

Environmental Permit No. EP-388/2010

Development of a Bathing Beach at Lung Mei, Tai Po

Independent Environmental Checker Verification


Reference Document/Plan

| | |
|--|---|
| Document/Plan to be Certified/ Verified: | 4 th Post-Translocation Ecological Monitoring Report (at the vicinity of Lung Mei) |
| Date of Report: | May 2020 |
| Date received by IEC: | 25 June 2021 |

Reference EP Condition / Updated EM&A Manual Requirement

| | |
|---|-----------------|
| Environmental Permit Condition / Updated EM&A Manual Reference | Section 7.2.1.5 |
| The qualified Marine Ecologist shall submit a report with six copies within one month from the completion of each marine ecological monitoring. | |

IEC Verification

| | |
|--|---|
| I hereby verify that the above referenced document/ plan complies with the above referenced condition / section of EP-388/2010 / Updated EM&A Manual | |
| Mr Terence Fong | Date: 28 June 2021 |
| Independent Environmental Checker |  |

Our ref: P:\Projects\0206709 IEC for Lung Mei EM&A\07_ET Submission\32_Marine Fauna Monitoring Report

Our Ref: TCS00874/16/300/L0754

Welcome Construction Co., Ltd.
Flat 01, 19/F, Westley Square,
48 Hoi Yuen Road,
Kwun Tong, Kowloon.

Attn: Mr. William Lam

28 June 2021
By e-mail

Dear Sir,

Re: CEDD Contract No. CV/2012/05 - Bathing Beach at Lung Mei, Tai Po
4th Post-Translocation Ecological Monitoring Report (at the vicinity of Lung Mei)

With reference to the revised 4th Post-Translocation Ecological Monitoring Report (at the vicinity of Lung Mei), we have no adverse comment on the report. We herewith certify the captioned submission in accordance with Section 7.2 of the Updated EM&A Manual.

Should you have any queries, please feel free to contact the undersigned at Tel: 2959-6059 or Fax: 2959-6079 or E-mail: twtam@fordbusiness.com.

Yours sincerely,
For and on Behalf of
Action-United Environmental Services & Consulting



T. W. Tam
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Development of a Bathing Beach at Lung Mei, Tai Po
Environmental Permit No. EP-388/2010
4th Post-Translocation Ecological Monitoring Report (at the vicinity of Lung Mei)
(May 2020)



ECO-ENVIRO CONSULTANTS COMPANY

1 Introduction

- 1.1 In accordance to Section 7.2 of the updated EM & A manual, it is required to conduct environmental monitoring after marine fauna relocation at a six-monthly interval at (i) vicinity site near bathing beach at Lung Mei and (ii) The Reception Site of Ting Kok East until expiry of the Contract Maintenance Period. .
- 1.2 Aim of this report is to present post-translocation monitoring objectives, methods, locations and results.

2 Objective

- 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 Lung Mei intertidal area due to the development of the bathing beach at Lung Mei, and (ii) at the Reception Site of Ting Kok East due to relocation of the target marine fauna.
- 2.2 This 4th Marine Fauna Monitoring Report covers the marine ecological surveys conducted at the Indirect Impact Site at Lung Mei during the construction phase.

3 Scope of Impact Marine Ecological Survey at Lung Mei

- Intertidal quantitative transect survey at one location
- Intertidal fish survey at one location
- Semi-quantitative Crustacean Survey at one location
- Benthic survey at three depth zones
- Gill netting surveys at five stations

4 Method

4.1 Intertidal quantitative transect survey

- 4.1.1 The intertidal quantitative transect survey was undertaken during daytime low tide (<1mCD), Three 30-m horizontal transects parallel to the shoreline were 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 were 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, photographic records were obtained, and the abundance of sessile fauna (e.g. barnacles and rock oysters, expressed as percentage planar cover of the quadrat) was then been estimated. Average percentage cover of each species was calculated by cumulated cover divided by number of quadrat. Surface sediment (approximate volume = 25 cm x 25cm x 5 cm = 3125 cm³) was wet-sieved in situ (mesh size of 2 mm) to obtain all 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.

4.1.2 Location of sampling transects is shown in Figure 1 of **Appendix I**. The selected marine ecological monitoring/survey site is about 500 m from the boundary of the project site. As the area east of the site is already highly developed or disturbed by human activities, the areas to be monitored therefore to the west and south of the site. This was suggested in the project Particular Specification Appendix 25.13.

4.2 *Semi-quantitative crustacean survey*

4.2.1 All crustacean species observed and their relative abundance along each transect (0.5m each side) shall also be recorded during the transect surveys.

4.3 *Intertidal fish survey*

4.3.1 The intertidal fish survey involved 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. 10 drop-trap samples were 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. Intertidal fish survey area is given in Figure 1 of **Appendix I**.

4.4 *Benthic survey*

4.4.1 During the benthic survey, benthic samples were collected from sub-tidal area within the monitoring area at 0 mCD, -1 mCD and -2 mCD. Three grab samples (at least 50m apart) were taken randomly at each depth zone. Each grab sampler with an opening dimension approx. 15cm x 20cm, and 15cm depth. The sediments were sieved in situ. The sediments were washed onto a sieve stack (comprising 1mm and 500µm meshes). Sediments put in the sieve were gently rinsed with seawater to remove all fine material. Material remaining on the sieve was removed into pre-labeled thick triple-bagged ziplock plastic bags. A 20% solution of buffered formalin containing Rose Bengal in seawater was then added to the bag to ensure tissue preservation. Samples were sealed in plastic containers for transport to the laboratory for sorting and identification of benthic organisms. Benthic sampling area is given in Figure 2 of **Appendix I**.

4.4.2 In the laboratory, benthic organisms were sorted from the sieved sediments. Taxonomic

identification of benthic organisms was performed using stereo dissecting and high-power compound microscopes. Benthic organisms were counted and identified to species level as far as practicable with biomass (wet weight, to 0.01gram) of each individual recorded. If breakage of soft-bodied organism occurs, only anterior portions of fragments were counted, although all fragments were retained and weighted for biomass determinations (wet weight, to 0.01gram). Data of species abundance and biomass was obtained.

4.4.3 As part of QA/QC requirements, field logs were maintained for all sampling works, noting the survey date, equipment used, name of field survey supervisor, and a record of all activities and observations. For sampling quality control purpose, only sediment fully filled grab samples were accepted. Otherwise, sediments were abandoned and re-sampling was performed.

4.5 Gill netting surveys

4.5.1 Five gill netting stations were sampled within the monitoring area. Two independent trammel (gill) nets were deployed for one hour at each of the five stations. The animals caught by the two independent gill nets were recorded as two replicates. The nets were 1 m deep, 36 m in length and comprised 3-layers, with two 20 cm mesh stretches sandwiching a 5 cm mesh stretch. When different sizes of nets were considered suitable to be used, approval by Engineer was obtained. Gill netting survey area is given in Figure 2 of **Appendix I**.

4.5.2 All fish and macro-invertebrates species captured during the one hour deployment were recorded. Community parameters, comprising: species composition, abundance and biomass of captured species were measured.

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

4.6.1 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:

$$J = H' / H_{\max} = H' / \ln S$$

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.

5 Survey Results

Quantitative quadrat survey results

5.1 Quantitative quadrat surveys were conducted at the vicinity site of Lung Mei beach in 13th January 2020. A total of 45 quadrats were surveyed from three shore heights (0.5 mCD, 1.0 mCD and 1.5 mCD), shown as **Appendix IIa** for the representative photos of the surveys and **Appendix III** for the survey results. A total of 18 epifauna species were recorded, comprising 16 mobile fauna and 2 sessile fauna. At all three shore heights, the highest number of species was the Mollusca among other taxonomic groups, representing over 83% of the total number of the species record in the quantitative quadrat survey (**Table.1**).

Table.1 Total Number of Recorded Epifauna Species in each Phylum/Subphylum

| Phylum/Subphylum | Number of Species | |
|----------------------|-------------------|-------------------------------------|
| | Baseline (Jun-17) | 4 th Monitoring (Jan-20) |
| Mollusca | 14 | 15 |
| Crustacea | 3 | 0 |
| Chordata | 1 | 1 |
| Annelida | 1 | 1 |
| Arthropoda | 1 | 1 |
| Polyplacophora | 1 | 0 |
| Total No. of Species | 21 | 18 |

5.2 Similar to the baseline survey, the highest abundance of epifauna was recorded at 1 mCD, in which total of 465 individuals of epifauna were recorded, followed by the survey results recorded at 1.5 mCD (260 individuals) and that recorded at 0.5 mCD (67 individuals). Sea snail *Batillaria multiformis* and mussel *Brachidontes variabilis* were still the most abundant species at 0.5 mCD. At 1 mCD, Sea snail *Batillaria multiformis* was the most abundant species while the crowned turban shell *Lunella coronata* was the most abundant species at 1.5 mCD. The most abundant species were all under taxonomic group of Mollusca. The summary of mobile species recorded with numerical abundance was shown in **Table 2**.

Table 2 No. of Mobile Animal Recorded during Baseline (Jun-17) and 4th Monitoring (Jan-20)

| Tidal Level | No. of mobile animal | |
|-------------|----------------------|-------------------------------------|
| | Baseline (Jun-17) | 4 th Monitoring (Jan-20) |
| 0.5mCD | 73 | 67 |
| 1.0mCD | 621 | 465 |
| 1.5mCD | 229 | 260 |

5.3 The mean number of species per quadrat for mobile epifauna and sessile epifauna at three tidal levels (0.5 mCD, 1.0 mCD and 1.5 mCD) were summarized in the **Table 3**. When compared with to baseline, the mean number of species of mobile fauna showed highest at 1.5 mCD and significantly higher with the number of 4.93 ± 1.79 in January 2020 monitoring survey, while the species number of sessile organisms at the three different tidal level ranged from 0.13-0.80 and showed no significant different. The overall mean of species number of mobile fauna and sessile organisms at Lung Mei were 4.00 ± 1.72 and 0.49 ± 0.66 respectively.

Table 3. The Mean Number of Epifaunal Species per Quadrat

| | Tidal level | | | | | | | |
|------------------------------------|-------------------|-----------------------------------|-------------------|-----------------------------------|-------------------|-----------------------------------|-------------------|-----------------------------------|
| | 0.5 mCD | | 1.0 mCD | | 1.5 mCD | | Overall | |
| | Baseline (Jun-17) | 4 th Monitoring Jul-19 | Baseline (Jun-17) | 4 th Monitoring Jan-20 | Baseline (Jun-17) | 4 th Monitoring Jan-20 | Baseline (Jun-17) | 4 th Monitoring Jul-19 |
| Mobile Fauna (no. of species) | 1.53 ± 1.51 | 3.13 ± 1.80 | 3.47 ± 1.64 | 3.93 ± 1.03 | 3.07 ± 1.53 | 4.93 ± 1.79 | 2.69 ± 1.74 | 4.00 ± 1.72 |
| Sessile Organisms (no. of species) | 1.07 ± 0.70 | 0.80 ± 0.86 | 0.67 ± 0.82 | 0.13 ± 0.35 | 1.00 ± 0.38 | 0.53 ± 0.52 | 0.91 ± 0.67 | 0.49 ± 0.66 |

5.4 Species richness, diversity and evenness indices are inter-related. A diversity index integrates two components: the total number of species (d) and the distribution of individuals among species, into a single number (H). H' is usually high (e.g. >3 or 4) in environmentally undisturbed benthic communities, and low (e.g. <1) in highly disturbed communities. Based on the calculation of Shannon-Weiner diversity and Pielou's Evenness (excluding sessile organism) and the calculated species diversity (H) and evenness (J) were showed in **Table 4**. The species diversity at 0.5 mCD (H=2.03) was the highest than those recorded at 1.0 mCD (H=1.07) and 1.5 mCD (H=1.74). The highest evenness was recorded 0.5 mCD (J=0.98), while the evenness at 1.0 mCD and 1.5 mCD were J=0.49 and J=0.79 respectively. The overall species diversity (H) and species evenness (J) of epifauna at Lung Mei were 1.45 and 0.66 respectively, showing no significant differences compare to the data collected from the preliminary survey

data. Both baseline and January 2020 monitoring surveys showed medium (between 1-3) species diversity and evenness (**Table 4**).

Table 4. Species Diversity and Evenness

| | | Tidal Level | | | |
|---|-----------------------------------|-------------|---------|---------|---------|
| | | 0.5 mCD | 1.0 mCD | 1.5 mCD | Overall |
| H | Baseline (Jun-17) | 2.02 | 1.11 | 1.58 | 1.55 |
| | 4th Monitoring (Jul 19) | 2.03 | 1.07 | 1.74 | 1.45 |
| J | Baseline (Jun-17) | 0.88 | 0.50 | 0.69 | 0.55 |
| | 4th Monitoring (Jul 19) | 0.98 | 0.49 | 0.79 | 0.66 |

Semi-quantitative crustacean survey results

5.5 Semi-quantitative crustacean surveys were undertaken to record all crustaceans along 1 m belt area on each side of the transect line, shown as **Table 5**. Similar to baseline, the highest number of species recorded was at 0.5 mCD (Baseline:16, Jan-20:10), followed by 1.0 mCD (Baseline:12, Jan-20:8) and 1.5 mCD (Baseline:4, Jan-20:3). The relative abundance of all crustaceans are shown in Table 6. The recorded species belong to common species (with no conservation interest).

Table 5. Total Number of Crustacean Species Recorded at Different Tidal Levels from Semi-quantitative Survey

| | 0.5 | | 1.0 | | 1.5 | |
|----------------------------------|----------------------|--------------------------|----------------------|--------------------------|----------------------|--------------------------|
| | Baseline (Jun-17) | 4th Monitoring Jan-20 | Baseline (Jun-17) | 4th Monitoring Jan-20 | Baseline (Jun-17) | 4th Monitoring Jan-20 |
| No. of Crustacean Species | 16 | 10 | 12 | 8 | 4 | 3 |

Table 6. Total Abundance of Crustacean Species Recorded from Semi-quantitative Survey

| | | 0.5m above mCD (Relative low tidal level) | | | | | | 1.0m above mCD (Medium tidal level) | | | | | | 1.5m above mCD (Relative high tidal level) | | | | | |
|---------------------------------|---------------------|---|--------|----------|--------|----------|--------|-------------------------------------|--------|----------|--------|----------|--------|--|--------|----------|--------|----------|--------|
| | | 1 | | 2 | | 3 | | 1 | | 2 | | 3 | | 1 | | 2 | | 3 | |
| Crustacean Species | Conservation Status | Baseline | Jan-20 | Baseline | Jan-20 | Baseline | Jan-20 | Baseline | Jan-20 | Baseline | Jan-20 | Baseline | Jan-20 | Baseline | Jan-20 | Baseline | Jan-20 | Baseline | Jan-20 |
| <i>Ligia exotica</i> | - | | | + | + | | | | | + | | | | ++ | + | + | | ++ | + |
| <i>Etisus laevimanus</i> | - | | | + | + | + | + | | | + | | | | | | | | | |
| <i>Gaetice depressus</i> | - | | | + | | + | | ++ | + | + | + | + | | | | + | + | | |
| <i>Lysmata wurdemanni</i> | - | + | + | + | | | | | | | | | | | | | | | |
| <i>Metopograpsus frontalis</i> | - | + | | ++ | + | ++ | + | ++ | | ++ | + | ++ | + | ++ | + | ++ | + | + | + |
| <i>Ocypode ceratophthalmus</i> | - | + | | | | | | | | | | | | | | | | | |
| <i>Palaemon serrifer</i> | - | | | + | | ++ | + | ++ | | ++ | + | + | + | | | | | | |
| <i>Petrolisthes japonicus</i> | - | | | | | + | | | | + | + | | | | | | | | |
| <i>Philyra carinata</i> | - | | | | | | | + | + | | | | | | | | | | |
| <i>Portunus pelagicus</i> | - | + | + | | | + | | | | | | | | | | | | | |
| <i>Portunus trituberculatus</i> | - | | | + | + | | | | | | | | | | | | | | |
| <i>Thalamita crenata</i> | - | + | + | + | | + | | | | + | | + | + | | | | | | |
| <i>Thalamita danae Stimpson</i> | - | | | + | | | | | | | | | | | | | | | |
| <i>Leptodius exaratus</i> | - | + | + | + | | + | | + | + | + | | + | | | | | | | |
| <i>Leptodius sp.</i> | - | | | | | | | | | | | + | + | | | | | | |
| <i>Alpheus</i> | - | | | + | + | + | + | + | + | | | + | + | | | | | | |

| | | | | | | | | | | | | | | | | | | | |
|-------------------------|---|---|--|---|---|---|---|---|---|---|--|---|--|--|--|--|--|--|--|
| <i>brevicristatus</i> | | | | | | | | | | | | | | | | | | | |
| <i>Alpheus lobidens</i> | - | + | | | | + | + | | | | | | | | | | | | |
| <i>Paguroidea sp.</i> | - | | | + | + | + | | + | + | + | | + | | | | | | | |

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

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

Intertidal fish survey result

5.6 The intertidal fish survey was conducted on 13th January 2020 in the area indicated in **Appendix I**. From the survey, a total of 7 species was recorded during the baseline survey. However, no fish was recorded during the January 2020 monitoring survey. Besides the drop net survey, Brown frillfin goby, dusky frillgoby, crescent-banded grunter and chameleon goby were recorded inside the survey area. The list of the recorded species and their abundance were shown in **Table 7**.

Table 7. Fish Species Recorded from the Intertidal Fish Survey (Average number of the 10 drop-traps)

| | | Abundance (no. of individual per m ²) | |
|---------------------------|------------------------------------|---|-----------------------|
| Common name | Species | Baseline (Jun-17) | 4th Monitoring Jan-20 |
| Brown frillfin goby | <i>Bathygobius fuscus</i> | 0.5 | 0 |
| Target shrimp goby | <i>Cryptocentrus strigilliceus</i> | 0.1 | 0 |
| Fan-bellied leatherjacket | <i>Monacanthus chinensis</i> | 0.1 | 0 |
| Pointed goatfish | <i>Parupeneus biaculeatus</i> | 0.2 | 0 |
| Japanese whiting | <i>Sillago japonicus</i> | 0 | 0 |
| Mottled Spinefoot | <i>Siganus fuscescens</i> | 0.5 | 0 |
| Shimofuri goby | <i>Tridentiger bifasciatus</i> | 0.2 | 0 |
| Chameleon goby | <i>Tridentiger trigonocephalus</i> | 0.1 | 0 |

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.

Benthic fauna survey result

5.7 The benthic survey was conducted on 13th January 2020 at three different height of tidal level, shown as **Appendix I**. A total of 9 samples were obtained from the survey. In total, 22 species of benthic fauna were recorded during the January 2020 survey. The highest number of benthic fauna species was at the height at -1 mCD (16 species) tidal levels, while highest numbers of benthic fauna was also recorded at -1 mCD tidal level (37 individuals) (**Table.8**). The representative photos of the benthic fauna survey were shown in **Appendix IIb**. The detailed result of the benthic fauna recorded was presented in **Appendix III**.

Table 8 Abundance and Species Diversity of Benthic Fauna Recorded During Baseline and 4th Monitoring

| | Baseline (Jun-17) | 4 th Monitoring (Jan-20) |
|--|-------------------|-------------------------------------|
|--|-------------------|-------------------------------------|

| | H* | M* | L* | H* | M* | L* |
|-------------------------------|----|----|----|----|----|----|
| Abundance (no. of individual) | 60 | 94 | 66 | 20 | 34 | 31 |
| Number of species | 23 | 23 | 17 | 9 | 15 | 14 |

Note: *= H, high tidal level(0 mCD); M, medium tidal level(-1 mCD); L, low tidal level (-2 mCD)

5.8 Based on the calculation of Shannon-Weiner diversity and Pielou's Evenness and the calculated results of Benthic Fauna were showed in **Table 9**. Similar to the baseline result, the species diversity (H) during the January 2020 survey at 0mCD (H=2.03) and -1.0mCD (H=2.39) were similar and they were higher than species diversity at -2.0mCD (H=2.29). The Pielou's evenness (J) at 0mCD, -1.0mCD and -2.0mCD were 0.97, 1.04 and 0.87 respectively. The overall of species diversity (H) was 2.87 and the overall evenness (J) was 0.94 at Lung Mei. Both baseline and January 2020 monitoring surveys showed medium (between 1-3) species diversity and evenness (**Table 9**).

Table 9. Species Diversity and Evenness for Benthic Survey

| | | Tidal level | | | |
|---|----------------------------|-------------|----------|---------|---------|
| | | 0 mCD | -1.0 mCD | -2.0mCD | Overall |
| H | Baseline (Jun-17) | 2.73 | 2.74 | 2.32 | 2.94 |
| | 4th Monitoring (Jan-20) | 2.03 | 2.39 | 2.29 | 2.87 |
| J | Baseline (Jun-17) | 0.87 | 0.88 | 0.55 | 0.81 |
| | 4th Monitoring (Jan-20) | 0.97 | 1.04 | 0.87 | 0.94 |

Gill netting survey result

5.9 Gill netting survey was performed at five locations. Two fishes with 1 species comprising of Chordata were recorded from the survey. The weight of caught species ranged from 85g to 150g. The survey result was summarized in **Appendix III**. **Since only two fish in 1 species were recorded**, species diversity and evenness were both shown zero. When compared with the baseline result, January 2020 monitoring showed a very low diversity and evenness.

Table 10. Species Diversity and Evenness for Gill Netting Survey

| | Overall | |
|-------------------|----------------------|----------------------------|
| | Baseline (Jun-17) | 4th Monitoring (Jan-20) |
| Shannon diversity | 2.09 | 0.00 |

| | | |
|----------------------|------|------|
| index(H) | | |
| Pielou's evenness(J) | 0.95 | 0.00 |

6 Summary

- 6.1 In summary, 18 epifauna species were recorded from the quantitative quadrat survey, of which the Mollusc was the taxonomic group contributed the highest number of species diversity. The highest abundance of epifauna was recorded at 1 mCD, in which total of 465 individuals of epifauna were recorded. Both baseline (Jun-17) and January 2020 monitoring surveys showed medium to high (between 1-5) species diversity and evenness (**Table 4**). There was no significant differences when compare the baseline and 4th monitoring surveys.
- 6.2 For semi-quantitative crustacean survey, a total of 11 species were recorded and they showed similar trend with the baseline results.
- 6.3 For the intertidal fish survey, no fish were recorded from the surveyed area.
- 6.4 21 benthic fauna were recorded from the benthic survey, with the highest species diversity at medium and high tidal levels and the highest abundance at medium tidal level. Two fishes with 1 species were recorded from the gill netting survey.. Benthic survey of baseline and January 2020 monitoring surveys showed medium (between 1-3) species diversity and evenness (**Table 9**). However, gill net survey showed zero species diversity and evenness (**Table 10**).
- 6.5 In conclusion, since the species diversity and evenness showed no significant differences or similar trends between baseline and the 4th monitoring survey except no fish were recorded during the intertidal survey.
- 6.6 No deterioration in the general condition of the habitat was observed. No deterioration of the animal community was observed in the ecological monitoring results when compared with the baseline ecological monitoring results.

Appendix 1: Figures



Figure 1. Survey transects and area for intertidal quantitative transect survey and intertidal fish survey in Lung Mei, Tai Po.








Figure 2. Survey areas for benthic survey and gill netting survey in Lung Mei, Tai Po.

Appendix IIa Photos – Survey Transects and Quadrats






Survey Location: Lung Mei

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






Transect 1A

| | |
|--|--|
|  |  |
| Quadrat 1 | Quadrat 2 |
|  |  |
| Quadrat 3 | Quadrat 4 |
|  | |
| Quadrat 5 | |

Transect 1B






| | |
|---|--|
|  |  |
| Quadrat 1 | Quadrat 2 |
|  |  |
| Quadrat 3 | Quadrat 4 |
|  | |
| Quadrat 5 | |

Transect 1C






| | |
|---|--|
|  |  |
| Quadrat 1 | Quadrat 2 |
|  |  |
| Quadrat 3 | Quadrat 4 |
|  | |
| Quadrat 5 | |

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






Transect 2A

| | |
|--|--|
|  |  |
| Quadrat 1 | Quadrat 2 |
|  |  |
| Quadrat 3 | Quadrat 4 |
|  | |
| Quadrat 5 | |

Transect 2B






| | |
|---|--|
|  |  |
| Quadrat 1 | Quadrat 2 |
|  |  |
| Quadrat 3 | Quadrat 4 |
|  | |
| Quadrat 5 | |

Transect 2C






| | |
|---|--|
|  |  |
| <p>Quadrat 1</p> | <p>Quadrat 2</p> |
|  |  |
| <p>Quadrat 3</p> | <p>Quadrat 4</p> |
|  | |
| <p>Quadrat 5</p> | |

Transect 3 (A-C): 1 m above mCD (medium tidal level)






Transect 3A

| | |
|--|--|
|  |  |
| Quadrat 1 | Quadrat 2 |
|  |  |
| Quadrat 3 | Quadrat 4 |
|  | |
| Quadrat 5 | |

Transect 3B

| | |
|---|--|
|  |  |
| Quadrat 1 | Quadrat 2 |
|  |  |
| Quadrat 3 | Quadrat 4 |
|  | |
| Quadrat 5 | |

Transect 3C

| | |
|---|--|
|  |  |
| Quadrat 1 | Quadrat 2 |
|  |  |
| Quadrat 3 | Quadrat 4 |
|  | |
| Quadrat 5 | |

Appendix IIb – Representative Photographs of Lung Mei Survey



Benthic Sample Collection



Sieving the benthic samples



Quadrat Survey



Sieving the quadrat sample



Gafrarium sp



Gill Net Survey



Acanthopagrus schlegelii

Appendix III Survey Results

Lung Mei Quantitative Quadrat Survey Result (0.5mCD)

| 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 | <i>Batillaria zonalis</i> | - | 2 | 3 | 1 | - | 0 | 0 | 1 | - | 2 | - | 1 | 0 | - | - | - |
| | | <i>Batillaria multiformis</i> | - | 2 | 1 | 0 | 0 | 0 | 1 | 2 | 1 | 2 | 1 | - | 0 | 1 | 0 | 1 |
| | | <i>Cerithidea cingulata</i> | - | - | 1 | 2 | - | - | - | 1 | - | 2 | - | 2 | - | - | - | - |
| | | <i>Lunella coronata</i> | - | 1 | 2 | - | 1 | - | 1 | 0 | - | 1 | 3 | 2 | 1 | - | - | 0 |
| | | <i>Cronia margariticola</i> | - | 1 | 1 | - | 0 | 0 | 0 | 0 | 2 | 1 | - | - | - | 0 | 0 | - |
| | | <i>Barbatia virescens</i> | - | 3 | 1 | - | - | - | 0 | - | - | 0 | - | - | 1 | - | - | - |
| | | <i>Brachidontes variabilis</i> | - | 1 | - | 0 | - | 0 | - | - | 0 | - | 2 | - | 1 | - | 2 | 1 |
| | | <i>Septifer virgatus</i> | - | 1 | 0 | - | - | 1 | 1 | 0 | - | - | 1 | 1 | - | 0 | 2 | 1 |
| | Crustacea | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| | | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Sessile Organisms | Mollusca | <i>Saccostrea cucullata</i> | - | 5% | - | - | 0% | - | 0% | 5% | 5% | 10% | 0% | 0% | - | 5% | - | 10% |
| | Annelida | <i>Serpulorbis imbricatus</i> | - | - | 0% | - | 5% | - | 0% | 5% | - | 5% | - | - | - | 5 | - | - |
| | Chordata | <i>Styela plicata</i> | - | 1% | - | - | 0% | - | - | - | - | 0% | - | - | - | - | 1 | - |

Lung Mei Quantitative Quadrat Survey Result (1.0mCD)

| Transect | | | | 1 | | | | | 2 | | | | | 3 | | | | |
|-------------------|------------|---------------------------------|---------------------|--------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Quadrat | | | | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| | Phylum | Scientific Name | Conservation Status | Relative Abundance | | | | | | | | | | | | | | |
| Mobile Fauna | Mollusca | <i>Batillaria zonalis</i> | - | 10 | 9 | 12 | 4 | 11 | 7 | 5 | 11 | 2 | 12 | 22 | 25 | 19 | 26 | 10 |
| | | <i>Batillaria multiformis</i> | - | 15 | 12 | 21 | 15 | 10 | 12 | 15 | 12 | 15 | 21 | 17 | 22 | 16 | 12 | 25 |
| | | <i>Cerithidea cingulata</i> | - | 0 | 0 | 2 | 3 | 1 | - | 0 | - | 0 | - | 2 | - | 1 | - | 3 |
| | | <i>Cerithidea djadjariensis</i> | - | - | 1 | 0 | - | - | - | - | 1 | - | 0 | - | - | - | - | - |
| | | <i>Clithon oualaniensis</i> | - | 1 | 0 | - | 1 | - | - | 2 | 0 | 0 | - | 1 | - | 1 | 0 | - |
| | | <i>Lunella coronata</i> | - | 1 | 0 | 2 | 1 | 1 | - | 0 | - | 1 | - | - | 0 | - | 2 | 1 |
| | | <i>Gafrarium sp.</i> | - | - | 1 | - | 0 | - | 1 | - | 0 | 1 | 1 | - | - | - | - | 0 |
| | | <i>Barbatia virescens</i> | - | - | 1 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| | | <i>Brachidontes variabilis</i> | - | - | - | 1 | - | 0 | 0 | - | 1 | - | - | 2 | - | - | - | - |
| Sessile Organisms | Mollusca | <i>Saccostrea cucullata</i> | - | - | - | - | - | - | - | - | 0% | - | - | - | 5% | - | - | 5% |
| | Arthropoda | <i>Amphibalanus amphitrite</i> | - | - | - | 0% | - | - | - | - | - | - | - | - | - | - | - | |
| | Annelida | <i>Serpulorbis imbricatus</i> | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | |

Lung Mei Quantitative Quadrat Survey Result (1.5mCD)

| Transect | | | | 1 | | | | | 2 | | | | | 3 | | | | |
|--------------------------|-----------------------|--------------------------------|---------------------|--------------------|----|-----|----|----|----|----|----|----|----|----|----|----|----|----|
| Quadrat | | | | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| | Phylum | Scientific Name | Conservation Status | Relative Abundance | | | | | | | | | | | | | | |
| Mobile Fauna | Mollusca | <i>Batillaria zonalis</i> | | 2 | - | 0 | 1 | 2 | 2 | - | 2 | 0 | 4 | 3 | - | 1 | 0 | 0 |
| | | <i>Batillaria multiformis</i> | | 6 | 3 | 8 | 12 | 3 | 5 | 0 | 0 | 3 | 3 | 4 | 0 | 9 | 12 | 8 |
| | | <i>Lunella coronata</i> | | 7 | 4 | 9 | 2 | 12 | 16 | 9 | 0 | 4 | 6 | 12 | - | 9 | - | 0 |
| | | <i>Gafrarium sp.</i> | | 2 | 2 | 1 | 2 | - | 2 | 0 | 0 | 0 | 2 | 3 | 1 | 2 | 4 | 2 |
| | | <i>Monodonta labio</i> | | - | 1 | 2 | 0 | 0 | 2 | 0 | 0 | 2 | 3 | 2 | 1 | 2 | 0 | 3 |
| | | <i>Cellana grata</i> | | - | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | - | - | 0 |
| | | <i>Cronia margariticola</i> | | 1 | 0 | 0 | 2 | 1 | 2 | 4 | 0 | 0 | 3 | 2 | 1 | 1 | 0 | 0 |
| | | <i>Perna viridis</i> | | - | 1 | 2 | - | - | - | 1 | - | 0 | - | 2 | 1 | - | - | 0 |
| | | <i>Brachidontes variabilis</i> | | 0 | 0 | 1 | 2 | 1 | - | - | - | 1 | - | 1 | - | 0 | 0 | - |
| | Crustacea | <i>Mictyris longicarpus</i> | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Sessile Organisms | Mollusca | <i>Saccostrea cucullata</i> | | 5 | 5% | 10% | 5% | 0% | 0% | 0% | 5% | 0% | 0% | 7% | 5% | 0% | 0% | 6% |
| | Polyplocophora | | | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

Lung Mei Intertidal fish survey results

| | Net Drop Replicates | | | | | | | | | |
|---|---------------------|---|---|---|---|---|---|---|---|----|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Species | Abundance | | | | | | | | | |
| <i>Bathygobius fuscus</i> | | | | | | | | | | |
| <i>Cryptocentrus strigiliceps</i> | | | | | | | | | | |
| <i>Monacanthus chinensis</i> | | | | | | | | | | |
| <i>Parupeneus biaculeatus</i> | | | | | | | | | | |
| <i>Sillago japonicus</i> | | | | | | | | | | |
| <i>Siganus fuscescens</i> | | | | | | | | | | |
| <i>Tridentiger bifasciatus</i> | | | | | | | | | | |
| <i>Tridentiger trionocephalus</i> | | | | | | | | | | |
| All the recorded fishes are common and listed as Least Concern in IUCN Red List except <i>Parupeneus biaculeatus</i> and <i>Tridentiger trionocephalus</i> which were not assessed. | | | | | | | | | | |

Lung Mei benthic survey results

| | L | | | M | | | H | | |
|-------------------------------|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 1 | 2 | 3 | 1 | 2 | 3 |
| <i>Acanthopleura japonica</i> | | | 2 | 1 | | 2 | 2 | | 1 |
| <i>Aomalocardia squamosa</i> | | | 1 | | | | 1 | 1 | |
| <i>c.f.Musculus cupreus</i> | 2 | | | | | | 1 | 2 | 1 |
| <i>Capitella sp.</i> | | | 1 | 2 | 2 | | | 2 | 1 |
| <i>Ceratonereis sp.</i> | | | | | | | | 1 | 1 |
| <i>Chaetopterus sp.</i> | | | | | | 2 | | | 1 |
| <i>Circe scripta</i> | | | | 1 | | 1 | 1 | | |
| <i>Cirriformia sp.</i> | 1 | 2 | | | | | | | |
| <i>Cyclina sp.</i> | | | | 2 | | 1 | 1 | | |
| <i>Eunice sp.</i> | | | | | | | | | |
| <i>Glycera sp.</i> | | | | 1 | | | 1 | | |
| <i>Glycindensp.</i> | | | 1 | | | | | | |
| <i>Meropesta sp.</i> | 2 | 1 | | | | | | | |
| <i>Nephtys sp.</i> | 1 | | 2 | | 1 | | 2 | | |
| <i>Nereis sp.</i> | | | | 1 | | | | | |
| <i>Paraprionospio sp.</i> | | | | | 1 | | | 2 | |
| <i>Prionospio sp.</i> | | | | 2 | 1 | | | | |
| <i>Saccostrea sp.</i> | | 1 | 1 | 2 | 2 | | 1 | | |
| <i>Salmacis sphaeroides</i> | | | 1 | | 2 | 1 | | 2 | |
| <i>Scapharca sp.</i> | | | 1 | | | | | | |
| <i>Scoletoma sp.</i> | 2 | | 1 | 1 | 2 | | | 1 | |
| <i>Styela plicata</i> | 1 | 2 | | | | | | | |

| | | | | | | | | | |
|----------------------|----|--|----|--|--|----|--|--|--|
| | | | | | | | | | |
| No. of Species | 9 | | 15 | | | 14 | | | |
| Total No. of animals | 20 | | 34 | | | 31 | | | |

Lung Mei gill net survey results

| Net | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---------------------------------|------------------|---|---|---|---|---|---|---|---|----|
| Scientific Name | Abundance | | | | | | | | | |
| <i>Acanthopagrus latus</i> | | | | | | | | | | |
| <i>Acanthopagrus schlegelii</i> | | | | | | | | | | |
| <i>Brachirus orientalis</i> | | | | | | | | | | |
| <i>Gerres filamentosus</i> | | 1 | 1 | | | | | | | |
| <i>Leiognathus brevirostris</i> | | | | | | | | | | |
| <i>Monacanthus chinensis</i> | | | | | | | | | | |
| <i>Mugil cephalus</i> | | | | | | | | | | |
| <i>Gymnura</i> sp. | | | | | | | | | | |
| <i>Rhabdosargus sarba</i> | | | | | | | | | | |
| <i>Charybdis japonica</i> | | | | | | | | | | |
| <i>Portunus pelagicus</i> | | | | | | | | | | |
| <i>Thalamita crenata</i> | | | | | | | | | | |
| <i>Charybdis feriata</i> | | | | | | | | | | |
| Total Number | | 1 | 1 | | | | | | | |

THE END