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JNCC/Cefas Partnership Report Series

Report No. 13

CEND11/16 Cruise Report: Monitoring Survey of North Norfolk Sandbanks and Saturn Reef cSAC/SCI, Inner Dowsing, Race Bank and North Ridge cSAC/SCI & Haisborough, Hammond and Winterton cSAC/SCI

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1 Introduction

The Joint Nature Conservation Committee (JNCC), Natural England (NE), the Centre for Environment, Fisheries and Aquaculture Science (Cefas) and the Environment Agency (EA) conducted a survey on board the RV Cefas Endeavour (cruise code CEND1116), Humber Guardian and Solent Guardian (cruise codes 2ENC30616 and 2GDK70616 respectively) to gather evidence to inform the ongoing monitoring of the designated features in three candidate Special Areas of Conversation/Sites of Community Importance (cSAC/SCI): North Norfolk Sandbanks and Saturn Reef (NNSSR); Inner Dowsing, Race Bank and North Ridge (IDRBNR); and Haisborough, Hammond and Winterton (HHW).

This collaborative survey was carried out in partnership between the JNCC, NE, the EA and Cefas. The Eastern Inshore Fisheries and Conservation Agencies (IFCA) were also represented as part of the scientific crew on board RV Cefas Endeavour for the duration of the survey.

1.1 Survey project team

This report details the operations carried out on board the RV Cefas Endeavour between the 31st May 2016 and 19th June 2016 (cruise code CEND1116). The survey team for the duration of the fieldwork consisted of marine scientists and surveyors from Cefas, JNCC, NE and the Eastern IFCA. A scheduled small boat transfer was conducted on the 9th June to enable three staff to disembark/embark, see below.

Original content was created pre-GDPR and has been removed as contained personal information.
No scientific or technical content has been removed.

1.2 Site description

Three sites were selected for survey during CEND1116: North Norfolk Sandbanks and Saturn Reef (NNSSR); Inner Dowsing, Race Bank and North Ridge (IDRBNR); and Haisborough, Hammond and Winterton (HHW) candidate Special Areas of Conservation/ Sites of Community Importance (cSAC/SCI) (see Figure 1).

The RV Cefas Endeavour was the largest of three survey vessels undertaking this survey and was restricted to operating within the greater than 15m depth contour (with fully deployed, blade mounted multibeam echo sounder system). The RV Cefas Endeavour

survey focused on the North Norfolk Sandbanks and Saturn Reef cSAC/SCI which is located in the southern North Sea, extending from about 40km off the north-east coast of Norfolk (Figure 1). This cSAC/SCI encloses a series of ten main sandbanks (Leman, Inner, Ower, Well, Broken, Swarte and four sandbanks collectively known as the Indefatigables) and associated fragmented smaller banks, which represent the most extensive example of the offshore linear ridge sandbank feature in UK waters (Graham *et al* 2001). The outer banks are the best example of open sea, tidal sandbanks in a moderate current strength in UK waters. The site boundary encloses the minimum area necessary to ensure protection of the Annex I habitats and takes into account potential movement of both the more naturally disturbed (inshore) and more stable (offshore) sandbanks (JNCC 2010). This cSAC/SCI also includes areas of Ross Worm (*Sabellaria spinulosa*, hereafter referred to as *Sabellaria*) biogenic reef, which qualify as Annex I habitat according to the European Commission (CEC 2007). A recent collaborative Management Investigation Report described *Sabellaria* reef and sandbank communities at this site (Jenkins *et al* 2015) based on surveys conducted on the RV Cefas Endeavour in 2013 (Vanstaen & Whomersley 2014).

The Inner Dowsing, Race Bank and North Ridge (IDRBNR) and Haisborough, Hammond and Winterton (HHW) study areas were selected for survey by the shallower draft EA Humber Guardian. However, side-scan operations were conducted by RV Cefas Endeavour within these sites, along with sampling at some of the more accessible grab and seabed imagery stations.

A more detailed description of the sites visited during this survey is provided by the Selection Assessment Document(s) for each site (JNCC 2010, 2012; JNCC & NE 2010a, 2010b, 2013a, 2013b).

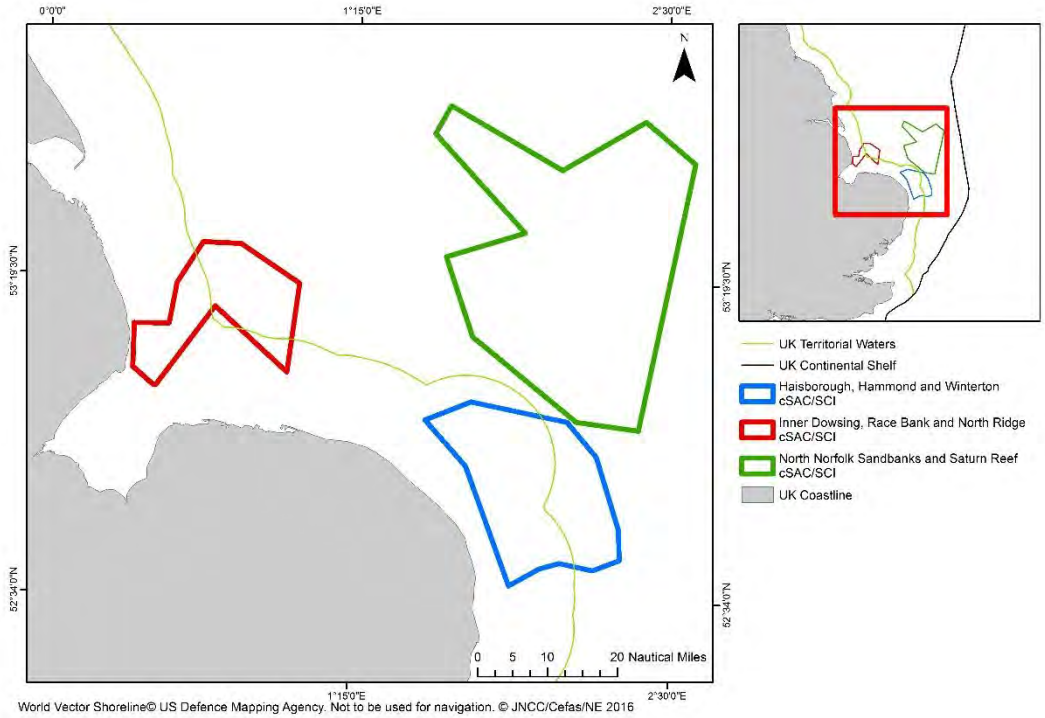

Figure 1. Location of the three North Sea sandbanks candidate Special Areas of Conservation/Sites of Community Importance surveyed during survey CEND1116.

2 Survey design and methods

2.1 Survey planning

In order to characterise sandbank morphology and their associated benthic community, two survey themes were developed. Case Study Areas consisted of a series of five parallel lines which were to be surveyed acoustically before positioning a number of sampling stations over the full depth profile of the bank. A series of single line Wider Characterising Transects were positioned over numerous banks across the three cSAC/SCI areas. Acoustic data was collected to inform the location of five sampling stations across the depth profile of each bank. The RV Cefas Endeavour component of the survey work consisted of two Case Study Areas (to acquire acoustic multibeam echo sounder data, sediment and epifauna samples) and 11 Wider Characterising Transects (to acquire acoustic multibeam echo sounder (MBES) data and sediment samples) within the North Norfolk Sandbanks and Saturn Reef cSAC/SCI. Two Case Study Areas selected for 'beyond slope' sub-features (at Inner Dowsing and Smith Knoll) were to be jointly surveyed by the Humber Guardian and Solent Guardian (MBES, sediment and epifauna sampling), and RV Cefas Endeavour (sediment and epifauna sampling).

In order to determine the presence and condition of *Sabellaria spinulosa* reef, a total of ten *Sabellaria* areas from across the three cSAC/SCIs were also planned for survey using side-scan sonar and a drop-down camera system.

The survey areas to be surveyed during cruise code CEND1116 on the RV Cefas Endeavour are shown in Figure 2.

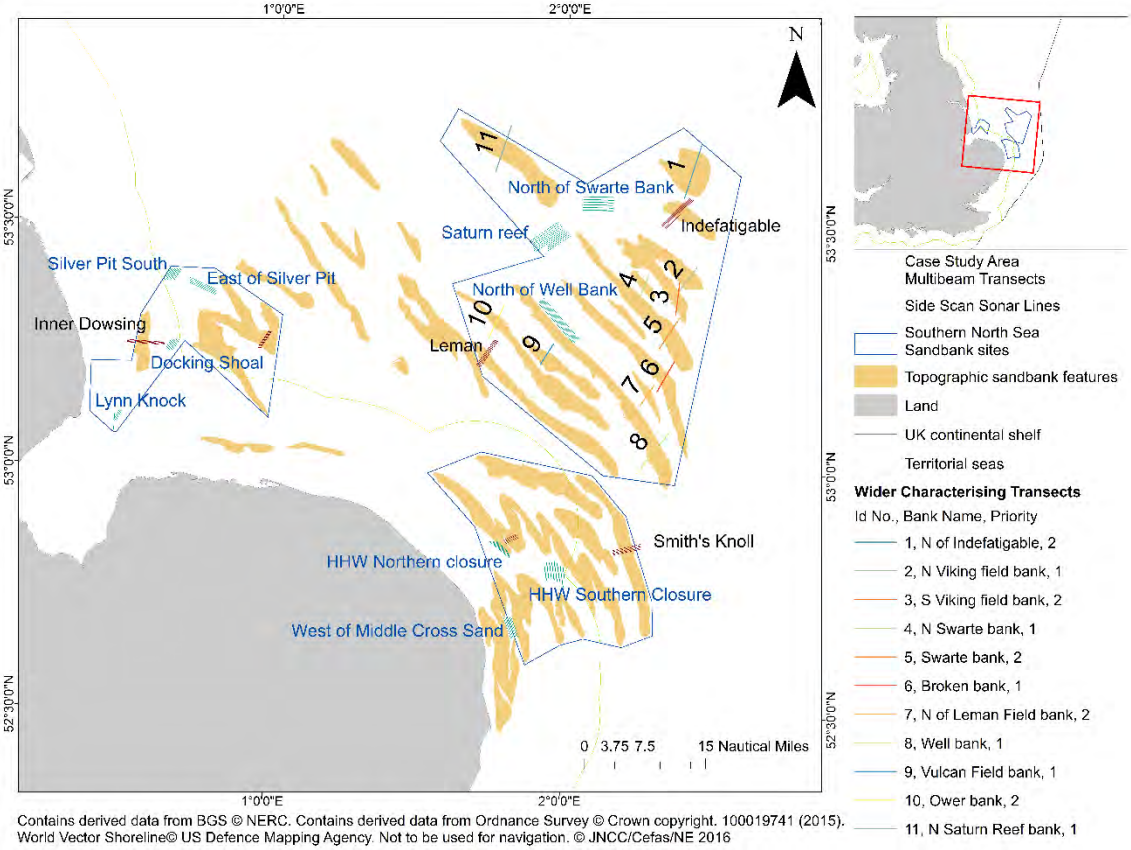

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Figure 2. A summary of the areas to be visited during cruise code CEND1116 showing the Case Study Areas (black text), Wider Characterising Transects (numbered lines) and *Sabellaria* areas of interest (blue text).

2.1.1 Aims

A plan of action document was initially drafted to detail the aims and objectives to be carried out during survey CEND1116.

The objectives are provided below in order of priority:

Objective 1. Acquire acoustic data to identify locations of topographical features of a series of sandbanks across NNSSR, IDRBNR and HHW.

Objective 1 has three sub-objectives:

i. **Collect acoustic corridors covering each of two case study areas (Indefatigable Bank and Leman Bank).**
ii. **Collect acoustic corridors across thirteen wider characterising transects.**
iii. **Collect acoustic corridors covering beyond sandbank areas at two of the case study areas.**

The data acquired will:

a) Enable positioning of sandbank sampling stations and epifaunal trawls during the survey based on bathymetry and backscatter.
b) Provide data for a monitoring time series, to monitor changes in the location of sandbank topographic features over time.
c) Enable a post-hoc comparison with acoustic data acquired in previous surveys (e.g. CEND 22/13 and CEND 05/11) to assist with determining changes in position of sandbank topographic features.

Objective 2. Collect data to investigate the structure, function, and distribution of biological communities in and between sandbanks across NNSSR, IDRBNR and HHW.

Objective 2 has three sub-objectives:

i. **Comprehensive sampling at two case study areas (Leman Bank and Indefatigable Bank).**
ii. **Lower intensity sampling along the wider characterising transects.**
iii. **Targeted investigation of the transition between delineated sandbank and trough areas.**

The data acquired will:

a) Provide data for a monitoring time series.
b) Improve understanding of functional sandbank ecology.
c) Provide information for condition assessment of the Annex I Sandbanks feature.

Objective 3. Acquire data to determine the presence and condition of *Sabellaria spinulosa* reef in 'high confidence' areas (closures, NE 'core reef' areas and other previously surveyed areas) cross NNSSR, IDRBNR and HHW.

Objective 3 has two sub-objectives:

i. **Acquire data to determine the presence and condition of *Sabellaria spinulosa* reef in 'higher confidence' areas.**
ii. **Verify presence and condition of *Sabellaria spinulosa* reef in two 'lower confidence' areas in HHW.**

The data acquired will:

a) Provide information on whether *Sabellaria* aggregations have persisted in specific locations over time and determine whether their condition at those locations has substantially changed.
b) Provide data for a monitoring time series.
c) Provide information for condition assessment of the Annex I Reef feature.

2.1.2 Hypotheses

The hypotheses which underpin the survey rational and experimental design are provided below in Table 1.

Table 1. Detailed hypotheses linked to survey specific objectives.

<table>
<tr><th>Objective</th><th colspan="2">Null hypothesis (H_0)</th></tr>
<tr><td>1</td><td colspan="2">There is no difference in sandbank morphology at the times sampled.</td></tr>
<tr><td rowspan="7">2i and 2ii</td><td rowspan="4">There is no difference in infaunal or epifaunal (metric/trait):</td><td>between the crest, mid-flank, trough and beyond sandbank areas.</td></tr>
<tr><td>between areas of different depth.</td></tr>
<tr><td>between areas of different hydrographic exposure.</td></tr>
<tr><td>between different sediment types.</td></tr>
<tr><td rowspan="2">There is no difference in infaunal or epifaunal (metric/trait) between the mid-flank, trough and beyond sandbank areas:</td><td>on either side of the same sandbank.</td></tr>
<tr><td>on the same side of different sandbanks.</td></tr>
<tr><td colspan="2">There is no species and taxa level correlation between the species found in stomach content analysis of fish species captured in the epifaunal sampling and the geo-spatially underlying infaunal communities.</td></tr>
<tr><td colspan="2">There is no difference in the infaunal and epifaunal communities between the three MPAs.</td></tr>
<tr><td>2 iii</td><td colspan="2">There is no difference in infaunal or epifaunal (metric/trait) observed between beyond sandbank (BS) and 'sandbank' areas (crest, mid-flank and trough) of the same sandbank (taking sediment type, hydrographic exposure and depth into account).</td></tr>
<tr><td rowspan="2">3</td><td colspan="2">There is no difference in the extent, distribution and reefiness of Sabellaria within the core reef areas.</td></tr>
<tr><td colspan="2">The predicted/modelled Sabellaria reefiness model does not reflect the reefiness observed.</td></tr>
</table>

2.2 Sample collection and processing

2.2.1 Sabellaria protocol

The following protocol was implemented during epifauna sample collection using the 2m scientific (Jennings) beam trawl to mitigate any potential impact to *Sabellaria* reef present and its associated communities (Table 2). Firstly, acquisition of seabed imagery was planned for those stations where *Sabellaria* might be expected to colonise (i.e. stations lying within the sandbank troughs and beyond) to determine the presence, and gauge the status, of any reef encountered. Where the seabed imagery was not of sufficient quality, due to underwater visibility or sea conditions, then side-scan sonar data would be acquired and processed to aid identification of potential *Sabellaria* reef from the acoustic signature. In addition to this, information gained from sediment samples acquired at the coincident stations would be used to provide further information on the status of biogenic reef observed to be present. Finally, the beam trawl methodology involved two hauls being collected per station and as such, if *Sabellaria* was encountered in the first haul a decision could be made as to whether or not to proceed with the second haul.

Table 2. Protocol for the mitigation of trawling *Sabellaria* reef.

Equipment	**Assessment**	**EA survey vessels**				**RV Cefas Endeavour**			
		Available	**Sequence**			**Available**	**Sequence**		
Drop camera	***Seabed imagery, visual*** *(presence and reef elevation)*	**Yes**	**Successful deployment and present**	**Successful deployment and absent**	**Unsuccessful deployment**	**Yes**	**Successful deployment and present**	**Successful deployment and absent**	**Unsuccessful deployment**
			Abandon station	Complete trawl	Go to next step		Abandon station	Complete trawl	Go to next step
Side-scan sonar	***Remote sensing*** *(presence and extent of acoustic signature)*	**No**	N/A			**Yes**	**Present**		**Absent**
							Abandon station		Complete trawl
Grab	***Visual*** *(presence, tube height, occupancy*	**Yes**	**Present**		**Absent**	**Yes**	**Present**		**Absent**
			Abandon station		Complete trawl		Abandon station		Complete trawl
Beam trawl	***Visual*** *(presence, tube height, occupancy*	**Yes**	**Present in first trawl**		**Absent in first trawl**	**Yes**	**Present in first trawl**		**Absent in first trawl**
			Abandon second trawl		Complete second trawl		Abandon second trawl		Complete second trawl

2.2.2 Acoustic data

2.2.2.1 Multibeam echo sounder

Multibeam echo sounder (MBES) data were acquired using a Kongsberg EM2040 single head transducer and Kongsberg SIS software (version 4.1.3). Survey lines from the Case Study Areas were positioned at approximately 300m intervals to allow the placement of sampling stations over the sandbank strata. The pulse length was set to medium continuous wave to optimise the quality of the backscatter data, with quality of both the multibeam and backscatter data being monitored during acquisition. A sound velocity profile was collected prior to commencing MBES data acquisition from each Case Study Area and Wider Characterising Transect. These data were uploaded into the MBES acquisition software to ensure accurate sound velocity offset calculations. MBES data were processed on board for bathymetry and backscatter using Caris HIPS and FMgt software. Bathymetry data were tidally corrected using tides derived from a CNAV 3050 GPS receiver. C tide software was used to reduce the height to chart datum using the VORF model.

A calibration was performed to ensure any offsets entered into the acquisition software were correct prior to survey at a known wreck in the North Sea (during survey CEND1016) and a test for heave pitch and roll was carried out following installation of a replacement transducer (RX unit), see Annex 6.2.1 for calibration logs.

2.2.2.2 Side-scan sonar

Side-scan sonar data were acquired using the Edgetech 4200 Multi Pulse (300/600kHz) tow-fish and acquisition software Edgetech Discover V 35.01.104 (Figure 3). Various acquisition parameters were set and fixed for the duration of the survey and the tow-fish was flown at an altitude of 10 - 15m above the seabed. A sufficient amount of cable was paid out to ensure the tow-fish was beyond the interference of the propeller wash, thus avoiding artefacts in the data, and the vessel survey speed was approximately 4.5 – 5.5 knots. Cable out was manually entered into the acquisition software and any changes updated immediately. An USBL was fitted to the tow-fish. However, this system does not operate efficiently in shallow water and provides unreliable positional information. Therefore, position offset of the stern gantry was logged every 15 seconds to enable a ‘lay back’ correction to be applied retrospectively to provide more accurate positional information.

Side-scan data were processed on board using Triton Imaging Perspective V7.6.278 to smooth the navigation, correct the slant range (removes nadir) and apply time varied gain. The output file type (.XYA) was gridded using Fledermaus 7.4.5 64 bit edition to create a floating point geotiff file for import into the geographic information system software Esri ArcMap 10.1.

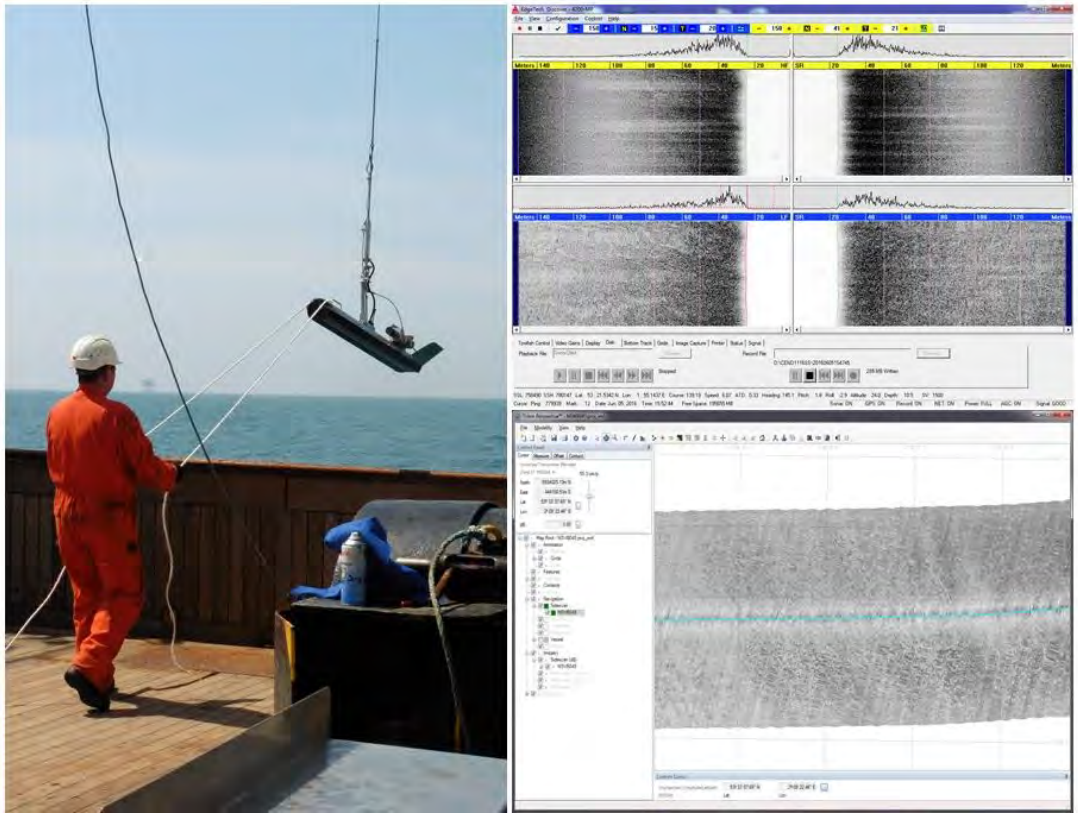

Figure 3. Deployment of the Edgetech 4200 MP side-scan sonar tow-fish images of acquisition (top) and processing software (bottom).

2.2.3 Sediment sampling

Sediment samples were acquired using a 0.1m^2 mini Hamon grab, deployed from the starboard side of the RV Cefas Endeavour (Figure 4). The Hamon grab is used to collect surficial sediment samples from coarse sediments to a depth of approximately 15cm (Oele 1978; Eleftheriou & Moore 2005; Ware & Kenny 2011). The system consists of an open bucket at the end of a levered stainless-steel arm which is released from a locked position upon impact with the seabed. The bucket collects a sediment sample as the cable is drawn through a series of pulleys once fired. The grab is recovered to the deployment platform where the sediment sample is processed. The sample is assessed as valid if there is no evidence of loss of sample during recovery and also where the sample is of sufficient volume for the sediment encountered. In this survey, a sediment sample was retained for subsequent analyses if the sample volume was larger than two litres, following the SICs discretion. An image is taken of the sediment once decanted from the grab and a *circa* 0.5 litre sub sample is transferred into a labelled container for subsequent particle size distribution analysis and stored at -20°C. The remaining sediment is processed on board for benthic community analysis and is sieved on a 5mm and 1mm sieve station to remove the finer sediment and faunal fractions. Images of the material on each mesh are taken and the sample is recombined into a labelled container prior to fixation in buffered 4% formaldehyde.

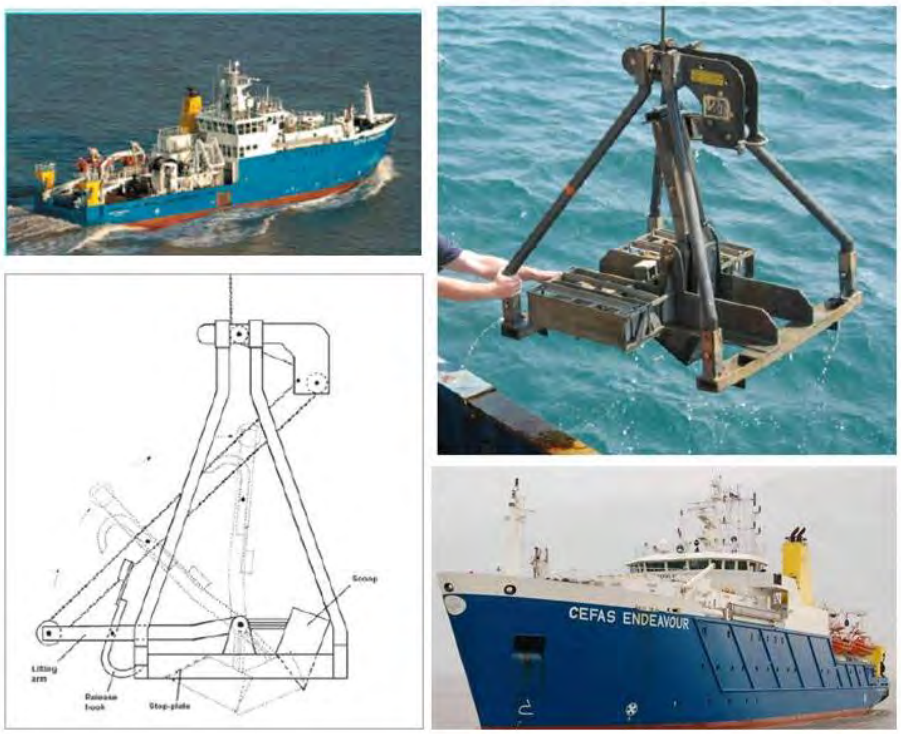

Figure 4. The 0.1 m^2 Hamon grab and the RV Cefas Endeavour. Line drawing (bottom left) from Eleftheriou and Moore 2005.

2.2.4 Seabed imagery

Video observations were made with STR SeaSpyder "Telemetry" Drop Camera System, comprising an HD-SDI 1080p/30 frame per second Subsea video camera and an 18 megapixel Underwater Digital Stills camera with a separate high-powered flash. The system is rated to 3000m. Illumination was provided by four 20W High Intensity LED Lights and scaling using 2x Dual Scaling Lasers, a 250kHz Precision Altimeter and combined compass and depth sensors. The amount of cable out was controlled via a winch operator in sight of the video feed. Ultra-Short Base Line (USBL) positioning was used to geo-reference the video footage and still images. In addition, the position of the gantry used to deploy the camera was also logged.

Illumination was provided by underwater LEDs and a synchronised flash unit. A scaling device consisting of two lasers (220mm linear maximum separation) was used to provide a reference scale in the video image (Figure 5). An acoustic imagery system, the ARIS Explorer 3000, was provided by the IFCA and optionally fitted on the drop frame with communication to top side through a dedicated umbilical cable.

Figure 5. The drop frame mounted high definition camera and laser scaling (220mm linear maximum).

2.2.5 Scientific (Jennings) beam trawl

The beam trawl used during this survey follows the design detailed in Jennings *et al* (1999) and is used as standard by Cefas for sampling epibenthic fauna (Figure 6). It has the advantage of being robust, easy to deploy, and produces manageable sample volumes. The design includes a heavy-duty steel beam, a chain mat to prevent the collection of large boulders, and chafers to limit net damage. In muddy sediments the chain mat may be removed as it tends to cause the net to fill with sediment. A 4mm knotless mesh liner is used in the cod-end to retain smaller organisms. All tows were carried out in a straight line, against the tide, over a fixed distance of approximately 150 metres; 5 minutes duration at 1 knot (speed over ground). Tow duration is measured from the time that the warp has ceased paying out (LOCK) to the time that hauling begins (HAUL). To ensure an accurate sample has been acquired and the gear has fished correctly the amount of warp deployed was determined using water depth, vessel speed and expert judgement from the vessels bridge crew.

The catch from each successful tow was photographed and rinsed over a 5mm screening mesh. Taxa were identified to the highest taxonomic level possible (species) and biomass (wet weight in g) was recorded for every enumerable individual. A combined weight was recorded where possible for colonial organisms.

Figure 6. Recovery of the scientific (Jennings) 2m beam trawl on the back deck of the RV Cefas Endeavour.

3 Survey narrative

All times are provided in GMT.

The RV Cefas Endeavour was mobilised on the morning of the 31st May 2016 before a vessel safety induction was conducted by the ship's Safety Officer at 12:00hrs. The vessel departed Lowestoft for a timed arrival at the North Norfolk Sandbanks and Saturn Reef (NNSSR) site at 05:00hrs on the 1st June 2016. The survey of the Indefatigable Bank Case Study Area (IDFB CSA) commenced with an acoustic multibeam echo sounder (MBES) survey along five planned transects across the feature. MBES data were successfully acquired by 12:00hrs and the resulting data were processed immediately to inform the placement of 53 sediment sampling stations, as per the survey objectives. A safety drill (muster and abandon ship due to galley fire) was attended by all survey staff between 12:30 – 13:30hrs. The 0.1m^2 mini Hamon grab survey commenced at 14:18hrs and continued until poor weather and sea conditions ceased operations at 03:45hrs on the 2nd June 2016. Following a short break to allow the sea state to subside, grab operations recommenced at 08:41hrs and were completed by 14:28hrs. The seabed imagery (drop frame mounted camera system) survey commenced at 15:05hrs and was completed at 20:33. Note the Ultra-Short Base Length (USBL) did not reliably work, most likely due to the seabed topography, sea state and depth. As such, the gantry position was used to infer the location of the seabed images acquired. The purpose of acquiring imagery from the stations within the troughs of the Indefatigable Bank CSA was to mitigate the use of the beam trawl on *Sabellaria* reef. No *Sabellaria* reef was encountered within this CSA and the beam trawl survey commenced at 20:53hrs and all 15 stations were successfully completed by 19:30hrs on the 3rd June 2016. The vessel then transited to a nearby Wider Characterising Transect (WCT), (North of Indefatigable Bank) to acquire a single line of MBES data, prior to placement of six grab stations. An additional station was placed on the bank crest as there appeared to be two distinct crests associated with this feature. These objectives were completed by 01:37hrs on the 4th June 2016. A second WCT (North of Saturn Reef Bank) was surveyed in a similar manner. However, the MBES system failed and MBES data were acquired from only the North-east half of the planned survey transect. Three grab stations were placed and sediment samples were successfully acquired while the MBES fault was addressed. The last section of MBES transect was abandoned due to the persistent fault in the MBES system and the decision made to commence side-scan objectives at the North of Swarte Bank survey area (50% coverage). Side-scan operations commenced at 12:50hrs on the 4th June 2016 and were completed at 23:23hrs. The vessel then transited a short distance to the North of Saturn Reef Bank side-scan area and commenced acquisition at 00:06hrs on the 5th June 2016. The final survey transect in this area was completed at 05:06hrs and side-scan operations at the third area of search (North of Well Bank) commenced at 14:25hrs. Seabed imagery was acquired from North of Swart Bank, Saturn Reef and North of Well Bank between 01:36hrs on the 6th June 2016 and 15:25hrs on the 7th June 2016 following the processing and interpretation of the side-scan sonar data to inform the placement of stations. A single line of side-scan data was acquired from the North of Swarte Bank site, orientated in a north/south direction and coincident with an area of deeper bathymetry where maintaining a safe fish altitude proved difficult during the planned run lines (10:58 – 12:07hrs on the 6th June 2016). The side-scan sonar was deployed at the East of Silver Pit site at 20:33hrs on the 7th June 2016. However, the equipment was recovered due to the presence of static fishing gear.

The Humber Guardian acquired MBES data and partially completed the sediment sampling survey at the Inner Dowsing Case Study Area (Nelson *et al*, in prep.). Communication between the two vessels allowed the RV Cefas Endeavour to visit the remaining stations and complete these sediment sampling stations while conducting the 'Beyond Slope' objectives

at the site. Successful sediment samples were acquired between 22:00hrs and 18:44hrs on the 8th June 2016. Seabed imagery was planned for collection at the Trough and Beyond Slope stations prior to deployment of the beam trawl to mitigate against the potential impact on *Sabellaria* reef. Visual assessment of the seabed was unsuccessful due to poor underwater visibility and strong tides in the area. Therefore, the decision was made to deploy the 2m scientific (Jennings) beam trawl at the Flank stations (which did not require mitigation using seabed imagery). Epifauna samples were collected from three stations on the west Flank of the Inner Dowsing Case Study Area between 23:37hrs on the 8th and 03:18hrs on the 9th June 2016. Acoustic data (side-scan sonar) were acquired from the western Beyond Slope stations to enable an assessment of possible *Sabellaria* presence prior to trawling (in the absence of seabed imagery). The 2m scientific (Jennings) beam trawl was deployed at station INNDF18 on the east of the bank (Flank station) and trawling operations were halted at this station due to the presence of *Sabellaria* in the first haul. Acoustic data (side-scan sonar) were acquired from the Flank stations on the east of the bank (north south orientated line covering all three planned Flank stations) and these data processed to inform a decision regarding the presence of *Sabellaria* in the area.

A small boat transfer was conducted at 13:00hrs on the 9th June 2016, nearby to the South of Silver Pit site, to allow survey staff changeover.

Acoustic data (side-scan sonar) were acquired from the East of Silver Pit and South of Silver Pit sites and the data processed before seabed imagery (drop down video) was acquired from 15 stations where acoustic signatures inferred the presence of *Sabellaria* reef. This element of the survey was completed between 13:08hrs on the 9th and 09:01hrs on the 10th June 2016.

Acoustic data (side-scan sonar) were then acquired from the Trough and Beyond Slope stations on the east of the Inner Dowsing Case Study Area. The side-scan sonar surveys of the Docking Shoal and Lynn Knock sites were conducted between 11:37hrs and 17:33hrs on the 10th June 2016. These data were processed and potential target areas (*Sabellaria* acoustic signatures) were selected for survey using the drop camera. Four transect lines were successfully completed at the Lynn Knock site between 19:45hrs and 20:55hrs before the side-scan operations at the Docking Shoal site recommenced at 00:47hrs on the 11th June 2016 to allow time for the processing and interpretation of acoustic data acquired earlier. The transects selected for survey with the drop camera were successfully acquired by 07:19hrs. The final drop camera survey within the Inner Dowsing, Race Bank and North Ridge cSAC/SCI was conducted following interpretation of the processed side-scan sonar data collected at South of Silver Pit and was completed at 15:26hrs on the 11th June 2016.

The replacement multibeam transducer (receiver head) was fitted during the transit between the Inner Dowsing, Race Bank and North Ridge cSAC/SCI and the North of Saturn Reef Wider Characterising Transect in the North Norfolk Sandbanks and Saturn Reef cSAC/SCI. Diagnostic (BIST) tests were conducted every 30 minutes to ensure communications between the acquisition software and replacement software before the final reassembly of the transducer head took place. The sound velocity profile from a CTD deployment was imported into the acquisition software and the two remaining stations were positioned following the successful acquisition of MBES data from the remainder of the North of Saturn Reef Wider Characterising Transect. The objectives for this WCT were completed at 00:30hrs on the 12th June 2016. A pitch and roll calibration of the new MBES system was performed over a bathymetric feature (Coal Pit) between 01:59hrs and 04:31hrs during the transit to the Leman Bank Case Study Area. The MBES survey of the Leman Bank CSA was conducted between 06:19hrs and 10:45hrs. Stations were located along the bank profile during MBES acquisition to reduce the time between completing the MBES survey and starting the sediment sampling survey. In total, 53 sediment samples were collected from the Leman Bank CSA between 12:21hrs on the 12th June and 02:42hrs on the 13th June 2016.

An interesting bathymetric feature was identified, from within the area between the north-east Flank and Trough stations, and the decision made to acquire simultaneous side-scan sonar and MBES data along a cross line in the north east of the Leman Bank CSA between 03:49hrs – 04:35hrs. Seabed imagery was then acquired from those stations in the north east of the site which required mitigation prior to beam trawl deployment. An additional line of MBES data was opportunistically acquired to the north of, and at the same spacing as, those previously collected, along the full length of the site on returning to the south west of the site to perform mitigation drop cameras. Seabed imagery was successfully acquired by 09:18hrs. Beam trawling commenced at 09:32hrs and continued following the survey of two additional seabed imagery stations (based on interpreted side-scan data). Epifauna sampling using the beam trawl recommenced at 02:05hrs on the 14th June 2016 and all stations due to be collected during CEND1116 from the Leman Bank CSA were completed by 08:33 hrs. Station LMBKT19 yielded only one successful tow as the presence of *Sabellaria* in the first haul lead to cessation of trawling.

Acoustic data (MBES) and sediment samples were acquired from the nine remaining Wider Characterising Transects in the North Norfolk Sandbanks and Saturn Reef cSAC/SCI between 11:50hrs on the 14th and 01:47hrs on the 16th June 2016.

Following a short transit to the Haisborough, Hammond and Winterton cSAC/SCI, a sediment sampling survey at the Smiths Knoll Case Study Area commenced at 04:19hrs. The RV Cefas Endeavour was used as the platform to collect samples from the flank, trough and beyond sandbank stations to the east of the bank while the Humber Guardian collected the remaining samples to the west of the bank. Sediment samples were successfully obtained from all target stations by 12:30hrs.

Acoustic (side-scan sonar and MBES) and seabed imagery (drop camera) operations were then conducted at the Haisborough, Hammond and Winterton *Sabellaria* areas of interest between 16:50hrs on the 16th June 2016 and 03:12hrs on the 19th June 2016. The acoustics imaging camera was deployed (during the day shift) at two stations within the 'Western Middle Cross Sands' area to investigate the *Sabellaria* reef evident on the seabed imagery and side-scan sonar data acquired previously.

All survey objectives pertaining to the RV Cefas Endeavour (excluding the epifauna sample collection at the Inner Dowsing site) were completed after which the vessel returned to Lowestoft port on the morning tide to commence demobilisation of equipment, samples and survey staff.

4 Preliminary results

The preliminary information presented in the following sections of the survey report consist of field observations made prior to the completion of laboratory analyses and should not be considered as final results. Similar information relating to the number and type of samples collected from the other survey platforms involved (Humber/Solent Guardian) is reported separately (Nelson *et al*, in prep).

Table 3. Table showing the bank name and the short code used during survey.

Area	Bank name	Code
Case Study Areas (CSAs) within the North Norfolk Sandbanks and Saturn Reef cSAC/SCI	Leman Bank	LMBK
	Indefatigable Bank	IDFB
Case Study Areas (CSAs) within the Inner Dowsing, Race Bank and North Ridge cSAC/SCI	Inner Dowsing	INND
Case Study Areas (CSAs) within the Haisborough, Hammond and Winterton cSAC/SCI	Smith's Knoll	SMKN
Wider Characterising Transects (WCTs) within the North Norfolk Sandbanks and Saturn Reef cSAC/SCI	North of Indefatigable	WCT_001
	North of Viking Field Bank	WCT_002
	South of Viking Field Bank	WCT_003
	North of Swarte Bank	WCT_004
	Swarte Bank	WCT_005
	Broken Bank	WCT_006
	North of Leman Field Bank	WCT_007
	Well Bank	WCT_008
	Vulcan Field Bank	WCT_009
	Ower Bank	WCT_010
	North of Saturn Reef Bank	WCT_011

Area	Bank name	Code
***Sabellaria* areas of interest within the Haisborough, Hammond and Winterton cSAC/SCI**	HHW Northern Closure	HWNC
	HHW Southern Closure	HWSC
	West of Middle Cross Sand	WMCS
***Sabellaria* areas of interest within the Inner Dowsing, Race Bank and North Ridge cSAC/SCI**	Docking Shoal	DKSH
	East of Silver Pit	ESVP
	Lynn Knock	LYKN
	Silver Pit South	SVPS
***Sabellaria* areas of interest within the North Norfolk Sandbanks and Saturn Reef cSAC/SCI**	North of Swarte Bank	NSWB
	North of Well Bank	NWBK
	Saturn Reef	STNR

4.1 Acoustic data

Acoustic data were preliminarily processed during survey to allow their use in positioning of seabed imagery stations. These data will be fully processed following completion of the survey to inform the final report.

4.1.1 Multibeam echo sounder

A total of 217km of MBES data was acquired during the survey. Ten pre-planned survey lines were acquired from the Indefatigable Bank (IDFB) and Leman Bank (LMBK) Case Study Areas within the North Norfolk Sandbanks and Saturn Reef cSAC/SCI. Additional MBES data, along a transect to the north of those planned/acquired at the Leman Bank Case Study Area, and two cross lines (collected during transit across the sandbank feature) were also acquired (Figure 7). MBES data were acquired along the full length of all 11 planned Wider Characterising Transects (Figure 8). An additional line of MBES data was also collected adjoining the Ower Bank WCT. MBES data were also acquired from two *Sabellaria* areas of search (Northern and Southern Closures) within the Haisborough, Hammond and Winterton cSAC/SCI during a simultaneous acoustic survey (MBES and side-scan sonar) (Figure 9).

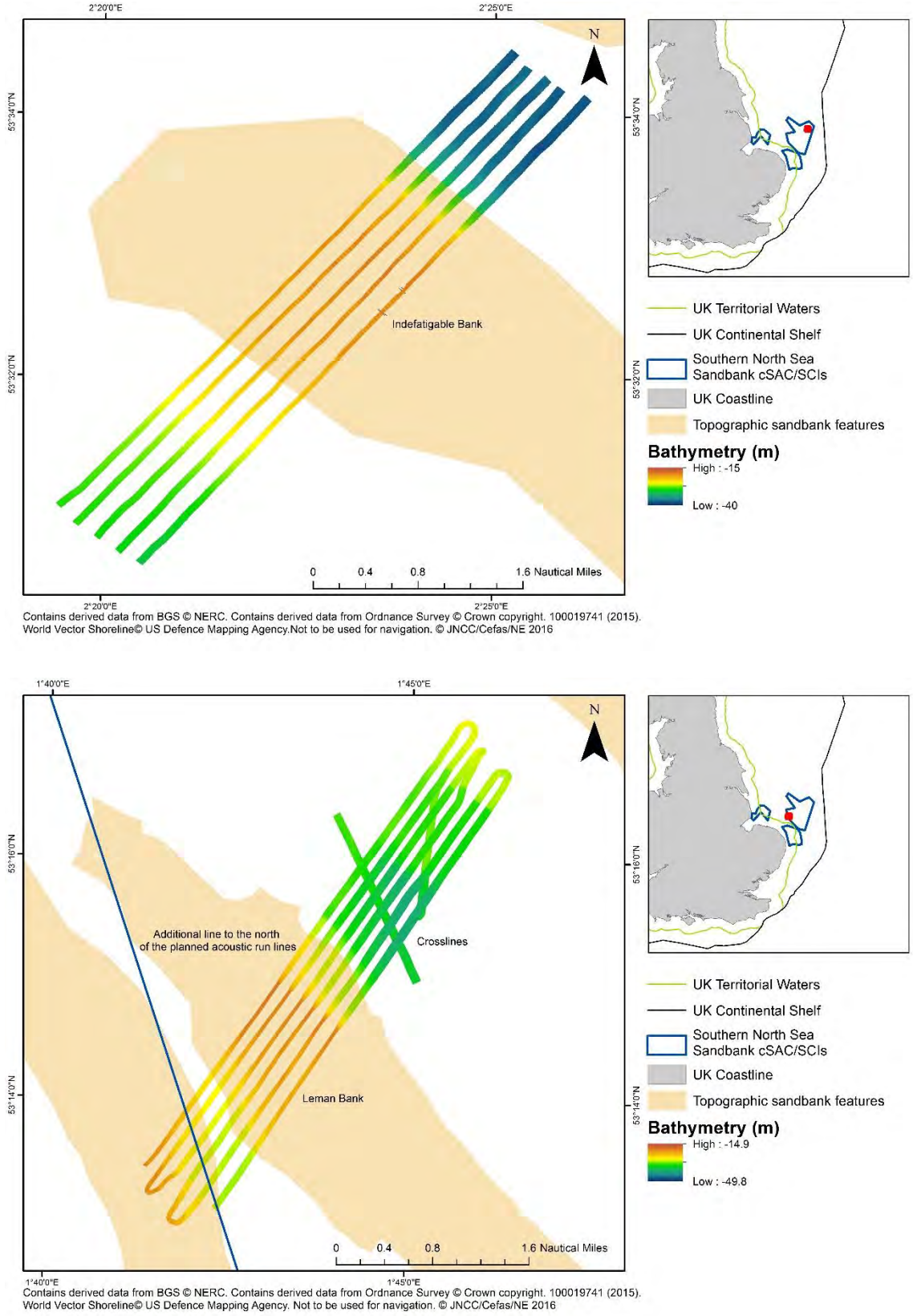

Figure 7. Multibeam echo sounder data acquired from the Indefatigable Bank (IDFB) (top), and Leman Bank (LMBK) (bottom) Case Study Area within the North Norfolk Sandbanks and Saturn Reef cSAC/SCI. Additional lines of data were acquired from the LMBK site during transit within the site and to investigate a sediment feature of interest.

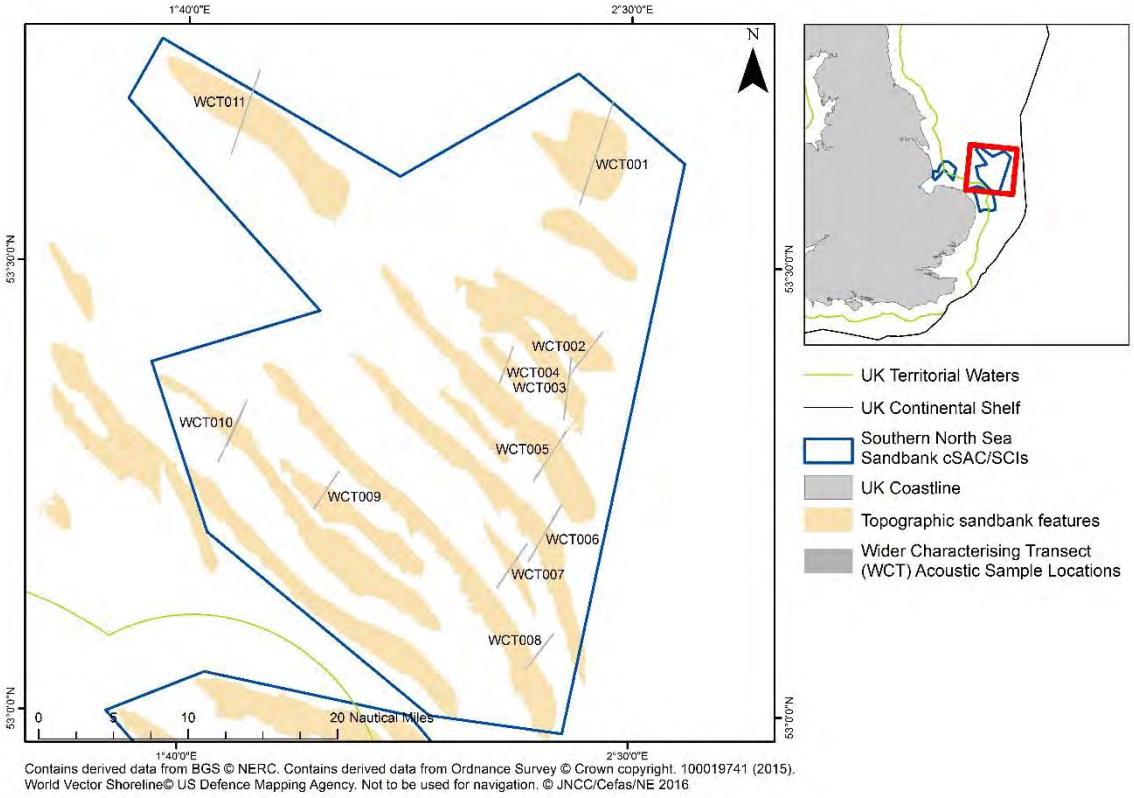

Figure 8. Location of the multibeam echo sounder data acquired from the Wider Characterising Transects within the North Norfolk Sandbanks and Saturn Reef cSAC/SCI.

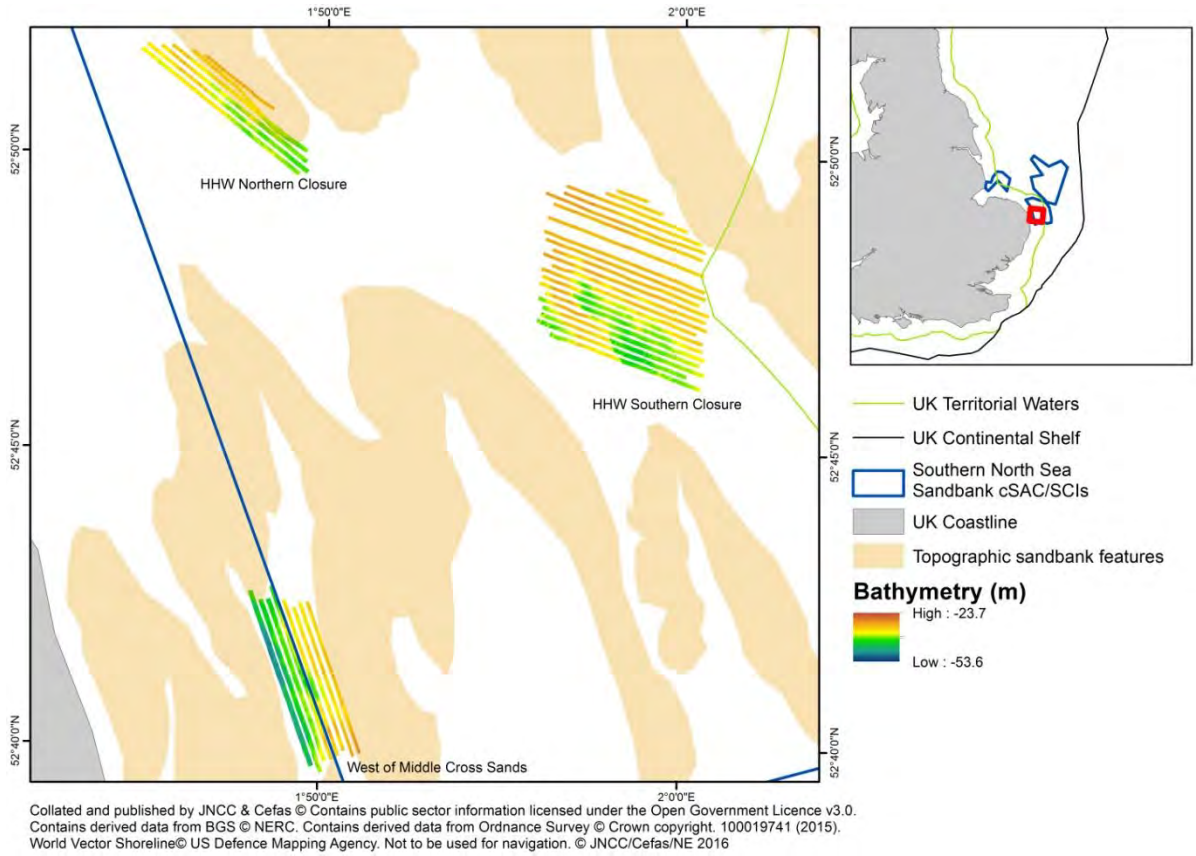

Figure 9. Multibeam echo sounder data acquired from three *Sabellaria* areas of interest within the Haisborough, Hammond and Winterton cSAC/SCI. These data were acquired during a simultaneous acoustic survey (MBES and side-scan sonar).

4.1.2 Side-scan sonar

A total of 554km of side-scan sonar data was acquired from the ten *Sabellaria* areas of interest planned for survey during cruise CEND1116. In addition, side-scan data were collected from the Inner Dowsing Case Study Area (as part of the *Sabellaria* mitigation protocol) and from the Leman Bank Case Study Area (to investigate an interesting seabed feature identified on survey). Figure 10 - Figure 12 show the coverage of the side-scan data collected at each cSAC/SCI (as floating point geotiff files or positions recorded during acquisition to indicate where data are available). Note, these data were processed on board and used to inform the placement of seabed imagery stations.

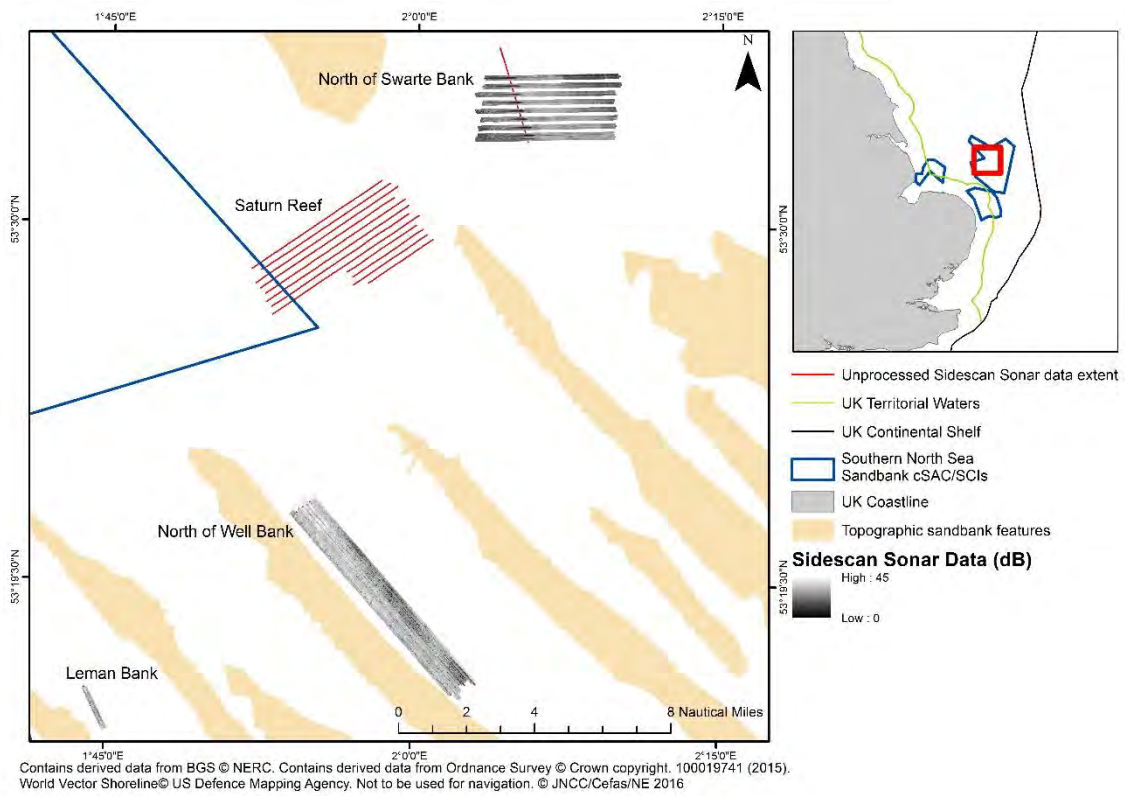

Figure 10. Side-scan sonar data acquired from three *Sabellaria* areas of interest and the Leman Bank Case Study Area within the North Norfolk Sandbanks and Saturn Reef cSAC/SCI.

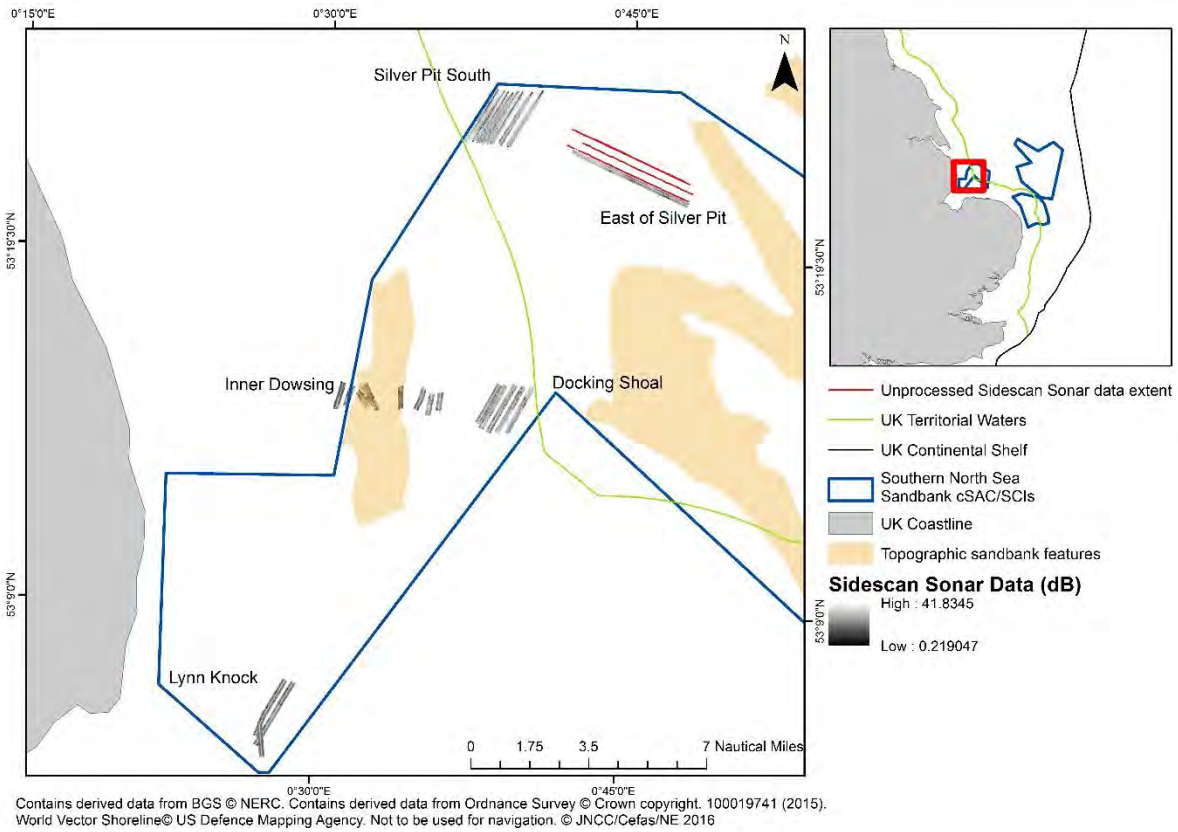

Figure 11. Side-scan sonar data acquired from four *Sabellaria* areas of interest and the Inner Dowsing Case Study Area within the Inner Dowsing, Race Bank and North Ridge cSAC/SCI.

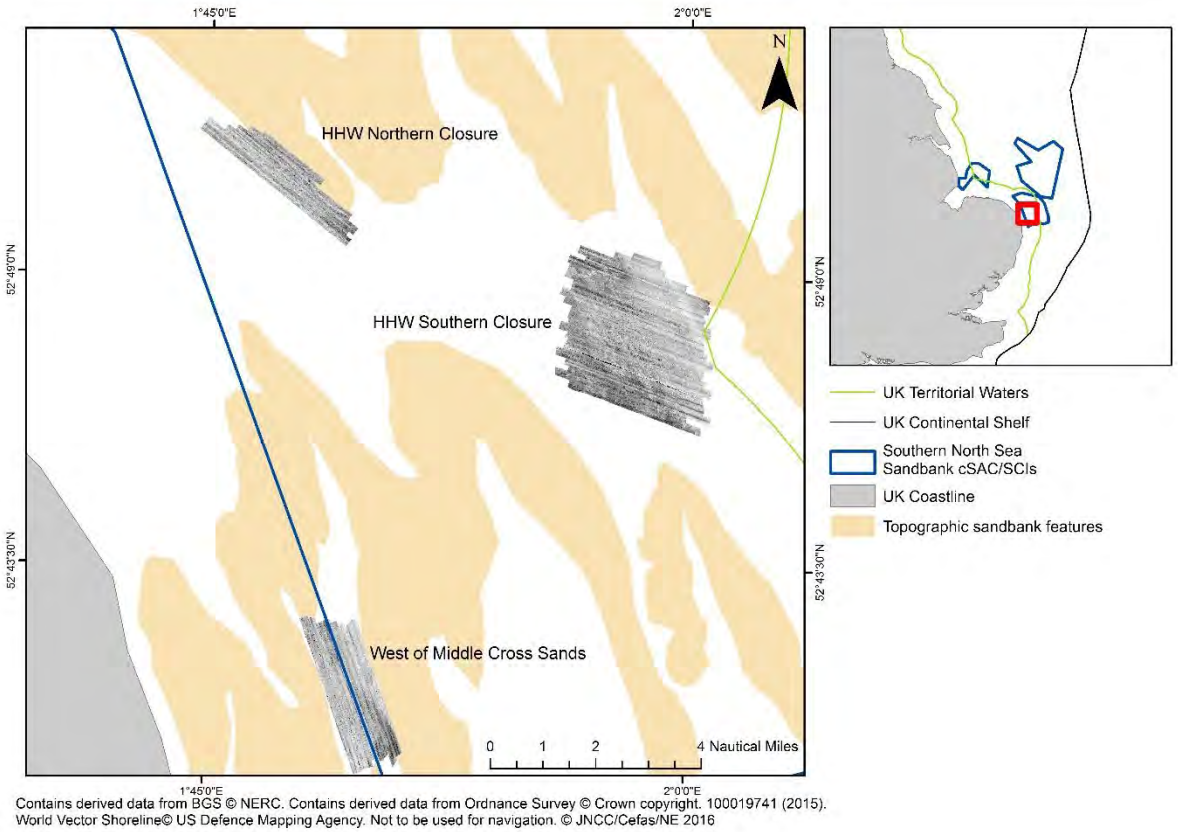

Figure 12. Side-scan sonar data acquired from three *Sabellaria* areas of interest within the Haisborough, Hammond and Winterton cSAC/SCI.

4.2 Sediment sampling

In total 216 sediment samples were collected using the 0.1m^2 mini Hamon grab for subsequent particle size distribution and infauna community analyses. A number of these samples consisted of small sediment volumes, likely due to the compacted nature of the sandy sediment resulting in shallow penetration. Images taken during deck processing showing the sediment collected (prior to subsampling); sediment retained on 5mm and 1mm mesh; sample volume are provided in the tables in section 6.5.1. Figure 13 - Figure 16 show the location of the sediment samples collected from each of the Case Study Areas and all Wider Characterising Transects.

In addition to the samples collected for infaunal and sediment particle size analyses, up to three sediment samples from each Case Study Area visited were frozen for subsequent stable isotope analysis (during survey CEND1116 two sediment samples for stable isotope analysis were collected from the Inner Dowsing Case Study Area and none from the Smiths Knoll Case Study Area; the remaining stations were sampled during the parallel survey conducted on Humber Guardian). During theCEND1116 survey, a total of 160 sediment samples were from four Case Study Areas and 56 from Wider Characterising Transects (five from each of 11 transects plus an additional 'Crest' sample from WCT_001 "Indefatigable Bank"). See Table 4 below for a summary of the samples collected during CEND1116.

Table 4. Summary of the sediment samples collected on the RV Cefas Endeavour during survey CEND1116.

Area	Number of sediment samples successfully collected
Indefatigable Bank	50 (Case Study Area and 3 Stable Isotope)
Inner Dowsing	30 (Case Study Area and 2 Stable Isotope)
Leman Bank	50 (Case Study Area and 3 Stable Isotope)
Smiths Knoll	30 (Case Study Area only)
Wider Charactering Transects	56 (WCT_001 with 6 samples. WCT_002-011 with 5 samples at each)

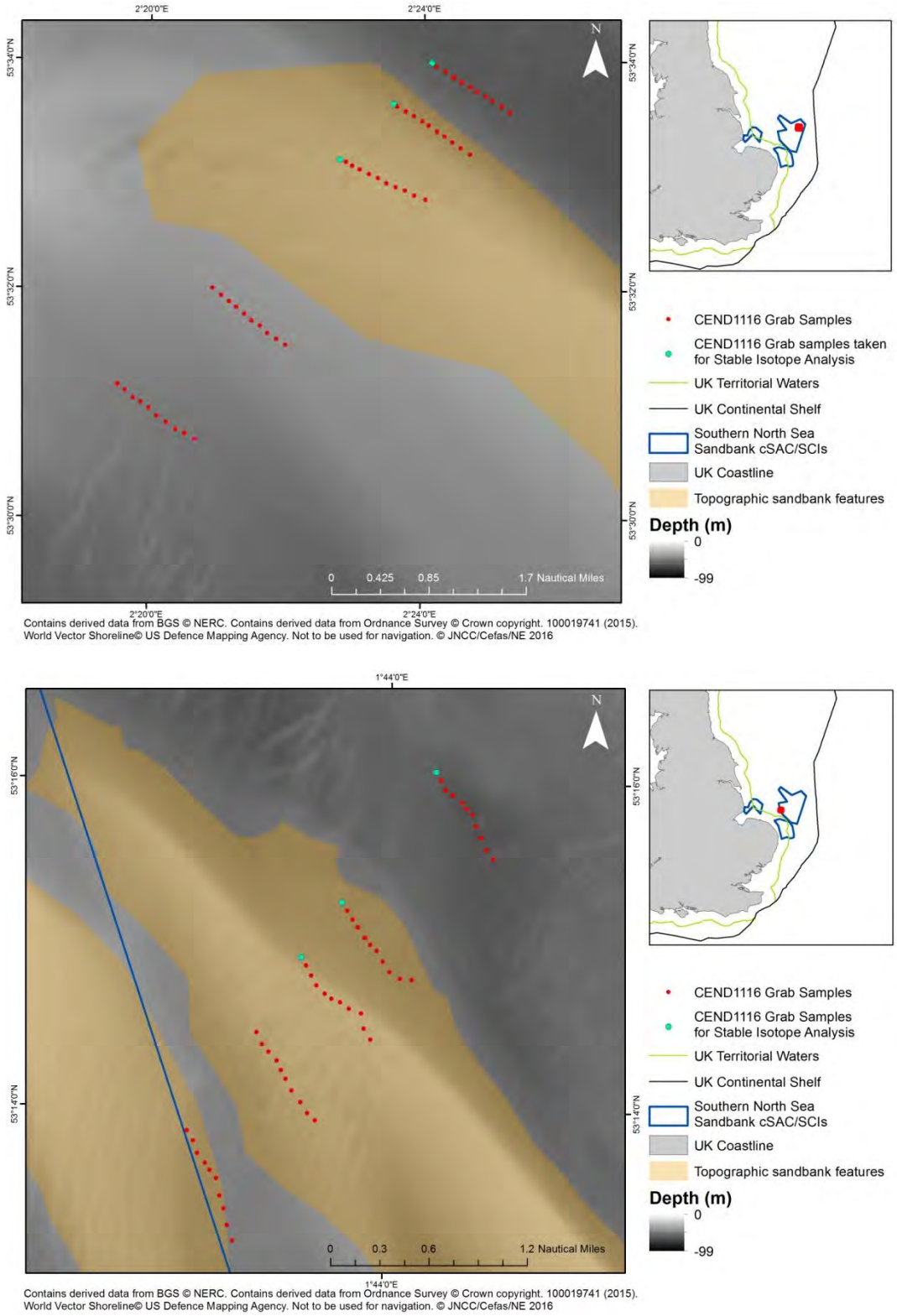

Figure 13. Sediment samples collected from the Indefatigable Bank (top) and Leman Bank (bottom) Case Study Areas within the North Norfolk Sandbanks and Saturn Reef cSAC/SCI.

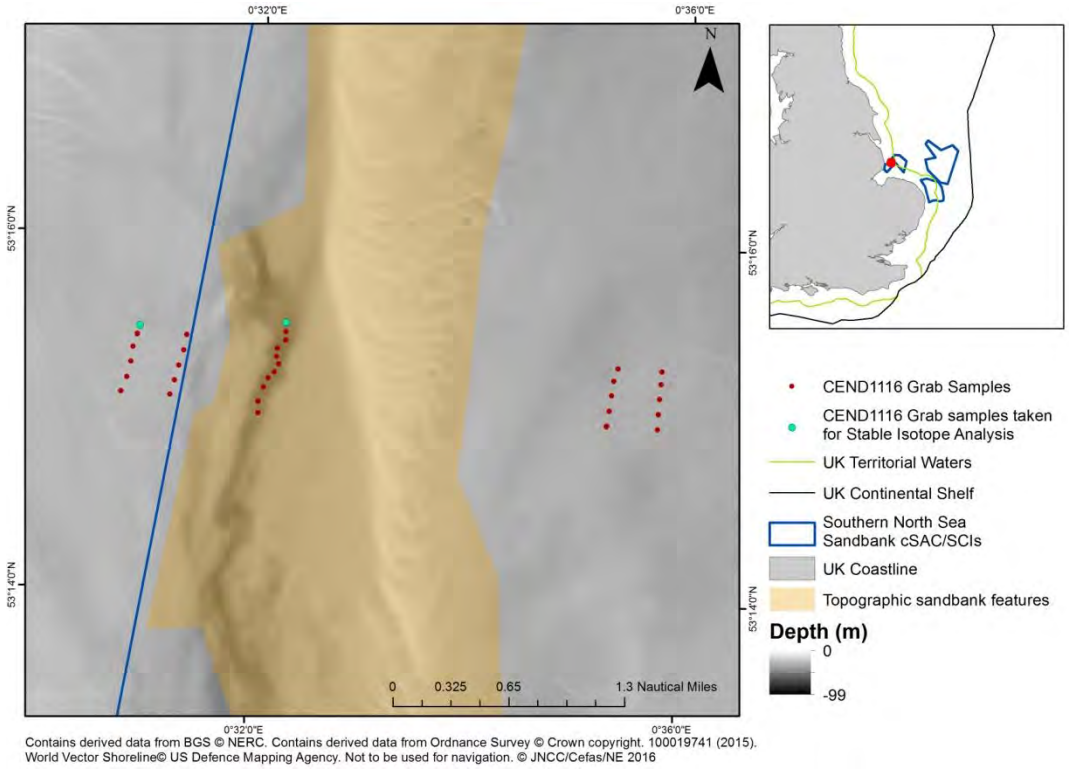

Figure 14. Sediment samples collected from the Inner Dowsing Case Study Areas within the Inner Dowsing, Race Bank and North Ridge cSAC/SCI.

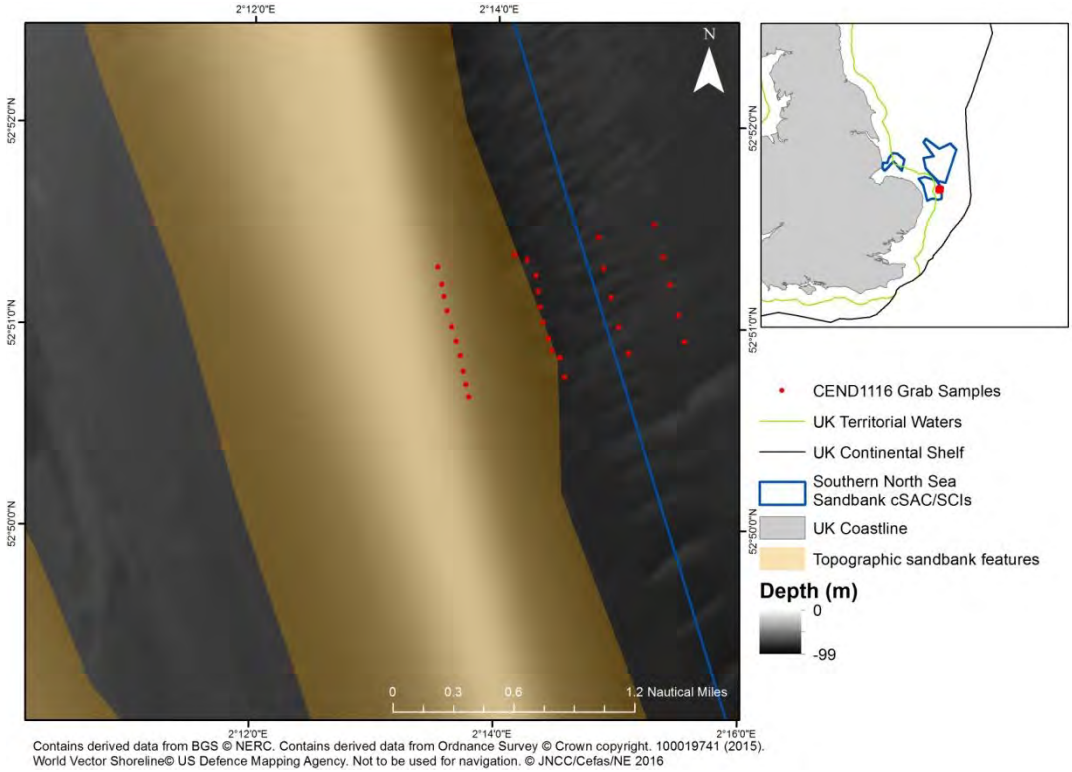

Figure 15. Sediment samples collected from the Smiths Knoll Case Study Areas within the Haisborough, Hammond and Winterton cSAC/SCI.

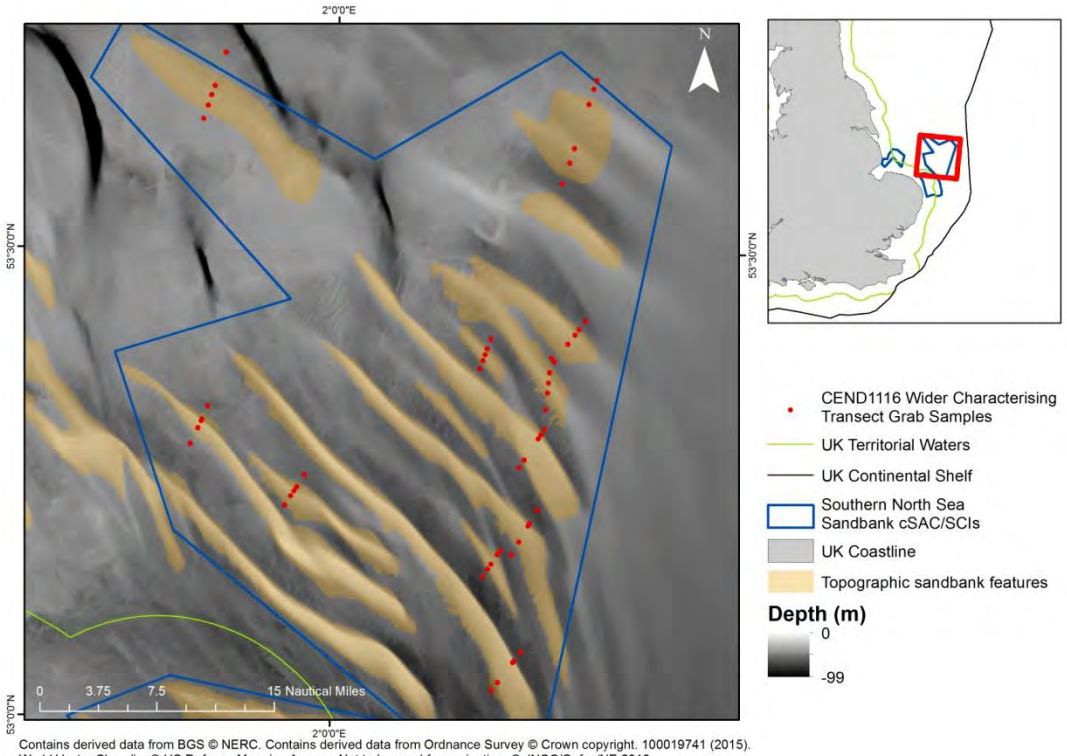

Figure 16. Sediment samples collected from the Wider Characterising Transects within the North Norfolk Sandbanks and Saturn Reef cSAC/SCI.

4.3 Seabed imagery

A total of 28 hours 44 minutes of video footage and 3037 digital still images were collected from 121 successful camera transects carried out during survey CEND1116. The locations of the seabed imagery acquired within each cSAC/SCI are provided in Figure 17 - Figure 19. Two stations within the Haisborough, Hammond and Winterton cSAC/SCI (WMCS04 and WMCS07) were surveyed simultaneously with the drop camera and an acoustic imaging system.

Representative images and preliminary assessment of *Sabellaria* presence from the immediate review of seabed imagery are provided in Annex 6.5.2.

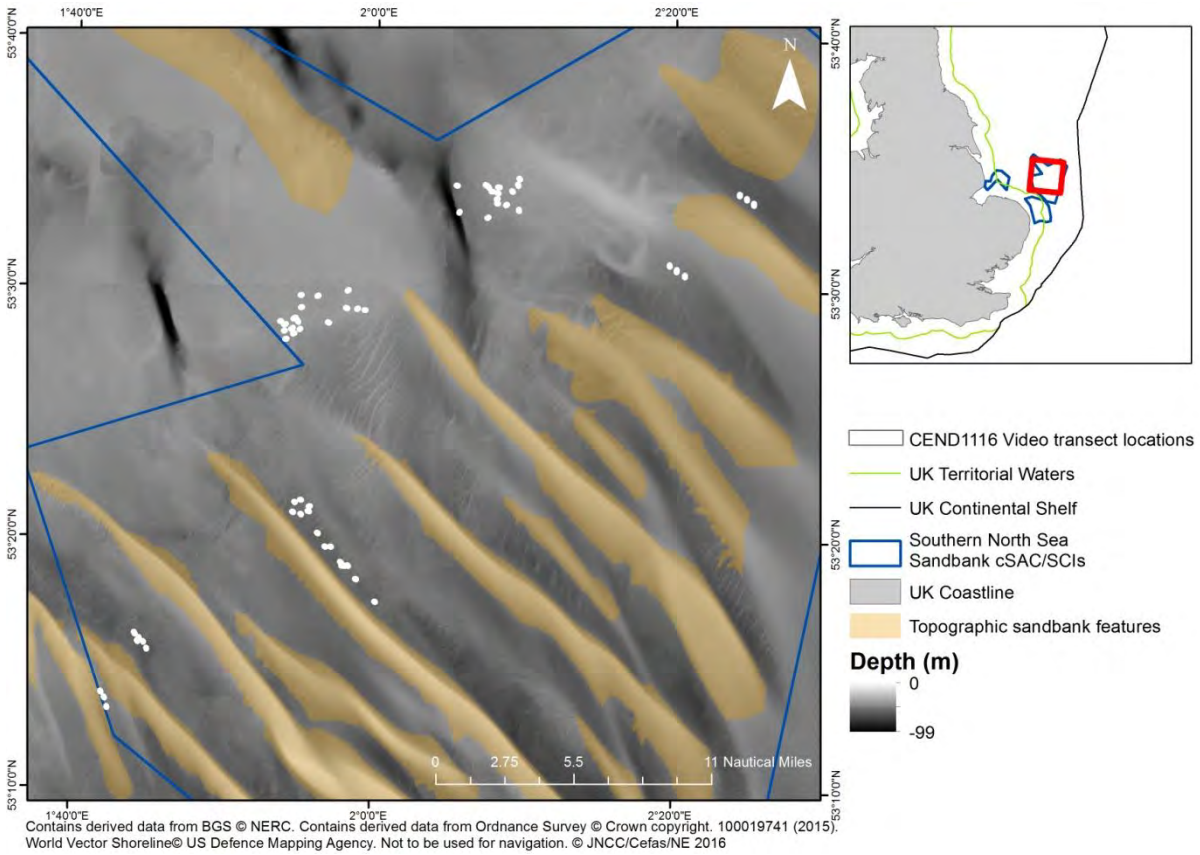

Figure 17. Location of the successful seabed imagery tows carried out within the North Norfolk Sandbanks and Saturn Reef cSAC/SCI.

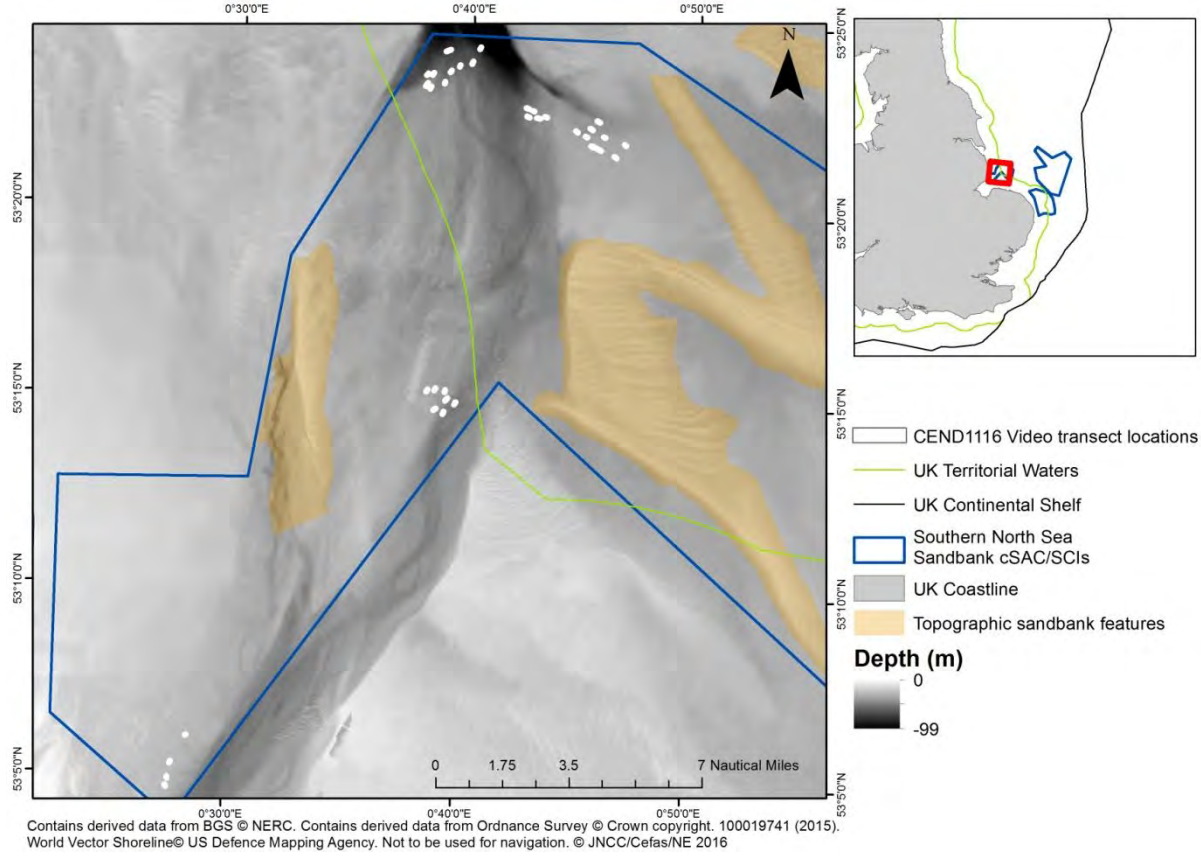

Figure 18. Location of the successful seabed imagery tows carried out within the Inner Dowsing, Race Bank and North Ridge cSAC/SCI.

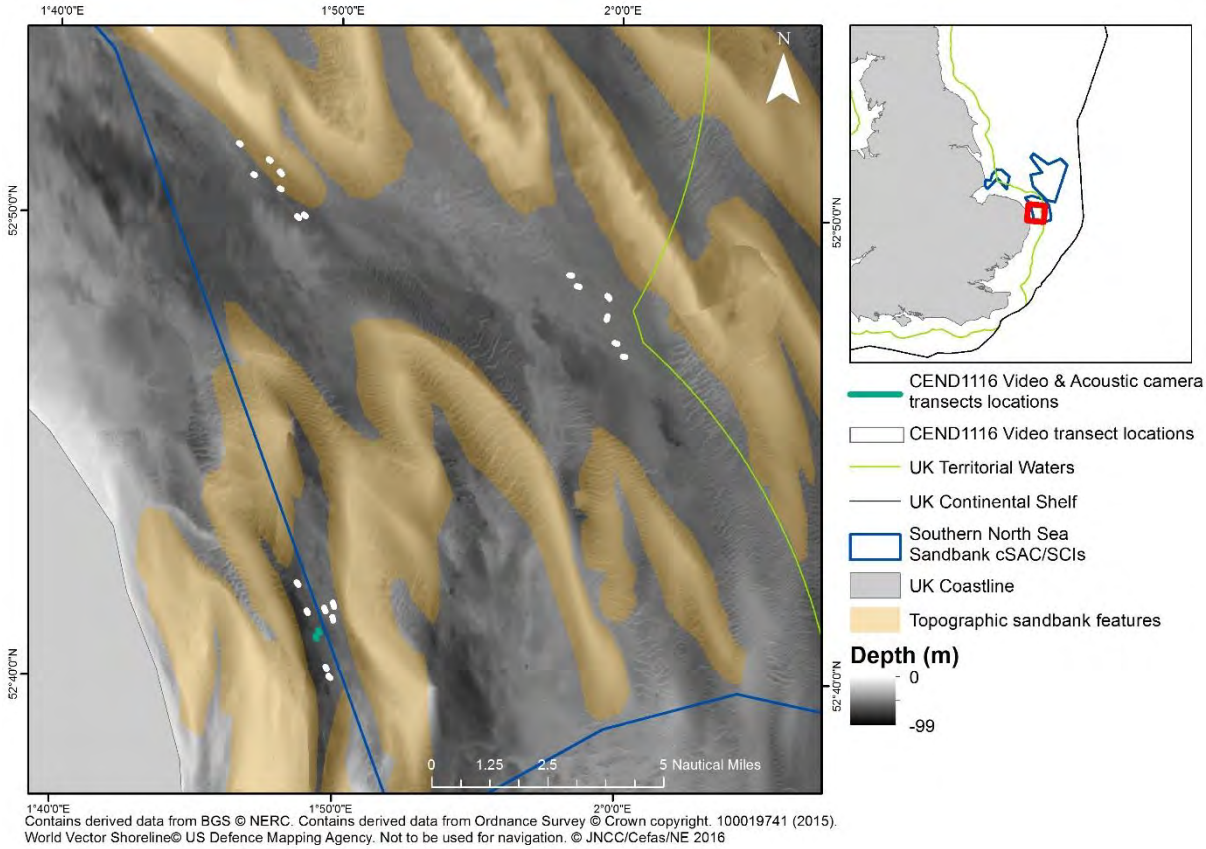

Figure 19. Location of the successful seabed imagery and ARIS camera tows carried out within the Haisborough, Hammond and Winterton cSAC/SCI.

4.4 Scientific (Jennings) beam trawl

A total of 66 successful beam trawl tows were conducted at three Case Study Areas (Table 5). A complete beam trawl survey was conducted at the Indefatigable Bank Case Study Area and one station was abandoned during the beam trawl survey of the Leman Bank Case Study Area (due to the presence of *Sabellaria* in the first haul) (Figure 20). The presence of *Sabellaria* in the first haul on the eastern mid flank of the Inner Dowsing Case Study Area lead to the decision to abandon further trawling operations in this area (Figure 21). Images of the beam trawl catch prior to processing are provided in the tables in Annex 6.5.3.

Table 5. Summary of the epifauna samples collected on the RV Cefas Endeavour during survey CEND1116.

Area	Number of epifauna samples successfully collected
Indefatigable Bank	30 hauls. Complete. 15 stations on five bank sub-features
Leman Bank	29 hauls. Partially complete. 14.5 stations on five bank sub-features
Inner Dowsing	7 hauls. Partially complete. 3.5 stations from two bank sub-features

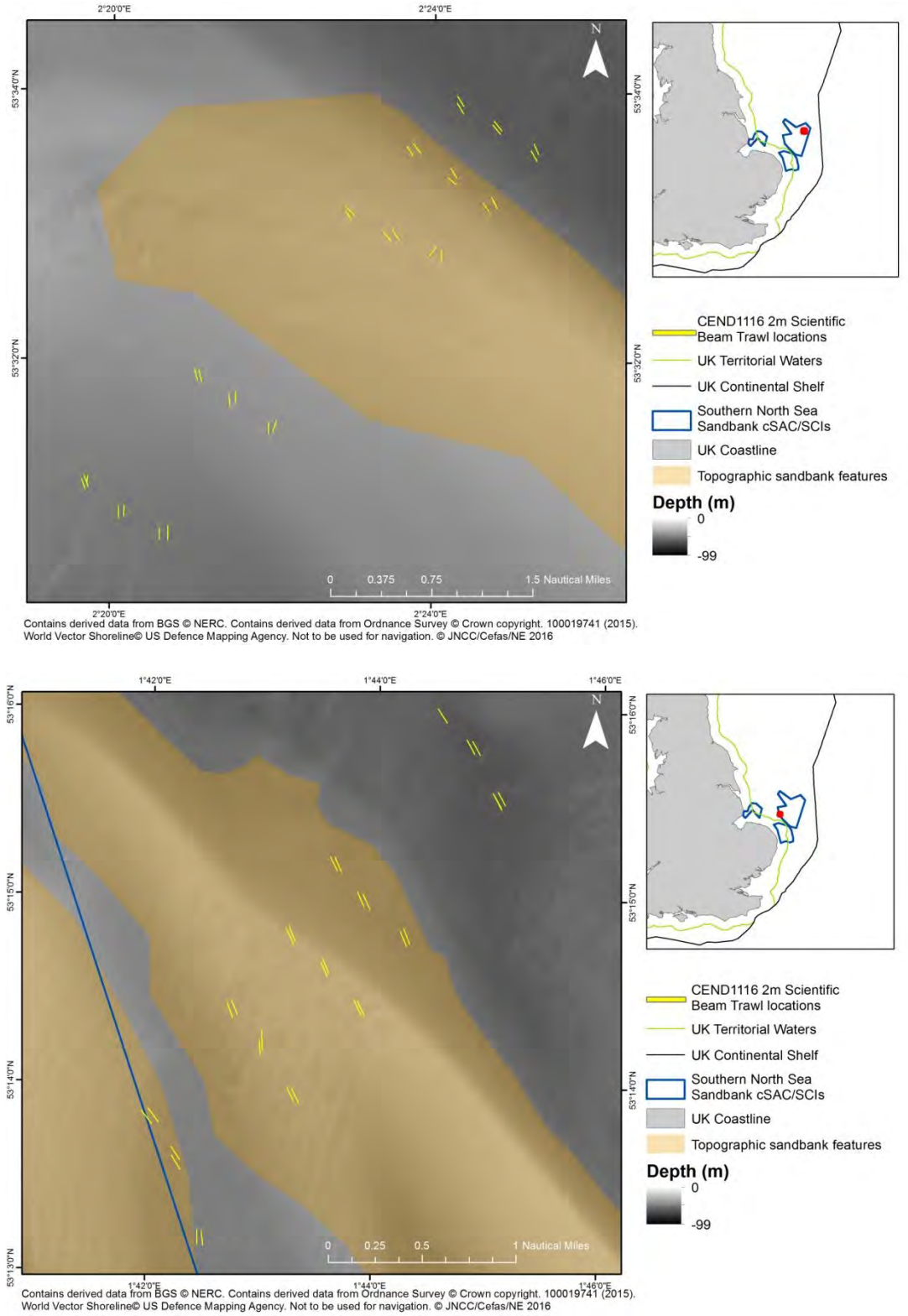

Figure 20. Location of the successful beam trawl tows carried out at the Indefatigable Bank (top) and Leman Bank (bottom) Case Study Areas within the North Norfolk Sandbanks and Saturn Reef cSAC/SCI.

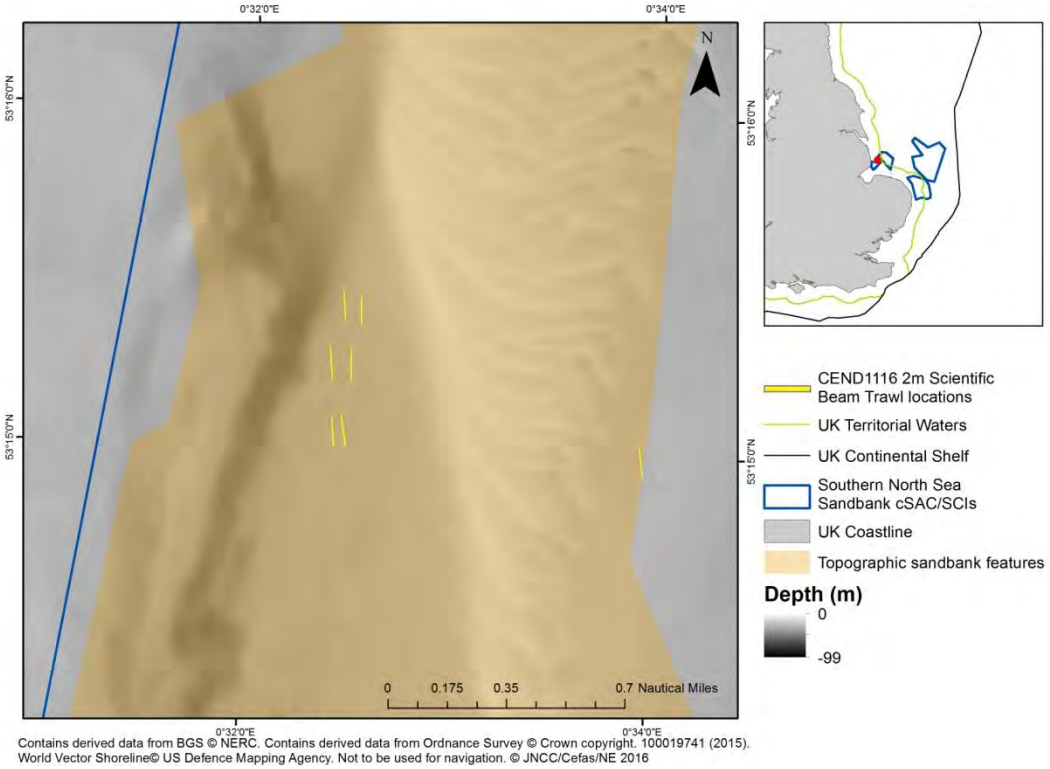

Figure 21. Location of the successful beam trawl tows carried out at the Inner Dowsing Case Study Area within the Inner Dowsing, Race Bank and North Ridge cSAC/SCI.

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6 Annexes

6.1 Positioning software and offsets

Vessel offsets are defined from the pitch roll centre of the vessel – the Common Reference Point (CRP). Tower CEMAP V3.9.0002 software was used to log an offset position when eventing stations to include the gantry from which equipment was deployed. Ultra-Short Base Length positioning beacons and a pole mounted transducer system (HiPap500) were used to geo reference the drop frame used for seabed imagery.

6.2 Acoustic system specifications

Multibeam echo sounder (MBES) data were acquired using a Kongsberg EM2040 single head transducer (300kHz) and Kongsberg SIS software (version 4.1.3). Swathe width was limited to 90m in hi resolution equidistant mode.

Latency correction – 1pps synchronised time system utilised on vessel. Backscatter recorded with raw. all file and acquired with fixed gains to optimise image. GPS height from a CNAV 3050 GPS receiver. Tides reduced to chart datum using the VORF model and applied to the bathymetry.

Side-scan sonar data were acquired using an Edgetech 4200 MP tow fish and Discover processing software.

6.2.1 Calibration logs

Two initial calibrations were performed during a previous survey (cruise code CEND1016) at UKHO Wreck ID 72847 inside the North East of Farnes Deep Marine Conservation Zone. A further calibration was made following the replacement of the receiver head during CEND1116. The calibration log sheets for each calibration are provided below (Figure 22, Figure 23 and Figure 24).

Calibration logsheet

Date	25/05/2016		**Cruise ID**	CEND1016		**Survey Area**	North East Farne MPA Wreck no 72847		**Surveyors**	BM
Feature Location	**Latitude**	55, 42.692N	**Longitude**	001, 34.504W	Beam Angle	70	Max Cov	150 Blade down full		
Roll calibration lines			Calibration performed in SIS v4.1.3							
Line ID	**Time (UTC)**	**Multibeam line count**	Line filename		**Current value**	**Adjustment**	**Comments**			
RUN	17:03	0002	0002_20160525_170339_CEND		0	-0.1	**SE to NW**			
RUN	17:14	0004	0004_20160525_171406_CEND				**NW to SE**			
Pitch calibration lines										
Line ID	**Time (UTC)**	**Multibeam line count**	Line filename		**Current value**	**Adjustment**	**Comments**			
RUN	17:03	0002	0002_20160525_170339_CEND		0	-2	**same as Roll**			
RUN	17:14	0004	0004_20160525_171406_CEND				**same as Roll**			
Heading calibration lines										
Line ID	**Time (UTC)**	**Multibeam line count**	Line filename		**Current value**	**Adjustment**	**Comments**			
CAL120	17:25	0006	0006_20160525_172506_CEND		0	2.3	**NW to SE**			
RUN	17:35	0008	0008_20160525_173456_CEND				**Return run**			
CAL-120	17:44	0009	0009_20160525_174416_CEND				**NW to SE**			
Timing calibration lines										
Line ID	**Time (UTC)**	**Multibeam line count**	Line filename		**Current value**	**Adjustment**	**Comments**			
							Timing lines not run			
Patch lines										
Line ID	**Time (UTC)**	**Multibeam line count**	Line filename		**Heading**		**Comments**			
							Patch lines were not run			

Figure 22. Calibration log sheet detailing the Roll, Pitch and Heading calibration run lines carried out during CEND1016 (25/05/2016).

Calibration logsheet

Date	26/05/2016		**Cruise ID**	CEND1016		**Survey Area**	North East Farne MPA Wreck no ?		**Surveyors**	BM
Feature Location	**Latitude**	55.87511N	**Longitude**	0.62027W	Beam Angle	70	Max Cov	150 Blade down full		
Roll calibration lines			Calibration performed in SIS v4.1.3			Note WCL data collected for lines 2,3,10,12 over wreck				
Line ID	**Time (UTC)**	**Multibeam line count**	Line filename		**Current value**	**Adjustment**	**Comments**			
RUN 2	17:15	0002	0002_20160526_172048_CEND		0		**NE to SW**			
RUN 2	17:29	0004	0004_20160526_172945_CEND				**NW to SE**			
Pitch calibration lines										
Line ID	**Time (UTC)**	**Multibeam line count**	Line filename		**Current value**	**Adjustment**	**Comments**			
RUN	17:03	0002	0002_20160526_172048_CEND		0		**same as Roll**			
RUN	17:14	0004	0004_20160526_172945_CEND				**same as Roll**			
Heading calibration lines										
Line ID	**Time (UTC)**	**Multibeam line count**	Line filename		**Current value**	**Adjustment**	**Comments**			
MBCAL_2-120	17:25	0006	0006_20160525_172506_CEND		0		**SW to NE**			
RUN 2	17:35	0008	0008_20160525_173456_CEND				**Return run**			
MBCAL_2 120	17:44	0009	0009_20160525_174416_CEND				**SW to NE**			
Timing calibration lines										
Line ID	**Time (UTC)**	**Multibeam line count**	Line filename		**Current value**	**Adjustment**	**Comments**			
							Timing lines not run			
Patch lines										
Line ID	**Time (UTC)**	**Multibeam line count**	Line filename		**Heading**		**Comments**			
							Patch lines were not run			

Figure 23. Calibration log sheet detailing the Roll, Pitch and Heading calibration run lines carried out during CEND1016 (26/05/2016).

Calibration logsheet

Date	12/06/2016		**Cruise ID**	CEND11 16		**Survey Area**	Coal Pit - SNS			**Surveyors**	BM
Feature Location	**Latitude**	53.4717N	**Longitude**	1.7711E	Beam Angle	65	Max Cov	150	Blade down 2m		
			Calibration check after new Rx head fitted at sea								
Roll calibration lines			Calibration performed in SIS v4.1.3								
Line ID	**Time (UTC)**	**Multibeam line count**	Line filename		**Current value**	**Adjustment**	**Comments**				
CAL	04:07	0007	0007_20160612_040735_CEND		0.54	0	**dir 237**				
CAL	04:24	0009	0009_20160612_042443_CEND				**dir 65**				
Pitch calibration lines											
Line ID	**Time (UTC)**	**Multibeam line count**	Line filename		**Current value**	**Adjustment**	**Comments**				
CAL	04:07	0007	0007_20160612_040735_CEND		-1.7	0	**dir 237**				
CAL	04:24	0009	0009_20160612_042443_CEND				**dir 65**				
Heading calibration lines											
Line ID	**Time (UTC)**	**Multibeam line count**	Line filename		**Current value**	**Adjustment**	**Comments**				
							Heading lines contained no contacts and were not used.				
Timing calibration lines											
Line ID	**Time (UTC)**	**Multibeam line count**	Line filename		**Current value**	**Adjustment**	**Comments**				
							Timing lines not run				
Patch lines											
Line ID	**Time (UTC)**	**Multibeam line count**	Line filename		**Heading**		**Comments**				
							Patch lines were not run				

Figure 24. Calibration log sheet detailing the Roll and Pitch calibration run lines carried out during CEND1116 (12/06/2016).

6.3 Research vessel

Port of registry	Lowestoft
Length OA	73.00m (excluding stern roller)
Length extreme	73.916m
Breadth (MLD)	15.80m
Depth (MLD)	8.20m
Design draft	5.00m
Deep draught	5.50m
LBP	66.50m
Gross tonnage	2983 tonnes
Net register tonnage	894 tonnes
Net lightship	2436 tonnes
Deadweight @ 5.00m	784 tonnes
Deadweight @ 5.50m	1244 tonnes
Displacement @ 5.00m	3210 tonnes
Displacement @ 5.50m	3680 tonnes
Builder	Ferguson Shipbuilders Limited, Port Glasgow
Commissioned	2003
Communications	In port BT Tel. Cellphone Voice/Fax/Data Radio TELEX Inmarsat C Fleet 77 (Inmarsat F) and VSAT (eutelsat) internet access
Endurance	42 days
Complement	En-suite accommodation for 16 crew and 19 scientists with dedicated hospital facility
Propulsion System	AC/DC Diesel Electric 3 x diesel electric AC generators, individually raft mounted 2 x tandem electric DC motors Single screw
Power generation	3240Kw
Power propulsion	2230Kw
Thrusters	Bow thruster (flush mounted azimuthing) Stern thruster (tunnel)
Trial speed	14.4 knots
Bollard pull	29 tonnes
Call sign	VQHF3

Official number	906938
MMSI	235005270
Lloyds/IMO number	9251107
Side Gantry	7.5 tonne articulated side A-frame
Stern Gantry	25 tonne stern A-frame
Winches	3 x cranes 35tM, heave compensated 2 x trawl winches 2 x drum winches, (1 double) Double barrel survey winch with motion compensation and slip rings Double barrel survey winch with slip rings Double barrel towing winch with slip rings Side-scan sonar winch with slip rings 3 x Gilson winches (one fitted to stern A-frame)
Transducers/Sea tube	Drop keel to deploy transducers outside the hull boundary layer in addition to hull mounted transducers 1.2m diameter sea tube/moon-pool
Acoustic equipment	Kongsberg Simrad: HiPAP 500 positioning sonar EK60, 38/120kHz scientific sounder EA 600, 50/200kHz scientific sounder Scanmar net mensuration system SH80 high frequency omni-directional sonar EM3002 swathe bathymetry sounder Hull mounted Scanmar fishing computer transducers
Boats	2 x 8m rigid work and rescue boats with suite of navigational equipment deployed on heave-compensated davits
Laboratories	Eight networked laboratories designed for optimum flexibility of purpose four serviced deck locations for containerised laboratories
Special features	Dynamic positioning system Intering anti-roll system Local Area Network with scientific data management system Ship-wide general information system CCTV
Class	LRS 100A1+LMC UMS SCM CCS ICC IP ES (2) DP(CM) ICE class 2

6.4 Bounding co-ordinates of the survey area

Table 6. Bounding co-ordinates (decimal degrees WGS84) for the sampling stations.

	North	South	East	West
North Norfolk Sandbanks survey 2016	53.715	53.268	2.708	0.493

*Note these bounding co-ordinates encompass all planned sampling stations and do not demark any individual candidate Special Area of Conservation/Site of Community Importance.

6.5 Image tables

6.5.1 Sediment sampling

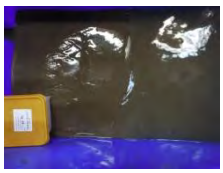
Images were taken during deck processing operations: 1) of the sediment decanted from the grab prior to sediment sub sampling; 2) of the sediment remaining on the 5mm screening mesh and 3) the sample fraction retained on the 1mm capture mesh. These images, alongside sediment volume details and preliminary broad scale habitat assessments, are presented in separate tables for each Case Study Area and a single table for all of the Wider Characterising Transects surveyed on the RV Cefas Endeavour CEND1116 survey.

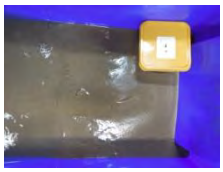
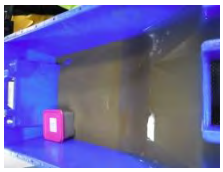
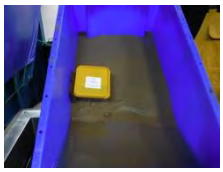
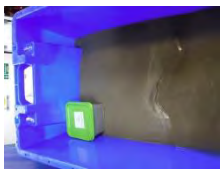
6.5.1.1 Case Study Areas

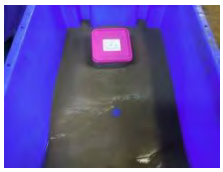
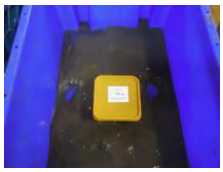
Table 7. Images taken of sediment samples during deck processing operations for the Indefatigable Bank Case Study Area within the North Norfolk Sandbanks and Saturn Reef cSAC/SCI (Samples collected during CEND1116 only).

Station code, number and replicate/attempt	Sample image	Greater than 5mm fraction	Greater than 1mm fraction	Preliminary BSH	Sample volume (l)	Container size (l)
IDBFT10_STN_003_A1				Sand	5	0.5
IDBFT09_STN_004_A1				Sand	4.5	0.5
IDBFT08_STN_005_A1				Sand	4	1
IDBFT07_STN_006_A1				Sand	4.5	0.5
IDBFT06_STN_007_A1				Sand	3	1

Station code, number and replicate/attempt	Sample image	Greater than 5mm fraction	Greater than 1mm fraction	Preliminary BSH	Sample volume (l)	Container size (l)
IDBFT05_STN_008_A1				Sand	3.5	0.5
IDBFT04_STN_009_A1				Sand	4	0.5
IDBFT03_STN_010_A1				Sand	3.5	0.5
IDBFT02_STN_011_A1				Sand	3	1.0
IDBFT01_STN_012_A1				Sand	3.5	1.0
IDFBF01_STN_013_A1				Sand	3.5	0.125
IDFBF02_STN_014_A1				Sand	4	0.5
IDFBF03_STN_015_A1				Sand	3	0.5

Station code, number and replicate/attempt	Sample image	Greater than 5mm fraction	Greater than 1mm fraction	Preliminary BSH	Sample volume (l)	Container size (l)
IDFBF04_STN_016_A1				Sand	2.5	0.125
IDFBF05_STN_017_A2				Sand	4.5	0.5
IDFBF06_STN_018_A1				Sand	5	0.125
IDFBF07_STN_019_A1				Sand	4.5	0.5
IDFBF08_STN_020_A1				Sand	4	0.125
IDFBF09_STN_021_A1				Sand	4	0.5
IDFBF10_STN_022_A1				Sand	6	0.125
IDFBC11_STN_023_A2				Sand	5	0.125

Station code, number and replicate/attempt	Sample image	Greater than 5mm fraction	Greater than 1mm fraction	Preliminary BSH	Sample volume (l)	Container size (l)
IDFBC10_STN_024_A2				Sand	4.5	0.125
IDFBC09_STN_025_A1				Sand	4..5	0.125
IDFBC08_STN_026_A1				Sand	6.5	0.125
IDFBC07_STN_027_A1				Sand	5	0.125
IDFBC06_STN_028_A1				Sand	6	0.125
IDFBC05_STN_029_A1				Sand	3.5	0.125
IDFBC04_STN_030_A1				Sand	5.5	0.125
IDFBC03_STN_031_A1			No Image	Sand	3	0.125

Station code, number and replicate/attempt	Sample image	Greater than 5mm fraction	Greater than 1mm fraction	Preliminary BSH	Sample volume (l)	Container size (l)
IDFBC02_STN_032_A1				Sand	3.5	0.125
IDFBC01_STN_033_A1				Sand	3	0.125
IDFBF11_STN_034_A1				Sand	3	0.5
IDFBF12_STN_035_A1				Sand	3	1
NNSB_CEND1116_IDFBF13_STN_036_A1				Sand	2.5	0.125
IDFBF14_STN_037_A1				Sand	2	0.5
IDFBF15_STN_038_A2				Sand	1.5	1
IDFBF16_STN_039_A1				Sand	4	0.5

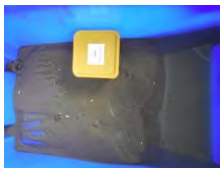
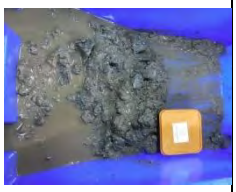
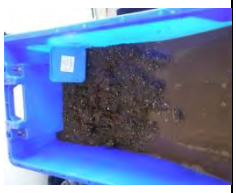
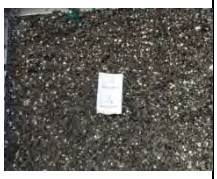
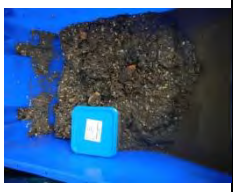
Station code, number and replicate/attempt	Sample image	Greater than 5mm fraction	Greater than 1mm fraction	Preliminary BSH	Sample volume (l)	Container size (l)
IDFBF17_STN_040_A1				Sand	2.5	1
IDFBF18_STN_041_A1				Sand	3	0.5
IDFBF19_STN_042_A2				Sand	3	0.125
IDFBF20_STN_043_A1				Sand	3.5	1
IDFBF21_STN_044_A1				Sand	3	0.5

Table 8. Images taken of sediment samples during deck processing operations for the Inner Dowsing Case Study Area within the Inner Dowsing, Race Bank and North Ridge cSAC/SCI (Samples collected during CEND1116 only).

Station code, number and replicate/attempt	Sample image	Greater than 5mm fraction	Greater than 1mm fraction	Preliminary BSH	Sample volume (l)	Container size (l)
INNDBS2_10_STN_143_A5				Mixed	8	10

Station code, number and replicate/attempt	Sample image	Greater than 5mm fraction	Greater than 1mm fraction	Preliminary BSH	Sample volume (l)	Container size (l)
INNDBS2_09_STN_144_A1				Mixed	7.5	5
INNDBS2_08_STN_145_A1				Mixed	7	5
INNDBS2_07_STN_146_A1				Mixed	6.5	5
INNDBS2_06_STN_147_A1				Mixed	8	10
INNDBS1_08_STN_148_A1				Mixed	8	5
INNDBS1_07_STN_149_A1				Mixed	5	5
INNDBS1_06_STN_150_A1				Mixed	8	10

Station code, number and replicate/attempt	Sample image	Greater than 5mm fraction	Greater than 1mm fraction	Preliminary BSH	Sample volume (l)	Container size (l)
INNDBS1_09_STN_151_A1				Mixed	8	10
INNDBS1_10_STN_152_A3				Mixed	5	5
INNDT10_STN_153_A1				Mixed	7	10
INNDT03_STN_154_A1				Mixed	10	10
INNDT09_STN_155_A1				Mixed	10	10
INNDT02_STN_156_A1				Mixed	14	10
INNDT05_STN_157_A1				Mixed	6.5	5

Station code, number and replicate/attempt	Sample image	Greater than 5mm fraction	Greater than 1mm fraction	Preliminary BSH	Sample volume (l)	Container size (l)
INNDT08_STN_158_A1				Sand	9	5
INNDT01_STN_159_A1				Mixed	8	5
INNDT07_STN_160_A1				Mixed	9	10
INNDT06_STN_161_A1				Mixed	10	2 x 10
INNDT04_STN_162_A1				Coarse	10	1x10 1x5
INNDT21_STN_163_A1	No Image			Mixed	9	10
INNDBS1_01_STN_164_A1				Mixed	7	10

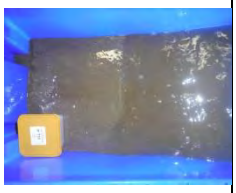
Station code, number and replicate/attempt	Sample image	Greater than 5mm fraction	Greater than 1mm fraction	Preliminary BSH	Sample volume (l)	Container size (l)
INNDBS1_02_STN_165_A1				Mixed	10	10
INNDBS1_03_STN_166_A1				Mixed	9.5	10
INNDBS1_04_STN_167_A1				Mixed	9	10
INNDBS1_05_STN_168_A1				Mixed	9	10
INNDBS2_01_STN_169_A1				Mixed	4	10
INNDBS2_02_STN_170_A1				Mixed	4.5	10
INNDBS2_03_STN_171_A1				Mixed	4.5	10

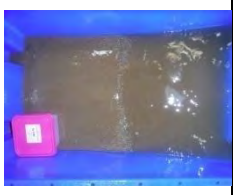
Station code, number and replicate/attempt	Sample image	Greater than 5mm fraction	Greater than 1mm fraction	Preliminary BSH	Sample volume (l)	Container size (l)
INNDBS2_04_STN_172_A1				Mixed	3	5
INNDBS2_05_STN_173_A1				Mixed	5.5	10
INNDBS2_11_STN_174_A1				Mixed	3.5	10

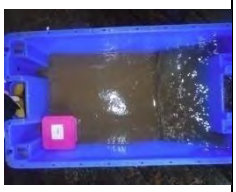
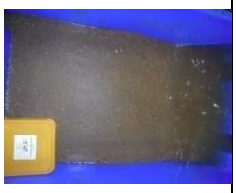
Table 9. Images taken of sediment samples during deck processing operations for the Leman Bank Case Study Area within the North Norfolk Sandbanks and Saturn Reef cSAC/SCI (Samples collected during CEND1116 only).

Station code, number and replicate/attempt	Sample image	Greater than 5mm fraction	Greater than 1mm fraction	Preliminary BSH	Sample volume (l)	Container size (l)
LMBKT10_STN_232_A1				Sand	9	0.5
LMBKT09_STN_233_A1				Coarse	8	2.5
LMBKT08_STN_234_A1				Coarse	6	5

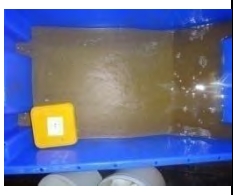
Station code, number and replicate/attempt	Sample image	Greater than 5mm fraction	Greater than 1mm fraction	Preliminary BSH	Sample volume (l)	Container size (l)
LMBKT07_STN_235_A1				Coarse	9	0.5
LMBKT06_STN_236_A1				Coarse	8	2.5
LMBKT05_STN_237_A1				Coarse	6	5
LMBKT04_STN_238_A1				Coarse	10	2.5
LMBKT03_STN_239_A1				Coarse	10	2.5
LMBKT02_STN_240_A1				Sand	7	2.5
LMBKT01_STN_241_A1				Sand	8	2.5

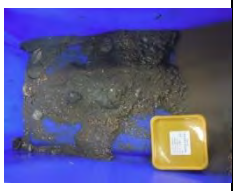
Station code, number and replicate/attempt	Sample image	Greater than 5mm fraction	Greater than 1mm fraction	Preliminary BSH	Sample volume (l)	Container size (l)
LMBKF01_STN_242_A1				Sand	8	0.5
LMBKF02_STN_243_A1				Sand	9	0.5
LMBKF03_STN_244_A1				Sand	9	0.5
LMBKF04_STN_245_A1				Sand	8.5	0.125
LMBKF05_STN_246_A1				Sand	9	0.125
LMBKF06_STN_247_A1				Sand	10	0.125
LMBKF07_STN_248_A1				Sand	9	0.5

Station code, number and replicate/attempt	Sample image	Greater than 5mm fraction	Greater than 1mm fraction	Preliminary BSH	Sample volume (l)	Container size (l)
LMBKF08_STN_249_A1				Sand	10+	0.125
LMBKF09_STN_250_A1				Sand	7.5	0.125
LMBKF10_STN_251_A1				Sand	7	0.125
LMBKC11_STN_252_A1				Sand	10	0.25
LMBKC10_STN_253_A1				Sand	7	0.125
LMBKC09_STN_254_A1				Sand	10	0.25
LMBKC08_STN_255_A1				Sand	9	0.5

Station code, number and replicate/attempt	Sample image	Greater than 5mm fraction	Greater than 1mm fraction	Preliminary BSH	Sample volume (l)	Container size (l)
LMBKC07_STN_256_A1				Sand	7.5	0.125
LMBKC06_STN_257_A1				Sand	10	0.25
LMBKC05_STN_258_A1				Sand	8.5	0.25
LMBKC04_STN_259_A1				Sand	10	0.5
LMBKC03_STN_260_A1				Sand	7.5	0.5
LMBKC02_STN_261_A1				Sand	10	0.25
LMBKC01_STN_262_A1				Sand	6.5	0.5

Station code, number and replicate/attempt	Sample image	Greater than 5mm fraction	Greater than 1mm fraction	Preliminary BSH	Sample volume (l)	Container size (l)
LMBKF11_STN_263_A1				Sand	5	0.5
LMBKF12_STN_264_A1				Sand	7	0.125
LMBKF13_STN_265_A1				Sand	8.5	0.5
LMBKF14_STN_266_A1				Sand	9	0.25
LMBKF15_STN_267_A1				Sand	8	0.25
LMBKF16_STN_268_A1				Sand	7	0.125
LMBKF17_STN_269_A1				Sand	10	2.5

Station code, number and replicate/attempt	Sample image	Greater than 5mm fraction	Greater than 1mm fraction	Preliminary BSH	Sample volume (l)	Container size (l)
LMBKF18_STN_270_A1				Coarse	6	1
LMBKF19_STN_271_A1				Coarse	5.5	1
LMBKF20_STN_272_A1				Coarse	10	1
LMBKF21_STN_273_A1				Coarse	7	2.5
LMBKT21_STN_274_A1				Mixed	9	5
LMBKT20_STN_275_A1				Mixed	10	5
LMBKT19_STN_276_A1				Mixed	10	5

Station code, number and replicate/attempt	Sample image	Greater than 5mm fraction	Greater than 1mm fraction	Preliminary BSH	Sample volume (l)	Container size (l)
LMBKT18_STN_277_A1				Mixed	8	5
LMBKT17_STN_278_A1				Coarse	9	5
LMBKT16_STN_279_A1				Mixed	10	5
LMBKT15_STN_280_A1				Mixed	8	5
LMBKT14_STN_281_A1				Mixed	8.5	10
LMBKT13_STN_282_A2				Mixed	3	2.5
LMBKT12_STN_283_A1				Mixed	6.5	5

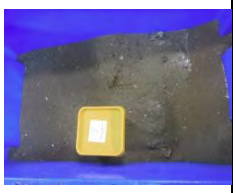
Station code, number and replicate/attempt	Sample image	Greater than 5mm fraction	Greater than 1mm fraction	Preliminary BSH	Sample volume (l)	Container size (l)
LMBKT11_STN_284_A1				Coarse	11	2.5

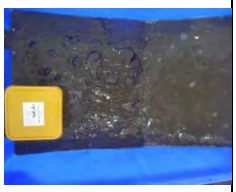
Table 10. Images taken of sediment samples during deck processing operations for the Indefatigable Bank Case Study Area within the Haisborough, Hammond and Winterton cSAC/SCI (Samples collected during CEND1116 only).

Station code, number and replicate/attempt	Sample image	Greater than 5mm fraction	Greater than 1mm fraction	Preliminary BSH	Sample volume (l)	Container size (l)
SMKNT21_STN_375_A1				Sand	10	1
SMKNT20_STN_376_A1				Mud	9	0.5
SMKNT19_STN_377_A1				Mixed	8	2.5
SMKNT18_STN_378_A1				Sand	6	1
SMKNT17_STN_379_A1				Sand	12	1

Station code, number and replicate/attempt	Sample image	Greater than 5mm fraction	Greater than 1mm fraction	Preliminary BSH	Sample volume (l)	Container size (l)
SMKNT16_STN_380_A1				Sand	4.5	2.5
SMKNT15_STN_381_A1				Mud	8	0.5
SMKNT14_STN_382_A1				Sand	7	1
SMKNT13_STN_383_A1				Sand	8	0.5
SMKNT12_STN_384_A1				Sand	10	1
SMKNF12_STN_385_A1				Mud	7.5	0.25
SMKNF13_STN_386_A1				Sand	7	0.25

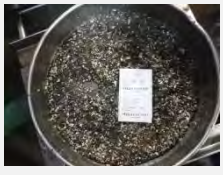
Station code, number and replicate/attempt	Sample image	Greater than 5mm fraction	Greater than 1mm fraction	Preliminary BSH	Sample volume (l)	Container size (l)
SMKNF14_STN_387_A1				Mud	8	2.5
SMKNF18_STN_388_A1				Mud	7	1
SMKNF16_STN_389_A1				Mud	8	1
SMKNF17_STN_390_A1				Sand	5	0.125
SMKNF18_STN_391_A1				Sand	5.5	0.125
SMKNF19_STN_392_A1				Sand	6	0.125
SMKNF20_STN_393_A1				Sand	7	0.5

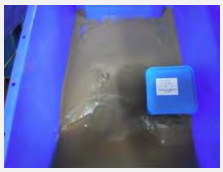
Station code, number and replicate/attempt	Sample image	Greater than 5mm fraction	Greater than 1mm fraction	Preliminary BSH	Sample volume (l)	Container size (l)
SMKN_F21_STN_394_A1				Sand	5.5	0.25
SMKN_B12_STN_395_A1				Sand	8	0.125
SMKN_B14_STN_396_A1				Sand	12	2.5
SMKNB16_STN_397_A1				Sand	8	1
SMKNB18_STN_398_A1				Sand	5.5	2.5
SMKNB20_STN_399_A1				Mixed	8	0.5
SMKNB21_STN_400_A1				Mixed	9	2.5

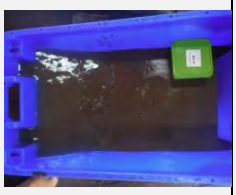
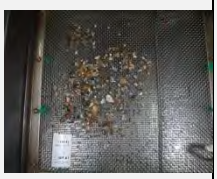
Station code, number and replicate/attempt	Sample image	Greater than 5mm fraction	Greater than 1mm fraction	Preliminary BSH	Sample volume (l)	Container size (l)
SMKNB19_STN_401_A1				Mud	7.5	2.5
SMKNB17_STN_402_A1				Mud	9.5	2.5
SMKNB15_STN_403_A1				Mud	9.5	2.5
SMKNB13_STN_404_A1				Mud	9	1

6.5.1.2 Wider Characterising Transects

Table 11. Images taken of sediment samples during deck processing operations for Wider Characterising Transects within the North Norfolk Sandbanks and Saturn Reef cSAC/SCI (Samples collected during CEND1116 only).

Station code, number and replicate/attempt	Sample image	Greater than 5mm fraction	Greater than 1mm fraction	Preliminary BSH	Sample volume (l)	Container size (l)
WCT001_T01_STN_079_A1				Sand	5.5	1
WCT001_F01_STN_080_A1				Sand	4	2.5

Station code, number and replicate/attempt	Sample image	Greater than 5mm fraction	Greater than 1mm fraction	Preliminary BSH	Sample volume (l)	Container size (l)
WCT001_C02_STN_081_A1				Sand	3.5	0.125
WCT001_C01_STN_082_A1				Sand	3.5	0.125
WCT001_F02_STN_083_A1				Sand	3	0.5
WCT001_T02_STN_084_A1				Mixed	5	5
WCT002_T02_STN_350_A1				Sand	8.5	1
WCT002_F02_STN_351_A1				Sand	9.5	0.25
WCT002_C01_STN_352_A1				Sand	9.5	0.125

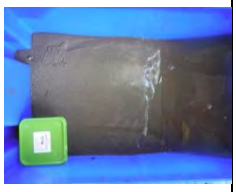
Station code, number and replicate/attempt	Sample image	Greater than 5mm fraction	Greater than 1mm fraction	Preliminary BSH	Sample volume (l)	Container size (l)
WCT002_F01_STN_353_A1				Sand	9.0	0.25
WCT002_T01_STN_354_A1				Sand	8.0	1
WCT003_T02_STN_355_A1				Sand	8	1
WCT003_F02_STN_356_A1				Sand	9	0.5
WCT003_C01_STN_357_A1				Sand	9	0.125
WCT003_F01_STN_358_A1				Sand	9	1
WCT003_T01_STN_359_A1				Sand	9	1

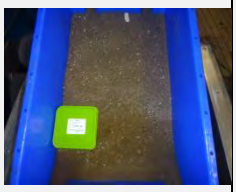
Station code, number and replicate/attempt	Sample image	Greater than 5mm fraction	Greater than 1mm fraction	Preliminary BSH	Sample volume (l)	Container size (l)
WCT004_T02_STN_341_A1				Course	9	5
WCT004_F02_STN_342_A1				Sand	9	0.5
WCT004_C01_STN_343_A1				Sand	8.5	0.125
WCT004_F01_STN_344_A1				Sand	9	0.5
WCT004_T01_STN_345_A1				Coarse	9.5	2.5
WCT005_T02_STN_360_A1				Mixed	10	2.5
WCT005_F02_STN_361_A1				Sand	8.5	0.25

Station code, number and replicate/attempt	Sample image	Greater than 5mm fraction	Greater than 1mm fraction	Preliminary BSH	Sample volume (l)	Container size (l)
WCT005_C01_STN_362_A1				Sand	10	0.125
WCT005_F01_STN_363_A1				Sand	10	0.125
WCT005_T01_STN_364_A1				Muddy gravelly sand	6	10
WCT006_T02_STN_365_A1				Mud	10	2.5
WCT006_F02_STN_366_A1				Sand	10	1
WCT006_C01_STN_367_A1				Sand	8	0.125
WCT006_F01_STN_368_A1				Sand	8	2.5

Station code, number and replicate/attempt	Sample image	Greater than 5mm fraction	Greater than 1mm fraction	Preliminary BSH	Sample volume (l)	Container size (l)
WCT006_T01_STN_369_A1				Mud	7	10
WCT007_T02_STN_370_A1				Sand	10	1
WCT007_F02_STN_371_A1				Sand	8	0.125
WCT007_C01_STN_372_A1				Sand	9	0.125
WCT007_F01_STN_373_A1				Sand	8.5	1
WCT007_T01_STN_374_A1				Sand	8	2.5
WCT008_T01_STN_328_A1				Sand	13	0.25

Station code, number and replicate/attempt	Sample image	Greater than 5mm fraction	Greater than 1mm fraction	Preliminary BSH	Sample volume (l)	Container size (l)
WCT008_F01_STN_329_A1				Sand	8	0.25
WCT008_C01_STN_330_A1				Sand	11	0.125
WCT008_F02_STN_331_A1				Sand	7	0.5
WCT008_T02_STN_332_A1				Slightly Gravelly Sand	10	10
WCT009_T02_STN_321_A1				Coarse	5.5	1
WCT009_F02_STN_322_A1				Sand	6	0.25
WCT009_C01_STN_323_A1				Sand	7	0.125

Station code, number and replicate/attempt	Sample image	Greater than 5mm fraction	Greater than 1mm fraction	Preliminary BSH	Sample volume (l)	Container size (l)
WCT009_F01_STN_324_A1				Sand	7	0.25
WCT009_T01_STN_325_A1				Mixed	8.5	5
WCT010_T02_STN_313_A1				Coarse	8	5
WCT010_F02_STN_314_A1				Sand	8	0.25
WCT010_C01_STN_315_A1				Sand	8.5	0.25
WCT010_F01_STN_316_A1				Sand	9	0.25
WCT010_T01_STN_317_A1				Mixed	8	5

Station code, number and replicate/attempt	Sample image	Greater than 5mm fraction	Greater than 1mm fraction	Preliminary BSH	Sample volume (l)	Container size (l)
WCT011_T01_STN_226_A1				Coarse	7	10
WCT011_F01_STN_227_A1				Coarse	9	5
WCT011_C01_STN_087_A1				Sand	4	0.125
WCT011_F02_STN_088_A1				Sand	4	0.5
WCT011_T02_STN_089_A1				Coarse	3.5	5

6.5.2 Seabed imagery

Representative images of the sediments surveyed during each successful dropdown video deployment are presented for each Case Study Area and *Sabellaria* area of search alongside a provisional assessment of the presence of *Sabellaria* reef.

6.5.2.1 Case Study Areas

Table 12. Representative seabed imagery from the *Sabellaria* mitigation drop camera deployments at the Indefatigable Bank Case Study Area within the North Norfolk Sandbanks and Saturn Reef cSAC/SCI (Samples collected during CEND1116 only).

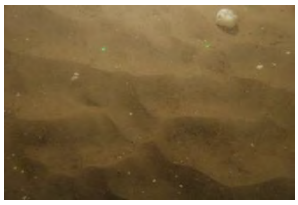
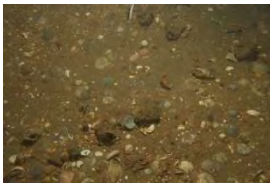
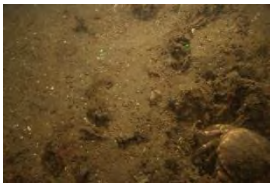
Station code, number and replicate attempt	Representative image			*Sabellaria* present?
	1	2	3	
IDFBT11_STN_056_A1				✗
IDFBT15_STN_057_A1				✗
IDFBT19_STN_058_A1				✗
IDFBT09_STN_059_A1				✗
IDFTB05_STN_060_A1				✗
IDFTB01_STN_061_A1				✗

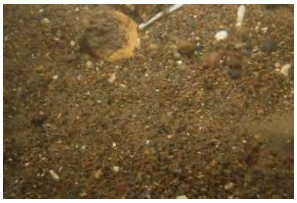
Table 13. Representative seabed imagery from the *Sabellaria* mitigation drop camera deployments at the Leman Bank Case Study Area within the North Norfolk Sandbanks and Saturn Reef cSAC/SCI (Samples collected during CEND1116 only).

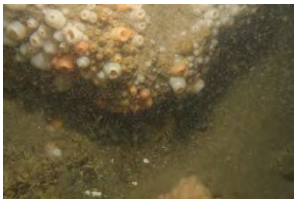
Station code, number and replicate attempt	Representative image			*Sabellaria* present?
	1	2	3	
LMBKT19_STN_287_A1				✗
LMBKT15_STN_288_A1				✗
LMBKT11_STN_289_A1				✗
LMBKT09_Cont_STN_291_A1				✗
LMBKT05_Cont_STN_292_A1				✗
LMBKT01_Cont_STN_293_A1				✗
LMBKTADD01_STN_306_A1				✗

Station code, number and replicate attempt	Representative image			*Sabellaria* present?
	1	2	3	
LMBKTADD02_STN_307_A1				✗

6.5.2.2 Sabellaria areas of search

Table 14. Representative seabed imagery from the drop camera deployments at the North of Swarte Bank *Sabellaria* area of interest within the North Norfolk Sandbanks and Saturn Reef cSAC/SCI (Samples collected during CEND1116 only).

Station code, number and replicate attempt	Representative image			*Sabellaria* present?
	1	2	3	
NSWB06_STN_094_A1				✗
NSWB05_STN_095_A1				✗
NSWB04_STN_096_A1				✗
NSWB07_STN_097_A1				✗
NSWB08_STN_098_A1				✗

Station code, number and replicate attempt	Representative image			*Sabellaria* present?
	1	2	3	
NSWB03_STN_099_A1				✗
NSWB01_STN_100_A1				✗
NSWB02_STN_101_A1				✗
NSWB09_STN_102_A1				✗
NSWB10_STN_103_A1				✗
NSWB11_STN_104_A1				✗
NSWB12_STN_105_A1				✗

Station code, number and replicate attempt	Representative image			*Sabellaria* present?
	1	2	3	
NSWB13_STN_106_A1				✗
NSWB15_STN_107_A1				✗
NSWB14_STN_108_A1				✗

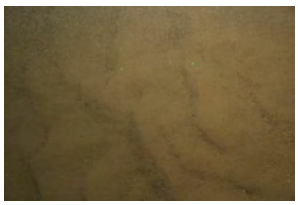
Table 15. Representative seabed imagery from the drop camera deployments at the North of Well Bank *Sabellaria* area of interest within the North Norfolk Sandbanks and Saturn Reef cSAC/SCI (Samples collected during CEND1116 only).

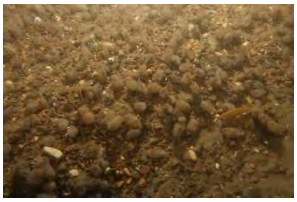
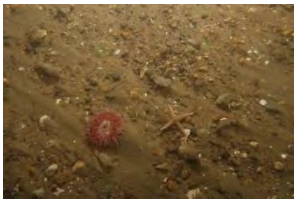
Station code, number and replicate attempt	Representative image			*Sabellaria* present?
	1	2	3	
NWBK06_STN_127_A1				✗
NWBK07_STN_128_A1				✗
NWBK09_STN_129_A2				✗

Station code, number and replicate attempt	Representative image			*Sabellaria* present?
	1	2	3	
NWBK15_STN_130_A2				✗
NWBK08_STN_131_A1				✗
NWBK14_STN_132_A1				✗
NWBK05_STN_133_A1				✗
NWBK13_STN_134_A1				✗
NWBK10_STN_135_A1				✗
NWBK11_STN_136_A1				✗

Station code, number and replicate attempt	Representative image			*Sabellaria* present?
	1	2	3	
NWBK03_STN_137_A1				x
NWBK01_STN_138_A1				x
NWBK01_STN_138_A1				x
NWBK02_STN_139_A1				x
NWBK04_STN_140_A1				x
NWBK12_STN_141_A1				x

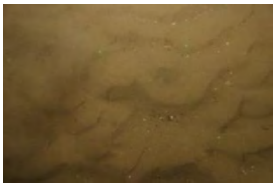
Table 16. Representative seabed imagery from the drop camera deployments at the Saturn Reef *Sabellaria* area of interest within the North Norfolk Sandbanks and Saturn Reef cSAC/SCI (Samples collected during CEND1116 only).

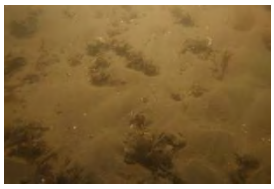
Station code, number and replicate attempt	Representative image			*Sabellaria* present?
	1	2	3	
STRN16_STN_110_A1				✗
STRN11_STN_111_A1				✗
STRN17_STN_112_A1				✗
STRN15_STN_113_A1				✓
STRN12_STN_114_A1				✓
STRN13_STN_115_A1				✗
STRN14_STN_116_A1				✓

Station code, number and replicate attempt	Representative image			*Sabellaria* present?
	1	2	3	
STRN01_STN_117_A1				✓
STRN03_STN_118_A1				✓
STRN04_STN_119_A1				✓
STRN05_STN_120_A1				✗
STRN06_STN_121_A1				✗
STRN07_STN_122_A1				✗
STRN08_STN_123_A1				✗

Station code, number and replicate attempt	Representative image			*Sabellaria* present?
	1	2	3	
STRN09_STN_124_A1				×
STRN10_STN_125_A1				×
STRN02_STN_126_A1				×

Table 17. Representative seabed imagery from the drop camera deployments at the East of Silver Pit *Sabellaria* area of interest within the Inner Dowsing, Race Bank and North Ridge cSAC/SCI (Samples collected during CEND1116 only).

Station code, number and replicate attempt	Representative image			*Sabellaria* present?
	1	2	3	
ESVP09_STN_183_A1				✓
ESVP06_STN_184_A1				×
ESVP05_STN_185_A1				×

Station code, number and replicate attempt	**Representative image**			***Sabellaria* present?**
	1	**2**	**3**	
ESVP02_STN_186_A1				×
ESVP01_STN_187_A1				×
ESVP04_STN_188_A1				×
ESVP07_STN_189_A1				✓
ESVP51_STN_190_A1				✓
ESVP52_STN_191_A1				×
ESVP08_STN_192_A1				×

Station code, number and replicate attempt	**Representative image**			***Sabellaria* present?**
	1	**2**	**3**	
ESVP03_STN_193_A1				×
ESVP48_STN_194_A1				✓
ESVP49_STN_195_A1				✓
ESVP50_STN_196_A1				✓
ESVP50_STN_196_A2				✓
ESVP53_STN_197_A1				✓

Table 18. Representative seabed imagery from the drop camera deployments at the Silver Pit South *Sabellaria* area of interest within the Inner Dowsing, Race Bank and North Ridge cSAC/SCI (Samples collected during CEND1116 only).

Station code, number and replicate attempt	Representative image			*Sabellaria* present?
	1	2	3	
SVPS_08_STN_214_A1				✓
SVPS_07_STN_215_A1				✓
SVPS_09_STN_216_A1				✓
SVPS_10_STN_217_A1				✓
SVPS_05_STN_218_A1				✓
SVPS_04_STN_219_A1				✓
SVPS_06_STN_220_A1				✓

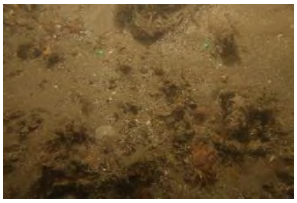
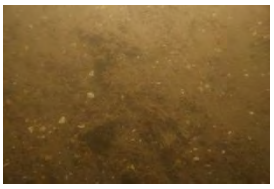
Station code, number and replicate attempt	Representative image			*Sabellaria* present?
	1	2	3	
SVPS_03_STN_221_A1				✓
SVPS_01_STN_222_A1				✓
SVPS_02_STN_223_A1				✓

Table 19. Representative seabed imagery from the drop camera deployments at the Docking Shoal *Sabellaria* area of interest within the Inner Dowsing, Race Bank and North Ridge cSAC/SCI (Samples collected during CEND1116 only).

Station code, number and replicate attempt	Representative image			*Sabellaria* present?
	1	2	3	
DKSH03_STN_207_A1				✓
DKSH02_STN_208_A1				✓
DKSH05_STN_209_A1				✓

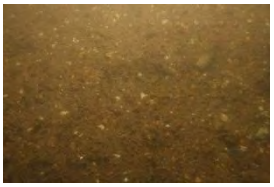
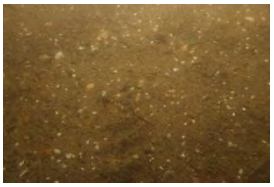
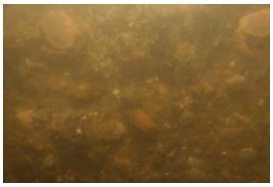
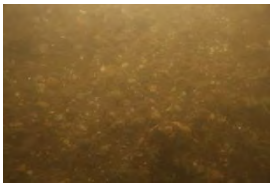
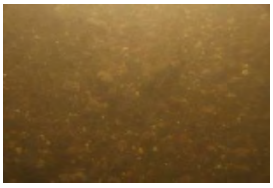
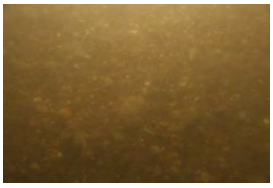
Station code, number and replicate attempt	**Representative image**			***Sabellaria* present?**
	1	**2**	**3**	
DKSH06_STN_210_A1				✓
DKSH07_STN_211_A1				✓
DKSH04_STN_212_A1				✓
DKSH01_STN_213_A1				✓

Table 20. Representative seabed imagery from the drop camera deployments at the Lynn Knock *Sabellaria* area of interest within the Inner Dowsing, Race Bank and North Ridge cSAC/SCI (Samples collected during CEND1116 only).

Station code, number and replicate attempt	**Representative image**			***Sabellaria* present?**
	1	**2**	**3**	
LYKN01_STN_201_A1				×
LYKN02_STN_202_A1				×

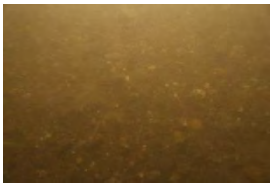
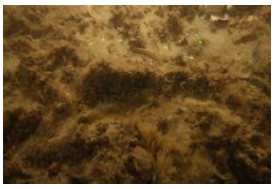
Station code, number and replicate attempt	Representative image			*Sabellaria* present?
	1	2	3	
LYKN03_STN_203_A1				×
LYKN04_STN_204_A1				×

Table 21. Representative seabed imagery from the drop camera deployments at the Haisborough, Hammond and Winterton Southern Closure *Sabellaria* area of interest within the Haisborough, Hammond and Winterton cSAC/SCI (Samples collected during CEND1116 only).

Station code, number and replicate attempt	Representative image			*Sabellaria* present?
	1	2	3	
HWSC06_STN_432_A1				✓
HWSC05_STN_433_A1				✓
HWSC03_STN_434_A1				✓
HWSC02_STN_435_A1				✓

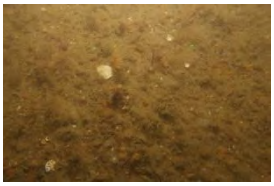
Station code, number and replicate attempt	Representative image			*Sabellaria* present?
	1	2	3	
HWSC01_STN_436_A1				✓
HWSC04_STN_437_A1				✓

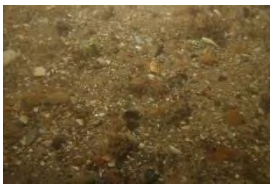
Table 22. Representative seabed imagery from the drop camera deployments at the Haisborough, Hammond and Winterton Northern Closure *Sabellaria* area of interest within the Haisborough, Hammond and Winterton cSAC/SCI (Samples collected during CEND1116 only).

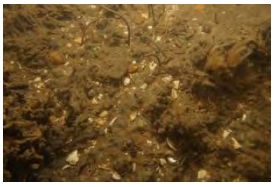
Station code, number and replicate attempt	Representative image			*Sabellaria* present?
	1	2	3	
HWNC08_STN_421_A1				✖
HWNC06_STN_422_A1				✓
HWNC07_STN_423_A1				✖
HWNC05_STN_424_A1				✖

Station code, number and replicate attempt	Representative image			*Sabellaria* present?
	1	2	3	
HWNC04_STN_425_A1				✓
HWNC01_STN_426_A1				✓
HWNC02_STN_427_A1				✓

Table 23. Representative seabed imagery from the drop camera deployments at the Western Middle Cross Sand *Sabellaria* area of interest within the Haisborough, Hammond and Winterton cSAC/SCI (Samples collected during CEND1116 only).

Station code, number and replicate attempt	Representative image			*Sabellaria* present?
	1	2	3	
WMCS05_STN_412_A1				✓
WMCS06_STN_413_A1				✓
WMCS03_STN_414_A1				✓

Station code, number and replicate attempt	**Representative image**			***Sabellaria* present?**
	1	**2**	**3**	
WMCS01_STN_415_A1				✓
WMCS02_STN_416_A1				✓
WMCS04_STN_417_A1 **(Station 430 deployed visual and acoustic imagery at WMCS04)**				✓
WMCS07_STN_418_A1 **(Station 431 deployed visual and acoustic imagery at WMCS431)**				✓
WMCS08_STN_419_A1				✖
WMCS09_STN_420_A1				✓

Station code, number and replicate attempt	Representative image			*Sabellaria* present?
	1	2	3	
WMCS09_STN_430_A1				✓
WMCS09_STN_431_A1				✓

6.5.3 Scientific (Jennings) beam trawl

Images showing the total catch of each individual haul, prior to processing, are presented below for each Case Study Area surveyed using the 2 m Scientific (Jennings) beam trawl during CEND1116.

Table 24. Images of the total catch per successful beam trawl deployment at the Indefatigable Bank Case Study Area within the North Norfolk Sandbanks and Saturn Reef cSAC/SCI.

Station code and number	Image of total catch	
	Replicate A	Replicate B
IDFBT01_STN_062		
IDFBT05_STN_063		

Station code and number	Image of total catch	
	Replicate A	Replicate B
IDFBT09_STN_064		
IDFBF09_STN_065		
IDFBF05_STN_066		
IDFBF01_STN_067		
IDFBC01_STN_068		

Station code and number	Image of total catch	
	Replicate A	Replicate B
IDFBC05_STN_069	No image taken	
IDFBC09_STN_070		
IDFBF19_STN_071		
IDFBF15_STN_072		
IDFBF11_STN_073		

Station code and number	Image of total catch	
	Replicate A	Replicate B
IDFBT11_STN_074		
IDFBT15_STN_075		
IDFBT19_STN_076		

Table 25. Images of the total catch per successful beam trawl deployment at the Leman Bank Case Study Area within the North Norfolk Sandbanks and Saturn Reef cSAC/SCI.

Station code and number	Image of total catch	
	Replicate A	Replicate B
LMBKT01_STN_294		

Station code and number	Image of total catch	
	Replicate A	Replicate B
LMBKT05_STN_295		
LMBKT09_STN_296		
LMBKF09_STN_297		
LMBKF05_STN_298		
LMBKF01_STN_299		
LMBKC01_STN_300		

Station code and number	Image of total catch	
	Replicate A	Replicate B
LMBKC05_STN_301		
LMBKC09_STN_302		
LMBKF19_STN_303		
LMBKF15_STN_304		
LMBKF11_STN_305		
LMBKT19_STN_308		No replicate taken

Station code and number	Image of total catch	
	Replicate A	Replicate B
LMBKT15_STN_309		
LMBKT11_STN_310		

Table 26. Images of the total catch per successful beam trawl deployment at the Inner Dowsing Case Study Area within the North Norfolk Sandbanks and Saturn Reef cSAC/SCI.

Station code and number	Image of total catch	
	Replicate A	Replicate B
INNDF02_STN_175		
INNDF06_STN_176		
INNDF10_STN_177		

Station code and number	Image of total catch	
	Replicate A	Replicate B
INNDF18_STN_179		No replicate taken

6.6 Daily progress reports

Original content was created pre-GDPR and has been removed as it contained personal information. No scientific or technical content has been removed.

6.7 Metadata

Metadata for the benthic sampling and acoustic surveys carried out during CEND1116 are available in the Cefas 'Digilog' database. A summary of each these queries is provided in the table below, and are each available as an appendix on the report page (correct at the time of publication).

Table 27. Sample details for the acoustic and benthic data acquired during CEND1116 with the specific query name as it appears on the Cefas Digilog survey meta data database and a brief description of the metadata included.

Query name	Description
CEND1116_AcousticMetaData	Line identification, station number, start and end positions and times and acoustic gear type
CEND1116_GrabMetaData	Station code and number, various sample details and barcodes and grab /sample type
CEND1116_TowedGearMetaData	Station code and number, start and end positions and times and gear type
CEND1116_VideoMetaData	Station code and number, start and end positions and times and gear type

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