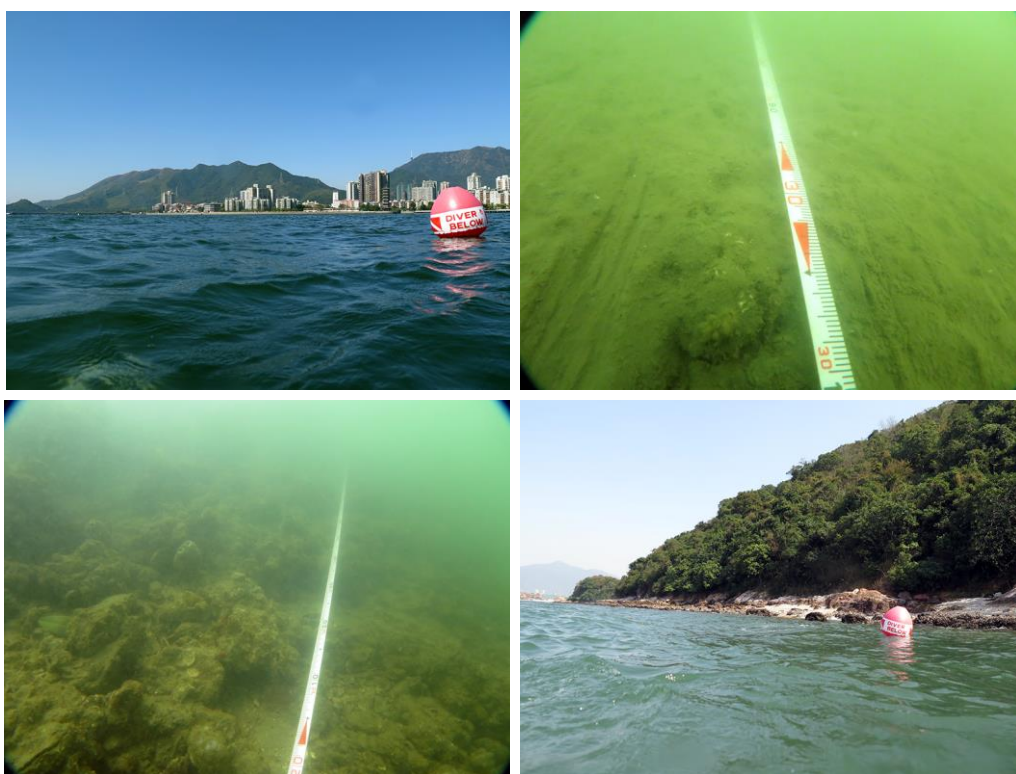


Agreement No. CE 63/2012 (DS) Expansion of Sha Tau Kok Sewage Treatment Works, Phase 1 – Investigation, Design and Construction



Report for Supplementary Coral Survey

February 2016



miniprojects co. Ltd.

Contents

1	INTRODUCTION	2
1.1	Project Background.....	2
2	METHODOLOGY	3
2.1	Dive Survey - Spot Dive and Rapid Ecological Assessment.....	3
3	RESULTS	6
3.1	Dive Survey – Spot Dive and Rapid Ecological Assessment	6
4	SUMMARY	11
5	REFERENCES	12

APPENDIX

Appendix I Photos of the Spot Dive Survey Sites at Sha Tau Kok.

Appendix I Photos of the Representative Taxa at the Spot Dive and REA Dive Survey Sites.

List of Figures

- 2.1 Map Showing Locations of the Dive Survey Sites at Sha Tau Kok.

List of Tables

- 2.1 Categories of a) benthic attributes, b) ordinal ranks of percentage cover of substrate type and c) ordinal ranks of taxa abundance.
- 3.1 Locations and Physical attributes of Sites for Dive Survey (L2, T1, T2 and T3).
- 3.2 Dive Survey - Ecological and Substrate Attributes, and Taxonomic Inventories along REA Transects at 4 Sites (L2, T1, T2 and T3).
- 3.3 Size, Percentage Area of Sedimentation (SD), Bleaching (B) and Partial Mortality (PM) of Hard Coral Colonies at each survey site in the Study Area.

1 INTRODUCTION

1.1 Project Background

- 1.1.1 Mott MacDonald Hong Kong Limited has been appointed to formulate a survey team to conduct a marine ecology (dive) survey for “Agreement No. CE 63/2012 (DS) Expansion of Sha Tau Kok Sewage Treatment Works, Phase 1 – Investigation, Design and Construction” (“the Project”).
- 1.1.2 miniprojects Company Limited (miniprojects co. Ltd.) have been commissioned by Mott MacDonald Hong Kong Limited to undertake supplementary coral survey at the eastern coast of Sterling Inlet near the newly proposed submarine outfall at Sha Tau Kok (“the Study Area”).
- 1.1.3 The coral survey aims to record the physical (substrate types) and ecological (marine benthic organisms and corals) benthic components at four selected locations.
- 1.1.4 This report presents the results of coral survey at four subtidal sites (L2, T1, T2 and T3). The survey methodology is described in Section 2, the results and summary of the survey findings are presented in Sections 3 and 4, respectively.

2 METHODOLOGY

2.1 Dive Survey – Spot Dive and Rapid Ecological Assessment

- 2.1.1 On 6 and 7 February 2016, dive surveys were conducted at four subtidal sites at Sha Tau Kok, including one site (L2) at the newly proposed submarine outfall, and three sites (T1, T2 and T3) at the eastern coast of Sterling Inlet near the newly proposed submarine outfall (Fig. 2.1) to assess the substrate type and ecological attributes (species compositions)..
- 2.1.2 Assessment of substrate and ecological attributes using two methods (1) spot dive and (2) a semi-quantitative, Rapid Ecological Assessment (REA) method (DeVantier et al. 1998) was conducted at each site. The field data were collected by marine ecologist using SCUBA dive.
- 2.1.3 At each site, both spot dive and REA surveys were performed along a 100m transect (Fig. 2.1).
- 2.1.4 For spot dive survey, the substrate type, associated sessile benthos, particularly the presence of coral communities (including all hard corals, octo corals and black corals) or other species of conservation importance were recorded at 10 points along a 100 m transect. Representative photographs of the seabed and associated fauna were taken.
- 2.1.5 For REA survey, substrate type along the transect was recorded at 1m intervals. The benthic cover, taxon abundance, and ecological attributes along the transect were recorded in a swathe of 2m wide, 1m either side of the transect.
- 2.1.6 Locations of corals and associated substrates were recorded, size and health status (including percentage cover of bleaching, mortality and sedimentation) recorded and feasibility of translocation assessed.
- 2.1.7 The locations of the REA transects were recorded on site using handheld GPS unit (Garmin GPSMap 60CS). Pictures of representative taxa along the transects were taken during the surveys.
- 2.1.8 Two major types of information were recorded:
(1) Cover of the major benthic groups;
(2) Inventory of sessile benthic taxa;
These were performed according to Tier I and Tier II levels of information.
- 2.1.9 Tier I: Categorization of ecological (benthic cover) and environmental variables.

To describe the benthic cover, six substrate and seven ecological attributes (Table 2.1a) were assigned. Each attribute was given a rank, from 0 to 6 (Table 2.1b) based on the overall cover along the survey area.

2.1.10 Tier II: Taxonomic inventories to define types of benthic communities.

An inventory of benthic taxa was compiled during each swim. Taxa were identified either in situ or with the aid of photos to confirm identification afterward.

Hard corals (Order Scleractinia) – to genus and species level where possible;

Soft corals (Subclass Octocorallia) – to genus level where possible;

Other benthos (such as sponges, zoanthids, bryozoans, macroalgae, etc) – to genus level where possible or phylum with growth form;

Each taxon in the inventory was given a rank (0 to 5) on the basis of its abundance in the community at the site (Table 2.1c). These broad categories rank the taxa in terms of the relative abundance of individuals, rather than the contribution to benthic cover, at each site.

Table 2.1 Categories of a) benthic attributes, b) ordinal ranks of percentage cover of substrate, and (c) ordinal ranks of taxa abundance.

a) Benthic attributes		b) Percentage Cover		c) Taxon abundance	
Substrate	Ecological	Rank	Percentage Cover	Rank	Abundance
Continuous Pavement (artificial)	Hard Coral	0	Not recorded	0	Absent
Bedrock	Dead Standing Coral	1	1-5%	1	Sparse
Large Boulders (>50 cm)	Soft Coral	2	6-10%	2	Uncommon
Small Boulders (26 - 50cm)	Black Coral	3	11-30%	3	Common
Rubble (<26cm)	Macroalgae	4	31-50%	4	Abundant
Sand with gravel	Turf Algae	5	51-75%	5	Dominant
Silt and Mud		6	76-100%		

2.1.11 A set of environmental site descriptions will also be recorded for each REA transect as follows:

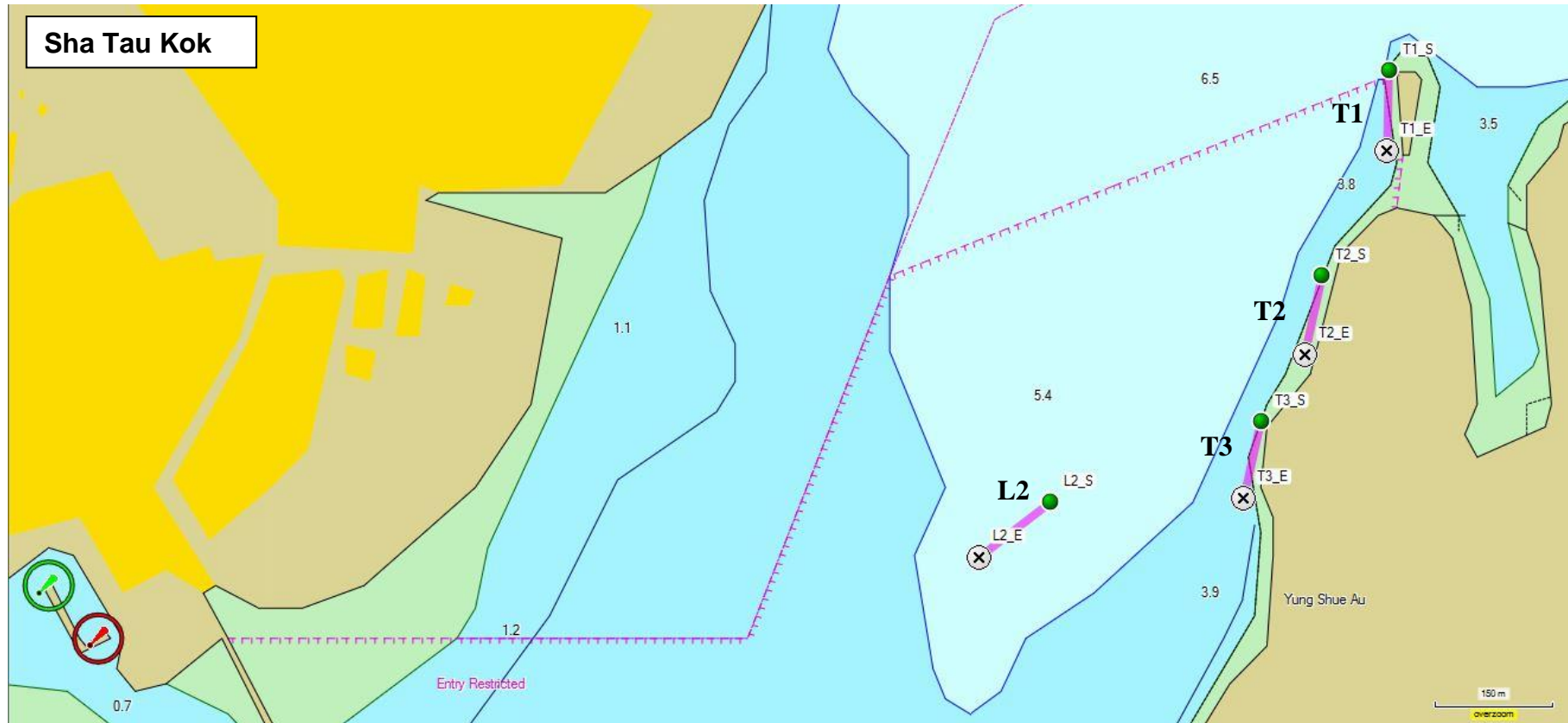
The degree of exposure to prevailing wave energy will be ranked from 1 - 4, where:

- 1 = sheltered (highly protected by topographic features from prevailing waves);
- 2 = semi-sheltered (moderately protected);
- 3 = semi-exposed (only partly protected); and
- 4 = exposed (experiences the full force of prevailing wave energy).

Sediment deposition on the reef substratum (particle sizes ranging from very fine to moderately coarse) rated on a four point scale from 0 - 3, where:

- 0 = no sediment;
- 1 = minor (thin layer) sediment deposition;
- 2 = moderate sediment deposition (thick layer), but substrate can be cleaned by fanning off the sediment; and
- 3 = major sediment deposition (thick, deep layer), and substrate cannot be cleaned by fanning.

Figure 2.1. Map showing Locations of Sites for Dive Survey at Sha Tau Kok. Green dots indicate starting points of 100m REA transects, purple lines indicate the transect direction and grey dots indicate the ending points of the transects.



3 RESULTS

3.1 Dive Survey – Spot Dive and Rapid Ecological Assessment

- 3.1.1 The dive surveys along the coastline of Sha Tau Kok were conducted on 6 and 7 February 2016.
- 3.1.2 The locations of the four dive sites (Sites L2, T1, T2 and T3) for spot dive and REA surveys are shown in Fig. 2.1, and survey conditions in Table 3.1. Ecological and substrate attributes, and taxonomic Inventories along the REA transects at the sites are presented in Table 3.2. Records of coral colonies are presented in Table 3.3. Photos of representative taxa and corals along each transect are shown in Appendix I.
- 3.1.3 Both spot dive and REA surveys were conducted at all sites. All hard substrates including bedrock, boulders and rubbles were mainly observed at shallow water (>3.0m below Chart Datum). Sea bottom at any deeper water depth was mainly dominated by coarse and fine sand or silt and mud, with sparse distribution of rubbles and boulders. For coral communities, only few small coral colonies were observed on hard substrates at shallow water; no coral was found on soft (sandy) sea beds.

Site L2

- 3.1.4 Site L2 is located at the middle of the bay and subtidal substrates were mainly composed of silt and mud (Table 3.2). No sessile plants or animals were observed on hard substrates. The dominant sessile animal on the soft bottom was sea anemone (Table 3.2; Appendix I).
- 3.1.5 No hard coral, black coral, soft coral or octocoral was recorded at Site L2.

Site T1

- 3.1.6 Site T1 was composed of bedrock, boulders, rubbles and sand (Table 3.2). The dominant sessile taxa on the hard substrates were sessile animals including rocky oysters, tunicates, bryozoans and sponges (Table 3.2; Appendices I and II).
- 3.1.7 Only one hard coral colony, *Oulastrea crispata* (Family: Faviidae), was observed (Table 3.3; Appendix II) at Site T1.
- 3.1.8 No black coral, soft coral or octocoral was recorded at Site T1.

Site T2

- 3.1.9 Site T2 was composed of boulders, rubbles and sand (Table 3.2). The dominant sessile taxa on the hard substrates were sessile animals including rocky oysters, tunicates, bryozoans and sponges (Table 3.2; Appendices I and II).
- 3.1.10 Only one hard coral colony, *Oulastrea crispata* (Family: Faviidae), was observed (Table 3.3; Appendix II) at Site T2.
- 3.1.11 No black coral, soft coral or octocoral was recorded at Site T2.

Site T3

- 3.1.12 Site T3 was composed of boulders, rubbles and sand (Table 3.2). The dominant sessile taxa on the hard substrates were sessile animals including rocky oysters, tunicates, bryozoans and sponges (Table 3.2; Appendices I and II).
- 3.1.13 Two hard coral colonies of *Oulastrea crispata* (Family: Faviidae) were observed (Table 3.3; Appendix II) at Site T3.
- 3.1.14 No black coral, soft coral or octocoral was recorded at Site T3.

Table 3.1. Locations and Physical attributes of Sites for Dive Survey (L2, T1, T2 and T3).

Sites	HK 1980 Grid Coordinates	Depth (m)	Visibility (m)	Substrate type	Presence of Hard Corals?	Presence of Soft Corals?	Degree of Exposure	Degree of Sediment Deposition
L2	Start N 845041.238 E 842536.470	6.0 – 7.5	0.5 – 1	Muddy	NO	NO	3	2
	End N 844973.353 E 842434.541							
T1	Start N 845586.348 E 843019.775	1.5 – 2.0	2 – 3	Bedrock, rubbles, boulders and sand with gravel	YES	NO	2	2
	End N 845485.432 E 843017.748							
T2	Start N 845327.370 E 842924.735	1.5 – 2.0	2 – 3	Sand with gravel, with patches of boulder and rubbles	YES	NO	2	2
	End N 845228.480 E 842900.012							
T3	Start N 845144.586 E 842837.396	1.5 – 2.0	2 – 3	Sand with gravel, with patches of boulder and rubbles	YES	NO	2	2
	End N 845048.128 E 842813.078							

Table 3.2 Dive Surveys - Ecological and Substrate Attributes, and Taxonomic Inventories along REA Transects at 4 Sites (L2, T1, T2 and T3).

Substrate attributes (0 – 6)	L2	T1	T2	T3
Continuous Pavement	0	0	0	0
Bedrock	0	3	0	0
Large Boulders (>50 cm)	0	1	1	0
Small Boulders (26 - 50cm)	0	2	3	3
Rubble (<26cm)	0	2	3	3
Sand with gravel	0	4	4	5
Mud & Silt	6	0	0	0
Ecological attributes (0 – 6)	L2	T1	T2	T3
Hard Coral	0	1	1	1
Dead Standing Coral	0	0	0	0
Soft Coral	0	0	0	0
Black Coral	0	0	0	0
Marcoalgae	0	0	0	0
Turf Algae	0	1	1	1
Taxonomic inventories (0 – 5)	L2	T1	T2	T3
Other sessile taxa				
Sponges	0	1	1	1
Encrusting algae	0	0	0	0
Coralline algae	0	0	0	0
Barnacles	0	0	0	0
Sea anemones	1	2	1	1
Rock oysters	0	4	5	4
Mussels	0	1	1	1
Bryozoans	0	1	1	1
Turnicates	0	2	2	2
	L2	T1	T2	T3
*No. Hard Coral Species	0	1	1	1
No. Soft Coral Species	0	0	0	0

*See Table 3.3 for details of coral species and number of colony found at the Study Area.

Table 3.3. Size, Percentage Area of Sedimentation (SD), Bleaching (B) and Partial Mortality (PM) of Hard Coral Colonies at each survey site in the Study Area.

Code	Site	No.	Family	Species	Size: Hard corals: L x W cm	%SD	%B	%PM	Associated Substrate Type
1	T1	1	Faviidae	<i>Oulastrea crispata</i>	5 x 5	0	0	0	Boulder (>50cm)
2	T2	2	Faviidae	<i>Oulastrea crispata</i>	5 x 5	0	0	0	Boulder (>50cm)
3	T3	3	Faviidae	<i>Oulastrea crispata</i>	10 x 5	0	0	0	Boulder (>50cm)
4	T3	4	Faviidae	<i>Oulastrea crispata</i>	10 x 10	0	0	0	Boulder (>50cm)

4 SUMMARY

Coral community in the Study Area

- 4.1.1 A total of four (4) hard coral colonies was found along three of the four transects in the Study Area in Sha Tau Kok, the colony size, percentage area of sedimentation, bleaching and partial mortality are shown in Table 3.3. Size of the hard coral colonies was ranged from 25 to 100 cm². All hard coral colonies were generally healthy, with no sedimentation, bleaching or partial mortality. All the hard coral colonies were associated with boulders (Table 3.3).
- 4.1.2 In the Study Area, only one hard coral species, *Oulastrea crispata* (Family: Faviidae), was observed (Table 3.3). The species diversity was low at each site. All colonies were small in size, with encrusting growth form, and patchily distributed. This species is commonly found in Hong Kong waters (Chan et al. 2005).
- 4.1.3 The abundance of hard corals was low at all sites (percentage cover <1%) in the Study Area. Most hard substrates were covered by sediments and dominated by suspension feeding sessile animals such as rock oysters and tunicates.
- 4.1.4 No black coral, soft coral, octocoral or other sessile taxon of high conservation interest was recorded in the Study Area.

5 REFERENCES

Chan ALK, Choi CLS, McCorry D, Chan KK, Lee MW, Put Jr. A (2005) Field Guide to Hard Corals of Hong Kong. Agriculture, Fisheries and Conservation Department, HKSAR.

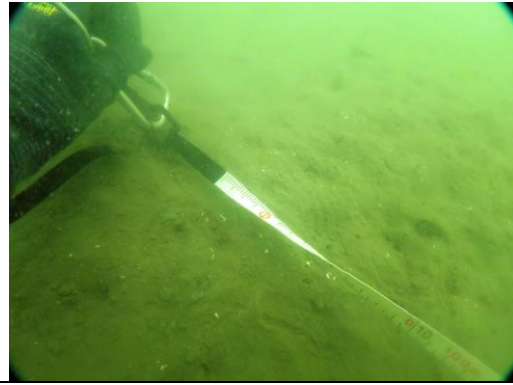
DeVantier L. M., De'Ath G., Done T. J., Turak E. (1998) Ecological Assessment of a complex natural system: A case study from the Great Barrier Reef, Ecological Applications 8, pp.480-496.

APPENDIX

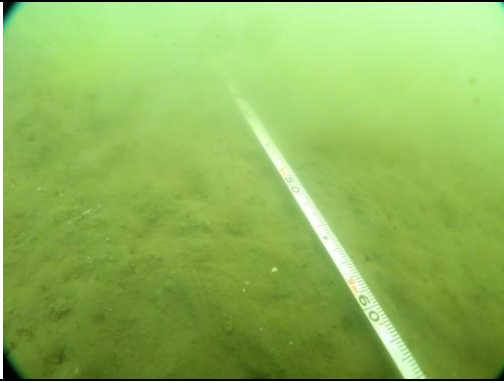
Appendix I Photos of the Spot Dive Survey Sites at Sha Tau Kok.



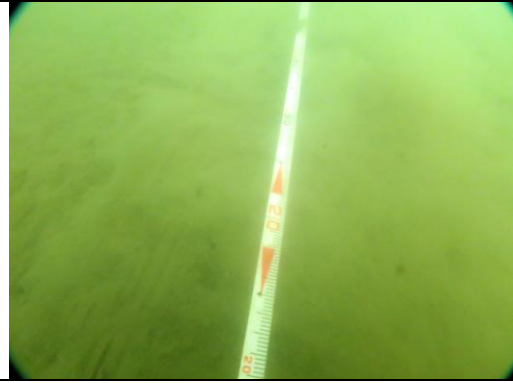
Site L2



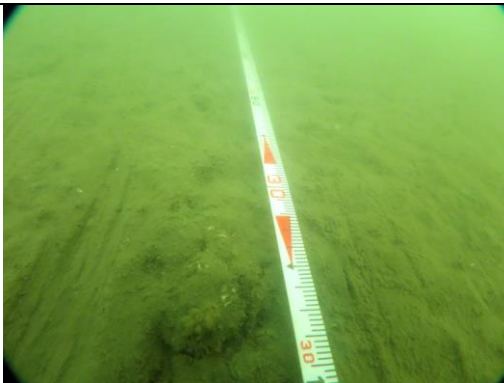
L2 - 0m



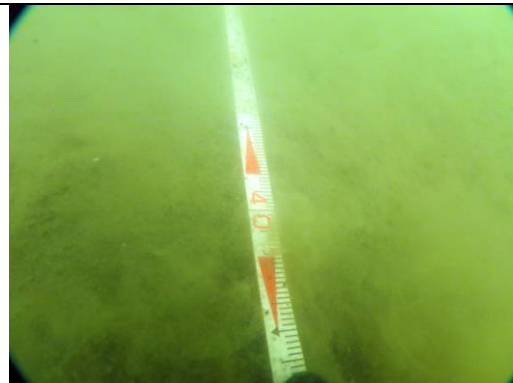
L2 - 10m



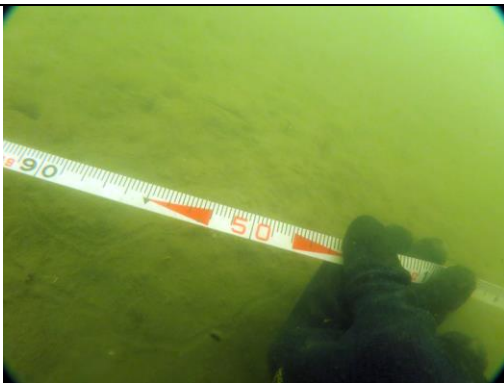
L2 - 20m



L2 - 30m



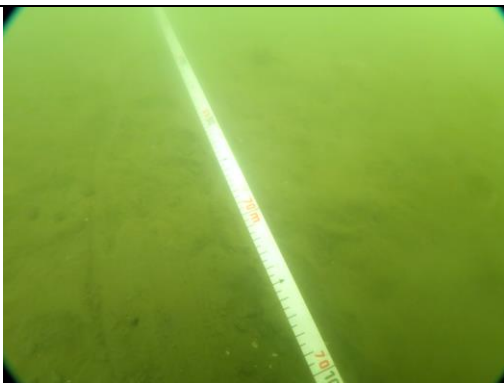
L2 - 40m



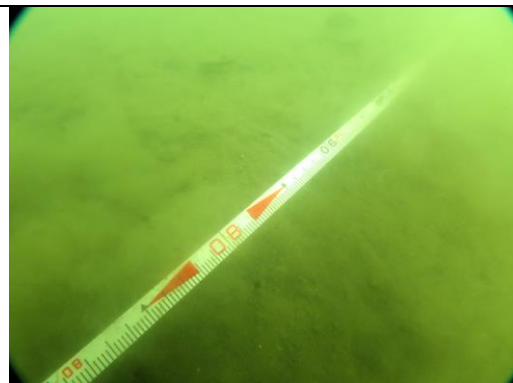
L2 - 50m



L2 - 60m

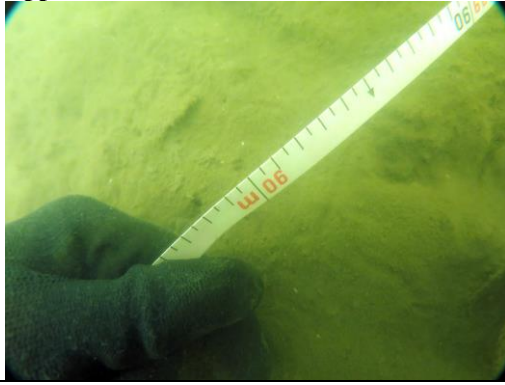


L2 - 70m

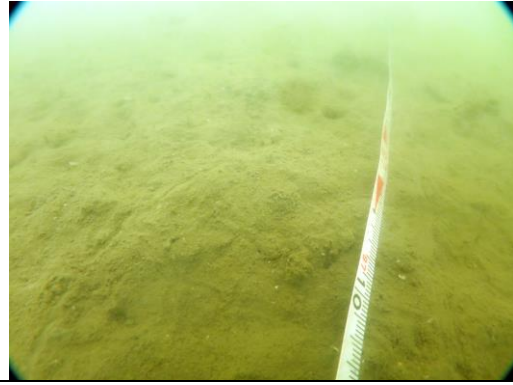


L2 - 80m

Appendix I Continued.



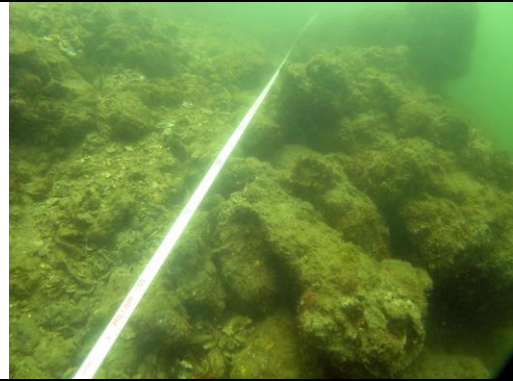
L2 - 90m



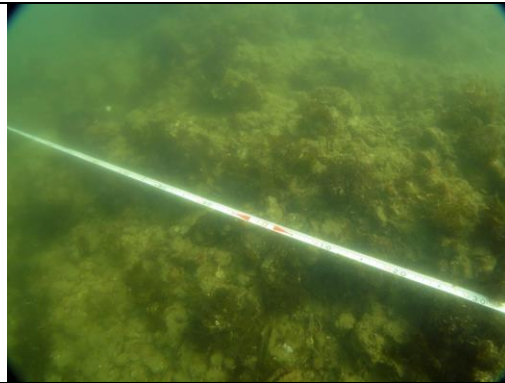
L2 - 100m



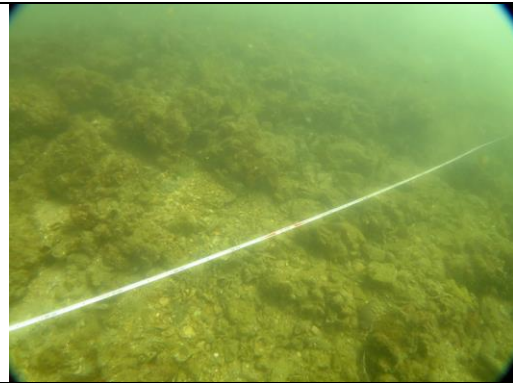
Site T1



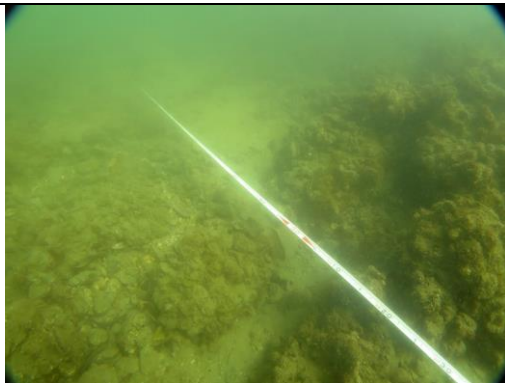
T1 - 0m



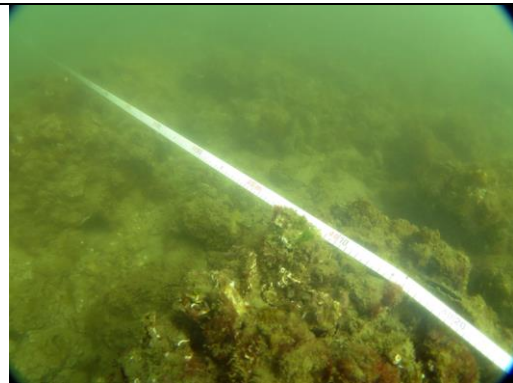
T1 - 10m



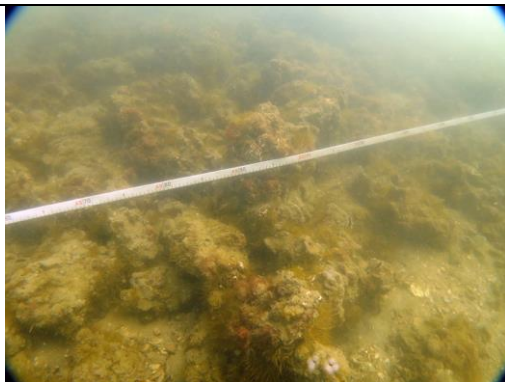
T1 - 20m



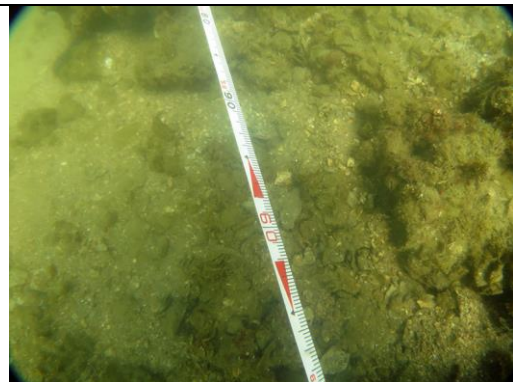
T1 - 30m



T1 - 40m



T1 - 50m

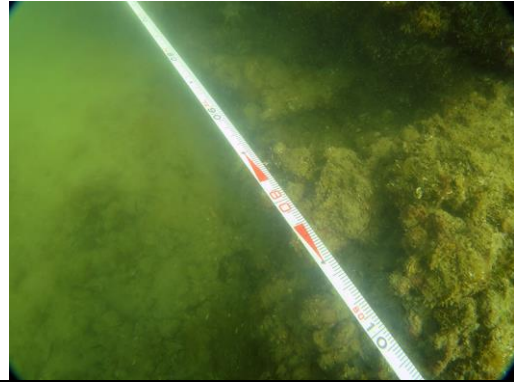


T1 - 60m

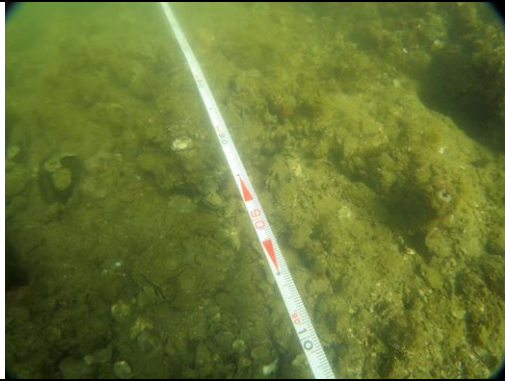
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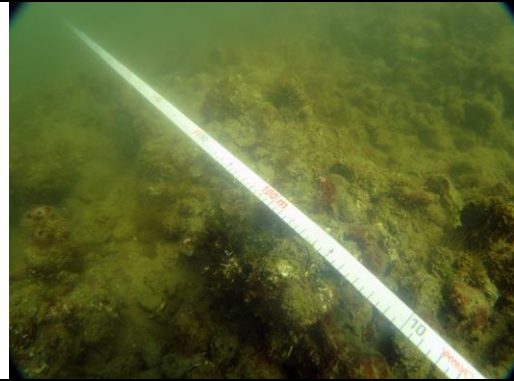
T1 - 70m



T1 - 80m



T1 - 90m



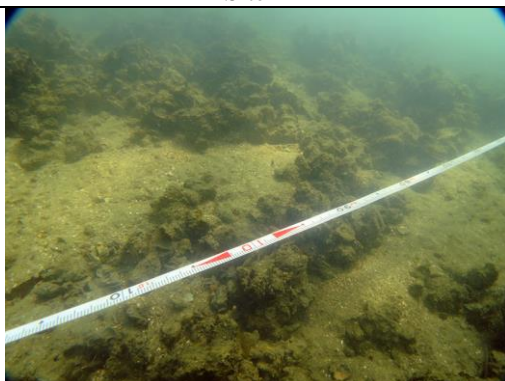
T1 - 100m



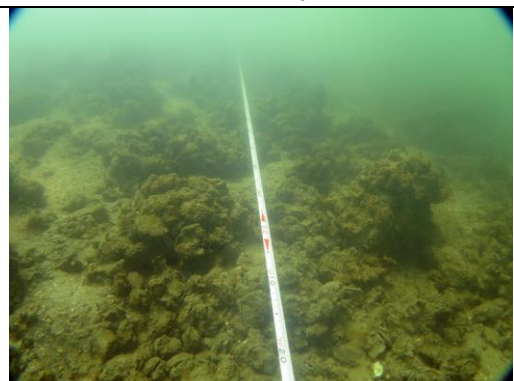
Site T2



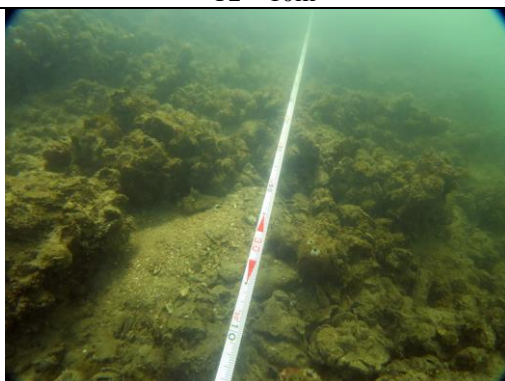
T2 - 0m



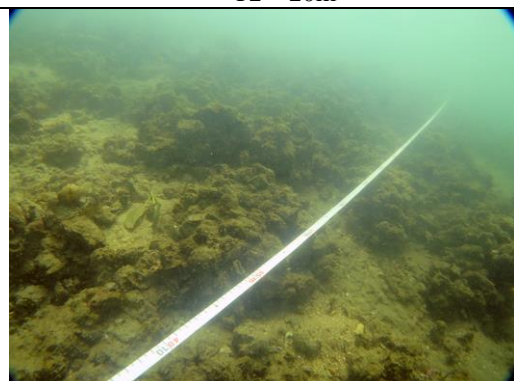
T2 - 10m



T2 - 20m

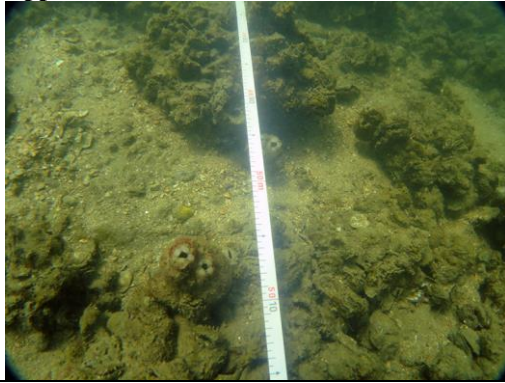


T2 - 30m

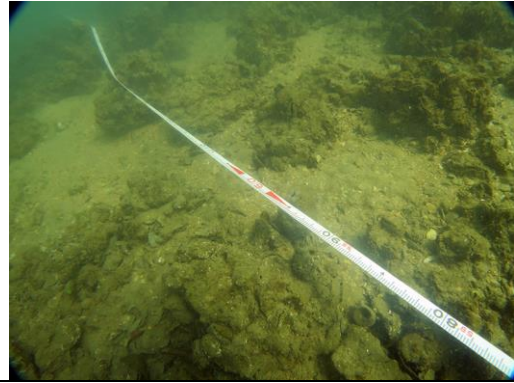


T2 - 40m

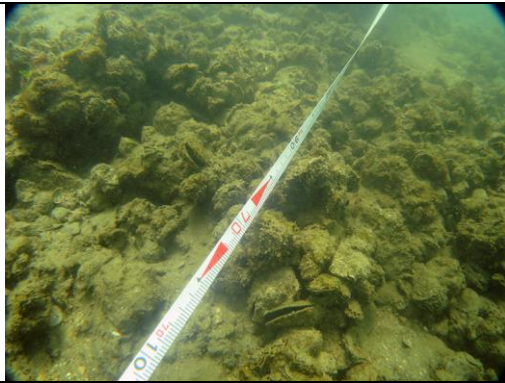
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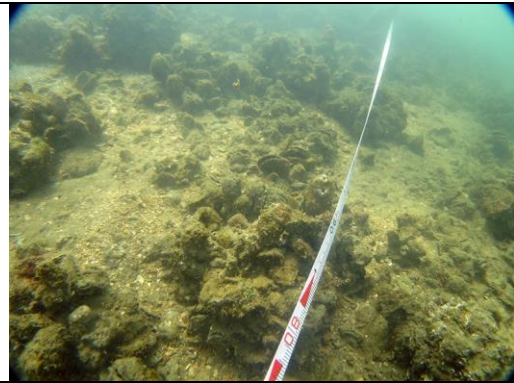
T2 – 50m



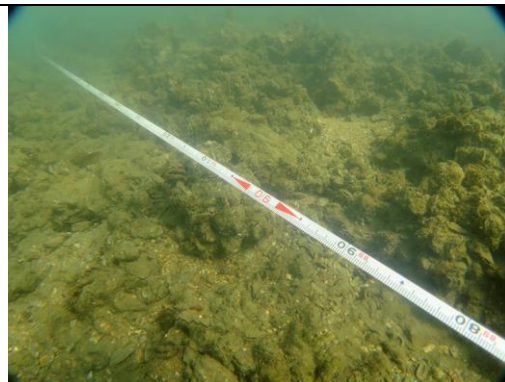
T2 – 60m



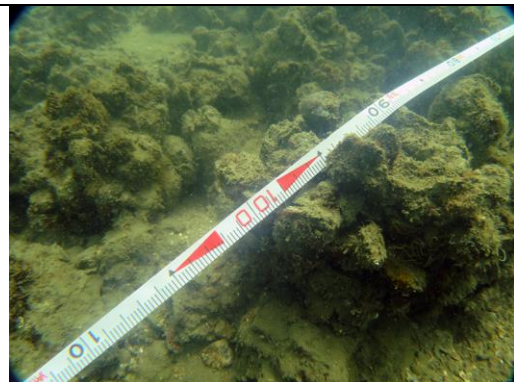
T2 – 70m



T2 – 80m



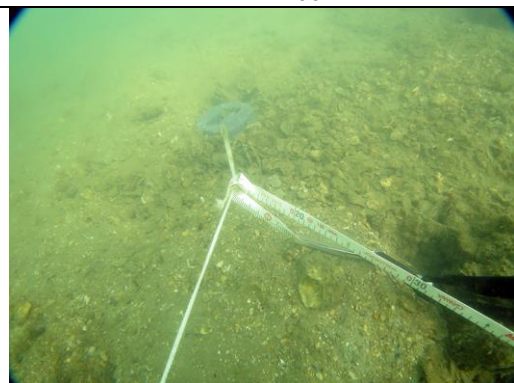
T2 – 90m



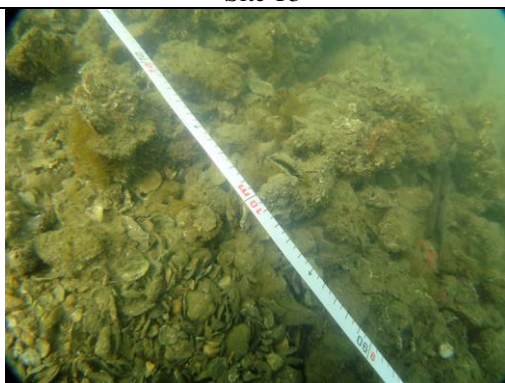
T2 – 100m



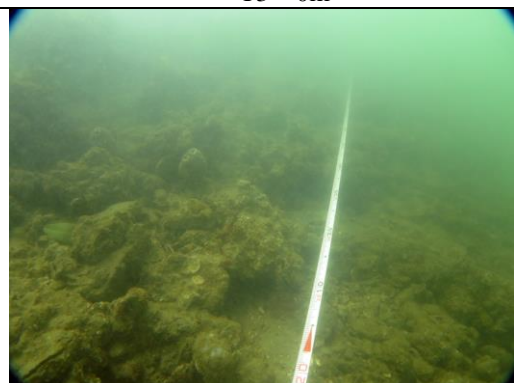
Site T3



T3 – 0m



T3 – 10m



T3 – 20m

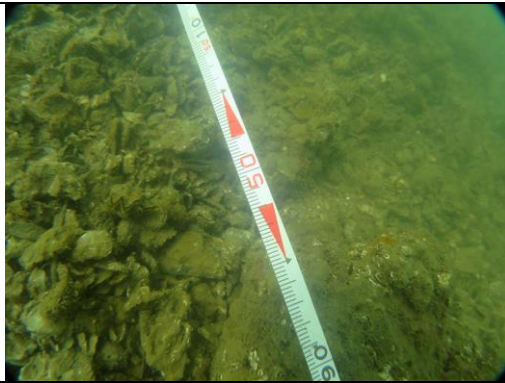
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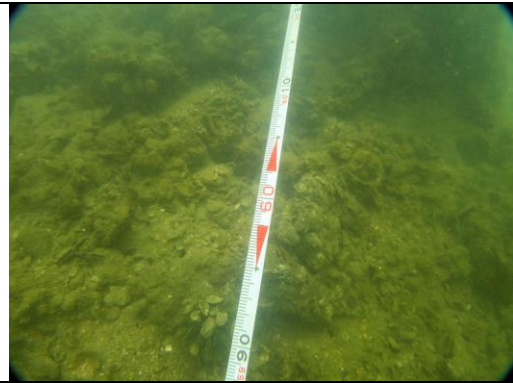
T3 - 30m



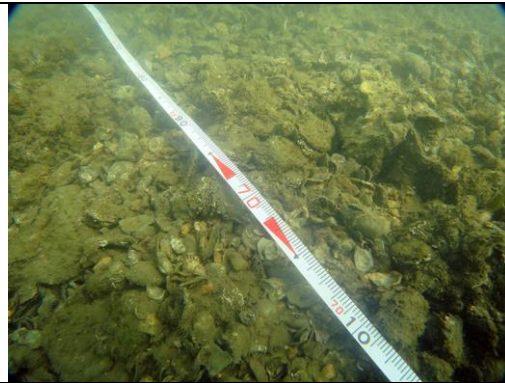
T3 - 40m



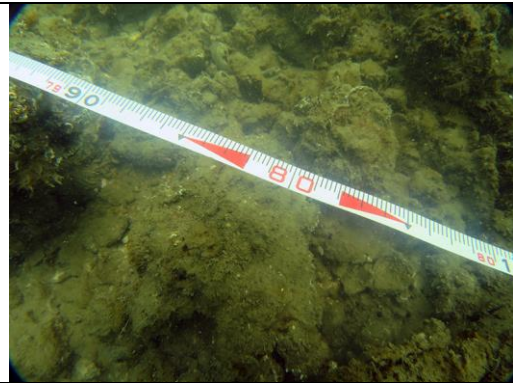
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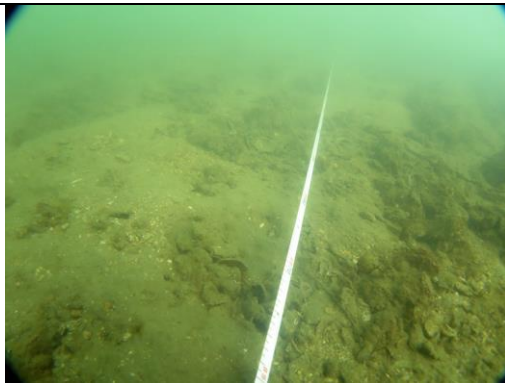
T3 - 60m



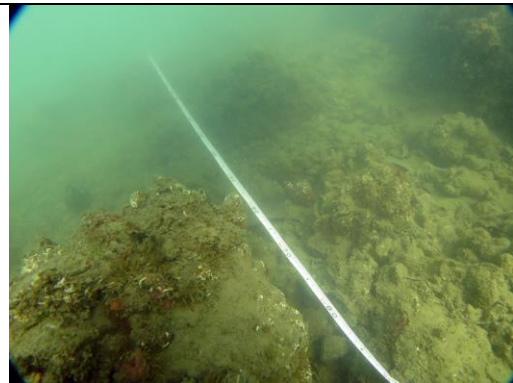
T3 - 70m



T3 - 80m



T3 - 90m



T3 - 100m

Appendix II Photos of the Representative Taxa at the Spot Dive and REA Survey Sites.



T1, T2 and T3 – Rock oysters



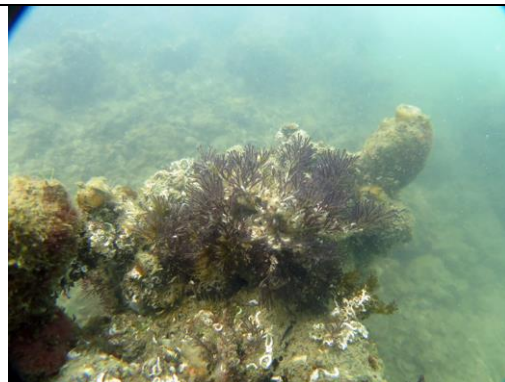
T1, T2 and T3 – Sea anemones



T1, T2 and T3 – Turnicates



T1, T2 and T3 - Sponges



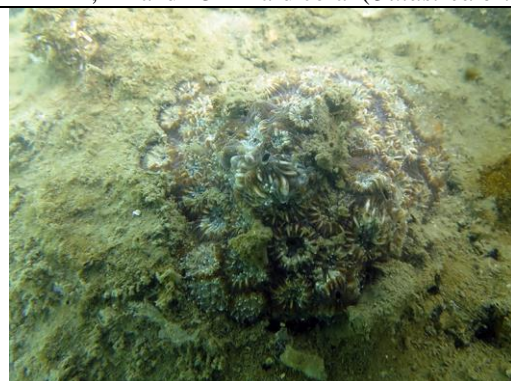
T1, T2 and T3 - Bryozoans



T1, T2 and T3 – Hard coral (*Oulastrea crispata*)



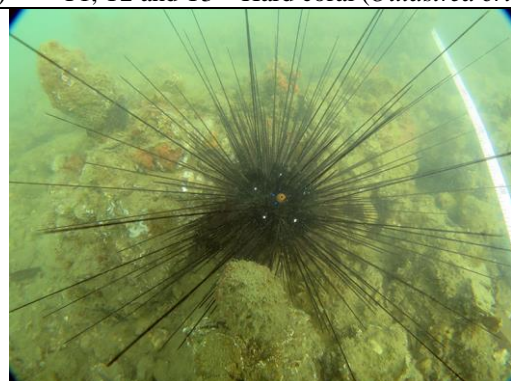
T1, T2 and T3 – Hard coral (*Oulastrea crispata*)



T1, T2 and T3 – Hard coral (*Oulastrea crispata*)



T1, T2 and T3 – Sea urchin (*Salmacis sphaeroides*)



T1, T2 and T3 – Sea urchin (*Diadema setosum*)