



Manacles MCZ Side-scan Sonar and Drop Down Video Survey 2016



Survey Field Report for the 2016 Manacles Side-scan Sonar and Drop Down video survey

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

Authors: Annie Jenkin, Hilary Naylor, Colin Trundle, Kimara Street and
Ryan Mathews.

Document History			
Version	Date	Author	Change
0.1	27/09/2016	H Naylor	Initial draft
0.2	28/09/2016	H Naylor	Additions to final draft
0.3	29/09/2016	C Trundle	Additions and minor amendments
0.4	04/10/2016	C Trundle	Additions and minor amendments
0.5	28/02/2017	H Naylor	QA
0.6	26/03/2018	A Jenkin	Amendments to introduction, methodology, addition of position information, GIS plots, equipment specifications and discussion
0.7	05/07/2018	A Jenkin	Final QA

Cited as:

Jenkin, A., Naylor, H., Trundle, C., Street, K and Mathews, R. 2017. Manacles MCZ Drop Down Video Survey. Cornwall Inshore Fisheries and Conservation Authority (Cornwall IFCA), Hayle.

This document has been produced by Cornwall Inshore Fisheries and Conservation Authority (Cornwall IFCA)

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

Tel: 01736 336842 Email: enquiries@cornwall-ifca.gov.uk

Contents

List of Figures	iii
List of Tables	iii
1 Project Background	iv
1.1 Aims and objectives.....	2
1.1.1 Aims.....	2
1.1.2 Objectives.....	2
2 Methodology	3
2.1 Survey area.....	3
2.2 Vessel Specification	3
2.3 Personnel.....	4
2.4 Personal Protective Equipment (PPE)	4
2.5 Acoustic Survey	4
2.5.1 Equipment specification.....	4
2.5.2 Methodology.....	6
2.5.3 Data processing.....	6
2.6 Drop Down Video (DDV) Survey.....	7
2.6.1 Equipment specification.....	7
2.6.2 Methodology.....	8
2.6.3 Data handling	8
2.7 Proposed sites for the DDV survey.....	9
3 Results.....	10
3.1 Side-scan sonar (SSS).....	10
3.2 Drop Down Video (DDV).....	12
3.3 Site descriptions	14
3.4 Anthropogenic Impacts	23
4 Discussion	23
5 Limitations	23
6 References	24
7 Appendices	25
Annex 1 – RV Tiger Lily Deck Plan & Offsets	25
Annex 2 – Daily Logs	27
Annex 3 – Video position data from the drop down video survey in the Manacles.....	30
Annex 4 – Still image locations and metadata from the drop down video survey in St.Austell Bay	32

List of Figures

Figure 1: The boundary of the Manacles Marine Conservation Zone (MCZ) in south-west England (Source: The Manacles designation map (Defra, 2013b)).	1
Figure 2: The Manacles survey area for the side-scan sonar and drop down video survey Cornwall IFCA carried out in 2016.	3
Figure 3: Cornwall IFCA's dedicated survey vessel, R/V Tiger Lily VI.	4
Figure 4: Images of the Edgetech 4200 side-scan sonar in preparation for deployment from the Cornwall IFCA survey vessel R/V Tiger Lily.	5
Figure 5: SeaSpyder drop camera housed in a purpose built frame on the aft deck and in the deployment position onboard R/V Tiger Lily VI.	7
Figure 6: The processed side-scan mosaic created from data collected on the 3 rd March 2016 by Cornwall IFCA within the Manacles MCZ overlaid onto the relevant Hydrographic Office chart.	11
Figure 7: The location of tows and still images from the drop down video survey carried out by Cornwall IFCA in 2016 within the Manacles MCZ.	13
Figure 8: Station overview including habitat classification with still images from a side-scan survey and drop down video survey for Tow 1 in the Manacles MCZ	15
Figure 9: Station overview including habitat classification with still images from a side-scan survey and drop down video survey for Tow 2 in the Manacles MCZ	16
Figure 10: Station overview including habitat classification with still images from a side-scan survey and drop down video survey for Tow 3 in the Manacles MCZ	17
Figure 11: Station overview including habitat classification with still images from a side-scan survey and drop down video survey for Tow 4 in the Manacles MCZ	18
Figure 12: Station overview including habitat classification with still images from a side-scan survey and drop down video survey for Tow 5 in the Manacles MCZ	19
Figure 13: Station overview including habitat classification with still images from a side-scan survey and drop down video survey for Tows 6, 6b, 6c and 6d in the Manacles MCZ	20
Figure 14: Station overview including habitat classification with still images from a side-scan survey and drop down video survey for Tow 7 in the Manacles MCZ	21
Figure 15: Station overview including habitat classification with still images from a side-scan survey and drop down video survey for Tow 8 in the Manacles MCZ	22

List of Tables

Table 1: The designated features and their general management approach of the Manacles Marine Conservation Zone.	2
Table 2: Details of the side-scan sonar system used for the side-scan survey carried out by Cornwall IFCA.	6
Table 3: The camera equipment specifications.	7
Table 4: The proposed camera sites for a survey carried out by Cornwall IFCA within the Manacles	9
Table 5: Daily log from survey carried out onboard R/V Tiger Lily on 3 rd March 2016.	27
Table 6: Daily log from survey carried on board R/V Tiger Lily on 16 th May 2016.	28

Glossary of terms and abbreviations

Anthropogenic Produced or caused by human activity

DDV Drop down video

IFCA Inshore Fisheries and Conservation Authority

MCZ Marine Conservation Zone

SSS Side-scan sonar

UTC Coordinated Universal Time

1 Project Background

Cornwall Inshore Fisheries and Conservation Authority (Cornwall IFCA) carried out a habitat mapping survey consisting of an initial acoustic survey followed by a remote underwater video survey with stills imagery. The acoustic survey was carried out using side-scan sonar (SSS) and the video and stills were collected using drop-down video (DDV). The survey was carried out onboard Cornwall IFCA’s survey vessel R/V Tiger Lily VI.

The main objective of the survey was to determine the distribution and extent of habitats, including maerl within the Manacles Marine Conservation Zone (MCZ). The survey was carried out in areas of the site which had not previously been surveyed during the MCZ designation process.

The Manacles MCZ is located in south-west England (approximately 10 km south of Falmouth), on the east coast of the Lizard Peninsular (Figure 1). The MCZ covers 3.5 km² and has a depth range of approximately 14 to 57 metres. The Manacles have been extensively studied and are known to cover an area that is rich in marine biodiversity and the MCZ consists of a variety of habitats including sedimentary habitats, vertical rock faces and rocky reefs that all support a number of highly sensitive features (Defra, 2013a).

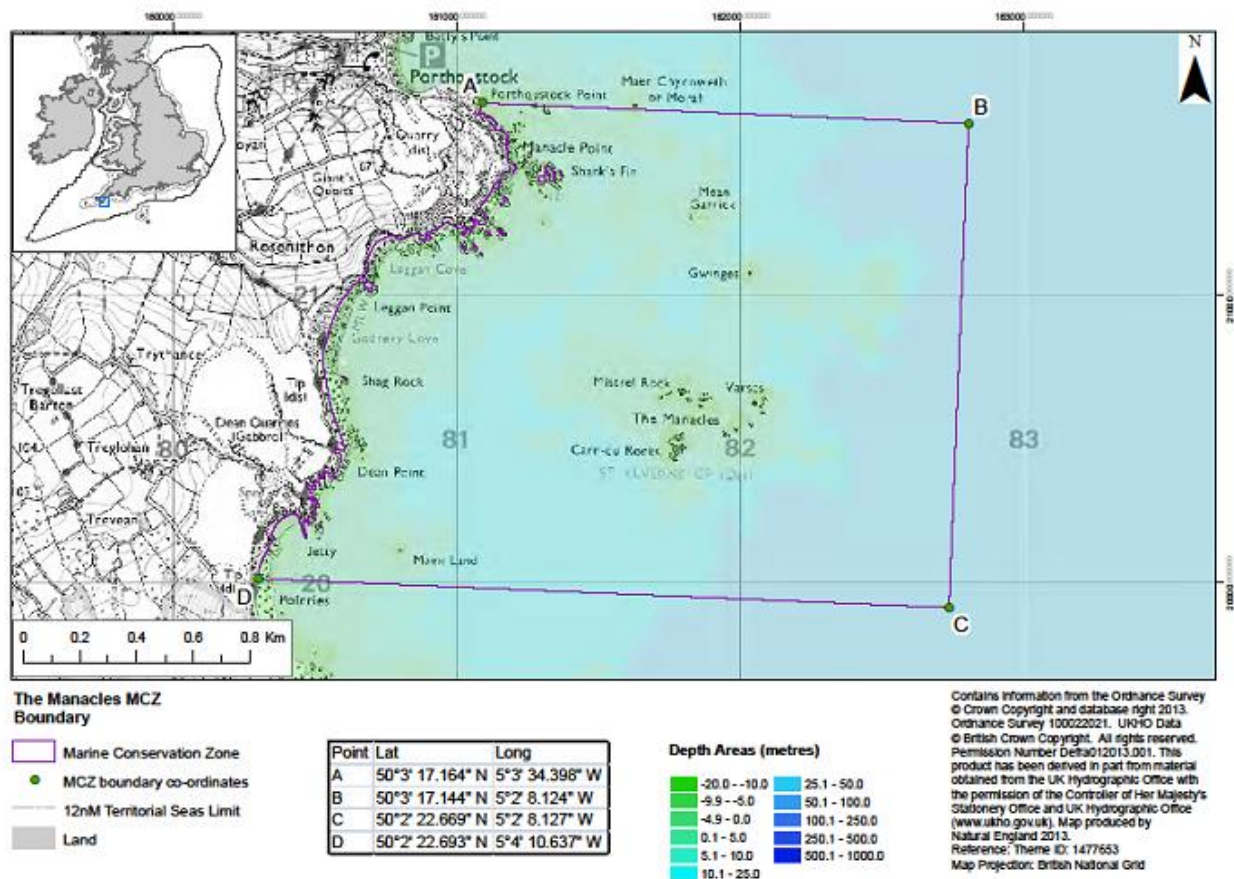


Figure 1: The boundary of the Manacles Marine Conservation Zone (MCZ) in south-west England (Source: The Manacles designation map (Defra, 2013b)).

Maerl beds are a designated feature of the MCZ site and have a conservation objective of ‘recover to favourable condition’. The other designated features of the MCZ and their conservation objectives are shown in Table 1.

Maerl is a collective term for various species of non-jointed red coralline algae (Hall-Spencer *et al.*, 2010; Grall and Hall-Spencer, 2003) that live unattached and can consist of either live or dead accumulations (Hall-Spencer *et al.*, 2010). They provide complex and extensive habitats which create important ecosystems because of their increased surface area, food availability, provision of shelter and a safe refuge for juveniles as well as a higher species diversity and richness (JNCC, 2015; Friedlander *et al.*, 2003). Maerl beds grow as unattached nodules on the seabed, especially in areas of coarse clean sediments or muddy mixed sediments which typically occur either on the open coast, in tide-swept channels or in sheltered areas of marine inlets with weak currents (Hall-Spencer *et al.*, 2010; Hall-Spencer *et al.*, 2008). Maerl requires light to photosynthesise and is therefore found in shallow waters to a maximum of 40m (Hall-Spencer *et al.*, 2010).

A number of past studies indicate that maerl beds have declined in both extent and quality mainly caused by anthropogenic impacts, this is in part due to the slow growth rate of the species (Bosence and Wilson, 2003) and the hard exoskeleton which is vulnerable to damage by abrasion and physical disturbance and changes to its environment (Hall-Spencer *et al.*, 2010).

Table 1: The designated features and their general management approach of the Manacles Marine Conservation Zone.

Features	General Management Approach
Intertidal coarse sediment	Maintain in favourable condition
Subtidal sand	Maintain in favourable condition
Subtidal macrophyte dominated sediment	Recover to favourable condition
Moderate energy intertidal rock	Maintain in favourable condition
Moderate energy infralittoral rock	Maintain in favourable condition
Moderate energy circalittoral rock	Maintain in favourable condition
Maerl beds	Recover to favourable condition
Sea-fan anemone (<i>Amphianthus dohrnii</i>)	Maintain in favourable condition
Spiny lobster (<i>Palinurus elephas</i>)	Recover to favourable condition
Stalked jellyfish - <i>Haliclystus</i> spp.	Maintain in favourable condition

1.1 Aims and objectives

1.1.1 Aims

- Use acoustic methods to determine the extent and distribution of broadscale habitats, including maerl within the Manacles MCZ.
- Confirm the presence and distribution of the maerl feature and habitat present within the Manacles MCZ using underwater video and still imaging methods.

1.1.2 Objectives

- To produce high quality acoustic imagery using SSS that can be used to identify habitats, including maerl within the MCZ.

- To ground truth the acoustic data using a DDV survey in an area of the Manacles MCZ that had not been previously surveyed.

2 Methodology

The survey was carried out in line with Mapping European Seabed Habitats (MESH) recommended operating guidelines for SSS surveys (Henriques *et al.*, 2013) and operating guidelines for underwater video and photographic imaging techniques (Coggan *et al.*, 20017).

2.1 Survey area

The Manacles survey site is shown in Figure 2.

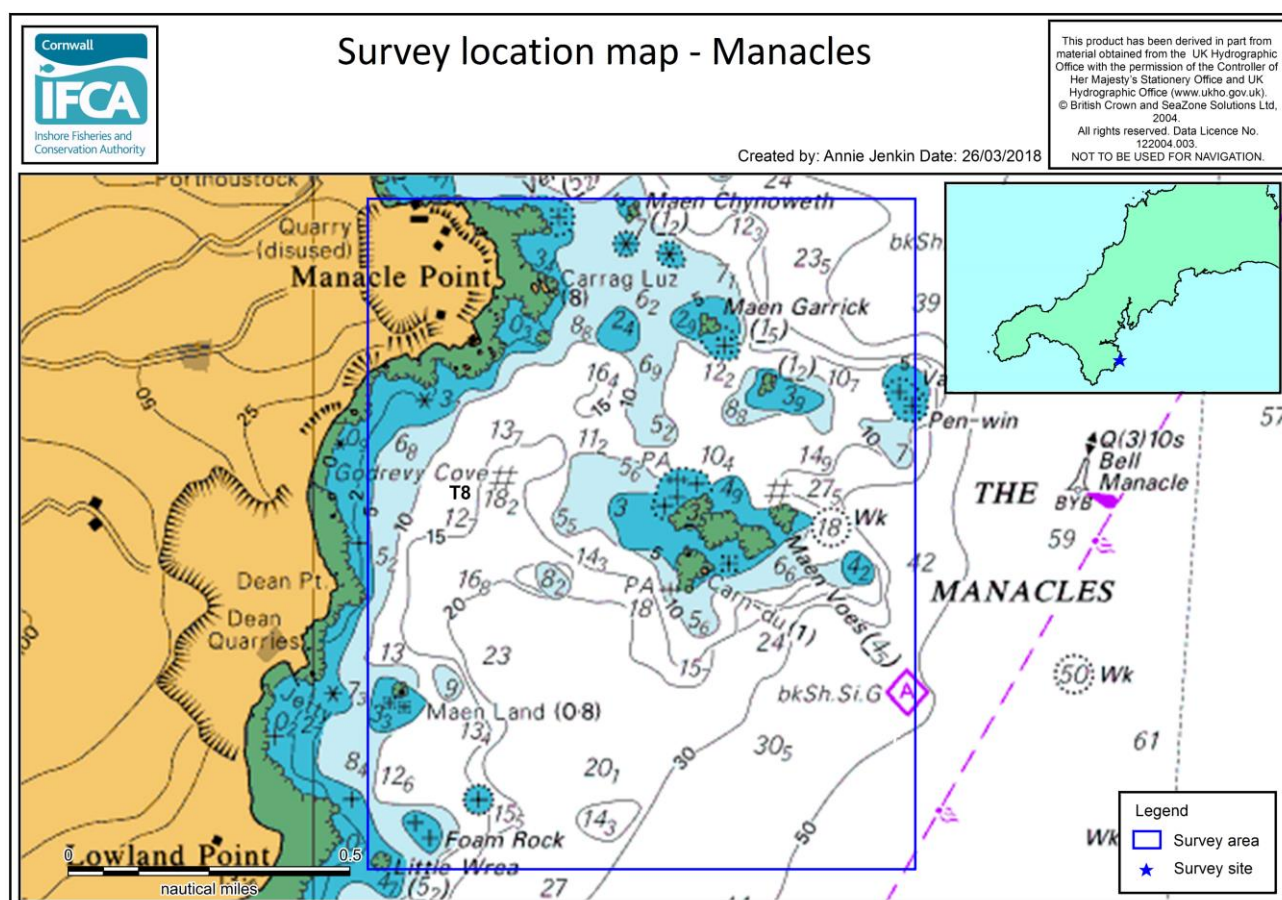


Figure 2: The Manacles survey area for the side-scan sonar and drop down video survey Cornwall IFCA carried out in 2016.

2.2 Vessel Specification

Both surveys were undertaken from Cornwall IFCA's Research Vessel (R/V) Tiger Lily VI (Figure 3). This vessel has been refitted for survey work and includes a purpose built survey station within the wheelhouse (See Annex 1). R/V Tiger Lily VI has been fitted with an inverter and uninterruptable power supply (UPS) to provide stable 240 v power, NMEA outputs and a dedicated GPS with WAAS enabled. All position information was recorded in the Long/Lat WGS84 projection and taken from a single GPS (Furuno GP-32). 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.

Tiger Lily VI is an MCA coded Cat 2 vessel and is fitted with all necessary safety equipment including life rafts, first aid kits and fire suppression systems.



Figure 3: Cornwall IFCA's dedicated survey vessel, R/V Tiger Lily VI.

2.3 Personnel

The crew during the surveys consisted of the skipper and up to four scientific officers. The crew roles rotated during the surveys and roles included deploying and recovering the SSS and DDV units, maintaining observation of the topside SS waterfall display, keeping a log and controlling the camera and video topside units.

2.4 Personal Protective Equipment (PPE)

Appropriate safety footwear and lifejackets with personal location beacons (PLBs) were worn at all times by members of the survey team whilst working on deck. Hard hats were worn during deployment and recovery of the SSS and DDV and the stern door was closed when the tow fish was in the water or on the deck and only opened during deployment and recovery. No accidents or near misses were reported.

2.5 Acoustic Survey

2.5.1 Equipment specification

An acoustic survey was carried out using a SSS. The SSS system works by emitting an acoustic signal that interacts with the seafloor and returns a signal which is interpreted based on its strength. Based on the reflectivity, different sediment types can be seen.

An EdgeTech 4200: Dual Frequency SSS System (Figure 4), with 300/600 kHz operating frequencies was used to capture acoustic imagery of the seabed. The SSS comes accompanied with a portable topside processor with laptop running windows 7 and EdgeTech Discover software for data capture. The add on, Discover Coverage, was used to enable the skipper to keep note of the seabed coverage of the acoustic swathe. The acoustic data was captured in both .jsf and .xtf file formats.

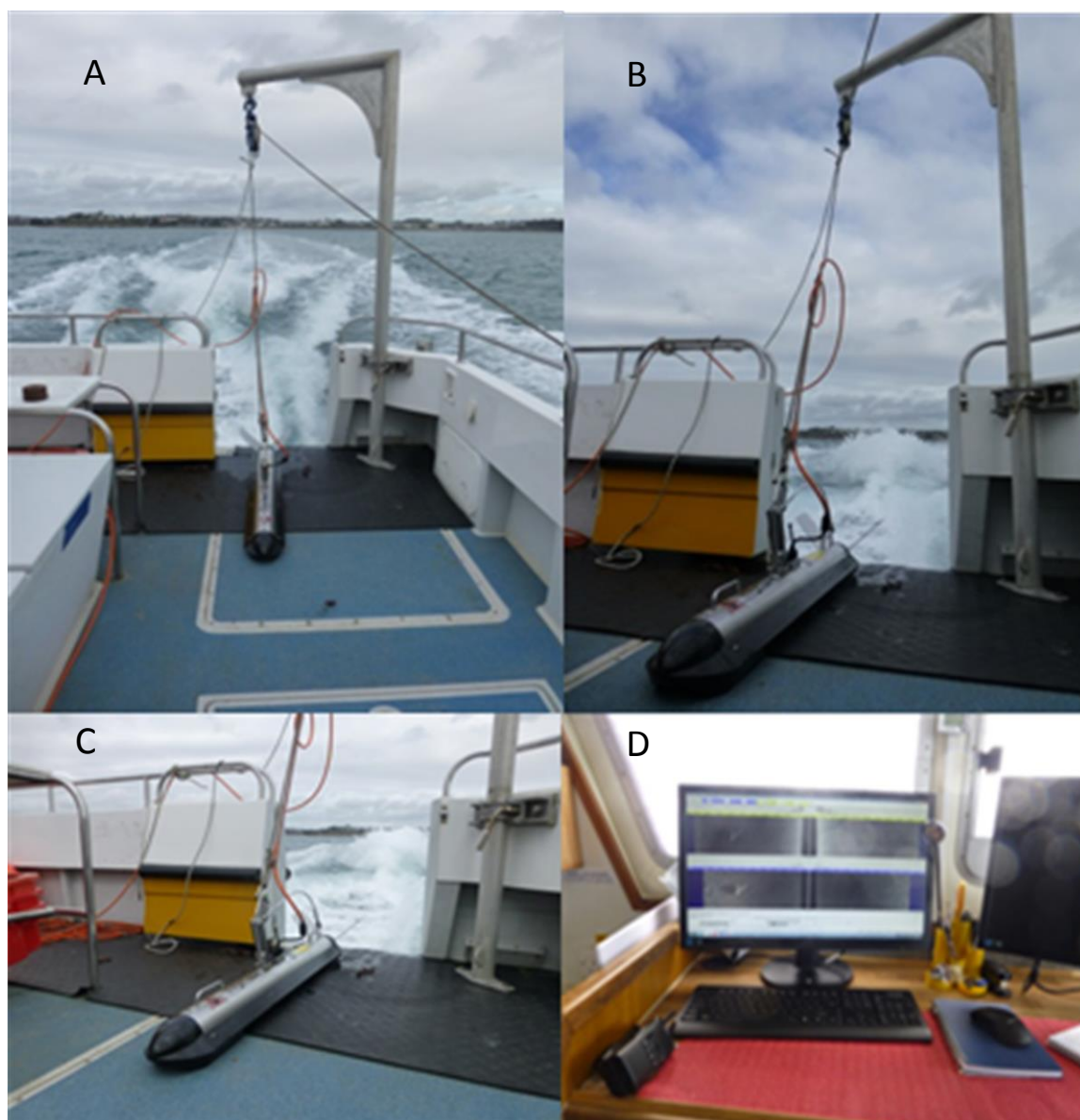


Figure 4: Images of the Edgetech 4200 side-scan sonar in preparation for deployment from the Cornwall IFCA survey vessel R/V Tiger Lily.

The equipment specifications of the side-scan sonar system are shown in Table 2. Details of the system are available online: <http://www.edgetech.com/pdfs/ut/4200-Brochure-122012.pdf>

Table 2: Details of the side-scan sonar system used for the side-scan survey carried out by Cornwall IFCA

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

2.5.2 Methodology

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 location, the SSS was deployed into the water from a davit point located on the stern port quarter. The SSS was then towed on a trial run to determine the correct gain and time viable gain (TVG) levels, after the trial run the settings were kept constant. This allowed for direct comparison between SS imagery on different survey days. The depth of the SSS was changed by altering the amount of tow line fed away via a hydraulic winch, the altitude (height above the seabed) of the tow fish was determined by the depth of the seabed from the sounder. A best suited altitude (10% of the desired range) was applied where possible. The survey speed (speed over ground SOG) was kept constant at 5.0 knots where possible which was determined to be the best speed on the trial run. Upon completion of the trial run, the vessel transited to the survey site. The stern door was closed when the SSS was in the water or on the deck and only opened for deployment and recovery. Once the SSS and the crew were happy with the in-situ outputs, the SSS was towed into position in line with the start of the first transect. When the vessel was on a steady course and the speed was constant, the start of line (SOL) was recorded. It was decided on the day that it would be easier to capture data by recording continuously.

Transects were pre-determined in areas of potential maerl but could be changed if necessary due to the strong tidal currents which can be un-predictable around the Manacles.

2.5.3 Data processing

High frequency data and low frequency data were both recorded at the same time. Data was saved in-situ onto the dedicated Edgetech side-scan laptop and backed up to an external hard drive at the end of each survey day. The settings on the side-scan on the day of sampling for the high frequency were Gain = +23 and TVG = +38 and for the low frequency were Gain = +0 and TVG = +33.

The .xtf data was then post processed using CodaOctopus:GEO (GeoSurveyTM v6.1.2). The acoustic image data was adjusted (TVG and image enhancement) to best quality applicable and then converted to a north-up geotiff file using GeoSurvey Mosaic software. The unusable data which was collected when the vessel was turning at the end of the lines or due to changes in bathymetry were excluded during this post processing stage.

Geotiff images were then imported into MapInfo Pro (v15.2.0) where they were corrected for geographic co-ordinate system Lat/Long WGS84.

2.6 Drop Down Video (DDV) Survey

2.6.1 Equipment specification

The camera used for the DDV survey was an STR SeaSpyder drop camera system contained in a custom built frame, allowing high resolution stills of the seabed to be taken using a surface controlled digital SLR camera (Figure 5). Separate real time video, with user-programmable overlay, allows positional information, time, bearing and depth to be recorded on the video output. Details of the system are available online: <http://www.str-subsea.com/sales/str-SeaSpyder-drop-camera-system>



Figure 5: SeaSpyder drop camera housed in a purpose built frame on the aft deck and in the deployment position onboard R/V Tiger Lily VI.

The camera equipment specifications are shown in Table 3.

Table 3: The camera equipment specifications

Equipment	Camera System
Manufacturer	SeaSpyder
Video	HD video 600 lines PAL
Stills	18 mega pixels
Trigger	Remote from deck
Height control	Video footage
Lighting	Four high density LED 20w lamps
Scale bar	4 Dual lasers for precise imagery scaling
Trigger	Remote from deck
Additional info	<ul style="list-style-type: none"> • Full remote control of camera functions including automatic and manual focus control • 'On-the-fly' image download • High speed digital telemetry link to camera and sensors • High power underwater flash

2.6.2 Methodology

The DDV survey was planned from the results of the acoustic survey which was carried out on 3rd March 2016. Sites were chosen across areas with potential maerl from the SS mosaic. Each proposed position was transferred to the vessel's Olex navigation plotter and a 150 metre radius added. The radius was added to enable a drift tow to pass over the identified position regardless of direction.

Prior to the deployment of the SeaSpyder for each transect, the video text overlay was checked and adjusted to display the survey name and transect number (e.g. "20160516 Cornwall IFCA DDV_'Site_Location'_ 'Station_no.'_'Tow_no.'") and the GPS, heading and depth info was checked to ensure that it was updating correctly. The SeaSpyder camera was deployed from the starboard side davit of R/V Tiger Lily VI (see Annex 1) and lowered to the seabed. The video was set to record once the camera was on the seabed. A waypoint (mark) was created in OLEX to indicate the start of line (SOL); this was repeated at the end of line (EOL). The SeaSpyder was 'flown' with the frame legs just above the seabed and periodically landed on the seabed to allow a high quality still image to be taken. Still images were captured at a frequency of one every 60 seconds; images separation varied slightly to ensure that the stills taken were of good quality (e.g. taken when the frame was stable and the lens unobstructed) this sometimes led to a delay. Immediately upon having captured a stills image a waypoint (mark) was created in OLEX. The camera was recovered to deck in between each transect.

The survey was carried out in line with Mapping European Seabed Habitats (MESH) recommended operating guidelines for underwater video and photographic imaging techniques (Coggan *et al.*, 20017).

2.6.3 Data handling

OLEX navigation software was used to record the vessels track and waypoints/marks at the start and end of each transect and at the location of every stills image. These were transferred out of OLEX in .gz file format. The file was then extracted using 7-Zip (7-Zip V9.20) enabling it to be converted using OLEX to GPSU File Converter (OLEX to GPSU File Converter V1.05). The file could then be converted to a .txt file using Notepad. Once opened in Excel, the file had all irrelevant header data removed and appropriate field headers added. Once completed, the Excel file was transferred to the GI software and data points were created to show the position of each still image.

Stills images from the SeaSpyder camera were initially stored on the internal computer (sub-surface), then on completion of each transect, the still images were transferred to the SeaSpyder topside control unit using FileZilla and filed by transect number.

Video files were captured to the SeaSpyder topside unit data drive (D:/).

The stills and video files were transferred from the topside unit to a WD Passport for transport and storage.

2.7 Proposed sites for the DDV survey

The planned DDV locations for the Manacles and the rationale for each feature or target are shown in Table 4.

Table 4: The proposed camera sites for a survey carried out by Cornwall IFCA within the Manacles

Site	Latitude	Longitude	Reason for selecting target or feature
S1	-5.049418	50.04774	Possible maerl habitat
S2	-5.050242	50.049889	Transition across different sediment types and potential seagrass
S3	-5.053093	50.048496	Transition across different sediment types
S4	-5.047122	50.047649	Transition across different sediment types
S5	-5.051329	50.040633	Transition across different sediment types
S6	-5.053988	50.042968	Transition across different sediment types

3 Results

3.1 Side-scan sonar (SSS)

The SSS was carried out on the 3rd March 2016 and a total of 1.19km² was mapped acoustically. The SSS provides an acoustic description of the seabed. A harder substrate will return a stronger signal and will be represented as a lighter colour.

Different seabed types could clearly be seen from the SS mosaic. An overview of the SS mosaic for the whole site is shown in Figure 6. The acoustic survey showed that the seabed is a mosaic of fine sediment, coarse sediment of pebbles and shell fragments, coarse sediment of cobbles and boulders and areas of bedrock.

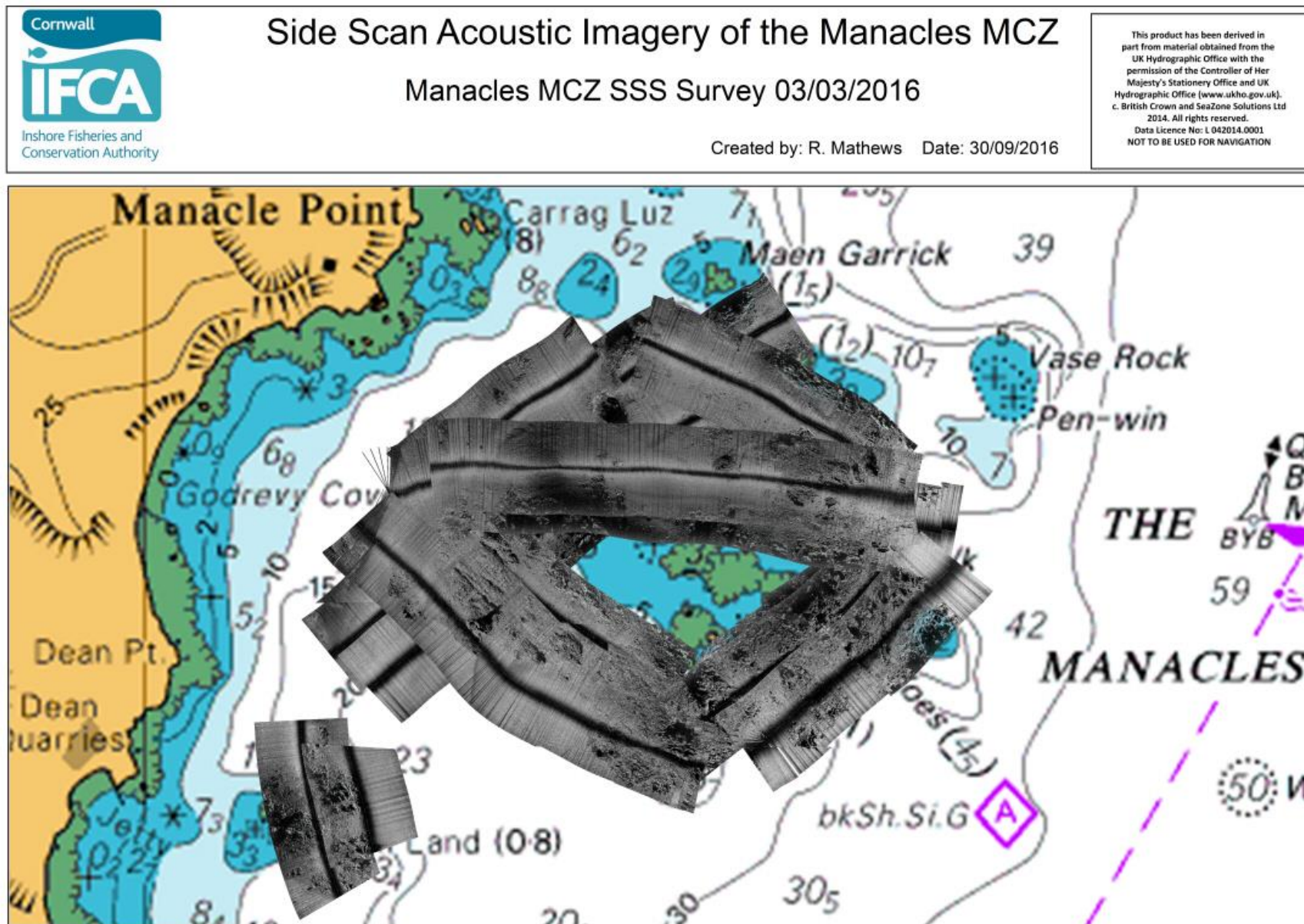


Figure 6: The processed side-scan mosaic created from data collected on the 3rd March 2016 by Cornwall IFCA within the Manacles MCZ overlaid onto the relevant Hydrographic Office chart.

3.2 Drop Down Video (DDV)

The DDV survey was carried out on the 16th May 2016 by Cornwall IFCA, the daily log is shown in Annex 2. High quality video data and stills were obtained across all sites and transects. A total of eight sites were completed; labelled as T1 to T8. T6 was repeated four times (T6, T6B, T6C, TCD) as the varying tidal conditions made it hard to stay on line. Video footage of the seabed and digital stills were collected at all sites surveyed. The locations of the still images per transect are shown in Figure 7.

A summary of the video data collected during the DDV survey is shown in Annex 3 and the position information for the stills images is shown in Annex 4.

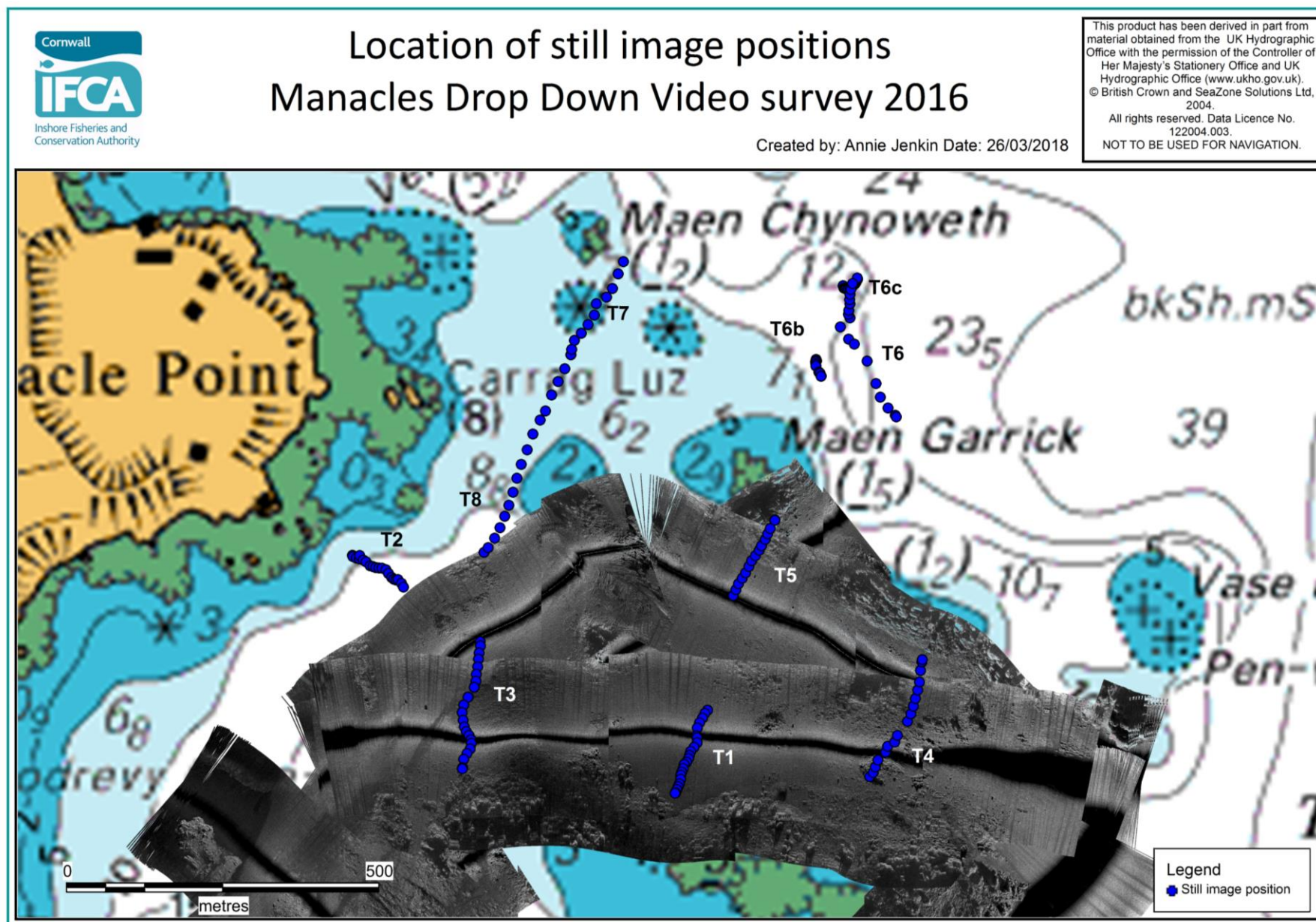


Figure 7: The location of tows and still images from the drop down video survey carried out by Cornwall IFCA in 2016 within the Manacles MCZ

3.3 Site descriptions

The survey area was composed of a mosaic of bedrock, coarse sediment with shell fragments and dead maerl gravel, or cobbles and boulders, coarse sediment with live maerl, fine sediment, The Udden-Wentworth scales was used for sediment descriptions.

A number of conspicuous fauna were observed on the reef habitat including dead man's fingers (*Alcyonium digitatum*), spiny starfish (*Marthasterias glacialis*), pink sea fans (*Eunicella verrucosa*), common urchin (*Echinus esculentus*), common sea cuculber (*Holothuria forskali*), cup corals (*Leptopsammia pruvoti*), jewel anemone (*Corynactis viridis*) and ross coral (*Pentapora foliacea*). The fine sediment had sparse fauna.

An overview of each tow including the SSS mosaic with the position of the still images overlain and four representative for each tow are shown below for each transect. The position of each transect within Box 1 is shown in Figure 8 Figure 15.

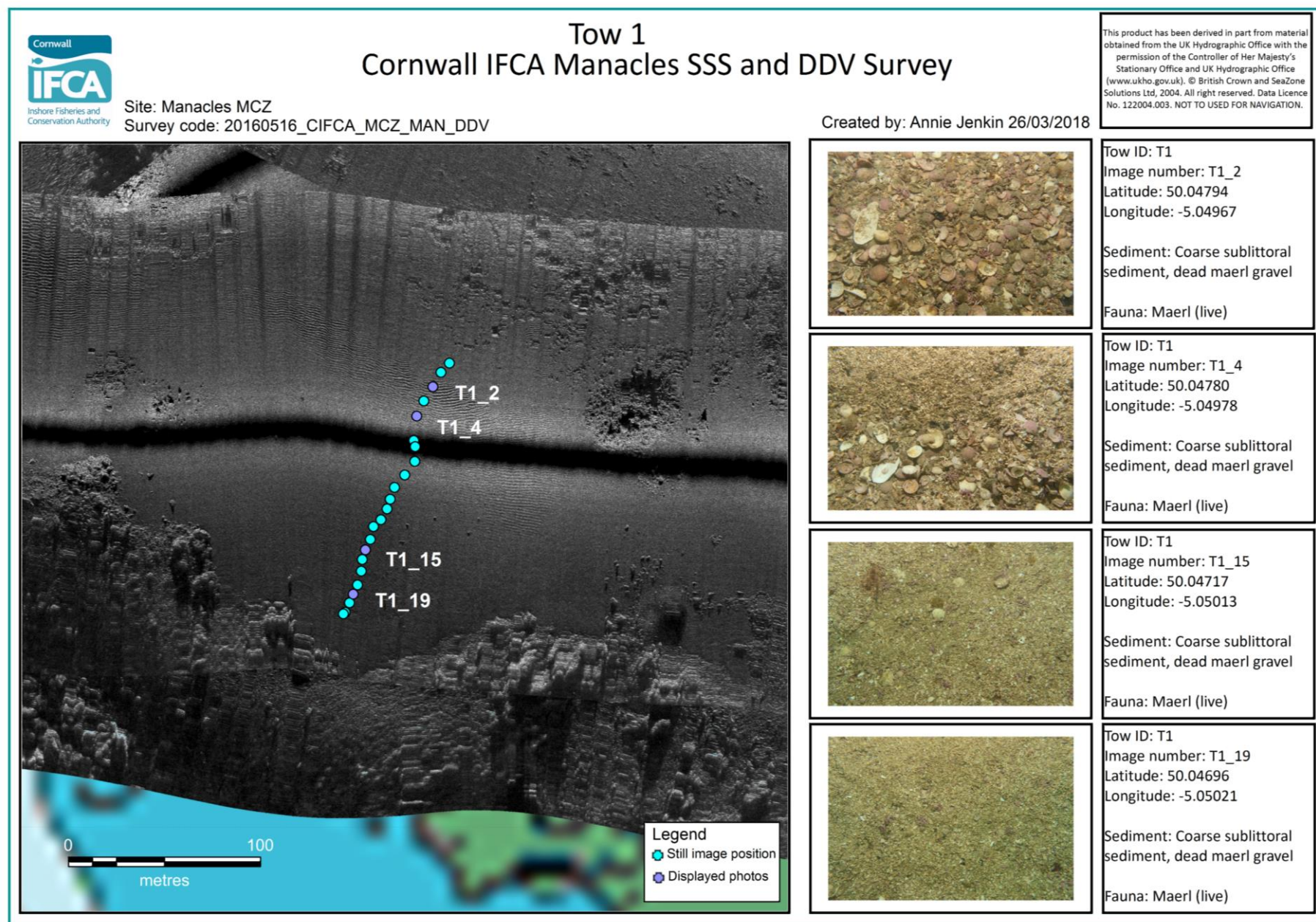


Figure 8: Station overview including habitat classification with still images from a side-scan survey and drop down video survey for Tow 1 in the Manacles MCZ

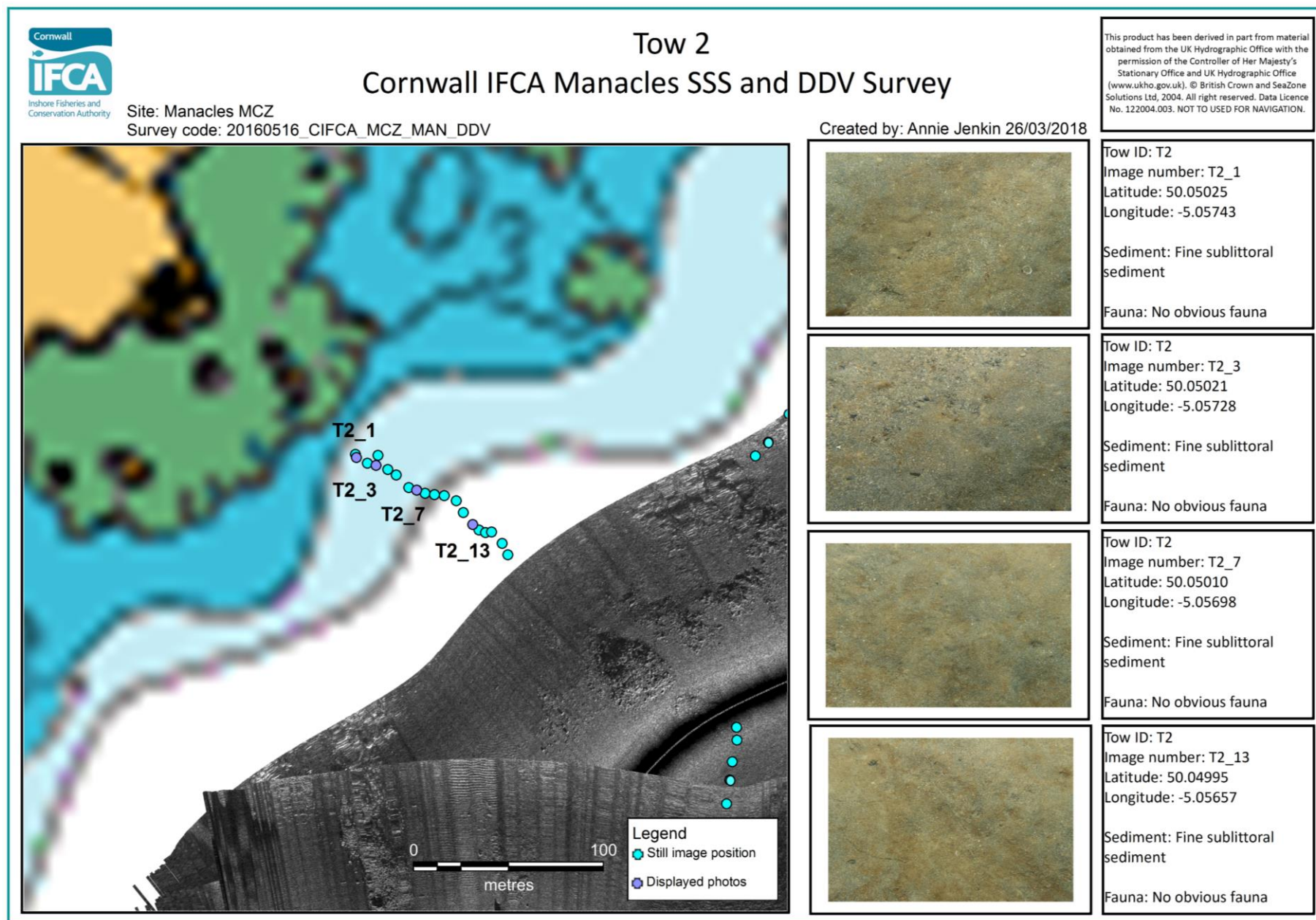


Figure 9: Station overview including habitat classification with still images from a side-scan survey and drop down video survey for Tow 2 in the Manacles MCZ

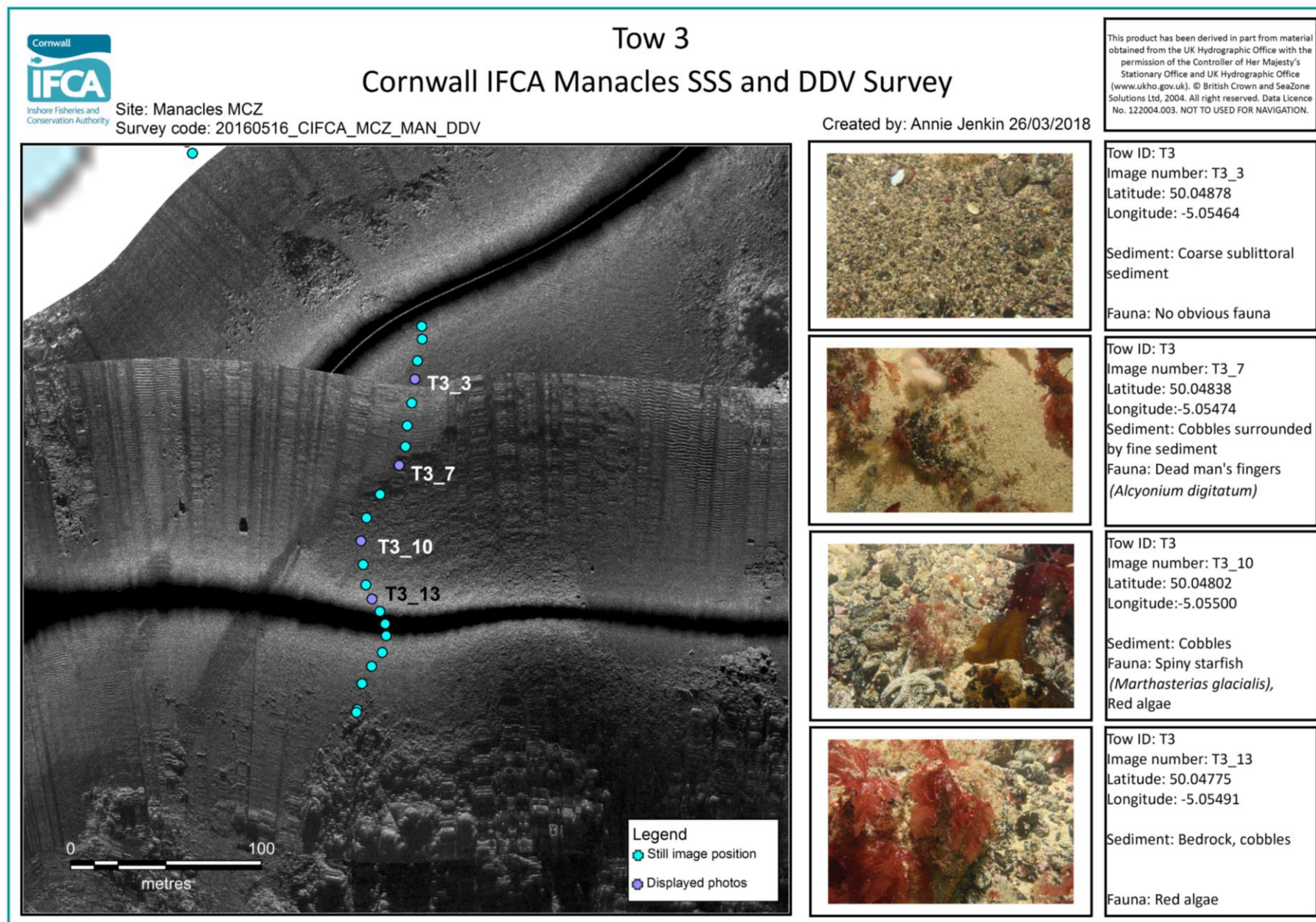


Figure 10: Station overview including habitat classification with still images from a side-scan survey and drop down video survey for Tow 3 in the Manacles MCZ

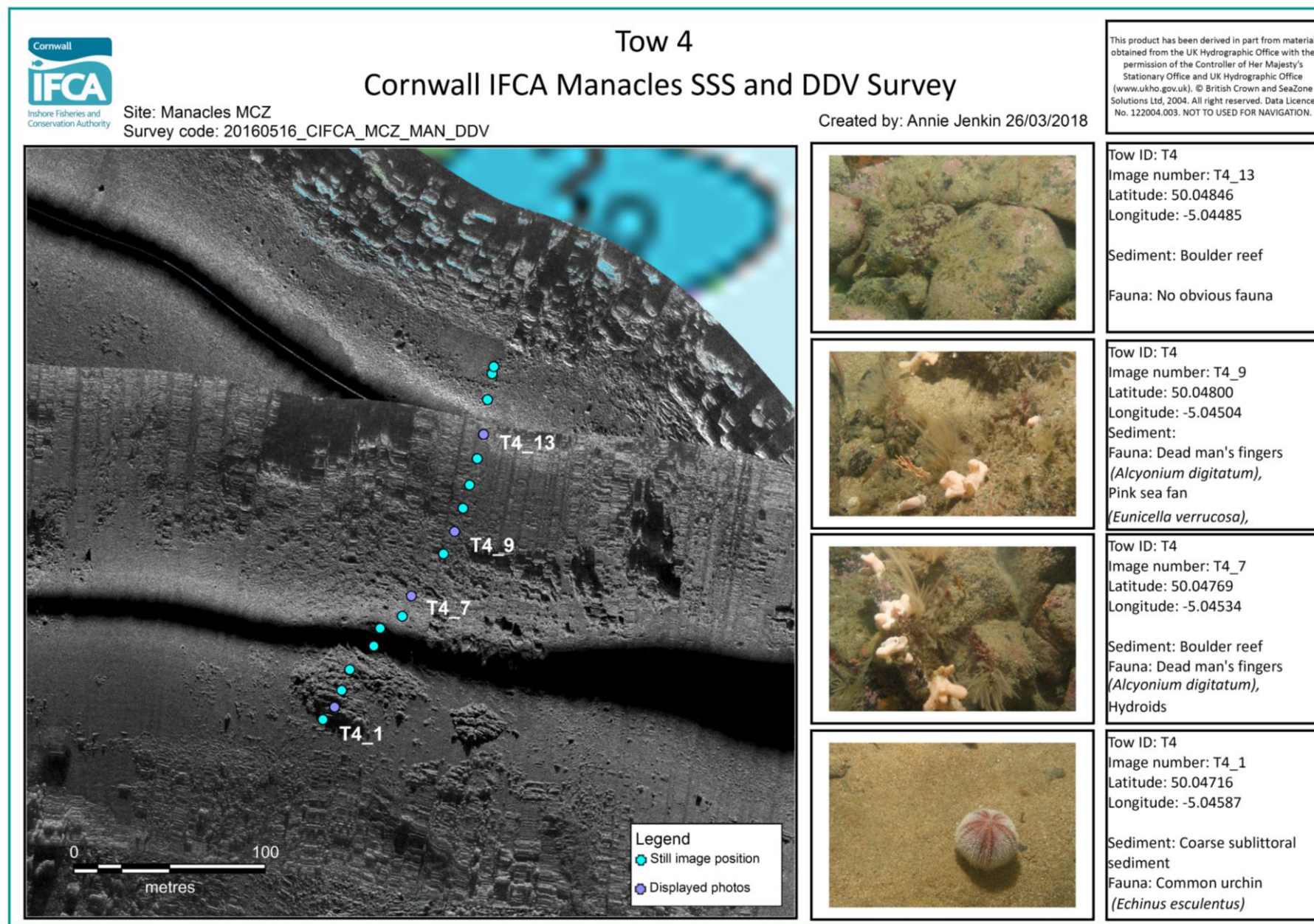


Figure 11: Station overview including habitat classification with still images from a side-scan survey and drop down video survey for Tow 4 in the Manacles MCZ

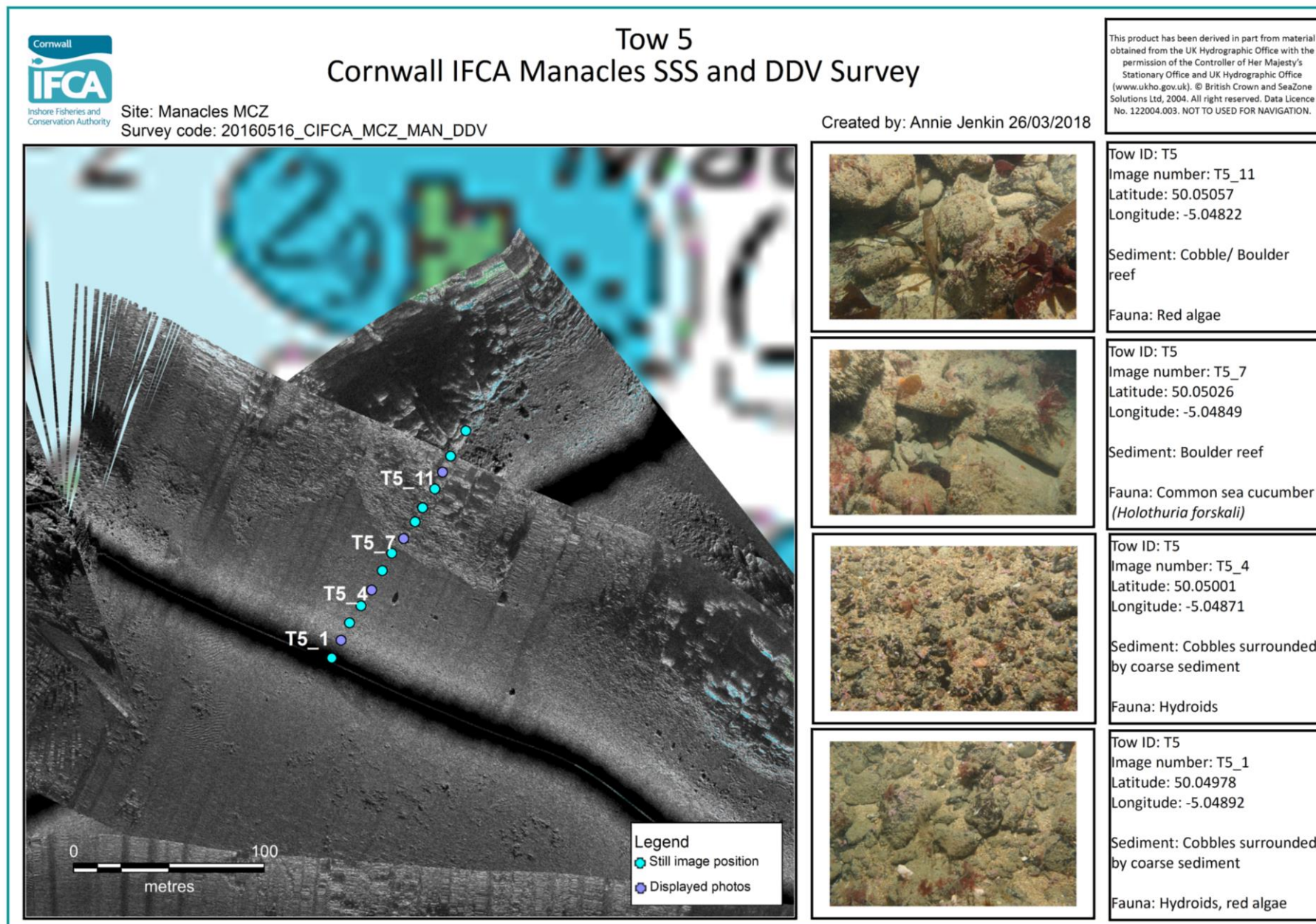


Figure 12: Station overview including habitat classification with still images from a side-scan survey and drop down video survey for Tow 5 in the Manacles MCZ

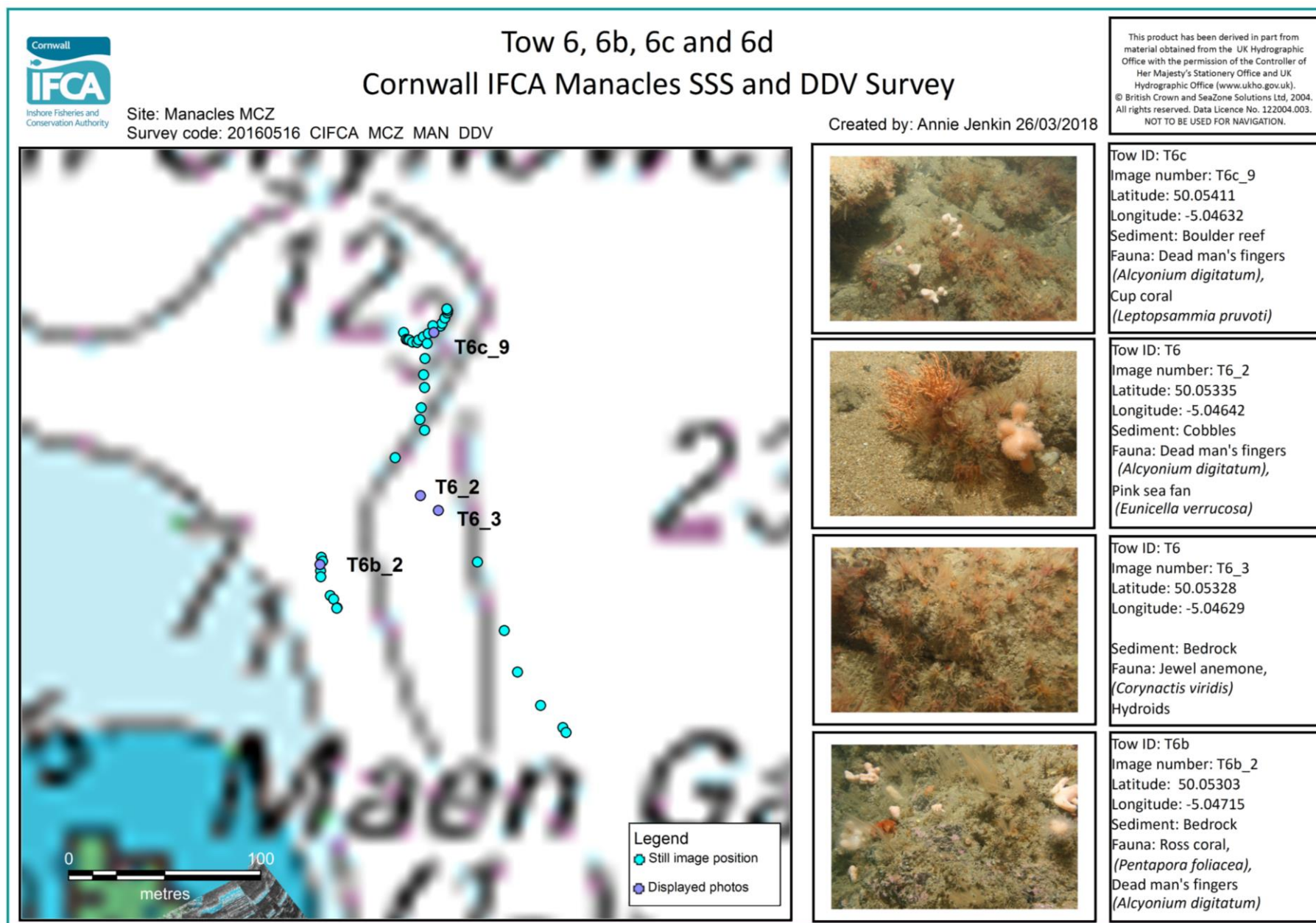


Figure 13: Station overview including habitat classification with still images from a side-scan survey and drop down video survey for Tows 6, 6b, 6c and 6d in the Manacles MCZ

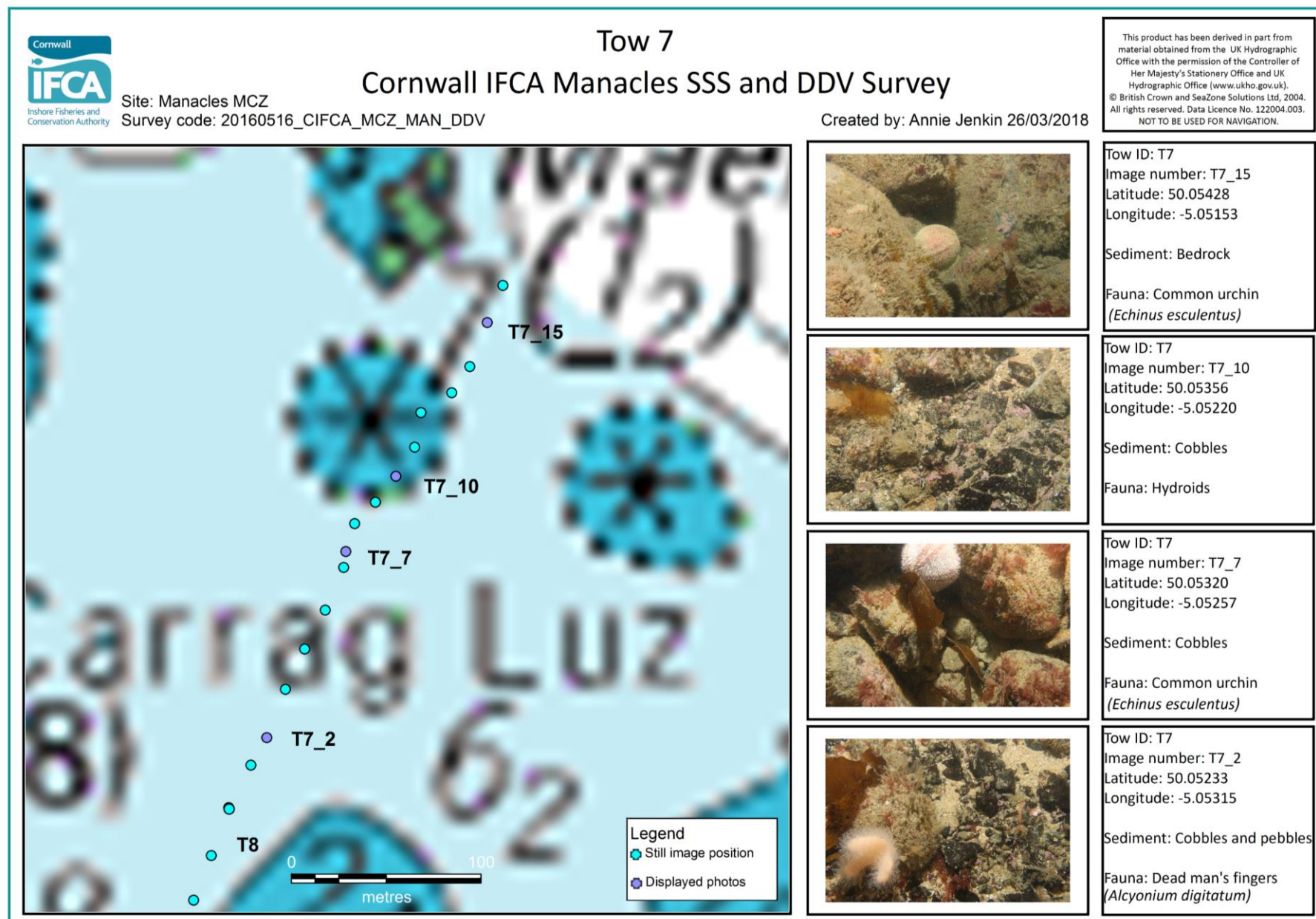


Figure 14: Station overview including habitat classification with still images from a side-scan survey and drop down video survey for Tow 7 in the Manacles MCZ

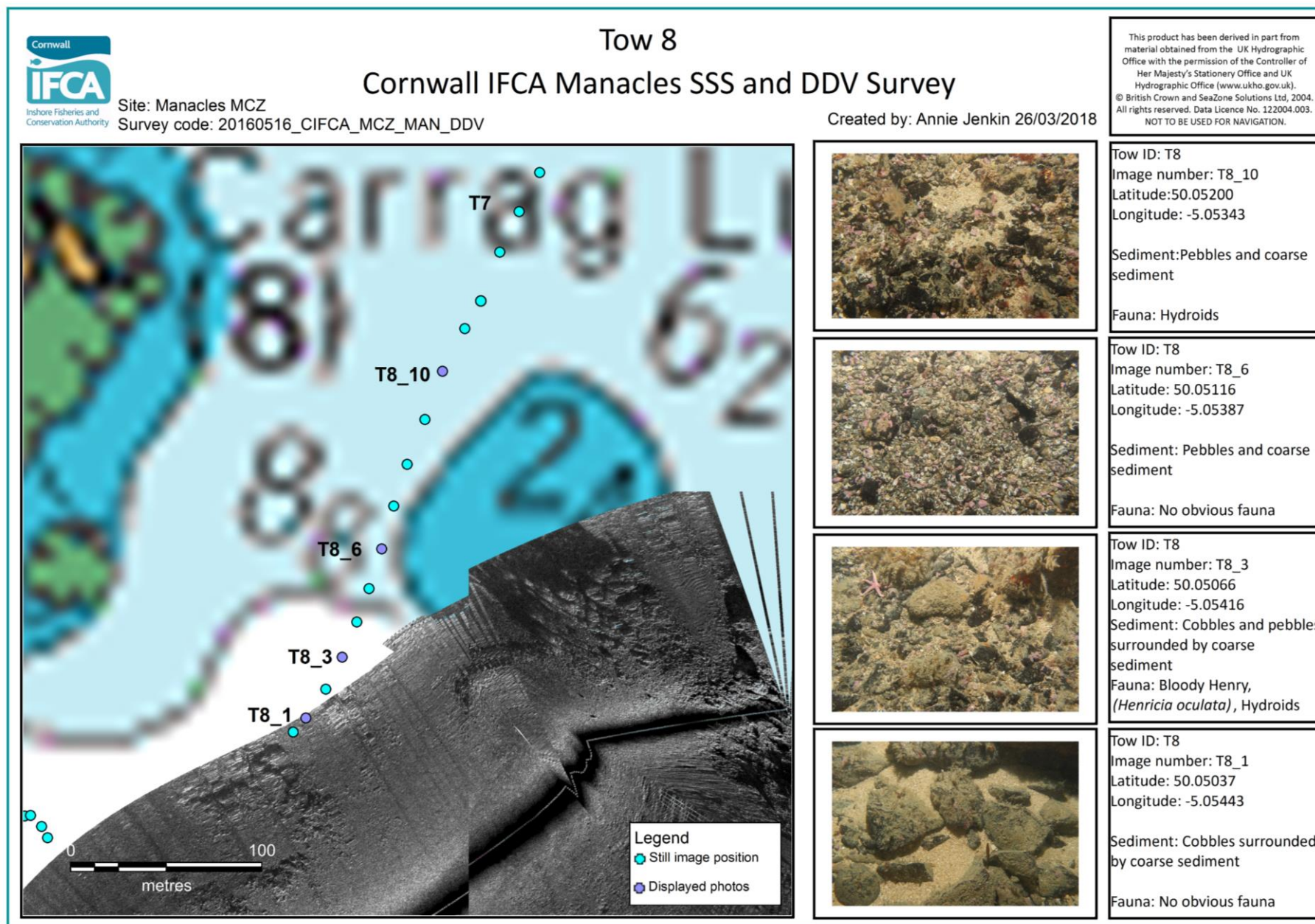


Figure 15: Station overview including habitat classification with still images from a side-scan survey and drop down video survey for Tow 8 in the Manacles MCZ

3.4 Anthropogenic Impacts

A string of crustacean pots was observed at one site.

4 Discussion

The acoustic survey and the DDV survey was carried out in slightly different areas and SSS data was not available for all areas that the DDV transects were carried out.

The geophysical survey indicated changes in seabed sediment type across the survey area, which included fine sediment, coarse sediment of pebbles and shell fragments, coarse sediment of cobbles and boulders and areas of bedrock. The DDV survey was successful in obtaining seabed imagery along all transects.

Live maerl was recorded across one tow, T1, located in the south of the survey area.

5 Limitations

There were a number of limitations on the day the survey was carried out. These included the following;

- The weather on the survey day was not ideal for collecting acoustic data and the wind increased beyond what was forecast causing more surface chop than expected which caused 'snatching' in the SSS data.
- Due to the weather conditions the SSS tows were shorter in length than planned.
- The weather deteriorated throughout the day and therefore the tows to the south and east were not completed.
- It was difficult to maintain course whilst towing the SSS due to the steep changes in bathymetry and unpredictable currents. This caused artefacts in the data which could lead to incorrect interpretation.

6 References

Bosence, D. and Wilson, J. 2003. Maërl growth, carbonate production rates and accumulation rates in the northeast Atlantic. *Aquatic Conservation: Marine and Freshwater Ecosystems* **13** pp 21-31.

Coggan, R., Mitchell, A., White, J. and Golding, N. 2007. Recommended operating guidelines (ROG) for underwater video and photographic imaging techniques. Mapping European Seabed Habitats (MESH) video working group report v.11.2.

Defra. 2013a. The Manacles MCZ Factsheet marine conservation zone. [ONLINE] Available at: <http://publications.naturalengland.org.uk/publication/5402553126748160?category=1721481> [Accessed 09.03.2018]

Defra. 2013b. Marine conservation zone 2013 designation: The Manacles. [ONLINE] Available at: <https://www.gov.uk/government/publications/marine-conservation-zone-2013-designation-the-manacles> [Accessed 28.09.2016].

Friedlander, A., Brown, E.K., Jokiel, P.L., Smith, W.R. and Rodgers, K.S. 2003. Effects of habitat, wave exposure, and marine protected area status on coral reef fish assemblages in the Hawaiian archipelago. *Coral Reefs*. **22** (3) pp 291-305.

Grall, J. and Hall-Spencer, J. 2003. Problems facing maerl conservation in Brittany. *Aquatic Conserv: Mar. Freshw. Ecosyst.*, 13(S1), pp.S55-S64.

Hall-Spencer, J.M., Kelly, J. and Maggs, C.A. 2008. Assessment of maerl beds in the OSPAR area and the development of a monitoring programme. DEHLG, Ireland.

Hall-Spencer, J.M., Kelly, J., and Maggs, C.A. 2010. Background document for Maerl beds. OSPAR Commission.

JNCC. 2015. Maerl Beds. [ONLINE] Available at: <http://jncc.defra.gov.uk/page-6023> [Accessed 28.09.2016]

UK Ocean Acidification programme. 2016. Seabed organisms and ecosystems. [ONLINE] Available at: <http://www.oceanacidification.org.uk/Oarp/media/images/PDF/UKOA-SeabedOrganisms> [Accessed 28.09.2016].

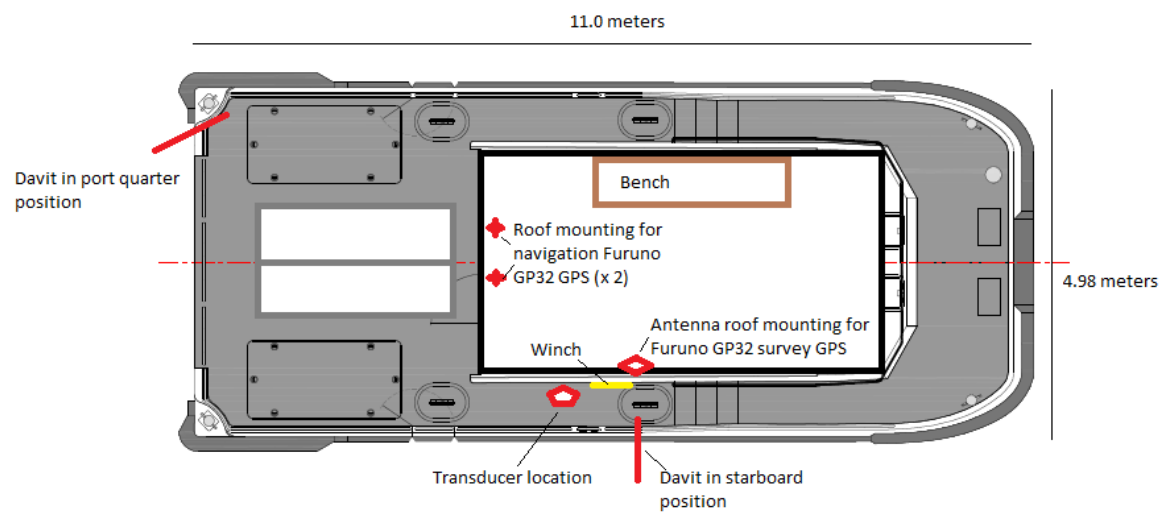
7 Appendices

Annex 1 – RV Tiger Lily Deck Plan and Offsets



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 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

Tiger Lily VI General Layout - Plan view



Settings

Equipment			Offset (m)		
NMEA Device	Make/Model	Offset Name	X (Forw'd)	Y (Port)	Z (+)
Navigation depth	Furuno Navnet	Furuno transducer	5.5	0.75	-0.5
Survey GPS	Furuno GP32	Furuno mushroom antenna	4.8	1.0	

Annex 2 – Daily Logs

3rd March 2016 – Manacles SSS survey

The daily log for the survey carried out on 3rd March 2016 is shown in Table 3.

Survey code: 20160303_CIFCA_MCZ_MAN_SSS

Staff: Colin Trundle (Principal Scientific Officer, Cornwall IFCA), Holly Latham (Scientific Officer, Cornwall IFCA), Kimara Street (Scientific Officer, Cornwall IFCA), Ryan Mathews (Scientific Officer, Cornwall IFCA), Chris Lowe (Skipper).

Vessel: Tiger Lily VI

All times recorded in UTC

Table 5: Daily log from survey carried out onboard R/V Tiger Lily on 3rd March 2016

Time	Activity
08:30	Arrive at Mylor
09:00	Set up the SSS equipment and familiarisation
10:00	Leave Mylor
10:26	Arrive off Maenporth for a set up / trial run
10:32	Start T1 record Data file – 20160303153256 Cable out = 10 m from davit 100 m swathe
11:23	Recover the fish off Swanpool
11:30	Steam to Volnay
11:40	Arrive at Volnay
11:42	Towfish in water Swathe = 100 m Layback – 9 marks, 18m
11:55	Record off
12:00	Slow transit to Manacles, fish in water
12:02	Record en route
12:03	Range increase to 125 m
12:04	Recording stopped – vessel speed too fast
12:14	Began recording Entering Manacles between Maen Garrick and Gwinges Swathe = 125 m Line out = 12 m in water LF gain = 0, TVG = 33, Max TVG = 67 HF Gain = 23, TVG = 38, Max TVG = 60
12:47	Exit out past Gwinges, Out and turn. Keep recording
14:27	Towfish recovered Steam towards Falmouth
14:46	Towfish in water, off Rosemullion Line out – 4.5 marks, 9 m Swathe = 100 m
16:10	Approaching Mylor
17:13	Alongside, SSS equipment dismantled and engines shut down

16th May 2016 – Manacles DDV survey

The daily log for the survey carried out on 16th May 2016 is shown in Table 3.

Survey code: 20160516_CIFCA_MCZ_MAN_DDV

Staff: Colin Trundle (Principal Scientific Officer, Cornwall IFCA), Hilary Naylor (Scientific Officer, Cornwall IFCA), Ryan Matthews (Scientific Officer, Cornwall IFCA), Dan Matthew (Skipper).

Vessel: R/V Tiger Lily

All times are in UTC.

Table 6: Daily log from survey carried on board R/V Tiger Lily on 16th May 2016

Time	Activity
0715	Leave Mylor Yacht Harbour pontoons, steam out of the Falmouth towards the Manacles.
0805	Arrive at Manacles. Carry out trial drifts. Camera deployed.
0807	Transect MCZMAN_T6 SOL. Tow speed: 0.8kts. Images: 0001-0009. Dead man's fingers, hydroids, pink sea fan, cup corals and jewel anemones.
0818	Transect MCZMAN_T6 EOL. Issues with drift meant this site was postponed till later when less current was expected.
0832	Transect MCZMAN_T2 SOL. Tow speed: 0.1kts. Images: 0012-0031. Sparse epifauna/fine sediment. 08:37 Fishing gear issue.
0854	Transect MCZMAN_T2 EOL.
0901	Transect MCZMAN_T3 SOL. Tow speed: 0.4kts. Images: 0032-0051. Spiny starfish, hydroids and dead mans fingers.
0921	Transect MCZMAN_T3 EOL.
0933	Transect MCZMAN_T1 SOL. Tow speed: 0.3kts. Images: 0052-0073. Coarse sediment/live maerl.
0954	Transect MCZMAN_T1 EOL.
1007	Transect MCZMAN_T6B SOL. Drift direction still causing issues so shorter tows made to ensure coverage of the planned transition. Tow speed: 0.1kts. Images: 0074-0083. Dead man's fingers, pink sea fan, common urchin, cup corals, hydroids, seven armed starfish, sea cucumber, jewel anemone, orange encrusting sponge, blenny and branching sponge.
1015	Transect MCZMAN_T6B EOL.
1023	Transect MCZMAN_T6C SOL. Tow speed: 0.1kts. Images: 0086-0100. Seven armed starfish, hydroids, cup coral, jewel anemone, dead man's fingers, spiny starfish and coarse sediment.
1036	Transect MCZMAN_T6C EOL.
1046	Transect MCZMAN_T6D SOL. Tow speed: 0.3kts. Images: 0101-0108. Hydroids, cup coral, dead man's fingers and coarse sediment.
1052	Transect MCZMAN_T6D EOL.
1104	Transect MCZMAN_T5 SOL. Tow speed: 0.3kts. Images: 0110-0124. Hydroids, coarse sediment, live maerl, sea cucumber, orange encrusting sponge, kelp and spiny starfish.
1118	Transect MCZMAN_T5 EOL.
1128	Transect MCZMAN_T4 SOL. Tow speed: 0.4kts. Images: 0125-0140. Fine/coarse sediment, common urchin, hydroids, sea cucumber, orange encrusting sponge, dead man's fingers, cup coral, pink sea fan and goldsinny wrasse.
1145	Transect MCZMAN_T4 EOL.
1158	Transect MCZMAN_T8 SOL. Tow speed: 0.6kts. Images: 0141-0150. Hydroids, common starfish, kelp and pebble reef.
1207	Transect MCZMAN_T8 EOL.
1208	Transect MCZMAN_T7 SOL. Tow speed: 0.8kts. Images: 0151-0166. Cobble reef, dead man's fingers, hydroids, orange encrusting sponge, kelp, common urchin and spiny starfish.

1224	Transect MCZMAN_T7 EOL.
1230	Leave Manacles MCZ; begin steam back to Mylor Yacht Harbour.
1330	Arrive back to Mylor Yacht Harbour.

Annex 3 – Video position data from the drop down video survey in the Manacles

Cornwall IFCA		Video Positioning Summary									
Area	Manacles	Project name		20160516_CIFCA_Manacles_DDV							
Vessel	Tiger Lily	Sampling position									
Sample type	TOW_ID	Date	Time SOL	Time EOL	SOL Latitude (decimal degrees)	SOL Longitude (decimal degrees)	EOL Latitude (decimal degrees)	EOL Longitude (decimal degrees)	Video length	Number of stills	Species observed
Camera	20160516_CIFCA_MAN_T1	16/05/2016	08:33:34	08:54:35	50.04806	-5.04956	50.04687	-5.05028	00:21:01	21	
Camera	20160516_CIFCA_MAN_T2	16/05/2016	07:32:06	08:01:30	50.05027	-5.05744	50.04904	-5.05461	00:29:24	20	
Camera	20160516_CIFCA_MAN_T3	16/05/2016	08:01:59	08:21:26	50.04898	-5.05460	50.04722	-5.05500	00:19:27	20	Spiny starfish (<i>Marthasterias glacialis</i>), hydroids, red algae and Dead man's fingers (<i>Alcyonium digitatum</i>)
Camera	20160516_CIFCA_MAN_T4	16/05/2016	10:28:17	10:45:15	50.04711	-5.04596	50.04878	-5.04479	00:16:58	14	Common urchin (<i>Echinus esculentus</i>), hydroids, Common sea cucumber (<i>Holothuria forskali</i>), Orange encrusting sponge, Dead man's fingers (<i>A. digitatum</i>), Cup coral (<i>Leptopsammia pruvoti</i>), Pink sea fan (<i>Eunicella verrucosa</i>) and Goldsinny wrasse (<i>Ctenolabrus rupestris</i>)
Camera	20160516_CIFCA_MAN_T5	16/05/2016	10:04:41	10:18:18	50.04970	-5.04899	50.05077	-5.04806	00:13:37	14	Hydroids, live maerl, Common sea cucumber (<i>H. forskali</i>), Orange encrusting sponge, Kelp (<i>Laminaria hyperborea</i>) and <i>M. glacialis</i> (common spiny starfish).
Camera	20160516_CIFCA_MAN_T6	16/05/2016	07:07:40	07:18:12	50.05353	-5.04661	50.05225	-5.04537	00:10:32	9	Dead man's fingers (<i>A. digitatum</i>), hydroids, Pink sea fan (<i>E. verrucosa</i>), Cup coral (<i>L. pruvoti</i>) and <i>Corynactis viridis</i> (jewel anemones).
Camera	20160516_CIFCA_MAN_T6B	16/05/2016	09:06:52	09:15:36	50.05307	-5.04715	50.05283	-5.04704	00:08:44	8	Dead man's fingers (<i>A. digitatum</i>), Pink sea fan (<i>E. verrucosa</i>), Common urchin (<i>E. esculentus</i>), up coral (<i>L. pruvoti</i>), hydroids, Seven armed starfish (<i>Luidia ciliaris</i>), Common sea cucumber (<i>H. forskali</i>), Jewel anemones (<i>C. viridis</i>), Orange encrusting sponge, Common blenny (<i>Ophioblennius steindachneri</i>) and branching sponge.
Camera	20160516_CIFCA_MAN_T6C	16/05/2016	09:22:27	09:36:21	50.05412	-5.04655	50.05423	-5.04623	00:13:54	14	Seven armed starfish (<i>L. ciliaris</i>), hydroids, Cup coral (<i>L. pruvoti</i>), Jewel anemones (<i>C. viridis</i>), Dead man's fingers (<i>A. digitatum</i>) and Spiny starfish (<i>M. glacialis</i>),
Camera	20160516_CIFCA_MAN_T6D	16/05/2016	09:45:31	09:52:23	50.05366	-5.04640	50.05415	-5.04634	00:06:52	7	Cup coral (<i>L. pruvoti</i>) and Dead man's fingers (<i>A. digitatum</i>)

Cornwall IFCA		Video Positioning Summary									
Area	Manacles	Project name		20160516_CIFCA_Manacles_DDV							
Vessel	Tiger Lily	Sampling position									
Sample type	TOW_ID	Date	Time SOL	Time EOL	SOL Latitude (decimal degrees)	SOL Longitude (decimal degrees)	EOL Latitude (decimal degrees)	EOL Longitude (decimal degrees)	Video length	Number of stills	Species observed
Camera	20160516_CIFCA_MAN_T7	16/05/2016	11:08:43	11:24:02	50.05220	-5.05327	50.05446	-5.05142	00:15:19	16	Dead man's fingers (<i>A. digitatum</i>), hydroids, Orange encrusting sponge, Kelp (<i>L. hyperborea</i>), Common urchin (<i>E. esculentus</i>) and Spiny starfish (<i>M. glacialis</i>)
Camera	20160516_CIFCA_MAN_T8	16/05/2016	10:57:54	11:07:43	50.05031	-5.05452	50.05200	-5.05343	00:09:49	10	Hydroids, Common starfish (<i>Asterias rubens</i>), Kelp (<i>L. hyperborea</i>) and Orange encrusting sponge.

Annex 4 – Still image locations and metadata from the drop down video survey in St.Austell Bay

Cornwall IFCA							Camera Positioning Summary		
Area		Manacles MCZ	Project name		20160516 Manacles MCZ DDV Field Report				
Vessel		Tiger Lily	Sampling position						
Projection									
Sample type	Station number	Image_ID	Date	Time	Latitude (decimal degrees)	Longitude (decimal degrees)	Depth (m)	Substrate	Comments
Camera	TOW 6	MCZMAN_T6_20160516_07_08_13_0001.JPG	16/05/2016	07:07:40	50.05353	-5.04661			
Camera	TOW 6	MCZMAN_T6_20160516_07_09_36_0002.JPG	16/05/2016	07:08:48	50.05336	-5.04642			
Camera	TOW 6	MCZMAN_T6_20160516_07_11_59_0003.JPG	16/05/2016	07:09:34	50.05329	-5.04630			
Camera	TOW 6	MCZMAN_T6_20160516_07_13_59_0004.JPG	16/05/2016	07:12:00	50.05305	-5.04601			
Camera	TOW 6	MCZMAN_T6_20160516_07_14_05_0005.JPG	16/05/2016	07:14:41	50.05272	-5.04582			
Camera	TOW 6	MCZMAN_T6_20160516_07_14_38_0006.JPG	16/05/2016	07:15:55	50.05253	-5.04572			
Camera	TOW 6	MCZMAN_T6_20160516_07_15_58_0007.JPG	16/05/2016	07:17:03	50.05237	-5.04555			
Camera	TOW 6	MCZMAN_T6_20160516_07_17_05_0008.JPG	16/05/2016	07:18:01	50.05227	-5.04539			
Camera	TOW 6	MCZMAN_T6_20160516_07_18_02_0009.JPG	16/05/2016	07:18:12	50.05225	-5.04537			
Camera	TOW 1	MCZMAN_T2_20160516_07_32_29_0012.JPG	16/05/2016	07:32:26	50.05025	-5.05744			
Camera	TOW 1	MCZMAN_T2_20160516_07_33_37_0013.JPG	16/05/2016	07:33:41	50.05023	-5.05735			
Camera	TOW 1	MCZMAN_T2_20160516_07_34_57_0014.JPG	16/05/2016	07:34:50	50.05022	-5.05729			
Camera	TOW 1	MCZMAN_T2_20160516_07_35_39_0015.JPG	16/05/2016	07:35:35	50.05027	-5.05728			
Camera	TOW 1	MCZMAN_T2_20160516_07_40_44_0017.JPG	16/05/2016	07:40:40	50.05020	-5.05720			
Camera	TOW 1	MCZMAN_T2_20160516_07_41_46_0018.JPG	16/05/2016	07:41:39	50.05018	-5.05714			
Camera	TOW 1	MCZMAN_T2_20160516_07_42_44_0019.JPG	16/05/2016	07:42:42	50.05012	-5.05705			
Camera	TOW 2	MCZMAN_T2_20160516_07_43_43_0020.JPG	16/05/2016	07:43:41	50.05011	-5.05699			
Camera	TOW 2	MCZMAN_T2_20160516_07_44_43_0021.JPG	16/05/2016	07:44:41	50.05009	-5.05693			
Camera	TOW 2	MCZMAN_T2_20160516_07_45_42_0022.JPG	16/05/2016	07:45:42	50.05009	-5.05686			
Camera	TOW 2	MCZMAN_T2_20160516_07_46_45_0023.JPG	16/05/2016	07:46:43	50.05009	-5.05679			

Cornwall IFCA							Camera Positioning Summary		
Area		Manacles MCZ	Project name		20160516 Manacles MCZ DDV Field Report				
Vessel		Tiger Lily	Sampling position						
Projection									
Sample type	Station number	Image_ID	Date	Time	Latitude (decimal degrees)	Longitude (decimal degrees)	Depth (m)	Substrate	Comments
Camera	TOW 2	MCZMAN_T2_20160516_07_47_48_0024.JPG	16/05/2016	07:47:46	50.05006	-5.05670			
Camera	TOW 2	MCZMAN_T2_20160516_07_48_43_0025.JPG	16/05/2016	07:48:40	50.05001	-5.05664			
Camera	TOW 2	MCZMAN_T2_20160516_07_49_42_0026.JPG	16/05/2016	07:49:40	50.04995	-5.05657			
Camera	TOW 2	MCZMAN_T2_20160516_07_50_43_0027.JPG	16/05/2016	07:50:41	50.04993	-5.05653			
Camera	TOW 2	MCZMAN_T2_20160516_07_51_45_0028.JPG	16/05/2016	07:51:43	50.04992	-5.05648			
Camera	TOW 2	MCZMAN_T2_20160516_07_52_43_0029.JPG	16/05/2016	07:52:42	50.04992	-5.05643			
Camera	TOW 2	MCZMAN_T2_20160516_07_53_46_0030.JPG	16/05/2016	07:53:43	50.04987	-5.05635			
Camera	TOW 2	MCZMAN_T2_20160516_07_54_45_0031.JPG	16/05/2016	07:54:40	50.04982	-5.05631			
Camera	TOW 3	MCZMAN_T3_20160516_08_02_02_0032.JPG	16/05/2016	08:01:59	50.04898	-5.05460			
Camera	TOW 3	MCZMAN_T3_20160516_08_03_19_0033.JPG	16/05/2016	08:03:18	50.04887	-5.05463			
Camera	TOW 3	MCZMAN_T3_20160516_08_04_16_0034.JPG	16/05/2016	08:04:14	50.04879	-5.05465			
Camera	TOW 3	MCZMAN_T3_20160516_08_05_20_0035.JPG	16/05/2016	08:05:18	50.04868	-5.05466			
Camera	TOW 3	MCZMAN_T3_20160516_08_06_19_0036.JPG	16/05/2016	08:06:16	50.04857	-5.05469			
Camera	TOW 3	MCZMAN_T3_20160516_08_07_01_0037.JPG	16/05/2016	08:07:02	50.04847	-5.05470			
Camera	TOW 3	MCZMAN_T3_20160516_08_07_55_0038.JPG	16/05/2016	08:07:54	50.04838	-5.05474			
Camera	TOW 3	MCZMAN_T3_20160516_08_09_21_0039.JPG	16/05/2016	08:09:19	50.04824	-5.05488			
Camera	TOW 3	MCZMAN_T3_20160516_08_10_21_0040.JPG	16/05/2016	08:10:19	50.04813	-5.05497			
Camera	TOW 3	MCZMAN_T3_20160516_08_11_20_0041.JPG	16/05/2016	08:11:17	50.04802	-5.05501			
Camera	TOW 3	MCZMAN_T3_20160516_08_12_19_0042.JPG	16/05/2016	08:12:17	50.04791	-5.05499			
Camera	TOW 3	MCZMAN_T3_20160516_08_13_22_0043.JPG	16/05/2016	08:13:19	50.04782	-5.05496			
Camera	TOW 3	MCZMAN_T3_20160516_08_14_19_0044.JPG	16/05/2016	08:14:17	50.04775	-5.05491			

Cornwall IFCA							Camera Positioning Summary		
Area		Manacles MCZ	Project name		20160516 Manacles MCZ DDV Field Report				
Vessel		Tiger Lily	Sampling position						
Projection									
Sample type	Station number	Image_ID	Date	Time	Latitude (decimal degrees)	Longitude (decimal degrees)	Depth (m)	Substrate	Comments
Camera	TOW 3	MCZMAN_T3_20160516_08_15_18_0045.JPG	16/05/2016	08:15:16	50.04770	-5.05485			
Camera	TOW 3	MCZMAN_T3_20160516_08_16_19_0046.JPG	16/05/2016	08:16:17	50.04764	-5.05481			
Camera	TOW 3	MCZMAN_T3_20160516_08_17_19_0047.JPG	16/05/2016	08:17:17	50.04758	-5.05480			
Camera	TOW 3	MCZMAN_T3_20160516_08_18_19_0048.JPG	16/05/2016	08:18:17	50.04750	-5.05483			
Camera	TOW 3	MCZMAN_T3_20160516_08_19_18_0049.JPG	16/05/2016	08:19:15	50.04744	-5.05490			
Camera	TOW 3	MCZMAN_T3_20160516_08_20_16_0050.JPG	16/05/2016	08:20:14	50.04736	-5.05497			
Camera	TOW 3	MCZMAN_T3_20160516_08_21_19_0051.JPG	16/05/2016	08:21:17	50.04723	-5.05500			
Camera	TOW 1	MCZMAN_T1_20160516_08_34_00_0052.JPG	16/05/2016	08:34:09	50.04801	-5.04962			
Camera	TOW 1	MCZMAN_T1_20160516_08_35_18_0054.JPG	16/05/2016	08:35:17	50.04795	-5.04967			
Camera	TOW 1	MCZMAN_T1_20160516_08_36_19_0055.JPG	16/05/2016	08:36:18	50.04788	-5.04974			
Camera	TOW 1	MCZMAN_T1_20160516_08_37_15_0056.JPG	16/05/2016	08:37:14	50.04781	-5.04979			
Camera	TOW 1	MCZMAN_T1_20160516_08_38_18_0057.JPG	16/05/2016	08:38:40	50.04769	-5.04980			
Camera	TOW 1	MCZMAN_T1_20160516_08_39_21_0058.JPG	16/05/2016	08:39:26	50.04766	-5.04979			
Camera	TOW 1	MCZMAN_T1_20160516_08_40_19_0059.JPG	16/05/2016	08:40:18	50.04759	-5.04979			
Camera	TOW 1	MCZMAN_T1_20160516_08_41_18_0060.JPG	16/05/2016	08:41:16	50.04753	-5.04986			
Camera	TOW 1	MCZMAN_T1_20160516_08_42_18_0061.JPG	16/05/2016	08:42:15	50.04747	-5.04993			
Camera	TOW 1	MCZMAN_T1_20160516_08_43_17_0062.JPG	16/05/2016	08:43:15	50.04741	-5.04996			
Camera	TOW 1	MCZMAN_T1_20160516_08_44_18_0063.JPG	16/05/2016	08:44:16	50.04737	-5.04998			
Camera	TOW 1	MCZMAN_T1_20160516_08_45_22_0064.JPG	16/05/2016	08:45:20	50.04732	-5.05003			
Camera	TOW 1	MCZMAN_T1_20160516_08_46_18_0065.JPG	16/05/2016	08:46:16	50.04728	-5.05008			
Camera	TOW 1	MCZMAN_T1_20160516_08_47_19_0066.JPG	16/05/2016	08:47:17	50.04722	-5.05010			

Cornwall IFCA							Camera Positioning Summary		
Area		Manacles MCZ	Project name		20160516 Manacles MCZ DDV Field Report				
Vessel		Tiger Lily	Sampling position						
Projection									
Sample type	Station number	Image_ID	Date	Time	Latitude (decimal degrees)	Longitude (decimal degrees)	Depth (m)	Substrate	Comments
Camera	TOW 1	MCZMAN_T1_20160516_08_48_17_0067.JPG	16/05/2016	08:48:24	50.04717	-5.05013			
Camera	TOW 1	MCZMAN_T1_20160516_08_49_17_0068.JPG	16/05/2016	08:49:15	50.04713	-5.05015			
Camera	TOW 1	MCZMAN_T1_20160516_08_50_16_0069.JPG	16/05/2016	08:50:14	50.04707	-5.05016			
Camera	TOW 1	MCZMAN_T1_20160516_08_51_19_0070.JPG	16/05/2016	08:51:17	50.04701	-5.05018			
Camera	TOW 1	MCZMAN_T1_20160516_08_52_19_0071.JPG	16/05/2016	08:52:17	50.04696	-5.05021			
Camera	TOW 1	MCZMAN_T1_20160516_08_53_16_0072.JPG	16/05/2016	08:53:14	50.04692	-5.05024			
Camera	TOW 1	MCZMAN_T1_20160516_08_54_18_0073.JPG	16/05/2016	08:54:16	50.04688	-5.05027			
Camera	TOW 6B	MCZMAN_T6B_20160516_09_07_15_0074.JPG	16/05/2016	09:06:52	50.05307	-5.04715			
Camera	TOW 6B	MCZMAN_T6B_20160516_09_07_25_0075.JPG	16/05/2016	09:07:35	50.05305	-5.04714			
Camera	TOW 6B	MCZMAN_T6B_20160516_09_08_41_0077.JPG	16/05/2016	09:08:42	50.05303	-5.04716			
Camera	TOW 6B	MCZMAN_T6B_20160516_09_09_52_0078.JPG	16/05/2016	09:09:50	50.05300	-5.04715			
Camera	TOW 6B	MCZMAN_T6B_20160516_09_10_43_0079.JPG	16/05/2016	09:10:41	50.05298	-5.04715			
Camera	TOW 6B	MCZMAN_T6B_20160516_09_12_57_0080.JPG	16/05/2016	09:12:58	50.05289	-5.04708			
Camera	TOW 6B	MCZMAN_T6B_20160516_09_13_48_0082.JPG	16/05/2016	09:13:45	50.05287	-5.04706			
Camera	TOW 6B	MCZMAN_T6B_20160516_09_15_23_0083.JPG	16/05/2016	09:15:22	50.05283	-5.04703			
Camera	TOW 6C	MCZMAN_T6C_20160516_09_23_46_0086.JPG	16/05/2016	09:23:46	50.05409	-5.04653			
Camera	TOW 6C	MCZMAN_T6C_20160516_09_24_15_0087.JPG	16/05/2016	09:24:11	50.05409	-5.04652			
Camera	TOW 6C	MCZMAN_T6C_20160516_09_25_12_0088.JPG	16/05/2016	09:25:12	50.05409	-5.04651			
Camera	TOW 6C	MCZMAN_T6C_20160516_09_26_17_0090.JPG	16/05/2016	09:26:16	50.05408	-5.04648			
Camera	TOW 6C	MCZMAN_T6C_20160516_09_27_12_0091.JPG	16/05/2016	09:27:12	50.05407	-5.04645			
Camera	TOW 6C	MCZMAN_T6C_20160516_09_28_13_0092.JPG	16/05/2016	09:28:13	50.05409	-5.04644			

Cornwall IFCA							Camera Positioning Summary		
Area		Manacles MCZ	Project name		20160516 Manacles MCZ DDV Field Report				
Vessel		Tiger Lily	Sampling position						
Projection									
Sample type	Station number	Image_ID	Date	Time	Latitude (decimal degrees)	Longitude (decimal degrees)	Depth (m)	Substrate	Comments
Camera	TOW 6C	MCZMAN_T6C_20160516_09_29_12_0093.JPG	16/05/2016	09:29:12	50.05410	-5.04640			
Camera	TOW 6C	MCZMAN_T6C_20160516_09_30_14_0094.JPG	16/05/2016	09:30:17	50.05412	-5.04637			
Camera	TOW 6C	MCZMAN_T6C_20160516_09_31_11_0095.JPG	16/05/2016	09:31:11	50.05412	-5.04633			
Camera	TOW 6C	MCZMAN_T6C_20160516_09_32_28_0096.JPG	16/05/2016	09:32:26	50.05415	-5.04628			
Camera	TOW 6C	MCZMAN_T6C_20160516_09_33_17_0097.JPG	16/05/2016	09:33:19	50.05416	-5.04627			
Camera	TOW 6C	MCZMAN_T6C_20160516_09_34_12_0098.JPG	16/05/2016	09:34:11	50.05419	-5.04625			
Camera	TOW 6C	MCZMAN_T6C_20160516_09_35_12_0099.JPG	16/05/2016	09:35:29	50.05421	-5.04623			
Camera	TOW 6C	MCZMAN_T6C_20160516_09_36_14_0100.JPG	16/05/2016	09:36:11	50.05422	-5.04623			
Camera	TOW 6D	MCZMAN_T6D_20160516_09_46_16_0102.JPG	16/05/2016	09:46:23	50.05371	-5.04643			
Camera	TOW 6D	MCZMAN_T6D_20160516_09_47_25_0103.JPG	16/05/2016	09:47:24	50.05377	-5.04642			
Camera	TOW 6D	MCZMAN_T6D_20160516_09_48_26_0104.JPG	16/05/2016	09:48:40	50.05386	-5.04640			
Camera	TOW 6D	MCZMAN_T6D_20160516_09_49_27_0105.JPG	16/05/2016	09:49:27	50.05392	-5.04640			
Camera	TOW 6D	MCZMAN_T6D_20160516_09_50_25_0106.JPG	16/05/2016	09:50:23	50.05400	-5.04639			
Camera	TOW 6D	MCZMAN_T6D_20160516_09_51_25_0107.JPG	16/05/2016	09:51:25	50.05407	-5.04638			
Camera	TOW 6D	MCZMAN_T6D_20160516_09_52_22_0108.JPG	16/05/2016	09:52:23	50.05415	-5.04634			
Camera	TOW 5	MCZMAN_T520160516_10_04_40_0110.JPG	16/05/2016	10:04:41	50.04970	-5.04899			
Camera	TOW 5	MCZMAN_T520160516_10_06_04_0111.JPG	16/05/2016	10:06:04	50.04978	-5.04893			
Camera	TOW 5	MCZMAN_T520160516_10_07_04_0112.JPG	16/05/2016	10:07:04	50.04986	-5.04887			
Camera	TOW 5	MCZMAN_T520160516_10_08_06_0113.JPG	16/05/2016	10:08:07	50.04994	-5.04879			
Camera	TOW 5	MCZMAN_T520160516_10_09_05_0114.JPG	16/05/2016	10:09:05	50.05002	-5.04871			
Camera	TOW 5	MCZMAN_T520160516_10_10_06_0115.JPG	16/05/2016	10:10:05	50.05011	-5.04864			

Cornwall IFCA							Camera Positioning Summary		
Area		Manacles MCZ	Project name		20160516 Manacles MCZ DDV Field Report				
Vessel		Tiger Lily	Sampling position						
Projection									
Sample type	Station number	Image_ID	Date	Time	Latitude (decimal degrees)	Longitude (decimal degrees)	Depth (m)	Substrate	Comments
Camera	TOW 5	MCZMAN_T520160516_10_11_07_0116.JPG	16/05/2016	10:11:06	50.05019	-5.04858			
Camera	TOW 5	MCZMAN_T520160516_10_12_07_0117.JPG	16/05/2016	10:12:09	50.05026	-5.04849			
Camera	TOW 5	MCZMAN_T520160516_10_13_24_0119.JPG	16/05/2016	10:13:23	50.05034	-5.04841			
Camera	TOW 5	MCZMAN_T520160516_10_14_06_0120.JPG	16/05/2016	10:14:06	50.05041	-5.04836			
Camera	TOW 5	MCZMAN_T520160516_10_15_22_0121.JPG	16/05/2016	10:15:22	50.05050	-5.04828			
Camera	TOW 5	MCZMAN_T520160516_10_16_16_0122.JPG	16/05/2016	10:16:15	50.05058	-5.04822			
Camera	TOW 5	MCZMAN_T520160516_10_17_13_0123.JPG	16/05/2016	10:17:13	50.05065	-5.04817			
Camera	TOW 5	MCZMAN_T520160516_10_18_18_0124.JPG	16/05/2016	10:18:18	50.05077	-5.04806			
Camera	TOW 4	MCZMAN_T420160516_10_28_39_0126.JPG	16/05/2016	10:29:01	50.04717	-5.04588			
Camera	TOW 4	MCZMAN_T420160516_10_29_56_0127.JPG	16/05/2016	10:29:54	50.04725	-5.04583			
Camera	TOW 4	MCZMAN_T420160516_10_30_58_0128.JPG	16/05/2016	10:30:57	50.04735	-5.04578			
Camera	TOW 4	MCZMAN_T420160516_10_32_10_0129.JPG	16/05/2016	10:32:09	50.04746	-5.04561			
Camera	TOW 4	MCZMAN_T420160516_10_33_10_0130.JPG	16/05/2016	10:33:07	50.04754	-5.04556			
Camera	TOW 4	MCZMAN_T420160516_10_33_53_0131.JPG	16/05/2016	10:33:51	50.04760	-5.04540			
Camera	TOW 4	MCZMAN_T420160516_10_34_55_0132.JPG	16/05/2016	10:34:53	50.04770	-5.04534			
Camera	TOW 4	MCZMAN_T420160516_10_37_55_0133.JPG	16/05/2016	10:37:54	50.04790	-5.04512			
Camera	TOW 4	MCZMAN_T420160516_10_38_55_0134.JPG	16/05/2016	10:38:54	50.04800	-5.04504			
Camera	TOW 4	MCZMAN_T420160516_10_39_56_0135.JPG	16/05/2016	10:39:56	50.04811	-5.04499			
Camera	TOW 4	MCZMAN_T420160516_10_40_55_0136.JPG	16/05/2016	10:40:53	50.04822	-5.04494			
Camera	TOW 4	MCZMAN_T420160516_10_41_56_0137.JPG	16/05/2016	10:41:54	50.04835	-5.04489			
Camera	TOW 4	MCZMAN_T420160516_10_42_54_0138.JPG	16/05/2016	10:42:54	50.04846	-5.04485			

Cornwall IFCA							Camera Positioning Summary		
Area		Manacles MCZ	Project name		20160516 Manacles MCZ DDV Field Report				
Vessel		Tiger Lily	Sampling position						
Projection									
Sample type	Station number	Image_ID	Date	Time	Latitude (decimal degrees)	Longitude (decimal degrees)	Depth (m)	Substrate	Comments
Camera	TOW 4	MCZMAN_T420160516_10_43_57_0139.JPG	16/05/2016	10:43:57	50.04862	-5.04483			
Camera	TOW 4	MCZMAN_T420160516_10_44_58_0140.JPG	16/05/2016	10:44:58	50.04875	-5.04480			
Camera	TOW 8	MCZMAN_T820160516_10_58_28_0141.JPG	16/05/2016	10:58:31	50.05038	-5.05443			
Camera	TOW 8	MCZMAN_T820160516_10_59_36_0142.JPG	16/05/2016	10:59:37	50.05051	-5.05428			
Camera	TOW 8	MCZMAN_T820160516_11_00_37_0143.JPG	16/05/2016	11:00:37	50.05066	-5.05417			
Camera	TOW 8	MCZMAN_T820160516_11_01_40_0144.JPG	16/05/2016	11:01:39	50.05083	-5.05406			
Camera	TOW 8	MCZMAN_T820160516_11_02_36_0145.JPG	16/05/2016	11:02:35	50.05098	-5.05397			
Camera	TOW 8	MCZMAN_T820160516_11_03_37_0146.JPG	16/05/2016	11:03:35	50.05117	-5.05388			
Camera	TOW 8	MCZMAN_T820160516_11_04_37_0147.JPG	16/05/2016	11:04:36	50.05137	-5.05379			
Camera	TOW 8	MCZMAN_T820160516_11_05_37_0148.JPG	16/05/2016	11:05:36	50.05157	-5.05369			
Camera	TOW 8	MCZMAN_T820160516_11_06_41_0149.JPG	16/05/2016	11:06:40	50.05178	-5.05356			
Camera	TOW 8	MCZMAN_T820160516_11_07_35_0150.JPG	16/05/2016	11:07:43	50.05200	-5.05343			
Camera	TOW 7	MCZMAN_T720160516_11_08_42_0151.JPG	16/05/2016	11:08:43	50.05220	-5.05327			
Camera	TOW 7	MCZMAN_T720160516_11_09_36_0152.JPG	16/05/2016	11:09:25	50.05233	-5.05315			
Camera	TOW 7	MCZMAN_T720160516_11_10_37_0153.JPG	16/05/2016	11:10:34	50.05256	-5.05302			
Camera	TOW 7	MCZMAN_T720160516_11_11_45_0154.JPG	16/05/2016	11:11:43	50.05275	-5.05288			
Camera	TOW 7	MCZMAN_T720160516_11_12_43_0155.JPG	16/05/2016	11:12:42	50.05293	-5.05273			
Camera	TOW 7	MCZMAN_T720160516_11_14_04_0156.JPG	16/05/2016	11:14:02	50.05313	-5.05259			
Camera	TOW 7	MCZMAN_T720160516_11_14_37_0157.JPG	16/05/2016	11:14:36	50.05321	-5.05258			
Camera	TOW 7	MCZMAN_T720160516_11_15_36_0158.JPG	16/05/2016	11:15:35	50.05334	-5.05251			
Camera	TOW 7	MCZMAN_T720160516_11_16_34_0159.JPG	16/05/2016	11:16:33	50.05344	-5.05236			

Cornwall IFCA								Camera Positioning Summary		
Area		Manacles MCZ	Project name		20160516 Manacles MCZ DDV Field Report					
Vessel		Tiger Lily	Sampling position							
Projection										
Sample type	Station number	Image_ID	Date	Time	Latitude (decimal degrees)	Longitude (decimal degrees)	Depth (m)	Substrate	Comments	
Camera	TOW 7	MCZMAN_T720160516_11_17_35_0160.JPG	16/05/2016	11:17:34	50.05356	-5.05221				
Camera	TOW 7	MCZMAN_T720160516_11_18_38_0161.JPG	16/05/2016	11:18:36	50.05370	-5.05207				
Camera	TOW 7	MCZMAN_T720160516_11_19_40_0162.JPG	16/05/2016	11:19:38	50.05386	-5.05203				
Camera	TOW 7	MCZMAN_T720160516_11_20_36_0163.JPG	16/05/2016	11:20:34	50.05396	-5.05180				
Camera	TOW 7	MCZMAN_T720160516_11_21_35_0164.JPG	16/05/2016	11:21:34	50.05408	-5.05167				
Camera	TOW 7	MCZMAN_T720160516_11_22_54_0165.JPG	16/05/2016	11:22:53	50.05429	-5.05154				
Camera	TOW 7	MCZMAN_T720160516_11_24_02_0166.JPG	16/05/2016	11:24:02	50.05446	-5.05142				