DOGGER BANK
TEESSIDE A & B

March
2014

Environmental Statement Chapter 12 Appendix D Tranche B Habitat mapping report

Application Reference 6.12.4

Tranche B and Teesside Cable Corridor Interpretation

Apr / 2013

Interpretation Report

Site

Dogger Bank OSWF Tranche B

Prepared for

Forewind

Prepared by

Envision Mapping Ltd.

Author(s)

Bob Foster-Smith
Ian Sotheran
Alison Benson

PREPARED FOR Forewind

TITLE Tranche B and Teesside Cable Corridor Interpretation

CONTRACT REF. 4200005415

REPORT ID. 2012-1009-CableCorridorInterpretation-01

DOCUMENT CONTROL

Revision	Originator	Date	Status	Checked & Approved	Date
0	Bob Foster-Smith	19/04/2013	Draft	Ian Sotheran	22/03/2013
1	Alison Benson	16/04/2013	Draft	Ian Sotheran	16/04/2013
2	Bob Foster-Smith	19/04/2013	To Submit	Ian Sotheran	19/04/2013

FILE P:\2012-1009-Forewind-Tranche B\REPORTS\2012-1009-TrancheB_Teesside_Habitata Mappping and Interpretation-v3.docx

PREPARED BY

Envision Mapping Ltd
6 Stephenson House
Horsley Business Centre
Horsley, Newcastle
Northumberland
NE15 0NY
United Kingdom

T: +44 (0)1661 854 250
F: +44 (0)1661 854 361

NOTES

Envision Mapping's environmental policy involves the use of 100% renewable electricity and recycled paper that is manufactured using wind-generated electricity

CONTENTS

FIGURES

1. Executive Summary

1. The analysis of Tranche B has been undertaken as part of an updated interpretation of all of the data available from the surveys to date. This is so that the data from the different areas can support the interpretation of adjacent areas and improve the performance of the maps.
2. The grab (infaunal) data (including Tranche B data) have been combined into a single dataset for the whole of the surveyed area. The benefit of re-analysing the data in this way is so that there is a continuum in the analysis across the Zone Wide areas and Cable Corridors to obtain a synoptic view of the biota throughout the areas of interest.
3. The geophysical data, however, have been interpreted in separate areas because the types of data available and the processing involved changes between the different surveys. The Zone Wide area (Tranches A and B and the moderate coverage Zone Wide data that includes Tranche C) has been interpreted as a single entity. However, the Creyke Beck Cable Corridor (see previous report) and the Teesside Cable Corridor have been interpreted separately.
4. Analysis of the infaunal data resulted in about 36 statistically significant clusters of samples. The individual samples were not matched directly to the Eunis classification for reasons described in the report. Instead, the summary descriptions from these clusters (average abundance and average contribution) were matched to the published compositions of the Eunis classes and matched to the closest Eunis class or classes where there was more than one option.
5. The epifaunal biotopes were assigned to samples directly although only a small number of broad classes were used.
6. Consideration was given to previous studies and an attempt has been made to reach a consensus on the biotopes found within the area. Particular attention has been given to the study by Diesing *et al.*(2009) which formed the basis of the SAC designation of the Dogger Bank by the JNCC. Indeed, data from this source was used to provide sample data for the Tranche C area. The main output from this stage in the analysis were ground truth datasets for use in integrated analysis of the geophysical data.
7. The interpretation of the geophysical data to derive the predicted distribution of the infaunal biotopes and epifaunal biotopes was undertaken separately and the epifaunal layer was overlain onto the distribution of the infauna.
8. The range of biotopes in the Zone Wide area is very limited and the samples share many of the same abundant species. However, there was a notable difference between the biotopes in Tranche A and B. It is likely that differences responsible for differences in assigned biotope may be due to temporal differences in the surveys.
9. The Zone Wide area is characterised by sand with occasional channels of mixed rock and sand. The biotopes are typical of disturbed sand and scoured rock and are tolerant of mobile substrata.
10. The Teesside Cable Corridor is mostly of fine sand (possibly slightly muddy) and may qualify as a Priority Habitat ("muddy habitats in deep water").

2. Introduction

The knowledge base of the composition and distribution of the biota of the Dogger Bank OSWF and its associated cable corridors is being built up in a series of stages as data are collected and become available. The basic process of gathering the data and information generally has proceeded as follows:- Geophysical data have been collected and interpreted as potential habitat types. This preliminary analysis has guided the sampling campaign and these sample observations (video, infaunal composition and PSA) have been used as 'ground truth' data to better interpret the geophysical data.

However, as the process evolves and is rolled out to larger areas and neighbouring sites, so the data already collected can be used to inform the geophysical interpretation of habitat types (step 1), even to the extent of producing a preliminary biotope distribution map.

Thus, the geophysical data for Tranche A was interpreted using ground truth data gathered using a stratified sampling design. Similarly the sampling design for Tranche B and the Teesside Cable Corridor have been based on a preliminary interpretation of the geophysical data. The sample data are now available for the ground truth analysis. However, a further stage was commissioned whereby widely spaced tracks of geophysical data have been interpreted using analysis of the geophysical features together with available ground truth data. The ground truth data consisted not only of the Tranche A sample data, but also of records collected over the whole of the UK Dogger Bank by Diesing et al.(2009).

We are now in a position where the composition and distribution of the biotopes for Tranche B can be interpreted. Rather than interpret this in isolation from the work that has preceded this analysis, it would clearly make sense to incorporate as much ancillary data from neighbouring Tranche A and the Zone Wide data.

There is also a progression for the analysis of sample data as the surveys encompass larger areas. Interpretation of the sample data from Tranche A followed the usual procedures for stand-alone surveys. The data are analysed using statistical techniques that derive 'clusters' within the data that are significantly distinct from each other to warrant their designation as a biological 'group'. These groups can be thought of as assemblages of species (although perhaps too purely statistical to be considered a 'community').

There is a need for this approach when surveying an area with little previous data since it is not known if the assemblages can be safely assigned to one of the many biotope classes in the published Eunis system. Many scientists feel that it is better to 'let the data tell their story' rather than over-interpret the data directly as biotope classes. If there are major differences between the newly collected data and the published biotope classes, these need to be raised and new classes/sub-classes proposed.

However, as the surveys accumulate more data a strong case can be made for endeavouring to match the results of analysis to preceding work and this may be facilitated by referring to a common biotope class structure. In a sense, this is part of the progression from data analysis and interpretation to increasing the knowledge-base of the area.

The Zone Wide analysis made a start at trying to correlate different datasets. We are now in a position where this work can be reinforced using further analysis. Again, rather than treating the data from Tranche B as stand-alone, it would be a significant step towards integrating analyses if the data were combined for analysis. Thus, the infauna (with some epifauna also captured by the grabs) have been combined into a single dataset for re-analysis.

Previous interpretation for the Dogger Bank area has stressed that the composition of the biota could be summarised as 'variations on a limited theme'. A small number of biotope classes have been considered necessary to 'capture' the range and distribution of the biota and provide an adequate description of the biotopes in the Dogger Bank area.

This report takes the analysis for the Dogger Bank OSWF area a stage further by incorporating the latest data and re-interpreting the geophysical data. A Section focusses on Tranche B, although this is really a sub-set of the Zone Wide interpretation.

The geophysical data for the Teesside Cable Corridor is interpreted separately, although the infaunal samples have been analysed as part of the combined sample dataset so that there is continuity between the biotopes throughout the survey area.

3. Methods

3.1. Outline of the approach to interpretation

The procedure for analysis of the grab data for this analysis is as follows:- The combined grab sample database will be analysed statistically to derive natural groups within the data. A high significance level (1%) will be used to avoid proliferation of the groups at this stage. These groups will be displayed geographically and compared to the previous interpretations of the distribution of the biotopes within the region. The purpose is to look for commonality between the new analysis and previous interpretation. If possible, the new data will be absorbed into the previous knowledge-base (i.e., using the same suite of biotopes to assign to samples if possible). This may seem like forcing the analyses to fit previous knowledge. However, all departures from a simple picture of the distribution of assemblages and biotopes will be highlighted and explained where possible. For example, statistical differences may be expected to occur between two different datasets simply due to natural changes in biota over time. These differences require expert knowledge in order to see that statistically significant differences, in fact, may be irrelevant when considering membership of the sample to a biotope class.

In other words, the preliminary statistical analysis of the data can be followed by a more 'expert-lead' interpretation as our experience widens with increasing survey effort.

The sample data (grab and video) form the basis of the description of the biotopes in the area of interest. The list of biotopes grows as the area covered by the survey increases (and to some extent the timespan over which the surveys have been conducted). If the sampling surveys have been properly stratified, and sampling sufficiently comprehensive, the list of biotopes should be relatively complete. As the area of survey increases, the pattern of the distribution of these biotopes should begin to reflect fine scale and broad scale trends in the environmental conditions. The broad scale perspective that is being built up for the Dogger Bank OSWF and the cable corridors provide a useful context for the individual Zones and cable corridors.

For this reason, it is important to analyse the samples as one single dataset so that the samples can be directly compared with one another and without the uncertainty that separate analyses would introduce into any discussion on biotope distribution. For this reason, the sample data from the cable corridors, Tranches A and B have been combined and re-analysed and re-assigned to biotopes. The results have been discussed in relation to previous analyses to achieve an overall consensus of the biotope composition of the whole area.

However, it is not so easy to combine the geophysical data into a common and comprehensive series of data layers. Not all areas have the same data available and the data have been processed differently for each area. The total size of the area surveyed is also very large and this would make analysis impractical at anything but a very coarse spatial resolution. For these reasons the interpretation of the geophysical data has been separated into the cable corridors and the Dogger Bank OSWF. The latter has been treated as one single combined dataset and this is about as large as is feasible. The Yorkshire Cable Corridor has already been interpreted and so this report describes the analyses and interpretation of the Dogger Bank OSWF area (particularly concentrating on Tranche B) and the Teesside Cable Route.

3.2. Analysis of the Sample Data

3.2.1. Statistical interpretation of grab data

Multivariate statistical analysis of site/species records used the PRIMER package favoured by marine benthic ecologists. The spreadsheets for each dataset (Tranche A, Tranche B, Yorkshire and Teesside Cable Corridors) were amalgamated and checked for the use of taxonomic synonyms and other duplications. In order to reduce the size of the dataset for ease of computation, species with very few occurrences were removed (less than 25 individuals for the combined dataset). Samples with no individuals were also removed from the analyses.

The abundances were square root transformed and then subject to classification and the SIMPROF routine (which lists species and their abundances that contribute most to the distinctiveness of the groups identified in the classification process. These average species abundances for the significant classes (groups) were arranged into a spreadsheet of the composition of these groups and the relationship between them (similarity) displayed using the ordination technique of multidimensional scaling (MDS).

The classification dendrogram, the average species composition of the resulting classes and the ordination diagram were used to justify and describe the characteristics of the groups. This process also drew upon the geographic plot of the groups, which showed where there were marked spatial clusters in the data.

3.2.2. Matching the records to the biotope classification

Individual samples were not matched to biotopes: Rather, the average composition of the classes resulting from the SIMPROF analysis were assigned to the closest biotope (and all the individual sample included in that class). This is justified because (a) the biotope classification derived from average composition is based on a similar process, (b) this procedure reduces the impact of sample-sample variance on the interpretation and (c) the process provides a way in which statistical analysis can be integrated with the biotope classification.

Matching results to the biotope classification is not a precise science and the subjective opinion of the analyst must play a role in the choice of a suitable biotope. The process adopted in this study is an attempt to introduce a systematic approach. The average species composition of the statistical classes were incorporated into a table based on the published faunal composition of the classes in the biotope classification and edited to include only those species that were common to both datasets. The data were fourth root transformed and a similarity matrix derived using PRIMER. The matrix was edited to show just the similarities between the statistical classes and the biotope classes. From this, a short-list was derived of the most similar biotope classes for each statistical class. These were inspected and options ruled out on the basis of depth zone (infra- and circalittoral) and sediment. The edited short list was inspected for key species and differences in significant contributors to the statistical classes. The process is still subjective, but proves to be a useful aide in assigning biotopes. Lastly, the classes were compared to other analyses, particularly the preceding Zone Wide work that integrated the results of Diesing *et al.*(2009) with the data from the Forewind surveys.

3.2.3. Video data

The records of conspicuous fauna from the video were used to indicate those samples that had significant rock habitat to be able to support epifauna or where the habitat supported larger infauna unlikely to be captured by grab sampling (sea pens and burrows of megafauna). The stills and video were briefly inspected to verify the records, but not extensively reviewed. The records were revised where necessary. Thus, the video records were not treated as systematically as the infaunal records and only a limited number of broad biotope classes were used to classify the epifaunal biotopes (i.e., epifauna and conspicuous, larger infauna).

These epifaunal biotope classes were assigned individually to each sample record (as opposed to the infaunal records which were first assigned to statistical clusters). The epifauna were not integrated with the infaunal to create a single biotope class for each sample. This left the option open for separate interpretation of the geophysical data after which the distribution of the epibiota could be overlain onto the distribution of the infauna.

3.2.4. The ground truth sample datasets

The last stage in the processing of the sample data is to derive a suitable dataset for ground truthing the geophysical data. The aim was to produce separate ground truth datasets for the Zone Wide areas and the Teesside Cable Corridor, and each area to have a ground truth dataset for the infaunal biotopes and epifaunal biotopes.

The sub-sets of the sample data for each ground truth dataset had to be carefully inspected to ensure that singleton records were avoided since successful interpretation depends on some replication of the biotope classes. The sample data were displayed geographically and inspected to ensure that the final selection were spatially coherent: ideally, the classes should relate to specific habitats and environmental conditions rather than be scattered over the habitat spectrum.

The subset of the sample data selected for ground truthing the geophysical data for the Zone Wide area was supplemented by the biotope data from the Cefas survey (Diesing *et al.*,2009) in the Tranche C zone in order to have better geographic coverage, as was done in the previous Zone Wide analysis (Envision, 2013).

3.3. Analysis of the geophysical data

The available geophysical datasets for Tranche A, Tranche B and the Zone Wide surveys were combined for the Zone Wide predictive analysis (see previous Envision report) and those geophysical layers were used in the updated interpretation described in this report. The layers used in the following integrated analysis were:-

Bathymetry
Rugosity
Slope
Sidescan
AGDS E1, E2 & E1 variability

The layers were transformed as necessary to provide layers that were as free from spurious artefacts as possible and render them in a suitable format for mathematical manipulation.

3.4. Integrated analysis of the sample and geophysical data

3.4.1. The Zone Wide area

Supervised classification was used as the general method for integrating the ground truth data and the geophysical data. The ground truth point samples (separate datasets for sediment, infaunal biotopes and epifaunal biotopes) were buffered to create circular training sites 100m in diameter. The training sites were used to extract data from each of the data layers and these data were used to create signatures for each of the ground truth classes. These signatures were then applied to the whole coverage for the Zone Wide area in which each pixel in the final image is assigned to the class with maximum probability. These operations were performed in Idrisi™ and the raster outputs converted to vector format for export into Arc GIS.

The results from the analysis of the epifaunal and infaunal ground truth data were designed to be complementary and the epifaunal information can be displayed over the infaunal biotopes.

3.4.2. Teesside Cable Corridor

A different approach was used for the Teesside Cable Corridor since the range of geophysically-based variables were fewer and more variable along the length of the route. The initial analysis undertaken for the route for sample site selection (see the Envision report "Teesside Cable Route: Sample Design" (2012)) employed both unsupervised classification and segmentation and found that the latter gave superior results due to problems in deriving uniform layers for the automated classification processes.

The alternative route for analysis was taken where the results from the segmentation process were matched to the ground truth data and the segmented habitats assigned to the class most frequently associated with that habitat segment (or classes if there was more than one association). The map shows the class(es) assigned to the segments with the ground truth data superimposed. In this case, the epifaunal data were incorporated into the biotope classes and only one combined layer representing both the infauna and the epifauna is presented.

4. Results

The cluster analysis with SIMPROF resulted in a large number (about 36) statistically significant clusters with two or more samples. However, the dendrogram indicated that many of these clusters could be considered part of more broadly based groups that are faunistically similar. The groups have been matched to biotopes within the Marine Habitat Classification for Britain and Ireland (V04.05) and a summary of the biotopes used together with the description given in the Habitat Classification is given in Table 1.

Table 1 gives a list of the biotopes referred to in the following text together with the description as given in the Marine Habitat Classification for Britain and Ireland.

Table 1. *Summary list of biotopes assigned to records*

Biotope	Description (Marine Habitat Classification)
SS.SCS.ICS.Glap	Glycera lapidum in impoverished infralittoral mobile gravel and sand
SS.SCS.ICS.SLan	Dense Lanice conchilega and other polychaetes in tide-swept infralittoral sand and mixed gravelly sand.
SS.SCS.CCS.Blan	Branchiostoma lanceolatum in circalittoral coarse sand with shell gravel
SS.SCS.CCS.MedLumVen	Mediomastus fragilis, Lumbrineris spp. and venerid bivalves in circalittoral coarse sand or gravel
SS.SCS.CCS.Pkef	Protodorvillea kefersteini and other polychaetes in impoverished circalittoral mixed gravelly sand
SS.SCS.CCS.PomB	Pomatoceros triqueter with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles
SS.SMx.CMx.FluHyd	Flustra foliacea and Hydrallmania falcata on tide-swept circalittoral mixed sediment
SS.SMx.CMx.MysThyMx	Mysella bidentata and Thyasira spp. in circalittoral muddy mixed sediment
SS.SMx.CMx.OphMx	Ophiothrix fragilis and or Ophiocomina nigra brittlestar beds on sublittoral mixed sediment
SS.SMx.OMx.PoVen	Polychaete-rich deep Venus community in offshore mixed sediments
SS.SSa.IFiSa.NcirBat	Nephtys cirrosa and Bathyporeia spp. in infralittoral sand
SS.SSa.CFiSa.ApriBatPo	Abra prismatica, Bathyporeia elegans and polychaetes in circalittoral fine sand
SS.SSa.CFiSa.EpusOborApri	Echinocyamus pusillus, Ophelia borealis and Abra prismatica in circalittoral fine sand
SS.SSa.IMuSa.EcorEns	Echinocardium cordatum and Ensis spp. in lower shore and shallow sublittoral slightly muddy fine sand
SS.SSa.IMuSa.FfabMag	Fabulina fabula and Magelona mirabilis with venerid bivalves and amphipods in infralittoral compacted fine muddy sand
SS.SSa.CMuSa.AbraAirr	Amphiura brachiata with Astropecten irregularis and other echinoderms in circalittoral muddy sand
SS.SMu.CFiMu.SpnMeg	Seapens and burrowing megafauna in circalittoral fine mud
SS.SMu.CSaMu.AfilNten	Amphiura filiformis and Nuculoma tenuis in circalittoral and offshore sandy mud
SS.SMu.CSaMu.ThyNten	Thyasira spp. and Nuculoma tenuis in circalittoral sandy mud

The following is a summary description of the classes. The tables 2 to 11 include the closest biotopes (using the level 3 or 4 codes only for brevity) that matched the clusters. In most cases the match was not clear and more than one biotope was indicated. This is perhaps not surprising given the frequency with which a limited number of species are distributed across the sample sites.

In the tables below, TA = Tranche A; TB = Tranche B; CBCC = Cryke Beck Cable Corridor; TCC = Teesside Cable Corridor.

Table 2. *Group 1 Summary Description*

Group 1	Depth	Sediment	Epifauna	Infauna	Location
A	29	G		Blan/Pkef	TA
B	31	sG/mixed	PomB	Blan/Pkef	TA
C	32	sG/mixed	PomB	Blan/Pkef	TA
D	36	sG		Blan/Glap	TA

This group is of coarse sediment, sometimes mixed with cobble and larger stones. The clusters are characterised by *Glycera*, *Protodorvillea kefersteini* and *Pisione*, and most samples have *Echinocyamus pusillus* and *Branchiostoma lanceolatum*. Class 'A' has very high numbers of *Protodorvillea kefersteini* and *Polygordius*. Epifaunal communities, when present, are characterised by *Spirobranchus* (formerly *Pomatoceros*).

Table 3. *Group 2 Summary Description*

Group 2	Depth	Sediment	Epifauna	Infauna	Location
E	32	sG	PomB	MedLumVen	TA
F	33	sG/mixed	PomB/ OphMx	MedLumVen	TA, TB

A coarse sediment group with encrusting epifauna and, in some samples, *Ophiothrix fragilis*. The infauna is characterised by *Mediomastus fragilis* and *Dosinia*. *Spiophanes* is also found, but this is a very common species amongst the sample set as a whole.

Table 4. *Group 3 Summary Description*

Group 3	Depth	Sediment	Epifauna	Infauna	Location
G	68	(g)S		ApriBatPo	CBCC, TCC
H	58	(g)S		ApriBatPo	CBCC
I	60	(g)S/mixed	PomB/ FaAlCr	ApriBatPo	CBCC

The infauna are characterised by *Nephtys sp.*, *Spiophanes bombyx*, *Batheporeia* and *Scoloplos armiger*. The biotope assignment rests on the whole species complement and the samples are not well represented by ApriBatPo. Many of the characterising species are more typical of infralittoral biotopes. However, the depths of the samples must rule out any possibility of an infralittoral biotope.

Table 5. *Group 4 Summary Description*

Group 4	Depth	Sediment	Epifauna	Infauna	Location
K	30	gsM		AfilMysAnit	TCC inshore

This is represented by only two samples. However, these muddy habitats are located very close inshore on the Teesside Cable Corridor and characterised by *Ophiura* and *Amphiura*.

Table 6. *Group 5 Summary Description*

Group 5	Depth	Sediment	Epifauna	Infauna	Location
L	61	(g)S/mixed		ThyNten/ApriBatPo	TCC offshore

This group of samples lies on the Teesside Cable Corridor, but is similar in composition to Group 3 samples. It has been treated separately from Group 3 for the purposes of analysis because of the geographic separation of the samples. However, they may be amalgamated at a later stage.

Table 7. *Group 6 Summary Description*

Group 6	Depth	Sediment	Epifauna	Infauna	Location
M	47	gS/mixed	PomB/FaAlCr	ThyNten/ApriBatPo	TA

This group is similar to Groups 3 and 5 with the notable absence of *Bathyporeia* and the presence of epifauna on larger stones.

Table 8. *Group 7 Summary Description*

Group 7	Depth	Sediment	Epifauna	Infauna	Location
N	15	(g)S		NcirBat	TCC inshore

An infralittoral sandy biotope characterised by *Nephtys*, *Bathyporeia* and bivalves.

Table 9. *Group 8 Summary Description*

Group 8	Depth	Sediment	Epifauna	Infauna	Location
Q	27	(g)S		EcorEns/SLan/ ApriBatPo	TB
R	33	(g)S		EcorEns/SLan/ ApriBatPo	TB
S	28	(g)S		EcorEns/ ApriBatPo	TB
T	31	(g)S		EcorEns/SLan/ AbraAirr	TB
U	29	(g)S		EcorEns/SLan/ ApriBatPo	TB
V	27	(g)S	Virgularia	EcorEns/SLan/ ApriBatPo	TB

Many of the samples present difficulties when assigning them to biotopes because the characterising species are more typical of infralittoral biotopes even though their depth should preclude this option. However, a case could be made for making an exception for the samples that comprise this group which are characterised by *Ensis sp* and (with the exception of cluster S) *Lanice conchilega*. The depths are moderate (arguably intermediate between infra- and circalittoral) and it is difficult to assign any other biotope with confidence. ApriBatPo or AbraAirr would be the closest matches amongst the circalittoral biotopes. *Bathyporeia* is found in all clusters with the exception of cluster T. The presence of *Virgularia* may indicate a difference in habitat type for cluster V.

Table 10. *Group 9 Summary Description*

Group 9	Depth	Sediment	Epifauna	Infauna	Location
W	30	(g)S		NcirBat/ FfabMag/ ApriBatPo	TA
Y	29	(g)S		NcirBat/ FfabMag/ ApriBatPo	TA
Z	24	sG		NcirBat/ FfabMag/ ApriBatPo	TA
AA	28	(g)S		NcirBat/ FfabMag/ ApriBatPo	TA
AB	25	(g)S		NcirBat/ ApriBatPo	TA

Group 9 Tranche A samples presents the same problems for biotope assignment as Group 8 (Tranche B), but with a different species composition. Again, the depths could be considered intermediate between infra- and circalittoral. However, the characterising species are *Nephtys*, *Bathyporeia*, *Magelona filiformis* and *Fabulina fabula*. Again, ApriBatPo would be the closest circalittoral biotope.

Table 11. *Group 10 Summary Description*

Group 10	Depth	Sediment	Epifauna	Infauna	Location
AC	51	Mixed	PomB/ OphMx	EpusOborApri/ OMx.PoVen	TCC
AD	61	Mixed	PomB/ OphMx	EpusOborApri/ OMx.PoVen	TCC

The composition of these samples is characterised by epifaunal crusts, *Ophiothrix fragilis*, *Echinocyamus pusillus* and *Glycera sp*. Class 'AC' has *Ophelia borealis* whilst class 'AD' has *Lumbrineris cingulata*.

Table 12. *Group 11 Summary Description*

Group 11	Depth	Sediment	Epifauna	Infauna	Location
AE	67	(g)S	SpnMeg	ThyNten or AfilNten	TCC
AF	81	(g)S	SpnMeg	ThyNten or AfilNten	TCC
AG	78	(g)S	SpnMeg	ThyNten or AfilNten	TCC
AH	72	(g)S	SpnMeg	ThyNten or AfilNten	TCC
AI	73	(g)S	SpnMeg	ThyNten or AfilNten	TCC

Although the sediment is classed as slightly gravelly sand, the sediment appears more muddy and firmer than other sandy habitats sampled and supports burrows and tubes. The dense sea pen community is characteristic of this group. Differences between the classes is mainly due to overall diversity, with classes 'AE' and 'AI' having much lower diversity than the others. ThyNten is considered to be a more disturbed version of AfilNten and the samples may reflect variations in stability due to fishing activity, for example.

Figure 1 shows the distribution of clusters. Many of the clusters are associated with particular locations, such as the shallow inshore sediments. However, there would appear to be a strong association of many of the clusters with their particular survey. For example, the Tranche A sediments were characterised by NcirBat (*Nephtys/Bathyporeia*) whilst similar sediments in similar depths in Tranche B were characterised by EcorEns (*Echinocardium/Ensis*) and SLan (*Lanice*). This may be due to differences the lapse of time between the sampling programs rather than any biogeographic boundary coincident with the Tranche A/B boundary.

Figure 2 shows the distribution of the records after being assigned to biotopes, or suites of biotopes where there was some ambiguity in the classification. Figure 3 shows the distribution of the sediment characteristics of the records standardised to the modified Folks classification.

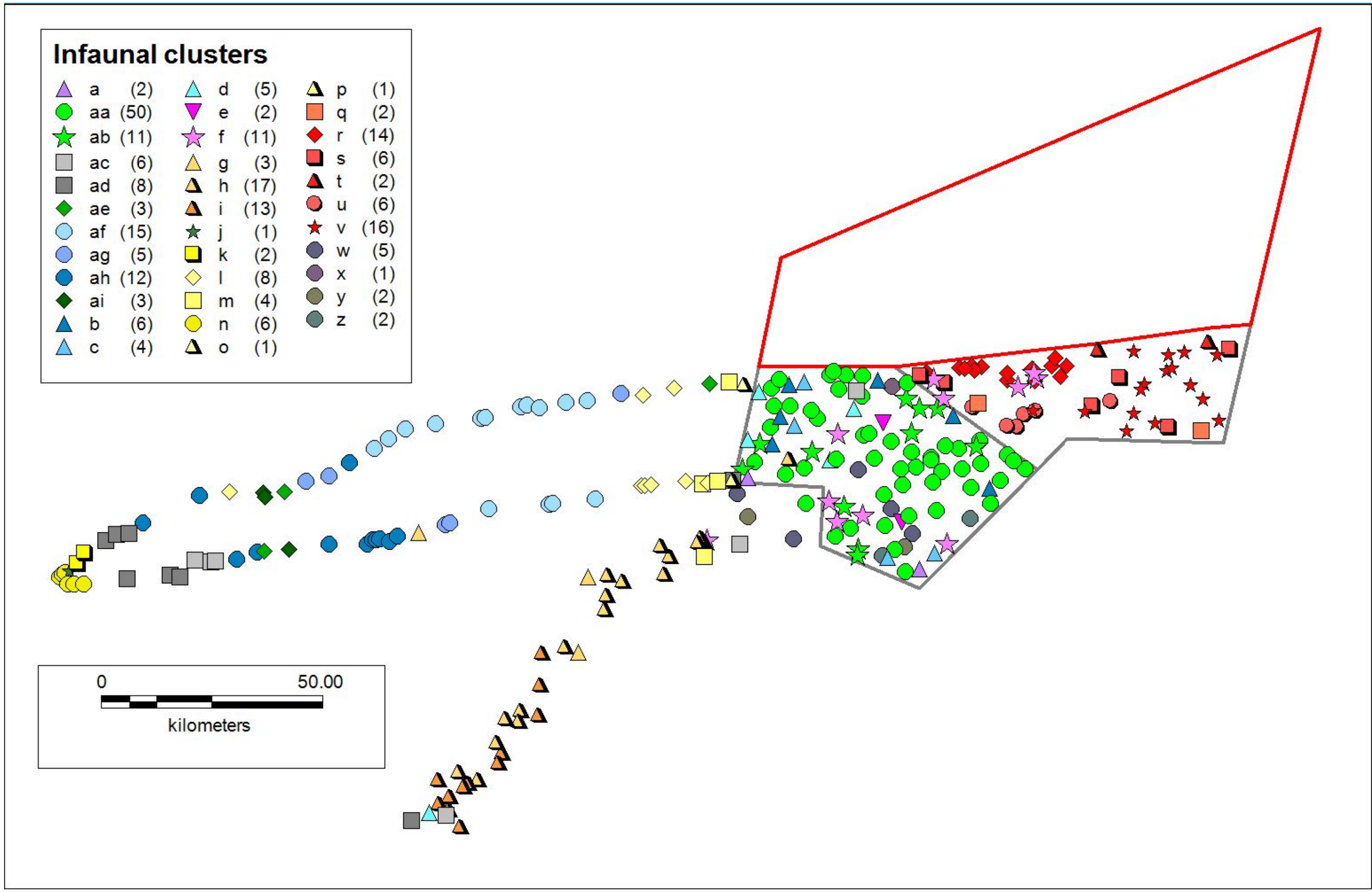

Figure 1.

Distribution of Infaunal Clusters from the statistical analysis of the combined grab samples. The colours group together clusters that are closely linked. It is apparent that those from Tranche A and B are statistically different at a high level of dissimilarity. Likewise the samples from the two cable corridors are different.

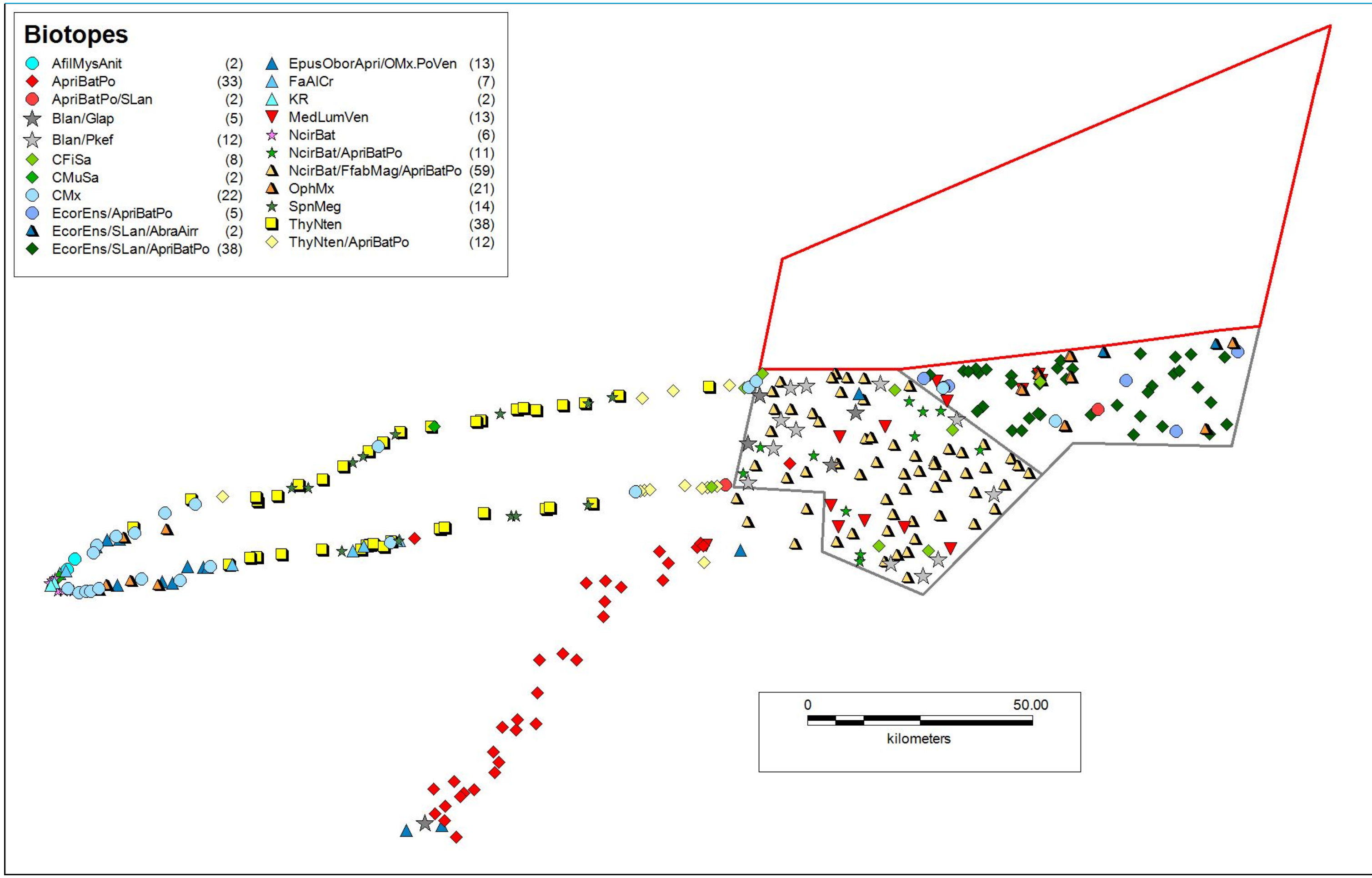

Figure 2.
Distribution of Biotopes assigned to records for the combined dataset.

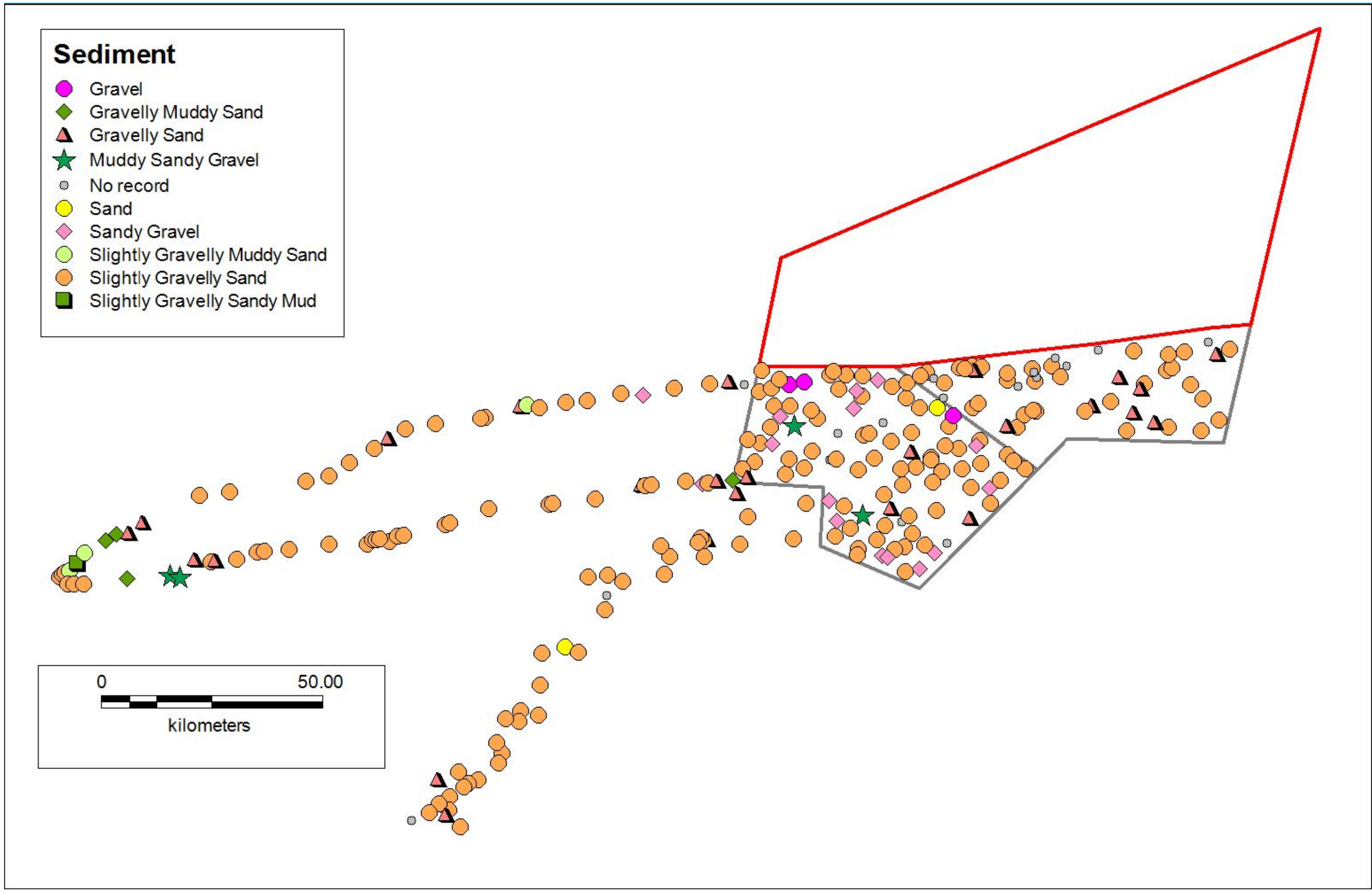

Figure 3.
Distribution of Sediment records (Folks classification) for the combined datasets.

4.1. Interpretation of the Zone Wide geophysical data

4.1.1. Zone Wide interpretation

The predominant habitat is slightly gravelly sand (Figure 4) sparsely populated by polychaetes, bivalves and amphipods (Figure 5). There are clear differences between Tranches A and B: Tranche A was slightly more gravelly, but both were predominantly sandy in nature. However, Tranche A was characterised by polychaetes and amphipods and lacked a significant presence of heart urchins (*Echinocardium*) and razor shells (*Ensis*) which characterised Tranche B. This may be an artefact of the temporal differences between the surveys and it is difficult to ascribe any great ecological significance to this. If correct in that the differences are due to change in time rather than habitat, then this points out the variable nature of these sandy, moderately disturbed habitats.

The mixed sediment habitats (sand, gravel, cobble and gravel) appear in both the infaunal and epifaunal interpretations. The samples have been separately assigned to mixed sediment biotopes based on infaunal analysis or the appearance of the sediment. The "epifaunal" version (Figure 6) appears more widespread and this is to be expected given the greater information from the grab samples with which to make a more discriminating classification. However, the infaunal mixed sediment lies within the epifaunal mixed sediment and the general pattern is one of extensive coverage in Tranche A and a more constrained, but very well defined feature in Tranche B running north-south and predicted to extend into Tranche C.

Tranche C is predicted to have mainly sandy sediments with perhaps more silty sediments towards the north-western boundary (which will probably be excluded from the forthcoming Tranche C survey).

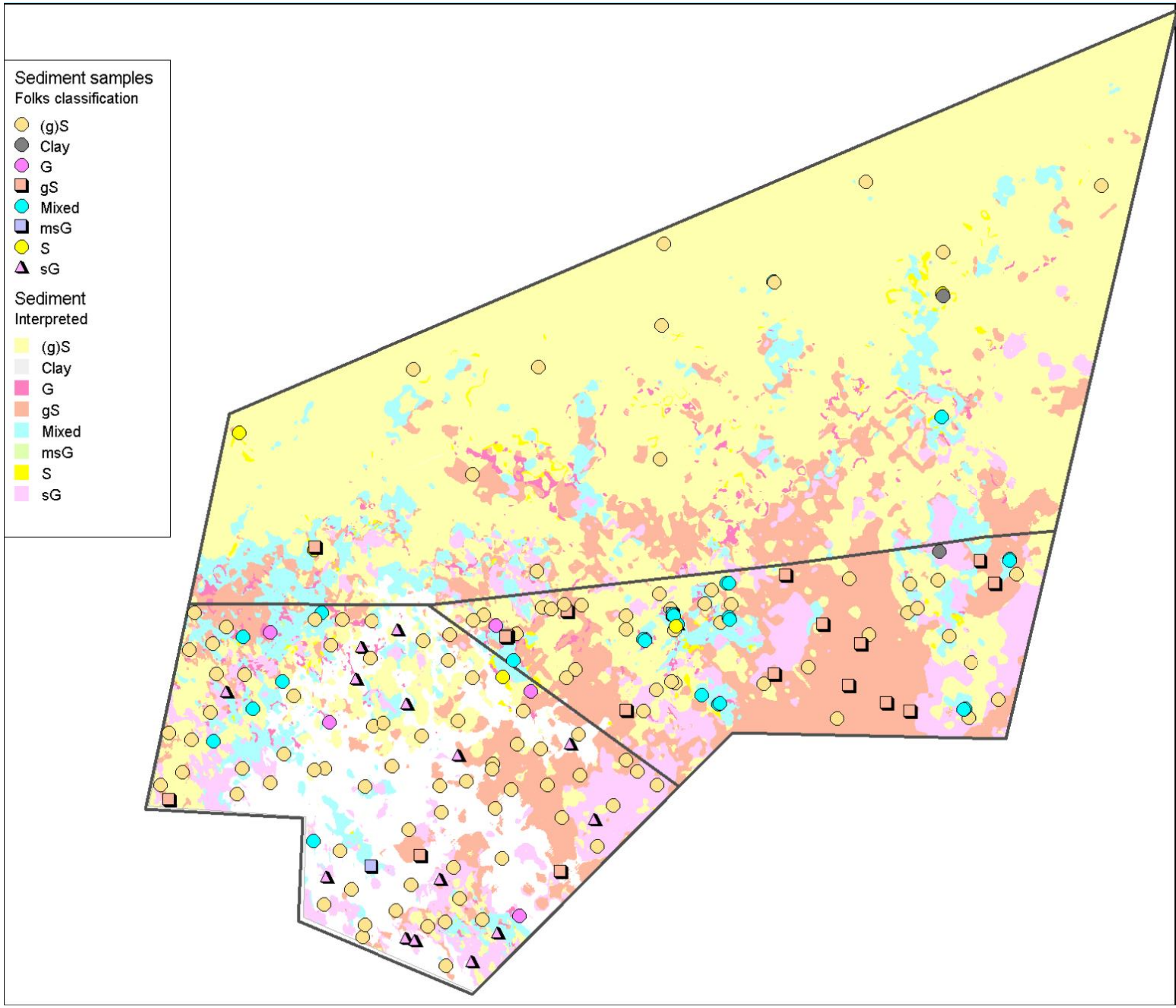

Figure 4.
Predicted distribution of surficial seabed sediments (Folks classification) and sample records for the Zone Wide area. The point data are the sediment records used for ground truthing the geophysical data

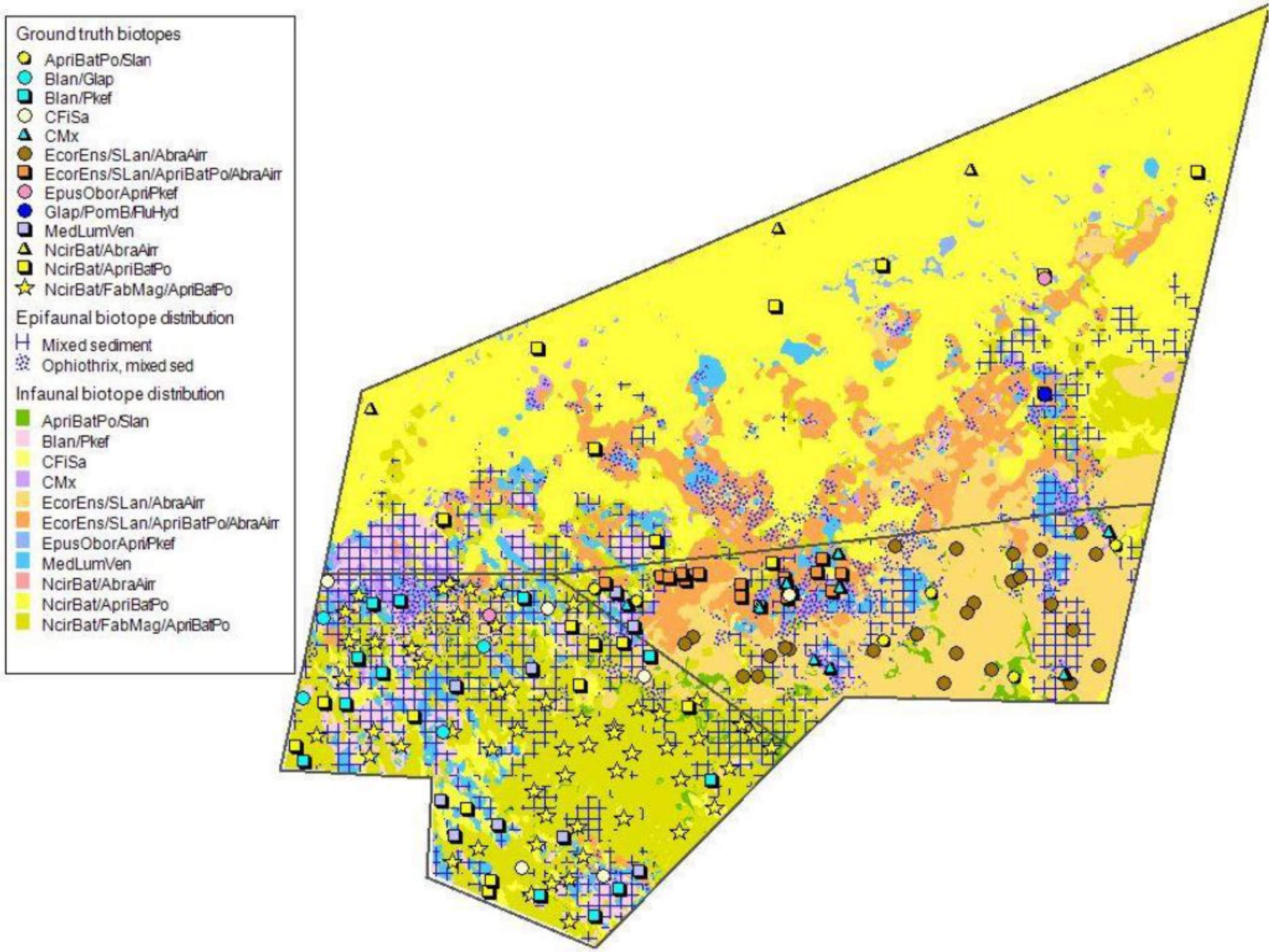

Figure 5.

Predicted distribution of infaunal biotopes and epifauna. Infaunal biotopes (solid colour) and epifauna (hatch overlay) for the Zone Wide area. The point data are the biotope records used for ground truthing the geophysical data.

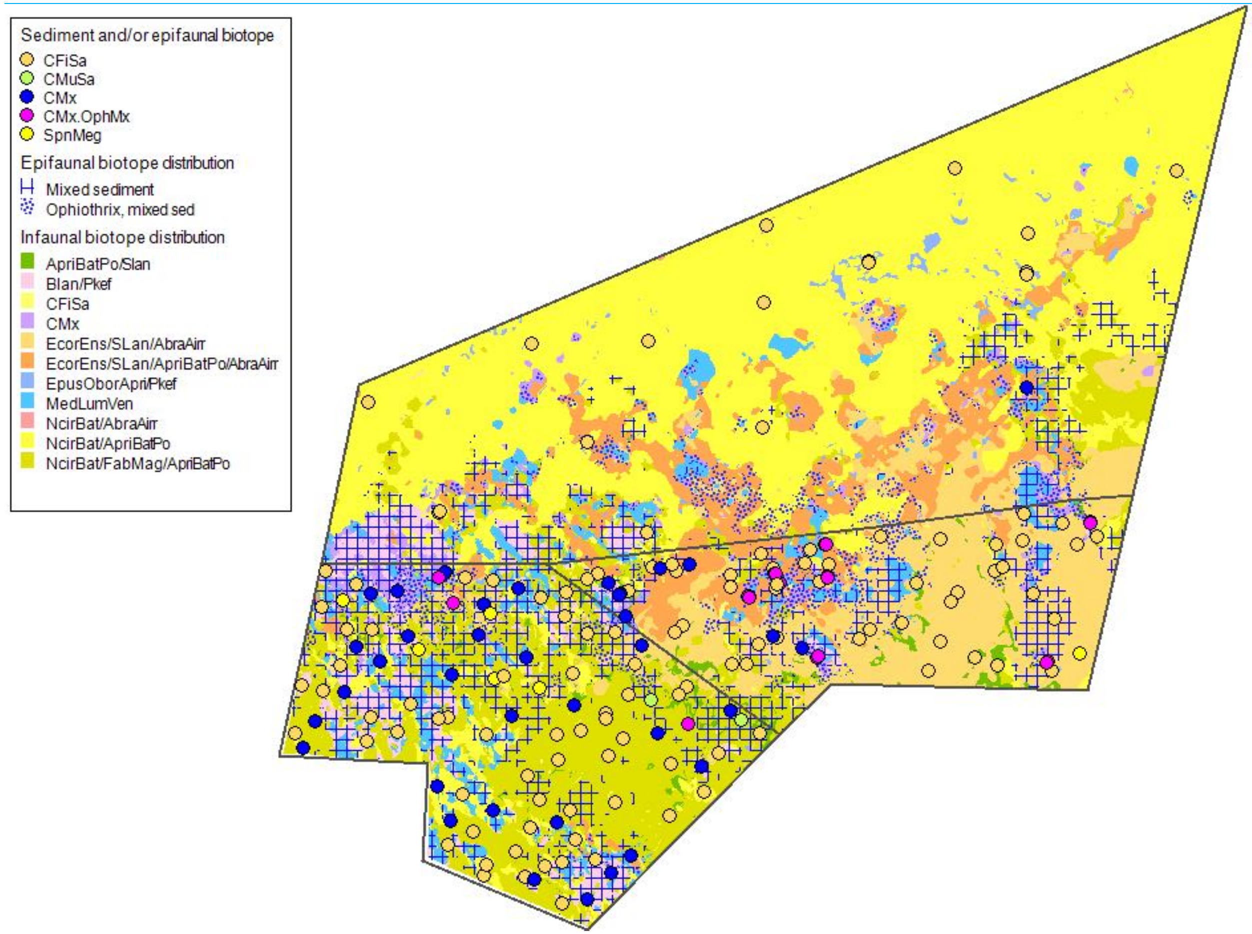

Figure 6.
Predicted distribution of infaunal biotopes and epifauna. Predicted distribution of infaunal biotopes (solid colour) and epifauna (hatch overlay) for the Zone Wide area. The point data are the epifaunal biotope records used for ground truthing the geophysical data that resulted in the epifaunal overlay.

4.2. Tranche B biotope distribution

The sediment distribution indicates a gradual transition from gravelly sand to slightly gravelly sand from south to north within Tranche B. There are areas of coarser sediment and a coarse sediment feature coincident with a depression running north-south in the eastern sector.

The range of biotopes that occurred in Tranche B is given in **Table 13**. This also gives the frequency with which the assigned biotopes were found, bearing in mind that most of the samples were assigned to more than one biotope to reflect the uncertainty of the biotope matching process. Note also that fine sand and mixed sediment at Level 3 in the biotope classification would also encompass any of the subsidiary Level 4 biotopes and these latter records have been included in the totals for the Level 3 biotopes in brackets.

Table 13. *Biotope frequency amongst the samples from Tranche B*

Biotope	Frequency
SS.SSa.CFiSa.ApriBatPo	44
SS.Ssa.CFiSa	1 (45 total)
SS.SMx.CMx	3 (18 total)
SS.SSa.IMuSa.EcorEns	45
SS.SCS.CCS.MedLumVen	5
SS.SMx.CMx.OphMx	15
SS.SCS.ICS.SLan	40
SS.SSa.CMuSa.AbraAirr	2
SS.SMu.CFiMu.SpnMeg	1

The interpreted distribution of the biotopes has been presented in Figures 7 and 8. As with the Zone Wide maps, the infaunal biotopes have been shown as polygons of solid colour and the epifaunal biotopes shown as hatch patterns overlying theinfauna. The hatched areas should be interpreted as representing areas where epifaunal biotopes may occur.

The infauna is characterised by polychaetes, razor shells and heart urchins – all typical of moderately disturbed fine sandy sediments and more often assigned to shallow Infralittoral habitats. The water depth over Tranche B is approximately 25-30m, which is at the deeper end of what could be considered infralittoral and this may reflect the extent of disturbance through the water column over the Dogger Bank.

Mixed sediments are not well represented in Tranche B as compared to Tranche A. However, aggregations of brittle stars on coarse sediment were common in some areas close to predicted mixed sediment habitats and probably form part of a continuum of these coarser habitats.

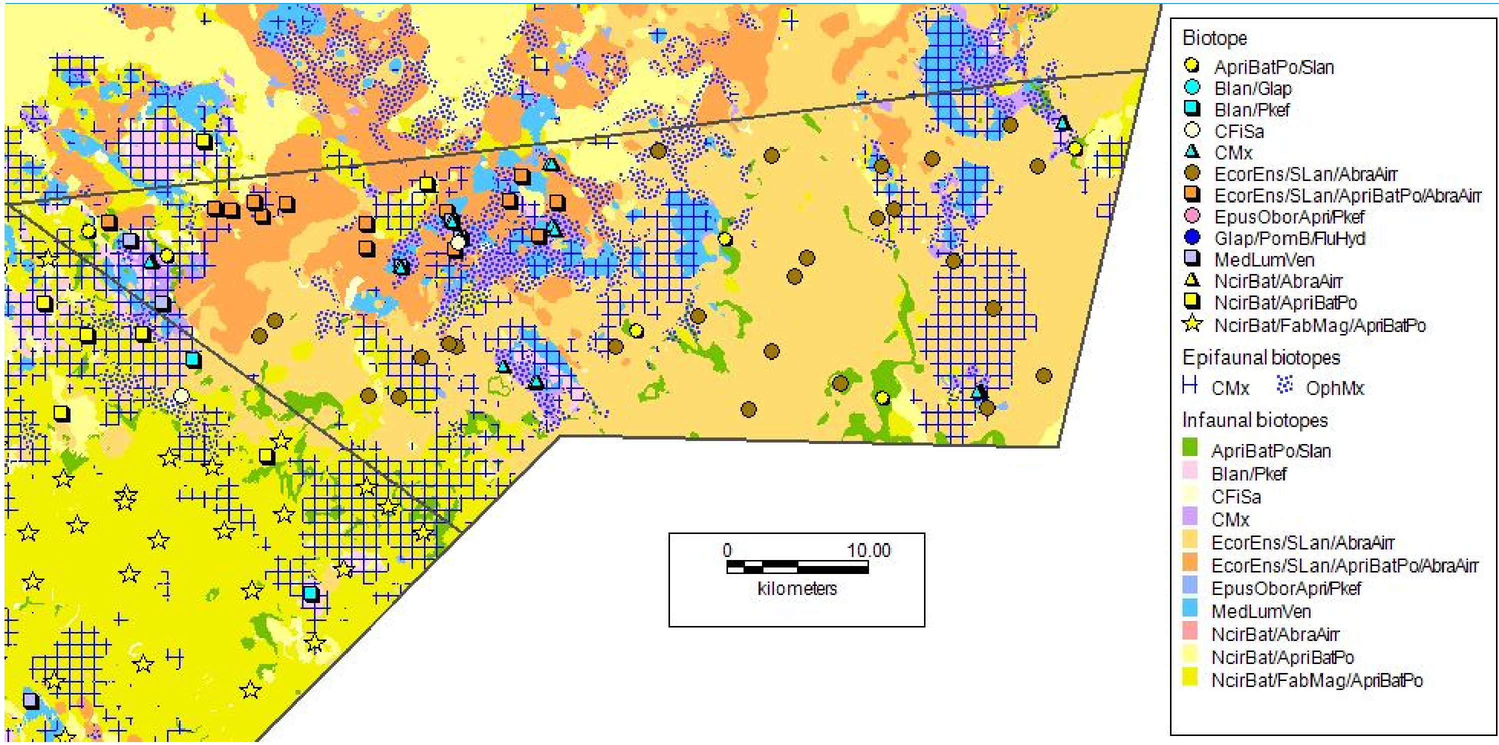

Figure 7.

Predicted distribution of infaunal biotopes (solid colour) and epifauna (hatch overlay) for Tranche B. The point data are the infaunal biotope records showing the corresponding biotopes.

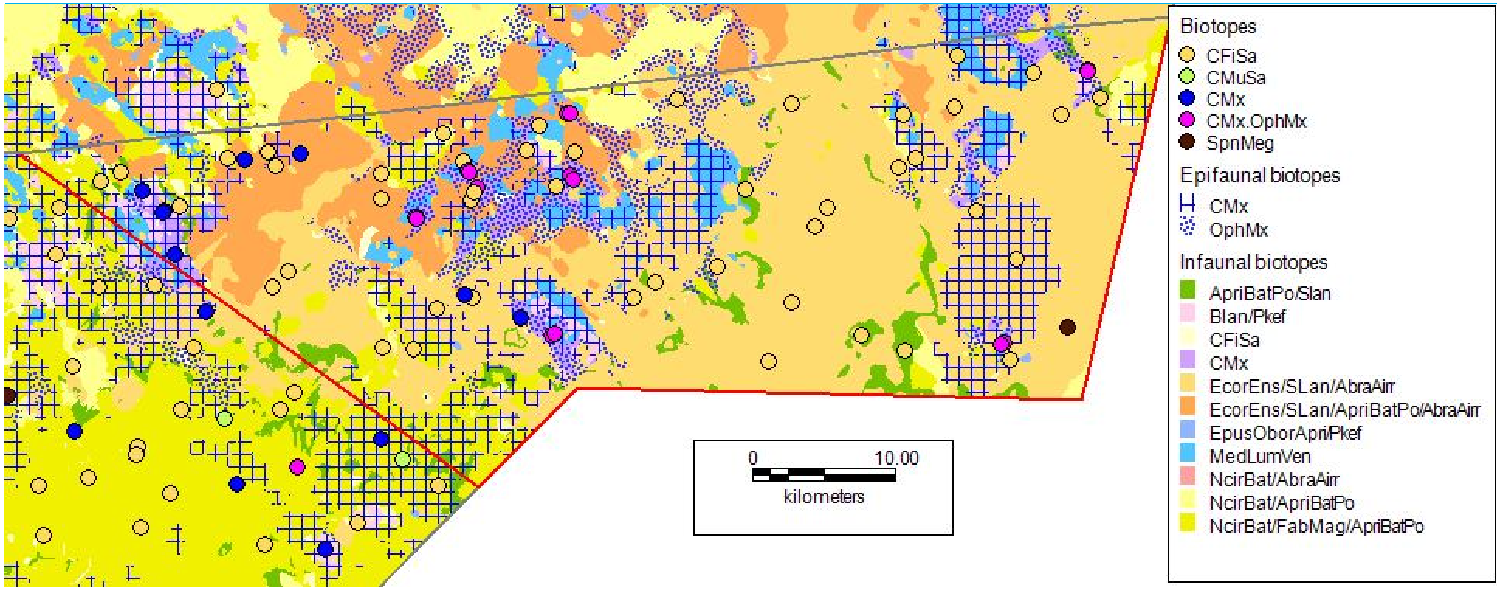

Figure 8.
Predicted distribution of infaunal biotopes (solid colour) and epifauna (hatch overlay) for Tranche B. The point data are the epifaunal biotope records that relate to the epifaunal overlay.

4.3. Teesside Cable Corridor

The Teesside Cable Corridor has a greater number of biotopes assigned, as would be expected from the greater range of depths and substrate types (Table 14).

The predominant sediment was classed as slightly gravelly sand although the fauna were more typical of muddier sediments. It is possible that the deep sediment may have been more stable and cohesive than the PSA results would indicate.

Table 14. *Biotope frequency amongst samples from the Teesside Cable Corridor*

Biotope	Frequency
CR.MCR.EcCr.FaAlCr	6
IR.MIR.KR	2
SS.SCS.ICS.SLan	1
SS.SMu.CFiMu.SpnMeg	14
SS.SMu.CSaMu.AfilMysAnit	2
SS.SMu.CSaMu.ThyNten/AfilNten	49
SS.SMx.CMx	21 (total 36)
SS.SMx.CMx.OphMx	6
SS.SMx.OMx.PoVen	9
SS.Ssa.CFiSa	2 (total 24)
SS.SSa.CFiSa.ApriBatPo	13
SS.SSa.CFiSa.EpusOborApri	9
SS.SSa.CMuSa	2
SS.SSa.IFiSa.NcirBat	6

The distribution of the biotopes along the Teesside Cable Corridor has been shown in three sections (from west to east) in Figures 9 to 11. The predicted biotopes have been interpreted from the segmentation analysis of the acoustic data and associations with the ground truth data. The predicted biotopes have been combined into suites of the most likely biotopes and the biotope records have been overlain as point symbols.

The distribution of habitats along the cable corridor follows a trend that is typical of those parts of the North Sea that are bordered by a rocky coastline. A wave-cut platform extends out some kilometres forming rocky outcrops interspersed by sand and mixed sediments. The Kelp rocky biotopes are found in shallow water and faunal crusts and turf below this depth. Thereafter, mixed sediments predominate out to 15-20 km and then give way to sandy mud habitats dominated by ThyNten/AfilNten biotopes. There are also frequent muddy areas with sea pens and burrowing megafauna and linear ribbons of coarser sediment.

Coarse sediments become more frequent as the sea floor rises close to the Dogger Bank at the eastern end of the Cable Corridor.

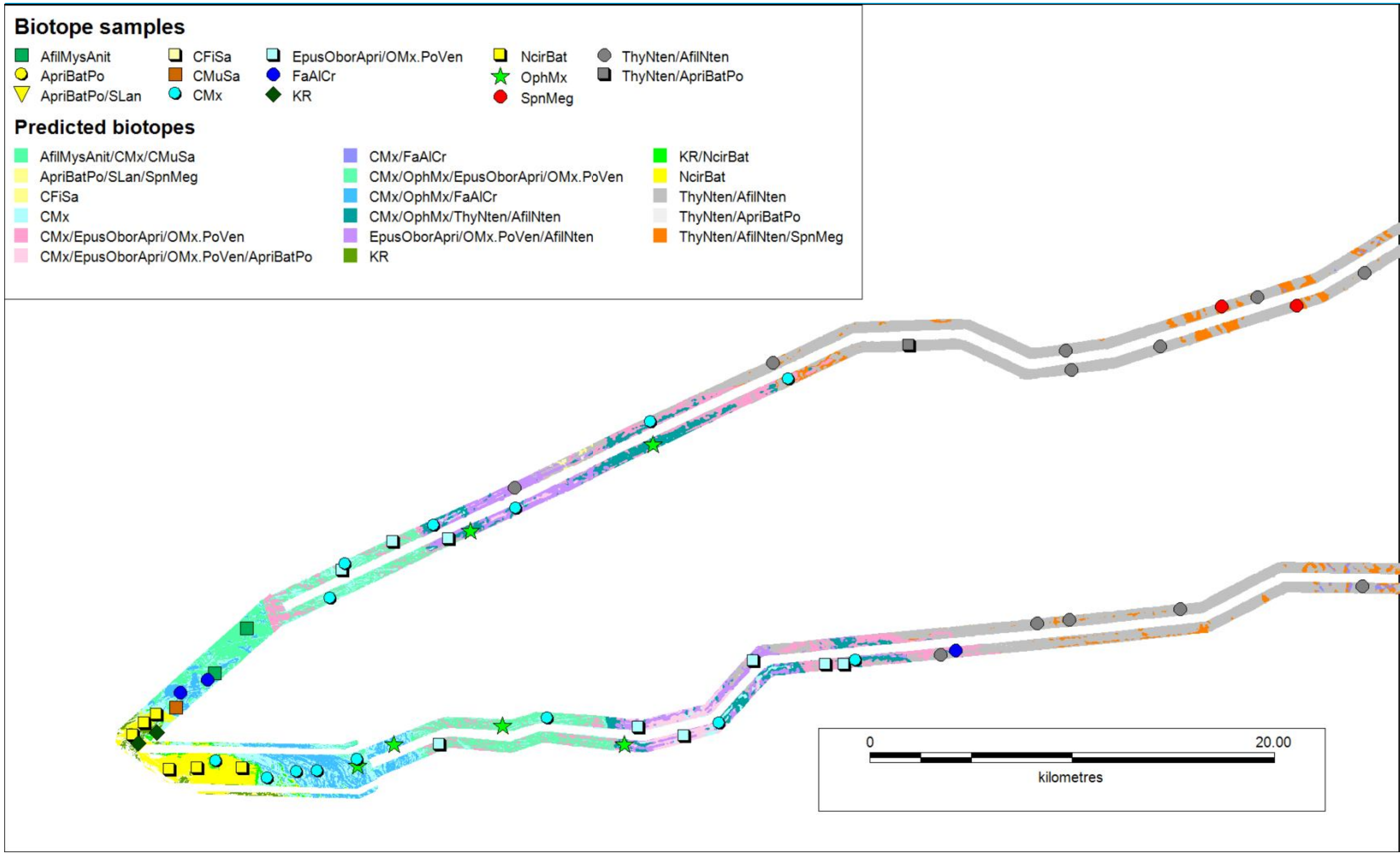

Figure 9.
Distribution of predicted biotopes for the western section of the Teesside Cable Corridor with samples overlain.

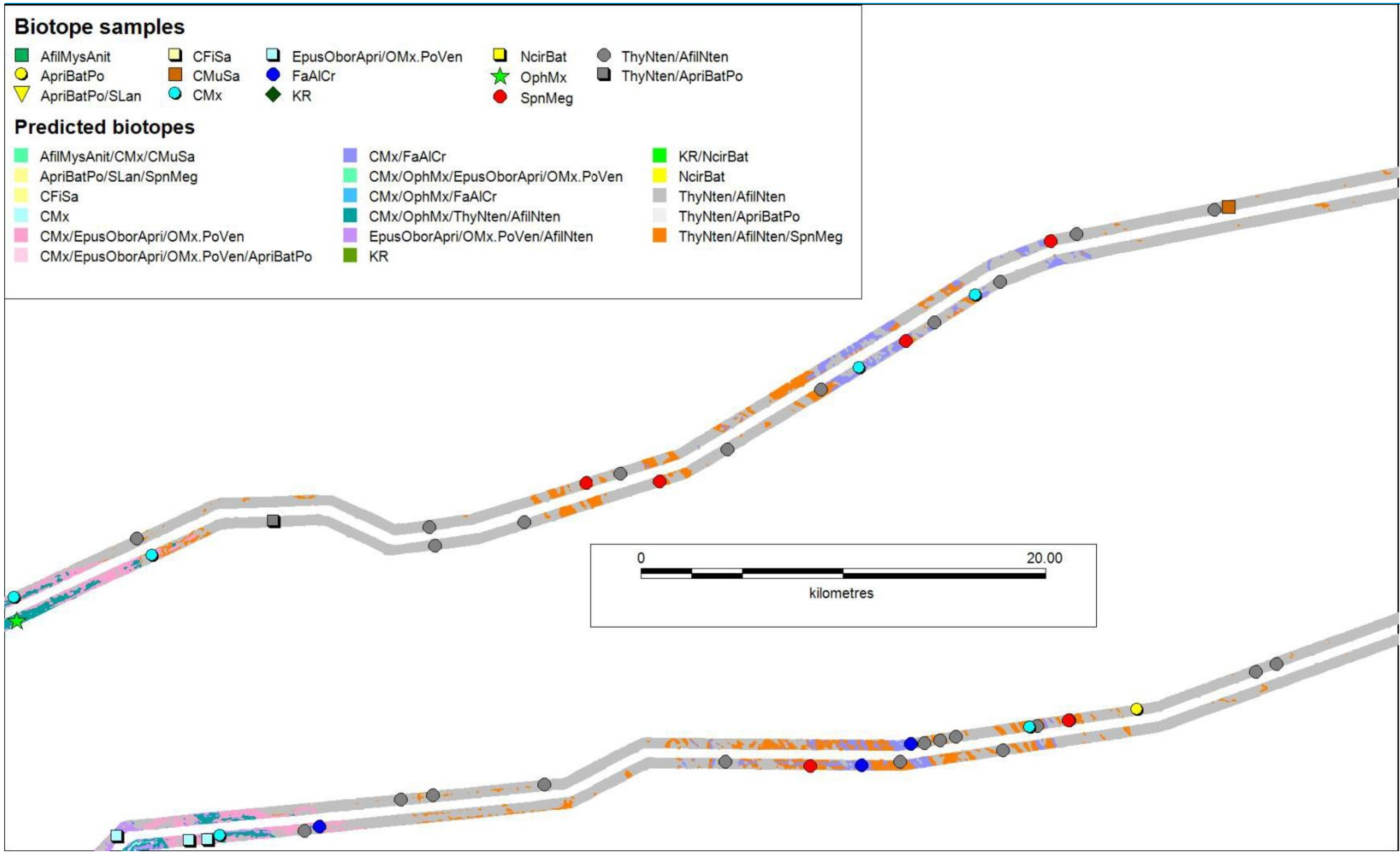

Figure 10.
Distribution of predicted biotopes for the central section of the Teesside Cable Corridor with samples overlain.

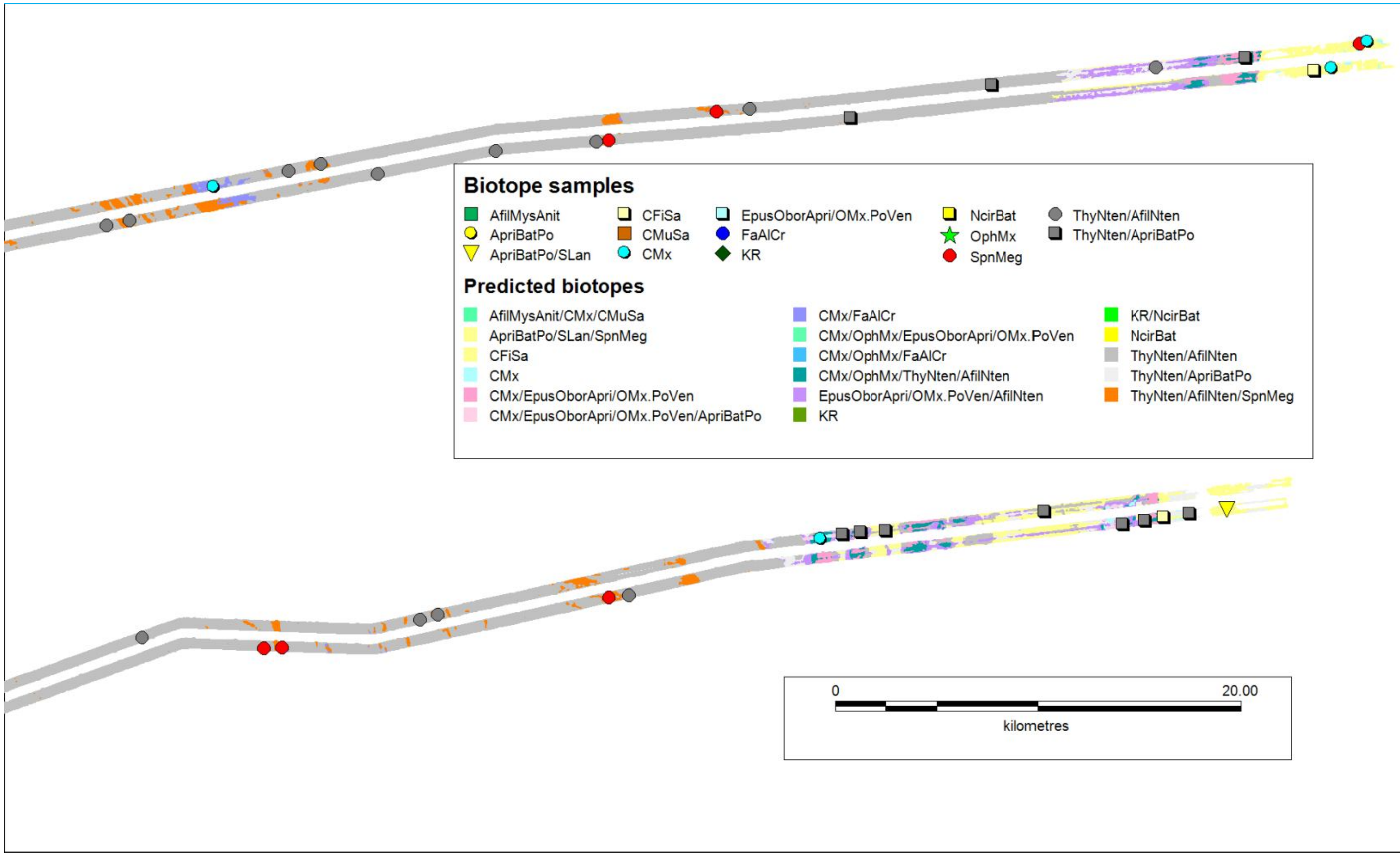

Figure 11.
Distribution of predicted biotopes for the eastern section of the Teesside Cable Corridor with samples overlain.

5. Conclusions

An argument has been made in this report for the collation of the data available in order to arrive at a consensus of the knowledge of the range, composition and distribution of habitats and biotopes in the area of interest. This has primarily involved collating the grab faunal data into one dataset and performing a single analysis to determine the nature of the statistically significant groupings. However, perhaps not entirely unexpectedly, groups have emerged that may owe their distinctiveness to differences between surveys (either sampling procedure or temporal differences).

Comparing the composition of these statistical groups to the common standard set by the Eunis classification may have overcome some of the differences by focusing on the key, defining species. However, even though the samples were standardised to the Eunis system, there were still differences in the biotopes assigned to the categories. This is especially apparent when comparing Tranches A and B.

It is likely that many of the biotope classes identified in these tranche areas are, in fact, rather similar to each other and share many of the same predominant species. These include the polychaetes *Spiophanes bombyx* and *Nephtys* spp, the amphipod *Bathyporeia* and in the coarser sediment the pea urchin *Echinocyamus pusillus* and the polychaete *Glycera* spp. This uniformity also to applies to diversity: The diversity of the samples is generally low, according to the analysis undertaken by Gardline (Environmental Characterisation Report, 2012). Although there are a few samples with high numbers of individuals, their distribution is scattered and it is hard to identify conditions or even biotopes that support high abundance. It is probable that these records may reflect a stochastic process (e.g., a random element in larval settlement or chance lack of disturbance from trawling).

Although all the biotopes within the Dogger Bank are qualifying features of the SAC, the disturbed nature of the sea floor and generally low diversity and robustness of the component species should be considered in any discussion on impacts and mitigation.

The biotopes most frequently identified along the deep water along the Cable Corridor are different from those found on the shallower sand banks of Dogger Bank. They are characterised by brittle stars *Ophiura* spp and *Amphiura filiformis*, the horseshoe worm *Phoronis* and the polychaete *Scoloplos armiger*. *Spiophanes bombyx* is also commonly found on the corridor. Despite the muddier sediment, the diversity of the samples along the corridor is also quite low.

However, "mud habitats in deep water" is a Priority Habitat as defined by the UK Biodiversity Action Plan (jncc.defra.gov.uk/page-5718) and the biotopes CMu.Sp.Meg (as SS.SMu.SpnMeg in the Marine Habitats Classification) "Seapens and burrowing megafauna in circalittoral fine mud" is specifically mentioned. Other communities, particularly those containing the hatchet shell *Thyasira* spp are also mentioned. This is a key component of the biotope SS.SMu.CSaMu.ThyNten which was commonly found along the Cable Corridor. The status of the deep muddy habitats along the corridor (e.g., probable extent and representation in the wider area north and south of the corridor and within the North Sea) may need to be assessed.

Although this report has not compared the faunal composition of the two cable corridors, it would appear that they differ significantly in their faunal composition. Both corridors are of a similar depth (50-60 m for much of their lengths) but the Creyke Beck corridor has been assigned to SS.SSa.CFiSa.ApriBatPo (*Abra prismatica*, *Bathyporeia elegans* and polychaetes in circalittoral fine sand), which has no special conservation status in offshore deep sediment habitats.

6. References

Diesing, M., Ware, S., Foster-Smith, R., Stewart, H., Long, D., Vanstaen, K., Forster, R. & Morando, A. 2009. Understanding the marine environment – seabed habitat investigations of the Dogger Bank offshore draft SAC. Joint Nature Conservation Committee, Peterborough. *JNCC Report* No. 429, 89 pp., 5 Appendices.

JNCC (accessed April 2013). The Biodiversity Action Plan (UK BAP). Jncc.defra.gov.uk/page-5155

Gardline 2012. Dogger Bank Offshore Wind Farm Tranche B and Teesside Cable Corridor Benthic Survey Environmental Characterisation. Report for Forewind Ltd