JNCC/Cefas Partnership Report Series

Report No. 15

CEND 03/13: Offshore seabed survey of Bassurelle Sandbank cSAC/SCI

Barrio Froján, C., Jenkins, C. & McIlwaine, P.

March 2017

ISSN 2051-6711

CEND 03/13: Offshore seabed survey of Bassurelle Sandbank cSAC/SCI

Barrio Froján, C., Jenkins, C. & McIlwaine, P.

Report completed 2013 and published March 2017

ISSN 2051-6711

For further information please contact:

Joint Nature Conservation Committee
Monkstone House
City Road
Peterborough PE1 1JY
www.jncc.defra.gov.uk

This report should be cited as:

Barrio Froján, C., Jenkins, C. & McIlwaine, P. 2017. CEND 03/13: Offshore seabed survey of Bassurelle Sandbank cSAC/SCI. *JNCC/Cefas Partnership Report Series* **No. 15**. JNCC, Peterborough.

Executive Summary

This report describes the findings of a dedicated survey by JNCC in partnership with Cefas to Bassurelle Sandbank Site of Community Importance (SCI).

Located in the Dover Straight and straddling the boundary between UK and French waters, the Bassurelle Sandbank SCI is an open shelf ridge sandbank formed by tidal currents, which has been designated to protect the EU Habitats Directive (1992) Annex I habitat feature "Sandbanks which are slightly covered by seawater all the time". The dedicated multidisciplinary survey (survey code CEND 03/13) was conducted by JNCC and Cefas in March 2013 aboard the RV *Cefas Endeavour* with the principal aim of collecting information to increase current knowledge of the distribution and heterogeneity of benthic habitats and communities present, to assist the development of future management advice and plans.

The survey was successful in acquiring new acoustic and groundtruthing data, which, in combination with existing historical datasets, has enabled the physical and benthic faunal characterisation of the sandbank feature and its immediate surroundings.

The Annex I sandbank feature within the Bassurelle Sandbank SCI has been delineated, though the ability to predict the extent of habitat types was limited by the extent of multibeam bathymetry and backscatter data collected. Collection of further bathymetry data would be of benefit in mapping the exact topographical boundaries of the sandbank.

There appears to be a close correspondence between the distribution of finer sandy sediments comprising the 'Sublittoral Sand' habitat type and relatively taxon poor benthic assemblages identified. Equally, there is close correspondence between the distribution of sediments with an increased gravel component, comprising the 'Sublittoral Coarse Sand' habitat type and more taxon rich benthic assemblages.

Evidence of human activity impacting the seabed has been observed within the boundary of the SCI in the form of trawl scars.

Contents

1 Background and Introduction **1**
2 Survey Design and Methods **2**
2.1 Survey plan 2
2.2 Acoustic and geophysical data acquisition 2
2.2.1 Sidescan sonar 2
2.2.2 Multibeam echosounder 3
2.3 Benthic sample and seabed imagery acquisition 3
2.4 Sample processing and data analysis 3
2.4.1 Acoustic data processing 3
2.4.2 Habitat mapping 3
2.4.3 Grab and trawl samples 5
2.4.4 Video and stills analysis 6
2.4.5 Particle size analysis 6
2.5 Data QA/QC 6
3 Results and Discussion **7**
3.1 Multibeam bathymetry and backscatter 7
3.2 Surficial sediments 9
3.3 Habitat map 12
3.4 Annex I habitat 11
3.5 Infauna 19
3.6 Epifauna 26
3.7 Anthropogenic impacts 32
3.8 Summary of habitats and features recorded 32
3.9 Data limitations 32
4 Summary **34**
References **35**
Appendices **36**
Appendix 1. Classification of sediment samples 36
Appendix 2. Species lists 39
Appendix 3. QA reports 44

1 Background and Introduction

The Bassurelle bank is a linear sandbank in the Dover Strait straddling the boundary between British and French waters. It is an example of an open shelf ridge sandbank, which is formed by tidal currents. The part of the sandbank within UK waters is approximately 2.5km at its widest point, and has a maximum height of around 15m. It extends for about 15km in a SW-NE direction to the UK-France median line, and continues for some distance into French waters (Graham *et al* 2001).

The Bassurelle bank conforms to the definition of a ‘sandbank which is slightly covered by sea water all the time’. As such, the feature has been proposed as a candidate special area of conservation (cSAC). A site remains a cSAC until it has been formally designated as a SAC by UK Government, following approval as a site of community importance (SCI) by the European Commission. Bassurelle Sandbank cSAC was submitted to the European Commission for consideration on 20th August 2010. It has since been approved by the European Commission as a site of community importance (SCI) (Figure 1).

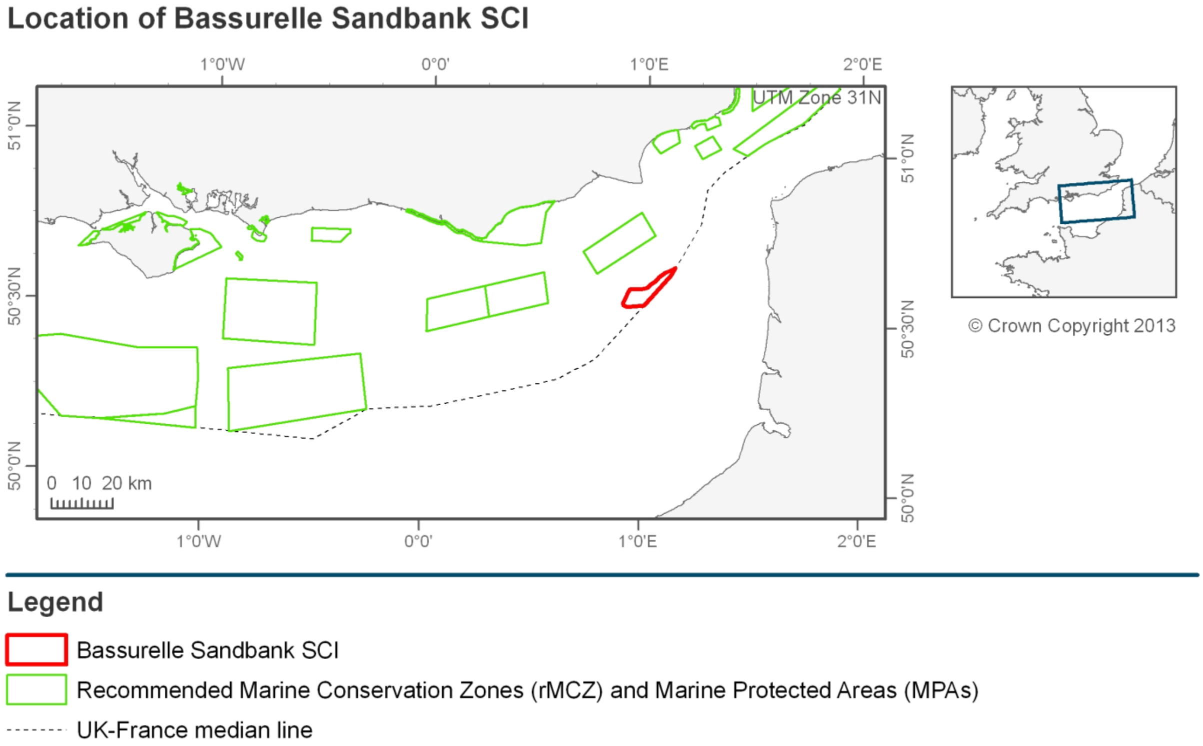


Figure 1. Location of the Bassurelle Sandbank SCI in relation to other marine protected areas (MPAs).

A dedicated multidisciplinary survey (CEND 03/13) of the Bassurelle Sandbank SCI was conducted in March 2013 aboard the RV *Cefas Endeavour* (Whomersley 2013) The principal aim of the survey was to collect additional information (acoustic and ground-truthing data) from the Bassurelle Sandbank SCI to increase current knowledge of the distribution and heterogeneity of benthic habitats and communities present, to assist the development of future management advice and plans.

2 Survey Design and Methods

2.1 Survey plan

For logistical purposes, the survey area around Bassurelle Sandbank SCI was split into two boxes, Box A to the west and Box B to the east. Each box was surveyed using acoustic and ground-truthing methods. Acoustic multibeam and side-scan sonar data were acquired along parallel corridors within each box. The emphasis of the acoustic data collection was on sidescan sonar data acquisition, as this was considered a better means than multibeam backscatter data of distinguishing any potential physical impacts on the seabed. Near 100% sidescan data coverage was obtained; multibeam data coverage obtained was significantly less due to limitations imposed by the shallow water depth. The location of the majority of ground-truthing stations was based on a 1km triangular grid across the entire survey area; additional sampling stations were targeted opportunistically between the gridded stations in an area towards the east of Box A (Figure 2).

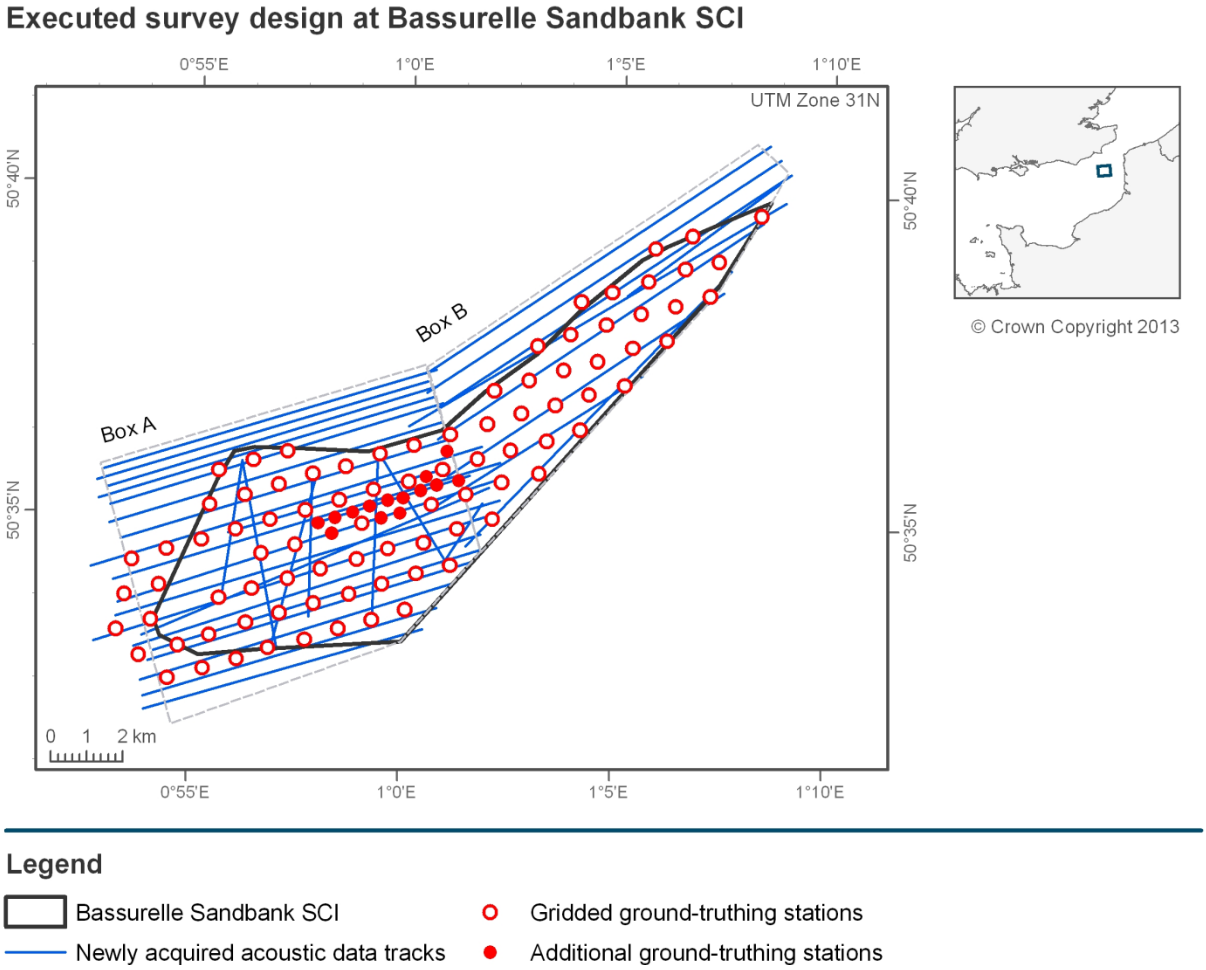


Figure 2. Acoustic and ground-truthing survey design executed at Bassurelle Sandbank SCI.

2.2 Acoustic and geophysical data acquisition

2.2.1 Sidescan sonar

An Edgetech FS-4200 dual frequency (300/600kHz) sidescan sonar was used in combination with the Edgetech Discovery software for data recording. Data were recorded in XTF format. The position of the sidescan towfish was calculated by a layback calculation using the ship's position as reference.

2.2.2 Multibeam echosounder

Multibeam bathymetry and backscatter data were acquired using the Kongsberg EM2040 system operated at 200kHz and deployed on the drop keel of RV *Cefas Endeavour*. Variations of sound velocity with water depth were determined using a CTD (conductivity-temperature-depth) probe with a sound velocity profile (SVP) measurement taken at least once every 24h; SVP data acquired were applied during multibeam data acquisition.

2.3 Benthic sample and seabed imagery acquisition

Ground-truthing stations were sampled using a HamCam (a 0.1m^2 mini--Hamon grab fitted with an underwater video camera) and a towed sledge fitted with a digital underwater video camera capable of taking still photographs. A Jennings 2m scientific beam trawl was also deployed at selected locations to collect qualitative information on the epifaunal assemblage. On recovery of the HamCam at each station, the sediment sample was decanted into a suitable container. The whole sample was photographed and the volume measured and recorded. A representative sub-sample of sediment (c. 0.5 litres) was taken for particle size analysis (PSA). The remaining sample was sieved over a 5mm and 1mm mesh sieve. Photographs were taken of the material retained on both sieves (see Whomersley 2013). The retained fractions were combined in a suitable container before being fixed with buffered 4% formalin solution.

The camera sledge system comprised of a video camera, laser-scaling device, underwater lights and a flash unit. During deployment, a note was made of the length of tow cable paid out to allow an estimate to be made of the distance of the sledge behind the vessel. USBL positioning was also used to log the position of the camera sledge on the seabed during each deployment. Video tows lasted c.10 minutes, with a still photograph taken at approximately one minute intervals, or opportunistically if a feature of interest was observed. Where deployed, the Jennings 2m beam trawl was towed at c.1.5 knots for c.5 minutes. On recovery, the catch was placed over a 5mm mesh sieve and all retained taxa were identified, enumerated and weighed.

2.4 Sample processing and data analysis

2.4.1 Acoustic data processing

Raw multibeam bathymetry data were processed using CARIS HIPS and QPS Fledermaus software packages. Tidal information was extracted from a high precision CNAV 3050 DGPS receiver. Tide height data were smoothed and extracted to reduce the bathymetry data to chart datum (CD). The soundings were cleaned by an experienced hydrographic surveyor using CARIS. Multibeam backscatter data were processed with the QPS Fledermaus geocoder toolbox (FMGT) software to produce floating point GeoTiff images.

2.4.2 Habitat mapping

EUNIS habitat class assignments from the particle size data were used in conjunction with the interpreted still images to inform the semi-automated process of map production using object-based image analysis (OBIA; Blaschke 2010), implemented in the software package eCognition v8.8.1. The OBIA was used to map habitats. It was not possible to use this technique for the mapping of Annex I habitats (specifically the sandbank feature at Bassurelle Sandbank SCI). Instead, an expert driven process of slope analysis in ArcGIS

9.3.1 and 3D visual interpretation using the Fledermaus v7 software package was used to identify the potential extent of the bank feature.

OBIA is a two-step approach consisting of segmentation and classification (Figure 3). The segmentation step divides the image into meaningful objects based on their spectral and spatial characteristics. The resulting objects can be characterised by their various features, such as layer values (mean, standard deviation, skewness, *etc*), geometry (extent, shape, *etc*), texture and many others. The subsequent step classification of the objects is based on combinations of these features.

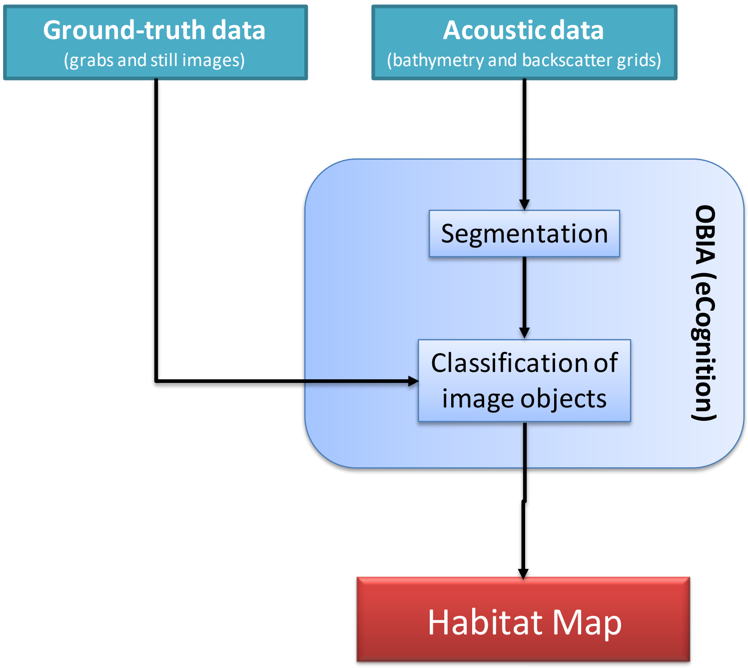


Figure 3. Flow chart outlining the process of producing the habitat map.

The input layers used for the OBIA were the multibeam backscatter strength and the multibeam bathymetry at a resolution of 0.5m. Segmentation was carried out employing the 'multiresolution segmentation' algorithm in eCognition. This is an optimisation procedure that starts with an individual pixel and consecutively merges it with neighbouring pixels to form an object. The process continues until a threshold value for a scale parameter is reached, the threshold being determined experimentally by the operator.

The goal of the segmentation is to create meaningful objects in the map image. The size of the objects is influenced by the chosen scale parameter and the heterogeneity of the image. For a fixed value of the scale parameter, a homogenous area of seabed will have larger objects than a heterogeneous area. Likewise for a fixed seabed heterogeneity, larger values of the scale parameter produce larger objects than smaller values. The multiresolution segmentation was carried out at pixel level on backscatter strength and bathymetry with a scale parameter of 10.

The classification of the resulting objects was carried out in several steps using the 'assign class' algorithm in eCognition, with choices made by the analyst informed by sediment classes determined for the ground-truth samples (as detailed above). Threshold conditions for defining and discriminating habitat classes were chosen experimentally. The resulting objects labelled with their respective class name (habitat type) were exported from eCognition as an ArcGIS shapefile for use in the creation of maps and figures presented later in this report report. Habitats were interpolated between survey lines using expert judgement to best assess the whole Bassurelle Sandbank SCI site, with interpolated regions being visually identifiable within the map.

Sidescan sonar data were assessed visually within the ESRI ArcGIS v9.3.1 software package to identify evidence of potential anthropogenic activity, for example trawl scars at the seabed.

2.4.3 Grab and trawl samples

Grab samples were processed for the extraction, identification and weighing of macrofauna by the Institute of Estuarine and Coastal Studies (IECS) following standard laboratory practices. Results were checked following the recommendations of the National Marine Biological Analytical Quality Control (NMBAQC) scheme (Worsfold *et al* 2010).

In addition to the data extracted from the grab samples collected during the 2013 dedicated survey of Bassurelle Sandbank SCI, macrofaunal abundance data from other grab surveys in the locality were identified and included in the analyses if they fell within the area covered by Box A and Box B around the SCI boundary. The East English Channel (EEC) Pressures survey (Jenkins *et al* 2015), completed in December 2011, included 32 samples that fell within the area of interest (Figure 4).

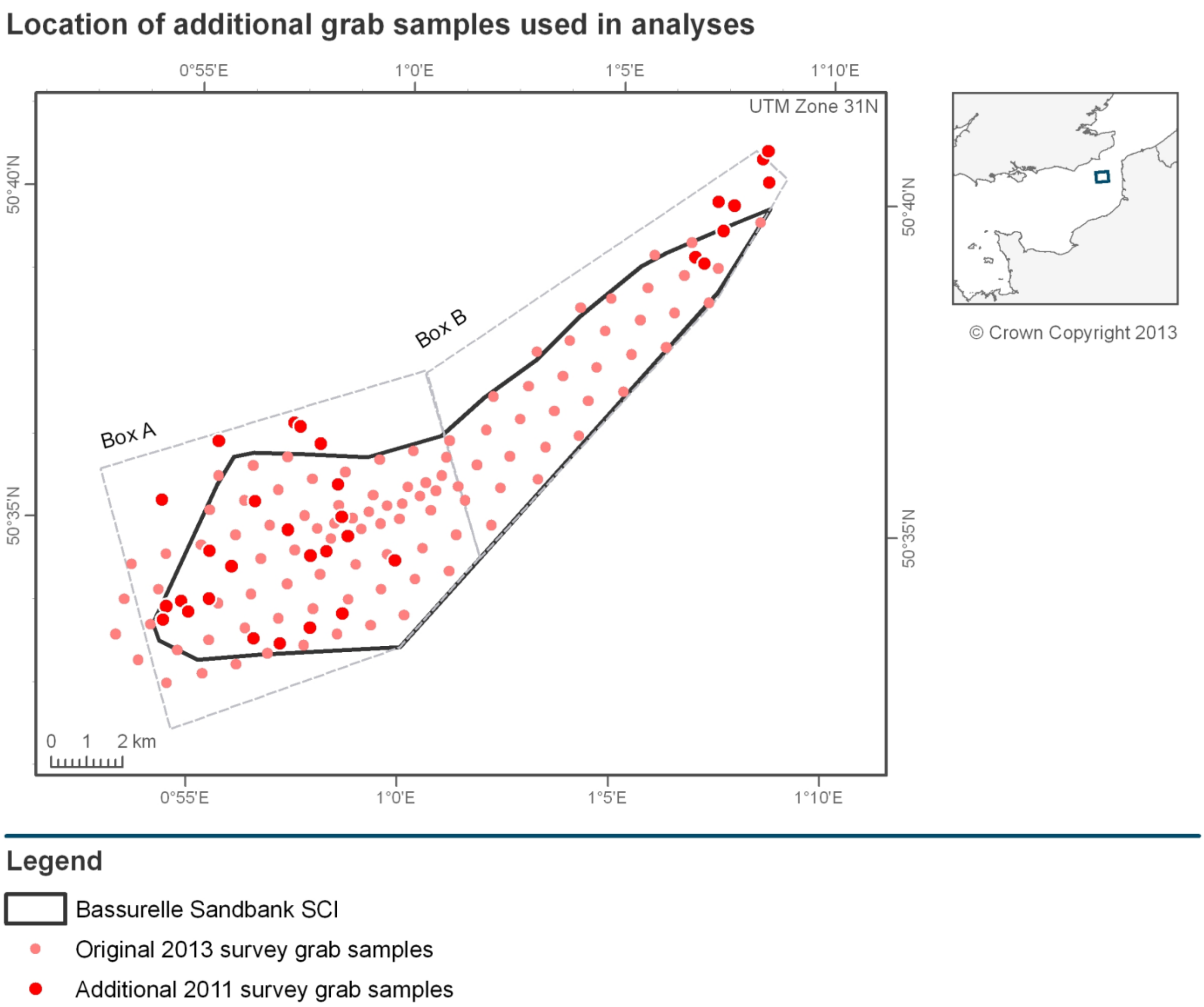


Figure 4. Location of the additional 32 grab samples (bold dots) identified from previous surveys in the Bassurelle Sandbank SCI area. Grab samples collected on this survey (CEND 03/13) are shown as transparent dots.

For the present report, standard univariate and multivariate analyses have been performed on the taxon abundance-by-sample matrix that included all samples. Prior to analyses, the data matrices were checked for inconsistencies and spurious entries (egg masses, fragments, *etc*). Metrics calculated for each sample included total macrofaunal abundance (N), total wet weight biomass (B), total number of taxa (S) and Hill's (1973) taxon diversity index (N1). Multivariate analyses were performed using the PRIMER 6 software package (Clarke & Gorley 2006). These analyses included calculations of faunal similarity (using the Bray-Curtis similarity coefficient applied to square-root transformed taxon abundance data). Sample clustering techniques (SIMPROF) were also employed to identify statistically significant groups of samples, and the SIMPER routine was performed to identify which taxa contributed to the similarity between these statistically defined groups.

Data from the onboard processing of beam trawl samples have also been supplemented with data from beam trawls carried out in the area by previous surveys. In total, six beam trawl samples were available for analysis (3 from the dedicated 2013 survey of the SCI and three from the 2011 EEC Pressures survey (Jenkins *et al* 2015)). Given such scarcity of samples, the available data have been used as supporting evidence of taxon presence, rather than subjected to formal statistical analyses.

2.4.4 Video and stills analysis

The purpose of acquiring and analysing video and still photograph samples was to note where one substrate type changed to another, identify habitat types, and provide semi-quantitative data on their physical and biological characteristics. In total, video footage from 32 stations was processed, together with 519 associated still photographs.

Acquired video and photographic stills were processed by APEM Ltd in accordance with the guidance documents developed by Cefas and JNCC for the acquisition and processing of video and stills data (Coggan & Howell 2005; JNCC 2014). The full report produced by APEM Ltd is provided as a separate document (available on request).

Taxon records extracted from video and still photograph samples have been analysed to ascertain any pattern in the dataset which may assist in the delineation of distinct epibenthic assemblages.

2.4.5 Particle size analysis

PSA was carried out by Cefas following standard laboratory practices and the results checked by specialist Cefas staff following the recommendations of the National Marine Biological Analytical Quality Control (NMBAQC) scheme (Mason 2011).

PSA data have been analysed in conjunction with benthic faunal datasets where appropriate to elucidate any possible correlations between the two datasets. Detailed descriptions of specific analyses are presented in context, below.

2.5 Data Quality Assurance (QA) and Quality Control (QC)

All activities in the field were performed according to the recommendations in the following documents:

- Biological Monitoring: General Guidelines for Quality Assurance
- Quality Assurance in Marine Biological Monitoring[1]

[1] Reference URL: http://www.nmbaqcs.org/qa-standards/qa-in-marine-biological-monitoring.aspx

- Recommended operating guidelines for underwater video and photographic imaging techniques[2]

Reports generated from the QA of the biological data generated by this study are listed in Appendix 3.

3 Results and Discussion

3.1 Multibeam bathymetry and backscatter

Within the surveyed area, water depth varied between 10 and 54m below chart datum (CD), the shallowest depths occurring towards the eastern half (Box B) of the SCI boundary (Figure 5). Megaripples were observed on the north-facing flank of the western half of the survey area (Box A), whilst on the south flank, large sand waves were observed. The Bassurelle sandbank drops away along its northern flank, whilst towards the south and east, the sandbank extends beyond the UK-France median line into French waters.

Backscatter values were relatively high across the survey site, indicative of a coarse and sandy substrate (Figure 6). Backscatter reflectivity, however, did not appear to mirror bathymetric features. There would appear to be a predominance of coarser sediments to the south and west of the survey area compared with sandier areas of lower reflectivity to the north and east.

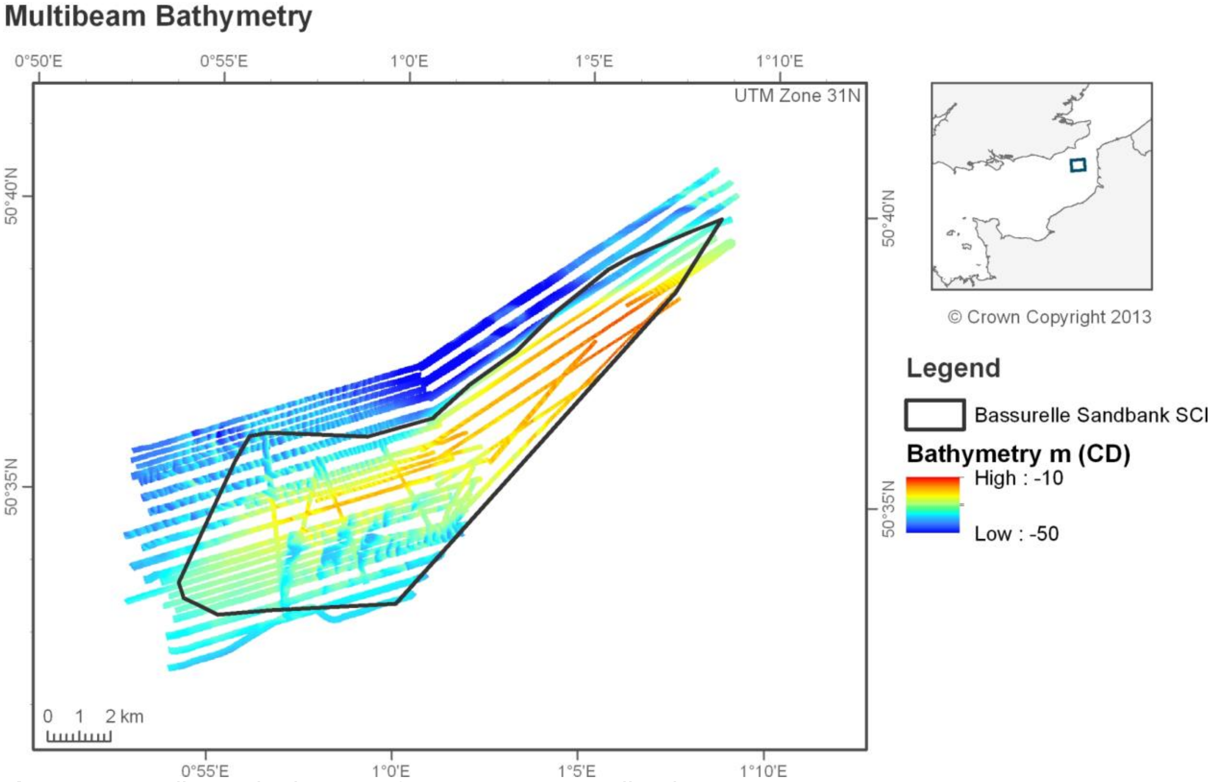


Figure 5. Multibeam bathymetry for Bassurelle Sandbank SCI.

[2] Reference URL: http://www.searchmesh.net/PDF/GMHM3_Video_ROG.pdf

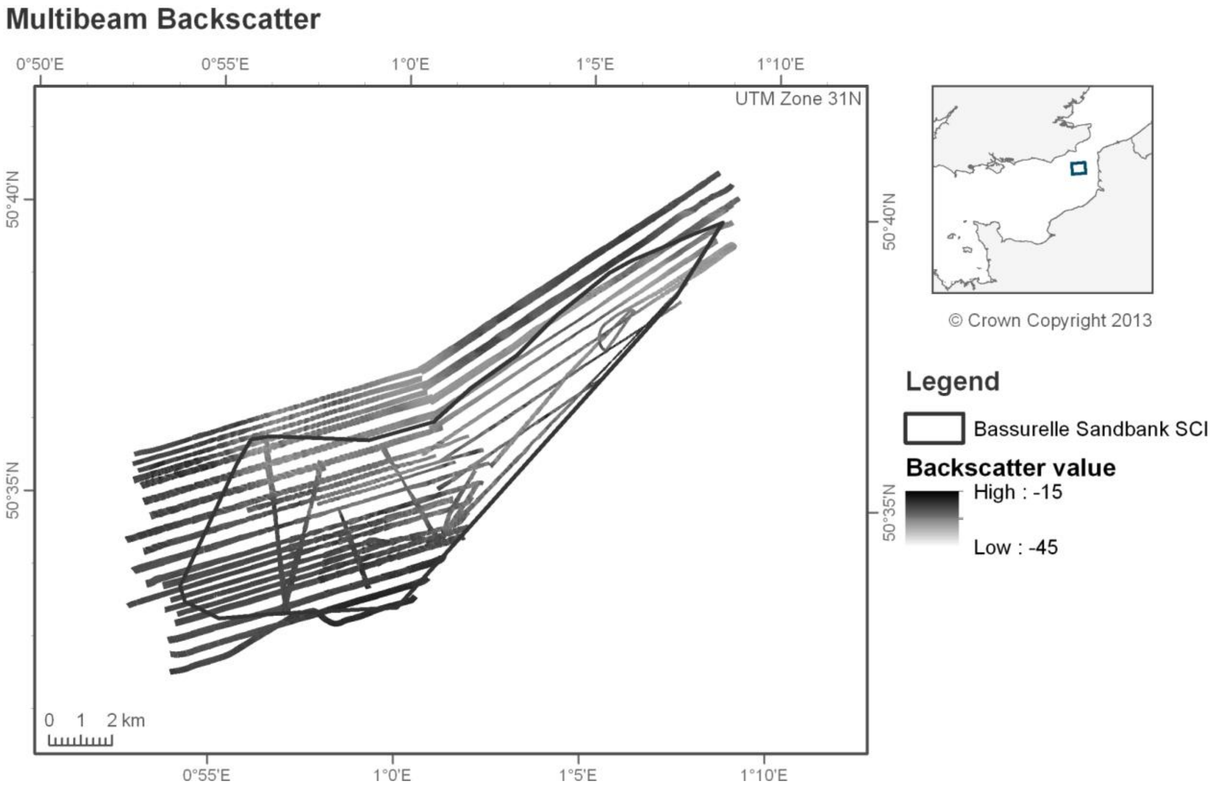


Figure 6. Multibeam backscatter for Bassurelle Sandbank SCI.

3.2 Surficial sediments

A total of 133 grab samples were available for the extraction and quantitative analysis of particle size data. From the PSA data generated, samples have been classified according to both the modified Folk (Long 2006) and the EUNIS[3] sediment classification system. Detailed results from the classification of each sample are presented in Appendix 1. Samples fell into one of five different classes of the Folk classification system: sand [S], slightly gravelly sand [(g)S], gravelly sand [gS], gravelly muddy sand [gmS], and sandy gravel [sG] (Figure 7). From the purely sandy sediments found at the highest elevation of the sandbank (shallowest water depth) towards the centre of the SCI, sediments get progressively very slightly coarser with increasing depth, towards the southwest and northeast corners of the SCI boundary. The sand fraction remains predominant across the site, with only two samples outside the northern boundary of the SCI being characterised predominantly by gravel.

According to the EUNIS sediment classification system (Level 3), the majority of samples (79) were classified as A5.2 Sublittoral Sand, 54 samples were classified as representing A5.1 Sublittoral Coarse Sediment, and a single sample was classified as A5.4 Sublittoral Mixed Sediment (Figure 8). Visual interpretation of the video footage and still photographs acquired from each video sampling station also revealed that 24 stations could be classed as A5.2 Sublittoral Sand, 14 as A5.1 Sublittoral Coarse Sediments and a single station represented A5.4 Sublittoral Mixed Sediments. Once again, the finer sediment classes were predominant towards the shallower reaches of the sandbank in the centre of the survey area, with sediments appearing coarser towards the deeper southwest and northeast. Mixed sediments were observed just inside the southern boundary of the Bassurelle Sandbank SCI.

[3] Reference URL: http://eunis.eea.europa.eu/about.jsp

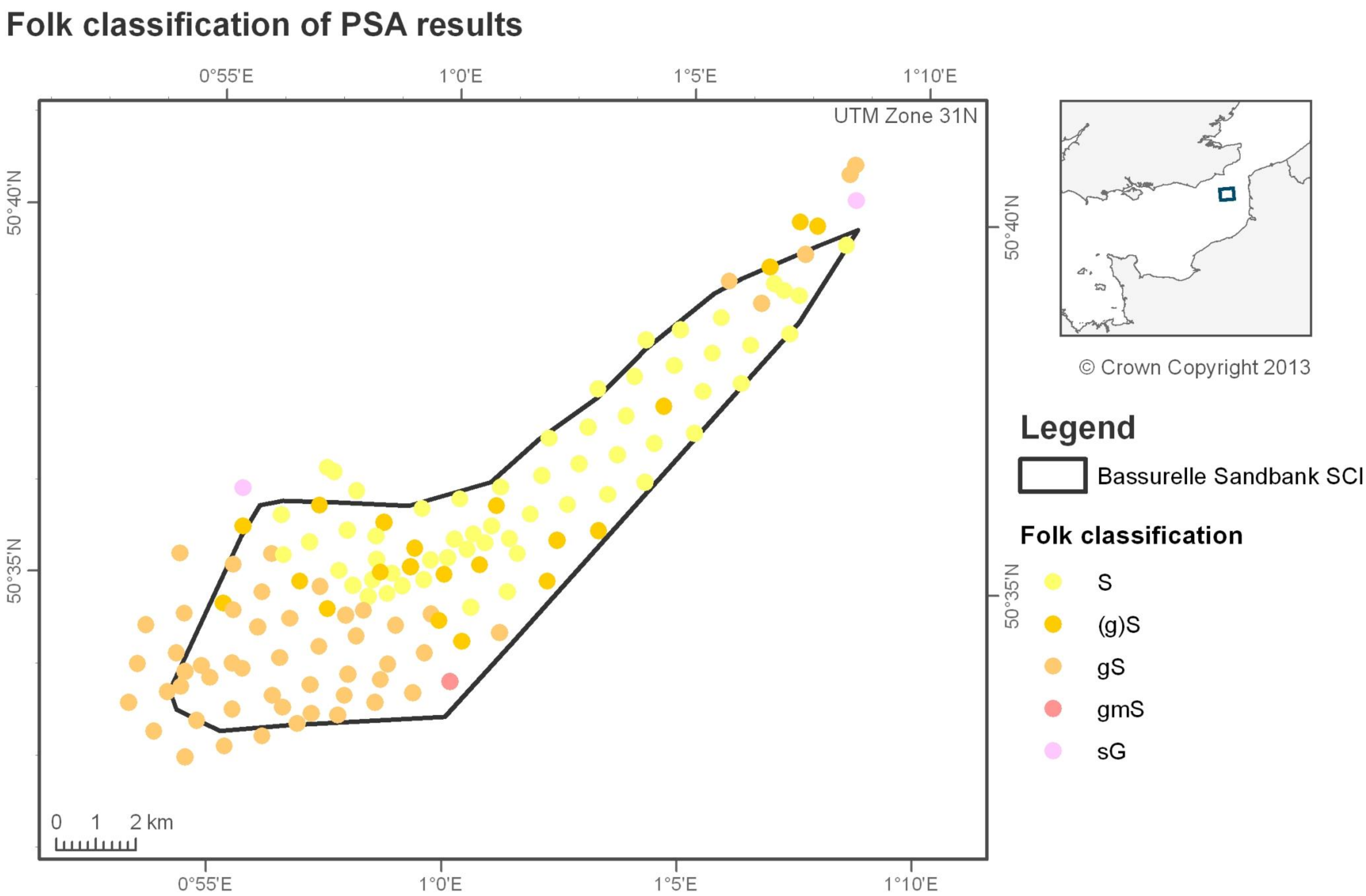


Figure 7. PSA results of sediment type, colour-coded according to the Folk classification system.

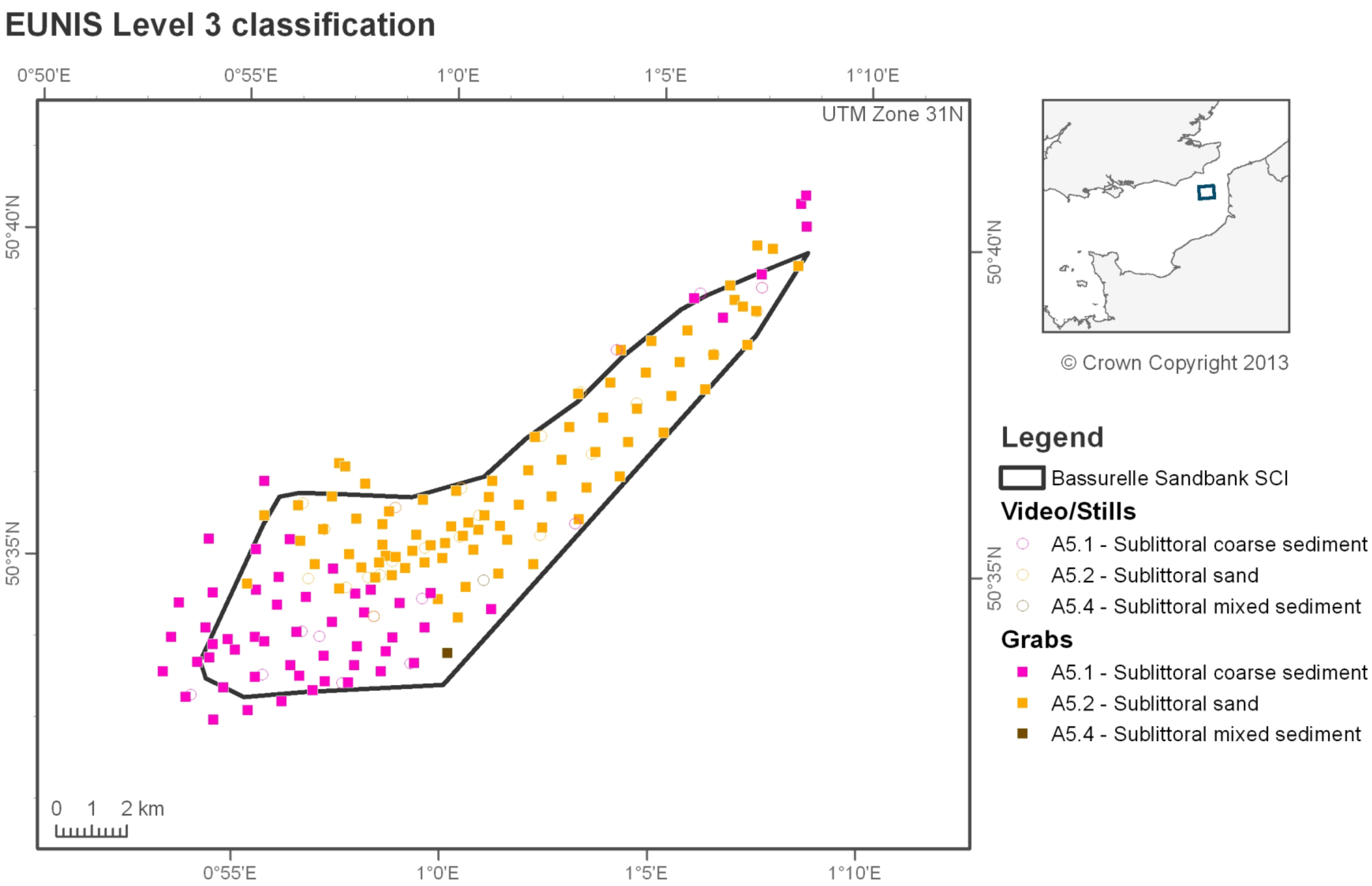


Figure 8. PSA results and data from the visual interpretation of video and stills from each sampling station, classified according to EUNIS Level 3.

3.3 Habitat map

Results of the OBIA suggest Bassurelle Sandbank SCI is predominantly comprised two habitat types: Sublittoral Sands and Sublittoral Coarse Sediments. Sublittoral Coarse Sediments predominated towards the southwest of the survey site, whilst Sublittoral Sands appeared to be prevalent across the rest of the area, with only a few patches of coarser habitat noted in the north-eastern corner of the survey area (Figure 9).

3.4 Annex I habitat

Bassurelle Sandbank SCI was recommended for designation as an SAC for its Annex I feature 'Sandbanks slightly covered by sea water all the time' under the criteria for site selection outlined in Annex III of the Habitats Directive (JNCC 2010). It is possible to categorise sandbanks either by their sediment type (sands, gravelly sands or muddy sands) and/or by topography (sandy mounds or current tidal sandbanks, that may be open shelf, ridge, estuary mouth or headland associated banks). The Annex I definition specifies that the top of the sandbank must lie at depths shallower than 20m of water, slightly covered by seawater at all times and be predominantly surrounded by deeper water.

JNCC has devised a methodology (Ellwood 2012) for the delineation of Annex I Sandbank features. This methodology relies on a mixture of slope analysis, using a 0.5° cut-off to define the bottom of the bank, as well as expert judgement from a range of potential data derivatives (namely sediment type, bathymetry, contours and aspect) depending on the prevailing conditions in which the sandbank is to be found.

Figure 10 shows the slope derivative map from a gridded (10m grid size) bathymetry layer for the Bassurelle Sandbank SCI. A 10m aggregation (grid size) was selected in an attempt to remove some of the small-scale complexity created by the megaripples present on the northern flank towards the west of the site.

Investigation of the slope derivative showed that using a 0.5° cut-off to delineate the bottom of the bank would not be feasible, and that an expert-driven approach would be necessary. This was due to slope analysis in ArcGIS 9.3 picking up the higher resolution slope changes from the megaripples and sandwaves to the north and south, respectively, of the Bassurelle sandbank. Therefore, the expected decrease in slope angle coming away from the flanks of the main bank was masked. Use of the Fledermaus v7 software allowed for 3D visualisation of the data, as well as an opportunity to exaggerate slope features for ease of interpretation. 3D profiles of the sandbank feature were created along the flanks to best identify and define the edges of the bank. On the north flank of the sandbank, using best judgement, it was Fepossible to interpolate between data points where the bottom of the bank may lie (Figure 11). Running profiles from the top of the bank to the edge of the collected data, progressively along the flank, allowed a dot-to-dot approach that could be followed to delineate the limit of the bank. Following this approach, however, was confounded by the complexity of the bank features to the south of the site as well as by the data gaps created by the corridor approach to data acquisition.

Figure 12 demonstrates the extent of the megaripples found to the north and west of the survey area, whereas the profile of Figure 13 shows the difficulty identifying a clear boundary for the limit of the sandbank feature within the megaripple region. Expert judgement and a familiarity with the data were relied upon to discern a potential sandbank boundary. The south flank of the western end of the Bassurelle sandbank was dominated by large sandwaves that appear to run like fingers from the bank feature southward. Due to the gaps in data along this stretch, it was not possible to better differentiate these sandwaves from the main bank, and were therefore mapped as part of the Bassurelle sandbank feature.

The resulting delineation boundary of the sandbank feature is illustrated in Figure 14, which depicts the potential Annex I sandbank extent, defined using the methodology described relative to the site boundary of Bassurelle Sandbank SCI.

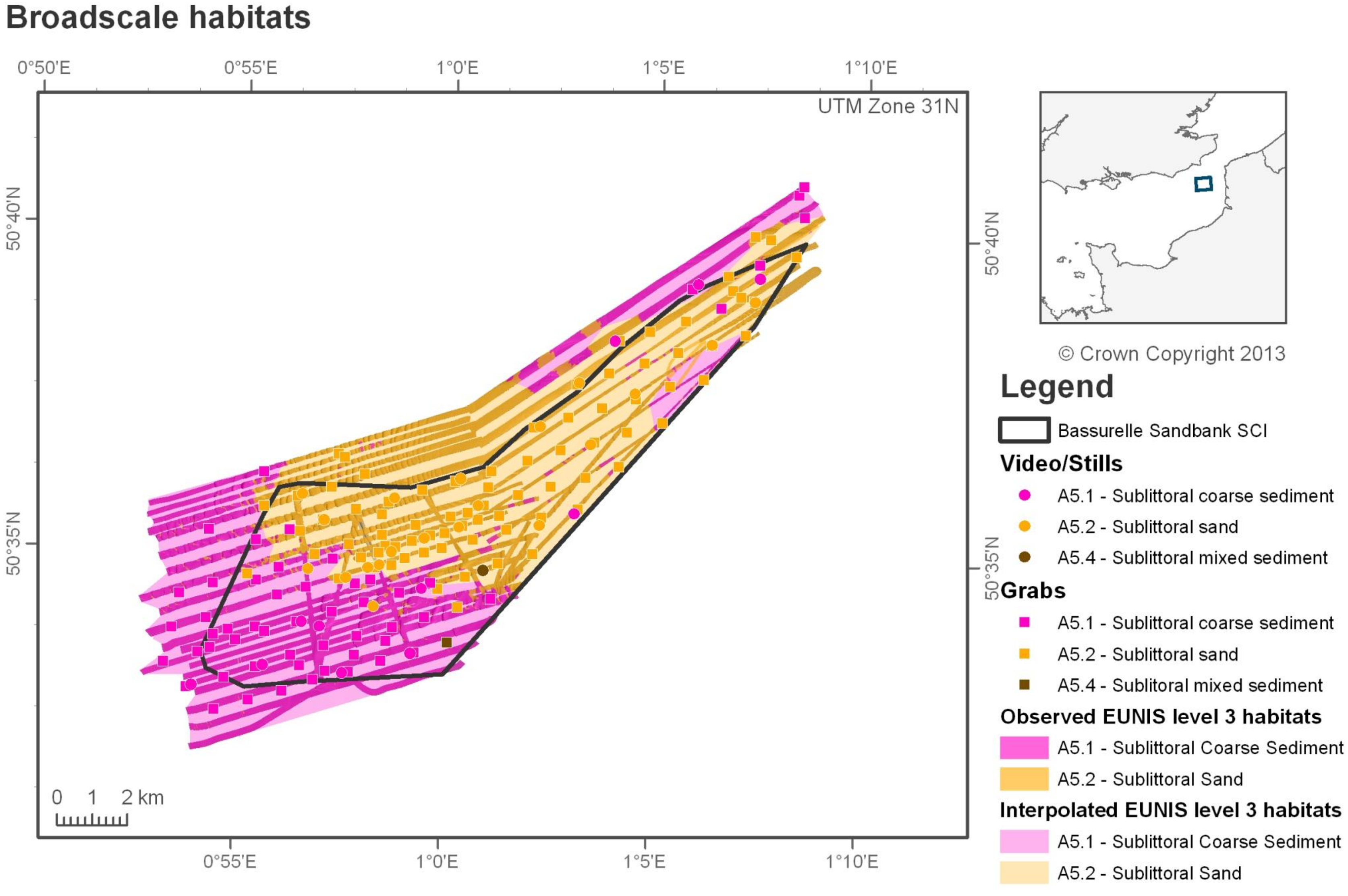


Figure 9. Observed and predicted habitat types at the Bassurelle Sandbank SCI.

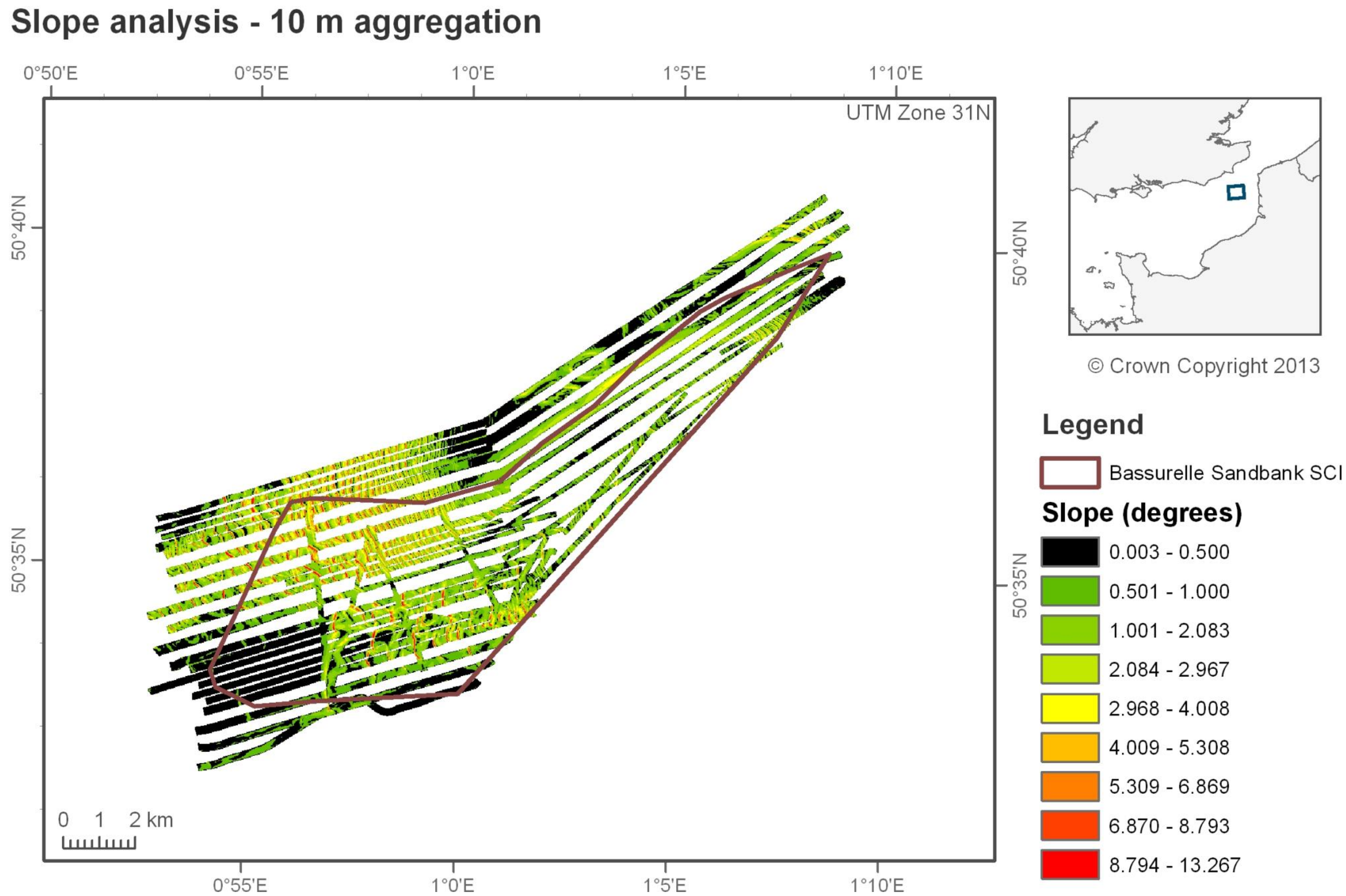


Figure 10. Slope derivative from the 10m gridded bathymetry data layer for Bassurelle Sandbank SCI.

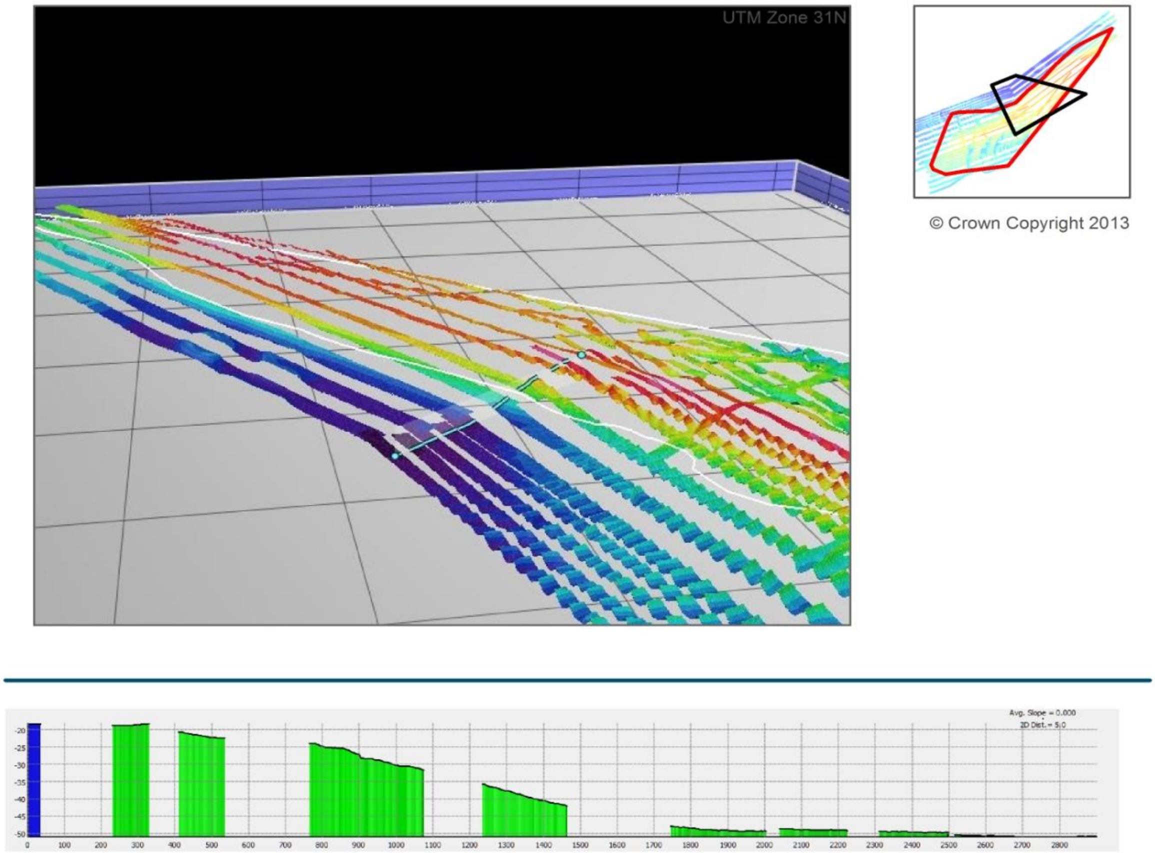


Figure 11. Above: 3D view of bathymetry data – view orientated from the northwest facing the southeast of the site. Note the blue line marking where a profile of the bank was taken. Below: profile taken from the top of the bank down the northerly flank along blue line in the top panel.

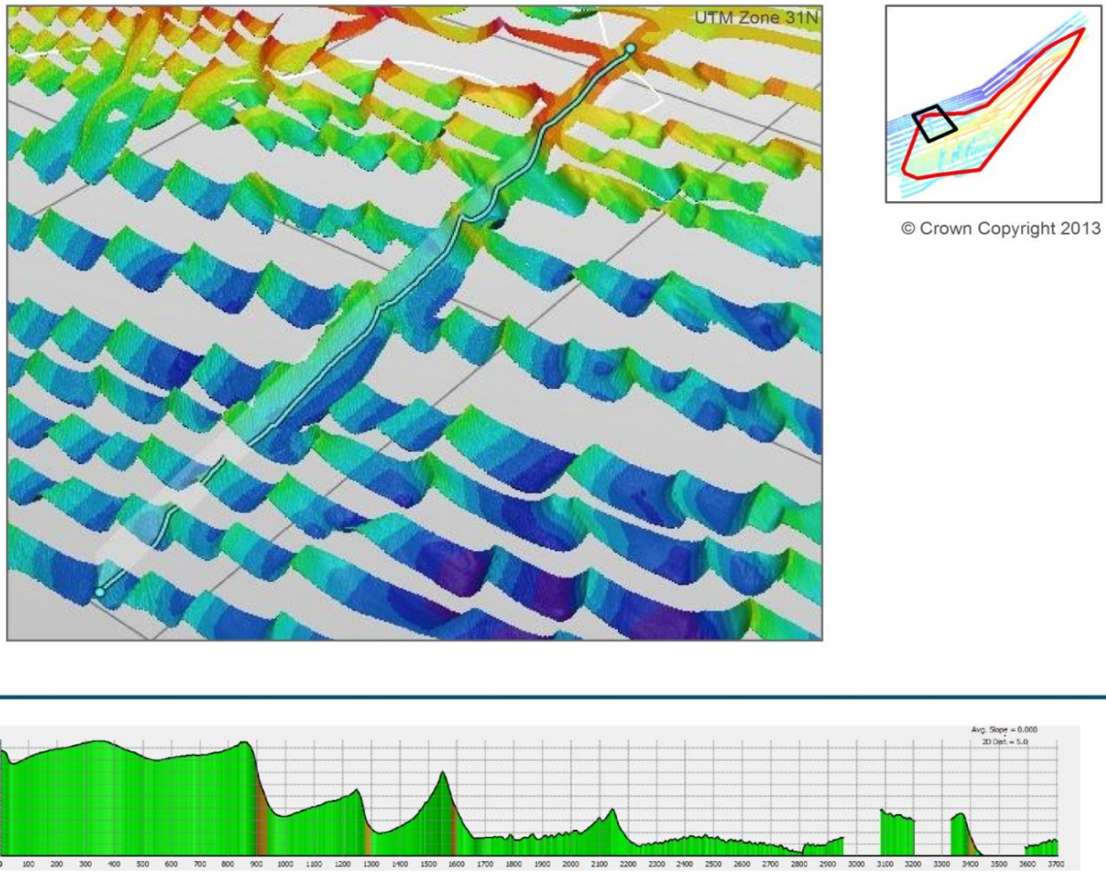
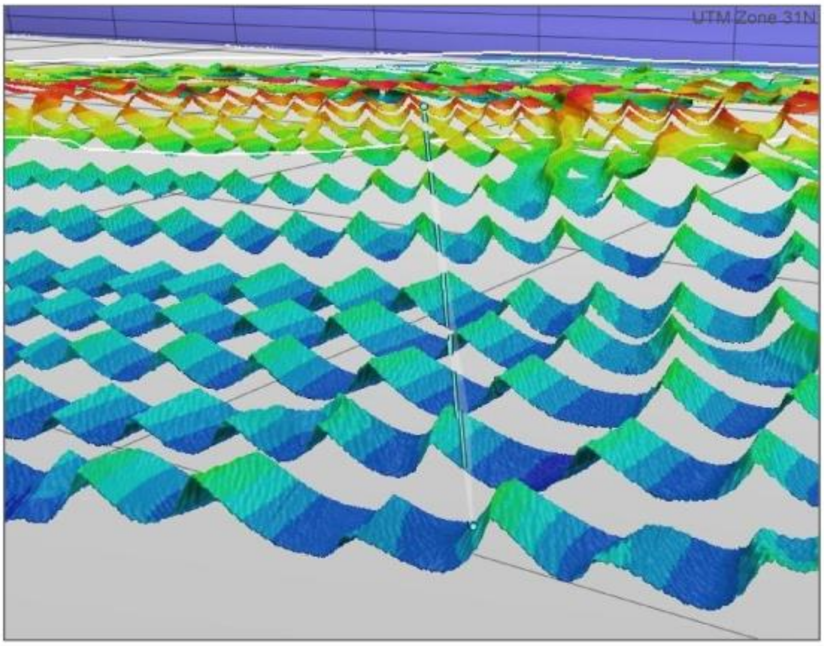
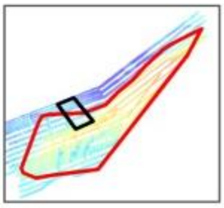


Figure 12. Above: 3D view of bathymetry data orientated from the northwest facing the south of the site. Note the blue line marking where a profile of the bank was taken. Below: Profile taken along north-south transit line, towards the bottom edge of the easterly flank along the blue line in the top panel.

3D bathymetry





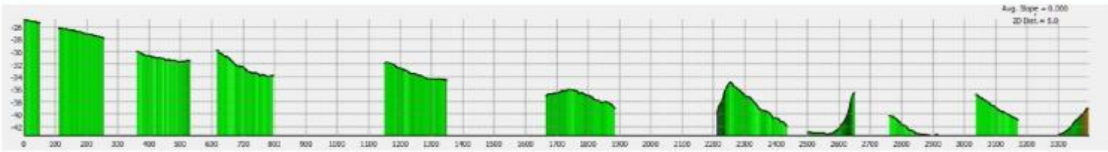


Figure 13. Above: 3D view of bathymetry data orientated from the north facing the south of the site. Note the blue line marking where a profile of the bank was taken. Below: Profile taken from the top of the bank down the northerly flank between megaripples along the blue line in top panel.

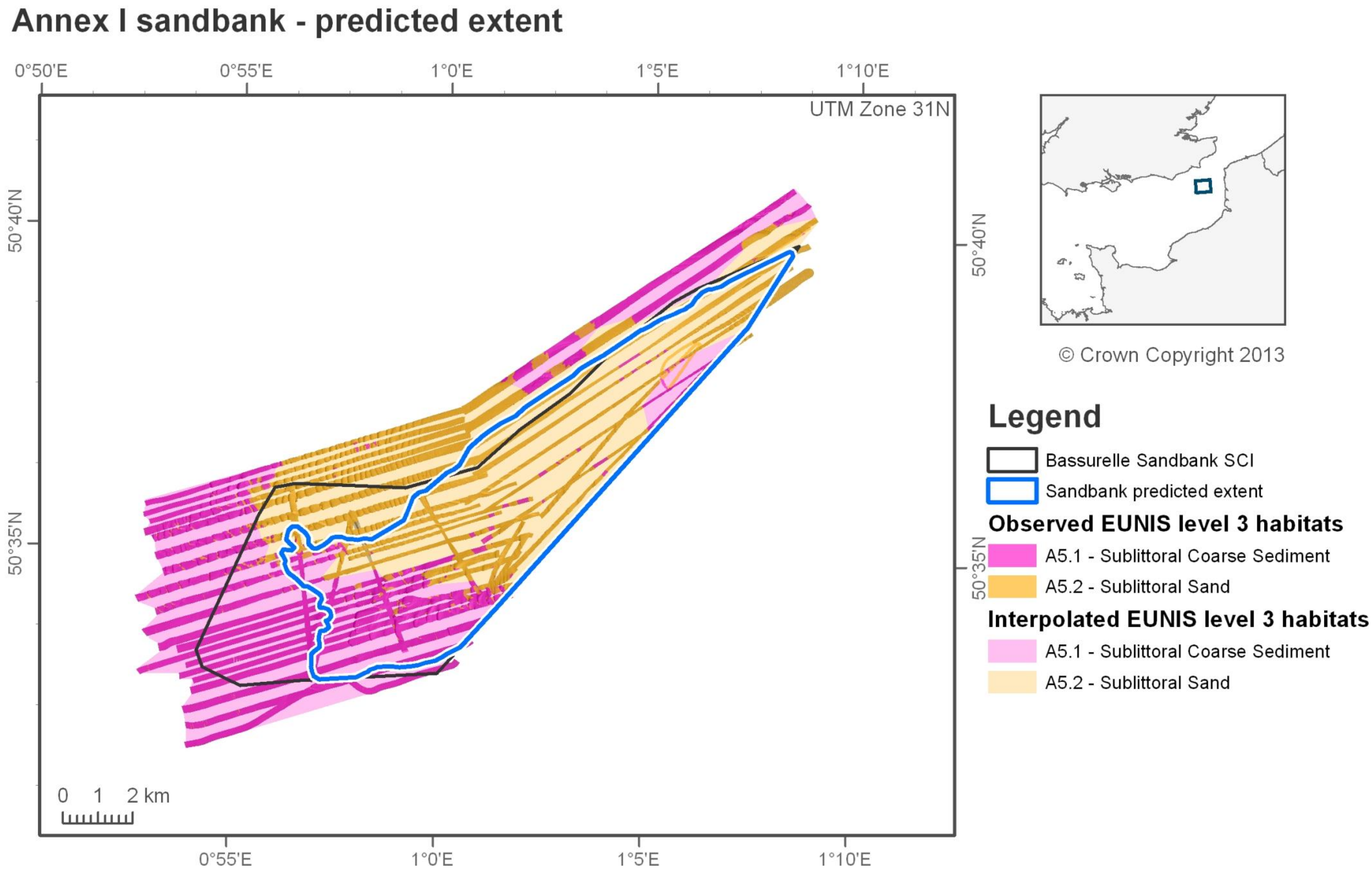


Figure 14. Predicted extent of Annex I sandbank relative to the boundary of Bassurelle Sandbank SCI.

3.5 Infauna

A total of 134 grab samples were available for infaunal analysis, 102 samples from the 2013 dedicated survey of the Bassurelle Sandbank SCI and 32 from the 2011 EEC Pressures project.

Taxa were most scarce along the predominantly sandy top of the bank, at the shallowest depths, with a notable increase in the number of taxa towards the northeast and southwest corners of the survey area and with increasing depth (Figure 15). Highest taxon numbers within the predicted extent of the sandbank feature were towards the southernmost edge, towards the west of the survey area (see Figure 20). The increase in taxa with increasing depth is likely to be a result of a coarsening of the sediment (see Figure 7), which in turn provides greater stability and texture to the substrate for faunal colonisation. Taxon diversity and total sample biomass had a similar distribution to that displayed by the number of taxa (data not shown).

The analysis of infaunal assemblage composition (excluding colonial taxa) resulted in a distribution of assemblages that reflected the pattern in the distribution of the number of taxa (Figure 16). Although many statistically distinct assemblages were identified, not all are likely to represent ecologically or functionally distinct assemblages. By observing the distribution and relative abundance of constituent taxa, assemblages a to k (coloured in varying shades of green in Figure 16) were very distinct from assemblages l to v (coloured in shades of yellow, orange and red). The former assemblages appeared to be concentrated around the shallower, sandy sediments at the top of the sandbank, whereas the latter assemblages were concentrated at greater depths towards the northeast and southwest of the survey area.

Assemblages in shallower, sandy sediments were represented by relatively few taxa occurring at relatively low levels of abundance, in contrast with relatively more abundant, taxon rich assemblages occurring on coarser substrates. On average, the abundance of taxa representing the taxon rich assemblages was three times greater than the abundance of taxa in the taxon poor assemblages (data not shown). Such patterns, however, can only be discerned by the exclusion of colonial taxa (which cannot easily be enumerated) and it is these colonial taxa which tend to be characteristic of coarser, more stable substrates. Therefore, further analyses have been conducted including all taxa but without a measure of relative abundance.

By analysing all recorded taxa (including colonials), results revealed a very similar pattern in the distribution of the distinct assemblages identified (Figure 17), as well as the possibility of identifying which of all the taxa were most responsible for the observed differences in assemblage composition. The statistically distinct assemblages coloured in shades of green (a to f in Figure 17) appear broadly intermingled with each other, yet collectively concentrated on the top of the sandbank. The taxa characterising the area covered by these assemblages are typical of relatively unstable, clean sandy sediments (e.g. *Nephtys cirrosa*, *Ophelia borealis*, *Spiophanes bombyx*). In the deeper and coarser sediments, assemblages k, l and m (coloured in shades of orange) were characterised by more sessile, encrusting sponges, bryozoans, anemones, barnacles and keel worms (see Appendix 2 for full taxon composition of each assemblage). Assemblages that were intermediate between the ones found at the shallowest and deepest extremes of the survey area (h, i, o and p – coloured in shades of yellow and red) harboured fewer of the more sessile taxa characteristic of coarser sediments. Assemblages ranging from the most to the least specious and diverse were present within the footprint of the predicted extent of the sandbank feature (see Figure 20) The pattern in the distribution of assemblages and the relative abundance of their constituent taxa was significantly correlated with the pattern of distribution of the different sediment fractions, as confirmed by results from a RELATE routine performed between PSA data and taxon-by-sample matrices with and without a measure of relative taxon abundance (Rho ≥ 0.571, 0.1% significance).

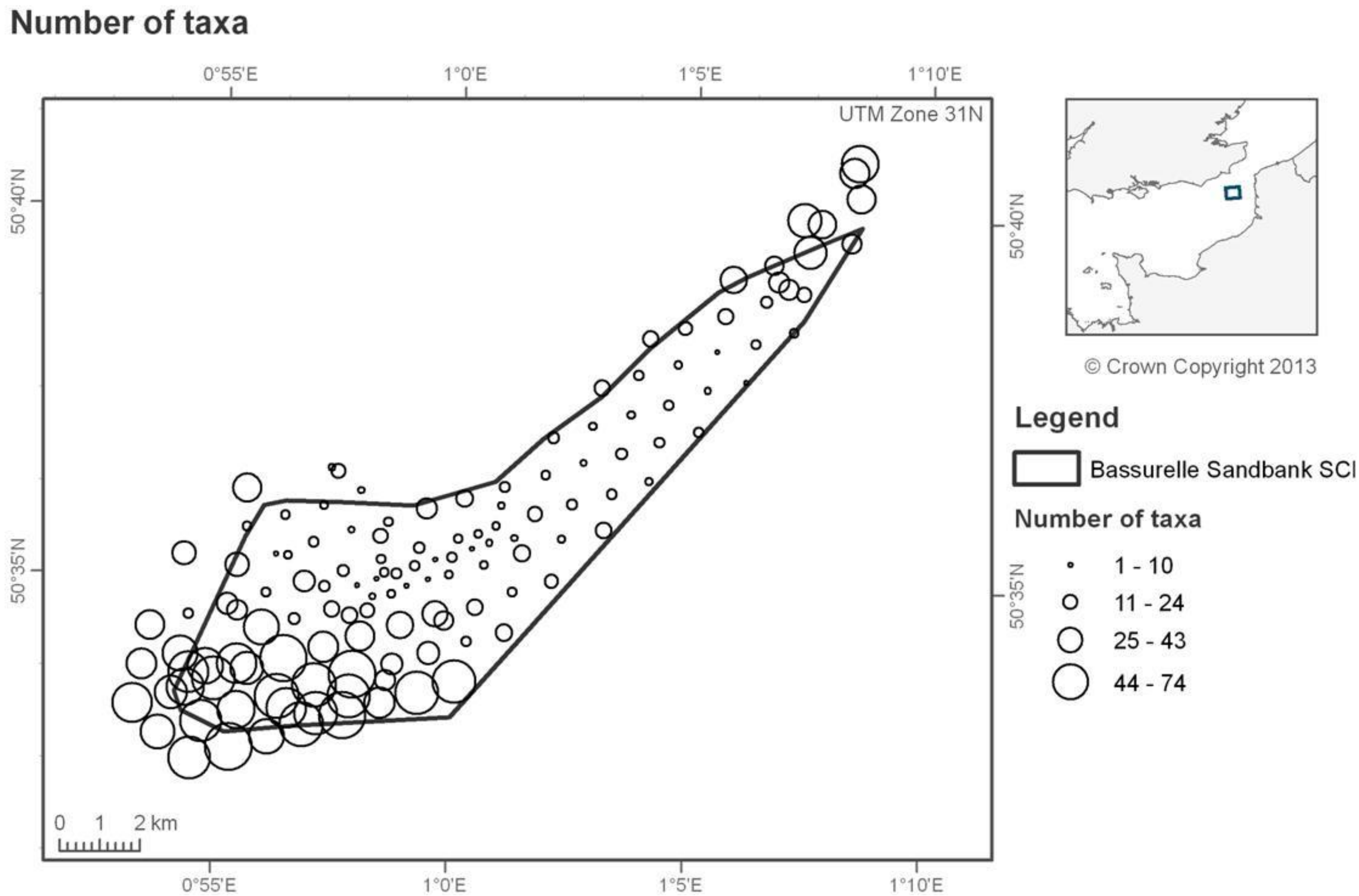
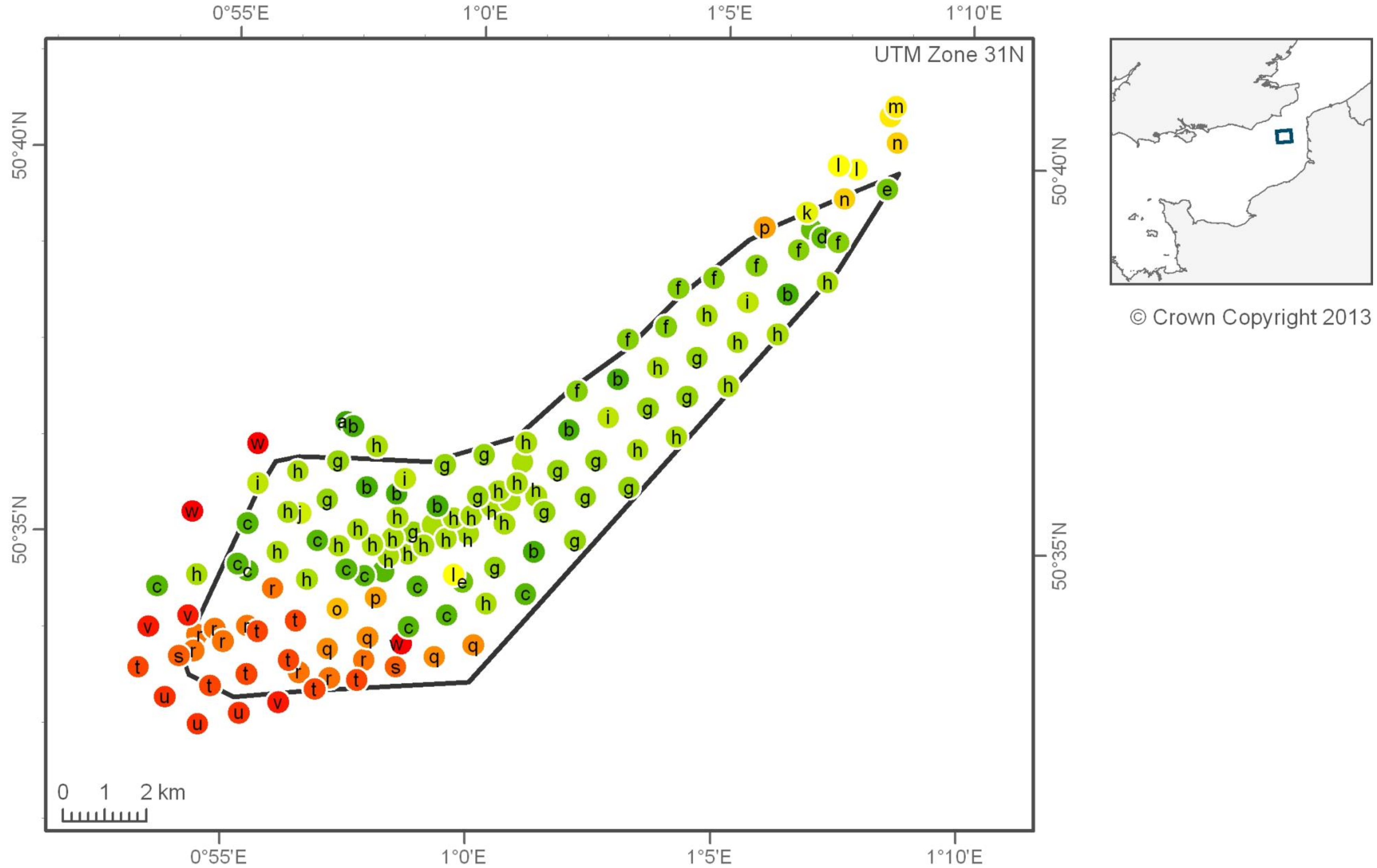


Figure 15. The relative number of infaunal taxa recorded at each sampling station.

Assemblages - square-root transformation



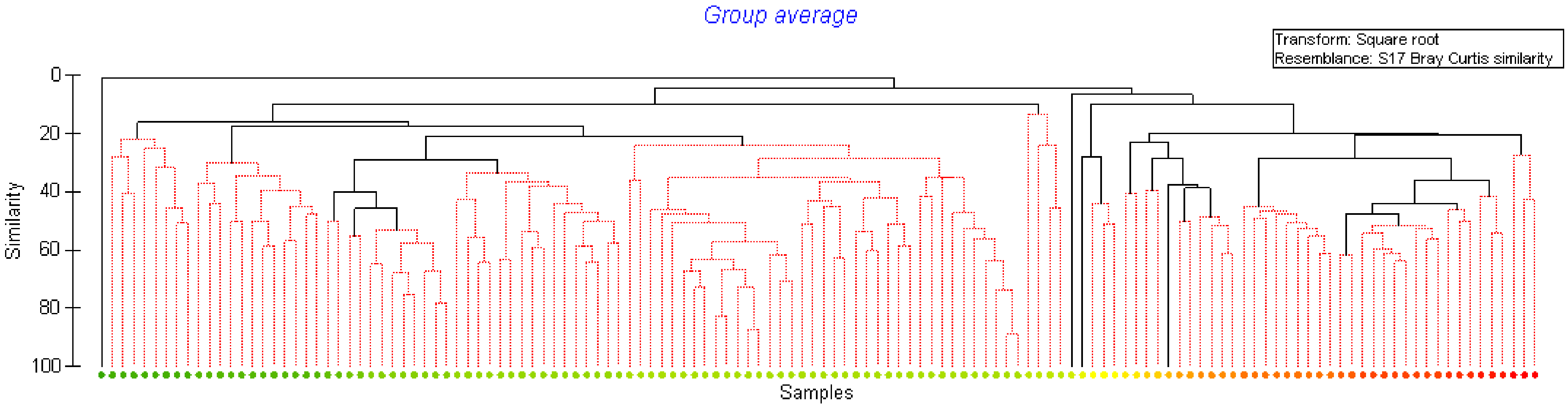
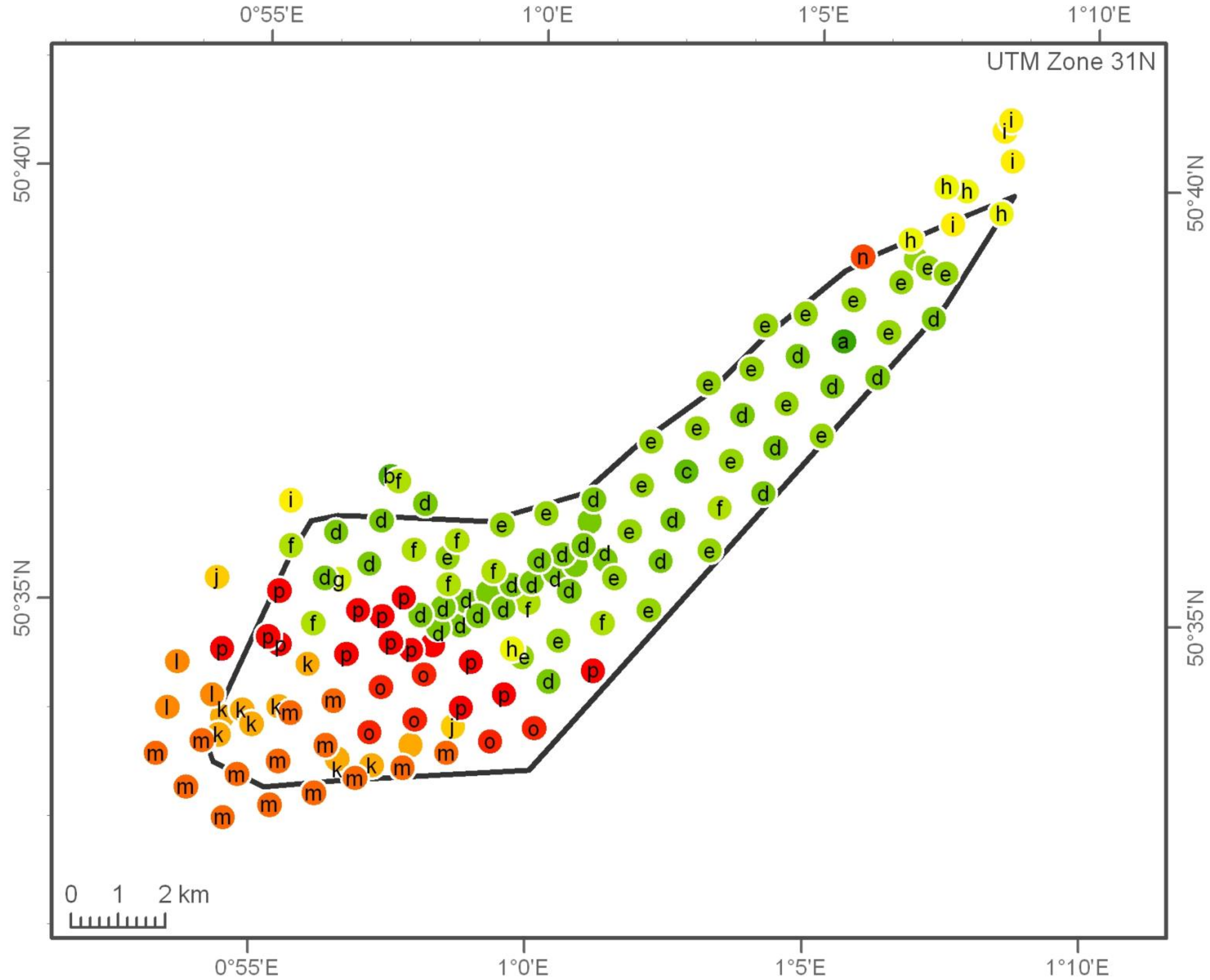


Figure 16. Display of the distribution of statistically distinct assemblages (labelled a to w) identified through multivariate analysis of infaunal abundance data (previous page), and dendrogram of samples resulting from clustering routine (above). Groups of samples connected by red lines and separated by black lines are statistically distinct from one another.

Assemblages - presence/absence transformation



© Crown Copyright 2013

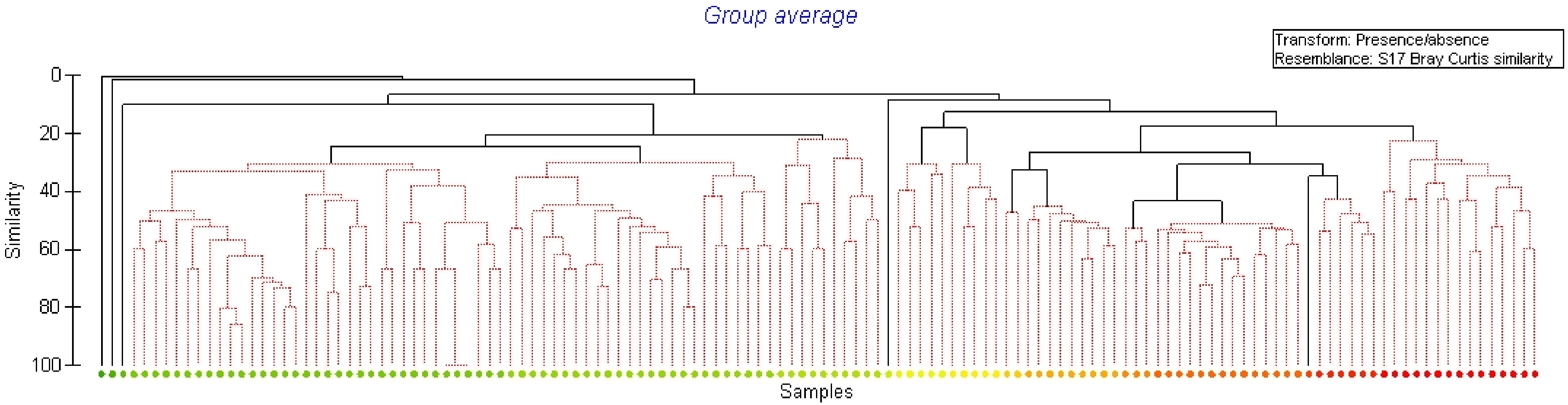


Figure 17. Display of the distribution of statistically distinct assemblages (labelled a to p) identified through multivariate analysis of infaunal presence/absence data (previous page), and dendrogram of samples resulting from clustering routine (above). Groups of samples connected by red lines and separated by black lines are statistically distinct from one another.

3.6 Epifauna

The epifaunal taxa analysed have been extracted from all digital stills taken at each of the video sampling stations. The distribution in the number of epifaunal taxa observed mirrored that of the infaunal taxa, with generally fewer taxa in the shallower sandy top of the sandbank than on its coarser and deeper flanks (Figure 18 and Figure 20).

Multivariate analysis of epifaunal data revealed five statistically distinct assemblages (Figure 19), two of which (a and b) were characterised by harbouring only one or two taxa. Stations where such few taxa were observed were on the top of the sandbank. The most widespread assemblage was assemblage e (coloured red), which was also represented along the top of the sandbank, but notably absent from the deeper and coarser south-western corner of the survey area (Figure 20). Taxa contributing the most to the similarity within assemblage e were mostly motile crustaceans and echinoderms (see Appendix 2 for a full taxon list). Assemblage d (coloured orange), spread across the southwest corner of the survey area, contained many of the taxa identified elsewhere, but in addition harboured more sessile taxa, such as hydroids/bryozoans and encrusting coral, typical of a more stable substrate (see Appendix 2). Assemblage c (coloured yellow) was a relatively depauperate assemblage, intermediate between the taxon poor assemblages a and b, and the taxon rich assemblages d and e. It is possible that given the motility of many taxa observed in the shallower reaches of the survey area, the failure to observe taxa at some stations was merely coincidence, rather than an accurate reflection of a site's true character. Table 1 presents the abundance of taxa collected from the six beam trawl samples used in the present investigation (3 from the EEC Pressures survey in 2011 and 3 from the dedicated 2013 survey of the Bassurelle SCI). The limited analyses possible on available beam trawl catch data did not provide any insightful supplementary information to that already presented and are not considered further in this report.

Table 1. Abundance of taxa collected from the 2m beam trawl samples at Bassurelle Sandbank SCI.

	Sample					
Taxa	**EEC_06_04**	**EEC_11_02**	**EEC_12_05**	**BSSSBT01**	**BSSSBT02**	**BSSSBT03**
Pagurus prideaux	13	11	7	44	1	
Psammechinus miliaris	1	15	3	31		
Asterias rubens	6	14	11	11	2	
Gobiidae	3	6	6	5	13	8
Pagurus bernhardus	8	11	7		1	4
Adamsia carciniopados	11	9	4	6		
Pontophilus		6	2			9
Echiichthys vipera				3	5	8
Hinia reticulata	7		5			
Ophiura albida	8	1	2			
Sagartia	7	4				
Liocarcinus marmoreus		9				
Callionymus lyra	3	1	2	1	1	
Liocarcinus depurator	3	1	3		1	
Arnoglossus laterna	2	1	2	1		1
Inachus dorsettensis	1	5	1			
Liocarcinus holsatus	3	3	1			
Macropodia tenuirostris	2	4				
Ophiothrix fragilis	6					
Buglossidium luteum			4			
Ammodytes				1		3
Pisidia longicornis		3				
Processa canaliculata	3					
Aequipecten opercularis		2				

	Sample					
Taxa	**EEC_06_04**	**EEC_11_02**	**EEC_12_05**	**BSSSBT01**	**BSSSBT02**	**BSSSBT03**
Anapagurus laevis			2			
Atelecyclus rotundatus		1		1		
Crangon allmanni	1		1			
Diplecogaster bimaculata		2				
Echinocardium cordatum	1				1	
Galathea		2				
Hyas coarctatus		2				
Ophiura ophiura	1		1			
Agonus cataphractus			1			
Calliostoma zizyphinum			1			
Cirolana		1				
Ensis ensis		1				
Eurynome aspera		1				
Hydrallmania falcata		1				
Macropodia		1				
Ophiura affinis		1				
Pasiphaea		1				
Polinices pulchellus			1			
Porifera	1					
Sepiola atlantica			1			
Solea solea	1					
Trisopterus minutus	1					
Limanda limanda				1		

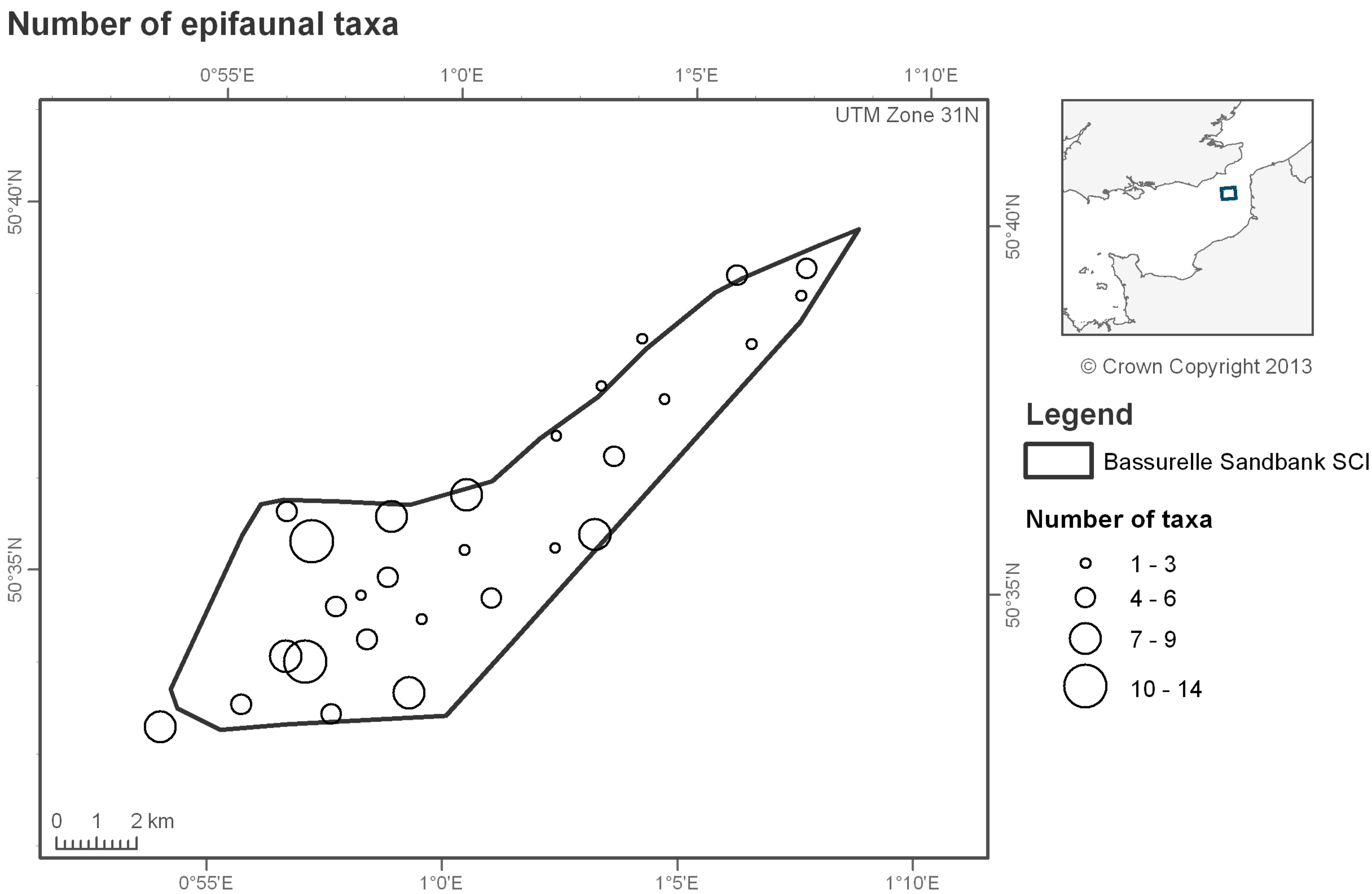
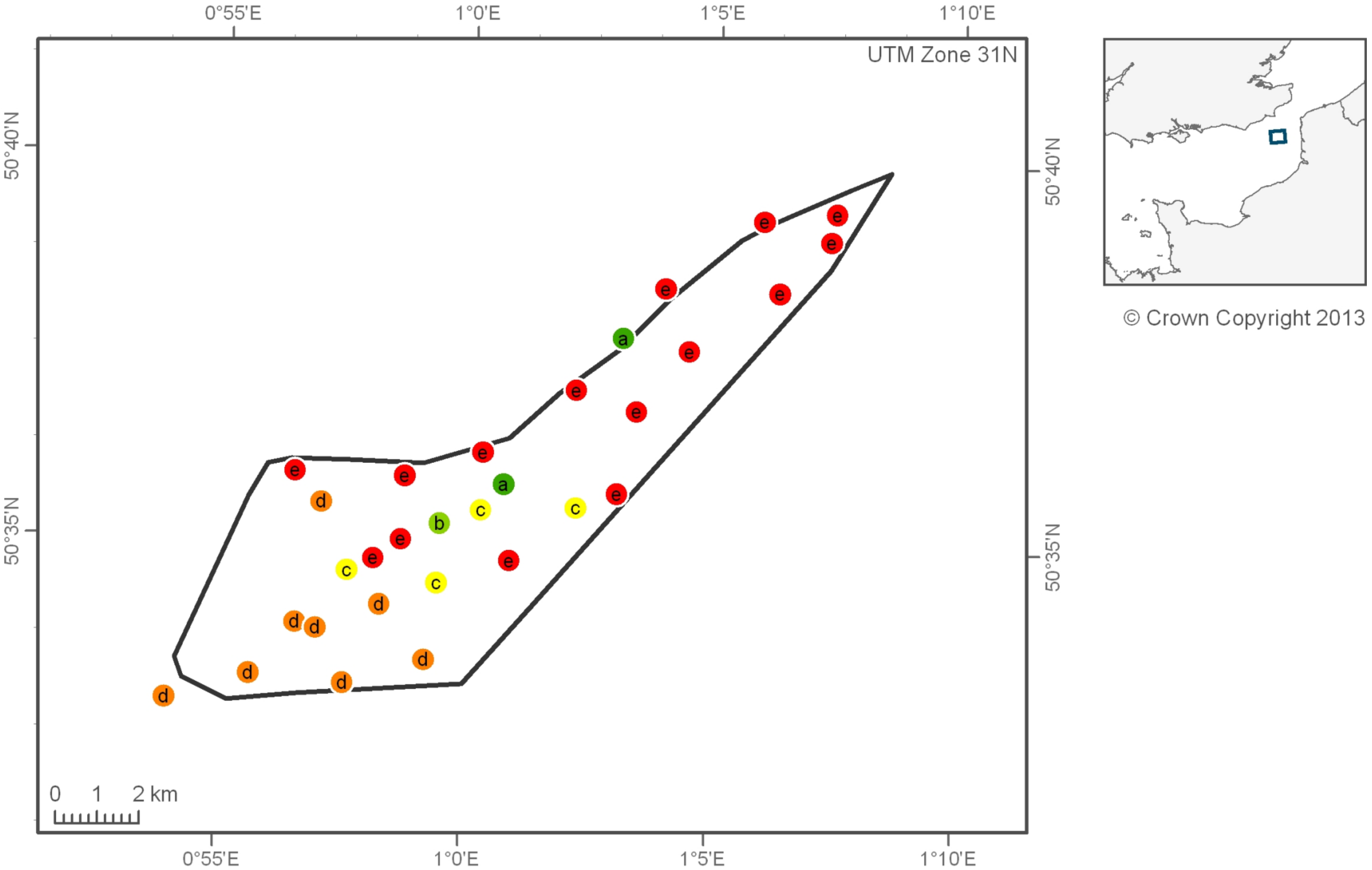


Figure 18. Display of the number of epifaunal taxa recorded at each sampling station.

Epifaunal assemblages - presence/absence transformation



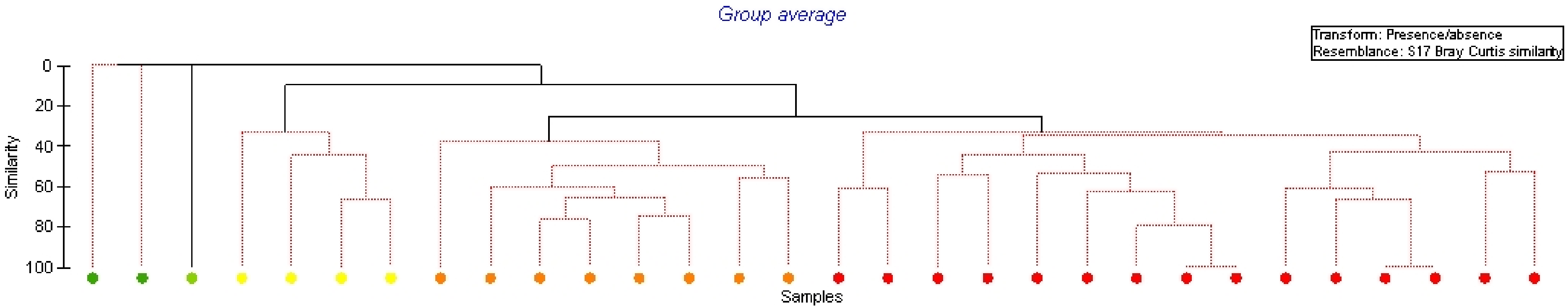


Figure 19. Display of the distribution of statistically distinct assemblages (labelled a to e) identified through multivariate analysis of epifaunal presence/absence data (previous page), and dendrogram of samples resulting from clustering routine (above). Groups of samples connected by red lines and separated by black lines are statistically distinct from one another.

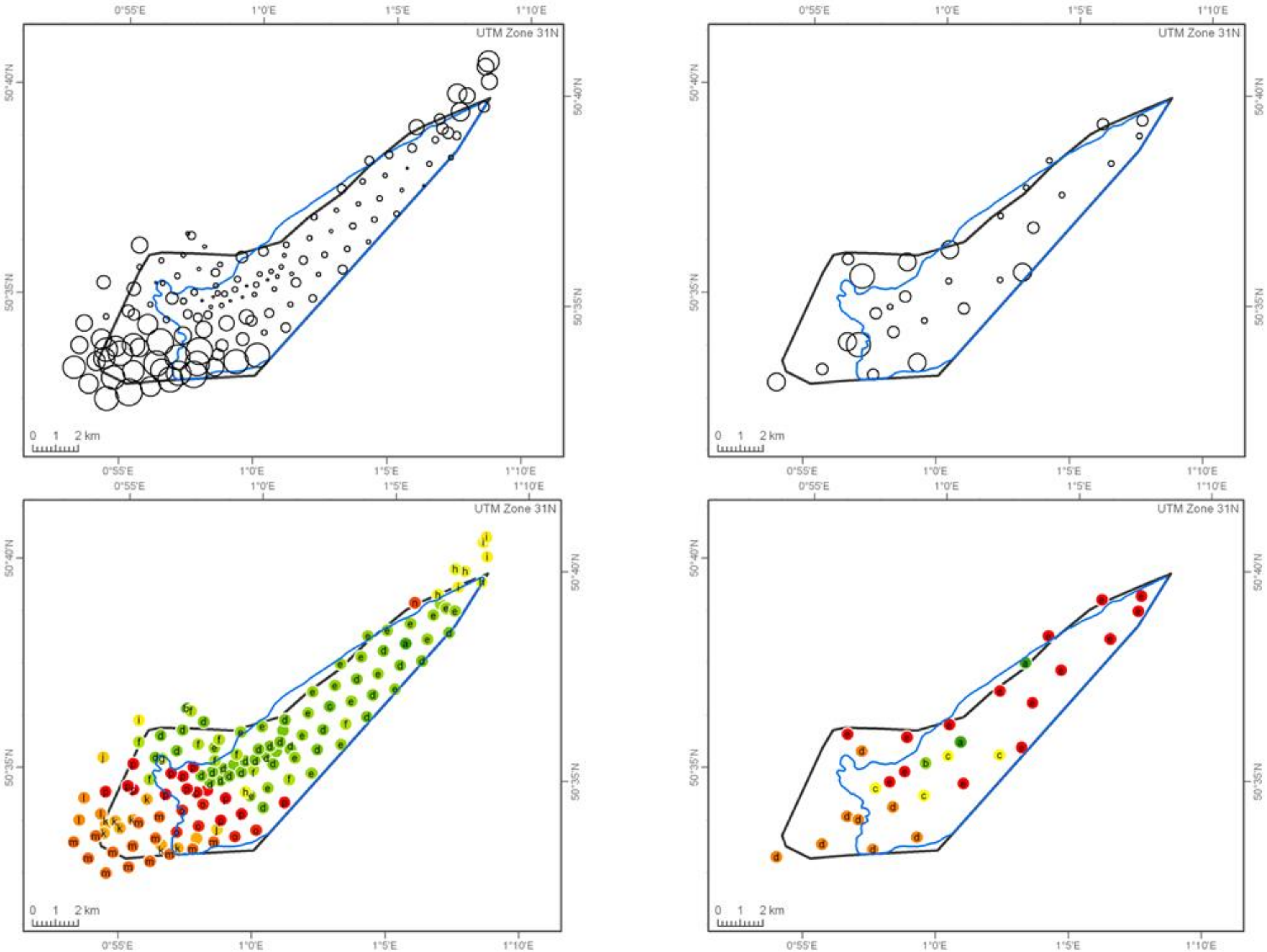


Figure 20. Distribution of the number of infaunal taxa (top left), infaunal assemblages (bottom left), number of epifaunal taxa (top right) and epifaunal assemblages (bottom right) in relation to the calculated extent of the sandbank feature (blue line).

3.7 Anthropogenic impacts

Figure 21 shows evidence from sidescan sonar data of anthropogenic disturbance on the seabed from trawling activities. The parallel tracks observed are indicative of those left by beam trawls as they are dragged across the seabed.

3.8 Summary of habitats and features recorded

The Bassurelle Sandbank SCI is characterised by the habitats A5.1 Sublittoral Coarse Sediments and A5.2 Sublittoral Sands, with coarser sediments being found mostly to the south and west of the survey area, and less so towards the northeast of the survey area. Ground-truthing data also identified two point locations of mixed sediments. Habitat predictions were made more confidently along areas covered by multibeam data, with reduced confidence where data was interpolated between survey lines.

Acoustic data and ground-truthing information allowed for the Annex I sandbank within the Bassurelle Sandbank SCI to be delineated. In the area to the west of the sandbank characterised by megaripples and sandwaves, expert judgement was used to best identify a potential boundary for the sandbank, in the absence of a distinct delineation between sandbank and surrounding seabed. To the southeast of the survey area the sandbank continues into French national waters and was not mapped as part of this investigation. The distribution of the two habitats recorded within the survey area coincided with the distribution of the two broad groups of distinct infaunal and epifaunal assemblages identified – the more taxon rich assemblages inhabiting the coarser and deeper sediments and the more depauperate assemblages inhabiting the shallower, sandier sediments at the top of the bank.

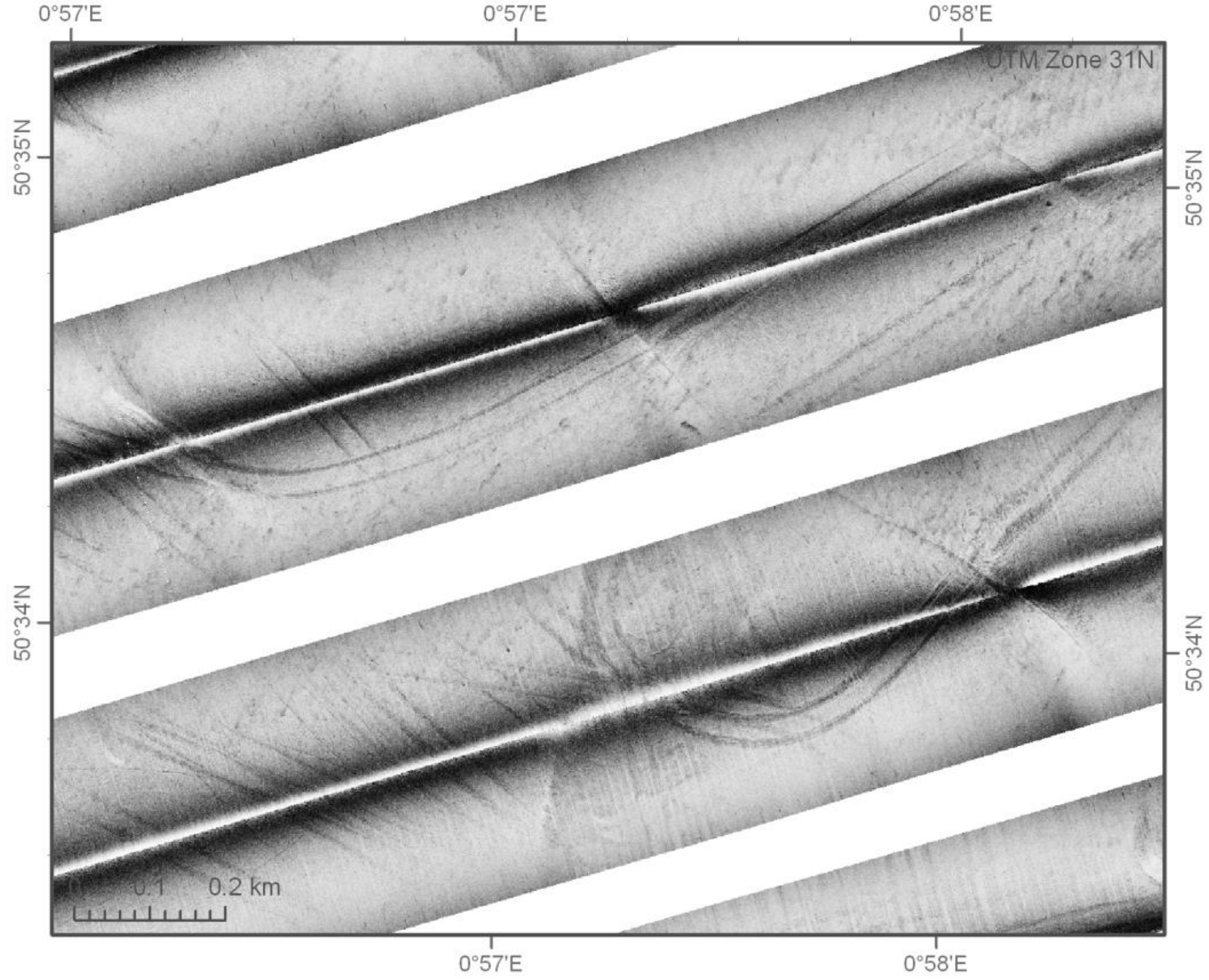
3.9 Data limitations

The ability to predict the extent of habitat types was limited by the extent of multibeam bathymetry and backscatter data collected. Evidence-based predictions for Level 3 EUNIS habitats were undertaken using the eCognition software that utilises machine learning to assign habitat types to backscatter reflectivity. Some sampling stations were located in areas where no multibeam data were collected and, therefore, were not used as part of the automated predictions. In areas of no coverage of remote sensing data, predictions were made using expert judgement but are of lower confidence as a consequence. For this reason, extrapolated boundaries between acquired survey data appear linear and angular, and are unlikely to reflect a true habitat transition. As it is impractical (and undesirable) to sample the entire area of the site with grabs and video, there is the potential that a feature may exist within the site but has not been recorded, but will be limited in extent.

As was the case for the prediction of EUNIS habitat types, the delineation of Annex I sandbank was hampered by the gaps in data between survey corridors. It is important, however, to note the limitations imposed by the nature of the sandbank feature itself. Megaripples along the northwest of the bank were characteristic of the topography of that area and made it more difficult to identify the transition from the sandbank feature to the surrounding flatter seabed. Sandwaves to the south and west of the site also hampered confident distinction of the sandbank from its surroundings. Further bathymetry data would be of benefit in mapping the exact topographical boundaries of the sandbank.

There are plans by the Maritime and Coastguard Agency (MCA) to complete a Civil Hydrography Programme bathymetric survey of Bassurelle Bank and the surrounding area in the near future – this dataset will provide a useful addition to allow the more accurate delineation of Annex I sandbank feature in the site.

Evidence of human activity



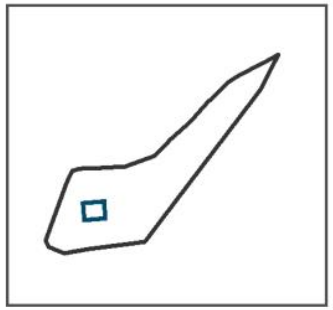


Figure 21. Processed sidescan sonar data towards the western side of the Bassurelle Sandbank SCI showing numerous trawl scars on the seabed.

4 Summary

The dedicated survey of the Bassurelle Sandbank SCI was successful in acquiring new acoustic and ground-truthing data, which, in combination with existing historical datasets, has enabled the physical and benthic faunal characterisation of the sandbank feature and its immediate surroundings. The sandbank feature corresponds with the definition of an Annex I sandbank habitat feature.

There appears to be a close correspondence between the distribution of finer sandy sediments comprising the Sublittoral Sand habitat type and relatively taxon poor benthic assemblages identified. Equally, there is close correspondence between the distribution of sediments with an increased gravel component, comprising the Sublittoral Coarse Sand habitat type and more taxon rich benthic assemblages that include taxa which depend on the increased stability offered by coarse substrates. Both of these habitat types are represented within the boundary of the Bassurelle Sandbank SCI and within the predicted boundary of the Annex I sandbank feature itself.

Evidence of human activity impacting the seabed has been observed within the boundary of the SCI in the form of trawl scars.

The presence of megaripples and sandwaves in close proximity to the Bassurelle sandbank, together with gaps in the data record due to the adoption of a corridor survey approach, makes it difficult to delineate the sandbank feature with greater confidence. Given such difficulties, the exact position of the boundary could be refined manually by taking into consideration the distribution of faunal assemblages that are typical of clean sandy sediments characteristic of a sandbank crest, and that of the neighbouring assemblages typical of coarser sediments that characterise the lower slopes and troughs of sandbanks.

References

Blaschke, T. 2010. Object based image analysis for remote sensing. *ISPRS Journal of Photogrammetry and Remote Sensing*, **65**, 2-16

Clarke, K.R. & Gorley, R.N. 2006. PRIMER v6: User manual/tutorial, PRIMER-E, Plymouth UK, 192pp.

Coggan, R. & Howell, K. 2005. Draft SOP for the collection and analysis of video and still images for ground-truthing an acoustic basemap. Video survey SOP version 5, 10pp.

Ellwood, H. 2012[4]. Method for Creating a Composite Map of Annex I Sandbanks slightly covered by seawater all of the time, 12pp. http://jncc.defra.gov.uk/PDF/20150727_UK_Sandbanks_Method_v1.2.pdf.

Graham, C., Campbell, E., Cavill, J., Gillespie, E. & Williams, R. 2001. JNCC Marine Habitats GIS Version 3: its structure and content. British Geological Survey Commissioned Report, CR/01/238. British Geological Survey.

Hill, M.O. 1973. Diversity and evenness: a unifying notation and its consequences. Ecology 54(2) 427-432.

Jenkins, C., Nelson, M., Whomersley, P., Johnson, G., Cameron, A., Barry, J., Eggleton, J., Church, N. & Webb, K. 2015. Developing appropriate, and ecologically significant, sampling units for broad scale monitoring of fisheries activity using up to date Vessel Monitoring System data. JNCC/Cefas Partnership Report Series No. 1.

JNCC. 2010. Offshore Special Area of Conservation: Bassurelle Sandbank - SAC Selection Assessment. Version 4.0 (20 August 2010), 13pp.

JNCC. 2014. JNCC video and stills analysis/processing protocol – internal document.

Long, D. 2006. BGS detailed explanation of seabed sediment modified Folk classification. http://www.searchmesh.net/PDF/BGS%20detailed%20explanation%20of%20seabed%20sediment%20modified%20folk%20classification.pdf

Mason, C. 2011. NMBAQC's best practice guidance: Particle size analysis (PSA) for supporting biological analysis. National Marine Biological AQC Coordinating Committee, 72pp. http://www.nmbaqcs.org/news/nmbaqc/nmbaqc-best-practice-guide-for-particle-size-analysis-is-now-available!.aspx.

Whomersley, P. 2013. Wight Barfleur Reef and Bassurelle Sandbank – SAC Management Survey. Cruise Report, 131pp.

Worsfold, T.M., Hall, D.J. & O'Reilly, M. 2010. Guidelines for processing marine macrobenthic invertebrate samples: a processing requirements protocol version 1. Unicomarine Report NMBAQCMbPRP to the NMBAQC Committee, 33pp.

[4] At time of writing the most up to date version was v1 (2012); an updated report (v1.2, 2015) is now available however, as provided in the link.

Appendices

Appendix 1. Classification of sediment samples

Survey	Stn Code	Folk	EUNIS
Bassurelle Sandbank	ADDGT01	S	sand and muddy sand
Bassurelle Sandbank	ADDGT02	S	sand and muddy sand
Bassurelle Sandbank	ADDGT03	S	sand and muddy sand
Bassurelle Sandbank	ADDGT04	S	sand and muddy sand
Bassurelle Sandbank	ADDGT05	(g)S	sand and muddy sand
Bassurelle Sandbank	ADDGT06	(g)S	sand and muddy sand
Bassurelle Sandbank	ADDGT07	S	sand and muddy sand
Bassurelle Sandbank	ADDGT08	S	sand and muddy sand
Bassurelle Sandbank	ADDGT09	S	sand and muddy sand
Bassurelle Sandbank	ADDGT10	S	sand and muddy sand
Bassurelle Sandbank	ADDGT11	S	sand and muddy sand
Bassurelle Sandbank	ADDGT12	S	sand and muddy sand
Bassurelle Sandbank	ADDGT13	S	sand and muddy sand
Bassurelle Sandbank	ADDGT14	(g)S	sand and muddy sand
Bassurelle Sandbank	BSSS001	gS	coarse sediment
Bassurelle Sandbank	BSSS002	gS	coarse sediment
Bassurelle Sandbank	BSSS003	gS	coarse sediment
Bassurelle Sandbank	BSSS004	gS	coarse sediment
Bassurelle Sandbank	BSSS005	gS	coarse sediment
Bassurelle Sandbank	BSSS006	gS	coarse sediment
Bassurelle Sandbank	BSSS007	gS	coarse sediment
Bassurelle Sandbank	BSSS008	gS	coarse sediment
Bassurelle Sandbank	BSSS009	gS	coarse sediment
Bassurelle Sandbank	BSSS010	gS	coarse sediment
Bassurelle Sandbank	BSSS012	gS	coarse sediment
Bassurelle Sandbank	BSSS014	gS	coarse sediment
Bassurelle Sandbank	BSSS015	gS	coarse sediment
Bassurelle Sandbank	BSSS016	(g)S	sand and muddy sand
Bassurelle Sandbank	BSSS019	gS	coarse sediment
Bassurelle Sandbank	BSSS020	gS	coarse sediment
Bassurelle Sandbank	BSSS023	gS	coarse sediment
Bassurelle Sandbank	BSSS024	gS	coarse sediment
Bassurelle Sandbank	BSSS025	gS	coarse sediment
Bassurelle Sandbank	BSSS026	(g)S	sand and muddy sand
Bassurelle Sandbank	BSSS028	gS	coarse sediment
Bassurelle Sandbank	BSSS029	gS	coarse sediment
Bassurelle Sandbank	BSSS030	gS	coarse sediment
Bassurelle Sandbank	BSSS033	gS	coarse sediment
Bassurelle Sandbank	BSSS034	gS	coarse sediment
Bassurelle Sandbank	BSSS035	(g)S	sand and muddy sand
Bassurelle Sandbank	BSSS036	S	sand and muddy sand
Bassurelle Sandbank	BSSS038	gS	coarse sediment
Bassurelle Sandbank	BSSS039	(g)S	sand and muddy sand
Bassurelle Sandbank	BSSS040	S	sand and muddy sand
Bassurelle Sandbank	BSSS043	gS	coarse sediment
Bassurelle Sandbank	BSSS044	gS	coarse sediment
Bassurelle Sandbank	BSSS045	S	sand and muddy sand
Bassurelle Sandbank	BSSS046	(g)S	sand and muddy sand
Bassurelle Sandbank	BSSS048	gS	coarse sediment
Bassurelle Sandbank	BSSS049	S	sand and muddy sand
Bassurelle Sandbank	BSSS050	gS	coarse sediment
Bassurelle Sandbank	BSSS051	gS	coarse sediment
Bassurelle Sandbank	BSSS052	S	sand and muddy sand
Bassurelle Sandbank	BSSS053	gS	coarse sediment

Survey	Stn Code	Folk	EUNIS
Bassurelle Sandbank	BSSS054	S	sand and muddy sand
Bassurelle Sandbank	BSSS055	(g)S	sand and muddy sand
Bassurelle Sandbank	BSSS057	gmS	mixed sediments
Bassurelle Sandbank	BSSS058	gS	coarse sediment
Bassurelle Sandbank	BSSS059	(g)S	sand and muddy sand
Bassurelle Sandbank	BSSS061	(g)S	sand and muddy sand
Bassurelle Sandbank	BSSS062	S	sand and muddy sand
Bassurelle Sandbank	BSSS064	S	sand and muddy sand
Bassurelle Sandbank	BSSS065	S	sand and muddy sand
Bassurelle Sandbank	BSSS067	gS	coarse sediment
Bassurelle Sandbank	BSSS068	(g)S	sand and muddy sand
Bassurelle Sandbank	BSSS069	S	sand and muddy sand
Bassurelle Sandbank	BSSS071	S	sand and muddy sand
Bassurelle Sandbank	BSSS072	S	sand and muddy sand
Bassurelle Sandbank	BSSS074	S	sand and muddy sand
Bassurelle Sandbank	BSSS075	S	sand and muddy sand
Bassurelle Sandbank	BSSS077	(g)S	sand and muddy sand
Bassurelle Sandbank	BSSS078	S	sand and muddy sand
Bassurelle Sandbank	BSSS080	(g)S	sand and muddy sand
Bassurelle Sandbank	BSSS081	S	sand and muddy sand
Bassurelle Sandbank	BSSS083	S	sand and muddy sand
Bassurelle Sandbank	BSSS084	S	sand and muddy sand
Bassurelle Sandbank	BSSS085	(g)S	sand and muddy sand
Bassurelle Sandbank	BSSS086	S	sand and muddy sand
Bassurelle Sandbank	BSSS088	S	sand and muddy sand
Bassurelle Sandbank	BSSS089	S	sand and muddy sand
Bassurelle Sandbank	BSSS091	S	sand and muddy sand
Bassurelle Sandbank	BSSS092	S	sand and muddy sand
Bassurelle Sandbank	BSSS093	S	sand and muddy sand
Bassurelle Sandbank	BSSS094	S	sand and muddy sand
Bassurelle Sandbank	BSSS096	S	sand and muddy sand
Bassurelle Sandbank	BSSS097	S	sand and muddy sand
Bassurelle Sandbank	BSSS098	(g)S	sand and muddy sand
Bassurelle Sandbank	BSSS099	S	sand and muddy sand
Bassurelle Sandbank	BSSS100	S	sand and muddy sand
Bassurelle Sandbank	BSSS101	S	sand and muddy sand
Bassurelle Sandbank	BSSS103	S	sand and muddy sand
Bassurelle Sandbank	BSSS104	S	sand and muddy sand
Bassurelle Sandbank	BSSS105	S	sand and muddy sand
Bassurelle Sandbank	BSSS107	S	sand and muddy sand
Bassurelle Sandbank	BSSS108	S	sand and muddy sand
Bassurelle Sandbank	BSSS110	S	sand and muddy sand
Bassurelle Sandbank	BSSS111	gS	coarse sediment
Bassurelle Sandbank	BSSS112	gS	coarse sediment
Bassurelle Sandbank	BSSS114	S	sand and muddy sand
Bassurelle Sandbank	BSSS115	(g)S	sand and muddy sand
Bassurelle Sandbank	BSSS117	S	sand and muddy sand
Bassurelle Sandbank	BSSS120	S	sand and muddy sand
EEC Pressures	EEC_06_01	S	sand and muddy sand
EEC Pressures	EEC_06_03	gS	coarse sediment
EEC Pressures	EEC_06_04	(g)S	sand and muddy sand
EEC Pressures	EEC_06_05	(g)S	sand and muddy sand
EEC Pressures	EEC_06_07	S	sand and muddy sand
EEC Pressures	EEC_06_08	sG	coarse sediment
EEC Pressures	EEC_06_09	gS	coarse sediment
EEC Pressures	EEC_06_10	gS	coarse sediment
EEC Pressures	EEC_08_01	sG	coarse sediment
EEC Pressures	EEC_09_02	S	sand and muddy sand
EEC Pressures	EEC_09_05	S	sand and muddy sand

Survey	Stn Code	Folk	EUNIS
EEC Pressures	EEC_09_10	S	sand and muddy sand
EEC Pressures	EEC_11_01	S	sand and muddy sand
EEC Pressures	EEC_11_02	gS	coarse sediment
EEC Pressures	EEC_11_03	gS	coarse sediment
EEC Pressures	EEC_11_04	gS	coarse sediment
EEC Pressures	EEC_11_05	gS	coarse sediment
EEC Pressures	EEC_11_06	gS	coarse sediment
EEC Pressures	EEC_11_07	gS	coarse sediment
EEC Pressures	EEC_11_08	gS	coarse sediment
EEC Pressures	EEC_11_09	gS	coarse sediment
EEC Pressures	EEC_11_10	gS	coarse sediment
EEC Pressures	EEC_12_01	S	sand and muddy sand
EEC Pressures	EEC_12_02	gS	coarse sediment
EEC Pressures	EEC_12_03	gS	coarse sediment
EEC Pressures	EEC_12_04	gS	coarse sediment
EEC Pressures	EEC_12_05	(g)S	sand and muddy sand
EEC Pressures	EEC_12_06	gS	coarse sediment
EEC Pressures	EEC_12_07	gS	coarse sediment
EEC Pressures	EEC_12_08	S	sand and muddy sand
EEC Pressures	EEC_12_09	(g)S	sand and muddy sand
EEC Pressures	EEC_12_10	gS	coarse sediment

Appendix 2. Species lists

Table A2.1. Table listing the taxa contributing 90% to the similarity amongst the infaunal assemblages (a to p) identified by multivariate analysis of presence/absence data (SIMPROF routine). Values represent the relative contribution of each taxon to the similarity within each assemblage. Assemblages not listed (a, b, c, g and n) were represented by a single sample, therefore no similarity values for the taxa within them are available. Colour coding of assemblages matches that in Figure 17.

	Assemblage										
Taxon	**d**	**e**	**f**	**h**	**i**	**j**	**k**	**l**	**m**	**o**	**p**
Echinocyamus pusillus				0.8	0.4	1	1	1	1	1	0.4
Schizomavella					0.4	1	0.89	1	1	0.67	0.4
Pseudonotomastus southerni					0.6	1	1	0.67	0.57	1	0.27
Moerella pygmaea						1	0.67	1	0.64	0.67	0.87
Diplodonta rotundata					0.8	1	0.44	1	0.5	0.83	0.27
Aonides paucibranchiata					0.8		1		0.93	1	0.27
Puellina innominata						1	0.89	1	0.86		
Nephtys cirrosa	1	0.8	0.5	0.4							1
Glycera lapidum (agg.)							1		0.93	1	0.47
Caulleriella alata				0.8	0.8		0.78			1	
Chorizopora brongniarti							0.56	1	0.93	0.83	
Nucula hanleyi					0.6		0.56	1	0.57	0.5	
Eulalia mustela							1	0.67	1	0.5	
PORIFERA								1	0.86	0.67	0.33
Polycirrus					0.8	1	0.89				
Syllis pontxioi								0.67	0.86	0.83	0.33
Epizoanthus couchii								1	0.79	0.5	0.27
Ophelia borealis	0.51	0.44	0.3		0.4						0.73
Polycirrus medusa								0.67	0.43	0.83	0.4
Eurydice truncata								1	0.79	0.5	
Phoronis				0.8	0.6					0.83	
Poecilochaetus serpens				0.8	0.6					0.83	
Lysilla nivea								0.67		1	0.53
Lumbrineris cingulata					0.8					0.83	0.53
Thracia villosiuscula								0.67	0.57	0.83	

	Assemblage										
Taxon	**d**	**e**	**f**	**h**	**i**	**j**	**k**	**l**	**m**	**o**	**p**
OPHIUROIDEA					1		0.89				
Syllis hyalina								1	0.86		
Glycera oxycephala							0.89		0.64		0.27
Notomastus					0.8					1	
Syllis garciai									0.86	0.83	
Amphitritides gracilis								0.67	0.5	0.5	
Mediomastus fragilis				0.4	0.6					0.67	
Moerella donacina					0.8					0.83	
Glycera (juv.)					0.6		1				
Trypanosyllis coeliaca							0.67		0.93		
Urothoe elegans				0.8	0.8						
Spiophanes bombyx			0.3	0.6						0.67	
Glycymeris glycymeris							0.56		1		
Lumbrineris						1	0.56				
Spirobranchus triqueter							0.67		0.86		
Pholoe baltica (sensu Petersen)					0.8					0.67	
Grania							0.67		0.79		
Malmgrenia ljungmani							1		0.43		
Protodorvillea kefersteini							0.67		0.71		
ACTINIARIA					0.8		0.56				
Magelona filiformis		0.56		0.8							
Pseudomystides limbata							0.56		0.79		
Hesionura elongata							0.44		0.5		0.4
Bathyporeia elegans		0.72		0.6							
Magelona johnstoni		0.72		0.6							
Malmgrenia darbouxi					0.6					0.67	
Palposyllis prosostoma							0.44		0.79		
Smittina cheilostoma								0.67	0.5		
Scoloplos armiger		0.68	0.4								
Polynoidae					0.4		0.67				

Taxon	Assemblage d	e	f	h	i	j	k	l	m	o	p
Urothoe brevicornis		0.56	0.5								
Bathyporeia tenuipes				1							
Collarina balzaci								1			
Corymorpha nutans										1	
Golfingia elongata									0.5	0.5	
Hagiosynodos latus								1			
Hippoporina pertusa								1			
Neolagenipora collaris								1			
Nephtyidae						1					
Syllis (Type H)							1				
Lovenella clausa			0.9								
Syllis (Type E)							0.89				
Fenestrulina malusii							0.44		0.43		
Disporella hispida									0.86		
Rhynchozoon bispinosum									0.86		
Polycirrus denticulatus										0.83	
ENTEROPNEUSTA				0.8							
Kurtiella bidentata					0.8						
Scalibregma inflatum					0.8						
Psammechinus miliaris							0.78				
Echinocardium cordatum	0.26	0.48									
Dendrodoa grossularia									0.71		
Microporella ciliata									0.71		
Reptadeonella violacea									0.71		
Bathyporeia guilliamsoniana		0.68									
Amphiura securigera										0.67	
Beania mirabilis							0.67				
Leptosynapta inhaerens										0.67	
Nereididae							0.67				
Pista cristata							0.67				
Polygordius							0.67				
Syllis (Type D)							0.67				
Polygordius appendiculatus									0.64		
Porella									0.64		
Abra alba				0.6							
Hinia reticulata					0.6						
Maldanidae				0.6							

	Assemblage										
Taxon	**d**	**e**	**f**	**h**	**i**	**j**	**k**	**l**	**m**	**o**	**p**
Ophiothrix fragilis					0.6						
Scalibregma celticum					0.6						
Tellimya ferruginosa				0.6							
Amphipholis squamata									0.57		
Schistomeringos neglecta							0.56				
Ampelisca brevicornis										0.5	
Asclerocheilus intermedius										0.5	
Cellepora pumicosa (?)									0.5		
Eumida bahusiensis										0.5	
Glycinde nordmanni										0.5	
Odontosyllis fulgurans										0.5	
Autolytus							0.44				
Eteone longa (agg.)							0.44				
Laonice bahusiensis							0.44				
Phisidia aurea							0.44				
Antalis vulgaris									0.43		
Arcopagia crassa									0.43		
Dosinia exoleta									0.43		
Leptochiton cancellatus									0.43		
Lumbrineris futilis									0.43		
Syllis licheri									0.43		
Chaetozone christiei				0.4							
Exogone hebes				0.4							
Leucothoe incisa				0.4							
Spio symphyta				0.4							
Upogebiidae					0.4						
Urothoe poseidonis		0.4									

Table A2.2. Table listing the taxa contributing to the similarity amongst the epifaunal assemblages (a to e) identified by multivariate analysis of presence/absence data (SIMPROF routine). Values represent the relative contribution of each taxon to the similarity within each assemblage. Assemblages not listed (and b) were either represented by a single sample or contained only a single taxon, therefore no similarity values for the taxa within them are available. Colour coding of assemblages matches that in Figure 19.

	Assemblage		
Taxon	**c**	**d**	**e**
Pagurus bernhardus		0.88	1
Asterias rubens		0.75	0.53
Hydrallmania falcata	1	0.13	0.13
Unidentified hydroid/bryozoan	0.25	0.88	
Lanice conchilega	0.5	0.25	0.27
Spirobranchus sp.		0.88	0.13
Corallinaceae		0.88	
Aequipecten opercularis	0.25	0.5	
Nassarius reticulatus	0.25		0.47
Sagartia troglodytes		0.25	0.27
Psammechinus miliaris		0.38	0.07
Atelecyclus rotundatus	0.25	0.13	
Bowerbankia		0.38	
Chaetopterus		0.38	
Corystes casivelaunus	0.25		0.13
Echinocardium cordatum		0.25	0.13
Liocarcinus sp.	0.25		0.07
Ophiura sp.		0.13	0.13
Glycymeris glycymeris		0.25	
Actiniaria		0.13	0.07
Arenicolidae			0.2
Ensis			0.2
Gadidae		0.13	0.07
Aphrodita aculeata		0.13	
Balanus crenatus		0.13	
Polychaeta			0.13
Sabellidae		0.13	
Spatangus purpureus		0.13	
Brissopsis lyrifera			0.07
Edwardsiidae			0.07
Mullus sermuletus			0.07
Philocheras?			0.07

Appendix 3. QA reports

The following reports and files which contain the outputs from QA protocols are delivered alongside this document:

- Bassurelle Sandbanks Video and Stills QA sheet
- Bassurelle Sandbanks Video Analysis Final Report (see Section 4)

Cefas

JNCC
Joint Nature Conservation Committee

JNCC/Cefas Partnership Report Series. *CEND 03/13: Offshore seabed survey of Bassurelle Sandbank cSAC/SCI*, **No. 15**. Barrio Froján, C., Jenkins, C. & McIlwaine, P. March 2017. ISSN 2051-6711