soft sediment	Many anemones		Fy
54.40491	-5.04688	9.03.11	Bedrock	Anemones & soft corals		Fy
54.48818	-5.04704	9.03.30	Bedrock	Heavily encrusted surfaces		Fy
54.40474	-5.04723	9.04.00	Bedrock	Abundant brittle stars		Fy
54.40459	-5.04750	9.04.50	Bedrock	Rock surfaces		Fy
54.40447	-5.04769	9.07.00	Bedrock	Heavily encrusted surfaces		Fy
54.40378	-5.04695	9.07.30	Cobble/Boulder	Many Anemones		Fy
54.40367	-5.04880	9.08.00	Cobble/Boulder			Fy
54.40351	-5.04900	9.08.30	Cobble/Boulder			Fy
54.40340	-5.04919	9.09.00	Cobble/Boulder			Fy
54.40332	-5.04938	9.09.30	Soft sediment			Fy
54.40321	-5.04959	9.10.00	Soft sediment			Fy
54.40312	-5.04977	9.11.00	Soft sediment			Fy
54.40303	-5.03660	9.11.30	Soft sediment	Burrows		Fy

54.40295	-5.03343	9.12.00	-			Fy
54.40297	-5.05022	9.12.30	Soft sediment			Fy
54.40280	-5.05035	9.13.00	-	Anemones		Fy
54.40272	-5.05048	9.13.30	Bedrock			Fy
54.40263	-5.05062	9.14.00	-			Fy
54.40254	-5.05074	9.14.32	Cobble/Boulder	Tubeworms		Fy
54.40244	-5.05091	9.15.00	Soft sediment			Fy
54.40236	-5.05105	9.15.30	Soft sediment			Fy
54.40227	-5.05120	9.16.00	Soft sediment			Fy
54.40219	-5.05136	9.16.30	-	Anemones		Fy
54.40209	-5.05150	9.17.00	Soft sediment			Fy
54.40198	-5.05165	9.17.29	Soft sediment			Fy
54.40186	-5.05180	9.18.00	-			Fy
54.40174	-5.05197	9.18.30	-			Fy
54.40162	-5.05212	9.19.00	-			Fy
54.40148	-5.05225	9.19.30	-			Fy
54.40136	-5.05238	9.20.00	-			Fy
54.40122	-5.05252	9.20.30	-			Fy
54.40105	-5.05276	9.21.00	Cobble/Boulder			Fy
54.40095	-5.05287	9.21.30				Fy
54.40085	-5.05299	9.22.00				Fy
54.40073	-5.05317	9.22.30				Fy
54.40063	-5.05333	9.23.00				Fy
54.40053	-5.05513	9.23.30				Fy
54.40039	-5.05366	9.23.59				Fy
54.40032	-5.05380	9.24.30				Fy
54.40022	-5.05397	9.25.00				Fy
54.40015	-5.05413	9.25.30				Fy
54.40011	-5.05434	9.26.00				Fy
54.39993	-5.05451	9.26.30	Cobble/Boulder			Fy

54.39984	-5.05463					Fy
54.39833	-5.89679	10.04.00			TOW 9	Flat y
54.39825	-5.89680	10.04.37			vis too poor	Flat y
54.39818	-4.93651	10.05.01			vis too poor	Flat y
54.39790	-5.06367	10.06.00	Mixed soft sediment		vis too poor	Flat y
54.39782	-5.06375	10.07.00	Mixed soft sediment		vis too poor	Flat y
54.39773	-5.06386	10.07.30	Mixed soft sediment		vis too poor	Flat y
54.39762	-5.06391	10.08.00	Mixed soft sediment		vis too poor	Flat y
54.39753	-5.06431	10.08.30	Mixed soft sediment		vis too poor	Flat y
54.39742	-5.06408	10.09.01	Mixed soft sediment		vis too poor	Flat y
54.39729	-5.06418	10.09.30	Soft sediment = mixed soft sediment		vis too poor	Flat y
54.39716	-5.06424	10.10.00	Soft sediment = mixed soft sediment		vis too poor	Flat y
54.39704	-5.06436	10.10.30	Soft sediment = mixed soft sediment		vis poor	Flat y
54.39675	-5.06434	10.11.00	Mixed soft sediment		vis poor	Flat y
54.39660	-5.06408	10.11.30	Mixed soft sediment		vis poor	Flat y
54.39640	-5.06447	10.12.00	Mixed soft sediment			Flat y
54.39628	-5.06451	10.12.30	Mixed soft sediment			Flat y
54.39615	-5.06456	10.13.00	Mixed soft sediment = Cobble/Boulder	Anemone		Flat y
54.39594	-5.06461	10.13.30	Mixed soft sediment < Cobble/Boulder			Flat y
54.39579	-5.06468	10.14.00	Cobble/Boulder			Flat y
54.39564	-5.06471	10.14.30	Mixed soft sediment = Cobble/Boulder			Flat y
54.39548	-5.06476	10.15.00	Mixed soft sediment = Cobble/Boulder			Flat y
54.39527	-5.06482	10.15.34	Mixed soft sediment = Cobble/Boulder	Anemone		Flat y
54.39515	-5.06484	10.15.59	Cobble/Boulder	Anemone & *Nephrops*		Flat y
54.39498	-5.06488	10.16.31	Cobble/Boulder	Anemone		Flat y
54.39481	-5.06492	10.17.00	Cobble/Boulder	Anemone		Flat y
54.39459	-5.06497	10.17.30	Cobble/Boulder			Flat y
54.39349	-5.06500	10.18.00	Mixed soft sediment < Cobble/Boulder	Anemone		Flat y
54.39375	-5.06506	10.18.30	Cobble/Boulder	Anemone		Flat y
54.39402	-5.06513	10.19.00	Cobble/Boulder			Flat y

54.39386	-5.06519	10.19.34	Cobble/Boulder	Anemone		Flat y
54.39372	-5.06525	10.20.00	Cobble/Boulder			Flat y
54.39359	-5.06532	10.20.30	Cobble/Boulder	Anemone		Flat y
54.39341	-5.06539	10.21.00	Cobble/Boulder			Flat y
54.39324	-5.06548	10.21.31	Cobble/Boulder	Anemone		Flat y
54.39307	-5.06552	10.22.02	Cobble/Boulder			Flat y
54.39290	-5.06557	10.22.30	Cobble/Boulder			Flat y
54.39276	-5.06564	10.23.20	Cobble/Boulder			Flat y
54.39255	-5.06572	10.23.30	Cobble/Boulder			Flat y
54.39241	-5.06581	10.24.00	Mixed soft sediment = Cobble/Boulder			Flat y
54.39230	-5.06591	10.25.00	Cobble/Boulder			Flat y
54.39213	-5.06597	10.25.30	Cobble/Boulder			Flat y
54.39210	-5.06605	10.25.59	Cobble/Boulder			Flat y
54.39182	-5.06610	10.26.30	Mixed soft sediment < Cobble/Boulder			Flat y
54.39169	-5.06617	10.27.00	Mixed soft sediment < Cobble/Boulder			stop
54.39148	-5.06628	10.27.35	Cobble/Boulder			Flat y
54.39132	-5.06636	10.28.02	Mixed soft sediment < Cobble/Boulder			Flat y
54.39119	-5.06646	10.28.33	Cobble/Boulder			Flat y
54.39106	-5.06656	10.29.02	Cobble/Boulder			Flat y
54.39092	-5.06666	10.29.33	Mixed soft sediment = Cobble/Boulder			Flat y
54.39082	-5.06677	10.30.00	Mixed soft sediment = Cobble/Boulder			Flat y
54.39069	-5.06688	10.30.30	Cobble/Boulder			Flat y
54.40562	-5.07392	11.01.00	Mixed soft sediment	Tow 10		Flat y
54.40721	-5.07401	11.01.10	Mixed soft sediment		poor vis	Flat y
54.40531	-5.07413	11.02.11	Soft sediment < mixed soft sediment	Burrows		Flat y
54.40521	-5.07414	11.02.31	Soft sediment < mixed soft sediment	Burrows		Flat y
54.40658	-5.07412	11.03.00	Soft sediment < mixed soft sediment			Flat y
54.40486	-5.07410	11.03.29	Mixed soft sediment			Flat y
54.40465	-5.07409	11.04.02	Mixed soft sediment > Cobble/Boulder	Anemones		Flat y
54.40447	-5.07407	11.04.30	Mixed soft sediment < Cobble/Boulder	Anemones		Flat y

54.40430	-5.07403	11.05.01	Mixed soft sediment > Cobble/Boulder	Anemones		Flat y
54.40411	-5.07405	11.05.30	Cobble/Boulder	Large boulders with Anemones		Flat y
54.40393	-5.07403	11.06.00	Mixed soft sediment < Cobble/Boulder			Flat y
54.40375	-5.07404	11.06.30	Cobble/Boulder			Flat y
54.40335	-5.07407	11.07.31	Soft sediment = mixed soft sediment			Flat y
54.40317	-5.07411	11.08.01	Mixed soft sediment	Burrows		Flat y
54.40298	-5.07416	11.08.30	Mixed soft sediment = Cobble/Boulder	Anemones		Flat y
54.40279	-5.07422	11.09.00	Mixed soft sediment = Cobble/Boulder			Flat y
54.40252	-5.07425	11.09.30	Mixed soft sediment > Cobble/Boulder			Flat y
54.40245	-5.07432	11.10.00	Soft sediment > mixed soft sediment			Flat y
54.40225	-5.07438	11.10.30	-	Burrows		Flat y
54.40209	-5.07440	11.11.01	Soft sediment > mixed soft sediment	Burrows		Flat y
54.40193	-5.07446	11.11.30	Soft sediment = mixed soft sediment	Burrows		Flat y
54.40178	-5.07454	11.11.59	Soft sediment = mixed soft sediment	Burrows		Flat y
54.40161	-5.07460	11.12.30	Soft sediment > mixed soft sediment	Burrows		Flat y
54.40147	-5.07463	11.13.00	Soft sediment > mixed soft sediment	Burrows		Flat y
54.40128	-5.07459	11.13.30	Soft sediment < mixed soft sediment	Burrows		Flat y
54.40112	-5.07463	11.14.00	Soft sediment < mixed soft sediment	Burrows		Flat y
54.40092	-5.07462	11.14.30	Mixed soft sediment > Cobble/Boulder	Burrows		Flat y
54.40067	-5.07459	11.15.09	Soft sediment < mixed soft sediment	Burrows		Flat y
54.40055	-5.07459	11.75.30	Soft sediment = mixed soft sediment	Burrows		Flat y
54.40033	-5.07463	11.16.00	Soft sediment = mixed soft sediment			Flat y
54.40008	-5.07475	11.16.30	Soft sediment > mixed soft sediment	Burrows		Flat y
54.39999	-5.07471	11.17.02	Soft sediment = mixed soft sediment			Flat y
54.39982	-5.07469	11.17.30	Mixed soft sediment > Cobble/Boulder	Burrows		Flat y
54.48295	-5.07488	11.18.10	Soft sediment < mixed soft sediment	Burrows		Flat y
54.39950	-5.07494	11.18.36	Mixed soft sediment			Flat y
54.39936	-5.07517	11.19.05	Mixed soft sediment			Flat y
54.39925	-5.07509	11.19.30	Mixed soft sediment	Burrows		Flat y
54.39910	-5.07515	11.19.59	Mixed soft sediment	Small burrows - fine sand		Flat y

54.39898	-5.07521	11.20.30	Mixed soft sediment				Flat y
54.39881	-5.07517	11.21.00	Mixed soft sediment	Small burrows			Flat y
54.39865	-5.07531	11.21.30	Mixed soft sediment	Small burrows			Flat y
54.39853	-5.07533	11.22.00	Mixed soft sediment				Flat y
54.39835	-5.07539	11.22.30	Soft sediment < mixed soft sediment	Large boulders & small			Flat y
54.39816	-5.07544	11.23.00	Soft sediment < mixed soft sediment	Large boulders & small			Flat y
54.39800	-5.07548	11.23.30	Soft sediment = mixed soft sediment	Large boulders & small			Flat y
54.39950	-5.07553	11.24.00	Soft sediment = mixed soft sediment	Large boulders & small			Flat y
54.39764	-5.07558	11.24.37	Mixed soft sediment > Cobble/Boulder				Flat y
54.39751	-5.07561	11.25.00	Soft sediment = mixed soft sediment				Flat y
54.39735	-5.07565	11.25.30	Soft sediment = mixed soft sediment	Large & small burrows			Flat y
54.39719	-5.07569	11.26.01	Soft sediment = mixed soft sediment	Small aperture burrows -			Flat y
54.39702	-5.07571	11.26.30	Soft sediment = mixed soft sediment				Flat y
54.39686	-5.07574	11.27.00	Soft sediment > mixed soft sediment				Flat y
54.39666	-5.07579	11.27.36	Soft sediment	*Sabella* & burrows			Flat y
54.39654	-5.07580	11.28.00	Mixed soft sediment	Large aperture burrows			Flat y
54.39637	-5.07582	11.28.31	Soft sediment = mixed soft sediment				Flat y
54.39621	-5.07586	11.28.59	Soft sediment				Flat y
54.39605	-5.07590	11.29.30	Cobble/Boulder	Anemones			Flat y
54.39589	-5.07594	11.30.00	Cobble/Boulder				Flat y
54.39571	-5.07598	11.30.31	Mixed soft sediment = Cobble/Boulder				Flat y
54.39555	-5.09169	11.30.59	Soft sediment > mixed soft sediment				Flat y
54.39536	-5.07606	11.31.30	Mixed soft sediment > Cobble/Boulder				Flat y
54.39516	-5.07512	11.32.04	Cobble/Boulder				Flat y
54.39478	-5.07624	11.33.10	Mixed soft sediment				Flat y
54.39467	-5.07628	11.39.30	Mixed soft sediment				Flat y
54.39449	-5.07632	11.33.58	Mixed soft sediment				Flat y
54.39432	-5.07637	11.34.28	Mixed soft sediment				Flat y
54.39414	-5.07634	11.35.08	Soft sediment	Burrows small			Flat y
54.39384	-5.07651	11.35.31	Soft sediment > mixed soft sediment	Burrows			Flat y

54.39382	-5.07656	11.36.01	Soft sediment = mixed soft sediment			Flat y
54.39366	-5.07662	11.36.30	Soft sediment > mixed soft sediment			Flat y
54.39350	-5.07668	11.37.00	Soft sediment > mixed soft sediment			Flat y
54.39333	-5.07674	11.37.30	Soft sediment			Flat y
54.39318	-5.07679	11.38.02	Soft sediment			Flat y
54.39305	-5.07681	11.38.30	Soft sediment > mixed soft sediment			Flat y
54.39289	-5.07681	11.39.07	Soft sediment	Burrows		Flat y
54.39239	-5.07684	11.39.30	Soft sediment > mixed soft sediment			Flat y
54.39224	-5.07685	11.40.00	Soft sediment			Flat y
54.39239	-5.07684	11.40.30	Soft sediment	Many burrows		Flat y
54.39224	-5.07685	11.41.00	Soft sediment > mixed soft sediment			Flat y
54.39204	-5.07687	11.41.30	Soft sediment > mixed soft sediment	Many burrows		Flat y
54.39290	-5.07688	11.42.01	Soft sediment			Flat y
54.39177	-5.07687	11.42.30	Soft sediment	*Nephrops*		Flat y
54.39167	-5.07687	11.42.59	Soft sediment			Flat y
54.39155	-5.07686	11.43.00	Soft sediment	Small burrows		Flat y
54.39139	-5.07684	11.43.31	Soft sediment	*Sabella* & burrows		Flat y
54.39090	-5.07676	11.45.00	Soft sediment	Burrows		Flat y
54.39068	-5.07671	11.45.30	Soft sediment			Flat y
54.39049	-5.07665	11.46.08	Soft sediment			Flat y
54.39000	-5.07650	11.47.00	Soft sediment > mixed soft sediment	Burrows & *Sabella*		Flat y
54.38983	-5.07640	11.48.00	Soft sediment > mixed soft sediment			Flat y
54.38952	-5.07637	11.49.00	Cobble/Boulder < Bedrock			
54.38926	-5.07580	11.50.00	Cobble/Boulder			
54.38886	-5.07652	11.51.00	Mixed soft sediment		END OF TOW	Flat y
54.39165	-5.01180	13.08.01	Soft sediment = mixed soft sediment		TOW 11	F Y
54.39178	-5.01182	13.08.38	Soft sediment < mixed soft sediment	*Sabella & Munida*		F Y
54.39188	-5.01186	13.09.00	Mixed soft sediment > Cobble/Boulder			F Y
54.39212	-5.01181	13.10.21	Mixed soft sediment	*Sabella*		F Y
54.39217	-5.01181	13.10.31	Mixed soft sediment			F Y

54.39230	-5.01181	13.11.01	Mixed soft sediment	*Sabella*		F Y
54.39240	-5.01180	13.11.30	Mixed soft sediment			F Y
54.39251	-5.01173	13.12.00	Soft sediment = mixed soft sediment	*Sabella*		F Y
54.39258	-5.01172	13.12.34	Mixed soft sediment = Cobble/Boulder			F Y
54.39258	-5.01177	13.13.00	Cobble/Boulder	*Nephrops & Munida*		F Y
54.39278	-5.01186	13.13.30	Cobble/Boulder	*Munida & Sabella*		F Y
54.39283	-5.01192	13.14.00	Cobble/Boulder	*Munida & Sabella*		F Y
54.39291	-5.01194	13.14.30	Cobble/Boulder	*Munida & Sabella*		F Y
54.39304	-5.01194	13.15.00	Cobble/Boulder	*Anemones & Munida*		F Y
54.39308	-5.01190	13.15.30	Cobble/Boulder			F Y
54.39306	-5.01190	15.16.00	Cobble/Boulder			F Y
54.39312	-5.01197	15.16.30	Mixed soft sediment			F Y
54.39315	-5.01213	15.17.04	Mixed soft sediment	*Sabella*		F Y
54.39319	-5.01227	15.17.37	Soft sediment	*Sabella* and small burrows		F Y
54.39324	-5.01237	15.17.39	Cobble/Boulder			F Y
54.39331	-5.01250	15.18.30	-			
54.39340	-5.01263	15.19.00	Cobble/Boulder			F Y
54.39345	-5.01268	15.19.32	-	Small aperture burrows		F Y
54.39352	-5.01271	15.20.01	Cobble/Boulder			F Y
54.39357	-5.01273	15.20.33	-			F Y
54.39363	-5.01273	15.21.00	-			F Y
54.39372	-5.01276	15.21.32	Cobble/Boulder			F Y
54.39380	-5.01288	15.21.59	-			F Y
54.39386	-5.01302	15.22.30	Bedrock	Anemones on small outcrop		F Y
54.39392	-5.01318	15.23.01	Soft sediment	*Munida* and Burrows		F Y
54.39402	-5.01339	13.23.32	Cobble/Boulder	Burrows		F Y
54.39408	-5.01353	13.24.30	Cobble/Boulder	High density		F Y
54.39424	-5.01380	13.25.00	Cobble/Boulder	Anemones		F Y
54.39430	-5.01392	13.25.32	Cobble/Boulder	*Munida*		F Y
54.39434	-5.01402	13.26.00	Cobble/Boulder			F Y

54.39441	-5.01418	13.26.30	Cobble/Boulder			F Y
54.39444	-5.01432	13.27.00	Cobble/Boulder			F Y
54.39444	-5.01443	13.27.30	Cobble/Boulder			F Y
54.39441	-5.01457	13.28.00	Mixed soft sediment			F Y
54.39443	-5.01467	13.28.27	Cobble/Boulder	Anemones		F Y
54.39452	-5.01480	13.29.00	Cobble/Boulder	*Luidia*		F Y
54.39458	-5.01151	13.29.30	Mixed soft sediment			F Y
54.39467	-5.01487	13.30.00	Cobble/Boulder			F Y
54.39479	-5.01485	13.30.30	Cobble/Boulder			F Y
54.39490	-5.01482	13.31.00	Cobble/Boulder			F Y
54.39502	-5.01480	13.31.33	Cobble/Boulder			
54.39507	-5.01479	13.22.00	Cobble/Boulder			F Y
54.39511	-5.01482	13.32.30	Mixed soft sediment			F Y
54.39514	-5.01488	13.32.47	Cobble/Boulder			F Y
54.39517	-5.01495	13.33,01	Cobble/Boulder			F Y
54.39526	-5.01515	13.33.30	Cobble/Boulder			F Y
54.39537	-5.01539	13.34.00	Cobble/Boulder			F Y
54.39545	-5.01561	13.34.30	Cobble/Boulder			F Y
54.39554	-5.01580	13.35.02	Bedrock	Anemones		n
54.39562	-5.01589	13.35.30	Bedrock			n
54.39574	-5.01598	13.36.00	Mixed soft sediment			F Y
54.39583	-5.01610	13.36.35	Soft sediment			F Y
54.39590	-5.01624	13.37.00	Soft sediment			F Y
54.39585	-5.01633	13.37.30	Soft sediment			F Y
54.40512	-5.04574	14.10.30	Mixed soft sediment	Poor viz	TOW 12	
54.40520	-5.04583	14.10.57	Bedrock	Anemones		
54.40529	-5.04590	14.11.37	Bedrock	Anemones		
54.40533	-5.04592	14.11.59	Bedrock	Anemones		
54.40540	-5.04590	14.12.31	Bedrock	Anemones soft corals		
54.40548	-5.04588	14.13.00	Bedrock	Anemones soft corals		

54.40583	-5.87856	14.15.29	Bedrock	Anemones soft corals		
54.40583	-5.87976	14.16.02	Bedrock	Anemones soft corals		
54.40579	-5.04666	14.16.35	Bedrock	Anemones soft corals		
54.40576	-5.04685	17.17.01	Bedrock			
54.40569	-5.04708	14.17.32	Bedrock			
54.40564	-5.04725	14.18.00	Bedrock			
54.38246	-5.03545	14.52.30	Soft sediment	Small burrows	TOW 13	F Y
54.38239	-5.03534	14.53.00	Soft sediment	Small burrows		F Y
54.38229	-5.03518	14.53.30	-	Anemones		F Y
54.38223	-5.03502	14.54.00	-	Small burrows		F Y
54.38219	-5.03478	14.54.19	-	Burrows & Anemones		F Y
54.38214	-5.03462	14.55.00	-	Burrows		F Y
54.38213	-5.03440	14.55.30	-	Small burrows		F Y
54.38215	-5.03417	14.56.09	-	Small burrows & Anemones		F Y
54.38214	-5.03400	14.56.30	Cobble/Boulder			F Y
54.38213	-5.03380	14.57.01	Soft sediment			F Y
54.38212	-5.03360	14.57.30	Mixed soft sediment	Anemones & Tubeworms		F Y
54.38204	-5.03352	14.58.00	Mixed soft sediment > Cobble/Boulder			F Y
54.38201	-5.03342	14.58.30	Mixed soft sediment	Small burrows		F Y
54.38191	-5.03339	14.59.00	Mixed soft sediment > Cobble/Boulder			F Y
54.38182	-5.03332	14.59.30	Soft sediment = mixed soft sediment			F Y
54.38171	-5.03318	15.00.00	Cobble/Boulder	Brittle stars & Anemones		F Y
54.38164	-5.03294	15.00.31	Mixed soft sediment < Cobble/Boulder	Anemones		F Y
54.38151	-5.03248	15.01.32	Soft sediment	Small burrows		F Y
54.38142	-5.03234	15.02.11	Soft sediment			F Y
54.38132	-5.03225	15.02.31	Soft sediment	Large burrows		F Y
54.38125	-5.03210	15.03.00	Soft sediment			F Y
54.38117	-5.03206	15.50.30	Soft sediment			F Y
54.38113	-5.03174	15.04.00	-			F Y
54.38105	-5.03163	15.04.30	Soft sediment			F Y

54.38096	-5.03149	15.05.00	-			F Y
54.38086	-5.03127	15.05.30	Soft sediment		END OF TOW	F Y
54.43737	-5.03303	17.08.30	Soft sediment = mixed soft sediment	Viz too poor	TOW 14	F Y
54.43744	-5.03301	17.09.00	Soft sediment = mixed soft sediment			F Y
54.43752	-5.03297	17.09.30	Soft sediment = mixed soft sediment			F Y
54.43764	-5.03288	17.10.00	Soft sediment = mixed soft sediment	Burrows		F Y
54.43777	-5.03278	17.11.30	Soft sediment = mixed soft sediment	Burrows		F Y
54.43779	-5.03276	17.12.10	Soft sediment = mixed soft sediment	Burrows		F Y
54.43784	-5.03171	17.12.30	Soft sediment = mixed soft sediment	Burrows		F Y
54.43789	-5.03265	17.13,00	-	Anemones		F Y
54.43798	-5.03256	17.13.30	Cobble/Boulder	Anemones		F Y
54.43803	-5.03251	17.13.59	Cobble/Boulder	Anemones		F Y
54.43810	-5.03245	14.14.31	Cobble/Boulder			F Y
54.43814	-5.03242	17.15.00	Cobble/Boulder			F Y
54.43818	-5.03239	17.15.36	Cobble/Boulder			F Y
54.43830	-5.03236	17.16.30	Cobble/Boulder			F Y
54.43837	-5.03229	17.17.02	Mixed soft sediment > Cobble/Boulder			F Y
54.43845	-5.03226	17.17.33	-			F Y
54.43849	-5.03222	17.18.00	Mixed soft sediment > Cobble/Boulder			F Y
54.43853	-5.03217	17.18.30	Cobble/Boulder			F Y
54.43856	-5.03215	17.18.59	Cobble/Boulder			F Y
54.43865	-5.03205	17.19.30	Cobble/Boulder	Anemones		F Y
54.43869	-5.03200	17.20.00	Cobble/Boulder		TOW END	F Y
54.43817	-5.04472	18.32.59	Soft sediment	Vis very poor	Tow 17	F Y
54.43830	-5.04439	18.33.59	Soft sediment			F Y
54.43833	-5.04420	18.34.30	Soft sediment = mixed soft sediment	Large burrows		F Y
54.43831	-5.04405	18.35.00	Soft sediment			F Y
54.43828	-5.04390	18.35.29	Mixed soft sediment			F Y
54.43826	-5.04373	18.36.00	Mixed soft sediment			F Y
54.43823	-5.04344	18.37.00	Mixed soft sediment			F Y

54.43820	-5.04331	18.37.30	Mixed soft sediment			F Y
54.43817	-5.04311	18.37.59	Mixed soft sediment			F Y
54.43818	-5.04298	18.38.30	Mixed soft sediment			F Y
4435.73333	-5.04279	18.38.59	Mixed soft sediment			F Y
54.43821	-5.04258	18.39.30	Mixed soft sediment			F Y
54.43823	-5.04237	18.40.00	Mixed soft sediment			F Y
54.43824	-5.04217	18.40.30	Mixed soft sediment			F Y
54.43827	-5.04199	18.41.00	Mixed soft sediment			F Y
54.43831	-5.04179	18.41.31	Mixed soft sediment			F Y
54.43835	-5.04161	18.42.00	Mixed soft sediment			F Y
54.43838	-5.04140	18.42.31	Mixed soft sediment < Cobble/Boulder			F Y
54.43843	-5.04119	18.43.00	Mixed soft sediment			F Y
54.43860	-5.04056	18.44.30	Mixed soft sediment			F Y
54.43865	-5.04036	18.45.00	Mixed soft sediment			F Y
54.43871	-5.04017	18.45.30	Soft sediment = mixed soft sediment			F Y
54.43875	-5.03999	18.46.00	Soft sediment = mixed soft sediment			F Y
54.43881	-5.03980	18.46.30	Mixed soft sediment			F Y
54.43888	-5.03959	18.47.00	Mixed soft sediment = Cobble/Boulder			F Y
54.43892	-5.03938	18.47.30	Mixed soft sediment < Cobble/Boulder	Vis too poor		F Y
54.43897	-5.03916	18.48.00	Mixed soft sediment < Cobble/Boulder	Anemones		F Y
54.43902	-5.03893	18.48.34	Mixed soft sediment = Cobble/Boulder	Anemones		F Y
54.43907	-5.03874	18.49.00	2.9	Anemones		F Y
54.43912	-5.03855	18.49.30	2.9			F Y
54.43916	-5.03833	18.50.02	Mixed soft sediment > Cobble/Boulder			F Y
54.43933	-5.03815	18.50.32	-			F Y
54.44000	-5.03905	18.52.00	Bedrock			F x
54.44053	-5.04952	19.46.06	Soft sediment	Burrows		F Y
54.44052	-5.04928	19.46.37	Soft sediment			F Y
54.44055	-5.04907	19.47.02	Soft sediment			F Y
54.44056	-5.04885	19.47.31	-			F Y

54.44055	-5.04864	19.48.00	-			F Y
54.44057	-5.04845	19.48.30	Soft sediment = mixed soft sediment	Tubeworms		F Y
54.44057	-5.04823	19.49.01	-			F Y
54.44056	-5.04802	19.49.33	Mixed soft sediment = Cobble/Boulder			F Y
54.44052	-5.04781	19.50.02	Soft sediment = mixed soft sediment			F Y
54.44052	-5.03809	19.50.32	Mixed soft sediment > Cobble/Boulder			F Y
54.44045	-5.04734	19.51.00	Soft sediment < mixed soft sediment	Tubeworms		F Y
54.44045	-5.04710	19.51.30	Soft sediment < mixed soft sediment			F Y
54.44055	-5.04684	19.52.00	Mixed soft sediment			F Y
54.44034	-5.04663	19.52.30	Mixed soft sediment			F Y
54.44027	-5.04631	19.53.00	Mixed soft sediment			F Y
54.44026	-5.04618	19.53.30	Mixed soft sediment			F Y
54.44022	-5.04598	19.54.00	Mixed soft sediment			F Y
54.44020	-5.04579	19.54.30	Soft sediment < mixed soft sediment			F Y
54.44013	-5.04557	19.55.00	Soft sediment < mixed soft sediment			F Y
54.44008	-5.04534	19.55.30	Soft sediment			F Y
54.44001	-5.04513	19.55.59	Soft sediment			F Y
54.43993	-5.04486	19.56.30	Soft sediment	Large burrows		F Y
54.43984	-5.04462	19.57.00	Soft sediment	Burrows		F Y
54.43979	-5.04439	19.57.30	-			F Y
54.43970	-5.04419	19.58.00	Soft sediment	Burrows		F Y
54.43965	-5.04397	19.58.30	Soft sediment			F Y
54.43958	-5.04376	19.59.00	Soft sediment	Burrows		F Y
54.43953	-5.04350	19.59.30	Soft sediment > mixed soft sediment	Burrows		F Y
54.43948	-5.04192	20.00.00	Soft sediment	*Nephrops*		F Y
54.43944	-5.04298	20.00.30	-			F Y
54.43939	-5.04279	20.01.00	Soft sediment > mixed soft sediment			F Y
54.43930	-5.04252	20.01.30	-			F Y
54.43929	-5.04231	20.02.00	Soft sediment > mixed soft sediment	Tubeworms		F Y
54.43923	-5.04204	20.02.30	Soft sediment > mixed soft sediment			F Y

54.43923	-5.04187	20.03.30	Soft sediment > mixed soft sediment			F Y
54.43919	-5.04163	20.03.00	Soft sediment > mixed soft sediment			F Y
54.43914	-5.04135	20.4.00	-			F Y
54.43907	-5.04105	20.4.30	Soft sediment			F Y
54.43902	-5.04080	20.05.00	Soft sediment = mixed soft sediment			F Y
54.43895	-5.04053	20.05.30	Soft sediment > mixed soft sediment			F Y
54.43889	-5.04025	20.05.59	Soft sediment = mixed soft sediment			F Y
54.43876	-5.03997	20.06.30	Soft sediment = mixed soft sediment			F Y
54.43865	-5.03970	20.07.00	-	*Munida* & Anemones		F Y
54.43856	-5.03945	20.07.30	Cobble/Boulder			F Y
54.43844	-5.03919	20.08.00	Cobble/Boulder			F Y
54.40488	-5.06270	16:18	Bedrock	Tubeworms		
54.40476	-5.06269		Soft sediment			
54.40437	-5.06257		Soft sediment			
54.40401	-5.06250		-			
54.40362	-5.06244		-			
54.40333	-5.06250	16:23	Soft sediment > mixed soft sediment			
54.40277	-5.06277		Soft sediment			
54.40233	-5.06315		Soft sediment = mixed soft sediment			
54.40217	-5.06332		Soft sediment < mixed soft sediment			
54.40198	-5.06358		Mixed soft sediment			
54.40180	-5.06390		Mixed soft sediment > Cobble/Boulder			
54.40160	-5.06427		Mixed soft sediment = Cobble/Boulder			
54.40135	-5.06465		-			
54.40110	-5.06496	16:32	Mixed soft sediment = Cobble/Boulder	Tubeworms		
54.39987	-5.05860	17:07	Cobble/Boulder	Tubeworms		
54.39969	-5.05841		Mixed soft sediment = Cobble/Boulder			
54.39933	-5.05820		Cobble/Boulder			
54.39901	-5.05803		Mixed soft sediment < Cobble/Boulder	Anemones		
54.39867	-5.05793		Mixed soft sediment = Cobble/Boulder	Tubeworms		

54.39830	-5.05775		Soft sediment = mixed soft sediment			
54.39798	-5.05768	17:13:04	Soft sediment = mixed soft sediment			
54.39763	-5.05759		Mixed soft sediment > Cobble/Boulder			
54.39746	-5.05751		Bedrock			
54.39719	-5.05738		Mixed soft sediment = Cobble/Boulder			
54.39698	-5.05725		Bedrock	Anemones		
54.39648	-5.05644	17:18	Mixed soft sediment > Cobble/Boulder			
54.39625	-5.05619		Mixed soft sediment			
54.39597	-5.05602		Mixed soft sediment > Cobble/Boulder	Anemones		
54.39557	-5.05590		Mixed soft sediment			
54.39526	-5.05590		Mixed soft sediment > Cobble/Boulder			
54.39486	-5.05593		Mixed soft sediment			
54.39451	-5.05589		Mixed soft sediment			
54.39425	-5.05573	17:25	Mixed soft sediment			
54.39387	-5.05541		Mixed soft sediment			
54.39369	-5.05529	17:27	Mixed soft sediment			
54.41249	-5.05262	18:32:04	Mixed soft sediment = Cobble/Boulder	Anemones		
54.41202	-5.05248		Cobble/Boulder	Anemones		
54.41172	-5.05232		Cobble/Boulder	Anemones		
54.41142	-5.05200		-			
54.41115	-5.05183		-	Burrows		
54.41088	-5.05165		Soft sediment = mixed soft sediment	Tubeworms & burrows		
54.41056	-5.05151		Mixed soft sediment > Cobble/Boulder	Tubeworms		
54.41019	-5.05143		Mixed soft sediment > Cobble/Boulder	Anemones		
54.40981	-5.05145	18:41	Soft sediment = mixed soft sediment	Tubeworms		
54.40953	-5.05147		Mixed soft sediment > Cobble/Boulder			
54.40918	-5.05138		Mixed soft sediment	Tubeworms		
54.40890	-5.05129		Soft sediment < mixed soft sediment	*Sebella* and Tubeworms		
54.40849	-5.05127		Mixed soft sediment > Cobble/Boulder	*Sebella* and Tubeworms		
54.40822	-5.05123		Mixed soft sediment			

54.40786	-5.05119	18:47:28	Mixed soft sediment > Cobble/Boulder	Hydriods and Anemones		
54.40761	-5.05115		Mixed soft sediment			
54.40738	-5.05112		Soft sediment < mixed soft sediment	*Sebella* and Tubeworms		
54.40696	-5.05102		Mixed soft sediment > Cobble/Boulder	Anemones		
54.40674	-5.05100		Mixed soft sediment			
54.40641	-5.05088		Mixed soft sediment			
54.40619	-5.05080		Soft sediment < mixed soft sediment	*Sebella* and Tubeworms		
54.40595	-5.05067	18:54	Mixed soft sediment > Cobble/Boulder	Anemones		
54.40564	-5.05055		Mixed soft sediment = Cobble/Boulder	Axinella		
54.40537	-5.05043		Mixed soft sediment = Cobble/Boulder	Anemones and sponges		
54.40512	-5.05037		Mixed soft sediment = Cobble/Boulder	Squats		
54.40483	-5.05025		Mixed soft sediment > Cobble/Boulder			
54.40445	-5.05011	18:59	Cobble/Boulder	Good turf		