ANNEX E Investigating the Use of Side Scan Sonar in the Solway Firth

Aims

i. To investigate the use of the side scan sonar (SSS) in the Solway, with a focus on distinguishing between habitat types.

ii. To investigate what conditions the SSS can operate in. The Solway offers challenging environmental conditions: there are fast currents with very little if any slack water at high and low tide; there is a mixture in current speeds and directions; the water has a high sediment load with floating debris.

iii. To test running the equipment from the bow of the vessel. The shallow water of the target area means that running the equipment off of the stern of the vessel is not possible because the towfish needs to get below the wash of the jet engines to ensure good data is collected.

iv. Produce a survey plan and methodology for future survey work in the Solway to investigate the mix of habitat and build on knowledge of the subtidal mussel in the channel.

1. Methodology

Equipment Used - Tritech Seaking Towfish SSS with the data acquisition through Tritech Seanet Pro Software (version 2.24).

Tide Selection

Data collection took place on the 10th September 2019 aboard North Western Protector. A neap high tide was chosen to ensure the best chance of the least amount of current and the greatest depth of water giving the most range and coverage of the equipment. This coincided with low wind speeds giving the best chance of flat water conditions.

Survey Plan

Based on previous knowledge on water depth it was decided to use an 80m range and 160m swathe at 675Khz, which would require a towfish altitude of approximately 8m from the sea bed (10% of range). A line plan was completed of the target area as shown in figure 1.

Figure 1 – Solway Sidescan Survey Line Plan September 2019

Data Collection

During deployment the vessel maintained a speed over ground (SOG) of 1.5-2 knots. The tidal current speed varied between of 0.75 to 1.5 knots. When current speed was higher the SOG was reduced. Data was only collected towing into the tide to ensure the towfish was straight. The layback was calculated to be negligible due to the towfish being setup on the bow of the vessel, the length of the cable and the location of the GPS hemisphere antenna. Data collection was not recorded until the start location of each tow line had been reached and the towfish was fully deployed and collecting data.

The settings within Seanet Pro for the data acquisition remained the same for each of the tows and are as follows:

- Sonar Gain – 10%
- Contrast – 47dB
- Range – 80m
- Resolution - Ult
- Frequency - 675kHz

Ten tows were completed with a summary of each tow below in the table.

Name	Current Speed (knot)	Speed Over Ground (knot)	Depth of towfish from seabed (m)	Length of cable (m)
2A	0.75	2.0	8-10	4
2B	0.75	2.0	8-10	4
2C	0.75	1.5	8-10	5
2D	0.75	2.0	8-10	5
2E	0.50	2.0	8-10	9
2F	0.50	2.0	8-10	9
3A	0.75	2.0	8-10	5
3B	0.75	2.0	8-10	5
3C	1.00	2.0	8-10	5
3D	1.50	2.0	8-10	5

Table 1 – Summary of SSS Transects

2. Data Handling and Analysis

The processing software used was Coda Octopus GeoSurvey (version 7.3.2). As Seanet Pro records the data in a .V4LOG format, and Geosurvey cannot read this file format, all of the files were converted into .xtf format. Tritech Seanet DumpLog (version 2.27) program was used for the conversion of the file format.

The .xft files were loaded into Geosurvey. The first tow was played back in the waterfall display. Image enhancement was applied inverting the grey scale to give white as high and black as low backscatter. The data was scaled using auto scale to achieve the best image. Time varying gain was applied to increase the gain at the outer edges of the swathe. Once the best image was achieved the settings were saved and applied to each of the tows. Seabed detection (identification of the seabed from imagery) was completed manually for each of the tows.

All the tows were loaded into the Mosaic window. Navigation smoothing was applied to all tows. The tows were layered from land in a north-westerly direction giving the best image. The image was exported as a north up geotiff, at a resolution of 2 pixels per geographical metre. The geotiff was loaded into MapInfo; the geotiff is georeferenced.

3. Data Acquisition

Ten transects were completed. The data in transect 2F was not useable due to the speed of the current, the speed over ground of the vessel and the varying altitude of the towfish. The data from transect 2F has not been included in the images below.

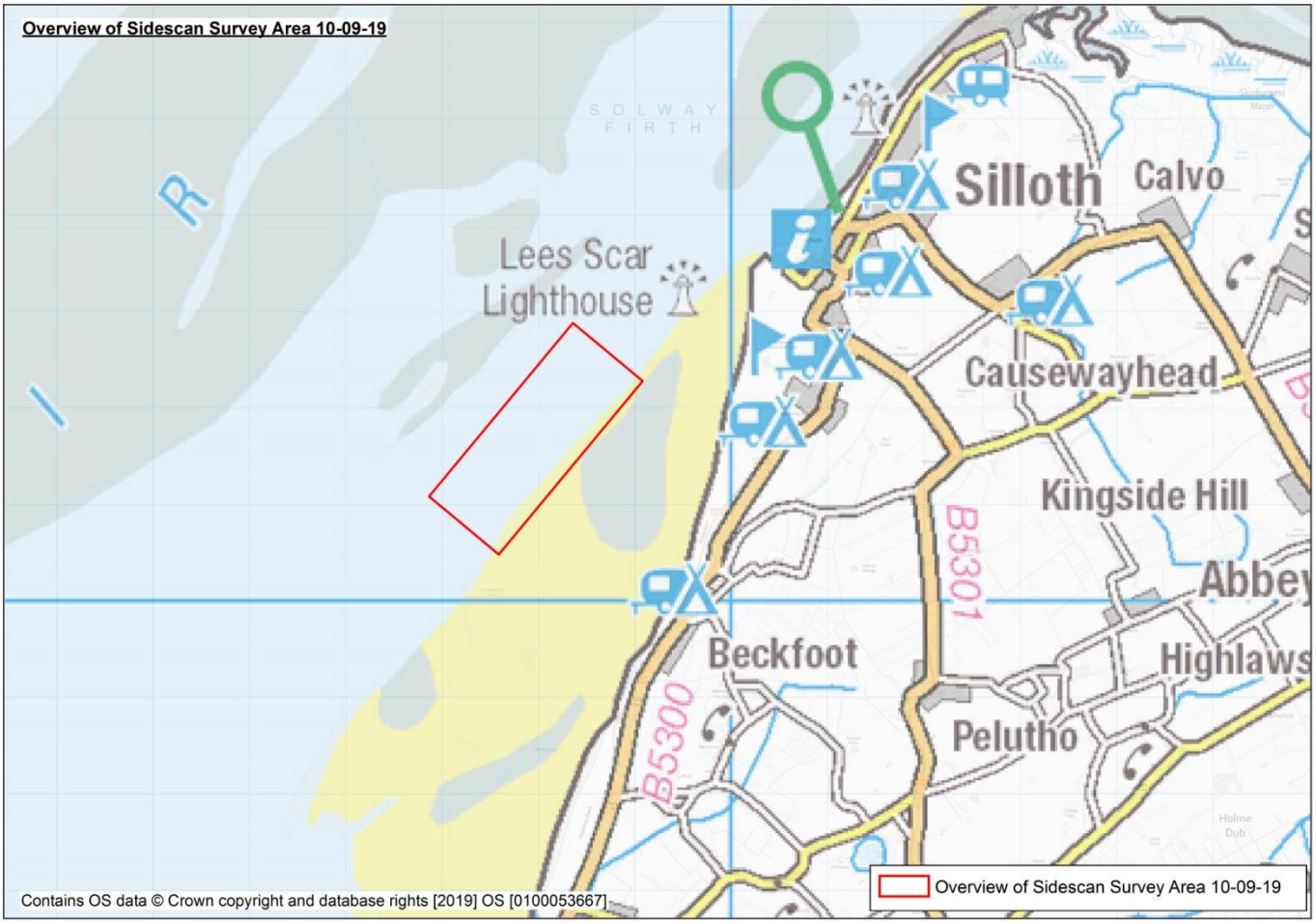

Figure 2 – Overview of the area covered by the SSS Survey 10th September 2019

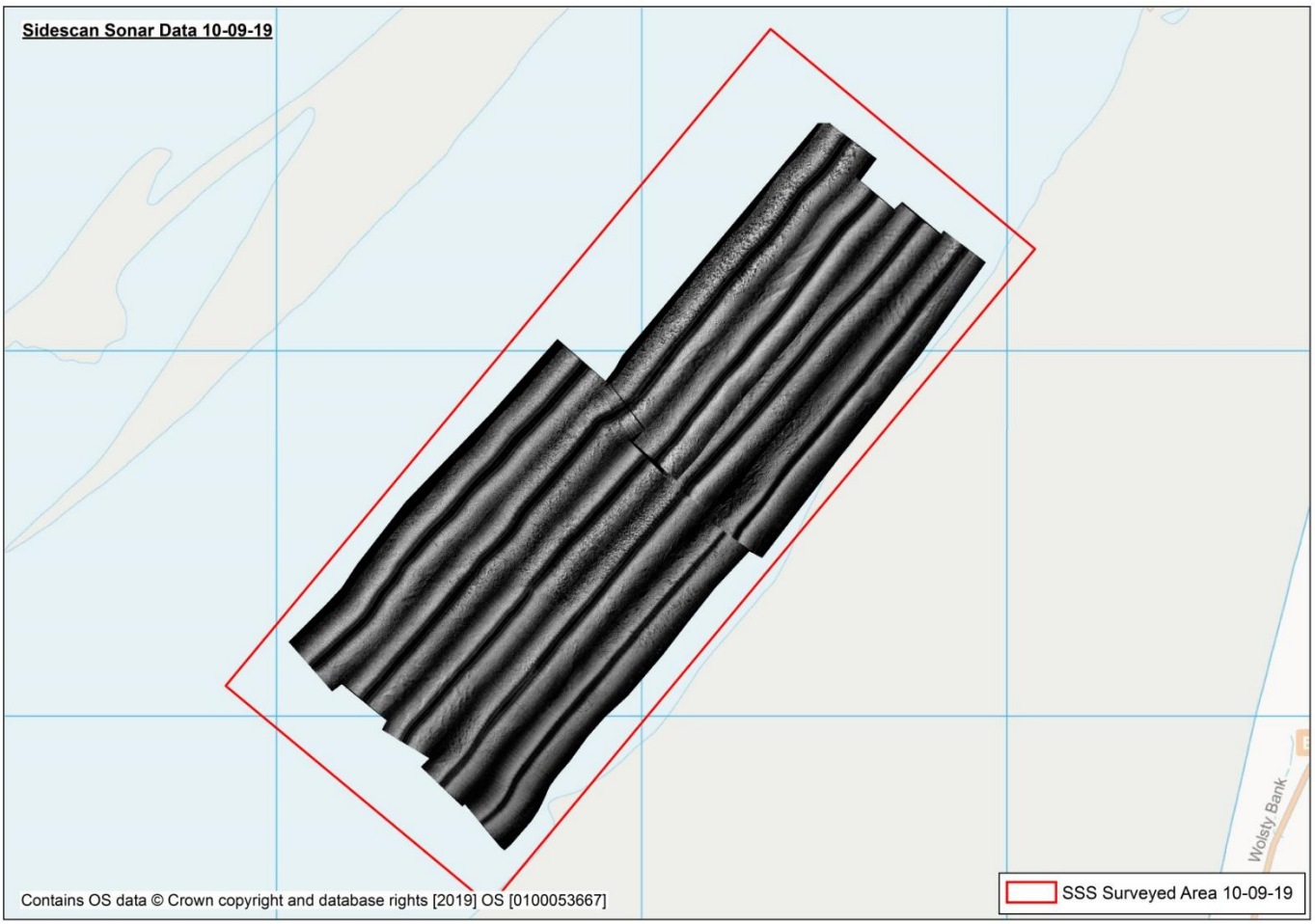

Figure 3 – Overview of SSS data 10th September 2019

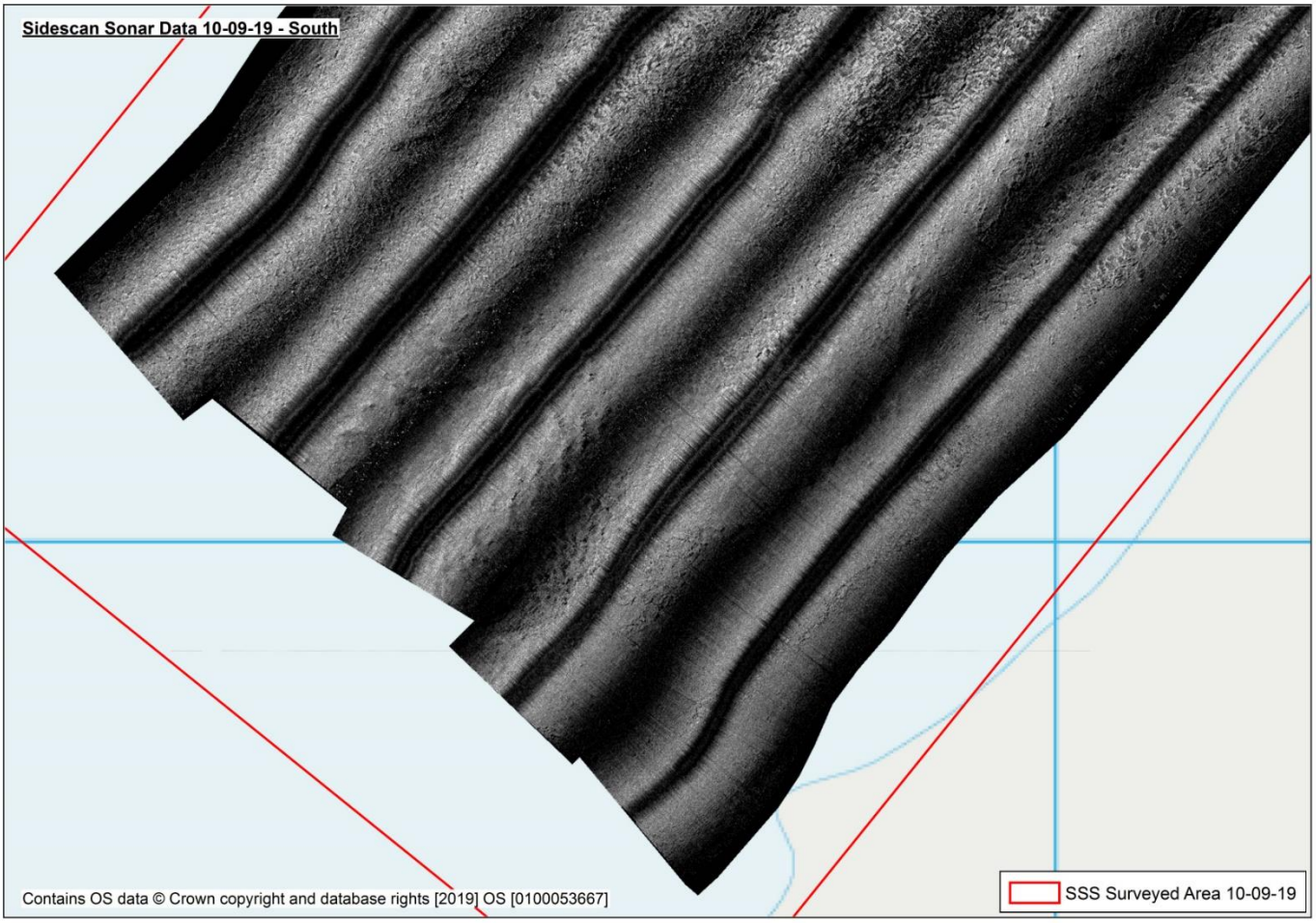

Figure 4 – Higher magnification of SSS data from the south of the surveyed area 10th September 2019

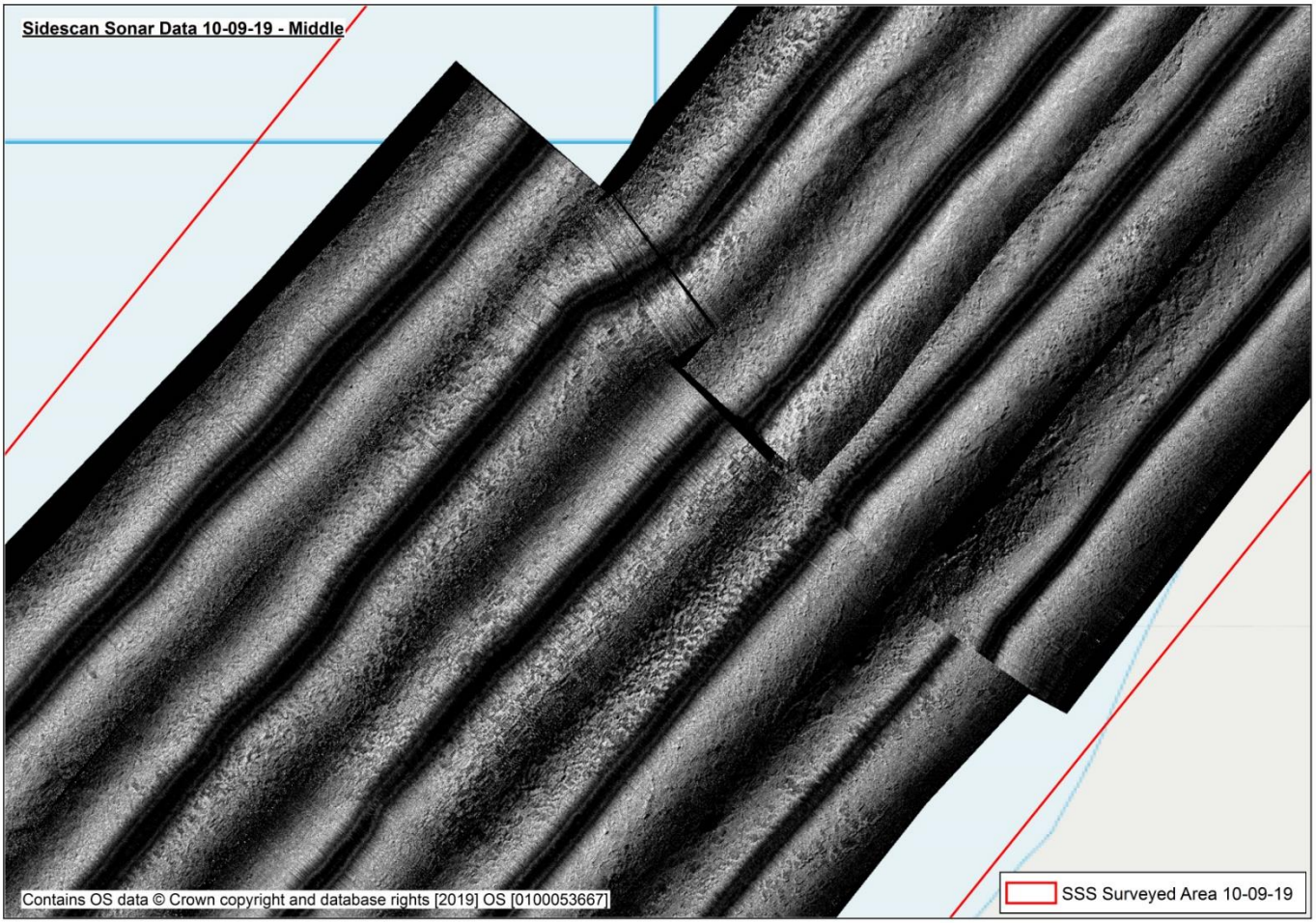

Figure 5 – Higher magnification of SSS data from the middle of the surveyed area 10th September 2019

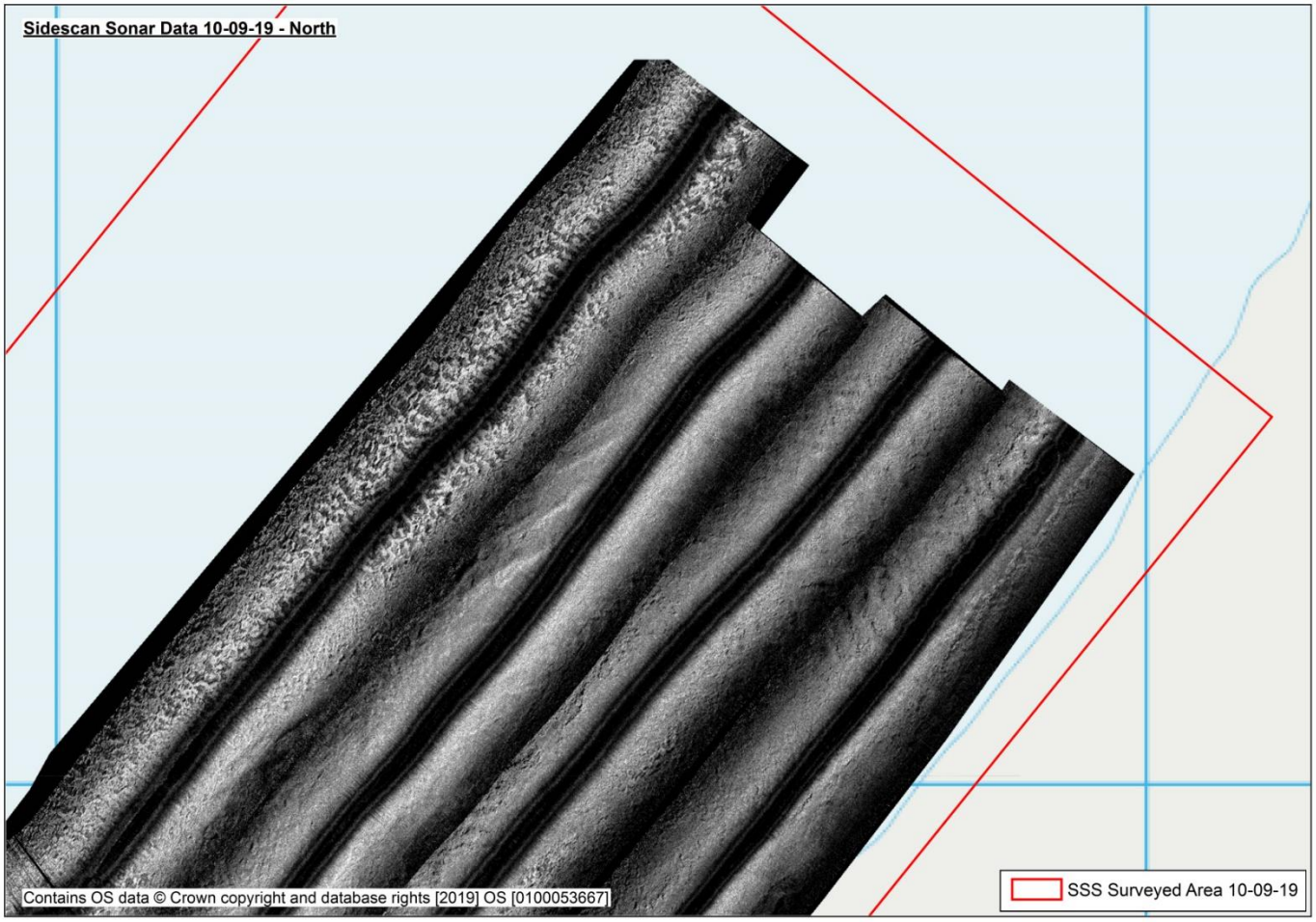

Figure 6 – Higher magnification of SSS data from the north of the surveyed area 10th September 2019

Figures 3 to 6 show the data that has been collected. ***The survey was to trial the SSS in the Solway and therefore there was no ground-truthing on the data collected. The data collected shows differences in hardness and texture but without ground-truthing there is no way to distinguish what the different habitats / substrates were.***

4. Discussion

Aims

i. To investigate the use of the side scan sonar (SSS) in the Solway, with a focus on distinguishing between mixed habitat types.

The data which has been collected has definition between different hardness and texture. Further work is required to identify what the various features are. For this, extensive ground-truthing is required in a small timeframe from when the data is collected. Until further knowledge is gained specifically within the Solway it is difficult to predict if different habitat types have different appearance, especially if mixed mussel, Sabellaria spp. and exposed cobble and boulder are present in the same geographical location. A portfolio should be compiled over multiple surveys to build confidence in assigning habitats.

On the 6th November a dredge survey was completed in the Solway which covered the area in the SSS survey. A full survey note has been produced separately for this survey. Figure 7 to 9 show the SSS data with the overlaid dredge data. Unfortunately due to the amount of time between the two surveys (8 weeks 1 day), the length of the tows and not knowing where on the tow the dredge material comes from, the information cannot be used for ground-truthing.

Due to the water quality (high sediment load) the use of video and cameras is not possible. Future surveys should include grab sampling to ground-truth as this will provide the greatest level of accuracy.

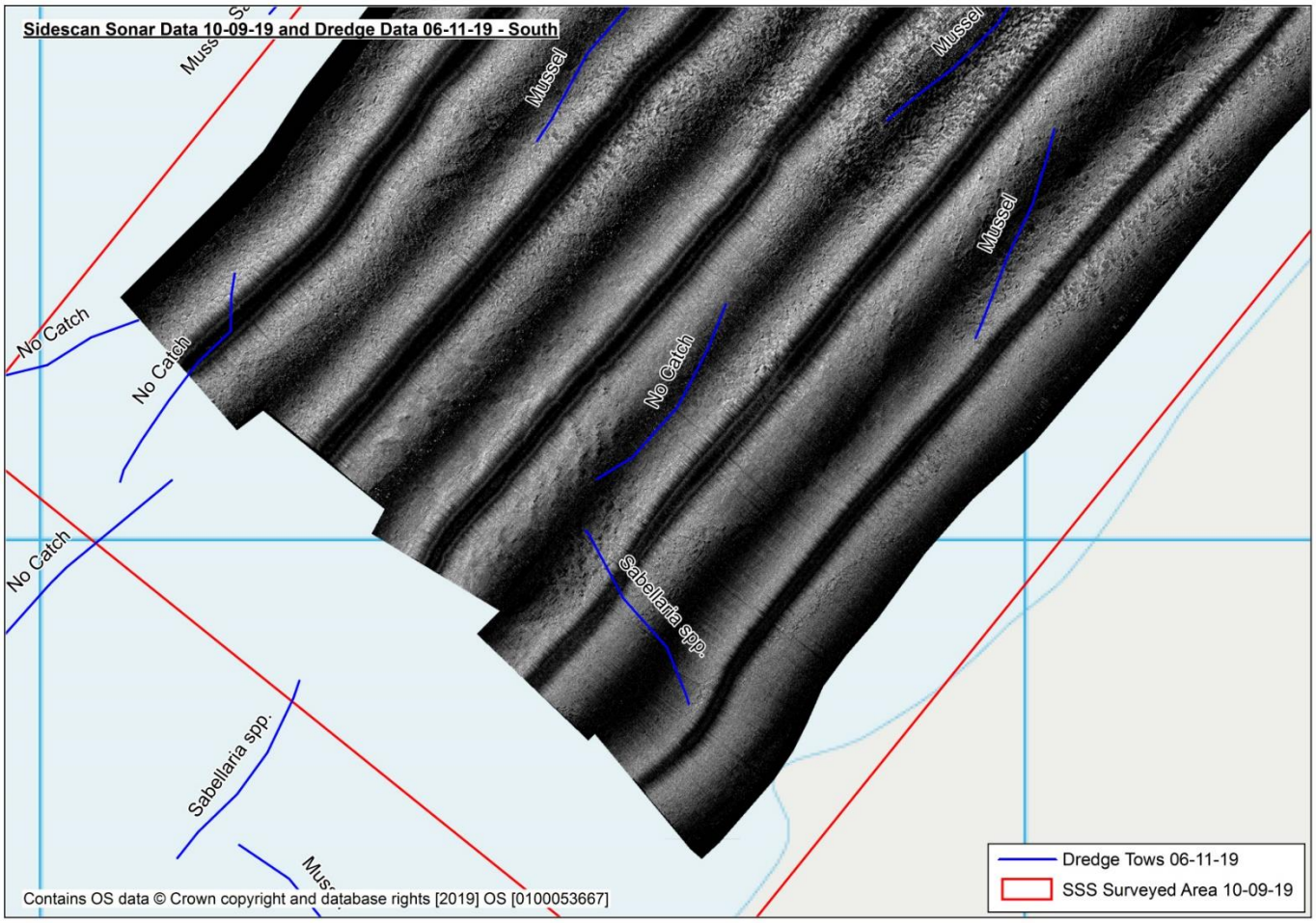

Figure 7 - SSS data (10-09-19) and dredge data (06-11-19) from the South of the surveyed area

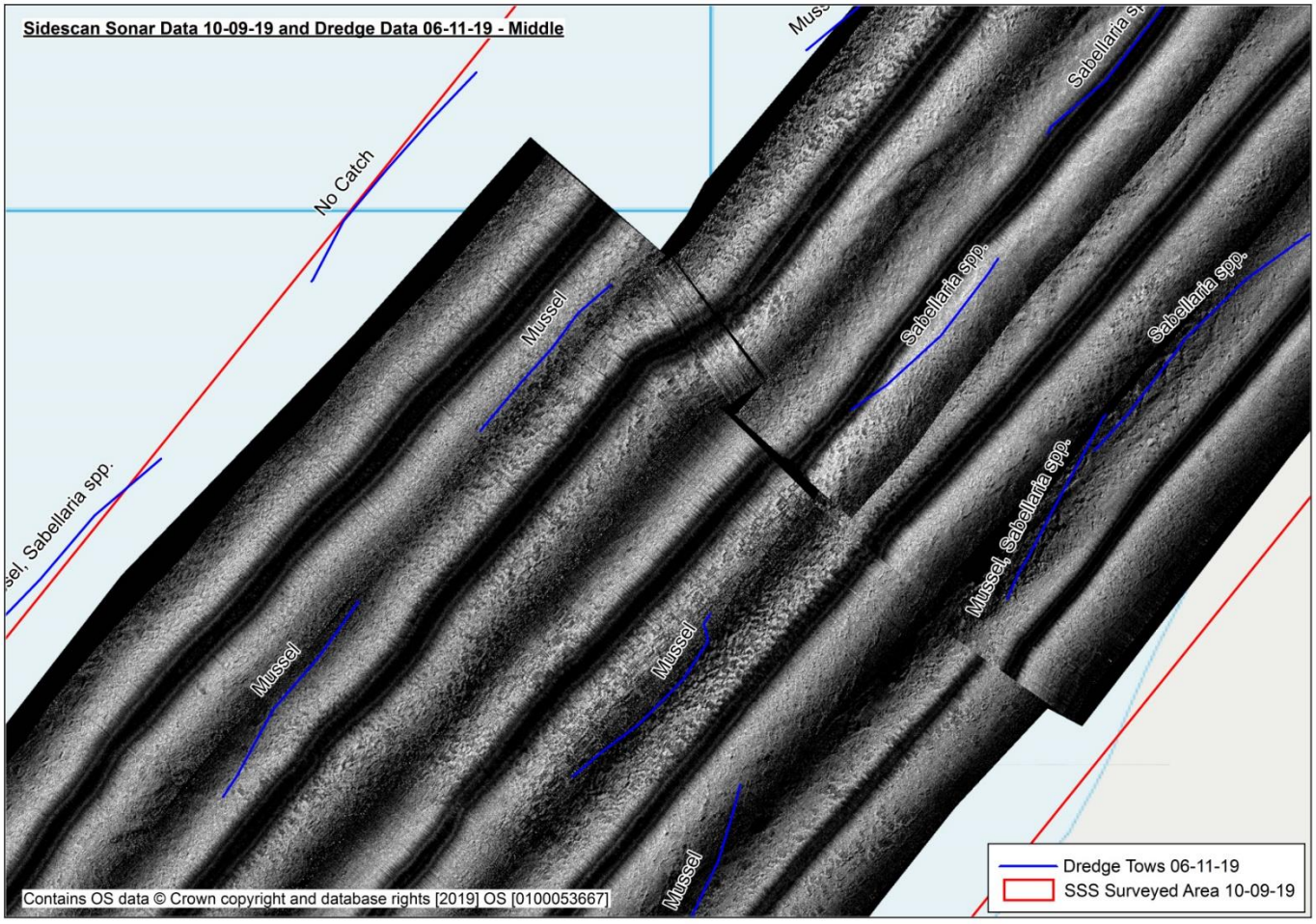

Figure 8 - SSS data (10-09-19) and dredge data (06-11-19) from the Middle of the surveyed area

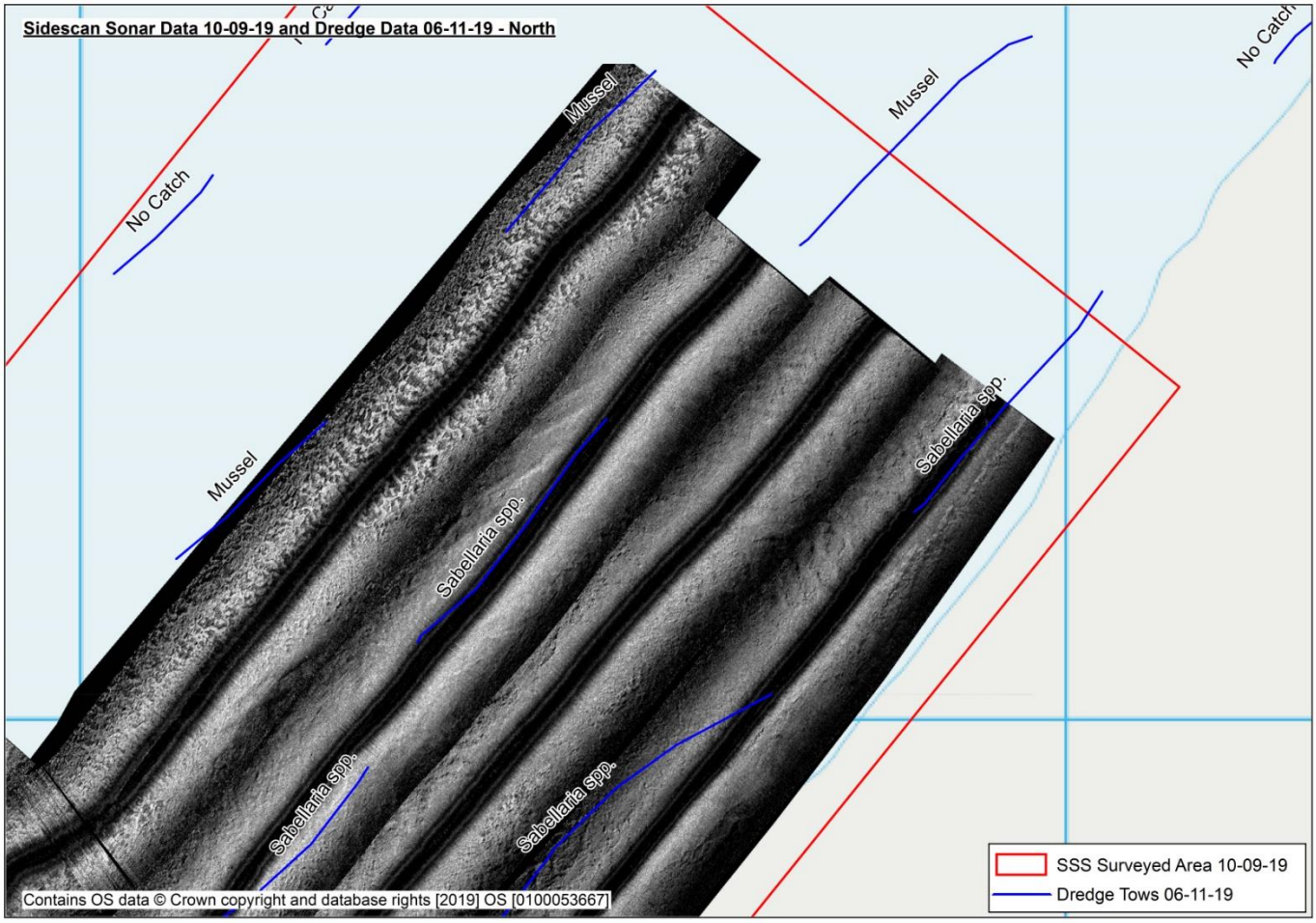

Figure 9 - SSS data (10-09-19) and dredge data (06-11-19) from the North of the surveyed area

ii. To investigate what conditions the SSS can operate in. The Solway offers challenging environmental conditions: there are fast currents with very little if any slack water at high and low tide; there is a mixture in current speeds and directions; the water has a high sediment load with floating debris.

iii. To test running the equipment from the bow of the vessel. The shallow water of the target area means that running the equipment off of the stern of the vessel is not possible because the towfish needs to get below the wash of the jet engines to ensure good data is collected.

It is possible to use the SSS in the Solway but due to environmental factors there are some limitations on using the equipment.

Towing speed

- Due to the current speed the speed over ground has to be reduced to between 1.5 – 2 knots.
- Once the current increases above 2 knots the surveying of SSS should cease.

This limits the amount of survey time to 1.5 to 2 hours either side of high or low water. The reduced towing speed limits the area which can be surveyed in one tide.

Tide selection and weather conditions

- Neap tide – this increases the amount of time where the current is below the working speed limit.
- High water – due to the depth of water some areas (transects 1A-1F, 2A-2C, 3A-2C, 4B-4C) can only be surveyed over high water. The other transects can be completed over the low water period.
- Minimum wind and swell – calm conditions are required to produce the best results. Swell has a greater effect on the data due to towing from the bow with a short cable. Swell causes stretching in the data.

Tide and weather requirements mean there are only short windows in which to complete the surveys.

Data Acquisition Settings

There are some improvements that could be made in the data acquisition in Seanet Pro; on the edges of the swath there has been some loss of data. Increasing gains should be considered.

iv. Produce a survey plan and methodology for future survey work in the Solway to investigate the mix of habitat and build on knowledge of the subtidal mussel in the channel.

A survey plan for future SSS surveys in the Solway has been produced.

Jon Haines

NWIFCA Deputy Senior Scientist

December 2019