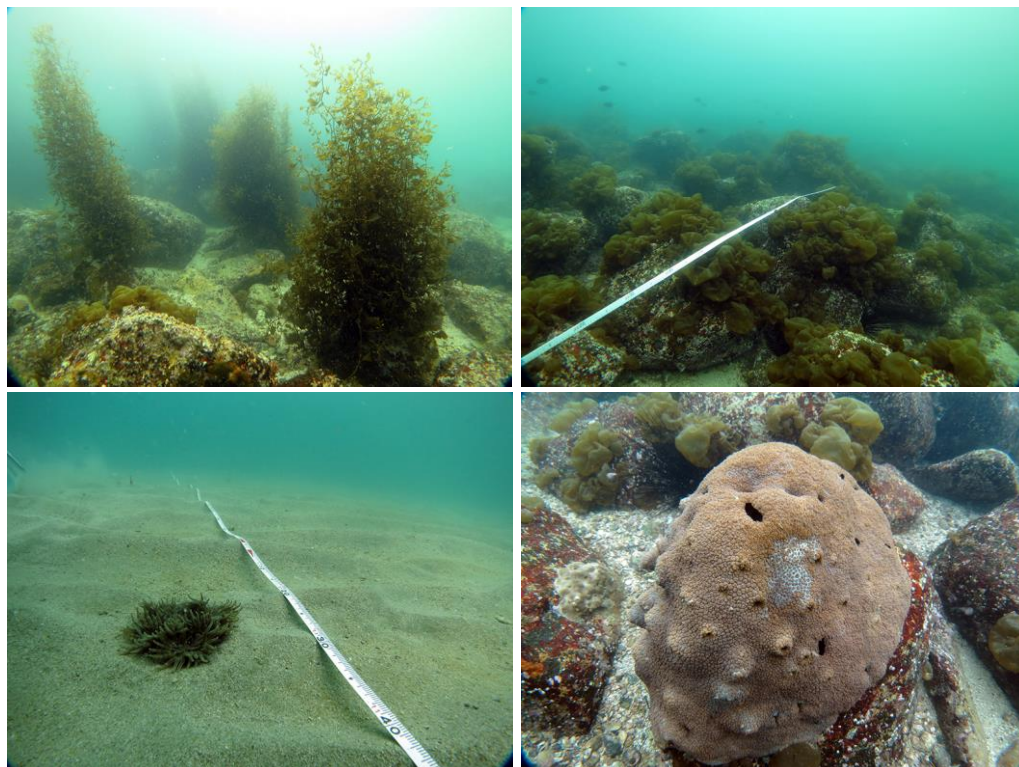


AGREEMENT NO. CE 41/2013 (EP)

**Port Shelter Sewerage, Stage 3 – Sewerage Works at Po Toi O
Environmental Impact Assessment Studies – Investigation**



**Report for Marine Ecological (Dive) Survey
(Baseline Coral Survey)**

March 2014



miniprojects co. Ltd.

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1 INTRODUCTION

1.1 Project Background

- 1.1.1 Cinotech Consultants Limited has been appointed to formulate a survey team to conduct a marine ecology (dive) survey for “AGREEMENT NO. CE 41/2013 (EP) Port Shelter Sewerage, Stage 3 – Sewerage Works at Po Toi O – Environmental Impact Assessment Studies – Investigation” (“the Project”).
- 1.1.2 miniprojects Company Limited (miniprojects co. Ltd.) have been commissioned by Cinotech Consultants Limited to undertake Marine Ecology Survey (Dive Survey) along the coastline of Po Toi O, Sai Kung (“the Study Area”).
- 1.1.3 The dive survey aims to record the physical (substrate types) and ecological (marine benthic organisms and corals) benthic components at eleven selected locations.
- 1.1.4 This report presents the results of dive survey at eleven subtidal sites (PTO1 to PTO11). 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 - Rapid Ecological Assessment

2.1.1 On 1, 2, 8 and 9 March 2014, eleven subtidal sites (Sites PTO 1 to PTO11; Fig. 2.1), were surveyed to assess the substrate type and ecological attributes (species compositions).

2.1.2 Assessment of substrate and ecological attributes using a semi-quantitative, Rapid Ecological Assessment (REA) method (DeVantier et al. 1998) was conducted at each site. The field data were collected by marine ecologists using SCUBA dive.

2.1.3 At each site, the REA survey was performed along a 50m transect parallel to the coastline. Substrate type along the transect was recorded at 1m intervals. The benthic cover, occurrence of both fishes and invertebrates and ecological attributes along the transect were recorded in a swathe of 2m wide, 1m either side of the transect.

2.1.4 The locations of the REA transects were recorded on site using handheld GPS unit. Pictures of representative taxa along the transects were taken during the surveys.

2.1.5 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.

2.1.6 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.

2.1.7 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;

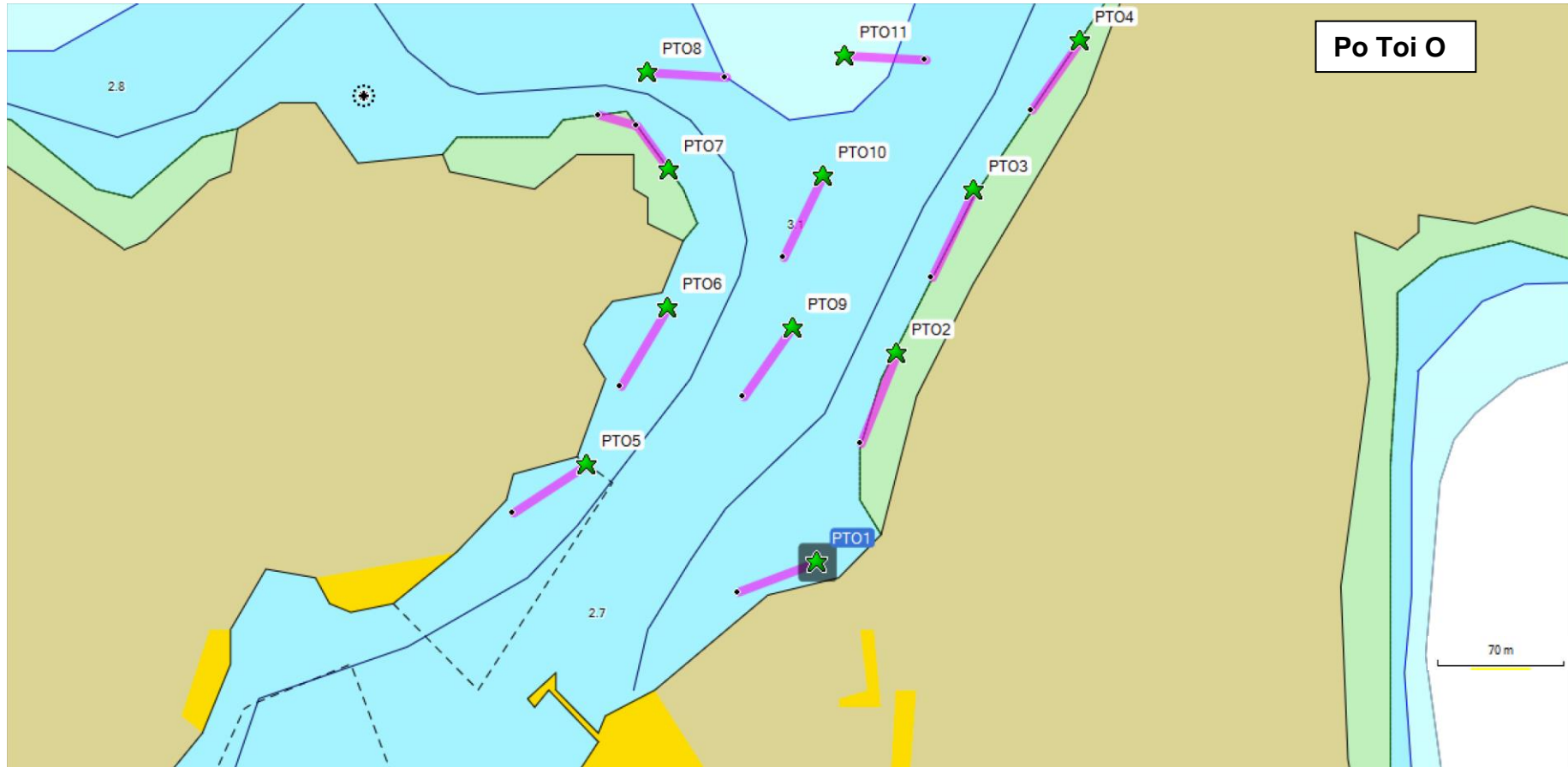
Other benthos (such as sponges, zoanths, bryozoans, macroalgae, etc) – to genus level where possible or phylum with growth form;

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
Bedrock	Hard Corals	0	Not recorded	0	Absent
Boulders (diameter >50cm)	Dead Coral Skeleton	1	1-5%	1	Sparse
Dead Corals	Soft Corals	2	6-10%	2	Uncommon
Rubble (diameter < 50cm)	Sea anemone beds	3	11-30%	3	Common
Sand with gravel	Encrusting Algae	4	31-50%	4	Abundant
Mud & Silt	Coralline Algae	5	51-75%	5	Dominant
	Erect Macroalgae	6	76-100%		

Figure 2.1 Map showing Locations of Sites for Dive Survey at Po Toi O. Green stars indicate starting points of 50m REA transects, purple lines indicate the transect direction.



3 RESULTS

3.1 Dive Surveys – Rapid Ecological Assessment

- 3.1.1 The dive surveys along the coastline of Po Toi O, Sai Kung were conducted on 1, 2, 8 and 9 March 2014.
- 3.1.2 The locations of the eleven dive sites (Sites PTO1 to PTO11) for 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 11 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 Appendices I and II, respectively.
- 3.1.3 REA surveys were conducted at all sites. All hard substrates including bedrock, boulders and rubbles were mainly observed at shallow water (> 2.5m below Chart Datum). Sea bottom at any deeper water depth was mainly dominated by coarse sand or fine sand. For coral communities, all corals were only observed on hard substrates at shallow water; no coral was found on soft (sandy) sea beds.

Site PTO1

- 3.1.4 Site PTO1 is a natural, sheltered rocky shore located at inner part of the bay. The rocky substrate was characterized by rubbles, large boulders and sand with gravels (Table 3.2). The common sessile taxa on the hard substrates included sessile plants, erect macroalgae and encrusting algae; sessile animals, barnacles, rock oysters and tube worms; and sparse distribution of coral algae, mussels, hydroids, bryozoans, sponges, sea anemone and hard corals (Table 3.2; Appendix I).
- 3.1.5 A total of 37 hard coral colonies of 14 species (belonging to 5 families) was observed, including *Porites* sp. (2 colonies), *Favites abdita* (4 colonies), *Favites rotumana* (9 colonies), *Favites pentagona* (7 colonies), *Cyphastrea serailia* (3 colonies), *Montipora mollis* (1 colony), *Favites chinensis* (2 colony), *Plesiastrea versipora* (2 colonies), *Goniopora columna* (1 colony), *Platygyra carnosus* (2 colonies), *Turbinaria peltata* (1 colony), *Favites* sp. (1 colony), *Psammocora superficialis* (1 colony), *Favia* sp. (1 colony) (Table 3.3; Appendix II).
- 3.1.6 No soft coral or octocoral was recorded at Site PTO1.

Site PTO2

- 3.1.7 Site PTO2 is a natural, sheltered rocky shore located at inner part of the bay. The rocky substrate was characterized by rubbles, large boulders and sand with gravels (Table 3.2). The common sessile taxa on the hard substrates included sessile plants, erect macroalgae, coralline algae and encrusting algae; sessile animals, rock oysters,

barnacles and tube worms; and sparse distribution of bryozoans, sponges, sea anemone and hard corals (Table 3.2; Appendix I).

3.1.8 A total of 5 hard coral colonies of 4 species (belonging to 2 families) was observed, including *Platygyra carnosus* (1 colony), *Platygyra acuta* (1 colony), *Favites abdita* (2 colonies) and *Porites* sp. (1 colony) (Table 3.3; Appendix II).

3.1.9 No soft coral or octocoral was recorded at Site PTO2.

Site PTO3

3.1.10 Site PTO3 is a natural, semi-exposed rocky shore. The substrate was characterized by rubbles, large boulders and sand with gravels (Table 3.2). The common sessile taxa on the hard substrates included sessile plants, erect macroalgae, encrusting algae and coralline algae; sessile animals, barnacles and tube worms; and sparse distribution of rock oysters, bryozoans, hydroids, sponges, sea anemone and hard corals (Table 3.2; Appendix I).

3.1.11 A total of 5 hard coral colonies of 2 species (belonging to 2 families) was observed, including *Montipora peltiformis* (4 colonies), and *Porites* sp. (1 colony). (Table 3.3; Appendix II).

3.1.12 No soft coral or octocoral was recorded at Site PTO3.

Site PTO4

3.1.13 Site PTO4 is a natural, semi-exposed rocky shore. The substrate was characterized by rubbles, large boulders and sand with gravels (Table 3.2). The common sessile taxa on the hard substrates included sessile plants, erect macroalgae, encrusting algae and coralline algae; sessile animals, barnacles and tube worms; and sparse distribution of rock oysters, bryozoans, hydroids, sponges, sea anemone and hard corals (Table 3.2; Appendix I).

3.1.14 A total of 13 hard coral colonies of 6 species (belonging to 4 families) was observed, including *Montipora peltiformis* (4 colonies), *Porites* sp. (3 colonies), *Favia rotumana* (3 colonies), *Cyphastrea serailia* (1 colony), *Plesiastrea versipora* (1 colony) and *Turbinaria peltata* (1 colony). (Table 3.3; Appendix II).

3.1.15 No soft coral or octocoral was recorded at Site PTO4.

Site PTO5

3.1.16 Site PTO5 is a natural, sheltered rocky shore located at inner part of the bay. The substrate was characterized by rubbles, large boulders and sand with gravels (Table 3.2). The common sessile taxa on the hard substrates included sessile plants, erect macroalgae and encrusting algae; sessile animals, barnacles and tube worms; and

sparse distribution of coralline algae, rock oysters, bryozoans, sponges, sea anemone and hard corals (Table 3.2; Appendix I).

3.1.17 Only 1 hard coral colony of *Leptastrea purpurea* (Faviidae) was observed. (Table 3.3; Appendix II).

3.1.18 No hard coral, soft coral or octocoral was recorded at Site PTO5.

Site PTO6

3.1.19 Site PTO6 is a natural, semi-exposed rocky shore. The substrate was characterized by rubbles, large boulders and sand with gravels (Table 3.2). The common sessile taxa on the hard substrates included sessile plants, erect macroalgae, encrusting algae and coralline algae; sessile animals, barnacles and tube worms; and sparse distribution of coralline algae, rock oysters, bryozoans, hydroids, sponges, sea anemone and hard corals (Table 3.2; Appendix I).

3.1.20 A total of 7 hard coral colonies of 6 species (belonging to 2 families) was observed, including *Favia rotumana* (2 colonies), *Plesiastrea versipora* (1 colony) *Favites pentagona* (1 colony) *Favia chinensis* (1 colony) *Acanthastrea* sp. (1 colony) and *Favites* sp. (1 colony). (Table 3.3; Appendix II).

3.1.21 No soft coral or octocoral was recorded at Site PTO6.

Site PTO7

3.1.22 Site PTO7 is a natural, semi-exposed rocky shore. The substrate was characterized by sand with gravels, rubbles and large boulders (Table 3.2). The common sessile taxa on the hard substrates included sessile plants, erect macroalgae, encrusting algae and coralline algae; sessile animals, barnacles and tube worms; and sparse distribution of coralline algae, rock oysters, bryozoans, hydroids, sponges, sea anemone and hard corals (Table 3.2; Appendix I).

3.1.23 Only 1 hard coral colony of *Plesiastrea versipora* (Faviidae) was observed. (Table 3.3; Appendix II).

3.1.24 No soft coral or octocoral was recorded at Site PTO7.

Site PTO8

3.1.25 Site PTO8 has a natural, sandy bottom. The substrate was mainly characterized by fine and coarse sand (Table 3.2). Only patches of sea anemones and detached macroalgae were observed (Table 3.2; Appendix I).

3.1.26 No hard coral, soft coral or octocoral was recorded at Site PTO8.

Site PTO9

3.1.27 Site PTO9 has a natural, sandy bottom, with patchy distribution of small rubbles. The substrate was mainly characterized by fine and coarse sand with gravels (Table 3.2). Only patches of sea anemones and detached macroalgae were observed (Table 3.2; Appendix I).

3.1.28 No hard coral, soft coral or octocoral was recorded at Site PTO9.

Site PTO10

3.1.29 Site PTO10 has a natural, sandy bottom. The substrate was mainly characterized by fine and coarse sand, with patchy distribution of small rubbles (Table 3.2). Only patches of sea anemones and detached macroalgae were observed (Table 3.2; Appendix I).

3.1.30 No hard coral, soft coral or octocoral was recorded at Site PTO10.

Site PTO11

3.1.31 Site PTO11 has a natural, sandy bottom. The substrate was mainly characterized by fine and coarse sand (Table 3.2). Only patches of sea anemones were observed (Table 3.2; Appendix I).

3.1.32 No hard coral, soft coral or octocoral was recorded at Site PTO11.

Table 3.1. Locations and Physical attributes of Sites for Dive Survey (PTO1 to PTO11).

Sites	GPS Coordinates	Depth (m)	Visibility (m)	Substrate type	Presence of Hard Corals?	Presence of Soft Corals?
PTO1	Start N 22°16.633' E 114°17.830'	2.0 – 2.5	4 – 5	Rubbles, boulders and sand with gravel	YES	NO
	End N 22°16.624' E 114°17.801'					
PTO2	Start N 22°16.695' E 114°17.859'	2.0 – 2.5	4 – 5	Rubbles, boulders and sand with gravel	YES	NO
	End N 22°16.668' E 114°17.846'					
PTO3	Start N 22°16.744' E 114°17.887'	2.0 – 2.5	4 – 5	Rubbles, boulders and sand with gravel	YES	NO
	End N 22°16.718' E 114°17.872'					
PTO4	Start N 22°16.788' E 114°17.926'	2.0 – 2.5	4 – 5	Rubbles, boulders and sand with gravel	YES	NO
	End N 22°16.768' E 114°17.908'					
PTO5	Start N 22°16.662' E 114°17.746'	2.0 – 2.5	4 – 5	Rubbles, boulders and sand with gravel	YES	NO
	End N 22°16.648' E 114°17.719'					
PTO6	Start N 22°16.709' E 114°17.776'	2.0 – 2.5	4 – 5	Rubbles, boulders and sand with gravel	YES	NO
	End N 22°16.685' E 114°17.759'					
PTO7	Start N 22°16.750' E 114°17.776'	2.0 – 2.5	4 – 5	Rubbles, boulders and sand with gravel	YES	NO
	End N 22°16.766' E 114°17.750'					
PTO8	Start N 22°16.779' E 114°17.768'	5.5 – 6.0	4 – 5	Sandy Bottom	NO	NO
	End N 22°16.778' E 114°17.797'					
PTO9	Start N 22°16.703' E 114°17.821'	3.0 – 4.0	4 – 5	Sandy Bottom	NO	NO
	End N 22°16.682' E 114°17.803'					
PTO10	Start N 22°16.748' E 114°17.832'	4.0 – 5.0	4 – 5	Sandy Bottom	NO	NO
	End N 22°16.724' E 114°17.818'					
PTO11	Start N 22°16.784' E 114°17.840'	5.5 – 6.0	4 – 5	Sandy Bottom	NO	NO
	End N 22°16.783' E 114°17.870'					

Table 3.2 Dive Surveys - Ecological and Substrate Attributes, and Taxonomic Inventories along REA Transects at 11 Sites (PTO1 to PTO11).

Substrate attributes (0 – 6)	PTO1	PTO2	PTO3	PTO4	PTO5	PTO6	PTO7	PTO8	PTO9	PTO10	PTO11
Bedrock	0	0	0	0	0	0	1	0	0	0	0
Boulder (diameter > 50cm)	3	3	3	3	1	2	3	0	0	0	0
Dead Coral	0	0	0	0	0	0	0	0	0	0	0
Rubble (diameter < 50cm)	5	6	5	5	6	6	3	0	1	1	0
Sand with gravel	2	1	3	3	1	1	4	6	6	6	6
Mud & Silt	1	0	0	0	0	0	0	0	0	0	0
Ecological attributes (0 – 6)	PTO1	PTO2	PTO3	PTO4	PTO5	PTO6	PTO7	PTO8	PTO9	PTO10	PTO11
Hard Corals	1	1	1	1	1	1	1	0	0	0	0
Dead Coral Skeleton	0	0	0	0	0	0	0	0	0	0	0
Soft Corals	0	0	0	0	0	0	0	0	0	0	0
Sea anemone beds	1	1	1	1	1	1	1	1	1	1	1
Encrusting Algae	4	2	3	3	2	3	3	0	0	0	0
Coralline Algae	1	3	2	3	1	3	2	0	0	0	0
Erect Macroalgae	5	5	3	3	5	4	3	0	0	0	0
Bare surface	3	0	3	3	2	2	2	0	0	0	0
Taxonomic inventories (0 – 5)	PTO1	PTO2	PTO3	PTO4	PTO5	PTO6	PTO7	PTO8	PTO9	PTO10	PTO11
Other sessile taxa Sponges	1	1	1	1	1	1	1	0	0	0	0
Bryozoans	1	1	1	1	1	1	1	0	0	0	0
Tunicates	0	0	0	0	0	0	0	0	0	0	0
Hydroids	1	0	1	1	0	1	1	0	0	0	0
Rock Oysters	2	2	1	1	1	1	1	0	0	0	0
Mussel beds	1	1	1	1	1	1	1	0	0	0	0
Barnacles	2	2	3	3	2	2	2	0	0	0	0
Tube worms	2	2	2	2	2	2	2	0	0	0	0
	PTO1	PTO2	PTO3	PTO4	PTO5	PTO6	PTO7	PTO8	PTO9	PTO10	PTO11
*No. Hard Coral Species	14	4	2	6	1	6	1	0	0	0	0
*No. Soft Coral Species	0	0	0	0	0	0	0	0	0	0	0

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

Summary - Coral community in the Study Area

- 3.1.33 A total of 69 hard coral colonies was found along 7 of the 11 transects in the Study Area in Po Toi O, Sai Kung, 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 100 to 4800 cm². All hard coral colonies were generally healthy, with low levels of sedimentation, bleaching and partial mortality, only few colonies showed low levels of sedimentation (0 - 5%) and mortality (0 - 50%), and most of the colonies were associated with rubbles and boulders (Table 3.3).
- 3.1.34 The species diversity of coral community in the Study Area was low to moderate, colonies were small to medium in size, with encrusting growth form, and patchily distributed. A total of 19 hard coral species of 6 families was observed in the Study Area (Table 3.3). The hard coral species were *Favites pentagona* (Family: Faviidae), *Cyphastrea serailia* (Faviidae), *Favites abdita* (Faviidae), *Favites chinensis* (Faviidae), *Favites rotumana* (Faviidae), *Favites chinensis* (Faviidae), *Platygyra carnosus* (Faviidae), *Plesiastrea versipora* (Faviidae), *Leptastrea purpurea* (Faviidae), *Favites* sp. 1 (Faviidae), *Favites* sp. 2 (Faviidae), *Favia* sp. (Faviidae), *Goniopora columna* (Poritidae), *Porites* sp. (Poritidae), *Montipora mollis* (Acroporidae), *Montipora peltiformis* (Acroporidae), *Turbinaria peltata* (Dendrophyllidae), *Psammocora superficialis* (Siderastreidae), *Acanthastrea* sp. (Mussidae). All these species have been recorded in Hong Kong waters (Chan et al. 2005).
- 3.1.35 Among sites with hard corals, Site PTO1 had the highest number of hard coral colonies (37 colonies) and species (14 species), followed by Sites PTO4 (13 colonies and 6 species), PTO 6 (7 colonies and 6 species), PTO2 (5 colonies and 4 species), PTO3 (5 colonies and 2 species), PTO5 (1 colony) and PTO7 (1 colony).
- 3.1.36 No soft coral colony was observed in the Study Area.
- 3.1.37 No other sessile taxon of high conservation interest was recorded in 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	Location on 50m transect (m)	Size: Hard corals: L x W cm (Soft corals: L x W x H cm)	%SD	%B	%PM	Associated Substrate Type
1	PTO1	1	Poritidae	<i>Porites</i> sp.	44.4	15 x 20	0	0	0	Boulder (> 50cm)
2	PTO1	2	Faviidae	<i>Favites abdita</i>	39.2	10 x 10	0	0	0	Boulder (> 50cm)
3	PTO1	3	Poritidae	<i>Porites</i> sp.	38.7	25 x 20	0	0	0	Boulder (> 50cm)
4	PTO1	4	Faviidae	<i>Favia rotumana</i>	38.4	15 x 10	5	0	0	Boulder (> 50cm)
5	PTO1	5	Faviidae	<i>Favites pentagona</i>	37.0	30 x 25	0	0	0	Boulder (> 50cm)
6	PTO1	6	Faviidae	<i>Cyphastrea serailia</i>	34.2	20 x 20	0	0	0	Rubble (< 50cm)
7	PTO1	7	Faviidae	<i>Favites abdita</i>	33.8	15 x 15	0	0	0	Rubble (< 50cm)
8	PTO1	8	Faviidae	<i>Favia rotumana</i>	32.8	10 x 10	0	0	0	Rubble (< 50cm)
9	PTO1	9	Acroporidae	<i>Montipora mollis</i>	35.0	60 x 40	0	0	0	Boulder (> 50cm)
10	PTO1	10	Faviidae	<i>Favites chinensis</i>	32.5	20 x 15	0	0	0	Boulder (> 50cm)
11	PTO1	11	Faviidae	<i>Plesiastrea versipora</i>	36.0	10 x 10	0	0	0	Rubble (< 50cm)
12	PTO1	12	Faviidae	<i>Favia rotumana</i>	36.0	10 x 10	0	0	0	Boulder (> 50cm)
13	PTO1	13	Faviidae	<i>Favia rotumana</i>	35.0	10 x 10	0	0	0	Boulder (> 50cm)
14	PTO1	14	Poritidae	<i>Goniopora columna</i>	36.0	50 x 40	0	0	0	Boulder (> 50cm)
15	PTO1	15	Faviidae	<i>Platygyra carnosus</i>	31.0	25 x 20	0	0	0	Boulder (> 50cm)
16	PTO1	16	Faviidae	<i>Favites pentagona</i>	29.0	15 x 10	0	0	0	Rubble (< 50cm)
17	PTO1	17	Faviidae	<i>Favia rotumana</i>	27.0	10 x 10	0	0	0	Rubble (< 50cm)
18	PTO1	18	Faviidae	<i>Favia rotumana</i>	27.0	10 x 10	0	0	0	Rubble (< 50cm)
19	PTO1	19	Faviidae	<i>Favites pentagona</i>	24.0	25 x 20	0	0	0	Boulder (> 50cm)
20	PTO1	20	Faviidae	<i>Favia rotumana</i>	24.0	15 x 15	0	0	0	Rubble (< 50cm)
21	PTO1	21	Faviidae	<i>Plesiastrea versipora</i>	23.0	20 x 15	0	0	0	Boulder (> 50cm)
22	PTO1	22	Faviidae	<i>Favites abdita</i>	23.0	15 x 15	0	0	0	Boulder (> 50cm)
23	PTO1	23	Faviidae	<i>Favites abdita</i>	23.0	15 x 15	0	0	0	Boulder (> 50cm)
24	PTO1	24	Faviidae	<i>Favites pentagona</i>	22.0	30 x 20	0	0	0	Boulder (> 50cm)
25	PTO1	25	Dendrophyllidae	<i>Turbinaria peltata</i>	20.0	15 x 15	0	0	0	Boulder (> 50cm)
26	PTO1	26	Faviidae	<i>Favites</i> sp. 1	20.0	15 x 20	0	0	0	Boulder (> 50cm)
27	PTO1	27	Siderastreidae	<i>Psammocora superficialis</i>	18.2	30 x 15	0	0	0	Boulder (> 50cm)

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28	PTO1	28	Faviidae	<i>Favites pentagona</i>	18.2	15 x 15	0	0	0	Boulder (> 50cm)
29	PTO1	29	Faviidae	<i>Favites chinensis</i>	18.2	20 x 15	0	0	0	Rubble (< 50cm)
30	PTO1	30	Faviidae	<i>Favites pentagona</i>	15.0	45 x 30	0	0	0	Boulder (> 50cm)
31	PTO1	31	Faviidae	<i>Cyphastrea serailia</i>	14.0	15 x 15	0	0	0	Boulder (> 50cm)
32	PTO1	32	Faviidae	<i>Favia rotumana</i>	14.0	10 x 10	0	0	0	Rubble (< 50cm)
33	PTO1	33	Faviidae	<i>Favites pentagona</i>	12.5	25 x 20	0	0	0	Boulder (> 50cm)
34	PTO1	34	Faviidae	<i>Platygyra carnosus</i>	12.5	20 x 15	0	0	0	Boulder (> 50cm)
35	PTO1	35	Faviidae	<i>Cyphastrea serailia</i>	10.7	15 x 15	0	0	0	Boulder (> 50cm)
36	PTO1	36	Faviidae	<i>Favia rotumana</i>	7.0	20 x 20	0	0	0	Boulder (> 50cm)
37	PTO1	37	Faviidae	<i>Favia</i> sp.	6.0	30 x 40	0	0	0	Boulder (> 50cm)
38	PTO2	1	Faviidae	<i>Platygyra carnosus</i>	45.4	20 x 15	0	0	0	Rubble (< 50cm)
39	PTO2	2	Faviidae	<i>Platygyra acuta</i>	38.2	30 x 15	0	0	0	Boulder (> 50cm)
40	PTO2	3	Faviidae	<i>Favites abdita</i>	32.0	20 x 20	0	0	0	Boulder (> 50cm)
41	PTO2	4	Faviidae	<i>Favites abdita</i>	28.6	15 x 15	0	0	0	Boulder (> 50cm)
42	PTO2	5	Poritidae	<i>Porites</i> sp.	10.2	30 x 20	0	0	10	Boulder (> 50cm)
43	PTO3	1	Acroporidae	<i>Montipora peltiformis</i>	49.0	25 x 20	0	0	0	Boulder (> 50cm)
44	PTO3	2	Poritidae	<i>Porites</i> sp.	48.5	15 x 10	0	0	50	Rubble (< 50cm)
45	PTO3	3	Acroporidae	<i>Montipora peltiformis</i>	39.5	45 x 30	0	0	0	Boulder (> 50cm)
46	PTO3	4	Acroporidae	<i>Montipora peltiformis</i>	16.0	50 x 50	0	0	0	Boulder (> 50cm)
47	PTO3	5	Acroporidae	<i>Montipora peltiformis</i>	5.1	40 x 40	0	0	0	Boulder (> 50cm)
48	PTO4	1	Acroporidae	<i>Montipora peltiformis</i>	49.5	20 x 15	0	0	0	Boulder (> 50cm)
49	PTO4	2	Poritidae	<i>Porites</i> sp.	49.5	20 x 25	0	0	0	Rubble (< 50cm)
50	PTO4	3	Acroporidae	<i>Montipora peltiformis</i>	48.0	60 x 40	0	0	0	Boulder (> 50cm)
51	PTO4	4	Acroporidae	<i>Montipora peltiformis</i>	38.2	20 x 20	0	0	0	Rubble (< 50cm)
52	PTO4	5	Faviidae	<i>Favia rotumana</i>	31.2	15 x 15	0	0	0	Boulder (> 50cm)
53	PTO4	6	Faviidae	<i>Cyphastrea serailia</i>	22.8	15 x 15	0	0	10	Boulder (> 50cm)
54	PTO4	7	Poritidae	<i>Porites</i> sp.	21.0	10 x 10	0	0	15	Rubble (< 50cm)
55	PTO4	8	Poritidae	<i>Porites</i> sp.	12.5	25 x 20	0	0	0	Boulder (> 50cm)
56	PTO4	9	Faviidae	<i>Favia rotumana</i>	8.0	25 x 20	0	0	0	Boulder (> 50cm)
57	PTO4	10	Faviidae	<i>Favia rotumana</i>	1.5	10 x 15	0	0	0	Boulder (> 50cm)

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58	PTO4	11	Acroporidae	<i>Montipora peltiformis</i>	1.2	30 x 25	0	0	0	Boulder (> 50cm)
59	PTO4	12	Faviidae	<i>Plesiastrea versipora</i>	1.0	60 x 50	0	0	0	Boulder (> 50cm)
60	PTO4	13	Dendrophyllidae	<i>Turbinaria peltata</i>	0.0	80 x 60	0	0	0	Boulder (> 50cm)
61	PTO5	1	Faviidae	<i>Leptastrea purpurea</i>	20.5	15 x 15	0	0	0	Rubble (< 50cm)
62	PTO6	1	Faviidae	<i>Plesiastrea versipora</i>	43.7	30 x 25	0	0	0	Boulder (> 50cm)
63	PTO6	2	Faviidae	<i>Favites pentagona</i>	46.5	25 x 15	0	0	0	Boulder (> 50cm)
64	PTO6	3	Faviidae	<i>Favia rotumana</i>	21.8	25 x 15	0	0	0	Rubble (< 50cm)
65	PTO6	4	Mussidae	<i>Acanthastrea</i> sp.	21.8	15 x 15	0	0	0	Boulder (> 50cm)
66	PTO6	5	Faviidae	<i>Favia rotumana</i>	20.0	40 x 30	0	0	0	Boulder (> 50cm)
67	PTO6	6	Faviidae	<i>Favites</i> sp. 2	8.8	25 x 25	0	0	0	Rubble (< 50cm)
68	PTO6	7	Faviidae	<i>Favites chinensis</i>	8.8	15 x 15	0	0	0	Rubble (< 50cm)
69	PTO7	1	Faviidae	<i>Plesiastrea versipora</i>	37.8	20 x 15	0	0	0	Rubble (< 50cm)

4 SUMMARY

Baseline Coral Survey

- 4.1.1 Dive surveys conducted at eleven sites showed that the abundance of hard corals was low in the Study Area. Most hard substrates were dominated by sessile plants such as erect macroalgae, encrusting algae, coralline algae, and also suspension feeding sessile animals such as barnacles and tube worms.
- 4.1.2 A total of 69 hard coral colonies was observed at seven of the eleven dive sites in the Study Area. All these coral colonies were generally in good and healthy condition, with low levels of sedimentation, bleaching and partial mortality.
- 4.1.3 In the Study Area, the percentage cover of coral community was low at all sites, and the species diversity was low (Sites PTO2 to PTO7) to moderate (Site PTO1); coral colonies were small to moderate in size, with encrusting growth form, and patchily distributed.
- 4.1.4 A total of 19 hard coral species of 6 families was observed in the Study Area (Table 3.3). The 6 families were Faviidae (12 species: *Favites pentagona*, *Cyphastrea serailia*, *Favites abdita*, *Favites chinensis*, *Favites rotumana*, *Favites chinensis*, *Platygyra carnosus*, *Plesiastrea versipora*, *Leptastrea purpurea*, *Favites* sp. 1, *Favites* sp. 2, *Favia* sp.); Poritidae (2 species: *Goniopora columna*, *Porites* sp.); Acroporidae (2 species: *Montipora mollis*, *Montipora peltiformis*); Dendrophyllidae (1 species: *Turbinaria peltata*); Siderastreidae (1 species: *Psammocora superficialis*); and Mussidae (1 species: *Acanthastrea* sp.). The coral species in these families are commonly recorded in Hong Kong waters (Chan et al. 2005).
- 4.1.5 No soft coral or other sessile taxon of specific conservation interest was recorded in the Study Area.

6 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

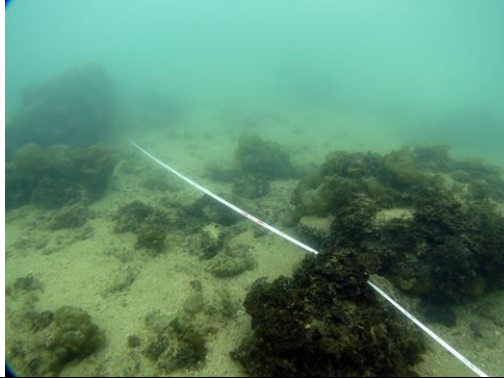
Appendix I Photos of the Dive Survey Sites at Po Toi O.



PTO1 – Natural Rocky Shore



PTO2 – Natural Rocky Shore



PTO1 and 2 – Boulders, rubbles and sand



PTO1 and 2 – Hard substrates covered by macroalgae



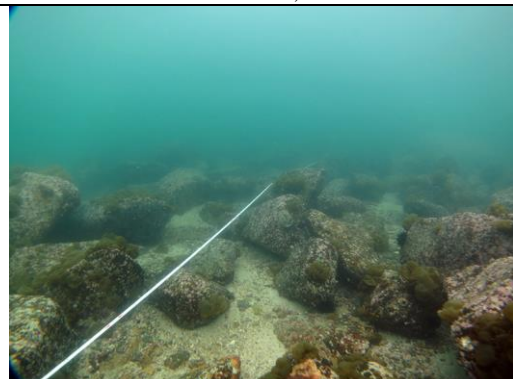
PTO3 – Natural Rocky Shore



PTO3 – Boulders, rubbles and sand



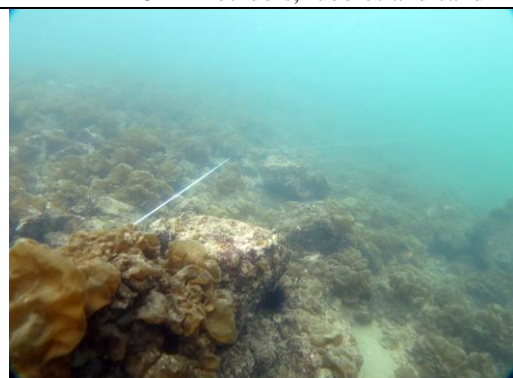
PTO4 – Natural Rocky Shore



PTO4 – Boulders, rubbles and sand



PTO5 – Natural Rocky Shore



PTO5 – Boulders, rubbles and sand

Appendix I Continued.



PTO6 – Natural Rocky Shore



PTO6 – Boulders, rubbles and sand



PTO7 – Natural Rocky Shore



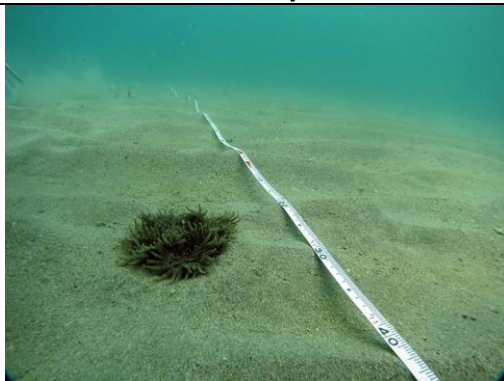
PTO7 – Boulders, rubbles and sand



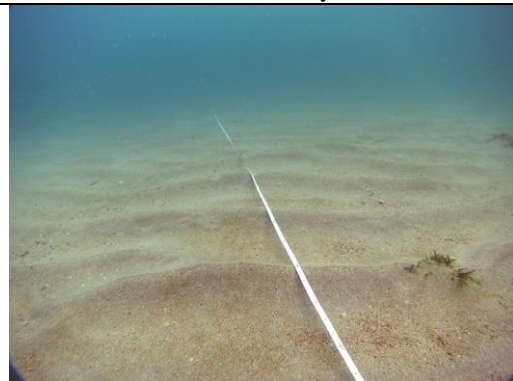
PTO8 – Sandy bottom



PTO9 – Sandy bottom



PTO10 – Sandy bottom



PTO11 – Sandy bottom



PTO 8, 9, 10 and 11 – Sea anemone



PTO 8, 9, 10 and 11 – Sandy bottom

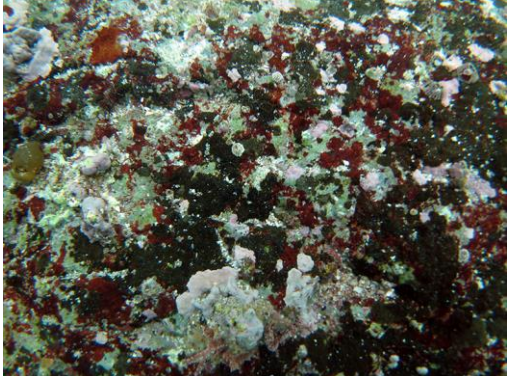
Appendix I Continued.



All sites – Sandy bottom at deeper water (> 2.5m depth)



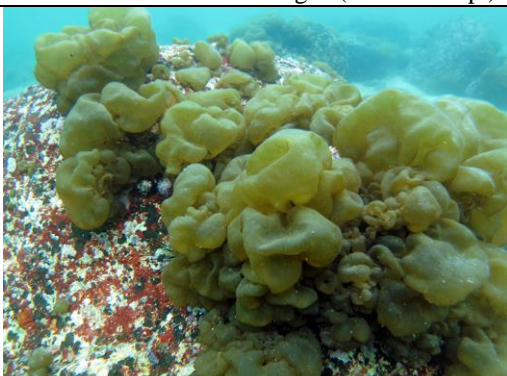
PTO1 to 7 – Most hard substrates were covered by macroalgae and encrusting algae



PTO1 to 7 – Encrusting algae PTO1 to 7 – Encrusting coralline algae and barnacles



PTO1 to 7 – Coralline algae (*Corallina* sp.) PTO3 to 7 – Macroalgae (*Sargassum* spp.)



PTO1 to 7 – Macroalgae (*Colpomenia sinuosa*) PTO5 and 6 – Sea anemones

Appendix I Continued.



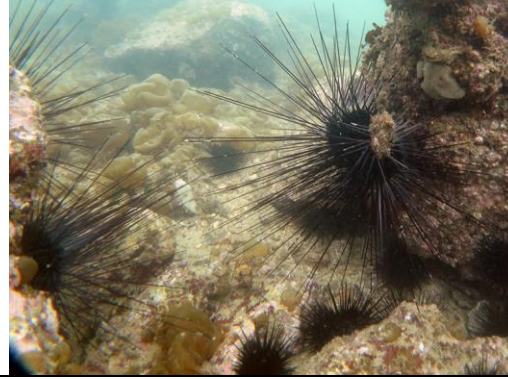
PTO1 to 7 – Hard corals on hard substrates



PTO1 to 7 – Hard corals on hard substrates



PTO1 to 7 – Encrusting bryozoans



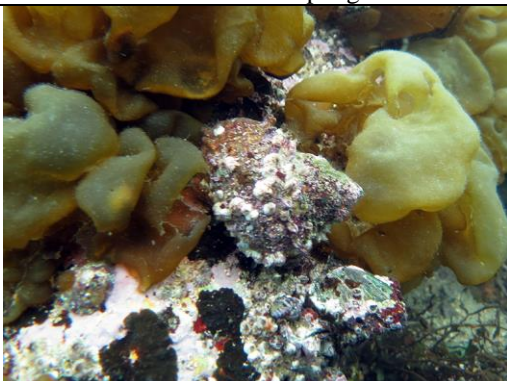
PTO 1 to 7 – Sea urchin (*Diadema setosum*)



PTO 1 to 7 – Sponges



PTO 1 to 7 – Sea cucumber (*Holothuria leucospilota*)



PTO1 to 7 – Herbivory gastropod (*Turbo* sp.)



PTO 1 to 7 – Sea urchin (*Salmacis sphaeroides*)

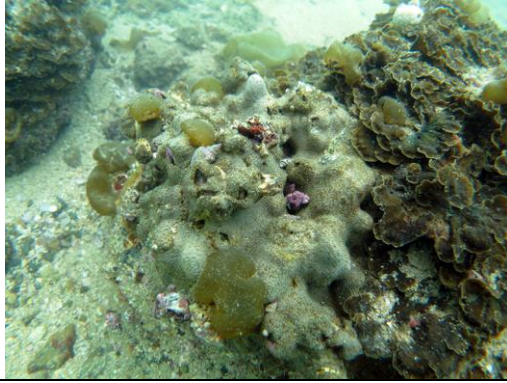


PTO3 and 4 - Nudibranch



PTO 1 to 7 – Sea urchin (*Anthocidaris crassispina*)

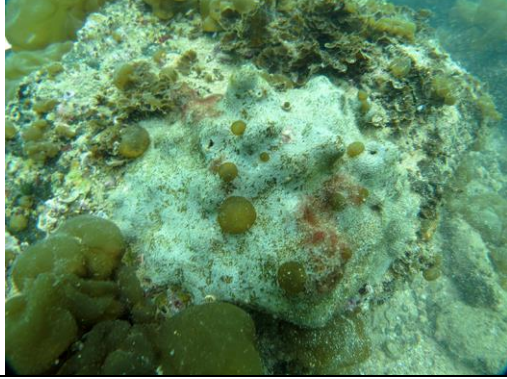
Appendix II Photos of Corals found at the Dive Survey Sites in Po Toi O



(1) PTO1 – Hard Coral (*Porites* sp.)



(2) PTO1 – Hard Coral (*Favites abdita*)



(3) PTO1 – Hard Coral (*Porites* sp.)



(4) PTO1 – Hard Coral (*Favia rotumana*)



(5) PTO1 – Hard Coral (*Favites pentagona*)



(6) PTO1 – Hard Coral (*Cyphastrea serailia*)



(7) PTO1 – Hard Coral (*Favites abdita*)



(8) PTO1 – Hard Coral (*Favia rotumana*)



(9) PTO1 – Hard Coral (*Montipora mollis*)



(10) PTO1 – Hard Coral (*Favites chinensis*)

Appendix II Continued.



(11)PTO1 – Hard Coral (*Plesiastrea versipora*)



(12)PTO1 – Hard Coral (*Favia rotumana*)



(13)PTO1 – Hard Coral (*Favia rotumana*)



(14)PTO1 – Hard Coral (*Goniopora columna*)



(15)PTO1 – Hard Coral (*Platygyra carnosus*)



(16)PTO1 – Hard Coral (*Favites pentagona*)



(17)PTO1 – Hard Coral (*Favia rotumana*)



(18)PTO1 – Hard Coral (*Favia rotumana*)



(19)PTO1 – Hard Coral (*Favites pentagona*)



(20)PTO1 – Hard Coral (*Favia rotumana*)

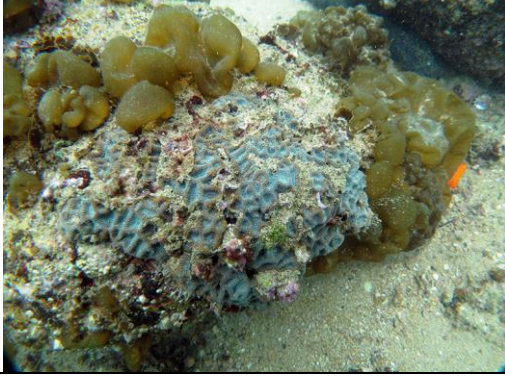
Appendix II Continued.



(21) PTO1 – Hard Coral (*Plesiastrea versipora*)



(22) PTO1 – Hard Coral (*Favites abdita*)



(23) PTO1 – Hard Coral (*Favites abdita*)



(24) PTO1 – Hard Coral (*Favites pentagona*)



(25) PTO1 – Hard Coral (*Turbinaria peltata*)



(26) PTO1 – Hard Coral (*Favites* sp.)



(27) PTO1 – Hard Coral (*Psammocora superficialis*)



(28) PTO1 – Hard Coral (*Favites pentagona*)



(29) PTO1 – Hard Coral (*Favites chinensis*)



(30) PTO1 – Hard Coral (*Favites pentagona*)

Appendix II Continued.



(31) PTO1 – Hard Coral (*Cyphastrea serailia*)



(32) PTO1 – Hard Coral (*Favia rotumana*)



(33) PTO1 – Hard Coral (*Favites pentagona*)



(34) PTO1 – Hard Coral (*Platygyra carnosus*)



(35) PTO1 – Hard Coral (*Cyphastrea serailia*)



(36) PTO1 – Hard Coral (*Favia rotumana*)



(37) PTO1 – Hard Coral (*Favia* sp.)



(38) PTO2 – Hard Coral (*Platygyra carnosus*)

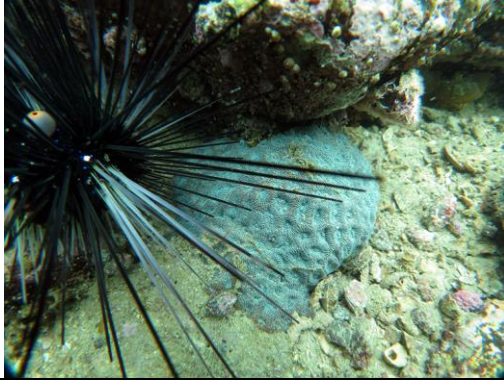


(39) PTO2 – Hard Coral (*Platygyra acuta*)



(40) PTO2 – Hard Coral (*Favites abdita*)

Appendix II Continued.



(41) PTO2 – Hard Coral (*Favites abdita*)



(42) PTO2 – Hard Coral (*Porites* sp.)



(43) PTO3 – Hard Coral (*Montipora peltiformis*)



(44) PTO3 – Hard Coral (*Porites* sp.)



(45) PTO3 – Hard Coral (*Montipora peltiformis*)



(46) PTO3 – Hard Coral (*Montipora peltiformis*)



(47) PTO3 – Hard Coral (*Montipora peltiformis*)



(48) PTO4 – Hard Coral (*Montipora peltiformis*)



(49) PTO4 – Hard Coral (*Porites* sp.)



(50) PTO4 – Hard Coral (*Montipora peltiformis*)

Appendix II Continued.



(51) PTO4 – Hard Coral (*Montipora peltiformis*)



(52) PTO4 – Hard Coral (*Favia rotumana*)



(53) PTO4 – Hard Coral (*Cyphastrea serailia*)



(54) PTO4 – Hard Coral (*Porites* sp.)



(55) PTO4 – Hard Coral (*Porites* sp.)



(56) PTO4 – Hard Coral (*Favia rotumana*)



(57) PTO4 – Hard Coral (*Favia rotumana*)



(58) PTO4 – Hard Coral (*Montipora peltiformis*)



(59) PTO4 – Hard Coral (*Plesiastrea versipora*)



(60) PTO4 – Hard Coral (*Turbinaria peltata*)

Appendix II Continued.



(61) PTO5 – Hard Coral (*Leptastrea purpurea*)



(62) PTO6 – Hard Coral (*Plesiastrea versipora*)



(63) PTO6 – Hard Coral (*Favites pentagona*)



(64) PTO6 – Hard Coral (*Favia rotumana*)



(65) PTO6 – Hard Coral (*Acanthastrea* sp.)



(66) PTO6 – Hard Coral (*Favia rotumana*)



(67) PTO6 – Hard Coral (*Favites* sp.)



(68) PTO6 – Hard Coral (*Favites chinensis*)



(69) PTO7 – Hard Coral (*Plesiastrea versipora*)