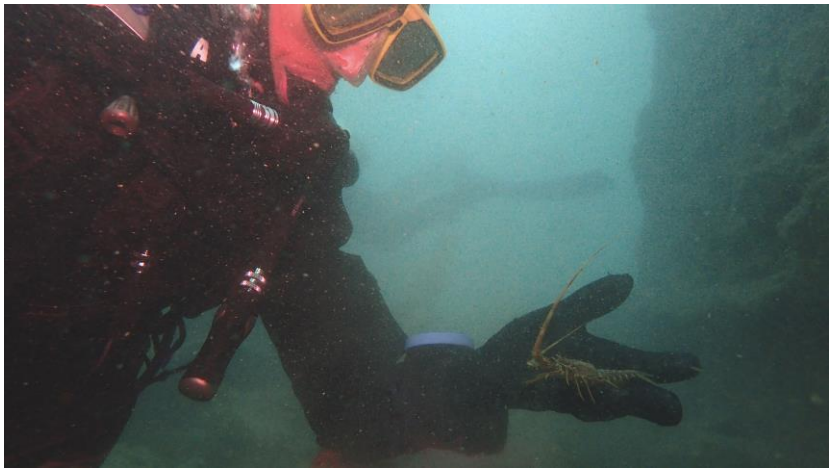
Cornwall IFCA/SeaSearch Spiny Lobster Survey

Incorporating trials of USBL diver positioning



20180329_CIFCA_Spiny_Lobster_SeaSearch: Field report

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

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Dates of survey work: 29th March 2018

Document History			
Version	Date	Author	Change
0.1	29/03/18	S Davies	Initial draft
0.2	12/04/18	S Davies	Results section and Figures 2-4 added
0.3	01/05/18	S Davies	Figures 5 and 6 added, discussion section
0.4	14/05/18	C Trundle	Text additions and QA

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1 Project Background

In the 1960s and 1970s the European spiny lobster[1] (*Palinurus elephas*) were overexploited after advancements in scuba diving gear and monofilament gill nets. However, in the past few years, reports spiny lobster sightings by divers and landings by fishermen have increased in the Cornwall IFCA district.

Within Cornwall Inshore Fisheries & Conservation Authority (IFCA) district, spiny lobsters are a designated feature of conservation importance in the Manacles Marine Conservation Zone (MCZ) and Padstow Bay and Surrounds MCZ. For both sites, spiny lobsters have a general management approach of 'recover' to favourable condition. The conservation objectives for the features of the MCZ are that they are brought into, and remain, in favourable condition. For each species of marine fauna, favourable condition means that the population within a zone is supported in numbers which enable it to thrive, by maintaining:

1. The quality and quantity of its habitat
2. The number, age and sex ratio of its population.

Any temporary reduction of numbers of a species is to be disregarded if the population is sufficiently thriving and resilient to enable its recovery.

The IFCA's responsibilities in relation to management of MCZs are laid out in Sections 125 to 128 of the Marine and Coastal Access Act (MACAA) 2009. Cornwall IFCA has duties under section 154 of MACAA 2009 which states;

154 Protection of marine conservation zones

(1) The authority for an IFC district must seek to ensure that the conservation objectives of any MCZ in the district are furthered.

(2) Nothing in section 153(2) is to affect the performance of the duty imposed by this section.

(3) In this section—

(a) "MCZ" means a marine conservation zone designated by an order under section 116

(b) The reference to the conservation objectives of an MCZ is a reference to the conservation objectives stated for the MCZ under section 117(2)(b).

Section 125 of the 2009 Act also requires that public bodies (which includes the IFCA) exercise its functions in a manner to best further (or, if not possible, least hinder) the conservation objectives for MCZs.

Cornwall IFCA are in the process of producing MCZ assessments for each site and feature in order to document and determine whether management measures are required to achieve the conservation objectives of the MCZ.

[1] Also referred to as crawfish

In order to gather more information about spiny lobster, Cornwall IFCA began a partner project with SeaSearch, a national citizen science project, which in Cornwall is coordinated by the Cornwall Wildlife Trust.

It seemed that from the anecdotal evidence of spiny lobster occurrence that the majority of individuals were pre-recruits to the fishery, meaning that they were smaller than the minimum conservation reference size (MCRS) and were being returned to the sea without any size data being recorded. It was felt it was important to attempt to investigate the size/age distribution of the pre-recruit individuals. Juvenile spiny lobsters can be difficult to survey as their habitat preferences can make them cryptic to remote video methods and the use of passive trapping can be very unreliable. It was felt that diver surveys may provide better information than other methods although there could be difficulties in positioning the results. It was hypothesised that it could be possible to use Ultra Short Baseline (USBL) equipment to track a diver during a survey dive, the diver take a still image of each spiny lobster located during the dive then cross reference the timecode of still images with the diver position timecode to plot the location of the recorded spiny lobsters.

1.1 Aims and objectives

1.1.1 Aims

- To investigate the effectiveness of using subsea positioning equipment (USBL) to track the position of a diver during a directed SeaSearch spiny lobster survey.
- Cross reference still image times with subsea track time data to map the exact positioning of each recorded spiny lobster.

1.1.2 Objectives

- To count the total number and plot the positions of spiny lobsters seen during the dive.
- Assess abundance of spiny lobsters over a ‘swept’ area.
- That the data contribute to a growing database of spiny lobster population information.

2 Methodology

2.1 Equipment Specifications

Research vessel (R/V) Tiger Lily is Cornwall IFCA’s research survey vessel (Figure 1). She is a South Boats 11m Island MkII catamaran with twin IVECO 450hp engines; her Callsign is MRWR7. Tiger Lily has been refitted for survey work and includes a purpose built survey station within the wheelhouse, fitted with an uninterruptable power supply (UPS) to provide a stable continuous 240v electric supply and a dedicated Global Navigation Satellite System (GNSS) with multiple NMEA 0183 data outputs (Annex 1, Page 13). All positions were recorded using WGS84 projection and sourced from the dedicated survey GNSS (Hemisphere V100). All times are recorded as Coordinated Universal Time (UTC) and taken from the same source as the position data.

Figure 1: R/V Tiger Lily – Cornwall IFCA's research survey vessel.

Other equipment:

Subsea positioning:

- Blueprint Subsea SeaTrac X150 USBL Beacon (referred to as local beacon)
- Blueprint Subsea X010 Transponder Modem Beacon (referred to as remote beacon)

Photographic:

- Olympus Tough TG-5 4k Digital Camera (Vessel)
- Olympus TG-4 Digital Camera (Diver 3)

2.2 Personal Protective Equipment (PPE)

Research vessel R/V Tiger Lily VI is MCA coded to Category 2 and is fitted with all necessary safety equipment for 14 persons (2 crew and 12 passengers). The safety equipment includes lifejackets, first aid kits and fire suppression systems. If working on deck, all persons are required to wear appropriate clothing, lifejackets with personal locator beacons (PLBs) and safety footwear. There were no reported accidents or near misses on the day.

2.3 Methodology

The survey log of the day can be seen in Annex 2 (Page 14).

The local beacon was mounted over the starboard side of Tiger Lily on a pole that extended to just below the level of the keel (Figure 2). Positioning the beacon below the keel meant that there was no acoustic shadow

caused by the hull. The offset was specified at 6m from the location of the GPS receiver and the position of the local beacon relative to the vessel.

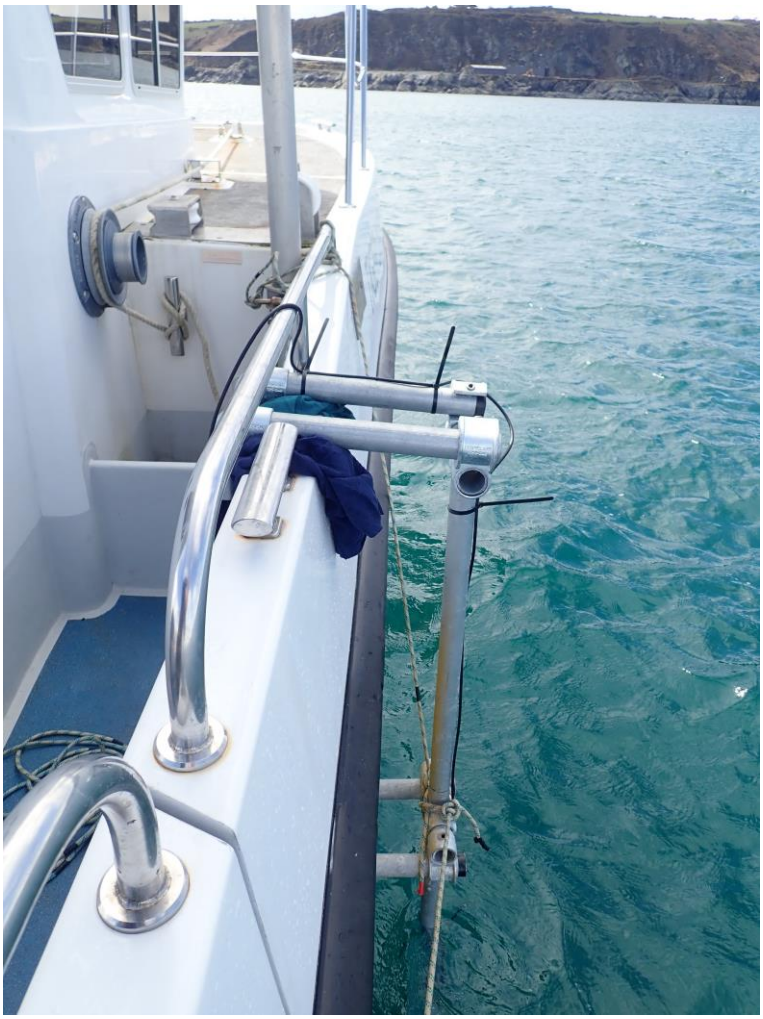


Figure 2: Mount setup on board R/V Tiger Lily for local beacon

The remote beacon was mounted onto the top of Diver 3's (Dive Team 2) dive cylinder using cable ties (Figure 3). The remote beacon number ID was recorded from observing the number of LED short flashes prior to deployment to configure with the local beacon. The local beacon was connected and tracking of the remote beacon started.

Figure 3: Remote beacon mounted on dive cylinder

The dive site, of the Volnay wreck (~22m maximum depth), was chosen due to previous records of spiny lobsters at the site and its close proximity (~2km) to the Manacles MCZ (Figure 7).

The divers were on board Stingray, a Category 4 MCA coded catamaran RHIB (Figure 4) owned by Atlantic Scuba (Owner/Skipper, Mark Milburn). The divers were split into two teams (see below) and divers descended on a shot line which was approximately positioned over the boilers of SS Volnay.

Dive Team 1:

1. Janet Dallimore (SeaSearch Volunteer)
2. John Yarrow (SeaSearch Volunteer)

Dive Team 2:

3. Matt Slater (Cornwall Wildlife Trust SeaSearch Coordinator)
4. Tom Daguerre (SeaSearch Volunteer & Hydro Motion Media CIC)
5. Gillian Burke (BBC Spring Watch Reporter)

Figure 4: Dive RHIB Stingray

SeaTrac PinPoint Tracking System Version 1.0.4b software application was used to perform real-time position logging of the diver. Once the diver had left the surface, the recording of the log file began.

2.4 Data handling

The data was exported from PinPoint at every minute interval and converted to be compatible with Mapinfo Pro Version 15.2. The track and spiny lobster sightings points were overlaid with previously recorded sidescan data of the Volnay (CIFCA, 2016) on MapInfo. The locations of spiny lobsters found were extracted using the camera time stamp to correspond with the time recorded on the track data. The time offset between the vessel GPS (UTC) and Diver 3 (BST) was 01:00:03.

3 Results

The track of Diver 3 could only be viewed through the PinPoint application as no output device was enabled. Therefore the position data was taken at 1 minute intervals from the log file. Figure 5 shows the plotted track of Diver 3 in relation to Tiger Lily and the Volnay. During post dive discussions with the diver teams about their locations during the dive it was estimated that there was a 25 meters positioning error.

The dive was for a total of 51 minutes with visibility of 8-10m, sea water temperature of 7.8°C and maximum dive depth of 19m recorded. The SeaSearch survey form of the dive can be seen in Annex 4.

Dive team 1 found a total of 19 spiny lobsters, whereas dive team 2 found 16. Divers noted that most of the spiny lobsters seen were juveniles, with an estimated carapace length ranging from 2 to 4cm. Figure 6 shows the sightings of spiny lobster in relation to the track of Diver 3.

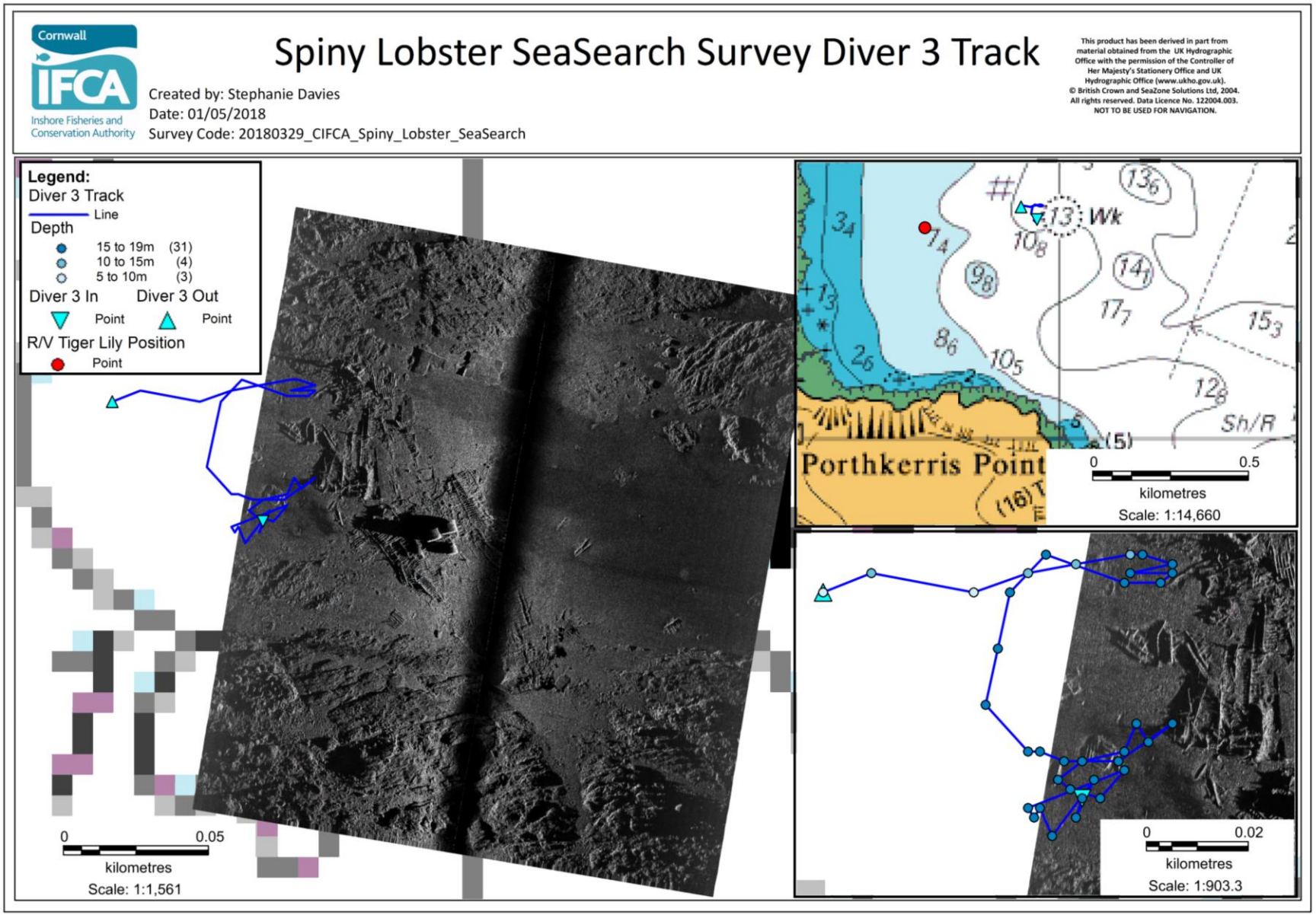


Figure 5: Spiny Lobster SeaSearch Survey Diver 3 Track

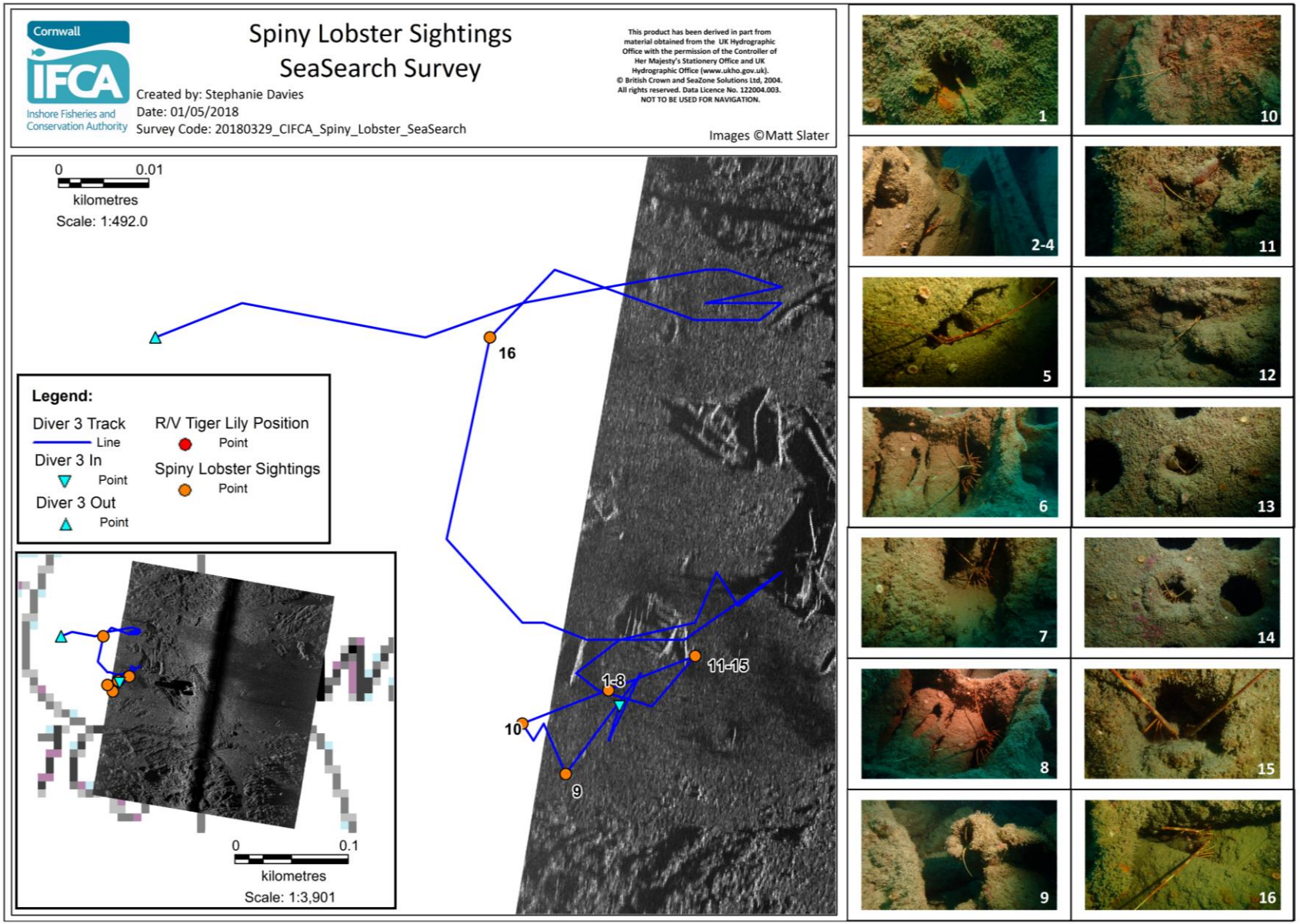


Figure 6: Spiny Lobster sightings SeaSearch Survey

4 Discussion

This initial trial and use of acoustic tracking of a diver was judged to be successful. A total of 16 spiny lobsters recorded which were able to be located on the track (Figure 5). Diver 3's photographs show many of the spiny lobsters recorded where found in the three large boilers that stand up to 5m high from the seabed (Figure 6) however the track location does not appear to be directly on the boilers of the Volnay. The photographs 11-15 (Figure 6) are actually 50m to the west of the boilers. It was estimated that the offset could be the result of a number of combining positioning errors. Although not wholly investigated, it was felt that there could be positional inaccuracy of the sidescan data or an error with the offset recorded for the local beacon and thus causing the discrepancies in positioning. Furthermore, the time stamp on Diver 3's camera only recorded to the nearest minute and therefore the photographs could not be precisely positioned against the time recorded from the remote beacon pings.

Additionally, Dive team 2 reported being stationary for most of the dive while photographing spiny lobsters, however the track of the remote beacon when watched on PinPoint *in situ* appeared to be jumping around and showing pings of up 0.75m apart. Static targets can be difficult to track, an example of this is positioning using a single antenna GPS when a vessel or vehicle is stationary. An output device was not enabled on the PinPoint application to allow the recording of the remote beacon data. To create the track, the location of Diver 3 was only mapped at every minute using the position data from the log file. This means the track displayed in Figure 5 and Figure 6 is a 'smoothed' version and not a true representation of the pings that were actually received. Given the nature of the 'live' track, using a manual method of transferring the positional data to the display probably provides a clearer result. In future, it may be advisable to filter the position data to provide a smoother horizontal profile of a dive track. Having now carried out the initial trial and which has highlighted the issues, it is felt that those issues can be adequately addressed in future dive surveys.

5 Recommendations

- During the survey the real-time track on the navigation display was intermittent with frequent fail reports. The broken connection between the local beacon and remote beacon may have been due to the diver's bubbles, when exhaling, blocking the connection. An alternative mounting position may be a solution.
- An output device was not enabled in PinPoint which meant the track could only be viewed in the application and not exported to another platform to record in a more usable format. For ease of data extraction from future surveys, an output device will in future be enabled.
- Check and improve the offset recorded of the local beacon to the vessels GPS receiver.
- Improve time stamp accuracy of camera to record to the nearest second.

6 Acknowledgments

Cornwall IFCA would like to thank the dive teams from SeaSearch and Atlantic Scuba for their time and involvement during the survey trial.

7 References

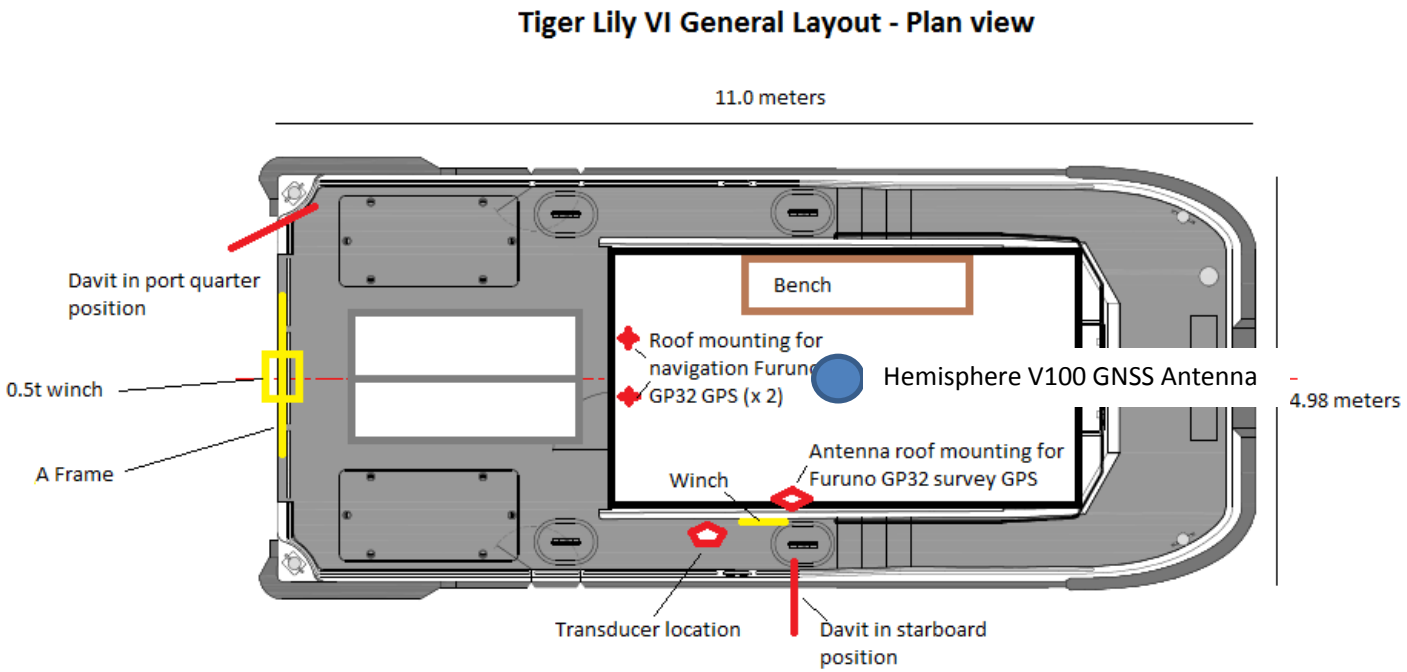
Cornwall IFCA, 2016. Manacles MCZ Side Scan Survey including west Falmouth Bay 20160303.

Natural England, 2017. Padstow Bay and Surrounds MCZ Conservation Advice. Available from: https://designatedsites.naturalengland.org.uk/Marine/MarineSiteDetail.aspx?SiteCode=UKMCZ0012 [Accessed 06/04/2018]

Natural England, 2017. Manacles MCZ Conservation Advice. Available from: https://designatedsites.naturalengland.org.uk/Marine/MarineSiteDetail.aspx?SiteCode=UKMCZ0018 [Accessed 06/04/2018]

8 Appendices

Annex 1 - Tiger Lily VI Deck Plan and Offsets



			Offset (m)		
NMEA Device	**Make/Model**	**Offset Name**	**X (Forw'd)**	**Y (Port)**	**Z (+)**
Navigation depth sounder	Furuno Navnet	Furuno transducer	5.0	0.75	-0.5
Survey GPS	Hemisphere V100		4.0	2.5	n/a

Annex 2 – Survey log

Table 1: Survey log of 29th March 2018 (time recorded in UTC)

Officers on board Tiger Lily: CT, KO, SD and DM	
Time	**Description**
07:00	Arrived at Mylor
07:15	Training and safety drills
08:37	Set up equipment
09:30	Met dive team and discussed dive plan
10:06	Depart from Mylor
10:38	Arrived at dive site – Volnay
10:43:15	First dive team left surface
10:55	Beacon attached to dive cylinder
11:07	Anchored at site (depth 17.4m)
11:11	USBL receiver attached to starboard side
11:11:45	Second dive team (plus beacon) left surface
11:30:00	One diver on surface (JD, Dive Team 1)
11:41:09	Second diver on surface (JY, Dive Team 1)
11:48:55	SMB on surface
11:56:06	Sechi disk reading of 6.5m. Position 50 04.363N 005 04.004W
12:02:24	Diver on surface (Dive Team 2)
12:04:40	Last two divers on surface (Dive Team 2)
12:19:13	Lifted anchor, departed site
13:20	Moored Tiger Lily at Mylor
13:30	Met the dive team in Mylor café to review survey
14:00	Left Mylor to return to the office

Annex 3 – Site Map

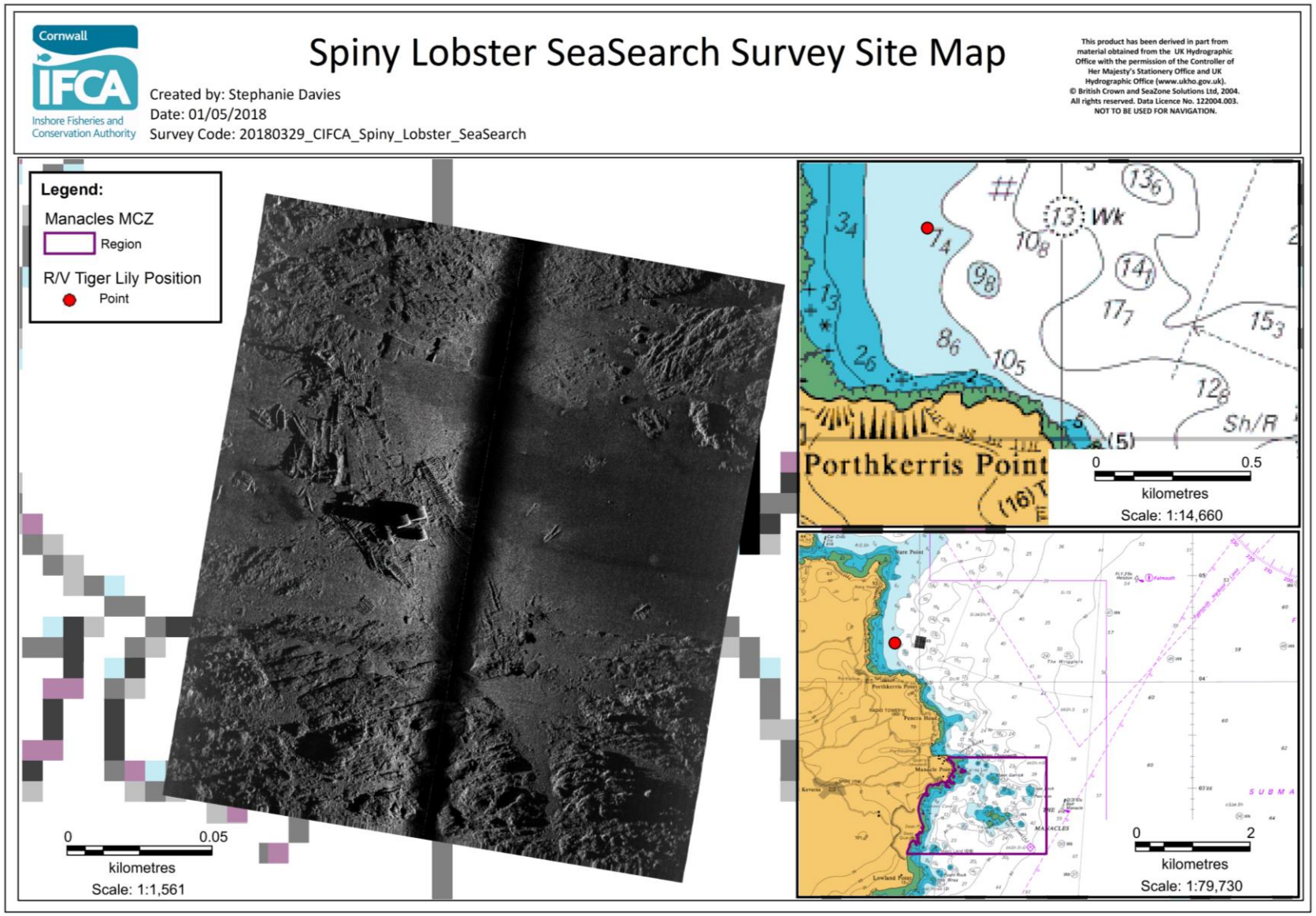


Figure 7: Spiny Lobster SeaSearch Survey Site Map - Volnay Wreck

Annex 4 – SeaSearch Survey Form

Please save your completed form then email it to the Dive Organiser, the local Seasearch Coordinator or info@seasearch.org.uk

Form no. (leave blank)

SEASEARCH SURVEY FORM

If anything is unclear please refer to the Guidance Notes.
Each pair of divers should complete a form between them.
Please complete all parts of the form. Where there is a * fill in the information only if you know it.

seasearch www.seasearch.org.uk

Validated by	Date	Entered by	Date	MR ref.
				Recorder leave blank for Seasearch use

Your details

Name	Matt Slater	Tel No.	hm/wk/mob mobile
Address		email	
		Buddy's name	Tom Daguerre and Gillian Burke
	Postcode		
Name of group or survey	Seasearch Cornwall		

Dive/site details

Site name	SS Volnay wreck			Date of dive	29/03/2108
General location	off Porthallow, Falmouth Bay			Start of dive	12.00 (24hr)
				Dive duration	51 (mins)
				Sea temperature	8 ℃
				U/W visibility	8 m
Position	Latitude	Longitude	W or E	Drift dive?	☐
Centre of site	50 ° 04.383	05 ° 04.000	W	Night dive?	☐
For drift dives				Did you or your buddy take any of the following?	
From	°	°		photographs	☑
To	°	°		video footage	☑
Or OS Grid Ref	square	E	N	specimens	☐
Position derived from				seaweeds for pressing	☐
GPS datum				For the area surveyed what was	
				the shallowest depth (m)?	13 bsl bcd
Exposure of site	moderately exposed			the deepest depth (m)?	19 bsl bcd
Max tidal stream	< 1 kt			Tidal correction to chart datum	m *

Seabed summary

Summarise: a. The main features of the site, b. Any unusual features or species, c. Any human activities or impacts at the site

Large wreck of steam ship- largely flattened but 3 large boilers remain standing 5m high.
Lots of juvenile crawfish - a totoal of 16 seen and photographed - all below min landing size - carapace ranging from 2 to 4 cm total length (estimated)

SS digital v60 Page 1 of 6

Habitat descriptions

*Complete a box below for each **habitat** you found on your dive. Normally the shallowest habitat is No. 1 even if you have done the deepest dive first. Each written description should tally with the information entered in the columns and diagrams on the next page. If you found more than 3 habitats, continue your descriptions on another form. Tick boxes where shown, and insert percentages (they must add up to 100%) or assign a score from 1-5 as appropriate. If you are uncertain leave the box blank. The biotope code will be assigned later from your description,*

1. DESCRIPTION (physical and community)

Steel wreckage - large 5m high steam boilers with tubes, covered in silty bryozoan and algae short turf and cup corals and occasional seafans and dmf

Biotope Code

Seabed type: rock ☐ boulders ☐ cobbles ☐ pebbles ☐ gravel ☐ sand ☐ mud ☐ wreckage ☑ other

Communities: kelp forest ☐ kelp park ☐ mixed seaweeds ☐ seagrass bed ☐ enc pink algae ☐

animal turf animal bed sediment with life ☐ barren sediment ☐

2. DESCRIPTION (physical and community)

Silty mud/ gravel between wreckage - some signs of life - lanice conchigla and Cerianthus burrowing anemones rare

Biotope Code

Seabed type: rock ☐ boulders ☐ cobbles ☐ pebbles ☐ gravel ☑ sand ☐ mud ☑ wreckage ☐ other

Communities: kelp forest ☐ kelp park ☐ mixed seaweeds ☐ seagrass bed ☐ enc pink algae ☐

animal turf animal bed sediment with life ☐ barren sediment ☐

3. DESCRIPTION (physical and community)

Biotope Code

Seabed type: rock ☐ boulders ☐ cobbles ☐ pebbles ☐ gravel ☐ sand ☐ mud ☐ wreckage ☐ other

Communities: kelp forest ☐ kelp park ☐ mixed seaweeds ☐ seagrass bed ☐ enc pink algae ☐

animal turf animal bed sediment with life ☐ barren sediment ☐

1	2	3	DEPTH LIMITS
m			
13	16		Upper (from sea level) (i.e. minimum)
19	19		Lower (from sea level) (i.e. maximum)
			Upper (from chart datum) *
			Lower (from chart datum) *

%			SUBSTRATUM	
			Bedrock type?	
			Boulders - very large	> 1.0 m
			- large	0.5 - 1.0 m
			- small	0.25 - 0.5 m
			Cobbles (fist - head size)	
			Pebbles (50p - fist size)	
	5		Gravel - stone	
	5		- shell fragments	
	10		Sand - coarse	
5			- medium	
			- fine	
10	80		Mud	
			Shells (empty or as large pieces)	
			Shells (living e.g. mussels, limpets)	
			Artificial - metal	
			- concrete	
			- wood	
80			Other (state) metal wreckage	
95	100		Total = 100 please!	

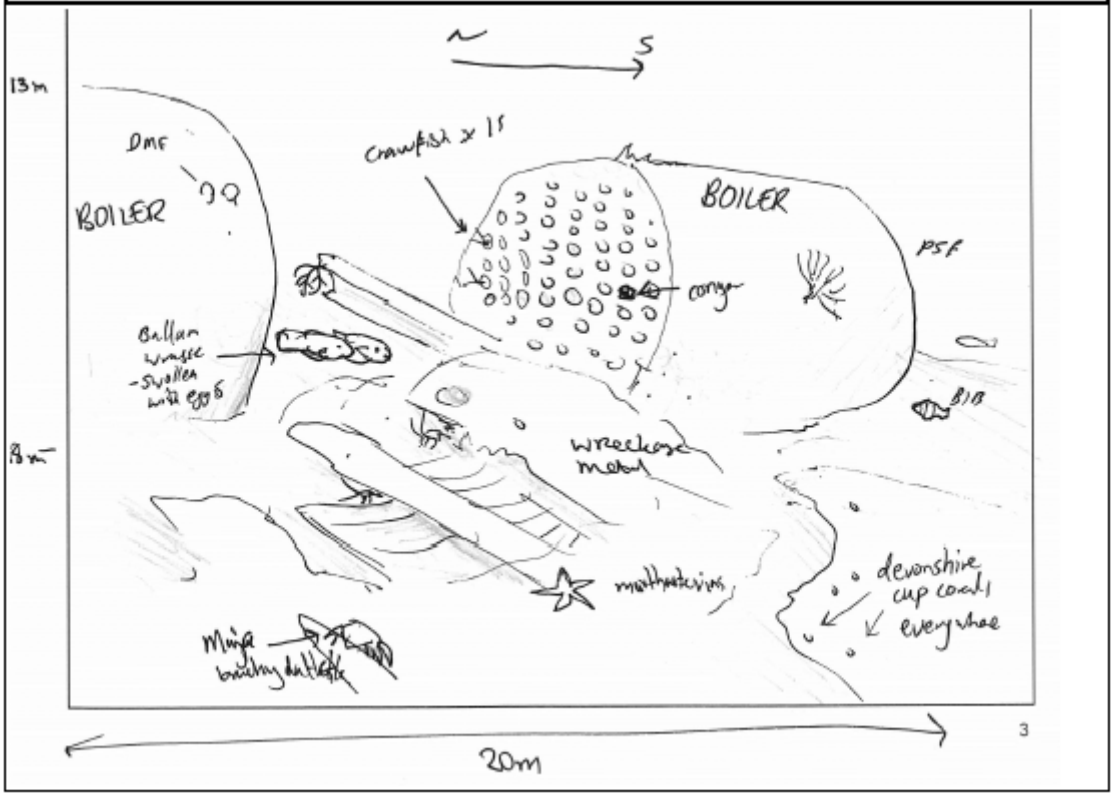
1	2	3	FEATURES - ROCK (all categories)	
1-5				
			Relief of habitat	(even - rugged)
			Texture	(smooth - pitted)
			Stability	(stable - mobile)
			Scour	(none - scoured)
			Silt	(none - silted)
			Fissures > 10 mm	(none - many)
			Crevices < 10 mm	(none - many)
			Boulder/cobble/pebble shape	(rounded - angular)
☐	☐	☐	Sediment on rock?	(tick if present)

tick			FEATURES -SEDIMENT (1)
☐	☐	☐	Mounds / casts
☐	☐	☐	Burrows / holes
☐	☐	☐	Waves (> 10 cm high)
☐	☐	☐	Ripples (< 10 cm high)
☐	☐	☐	Subsurface coarse layer
☐	☐	☐	Subsurface anoxic (black) layer

1-5			FEATURES - SEDIMENT (2)	
			Firmness	(firm - soft)
			Stability	(stable - mobile)
			Sorting	(well - poor)

Sketches and plans

Insert a profile and/or plan of the seabed you encountered on your dive into the space below (click in the space). Mark (& number the different habitats, corresponding to the written descriptions on p.2. Indicate conspicuous and/or characteristic species. Make sure you include ***depth(s)*** *(vertical axis and a* ***distance*** *scale (horizontal axis) for a profile and scale and north point for a plan. Indication the direction of the profile or plan and the direction of any current.*



Species List

*Score the abundance of each group of animals and plants **in each habitat** alongside the name. In the blank spaces list the seaweeds and animals that you were able to identify **positively** from the different habitats. Use Latin names if possible, but if you do not know them common or descriptive names are acceptable. If you are not 100% sure about any, add a question mark. Do not enter names as guesses - it is better to exclude them than to include incorrect identifications. Give abundances in the columns: **S**uperabundant, **A**bundant, **C**ommon, **F**requent, **O**ccasional & **R**are.If you did not note abundances, simply enter a **P** for Present. Continue on a separate sheet if necessary. If you have a photograph of the species tick the **ph** column.*

YOU CAN CUT AND PASTE GROUP HEADINGS FROM THE BOTTOM INTO ANY POSITION IN THE LIST

	ph	1	2	3		ph	1	2	3
SPONGES					FISHES				
Polymastia penicillis					Labrus bergylta	✓	C		
					Labrus mixtus	✓	O		
					Centrolabrus exoletus		O		
					Trisopterus luscus	✓	C		
					Centrolabrus rupestris		O		
					Conger conger	✓	R		
CNIDARIANS: hydroids/anemones/corals									
Caryophyllia smithii	✓	C							
Eunicella verrucosa	✓	O			SEAWEEDS				
Alcionium digitata	✓	F			Delessaria sanguinea	✓	R		
Nemertesia antennina	✓	F			Bryopsis spp	✓	R		
Cerianthus lloydii	✓		R						
Nemertesia ramosa	✓								
Alcyonium glomeratum (yellow varity)	✓	R							
Caryophyllia inornata	✓	F							
WORMS									
Bispira volunticornis	✓	R							
Lanice conchigla	✓		R						
CRUSTACEANS									
Palinurus elephas Juvenile x 16	✓	F							
Maja brachydactyla x 1	✓	R							
MOLLUSCS									
Nudi eggs - probably Sea Lemon	✓	R							
BRYOZOANS									
Bugula spp		R							
Crisia - silty and hard to see		O							
Cellepora pumiscosa	✓	O							
ECHINODERMS									
Marthasterias glacias	✓	F							
Echinus esculentus	✓	O							
SEA SQUIRTS									
Ascidella aspersa	✓	A							
Ascidia mentula	✓	R							
					OTHER				

You can continue your species list on the next page

Species List (continued)

*Score the abundance of each group of animals and plants **in each habitat** alongside the name. In the blank spaces list the seaweeds and animals that you were able to identify **positively** from the different habitats. Use Latin names if possible, but if you do not know them common or descriptive names are acceptable. If you are not 100% sure about any, add a question mark. Do not enter names as guesses - it is better to exclude them than to include incorrect identifications. Give abundances in the columns: Superabundant, Abundant, Common, Frequent, Occasional & Rare.If you did not note abundances, simply enter a P for Present. Continue on a separate sheet if necessary. If you have a photograph of the species tick the **ph** column.*

YOU CAN CUT AND PASTE GROUP HEADINGS FROM THE BOTTOM INTO ANY POSITION IN THE LIST

	ph	1	2	3		ph	1	2	3
					SPONGES				
					CNIDARIANS: hydroids/anemones/corals				
					WORMS				
					CRUSTACEANS				
					MOLLUSCS				
					BRYOZOANS				
					ECHINODERMS				
					SEA SQUIRTS				
					FISHES				
					SEAWEEDS				
					OTHER				

Once completed, return the form to the Dive Organiser, to your local coordinator, or to Seasearch, Marine Conservation Society, Over Ross House, Ross Park, Ross-on-Wye, Herefordshire, HR9 7QQ (email: info@seasearch.org.uk).

Your contact details will be included on the Seasearch database and those of partner organisations and will be used to send you information about Seasearch and associated projects. They will not be passed to third parties without your consent. The location, dive details, habitats and species information and the name of the recorder will be entered into a database and made available to the participating organisations and the general public through the Seasearch and NBN websites. If you do not agree with this use of the data do not submit the form.

Please use this page for any additional observations and notes that you think may be useful