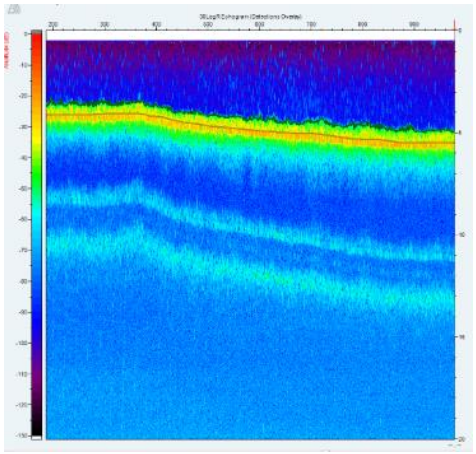
Acoustic Survey of the seagrass beds within the Fal and Helford Special Area of Conservation 2021



Survey field report for the 2021 Acoustic Survey of the seagrass beds within the Fal and Helford Special Area of Conservation

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

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A Jenkin	30/07/2021	First draft	0.1
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A Jenkin	03/09/2021	QA comment amendments	Final

Summary

This report summarises the operations and data acquired during the 2021 acoustic survey of the seagrass beds within the Fal and Helford Special Area of Conservation (SAC). The survey was carried out over eight days, between the 18th May 2021 and the 16th August 2021.

The aim of the survey was to map the extent and coverage of the seagrass beds within the Fal and Helford SAC using a Biosonics MX Scientific Echosounder. In total 407 MX tows were completed of which 403 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

ROV – Remotely Operated Vehicle

SAC – Special Area of Conservation

SOL – Start of Line

1 Background and Introduction

Cornwall Inshore Fisheries and Conservation Authority (Cornwall IFCA) were contracted by the University of Exeter to map the extent of the seagrass within the Fal and Helford Special Area of Conservation (SAC). The contract includes joint intellectual property (IP) of all data collected.

In 2020, Cornwall Council declared a climate emergency and set new targets to achieve carbon net zero by 2030. To achieve carbon neutrality, a climate change action plan was produced. The project was commissioned to consider how specialist evidence and development of nature recovery plans can be used in the marine environment to help deliver Cornwall Councils carbon neutral and environmental growth goals. The seagrass was mapped "to gather specialist evidence for restoration plans and blue carbon accounts to guide the delivery of practical measures to maximise marine nature recovery and carbon drawdown by eelgrass in the Fal and Helford estuaries" (Cornwall Council, 2021).

1.1 Aims & Objectives

1.1.1 Aims

- Map the extent of the seagrass within the Fal and Helford SAC.

1.1.2 Objectives

- Collate database of all known extents of seagrass within the Fal and Helford SAC.
- Complete acoustic survey using MX Aquatic Habitat Echosounder in areas of known seagrass.
- Verify the acoustic signal in areas where it is difficult to determine if seagrass is 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 Survey Operations

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

All survey days consisted of one Scientific Officer and an independent skipper onboard and two scientific officers working remotely from home due to Coronavirus (COVID-19).

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. Hard hats were worn during deployment and recovery of the pole. There were no reported accidents or near misses throughout the survey.

3 Survey Methodology

Historic survey data of seagrass within the Fal and Helford SAC were download using the latest marine data release provided by Natural England and EMODnet and a 40 m buffer was created around each bed. These positions were uploaded onto HYPACK MAX Version 2019 software. For each polygon, survey lines were created depending on the aspect of each individual bed so that the survey lines ran perpendicular where possible to the coastline following the Environment Agency methodology of subtidal seagrass monitoring for the Water Framework Directive (WFD) (Environment Agency, 2019). Each survey line ran further than the known extent of each bed to capture any changes to the bed extent since they were last surveyed. The survey lines were set up with 20 m line spacing.

Acoustic data was acquired using a MX Aquatic Habitat Echosounder (Appendix 2). The echosounder lets you simultaneously acquire submerged aquatic vegetation (including seagrass), 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 nine survey areas to map the extent of the beds.

Remote access software was used on all laptops to enable the home based Scientific officers to independently operate the MX Echosounder 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.

On arrival at each bed, 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 each 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. 20210701_125251.

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.

In areas where it was hard to decipher if patchy seagrass was present, a sport action HD camera or Remotely Operated Vehicle (ROV) were deployed to verify the acoustic signature. A target was created in HYPACK to indicate SOL and EOL and the footage was reviewed once the camera was recovered to the deck.

4 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.

5 Cruise Narrative

All times are Universal Time Coordinated (UTC).

18th May 2021

R/V Tiger Lily VI departed Mylor at 08:10 on the 18/05/2021 with one Scientific Officer and an independent skipper on board. Two scientific officers worked remotely. The vessel arrived on site at Porthallow at 08:45. A CTD drop was carried out at 09:18 and a repeat was done at 09:31 to double check the values recorded. A total of 23 MX tows were completed at Porthallow and five HD camera drops to verify the acoustic signature, the camera turned off for one of the drops and no file was recorded.

The vessel transited to Maenporth and arrived on site at 12:45. A CTD drop was done at 12:59. A total of 33 MX tows were completed. One HD camera drop was done to verify the seagrass in the south of the bed. R/V Tiger Lily VI arrived alongside Mylor at 16:25.

19th May 2021

R/V Tiger Lily VI departed Mylor at 06:47 on the 19/05/2021 with one Scientific Officer and an independent skipper on board. Two scientific officers worked remotely. The vessel arrived on site at Maenporth at 07:11. A CTD drop was carried out at 07:30. A total of 53 MX tows were completed at Maenporth and four HD camera drops to verify the acoustic signature, the camera turned off for during one of the drops so only a very short file was recorded and one of the deployments was to look at a ridge where the seabed drops off to the east of the site.

The vessel transited to Swanpool and arrived on site at 13:46. A CTD drop was done at 13:56. A total of 20 MX tows were completed. R/V Tiger Lily VI arrived alongside Mylor at 15:46.

10th June 2021

R/V Tiger Lily VI departed Mylor at 09:25 on the 10/06/2021 with one Scientific Officer and an independent skipper on board. Two scientific officers worked remotely. The vessel arrived on site at Porthallow at 10:15. A CTD drop was carried out at 10:21. A total of seven MX tows were completed at Porthallow and two HD camera which showed no seagrass and the extent of the bed had been located.

The vessel transited to Durgan (north Helford) and arrived on site at 12:10. A CTD drop was done at 12:40. A total of 29 MX tows were completed. R/V Tiger Lily VI arrived alongside Mylor at 17:20.

30th June 2021

R/V Tiger Lily VI departed Mylor at 06:40 on the 30/06/2021 with one Scientific Officer and an independent skipper on board. One scientific officer worked remotely. The vessel arrived on site in the Helford River at 07:05. A CTD drop was carried out at 08:14. A total of11 MX tows were completed at Durgan (north side) of the Helford, 20 at Padagagarrack (south side) and 11 at Bosahan (south side). Two HD camera tows were done to verify the acoustic signal at the edge of one bed.

The vessel transited to Gyllyngvase and arrived on site at 13:59. A CTD drop was done at 14:00. One MX tow was completed then the survey was aborted at this site due to the number of water users over the seagrass. The vessel transited to St.Mawes and a CTD drop was carried out at 14:36, a repeat was done at 14:38 as the first one failed. A total of 29 MX tows were completed. Two HD camera tows were done in St.Mawes to verify the extent of the seagrass bed.

R/V Tiger Lily VI arrived alongside Mylor at 17:05.

1st July 2021

R/V Tiger Lily VI departed Mylor at 06:15 on the 01/07/2021 with one Scientific Officer and an independent skipper on board. The vessel arrived on site at Gyllyngvase at 06:40. A CTD drop was carried out at 06:48. A total of 11 MX tows were completed at Gyllyngvase. The vessel transited to Flushing and arrived on site at 07:55. A total of 11 MX tows were completed. The vessel transited to Penarrow and arrived on site at 09:02. A CTD drop was carried out at 09:09. A total of 35 MX tows were completed. The vessel then transited to the last site of the day at St.Mawes Bank and arrived on site at 12:45. A total of nine MX tows were completed. R/V Tiger Lily VI arrived alongside Mylor at 14:20.

8th July 2021

R/V Tiger Lily VI departed Mylor at 10:02 on the 08/07/2021 with one Scientific Officer and an independent skipper on board. Two scientific officers worked remotely. The vessel refuelled at Mylor harbour at 10:08 and arrived on site at St.Mawes harbour at 10:44. A CTD drop was carried out at 10:59. A total of 58 MX tows were completed at St.Mawes Harbour.

The vessel transited to St.Mawes Bank and arrived on site at 15:30. A total of five MX tows were completed. The vessel transited to Penarrow and arrived on site at 16:20. A total of four MX tows were completed. R/V Tiger Lily VI arrived alongside Mylor at 16:54.

9th July 2021

R/V Tiger Lily VI departed Mylor at 08:10 on the 09/07/2021 with one Scientific Officer and an independent skipper on board. One scientific officer worked remotely. The survey plan was to use the ROV to verify the acoustic signature at some of the sites. The HD camera was attached to the ROV but was operating intermittingly and removed after a few tows. The vessel arrived on site at Porthallow at 08:35. A total of three ROV tows were completed at Porthallow, four at Durgan (Helford north side), one south side of the Helford, four at Maenporth, three at St.Mawes Bank and four at Penarrow.

R/V Tiger Lily VI arrived alongside Mylor at 14:20.

16th August 2021

R/V Tiger Lily VI departed Mylor at 08:15 on the 16/08/2021 with one Scientific Officer and an independent skipper on board. Two scientific officers worked remotely. A CTD drop was carried out at 09:41. A total of 12 MX tows were completed at Helford Passage and eight on the south side of the Helford River.

The vessel transited to St.Mawes and a total of six MX tows were completed.

R/V Tiger Lily VI arrived alongside Mylor at 14:45.

6 Acoustic Data acquisition

Acoustic imagery was acquired at nine seagrass beds within the Fal and Helford SAC. A summary of the data collected can be found in Table 1. A total of 407 lines were completed and a total of 403 lines were included in the data analysis.

Table 1: MX line metadata for the 2021 survey of the seagrass within the Fal and Helford Special Area of Conservation

Seagrass bed	Number of lines	Number of lines included in data analysis	Reason why discounted
Penarrow Point	48	48	
Flushing	11	10	1 tow too short
St.Mawes Bank	14	14	
St.Mawes	93	91	1 tow too short 1 tow too many pings as vessel moving slowly
Gyllyngvase	14	14	
Swanpool	20	20	
Maenporth	86	86	
Helford	91	90	1 tow had too many turns in it
Porthallow	30	30	

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

The MX lines completed are shown for each bed from Figure 1 to Figure 9. 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.

6.1 Penarrow Point

Figure 1: Acoustic survey lines completed at Penarrow Point using an MX Echosounder by Cornwall IFCA 2021

6.2 Flushing

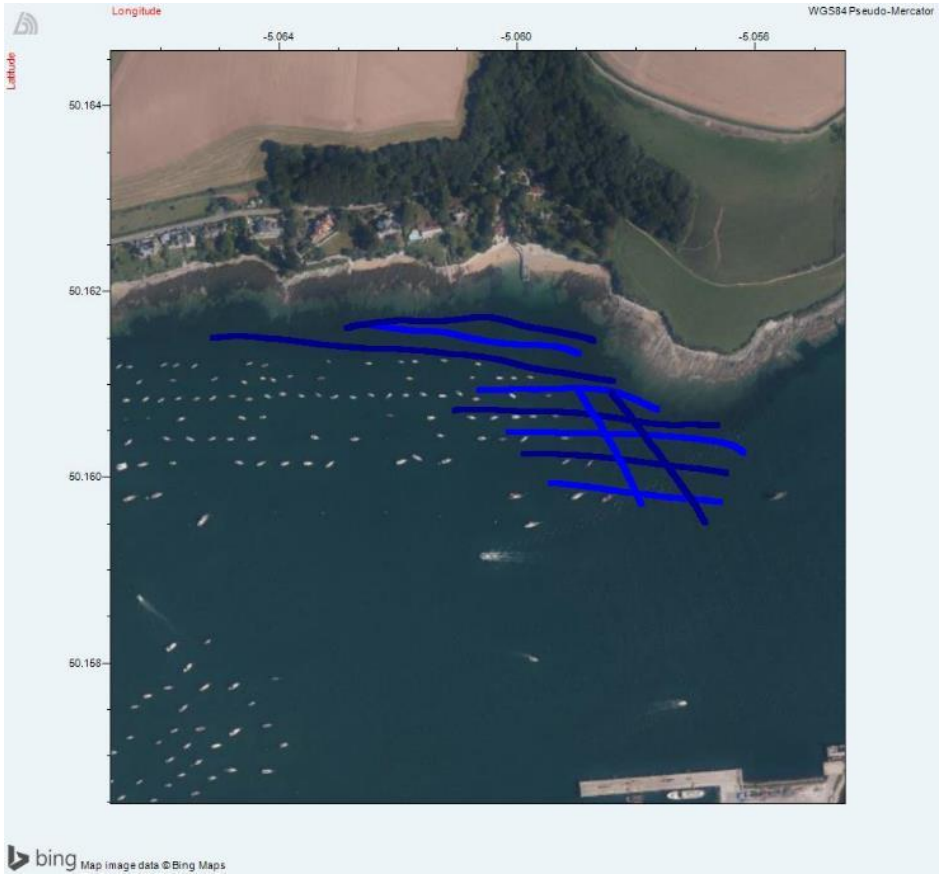

Figure 2: Acoustic survey lines completed at Flushing using an MX Echosounder by Cornwall IFCA 2021

6.3 St.Mawes Bank

Figure 3: Acoustic survey lines completed at St.Mawes Bank using an MX Echosounder by Cornwall IFCA 2021

6.4 St.Mawes

Figure 4: Acoustic survey lines completed at St.Mawes using an MX Echosounder by Cornwall IFCA 2021

6.5 Gyllyngvase

Figure 5: Acoustic survey lines completed at Gyllngnvase using an MX Echosounder by Cornwall IFCA 2021

6.6 Swanpool

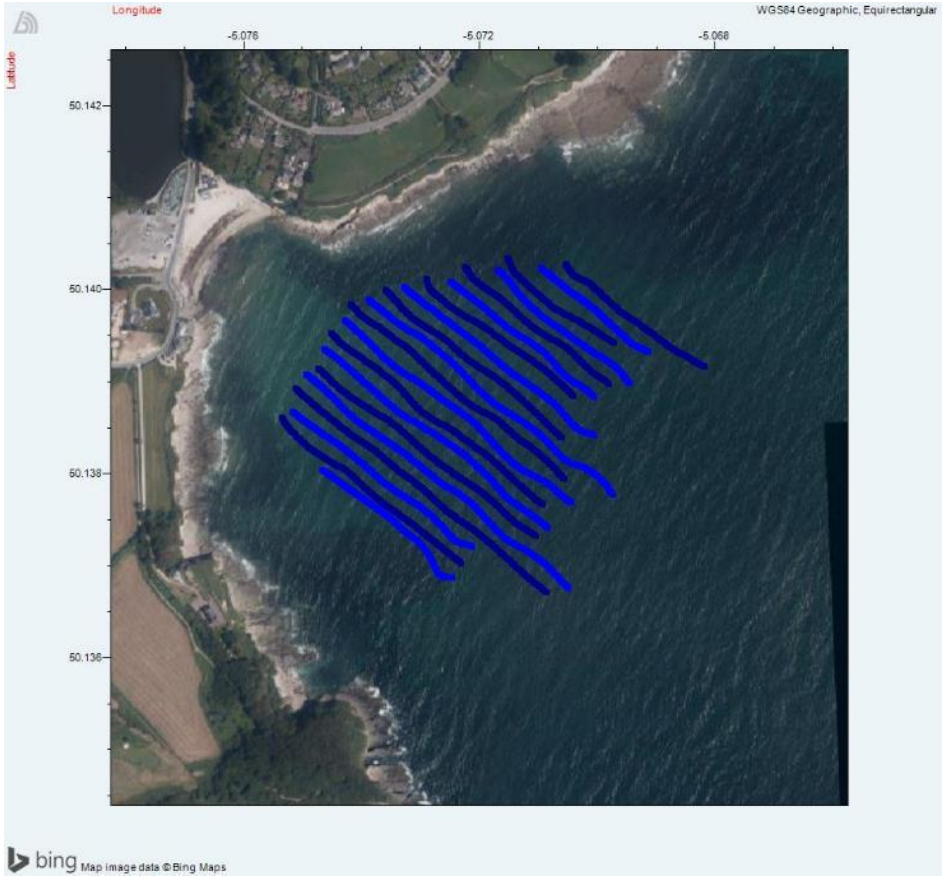

Figure 6: Acoustic survey lines completed at Swanpool using an MX Echosounder by Cornwall IFCA 2021

6.7 Maenporth

Figure 7: Acoustic survey lines completed at Maenporth using an MX Echosounder by Cornwall IFCA 2021

6.8 Helford

Figure 8: Acoustic survey lines completed in the Helford River using an MX Echosounder by Cornwall IFCA 2021

6.9 Porthallow

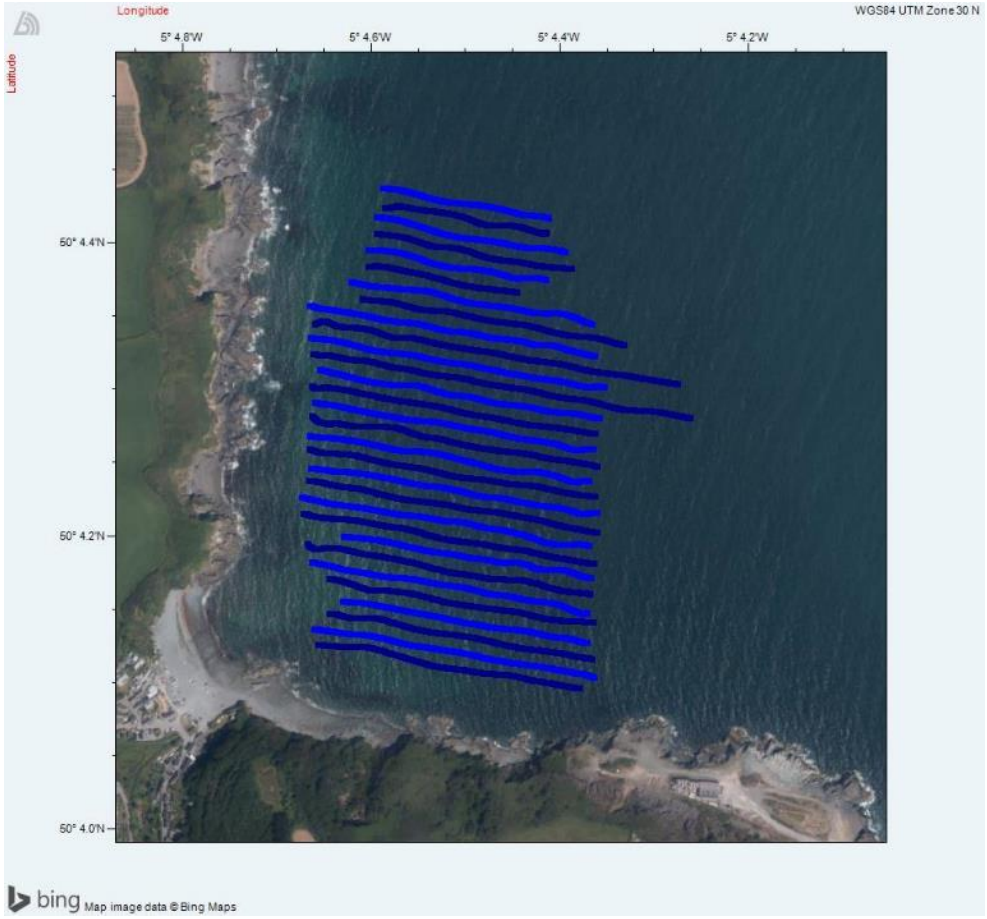

Figure 9: Acoustic survey lines completed at Porthallow using an MX Echosounder by Cornwall IFCA 2021

7 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 2.

Table 2: A summary of the visual imagery used during the seagrass survey by Cornwall IFCA.

Date	Equipment	Number of tows	Notes
18/05/2021	HD camera - AKASO EK7000	5	Verifying acoustic signature – Porthallow. One file didn't record.
19/05/2021	HD camera - AKASO EK7000	4	Verifying acoustic signature – Maneporth
10/06/2021	HD camera - AKASO EK7000	2	Verifying acoustic signature – Porthallow
30/06/2021	HD camera - AKASO EK7000	4	Verifying acoustic signature – Helford, St.Mawes
09/07/2021	ROV	19	Verifying acoustic signature – Porthallow, Helford, Maenporth, St.Mawes Bank, Penarrow
16/08/2021	HD camera - AKASO EK7000	7	Verifying acoustic signature – Helford, St.Mawes

The SOL and EOL positions were uploaded into MapInfo Professional Advanced (Version 17.0.4). The position of the HD camera and ROV tow positions are shown in Figure 10 and Figure 11. The habitat verification and HYPACK GPS track positions in the Helford River are shown in Figure 12.

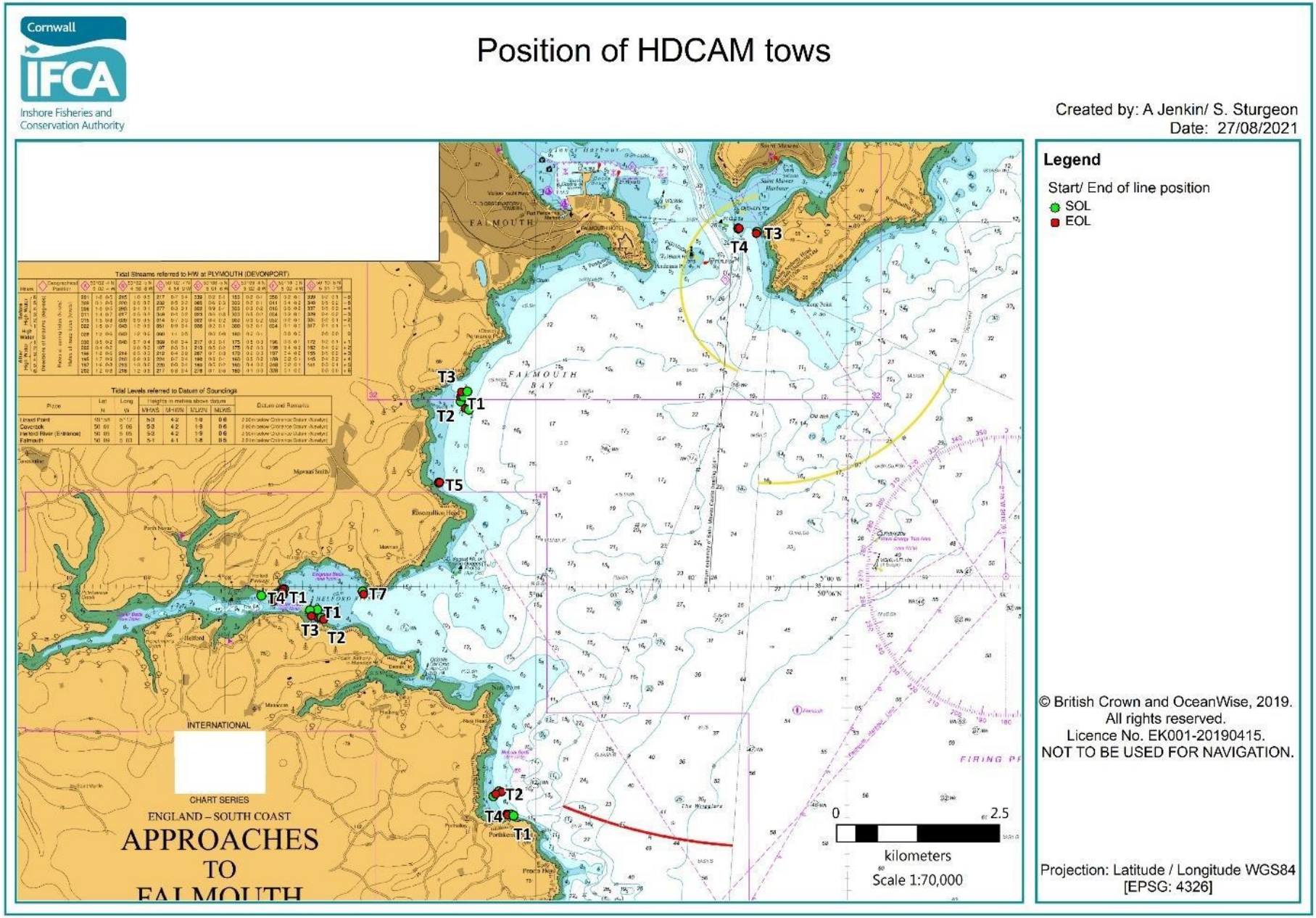

Figure 10: Position of the HD camera (HDCAM) tows within the Fal and Helford Special Area of Conservation

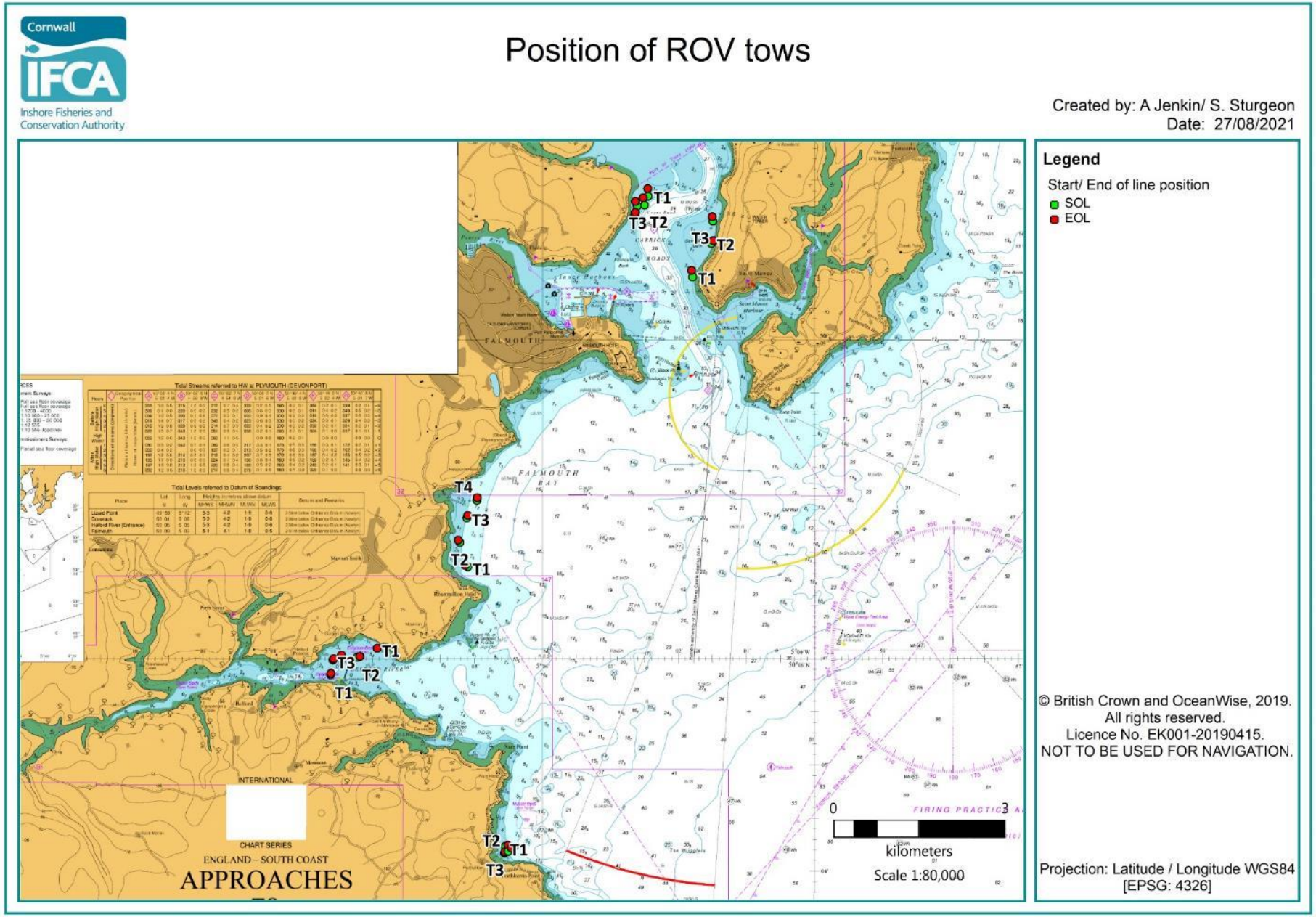

Figure 11: Position of the Remotely Operated Vehicle (ROV) tows within the Fal and Helford Special Area of Conservation

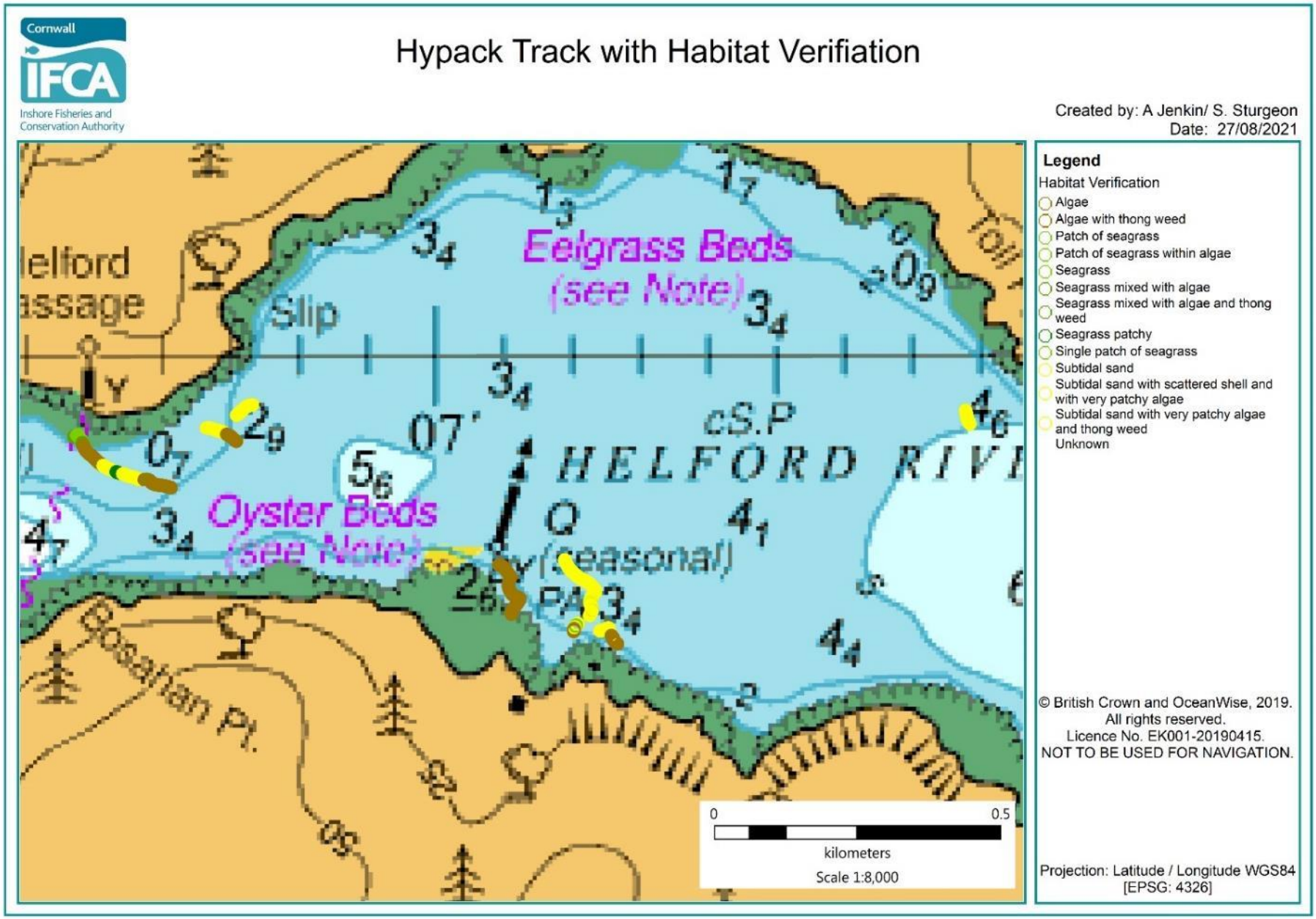

Figure 12: HYPACK GPS Track and Habitat Verification from the HD camera tows in the Helford River

8 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 3).

Table 3: Threshold settings for Visual Aquatic and the plant length detection criteria (cm) for each seagrass bed surveyed by Cornwall IFCA

Seagrass bed	Rising edge threshold Db (bottom line)	Plant detection threshold dB (plant line)	Plant detection length criterion (cm)
Penarrow Point	-30	-60	10
Flushing	-30	-60	10
St.Mawes Bank	-30	-60	10
St.Mawes	-30	-60	10
Gyllyngvase	-40	-60	10
Swanpool	-40	-60	10
Maenporth	-40	-60	10
Helford	-30	-60	10
Porthallow	-30	-60	10

An example of the bottom line (orange) and plant line (green) in areas of varying seagrass collected within the Helford River can be seen in Figure 13.

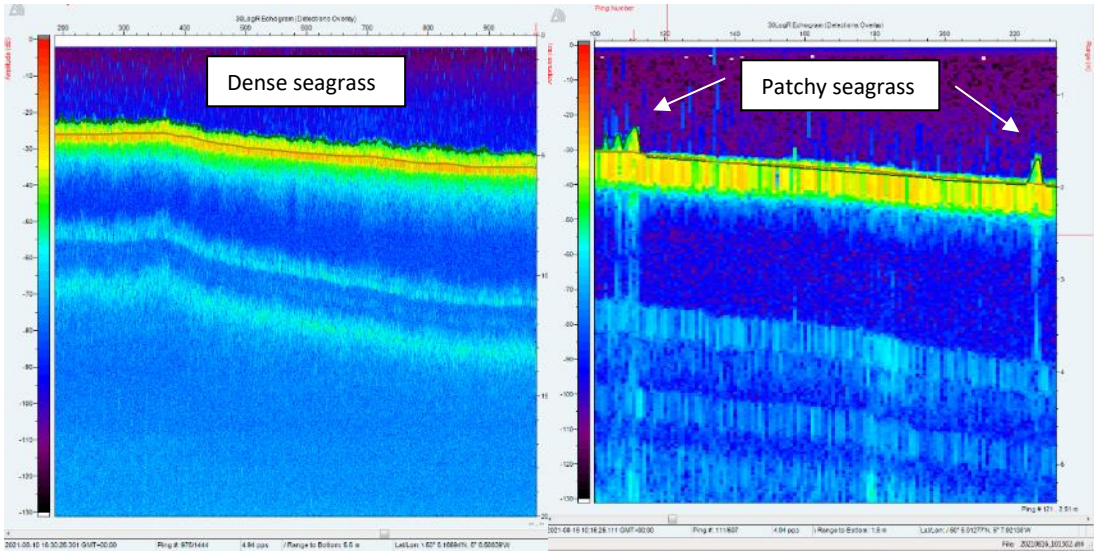

Figure 13: Bottom line (orange) and Plant line (green) in Visual Aquatic by Biosonics software in a dense seagrass bed and patchy seagrass in the Helford River

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 when anything other than seagrass present such as algae (kelp beds on rock, areas of long seaweed such as *Sargassum muticum* and areas of low lying weed such as algal turf. An example of algae can be seen in Figure 14), if there was noise in the water column when the vessel was turning, or if fish were in the water column.

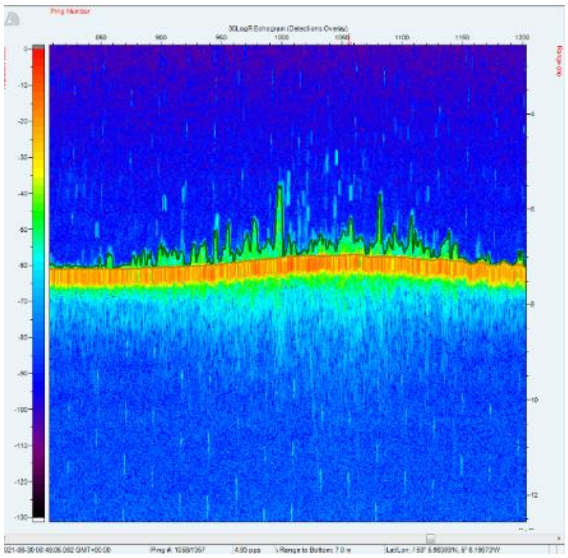

Figure 14: Plant line (green) in Visual Aquatic by Biosonics software in an area of algae in the Helford River verified using imagery

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 polygon was drawn around each survey area clipped to the point at the start and end of each tow. 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, clipped to polygon for each survey area, cell size: user suggested and interpolated along edges. Advanced colour was used to define the colour scales.

Plots for points of plant height (m), percentage cover (%) of seagrass, contour plot of plant height (m) and the contour plot of percentage cover of seagrass (%) are shown in Figure 15 to Figure 50.

8.1 Penarrow Point

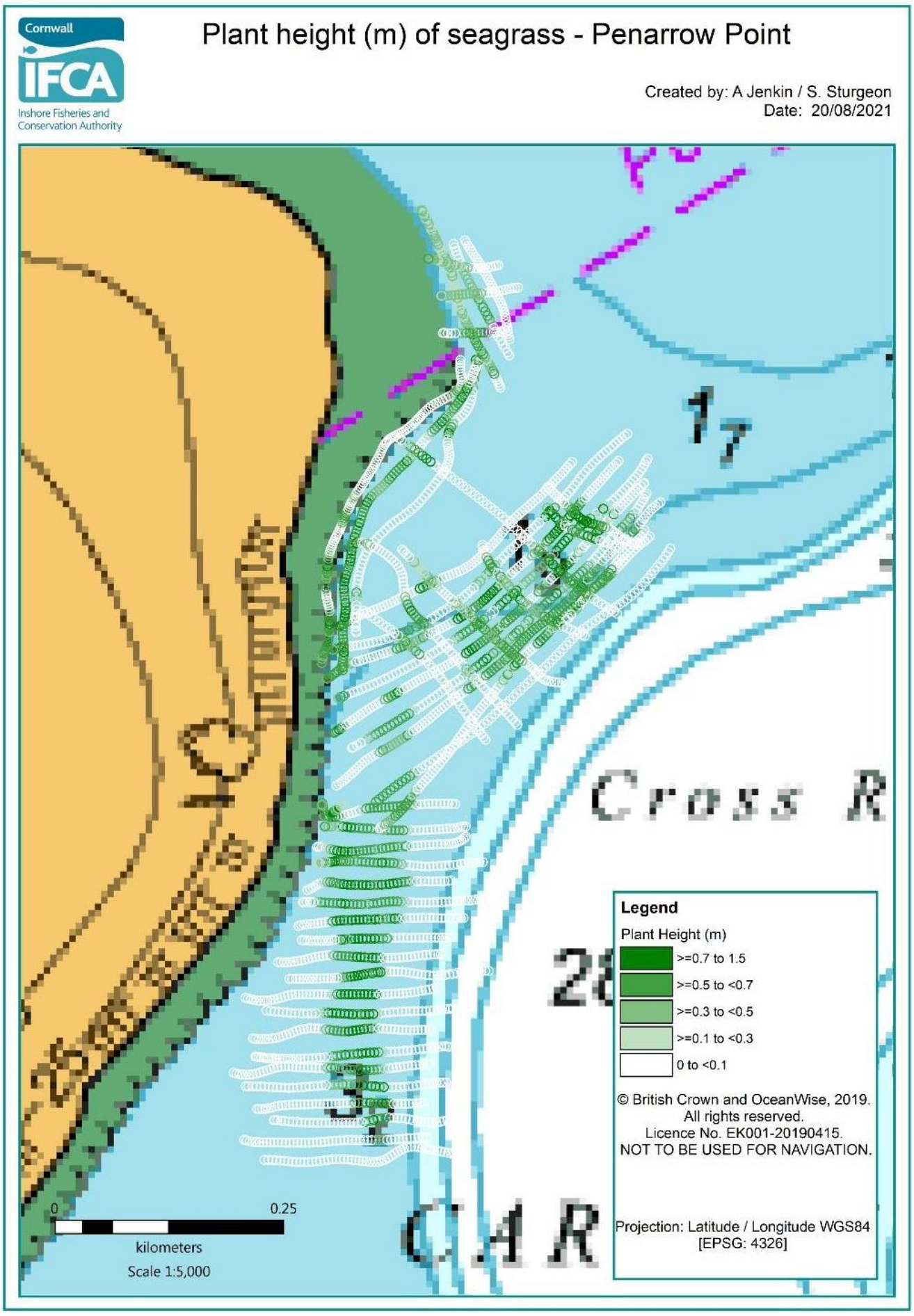

Figure 15: Plant height (m) of seagrass (*Zostera marina*) completed at Penarrow Point using an MX Echosounder by Cornwall IFCA 2021

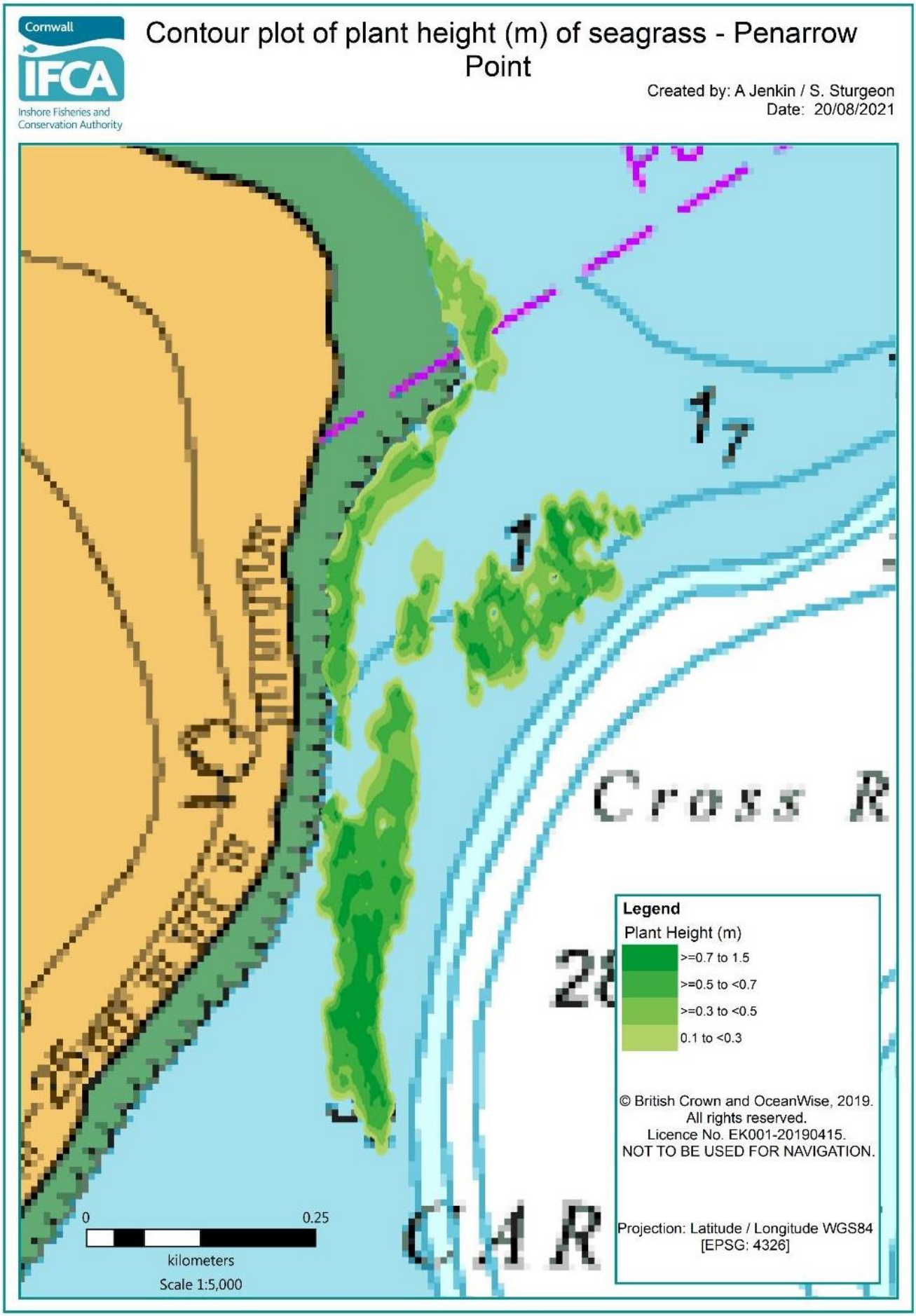

Figure 16: Contour plot displaying plant height (m) of seagrass (*Zostera marina*) completed at Penarrow Point using an MX Echosounder by Cornwall IFCA 2021

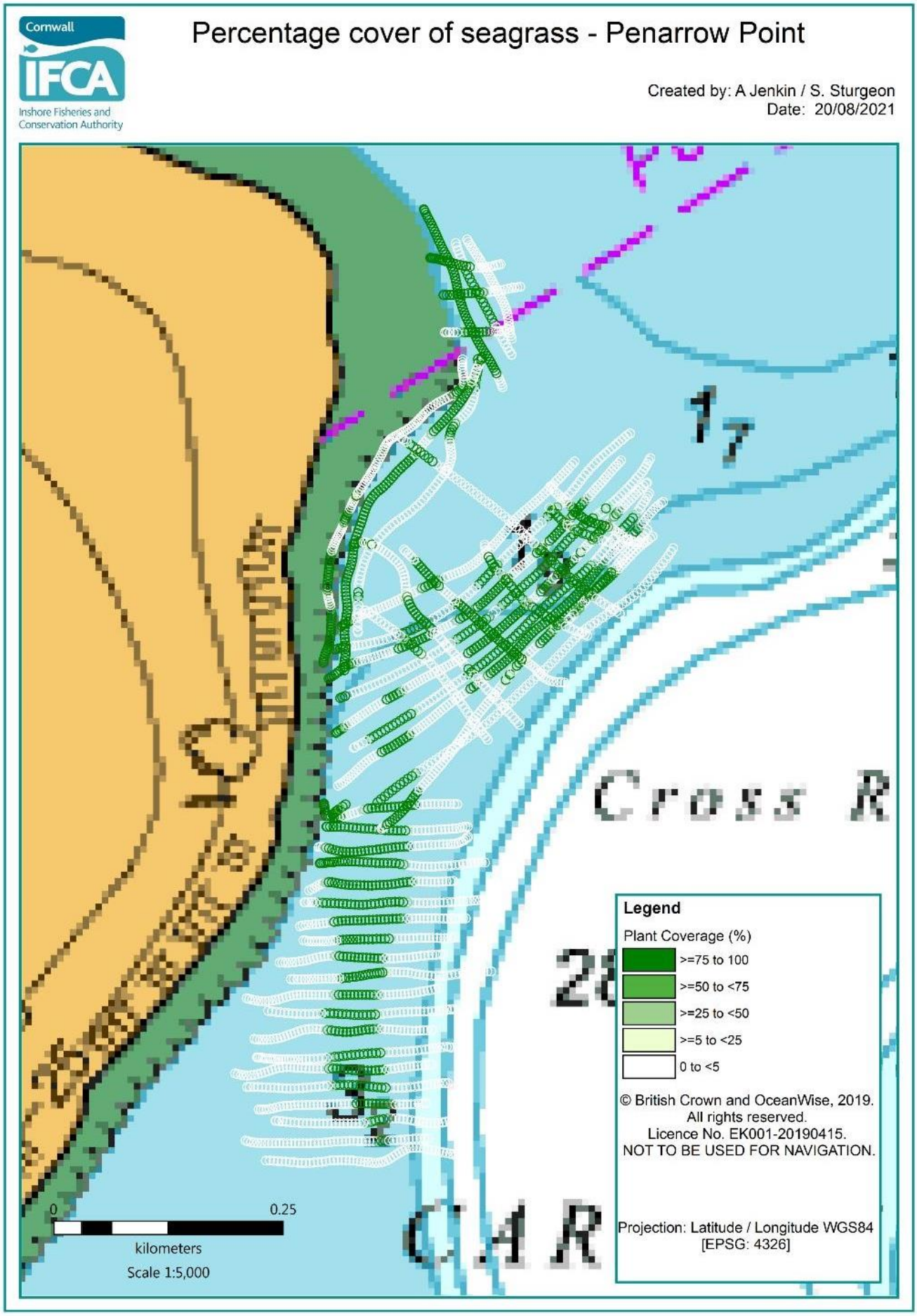

Figure 17: Plant coverage (%) of seagrass (*Zostera marina*) completed at Penarrow Point using an MX Echosounder by Cornwall IFCA 2021

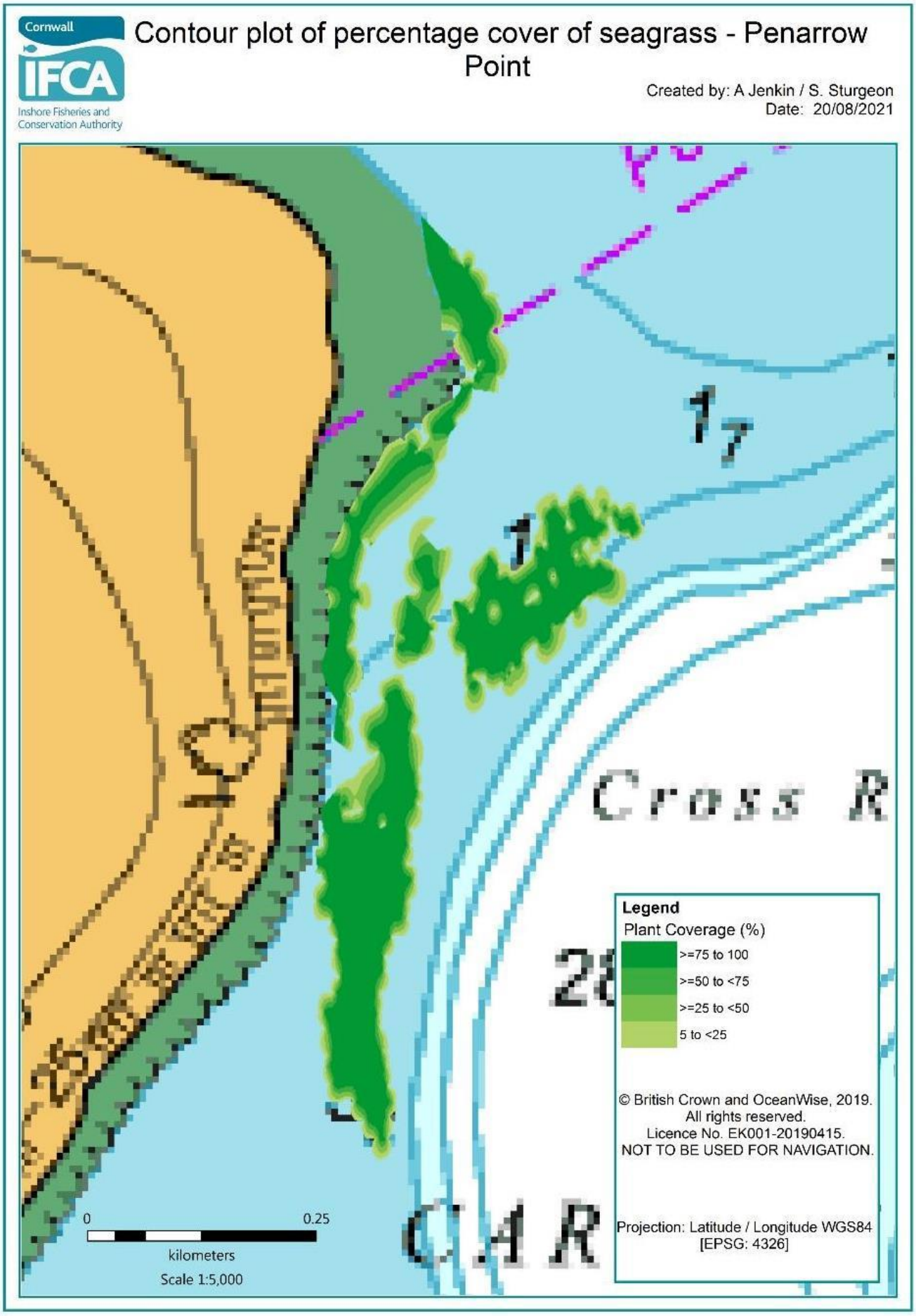

Figure 18: Contour plot displaying plant coverage (%) of seagrass (*Zostera marina*) completed at Penarrow Point using an MX Echosounder by Cornwall IFCA 2021

8.2 Flushing

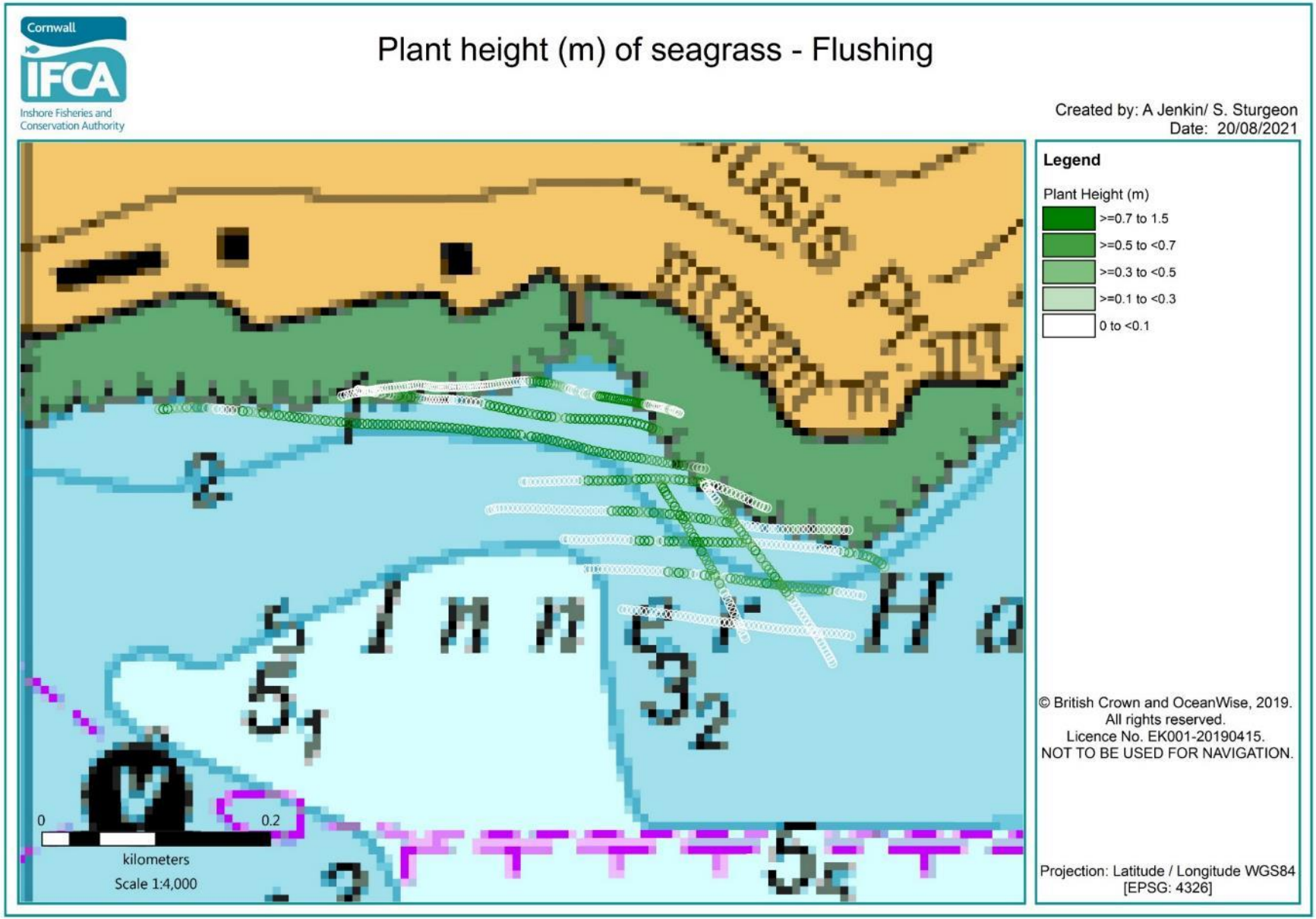

Figure 19: Plant height (m) of seagrass (*Zostera marina*) completed at Flushing using an MX Echosounder by Cornwall IFCA 2021

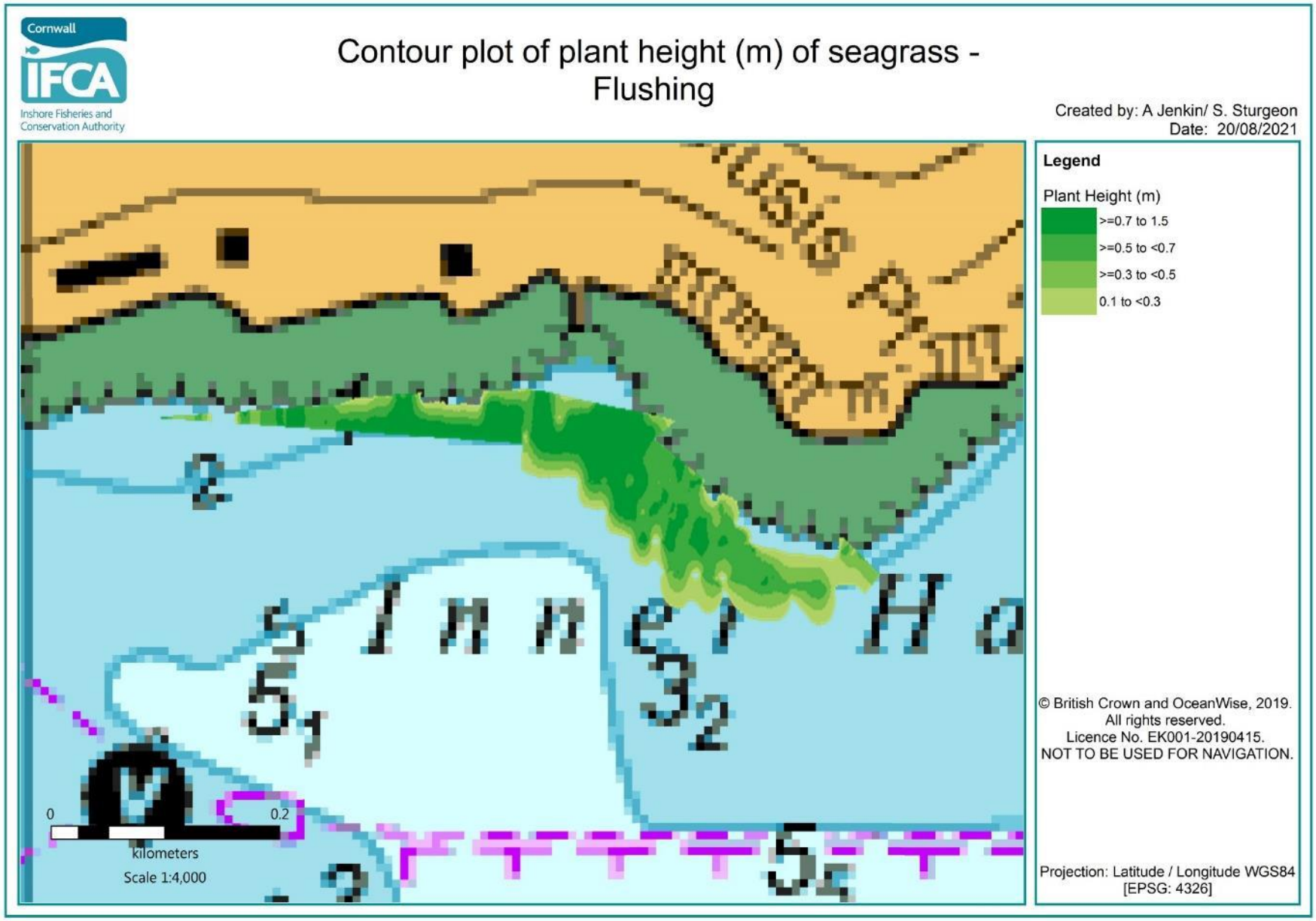

Figure 20: Contour plot displaying plant height (m) of seagrass (*Zostera marina*) completed at Flushing using an MX Echosounder by Cornwall IFCA 2021

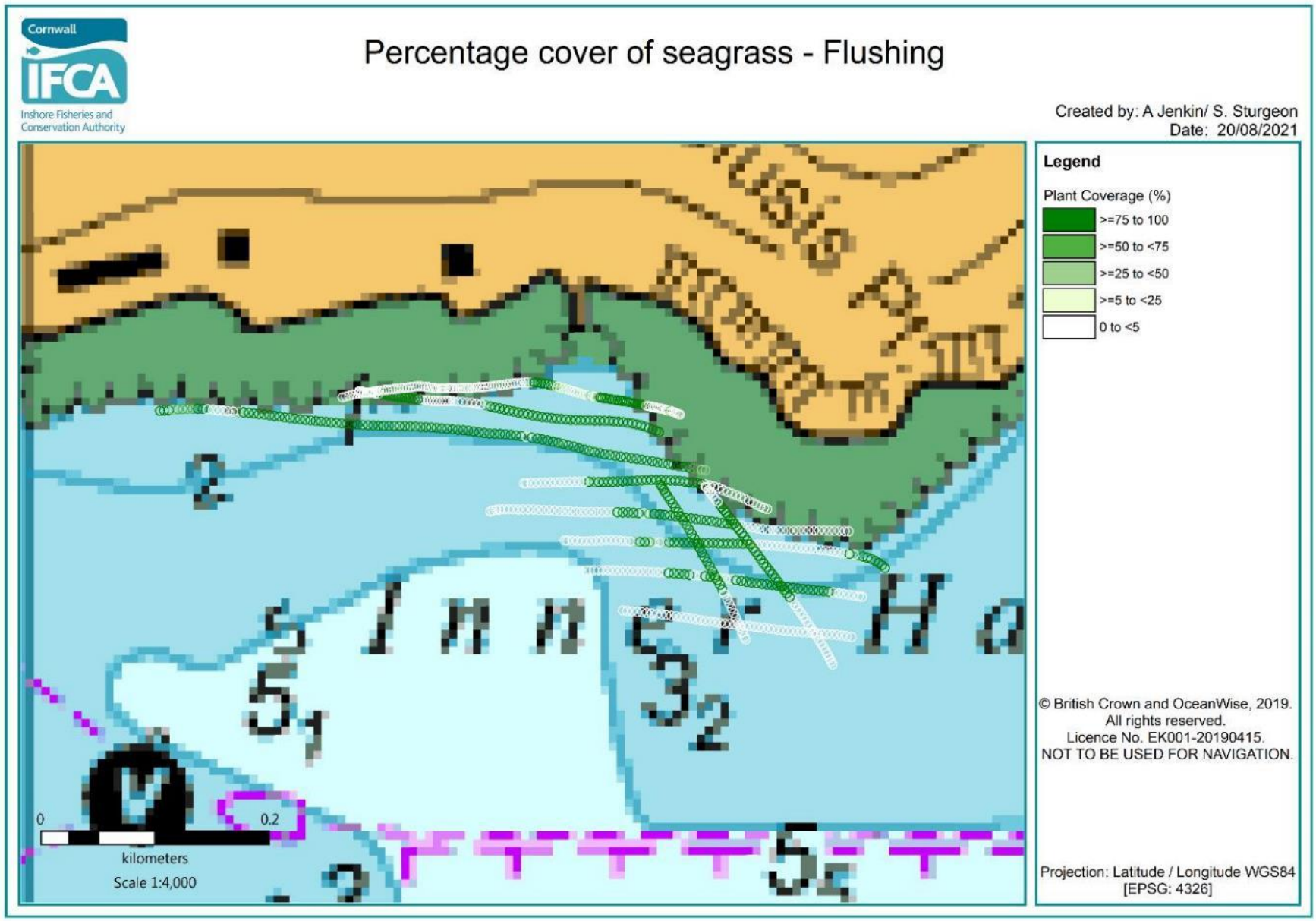

Figure 21: Plant coverage (%) of seagrass (*Zostera marina*) completed at Flushing using an MX Echosounder by Cornwall IFCA 2021

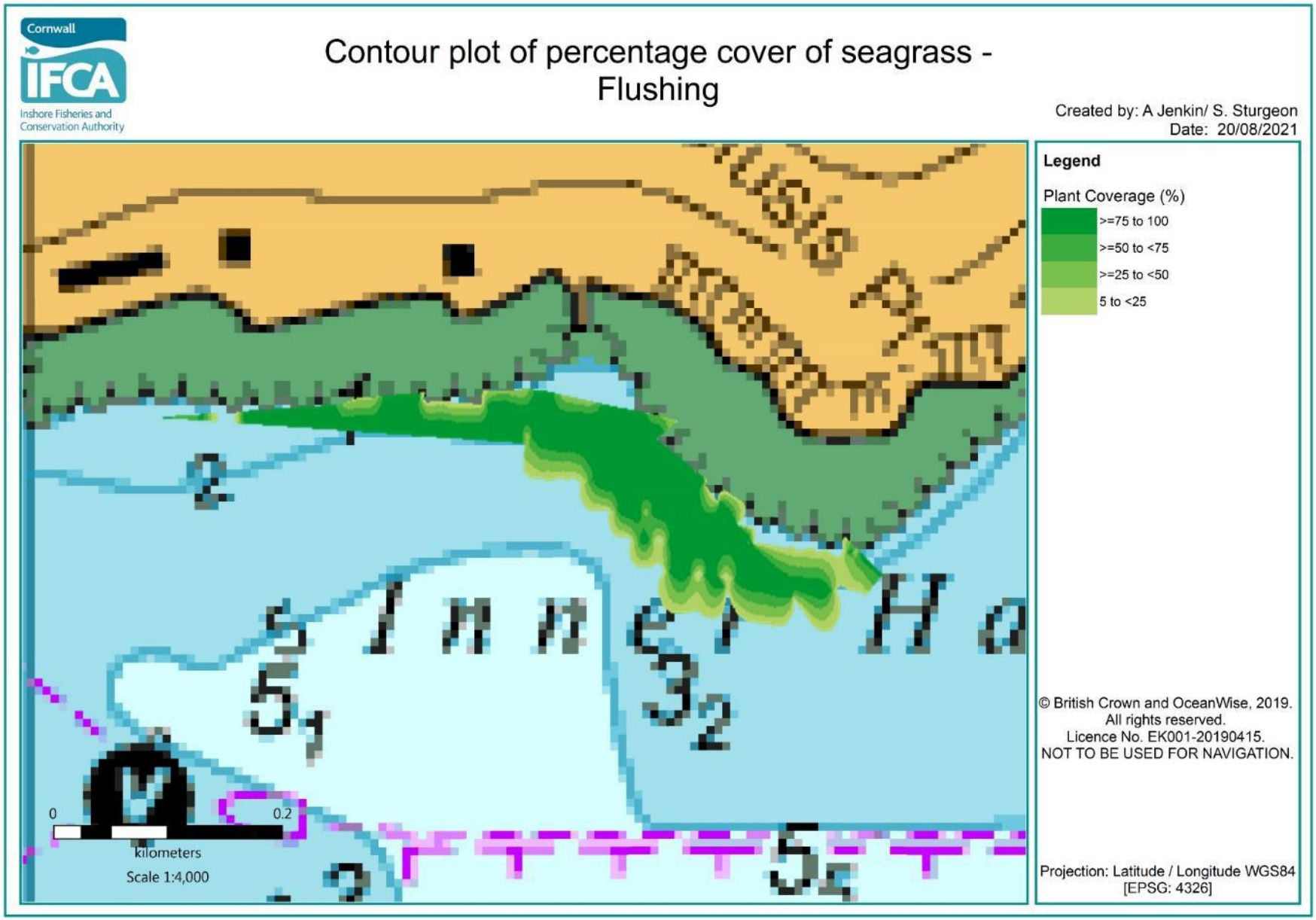

Figure 22 Contour plot displaying plant coverage (%) of seagrass (*Zostera marina*) completed at Flushing using an MX Echosounder by Cornwall IFCA 2021

8.3 St.Mawes Bank

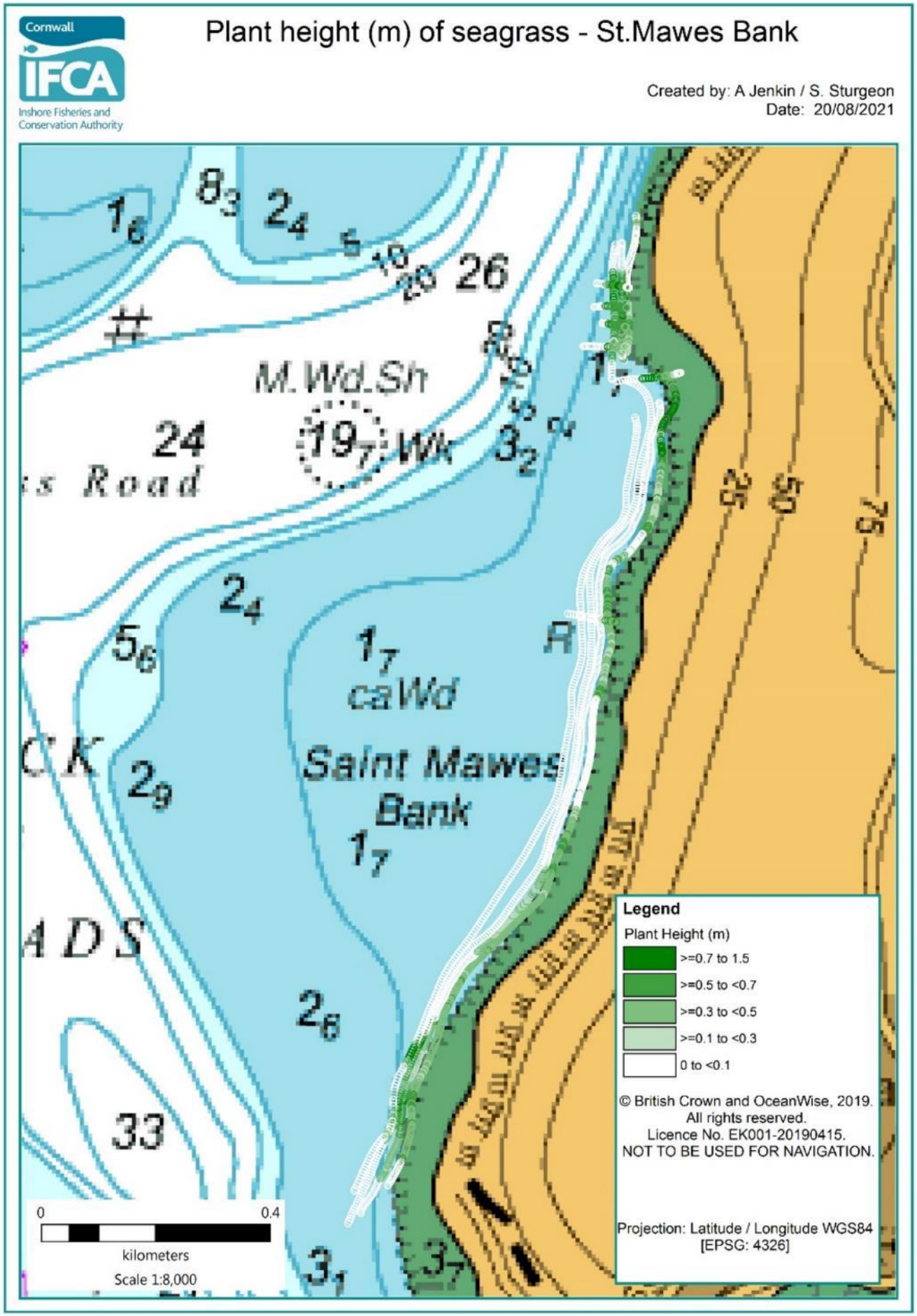

Figure 23: Plant height (m) of seagrass (*Zostera marina*) completed at St.Mawes Bank using an MX Echosounder by Cornwall IFCA 2021

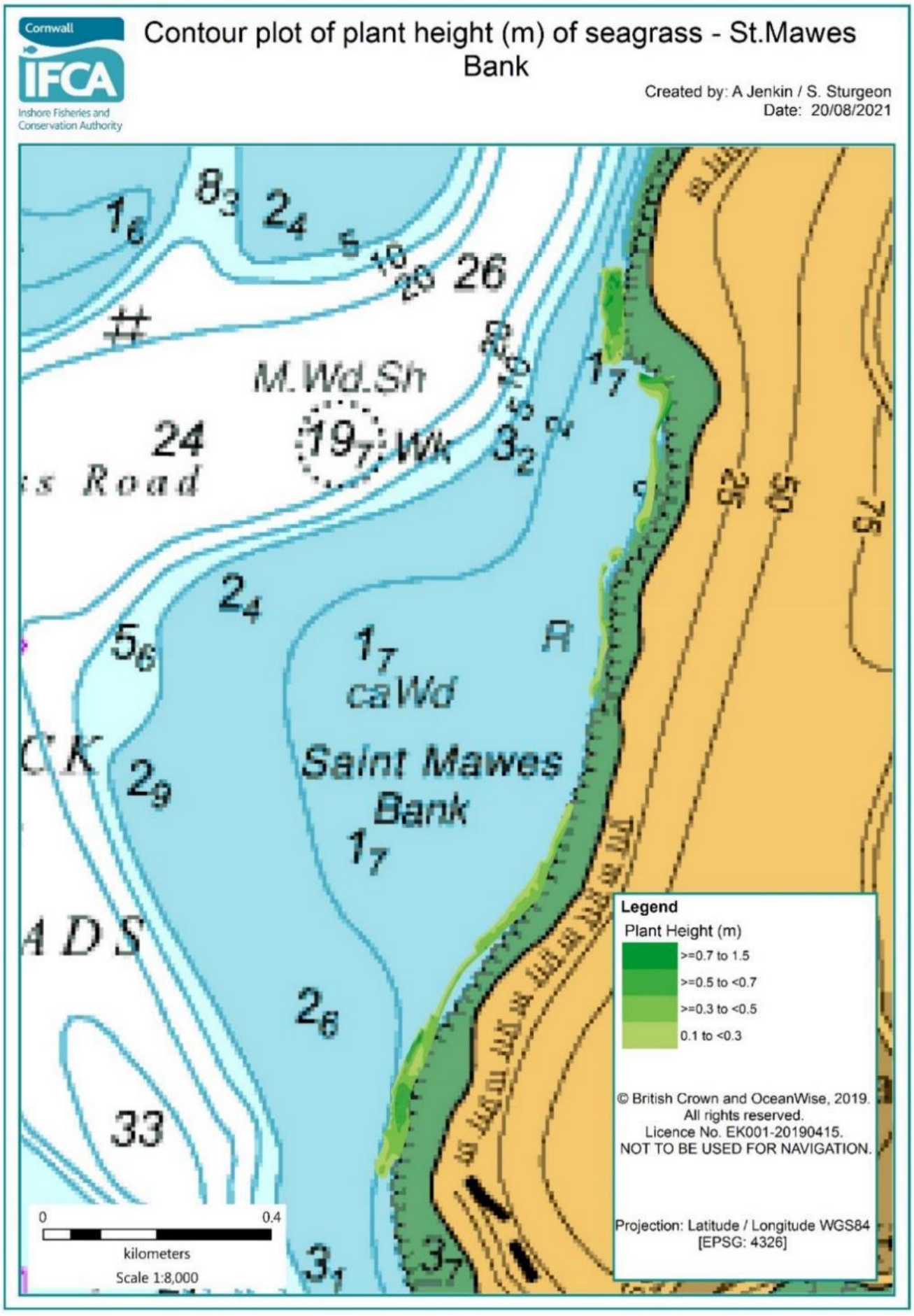

Figure 24: Contour plot displaying plant height (m) of seagrass (*Zostera marina*) completed at St.Mawes Bank using an MX Echosounder by Cornwall IFCA 2021

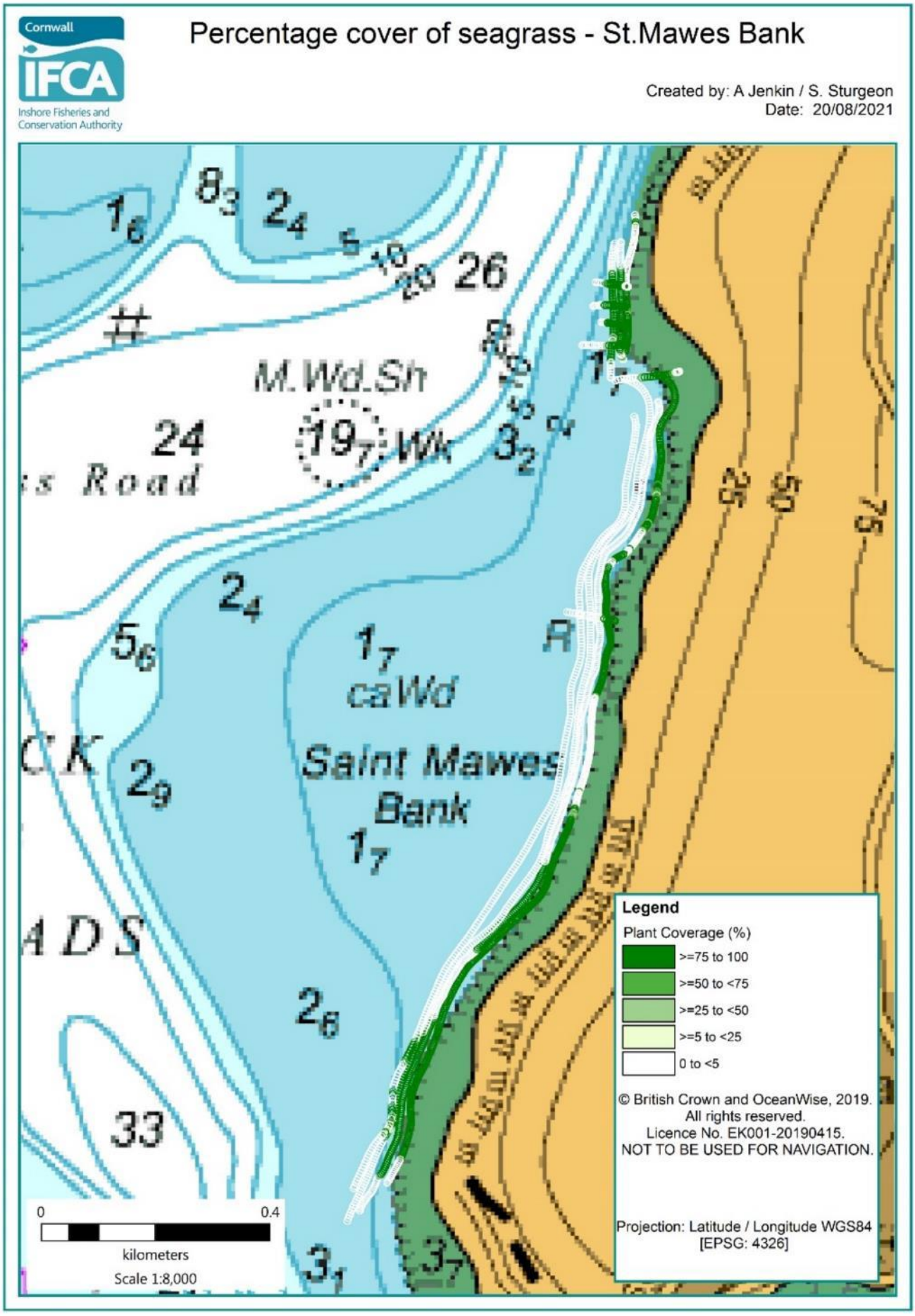

Figure 25: Plant coverage (%) of seagrass (*Zostera marina*) completed at St.Mawes Bank using an MX Echosounder by Cornwall IFCA 2021

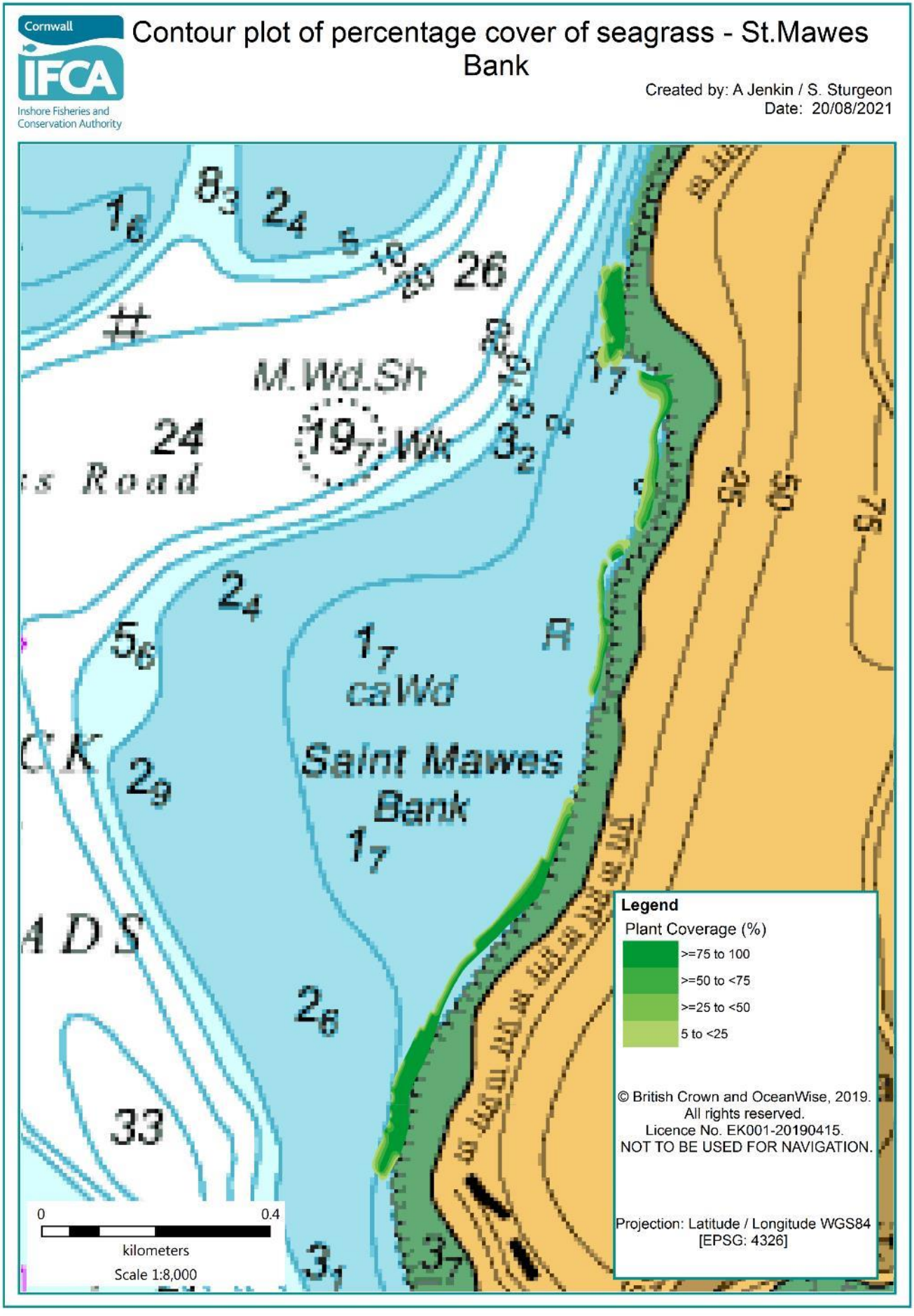

Figure 26 Contour plot displaying plant coverage (%) of seagrass (*Zostera marina*) completed at St.Mawes Bank using an MX Echosounder by Cornwall IFCA 2021

8.4 St.Mawes

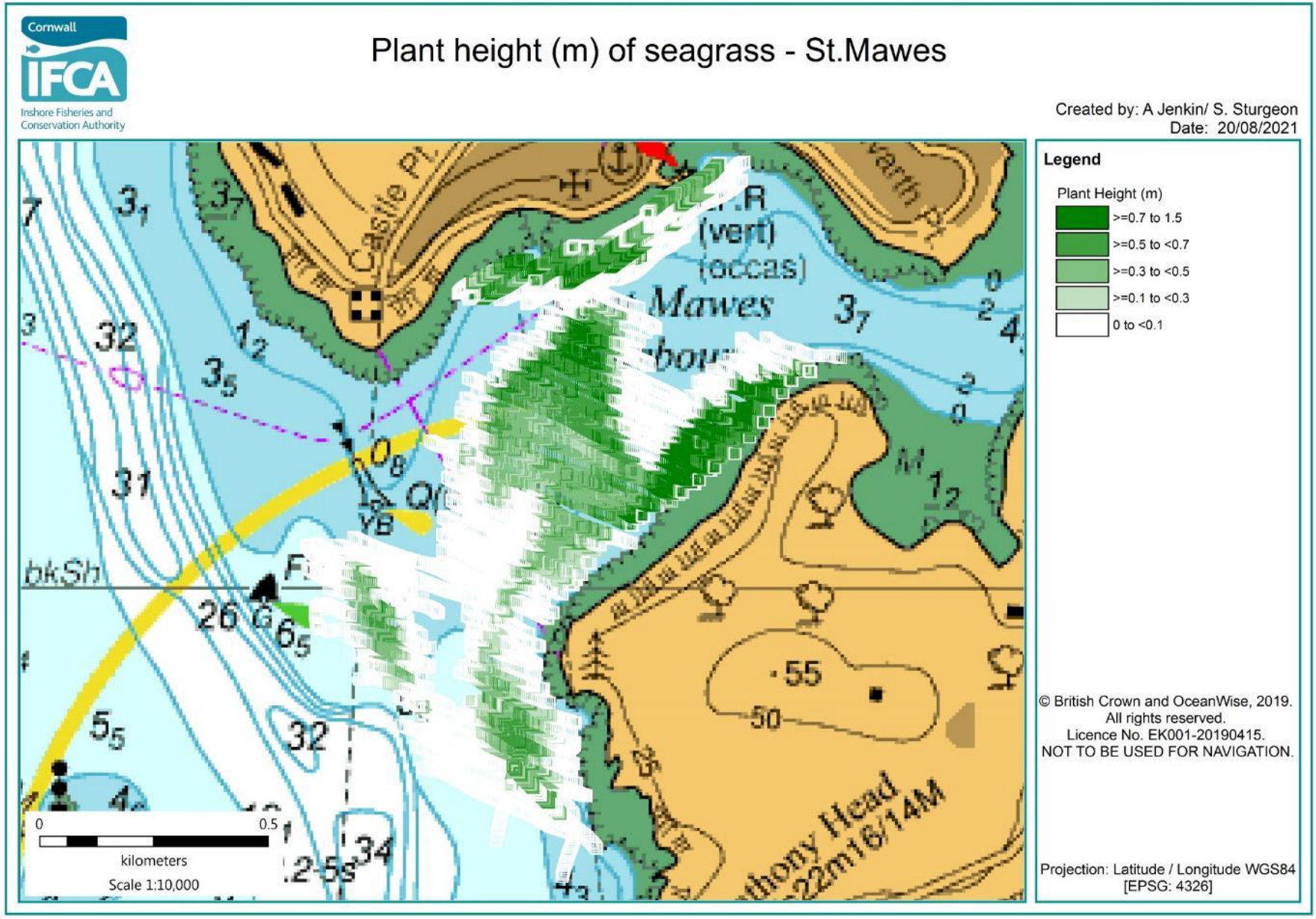

Figure 27: Plant height (m) of seagrass (*Zostera marina*) completed at St.Mawes using an MX Echosounder by Cornwall IFCA 2021

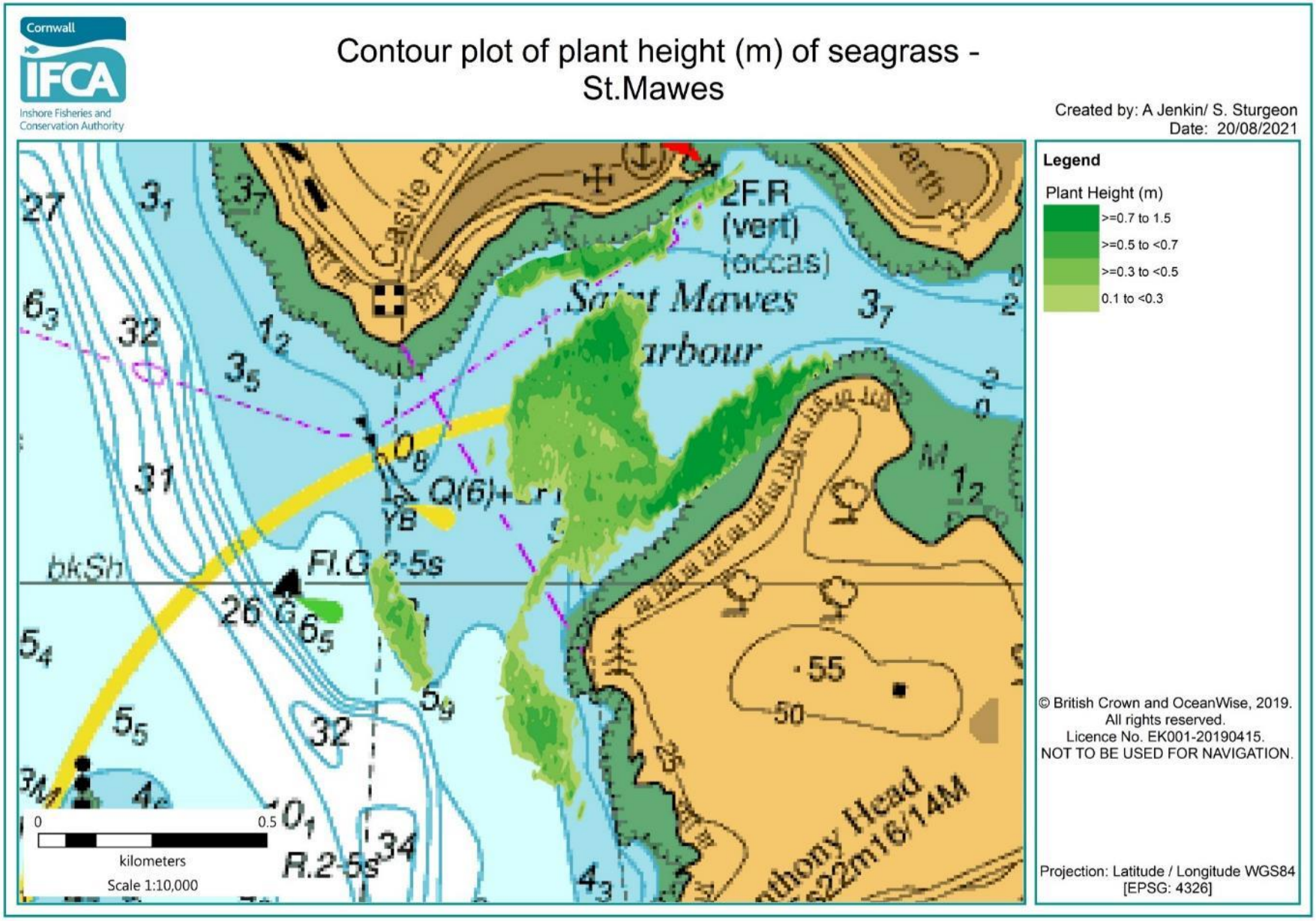

Figure 28: Contour plot displaying plant height (m) of seagrass (*Zostera marina*) completed at St.Mawes using an MX Echosounder by Cornwall IFCA 2021

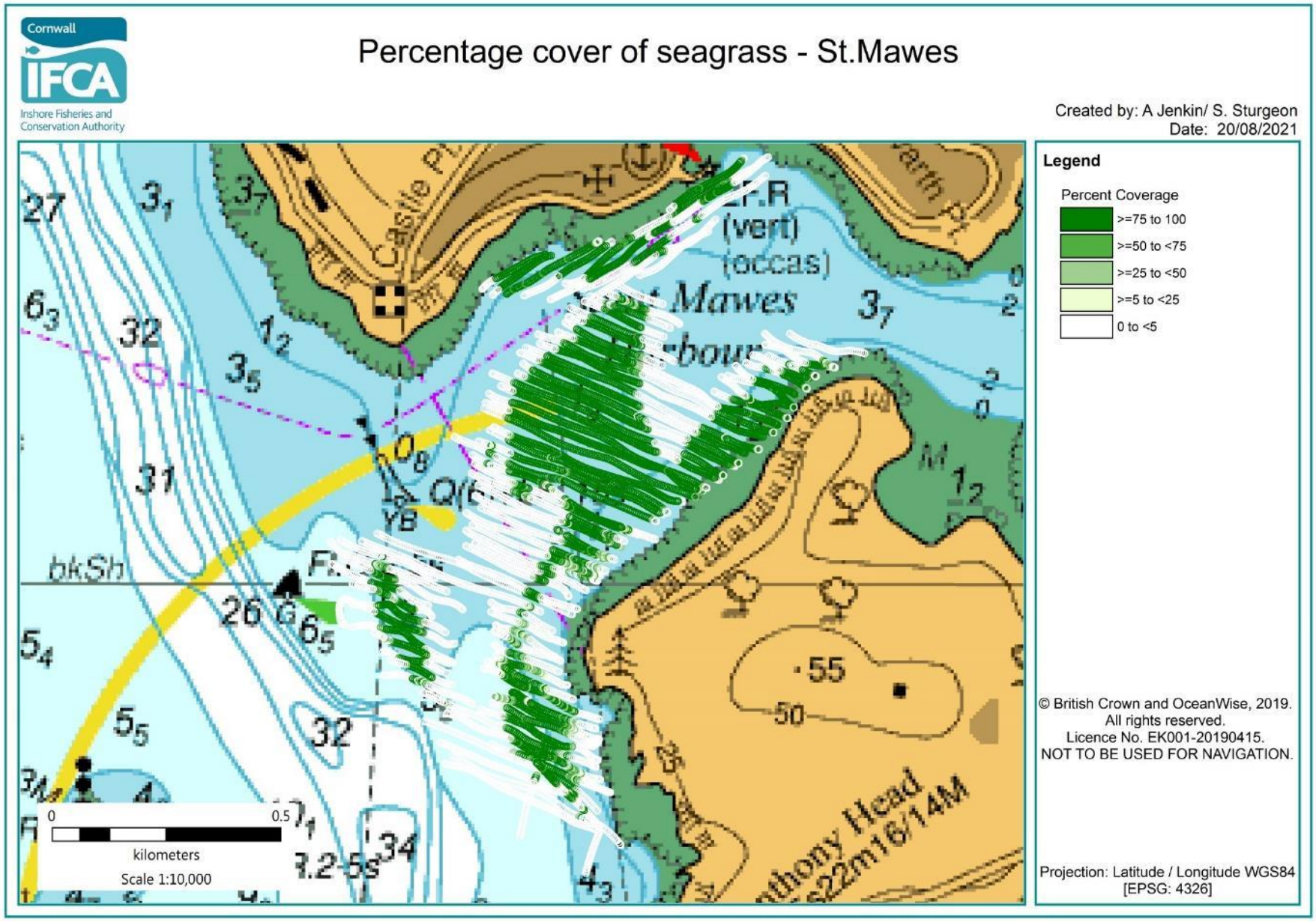

Figure 29: Plant coverage (%) of seagrass (*Zostera marina*) completed at St.Mawes using an MX Echosounder by Cornwall IFCA 2021

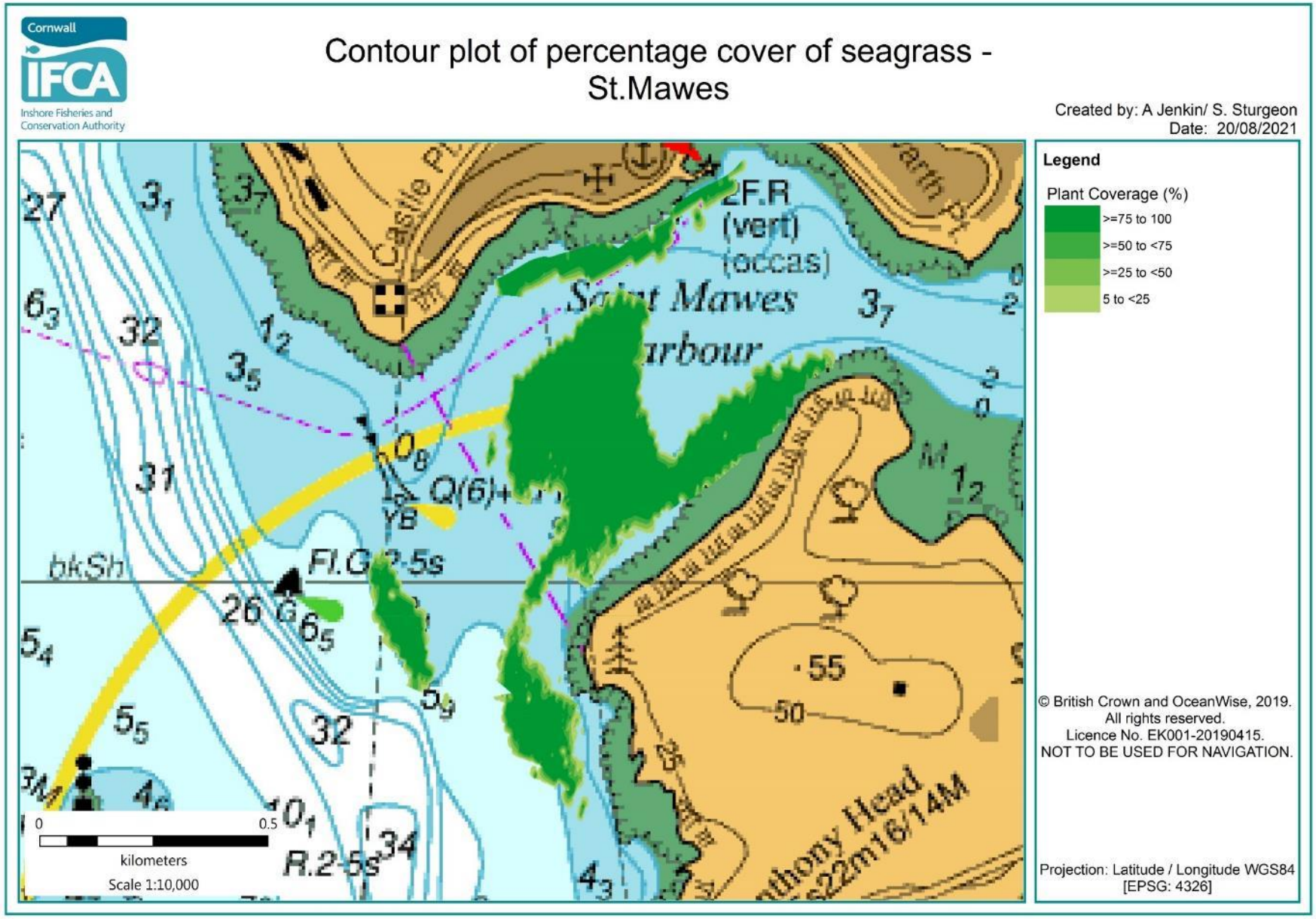

Figure 30 Contour plot displaying plant coverage (%) of seagrass (*Zostera marina*) completed at St.Mawes using an MX Echosounder by Cornwall IFCA 2021

8.5 Gyllyngvase

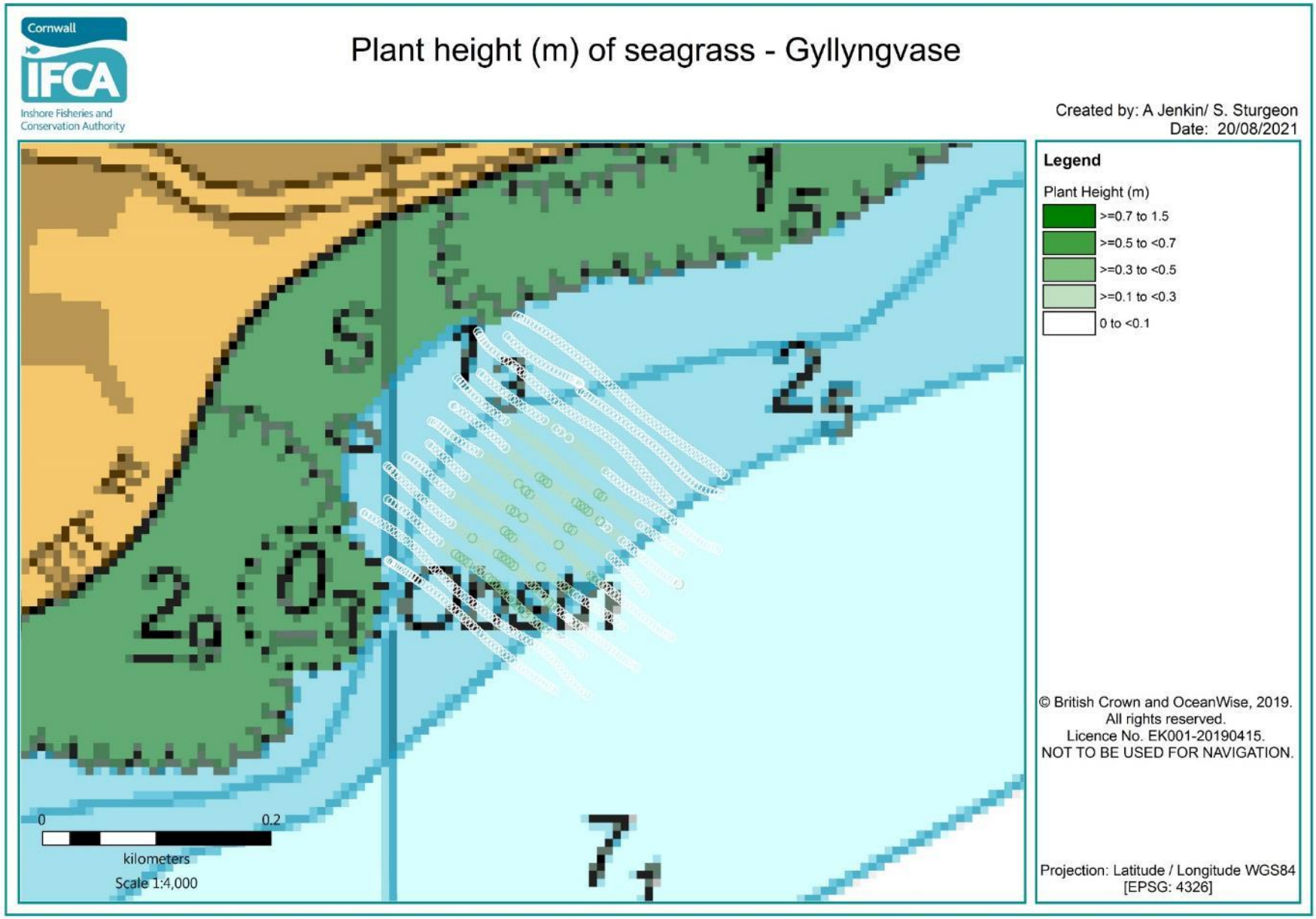

Figure 31: Plant height (m) of seagrass (*Zostera marina*) completed at Gyllyngvase using an MX Echosounder by Cornwall IFCA 2021

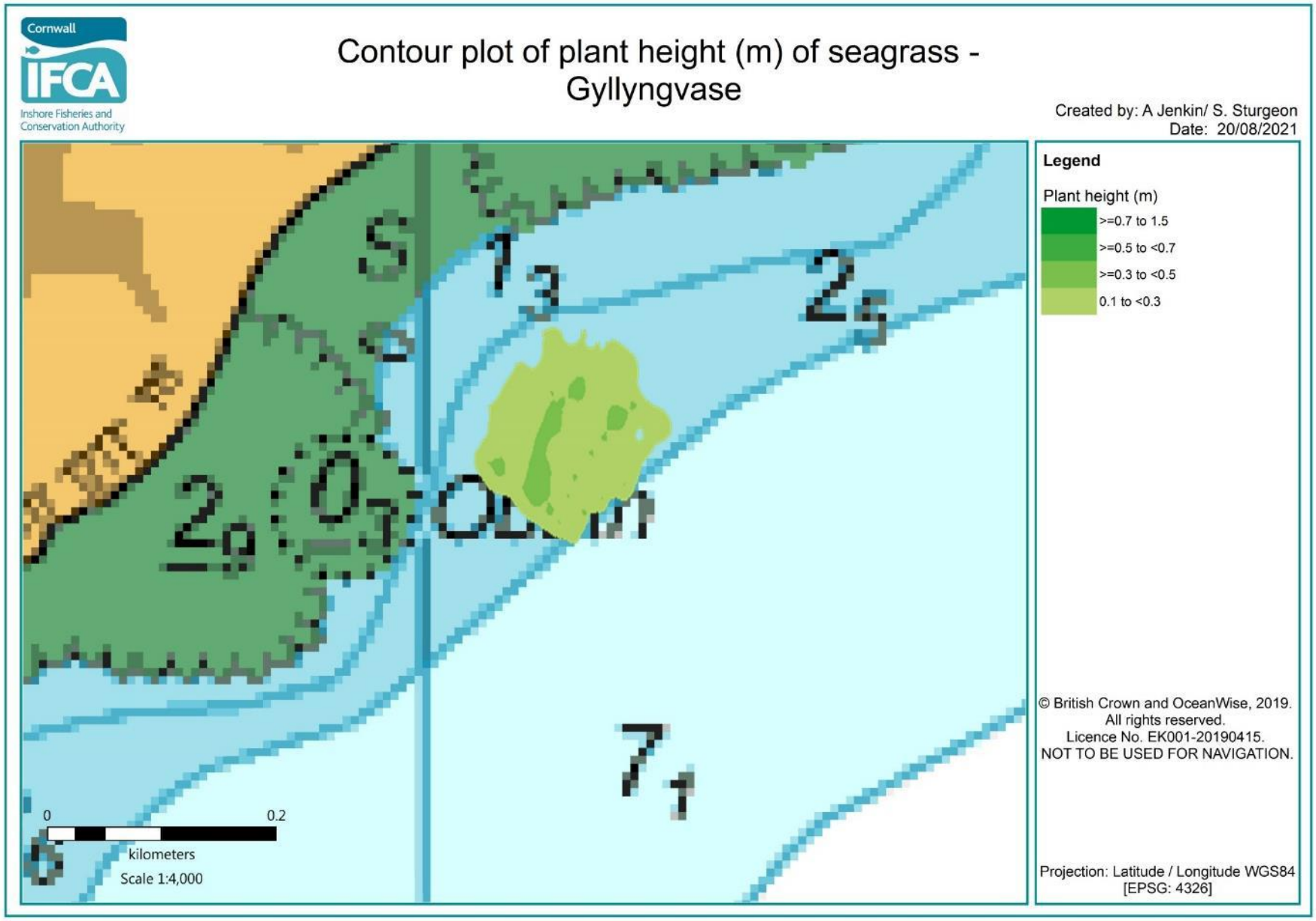

Figure 32: Contour plot displaying plant height (m) of seagrass (*Zostera marina*) completed at Gyllngnvase using an MX Echosounder by Cornwall IFCA 2021

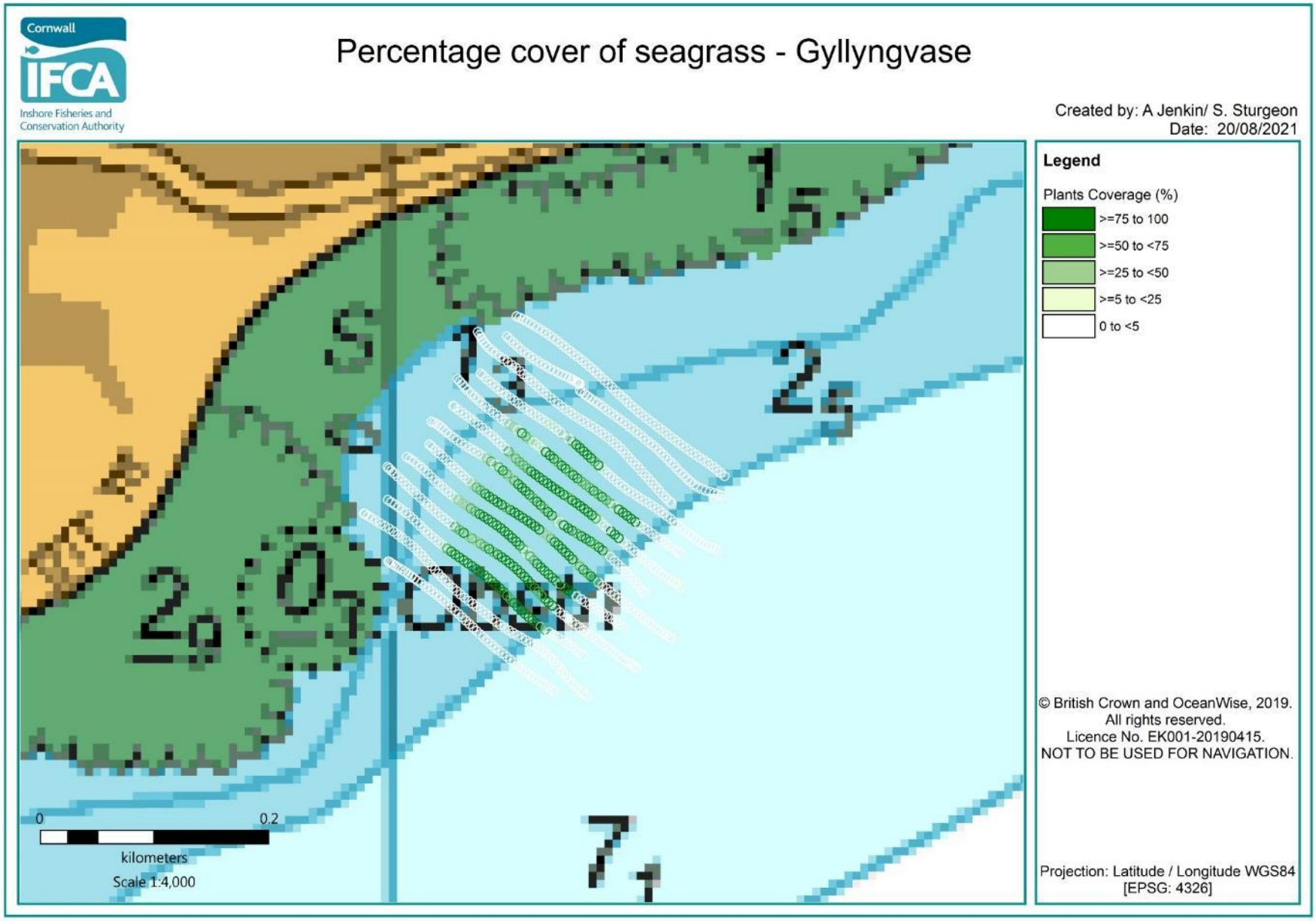

Figure 33: Plant coverage (%) of seagrass (*Zostera marina*) completed at Gyllyngvase using an MX Echosounder by Cornwall IFCA 2021

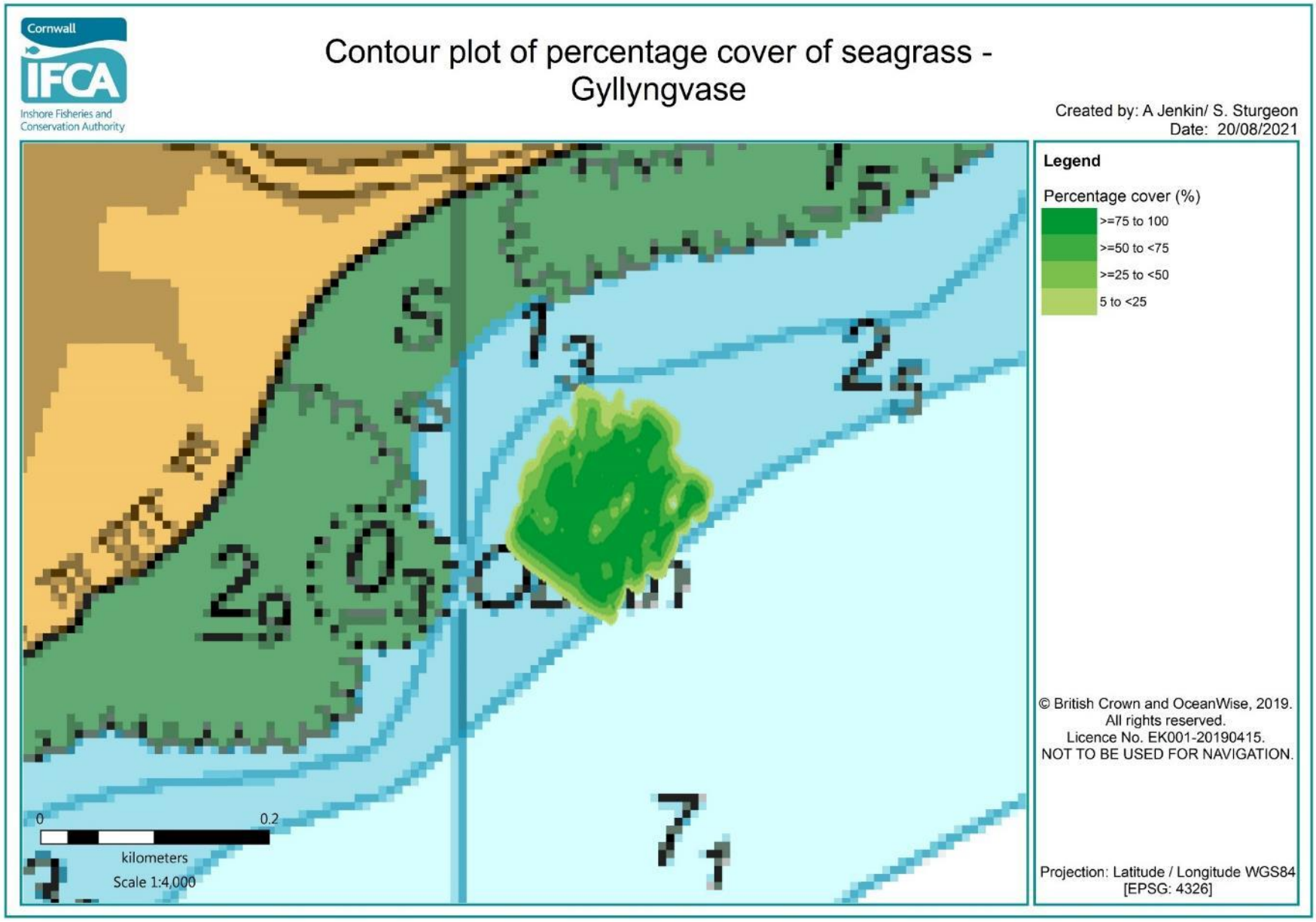

Figure 34 Contour plot displaying plant coverage (%) of seagrass (*Zostera marina*) completed at Gyllyngvase using an MX Echosounder by Cornwall IFCA 2021

8.6 Swanpool

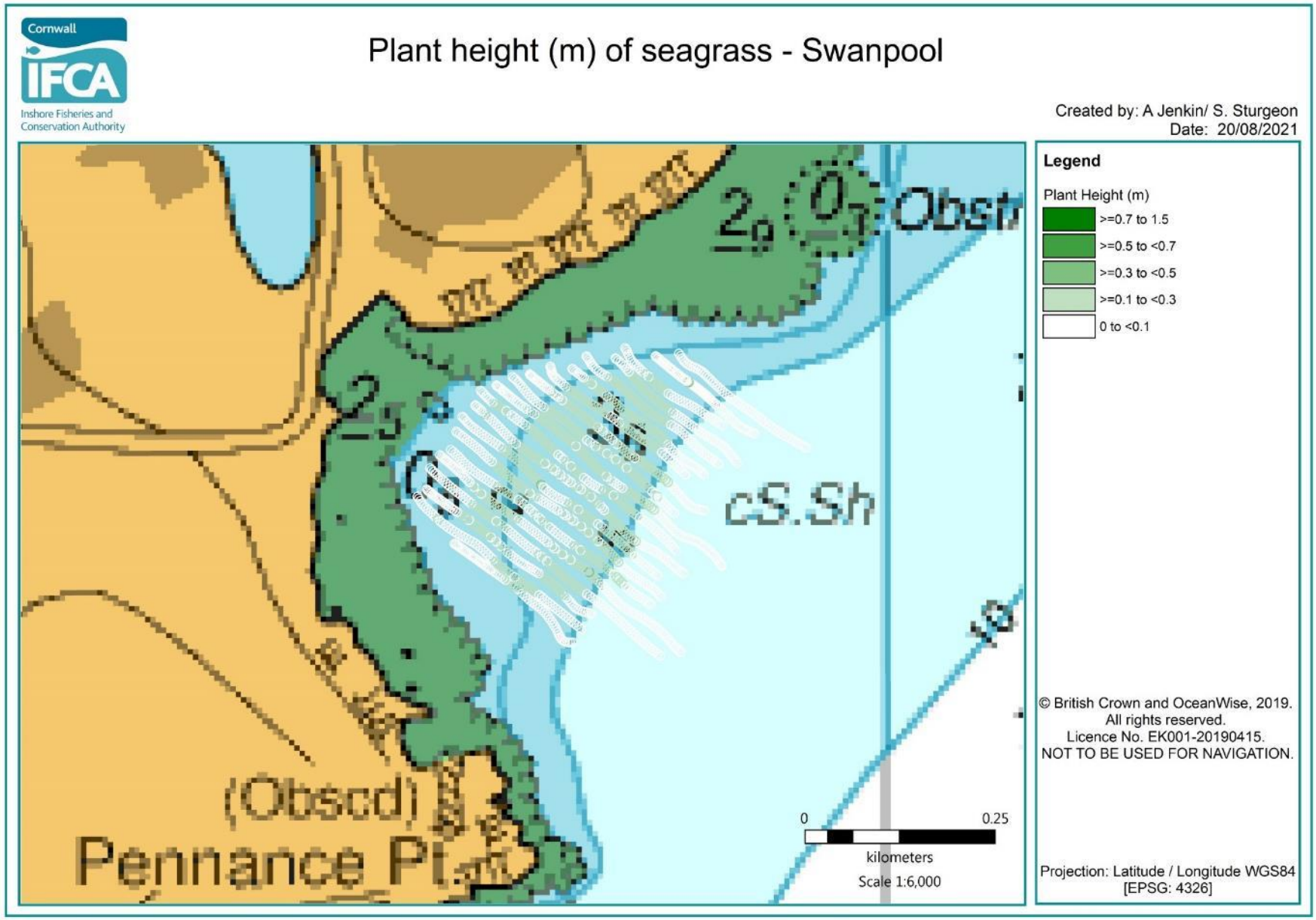

Figure 35: Plant height (m) of seagrass (*Zostera marina*) completed at Swanpool using an MX Echosounder by Cornwall IFCA 2021

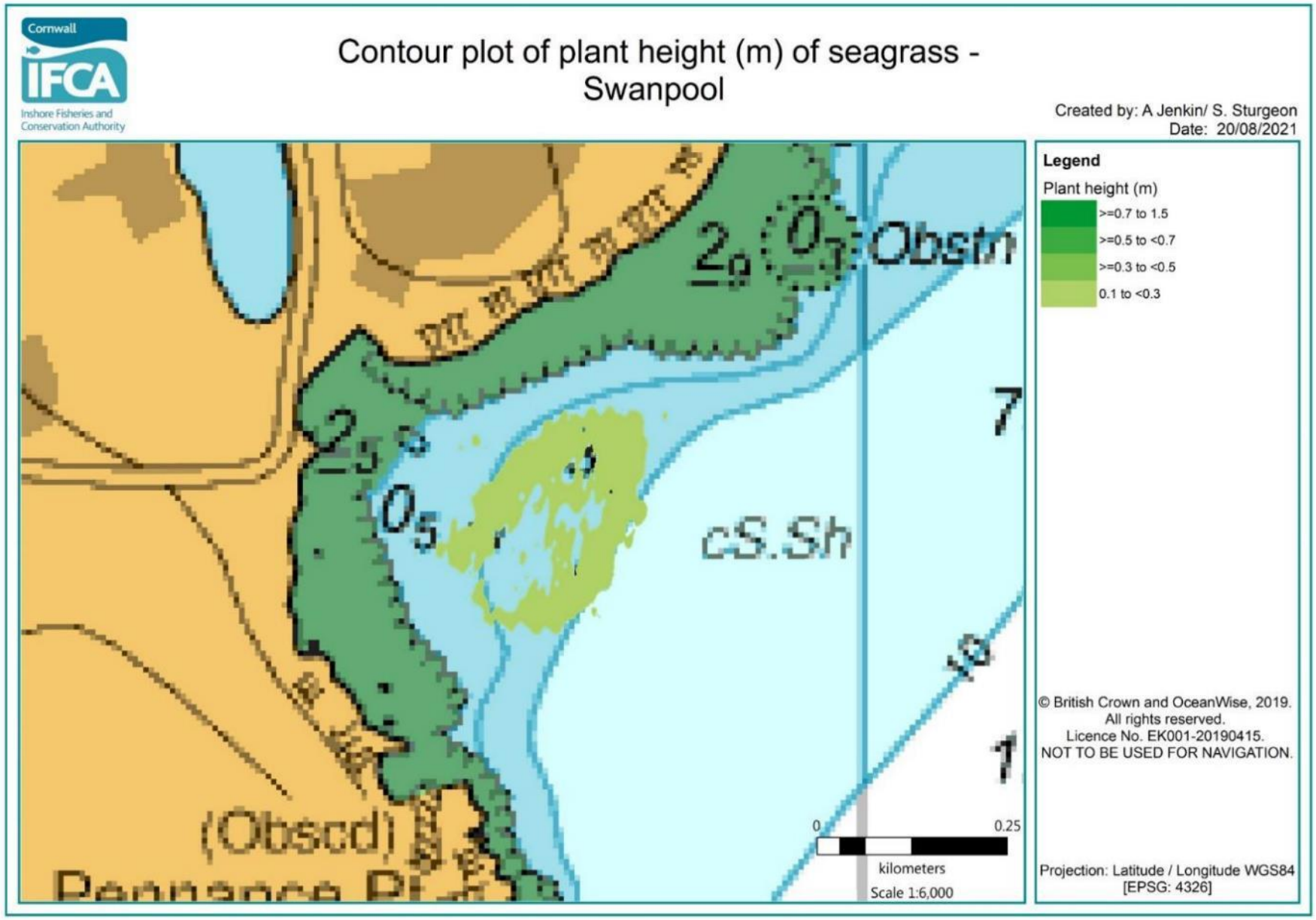

Figure 36: Contour plot displaying plant height (m) of seagrass (*Zostera marina*) completed at Swanpool using an MX Echosounder by Cornwall IFCA 2021

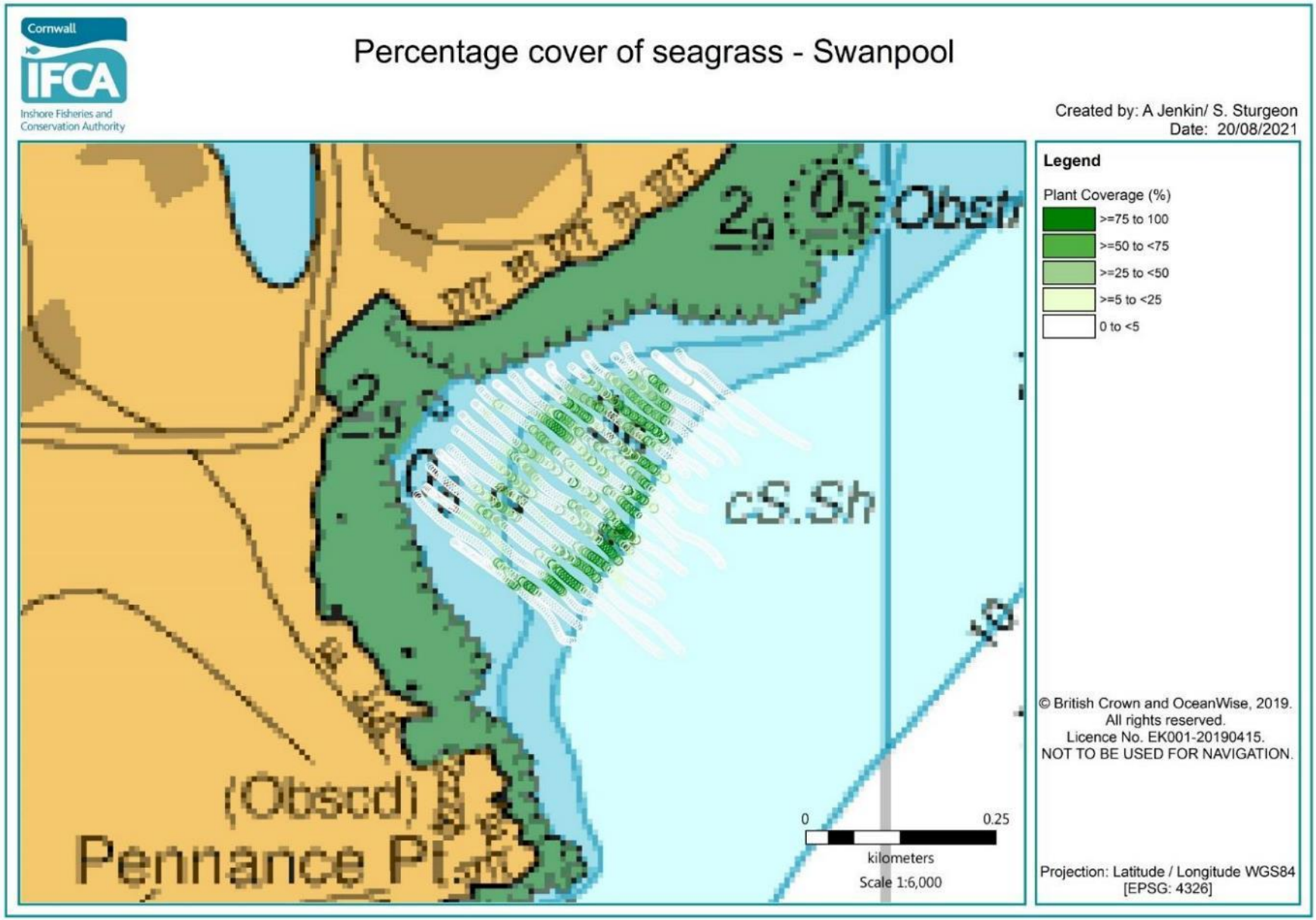

Figure 37: Plant coverage (%) of seagrass (*Zostera marina*) completed at Swanpool using an MX Echosounder by Cornwall IFCA 2021

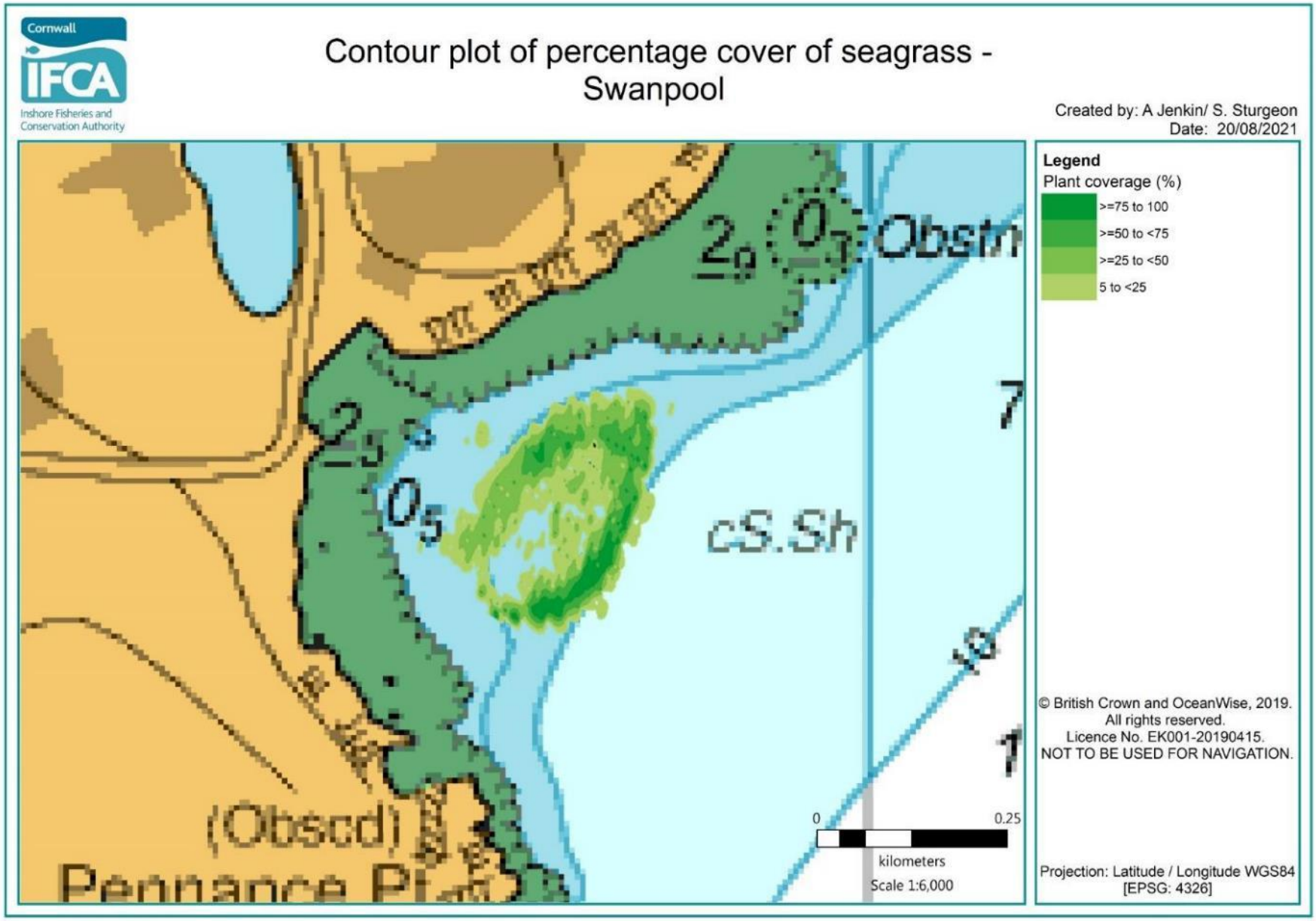

Figure 38: Contour plot displaying plant coverage (%) of seagrass (*Zostera marina*) completed at Swanpool using an MX Echosounder by Cornwall IFCA 202

8.7 Maenporth

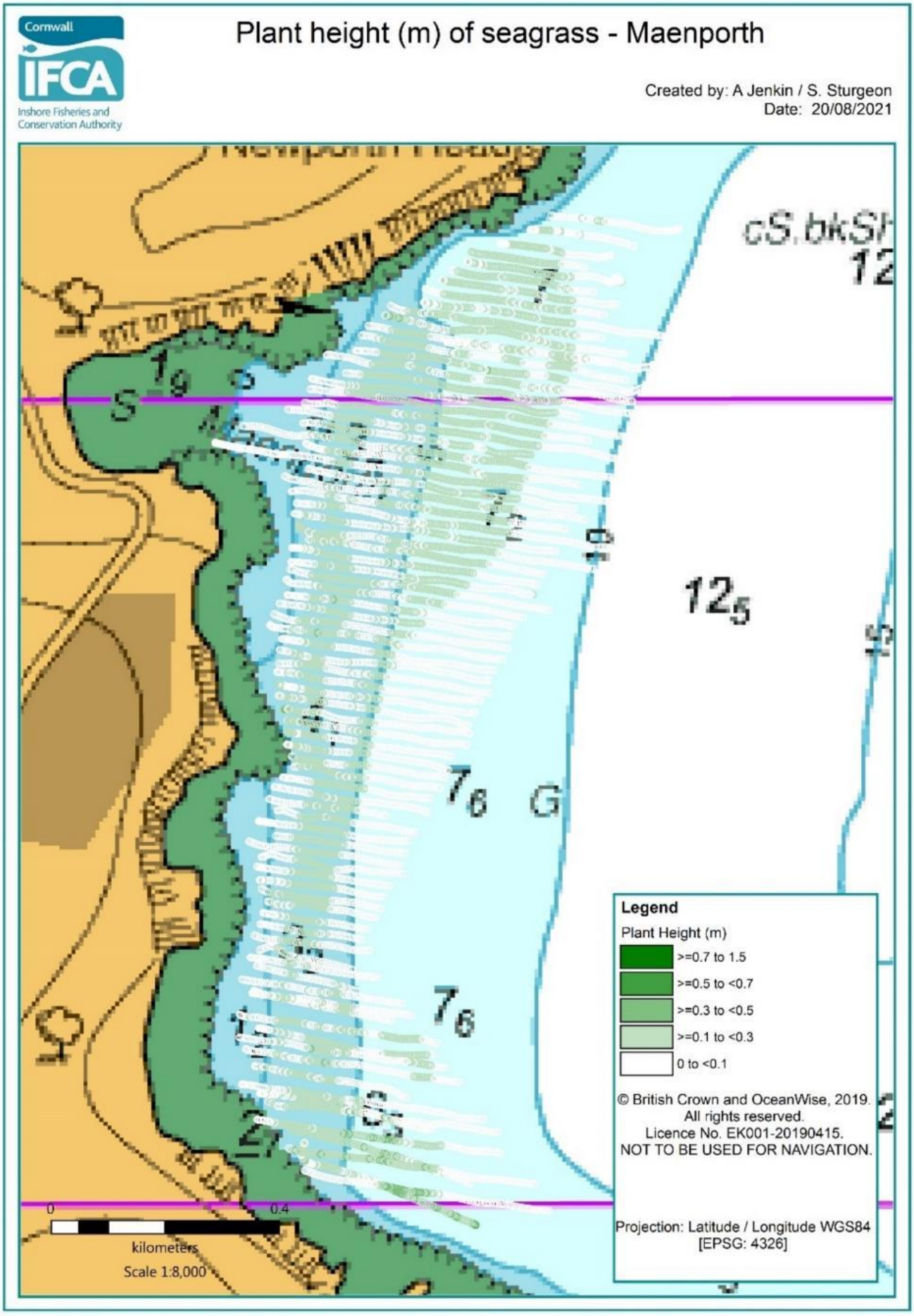

Figure 39: Plant height (m) of seagrass (*Zostera marina*) completed at Maenporth using an MX Echosounder by Cornwall IFCA 2021

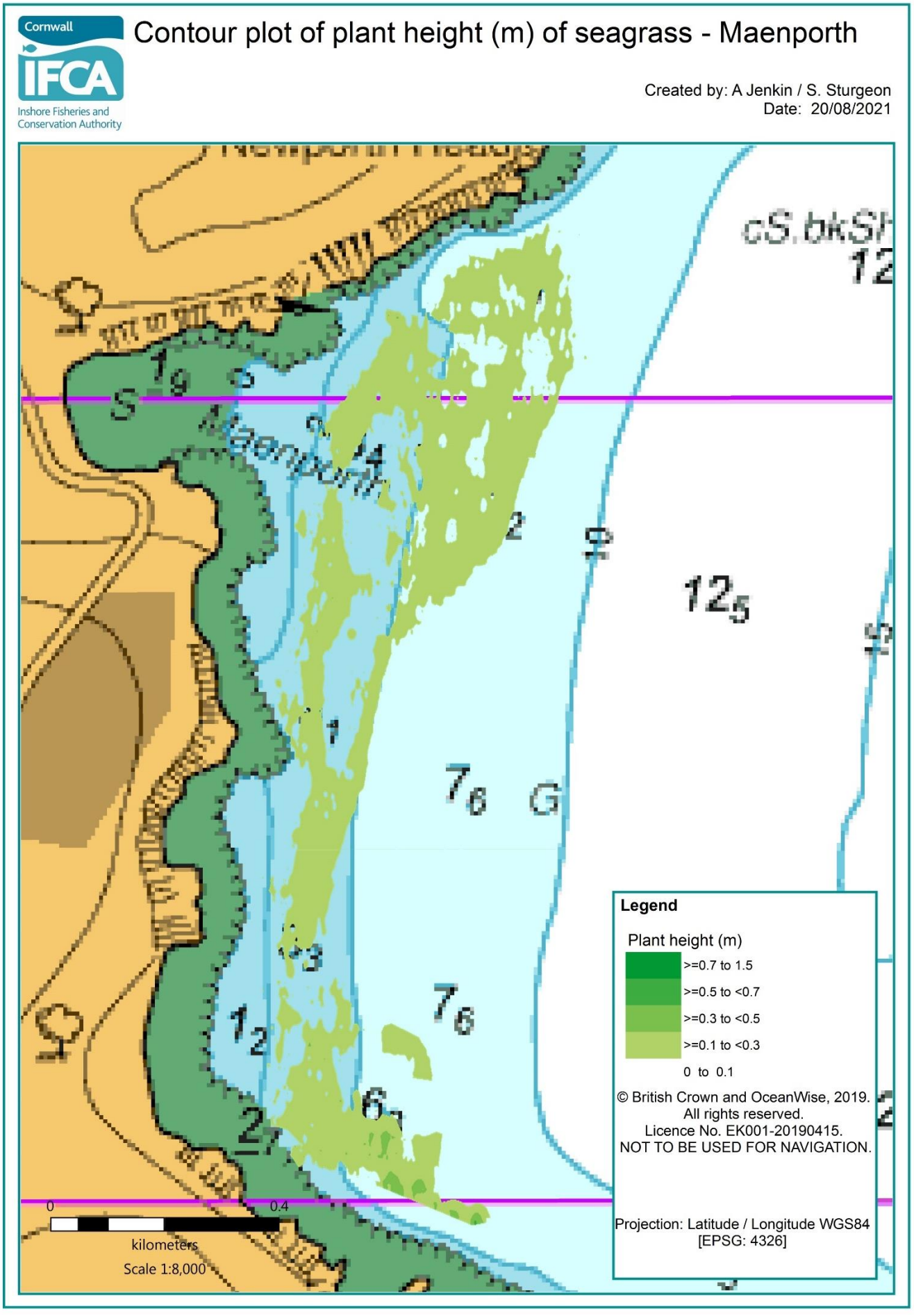

Figure 40: Contour plot displaying plant height (cm) of seagrass (*Zostera marina*) completed at Maenporth using an MX Echosounder by Cornwall IFCA 2021

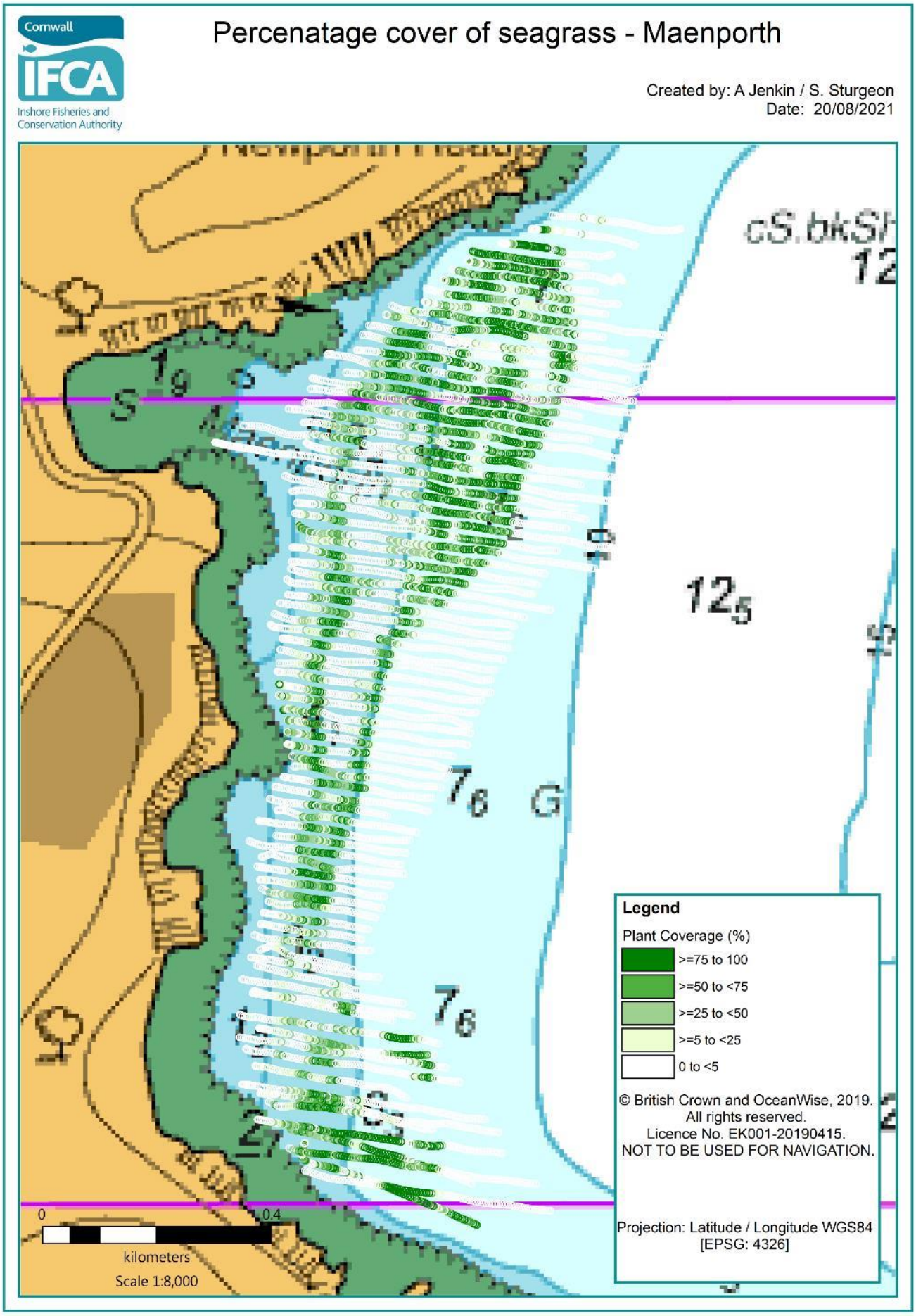

Figure 41: Plant coverage (%) of seagrass (*Zostera marina*) completed at Maenporth using an MX Echosounder by Cornwall IFCA 2021

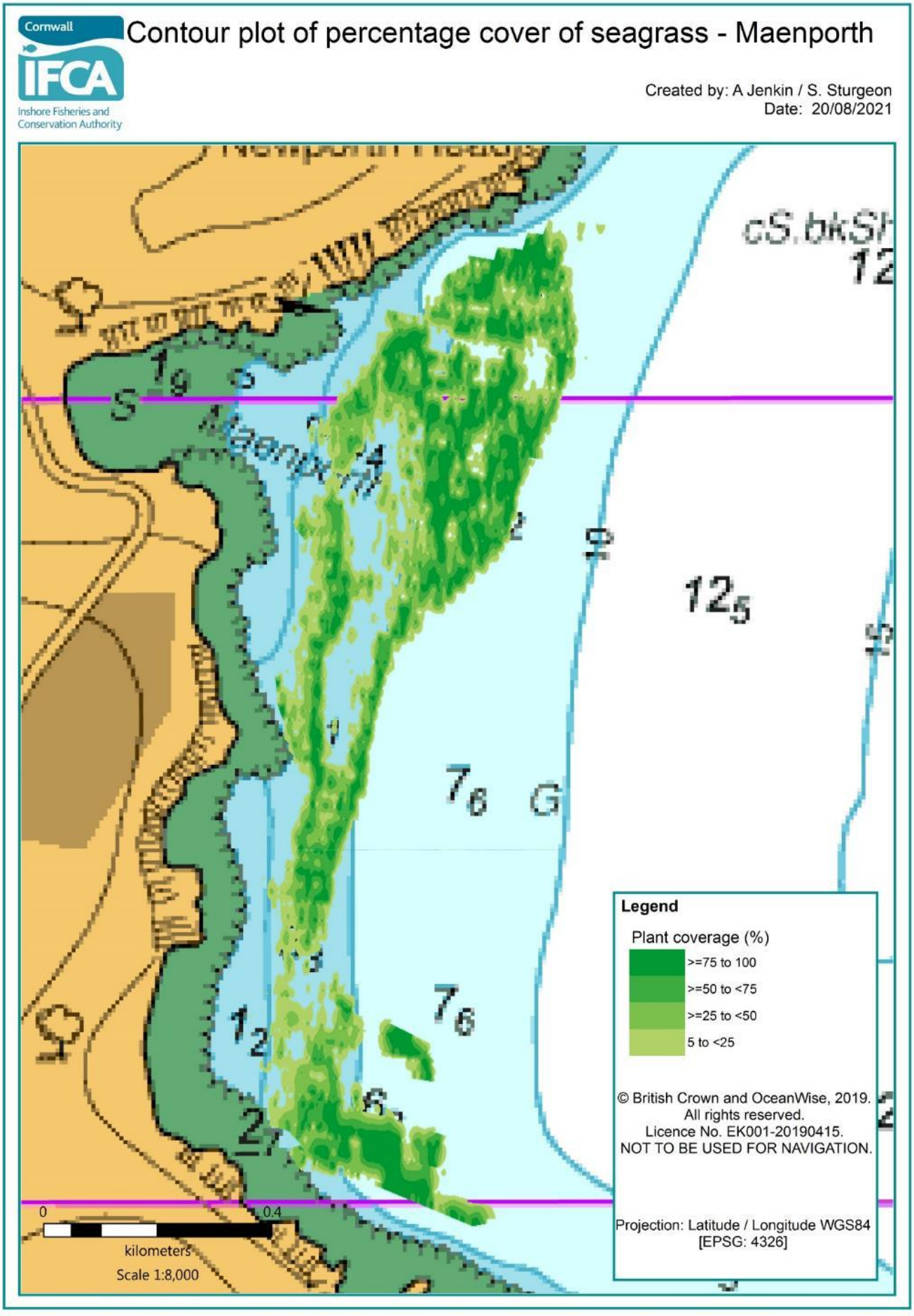

Figure 42: Contour plot displaying plant coverage (%) of seagrass (*Zostera marina*) completed at Maenporth using an MX Echosounder by Cornwall IFCA 2021

8.8 Helford

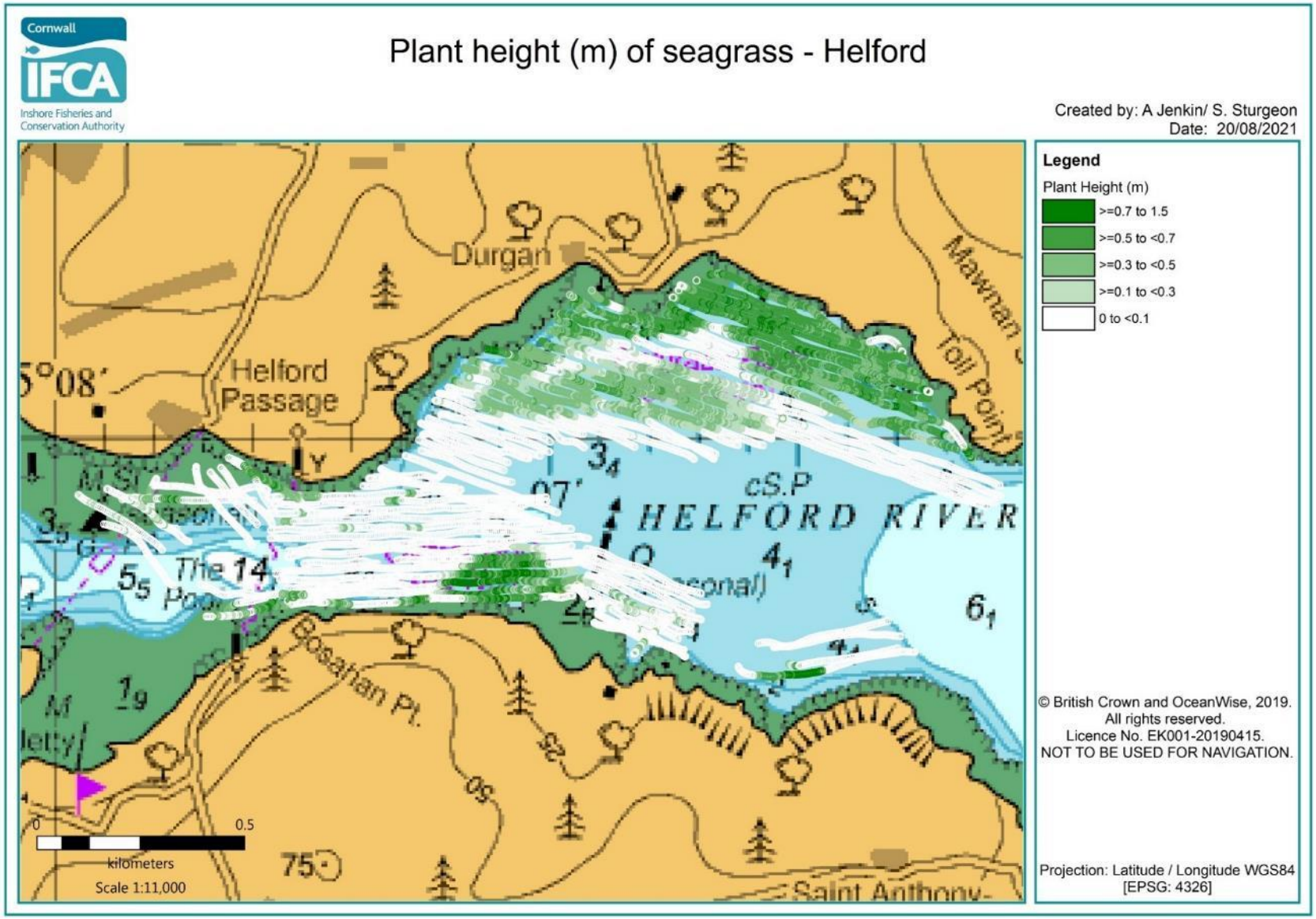

Figure 43: Plant height (m) of seagrass (*Zostera marina*) completed in the Helford River using an MX Echosounder by Cornwall IFCA 2021

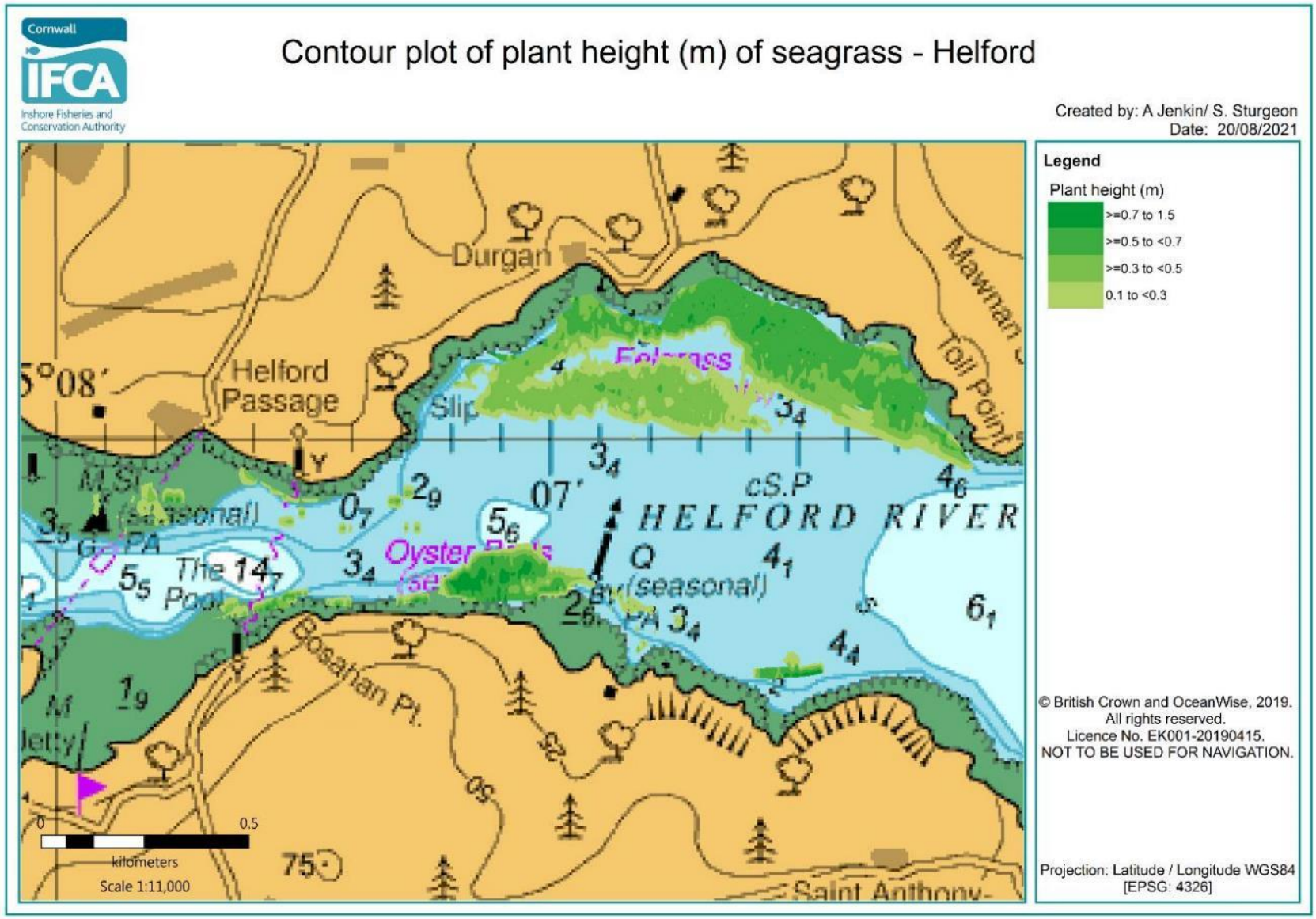

Figure 44: Contour plot displaying plant height (m) of seagrass (*Zostera marina*) completed in the Helford River using an MX Echosounder by Cornwall IFCA 2021

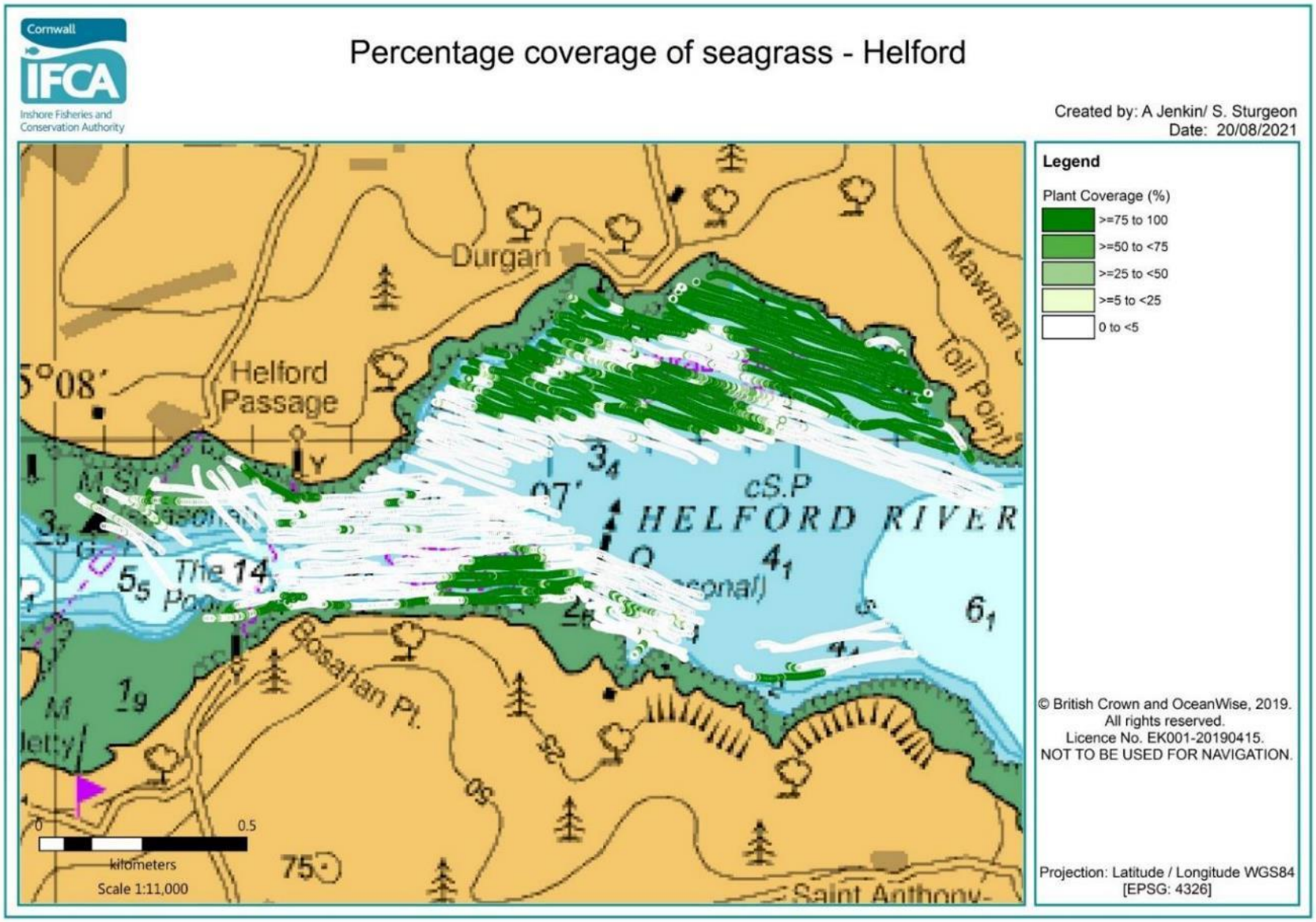

Figure 45: Plant coverage (%) of seagrass (*Zostera marina*) completed in the Helford River using an MX Echosounder by Cornwall IFCA 2021

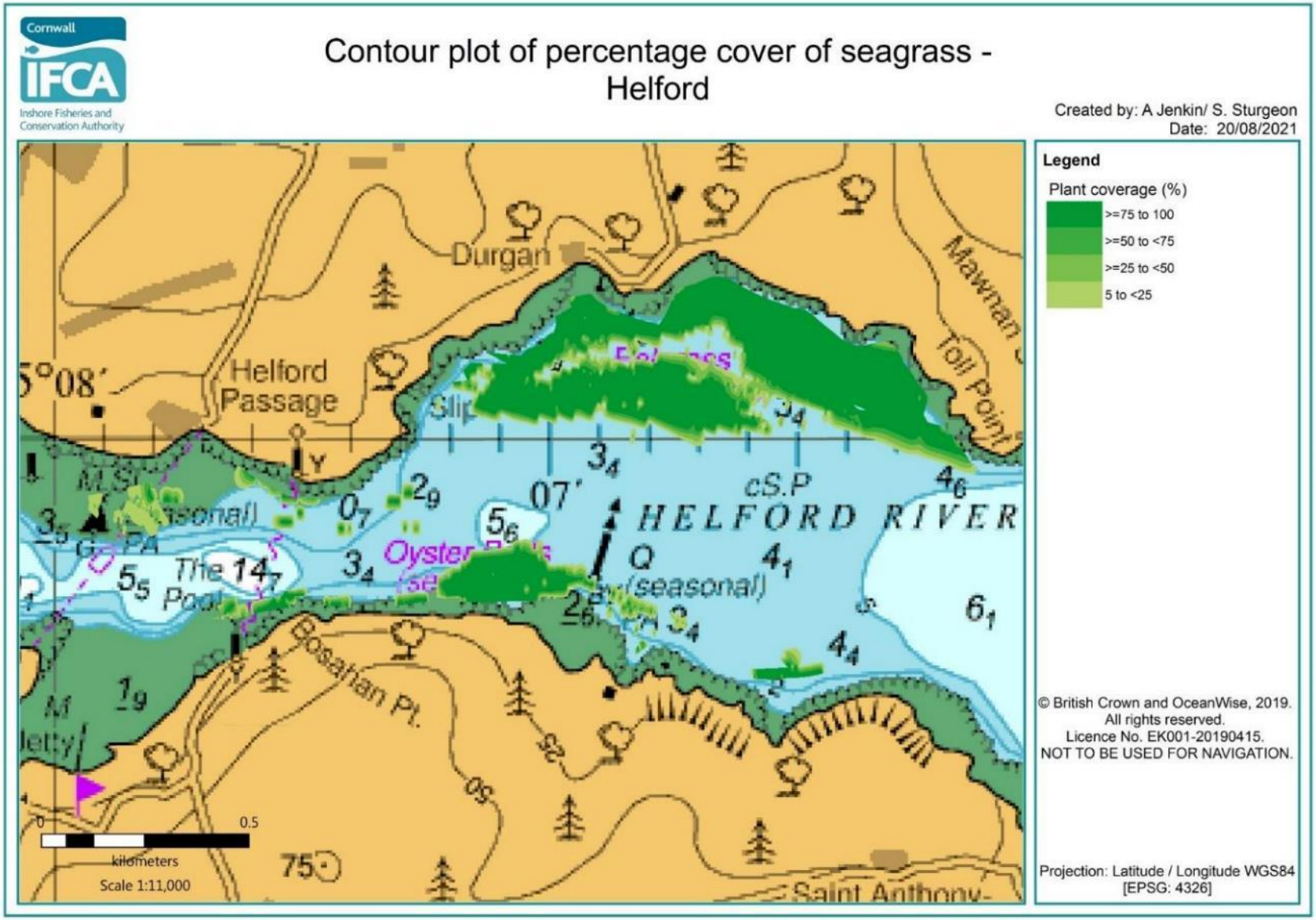

Figure 46: Contour plot displaying plant coverage (%) of seagrass (*Zostera marina*) completed in the Helford River using an MX Echosounder by Cornwall IFCA 2021

8.9 Porthallow

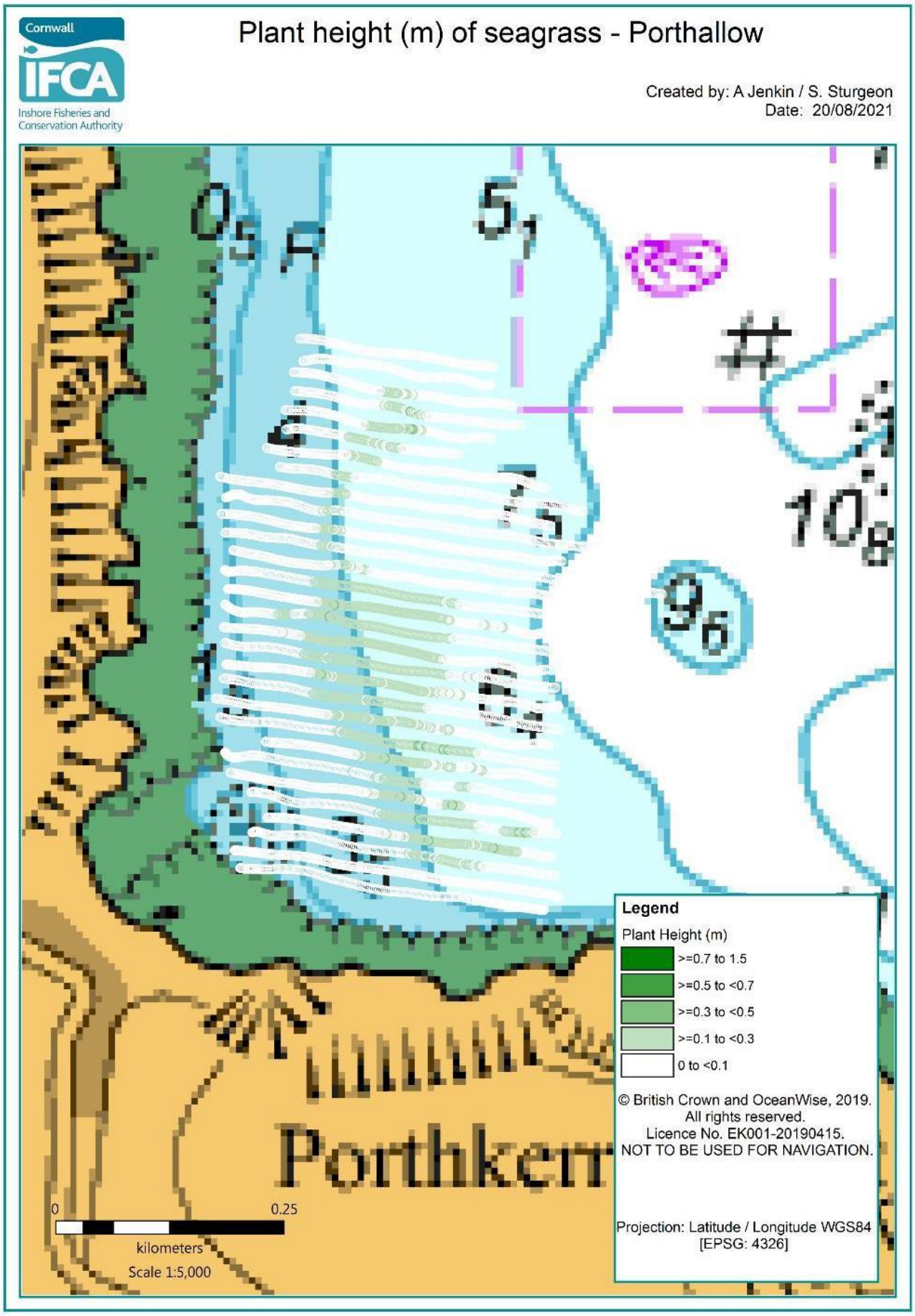

Figure 47: Plant height (m) of seagrass (*Zostera marina*) completed at Porthallow using an MX Echosounder by Cornwall IFCA 2021

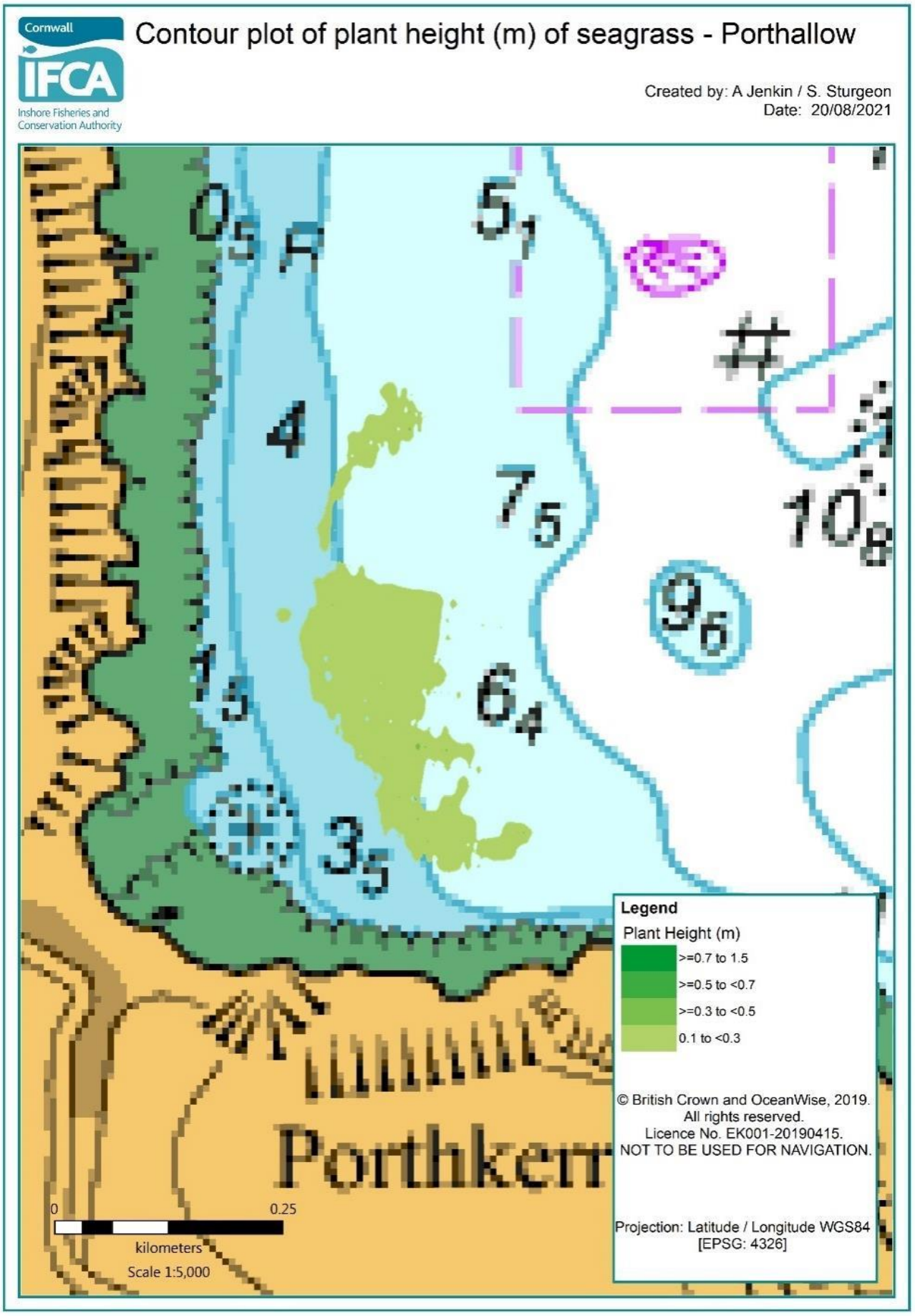

Figure 48: Contour plot displaying plant height (m) of seagrass (*Zostera marina*) completed at Porthallow using an MX Echosounder by Cornwall IFCA 2021

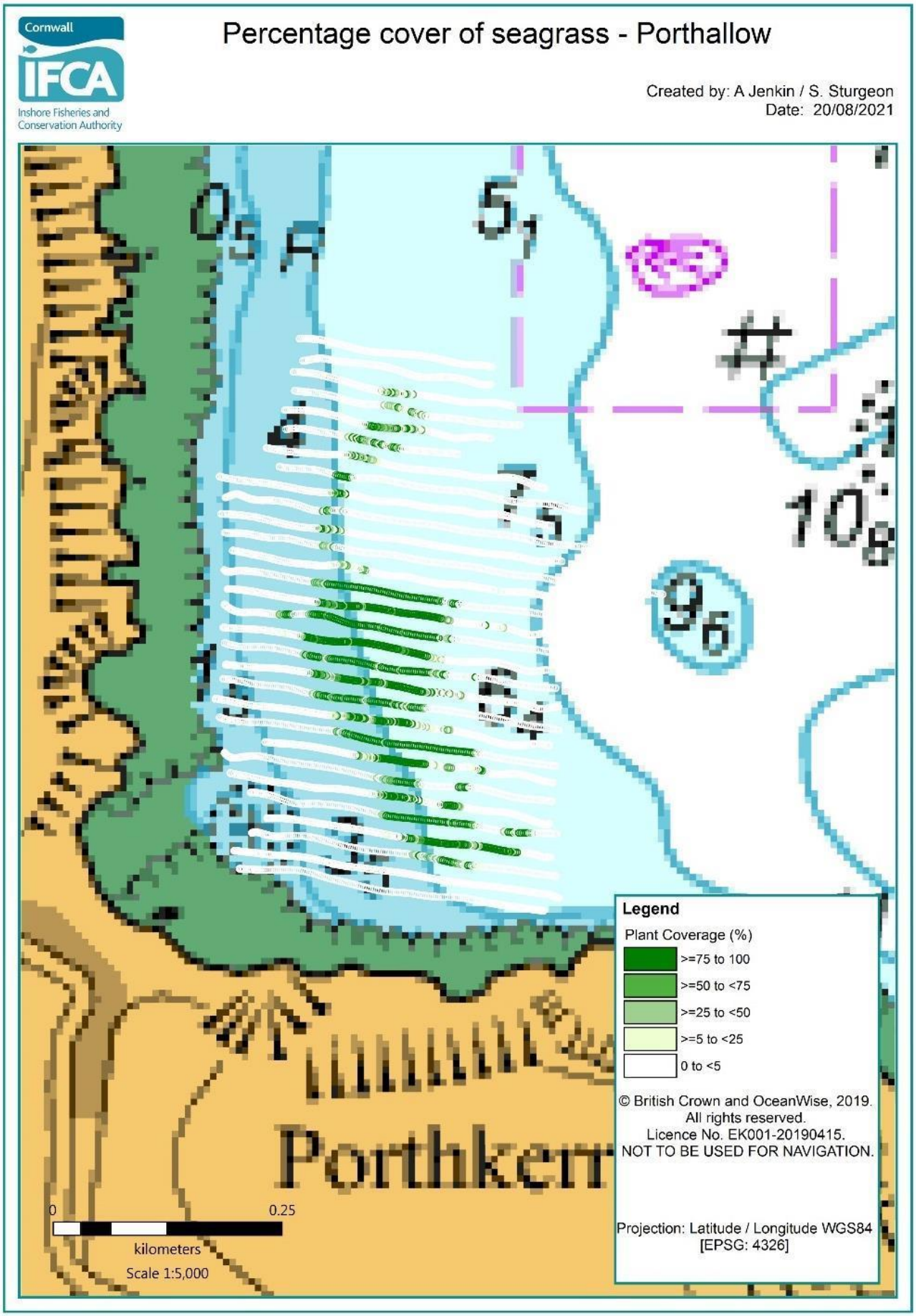

Figure 49: Plant coverage (%) of seagrass (*Zostera marina*) completed at Porthallow using an MX Echosounder by Cornwall IFCA 2021

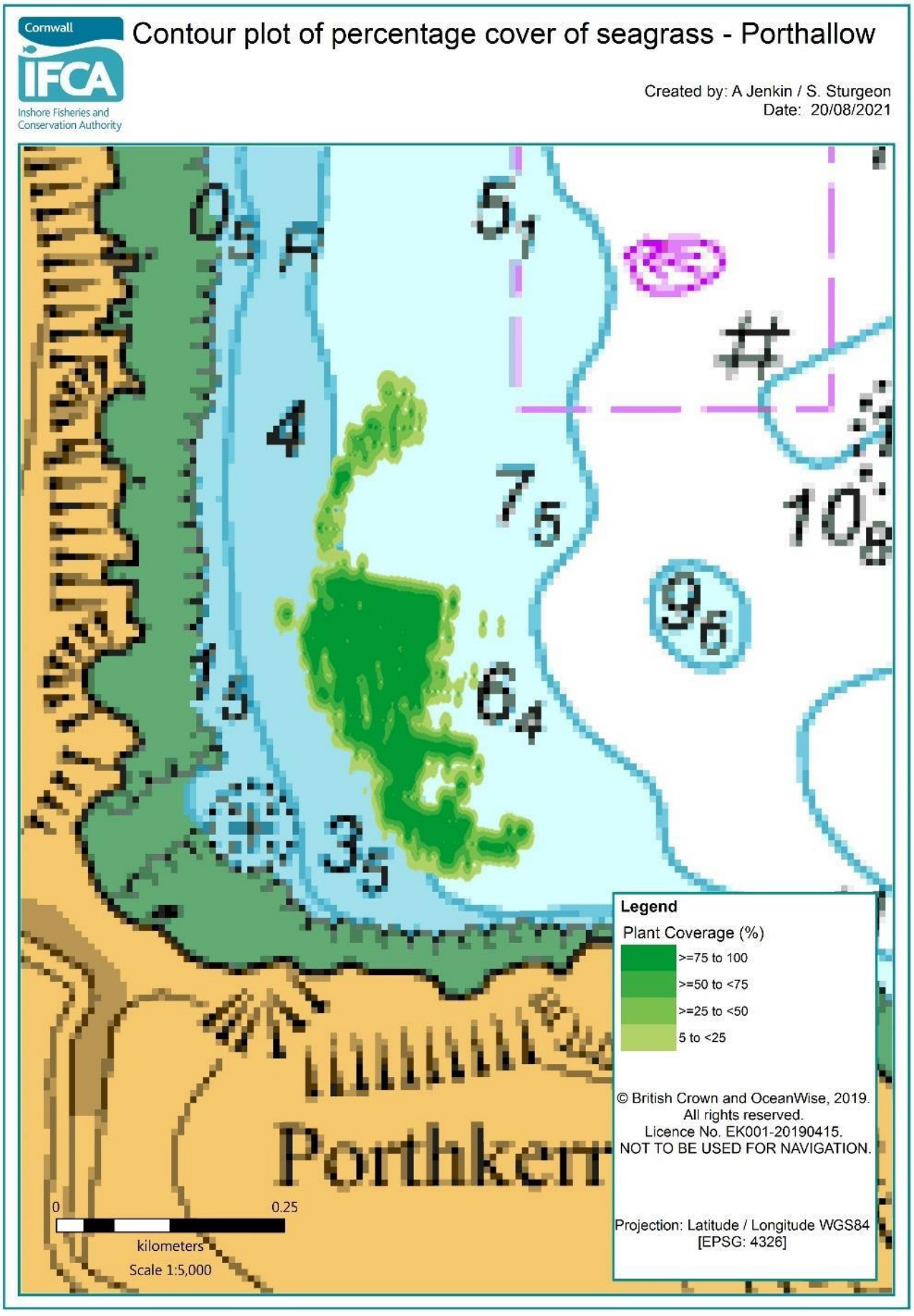

Figure 50: Contour plot displaying plant coverage (%) of seagrass (*Zostera marina*) completed at Porthallow using an MX Echosounder by Cornwall IFCA 2021

8.10 Area (ha) of seagrass surveyed

The area (ha) of plant coverage >=5% to 100% was calculated by converting the raster from the percentage coverage using the polygonise tool in MapInfo Professional Advanced (Version 17.0.4) to draw a polygon displaying seagrass coverage from >=5 to 100%.

The area (ha) of plant coverage >=5% to 100% for the seagrass within the Fal and Helford SAC is shown in Table 4. The total area (ha) of seagrass was calculated as 127.37.

Table 4: The area (ha) of seagrass >=5% to 100% plant coverage of seagrass within the Fal and Helford Special Area of Conservation as surveyed by Cornwall IFCA 2021

Seagrass bed	Area (ha) of seagrass >=5% to 100% plant coverage
Penarrow Point	9.38
Flushing	3.43
St.Mawes Bank	3.77
St.Mawes	29.87
Gyllyngvase	2.36
Swanpool	5.41
Maenporth	31.86
Helford	35.40
Porthallow	5.89

9 Discussion

The 2021 survey of the Fal and Helford SAC seagrass beds provided an updated extent and plant height (cm) and plant coverage (%) for the University of Exeter. A number of the seagrass beds are larger than previously mapped, this is likely to be because the full extent of these areas had not been surveyed previously. A known seagrass bed exists at Parbean cove (Ecospan, 2015) however due to the draught of R/V Tiger Lily VI it was not possible to survey the bed safely as part of this project. Another potential area of seagrass could be seen to the east of the pontoon at Ponsharden Boatyard using the MapBox satellite imagery used as the background in the GPSLive platform. This was not surveyed as part of this project as it was out of the scope of work but if there is available time, it may be investigated to provide a full picture of seagrass occurrence in the SAC .

A number of mooring blocks present within the seagrass beds were clearly visible on the Visual Aquatic with a gap in the seagrass and a hard, raised signature in the gap, an example is shown in Figure 51.

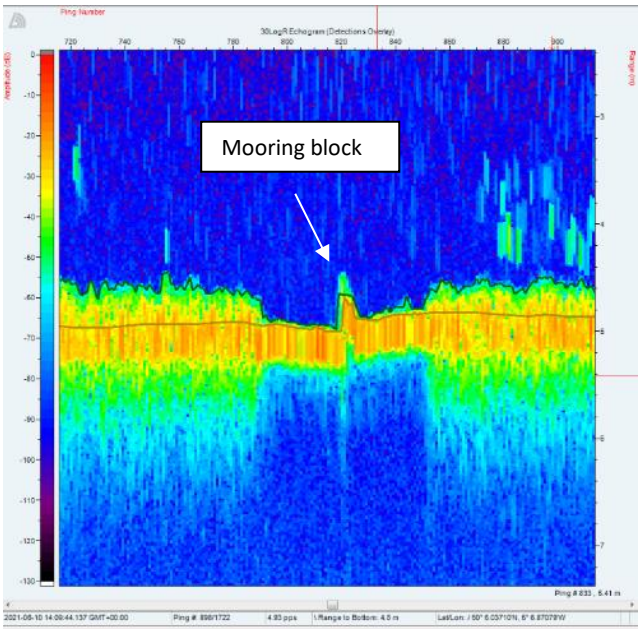

Figure 51: Mooring block visible within a seagrass bed as seen on Visual Aquatic by BioSonics software.

The extent of the seagrass within the Fal and Helford SAC was calculated as 127.37 ha. The previous extent of the seagrass beds was also calculated as 127.37 ha (Natural England, 2021; Cornwall Wildlife Trust, 2004; Moore *et al.*, 1999, Curtis, 2015). The extent of each individual bed has changed and the bed at Parbean cove was not surveyed as part of this project but the overall extent (ha) of the beds within the SAC is the same as last surveyed.

10 Limitations

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

- It was frequently hard to determine if seagrass or other vegetation were present.
- In areas where *Sargassum muticum* is growing within a seagrass bed, it is sometimes hard to pick out the plant height (m) of the seagrass beds
- The plant height (m) may not be the absolute plant height as some areas were surveyed over 2 hours either side of high or low water.

- Areas where seagrass is growing amongst algae (Figure 52) such as thong weed and *Ulva* sp. it isn't possible to pick out the seagrass using the MX alone.

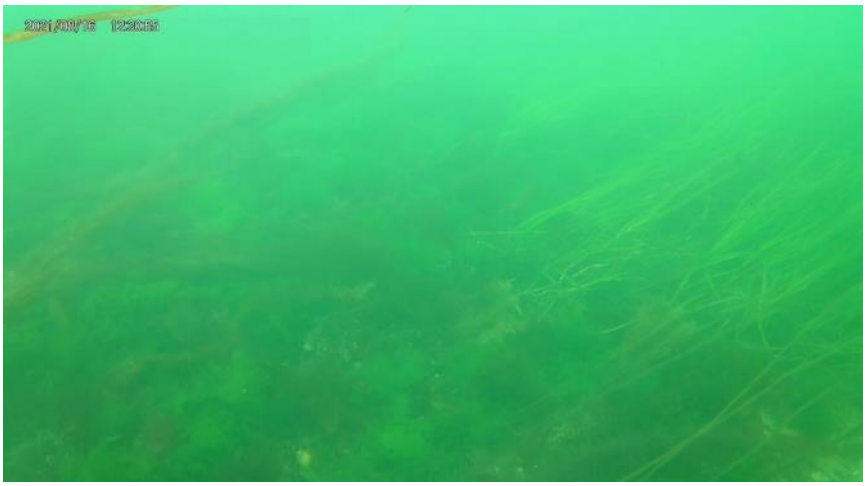

Figure 52: A patch of seagrass within an area of algae recorded on an HDCAM by Cornwall IFCA.

- Small isolated patches of seagrass within areas of algae or subtidal sand could have been missed during data collection or removed during processing.
- The video imagery was limited positionally by drifting with the tide and was often limited visually making it hard to see what was present in the videos.
- The landward extent of some seagrass beds may not be fully mapped as the draught of the vessel limited how shallow the vessel can go.
- Survey is based on historic beds so there may not be other areas within the Fal and Helford containing seagrass which were not surveyed as part of this project.
- Lack of 4G in some survey areas meant to the scientific officers working at home lost contact with the vessel.
- One of the HD Cameras used to ground-truth potential areas of seagrass was temperamental and often shut down when being used and for both cameras, the battery life was found to be limited.
- The ROV position was accurate at SOL and was piloted on a steady bearing for 80 m of cable. The EOL position however would be at a position that would be at the bisect point of a line drawn from the SOL using the main heading of the vehicle and a radius of 80 m centred on the EOL position.
- If vessels pass by and cause a wake this causes 'waves' in the data which makes it hard to determine if seagrass is present.

11 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.

12 References

Cornwall Council, 2021. Carbon accounts for eelgrass beds in Fal and Helford Estuaries, Cornwall Environment Service, Cornwall Council.

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Curtis, L. A. 2015. Fal and Helford SAC: Subtidal Seagrass Condition Assessment 2015: Ecospan Environmental Ltd.

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Moore, J., Smith, J. and Northen, K. O. 1999. Marine Nature Conservation Review: Sector 8. Inlets in the western English Channel : area summaries Peterborough: Joint Nature Conservation Committee (JNCC).

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 Echsounder Systems.

13 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.

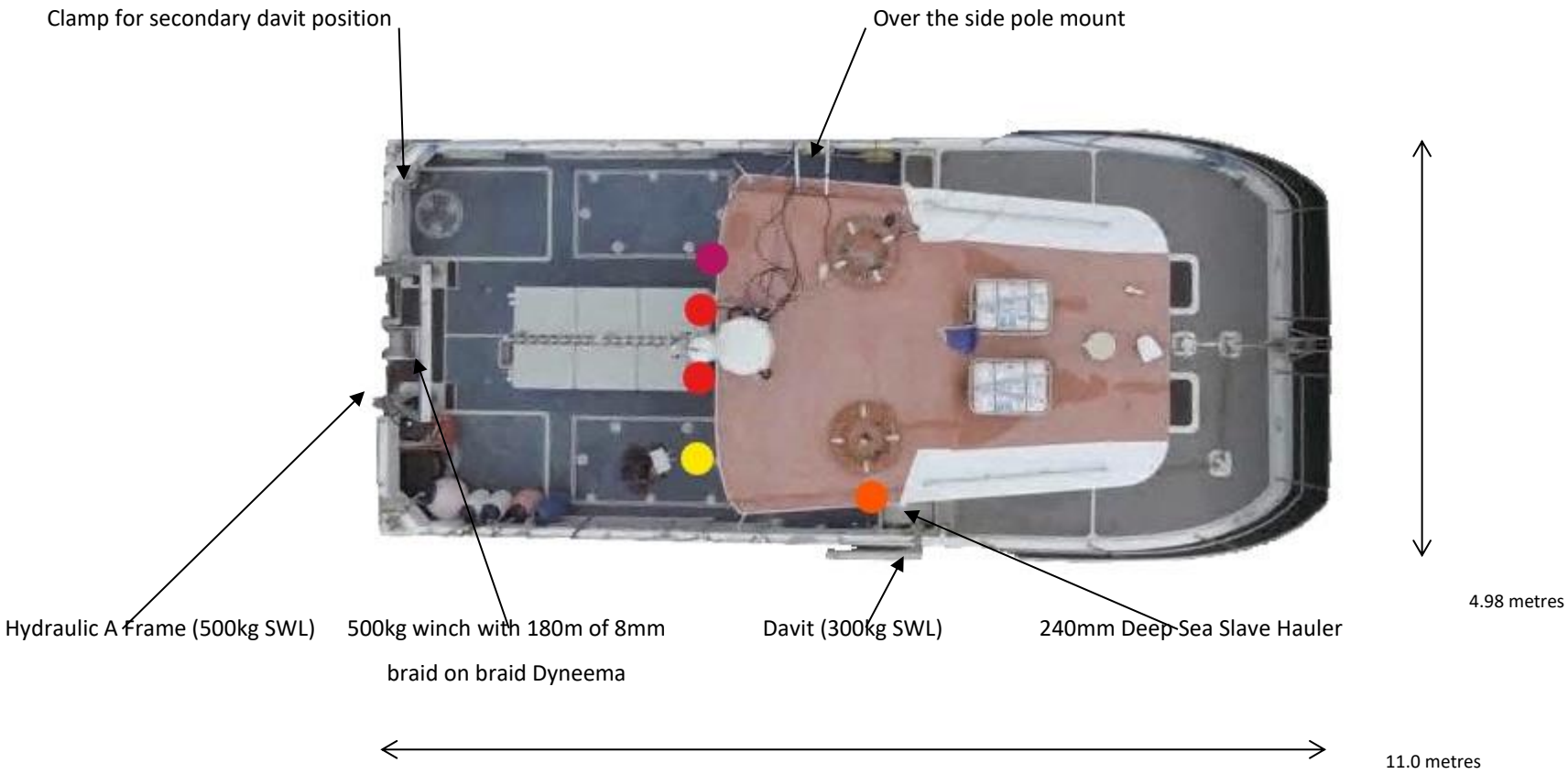
Annex Figure A: Cornwall IFCA's dedicated survey vessel, R/V Tiger Lily VI.

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

MX Aquatic Habitat Echosounder

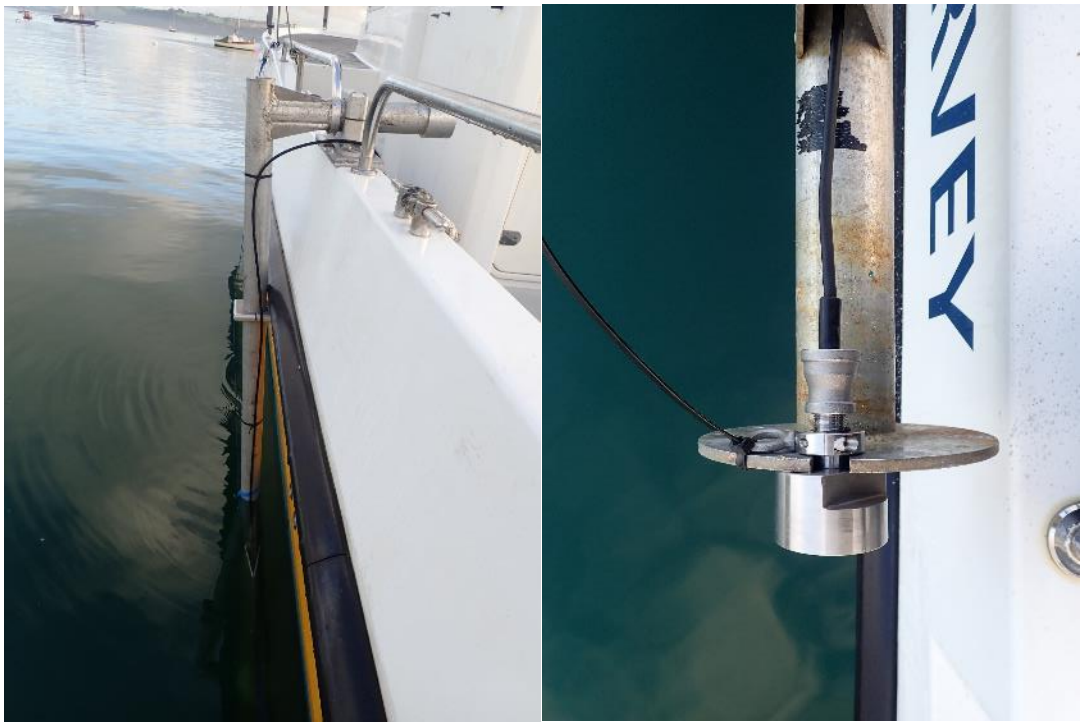
Details of the system are shown in Annex Table A and are available online:

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



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

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

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

VideoRay Pro 4 ROV

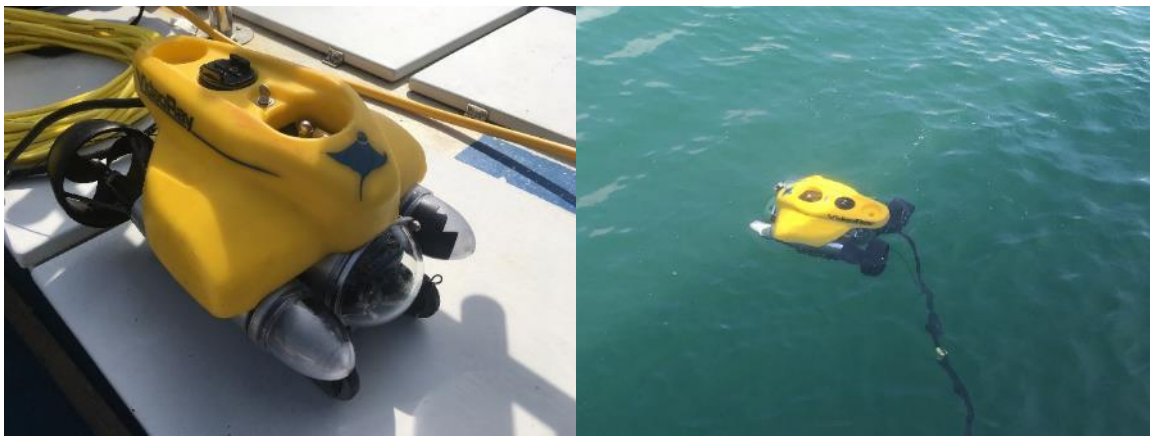
The ROV system is a Pro 4 IP-65 Base ROV System with advanced port security operations.

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

https://videoray.com/rovs/videoray-pro-4/pro-4-ip-65-control-panel.html#!IP65_Front

Annex Table C: Equipment specification of the VideoRay Pro 4 ROV

Specification	Details
Manufacturer	VideoRay
Depth rating	305 m
System weight	38.5 kg
Propulsion	3 thrusters (2 horizontal/ 1 vertical)
Lighting	Optimized LED arrays
Integrated sensors	Accelerometer: 3d Tilt Compensated Compass Leak indicator: Internal temperature Depth sensor: MEMS Gyro Temperature: System voltage
Camera	High resolution Colour or Black and White Wide dynamic range Digital slow shutter White balance 20+ real time camera settings
Tether	140 m of tether in 2 lengths: 100m of standard neutrally buoyant and 40 m of neutral performance tether
Port and Security Additions	Hull crawler which latches on to ships hulls in high current conditions for stable video inspections Rotating manipulator arm which rotates 360° and features 5 difference jaws that cab grab, scoop, cut or retrieve objects up to 45 kg or collect samples up to45 ml Extrernal camera which can be mounted in any direction on top of the sub to provide an alternate view



Annex Figure D: VideoRay Pro 4 Remotely Operated Vehicle deployed from R/V Tiger Lily VI

Sport Action Camera – AKASO EK7000

Details of the system are shown in

https://www.akasotech.com/ek7000

Annex Table D and are available online:

https://www.akasotech.com/ek7000

Annex Table D: 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