5.1 Regional Hamon Grab Survey Particle Size Analysis Results

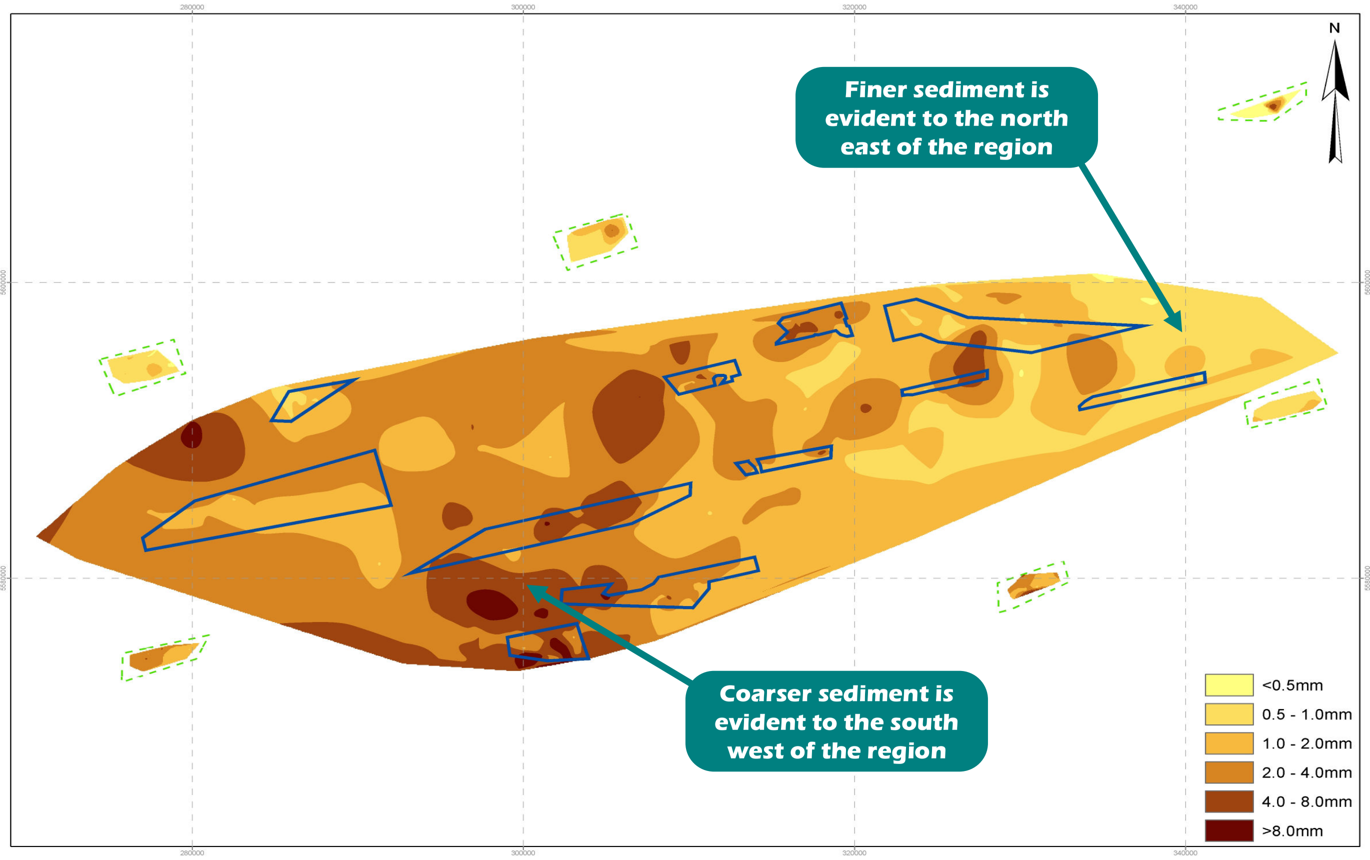
Results of particle size analysis carried out on Hamon grab samples are presented in **Appendix 19**. **Figures 47** to **53** present regional illustrations of the results. Percentages of gravel, sand and silt in samples are presented along with a regional plot of the d50(mm) value for samples.

The results show that to the north east of the region seabed sediment has a higher proportion of sand. To the south and west of the region the proportion of gravel (grain size >2mm) in sediment increases. The highest proportion of gravel in sediment (>49%) is evident in Areas 461, 478 and 475. Areas 473 East and West also have areas of sediment with high proportions of gravel. There also seems to be a suggestion that the percentage of gravel in sediments is higher through the central region of the survey area from Area 473 East through Area 473 West and 478 down towards Areas 475 and 461 (see below).

Due to the low proportion of silt in the samples (generally <5%) the proportion of sand in samples can be considered the opposite of that seen for gravel. Lower proportions of sand are evident in sediment to the south west with the highest proportion in the north east. These results, demonstrating generally coarser sediment to the south west and a generally low proportion of silt in all sediments, concur with the conclusions of the REA (2003).

A plot of d50(mm) across the region shows that whilst gravel forms a higher proportion of the sediment in the areas described above, the sediments in Area 461, 475 and 478 are coarser than those in other 'gravel rich' areas. Again, this confirms the findings of previous studies that noted the seabed in Area 461, and to a lesser extent 475 and 478, was significantly coarser than other areas in the region.

Illustrative plot showing median (d50) particle size (mm) of samples acquired during the regional Hamon grab survey.



5.2 Area 473 East Seabed Sediment Survey Results

The seabed photographs and images of grab samples taken are shown in **Appendix 5**. The SPI images taken are presented in **Appendix 5**. The full report of seabed sediment survey operations, including SPI deployment, is provided in **Appendix 2** (Utec, 2005).

Video transect footage are stored on original DV media. Copies of the DV tapes have been made. The video is not presented in this report. Analysis and reporting of video data will be completed when repeat data are available for comparison.

Preliminary review of the seabed photographs (**Figure 12**) and grab images shows that the seabed sediment in the area is almost exclusively gravely sand and sandy gravel. Seabed photographs show that the *in situ* seabed surface is generally gravely, with varying proportions of cobbles and shell particles. No fine, mobile sediment was evident at any of the sites although, to the east and north of the survey, area some areas were noticeably sandier than the majority of sites.

The grab sampling provided seabed samples with varying degrees of success. Generally, between 15-30cm of sediment was sampled, although in some areas, coarser sediments prevented completed closure of the grab jaws and as a result samples were washed out.

Samples showed that the upper layers of seabed sediment in the survey area are composed of a mixture of sand and gravel with no evidence of discrete sediment units in the vertical profile. Interestingly, the grab samples showed that the lag gravel deposit evident at the seabed surface in drop camera images is generally underlain by a coarse sand and gravel mix, containing varying amounts of shell and cobbles.

The results of the seabed photography and grab sampling provide an initial picture of the seabed within the study area that supports the interpretation of the sidescan sonar data; notably that the seabed within the area is almost exclusively composed of sandy gravel or gravely sand.

Beyond this general description, a review of the seabed photography and grab images provides some indication of broad-scale differences over the survey area. To the east of the survey area, several of the sites were noticeably sandier with a predominantly fine gravel fraction evident at the seabed surface.

Elsewhere in the survey area, a lower proportion of sand was evident combined with a coarser gravel fraction. In some areas to the north of the survey area, shell fragments made up a significant proportion of the sample although these sites were not common.

The SPI survey was generally successful. With the exception of poor penetration at 2 sites, good images of the sediment water interface were taken at all sites. Surface images of the sampling sites were also taken and these are provided in the SPI survey report.

The SPI images show that the upper layer of the seabed sediment is composed of gravely sand/sandy gravel and that sediment at all sites is similar in composition. The sand fraction at all sites contains a proportion of shell fragments.

A preliminary review of video transect data by ecologists has confirmed that the quality of the data is sufficient to allow description of the seabed character. A full review of the video transect data will be undertaken prior to the first repeat seabed sediment survey.

5.3 Results of Particle Size Analysis of Core Samples taken from Clamshell Grab Samples

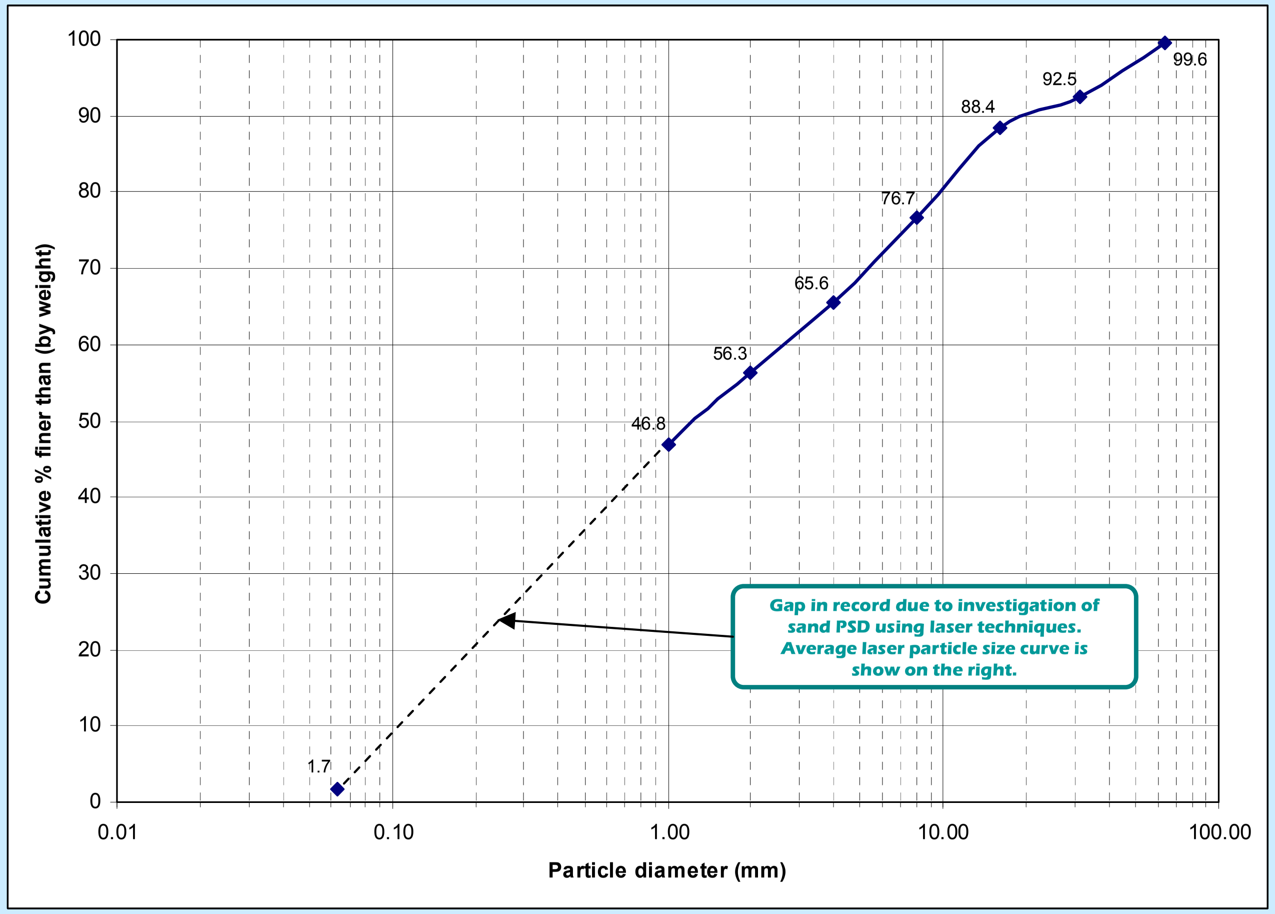
Two methods were used to determine the particle size distributions for samples taken during the clamshell grab survey. The small core samples were initially processed by sieving to determine the particle size distribution for the coarse (>2mm) fraction of the sample. The <2mm (sand, silt and clay) fraction was separated during sieving and subsequently analysed using laser particle size techniques.

The results of the sieving analysis are illustrated in **Figures 13** and **14**. The proportion of gravel in seabed sediment samples varied from 25-75%. Proportion of fine sediment (silt-clay) was in all cases less than 4.5% (average 1.7%).

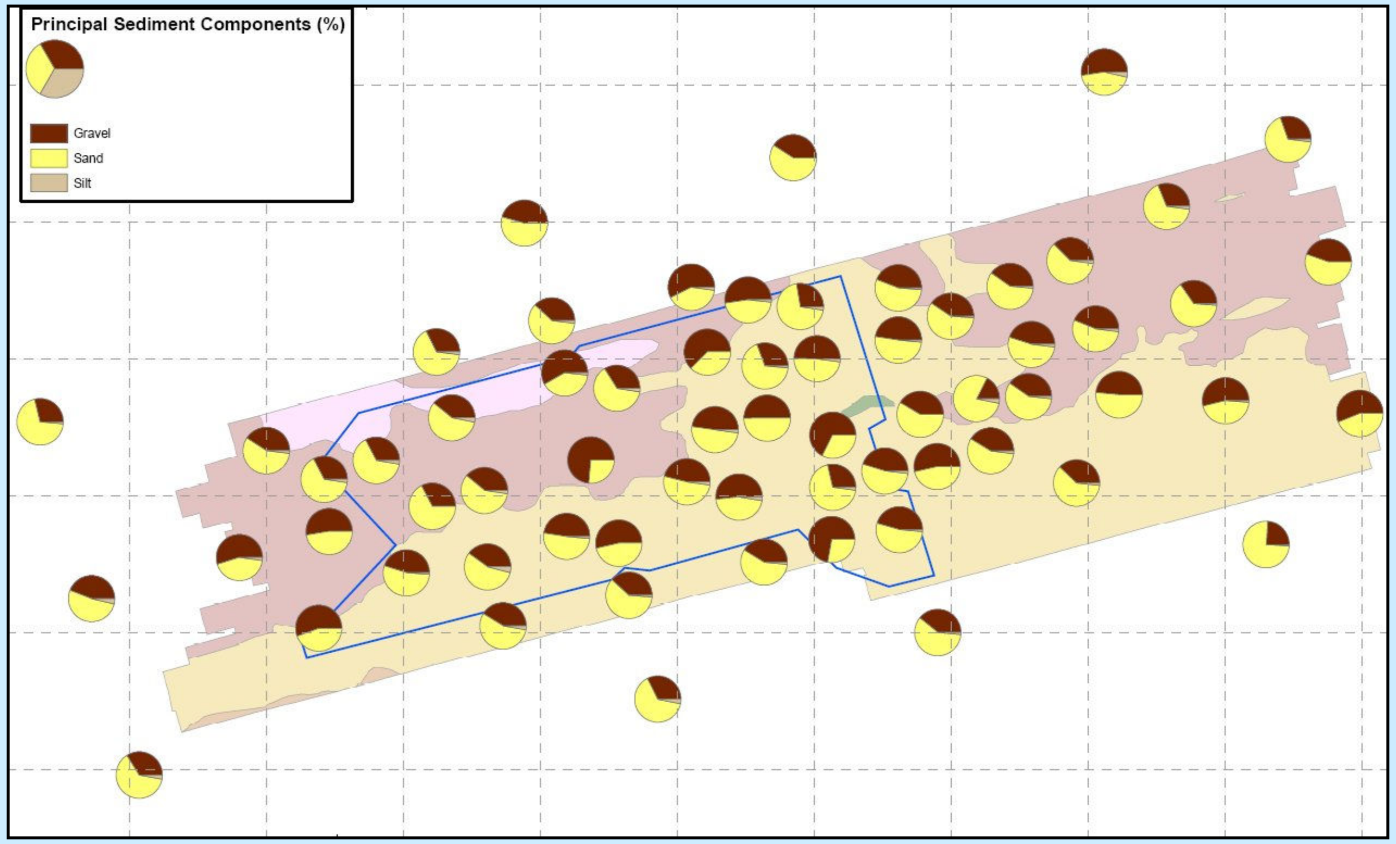
The laser particle size analysis shows that the sand fraction of the sediment in the survey area is principally (>75% by volume) composed of very coarse, coarse and medium sand (**Figure 15**). Of the 65 samples analysed, 61 were identified as being unimodal in character, varying from moderately to poorly sorted in character. The remaining 4 samples were all bimodal in character.

58 of the unimodal samples were identified as having modal values of between 0.355-0.447mm. The remaining unimodal samples all exhibited modal values of >0.550mm. The four bimodal samples were identified as distinct due to a second mode at approx 0.825mm that is attributed to shell fragments in the sample.

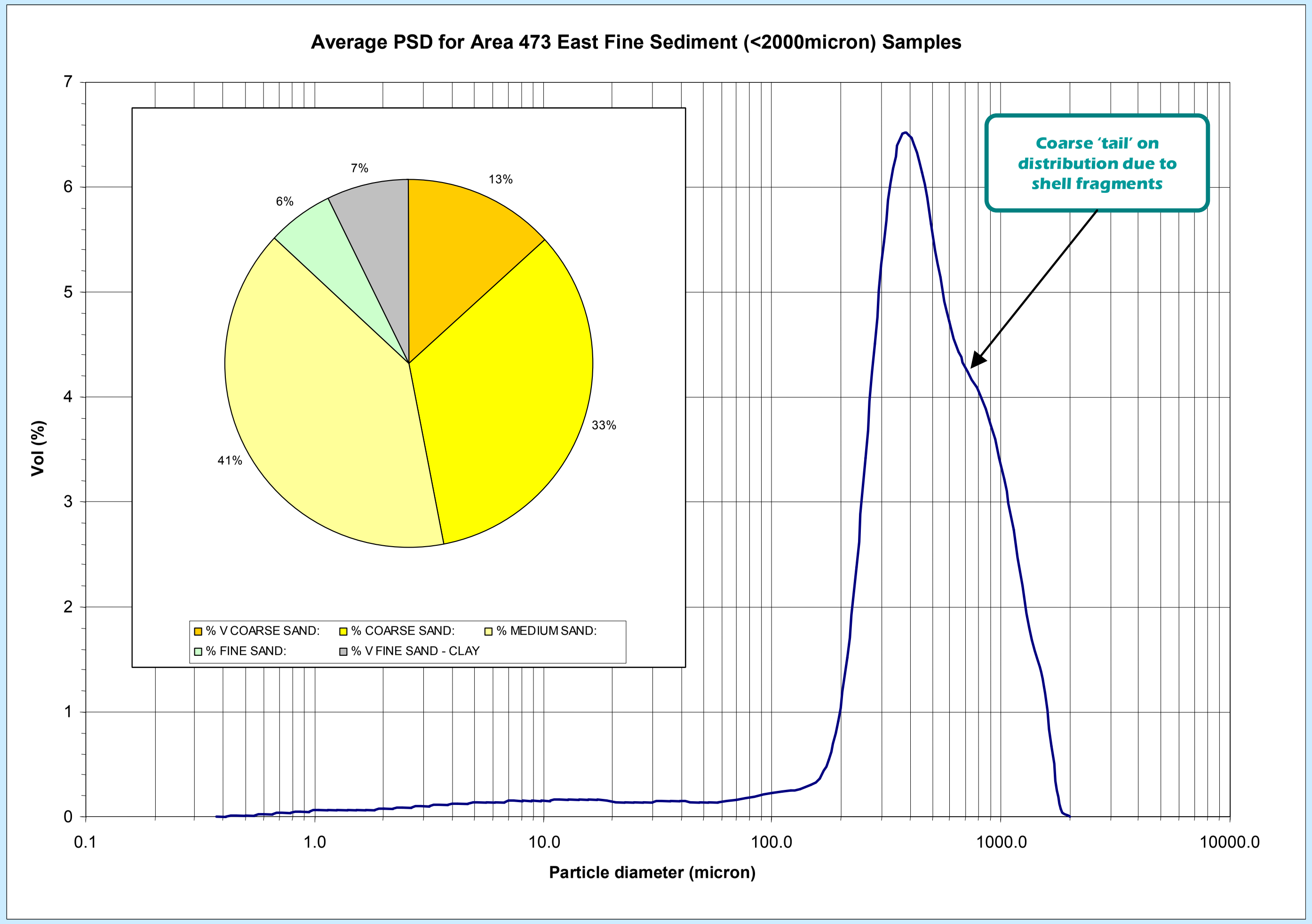
52 of the samples analysed by laser diffraction techniques were described as either medium silty, poorly or moderately sorted medium sand. The remaining 13 samples were identified as poorly or moderately sorted coarse sand. The plot of the proportion of medium, fine and very fine sand in laser analysis samples (**Figure 16**) shows that the majority of the area under investigation is composed of between 40-60% of these size fractions. The remainder of the <2mm components of the seabed sediment are principally coarse or very coarse sand, with approximately 10% of the complete sample composed of shell fragments (0.7-0.8mm).



The proportion of three main sediment constituents in hand cores taken from clamshell grab samples (gravel = >2mm, sand = 2mm-0.063mm, silt/clay = <0.063mm) is shown below (determined by sieve analysis).



Following sieve analysis, the fine fraction of the samples was subjected to laser particle size analysis. The resulting average size distribution is shown below.



Summary of the Results of the Regional and Area 473 East Seabed Sediment Surveys

→ **The seabed within the ECR is composed almost exclusively of sand and gravel. Regional variation exists in the dominant proportion of each component. To the east and north of the region sediment is predominantly sandy. Coarser sediment exists in the central and southern area of the region with some coarser areas to the far west of the region.**

→ **The seabed sediment in the region is poorly sorted to the north east, with extensive areas to the south west that are very poorly sorted. Fine sediment (<0.063mm) represents <1% (by weight) of the seabed sediment across the majority of the region.**

→ **The seabed within Area 473 East is composed of gravely sand and sandy gravel. Very little fine, mobile sediment exists upon the seabed surface. There is no evidence of sediment bedforms on acoustic monitoring data. The seabed is virtually featureless showing very little variation in character.**

→ **Laser particle size analysis of clamshell grab sand samples show that the sand fraction of the sediment within and surrounding Area 473 East is principally composed of medium, coarse and very coarse sand (<2mm and >0.2mm). The fine sand fraction (<0.2mm and >0.063mm), that is of interest when considering the development of fine sand deposits as predicted in the REA, makes up approximately 4% of the >2mm fraction by volume.**

5.4 Regional Static Image Analysis from Hamon Grab Survey

The static image data has been used in two ways; production of simple species distribution plots and community plots based on PRIMER analysis. Due to the uncertainty or, in some cases, generality of the species identification, PRIMER could not be used to its full advantage with these data. However, several trends are evident with respect to communities which may be characterised on the basis of single or small groups of species.

A total of 82 taxa were identified with the most frequently occurring species comprising the following:

- ***Pomatoceros spp***
- ***Coralline algae***
- ***Bryozoan crusts***
- ***Aequipecten opercularis***
- ***Galathea spp***
- ***Cellapora pumicosa***
- ***Psammechinus miliaris***

The highest overall abundances were found for *Pomatoceros* spp, *Aequipecten opercularis*, Coralline algae and *Ophiothrix fragilis*

The cluster analysis revealed 6 groups of sites, of which two were distinct from the initial MDS analysis, comprising afaunal sands and the remainder. The remaining sites indicate a further relatively clear division into three groups, with two further less well defined groups (see **Figure 54**) although the plot is a relatively poor representation of the cluster analysis. The characteristics of the clusters may be described as follows with equivalent biotope codes from Conner *et al* (2004) included:

AF No evident epifauna in sandy sediments (**SS.SCS.OCS.** Offshore circalittoral coarse sediment)

A Very shelly coarse gravel with low diversity fauna, sparse hydroid (*Hydrallmania falcata*) and bryozoan growth (*Cellapora pumicosa*). (Impoverished version of **SS.SMx.CMx.FluHyd.** *Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment

B Very coarse gravels with low diversity species, dominated by *Pomatoceros* spp. (**SS.SCS.CCS.PomB.** *Pomatoceros triqueter* with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles)

D Shelly gravel characterised by *Ophiura* sp. bryozoan crusts and *Galathea* sp. (The nearest biotope description is at habitat level, **SS.SCS.OCS.** Offshore circalittoral coarse sediment)

E Coarse gravel with shell dominated by *Aequipecten opercularis*. More stable version of **SS.SCS.CCS.PomB** including abundant *Aequipecten* (**SS.SCS.CCS.PomB.Aeq.** Pomatoceros triqueter with barnacles, bryozoan crusts and *Aequipecten opercularis* on circalittoral pebbles and gravel)

F Cobbles and very coarse gravel, with abundant *Ophiothrix fragilis*. (**SS.SMx.CMx.OphMx.** *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment)

The distribution of the clusters across the area is illustrated in **Figure 55**. The interpolation of the clusters imposed on the data is based on the principal physical variables in the PCA plot (**Figure 56**), with the sequence of physical variables progressing from cobbles to sand, via gravel. The distribution of the habitats, with associated principal species, is used to describe the baseline situation, rather than the less precise biotopes

The region to the north and east is comprised of sands with no evident epifauna. Over the remainder of the region it is evident that the majority of the area falls either within the Shelly gravel (Cluster D) characterised by *Ophiura* sp, bryozoan crusts and *Galathea* sp habitat, or the Coarse gravel (Cluster E) with shell dominated by *Aequipecten opercularis* habitat. If considered in relation to the physical conditions in these habitats it is evident that *Ophiura* is tending towards the sediments with a larger shell and gravel fraction, while *Aequipecten* is corresponding with the coarser pebbles and gravels. (**Figures 57** and **58**). If the distribution of these two species is considered (**Figures 59** and **60**) it is evident that the latter is widely present, and generally in high numbers, in both the south and southwest of the area. Although some overlap occurs, generally, where *Aequipecten* is found *Ophiura* is absent and *vice versa*.

The *Ophiothrix* dominated habitat shows a clear and well defined distribution in the central southern area of the region (**Figure 61**), where the sediments tend to be very coarse, including a significant proportion of cobbles (**Figure 64**).

Cluster B, although characterised by high abundance *Pomatoceros* sp, was only sporadically evident, whereas the species that characterises this cluster is widely distributed across the region. The sites where this habitat was found correspond with the sites where *Pomatoceros* sp was evident in abundance, predominantly in the south west of the region. (**Figure 63**)

Cluster A was also very limited in distribution and tended to be located in isolated patches, although the interpolation method employed in **Figure 55** tends to overemphasize its distribution. Other species show interesting trends including the echinoderm *Psammechinus miliaris* (**Figure 62**), which has a reasonably discrete distribution, with the highest abundances found in the south west of the area. This species is recorded as a subdominant species in both the *Aequipecten* and *Ophiothrix* dominated habitats.

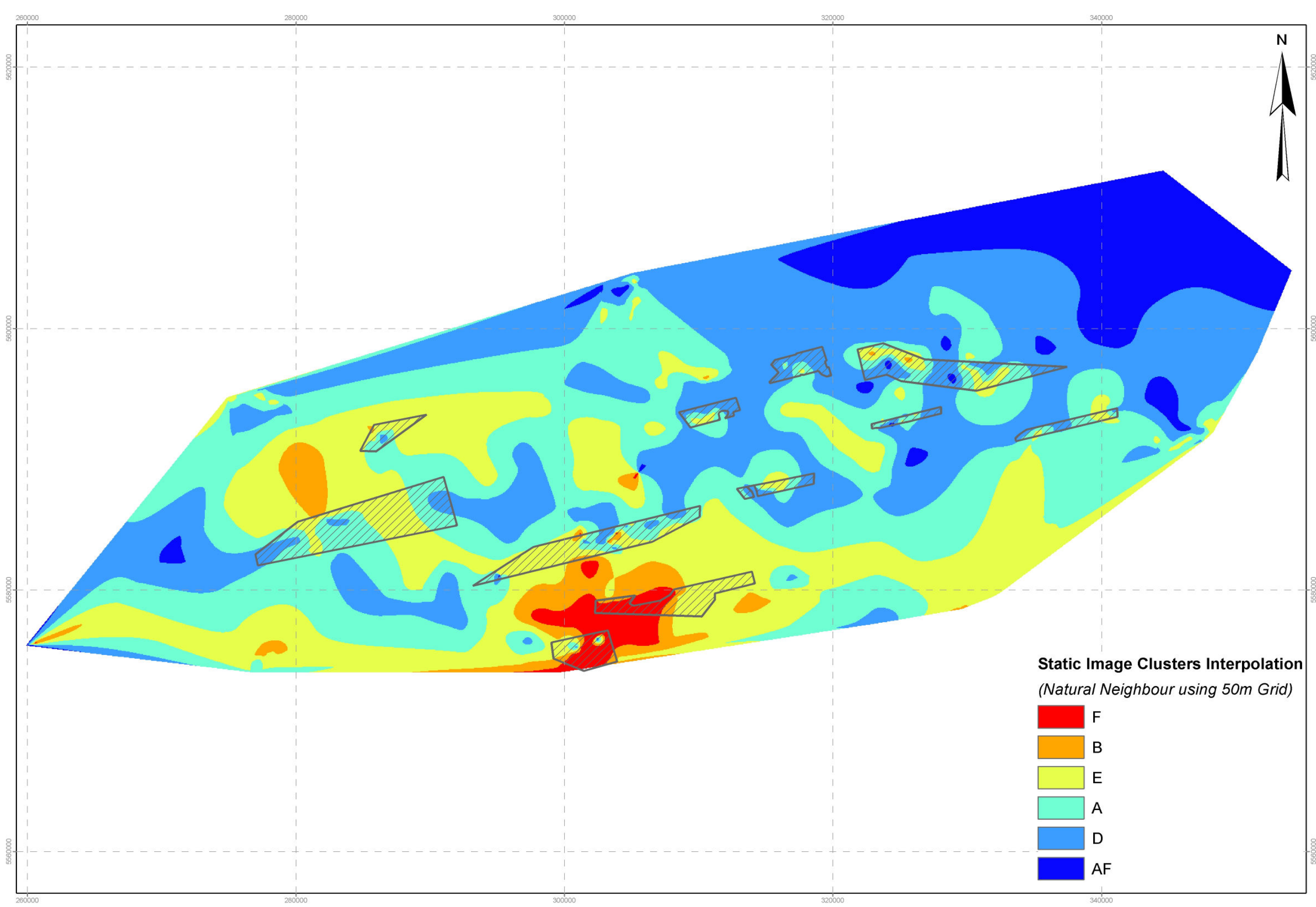


Figure 55 Analysis of static images has resulted in a characterisation of seabed communities in terms of indicative species leading to a biotope classification.

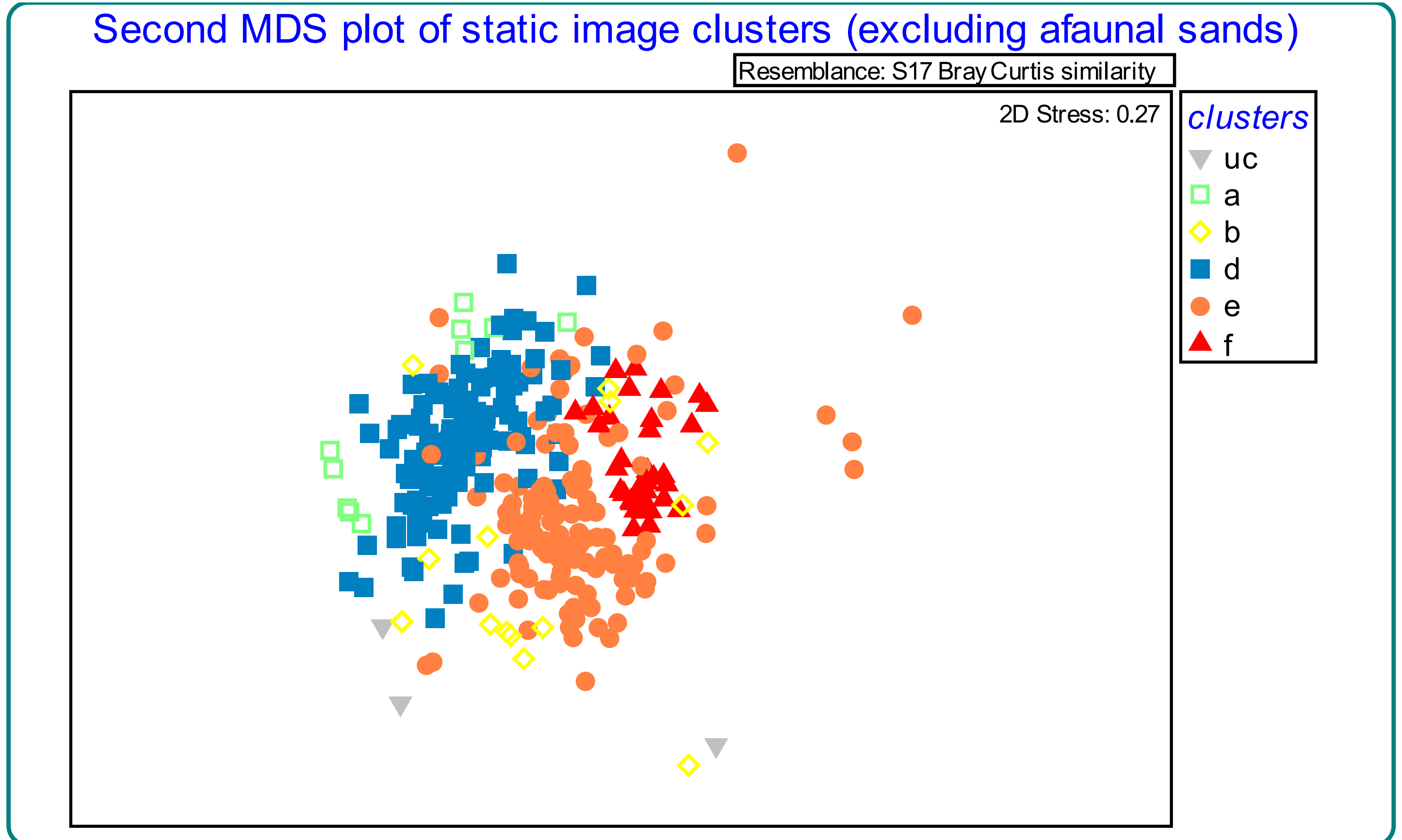


Figure 54

Multi-dimensional scaling plot of data acquired from static image analysis.

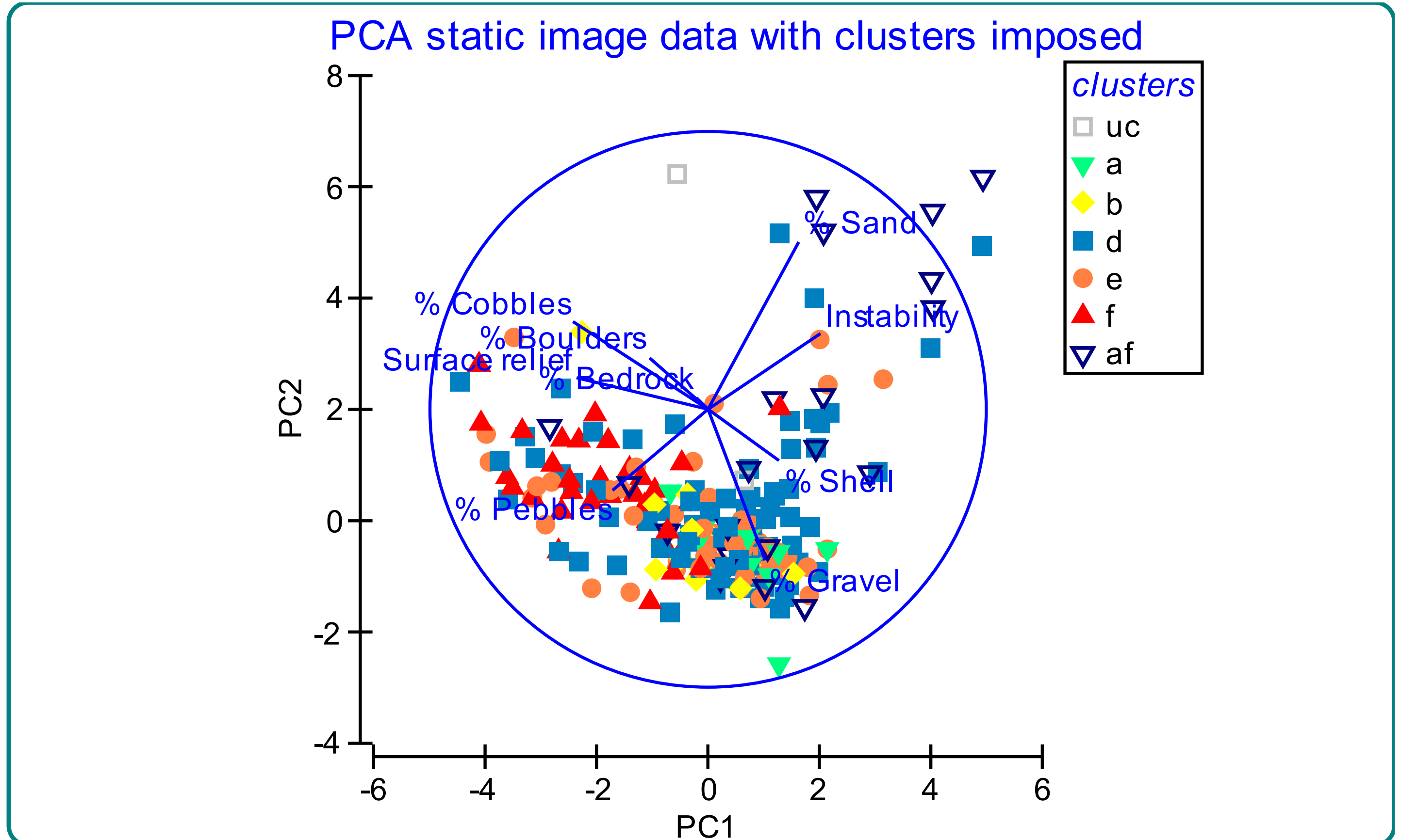


Figure 56

Principal components analysis (PCA) of static image data showing the influence of physical variables on the clusters.

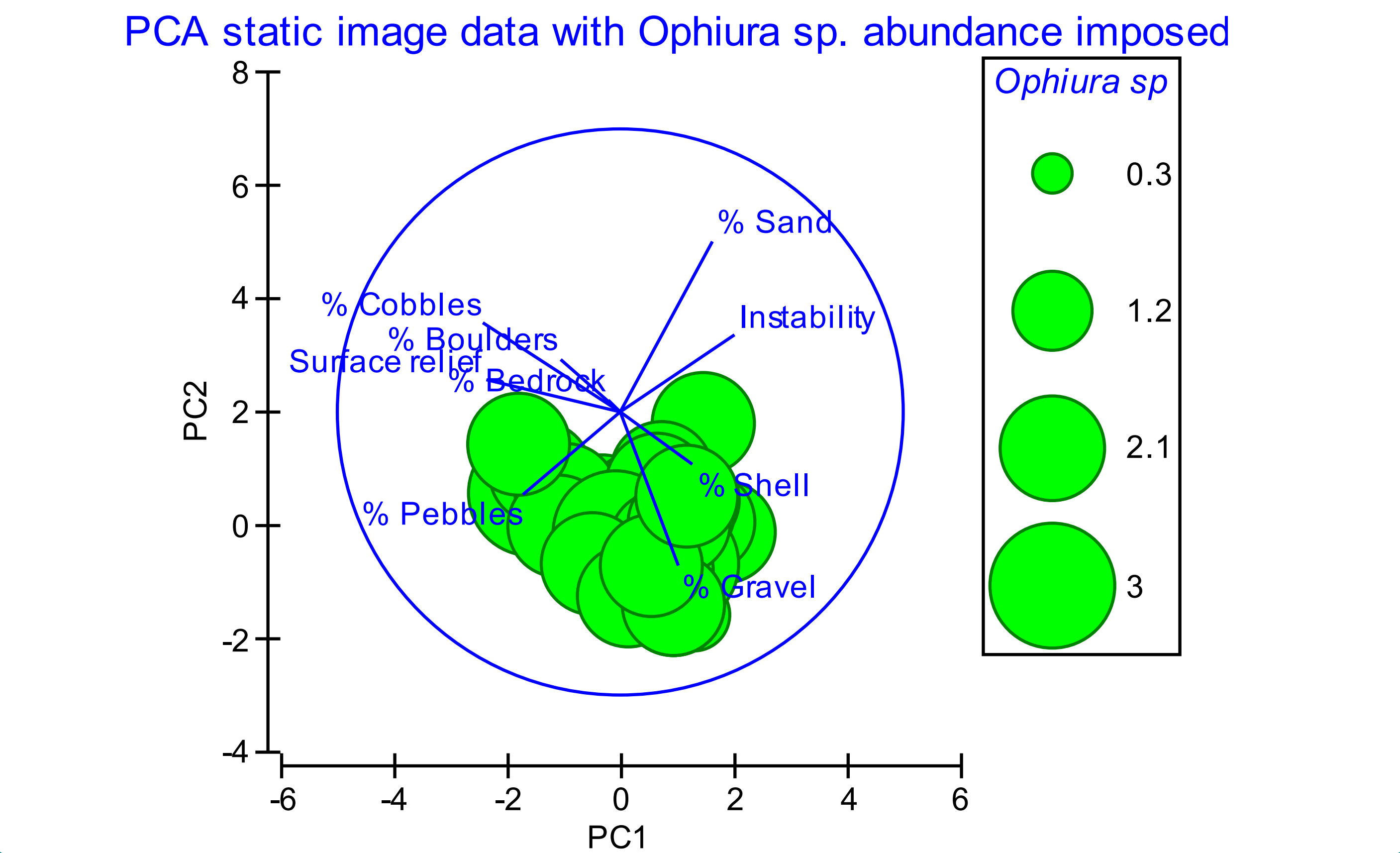


Figure 57

PCA plot showing the influence of *Ophiura sp.* on the clusters identified.

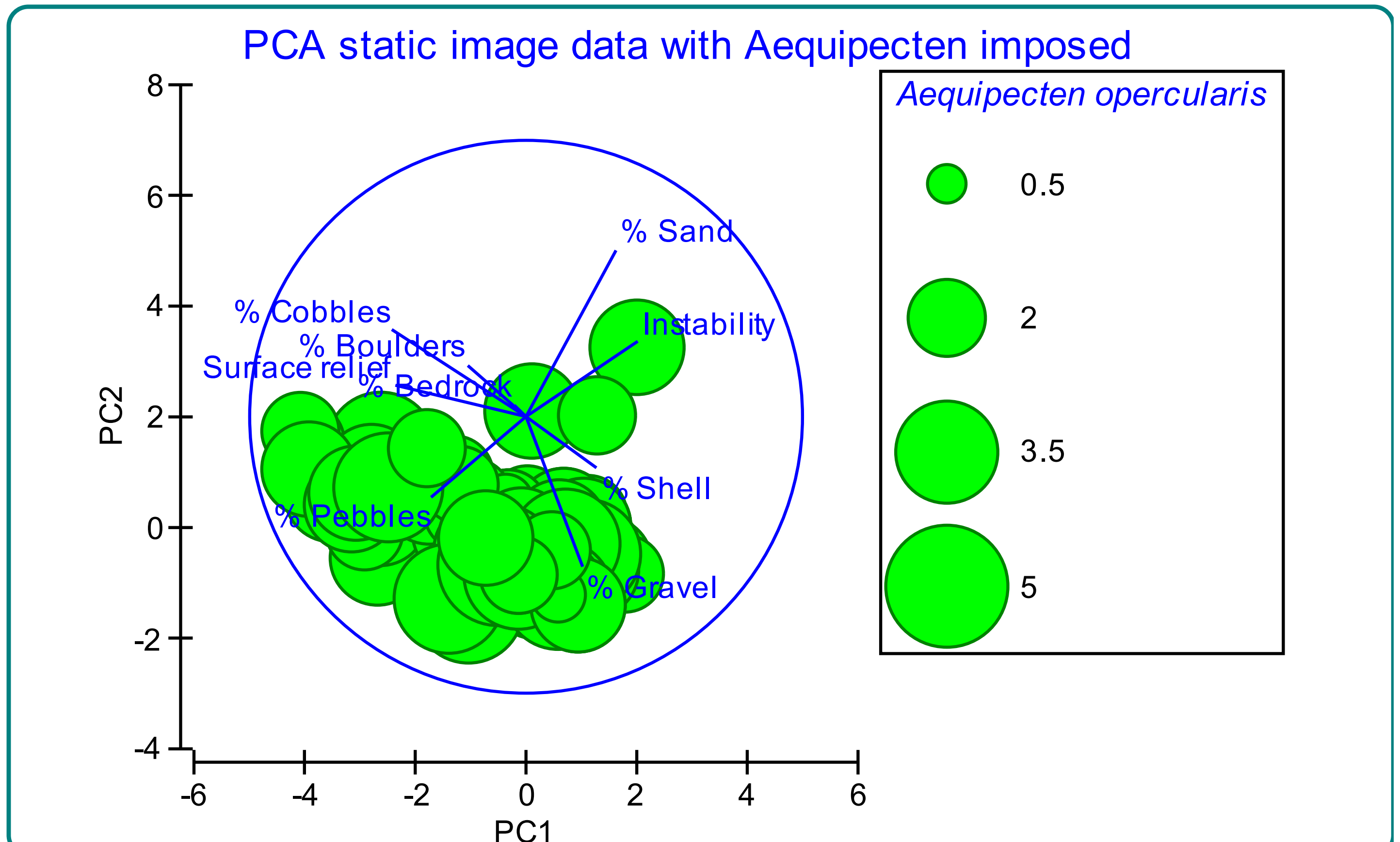


Figure 58

PCA plot showing the influence of *Aequipecten* on the clusters identified.

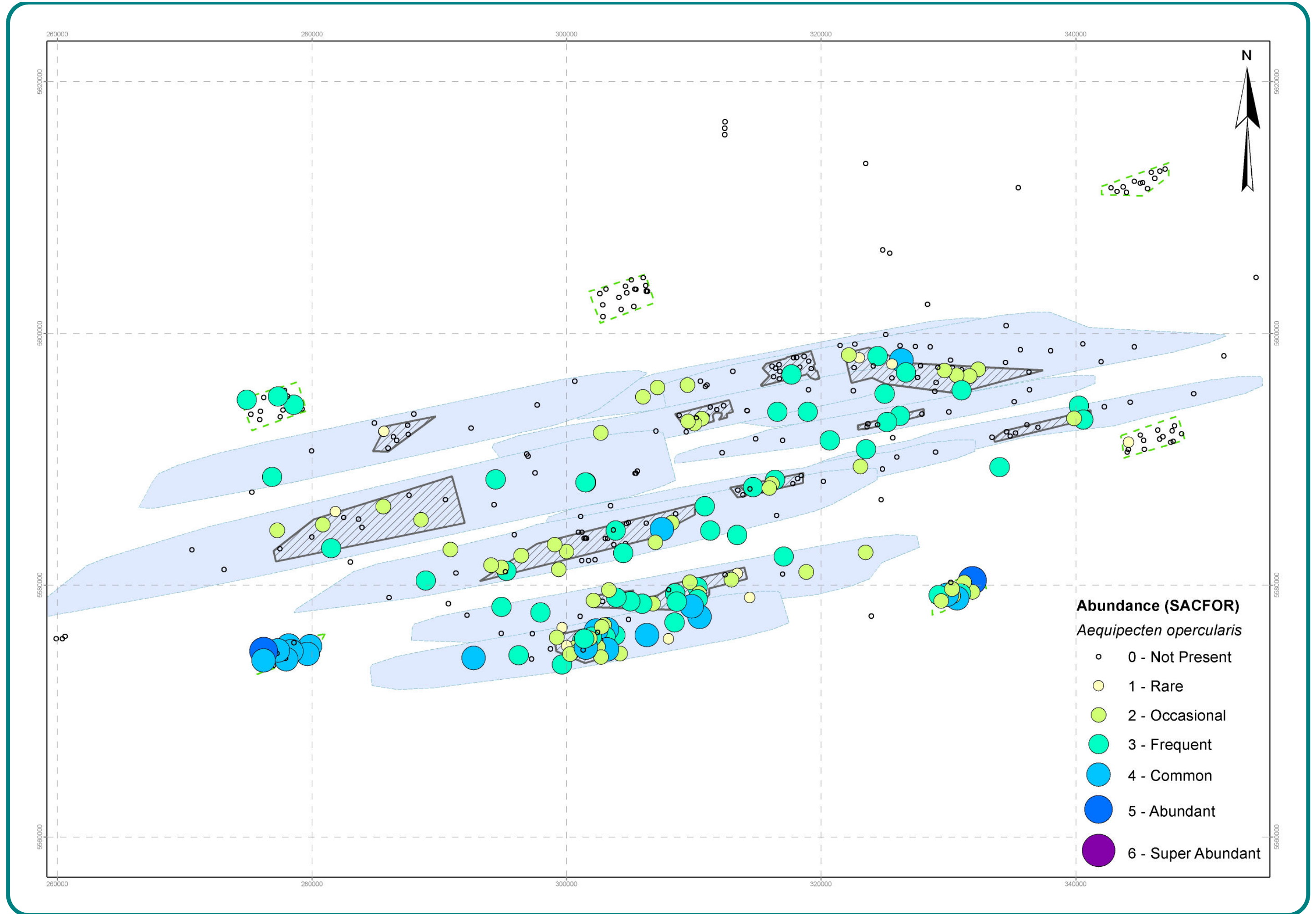


Figure 59 Abundance (SACFOR) of *A. opercularis* noted on static images of the seabed acquired during Hamon grab survey.

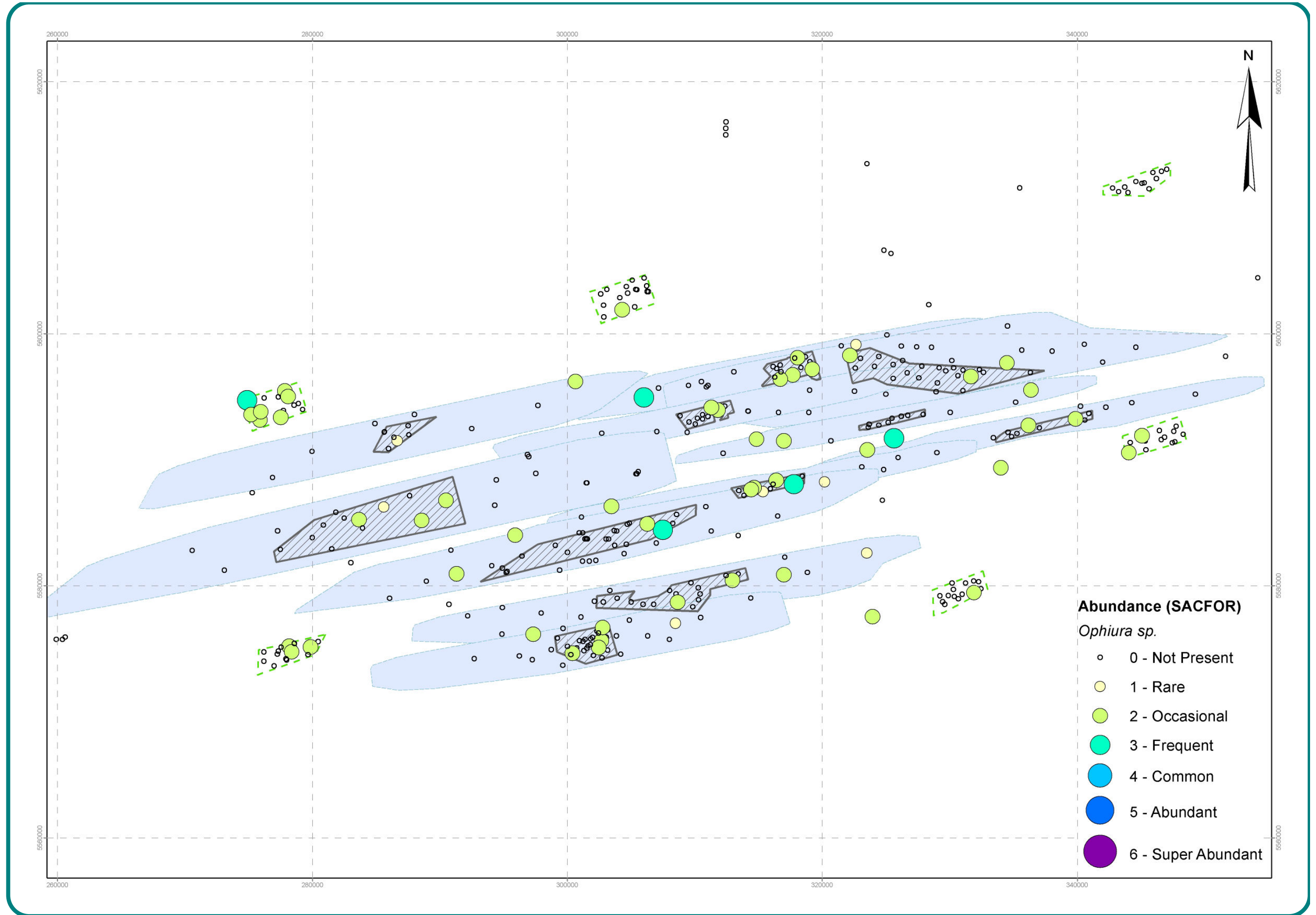


Figure 60 Abundance (SACFOR) of *Ophiura* sp. noted on static images of the seabed acquired during Hamon grab survey.

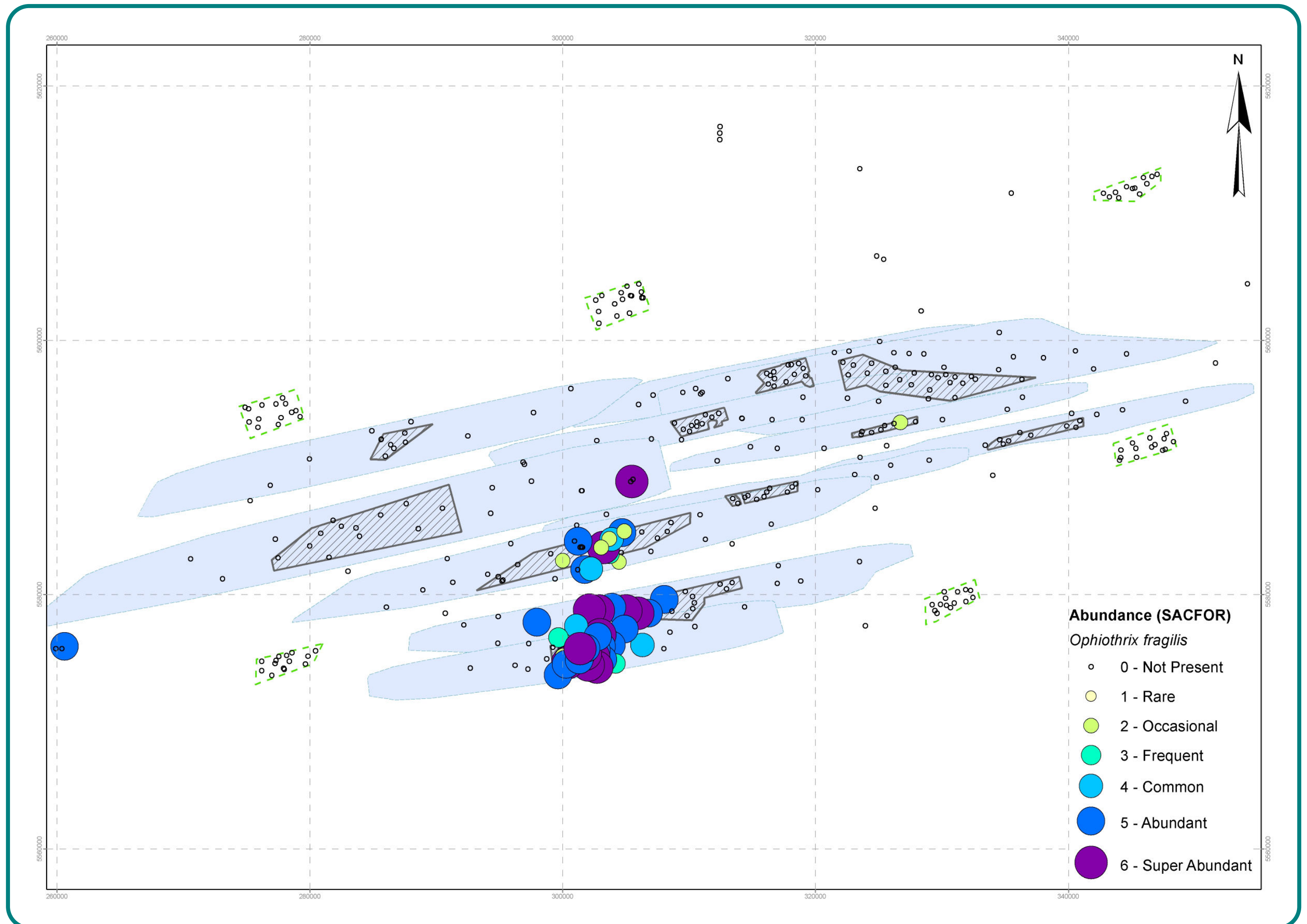


Figure 61 Abundance (SACFOR) of *O. fragilis* noted on static images of the seabed acquired during Hamon grab survey.

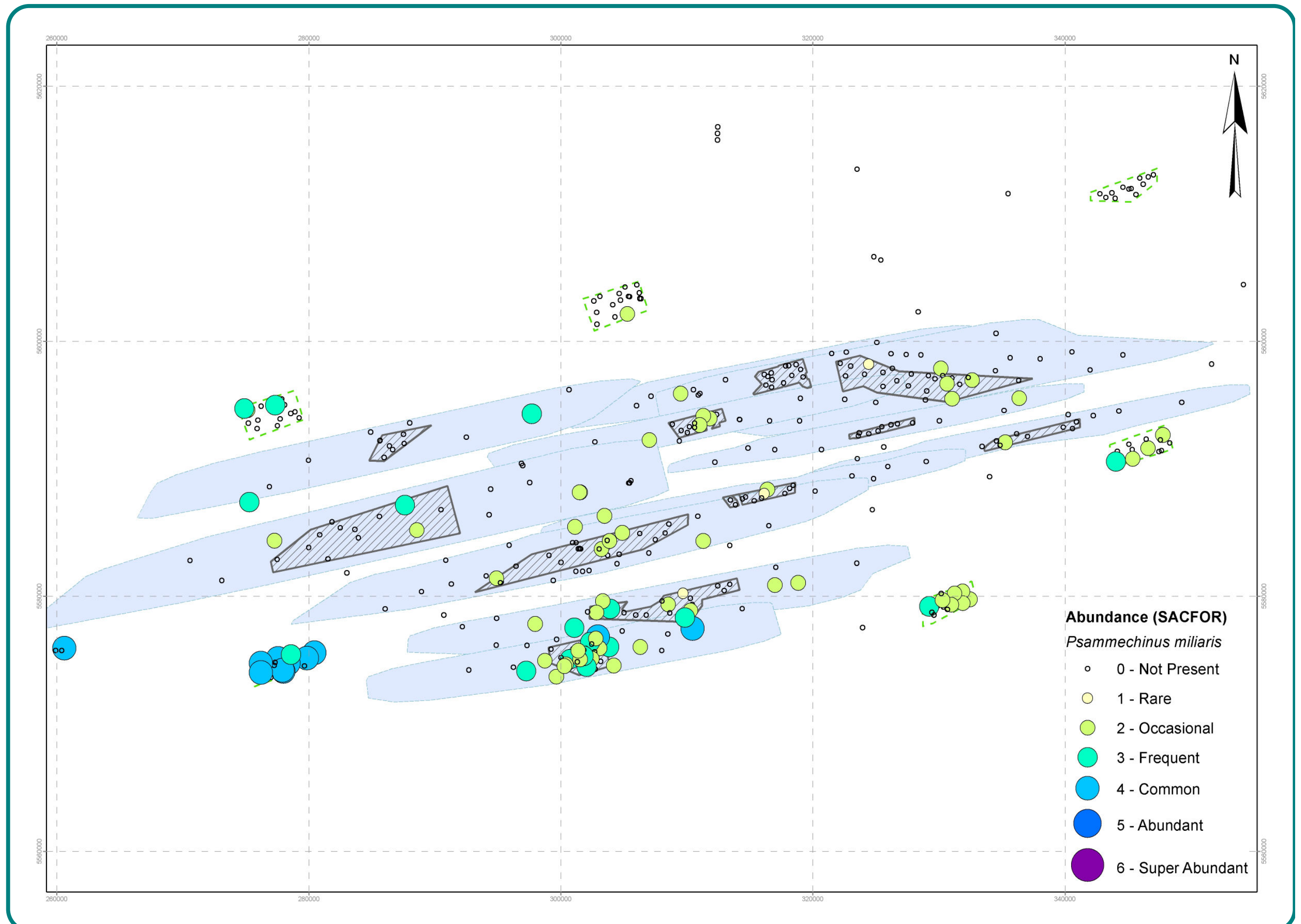


Figure 62 Abundance (SACFOR) of *P. miliaris* noted on static images of the seabed acquired during Hamon grab survey.

Summary of the Results of the Static Image Analysis

→ The value of the data derived from the static image survey is greatest with respect to determination of the distribution of individually recognisable species such as *Aequipecten opercularis* or *Psammechinus miliaris*. The data are less useful when considering multivariate analysis due to the lack of precision with respect to various taxonomic groups, such as the bryozoa and the hydrozoa.

→ Six habitat and community groups were defined and biotopes attributed to them. In some cases biotopes at a detailed level could not be attributed. One of the most widespread of the biotopes was a variant of the PomB, taking account of the abundance of *Aequipecten opercularis*, i.e. PomB.Aequ, which it is suggested should be established as a separate biotope in Connor *et al* (2004).

→ The habitats and associated communities demonstrate a gradient from the north east of the region to the south west, based on principal sediment components and dominant or characterising species. In the north east of the area, afaunal sand has been identified, with the majority of the of the remainder of the area comprised of a mosaic of *Ophiura* with shell gravel and *Aequipecten* in coarse gravel, with the former predominating in the north east and the latter in the south west. An area of well defined *Ophiothrix* beds was observed in the central south of the region.

5.5 Hamon Grab Sample Faunal Analysis Results

Following data rationalisation and truncation, which eliminated or combined species identified to different taxonomic levels by different laboratories a total of 540 taxa were recorded for inclusion in subsequent analysis. These were composed of the following major groups;

- ***Cnidaria (Anthozoa)*** ***3***
- ***Sipuncula*** ***4***
- ***Polychaeta*** ***207***
- ***Oligochaeta*** ***3***
- ***Crustacea*** ***170***
- ***Mollusca*** ***112***
- ***Echinodermata*** ***28***
- ***Pisces*** ***6***

Single examples of the Turbellaria, Nemertea, Chaetognatha, Sipuncula and Cephalochordata were also noted.

The most frequently occurring species overall were:

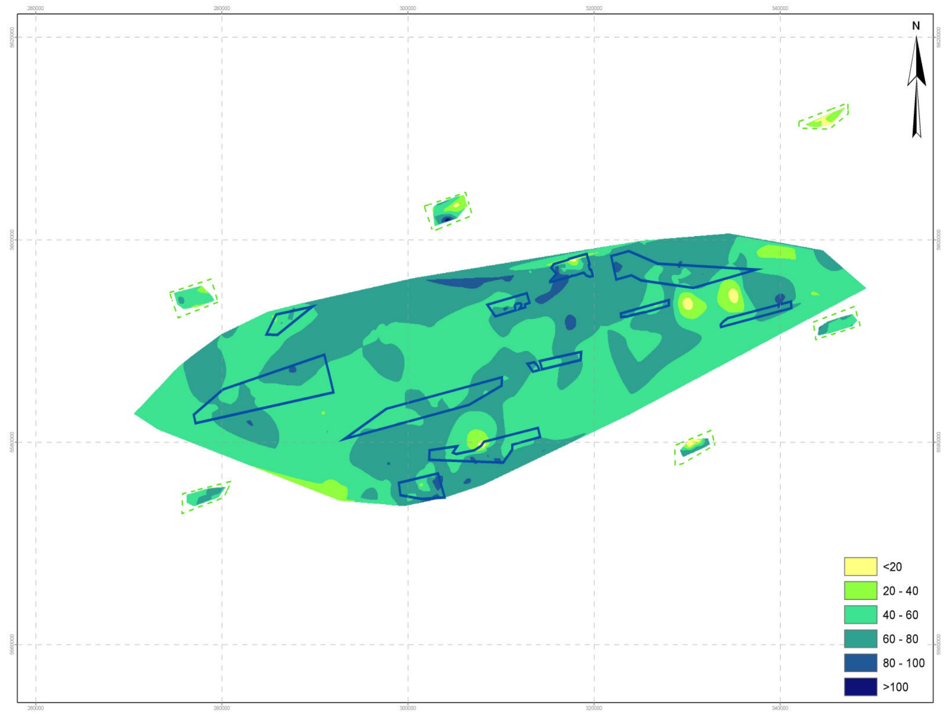
Taxa	Percentage occurrence
Galathea intermedia	93
Aonides paucibranchiata	90
NEMERTEA	89
Glycera lapidum (agg)	88
Apherusa bispinosa	87
Laonice bahusiensis	84
Pomatoceros triqueter	83

The most numerous individuals were from the Crustacea, with *Galathea intermedia* present at a maximum abundance of 181 (per 0.1m^2), *Apherusa bispinosa* at 69 and *Pisidia longicornis* at 568. The most abundant polychaete species was *Pomatoceros triqueter* at 145 individuals per 0.1m^2.

The number of species at each site is illustrated in **Figure 18**. No clear overall trend exists although low numbers of species were found in the north east of the area, particularly in reference area 3. The mean number of species overall was 58 (sd 17).

The numbers of individuals per site was variable with values between 1 and 983, although the mean was 195 (sd 106). **Figure 19** illustrates the numbers of individuals at each site. Consistently low numbers of individuals were found in the north east of the area, particularly in reference area 3.

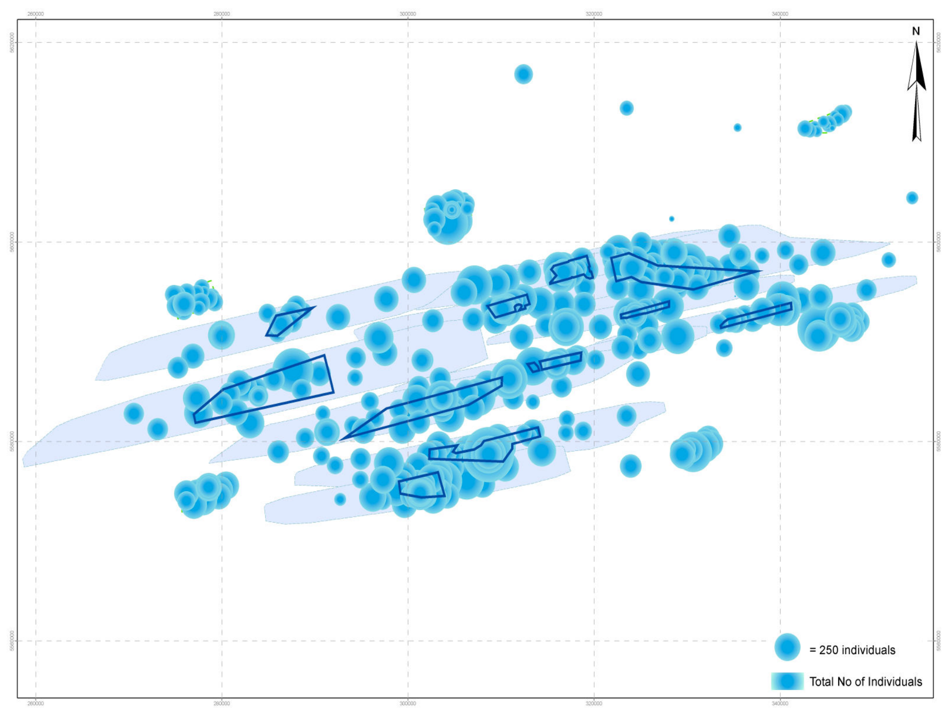
Biomass values are illustrated in **Figure 20**. Low biomass was evident over most of the survey area with the highest values occurring most consistently towards the south west.



Number of Species

No distinct trends were evident across the region.

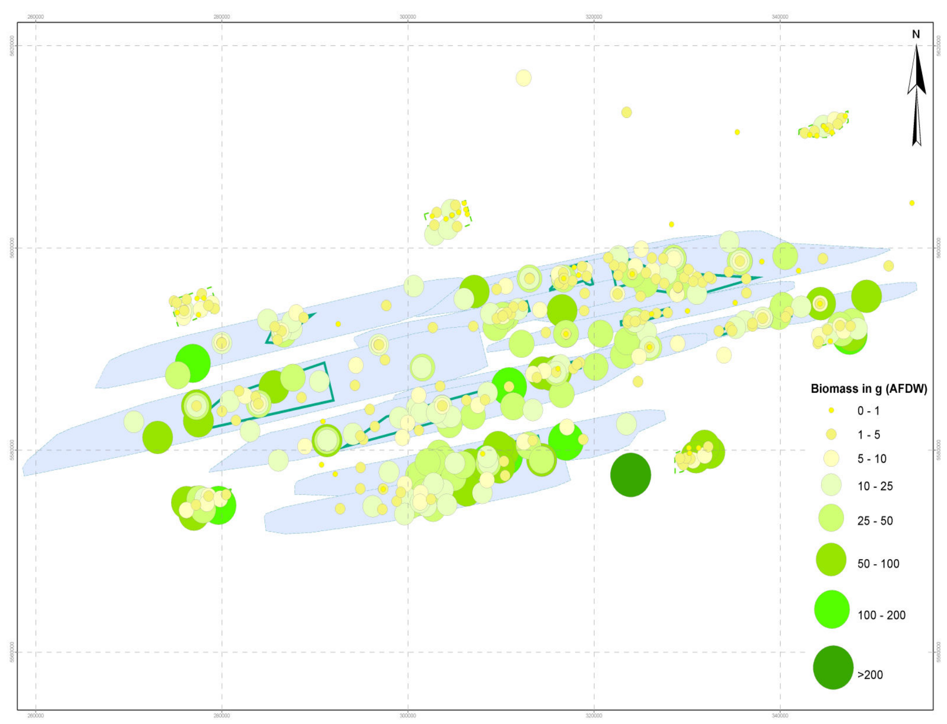
Low numbers of species were evident in the far north east of the region.



Number of Individuals

Average numbers of individuals across the region was 195.

Consistently low numbers of individuals were found to the north east of the area.



Biomass

Low biomass was evident across most of the region with highest values noted in the south west.

5.6 Regional Infaunal Communities Identified from Hamon Grab Samples

The Initial PRIMER analysis using Bray and Curtis clustering and supported by SIMPROF revealed 69 groupings. These were considered to be too complex to provide descriptions of the associated fauna. Lower level similarity clusters were therefore derived which were initially used to describe 21 clusters. These in turn were found to have substantially similar species groupings present within them that could be further amalgamated into 8 clusters. **Figure 65** illustrates the MDS with the final 8 clusters imposed. It is evident that a degree of overlap occurs between several of the core clusters HI3 to HI7. Despite these overlaps, differences in faunal composition and structure are evident, which can be illustrated through description of each of the clusters.

The species composition of these groupings and their associated physical characteristics are summarised in the tables on **page 50**. These summaries are based on the output from SIMPER analysis and indicate the species that contribute 50% of the community similarity. Highlighted on these tables are the species that are particularly indicative using a colour scale. Additional community structure measures and physical summaries are included.

It is evident that Clusters HI1 to HI7 (note HI2 was amalgamated during the analysis process) are based on a broadly similar group of species, generally dominated by *Galathea intermedia*, with *Pomatoceros triqueter*, *Apherusa bispinosa* and *Echinocyamus pusillus* and *Pisidia longicornis* the subdominant species. The variation in the abundance of these species and the appearance of several other less abundant species has resulted in the split in the overall cluster.

Two high abundance and high diversity clusters exist, HI5 and HI6. HI5 is dominated and characterised by *Pisidia longicornis*, with *Ophiothrix fragilis* characteristically present. This cluster was also the group of sites with the highest proportions of gravel and cobbles. HI6 in contrast supported *Galathea intermedia* as the most characteristic species, but also supported a small group of species including *Gari tellinella*, *Limatula* sp and *Maera othonis*, which may be responding to the increased levels of sand at these sites.

HI7 supported a similar species composition to HI6 but with reduced overall abundance and the absence of the cryptic dwelling crab species *Pisidia longicornis*. The characteristic species are indicative of coarse sands including *Eunice vittata* and *Apherusa bispinosa*. Cluster HI4 is a reduced version of HI7 with reduced overall abundances and fewer evident characterising species. The physical conditions in this cluster were very similar to those in HI7.

HI3 is a gravely sand habitat which is dominated by *Galathea intermedia* but is characterised by the presence of the echinoderm *Echinocyamus pusillus*. A reduced version of this cluster is found in HI1, where the overall diversity and abundance is lower although the dominant and characterising species are similar. In the case of H1 *Pomatoceros triqueter* is relatively more important and is probably responding to the greater proportion of coarse sediments, including cobbles.

The final two clusters HI8 and HI9 are both essentially sand with HI9 comprising the finest and most well sorted sediments, also with the most reduced fauna. Individual abundances were low with the polychaete *Spiophanes bombyx* and the bivalve *Moerella pygmaea* the most characteristic species. The slightly more shelly and gravely sands found in cluster HI8 supported a well defined group of species including the characteristic polychaetes *Spio filicornis* and *Polygordius* sp and the crustacean *Atylus vedlomensis*.

To illustrate the influence of the principal environmental conditions on the species at each site a BEST analysis from the BIO-ENV routine has been employed. On the basis of single variables the physical factor showing greatest correspondence with the fauna is the sorting value, followed by percentage sand and percentage gravel. Considering the best combination of factors the majority of the variability is explained through the combined variables, sand, sorting, skewness, kurtosis and depth to seabed.

The influence of the physical conditions have been further illustrated through employment of PCA. The environmental variables have been expressed in terms of the clustering of sites in **Figure 66** (INF2). The gradient between sand and gravel is evident with the co-related variable for Median diameter (this is an inverse variable, with larger phi values equating to a smaller particle size), skewness and cobbles related to clusters HI5, HI7 and HI4. A similar grouping of sites is evident around the vector for sand, which corresponds to clusters, HI6, HI3, HI8 and HI9. This group is also on the reciprocal vector for sorting, which is an inverse variable, i.e. with 0 equaling perfect sorting and increasing numbers relating to less well sorted sediments. The reciprocal of this vector is, therefore, an important factor in relation to the sand influence clusters. Depth is a potentially important factor overall, with some of the sites from the shallow water sites in clusters HI3, HI6 apparently influenced by this variable.

The influence of the principal environmental variables with respect to some of the characteristic species is illustrated in **Figures 67** To **72**. Two of the most widely occurring species *Pomatoceros triqueter* and *Echinocyamus pusillus* illustrate the opposing influences of sand and gravel/cobbles. The former species is most abundant in the gravely sediments, while the latter is found in the sandier sediments, although it is clear that a broad area of overlap occurs. A clearer separation is evident for the species *Atylus vedlomensis* and *Pisidia longicornis* (**Figures 69** and **70**). In this instance the two species are more or less separate in their distributions, with *Pisidia* strongly associated with gravels and *Atylus* with sands. The final two species considered are the brittlestar *Ophiothrix fragilis* and the polychaete *Spio filicornis*. These again illustrate the influence of the gravel and sand components, with *Spio* (**Figure 72**) only found in the sandiest of sediments, and *Ophiothrix* found in the cobbley gravels, in some instances with a small silt clay influence (**Figure 71**).

The trend in community types, as represented by the clusters, has been overlain on a chart of the area. The order of the clusters has been determined from the PCA plot, with the gradient from gravel to sand considered to be the most influential. **Figure 73** illustrates the location of the clusters on a site by site basis, while **Figure 74** is an interpolation of the clusters using biotope classification to describe them in the following order:

1. HI5 — **SS.SMx.CMx.OphMx.** *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment.
2. HI7 — **SS.SCS.CCS.** Circalittoral Coarse Sediments.
3. HI4 — **SS.SCS.CCS.** Circalittoral Coarse Sediments
4. HI1 — **SS.SCS.CCS.** Circalittoral Coarse Sediments
5. HI6 — **SS.SCS.CCS.** Circalittoral Coarse Sediments
6. HI3 — (Variant of) **SS.SSa.CFiSa.EpusOborApri.** *Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand.
7. HI8 — **SS.SCS.CCS.Blan** *Branchiostoma lanceolatum* in circalittoral coarse sand with shell gravel
8. HI9 — (Impoverished version of) **SS.SSa.CFiSa.EpusOborApri.** *Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand.

The biotope classification has been attributed to these clusters on the basis of their physical and biological composition, although no clear biotopes have been attributed to several of the clusters due to the lack of similarity to any existing descriptions. Cluster HI8 does not contain the species *Branchiostoma lanceolatum* in abundance but this was one of the species consistently present in this cluster and is characteristic of the biotope. The method of interpolation does, in some cases, introduce artificial gradients, where in reality patches with clear boundaries may exist. However, in terms of demonstrating a trend across the area, it provides a clear impression of the regional distribution of habitat and community types.

Figure 73 indicates two relatively clear regions with the east and north-east comprising the sandier habitats, with clusters HI6, HI3 and HI8 occurring almost exclusively in this area. Licence Areas 473 East, 474 East and 464/458 are primarily comprised of these habitat and community types. Licence Areas 474 Central and West, along with 473 West are located on an apparent boundary between the two regions with a mix of habitat and community type. The south and west of the area comprise the habitats with the highest gravel content, the most extreme version of which is found in the *Ophiothrix* biotope (HI5). This habitat is centered between the two licence areas, 475 and 461, extending to a lesser extent into area 478. Area 477 was comprised primarily of clusters HI7.

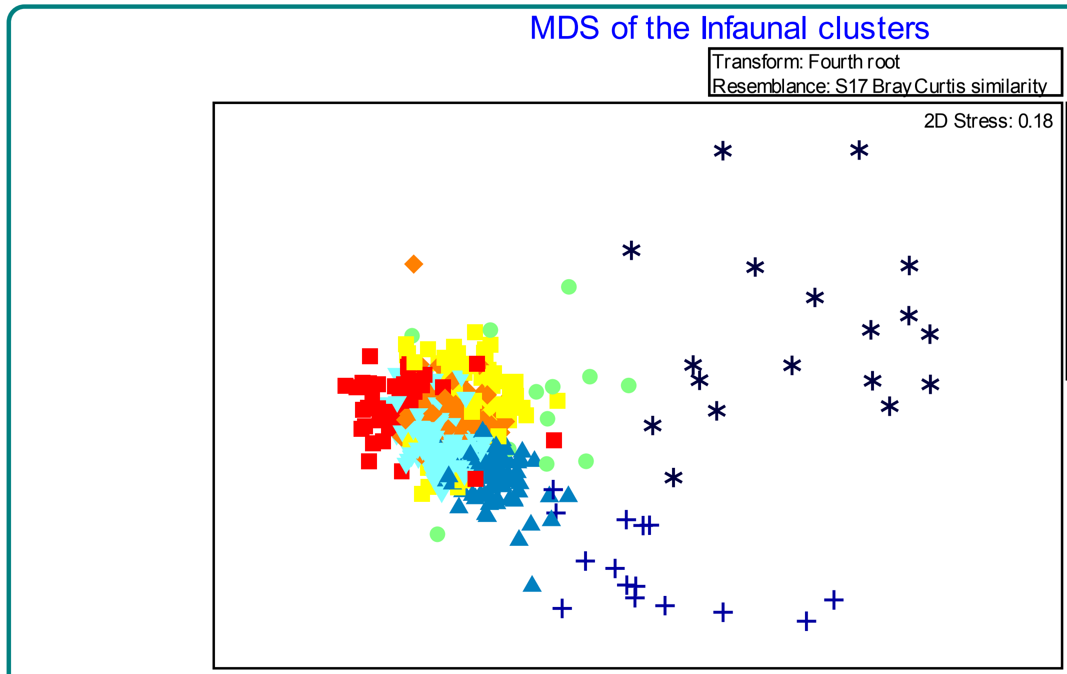


Figure 65 MDS of infaunal clusters

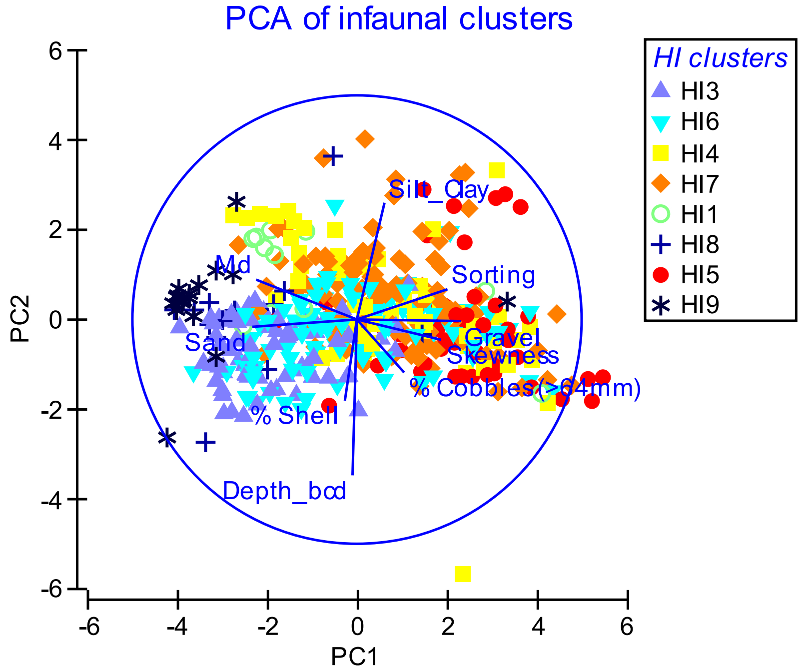


Figure 66 PCA of infaunal clusters

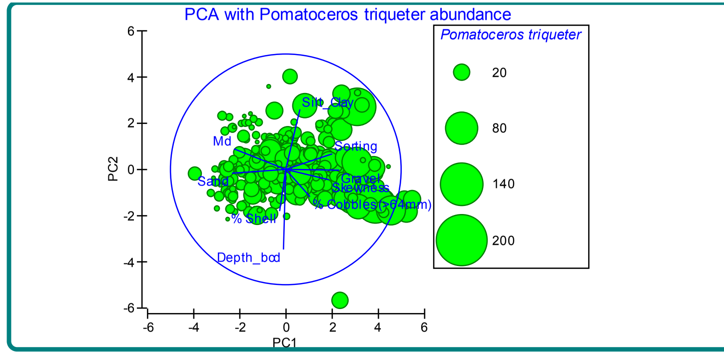


Figure 67 Influence of principal environmental variables on the occurrence of *P. triqueter*.

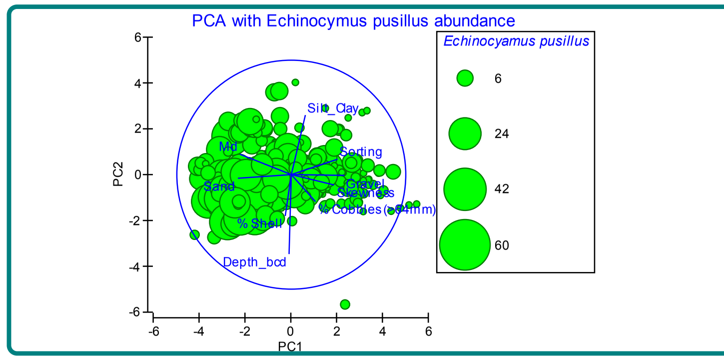


Figure 68 Influence of principal environmental variables on the occurrence of *E. pusillus*.

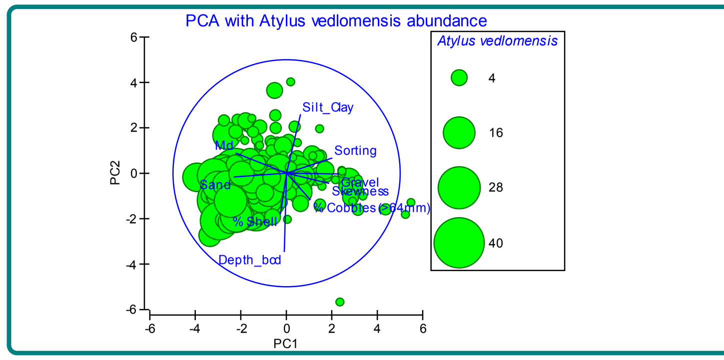


Figure 69 Influence of principal environmental variables on the occurrence of *A. vedlomensis*.

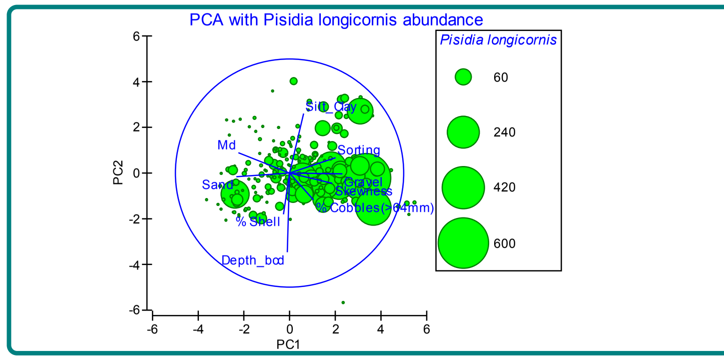


Figure 70 Influence of principal environmental variables on the occurrence of *P. longicornis*.

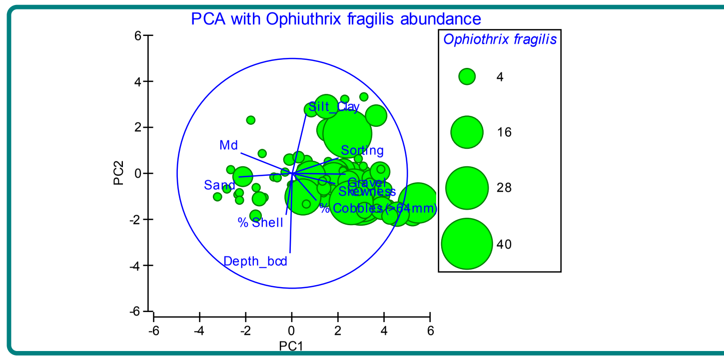


Figure 71 Influence of principal environmental variables on the occurrence of *O. fragilis*.

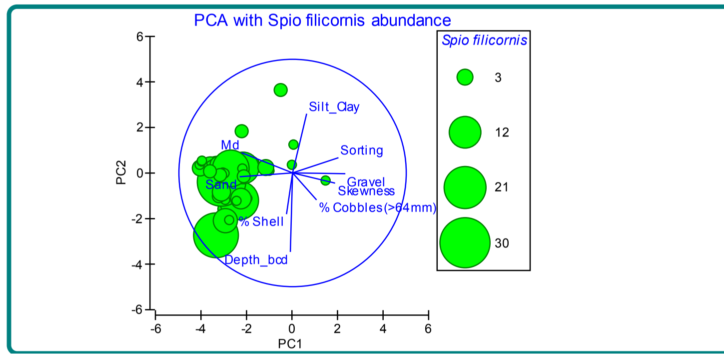


Figure 72 Influence of principal environmental variables on the occurrence of *S. filicornis*.

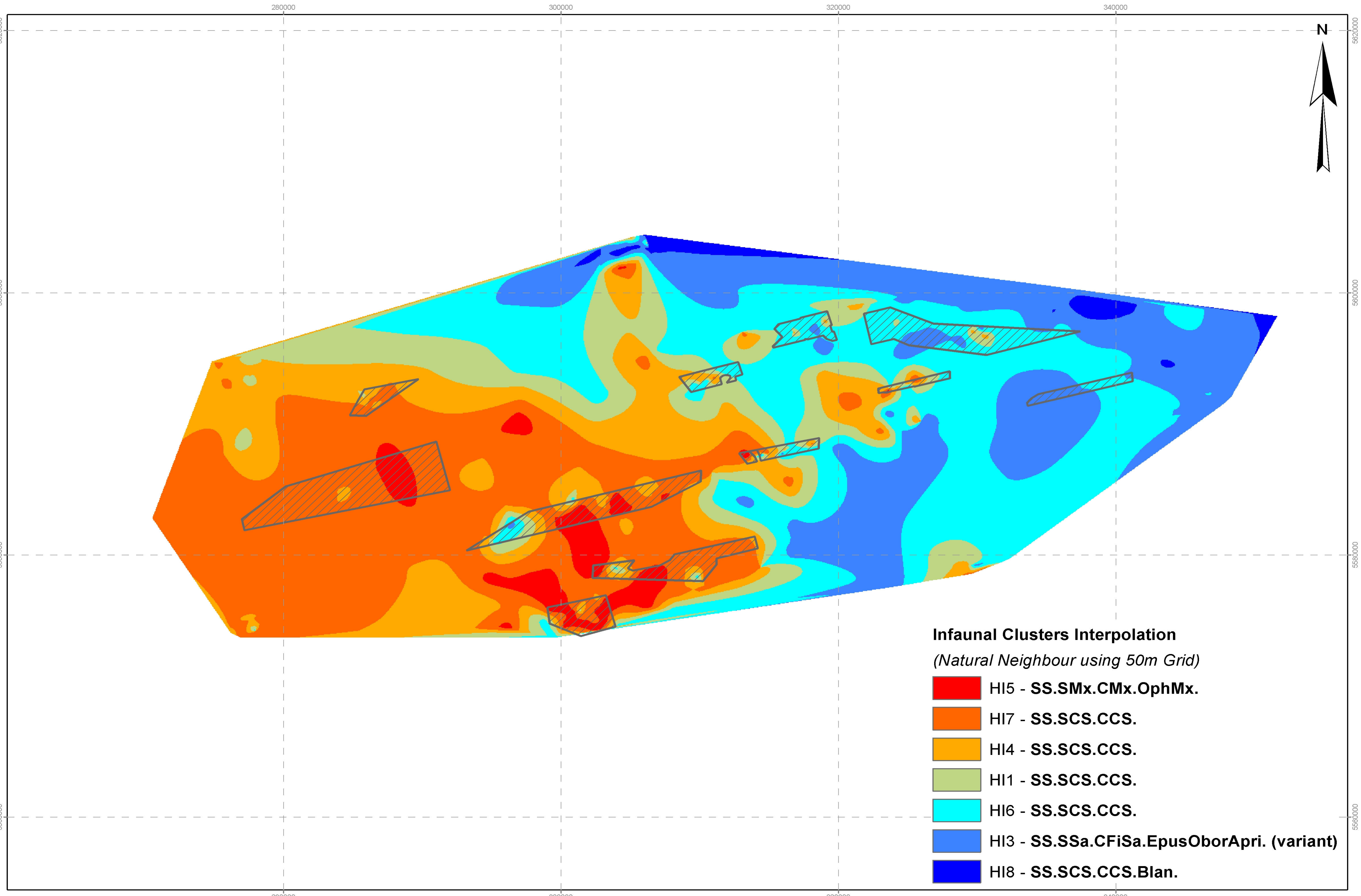


Figure 22

Interpolation of clusters identified during the analysis of infaunal species sampled using the Hamon grab. Biotope classifications have been used to further describe the clusters.

Characteristic species of clusters identified

HI1	No. ind	HI3	No. ind	HI4	No. ind	HI5	No. ind	HI6	No. ind	HI7	No. ind	HI8	No. ind	HI9	No. ind
Galathea intermedia	9.69	Galathea intermedia	14.75	Galathea intermedia	25.42	Pisidia longicornis	41.06	Galathea intermedia	40.2	Galathea intermedia	29.77	Spio filicornis	8.27	Spiophanes bombyx	2.44
Pomatoceros triqueter	5.62	Echinocyamus pusillus	11.29	Pomatoceros triqueter	8.12	Galathea intermedia	34.9	Pomatoceros triqueter	13.38	Apherusa bispinosa	13.15	Atylus vedlomensis	7	Echinocyamus pusillus	3.22
Echinocyamus pusillus	4.69	Apherusa bispinosa	8.43	Apherusa bispinosa	5.98	Pomatoceros triqueter	32.18	Pisidia longicornis	11.95	Pomatoceros triqueter	8.58	Polygordius sp.	5.53	NEMERTEA	2.89
Aonides paucibranchiata	3.54	Atylus vedlomensis	6.77	Pisidia longicornis	4.41	Ophiothrix fragilis	8	Apherusa bispinosa	10.98	Eunice vittata	5.51	Echinocyamus pusillus	3.8	Moerella pygmaea	2.44
Atylus vedlomensis	3.08	Aonides paucibranchiata	6.51	Aonides paucibranchiata	4.05	Typosyllis sp.	7.37	Echinocyamus pusillus	9.75	Laonice bahusiensis	5.35	Typosyllis sp.	3.73	Eurydice spp	2.17
Capitellidae indet	2.46	Glycera lapidum (agg)	6.06	Echinocyamus pusillus	3.49	Amphipholis squamata	6.24	Typosyllis sp.	8.83	Amphipholis squamata	5.19	Aonides paucibranchiata	3.67	Ampelisca brevicornis	1.89
Amphipholis squamata	2.38	Gari tellinella	5.94	Amphipholis squamata	3.29	Apherusa bispinosa	6.24	Aonides paucibranchiata	5.53	Limatula sp	4.88	Glycera lapidum (agg)	3.53	Lumbrineris gracilis	1.83
Poecilochaetus serpens	1.92	Polygordius sp.	5.08	Laonice bahusiensis	3.03	Lepidonotus squamatus	4.96	Gari tellinella	5.49	Ampharete lindstroemi	4.73	NEMERTEA	2.67	Nephtys cirrosa	1.61
Apherusa bispinosa	1.85	Typosyllis sp.	4.48	NEMERTEA	2.98	Laonice bahusiensis	4.16	Limatula sp	5.3	NEMERTEA	4.44	Eurydice spp	1.6	Aonides paucibranchiata	1.61
Laonice bahusiensis	1.54	NEMERTEA	4.18	Glycera lapidum (agg)	2.36	Harmothoe extenuata	4.12	Maera othonis	5.3	Maera othonis	4.29			Ophelia celtica	1.33
Typosyllis sp.	1.38	Amphipholis squamata	3.81	Ampharete lindstroemi	2.1	Lumbrineris gracilis	3.73	Glycera lapidum (agg)	4.86	Aonides paucibranchiata	4.23				
Polycirrus sp.	1.31	Pomatoceros triqueter	3.45	Poecilochaetus serpens	2.08	Aonides paucibranchiata	3.71	NEMERTEA	4.8	Glycymeris glycymeris	4.02				
Ampelisca spinipes	1	Eulalia mustela	3.01	Limatula sp	2.02	NEMERTEA	3.57	Amphipholis squamata	4.8	Tapes rhomboides	3.96				
Aphelochaeta sp.	0.77	Eunice vittata	2.88	Capitellidae indet	1.92	Sclerocheilus minutus	2.86	Laonice bahusiensis	3.25	Capitellidae indet	3.73				
		Limatula sp	2.71	Ampelisca spinipes	1.85	Scalibregma celticum	2.57	Eulalia mustela	3.07	Glycera lapidum (agg)	3.4				
				Sclerocheilus minutus	1.81	Glycera lapidum (agg)	2.41	Eunice vittata	2.85	Sclerocheilus minutus	2.95				
				Glycymeris glycymeris	1.61					Gari tellinella	2.91				

Most Characteristic

Least Characteristic

Community structure measures

HI1		HI3		HI4		HI5		HI6		HI7		HI8		HI9	
S	40	S	56	S	52	S	68	S	71	S	60	S	26	S	23
N	90	N	165	N	143	N	292	N	252	N	202	N	72	N	50
d	8.63	d	10.75	d	10.24	d	12.01	d	12.68	d	11.23	d	5.95	d	5.55
J'	0.90	J'	0.88	J'	0.86	J'	0.80	J'	0.84	J'	0.85	J'	0.88	J'	0.91
H'(loge)	3.28	H'(loge)	3.54	H'(loge)	3.38	H'(loge)	3.37	H'(loge)	3.57	H'(loge)	3.48	H'(loge)	2.81	H'(loge)	2.75
1-Lambda'	0.95	1-Lambda'	0.96	1-Lambda'	0.94	1-Lambda'	0.92	1-Lambda'	0.95	1-Lambda'	0.94	1-Lambda'	0.92	1-Lambda'	0.93

Physical conditions

HI1		HI3		HI4		HI5		HI6		HI7		HI8		HI9	
Md Phi	-0.121	Md Phi	0.003	Md Phi	-0.978	Md Phi	-1.75	Md Phi	-0.664	Md Phi	-0.985	Md Phi	0.386	Md Phi	1.28
Depth_bcd m	-42.7	Depth_bcd m	-35.3	Depth_bcd m	-41.7	Depth_bcd m	-37	Depth_bcd m	-37	Depth_bcd m	-41.9	Depth_bcd m	-38.7	Depth_bcd m	-39.1
% Cobbles (>64mm)	5.38	% Cobbles (>64mm)	0.6	% Cobbles (>64mm)	4.41	% Cobbles (>64mm)	11.8	% Cobbles (>64mm)	4.76	% Cobbles (>64mm)	2.83	% Cobbles (>64mm)	0	% Cobbles (>64mm)	1.67
% Gravel	30.5	% Gravel	19.4	% Gravel	39.5	% Gravel	48.1	% Gravel	32.7	% Gravel	39.2	% Gravel	14.8	% Gravel	7.25
% Sand	69	% Sand	80.3	% Sand	59.8	% Sand	50.4	% Sand	66.6	% Sand	59.6	% Sand	84.7	% Sand	92.1
% Silt_Clay	0.54	% Silt_Clay	0.31	% Silt_Clay	0.688	% Silt_Clay	1.56	% Silt_Clay	0.685	% Silt_Clay	1.18	% Silt_Clay	0.583	% Silt_Clay	0.616
% Shell	8.46	% Shell	21.6	% Shell	13.4	% Shell	14.3	% Shell	15.9	% Shell	15.2	% Shell	14	% Shell	0.278
Sorting	2.23	Sorting	1.78	Sorting	2.32	Sorting	2.63	Sorting	2.21	Sorting	2.28	Sorting	1.62	Sorting	1.01

Summary of the Results of the Infaunal Analysis

→ **The principal species characterising the faunal groupings of infauna were from the polychaeta, crustacea and echinodermata, with the crustacean *Galathea intermedia* the most frequently present and the single most numerous species being *Pisidia longicornis*.**

→ **The infauna (including epifauna that could be enumerated) were analysed using PRIMER and eight relatively distinct clusters were identified. Biotopes were attributed to each of the clusters, although several were not described at a very high level of definition.**

→ **The most important physical variables in relation to the clustering of the infauna sites were determined to be percentage sand, percentage gravel and sediment sorting. Several clear relationships were apparent with respect to individual species abundance and gradients in the physical variables. Good examples are *Pomatoceros triqueter* and *Echinocyamus pusillus* which correspond with increased gravel and sand respectively.**

→ **The habitats and associated communities identified show a clear gradient across the area with the region to the north east supporting the low diversity sand communities, dominated or characterised by *Echinocyamus pusillus* or *Branchiostoma lanceolatum*. A transition or boundary region appears across the centre of the region running from north to south, although extending into Areas 473 and 474. West and south west of this area the seabed is characterised by a greater percentage of coarse sediment, which is most characteristically occupied by *Ophiothrix fragilis* in the central southern sector of the region, in the vicinity of Areas 461 and 475.**

5.7 Regional Epifaunal Communities Identified from Hamon Grab Samples

A subset of the sampling sites was analysed for epifauna in combination with the infauna. The purpose of this analysis is to give an impression of the overall distribution of biotopes and to determine the importance of the epifaunal component in assessing the impacts of dredging activities in future years. Included within these analysis were the Coralline algae.

A total of 646 species were identified. Of these the most frequently present were a group of almost ubiquitous bryozoa with several infaunal species present in approximately 90% of sites. The species most commonly present are summarised in the table below:

Taxa	Percentage occurrence
Disporella hispida	99
Schizomavella auriculata	99
Rhynchozoon bispinosum	98
Microporella ciliata	98
Galathea intermedia	97
Chorizopora brongniartii	96
Diastoporidae	96
Porella concinna	93
Escharella immersa	93
Cliona sp	92
Glycera lapidum (agg)	92
Porifera	91
Aonides paucibranchiata	91
NEMERTEA	91
Reptadeonella violacea	91
Apherusa bispinosa	90
Escharella ventricosa	88
Pomatoceros triqueter	88

The most numerous individuals, taking into consideration the fact that the colonial epifauna values are based on abundance estimates, were from the Crustacea and Hydrozoa (maximum abundances for *Pisidia longicornis* 568 per 0.1m^2 and *Nemertesia* sp. 389 per 0.1m^2) respectively.

Other abundant species included the Coralline algae and several bryozoa, such as *Schizomavella auriculata* and *Reptadeonella violacea* both present at peak values greater than 200 per 0.1m^2. *Schizomavella auriculata* and the Coralline algae also had the highest mean abundances, along with the crustacean *Galathea intermedia* (all greater than 25 per 0.1m^2).

The cluster analysis indicated that several small clusters exist, separate from a main grouping of sites. However, this core group of sites could also be separated into several subgroups, which, although not wholly separate on the MDS plot (**Figure 74**), indicate that divisions were evident that were worth exploring in terms of faunal composition and community structure.

Based on the combined output of the cluster analysis and MDS, a total of 8 clusters were identified, with several sites defined as unclassified. The faunal composition and associated physical descriptions are provided in the tables on **page 56** with colour coded characteristic species.

Two high diversity and high abundance fauna clusters sites were noted; HC2 and HC 7. The physical character of these two clusters was different in that HC2 was a mixed gravely sand, with an almost equal split between the sand and gravel components. This cluster also had the largest proportion of cobbles. HC7 in contrast was a more sandy habitat, although still with a significant gravel component (38%).

The fauna were clearly different in the two habitats with a mixture of epifaunal and infaunal species dominating in HC2 (*Pisidia longicornis* particular characteristic) with subdominant Hydrozoa e.g. *Abietinaria abietina* and Bryozoa, e.g. *Parasmittina trispinosa*. This cluster also supported the highest numbers of *Galathea intermedia* and *Pomatoceros triqueter*. The fauna in HC7 were dominated by a characteristic group of colonial bryozoa such as *Schizomavella auriculata* and *Reptodeonell violacea*, as well as Coralline algae. Although many of the species found in HC2 are also present in HC7 most are at reduced abundances in the former. It was also noted that HC7 supported sites with the characteristic brittlestar *Ophiothrix fragilis*, although generally in low numbers.

In terms of physical conditions the sites from HC1 were most similar to HC2, but the fauna were, in contrast, much reduced with very low diversity and low abundance. The faunal composition was considerably different with infauna largely absent from HC1. Similarly HC6 was physically comparable to HC7 although the faunal composition was reduced in terms of number of species and abundance. Only the ascidian *Dendrodoa grossularia* was truly characteristic of HC6, most of the other species found in abundance in HC6 were also found in HC7.

The remaining clusters HC4, HC5, HC6 and HC7 appear to be on a gradient of reducing diversity, which may correspond to an increasing quantity of both sand and shell material. HC4 was the most gravely with colonial bryozoa abundant, but the amphipod crustacean *Apherusa bispinosa* characteristic of the cluster. HC5 was the next most sandy with a relatively high level of shell material. The presence of gravel is still encouraging colonial epifauna but the coarse sand species, such as *Aonides paucibranchiata* and *Echinocyamus pusillus* are characteristically present. The other characteristic species is a boring sponge, *Cliona* sp. which may well be responding to the high levels of shell material.

The two sand dominated clusters are HC8 and HC9. The former is relatively high abundance and characterised by *Echinocyamus pusillus* and the amphipod *Atylus vedlomensis* although the coralline algae are still numerically dominant. The remaining group of sites, HC9, were found in sediments composed almost exclusively of sand with a very high shell component. These sites supported low diversity and abundance communities with the characteristic and dominant species comprising the polychaetes *Spio filicornis* and *Polygordius* sp, along with the anthozoa *Sarcodictyon roseum* and to a lesser extent the bivalve *Moerella pygmaea*. Also of significance to this cluster was the presence of the lancelet *Branchiostoma lanceolatum*, although in low abundances.

The influence of the sand and gravel components of the sediment are indicted by the BEST analysis of environmental variables. The single most important variable was sand followed by gravel and sorting. However the best combination of variables were sand, sorting and depth to seabed.

These variables have been displayed in a PCA analysis with the clusters highlighted (**Figure** EP2). It is apparent that the principal trend is along a gravel to sand gradient, with the inverse of sorting also explaining much of the variation. HC9 it is at the most extreme boundary with respect to the sand variable, while HC7 is related more to the gravel and cobbles components, HC6 corresponding to a mixture of sand and gravel.

The relationship of some of the species considered to be indicative of the various clusters, is illustrated in **Figures 77** to **85**. *Pisidia longicornis* (**Figure 77**) from cluster HC2 is clearly associated with the coarser sediments and in particular the coarser gravels and cobbles.

This species is somewhat similar to *Pomatoceros triqueter* in its habitat preference, although the later is more prevalent in sediments with a larger sand component (**Figure 78**).

When compared with the some of the indicative species from Cluster HC7, such as *Chorizopora brogniartii* (**Figure 79**) and the Coralline algae (**Figure 80**), it is evident that they extend across a wide range of gravels and sands.

The brittlestar, *Ophiothrix fragilis* also fell within this cluster but tends to be found in those sites with a limited sand component (**Figure 81**). *Dendrodoa grossularia*, which was indicative of the gravely sands of cluster HC6 tended to be found where neither high levels of gravel or sand were present.

Apherusa bispinosa from cluster HC4 was similar to the species indicative of HC7 with the exception that it was found in siltier sediments in deeper waters (**Figure 82**).

The increasing influence of the sand component is evident with species such as *Aonides paucibranchiata*, which, although tolerant of gravels, tends to be found in coarse sands.

The species *Echinocyamus pusillus* (**Figure 83**) and *Atylus vedlomensis* (**Figure 84**), which characterised cluster HC8 show an even stronger tendency towards the sandier sediments, with the final two species *Polygordius* sp. and *Spio filicornis* (**Figure 85**) both occurring at the extreme limit of the gravel to sand gradient.

An interpolation method, using the gradient of gravel to sand across each of the clusters has been employed to illustrate the spatial distribution of the communities, as utilised for the infaunal data (**Figure 86**).

Cluster HC 1 was excluded due to the limited number of sites included within it and HC3 was eliminated in the analysis process. The order of the clusters is given below, with the most appropriate biotope appended:

1. HC2 – (Sedimentary version of) **CR.MCR.EcCr.** Echinoderms and crustose communities
2. HC7 – (Sedimentary version of) **CR.MCR.EcCr.FaAlCr.Bri.** Brittlestars on faunal and algal encrusted exposed to moderately wave-exposed circalittoral rock (including patches of *Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment)
3. HC6 – **SS.SCS.CCS.** Circalittoral Coarse Sediments
4. HC4 – **SS.SCS.CCS.** Circalittoral Coarse Sediments
5. HC5 – **SS.SCS.CCS.** Circalittoral Coarse Sediments
6. HC8 – (Coarse sediment variant of) **SS.SSa.CFiSa.EpusOborApri.** *Echinocyamus pusillus*, *Ophelia borealis* and *Abra prismatica* in circalittoral fine sand
7. HC9 – (Reduced version of) **SS.SCS.CCS.** *Branchiostoma lanceolatum* in circalittoral coarse sand with shell gravel

The distribution of the habitats and associated communities is clearly similar to that described for the infauna, although the reduced number of sites has resulted in a less well defined pattern in certain areas where the least number of sites were analysed. The same south west to north east gradient exists, as demonstrated for the infauna, although the distinct *Ophiothrix* based community, in the south of the region in licence areas 461 and 475, is not clearly evident when examining the combined infauna and epifauna

The less well defined gravel based community found in HC7, including *Ophiothrix,* is now evident over a wider area to the north, including licence areas 473 East and West. This blurring of certain communities may be due to the very large number and abundance of the encrusting epifaunal species, particularly the Bryozoa, identified from the coarser sediment areas, such as those typifying cluster HC7. The licence areas 474 West and 475 Central still fall on the boundary between the gravel habitat areas and the more sandy habitats.

Figure 74
MDS of combined infaunal and epifaunal clusters

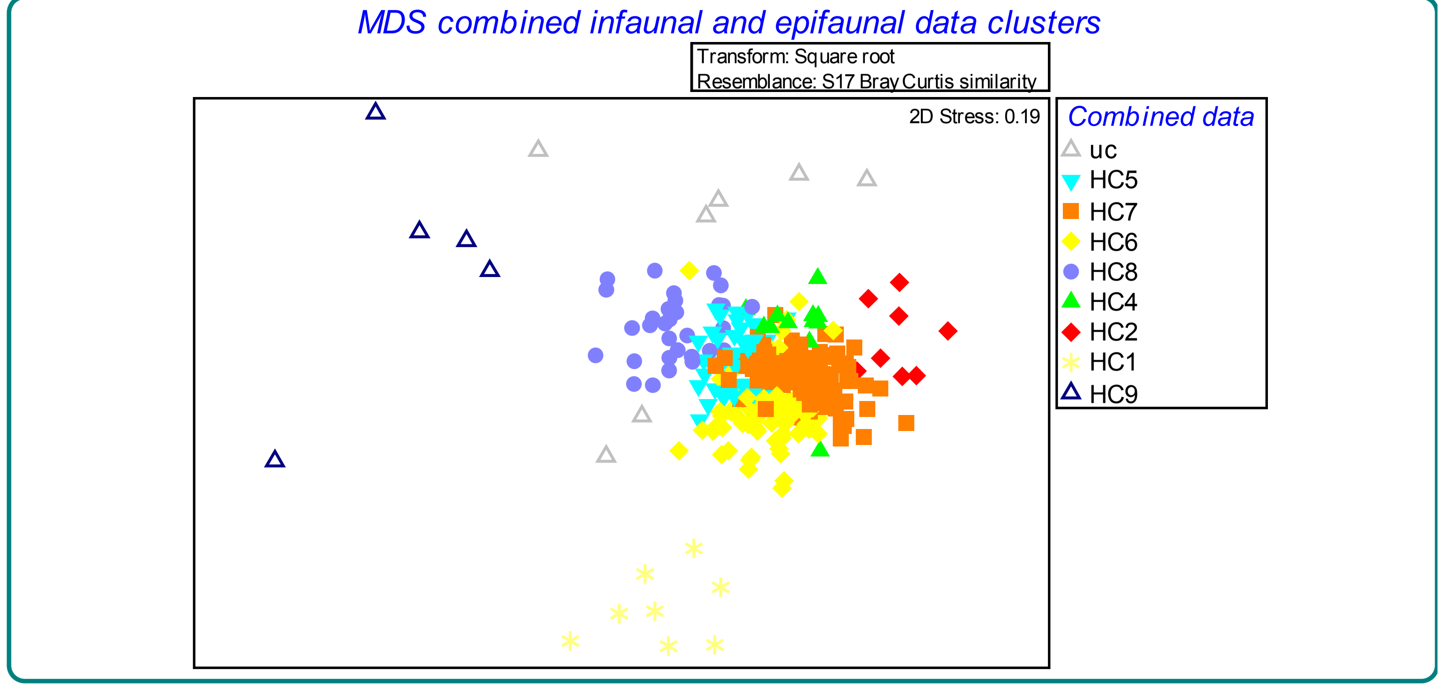
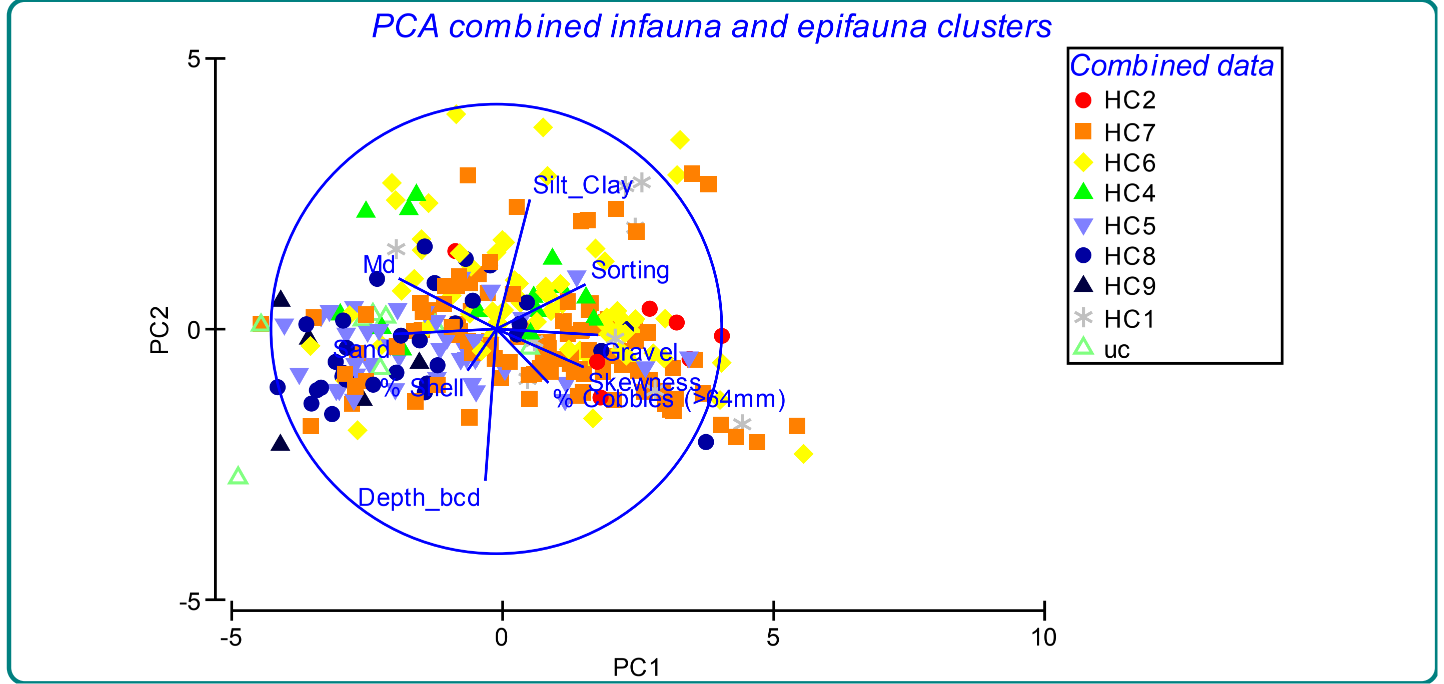


Figure 75
PCA of combined infaunal and epifaunal clusters



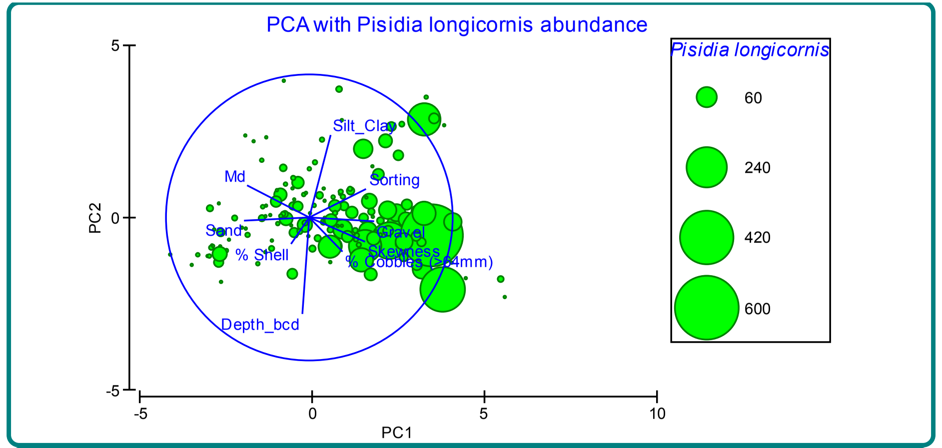


Figure 77
Influence of principal environmental variables on the occurrence of *P. longicornis*.

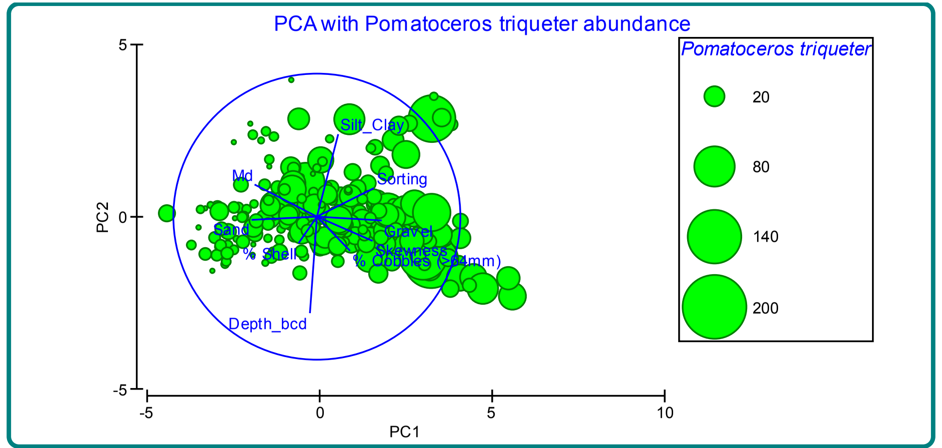


Figure 78
Influence of principal environmental variables on the occurrence of *P. triqueter*.

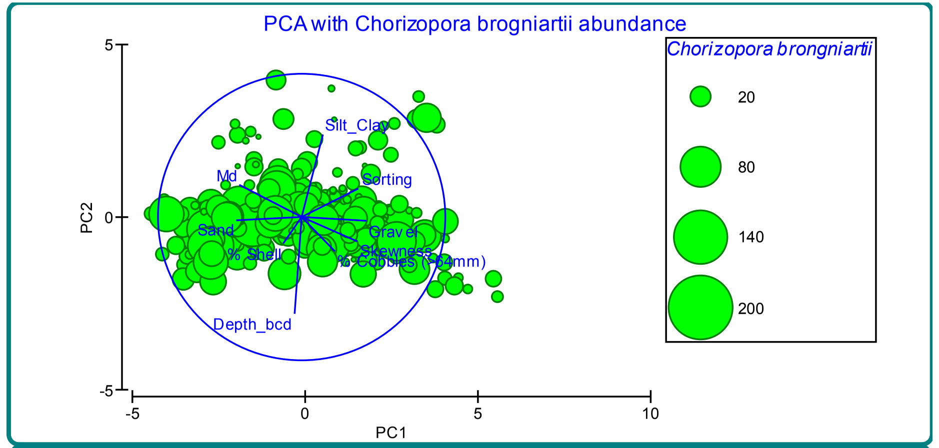


Figure 79
Influence of principal environmental variables on the occurrence of *C. brogniartii*.

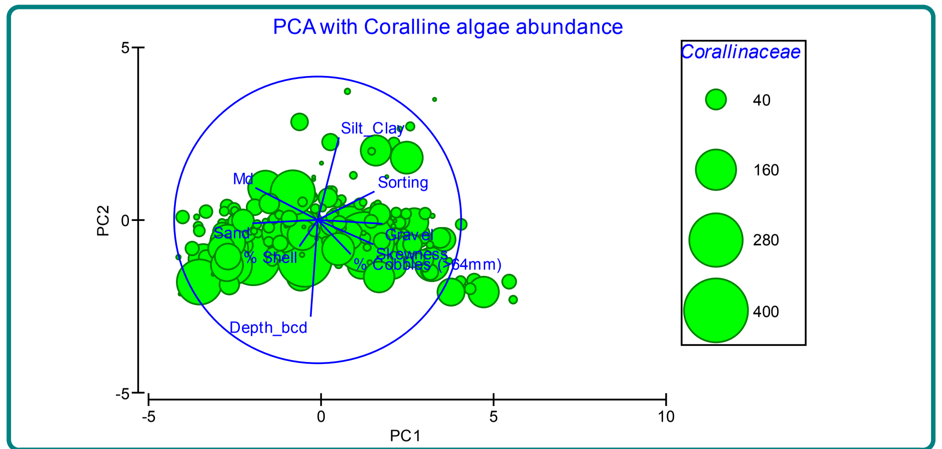


Figure 80
Influence of principal environmental variables on the occurrence of coralline algae.

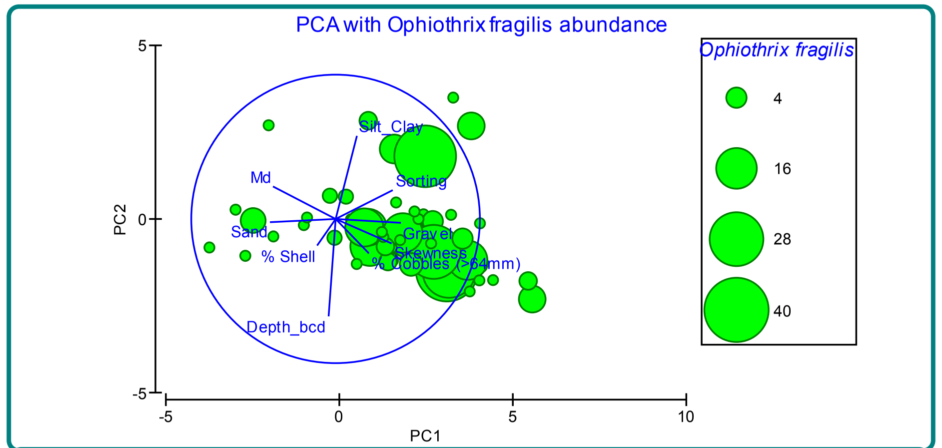


Figure 81
Influence of principal environmental variables on the occurrence of *O. fragilis*.

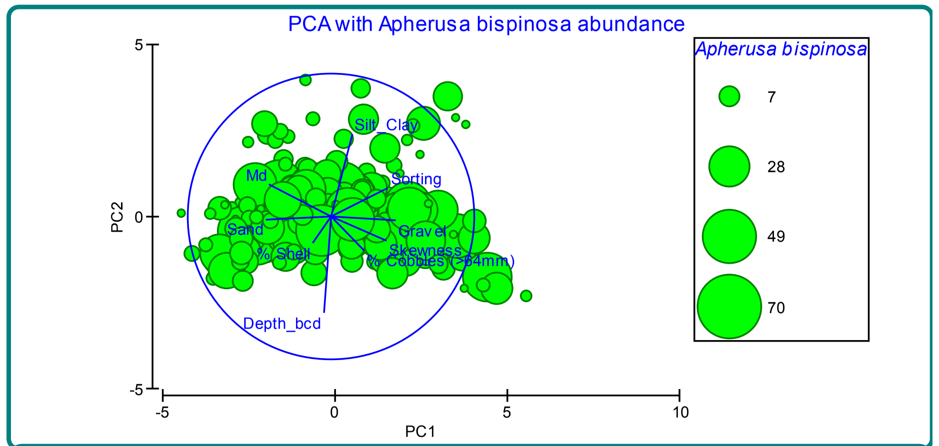


Figure 82
Influence of principal environmental variables on the occurrence of *A. bispinosa*.

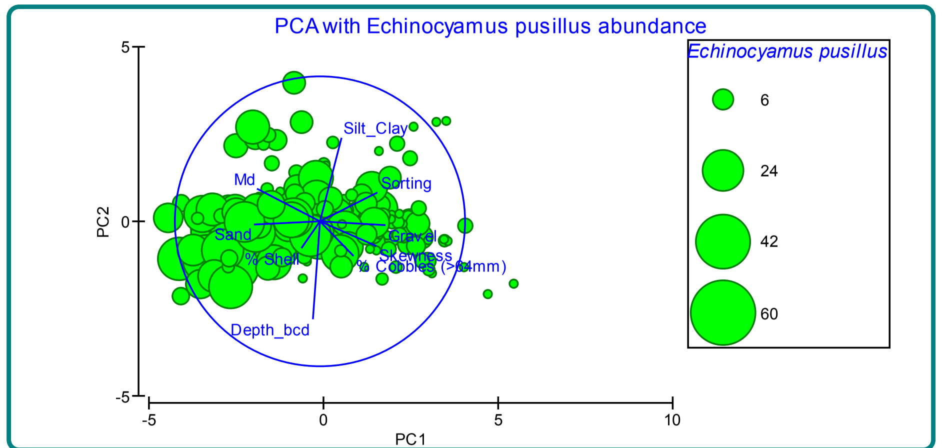


Figure 83
Influence of principal environmental variables on the occurrence of *E. pusillus*.

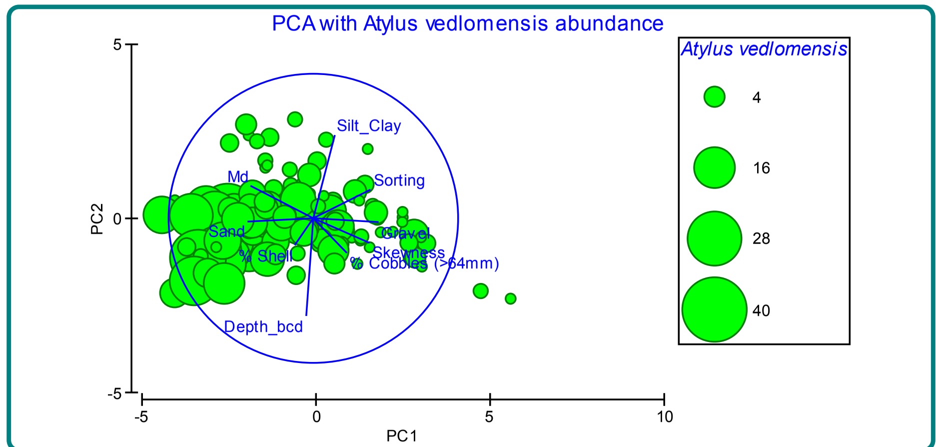


Figure 84
Influence of principal environmental variables on the occurrence of A. vedlomensis.

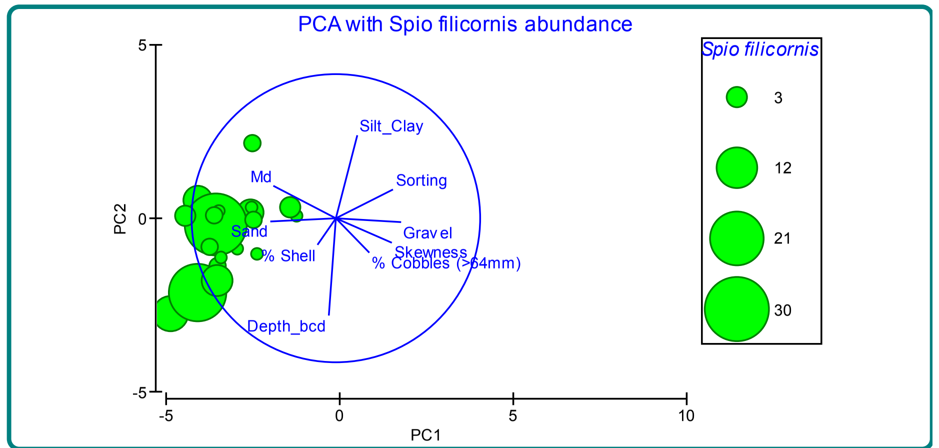


Figure 85
Influence of principal environmental variables on the occurrence of *S. filicornis*.

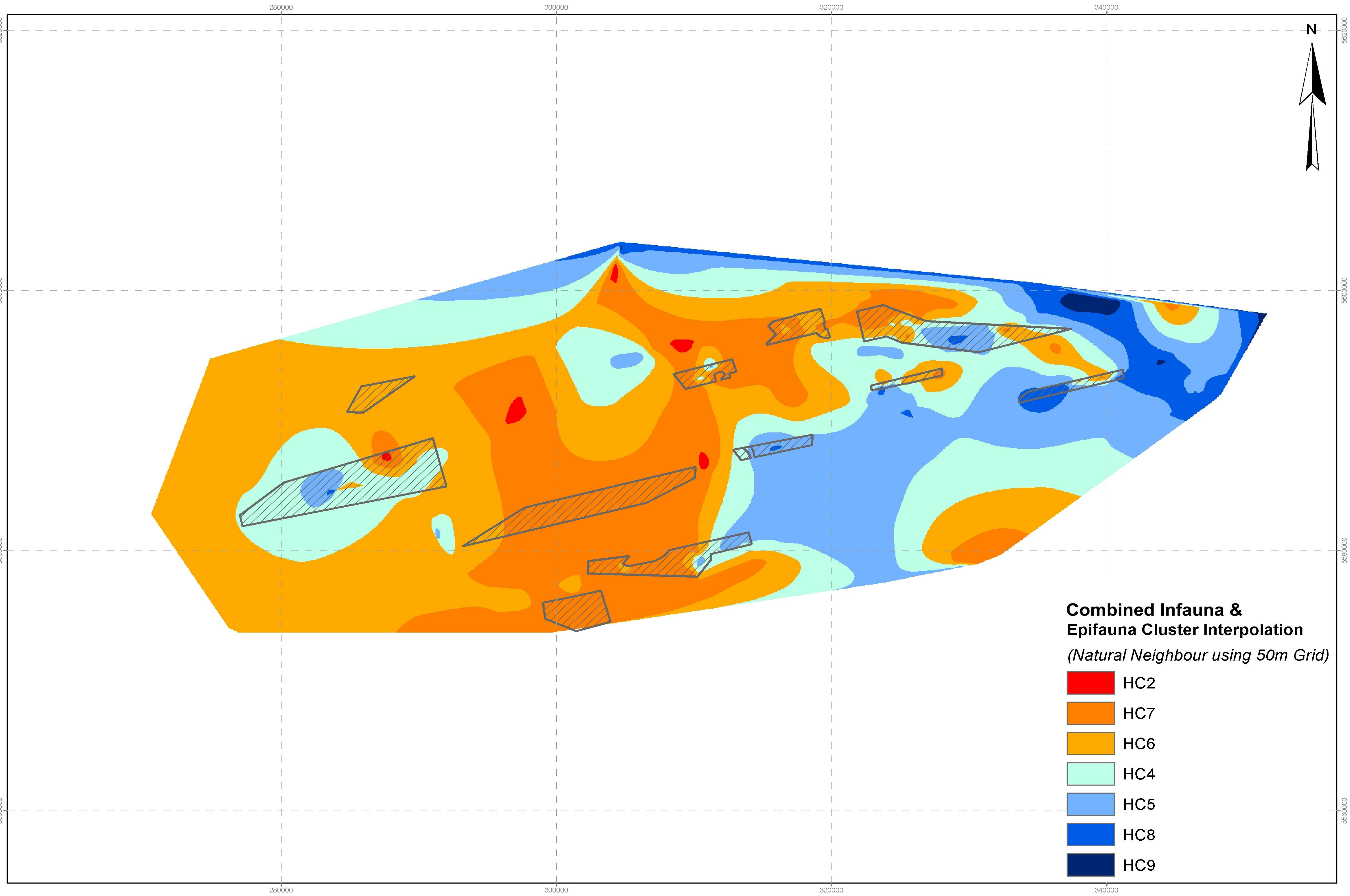


Figure 24

Interpolation of clusters identified during the analysis of epifaunal species sampled using the Hamon grab, combined with infaunal community data. Characteristic species of clusters and related community structure measures are shown in the tables below.

Characteristic species of clusters identified

HC1	Mean no.	HC2	Mean no.	HC4	Mean no.	HC5	Mean no.	HC6	Mean no.	HC7	Mean no.	HC8	Mean no.	HC9	Mean no.
Porella concinna	26.67	Pisidia longicornis	51.13	Schizomavella auriculata	37.93	Schizomavella auriculata	46.53	Schizomavella auriculata	56.67	Schizomavella auriculata	76.23	Corallinaceae	24.79	Spio filicornis	12.4
Schizomavella auriculata	21.33	Galathea intermedia	42	Galathea intermedia	28.38	Corallinaceae	37.37	Rhynchozoon bispinosum	23.65	Corallinaceae	44.94	Schizomavella auriculata	15.36	Polygordius sp.	7.2
Rhynchozoon bispinosum	14.22	Pomatoceros triqueter	39.38	Apherusa bispinosa	19.9	Cliona sp	30.63	Galathea intermedia	22.8	Galathea intermedia	37.01	Echinocyamus pusillus	11.09	Sarcodictyon roseum	5.8
Chorizopora brongniartii	12.22	Schizomavella auriculata	38.5	Cliona sp	17.48	Rhynchozoon bispinosum	21.65	Porella concinna	22.49	Reptadeonella violacea	36.2	Cliona sp	10.58	Moerella pygmaea	4.4
Reptadeonella violacea	11.56	Abietinaria abietina	29.63	Disporella hispida	16.48	Reptadeonella violacea	17.86	Reptadeonella violacea	19.06	Rhynchozoon bispinosum	31.19	Galathea intermedia	9.97	Corallinaceae	4.4
Cliona sp	9.78	Parasmittina trispinosa	20.38	Rhynchozoon bispinosum	15.07	Galathea intermedia	17.65	Escharella immersa	15.27	Chorizopora brongniartii	28.4	Chorizopora brongniartii	9.42	Typosyllis sp.	4
Hippothoa divaricata	8.67	Chorizopora brongniartii	19.13	Pomatoceros triqueter	10.9	Disporella hispida	14.84	Cliona sp	15.18	Porella concinna	28.04	Atylus vedlomensis	9.21	Echinocyamus pusillus	4
Disporella hispida	7.89	Alcyonium digitatum	13.88	Porella concinna	10.17	Chorizopora brongniartii	13.6	Chorizopora brongniartii	13.96	Cliona sp	27.21	Disporella hispida	9.18	Atylus vedlomensis	4
Escharella immersa	6.56	Hydrallmania falcata	12.25	Escharella immersa	9.79	Porella concinna	11.37	Dendrodoa grossularia	13.59	Disporella hispida	25.42	Gari tellinella	7.52	Disporella hispida	3
Parasmittina trispinosa	5.67	Erichthonius punctatus	12.25	Corallinaceae	9.03	Apherusa bispinosa	10.56	Disporella hispida	12.9	Pisidia longicornis	22.1	Rhynchozoon bispinosum	6.85	NEMERTEA	2.8
		Typosyllis sp.	11.25	Electra pilosa	8.79	Echinocyamus pusillus	9.56	Escharella ventricosa	12.8	Pomatoceros triqueter	18.78	Apherusa bispinosa	6.12	Rhynchozoon bispinosum	2.8
		Escharella immersa	11.13	Eunice vittata	7.9	Aonides paucibranchiata	7.44	Pomatoceros triqueter	9.69	Epizoanthus couchii	15.8	Polygordius sp.	5.58	Eulalia mustela	2.4
		Calycella syringa	8.75	Dendrodoa grossularia	7.9	Diastoporidae	7.12	Parasmittina trispinosa	8.55	Escharella immersa	14.51	Glycera lapidum (agg)	5.36		
		Sertularia sp.	8.75	Parasmittina trispinosa	7.17	Gari tellinella	6.02	Apherusa bispinosa	8.06	Diastoporidae	14.37	Typosyllis sp.	5.27		
		Porella concinna	8.38	Limatula sp	6.83	Glycera lapidum (agg)	5.93	Diastoporidae	7.53	Hippothoa divaricata	13.03	Aonides paucibranchiata	4.91		
		Polydora spp	8.25	Porifera	6.79	Microporella ciliata	5.93	Microporella ciliata	6.22	Parasmittina trispinosa	12.8	NEMERTEA	4.61		
		Epizoanthus couchii	7.25	Diastoporidae	6.66	Typosyllis sp.	5.35			Microporella ciliata	11.36	Reptadeonella violacea	4.52		
		Rhynchozoon bispinosum	7.13	NEMERTEA	5.45	Escharella immersa	5			Typosyllis sp.	9.52	Porella concinna	4.09		
		Lumbrineris gracilis	6.63	Escharella ventricosa	5.34	NEMERTEA	4.16			Apherusa bispinosa	9.36	Puellina innominata	3.91		
		Laonice bahusiensis	6.13	Chorizopora brongniartii	4.69	Eulalia mustela	3.77					Limatula sp	3.33		
		Escharella ventricosa	6.13	Laonice bahusiensis	4.45							Eulalia mustela	3.24		
		Lepidonotus squamatus	4.13	Microporella ciliata	4.28							Microporella ciliata	3.21		
				Ampharete lindstroemi	4.17							Diastoporidae	2.64		

Most Characteristic

Least Characteristic

Community structure measures

HC1		HC2		HC4		HC5		HC6		HC7		HC8		HC9	
S	27	S	111	S	97	S	88	S	81	S	103	S	79	S	37.4
N	189	N	604	N	357	N	457	N	318	N	731	N	291	N	98
d	5.1	d	17.2	d	16.3	d	14.4	d	13.9	d	15.6	d	13.8	d	8.0
J'	0.80	J'	0.80	J'	0.86	J'	0.81	J'	0.82	J'	0.78	J'	0.86	J'	0.86
H'(loge)	2.62	H'(loge)	3.71	H'(loge)	3.93	H'(loge)	3.64	H'(loge)	3.62	H'(loge)	3.61	H'(loge)	3.75	H'(loge)	3.07
1-Lambda'	0.89	1-Lambda'	0.95	1-Lambda'	0.97	1-Lambda'	0.95	1-Lambda'	0.95	1-Lambda'	0.95	1-Lambda'	0.96	1-Lambda'	0.94

Physical conditions

HC1		HC2		HC4		HC5		HC6		HC7		HC8		HC9	
Md (phi)	-1.4	Md (phi)	-1.6	Md (phi)	-0.394	Md (phi)	-0.281	Md (phi)	-1.03	Md (phi)	-0.975	Md (phi)	-0.285	Md (phi)	0.358
Depth_bcd m	-38.7	Depth_bcd m	-41.4	Depth_bcd m	-43.2	Depth_bcd m	-36.1	Depth_bcd m	-42.1	Depth_bcd m	-36.5	Depth_bcd m	-37	Depth_bcd m	-35.8
% Cobbles (>64mm)	6.67	% Cobbles (>64mm)	10	% Cobbles (>64mm)	3.08	% Cobbles (>64mm)	0.698	% Cobbles (>64mm)	2.54	% Cobbles (>64mm)	7.02	% Cobbles (>64mm)	1.21	% Cobbles (>64mm)	0
% Gravel	44.1	% Gravel	46.9	% Gravel	32.5	% Gravel	25.8	% Gravel	39.1	% Gravel	37.9	% Gravel	24.3	% Gravel	12.2
% Sand	53.9	% Sand	52.3	% Sand	66.5	% Sand	73.7	% Sand	59.9	% Sand	61.1	% Sand	75.3	% Sand	87.7
% Silt_Clay	2.05	% Silt_Clay	0.787	% Silt_Clay	1.05	% Silt_Clay	0.508	% Silt_Clay	1.01	% Silt_Clay	0.999	% Silt_Clay	0.453	% Silt_Clay	8.63E-02
% Shell	11.1	% Shell	15	% Shell	14.2	% Shell	16.5	% Shell	15.4	% Shell	13.1	% Shell	20	% Shell	32
Sorting	2.55	Sorting	2.52	Sorting	2.29	Sorting	1.95	Sorting	2.32	Sorting	2.32	Sorting	1.94	Sorting	1.54

Summary of the Results of the Combined Infaunal and Epifaunal Analysis

→ **The faunal data, when considering combined infaunal and colonial epifaunal species, revealed that the bryozoa, in particular, were frequently present across the area and a group of 5 bryozoan species were found in more than 95% of sites. *Pisidia longicornis* was still the most abundant species at any site but the hydroid species, *Nemertesia* sp. and the bryozoa, including *Schizomavella auriculata* and *Reptadeonella violacea* were also noted in great abundance.**

→ **Eight clusters of sites were identified and biotopes attributed to each, although again the level of definition in several cases was quite poor.**

→ **The principal physical variables were sand, gravel and sorting. The clustering of sites was related to these principal variables with the ratio of sand to gravel particularly indicative. The most gravely sediments supported *Pisidia longicornis*, along with the bryozoan, *Chorizopora brogniartii* and the brittle star *Ophiothrix fragilis*. At the other end of the scale, the species with a preference for sand habitats appear, such as *Echinocyamus pusillus* and in the most sandy sediments *Spio filicornis*.**

→ **The habitats and associated communities derived from the analysis of the infauna and epifauna show a similar type of gradient across the survey area to that of the infauna alone. The seabed to north east of the area is formed of sandier sediments characterised by the echinoderm *Echinocyamus pusillus* with increasing amounts of shell and gravel towards the west. The same boundary or transition area is evident, which extends from the west of Area 464 to Area 475. West of this area the biotopes with Echinoderms and crustose communities prevail, including patches of *Ophiothrix* beds. The latter however is not as clearly defined as it is in either the infaunal analysis or the static image analysis.**

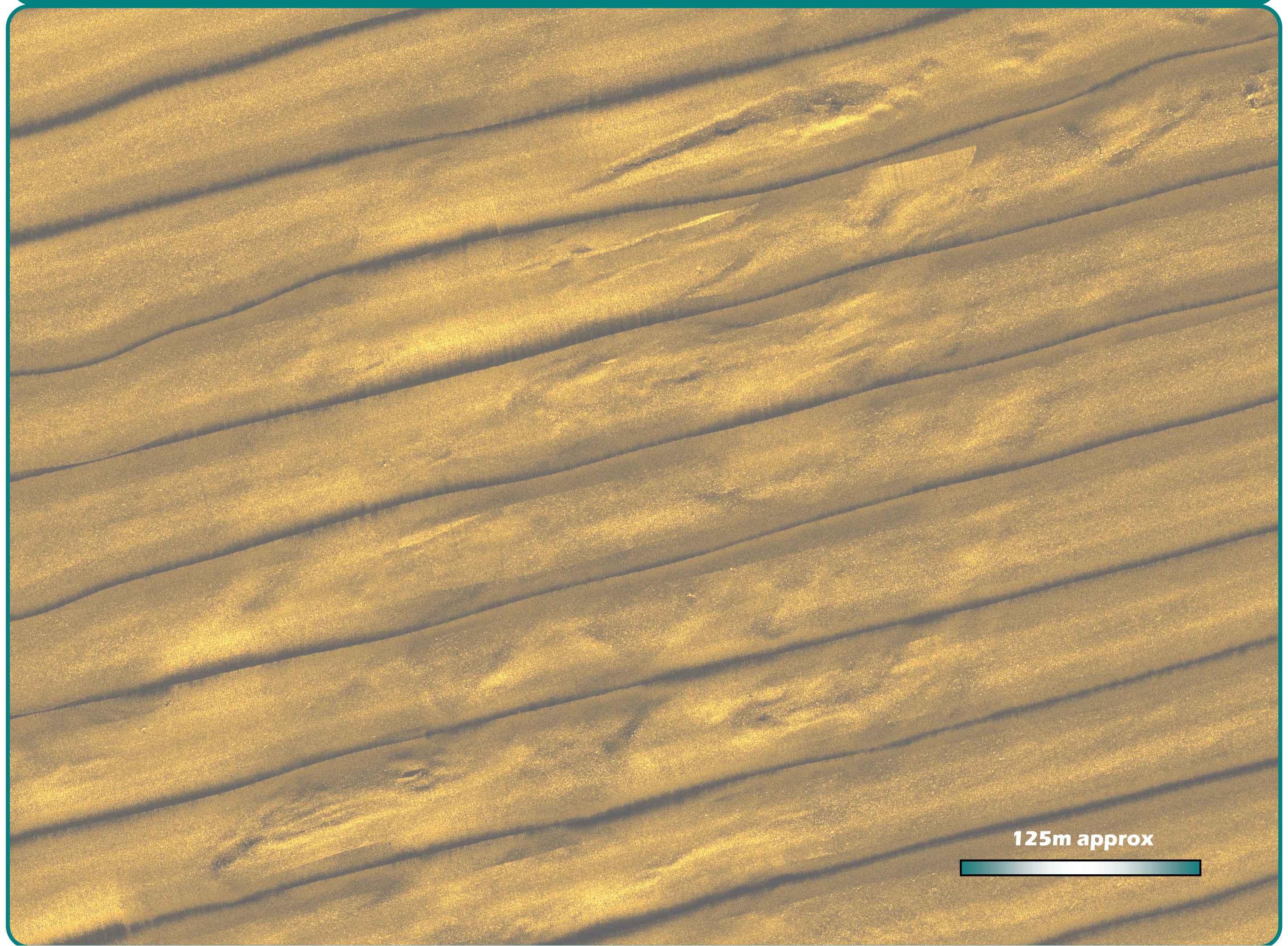
5.8 Sidescan Sonar and Video Habitat Survey

The review of sidescan sonar data from the two areas to the south west of Area 461 resulted in broadscale interpretations that are used in **Figures 85** to **94**. The results show that there was virtually no variation in seabed character for the north east area and as such the entire area has been interpreted as uniform sandy gravel. The seabed within the area produced a very even reflectivity with some isolated targets that are interpreted as coarser particles and boulders. Evidence of trawling and scallop dredge activity can be seen across the entire area. The swath bathymetry for this area suggests some depth variation in the south west of the region around which the video data collection points were located.

The seabed within the south west area was also interpreted as being composed of sandy gravel although some distinct linear features were evident within the area. Two sub areas were identified, within which these seabed features were evident, and these were the focus of the video survey. Review of the sidescan sonar in conjunction with the swath bathymetry acquired over the area show that the features exist over areas of the seabed that are variable in depth.

This initial review of data suggests that the features are linear gravel ridges, orientated along the axis of tidal currents. It is not thought that they are the result of bedrock out-crop although bedrock just below the seabed surface may be a factor in their formation. Further investigation will be undertaken during subsequent surveys to improve on the current understanding.

Sidescan sonar from the regional habitat and biotope survey were reviewed prior to drop-down video investigation of distinct features. The north east area was seen to be largely uniform but in the southwest area distinct features were evident as shown below.



Despite the areas of variable bathymetry and the linear features identified, there was generally little variation in the reflectivity of the seabed across the area and as such the seabed has been interpreted as sandy gravel, with or without the existence of the linear features described above. As with the north east area evidence of demersal fishing was noted across the area.

The video survey data set presented relates to the two blocks located in the south west of the regional study area (**Figure 8**). The initial sidescan data was used to identify potential boundaries based on sediment/substrata change, with video employed to identify habitat and biotope differences.

The outcome of the survey in terms of interpretation of seabed types is illustrated in **Figures 85** to **94**. Three basic seabed features are evident comprising sandy gravel, sandy gravel with linear ridge features and uniform sandy gravel with isolated cobbles and boulders.

The impact area (to the north east) is comprised of exclusively the latter, while the reference area (to the south west) supports all three types.

The observed substrata types from the video studies indicate that most of the area is comprised of mixed sandy gravel, generally consisting of over 80% of the seabed on each transect. (**Figure 85**).

The presence of small quantities of cobbles and boulders is common throughout the area but at only two sites does it comprise of a relatively significant amount of the seabed (>20%) (**Figure 86**) Similarly the areas of sand are relatively small, rarely exceeding 20% of the sample area (**Figure 87**).

The distribution of the dominant biotope on each video transect in the area has been overlaid on the sidescan interpretation and swath data. Seven biotopes were identified (**Figure 88**), although two principal types were noted; *Ophiothrix fragilis* and/or *Ophicoma nigra* brittlestar beds on sublittoral mixed sediments (OphMx) and *Pomatoceros triqueter* with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles (**PomB**).

The latter has had an additional biotope added to it, where the numbers of the queen scallop *Aequipecten opercularis* were found to be high (**PomB.Aeq**). The full range of biotopes is listed below:

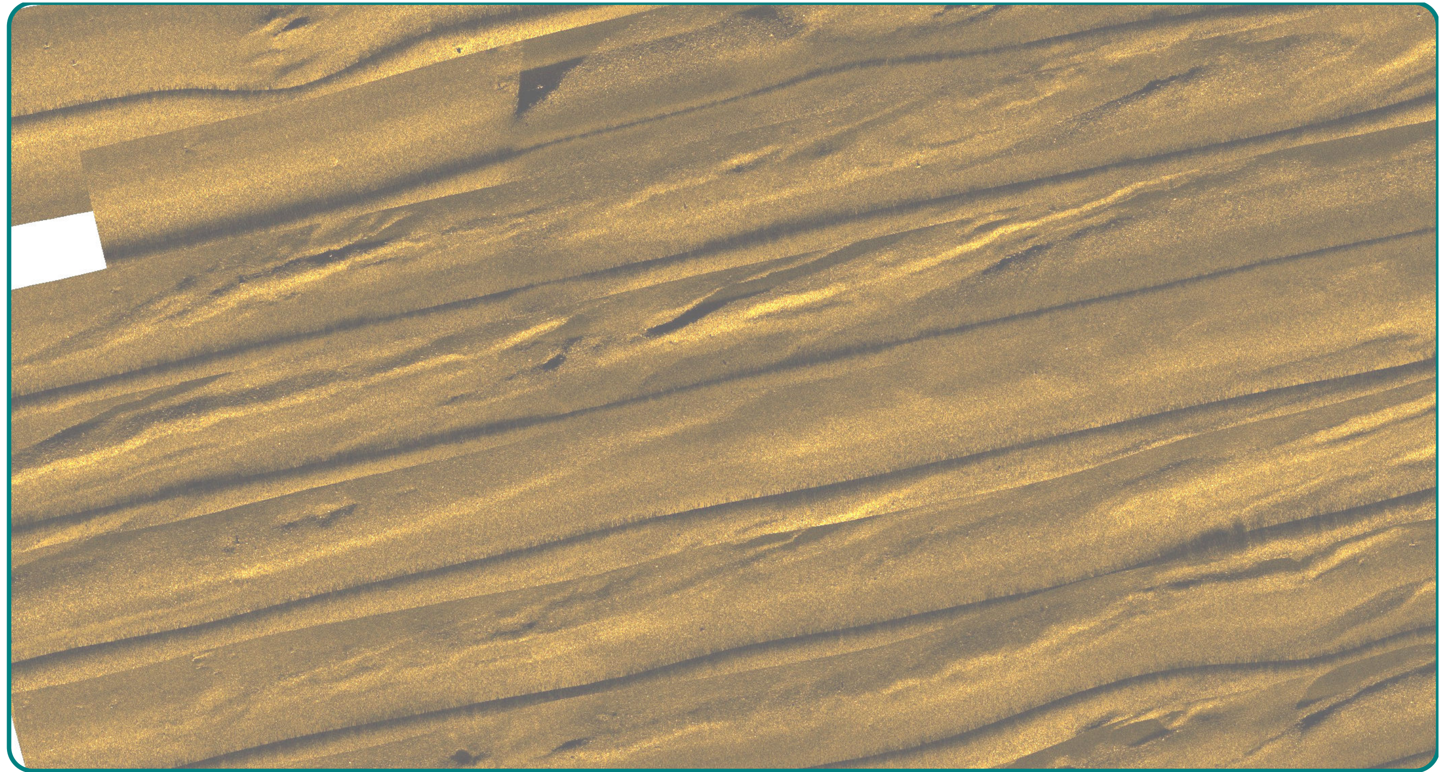
CR.HCR.XFa.	Mixed faunal turf communities
CR.HCR.XFa.SpNemAdia.	Sparse sponges, *Nemertesia* spp. and *Alcyonidium diaphanum* on circalittoral mixed substrata
CR.MCR.EcCr.FaAlCr.Pom.	Faunal and algal crusts with *Pomatoceros triqueter* and sparse *Alcyonium digitatum* on exposed to moderately wave-exposed circalittoral rock
SS.SCS.CCS.PomB.	*Pomatoceros triqueter* with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles
SS.SCS.CCS.PomB.Aeq.	*Pomatoceros triqueter* with barnacles, bryozoan crusts and *Aequipecten opercularis* on circalittoral pebbles and gravel
SS.SMx.CMx.FluHyd.	*Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment
SS.SMx.CMx.OphMx.	*Ophiothrix fragilis* and/or *Ophiocomina nigra* brittlestar beds on sublittoral mixed sediment

The distribution of the biotopes (and abundances of characterising species in **Figures 89** to **94**) indicates that the impact zone comprised almost exclusively of the PomB biotope in combination with the **PomB.Aeq**. The biotopes tended to be evident as discrete patches in the north of the impact zone, while in the south of the impact zone the biotopes were more mixed including the less frequently noted exposed circalittoral rock with *Pomatoceros* (**FaAlCr.Pom**).

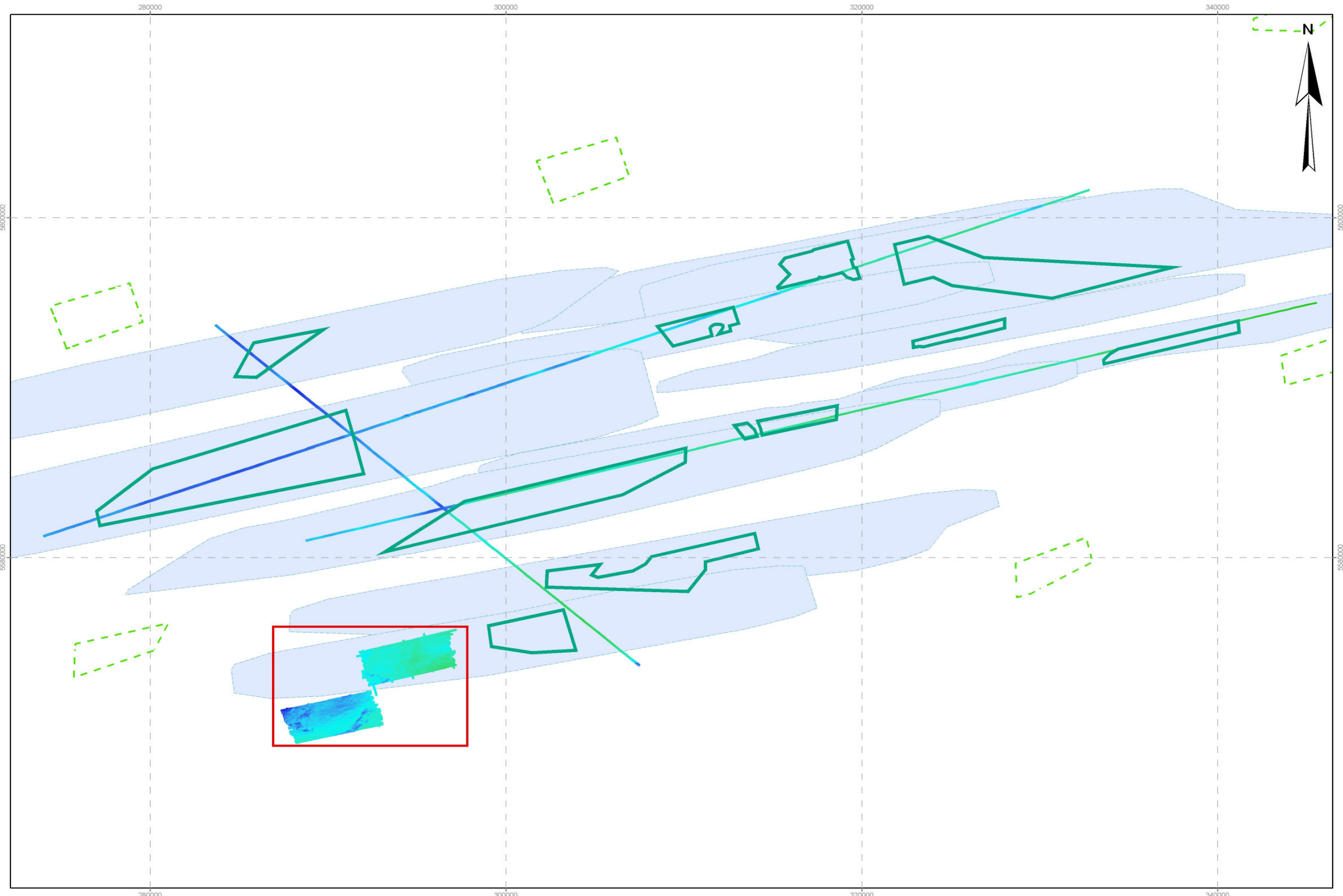
The southern part of the impact zone also supported small patches of brittlestar bed (**OphMx**). Boundaries between these biotopes may not be easily identified in this area due to the relative uniformity of the physical characteristics of the seabed although variation in seabed topography appears to correspond to an increase in biotope diversity.

In contrast to the impact area, the reference zone supports several biotopes, with **OphMx** dominating in relatively discrete areas. The occurrence of the biotopes tends to be largely independent of the underlying substrata although apparent correspondence with variable bathymetry is evident. Associated with the brittlestar beds were the *Pomatoceros* based biotopes, including those with and without *Aequipecten*.

The more diverse epifaunal based biotopes, were limited in distribution, with the exception of the *Flustra foliacea* and *Hydrallmania falcata* on tide swept circalittoral mixed sediment, which was consistently evident along a transect across the southeast corner of the reference area, relating to both a sedimentary and bathymetric boundary.

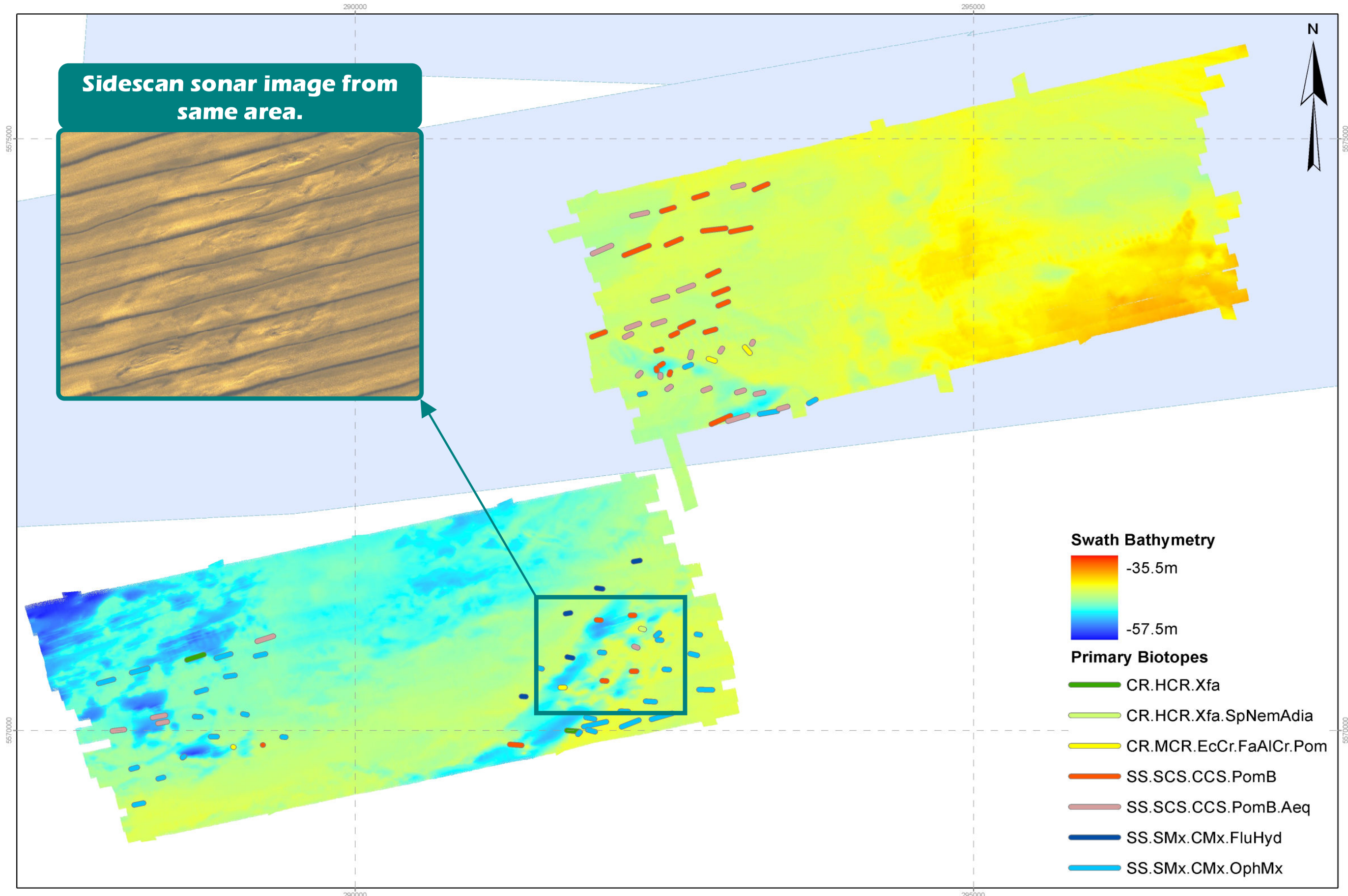


The image above shows sidescan sonar data of part of the south west regional survey area. The location of the image is shown by the red box in the image below. Several distinct linear features are evident in the image.



The regional bathymetry, sidescan sonar and video survey acquired data along the transects and areas shown above.

The area bounded by the red box is shown in more detail in the image on the right.



The regional sidescan sonar and video survey identified several biotopes within the more southerly area where the seabed appeared to be more variable in character – both in terms of its bathymetry and the texture of the seabed recorded by the sidescan sonar.

The more northerly area was less variable and fewer biotopes were recorded over a larger area.

Summary of the Results of the Sidescan Sonar and Video Habitat Survey

→ The data from the sidescan sonar and swath surveys were used to identify potential boundaries on the seabed in the two survey regions. The video survey outputs have subsequently been overlaid on the geophysical data with respect to describing biotope distributions. Problems occurred with the video information due to the limited capability to identify all species accurately, despite a very high level of image definition. Maximum value was achieved through identification and enumeration of a selected range of easily identifiable species.

→ Seven biotopes were identified although only two principal types were noted; *Ophiothrix fragilis* and/or *Ophicoma nigra* brittlestar beds on sublittoral mixed sediments (OphMx) and *Pomatoceros triqueter* with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles (PomB). The latter has had a modified biotope added to it, where the numbers of the queen scallop *Aequipecten opercularis* were found to be high (PomB.Aeq).

→ The impact zone supported few biotopes with PomB and PomB.Aeq occurring most extensively. In the extreme south west of the impact area the seabed topography was variable and in this region the biotopes were more complex, including patches of OphMx.

→ The reference area supported a wider range of biotopes with OphMx dominating in relatively well defined areas. Associated with the brittlestar beds were the *Pomatoceros* based biotopes, including those with and without *Aequipecten*. Bathymetry appeared to be a key factor in the distribution of the OphMx biotope, while the *Flustra foliacea* and *Hydrallmania falcata* on tide swept circalittoral mixed sediment, is responding to an apparent sedimentary and bathymetric boundary.

5.9 2m Beam Trawl Results

A total of 320 species were identified from the 2m beam trawl samples. Of these the most frequently occurring were from a variety of taxonomic groups (see table below):

Species	% frequency
Hydrallmania falcata	98%
Pagurus bernhardus	98%
Asterias rubens	98%
Pomatoceros triqueter	96%
Aequipecten opercularis	96%
Psammechinus miliaris	96%
Alcyonium digitatum	94%
Disporella hispida	94%
Ophiothrix fragilis	94%
Balanus crenatus	92%
Galathea intermedia	92%
Cellepora pumicosa	92%
Abietinaria abietina	90%

The species recorded at the highest abundances are noted in the following table:

	Abundance per tow	
Species	mean	max
Psammechinus miliaris	275.80	2174.00
Aequipecten opercularis	264.60	1287.00
Balanus crenatus	241.30	1832.00
Ophiothrix fragilis	99.20	1713.00
Pomatoceros triqueter	80.30	298.00
Alcyonium digitatum	48.60	820.00
Asterias rubens	47.90	170.00
Pagurus bernhardus	29.40	117.00
Ophiura albida	21.10	235.00

The 2m beam trawl data were subjected to PRIMER analysis (4th root transformation) to determine trends in the faunal groupings. Three principal groups emerge from the cluster analysis with one outlier. These same groups are evident on the MDS analysis, although with a relatively high degree of associated stress (0.21). (see **Figure 95**).

The characteristics of these clusters have been summarised in the tables inset on **page 62** below (species contributing to 80% of similarity).

Cluster 2Mb is comprised of a relatively diverse community with a mean number of 50 species although abundance was not high for any individual species except *Ophiothrix fragilis*, which was characteristic of this cluster, along with *Pisidia longicornis*.

Cluster 2Md is comprised of a greater number of species, with several at very high abundances, of which *Psammechinus miliaris* and *Aequipecten opercularis* were co-dominant and indicative of this cluster. Several other potentially indicative species were noted including *Dendrodoa grossulari* and *Alcyonium digitatum*.

Cluster 2Ma comprised of a reduced number of species but with a single high density of individuals, with *Balanus crenatus* constituting over 80% of the abundance.

The outlier site (1) was also clearly dominated by a single species; in this case *Ophiothrix fragilis*. The lack of any other species in any abundance at this site has resulted in the separation of this site from the relatively similar cluster 2Mb.

The influence of the characteristic species is illustrated in **Figures 96** to **99**, which show abundances linked to the position within the MDS plot. The distribution of the clusters has been illustrated in **Figure 100**. The sites from cluster 2Md are the most widely distributed occurring across the whole area, including 5 out of 6 of the reference areas. Cluster 2Mb, in contrast, was present in a limited area dividing the two halves of the survey region and potentially including Areas 461, 475 and 478.

Cluster 2Ma was limited to the north east of the survey area, beyond the licence and application areas and secondary impact zones.

This distribution of clusters tends to support the infaunal and epifaunal benthic studies. A north easterly impoverished community, probably related to the sandier sediments is noted along with a centrally located community corresponding to the presence in abundance of *Ophiothrix fragilis*. The extent of this community differs from the area identified in the other studies, but the general location is consistent.

Figure 95 MDS of 2m beam trawl clusters

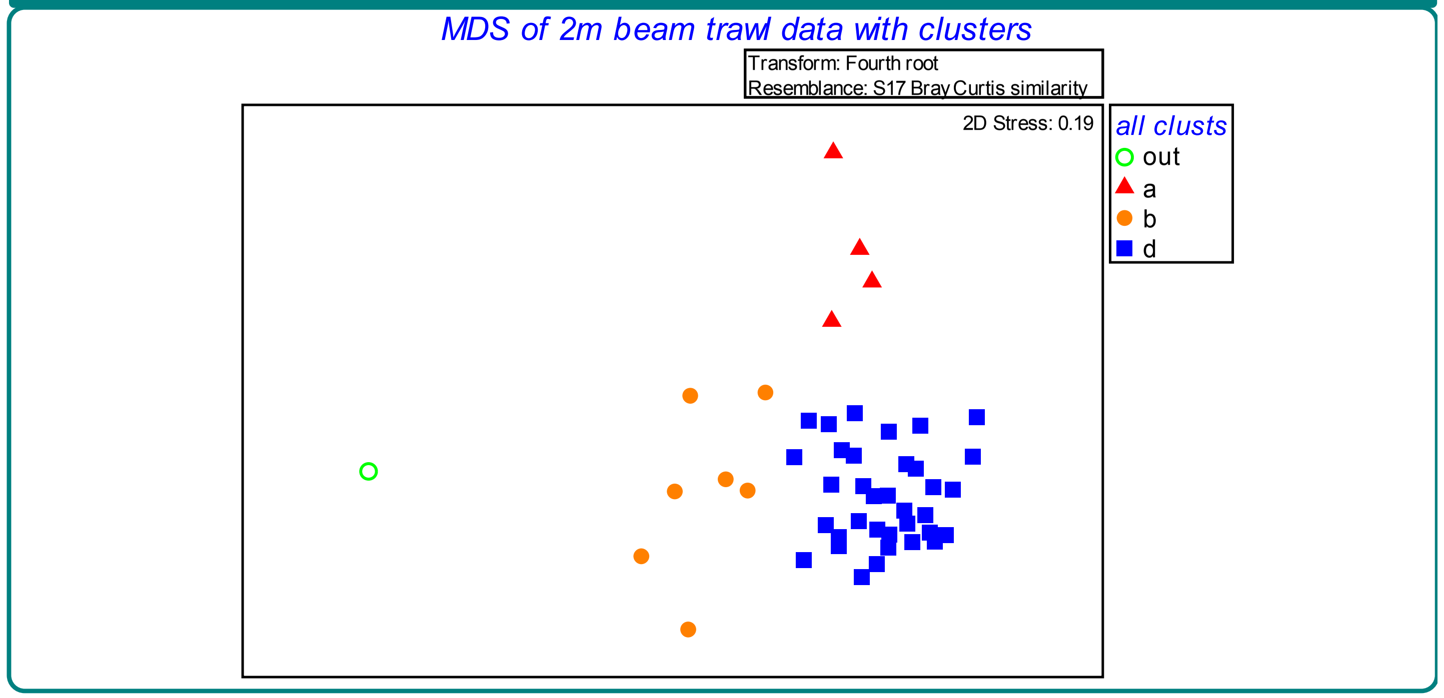


Figure 96 MDS plot of 2m beam trawl clusters with influence *A. opercularis*.

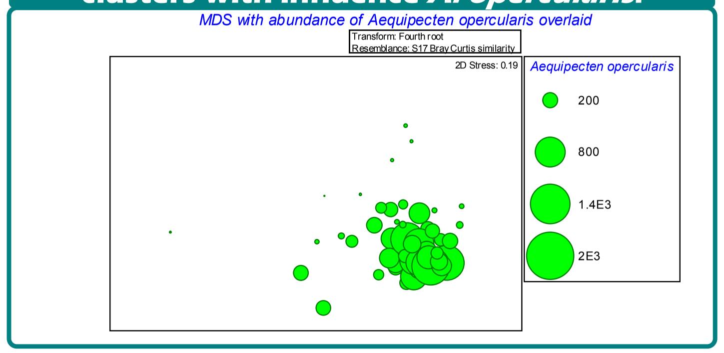


Figure 97 MDS plot of 2m beam trawl clusters with influence *P. miliaris*.

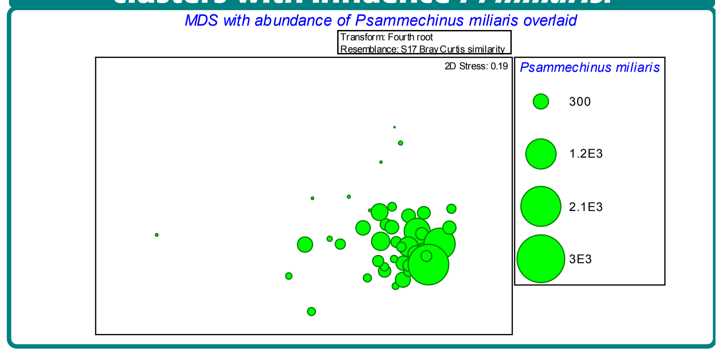


Figure 98 MDS plot of 2m beam trawl clusters with influence *O. fragilis*.

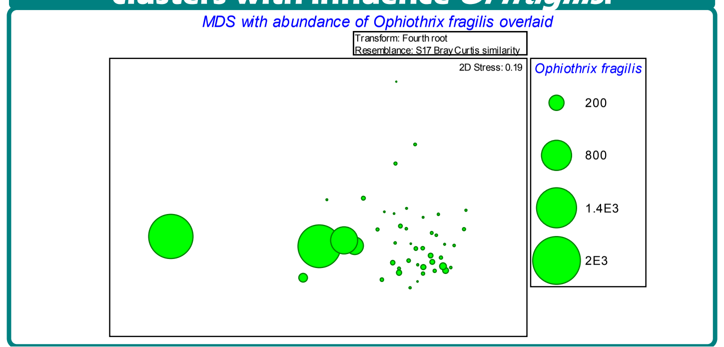
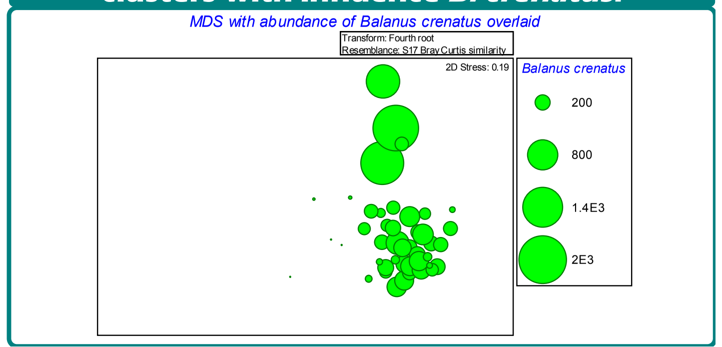
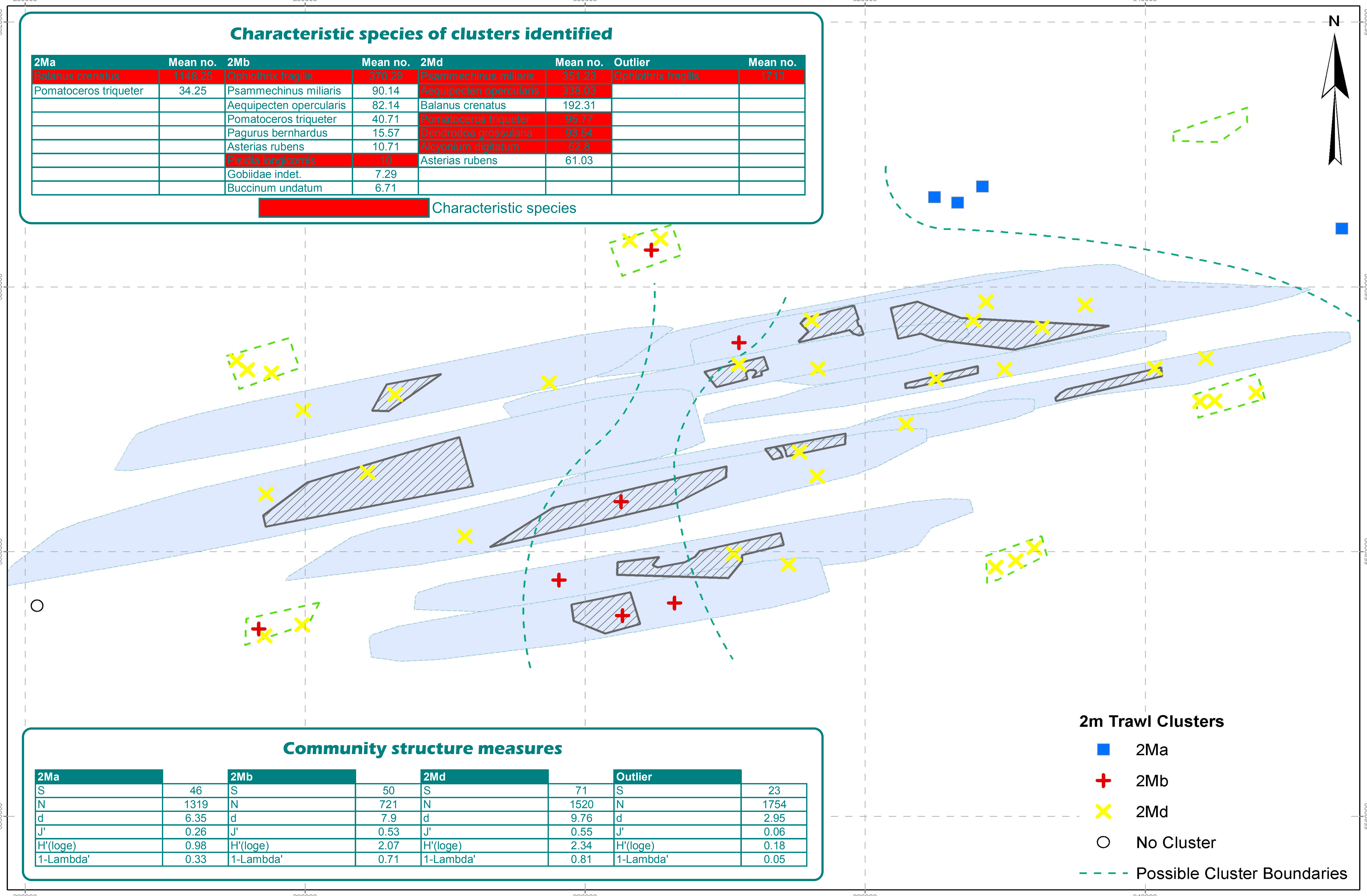


Figure 99 MDS plot of 2m beam trawl clusters with influence *B. crenatus*.





Characteristic species of clusters identified

2Ma	Mean no.	2Mb	Mean no.	2Md	Mean no.	Outlier	Mean no.
Balanus crenatus	1148.25	Ophiothrix fragilis	370.29	Psammechinus miliaris	351.23	Ophiothrix fragilis	1713
Pomatoceros triqueter	34.25	Psammechinus miliaris	90.14	Aequipecten opercularis	338.03		
		Aequipecten opercularis	82.14	Balanus crenatus	192.31		
		Pomatoceros triqueter	40.71	Pomatoceros triqueter	95.77		
		Pagurus bernhardus	15.57	Dendrodoa grossularia	93.54		
		Asterias rubens	10.71	Alcyonium digitatum	62.8		
		Pisidia longicornis	10	Asterias rubens	61.03		
		Gobiidae indet.	7.29				
		Buccinum undatum	6.71				

Characteristic species

Community structure measures

2Ma		2Mb		2Md		Outlier	
S	46	S	50	S	71	S	23
N	1319	N	721	N	1520	N	1754
d	6.35	d	7.9	d	9.76	d	2.95
J'	0.26	J'	0.53	J'	0.55	J'	0.06
H'(loge)	0.98	H'(loge)	2.07	H'(loge)	2.34	H'(loge)	0.18
1-Lambda'	0.33	1-Lambda'	0.71	1-Lambda'	0.81	1-Lambda'	0.05

Figure 25

Community clusters identified from analysis of 2m beam trawl data. Cluster 2Md, characterised by *P. miliaris, A. opercularis, B. crenatus, P. triqueter, D. grossularia, A. digitatum* and *A. rubens*, was the most common across the region being identified at 35 of 48 sites.

Summary of the Results of the 2m Beam Trawl Survey

→ **The fauna from the 2m beam trawl surveys included a wide range of taxonomic groups in the most frequently occurring and abundant species, including; *Hydrallmania falcata, Pagurus bernhardus, Asterias rubens, Pomatoceros triqueter, Aequipecten opercularis* and *Psammechinus miliaris*.**

→ **Three clusters were derived from the PRIMER analysis of the data with an *Aequipecten/Psammechinus* dominated community, an *Ophiothrix/Pisidia* based community and a low diversity *Balanus* dominated community resulting from the occurrence of isolated cobbles and shell material on otherwise sandy seabed.**

→ **The communities identified conform to a similar distribution to that of the grab and video data, with the north eastern area supporting the low diversity *Balanus* community, the majority of the rest of the area supporting the *Aequipecten/Psammechinus* community and the brittlestar beds occurring as a discrete area to the central south.**

5.10 Scallop Dredge Survey – Shellfish Results

A. opercularis was recorded at 47 of the 48 sample sites at abundances ranging from 0.000500 per m² (0.5 per 1000m²) to 0.265856 per m² (265.856 per 1000m²). The distribution of this species over the ECR (**Figure 26**) indicates certain areas where greater abundances were recorded compared to other sites. Of particular note is a group of sites in the central part of the array (comprising sites 18, 20, 21, 24, 25, 26 and 32) that all had high abundance values. The reference areas were notable for all generally having lower abundances per m² than other sites within actual licence areas.

P. maximus was recorded at 46 of the 48 sample sites at abundances ranging from 0.000210 per m² (0.21 per 1000m²) to 0.01481 per m² (14.81 per 1000m²). The spatial distribution of this species over the ECR does not indicate any noticeable trend (**Figure 27**). However, one observation of potential note is that the relatively higher abundances, compared to surrounding sites, of *P. maximus* at sites 4, 5 and 14, corresponds to the higher abundances of *A. opercularis* relative to surrounding sites, at these same sites.

C. pagurus was recorded at only 1 of the 48 sample sites (Site 43). It is unlikely that this is an accurate representation of the distribution of this species across the survey area, rather it more likely reflects the unsuitability of the scallop dredge in sampling this mobile species (**Figure 28**).

B. undatum was recorded at 17 of the 48 sample sites at abundances ranging from 0.000226 per m² (0.226 per 1000m²) to 0.0028 per m² (2.8 per 1000m²). The spatial distribution of this species over the ECR does not indicate any noticeable trend (**Figure 29**). However, one observation of potential note is that the relatively higher abundances, compared to surrounding sites, of *B. undatum* at sites 3, 4, 5, 7 and 12 corresponds to the higher abundances of *A. opercularis* and *P. maximus* relative to surrounding sites, at these same sites.

M. squinado was recorded at only 2 of the 48 sample sites with the greatest abundance recorded at Station 43 (0.000297 per m² (0.297 per 1000m²). As with the data for *C. pagurus*, it is unlikely that these results represent the true distribution of *M. squinado* throughout the survey area (**Figure 30**), rather, they reflect the fact that scallop dredges are not efficient at sampling these mobile crustaceans.

5.11 4m Beam Trawl Survey – Shellfish Results

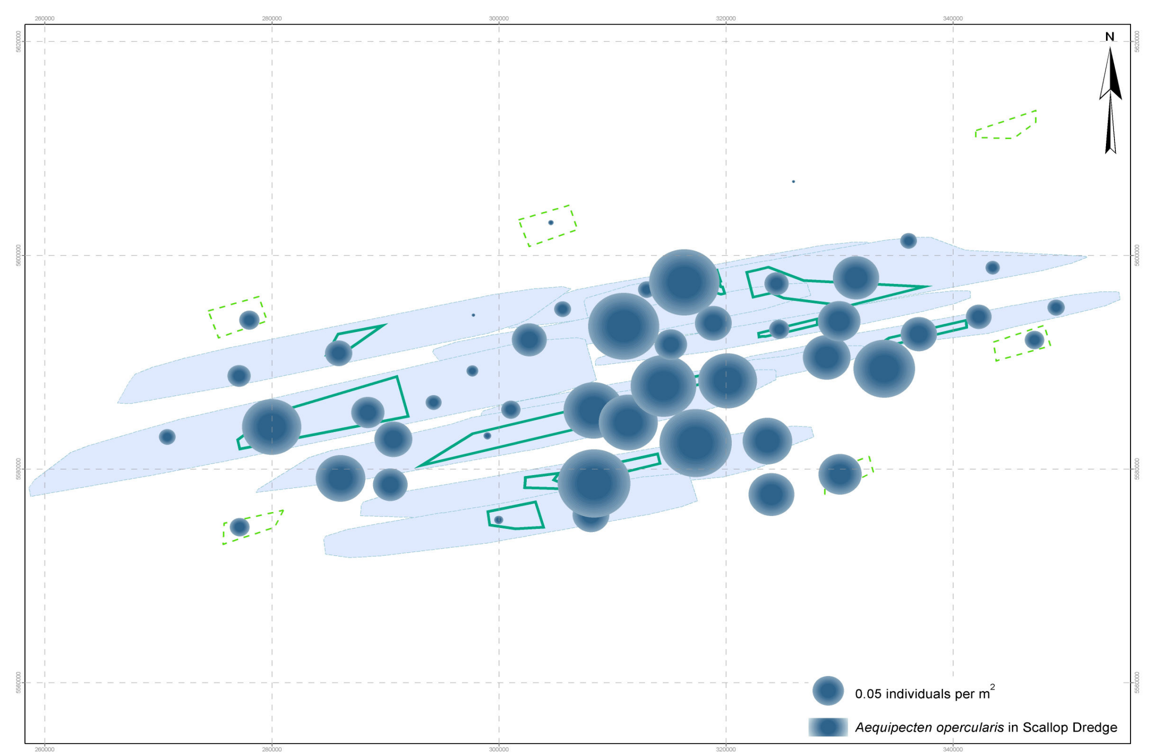
A. opercularis was recorded at all of the 48 sample sites at abundances ranging from per 0.001876 per m² (1.876 per 1000m²) to 0.722 per m² (722 per 1000m²). The spatial distribution of this species over the ECR (**Figure 31**) indicates certain areas where the abundance of *A. opercularis* was noticeably greater than surrounding areas. For example, there appears to be high abundances at Stations 35, 36, 37, 38 and 40 which are based around application Areas 474 Central, 464-2 and 458. However, there are also sites some distance from any application area that also have high abundances of this species. Station 34 recorded the 2nd highest abundance of the 48 sites.

P. maximus was recorded at 43 of the 48 sample sites at abundances ranging from 0.000189 per m² (0.189 per 1000m²) to 0.010945 per m² (10.945 per 1000m²). The spatial distribution of this species over the ECR indicated no obvious trends (**Figure 32**). Of note is that the two greatest abundances of this species were recorded at Station 4 and Station 42 which are located within Areas 477 South and Area 474 East respectively.

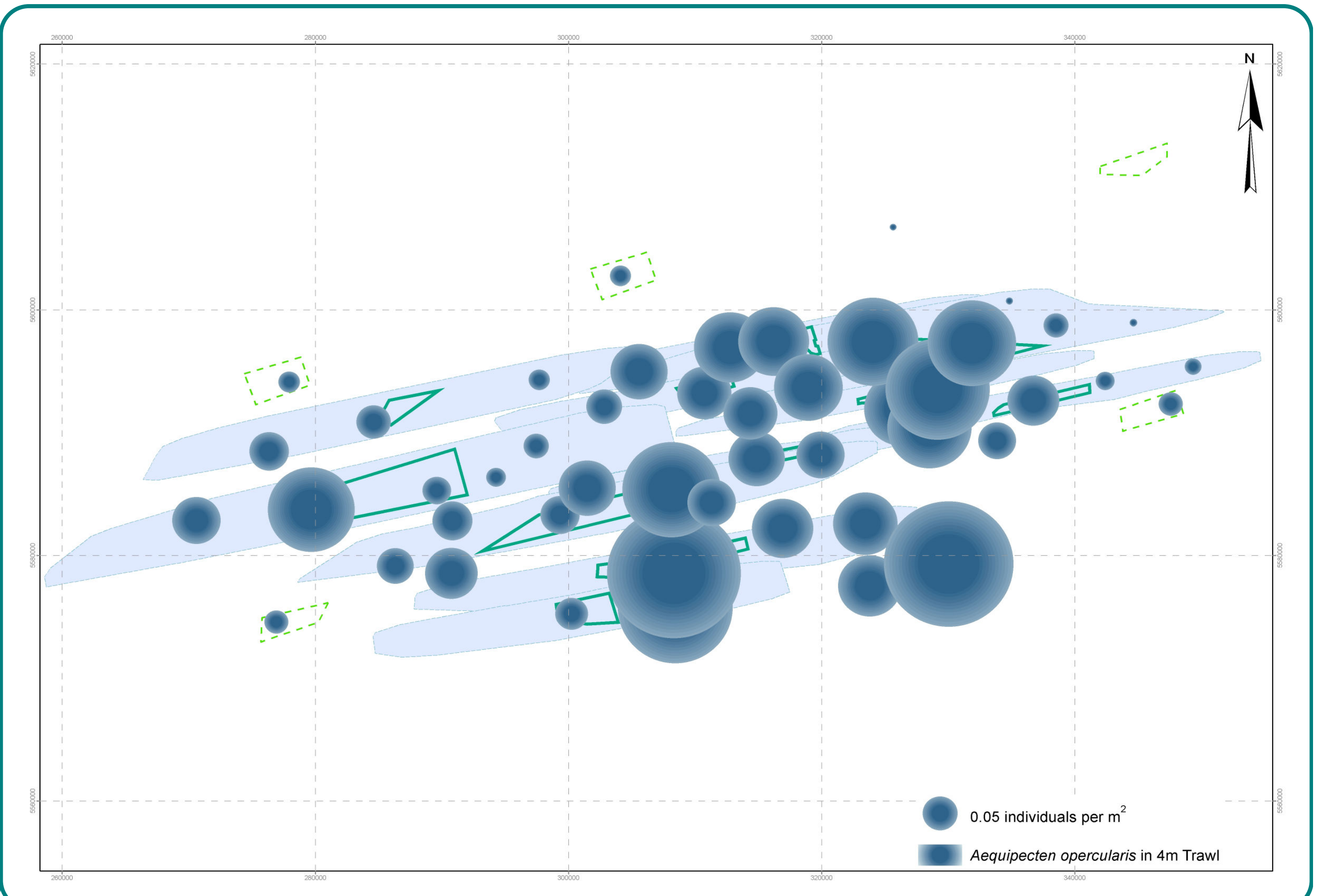
C. pagurus was recorded at only 5 of the 48 sample sites at abundances ranging from 0.000100 per m² (0.100 per 1000m²) to 0.000189 per m² (0.189 per 1000m²) (**Figure 33**). It is unlikely that this is an accurate representation of the distribution of this species across the survey area rather it more likely reflects the unsuitability of the 4m beam trawl in capturing this mobile species.

B. undatum was recorded at 44 of the 48 sample sites at abundances ranging from 0.000214 per m² (0.214 per 1000m²) to 0.013297 per m² (13. 297 per 1000m²). There was no obvious trend in the spatial distribution of this species over the survey area (**Figure 34**), with it being recorded at the majority of sites sampled.

M. squinado was recorded at 13 of the 48 sample sites at abundances ranging from 0.000100 per m² (0.100 per 1000m²) to 0.000636 per m² (0.636 per 1000m²) (**Figure 35**).



A. opercularis was evident across the region. Patterns of abundance were similar using both scallop dredge (left figure) and 4m beam trawl (right figure) survey gear. It is interesting to note that the 4m beam trawl sampled scallop more efficiently that the dredge gear.



5.12 4m Beam Trawl Survey – Fish Results

Species Diversity

The number of fish species recorded from each of the 4m beam trawl sample stations is shown in **Figure 100**. From this it can be noted that there were no obvious trends in the distribution of total fish species across the ECR survey array.

Apart from Station 25, where no fish species were recorded, the minimum number of fish species recorded at any one station was 3 (Stations 5 and 46), whilst the maximum number of species recorded at a station was 13 (Station 16). Across the entire array, the average number of fish species recorded at each site during the 4m beam trawl survey was 7.48.

Length Frequency Analysis of Selected Demersal Species across ECR Survey Array

Figures 36 to **41** show the length frequency of selected demersal species sampled during the EEC 4m beam trawl survey, undertaken in August 2005. The results shown in these figures are discussed below.

A. cuculus was recorded at 42 of the 48 sample stations surveyed in August 2005. At the majority of sites where this species was recorded several size classes were noted, suggesting that different year classes of fish currently exist at these sites. The size of this species recorded across the EEC survey array ranged from 7cm to 48cm.

According to Dorel (1986), this species reaches maturity at 25cm length in the Channel region. Based upon the length frequency data obtained in August 2005, both immature and mature species were recorded in the EEC region during this survey.

C. lyra was recorded at 47 of the 48 sample stations surveyed in the August 2005 4m beam trawl survey. The size of this species recorded across the EEC survey array ranged from 7cm (Stations 21 and 46) to 50cm (Station 21). Beverton & Holt (1959) states that this species achieves sexual maturity at 17.4cm.

Based upon the 2005 4m beam trawl data, the majority of sites where this species was recorded contained a mixture of mature fish that will form part of the spawning stock and also juvenile (<17.4cm) fish that have not yet recruited to this spawning stock.

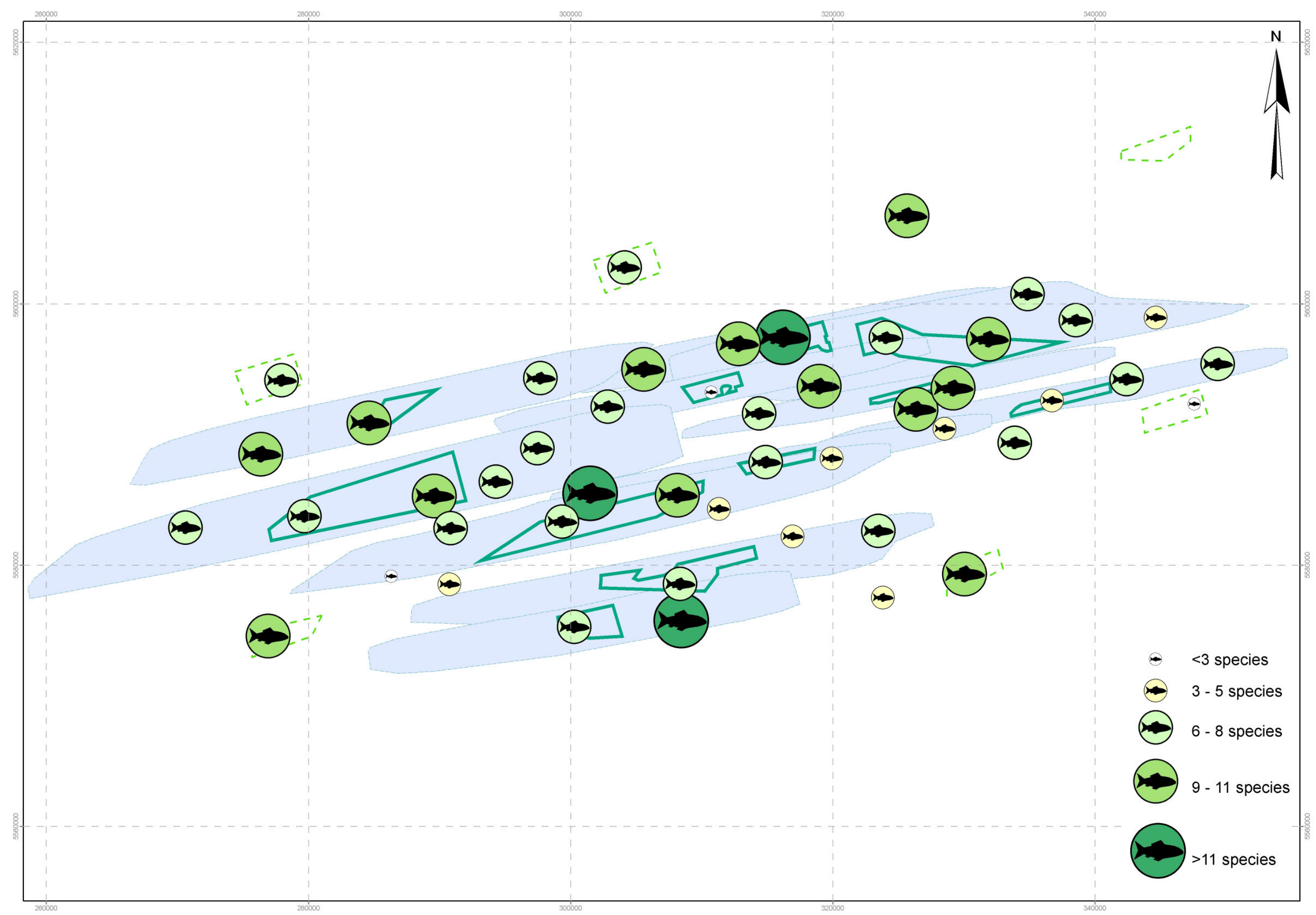
R. clavata was recorded at 11 of the 48 sample stations surveyed in the August 2005 4m beam trawl survey. The greatest range of sizes at an individual site was noted at Station 32 where 3 fish ranging from 54 to 79cm were recorded.

According to Dorel (1986), the male of this species reaches maturity at 80cm length in the Channel region, with the female recorded as maturing at 95cm. The largest example of this species recorded in the August 2005 survey was a male of 79cm (at Station 32), suggesting that all other fish, apart from potentially this individual, were juveniles that had not yet reached sexual maturity.

P. platessa was recorded at 5 of the 48 sample stations surveyed in the August 2005 4m beam trawl survey. The size of this species recorded across the EEC survey array ranged from 25cm (Station 48) to 45cm (Station 32). According to Dorel (1986), this species reaches maturity at 25cm length in the Channel region, therefore, all the fish recorded during this trawl survey are likely to have been mature members of the adult stock, with no juveniles recorded.

S. solea was recorded at 20 of the 48 sample stations surveyed in the August 2005 4m beam trawl survey. It is notable that this species was not recorded at any of the survey stations west of Station 15, being found predominantly in the most easterly sites. The size of this species recorded across the EEC survey array ranged from 6cm (Station 38) to 35cm (Station 45), although the majority of *S. solea* recorded were in the size class 10-15cm. According to Dorel (1986), this species reaches maturity at 28cm length in the Channel region. Therefore, the majority of fish recorded during the August 2005 trawl survey were immature juvenile fish that do not form part of the adult stock.

T. minutus was recorded at 6 of the 48 sample stations surveyed in the August 2005 4m beam trawl survey. The size of this species recorded across the EEC survey array ranged from 6cm to 18cm, although the majority of *T. minutus* recorded were in the size class 5-10cm. Beverton & Holt (1959) states that this species achieves sexual maturity at 11cm in the Channel region. The data from the 2005 survey indicates that at the sites where this species was recorded, both immature and mature species were typically found. Of particular note is Station 2 where approximately 150 individuals were recorded in total. Of the 100 measured in the subsample, 97 were in the size range 5-10cm, indicating a large number of juvenile fish at this site.



Results of fish surveys using 4m beam trawl gear will be subsequently reviewed within the context of wider scientific surveys (Cefas Channel beam trawl surveys). Annual regional comparisons of ECR data will attempt to identify broad-scale changes in species distribution rather than site specific changes at individual trawl stations.

Abundance of Selected Demersal Fish Species across ECR Survey Array

Figures 101 to **108** show the abundance per 1000m² of selected demersal species sampled during the EEC 4m beam trawl survey, undertaken in August 2005.

A. cuculus was recorded at 43 of the 48 sample sites at abundances ranging from 0.21 per 1000m² (station 36) to 4.25 per 1000m² (station 18).

The spatial distribution of this species over the EEC survey array indicates no particular trend, with this species being recorded at the majority of sites.

This indicates that this species is fairly well distributed throughout the EEC region. This species was also recorded within all the reference areas sampled.

C. lyra was recorded at all of the 48 sample sites at abundances ranging from 0.18 per 1000m² (station 17) to 5.67 per 1000m² (station 16).

The spatial distribution of this species over the EEC survey array appears to indicate that the greatest abundances of *C. lyra* were recorded at stations in the eastern part of the survey array. However, as with *A. cuculus* this species was distributed throughout the EEC region.

R. clavata was recorded at 11 of the 48 sample sites at abundances ranging from 0.16 per 1000m² (station 2) to 0.89 per 1000m² (station 29). Due to the limited number of stations at which this species was recorded, no obvious trends in the spatial distribution are apparent. However, it is notable that no *R. clavata* was recorded east of Station 41.

P. platessa was recorded at only 5 of the 48 sample sites at abundances ranging from 0.20 per 1000m2 (station 32) to 1.17 per 1000m2 (station 41). Due to the limited number of stations at which this species was recorded, no obvious trends in the spatial distribution are apparent.

However, it is notable that the two stations where the greatest abundance was recorded (23 & 41) were reference areas outside the predicted dredging impact zones.

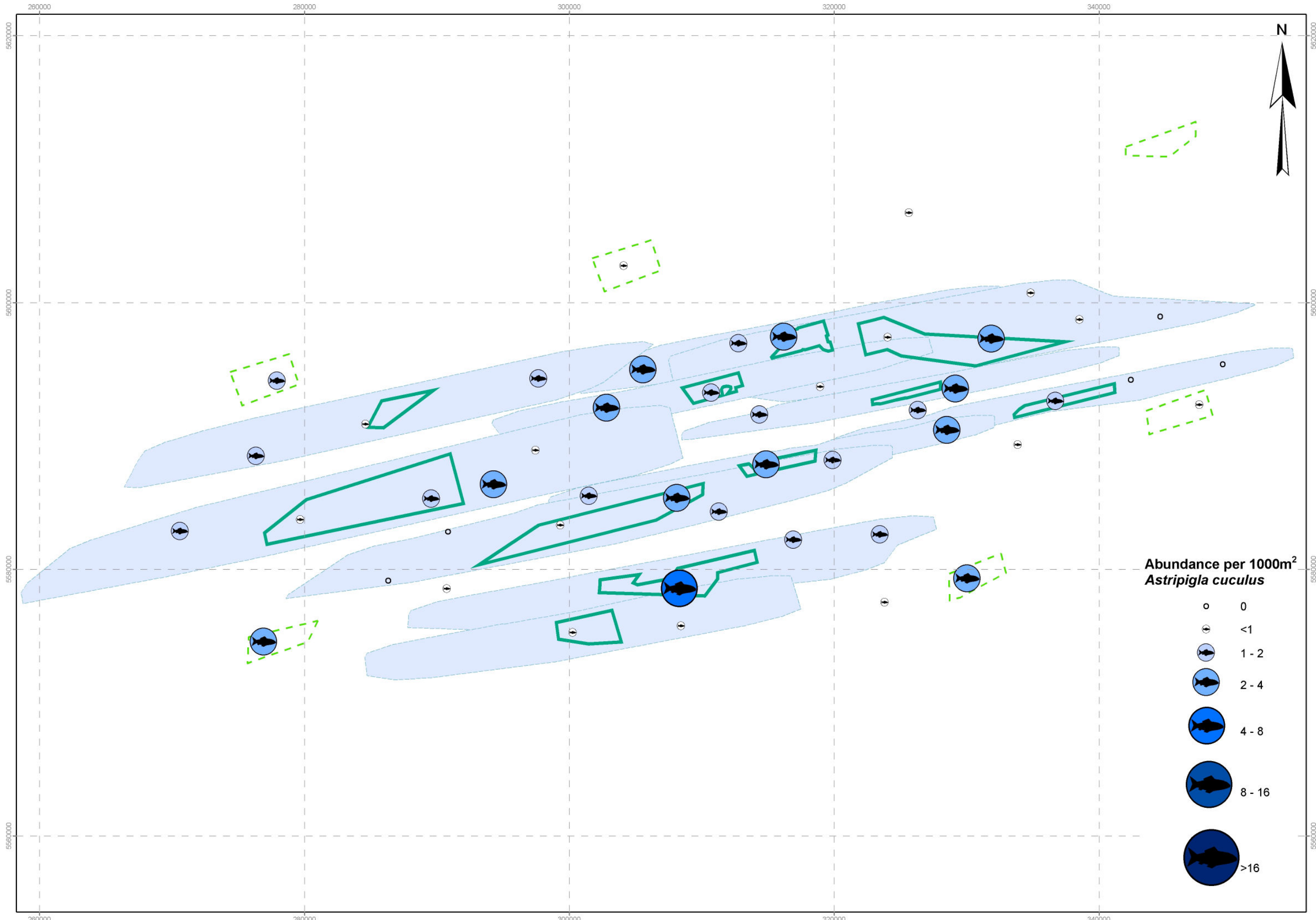
S. solea was recorded at 20 of the 48 sample sites at abundances ranging from 0.16 per 1000m² (station 39) to 2.17 per 1000m² (station 45). The spatial distribution of this species over the EEC survey array appears to indicate that the greatest abundances of *S. solea* were recorded at stations in the eastern part of the survey array. No *S. solea* were recorded west of station 15.

T. minutus was recorded at 6 of the 48 sample sites at abundances ranging from 2.883199 per 1000m² (station 6) to 24.41 per 1000m² (station 2).

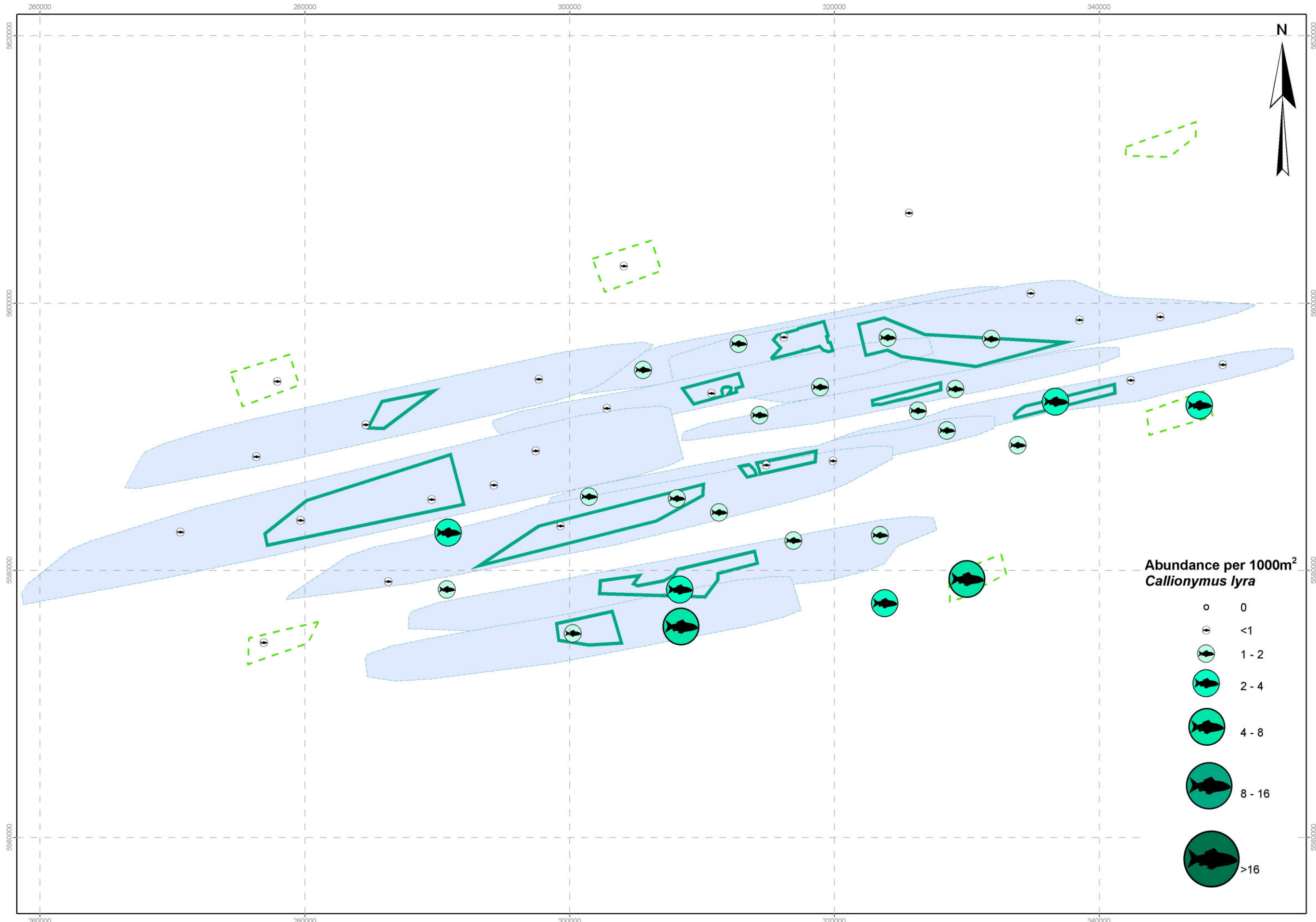
In terms of the spatial distribution of this species across the EEC survey array, although *T. minutus* was recorded at only a limited number of stations, it is notable that these 5 of these 6 stations were grouped in the western part of the survey array.

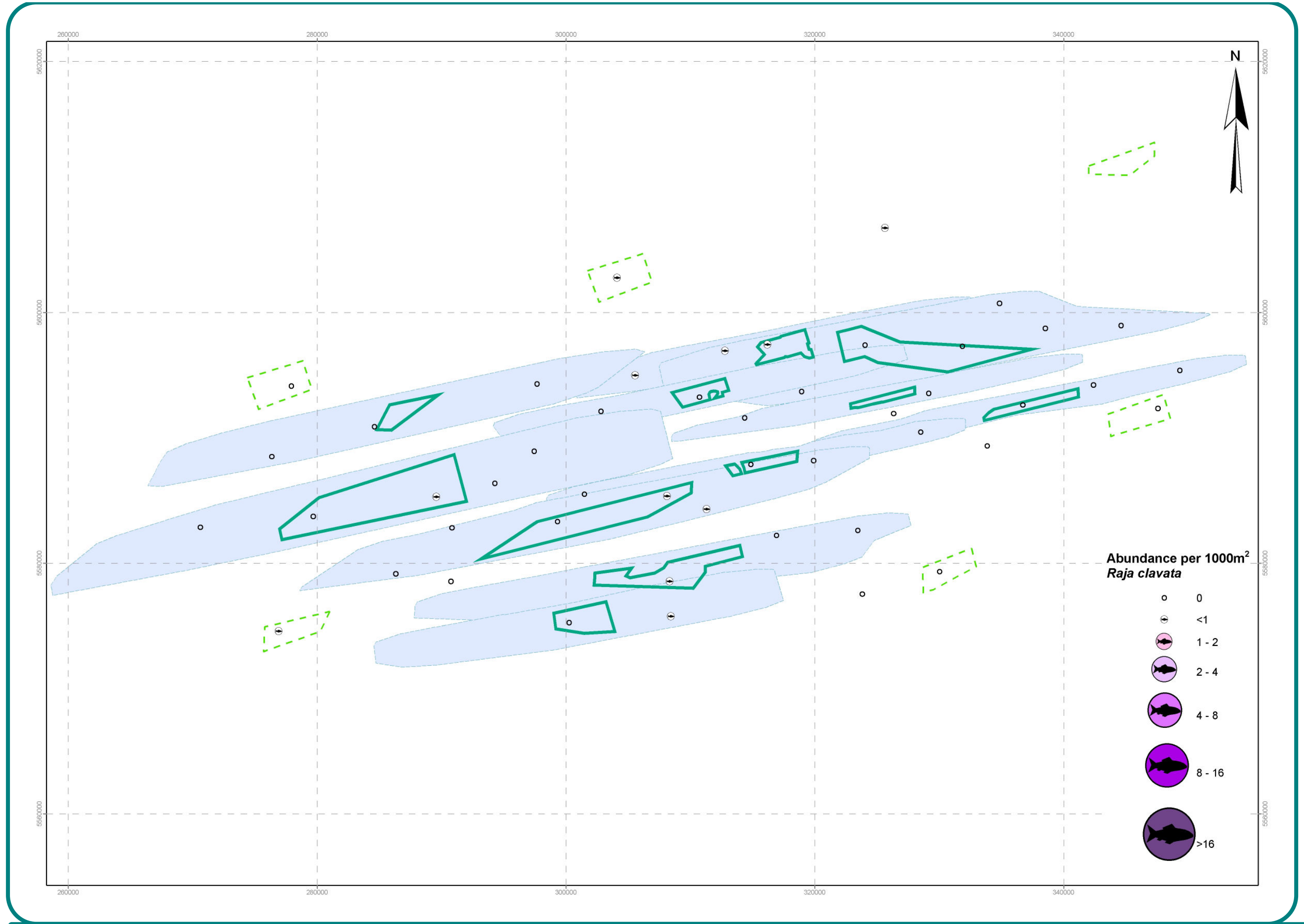
S. canicula was recorded at 42 of the 48 sample stations at abundances ranging from 0.23 per 1000m² (station 43) to 11.13 per 1000m² (station 18).

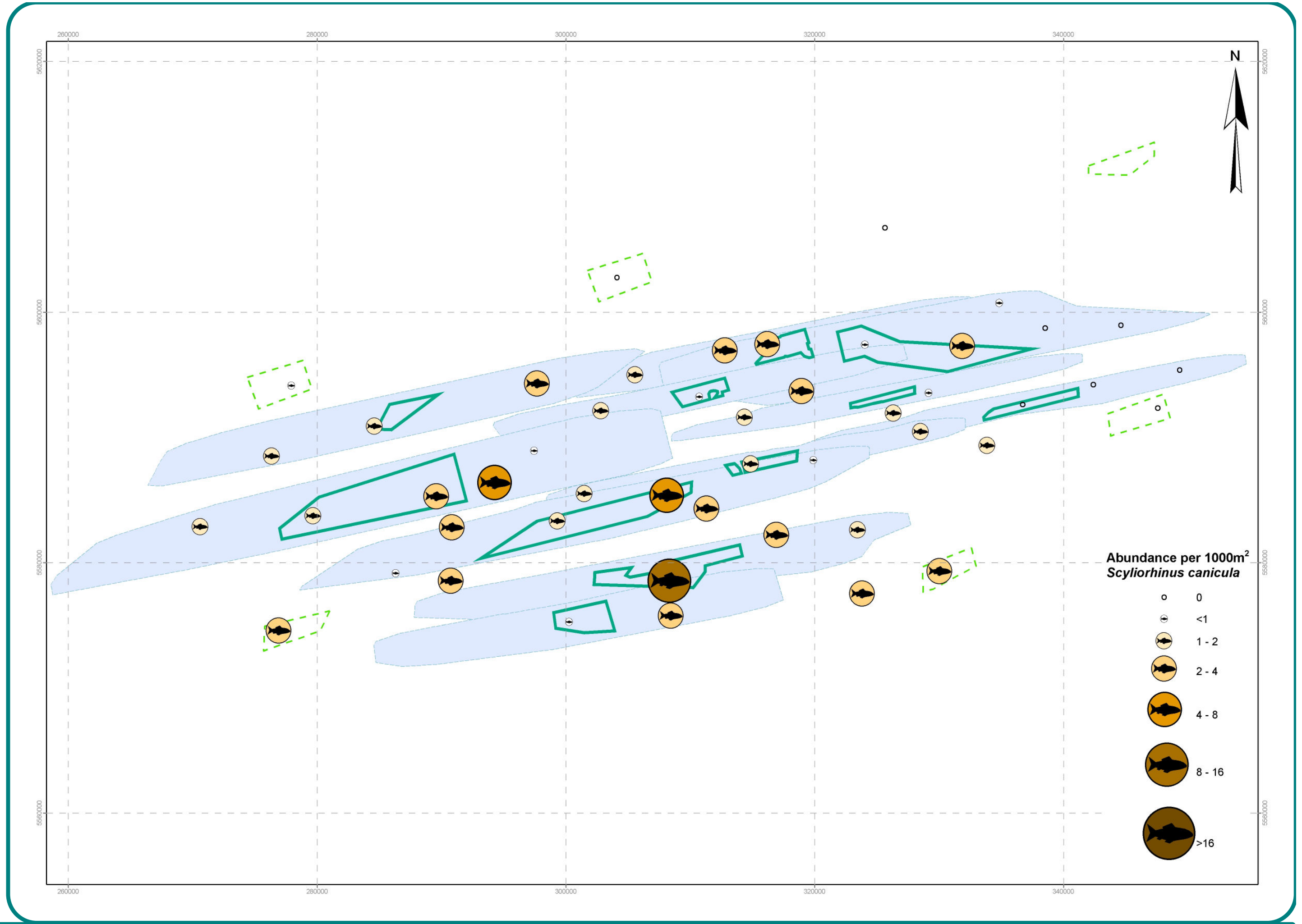
The spatial distribution of this species over the EEC survey array indicates no particular trend, with this species being recorded at the majority of sites. This indicates that this species is fairly well distributed throughout the EEC region.



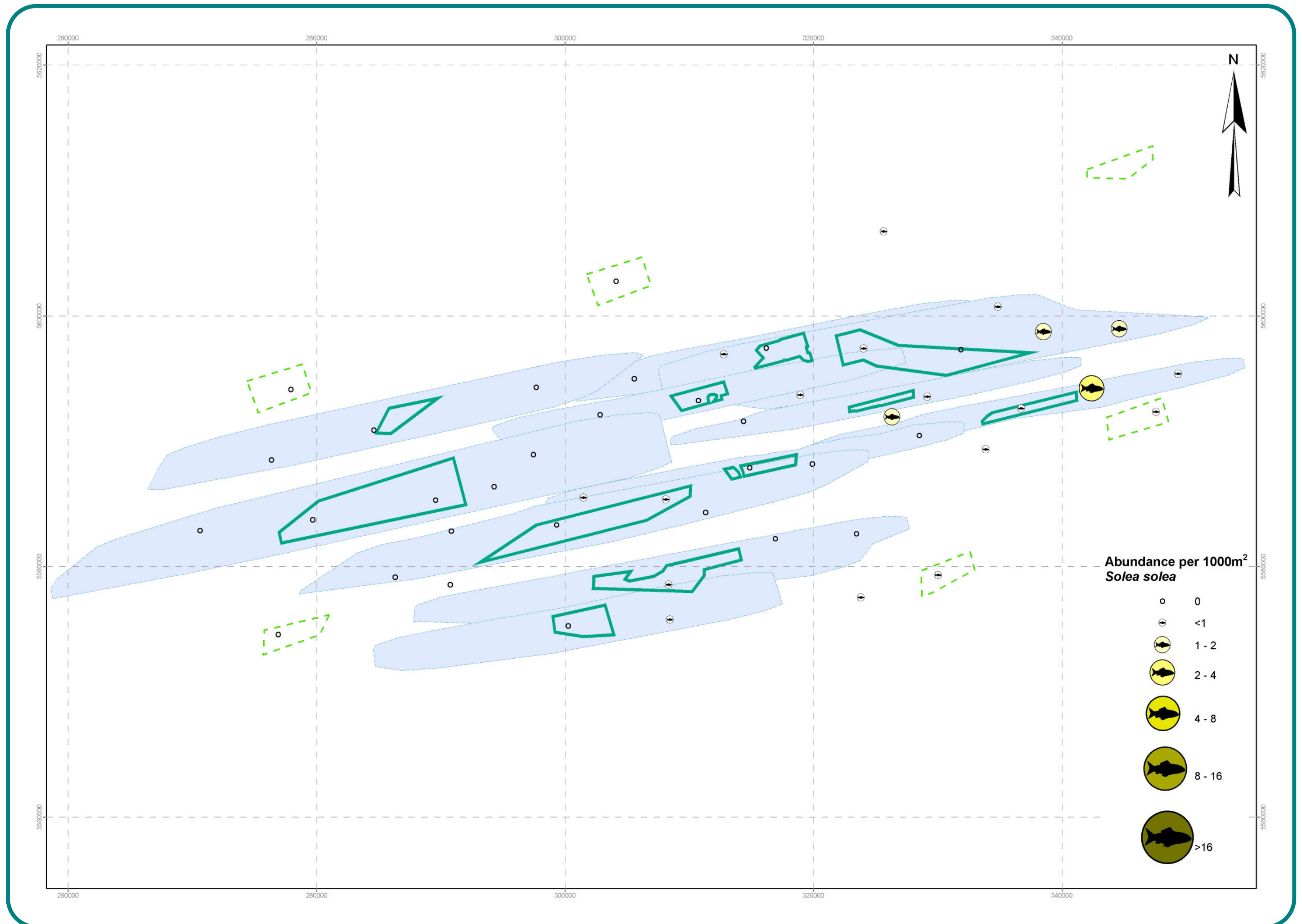
Aspitrigla cuculus **(above) was seen to be distributed across the majority of the region. No distinct trends appear to be evident although lower numbers were sampled to the far east of the region.** ***Callionymus lyra*** **(below) was evident in the south central part of region, with fewer individuals evident towards the north east. Far fewer individuals were sampled to the west in deeper water.**

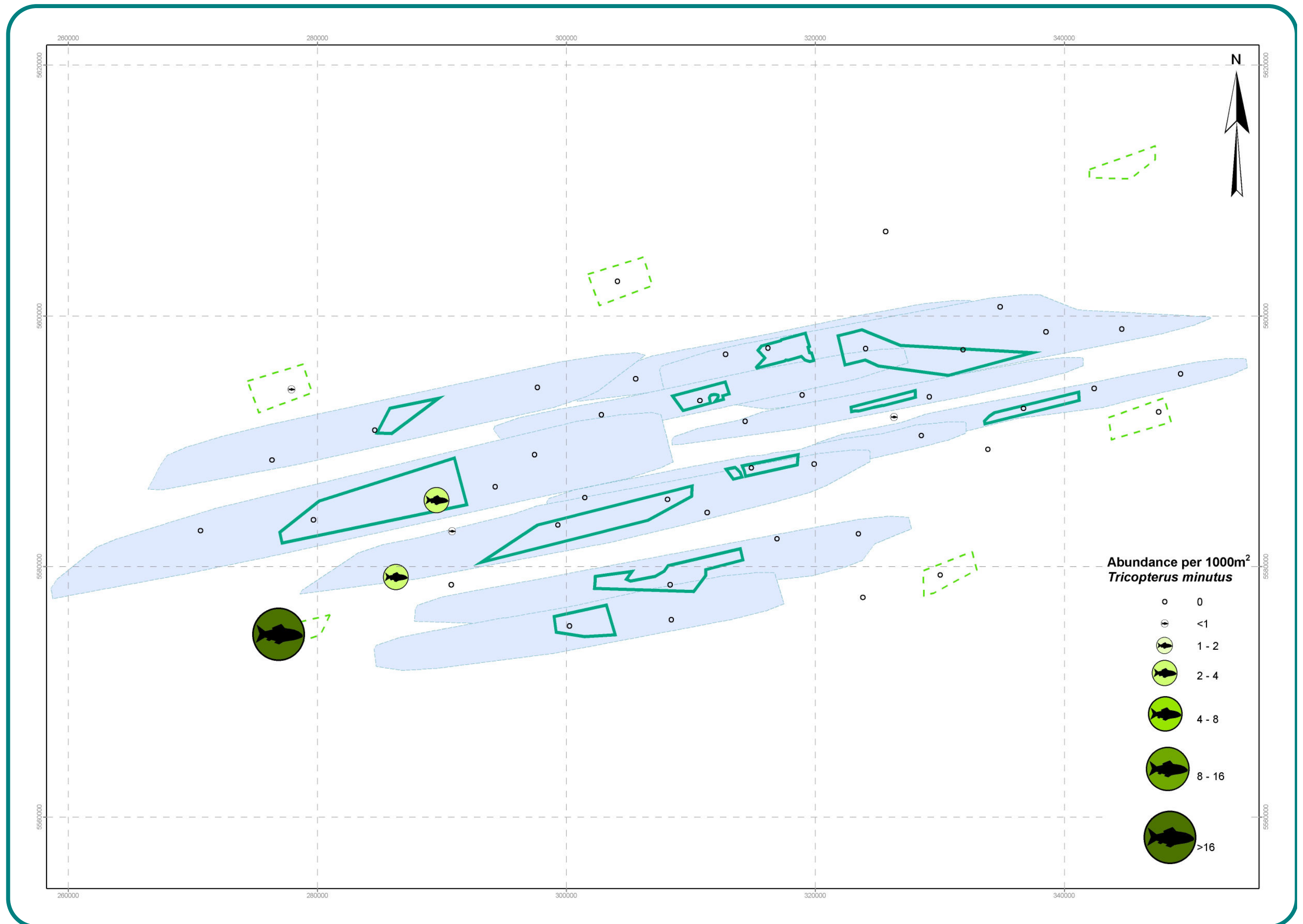






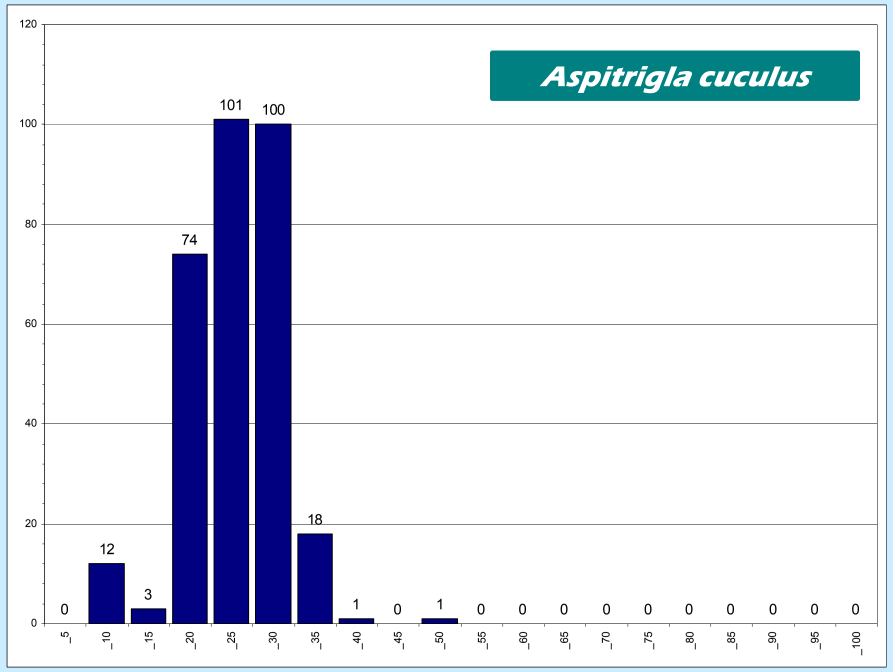
Raja clavata **(above left) was not evident in large numbers anywhere within the region.** ***Scyliorhinus canicula*** **(above right) were evident across the whole region with highest abundances in the central part of the region. Abundances of this species were lower to the far north and east of the region.**

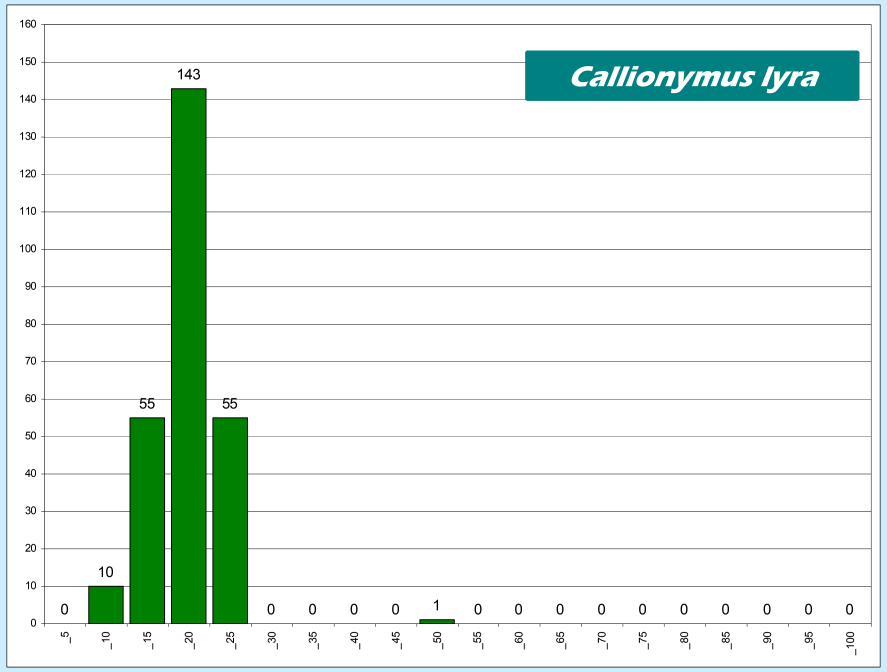


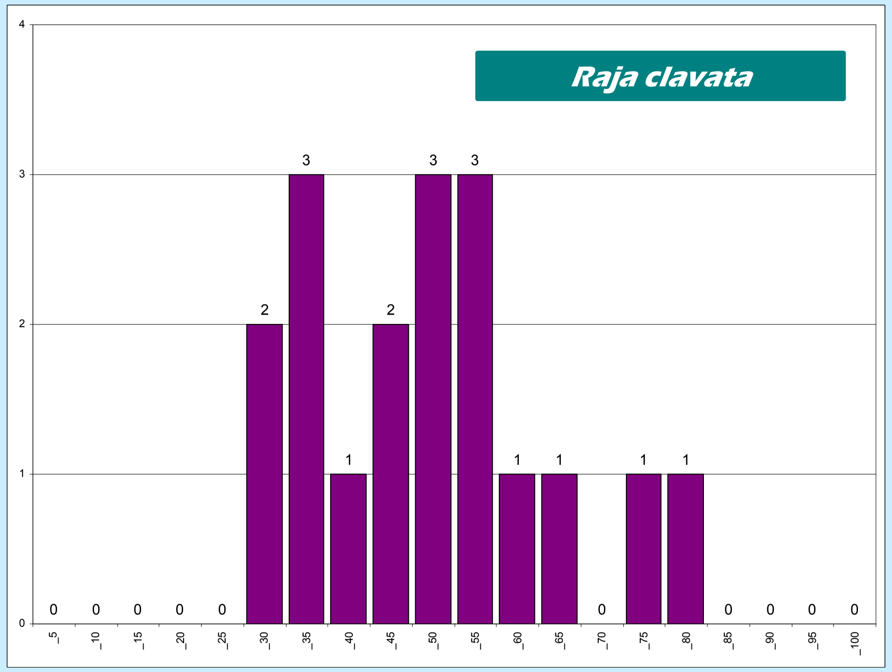


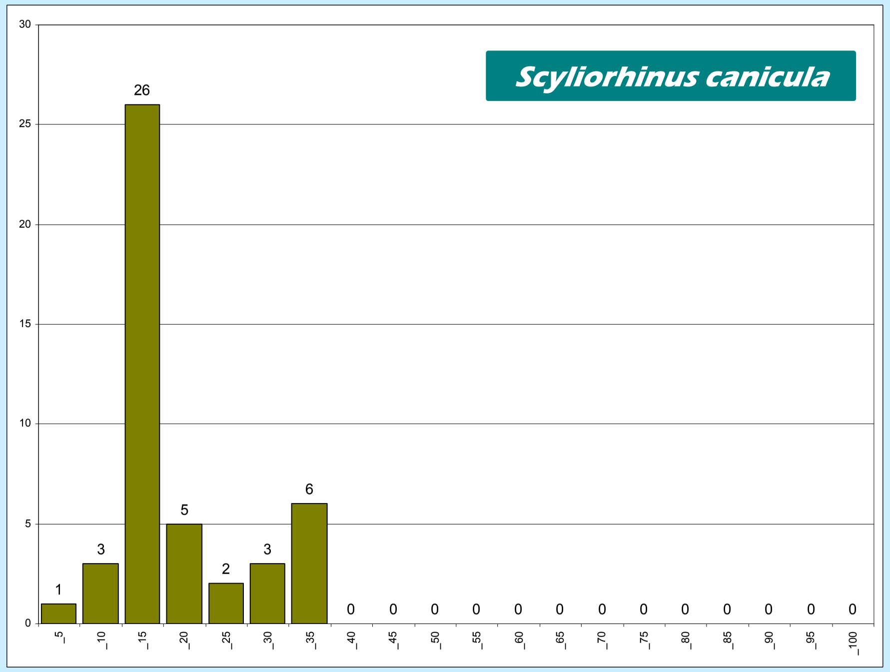
Solea solea **(above left) was only recorded at sites from the central pat of the region towards the east. Significant numbers were only recorded to the far east and this may constitute a possible indicator of sandier sediment.** ***Trisopterus minutus*** **(above right) was only evident to the west of the region. Significant numbers of this species were only recorded at 3 sites.**

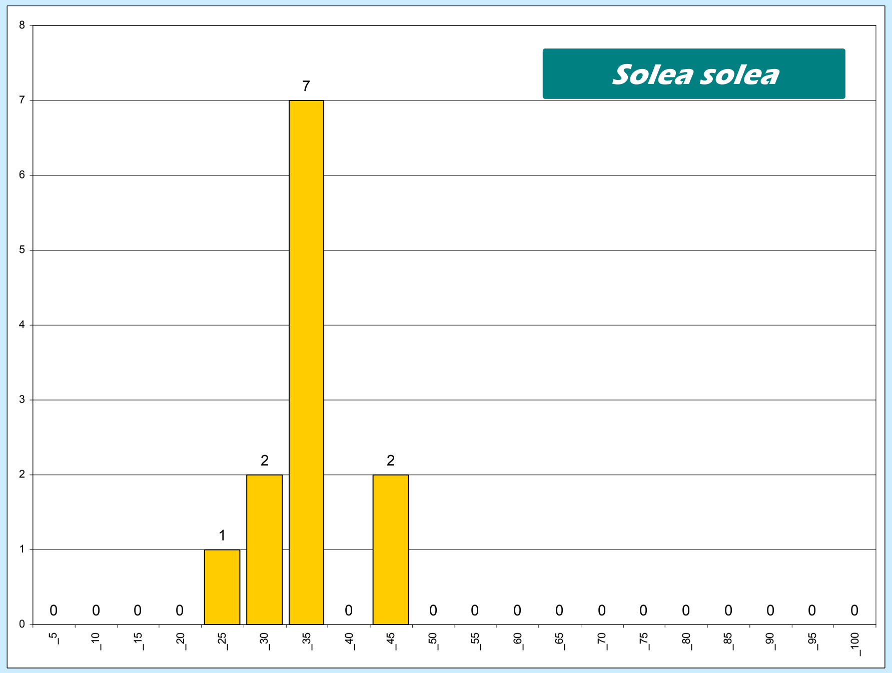
Length Frequency Plots – figures present aggregated data from across the region – x axis labels denote upper limit of length class (cm) and y axis denote the number of individuals recorded in that length class.

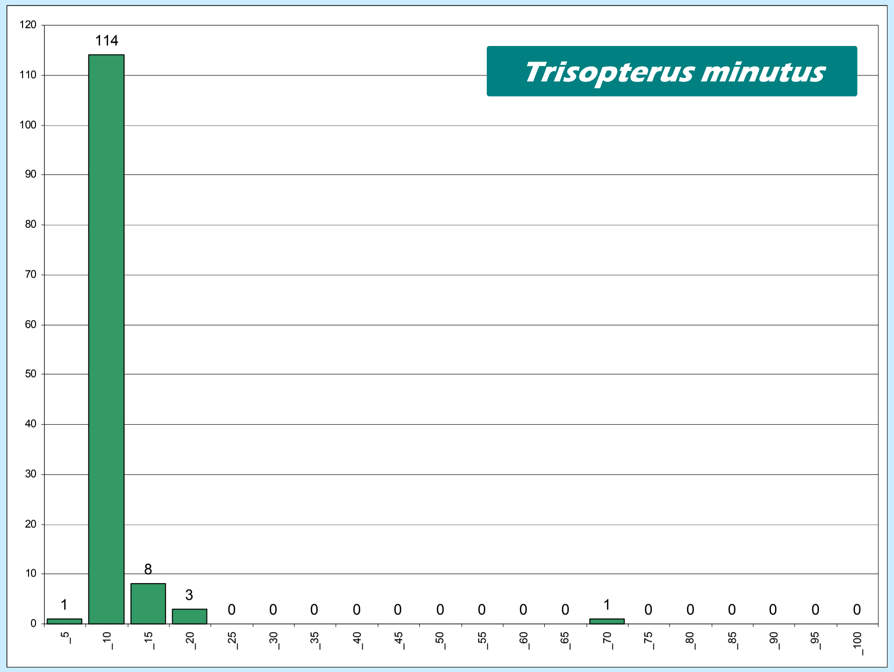












The plots on the left describe the length frequency distributions of 6 fish species named in the Blueprint v0.3.

The plots show the length frequency distribution of each species for the entire region.

It is likely that the most value from this aspect of regional monitoring will be gained from undertaking annual comparative studies of whole region length frequency data.

By undertaking such studies loss of part or, in a worst case scenario, all of the length classes identified during baseline surveys, will highlight changes in the species population structure.

A useful time series of data (3-5 years) will be required, in order to better understand natural fluctuations, before it will be possible to investigate dredging related change.

5.13 4m Beam Trawl Survey - Consideration of 4m Beam Trawl Fish Communities and Combined Epibenthic and Fish Communities Data

Fish Communities

A total of 36 fish species were recorded. The most frequently recorded species and the most abundant (peak and mean) are noted in the table below:

Species	Frequency
Callionymus lyra	100%
Aspitrigla cuculus	90%
Scyliorhinus canicula	83%
Trigula lucerna	44%
Agonus cataphractus	44%
Solea solea	42%
Trigloporus lastoviza	38%
Trisopterus luscus	31%
Pomatoschistus sp.	27%
Scyliorhinus stellaris	19%
Trisopterus minutus	15%
Pleuronectes platessa	10%

Clearly the most frequently present was *Callionymus lyra* with *Aspitrigla cuculus* and *Scyliorhinus canicula* both present in greater than 80% of sites. All other species were only found in 44% or less sites. The single largest abundance was attributable to *Trisopterus luscus,* which has distorted the mean value for this species (see table below):

	Abundance per tow	
Species	mean	max
Trisopterus luscus	25.84	632.49
Scyliorhinus canicula	9.61	54.49
Aspitrigla cuculus	6.83	38.80
Callionymus lyra	6.03	38.80
Trigula lucerna	2.37	62.08
Pomatoschistus sp.	2.07	81.66
Mustelus mustelus	1.59	75.00
Trigloporus lastoviza	1.20	9.39
Solea solea	1.09	8.68
Pleuronectes platessa	1.07	40.97

Of the remaining species the highest mean number of individuals was noted for *Scyliorhinus canicula,* with both *Callionymus lyra* and *Aspitrigla cuculus* at similarly large mean abundances. The fish species analysis using cluster and MDS revealed (**Figure 109**) two major clusters with one outlier at a separation level of 35% similarity. Within the largest group a further division was evident corresponding to a 50% similarity level.

These data are shown in **Figure 42** and have been summarised in the tables inset on **page 71**. The clusters 4MF1 and 4MF2b appear to be similar in terms of species number and overall abundance, however, the composition is quite different, with 4MF1 supporting *Mustelus mustelus* and *Pleuronectes platessa,* while 4mF2b supports *Scyliorhinus canicula* and *Aspitrigla cuculus.* The other major cluster 4mF2a supports very high abundances of *Trisopterus luscus* (although distorted by one very large value) and moderate abundances of *Pomatoschistus* sp. The importance of some of the indicative species in the separation of the clusters is illustrated in Figures **110** to **113**. The distribution of the clusters derived from the fish species only is illustrated in Fig. 4m3. Cluster 4mF2b is clearly the most wide spread, extending over the majority of the survey area. The other two clusters, in contrast, are limited to a region in the north east 4mF1 and a central region 4mF2a.

Combined Fish and Invertebrate Communities

A total of 170 species were identified from the combined fish and invertebrate data. The most frequently present species have been listed in the first table below with a summary of the mean and peak abundance listed below this.

Species	Frequency
Aequipecten opercularis	100%
Asterias rubens	100%
Callionymus lyra	100%
Pagurus bernhardus	98%
Psammechinus miliaris	96%
Buccinum undatum	92%
Aspitrigla cuculus	90%
Pecten maximus	88%
Scyliorhinus canicula	83%
Hydrallmania falcata	81%
Anseropoda placenta	79%

	Abundance per tow	
Species	Mean	Max
Aequipecten opercularis	1541.00	8150.00
Psammechinus miliaris	820.00	4873.00
Asterias rubens	158.00	756.00
Ophiura ?albida	100.00	1296.00
Pagurus bernhardus	52.00	288.00
Buccinum undatum	42.00	946.00
Pecten maximus	26.00	336.00
Ophiothrix fragilis	23.00	192.00
Pagurus prideaux	18.00	182.00
Inachus dorsettensis	13.00	81.00
Scyliorhinus canicula	12.00	66.00
Anseropoda placenta	10.00	108.00
Aspitrigla cuculus	8.00	45.00
Crossaster papposus	8.00	104.00

The invertebrates are clearly present more frequently than most of the fish species with several of them present in considerable abundance. The most frequently recorded invertebrate was *Aequipecten opercularis*, which was also the species with the highest mean abundance and individual peak abundance. Species from the Echinodermata formed the majority of the overall abundance, including four of the top five species.

Cluster analysis and MDS revealed two major groups, with several outliers. The two major clusters comprised several sub-clusters as indicated in **Figure 114**.

The inset tables on **page 73** summarise the combined fish and invertebrate data for the clusters identified during analysis of 4m trawl data. In general diversity varied little, with a mean of between 27 and 41 species per cluster. Abundance values, in contrast, varied considerably, ranging from a mean of 450 per trawl to 9371. The dominant species in most clusters was *Aequipecten opercularis*, the exception being cluster 4MC3b where *Psammechinus miliaris* was dominant. The subdominant species in most cases were indicative of the clusters, with 4MC2a characterised by a low diversity, low abundance community with *Asterias rubens* as the species most characteristic.

In cluster 4MC2b, despite the high overall diversity and moderately high abundance, the characterising species were generally low in abundance, particularly the bib *Trisopterus luscus*. **Figures 115** to **121** (4m5a-g) illustrate the influence of these species on the clustering, with the high abundance *T. luscus* centered around cluster 4MC2b.

Cluster 4MC2c is to some extent distorted by a single high abundance site for *Ophiothrix fragilis* (see **Figure 116**), this species also contributing to several other clusters at low abundance. However, other characterising species included *Pomatoschistus* sp. and to a lesser extent *Crossaster papposus* (**Figures 117** and **118**).

Cluster 4MC3a comprised the sites with relatively high diversity and considerable abundance, with both *Aequipecten* and *Psammechinus* present in large numbers >3000 per 1000m². The influence of these two species on the clustering is illustrated in **Figures 119** and **120**. The final cluster, 4MC3b is a reduced version of 4MC3a, with *Psammechinus* dominating, albeit in lower numbers than found in 4MC3a. The characterising species in this instance was the brittle star *Ophiura albida* see **Figure 121**.

The spatial distribution of the clusters have been plotted in **Figure 43**. An east to west trend is evident as in the other plots, but in this case the areas to the east also have a north to south division. The areas to the south supporting the very high abundance sites (Cluster 4MC3a), with considerable *Aequipecten* and *Psammechinus*. This area is adjacent to the lower abundance *Aequipecten* sites to the north and east from cluster 4MC2b. To the north east, in cluster 4MC3b the sites comprise the reduced *Aequipecten* population, but still with abundant *Psammechinus*. A vertical dividing line is created by cluster 4MC2c, which may reflect the presence of the coarse seabed occupied by *Ophiothrix*. To the west of the area the low diversity and abundance sites were evident in cluster 4MC2a.

Comparing the combined data with the fish data alone it is apparent that a similar trend is evident, with a central dividing line, occupied by the fish species *Trisopterus* and *Pomatoschistus* which were also characteristic of the combined data clusters 4mC2b and 4mC2c.

The areas to the east and west of this central group were dominated by the dogfish *Scyliorhinus canicula* also found in clusters 4MC2a and 4MC2b. The area to the east and north east was characterised by the smooth-hound *Mustelus mustelus* and the plaice *Pleuronectes platessa* which may be responding to the sandier sediments occupied by numerous hermit crabs and *Psammechinus miliaris*, characteristic of clusters 4MC3a and 4MC3b.

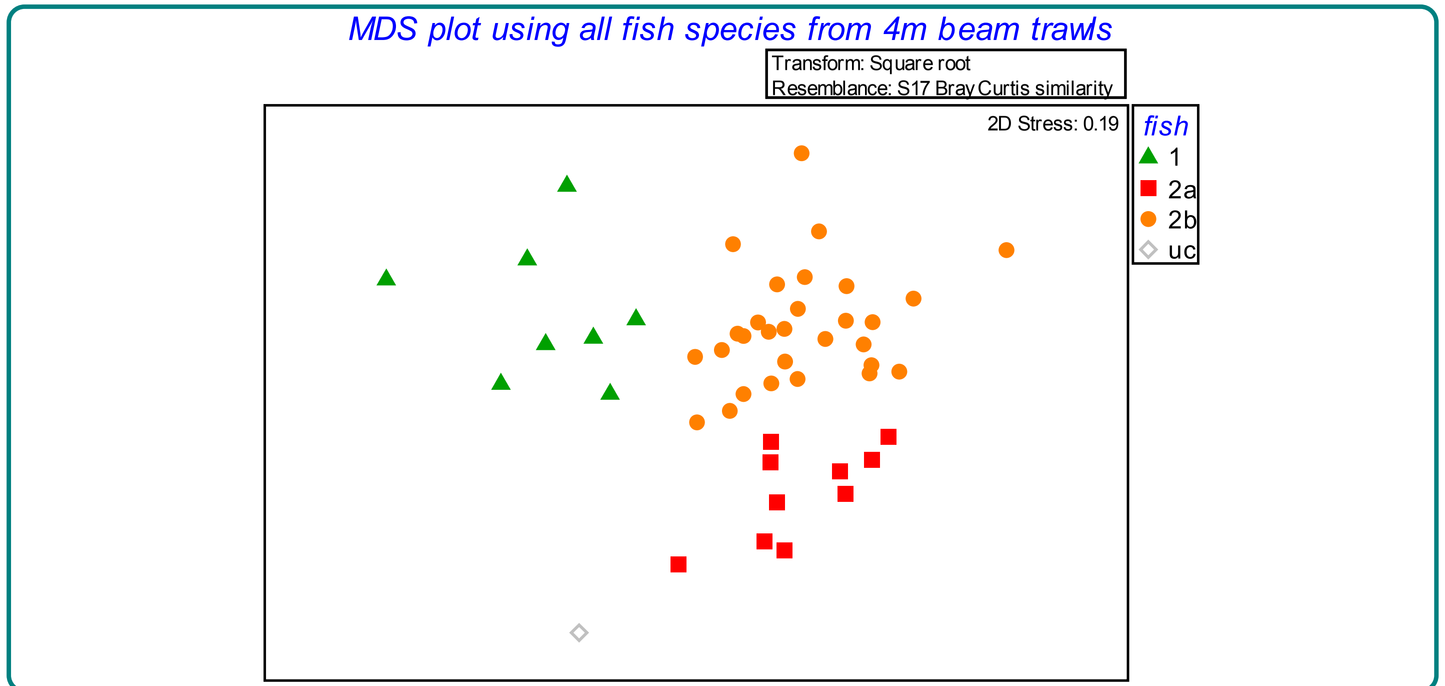
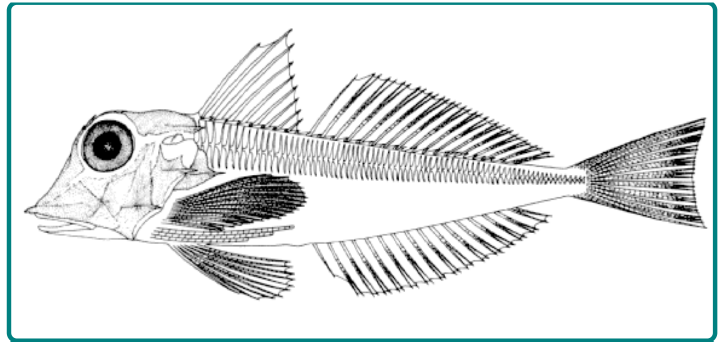
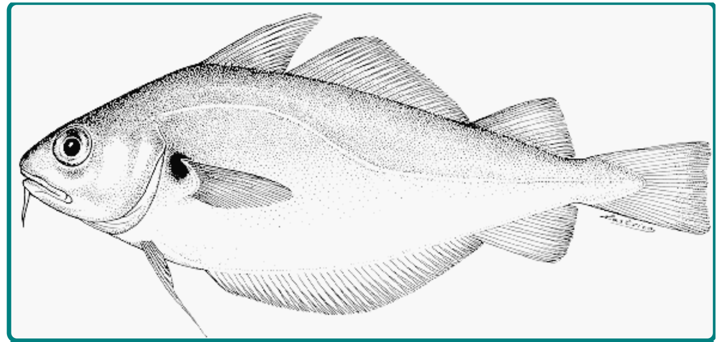


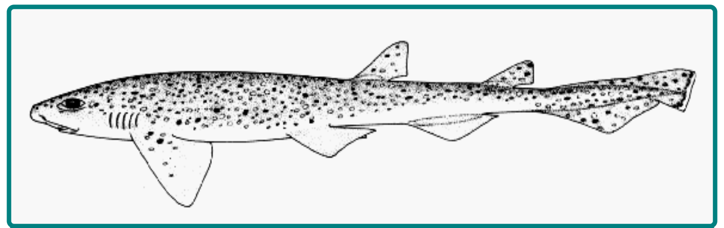
Figure 109 MDS plot of fish species clusters from data acquired using the 4m beam trawl.



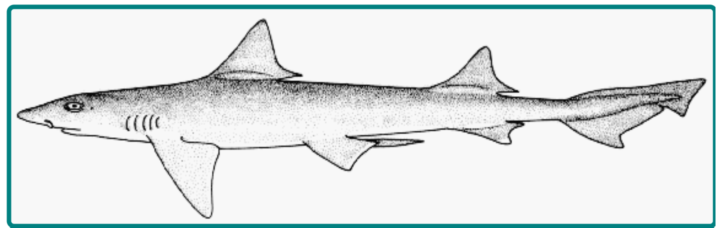
***A. cuculus* – red gurnard**



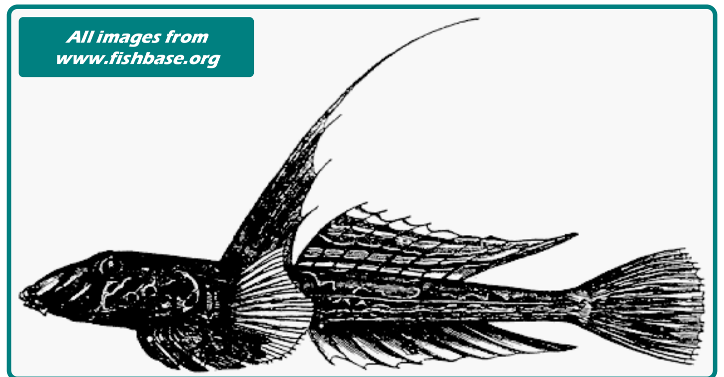
***T. luscus* – bib (pouting)**



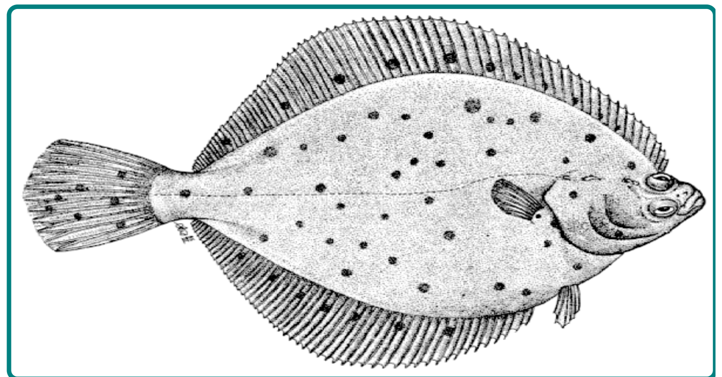
***S. canicula* – dogfish**



***M. mustelus* – smooth hound**



***C. lyra* – dragonet (male)**



***P. platessa* – plaice**

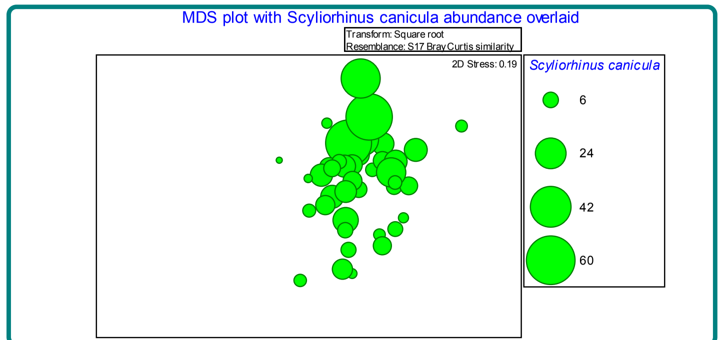


Figure 110 MDS plot of 4m beam trawl clusters with influence *S. canicula*.

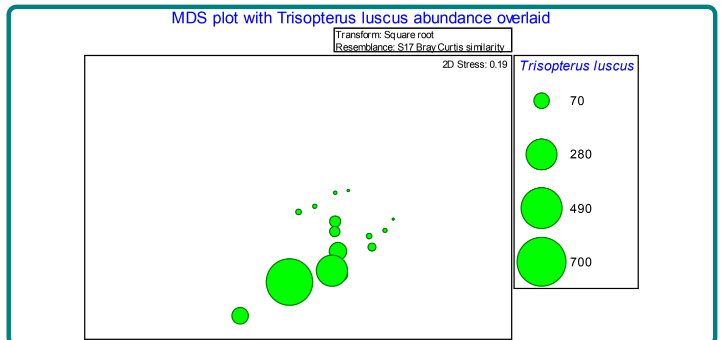


Figure 111 MDS plot of 4m beam trawl clusters with influence *T. luscus*.

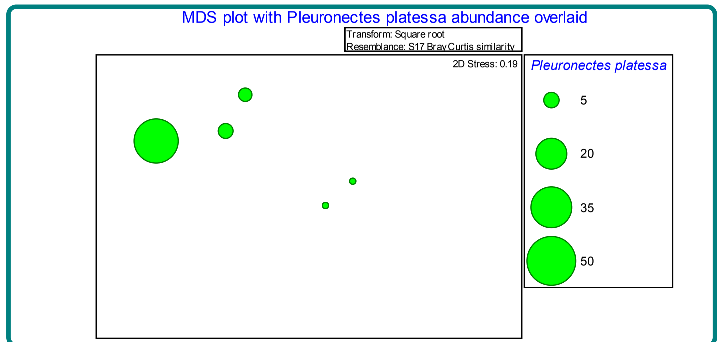


Figure 112 MDS plot of 4m beam trawl clusters with influence *P. platessa*.

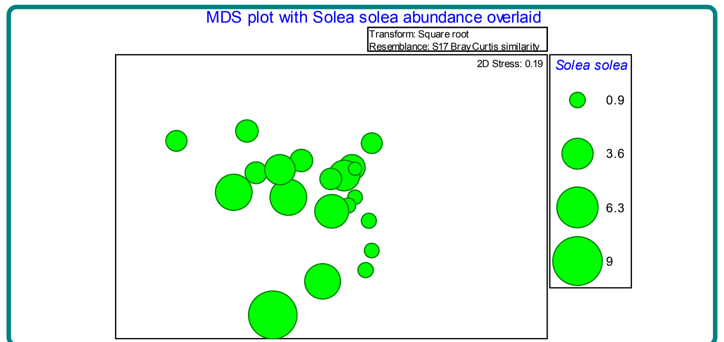
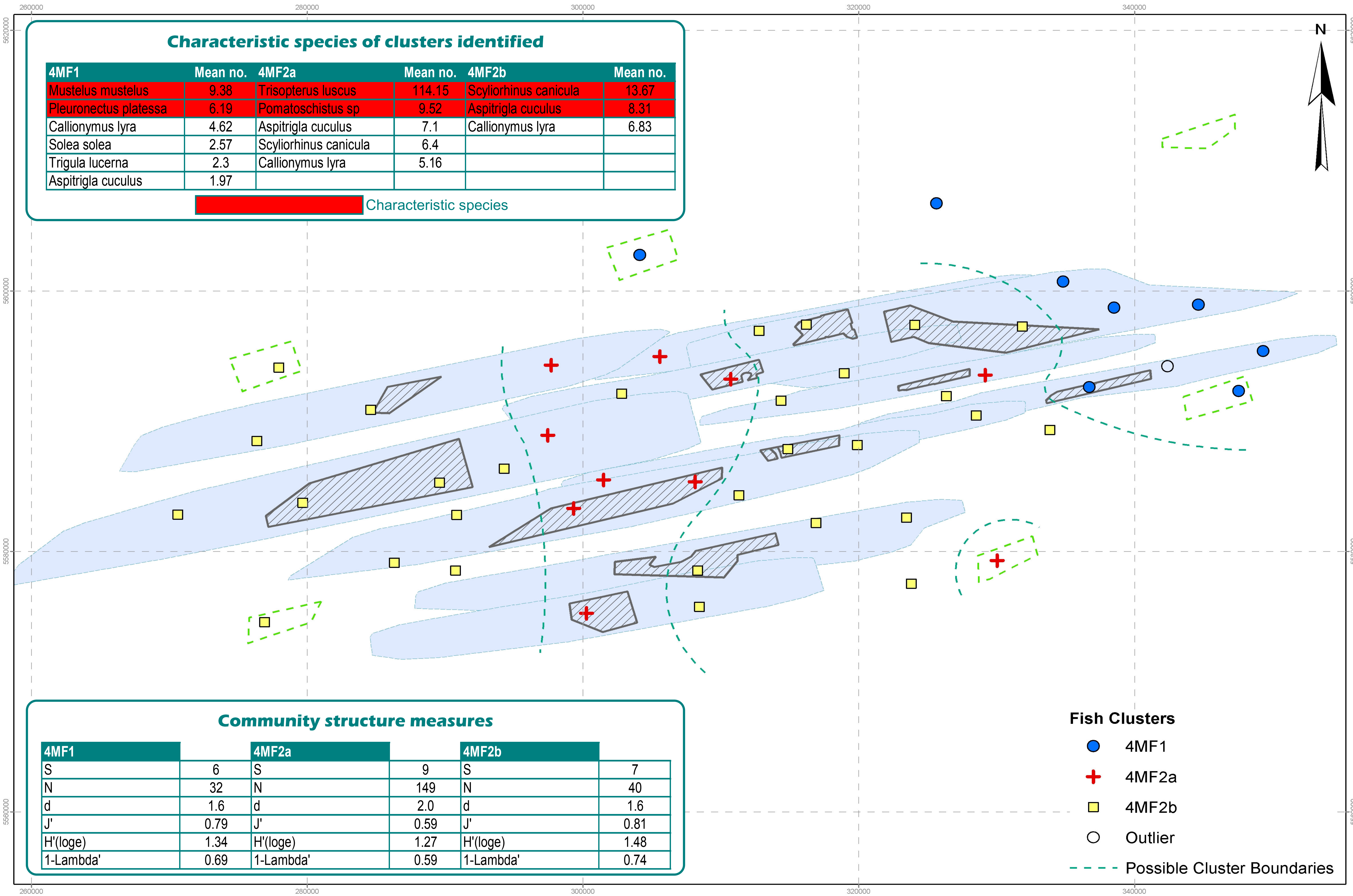


Figure 113 MDS plot of 4m beam trawl clusters with influence *S. solea*.



Characteristic species of clusters identified

4MF1	Mean no.	4MF2a	Mean no.	4MF2b	Mean no.
Mustelus mustelus	9.38	Trisopterus luscus	114.15	Scyliorhinus canicula	13.67
Pleuronectus platessa	6.19	Pomatoschistus sp	9.52	Aspitrigla cuculus	8.31
Callionymus lyra	4.62	Aspitrigla cuculus	7.1	Callionymus lyra	6.83
Solea solea	2.57	Scyliorhinus canicula	6.4		
Trigula lucerna	2.3	Callionymus lyra	5.16		
Aspitrigla cuculus	1.97				

Characteristic species

Community structure measures

4MF1		4MF2a		4MF2b	
S	6	S	9	S	7
N	32	N	149	N	40
d	1.6	d	2.0	d	1.6
J'	0.79	J'	0.59	J'	0.81
H'(loge)	1.34	H'(loge)	1.27	H'(loge)	1.48
1-Lambda'	0.69	1-Lambda'	0.59	1-Lambda'	0.74

Figure 42
Community clusters identified from analysis of 4m beam trawl fish data. Clusters 4MF1 and 4MF2a and b are similar in terms of there species number and overall abundance, however species composition is different. 4MF1 supports *M. mustelus* and *P. platessa*, whilst the characterising species of 4MF2a are *T. luscus* and *Pomatoschistus* sp. and 4MF2b are *S. canicula* and *A. cuculus*.

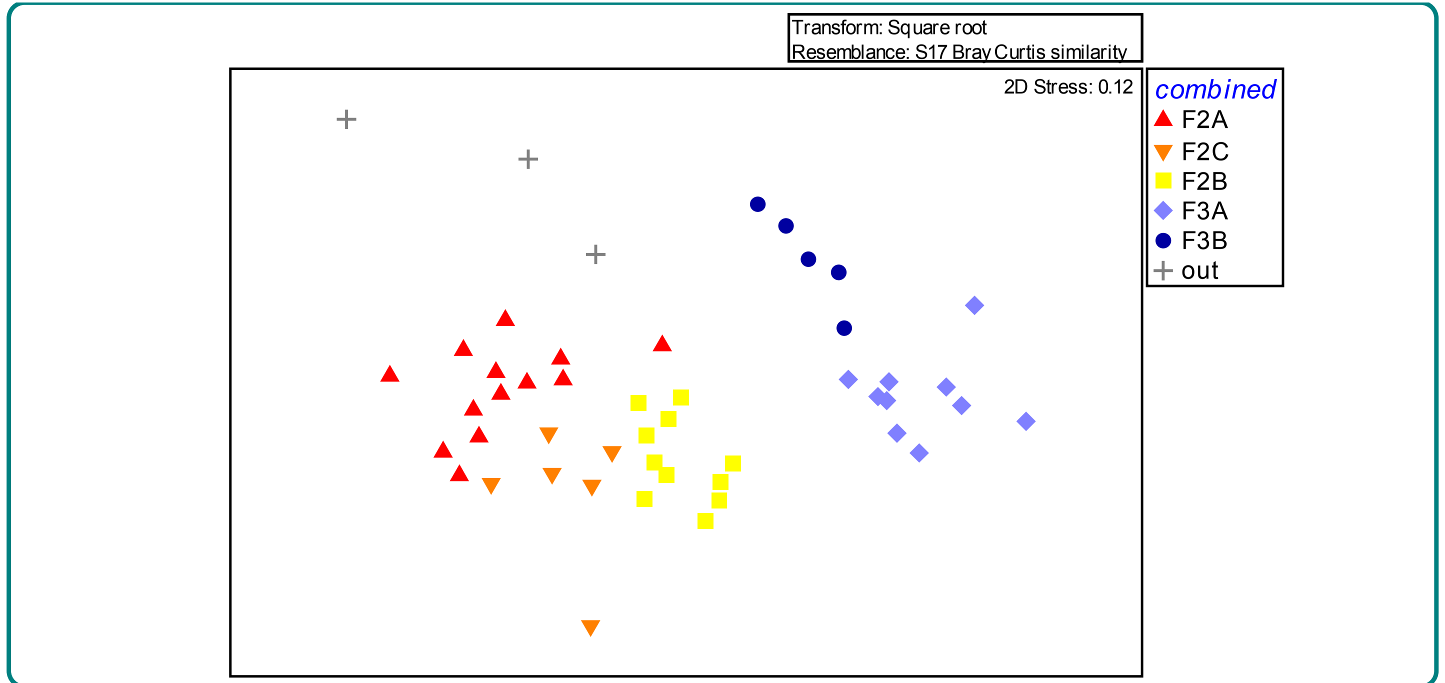


Figure 114 MDS plot of fish and invertebrate species clusters from data acquired using the 4m beam trawl.

The brittlestar *O. fragilis* was evident over considerable areas of the region. Where it did occur it was usually the dominant species.

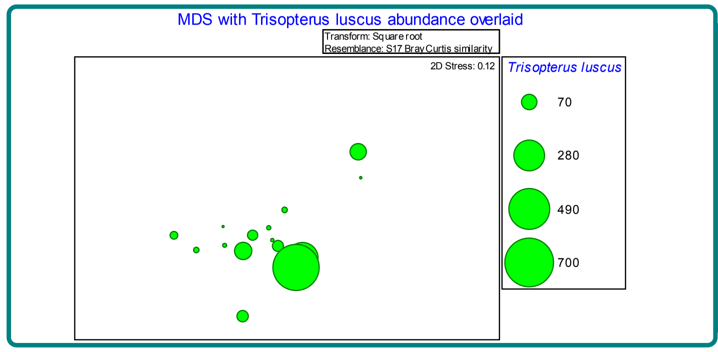


Figure 115 MDS plot of 4m beam trawl clusters with influence *T. luscus*.

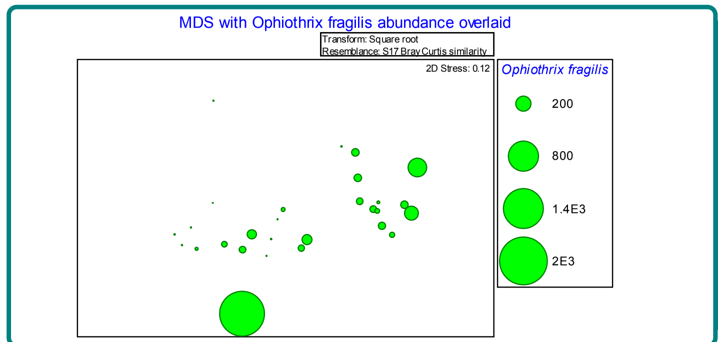


Figure 116 MDS plot of 4m beam trawl clusters with influence *O. fragilis*.

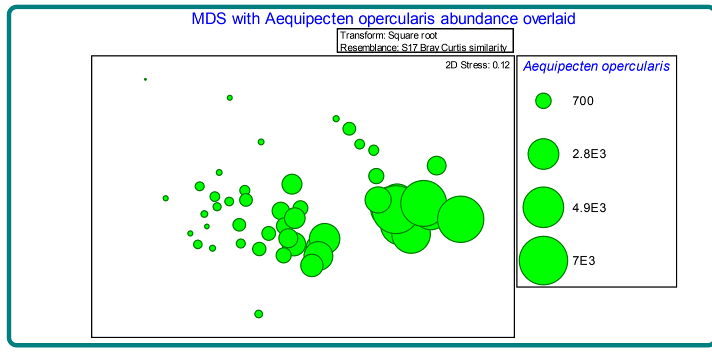


Figure 119 MDS plot of 4m beam trawl clusters with influence *A. opercularis*.

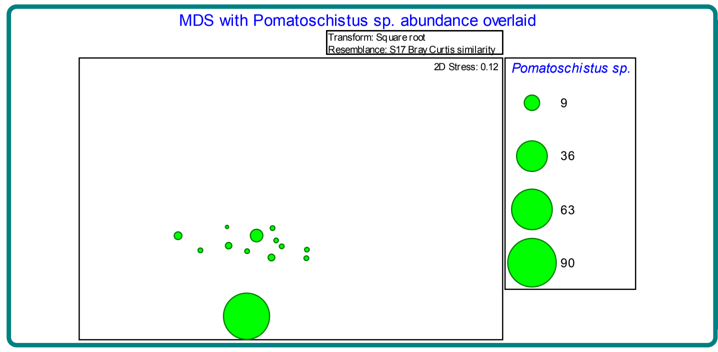


Figure 117 MDS plot of 4m beam trawl clusters with influence *Pomatoschistus* sp.

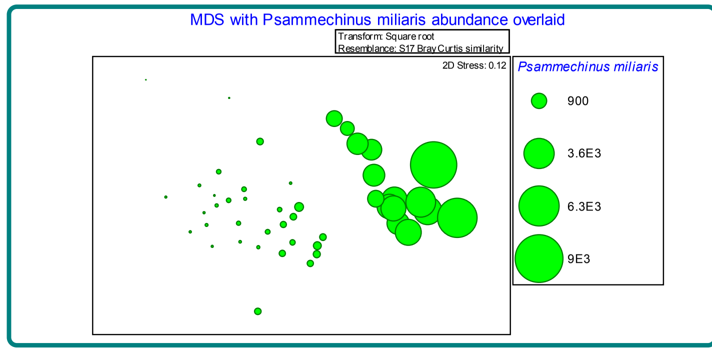


Figure 120 MDS plot of 4m beam trawl clusters with influence *P. miliaris*.

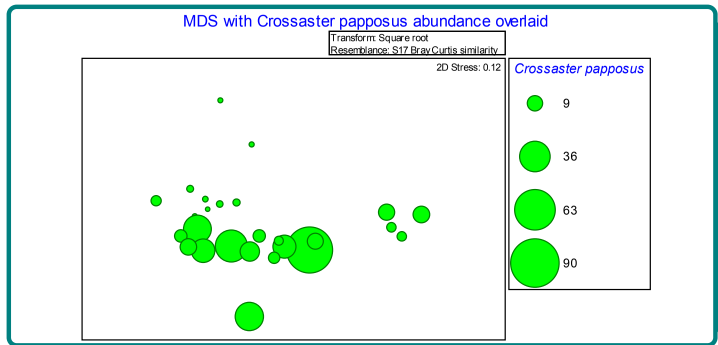


Figure 118 MDS plot of 4m beam trawl clusters with influence *C. papposus*.

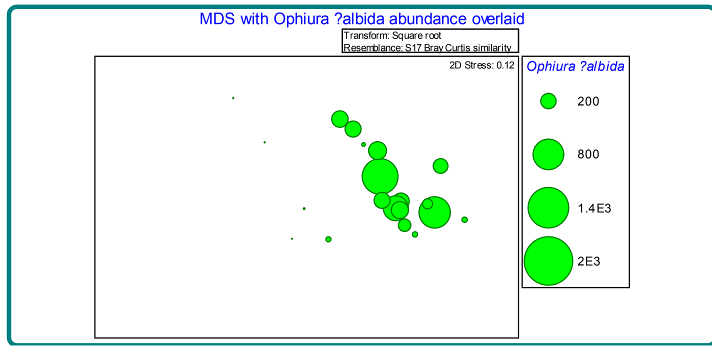
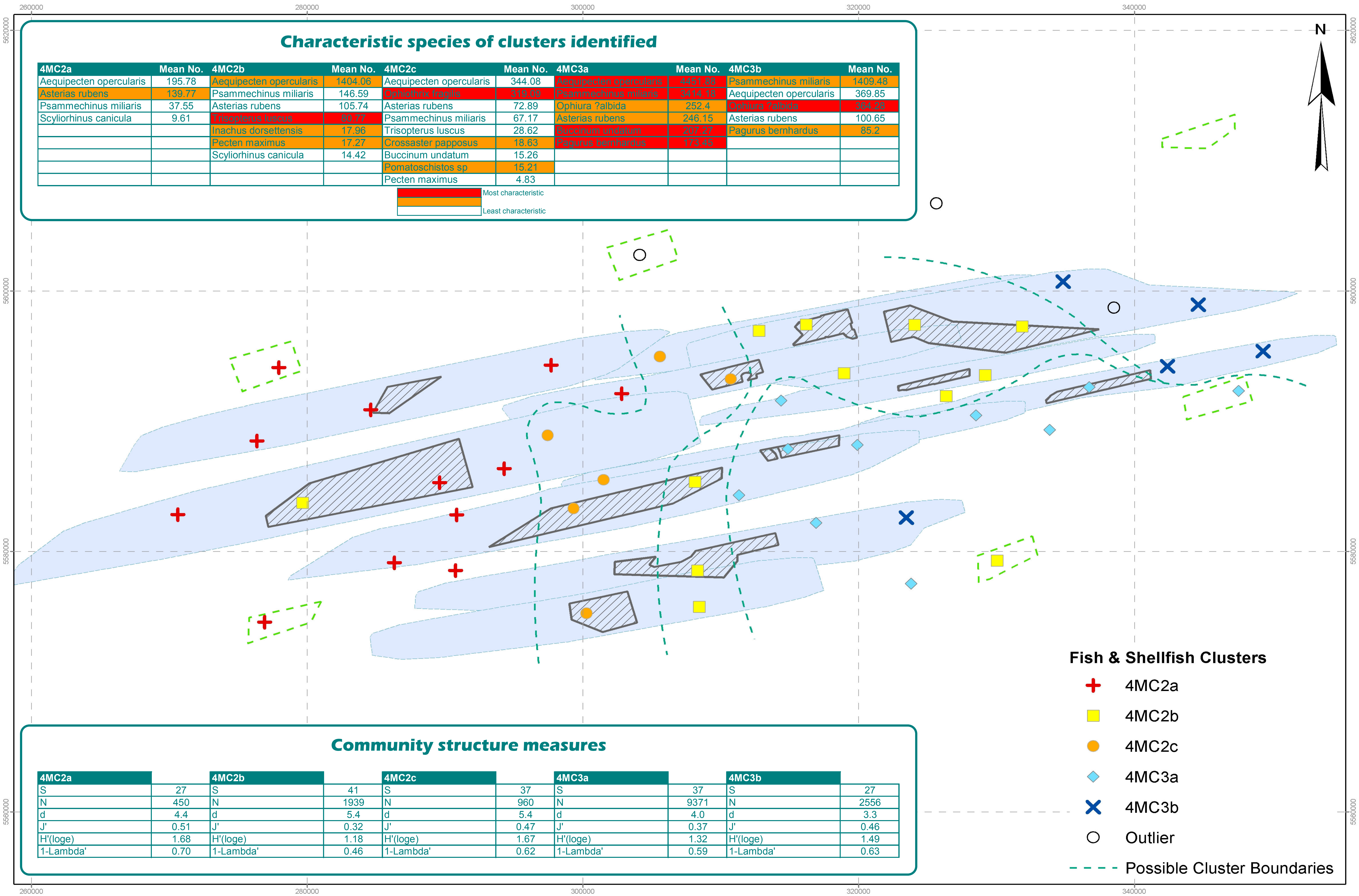


Figure 121 MDS plot of 4m beam trawl clusters with influence *O. albida*.



Characteristic species of clusters identified

4MC2a	Mean No.	4MC2b	Mean No.	4MC2c	Mean No.	4MC3a	Mean No.	4MC3b	Mean No.
Aequipecten opercularis	195.78	Aequipecten opercularis	1404.06	Aequipecten opercularis	344.08	Aequipecten opercularis	4451.88	Psammechinus miliaris	1409.48
Asterias rubens	139.77	Psammechinus miliaris	146.59	Ophiothrix fragilis	318.09	Psammechinus miliaris	3414.18	Aequipecten opercularis	369.85
Psammechinus miliaris	37.55	Asterias rubens	105.74	Asterias rubens	72.89	Ophiura ?albida	252.4	Ophiura ?albida	364.28
Scyliorhinus canicula	9.61	Trisopterus luscus	80.77	Psammechinus miliaris	67.17	Asterias rubens	246.15	Asterias rubens	100.65
		Inachus dorsettensis	17.96	Trisopterus luscus	28.62	Buccinum undatum	207.27	Pagurus bernhardus	85.2
		Pecten maximus	17.27	Crossaster papposus	18.63	Pagurus bernhardus	175.45		
		Scyliorhinus canicula	14.42	Buccinum undatum	15.26				
				Pomatoschistos sp	15.21				
				Pecten maximus	4.83				

Most characteristic
Least characteristic

Community structure measures

4MC2a		4MC2b		4MC2c		4MC3a		4MC3b	
S	27	S	41	S	37	S	37	S	27
N	450	N	1939	N	960	N	9371	N	2556
d	4.4	d	5.4	d	5.4	d	4.0	d	3.3
J'	0.51	J'	0.32	J'	0.47	J'	0.37	J'	0.46
H'(loge)	1.68	H'(loge)	1.18	H'(loge)	1.67	H'(loge)	1.32	H'(loge)	1.49
1-Lambda'	0.70	1-Lambda'	0.46	1-Lambda'	0.62	1-Lambda'	0.59	1-Lambda'	0.63

Figure 43

Community clusters identified from analysis of 4m beam trawl data. The data plotted above shows the clusters identified following combination of the available fish and invertebrate date.

Summary of the Results of the 4m Beam Trawl Survey

→ The community analysis of the fish from the 4m beam trawl survey identified three clusters. These correspond with a high diversity and abundance group dominated by *Trisopterus luscus* and *Pomatoschistus* spp (4MF2b), with the other two groups similar in terms of diversity and abundance, one dominated by *Mustelus mustelus* and *Pleuronectes platessa (4MF1)*, the other by *Scyliorhinus canicula* and *Aspitrigla cuculus (4MF2b)*.

→ The distribution of the species clusters fell into a similar pattern to the other data sets, with the north and east dominated by the sand associated species (*M. mustelus* and *P. platessa*), the wider area supporting *S. canicula* and *A. cuculus* while the *T. luscus* and *Pomatoschistus* spp cluster was found in a relatively well defined corridor running from central south to north. The epifaunal invertebrates derived from the 4m beam trawl were characteristically dominated by *Aequipecten opercularis* and a range of echinoderms.

→ The combination of the fish data with the invertebrate data from the 4m beam trawls revealed 5 groupings of sites based on the faunal similarity. Two of the clusters supported high abundance *Aequipecten opercularis*, with one of these characterised by this species and *Psammechinus miliaris*, the other cluster characterised by *Ophiura albida*. The other three clusters were lower in overall abundance, with *Ophiothrix fragilis* characterising one group, the fish *Trisopterus luscus* in combination with *A. opercularis* another, and the remaining cluster representing a low diversity and low abundance group with no clearly characteristic species.

→The distribution of the clusters is similar to that of the other invertebrate fauna and fish cluster distributions. One cluster is evident in the north east, although this also extends to the south in the similarly, *Aequipecten* dominated sand habitat. To the west, the generally low diversity and low abundance community was observed, with a differing central corridor also evident. In this case the central area was divided into two, the area to the west comprising the brittlestar characterised sites and the areas to the east those with *Trisopterus luscus*. This follows quite closely the clusters derived from the combined infauna and epifauna data from the Hamon grab samples.

Report Part 1 – Section 5: Summary

→ Regional investigation of sediment characteristics show the ECR is located in an area where the seabed is composed of sand and gravel. The proportion of each varies across the region. To the north east the seabed is sand dominated. The seabed within the central, southern and western areas of the region is coarser. Coarsest sediment is noted from the south central to south western areas of the region. Cobbles and shell material are evident at the surface across large areas of the region.

→ The investigation of Area 473 East has clearly described the nature of the seabed within the boundaries of an area that may be influenced by dredging, as predicted in the REA model. The seabed is largely featureless, with distinctive areas - due to concentrations of coarse sediment (cobbles) or sand – limited in spatial extent. The data acquired during baseline surveys provide a sound baseline description of the seabed that future data may be compared with the detect deposition of fine sand.

→ Faunal communities identified through analysis of Hamon grab samples, show that the principal species characterising the faunal groupings of infauna were from the polychaeta, crustacea and echinodermata. The most important physical variables in relation to the clustering of the infauna sites were determined to be percentage sand, percentage gravel and sediment sorting. The habitats and associated communities identified show a clear gradient across the area with the region to the north east supporting the low diversity sand communities, dominated or characterised by *Echinocyamus pusillus* or *Branchiostoma lanceolatum*. A transition or boundary region appears across the centre of the ECR running from north to south, although extending into the licence Areas 473 and 474. West and south west of this area the seabed is characterised by a greater percentage of coarse sediment, which is most characteristically occupied by *Ophiothrix fragilis* in the central southern sector of the region, in the vicinity of areas 461 and 465.

→ The faunal data, when considering combined infaunal and colonial epifaunal species, revealed that the bryozoa, in particular, were frequently present across the area and a group of 5 bryozoan species were found in more than 95% of sites. The principal physical variables were sand, gravel and sorting. The clustering of sites was related to these principal variables with the ratio of sand to gravel particularly indicative. The habitats and associated communities derived from the analysis of the infauna and epifauna show a similar type of gradient across the survey area to that of the infauna alone. The seabed to north east of the area is formed of sandier sediments characterised by the echinoderm *Echinocyamus pusillus* with increasing amounts of shell and gravel towards the west. The same boundary or transition area is evident, which extends from the west of Area 464 to Area 475. West of this area the biotopes with Echinoderms and crustose communities prevail, including patches of *Ophiothrix* beds. The latter however is not as clearly defined as it is in either the infaunal analysis or the static image analysis.

Report Part 1 – Section 5: Summary (continued)

→ Seven biotopes were identified during the sidescan sonar and video habitat survey, although only two main types were noted; *Ophiothrix fragilis* and/or *Ophicoma nigra* brittlestar beds on sublittoral mixed sediments (OphMx.) and *Pomatoceros triqueter* with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles (PomB.). The impact zone supported few biotopes with PomB. and PomB.Aeq. occurring most extensively. In the extreme south west of the impact area the seabed topography was variable and in this region the biotopes were more complex, including patches of OphMx. The reference area supported a wider range of biotopes with OphMx. dominating in relatively well defined areas. Associated with the brittlestar beds were the Pomatoceros based biotopes. Bathymetry appeared to be a key factor in the distribution of the OphMx. biotope, while the *Flustra foliacea* and *Hydrallmania falcata* on tide swept circalittoral mixed sediment, is responding to an apparent sedimentary and bathymetric boundary.

→ The fauna from the 2m beam trawl surveys included a wide range of taxonomic groups. Three clusters were derived from the PRIMER analysis of the data with an *Aequipecten/Psammechinus* dominated community, an *Ophiothrix/Pisidia* based community and a low diversity *Balanus* dominated community. The communities identified conform to a similar distribution to that of the grab and video data, with the north eastern area supporting the low diversity *Balanus* community, the majority of the rest of the area supporting the *Aequipecten/Psammechinus* community and the brittlestar beds occurring as a discrete area to the central south.

→ The community analysis of the fish from the 4m beam trawl survey indicated three clusters. The distribution of the species clusters fell into a similar pattern to the other data sets, with the north and east dominated by the sand associated species (*M. mustelus* and *P. platessa*), the wider area supporting *S. canicula* and *A. cuculus,* while the *T. luscus* and *Pomatoschistus* spp cluster was found in a relatively well defined corridor running from central south to north. The epifaunal invertebrates derived from the 4m beam trawl were characteristically dominated by *Aequipecten opercularis* and a range of echinoderms. The combination of the fish data with the invertebrate data from the 4 metre beam trawls revealed 5 groupings of sites based on the faunal similarity. The distribution of the clusters is similar to that of the other invertebrate fauna and fish cluster distributions. One cluster is evident in the north east, although this also extends to the south in the similarly, *Aequipecten* dominated sand habitat. To the west, the generally low diversity and low abundance community was observed, with a central corridor area also evident. In this case the central area was divided into two, the area to the west comprising the brittlestar characterised sites and the areas to the east those with *Trisopterus luscus*. This follows quite closely the clusters derived from the combined infauna and epifauna data from the Hamon grab samples.