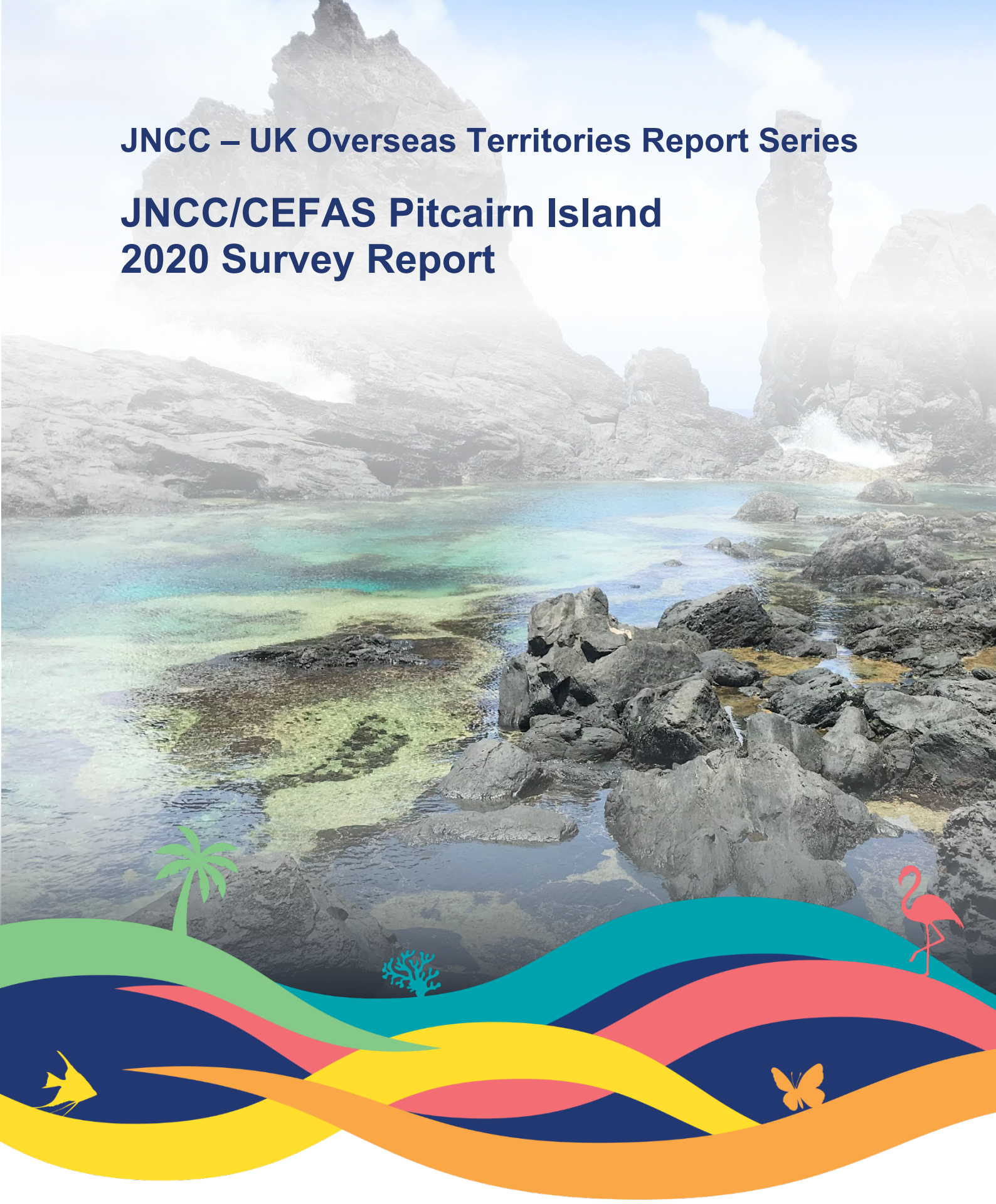
JNCC – UK Overseas Territories Report Series

JNCC/CEFAS Pitcairn Island 2020 Survey Report



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This report has been produced as part of the JNCC – UK Overseas Territories Report Series for the JNCC-led programme of work: Building Environmental resilience and security in a changing climate through biodiversity conservation in the UK overseas Territories. JNCC is supporting the UK Overseas Territories to build the resilience of key ecosystems through a nature-based solutions approach. Projects undertaken within the programme work with well-established partners in the UK Overseas Territories governments, and with local stakeholders, to build capacity in monitoring environmental change, integrating environmental evidence into economic policy, and building disaster resilience in the face of climate change. This work is funded with UK aid from the UK government through the Conflict, Stability and Security Fund (CSSF). This work builds upon the CSSF funded, JNCC-led, Natural Capital in the Caribbean and South Atlantic Overseas Territories programme, undertaken from 2016 to 2020, and the Coral Reef Action Plans developed through the UK Overseas Territories Coral Reef Initiative since 2019.

Project details

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Evidence Quality Assurance:

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Contents

1. Introduction

The Pitcairn Islands are an archipelago of four small volcanic and coral islands in the remote South Pacific (Pitcairn, Oeno, Henderson, and Ducie Islands). Only the second largest island, Pitcairn, is inhabited, with approximately 45–50 permanent residents. There is no permanent consular presence and the Territory is administered remotely by the FCO in London and the British High Commission in New Zealand.

The four islands total a land area of approximately 47 km^2 along the Foundation Seamounts chain running WNW-ESE through the central south Pacific. The Exclusive Economic Zone (EEZ) covers an area of approximately 834,000 km^2, largely comprised of abyssal depth waters (> 3,000 m), except for the narrow chain of Foundation Seamounts, most of which do not reach the surface.

In January 2020 JNCC and Cefas undertook a benthic ground-truthing and coral reef monitoring survey around the inhabited island of Pitcairn Island. The data from the survey will feed directly into the management of the marine environment within the Pitcairn MPA.

2. Survey outline

JNCC and Cefas conducted a six-day survey of the inshore regions around the UK Overseas Territory of Pitcairn Island from the 12 to 17 January 2020 (inclusive).

The survey was conducted from a VSAID-certified local vessel 'Via Papa' (see Figure 1 and Section 4). A Vessel Safety Assessment & Inspections Document (VSAID) is an internal Cefas process for ensuring that a vessel meets the minimum requirements for safety while working at sea.

The survey team arrived on Pitcairn on 9 January, mobilised on 10/11 January, demobilised 18 January and departed Pitcairn on 19 January.

Figure 1. VSAID-certified local survey vessel Via Papa.

3. Planned and completed survey aims and objectives

The primary aim of the survey was to gather a dataset which can be used to characterise and monitor Pitcairn's coral reefs. Data collected will also be used to create a shallow water substrate map for Pitcairn to feed into zoning discussions and the Pitcairn Marine Management Plan.

The planned objectives of the survey are given in Table 1. Planned and completed objectives for the Pitcairn Island Survey along with priority, rationale and the proposed method for achieving these.

Please note Objective 1 and 2 were completed simultaneously at the beginning of the survey with additional time dedicated to completing data collection for each Objective separately as the survey progressed (i.e. as we developed an understanding of the distribution of benthic habitats and coral communities around Pitcairn).

In total 58 camera and five CTD stations were completed.

Table 1. Planned and completed objectives for the Pitcairn Island Survey.

Priority	Objective	Rationale	Method	Competed?
1a	Map the extent and distribution of the coral reef communities around Pitcairn.	Data will be used to create coral reef map	Drop-down camera frame transect	Yes
1b	Assess condition of the coral reef using following metrics: • Community composition and diversity • Coral health (i.e. bleaching, damage, disease, trash, algal overgrowth) • Presence and abundance of Crown-of-thorns starfish and predation scars	Data will be used to inform assessment of coral reef condition and will form the first point in a timeseries to monitor changes to condition over time	Drop-down camera frame transect	Data collected should allow these metrics to be assessed
1c	Identification of suitable coral reef monitoring sites and the collection of the first set of data points for an ongoing programme.	Data collected from these stations will form the first point in a timeseries to monitor changes to reef extent, distribution and condition over time	Drop-down camera frame transect	Data collected should allow for suitable monitoring sites to be identified
1d	Collect presence and abundance data on the populations of lobsters (spiny and slipper) around Pitcairn	Lobster species are commercially important; data may help inform assessment of efficacy of the proposed restrictions in the Inshore Fisheries Management Plan	Drop-down camera frame transect	No; no lobsters observed on preliminary viewing of imagery data collected

Priority	Objective	Rationale	Method	Competed?
2a	Collect ground-truthing information on the substrate around Pitcairn Island	The data will be utilised to create a shallow water substrate map for Pitcairn. The data will feed into the zoning information and the MMP	Drop-down camera frame transect	Yes
2b	Collect information on the community structures of the different habitats around the island	Information on the biota will allow the correct habitat designations to be applied to the substrate map. Information will also be used to assess the current status of the habitats surrounding Pitcairn and help inform the MMP	Drop-down camera frame transect	Yes
3	Collect bathymetry data from around Pitcairn Island	Bathymetry data will be used to create a satellite derived bathymetry map for the shallow waters around Pitcairn. This data will feed into the MMP and possible anchor zoning	Single Beam Echo Sounder (SBES) GNSS positioning system	Partially - SBES system did not work so Sonar Ball bathymetry data recorded for start and end locations of camera transects
4	Collect CTD data from around Pitcairn Island	Data will be used to investigate whether differences in coral reefs relate to differences in temperature and salinity	CTD	Partially - five CTD stations completed
5	Collect geodetic information around the island	Accurate point information from around the island will help in the geolocation of the satellite data and increase the accuracy of the derived products	GNSS positioning system	Objective not attempted as low priority and limited time

4. Existing information

Prior to the survey, data collected by the Sentinel 2A satellite were used to create a depth corrected image of the seabed around Pitcairn which was segmented within ArcMap v10.5.

After segmentation the resulting objects were classified by an unsupervised method into different predicted habitat types, with 84 habitat mapping stations then randomly positioned throughout these habitats (see Appendix 2 for map of planned stations and habitat classes).

5. Methods

5.1. Drop-Down Camera

The planned specification for the drop-down camera (DDC) system was a high definition Go Pro 7 video camera, a standard definition video to topside camera and a 12 MP stills camera linked to a strobe via an optic fibre link. Unfortunately, the survey laptop failed on the second day of survey, resulting in a day's worth of topside collected data, with the remaining data collected using the methodology described in 5.4 below.

The stills camera was set to interval shooting at a rate of one image every 10 second. Two lasers were fitted to the frame 11.5 cm apart to provide scale within each still image taken.

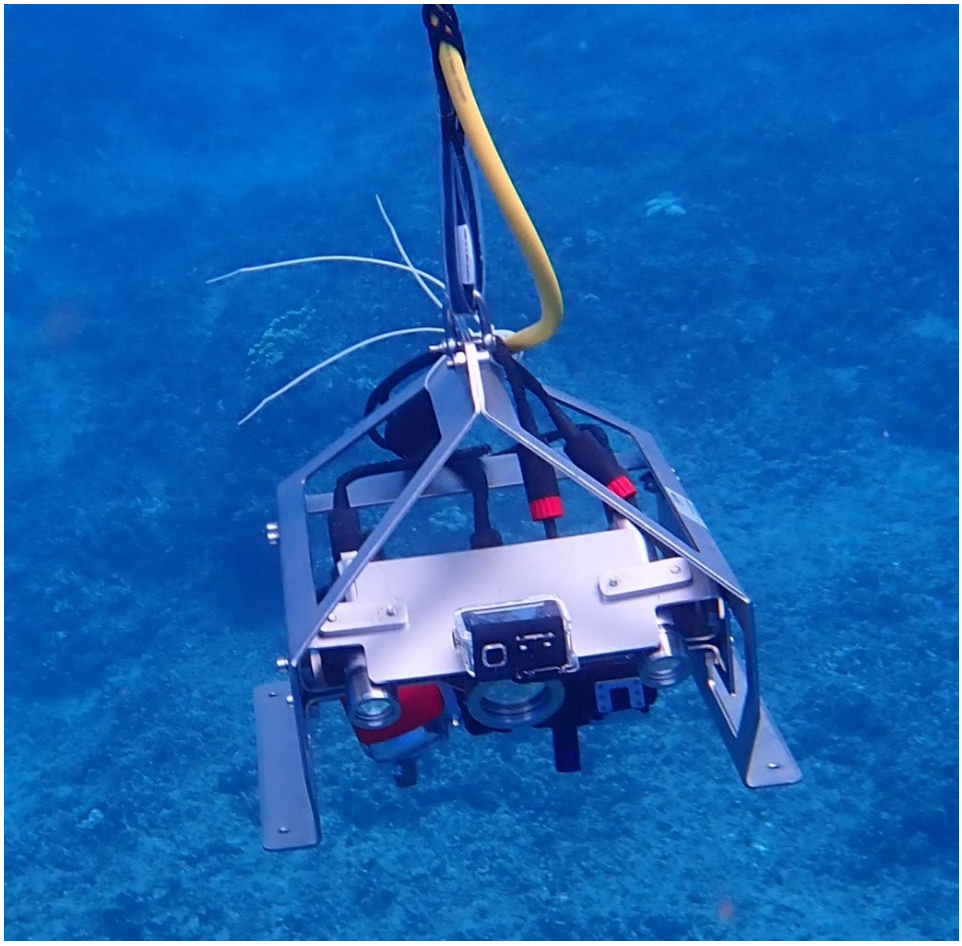

Figure 2. Drop-down camera system.

5.2. Bathymetry data

The plan was to collect bathymetric data using a CEE-line single beam echo sounder (SBES). Due to the failure of the survey laptop on the second day this was not possible. A Deeper Sonar Ball (DSB, see Figure 3) was used instead from the third day onwards which provided both bathymetric and positional data for each DDC deployment. Seabed depth was recorded for the start and end points of each deployment with positional information recorded from the boat's GPS.

Following the survey, DSB profile data could not be retrieved from the My Deeper website.

Figure 3. Deeper-sonar ball.

5.3. CTD data

Environmental data (temperature and salinity) were collected using a Valeport Swift CTD.

5.4. DDC and DSB Deployment

The DDC was deployed for either a 10- or 5-minute tow depending on distance travelled, the vicinity of hazards and direction of drift. Most stations were carried out by allowing the vessel to drift. When the drift rate was not enough the vessel was propelled in the most favourable direction in relation to sea state and wind direction.

At the beginning of each tow the Deeper Sonar Ball was first deployed, and a connection established with the designated iPhone. Once a connection was confirmed the DDC was lowered over the side to a depth of two metres. When the DDC was visible on the output from the DSB it was slowly lowered by hand to ~2 m above the seabed. Position, depth and time of Start-Of-Line (SOL) were logged. During the tow the altitude of the DDC above the seabed was monitored using the output from the DSB and adjusted by hauling out/paying in as needed. On completion of the tow an End-Of-Line (EOL) position, depth and time were logged before retrieving the DDC back on to deck.

6. Preliminary results

6.1. Habitat mapping imagery (Objective 2)

As approximately three days were available for this work, survey efforts were focussed on the 40 highest priority stations. Data collected for Objective 1 will also be used to achieve this objective.

Completed stations are shown in Figure 4.

Ten additional habitat mapping stations were surveyed in Bounty Bay on request from Pitcairn Government to inform vessel anchoring and mooring management planning.

6.2. Coral Reef monitoring imagery (Objective 1)

Imagery data collected to inform Objective 2 and local expertise were used to identify areas of coral reef which were targeted for coral reef monitoring. Approximately two days were dedicated to this work.

Data collected for Objective 2 will also be used to achieve this objective. Completed stations are shown in Figure 4.

6.3. Bathymetry data collection (Objective 3)

Bathymetry data profiles were collected along camera transects using the Sonar Ball (see Section 4 for more information); please note following the survey DSB data could not be retrieved from the My Deeper website. Seabed depth records are therefore limited to those logged at the start and end points of each deployment with associated positional information logged from the boat's GPS (see Appendix 1).

6.4. Environmental data collection (Objective 4)

Environmental (CTD) data were collected opportunistically during the survey at a subset of five stations.

Completed stations are detailed in Figure 4.

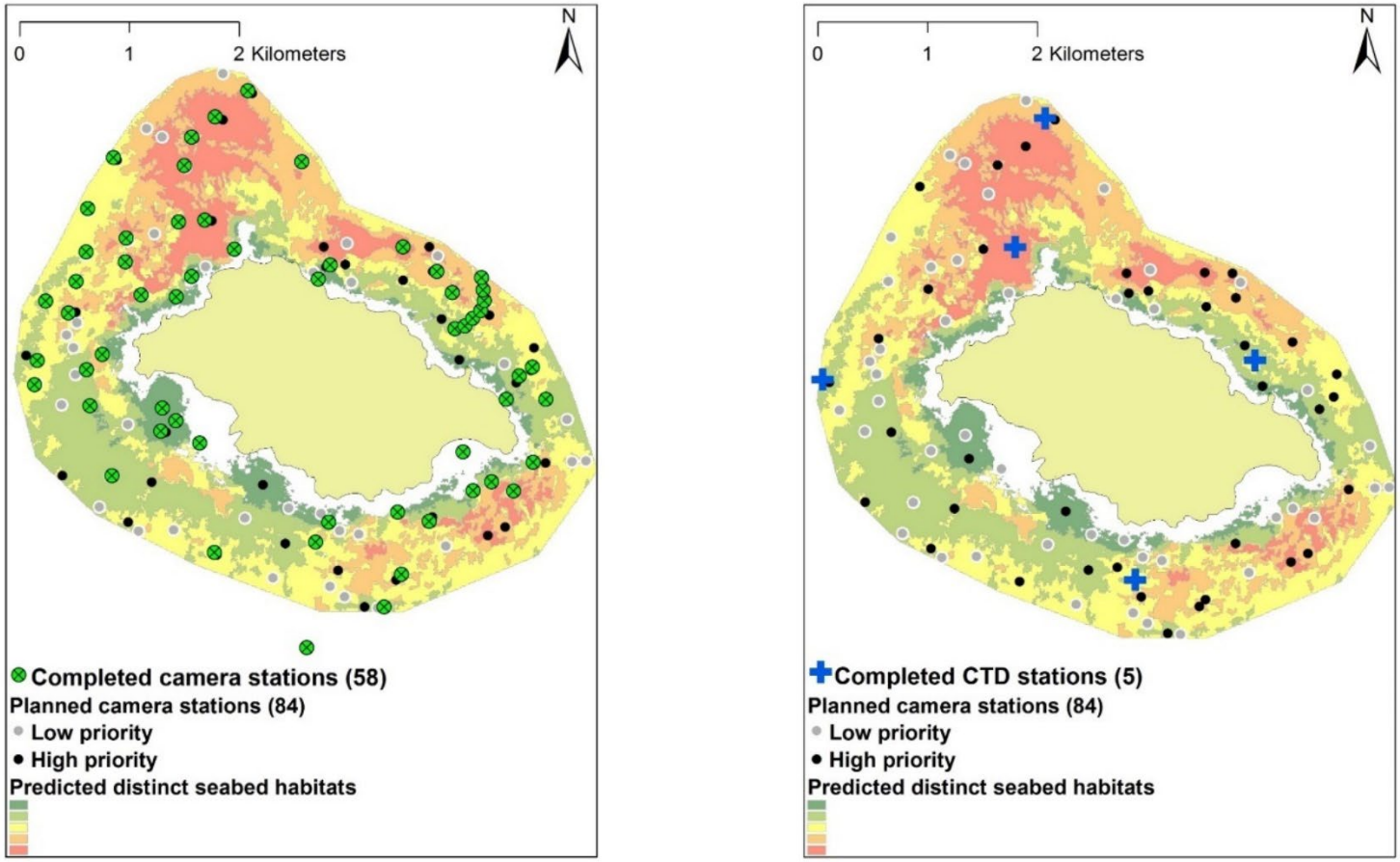

Figure 4. Completed camera (left map) and CTD (right map) stations. Note colours of predicted distinct seabed habitats represent 'different' habitats, they do not predict what these habitats are.

7. Lessons learnt and recommendations

- Hand-deployed camera system operations worked better without topside or laptop using Deeper Sonar Ball to ‘fly’ camera; suggest using this configuration for similar work (e.g. from small boats) going forward.
- Charging the Sonar Ball between stations was an issue, recommend taking two units so one can be on charge while one is operational.
- GoPro 7 footage was superior to topside unit video and to stills; suggest considering using multiple GoPro’s (including to collect time-lapse stills) for similar work going forward.
- Solution for powering and charging laptop using standalone batteries requires further development; the batteries we took did not power the laptop despite being on charge for two days before being used at sea. A small petrol-powered generator worked well during this survey.
- More camera batteries should be taken.

Appendix 1. Summary metadata

Table 2. Details of the metadata for each station.

Station Number	Station Code	Gear	Date	SOL Time	SOL Longitude	SOL Latitude	EOL Time	EOL Longitude	EOL Latitude	Depth (m)	Comment
1	48	CTD	12/01/2020	18:18:00	-25.05653	-130.11573	n/a	n/a	n/a	18	CTD deployment
2	48	DC	12/01/2020	19:13:00	-25.0565	-130.11638	19:25:00	-25.05682	-130.1187	18	Rippled sand with occasional rock
3	86	DC	12/01/2020	19:55:00	-25.06306	-130.13083	20:05:00	-25.0638	-130.1325	71	Rippled sand with occasional rock and coral
4	34	DC	13/01/2020	17:46:00	-25.09183	-130.1075	17:57:00	-25.0925	-130.1085	70	Sand, rock and seaweed
5	18	DC	13/01/2020	18:30:00	-25.0815	-130.09633	18:40:00	-25.08233	-130.0976	20	Rippled sand and coral reef
6	85	DC	13/01/2020	18:51:00	-25.08073	-130.09917	19:02:00	-25.0811	-130.0996	11	Coral
7	31	DC	13/01/2020	19:13:00	-25.0815	-130.10542	19:30:00	-25.08145	-130.1063	n/a	Patchy bedrock with weed and coral
8	53	DC	13/01/2020	20:24:00	-25.07387	-130.12053	20:34:00	-25.07467	-130.1223	n/a	Rocky reef, weed and coral - lack of drift - had to drive transect
9	16	DC	13/01/2020	21:10:00	-25.06027	-130.1051	21:20:00	-25.0612	-130.1035	n/a	Patchy bedrock with weed and coral
10	6	DC	13/01/2020	21:32:00	-25.0609	-130.09547	21:42:00	-25.06128	-130.09523	24	Patchy rock and sand with coral

Station Number	Station Code	Gear	Date	SOL Time	SOL Longitude	SOL Latitude	EOL Time	EOL Longitude	EOL Latitude	Depth (m)	Comment
11	14	DC	13/01/2020	22:01:00	-25.05882	-130.0985	22:07:00	-25.05898	-130.09778	33	Rippled sand (5-minute tow)
12	5	DC	14/01/2020	16:10:00	-25.06957	-130.0881	16:20:00	-25.06945	-130.08804	39	n/a
13	9	DC	14/01/2020	16:35:00	-25.06883	-130.08691	16:45:00	-25.06853	-130.08655	40	n/a
14	20	DC	14/01/2020	17:00:00	-25.07668	-130.08691	16:45:00	-25.07488	-130.08475	26-39	n/a
15	87	DC	14/01/2020	17:21:00	-25.07152	-130.08572	17:31:00	-25.07165	-130.08904	8-18	Coral station
16	88	DC	14/01/2020	17:38:00	-25.07148	-130.08928	17:49:00	-25.07089	-130.08888	9-17	Coral station
17	89	DC	14/01/2020	18:11:00	-25.0758	-130.09322	18:21:00	-25.07628	-130.09392	6-14	Coral station
18	33	DC	14/01/2020	20:10:00	-25.08586	-130.09888	20:20:00	-25.08628	-130.10008	n/a	n/a
19	45	DC	14/01/2020	20:30:00	-25.08852	-130.10046	20:40:00	-25.08895	-130.10336	27	n/a
20	37	DC	14/01/2020	20:50:00	-25.08312	-130.10663	21:00:00	-25.0838	-130.10577	20	n/a
21	49	CTD	14/01/2020	21:05:00	-25.08406	-130.1051	n/a	n/a	n/a	33	CTD deployment
22	49	DC	14/01/2020	21:40:00	-25.08393	-130.11578	21:50:00	-25.08361	-130.11624	30	n/a
23	15	DC	14/01/2020	22:14:00	-25.079	-130.09237	22:24:00	-25.07912	-130.09236	14-16	n/a
24	13	DC	14/01/2020	22:34:00	-25.07827	-130.09068	22:44:00	-25.07808	-130.09068	21	n/a
25	24	DC	14/01/2020	22:52:00	-25.07905	-130.08871	22:56:00	-25.07884	-130.08892	23	n/a
26	64	CTD	15/01/2020	15:43:00	-25.0459	-130.11292	n/a	n/a	n/a	56	CTD deployment
27	64	DC	15/01/2020	15:55:00	-25.04583	-130.11241	16:05:00	-25.04486	-130.11469	30	Coarse sand
28	55	DC	15/01/2020	16:40:00	-25.04797	-130.11537	16:50:00	-25.04729	-130.11772	39	Clean rippled sand, some seaweed

Station Number	Station Code	Gear	Date	SOL Time	SOL Longitude	SOL Latitude	EOL Time	EOL Longitude	EOL Latitude	Depth (m)	Comment
29	61	DC	15/01/2020	17:04:00	-25.04963	-130.11752	17:15:00	-25.04907	-130.12036	30-40	Sand with individual coral colonies and seaweed on rock
30	51	DC	15/01/2020	17:33:00	-25.05661	-130.11876	17:43:00	-25.05652	-130.12044	20-23	Mosaic of sand and rock with individual coral colonies
31	66	DC	15/01/2020	17:50:00	-25.05987	-130.12358	18:00:00	-25.06071	-130.12152	22-25	Mosaic of sand and rock with seaweed
32	90	DC	15/01/2020	18:12:00	-25.06113	-130.1176	18:22:00	-25.06186	-130.11893	11-15	Lots of coral and seaweed on rocky reef with some sand
33	62	DC	15/01/2020	18:44:00	-25.05197	-130.11818	18:54:00	-25.05176	-130.1212	28-40	Sand and seaweed moving to mosaic of sand and rock with individual coral colonies
34	91	DC	15/01/2020	21:05:00	-25.06143	-130.10617	21:15:00	-25.06117	-130.10609	2-6	Coral station: Lots of coral and fish, sea cucumbers
35	43	DC	15/01/2020	21:48:00	-25.05172	-130.1076	21:58:00	-25.05188	-130.10843	45-47	Rippled sand with seaweed on rock

Station Number	Station Code	Gear	Date	SOL Time	SOL Longitude	SOL Latitude	EOL Time	EOL Longitude	EOL Latitude	Depth (m)	Comment
36	72	DC	15/01/2020	22:14:00	-25.05127	-130.1246	22:25:00	-25.05087	-130.12582	58-70	Clean rippled sand, some seaweed
37	78	DC	15/01/2020	22:41:00	-25.06405	-130.12877	22:51:00	-25.06417	-130.13066	27-42	Consolidated coarse material and rock with individual coral colonies and fish
38	84	CTD	16/01/2020	17:48:00	-25.06732	-130.13321	n/a	n/a	n/a	n/a	CTD deployment
39	84	DC	16/01/2020	18:00:00	-25.06797	-130.13161	18:10:00	-25.06675	-130.13263	60	Bedrock with individual coral colonies and fish (broken coral observed)
40	81	DC	16/01/2020	18:25:00	-25.06996	-130.1319	18:39:00	-25.06867	-130.13319	60	Bedrock with individual coral colonies and fish (broken coral observed)
41	71	DC	16/01/2020	18:50:00	-25.07174	-130.12689	19:00:00	-25.06964	-130.12852	34-53	Rock, sand, seaweed and coral
42	70	DC	16/01/2020	19:10:00	-25.06876	-130.12717	19:26:00	-25.06625	-130.12888	22-26	Sand, rocky out crops - seaweed with fish
43	52	DC	16/01/2020	19:50:00	-25.07487	-130.117	19:56:00	-25.0735	-130.11774	9-16	Rippled sand to bedrock covered in seaweed and coral

Station Number	Station Code	Gear	Date	SOL Time	SOL Longitude	SOL Latitude	EOL Time	EOL Longitude	EOL Latitude	Depth (m)	Comment
44	60	DC	16/01/2020	20:08:00	-25.07751	-130.12498	20:21:00	-25.07601	-130.12747	28-29	Bedrock with seaweed and corals
45	51	DC	16/01/2020	20:40:00	-25.06262	-130.12219	20:50:00	-25.06309	-130.12411	19	Sand with outcrops of bed rock covered in seaweed
46	75	DC	16/01/2020	21:00:00	-25.05904	-130.12711	21:16:00	-25.06068	-130.1308	66	Rippled sand, patches of sand covered bedrock with seaweed
47	83	DC	16/01/2020	21:26:00	-25.05546	-130.12694	21:38:00	-25.05592	-130.12806	60-67	Sand and seaweed
48	63	DC	16/01/2020	22:14:00	-25.05792	-130.1235	22:24:00	-25.05855	-130.12541	25-28	Sand and patches of bedrock covered in seaweed and coral
49	92	DC	17/01/2020	15:40:00	-25.06563	-130.09387	15:45:00	-25.06522	-130.09468	15	Landing zone. Rock and sand mosaic with coral and some seaweed- sonar ball reading in 16/1 file

Station Number	Station Code	Gear	Date	SOL Time	SOL Longitude	SOL Latitude	EOL Time	EOL Longitude	EOL Latitude	Depth (m)	Comment
50	93	DC	17/01/2020	15:50:00	-25.0654	-130.09296	15:55:00	-25.06522	-130.09468	19	Landing zone. Rock and sand mosaic with coral and some seaweed- sonar ball reading in 16/1 file
51	94	DC	17/01/2020	16:05:00	-25.06476	-130.09225	16:10:00	-25.06438	-130.09328	22	Landing zone. Rock and sand mosaic with seaweed- sonar ball reading in 16/1 file
52	95	DC	17/01/2020	16:20:00	-25.06416	-130.09151	16:25:00	-25.0636	-130.09241	24	Landing zone. Rock and sand mosaic with seaweed and occasional coral- sonar ball reading in 16/1 file
53	96	DC	17/01/2020	16:30:00	-25.06334	-130.09119	16:35:00	-25.06282	-130.0923	27-30	Landing zone
54	97	DC	17/01/2020	16:45:00	-25.06243	-130.09129	16:50:00	-25.06196	-130.09222	35-41	Landing zone
55	98	DC	17/01/2020	17:00:00	-25.06263	-130.09407	17:05:00	-25.06203	-130.09515	22	Landing zone
56	99	DC	17/01/2020	18:00:00	-25.06142	-130.09142	18:10:00	-25.06103	-130.09338	52	Landing zone
57	100	DC	17/01/2020	18:36:00	-25.05892	-130.11375	18:40:00	-25.05812	-130.11406	15	Landing zone: Only two minutes of stills, battery died during tow

Station Number	Station Code	Gear	Date	SOL Time	SOL Longitude	SOL Latitude	EOL Time	EOL Longitude	EOL Latitude	Depth (m)	Comment
58	101	DC	17/01/2020	18:55:00	-25.06281	-130.11902	19:03:00	-25.06369	-130.1189	6	Landing zone
59	102	DC	17/01/2020	19:16:00	-25.06148	-130.12807	19:26:00	-25.06211	-130.12959	31	Coral station
60	103	DC	17/01/2020	19:35:00	-25.0675	-130.12575	19:45:00	-25.06755	-130.12534	11-15	Coral station
61	50	DC	17/01/2020	20:20:00	-25.07197	-130.12036	20:30:00	-25.07227	-130.12233	7-19	Coral station
62	104	DC	17/01/2020	20:40:00	-25.07303	-130.11916	20:45:00	-25.07231	-130.11961	8-9	Coral station
63	105	CTD	17/01/2020	22:00:00	-25.06602	-130.09413	n/a	n/a	n/a	14	CTD deployment

Appendix 2. Planned drop-down camera locations and habitat classes

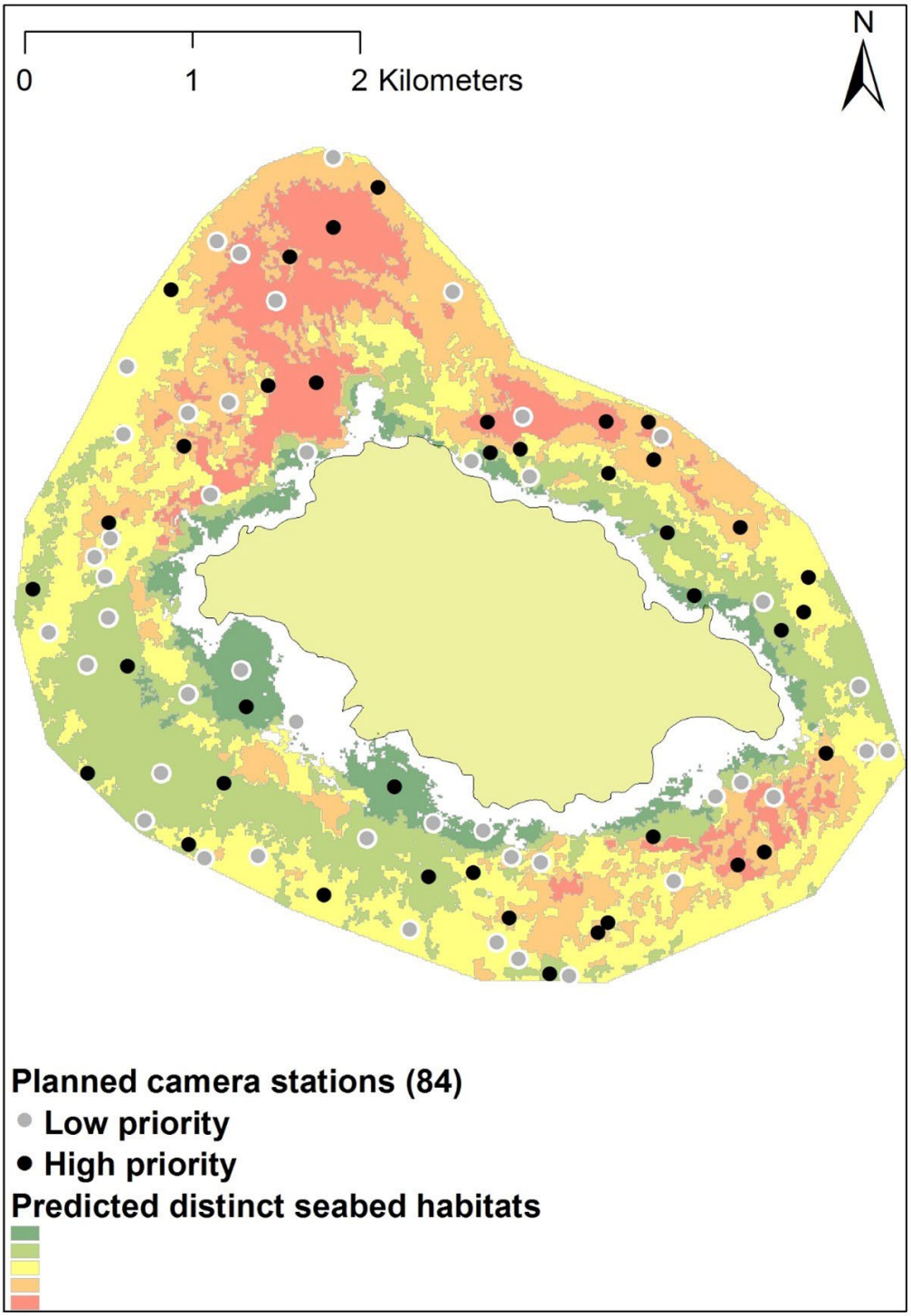

Figure 5. Planned drop-down camera locations stratified by and randomly distributed in predicted habitat classes.

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