



JNCC/Cefas Partnership Report Series

Report 43

**CEND1921 Fulmar and Berwick to St Mary's Marine Conservation Zone (MCZ)
2021 Survey Report**

Wood, D., Stones, S., Tate, J. & Lake, I.

December 2024

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Abbreviations

2IC	2 nd in Charge
AV	Added Value
BACI	Before-After-Control-Impact design
BSH	Broadscale Habitats
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CRP	Common reference Point
CTD	Conductivity, Temperature and Depth
Defra	Department for Environment, Food and Rural Affairs
DC	Drop Camera
DDV	Drop-down Video
DIC	Dissolved Inorganic Carbon
DOC	Dissolved Organic Carbon
EOL	End of Line
EUNIS	European Nature Information System
FOCI	Feature of Conservation Interest
GPS	Global Positioning System
HiPAP	High Precision Acoustic Positioning
JNCC	Joint Nature Conservation Committee
MCZ	Marine Conservation Zone
MESH	Mapping European Seabed Habitats
MPA	Marine Protected Area
NIOZ	Royal Netherlands Institute for Sea Research box corer
PAH	Polycyclic Aromatic Hydrocarbons
PIC	Particulate Inorganic Carbon
POC	Particulate Organic Carbon
PON	Particulate Organic Nitrogen
PSA	Particle Size Analysis
ROG	Recommended Operating Guidelines
RV	Research Vessel
SIC	Scientist in Charge
SOL	Start of Line
SPI	Sediment Profile Imaging
SPM	Suspended Particulate Matter
STR	Subsea Technology and Rentals

1 Introduction

The CEND1921 survey was conducted aboard the RV *Cefas Endeavour* between 28 November and 19 December 2021 to address the requirements of multiple marine programmes.

The survey aimed to acquire seabed data within the Fulmar Marine Conservation Zone (MCZ) and the Berwick to St Mary's MCZ to inform ongoing site condition monitoring, in addition to water column and seabed data acquisition to support wider Defra marine work areas (Blue Carbon and 'Added Value' sampling). In addition to this sampling, maintenance of the SmartBuoy network was scheduled.

This report covers the aims, objectives, survey design and sampling methodologies of the various CEND1921 components, the events of the survey and the data collected. Detailed information on equipment, sampling and processing is presented in Appendix 1 and Appendix 2 (Blue Carbon sampling).

2 Survey components

2.1 Fulmar MCZ

2.1.1. Aims and objectives

The aim of the Fulmar MCZ survey was to collect data from the site to inform assessment of the condition of the feature attributes (extent, distribution, structure, function and supporting processes) of the designated features (the Broadscale Habitats (BSH) Subtidal mud, Subtidal sand and Subtidal mixed sediments, and the species Feature of Conservation Importance (FOCI) ocean quahog (*Arctica islandica*)). The data from this survey will form the first data point (T0) in a monitoring time-series to enable assessment of change in the designated features over time.

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

- Collect high quality imagery at 60 randomly designated stations (150 m transects).
- Collect Particle Size Analysis (PSA) and infauna samples at 60 randomly designated stations coincident with the above camera locations.
- Collect triplicate infauna samples at five of the above grab stations to compare the effectiveness of higher replication sampling (the five stations were assigned randomly).
- Collect multibeam echosounder data within Fulmar MCZ to further improve understanding of BSH distribution (poor weather contingency only).

2.1.2. Survey design and planned sampling

Sixty stations inside the MCZ were selected for sampling. Stations were randomly generated across the site, at which both a camera transect, and a single grab replicate were planned. Five stations were selected for triplicate infaunal grab sampling, requiring three grab deployments. An 800 m safety buffer was applied to all oil and gas infrastructure within the site, as well as a 500 m site edge buffer. An overview of the planned sampling locations is presented in Figure 1.

At each of the 60 stations a single camera sledge transect of approximately 150 m was conducted. To achieve this a 150 m bullring was applied to each target location to facilitate vessel positioning. Once the vessel was on location the camera was deployed to the seabed. On the run-in to the sampling location, stills and video settings were reviewed to ensure that high-quality data were collected. Once the settings were refined, recording commenced, and the vessel proceeded along the line at a speed of 0.3 kts. Still images were acquired at approximately 10 second intervals where visibility allowed, and high-definition video was acquired continuously throughout the transect. Fixes were taken in the Tower software at an interval of 5 seconds, to allow for tracking of the camera sledge and location matching of still images.

A single sample was collected at 55 locations using a 0.1 m² Day grab, with the remaining five stations being sampled in triplicate for PSA and infauna. A photograph was taken in situ, and the depth of each grab sample was measured prior to further processing. A minimum depth of 7 cm, corresponding to roughly 5 L in volume was considered a valid sample. A small subsample was collected for PSA, with the remainder of the sample being sieved over 5 mm and 1 mm sieves, and the resulting faunal residue being fixed in a 4% formaldehyde solution for analysis. At stations where triplicate sampling was carried out, the PSA sample was obtained from the first grab sample only.

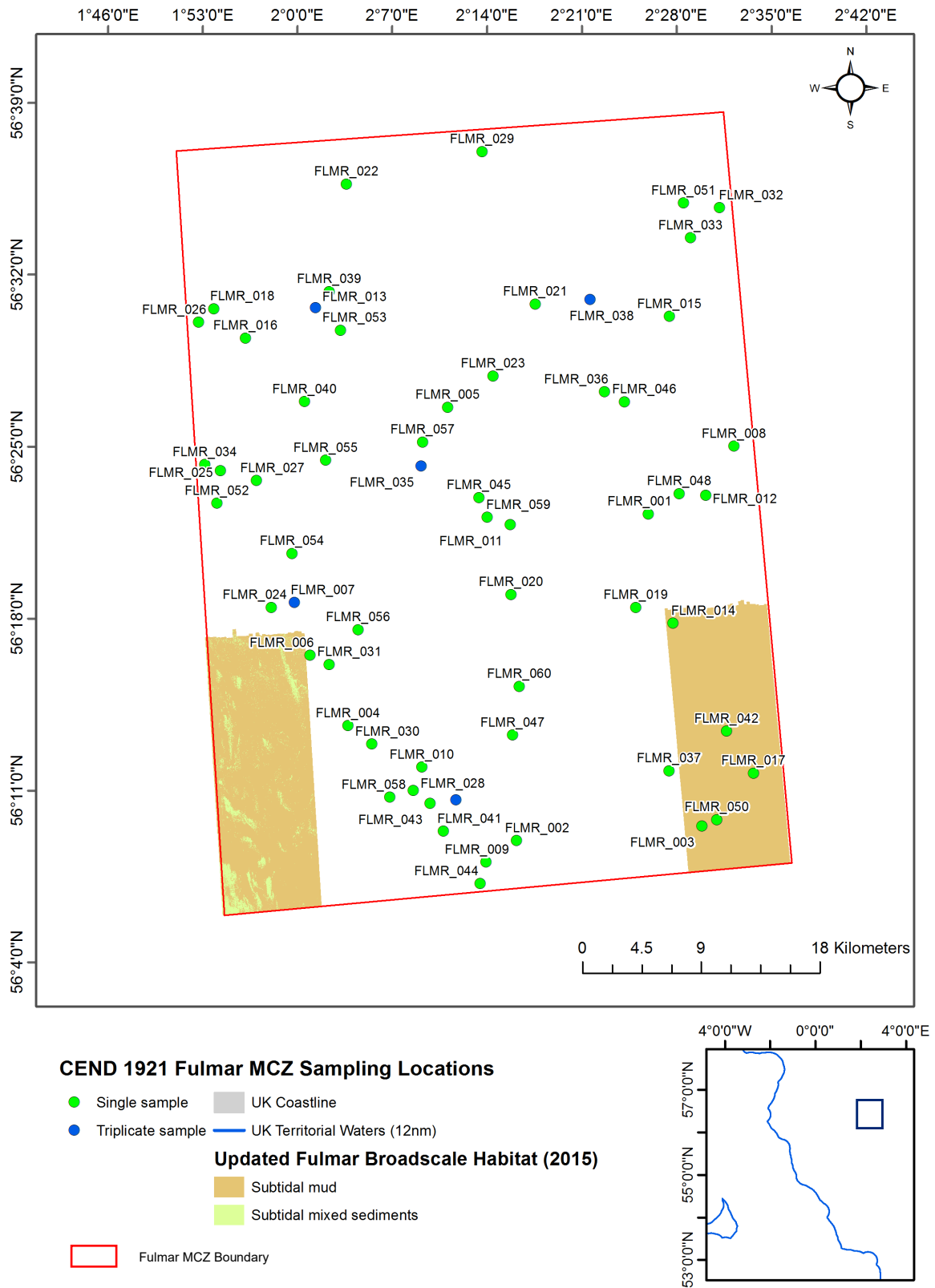


Figure 1. Fulmar MCZ CEND1921 planned sampling stations.

2.2 Berwick to St Mary's MCZ

2.2.1. Aims and objectives

The CEND1921 survey re-visits previous survey stations designed with the aim of quantifying the extent and the distribution of the undesignated habitat Feature of FOCI 'Sea Pen and Burrowing Megafauna Communities', and the BSH Subtidal mud, within the Berwick to St Mary's MCZ.

The objectives for 2021 sampling to achieve this aim were:

- Acquire high quality biological infauna, sediment granulometry and relevant physico-chemical data of suitable resolution to allow temporal and spatial variability in the sediment BSH extent, distribution, and community structure to be established. These data will also provide evidence on extent, distribution and community structure of 'Sea Pen and burrowing Megafauna Communities' habitat and allow for Before-After-Control-Impact (BACI) assessment to be conducted against previously acquired data;
- Acquire high quality video/image data sufficient to verify the extent and distribution of any 'Sea Pen and Burrowing Megafauna Communities' habitat and sediment BSH extents. Denote the main characterising species present within such habitats so that BACI assessments and temporal comparisons can be made, as far as possible, with previous data collected.

2.2.2. Survey design and sampling

The Berwick to St Mary's CEND1921 sampling was intended to re-sample locations from a previous 2016 survey. Stations to be resampled were located both inside and outside of the MPA across grouped into sampling areas shown in Figure 2. Stations were intended to be sampled by a drop-down video (DDV) transect, a 0.1 m² Day grab, NIOZ box corer and Sediment Profile Imagery (SPI) camera system in combination, as set out by previous survey records.

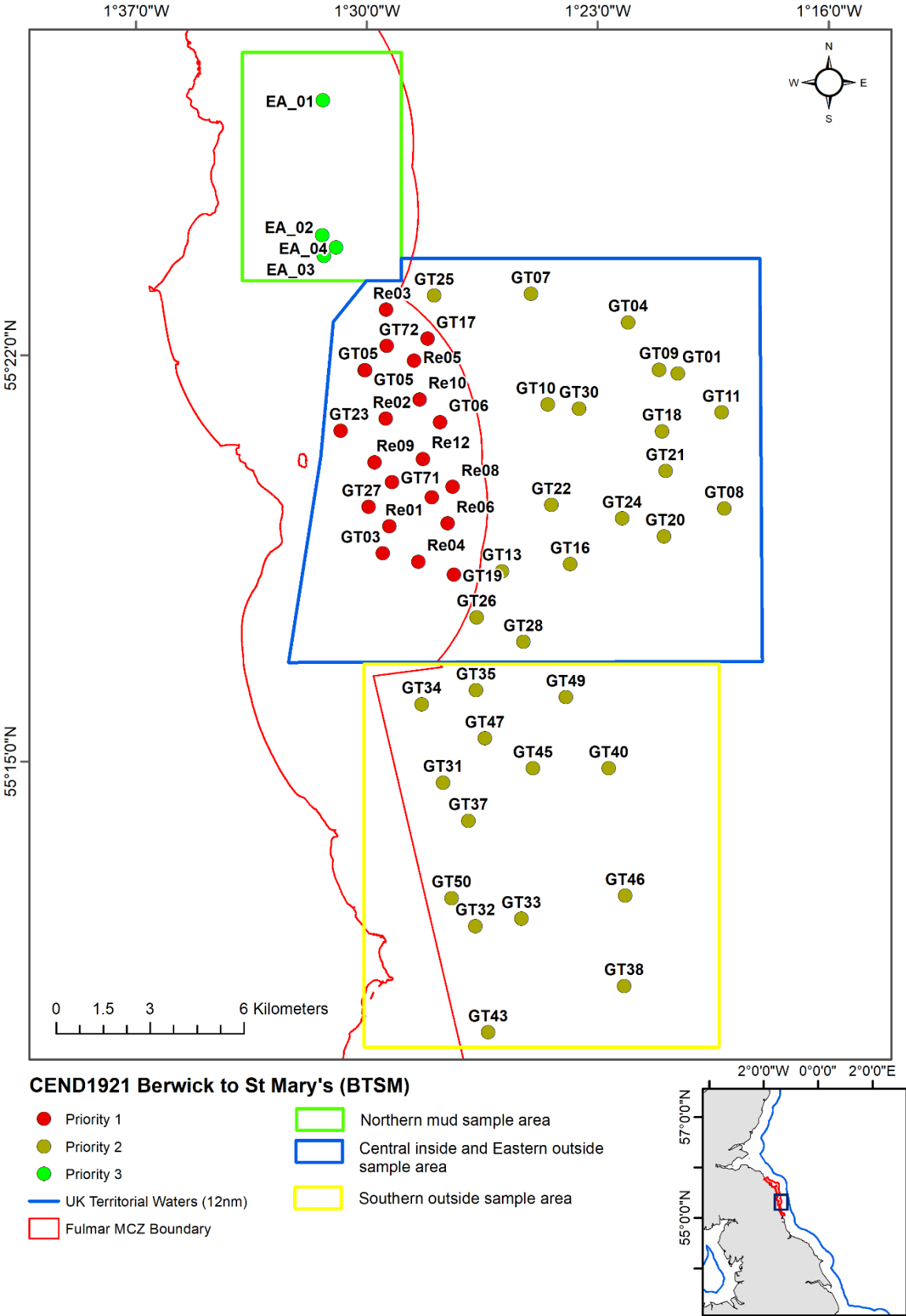


Figure 2. Berwick to St Mary's MCZ CEND1921 planned sampling stations.

2.3 Blue Carbon sampling

2.2.3. Aims and objectives

The aim of the Blue Carbon work was to collect observational data on seabed biogeochemical parameters to inform on carbon stock, burial, and provenance in English Secretary of State North Sea shelf sediments. The work was to be carried out as part of the C8116 research and development programme, to inform Blue Carbon / Nature Based Solutions to Climate Change advice evidence needs. The important considerations of this programme are gradients of fishing pressure (informing carbon vulnerability) and the input of carbon from terrestrial vs marine sources.

Under the Natural Capital Ecosystem Assessment programme an initial attempt was made in February 2021 to collect observational samples for carbon related parameters. Surveys planned for April, August, and November 2021 to inform planning under C8116 using shallow (surface to ~30 cm) NIOZ cores and deep (up to 1.5 m depth) piston cores did not go ahead as planned, primarily due to COVID-related issues. In February 2021, many of the planned stations were missed due to the short survey window available and poor weather. These stations were re-considered for November (CEND1721) and December (CEND1921).

2.2.4. Survey design and sampling

Due to the limited survey time available on CEND1921 the sampling plan was split into two elements to deliver against evidence needs and the survey aims and objectives:

1. 'Drive by stations' (transects A and B): to deliver understanding of burial, stock, and impact from fishing across sediment types (Figure 3).
2. In-shore stations to look at terrestrial / marine C mixes (transect) and response to fishing pressure (Figure 4).

The sampling planned at Blue Carbon stations comprised water column sampling (using a CTD rosette and Niskin water bottles) and sediment sampling using a 0.1 m² NIOZ box corer. Detailed information on the parameters measured and sub-sampling methods used is provided in Appendix 2.

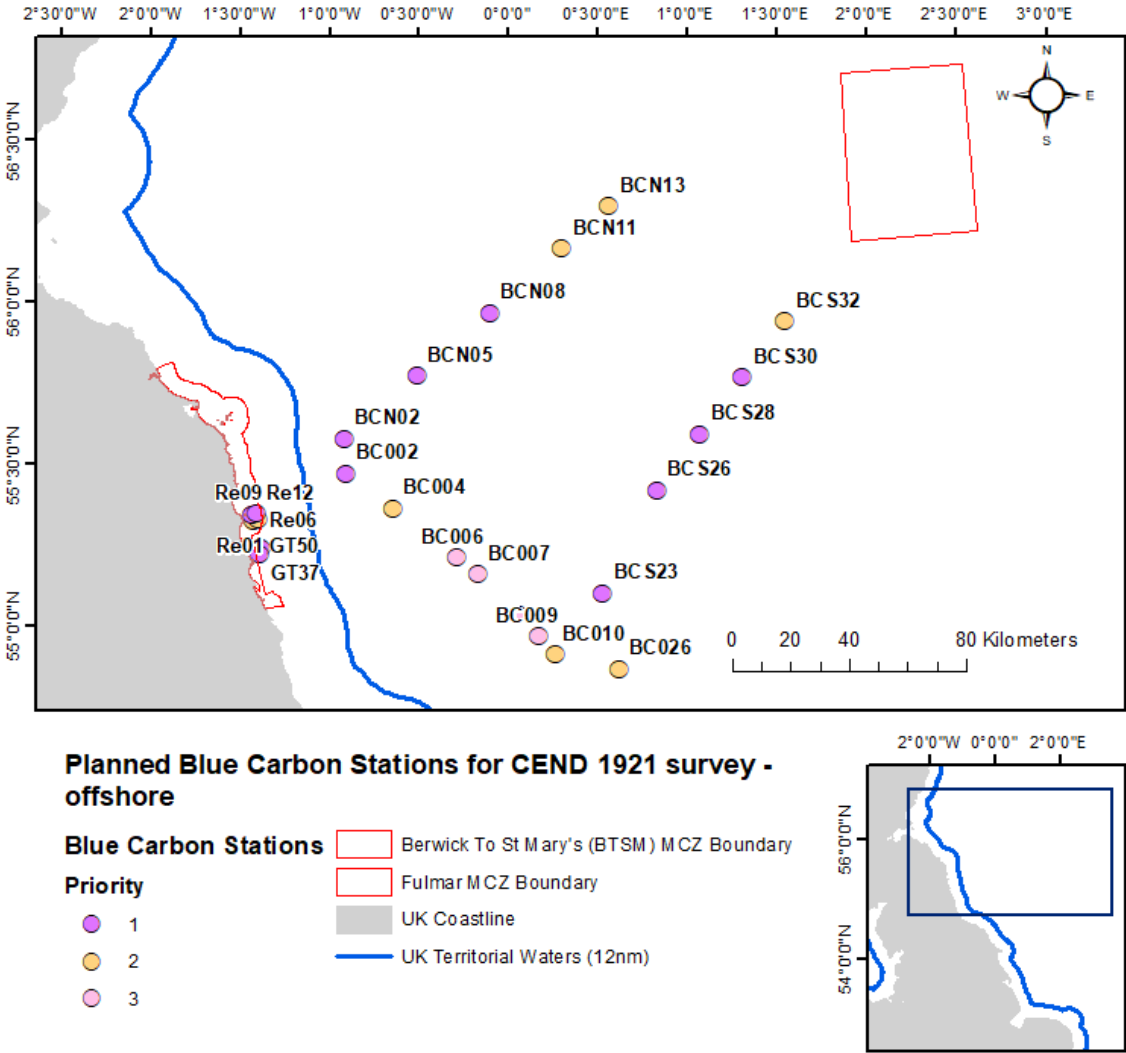
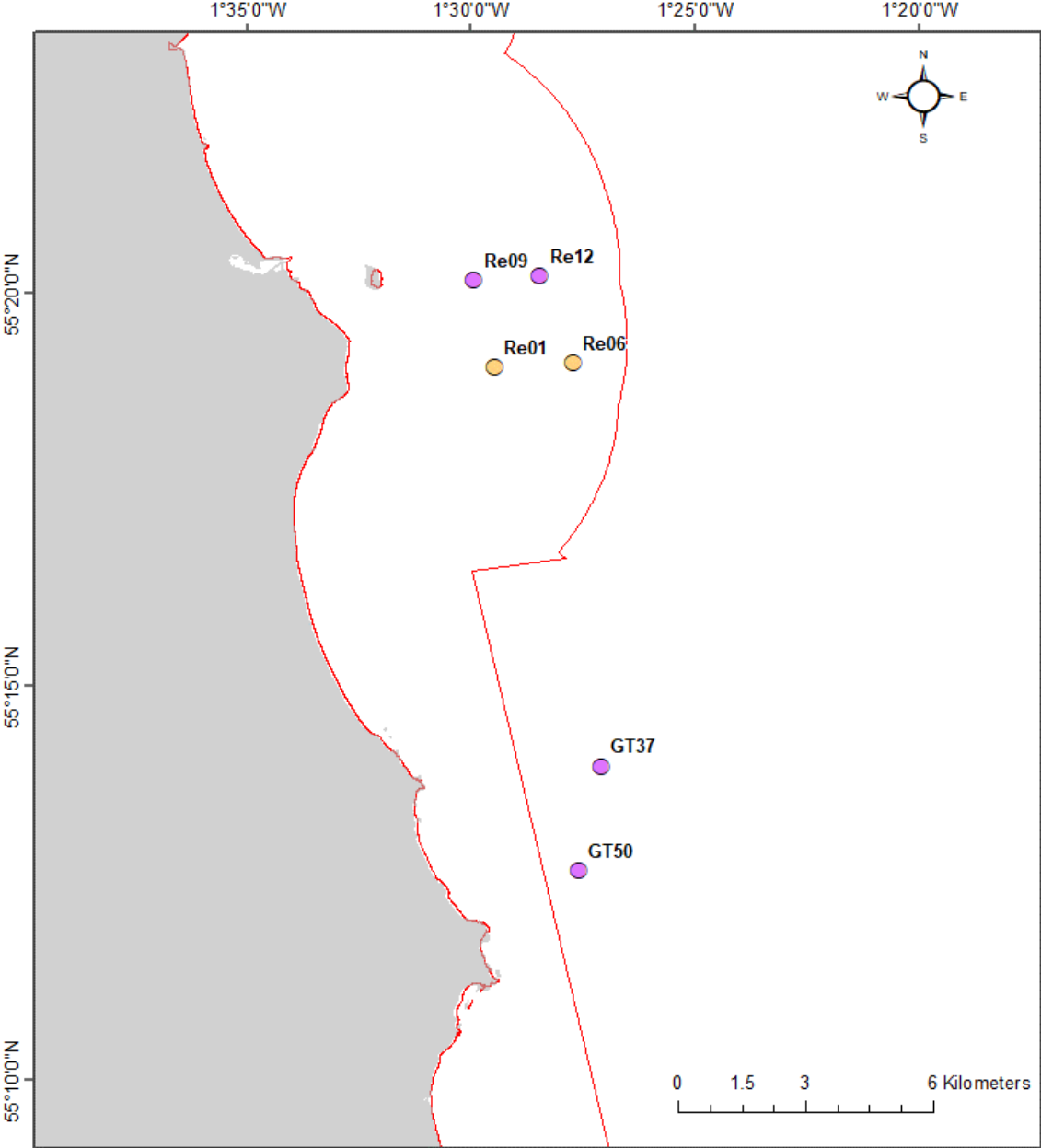
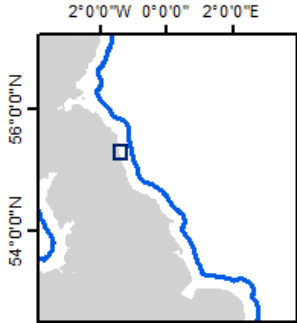


Figure 3. Blue Carbon stations planned for the CEND1921 survey: offshore stations.



Planned Blue Carbon Stations for CEND 1921 survey - inshore

- Blue Carbon Stations**
 - Berwick To St Mary's (BTSM) MCZ Boundary
 - UK Coastline
 - UK Territorial Waters (12nm)
- Priority**
 - 1
 - 2
 - 3



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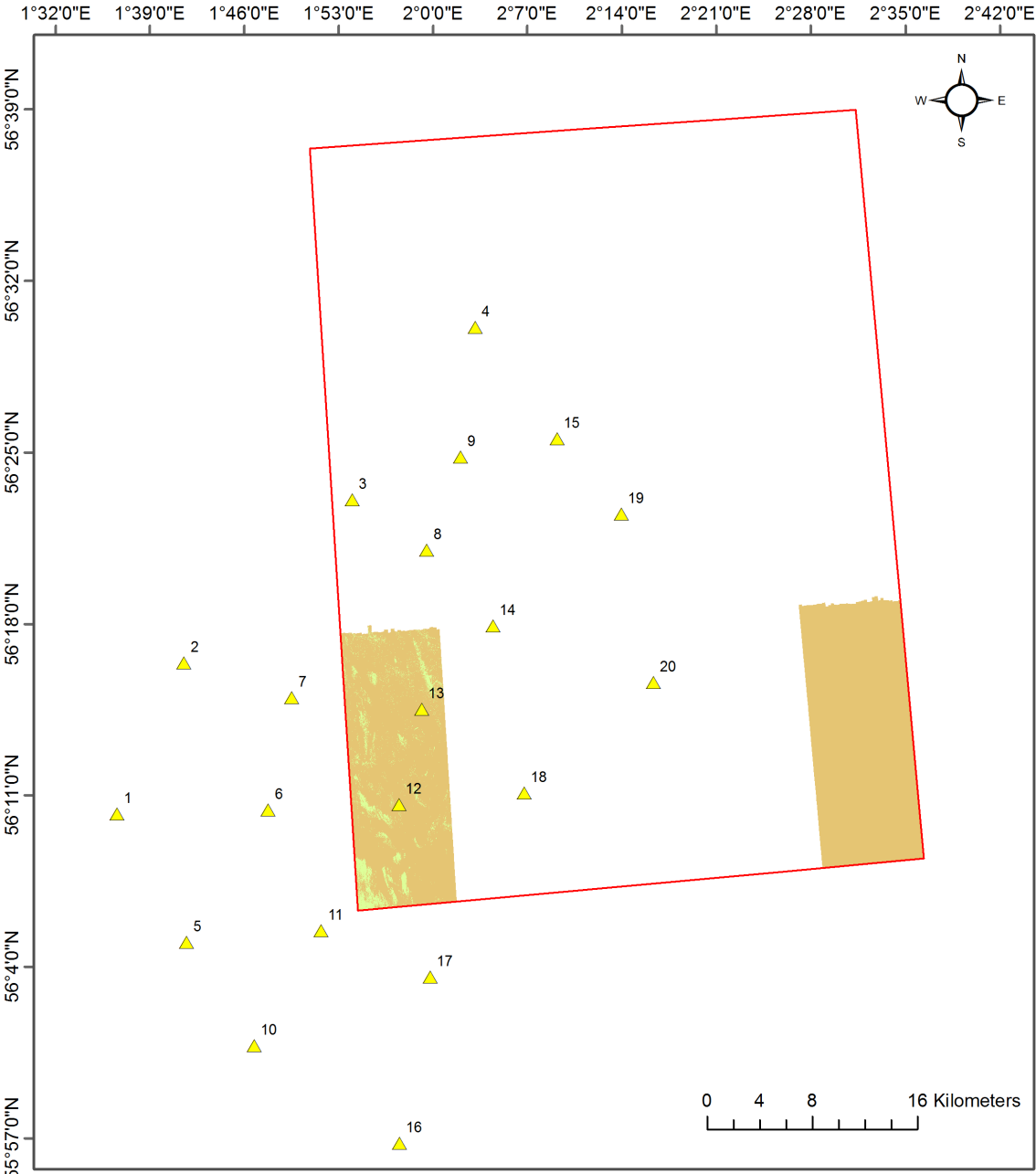
Figure 4. Blue Carbon stations planned for CEND1921 survey: inshore Berwick to St Mary's MCZ stations.

3 'Added Value' sampling at Fulmar MCZ

Under the Marine Natural Capital Ecosystem Assessment, R&D – improving integrated seabed understanding and Biodiversity Evidence Collection (MPA) programmes, a limited number of stations for extended ('Added Value') sampling were incorporated into the survey activities under CEND1921.

A suite of stations for Added Value (AV) sampling were previously identified across the North Sea; of these stations a grid of 20 were identified around the south-west quarter of the Fulmar MCZ, extending out beyond the boundary of the site. Originally identified by means of a triangular grid, some of the stations were manually moved to:

- Re-visit stations previously sampled.
- Maximise the spread of sampling across the range of modelled parameters (% fines / mud, POC – (carbon stock) and estimated fishing effort (derived from averaged VMS data)).
- Ensure sampling stations were not placed within safety buffers of seabed and surface obstructions.



CEND1921 Added Value 20 Stations

- ▲ Added Value Stations
- UK Territorial Waters (12nm)

Updated Fulmar Broadscale Habitat (2015)

- Subtidal mud
- Subtidal mixed sediments
- Fulmar MCZ boundary

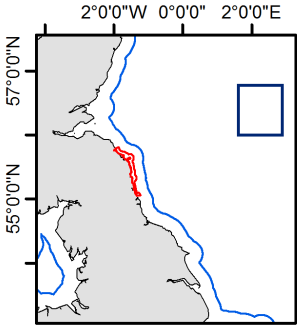


Figure 5. Added Value 20 stations at Fulmar MCZ.

4 SmartBuoy operations

CEND1921 was requested to carry out SmartBuoy and noise lander servicing. These operations were originally planned for CEND1721 but cancelled due to COVID-19. The operations covered two CTD rosette deployments and swapping the Smart Buoy and noise lander at the Warp, swapping the Smart Buoy and a plankton net sample at West Gabbard, swapping of the noise lander at Dowsing, and CTD rosette deployments at the Wash and Humber (Figure 6).

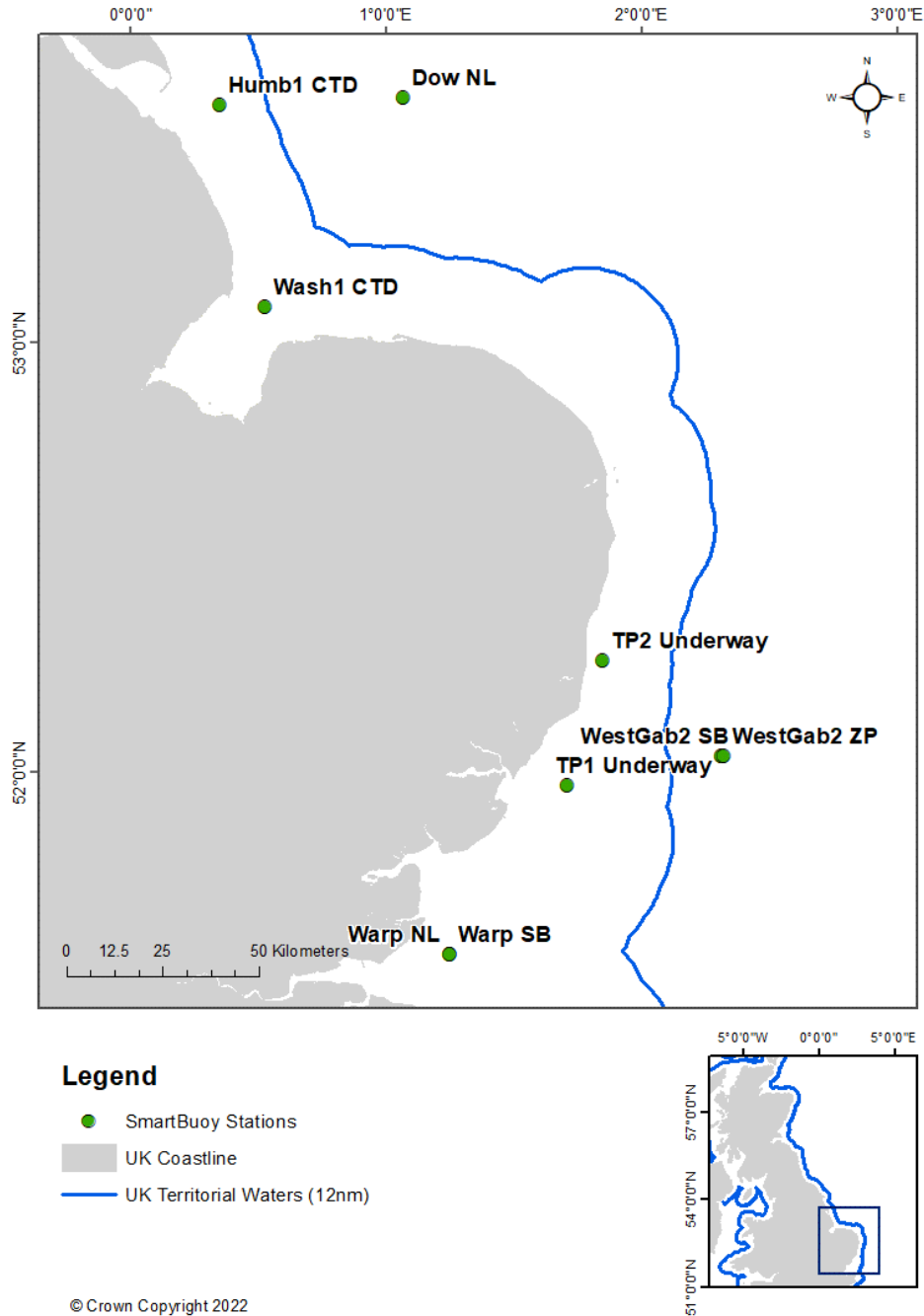


Figure 6. Planned locations of SmartBuoy operations. TP = Thames Plume, SB = Smart Buoy, WestGab = West Gabbard, Dow = Dowsing, Humb = Humber, NL = Noise Lander, ZP = zooplankton, CTD = conductivity, temperature, depth.

5 Survey logistics and narrative

5.1 Survey project team

The survey team for the duration of CEND1921 included Cefas marine ecologists, marine surveyors, habitat mappers and marine chemists along with marine monitoring specialists from the Joint Nature Conservation Committee (JNCC). The roles and shift patterns are presented in Table 1.

Table 1. CEND1921 survey roles and shift patterns.

Role	Shift
Scientist in Charge (SIC)	06:00 – 18:00
Second in Charge (2IC)	06:00 – 18:00
Data Manager	06:00 – 18:00
JNCC Monitoring Specialist	06:00 – 18:00
Day Shift Lead	12:00 – 24:00
Survey Scientist	12:00 – 24:00
Marine Operations Technician	12:00 – 24:00
Biogeochemistry	12:00 – 24:00
Survey Scientist	12:00 – 24:00
Night Shift Lead	00:00 – 12:00
Biogeochemistry	00:00 – 12:00
Marine Operations Technician	00:00 – 12:00
Survey Scientist	00:00 – 12:00
Survey Scientist	00:00 – 12:00
Survey Scientist	00:00 – 12:00

5.2 Survey narrative

All times are UTM. Survey equipment and consumables were mobilised in advance of sailing. All dates are 2021.

Sunday 28 November 2021: All survey staff boarded the vessel at 09:00, COVID-19 tests were conducted, and staff isolated in cabins awaiting results.

Monday 29 November: Isolation continued until all COVID results were returned negative. At 16:00 the All Clear was given, and staff were allowed to leave their cabins.

Tuesday 30 November: Inductions for all joining staff were completed between 08:30 and 10:50. A fire drill and muster was carried out at 11:30. Mobbing activities continued, and all equipment was stowed. Pilot came aboard at 15:30 and RV *Cefas Endeavour* set sail and transited down to the warp SmartBuoy location. Two underway water samples were collected.

Wednesday 1 December 2021: A timed arrival for SmartBuoy servicing at 06:00. A conductivity-temperature-depth (CTD) rosette was deployed beforehand to sample bottom and surface water. Oxygen, salinity, chlorophyll, nutrients and suspended particulate matter (SPM) water samples were collected for analysis. Warp SmartBuoy and noise landers were recovered onboard, a new SmartBuoy and noise lander replaced them. Another CTD rosette was deployed and sampled for the same analysis as the firSt Poor weather forecast dictated the decision to transit to the Wash CTD site. Two hourly underway water samples were collected along the way.

Thursday 2 December: Poor weather overnight slowed down transit. Arrival at the Wash CTD site was 06:00. A CTD rosette was deployed to sample bottom and surface water. Oxygen, salinity, chlorophyll, nutrients and SPM water samples were collected for analysis. The vessel then began transit to the Humber CTD site, collecting hourly underway water samples during transit, arriving at 18:00. A CTD rosette was deployed to sample bottom and surface water. Oxygen, salinity, chlorophyll, nutrients and SPM water samples were collected for analysis.

Friday 3 December: The vessel arrived at the Berwick to St Mary's MCZ at 08:30. The deck was prepared for deployment of MCZ equipment (this could not be done during transit due to poor weather). Camera sledge deployment was attempted, but operations were abandoned due to poor visibility. A single successful Day grab sample was collected and processed. NIOZ coring operations then commenced and continued at Priority 1 stations until 00:00. Eighteen samples were collected at six stations.

Saturday 4 December: Camera sledge operations were attempted but abandoned due to poor visibility. Day grabs continued until 10:00 when all Priority 1 grab samples were completed. Forty samples were collected at 20 stations. Camera sledge operations were again attempted at 10:30 but abandoned due to poor visibility. The deck was set up for NIOZ coring to resume at 12:00. One Blue Carbon station was completed, including CTD deployment.

Sunday 5 December: Poor weather (Force 9 gale) stopped operations at 01:00. Conditions improved sufficiently to resume Day grab operations at 18:00 and sampling was completed at eight stations.

Monday 6 December: Day grab operations continued until 11:00. The swell had calmed down sufficiently to allow for SPI camera deployments, which commenced at 12:00. During the second deployment the umbilical for the external camera unmounted. SPI deployments continued without the external camera.

Tuesday 7 December: Work commenced at Blue Carbon Priority 1 site with the CTD rosette deployed for water sampling, followed by NIOZ coring. Four Blue Carbon Priority 1 sites were completed. Day grab sampling continued before weather deteriorated at 14:00. The vessel transited north to shelter from Storm Barra.

Wednesday 8 December: The vessel sheltered from Storm Barra in the Firth of Forth. At 08:00 the vessel transited south to determine whether the weather was suitable for survey work. Operations resumed at 14:18, and some of the remaining Day grab stations were completed during the transit south and outstanding samples were processed.

Thursday 9 December: Six Day grab samples were collected from outside the Berwick to St Mary's MCZ boundary. The weather was unfavourable for the transit to Fulmar MCZ; therefore, a test deployment of the Haps corer was conducted at a Blue Carbon Priority 1 site. Nine separate cores were collected for analysis in total, eight to represent a Blue Carbon suite of samples, and an additional core for macrofauna and PSA. Following this

successful Haps deployment, the SPI camera was successfully wet-tested following its repair. The vessel departed to Fulmar MCZ at 10:00.

Friday 10 December: The vessel arrived safely at Fulmar MCZ and commenced Day grab sampling. Progress was slow due to marginal weather conditions.

Saturday 11 December: The weather significantly improved, and 33 Day grab stations were completed at Fulmar MCZ, three of which were sampled in triplicate. The primary camera system was swapped with the back-up system following water ingress, and nine successful camera transects were completed.

Sunday 12 December: Good progress was made at Fulmar, with just seven Day grab samples remaining at the end of the day. Twenty camera transects were completed. A bomb search drill took place at 11:00, with all on-shift scientists involved in a detailed search of the vessel.

Monday 13 December: All planned Day grabs at Fulmar were completed in the early hours of the morning, the remaining camera sledge operations were commenced. At 04:30 the sea state was no longer safe to deploy the camera sledge. The long range forecast was poor until Wednesday 15th December, therefore the vessel transited to Dowsing to carry out the noise lander and wave rider service.

Tuesday 14 December: The vessel arrived at Dowsing just after 00:00. Multibeam echosounder data was acquired at the last known position of a noise lander which was not located during a previous servicing attempt. The first line of multibeam identified the correct dimensions of the lander and clump weight holding it in position. At first light the existing wave rider and noise landers were successfully recovered, and grappling attempts were made for the missing lander. After a few unsuccessful attempts we recovered some old fishing gear, suspected to have been tangled into the lander. At 11:30 the lander had not been recovered. Its suspected position was marked, and the new wave rider and noise lander were deployed at a safe distance. The transit back to Fulmar commenced shortly after 15:00.

Wednesday 15 December: The vessel arrived back at Fulmar at 08:00 and the camera sledge was deployed at 08:50. Three stations were successfully surveyed before the swell built up to a point where it was no longer safe to deploy. The vessel was on weather downtime from 12:00 to 15:45, when camera sledge operations resumed. At 20:30 a system warning was received on the topside unit and the camera was recovered to deck. On inspection there was damage to the fibre cable, meaning it could not be used for the remainder of the survey. Survey operations moved to the Added Value stations while the coaxial wire was installed.

Thursday 16 December: Upon deployment of the second NIOZ core of the first Added Value station (at 02:00) there was a major mechanical failure of the coring winch. Following inspection, it was deemed no longer safe to use. This resulted in the inability to deploy anything other than the CTD rosette or the plankton ring net from the side gantry. The camera sledge coaxial installation was completed at 08:00 and camera sledge operations resumed. The impact of the winch failure on the survey scope was discussed (no Added Value or remaining Blue Carbon stations would be able to be visited and sampled on this survey.) It was decided that camera stations would be completed at Fulmar MCZ, including a number of repeats to aim to capture video and still imagery with better visibility than the originals. A number of CTD rosettes would be collected at camera station locations to obtain samples to support the proof of concept for new laboratory methods.

Friday 17 December: Progress continued, with the camera sledge transects completed throughout the day. The additional four CTD stations were completed successfully.

Saturday 18 December: The final camera sledge station was completed at 04:40 and the vessel began transit to Gabbard SmartBuoy.

Sunday 19 December: The vessel arrived at Gabbard at 08:00 and CTD water sampling was conducted. The SmartBuoy was then recovered, and the replacement deployed. A final CTD rosette was deployed, and a plankton ring net sample collected. The recovered SmartBuoy was stripped down and cleaned during the transit back to Lowestoft. The pilot boarded at 20:00 and the vessel came alongside in Lowestoft.

Monday 20 December 2021: Personnel and samples were demobbed.

5.3 Breakdown of survey time

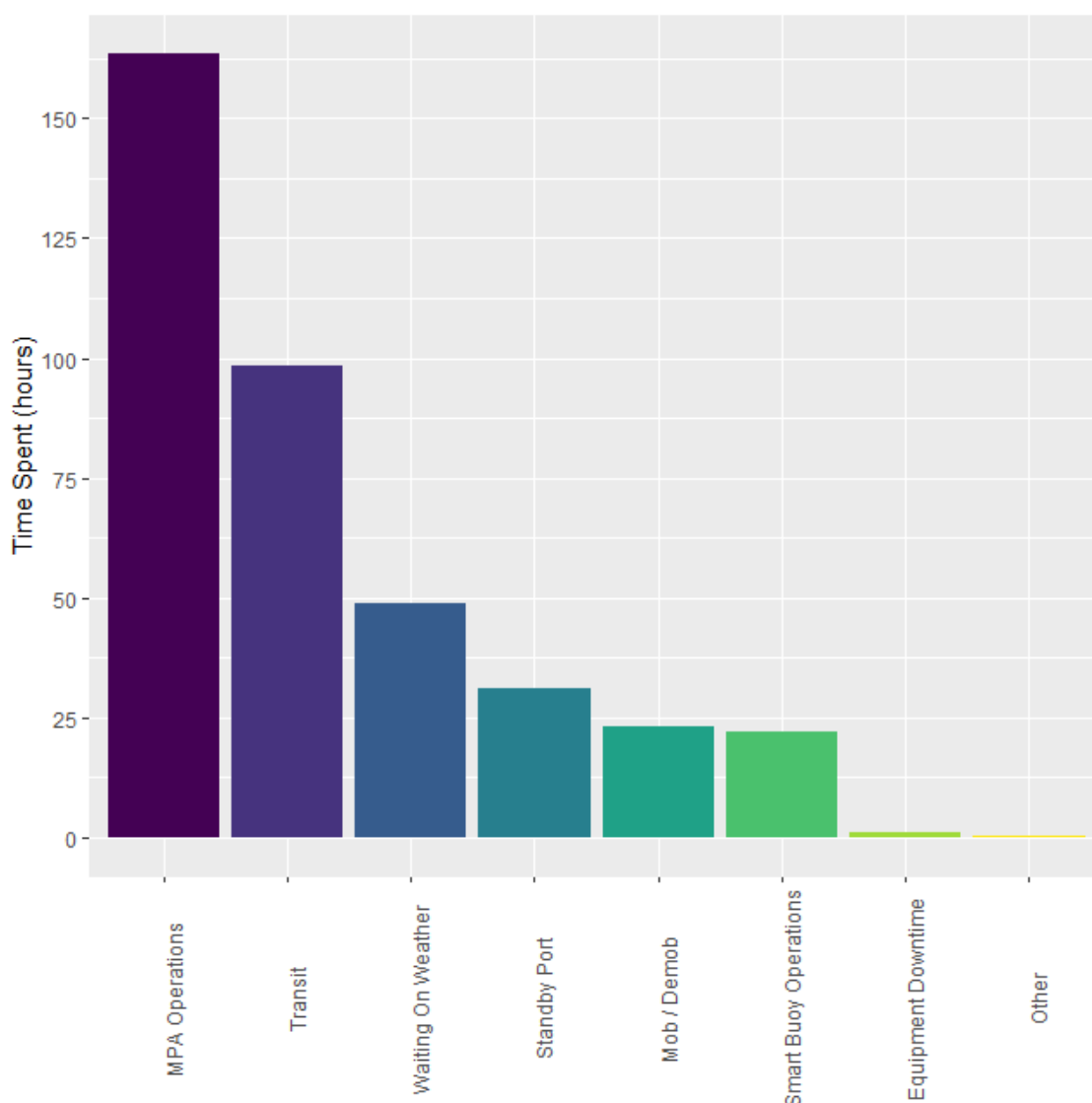


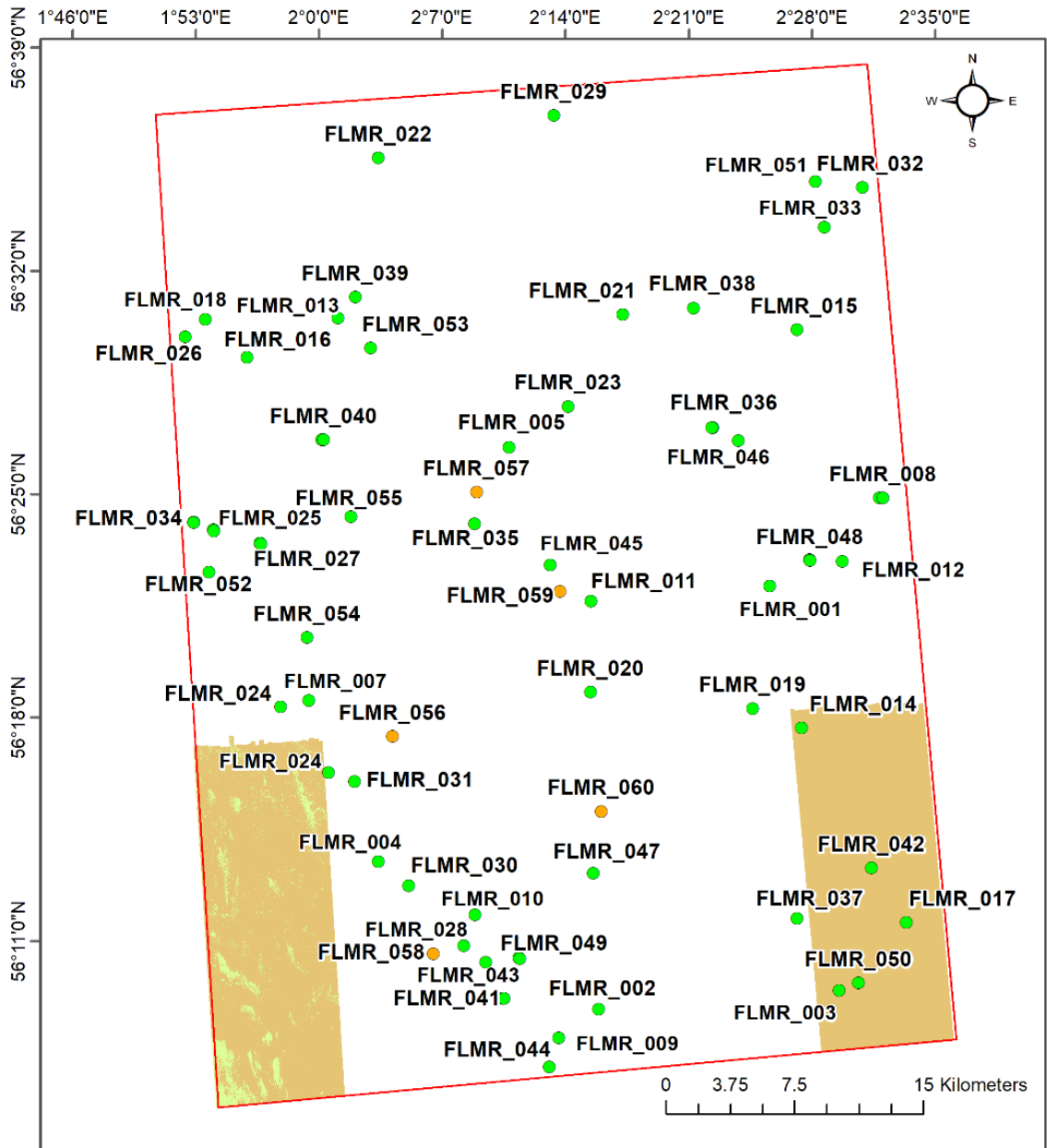
Figure 7. Breakdown of survey time between different activities. ‘Transit’ = both MPA and SmartBuoy transiting, ‘Standby port’ = time spent whilst waiting for COVID test results, ‘Other’ = safety drills.

6 Data acquired

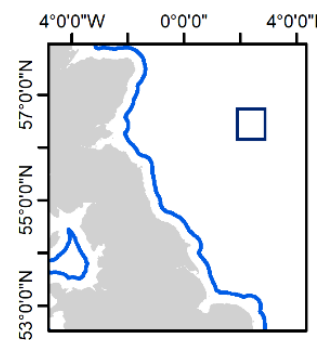
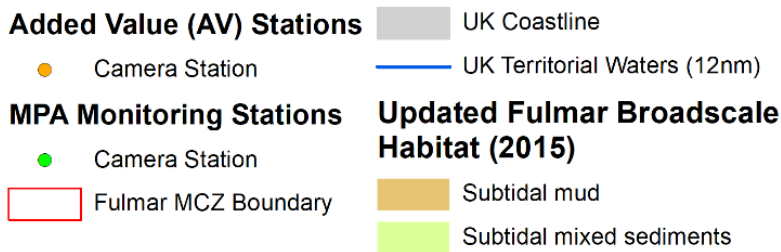
This section summarises the data acquired, and operations conducted on CEND1921 whilst detailed metadata for each sampling station is provided in Appendix 3.

6.1 Fulmar MCZ

All 60 stations were visited within the Fulmar MCZ (Figures 8 and 9). Imagery transects were completed at all stations. All but one planned Day grab sample (FLMR006) were collected (See Appendix 1). One station returned failed samples with cobbles blocking the jaws of the grab from closing.

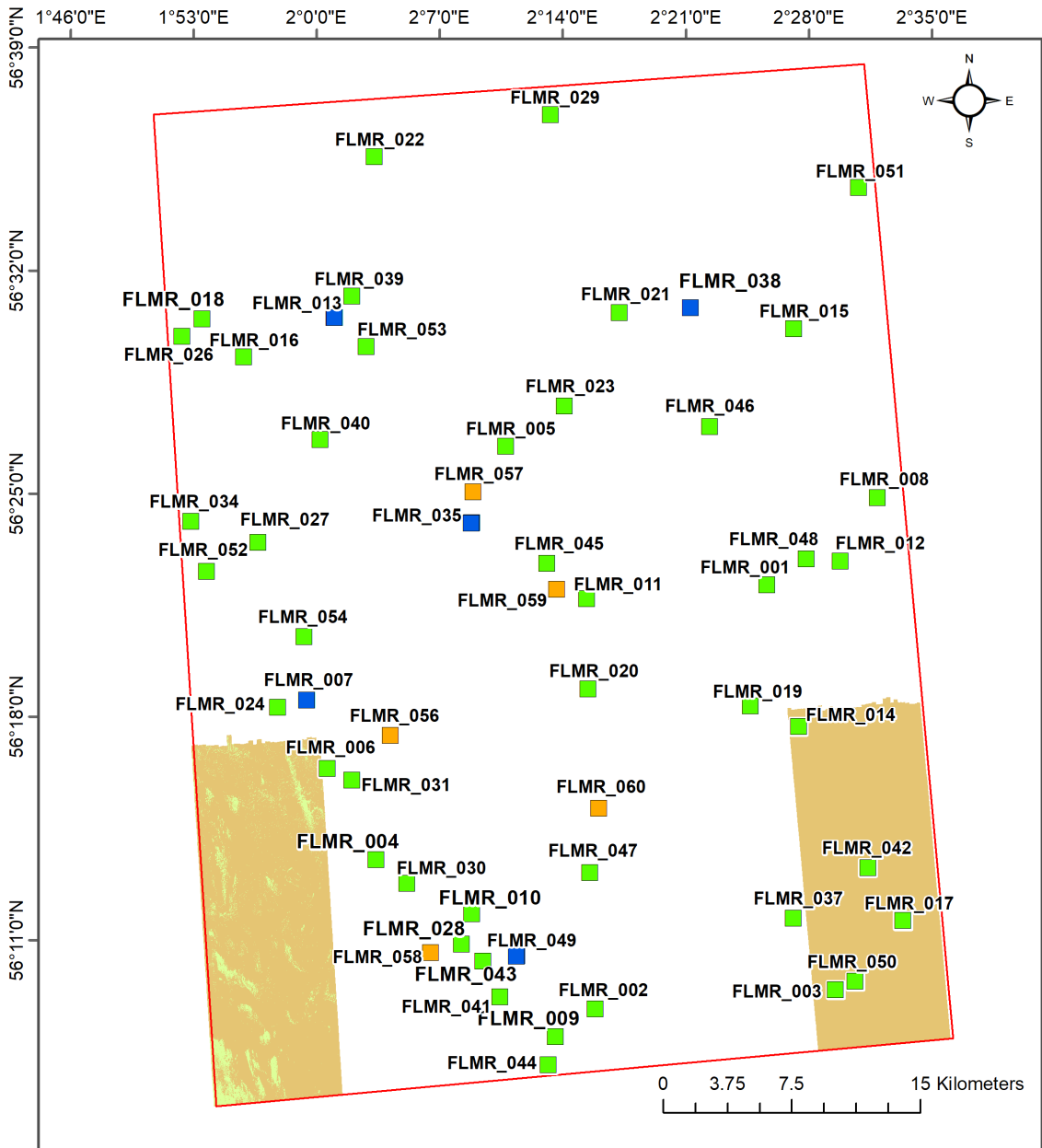


CEND 1921 Fulmar MCZ Collected Camera Samples



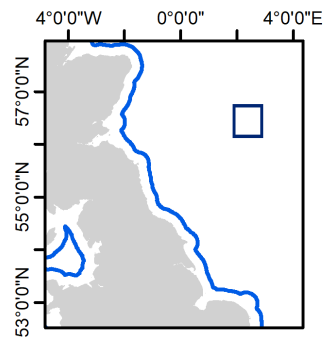
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Figure 8. Camera sledge sampling at Fulmar MCZ on CEND1921.



CEND 1921 Fulmar MCZ Collected Grab Samples

- | | |
|----------------------------------|---|
| Added Value (AV) Stations | UK Coastline |
| Grab Station | UK Territorial Waters (12nm) |
| MPA Monitoring Stations | Updated Fulmar Broadscale Habitat (2015) |
| Grab Station replicate x1 | Subtidal mud |
| Grab Station replicate x3 | Subtidal mixed sediments |
| Fulmar MCZ Boundary | |



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Figure 9. Grab samples acquired at Fulmar MCZ on CEND1921. The only failed grab was FLMR_006.

6.2 Berwick to St Mary's MCZ

Poor underwater visibility conditions resulted in no imagery sampling being successfully completed from the inshore Berwick to St Mary's intended imagery sampling stations.

All other sampling stations were visited and sampling completed as planned for the site (Figures 10 to 13).

Seventy eight grab samples were collected. Forty five samples were collected from NIOZ core stations. SPI imagery was successfully collected from 10 stations.

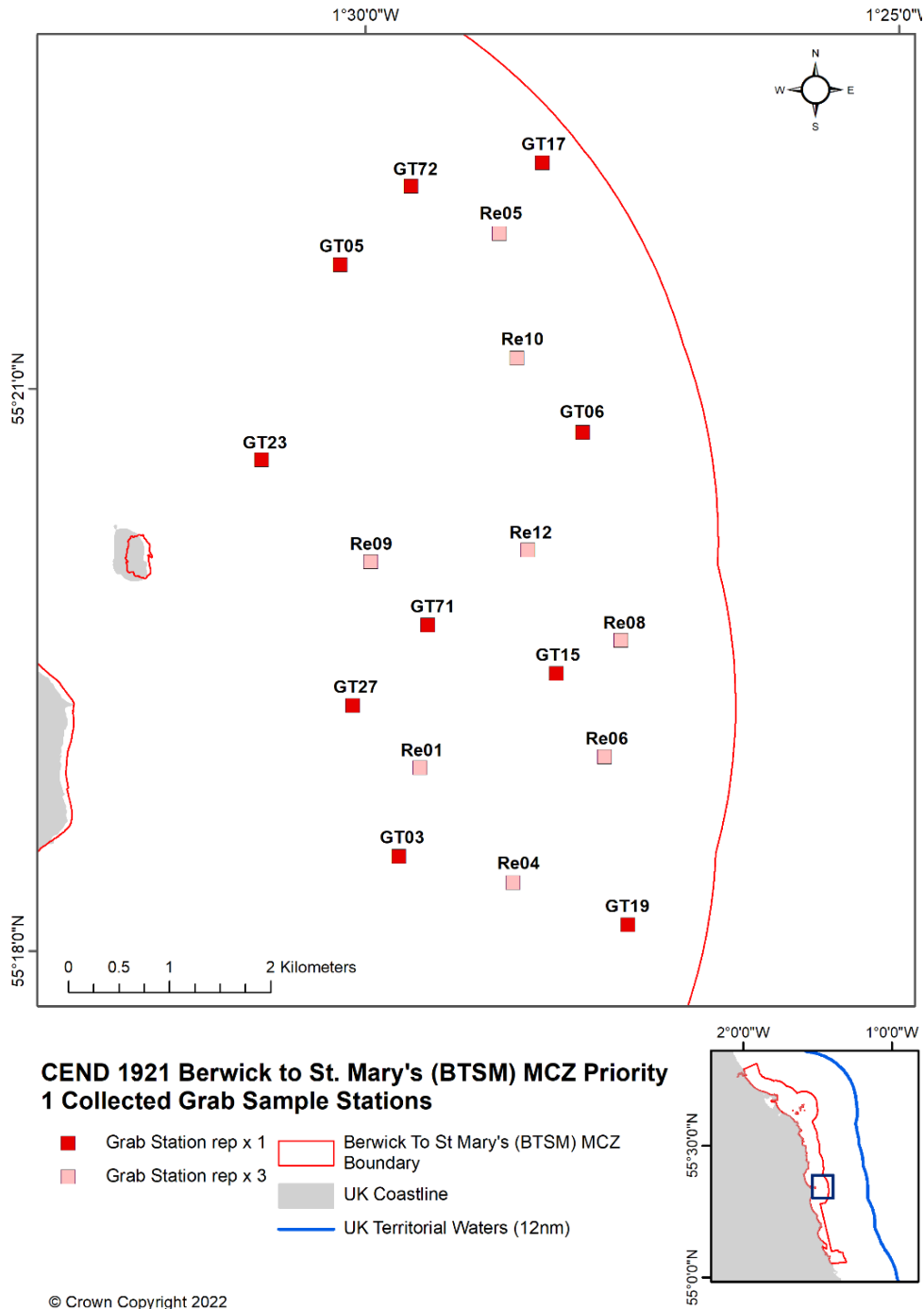
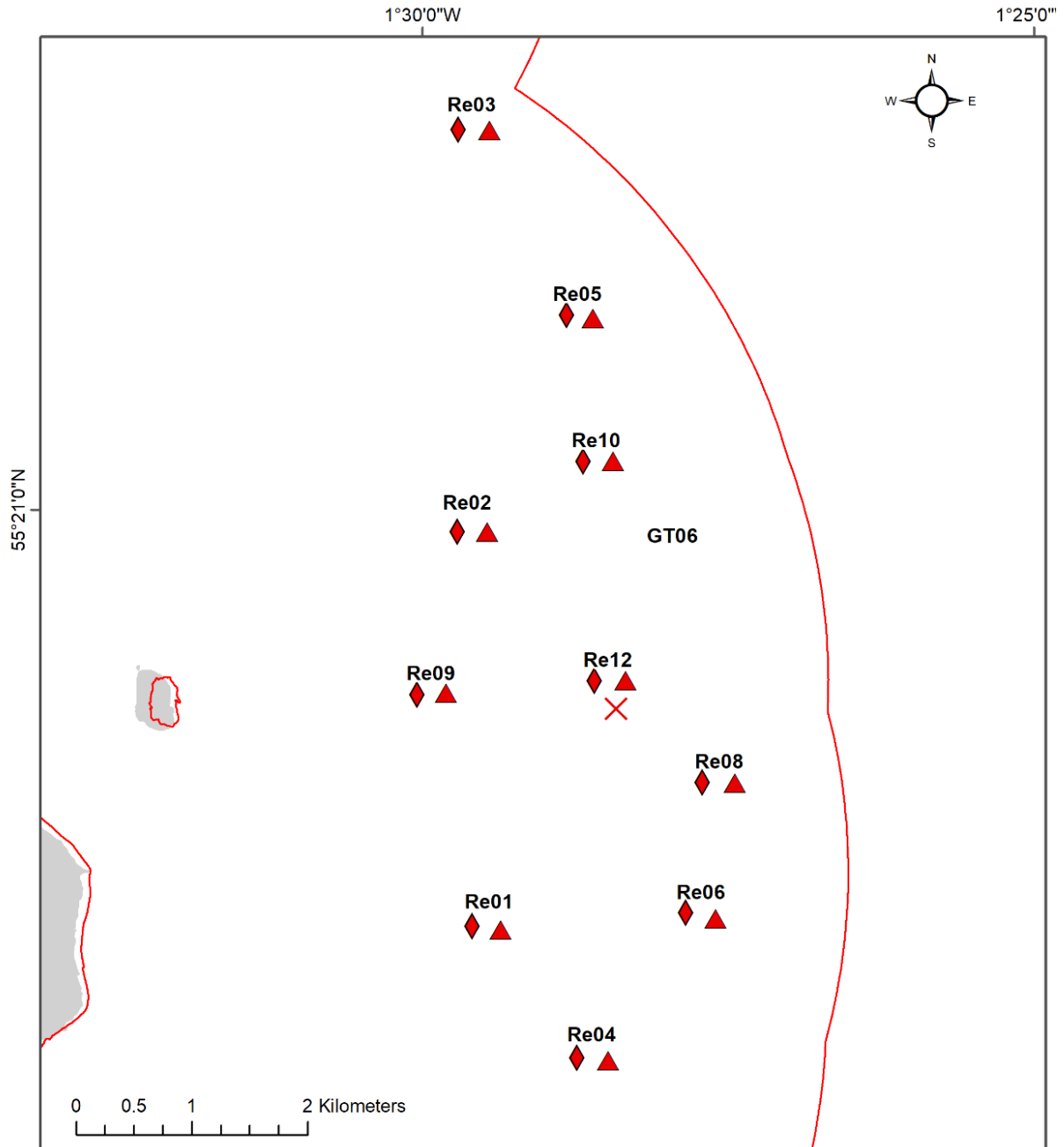


Figure 10. Berwick to St Mary's MCZ grab samples collected (Priority 1 stations).

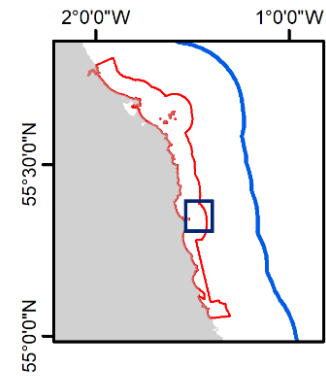


CEND 1921 Berwick to St. Mary's (BTSM) MCZ Priority 1 Collected Sample Stations

Gear Type

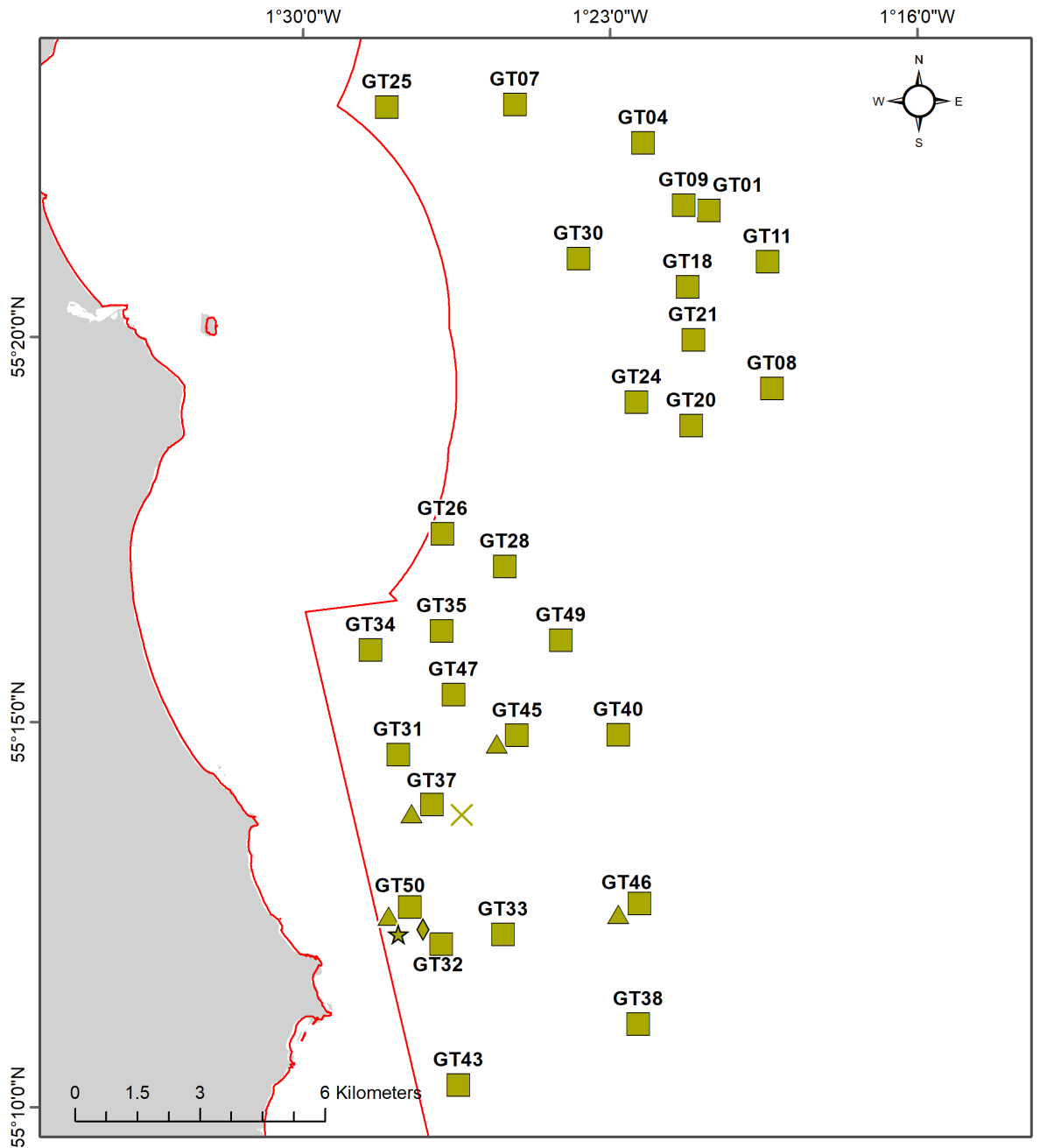
- ▲ NIOZ Stations rep x3
- ◆ SPI Stations
- ✕ CTD Station

- Berwick To St Mary's (BTSM) MCZ Boundary
- UK Coastline
- UK Territorial Waters (12nm)



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Figure 11. Berwick to St. Mary's NIOZ core, Sediment Profile Imaging and CTD samples collected (priority 1 stations).



CEND 1921 Berwick to St. Mary's (BTSM) MCZ Priority 2 Collected Sample Stations

Gear Type

- Grab Station rep x1
- × CTD Station
- ▲ NIOZ Stations rep x3
- ★ HAPS Station
- ◆ SPI Station

- Berwick To St Mary's (BTSM) MCZ Boundary
- UK Coastline
- UK Territorial Waters (12nm)

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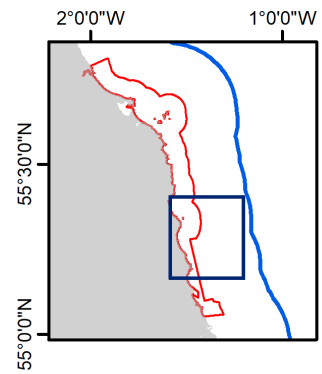
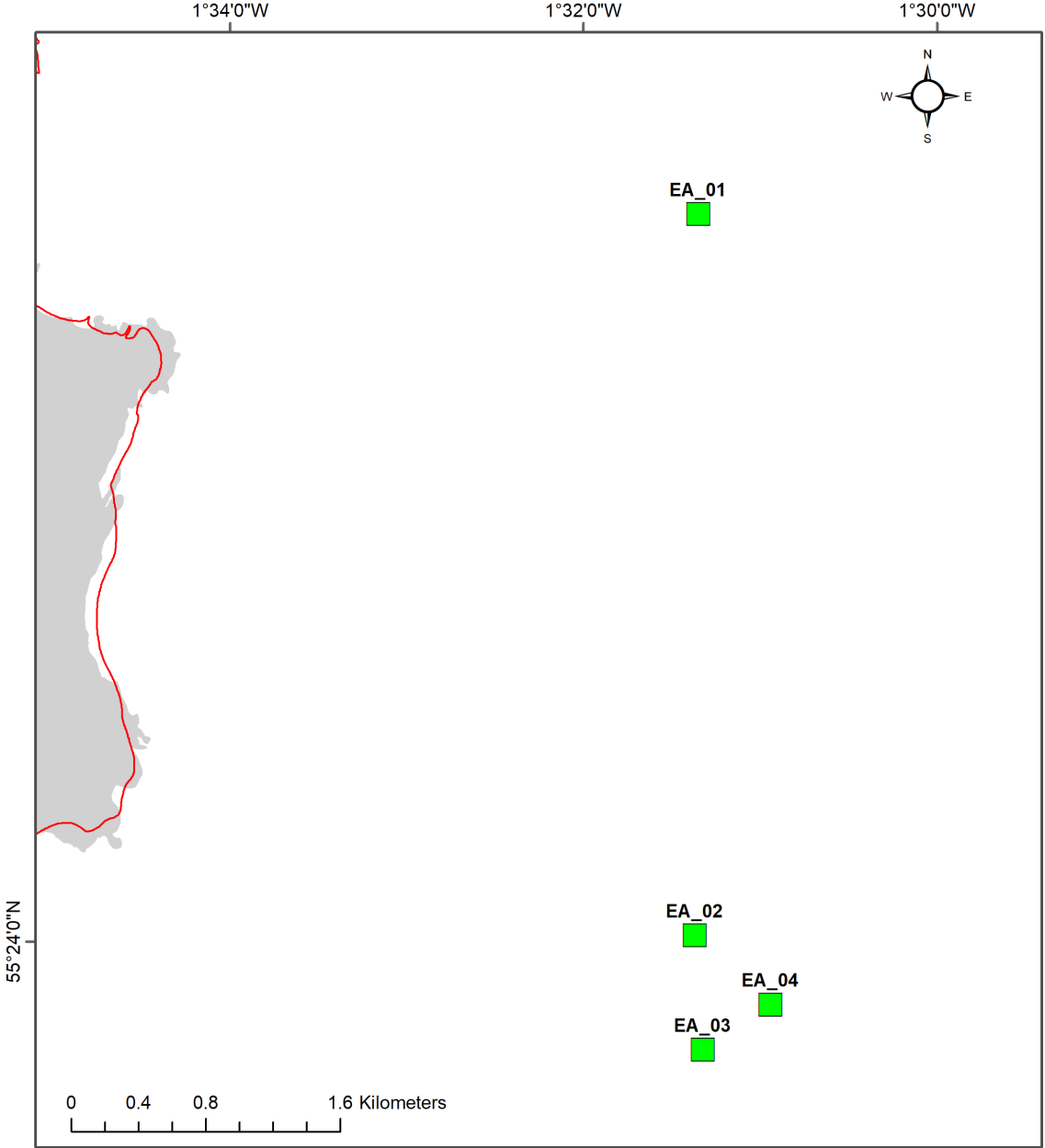


Figure 12. Berwick to St Mary's grab, CTD, core (NIOZ and HAPS) and Sediment Profile Imaging samples collected (priority 2 stations).



CEND 1921 Berwick to St. Mary's (BTSM) MCZ Priority 3 Collected Sample Stations

- Grab Station rep x1
- Berwick To St Mary's (BTSM) MCZ Boundary
- UK Coastline
- UK Territorial Waters (12nm)

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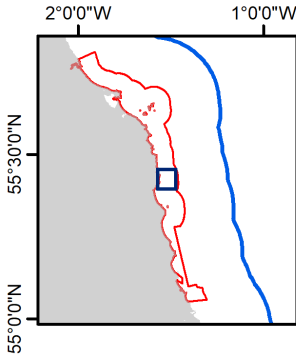


Figure 13. Berwick to St Mary's MCZ grab samples collected (priority 3 stations).

6.3 Blue Carbon sampling

Due to poor weather, it was only possible to collect samples at four of the 12 priority Blue Carbon stations. All the sampled stations were within the Berwick to St Mary's MCZ. Details of the water samples and NIOZ samples collected are summarised in Tables 2 and 3.

Table 2. Water samples collected at Blue Carbon stations.

CTD sensor data (full water column profile)	Water Samples (rosette Niskin bottles) from surface, bottom and intermediate depths if required (max no of samples = 20 (5 stations, 4 depths))	Stations attempted	Stations sampled
Temperature	Temperature	2	2
Salinity	Salinity	2	2
Chlorophyll/Pigments	Chlorophyll/Pigments	2	2
Turbidity	SPM	2	2
	Nutrients	2	2
	Dissolved inorganic and organic carbon	2	2
	Particulate inorganic and organic carbon	2	2
Dissolved Oxygen	Dissolved Oxygen (bottom only)	2	2

Table 3. Samples collected from NIOZ coring operations at Blue Carbon stations.

Parameter	Processing	Stations attempted	Stations sampled
Porewater – Nutrients	Extracted and filtered from known depths	4	4
Sediment Particle Size Analysis (PSA)*	* $\frac{3}{4}$ of each slice of 1 x \varnothing 10 cm sub core	4	4
Carbon and Nitrogen (POC / PON, PIC, Black Carbon)*	*Same sample as particle size, organic matter, and isotopes (d13C/d15N)	4	4
Porosity & Chlorophyll / pigments	$\frac{1}{4}$ of each slice 1 x \varnothing 10 cm sub core	4	4
Lead dating (Pb-210) & Thorium	Whole slices from one sub core	4	4
PAHs / Alkanes / Fingerprinting	Whole slices (sampled using metal cookie cutter) from 1 x \varnothing 10 cm sub core	4	4
Microplastics UEA	1 x \varnothing 5 cm metal sub core	4	4
Bulk biogeochemistry	Whole slice (bulked at 5 cm intervals) from 1 x \varnothing 10 cm sub core	4	4

6.4 Added Value sampling at Fulmar MCZ

Unfortunately, none of the AV sampling intended under this component of the survey plan could be undertaken, due to delays to survey progress whilst sheltering from multiple storm weather systems and mechanical issues.

6.5 SmartBuoy operations

All planned servicing and deployments were conducted successfully, aside from an unsuccessful attempt to recover a missing noise lander.

7 References

Coggan, R., Mitchell, A., White, W. & Golding, N. (2007). Recommended operating guidelines (ROG) for underwater video and photographic imaging techniques V11.2 (<http://www.emodnet-seabedhabitats.eu/default.aspx?page=1915>) [Accessed 14/10/2022]

Appendix 1. Survey equipment and sample processing

A1.1 Grab sampling

The 0.1 m² Day grab (Figure 14) was used throughout to collect sediment for PSA and macrofauna sampling. Grab samples were collected from within a 50 m radius around each target location. On recovery of each grab sample, a photograph was taken in situ and the sample depth measured to ensure the minimum sample size was obtained. A core was collected for PSA before the remaining sample was processed for infaunal analysis.

The infaunal sample was decanted into a plastic box and transferred to the sample processing area onboard the vessel. Benthic fauna were collected by washing the sample with sea-water over a 5 mm and 1 mm sieve. The retained >1 mm fraction was transferred to a labelled container and preserved in buffered 4% formaldehyde for later analysis ashore. A visual assessment was made of the sediment type sampled by the grab and noted on the field records, assigning the sample to a Folk class and its equivalent EUNIS and BSH sediment classes.

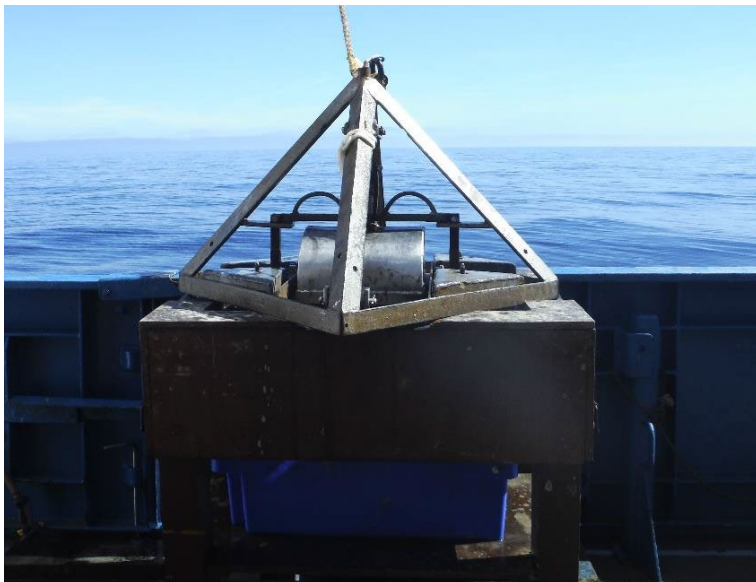


Figure 14. Day grab (0.1 m²).

A1.2 Camera (sledge) sampling

The camera sledge (Figure 15a) 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.

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 of BSH that had been observed.



Figure 15a. The camera sled.

A1.3 0.1 m² NIOZ standard Box Corer



Figure 15b. 0.1 m² NIOZ standard Box Corer.

The NIOZ standard Box Corer (Figure 15b) is the primary equipment used for seabed biogeochemistry sampling. This corer is selected for its ability to penetrate the seabed to a depth of 30 cm and provide samples with an undisturbed sediment surface and intact sediment-water interface. Due to the size and weight of this corer, safe use is limited to calm weather conditions.

A1.4 SPI Camera

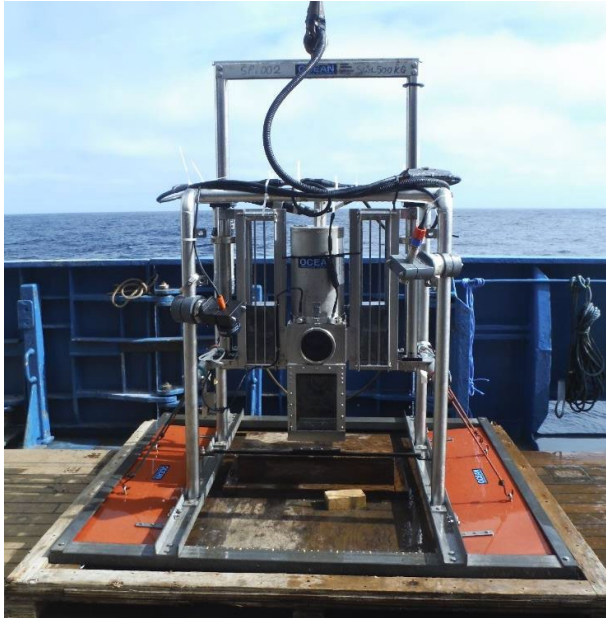


Figure 15c. SPI Camera.

The SPI camera system (Figure 15c) is a self-contained photographic system for collecting in situ images of the sediment/water interface. The system is comprised of a Nikon D100 digital camera, 35 mm lens, water filled prism, a self-contained strobe light, adjustable penetration stops, adjustable fall rate, and a stainless-steel construction frame. The frame also has mud doors to facilitate the use of the camera in low shear strength muds. The supporting frame lands on the seabed first, leaving the area directly under the prism undisturbed. As the winch wire is slackened, the prism cradle descends toward the bottom at a controlled rate of fall and as the wedge-shaped prism enters the muddy bottom it is driven into the sediment by its weight. The piston ensures that the prism enters the bottom slowly and does not disturb the sediment - water interface.

On impact with the seabed, a trigger activates a time delay on the camera shutter release and two photographs are taken. Once the images are acquired, tension on the winch wire raises the prism cradle to the up position, a wiper blade cleans off the face plate, the strobe is recharged, and the system can be lowered for another image. The SPI system can therefore be 'hopped' over the seabed providing a series of images along transects.

A1.5 CTD Rosette



Figure 15d. CTD Rosette.

Mobilised to collect water column continuous instrument (CTD) (Figure 15d) sensor data and physical water samples from Niskin bottles. CTD sensor data collected and physical water samples to validate sensor data and provide additional sample data taken for processing during the survey and for laboratory processing are given below.

Table 4. Environmental parameters measured via CTD and water samples.

CTD sensor data (full water column profile)	Water Samples (rosette Niskin bottles)
Temperature	
Salinity	Salinity
Chlorophyll/Pigments	Chlorophyll/Pigments
Turbidity	SPM
	Nutrients
	Dissolved inorganic and organic carbon
	Particulate inorganic and organic carbon
Dissolved Oxygen	Dissolved Oxygen (bottom only)

A1.6 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. 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.

A1.7 RV Cefas Endeavour

Full details of the RV *Cefas Endeavour* can be found on the Cefas website:
<https://www.cefas.co.uk/about-us/facilities/rv-cefas-endeavour/>

Appendix 2. Blue Carbon sample processing

A2.1 Water sampling

Table 5. Blue Carbon planned water column sampling.

CTD sensor data (full water column profile)	Water Samples (rosette Niskin bottles) from surface, bottom and intermediate depths if required (max no of samples = 20 (5 stations, 4 depths))	Sample Storage
Temperature		
Salinity	Salinity	Salinity bottles
Chlorophyll/Pigments	Chlorophyll/Pigments	Filters frozen at -80°C
Turbidity	SPM	Filters stored upright in dry lab
	Nutrients	Nutrient pots frozen at -20°C
	Dissolved inorganic and organic carbon	Preserved (merc chl), store in dry lab
	Particulate inorganic and organic carbon	Filters frozen at -20°C
Dissolved Oxygen	Dissolved Oxygen (bottom only)	Analysed on-board

A2.2 Water sampling

A 0.1 m² NIOZ box core sampler was used for the collection of PSA and infauna samples. The corer was used to collect undisturbed sediment samples of up to 50 cm in depth at selected stations. A minimum of three replicate cores spaced a minimum of 5m apart were collected from within a 50 m radius around each target location. On recovery of the NIOZ corer, a photograph of the sediment surface was taken in situ.

Three NIOZ cores were taken at each station. A Haps corer was used where weather prevented the NIOZ corer being safely deployed. A single Haps core was deemed to be the equivalent of a NIOZ sub-core.

The first NIOZ core was to be used for porewater analysis, as described in Table 6.

Table 6. Details of Porewater sampling to be taken from NIOZ core.

Parameter	Sample required	Depth Profiles / sub samples	Equipment	Description	Storage
Porewater – Nutrients	1 x NIOZ core	Set depth profiles: Surficial water, 1 cm intervals 1–5 cm, 7.5 cm 10 cm 14 cm 17 cm and 20 cm	Porewater nutrients Sipper Sipper filters sample tubes Secondary filters	Plastic pots	Frozen - 20°C

The second and third NIOZ cores were to be sub-sampled using 10 cm cores as shown in Figure 16. Sub-cores 1, 2 and 3 were sliced at 1 or 2 cm intervals, sub-core 4 was left whole and sub-core 5 was sliced at 5 cm intervals (Figure 17). Details of the sub-sampling are given in Table 7 and Table 8.

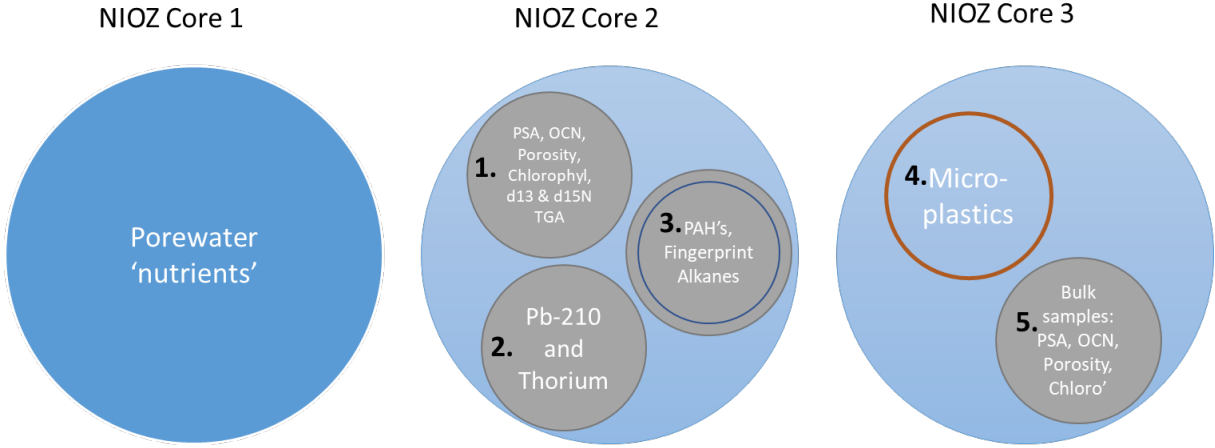


Figure 17. NIOZ core sampling for Blue Carbon. Blue ring in sub-core 3 = Ø 8 cm cookie cutter, red ring = metal microplastics core.

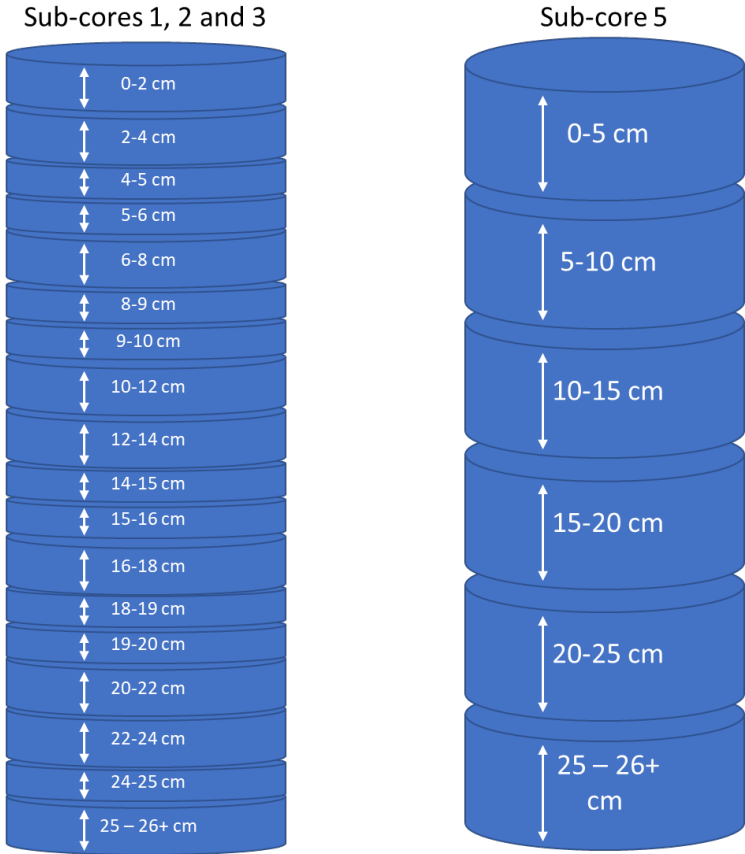


Figure 18. Slicing intervals of sub-cores 1, 2, 3 and 5. (sub-core 4 was left whole).

Table 7. Details of the sub-sampling of NIOZ core 2.

Sub-core	Parameter	Processing
1	Sediment Particle Size Analysis (PSA)*	* $\frac{3}{4}$ of each slice of 1 x \varnothing 10 cm sub core
	Carbon and Nitrogen (POC / PON, PIC, Black Carbon)*	*Same sample as particle size, organic matter, and isotopes (d13C/d15N)
	Porosity & Chlorophyll / pigments	$\frac{1}{4}$ of each slice 1 x \varnothing 10 cm sub core
2	Lead dating (Pb-210) & Thorium	Whole slices from one sub core
3	PAHs / Alkanes / Fingerprinting	Whole slices (from metal sub core) from 1 x \varnothing 10 cm sub core

Table 8. Details of the sub-sampling of NIOZ core 3.

Sub-core	Parameter	Processing
4	Microplastics UEA	1 x \varnothing 5 cm sub core
5	Sediment Particle Size Analysis (PSA)*	* $\frac{3}{4}$ of each slice of 1 x \varnothing 10 cm sub core
	Carbon and Nitrogen (POC / PON, PIC, Black Carbon)*	*Same sample as particle size, organic matter, and isotopes (d13C/d15N)
	Porosity & Chlorophyll / pigments	$\frac{1}{4}$ of each slice 6x \varnothing 10 cm sub core

Appendix 3. Survey metadata

Table 9. Grab samples acquired from Berwick to St Mary's MCZ and Fulmar MCZ.

Event	Station Code	Sample	Replicate Attempt	Depth of Sample	Water Depth (m)	Date	Time	Latitude	Longitude	Notes
030	GT19	PSA, Macrofauna	A1	10	46.99	03/12/2021	11:30:40	55.301161	-1.4620367	
038	Re02	PSA, Macrofauna	A1	13	42.81	04/12/2021	00:55:47	55.3463845	-1.494744	
038	Re02	PSA, Macrofauna	B1	13	42.72	04/12/2021	01:05:26	55.3464343	-1.4947458	
038	Re02	PSA, Macrofauna	C1	12	43.11	04/12/2021	01:11:34	55.3464871	-1.4947366	
039	GT23	PSA, Macrofauna	A1	13	38.3	04/12/2021	01:47:52	55.3432224	-1.5175392	
040	GT05	PSA, Macrofauna	A1	11	38.35	04/12/2021	02:21:12	55.3604125	-1.5046443	
041	GT72	PSA, Macrofauna	A1	12	44.03	04/12/2021	02:48:52	55.3672899	-1.4933534	
042	Re03	PSA, Macrofauna	A1	12	44.47	04/12/2021	03:09:52	55.3775736	-1.4932905	
042	Re03	PSA, Macrofauna	B1	13	44.56	04/12/2021	03:15:12	55.3776208	-1.4932984	
042	Re03	PSA, Macrofauna	C1	11	44.44	04/12/2021	03:20:11	55.3776691	-1.4933017	
043	GT17	PSA, Macrofauna	A1	13	47.75	04/12/2021	03:56:08	55.3690967	-1.4727252	
044	Re05	PSA, Macrofauna	A1	10	46.65	04/12/2021	04:21:35	55.3628943	-1.4796735	
044	Re05	PSA, Macrofauna	B1	9	46.32	04/12/2021	04:28:04	55.3628691	-1.4797193	
044	Re05	PSA, Macrofauna	C1	13	46.48	04/12/2021	04:33:26	55.3628324	-1.4797763	
045	Re10	PSA, Macrofauna	A1	11	46.52	04/12/2021	04:55:01	55.3517755	-1.4774031	
045	Re10	PSA, Macrofauna	B1	11	46.25	04/12/2021	05:00:26	55.3517472	-1.4774662	
045	Re10	PSA, Macrofauna	C1	11	46.33	04/12/2021	05:06:24	55.3517322	-1.4775339	

Event	Station Code	Sample	Replicate Attempt	Depth of Sample	Water Depth (m)	Date	Time	Latitude	Longitude	Notes
046	GT06	PSA, Macrofauna	A1	7	46.02	04/12/2021	05:33:24	55.3450422	-1.4674127	Internal label may read STN 47, or two internal labels may be present. The correct station number is STN 46.
047	Re12	PSA, Macrofauna	A1	10	44.88	04/12/2021	05:55:15	55.3346869	-1.4763079	
047	Re12	PSA, Macrofauna	B1	11	44.88	04/12/2021	06:00:44	55.3346336	-1.4763389	
047	Re12	No Sample	C1	0	44.94	04/12/2021	06:05:30	55.3345971	-1.4763841	No fire
047	Re12	PSA, Macrofauna	C2	11	44.85	04/12/2021	06:08:22	55.3346253	-1.4763152	Fauna/PSA labelled as C1
048	Re08	PSA, Macrofauna	A1	9	46.11	04/12/2021	06:24:19	55.3264617	-1.4620998	
048	Re08	PSA, Macrofauna	B1	10	45.61	04/12/2021	06:29:43	55.32643	-1.4620171	
048	Re08	PSA, Macrofauna	C1	11	45.72	04/12/2021	06:34:39	55.3264284	-1.4619231	
049	GT15	PSA, Macrofauna	A1	13	44.06	04/12/2021	06:45:04	55.3236282	-1.4723046	
050	Re06	PSA, Macrofauna	A1	10	44.61	04/12/2021	07:00:51	55.3161422	-1.4650655	
050	Re06	PSA, Macrofauna	B1	9	44.47	04/12/2021	07:05:25	55.3161127	-1.4649876	
050	Re06	PSA, Macrofauna	C1	10	44.62	04/12/2021	07:10:20	55.3160917	-1.4649178	
051	Re04	PSA, Macrofauna	A1	13	41.7	04/12/2021	08:01:12	55.305115	-1.4798101	
051	Re04	PSA, Macrofauna	B1	13	41.82	04/12/2021	08:06:21	55.3051026	-1.4797348	
051	Re04	PSA, Macrofauna	C1	13	41.44	04/12/2021	08:11:17	55.3050914	-1.4796526	
052	GT03	PSA, Macrofauna	A1	12	37.57	04/12/2021	08:26:45	55.307691	-1.497465	

Event	Station Code	Sample	Replicate Attempt	Depth of Sample	Water Depth (m)	Date	Time	Latitude	Longitude	Notes
053	Re01	PSA, Macrofauna	A1	12	39.36	04/12/2021	08:39:46	55.3155399	-1.4939015	
053	Re01	PSA, Macrofauna	B1	10	39.26	04/12/2021	08:45:01	55.3154657	-1.4938335	
053	Re01	PSA, Macrofauna	C1	11	39.35	04/12/2021	08:49:27	55.3154554	-1.4937697	
054	GT27	No Sample	A1	0	35.24	04/12/2021	09:10:06	55.3211948	-1.5041644	Misfired
054	GT27	PSA, Macrofauna	A2	9	35.34	04/12/2021	09:12:47	55.3211942	-1.504146	
055	GT71	PSA, Macrofauna	A1	10	40.71	04/12/2021	09:37:47	55.3281914	-1.4921808	
056	Re09	PSA, Macrofauna	A1	13	38.8	04/12/2021	09:59:03	55.3339458	-1.5008597	
056	Re09	PSA, Macrofauna	B1	13	39	04/12/2021	10:03:18	55.3339509	-1.5007844	
056	Re09	PSA, Macrofauna	C1	13	39.09	04/12/2021	10:07:30	55.3339399	-1.5006916	
066	GT25	PSA, Macrofauna	A1	9	46.23	05/12/2021	18:35:50	55.3814515	-1.4687892	
067	GT07	No Sample	A1	0	50.03	05/12/2021	19:05:53	55.3813834	-1.4200341	No Sample, only brought up water
067	GT07	No Sample	A2	0	49.45	05/12/2021	19:13:49	55.3814158	-1.4200759	No Sample, only brought up water
067	GT07	PSA, Macrofauna	A3	11	48.55	05/12/2021	19:20:31	55.3814398	-1.420129	
068	GT30	PSA, Macrofauna	A1	9	53.37	05/12/2021	19:53:58	55.347751	-1.3972031	
069	GT26	No Sample	A1	0	45.79	05/12/2021	20:50:56	55.2889157	-1.4511213	No Sample
069	GT26	No Sample	A2	0	46.39	05/12/2021	20:56:43	55.2889252	-1.4510243	No Sample
069	GT26	No Sample	A3	0	45.47	05/12/2021	21:02:46	55.288909	-1.4509369	No Sample

Event	Station Code	Sample	Replicate Attempt	Depth of Sample	Water Depth (m)	Date	Time	Latitude	Longitude	Notes
069	GT26	PSA, Macrofauna	A4	12	45.89	05/12/2021	21:15:38	55.288861	-1.4508608	Decision made to continue beyond 3 attempts. The no samples were not due to the seabed but the swell. Day grab misfiring on water. Bungee cords added to resolve problem and rectified the issue.
070	GT35	PSA, Macrofauna	A1	15	43.43	05/12/2021	21:56:05	55.2678176	-1.4523791	
071	GT47	PSA, Macrofauna	A1	12	43.28	05/12/2021	22:27:25	55.2540214	-1.4483888	
072	GT45	PSA, Macrofauna	A1	10	47.16	05/12/2021	22:57:17	55.2449665	-1.4247958	
073	GT37	PSA, Macrofauna	A1	15	39.93	05/12/2021	23:35:24	55.2303599	-1.4574752	
074	GT50	PSA, Macrofauna	A1	12	36.83	06/12/2021	00:15:18	55.2082686	-1.4666907	
075	RP05	PSA, Macrofauna	A1	13	43.2	06/12/2021	01:05:38	55.1797483	-1.4359458	
076	GT38	PSA, Macrofauna	A1	11	53.18	06/12/2021	01:47:18	55.1818587	-1.3812806	
077	RP06	PSA, Macrofauna	A1	10	54.87	06/12/2021	02:11:17	55.1941635	-1.365998	
078	GT46	PSA, Macrofauna	A1	12	55.09	06/12/2021	02:34:32	55.2078864	-1.3797567	
079	RP03	PSA, Macrofauna	A1	7	53.93	06/12/2021	03:05:41	55.2210817	-1.39713	
080	RP02	PSA, Macrofauna	A1	5	53.7	06/12/2021	03:35:34	55.234047	-1.4070128	

Event	Station Code	Sample	Replicate Attempt	Depth of Sample	Water Depth (m)	Date	Time	Latitude	Longitude	Notes
081	GT40	PSA, Macrofauna	A1	7	55.84	06/12/2021	04:14:24	55.2445367	-1.3863429	
082	GT49	PSA, Macrofauna	A1	7	55.92	06/12/2021	04:46:58	55.2652695	-1.407205	
083	GT28	PSA, Macrofauna	A1	8	50.59	06/12/2021	05:34:22	55.2814635	-1.4279504	
084	GT24	No Sample	A1	0	54.56	06/12/2021	06:31:01	55.3163811	-1.3765984	Misfire
084	GT24	PSA, Macrofauna	A2	9	55.9	06/12/2021	06:34:52	55.3163624	-1.3766528	
085	GT20	PSA, Macrofauna	A1	8	59.1	06/12/2021	06:50:58	55.3110517	-1.3559703	
086	GT08	No Sample	A1	0	53.85	06/12/2021	07:12:22	55.3186215	-1.3249404	Misfire
086	GT08	PSA, Macrofauna	A2	8	54.45	06/12/2021	07:18:10	55.3184854	-1.3252312	
087	GT21	PSA, Macrofauna	A1	7	56.66	06/12/2021	07:55:07	55.329576	-1.354337	
088	GT18	PSA, Macrofauna	A1	7	60.09	06/12/2021	08:32:16	55.3410848	-1.3560077	
089	GT11	PSA, Macrofauna	A1	5	54.62	06/12/2021	08:52:38	55.3460878	-1.3254247	
090	GT01	No Sample	A1	0	62.75	06/12/2021	09:25:55	55.3574689	-1.3473107	Misfire
090	GT01	No Sample	A2	0	62.74	06/12/2021	09:30:32	55.3574963	-1.3472736	Small Sample
090	GT01	PSA, Macrofauna	A3	8	62.85	06/12/2021	09:36:12	55.3575027	-1.3471937	PSA labelled as A1
091	GT09	PSA, Macrofauna	A1	7	57.97	06/12/2021	09:58:58	55.3587603	-1.3568293	
092	GT04	No Sample	A1	0	57.42	06/12/2021	10:37:43	55.3724439	-1.3717447	Cobble in jaw
092	GT04	No Sample	A2	0	56.85	06/12/2021	10:41:39	55.3724798	-1.3716332	Small Sample
092	GT04	PSA, Macrofauna	A3	9	57.48	06/12/2021	10:47:04	55.3724798	-1.3715415	
093	EA02	PSA, Macrofauna	A1	12	32.73	06/12/2021	11:48:40	55.3996011	-1.5246479	
109	GT32	PSA, Macrofauna	A1	7	40.06	07/12/2021	11:31:21	55.2000889	-1.4551125	

Event	Station Code	Sample	Replicate Attempt	Depth of Sample	Water Depth (m)	Date	Time	Latitude	Longitude	Notes
110	GT43	No Sample	A1	0	37.35	07/12/2021	12:49:43	55.1696506	-1.4503112	No sample Cobble
110	GT43	No Sample	A2	0	37.1	07/12/2021	12:57:23	55.1697103	-1.4504247	No sample Bungee issues
110	GT43	No Sample	A3	0	37.76	07/12/2021	13:11:23	55.1696421	-1.4503933	No sample
110	GT43	No Sample	A4	0	36.61	07/12/2021	13:19:43	55.1696265	-1.4504843	No sample
111	EA01	PSA, Macrofauna	A1	11	37.1	08/12/2021	14:18:54	55.4382491	-1.5228769	
112	EA03	PSA, Macrofauna	A1	14	34.29	08/12/2021	14:58:26	55.3934669	-1.5241377	
113	EA04	PSA, Macrofauna	A1	15.5	36.7	08/12/2021	15:15:32	55.3958056	-1.5176527	
114	GT34	PSA, Macrofauna	A1	14	41.2	08/12/2021	16:36:09	55.2641236	-1.4794535	
120	GT43	No Sample	A1	0	36.03	09/12/2021	00:21:04	55.169549	-1.4498302	No Sample
120	GT43	PSA, Macrofauna	A2	12	35.6	09/12/2021	00:25:27	55.1695392	-1.4499107	
121	RP04	No Sample	A1	0	42.53	09/12/2021	01:09:07	55.1969331	-1.4136085	No Sample
121	RP04	PSA, Macrofauna	A2	8	43.03	09/12/2021	01:13:22	55.1969246	-1.4137012	
122	GT33	No Sample	A1	11	43.68	09/12/2021	01:33:31	55.2019351	-1.43169	Processed, but NO SAMPLE. Fish box had holes. Sample containers to be delivered to lab, but not to be processed.
123	RP01	PSA, Macrofauna	A1	12	43.81	09/12/2021	01:59:45	55.2215867	-1.4379133	
124	GT31	PSA, Macrofauna	A1	12	36.98	09/12/2021	02:29:35	55.2413479	-1.4697639	

Event	Station Code	Sample	Replicate Attempt	Depth of Sample	Water Depth (m)	Date	Time	Latitude	Longitude	Notes
125	GT33	PSA, Macrofauna	A1	12	44.67	09/12/2021	03:13:14	55.2019589	-1.4319127	Repeat 122, with non-perforated blue benthos crate
128	FLMR002	PSA, Macrofauna	A1	10	83.6	10/12/2021	00:43:15	56.125997	2.1944497	
129	FLMR009	PSA, Macrofauna	A1	10	84.11	10/12/2021	01:22:33	56.1131204	2.1553577	
130	FLMR044	PSA, Macrofauna	A1	9	84.17	10/12/2021	01:45:10	56.0987343	2.1466127	
131	FLMR041	PSA, Macrofauna	A1	10	84.73	10/12/2021	02:29:01	56.1361864	2.1063533	
132	FLMR049	PSA, Macrofauna	A1	9	84.49	10/12/2021	02:59:38	56.1569025	2.124798	
132	FLMR049	PSA, Macrofauna	B1	10	84.53	10/12/2021	03:06:10	56.156851	2.1247725	
132	FLMR049	PSA, Macrofauna	C1	9	84.29	10/12/2021	03:12:18	56.1567995	2.1247342	
134	FLMR043	No Sample	A1	0	84.57	10/12/2021	04:32:55	56.1555756	2.0926346	Small sample
134	FLMR043	PSA, Macrofauna	A2	8	84.64	10/12/2021	04:38:54	56.1555993	2.0926683	
135	FLMR058	PSA, Macrofauna	A1	8	85.15	10/12/2021	05:07:35	56.1618718	2.0442447	
136	FLMR028	PSA, Macrofauna	A1	9	85.55	10/12/2021	05:32:23	56.1653014	2.0738719	
137	FLMR010	PSA, Macrofauna	A1	9	85.16	10/12/2021	05:58:25	56.1806768	2.0857279	
138	FLMR030	No Sample	A1	0	86.22	10/12/2021	06:33:38	56.1990211	2.026578	Small sample
138	FLMR030	No Sample	A2	0	86	10/12/2021	06:42:01	56.1989186	2.0266665	Small sample
138	FLMR030	No Sample	A3	0	85.57	10/12/2021	06:46:39	56.1988285	2.0267884	Small sample
139	FLMR004	No Sample	A1	0	88.25	10/12/2021	07:06:22	56.2122877	1.9994166	Small sample
140	FLMR030	PSA, Macrofauna	A1	7	85.03	10/12/2021	10:12:05	56.1989903	2.0268586	
141	FLMR004	PSA, Macrofauna	A1	7	86.06	10/12/2021	10:44:22	56.2125866	1.9996059	

Event	Station Code	Sample	Replicate Attempt	Depth of Sample	Water Depth (m)	Date	Time	Latitude	Longitude	Notes
142	FLMR031	PSA, Macrofauna	A1	5	87.21	10/12/2021	11:32:15	56.2552597	1.9823886	
143	FLMR006	No Sample	A1	0	86.54	10/12/2021	12:13:41	56.262128	1.9598887	Cobble in jaw
143	FLMR006	No Sample	A2	0	87.75	10/12/2021	12:20:29	56.2620731	1.9599088	Cobble in jaw
143	FLMR006	No Sample	A3	0	87.65	10/12/2021	12:25:57	56.2620541	1.9599048	Cobble in jaw
145	FLMR056	PSA, Macrofauna	A1	9	86.3	10/12/2021	14:36:00	56.2771503	2.0214947	
146	FLMR007	PSA, Macrofauna	A1	12.5	86.58	10/12/2021	16:16:38	56.2986494	1.9455526	
146	FLMR007	PSA, Macrofauna	B1	10	86.62	10/12/2021	16:25:52	56.298648	1.9455173	
146	FLMR007	PSA, Macrofauna	C1	9	87.05	10/12/2021	16:34:25	56.298743	1.9453412	
148	FLMR024	PSA, Macrofauna	A1	10	87.11	10/12/2021	18:28:47	56.2961229	1.9175928	
149	FLMR054	PSA, Macrofauna	A1	12	88.68	10/12/2021	19:17:18	56.3320009	1.9472639	
150	FLMR052	PSA, Macrofauna	A1	9	86.87	10/12/2021	20:02:43	56.3697509	1.8598178	
152	FLMR027	PSA, Macrofauna	A1	9.5	86.98	10/12/2021	21:26:05	56.3830471	1.9102039	
155	FLMR025	PSA, Macrofauna	A1	9	86.74	10/12/2021	23:33:26	56.3919412	1.8659051	
156	FLMR034	PSA, Macrofauna	A1	7	87.96	11/12/2021	00:03:05	56.396421	1.8484602	
159	FLMR055	No Sample	A1	0	85.22	11/12/2021	03:13:38	56.3937664	1.9966295	Small sample - coarse
159	FLMR055	No Sample	A2	0	85.63	11/12/2021	03:18:30	56.3937856	1.9966022	Small sample - coarse
159	FLMR055	PSA, Macrofauna	A3	5	84.64	11/12/2021	03:23:58	56.3938479	1.9964879	
160	FLMR040	No Sample	A1	0	83.99	11/12/2021	04:08:55	56.4344902	1.9756078	Misfire, swivel caught, safely landed on deck
160	FLMR040	No Sample	A2	0	85.25	11/12/2021	04:14:39	56.4344951	1.9756063	Small sample

Event	Station Code	Sample	Replicate Attempt	Depth of Sample	Water Depth (m)	Date	Time	Latitude	Longitude	Notes
160	FLMR040	PSA, Macrofauna	A3	5	84.84	11/12/2021	04:24:32	56.4345041	1.975625	
162	FLMR016	PSA, Macrofauna	A1	6	88.8	11/12/2021	05:46:14	56.4805548	1.9091654	
163	FLMR026	No Sample	A1	0	89.13	11/12/2021	06:15:08	56.493633	1.8522021	Small sample
163	FLMR026	PSA, Macrofauna	A2	8	89.15	11/12/2021	06:20:10	56.4935882	1.8523203	
164	FLMR018	PSA, Macrofauna	A1	7	91.08	11/12/2021	06:38:02	56.5020511	1.8726895	
165	FLMR053	PSA, Macrofauna	A1	7	86.31	11/12/2021	07:23:15	56.4813262	2.0257683	
166	FLMR013	No Sample	A1	0	85.82	11/12/2021	08:04:03	56.4976879	1.997401	Small sample
166	FLMR013	No Sample	A2	0	85.58	11/12/2021	08:08:38	56.4976737	1.997493	Small sample
166	FLMR013	PSA, Macrofauna	A3	5	85.63	11/12/2021	08:12:59	56.4976298	1.9976272	
166	FLMR013	PSA, Macrofauna	B1	8	85.96	11/12/2021	08:19:39	56.4976336	1.997755	
166	FLMR013	PSA, Macrofauna	C1	7	85.23	11/12/2021	08:25:40	56.4976156	1.9978349	
167	FLMR039	PSA, Macrofauna	A1	8	87.13	11/12/2021	08:42:29	56.508231	2.0155453	
168	FLMR022	No Sample	A1	0	86.71	11/12/2021	09:30:37	56.5803808	2.0466383	Small Sample
168	FLMR022	PSA, Macrofauna	A2	7	86.06	11/12/2021	09:35:35	56.5803426	2.0466277	
169	FLMR029	No Sample	A1	0	80.44	11/12/2021	10:25:48	56.5954102	2.2163072	Small Sample
169	FLMR029	PSA, Macrofauna	A2	5	79.95	11/12/2021	10:30:00	56.5953807	2.2163932	
172	FLMR032	PSA, Macrofauna	A1	8	72.06	11/12/2021	14:00:47	56.5447232	2.5026094	
175	FLMR051	PSA, Macrofauna	A1	9	73.42	11/12/2021	13:31:16	56.5498001	2.4586559	Photographs for this sample show station incorrectly as 171 but should be 175.

Event	Station Code	Sample	Replicate Attempt	Depth of Sample	Water Depth (m)	Date	Time	Latitude	Longitude	Notes
176	FLMR033	PSA, Macrofauna	A1	9	74.13	11/12/2021	16:08:37	56.5258195	2.4640562	
177	FLMR015	PSA, Macrofauna	A1	8	75.16	11/12/2021	17:21:08	56.4735596	2.4306567	
180	FLMR038	PSA, Macrofauna	A1	5	78.03	11/12/2021	19:36:04	56.4891455	2.3346679	
180	FLMR038	PSA, Macrofauna	B1	6	77.92	11/12/2021	19:41:51	56.4890993	2.3346427	
180	FLMR038	PSA, Macrofauna	C1	8.5	78.31	11/12/2021	19:48:00	56.4890112	2.3346426	
181	FLMR021	PSA, Macrofauna	A1	6	79.09	11/12/2021	20:25:23	56.4890704	2.2672584	
183	FLMR023	PSA, Macrofauna	A1	11	83.45	11/12/2021	22:01:23	56.4425909	2.2084567	
184	FLMR005	PSA, Macrofauna	A1	9.5	81.74	11/12/2021	22:48:21	56.4238269	2.1504551	
185	FLMR057	PSA, Macrofauna	A1	10.5	83.7	11/12/2021	23:32:36	56.4013407	2.1164722	
186	FLMR035	No Sample	A1	0	82.25	12/12/2021	00:07:58	56.3851465	2.1127694	No Sample
186	FLMR035	PSA, Macrofauna	A2	5	82.13	12/12/2021	00:13:53	56.3850603	2.1126924	
186	FLMR035	PSA, Macrofauna	B1	5	82.15	12/12/2021	00:19:28	56.3850215	2.1126242	
186	FLMR035	PSA, Macrofauna	C1	5	81.75	12/12/2021	00:25:25	56.3850019	2.1125974	
187	FLMR045	PSA, Macrofauna	A1	6	80.92	12/12/2021	01:04:03	56.3609825	2.180615	
188	FLMR059	PSA, Macrofauna	A1	6	82.66	12/12/2021	01:30:21	56.3469545	2.1882437	
189	FLMR011	PSA, Macrofauna	A1	5	80.11	12/12/2021	01:57:00	56.3408421	2.2157878	
190	FLMR036	PSA, Macrofauna	A1	5	77.3	12/12/2021	02:58:08	56.4259467	2.3441884	
193	FLMR046	PSA, Macrofauna	A1	7	76.55	12/12/2021	05:25:17	56.418094	2.3671152	
194	FLMR008	PSA, Macrofauna	A1	6	72.52	12/12/2021	06:10:37	56.3818775	2.4968178	
196	FLMR012	PSA, Macrofauna	A1	6	72.88	12/12/2021	07:14:33	56.3503194	2.4570185	
198	FLMR048	PSA, Macrofauna	A1	6	74.28	12/12/2021	08:49:11	56.352807	2.4251509	

Event	Station Code	Sample	Replicate Attempt	Depth of Sample	Water Depth (m)	Date	Time	Latitude	Longitude	Notes
200	FLMR001	PSA, Macrofauna	A1	5	76.01	12/12/2021	09:50:58	56.3408035	2.3859991	
202	FLMR014	PSA, Macrofauna	A1	6	74.32	12/12/2021	11:31:51	56.2655151	2.4055097	
204	FLMR019	PSA, Macrofauna	A1	9	76.15	12/12/2021	13:23:58	56.2782151	2.3618347	
206	FLMR020	PSA, Macrofauna	A1	10	79.92	12/12/2021	15:00:48	56.2935626	2.2106921	Angled Bite
208	FLMR060	No Sample	A1	0	82.2	12/12/2021	16:26:54	56.2308806	2.2120683	Grab jaw held open by shell
208	FLMR060	PSA, Macrofauna	A2	10	82.34	12/12/2021	16:32:29	56.2308414	2.2120617	
210	FLMR047	PSA, Macrofauna	A1	10	84.04	12/12/2021	18:15:10	56.1976873	2.1992792	
212	FLMR042	PSA, Macrofauna	A1	8	76.66	12/12/2021	19:55:56	56.188911	2.4599348	
214	FLMR017	No Sample	A1	0	79.52	12/12/2021	20:55:39	56.159766	2.4886126	
214	FLMR017	PSA, Macrofauna	A2	10	79.66	12/12/2021	21:02:34	56.1598156	2.4886137	
216	FLMR050	PSA, Macrofauna	A1	7	77.53	12/12/2021	22:12:33	56.1299893	2.43958	
218	FLMR003	PSA, Macrofauna	A1	8	76.38	12/12/2021	23:19:56	56.1263924	2.4206223	
220	FLMR037	PSA, Macrofauna	A1	7	75.59	13/12/2021	00:41:50	56.1656651	2.3864792	

Table 10. Video stations; Berwick to St Mary’s MCZ and Fulmar MCZ.

Event	Station Code	Replicate	Depth	SOL Time	Latitude	Longitude	EOL Time	Latitude	Longitude	Notes
029	GT19	A1	46.39	10:50:04	55.3012469	-1.4630579	10:55:03	55.3011921	-1.4623314	HIPAP INTERMITTENT
037	Re02	A1	42.95	00:32:41	55.346054	-1.494833	00:34:17	55.346191	-1.4948284	POOR VIS CANCELLED TOW
057	Re09	A1	39.53	10:30:00	55.3346288	-1.5004696	10:31:15	55.3345287	-1.5005171	HIPAP: M31, PANTS VIS, HiPAP intermittent. 230 degrees @ 0.4knt
104	Re09	A1	39.94	00:48:44	55.334003	-1.5005749	00:52:32	55.3338704	-1.5010692	HIPAP:M34 on but not working, ESM2 on
144	FLMR006	A1	88.63	13:21:17	56.2606649	1.9587396	13:36:47	56.2594836	1.9577597	HIPAP NOT WORKING, fixes every 10 nav cycles, pictures every 10 sec
147	FLMR007	A1	87.73	17:40:29	56.2988834	1.9449195	17:54:59	56.2997836	1.9436591	HiPAP not working, cable extended to 135 at 17:47
151	FLMR052	A1	85.81	20:32:43	56.3697488	1.8596846	20:47:38	56.3708118	1.8586197	HiPAP dodgy. '+5 m at 20:41, Video watermark shows station code FLMR52, rather than FLMR052.
153	FLMR027	A1	85.22	22:00:16	56.3830916	1.9099639	22:15:55	56.3841059	1.9084725	HiPAP dodgy. Tide was with us so cloudy at times
154	FLMR025	A1	87.73	22:59:34	56.3918	1.8667436	23:14:40	56.3919666	1.8645065	HiPAP dodgy. 8 Raw images lost from raw image folder.
157	FLMR034	A1	87.05	00:54:41	56.396442	1.8489256	01:10:45	56.3970038	1.8467263	HiPAP on but data poor. Logger on. Line lasers at 82cm. Spot lasers at 300 mm. Using 2nd pc to run stills and video. Poor screen resolution on monitor feeding the wet lab and bridge. Video footage fuzzy. Video watermark shows station code as FLMR_034, rather than FLMR034
158	FLMR055	A1	85.61	02:40:48	56.3933892	1.9971703	02:56:21	56.3945875	1.9945965	Still images appear to show water ingress noticed after deployment at station number 161. HiPAP on but poor signal. Logger on. 2 sea spider pc used for stills and video acquisition. Drogue attached (possibly remove)

Event	Station Code	Replicate	Depth	SOL Time	Latitude	Longitude	EOL Time	Latitude	Longitude	Notes
161	FLMR040	A1	85.26	04:46:20	56.4346298	1.9749807	04:47:48	56.434737	1.9746562	Stills camera appears to have water ingress HiPAP on but not working effectively. Logger on. Telemetry not working (no depth). Water drop seen on stills so recovered to check-water ingress.
170	FLMR029	A1	80.08	10:56:47	56.5950571	2.2165192	11:12:16	56.5961733	2.2131635	Spare camera fitted (from the DC) and recorded only .jpg format. HiPAP recorded but extremely poor.
171	FLMR051	A1	73.79	12:59:29	56.5498789	2.4589546	13:14:44	56.5489062	2.4574766	HiPAP on but poor signal. Logger on. 2 sea spider pc used for stills and video acquisition.
173	FLMR032	A1	72.6	14:32:25	56.5450152	2.5030505	15:35:46	56.5256926	2.4640972	HiPAP on but poor signal. Logger on. 2 sea spider pc used for stills and video acquisition.
174	FLMR033	A1	73.47	15:35:46	56.5256926	2.4640972	15:50:45	56.5247349	2.4626625	HiPAP on but poor signal. Logger on. 2 sea spider pc used for stills and video acquisition.
178	FLMR015	A1	74.54	17:48:30	56.473389	2.4304708	18:04:01	56.471847	2.4287453	Visibility poor so speed increased to 0.5 knots at 17:55. HiPAP not working.
179	FLMR038	A1	77.26	18:56:47	56.4888518	2.3344402	19:19:13	56.4859278	2.3325538	Visibility poor so towed at 0.5 knots. Tower not fixing correctly for first 10 minutes, so tow extended. HiPAP not working. Disturbed sediment causing cloudy visibility (cause: tidal).
182	FLMR021	A1	78.64	20:43:49	56.488459	2.2673689	20:58:48	56.4864158	2.2673554	HiPAP not working, EMS logger left on from this tow until the beginning of the next tow (after a period of weather). Visibility poor so towed at 0.5 knots.
191	FLMR036	A1	76	03:26:03	56.4257047	2.343908	03:42:10	56.4243531	2.3408686	HiPAP working but bearing solution very poor. Stills out of focus. Logger on. EK80 x2 water depth.

Event	Station Code	Replicate	Depth	SOL Time	Latitude	Longitude	EOL Time	Latitude	Longitude	Notes
192	FLMR046	A1	76.27	04:46:47	56.4179846	2.3671838	05:02:04	56.4167859	2.3640773	HIPAP working but bearing solution very poor. No M34. Water depth in tower correct. Logger on. Zoom malfunctioned. Stills out of focus.
195	FLMR008	A1	72.77	06:29:18	56.3821505	2.4952575	06:44:59	56.3826086	2.4914014	HIPAP working but bearing solution very poor. No M34. Logger on.
197	FLMR012	A1	72.9	08:16:59	56.3504234	2.4559093	08:31:57	56.3509773	2.452306	HIPAP working but bearing solution very poor. Logger on. Visibility poor so towed at 0.5 knots.
199	FLMR048	A1	74.74	09:11:34	56.3527536	2.4253513	09:25:56	56.3532856	2.4218773	HIPAP working but bearing solution very poor. Logger on. Visibility poor so towed at 0.5 knots.
201	FLMR001	A1	75.86	10:13:44	56.3407058	2.3857892	10:28:56	56.3405732	2.3835243	HIPAP working but bearing solution very poor. Logger on.
203	FLMR014	A1	74.17	12:35:07	56.265295	2.405252	12:50:12	56.2646716	2.4032969	HIPAP working but bearing solution very poor.
205	FLMR019	A1	76.49	13:44:23	56.2774951	2.360615	13:59:45	56.2766583	2.3589092	HIPAP working but bearing solution very poor
207	FLMR020	A1	80.52	15:19:32	56.2926217	2.2099257	15:34:37	56.2915352	2.2088018	HIPAP working but bearing solution very poor
209	FLMR060	A1	82.05	17:33:34	56.2298292	2.2115483	17:48:43	56.2286468	2.2107388	HIPAP working but bearing solution very poor
211	FLMR047	A1	83.98	18:31:28	56.1977954	2.1995416	18:47:03	56.1960298	2.1989886	HIPAP working but bearing solution very poor. 0.5 Knots at the start
213	FLMR042	A1	76.86	20:12:18	56.1894271	2.4602567	20:27:20	56.1877659	2.4599793	HIPAP working but bearing solution very poor
215	FLMR017	A1	79.3	21:24:23	56.1594754	2.4886775	21:39:29	56.1582264	2.4883489	HIPAP working but bearing solution very poor

Event	Station Code	Replicate	Depth	SOL Time	Latitude	Longitude	EOL Time	Latitude	Longitude	Notes
217	FLMR050	A1	76.7	22:34:55	56.1298252	2.4394591	22:49:47	56.1286762	2.4386892	HIPAP working but bearing solution very poor
219	FLMR003	A1	75.96	23:42:52	56.1265797	2.4209569	23:58:05	56.1254697	2.4198685	HIPAP working, but bearing solution very poor
221	FLMR037	A1	74.88	01:07:26	56.1659284	2.3867064	01:22:55	56.1647397	2.3857415	HIPAP working but bearing solution very poor. Logger on. Overlay watermark reads STN_220, should read STN_221
222	FLMR002	A1	81	02:49:57	56.1264786	2.1950094	03:04:58	56.1253031	2.1942888	HIPAP working but bearing solution very poor. Logger on. Depth may be from sledge.
223	FLMR009	A1	84.15	03:58:46	56.113062	2.1556672	04:13:56	56.1119014	2.1545778	Depth reading back working, HIPAP on but very poor signal, logger on, sledge lifted at 04:09 + can see cable scars in footage.
229	FLMR044	A1	84.31	08:54:49	56.0982643	2.1451226	09:09:56	56.0974915	2.1416317	HIPAP working but bearing solution very poor. Logger on. Camera hopping - tide running in same direction as tow.
230	FLMR041	A1	84	10:02:27	56.1359985	2.1058828	10:17:59	56.1352398	2.1022527	HIPAP working but bearing solution very poor. Logger on. Depth not working EK80. Tide running with direction of tow 251 degrees.
231	FLMR049	A1	84.52	11:02:21	56.1566563	2.1239147	11:17:24	56.1559253	2.1205605	HIPAP working but bearing solution very poor. Logger on. EK80 depth working again. Moderate sea state 3 m swell, tide same direction as tow - 250 degrees. Additional Raw image collected - marked as 'additional' in file name.
232	FLMR043	A1	83.9	15:59:10	56.155593	2.0928228	16:15:10	56.155147	2.0905665	HIPAP working but bearing solution very poor. Logger on. No altimeter
233	FLMR058	A1	85.35	17:25:39	56.1618856	2.0443408	17:40:29	56.1615388	2.0422495	HIPAP working but bearing solution very poor. Logger on.

Event	Station Code	Replicate	Depth	SOL Time	Latitude	Longitude	EOL Time	Latitude	Longitude	Notes
234	FLMR028	A1	84.64	18:16:03	56.1650573	2.0734515	18:31:01	56.1643848	2.0706793	HIPAP working but bearing solution very poor. Logger on.
235	FLMR010	A1	85.71	18:31:01	56.1643848	2.0706793	19:18:34	56.1801786	2.0832164	HIPAP working but bearing solution very poor. Logger on.
236	FLMR030	A1								ABANDONED. Issues with camera, no fixes taken.
240	FLMR030	A1	85.51	08:41:14	56.1983128	2.0258817	08:56:58	56.1971201	2.023603	HIPAP working but bearing solution very poor. Logger on. 18 seconds difference between IP camera and tower clock. 2 or 3 seconds between stills camera time and tower. Coaxial cable. IP camera. Beacon M34. COG 230. Overlay is STN 236 number.
241	FLMR004	A1	86.08	09:42:09	56.2122528	1.9992045	09:57:57	56.211535	1.9963374	HIPAP working but bearing solution very poor. Logger battery flat. Coaxial cable. IP camera. Beacon M34. Logsheet recorded stills as 63, 64 images acquired.
242	FLMR031	A1	86.2	11:08:15	56.2548312	1.9822392	11:23:58	56.2542274	1.9792946	HIPAP working but bearing solution very poor. Logger removed from CS. Coaxial cable. IP camera. Beacon M34. COG 264 (same as bottom current)
243	FLMR056	A1	86.51	12:27:22	56.277034	2.0212148	12:42:45	56.2768152	2.0187952	HIPAP working but bearing solution very poor. Coaxial cable for video link. IP camera. Logger replaced (RSA flag on it). Video overlay is advanced by circa 25 sec from tower time. Single missing Raw image corresponding to .jpg 063
244	FLMR024	A1	86.19	14:00:37	56.296649	1.9179156	14:15:36	56.296164	1.915854	HIPAP working but bearing solution very poor. Coaxial cable for video. IP camera. Either three missing .jpg images or 3 duplicated raw images.

Event	Station Code	Replicate	Depth	SOL Time	Latitude	Longitude	EOL Time	Latitude	Longitude	Notes
245	FLMR054	A1	88.14	15:12:09	56.3320306	1.9476229	15:27:04	56.3319088	1.9454034	HIPAP working but bearing solution very poor. Coaxial cable for video. IP camera.
246	FLMR040	A1	84.42	16:41:15	56.4347229	1.9766575	16:55:11	56.4341266	1.9748622	HIPAP working but bearing solution very poor. Coaxial cable for video. IP camera. Video finished at 16:59, but tower stopped logging at 16:55. Fix number is correct for 16:55 finish time.
247	FLMR016	A1	88.93	18:02:43	56.4805368	1.9099613	18:17:39	56.480297	1.9077585	HIPAP working but bearing solution very poor. Coaxial cable for video. IP camera. Overlay erroneously displays as FLMR046, but should be FLMR016
248	FLMR026	A1	89.37	19:25:06	56.4936081	1.8533086	19:40:28	56.4935775	1.8510039	HIPAP working but bearing solution very poor. Coaxial cable for video. IP camera.
249	FLMR018	A1	90.04	20:31:14	56.5018757	1.8733097	20:33:46	56.501904	1.8729347	HIPAP working but bearing solution very poor. Coaxial cable for video. IP camera. 20:32 transect aborted due to loss of comms with stills camera.
249	FLMR018	A2	90.73	20:58:36	56.5017536	1.8737478	21:13:32	56.5018593	1.8715008	HIPAP working but bearing solution very poor. Coaxial cable for video. IP camera.
250	FLMR053	A1	85.66	22:33:04	56.4808358	2.0271256	22:47:59	56.4811466	2.0249361	HIPAP working but bearing solution very poor. Coaxial cable for video. IP camera. Marine litter, rope (A7).
251	FLMR013	A1	85.69	23:41:24	56.4975838	1.998546	23:56:17	56.4977153	1.9963046	HIPAP working but bearing solution very poor. Coaxial cable for video. IP camera. Marine litter, rope (A7). Average visibility (plume affected in places). Overlay offset.
252	FLMR039	A1	86.78	01:08:08	56.5079185	2.0162942	01:23:56	56.5083775	2.0140719	HIPAP working but bearing solution very poor. Coaxial cable for video. IP camera. ESM logger left on after recovery.

Event	Station Code	Replicate	Depth	SOL Time	Latitude	Longitude	EOL Time	Latitude	Longitude	Notes
253	FLMR022	A1	86.77	02:40:40	56.5799006	2.0474886	02:56:00	56.5802999	2.0452821	HIPAP working but bearing solution very poor. Coaxial cable for video. IP camera. ESM logger left on from previous station. MUX reset as lost connection before download
254	FLMR023	A1	82.38	04:46:37	56.4425786	2.2094602	05:01:39	56.4421531	2.2073388	HIPAP working but bearing solution very poor. Coaxial cable for video. IP camera.
255	FLMR005	A1	81.4	05:56:29	56.4236139	2.1507115	06:11:33	56.4230849	2.1486724	HIPAP working but bearing solution very poor. Coaxial cable for video. IP camera. Overlay watermark labelled as FLMR_CEND1921_FLMR023_STN_254_A1 but should be FLMR_CEND1921_FLMR005_STN_255_A1. Telemetry missing for this station.
256	FLMR057	A1	82.53	06:57:55	56.401334	2.1172129	07:12:59	56.400621	2.1153639	HIPAP working but bearing solution very poor. Coaxial cable for video. IP camera. SPOON 07:01. Logger on.
257	FLMR035	A1	81.74	08:10:21	56.3848959	2.1130629	08:25:58	56.3847907	2.1107127	HIPAP working but bearing solution very poor. Coaxial cable for video. IP camera. Logger on.
259	FLMR045	A1	81.6	10:12:45	56.3604074	2.1811692	10:29:06	56.3611149	2.1790832	HIPAP working but bearing solution very poor. Coaxial cable for video. IP camera. Logger on. COG 295, same as bottom current. (sediment plumes)
260	FLMR011	A1	80.42	11:13:39	56.3400129	2.2167269	11:28:59	56.3410587	2.215418	HIPAP working but bearing solution very poor. Coaxial cable for video. IP camera. Logger on. Logsheet recorded 55 stills acquired, 52 stills acquired.
261	FLMR059	A1	82.85	12:38:50	56.346363	2.1886994	12:52:45	56.3473814	2.1877128	HIPAP working but bearing solution very poor. Coaxial cable for video. IP camera. Logger on

Event	Station Code	Replicate	Depth	SOL Time	Latitude	Longitude	EOL Time	Latitude	Longitude	Notes
262	FLMR048	A1	74.86	14:17:09	56.3523293	2.4256746	14:32:32	56.3533552	2.4243135	HIPAP working but bearing solution very poor. Coaxial cable for video. IP camera. Logger on
264	FLMR012	A1	72.86	15:39:15	56.3499604	2.457927	15:54:10	56.3508119	2.4563012	HIPAP working but bearing solution very poor. Coaxial cable for video. IP camera. Logger on
265	FLMR008	A1	73	16:47:05	56.3820452	2.49863	17:02:02	56.3820515	2.4963916	HIPAP working but bearing solution very poor. Coaxial cable. IP camera.
267	FLMR046	A1	76.13	18:23:00	56.4187228	2.367766	18:37:59	56.4175885	2.366811	HIPAP working but bearing solution very poor. Coaxial cable. IP camera.
268	FLMR036	A1	76.27	19:35:03	56.4257575	2.3429476	19:49:58	56.4258136	2.3451776	HIPAP working but bearing solution very poor. Coaxial cable for video. IP camera.
269	FLMR027	A1	85.24	21:51:32	56.3826572	1.9105478	22:06:27	56.3836528	1.9091843	HIPAP working but bearing solution very poor. Coaxial cable for video. IP camera.
271	FLMR025	A1	87.65	23:16:20	56.3911575	1.8673506	23:31:06	56.39218	1.8661312	HIPAP working but bearing solution very poor. Coaxial cable for video. IP camera. Some stills affected by plume. 12 missing Raw image files.
272	FLMR034	A1	87.94	00:23:30	56.3961967	1.8488579	00:38:58	56.3970182	1.8470794	HIPAP working but bearing solution very poor. Coaxial cable for video. IP camera. Logger on. COG 320, cross current.
273	FLMR049	A1	85.75	02:57:22	56.1559765	2.1250776	03:12:58	56.1572285	2.1244536	HIPAP working but bearing solution very poor. Coaxial cable for video. IP camera. Logger on. COG 320, cross current.
274	FLMR041	A1	84.95	04:02:48	56.1358177	2.1075187	04:17:13	56.1359516	2.1053789	HIPAP working but bearing solution very poor. Coaxial cable for video. IP camera.

Table 11. NIOZ Core samples; Berwick to St Mary's MCZ

Event	Station Code	Sample	Replicate Attempt	Water Depth	Date	Time	Latitude	Longitude	PSA Container	Fauna Container Size	Notes
031	Re04	PSA, Macrofauna	A1	45.64	03/12/2021	13:28:48	55.30514	-1.479849	Plastic Tub	2.5 Litres	
031	Re04	PSA, Macrofauna	B1	45.71	03/12/2021	13:51:00	55.30517	-1.479918	Plastic Tub	2.5 Litres	
031	Re04	PSA, Macrofauna	C1	45.76	03/12/2021	14:14:41	55.30521	-1.479979	2.5 L Bucket	1 Litres	
032	Re01	PSA, Macrofauna	A1	42.69	03/12/2021	15:24:39	55.31547	-1.494067	Plastic Tub	1 Litres	
032	Re01	PSA, Macrofauna	B1	43.32	03/12/2021	15:42:28	55.31554	-1.494078	2.5 L Bucket	2.5 Litres	Coal lumps in sample
032	Re01	PSA, Macrofauna	C1	42.98	03/12/2021	15:54:34	55.31555	-1.494164	2.5 L Bucket	2.5 Litres	
033	Re06	PSA, Macrofauna	A1	46.11	03/12/2021	17:38:31	55.31596	-1.464755	Plastic Tub	3.5 Litres	
033	Re06	PSA, Macrofauna	B1	45.48	03/12/2021	17:51:24	55.31599	-1.464706	Plastic Tub	2.5 Litres	
033	Re06	PSA, Macrofauna	C1	45.32	03/12/2021	18:02:10	55.31603	-1.464664	Plastic Tub	1 Litres	
034	Re08	PSA, Macrofauna	A1	45.24	03/12/2021	19:42:11	55.32646	-1.461748	Plastic Tub	1 Litres	
034	Re08	PSA, Macrofauna	B1	44.93	03/12/2021	19:58:37	55.32645	-1.461689	2.5 L Bucket	1 Litres	
034	Re08	PSA, Macrofauna	C1	44.94	03/12/2021	20:10:38	55.32644	-1.46161	Plastic Tub	1 Litres	
035	Re09	PSA, Macrofauna	A1	39.34	03/12/2021	21:33:32	55.33395	-1.500842	Plastic Tub	2.5 Litres	Priority 1 Blue Carbon
035	Re09	PSA, Macrofauna	B1	39.56	03/12/2021	21:43:38	55.33394	-1.500753	2.5 L Bucket	2.5 Litres	Priority 1 Blue Carbon
035	Re09	PSA, Macrofauna	C1	39.95	03/12/2021	21:54:53	55.33391	-1.500683	Plastic tub	2.5 Litres	Priority 1 Blue Carbon
036	Re12	PSA, Macrofauna	A1	45.33	03/12/2021	22:50:37	55.33462	-1.476358	Plastic Tub	2.5 Litres	Priority 1 Blue Carbon
036	Re12	PSA, Macrofauna	B1	45.73	03/12/2021	23:02:45	55.33461	-1.476292	Plastic Tub	2.5 Litres	Priority 1 Blue Carbon

Event	Station Code	Sample	Replicate Attempt	Water Depth	Date	Time	Latitude	Longitude	PSA Container	Fauna Container Size	Notes
036	Re12	PSA, Macrofauna	C1	45.8	03/12/2021	23:15:51	55.3346	-1.476191	Plastic tub	2.5 Litres	Priority 1 Blue Carbon
058	Re02	PSA, Macrofauna	A1	42.07	04/12/2021	12:19:02	55.34639	-1.494713	2.5 L Bucket	2.5 Litres	
058	Re02	PSA, Macrofauna	B1	42.18	04/12/2021	12:29:17	55.34643	-1.494709	2.5 L Bucket	2.5 Litres	
058	Re02	PSA, Macrofauna	C1	42.27	04/12/2021	12:41:57	55.34648	-1.49472	2.5 L Bucket	1 Litres	
059	Re10	PSA, Macrofauna	A1	47.43	04/12/2021	13:20:42	55.35167	-1.477395	2.5 L Bucket	1 Litres	
059	Re10	PSA, Macrofauna	B1	47.42	04/12/2021	13:31:28	55.35163	-1.477389	2.5 L Bucket	1 Litres	
059	Re10	PSA, Macrofauna	C1	47.57	04/12/2021	13:41:25	55.35159	-1.477372	2.5L Bucket	1 Litres	
060	Re05	PSA, Macrofauna	A1	47.68	04/12/2021	14:30:15	55.36281	-1.479681	2.5 L Bucket	1 Litres	
060	Re05	PSA, Macrofauna	B1	47.65	04/12/2021	14:42:36	55.36276	-1.479649	2.5 L Bucket	0.5 Litres	
060	Re05	PSA, Macrofauna	C1	47.47	04/12/2021	14:52:27	55.36272	-1.479624	Plastic tub	0.5 Litres	
061	Re03	PSA, Macrofauna	A1	44.9	04/12/2021	15:31:18	55.37758	-1.493246	2.5 L Bucket	1 Litres	
061	Re03	PSA, Macrofauna	B1	44.65	04/12/2021	15:41:58	55.37763	-1.493273	2.5 L Bucket	0.25 Litres	
061	Re03	PSA, Macrofauna	C1	44.27	04/12/2021	15:53:06	55.37767	-1.493292	2.5 L Bucket	0.5 Litres	
115	GT45	PSA, Macrofauna	A1	51.54	08/12/2021	17:41:20	55.24508	-1.424602	Plastic Tub	2.5 Litres	
115	GT45	PSA, Macrofauna	B1	51.98	08/12/2021	17:52:19	55.24513	-1.42459	Plastic Tub	2.5 Litres	
115	GT45	PSA, Macrofauna	C1	51.87	08/12/2021	18:00:55	55.24518	-1.424629	Plastic Tub	2.5 Litres	
116	GT37	PSA, Macrofauna	A1	44.73	08/12/2021	18:33:31	55.23031	-1.457407	2.5 L Bucket	1 Litres	
116	GT37	PSA, Macrofauna	B1	44.28	08/12/2021	18:42:24	55.23028	-1.457367	2.5 L Bucket	0.5 Litres	
116	GT37	PSA, Macrofauna	C1	43.7	08/12/2021	18:51:09	55.23024	-1.457355	2.5 L Bucket	1 Litres	
117	GT50	PSA, Macrofauna	A1	39.07	08/12/2021	19:18:19	55.20829	-1.467093	2.5 L Bucket	2.5 Litres	
117	GT50	PSA, Macrofauna	B1	40.55	08/12/2021	19:35:31	55.2087	-1.466885	2.5 L Bucket	2.5 Litres	
117	GT50	No Sample	C1	39.18	08/12/2021	19:44:44	55.20866	-1.466867			No Sample

Event	Station Code	Sample	Replicate Attempt	Water Depth	Date	Time	Latitude	Longitude	PSA Container	Fauna Container Size	Notes
117	GT50	PSA, Macrofauna	C2	39.39	08/12/2021	19:54:44	55.2086	-1.466875	2.5 L Bucket	1 Litres	
118	GT46	PSA, Macrofauna	A1	55.01	08/12/2021	20:34:28	55.20759	-1.380084	Plastic Tub	10 Litres	
118	GT46	PSA, Macrofauna	B1	54.02	08/12/2021	20:46:02	55.20764	-1.380056	Plastic Tub	10 Litres	
118	GT46	PSA, Macrofauna	C1	53.98	08/12/2021	20:56:01	55.20768	-1.380012	Plastic Tub	10 Litres	
119	RP05	No Sample	A1	43.43	08/12/2021	21:42:08	55.17967	-1.435634			Cable malfunction
119	RP05	PSA, Macrofauna	A2	43.43	08/12/2021	22:07:29	55.17968	-1.435639	2.5 L Bucket	0.25 Litres	
119	RP05	PSA, Macrofauna	B1	42.84	08/12/2021	22:20:32	55.17967	-1.435722	2.5 L Bucket	0.25 Litres	
119	RP05	PSA, Macrofauna	C1	42.88	08/12/2021	22:34:07	55.17966	-1.435824	2.5 L Bucket	0.5 Litres	Container size may be inaccurate.
126	GT50	PSA, Macrofauna	A1	39.83	09/12/2021	06:12:31	55.20837	-1.466246	Plastic tub	0.25 Litres	Full penetration (60 ml syringe)
126	GT50	No Sample	B1	39.84	09/12/2021	06:23:32	55.20838	-1.466218			Misfire
126	GT50	PSA, Macrofauna	B2	39.65	09/12/2021	06:27:07	55.20838	-1.466226	Plastic tub	0.25 Litres	Full penetration (60 ml syringe)
126	GT50	No Sample	C1	39.81	09/12/2021	06:34:24	55.20834	-1.466309			Water only
126	GT50	PSA, Macrofauna	C2	39.44	09/12/2021	06:38:37	55.20832	-1.466384	Plastic tub	0.25 Litres	Full penetration (60 ml syringe)

Table 12. CTD casts & water samples; Berwick to St Mary’s MCZ and Fulmar MCZ.

Event	Station Code	Replicate	Depth	CTD Sample Depth	Date	Time	Latitude	Longitude	Notes	O2	Sal	Clr	Nuts	SPM	DIC/DOC	PIC/POC
064	Re12	A1	43.71	37.2	04/12/2021	20:57:00	55.3347342	-1.4760036		3	1	1	1	1	1	1
064	Re12	A1	43.76	22.7	04/12/2021	20:59:25	55.3347076	-1.475593		0	1	1	1	1	1	1
064	Re12	A1	44.07	3.6	04/12/2021	21:02:44	55.3346073	-1.4750478		0	1	1	1	1	1	1
106	GT37	A1	45.29	42	07/12/2021	04:57:20	55.227998	-1.4532538		3	1	1	1	1	1	1
106	GT37	A1	45.92	22.7	07/12/2021	05:00:52	55.2270312	-1.4513352		0	1	1	1	1	1	1
106	GT37	A1	46.13	2	07/12/2021	05:05:31	55.2261288	-1.449121		0	1	1	1	1	1	1
237	FLMR062	A1	87		15/12/2021				Fixed to stern in error. A1 aborted due to warp on wire, no fixes taken.							
237	FLMR062	A2	88.01	80.3	15/12/2021	21:51:43	56.2230011	1.933413	Fixed to stern in error.	3	1	1	1	1	1	1
237	FLMR062	A2	88.44	54.8	15/12/2021	21:54:49	56.2228139	1.9346301	Fixed to stern in error.	0	1	1	1	1	1	1
237	FLMR062	A2	87.15	30.5	15/12/2021	21:57:50	56.2226226	1.9357681	Fixed to stern in error.	0	1	1	1	1	1	1
237	FLMR062	A2	87.65	5.9	15/12/2021	22:01:18	56.2223664	1.9370882	Fixed to stern in error.	0	1	1	1	1	1	1
258	FLMR035	A1	81.91	79	17/12/2021	09:09:56	56.383511	2.1139792		3	1	1	1	1	1	1
258	FLMR035	A1	81.96	2	17/12/2021	09:19:53	56.382645	2.1156547		0	1	1	1	1	1	1

Event	Station Code	Replicate	Depth	CTD Sample Depth	Date	Time	Latitude	Longitude	Notes	O2	Sal	Clr	Nuts	SPM	DIC/DOC	PIC/POC
263	FLMR012	A1	73.19	66.7	17/12/2021	15:06:36	56.3469101	2.462805		3	1	1	1	1	1	1
263	FLMR012	A1	73.43	4.5	17/12/2021	15:11:58	56.3464324	2.4635424		0	1	1	1	1	1	1
266	FLMR046	A1	76.06	72.2	17/12/2021	17:58:17	56.4207831	2.3706842		3	1	1	1	1	1	1
266	FLMR046	A1	75.75	4.6	17/12/2021	18:06:06	56.4209236	2.3717113		0	1	1	1	1	1	1
270	FLMR025	A1	87.56	82.7	17/12/2021	22:44:41	56.3900268	1.8690292		3	1	1	1	1	1	1
270	FLMR025	A1	87.31	4.1	17/12/2021	22:52:08	56.3891254	1.8703592		0	1	1	1	1	1	1

