

East Channel association

**Interim Regional Environmental
Monitoring and Management Report**

April 2007

Presented for Review to the ECR Technical Working Group

The East Channel Association (ECA) is formed of 6 companies that are extracting, or that have applied to extract marine aggregate from the East Channel Region (ECR).

This document summarises regional environmental monitoring and management activities undertaken in the East Channel Region by, and on behalf of, the East Channel Association (ECA). The document is intended for review, along with supporting information, by the ECR Technical Working Group (TWG).

The works described are required as part of the ECA Charter (see right), specifically to undertake coordinated regional monitoring and management of marine aggregate extraction in order to adequately assess the cumulative and in-combination effects of activities.

The document has been presented in order that an eight week review period is available to TWG members prior to the annual TWG meeting that is scheduled to be held on the 5th June 2007.

Personnel tasked with reviewing the information in this document should visit www.eastchannel.info to download the associated figures and appendices.



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www.marinespace.co.uk

info@marinespace.co.uk

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The ECA Charter

In the Regional Environmental Assessment (REA) (Posford Haskoning, 2003), the applicant companies agreed to adhere to the ECA Charter which ensures that companies operating in the ECR commit to:

- Implement the results and recommendations of the REA and ensuing studies as appropriate to individual applications.
- Co-operate with and fund future regional environmental studies and research.
- Recognise the results of further environmental studies and respond to recommendations.
- Monitor, mitigate and manage environmental impacts and operational activity on a regional basis.
- Careful management of dredge area, with an aim of reducing the dredged area to a minimum.
- Zoning of permission areas to restrict operational dredging areas.
- Only dredging resources >2m thick.
- Minimise screening.
- Transparency – make all relevant dredging data publicly available through regular company reporting.
- Audit – all relevant data will be made available for analysis by independent experts.

This document should be referred to as:

ECA. 2007. The East Channel Region Interim Regional Environmental Monitoring and Management Report 2006-2007.

The document has been produced on behalf of the ECA by MarineSpace Ltd. Input to the report has been provided by:

Dr Nigel Thomas, Emu Ltd, Biological Monitoring
Dr Mark Lee, Emu Ltd, Tracer Study
Mr Nigel Feates and Dr Mike Dearnaley, HR Wallingford Ltd, Plume Study
RPS plc, Herring Spawning Potential Study

Development of specific aspects of the regional management mechanisms are attributable to the following:

The Geodata Institute: ECA Scheduling Website
Daybreak Communications: ECA Website

Any comments or queries regarding the information contained in this report can be directed to the following parties:

ECA Facilitator

Mr Graham Singleton
CEMEX UK Marine Ltd
Baltic Wharf
Marine Parade
Southampton
SO14 5JF

graham.singleton@cemex.com

ECA Regional Development Manager

ECA RDM
c/o MarineSpace Ltd
PO Box 6687
Wimborne
Dorset
BH21 9DR

rdm@marinespace.co.uk

Circulation List

This report has been circulated for review and comment to:

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The report has been circulated for information to:

***BMAPA
BGS
South East Coastal Group
South Downs Coastal Group
ECR Fishing Liaison Group
Wessex Archaeology
The ECEN Chairperson
The MCA/CNIS***

The report and supporting information is available for download from the ECA website at
www.eastchannel.info

Notes

1.	Introduction	1
1.1.	Terms of Reference	1
1.2.	The Purpose of the Interim REMM (IREMM) report	2
1.3.	The Format of the IREMM report	2
2.	Regional Monitoring Update	3
2.1.	Regional Seabed Sediment and Biological Monitoring	3
2.1.1.	Regional Hamon Grab Survey Particle Size Analysis Results	3
2.1.2.	Hamon Grab Infaunal Analysis Results	4
2.1.3.	Regional Infaunal Communities Identified from Hamon Grab Samples	4
2.1.4.	Regional Static Image Analysis from Hamon Grab Survey	10
2.1.5.	2m Beam Trawl Results	14
2.1.6.	4m Beam Trawl Survey – Fish Results	20
2.1.7.	4m Beam Trawl Survey – Consideration of Fish Communities	21
2.1.8.	4m Beam Trawl Combined Invertebrates and Fish Data	23
2.1.9.	Scallop Dredge Survey – Shellfish Results	28
2.1.10.	4m Beam Trawl Survey – Shellfish Results	28
2.1.11.	2007 Biological Monitoring Programme	29
2.2.	Collated Data Analysis	31
2.2.1.	Herring Spawning Potential Assessment	31
2.2.2.	Fishing Activity Reporting	33
2.2.3.	Archaeological Assessment	33
2.3.	Physical Process Monitoring	34
2.3.1.	Area 473 East Seabed Sediment Survey	34
2.3.2.	Tracer Study	36
2.3.3.	Plume Monitoring	40
2.3.4.	2007 Physical Monitoring Programme	44
3.	Regional Management Update	46
3.1.	Active Licence Areas	46
3.2.	Operational Licence Activity	46
3.3.	Application Progress	48
3.4.	Fishing Liaison	48
3.5.	Navigation Liaison	49
3.6.	The ECR Biodiversity Action Plan	50
3.7.	The ECA Geographical Information System	53
3.8.	The ECA Website	53
3.9.	Meetings and Reporting	53

Figures Figures referred to in this report, where not included in the text, can be downloaded from www.eastchannel.info

Appendices Appendices referred to in this report can be downloaded from www.eashchannel.info

Notes

1. Introduction

The East Channel Association (ECA) is formed of 6 companies who operate, or have applied to operate, marine aggregate extraction licences in the East Channel Region (ECR).

Monitoring and management of marine aggregate extraction activities in the ECA requires regular regional and licence specific survey and reporting. To date, irrespective of licence specific activities, regional baseline environmental surveys have been undertaken that describe the seabed character and associated biological communities across the region. The purpose of the surveys is to provide information that will enable impacts of marine aggregate extraction to be identified and tracked over time and space. In addition to this, surveys related to the physical processes of sediment mobilisation and deposition caused by dredging have been initiated.

Collation of data generated by the individual marine aggregate licence applications and third party sources is also being undertaken in order to present a regional view of maritime heritage resources, fishing activity and herring spawning activity.

Aspects of the management of aggregate extraction activities is also being coordinated by the companies of the East Channel Association. Coordinated regional management activities include navigation and fishing liaison, data management/dissemination (GIS), liaison meetings, biodiversity monitoring/reporting and presentation of information on the ECA website.

1.1. Terms of Reference

The companies of the East Channel Association made a commitment in the ECA Charter (Posford Haskoning, 2003) to co-operate in order to monitor and manage the combined effects of their operations. The ECA charter sets out common principles to which all ECA members adhere. Of most relevance to this report is the commitment to:

‘Monitor, mitigate and manage environmental impacts and operational activity on a regional basis’ (from ECA Charter, Posford Haskoning, 2003).

The first result of this coordinated approach was to produce the ECR Regional Environmental Assessment (REA) (Posford Haskoning, 2003). This document provides the basic description of the regional environment and the foundation upon which the determination of potential combined and cumulative impacts of aggregate extraction are based.

Following completion of the REA, a regional environmental monitoring programme was developed by the ECA. The monitoring programme was developed with assistance from Emu Ltd and HR Wallingford. The proposed methods and survey plans were published in the ECA Regional Monitoring Blueprint v0.3 (ECA/Emu, 2005). The Blueprint v0.3 provides information related to the rationale, methods, location and frequency of the regional environmental monitoring. Field work has since been undertaken using the Blueprint v0.3 as the guide for activities.

Collation of third party data was also initiated during 2005-2006 to accumulate data capable of describing fishing activity, regional heritage resources and herring spawning activity.

During development of the Blueprint v0.3 and completion of baseline survey activities, other, operational management related, aspects of the ECA activities were developed. These included development of the ECR Biodiversity Action Plan (BAP), initiation of Technical Working Group (TWG) and East Channel Environmental Network (ECEN) meetings, construction of the ECA Geographical Information System (GIS) and update of the ECA website (www.eastchannel.info).

The first annual coordinated report of activities related to ECR monitoring and management was presented in the ECA Regional Environmental Monitoring and Management Report 2005-2006 (REMM, 2006). The report was presented to stakeholders in January 2007. The next annual REMM, covering activities for the 18 months prior to January 2008, will be issued in December 2007.

1. Introduction

1.2. The Purpose of the Interim REMM (IREMM) Report

This report constitutes an Interim REMM (IREMM) for consideration by TWG members prior to the TWG Meeting in June 2007. The report presents information related to the monitoring and management activities of the ECA as follows.

I Monitoring

- i. Regional biological survey activities and data analysis since July 2006
- ii. Collated data methods, analysis and presentation
- iii. Development of methodologies for regional physical process monitoring since July 2006
- iv. Development of comparative data analysis methods and discussion of indicators of change where relevant

II Management

- i. Licence application progress
- ii. Dredging activity update
- iii. Liaison activity update
- iv. Development of the ECA GIS and website
- v. TWG and ECEN meeting proposals and timetable for completion of the ECA REMM 2006-2007

As stated, the information included in the IREMM is intended for review by the TWG during the agreed 8 week review period in April and May. Following review the TWG members will meet to discuss ECR activities and determine progression of regional monitoring and management activities. The IREMM report will also be presented to ECEN members for review.

1.3. The Format of the IREMM Report

The main part of this report presents an overview of monitoring activities and, where relevant the main themes and findings of work undertaken.

Technical information related to the design, methods, field activities and data analysis for surveys is presented in specific documents appended to the IREMM report.

A summary of management information is presented in the document to describe the main aspects of management activity. In both the case of monitoring and management activities, a forecast of activity up to the presentation of the second annual REMM report is provided.

Access to Supporting Information

The REA, Blueprint v0.3 and REMM 2005-2006 and supporting information for this report are available for download from the ECA website. Visit www.eastchannel.info/library01.htm to access the files.



2. Regional Monitoring Update

Regional monitoring activities in the ECR have included field work during repeat biological monitoring and background fluorescence monitoring undertaken in support of the regional tracer study. Visits to dredging vessels have also been made by consultants developing the scope of work for the regional plume study. In addition to the field work undertaken the specifications and operating procedures for the tracer and plume study have also been developed.

A more detailed description of the work undertaken is presented below and in the relevant technical appendices that accompany this report.

2.1. Regional Seabed Sediment and Biological Monitoring

The results of baseline sampling were presented in the ECR REMM 2005-2006 report. All available data were presented along with consideration of the results with reference to the Theoretical Frameworks for determination of future impacts of aggregate extraction. A brief overview of the 1st repeat biological survey was also presented. The results of this 1st repeat survey are presented below and in the relevant technical appendices.

2.1.1. Hamon Grab Survey Particle Size Analysis Results

The results of the particle size analysis are presented in the relevant appendix. Figures 1 to 6 illustrate trends across the region.

Considering the different components of the particle size a trend across the area is evident. Figure 1 illustrates the percentage gravel in the samples with a concentration of coarse material in the south west extending from Areas 461 to 478 and 473. Isolated patches of coarser sediment were also observed in reference areas 4 and 5, with the new reference area (7) comprising between 20-40% gravel. The lowest percentage gravel was found in the north east.

The percentage of sand is effectively the reciprocal of the gravel with the greatest proportions of sand found to the north east, although significant amounts were also found in reference areas 1, 2 and 6 (Figure 2). Fines in general were very low, with only sporadically raised levels in the south west of the region (Figure 3).

The video data contained useful information with respect to the quantities of visible shell and these are illustrated in Figure 4. In most cases the levels of shell were low (<10%) but raised levels up to 60% of the visible surface were covered with shell in the east and south east of the region, including sites in the reference areas 5, 6 and 7. Other raised levels were noted in reference area 2.

Sediment sorting (Figure 5) was generally poor or very poor, although a region of moderately sorted sediment was noted to the north east of the area, with two moderately well sorted or well sorted sites noted to the extreme north east of the region.

The median grain size represented by the d50 (Figure 6) suggests a similar trend to the other data with an area to the south west supporting the generally coarse sediments and a region of reasonably coarse material extending north and east to Area 473. The smallest median diameter was noted to the north east of the region including reference area 6.



Image: MarineSpace

2. Regional Monitoring Update

2.1.2. Hamon Grab Infaunal Analysis Results

Following data rationalisation a total of 389 species of fauna were identified from the Hamon grab survey. These were comprised primarily of polychaetes species (155), arthropods (116), molluscs (84) and echinoderms (17). Several other phyla were also present including species from the Sipunculida and Cnidaria. A full species list is included in the relevant appendix. The most frequently occurring species are listed in Table 1.

Table 1 The most frequently appearing infaunal species in ECR Hamon grab samples.

<i>Aonides paucibranchiata</i>	91%
<i>Pomatoceros triqueter</i>	86%
<i>Amphipholis squamata</i>	85%
<i>Galathea intermedia</i>	83%
<i>Glycera lapidum</i>	82%
NEMERTEA	77%
<i>Laonice bahusiensis</i>	77%

The most numerous individuals were from the Crustacea with *Pisidia longicornis* present at a maximum abundance of 218 (per 0.1m²). The polychaetes were also well represented with *Pomatoceros triqueter* noted at 97 (per 0.1m²) and *Spio filicornis* at a maximum of 158 (per 0.1 m²) although only present at 7% of the sites.

The number of species ranged from 5 to 103, with a mean number of 51 (sd 17). The distribution of the number of species across the area is presented in Figure 7. It is evident that the number of species is relatively evenly distributed across the area with few areas of high species numbers and few with low. The high species numbers were noted generally in Area 478, and the reference areas 5, 6 and 7 in the south east of the region. Lowest species number was noted in the north east.

A relationship between the number of species and the median diameter of the sediment is illustrated in Figure 8, with a generally decreasing trend in species number corresponding to an increase in the Md phi value, i.e. the finer sediments.

The number of individuals ranged from 8 to 608 with a mean number of 143 (sd 87). The abundance at each site is illustrated in Figure 9, which repeats the general trend illustrated for the number of species, with greatest abundance in the central Area 478 and the reference areas 5 and 6.

The biomass values are illustrated in Figure 10 with low biomass over most of the area, the high values being noted in the central south and south east of the area, within licence Areas 478, 475, and reference areas 5 and 7.

2.1.3. Regional Infaunal Communities Identified from Hamon Grab Samples

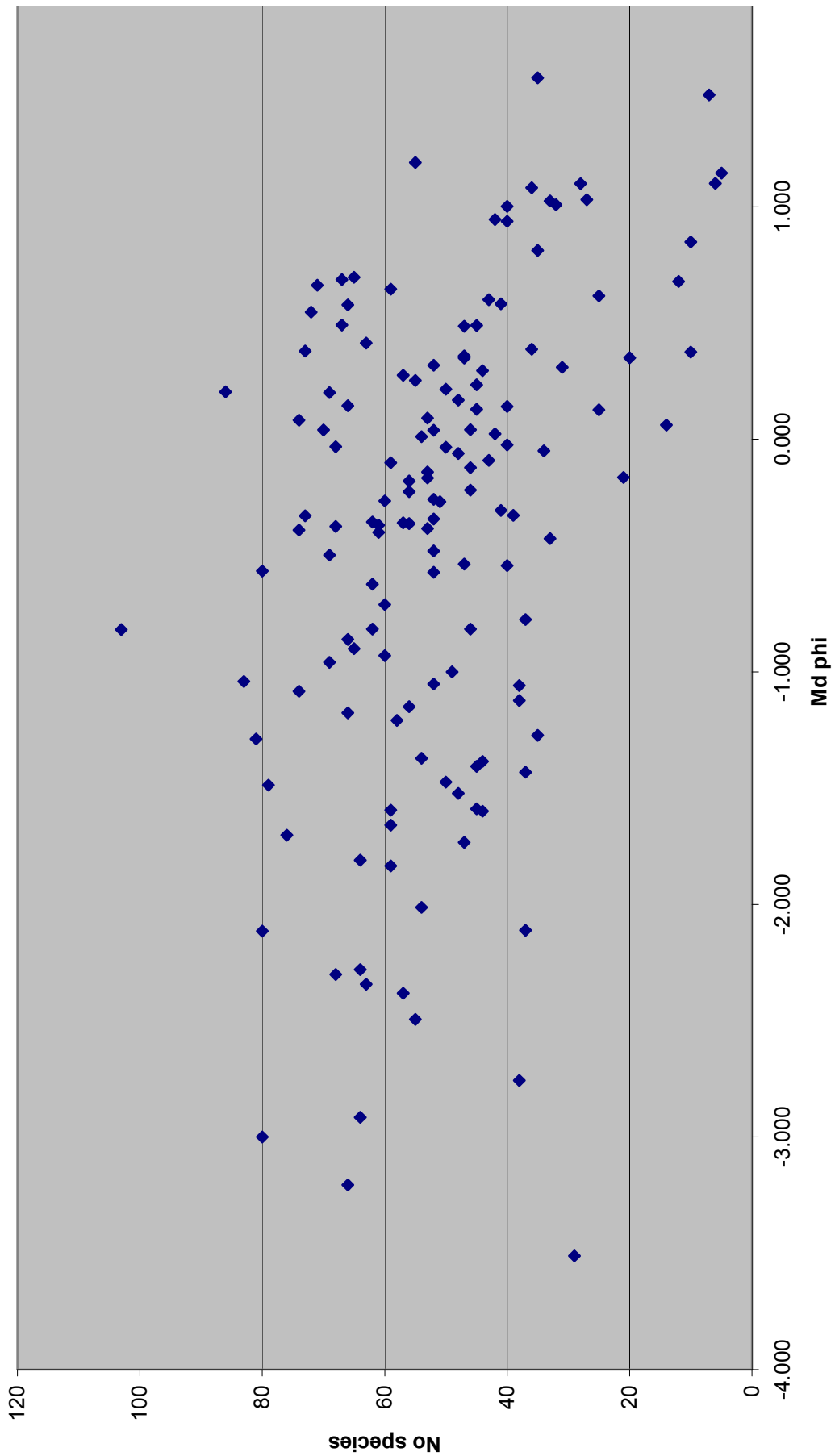
The analysis of the infaunal benthic communities using PRIMER has revealed that the majority of the fauna are linked at a similarity of between 40 and 60% (see relevant appendix). Several lower similarity groups were identified and a single relatively high similarity group within the remaining sites was isolated following several iterative analyses of the species composition from SIMPER analysis. The final grouping of sites is illustrated in Figure 11, with 5 clusters identified plus one outlier site.

The species composition of the different clusters is provided in Table 2 along with community structure measures and a summary of physical conditions.

One low diversity and low abundance group was evident with cluster HI1 represented by just 9 species, all at low abundance, the most characteristic species comprising the polychaetes *Protodorvillia kefersteini* and *Nephtys cirrosa*. The physical factors at these sites suggest well sorted, relatively shallow water sands.

2. Regional Monitoring Update

Figure 8 Relationship between the number of species and the median diameter of the sediment in Hamon grab samples.



2. Regional Monitoring Update

Clusters HI2 and HI3, indicate a degree of similarity with respect to the physical conditions, both occurring in deeper water, comprising gravelly sands with a moderate amount of shell material. A small but potentially significant difference is evident between the median diameters with HI2 in finer sands than HI3. HI3 also had a small proportion of cobbles in the sites sampled. The community structure in each of the clusters was broadly similar with slightly fewer species in HI2 than HI3 (29 as opposed to 40). It is apparent from the other indices that a greater concentration of dominance was evident in HI2 compared to HI3 with lower diversity and evenness values.

This may be due to the considerable abundance of one species *Spio filicornis* in HI2, along with the other characteristic species, comprising *Typosyllis* spp and *Atylus vedlomensis*. HI3 in contrast was not characterised well by any particular species, potentially representing a transitional community between HI2 and the high diversity, high abundance communities found in HI4 and HI5

Cluster HI4 had the greatest number of species and highest abundance of all the clusters, with a mean of 62 species and 184 individuals. The fauna were characterised by relatively high abundance echinoderms *Echinocyamus pusillus* and *Amphipholis squamata* as well as a range of polychaetes, including *Aonides paucibranchiata* and *Glycera lapidum*, bivalves molluscs including *Gari tellinella* and crustacea, such as *Maera othonis*.

The physical conditions of the cluster suggest it is found in a relatively shallow water, coarse sediment, with a mix of gravelly sand similar to clusters HI2 and HI3. The most important difference from the clusters HI2 and HI3 was the greater proportion of shell material found, which comprised, on average, 23% of the surface cover.

The final cluster HI5 supported a relatively great number of species, which were also at high abundance, although they were at levels just below those found in HI4. The composition of the dominant species, however, was different, with the fauna characterised by the encrusting polychaete *Pomatoceros triqueter* and several crustacean species including, *Pisidia longicornis* and *Galathea intermedia*.

Some overlap with the species from HI4 was found, although generally in lower abundances in HI5. The physical conditions related to this cluster indicated that the substrata were the coarsest of all the sediments, although still generally comprising gravelly sands. The poorly sorted particles included cobbles and silts, and the median diameter was the largest of all the clusters.

Overall the most important combination of physical variables indicated by the BEST analysis comprised the derived variables of sorting, skewness and kurtosis in combination with depth. Considering the basic variables it is evident that the most important single variable was depth followed by percentage sand and gravel.

The relationship of all the sites to these variables can be seen from the PCA plot (Figure 12). To improve the clarity of the presentation of this data several of the physical data sets, which are alternatively represented by other variables, have been deleted.

Several clear groupings of clusters exist with respect to physical variables, with HI1 corresponding to the inverse of sorting (i.e. the low sorting values which are the most well sorted) and the sandiest sediments. The HI5 sites are most closely linked to the least well sorted gravels. The PCA plot also confirms that a proportion of the sites from Cluster HI4, generally found in a mix of gravelly sand were also potentially influenced by the significant proportion of shell. The other clusters appear to be mixed in their response to physical variables, although HI3 tended to be found in the deeper sites with the presence of cobbles potentially influencing the fauna at the sites.

2. Regional Monitoring Update

Figures 13 to 18, indicate the relationship of the physical variables to the individual species that have been identified from SIMPER as characterising the different clusters (see Table 2).

Figure 13 illustrates the presence in abundance of *Protodorvillea kefersteini* in the sandier sediments. The scattered occurrence of the polychaetes *Spio filicornis* is illustrated in Figure 14, although the considerable abundance of this species in the shelly sand sites is evident.

The relationship of *Echinocyamus pusillus* to the physical variables is illustrated in Figure 15, with a clear preference for the shelly sediments, although it was present across a range of sands and gravels. A species linked to *E. pusillus* in cluster HI4 was *Amphipholis squamata* and Figure 16 indicates that this species tended to be found in greater abundance in the more gravelly and poorly sorted sediments, rather than the specifically shelly sediments.

The final group of species were those characteristic of Cluster HI5, which were linked to the presence of the coarsest gravels, *Pomatoceros triqueter* (Figure 17) and *Galathea intermedia* (Figure 18), although the latter also showed a potential relationship with the presence of shell material.

The distribution of the clusters across the region is illustrated in Figure 19. It is apparent that the area to the east and south east is comprised largely of cluster HI4, which is dominated by the mixed shelly sands and gravels in terms of sediment and by the echinoderms *Echinocyamus pusillus* and *Amphipholis squamata*, in terms of fauna. The majority of the rest of the region in the vicinity of the licence areas comprises the cluster HI5, which is characterised by coarse gravelly sands, dominated by *Pomatoceros triqueter* and *Galathea intermedia*. To the north and north east, the sediments become more sandy with the clusters HI3, HI2 and HI1 present, although HI3, which appears to be a transition community, is scattered across the region, particularly in the south east.

Figure 11

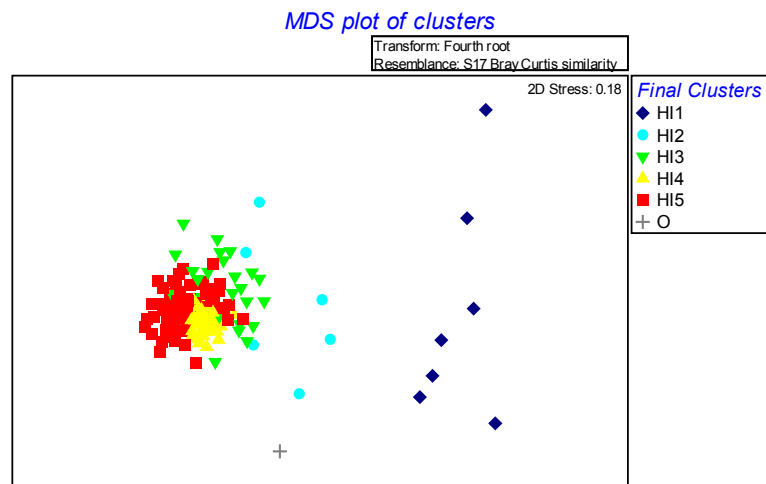
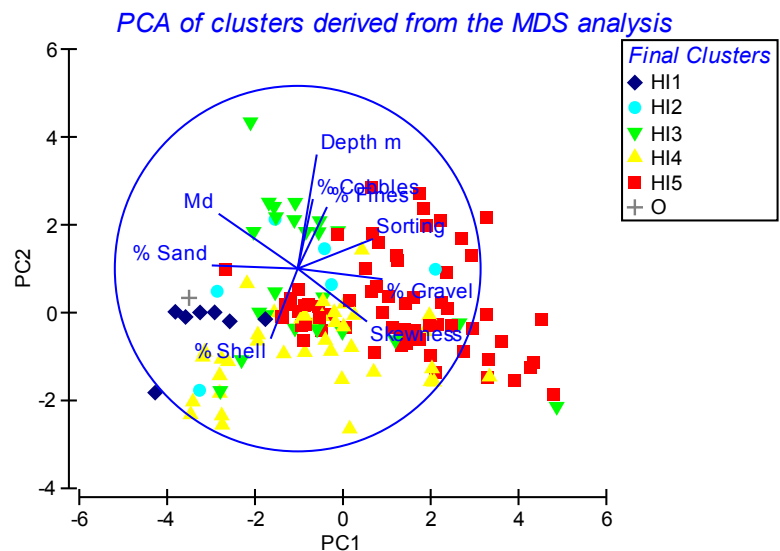


Figure 12



2. Regional Monitoring Update

Figure 13

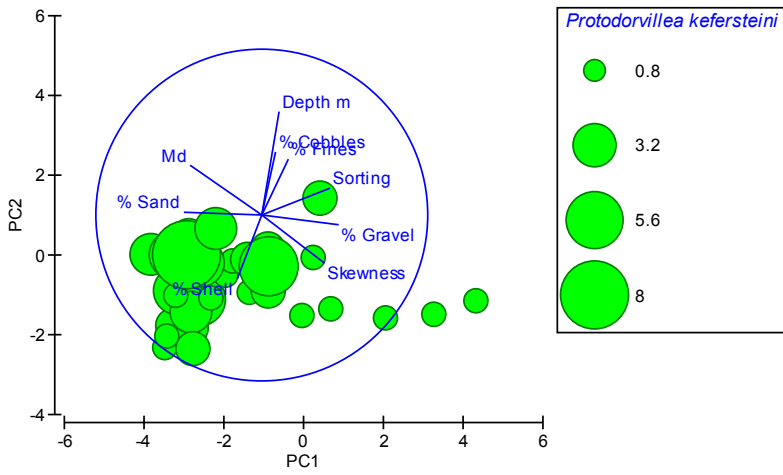


Figure 14

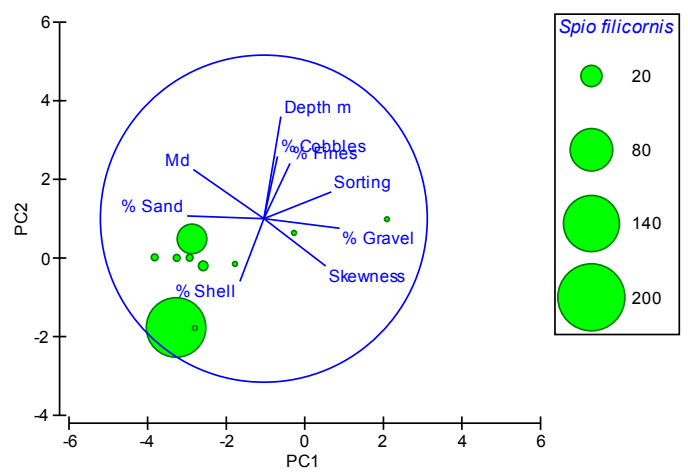


Figure 15

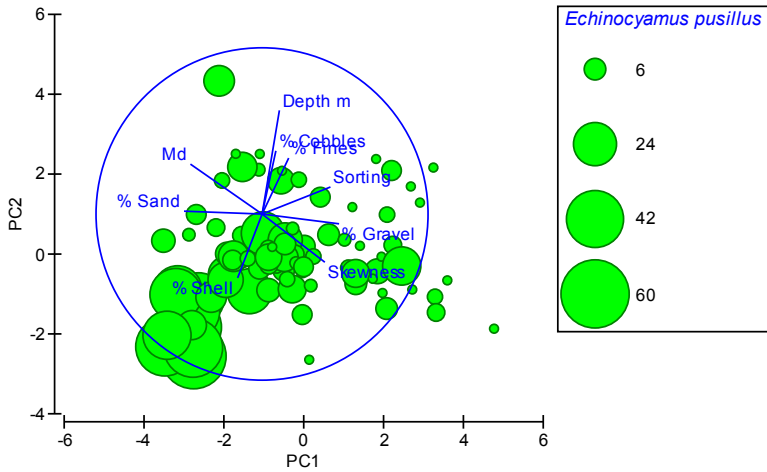


Figure 16

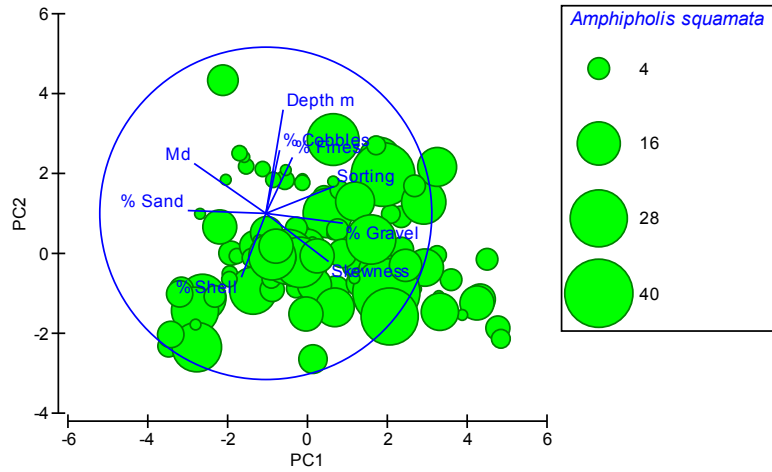


Figure 17

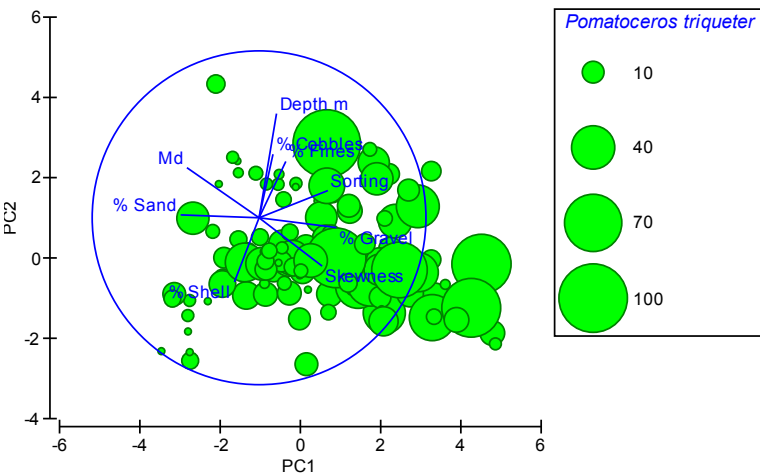
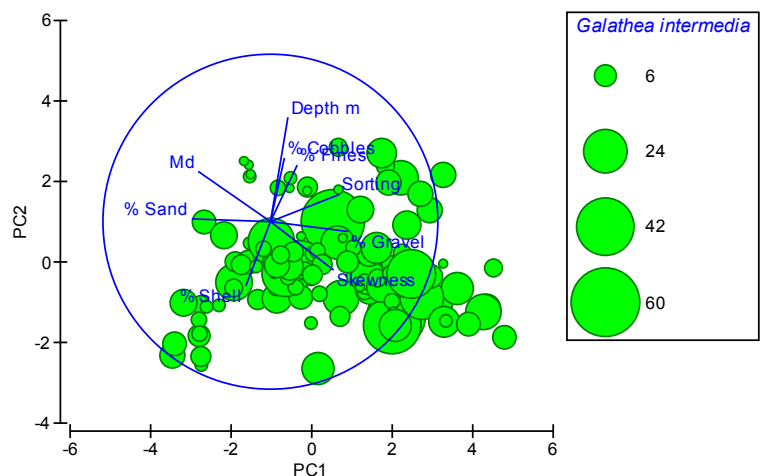


Figure 18



2. Regional Monitoring Update

2.1.4. Regional Static Image Analysis from Hamon Grab Survey

The static image data gathered by identification of epibenthic faunal species visible on the seabed was analysed using PRIMER to produce simple species distribution and community plots. Because identification of the fauna to species level was often not possible using this *in situ* technique, the PRIMER suite of analyses could not be used to full advantage. However, the analyses applied to the data available can characterise the main communities present and reveal the factors that are driving their geographical distribution.

A total of 24 taxa were identified, with only a few animals identified to actual species level when there was no doubt to their identification. The most frequently recorded conspicuous fauna were:

- Pomatoceros* spp. (keel worm)
- Bryozoan crusts (e.g. sea mats)
- Coralline algae
- Hydrozoa (e.g. sea firs)
- Aequipecten opercularis* (queen scallop)
- Ascidiacea (sea squirts)
- Suberites ficus* spp. agg. (sponge)
- Psammechinus miliaris* (purple sea urchin)
- Asterias rubens* (common starfish)
- Nemertesia antennina* (sea beard)
- Ophiothrix fragilis* (brittle star)

The highest abundances were recorded for *Pomatoceros* spp., Bryozoan crusts, Coralline algae, Hydrozoa and *Aequipecten opercularis*.

The Cluster analysis from PRIMER using the *in situ* data revealed some structure to the communities and their distribution across the survey area. Six cluster groups could be defined from the Cluster analysis and shown on the MDS plot (Figure 20) although the cluster groupings were not statistically significant (an artefact of the type of dataset analysed). Three sites formed a distinct group, having no visible epibenthic fauna on a sandy substrate (labelled as 'afaunal sands') and were therefore excluded from the MDS plot. Two more cluster groupings were quite evident, with three being less defined.

The MDS plot reveals the high stress in manipulating the data indicating the plot is a relatively poor representation of the communities present. Nevertheless, the general character of the cluster groupings can still be described as follows using the community biotopes supplied by Conner *et al* (2004):

AF No evident fauna on unstable sandy sediments (SS.SCS.OCS – Offshore circalittoral coarse sediment).

A Poorly sorted mosaic of shell and pebbles on sand and gravel with low diversity of epibenthic fauna, sparse hydroids, coralline algae and bryozoan crusts (SS.SMx.CMx – Circalittoral mixed sediment)

B Coarse gravel and pebbles with shell. A more stable version of SS.SCS.CCS.PomB with abundant *Aequipecten opercularis* (SS.SCS.CCS.PomB.Aeq – *Pomatoceros triqueter* (or *P. lamarcki*) with barnacles, bryozoan crusts and *Aequipecten opercularis* on circalittoral pebbles and gravel)

C Unstable coarse gravel, pebble and some cobble and a low species diversity (SS.SCS.CCS.PomB – *Pomatoceros triqueter* (or *P. lamarcki*) with barnacles and bryozoan crusts on unstable circalittoral pebbles and gravel)

D Unstable coarse gravel, pebble and some cobble and a low species diversity and dominated by *Asterias rubens* (SS.SCS.CCS.PomB.Ast – *Pomatoceros triqueter* (or *P. lamarcki*) with barnacles and bryozoan crusts on circalittoral pebbles and gravel)

E Mixed sediment with cobbles and pebbles (SS.SMx.CMx.OphMx – *Ophiothrix fragilis* and/or *Ophiocolina nigra* brittlestar beds on sublittoral mixed sediment)

2. Regional Monitoring Update

The interpretation of the physical conditions with respect to the clustering of the groups is illustrated in the PCA plot (Figure 21). The PCA plot shows that there is a great deal of overlap between the main cluster groupings indicating the heterogeneous nature of the substrate and to some extent, the low resolution of the dataset. The close relatedness of the biotopes is expected when recording the presence of so many mobile species which may disperse or aggregate, depending on the season, and change in numbers depending on recruitment successes. These changes in the epibenthic community structure can affect the faunal observations at the time of survey and biotopes chosen after the analyses.

The high numbers of *Pomatoceros* spp. across the surveyed region naturally relates to the abundance of suitable stable gravels, pebbles and cobbles for them to adhere their tubes to and then remain fixed to during their lifetime (Figure 22). The distribution of bryozoans, hydroids, sponges and coralline algae also related to the amount of coarse substrate to colonise. The mobile queen scallop *Aequipecten opercularis* prefers the coarse gravel, shell and pebble habitat but they were not found in the cobble strewn sediments (Figure 23). The preferred *Ophiothrix fragilis* brittlestar habitat was the more stable coarse gravels and pebbles with some cobble present (Figure 24). The sites favoured by beds of *O. fragilis* were also favoured by larger echinoderms such as *Psammechinus miliaris* (Figure 25) and *Asterias rubens* (Figure 26), although they also occurred in the more gravelly sediments.

The distribution of *O. fragilis* was much more limited than *A. opercularis* potentially due to its preference for coarse sediments in apparently more stable substrata conditions. Unlike *O. fragilis*, the scallop *A. opercularis* is more capable of movement by swimming and, therefore, less susceptible to the small scale sediment instability that occurs in the finer sediments. The brittlestars *Ophiura* spp. were very patchy in distribution and only recorded as present in two sites (29 and 130) from the static images, however, at these sites, one sandy and one of pebbles and gravels, they were observed as being common.

The *Ophiura* spp. were observed with *P. miliaris*, but did not overlap with any of the other large epibenthic species recorded.

It should be noted that the afaunal sites are so called because of the absence of any visible epibenthic species, the type of in situ observation could not account for any infaunal species that may be present at these sites. It also follows that the biotopes and communities described in this section will not reflect the whole community structure described by physically taking a sediment sample and identifying all animals within.

The distribution of the principal species identified in the static image survey are presented in Figures 27 to 30. *Pomatoceros* spp were clearly widely distributed over the whole region and in most cases were noted as common (Figure 27). The sites where they tended to be in lower abundance were to the north east, although an area of reduced abundance was noted in the vicinity of Area 477 south. Where it was recorded, *Aequipecten opercularis* was found to be at an abundance of common (Figure 28). It was distributed sporadically across the whole area, although was not generally found in the more peripheral sites.

Ophiothrix fragilis had a highly concentrated distribution (Figure 29) with the central southern area, around licence Areas 461, 475 and 478, supporting this species, generally in great abundance. One other site, on the periphery of the region in the south west also supported large numbers of this species. Many of the other species demonstrated scattered distributions, such as *Psammechinus miliaris*, whereas the common starfish, *Asterias rubens*, was relatively well defined in its distribution (Figure 30) occurring substantially in the north east of the region.

The final distribution map illustrates the defined biotopes (Figure 31). It is apparent that Clusters C and B (both PomB biotopes, with the latter supporting additional *Aequipecten*) were widely distributed across the area. In contrast the PomB biotope which supported additional *Asterias rubens*, (Cluster D) was limited to the east and north east of the region.

2. Regional Monitoring Update

Figure 20

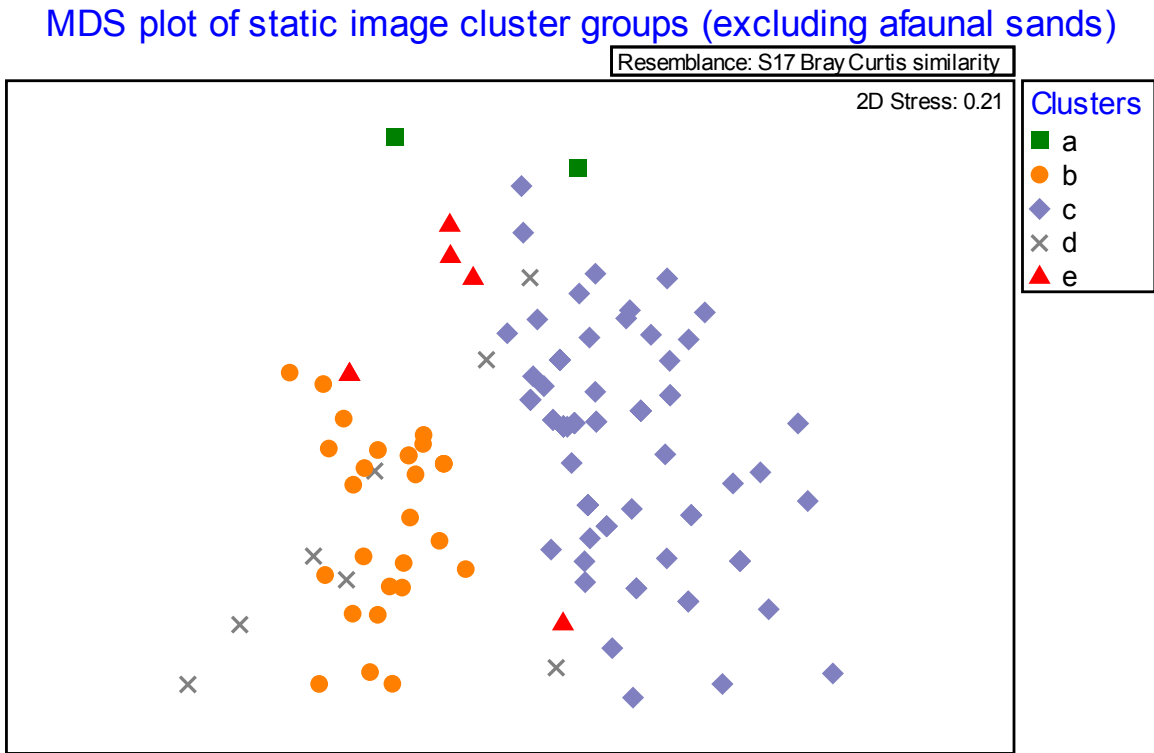
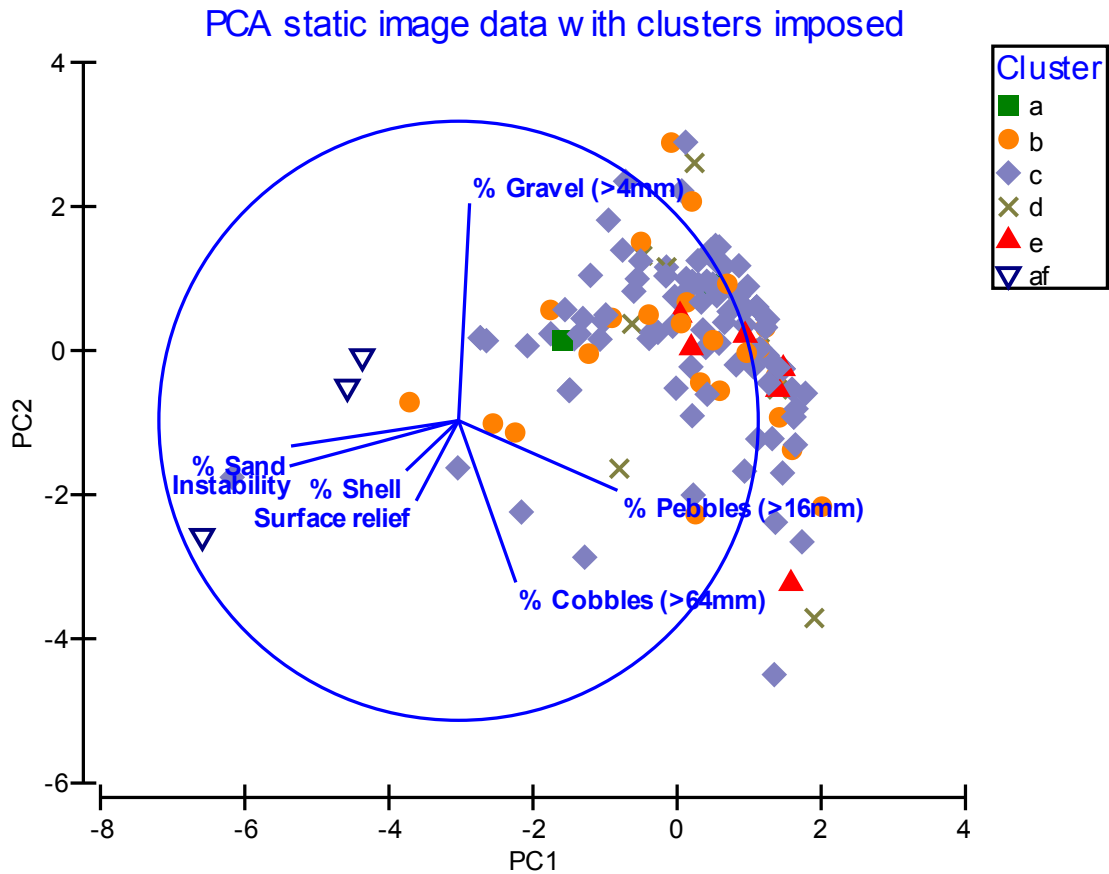


Figure 21



2. Regional Monitoring Update

Figure 22

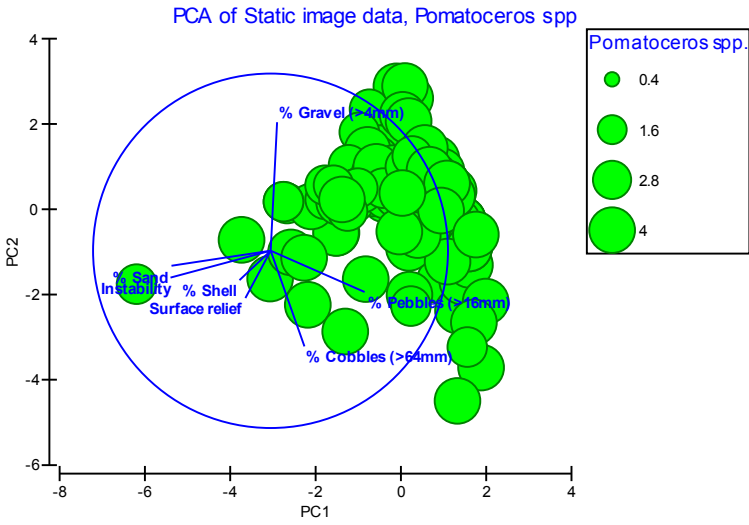


Figure 23

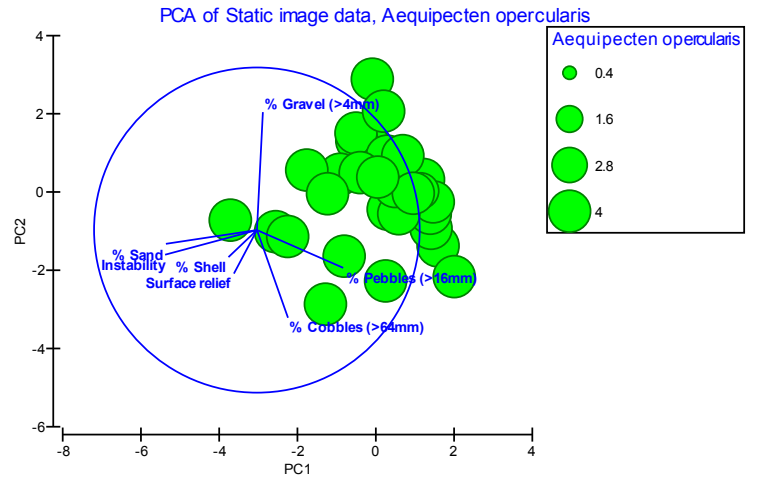


Figure 24

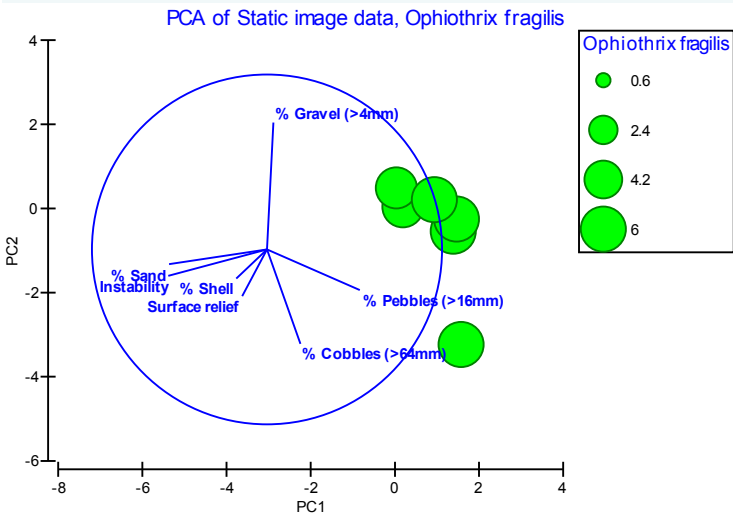


Figure 25

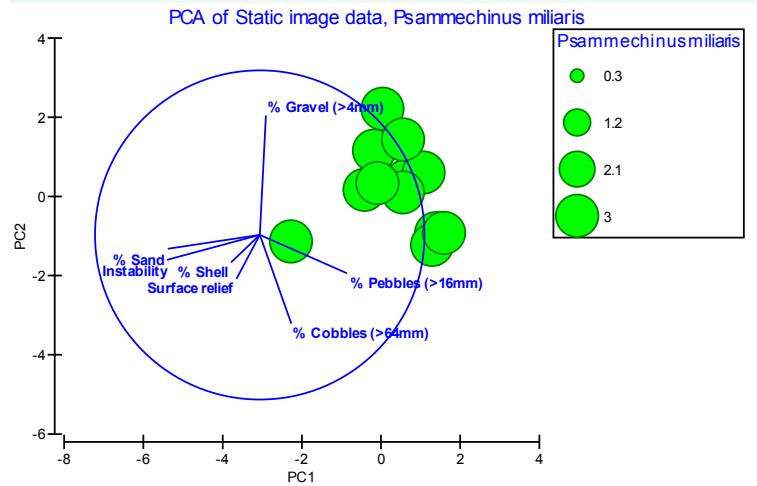
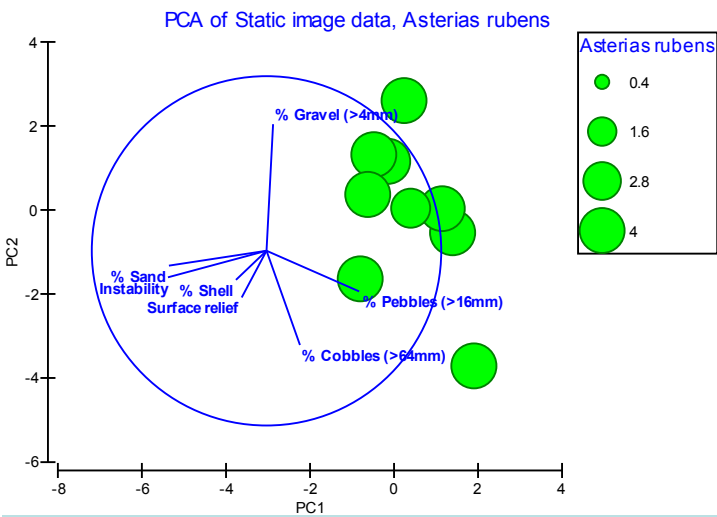


Figure 26



2. Regional Monitoring Update

An afaunal area was noted in the extreme north east and further patches of this type of habitat will occur wherever mobile sands exist. The other area where a reasonably well defined grouping of sites was found was that related to the *Ophiothrix fragilis* populations, which dominated the OphMx biotope (Cluster E). These were clearly located in the central south of the area.

2.1.5. 2m Beam Trawl Results

A total of around 280 species were identified from the 2m beam trawl samples. It can be seen from the table below (Table 3) that the most frequently occurring were from a variety of taxonomic groups. The species with greatest abundances are noted in Table 4, below. It is evident that two species in particular were present in very high abundances throughout the area, namely *Balanus crenatus* and *Pomatoceros* spp.

The 2m beam trawl data were subjected to a rationalisation process and analysed using PRIMER to determine the trends in faunal distribution. A fourth root transformation was applied to the Cluster and MDS analysis to down weight the importance of the highly abundant species. Site 44 was not included in the analyses as it had incomplete data.

Four principal cluster groupings emerged from the Cluster analysis and were overlaid onto the MDS plot. The relatively high stress levels (0.21) on the MDS plot indicate that the data is a poor representation of the actual community structure (Figure 32).

The characteristics of the cluster groupings was calculated using SIMPER analysis to list the species contributing 90% similarity to the clusters, with the most characteristic species identified at a cut off greater than 1% individual contribution to dis-similarity. The species diversity and abundance indices were calculated by the PRIMER DIVERSE routine. Table 5, summarises the dominant species in each group with the most characteristic highlighted in colour. Much of the characterisation is based on differences in abundance, with a high degree of uniformity in terms of species common to all clusters.

Cluster 2MC comprised most of the trawled sites and supported the highest diversity with a mean of 77 species per trawl. The abundances were also the highest of all the clusters with a mean of 11,507 individuals per trawl. These high abundances were contributed to by a range of species, some of which were characteristic of this cluster in these high abundances, primarily *Balanus crenatus*, *Pomatoceros* spp., *Psammechinus miliaris*, *Asterias rubens*, and *Alcyonium digitatum*. One other species occurred in abundance but was not clearly characteristic of the cluster, namely *Aequipecten opercularis*. The importance of the characterising species to the clustering of sites is illustrated by two examples in Figures 33 and 34, which are species abundance values for *Asterias rubens* and *Alcyonium digitatum* respectively, overlain on the MDS plots.

Cluster 2MC contained the highest diversity of taxonomic groups compared to the other clusters, with examples of bryozoans, hydroids, crustaceans, polychaetes, molluscs, fish and echinoderms. Species evident in this cluster and appearing rarely if at all in the other clusters included the polychaete *Thelepus cincinnatus* (see Figure 35) the prawns and shrimps *Pandalina brevirostris* and *Hippolyte longirostris*, the sea urchins *Spatangus purpureus*, *Paracentrotus lividus* and the cushion star *Asterina gibbosa*.

Cluster 2MA contained an average of 66 species but with a low average abundance of 3366 individuals per trawl. The same group of species that dominated cluster 2MC were evident, including *Pomatoceros* spp, *Balanus crenatus*, *Psammechinus miliaris*, *Aequipecten opercularis*, and *Alcyonium digitatum*. This cluster appears to be a low density version of Cluster 2MC, with few characterising species other than relatively rarely occurring species such as *Ampelisca spinipes*, *Crangon bispinosus* and *Gastrosaccus normani*, all species more common on mobile sandy sediments. The group also has a record of the seahorse *Hippocampus hippocampus* found in Trawl 13.

2. Regional Monitoring Update

Table 3 Most frequently occurring species from the 2m beam trawl surveys.

Species	Taxa	% frequency
<i>Hydrallmania falcata</i>	Hydrozoa	100
<i>Pagurus prideaux</i>	Crustacea	100
<i>Aequipecten opercularis</i>	Mollusca	100
<i>Asterias rubens</i>	Echinodermata	100
<i>Psammechinus miliaris</i>	Echinodermata	100
<i>Adamsia carciniopados</i>	Cnidaria	97
<i>Pomatoceros spp.</i>	Polychaeta	97
<i>Balanus crenatus</i>	Crustacea	97
<i>Pagurus bernhardus</i>	Crustacea	97
<i>Galathea intermedia</i>	Crustacea	97
<i>Macropodia tenuirostris</i>	Crustacea	97
<i>Ophiothrix fragilis</i>	Echinodermata	97
<i>Alcyonium digitatum</i>	Cnidaria	93
<i>Pododesmus patelliformis</i>	Mollusca	93
<i>Porella concinna</i>	Bryozoa	90
<i>Schizomavella auriculata</i>	Bryozoa	90
<i>Ophiura albida</i>	Echinodermata	90

Table 4 Mean and peak abundances of the dominant species from the 2m beam trawl tows.

Species	Abundance per tow	
	Mean	Max
<i>Balanus crenatus</i>	3148	94467
<i>Pomatoceros spp.</i>	2140	64223
<i>Psammechinus miliaris</i>	846	25402
<i>Aequipecten opercularis</i>	390	11706
<i>Asterias rubens</i>	243	7292
<i>Alcyonium digitatum</i>	226	6802
<i>Macropodia tenuirostris</i>	41	1244
<i>Ciona intestinalis</i>	40	1217
<i>Pagurus bernhardus</i>	38	1164
<i>Pandalina brevisrostris</i>	34	1028
<i>Ascidia conchilega</i>	33	1007
<i>Ophiura albida</i>	32	977
<i>Pododesmus patelliformis</i>	31	934
<i>Ophiothrix fragilis</i>	26	789

2. Regional Monitoring Update

Table 5 Characterising species and community structure measures. Colour coding indicates most characteristic (red) to least characteristic (yellow). All species listed are within the 90% cumulative contribution to cluster similarity and colour coded species >1% individual contribution to dissimilarity (except *).

Characterising Species							
Cluster 2mA	No ind	Cluster 2mB	No ind	Cluster 2mC	No ind	Cluster 2mD	No ind
<i>Pomatoceros</i> spp.	1236	<i>Balanus crenatus</i>	1584	<i>Balanus crenatus</i>	4898	<i>Balanus crenatus</i>	2601
<i>Balanus crenatus</i>	1125	<i>Pomatoceros</i> spp.	1246	<i>Pomatoceros</i> spp.	2899	<i>Pomatoceros</i> spp.	2932
<i>Psammochinus miliaris</i>	400	<i>Psammochinus miliaris</i>	537	<i>Psammochinus miliaris</i>	1280	<i>Psammochinus miliaris</i>	311
<i>Aequipecten opercularis</i>	186	<i>Aequipecten opercularis</i>	327	<i>Aequipecten opercularis</i>	562	<i>Pagurus prideaux</i>	204
<i>Alcyonium digitatum</i>	72	<i>Asterias rubens</i>	117	<i>Asterias rubens</i>	425	<i>Aequipecten opercularis</i>	144
<i>Macropodia tenuirostris</i>	40	<i>Pagurus bernhardus</i>	80	<i>Alcyonium digitatum</i>	399	<i>Adamsia carcinopados</i>	125
<i>Ophiothrix fragilis</i>	32	<i>Eunice vittata</i>	36	<i>Ciona intestinalis</i>	77	<i>Macropodia tenuirostris</i>	113
<i>Asterias rubens</i>	20	<i>Buccinum undatum</i>	21	* <i>Pandalina brevis</i>	66	* <i>Alcyonium diaphanum</i>	101
<i>Pagurus bernhardus</i>	19	<i>Gibbula tumida</i>	12	<i>Ascidia conchilega</i>	57	<i>Ophiura albida</i>	77
Gobiidae	14	<i>Pagurus prideaux</i>	8	<i>Pododesmus patelliformis</i>	54	Gobiidae	69
<i>Ophiura albida</i>	13	Gobiidae	8	<i>Thelepus cincinnatus</i>	49	<i>Alcyonium digitatum</i>	51
<i>Alcyonium diaphanum</i>	13	<i>Adamsia carcinopados</i>	8	<i>Macropodia tenuirostris</i>	48	<i>Asterias rubens</i>	47
<i>Adamsia carcinopados</i>	13	<i>Diplecogaster bimaculata</i>	7	<i>Ophiura albida</i>	46	<i>Pagurus bernhardus</i>	36
<i>Pagurus prideaux</i>	11	<i>Antedon bifida</i>	7	<i>Pagurus bernhardus</i>	37	* <i>Ammodytes tobianus</i>	35
<i>Inachus dorsetensis</i>	10	<i>Pyura squamulosa</i>	6	<i>Ophiothrix fragilis</i>	33	<i>Liocarcinus pusillus</i>	33
<i>Buccinum undatum</i>	8	ACTINARIA	4	<i>Pisidia longicornis</i>	29	ACTINARIA	26
<i>Dendrodoa grossularia</i>	7			<i>Galathea intermedia</i>	29	<i>Paguridae</i>	20
<i>Verruca stroemia</i>	7			<i>Eunice vittata</i>	28	<i>Galathea intermedia</i>	17
<i>Ascidia conchilega</i>	6			<i>Dendrodoa grossularia</i>	22	<i>Inachus dorsetensis</i>	16
<i>Pododesmus patelliformis</i>	5			ACTINARIA	21	<i>Callionymidae</i>	15
<i>Galathea intermedia</i>	4			<i>Crepidula fornicata</i>	18	<i>Flustra foliacea</i>	10
<i>Crossaster papposus</i>	3			<i>Inachus dorsetensis</i>	13	<i>Macropodia rostrata</i>	8
						<i>Pisidia longicornis</i>	5

Community Structure Measures			
Cluster 2mA	Cluster 2mB	Cluster 2mC	Cluster 2mD
S	66 S	58 S	77 S
N	3366 N	4180 N	11507 N
d	8.06 d	6.95 d	8.26 d
J'	0.39 J'	0.42 J'	0.39 J'
H'(loge)	1.61 H'(loge)	1.71 H'(loge)	1.70 H'(loge)
1-Lambda'	0.613 1-Lambda'	0.709 1-Lambda'	0.672 1-Lambda'
			64 S
			7368 N
			7.27 d
			0.42 J'
			1.72 H'(loge)
			0.646 1-Lambda'

2. Regional Monitoring Update

Figure 32

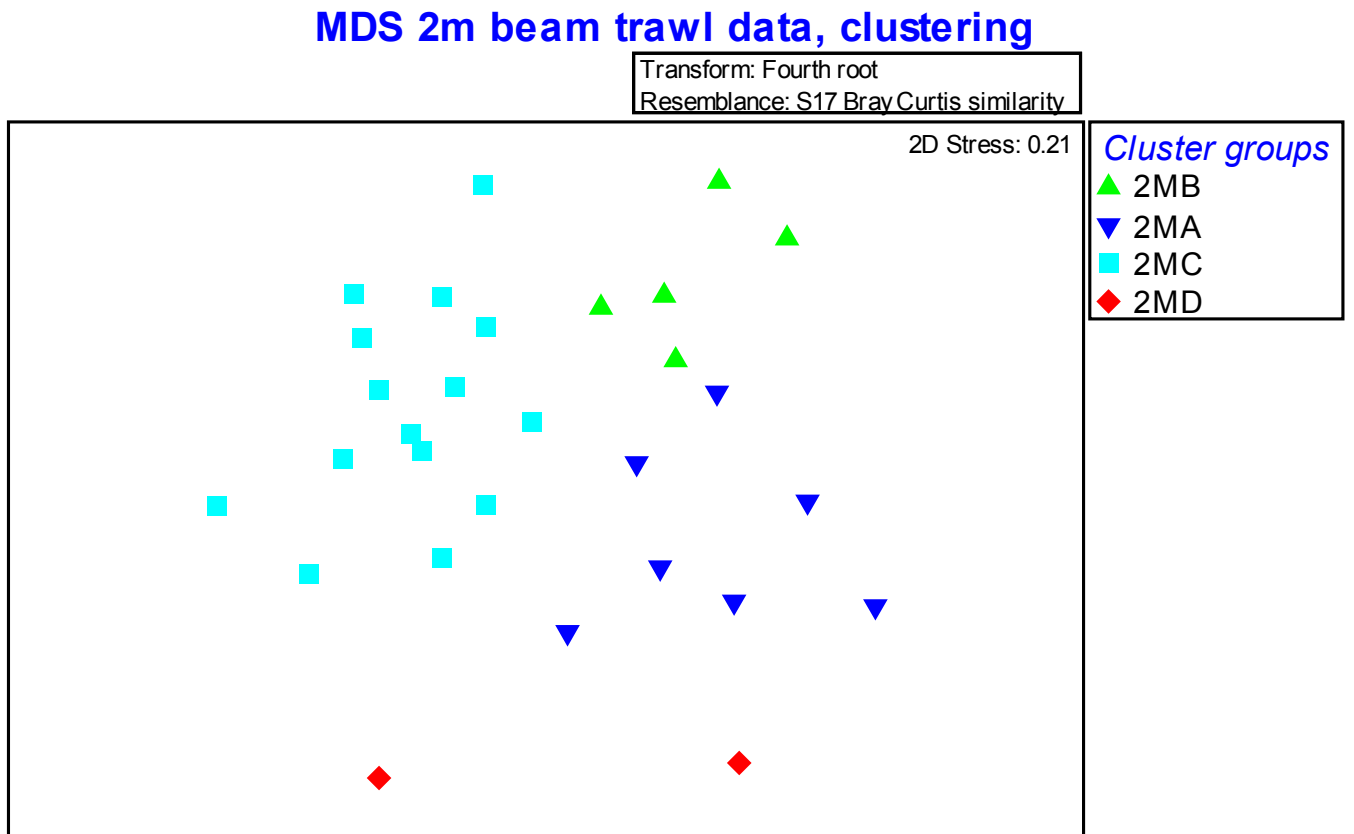


Figure 33

MDS 2m beam trawl data, *Asterias rubens* abundance

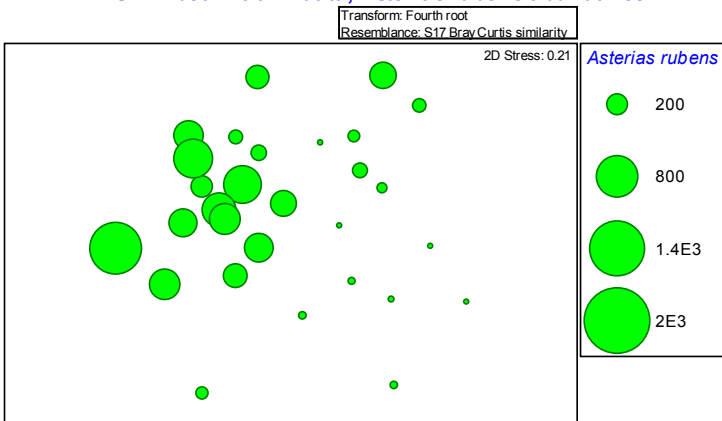
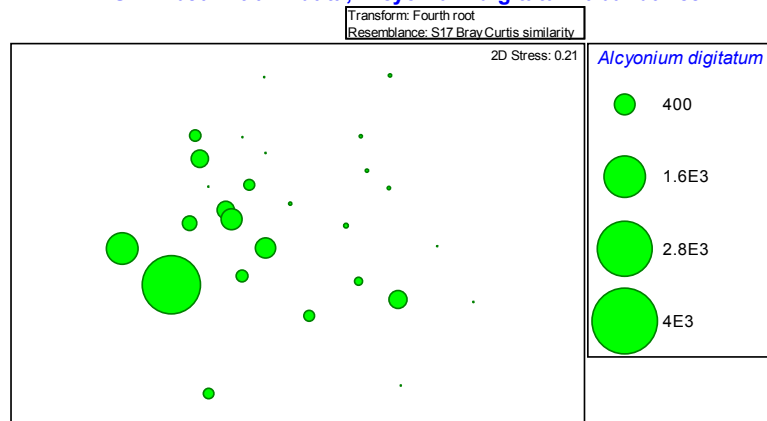


Figure 34

MDS 2m beam trawl data, *Alcyonium digitatum* abundance



2. Regional Monitoring Update

Figure 35

MDS 2m beam trawl data, *Thelepus cincinnatus* abundance

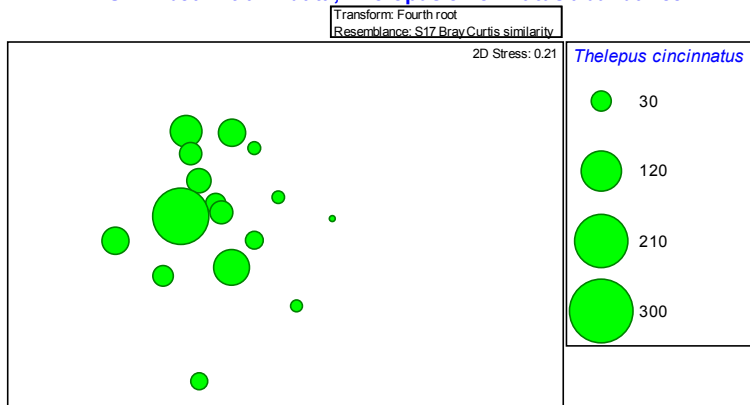


Figure 36

MDS 2m beam trawl data, *Buccinum undatum* abundance

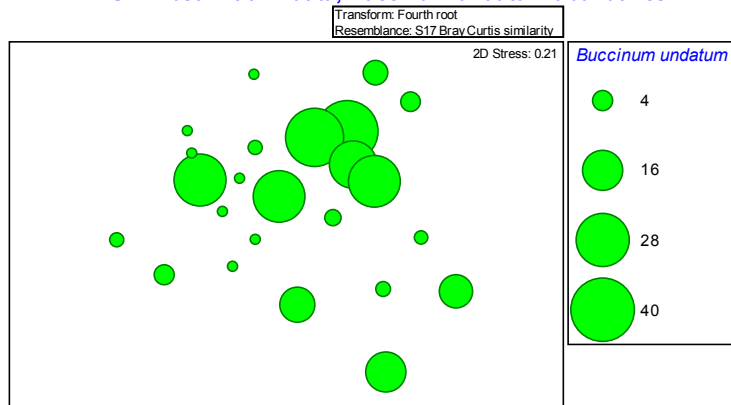
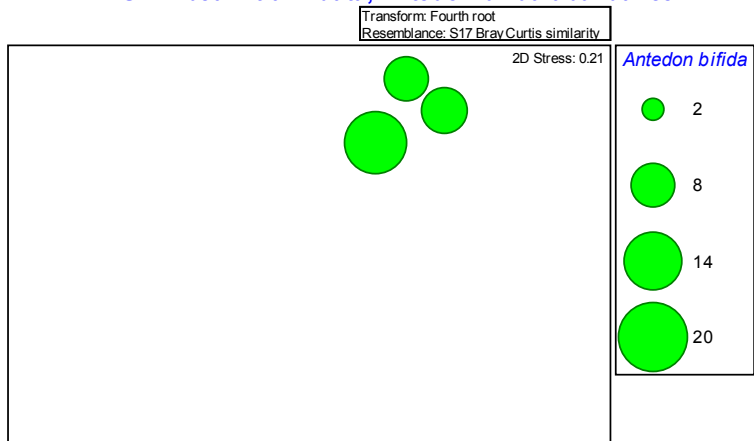


Figure 37

MDS 2m beam trawl data, *Antedon bifida* abundance



2. Regional Monitoring Update

Cluster 2MB supported a mean number of 58 species with *Balanus crenatus*, *Pomatoceros* spp., *Psammechinus miliaris*, *Aequipecten opercularis* and *Asterias rubens* being the most abundant species within the group. This cluster supported the smallest mean number of species of all the clusters, also with a generally low abundance of individuals. The species that characterised the group included the scaleworm *Eunice vittata* as well as the whelk *Buccinum undatum* and the echinoderm *Antedon bifida*, although none of the species except *Antedon bifida* were exclusively found in this cluster (see Figures 36 and 37).

Cluster 2MD contained only 2 trawls with a mean number of 64 species. The abundance in this instance was relatively high at 7368 individuals per trawl. Again *Balanus crenatus*, *Pomatoceros* spp., and *Psammechinus miliaris* were the most abundant. The characterising species of this group however were the Pagurids, specifically, *Pagurus prideux* with its commensal anemone *Adamsia carciniopados* along with several fish species including the sand eel, *Ammodytes tobianus* and the Gobidae and Callionymidae. Other important invertebrates included the bryozoans *Alcyonidium diaphanum* and *Flustra foliacea*.

The distribution of the clusters derived from the 2m beam trawl data is illustrated in Figure 38. It is apparent that most of the region comprises the single cluster 2MC, which occupies all of the eastern part of the region in the vicinity of the licence blocks. It also occupies three of the reference areas (5, 6 and 7). In contrast the reference areas to the north west were occupied by the low abundance cluster 2MA. This cluster appears to be responding to a degree of sediment mobility across the area, although not to the extent that it has eliminated many of the species characteristic of coarse sediments, e.g. *Alcyonium digitatum* and *Ophiothrix fragilis*.

Cluster 2MB extended to the south east of the region, while the sand dominated areas to the north east were occupied by the cluster 2MD.



Image: MarineSpace

2. Regional Monitoring Update

2.1.6. 4m Beam Trawl Survey – Fish Results

Figures 39 – 45 present the distribution of the abundance of selected demersal fish species collected in the 4m beam trawl across the ECR study area in August 2006. Abundance data were standardised to a single catch per unit effort (CPUE) index reflecting numbers of each fish species per 1000m tow. The selected fish species are given in Table 6 below.

Table 6 Selected Fish Species sampled with the 4m Beam Trawl in the ECR

Common Name	Scientific Name
Gurnard	<i>Aspitrigla cuculus</i>
Common dragonet	<i>Callionymus lyra</i>
Thornback ray	<i>Raja clavata</i>
Plaice	<i>Pleuronectes platessa</i>
Sole	<i>Solea solea</i>
Poor cod	<i>Trisopterus minutus</i>
Lesser spotted dogfish	<i>Scyliorhinus canicula</i>

A. cuculus (Figure 39) occurred commonly across the survey area and was recorded in 43 of the 48 4m beam trawl samples collected. Densities of this fish species were relatively uniform throughout the ECR, including the reference stations, with peak abundance occurring at station 24 located to the south of the sampling array (24.30 per 1000m). No clear pattern in the distribution of this fish species was evident.

C. lyra (Figure 40) was similarly well distributed throughout the study area and was recorded at 44 of the 48 sample stations. *C. lyra* was also represented at all of the reference stations. Again, there was no clear pattern in the distribution of this fish species and densities across the ECR although higher densities tended to be found in the east and south east, up to 7.18 fish per 1000m.

R. clavata (Figure 41) was recorded at 15 stations. Numbers of this species were consistently low in all samples ranging between 0.58 and 1.49 per 1000m. As a result of the low number of observations for this species it was not possible to identify a clear distribution pattern.

However, it was noted that *R. clavata* was absent within 4m beam trawls collected from the far east of the study area.

P. platessa (Figure 42) was not commonly encountered during the 4m beam trawl survey and was only noted in 5 of the 48 samples collected. Numbers were comparatively low with a peak abundance of 1.58 per 1000m at station 41. This species also tended to be caught towards the north and east of the ECR and was apparently absent from 4m beam trawl samples collected from central, southern and western portions of the study area in 2006.

S. solea (Figure 43) were only recorded at 2 sample stations located towards the north and east of the ECR study area in 2006. Numbers were very low at 0.52 and 0.53 per 1000m.

T. minutus (Figure 44) was relatively restricted in terms of its spatial distribution across the ECR and was only recorded at 6 of the 48 sample stations located broadly within the centre of the sampling array. This fish species was not recorded in 4m beam trawl samples collected over eastern and western portions of the study area. The abundance values were also relatively low ranging between 0.70 and 3.45 per 1000m.

S. canicula (Figure 45) occurred frequently throughout the study area and was recorded at 42 beam trawl sample stations. Abundances of this fish species ranged between 0.53 and 17.29 per 1000m. There was no clear spatial distribution pattern although greatest densities of this fish species tended to occur to the west and south of the sampling array whilst northern and central portions supported lower numbers. This species was considered to be well distributed throughout the ECR study area although it was apparently absent from 4m beam trawl samples towards the extreme east of the array.

One other species is illustrated in Figure 46, *Trisopterus luscus*, which was found at very high abundance at one site only (38) with only low abundances elsewhere. The other sites it was found at tended to be located in the central southern areas of the region.

2. Regional Monitoring Update

2.1.7. 4m Beam Trawl Survey – Consideration of Fish Communities

The PRIMER analysis of the fish species alone indicated four clusters with two outlier sites. The clusters are illustrated in Figure 47, the MDS output based on SIMPROF clustering with a 5% significance level. The MDS is a relatively poor representation of the site divisions at a stress level of 0.2, but the overall groups are evidently separate. The dominant and characterising species in each cluster, along with the community structure measures are presented in Table 8. The dominant species in two of the clusters is *Aspitrigla cuculus*, with *Scyliorhinus canicula* dominant in one other and *Callionymus lyra* in the remaining cluster. One or other of these species was the secondary dominant in clusters 4MB, 4MC and 4MC. Cluster 4MA was clearly the most different from all other clusters, with the smallest number of species and the lowest average abundances. The most characteristic species was the thick-backed sole, *Microchirus variegatus*, with *Callionymus lyra* the dominant species and at the highest density of all the clusters.

Cluster 4MB had the highest mean number of species of all the clusters with a relatively high number of individuals.

The dominant species was *Aspitrigla cuculus* with *Callionymus lyra* and *Scyliorhinus canicula* secondary dominant. The characteristic species, however, were drawn from a diverse range of other species at low abundance, particularly the poor cod, *Trisopterus minutus*, black bream, *Spondylisoma cantharus* and a group of Gobiidae.

Figure 47

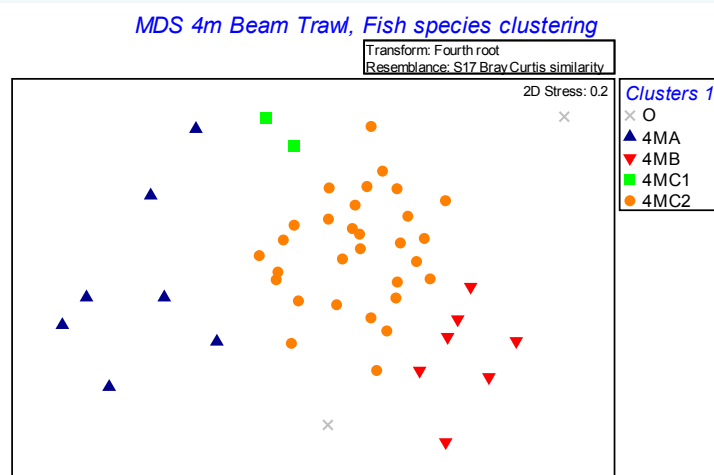


Table 7 Summary of the most frequently occurring species present in the 4M beam trawls and their abundances.

Scientific Name	Common Name	MCS Code	% Frequency	Mean	Max
<i>Callionymus lyra</i>	Common dragonet	ZG0452	92	1.99	7.18
<i>Aspitrigla cuculus</i>	Gurnard	ZG0262	90	3.48	24.30
<i>Scyliorhinus canicula</i>	Lesser spotted dogfish	ZF0028	88	4.43	17.29
<i>Trigla lucerna</i>	Tub gurnard	ZG0269	38	0.39	3.09
<i>Agonus cataphractus</i>	Pogge	ZG0291	38	0.40	2.07
<i>Raja clavata</i>	Thornback ray	ZF0089	31	0.26	1.49
<i>Microchirus variegatus</i>	Thickback sole	ZG0588	31	0.54	7.99
<i>Gobiidae indet.</i>	Goby	ZG0455	29	0.37	7.85
<i>Spondylisoma cantharus</i>	Black bream	ZG0364	27	0.36	4.71
<i>Trigloporus lastoviza</i>	Streaked gurnard	ZG0272	25	0.40	4.89
<i>Trachinus draco</i>	Greater weever	ZG0403	17	0.15	1.71
<i>Trisopterus luscus</i>	Bib	ZG0143	15	5.01	232.51
<i>Phrynorhombus regius</i>	Bloch's topknot	ZG0552	15	0.19	3.93
<i>Trisopterus minutus</i>	Poor cod	ZG0144	13	0.24	3.45
<i>Scyliorhinus stellaris</i>	Huss	ZF0029	10	0.07	1.16
<i>Diplecogaster bimaculata</i>	Two spotted clingfish	ZG0086	10	0.09	2.20
<i>Hippoglossoides platessoides</i>	American plaice	ZG0568	10	0.10	1.97
<i>Pleuronectes platessa</i>	Plaice	ZG0578	10	0.11	1.58
<i>Solea lascaris</i>	Sand sole	ZG0590	10	0.07	0.86

2. Regional Monitoring Update

Table 8 Summary of the dominant and characterising species in each cluster, identified in the 4m beam trawl data, and the community structure measures.

Cluster 4MA	No Ind	Cluster 4MB	No Ind	Cluster 4MC1	No Ind	Cluster 4MC2	No Ind
<i>Callionymus lyra</i>	2.8	<i>Aspitrigla cuculus</i>	5.0	<i>Aspitrigla cuculus</i>	3.0	<i>Scyliorhinus canicula</i>	6.3
<i>Microchirus variegatus</i>	2.0	<i>Callionymus lyra</i>	2.1	<i>Callionymus lyra</i>	1.5	<i>Aspitrigla cuculus</i>	4.0
<i>Trachinus draco</i>	0.5	<i>Scyliorhinus canicula</i>	2.1	<i>Pleuronectes platessa</i>	1.5	<i>Callionymus lyra</i>	1.9
		<i>Trisopterus minutus</i>	1.6	<i>Echiichthys vipera</i>	1.0	<i>Trigla lucerna</i>	0.6
		<i>Spondyliosoma cantharus</i>	1.5	<i>Scyliorhinus canicula</i>	1.1	<i>Raja clavata</i>	0.3
		<i>Gobiidae indet.</i>	1.5	<i>Trigla lucerna</i>	0.9		
		<i>Agonus cataphractus</i>	1.1	<i>Trachinus draco</i>	0.7		
		<i>Trigloporus lastoviza</i>	1.0				
		<i>Phrynorhombus regius</i>	0.8				
Community Structure Measures							
S	4.1	S	10.7	S	9.5	S	6.3
N	6.9	N	18.9	N	10.9	N	22.5
d	1.73	d	3.39	d	3.60	d	2.04
J'	0.81	J'	0.85	J'	0.91	J'	0.78
H'(loge)	1.15	H'(loge)	2.01	H'(loge)	2.05	H'(loge)	1.42
1-Lambda'	0.71	1-Lambda'	0.87	1-Lambda'	0.93	1-Lambda'	0.74

2. Regional Monitoring Update

The two remaining clusters comprised a relatively high diversity but low abundance cluster (4MC) and a low diversity but high abundance group (4MD). Although dominated by *Aspitrigla cuculus*, abundances of all species in cluster 4MC were low, with the characteristic species *Echiichthys vipera* (lesser weaver) and *Trigla lucerna* (tub gurnard) in very low densities (<1 per 1000m tow). In contrast the abundance of the dominant and characteristic species of cluster 4MD, the lesser spotted dogfish *Scyliorhinus canicula* was found in the highest mean abundance of any of the characteristic species, at 6 individuals per 1000m tow.

One of the outlier sites, 4M38, was separated primarily due to the exceptionally high abundance of a single species, with *Trisopterus luscus* present at 233 individuals per 1000m tow. The remaining site, 4M26, was a faunally impoverished version of the fauna found in clusters 4MB, 4MC and 4MD.

The regional distribution of the clusters is illustrated in Figure 48. There are several clear site groupings with the faunally impoverished, sand related cluster, 4MA found to the north east of the region. The high diversity sites (4MB) were clustered across the middle of the region in a north south direction, from Area 461 to reference area 2. Other sites from this cluster were also found in the north of the area. The cluster dominated by the lesser spotted dogfish, 4MD, which also supported the highest numbers of individuals but comprised few species, was extensively distributed and covered the remainder of the licence block areas. The northern edge of the region, was occupied by cluster 4MC which comprised a sand based community type characterised by *Echiichthys vipera* and, when compared with Figure 42, the presence of *Pleuronectes platessa*.

2.1.8. 4m Beam Trawl Combined Invertebrates and Fish Data

A total of 162 taxa were identified from the 4m beam trawl survey (see relevant appendix). The invertebrate fauna were drawn from a range of taxonomic groups, including the echinodermata (12) mollusca (25), crustacea (29), cnidaria (14), ascidiacea (11).

The fish species were well represented with 43 species. Table 9 lists the most frequently occurring of these species with their frequency of occurrence.

Table 9 Most frequently occurring species from the 4m beam trawl combined epifauna and fish data.

Taxon	Frequency
<i>Psammechinus miliaris</i>	100%
<i>Asterias rubens</i>	98%
<i>Aequipecten opercularis</i>	94%
<i>Sepia officinalis</i>	92%
<i>Anseropoda placenta</i>	92%
<i>Callionymus lyra</i>	92%
<i>Aspitrigla cuculus</i>	90%
<i>Scyliorhinus canicula</i>	88%
<i>Alcyonium digitatum</i>	85%
<i>Pagurus bernhardus</i>	85%
<i>Ascidia virginea</i>	83%

The greatest overall abundance was evident for several of the most frequently found species, particularly *Aequipecten opercularis* (277 per 1000) and *Psammechinus miliaris* (230 per 1000m). The greatest individual abundance of any species at any site, however, was noted for *Ophiothrix fragilis* (15,153 per 1000m at site 4M11). Fish rarely contributed to the numerical abundance at any site, although *Trisopterus luscus* was found at one site in excess of 200 per 1000m tow. The most abundant species are listed in Table 10.

Table 10 Most abundant species from the 4m beam trawl combined data.

Taxon	Mean	Max
<i>Ophiothrix fragilis</i>	339.4	15153
<i>Aequipecten opercularis</i>	277.0	1009
<i>Psammechinus miliaris</i>	229.6	2761
<i>Alcyonium digitatum</i>	164.3	1917
<i>Asterias rubens</i>	124.8	526
<i>Ciona intestinalis</i>	21.0	554
<i>Pagurus bernhardus</i>	10.5	144
<i>Anseropoda placenta</i>	6.1	30
<i>Trisopterus luscus</i>	5.0	233
<i>Crossaster papposus</i>	4.7	46
<i>Pagurus prideaux</i>	4.5	52
<i>Scyliorhinus canicula</i>	4.4	17
<i>Aspitrigla cuculus</i>	3.4	24
<i>Sepia officinalis</i>	3.1	9
<i>Buccinum undatum</i>	3.0	33

2. Regional Monitoring Update

The PRIMER analysis of the data revealed 5 clear groupings with 5 outliers, using classification with SIMPROF (see relevant appendix). These were also evident in the MDS analysis, although two of the outliers determined from the SIMPROF appear to be better included in the adjacent spatial groups in the MDS (Figure 49).

The clusters derived are summarised in Table 11, with summarised community structure measures included. All of the clusters were dominated by a similar group of species comprising *Aequipecten opercularis*, *Psammechinus miliaris* and *Asterias rubens*. Variations in the abundance of these species and in the abundance and character of the subdominant species have caused the clusters to separate.

In summary the clusters were as follows:

Cluster 4MC.C supported the lowest number of species and the lowest overall abundances. Very few species characterised this cluster, with only the barnacle *Balanus crenatus* considered as distinctive (Figure 50), although abundances for this species were very low. The cluster has separated from the remaining sites primarily due to the impoverished nature of the dominant species.

Cluster 4MC.F supported a similarly low number of species as C, but the overall abundance was considerably more, with over 1300 individuals per 1000m trawl. This cluster also supported several very distinctive characterising species with the overwhelming dominance of *Psammechinus miliaris* most important (Figure 51). The other particularly characteristic species, due to their almost exclusive presence in this cluster, were *Ciona intestinalis* (Figure 52) and *Adamsia carcinopados* (Figure 53). The latter is commensal with the Pagurids (hermits crabs), which were also indicative of this cluster.

Cluster 4MC.G supported an intermediate number of species and intermediate abundances, with *Aequipecten* dominant. This cluster had the lowest evenness suggesting a concentration of dominance in a few species.

The most characteristic species were the whelk *Buccinum undatum* (Figure 54) and the large infaunal bivalve *Glycymeris glycymeris* although both species were present in other clusters in sporadically high abundances.

Cluster 4MC.H had the highest overall abundance with a large number of species (31). This cluster was typified by the considerable abundance of *Aequipecten opercularis* (Figure 55) and *Asterias rubens*. However, both species were present in moderate to high abundances in other clusters, particularly G and J.

Cluster 4MC.J supported the highest overall number of species of all the clusters with an average of 37 species; abundance in contrast was the second lowest at 591 per 1000m trawl. Although the dominant species was *Aequipecten opercularis* the most characteristic of the cluster was the anthozoan *Alcyonium digitatum* (Figure 56), although this species was also important in the outlier sites and to some extent cluster F. Other particularly distinctive species included *Ophiothrix fragilis* (Figure 57) and *Crossaster papposus* (Figure 58). These two species have also contributed to a division within this cluster with a particular group of sites supporting large numbers of the latter, but reduced numbers of the former.

The overall distribution of the clusters is illustrated in Figure 59. Clearly the most widespread is cluster 4MC.J occurring over the majority of the central sites. The possible subdivision in this cluster caused by the reduced numbers of *Ophiothrix fragilis* is evident in the sites to the east of the cluster (indicated as a subset in Figure 59).

Cluster 4MC.F tended to be limited to the east of the survey area, including reference area 6, although two other sites from this cluster were identified in the centre and west of the array.

2. Regional Monitoring Update

Table 11 Summarised species and community structure measures from the 4m beam trawl combined epifauna and fish data.

Cluster 4MC.C	No Ind	Cluster 4MC.F	No Ind	Cluster 4MC.G	No Ind	Cluster 4MC.H	No Ind	Cluster 4MC.J	No Ind
<i>Aequipecten opercularis</i>	54.4	<i>Psammochinus miliaris</i>	729.4	<i>Aequipecten opercularis</i>	499.7	<i>Aequipecten opercularis</i>	706.3	<i>Aequipecten opercularis</i>	219.5
<i>Asterias rubens</i>	24.1	<i>Asterias rubens</i>	166.8	<i>Psammochinus miliaris</i>	118.9	<i>Psammochinus miliaris</i>	238.9	<i>Alcyonium digitatum</i>	145.3
<i>Psammochinus miliaris</i>	17.7	<i>Aequipecten opercularis</i>	136.5	<i>Asterias rubens</i>	69.7	<i>Asterias rubens</i>	216.8	<i>Asterias rubens</i>	103.1
<i>Pagurus bernhardus</i>	3.0	<i>Alcyonium digitatum</i>	116.1	<i>Pagurus bernhardus</i>	10.8	<i>Scyliorhinus canicula</i>	10.7	<i>Psammochinus miliaris</i>	49.5
<i>Scyliorhinus canicula</i>	1.7	<i>Ciona intestinalis</i>	93.7	<i>Buccinum undatum</i>	10.6	<i>Anseropoda placenta</i>	10.4	<i>Ophiotrix fragilis</i>	23.4
<i>Aspitrigia cuculus</i>	1.7	<i>Pagurus bernhardus</i>	34.0	<i>Glycymeris glycymeris</i>	9.0	<i>Pagurus bernhardus</i>	9.3	<i>Anseropoda placenta</i>	7.8
<i>Callionymus lyra</i>	1.7	<i>Pagurus prideaux</i>	19.3	<i>Scyliorhinus canicula</i>	8.1	<i>Ciona intestinalis</i>	8.7	<i>Crossaster papposus</i>	6.7
<i>Adamsia carolinopados</i>	0.8	<i>Adamsia carolinopados</i>	12.2	<i>Aspitrigia cuculus</i>	3.1	<i>Crossaster papposus</i>	8.1	<i>Scyliorhinus canicula</i>	4.0
<i>Pagurus prideaux</i>	0.8	<i>Pecten maximus</i>	4.9	<i>Pecten maximus</i>	2.9	<i>Buccinum undatum</i>	6.8	<i>Aspitrigia cuculus</i>	4.0
<i>Hydrallmania falcata</i>	0.6	<i>Sepia officinalis</i>	3.5	<i>Callionymus lyra</i>	1.7	<i>Aspitrigia cuculus</i>	6.6	<i>Sepia officinalis</i>	3.2
<i>Balanus crenatus</i>	0.6	<i>Anseropoda placenta</i>	3.0	<i>Sepia officinalis</i>	1.1	<i>Pecten maximus</i>	5.8	<i>Pagurus bernhardus</i>	1.9
<i>Inachus dorsetensis</i>	0.6	<i>Ophiura albida</i>	3.0	<i>Sepiella atlantica</i>	0.9	<i>Sepia officinalis</i>	4.8	<i>Callionymus lyra</i>	1.6
<i>Liocarcinus holsatus</i>	0.6	<i>Callionymus lyra</i>	2.3	<i>Alcyonium digitatum</i>	0.7	<i>Callionymus lyra</i>	3.1	<i>Archidoris pseudoargus</i>	1.3
<i>Loligo vulgaris</i>	0.6	<i>Crepidula fornicata</i>	2.2	<i>Henricia oculata</i>	0.7	<i>Inachus dorsetensis</i>	0.9	<i>Buccinum undatum</i>	1.2
<i>Crossaster papposus</i>	0.6	<i>Buccinum undatum</i>	1.7	<i>Ascidia virginea</i>	0.7	<i>Hydrallmania falcata</i>	0.8	<i>Pecten maximus</i>	1.1
		<i>Microchirus variegatus</i>	1.5	<i>Trigla lucerna</i>	0.7	<i>Macropodia tenuirostris</i>	0.8	<i>Nemertea spp.</i>	0.9
		<i>Ascidia conchilega</i>	0.7					<i>Agonus cataphractus</i>	0.7
		<i>Ascidia virginea</i>	0.7					<i>Hyas coarctatus</i>	0.6

Community Structure Measures									
S	27.5	S	27.9	S	29.8	S	31.7	S	37.5
N	120	N	1345	N	753	N	1403	N	591
d	5.54	d	3.96	d	4.35	d	4.26	d	5.84
J'	0.56	J'	0.48	J'	0.34	J'	0.40	J'	0.43
H'(loge)	1.85	H'(loge)	1.59	H'(loge)	1.15	H'(loge)	1.36	H'(loge)	1.55
1-Lambda'	0.73	1-Lambda'	0.69	1-Lambda'	0.52	1-Lambda'	0.64	1-Lambda'	0.66

2. Regional Monitoring Update

Figure 49

MDS 4M Beam Trawl all data clustering

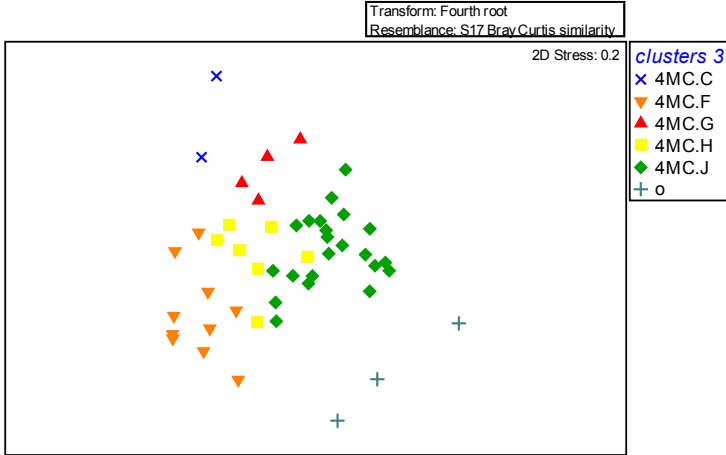


Figure 50

MDS 4M Beam Trawl all data, *Balanus crenatus* abundance

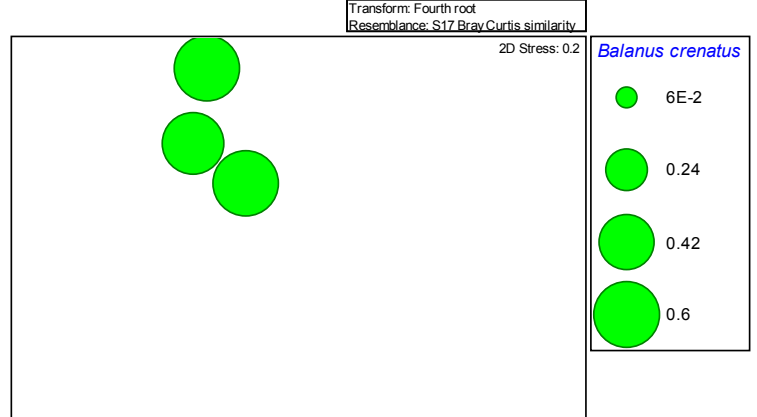


Figure 51

MDS 4M Beam Trawl all data, *Psammechinus miliaris* abundance

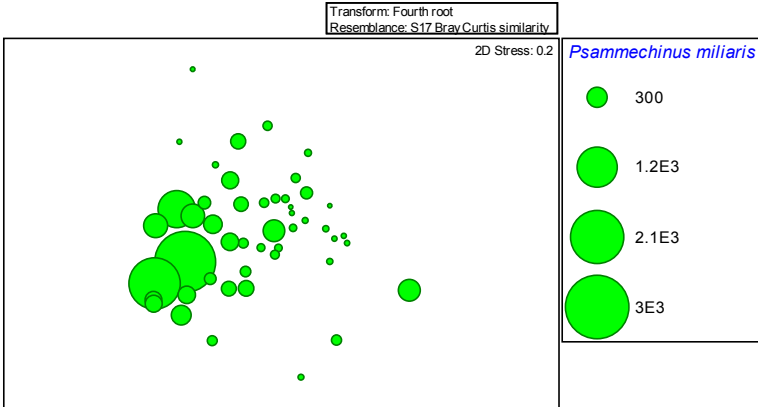


Figure 52

MDS 4M Beam Trawl all data, *Ciona intestinalis* abundance

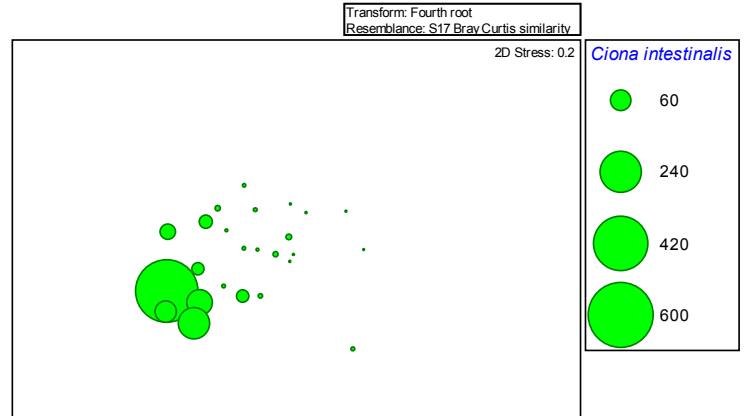


Figure 53

MDS 4M Beam Trawl all data, *Adamsia carcinopados* abundance

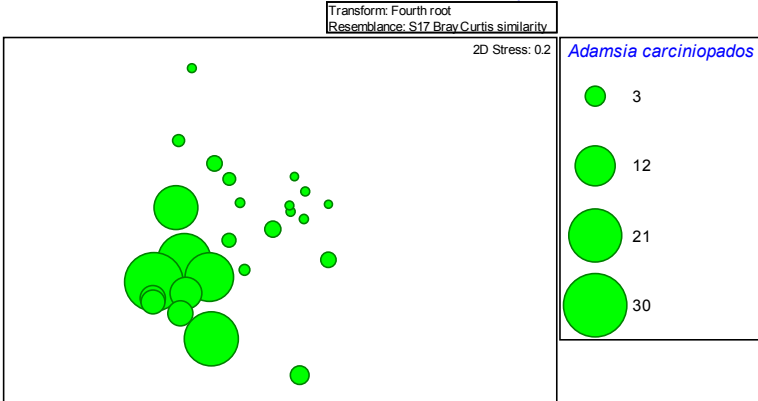
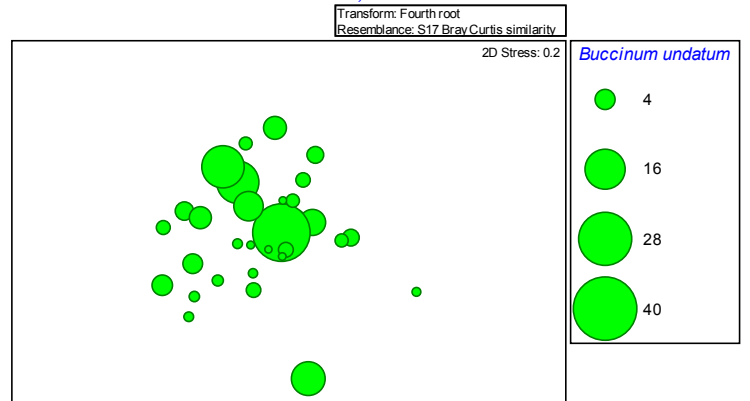


Figure 54

MDS 4M Beam Trawl all data, *Buccinum undatum* abundance



2. Regional Monitoring Update

Figure 55

MDS 4M Beam Trawl all data, *Aequipecten opercularis* abundance

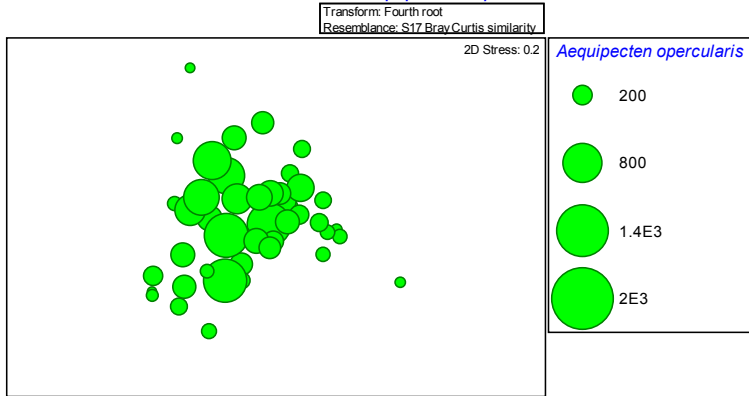


Figure 56

MDS 4M Beam Trawl all data, *Alcyonium digitatum* abundance

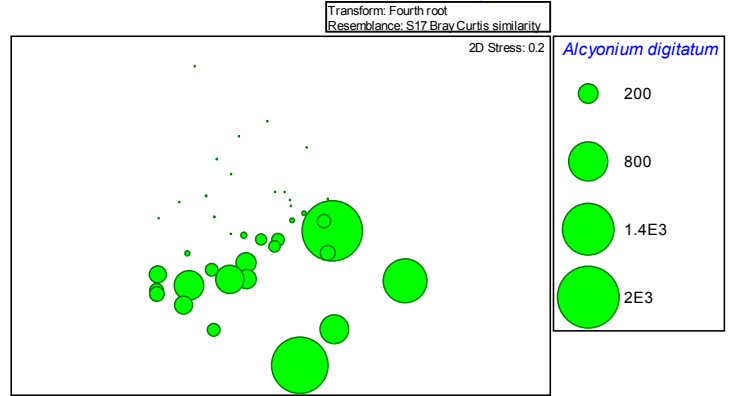


Figure 57

MDS 4M Beam Trawl all data, *Ophiothrix fragilis* abundance

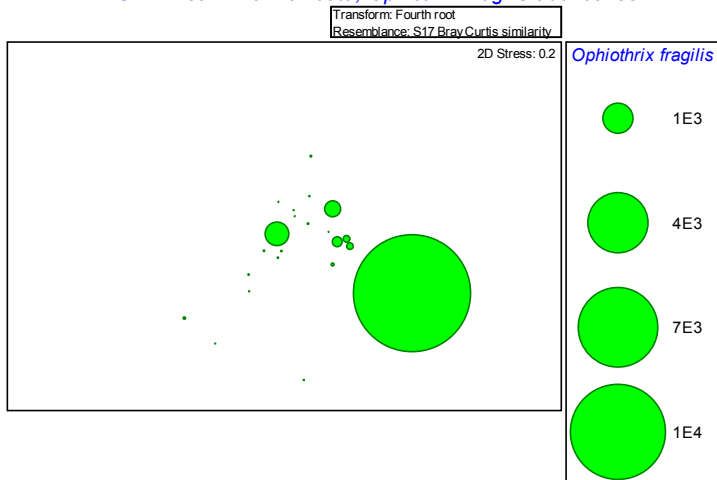
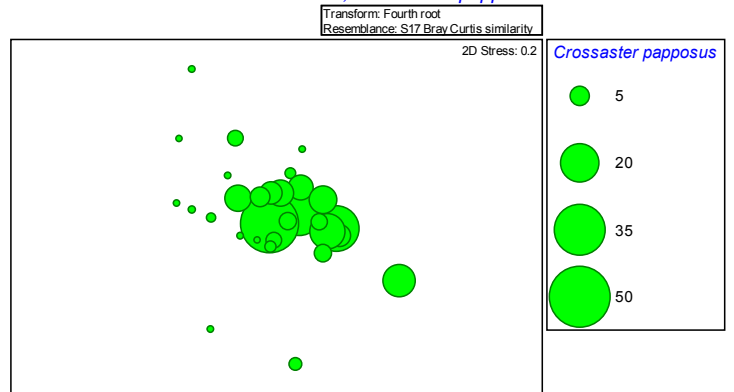


Figure 58

MDS 4M Beam Trawl all data, *Crossaster papposus* abundance



2. Regional Monitoring Update

The south west of the area was characterised by cluster 4MC.G, including reference area 4, while 4MC.H was confined to the south east, including reference area 5. The northern edge of the region, including reference areas 1 and 3, was occupied by the impoverished sites comprising cluster 4MC.C. This northern edge also included one of the low diversity outliers in reference area 2. Two other outliers occurred, one in the central south, which supported very high numbers of the brittlestar *Ophiothrix fragilis*, while the other site was distinctive because of the high numbers of the fish species *Trisopterus luscus*.

2.1.9. Scallop Dredge Survey – Shellfish Results

Aequipecten opercularis was recorded at 47 of the 48 sample sites at abundances ranging from 1.2 per 1000 m² to 316.5 per 1000 m². The distribution of this species over the ECR (Figure 60) indicates certain areas where greater abundances were recorded compared with other sites. Of particular note is a group of sites in the central and eastern part of the array (comprising sites 9, 22, 25, 29) that all had high abundance values. All the reference areas were notable for having generally lower abundances than other sites within the licence areas.

Pecten maximus was recorded at 47 of the 48 sample sites at abundances ranging from 0.3 per 1000 m² to 24.6 per 1000 m². The spatial distribution of *P. maximus* over the ECR generally shows higher abundances at sites in the central and western part of the array (Figure 61). It is worth noting that the distribution of *P. maximus* shows an opposing trend with the distribution of *A. opercularis* yet both share relatively high abundance values at sites in the centre of the array.

Cancer pagurus was recorded at only 3 of the 48 sample sites, at abundances ranging from 0.3 per 1000 m² to 0.4 per 1000 m². 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 dredges in sampling this mobile species (Figure 62).

Buccinum undatum was recorded at 42 of the 48 sample sites at abundances ranging from 0.3 per 1000 m² to 11.5 per 1000 m². Higher numbers of *B. undatum* generally tend to be distributed in the central and western part of the array. Several sites (1, 13 and 15) appear to correspond with sites where reasonably high abundances of *A. opercularis*, and *P. maximus* were also found (Figure 63).

Maja squinado was recorded only at 4 of the 48 sample sites at abundances ranging from 0.3 per 1000 m² to 0.4 per 1000 m². As with data for *C. pagurus*, it is unlikely that this is an accurate representation of the distribution of this species across the survey area; rather the results more likely reflect the fact that scallop dredges are inefficient at sampling this mobile species (Figure 64).

2.1.10. 4m Beam Trawl Survey – Shellfish Results

A. opercularis was recorded at 44 of the 48 sample sites at abundances ranging from 2.9 per 1000 m² to 252 per 1000 m². The spatial distribution of this species over the ECR (Figure 65) indicates certain areas where the abundance of *A. opercularis* was noticeably greater than surrounding areas. Sites 1, 4, 16, 28, and 34 in particular, from the southern half of the array had high abundance values. Of these five sites only two sites (sites 4 and 16) were in or near application areas. The highest abundance was recorded at site 34.

P. maximus was recorded at 35 of the 48 sample sites at abundances ranging from 0.1 per 1000 m² to 6.7 per 1000 m². The spatial distribution of this species indicated no noticeable trends (Figure 66), although it is of note is that the greatest abundance of this species was recorded at station 26.

2. Regional Monitoring Update

C. pagurus was recorded only at 5 of the 48 sample sites at abundances ranging from 0.1 per 1000 m² to 0.3 per 1000 m². It is unlikely that this is an accurate representation of the distribution of this species across the survey area; rather it is more likely to reflect the unsuitability of the 4m beam trawl in sampling this mobile crustacean (Figure 67).

B. undatum was recorded at 31 of the 48 sample sites at abundances ranging from 0.1 per 1000 m² to 8.2 per 1000 m². There was no clear trend in the spatial distribution of *B. undatum* over the survey area (Figure 68) although raised abundances were noted from several sites in the south west.

M. squinado was recorded only at 9 of the 48 sample sites at abundances ranging from 0.1 per 1000 m² to 0.4 per 1000 m² (Figure 69).

2.1.11. 2007 Biological Monitoring Programme

In 2007, repeat drop camera and Hamon grab survey operations will be undertaken in the ECR. The scale of the sampling programme has been determined by Emu Ltd who will undertake the survey works. In discussions with Cefas over the last three months it has been determined that repeat sampling of camera/grab sites will be required on the following basis:

- All reference sites.
- All sites related to dredging areas where activity has taken place in the previous twelve months or is expected to take place before survey period in 2008.
- All context/baseline sites throughout the region.
- Low density sampling of inactive areas.

On this basis the scale of repeat sampling has been determined and the 2007 drop camera/Hamon grab survey will include the majority of sites sampled during the 2005 baseline survey (Figure 70). Some of the sites related to Area 477 will not be sampled in 2007 as no extraction activity will occur in the area prior to summer 2008.

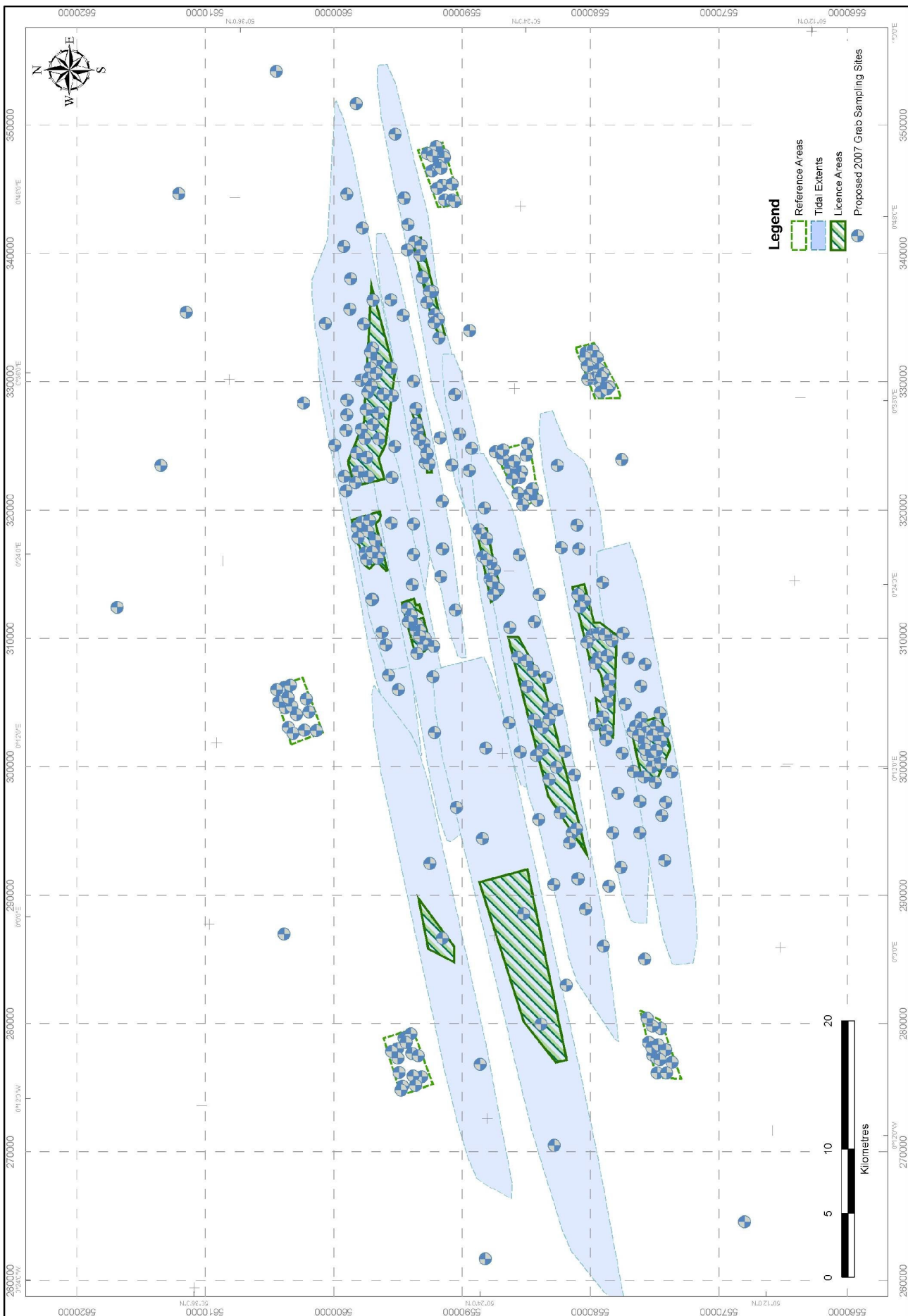
In addition to the drop camera and Hamon grab sampling programme there will also be a full repeat of all 2m and 4m beam trawl survey sites and the scallop dredge survey. The location of these sites can be seen in relevant charts in Blueprint v0.3 and subsequent monitoring reports.



Image: MarineSpace

2. Regional Monitoring Update

Figure 70 Proposed ECR sampling sites for regional Hamon grab/drop camera survey 2007.



2. Regional Monitoring Update

2.2. Collated Data Analysis

2.2.1. Herring Spawning Potential Assessment

RPS have been contracted to undertake the ECR Herring Spawning Potential Assessment. The method by which this will be undertaken is described below.

Stage 1: Develop high-resolution grid showing herring larval densities

One of the first activities to be undertaken would be a discussion/meeting between RPS GIS staff and Emu GIS staff. The purpose of this meeting would be to discuss the type/quality/status of the GIS data currently held by Emu and any data transfer/compatibility issues. Such a meeting will be essential at an early stage of the project in order to deal with this important issue.

Contact will also be made at this stage with a representative of the ICES HAWG to check the availability of herring larval data for the most recent annual survey (Dec 06-Feb 07). If these data are available, they shall be obtained and incorporated into the existing larval data-set.

Once these data have been obtained, the information will be incorporated into the RPS project-specific GIS. A high-resolution grid identical in scale to that used by Mills *et al* (2003) will be developed and overlain over the area covered by the ICES larval data. Densities of herring larvae (size classes 9-10mm and 11-12mm) for 5 year-periods between 1972 to 2006 will be calculated and the varying densities per individual grid square displayed using a colour coding system, again based on that used by Mills *et al* (2003).

The key output of Stage 1 will be a series of charts showing the mean density of herring larvae on the high-resolution grid for 5-year periods between 1972 and 2006. Figures will be produced for 9-10mm and 11-12mm size classes.

Stage 2: Determination of dispersion rate/direction of herring larvae

The following information will be used during stage 2 of the assessment;

- (a) details of hydrodynamic models that exist for the ECR; and
- (b) references describing the growth rates of herring larvae.

Using the references describing growth rate, the time taken for herring larvae to reach certain size classes (9-10mm; 11-12mm) will be determined and assessed against the potential drift of these larvae under prevailing hydrodynamic conditions which exist in this region. It should be noted that confidence in this particular stage of the study will rely heavily on the spatial coverage/quality of the hydrodynamic model for this area.

Stage 3: Analysis of larval densities vs other characteristics

Once larval density plots using the high-resolution grid have been produced, these will be overlain on existing physical data sets provided to RPS. It is expected that the following data will be made available:

- seabed photography;
- swath bathymetry;
- high-resolution sidescan;
- sediment data (from benthic grab surveys);
- sediment data (from specific PSA surveys).

It is proposed that the EU-SEASED database and will be interrogated as part of this project and efforts will be made to contact French geological authorities to determine the existence and status of seabed data for the area south of the Median Line. If such data are available, recommendations will be made within the annual report as to how these data may be used for future assessments. This will aid the assessment of any correlations between herring larval densities and seabed sediment types in the wider region.

2. Regional Monitoring Update

To further assist this stage of the project, fisheries surveillance data collated by the Marine & Fisheries Agency will be obtained and incorporated into the project-specific GIS. It is understood that these data are currently held by Emu Ltd and will therefore be requested during the initial GIS meeting between RPS/Emu (see Stage 1).

Once these data are made available, the data will be screened to identify gear types known to target pre-spawning aggregations of herring, i.e. pelagic trawls, purse seiners.

Once all these data are available within the GIS, assessment of the potential for herring spawning will be undertaken. It is currently proposed that the methodology developed by Gardline in 2002 will be followed, whereby the potential for herring spawning will be correlated with areas satisfying certain physical characteristic criteria, i.e. % gravel and fines in sediment samples.

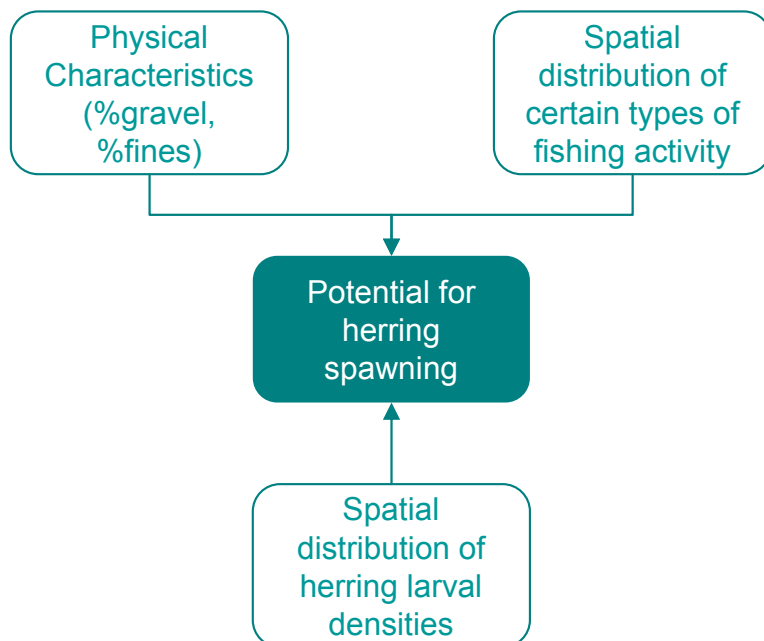
This methodology will be augmented through assessment of the herring larvae data to identify areas where high densities of larvae correspond with areas of suitable physical habitat. Finally, fisheries surveillance data will be used to identify areas where concentrations of pelagic trawling are apparent.

A ranking system, similar to that developed by Gardline, will be used for this project. This system will take account of not only physical characteristics but also the herring larval data and potential fisheries data. For example, an area may be assigned a 'Very High' potential for herring spawning if the following criteria are achieved:

- sediments contain high % of gravel and low % of fines;
- larval densities are high;
- fisheries surveillance data indicate the presence of pelagic trawling activity.

It is proposed that the exact ranking system be developed through discussion with the ECA and CEFAS to ensure that a robust, acceptable system is used.

Figure 71 Overview of data sources to be used in assessment of herring spawning potential in ECR.



A key output of this stage of the project will be a series of GIS-based charts that assign "herring spawning potential" grades at the best available resolution (the exact resolution will rely on the spatial coverage of sediment (PSA) data).

The final element of this stage of the project will be to combine the key outputs from Stages 2 and 3 to make an informed assessment of the interaction between potential spawning areas and hydrodynamic conditions, i.e. drift of larval stages.

With knowledge of the potential drift rates of larvae from original spawning grounds (obtained from Stage 2 work), the correlation between high larval densities and suitable physical habitats will be explored in more detail.

2. Regional Monitoring Update

Stage 4: Reporting

A short update report will be prepared for presentation at the annual ECEN meeting. This report will follow a format suggested by the ECA to ensure consistency with the overall project reporting format.

It is expected that the update report (May/June 2007), will contain the outputs of Stage 1 of the project, i.e. GIS-based figures that show the 1972-2006 herring larval data plotted up on a high-resolution grid, as per Mills *et al* (2003), as well as presenting preliminary findings from Stages 2 and 3.

The final report (due for completion by end of September 2007) will be a fully referenced, illustrated report, with appropriate data sheets contained in Appendices. The report will include guidance on a preferred methodology for future annual herring spawning assessments, plus recommendations as to how the findings of this assessment (and future assessments) may be used to inform dredge management plans. This report will follow the format specified by the ECA.

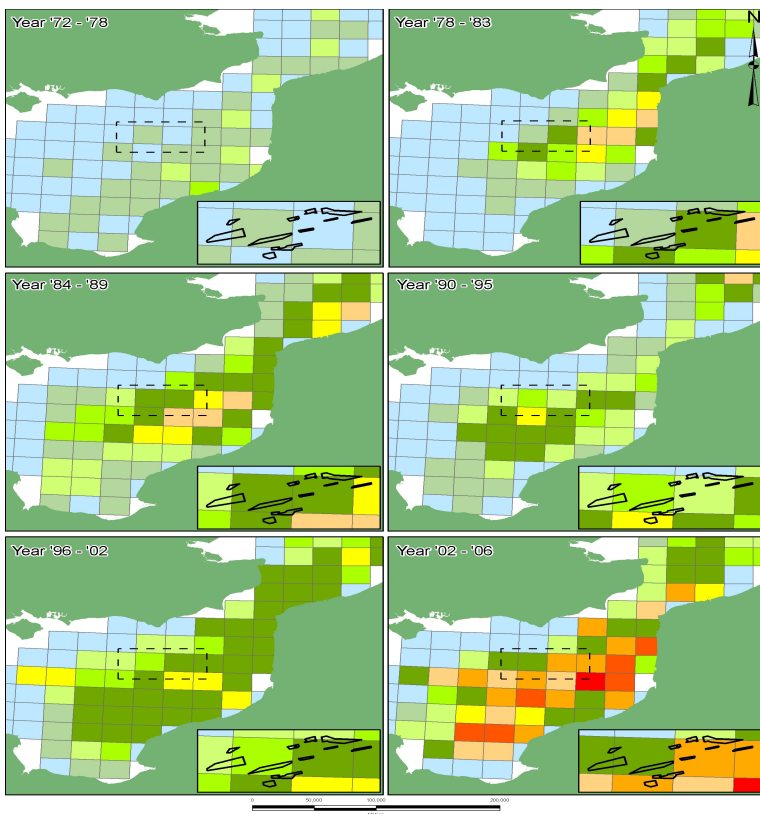
2.2.2. Fishing Activity Reporting

The ECA are committed to collating and reporting fishing activity in the ECR to develop an understanding of the areas within which fishing fleets operate and the seasonality of activity. To this end overflight data are being collated and added to the ECA GIS to allow analysis of interaction between aggregate dredging and fishing activity. In addition to this, members of the fishing industry that are active in the ECR will be approached to supply information regarding the areas within which they operate and the seasonality of their operations.

The results of this fishing activity analysis will be presented in the next annual REMM report that will be published in December 2007.

2.2.3. Archaeological Assessment

Assessments of archaeological potential are undertaken on a licence specific basis by applicants and licencees. The results of archaeological assessments are initially presented with pre-dredge reports for dredging permission areas. A regional overview of archaeological potential and the management mechanisms implemented by licencees will be presented in the next annual REMM report. This will include a review of all archaeological sites identified during pre-dredge assessments and a description of the management mechanisms (eg exclusions zones) that have been implemented to prevent damage to artifacts.



Mean No' Herring Larvae (Size Class 11-12mm) per m²

2. Regional Monitoring Update

2.3. Physical Process Monitoring

2.3.1. Area 473 East Seabed Sediment Survey

The baseline seabed sediment (SBS) survey was undertaken in 2005 and reported in the REMM Report 2005-2006. The proposals for repeat surveys were described in the Blueprint v0.3. It was proposed that repeat surveys would be undertaken on a 6 monthly basis in the first 2 years of extraction activity in Area 473 East. Repeat surveys will replicate the activities undertaken during the baseline survey. Sampling and data acquisition will be undertaken as follows:

- Full coverage sidescan sonar and swath bathymetry (acquired by the licencees and submitted to the regional monitoring programme)
- Drop camera images acquired at 74 sites
- Large volume sediment grabs acquired at 74 sites
- Seabed profile images acquired at 10 sites
- Video trawls along prescribed transects

The timing of surveys is currently being determined. Extraction activity began in Area 473 East in November. Activity to date has been very limited due to operational difficulties caused by the winter weather. Effectively these difficulties have resulted in a 2 month period when no dredging activity has occurred. In view of this it is proposed that the timing of the first repeat survey is delayed to ensure that 6 months of dredging activity has occurred. This is considered acceptable from both an environmental protection standpoint, as only limited impacts will have occurred, and also from a monitoring standpoint, as detection of the very limited impacts of activity to date will be difficult and limit the cost/benefit of a repeat survey after only 6 months since the start of dredging.

Therefore the current proposal for the first repeat survey is for swath and sidescan sonar surveys to be undertaken in May/June, with field sampling to be undertaken as soon as possible after this, and in any event before the end of August 2007. The separation of acoustic survey and field survey will enable review of the geophysical data and allow modification of the sampling regime if required.

Sediment Grab Sampling Methods

In the baseline survey a clamshell grab was employed to acquire seabed samples. It is proposed that a similar method is employed during the repeat survey but modification of the grab will be required to ensure that fine sediment accumulations on the seabed, predicted to be one of the impacts resulting from dredging, are effectively sampled. The advice of the TWG members will be sought when determining the gear that will be employed for seabed sediment sampling during repeat surveys.

Data analysis will be carried out as follows:

- Comparative assessment of sidescan sonar and swath bathymetry to determine natural and dredging related changes in depth and seabed texture
- Comparative assessment of seabed images (drop camera and sediment profile images) to determine natural and dredging related changes in seabed character
- Sieve and laser particle size analysis of sediment samples will be followed by comparative analysis of baseline and repeat samples to quantify natural variation and dredging related changes in sediment character
- Comparative assessment of video trawl data to determine natural and dredging related changes in seabed character

Data Presentation and Reporting

The results of comparative analysis will describe changes detected within the area of the survey in the following ways:

Bathymetric Data

Difference plots will be produced to highlight areas where bathymetry has changed. Any changes detected will be related to the zones within which dredging has occurred through the use of EMS data.

2. Regional Monitoring Update

Sidescan Sonar Data

The comparison of baseline and repeat sidescan sonar data will identify areas of the seabed where significant changes in seabed texture have occurred due to the deposition of fine sediment resulting from the dredging process.

The location of any deposits identified will be related to the zones within which dredging has occurred.

Natural changes in seabed sediment character will also be investigated along with identification of evidence of demersal trawl/dredge fishing activity.

Seabed Image Data

A like for like comparison of seabed images will be carried out. A comparative assessment of seabed character will be presented for each site that qualitatively describes:

- The relative proportion of the principle sediment components (sand/gravel) and differences between baseline and repeat survey data
- Conspicuous epifauna based on the SACFOR scale with abundance and presence/absence differences between baseline and repeat survey data
- Change in the seabed profile due to accumulation of fine sediment

Particle Size Data

Like for like baseline and repeat PSD data will be statistically analysed to identify significant changes in the proportions of sand and gravel. Any changes identified will be related to dredging activity through use of EMS data.

Video Transect Data

Video trawl data will sub-sampled at 100m intervals and like for like comparison of baseline and repeat data will be undertaken to investigate variation in seabed character. If significant changes in seabed character are identified coverage of sub-sample analysis will be extended in the area of the identified change.

Seabed Sediment Survey Report

The data acquisition programme will be reported with specific reference to the REA model of sediment deposition and transport. Any significant differences in the seabed sediment composition, due to accumulations of fine sand, will be identified and related to a version of the REA model that has been modified to account for the location of dredging activity that has occurred in Area 473 East since the baseline survey.

This approach will enable separation of influences due to natural variation in seabed sediment and those due to dredging activity and also allow initial conclusions to be drawn regarding the nature and extent of actual impacts compared with those forecast by the model.

The report will also investigate the nature of any dredging related changes in the context of their significant for biological communities and discuss results in the context of dredging activity in the region as a whole. Estimation of impacts in the ECR due to combined effects of activity at multiple extraction sites will be discussed.



Image: ECA/Emu

2. Regional Monitoring Update

2.3.2. Tracer Study

Introduction

This report has been prepared at the request of the East Channel Association (ECA) to provide a summary of the work undertaken to date on the Eastern English Channel (EEC) Sediment Tracer Study.

The EEC Sediment Tracer Study is a component of the Physical Monitoring Studies which are to be undertaken in the Eastern English Channel as set out in the East Channel Association's Regional Monitoring Blueprint.

Emu Ltd has been contracted by the East Channel Association to undertake the technical component of a Background Study in support of a proposed tracer investigation to be undertaken in the Eastern English Channel. The purpose of the Background Study is to check that no fluorescent material is present at the proposed field site which could interfere with / invalidate the results of a tracer study. Pending the results of the Background Study Emu Ltd has an order to commence manufacture of the tracer material to be used during the tracer investigation.

Summary of Progress to Date

Prior to the end of December 2006, the work undertaken towards completion of the Eastern English Channel (EEC) Sediment Tracer Study can be summarised as shown in Table 12.

On the 16th of January 2007, a meeting between Emu Ltd and the ECA was held. At this meeting a schedule for work to be undertaken towards the Sediment Tracer Study during the year 2007 was proposed by the ECA's Regional Development Manager. The schedule presented is shown in Table 13. Progress on Emu Ltd's part towards meeting this schedule has been good, however, overall progress has been delayed by equipment (vibrocorer) failure and logistical constraints (vessel availability). At the time of writing, the status of tasks scheduled to be undertaken in the first quarter of 2007 can be summarised as follows

Background Study

As already described, progress towards completion of the Background Study has been delayed by failure of the vibrocorer being used for sample collection and limitations in terms of vessel availability. Despite these factors the Background Study is now complete. Collection of all of the planned clamshell grab samples (and 5 additional samples) has been completed. The total number of clamshell grab samples collected was 40. Each sample consisted of two parts: 0 (surface of seabed) to 2 cm depth; and, 2cm depth through to the base of the sample. All of these samples have undergone analysis for the detection of indigenous fluorescent material (the two parts of each sample undergoing analysis separately). The stages involved in the sample analysis can be summarised as follows:

- sample registration;
- drying of the sample;
- weighing of sample;
- wet splitting of the sample (all material >2.8mm and <125µm is removed);
- drying of fraction between 2.88mm and 125µm;
- weighing of fraction between 2.88mm and 125µm;
- sub-sampling of the dried sediment; and,
- UV analysis to detect indigenous fluorescent material.

The results of the analysis undertaken reveal the presence of potentially significant quantities of indigenous fluorescent material (as was the case for the archived vibrocores analysed in October 06). The averaged results for all 40 samples are shown in Figure 72.

2. Regional Monitoring Update

The presence of such fluorescent material is potentially problematic as it could corrupt the results of the proposed study. However, Emu Ltd's particle detection and counting system has the capability to distinguish between different shades of colour and different particle sizes. The ability of the system to reliably differentiate between the indigenous fluorescent sediment and the tracer is currently being thoroughly tested.

Collection of the remaining Background Study samples (15 vibrocores, each ~1m in length) is currently underway and should be completed within the next 24hrs if the work goes to plan. The samples will then be shipped to Emu Ltd's laboratory for analysis (expected to take 2-3 weeks depending upon content of the samples).

Schedule for Ongoing & Future Work

Assuming that the issues surrounding the presence of indigenous fluorescence can be resolved, the anticipated schedule for the remainder of 2007 is shown in Table 15.

This schedule is based upon standard timescales for particular tasks such as tracer manufacture (these are the timescales originally submitted to the ECA in June 06). Emu Ltd is aware that the ECA has a deadline for reporting the outcome of the tracer study, this is understood to be September 07. In view of this deadline, there is an option for Emu Ltd to devote more resources to the project in order to reduce some of the timescales presented above. Options to reduce timescales in this way have not been considered in detail, however, it may be possible to complete tracer manufacture in August, with the result that field operations are undertaken in August and September.

Table 12 Tracer study tasks completed 2006.

Description of Task	Status	Comments
Design guidance relating to sediment tracer studies issued to the ECA.	Completed September 04.	
Writing of scope of work for inclusion within the Regional Monitoring Blueprint.	Completed January 05.	
Meeting with CEFAS in Lowestoft to discuss scope of work.	Completed January 05.	Agreement from CEFAS (P. Larcombe) that the Tracer Study component of the Blueprint is not well suited to having hypotheses and hypothesis testing. Recommendation to ECA from Emu Ltd and acceptance from CEFAS that hypotheses should be removed from tracer study component.
The quantity of tracer required to undertake the study was estimated and the calculations undertaken were submitted to CEFAS for review.	Completed June 05.	
At the request of the ECA a proposal was prepared for the manufacture of the tracer.	Completed December 05.	
Submission of status report setting out approximate costs for a range of different project scopes.	Completed January 06.	Discussion of the document within the ECA led to adoption of a reduced scope of work.
At the request of the ECA, a proposal was drawn-up and submitted for the technical component of the Background Study and for the tracer manufacture.	Completed June 06.	
Submission of draft project schedule to ECA.	Completed July 06.	
Completion of SOP for clamshell grabbing as part of the Background Study.	Completed September 06.	
Analysis of the ECA's archived vibrocores and submission of results.	Completed October 06.	Significant numbers of fluorescent particles and fluorescent fibres were found in the samples, sufficient to yield erroneous results in the case of a standard tracer study. Option of undertaking further analysis of the cores was raised with the ECA. Presence of the fluorescence reinforced the decision to collect further sediment samples from the proposed study site.
Meeting of the EEC Physical Studies Group (HR Wallingford and Emu Ltd) and representatives from the NOC.	Completed October 06.	Agreement that monitoring of wave and current conditions during the tracer study and plume study is necessary. This view was conveyed to ECA who stated that such monitoring would be undertaken.
Rationale for the Background Study sampling design submitted to the ECA for approval.	Completed November 06.	
Following approval from the ECA, the SOP for clamshell grabbing as part of the Background Study and the rationale for the sampling design to be used for the background study were submitted to CEFAS.	Completed November 06.	
Draft letter for consultees, giving preliminary notification of the planned Background Study was submitted to the ECA for approval.	Completed November 06.	
Submission of letter to consultees providing preliminary notification of the planned Background Study.	Completed November 06.	

2. Regional Monitoring Update

Table 13 Tracer study tasks required in 2007

Month	Quarter	Tasks
January	1 st	<ul style="list-style-type: none"> • Submission to CEFAS of SOP and Background Study sampling design • Finalise plan for acquisition of Background Study samples • Determine best / most likely period for field operations (earliest 07 for Background Study and July / August for main event)
February		<ul style="list-style-type: none"> • Background Study field operations if weather permits • Sample analysis when survey completed
March		<ul style="list-style-type: none"> • Background Study field operations if weather permits • Sample analysis when survey completed • Tracer manufacture begins as soon as results permit
April	2 nd	<ul style="list-style-type: none"> • Tracer manufacture ongoing • Main sampling array design and submission to CEFAS
May		<ul style="list-style-type: none"> • Tracer manufacture ongoing • Main sampling array design and submission to CEFAS
June		<ul style="list-style-type: none"> • Tracer manufacture ongoing • Main sampling array revision if required
July	3 rd	<ul style="list-style-type: none"> • Field operations and sample analysis
August		<ul style="list-style-type: none"> • Field operations and sample analysis
September		<ul style="list-style-type: none"> • Data interpretation and reporting to main REMM report
October	4 th	<ul style="list-style-type: none"> • Data interpretation and reporting to main REMM report
November		<ul style="list-style-type: none"> • Input to REMM and modification of ongoing survey plans / data interpretation
December		<ul style="list-style-type: none"> • Input to REMM and modification of ongoing survey plans / data interpretation

Table 14 Progress towards completion of tracer study tasks.

Tasks Completed	Ongoing Tasks	Tasks Outstanding
Submission to CEFAS of SOP and Background Study sampling design Finalise plan for acquisition of Background Study samples Determine best / most likely period for field operations	Background Study field operations if weather permits Sample analysis when survey completed	Tracer manufacture begins as soon as results permit

2. Regional Monitoring Update

Figure 72 Preliminary results of analysis of tracer background fluorescence study.

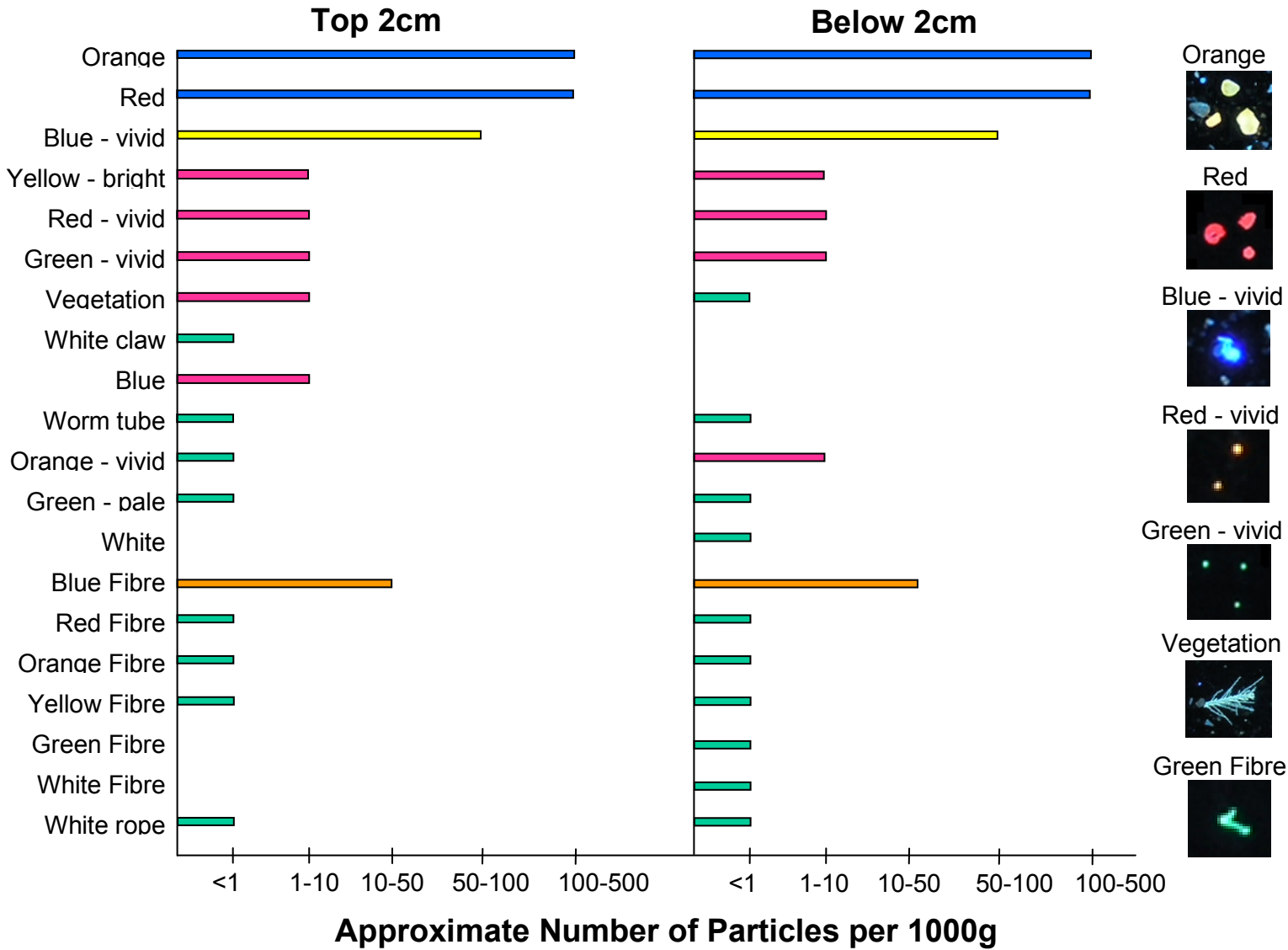


Table 15 Programme for continuation of ECR tracer study during 2007.

Task	Month									
	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	
Background Study field operations if not completed in March	█									
Sample analysis when Background Study field operations completed	█	█								
Tracer manufacture		█	█	█	█	█	█	█	█	
Main sampling array design and submission to CEFAS			█							
Main sampling array revision if required				█						
Field operations and sample analysis									█	█

2. Regional Monitoring Update

2.3.3. Plume Monitoring

Introduction

It is understood that future aggregate dredging in Area 473 East will comprise contractors winning both all-in and screened loads. Although screening has not yet been undertaken there may be the requirement to do so in the future, therefore the ECA considers that it is important that the impacts of this should be monitored and reported for future reference. Therefore, in order to provide the information required for the proposed subsequent numerical modelling it is recommended that two dredged loads are monitored. The loads will be representative of normal dredging activities undertaken in the Eastern English Channel, one screened and one all-in. Monitoring of these two loads will include on-board measurement and sampling of the overflow and survey vessel measurements of the (dynamic) near and (passive) far-field sediment plumes. The cargoes collected will also be sampled from quayside during the unloading operation.

A third special “one off” load to measure the physical properties of the screened material by reversing the screening towers will also be collected from Area 473 East and sampled from quayside during the unloading operation.

Site hydrodynamics

In order that the results of the plume dispersion measurements be put into context, it is essential that the hydrodynamic conditions that exist at the site are measured for the duration of the monitoring exercises at two locations, one at each end of the proposed dredging area within Area 473 East. Measurements of water elevation and wave height, period and direction would also be of benefit to the study.

Timescale of Measurements

The target window for carrying out the plume measurements is 23 to 25 June 2007 with a spare day on 27 June for additional measurements if required. It is preferred by the ECA that the measurements be undertaken during flood neap tides. Dredging during flood tides is preferable to the ECA as any generated sediment plumes will be carried over an area already designated as “area of secondary impact”. Monitoring during neap tides is preferable as this is considered to be the “worst case” scenario (in terms of suspended sediment concentrations) as current speeds are lower which will result in a slower dispersion of the plumes.

As the collection of the reversed screen load does not require any involvement by the survey vessels this can be treated as a separate activity to be carried out within a few days of the plume measurements at a time convenient to the ECA and HR Wallingford.

For continuity, it is essential for all measurements that the dredger(s) are working the same area of seabed. For the purposes of scheduling the measurements that require the use of survey vessels it has been assumed that the turnaround time for target dredger working out of the River Thames is between 30 and 36 hours and that no measurements are to be made outside of daylight hours.

Due to the long turnaround time of the target dredger there will be opportunities for the two survey vessels to make further plume measurements around comparable dredgers. These vessels will not be equipped for on-board sampling so no information about the source term for these loads will be collected. These additional plume measurements will be useful in providing further information towards the understanding of the way in which the plume material disperses and makes the transition from the dynamic to passive plume phases.

2. Regional Monitoring Update

Choice of “target vessel”

The aggregate dredgers operated by the six members of the ECA vary in size and to a certain degree, mode of operation. For the purpose of the plume monitoring study it is very important that the “target vessel” selected for the plume monitoring measurements is typical of those that will most frequently be working in the ECR areas. For this reason, it has been agreed that one of the four Hanson A-Class dredgers will be used as the target vessel.

Loading and setting up the water sampling equipment aboard the target vessel will be time consuming. To minimise operational delays it is proposed to rig the sampling equipment aboard the Arco Arun whilst she is in dry dock for re-fit on Teeside. The re-fit is due to be completed about one week prior to the programmed start of the plume measurements.

Database of Load Variability

In order to determine how representative the measured cargoes are it will be necessary to build up a database of variability of a number of loads (say fifty) collected prior to and after the plume measurements being undertaken. It is suggested that ten all-in loads and ten screened cargoes are sampled prior to the field measurements and ten afterwards. For the reversed screen cargoes, it is suggested that ten loads are sampled, five before and five after collection of the observed load. The cargo samples will be analysed for particle size distribution.

For each of the database loads it is essential that detailed dredging records be provided. This information will include, amongst other things, information from on-board EMS system and track plot and times, draghead depths and bed depths and information from on-board meters (pump discharge, vessel displacement etc.). Data concerning the principle dimensions of the dredger and hopper, draghead and suction pipe screen mesh will also be provided along with weather records/logs.

Screening Losses

The scientific interest surrounding screening from an impact point of view is currently greater than that associated with the overflow (for aggregate dredging) but the practical problems of screening measurement are even more severe than those of the overflow because of the greater discharges associated with screening. It has been agreed that monitoring the screening losses will be undertaken by reversing the screening towers (reversed screening) such that the normally rejected material would be collected in the hopper. A full cargo of screened material will be collected and sampled from the quayside during the unloading operation.

The total mass of screened material in the hopper at the end of loading will be determined from measurements of the ship’s displacement before and after dredging.

The measurement of screening losses will not require survey vessels to be in attendance.

Overflow Losses

There will be a requirement to determine from representative sampling the overflow spillway discharge over the period of loading for both the screened and all-in cargoes. A-Class aggregate dredgers have two overflow spillways on each side of the ship, two at the forward end and two at the aft end of the hopper. Due to the way in which loading of the hopper is undertaken discharge through the forward overflows does not take place until the last quarter of the dredging cycle, by which time the overflow will contain a large proportion of coarse material. For this reason, samples will be collected from adjacent to the two overflows at the stern of the hopper only.

2. Regional Monitoring Update

Water samples will be collected by pumping from the hopper, adjacent to the overflow openings, via long pipelines. It is proposed that two 3" diesel powered pumps are used for this purpose. In order to increase the flow velocity in the long suction pipelines, thereby reducing the likelihood of material settling out and accumulating, the pipe diameter will be reduced to 2". This pumping system will be laboratory trialled at HR Wallingford prior to the field measurements being undertaken. (Note that it was originally proposed that the trials would be undertaken on board a representative vessel).

Sufficiently large volume samples (to be no more than 20 Litres to comply with Safe Manual Handling regulations) will be collected. The sample collection method will be determined during the laboratory trials. The overflow samples will be analysed for particle size distribution.

HR Wallingford has designed and manufactured steel frames that attach to the hopper coaming to support the suction hoses. The suitability of these frames was confirmed during a visit to the Hanson A-Class dredger Arco Adur at Southampton on 21 March 2007.

In addition to pumped sampling from the hopper HR Wallingford is currently investigating the possibility of utilising an in-line turbidity meter, that would be installed within a section of the suction hose, to provide a time-series of estimated overflow concentration.

Dynamic Plume

Both the source term (shape and concentration) of the passive plume resulting from loss of fine sediment in the overflow and the footprint (area and thickness) of screened material on the bed are a function of the dynamic plume processes that occur when sediment water mixtures are discharged from the dredger.

The discharge of both overflow and screened material onto the water surface (as opposed to discharge through the dredger hull) will however reduce the significance of the dynamic phase. In this case, significant mixing will occur on impact and moreover, the ship-side spill of overflow through a number of discharge points means that the overflow plume will be more mixed and diffuse (compared to that through a central hull spillway). If the (weak) dynamic plume does not move downwards sufficiently rapidly the propeller wake will impact on the dynamic plume mixing it rapidly through the upper part of the water column.

It is of key interest as to whether the overflow plume and/or the screening plume form a dynamic plume which escapes the propeller wake and whether these plumes are distinct or blend into one another.

Two methods exist to examine the fate of the dynamic plume. Each supplies different, but complementing, information about the plume.

The first method to monitor the development of the dynamic plume is to direct a scanning sidescan sonar or multibeam echo sounder sidewise at the plume as a survey vessel sails alongside the dredger. This produces sonar imagery of the dynamic plume from which the (lower and near) longitudinal edges of the dynamic plume can be defined.

As this is a non-standard application of these instruments, this imaging technique will be thoroughly practiced in the field in advance of undertaking the plume monitoring measurements in order that it can be confirmed that this is a suitable method to apply for plume detection. This activity will also provide an opportunity for the surveyor to determine the optimum instrument configuration such that he can be confident in obtaining high quality data during the course of the programmed plume measurements (the value of monitoring around other dredgers working on the ECA during the monitoring period is clearly demonstrated).

2. Regional Monitoring Update

The second method is for the survey vessel, equipped with a vessel-mounted Acoustic Doppler Current Profiler (ADCP), to sail a line immediately across the stern of the trailer through the generated plume as the dredger passes. The measured ADCP backscatter will enable an estimate of the orthogonal width of the dynamic plume passing under the sensor to be made. It is not intended to attempt to calibrate the ADCP backscatter signals with particular suspended solids concentrations.

By combining the longitudinal plume dimensions determined from the sonar imagery and the orthogonal dimensions determined from the ADCP backscatter an estimate of the near-field plume volume can be made, allowing the path and rate of dilution mixing of the dynamic plume to be deduced.

Passive Plume

For these measurements a second survey vessel will use a vessel-mounted ADCP to make orthogonal transects (perpendicular to the plume axis) of the passive plume at set distances downstream of the “start point”. To ensure that the ADCP transects always pass through the same parcel of water a drogued float will be deployed at the start point, just downstream of the dredger.

It is anticipated that it should be possible to track the plume for two hours from the start point assuming that the tidal stream direction does not change during this period. If time permits the survey vessel will then “catch up” with the dredger prior to commencing a further plume tracking exercise. If the definition of the plume is lost to the background backscatter intensity within the two-hour period the plume tracking will stop and a new plume will be tracked.

These measurements will require the collection of supporting through-depth water samples in combination with use of optical turbidity sensors for calibration of the ADCP backscatter output for particular solids concentration. The water samples will be analysed for total suspended solids concentration. Plume concentration estimates will be derived through post-processing of the recorded and water sample data using the backscatter calibration software suite SEDIVIEW. Analysis of the measured and post-processed data will provide a time series of the plume status and a determination of the dispersion and settlement rate of the plume material.

Health and Safety

HR Wallingford and ECA representatives met at Southampton on 21 March 2007 to discuss the proposed study and in particular the associated Health and Safety issues.

The main area of concern was the adherence to HSE regulations pertaining to Manual Handling of water samples and the safe storage of potentially heavy sample containers. HR Wallingford is currently investigating the possibility of utilising an in-line turbidity meter, that would be installed within a section of the suction hose, to provide a time-series of estimated overflow concentration. This may reduce the number (and volume) of water samples that are required to be collected.



2. Regional Monitoring Update

2.3.4. 2007 Physical Monitoring Programme

Seabed Sediment Survey

There will be a full repeat of the baseline seabed sediment survey activity at Area 473 East in the following 4-6 months. This will consist of swath and sidescan sonar surveys and seabed investigation/sampling using SPI camera, drop camera, video sledge and clamshell grab.

The exact timing of the surveys is currently being determined in an attempt to combine survey effort with other aspects of regional and licence specific monitoring.

Plume Monitoring

As per the information presented in HR Wallingford's proposal, plume monitoring activity will take place in the next 2-3 months. This activity will include ship board monitoring of screening and overspill discharge and also monitoring of the plume in the water column.

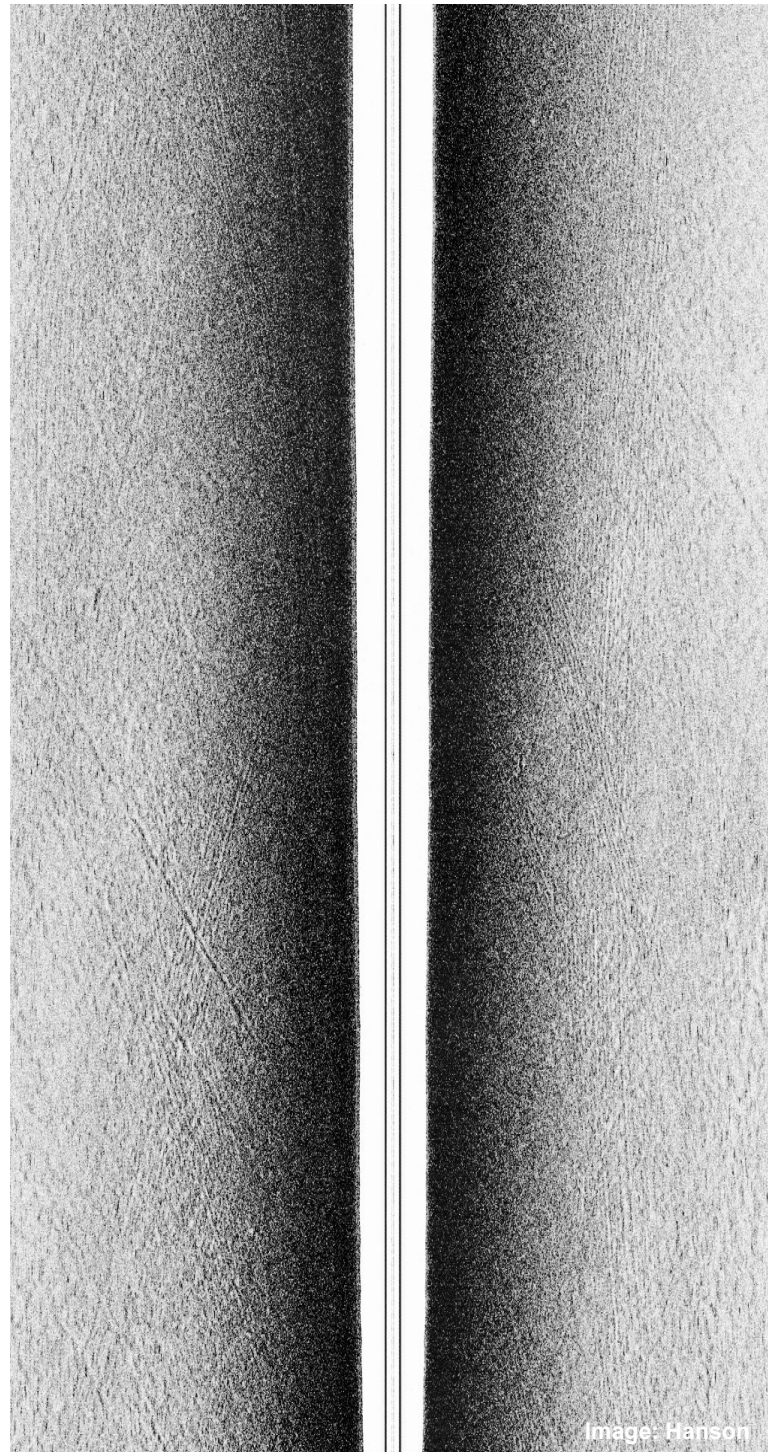
Tracer Monitoring

At present the timing of the tracer monitoring programme is dependant on the results of the background fluorescence study. Sampling undertaken during the background study was completed on the 29th March 2007 and following analysis of samples tracer manufacture will begin. The length of time needed for tracer manufacture will dictate the exact timing of the tracer injection and sampling programme.

Another consideration for the timing of the tracer study is the level of dredging activity that will have occurred at Area 473 East prior to the tracer injection activity. The purpose of the tracer study is to monitor the transport of fine sediment at the seabed. For this to be of value in determining the fate of dredging derived fine sediment there must be an accumulation of fine sediment on the seabed as a result of dredging.

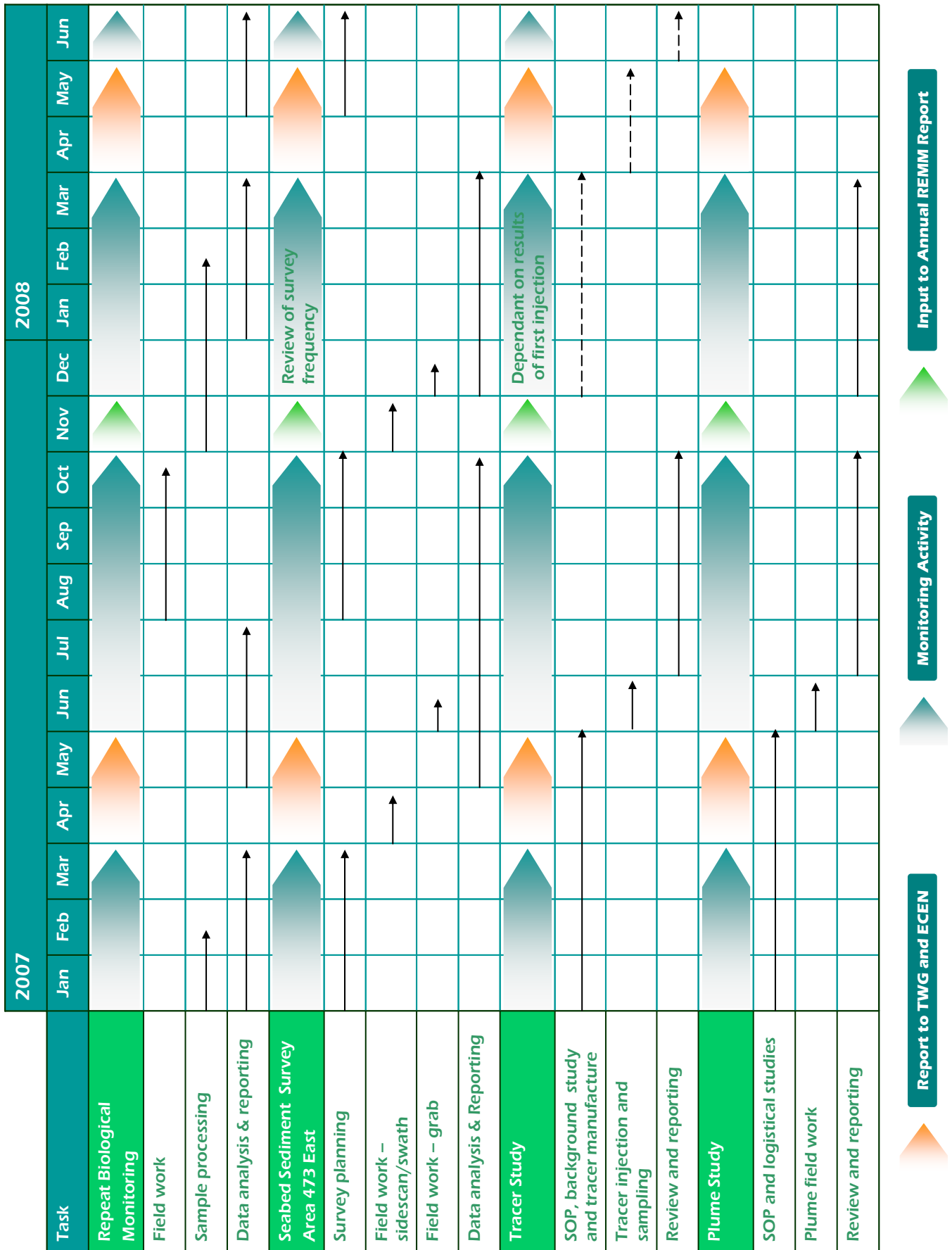
At present, due to the limited level of activity in Area 473 East it is possible that a delay in the tracer injection programme may be required to ensure that fine sediment exists on the seabed.

The development of fine sediment deposits on the seabed will be investigated during the repeat seabed sediment survey during summer 2007 and the results of this investigation will be used to inform the timing of the tracer injection programme.



2. Regional Monitoring Update

Outline project plan presented in the REMM 2005-2006. Some modification of the timing of activities (notably the tracer study) may be required due to the limited dredging activity that has occurred in Area 473 East. This will be discussed at the 2007 TWG meeting.



3. Regional Management Update

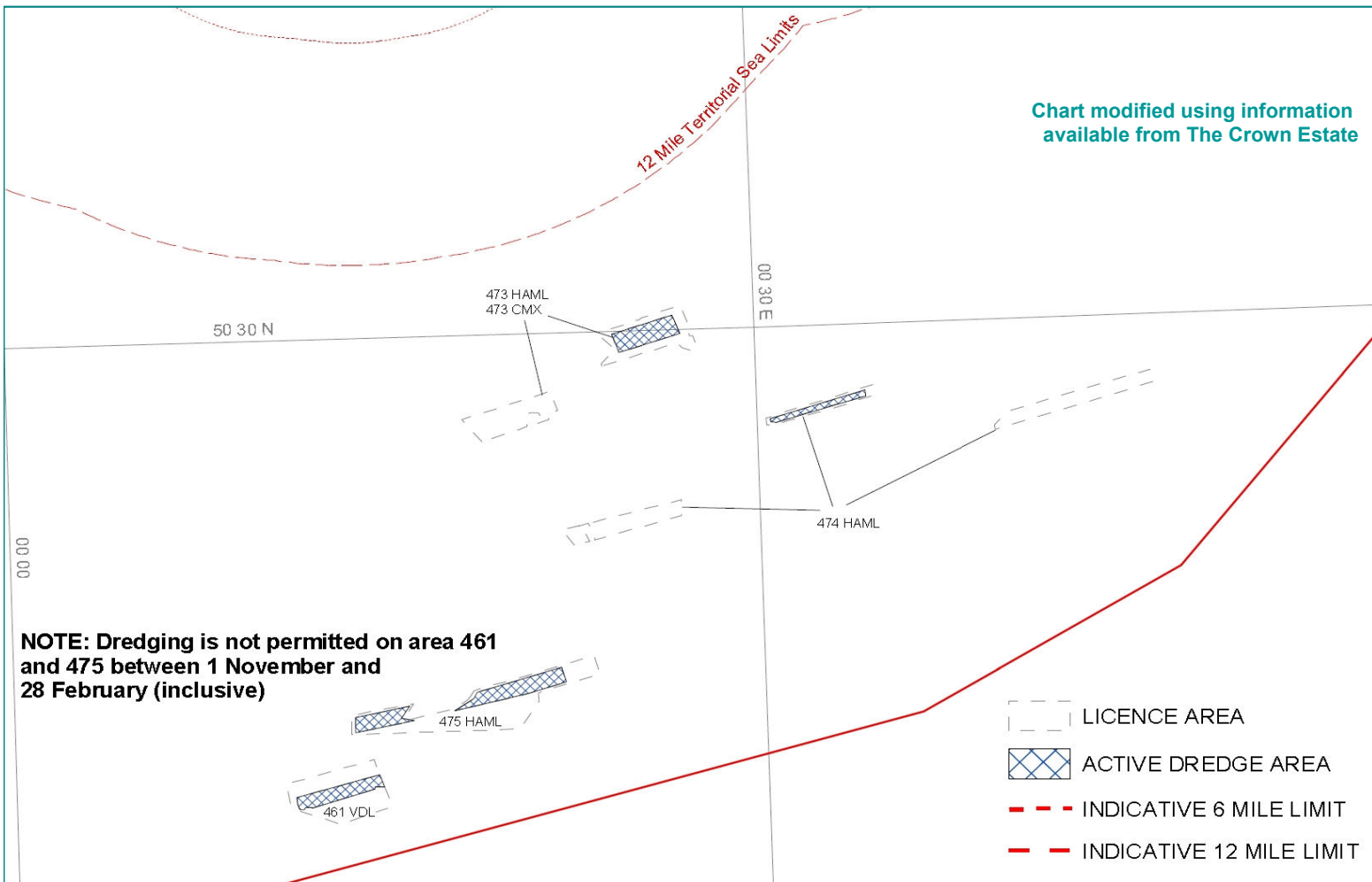
3.1. Active Licence Areas

At present there are 4 active areas within the ECR – Areas 461, 475, 473 East and 474 Central. These areas are shown on the chart below (Figure 73, The Crown Estate, 2007). At the time of writing, dredging activity has taken place in 3 of these areas. Dredging activity is described in more detail later in the report. There are also three other dredging permission marked on the chart below that have received positive Government Views – Areas 473 West, Area 474 West and Area 474 East. The licencees are currently collating pre-dredge report information for these areas which, once submitted, will enable activity to begin on these areas. Initial active dredge zones for these areas will be agreed as part of the pre-dredge report programme.

3.2. Operational Licence Activity

Currently, Areas 461, 473, 474 and 475 have received positive Government View decisions and fulfilled pre-dredge reporting requirements. Active areas are presented in Figure 72. Dredging activity has been initiated in Areas 461, 473 East, 474 Central and, most recently, 475. A plot of EMS data describing activity between September 2006 and February 2007 is presented below (Figure 74). No activity occurred within this period in Area 475 but activity is planned for March 2007.

Figure 73 Current Active Dredge Areas in the East Channel Region (source: The Crown Estate, 2007).



3. Regional Management Update

Dredging intensity is displayed in the plot of activity. Intensity is described in terms of the amount of time dredging has occurred within 50m x 50m cells. The plots of activity clearly show the restriction of activity to lanes within active dredging areas.

The total area of dredging in the region, up to and including February 2007 is approximately 2.39km² (Table 16). Within the areas where dredging is permitted, 40% of the seabed as been directly influenced by dredging activity. Assuming that the ECR covers 1132km² (REA, 2003) the activity to date has directly influenced 0.002% of the region.

Figure 74 Area of impact of dredging in the East Channel Region, September 2006 – February 2007 (source: EMS data collated by the Crown Estate, 2007)

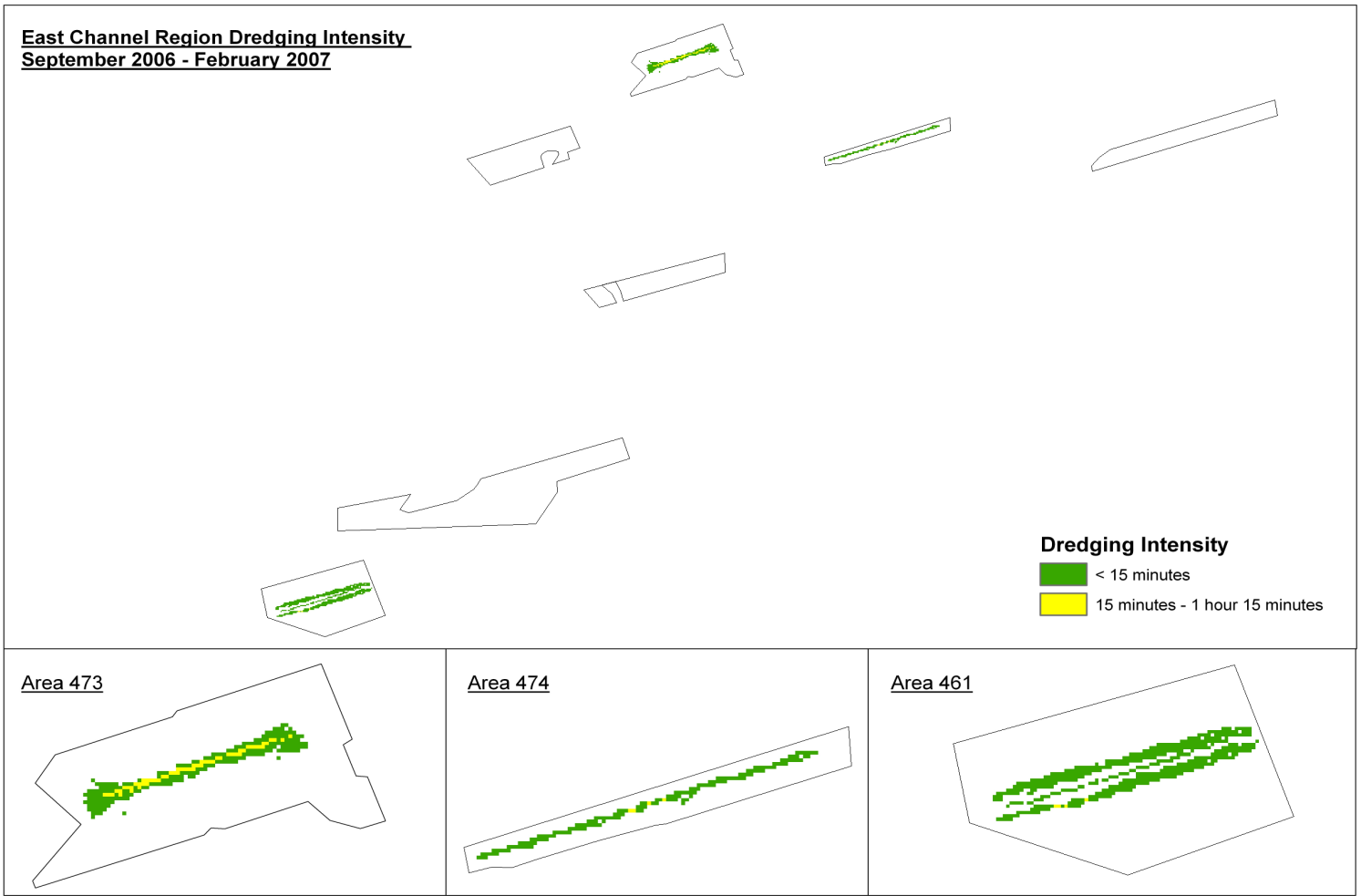


Table 16 Area of impact of dredging in the East Channel Region, September 2006 – February 2007 (source: EMS data collated by the Crown Estate, 2007)

	50m x 50m cells	Low Intensity	Medium Intensity	Total Area (km ²)	Low Intensity Area (km ²)	Medium Intensity Area (km ²)	Permission Area (km ²)	Area of Impact as %age of Permission Area	Area of Low Intensity Impact as %age of Permission Area	Area of Medium Intensity Impact as %age of Permission Area
461	523	519	4	1.31	1.30	0.01	8.90	14.69	14.58	0.11
473 East	273	217	56	0.68	0.54	0.14	6.90	9.89	7.86	2.03
474 Central	158	154	4	0.40	0.39	0.01	2.60	15.19	14.81	0.38
Regional Totals	954	890	64	2.39	2.23	0.16	18.40	39.77	37.25	2.53

3. Regional Management Update

3.3. Application Progress

Areas 464/458

A positive Government View has been issued by The Department for Communities and Local Government for Area 464/458. The licencees, CEMEX UK Marine Ltd and United Marine Aggregates Ltd are currently collating their pre-dredge report information as per the conditions of the GV decision.

Following provision of the pre-dredge report information, agreement of initial active dredge zones, and issue of a commercial licence by The Crown Estate, it is likely that activities will begin in the Area 464/458 later in 2007.

Area 478

The application for Area 478 is currently at the decision stage of the Interim Government View Procedure. A decision regarding the application is expected later in 2007.

Area 477

The application for Area 477 is currently at the assessment stage of the Interim Government View Procedure. The applicants, Britannia Aggregates Ltd, will be undertaking further resource evaluation work this summer. ERM have been appointed as the applicant's consultants and they will begin the EIA process later in the year. Emu Ltd will undertake a suitable level of biological monitoring during regional monitoring activities in 2007 in order to inform the EIA process for Area 477.

Other Areas

Area 479

Area 479 is no longer being progressed and as such will not be included in future reports related to activity in the ECR

EEC 5 South

This area was described in the REA but has not been progressed since prospecting.

3.4. Fishing Liaison

The companies of the ECA operate under the requirements of the ECR Fishing Liaison Protocol (FLP). The FLP is presented in full in the REMM 2005-2006. Fishing liaison is an ongoing process with regular updates being sent to FL contacts describing regional dredging activity and active dredge zones.

The ECA Regional Development Manager currently undertakes the role of FL Officer (FLO). It is proposed that an alternative FLO is appointed in due course. It is likely that the alternative FLO will be appointed later in 2007. It is suggested that fishing industry organisations and representatives determine their future requirements for fishing liaison for discussion during the ECEN meeting in 2007.



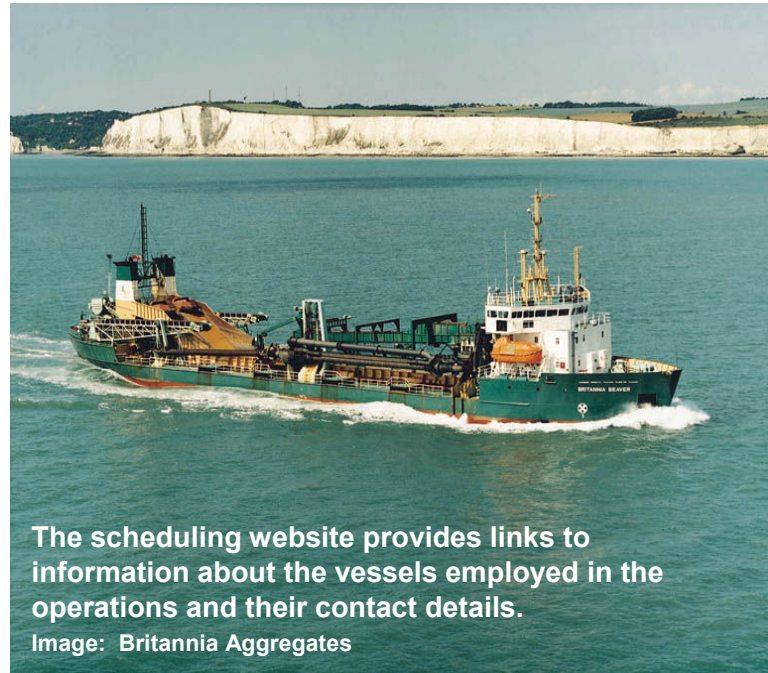
Image: MarineSpace

3. Regional Management Update

3.5. Navigation Liaison

Navigation liaison is ongoing through use of the ECA scheduling website that is accessed through the website at www.ecascheduler.eu. Access is open to authorised users only at present. The site allows ECA companies who have permission to operate in the ECR to post details of forthcoming activities. This information can then be viewed by the Maritime and Coastguard Agency and the CNIS at Dover to ensure they are aware of dredger movements.

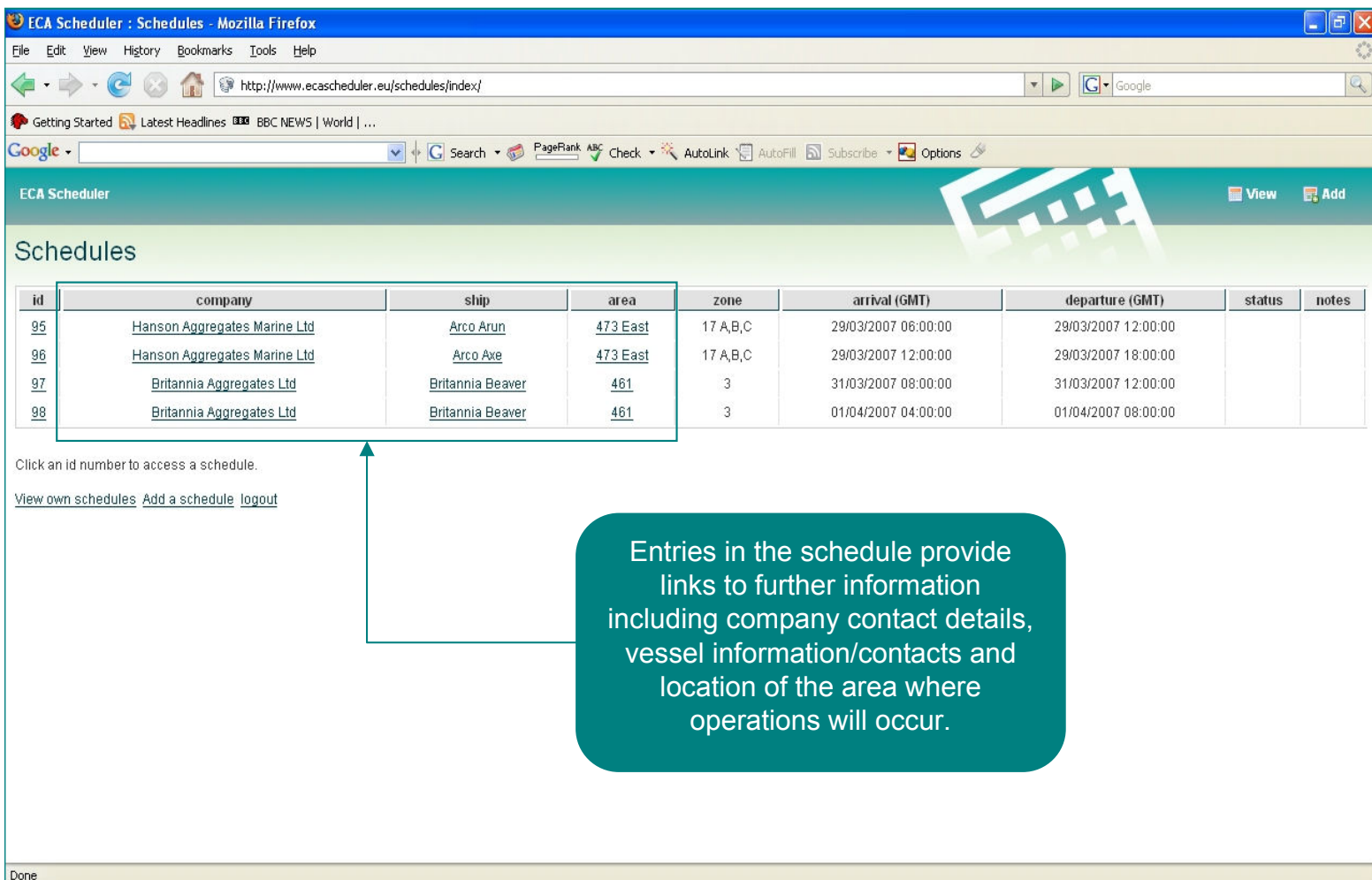
In the example shown below, Hanson Aggregates Marine Ltd and Britannia Aggregates have posted information related to operations in Areas 473 East and 461 to be carried out by the Arco Arun, Arco Axe and Britannia Beaver. Estimated date and time of arrival are posted along with the zone within which operations will occur. Update of the information is possible if cargos are cancelled due to operational or weather restrictions.



The scheduling website provides links to information about the vessels employed in the operations and their contact details.

Image: Britannia Aggregates

Users of the scheduling website are invited to provide comments to the ECA to describe their experience of using the facility and to present ideas for modification to improve its value.



Click an id number to access a schedule.

[View own schedules](#) [Add a schedule](#) [logout](#)

id	company	ship	area	zone	arrival (GMT)	departure (GMT)	status	notes
95	Hanson Aggregates Marine Ltd	Arco Arun	473 East	17 A,B,C	29/03/2007 06:00:00	29/03/2007 12:00:00		
96	Hanson Aggregates Marine Ltd	Arco Axe	473 East	17 A,B,C	29/03/2007 12:00:00	29/03/2007 18:00:00		
97	Britannia Aggregates Ltd	Britannia Beaver	461	3	31/03/2007 08:00:00	31/03/2007 12:00:00		
98	Britannia Aggregates Ltd	Britannia Beaver	461	3	01/04/2007 04:00:00	01/04/2007 08:00:00		

Entries in the schedule provide links to further information including company contact details, vessel information/contacts and location of the area where operations will occur.

3. Regional Management Update

3.6. The ECR Biodiversity Action Plan (BAP)

An updated set of ECR BAP objectives, actions and targets were presented in the REMM 2005-2006. These are presented below. A summary of progress towards these targets is presented below in Table 17.

Activity toward completion of the actions for 2007 is ongoing for some of the objectives. Completion of some of the actions has been achieved.

Review of the objectives of the ECR BAP will be undertaken prior to completion of the next annual REMM report.

Objective 1

Continue to develop an understanding of the baseline data acquired to improve the habitat description for the region and determine suitable comparative measures to inform assessment of aggregate extraction impact.

Action	Target
Completion of epifaunal analysis and integration with baseline data set.	Completion by March 2007
Determination of suitable comparative measures for habitat monitoring.	Completion by March 2007

Objective 2

Maintain ECR specific Habitat and Species Action Plans, in support of relevant UKBAP plans, and report and review annually the status of habitats and species in the ECR.

Action	Target
Annual review of habitat and species status in the region and necessary modification of HAP and SAP documentation.	Completion by March 2007

Objective 3

Initiate, maintain and improve working practices and reporting to account for the requirements of the UKBAP, Habitats Directive and marine nature conservation in general. Seek to develop links with groups undertaking similar monitoring survey work in the region for information exchange and collaboration where appropriate.

Action	Target
Develop links with ALSF and MESH programmes to integrate ECR and wider regional data sets.	Ongoing to August 2007

Objective 4

Work to improve understanding of the specific biotopes that exist in the ECR and increase understanding of the nature and extent of expanded MNCR biotope classifications. Where necessary initiate dredging management practices that seek to preserve rare or unusual areas.

Action	Target
Initiate and maintain dialogue with key conservation stakeholders to ensure that biotope descriptions used in the ECR are relevant to national classification systems.	Ongoing until August 2007

3. Regional Management Update

Objective 5

Identify areas where no impact from dredging will occur and monitor to assess health of such representative areas. Monitor the health of species identified during baseline benthic monitoring surveys in areas surrounding licence areas where secondary impacts may occur. Monitor the effect of extraction on species identified during baseline benthic monitoring surveys within the licence areas.

Action	Target
Complete analysis of 2006 repeat survey data to develop understanding of the natural variability in seabed composition and associated faunal communities.	Completion by March 2007

Objective 6

Provide a comparison of baseline description of habitat with habitat status at cessation of dredging.

Action	Target
Initiate dredging activity reporting in concert with regional environmental monitoring to inform descriptions of habitat change to the point of cessation.	Ongoing to August 2007

Objective 7

Monitor the recovery of biotopes and associated species within licence areas following cessation of extraction activities.

Action	Target
Continue to develop understanding of the distribution of regionally characteristic biotopes and species to assist in determination of recovery towards pre-dredge status.	Ongoing to August 2007

Objective 8

Provide environmental data to stakeholders, wider public and regional management frameworks for review and comment. Raise awareness of the characteristic habitats and species of the ECR, their status and the nature of threats to their health.

Action	Target
Continue to develop the ECA website and GIS as tools for provision of information to stakeholders.	Ongoing to August 2007
Review of terms of reference and timings for TWG and ECEN meetings to ensure best use of meeting time and output value.	

3. Regional Management Update

Table 17 Activity towards completion of the actions specified in the revised ECR BAP as presented in the 2005-2006 REMM report (yellow denotes ongoing activity, green denotes completed activity).

Objective	Action	Status
1	Completion of epifaunal analysis and integration with baseline data set. Determination of suitable comparative measures for habitat monitoring.	Due to logistical constraints of analysis, strategy currently is to complete epifaunal analysis on an as-needed basis for pre-dredge reports. Comparative measures for habitat monitoring to be achieved through like for like comparison of seabed sediment characteristics, biotopes and regional faunal communities.
2	Annual review of habitat and species status in the region and necessary modification of HAP and SAP documentation.	Review of HAP and SAP documents completed. No modification required at present. Review, and modification if required, to be undertaken prior to 2006-2007 REMM report.
3	Develop links with ALSF and MESH programmes to integrate ECR and wider regional data sets.	Presentation given at MESH conference and RDM attended ALSF EECHM steering group meeting. Consideration of integration of data ongoing.
4	Initiate and maintain dialogue with key conservation stakeholders to ensure that biotope descriptions used in the ECR are relevant to national classification systems.	Ongoing.
5	Complete analysis of 2006 repeat survey data to develop understanding of the natural variability in seabed composition and associated faunal communities.	Analysis of repeat samples surveys completed March 2007. Comparative analysis of baseline (2005) and repeat (2006) data to be undertaken in 2007 and reported in REMM 2006-2007.
6	Initiate dredging activity reporting in concert with regional environmental monitoring to inform descriptions of habitat change to the point of cessation.	Dredging activity reporting initiated. Activity for September 2006 to February 2007 reported in IREMM. Activity reporting to continue through to REMM 2006-2007.
7	Continue to develop understanding of the distribution of regionally characteristic biotopes and species to assist in determination of recovery towards pre-dredge status.	Ongoing.
8	Continue to develop the ECA website and GIS as tools for provision of information to stakeholders. Review of terms of reference and timings for TWG and ECEN meetings to ensure best use of meeting time and output value.	TWG and ECEN terms of reference modified in REMM 2005-2006. GIS updated and latest version issued with IREMM. Website redeveloped to include monitoring and management reports.

3. Regional Management Update

3.7. The ECA Geographical Information System (GIS)

The ECA GIS is currently operated by Emu Ltd. The GIS has been built using an ESRI ArcGIS platform. All the data from the EEC Regional Baseline Monitoring survey (2005) has been collated and published in a GIS. The contents include everything from grab, trawl and scallop dredge data to sidescan and bathymetry. Additional information is also available through the hyperlink function enabling access to photographs, sediment data and metadata. The GIS was presented on DVD as an appendix to the final report. The 2006 dataset is now undergoing processing for this years publication. It will also be published on DVD. However, the functionality of a DVD is limited by space. It can only store up to 4.7Gb (gigabytes) of data. The bathymetry data from 2005 consumes nearly half of this alone. When the 2006 data is added to this available space will be extremely limited. It has been proposed that the next phase of ECR GIS includes the development of an interactive web site. This will allow easy access to, and investigation of, the large amount of information available, with fewer restrictions on the size and amount of data. It will also incorporate the ability to compare time-series datasets demonstrating any changes occurring over the consecutive survey periods. Time-series comparisons will initially be very simple, graphical and spatial comparisons of the data from 2005 and 2006. As additional years of data are added, software such as Timemap© will become useful in displaying multiple year datasets.

3.8. The ECA Website

The ECA website can be viewed at www.eastchannel.info. The site has undergone modification and update to account for recent activities in the ECR. The site now includes information related to current active zones and also all relevant report files. The reports, contained in the library, include the Regional Environmental Assessment, the Regional Monitoring Blueprint and the Regional Environmental Monitoring and Management Report. The files related to this IREMM report will also be posted on the website.

Future development will include addition of an online mapping tool that will enable display of data included in the ECA GIS, update of the files contained in the ECA library and addition of an online response tool to allow stakeholders and interested parties to make representation to the ECA.

3.9. Meetings and Reporting

The 2007 ECR TWG Meeting

The ECR TWG meeting will be held on the 5th June 2007. Attendance is by invitation only and the purpose of the meeting is to discuss the 2005 and 2006 survey activity, the findings of the 2005-2006 REMM report and the information presented in this report.

The 2007 ECEN Meeting

It is likely that the annual ECEN meeting will be held in July 2007. Attendance is open to all interested parties. The format of the meeting will follow that of the 2006 meeting consisting of short introductory presentations by the ECEN Chairperson and Regional Development Manager followed by review of poster presentations describing the monitoring and management activities of the ECA. Following this there will be an open forum to enable stakeholders to raise issues, comments and queries. The date of the 2007 ECEN meeting will be publicised by mail to 2006 attendees and also via announcements on the ECA website.

The 2006-2007 REMM Report

The annual Regional Environmental Monitoring and Management Report covering activity in 2006-2007 will be published in December 2007. The format of the report will follow that of the 2005-2006 report but will be adapted where required in light of comments received during TWG and ECEN meetings.

3. Regional Management Update

Notes