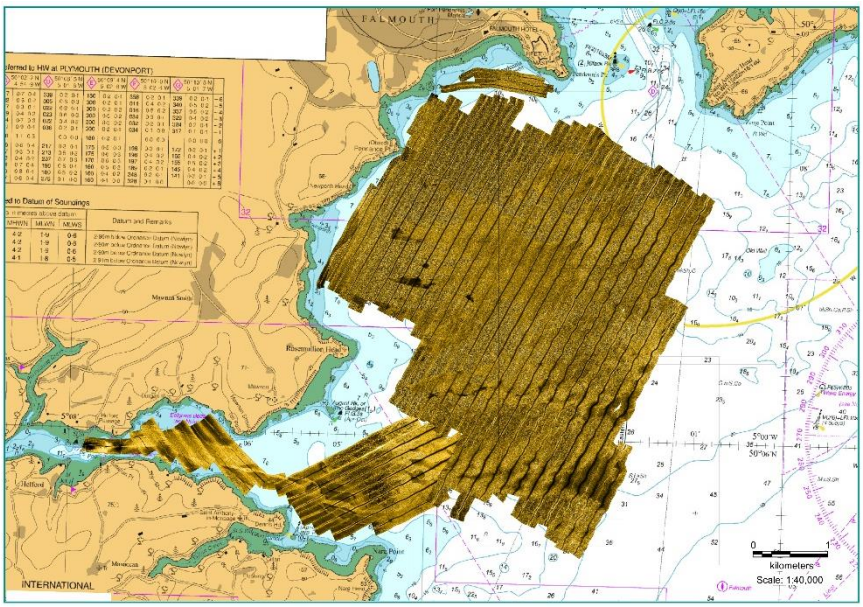
Side Scan Sonar survey of Falmouth Bay within the Fal and Helford Special Area of Conservation 2021



Survey field report for the 2020/2021 Side Scan Sonar survey of Falmouth Bay within the Fal and Helford Special Area of Conservation

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CIFCA_2021_FalmouthBay_SSS

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Authors	**Date**	**Comment**	**Version**
S Sturgeon	15/09/2021	First draft	0.1
S Sturgeon	20/05/2022	Addition of figures	0.1
A Jenkin	10/06/2022	QA	0.2
C Trundle	27/06/2022	QA	0.2
S Sturgeon	29/06/2022	QA comment amendments	Final

Summary

This report summarises the operations and data acquired during the 2020/2021 side scan sonar survey of Falmouth Bay within the Fal and Helford Special Area of Conservation (SAC). The survey was carried out over three days, 9th June 2020, 13th July 2020 and 16th March 2021.

The aim of the survey was to gather acoustic data with 100% coverage of Falmouth Bay within the Fal and Helford SAC using an EdgeTech 4200 Side Scan Sonar. In total, 48 tows were completed covering an area from Pendennis Point to the Helford River out to the Fal and Helford SAC boundary from Zone Point towards Manacle Point. Sea conditions were favourable throughout the survey.

Table of Contents

List of Figures

List of Annex Figures

List of Tables

List of Annex Tables

Glossary of Terms and Abbreviations

EOL – End of Line

IFCA – Inshore Fisheries and Conservation Authority

SAC – Special Area of Conservation

SOL – Start of Line

SSS – Side scan sonar

1 Background and Introduction

Cornwall Inshore Fisheries and Conservation Authority (Cornwall IFCA) carried out a side scan sonar survey (SSS) within Falmouth Bay to acoustically image the seabed within the Fal and Helford Special Area of Conservation (SAC).

1.1 Aims & Objectives

1.1.1 Aims

- Collect acoustic data of the seabed with 100% coverage in Falmouth Bay within the Fal and Helford SAC.

1.1.2 Objectives

- Collect high frequency (600kHz) data using EdgeTech 4200 SSS in Falmouth Bay.
- Use HYPACK Targeting and Mosaicking software to process data.
- Use MapInfo Professional Advanced software to create plots of side scan coverage.

2 Survey Operations

All data collection was undertaken aboard the Research Vessel (R/V) Tiger Lily VI. Details of the vessel and the equipment used are provided in Appendix 1. Survey operations and protocols are described below.

2.1 Personnel

All survey days consisted of one scientific officer and an independent skipper onboard and one or two scientific officers working remotely from home due to Cornwall IFCA Coronavirus (COVID-19) procedures.

2.2 Personal Protective Equipment (PPE)

While working on deck all crew were required to wear lifejackets, personal location beacons (PLBs) and steel toe cap boots. There were no reported accidents or near misses throughout the survey.

3 Survey Methodology

The survey was carried out applying the 'Mapping European Seabed Habitats (MESH) Recommended Operating Guidelines (ROG) for side-scan surveys' (Henriques *et al.,* 2013).

Planned survey lines were created in HYPACK Max Version 2019 software. Lines were created with 180 m spacing running 209 degrees (NNE-SSW) parallel across Falmouth Bay using the Fal and Helford SAC boundary as the outer survey limit. 180 metre spacing was used to provide a 20% overlap on the outer edges of the swathe when using 100 metre range.

The towfish was connected to the tow line and data cables on the stern deck of the vessel. The computer was set up on the workbench inside the wheelhouse. The system was tested prior to deployment on the journey from Mylor Harbour, Falmouth to the survey site. Once on site the towfish was deployed from the A frame on the stern of the vessel. The towfish was then towed on a trial run to determine the correct gain and time viable gain (TVG) levels and after the trial run the settings were kept constant.

To achieve a 100 m swathe at 600 kHz an altitude of approximately 10 m from the seabed is recommended (10% of range). However, such an altitude was difficult to maintain in the shallow depth of water (ranging from 5 to 20 m) on site at a tow speed of 4.5-5 knots.

The depth of the towfish was changed by altering the amount of tow line fed away via a hydraulic winch. During deployment the survey vessel maintained a speed over the ground (SOG) of 4.5-5 knots whilst the survey crew increased the length of tow cable in the water. The layback of the towfish from the survey GPS antenna was calculated and maintained for the duration of the survey. The offset of the antenna was combined with the length of deployed warp to estimate the layback of the sonar fish. In HYPACK a Towfish Driver is used to automatically calculate the layback using the 'HYPACK Standard' layback method which includes information from A-frame offsets, water depth, fish depth, cable out and catenary factor of 0.81 to calculate a position for the sonar fish.

Once the crew were happy and all checks and set up procedures were complete the survey skipper positioned the vessel at the start of the first tow line. Recording of data in EdgeTech Discover 4200-MP (Version 33.0.1.112) software and HYPACK was started when the towing speed was between 4.5-5 knots and a consistent heading was maintained. A start of line (SOL) target was then created in HYPACK. Track logging automatically began in HYPACK once SSS data was being recorded. Recording was stopped at the end of each tow and re-started at the start of the next tow, when the

vessel was maintaining a constant heading and speed. An end of line (EOL) target was created in HYPACK at the end of each tow and track logging stopped.

Data was recorded in both; .jsf and .xtf file formats in EdgeTech Discover. The data was also logged in .hsx format in HYPACK. Display gains were not recorded. No lay back was applied to the files in EdgeTech Discover, however lay back was recorded in the data logged in HYPACK. At the end of the survey all data were transferred to an external hard drive.

Remote access software was used on all laptops to enable the home-based scientific officers to independently operate the EdgeTech Discover controls and HYPACK. Microsoft Teams was also used throughout each survey day to enable the home-based officers to maintain continuous communication with the survey crew aboard the vessel.

4 Data handling

SOL and EOL positions were recorded in the Lat/Long WGS84 projection and taken from the Hemisphere V500 GNSS system on Tiger Lily VI. HYPACK targets were extracted as a .txt file format and opened in Microsoft Excel (comma delimited).

The .jsf, .xtf and .hsx files were transferred from the PC to a WD Passport for transport and storage at the end of each survey day. The log sheets were worked on from the shared network drive and saved at the end of each day.

5 Cruise Narrative

All times are Universal Time Coordinated (UTC).

9th June 2020

R/V Tiger Lily VI departed Mylor at 07:17 on the 09/06/2020 with one scientific officer and an independent skipper on board. Two scientific officers worked remotely. The vessel arrived on site and deployed the towfish at 07:40. A total of 21 SSS tows were completed within Falmouth Bay from Pendennis to Rosemullion Head. R/V Tiger Lily VI arrived alongside Mylor at 16:36.

13th July 2020

R/V Tiger Lily VI departed Mylor at 08:00 on the 13/07/2020 with one scientific officer and an independent skipper on board. One scientific officer worked remotely. The vessel arrived on site and deployed the towfish at 08:51. A total of 12 SSS tows were completed within Falmouth Bay to the outer boundary of the Fal and Helford SAC (from Zone Point towards Manacle Point). R/V Tiger Lily VI arrived alongside Mylor at 15:50.

16th March 2021

R/V Tiger Lily VI departed Mylor at 11:30 on the 16/03/2021 with one scientific officer and an independent skipper on board. Two scientific officers worked remotely. The vessel arrived on site near the mouth of the Helford and deployed the towfish at 12:28. A total of 15 SSS tows were completed within Falmouth Bay and into the Helford River. R/V Tiger Lily VI arrived alongside Mylor at 16:55.

6 Acoustic Data acquisition

Acoustic imagery was acquired for the majority of the sediment habitat covering Falmouth Bay within the Fal and Helford SAC, avoiding areas of bedrock reef. An overview of the planned survey lines can be seen in Figure 1. A total of 48 tows were completed and all were included for processing (Table 1).

Table 1: Side scan sonar metadata for the 2020/2021 survey of Falmouth Bay within the Fal and Helford Special Area of Conservation

Date	Number of tows	File format	Range (metres)	Layback
09/06/2020	21	.jsf .xtf	Tows 1-14; 100 m Tows 15-21; 50 m	.jsf and .xtf: Manually calculated with Tows 1-10; 39.4 m, Tows 11-12; 21 m and Tows 13-21; 14 m
13/07/2020	12	.jsf .xtf	Tows 1-12; 100 m	.jsf and .xtf: Manually calculated with Tows 1-12; 44 m
16/03/2021	15	.jsf .xtf .hsx	Tows 1-15; 100 m	.jsf and .xtf: Manually calculated with Tows 1-15; 9.4 m .hsx: HYPACK Towfish driver recorded layback in-situ

For vessel specifications see Appendix 1 and the equipment specification can be found in Appendix 2. The daily logs are shown in Appendix 3.

6.1 Falmouth Bay

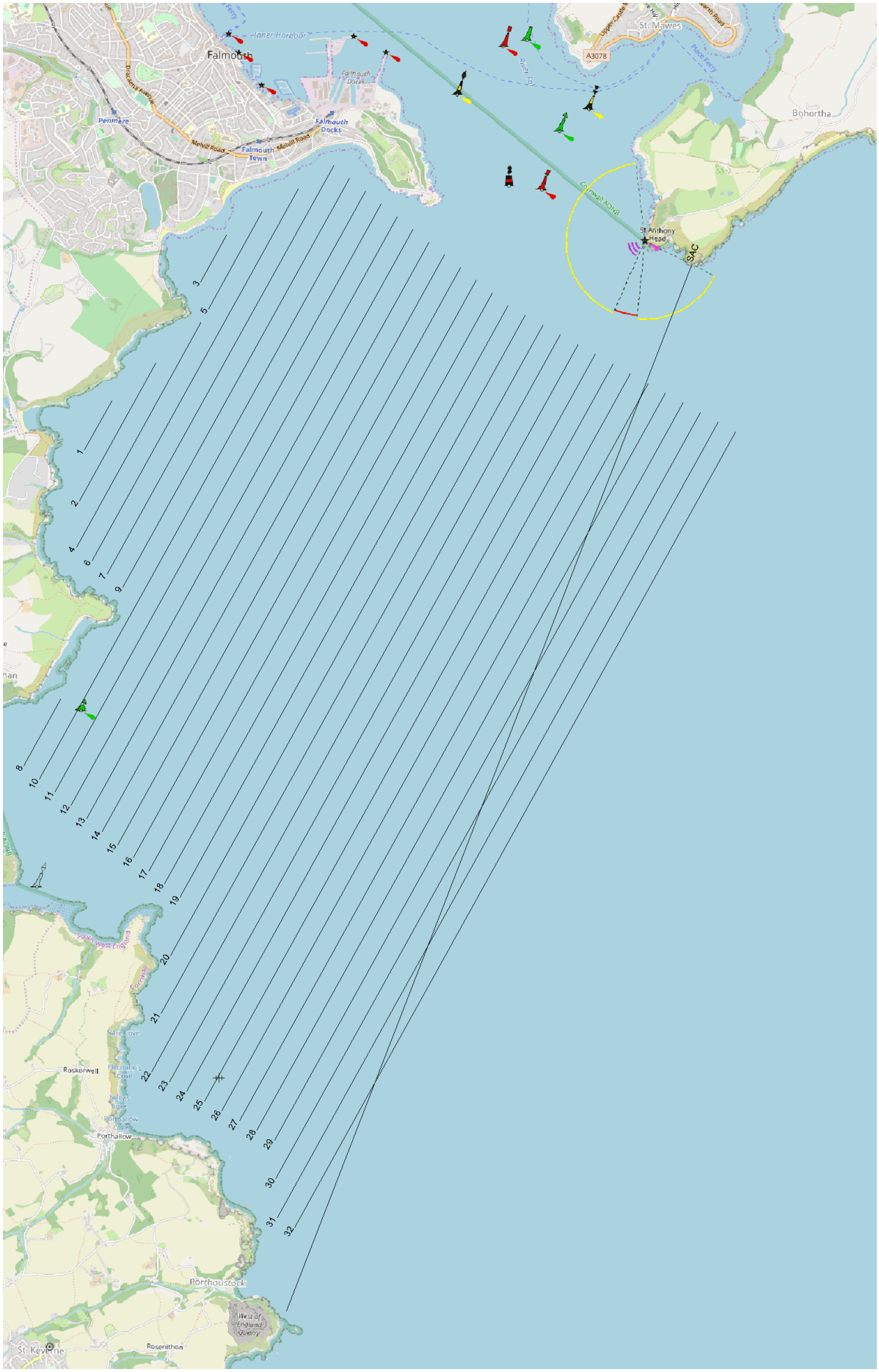


Figure 1: Planned acoustic survey lines within Falmouth Bay created in HYPACK MAX.

7 Data analysis

Tows were separated by each survey day and loaded into HYPACK Targeting and Mosaicking software, these were loaded as a batch depending on file type (.jsf or .hsx) and layback parameters, then analysed individually. No changes were made to the raw files and the edited versions are saved as .hs2 files in HYPACK.

The towfish altitude was determined to accurately remove the water column to the point before distortion to the near field zone occurs by using auto-bottom detection (using the settings, Blanking 1.5 m, Gate size 3 m and Sensitivity 9). Any areas which needed amending were digitized manually. Vertical adjustments were then made by lowering the profile by 1 percent and the whole profile was also smoothed twice. If needed, track lines were edited to remove turns or position spikes by deleting segments of the track. Heading was smoothed (once) for the entire line. This processing was repeated for all tows loaded into the software.

The colour 'gold' was chosen for mosaic display and gains were selected for high frequency using Auto TVG with a sensitivity of 6 and smoothing of 1. The display range was selected (100 m) and the water column removed.

For the mosaic the tows were layered to ensure the clearest data was displayed on top and for overlapping areas, overlay was selected. Fill gaps was selected to interpolate the data to fill uncovered areas.

Resolution of 0.08 meters per pixel was selected as which resulted in the generation of multiple tiles. The mosaic was exported as a GeoTif (embedded TFW). A GeoTif is an image file that has an additional data file that provides geographic positioning enabling the image to be used in a GIS.

After processing, the mosaic was loaded into MapInfo Professional Advanced (Version 17.0.4) and displayed over the relevant admiralty chart for the area which can be seen in Figure 2.

7.1 Falmouth Bay

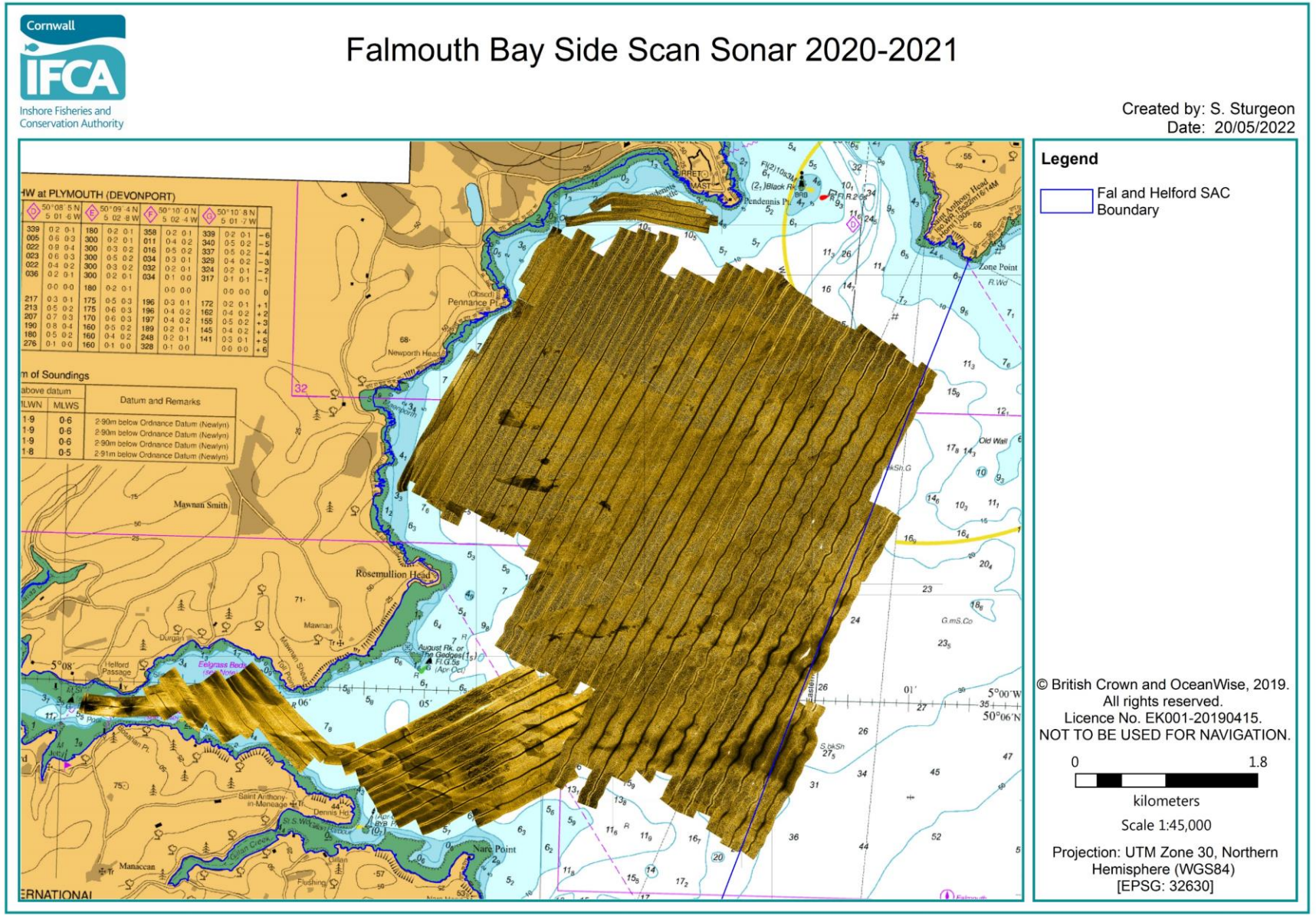


Figure 2: Side scan sonar survey completed within Falmouth Bay using an EdgeTech 4200 side scan sonar by Cornwall IFCA in 2020-2021

8 Discussion

The overall aim of the SSS survey of Falmouth Bay was completed successfully. The data collected within the Fal and Helford SAC will provide useful information on the distribution of substrate signatures across Falmouth Bay and for drop down video surveys.

Some anthropogenically derived impacts were visible on the acoustic imagery during the survey. Geo referenced snapshots were taken during the data collection and reviewed at a later time. After review, it was believed that the patterns in the data were caused by ship's anchor cables whilst they were anchored in the bay. An example can be seen in Figure 3.

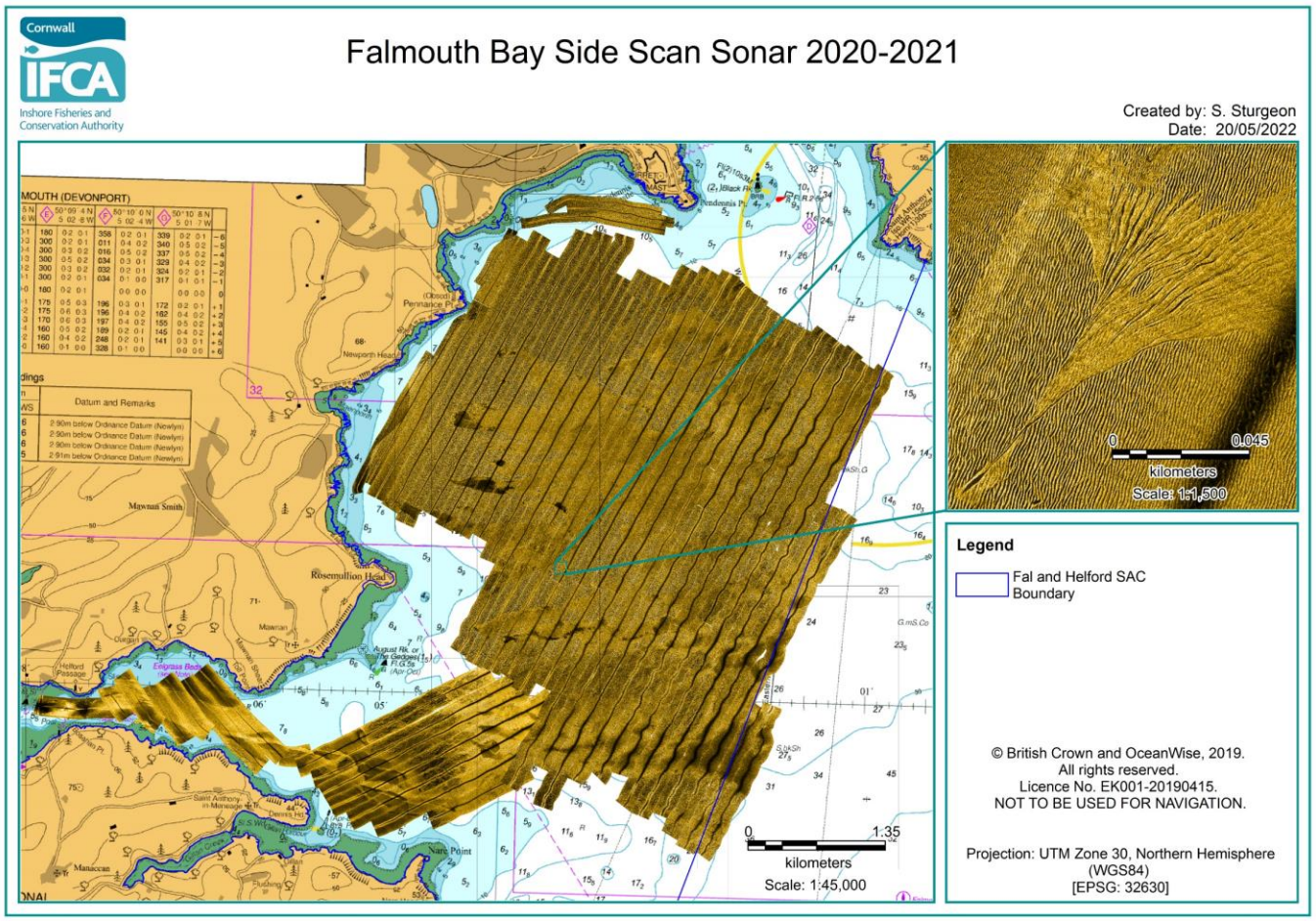


Figure 3: Anchor marks visible during side scan sonar survey completed within Falmouth Bay using an EdgeTech 4200 side scan sonar by Cornwall IFCA 2021

9 Limitations

There were a number of limitations to the survey methodology which included;

- Areas of Falmouth Bay close in shore were not covered by the SSS due to the shallow and rocky seabed.
- Lack of 4G in some survey areas meant to the scientific officers working at home lost contact with the vessel.

10 Recommendations

Areas are identified from the SSS mosaic within Falmouth Bay to carry out a drop down video survey to verify the acoustic signatures.

11 References

Henriques, V., Mendes, B., Pinheiro, L.M., Goncalves, D. and Long, D. 2013. Recommended Operating Guidelines (ROG) for side-scan sonars. *MeshAtlantic Recommended Operating Guideline.*

HYPACK. 2019. HYPACK 2019 Manual. Available from: https://www.hypack.com/File%20Library/Resource%20Library/Manuals/2019/2019-HYPACK-User-Manual.pdf [Accessed: 07/05/2019]

12 Appendices

Appendix 1. **Vessel specification**

R/V Tiger Lily VI

The survey was undertaken from Cornwall IFCA's Research Vessel (R/V) Tiger Lily VI (Annex Figure A). Tiger Lily VI is an MCA coded Cat 2 vessel. The vessel has been refitted for survey work and includes a purpose built survey station within the wheelhouse. R/V Tiger Lily VI has been fitted with an inverter and uninterruptable power supply (UPS) to provide stable, continuous 240 v power, NMEA outputs and a dedicated GPS with WAAS enabled. All times are recorded as UTC and taken from the same source as the position data. The clocks on all of the data capture PCs were synched prior to departing the vessel's mooring.

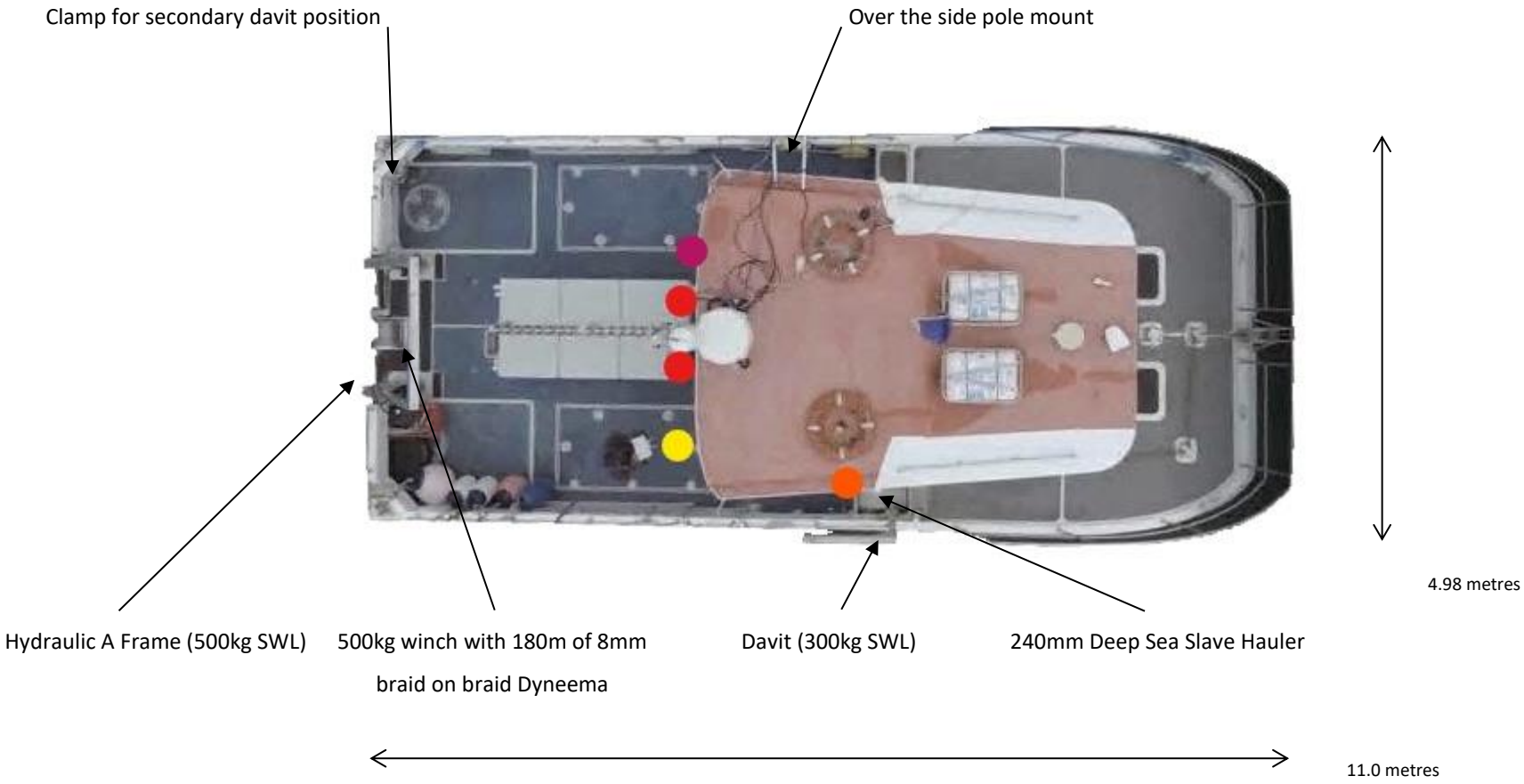
Annex Figure A: Cornwall IFCA's dedicated survey vessel, R/V Tiger Lily VI.

Builder	South Boats Ltd
Model	Island MkII
Built	2007
LOA	11.0m
Beam	4.98m
Draught	1.1m (aft)
Tonnage	c.10 tonnes
Area of operation	MCA Category 2
Call sign	MRWR7
MMSI Number	235054954
MECAL Certification number	M07WB0111059
Complement	14 (including min 2 crew)
Propulsion	2 x 450hp Iveco NEF series
Speed	Cruising: 16 – 18 knots Top: 24 – 26 knots
Range	c. 400 nautical miles
240v AC supply	Victron 3Kw power inverter

	5KvA Volvo-Perkins generator (All 240 AC power is accessed via APC Smart UPS C1500)
Stern Gantry	500kg SWL
Winch (on stern gantry)	Spencer Carter 0.5t with scrolling level wind
Slave hauler	Sea Winch 200m dia.
Electric line hauler	12v Spencer Carter Bandit
Positioning	Hemisphere V500 GNSS 3 x Furuno GP32
NMEA data outputs	4 x USB 4 x Serial 4 x banjo
Navigation	Olex with data export Knockle Hypack Max
Connectivity	SATFI 4G Mobile broadband

Appendix 2. Equipment specification

Positioning Software and Offsets



Equipment				Offset (m)		
NMEA Device	**Plan Symbol**	**Make/Model**	**Offset Name**	**X (Forw'd)**	**Y (Port)**	**Z (+/-)**
Navigation depth sounder		Furuno Navnet	Furuno transducer	7.0m	0.75m	- 0.5m
GPS		Furuno GP32 x 2	Furuno mushroom antenna	4.8m	2.1m & 2.35m	+ 3.5m
GPS		Furuno GP32	Furuno mushroom antenna	3.5m	0.5m	+ 2.0m
GNSS		Hemisphere V500	Main GPS	4.8m	3.0m	+ 2.5m

EdgeTech 4200 Side Scan Sonar

An EdgeTech 4200 Multi Pulse (MP) Dual Frequency (300 kHz & 600 kHz) Side Scan Sonar (SSS) system was used for data collection. EdgeTech 'Discover 4200-MP' (Version 33.0.1.112) and HYPACK Max (Version 2019) software was used for data capture. Hemisphere V500 was used for all positional data. Details of the system are shown in Annex Table A and further information is available in the manual[1]. Annex Figure B shows the side scan sonar being deployed from the A-frame of Cornwall IFCA's Research Vessel (R/V) Tiger Lily VI.

Annex Table A: Equipment specification of the EdgeTech 4200 side scan sonar

Specifications		**Details**	
Manufacturer		EdgeTech	
Main System Components	Topside Processor	4200-P (Portable) Unit with Laptop Computer	
	Umbilical Cable	Kevlar-reinforced cable, 150 m length	
	Tow vehicle	4200 Multi Pulse (MP) side-scan sonar	
		Depth rating	2000 m (Stainless Steel)
		Frequencies	300/ 600 kHz
		Modulation	Full-spectrum chirp frequency-modulated pulse with amplitude and phase weighting
		Expected operating range (per side)	230 m (300 kHz) 120 m (600 kHz)
		Output pulse energy	3 j (300 kHz) 1 j (600 kHz)
		Pulse length	Up to 12 ms (300 kHz) Up to 5 ms (600 kHz)
		Digital link	4 Mbits/sec (typical), 4 channels of side scan data plus sensor data
		Across track resolution	3 cm (300 kHz) 1.5 cm (600 kHz)
		Along track resolution	1.3 m @ 150 m (300 kHz) 0.45 m @ 100 m (600 kHz)
		Horizontal beam width (4200-MP):	High Definition Mode (HDM): 0.28° (300 kHz) 0.26° (600 kHz) High-Speed Mode (HSM): 0.54° (300 kHz) 0.34° (600 kHz)
		Transducer array depression angle (4200-MP)	26° downward
		Dynamic range	24 bits
		Vertical beam width	50°
		Maximum towing speed while meeting NOAA and IHO-44S specifications of 3 pings	HDM: 4.8 knots HSM: 9.6 knots

[1] Available from: https://www.edgetech.com/wp-content/uploads/2019/07/0004842_Rev_P.pdf [Accessed 28/09/2021]

		on a 1-meter cubed target at 100 meters (4200-MP):	
		Maximum safe towing speed	12 knots
		Operating temperature	0–45°C
		Heading accuracy	For Indicative use only
		Heading resolution	0.1°
		Pitch and roll accuracy	For Indicative use only
		Optional sensor port	RS-232
Optional Equipment	Tow vehicle	Depressor Wing	No
		Magnetometer	No
		Acoustic tracking system	No
		Pressure sensor	3000-psi pressure
		Temperature sensor	No
		Power loss pinger	No

Annex Figure B: EdgeTech 4200 Multi Pulse (MP) Dual Frequency (300 kHz & 600 kHz) side scan sonar deployed from R/V Tiger Lily VI.

Appendix 3. **Daily logs**

Annex Table B: Daily log of the survey on 9th June 2020

Project	Falmouth Bay SSS		**Survey code**	20200609_CIFCA_SSS_FalBay		
Date	2020-06-09	**Coordinate reference system**	WGS84	**Weather**		
Location	Falmouth Bay	**Position Fix**	Hemisphere V500 GNSS (GPS)	**Wind direction**	W	
Survey Type	SSS	**Horizontal Accuracy**	0.5 m	**Wind speed**	3-11 mph	
Vessel	Tiger Lily VI	**Time zone**	UTC	**Beaufort scale**	1	
Skipper	Chris Lowe	**Depth reference system**	Lowest Astronomical Tide	**Cloud coverage**	8/8	
IFCA officers	Colin Trundle, Stephanie Sturgeon			**Time recorded**	07:57	
Visitors	None			**Weather**		
Time depart Mylor	07:17	**Side scan make and model**	EdgeTech 4200 MP (300/600 kHz)	**Wind direction**	NNW	*Data entered by*
Time arrive Mylor	16:36	**Towing point**	Snatch block on lower guard on A frame	**Wind speed**	10 mph	SS 09/06/2020
High water time	07:30:00 (UTC)	**Notes**		**Beaufort scale**	1	
High water (m)	4.76 m	**Toolbox time**	-	**Cloud coverage**	8/8	*QA*
Tide recorded from	Falmouth	**Induction**	Not required	**Time recorded**	12:00	SS 01/10/2021
Description of survey	21 SSS tows in Falmouth Bay from Pendennis to Rosemullion Head					

Time	**Type**	**Details/description**
07:00		On board, setting up
07:17		Depart Mylor
07:40		Setting up equipment, deploying SSS
07:50		Checking logging settings & nav output
08:13:00	SSS	Tow 1 SOL
08:41:05	SSS	Tow 1 EOL
08:45:03	SSS	Tow 2 SOL
09:14:34	SSS	Tow 2 EOL
09:17:29	SSS	Tow 3 SOL
09:46:02	SSS	Tow 3 EOL
09:50:05	SSS	Tow 4 SOL
10:21:15	SSS	Tow 4 EOL
10:23:20	SSS	Tow 5 SOL
10:50:44	SSS	Tow 5 EOL
10:54:27	SSS	Tow 6 SOL
11:23:19	SSS	Tow 6 EOL

11:27:27	SSS	Tow 7 SOL
11:48:01	SSS	Tow 7 EOL
11:51:01	SSS	Tow 8 SOL
12:13:45	SSS	Tow 8 EOL
12:17:26	SSS	Tow 9 SOL
12:38:26	SSS	Tow 9 EOL
12:40:59	SSS	Tow 10 SOL
13:00:18	SSS	Tow 10 EOL
13:07:18	SSS	Tow 11 SOL
13:28:53	SSS	Tow 11 EOL
13:31:31	SSS	Tow 12 SOL
13:51:10	SSS	Tow 12 EOL
14:01:45	SSS	Tow 13 SOL
14:21:22	SSS	Tow 13 EOL
14:23:19	SSS	Tow 14a SOL
14:37:07	SSS	Tow 14a EOL
14:37:08	SSS	Tow 14b SOL
14:41:52	SSS	Tow 14b EOL
14:44:44	SSS	Tow 15 SOL
14:48:15	SSS	Tow 15 EOL
14:50:15	SSS	Tow 16 SOL
15:02:37	SSS	Tow 16 EOL
15:04:15	SSS	Tow 17 SOL
15:13:55	SSS	Tow 17 EOL
15:21:41	SSS	Tow 18 SOL
15:30:46	SSS	Tow 18 EOL
15:32:13	SSS	Tow 19 SOL
15:39:34	SSS	Tow 19 EOL
15:41:20	SSS	Tow 20 SOL
15:48:48	SSS	Tow 20 EOL
15:53		Retrieving SSS
15:57		Depart for Mylor
16:36		Arrive Mylor

CIFCA_2021_FalmouthBay_SSS

Annex Table C: Daily log of the survey on 13th July 2020

Project	Falmouth Bay Side Scan Sonar (SSS)		**Survey code**	20200713_CIFCA_SSS_FalBay		
Date	2020-07-13	**Coordinate reference system**	WGS84	**Weather**		
Location	Falmouth Bay	**Position Fix**	Hemisphere V500 GNSS (GPS)	**Wind direction**	WSW	
Survey Type	SSS	**Horizontal Accuracy**	0.5 m	**Wind speed**	9-17	
Vessel	Tiger Lily VI	**Time zone**	UTC	**Beaufort scale**	3	
Skipper	David Raymond	**Depth reference system**	Lowest Astronomical Tide	**Cloud coverage**	8/8	
IFCA officers	Colin Trundle, Stephanie Sturgeon			**Time recorded**	07:57	
Visitors	None			**Weather**		
Time depart Mylor	08:00	**Side scan make and model**	EdgeTech 4200 MP (300/600 kHz)	**Wind direction**	WSW	*Data entered by*
Time arrive Mylor	15:50	**Towing point**	Snatch block on lower guard on A frame	**Wind speed**	13-26	SS 13/07/2020
High water time	10:37:00 (UTC)	**Notes**		**Beaufort scale**	4	
High water (m)	4.08 m	**Toolbox time**	-	**Cloud coverage**	8/8	*QA*
Tide recorded from	Falmouth	**Induction**	Not required	**Time recorded**	16:14	SS 01/10/2021
Description of survey	Continuation of previous Falmouth Bay SSS. 12 SSS tows in Falmouth Bay, near outer Fal & Helford SAC Boundary (from Zone Point towards Nare Head)					

Time	**Type**	**Details/description**
07:00		On board, setting up
08:00		Depart Mylor
08:51		Setting up equipment, deploying SSS
09:06:57	SSS	Tow 1 SOL
09:41:57	SSS	Tow 1 EOL
09:45:44	SSS	Tow 2 SOL
10:19:43	SSS	Tow 2 EOL
10:25:02	SSS	Tow 3 SOL
10:57:28	SSS	Tow 3 EOL
11:04:00	SSS	Tow 4 SOL
11:05		SS on lunch
11:35:16	SSS	Tow 4 EOL
11:39:12	SSS	Tow 5 SOL
12:12:23	SSS	Tow 5 EOL
12:16:28	SSS	Tow 6 SOL
12:50:31	SSS	Tow 6 EOL
12:54:54	SSS	Tow 7 SOL
13:26:49	SSS	Tow 7 EOL
13:31:36	SSS	Tow 8 SOL

13:54:00	SSS	Tow 8 EOL
13:56:23	SSS	Tow 9 SOL
14:20:22	SSS	Tow 9 EOL
14:22:42	SSS	Tow 10 SOL
14:33:05	SSS	Tow 10 EOL
14:34:06	SSS	Tow 11 SOL
14:45:07	SSS	Tow 11 EOL
14:52:08	SSS	Tow 12 SOL
15:25:33	SSS	Tow 12 EOL
15:28		Retrieving SSS
15:35		Depart for Mylor
15:50		Arrive Mylor

Annex Table D: Daily log of the survey on 16th March 2021

Project	Falmouth Bay Side Scan Sonar (SSS)		**Survey code**	20210316_CIFCA_SSS_FalBay		
Date	2021-03-16	**Coordinate reference system**	UTM Zone 30N WGS84	**Weather**		
Location	Falmouth Bay	**Position Fix**	Hemisphere V500 GNSS (GPS)	**Wind direction**	NNW	
Survey Type	SSS	**Horizontal Accuracy**	0.5 m	**Wind speed**	14 to 20 mph	
Vessel	Tiger Lily VI	**Time zone**	UTC	**Beaufort scale**	4	
Skipper	David Raymond	**Depth reference system**	Lowest Astronomical Tide	**Cloud coverage**	2/8	
IFCA officers	Colin Trundle, Stephanie Sturgeon, Annie Jenkin			**Time recorded**	12:27	
Visitors	None			**Weather**		
Time depart Mylor	11:30	**Side scan make and model**	EdgeTech 4200 MP (300/600 kHz)	**Wind direction**		*Data entered by*
Time arrive Mylor	16:55	**Towing point**	Snatch block on lower guard on A frame	**Wind speed**		SS/ AJ 16/03/2021
High water time	06:56	**Notes**		**Beaufort scale**		
High water (m)	5.18 m	**Toolbox time**	-	**Cloud coverage**		*QA*
Tide recorded from	Helford River	**Induction**	Not required	**Time recorded**		SS 01/10/2021
Description of survey	Continuation of previous Falmouth Bay SSS. 15 SSS tows were completed within Falmouth Bay and into the Helford River.					

Time	**Type**	**Details/description**
11:30		Depart Mylor
12:26		Arrive on site
12:28		Deploy SSS
12:30		SSS deployed. Setting up equipment
12:31		Issues connecting Echosounder
12:47	SSS	Tow 1_SOL

13:01:02	SSS	Tow 1_EOL
13:02:40	SSS	Tow 2_SOL
13:15:14	SSS	Tow 2_EOL
13:17:49	SSS	Tow 3_SOL
13:30:38	SSS	Tow 3_EOL
13:32:05	SSS	Tow 4_SOL
13:46:28	SSS	Tow 4_EOL
13:49:37	SSS	Tow 5_SOL
14:02:34	SSS	Tow 5_EOL
14:04:38	SSS	Tow 6_SOL
14:14:19	SSS	Tow 6_EOL
14:16:13	SSS	Tow 7_SOL
14:22:22	SSS	Tow 7_EOL
14:34:37	SSS	Tow 8_SOL
14:41:34	SSS	Tow 8_EOL
14:51:59	SSS	Tow 9_SOL
14:59:37	SSS	Tow 9_EOL
15:01:00	SSS	Tow 10_SOL
15:08:28	SSS	Tow 10_EOL
15:13:25	SSS	Tow 11_SOL
15:18:22	SSS	Tow 11_EOL
15:19:24	SSS	Tow 12_SOL
15:23:52	SSS	Tow 12_EOL
15:26:52	SSS	Tow 13_SOL
15:30:37	SSS	Tow 13_EOL
15:32:03	SSS	Tow 14_SOL
15:36:17	SSS	Tow 14_EOL
15:41:42	SSS	Tow 15_SOL
15:46:54	SSS	Tow 15_EOL
15:47		Recover SSS to deck
16:55		Arrive Mylor