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Swallow Sand MCZ 2016 Survey Report (Version 3)

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JNCC EQA Statement:

This report is compliant with the JNCC **Evidence Quality Assurance Policy** https://jncc.gov.uk/about-jncc/corporate-information/evidence-quality-assurance/ and was reviewed by Cefas and JNCC.

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Please Note:

This work was delivered by Cefas and JNCC on behalf of the Marine Protected Areas Survey Coordination & Evidence Delivery Group (MPAG) and sponsored by Defra. MPAG was established in November 2012 and continued until March 2020. MPAG, was originally established to deliver evidence for Marine Conservation Zones (MCZs) recommended for designation. In 2016, the programme of work was refocused towards delivering the evolving requirements for Marine Protected Area (MPA) data and evidence gathering to inform the assessment of the condition of designated sites and features by SNCBs, in order to inform Secretary of State reporting to Parliament. MPAG was primarily comprised of members from Defra and its delivery bodies which have MPA evidence and monitoring budgets and/or survey capability. Members included representatives from Defra, JNCC, Natural England, Cefas, the Environment Agency, the Inshore Fisheries Conservation Authorities (IFCAs) and the Marine Management Organisation (MMO)).

Since 2010, offshore MPA surveys and associated reporting have been delivered by JNCC and Cefas through a JNCC\Cefas Partnership Agreement (which remained the vehicle for delivering the offshore survey work funded by MPAG between 2012 and 2020).

This report, originally published by Defra in 2017, has been revised to comply with GDPR and provide a clearer explanation of the survey design used.

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1 Background and Introduction

1.1 Survey project team

The survey at Swallow Sand Marine Conservation Zone (MCZ) was carried out between 17 – 29 May 2016 on the RV *Cefas Endeavour* cruise CEND1016. The survey team for the duration of the fieldwork included Cefas marine ecologists, marine surveyors, habitat mappers and marine chemists along with a marine monitoring specialist from the Joint Nature Conservation Committee (JNCC).

1.2 Swallow Sand MCZ

Swallow Sand MCZ is located approximately 100km offshore from the Northumberland coast, in the central North Sea (Figure 1). The site comprises a sandy plane ranging in depth below chart datum from 50m at its shallowest, down to 150m in the north-west corner of the site, marking the glacial tunnel valley geological feature. The site covers 4,746km^2.

Swallow Sand MCZ was designated under the Marine and Coastal Access Act as a MCZ in November 2013. The site is designated for the broadscale habitats 'Subtidal coarse sediment' and 'Subtidal sand' and the Geological/Geomorphological feature 'Swallow Hole', which is a North Sea glacial tunnel valley.

'Subtidal sand' is the most abundant feature across the site, with evidence also of patches of coarse and mixed sediments and also mud occurring within the site. This sediment habitat is characteristic of those found in offshore waters deeper than 30m, experiencing low tidal stress and constituting a relatively stable habitat that supports a diverse range of marine flora and fauna.

Knowledge of feature extent within the site is supported by UKSeaMap and ground truth data collected during MB0120 MCZ verification surveys CEND8_12b & CEND0514 in 2012 and 2014. These data have subsequently informed an updated habitat map for the site produced by the British Geological Survey (BGS).

Additionally, taxon data from six surveys undertaken in the site between 2000 and 2012 has been reviewed by JNCC. These data reveal that Ocean quahog (*Arctica islandica*), a species Feature of Conservation Importance (FOCI), is present within Swallow Sand MCZ. A further 35 *Arctica islandica* samples were found during the 2012 survey, however at present this feature is not designated within the site. There are several additional broadscale habitats which have been found to occur within the site but are not currently designated; these include; 'Subtidal mud', 'Subtidal mixed sediments', 'Mud habitats in deep water' and 'Sea-pen and burrowing megafauna communities'.

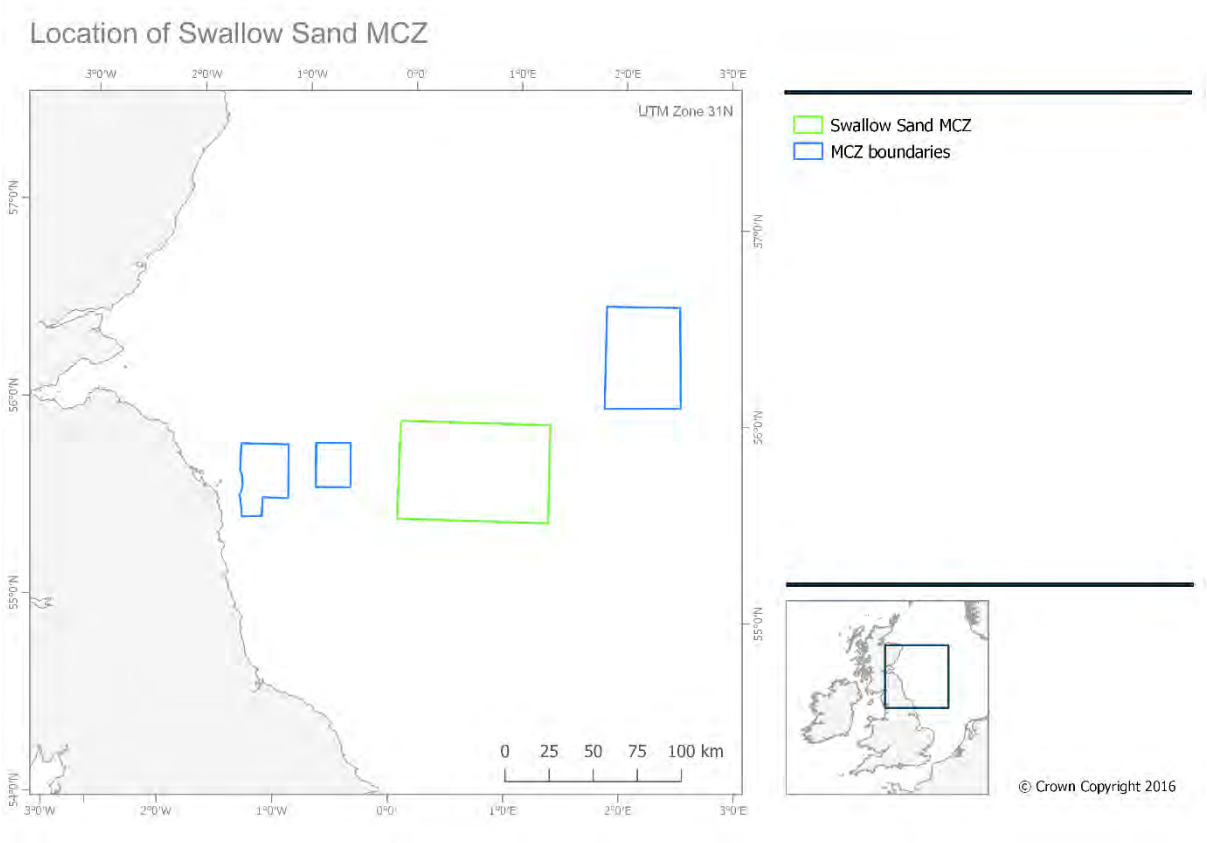


Figure 1. The boundary of Swallow Sand MCZ.

1.3 Site designations

Table 1. Site designations and proposed general management at Swallow Sand MCZ.

Feature	Feature Type	General Management Approach
A5.1 Subtidal coarse sediment	Broadscale Habitat	Maintain in favourable condition
A5.2 Subtidal sand	Broadscale Habitat	Recover to favourable condition
North Sea glacial tunnel valleys (Swallow Hole)	Geological/Geomorphological Feature	Maintain in favourable condition

1.4 Survey aims and objectives

The aim of the Swallow Sands MCZ survey was to gather the initial dataset of a site monitoring time-series, that will contribute information on the habitats found at this site to inform habitat specific assessments.

The survey focused on Type 1 monitoring (see Table 2 below) of the designated broadscale habitat features of this site.

Table 2. Definitions of monitoring types and approaches.

Definition of monitoring types
Type 1 monitoring constitutes a design to measure the rate and direction of change in the long-term (at the scale appropriate to the question) whilst at the same time collecting relevant information on environmental variables and human pressures to allow inference to be made about possible causes of such change.
Type 2 monitoring specifically examines habitats subject to different levels of a pressure to create a balanced design to answer questions about the relationship between cause and effect (i.e. measurements along a gradient of pressure). If the conditions on the seabed allow (i.e. the change in human pressure is not confounded by a change in another key variable, such as depth or temperature), then this is potentially a more powerful design than Type 1 when specifically looking to improve understanding of any state / pressure relationship.
Type 3 monitoring is about designing an experiment (i.e. changing levels of a pressure experimentally by adding or removing the pressure through management) to find evidence of cause and effect. In principle, this can be a very powerful design (i.e. using Before-After-Control-Impact (BACI) designs) but can be difficult to achieve in practice.

The objectives of the monitoring survey were as follows (listed in order of priority):

1. Collect data (infauna, particle size and underwater video and still images) to form the first dataset of a time-series against which to monitor change in condition of the designated broadscale habitat features of Swallow Sand MCZ. While doing so incorporate revisits to previously sampled stations to allow an assessment of temporal variability to be carried out.
2. Collect water samples for determination of chlorophyll and suspended particulate matter that will be used for calibrating SmartBuoy, Ferrybox and ocean colour space-borne data (for the EU FP7 project HIGHROC, C5878).
3. Process invalid grabs for future genetic analysis of infaunal species.

1.5 Contingency

Survey contingencies were planned in case of bad weather or gear failure (in practice only one contingency activity was conducted):

1. Collection of multibeam echosounder (MBES) bathymetry and backscatter data within priority boxes to inform the delineation of the extent of the broadscale habitats present.

2 Survey Design and Methods

2.1 Survey planning and design

Four survey boxes were designed to target the designated biodiversity features of the site (subtidal coarse sediment and subtidal sand). Sample stations were placed within the boxes using a 1.5km grid spacing. Where sample stations from previous surveys were present inside or outside a survey box, these were incorporated into the design to facilitate the building of a temporal data set from the site. A single Hamon grab sample was collected from each sample site. At approximately every third station an underwater camera deployment was undertaken (Figures 2-6). Stations labelled as contingency were visited if time was available. During the survey an extra box was added to the survey plan. Box 5 was positioned to the south of Box 2 in order to identify the extent of a geological feature (more details on Box 5 can be found in sections 3 and 4).

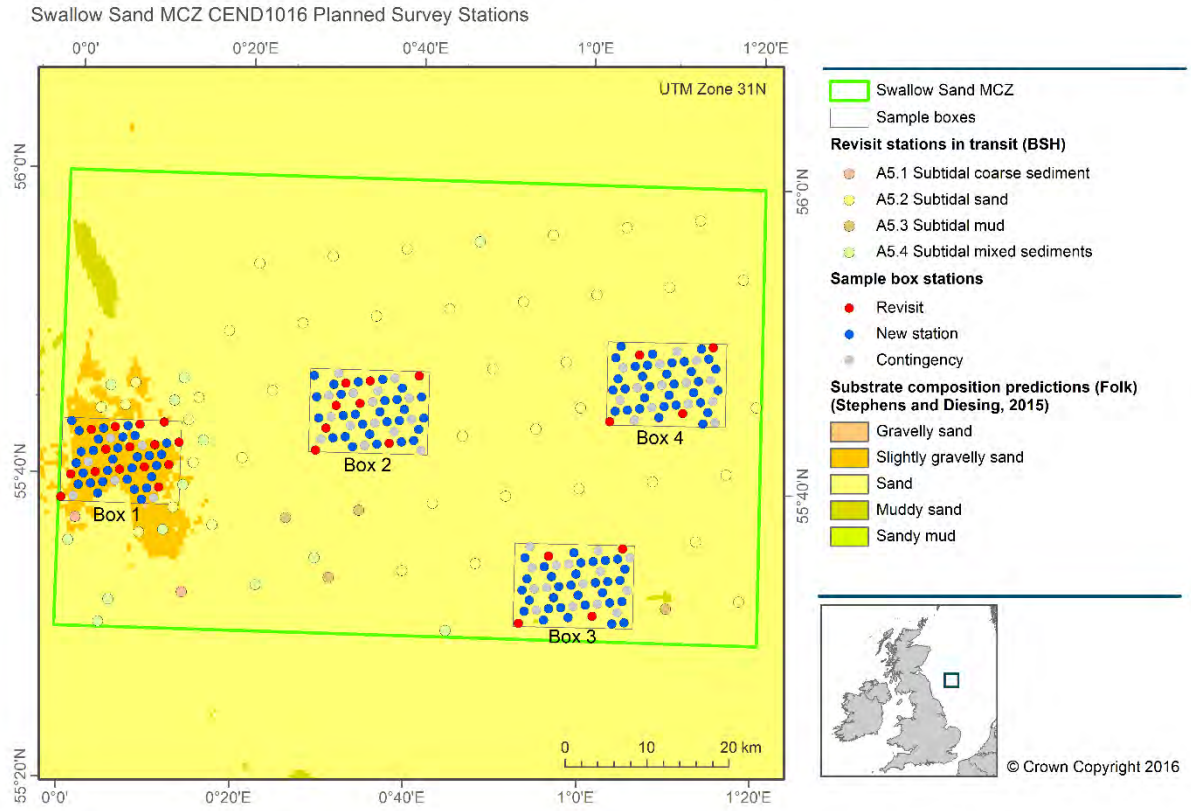


Figure 2. Swallow Sands MCZ CEND1016 planned sampling stations including priority boxes and revisit stations.

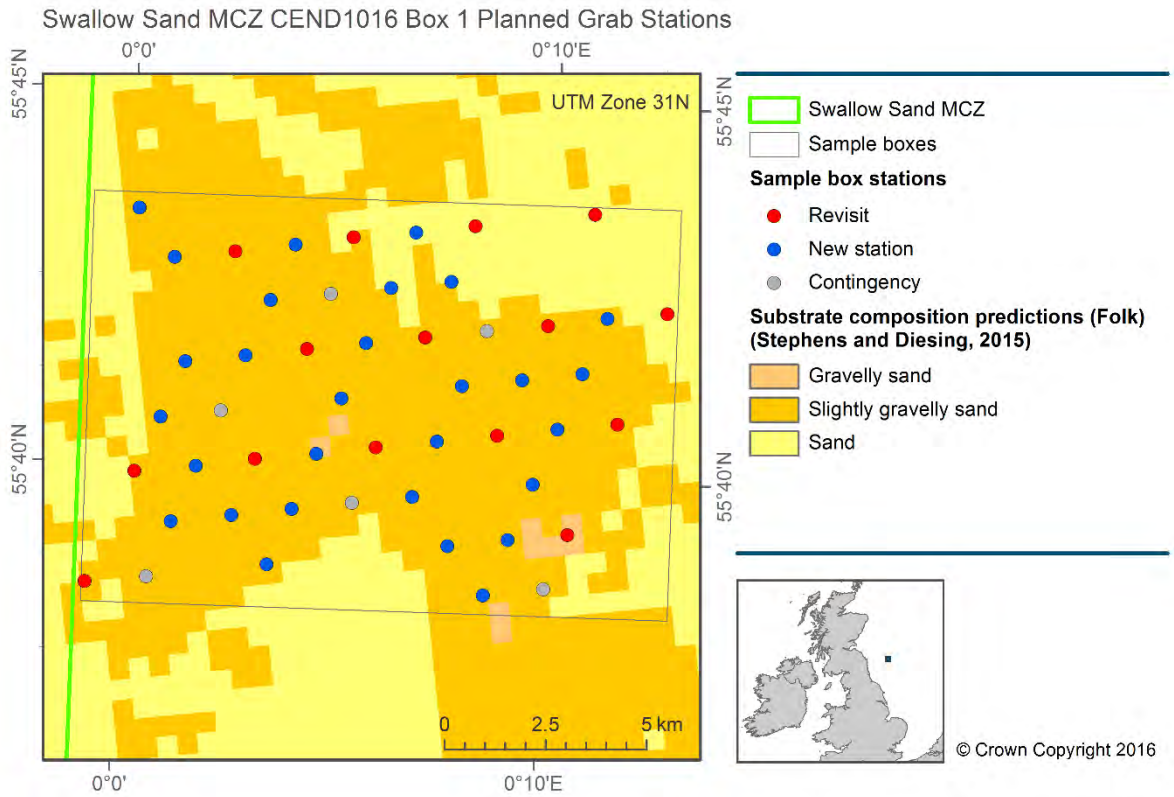


Figure 3. Swallow Sand MCZ CEND1016 priority Box 1 planned survey.

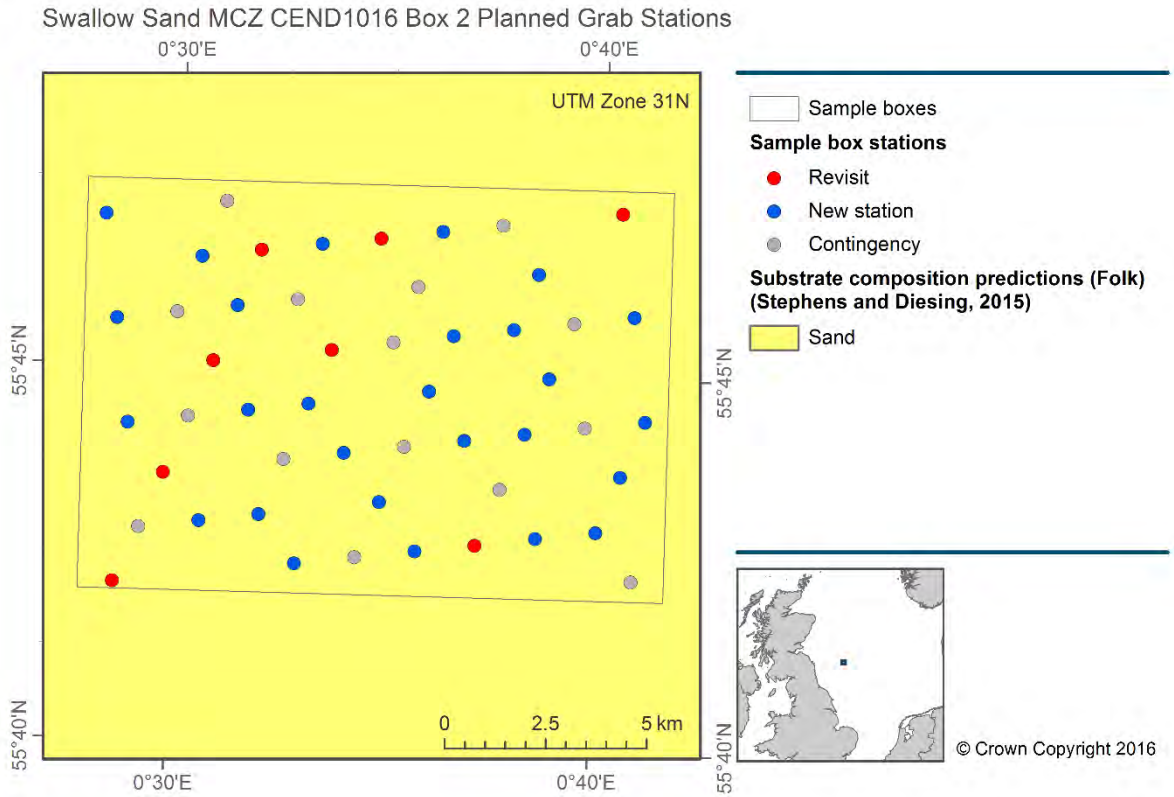


Figure 4. Swallow Sand MCZ CEND1016 priority Box 2 planned survey.

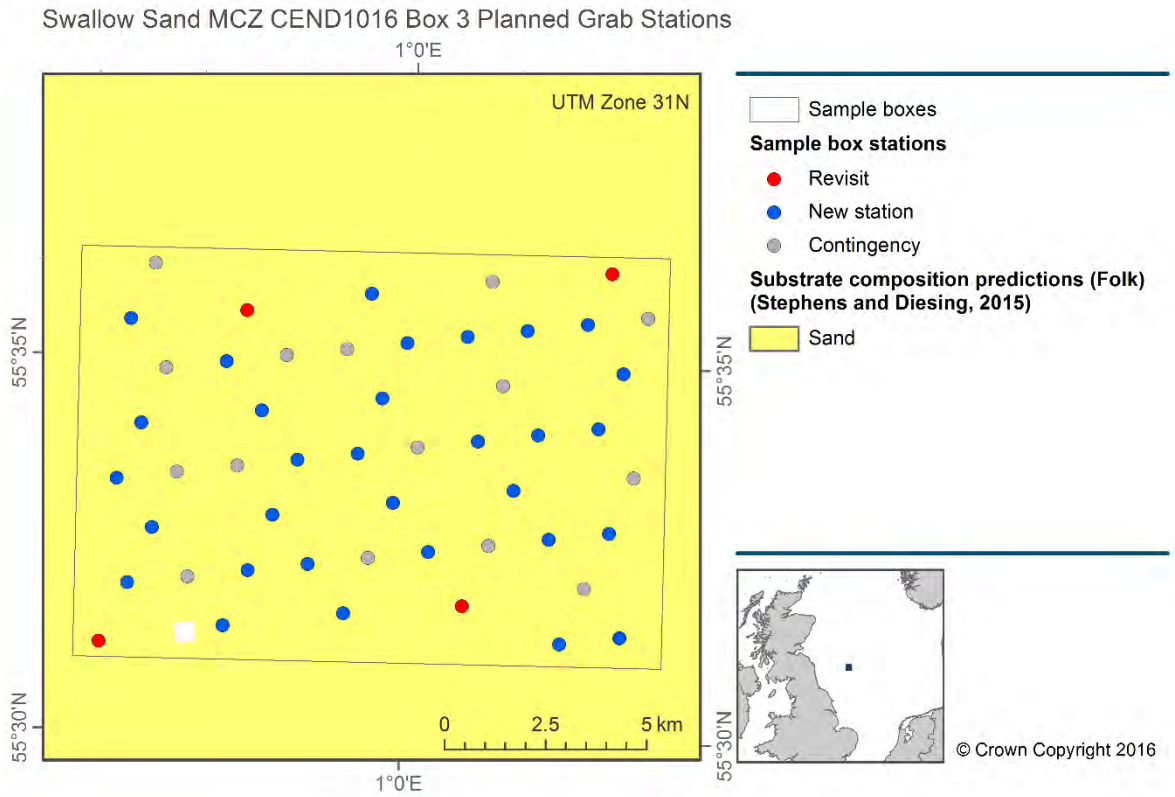


Figure 5. Swallow Sand MCZ CEND1016 priority Box 3 planned survey.

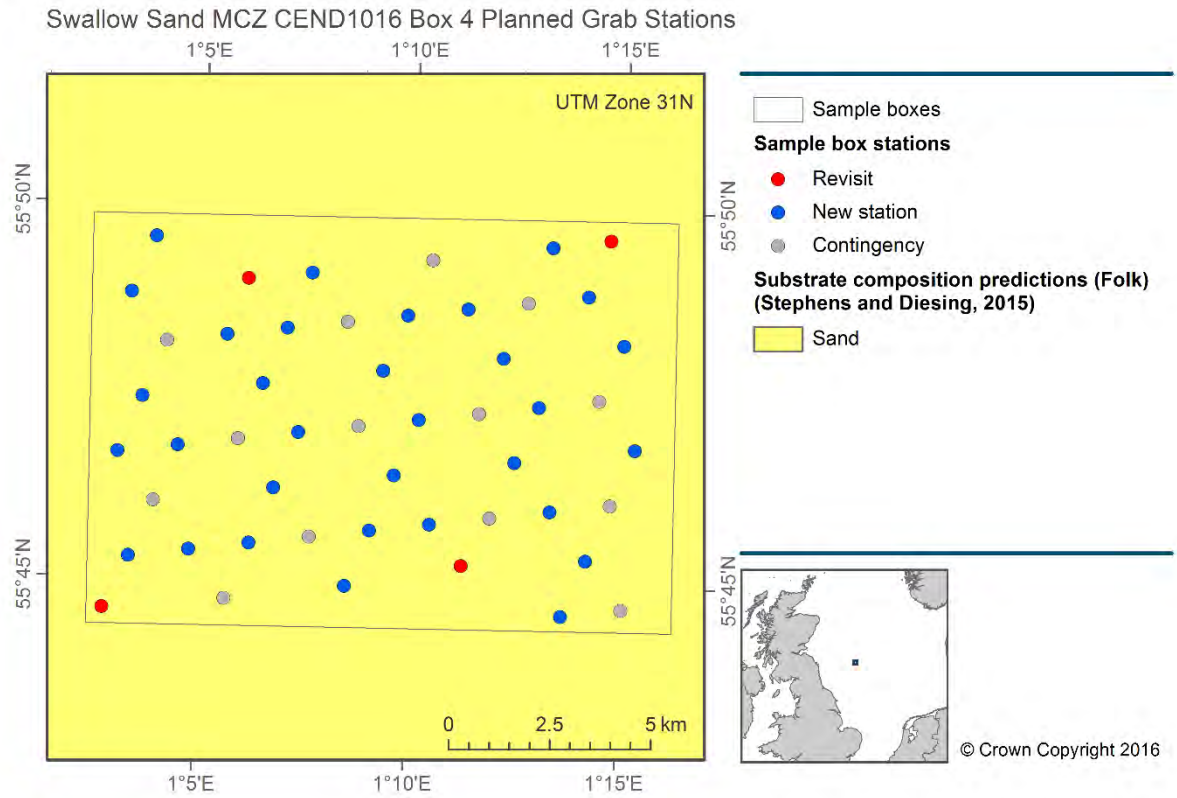


Figure 6. Swallow Sand MCZ CEND1016 priority Box 4 planned survey.

2.2 Survey equipment and sample processing

2.2.1 Multibeam echosounder bathymetry and backscatter

MBES bathymetry and backscatter data were acquired using the Kongsberg EM2040 system operated at 300kHz and deployed on the drop keel of RV *Cefas Endeavour*, which was lowered to its full extent to minimise the effect of bad weather on the acoustic signal. Variations of sound velocity with water depth were determined using a Conductivity Temperature Depth (CTD) probe and applied during MBES data acquisition. Details of the MBES equipment are provided in Annex 6.4 and a calibration report in Annex 6.5.

The raw MBES bathymetry data was processed using CARIS HIPS. Tidal information was gathered using a CNAV 3050 DGPS receiver. Tide height data was smoothed and extracted to reduce the tide on the bathymetry. The soundings were cleaned and smoothed using CARIS in accordance with the International Hydrographic Organisation (IHO) Standards for Hydrographic Surveys - Order 1 (IHO 2008). MBES backscatter data were processed with Fledermaus Geocoder Toolbox (GT) to produce standard and floating point (FP) geotiffs. Separate processing reports are provided, which detail quality assurance (QA) steps undertaken.

2.3 Sampling

Ground truth sampling was achieved using the 0.1m^2 Hamon grab and underwater video cameras, on both a sledge and drop frame.

2.3.1 Grabs

The grab system used during the survey was a 0.1m^2 mini Hamon grab (Figure 7). Samples were collected from anywhere within a 100m radius bullring centred on the target location. On recovery, the grab was emptied into a large plastic bin and a representative sub-sample of sediment (approx. 0.5 litres) taken for Particle Size Analysis (PSA). The sample was stored in a labelled plastic container and frozen ready for transfer to a laboratory ashore. The remaining sample was photographed and the volume of sediment measured and recorded. Benthic fauna were collected by washing the sample with seawater over a 1mm sieve. The retained >1mm fraction was transferred to a labelled container and preserved in buffered 4% formaldehyde for later analysis ashore. For each grab, a preliminary visual assessment of sediment type was performed on board the vessel and noted on the field records. The assessment was to assign the sample to a Folk class and its equivalent EUNIS and broadscale habitat sediment classes.

Figure 7. 0.1m^2 mini Hamon grab.

2.3.2 Cameras (sledge)

The sledge (Figure 8) was fitted with an STR Seaspyder Telemetry (Canon EOS) 18 megapixel digital stills camera with quartz corrected dome lens and STR MP-F through-the-lens-controlled flash. It was controlled through a dual role copper/fibre multiplexor custom built to Cefas specification. The video footage was shot using an STR SP-IPC-3000a 1080p video camera with a 0.1 Lux colour 5-megapixel sensor. Illumination was provided by four to six STR MP-3 LED lights running at 1500 Lumens light intensity per unit. Laser scaling was provided by two green dot class 3r laser pointers providing a reference width of 21cm on the seabed. The sledge was also fitted with a digital heading/pitch/roll sensor, altimeter and water temperature sensor. This was recorded in real time along with GPS time and position using a video overlay. Set-up and operation followed the MESH 'Recommended Operating Guidelines (ROG) for underwater video and photographic imaging techniques' (Coggan *et al*. 2007). The digital stream was captured by a surface PC and recorded direct to MP4 format video files.

Figure 8. Camera sledge with video and still imaging system.

2.3.3 Camera (drop frame)

The stills camera fitted to the drop frame (Figure 9) was an STR Seaspyder Telemetry (Canon EOS) 18 megapixel digital stills camera with flat lens and STR MP-F through-the-lens-controlled flash. It was controlled through a dual role copper/fibre multiplexor custom built to Cefas specification.

The video footage was shot using an STR SP-HDC-3000aw 1080p video camera with a 1 Lux colour 2-megapixel sensor. It was run at 1080p (25 frames per second) video resolution along with all other control signals over a dual fibre optic cable. The digital stream was captured by the surface PC and recorded direct to MP4 format video files. Lighting was provided by four STR MP-3 LED lights running at 1500 Lumens light intensity per unit. Laser scaling was provided by two green dot class 3r laser pointers providing a reference width of 21cm on the seabed. The drop frame was also fitted with a digital heading/pitch/roll sensor, altimeter and water temperature sensor. This was recorded in real time along with GPS time and position using a video overlay. Set-up and operation followed the MESH 'Recommended Operating Guidelines (ROG) for underwater video and photographic imaging techniques' (Coggan *et al*. 2007).

Figure 9. STR drop frame with video and still imaging system.

Field notes were made during each camera deployment, noting station and sample metadata, real-time observations of substrate and taxa, and an initial assessment of the range BSHs that had been seen. A summary pencil sketch depicting the main site characteristics was often included.

2.4 GPS positions and corrections

GPS fixes were recorded using the Tower Navigation system on RV *Cefas Endeavour*. This records the Lat/Long position of the gantry from which the sampling equipment is being deployed, automatically compensating for the offset between these gantries and the GPS antenna. Fixes for grab samples were taken at the instant the grab contacted the seabed. The grab was always deployed from the side gantry and the position recorded is taken to be the true position of the grab sample, as the grab typically drops directly down from the gantry. In strong tides an offset of up to about 10 metres may occur, but is not accounted for.

Fixes of start and end of camera survey line were taken from the stern gantry and the HiPAP beacon attached to the camera sledge.

3 Survey Narrative

3.1 Swallow Sand MCZ

The survey was carried out between 12:30 hrs on 18/05/16 and 19:00 hrs on 24/05/16.

The survey areas within Swallow Sand MCZ were prioritised 1-4. RV *Cefas Endeavour* disembarked Lowestoft at 17:30, 17/05/16 and transited north to Swallow Sand MCZ. On arrival at the site several grab samples were collected using the Hamon grab at sites previously sampled during the 2014 benthic survey. On arrival at priority Box 1 work began on the planned Hamon grab survey. On completion of the planned grab survey of priority Box 1 (Coarse sediment feature) camera sites were selected based on the occurrence of course sediment in the grab sample collected from priority Box 1. On completion of the camera survey in priority Box 1 RV *Cefas Endeavour* transited east to priority Box 2 to begin the planned grab survey. During the transit sample sites outside of the priority survey areas that had been previously sampled during the 2014 survey were revisited and sampled using the Hamon grab. On completion of the Hamon grab survey within priority Box 2 camera sites were selected based on the presence of muddy sediment in the grab samples collected from within priority Box 2. On completion of the camera survey at priority Box 2 RV *Cefas Endeavour* transited to priority Box 3. During the transit sample sites outside of the priority survey areas that had been previously sampled during the 2014 benthic survey were revisited and sampled using the Hamon grab. On arrival at priority Box 3 work began on the planned Hamon grab survey. On completion of the Hamon grab survey in priority Box 3 camera sites were selected based on the presence of muddy sediment in the grab samples collected from within priority Box 3. While carrying out the planned camera survey the weather deteriorated preventing the safe deployment and recovery of the camera system. To avoid weather downtime the RV *Cefas Endeavour* transited north to priority Box 4 to begin the planned Hamon grab survey. On completion of the Hamon grab and camera survey RV *Cefas Endeavour* transited west back to priority Box 2 to begin the planned MBES survey. En route several stations from the 2014 benthic survey were sampled using the Hamon grab.

On arrival at Box 2, a CTD cast was carried out to calibrate the MBES system. On completion of the calibration, the planned MBES survey of Box 2 took place. During the survey a potential geological feature was identified inside Box 2 and additional survey lines were added outside of the box to further assess the extent of the feature to the south of Box 2. On completion of this survey RV *Cefas Endeavour* transited to priority Box 3 to carry out a second MBES survey. On completion of the MBES survey in Box 3, four drop camera deployments were carried out (survey equipment was changed from camera sledge to drop camera due to a problem with the ships bow thruster) before beginning the transit to North East of Farnes Deep MCZ. En route an additional three grab samples were taken at stations previously sampled during the 2014 benthic survey. On completion of the survey at North East of Farnes Deep MCZ, as all the survey objectives had been completed with time remaining, an additional survey box (Box 5) was created in Swallow Sand. Box 5 was drawn to cover the area of MBES acquired to the south of Box 2. A Hamon grab and camera survey aimed at ground truthing the MBES data acquired within Box 5 was undertaken.

When “no samples” occurred during Hamon grab sampling (sample volumes less than three litres), the sample was retained and processed for future genetic analyses. In areas where 100 % sampling success occurred additional replicates were taken.

3.2 Water sampling

A water sample was taken every 24 hours and filtered on board for determination of chlorophyll and suspended particulate matter. This sample will be used to calibrate SmartBuoy, Ferrybox and ocean colour space-borne data (for the EU FP7 project HIGHROC, C5878).

4 Data acquired

4.1 Acoustic surveys

MBES bathymetry acquired over boxes 2 and 5 revealed the presence of what is potentially a paleo/tunnel valley (Figure 10). Benthic grab samples revealed the presence of mud within the deeper areas. A similar geological feature was also observed during the MBES survey carried out within priority Box 3 (Figure 11).

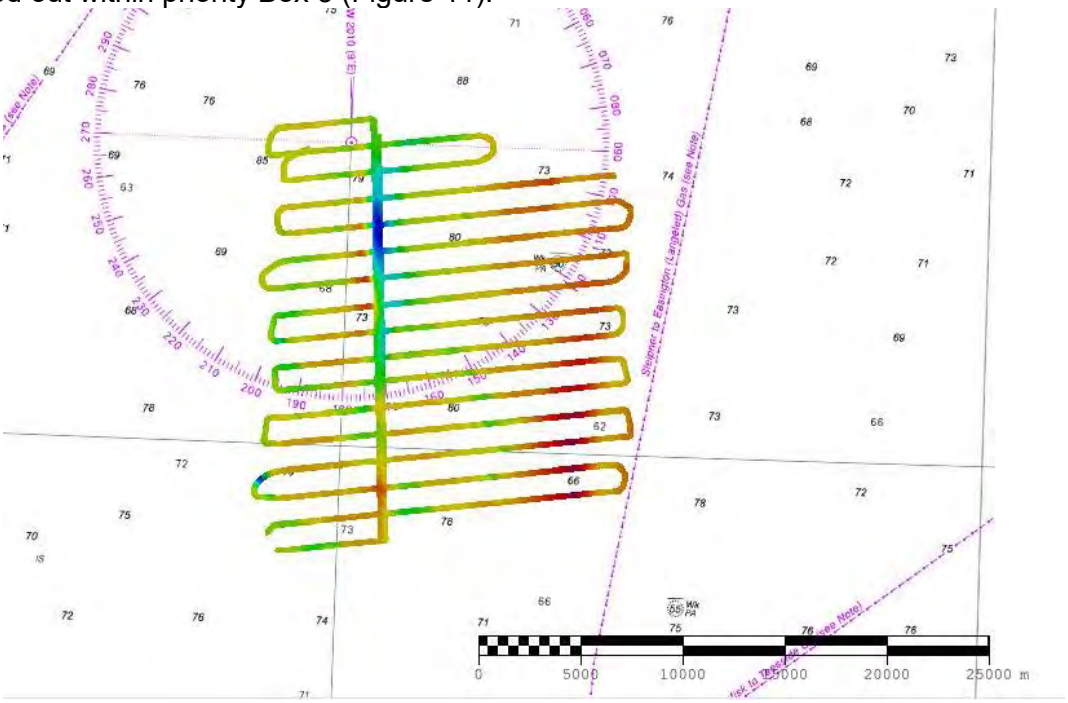


Figure 10. MBES bathymetric data collected over priority boxes 2 and 5.

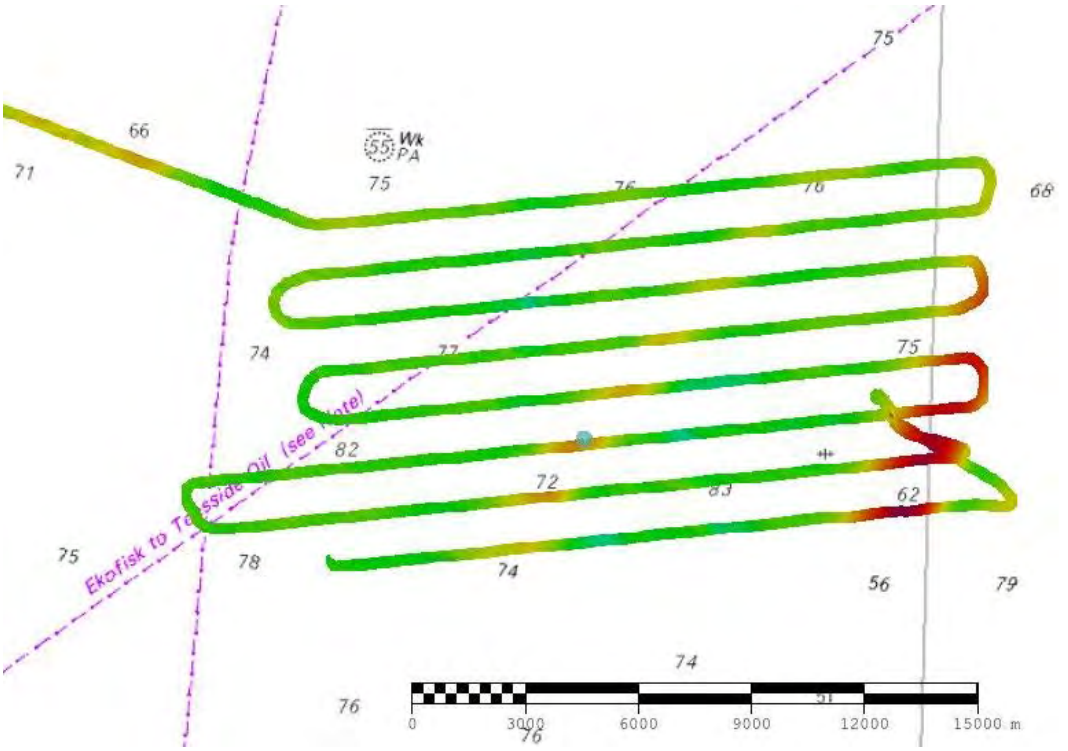


Figure 11. MBES bathymetric data collected over priority Box 3.

4.2 Grab and imagery samples

Figure 12 shows the locations of Hamon grab samples and seabed imagery collected at Swallow Sand MCZ. All priority survey boxes visited at Swallow Sand MCZ are shown in Figure 12 and the coordinates of box vertices are provided in Table 3, this includes the additional Box 5.

Note that the camera sledge was used to collect imagery data for most of the survey however due to an issue with the ships bow thruster, which could not be repaired while at sea, the drop camera was used at priority boxes 3 and 5 (Figure 12).

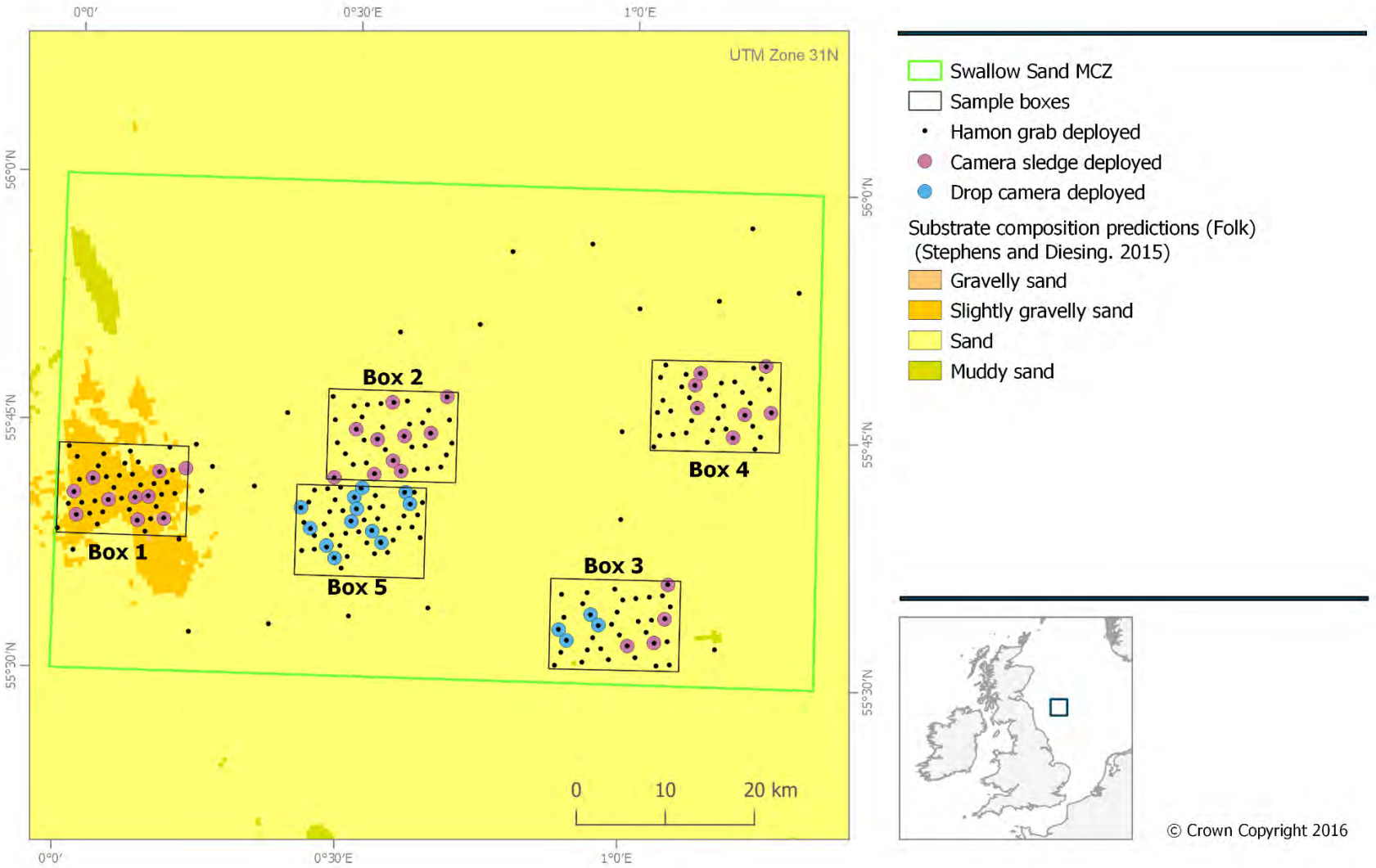


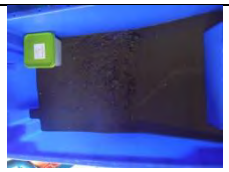
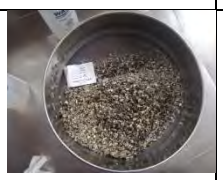
Figure 12. The five survey boxes and all sampling stations visited with the Hamon grab, camera sledge and drop camera at Swallow Sand MCZ. The base map shows predicted broad-scale habitats.

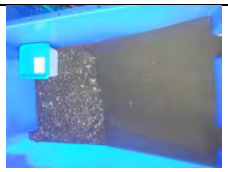
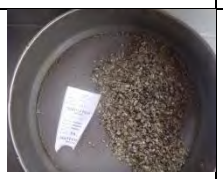
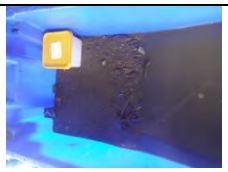
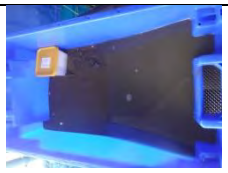
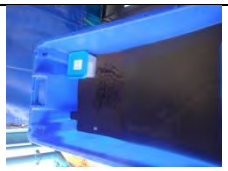
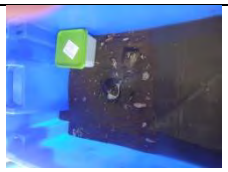
Table 3. Vertex coordinates (decimal degrees) of the five survey boxes sampled at Swallow Sand MCZ.

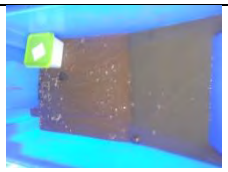
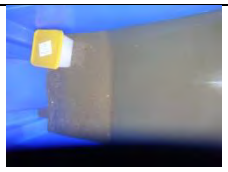
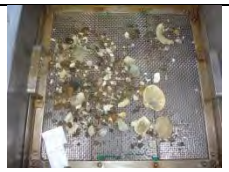
Survey Box	Vertex order	Latitude	Longitude
1	1	55.72775451	0.21611260
1	2	55.63656377	0.21691268
1	3	55.63569927	-0.01393941
1	4	55.72689522	-0.01528015
2	1	55.79193966	0.69398327
2	2	55.70074999	0.69466138
2	3	55.69998394	0.46387447
2	4	55.79117916	0.46265606
3	1	55.60810033	1.10116270
3	2	55.51691065	1.10184081
3	3	55.51614460	0.87105390
3	4	55.60733982	0.86983549
4	1	55.83144803	1.27063730
4	2	55.74025836	1.27131541
4	3	55.73949231	1.04052850
4	4	55.83068753	1.03931009
5	1	55.69439469	0.64298912
5	2	55.60320502	0.64366722
5	3	55.60243897	0.41288031
5	4	55.69363419	0.41166191

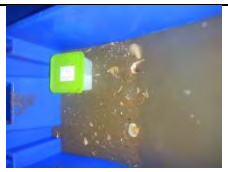
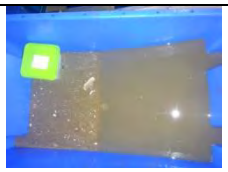
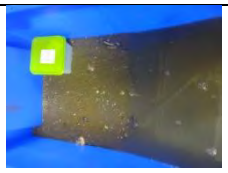
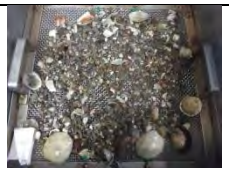
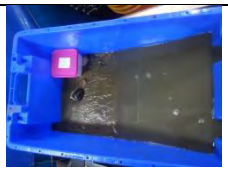
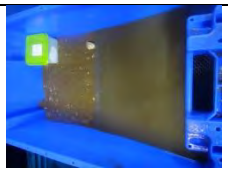
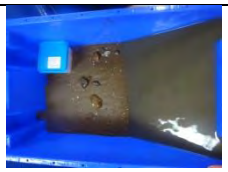
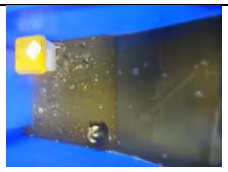
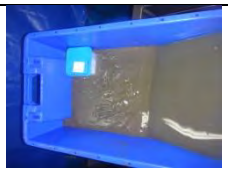
Images of grab samples collected are shown in Table 4.

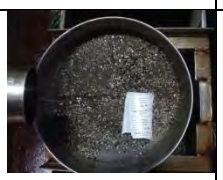
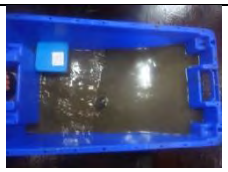
Table 4. Photographs of grab samples and 5mm sieve mesh, showing preliminary classification of sediment type.

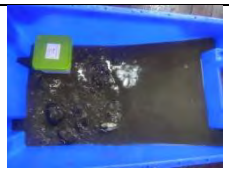
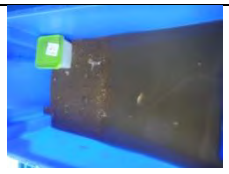
Station code	Sample image	5mm	1mm	Sample volume (l)	Container size (l)
SWSD_CEND1016_SWSD225_STN_001_A1				7	5
SWSD_CEND1016_SWSD018_STN_002_A1				5	5
SWSD_CEND1016_SWSD032_STN_003_A1				4	2.5

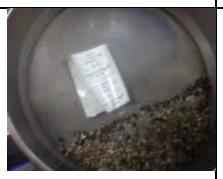
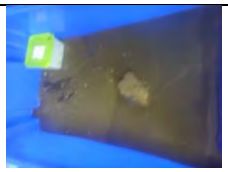
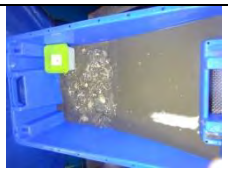
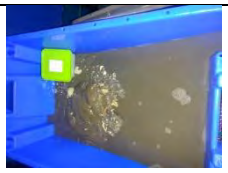
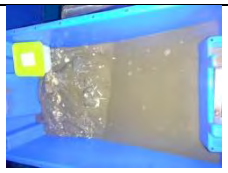
Station code	Sample image	5mm	1mm	Sample volume (l)	Container size (l)
SWSD_CEND1016_SWSD017_STN_004_A1				5	5
SWSD_CEND1016_SWSD033_STN_005_A1				6	2.5
SWSD_CEND1016_SWSD036_STN_006_A1				9	10
SWSD_CEND1016_SWSD037_STN_007_A1				9	1
SWSD_CEND1016_SWSD034_STN_008_A1				8	1
SWSD_CEND1016_SWSD044_STN_009_A1				4.5	2.5
SWSD_CEND1016_SWSD042_STN_010_A1				4	2.5
SWSD_CEND1016_SWSD011_STN_011_A1				7	2.5
SWSD_CEND1016_SWSD040_STN_012_A2				7	2.5

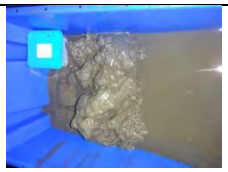
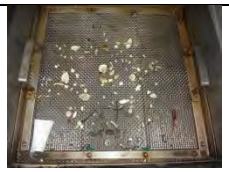
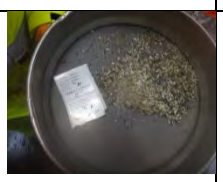
Station code	Sample image	5mm	1mm	Sample volume (l)	Container size (l)
SWSD_CEND1016_SWSD016_STN_013_A2				4	2.5
SWSD_CEND1016_SWSD035_STN_014_A1				4	2.5
SWSD_CEND1016_SWSD038_STN_015_A1				5	2.5
SWSD_CEND1016_SWSD039_STN_016_A1				7.5	2.5
SWSD_CEND1016_SWSD041_STN_017_A3				5	2.5
SWSD_CEND1016_SWSD043_STN_018_A3				3.5	2.5
SWSD_CEND1016_SWSD045_STN_019_A1			No photo taken	8	0.5
SWSD_CEND1016_SWSD046_STN_020_A2			No photo taken	8.5	2.5
SWSD_CEND1016_SWSD048_STN_021_A2				4	2.5

Station code	Sample image	5mm	1mm	Sample volume (l)	Container size (l)
SWSD_CEND1016_SWSD051_STN_023_A2				4.5	5
SWSD_CEND1016_SWSD054_STN_024_A1				10	10
SWSD_CEND1016_SWSD014_STN_025_A1				5.5	5
SWSD_CEND1016_SWSD053_STN_026_A1				4.5	5
SWSD_CEND1016_SWSD050_STN_027_A1				4.5	5
SWSD_CEND1016_SWSD015_STN_028_A1				4.5	2.5
SWSD_CEND1016_SWSD047_STN_029_A1				3	2.5
SWSD_CEND1016_SWSD049_STN_030_A1		No photo taken	No photo taken	4.5	2.5
SWSD_CEND1016_SWSD052_STN_031_A1				5.5	2.5

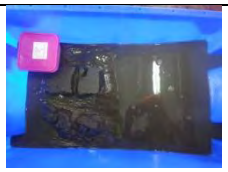
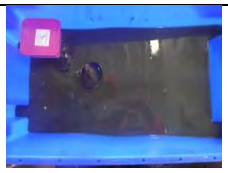
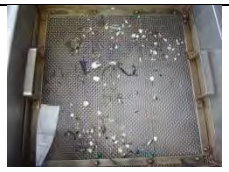
Station code	Sample image	5mm	1mm	Sample volume (l)	Container size (l)
SWSD_CEND1016_SWSD055_STN_032_A1				5	5
SWSD_CEND1016_SWSD024_STN_033_A1				6	2.5
SWSD_CEND1016_SWSD056_STN_034_A1				4	2.5
SWSD_CEND1016_SWSD019_STN_035_A1				3	5
SWSD_CEND1016_SWSD057_STN_036_A1				4.5	2.5
SWSD_CEND1016_SWSD020_STN_037_A1				6	5
SWSD_CEND1016_SWSD021_STN_038_A1				3	1
SWSD_CEND1016_SWSD060_STN_040_A1				5	1
SWSD_CEND1016_SWSD059_STN_041_A1				2.5	1

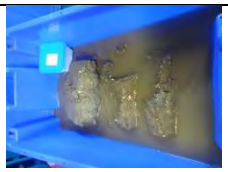
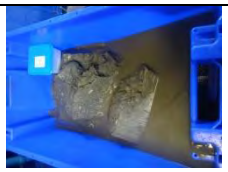
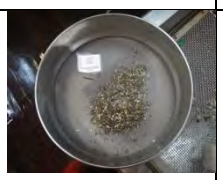
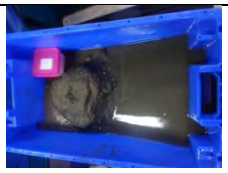
Station code	Sample image	5mm	1mm	Sample volume (l)	Container size (l)
SWSD_CEND1016_SWSD058_STN_042_A1				7	1
SWSD_CEND1016_SWSD023_STN_043_A1				9	1
SWSD_CEND1016_SWSD235_STN_044_A1				8	5
SWSD_CEND1016_SWSD236_STN_045_A1				7.5	2.5
SWSD_CEND1016_SWSD237_STN_046_A1				9	0.5
SWSD_CEND1016_SWSD006_STN_047_A2				5	5
SWSD_CEND1016_SWSD064_STN_048_A1				9	1
SWSD_CEND1016_SWSD233_STN_049_A1				7	2.5
SWSD_CEND1016_SWSD229_STN_060_A1				8	2.5

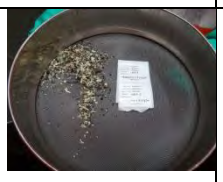
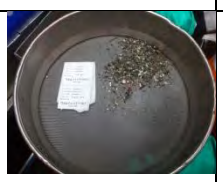
Station code	Sample image	5mm	1mm	Sample volume (l)	Container size (l)
SWSD_CEND1016_SWSD218_STN_061_A1				9	1
SWSD_CEND1016_SWSD007_STN_062_A1				9	1
SWSD_CEND1016_SWSD061_STN_063_A1				7	2.5
SWSD_CEND1016_SWSD062_STN_064_A1				8	2.5
SWSD_CEND1016_SWSD063_STN_065_A1				9	1
SWSD_CEND1016_SWSD065_STN_066_A1				7	2.5
SWSD_CEND1016_SWSD009_STN_067_A1				10	0.5
SWSD_CEND1016_SWSD068_STN_068_A1				12	0.5
SWSD_CEND1016_SWSD008_STN_069_A1				9.5	0.25

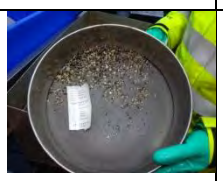
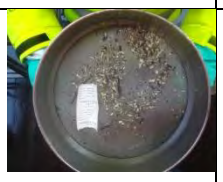
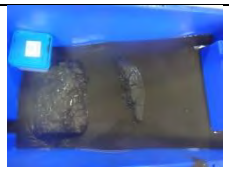
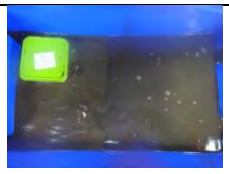
Station code	Sample image	5mm	1mm	Sample volume (l)	Container size (l)
SWSD_CEND1016_SWSD067_STN_070_A1				9.5	0.25
SWSD_CEND1016_SWSD066_STN_071_A1				9	0.5
SWSD_CEND1016_SWSD069_STN_072_A1				5.5	1
SWSD_CEND1016_SWSD073_STN_073_A1				5.5	2.5
SWSD_CEND1016_SWSD071_STN_074_A1				8	1
SWSD_CEND1016_SWSD070_STN_075_A1				8.5	1
SWSD_CEND1016_SWSD005_STN_076_A1				7	1
SWSD_CEND1016_SWSD072_STN_077_A1				7.5	1
SWSD_CEND1016_SWSD004_STN_078_A1				9	0.5

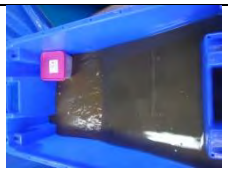
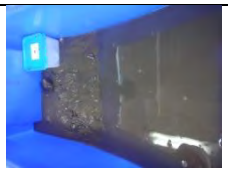
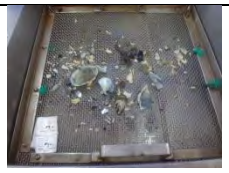
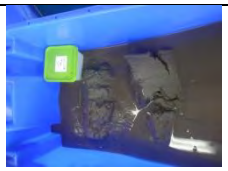
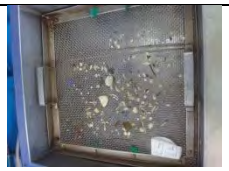
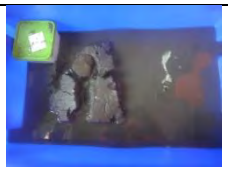
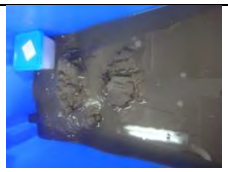
Station code	Sample image	5mm	1mm	Sample volume (l)	Container size (l)
SWSD_CEND1016_SWSD078_STN_079_A1				7.5	1
SWSD_CEND1016_SWSD077_STN_080_A1				8	1
SWSD_CEND1016_SWSD075_STN_081_A1				8	2.5
SWSD_CEND1016_SWSD076_STN_082_A1				6	1
SWSD_CEND1016_SWSD074_STN_083_A1				4.5	2.5
SWSD_CEND1016_SWSD025_STN_084_A1				7	1
SWSD_CEND1016_SWSD079_STN_085_A1				8.5	1
SWSD_CEND1016_SWSD080_STN_086_A1				7.5	1
SWSD_CEND1016_SWSD082_STN_087_A1				7.5	1

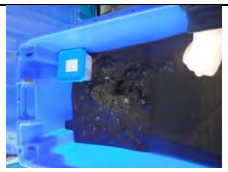
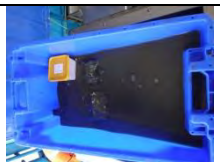
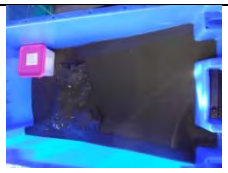
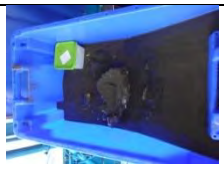
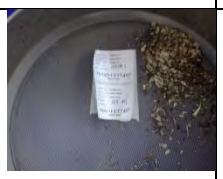
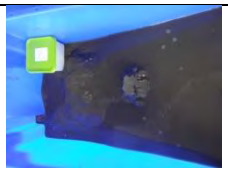
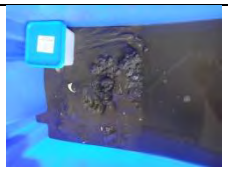
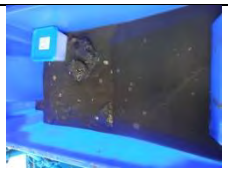
Station code	Sample image	5mm	1mm	Sample volume (l)	Container size (l)
SWSD_CEND1016_SWSD081_STN_088_A1				6	0.5
SWSD_CEND1016_SWSD083_STN_089_A1				7	1
SWSD_CEND1016_SWSD003_STN_090_A1				7.5	1
SWSD_CEND1016_SWSD087_STN_091_A1				5.5	1
SWSD_CEND1016_SWSD086_STN_092_A1				6	1
SWSD_CEND1016_SWSD085_STN_093_A1				6.5	0.5
SWSD_CEND1016_SWSD084_STN_094_A1				7.5	2.5
SWSD_CEND1016_SWSD238_STN_105_A1				8	1
SWSD_CEND1016_SWSD239_STN_106_A1				8	0.5

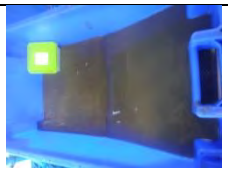
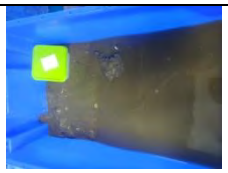
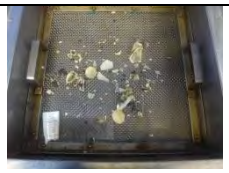
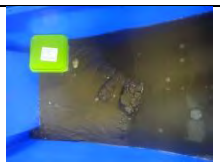
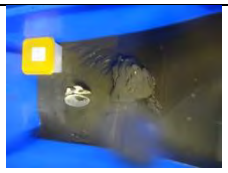
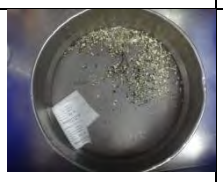
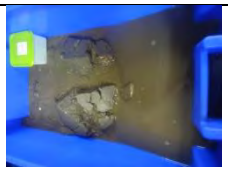
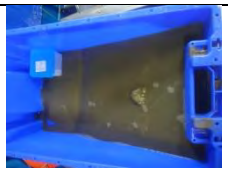
Station code	Sample image	5mm	1mm	Sample volume (l)	Container size (l)
SWSD_CEND1016_SWSD254_STN_107_A1				7	2.5
SWSD_CEND1016_SWSD030_STN_108_A1				11	1
SWSD_CEND1016_SWSD088_STN_109_A1				12	0.5
SWSD_CEND1016_SWSD090_STN_110_A1				12	0.5
SWSD_CEND1016_SWSD089_STN_111_A1				9	2.5
SWSD_CEND1016_SWSD097_STN_112_A1				8	1
SWSD_CEND1016_SWSD092_STN_113_A1				6.5	0.5
SWSD_CEND1016_SWSD031_STN_114_A1				9	0.5
SWSD_CEND1016_SWSD095_STN_115_A1				8	0.5

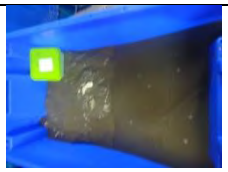
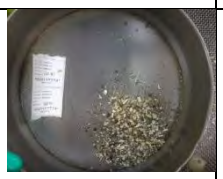
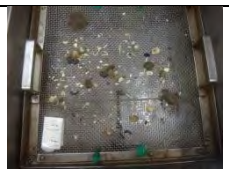
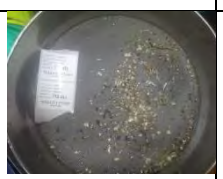
Station code	Sample image	5mm	1mm	Sample volume (l)	Container size (l)
SWSD_CEND1016_SWSD097_STN_116_A1				7	0.5
SWSD_CEND1016_SWSD099_STN_117_A1				7.5	1
SWSD_CEND1016_SWSD096_STN_118_A1				7	0.5
SWSD_CEND1016_SWSD094_STN_119_A1				8.5	1
SWSD_CEND1016_SWSD093_STN_120_A1				8.5	1
SWSD_CEND1016_SWSD100_STN_121_A1				7.5	0.5
SWSD_CEND1016_SWSD098_STN_122_A1				8.5	0.5
SWSD_CEND1016_SWSD102_STN_123_A1				7.5	1
SWSD_CEND1016_SWSD101_STN_124_A1				8	1

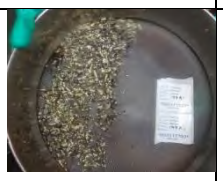
Station code	Sample image	5mm	1mm	Sample volume (l)	Container size (l)
SWSD_CEND1016_SWSD103_STN_125_A1				6	2.5
SWSD_CEND1016_SWSD104_STN_126_A1				7.5	2.5
SWSD_CEND1016_SWSD106_STN_127_A1				6.5	0.5
SWSD_CEND1016_SWSD108_STN_128_A1				7.5	0.5
SWSD_CEND1016_SWSD107_STN_129_A1				5.5	1
SWSD_CEND1016_SWSD105_STN_130_A1				4.5	1
SWSD_CEND1016_SWSD029_STN_131_A1				5.5	1
SWSD_CEND1016_SWSD111_STN_132_A1				6	0.5
SWSD_CEND1016_SWSD109_STN_133_A1				4.5	0.5

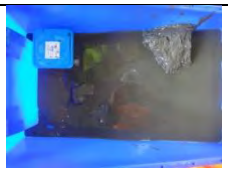
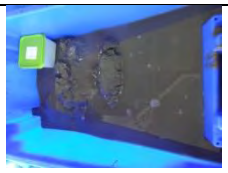
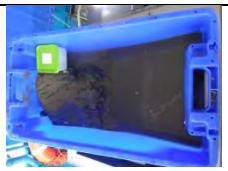
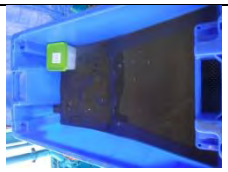
Station code	Sample image	5mm	1mm	Sample volume (l)	Container size (l)
SWSD_CEND 1016_SWSD1 12_STN_134_ A1				6.5	0.5
SWSD_CEND 1016_SWSD1 13_STN_135_ A1				3.5	1
SWSD_CEND 1016_SWSD1 17_STN_137_ A1				6	0.5
SWSD_CEND 1016_SWSD0 28_STN_138_ A1				6.5	1
SWSD_CEND 1016_SWSD1 18_STN_139_ A1				7	0.5
SWSD_CEND 1016_SWSD1 16_STN_140_ A1				6.5	1
SWSD_CEND 1016_SWSD1 15_STN_141_ A1				6.5	0.5
SWSD_CEND 1016_SWSD1 10_STN_142_ A1				7.5	0.5
SWSD_CEND 1016_SWSD1 14_STN_143_ A2				4.5	1

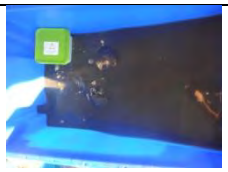
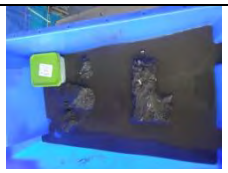
Station code	Sample image	5mm	1mm	Sample volume (l)	Container size (l)
SWSD_CEND 1016_SWSD2 50_STN_144_ A1				6.5	1
SWSD_CEND 1016_SWSD2 45_STN_150_ A1				7.5	1
SWSD_CEND 1016_SWSD2 44_STN_151_ A1				7	1
SWSD_CEND 1016_SWSD0 26_STN_152_ A1				6	1
SWSD_CEND 1016_SWSD1 19_STN_153_ A1				6	1
SWSD_CEND 1016_SWSD1 23_STN_154_ A1				6	2.5
SWSD_CEND 1016_SWSD1 24_STN_155_ A1				5	1
SWSD_CEND 1016_SWSD1 20_STN_156_ A1				7.5	1
SWSD_CEND 1016_SWSD1 21_STN_157_ A1				6.5	0.25

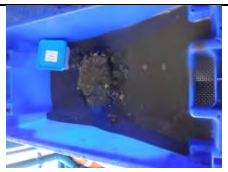
Station code	Sample image	5mm	1mm	Sample volume (l)	Container size (l)
SWSD_CEND1016_SWSD122_STN_158_A1				7	0.25
SWSD_CEND1016_SWSD125_STN_159_A1				8	0.25
SWSD_CEND1016_SWSD002_STN_160_A1				7	0.5
SWSD_CEND1016_SWSD133_STN_161_A1				7.5	0.25
SWSD_CEND1016_SWSD131_STN_162_A1				8.0	0.5
SWSD_CEND1016_SWSD127_STN_163_A1				8	0.5
SWSD_CEND1016_SWSD129_STN_164_A1				7	0.5
SWSD_CEND1016_SWSD130_STN_165_A1				8	1
SWSD_CEND1016_SWSD128_STN_166_A1				7	0.5

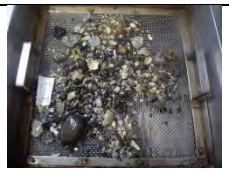
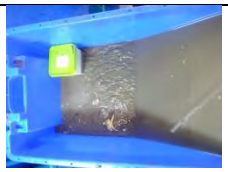
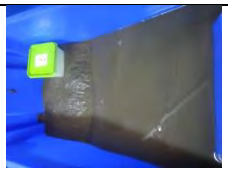
Station code	Sample image	5mm	1mm	Sample volume (l)	Container size (l)
SWSD_CEND1016_SWSD126_STN_167_A1				6	1
SWSD_CEND1016_SWSD132_STN_168_A1				5.5	0.5
SWSD_CEND1016_SWSD134_STN_169_A1				6.5	0.5
SWSD_CEND1016_SWSD135_STN_170_A2				8	2.5
SWSD_CEND1016_SWSD138_STN_171_A1				7.5	0.5
SWSD_CEND1016_SWSD136_STN_172_A1				6	0.5
SWSD_CEND1016_SWSD139_STN_173_A1				7	2.5
SWSD_CEND1016_SWSD140_STN_174_A1				7.5	0.5
SWSD_CEND1016_SWSD142_STN_175_A1				7.5	0.5

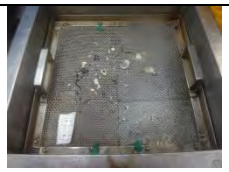
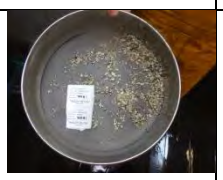
Station code	Sample image	5mm	1mm	Sample volume (l)	Container size (l)
SWSD_CEND 1016_SWSD1 45_STN_176_ A1				7	0.5
SWSD_CEND 1016_SWSD1 41_STN_177_ A1				7.5	0.5
SWSD_CEND 1016_SWSD1 37_STN_178_ A1				7.5	0.5
SWSD_CEND 1016_SWSD0 27_STN_179_ A1				7	0.5
SWSD_CEND 1016_SWSD1 43_STN_180_ A1				7	1
SWSD_CEND 1016_SWSD1 46_STN_181_ A1				6.5	0.5
SWSD_CEND 1016_SWSD1 44_STN_182_ A1				7	0.5
SWSD_CEND 1016_SWSD1 49_STN_183_ A1				6	0.5
SWSD_CEND 1016_SWSD1 50_STN_184_ A1				6.5	0.5

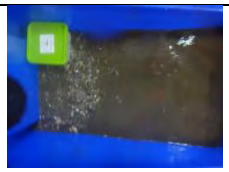
Station code	Sample image	5mm	1mm	Sample volume (l)	Container size (l)
SWSD_CEND1016_SWSD148_STN_185_A1				6.5	1
SWSD_CEND1016_SWSD001_STN_186_A1				7.5	0.5
SWSD_CEND1016_SWSD147_STN_187_A1				7.5	0.5
SWSD_CEND1016_SWSD215_STN_195_A1				6.5	0.25
SWSD_CEND1016_SWSD201_STN_196_A1				8.5	0.25
SWSD_CEND1016_SWSD214_STN_197_A1				7.5	0.25
SWSD_CEND1016_SWSD213_STN_198_A1				6.5	0.25
SWSD_CEND1016_SWSD203_STN_199_A1				7.5	1.0
SWSD_CEND1016_SWSD204_STN_200_A1				5.5	1.0

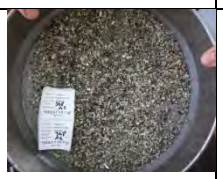
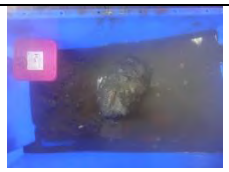
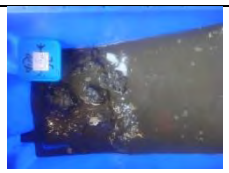
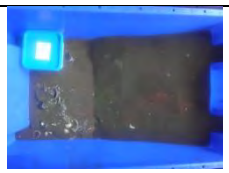
Station code	Sample image	5mm	1mm	Sample volume (l)	Container size (l)
SWSD_CEND1016_SWSD211_STN_201_A1				4.5	2.5
SWSD_CEND1016_SWSD210_STN_202_A1				7.5	2.5
SWSD_CEND1016_SWSD255_STN_213_A1				8.5	0.5
SWSD_CEND1016_SWSD257_STN_214_A1				4.5	2.5
SWSD_CEND1016_SWSD258_STN_215_A1				3	1.0
SWSD_CEND1016_SWSD264_STN_327_A1				5.5	0.5
SWSD_CEND1016_SWSD267_STN_328_A1				5.5	0.5
SWSD_CEND1016_SWSD265_STN_329_A1				8.5	1.0
SWSD_CEND1016_SWSD261_STN_330_A1				7.0	0.5

Station code	Sample image	5mm	1mm	Sample volume (l)	Container size (l)
SWSD_CEND1016_SWSD263_STN_331_A1				8	0.5
SWSD_CEND1016_SWSD266_STN_332_A1				7	2.5
SWSD_CEND1016_SWSD268_STN_333_A1				5	0.25
SWSD_CEND1016_SWSD275_STN_334_A1				6.5	1.0
SWSD_CEND1016_SWSD281_STN_335_A1				5.5	1.0
SWSD_CEND1016_SWSD277_STN_336_A1				4.5	0.25
SWSD_CEND1016_SWSD280_STN_337_A1				4.5	0.5
SWSD_CEND1016_SWSD274_STN_338_A1				3.5	0.5
SWSD_CEND1016_SWSD271_STN_339_A3				3	2.5

Station code	Sample image	5mm	1mm	Sample volume (l)	Container size (l)
SWSD_CEND 1016_SWSD2 73_STN_340_ A3				4	2.5
SWSD_CEND 1016_SWSD2 70_STN_341_ A1				4.5	2.5
SWSD_CEND 1016_SWSD2 72_STN_342_ A1_				7	0.5
SWSD_CEND 1016_SWSD2 69_STN_343_ A2				4.5	2.5
SWSD_CEND 1016_SWSD2 78_STN_344_ A2				5	2.5
SWSD_CEND 1016_SWSD2 76_STN_345_ A1				4	5
SWSD_CEND 1016_SWSD2 79_STN_346_ A1				5	2.5
SWSD_CEND 1016_SWSD2 84_STN_347_ A1				4	0.25
SWSD_CEND 1016_SWSD2 82_STN_348_ A1				5	1

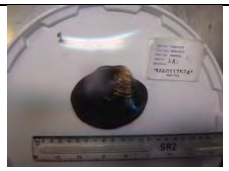
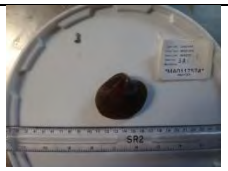
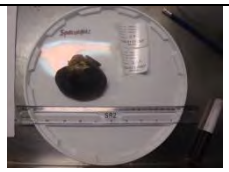
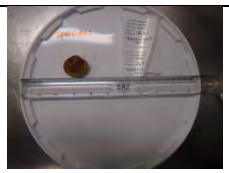
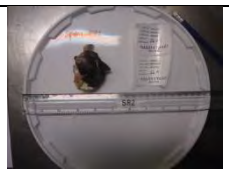
Station code	Sample image	5mm	1mm	Sample volume (l)	Container size (l)
SWSD_CEND1016_SWSD285_STN_349_A1				5	1
SWSD_CEND1016_SWSD283_STN_350_A1				7.5	0.5
SWSD_CEND1016_SWSD288_STN_351_A4				6	0.5
SWSD_CEND1016_SWSD293_STN_352_A1				3.5	1
SWSD_CEND1016_SWSD295_STN_353_A1				4.5	0.25
SWSD_CEND1016_SWSD291_STN_354_A1				4	0.5
SWSD_CEND1016_SWSD287_STN_355_A3				6.5	0.5
SWSD_CEND1016_SWSD292_STN_356_A1				5	2.5
SWSD_CEND1016_SWSD290_STN_357_A1				4.5	1

Station code	Sample image	5mm	1mm	Sample volume (l)	Container size (l)
SWSD_CEND1016_SWSD294_STN_358_A3				5	5
SWSD_CEND1016_SWSD297_STN_359_A4				5.5	0.5
SWSD_CEND1016_SWSD286_STN_360_A1				4	1
SWSD_CEND1016_SWSD289_STN_361_A1				6	0.5
SWSD_CEND1016_SWSD301_STN_362_A2				7.5	1
SWSD_CEND1016_SWSD296_STN_363_A1				5	1
SWSD_CEND1016_SWSD298_STN_364_A1				3	1
SWSD_CEND1016_SWSD299_STN_365_A1				4.5	1
SWSD_CEND1016_SWSD303_STN_366_A1				6	1

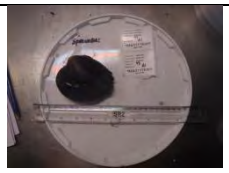
Station code	Sample image	5mm	1mm	Sample volume (l)	Container size (l)
SWSD_CEND1016_SWSD300_STN_367_A1				5	1
SWSD_CEND1016_SWSD306_STN_368_A2				3.5	2.5
SWSD_CEND1016_SWSD307_STN_369_A1				5	0.5
SWSD_CEND1016_SWSD305_STN_370_A2				4	1
SWSD_CEND1016_SWSD302_STN_371_A2				5	1
SWSD_CEND1016_SWSD304_STN_372_A2				3.5	2.5

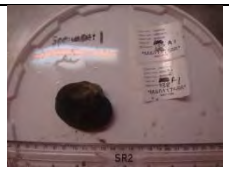
Where *Arctica islandica* were observed in the Hamon grab samples the bivalve was measured (width and length) and photographed with the sample label and scale bar. Intact specimens were returned and noted as present on the grab log sheet (Table 5). Damaged specimens were retained.

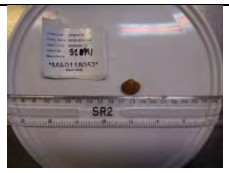
Table 5. Specimens of *Arctica islandica* sampled using the Hamon grab.

Station code	Specimen 1	Specimen 2	Specimen 3	Specimen 4
SWSD_CEND1016_SWSD032_STN_003_A1				_____
	Length: 8cm Width: 9.5cm	Length: 6cm Width: 7.5cm	Length: 5.5cm Width: 6.5cm	_____
SWSD_CEND1016_SWSD040_STN_012_A2		_____	_____	_____
	Length: 7cm Width: 8.5cm	_____	_____	_____
SWSD_CEND1016_SWSD051_STN_023_A2		_____	_____	_____
	Length: 2.2cm Width: 2.7cm	_____	_____	_____
SWSD_CEND1016_SWSD053_STN_026_A1			_____	_____
	Length: 3.5cm Width: 4.0cm	Damaged by grab. No measurements.	_____	_____

Station code	Specimen 1	Specimen 2	Specimen 3	Specimen 4
SWSD_CEND1016_SWSD050_STN_027_A1		_____	_____	_____
	Length: 6cm Width: 7cm	_____	_____	_____
SWSD_CEND1016_SWSD047_STN_029_A1		_____	_____	_____
	Length: 5.5cm Width: 6.7cm	_____	_____	_____
SWSD_CEND1016_SWSD049_STN_030_A1		_____	_____	_____
	Length: 8cm Width: 8.8cm	_____	_____	_____
SWSD_CEND1016_SWSD021_STN_038_A1		_____	_____	_____
	Length: 7cm Width: 8.2cm	_____	_____	_____
SWSD_CEND1016_SWSD069_STN_072_A1		_____	_____	_____
	Length: 7.2cm Width: 8cm	_____	_____	_____

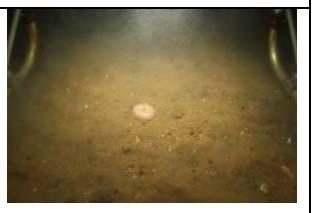
Station code	Specimen 1	Specimen 2	Specimen 3	Specimen 4
SWSD_CEND1016_SWSD073_STN_073_A1			_____	_____
	Length: 7.5cm Width: 9cm	Length: 5.7cm Width: 6.5cm	_____	_____
SWSD_CEND1016_SWSD085_STN_093_A1		_____	_____	_____
	Length: 8cm Width: 10cm	_____	_____	_____
SWSD_CEND1016_SWSD084_STN_094_A1		_____	_____	_____
	Length: 5.3cm Width: 5.9cm	_____	_____	_____
SWSD_CEND1016_SWSD254_STN_107_A1		_____	_____	_____
	Length: 8.5cm Width: 10cm	_____	_____	_____
SWSD_CEND1016_SWSD091_STN_112_A1	No photo taken	_____	_____	_____
	Length: 2.5cm Width: 2.5cm	_____	_____	_____

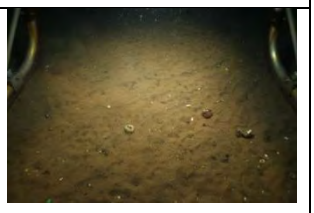
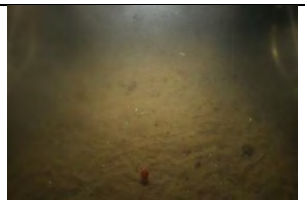
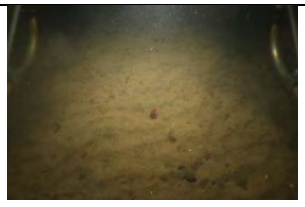
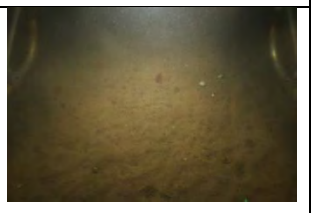
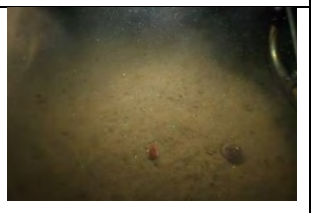
Station code	Specimen 1	Specimen 2	Specimen 3	Specimen 4
SWSD_CEND1016_SWSD103_STN_125_A1		_____	_____	_____
	Length: 5.5cm Width: 6.3cm	_____	_____	_____
SWSD_CEND1016_SWSD108_STN_128_A1		_____	_____	_____
	Length: 8.7cm Width: 7.5cm	_____	_____	_____
SWSD_CEND1016_SWSD109_STN_133_A1		_____	_____	_____
	Length: 10cm Width: 8.5cm Damaged	_____	_____	_____
SWSD_CEND1016_SWSD113_STN_135_A1		_____	_____	_____
	Length: 6.5cm Width: 6cm	_____	_____	_____
SWSD_CEND1016_SWSD028_STN_138_A1		_____	_____	_____
	Length: 5cm Width: 6.1cm	_____	_____	_____

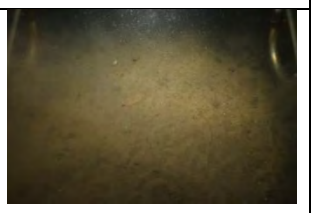
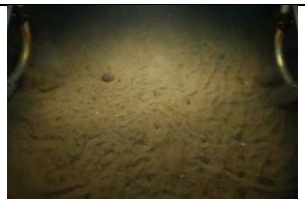
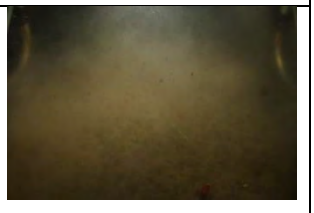
Station code	Specimen 1	Specimen 2	Specimen 3	Specimen 4
SWSD_CEND1016_SWSD139_STN_173_A1		_____	_____	_____
	Length: 7.2cm Width: 9.5cm	_____	_____	_____
SWSD_CEND1016_SWSD267_STN_328_A1		_____	_____	_____
	Length: 0.7cm Width: 0.9cm Length: 0.8cm Width: 1cm	_____	_____	_____
SWSD_CEND1016_SWSD265_STN_329_A1		_____	_____	_____
	Length: 1.6cm Width: 1.8cm	_____	_____	_____

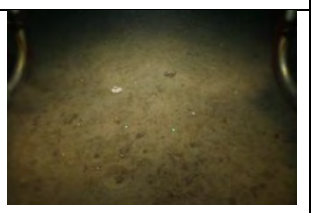
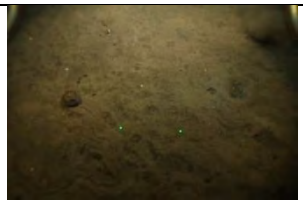
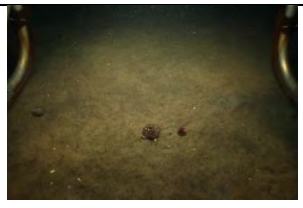
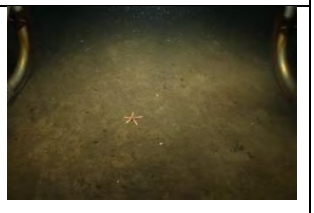
A selection of three still images from each of the camera sledge and drop camera deployments is presented in Table 6 to illustrate what was observed on the video.

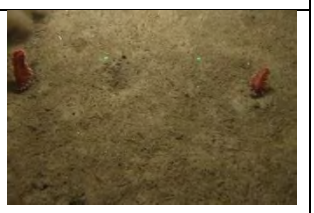
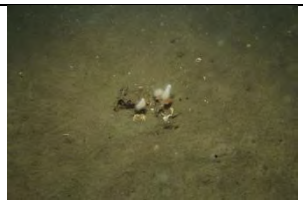
Table 6. Selection of seabed images for each camera deployment.

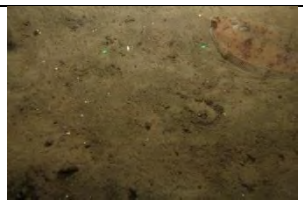
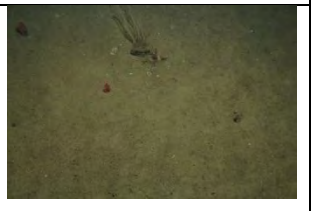
Station code / filename	Representative sample 1	Representative sample 2	Representative sample 3
SWSD_CEND1016_SWSD032_STN_050_A2			
SWSD_CEND1016_SWSD033_STN_051_A1			
SWSD_CEND1016_SWSD040_STN_052_A1			
SWSD_CEND1016_SWSD043_STN_053_A1			
SWSD_CEND1016_SWSD050_STN_054_A1			
SWSD_CEND1016_SWSD049_STN_055_A1			
SWSD_CEND1016_SWSD024_STN_056_A1			

Station code / filename	Representative sample 1	Representative sample 2	Representative sample 3
SWSD_CEND1016_SWSD019_STN_057_A1			
SWSD_CEND1016_SWSD020_STN_058_A1			
SWSD_CEND1016_SWSD022_STN_059_A1			
SWSD_CEND1016_SWSD082_STN_095_A1			
SWSD_CEND1016_SWSD003_STN_096_A1			
SWSD_CEND1016_SWSD075_STN_097_A1			
SWSD_CEND1016_SWSD074_STN_098_A1			
SWSD_CEND1016_SWSD073_STN_099_A1			

Station code / filename	Representative sample 1	Representative sample 2	Representative sample 3
SWSD_CEND1016_SWSD069_STN_100_A1			
SWSD_CEND1016_SWSD070_STN_101_A1			
SWSD_CEND1016_SWSD004_STN_102_A1			
SWSD_CEND1016_SWSD008_STN_103_A1			
SWSD_CEND1016_SWSD006_STN_104_A1			
SWSD_CEND1016_SWSD028_STN_145_A1			
SWSD_CEND1016_SWSD116_STN_146_A1			
SWSD_CEND1016_SWSD111_STN_147_A1			

Station code / filename	Representative sample 1	Representative sample 2	Representative sample 3
SWSD_CEND1016_SWSD105_STN_149_A1			
SWSD_CEND1016_SWSD133_STN_188_A1			
SWSD_CEND1016_SWSD131_STN_189_A1			
SWSD_CEND1016_SWSD130_STN_190_A1			
SWSD_CEND1016_SWSD027_STN_191_A1			
SWSD_CEND1016_SWSD141_STN_192_A1			
SWSD_CEND1016_SWSD149_STN_193_A1			
SWSD_CEND1016_SWSD001_STN_194_A1			

Station code / filename	Representative sample 1	Representative sample 2	Representative sample 3
SWSD_CEND1016_SWSD090_STN_209_A1			
SWSD_CEND1016_SWSD099_STN_210_A1			
SWSD_CEND1016_SWSD097_STN_211_A1			
SWSD_CEND1016_SWSD089_STN_212_A1			
SWSD_CEND1016_SWSD272_STN_373_A1			
SWSD_CEND1016_SWSD270_STN_374_A1			
SWSD_CEND1016_SWSD265_STN_375_A1			
SWSD_CEND1016_SWSD263_STN_376_A1			

Station code / filename	Representative sample 1	Representative sample 2	Representative sample 3
SWSD_CEND1016_SWSD288_STN_377_A1			
SWSD_CEND1016_SWSD283_STN_378_A1			
SWSD_CEND1016_SWSD285_STN_379_A1			
SWSD_CEND1016_SWSD282_STN_380_A1			
SWSD_CEND1016_SWSD290_STN_381_A1			
SWSD_CEND1016_SWSD297_STN_382_A1			
SWSD_CEND1016_SWSD300_STN_383_A1			
SWSD_CEND1016_SWSD303_STN_384_A1			

5 References

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6 Annexes

6.1 RV Cefas Endeavour

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 EM3002D & EM2040 swathe bathymetry sounders 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	8 networked laboratories designed for optimum flexibility of purpose 4 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

6.2 Camera sledge

STR Seaspyder Telemetry (Canon EOS) 18-Megapixel digital stills camera with quartz corrected dome lens and STR MP-F through-the-lens-controlled flash. It is controlled through a dual role copper/fibre multiplexor custom built to Cefas specification.

STR SP-IPC-3000a 1080p video camera with a 0.1 Lux colour 5-megapixel sensor. It is run at 720p (25 frames per second) video resolution along with all other control signals ran over a single coax copper cable.

Lighting is provided by four to six STR MP-3 LED lights running at 1500 Lumens light intensity per unit.

Laser scaling is provided by two green dot class 3r laser pointers providing a reference width of 21cm on the seabed.

The sledge is also fitted with a digital heading/pitch/roll sensor, altimeter and water temperature sensor. This is recorded in real time along with GPS time and position using a video overlay

6.3 Position logging software – tower navigation

Vessel offsets are defined from the pitch roll centre of the vessel – the Common Reference Point (CRP) used by the Tower CEMAP software to calculate offsets.

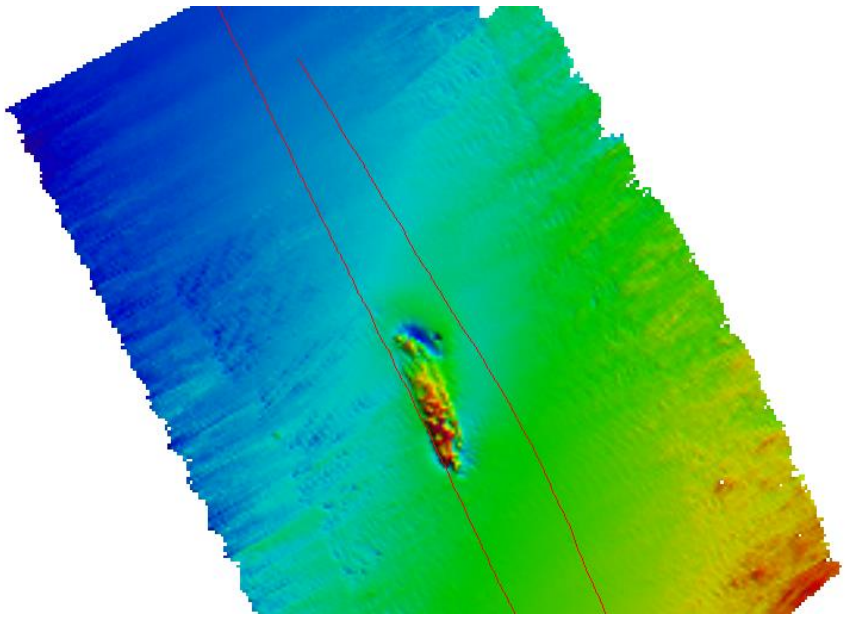
6.4 Multibeam echosounder acoustic systems

Model: Simrad EM2040 operated at 300kHz. Calibrated by patch test on 4 July 2012 (see calibration report below).

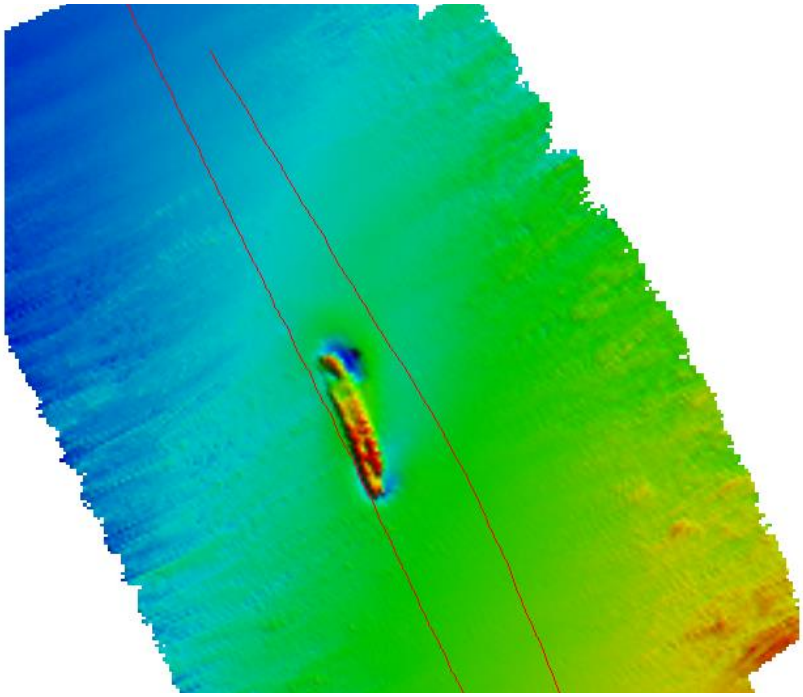
Hardware On-line	**Remarks**
Kongsberg EM2040	Head serial 220
Seapath 330 plus MRU-5	Serial MRU-5 2043 Serial Seapath S/N10580
C-Nav 3050 GPS	C-NAVC2 (GPS + GLONASS)
Thales 3011 GPS	Fugro Seastar differential corrections
MAHRS Gyro	SN 040644
SAIV SD204	CTD casts SN 718
Reson SVP24	Mounted on blade next to sonar heads
Druck PTX 1830	Vessel draft sensor
Software (including version)	**Remarks**
Kongsberg SIS V3.83	-
Caris HIPS V7.1 SP2 Hotfix 1-5	-
IVS3D Fledermaus GT v7.3.2a	-

6.5 Recalibration report, Kongsberg EM2040 multibeam echosounder

The deep water recalibration of the EM2040 was carried out over an unknown wreck situated just north of North East of Farnes Deep MCZ. A recalibration of data collected in April 2016 was carried out after noticing poor registration of a wreck during survey.



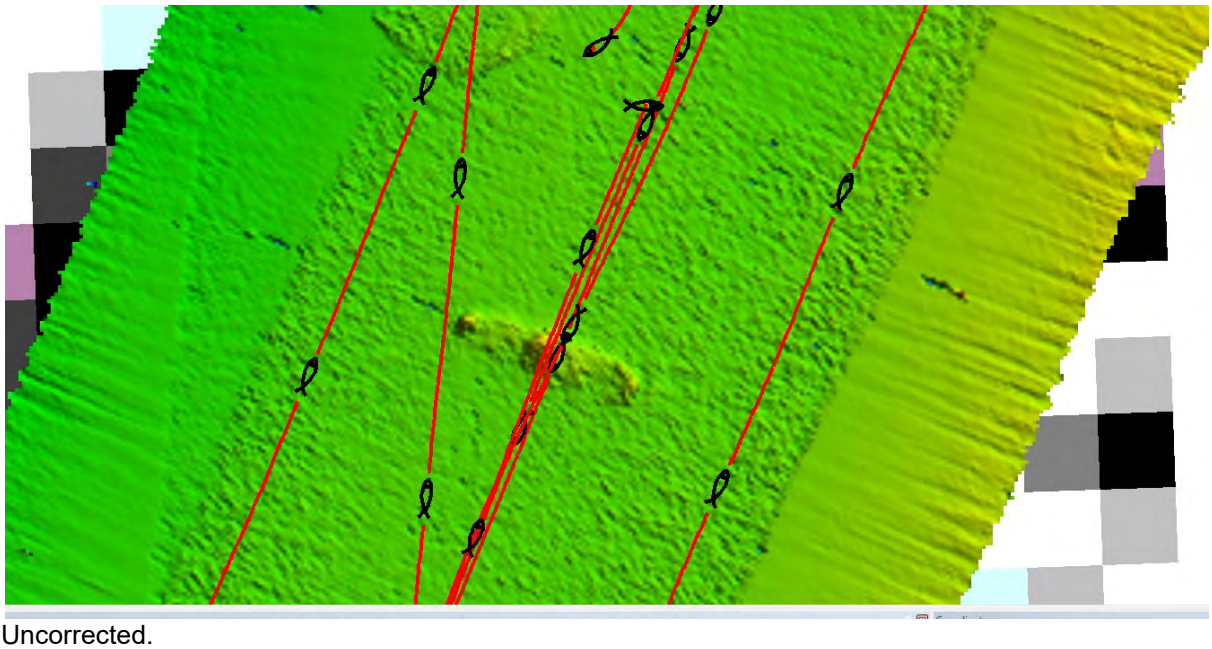
Caris image uncorrected vessel file (R 0.0 P 0.0 Yaw 0.0).



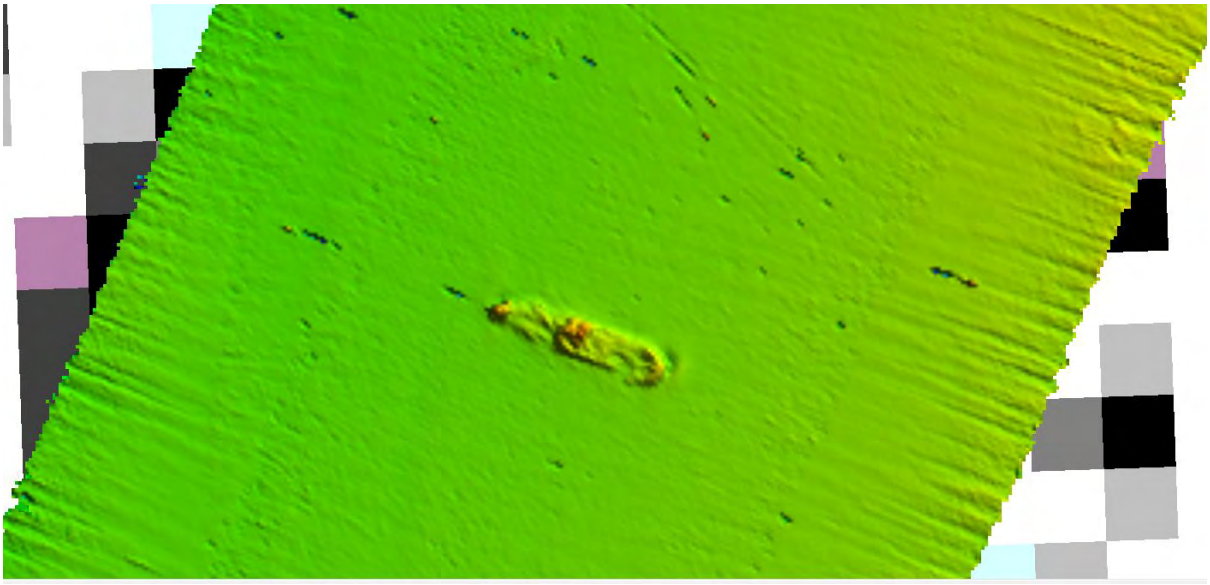
Caris image with corrected vessel file (R -0.1 P -0.4 Yaw 2.3).

	Date	Time	Time Correctio...	X (m)	Y (m)	Z (m)	Pitch (deg)	Roll (deg)	Yaw (deg)	Manufacturer	Model	Serial Numb
1	2012-158	00:00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Kongsberg	Simrad EM204	
2	2016-092	00:00	0.000	0.000	0.000	0.000	-0.400	-0.100	2.300	Kongsberg	Simrad EM204	
3	2016-147	00:00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	Kongsberg	Simrad EM204	
4		00:00										

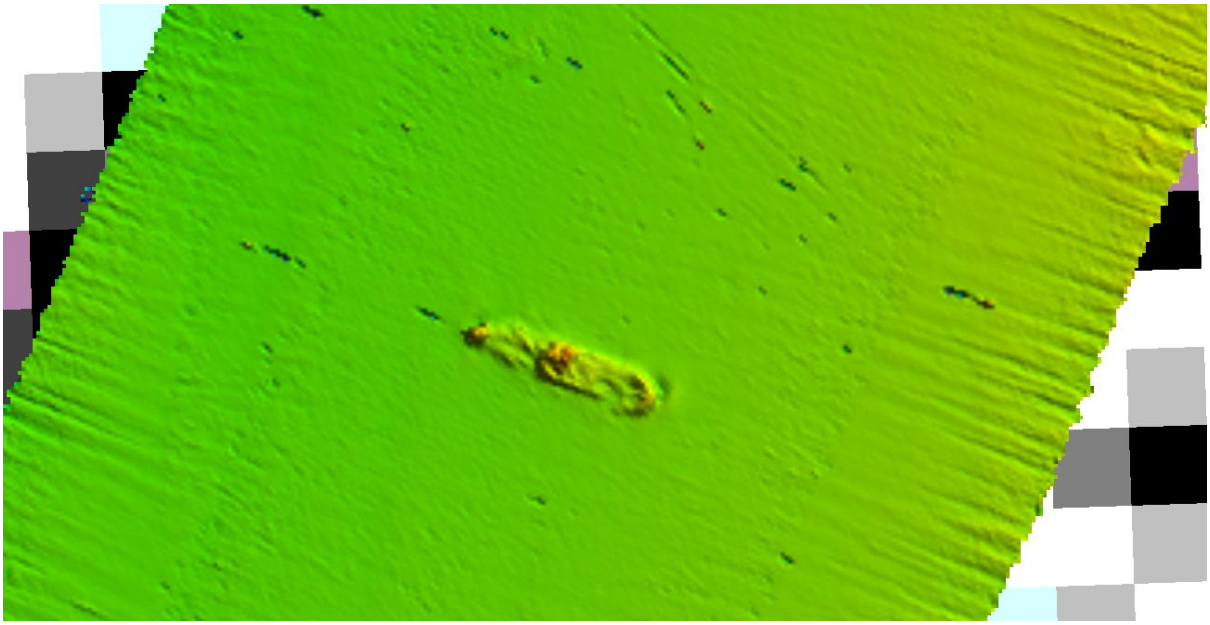
Vessel file modified to correct data during period of April to May 24 when SIS was updated with new calibration details from North East of Farnes Deep calibration wreck.



Uncorrected.



Corrected head -1.8.



Corrected head 1.1.

6.6 Station metadata

All stations were sampled on Cruise CEND1016. Station Code is used to identify the location of the sampling station. Station Number is a sequential event number for the cruise, so changes each time a new gear is used or a new location is sampled. MB2= Kongsberg EM2040 Multibeam echosounder, HG=Hamon grab, CS=Camera Sledge, DC, Drop Camera, SOL = Start Of Line, EOL = End Of Line. All positions in decimal degrees, Lat/Long WGS84.

Table 7. Survey metadata for Swallow Sand MCZ CEND1016.

StnCode	Stn Num	Attempt	SOL/ EOL	Time	Date	GearCode	LatDD	LongDD
SWSD225	1	A1	-	11:20	18/05/2016	HG	55.618880	0.016878
SWSD018	2	A1	-	11:49	18/05/2016	HG	55.640120	0.012536
SWSD032	3	A1	-	12:14	18/05/2016	HG	55.654310	0.020508
SWSD017	4	A1	-	12:33	18/05/2016	HG	55.665030	0.005151
SWSD033	5	A1	-	12:55	18/05/2016	HG	55.677250	0.014514
SWSD036	6	A1	-	13:18	18/05/2016	HG	55.689830	0.023281
SWSD037	7	A1	-	13:44	18/05/2016	HG	55.712940	0.017505
SWSD034	8	A1	-	14:03	18/05/2016	HG	55.723540	0.002623
SWSD044	9	A1	-	14:27	18/05/2016	HG	55.716690	0.064710
SWSD042	10	A1	-	14:43	18/05/2016	HG	55.704240	0.055778
SWSD011	11	A1	-	15:01	18/05/2016	HG	55.693660	0.071113
SWSD040	12	A1	-	15:18	18/05/2016	HG	55.691740	0.046989
SWSD040	12	A2	-	15:23	18/05/2016	HG	55.691730	0.046968
SWSD016	13	A1	-	15:44	18/05/2016	HG	55.668750	0.052428
SWSD016	13	A2	-	15:49	18/05/2016	HG	55.668750	0.052429
SWSD035	14	A1	-	16:31	18/05/2016	HG	55.666710	0.029194
SWSD038	15	A1	-	16:49	18/05/2016	HG	55.656090	0.044025
SWSD039	16	A1	-	17:04	18/05/2016	HG	55.645460	0.058590
SWSD041	17	A1	-	17:22	18/05/2016	HG	55.658040	0.067042
SWSD041	17	A2	-	17:27	18/05/2016	HG	55.658050	0.066956
SWSD041	17	A3	-	17:32	18/05/2016	HG	55.658020	0.067101
SWSD043	18	A1	-	17:52	18/05/2016	HG	55.670710	0.076019
SWSD043	18	A2	-	17:56	18/05/2016	HG	55.670690	0.076064
SWSD043	18	A3	-	18:01	18/05/2016	HG	55.670670	0.076168
SWSD045	19	A1	-	18:18	18/05/2016	HG	55.683080	0.085272
SWSD046	20	A1	-	18:33	18/05/2016	HG	55.695660	0.093749
SWSD046	20	A2	-	18:38	18/05/2016	HG	55.695530	0.094215
SWSD048	21	A1	-	18:52	18/05/2016	HG	55.708090	0.102582
SWSD048	21	A2	-	18:57	18/05/2016	HG	55.708020	0.103123
SWSD012	22	A1	-	19:13	18/05/2016	HG	55.719110	0.087716
SWSD012	22	A2	-	19:18	18/05/2016	HG	55.718860	0.087428
SWSD012	22	A3	-	19:22	18/05/2016	HG	55.718860	0.087443
SWSD051	23	A1	-	19:41	18/05/2016	HG	55.720480	0.111383
SWSD051	23	A2	-	19:46	18/05/2016	HG	55.720470	0.111976
SWSD054	24	A1	-	20:17	18/05/2016	HG	55.709900	0.126841

StnCode	Stn Num	Attempt	SOL/ EOL	Time	Date	GearCode	LatDD	LongDD
SWSD014	25	A1	-	20:36	18/05/2016	HG	55.697180	0.117433
SWSD053	26	A1	-	20:52	18/05/2016	HG	55.686890	0.132575
SWSD050	27	A1	-	21:11	18/05/2016	HG	55.674360	0.123602
SWSD015	28	A1	-	21:28	18/05/2016	HG	55.672620	0.099821
SWSD047	29	A1	-	21:46	18/05/2016	HG	55.661540	0.114611
SWSD049	30	A1	-	22:05	18/05/2016	HG	55.651070	0.129178
SWSD052	31	A1	-	22:25	18/05/2016	HG	55.640310	0.143789
SWSD055	32	A1	-	22:47	18/05/2016	HG	55.653140	0.152996
SWSD024	33	A1	-	23:16	18/05/2016	HG	55.654530	0.176388
SWSD056	34	A1	-	23:55	18/05/2016	HG	55.665720	0.162189
SWSD019	35	A1	-	00:13	19/05/2016	HG	55.676240	0.147103
SWSD057	36	A1	-	00:35	19/05/2016	HG	55.688630	0.156386
SWSD020	37	A1	-	00:56	19/05/2016	HG	55.700920	0.165610
SWSD021	38	A1	-	01:21	19/05/2016	HG	55.726050	0.182279
SWSD022	39	A1	-	01:50	19/05/2016	HG	55.704870	0.212215
SWSD022	39	A2	-	01:56	19/05/2016	HG	55.704860	0.212203
SWSD022	39	A3	-	02:03	19/05/2016	HG	55.704810	0.212214
SWSD060	40	A1	-	02:23	19/05/2016	HG	55.702980	0.188836
SWSD059	41	A1	-	02:42	19/05/2016	HG	55.690630	0.179779
SWSD058	42	A1	-	03:38	19/05/2016	HG	55.678090	0.170837
SWSD023	43	A1	-	03:55	19/05/2016	HG	55.679660	0.194310
SWSD235	44	A1	-	04:20	19/05/2016	HG	55.683240	0.241834
SWSD236	45	A1	-	04:44	19/05/2016	HG	55.708310	0.259541
SWSD237	46	A1	-	05:14	19/05/2016	HG	55.690280	0.335879
SWSD006	47	A1	-	05:53	19/05/2016	HG	55.701340	0.477696
SWSD006	47	A2	-	05:59	19/05/2016	HG	55.701670	0.477617
SWSD064	48	A1	-	06:20	19/05/2016	HG	55.715750	0.510790
SWSD233	49	A1	-	07:41	19/05/2016	HG	55.633700	0.205021
SWSD032	50	A1	SOL	08:51	19/05/2016	CS	55.654180	0.020416
SWSD032	50	A1	EOL	09:03	19/05/2016	CS	55.653260	0.020889
SWSD032	50	A2	SOL	09:24	19/05/2016	CS	55.654000	0.020326
SWSD032	50	A2	EOL	09:34	19/05/2016	CS	55.653180	0.020795
SWSD033	51	A1	SOL	10:32	19/05/2016	CS	55.677340	0.014504
SWSD033	51	A1	EOL	10:44	19/05/2016	CS	55.676440	0.015076
SWSD040	52	A1	SOL	11:30	19/05/2016	CS	55.691770	0.047092
SWSD040	52	A1	EOL	11:40	19/05/2016	CS	55.691020	0.046473
SWSD043	53	A1	SOL	12:22	19/05/2016	CS	55.670570	0.076495
SWSD043	53	A1	EOL	12:32	19/05/2016	CS	55.669720	0.076212
SWSD050	54	A1	SOL	13:17	19/05/2016	CS	55.674130	0.123577
SWSD050	54	A1	EOL	13:27	19/05/2016	CS	55.673360	0.123122
SWSD049	55	A1	SOL	13:59	19/05/2016	CS	55.651320	0.129506
SWSD049	55	A1	EOL	14:09	19/05/2016	CS	55.650510	0.129089
SWSD024	56	A1	SOL	14:50	19/05/2016	CS	55.654000	0.176482

StnCode	Stn Num	Attempt	SOL/ EOL	Time	Date	GearCode	LatDD	LongDD
SWSD024	56	A1	EOL	15:12	19/05/2016	CS	55.655700	0.175543
SWSD019	57	A1	SOL	15:44	19/05/2016	CS	55.675890	0.147287
SWSD019	57	A1	EOL	15:54	19/05/2016	CS	55.676650	0.146579
SWSD020	58	A1	SOL	16:41	19/05/2016	CS	55.701190	0.164932
SWSD020	58	A1	EOL	16:53	19/05/2016	CS	55.700230	0.164443
SWSD022	59	A1	SOL	17:25	19/05/2016	CS	55.704940	0.212335
SWSD022	59	A1	EOL	17:35	19/05/2016	CS	55.704110	0.212057
SWSD229	60	A1	-	18:02	19/05/2016	HG	55.730130	0.229278
SWSD218	61	A1	-	18:50	19/05/2016	HG	55.765610	0.390098
SWSD007	62	A1	-	19:34	19/05/2016	HG	55.726280	0.496069
SWSD061	63	A1	-	19:49	19/05/2016	HG	55.737090	0.481015
SWSD062	64	A1	-	20:10	19/05/2016	HG	55.760170	0.475821
SWSD063	65	A1	-	20:39	19/05/2016	HG	55.783530	0.470313
SWSD065	66	A1	-	21:06	19/05/2016	HG	55.774700	0.508562
SWSD009	67	A1	-	21:28	19/05/2016	HG	55.776530	0.532237
SWSD068	68	A1	-	21:53	19/05/2016	HG	55.763910	0.523411
SWSD008	69	A1	-	22:15	19/05/2016	HG	55.751440	0.514084
SWSD067	70	A1	-	22:38	19/05/2016	HG	55.740720	0.528612
SWSD066	71	A1	-	23:07	19/05/2016	HG	55.717720	0.534144
SWSD069	72	A1	-	23:31	19/05/2016	HG	55.707150	0.549266
SWSD073	73	A1	-	23:59	19/05/2016	HG	55.721230	0.581851
SWSD071	74	A1	-	00:27	20/05/2016	HG	55.731840	0.567080
SWSD070	75	A1	-	00:50	20/05/2016	HG	55.742250	0.552297
SWSD005	76	A1	-	01:18	20/05/2016	HG	55.754490	0.561083
SWSD072	77	A1	-	01:47	20/05/2016	HG	55.778130	0.556302
SWSD004	78	A1	-	02:07	20/05/2016	HG	55.779730	0.579256
SWSD078	79	A1	-	02:27	20/05/2016	HG	55.781700	0.603604
SWSD077	80	A1	-	02:49	20/05/2016	HG	55.758380	0.608784
SWSD075	81	A1	-	03:29	20/05/2016	HG	55.746040	0.599901
SWSD076	82	A1	-	03:46	20/05/2016	HG	55.735420	0.614535
SWSD074	83	A1	-	04:09	20/05/2016	HG	55.710550	0.596337
SWSD025	84	A1	-	04:27	20/05/2016	HG	55.712300	0.619858
SWSD079	85	A1	-	04:46	20/05/2016	HG	55.714150	0.643535
SWSD080	86	A1	-	05:09	20/05/2016	HG	55.737080	0.637934
SWSD082	87	A1	-	05:28	20/05/2016	HG	55.749930	0.646987
SWSD081	88	A1	-	05:42	20/05/2016	HG	55.760190	0.632089
SWSD083	89	A1	-	05:59	20/05/2016	HG	55.772930	0.642206
SWSD003	90	A1	-	06:21	20/05/2016	HG	55.787130	0.674156
SWSD087	91	A1	-	07:00	20/05/2016	HG	55.763940	0.679892
SWSD086	92	A1	-	07:19	20/05/2016	HG	55.740710	0.685650
SWSD085	93	A1	-	07:35	20/05/2016	HG	55.728600	0.676354
SWSD084	94	A1	-	07:50	20/05/2016	HG	55.716240	0.667346
SWSD082	95	A1	SOL	09:16	20/05/2016	CS	55.749780	0.647248

StnCode	Stn Num	Attempt	SOL/ EOL	Time	Date	GearCode	LatDD	LongDD
SWSD082	95	A1	EOL	09:26	20/05/2016	CS	55.749150	0.646339
SWSD003	96	A1	SOL	10:12	20/05/2016	CS	55.787020	0.674190
SWSD003	96	A1	EOL	10:23	20/05/2016	CS	55.786210	0.673379
SWSD075	97	A1	SOL	11:18	20/05/2016	CS	55.746190	0.600181
SWSD075	97	A1	EOL	11:28	20/05/2016	CS	55.745720	0.598917
SWSD074	98	A1	SOL	12:08	20/05/2016	CS	55.710460	0.596332
SWSD074	98	A1	EOL	12:18	20/05/2016	CS	55.709870	0.595282
SWSD073	99	A1	SOL	12:48	20/05/2016	CS	55.721200	0.581751
SWSD073	99	A1	EOL	12:58	20/05/2016	CS	55.722030	0.582191
SWSD069	100	A1	SOL	13:36	20/05/2016	CS	55.707020	0.549030
SWSD069	100	A1	EOL	13:46	20/05/2016	CS	55.707820	0.549518
SWSD070	101	A1	SOL	14:24	20/05/2016	CS	55.742180	0.552594
SWSD070	101	A1	EOL	14:34	20/05/2016	CS	55.743010	0.552351
SWSD004	102	A1	SOL	15:30	20/05/2016	CS	55.779790	0.578040
SWSD004	102	A1	EOL	15:41	20/05/2016	CS	55.779790	0.579776
SWSD008	103	A1	SOL	16:46	20/05/2016	CS	55.751380	0.513077
SWSD008	103	A1	EOL	16:57	20/05/2016	CS	55.751650	0.511552
SWSD006	104	A1	SOL	17:40	20/05/2016	CS	55.701700	0.477660
SWSD006	104	A1	EOL	17:52	20/05/2016	CS	55.700790	0.477150
SWSD238	105	A1	-	18:39	20/05/2016	HG	55.626970	0.424494
SWSD239	106	A1	-	19:19	20/05/2016	HG	55.637660	0.564793
SWSD254	107	A1	-	20:02	20/05/2016	HG	55.573490	0.652533
SWSD030	108	A1	-	21:05	20/05/2016	HG	55.519790	0.880972
SWSD088	109	A1	-	21:27	20/05/2016	HG	55.533110	0.891541
SWSD090	110	A1	-	21:45	20/05/2016	HG	55.545370	0.900782
SWSD089	111	A1	-	22:05	20/05/2016	HG	55.556170	0.886051
SWSD091	112	A1	-	22:23	20/05/2016	HG	55.568520	0.895193
SWSD092	113	A1	-	22:48	20/05/2016	HG	55.591590	0.889705
SWSD031	114	A1	-	23:14	20/05/2016	HG	55.594170	0.935148
SWSD095	115	A1	-	23:33	20/05/2016	HG	55.582820	0.928027
SWSD097	116	A1	-	23:55	20/05/2016	HG	55.571860	0.942125
SWSD099	117	A1	-	00:14	21/05/2016	HG	55.561130	0.956962
SWSD096	118	A1	-	00:35	21/05/2016	HG	55.548810	0.947419
SWSD094	119	A1	-	00:52	21/05/2016	HG	55.536260	0.938648
SWSD093	120	A1	-	01:11	21/05/2016	HG	55.523800	0.929485
SWSD100	121	A1	-	01:36	21/05/2016	HG	55.527110	0.976537
SWSD098	122	A1	-	01:57	21/05/2016	HG	55.537910	0.962430
SWSD102	123	A1	-	02:20	21/05/2016	HG	55.552290	0.994938
SWSD101	124	A1	-	02:38	21/05/2016	HG	55.562890	0.980434
SWSD103	125	A1	-	02:55	21/05/2016	HG	55.575320	0.989602
SWSD104	126	A1	-	03:31	21/05/2016	HG	55.598470	0.984292
SWSD106	127	A1	-	03:47	21/05/2016	HG	55.587760	0.999018
SWSD108	128	A1	-	04:04	21/05/2016	HG	55.589560	1.022237

StnCode	Stn Num	Attempt	SOL/ EOL	Time	Date	GearCode	LatDD	LongDD
SWSD107	129	A1	-	04:26	21/05/2016	HG	55.566500	1.027715
SWSD105	130	A1	-	04:48	21/05/2016	HG	55.541530	1.009304
SWSD029	131	A1	-	05:05	21/05/2016	HG	55.529780	1.023548
SWSD111	132	A1	-	05:26	21/05/2016	HG	55.545020	1.056823
SWSD109	133	A1	-	05:42	21/05/2016	HG	55.555680	1.042173
SWSD112	134	A1	-	05:59	21/05/2016	HG	55.568190	1.051167
SWSD113	135	A1	-	06:18	21/05/2016	HG	55.591370	1.046272
SWSD028	136	A1	-	07:00	21/05/2016	HG	55.604310	1.078614
SWSD117	137	A1	-	07:19	21/05/2016	HG	55.593110	1.069459
SWSD028	138	A1	-	07:38	21/05/2016	HG	55.604620	1.078501
SWSD118	139	A1	-	07:59	21/05/2016	HG	55.582220	1.083886
SWSD116	140	A1	-	08:24	21/05/2016	HG	55.569900	1.074876
SWSD115	141	A1	-	08:51	21/05/2016	HG	55.546860	1.080096
SWSD110	142	A1	-	09:30	21/05/2016	HG	55.522030	1.061498
SWSD114	143	A1	-	09:51	21/05/2016	HG	55.523570	1.085227
SWSD114	143	A2	-	09:56	21/05/2016	HG	55.523450	1.085193
SWSD250	144	A1	-	10:34	21/05/2016	HG	55.539940	1.164678
SWSD028	145	A1	SOL	11:46	21/05/2016	CS	55.604400	1.079525
SWSD028	145	A1	EOL	11:56	21/05/2016	CS	55.604710	1.080932
SWSD116	146	A1	SOL	12:40	21/05/2016	CS	55.569870	1.074632
SWSD116	146	A1	EOL	12:52	21/05/2016	CS	55.570810	1.075048
SWSD111	147	A1	SOL	13:31	21/05/2016	CS	55.544920	1.056628
SWSD111	147	A1	EOL	13:41	21/05/2016	CS	55.544150	1.056310
SWSD111	148	A1	-	13:50	21/05/2016	HG	55.543750	1.055992
SWSD105	149	A1	SOL	14:34	21/05/2016	CS	55.541400	1.009333
SWSD105	149	A1	EOL	14:45	21/05/2016	CS	55.542270	1.009359
SWSD245	150	A1	-	15:45	21/05/2016	HG	55.668870	0.991165
SWSD244	151	A1	-	16:35	21/05/2016	HG	55.757510	0.989246
SWSD026	152	A1	-	17:04	21/05/2016	HG	55.743160	1.046746
SWSD119	153	A1	-	17:23	21/05/2016	HG	55.754600	1.056733
SWSD123	154	A1	-	17:40	21/05/2016	HG	55.756370	1.080235
SWSD124	155	A1	-	18:03	21/05/2016	HG	55.779870	1.075032
SWSD120	156	A1	-	18:20	21/05/2016	HG	55.777950	1.051631
SWSD121	157	A1	-	18:37	21/05/2016	HG	55.790430	1.060740
SWSD122	158	A1	-	19:02	21/05/2016	HG	55.813470	1.055274
SWSD125	159	A1	-	19:22	21/05/2016	HG	55.826080	1.064097
SWSD002	160	A1	-	19:43	21/05/2016	HG	55.817160	1.100798
SWSD133	161	A1	-	19:59	21/05/2016	HG	55.818600	1.125995
SWSD131	162	A1	-	20:31	21/05/2016	HG	55.806330	1.117128
SWSD127	163	A1	-	20:54	21/05/2016	HG	55.804480	1.093537
SWSD129	164	A1	-	21:21	21/05/2016	HG	55.793770	1.107958
SWSD130	165	A1	-	21:43	21/05/2016	HG	55.783230	1.121918
SWSD128	166	A1	-	22:04	21/05/2016	HG	55.770650	1.112921

StnCode	Stn Num	Attempt	SOL/ EOL	Time	Date	GearCode	LatDD	LongDD
SWSD126	167	A1	-	22:24	21/05/2016	HG	55.758150	1.103898
SWSD132	168	A1	-	22:50	21/05/2016	HG	55.749270	1.141950
SWSD134	169	A1	-	23:14	21/05/2016	HG	55.761510	1.150891
SWSD135	170	A1	-	23:33	21/05/2016	HG	55.773790	1.160245
SWSD135	170	A2	-	23:40	21/05/2016	HG	55.773800	1.160272
SWSD138	171	A1	-	23:59	21/05/2016	HG	55.786250	1.169497
SWSD136	172	A1	-	00:21	22/05/2016	HG	55.797080	1.154903
SWSD139	173	A1	-	00:45	22/05/2016	HG	55.809380	1.164345
SWSD140	174	A1	-	01:04	22/05/2016	HG	55.810990	1.188256
SWSD142	175	A1	-	01:23	22/05/2016	HG	55.800600	1.202603
SWSD145	176	A1	-	01:44	22/05/2016	HG	55.789870	1.217053
SWSD141	177	A1	-	02:04	22/05/2016	HG	55.777520	1.207975
SWSD137	178	A1	-	02:26	22/05/2016	HG	55.763250	1.174748
SWSD027	179	A1	-	02:44	22/05/2016	HG	55.754260	1.187762
SWSD143	180	A1	-	03:06	22/05/2016	HG	55.743490	1.227434
SWSD146	181	A1	-	03:42	22/05/2016	HG	55.755860	1.236818
SWSD144	182	A1	-	03:59	22/05/2016	HG	55.766630	1.222461
SWSD149	183	A1	-	04:21	22/05/2016	HG	55.780670	1.255347
SWSD150	184	A1	-	04:41	22/05/2016	HG	55.803970	1.250429
SWSD148	185	A1	-	04:59	22/05/2016	HG	55.814630	1.235801
SWSD001	186	A1	-	05:16	22/05/2016	HG	55.827130	1.244149
SWSD147	187	A1	-	05:34	22/05/2016	HG	55.825300	1.221553
SWSD133	188	A1	SOL	06:27	22/05/2016	CS	55.818470	1.126150
SWSD133	188	A1	EOL	06:38	22/05/2016	CS	55.818060	1.124809
SWSD131	189	A1	SOL	07:24	22/05/2016	CS	55.806300	1.117368
SWSD131	189	A1	EOL	07:34	22/05/2016	CS	55.805640	1.116433
SWSD130	190	A1	SOL	08:07	22/05/2016	CS	55.783230	1.122571
SWSD130	190	A1	EOL	08:18	22/05/2016	CS	55.782390	1.121927
SWSD027	191	A1	SOL	09:12	22/05/2016	CS	55.754160	1.187943
SWSD027	191	A1	EOL	09:26	22/05/2016	CS	55.753060	1.188720
SWSD141	192	A1	SOL	11:56	22/05/2016	CS	55.777780	1.207749
SWSD141	192	A1	EOL	12:06	22/05/2016	CS	55.777020	1.208331
SWSD149	193	A1	SOL	12:39	22/05/2016	CS	55.780530	1.254933
SWSD149	193	A1	EOL	12:49	22/05/2016	CS	55.781090	1.255976
SWSD001	194	A1	SOL	13:36	22/05/2016	CS	55.827780	1.243408
SWSD001	194	A1	EOL	13:47	22/05/2016	CS	55.828510	1.242633
SWSD215	195	A1	-	14:33	22/05/2016	HG	55.901910	1.299734
SWSD201	196	A1	-	15:23	22/05/2016	HG	55.965930	1.213439
SWSD214	197	A1	-	16:32	22/05/2016	HG	55.891930	1.156913
SWSD213	198	A1	-	17:18	22/05/2016	HG	55.882040	1.014840
SWSD203	199	A1	-	17:59	22/05/2016	HG	55.946040	0.926856
SWSD204	200	A1	-	18:44	22/05/2016	HG	55.935960	0.783940
SWSD211	201	A1	-	18:44	22/05/2016	HG	55.861420	0.729359

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SWSD210	202	A1	-	20:20	22/05/2016	HG	55.851040	0.586974
MB_BOX2_CTD1	203	A1	-	21:35	22/05/2016	CTD	55.793270	0.709253
MB_BOX2_01	204	A1	SOL	22:08	22/05/2016	MB2	55.789170	0.707295
MB_BOX2_01	204	A1	EOL	23:12	22/05/2016	MB2	55.770660	0.458122
MB_BOX2_02	204	A1	SOL	23:23	22/05/2016	MB2	55.758790	0.457565
MB_BOX2_02	204	A1	EOL	00:29	22/05/2016	MB2	55.777620	0.703095
MB_BOX2_03	204	A1	SOL	00:41	22/05/2016	MB2	55.765380	0.702527
MB_BOX2_03	204	A1	EOL	01:45	22/05/2016	MB2	55.746870	0.454932
MB_BOX2_04	204	A1	SOL	01:59	22/05/2016	MB2	55.735190	0.458049
MB_BOX2_04	204	A1	EOL	03:05	22/05/2016	MB2	55.754330	0.707532
MB_BOX2_05	204	A1	SOL	03:16	22/05/2016	MB2	55.742240	0.705320
MB_BOX2_05	204	A1	EOL	04:20	22/05/2016	MB2	55.723270	0.458426
MB_BOX2_06	204	A1	SOL	04:33	22/05/2016	MB2	55.711570	0.456931
MB_BOX2_06	204	A1	EOL	05:38	22/05/2016	MB2	55.730480	0.704283
MB_BOX2_07	204	A1	SOL	05:48	22/05/2016	MB2	55.718830	0.705945
MB_BOX2_07	204	A1	EOL	06:51	22/05/2016	MB2	55.700310	0.458718
MB_BOX2_08	204	A1	SOL	07:01	22/05/2016	MB2	55.689910	0.456563
MB_BOX2_08	204	A1	EOL	08:05	22/05/2016	MB2	55.708310	0.703828
MB_BOX2_09	204	A1	SOL	08:18	22/05/2016	MB2	55.696880	0.704500
MB_BOX2_09	204	A1	EOL	09:22	22/05/2016	MB2	55.677970	0.457847
MB_BOX2_10	204	A1	SOL	09:39	22/05/2016	MB2	55.666580	0.460400
MB_BOX2_10	204	A1	EOL	10:41	22/05/2016	MB2	55.685090	0.704598
MB_BOX2_10.5	204	A1	SOL	10:56	22/05/2016	MB2	55.673390	0.705934
MB_BOX2_10.5	204	A1	EOL	11:59	22/05/2016	MB2	55.654420	0.455595
MB_BOX2_12	204	A1	SOL	12:12	22/05/2016	MB2	55.642190	0.452090
MB_BOX2_12	204	A1	EOL	13:21	22/05/2016	MB2	55.661440	0.703871
MB_BOX2_13	204	A1	SOL	13:34	22/05/2016	MB2	55.649680	0.704845
MB_BOX2_13	204	A1	EOL	14:39	22/05/2016	MB2	55.630780	0.455889
MB_BOX2_14	204	A1	SOL	15:01	22/05/2016	MB2	55.619340	0.452271
MB_BOX2_14	204	A1	EOL	15:22	22/05/2016	MB2	55.624770	0.528825
MB_BOX2_24	204	A1	SOL	15:26	22/05/2016	MB2	55.628130	0.536511
MB_BOX2_24	204	A1	EOL	16:45	22/05/2016	MB2	55.803780	0.520893
MB_BOX2_CTD2	205	A1	-	16:52	23/05/2016	CTD	55.806730	0.511704
MB_BOX2_251294	206	A1	SOL	17:31	23/05/2016	MB2	55.781930	0.452146
MB_BOX2_251294	206	A1	EOL	18:06	23/05/2016	MB2	55.792640	0.594214
MB_BOX2_252588	206	A1	SOL	18:18	23/05/2016	MB2	55.804270	0.594925
MB_BOX2_252588	206	A1	EOL	18:56	23/05/2016	MB2	55.792850	0.441912
MB_BOX2_253882	206	A1	SOL	19:06	23/05/2016	MB2	55.805420	0.450078
MB_BOX2_253882	206	A1	EOL	19:22	23/05/2016	MB2	55.810080	0.514064
MB_BOX2-24.200	206	A1	SOL	19:23	23/05/2016	MB2	55.808420	0.516890
MB_BOX2-24.200	206	A1	EOL	20:46	23/05/2016	MB2	55.624890	0.533834
MB_BOX3_CTD1	207	A1	-	21:48	23/05/2016	CTD	55.582900	0.740241
MB_BOX31294	208	A1	SOL	22:19	23/05/2016	MB2	55.580490	0.738111

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MB_BOX31294	208	A1	EOL	23:25	23/05/2016	MB2	55.599330	0.996210
MB_BOX3	208	A1	SOL	23:41	23/05/2016	MB2	55.587780	0.999586
MB_BOX3	208	A1	EOL	00:45	23/05/2016	MB2	55.569210	0.747126
MB_BOX3-1294	208	A1	SOL	01:01	23/05/2016	MB2	55.557600	0.748703
MB_BOX3-1294	208	A1	EOL	02:09	23/05/2016	MB2	55.576260	1.001696
MB_BOX3-2588	208	A1	SOL	02:20	23/05/2016	MB2	55.564600	1.004246
MB_BOX3-2588	208	A1	EOL	03:24	23/05/2016	MB2	55.546150	0.751281
MB_BOX3-3882	208	A1	SOL	03:35	23/05/2016	MB2	55.534420	0.752804
MB_BOX3-3882	208	A1	EOL	04:41	23/05/2016	MB2	55.553090	1.005791
MB_BOX3-5176	208	A1	SOL	04:52	23/05/2016	MB2	55.541740	1.009695
MB_BOX3-5176	208	A1	EOL	06:10	23/05/2016	MB2	55.518420	0.695231
MB_BOX3-6470	208	A1	SOL	06:32	23/05/2016	MB2	55.511330	0.756576
MB_BOX3-6470	208	A1	EOL	07:37	23/05/2016	MB2	55.530010	1.011498
WRECK1	208	A1	SOL	07:46	23/05/2016	MB2	55.538170	0.985093
WRECK1	208	A1	EOL	07:48	23/05/2016	MB2	55.539680	0.983698
WRECK1 (Re-run)	208	A1	SOL	07:54	23/05/2016	MB2	55.541870	0.982169
WRECK1 (Re-run)	208	A1	EOL	07:55	23/05/2016	MB2	55.540410	0.983793
MB_BOX3-7764	208	A1	SOL	08:16	23/05/2016	MB2	55.518480	1.013887
MB_BOX3-7764	208	A1	EOL	09:18	23/05/2016	MB2	55.500120	0.763340
SWSD090	209	A1	SOL	10:31	24/05/2016	DC	55.545060	0.900555
SWSD090	209	A1	EOL	10:40	24/05/2016	DC	55.544620	0.897330
SWSD099	210	A1	SOL	12:02	24/05/2016	DC	55.561650	0.956870
SWSD099	210	A1	EOL	12:12	24/05/2016	DC	55.563010	0.956716
SWSD097	211	A1	SOL	12:36	24/05/2016	DC	55.571990	0.942696
SWSD097	211	A1	EOL	12:46	24/05/2016	DC	55.574150	0.941397
SWSD089	212	A1	SOL	13:17	24/05/2016	DC	55.555870	0.886508
SWSD089	212	A1	EOL	13:27	24/05/2016	DC	55.557520	0.886532
SWSD255	213	A1	-	15:06	24/05/2016	HG	55.562710	0.511800
SWSD257	214	A1	-	15:54	24/05/2016	HG	55.551920	0.370093
SWSD258	215	A1	-	16:50	24/05/2016	HG	55.541090	0.228252
SWSD264	327	A1	-	14:12	27/05/2016	HG	55.628820	0.446789
SWSD267	328	A1	-	14:35	27/05/2016	HG	55.642570	0.446016
SWSD265	329	A1	-	14:52	27/05/2016	HG	55.649680	0.438623
SWSD261	330	A1	-	15:09	27/05/2016	HG	55.655460	0.426476
SWSD263	331	A1	-	15:28	27/05/2016	HG	55.670270	0.420007
SWSD266	332	A1	-	15:46	27/05/2016	HG	55.676120	0.433939
SWSD268	333	A1	-	16:40	27/05/2016	HG	55.688440	0.443280
SWSD275	334	A1	-	17:05	27/05/2016	HG	55.690360	0.466591
SWSD281	335	A1	-	17:21	27/05/2016	HG	55.692270	0.489627
SWSD277	336	A1	-	17:37	27/05/2016	HG	55.679480	0.480709
SWSD280	337	A1	-	17:54	27/05/2016	HG	55.668680	0.495193
SWSD274	338	A1	-	18:08	27/05/2016	HG	55.667280	0.471806
SWSD271	339	A1	-	18:23	27/05/2016	HG	55.654440	0.463153

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SWSD271	339	A2	-	18:28	27/05/2016	HG	55.654540	0.462823
SWSD271	339	A3	-	18:31	27/05/2016	HG	55.654550	0.462688
SWSD273	340	A1	-	18:46	27/05/2016	HG	55.644060	0.477760
SWSD273	340	A2	-	18:52	27/05/2016	HG	55.643980	0.476866
SWSD273	340	A3	-	18:58	27/05/2016	HG	55.643750	0.476710
SWSD270	341	A1	-	19:12	27/05/2016	HG	55.631480	0.468510
SWSD272	342	A1	-	19:33	27/05/2016	HG	55.620780	0.483012
SWSD269	343	A1	-	19:46	27/05/2016	HG	55.610480	0.496399
SWSD269	343	A2	-	19:50	27/05/2016	HG	55.610730	0.495708
SWSD278	344	A1	-	20:10	27/05/2016	HG	55.622490	0.506379
SWSD278	344	A2	-	20:13	27/05/2016	HG	55.622600	0.505937
SWSD276	345	A1	-	20:44	27/05/2016	HG	55.633430	0.492236
SWSD279	346	A1	-	21:02	27/05/2016	HG	55.645950	0.501739
SWSD284	347	A1	-	21:23	27/05/2016	HG	55.647930	0.524772
SWSD282	348	A1	-	21:46	27/05/2016	HG	55.658590	0.510310
SWSD285	349	A1	-	22:05	27/05/2016	HG	55.671080	0.519332
SWSD283	350	A1	-	22:28	27/05/2016	HG	55.682710	0.515082
SWSD288	351	A1	-	22:54	27/05/2016	HG	55.691930	0.528037
SWSD288	351	A2	-	22:58	27/05/2016	HG	55.692050	0.528269
SWSD288	351	A3	-	23:04	27/05/2016	HG	55.692330	0.528510
SWSD288	351	A4	-	23:18	27/05/2016	HG	55.692030	0.526267
SWSD293	352	A1	-	23:40	27/05/2016	HG	55.685170	0.552178
SWSD295	353	A1	-	23:58	27/05/2016	HG	55.674560	0.566262
SWSD291	354	A1	-	00:21	28/05/2016	HG	55.672650	0.543111
SWSD287	355	A1	-	00:39	28/05/2016	HG	55.660380	0.533501
SWSD287	355	A2	-	00:43	28/05/2016	HG	55.660500	0.533380
SWSD287	355	A3	-	00:54	28/05/2016	HG	55.660100	0.533776
SWSD292	356	A1	-	01:17	28/05/2016	HG	55.661900	0.557708
SWSD290	357	A1	-	01:36	28/05/2016	HG	55.649720	0.548251
SWSD294	358	A1	-	01:55	28/05/2016	HG	55.651460	0.572212
SWSD294	358	A2	-	01:59	28/05/2016	HG	55.651470	0.572207
SWSD294	358	A3	-	02:06	28/05/2016	HG	55.651090	0.571765
SWSD297	359	A1	-	02:29	28/05/2016	HG	55.638780	0.565133
SWSD297	359	A2	-	02:32	28/05/2016	HG	55.638810	0.565125
SWSD297	359	A3	-	02:37	28/05/2016	HG	55.638130	0.565114
SWSD297	359	A4	-	02:45	28/05/2016	HG	55.638460	0.564645
SWSD286	360	A1	-	03:31	28/05/2016	HG	55.637150	0.539990
SWSD289	361	A1	-	03:51	28/05/2016	HG	55.626480	0.554447
SWSD301	362	A1	-	04:11	28/05/2016	HG	55.628520	0.578455
SWSD301	362	A2	-	04:14	28/05/2016	HG	55.628180	0.577412
SWSD296	363	A1	-	04:32	28/05/2016	HG	55.640820	0.586784
SWSD298	364	A1	-	04:48	28/05/2016	HG	55.653260	0.596172
SWSD299	365	A1	-	05:09	28/05/2016	HG	55.665520	0.604414

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SWSD303	366	A1	-	05:33	28/05/2016	HG	55.677610	0.614798
SWSD300	367	A1	-	05:52	28/05/2016	HG	55.689350	0.604146
SWSD306	368	A1	-	06:10	28/05/2016	HG	55.690290	0.622161
SWSD306	368	A2	-	16:13	28/05/2016	HG	55.689830	0.621563
SWSD307	369	A1	-	07:04	28/05/2016	HG	55.679650	0.636729
SWSD305	370	A1	-	07:21	28/05/2016	HG	55.667260	0.628451
SWSD305	370	A2	-	07:26	28/05/2016	HG	55.667100	0.628841
SWSD302	371	A1	-	07:42	28/05/2016	HG	55.654800	0.619797
SWSD302	371	A2	-	07:46	28/05/2016	HG	55.654590	0.619538
SWSD304	372	A1	-	08:02	28/05/2016	HG	55.644000	0.633688
SWSD304	372	A2	-	08:08	28/05/2016	HG	55.644120	0.634690
SWSD272	373	A1	SOL	09:14	28/05/2016	DC	55.620570	0.483516
SWSD272	373	A1	EOL	09:27	28/05/2016	DC	55.619680	0.483383
SWSD270	374	A1	SOL	10:04	28/05/2016	DC	55.632960	0.468057
SWSD270	374	A1	EOL	10:14	28/05/2016	DC	55.632180	0.468631
SWSD265	375	A1	SOL	10:40	28/05/2016	DC	55.649850	0.437906
SWSD265	375	A1	EOL	10:53	28/05/2016	DC	55.650280	0.437278
SWSD263	376	A1	SOL	11:16	28/05/2016	DC	55.670490	0.420216
SWSD263	376	A1	EOL	11:26	28/05/2016	DC	55.670740	0.418391
SWSD288	377	A1	SOL	12:04	28/05/2016	DC	55.692550	0.528480
SWSD288	377	A1	EOL	12:14	28/05/2016	DC	55.692980	0.530245
SWSD283	378	A1	SOL	12:33	28/05/2016	DC	55.682720	0.514524
SWSD283	378	A1	EOL	12:43	28/05/2016	DC	55.683820	0.514525
SWSD285	379	A1	SOL	13:02	28/05/2016	DC	55.671090	0.519928
SWSD285	379	A1	EOL	13:12	28/05/2016	DC	55.672150	0.521163
SWSD282	380	A1	SOL	13:31	28/05/2016	DC	55.658130	0.510941
SWSD282	380	A1	EOL	13:41	28/05/2016	DC	55.659200	0.510753
SWSD290	381	A1	SOL	14:10	28/05/2016	DC	55.648980	0.548813
SWSD290	381	A1	EOL	14:20	28/05/2016	DC	55.649600	0.547840
SWSD297	382	A1	SOL	14:41	28/05/2016	DC	55.637860	0.565878
SWSD297	382	A1	EOL	14:51	28/05/2016	DC	55.637620	0.564350
SWSD300	383	A1	SOL	15:26	28/05/2016	DC	55.689470	0.606449
SWSD300	383	A1	EOL	15:36	28/05/2016	DC	55.688570	0.605340
SWSD303	384	A1	SOL	15:50	28/05/2016	DC	55.677920	0.614292
SWSD303	384	A1	EOL	16:00	28/05/2016	DC	55.676770	0.612990

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