Environmental Impact Assessment for Development of a Bathing Beach at Lung Mei, Tai Po
Environmental Permit No. EP-388/2010

Baseline Marine Ecological Monitoring Report (at the Ting Kok East)

（Revised, October 05, 2018）

Report Prepared and Submitted by China Hong Kong Ecology Consultants Ltd.			
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1 Introduction

1.1 In accordance with the project EP condition (Part C Permit Conditions) Section 4.2 (a), it is required to conducting baseline environmental monitoring before construction of the project. Detailed requirements including monitoring methodology for ecological baseline monitoring were stipulated in Section 7.2 of the updated EM & A manual.

1.2 Aim of this report is to present pre-construction ecological baseline monitoring objectives, methods, locations and results.

2 Objectives

2.1 The objectives of the marine ecological monitoring are to collect data for determining whether there is any impact on the marine ecological resources (i) in the vicinity of the Site due to the development of the bathing beach at Lung Mei, and (ii) at the Receptor Site of Ting Kok East due to relocation of the target marine fauna.

2.2 This Report covers the baseline marine ecological surveys conducted at the Receptor Site at Ting Kok East. Future monitoring results from Ting Kok East and by the same sampling methods will be used for comparing with baseline data to determine if there are any significant changes due to relocation of target marine fauna.

3 Scope of Baseline Marine Ecological Survey

- Intertidal quantitative transect survey at one location
- Intertidal fish survey at two locations

4 Methodology

4.1 Intertidal quantitative transect survey

4.1.1 The reception site at Ting Kok East for fauna relocation from the project site was identified and recommended during EIA stage. The project specification required that the captured target marine fauna from the project site should be released to the reception area with similar habitat and shore elevation where they are captured. The target fauna will be captured from the full tidal range at the project site. Therefore inter-tidal habitats at representative three tidal levels for full tidal range at Ting Kok East are selected to be sampled to collect data to characterize baseline condition.

4.1.2 The intertidal quantitative transect survey was undertaken during daytime low tide (<1mCD), Three 30-m horizontal transects parallel to the shoreline was haphazardly deployed at each of the three shore heights (0.5 mCD, 1.0 mCD and 1.5 mCD) areas where most of the intertidal fauna inhabit) within the intertidal and shallow subtidal zones. Five 0.25m x 0.25m quadrats was placed randomly along each transect to assess the abundance and diversity of marine fauna (total sample number = 3 shore heights x 3 transects x 5 quadrats = 45). For each quadrat, a photographic record was obtained, and the abundance of sessile fauna (e.g. barnacles and rock oysters, expressed as percentage planar cover of the quadrat) would be

estimated. Surface sediment (approximate volume = 25 cm x 25cm x 5 cm =3,125 cm^3) was wet-sieved in situ (mesh size of 2 mm) to obtain all mobile organisms living on or in the surface sediment within each quadrat ('epifauna', including underside of the boulders/cobbles). Epifauna was identified to species level where possible and their abundance recorded to calculate epifaunal abundance per quadrat for comparison of abundance during subsequent ecological monitoring. Average percentage cover of each species was calculated by cumulated cover divided by number of quadrat.

4.1.3 All crustacean species observed and their relative abundance along each transect was also recorded during the transect surveys (semi-quantitative crustacean surveys) along 1 m belt area on each side of the transect line.

4.1.4 Sampling transects are shown in **Appendix I**. The selected marine ecological monitoring/survey site is the reception site for fauna relocation programme at the bathing beach construction site.

4.2 Semi-quantitative survey

4.2.1 To supplement quantitative survey by quadrat described above, semi- quantitative survey was performed by walking along transects lines to observe and record of animals. All species observed and their relative abundance along approximately 1 m each side of transects were recorded during the transect survey.

4.3 Intertidal fish survey

4.3.1 The intertidal fish survey was involve field observation, photographic record and drop-trapping during daytime low tide (tidal level <1.5 mCD) to examine the diversity and abundance of fish species. One-metre-square drop-traps was deployed by two persons, each holding the trap above the water surface when the water depth is about 0.2-0.5 m, and then dropped onto the sediment surface to capture intertidal fish. All intertidal fish captured using this method was recorded. At least 10 drop-trap samples was collected during each survey. All captured intertidal fish was identified to species level wherever possible and returned to their natural habitats after identification works as far as practicable.

4.3.2 Intertidal fish survey area is given in **Appendix I**.

4.4 Shannon diversity index (H) and Pielou's evenness index (J)

4.4.1 The Shannon diversity index (H) is another index that is commonly used to characterize species diversity in a community. Shannon's index accounts for both abundance and evenness of the species present. The proportion of species *i* relative to the total number of species (p_i) is calculated, and then multiplied by the natural logarithm of this proportion ($\ln p_i$). The resulting product is summed across species, and multiplied by -1:

$$H = -\sum_{i=1}^{s} p_i \ln p_i$$

The evenness of a community can be represented by Pielou's evenness index:

$$J = H' / Hmax = H' / \ln S$$

Where H ′ is the number derived from the Shannon diversity index and H' max is the maximum possible value of H ′, equal to:

$$H_{max} = -\sum_{i=1}^{S} \frac{1}{S} \ln \frac{1}{S} = \ln S$$

J is constrained between 0 and 1. The less evenness in communities between the species (and the presence of a dominant species), the lower J is.

4.5 In order to make data comparable, same sampling methodology including sampling technique, replicates and locations will be used during impact monitoring.

4.6 Statistic analysis such as ANOVA or any other suitable multidimensional scaling method may be used to detect where significant difference of data between baseline and impact monitoring occurred. This will be further elaborated when preparing impact monitoring report.

5 Survey Results

Quantitative quadrats survey results

5.1 Quantitative quadrat surveys were conducted at Ting Kok East should be 22 June 2017 (10:00-18:00), 23 June 2017 (12:00-18:00) and 27 June 2017 (15:00-18:00). A total of 45 quadrats were surveyed from three shore heights (0.5 mCD, 1.0 mCD and 1.5 mCD). The representative photos of survey transect and quadrats were presented in **Appendix IIa.** The survey results of quantitative quadrat survey were summarized in **Appendix IIIa**. A total of 28 epifauna species were recorded, comprising 23 mobile fauna and 5 sessile fauna. At three heights, the highest number of species was the Mollusca among other taxonomic group, followed by Arthropoda (**Table.1**)

Table.1 Total Number of Recorded Epifauna Species in Each Phylum

Phylum/Subphylum	Number of Species
Mollusca	17
Chordata	2
Annelida	2
Arthropoda	5
Sipuncula	1

Polyplacophora	1

5.2 The highest abundance of epifauna was recorded at 1 mCD, in which total of 492 individuals of epifauna were recorded, followed by 1.5 mCD (213 individuals) and 0.5 mCD (131 individuals). The most abundant species at 0.5 mCD, 1 mCD and 1.5 mCD were sea snails *Cerithidea cingulata*, sandy shore snail *Batillaria zonalis*, and the crowned turban shell *Lunella coronata* respectively. The most abundant species were all under taxonomic group of Mollusca. The summary of abundant species of mobile epifauna was presented in **Table 2**. The mean abundance of epifauna per quadrat (volume of each quadrat is 3,125 cm^2) at three tidal levels (0.5 mCD, 1.0mCD and 1.5mCD) were summarized in the **Table 2**. For the mobile fauna, the highest abundance (37.85±65.30) was recorded at 1.0mCD.

Table 2. Numerical Abundance and Percentage of Mobile Faunal Species Recorded at Three Tidal Levels on Tidal Zone (0.5 mCD, 1 mCD and 0. 1.5 mCD).

0.5 mCD				1 mCD				1.5 mCD			
Common name	Species	Abundance	Percentage	Common name	Species	Abundance	Percentage	Common name	Species	Abundance	Percentage
Zoned Horned Shell	*Batillaria zonalis*	11	8.40%	Zoned Horned Shell	*Batillaria zonalis*	224	45.53%	Zoned Horned Shell	Batillaria zonalis	17	7.98%
Many-formed Cerith	*Batillaria multiformis*	23	17.56%	Many-formed Cerith	*Batillaria multiformis*	126	25.61%	Many-formed Cerith	Batillaria multiformis	41	19.25%
Mud snail	*Cerithidea cingulata*	53	40.46%	Mud snail	*Cerithidea cingulata*	29	5.89%	Mud snail	Cerithidea cingulata	5	2.35%
Leaf Oyster	*Isognomon isognomum*	1	0.76%	The truncated mangrove snail	*Cerithidea djadjariensis*	8	1.63%	Turban shell	Lunella coronata	89	41.78%
Turban shell	*Lunella coronata*	11	8.40%	Dubious Nerite	*Clithon oualaniensis*	1	0.20%	Comb venus	Gafrarium pectinatum	22	10.33%
Comb venus	*Gafrarium pectinatum*	5	3.82%	Turban shell	*Lunella coronata*	37	7.52%	Lipped Top Shell	Monodonta labio	4	1.88%
-	*Asaphis dichotoma*	4	3.05%	Comb venus	*Gafrarium pectinatum*	4	0.81%	Japanese grata limpet	Cellana grata	2	0.94%
Shouldered Castor Bean	*Cronia margariticola*	3	2.29%	-	*Asaphis dichotoma*	24	4.88%	-	Asaphis dichotoma	23	10.80%
Blood clam	*Barbatia virescens*	5	3.82%	Ark shell	*Tegillarca granosa*	2	0.41%	Variable mussel	Brachidontes variabilis	3	1.41%
Variable mussel	*Brachidontes variabilis*	1	0.76%	Corneous ark	*Scapharca cornea*	5	1.02%	Purple climber crabs	Metopograpsus frontalis	3	1.41%

Corneous ark	*Scapharca cornea*	3	2.29%	Japanese grata limpet	*Cellana grata*	2	0.41%	Crenate swimming crab	Thalamita crenata	2	0.94%
Brownbar snapping shrimp	*Alpheus lobidens*	4	3.05%	Variable mussel	*Brachidontes variabilis*	29	5.89%	-	Dendronereides sp.	2	0.94%
Hermit Crab	*Paguroidea sp.*	3	2.29%	-	*Dendronereides sp.*	1	0.20%				
Brown Frillfin Goby	*Bathygobius fuscus*	1	0.76%								
Marine worm	*Sipunculidea Sipunculus nudus*	3	2.29%								
Total		131	100%	Total		492	100%	Total		213	100%
No of replicates		15		No of replicates		15		No of replicates		15	
Mean		8.73		Mean		32.80		Mean		14.20	
Standard deviations		13.51		Standard deviations		65.30		Standard deviations		25.57	

5.3 The coverage of sessile fauna within each quadrat was estimated and the results were summarized in **Table 3**. Natak rock oyster *Saccostrea cucullata* had the highest coverage at all shore heights among other sessile fauna recorded. The mean abundance of sessile organisms per quadrat (volume of each quadrat is 3,125 cm^2) at three tidal levels (0.5 mCD, 1.0 mCD and 1.5 mCD) were summarized in the **Table 3**. For highest coverage of sessile organisms was found at 0.5 mCD (22.48%).

Table 3. Abundance Presented as Percentage Cover of Sessile Faunal Species Recorded at Three Tidal Levels on Tidal Zone (0.5 mCD, 1 mCD and 0. 1.5 mCD).

0.5 mCD			1 mCD			1.5 mCD		
Common name	Species	Average Coverage Percentage/ Standard Deviation	Common name	Species	Average Coverage Percentage/ Standard Deviation	Common name	Species	Average Coverage Percentage/ Standard Deviation
Rock Oyster	*Saccostrea cucullata*	19.67% (±17.67%)	Rock Oyster	*Saccostrea cucullata*	12.47% (±7.31%)	Rock Oyster	*Saccostrea cucullata*	5.40% (±5.38%)

Pleated Sea Squirt	*Styela plicata*	2.67% (±4.58%)	Barnacle	*Amphibalanus amphitrite*	1.13% (±1.92%)	Worm -snails	*Serpulorbis imbricatus*	0.27% (±0.80%)
Barnacle	*Amphibalanus amphitrite*	0.07% (±0.26%)	Worm -snails	*Serpulorbis imbricatus*	0.20% (±0.77%)	Barnacle	*Amphibalanus amphitrite*	0.13% (±0.35%)
Worm -snails	*Serpulorbis imbricatus*	0.07% (±0.26%)	Chitons	*Acanthopleura japonica*	0.07% (±0.26%)			
			Pleated Sea Squirt	*Styela plicata*	0.07% (±0.26%)			
No of replicates		15	No of replicates		15	No of replicates		15
Total coverage by mean		22.48%	Total coverage by mean		13.94%	Total coverage by mean		5.80%

5.4 The mean number of species per quadrat for mobile fauna and sessile fauna at three tidal levels were summarized in the **Table 4.** The highest number of species of mobile fauna and sessile organisms were both recorded at the 1.0 mCD, they are 4.53±1.25 and 1.53±0.64 respectively. The overall mean of species number of mobile fauna and sessile organisms at Ting Kok East were 3.49±1.56 and 1.36±0.68 respectively.

Table 4. The Mean Number of Epifaunal Species per Quadrat

	Tidal level			
	0.5 mCD	**1.0 mCD**	**1.5 mCD**	**Overall**
Mobile Fauna (no. of species)	2.80±1.66	4.53±1.25	3.13±1.25	3.49±1.56
Sessile Organisms (no. of species)	1.40±0.74	1.53±0.64	1.13±0.64	1.36±0.68

5.5 Based on the calculation (excluding sessile organism), the species diversity at 0.5 mCD (H=2.01) was higher than 1.0 mCD (H=1.61) and 1.5 mCD (H=1.77). The overall species diversity (H) of epifauna was 2.00. The species evenness (J) was similar among three tidal levels ranging from 0.63 to 0.74, while the overall species evenness was 0.64. The calculated results were showed in **Table 5.**

Table 5. Species Diversity and Evenness

	Tidal level			
	0.5 mCD	**1.0 mCD**	**1.5 mCD**	**Overall**
Shannon diversity index(H)	2.01	1.61	1.77	2.00
Pielou's evenness(J)	0.74	0.63	0.71	0.64

Semi-quantitative survey results

5.6 Semi-quantitative surveys were undertaken to record epifauna along 1 m belt area on each side of the transect line, shown as **Appendix IIa**. The survey results were shown in **Appendix IIIb.** The highest number of species recorded was at 0.5 mCD (52 species), followed by 1.0 mCD (40 species) and 1.5 mCD (17 species), summarized in **Table 6**. The species of the Mollusca occupied the highest proportion of species composition among the rest of taxonomic group, followed by the Arthropoda. In total, 61 species were recorded from 9 transect lines at 3 different shore heights. The recorded species belong to common species (with no conservation interest). Some representative photos of recorded fauna were shown in **Appendix IIb.**

Table 6. Total Number of Species recorded from Semi-quantitative Survey

	0.5 mCD	**1.0 mCD**	**1.5 mCD**
Phylum	Number of Species		
Mollusca	21	17	9
Chordata	3	4	0
Annelida	2	4	3
Sipuncula	1	1	0
Echinodermata	4	0	0
Arthropoda	19	14	5
Cnidaria	1	0	0
Porifera	1	0	0
Total number of species	52	40	17

Inter-tidal fish survey results

5.7 The inter-tidal fish survey was conducted at the area indicated in **Appendix I**. From the survey, a total of 7 species were recorded. The recorded species were low in abundance ranging from 0.1 to 0.4 individual per square meter. The list of the recorded species and their abundance were shown in **Table 7.** The recorded fish species belong to common species (with no conservation interest). The survey results were shown in **Appendix IIIc.**

Table 7. Average Abundance of Inter-tidal Fish Recorded from 10 drop-traps

Common Name	Species	Abundance per m^2
Dusky frillgoby	*Bathygobius fuscus*	0.3
Target shrimp goby	*Cryptocentrus strigilliceps*	0.1
Fan-bellied leatherjacket	*Monacanthus chinensis*	0.1
Pointed goatfish	*Parupeneus biaculeatus*	0.1

Mottled spinefoot	*Siganus fuscescens*	0.4
Tridentiger bifasciatus	*Tridentiger bifasciatus*	0.2
Chameleon goby	*Tridentiger trigonocephalus*	0.1
Note: All the recorded fishes are common and listed as Least Concern in IUCN Red List except *Parupeneus biaculeatus* and *Tridentiger trigonocephalus* which were not assessed.		

Other observations

5.8 Rock oyster (*Saccostrea cucullata*) collection was commonly seen at the intertidal area where people collect larger specimens and open the shell in order to get soft meat by special tools (**Photos 2-4 in Appendix IIc**)

5.9 Shell collection was a very common practice by hand or tools at low tidal period (**Photos 5-6 in Appendix IIc**);

5.10 Sipuncula (*Sipunculus nudus*) harvesting by digging the soft sea bottom to a depth of 0.2 to 0.4 meter by spate (**Photos 7-8 in Appendix IIc**);

5.11 Gill net fishing and live trapping of crabs and other marine organisms by local fisherman;

5.12 Entertainment activities observed in the area including swimming, playing, boating and etc;

6 Discussion and Summary

6.1 A total of 28 epifauna species were recorded from the quantitative quadrat survey. The highest abundance was recorded at 1mCD, where 492 individuals of epifauna were recorded. The mean abundance and number of species per quadrat (excluding sessile organisms) for the Ting Kok East were 21.24±13.47 and 3.49±1.56 respectively. The overall species diversity (H) and species evenness (J) were 2.0 and 0.64 respectively.

6.2 For the semi-quantitative survey, a total of 61 species were recorded from 9 transects at 3 different shore heights. The recorded species comprised mostly common species.

6.3 For the inter-tidal fish survey, total of 7 common species were recorded.

Appendix I Figure

Figure 1. Survey locations at Ting Kok East.

Appendix IIa Photos – Survey Transects and Quadrats

Survey Location: Ting Kok East

Transect 1: 0.5 m above mCD (relative low tidal level)

Transect 2: 1 m above mCD (medium tidal level)

Transect 3: 1.5 m above mCD (relative high tidal level)

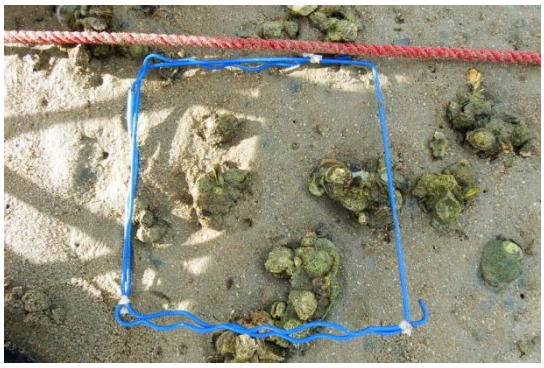
Transect 1A

			
Date: 23/6/2017	Quadrat 1	Date: 23/6/2017	Quadrat 2
			
Date: 23/6/2017	Quadrat 3	Date: 23/6/2017	Quadrat 4
			
Date: 23/6/2017	Quadrat 5	Date: 23/6/2017	Full Transect View

Transect 1B

			
Date: 27/6/2017	Quadrat 1	Date: 27/6/2017	Quadrat 2
			
Date: 27/6/2017	Quadrat 3	Date: 27/6/2017	Quadrat 4
			
Date: 27/6/2017	Quadrat 5	Date: 27/6/2017	Full Transect View

Transect 1C

			
Date: 27/6/2017	Quadrat 1	Date: 27/6/2017	Quadrat 2
			
Date: 27/6/2017	Quadrat 3	Date: 27/6/2017	Quadrat 4
			
Date: 27/6/2017	Quadrat 5	Date: 27/6/2017	Full Transect View

Transect 2A

			
Date: 23/6/2017	Quadrat 1	Date: 23/6/2017	Quadrat 2
			
Date: 23/6/2017	Quadrat 3	Date: 23/6/2017	Quadrat 4
			
Date: 23/6/2017	Quadrat 5	Date: 23/6/2017	Full Transect View

Transect 2B

			
Date: 27/6/2017	Quadrat 1	Date: 27/6/2017	Quadrat 2
			
Date: 27/6/2017	Quadrat 3	Date: 27/6/2017	Quadrat 4
			
Date: 27/6/2017	Quadrat 5	Date: 27/6/2017	Full Transect View

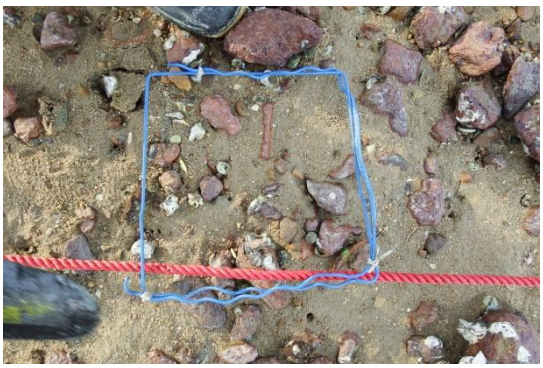
Transect 2C

			
Date: 27/6/2017	Quadrat 1	Date: 27/6/2017	Quadrat 2
			
Date: 27/6/2017	Quadrat 3	Date: 27/6/2017	Quadrat 4
			
Date: 27/6/2017	Quadrat 5	Date: 27/6/2017	Full Transect View

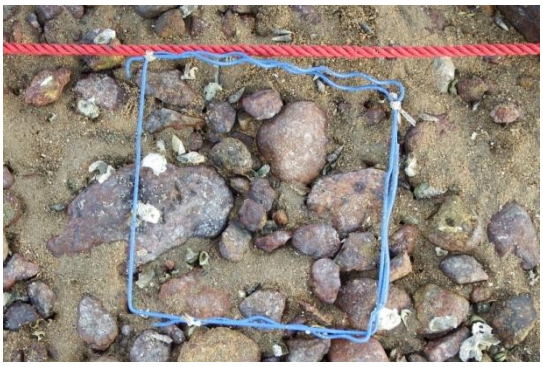
Transect 3A

			
Date: 22/6/2017	Quadrat 1	Date: 22/6/2017	Quadrat 2
			
Date: 22/6/2017	Quadrat 3	Date: 22/6/2017	Quadrat 4
			
Date: 22/6/2017	Quadrat 5	Date: 22/6/2017	Full Transect View

Transect 3B

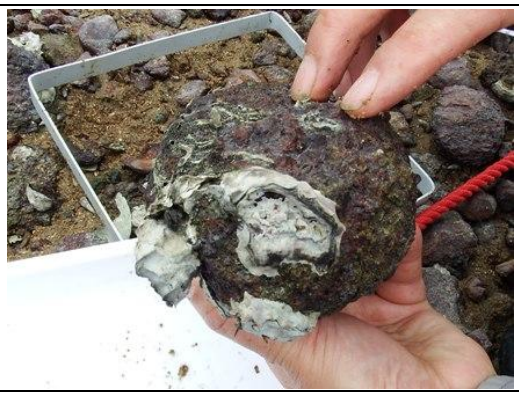
			
Date: 27/6/2017	Quadrat 1	Date: 27/6/2017	Quadrat 2
			
Date: 27/6/2017	Quadrat 3	Date: 27/6/2017	Quadrat 4
			
Date: 27/6/2017	Quadrat 5	Date: 27/6/2017	Full Transect View

Transect 3C

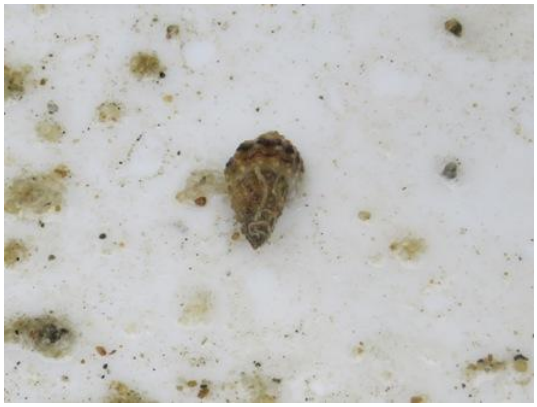
			
Date: 27/6/2017	Quadrat 1	Date: 27/6/2017	Quadrat 2
			
Date: 27/6/2017	Quadrat 3	Date: 27/6/2017	Quadrat 4
			
Date: 27/6/2017	Quadrat 5	Date: 27/6/2017	Full Transect View

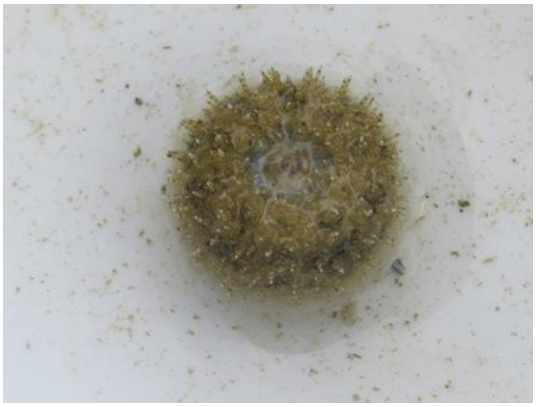
Appendix IIb - Photographs of species were found at Ting Kok East

	
Cryptocentrus strigilliceps	*Bathygobius fuscus*
	
Parupeneus biaculeatus	*Tridentiger bifasciatus*
	
Tridentiger trigonocephalus	*Monacanthus chinensis*

	
Siganus fuscescens	*Portunus pelagicus*
	
Charybdis japonica	*Thalamita crenata*
	
Etisus laevimanus	*Alpheus lobidens*
	
Saccostrea cucullata	*Scapharca cornea*

	
Metopograpsus frontalis	*Archaster typicus*
	
Gafrarium sp.	*Thalamita crenata*
	
Barbatia virescens	*Petrolisthes japonicus*
	
Circe scripta	*Leptodius exaratus*

	
Paguroidea sp.	*Halichondria sp*
	
Holothuria atra	*Thalamita danae Stimpson*
	
Philyra carinata	*Cronia margariticola*

	
Anomalocardia squamosa	*Salmacis sphaeroides*
	
Batillaria zonalis	*Placamen tiara*
	
Circe scripta subsp. scripta	*Capitella capitata*

	
Liolophura japonica	*Ophiocoma dentata*
	
Lysmata wurdemanni	*Isognomon isognomum*
	
Portunus trituberculatus	*Styela plicata*

Appendix IIc Photos – Humam disturbance

Photo 1. Intertidal zone at Ting Kok East

Photo 2. Harvesting oyster at intertidal zone at Ting Kok East

Photo 3. Harvesting oyster at intertidal zone at Ting Kok East

Photo 4. Harvested oyster meat at intertidal zone at Ting Kok East

Photo 5. Harvesting shells at intertidal zone at Ting Kok East

Photo 6. Harvested shells at intertidal zone at Ting Kok East

Photo 7. Harvesting sipuncula at intertidal zone at Ting Kok East

Photo 8. Harvested sipuncula and *Ochetostoma erythrogrammon* at intertidal zone at Ting Kok East

Appendix III Survey Results

Appendix IIIa Quantitative quadrat survey results (0.5 mCD)

Survey date				23/6/2017, 27/6/2017																
No. of surveyor				5																
Survey time				23/6/2017 (12:00-18:00), 27/6/2017 (15:00-18:00)																
Survey location				Ting Kok																
Tidal level				0.5 m above mCD (relative low tidal level)																
Intertidal type				Sand with rubbles																
Transect Length (m)				30 m																
Transect				1					2					3						
Quadrat				1	2	3	4	5	1	2	3	4	5	1	2	3	4	5		
	Phylum	Scientific Name	Conversation status	Relative Abundance																
Mobile Fauna	**Mollusca**	*Batillaria zonalis*	-	-	-	-	-	-	-	-	-	11	-	-	-	-	-	-		
		Batillaria multiformis	-	6	-	-	-	-	1	-	1	9	-	4	2	-	-	-		
		Cerithidea cingulata	-	1	6	3	9	-	-	-	-	-	5	3	12	4	6	4		
		Isognomon isognomum	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-		
		Lunella coronata	-	-	-	-	-	-	1	-	-	-	4	-	-	-	3	3		
		Gafrarium pectinatum	-	-	-	-	-	-	-	-	-	-	-	-	-	3	1	1		
		Asaphis dichotoma	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4		
		Cronia margariticola	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	2		
		Barbatia virescens	-	1	1	3	-	-	-	-	-	-	-	-	-	-	-	-		
		Brachidontes variabilis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-		
		Scapharca cornea	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	2		
	Arthropoda	*Alpheus lobidens*	-	1	-	1	-	-	-	-	-	-	-	-	2	-	-	-		
		Paguroidea sp.	-	-	-	1	-	-	-	1	-	-	-	1	-	-	-	-		
	Chordata	*Bathygobius fuscus*	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	Sipuncula	*Sipunculus nudus*	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-		
Sessile Organisms	**Mollusca**	*Saccostrea cucullata*	-	70%	20%	40%	30%	5%	15%	5%	-	30%	20%	10%	10%	10%	10%	20%		
	Arthropoda	*Amphibalanus amphitrite*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1%	-		
	Annelida	*Serpulorbis imbricatus*	-	-	-	-	-	-	1%	-	-	-	-	-	-	-	-	-		
	Chordata	*Styela plicata*	-	-	-	-	-	-	-	-	-	-	-	10%	15%	5%	5%	5%		

Appendix IIIa Quantitative quadrat survey results (1.0 mCD)

Survey date				23/6/2017, 27/6/2017															
No. of surveyor				5															
Survey time				23/6/2017 (12:00-18:00), 27/6/2017 (15:00-18:00)															
Survey location				Ting Kok															
Tidal level				1.0 m above mCD (medium tidal level)															
Intertidal type				Sand with rubbles															
Transect Length (m)				30 m															
Transect				1					2					3					
Quadrat				1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	
	Phylum	Scientific Name	Conversation status	Relative Abundance															
Mobile Fauna	**Mollusca**	*Batillaria zonalis*	-	28	15	6	30	27	14	20	12	5	7	17	9	14	9	11	
		Batillaria multiformis	-	2	-	-	2	4	12	11	10	9	20	14	10	7	11	14	
		Cerithidea cingulata	-	-	-	-	-	-	8	-	-	-	-	6	-	6	9	-	
		Cerithidea djadjariensis	-	-	-	-	-	-	-	5	1	1	-	-	-	1	-	-	
		Clithon oualaniensis	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	
		Lunella coronata	-	3	3	1	1	-	8	1	3	6	-	5	1	-	-	5	
		Gafrarium pectinatum	-	-	-	-	-	1	-	1	1	-	-	-	-	-	-	1	
		Asaphis dichotoma	-	-	-	-	-	-	-	-	-	10	-	2	-	9	-	3	
		Tegillarca granosa	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	
		Scapharca cornea	-	-	-	-	-	-	1	-	-	-	-	-	1	1	2	-	
		Cellana grata			2														
		Brachidontes variabilis	-	1	-	1	18	9	-	-	-	-	-	-	-	-	-	-	
	Annelida	*Dendronereides sp.*	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Sessile Organisms	**Mollusca**	*Saccostrea cucullata*	-	2%	5%	20%	10%	10%	20%	5%	25%	20%	5%	10%	5%	15%	15%	20%	
	Arthropoda	*Amphibalanus amphitrite*	-	-	-	-	-	-	5%	-	1%	4%	-	2%	5%	-	-	-	
	Polyplacophora	*Acanthopleura japonica*	-	-	-	1%	-	-	-	-	-	-	-	-	-	-	-	-	
	Annelida	*Serpulorbis imbricatus*	-	-	-	-	-	-	-	-	-	-	-	3%	-	-	-	-	
	Chordata	*Styela plicata*	-	-	-	-	-	-	-	-	-	-	-	-	-	1%	-	-	

Appendix IIIa Quantitative quadrat survey results (1.5 mCD)

Survey date				22/6/2017, 27/6/2017													
No. of surveyor				5													
Survey time				22/6/2017(10:00-18:00), 27/6/2017 (15:00-18:00)													
Survey location				Ting Kok													
Tidal level				1.5 m above mCD (relative high tidal level)													
Intertidal type				Sand with rubbles													
Transect Length (m)				30 m													
Transect				1					2					3				
Quadrat				1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
	Phylum	Scientific Name	Conversation status	Relative Abundance														
Mobile Fauna	**Mollusca**	*Batillaria zonalis*	-	-	-	8	5	2	-	2	-	-	-	-	-	-	-	-
		Batillaria multiformis	-	3	-	5	6	3	13	1	-	-	-	3	4	-	3	-
		Cerithidea cingulata	-	-	-	5	-	-	-	-	-	-	-	-	-	-	-	-
		Lunella coronata	-	2	5	6	4	11	9	1	5	8	4	-	3	8	8	15
		Gafrarium pectinatum	-	-	-	-	-	-	2	-	-	-	-	2	-	2	4	12
		Monodonta labio	-	-	-	-	-	-	1	-	-	3	-	-	-	-	-	-
		Cellana grata	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-
		Asaphis dichotoma	-	-	4	7	-	1	-	-	2	6	3	-	-	-	-	-
		Brachidontes variabilis	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-
	Arthropoda	*Metopograpsus frontalis*	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-
		Thalamita crenata	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-
	Annelida	*Dendronereides sp.*	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sessile Organisms	**Mollusca**	*Saccostrea cucullata*	-	10%	10%	-	1%	7%	20%	1%	3%	-	5%	2%	1%	5%	8%	8%
	Arthropoda	*Amphibalanus amphitrite*	-	1%	-	-	-	-	-	-	1%	-	-	-	-	-	-	-
	Annelida	*Serpulorbis imbricatus*	-	-	-	-	-	1%	3%	-	-	-	-	-	-	-	-	-

Appendix IIIb Semi-quantitative survey results

Survey date				22/06/2017, 23/06/2017, 27/06/2017								
Survey Location				Ting Kok								
Transect Length (m)				30 m								
Tidal Level				0.5m above mCD (Relative low tidal level)			1.0m above mCD (Medium tidal level)			1.5m above mCD (Relative high tidal level)		
Transect				1	2	3	1	2	3	1	2	3
Intertidal Type		Rock		30%	25%	25%	25%	30%	40%	80%	80%	80%
		Sand		70%	65%	65%	65%	70%	60%	20%	20%	20%
	Phylum	Scientific Name	Conservation Status	Relative abundance								
Mobile Fauna	Mollusca	*Asaphis dichotoma*	-			+	+	++	++	++	++	++
		Barbatia virescens	-	+		+			+			
		Batillaria multiformis	-	++	+++	++	+++	+++	+++	+++	+	+
		Batillaria zonalis	-	++	++	++	+++	+++	+++	++	+	+
		Brachidontes variabilis	-			+	++		+			
		Cellana grata	-			+	+					
		Cerithidea cingulata	-	+++	++	+++	++	++	++			
		Cerithidea djadjariensis	-					+	+			
		Clithon oualaniensis	-					+				
		Cronia margariticola	-	+		+						
		Gafrarium sp.	-	+		+	++	+	++	+	+	+++
		Isognomon isognomum	-	+	+			+	+			
		Lunella coronata	-	+	+	+	++	++	++	+++	+++	+++
		Monodonta labio	-			+					++	
		Scapharca cornea	-		+	+		+	+			
		Strombus urceus	-		+							
		Anomalocardia squamosa	-		+							
		Circe scripta scripta	-			+						
		Placamen tiara	-	+		+		+			+	
		Cyclina sinensis	-	+								
		Dendrodoris fumata	-								+	
		Tegillarca granosa	-	+	+		+	+				
	Chordata	*Bathygobius fuscus*	-	+				+				
		Cryptocentrus strigilliceps	-			+						
		Tridentiger bifasciatus	-					+	+			
		Tridentiger trigonocephalus	-					++				
	Annelida	*Capitella capitata*	-					+				+
		Ochetostoma erythrogrammon	-					+	++	+	+	
		Dendronereides sp.	-	+			+					
	Sipuncula	*Sipunculus nudus*	-	++			+	+	+			
	Echinodermata	*Salmacis sphaeroides*	-	+		+						
		Archaster typicus	-	+								
		Ophiocoma dentata	-		+							
		Holothuria atra	-		+							
	Arthropoda	*Ligia exotica*	-						+	+		+
		Alpheus brevicristatus	-	++		++	+		+			
		Alpheus lobidens	-	++			+	++	+			
		Clibanarius longitarsus	-	+	+	+	+	+				
		Metopograpsus frontalis	-	+	+	+	++	+	+	+	+	+
		Palaeman serrifer	-	+	+	+	+	+	+			
		Pyrhila pisum	-		+							
		Etisus laevimanus	-		+	+			+			
		Gaetice depressus	-		+			+		+	+	
		Leptodius exaratus	-		++	+	+	+				
		Lysmata wurdemanni	-	+	+							
		Petrolisthes boscii	-	+								
		Philyra pisum	-		+	+		+				
		Portunus pelagicus	-		+							
		Thalamita danae Stimpson	-		+	+						
		Perisesarma bidens	-		+				+			
		Thalamita crenata	-		++				+			+
		Amphipada sp.	-			+			+			
	Cnidaria	*Haliplanella lineata*	-	+								
Sessile Organisms	Mollusca	*Liolophura japonica*	-			+	+					
		Saccostrea cucullata	-	+++	++	++	++	++	++	++	++	++
	Arthropoda	*Amphibalanus amphitrite*	-			+		+	+	+	+	
		Megabalanus volcano	-			+						
	Annelida	*Serpulorbis imbricatus*	-	+	+	+			+	+	+	+
	Porifera	*Halichondria sp*	-		+	+						
	Chordata	*Styela plicata*	-		++	+		+				

NOTE: "+"Occur "++" Common "+++" Abundant

* Species listed as "Lwast Concern" in IUCN Red List was not shown in the Conservation Status Column

Appendix IIIc. Inter-tidal fish survey results

	Net Drop Replicates									
	1	2	3	4	5	6	7	8	9	10
Species	Abundance									
Bathygobius fuscus			1		1				1	
Cryptocentrus strigilliceps						1				
Monacanthus chinensis		1								
Parupeneus biaculeatus				1						
Siganus fuscescens			1		2				1	
Tridentiger bifasciatus			1						1	
Tridentiger trigonocephalus										1

All the recorded fishes are common and listed as Least Concern in IUCN Red List except *Parupeneus biaculeatus* and *Tridentiger trigonocephalus* which were not assessed.