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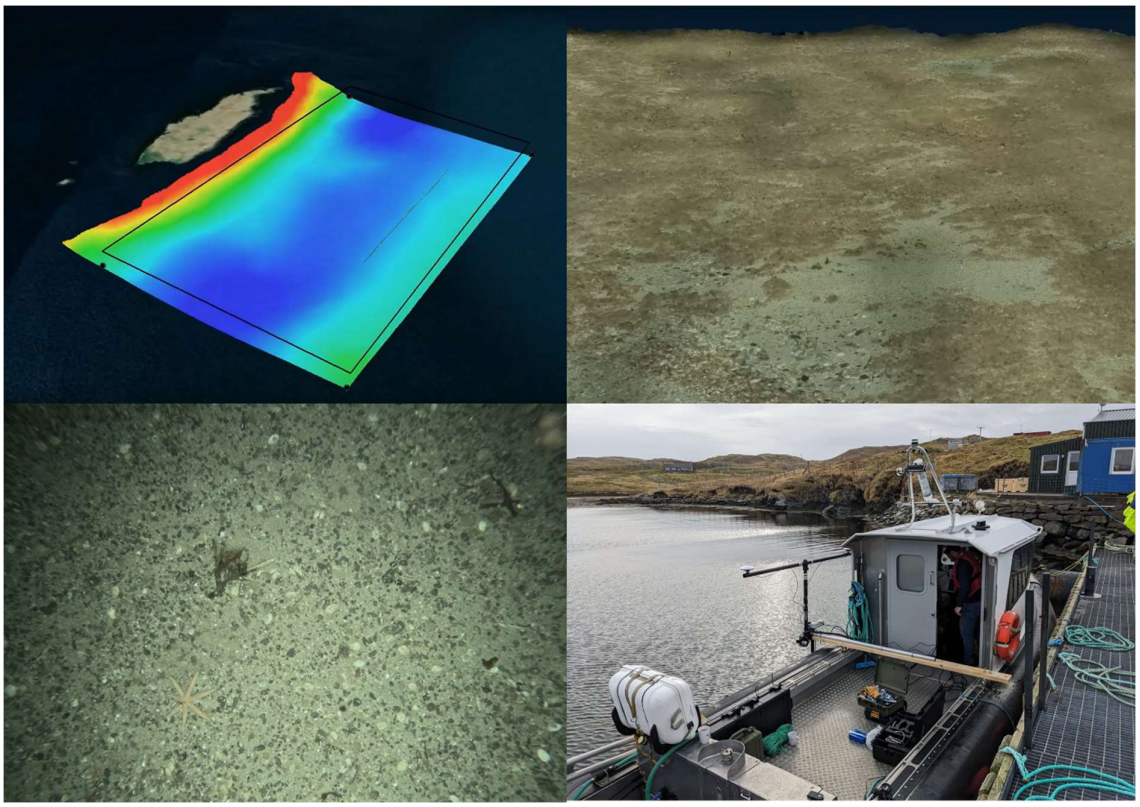
TRITONIA SCIENTIFIC LTD., REPORT No: SSF-077075

Fish Holm, Shetland Isles: baseline seabed survey using multibeam echosounder and georeferenced 3D photogrammetry



Prepared for Scottish Sea Farms Ltd. [redacted]

April 2024

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Background & context

A baseline survey was requested by Scottish Sea Farms Ltd (SSF) to fulfil SEPA requirements for a proposed Atlantic salmon fish farm site at Fish Holm, in the Setterness region of NE Mainland Shetland. The proposed development comprises 12 x 200m circular pens with a total allowable biomass of 6000 tonnes, and would replace a smaller currently consented site, which was operational from 2004 to 2012 with a maximum biomass of 1910 tonnes.

Aims

The specific aims of the survey were to fulfil the four requirements as stated in SEPA's Baseline Survey Design guidance document, version 2, May 2022, i.e. to:

- Characterise the seabed in and around the farm's predicted area of impact
- Identify any protected habitats or species within that area
- Provide an assessment of the existing environmental status of the seabed, including existing impacts
- Address any potential risks identified in the wider area

In order to fulfil these requirements, two survey formats were proposed and agreed as follows:

(a) A complete multi-beam sonar survey of the target area (proposed site lease area, Figure 1) to provide a comprehensive hydrographical overview of the site, as well as identifying any areas of interest.

(b) Georeferenced ROV-based video transects across the modelled area of impact (Figure 2), providing visual evidence of seabed conditions. Any areas of interest to be surveyed in more detail. To be combined in post-processing with Georeferenced 3D photogrammetry models of multiple 'dive sites', produced using ROV-based imagery.

Survey design

The survey design was produced by SSF based on the lease area and the modelled NewDepomod footprint of the proposed fish farm (Figures 1 and 2). The scope of the survey was agreed with SEPA and NatureScot in advance.

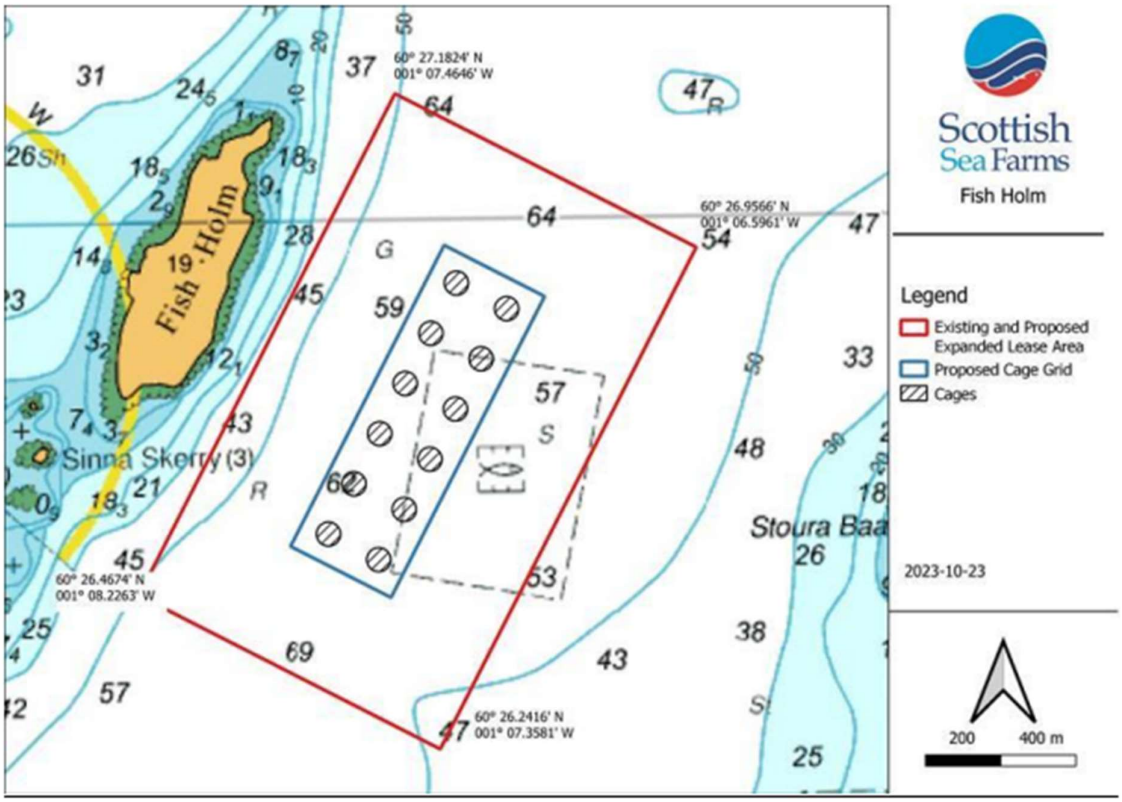


Figure 1. Proposed fish farm site at Fish Holm. The red box delimits the lease area, and the area to be covered by the multibeam survey.

Seven ROV transects were proposed totalling 7 km of footage, with start and end co-ordinates as detailed in Table 1 and Figure 2.

Table 1. Proposed ROV transect details

Fish Holm	start		end		bearing	distance (m)
1	60.44195	-1.12207	60.44752	-1.13126	321	800
2	60.44259	-1.1312	60.45047	-1.12251	29	1000
3	60.44284	-1.13528	60.45386	-1.12304	29	1400
4	60.44055	-1.12853	60.44999	-1.11803	29	1200
5	60.44544	-1.11979	60.45101	-1.12899	321	800
6	60.4403	-1.12389	60.44818	-1.1152	29	1000
7	60.44857	-1.11789	60.45414	-1.12709	321	800

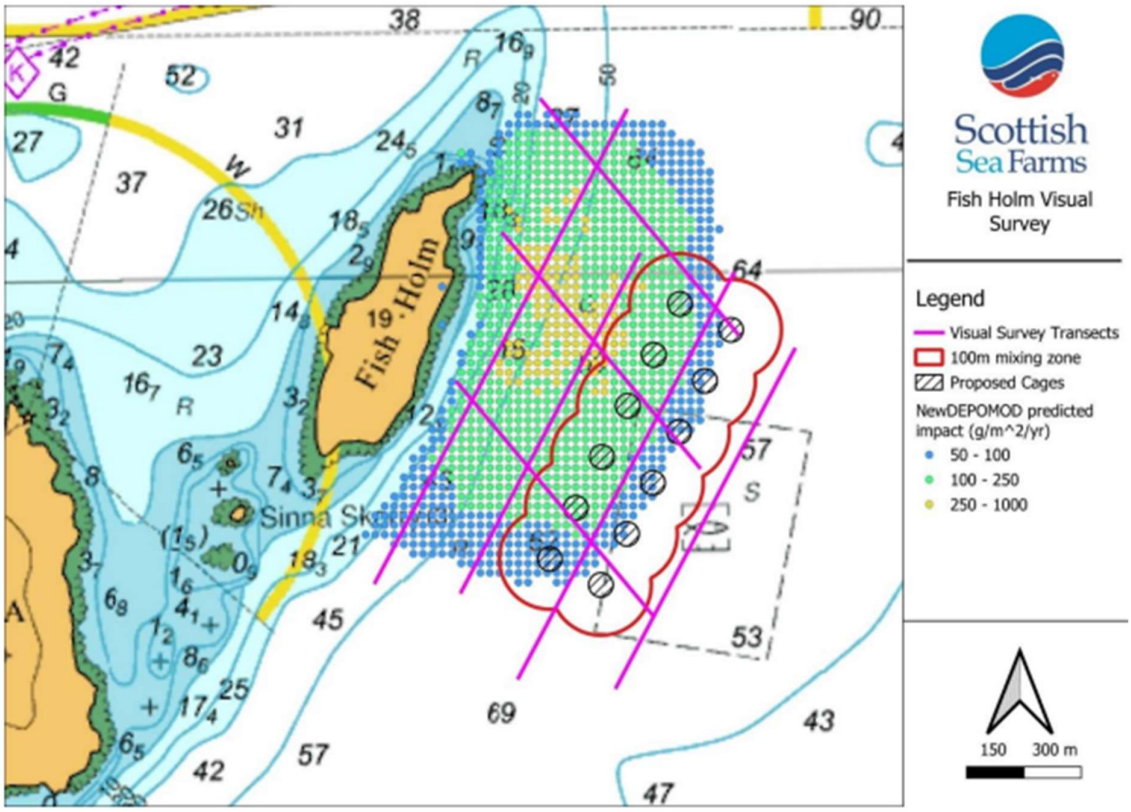


Figure 2: Proposed fish farm site and modelled area of impact. ROV transects shown in pink.

Additional transects for photogrammetry modelling were proposed for the transect intersections, and over any specific features of interest identified by the multibeam/ROV surveys.

Deviations from survey design

The survey was carried out between 28th February and 10th March 2024 using SSF's Flugga boats. The weather was highly changeable, with strong winds and waves/swell presenting considerable challenges on and off throughout the survey period. As a result, three days of surveying were lost (wind either at least F6 from the exposed east/northeast or >F6 from other directions) and the trip had to be extended in order to get the work completed. In the final few days, strong and increasing tidal currents (Figure 3) caused significant difficulties in maintaining the ROV lines, and one transect (T7) and one plot (Plot I) could not be surveyed at all.

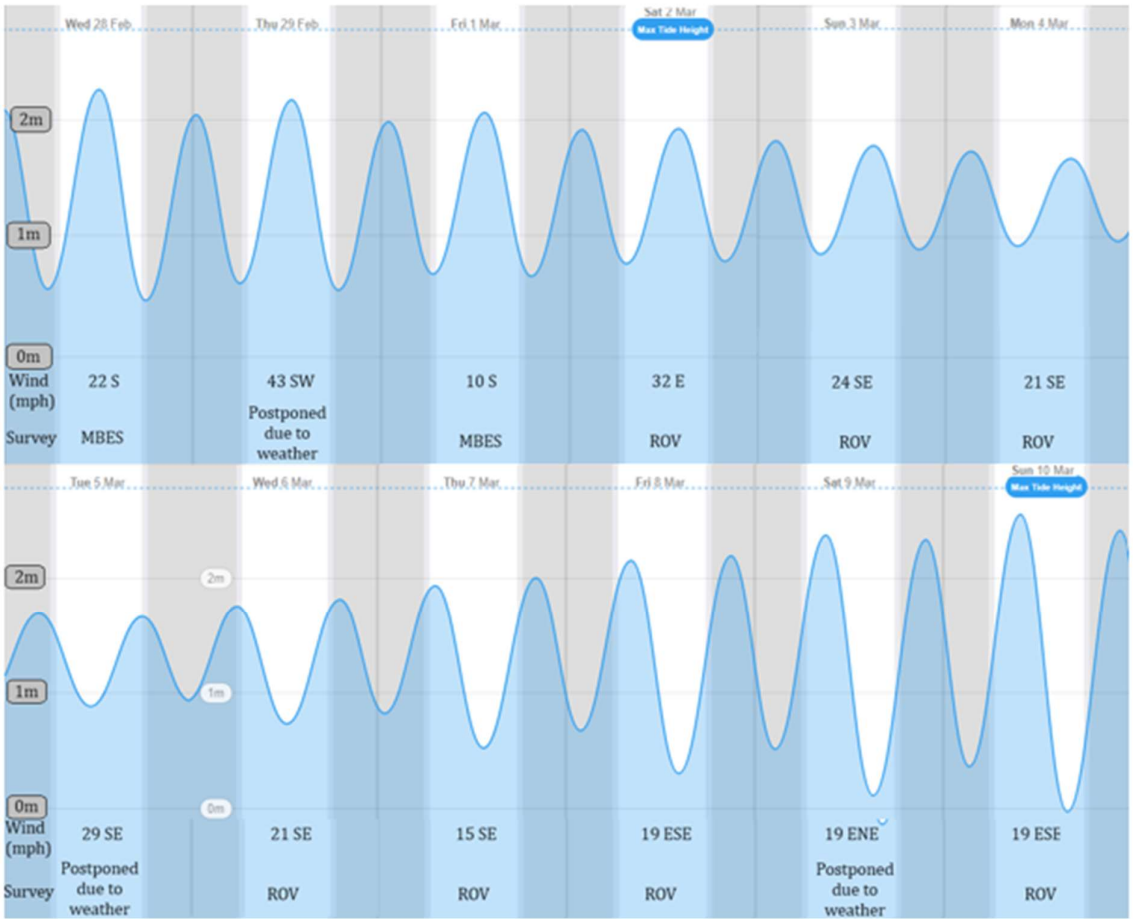


Figure 3. Tide times and heights for Samphrey Island (2.57km from survey site) during the survey period (28th Feb-10th March 2024). Daily wind speed and direction (12:00:00, Lerwick), and daily survey type included.

Tidal graph retrieved from https://tides.willyweather.co.uk/os/shetland-islands/samphrey-island.html on Apr 4th 2024

Wind speeds retrieved from https://www.timeanddate.com/weather/uk/lerwick/historic?month=3&year=2024 on Apr 4th 2024

Actual ROV transects and photogrammetry plot tracks are shown in Figure 4, where notable drifting is evident across multiple survey lines. This can largely be attributed to exceptionally strong tidal currents prevalent in the area, particularly pronounced in deeper sections where the ROV tether experienced increased drag. Additionally, adverse wind conditions during ROV operations contributed to suboptimal topside survey vessel positioning, consequently amplifying noise and positional error in the UGPS data. However, during the survey period, the ROV achieved considerable coverage of the proposed site over a variety of depths and seabed types. The data gathered was of sufficient quantity and quality to fulfil the aims of the survey work as described above.

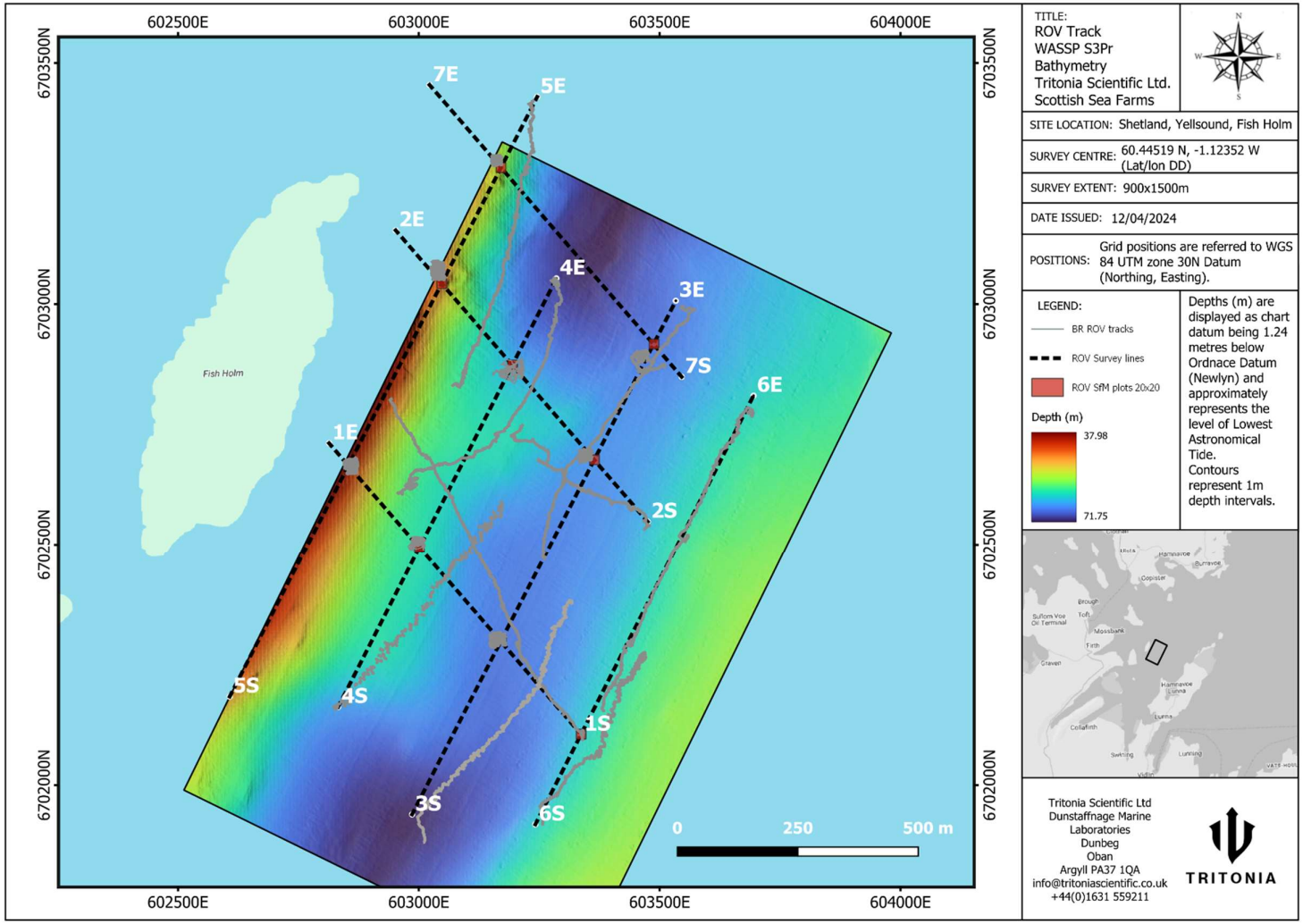


Figure 4: Tracks of the Blue Robotics Blue ROV 2, as recorded by the WaterLinked UGPS subsea positioning system between 28th February and 10th March.

Bathymetry Methodology

WASSP S3Pr System

All bathymetry data were collected on 28th February and 1st March 2024 using a WASSP S3Pr multibeam echosounder (MBES), methodology as follows:

The wideband fairing transducer head and Ellipse IMU Sensor were vertically side-mounted to the survey vessel (in this case, SSF's Flugga boat). Pings were collected using a 120 degree swath at a default centre frequency of 160 kHz. A WASSP IP66 DRX-32 was used for computation of the MBES data stream. These data were transferred to acquisition software using an RPM module on a fixed local IP. The Ellipse Dual Antenna Real-Time Kinematic (RTK) Global Navigation Satellite System (GNSS) Inertial Navigation System (INS) was used to provide 0.2° heading, and attain 1 cm RTK GNSS positioning. The Ellipse sensor box with an integrated SBG Ellipse-D Inertial Measurement Unit (IMU) was used to compute and correct for pitch, roll and heave motion. To achieve RTK corrections, an RTK VRS Network licence from a third party provider called RTK FIX was used. A Valeport Swift Sound Velocity Sensor (SVS) (resolution 0.001m/s and accuracy +/- 0.02 m/s) was used to measure sound velocity at the transducer head, and to obtain sound velocity profiles, which were subsequently used to correct the bathymetry data. The WASSP S3Pr system complies with International Hydrographic Organization (IHO) S-44 Special Order and IHO S-44 Standard 1A and 1B.

Correction for Sound Velocity, Antennae and Transducer Offsets

Following installation of the MBES system onto the survey vessel, power and network connections were established. Subsequently, precise measurements were taken of the x, y and z relative offsets from the fore and aft Ellipse dual RTK antennae to the Ellipse-D IMU. Following this, Sound Velocity Profiles (SVPs) were collected and a patch testing procedure was carried out. This involved recording multibeam data along two parallel transect lines, preplanned to encompass both flat and sloping seabed topography. The calibration of pitch, roll and yaw transducer offsets was performed using the BeamworX software suite (see appendix; annex 1, 2 and 3). The acquired SVPs (see appendix, annex 4, 5 and 6), along with antenna and transducer offsets, were then applied to the survey configuration. This ensured that subsequently collected data were pre-corrected for survey data acquisition. Additional SVPs were obtained and applied in cases where the sound velocity recorded by the SVS (mounted above the head) deviated by +/- 2m/s from the sound velocity recorded at the corresponding depth on the SVP. These additional measurements were conducted at intervals of 2 to 3 hours throughout the data acquisition process. The real-time corrections for tidal height were automatically performed by RTK positioning upon acquisition.

Data Acquisition

Lines were sailed to achieve a minimum of 50% swath overlap with previous lines, to allow for the clipping of the outer extents of the swath during post-processing. The vessel surveying speed was typically between 1.5 and 3 m/s, varying with the sea state and depth. All data acquisition was carried out using the BeamworX software suite. Data was collected in the Ordnance Survey Great Britain 36 (OSGB36), ESPG:27700 Coordinate Reference System (CRS)

and then subsequently transformed to World Geodetic System 84 UTM zone 30N, EPSG 32630.

Post-Processing

All bathymetry data were post-processed using the BeamworX software suite. All Z data were transformed from ordnance datum (OSGB36) to chart datum using a site-specific z-shift of -1.24m. This transformation was sourced using an admiralty nautical chart, and refers to the tidal heights at Burravoe (Yell sound), 7km from the survey site. A comparison with corresponding admiralty depths was used as a gross error check.

The following filters were applied to the data in order to compensate for inevitable increased error at the outer extent of swaths:

- Slope filter (rejects points based on its mean slope to its neighbours)
- Clip outer beams (rejects 10% of the outer beams of the swath)
- Overlap fixer (corrects for refraction on file overlaps)
- Mean height 0.5m (smooths points based on mean height of neighbouring points)
- Clip intensity (rejects points within a range of specified intensity values)

Data for mean bathymetry and intensity (backscatter) was exported as geotiff files, then imported and presented in Quantum Geographic Information System (QGIS).

ROV Videography

ROV visual survey transects and plots were run from 2nd-4th, 6th-8th and 10th March. A total of 16 hours and 55 minutes of data were collected, covering six transects and eight photogrammetry plots.

Georeferenced Video Transects

A BlueROV2™ Heavy Configuration was used to record georeferenced video transects. The ROV foundation comprised an 8 thruster configuration, low-light navigation HD camera, dimmable Lumen Subsea™ lights (4 x 1500 lumens), Pressure Sensor (BlueRobotics™ Bar30) and 6-axis IMU sensors.

Navigation System

The ROV utilised a Short Base Line (SBL) acoustic positioning system, which consisted of a WaterLinked G2 ™ Topside unit adapted with a heading sensor and dual Simrad™ HS60 GPS antennae. A WaterLinked™ Antenna fitted with four D1 acoustic receivers was side mounted at 1m below the waterline, and an A1 locator integrated and mounted on the starboard side of the ROV. The system triangulated and calculated the position of the locator based on the acoustic signals received, combined with global coordinates and data from the pressure sensor, achieving accurate geolocation of the ROV.

A Doppler Velocity Log (DVL), WaterLinked™ DVL A50 was integrated into the ROV system, enhancing position-keeping, stabilisation, and velocity computation. This augmented the

navigation system and enabled semi-autonomous missions and achieved precise geolocated transects.

Telemetry data was continuously recorded throughout the dive, facilitating precise spatial referencing for the videos and still imagery, thereby enhancing the production of data visualisation.

Video and Imagery Collection

The still images (27.13MP) used for the photogrammetry plots were recorded using a GoPro® HERO 12 and the video transects (4k) with a DeepWater explorerHD™ 3.0 camera for high-definition live streaming and recording. The BlueROV2™ was equipped with 4 x 1500 lumens internal, dimmable lights, and two supplementary external lights (up to 18000 lumens each) (used in lower light conditions. Both the cameras and lights were positioned facing downwards for optimal illumination and image capture.

Results & Interpretations

Multibeam bathymetry and backscatter

Within the proposed lease area, minimum depths are approximately 40m along much of the western boundary adjacent to Fish Holm island (min 37.98m) with maximum depths of approximately 70m (max 71.75m) at the north and south end (Figure 5). Depths along the eastern boundary show the seafloor beginning to shallow again in this direction. This is broadly consistent with hydrographic charts of the area, which show the survey area lying over a channel of relatively deep water which shallows steeply towards the islands of Fish Holm and Linga to the west and more gently towards the Hamnavoe peninsula to the east (Figure 5). Within the main body of the channel the bathymetry is fairly flat, with depths at around 55-65m and slightly deeper areas at the north and south ends of the survey area.

Backscatter intensity across the area surveyed ranges from approximately between -9 and -17 dB on the west side and north and southwest end to approximately between -17 and -25dB in the centre and east side of the area (Figure 6). The maximum backscatter intensity (hardest substrate) was observed in the southwest corner of the area (-9.14dB), but much of the north and northeast areas also have considerably high intensities. The minimum backscatter intensity (softest substrate) was observed in the centre area (-25.36dB), but large areas of the centre and east points, as well as smaller localised areas on the slopes towards Fish Holm island have generally lower backscatter intensities.

Visual survey data from the photogrammetry plots and T5 were used to ground truth the backscatter, and showed good correlation with sandier seabeds characterised by lower backscatter intensities (-20 to -25 dB) and gravelly/cobbly seabeds characterised by higher backscatter intensities (-9 to -15 dB) (Figure 7). It's noteworthy to mention that the two brittlestar bed images have higher intensities, presumably reflecting the cobbles/rocky substrate underneath them.

No particular areas of interest warranting more detailed investigation were identified in the multibeam bathymetry or backscatter data.

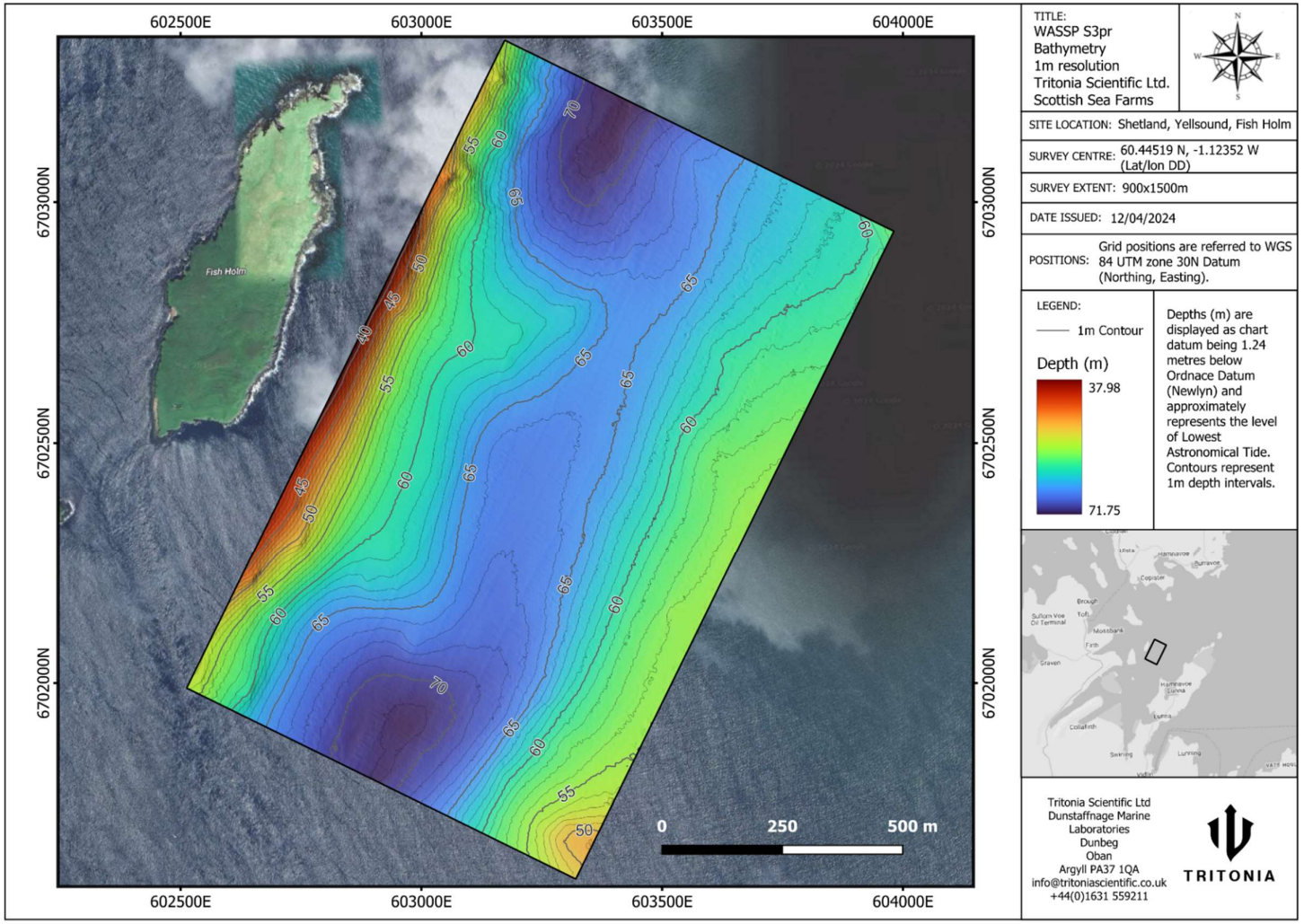


Figure 5. Digital Elevation Model (DEM) of bathymetry data for the survey site.

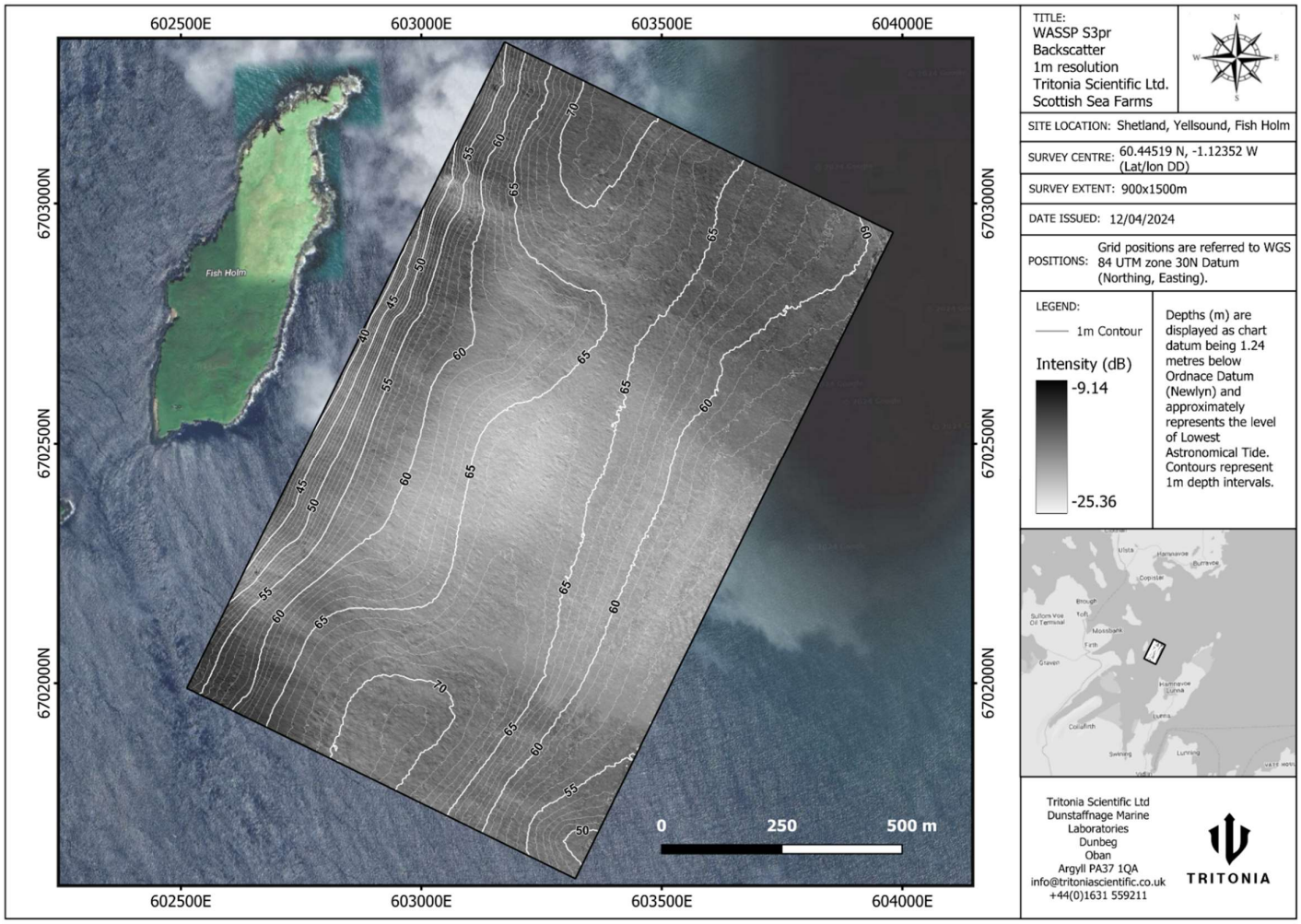


Figure 6. Backscatter data showing intensities for the seabed of the survey site (higher dB represents harder substrate and lower dB represents softer substrate).

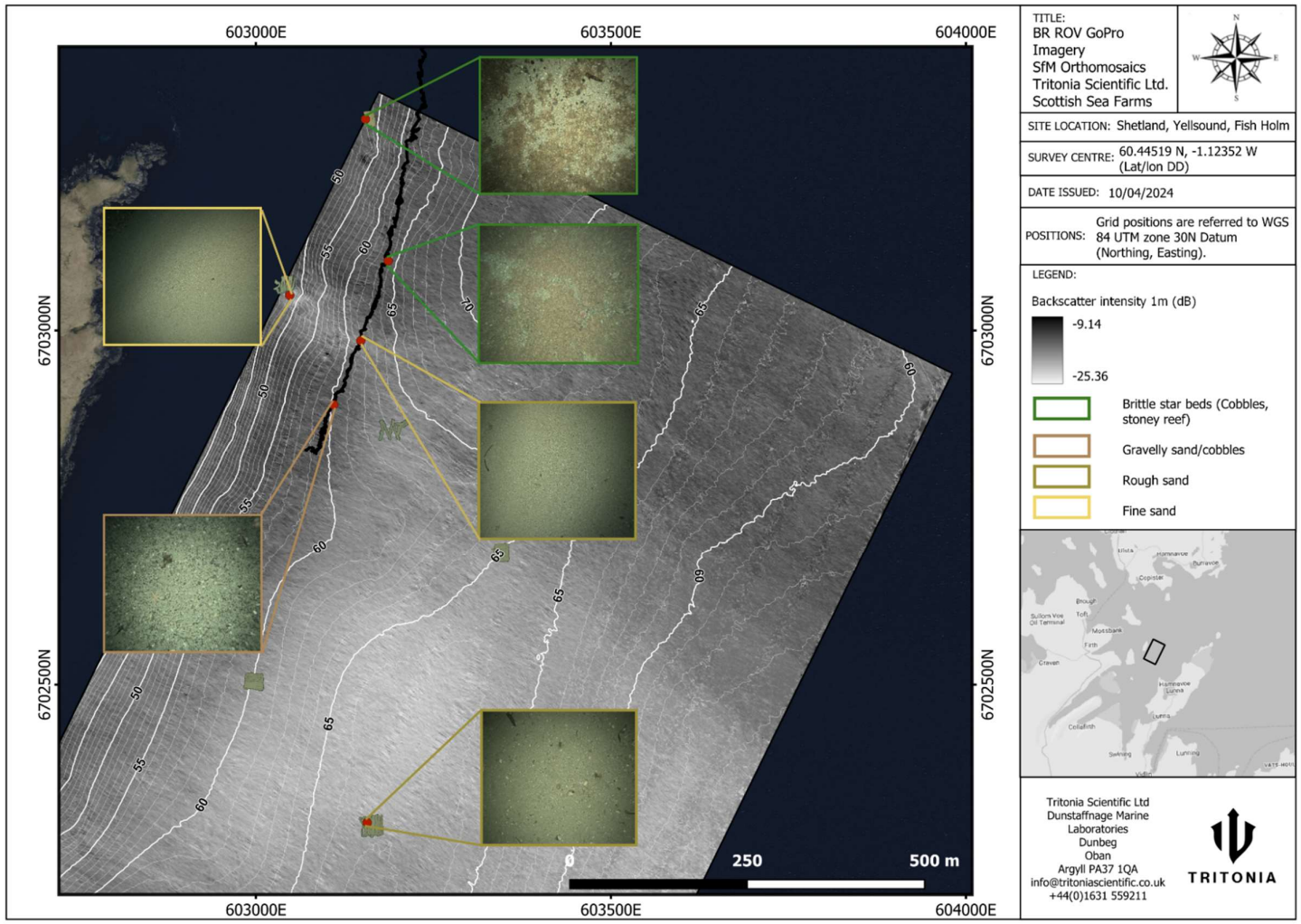


Figure 7. Ground truthing of the backscatter data using representative photogrammetry images.

ROV visual survey

ROV data were collected on 2nd-4th, 6th-8th and 10th March 2024 (Figure 3). The locations of the ROV transects and photogrammetry plots are shown in Figure 4.

Transect 1: 60.44200°N, -1.12203°E to 60.44826°N, -1.12890°E; 794m

The seabed is composed of sand and shell/shell fragments, becoming gravelly in the most northeasterly 100m (Figure 8). The shell component is patchy in distribution, and tends to correlate positively with faunal abundance (especially brittlestars). Epifauna are dominated by echinoderms (sea urchins, especially *Echinus esculentus*, and several species of brittle stars and starfish). Some molluscs are also present, including whelks, king and queen scallops and other bivalves. A number of thornback rays and a single monkfish were noted along the transect between 400m and 600m from the SE end.

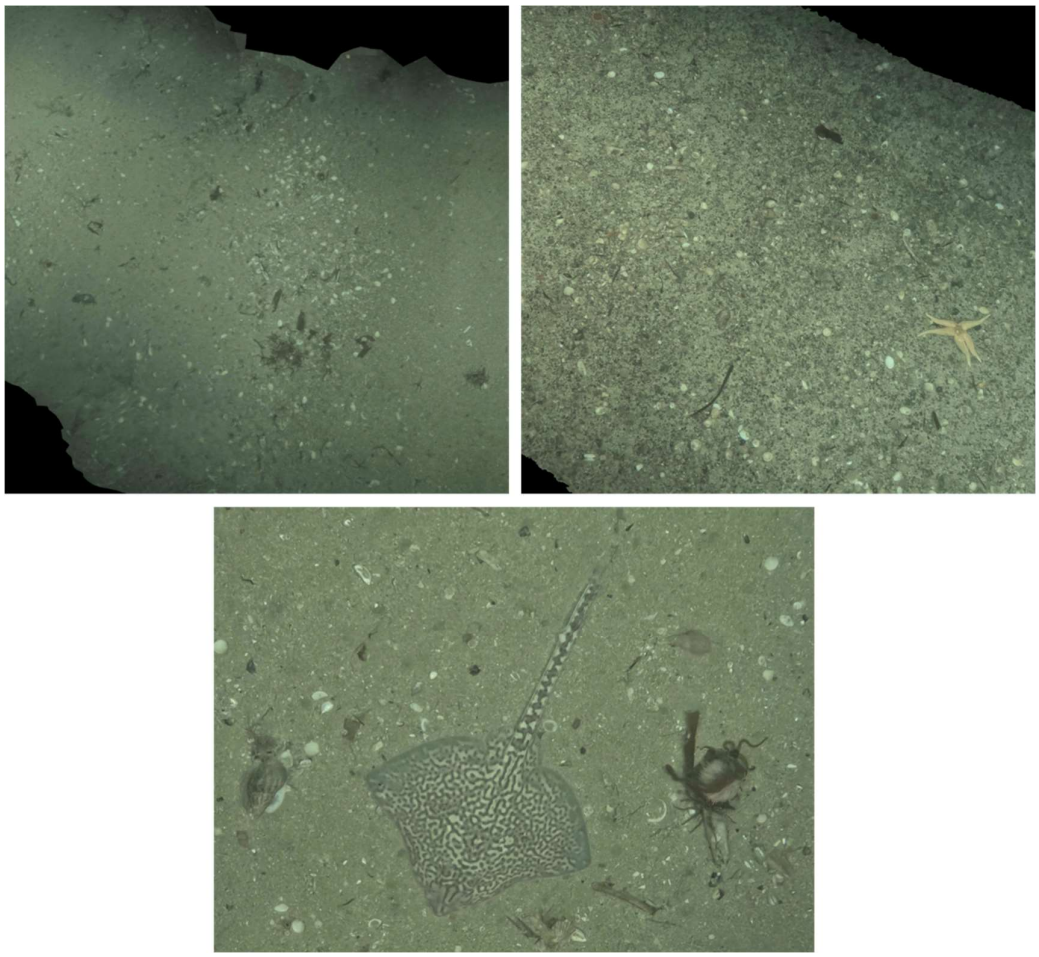


*Figure 8. Above left: Image representative of most of Transect 1. Sandy seabed with scattered shells and a shellier patch in the middle (depth 62m). Right: NE end of the transect, showing a similar sandy seabed but with much higher gravel content (depth 47m). Below: Thornback ray with whelks and a sea urchin (*Echinus esculentus*) partially obscured by kelp.*

Transect 2: 60.44613°N, -1.11946°E to 60.44760°N, -1.12442°E; 318m

The seabed is composed of sand and scattered shells/shell fragments, becoming slightly gravelly in the NW. There are a number of exposed boulders at the NW end of the transect, colonised by urchins, brittle stars and anemones (Figure 9). Epifauna are dominated by echinoderms (sea urchins, especially *Echinus esculentus*, and several species of brittle stars and starfish). Bivalves (including scallops) are also present, but not abundant. A couple of thornback rays occur 300 to 400m from the SE end of the transect.

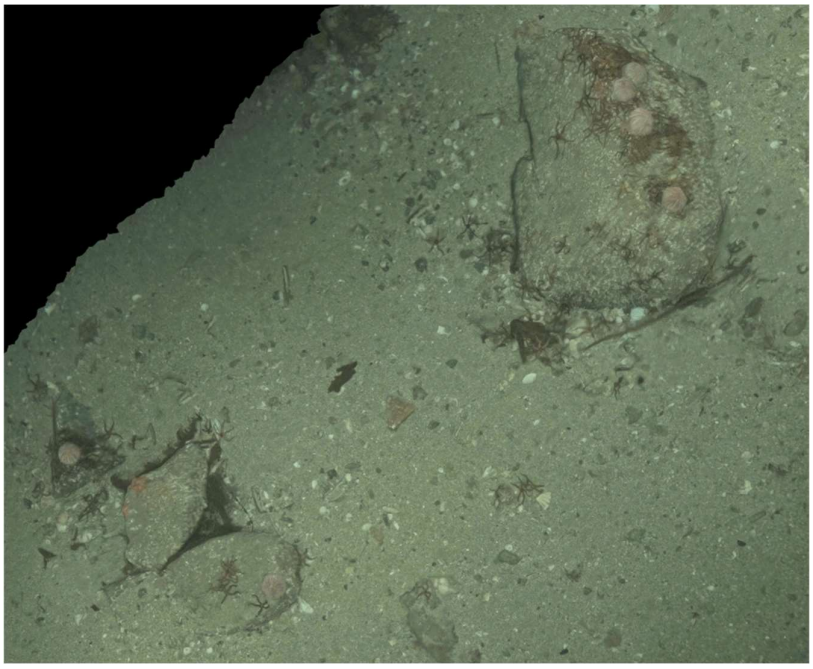


Figure 9. Exposed boulders at the NW end of Transect 2 (depth 50m). The substrate under and around the boulders is representative of the seabed along the rest of the transect.

Transect 3: 60.44067°N, -1.12804°E to 60.44987°N, -1.11778°E; 1,134m

The seabed along most of the transect is sandy with gravel and shells/shell fragments, grading into mud towards the in the central part (Figure 10) and becoming more gravelly again at the SW end. Epifauna are dominated by echinoderms (sea urchins, especially *Echinus esculentus*, and several species of brittlestar and starfish). Brittlestars are intermittently very abundant, partially carpeting the seafloor in some places at the N end of the transect. Bivalves (including scallops) are also present, but not abundant. Spiny dogfish, cuckoo and thornback rays and plaice were all observed along this transect (Figure 11). A number of possible horse mussels (*Modiolus modiolus*) were also recorded. The track crosses a piece of rope and a drag marks on the seabed at around 60.44437°N, -1.12037°E (Figure 12).

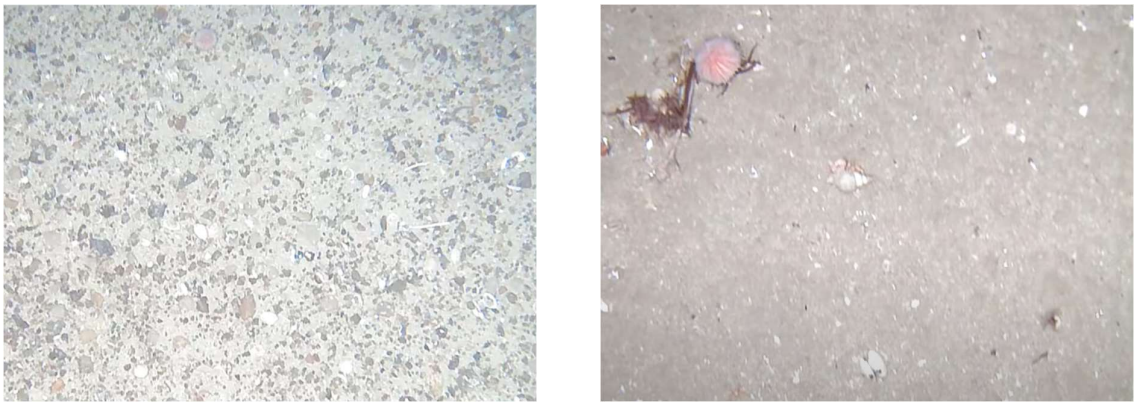


Figure 10. Left: Representative seabed from near the NE end of Transect 3 showing a sandy/muddy substrate with shells/shell fragments and a fairly high proportion of gravel. Right – representative image from the central part of the transect. The seabed here is composed of finer sand/mud, with some shell/shell fragments and virtually no gravel.

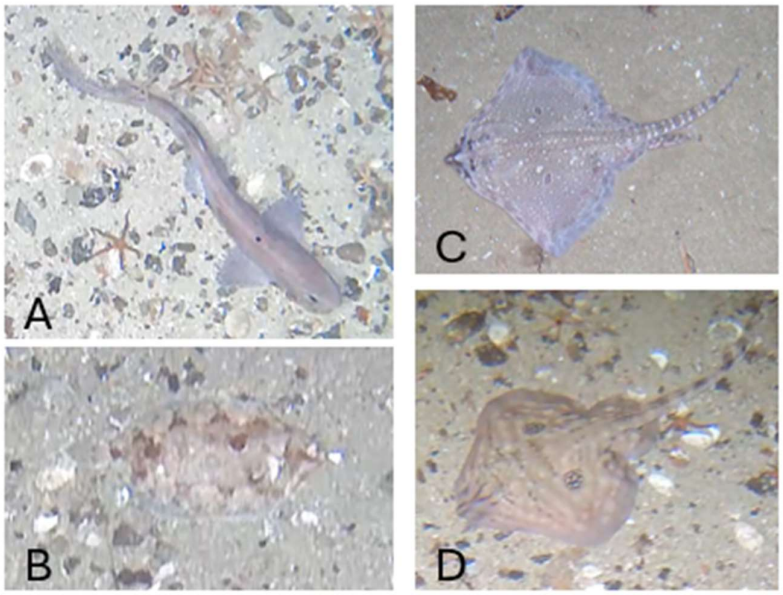


Figure 11. Fish observed along Transect 3. A: spiny dogfish B: well camouflaged plaice C: thornback ray D: cuckoo ray

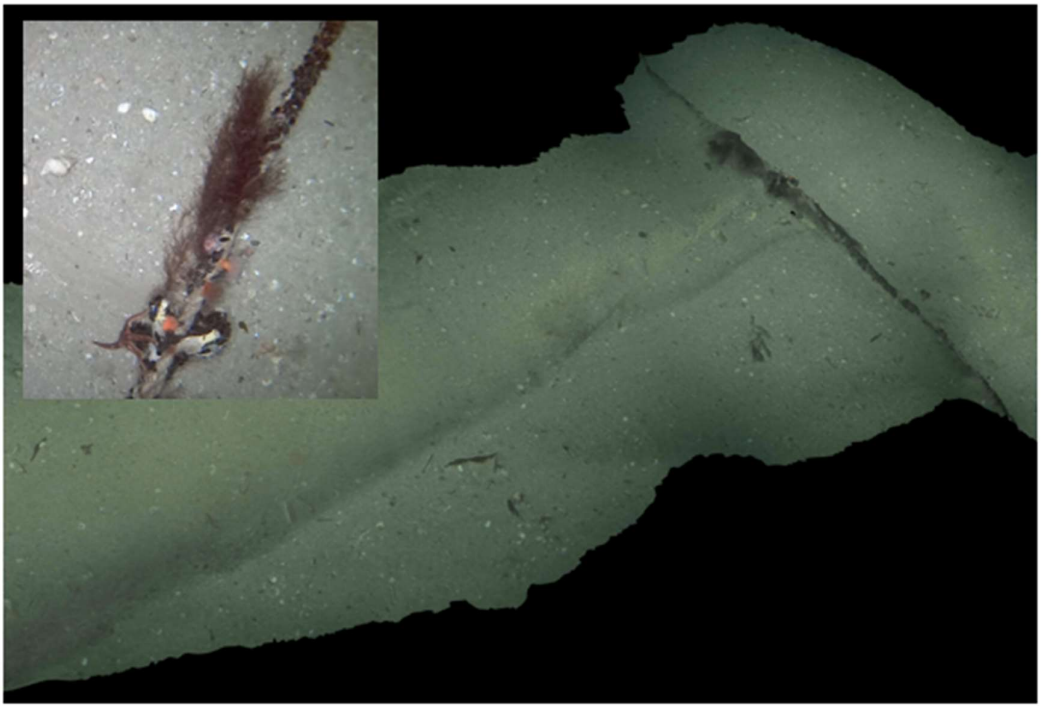


Figure 12. Photogrammetry image showing a section of rope which has apparently been dragged along the seafloor. Inset: still from video showing the tied ends of the rope and colonisation by fauna/seaweed.

Transect 4: 60.44227°N, -1.12965°E to 60.45047°N, -1.12254°E; 1,103m

Transect 4 comprises a muddy/sandy seafloor with shells/shell fragments and gravel, and a few exposed boulders (Figure 13). Shell and gravel content is high at the SW end of the transect, but decreases rapidly to the NE (Figure 14). Epifauna are dominated by echinoderms (sea urchins, especially *Echinus esculentus*, and several species of brittlestar and starfish). Individual horse mussels (*Modiolus modiolus*) occur along the transect and are relatively abundant among and between patchy brittlestar bed at the north end (Figure 15). Other species observed include burrowing anemones, king and queen scallops and other bivalves, whelks, crabs and hermit crabs. King scallops are relatively abundant in places. Fauna are relatively sparse along the central part of the transect and broken pieces of kelp are common, possibly indicating storm damage (Figure 16). Several thornback rays and a lesser spotted dogfish or nursehound (Figure 17) were also observed.

Figure 13. Exposed boulders colonised by urchins, anemones and keelworms

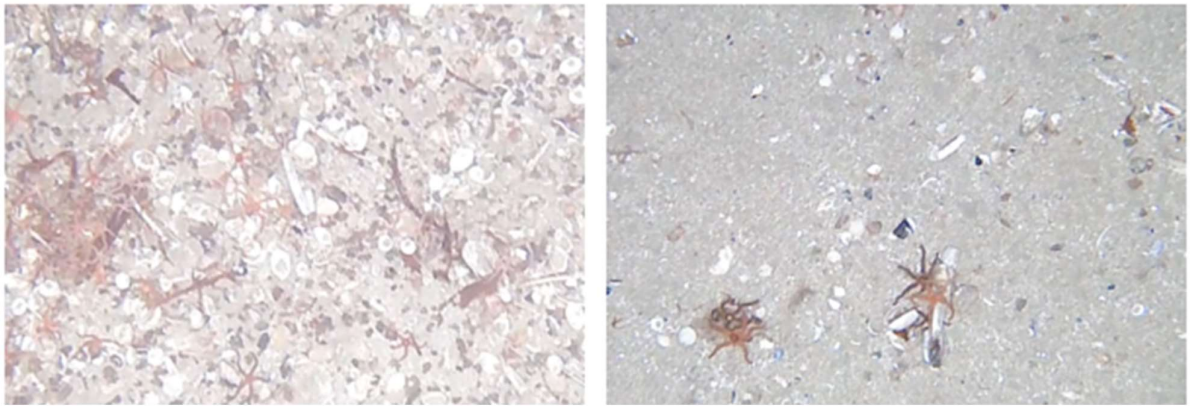


Figure 14. Representative seabed images from the SW end (left) and central part (right) of Transect 4, showing a shelly, gravelly seabed grading into muddy sand.

Figure 15. Horse mussels are intermittently abundant at the N end of Transect 4.

Figure 16. Broken kelp colonised by urchins and brittlestars.

Figure 17: Lesser spotted dogfish or nursehound (unclear which)

Transect 5: 60.44854°N, -1.12642°E to 60.45362°N, -1.12327°E; 592m

Transect 5 comprises a sandy seafloor with shells/shell fragments and gravel (Figure 18). Epifauna are dominated by echinoderms (sea urchins, especially *Echinus esculentus*, and several species of brittlestar and starfish), with brittlestars especially abundant in places. Where these form beds horse mussels are frequently seen, suggesting that horse mussel bed may underlie the brittlestars. Other species observed include burrowing anemones, whelks, scallops and other bivalves. A gurnard and a monkfish were also captured in the data on this transect (Figure 19).

Figure 18: Image representative of the seabed substrate along Transect 5. Left: sandy sediment with shells/shell fragments and gravel, fauna dominated by echinoderms. Right: Partial brittlestar bed with horse mussels and shells.

Figure 19: Monkfish (left); gurnard (right)

Transect 6: 60.44242, -1.12127 to 60.44799, -1.11544; 700m

Transect 6 comprises a sandy seafloor with shells/shell fragments and varying quantities of gravel (generally increasing to the north (Figure 20). Epifauna are dominated by echinoderms (sea urchins, especially *Echinus esculentus*, and several species of brittlestar and starfish). These are more numerous in the NE half of the transect where brittlestars are extremely abundant, carpeting the seafloor in some places. Other species observed include scallops, other bivalves and hermit crabs. Thornback rays and spiny dogfish can also be seen on occasion along the transect.

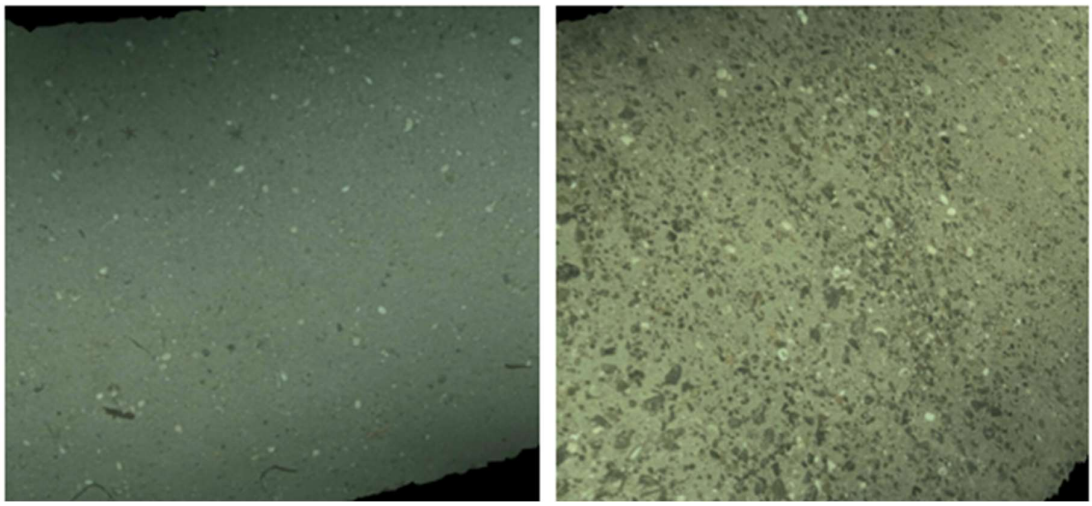


Figure 20: Representative seabed images from the south (left) and north (right) ends of Transect 6, showing a muddy/sandy seabed with scattered shell/shell fragments and little gravel grading into a much coarser sandy substrate with a high gravel content.

Photogrammetry

Additional data was collected at the transect intersections in order to create photogrammetry models for more detailed analysis of the seabed, to ground truth the observations made from the visual survey data. Three of the plots (B, E and H) were impacted by strong tidal currents (ROV unable to hold course), and one plot (I) could not be collected at all. However, all data collected were useful, and allowed cross-checking and confirmation of visual survey interpretations. Plot locations are shown in Table 2 and Figure 21, and Figures 22-29 show representative extracts from each plot.

Table 2. Plot locations

Plot	*Plot Centre Location (DD)*
A	*60.44709, -1.13042*
B	*60.45062, -1.12691*
C	*60.45270, -1.12465*
D	*60.44562, -1.12801*
E	*60.44876, -1.12430*
F	*60.44375, -1.12509*
G	*60.44715, -1.12162*
H	*60.44895, -1.11949*

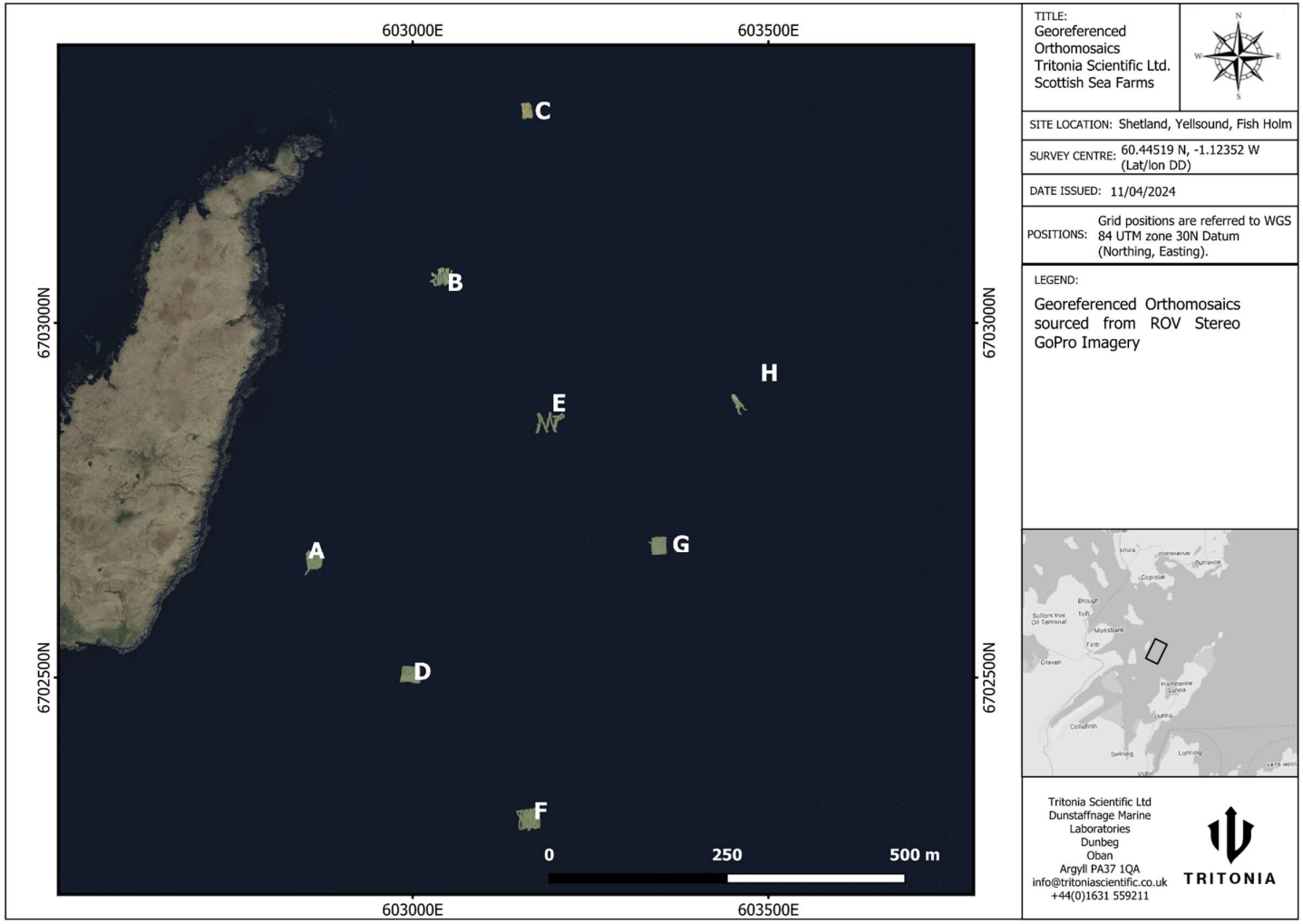


Figure 21. Location of photogrammetry plots.

Figure 22. Plot A: Sandy seabed, with gravel and shells/shell fragments. Fauna dominated by echinoderms (urchins, starfish and brittlestars), although these are fairly sparsely distributed. Some bivalves also present, including king scallops and horse mussels.

Figure 23. Plot B: Sandy seabed, with gravel present in varying quantities. Fauna are dominated by echinoderms, and are fairly sparsely distributed within the plot area. Water depth 43m.

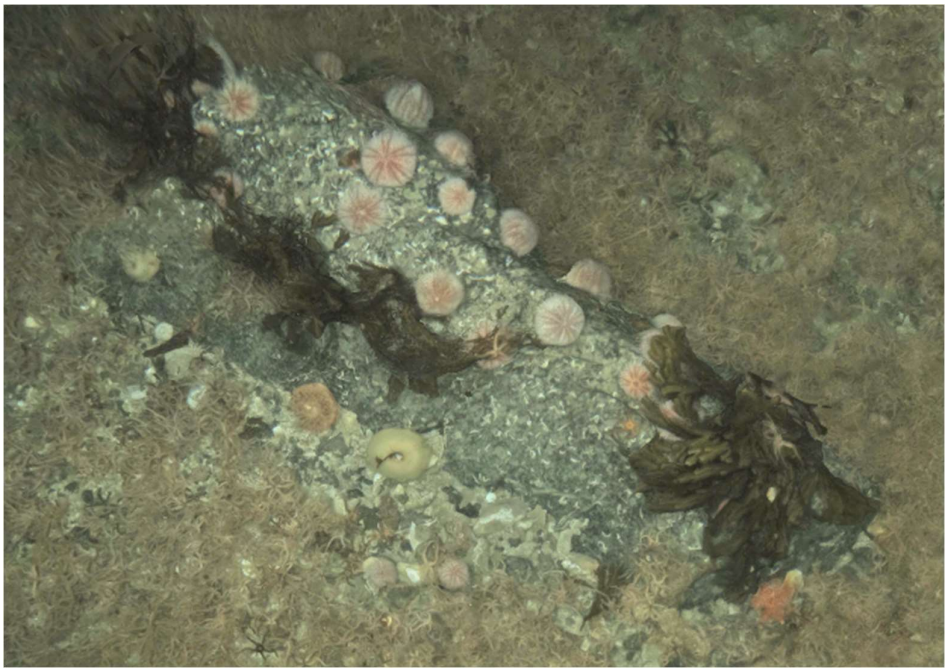


Figure 24. Plot C: Sandy seafloor with patches of gravel. Brittlestars in are present in abundance, carpeting most of the plot area. Rocky outcrop has been colonised by kelp and an assortment of fauna including urchins, anemones, starfish and numerous calcareous keelworm tubes.

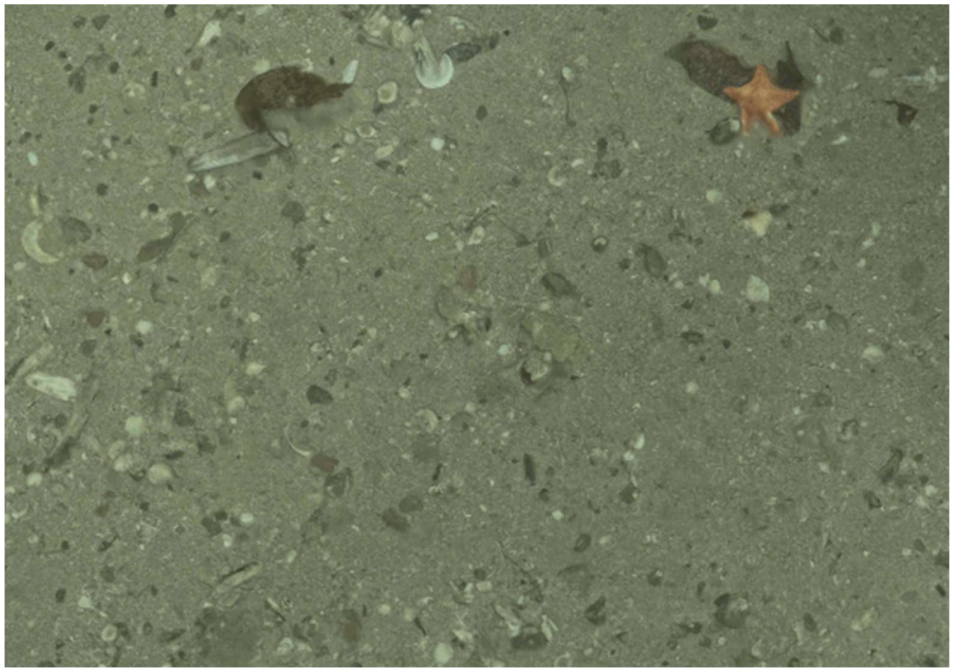


Figure 25. Plot D: Sandy seabed with scattered shells/shell fragments and gravel. Sparse epifauna dominated by echinoderms. Water depth approx. 55-60m.

Figure 26. Plot E: Sandy seabed with scattered shells and shell fragments. Epifauna dominated by echinoderms. Water depth 53-58m.

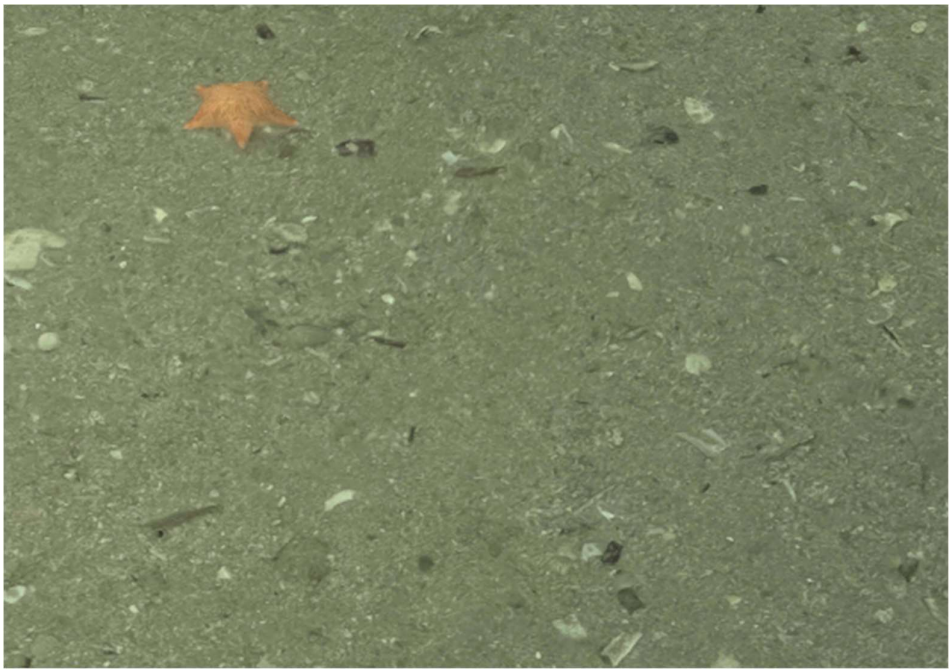


Figure 27. Plot F: Sandy seabed with scattered shells and shell fragments. Epifaunal distribution is fairly sparse, and dominated by echinoderms. Scallops are also occasionally present, but not abundant. Thornback rays (3) also occur within the plot area.

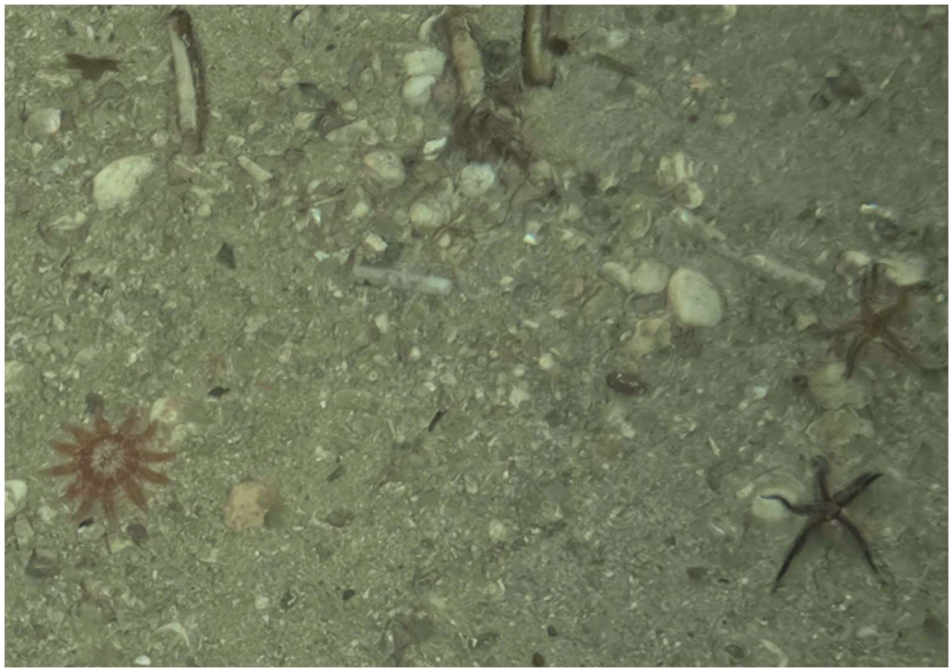


Figure 28. Plot G: Sandy seabed with scattered shells and shell fragments. Abundant epifauna dominated by echinoderms, with some scallops also present although not abundant.

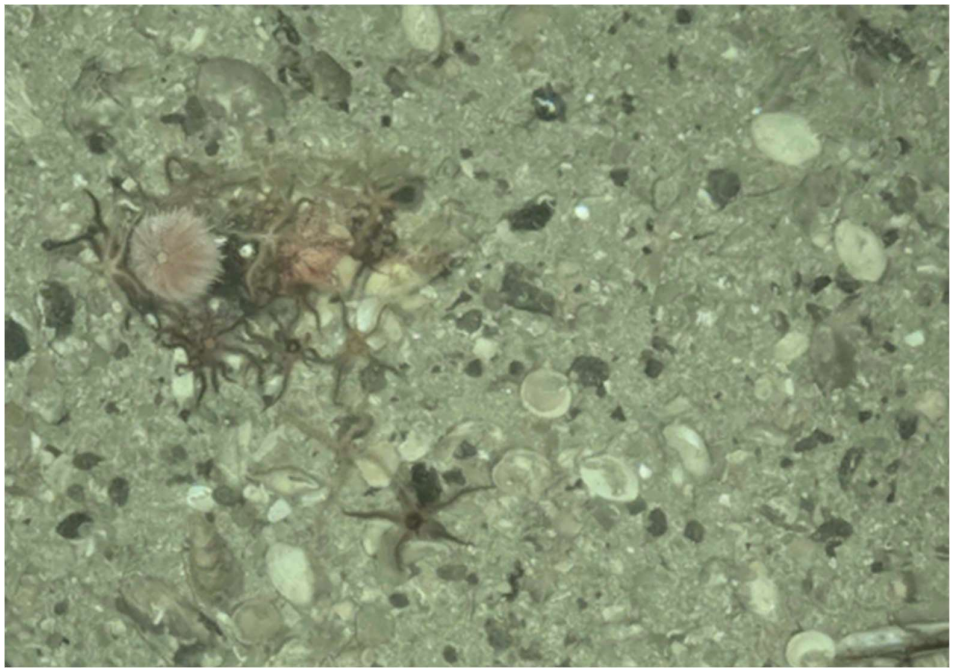


Figure 29. Plot H: Sandy seabed with scattered shells/shell fragments and gravel. Relatively abundant epifauna dominated by echinoderms. A few scallops also present. Water depth 65m.

Summary

Habitat types by transect are summarised in Table 3. Three main types of habitat have been identified as follows:

1. Muddy sand with varying quantities of shell, shell fragments and gravel. This substrate comprises the great majority of the survey area. Where gravel content is especially high, covering most of the sediment surface, the habitat is described as:
2. Gravelly sand with shells/shell fragments. The transition between these two substrates is generally gradual, so boundaries are inexactly defined (within a transitional zone).
3. The third substrate, occurring along most of T5 and in the northern part of T4, comprises brittlestar beds which are associated in places with horse mussels. It is possible that these beds overlie horse mussel beds in some places, but this cannot be positively ascertained.

Habitats 1 and 2 should be possible to sample using a van Veen grab sampler, although exposed boulders are present on occasion within both of them.

It is recommended that Habitat 3 should not be sampled without prior discussion with NatureScot, given the potential presence here of PMF (horse mussel bed) habitat.

Further information on these habitats (distribution within the survey area and a list of representative figures) are provided in Tables 3-5. For ease of cross-checking, co-ordinates are given as shown on the relevant media, i.e. degrees/minutes/seconds for the seabed videos and decimal degrees for the photogrammetry models.

Table 3. Habitat type by transact

Time	Lat (N) dd mm ss.s	Long (W) dd mm ss.s	Depth (m)	Lat (N) dd mm ss.s	Long (W) dd mm ss.s	Depth (m)	Habitat	Comment
	Start			End				
Transect 1 Video ref: T1 (heading SE to NW)								
04:50-09:50	60 26 31.1	01 07 19.4	57.7	60 26 33.6	01 07 23.5	62.9	Muddy sand with varying quantities of shell/shell fragments and gravel.	
09:50-14:50	60 26 33.6	01 07 23.5	62.9	60 26 36.1	01 07 26.8	64.8	Muddy sand with varying quantities of shell/shell fragments and gravel.	
14:50-19:50	60 26 36.1	01 07 26.8	64.8	60 26 38.6	01 07 28.5	64.6	Muddy sand with varying quantities of shell/shell fragments and gravel.	
19:50-24:50	60 26 38.6	01 07 28.5	64.6	60 26 41.2	01 07 30.5	64.1	Muddy sand with varying quantities of shell/shell fragments and gravel.	
24:50-29:50	60 26 41.2	01 07 30.5	64.1	60 26 43.4	01 07 32.7	63.7	Muddy sand with varying quantities of shell/shell fragments and gravel.	
29:50-34:50	60 26 43.4	01 07 32.7	63.7	60 26 45.8	01 07 35.0	60.8	Muddy sand with varying quantities of shell/shell fragments and gravel.	
34.50-39.50	60 26 45.8	01 07 35.0	60.8	60 26 48.1	01 07 37.2	58.5	Muddy sand with varying quantities of shell/shell fragments and gravel.	
39:50-44:50	60 26 48.1	01 07 37.2	58.5	60 26 50.7	01 07 40.6	55.2	Muddy sand with varying quantities of shell/shell fragments and gravel, grading into gravelly sand with shell/shell fragments	
44:50-49:50	60 26 50.7	01 07 40.6	55.2	60 26 53.1	01 07 43.4	47.2	Gravelly sand with shells/shell fragments.	
49:50-50:34	60 26 53.4	01 07 43.4	47.2	60 26 53.1	01 07 43.4	42.7	Gravelly sand with shells/shell fragments.	
Transect 2: Video ref: T2_half_tide (heading SE to NW)								
05:15-10:15	60 26 45.6	01 07 09.8	56.9	60 26 46.9	01 07 15.2	61.3	Muddy sand with varying quantities of shell/shell fragments and gravel.	
10:15-15:15	60 26 46.9	01 07 15.2	61.3	60 26 47.5	01 07 18.3	60.9	Muddy sand with varying quantities of shell/shell fragments and gravel.	
15:15-20:15	60 26 47.5	01 07 18.3	60.9	60 26 48.8	01 07 20.8	61.5	Muddy sand with varying quantities of shell/shell fragments and gravel.	
20:15-25:15	60 26 48.8	01 07 20.8	61.5	60 26 49.5	01 07 22.9	59.8	Muddy sand with varying quantities of shell/shell fragments and gravel.	
25:15-30:15	60 26 49.5	01 07 22.9	59.8	60 26 50.9	01 07 25.0	58.3	Muddy sand with varying quantities of shell/shell fragments and gravel.	
30:15-33:40	60 26 50.9	01 07 25.0	58.3	60 26 51.5	01 07 26.8	55.6	Muddy sand with varying quantities of shell/shell fragments and gravel.	
Transect 3: Video ref: T3_NS (northern section heading north to south)								
03:50-08:50	60 26 58.8	01 07 03.3	60.8	60 26 56.3	01 07 07.8	62.0	Gravelly sand with shells/shell fragments.	Patchy brittle star bed/clusters which do not appear to be associated with horse mussels.
08:50-13:50	60 26 56.3	01 07 07.8	62.0	60 26 54.2	01 07 11.0	62.5	Gravelly sand with shells/shell fragments, grading into muddy sand with varying quantities of shell/shell fragments and gravel.	
13:50-18:50	60 26 54.2	01 07 11.0	62.5	60 26 51.5	01 07 15.4	61.8	Muddy sand with varying quantities of shell/shell fragments and gravel.	
18:50-23:50	60 26 51.5	01 07 15.4	61.8	60 26 49.5	01 07 19.1	60.0	Muddy sand with varying quantities of shell/shell fragments and gravel.	
23:50-28:50	60 26 49.5	01 07 19.1	60.0	60 26 47.0	01 07 21.9	61.1	Muddy sand with varying quantities of shell/shell fragments and gravel.	
28:50-33:50	60 26 47.0	01 07 21.9	61.1	60 26 44.1	01 07 23.7	61.7	Muddy sand with varying quantities of shell/shell fragments and gravel.	
33:50-35:45	60 26 44.1	01 07 23.7	61.7	60 26 42.9	01 07 23.7	61.1	Muddy sand with varying quantities of shell/shell fragments and gravel.	

Table 3 (cont). Habitat type by transect

Transect 3: Video ref: T3_SN_cont (southern section heading south to north)								
03:35-08:35	60 26 25.9	01 07 41.9	64.3	60 26 28.0	01 07 37.7	66.1	Muddy sand with varying quantities of shell/shell fragments and gravel.	Brittle star aggregations common until about 06:30 (60°27'27.0"N, 01°07'39.4"W)
08:35-13:35	60 26 28.0	01 07 37.7	66.1	60 26 30.1	01 07 32.7	65.0	Muddy sand with varying quantities of shell/shell fragments and gravel.	
13:35-18:35	60 26 30.1	01 07 32.7	65.0	60 26 31.9	01 07 29.5	63.1	Muddy sand with varying quantities of shell/shell fragments and gravel.	
18:35-23:35	60 26 31.9	01 07 29.5	63.1	60 26 33.4	01 07 26.4	61.6	Muddy sand with varying quantities of shell/shell fragments and gravel.	
23:35-28:35	60 26 33.4	01 07 26.4	61.6	60 26 35.1	01 07 24.6	61.1	Muddy sand with varying quantities of shell/shell fragments and gravel.	
28:35-33:35	60 26 35.1	01 07 24.6	61.1	60 26 36.2	01 07 24.0	61.3	Muddy sand with varying quantities of shell/shell fragments and gravel.	
33:35-38:35	60 26 36.2	01 07 24.0	61.3	60 26 37.0	01 07 23.6	61.8	Muddy sand with varying quantities of shell/shell fragments and gravel.	
38:35-43:35	60 26 37.0	01 07 23.6	61.8	60 26 38.4	01 07 22.2	61.4	Muddy sand with varying quantities of shell/shell fragments and gravel.	
43:35-48:35	60 26 38.4	01 07 22.2	61.4	60 26 39.5	01 07 21.0	61.6	Muddy sand with varying quantities of shell/shell fragments and gravel.	
48:35-51:10	60 26 39.5	01 07 21.0	61.6	60 26 40.0	01 07 20.5	60.2	Muddy sand with varying quantities of shell/shell fragments and gravel.	
Transect 4: Video ref: T4_SN (southern section heading south to north)								
08:10-13:10	60 26 33.6	01 07 51.5	58.0	60 26 35.1	01 07 48.6	56.4	Gravelly sand with shells/shell fragments, grading into muddy sand with varying quantities of shell/shell fragments and gravel.	Patchy brittle star bed/clusters which do not appear to be associated with horse mussels.
13:10-18:10	60 26 35.1	01 07 48.6	56.4	60 26 36.7	01 07 46.1	56.3	Muddy sand with varying quantities of shell/shell fragments and gravel.	
18:10-23:10	60 26 36.7	01 07 46.1	56.3	60 26 38.0	01 07 43.3	56.6	Muddy sand with varying quantities of shell/shell fragments and gravel.	
23:10-28:10	60 26 38.0	01 07 43.3	56.6	60 26 39.4	01 07 40.7	55.9	Muddy sand with varying quantities of shell/shell fragments and gravel.	
28:10-33:10	60 26 39.4	01 07 40.7	55.9	60 26 40.5	01 07 39.4	56.6	Muddy sand with varying quantities of shell/shell fragments and gravel.	
33:10-38:10	60 26 40.5	01 07 39.4	56.6	60 26 41.9	01 07 37.2	57.2	Muddy sand with varying quantities of shell/shell fragments and gravel.	
38:10-43:10	60 26 41.9	01 07 37.2	57.2	60 26 43.0	01 07 34.9	58.2	Muddy sand with varying quantities of shell/shell fragments and gravel.	
43:10-48:10	60 26 43.0	01 07 34.9	58.2	60 26 44.0	01 07 33.1	59.7	Muddy sand with varying quantities of shell/shell fragments and gravel.	
48:10-53:10	60 26 44.0	01 07 33.1	59.7	60 26 45.3	01 07 32.0	59.5	Muddy sand with varying quantities of shell/shell fragments and gravel.	
53:10-58:10	60 26 45.3	01 07 32.0	59.5	60 26 46.1	01 07 30.5	59.5	Muddy sand with varying quantities of shell/shell fragments and gravel.	
58:10-1:01:1	60 26 46.1	01 07 30.5	59.5	60 26 46.5	01 07 29.3	58.8	Muddy sand with varying quantities of shell/shell fragments and gravel.	
Transect 4: Video ref: T4_NS (northern section heading north to south)								
03:50-08:50	60 27 01.2	01 07 20.7	60.3	60 27 00.9	01 07 20.7	63.0	Patchy brittlestar bed possibly overlying horse mussels. Exposed substrate is gravelly sand with shells/shell fragments.	
08:50-13:50	60 27 00.9	01 07 20.7	63.0	60 26 58.6	01 07 21.5	62.0	As above, grading into muddy sand with varying quantities of shell/shell fragments and gravel.	
13:50-18:50	60 26 58.6	01 07 21.5	62.0	60 26 56.1	01 07 23.1	59.1	Muddy sand with varying quantities of shell/shell fragments and gravel.	
18:50-23:50	60 26 56.1	01 07 23.1	59.1	60 26 53.6	01 07 25.8	56.2	Muddy sand with varying quantities of shell/shell fragments and gravel.	
23:50-28:50	60 26 53.6	01 07 25.8	56.2	60 26 51.3	01 07 29.9	54.7	Muddy sand with varying quantities of shell/shell fragments and gravel.	
28:50-33:50	60 26 51.3	01 07 29.9	54.7	60 26 50.2	01 07 32.8	54.4	Muddy sand with varying quantities of shell/shell fragments and gravel.	
33:50-38:50	60 26 50.2	01 07 32.8	54.4	60 26 49.2	01 07 38.8	54.4	Muddy sand with varying quantities of shell/shell fragments and gravel.	
38:50-43:50	60 26 49.2	01 07 38.8	54.4	60 26 48.5	01 07 40.8	51.8	Muddy sand with varying quantities of shell/shell fragments and gravel.	
43:50-48:50	60 26 48.5	01 07 40.8	51.8	60 26 47.6	01 07 42.9	51.1	Muddy sand with varying quantities of shell/shell fragments and gravel.	
48:50-50:01	60 26 47.6	01 07 42.9	51.1	60 26 47.6	01 07 43.3	47.7	Muddy sand with varying quantities of shell/shell fragments and gravel.	

Table 3 (cont). Habitat type by transact

Transect 5: Video ref: T5_NS (heading north to south)								
05:40-10:40	60 27 13.3	01 07 23.9	56.8	60 27 10.6	01 07 23.8	56.9	Brittlestar bed possibly overlying horse mussels. Exposed substrate is gravelly sand with shells/shell fragments.	
10:40-15:40	60 27 10.6	01 07 23.8	56.9	60 27 08.7	01 07 25.2	56.1	Brittlestar bed possibly overlying horse mussels. Exposed substrate is gravelly sand with shells/shell fragments.	
15:40-20:40	60 27 08.7	01 07 25.2	56.1	60 27 05.9	01 07 26.2	57.6	Brittlestar bed possibly overlying horse mussels. Exposed substrate is gravelly sand with shells/shell fragments.	
20:40-25:40	60 27 05.9	01 07 26.2	57.6	60 27 03.5	01 07 27.4	58.8	Brittlestar bed possibly overlying horse mussels. Exposed substrate is gravelly sand with shells/shell fragments.	
25:40-30:40	60 27 03.5	01 07 27.4	58.8	60 27 01.4	01 07 28.7	59.0	Brittlestar bed possibly overlying horse mussels. Exposed substrate is gravelly sand with shells/shell fragments.	
30:40-35:40	60 27 01.4	01 07 28.7	59.0	60 27 00.2	01 07 29.7	58.2	Brittlestar bed possibly overlying horse mussels. Exposed substrate is gravelly sand with shells/shell fragments.	Brittlestar bed becomes patchy and ends at 34:00 (60°27'00.5"N, 1°07'29.6"W).
35:40-40:40	60 27 00.2	01 07 29.7	58.2	60 26 58.1	01 07 31.5	56.6	Gravelly sand with shells/shell fragments	
40:40-45:40	60 26 58.1	01 07 31.5	56.6	60 26 56.3	01 07 33.4	55.8	Gravelly sand with shells/shell fragments	
45:40-50:27	60 26 56.3	01 07 33.4	55.8	60 26 54.7	01 07 34.5	50.7	Gravelly sand with shells/shell fragments.	
Transect 6: Photogrammetry ref SSF T6 (heading south to north)								
Segment 1	60.44242	1.12129	55.4	60.44322	1.12059	55.7	Muddy sand with varying quantities of shell/shell fragments and gravel.	
Segment 2	60.44322	1.12059	55.7	60.44402	1.11971	55.6	Muddy sand with varying quantities of shell/shell fragments and gravel.	
Segment 3	60.44402	1.11971	55.6	60.44482	1.11899	56.8	Muddy sand with varying quantities of shell/shell fragments and gravel.	
Segment 4	60.44482	1.11899	56.8	60.44562	1.11794	55.8	Muddy sand with varying quantities of shell/shell fragments and gravel.	
Segment 5	60.44562	1.11794	55.8	60.44642	1.11704	58.7	Muddy sand with varying quantities of shell/shell fragments and gravel, grading into gravelly sand with shells/shell fragments.	Brittlestars becoming increasingly abundant.
Segment 6	60.44642	1.11704	58.7	60.44722	1.11612	56.2	Gravelly sand with shells/shell fragments	Patchy brittle star bed/clusters which do not appear to be associated with horse mussels.
Segment 7	60.44722	1.11612	56.2	60.44799	1.11544	56.7	Gravelly sand with shells/shell fragments	

Table 4 shows how the habitat types are distributed over the six transects. Example images of each habitat are listed against location in Table 5.

Table 4. Habitat distribution

Transect	Muddy sand with varying quantities of shell/shell fragments and gravel.	Gravelly sand with shells/shell fragments.	Brittlestar bed possibly overlying horse mussels. Exposed substrate is gravelly sand with shells/shell fragments.
T1	South end of transect (60°26'31.1"N, 01° 07' 19.4"W) to approx. 60° 26'48.1"N, 01° 07' 37.2"W (most of transect)	From approx. 60°26'48.1"N, 01°07'37.2"W to 60°26'53.1 N, 01°07'43.4"W (north end of transect)	Not present
T2	Whole transect (60°26'45.6"N, 01°07'09.8"W to 60°26'50.9"N, 01°07'25.0"W)	Not present	Not present
T3	Between approx. 60°26' 51.5"N, 01°07'15.4"W and 60°26'40.0"N, 01°07'20.5"W (most of N section, whole of S section)	From 60°26'56.3", 01°07'07.8" to approx 60°26'54.2", 01° 07'11.0" (north part of N section)	Not present
T4	Between approx. 60°26'35.1"N, 01°07' 48.6"W and 60°26'58.6"N, 01°07'21.5"N (most of transect)	Between approx. 60°26'33.6", 01° 07'51.5"W and 60°26' 35.1"N, 01° 07' 48.6"W (south end of S section)	Between approx. 60°26'58.6 "N, 01°07' 21.5"N and 60° 27' 01.2" N, 01°07' 20.7" W (north end of N section)
T5	Not present	Between approx. 60°26' 54.7, 01° 07'34.5"W and 60°27'00.5"N, 01°07' 29.6"W (south end of transect)	Between approx. 60°27'00.5"N, 01°07' 29.6"W and 60°27'13.3"N, 01°07'23.9"W (most of transect)
T6*	From start (60.44242°N, -1.12129°E) to approx. 60.44562°N, 1.-11794°E (most of transect)	Between approx. 60.44562° N, -1.11794°E and 60.44799° N, -1.11544° E (north end of transect)	Not present

**Due to technical difficulties during the survey, DWE (downward facing) camera video is not available for Transect 6, which was therefore analysed using the photogrammetry model.*

Table 5. List of figures in the report showing examples of the three habitat types.

Muddy sand with varying quantities of shell/shell fragments and gravel.	Gravelly sand with shells/shell fragments.	Brittlestar bed possibly overlying horse mussels. Exposed substrate is gravelly sand with shells/shell fragments.
T1, Figure 8 (left), 60.44252°N, -1.12118°W T2, Figure 9, 60.44754°N, -1.12427°W T3, Figure 10 (right), 60°26'43.4"N, 01°07'23.9"W T4, Figure 14 (right), 60°26'46.1"N, 01°07' 30.5"W T5, Figure 18, 60.44987°N, -1.12506°E T6, Figure 20 (left), 60.44252°N, -1.12118°E	T1, Figure 8 (right), 60.44821° N, -1.12883°W T3, Figure 10 (left), 60°26'58.7"N, 01°07'03.3"W T4, Figure 14 (left), 60°26'33.8"N, 01°07'51.8" W T6, Figure 20 (right), 60.44669° N, -1.11672° E	T4, Figure 15 (left), 60°27'01.2"N, 01°07'21.0"W T5, Figure 18 (right), 60°27'07.4"N, 01°07'25.7"W

Referring back to the Aims of the project, these have been fulfilled as follows.

- **Characterise the seabed in and around the farm's predicted area of impact**
  The seabed across the survey area has been characterised using multibeam bathymetry and backscatter, ROV visual transects and photogrammetry models. Bathymetry (Figure 5) is consistent with hydrographic charts of the area, showing the proposed site situated over a relatively deep (55-65m) channel of water which rises steeply to the west and more gently to the east. Backscatter data (Figures 6 and 7) indicate areas of relatively hard/soft seabed substrate, with softer sediment distributed through the central part of the survey area and some smaller areas within the harder substrate adjacent to Fish Holm island. The visual survey data and photogrammetry models (Figures 8-29) show that the seabed is composed of sand and muddy sand with shells/shell fragments and gravel, becoming more gravelly to the north and west end. Epifauna throughout the survey area is dominated by echinoderms, particularly brittlestars which are extremely abundant in some areas. King and queen scallops and horse mussels are also present along with other bivalve species, burrowing anemones and a few whelks and crabs (mainly hermit crabs). Fish species noted within the survey area include thornback ray, spiny dogfish, lesser spotted dogfish/nursehound, monkfish, plaice and gurnard.

- **Identify any protected habitats or species within that area**
  A few individual horse mussels were observed on occasion along some transects (Figures 30 and 32), and the species occurs at the north end of T4 and through most of T5 in relative abundance (Figure 15). To qualify for PMF status, horse mussels and their shells must cover >30% of the seabed over a minimum area of 5m x 5m. Although this cannot be confirmed from the data (given the ROV field of view is limited to around 2m) horse mussels were observed to be abundant along parts of T4 and T5. Their occurrence in association with often thick and extensive brittlestar beds (Figures 15 and 18) suggests the possibility that horse mussel bed habitat may underlie the brittlestars in some areas.

*Figure 30. Horse mussels (*Modiolus modiolus*) seen along T1, T3 and T4.*

- **Provide an assessment of the existing environmental status of the seabed, including existing impacts**

  Dredging: Dredgers were seen operating in the area during the survey period and there was potential evidence of benthic damage in places (possible dredge marks on the seabed, and relative sparsity of epifauna along the northerly sections of T3 and T4). However, some of this could represent storm damage/natural variability, and cannot be positively ascribed to dredging.

  Old Fish Holm site: The previously existing fish farm at Fish Holm lies within the survey area, and is crossed by T1 at its northeasterly end (Figure 31).

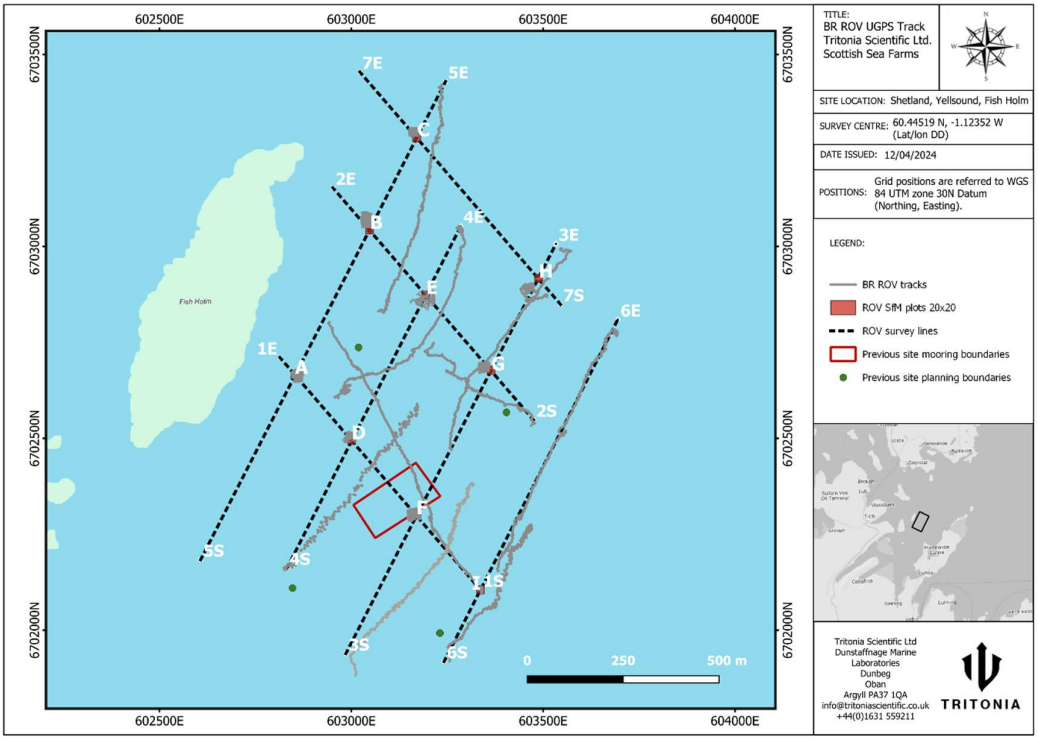


Figure 31. Previously existing Fish Holm site (red boundary) and transect/plot locations.

Photogrammetry Plot F lies across the easterly boundary of the mooring area, and Plot D (the next closest) is approximately 170m to the northwest. No clear evidence of continuing impact from the farm was observed, either in the plots or in the overlapping section of T1. Epifauna were noted to be fairly sparse in both plots and the transect section, but this is also true of Plots A and B further to the north/northwest and parts of other transects (e.g. T3 and T4 as noted above). It's not clear whether the observed variability in faunal distribution is due to natural variation only, or is influenced by dredging, storms, historic fish farm impact (in the vicinity of the old site) and/or other unknown factors.

Marine litter: There was little evidence of marine litter/debris within the surveyed area, limited to the rope in Figure 29 and a single observation of a piece of pipe partially visible at the edge of the data in T5 (Figure 32).

*Figure 32: Photogrammetry image showing a piece of pipe on the seabed at 60.45261°N, -1.12349°E (east side of Transect 5). Two sunstars are outside the mouth of the pipe, and a number of horse mussels (*Modiolus modiolus*) are among the gravel/stones scattered about.*

- **Address any potential risks identified in the wider area**
  Aside from the possible presence of horse mussel bed habitat, nothing else was observed during the survey or subsequent analysis of the data that could be considered a potential risk to, or at risk from, the proposed development.

Data Access

Photogrammetry orthomosaic models can be accessed at:

https://www.construkted.com/project/pokugkf729x/ (transects)

https://www.construkted.com/project/pczw00mrokv/ (plots)

Visual survey videos can be accessed at:

Survey Code	Link
T1	https://www.youtube.com/watch?v=lRVSGZBWorw
T2_half_tide	https://www.youtube.com/watch?v=PO4Cx05jOfo
T3_SN_cont	https://www.youtube.com/watch?v=uPvKbSO8Dk8
T3_NS	https://www.youtube.com/watch?v=yGABv3Ao6-E
T4_SN	DWE T4 SN (youtube.com)
T4_NS	https://www.youtube.com/watch?v=fapfDY2x2Lo
T5_NS	https://www.youtube.com/watch?v=OwLWgetcaE4
T6_SN_2	https://www.youtube.com/watch?v=I5vXO4YifLs

Appendix

Annex 1. MBES Patch test calibration results

AutoPatch (V2023.3.1.1) Calibration Report - 11 - 04 - 2024 17:07:10

TRANSDUCER ALIGNMENT CALIBRATION	
Current User	[redacted]
Project Folder	Z:/Projects/Scottish Sea Farms/280224 Shetland/Data/MBES/01_03_24_MBES/MBES/Data
Number of Raw Files	8
Project	20240301Glaucus-WASSP Transducer1
Surveyor	
Job	
Vessel	Glaucus

RAW FILE LIST					
Date	Start	End	Heading	Speed	File Name
01 - 03 - 2024	10:10:51	10:10:59	137.3°	2.6	0025_20240301_101050_PatchTest_1.0001.bwxraw
01 - 03 - 2024	10:12:25	10:14:26	323.9°	1.8	0026_20240301_101224_PatchTest_2.0001.bwxraw
01 - 03 - 2024	10:15:27	10:16:51	181.3°	1.7	0027_20240301_101526_PatchTest_2.0001.bwxraw
01 - 03 - 2024	10:20:57	10:23:51	151.4°	2.6	0028_20240301_102056_PatchTest_2.0001.bwxraw
01 - 03 - 2024	10:24:35	10:26:04	327.1°	2.8	0029_20240301_102434_PatchTest_2.0001.bwxraw
01 - 03 - 2024	10:27:14	10:29:32	150.1°	2.7	0030_20240301_102713_PatchTest_1.0001.bwxraw
01 - 03 - 2024	10:33:18	10:35:08	322.7°	2.8	0031_20240301_103317_PatchTest_1.0001.bwxraw
01 - 03 - 2024	10:35:49	10:37:07	139.1°	2.8	0032_20240301_103548_PatchTest_1.0001.bwxraw

Post-Processing Trajectory	
File:	Not Used

OFFSET LOCATIONS			
Description	Starboard [m]	Forward [m]	Up [m]
COG	0.000	0.000	0.000
Ellipse	0.000	0.000	0.000
WASSP transducer	-0.085	-0.150	-1.170

COMPUTATION SETTINGS	
Positioning System	Ellipse-D Position
Heading System	Ellipse-D MRU
Pitch/Roll/Heave System	Ellipse-D MRU
Height Mode	Use Position and Heave

SOUND VELOCITY PROFILE		
From Internal Records		
669 records		
Min Speed = 1467.87m/s	Min Cast Depth = 0.22m	Min Survey Depth = 2.70m
Max Speed = 1482.35m/s	Max Cast Depth = 66.36m	Max Survey Depth = 76.00m

MRU ALIGNMENT			
Name	Roll	Pitch	Heading
Ellipse-D MRU	0.000 °	0.000 °	0.000 °

VALID DATA GATES		
	Minimum	Maximum
Depth	2.70	76.00
Sector	-63.90°	57.30°

ADJUSTMENTS
No Adjustments were made

DATA PAIRING & ROLL AREA SETTINGS	
Parameter	Value
Min. Roll-Pitch Overlap	80
Max. Heading Overlap	60
Line Heading Margin	30
Line Speed Margin	1
Roll Calibration Area Placement	Automatically, based on seabed features

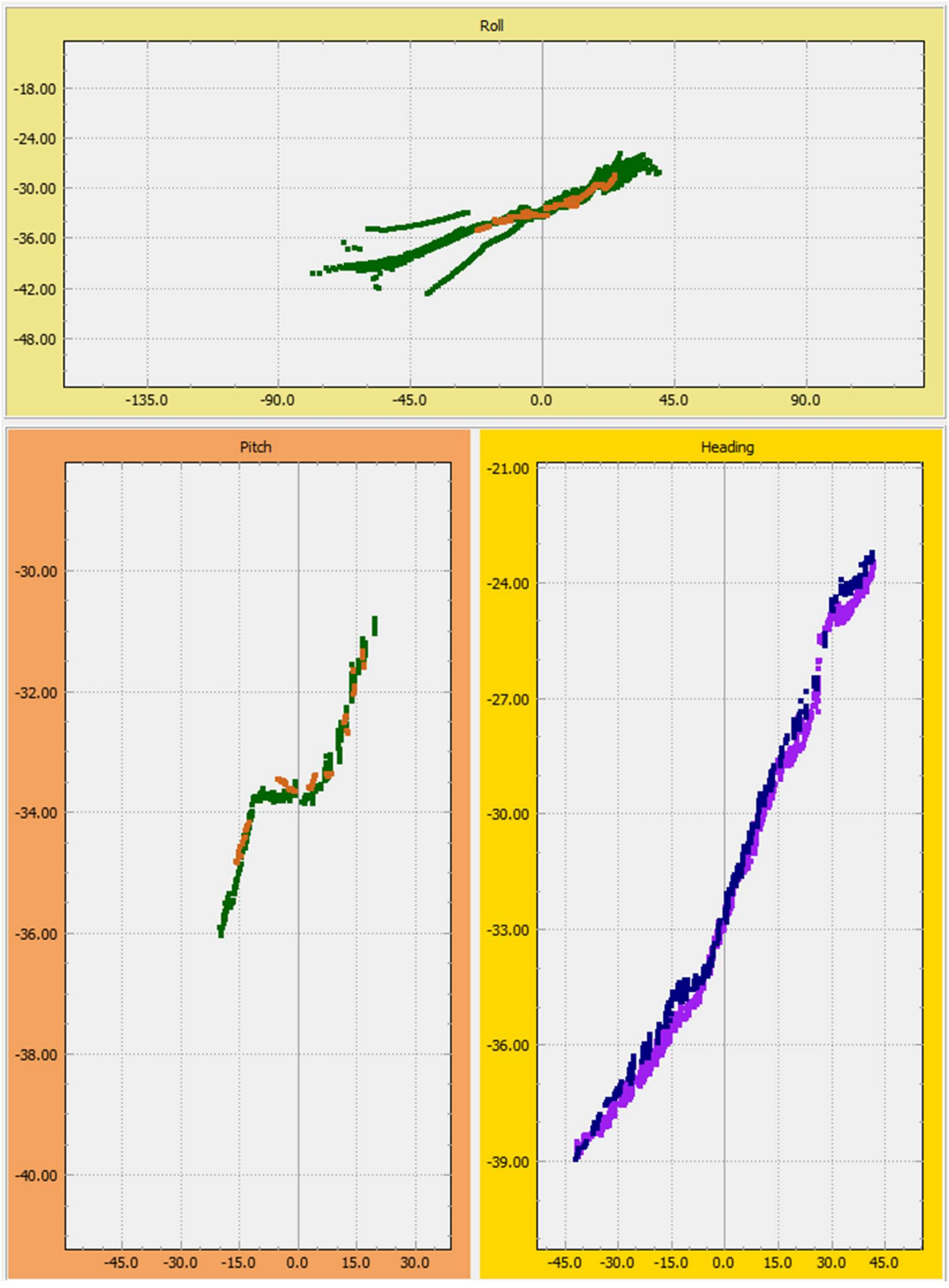
CALIBRATION OFFSET RESULTS					
Roll-Pitch	Hdg	Roll	Pitch	Heading	
5 - 8	2 - 5	?	?	?	
5 - 8	2 - 7	?	?	?	
5 - 8	3 - 4	?	?	?	
5 - 8	4 - 6	?	?	?	
5 - 8	4 - 8	?	?	?	
7 - 8	2 - 5	?	?	?	
7 - 8	2 - 7	?	?	?	
7 - 8	3 - 4	?	?	?	
7 - 8	4 - 6	?	?	?	
7 - 8	4 - 8	?	?	?	
	PRESET	**3.804°**	**-1.12°**	**7.91°**	
	AVERAGE	**0.000°**	**0.00°**	**0.00°**	**ADVISED MOUNTING ANGLES**
	SDEV	0.000°	0.00°	0.00°	

MOUNTING ANGLE SIGN CONVENTION	
Roll	Positive when Transducer center beam points towards port
Pitch	Positive when Transducer center beam points towards bow
Heading	Positive when Transducer is rotated clockwise around vertical axis of vessel
Note: All angles are absolute w.r.t. the vessel reference frame	

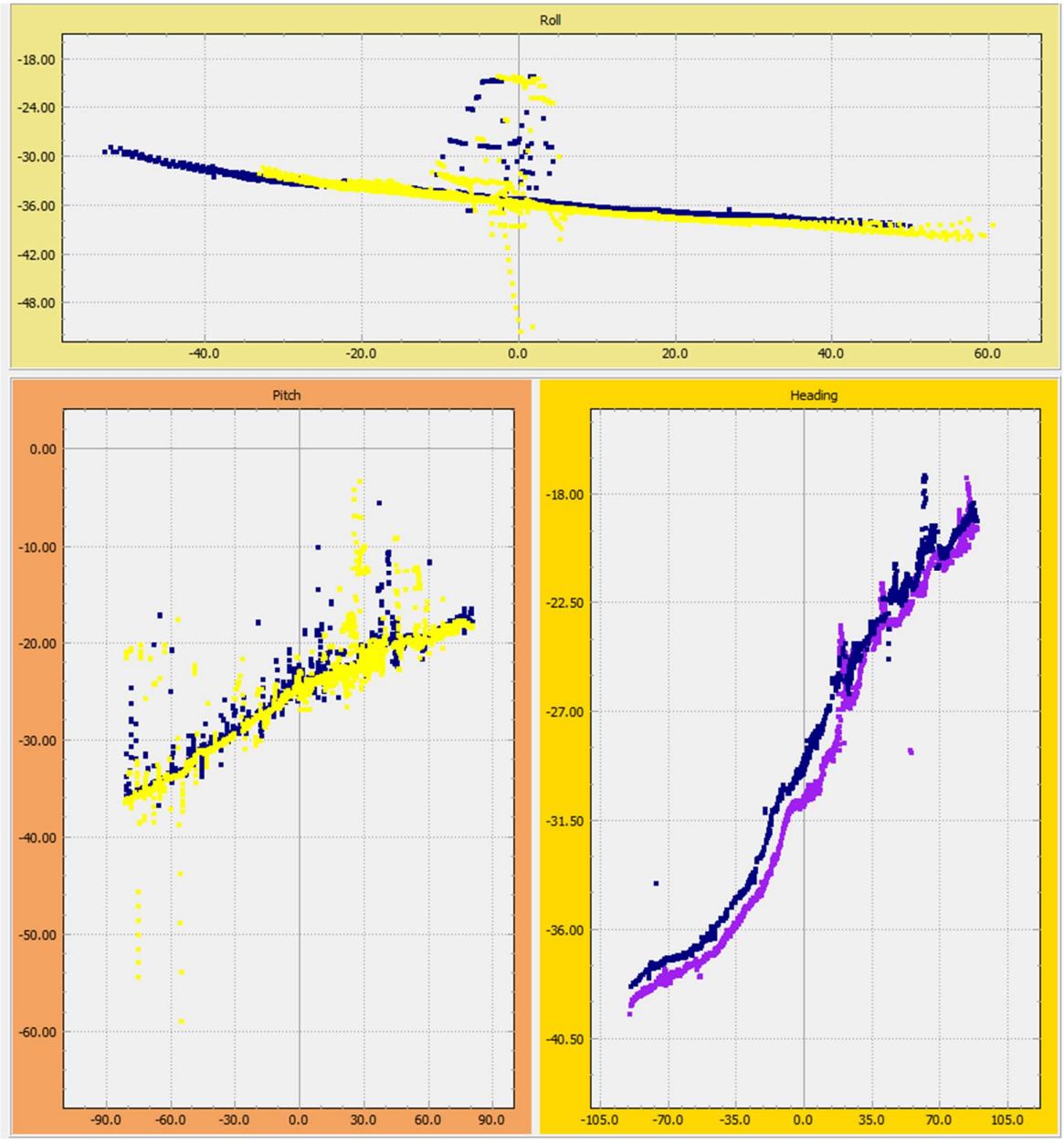
ACCURACY	
Average Error	99.635 cm/m2

WARNINGS
The difference between the profile and the average sound velocity at the transducer is 4.9 m/s
Sound Velocity beam angle correction is used

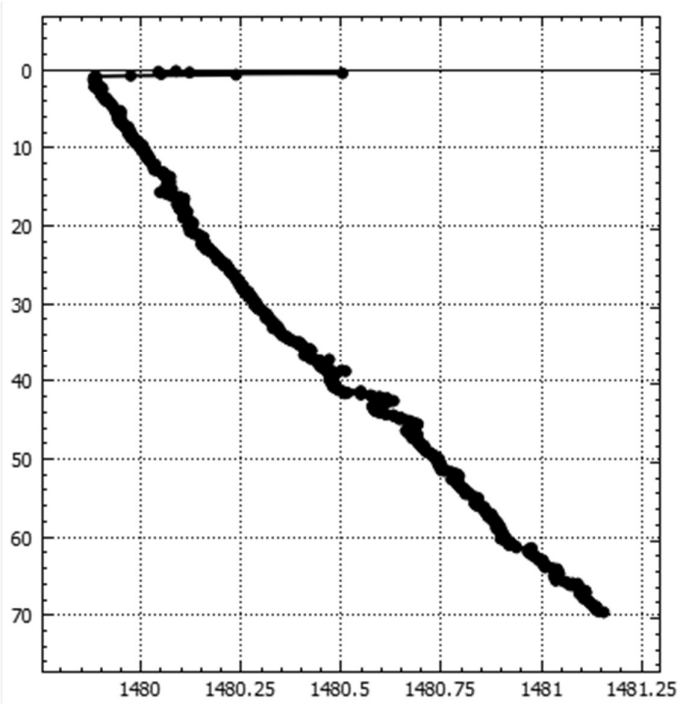
Annex 2. MBES Calibration results, roll, pitch and heading, completed 28/02/2024



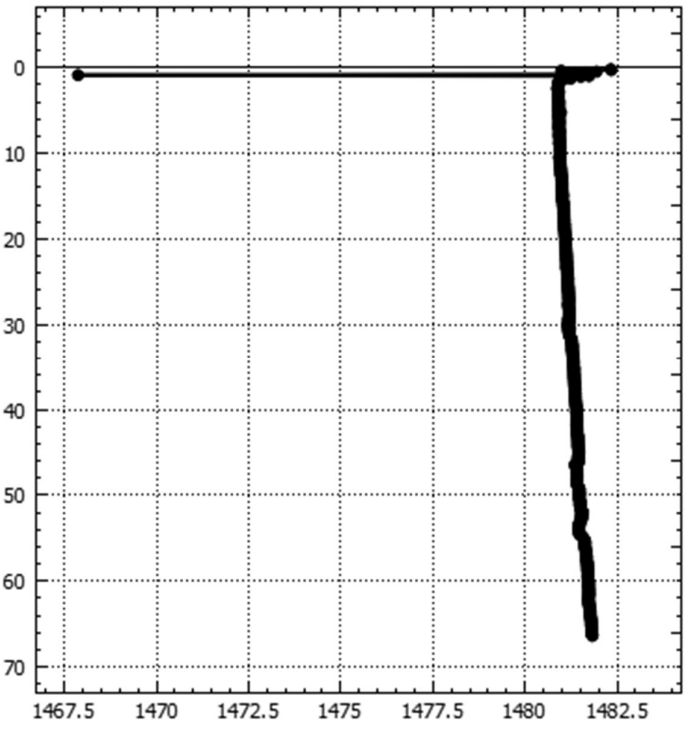
Annex 3. MBES Calibration results, roll, pitch and heading, completed 01/03/2024



Annex 4. Sound Velocity Profile collected on 28/02/2024 at 12:53:00, 60.45014 °N, -1.12329 °E



Annex 5. Sound Velocity Profile collected on 01/03/2024 at 10:04:00, 60.45119 °N, -1.11687 °E



Annex 6. Sound Velocity Profile collected on 01/03/2024 at 14:33:00, 60.45305 °N, -1.11443 °E