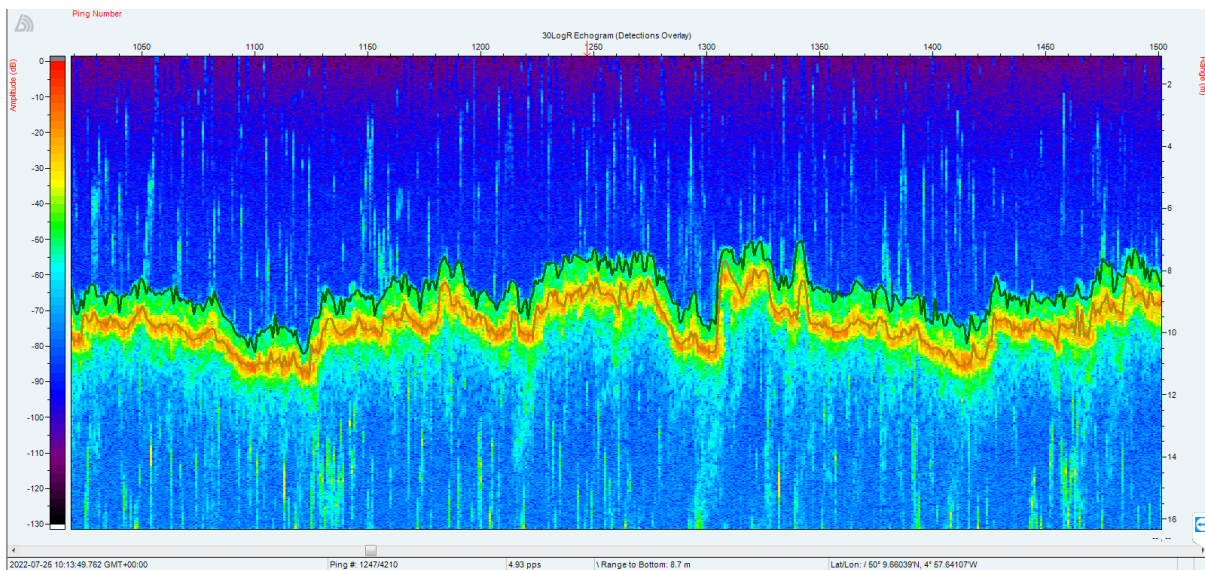




Acoustic Survey of the kelp forest within the Bizzies 2022



Survey report for the 2022 Acoustic Survey of the kelp forest within the Bizzies

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Summary

This report summarises the operations and data acquired during the 2022 acoustic survey of the kelp forest within the Bizzes reef in Gerran's Bay. The survey was carried out over one day on the 27th July 2022.

The aim of the survey was assess the effectiveness of acoustic techniques to map the extent and coverage of the kelp forest within the Bizzies using a Biosonics MX Scientific Echosounder. In total 24 MX survey lines were completed of which 22 were included in the analysis. Sea conditions were favourable throughout the survey.

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Glossary of Terms and Abbreviations

CTD – Conductivity, Temperature, and Depth

EOL – End of Line

IFCA – Inshore Fisheries and Conservation Authority

SOL – Start of Line

1 Background and Introduction

Cornwall Inshore Fisheries and Conservation Authority (Cornwall IFCA) were contracted by the University of Portsmouth to map the extent of the kelp forest within the Bizzies Reef in Gerrans Bay. The data collected by the University was used to assess kelp as a blue carbon habitat. The contract includes joint intellectual property (IP) of all data collected. Cornwall IFCA were keen to use the survey to test the sampling method to map areas of kelp.

1.1 Aims & Objectives

1.1.1 Aims

- To test the sampling method of mapping areas of kelp using a MX Aquatic Habitat Echosounder.

1.1.2 Objectives

- Complete acoustic survey using MX Aquatic Habitat Echosounder in areas of known kelp.
- Verify the acoustic signal to determine what species of algae were present by using visual imagery.
- Use Visual Aquatic by Biosonics software to analyse data.
- Use MapInfo Professional Advanced software to create contour plots of plant height (cm) and plant coverage (%).

2 Methodology

2.1 Survey Area

The survey took place in the Bizzies, a known area of kelp due to the rocky pinnacles present within the site.

2.2 Vessel Specifications

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.

2.3 Personnel

The crew during the survey day consisted of the Principal Scientific Officer, two scientific officers, an independent skipper and three students from the University of Portsmouth onboard.

2.4 Personal Protective Equipment (PPE)

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

2.5 Survey methodology

Survey lines were set up in HYPACK MAX Version 2019 software with 20 m line spacing.

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Acoustic data was acquired using a MX Aquatic Habitat Echosounder (Appendix 2). The echosounder lets you simultaneously acquire submerged aquatic vegetation, substrate and bathymetry data using Visual Acquisition by BioSonics (Version 6.4) software. The transducer was deployed over the port side of the vessel via a pole mounted on the side which can be deployed for survey operations.

Acoustic data was collected in one survey area.

On arrival at the survey area, a Valeport Swift Sound Velocity Profiler was deployed to measure the Conductivity, Temperature, and Depth (CTD). Once recovered to deck the data was downloaded using Valeport Data log X2 software and the temperature and salinity values from the bottom depth were input into the Visual Acquisition software.

A folder for the survey area was created prior to the deployment of the MX and data was recorded with date and time stamps for each file e.g. Bizzies_20220725_121346.

A target was created in HYPACK to indicate the start of line (SOL); this was repeated at the end of line (EOL). The speed over ground was aimed to be at a constant of 4.5 knots so that the pings from the MX were at a consistent distance.

A sport action HD camera was deployed to verify the acoustic signature and check what species of kelp were present. A target was created in HYPACK to indicate SOL and EOL and the footage was reviewed once the camera was recovered to the deck.

2.6 Data handling

MX SOL and EOL positions, targets for verification and video tow SOL and EOL positions were recorded in the Lat/Long WGS84 projection taken from a single GPS, 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 video files and raw MX files (.DT4 and .RTPX) 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.

3 Cruise Narrative

All times are Universal Time Coordinated (UTC).

25^h July 2022

R/V Tiger Lily VI departed Mylor at 07:40 on the 25/07/2022 with the Principal Scientific Officer, two Scientific Officers, an independent skipper and three students from the University of Portsmouth onboard. The vessel arrived on site at the Bizzies at 08:08. A CTD drop was carried out at 08:14. A total of 24 MX survey lines were completed and one HD camera drop to verify the acoustic signature. R/V Tiger Lily VI departed the survey site at 14:46 and arrived alongside Mylor at 15:15.

4 Data analysis

All lines for each bed were loaded into Visual Aquatic by BioSonics software in a batch, then analysed individually. The threshold for the bottom line, plant line as well as the plant length detection criteria (cm) were analysed for each line in a bed using the same settings (Table 1).

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Table 1: Threshold settings for Visual Aquatic and the plant length detection criteria (cm) for the kelp forest within the Bizzies surveyed by Cornwall IFCA

Kelp forest	Rising edge threshold Db (bottom line)	Plant detection threshold dB (plant line)	Plant detection length criterion (cm)
Bizzies	-30	-60	5

An example of the bottom line (orange) and plant line (green) in areas of algae on rock prior to processing (Figure 1). Spikes in the data due to noise are shown which were removed during analysis.

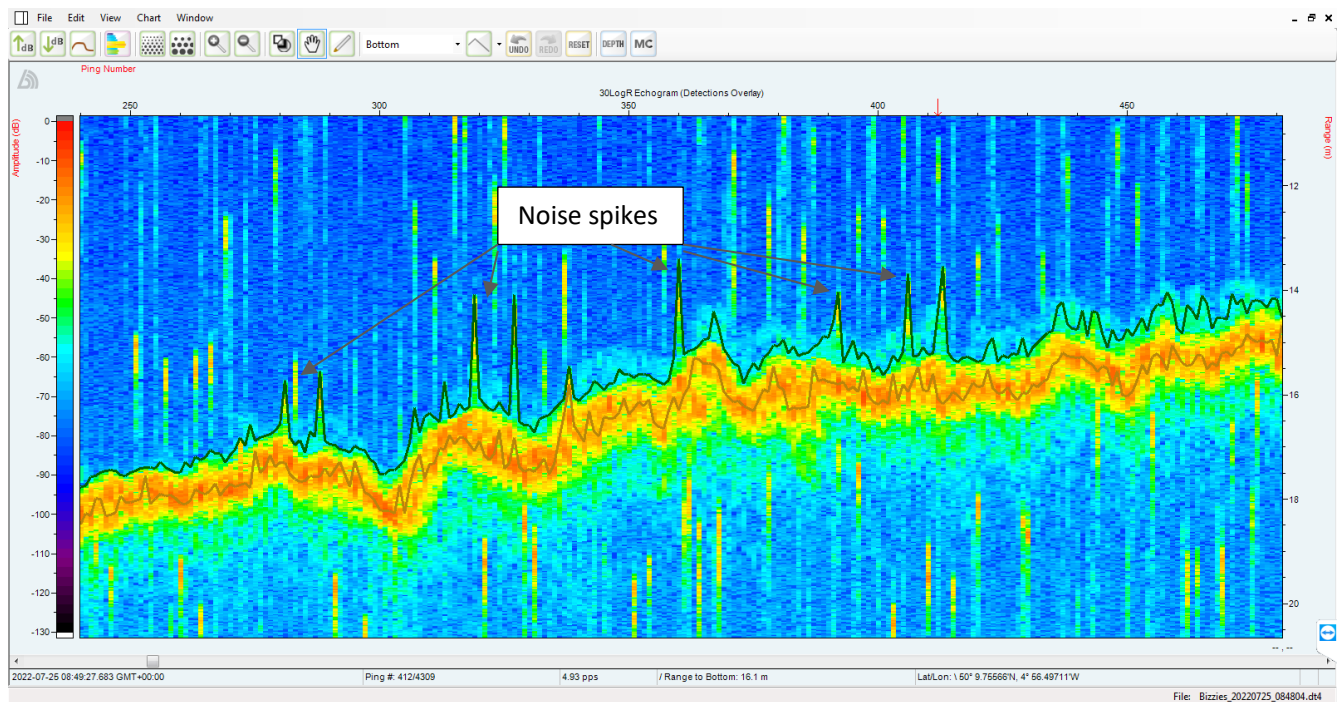


Figure 1: Plant line (green) in Visual Aquatic by Biosonics software prior to processing with noise spikes visible

Quality assurance (QA) was carried out for tows individually and the bottom line and plant line were manually adjusted where there were errors. The plant line was adjusted for noise in the water column with manual edits to remove the spikes with lines running W to E containing more noise in the water column due to the weather conditions on the day of survey.

Once each line was corrected, the post processing information was recorded in the survey log. The analysed data were exported from Visual Aquatic as a .csv file which records the data as an average of every ten pings. The data was copied to Microsoft Excel pasted to columns with corrected headers including latitude, longitude, date, time and notes. This was saved as a .xls file and imported into MapInfo Professional Advanced (Version 17.0.4) to create points.

A theme was added to the points data for the plant height (m) and the plant coverage (%). A raster was created using the natural neighbour function for plant height (m) and plant coverage (%). The settings for the raster were distance: 20 m, smoothing: 0 and cell size: user suggested. Advanced colour was used to define the colour scales.

5 Results

5.1 Acoustic Data acquisition

Acoustic imagery was acquired at one survey area within the Bizzies. A summary of the data collected can be found in Table 2. A total of 24 lines were completed and a total of 22 lines were included in the data analysis.

Table 2: MX line metadata for the 2022 survey of the kelp forest within the Bizzies

Kelp forest	Number of lines	Number of lines included in data analysis	Reason why discounted
Bizzies	24	22	Initial two survey lines in north of survey area, due to time constraints the decision was made to continue survey operations further south over the reef area where it was more likely that kelp would be present.

For vessel specifications see Appendix 1, equipment specification see Appendix 2. The daily logs are available on request.

The MX lines completed are shown in Figure 2. The different blue colouring of the lines denotes the orientation of the data capture, i.e. either towards the shore or away from the shore.

5.2 Bizzies

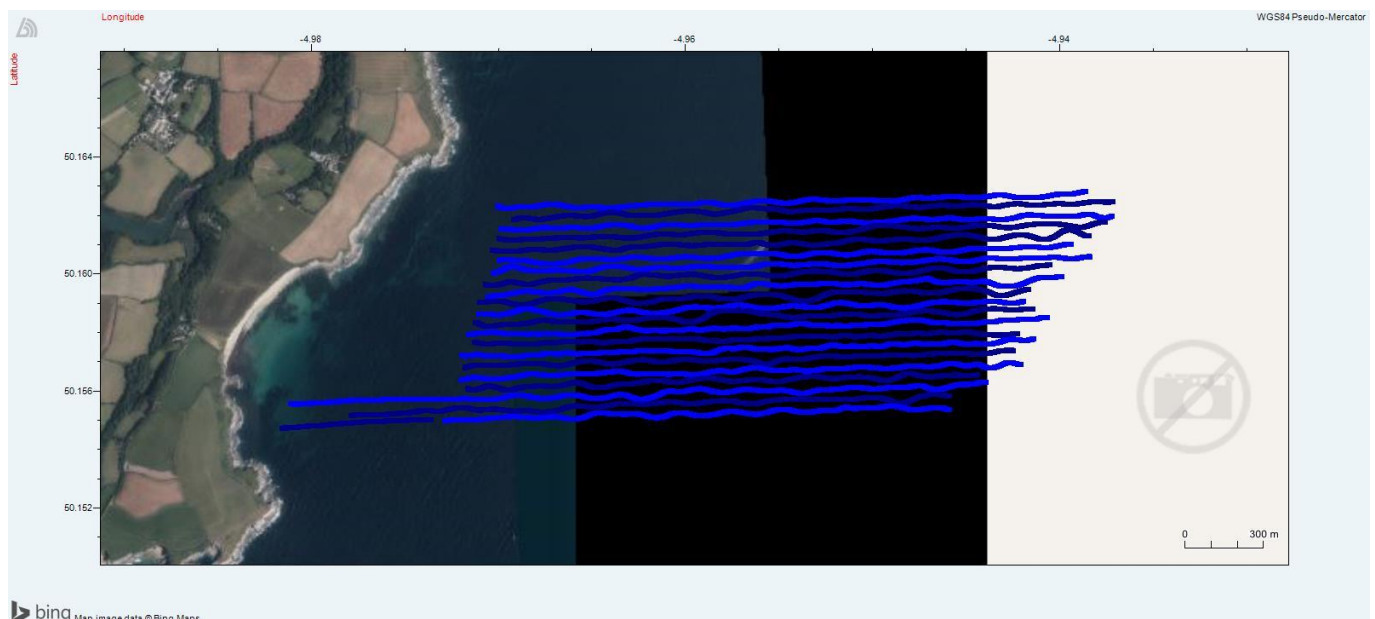


Figure 2: Acoustic survey lines completed at Bizzies using an MX Echosounder by Cornwall IFCA 2022

The survey location and pings from the MX Echosounder are shown in Figure 3.

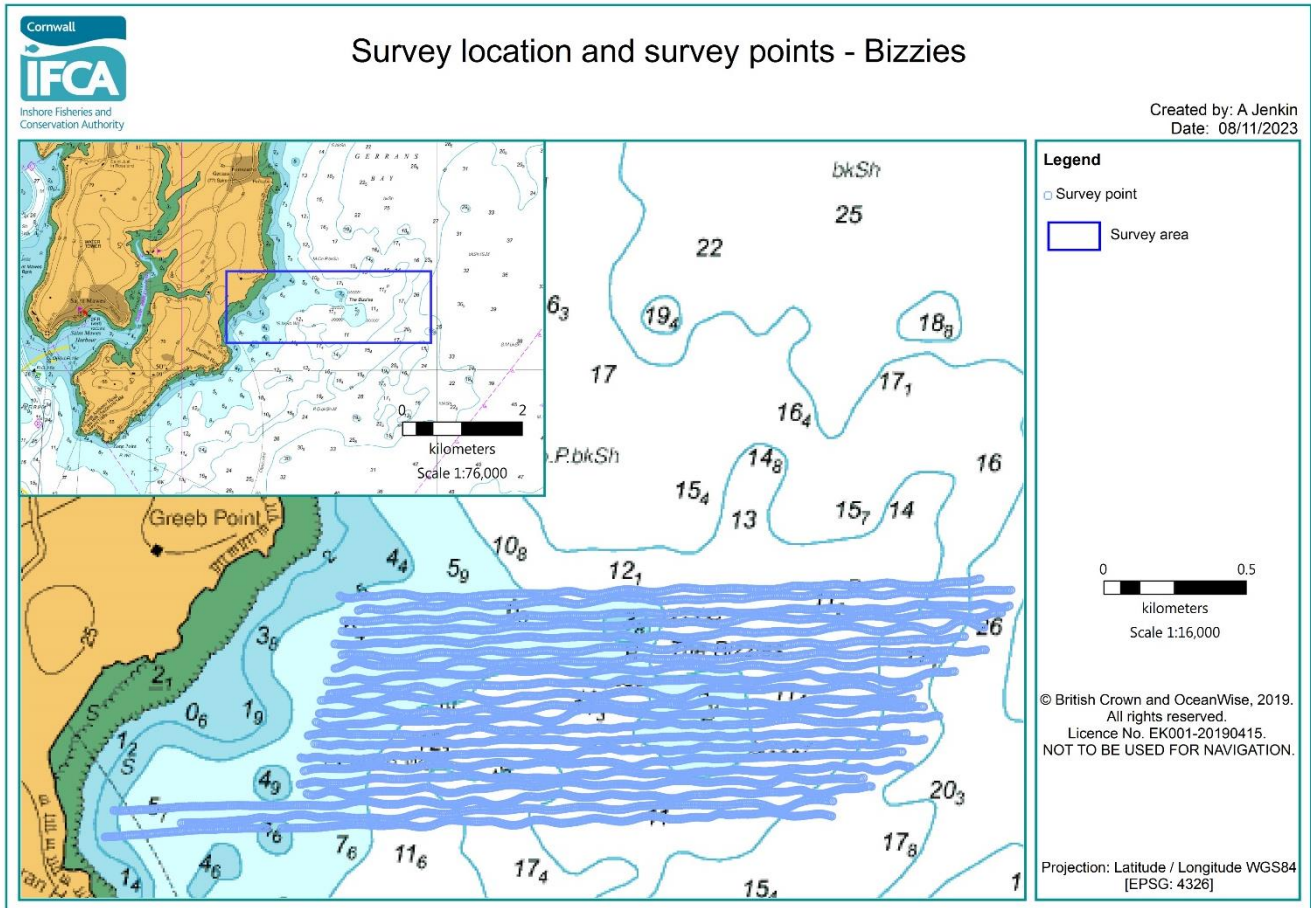


Figure 3: Survey location and survey points at Bizzies recorded by Cornwall IFCA 2022

Plots for points of plant height (m), percentage cover (%) of seagrass and the contour plot of plant height (m) are shown in Figure 4, Figure 5 and Figure 6.

The plant height (m) recorded at the Bizzies is shown in Figure 4.

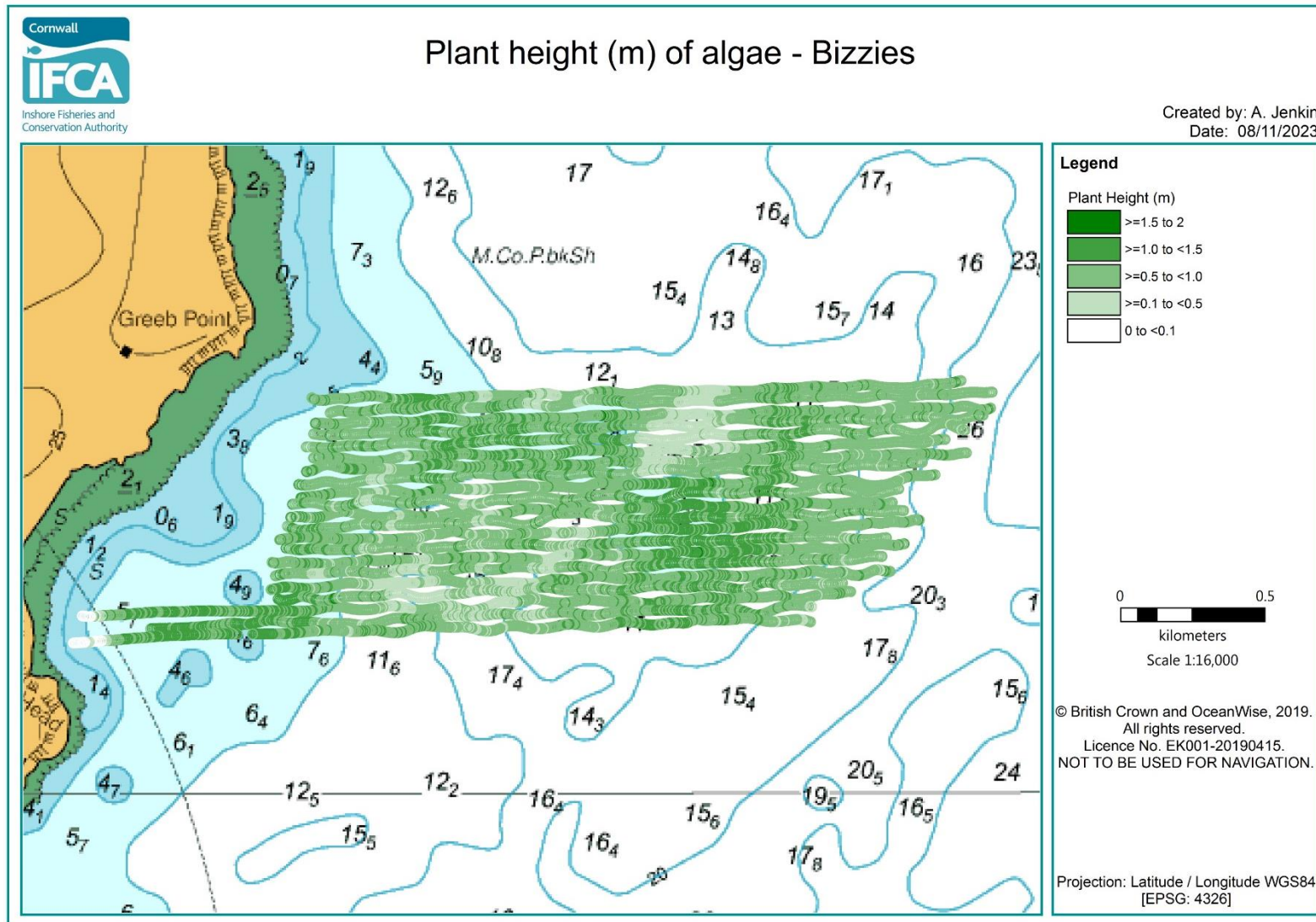


Figure 4: Plant height (m) completed at the Bizzies using an MX Echosounder by Cornwall IFCA 2022

A contour of plant height (m) is shown in Figure 5.

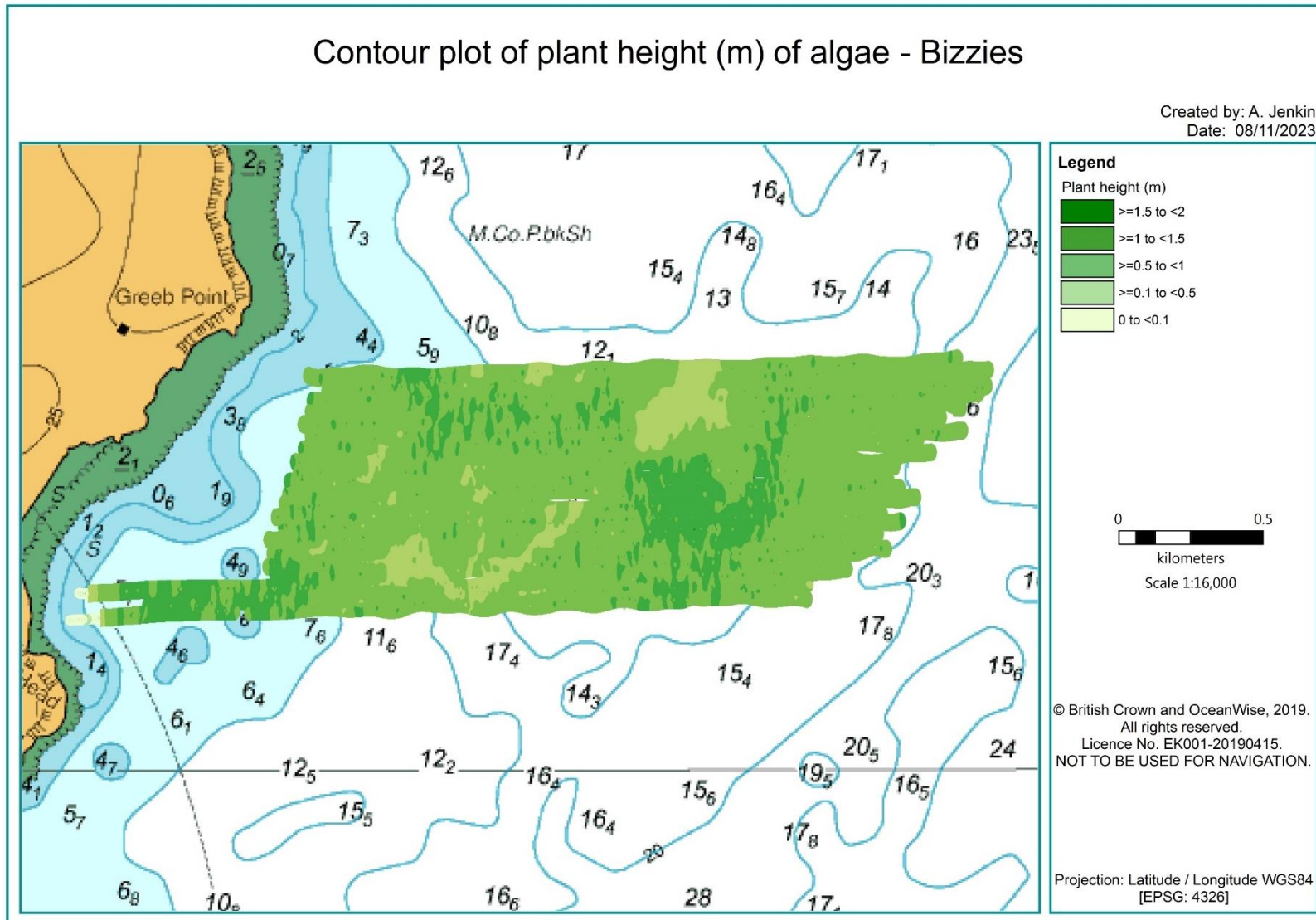


Figure 5: Contour plot displaying plant height (m) completed at Bizzies using an MX Echosounder by Cornwall IFCA 2022

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Plant coverage (%) across the survey area is shown in Figure 6.

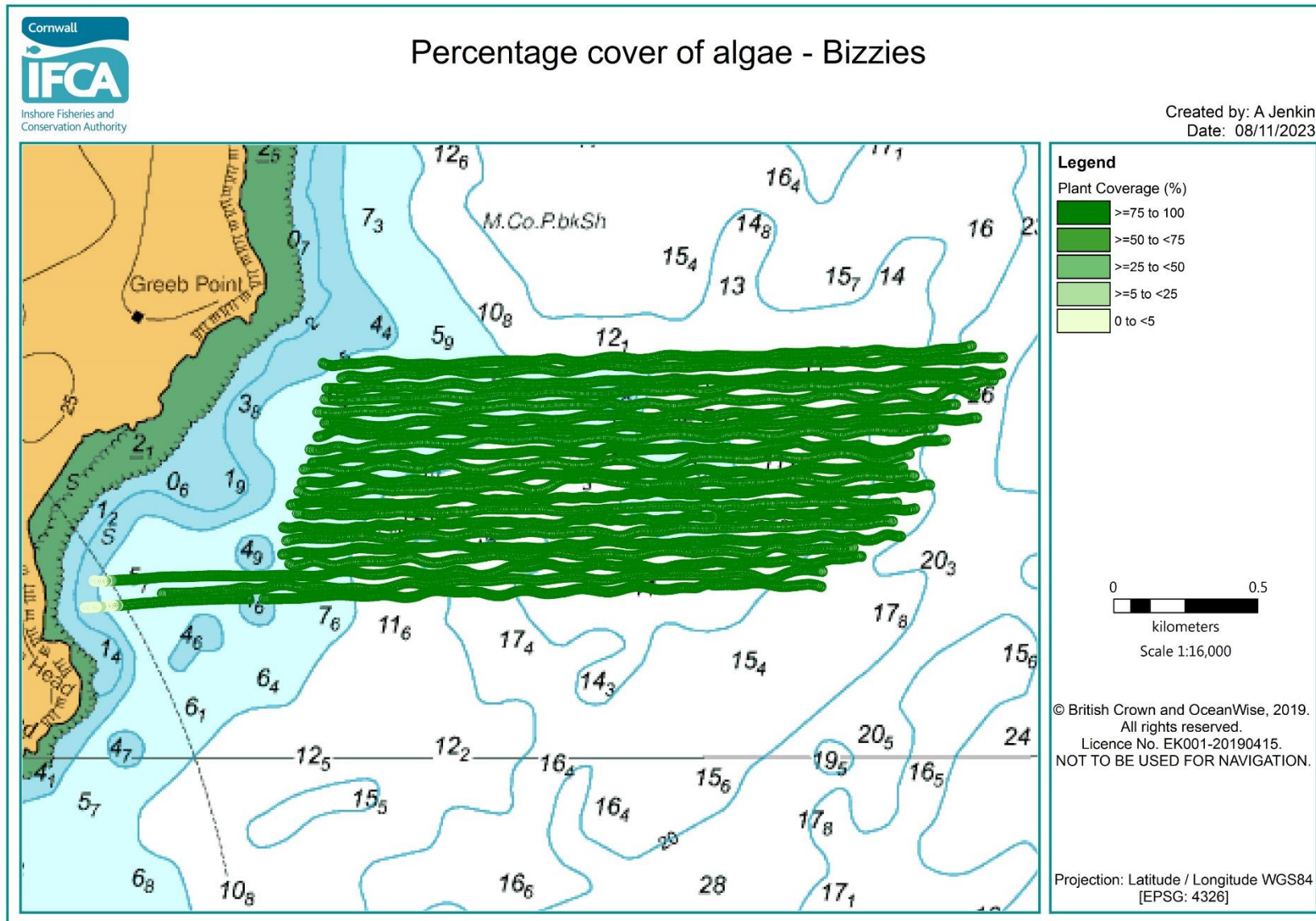


Figure 6: Plant coverage (%) completed at Bizzies using an MX Echosounder by Cornwall IFCA 2022

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The bathymetry (m) data (depth) for the site is shown in Figure 7.

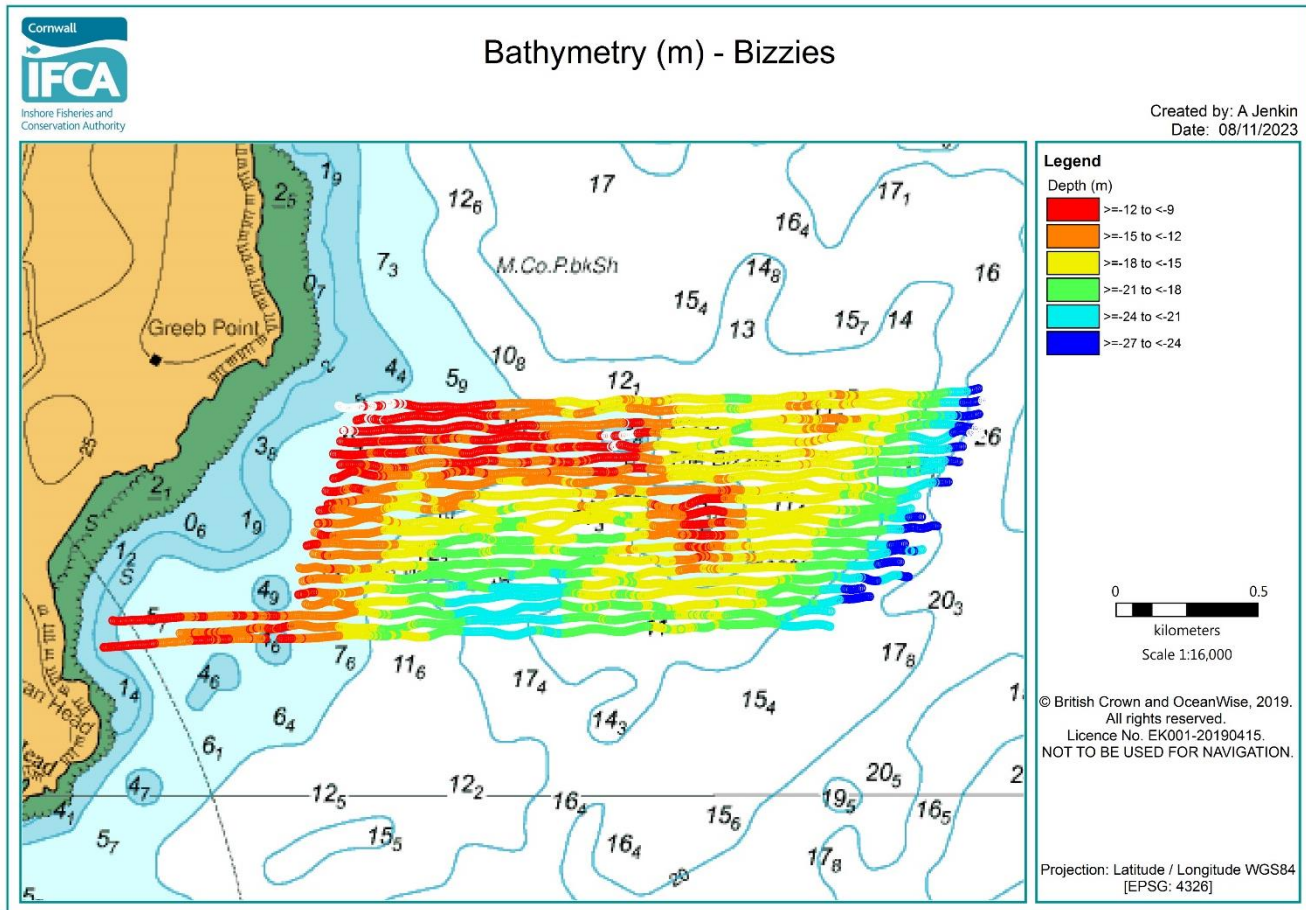


Figure 7: Bathymetry (m) recorded at Bizzies by Cornwall IFCA 2022

5.3 Habitat Verification

Visual imagery was collected during the survey to verify the acoustic signature. A summary of the visual imagery collected is shown in Table 3.

Table 3: A summary of the visual imagery used during the kelp survey by Cornwall IFCA.

Date	Equipment	Number of tows	Notes
25/07/2022	HD camera - AKASO EK7000	1	Verifying acoustic signature – Bizzies

The SOL and EOL positions were uploaded into MapInfo Professional Advanced (Version 17.0.4). The position of the HD camera tow positions are shown in Figure 8. An example of kelp recorded on the HD camera is shown in Figure 9. The HD camera was used for a quick visual reference and Cornwall IFCA officers are aware the footage is not of the best quality.

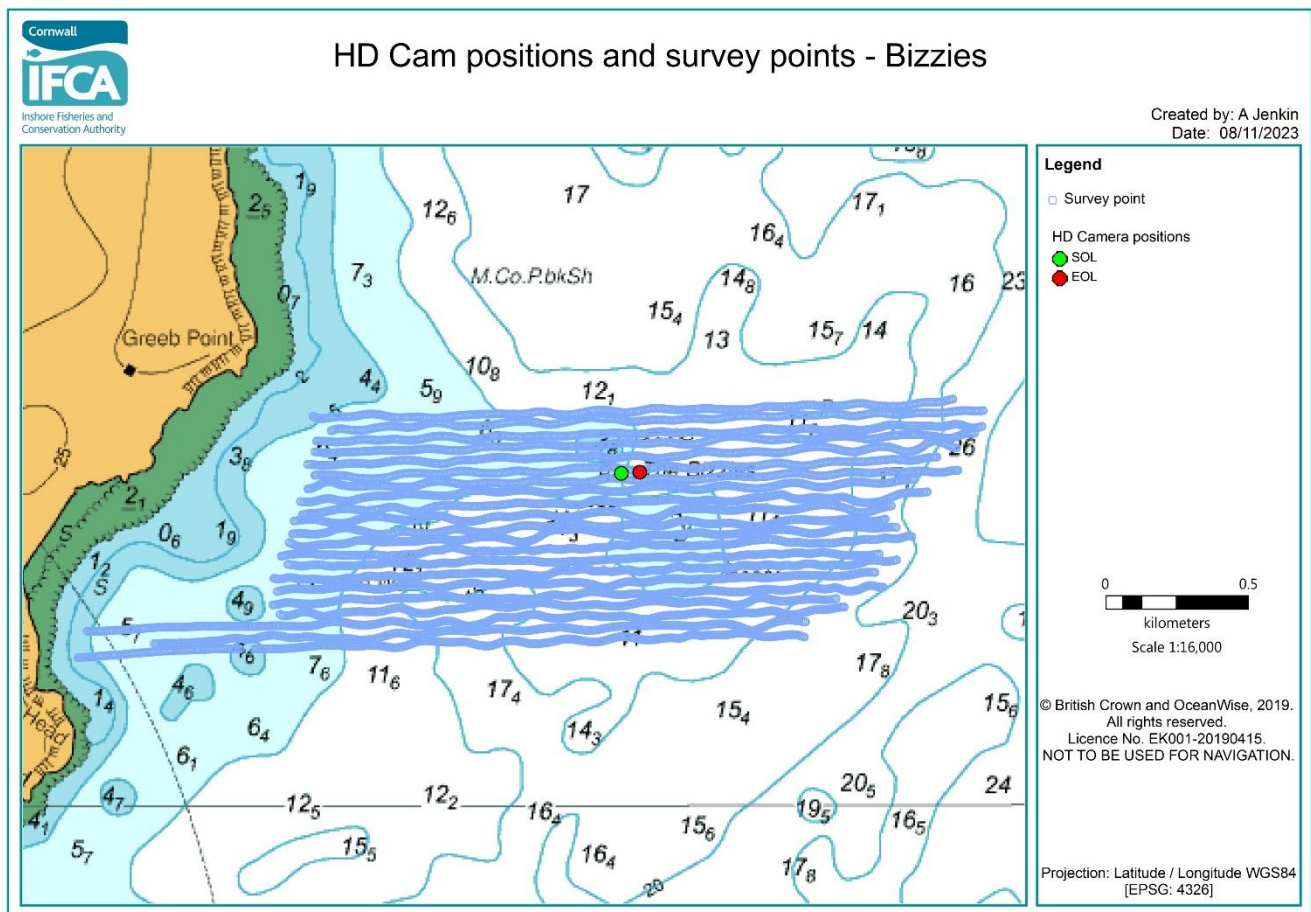


Figure 8: Position of the HD camera (HDCAM) tows within the Bizzies



Figure 9: Kelp recorded on the HD cam at the Bizzies by Cornwall IFCA.

6 Discussion

The 2022 survey of the kelp forest on the Bizzies provided updated information for the plant height (cm) and plant coverage (%) in the survey area with a quick, repeatable survey methodology. The site is comprised of rocky reef of varying depths with almost 100% plant coverage. It is not possible to identify which species of algae are present from the Biosonics signature alone, although kelp was recorded on the HD cam.

Species of kelp which have been recorded on the Bizzies, or nearby, include Golden kelp (*Laminaria ochroleuca*) (NBN Atlas, 2023; Seasearch, 2023), Forest kelp (*Laminaria hyperborea*) (NBN Atlas, 2023; Seasearch, 2023), Oar weed

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(*Laminaria digitata*) (NBN Atlas, 2023), Sugar kelp (*Saccharina latissimi*) (NBN Atlas, 2023; Seasearch, 2023) and Furbellows (*Saccorhiza polyschides*) (NBN Atlas, 2023; Seasearch, 2023). There are records of *L. digitata* in the intertidal zone near to the Bizzies on Seasearch, 2023.

The kelp species Sugar kelp (*S. latissimi*), Forest kelp (*L. hyperborea*) and Golden kelp (*L. ochroleuca*), have been recorded to depths of 30 m in clear coastal waters (Tyler-Walters, 2007; Smirthwaite, 2007; White and Marshall, 2007) and have all been recorded off the coast of Cornwall.

7 Limitations

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

- It is not possible to determine if kelp is present from the Biosonics signature alone, although the depth, substrate and location can give an indication.
- Isolated patches of other species of algae, were recorded on the HD cam but it is not possible to distinguish these patches using the Biosonics signature alone.
- The plant height (m) may not be the absolute canopy height as some areas were surveyed over two hours either side of low water.

8 Recommendations

Ideally the survey would run concurrently with a drop-down video survey with positions set out in a gridded system to verify the acoustic signature at frequent intervals. However, this would increase the time resource required to replicate these surveys at this data capture resolution.

9 References

NBN atlas, 2023. Species search <https://species.nbnatlas.org/> [Accessed 20/12/2023].

Seasearch, 2023. Seasearch – Data <https://www.seasearch.org.uk/data> [Accessed 20/12/2023].

Smirthwaite, J. 2007. *Laminaria ochroleuca* Golden kelp. In Tyler-Walters H. and Hiscock K. Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 02-11-2023]. Available from: <https://www.marlin.ac.uk/species/detail/1838>

Tyler-Walters, H., 2007. *Laminaria hyperborea* Tangle or cuvie. In Tyler-Walters H. Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 02-11-2023]. Available from: <https://www.marlin.ac.uk/species/detail/1309>

Visual Aquatic, 2021. Post-processing and data visualisation software for Biosonics echosounder systems.

Visual Acquisition MX, 2021. Real-time data acquisition and playback software for Biosonics MX Echosounder Systems.

White, N. & Marshall, C.E. 2007. *Saccharina latissima* Sugar kelp. In Tyler-Walters H. Marine Life Information Network: Biology and Sensitivity Key Information Reviews, [on-line]. Plymouth: Marine Biological Association of the United Kingdom. [cited 02-11-2023]. Available from: <https://www.marlin.ac.uk/species/detail/1375>

10 Appendices

Appendix 1. Vessel specification

10.1 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. She is a South Boats 11 m Island MkII catamaran with twin IVECO 450hp engines; her Callsign is MRWR7. The general layout of Tiger Lily VI is shown in Appendix 1. The vessel has been refitted for survey work and includes a purpose built survey station within the wheelhouse, fitted with an inverter and uninterruptable power supply (UPS) to provide stable, continuous 240 v power, NMEA outputs and a dedicated Global Positioning System (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 synced 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

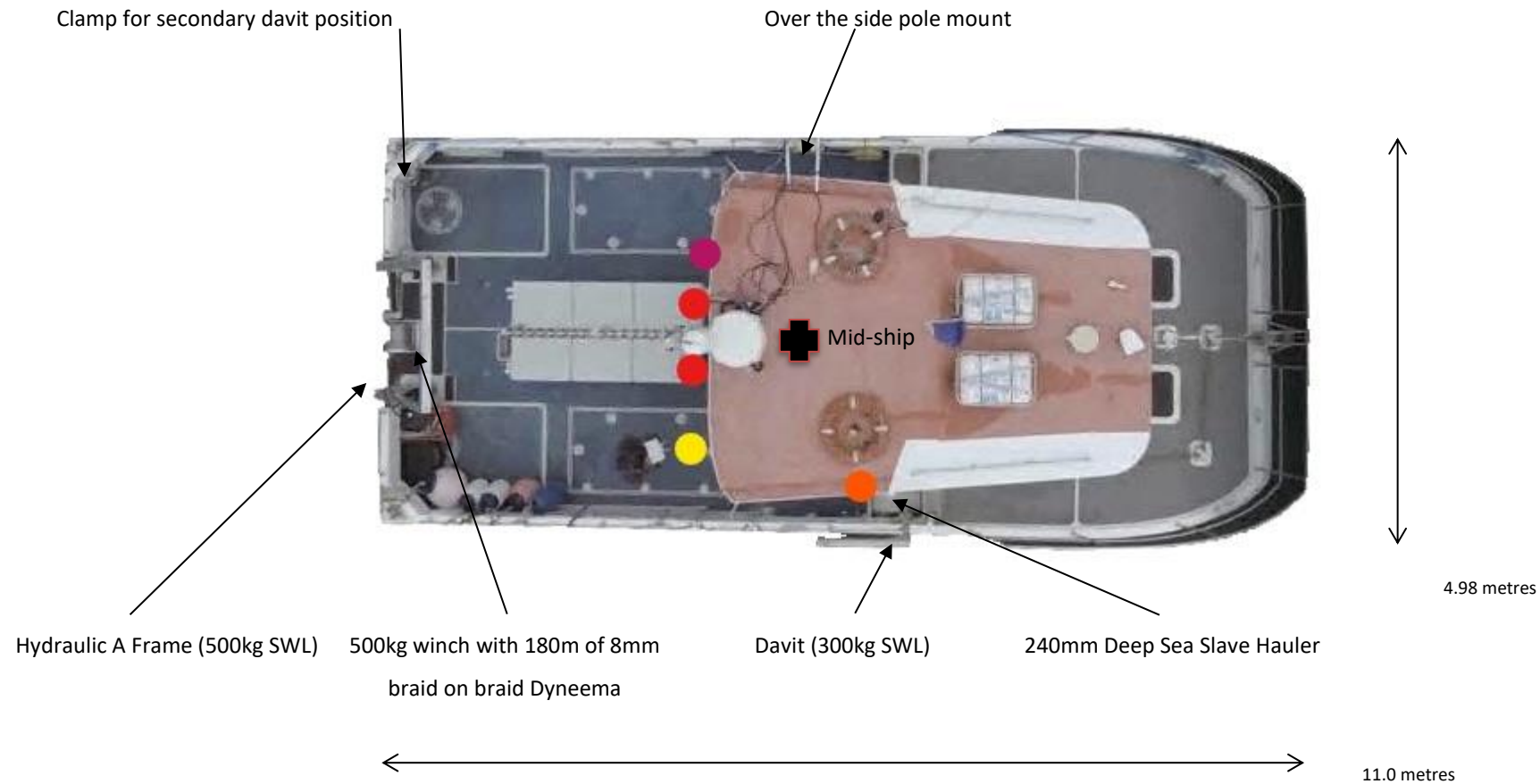
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	(All 240 AC power is accessed via APC Smart UPS C1500)
Stern Gantry	500kg SWL
Winch (on stern gantry)	Spencer Carter 0.5t with scrolling level wind
Slave hauler	Sea Winch 200m dia.
Electric line hauler	12v Spencer Carter Bandit
Positioning	Hemisphere 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

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Appendix 2. Equipment specification

10.2 Positioning Software and Offsets



Equipment			Offset (m)					
NMEA Device	Plan Symbol	Make/Model	Offset Name	X (from bow)	X (mid-ship)	Y (from bow)	Y (mid-ship)	Z (from WL)
Navigation depth sounder	●	Furuno Navnet	Furuno transducer	6.10m	-0.60m	0.40m	2.09m	- 0.50m
GPS	●	Furuno GP32 x 2	Furuno mushroom antenna	6.40m	-0.90m	2.30m/2.85m	0.19m/-0.36m	+ 4.25m
GPS	●	Furuno GP32	Furuno mushroom antenna	4.80m	0.70m	0.80m	1.69m	+ 2.90m
GNSS	●	Hemisphere V500	Main GPS	6.40m	-0.90m	3.20m	-0.71m	+ 3.85

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10.3 MX Aquatic Habitat Echosounder

Details of the system are shown in Annex Table A and are available online:

<https://www.biosonicsinc.com/wp-content/uploads/2020/09/BioSonics-MX-Spec-Sheet.pdf>

Annex Figure B shows the pole mount and MX Acoustic Echosounder on the port side of R/V Tiger Lily VI.

Annex Table A: Equipment specification of the BioSonics MX Aquatic Habitat Echosounder

Specification	Details
Manufacturer	BioSonics
Transducer	Single frequency 204.8kHz Beam angle 8.5 degree conical
Transmit Power	105 Watts RMS
Input power	12-18 VDC or 85-264 VAC
Draw	5 Watts, Fuses: 1 Amp AC 1.5 Amp DC
Transmit source level	213 dB re 1uPa
Pulse length	0.4ms, Ping rate 5Hz
Range resolution	1.7cm
Accuracy	1.7cm +/- 0.2% of depth
Depth range:	0-100m
Operating condition:	0-50 °C
DGPS positional accuracy:	<3m, 95% typical
DGPS velocity accuracy:	0.1 knot RMS
DGPS update rate:	1 sec

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Annex Figure B: Pole mount and MX Acoustic Echosounder onboard R/V Tiger Lily VI

10.4 Valeport Swift Sound Velocity Profiler

Details of the system are shown in Annex Table B and are available online:

<https://www.valeport.co.uk/content/uploads/2021/05/Valeport-SWiFT-CTD-Datasheet.pdf>

Annex Table B: Equipment specification of the Valeport Swift Sound Velocity Profiler

Specification	Details
Manufacturer	Valeport
Conductivity	
Range	0-80 mS/cm
Resolution	0.001 m/s
Accuracy	±0.01 m/s
Temperature	
Range	-5°C – +35°C
Resolution	0.001°C
Accuracy	±0.01°C
Pressure	
Range	50 Bar
Resolution	0.001% FS
Accuracy	±0.01% FS

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Annex Figure C: Valeport Swift Sound Velocity Profiler deployed from R/V Tiger Lily VI

10.5 Sport Action Camera – AKASO EK7000

Details of the system are shown in

<https://www.akasotech.com/ek7000>

Annex Table C and are available online:

<https://www.akasotech.com/ek7000>

Annex Table C: Equipment specification of the AKASO EK7000 HD Camera

Specification	Details
Manufacturer	Akasotech
Details	4k video recording 25 frames per second 30 m waterproof 170° wide angle lens Loop recording Remote control