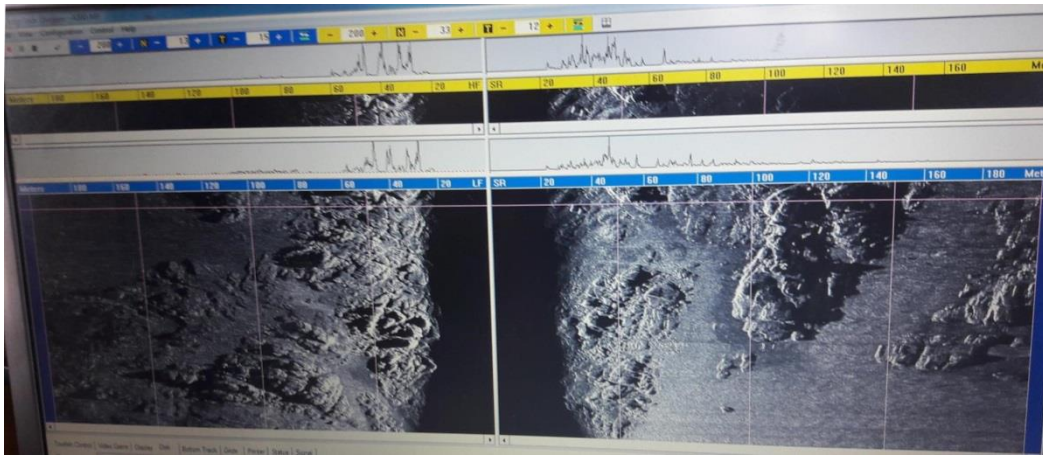




## **Eddystone Reefs Box 4 Side-Scan Sonar 2019**



## **Survey field report for the Eddystone Reefs Box 4 Side-Scan Sonar Survey**

Completed by: Cornwall Inshore Fisheries and Conservation Authority  
(Cornwall IFCA)

Authors: Kate Owen, Colin Trundle, Annie Jenkin, Steph Sturgeon and Hilary Stidwell

CIFCA\_2019\_ Eddystone Reefs\_Box4\_SSS

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Cornwall IFCA  
Chi Gallos  
Hayle Marine Renewables Business Park  
North Quay  
Hayle  
Cornwall  
TR27 4DD

Tel: 01736 336842 Email: [enquiries@cornwall-ifca.gov.uk](mailto:enquiries@cornwall-ifca.gov.uk)

## Cornwall IFCA Document Control

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K Owen	24/07/2019	First Draft	0.1
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## Summary

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This report summarises the operations and data acquired during the 2019 side-scan sonar (SSS) survey of Box 4, located inside the Eddystone Reefs part of the Plymouth Sound to Start Point and Eddystone Special Area of Conservation (SAC). The survey was carried out on the 16<sup>th</sup> July 2019.

The aim of this survey was to collect acoustic data of the seabed in Box 4. Five SSS tows were successfully completed in Box 4 and sea conditions were good throughout the survey.

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## 1 Background and Introduction

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Following the introduction of a byelaw that either wholly or partially prohibited the use of bottom towed gears in European Marine Sites (EMS), Cornwall Inshore Fisheries and Conservation Authority (Cornwall IFCA), the Marine Conservation Society (MCS) and the University of Exeter Environment Sustainability Institute (ESI) have collaborated on a study in the Eddystone reefs part of the Start Point to Plymouth Sound and Eddystone Special Area of Conservation (SAC). The project was initially funded by the Pigshed Trust between 2014 and 2016 and Princess Yachts International of Plymouth from 2017 to 2019.

The aim of the partnership study has been to collect seabed imagery over time to enable a comparison of the epifaunal assemblages (by statistical analysis) within areas that are open and closed to bottom towed gear. Data has been collected from one treatment and two control survey boxes. The three sites were selected due to their similarity; they all have similar bathymetry, reef to the western side and have all been/are subject to towed gears.

In 2014 and 2015 Cornwall IFCA also collected data from a fourth survey box (Box 4). Box 4 is located in a zone that was closed to bottom towed gear (Figure 1). Due to its differences to the main study survey boxes, data collected from Box 4 has not been included in the main project and has been treated as a standalone study. Whereas the other boxes have reef to the west and are open to the east, Box 4 has reef to both its eastern and western sides. Drop down video (DDV) tows have not been conducted in this survey box since 2015. The aim of this study was to return to Box 4 and collect high quality video and still image data, repeating previous video transects wherever possible. Analysis of the collected data will enable analysis epifaunal assemblages to be carried out and comparisons drawn with the baseline data collected in 2015.

The side-scan sonar (SSS) survey was carried out to acoustically image the seabed within the survey area. Positional data of the subsequent video/stills surveys were then overlaid on the image providing context to the image data.

### 1.1 Aims & Objectives

#### 1.1.1 Aims

- To achieve 100% coverage of low frequency (300kHz) SSS data for Box 4.

#### 1.1.2 Objectives

- Collect low frequency (300 kHz) SSS data in Box 4.
- Process the data and produce a mosaic output to be viewed in GIS software.

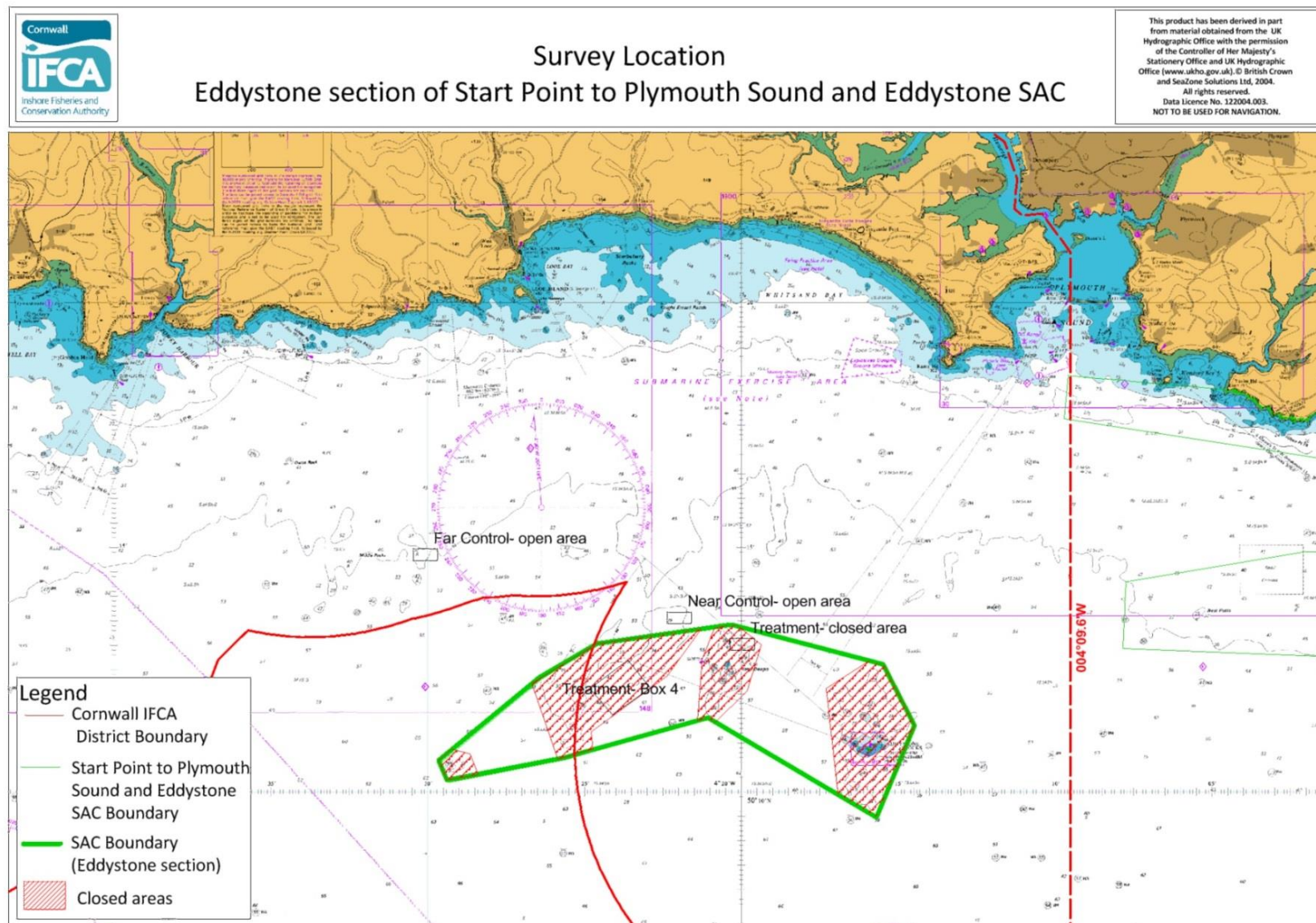


Figure 1: Location of four survey boxes within the Start Point to Plymouth Sound SAC. Box 1 = Treatment - closed area, Box 2 = Near control - open area, Box 3= Far control - open area, Box 4 = Treatment.

## 2 Survey Operations

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The survey 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

The survey on the 16<sup>th</sup> July 2019 consisted of two Scientific Officers and one Principal Scientific Officer. Also on board were Sangeeta McNair (Natural England) and Jake Georgelin (work experience).

### 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 on the day.

## 3 Methodology

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

The SSS 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 wheel house. The system was tested prior to deployment on the journey from Mylor Harbour, Falmouth to the survey site. Once on site the SSS was deployed from the A frame on the stern of the vessel. The SSS 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 400 m swathe at 300 kHz an altitude of approximately 20m from the seabed is recommended (10% of range). However, such an altitude was difficult to achieve in the depth of water on site at a tow speed of 4-4.5 knots without using a depressor plate on the sonar.

The depth of the SSS 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 4-4.5 knots whilst the survey crew increased the length of tow cable in the water to 100 m. Referring to the datasheet in **Error! Reference source not found.**, the fish would therefore have been at a depth of approximately 30 m, in water ranging from 49 m to 59 m over the five tows conducted. The layback of the SSS from the survey GPS antenna was calculated to be approximately 105.5m and maintained for the duration of the survey. The offset of the antenna (6.5 m) was combined with the length of deployed warp (100 m) to estimate the layback of 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 Discover was started when the towing speed was between



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4-4.5 knots and a consistent heading was maintained. A start-of-line (SOL) target was then created in Hypack Max Version 2018. Track logging was started in Hypack slightly before the SOL. Recording in Discover 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 formats. No lay back was applied to the .xtf files, nor were any display gains recorded. At the end of the survey all data were transferred to an external hard drive.

## 4 Data handling and analysis

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The .xtf files were loaded into Coda Octopus 'GeoSurvey' Version 6.1.0. The first tow was played back in the waterfall display then an area of homogenous sediment across the whole scan was selected as a trial area to optimise the display preferences. Image enhancement was applied, inverting the grey scale to give white as high and black as low backscatter, and gamma value increased to 1.2. The data was scaled using auto scale in the 'Scale Display Data' setting to achieve optimum display scale and gains. 'Time-Varying Gain' (TVG) was applied to increase the gain at the outer edges of the swathe and lower the gain in the lower end of the range. These settings were saved and 'locked' to be applied to all tows.

'Auto tracking: Sidescan edge detection' was used to calculate the seabed position, set at 30% sensitivity. This was then played back to manually check for, and correct, any errors. 'Slant Range Correction' was then applied before loading the file into Coda Octopus, GeoSurvey Mosaic Version 5.16. This process was repeated for each tow.

Once all tows were loaded into Mosaic the 105.5 m layback was applied to all data. 'Navigation Smoothing' was also applied to all data removing outliers. The tows were layered to ensure the clearest data was displayed on top. The images for each survey Box were exported as a 'North Up GeoTiff', at a resolution of 2 pixels per geographical metre. A geotiff 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 Version 17.0.2 and displayed over the admiralty charts for the area.

## 5 Cruise Narrative

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All times are in Universal Time Coordinated (UTC).

### 16th July 2019

Tiger Lily departed Mylor at 07:00, arriving on site in Box 4 at 08:47. At 09:00 a Toolbox talk was conducted and at 09:06 the vessel was manoeuvred into position for the first survey line. By 09:20 the SSS was fully deployed and ready for display tuning and at 09:32 the first tow began. Tow 1 ran in a northerly direction, with 100 m of cable in the water. Vessel speed was maintained at 4-4.5 knots and the tow concluded at 09:49. The length of cable in the water and speed of tow was kept consistent throughout all of the tows. Tow 2 began at 10:00, running in a southerly direction and concluded at 10:18. Tow 3 began at 10:24, running in a northerly direction and concluded at 10:24. Tow 4 began at 10:51, running in a southerly direction and concluded at 11:12. The final tow began at 11:23, running in a northerly direction and concluded at 11:39. At 11:41 operations finished and the crew recovered the SSS to the deck, this was complete by 11:50 and Tiger Lily then motored to Porthallow to conduct SSS work for a different project.

The vessel arrived onsite at Porthallow at 13:20. Survey work here involved checking on two crawfish collectors and running four short SSS survey lines. This work was complete by 14:30 and Tiger Lily departed for Mylor, arriving alongside at 15:05.

## 6 Data acquisition

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Side-scan sonar data was acquired for later processing within Box 4 in the Start Point to Plymouth Sound and Eddystone SAC.

Five tows were completed within Box 4 (Figure 2). The data collected from these tows were processed using Coda Octopus and the mosaic is shown in Figure 3. Details of the SSS tows are shown in Appendix 2 and the daily logs are shown in Appendix 3.

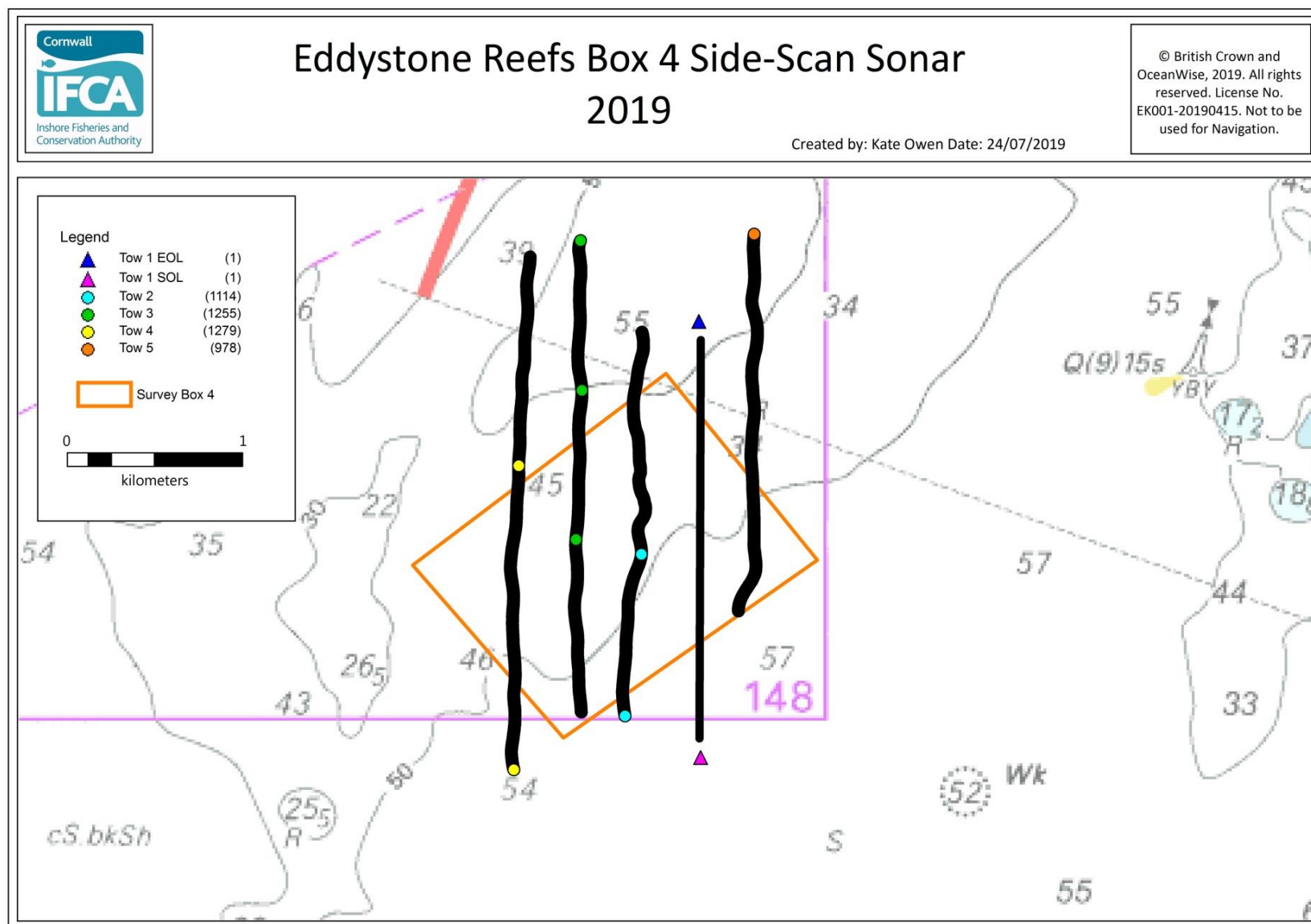


Figure 2: Side-Scan Sonar tows completed by Cornwall IFCA on 16<sup>th</sup> July 2019. Plotted data is from the Hypack log files. N.B Tow 1 did not have a log file and therefore the SOL and EOL have been plotted and joined with a straight line.

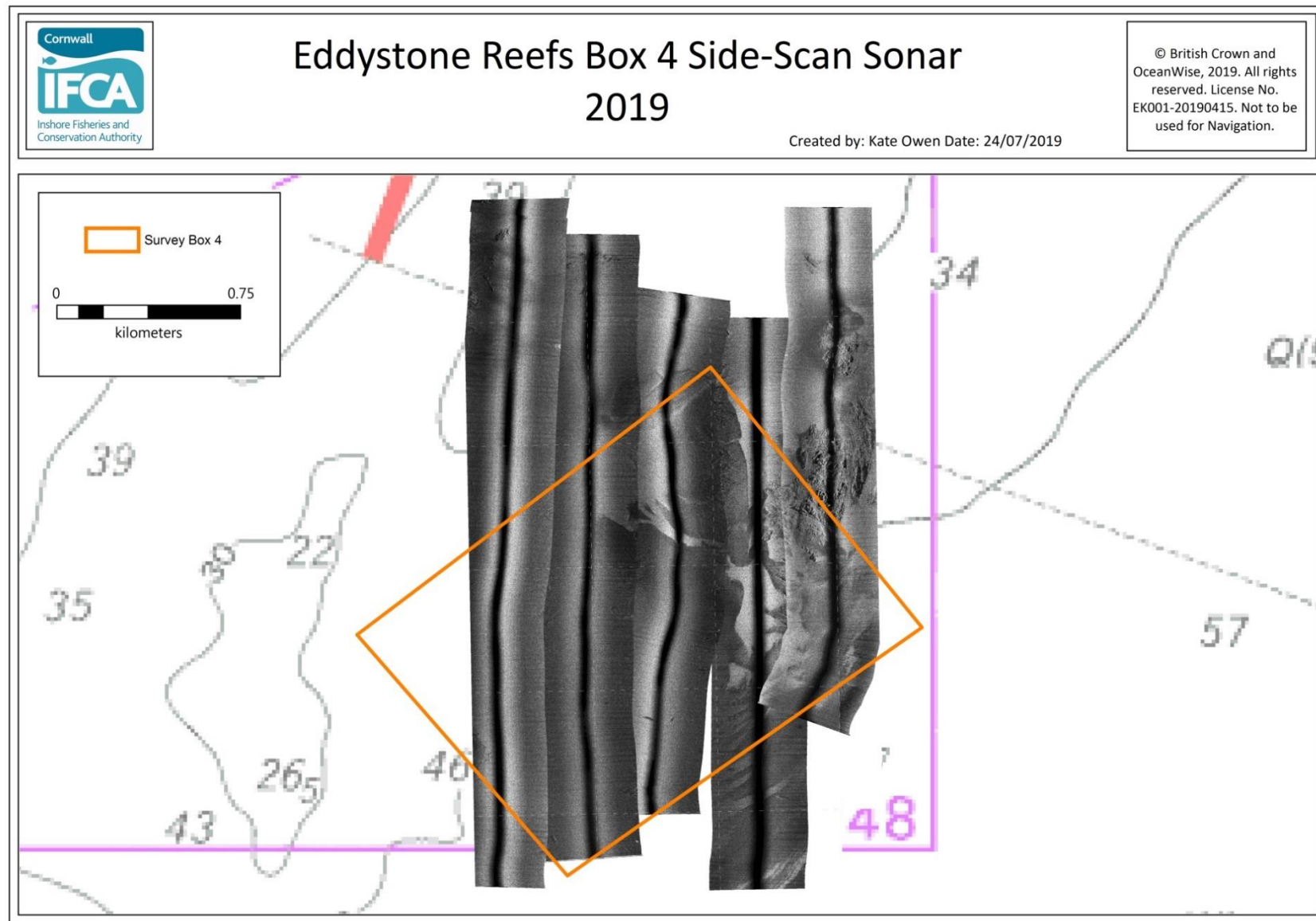


Figure 3: Processed Side-Scan Sonar data collected by Cornwall IFCA in Box 4 on the 16th July 2019.

## 7 References

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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*.

## 8 Appendices

### Appendix 1. Vessel and equipment used

#### R/V Tiger Lily VI

The survey was undertaken from Cornwall IFCA's Research Vessel (R/V) Tiger Lily VI (Annex Figure A **Error! Reference source not found.**). Tiger Lily VI is an MCA coded Cat 2 vessel. R/V Tiger Lily VI is fitted with all necessary safety equipment, including life rafts, lifejackets, first aid kits and fire suppression systems. 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.

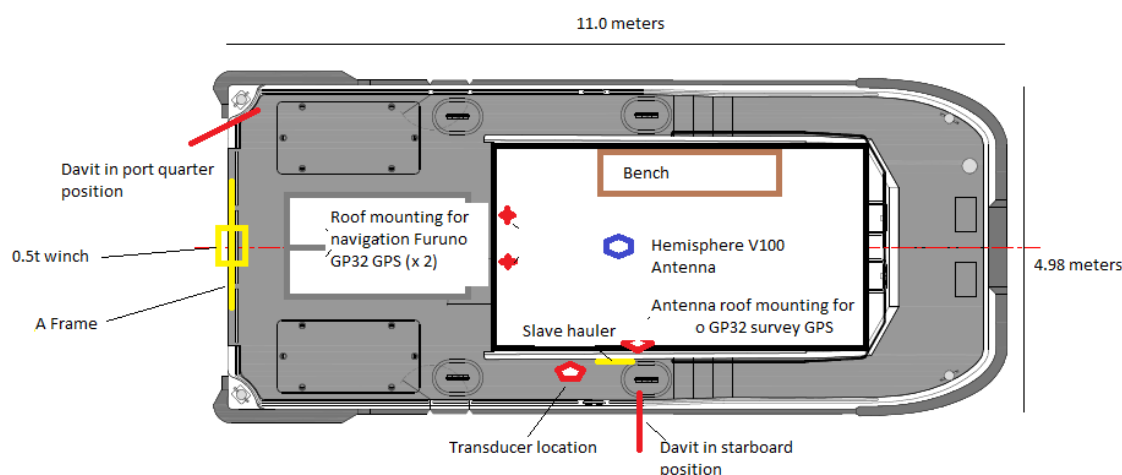
Builder	South Boats Ltd
Model	Island MkII
Built	2007
LOA	11.0m
Beam	4.98m
Draught	1.1m (aft)
Tonnage	c.10 tonnes
Area of operation	MCA Category 2
Call sign	MRWR7
MMSI Number	235054954
MECAL Certification number	M07WB0111059
Complement	14 (including min 2 crew)

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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 V100 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

## 8.1 Positioning Software and Offsets

Tiger Lily VI General Layout - Plan view



Equipment			Offset (m)		
NMEA Device	Make/Model	Offset Name	X (fwd)	Y (port)	Z (+/-)
Sounder	Furuno Navnet	Transducer	7.0	4.2	-0.5
GPS	Furuno GP32	GPS 1	5.5	2.5	+3
GNSS	Hemisphere V100	GNSS 1	5.0	2.5	+2.35

## 8.2 EdgeTech 4200 Side- Scan Sonar

An EdgeTech 4200 dual Frequency SSS system, with 300/600 kHz operating frequencies was used for data collection.

EdgeTech 'Discover 4200-MP' (Version 33.0.1.112) software was used for data capture, and EdgeTech 'Discover

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Coverage Mapper' (Version 1.02) used to display swathe coverage to ensure 100% coverage of the low frequency data (300 kHz) was achieved in Box 4. A Furuno GP-32 GPS was used for all positional data, the GPS antenna is mounted on the starboard side of the wheel house roof. The equipment specifications of the SSS system are shown in **Error! eference source not found..** Details of the system are available online: <http://www.edgetech.com/pdfs/ut/4200-Brochure-122012.pdf>

Equipment	Camera System
Manufacturer	Edgetech
Model	Edgetech 4200 side-scan sonar
Frequency	Dual frequency (300/ 600 kHz)



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## Appendix 2. Details of Side-Scan Sonar tows

Side-Scan Sonar Positioning Summary													
Location		Eddystone Reef		Project name		2019 Eddystone Reefs Box 4 side-scan sonar							
Vessel		Tiger Lily		Sampling position		A-Frame at the stern of the vessel							
Tow	Date	Time SOL (UTC)	SOL Latitude (decimal degrees)	SOL Longitude (decimal degrees)	Time EOL (UTC)	EOL Latitude (decimal degrees)	EOL Longitude (decimal degrees)	Direction	Speed (knots)	Cable in water (m)	Layback (m)	Range (m)	Depth (m)
1	12/07/2019	09:32:32	50.191308	- 4.391023	09:49:44	50.213523	- 4.391157	North	4.5	100	98.5	200	59
2	12/07/2019	10:00:41	50.212677	- 4.395605	10:18:45	50.193692	- 4.397117	South	4.5	100	98.5	200	54
3	12/07/2019	10:24:46	50.193823	- 4.400557	10:44:41	50.216637	- 4.400635	North	4.5	100	98.5	200	53
4	12/07/2019	10:51:25	50.216672	- 4.404628	11:12:21	50.191055	- 4.406042	South	4.5	100	98.5	200	49
5	12/07/2019	11:23:59	50.198857	- 4.388005	11:39:50	50.217552	- 4.386795	North	4.5	100	98.5	200	53

### Appendix 3. Daily Log

Project information		
Project	Eddystone SSS Box 4	
Survey code	2019_CIFCA_SAC_EDD_SSS	
Location	Eddystone Box 4	
Date	16/07/2019	
Vessel	Tiger Lily	
Olex mark	Single fish	
Staff		
Survey role	Company	Name
Principal Scientific Officer	Cornwall IFCA	Colin Trundle
Scientific Officer	Cornwall IFCA	Annie Jenkin
Scientific Officer	Cornwall IFCA	Kate Owen
Skipper	Cornwall IFCA	Colin Trundle
Guest	Natural England (NE)	Sangeeta McNair
Guest	Work experience (NE)	Jake Georgelin
Weather and tides		
High water time (Plymouth):	06:11 (UTC)	
High water (m)	4.96 m	
Time weather recorded (Falmouth)	08:46	
Wind direction	S	
Wind speed	15 mph (Weather improved at the Eddystone site and wind dropped to approximately 4mph)	
Beaufort scale	3	
Cloud coverage	0/8	
Safety		
Toolbox talk time	09:00	
Induction	06:50	
Summary of operations		
Time (UTC)	Type	Activity
07:00		Depart Mylor
08:47		Arrive at survey site
09:00		Toolbox
09:06		Re-position vessel
09:12		Deploy SSS
09:20		SSS deployed
09:32:32	SSS	Tow 1 SOL
09:49:44	SSS	Tow 1 EOL
10:00:41	SSS	Tow 2 SOL
10:18:45	SSS	Tow 2 EOL
10:24:46	SSS	Tow 3 SOL
10:44:41	SSS	Tow 3 EOL
10:51:25	SSS	Tow 4 SOL
11:12:21	SSS	Tow 4 EOL
11:23:59	SSS	Tow 5 SOL
11:39:50	SSS	Tow 5 EOL
11:41		Finish operations, recover SSS to deck
11:50		SSS recovered to deck. Transit to Porthallow

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13:20		Arrive at survey site Porthallow
13:25		Check on crawfish collectors
13:30		Crawfish collector weight adjusted
13:42		Deploy SSS
13:49:22	SSS	Tow 1 SOL
13:53:23	SSS	Tow 1 EOL
13:55:41	SSS	Tow 2 SOL
13:59:28	SSS	Tow 2 EOL
14:02:08	SSS	Tow 3 SOL
14:05:43	SSS	Tow 3 EOL
14:07:39	SSS	Tow 4 SOL
14:11		Caught on crawfish string, recover SSS and crawfish gear to deck
14:15:24	SSS	Tow 4 EOL
14:21		Return crawfish gear (yellow strings) to location
14:30		Depart site for Mylor
15:05		Arrive Mylor