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To	Veronica Mair	Email	Veronica.mair@kimberleyports.wa.gov.au
From	Brooke Campbell	Email	Brooke.campbell@o2marine.com.au
	Dylan Todd		Dylan.todd@o2marine.com.au
Subject	Broome Wharf extension BCH field survey		

1. Introduction

Kimberly Ports Authority (KPA) is proposing to undertake several improvements and modifications (works) to the wharf at the Port of Broome to maximize wharf space and facilities while assisting with safe and efficient operations. The works involve extending the wharf deck and piling in two areas on the wharf:

- Area 1: infill of the area adjacent to the wharf neck and berth 11; and
- Area 2: extension of the lumpers mess deck

Area 1 is approx. 610 m² will be utilised primarily for storing miscellaneous stevedoring equipment such as gangways, rigging boxes, sea containers and forklifts. Area 2 is approx. 495m² and will be the foundation for new facilities including stevedore amenities.

KPA's preliminary design suggests there will be approx. 26 piles required and the plan is for the work to be completed from the existing wharf and for piles to be driven in with a hammer (size of hammer will be determined by the contractor).

During the preliminary environmental impact assessment for the works, it was recommended that the ground truthing of the existing habitat mapping of the wharf extension areas (Area 1 and Area 2) (Figure 1) and a potential pylon installation location be undertaken. O2 Marine was contracted to complete underwater camera BCH surveys to collect ground truthing data within these areas to update the habitat maps of the area to support the environmental impact assessment process. The survey was conducted by O2 Marine on 24 October 2023. This memorandum provides a synopsis of field methods and data analysis employed on the collected ground-truthed data.

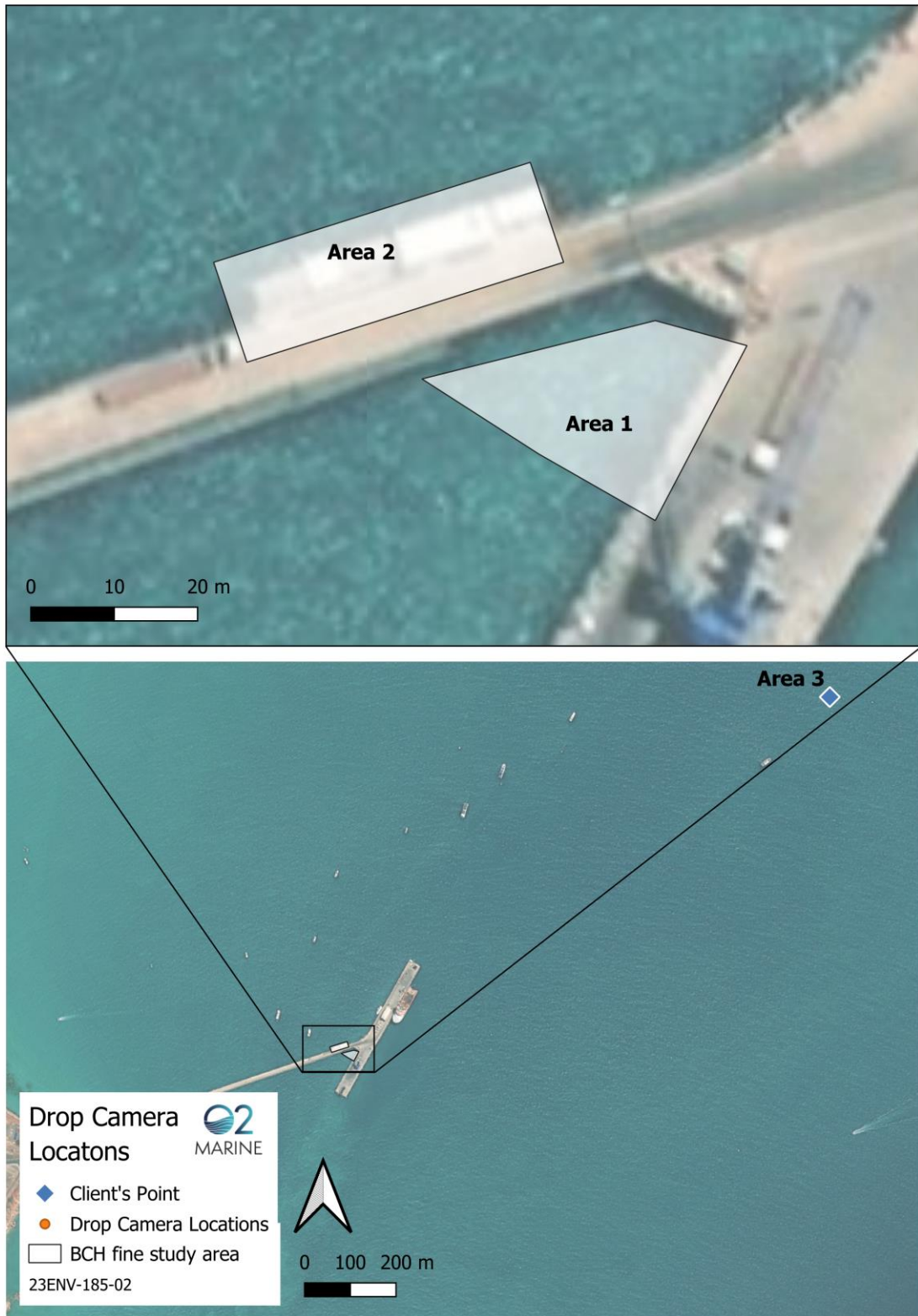


Figure 1 Proposed survey areas

2. Methods

2.1. Field survey

Ground truthing tow video was captured using a Spot X PRO SQUID 3 real-time subsea high definition (HD) video camera. The towed video camera (TVC) system was deployed from the vessel at each target location and operated by a scientist using the topside unit control box. The topside unit provided live video feed for continuous quality control and allows adjustment of lights and camera settings.

At each location, the TVC system was lowered to a depth of approximately 0.5 m above the seabed. Vessel speed was maintained between 1-2 knots and was controlled by the skipper to follow the planned transect route and allow for the recording of good quality footage. Additional drop camera footage was also collected using a DJI Osmo action camera (equivalent to GoPro) to capture higher quality imagery.

During the survey, 5 transects were conducted along the potential pylon area and 49 drop camera points were collected across the two proposed wharf extension areas (Figure 2).

The following information was recorded at each location in the field:

- Date and time
- GPS coordinates
- Dominant BCH type
- Comments to aid post-processing.

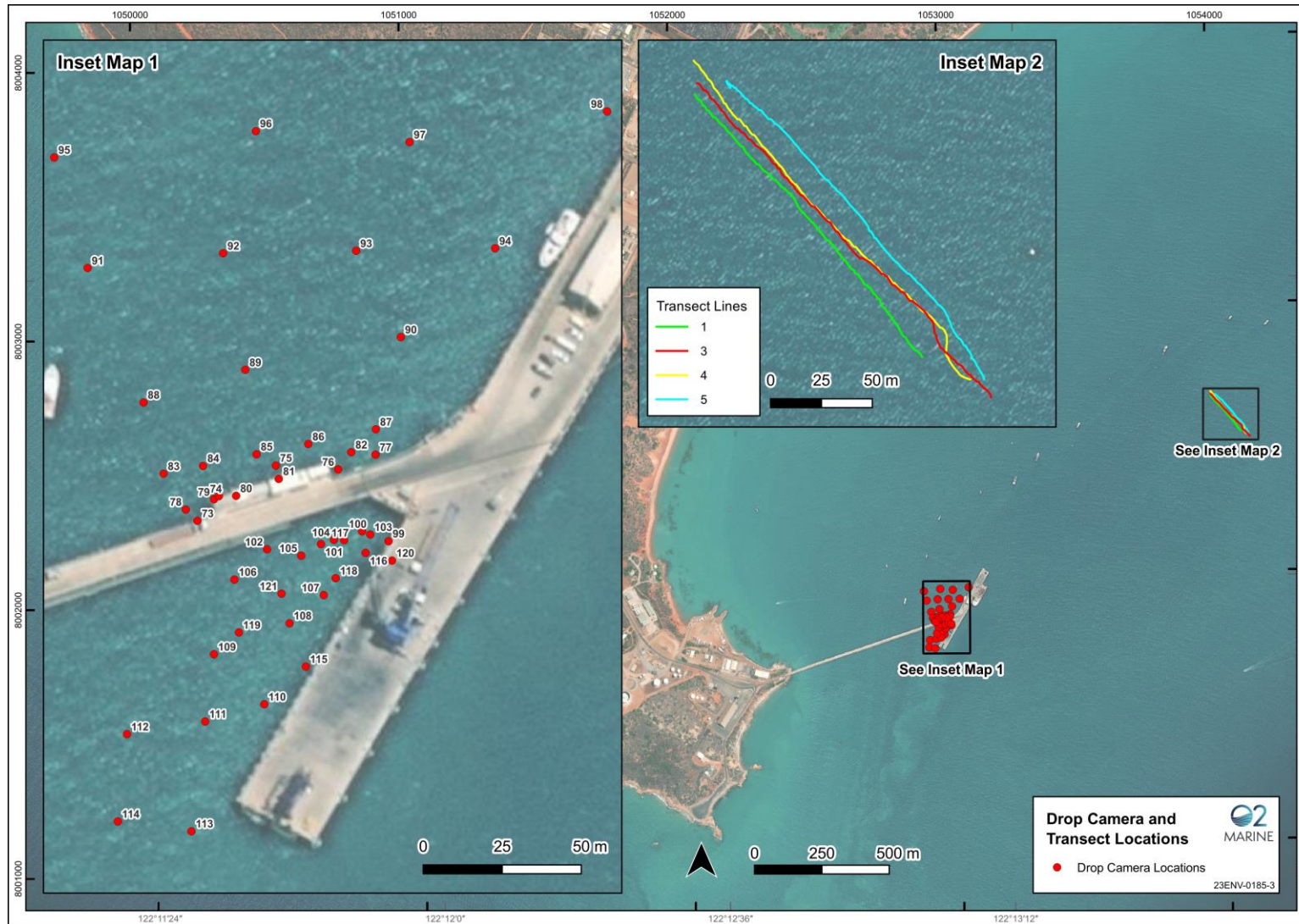


Figure 2: Project area and activity extent with Drop Camera Locations and Transect lines

2.2. Data analysis

The underwater footage of the BCH was visually analysed and classified into habitat classes in accordance with the Collaborative and Automated Tools for Analysis of Marine Imagery (CATAMI) standard classification scheme (Althaus et al. 2015) which defines benthic habitats based on the physical and biological characteristics, including:

- Relief
- Substrate
- Bedforms
- Visual estimate of percent cover of benthic flora and fauna
- Dominant taxa.

These habitat classes were then grouped into an overall classification, primarily based on relief and substrate to inform piling methods and underwater noise modelling. These overall classifications are listed below in Figure 2. The classified points were then used to update existing habitat maps created by O2 Marine (Figure).





Figure 3: BCH classification a- Bioturbated bare sand, b- Low relief rock with sand, c- Low relief rock, d- Moderate relief rock, e- Rubble

3. Results and Discussion

The benthic habitats within the two wharf extension areas are characterised by low to moderate relief rocky reef with patches of unconsolidated bare sand (Figure 4; Appendix 1 Table A- 1). The BCH communities present on the reef areas close to the wharf are a mixed assemblage of filter feeders, sponges, macroalgae and corals with some other invertebrates also present. The density of the BCH present ranged from sparse to high cover with sponges and macroalgae being the most dominant types.

The third area designated for a potential pylon is consistently bioturbated bare sand with a thin layer of algal slime of varying densities, with no significant BCH types present in the surveyed area.

Due to the presence of the rocky reef and BCH communities within the proposed wharf extension areas, it is recommended that further geotechnical studies be completed to further inform piling methods within these areas (including whether impact, drill or vibration piling is appropriate).

Talis Consultants are currently undertaking an underwater noise assessment for the works. As detailed geotechnical information of the rocky substrate is not currently available, it has been agreed at this stage to model the most conservative approach (loudest) which is high hammer energy and piling straight through the rocky reef.

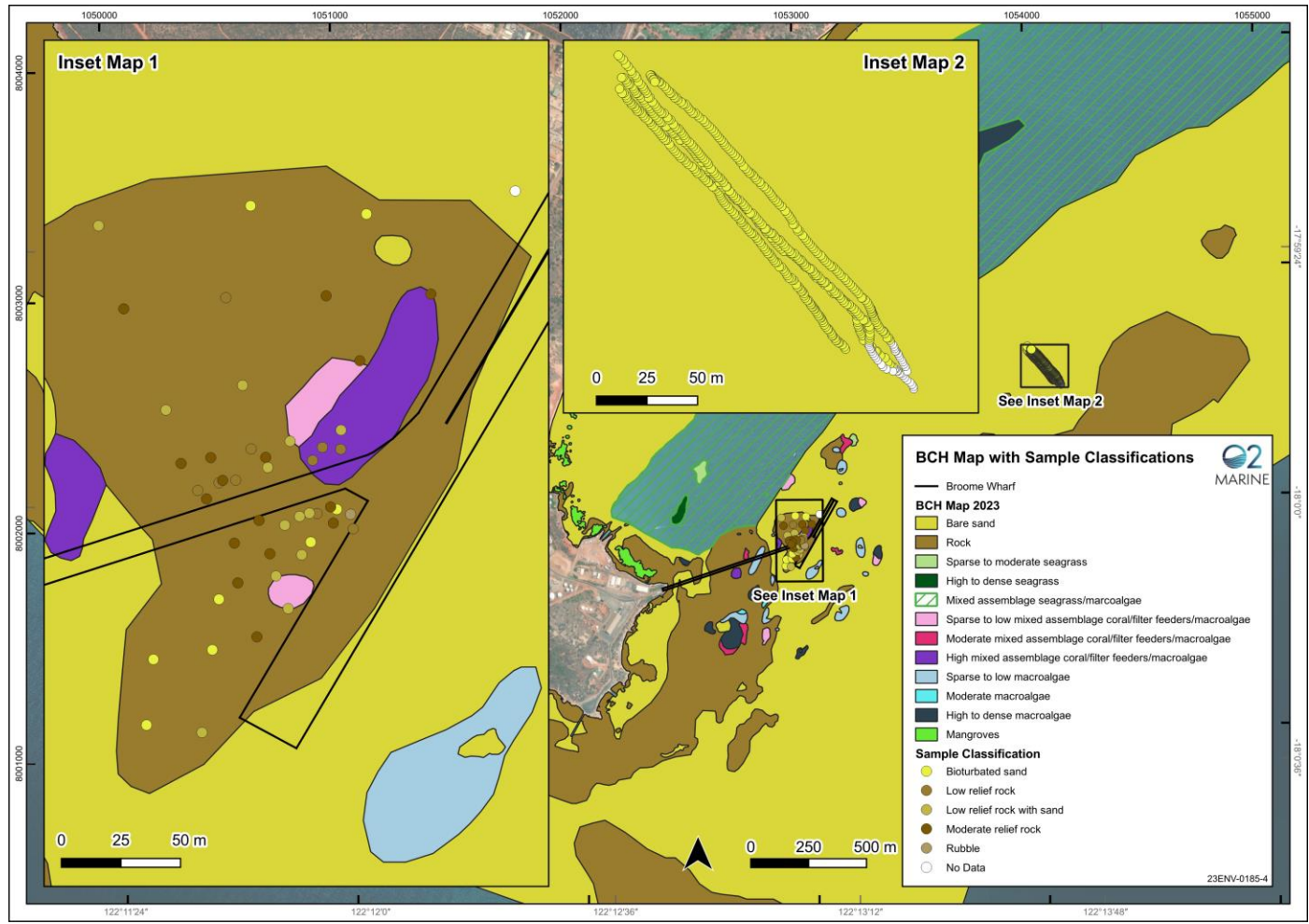


Figure 4 Broome wharf habitat map




4. References

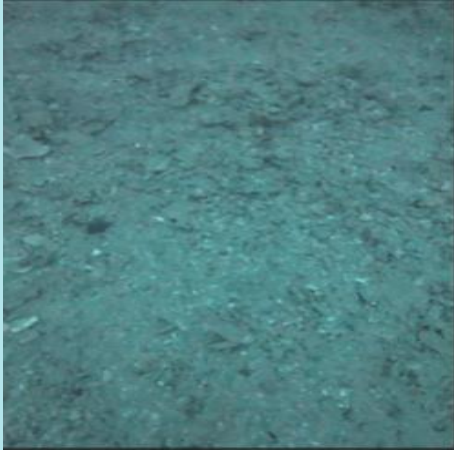
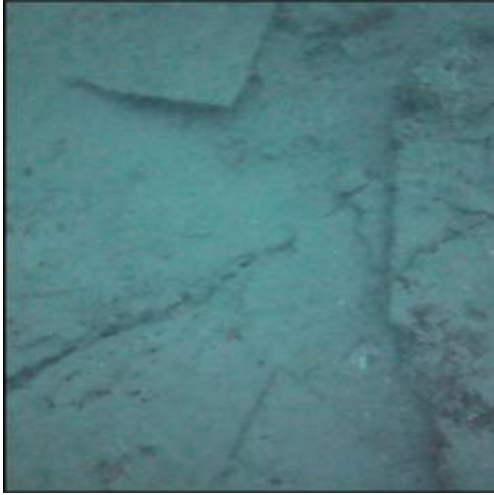

Althaus F, Hill N, Ferrari R, Edwards L, Przeslawski R, Schönberg CHL, Stuart-Smith R, Barrett N, Edgar G, Colquhoun J, Tran M, Jordan A, Rees T and Gowlett-Holmes K (2015) A Standardised Vocabulary for Identifying Benthic Biota and Substrata from Underwater Imagery: The CATAMI Classification Scheme. *PLOS ONE*, 10(10), e0141039. doi: 10.1371/journal.pone.0141039




O2 Marine (2023) *KPA Annual Report*, Prepared by O2 Marine for Kimberly Ports Authority




Appendix 1: Area 1 and Area 2 drop camera results




Table A- 1: Drop camera habitat classifications




GPS waypoint	Habitat classification	Image
121	Moderate relief rock Sparse mixed assemblage – sponges, macroalgae	
120	Low relief rock Sparse mixed assemblage – sponges, macroalgae	
119	Moderate relief rock Moderate mixed assemblage – sponges, macroalgae filter feeders	




GPS waypoint	Habitat classification	Image
118	Bioturbated sand Bare sand	
117	Low relief Rock Sparse mixed assemblage- sponges, macroalgae, filter feeders	
116	moderate relief rock moderate mixed assemblage sponges, filter feeders, macroalgae	

GPS waypoint	Habitat classification	Image
115	Low relief rock with sand Sparse mixed assemblage- sponges, macroalgae, filter feeders	
114	Bioturbated sand Bare sand	
113	low relief rock with sand Sparse mixed assemblage- sponges, macroalgae, filter feeders	




GPS waypoint	Habitat classification	Image
112	Bioturbated sand Bare sand	
111	Bioturbated sand bare sand	
110	Moderate relief rock Moderate mixed assemblage- sponges, macroalgae, filter feeders	




GPS waypoint	Habitat classification	Image
109	Bioturbated sand Bare sand	
108	Low relief rock with sand Sparse mixed assemblage- sponges, macroalgae, filter feeders	
107	Low relief rock with sand Sparse mixed assemblage- sponges, macroalgae, filter feeders	



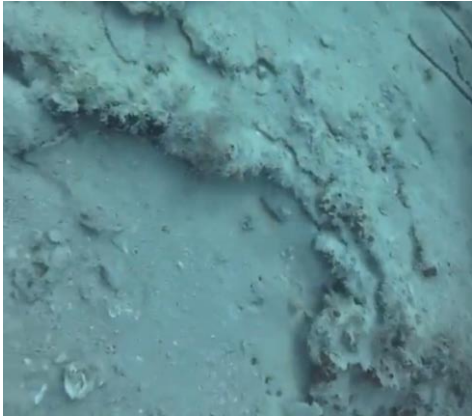
GPS waypoint	Habitat classification	Image
106	Moderate relief rock Moderate mixed assemblage- sponges, macroalgae, filter feeders	
105	Low relief rock with sand Moderate mixed assemblage- sponges, macroalgae, filter feeders	
104	Low relief rock with sand Sparse mixed assemblage - sponges, macroalgae, filter feeders	




GPS waypoint	Habitat classification	Image
103	Bioturbated sand	
102	Moderate relief rock Moderate mixed assemblage- sponges, macroalgae, filter feeders	
101	Low relief rock with sand Moderate mixed assemblage- sponges, macroalgae, filter feeders	




GPS waypoint	Habitat classification	Image
100	Moderate relief rock Moderate mixed assemblage- sponges, macroalgae, filter feeders	
99	Rubble	
98	No data	
97	Bioturbated sand	




GPS waypoint	Habitat classification	Image
96	Bioturbated sand	
95	Low relief rock with sand Sparse mixed assemblage- sponge, macroalgae, filter feeders	
94	Moderate relief rock Sparse mixed assemblage- sponge, macroalgae, filter feeders	




GPS waypoint	Habitat classification	Image
93	Moderate relief rock Moderate mixed assemblage- sponge, macroalgae, filter feeders	
92	Low relief rock Sparse mixed assemblage- sponge, macroalgae, filter feeders	
91	Moderate relief rock Moderate mixed assemblage- sponge, macroalgae, filter feeders	


GPS waypoint	Habitat classification	Image
90	Moderate relief rock Moderate mixed assemblage- sponge, macroalgae, filter feeders	
89	Low relief rock with sand Sparse mixed assemblage- sponge, macroalgae, filter feeders	
88	Low relief rock with sand	No image
87	Low relief rock with sand Sparse mixed assemblage- sponge, macroalgae, filter feeders	

GPS waypoint	Habitat classification	Image
86	Low relief rock with sand Sparse mixed assemblage- sponge, macroalgae, filter feeders	
85	Low relief rock Moderate mixed assemblage- sponge, macroalgae, filter feeders	
84	Moderate relief rock High cover mixed assemblage- sponge, macroalgae, filter feeders	

GPS waypoint	Habitat classification	Image
83	Moderate relief rock Sparse mixed assemblage- sponge, macroalgae, filter feeders	
82	Low relief rock Sparse mixed assemblage- sponge, macroalgae, filter feeders	
81	low relief rock with sand Moderate mixed assemblage- sponge, macroalgae, filter feeders	

GPS waypoint	Habitat classification	Image
80	<p>Low relief rock</p> <p>High cover mixed assemblage- sponge, macroalgae, filter feeders</p>	
79	<p>Low relief rock</p> <p>Sparse mixed assemblage- sponge, macroalgae, filter feeders</p>	
78	<p>Low relief rock</p> <p>Sparse mixed assemblage- sponge, macroalgae, filter feeders</p>	

GPS waypoint	Habitat classification	Image
77	<p>Low relief rock</p> <p>Sparse mixed assemblage- sponge, macroalgae, filter feeders</p>	
76	<p>Low relief rock</p> <p>Sparse mixed assemblage- sponge, macroalgae, filter feeders</p>	
75	<p>Moderate relief rock</p> <p>Sparse mixed assemblage- sponge, macroalgae, filter feeders</p>	

GPS waypoint	Habitat classification	Image
74	Moderate relief rock Sparse mixed assemblage- sponge, macroalgae, filter feeders	
73	Moderate relief rock Sparse mixed assemblage- sponge, macroalgae, filter feeders	