Environmental Impact Assessment (EIA) Ordinance, Cap. 499
Application for Approval of Environmental Impact Assessment Report
Project Title : Development of a Bathing Beach at Lung Mei, Tai Po

Additional Information in response to EPD's letter ref. (92) in EP2/N5/C/46 Pt. 4 dated 5 February 2008

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Elaborations and clarifications on the purpose, methodology, findings and conclusion of the ecological survey undertook for the EIA study.

Responses

The purpose of the ecological survey was focused on collecting representative ecological data to fill information gaps concerning the following:

(i) to identify the dominant and typical flora and fauna species present in Study Area (included 500m from Project Site Boundary);
(ii) to establish the general ecological profile, physical and ecological characteristics of the site; and
(iii) to determine the presence of key factors described in Notes 1 to 3 attached to *Appendix A of Annex 16 of EIAO TM*, including recognized sites of conservation importance, important habitats where an ecological assessment will be necessary and species of conservation importance.

The methodology adopted in the EIA is summarized as follows:

Step 1 - literature review of Study Area
Step 2 - reconnaissance survey & habitat mapping in the Summer of 2006
Step 3 - conduct of 2 season surveys (wet/dry):
Terrestrial: habitat mapping, vegetation, mammals, herpetofauna, invertebrates.
Aquatic: freshwater fish, intertidal (mangrove, artificial rocky & sandy shores), subtidal infauna and subtidal dive survey
Step 4 - utilised the data gathered above to evaluate the importance of the habitats inside and outside of the works areas
Step 5 - predict severity of impacts to identified habitat, fauna & flora and identify need for mitigation measures according to *EIAO TM Annexes 8 & 16*
Step 6 - examine the residual impacts and highlight the need for EM&A

In the EIA study, baseline conditions for ecological components of the study area were evaluated based on information from available literature and focussed field surveys conducted for the purposes of this EIA. A literature review was first conducted to determine the existing ecological conditions within the Study Area to identify habitat resources and species of potential importance. Further to the findings of the literature review, there was limited ecological baseline information available in the Study Area; therefore detailed ecological surveys were required to fill in the data gaps.

To supplement the limited available information within the Study Area, more than 6 months of

terrestrial and aquatic ecological baseline surveys were conducted to collect ecological baseline information of the Study Area. The surveys were conducted during July to October (wet season) and November 2006 to January 2007 (dry season), which included habitat/vegetation, terrestrial mammal, bird, herpetofauna, invertebrates (butterfly and dragonfly) and freshwater fish surveys for terrestrial ecology, and subtidal (dive) surveys, benthic survey and intertidal (include mangrove) survey along the coastal habitats in close proximity of the Study Area.

It is important to note that the design of the EIA baseline survey method was prepared in reference to *EIAO* Guidance Note Nos. 7/2002 "Ecological Baseline Survey For Ecological Assessment", 10/2004 "Methodologies for Terrestrial and Freshwater Ecological Baseline Surveys" and 11/2004 "Methodologies for Marine Ecological Baseline Surveys", as well as international approved survey methods (ie Rapid Ecological Assessment for subtidal survey) and other approved EIAs.

The survey design is considered appropriate for EIA purpose, note guidance under 2.3 of GN 7/2002: *"2.3 In most cases, it is impractical for an ecological baseline survey to provide exhaustive ecological information of a site (e.g. an exhaustive species list). It should also be noted that ecological assessment of an EIA differs from an academic study (e.g. autecology of a certain species) in that the latter aims at revealing specific biological information in great details or depth. An ecological baseline survey is more general in nature and mainly aims at revealing the general ecological profile of the study area to facilitate the subsequent impact assessment."*

The gathered ecological information was then evaluated in accordance with the criteria stipulated in *Annex 8 of the EIAO TM.* The survey methodology and impact assessment followed the Study Brief, *EIAO TM* requirements and the relevant Guidance Notes which are prepared in accordance with scientific literature, and represented acceptable practices for EIA studies in Hong Kong. It is important to note that mainly dominant and representative species reported in the EIA report (not including marine fish and commercial fisheries species (ie crabs, prawn and octopus) which are typically discussed under a fisheries impact assessment). Since the site is not an important fisheries spawning and nursery area, and fish are free to move and can avoid the works areas, fish surveys are not required for the EIA study.

Results of the intertidal surveys conducted for the EIA study showed that the sandy shores within the Study Area supported low diversity of species. The sandy shores were predominantly covered by coarse grains and rubbles with increasing proportion of finer grains towards the lower intertidal zone. Faunal species recorded were typical species that can be found on sandy and rocky shores in Hong Kong, and all species found are regarded as common or very common species in Hong Kong. Whilst relatively undisturbed mangroves were only found in the nearby Ting Kok SSSI, the artificial/ disturbed shore at the east of the Study Area adjacent to the Tai Mei Tuk also only supported a low diversity of species.

Based on the marine ecological information collected during the EIA study, the ecological value of sandy shore with backshore vegetation, village/modified area, and the lower course of Lo Tsz River within the Proposed Beach Development were considered to be low in the EIA study.

For reference, habitat evaluation for different soft-bottomed intertidal habitats, in previously approved EIA reports, is summarised in Table 1.

Table 1 Habitat evaluation for different soft-bottomed intertidal habitats, in previously approved EIA reports.

EIA Study	Location	Habitat	Survey Method	Reported Ecological Value	Remarks
Drainage Improvement in Sai Kung, EIA-101/2004	Ho Chung (Hebe Haven)	Large mudflat	Qualitative, presence only and mention of dominant species	Moderate	Isolated seagrass patch
	Pak Kong (Hebe Haven)	Large mudflat	Qualitative, presence only and mention of dominant species	Moderate	Isolated seagrass patch
	Sha Ha (Sai Kung)	Large sandy/ muddy flat	Qualitative, presence only and mention of dominant species	Low	Large breeding aggregation of common starfish reported
Drainage Improvement in Sha Tin and Tai Po, EIA-130/2007	Adjacent to Wa Ha River / Shuen Wan	Moderate sized intertidal flat (60-150m in width)	Qualitative, relative abundance (abundant, frequent, occasional, scarce)	Moderate	Partially within Ting Kok SSSI
Outlying Islands Sewerage Stage 1, Phase II Package J - Sok Kwu Wan Sewage Collection, Treatment & Disposal Facilities, EIA-091/2003	Sok Kwu Wan	Sandflat on 2.8 km of coastline	Qualitative	Moderate	Juvenile Horseshoe Crab reported
Road P1 Advance Works at Yam O on Lantau Island, EIA-109/2005	Yam O (Sunny Bay)	Mudflat (2.5 ha)	Qualitative, and seagrass mapping	Moderate to high	Very extensive (0.8 ha) seagrass bed on mudflat recorded
	Luk Keng Bay and Yam Tsai Wan	Sandy shore	Observations and quantitative, sand cores from transects	Low	Undisturbed
Siu Ho Wan Water Treatment Works Extension, EIA-100/2004	Pui O, South Lantau	Sandy shore	Qualitative observations, species list	Low to moderate	
Further Development of Tseung Kwan O Feasibility Study, EIA-111/2005	Chui Keng Wan (Junk Bay)	Sandy shore	Qualitative observations and Quantitative sand cores along transects in 2 sandy bays	Low to Moderate	Undisturbed small bays

EIA Study	Location	Habitat	Survey Method	Reported Ecological Value	Remarks
Proposed Extension of Public Golf Course at Kau Sai Chau Island, Sai Kung, EIA-112/2005	Kau Sai Chau	Sandy flats	Semi-quantitative, species list and relative abundance	Low to Moderate	
Repositioning and Long Term Operation Plan of Ocean Park, EIA-121/2006	Headland area of Deep Water Bay	Sandy shore	Qualitative observations and used one quantitative line transect	Low	Relatively free from physical modifications
Liquefied Natural Gas (LNG) Receiving Terminal and Associated Facilities, EIA-125/2006	Tung Wan and Sai Wan, South Soko Island	Sandy shore	Qualitative observations and quantitative sand cores along transects in 2 sandy bays	Low	
	Pak Tso Wan, South Soko Island	Sandy shore	Qualitative	Moderate	Habitat evaluation mainly based on recent scientific study
	Shek Pik, South Lantau	Sandy shore	Qualitative observations and quantitative sand cores along transects	Low	
Tung Chung - Ngong Ping Cable Car Project, EIA-090/2003	Tung Chung Bay, North Lantau,	Mangrove/ mudflat	Literature review	High	Large (20 ha) mangrove/ mudflat with beds of 2 seagrass species

As demonstrated in the previously approved EIA reports, sandy shore habitats are often graded as low or low to moderate aside from where notable features eg seagrass patches or juvenile horseshoe crab are recorded. It should be noted that none of such features were recorded within the Works Area at Lung Mei.

Intertidal soft shore habitat within the Project Site was classified as low ecological value in the EIA. The habitat characteristics offered by the sandy shore within the Project Site are very common in Hong Kong. Intertidal faunal species recorded during the baseline survey conducted for the EIA Study (not including marine fish and commercial fisheries species (ie crabs, prawn and octopus) which are typically discussed under fisheries impact assessment) were typical species that can be found on sandy and rocky shores in Hong Kong.

Comments from EPD (ii)

Elaborations, based on the latest information available, on the considerations of the ecological impact assessment which concluded that the overall ecological value of the beach was indeed a low one.

Responses

It should be noted that the EIA ecological baseline and impact assessment complies with the *EIAO TM* and the *Study Brief* and is the recognised approach for EIAs in Hong Kong. The EIA report presented details on the general ecological profile, physical and ecological characteristics of the site, dominant and representative species from the intertidal & subtidal areas in accordance with the guidance under 2.3 of GN 7/2002. The surveys of marine fish, pelagic and subtidal marine fauna (ie swimming crabs, cuttlefish and octopus) are typically not required under *EIAO TM* and *Study Brief* for the ecological assessment.

In response to the reservations of Members of the ACE on the sufficiency of ecological information, a consultant was commissioned to undertake ecological survey (dry and wet seasons) between February 2008 and July 2008 in order to obtain further information on the ecological status of the habitat of Lung Mei Beach. In order to provide further information to evaluate the overall ecological value of the habitat of Lung Mei Beach, additional extensive intertidal surveys, including active search and quantitative surveys, were carried out at Lung Mei in accordance with the criteria stipulated in *Annex 8 of the EIAO TM*. In order to put the findings of the additional surveys into context with other soft shore habitats in Plover Cove and Tolo Harbour/Channel, five reference sites located at Ting Kok East, Shuen Wan, Wu Chau, Yung Shue O North and Lai Chi Chong were also surveyed. It is important to note that these additional surveys are specifically designed to address ACE Members' reservation on the sufficiency of ecological information presented in the EIA report and the public comments. Therefore, the methodology of the additional surveys is very different from that adopted in the EIA study and indeed similar EIA studies which would aim specifically at addressing the requirements set out in the EIAO Technical Memorandum (TM) and the project-specific Study Brief. Given the differences in objectives and hence methodologies, findings of these additional surveys and the EIA report would invariably differ and it might not be appropriate to make direct comparison between the data obtained from these different surveys.

The additional active search involved intensively searching for different types of species at Lung Mei and the reference sites. Such intensive search with a primary purpose of compiling a comprehensive list of species present is not a typical or formal ecological survey method for this kind of habitat, and may not be the optimal method to establish the general ecological profile of a sandy shore, e.g. increased disturbance to the habitats and the associated organisms. This kind of active search would serve primarily to generate a more complete species list of the surveyed sites or to confirm the presence or otherwise of a particular species. It is important to note that mobile marine fauna can move freely in and out of a site and the record of presence of a marine species

does not mean that the site is important for the species, i.e. the species may not utilise the site as a spawning or nursery ground and it is possible that the species is only a passing through.

A species list was compiled for Lung Mei and each of the five reference sites under investigation (Ting Kok East, Shuen Wan, Wu Chau, Yung Shue O North and Lai Chi Chong; see Annex B). All species found in Lung Mei during the additional active search have previously been reported in local and international literature and were also present in the reference sites. As is typical with a sandy shore the majority of the species recorded during the active search were highly mobile species which can move freely in and out of a site. This is reflected in the fact that the active search results indicated that none of the species recorded at Lung Mei were specific or endemic to the marine habitats at the site. All of the species are considered to be typical sandy shore species and can be found in similar habitats in Hong Kong. Findings of the surveys are presented in detail in Annex B.

Results of the additional active search showed that three reference sites, namely Ting Kok East, Yung Shue O North and Lai Chi Chong shared similar ecological characteristics with Lung Mei. Lung Mei and these three reference sites were thus subject to in depth detailed quantitative intertidal surveys. The additional quantitative surveys, which included intertidal transects, intertidal benthic cores, intertidal crustacean and fish surveys, were conducted to examine the diversity and abundance of intertidal and shallow subtidal fauna at Lung Mei and the three selected reference sites (see Annex C) in order to provide detailed ecological information of these sites. It should be noted that the additional intertidal surveys are more extensive than those normally required in the baseline survey of an ecological impact assessment. In particular, the intertidal fish survey is beyond the scope and requirements of a typical ecological impact assessment conducted as part of an EIA study.

Findings of the additional quantitative surveys revealed that Lung Mei had the lowest number of epifaunal and infaunal species among all surveyed sites. Diversity of crustaceans was also the lowest at Lung Mei. The results are consistent with those of the active search which identified Lung Mei as having the lowest number of marine faunal species when compared with Ting Kok East, Yung Shue O North and Lai Chi Chong, and Lung Mei exhibited a low diversity of species among the four sites studied. Findings of the surveys are presented in detail in Annex C.

The ecological value of sandy shore with backshore vegetation and proposed beach has been evaluated based on results of the additional extensive intertidal surveys (*Table 2*).

Table 2 Ecological evaluation of sandy shore with backshore vegetation and proposed beach development

Criteria	**Sandy Shore with backshore vegetation**	**Proposed Beach Development**
Naturalness	Natural with certain disturbance Note: Increased human activities including fishing activities, shellfish collection and littering were recorded during the additional intertidal surveys.	Dominated by man-made habitat (village/modified area, and lower course of Lo Tsz River). Natural habitats included sandy shore with backshore vegetation which has certain degree of disturbance (littering) were recorded.
Size	Approximately 1.0 ha of this habitat was recorded within the Study Area, in which approximately 0.5 ha of this habitat was recorded within the Project Site.	Approximately 1.0ha of village/ modified area, approximately 10 m of lower course of Lo Tsz River, approximately 0.5ha of sandy shore with backshore vegetation and approximately 5.4 ha of subtidal habitats to be affected (permanent and temporary). Approximately 80 mangrove seedlings/ plants (with a height below 0.5 m) of *Aegiceras corniculatum*, *Avicennia marina* and *Kandelia obovata* were found scattered along the sandy shore within the site.
Diversity	Low for vegetation and terrestrial fauna (refer to EIA Report). Comparatively low for intertidal and shallow subtidal fauna, taking into consideration the information reported by the additional quantitative surveys (details refer to *Annex C*).	Low to moderate for vegetation and terrestrial fauna (refer to EIA Report). Comparatively low for intertidal and shallow subtidal fauna, taking into consideration the information reported by the additional quantitative surveys (details refer to *Annex C*). Subtidal soft benthos assemblages were low in diversity (refer to EIA Report).
Rarity	Based on the results of the additional active search and quantitative surveys (*Annexes B & C*), and with reference to *Table 3*, species of conservation importance confirmed to be present at Lung Mei includes the Two-spot Goby *Psammogobius biocellatus* (listed as Lower Risk Near Threatened under IUCN Red List), Tropical Sand Goby *Favonigobius reichei* (listed as Lower Risk Near Threatened under IUCN Red List) and Grass Puffer *Takifugu niphobles* (listed as Data Deficient under IUCN Red List). Further to recent available information, it is confirmed that these three species are very common in the Tolo area (Plover Cove and Tolo Harbour/Channel) as well as elsewhere in Hong Kong (*Annex B*). No seagrass, established mangrove and coral habitats recorded within the area. Mangrove habitats (of high ecological value) are commonly found in areas within Plover Cove (ie Ting Kok East, Shuen Wan) and Tolo Harbour (ie Wu Chau, Yung Shue O North and Lai Chi Chong).	With reference to *Table 3*, species of conservation interest include: Common Rat Snake found in village/ modified areas (refer to EIA Report); Tropical Sand Goby *Favonigobius reichei*, Two-spot Goby *Psammogobius biocellatus* and Grass Puffer *Takifugu niphobles* found in Sandy Shore with backshore vegetation based on the results of the additional active search (*Annex B*). All three species are very common in the Tolo area (Plover Cove and Tolo Harbour/Channel) as well as elsewhere in Hong Kong (*Annex B*).
Re-creatability	The habitat can readily be recreated.	All of the habitats can readily be recreated.
Fragmentation	Not applicable.	Not applicable.
Ecological Linkage	Not functionally linked to any highly valued habitat in close proximity.	Not functionally linked to any highly valued habitat in close proximity.
Potential Value	Low. Due to the high degree of human disturbance and the habitat quality, it has low ecological potential value.	Low. Due to the high degree of human disturbance and the habitat quality, it has low ecological potential value.
Nursery/Breeding Ground	No significant nursery or breeding ground recorded.	No significant nursery or breeding ground recorded.
Age	Not applicable.	Not applicable.

Criteria	Sandy Shore with backshore vegetation	Proposed Beach Development
Abundance/Richness of Wildlife	Based on the results of the additional quantitative surveys, overall abundance of marine fauna considered to be comparatively low to moderate (details refer to *Annex C*).	Overall abundance and richness of terrestrial wildlife and marine fauna were comparatively low and low to moderate respectively (*Annex C*).
Overall Ecological Value	Low	**Overall Low**, taking into consideration the information reported by members of the public recently and the additional extensive intertidal surveys.

Table 3 Evaluation of the combined information (recorded during the baseline survey conducted for the EIA Study and reported additional extensive intertidal surveys) against the Notes 2 to 3 of Appendix A of Annex 16 of the EIAO TM

Key Factors		Evaluation under this EIA
Note 2 : Important Habitats Where an Ecological Assessment Will Be Necessary		
An ecological assessment will be needed if a proposed development will affect		
1.	over one hectare of woodland	Not affected
2.	over one hectare/500 metres of undisturbed natural coast	Approximately 200m of partially disturbed coastline will be directly affected
3.	over 0.5 hectare of intertidal mudflats	Mudflat not affected, Lung Mei is a sandy shore
4.	established mangrove stands of any size	Established mangrove habitats at Ting Kok not affected. No established mangrove habitat recorded in Lung Mei as only mangrove seedlings were found
5.	over 0.5 hectare of freshwater or brackish marshes	Not affected
6.	established seagrass (*Zostera* or *Halophila* or *Ruppia* species) bed of any size	No seagrass recorded within the Project Site and Study Area
7.	over 100 metres of natural stream courses and rivers of significant length	Only 10 m of partially-channelised Lo Tsz River (next to Ting Kok Road) will be affected.
8.	over one hectare wetlands (as defined by the Ramsar Convention) other than those mentioned in 2 to 7 above	Not affected
9.	established coral communities of any size	No corals recorded within the Project Site
10.	other habitats considered as having special conservation importance by documented scientific studies	No habitats considered as having special conservation importance by documented scientific studies recorded within the Project Site
Note 3 : Species of Conservation Importance		
An ecological assessment will be needed if the proposed development will affect habitats supporting significant population of wild fauna or flora that are :		
1.	listed in IUCN Red Data Books or those of the South China region;	Two-spot Goby *Psammogobius biocellatus* (listed as Lower Risk Near Threatened under IUCN Red List), Tropical Sand Goby *Favonigobius reichei* (listed as Lower Risk Near Threatened under IUCN Red List) and Grass Puffer *Takifugu niphobles* (listed as Data Deficient under IUCN Red List) were recorded at Lung Mei (*Annex B*). Further to recent available information, it is confirmed that these three species are very common in the Tolo area (Plover Cove and Tolo Harbour/Channel) as well as elsewhere in Hong Kong (*Annex B*).

Key Factors		Evaluation under this EIA
2.	listed in international conventions for conservation of wildlife;	Common Rat Snake listed in Appendix II of CITES
3.	endemic to Hong Kong or South China;	None
4.	listed under local legislation :	
	i. Forestry Regulation (under Forests and Countryside Ordinance Cap. 96);	None, including the species reported by members of the public recently
	ii. Wild Animals Protection Ordinance Cap. 170;	None, including the species reported by members of the public recently, except the Common Rat Snake found in the village/ disturbed area which has been reported in the EIA report
	iii. Protection of Endangered Species of Animals and Plants Ordinance Cap. 586;	The Common Rat Snake is a scheduled species under Cap. 586.
	iv. Other relevant Ordinances or Regulations such as Marine Parks and Marine Reserves Regulation (under Marine Parks Ordinance Cap. 476);	Project Site located away from Marine Parks and Marine Reserves
	(References shall also be made to species protected by legislation in China, especially the Guangdong Province.)	None
5.	considered as rare in the territory or having special conservation importance by scientific studies other than those listed above.	None

The additional surveys are intended to provide data for re-examining the evaluation given in the EIA report with respect to criteria such as diversity, rarity and abundance/ richness of wildlife to facilitate a review of the overall ecological value of Lung Mei. It has been demonstrated that intertidal and shallow subtidal faunal species at Lung Mei, whether those recorded during the baseline survey conducted for the EIA Study or those reported by members of the public recently or those reported from the additional extensive intertidal surveys, were mostly typical species that can be found on other sandy and rocky shores in Hong Kong (Annexes B and C). Lung Mei did not appear to serve as critical/ unique habitats for species of conservation importance, or support significant populations of such species.

Using the information obtained from the additional extensive intertidal surveys, the evaluation for the above criteria (diversity, rarity and abundance/ richness of wildlife) has been reviewed and updated where appropriate (Table 2). Further consideration has been given to the evaluation on the habitat quality criteria (Table 2) in response to these updates; however it is considered that no change to these habitat quality criteria is required. It is necessary to point out that the evaluation of overall ecological value under the *EIAO TM* is heavily weighed on the evaluation of habitat quality criteria, and a similar approach was also adopted for the evaluation of ecological value of 40 soft shores in Hong Kong [(1) (2)]. The review confirmed that the overall ecological value of Lung Mei was low, hence drawing the same conclusion as in the EIA report.

Given the small total size of affected intertidal and subtidal soft bottom habitat (approximately 200m of shoreline) and the large extent of similar intertidal and subtidal habitats in the vicinity (>9

([1]) Tai K.K. 2005. Ecological status and conservation value of soft shore habitats in Hong Kong. MPhil. Thesis, Department of Biology and Chemistry, City University of Hong Kong.

([2]) Shin P.K.S. & Cheung S.G. 2005. A Study of Soft Shore Habitats in Hong Kong for Conservation and Education Purposes. City University of Hong Kong. ECF Project 23/99.

km), unacceptable impacts have not been predicted for the Project. Based on the recent information (Annex B), although three of the fish species recorded at Lung Mei are considered of conservation importance (Table 3): Two-spot Goby *Psammogobius biocellatus* (listed as Lower Risk Near Threatened under IUCN Red List), Tropical Sand Goby *Favonigobius reichei* (listed as Lower Risk Near Threatened under IUCN Red List) and Grass Puffer *Takifugu niphobles* (listed as Data Deficient under IUCN Red List), according to recent available information, these three species are very common in Tolo Harbour and other parts of Hong Kong waters, thus indicating that Lung Mei is unlikely an important habitat for these species. It should also be noted that the Two-spot Goby, Tropical Sand Goby, and particularly the pelagic Grass Puffer, are highly mobile marine organisms which can move freely in the marine environment. When disturbed, these three mobile fish species are able to respond quickly by fleeing. It is, therefore, considered that the impact assessment conclusions as stated in the EIA report are still valid.

An assessment of the beach quality of Lung Mei and other three selected reference sites (i.e. Ting Kok East, Yung Shue O North and Lai Chi Chong) is provided in Table 3. The assessment showed that the diversity of intertidal and shallow subtidal species was the lowest in Lung Mei among the four sites examined. The three species of conservation importance, i.e. Two-spot Goby *Psammogobius biocellatus*, Tropical Sand Goby *Favonigobius reichei* and Grass Puffer *Takifugu niphobles*, were also present in the three reference sites. Whilst the habitat of Lung Mei Beach is considered to be re-creatable, habitats at the three reference sites cannot be re-created since established mangrove and/ or seagrass habitats are present at the reference sites. The overall habitat quality of Lung Mei is, therefore, considered to be relatively low, thereby confirming that the overall ecological value of Lung Mei was low and drawing the same conclusion as in the EIA report.

Table 4 Ecological Evaluation of Ting Kok East, Yung Shue O North and Lai Chi Chong. Evaluation was based on the characteristics of the sandy Shore with backshore vegetation at these four sites.

Criteria	**Lung Mei**	**Ting Kok East**	**Yung Shue O North**	**Lai Chi Chong**
Naturalness	Natural with certain disturbance Note: Increased human activities including fishing activities, shellfish collection and littering were recorded during the additional intertidal surveys.	Natural with certain disturbance, ie shellfish collection and tourist	Natural with minimal disturbance, ie shellfish collection, with natural and unpolluted stream	Natural and nearly undisturbed, with natural and unpolluted stream
Size	Approximately 1.0 ha of this habitat was recorded within the Study Area, in which approximately 0.5 ha of this habitat was recorded within the Project Site.	Large size of intertidal habitat.	Large size of intertidal habitat.	Moderate size of intertidal habitat.

Criteria	**Lung Mei**	**Ting Kok East**	**Yung Shue O North**	**Lai Chi Chong**
Diversity	Comparatively low for intertidal and shallow subtidal fauna, taking into consideration the information reported by the additional quantitative surveys (details refer to *Annex C*).	Comparatively moderate for intertidal and shallow subtidal fauna, taking into consideration the information reported by the additional quantitative surveys (details refer to *Annex C*). With continuous patches of mangrove habitat.	Comparatively moderate for intertidal and shallow subtidal fauna, taking into consideration the information reported by the additional quantitative surveys (details refer to *Annex C*). With continuous patches of mangrove habitat.	Comparatively high for intertidal and shallow subtidal fauna, taking into consideration the information reported by the additional quantitative surveys (details refer to *Annex C*). With small patch of mangrove and seagrass habitats.
Rarity	Based on the results of the additional active search and quantitative surveys (*Annexes B & C*), and with reference to *Table 3*, species of conservation importance confirmed to be present at Lung Mei includes the Two-spot Goby *Psammogobius biocellatus* (listed as Lower Risk Near Threatened under IUCN Red List), Tropical Sand Goby *Favonigobius reichei* (listed as Lower Risk Near Threatened under IUCN Red List) and Grass Puffer *Takifugu niphobles* (listed as Data Deficient under IUCN Red List). Further to recent available information, it is confirmed that these three species are very common in the Tolo area (Plover Cove and Tolo Harbour/Channel) as well as elsewhere in Hong Kong (*Annex B*). No seagrass, established mangrove and coral habitats recorded within the area.	Based on the results of the additional active search and quantitative surveys (*Annexes B & C*), and with reference to *Table 3*, species of conservation importance confirmed to be present at Ting Kok East includes the Two-spot Goby *Psammogobius biocellatus* (listed as Lower Risk Near Threatened under IUCN Red List), Tropical Sand Goby *Favonigobius reichei* (listed as Lower Risk Near Threatened under IUCN Red List) and Grass Puffer *Takifugu niphobles* (listed as Data Deficient under IUCN Red List). Further to recent available information, it is confirmed that these three species are very common in the Tolo area (Plover Cove and Tolo Harbour/Channel) as well as elsewhere in Hong Kong (*Annex B*). Mangrove habitats (of high ecological value) are found in Ting Kok East.	Based on the results of the additional active search and quantitative surveys (*Annexes B & C*), and with reference to *Table 3*, species of conservation importance confirmed to be present at Yung Shue O North include Two-spot Goby *Psammogobius biocellatus* (listed as Lower Risk Near Threatened under IUCN Red List), Tropical Sand Goby *Favonigobius reichei* (listed as Lower Risk Near Threatened under IUCN Red List) and Grass Puffer *Takifugu niphobles* (listed as Data Deficient under IUCN Red List). Further to recent available information, it is confirmed that these three species are very common in the Tolo area (Plover Cove and Tolo Harbour/Channel) as well as elsewhere in Hong Kong (*Annex B*). Mangrove habitats (of high ecological value) are found in Yung Shue O North.	Based on the results of the additional active search and quantitative surveys (*Annexes B & C*), and with reference to *Table 3*, species of conservation interest confirmed to have population at Lai Chi Chong include Two-spot Goby *Psammogobius biocellatus* (listed as Lower Risk Near Threatened under IUCN Red List), Tropical Sand Goby *Favonigobius reichei* (listed as Lower Risk Near Threatened under IUCN Red List) and Grass Puffer *Takifugu niphobles* (listed as Data Deficient under IUCN Red List). Further to recent available information, it is confirmed that these three species are very common in the Tolo area (Plover Cove and Tolo Harbour/Channel) as well as elsewhere in Hong Kong (*Annex B*). Mangrove and seagrass habitats (of high ecological value) are found in Lai Chi Chong.
Re-creatability	The habitat can readily be recreated.	The habitat cannot be recreated.	The habitat cannot be recreated.	The habitat cannot be recreated.
Fragmentation	Not applicable for coastal habitats.	Not applicable for coastal habitats.	Not applicable for coastal habitats.	Not applicable for coastal habitats.
Ecological Linkage	Not functionally linked to any highly valued habitat in close proximity.	Functionally linked to continuous patches of mangrove habitat in close proximity.	Not functionally linked to continuous patches of mangrove habitat and natural and unpolluted stream in close proximity.	Not functionally linked to mangrove habitat and natural and unpolluted stream in close proximity.

Criteria	Lung Mei	Ting Kok East	Yung Shue O North	Lai Chi Chong
Potential Value	Low. Due to the high degree of human disturbance and the habitat quality, it has low ecological potential value.	Moderate. Due to the high degree of human disturbance, ie shellfish collection and tourist, it has moderate ecological potential value.	High.	High.
Nursery/Breeding Ground	No significant nursery or breeding ground recorded.	Mangrove habitats are proved significant nursery or breeding ground.	Mangrove habitats are proved significant nursery or breeding ground.	Mangrove and seagrass habitats are proved significant nursery or breeding ground.
Age	Not applicable.	Not applicable.	Not applicable.	Not applicable.
Abundance/Richness of Wildlife	Based on the results of the additional quantitative surveys, overall abundance and richness of marine fauna considered to be comparatively low to moderate (details refer to *Annex C*).	Based on the results of the additional quantitative surveys, overall abundance and richness of marine fauna considered to be comparatively moderate (details refer to *Annex C*).	Based on the results of the additional quantitative surveys, overall abundance and richness of marine fauna considered to be comparatively moderate to high (details refer to *Annex C*).	Based on the results of the additional quantitative surveys, overall abundance and richness of marine fauna considered to be comparatively low to moderate (details refer to *Annex C*).
Overall Ecological Value	Low	Moderate	Moderate to High	Moderate to High

Attention should also be drawn to the ecological values reported in other relevant approved EIA studies (Table 1). It should be highlighted that an overall 'high' ecological value is generally associated with habitats with extensive area of important habitats (e.g. mangroves, seagrass beds and mudflats), while an overall 'moderate' ecological value is generally associated with habitats with isolated patches of important habitats, potential nursery/ spawning grounds, or with known species listed under *Note 3* of *Appendix A* of *Annex 16* of *EIAO TM* (e.g. horseshoe crabs). Taking into account these previous relevant EIA studies, since the aforementioned habitats are not present in the habitat of Lung Mei, it is considered that Lung Mei is unlikely to have either a 'high' or 'moderate' overall ecological value. The overall ecological value of Lung Mei was thus considered to be low, hence drawing the same conclusion as in the EIA report.

Comments from EPD (iii)

Clarifications on the mitigation measures for the protection of rare or ecologically important species of marine fauna, if any to be affected by the project.

Responses

As discussed above, all species recorded at Lung Mei during the EIA and the additional extensive intertidal surveys are common in Hong Kong and the overall ecological value of the Lung Mei Beach is low. Given the small total size of affected intertidal and subtidal soft bottom habitat (approximately 200m of shoreline) and the large extent of similar intertidal and subtidal habitats in the vicinity (>9 km within Plover Cove), and with the implementation of the mitigation measures proposed in the EIA Report, no significant residual impact is anticipated to arise from the Project. It should also be noted that the Two-spot Goby, Tropical Sand Goby, and particularly the pelagic Grass Puffer, are highly mobile marine organisms which can move freely in the marine environment. When disturbed, these three mobile fish species are able to respond quickly by fleeing.

In order to address ACE's comments and concerns from members of the public on protection of ecological important species of marine fauna, the following additional precautionary measures will be implemented during the construction phase to further minimize the potential impacts on the benthic fishes Two-spot Gobv and Tropical Sand Goby::

- The removal of rocks/ hard objects in the intertidal zone will be conducted progressively during low tide (ie $10m^2$ for each removal) and under the supervision of a qualified fish specialist. Two-spot Goby and Tropical Sand Goby are expected to move away during the rocks/ hard objects removal works (Grass Puffer is not expected to occur in the intertidal zone during low tide). The qualified fish specialist will be responsible for checking for any Two-spot Goby and Tropical Sand Goby or under the rocks/ hard objects to be removed;
- The "cleared" areas will be properly fenced off (e.g. by geotextile curtain) immediately after removal of the rocks/ hard objects. The qualified fish specialist will inspect the areas beforehand to avoid trapping any Two-spot Goby and Tropical Sand Goby inside the enclosed area; and
- A trial will be conducted in the beginning of the rock removal work so as to fine-tune the above method, if necessary.

It should be noted that unnecessary dredging operation will be avoided during the construction phase, and only the groyne location and areas of rock/ hard objects will be dredged (restricted to the top layer, approximately 0.5 m) to remove potential hazards to swimmers. Lower intertidal and subtidal areas mainly comprise soft sediments where dredging works are minimal and the associated impacts to marine organisms would thus be largely reduced. During sand filling operations, the sand will be placed gradually in a manner to ameliorate impacts to marine organisms. Eventually, the beach will reprofile itself with help from wave action, current movement and wind.

Hence no significant impacts would be induced by the sand filling works on marine organisms inhabiting the lower intertidal zone.

Comments from EPD (iv)

Clarifications on measures taken to minimize the environmental impact of the project particularly through reduction in the footprint of the project.

Responses

The estimated beach attendance for the Lung Mei Beach upon finalization of the scope of development in 2005 was based on the assumptions adopted in the Architectural Services Department Feasibility Study in 2001 of 2,000 (non-peak) and 4,000 (peak) per day and review of the attendances in 2005 for a beach of comparable scale and similar anticipated patronage i.e. Cafeteria New Beach which is a popular beach in New Territories West with similar size of Lung Mei Bathing Beach. In the year of 2005, the daily average attendance of Cafeteria New Beach on Sundays in non-peak months is 1,800. For peak months, the daily average attendance is 3,800 on Sundays.

Given that the Lung Mei Beach after enhancement of the facilities would be the only beach in the east region of the New Territories (except Sai Kung District), and that Lung Mei Beach is part of the Tai Mei Tuk which is a popular visiting area by holiday-makers and is well developed for recreational, sports, barbecue, cycling and hiking activities etc, particularly during weekend, Sundays, public and summer holidays, Lung Mei Beach should be developed with adequate facilities to accommodate peak user rate of 4,000 per day.

In order to cater for the estimated beach attendance, TIA study has been carried out to estimate the parking spaces required for Lung Mei Beach according to the traffic surveys and parking surveys taken at Clear Water Bay Second Beach (reference beach). The average parking duration at the reference beach was 100 minutes (or 1.67 hrs). The adopted parking duration for the TIA study was adjusted to take account for the broader range of recreation activities available in the vicinity of the Lung Mei Beach. 25% of 4,000 daily visitors arrive by private cars was assumed based on traffic surveys at Clear Water Bay Second Beach, and also the average parking duration was estimated to be about 2.5 hours. With these assumptions, it was estimated that a total 106 parking spaces are required at Lung Mei Beach. Therefore, the provision of 100 parking spaces at Lung Mei Beach is considered not excessive and the footprint of the carpark has already been minimized.

The design of the beach building and the carpark is based on the approved Schedule of Accommodation. Also, it is required to meet the statutory requirements, e.g. Building Ordinance, Town Planning Ordinance, and Hong Kong Planning Standard and Guidelines, which govern various design parameters like the width of means of escape/ means of access, the provision of Emergency Vehicular Access (EVA), the provision of the sanitary fitments, the barrier free setting, the size of the refuse collection point etc. Besides, the building should also be designed to cater for different utilities, e.g. the provision of the transformer room, switch room, water tank etc. Although the project is required to cater for various functions and different end users, the footprint

of the building has already been reduced to cope with the demand and the minimum statutory requirements.

In order to minimize the reclamation area, the layout is so designed that the carpark area will be sited mostly on the existing land and the footprint of reclamation for the construction of beach building and beach area has been minimized while satisfying the various statutory requirements. In order to further reduce the reclamation area, it is proposed to reduce the width of two groynes resulting in reduction of the total reclamation area by 20 about sq.m. Such reduction could minimize not only the environmental impacts to the foreshore and seabed, but also the amount of marine sediments generated from the dredging operation.

Other information that the Authority may wish to consider

The following subsection presented information that is considered necessary in response to the comments/concern raised by members of the public.

Marine Faunal Species reported by Members of the Public

Members of the public reported that there is a total of 165 marine faunal species recorded in Lung Mei from December 2007 to October 2008 (at least 15 visits, *Annex A*). The list has been reviewed by the Project Team but has not been independently verified for accuracy (eg in taxonomy as it is very difficult to confirm species identification through photographs. Intertidal fauna, reported by members of the public, were species that typically found on sandy and sheltered rocky/boulder shores in Hong Kong). It is also understood that field surveys conducted by members of the public utilized methodologies different from the EIA report and the additional extensive intertidal surveys, for example the additional active search only included a total of two visits to Lung Mei while the additional quantitative surveys included another two visits. Findings of the surveys by the public and those of the EIA report and the additional extensive intertidal surveys would, therefore, invariably differ and it might not be appropriate to make direct comparison between the data obtained from these different surveys.

A number of marine fauna species were reported by the public at Lung Mei and were considered notable with important conservation status. Not only the taxonomic identifications of these recorded species have not been verified, but the reported status has not been carefully studied. Based on the results from this Additional Study, only three species were considered as Species of Conservation Importance (ie *Note 3* of *Appendix A* of *Annex 16* of *EIAO TM*) and assessment of their conservation status are presented in *Annexes B* and *C*.

Nonetheless, in response to public concern, after review of available literature, the following *Table 1* summarized the information regarding the identified notable species.

Table 1 Notable species at Lung Mei as reported by members of the public

Scientific Name	Common Name	Description	Reference
Pardachirus pavoninus	Peacock sole	• Tropical, reef associated marine fish. Inhabit sand and mud bottoms of lagoon and seaward reefs. Found in Indo-Pacific region including Sri Lanka, Japan and Australia • Recorded by AFCD in 1961	• Fishbase • AFCD. Hong Kong Fish Collection. http://www.hk-fish.net/museum/
Diplogrammus xenicus	Northern Dragonet	• Subtropical, reef-associated marine fish. Inhabit sandy bottoms of rocky or coral reefs • Recorded in coarse sand within in Hoi Ha Wan Marine Park, locally rare but can also be found in Japan, Ryukyu Islands and Taiwan • Also recorded on coarse sandy bottom of the rocky area in Port Shelter and Long Ke	• Fishbase • Sadovy Y, Cornish AS (2000) Reef Fishes of Hong Kong. Hong Kong University Press, Hong Kong • AFCD. Hong Kong Corals and Associated Wildlife. http://www.afcd.gov.hk/english/conservation/con_mar/con_mar_cor/con_mar_cor_hkcaml/corals_chor26.html • Ni IH and Kwok KY (1999) Marine fish fauna in Hong Kong waters. Zool. Stud. 38(2):130-152.
Heteropanope glabra	Pebble crab	• Prefers rocky areas with muddy substrates • Belongs to the Family Pilumnidae, whose members are extremely common in the Indo-Pacific • Found Northern and East Coast of Australia, and Indo-west Pacific Oceans including East Africa to Hong Kong and New Calendonia. Inhabit estuarine, mangrove, intertidal and mud substrate.	• LWH Tan and PKL Ng (1988) A Guide to Seashore Life. Published by the Singapore Science Centre. • PKL Ng (1987) The Indo-Pacific Pilumnidae II. A revision of the genus *Rhizopa* Stimpson, 1858, and the status of the Rhizopinae Stimpson, 1958 (Crustacea, Decapoda, Brachyura). Indo-Malayan Zoology 4: 69-111. • Australian Biological Resources Study. http://www.environment.gov.au/biodiversity/abrs/index.html
Psammogobius biocellatus	Sleepy goby	• Tropical fish inhabiting intertidal, estuaries, lagoons and coastal rivers. Common in mangrove and occasionally in freshwater stream. Found in Indo-Pacific region, East London, south Africa and Guam • Recorded in Sai Kung, Lantau and Northern New Territories • Listed as Lower Risk/Near Threatened by the IUCN Red List	• Fishbase • Lee LF, Lam KS, Ng KY, Chan KT and Young LC (2004) Field Guide to the Freshwater Fish of Hong Kong. Published by Friends of the Country Parks.

Scientific Name	Common Name	Description	Reference
Crytocentrus leptocephalus	Pink shrimpgoby	• Tropical, reef associated marine fish. Found on silty bottoms of coastal reefs and inner reef flats. Inhabits mangroves, large tidal pools or inner reef lagoons, on sand and rubble substrates • First recorded in Hong Kong in 2000, locally rare but was abundant in a shallow patch of fine sand within the Hoi Ha Wan Marine Park • Recorded by Ching et al. in 2006 in Sai Kung, within Port Shelter, namely Sharp Island, Shelter Island, Kau Sai Chau, Jin Island, Bluff Island and Trio Island	• Sadovy Y, Cornish AS (2000) Reef Fishes of Hong Kong. Hong Kong University Press, Hong Kong • Cornish AS (2000) The reef fish species of the Cape d'Aguilar marine reserve, Hoi Ha Wan marine park, Yan Chau Tong marine park and Ping Chau, Hong Kong. In: The Marine Flora and Fauna of Hong Kong and Southern China V (B Morton ed). Proceedings of the Tenth International Marine Biological Workshop: The Marine Flora and Fauna of Hong Kong and Southern China, Hong Kong, 6-26 April 1998. Hong Kong: Hong Kong University Press 2000 • Ching K, Situ A, To AWL (2006) A survey of reef fish diversity in Port Shelter. Porcupine! 34
Upogebia major	Mud shrimp	• Prefer to inhabit muddy sand • Abundant and common in Hong Kong • Listed as Endangered (EN) by the China Species Red List due to commercial harvest and urban development	• Morton B, Morton J (1983) The Sea Shore Ecology of Hong Kong. Hong Kong University Press, Hong Kong • Chan BKK, Caley KJ (2003) Hong Kong Field Guides IV: Sandy shores. Wanli Publishing.
Abroscelis (Cicindela) anchoralis	Beach tiger beetle	• Recorded in China, Taiwan, South Korea and Japan • Listed as "Threatened I (CR+EN) by the Ministry of the Environment, Japan due to urban development and over-collection • *Abroscelis (Cicindela) anchoralis* is a true littoral species, actively hunting other insects on beaches by flying or running and pouncing, but is not associated with seaweed. • This species has been reported at least since 1863, and de Rougemont reported this species as "Locally common"	• Morton B, Morton J (1983) The Sea Shore Ecology of Hong Kong. Hong Kong University Press, Hong Kong • Cheng L, Hill DS (1980) Marine insects of Hong Kong, pp. 173-183. In: Proceedings of the First International Marine Biological Workshop (Morton BS, Tseng CK eds). The marine fauna and flora of Hong Kong and southern China. Hong Kong University Press. • de Rougemont G (2000) Beetles in seaweed in Hong Kong. Porcupine! 21 • Red Data Book, Japan Integrated Biodiversity Information System, Biodiversity Centre of Japan, Ministry of the Environment, Japan (Last revised Aug 2006)
Phoronis australis (Phylum Phoronida)	Horseshoe worm	• A commensal phoronid worm with *Cerianthus filiformis.* The reddish-brown, unusual and rare worm *Phoronis australis* embeds in the leathery tube of the burrowing anemone *Cerianthus* thereby gaining protection.	• Morton B, Morton J (1983) The Sea Shore Ecology of Hong Kong. Hong Kong University Press, Hong Kong

Lung Mei is not a Mudflat

Lung Mei is a sandy shore predominantly covered by coarse sand and rubble with an increasing proportion of finer sand towards the lower intertidal / shallow subtidal zone (please refer to *Figures 8.4* & *8.8* and *pages 177* & *182* of the *EIA report*). A Particle Size Distribution (PSD) analysis was conducted as part of the additional extensive intertidal surveys to examine the particle size and the type of soft shore habitats to which the Lung Mei Beach belongs. Results of the PSD analysis showed that the mean particle diameter of sediment of all sites were generally regarded as coarse sand (i.e. 0.5 – 1 mm; see *Figures C5* and *C6* in *Annex C*), which suggests that the habitat of Lung Mei Beach should be regarded as an open sandy beach as defined by Wentworth (1922) [(1)], Folk and Ward (1957) [(2)] and Morton and Morton (1983) [(3)]. It is, therefore, inappropriate to identify Lung Mei as a 'mudflat' and mudflats comprise a large proportion of silt and clay (Morton and Morton 1983). No mudflat was found within the Study Area.

Sand Loss Issue

The hydrodynamic forces at the proposed project site that may be affected by the proposed development are littoral (longshore) processes caused by wind/wave action and tidal currents. The hydrodynamic study has shown that there is very limited potential for significant wave action at the proposed site – maximum normal wave heights are around 0.3m with a period of around 2.15 seconds [(4)], 1 in 100 year extreme wave heights are around 1.15m with a period of around 3.36 seconds [(5)]. This limited potential for littoral drift across the beach frontage is not sufficient to cause significant up-drift or down-drift effects on the adjacent coastline.

Furthermore, hydrodynamic analysis of the beach development has been carried out during the project feasibility stage. Site measurement of current velocities, and later verified by hydrodynamic modeling, indicated very light pre-construction currents in the areas of the proposed development of around 0.05m/s. Subsequent modeling to investigate changes in the current regime as a result of the beach development indicated that the development would cause no change to the existing flow patterns, with residual currents (i.e. change in current as a result of the development) being extremely low (0.005m/s). These results again demonstrate that the introduction of the proposed beach development will not result in sedimentation or erosion up-drift and down-drift of the beach. In addition, it is observed from the modelling results that the maximum bottom current velocities at Ting Kok SSSI would not be higher than 0.05 m/s regardless of the presence of the beach development. This indicates that Ting Kok SSSI situates at a low hydraulic energy area and the beach layout has insignificant impact on the water currents. As such,

(1) Wentworth CK (1922) A scale of grade and class terms for clastic sediments. *J Geology* 30: 377-392.
(2) Folk RL, Ward WC (1957) Brazos river bar: a study of significante of grain size parameters. *J Sediment Petrol* 27 : 3-26
(3) Morton B, Morton J (1983) The Seashore Ecology of Hong Kong, Hong Kong University Press
(4) 1st bullet point of Section 5 "Conclusions" in Appendix B "Wave and Sediment Modelling Report (September 2007) in Volume II of the EIA report.
(5) 4th bullet point of Section 5 "Conclusions" in Appendix B "Wave and Sediment Modelling Report (September 2007) in Volume II of the EIA report.

it is not expected that the sedimentation pattern will be significantly changed in the presence of the beach development.

Numerical model simulations were undertaken to assess the cross-shore stability of the beaches under extreme wave conditions. The sediment sizes used for the modeling were 0.2mm, 0.25mm, 0.3mm and 0.5mm, and as such they were chosen to help understand how grain size affects the changes to beach profile under storm condition. The cross-shore sediment transport modelling showed the existing beach profile to be stable during the storm events modeled with no significant changes predicted. Two typical design profiles were simulated, which could be applied to anywhere in the proposed bathing beach between the two groynes. In general, there is no significant problem with cross-shore sediment movement under storm wave conditions for the grain sizes modeled but there will be small adjustment of the beach profile as the beach adjust itself in equilibrium. Simulations looking at the long-shore transport of sediments have also been undertaken and the conclusion showed that the longshore transport rate to be low. However, the proposed groyns are designed to minimize any loss of sand from the beach due to long-shore sediment movement.

In a coastal location subject to dynamic coastal processes changes to the shape of the coastline brought about by the construction of structures or reclamation encroaching seaward would be expected to have an effect on the adjacent coastline, particularly if the coastline is subject to significant littoral (longshore) processes. This would also be expected to be the case if the coastline is subject to significant hydrodynamic forces arising from tidal currents. However, at Lung Mei and Ting Kok areas, as explained above, modeling has shown that the littoral and hydrodynamic coastal regime at the site is not significant and the proposed beach development will have negligible long-term effect on the existing coastal hydrodynamic regime. Therefore, in light of the above and data in the EIA report, we can conclude that the sand loss in the long term and the sustainability of the proposed beach sand would not be an issue for the beach development at Lung Mei, Tai Po.

ANNEX A

Data retrieved from Lung Mei Forum as of 21 October 2008

龍尾動物名錄：軟體動物（合共 45 種）
Gastropoda 腹足綱 (共 28 種)
Batillaria multiformis 多形灘棲螺
Batillaria zonalis 縱帶灘棲螺
Bursatella leachii 褐海兔
Cerithidea rhizophorarum 紅樹疑蟹守螺
Clithon faba 豆彩螺
Clithon oualaniensis 奧萊彩螺
Cronia margariticola 棱結螺
Cypraea caurica 清齒寶螺
Dendrodoris fumata 煙色枝鰓海牛
Dendrodoris nigra 黑枝鰓海牛
Discodoris sp. 盤海牛屬
Gymnodoris inornata 無飾裸海牛
Gymnodoris sp. 裸海牛屬
Hoplodoris sp. 海牛
Littoraria sinensis 中華濱螺
Lunella coronata 朝 朝鮮花冠小月螺
Monodonta labio 單齒螺
Nassarius festivus 秀麗織紋螺
Nerita albicilla 漁舟蜑螺
Nerita chamaeleon 色變蜑螺
Onchidium hongkongensis 石磺
Planaxis sulcatus 平軸螺
Polinices mammilla 白玉螺
Strombus urceus 鐵斑鳳凰螺
Strombus vittatus 竹筍鳳凰螺
Tectus pyramis 銀塔鐘螺
Thais clavigera 疣荔枝螺
Zeuxis sp. 織紋螺屬

Bivalvia 雙殼綱 (共 13 種)
Anomalocardia flexuosa 曲畸心蛤
Asaphis dichotoma 對生蒴蛤
Barbatia virescens 青蚶
Caecella chinensis 中華尖峰蛤
Grafrarium sp. 加夫蛤
Isognomon isognomum 鉗蛤
Meretrix meretrix 文蛤 (7/7/08)
Perna sp. 貽貝
Pinctada albina 馬氏朱母貝
Saccostrea cucullata 僧帽牡蠣
Scapharca cornea 角毛蚶
Septifer virgatus 條紋隔貽貝
Soletellina diphos 紫貝

Cephalopoda 頭足綱 (共 4 種)
Octopoda 八爪魚
Sepioteuthis lessoniana 白烏賊
Euprymna sp. 耳烏賊
Sepiida 烏賊

龍尾動物名錄：魚（合共 42 種）
Gobiidae 鰕虎科 (共 12 種)
Amblygobius phalaena 尾斑鈍鰕虎魚
Bathygobius fuscus 深鰕虎魚
Cryptocentrus leptocephalus 小頭絲鰕虎魚
Cryptocentrus strigilliceps 紋斑絲鰕虎魚
Glossogobius biocellatus 雙斑舌鰕虎魚
Lucigobius guttatus 竿鰕虎魚
Mugilogobius abei 阿部鯔鰕虎魚
Papillogobius reichei 乳突鰕虎魚（雷氏斑點鰕虎)
Periophthalmus modestus 廣東彈塗魚
Tridentiger bifasciatus 雙帶縞鰕虎魚
Tridentiger trigonocephalus 紋縞鰕虎魚
Valenciennea immaculate 無斑凡塘鱧

Others 其他 (共 28 種)
Ambassis buruensis 彎線雙邊魚
Apogon niger 黑天竺鯛，俗稱龍躉蘿，印度疏蘿
Apogonidae 天竺鯛科
Bothus pantherinus 豹紋鮃
Chelonodon patoca 雞泡魚
Dactylopus dactylopus 指腳沙鰍
Diplogrammus sp. 雙線魚(銜)
Engraulidae 鯷科
Gerres sp. 連米
Hypodytes rubripinnis 老虎魚
Hyporhamphus limbatus 緣下鱵魚（水針、青針）
Lactoria cornuta 牛角
Liachirus melanospilos 星點圓鱗鰨
Liza macrolepis 鱭魚
Mugil cephalus 烏頭
Omobranchus fasciolatoceps 斑頭肩鰓鰕
Omobranchus punctatus 斑點肩鰓鰕
Oreochromis niloticus 羅非魚(尼羅河口孵魚) (updated 12/8/08)
Pardachirus pavoninus 豹鰨
Petroscirtes breviceps 咬手仔
Rogadius asper 牛鰍
Sebastiscus marmoratus 石狗公
Sillago maculata 沙鑽
Synchiropus grinnelli 格氏連鰭魚(銜)
Syngnathidae 海龍 2 種
Terapon jarbua 釘公 (
Upeneus tragula 石鬚

尚未確認 (共 2 種)
其一：http://www.hkwildlife.net/viewth ... &extra=page%3D1
其二：疑似 Synchiropus kuiteri (Orange and Black

Dragonet) http://www.hkwildlife.net/viewth ... &extra=page%3D1

龍尾動物名錄：節肢動物 (合共 53 種)
Crabs 蟹 (共 32 種)
Charybdis acutifrons 尖額蟳
Charybdis japonica 日本蟳
Chasmagnathus convexus 隆背張口蟹
Crytopodia sp. 隱足蟹
Demania scaberrima 粗棘鱗斑蟹
Epixanthus frontalis 平額石扇蟹
Eriocheir japonicus 日本絨螯蟹
Etisus laevimanus 光掌滑面蟹
Eucrate crenata 隆線強蟹
Eucrate sp. 強蟹屬
Gaetice depressus 平背蜞
Hemigrapsus penicillatus 絨毛近方蟹
Heteropanope glabra 光滑異裝蟹
Ilyoplax sp. 泥蟹
Leptodius sp. 皺蟹屬
Leptodius exaratus 溝痕皺蟹/火紅皺蟹
Majidae sp. 蜘蛛蟹科
Metopograpsus frontalis 寬額大額蟹
Mictyris brevidactylus 短指和尚蟹
Nanosesarma minutum 小相手蟹
Ocypode ceratophthalmus 角眼沙蟹
Parasesarma pictum 斑點相手蟹/神妙擬相手蟹
Parasesarma plicatum 摺痕相手蟹/摺痕擬相手蟹
Perisesarma bidens 雙齒近相手蟹
Portunus iranjae 淺礁梭子蟹
Portunus pelagicus 遠海梭子蟹
Portunus trituberculatus 三疣梭子蟹
Scopimera sp. 股窗蟹屬
Thalamita crenata 鈍齒短槳蟹
Thalamita danae 少刺短槳蟹
Thalamita gloriensis 盛名短槳蟹
Tmethypocoelis ceratophora 角眼切腹蟹/角眼拜佛蟹

Shrimps 蝦 (共 12 種)
Alpheus brevicristatus 短脊槍蝦
Alpheus lobidens 無刺槍蝦(圓鎚槍蝦)
Alpheus spp. 鼓蝦
Upogebia major 大螻蛄蝦
Laomedia astacina 大指泥蝦
Lysmata vittata 薄荷蝦
Palaemon pacificus 太平洋長臂蝦
Palaemon serrifer 鋸齒長臂蝦
Penaeus latisulcatus 寬溝對蝦
Periclimenes sp. 岩蝦
未明蝦類 2 種

Hermit Crabs 寄居蟹 (共 3 種)
Clibanarius infraspinatus 下齒細螯寄居蟹
Diogenes spinifrons 棘刺活額寄居蟹
Pagurus dubius 長指寄居蟹/猶豫寄居蟹

Petrolisthes 瓷蟹 (共 3 種)
Petrolisthes japonicus 日本岩瓷蟹
Petrolisthes boscii 薄氏岩瓷蟹
Petrolisthes sp. 岩瓷蟹

Others 其他 (共 3 種)
Chthamalus sp. 小藤壺
Ligia exotica 海蟑螂
Amphipoda sp. 端足目生物

龍尾動物名錄：其他無脊椎動物 (合共 25 種)
Polychaeta 多毛綱 (共 4 種)
Tubeworm 管蟲
Dendronereides sp. 沙蠶
Ceratonereis sp. 角沙蠶
Capitella sp. 小頭蟲

Sea Anemones 海葵 (共 3 種)
Anthozoa Actiniaria 海葵
Anthozoa Ceriantharia 管海葵
Anthozoa Haliplanella lineata 海葵

Starfish 海星 (共 4 種)
Archaster typicus 飛白楓海星
Pentaceraster cumingi 紅海星
Protoreaster nodosus 朱古力海星
Luidia maculata 斑砂海星

Sea Urchins 海膽 (共 2 種)
Diadema setosum 長棘海膽
Salmacis sphaeroides 雜色角孔海膽

Sea Cucumbers 海參 (共 3 種)
Holothuria atra 黑海參
Unknown sp. 海參
Unknown sp. 海參

Echiurida 蜇綱 (共 1 種)
Ochetostoma erythrogrammon 絳體管口蜇

Turbellaria 扁蟲 (共 2 種)
Pseudobiceros hancockanus 橙邊黑扁蟲
1 Unknown sp. 不知名扁蟲

Sipuncula 星蟲 (共 1 種)
Sipunculidea Sipunculus nudus 星蟲

Sea Squirts 海鞘 (最少共 3 種)
Styela plicata 皺瘤海鞘

2+ Styela sp. 不知名海鞘

其他 (共 2 種)
Noctiluca dinoflagellates 夜光藻
Phoronis australis 南方帚蟲/馬蹄蟲

TOTAL = 165

Data were collected by the public of the forum in the following dates:

- 22nd December 2007
- 29th December 2007
- 1st January 2008
- 20th January 2008
- 11th February 2008
- 20th February 2008
- 23rd February 2008
- 16th March 2008
- 6th April 2008
- 7th April 2008
- 8th April 2008
- 4th May 2008
- 22nd June 2008
- 7th July 2008
- 14th July 2008

ANNEX B ADDITIONAL ACTIVE SEARCH SURVEYS

B.1 INTRODUCTION

As part of the objective of providing information to evaluate the overall ecological value of the habitat of Lung Mei Beach in the context of other similar habitats within Plover Cove and Tolo Harbour/Channel, additional active search surveys were carried out at Lung Mei and several locations within Plover Cove and Tolo Harbour/Channel of similar habitat characteristics of Lung Mei to examine the intertidal and shallow subtidal faunal diversity at these sites. These additional surveys are very different from the standard and recognized survey methodologies adopted in the EIA study and indeed similar EIA studies which would aim at addressing the requirements set out in the *EIAO Technical Memorandum* (*TM*) and the project-specific Study Brief.

The additional active search involved intensively searching for different types of species at Lung Mei and the reference sites. Such an intensive search with a primary purpose of compiling a comprehensive list of species is not a typical or formal ecological survey method for this kind of habitat, and may not be the optimal method to establish the general ecological profile of a sandy shore, e.g. increased disturbance to the habitats and the associated organisms. This kind of active search would serve primarily to generate a more complete species list of the surveyed sites or to confirm the presence or otherwise of a particular species. It is important to note that mobile marine fauna can move freely in and out of a site and the record of presence of a marine species does not mean that the site is important for the species concerned, i.e. the species may not utilise the site as a feeding, spawning or nursery ground and it is possible that the species is only passing through.

A desktop review of aerial photographs, scientific papers, journals and habitat maps presented in various EIA reports and other studies, was conducted to identify reference sites within Plover Cove and Tolo Harbour/Channel that have similar habitat characteristics to Lung Mei. Lung Mei is a sandy shore predominantly covered by coarse sand and rubble with an increasing proportion of finer sand towards the lower intertidal / shallow subtidal zone.

Site visits (during daytime when the tidal level is below 1 m above Chart Datum [mCD]) were undertaken at each of the potential reference sites from 20 February to 11 March 2008 to investigate and verify the habitat characteristics, nature of the substratum and surrounding environment, as well as the abiotic conditions (e.g. the expected level of exposure to wave action judging from openness of the site).

Based on the results of the site visits (refer to *Section B3*), **five** reference sites were identified for intensive active search for marine organisms inhabiting the intertidal and shallow subtidal regions as well as other associated habitat in close proximity (e.g. stream mouths). A site map showing the habitat characteristics (i.e. proportion of boulder shore, sandy shore or sand flat in different tidal zones), nature of the

(3) Hong Kong Observatory. Marine Meteorological Services: Tidal Information (Predicted Tide). http://www.hko.gov.hk/tide/eTPKtide.htm

substratum (i.e. mud, sand, cobbles and boulders) and surrounding environment (i.e. any mangrove, seagrass or freshwater stream in close proximity) was prepared for each of the five reference sites and Lung Mei.

B.2 ACTIVE SEARCH METHODOLOGY FOR MARINE FAUNA

Additional active search was undertaken at Lung Mei and the five reference sites during low tide (tidal level < 1 mCD whenever possible), once in the dry season (Feb/March 2008) and once in the wet season (May 2008) so as to produce an extensive list of marine fauna at the six study sites. It should be noted that extreme spring low tides (tidal level < 0.5 mCD) mainly occur during night-time in February and March (dry season), but during daytime from April to June (wet season) [(3)]. Therefore, the additional active search was conducted during night-time in the dry season and during daytime in the wet season.

The additional active search was conducted in the intertidal and shallow subtidal zones (0.5 m to 2 mCD). Direct observations and active searching of organisms were made in all major habitat / substrate types and in potential hiding places of organisms such as among litter / debris, inside holes / crevices and under cobbles / boulders within the site. Hand netting was employed to collect highly mobile organisms, i.e. shrimp, crab and fish. Burrowing organisms and infauna usually leave marks on the surface of the soft shore and the organisms can be caught by careful digging. All organisms encountered were identified to genus level, and to species level where possible. If a specimen could not be identified *in situ*, it would be collected for further taxonomic identification. All organisms collected were returned to their natural habitat after the identification works as far as possible. Specimens were handled with care and disturbance to marine fauna minimized. Head light and hand torch were used during the night-time surveys. The dry season surveys were conducted by 4 - 7 specialists, each spending 2 - 3 hours at a site, subject to the site and tidal conditions. The total man hours spent at each site was recorded. The effort spent on searching at each site was standardized to facilitate comparison of occurrence of species using the number per standard unit effort approach (i.e. number of man hours). A species list was compiled for Lung Mei and each of the five reference sites, using a variety of marine faunal identification guides in Hong Kong [(1)(2)(3)(4)(5)(6)(7)(8)].

This survey was undertaken by a team of specialists who have relevant experience in conducting marine ecological studies in Hong Kong, particularly with a focus on intertidal ecology. The qualifications of each team member are described in *Table B1*.

(1) Morton B, Morton J (1983) The Seashore Ecology of Hong Kong, Hong Kong University Press

(2) Williams GA (2003) Hong Kong Field Guides I: Rocky shores. Wanli Publishing.

(3) Chan BKK, Caley KJ (2003) Hong Kong Field Guides IV: Sandy shores. Wanli Publishing.

(4) Lee LF, Lam KS, Ng KY, Chan KT and Young LC (2004) Field Guides to the Freshwater Fish of Hong Kong. Friends of the Country Parks.

(5) AFCD. Hong Kong Marine Fish Data Base: http://www.hk-fish.net/eng/database/index.htm.

(6) Sadovy Y, Cornish AS (2000) Reef Fishes of Hong Kong. Hong Kong University Press.

(7) Fong CW, Lai CS, Lui TH (2005) Photographic Guide Series to Hong Kong (2): Estuarine Organisms – Mangrove, Mudflat and Seagrass Bed. Hong Kong Discovery Limited.

(8) Lai CS, Lui TH, Fong CW (2005). Photographic Guide Series to Hong Kong (9): Hard Shore Organisms – Rocky Shore and Boulder Shore. Hong Kong Discovery Limited.

Table B1 Study Team for the Additional Active Search

Team Member	Expertise	Responsibility
Dr Robin Kennish, BSc PhD (Intertidal Ecology)	Specialised in environmental management with extensive experience in the fields of ecological restoration, coastal ecology, marine ecology and field-based data collection.	Dr Kennish was responsible for overall direction of the work, design of scientific survey methods and technically reviewing all deliverables to ensure the findings are robust and defensible.
Terence Fong, BSc MPhil (Intertidal Ecology)	Specialised in coastal habitats including mangrove, seagrass, coral, mudflat and sandy shore, and familiar with intertidal fauna identification.	Mr Fong was the Survey Team Leader responsible for survey coordination, reference site selection, intensive active search, quantitative survey and intertidal fauna identification.
Dr Tom Glenwright, BSc PhD	Specialised in coastal ecology in Hong Kong with over 8 years experience.	Dr Glenwright was responsible for the quantitative surveys and data analysis.
Dr Jasmine Ng, BSc PhD (Intertidal Ecology)	Specialised in coastal ecology in Hong Kong	Dr Ng was responsible for the intensive active search, quantitative surveys, intertidal fauna identification and data analysis.
Jovy Tam, BSc MPhil	Specialised in coral and marine fish biology.	Mr Tam was responsible for the intensive active search, quantitative surveys and intertidal fish sampling.
Karen Lui, BSc MPhil	Specialised in soft-bottomed coastal habitats and familiar with intertidal fauna identification.	Ms Lui was responsible for reference site selection, intensive active search, quantitative survey, intertidal fauna identification and data analysis.
Vincent Lai, BSc MPhil (Intertidal Ecology)	Hong Kong's leading crustacean specialist	Mr Lai was responsible for the intensive active search, crustacean sampling and identification.
Chong Dee Hwa	Hong Kong's leading fish specialist	Mr Chong was responsible for the intensive active search, intertidal fish sampling and identification.
Prof Cai Lizhe	Benthic organism taxonomist familiar with Hong Kong benthos	Prof Cai was responsible for benthic organism identification works.

B.3 RESULTS AND DISCUSSION

B.3.1 Reference Site Selection

A total of 12 potential reference sites were selected following the initial desktop review, including Ting Kok East, Ting Kok, Shuen Wan, Sha Lan, Luen Yick San Tsuen, Lok Wo Sha (Starfish Bay), Nai Chung, Nai Chung East, Kei Ling Ha North, Wu Chau (Kei Ling Ha), Yung Shue O North and Lai Chi Chong (*Figure B1*). Site visits were then carried out to investigate and verify the habitat characteristics and other abiotic factors. The site descriptions are shown in *Table B2*.

Table B2 Habitat Characteristics of Lung Mei and the 12 Potential Reference Sites

Site Name	Shore Size (m)	Habitat Characteristics	Common Species	Wave Exposure Level	Remarks
Lung Mei (LM)	~ 400m	Boulders with sand and many small boulders with oyster, backshore with sand; some mangrove and stream noted	Typical sandy shore species	Sheltered	-
Ting Kok (TK)	> 1km	Sand/mud flat with few boulders, large mangrove area with small intertidal zone, stream from mangrove onto shore	Typical sandy and mangrove species (high number of gastropods and crab burrows)	Very sheltered	Muddier than LM
Ting Kok East (TKE)	> 1km	Sand flat with boulders (oysters), mangrove on upper shore, shoreline regularly indented, stream from mangrove onto shore	Typical sandy and mangrove species (including *Ulva* sp. and crab burrows)	Sheltered	Very similar to LM
Shuen Wan (SW)	~ 500m	Boulders with sand, many oysters, upper shore with mangrove, stream from village onto shore	Typical sandy shore species	Sheltered	Very similar to LM
Sha Lan (SL)	~ 400m	Mainly sandy with very small boulders, small mangrove and small stream	Typical sandy shore species dominated by clithons	Very sheltered	No similar boulders area to LM
Luen Yick San Tsuen (LYST)	~ 500m	Many boulders with oyster	Typical sandy shore species	Sheltered	More boulders than LM
Nai Chung (NC)	~ 600m	Boulders with sand, upper shore with mangrove, one large stream	Typical sandy shore species (dominating by ceriths)	Very sheltered	Backshore highly disturbed
Nai Chung East (NCE)	~ 700m	Many boulders	Typical sandy shore species	Sheltered	More boulders than LM
Lok Wo Sha (Starfish Bay) (LWS)	~ 800m	Sandy with very few boulders, with one stream	Typical sandy shore species (high number of sea hares, starfish and soldier crabs)	Sheltered	Boulder areas not similar to LM
Kei Ling Ha North (KLH)	> 1km	Sandy with some boulder areas (oyster), backshore with large mangrove and streams	Typical sandy shore species (dominated by ceriths; high number of polychaetes mounts)	Very sheltered	Boulder areas not similar to LM
Wu Chau (Kei Ling Ha) (WC)	~ 500m	Sandy with small rubbles and boulders (oyster), narrow intertidal zone, backshore with mangroves and small stream	Typical sandy shore species	Sheltered	Similar to LM
Yung Shue O North (YSON)	~ 700m	Boulders with sand, backshore with mangroves and streams	Typical sandy shore species	Sheltered	Boulder areas similar to LM
Lai Chi Chong (LCC)	~ 600m	Boulders with sand, backshore with mangroves and one large stream	Typical sandy shore species	Sheltered	Boulder areas similar to LM

Due to the similarity in their physical and biological characteristics in terms of habitat structure, nature of substratum and associated species, the following five reference sites were shortlisted and a site map was also prepared for each site (including Lung Mei) showing the nature of the substratum (*Figures B2-B7*).

Lung Mei

Located at the mouth of Plover Cove, Lung Mei comprises a mix of soft and hard shore habitats with freshwater runoff from Lo Tsz River and box culvert. A thin sandy beach can be found in the backshore with some boulders. The mid-intertidal zone consists of boulders and rubbles with sand bottom while the low-intertidal zone consists of mainly fine sand with boulders and rubbles. Based on direct observation during site visits, species commonly found are *Batillaria* spp., *Cerithidea* spp. and *Monodonta labio*.

Ting Kok East

Located next to Lung Mei and within Plover Cove, Ting Kok East is also comprised of a mix of soft and hard shores habitats with very gentle gradient. High- and mid-intertidal zones mainly consist of boulders and cobbles with sand bottom. A large area of mangroves and freshwater runoff from Shan Liu River can also be found in the area. Based on direct observation during site visits, species commonly found are *Batillaria* spp., *Cerithidea* spp. and *Monodonta labio*.

Shuen Wan

Located within Plover Cove and opposite to Ting Kok, Shuen Wan contains mixed soft and hard shore habitats with mainly fine sand in the mid- and low-intertidal zones, and contains fewer boulders, rubbles and cobbles. A large bedrock area can be found in the high intertidal zone. The shore also exhibits a gentle gradient and mangroves can be found along the backshore. There is freshwater runoff from San Tau Kok stream and Po Sam Pai stream. Based on direct observation during site visits, species commonly found are *Batillaria* spp., *Cerithidea* spp., *Clithon* spp. and *Monodonta labio*.

Wu Chau

Located within Tolo Harbour at Three Fathoms Cove, Wu Chau contains mixed soft and hard shore habitats with mainly fine sand in the mid and lower intertidal zones, and contains fewer boulders, rubbles and cobbles. A sand bar is observed during low tide adjoining Wu Chau and Tseng Tau. Freshwater runoff from natural streams and mangroves are found in the area. Based on direct observation during site visits, species commonly found are *Batillaria* spp., *Cerithidea* spp., *Clithon* spp. and *Monodonta labio*.

Yung Shue O North

Located within Tolo Harbour at Three Fathoms Cove and opposite to Wu Chau, Yung Shue O North contains mixed soft and hard shore habitats with freshwater runoff from one large natural stream and a larger area of mangroves. The mid-intertidal zone consists of boulders and rubble with a sand bed while the low-intertidal zone consists mainly of fine sand with boulders and rubbles. Based on direct observation during site visits, species commonly found are *Batillaria* spp., *Cerithidea* spp., *Nassarius festivus* and *Monodonta labio*.

Lai Chi Chong

Located within Tolo Channel and next to the Sai Kung West Country Park, Lai Chi Chong contains mixed soft and hard shore habitats with a gentle gradient in some areas. A thin sand beach can be found in the backshore with some boulders. The mid-intertidal zone consists of boulders and rubble with sand bottom while the low-intertidal zone consists mainly of fine sand with boulders and rubbles. Freshwater runoff from natural streams and mangroves are found in the area. Based on direct observation during site visits, species commonly found are *Batillaria* spp., *Cerithidea* spp., *Nassarius festivus* and *Monodonta labio*.

The habitat characteristics of Lung Mei and the five reference sites were summarised in *Table B3*.

Additional active search was then carried out to examine the intertidal faunal diversity at the habitat of Lung Mei Beach in the context of these five sites within Plover Cove and Tolo Harbour/Channel. These results are presented in the following section.

Table B3 Physical Conditions and Habitat Characteristics of Lung Mei and the Five Reference Sites.

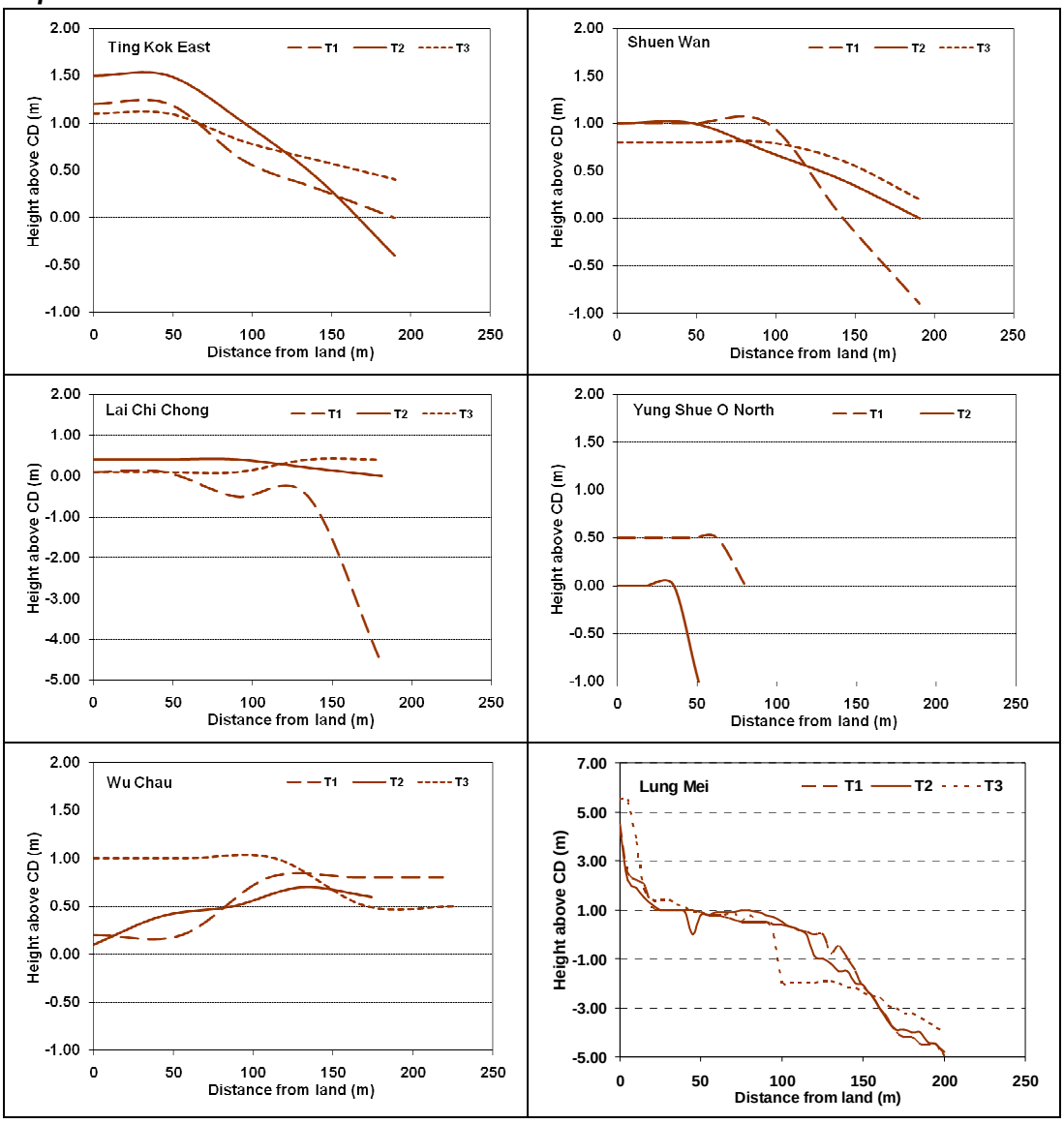
Characteristics	Lung Mei	Ting Kok East	Shuen Wan	Wu Chau	Yung Shue O North	Lai Chi Chong
Nature of the Substratum	With mixed substrate: *Higher intertidal zone –* 1. Thin sand beach, 2. Cobbles & boulders, and 3. Boulders and rubbles with soft bottom *Mid intertidal zone –* 1. Boulders and rubbles with soft bottom and 2. Soft bottom with scattered rubbles (~10%) *Lower intertidal zone –* 1. Fine sands	With mixed substrate: *Higher intertidal zone –* 1. Thin sand beach, 2. Cobbles & boulders, and 3. Boulders and rubbles with soft bottom *Mid intertidal zone –* 1. Boulders and rubbles with soft bottom and 2. Soft bottom with scattered rubbles (~5%) *Lower intertidal zone –* 1. Fine sands	With mixed substrate: *Higher intertidal zone –* 1. Bedrock, and 2. Boulders and rubbles with soft bottom *Mid intertidal zone –* 1. Boulders and rubbles with soft bottom and 2. Soft bottom with scattered rubbles (~5%) *Lower intertidal zone –* 1. Fine sands	With mixed substrate: *Higher intertidal zone –* 1. Cobbles & boulders, and 2. Boulders and rubbles with soft bottom *Mid intertidal zone –* 1. Boulders and rubbles with soft bottom and 2. Soft bottom with scattered rubbles (~10%) *Lower intertidal zone –* 1. Fine sands	With mixed substrate: *Higher intertidal zone –* 1. Cobbles & boulders, and 2. Boulders and rubbles with soft bottom *Mid intertidal zone –* 1. Boulders and rubbles with soft bottom and 2. Soft bottom with scattered rubbles (~10%) *Lower intertidal zone –* 1. Fine sands	With mixed substrate: *Higher intertidal zone –* 1. Thin sand beach, 2. Cobbles & boulders, and 3. Boulders and rubbles with soft bottom *Mid intertidal zone –* 1. Boulders and rubbles with soft bottom and 2. Soft bottom with scattered rubbles (~10%) *Lower intertidal zone –* 1. Fine sands
Habitat Characteristics	Mixed soft and hard shores habitats	Mixed soft and hard shores habitats, with very gentle gradient.	Mixed soft and hard shores habitats, but manly fine sands in mid and lower intertidal zones (with less boulder, rubbles and cobbles), with very gentle gradient	Mixed soft and hard shores habitats, but manly fine sands in mid and lower intertidal zones (with less boulder, rubbles and cobbles)	Mixed soft and hard shores habitats	Mixed soft and hard shores habitats, with gentle gradient in some location
Surrounding Environment	With freshwater runoff from Lo Tsz River and box culvert	With freshwater runoff from Shan Liu River With mangrove adjoining the site	With freshwater runoff from San Tau Kok stream and Po Sam Pai stream With mangrove adjoining the site	With freshwater runoff from natural streams in the surrounding areas With mangrove adjoining the site	With freshwater runoff from natural streams With mangrove adjoining the site	With freshwater runoff from natural streams With mangrove adjoining the site

Characteristics	Lung Mei	Ting Kok East	Shuen Wan	Wu Chau	Yung Shue O North	Lai Chi Chong
Openness of the Site	Located at the mouth of Plover Cove and open to Tolo Harbour	Located within Plover Cove and open to Tolo Harbour	Located within Plover Cove and open to Tolo Harbour	Located within the Tolo Harbour at Three Fathoms Cove and enclosed by sand bar adjoining Wu Chau and Tseng Tau during low tide	Located within the Tolo Harbour at Three Fathoms Cove	Open to Tolo Channel
Typical Faunal Compositions	Typical coastal species including soft and hard shore species	Generally the representative species recorded at Lung Mei can also be found at the site.	Generally the representative species recorded at Lung Mei can also be found at the site. But with more mangrove associated species	Generally the representative species recorded at Lung Mei can also be found at the site. But with more mangrove associated species	Generally the representative species recorded at Lung Mei can also be found at the site.	Generally the representative species recorded at Lung Mei can also be found at the site.
SITE COMPARISONS	**-**	**Ting Kok East shares very similar physical conditions and habitat characteristics compared with Lung Mei**	**Shuen Wan shares similar physical conditions and habitat characteristics compared with Lung Mei, but with the following major difference:** **1. Less boulders/ rubbles in mid intertidal zone**	**Wu Chau shares similar physical conditions and habitat characteristics compared with Lung Mei, but with the following major difference:** **1. Less boulders/ rubbles in mid intertidal zone** **2. Enclosed by sand bar adjoining Wu Chau and Tseng Tau during low tide**	**Yung Shue O North shares very similar physical conditions and habitat characteristics compared with Lung Mei**	**Lai Chi Chong shares very similar physical conditions and habitat characteristics compared with Lung Mei**

B.3.2 Shore Profile

The information on the shore profile at each site, aside from Lung Mei, was provided by CEDD's database and are presented in *Figure B8*. Ting Kok East and Shuen Wan exhibited similar shore profile, while Lai Chi Chong and Wu Chau were relatively flat. Although limited data were available for Yung Shue O North, a relatively steep, narrow shore profile was observed at this site. From visual observations during the survey, sand pits and tidal pools were observed in Lung Mei, Ting Kok East and Lai Chi Chong.

Figure B8. ***Beach profile (height – m above C.D.) of each site, except Lung Mei. T1- T3: vertical transects at each site (see Figures B2-B7 for locations). Data extracted from CEDD's database.***



B.3.3 Additional Active Search for Marine Fauna

A total of 24 man hours (a total two visits, 12 hours per visit per season; one visit per site per season) was spent at each site by 5 – 6 specialists to undertake the additional active search (*Table B4*).

Table B4 ***Summary Table of Number of Man Hours for the Additional Active Search***

Site Name	Survey Date	Tidal Range	Total Number of Survey Members	Survey Efforts (Man Hours)
Lung Mei	6 March 08	0.5 – 2mCD	6	12
	22 May 08	0.5 – 2mCD	6	12
Ting Kok East	5 March 08	0.5 – 2mCD	6	12
	21 May 08	0.5 – 2mCD	6	12
Shuen Wan	8 March 08	0.5 – 2mCD	6	12
	19 May 08	0.5 – 2mCD	3	6
	18 Jun 08	0.5 – 2mCD	2	6
Wu Chau	9 March 08	0.5 – 2mCD	6	12
	20 May 08	0.5 – 2mCD	3	6
	18 Jun 08	0.5 – 2mCD	2	6
Yung Shue O North	4 March 08	0.5 – 2mCD	6	12
	24 May 08	0.5 – 2mCD	6	12
Lai Chi Chong	7 March 08	0.5 – 2mCD	5	12
	23 May 08	0.5 – 2mCD	6	12

A total of 218 faunal species were found in the additional active search (*Table B7*), with the highest number recorded in Lai Chi Chong and the lowest recorded in Wu Chau (*Table B5*). Lung Mei ranked the fourth among the six sites (*Table B5*).

The Phylum Mollusca was the most dominant taxonomic group at all sites. TKE had the highest number of molluscan species while LCC has both the highest numbers of crustacean and fish species among all sites. Species lists compiled for Lung Mei and each of the five reference sites are presented in *Table B7*.

Table B5 ***Total Number of Marine Faunal Species in Major Taxon Groups recorded during the 24 man-hours Additional Active Search. LM: Lung Mei, TKE: Ting Kok East, SW: Shuen Wan, WC: Wu Chau, YSON: Yung Shue O North, LCC: Lai Chi Chong***

Phylum	LM	TKE	SW	WC	YSON	LCC
Annelida	3	3	3	4	3	3
Crustacea	33	37	42	30	45	49
Brachiopoda	0	1	0	0	0	0
Chordata	39	38	37	39	45	46
Cnidaria	2	2	2	3	2	3
Echinodermata	9	8	4	4	8	8
Echiura	2	2	2	2	2	2
Mollusca	50	56	47	48	50	55
Platyhelminthes	1	1	1	2	1	0
Total	**139**	**148**	**138**	**132**	**156**	**166**
Percentage of Total No. of species (i.e. 218 species)	**64 %**	**68 %**	**63 %**	**61 %**	**72 %**	**76 %**

51 % of the 139 species recorded during the additional active search in Lung Mei are subtidal species (refer to *Table B8*). These subtidal species include polychaetes, swimming crabs (e.g. *Portunus* spp. and *Thalamita* spp.), shrimps (e.g. *Penaeus* sp.), fish, cephalopods, some gastropods (e.g. *Strombus* sp. and *Tectus* sp.) and nudibranchs.

All species except two unidentifiable Holothuroidea species encountered at Lung Mei during the additional active search were also present in the five reference sites, thus the intertidal and shallow subtidal fauna at Lung Mei are considered to be common in coastal soft shore habitats of Hong Kong. These species at Lung Mei have also been previously reported in Hong Kong as shown in local and international literature (*Table B7*).

As is typical with a sandy shore the majority of the species recorded at Lung Mei during the active search (~ 90%) were highly mobile species which can move freely in and out of a site. This is reflected in the fact that the active search results indicated that none of the species recorded at Lung Mei were specific or endemic to the marine habitats at the site, and all of the species are considered to be typical sandy shore species and can be found in similar habitats in Hong Kong.

Species of Conservation Importance (Note 3, EIAO TM)

The conservation status of each species encountered at Lung Mei during the additional active search was checked against the criteria outlined in *Note 3* of *Appendix A* of *Annex 16* of *EIAO TM*. It is understood that only *Point 1* of *Note 3* is applicable to this Study and the species listed under the IUCN Red List [(1)] are discussed below. The associated criteria for evaluation in the IUCN Red List are presented in *Table B6*.

Table B6 IUCN Red List - Categories & Criteria (extracted for those applicable in this Study)

Category	Criteria
LOWER RISK NEAR THREATENED (LRNT)	A taxon is Lower Risk when it has been evaluated, does not satisfy the criteria for any of the categories Critically Endangered, Endangered or Vulnerable. Near Threatened Taxa are those which do not qualify for Conservation Dependent, but which are close to qualifying for Vulnerable.
LEAST CONCERN (LC)	A taxon is Least Concern when it has been evaluated against the criteria and does not qualify for Critically Endangered, Endangered, Vulnerable or Near Threatened. Widespread and abundant taxa are included in this category.
Data Deficient (DD)	A taxon is Data Deficient when there is inadequate information to make a direct, or indirect, assessment of its risk of extinction based on its distribution and/or population status. A taxon in this category may be well studied, and its biology well known, but appropriate data on abundance and/or distribution is lacking. Data Deficient is therefore not a category of threat or Lower Risk. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that threatened classification is appropriate. It is important to make positive use of whatever data are available. In many cases great care should be exercised in choosing between DD and threatened status. If the range of a taxon is suspected to be relatively circumscribed, if a considerable period of time has elapsed since the last record of the taxon, threatened status may well be justified.

Three of the fish species recorded at Lung Mei are listed in the IUCN Red List: Two-spot Goby *Psammogobius biocellatus* (listed as Lower Risk Near Threatened), Indo-Pacific Tropical Sand Goby *Favonigobius reichei* (listed as Lower Risk Near Threatened) and Grass Puffer *Takifugu niphobles* (listed as Data Deficient). All three fish species were, however, found in all five reference sites during the additional active search and confirmed to be common in the Tolo area (Plover Cove and Tolo Harbour/Channel) as well as Hong Kong (see detailed discussion below). Besides,

(1) The IUCN Species Survival Commission: 2008 IUCN Red List of Threatened Species. <http://www.iucnredlist.org>

all other species recorded at Lung Mei during the additional active search are common in Hong Kong.

Two-spot Goby *Psammogobius biocellatus* (formerly referred to as *Glossogobius biocellatus*) has been reported elsewhere from intertidal areas, estuaries, lagoons, coastal river mouth, mangroves and subtidal area of sand and rubble (down to 10 m deep) [(1) (2) (3)]. It is a highly mobile benthic fish species typically found in mangrove areas. It can move quickly and usually hides under rocks/ boulders once disturbed. It has a relative wide distribution, extending from Indo-Pacific (south to east) to Western Central Pacific (Guam) and South Africa. In Hong Kong, apart from its noted occurrence in the five reference sites, it has been reported in Sai Kung, Lantau and the Northern New Territories [(4)]. This species has high resilience with a minimum population doubling time of less than 15 months indicating relatively high recovery capability.

The Indo-Pacific Tropical Sand Goby *Favonigobius reichei* (formerly referred to as *Papillogobius reichei*) is found over sandy and muddy bottoms, often in weedy areas of the intertidal zone and also in mangroves, estuaries, lagoons and rivers. It is a highly mobile benthic fish species typically found in extensive sandy bottom and can move quickly once disturbed. It has a wide distribution in the Indo-West Pacific, extending from East Africa to the Philippines, north to Japan, south to northern Australia [(5)]. Apart from its noted occurrence in the five reference sites, it is commonly found in intertidal waters throughout Hong Kong, including numerous locations in northeast and southwest Lantau Island, eastern Hong Kong Island, and northeast and southwest New Territories [(6)]. This species has high resilience with a minimum population doubling time of less than 15 months indicating relatively high recovery capability.

Grass Puffer *Takifugu niphobles* is common and moderately abundant in Hong Kong [(8)], with wide distribution in the Northwest Pacific, including Japan and southern Korea to Viet Nam (Hong Kong; Japan; Taiwan, China; Viet Nam). It is a highly mobile pelagic fish species and moves quickly once disturbed. Apart from its noted occurrence in the five reference sites, it has been reported to inhabit shallow boulder

(1) Sadovy Y and Cornish AS (2000). Reef Fishes of Hong Kong Published by Hong Kong University Press.

(2) Lee LF, Lam KS, Ng KY, Chan KT and Young LC (2004) Field Guide to the Freshwater Fish of Hong Kong. Published by Friends of the Country Parks.

(3) Fishbase.

(4) Lee LF, Lam KS, Ng KY, Chan KT and Young LC (2004) Field Guide to the Freshwater Fish of Hong Kong. Published by Friends of the Country Parks.

(5) Fishbase.

(6) Lee LF, Lam KS, Ng KY, Chan KT and Young LC (2004) Field Guide to the Freshwater Fish of Hong Kong. Published by Friends of the Country Parks.

(8) Yu PHF (2002) The annual toxicological profiles of two common puffer fish, *Takifugu niphobles* (Jordan and Syder) and *Takifugu alboplumbeus* (Richardson), collected along Hong Kong Published by Hong Kong University Press.coastal waters. Toxicon, 40(3), 313-316.

shores, such as within the Cape d'Aguilar Marine Reserve and Tseung Kwan O [1][2]. This species has high resilience with a minimum population doubling time of less than 15 months indicating relatively high recovery capability.

Redigobius sp. was also recorded in Lung Mei, Ting Kok East, Yung Shue O North and Lai Chi Chong. Species under the genus *Redigobius* could not be identified to species level in the field because it is difficult to identify live specimens of this fish without causing distress, as fish identification often requires counting of fin spines and soft rays. For this particular reason it is thus also difficult to identify species of this genus from photographic records. As one of the main concerns of this Study was not to cause unnecessary distress to the organisms (*Section B.2*, see also *Clause 5.1.3, Annex 16, EIAO TM*), *Redigobius* sp. was not further identified. Species of this genus was also not identified to species level in Lee et al. (2004) [3] published by AFCD, who reported the occurrence of a *Redigobius* sp. in Sai Kung, northeastern New Territories and on Lantau Island. To-date, a total of 12 species of *Redigobius* have been reported in the literature [4], two of which (Bigmouth Goby *R. bikolanus* [JN1]and Checked Goby *R. dewaali*[JN2]) are listed under IUCN Red List (Lower Risk Near Threatened and Least Concern for *R. bikolanus* and *R. dewaali* respectively). These two species have not been previously reported in Hong Kong and given the bulk of both local and international literature on fish diversity of Hong Kong, it can be conservatively assumed that the species found in Lung Mei does not belong to either of these species.

Overall, although the Two-spot Goby *Psammogobius biocellatus* (listed as Lower Risk Near Threatened under IUCN Red List), Tropical Sand Goby *Favonigobius reichei* (listed as Lower Risk Near Threatened under IUCN Red List) and Grass Puffer *Takifugu niphobles* (listed as Data Deficient) found in Lung Mei are considered to be species of conservation importance according to the criteria stipulated in *Note 3* of *Appendix A* of *Annex 16* of *EIAO TM*, recent available information gathered from the additional active search indicated that these species are common in the Tolo area (Plover Cove and Tolo Harbour/Channel), as they were also found in the five reference sites, as well as in Hong Kong, as reported in both local and international literature. This indicates that these species are expected to be found not in the Project Site (200m long) alone but are also commonly found in other locations given the fact that extensive similar habitats are available in Hong Kong. The Project Site, therefore, does not appear to be an important, unique habitat for these species. It would therefore appear that habitats at the Lung Mei Beach are unlikely to be of high ecological importance to the above three fish species.

(1) Sadovy Y and Cornish AS (2000) Reef Fishes of Hong Kong Published by Hong Kong University Press.

(2) CEDD (2005) Further Development of Tseung Kwan O – Feasibility Study. EIA Report submitted to EPD.

(3) Lee LF, Lam KS, Ng KY, Chan KT and Young LC (2004) Field Guide to the Freshwater Fish of Hong Kong. Published by Friends of the Country Parks.

(4) Fishbase.

Table B7 ***A Full List of Faunal Species Recorded from Additional Active Search at Lung Mei and Five Reference Sites in March and May 2008. "1" indicates occurrence of the species. Refer to Table B6 for Categories of Conservation Status ("--" denotes species with no conservation status known to-date). "Y" represents presence of existing record of that species in Hong Kong/ China.***

No.	Phylum/Class/Order/Family	Species	Tidal Zone	LM	TKE	SW	WC	YSON	LCC	Conservation Importance (1)	Remarks	Recorded in HK/China?	Reference (3)
	Annelida												
	Polychaeta												
1	Nereididae	*Dendronereides* sp.	Subtidal	1	1	1	1	1	1	--	--	Y	a
2	Polynoidae	*Harmothoe imbricata*	Subtidal				1			--	--	Y	b, c
3	Sabellidae	*Sabellastarte indica*	Subtidal	1	1	1	1	1	1	--	--	Y	d
4	Serpulidae	*Hydroides* sp.	Subtidal	1	1	1	1	1	1	--	--	Y	c, d
	Crustacea												
	Amphipoda												
5	-	Amphipod sp.	Intertidal			1		1		--	--	--	--
	Anomura												
6	Chirostylidae	*Petrolisthes japonicus*	Intertidal	1	1	1	1	1	1	--	--	Y	c, d
	Maxillopoda												
7	Balanidae	*Balanus amphitrite*	Intertidal	1	1	1	1	1	1	--	--	Y	d
	Isopoda												
8	-	Isopod sp.	Intertidal						1	--	--	--	--
	Decapoda												
9	Parthenopidae	*Parthenope* sp.	Subtidal						1	--	--	Y	b
10	Calappidae	*Calappa philargius*	Subtidal						1	--	--	Y	b
11	Diogenidae	*Clibanarius infraspinatus*	Intertidal	1	1	1	1	1	1	--	--	Y	b
12	Diogenidae	*Diogenes spinifrons*	Intertidal	1	1	1	1	1	1	--	--	Y	e
13	Diogenidae	*Pagurus dubius*	Intertidal	1	1	1	1	1	1	--	--	Y	c
14	Goneplacidae	*Eucrate crenata*	Subtidal		1			1	1	--	--	Y	b
15	Grapsidae	*Clistocoeloma* sp.	Intertidal			1		1	1	--	--	Y	d
16	Grapsidae	*Eriocheir japonica*	Freshwater	1	1	1	1	1	1	--	--	Y	f
17	Grapsidae	*Gaetice depressus*	Intertidal	1	1	1	1	1	1	--	--	Y	g

No.	Phylum/Class/Order/Family	Species	Tidal Zone	LM	TKE	SW	WC	YSON	LCC	Conservation Importance [1]	Remarks	Recorded in HK/China?	Reference [3]
18	Grapsidae	*Hemigrapsus penicillatus*	Intertidal	1	1	1	1	1	1	--	--	Y	g
19	Grapsidae	*Metaplex* sp.	Intertidal			1			1	--	--	Y	h
20	Grapsidae	*Metopograpsus frontalis*	Intertidal	1	1	1	1	1	1	--	--	Y	d
21	Grapsidae	*Nanosesarma minutum*	Intertidal	1	1	1	1	1	1	--	--	Y	d
22	Grapsidae	*Neosarmatium smithi*	Intertidal					1		--	--	Y	h
23	Grapsidae	*Parasesarma pictum*	Intertidal	1	1	1	1	1	1	--	--	Y	g
24	Grapsidae	*Parasesarma plicata*	Intertidal	1						--	--	Y	g
25	Grapsidae	*Parasesarma tripectinis*	Intertidal			1		1	1	--	--	Y	i
26	Grapsidae	*Perisesarma bidens*	Intertidal		1	1				--	--	Y	h
27	Grapsidae	*Perisesarma fasciata*	Intertidal	1		1		1	1	--	--	Y	h
28	Grapsidae	*Sesarmops sinensis*	Intertidal			1				--	--	Y	g
29	Leucosiidae	*Philyra carinata*	Intertidal			1			1	--	--	Y	g
30	Diogenidae	*Clibanarius longitarsus*	Intertidal	1	1	1	1	1	1	--	--	Y	d
31	Menippidae	*Epixanthus frontalis*	Intertidal				1			--	--	Y	g
32	Mictyridae	*Mictyris brevidactylus*	Intertidal	1	1	1		1	1	--	--	Y	g
33	Ocypodidae	*Macrophthalmus convexus*	Intertidal					1	1	--	--	Y	d
34	Ocypodidae	*Scopimera globosa*	Intertidal	1	1	1		1	1	--	--	Y	d
35	Ocypodidae	*Tmethypocoelis ceratophora*	Intertidal	1	1	1		1	1	--	--	Y	g
36	Ocypodidae	*Uca borealis*	Intertidal					1	1	--	--	Y	g
37	Ocypodidae	*Uca lactea*	Intertidal					1		--	--	Y	g
38	Parthenopidae	*Cryptopodia fornicata*	Subtidal		1			1	1	--	--		
39	Parthenopidae	*Parthenope validus*	Subtidal					1	1	--	--	Y	b
40	Upogebiidae	*Upogebia major*	Intertidal	1	1	1	1	1	1	--	Listed as "Endangered" under the China Species Red List due to rapid population decline as a result of over-exploitation [3]	Y	d, g
41	Portunidae	*Charybdis hellerii*	Subtidal	1	1	1	1	1	1	--	--	Y	j
42	Portunidae	*Charybdis japonica*	Subtidal						1	--	--	Y	d
43	Portunidae	*Charybdis natator*	Subtidal			1				--	--	Y	b

No.	Phylum/Class/Order/Family	Species	Tidal Zone	LM	TKE	SW	WC	YSON	LCC	Conservation Importance [1]	Remarks	Recorded in HK/China?	Reference [3]
44	Portunidae	*Portunus pelagicus*	Subtidal	1	1	1	1	1	1	--	--	Y	g
45	Portunidae	*Portunus trituberculatus*	Subtidal	1	1	1	1		1	--	--	Y	d
46	Portunidae	*Thalamita crenata*	Subtidal	1	1	1	1	1	1	--	--	Y	g
47	Portunidae	*Thalamita danae*	Subtidal	1	1	1	1	1	1	--	--	Y	g
48	Portunidae	*Thalamita sima*	Subtidal			1	1	1	1	--	--	Y	b
49	Portunidae	*Thalamita spinimana*	Subtidal		1	1	1			--	--	Y	g
50	Xanthidae	*Actaea* sp.	Subtidal						1	--	--	Y	g
51	Xanthidae	*Chlorodiella nigra*	Subtidal						1	--	--	Y	d
52	Xanthidae	*Demania scaberrima*	Subtidal					1		--	--	Y	k
53	Xanthidae	*Etisus laevimanus*	Subtidal	1	1		1	1	1	--	--	Y	d
54	Xanthidae	*Heteropanope glabra*	Intertidal		1			1	1	--	--		
55	Xanthidae	*Leptodius* sp.	Subtidal	1	1	1		1	1	--	--	Y	l
56	Xanthidae	*Liomera venosa*	Subtidal						1	--	--	Y	d
57	Xanthidae	*Pilumnopeus eucratoides*	Subtidal		1			1	1	--	--		
58	Alpheidae	*Alpheus brevicristatus*	Intertidal	1	1	1	1	1	1	--	--	Y	b
59	Alpheidae	*Alpheus lobidens*	Intertidal	1	1	1	1	1	1	--	--	Y	m
60	Alpheidae	*Athanus* sp.	Unknown	1	1	1		1	1	--	--	Y	d
61	Palaemonidae	*Macrobrachium* sp.	Freshwater					1		--	--	Y	d
62	Palaemonidae	*Palaemon serrifer*	Subtidal	1	1	1	1	1	1	--	--	Y	b
63	Ligiidae	*Ligia exotica*	Intertidal	1	1	1	1	1	1	--	--	Y	c
64	Upogebiidae	*Laomedia astacina*	Intertidal	1	1		1			--	--	Y	d
65	Varunidae	*Chasmagnathus convexum*	Intertidal	1		1				--	--	Y	d
66	Penaeidae	*Metapenaeus* sp.	Subtidal				1			--	--	Y	d
67	Penaeidae	*Penaeus latisulcatus*	Subtidal	1	1	1	1	1	1	--	--	Y	d
68	Rhynchocinetidae	*Rhynchocinetes* sp.	Subtidal					1		--	--	Y	n
	Stomatopoda												
69	-	Stomatopod sp.	Subtidal		1	1	1			--	--	Y	o
70	Squillidae	*Erugosquilla woodmasoni*	Subtidal			1				--	--	Y	o
	Brachiopoda												
71	Lingulidae	*Lingula lingua*	Intertidal		1					--	--	Y	d

No.	Phylum/Class/Order/Family	Species	Tidal Zone	LM	TKE	SW	WC	YSON	LCC	Conservation Importance [1]	Remarks	Recorded in HK/China?	Reference [3]
	Chordata												
	Actinopterygii												
72	Ambassidae	*Ambassis gymnocephalus*	Subtidal	1	1	1	1	1	1	--	--	Y	p, q
73	Anguillidae	*Anguilla japonica*	Subtidal	1	1	1	1	1	1	--	--	Y	r
74	Apogonidae	*Apogon niger*	Subtidal	1			1	1	1	--	--	Y	s
75	Blenniidae	*Omobranchus fasciolatoceps*	Subtidal	1	1	1	1	1	1	--	--	Y	t
76	Blenniidae	*Petroscirtes breviceps*	Subtidal	1	1			1	1	--	--	Y	s
77	Callionymidae	*Callionymus enneactis*	Subtidal	1	1		1	1	1	--	--		q
78	Eleotridae	*Bostrychus sinensis*	Subtidal					1	1	--	--	Y	r
79	Eleotridae	*Eleotris acanthopoma*	Subtidal					1	1	--	--	Y	r
80	Eleotridae	*Eleotris oxycephala*	Subtidal					1	1	--	--	Y	r
81	Gerreidae	*Gerres oynea*	Subtidal	1	1	1	1	1	1	--	--	Y	r
82	Gobiidae	*Acentrogobius caninus*	Subtidal	1	1	1	1	1	1	--	--	Y	r
83	Gobiidae	*Amblygobius phalaena*	Subtidal	1	1	1	1	1	1	--	--	Y	r
84	Gobiidae	*Bathygobius fuscus*	Subtidal	1	1	1	1	1	1	--	--	Y	r
85	Gobiidae	*Drombus* sp.	Subtidal	1	1	1	1	1	1	--	--	Y	r
86	Gobiidae	*Psammogobius biocellatus*	Subtidal	1	1	1	1	1	1	LRNT	--	Y	r
87	Gobiidae	*Glossogobius giuris*	Subtidal					1	1	--	--	Y	r
88	Gobiidae	*Luciogobius guttatus*	Subtidal	1	1	1	1	1	1	--	--	Y	r
89	Gobiidae	*Mugilogobius abei*	Freshwater	1	1	1	1	1	1	--	--	Y	r
90	Gobiidae	*Favonigobius reichei*	Subtidal	1	1	1	1	1	1	LRNT	--	Y	r
91	Gobiidae	*Periophthalmus modestus*	Intertidal	1	1	1	1	1	1	--	--	Y	r
92	Gobiidae	*Pseudogobius javanicus*	Subtidal	1	1	1	1	1	1	--	--	Y	r
93	Gobiidae	*Redigobius* sp.	Subtidal	1	1			1	1	LRNT for *R. bikolanus* and LC for *R. dewaali*	--	Y	r
94	Gobiidae	*Rhinogobius giurinus*	Subtidal					1	1	--	--	Y	r
95	Gobiidae	*Tridentiger bifasciatus*	Subtidal	1	1	1	1	1	1	--	--	Y	q, u
96	Haemulidae	*Pomadasys maculatus*	Subtidal	1	1	1	1	1	1	--	--	Y	r
97	Hemiramphidae	*Strongylura strongylura*	Subtidal	1	1	1	1	1	1	--	--	Y	r

No.	Phylum/Class/Order/Family	Species	Tidal Zone	LM	TKE	SW	WC	YSON	LCC	Conservation Importance [1]	Remarks	Recorded in HK/China?	Reference [3]
98	Lutjanidae	*Lutjanus argentimaculatus*	Subtidal	1	1	1	1	1	1	--	--	Y	r
99	Lutjanidae	*Lutjanus russellii*	Subtidal	1	1	1	1	1	1	--	--	Y	r
100	Monacanthidae	Monacanthidae sp.	Subtidal				1	1	1	--	--	Y	s, t
101	Mugilidae	*Mugil cephalus*	Subtidal	1	1	1	1	1	1	--	--	Y	r
102	Mugillidae	*Liza subviridis*	Subtidal	1	1	1	1	1	1	--	--	Y	q, v
103	Mullidae	*Upeneus tragula*	Subtidal	1	1	1	1	1	1	--	--	Y	d, q
104	Platycephalidae	*Platycephalus* sp. A	Subtidal			1	1			--	--	Unknown	--
105	Platycephalidae	*Platycephalus* sp. B	Subtidal	1	1	1	1	1	1	--	--	Unknown	--
106	Scatophagidae	*Scatophagus argus*	Subtidal	1	1	1	1	1	1	--	--	Y	r
107	Sebastidae	Scorpion fish sp.	Subtidal	1	1	1	1	1	1	--	--	--	--
108	Sebastidae	*Sebastiscus marmoratus*	Subtidal	1	1	1	1	1	1	--	--	Y	s
109	Siganidae	*Siganus canaliculatus*	Subtidal	1	1	1	1	1	1	--	--	Y	r
110	Sillaginidae	*Sillago aeolus*	Subtidal	1	1	1	1	1	1	--	--	Y	q
111	Sillaginidae	*Sillago japonica*	Subtidal	1	1	1	1	1	1	--	--	Y	q, t
112	Sparidae	*Acanthopagrus latus*	Subtidal	1	1	1	1	1	1	--	--	Y	r
113	Syngnathidae	*Hippichthys* sp.	Subtidal			1				--	--	Y	t
114	Terapontidae	*Terapon jarbua*	Subtidal	1	1	1	1	1	1	--	--	Y	r
115	Tetraodontidae	*Takifugu niphobles*	Subtidal	1	1	1	1	1	1	DD	--	Y	q, t
116	Tetraodontidae	*Takifugu ocellatus*	Subtidal	1	1	1	1	1	1	--	--	Y	q, t
117	To be confirmed	Unknown sp. A	Subtidal						1	--	--	Unknown	--
	Tunicata												
118	Styelidae	*Styela plicata*	Subtidal	1	1	1	1	1	1	--	--	Y	c
119	Styelidae	*Styela* sp.	Subtidal	1	1	1	1	1	1	--	--	Y	d
	Cnidaria												
	Actiniaria												
120	-	Actiniaria sp.	Subtidal				1		1	--	--	Y	d
121	Haliplanellidae	*Haliplanella lineata*	Intertidal	1	1	1	1	1	1	--	--	Y	c
122	Cerianthidae	Cerianthidae sp.	Subtidal	1	1	1	1	1	1	--	--	Y	d

No.	Phylum/Class/Order/Family	Species	Tidal Zone	LM	TKE	SW	WC	YSON	LCC	Conservation Importance [1]	Remarks	Recorded in HK/China?	Reference [3]
	Echinodermata												
123	Temnopleuroidae	*Salmacis sphaeroides*	Subtidal	1	1	1	1	1	1	--	--	Y	d
	Asteroidea												
124	Archasteridae	*Archaster typicus*	Intertidal	1	1	1	1	1	1	--	--	Y	d, g
125	Luidiidae	*Luidia maculata*	Subtidal	1	1			1	1	--	--	Y	d
126	Oreasteridae	*Pentaceraster cumingi*	Subtidal	1	1					--	--		
127	Oreasteridae	*Protoreaster nodosus*	Subtidal	1	1			1		--	--		w
	Diadematoida												
128	Diadematidae	*Diadema setosum*	Subtidal	1	1	1	1	1	1	--	--	Y	d
	Ehinoidea												
129	Schizasteridae	*Holothuria atra*	Subtidal	1	1	1	1	1	1	--	--		w
	Holothuroidea												
130	-	Holothuroidea sp. A	Subtidal	1						--	--	Unknown	--
131	-	Holothuroidea sp. B	Subtidal	1						--	--	Unknown	--
132	-	Holothuroidea sp. C	Subtidal		1					--	--	Unknown	--
133	-	Holothuroidea sp. D	Subtidal						1	--	--	Unknown	--
134	Chiridotidae	*Polycheira rufescens*	Subtidal					1	1	--	--	Y	d
	Ophiuroidea												
135	-	Brittle star sp. A	Subtidal					1		--	--	Unknown	--
	Spatangoidea												
136	Loveniidae	*Lovenia elongata*	Subtidal						1	--	--	Y	d
	Echiura												
137	Echiuridae	*Ochetostoma erythrogrammon*	Intertidal	1	1	1	1	1	1	--	--	Y	g
138	Sipunculidae	*Sipunculus nudus*	Intertidal	1	1	1	1	1	1	--	--	Y	g
	Mollusca												

No.	Phylum/Class/Order/Family	Species	Tidal Zone	LM	TKE	SW	WC	YSON	LCC	Conservation Importance [1]	Remarks	Recorded in HK/China?	Reference [3]
	Bivalvia												
139	Arcidae	*Barbatia virescens*	Intertidal	1	1	1	1	1	1	--	--	Y	c, d
140	Arcidae	*Scapharca cornea*	Intertidal	1	1	1	1	1	1	--	--	Y	d
141	Corbulidae	*Solidicorbula erythrodon*	Intertidal	1	1					--	--	Y	x
142	Donacidae	*Donax faba*	Intertidal	1	1		1	1	1	--	--	Y	x
143	Isognomoidae	*Isognomon isognomum*	Intertidal	1	1	1	1	1	1	--	--	Y	c, d
144	Mesodesmatidae	*Caecella turgida*	Intertidal	1	1					--	--	Y	g
145	Mytidae	*Septifer virgatus*	Intertidal	1	1	1	1	1	1	--	--	Y	c, d
146	Mytilidae	*Modiolus* sp.	Intertidal		1	1	1			--	--	Y	d
147	Mytilidae	*Perna* sp.	Intertidal	1		1			1	--	--	Y	c, d
148	Ostreidae	*Saccostrea cucullata*	Intertidal	1	1	1	1	1	1	--	--	Y	c, d
149	Pinnidae	*Pinna muricata*	Subtidal		1		1			--	--	Y	d
150	Plicatulidae	*Plicatula plicata*	Intertidal	1	1			1	1	--	--	Y	d
151	Psammobiidae	*Asaphis dichotoma*	Intertidal	1	1		1	1	1	--	--	Y	d, g
152	Psammobiidae	*Soletellina diphos*	Intertidal	1	1					--	--	Y	d, g
153	Pterridae	*Pinctada* sp.	Intertidal		1	1	1	1	1	--	--	Y	d
154	Semelidae	*Ervilia* sp.	Intertidal		1					--	--	Y	d, g
155	Veneridae	*Anomalocardia squamosa*	Intertidal	1	1	1	1	1	1	--	--	Y	d, g
156	Veneridae	*Arcopagia inflata*	Intertidal		1	1	1	1	1	--	--	Y	d, g
157	Veneridae	*Atactodea striata*	Intertidal	1			1	1		--	--	Y	d, g
158	Veneridae	*Chama reflexa*	Intertidal		1		1		1	--	--	Y	d
159	Veneridae	*Circe scripta*	Intertidal		1	1	1	1	1	--	--	Y	d, g
160	Veneridae	*Dosinia japonica*	Intertidal	1	1	1	1	1	1	--	--	Y	d, g
161	Veneridae	*Gafrarium pectinatum*	Intertidal	1	1	1	1	1	1	--	--	Y	d, x
162	Veneridae	*Marcia hiantina*	Intertidal	1	1	1	1	1	1	--	--	Y	d, g
163	Veneridae	*Marcia japonica*	Intertidal		1	1			1	--	--	Y	d, x
164	Veneridae	*Marcia marmorata*	Intertidal			1				--	--	Y	d, x
165	Veneridae	*Meretrix meretrix*	Intertidal			1				--	--	Y	d, g
166	Veneridae	*Placamen tiara*	Intertidal			1				--	--	Y	d
167	Veneridae	*Tapes dorsatus*	Intertidal			1				--	--	Y	d
168	Veneridae	*Tapes philippinarum*	Intertidal	1	1	1	1	1	1	--	--	Y	d, x

No.	Phylum/Class/Order/Family	Species	Tidal Zone	LM	TKE	SW	WC	YSON	LCC	Conservation Importance [1]	Remarks	Recorded in HK/China?	Reference [3]
169	Veneridae	*Tapes variegatus*	Intertidal	1	1	1	1	1	1	--	--	Y	d, x
	Cephalopoda												
170	Loliginidae	*Sepioteuthis lessoniana*	Subtidal	1	1	1	1	1	1	--	--	Y	y
171	Octopoda	Octopus sp.	Subtidal	1	1	1	1	1	1	--	--	Y	d, y
172	Sepiidae	Sepiida sp.	Subtidal	1				1	1	--	--	Y	y
173	Sepiolidae	*Euprymna* sp.	Subtidal	1				1	1	--	--	Y	d, y
	Gastropoda												
174	Acmaeidae	*Patelloida pygmaea*	Intertidal	1	1	1	1		1	--	--	Y	c, d
175	Batillariidae	*Batillaria multiformis*	Intertidal	1	1		1	1		--	--	Y	d, g, x
176	Batillariidae	*Batillaria zonalis*	Intertidal	1	1	1	1	1	1	--	--	Y	d, g, x
177	Calyptraeidae	*Crepidula onyx*	Intertidal						1	--	--	Y	d
178	Axioidea	*Lepidozona coreanica*	Intertidal		1	1		1	1	--	--	Y	d
179	Cypraeidae	*Cypraea caurica*	Subtidal				1		1	--	--	Y	d
180	Fissurellidae	*Diodora reevei*	Intertidal		1	1				--	--	Y	d
181	Littorinidae	*Littoraria articulata*	Intertidal	1	1	1	1	1	1	--	--	Y	c, x
182	Lottoidae	*Nipponacmea concinna*	Intertidal	1	1	1	1	1	1	--	--	Y	c, d
183	Muricidae	*Cronia margariticola*	Subtidal	1	1		1	1	1	--	--	Y	d
184	Muricidae	*Morula musiva*	Intertidal		1					--	--	Y	c ,d
185	Muricidae	*Thais clavigera*	Intertidal	1	1	1	1	1	1	--	--	Y	c, d
186	Nassariidae	*Echinolittorina trochoides*	Intertidal						1	--	--	Y	c
187	Nassariidae	*Nassarius festivus*	Intertidal	1	1	1	1	1	1	--	--	Y	d, g, x
188	Nassariidae	*Nassarius nodiferus*	Intertidal						1	--	--	Y	d
189	Nassariidae	*Zeuxis* sp.	Subtidal	1	1					--	--	Y	b, z
190	Naticidae	*Polinices mammilla*	Intertidal	1	1	1	1	1	1	--	--	Y	A
191	Neritidae	*Clithon faba*	Intertidal	1	1	1	1	1	1	--	--	Y	d
192	Neritidae	*Clithon oualaniensis*	Intertidal	1	1	1	1	1	1	--	--	Y	d, g, x
193	Neritidae	*Nerita chamaeleon*	Intertidal	1	1	1	1	1	1	--	--	Y	d
194	Neritidae	*Nerita polita*	Intertidal			1		1	1	--	--	Y	d, x
195	Onchidiidae	*Onchidium hongkongensis*	Intertidal	1	1	1	1	1	1	--	--	Y	A
196	Onchidiidae	*Onchidium verruculatum*	Intertidal					1		--	--	Y	d
197	Patellidae	*Cellana grata*	Intertidal					1		--	--	Y	c, d

No.	Phylum/Class/Order/Family	Species	Tidal Zone	LM	TKE	SW	WC	YSON	LCC	Conservation Importance [1]	Remarks	Recorded in HK/China?	Reference [3]
198	Patellidae	*Siphonaria japonica*	Intertidal						1	--	--	Y	c, d
199	Planaxidae	*Planaxis sulcatus*	Intertidal	1	1	1	1	1	1	--	--	Y	c, d
200	Potamididae	*Cerithidea cingulata*	Intertidal	1	1	1	1	1	1	--	--	Y	d, g, x
201	Potamididae	*Cerithidea djadjariensis*	Intertidal	1	1	1	1	1	1	--	--	Y	d, g, x
202	Potamididae	*Cerithidea rhizophorarum*	Intertidal	1			1			--	--	Y	d, g, x
203	Potamididae	*Clypeomorus humilis*	Intertidal	1	1	1	1	1	1	--	--	Y	d
204	Potamididae	*Terebralia sulcata*	Intertidal				1	1		--	--	Y	d, x
205	Strombidae	*Strombus urceus*	Subtidal	1	1	1		1	1	--	--	Y	A
206	Trochidae	*Monodonta labio*	Intertidal	1	1	1	1	1	1	--	--	Y	c, d
207	Trochidae	*Tectus pyramis*	Subtidal	1	1					--	--	Y	d
208	Turbinidae	*Lunella coronata*	Intertidal	1	1	1	1	1	1	--	--	Y	c, d, g
	Nudibranchia												
209	Aplysiidae	*Bursatella leachii*	Subtidal	1	1			1	1	--	--	Y	d
210	Dendrodorididae	*Dendrodoris fumata*	Subtidal	1	1	1	1	1	1	--	--	Y	B
211	Dendrodorididae	*Dendrodoris nigra*	Subtidal	1	1	1	1	1	1	--	--	Y	B
212	Doridiidae	*Discodoris* sp. A	Subtidal				1			--	--	Y	d
213	Doridiidae	*Discodoris* sp. B	Subtidal	1	1	1	1	1	1	--	--	Y	d
214	Pleurobranchaeidae	*Philine orientalis*	Subtidal						1	--	--	Y	d
	Platyhelminthes												
	Turbellaria												
215	To be confirmed	Flatworm sp. A	Subtidal				1	1		--	--	Unknown	--
216	To be confirmed	Flatworm sp. B	Subtidal			1				--	--	Unknown	--
217	To be confirmed	Flatworm sp. C	Subtidal				1			--	--	Unknown	--
218	Pseudocerotidae	*Pseudobiceros hancockanus*	Subtidal	1	1					--	--	Y	n

(1) The IUCN Species Survival Commission: 2008 IUCN Red List of Threatened Species. <http://www.iucnredlist.org>

(2) References cited (see below table)

Code	Reference
a	Lui TH, Lee SY, Sadovy YJ (2002) Macrobenthos of a tidal impoundment at the Mai Po Marshes Nature Reserve, Hong Kong. Hydrobiologia 468:193-211
b	CityU Professional Services Limited (2002) Consultancy Study on Marine Benthic Communities in Hong Kong (Agreement No. CE 69/2000). Final Report submitted to AFCD
c	Williams GA (2003) Rocky Shores (Hong Kong Field Guides 1). The University of Hong Kong & Wan Li Book Co Ltd, Hong Kong
d	Morton B, Morton J (1983) The Sea Shore Ecology of Hong Kong. Hong Kong University Press, Hong Kong
e	Poon DYN, Chan BKK (2001) Shui Hau - Past and Present (in Porcupine! 22). Department of Ecology & Biodiversity, The University of Hong Kong
f	Yam R, Cheung SM, Chan BKK (2002) Explorations of two underground water channels in Hong Kong (in Porcupine! 27). Department of Ecology & Biodiversity, The University of Hong Kong
g	Shin PKS, Cheung SG (2005) A Study of Soft Shore Habitats in Hong Kong for Conservation and Education Purposes (ECF Project 23/99). Final Report
h	Kwok WPW, Tang WS (2005) An Introduction to Common Sesarmine Crabs of Hong Kong. Hong Kong Biodiversity Issue 9
i	Hong Kong Mangrove Fauna. AFCD Website <http://www.afcd.gov.hk/english/conservation/hkbiodiversity/speciesgroup/speciesgroup_mangrove.html#crabs>
j	Leung TY, Jones DS (2000) Barnacles (Cirripedia: Thoracica) from Epibenthic Substrata in the Shallow Offshore Waters of Hong Kong. In: The Marine Flora and Fauna of Hong Kong and Southern China V (ed Morton B): Proceedings of the Tenth International Marine Biological Workshop: The Marine Flora and Fauna of Hong Kong and Southern China, Hong Kong, 6-26 April 1998. Hong Kong University Press, Hong Kong
k	Blackmore G, Rainbow PS (2000) Epibenthic crab (Crustacea: Brachyura) assemblages of the southeastern waters of Hong Kong: the 1998 trawl programme. In: The Marine Flora and Fauna of Hong Kong and Southern China V (ed Morton B): Proceedings of the Tenth International Marine Biological Workshop: The Marine Flora and Fauna of Hong Kong and Southern China, Hong Kong, 6-26 April 1998. Hong Kong University Press, Hong Kong
l	Chan BKK, Poon DYN (2001) Sacculina in Hong Kong: A special form of barnacle you may never have noticed (in Porcupine! 23). Department of Ecology & Biodiversity, The University of Hong Kong
m	Markham JC (1982) Bopyrid isopods parasitic on decapod crustaceans in Hong Kong and Southern China. In: The Marine Flora and Fauna of Hong Kong and Southern China (eds Morton B & Tseng CK): Proceedings of the First International Marine Biological Workshop: The Marine Flora and Fauna of Hong Kong and Southern China, Hong Kong,1980. Hong Kong University Press, Hong Kong
n	Hong Kong Corals & the Associated Marine Life. AFCD Website <http://www.afcd.gov.hk/english/conservation/con_mar/con_mar_cor/con_mar_cor_hkcaml/corals_arth1.html>
o	Lui KKY, Ng JSS, Leung KMY (2007) Spatio-temporal variations in the diversity and abundance of commercially important Decapoda and Stomatopoda in subtropical Hong Kong waters. Estuarine, Coastal and Shelf Science 72:635-647
p	Ni IH, Kwok KW (1999) Marine fish fauna in Hong Kong waters. Zool. Stud. 38:130-152
q	Fishbase Website <http://www.fishbase.org>
r	Lee VLF, Lam SKS, Ng FKY, Chan TKT, Young MLC (2004) Field Guide to the Freshwater Fish of Hong Kong. Agriculture, Fisheries and Conservation Department, Hong Kong
s	Wilson KDP (2003) Artificial Reefs and Reef Fish in Hong Kong. Agriculture, Fisheries and Conservation Department, Hong Kong
t	Sadovy Y, Cornish AS (2000) Reef Fishes of Hong Kong. Hong Kong University Press, Hong Kong
u	Matern SA, Fleming KJ (1995) Invasion of a third Asian goby, Tridentiger bifasciatus, into California, Californian Fish and Game 81:71-76
v	Man SH & Hodgkiss IJ (1981) Hong Kong Freshwater Fishes. The Urban Council, Hong Kong
w	Liao Y (1998) The echinoderm fauna of Hainan Island. In: The Marine biology of the South China Sea III (ed Morton B): Proceedings of the Third International Conference on the Marine Biology of the South China Sea, Hong Kong, 28 October - 1 November 1996. Hong Kong University Press, Hong Kong
x	Leung KMY, Lui KKY, Wai TC, Cheung YT, Chan BKK, Yau C (2006) Study on the Soft Shore in Hoi Ha Wan Marine Park (Agreement No. AFCD/SQ/2/05). Final Report to AFCD
y	Voss GL, Williamson GR (1971) Cephalopods of Hong Kong. Hong Kong: Hong Kong Government Press. 138pp
z	Knudsen J (1997) Observations on the egg capsules and reproduction of fours species of Ovulidae and of Nassarius (Zeuxis) siquijorensis (A.Adams, 1852), (Gastropoda: Prosobranchia) from Hong

Code	Reference
	Kong. In: The Marine Flora and Fauna of Hong Kong and Southern China IV (ed Morton B): Proceedings of the Eighth International Marine Biological Workshop: the marine flora and fauna of Hong Kong and Southern China, Hong Kong, 2-20 April, 1995. Hong Kong University Press, Hong Kong
A	Yang JKY (2007) A Brief Account and Revision on Gastropods Found in Local Mangroves. Hong Kong Biodiversity Issue 14
B	Brodie GD, Willan RC, Collins JD (1997) Taxonomy and occurrence of Dendrodoris nigra and Dendrodoris fumata (Nudibranchia: Dendrodorididae) in the Indo-west Pacific Region. J Moll Stud 63:407-423
C	Yip KL, Lai CCP (2006) Halophila minor (Hydrocharitaceae), a new record with taxonomic notes of the Halophila from the Hong Kong Special Administrative Region, China. Acta Phytotaxonomica Sinica 44:457–463
D	Shin PKS (1998) Biodiversity of subtidal benthic polychaetes in Hong Kong coastal waters. In: The Marine biology of the South China Sea III (ed Morton B): Proceedings of the Third International Conference on the Marine Biology of the South China Sea, Hong Kong, 28 October - 1 November 1996. Hong Kong University Press, Hong Kong
E	Shin PKS, Thompson GB (1982) Spatial distribution of the infaunal benthos of Hong Kong. Mar Ecol Prog Ser 10:37-47

(3) The mud shrimp, *Upogebia major*, is evaluated as Endangered (EN) by the China Species Red List due to the rapid decline in their population abundance in China (current number dropped to 1% of the total global population). Such decline is mainly due to species exploitation (i.e. commercial harvest) and habitat destruction in China. *U. major* is abundant and common in sandy shore habitats of Hong Kong (see Reference g), and it is not a commercially important species in Hong Kong. Thus it is highly unlikely that populations of *U. major* in Hong Kong would experience similar decline and fate as in China. It was also recorded on all six study sites in this additional active search. As such, it is not considered as a species of conservation importance in the context discussed in this study.

ANNEX C ADDITIONAL QUANTITATIVE SURVEYS

C.1 INTRODUCTION

As part of the objective of providing information to evaluate the overall ecological value of the habitat of Lung Mei Beach in the context of other similar habitats within Plover Cove and Tolo Harbour/Channel, additional quantitative surveys which included intertidal transect, benthic core, crustacean and fish surveys were conducted to examine the diversity and abundance of intertidal and shallow subtidal fauna at Lung Mei and the three selected reference sites in order to provide detailed ecological information of these sites.

Following the active search surveys (*Annex B*) Lung Mei and three of the reference sites (Ting Kok East, Yung Shue O North and Lai Chi Chong) were subject to in depth detailed quantitative intertidal surveys. The three reference sites showed higher similarity with Lung Mei, on the basis of the nature of the substratum (ie boulder and cobbles dominating), habitat characteristics (ie mixture of soft and hard shore habitats), surrounding environment (ie with freshwater output in the close vicinity) and faunal composition. The three shortlisted sites (Ting Kok East, Yung Shue O North and Lai Chi Chong) were therefore chosen for detailed quantitative surveys. The eliminated sites (ie Wu Chau and Shuen Wan) were not selected mainly due to the relatively lower amount of cobbles and boulders.

Additional quantitative surveys were conducted at Lung Mei and the three shortlisted reference sites during daytime low tide (tidal level < 1 mCD). The design of the additional quantitative surveys followed internationally adopted survey techniques [(1) (2) (3) (4) (5)] and aimed to provide detailed ecological information of these sites. The additional quantitative intertidal surveys are much more extensive than those normally required in the baseline survey of an ecological impact assessment. In particular, the intertidal fish survey is beyond the scope and requirements of a typical ecological impact assessment conducted as part of an EIA study. Results of the additional quantitative surveys have been used to evaluate the overall ecological value of the habitat of Lung Mei Beach. The surveys included:

- Intertidal transect survey (including quadrat and semi-quantitative crustacean survey);
- Intertidal benthic core survey; and
- Intertidal fish survey.

(1) Baker, J.M. and Wolff, W.J. (1987) Biological Surveys of Estuaries and Coasts. Cambridge University Press, UK.

(2) Fong, C W. (1998) Some aspects of ecology of seagrass *Zostera japonica* in Hong Kong. MPhil. Thesis, Department of Ecology and Biodiversity, University of Hong Kong.

(3) Tai K.K. (2005) Ecological status and conservation value of soft shore habitats in Hong Kong. MPhil. Thesis, Department of Biology and Chemistry, City University of Hong Kong.

(4) Shin P.K.S. and Cheung S.G. (2005) A Study of Soft Shore Habitats in Hong Kong for Conservation and Education Purposes. City University of Hong Kong. ECF Project 23/99.

(5) Davies J (2001) Marine Monitoring Handbook. UK Marine SACs Project

This survey was undertaken by a team of specialists who have relevant experience in the marine ecology of Hong Kong, particularly with a focus on intertidal ecology. Details of their qualifications and responsibility are presented in *Annex B2*. References used for faunal identification are also detailed in *Annex B2*.

C.2 METHODOLOGY

C.2.1 Intertidal Transect Survey

At each site, three 30 m horizontal transects parallel to the shoreline were haphazardly deployed at each of the three shore heights (0.5 mCD, 1 mCD and 1.5 mCD, in which most of the intertidal fauna inhabit) within the intertidal and shallow subtidal zones. The detailed site maps prepared during the reference site selection were used for planning the location of the quantitative surveys, and local tide tables (predicted tides of Tai Po Kau) (1) and cross-staff were used to assess the shore heights at the sites and transects were placed accordingly. Five 25 cm × 25 cm quadrats were placed randomly along each transect to assess the abundance and diversity of marine fauna (Σn = 3 shore heights x 3 transects x 5 quadrats = 45). The location of the transects at each site is shown in *Figures C1 to C4.*

For each quadrat, a photo record was first obtained. The abundance of sessile fauna (e.g. barnacles and rock oysters; expressed as percentage cover of the quadrat) was estimated using a double-strung, 25 cm × 25 cm quadrat. Surface sediment (volume = 25 cm × 25 cm × 5 cm = 3125 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 were identified to species level where possible and their abundance recorded to calculate epifaunal abundance per quadrat.

All crustacean species observed and their relative abundance along the transects were also recorded during the surveys (semi-quantitative crustacean survey).

The intertidal surveys were conducted once in the dry season (22 to 26 March 2008) and once in the wet season (2 to 5 June 2008).

C.2.2 Benthic Core Survey

Benthic core sediments were collected from three shore heights (0.5 mCD, 1 mCD and 1.5 mCD) within each site, using a plastic core sampler (10 cm diameter × 20 cm depth). A total of seven core samples were taken randomly along the transects at each shore height; two of these samples were analyzed for particle size distribution (PSD; Σn = 3 shore heights × 2 core samples = 6), whereas the remaining five samples were used to examine the diversity and abundance of infauna (organisms > 0.5 mm living in the sediments; Σn = 3 shore heights × 5 core samples = 15). Core sediments for infaunal investigation were wet-sieved *in situ* (mesh size of 0.5 mm), and all materials retained on the sieve following gentle rinsing with seawater (to remove all fine materials) were carefully placed into pre-labelled thick triple-bagged ziplock plastic bags. A 4 % solution of seawater-buffered formalin containing rose bengal

(1) Hong Kong Observatory. Marine Meteorological Services: Tidal Information (Predicted Tide). http://www.hko.gov.hk/tide/eTPKtide.htm

was then added to the bag to ensure tissue preservation. Samples were sealed in plastic containers for transport to the taxonomy laboratory for sorting and identification. The benthic core surveys were conducted once in the dry season (22 to 26 March 2008) and once in the wet season (2 to 5 June 2008).

C.2.3 Intertidal Fish Survey

The intertidal fish surveys involved field observation, photographic survey and drop-trapping during low tide (tidal level < 1.5 mCD) to examine the diversity and abundance of fish species in the sites. Whilst field observation and photographic surveys provided qualitative information, drop-trapping allows quantitative data to be collected [(1)] and is particularly useful when the target fish species are highly mobile. Drop-traps are essentially bottomless boxes that are dropped onto the sediment surface to enclose a known area, and are suitable for repetitive sampling of small fishes and/ or highly mobile marine organisms such as shrimp and crabs in shallow water. The trap (1 m^2) is deployed by two persons, each holding the trap above the water surface when the water depth is ~ 0.2 - 0.5 m. It is then dropped onto the sediment surface to capture intertidal fish. All captured intertidal fish were then recorded. At least 10 drop-net samples were collected at each site, and samples were collected within similar shore height among sites. All enclosed captured intertidal fish were identified to species level whenever possible and returned to their natural habitats after identification works as far as possible.

C.2.4 Laboratory Analysis

Taxonomic Identification of Infauna

Taxonomic identification and enumeration of infauna collected from the quantitative surveys was performed using stereo-dissecting microscope. Specimens were generally identified to species level where possible (or the lowest practicable taxon), and abundance of each species/taxa recorded. The meticulous sampling procedure employed can minimise fragmentation of organisms. Should breakage of soft-bodied organisms occur, only the anterior portions of fragments were counted.

Particle Size Distribution (PSD)

The objective of the Particle Size Distribution (PSD) analysis is to examine the type of soft shore habitats to which the Lung Mei Beach belongs. Sediment particle size of benthic core samples was determined using the wet-sieving method with a series of standard sieves (mesh size of 0.063, 0.125, 0.25, 0.5, 1.0 and 2.0 mm). For the determination of PSD, seven particle size classes were used (<0.063, 0.063, 0.125, 0.25, 0.5, 1.0 and 2.0 mm). Calculation and description of mean particle size (ϕ value) was performed according to *Table C1* [(2)].

(1) Davies J (2001) Marine Monitoring Handbook. UK Marine SACs Project

(2) Folk RL, Ward WC (1957) Brazos river bar : a study of significante of grain size parameters. *J Sediment Petrol* 27 : 3-26

Table C1 ***Statistical formulae used in the calculations of particle size parameters, the size scale and its description adopted from Folk & Ward (1957). ϕ_x is particle diameter, in phi units, at the cumulative percentile value of x***

Particle size		Sediment type	Descriptive term
ϕ = -log$_2$(size in mm)	mm		
-1 – -2	2 – 4	Gravel	Very fine
0 – -1	1– 2	Sand	Very coarse
1 – 0	0.500 – 1		Coarse
2 – 1	0.250 – 0.050		Medium
3 – 2	0.125 – 0.250		Fine
4 – 3	0.063 – 0.125		Very fine
5 – 4	0.031 – 0.063	Silt	Very coarse
6 – 5	0.016 – 0.031		Coarse
> 6	< 0.016		Medium

Mean Particle Diameter
$M_Z = \frac{\phi_{16} + \phi_{50} + \phi_{84}}{3}$

C.2.5 Statistical Analysis for Quantitative Survey Data

Mobile epifaunal and infauna assemblage structures at Lung Mei and the three shortlisted reference sites were evaluated in terms of abundance, number of species (S), Shannon-Weiner diversity (H') [(1)] and Pielou's Evenness (J) [(2)]. Both parametric, univariate analyses and multivariate analyses were used to evaluate patterns of spatial and seasonal variation in faunal assemblage structures at the four sites. Firstly, two-way analysis of variance (ANOVA) tests were performed to determine whether the above biological indices varied between seasons (2 levels, dry vs wet; fixed and orthogonal) and site (4 levels, Lung Mei and the three shortlisted reference sites; fixed and orthogonal), separately for mobile epifauna and infauna.

Secondly, similarities in faunal assemblage structure at the four sites were visualised by non-metric multidimensional scaling (nMDS) using Bray-Curtis similarity matrices converted from normalised, square-root transformed percentage cover and abundance data of epifauna and infauna (PRIMER v6) [(3)]. Differences in faunal assemblage patterns were compared between seasons and sites by two-way crossed, permutation-based analysis of similarity (ANOSIM), and were explored using the similarity percentage routine (SIMPER) to identify the species/taxon which contributed most to season/site separations.

Patterns of spatial and seasonal variation in sediment characteristics were examined by parametric, univariate analyses. Separate two-way ANOVA tests were performed to

(1) Shannon, Weaver (1963) The Mathematical Theory of Communication University of Illinois Press, Urbana. 125 pp.

(2) Pielou EC (1969) An Introduction to Mathematical Ecology. Wiley-Interscience, New York. 286 pp.

(3) Clarke, Gorley (2006) PRIMER v6.1.5: User Manual/Tutorial. Plymouth Marine Laboratory, Plymouth.

determine whether the mean particle diameter differed significantly between seasons and site, using the same ANOVA model for testing biological indices.

Prior to analysis using ANOVA tests, all raw data were tested for homogeneity of variance using Levene's test. Should the data show heterogeneity of variance which could not be stabilised by transformation, ANOVA was performed on untransformed data but results were interpreted with a more conservative significant level of $\alpha = 0.01$ to reduce the possibility of committing a Type I error [(1)]. For factors with significant differences detected, Tukey's tests were used for multiple comparisons. All ANOVA tests were performed using SPSS for Windows (v14, SPSS Inc.).

C.3 RESULTS AND DISCUSSION

C.3.1 Particle Size Distribution

The mean particle diameter (in phi) of sediment of all sites were generally regarded as coarse sand (i.e. 0.5 – 1 mm; *Figures C5 & C6*), which suggests that the habitat of Lung Mei Beach should be regarded as an open sandy beach as defined by Wentworth (1922) [(2)], Folk and Ward (1957) [(3)] and Morton and Morton (1983) [(4)]. Mean particle diameter appeared to decrease from high to low shore in both season (*Figure C5*), and significant difference in mean particle diameter among sites was not detected (*Table C2*). Mean particle diameter was significantly larger in the wet season than in dry season (*Table C2*). Sediment characteristics on soft shores are highly dynamic in nature, and it has been reported that over 20 biotic and abiotic factors are important in controlling sediment erodibility and hence particle size [(5)]. It is therefore considered that the temporal heterogeneity in particle size distribution observed on these sites may be the result of complex interactions among these spatially- and temporally-variable factors, and the specific factors contributing to the observed temporal pattern remain unclear and would warrant further investigation.

(1) Underwood AJ (1997) Experiments in ecology: their logical design and interpretation using analysis of variance. Cambridge University Press, Cambridge

(2) Wentworth CK (1922) A scale of grade and class terms for clastic sediments. *J Geology* 30: 377-392.

(3) Folk RL, Ward WC (1957) Brazos river bar : a study of significante of grain size parameters. *J Sediment Petrol* 27 : 3-26

(4) Morton B, Morton J (1983) The Seashore Ecology of Hong Kong, Hong Kong University Press

(5) Tolhurst TJ, Defew EC, Perkins RG, Sharples A, Paterson DM (2006) The effects of tidally driven temporal variation on measuring intertidal cohesive sediment erosion threshold. Aquatic Ecology 40:521-53

Figure C5 ***Mean particle size (phi + SD) of sediment samples at 0.5 – 1.5m above C.D. at each Site in dry and wet seasons.***

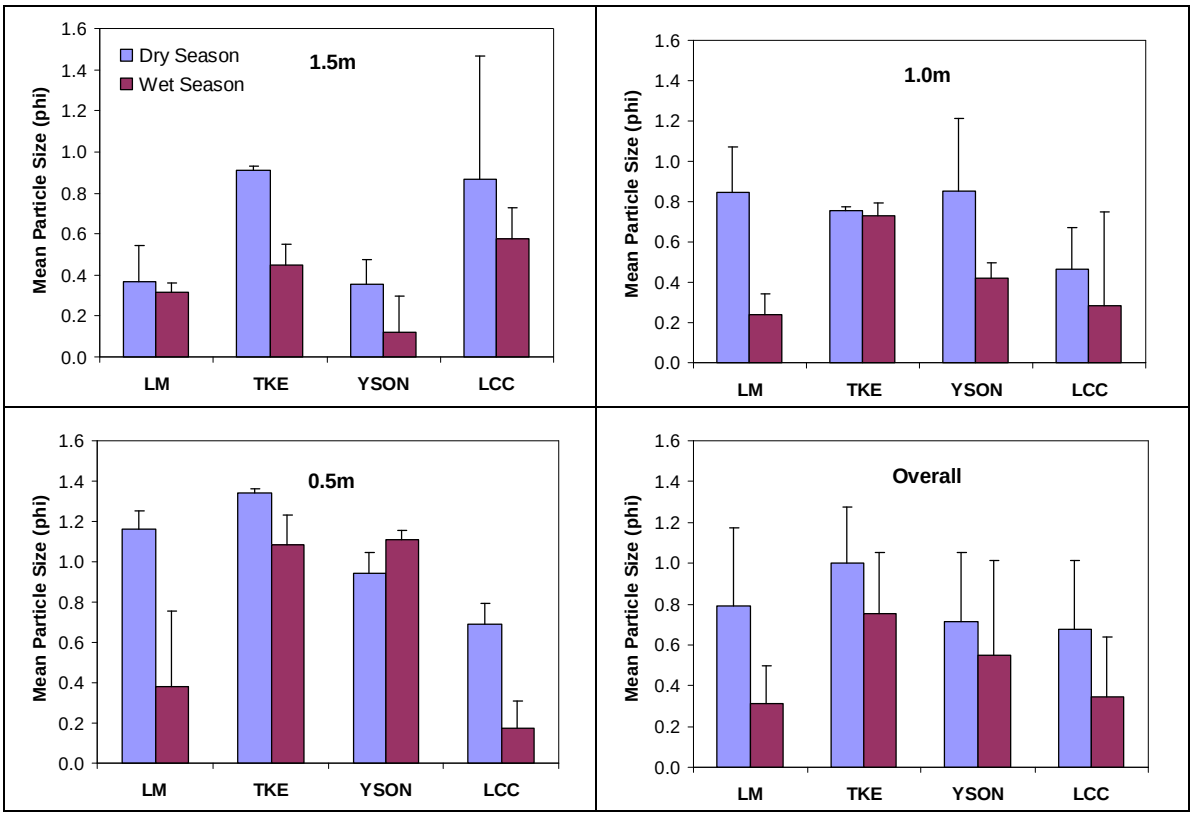
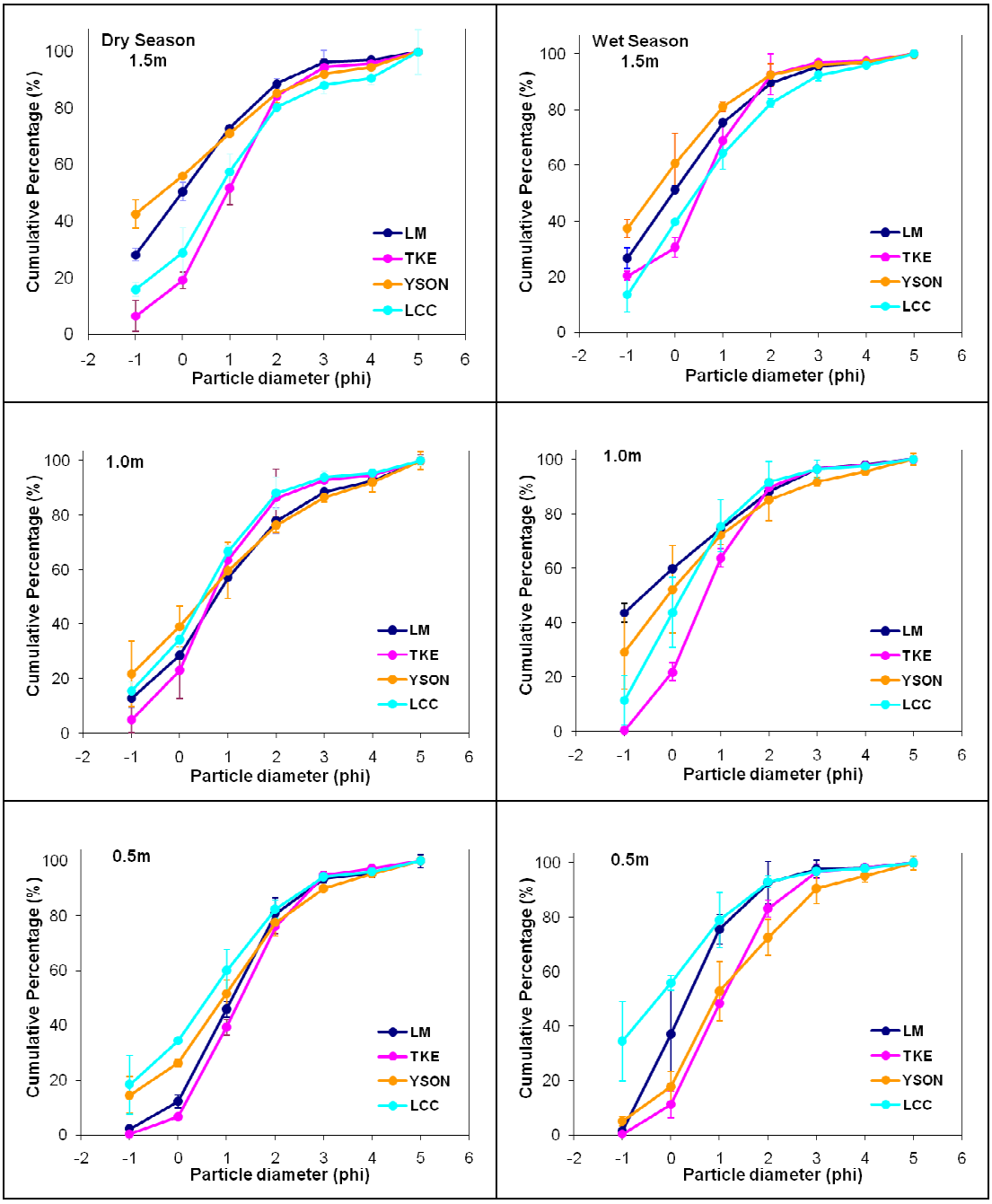
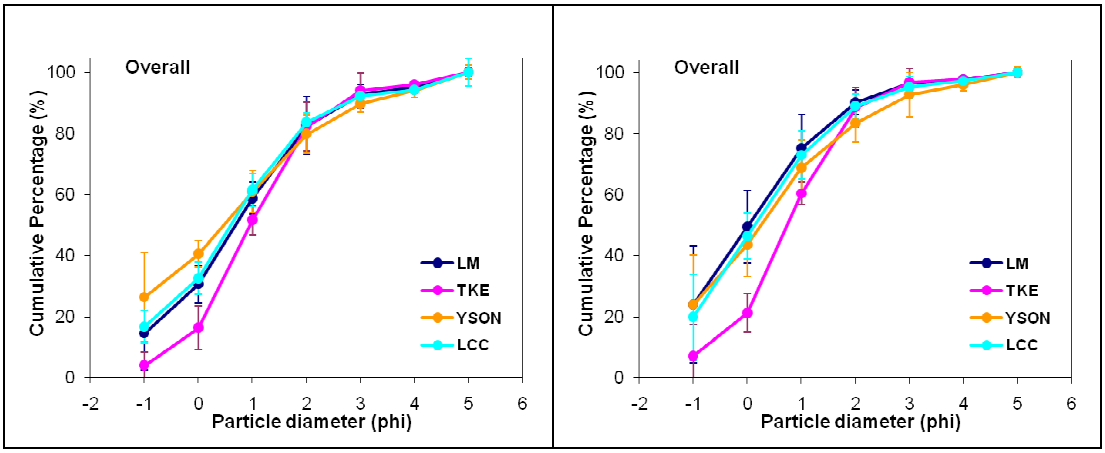


Table C2 ***Comparison of mean particle diameter among Sites in both seasons (dry vs. wet) using two-way ANOVA. Data were homogeneous (Levene's test: p>0.05) and not transformed. Significant differences are given in bold type.***

Source	*df*	MS	F	*p*
Season	1	0.082	5.160	**0.029**
Site	3	0.029	1.851	0.153
Season x Site	3	0.003	0.201	0.895
Error	40	0.016		

Figure C6 ***Cumulative percentage curves of the particle size distribution of sediment samples at 0.5 – 1.5m above C.D. in dry and wet seasons at each Site.***





C.3.2 Intertidal Transect Survey

Species Composition of Epifauna

A total of 96 marine epifaunal species were recorded in the intertidal transect surveys (results obtained from 360 quadrats, Σn = 3 shore heights x 3 transects x 5 quadrats x 4 sites x 2 seasons) (*Table C3*). In both seasons, the most dominant taxonomic group was the Mollusca, followed by Annelida and Crustacea (*Tables C4 & C5*). LCC had the highest number of species from these three groups and also had the highest total number of species among all sites. The lowest total number of species recorded was at LM during both dry and wet seasons. The most abundant species recorded at the four sites were the gastropods *Cerithidea* spp. and *Batillaria* spp., which is similar to the result presented in the EIA Report.

Among the major phyla, mean abundance of epifauna was higher in Mollusca, Annelida and Crustacea than in other phyla (*Figure C7*). In both seasons, LCC had the highest mean abundance of annelids, YSON had the highest mean abundance of crustaceans and TKE had the highest mean abundance of molluscs.

(1) Wai TC, Ng JSS, Leung KMY, Williams GA, Dudgeon D (2008) The source and fate of organic matter and the significance of detrital pathways in a tropical coastal ecosystem. Limnology and Oceanography 53(4): 1479-1492

Table C5 ***A Full List of Species of Epifauna Recorded from Quantitative Transect Survey at Lung Mei and Three Reference Sites. "1" indicates occurrence of the species. LM: Lung Mei (90 quadrats), TKE: Ting Kok East (90 quadrats), YSON: Yung Shue O North (90 quadrats), LCC: Lai Chi Chong (90 quadrats). Refer to Table B6 for Categories of Conservation Status ("--" denotes species with no conservation status known to-date). "Y" represents presence of existing record of that species in Hong Kong/ China. For footnotes see Table B7.***

No.	Phylum/ Class/ Family	Genus/Species	LM	TK	LCC	YSON	Conservation Importance (1)	Remarks	Recorded in HK/China?	Reference (2)
	Annelida									
	Polychaeta									
1	Amphinomidae	*Amphinome rostrata*	0	0	1	0	--	--	Y	D
2	Amphinomidae	*Chloeia fusca*	0	1	1	0	--	--	Y	E
3	Amphinomidae	*Chloeia parva*	0	0	1	0	--	--	Y	b
4	Capitellidae	*Capitella capitata*	0	1	0	0	--	--	Y	b
5	Capitellidae	*Dasybranchus caducus*	1	1	1	1	--	--		
6	Capitellidae	*Mediomastus californiensis*	1	1	1	0	--	--	Y	b
7	Capitellidae	*Notomastus latericens*	1	1	1	1	--	--	Y	b
8	Cirratulidae	*Cirratulus* sp.	0	0	1	1	--	--	Y	b
9	Eunicidae	*Marphysa depressa*	1	1	1	0	--	--	Y	b
10	Eunicidae	*Marphysa sanguinea*	0	1	0	0	--	--	Y	b
11	Glyceridae	*Glycera chirori*	0	0	1	0	--	--	Y	b
12	Glyceridae	*Glycera onomichiensis*	0	1	1	1	--	--	Y	b
13	Goniadidae	*Goniada* sp.	0	1	0	0	--	--	Y	b
14	Hesionidae	*Micropodarke dubia*	0	0	1	0	--	--	Y	b
15	Lumbrineridae	*Lumbrineris* sp.	0	0	0	1	--	--	Y	b
16	Nephtyidae	*Nephtys oligobranchia*	0	1	1	1	--	--	Y	b
17	Nereidae	*Ceratonereis erythraeensis*	1	1	1	1	--	--	Y	b
18	Nereidae	*Nereis* sp.	0	0	0	1	--	--	Y	b
19	Opheliidae	*Armandia intermedia*	0	1	1	0	--	--	Y	b
20	Orbiniidae	*Naineris laevigata*	0	1	0	0	--	--	Y	b
21	Orbiniidae	*Scoloplos* sp.	0	1	1	0	--	--	Y	b
22	Paraonidae	*Paraonis* sp.	0	1	1	0	--	--	Y	b
23	Poecilochaetidae	*Poecilochaetus serpens*	0	1	0	0	--	--	Y	b
24	Polynoidae	*Lepidonotus squamatus*	0	1	0	0	--	--	Y	b
25	Spionidae	*Aonides oxycephala*	0	0	1	0	--	--	Y	g

No.	Phylum/ Class/ Family	Genus/Species	LM	TK	LCC	YSON	Conservation Importance [1]	Remarks	Recorded in HK/China?	Reference [2]
26	Spionidae	*Paraprionospio pinnata*	0	0	0	0	--	--	Y	E
27	Spionidae	*Prionospio* sp.	0	1	0	0	--	--	Y	b
28	Spionidae	*Scolelepis squamata*	0	1	1	0	--	--	Y	b
29	Syllidae	*Ancistrosyllis breviceps*	0	1	0	0	--	--	Y	D
30	Syllidae	*Pionosyllis malmgreni*	0	0	1	0	--	--		
31	Terebellidae	*Lanice* sp.	0	0	1	0	--	--	Y	d
32	Terebellidae	*Loimia medusa*	0	0	1	0	--	--	Y	b
	Cnidaria									
	Anthozoa									
33	Haliplanellidae	*Haliplanella lineata*	1	0	1	1	--	--	Y	c
	Crustacea									
	Decapoda									
34	Parthenopidae	*Parthenope* sp.	0	0	1	1	--	--	Y	b
35	Alpheidae	*Alpheus* sp.A	0	1	1	1	--	--	Y	b
36	Alpheidae	*Alpheus* sp.B	1	1	1	1	--	--	Y	b
37	Diogenidae/ Paguridae	Hermit crabs	1	1	1	1	--	--	Y	d, x
38	Goneplacidae	*Hexapus granuliferus*	0	0	0	1	--	--	Y	b
39	Grapsidae	*Gaetice depressus*	1	1	1	1	--	--	Y	g
40	Grapsidae	*Metopograpsus frontalis*	0	1	1	1	--	--	Y	d
41	Ocypodidae	*Scopimera globosa*	1	1	1	1	--	--	Y	d
42	Upogebiidae	*Upogebia major*	0	0	1	0	--	Listed as "Endangered" under the China Species Red List due to rapid population decline as a result of over-exploitation [3]	Y	d, g
43	Portunidae	*Portunus pelagicus*	1	0	0	1	--	--	Y	g
44	Portunidae	*Thalamita crenata*	0	1	1	0	--	--	Y	g
45	Sesarmidae	*Nanosesarma* sp.	0	0	1	0	--	--	Y	d
46	Unknown	Unidentified crab sp. A	0	0	0	1	Unknown	--	Unknown	--
47	Unknown	Unidentified crab sp. B	0	0	1	0	Unknown	--	Unknown	--
	Echinodermata									

No.	Phylum/ Class/ Family	Genus/Species	LM	TK	LCC	YSON	Conservation Importance [1]	Remarks	Recorded in HK/China?	Reference [2]
	Asteroidea									
48	Archasteridae	*Archaster typicus*	1	1	0	1	--	--	Y	d, g
49	Schizasteridae	*Schizaster lacunosus*	0	0	1	0	--	--	Y	d
50	Temnopleuridae	Unidentified juvenile sea urchin	0	0	1	0	Unknown	--	--	--
51	Holothuriidae	*Holothuria leucospilota*	0	0	0	1	--	--	Y	d
	Echiura									
52	Echiuridae	*Listriolobus brevirostris*	0	0	0	1	--	--	Y	b
53	Echiuridae	*Ochetostoma erythrogrammon*	1	1	1	1	--	--	Y	g
	Mollusca									
	Bivalvia									
54	Arcidae	*Scapharca cornea*	1	1	1	1	--	--	Y	d
55	Cardiidae	*Fulvia* sp.	1	1	0	1	--	--	Y	d, x
56	Corbulidae	*Solidicorbula erythrodon*	0	0	0	1	--	--	Y	x
57	Donacidae	*Donax* sp.	1	1	1	1	--	--	Y	x
58	Mesodesmatidae	*Caecella turgida*	0	1	1	0	--	--	Y	g
59	Mytilidae	*Perna* sp.	0	0	1	0	--	--	Y	c, d
60	Psammobiidae	*Asaphis dichotoma*	1	1	1	1	--	--	Y	d, g
61	Tellinidae	*Arcopagia inflata*	1	0	0	0	--	--	Y	d, g
62	Veneridae	*Anomalocardia squamosa*	1	1	1	1	--	--	Y	d, g
63	Veneridae	*Circe scripta*	0	0	1	1	--	--	Y	d, g
64	Veneridae	*Dosinia japonica*	0	1	1	1	--	--	Y	d, g
65	Veneridae	*Gafrarium pectinatum*	1	1	1	1	--	--	Y	d, x
66	Veneridae	*Marcia hiantina*	0	0	0	1	--	--	Y	d, g
67	Veneridae	*Marcia japonica*	0	0	1	0	--	--	Y	d, x
68	Veneridae	*Placamen tiara*	0	1	0	1	--	--	Y	d
69	Veneridae	*Tapes philippinarum*	1	1	1	1	--	--	Y	d, x
70	Veneridae	*Tapes variegatus*	1	1	1	1	--	--	Y	d, x
	Gastropoda									
71	Acmaeidae	*Patelloida pygmaea*	1	0	1	0	--	--	Y	c, d
72	Batillariidae	*Batillaria multiformis*	1	1	0	0	--	--	Y	d, g, x
73	Batillariidae	*Batillaria zonalis*	1	1	1	1	--	--	Y	d, g, x

No.	Phylum/ Class/ Family	Genus/Species	LM	TK	LCC	YSON	Conservation Importance [1]	Remarks	Recorded in HK/China?	Reference [2]
74	Cerithiidae	*Clypeomorus humilis*	1	1	1	1	--	--	Y	d
75	Cypraeidae	*Cypraea caurica*	0	0	1	0	--	--	Y	d
76	Littorinidae	*Littoraria articulata*	1	1	1	1	--	--	Y	c, x
77	Muricidae	*Cronia margariticola*	0	1	1	1	--	--	Y	d
78	Nassariidae	*Nassarius festivus*	1	1	1	1	--	--	Y	d, g, x
79	Naticidae	*Polinices tumidus*	1	1	1	1	--	--	Y	d
80	Neritidae	*Clithon oualaniensis*	1	1	1	1	--	--	Y	d, g, x
81	Neritidae	*Nerita chamaeleon*	1	1	1	1	--	--	Y	d
82	Neritidae	*Nerita polita*	1	1	1	1	--	--	Y	d, x
83	Onchidiidae	*Onchidium* sp.	0	1	1	0	--	--	Y	d
84	Patellidae	Unidentified juvenile limpet	1	0	0	0	--	--	--	--
85	Planaxidae	*Planaxis sulcatus*	1	1	1	1	--	--	Y	c, d
86	Potamididae	*Cerithidea cingulata*	1	1	1	1	--	--	Y	d, g, x
87	Potamididae	*Cerithidea djadjariensis*	1	1	1	1	--	--	Y	d, g, x
88	Potamididae	*Cerithidea rhizophorarum*	1	0	0	0	--	--	Y	d, g, x
89	Strombidae	*Strombus* sp.	0	0	1	0	--	--	Y	d
90	Trochoidae	*Monodonta labio*	1	1	1	1	--	--	Y	c, d
91	Turbinidae	*Lunella coronata*	1	1	1	1	--	--	Y	c, d, g
	Polyplacophora									
92	Chitonidae	Unidentified juvenile chiton	0	1	0	0	Unknown	--	--	--
	Nemertinea									
	Anopla									
93	Cerebratulidae	*Cerebratulina* sp.	1	0	1	0	--	--	Y	b
	Plathyhelminthes									
	Turbellaria									
94	Leptoplanidae	*Leptoplana* sp.	0	0	1	0	--	--		
	Sipuncula									
	Phascoloplosomatidea									
95	Phascoloplosomatidae	*Phascolosoma* sp.	1	1	1	0	--	--	Y	b
	Sipunculidea									

No.	Phylum/ Class/ Family	Genus/Species	LM	TK	LCC	YSON	Conservation Importance [1]	Remarks	Recorded in HK/China?	Reference [2]
96	Sipunculidae	*Sipunculus nudus*	1	1	0	1	--	--	Y	g

(1) The IUCN Species Survival Commission: 2008 IUCN Red List of Threatened Species. <http://www.iucnredlist.org>

(2) References cited (see Table B7)

(3) The mud shrimp, *Upogebia major*, is evaluated as Endangered (EN) by the China Species Red List due to the rapid decline in their population abundance in China (current number dropped to 1% of the total global population). Such decline is mainly due to species exploitation (i.e. commercial harvest) and habitat destruction in China. *U. major* is abundant and common in sandy shore habitats of Hong Kong (see Reference g in Table B7), and it is not a commercially important species in Hong Kong. Thus it is highly unlikely that populations of *U. major* in Hong Kong would experience similar decline and fate as in China. It was also recorded on all six study sites in this additional active search. As such, it is not considered as a species of conservation importance in the context discussed in this study.

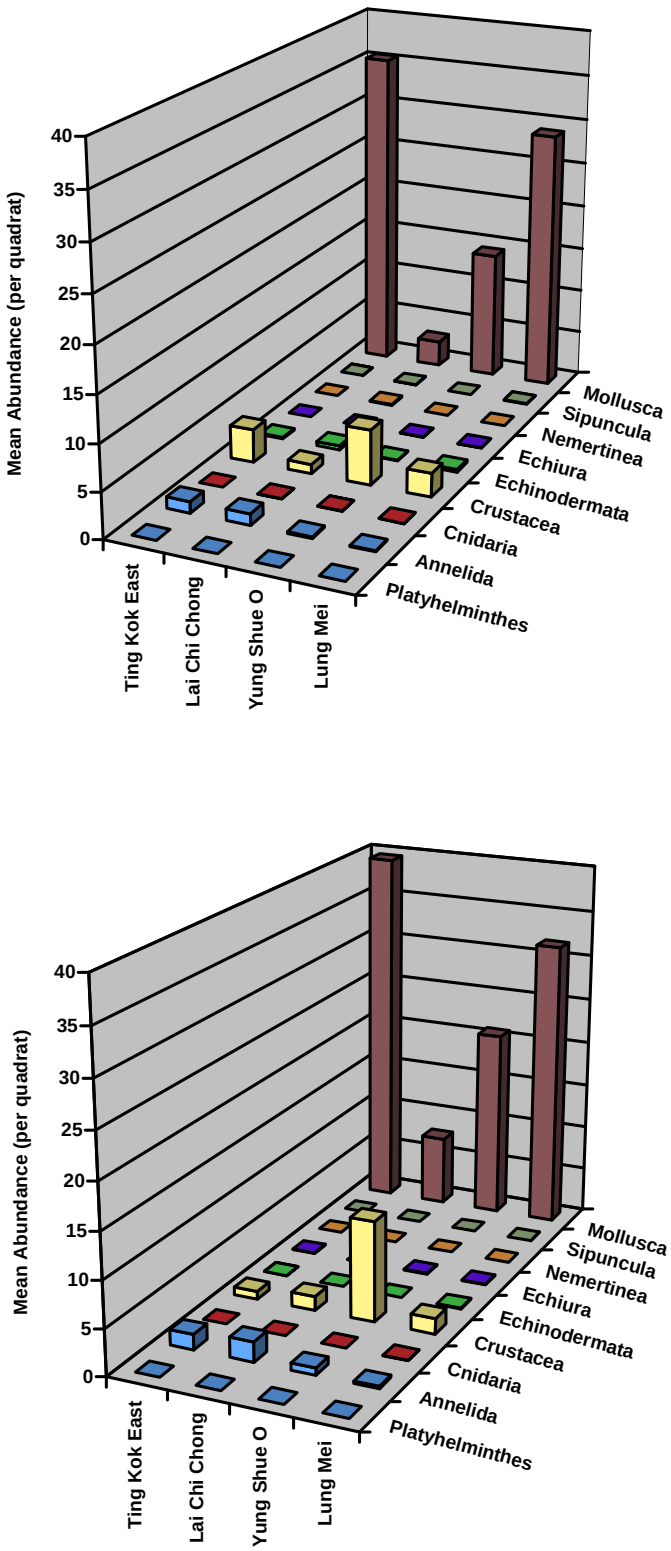
Table C6 ***Total Number of Epifaunal Species in Different Phyla recorded during Intertidal Transect Survey in Dry Season. LM: Lung Mei (90 quadrats), TKE: Ting Kok East (90 quadrats), YSON: Yung Shue O North (90 quadrats), LCC: Lai Chi Chong (90 quadrats)***

Phylum/ Subphylum	LM	TKE	YSON	LCC
Annelida	3	11	4	12
Cnidaria	1	0	1	1
Crustacea	4	7	9	10
Echinodermata	1	1	2	2
Echiura	1	0	1	0
Mollusca	20	23	21	23
Nemertinea	0	0	0	1
Platyhelminthes	0	0	0	0
Sipuncula	1	1	0	1
TOTAL	**31**	**43**	**38**	**50**

Table C7 ***Total Number of Epifaunal Species in Different Phyla recorded during Intertidal Transect Survey in Wet Season. LM: Lung Mei (90 quadrats), TKE: Ting Kok East (90 quadrats), YSON: Yung Shue O North (90 quadrats), LCC: Lai Chi Chong (90 quadrats)***

Phylum/ Subphylum	LM	TKE	YSON	LCC
Annelida	3	14	7	12
Cnidaria	1	0	0	0
Crustacea	4	4	6	6
Echinodermata	1	1	1	0
Echiura	1	1	2	1
Mollusca	23	21	23	25
Nemertinea	1	0	0	1
Platyhelminthes	0	0	0	1
Sipuncula	1	1	1	0
TOTAL	**35**	**42**	**40**	**46**

Figure C7 ***Mean abundance (number per quadrat) of epifauna in different phyla at different sites in dry (upper) and wet (lower) seasons.***



Species Composition of Infauna

A total of 86 marine infaunal species were recorded in the benthic core sampling (results obtained from 120 quadrats, Σn = 3 shore heights x 5 cores x 4 sites x 2 seasons; *Table C6*). In both seasons, the most dominant taxonomic group was the Mollusca, followed by Annelida and Crustacea (*Tables C7 & C8*). YSON had the highest number of species of molluscs while LCC had the highest number of species of annelids. For crustaceans, the number of species was the highest in LCC in the dry season and YSON in the wet season.

The total number of species recorded was the highest at YSON and the lowest at TKE during the dry season (*Table C7*); while during the wet season, it was the highest at YSON and LCC, and the lowest at TKE (*Table C8*). The most abundant species recorded at the four sites were the gastropods *Cerithidea* spp. and *Batillaria* spp., which was similar to the result presented in the EIA Report.

Among the major phyla, mean abundance of infauna were higher in Mollusca, Annelida and Crustacea than in other phyla (*Figure C8*). In both seasons, LCC had the highest mean abundance of annelids and TKE has the highest mean abundance of molluscs. For crustaceans, mean abundance was the highest at LCC in the dry season and at YSON in the wet season.

Table C8 ***A Full List of Species of Infauna Recorded from Benthic Core Survey at Lung Mei and Three Reference Sites. "1" indicates occurrence of the species. LM: Lung Mei (30 cores), TKE: Ting Kok East (30 cores), YSON: Yung Shue O North (30 cores), LCC: Lai Chi Chong (30 cores). Refer to Table B7 for Categories of Conservation Status ("--" denotes species with no conservation status known to-date). "Y" represents presence of existing record of that species in Hong Kong/ China. For footnotes see Table B7***

No.	Phylum/Class/Family	Species	LM	TK	YSON	LCC	Conservation Importance (1)	Remarks	Recorded in HK/China?	Reference (2)
	Annelida									
	Polychaeta									
1	Amphinomidae	*Chloeia parva*	0	0	0	1	--	--	Y	b
2	Capitellidae	*Dasybranchus caducus*	1	1	1	1	--	--		
3	Capitellidae	*Notomastus latericens*	1	1	1	0	--	--	Y	b
4	Chrysopetalidae	*Bhawania cryptocephala*	0	0	1	0	--	--	Y	b
5	Cirratulidae	*Cirriformia tentaculata*	0	0	0	1	--	--	Y	b
6	Cirratulidae	*Cirratulus* sp.	0	0	0	1	--	--	Y	b
7	Dorvilleidae	*Dorvillea* sp.	1	0	0	0	--	--	Y	E
8	Eunicidae	*Marphysa depressa*	0	1	1	0	--	--	Y	b
9	Glyceridae	*Glycera onomichiensis*	0	0	1	1	--	--	Y	b
10	Goniadidae	*Glycinde gurjanovae*	0	0	0	1	--	--	Y	b
11	Goniadidae	*Goniada* sp.	0	0	1	1	--	--	Y	b
12	Hesionedae	*Micropodarke dubia*	0	0	0	1	--	--	Y	b
13	Lacydoniidae	*Paralacydonia paradoxa*	0	0	1	1	--	--	Y	b
14	Lumbrineridae	*Lumbrineris heteropoda*	0	0	0	1	--	--	Y	b
15	Nephtyidae	*Nephtys oligobranchia*	0	0	1	1	--	--	Y	b
16	Nereidae	*Ceratonereis erythraeensis*	1	1	1	1	--	--	Y	b
17	Nereidae	*Nereis* sp.	1	1	1	1	--	--	Y	b
18	Opheliidae	*Armandia intermedia*	1	0	1	1	--	--	Y	b
19	Opheliidae	*Travisia japonica*	0	1	0	0	--	--		
20	Orbiniidae	*Scoloplos* sp.	0	1	1	1	--	--	Y	b
21	Paraonidae	*Paraonis* sp.	0	0	0	1	--	--	Y	b
22	Phyllodocidae	*Phyllodoce* sp.	0	0	0	1	--	--	Y	b
23	Pilargiidae	*Sigambra hanaokai*	0	1	0	1	--	--	Y	b
24	Poecilochaetidae	*Poecilochaetus serpens*	0	0	1	0	--	--	Y	b
25	Serpulidae	*Hydroides elegans*	0	0	0	1	--	--	Y	d

No.	Phylum/Class/Family	Species	LM	TK	YSON	LCC	Conservation Importance [1]	Remarks	Recorded in HK/China?	Reference [2]
26	Spionidae	*Scolecolepides aciculatus*	0	0	0	1	--	--		
27	Syllidae	*Eusyllis* sp.	1	1	0	0	--	--	Y	b
	Crustacea									
	Decapoda									
28	Alpheidae	*Alpheus* sp.	0	0	1	0	--	--	Y	b
29	Callianassidae	*Callianassa* sp.	0	0	1	0	--	--	Y	d
30	Corophiidae	*Corophium sinensis*	1	1	1	1	--	--	Y	b
31	Diogenidae	*Diogenes* sp.	1	1	1	1	--	--	Y	d
32	Grapsidae	*Sesarma* sp.	0	0	1	1	--	--	Y	d
33	Ocypodidae	*Ilyoplax ningpoensis*	1	0	0	0	--	--	Y	d
34	Ocypodidae	*Macrophthalmus* sp.	0	0	0	1	--	--	Y	b
35	Ocypodidae	*Scopimera globosa*	0	0	1	1	--	--	Y	d
36	Ocypodidae	*Tmethypocoelis ceratophora*	0	0	0	1	--	--	Y	g
37	Portunidae	*Portunus hastatoides*	1	0	0	1	--	--	Y	k
38	Upogebiidae	*Upogebia major*	0	1	0	0	--	Listed as "Endangered" under the China Species Red List due to rapid population decline as a result of over-exploitation [3]	Y	d, g
	Brachiopoda									
39	Lingulidae	*Lingula lingua*	0	0	0	1	--	--	Y	d
	Chordata									
	Cephalochordata									
40	Branchiostomatidae	*Branchiostoma belcheri*	1	0	0	0	--	Listed as "Endangered" under the China Species Red List due to rapid population decline as a result of habitat destruction [4]	Y	b, d, g
	Echinodermata									
	Asteroida									

No.	Phylum/Class/Family	Species	LM	TK	YSON	LCC	Conservation Importance [1]	Remarks	Recorded in HK/China?	Reference [2]
41	Luidiidae	*Luidia maculosa*	0	0	1	0	--	--	Y	d
	Echinoida									
42	Loveniidae	*Lovenia subcarinata*	0	0	0	1	--	--	Y	E
43	Temnopleuridae	*Temnopleurus toreumaticus*	0	0	0	1	--	--	Y	d
	Echiura									
	Echiurida									
44	Echiuridae	*Listriolobus brevirostris*	0	1	1	0	--	--	Y	b
	Mollusca									
	Bivalvia									
45	Arcidae	*Scapharca cornea*	0	0	1	1	--	--	Y	d
46	Arcidae	*Arca avellana*	0	0	1	0	--	--	Y	d
47	Arcidae	*Barbatia virescens*	0	0	1	0	--	--	Y	c, d
48	Corbulidae	*Potamocorbula laevis*	0	0	0	1	--	--	Y	b
49	Corbulidae	*Solidicorbula erythrodon*	0	0	1	0	--	--	Y	x
50	Lucinidae	*Lucinoma* sp.	0	0	1	0	--	--		
51	Lucinidae	*Pillucina pisidium*	0	1	0	0	--	--		
52	Mactridae	*Meropesta nicobarica*	1	0	0	0	--	--	Y	d
53	Mesodesmatidae	*Atactodea striata*	0	0	1	0	--	--	Y	d, g
54	Mytilidae	*Musculus senhousia*	0	0	1	1	--	--		
55	Psammobiidae	*Asaphis dichotoma*	1	1	1	1	--	--	Y	d, g
56	Tellinidae	*Arcopagia diaphana*	0	0	0	1	--	--	Y	d
57	Tellinidae	*Tellina* sp.	1	0	0	0	--	--	Y	d
58	Veneridae	*Anomalocardia squamosa*	1	0	1	1	--	--	Y	d, g
59	Veneridae	*Callista erycina*	0	1	0	0	--	--		
60	Veneridae	*Circe scripta*	0	0	1	1	--	--	Y	d, g
61	Veneridae	*Dosinia japonica*	0	0	1	0	--	--	Y	d, g
62	Veneridae	*Gafrarium pectinatum*	1	1	1	1	--	--	Y	d, x
63	Veneridae	*Marcia* sp.	0	0	1	0	--	--	Y	d, x
64	Veneridae	*Tapes philippinarum*	0	0	1	0	--	--	Y	d, x
65	Veneridae	*Tapes variegatus*	1	0	0	0	--	--	Y	d, x
	Gastropoda									

No.	Phylum/Class/Family	Species	LM	TK	YSON	LCC	Conservation Importance [1]	Remarks	Recorded in HK/China?	Reference [2]
66	Bullidae	*Bulla ampulla*	0	0	0	1	--	--	Y	d
67	Cerithiidae	*Clypeomorus humilis*	1	1	1	1	--	--	Y	d
68	Mitridae	*Mitra chinensis*	1	1	1	1	--	--	Y	g
69	Muricidae	*Thais clavigera*	0	0	0	1	--	--	Y	c, d
70	Nassariidae	*Nassarius festivus*	1	1	1	0	--	--	Y	d, g, x
71	Nassariidae	*Nassarius hepaticus*	0	0	0	1	--	--		
72	Nassariidae	*Nassarius papillosus*	1	0	1	0	--	--		
73	Naticidae	*Polinices* sp.	0	0	1	1	--	--	Y	d
74	Neritidae	*Clithon oualaniensis*	1	1	1	1	--	--	Y	d, g, x
75	Neritidae	*Nerita albicilla*	0	0	1	1	--	--	Y	c, d
76	Potamididae	*Batillaria multiformis*	0	1	0	0	--	--	Y	d, g, x
77	Potamididae	*Batillaria zonalis*	1	1	1	1	--	--	Y	d, g, x
78	Potamididae	*Cerithidea cingulata*	1	1	1	1	--	--	Y	d, g, x
79	Potamididae	*Cerithidea djadjariensis*	0	0	1	0	--	--	Y	d, g, x
80	Rissoidae	*Rissoina* sp.	0	0	0	1	--	--		
81	Strombidae	*Strombus urceus*	0	0	0	1	--	--	Y	A
82	Trochidae	*Monodonta labio*	1	0	0	1	--	--	Y	c, d
83	Turbinidae	*Lunella coronata*	1	0	1	1	--	--	Y	c, d, g
	Nemertinea									
	Anopla									
84	Cerebratulidae	*Cerebratulina* sp.	1	1	1	1	--	--	Y	b
	Sipuncula									
	Phascoloplosomatidea									
85	Phascoloplosomatidae	*Phascolosoma* sp.	1	0	1	1	--	--	Y	g
	Sipunculidea									
86	Sipunculidae	*Sipunculus nudus*	0	0	1	1	--	--		

(1) The IUCN Species Survival Commission: 2008 IUCN Red List of Threatened Species. <http://www.iucnredlist.org>

(2) References cited (see Table B7)

(3) The mud shrimp, *Upogebia major*, is evaluated as Endangered (EN) by the China Species Red List due to the rapid decline in their population abundance in China (current number dropped to 1% of the total global population). Such decline is mainly due to species exploitation (i.e. commercial harvest) and habitat destruction in China. *U. major* is abundant and common in sandy shore habitats of Hong Kong (see Reference g in Table B7), and it is not a commercially important species in Hong Kong. Thus it is highly unlikely that populations of *U. major* in Hong Kong would experience similar decline and fate as in China. It was also recorded on all six study sites in this additional active search. As such, it is not considered as a species of conservation importance in the context discussed in this study.

(4) One individual of the amphioxus *Branchiostoma belcheri* (with body length (BL) <15mm), was found in the core samples at the low shore (0.5mCD). Amphioxus is known to be of potential evolutionary importance as it provides a linkage between marine vertebrates and invertebrates. In China, where it was an important fishery resource, it is listed as a Class II protected species due to over-exploitation. In Hong Kong, *B. belcheri* was recently recorded from a number of sampling sites across eastern Hong Kong waters from Tai Long Wan, Long Ke Wan, Pak Lap Wan, Nam She Wan, Sai Kung to Ninepins the Tathong Channel, Victoria Harbour and Tung Wan, South Soko. Chen (2007) * recorded high abundances of amphioxus in specific locations in Sai Kung. It is also noted that this species is not listed as protected in Hong Kong. Repeated active searches for the amphioxus *B. belcheri* were undertaken at Lung Mei but no amphioxus was recorded in any of the 260 quadrat/ core/ grab samples. It is thus concluded that Lung Mei is not an important habitat of *B. belcheri* as significant populations of this species could not be found, and the record of the individual is considered a chance occurrence.

* Chen Y (2007) *The Ecology and Biology of Amphioxus in Hong Kong*. PhD Thesis, City University of Hong Kong

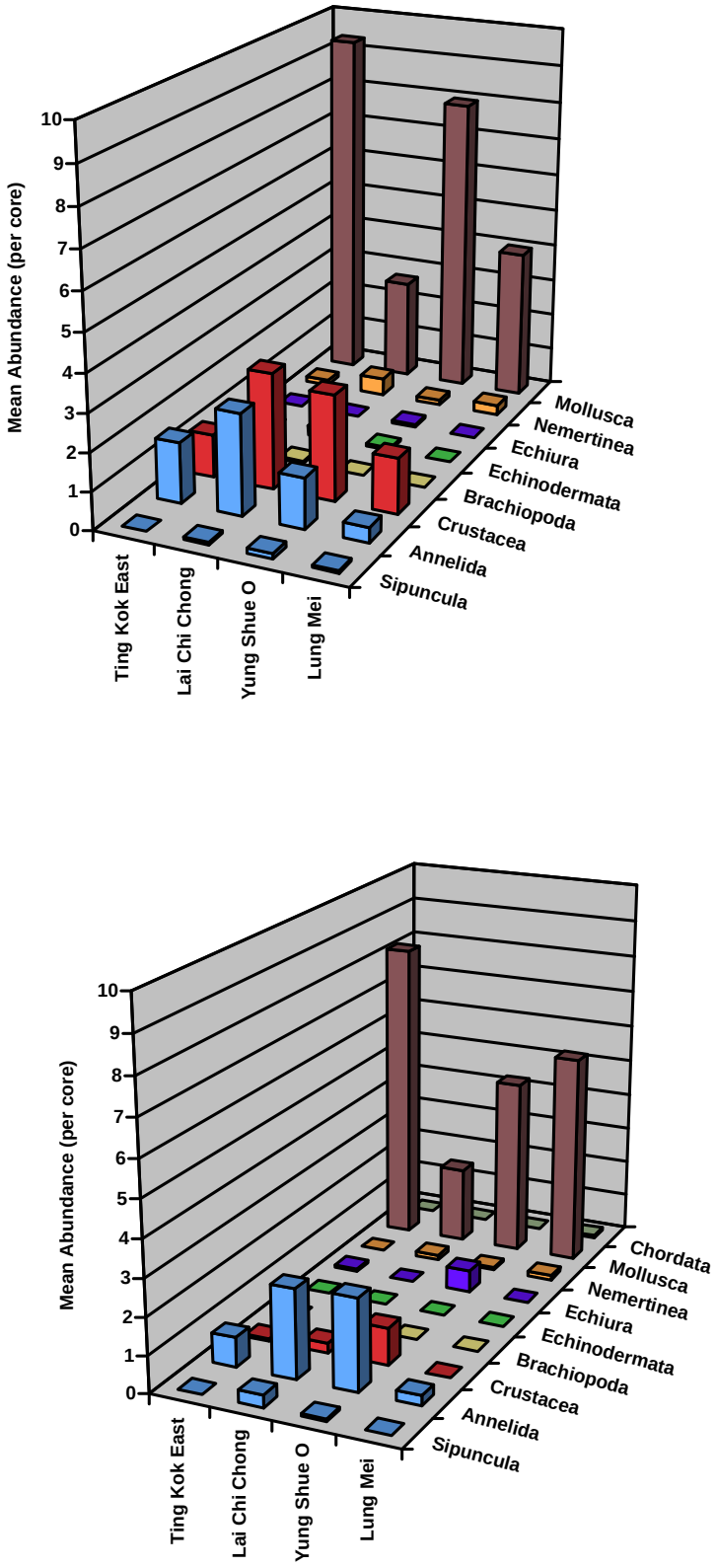
Table C9 ***Total Number of Infaunal Species in Different Phyla recorded during Intertidal Benthic Core Survey in Dry Season. LM: Lung Mei (30 cores), TKE: Ting Kok East (30 cores), YSON: Yung Shue O North (30 cores), LCC: Lai Chi Chong (30 cores)***

Phylum/ Subphylum	LM	TKE	YSON	LCC
Annelida	4	6	8	9
Crustacea	4	3	3	5
Brachiopoda	0	0	0	1
Chordata	0	0	0	0
Echinodermata	0	0	1	2
Echiura	0	0	1	0
Mollusca	9	7	21	14
Nemertinea	1	1	1	1
Sipuncula	1	0	2	1
TOTAL	**19**	**17**	**37**	**33**

Table C10 ***Total Number of Infaunal Species in Different Phyla recorded during Intertidal Benthic Core Survey in Wet Season. LM: Lung Mei (30 cores), TKE: Ting Kok East (30 cores), YSON: Yung Shue O North (30 cores), LCC: Lai Chi Chong (30 cores)***

Phylum/ Subphylum	LM	TKE	YSON	LCC
Annelida	4	6	10	15
Crustacea	0	1	4	2
Brachiopoda	0	0	0	0
Chordata	1	0	0	0
Echinodermata	0	0	0	0
Echiura	0	1	1	0
Mollusca	12	7	16	14
Nemertinea	1	0	1	1
Sipuncula	0	0	1	1
TOTAL	**18**	**15**	**33**	**33**

Figure C8 ***Mean abundance (number per quadrat) of infauna in different phyla at different sites in dry (upper) and wet (lower) seasons.***



Abundance per Unit Area

The site overall mean abundance of epifauna was higher in the wet season than in the dry season at all sites (*Figure C9*), although significant statistical difference between seasons cannot be detected by ANOVA tests (*Table C9*). Such a pattern was consistent across all shore heights at all sites, except at 1.0 mCD at TKE and 0.5 mCD at LM (*Figure C9*). Significant difference in site overall epifaunal mean abundance was detected (*Table C9*); the highest mean abundance was observed in TKE (41.3 individuals/quadrat), while the lowest was observed in LCC (8.7 individuals/quadrat).

For infaunal species, the site overall mean abundance was higher in the dry season than in the wet season at all sites (*Figure C9*), although significant statistical differences between seasons cannot be detected by ANOVA tests (*Table C10*). Such a pattern was consistent across all shore heights at all sites, except at 1.5 mCD at YSON and LCC, and 1.0 mCD at LM (*Figure C9*). Significant difference in site overall infaunal mean abundance was not detected (*Table C10*); the highest mean abundance was observed in YSON (10.7 individuals/core), while the lowest was observed in LM (6.2 individuals/core).

Number of Species per Unit Area (S)

For overall total number of epifaunal species, it was higher in the wet season than in the dry season at all sites (*Figure C10*), and significant statistical difference between seasons was also detected by ANOVA tests (*Table C9*). Such a pattern was consistent across all shore heights at all sites, except at 0.5 mCD at LCC, LM and YSON (*Figure C10*). Significant difference in site overall total number of epifaunal species was detected (*Table C9*); LM and TKE showed significantly higher total number than YSON and LCC. The highest total number was observed in TKE (5.1 species/quadrat) and LM (5.0 species/quadrat), while the lowest was observed in LCC (4.0 species/quadrat).

Site overall total number of infaunal species was similar between seasons (*Figure C10*), and such pattern was substantiated by ANOVA results (*Table C10*). Significant difference in site overall infaunal species was detected (*Table C10*); the highest number of species was observed in YSON (5.7 species/core), while the lowest was observed in LM (2.8 individuals/core).

Species Diversity (H')

For site overall species diversity of epifauna, it was higher in the wet season than in the dry season at all sites (*Figure C11*), although significant statistical difference between seasons cannot be detected by ANOVA tests (*Table C9*). Such pattern was consistent across all shore heights at all sites, except at 1.0 mCD at LM, and 0.5mCD at LCC, LM and YSON (*Figure C11*). The site overall H' were similar at all sites, and significant site difference was not detected by ANOVA tests (*Table C9*).

For infaunal species, species diversity was similar between seasons (*Figure C11*) and such pattern was substantiated by ANOVA results (*Table C10*). Significant difference in site overall infaunal species diversity was detected (*Table C10*); the highest H' was observed in YSON (1.5), while the lowest was observed in TKE (0.7).

Evenness (J)

For site overall evenness of epifauna, it was similar between seasons at all sites (*Figure C12*), and such pattern was substantiated by ANOVA results (*Table C9*). Significant difference in site overall evenness was detected (*Table C9*); the highest evenness was observed in LCC (0.9), while the lowest was observed in TKE (0.7).

For site overall evenness of infauna, it was similar between seasons at all sites (*Figure C12*), and such pattern was substantiated by ANOVA results (*Table C10*). Significant difference in site overall evenness was detected (*Table C10*); the highest J was observed in YSON (0.9), while the lowest was observed in TKE (0.8).

Figure C9 ***Abundance (mean ± standard deviation) in all sites in both seasons.***

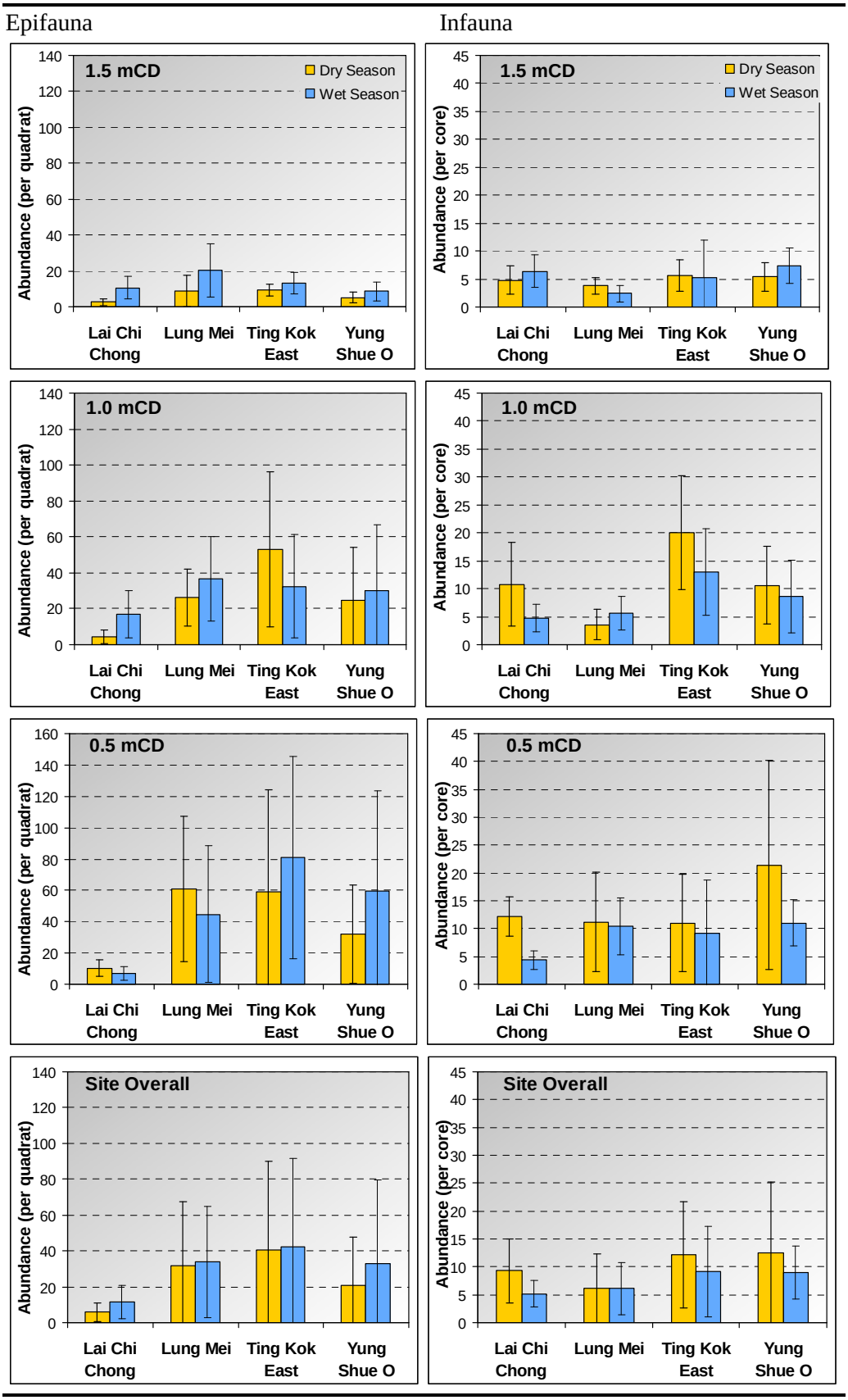


Figure C10 ***Number of epifauna and infauna species (mean± standard deviation) in all sites in both seasons.***

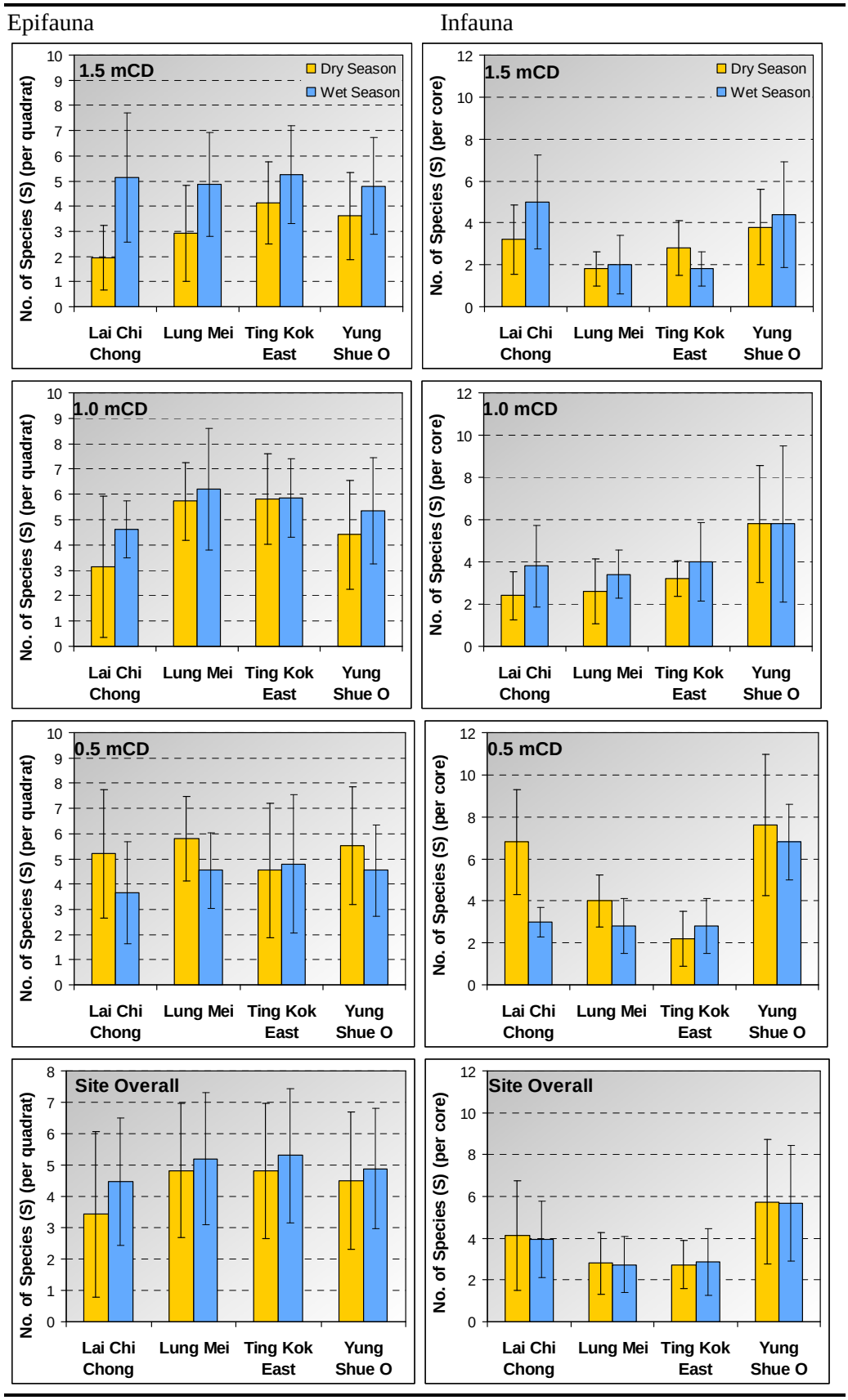


Figure C11 ***Shannon-Weiner Diversity (H') (mean ± standard deviation) in all sites in both seasons..***

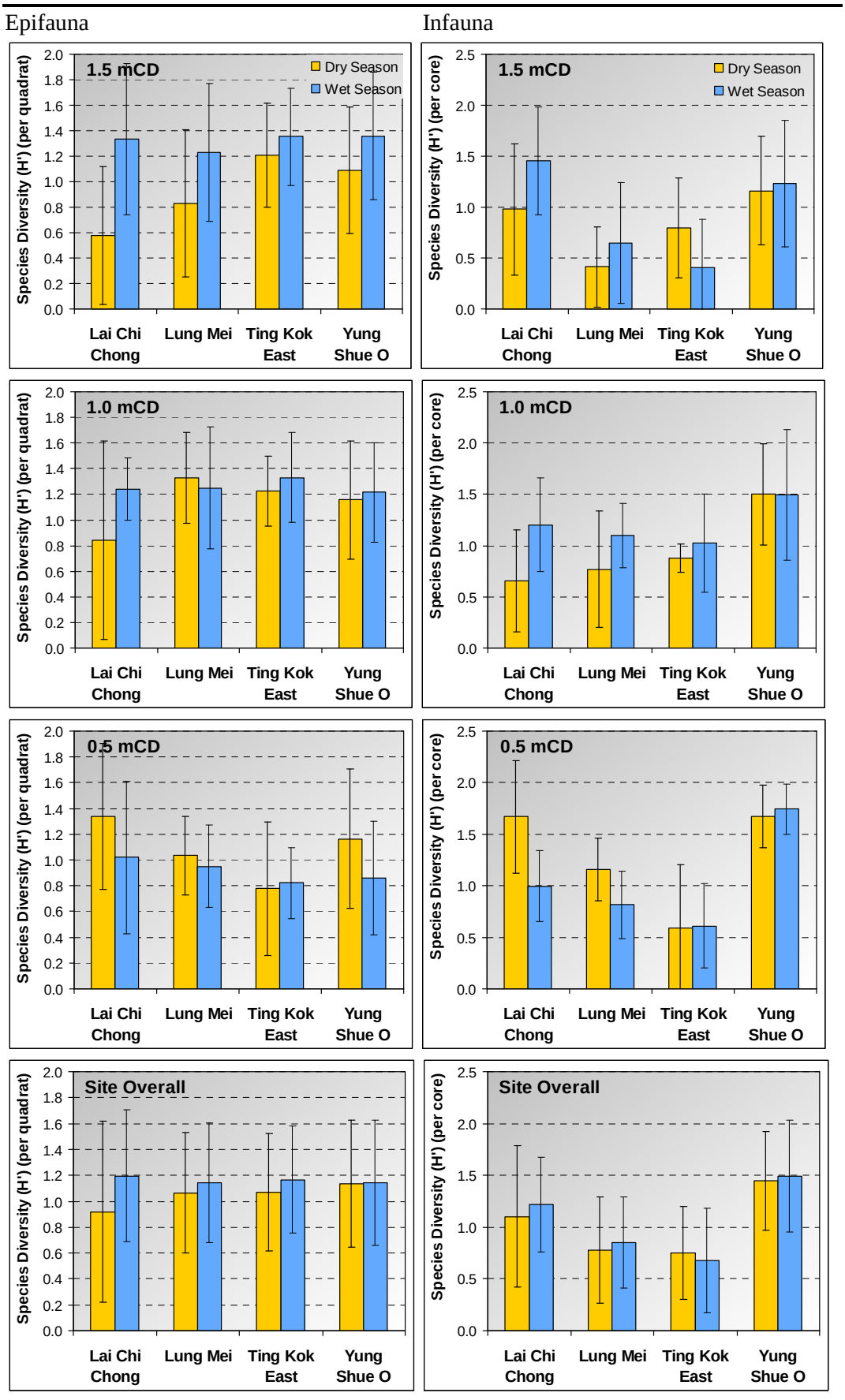


Figure C12 Pielou's evenness (J) (mean ± standard deviation) in all sites in both seasons.

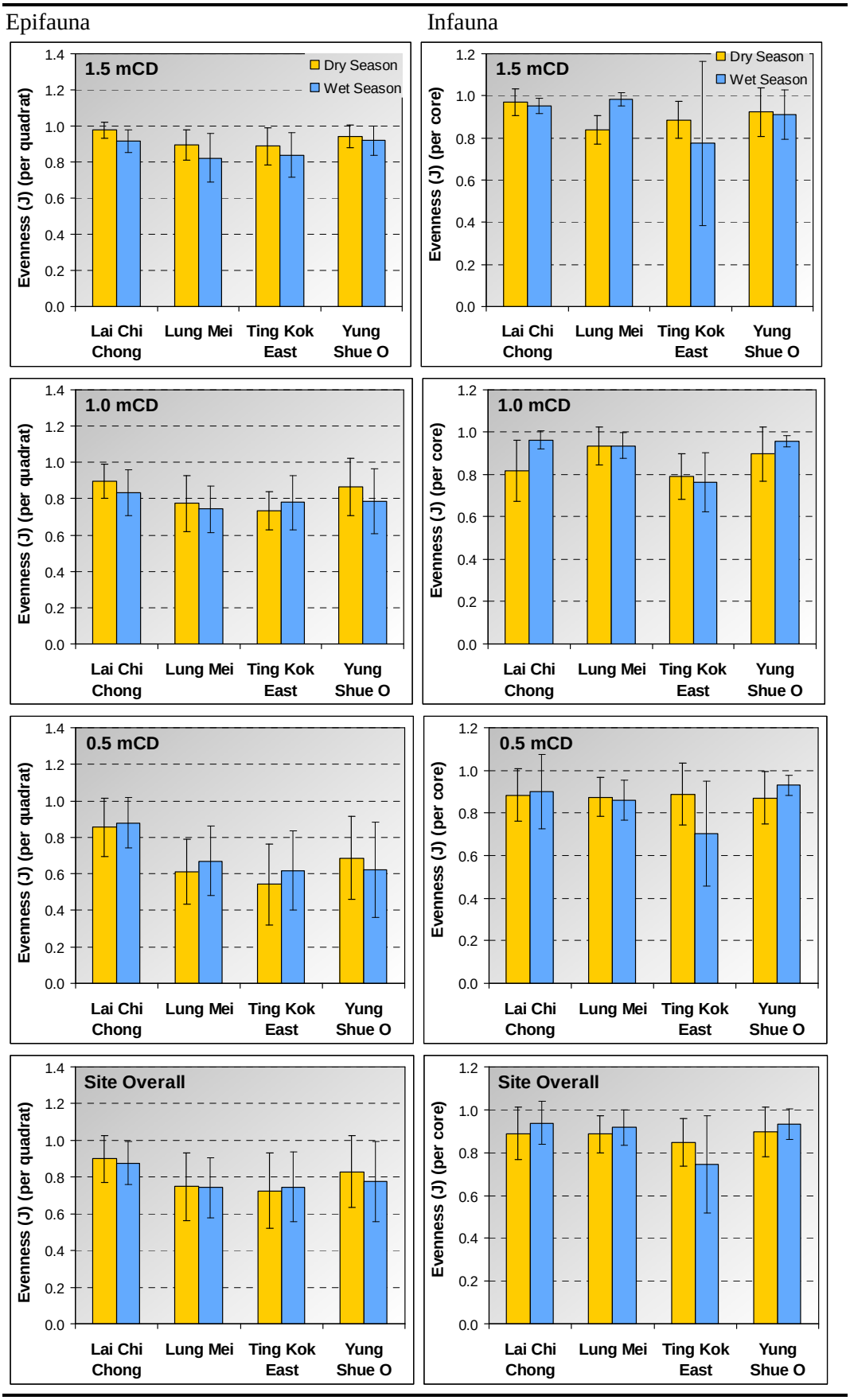


Table C11 ***Comparison of epifaunal abundance (number per quadrat), total number of species (S), species diversity (H') and evenness (J) among Sites in both seasons (dry vs. wet) using two-way ANOVA. Data were not homogeneous for (a), (c) & (d) (Levene's test: p<0.05) and significance level of 0.01 was used in these cases. Data were not transformed. Significant differences are given in bold type.***

(a) Abundance				
Source	***df***	**MS**	**F**	***p***
Season	1	2.555	2.011	0.157
Site	3	17.324	13.634	**<0.001**
Season x Site	3	530	0.417	0.741
Error	352	1.271		
Tukey's multiple comparison		TKE >= LM = YSON > LCC		
(b) S				
Source	***df***	**MS**	**F**	***p***
Season	1	29.469	6.219	**0.013**
Site	3	24.018	5.069	**0.002**
Season x Site	3	2.292	0.484	0.694
Error	352	4.738		
Tukey's multiple comparison		LM = TKE >= YSON = LCC		
(c) H'				
Source	***df***	**MS**	**F**	***p***
Season	1	1.207	4.758	0.030
Site	3	0.109	0.429	0.732
Season x Site	3	0.294	1.158	0.326
Error	352	0.254		
(d) J				
Source	***df***	**MS**	**F**	***p***
Season	1	0.018	0.565	0.453
Site	3	0.387	11.901	**<0.001**
Season x Site	3	0.021	0.653	0.581
Error	328	0.032		
Tukey's multiple comparison		LM = TKE = YSON < LCC		

Table C12 ***Comparison of infaunal abundance (number per quadrat), total number of species (S), species diversity (H') and evenness (J) among Sites in both seasons (dry vs. wet) using two-way ANOVA. Data were not homogeneous for (a), (b) & (d) (Levene's test: p<0.05) and significance level of 0.01 was used in these cases. Data were not transformed. Significant differences are given in bold type.***

(a) Abundance				
Source	***df***	**MS**	**F**	***p***
Season	1	210.675	3.805	0.054
Site	3	164.031	2.962	0.035
Season x Site	3	24.675	0.446	0.721
Error	112	55.375		
(b) S				
Source	***df***	**MS**	**F**	***p***
Season	1	0.033	0.008	0.930
Site	3	56.600	13.087	**<0.001**
Season x Site	3	0.144	0.033	0.992
Error	112	4.325		
Tukey's multiple comparison		LM = TKE = LCC < YSON		
(c) H'				
Source	***df***	**MS**	**F**	***p***
Season	1	0.064	0.244	0.622
Site	3	3.475	13.282	**<0.001**
Season x Site	3	0.054	0.206	0.892
Error	112	0.262		
Tukey's multiple comparison		TKE = LM <= LCC <= YSON		
(d) J				
Source	***df***	**MS**	**F**	***p***
Season	1	0.001	0.036	0.849
Site	3	0.083	5.691	**0.001**
Season x Site	3	0.032	2.188	0.094
Error	99	0.015		
Tukey's multiple comparison		TKE < LM = YSON = LCC		

Multivariate Analysis

From the nMDS ordination plots of both epifauna and infauna, there were no clear seasonal and spatial group separations in terms of abundance data. Clear spatial variations in these values were however observed among shore heights (*Figures C13* and *C14*). Results of the ANOSIM analysis, however, revealed significant spatial and seasonal variations in abundance (*Table C11*). SIMPER results showed that such variations were contributed by high hermit crab abundance in YSON for epifauna data and high abundance of polychates in LCC for infauna data.

Table C13 ***Comparison of abundance of macrobenthos in quadrat (epifaunal) and core (infauna) samples between (a) Seasons, and among (b) Sites using two-way ANOSIM. Data were square-root transformed. Significant differences are given in bold type.***

(a) Epifauna		
Factor	R-statistic	*p*
(a) seasons	0.072	0.001
(b) sites	0.136	0.001
Pairwise tests	LM TKE YSO LCC	
(b) Infauna		
Factor	R-statistic	*p*
(a) seasons	0.114	0.001
(b) sections	0.178	0.001
Pairwise tests	LM TKE YSO LCC	

Figure C13 nMDS ordination plots of seasonal and spatial patterns from abundance of macrobenthos (epifaunal) in quadrat samples

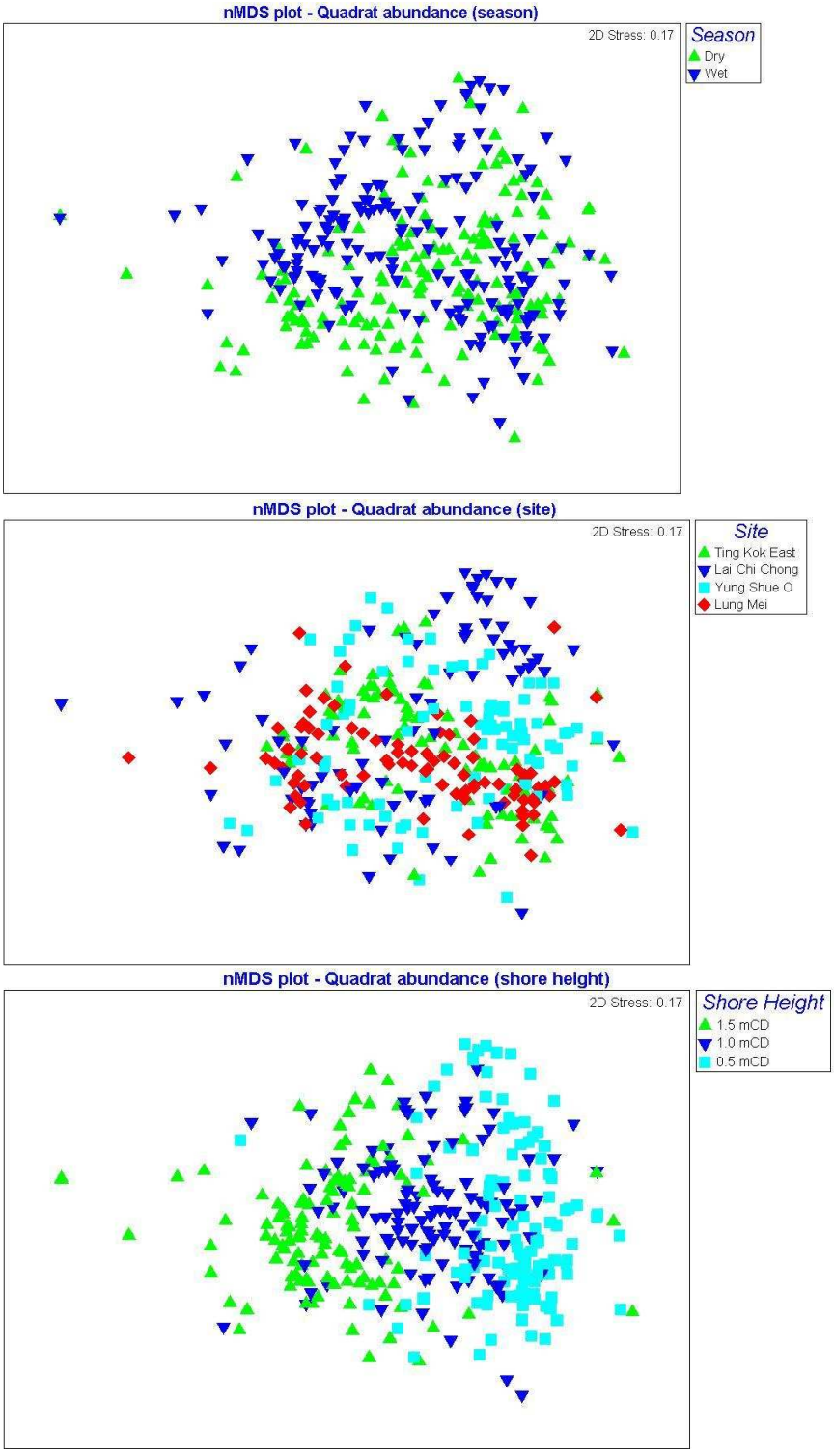
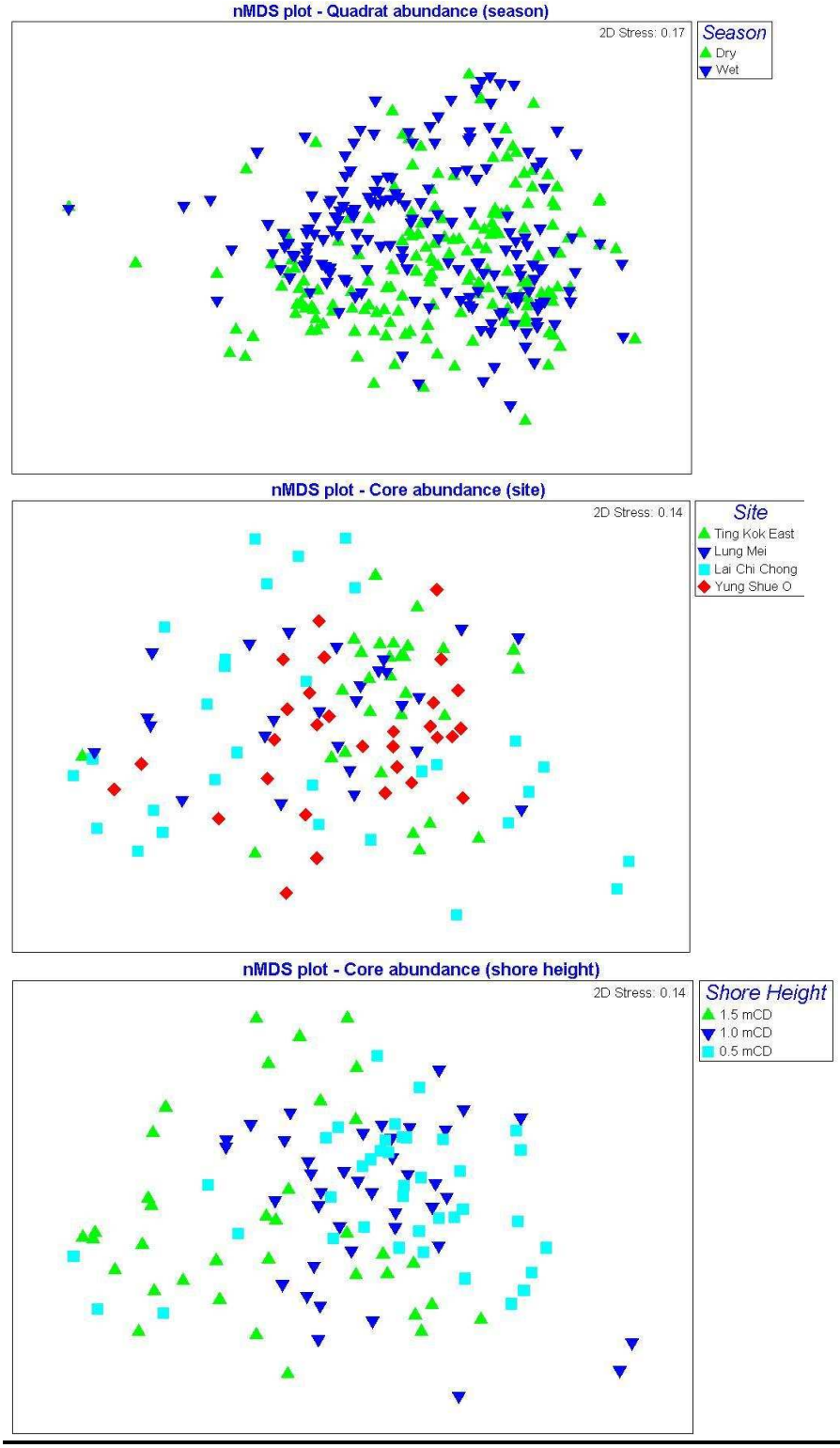


Figure C14 ***nMDS ordination plots of seasonal and spatial patterns from abundance of macrobenthos (infauna) in quadrat samples***



C.3.3 Intertidal Semi-quantitative Crustacean Survey

The total numbers of crustacean species recorded at LM, TKE, YSON and LCC during the intertidal semi-quantitative crustacean survey were 28, 34, 36 and 42 respectively. Therefore among all sites, LCC had the highest total number of crustacean species while LM has the lowest total number of species recorded (*Table C12*). In general, YSON and LCC had the highest relative abundance of crustacean species, while LM had the lowest relative abundance (*Table C12*).

Across all sites, *Thalamita crenata* is the most abundant crustacean recorded while *Nanosesarma minutum* is also abundant in LM, TKE and YSON. *Alpheus brevicristatus* is abundant in TKE, YSON and LCC. *Metopograpsus frontalis*, *Scopimera* sp. and *Clibanarius longitarsus* were abundant in TKE, LM and LCC, respectively (*Table C12*).

C.3.4 Intertidal Fish Survey

Among all sites, YSON has the highest mean abundance (10.3 individuals / quadrat) and mean total number of fish species (3.5 species/ quadrat) while LM has the lowest mean abundance (3.2 individuals /quadrat) and mean total number of fish species (1.9 species/ quadrat) (*Figure C15*).

Survey results showed that the most abundant species at LM and LCC were *Ambassis gymnocephalus* and *Ambassis* sp. respectively (*Table C13*). Whilst the most abundant species at TKE was *Drombus* sp., it was *Pseudogobius javanicus* and *Mugil cephalus* in YSON (*Table C13*).

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TableC14 Relative abundance of crustacean species recorded in Lung Mei, Ting Kok East, Yung Shue O North and Lai Chi Chong in dry and wet season during the intertidal semi-quantitative transect surveys.

No.	*Family/Species*	Lung Mei						Ting Kok East						Yung Shue O North						Lai Chi Chong					
		Dry			Wet			Dry			Wet			Dry			Wet			Dry			Wet		
		H	M	L	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L
	Penaeidae																								
1	*Metapenaeus* sp.												*												
2	*Penaeus latisulcatus*			**						**			*			*			*			**			*
	Rhynchocinetidae																								
3	*Rhynchocinetes* sp.									*															
	Palaemonidae																								
4	*Palaemon serrifer*		***			***			**			***			***	**		***	**		**			**	
	Alpheidae																								
5	*Alpheus lobidens*		***			***		**	***	*	**	*** *		*	***		*	***			**	**		**	**
6	*Alpheus brevicristatus*			*** *			***	*	**	***	*	***	***		***	*** *		***	***		***	**		***	**
7	*Athanas* sp.		*			*			**			*			**			**			**	**		*	*
	Laomediidae																								
8	*Laomedia astacina*	**			**			*			*														
	Upogebiidae																								
9	*Upogebia major*		**			**			***			**		*	**		*	**			***			**	
	Diogenidae																								
10	*Clibanarius longitarsus*		**	**		**	**			***			***		**	***		**	**		**	***		**	*** *
	Porcellanidae																								
11	*Petrolishthes japonicus*		**			***		**	***		**	*** *			***			***			***			***	
	Leucosiidae																								
12	*Philyra carinata*																							*	
	Calappidae																								
13	*Calappa philargius*																								*
	Parthenopidae																								
14	*Cryptopodia fornicata*												*						*						*
15	*Parthenope validus*															*			*			*			*
	Portunidae																								
16	*Charybdis hellerii*			**			**			***		*	**			***		**	***		**	***		**	***
17	*Charybdis japonica*																								*

No.	*Family/Species*	Lung Mei						Ting Kok East						Yung Shue O North						Lai Chi Chong					
		Dry			Wet			Dry			Wet			Dry			Wet			Dry			Wet		
		H	M	L	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L
18	*Macropipus corrugatus*																					**			
19	*Portunus pelagicus*			***			***			**			***			*** *			***			***			**
20	*Thalamita crenata*		**	**		**	**	*	**	**	**	***	***			*** *		***	*** **		**	**		**	*** **
21	*Thalamita danae*			**			**		*	***		**	**		*	**		**				***			***
22	*Thalamita sima*															**		*	***		**	**		**	***
23	*Thalamita spinimana*									***			**												
	Xanthidae																								
24	*Actaea* sp.																					*			
25	*Chlorodiella nigra*																					**			***
26	*Demania scaberrima*															*									
27	*Etisus laevimanus*	*					*			*			**			**			**			*			**
28	*Heteropanope glabra*							*			***			**			**			*			*		
29	*Leptodius* sp.		**			**			**		*	**			***			***			**			*	
30	*Liomera venosa*																					*			
31	*Pilumnopeus eucratoides*												*			*			*			*			*
	Goneplacidae																								
32	*Eucrate crenata*												**			***			*** *			**			***
	Mictyridae																								
33	*Mictyris brevidactylus*	*			*			*			**			**			***				**			*** *	
	Ocypodidae																								
34	*Macrophthalmus convexus*													**	**		**	**						**	
35	*Scopimera* sp.	**	***		**	***		**			***			**			**				**			**	
36	*Tmethypocoelis ceratophora*	**	*		**	*		***			***			**			**				**		*	***	
37	*Uca borealis*										**				**			***			**			**	
	Grapsidae																								
38	*Chasmagnathus convexum*				**																				
39	*Clistocoeloma* sp.													**			**				**		**		
40	*Eriocheir japonica*			**						***						***						**			
41	*Gaetice depressus*	*	**		*	**								**	**		**	**		*** **			*** *		
42	*Hemigrapsus penicillatus*	*			*						*			**			**			*			*		
43	*Metaplex* sp.																						**		

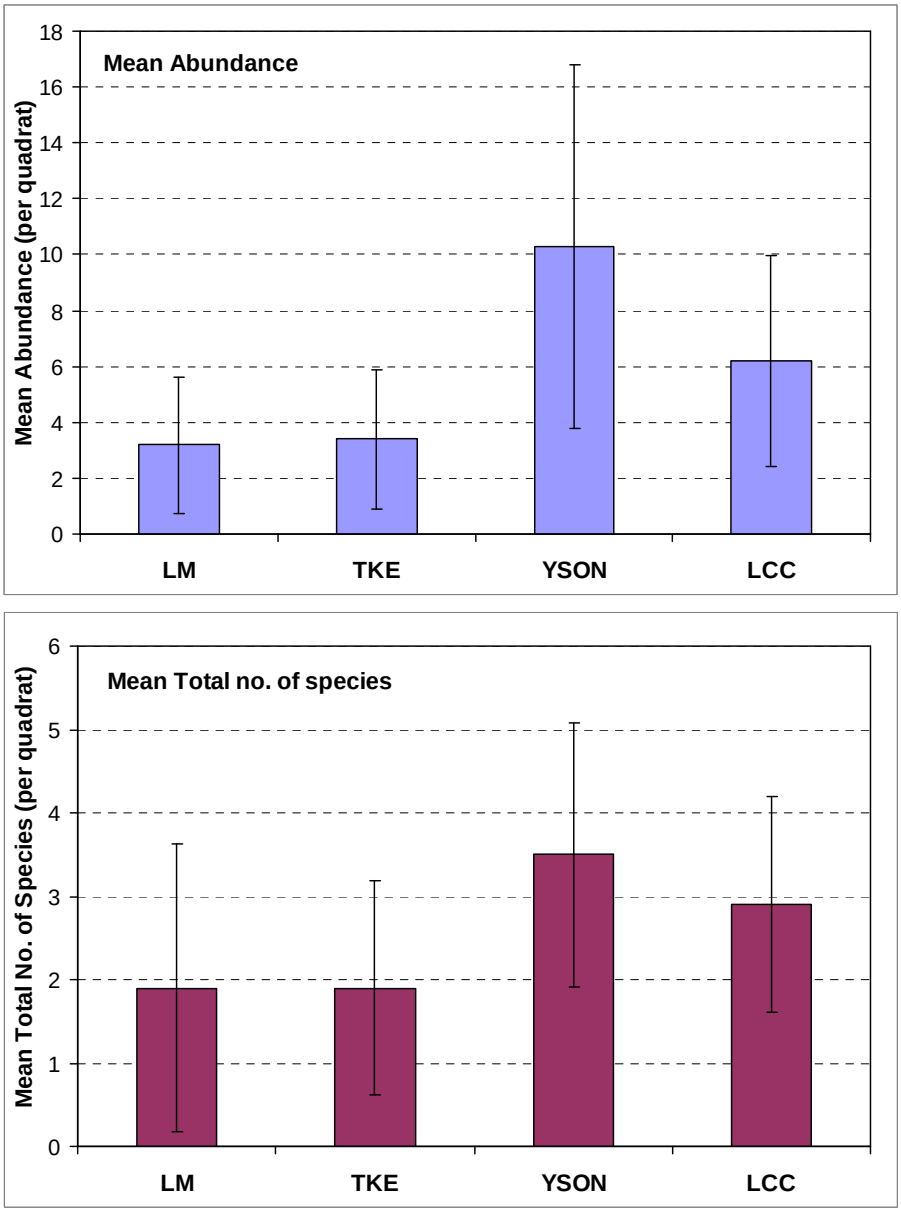
No.	*Family/Species*	Lung Mei						Ting Kok East						Yung Shue O North						Lai Chi Chong					
		Dry			Wet			Dry			Wet			Dry			Wet			Dry			Wet		
		H	M	L	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L
44	*Metopograpsus frontalis*	*	**		*	**		*** **	*** *		*** **	***		***	**		**	**		***			***		
45	*Nanosesarma minutum*	**	***		**	***			*** *	***		*** *	***		***	***		***	***	*	***		*	***	
46	*Neosarmatium smithi*																**								
47	*Parasesarma pictum*	*			**			***			*** *			***			***			**			***		
48	*Parasesarma plicata*				**																				
49	*Perisesarma bidens*										*														
50	*Perisesarma fasciata*				**									**			*** *			***			**		
	Ligiidae																								
51	*Ligia exotica*	*			*			*			**			*			**			*			**		
	Stomatopoda																								
52	*Stomatopod* sp.									*															
	Total Number of Crustacean Species	**11**	**13**	**8**	**13**	**13**	**7**	**12**	**11**	**14**	**16**	**12**	**14**	**14**	**14**	**16**	**15**	**17**	**14**	**8**	**17**	**19**	**11**	**18**	**18**

Noted: * indicates abundance <5; ** indicates abundance <10; *** indicates abundance <50; **** indicates abundance <100; ***** indicates abundance >100

Table C15 ***Mean abundance per quadrat (n=10, quadrat size = 1m^2) of each fish species recorded during the Intertidal Fish Survey.***

No.	Species Name	Lung Mei	Ting Kok East	Yung Shue O North	Lai Chi Chong
1	*Acanthopagrus latus*	0	0.6	0	0
2	*Ambassis gymnocephalus*	1.1	0	0	0
3	*Ambassis* sp.	0	0	0	2.1
4	*Apogon niger*	0.1	0	0	0
5	*Bathygobius fuscus*	0	0.2	1.6	2
6	*Drombus* sp.	0.6	1.4	1.4	0.7
7	*Gerres oynea*	0.3	0	0	0
8	*Psammogobius biocellatus*	0	0	0.1	0
9	*Mugil cephalus*	0.5	0.8	3	0.6
10	*Mugilogobius abei*	0	0	0	0
11	*Omobranchus fasciolatoceps*	0.1	0.3	0.2	0.3
12	*Favonigobius reichei*	0.4	0	0.2	0.1
13	*Platycephalus* sp.	0	0	0.1	0
14	*Pseudogobius javanicus*	0	0	3	0.2
15	*Sillago maculata*	0	0.1	0	0.1
16	*Terapon jarbua*	0	0	0.2	0.1
17	*Tridentiger bifasciatus*	0	0	0.1	0
18	Sea bream sp.	0.1	0	0.4	0

Figure C15 ***Abundance and Total number of fish species (per quadrat; mean ± SD) in each site during the Intertidal Fish Survey.***



C.4 *DISCUSSION*

All species encountered at Lung Mei during the additional quantitative surveys were also present in the three reference sites, thus the intertidal and shallow subtidal fauna at Lung Mei are considered to be common in coastal soft shore habitats of Hong Kong and in particular the Plover Cove, Tolo Harbour and Channel Area. These species at Lung Mei have also been previously reported in Hong Kong as shown in local and international literature (*Tables C3* and *C6*).

As is typical with a sandy shore, the majority of the species recorded at Lung Mei during the active search (~ 90%) were highly mobile species which can move freely in and out of a site. This is reflected in the fact that the additional quantitative survey results indicated that none of the species recorded at Lung Mei were specific or endemic to the marine habitats at the site, and all of the species are considered to be typical sandy shore species and can be found in similar habitats in Hong Kong.

C.4.1 Intertidal and Shallow Subtidal Faunal Diversity

The datasets of epifaunal, infaunal, crustacean and fish species recorded during intertidal transect, benthic core, semi-quantitative crustacean and fish surveys were combined to represent the occurrence of species found on each site under investigation. The total numbers of species of each site were counted on a presence-absence basis for standardising the samples collected in different surveys. On the basis of this, the marine faunal diversity at Lung Mei, Ting Kok East, Yung Shue O North and Lai Chi Chong was evaluated (*Table C14*).

A total of 207 species encountered in the additional quantitative survey, with the highest number recorded in Lai Chi Chong and the lowest recorded in Lung Mei (*Table C14*).

Lai Chi Chong had the highest number of epifaunal and infaunal species recorded during the intertidal transect surveys (*Table C14*) and the highest number of crustacean species recorded during intertidal semi-quantitative crustacean survey (*Table C14*). Yung Shue O North exhibited the highest number of fish species among the four sites (*Table C14*). Lung Mei had the lowest epifaunal and infaunal species (*Table C14*) and crustacean species (*Table C14*) among all surveyed sites. Overall, Lai Chi Chong is considered to exhibit high marine faunal diversity (71 % of all species encountered), while Yung Shue O North and Ting Kok East exhibit moderate diversity (> 50 % of all species encountered). Lung Mei, however, only exhibits low diversity among the four sites studied (43 % of all species encountered, *Table C14*).

Results of the intertidal quantitative surveys are consistent with those of the additional active search (*Annex B*) which identified Lung Mei as having the lowest number of intertidal and shallow subtidal faunal species when compared with Ting Kok East, Yung Shue O North and Lai Chi Chong.

Table C16 Summary of Marine Faunal Diversity recorded during intertidal transect surveys, benthic core survey, intertidal semi-quantitative crustacean survey and intertidal fish survey.

Taxa	Lung Mei	Ting Kok East	Yung Shue O North	Lai Chi Chong
Epifauna & Infauna (combined data from *Tables C4 & C7*)	55 species	71 species	76 species	100 species
Crustacean	28 species	34 species	36 species	42 species
Fish	8 species	6 species	11 species	9 species
Total No. of species recorded *	89 species	108 species	120 species	146 species
Percentage of Total No. of species (i.e. 207 species)	43 %	52 %	58 %	71 %

* The total no. of species recorded is not the same as the sum of no. of species recorded in each taxon, i.e. sum of the first three rows, because there was overlapping of species recorded in the epifauna/infauna survey and the semi-quantitative crustacean survey.

C.4.2 Abundance of Intertidal and Shallow Subtidal Fauna

The overall abundance of epifauna, infauna, crustacean and fish are summarised in *Table C15*. In terms of epifauna, overall mean abundance was the highest at Ting Kok East and the lowest at Lai Chi Chong. Ting Kok East and Yung Shue O North have the highest overall mean abundance for infauna, while Lung Mei has the lowest mean abundance. In terms of crustacean found during the semi-qualitative survey, its

relative abundance was considered high in Yung Shue O North and Lai Chi Chong and moderate in Lung Mei and Ting Kok East. Yung Shue O North has the highest overall mean abundance for fish while Lung Mei has the overall lowest mean abundance.

Table C17 ***Overall Mean Abundance of Marine Fauna Recorded in Lung Mei, Ting Kok East, Yung Shue O North and Lai Chi Chong.***

Taxa	Lung Mei	Ting Kok East	Yung Shue O North	Lai Chi Chong
Epifauna	33.0/quadrat (528.0 ind/m^2) (Moderate)	41.3/quadrat (660.8 ind/m^2) (Moderate to High)	26.7/quadrat (427.2 ind/m^2) (Moderate)	8.7/quadrat (139.2 ind/m^2) (Low)
Infauna	6.2/core (789.8 ind/m^2) (Low to Moderate)	10.7/core (1363.1 ind/m^2) (High)	10.7/core (1363.1 ind/m^2) (High)	7.2/core (917.2 ind/m^2) (Moderate)
Crustacean (relative abundance)	Moderate	Moderate	High	High
Fish	3.2/m^2 (Low)	3.4/m^2 (Low)	10.3/m^2 (High)	6.2/m^2 (Moderate)

C.4.3 Species of Conservation Importance (Note 3, EIAO TM)

The conservation status of each species encountered at Lung Mei during the additional quantitative surveys was checked against the criteria outlined in *Note 3* of *Appendix A* of *Annex 16* of *EIAO TM*. It is understood that only *Point 1* of *Note 3* is applicable to this Study and the species listed under the IUCN Red List [(1)] are discussed below. The associated criteria for evaluation in the IUCN Red List are presented in *Table B6*.

All of the species recorded during the intertidal transect survey, benthic core survey, intertidal semi-quantitative crustacean survey and intertidal fish survey are common intertidal and shallow subtidal fauna in Hong Kong. One of the recorded fish species recorded at Lung Mei, Tropical Sand Goby *Favonigobius reichei* (listed as Lower Risk Near Threatened under IUCN Red List) is considered to be of conservation importance. This species, however, was found at Yung Shue O North and Lai Chi Chong during the intertidal fish survey (*Table C13*), and has also been confirmed to be common in the Tolo area (Plover Cove and Tolo Harbour/Channel) as well as Hong Kong (see detailed discussion in *Section B.3.3*). Results of the intertidal fish survey also suggested that Lung Mei is considered unlikely to support significant populations of these species (*Table C13*). It would therefore appear that habitats at the Lung Mei Beach are unlikely to be an important, unique habitat for this species, and are thus unlikely to be of high ecological importance to this fish species.

(1) The IUCN Species Survival Commission: 2008 IUCN Red List of Threatened Species. <http://www.iucnredlist.org>

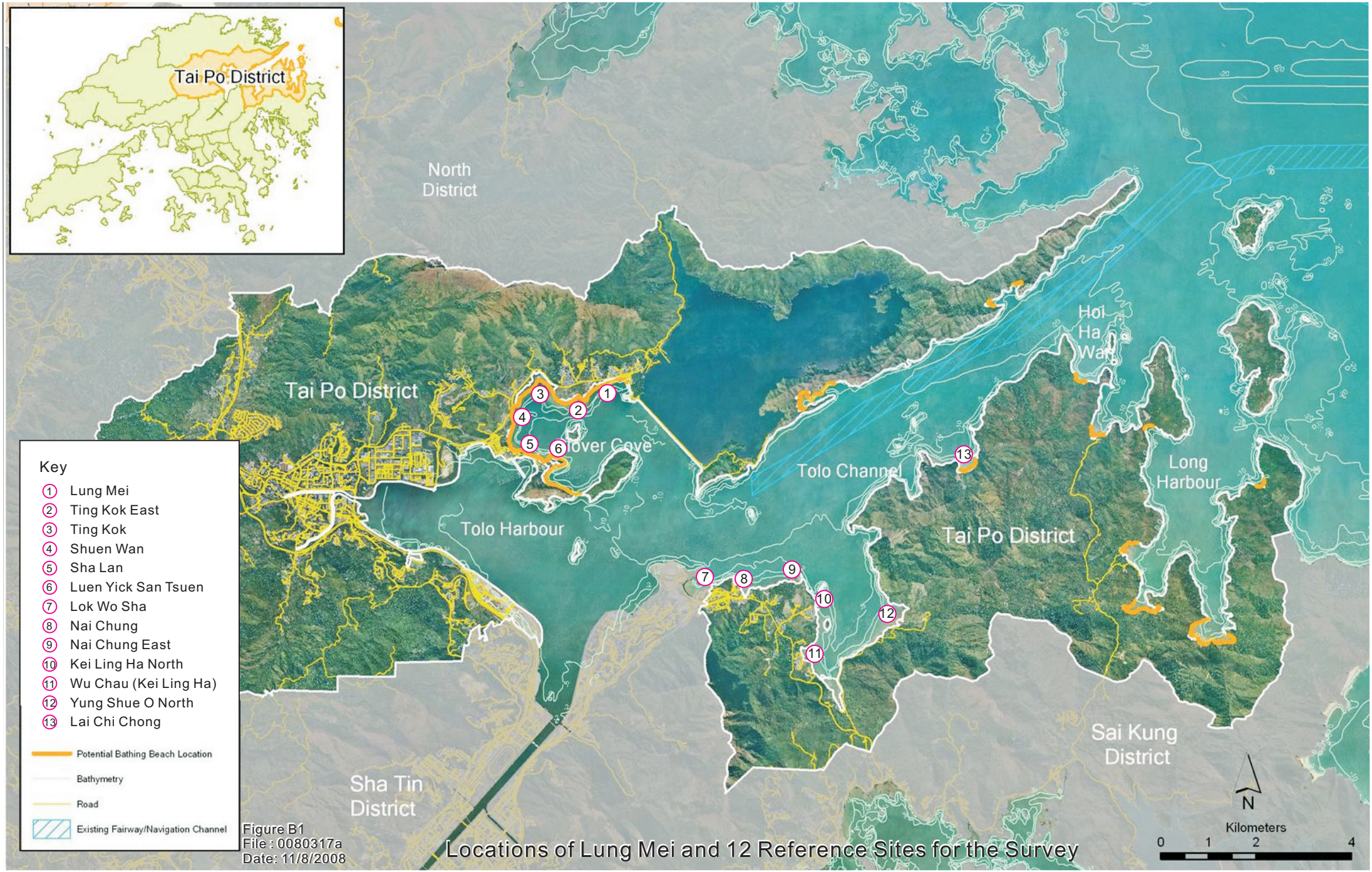


Figure B1
File : 0080317a
Date: 11/8/2008

Locations of Lung Mei and 12 Reference Sites for the Survey

Figure B2
Lung Mei
Scale:1:1500
File: 0080317_basemap_LM.mxd
Date: 28/02/2008

Site Map of Soft Shore at Lung Mei

C
C
C
C
B
B
C
C
C
C
A
T1
T2
T3
Subtidal Zone
Subtidal Zone
-2
0
-2
N
Meters
0 20 40 80
Site Map of Soft Shore at Ting Kok East
Figure B3
Ting Kok East
Scale:1:1500
File:0080317_basemap_TKE.mxd
Date: 28/02/2008

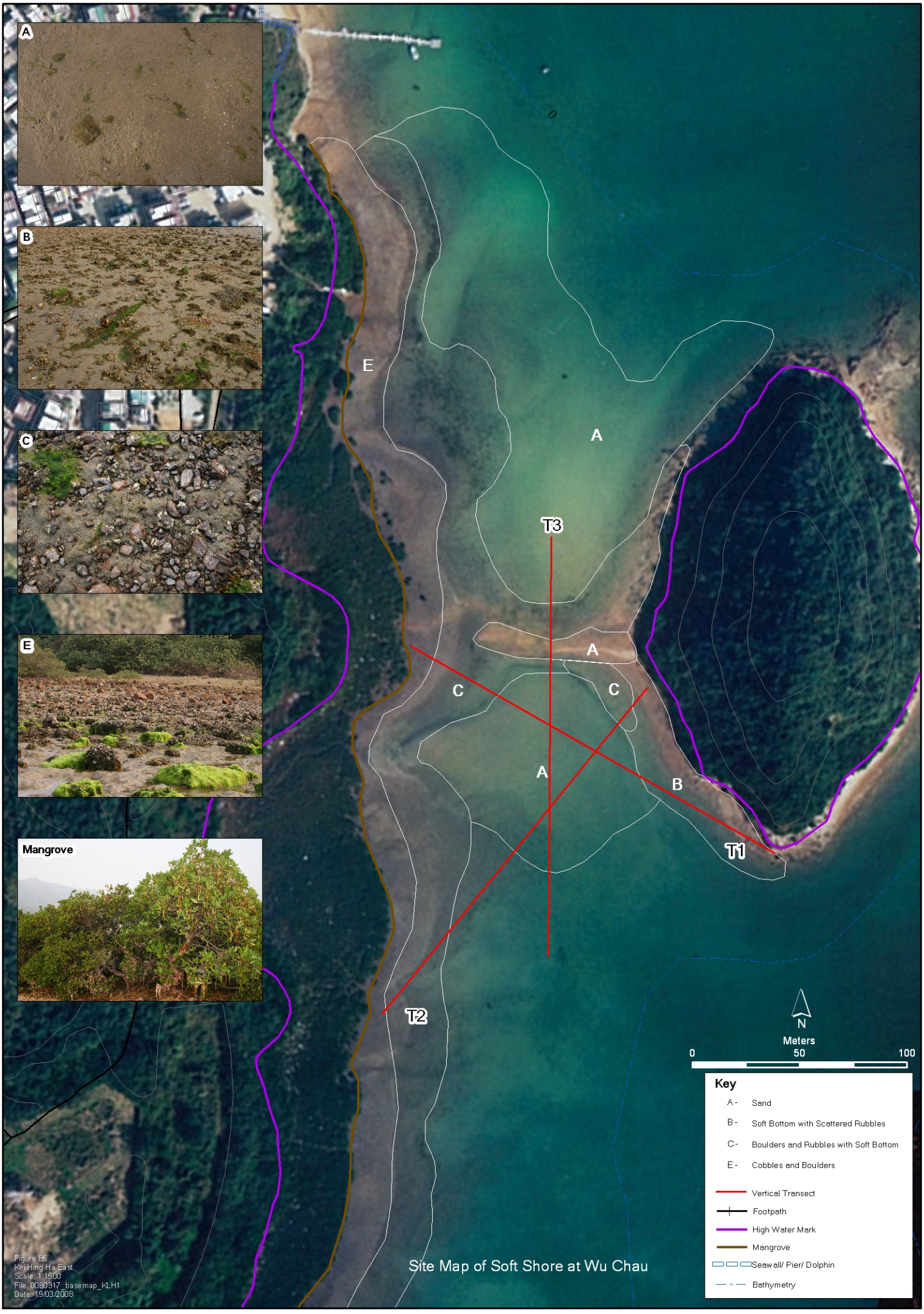
Key
A - Sand
B - Soft Bottom with Scattered Rubbles
C - Boulders and Rubbles with Soft Bottom
Vertical Transect
Footpath
Mangrove
High Water Mark
Bathymetry
Stream/ Freshwater Runoff

B
B
T3
T2
T1
B
C
A
B
I
F
F
C
0
2
N
0 25 50 100
Meters

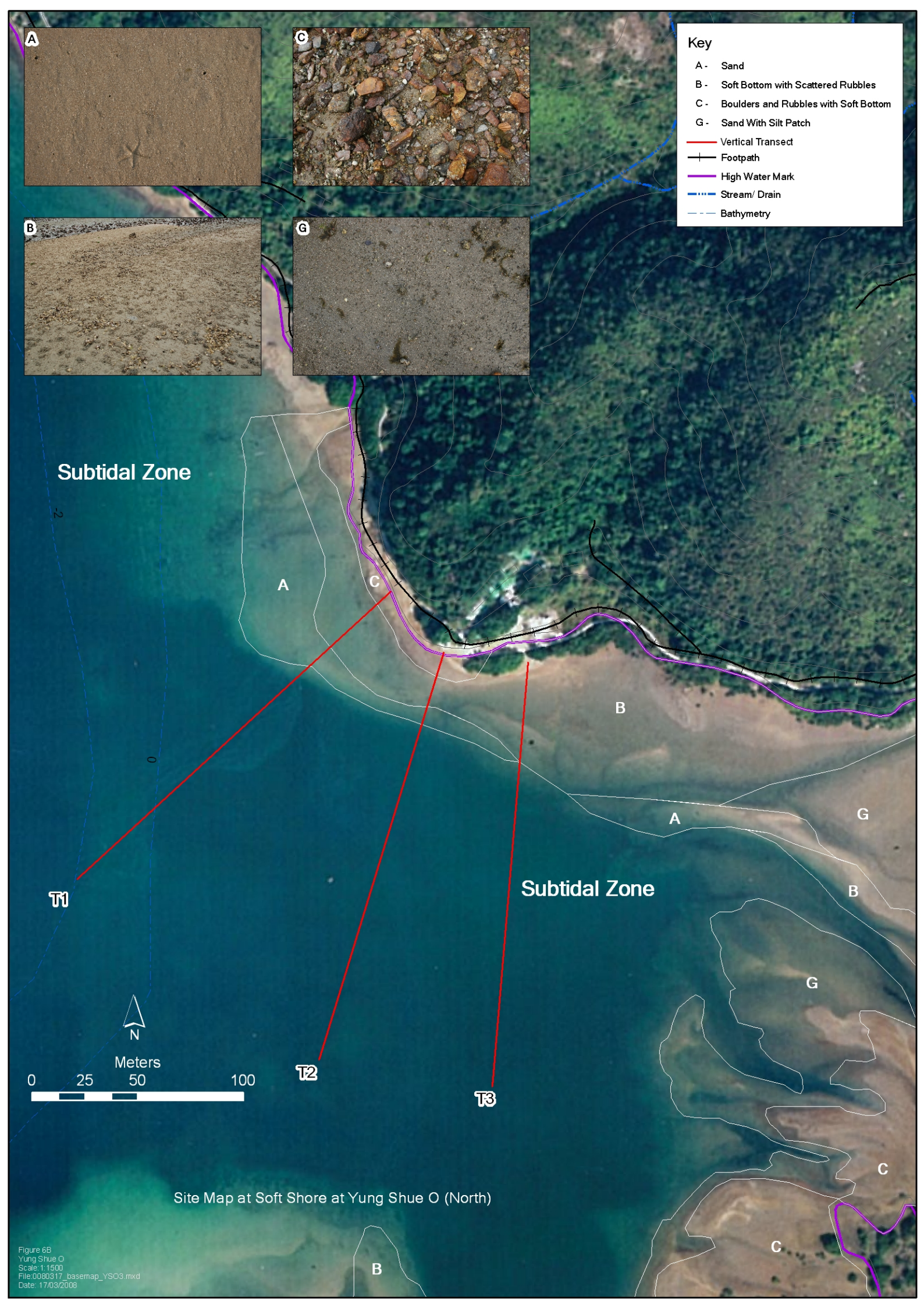
Key
A - Sand
B - Soft Bottom with Scattered Rubbles
C - Boulders and Rubbles with Soft Bottom
F - Big Boulders
I - Back Rock
Vertical Transect
Footpath
High Water Mark
Mangrove
Bathymetry
Stream/ Freshwater Runoff

Figure B4
Shuen Wan
Scale: 1:1500
File: 0080317_basemap_SW.mxd
Date: 19/03/2008

Site Map of Soft Shore at Shuen Wan

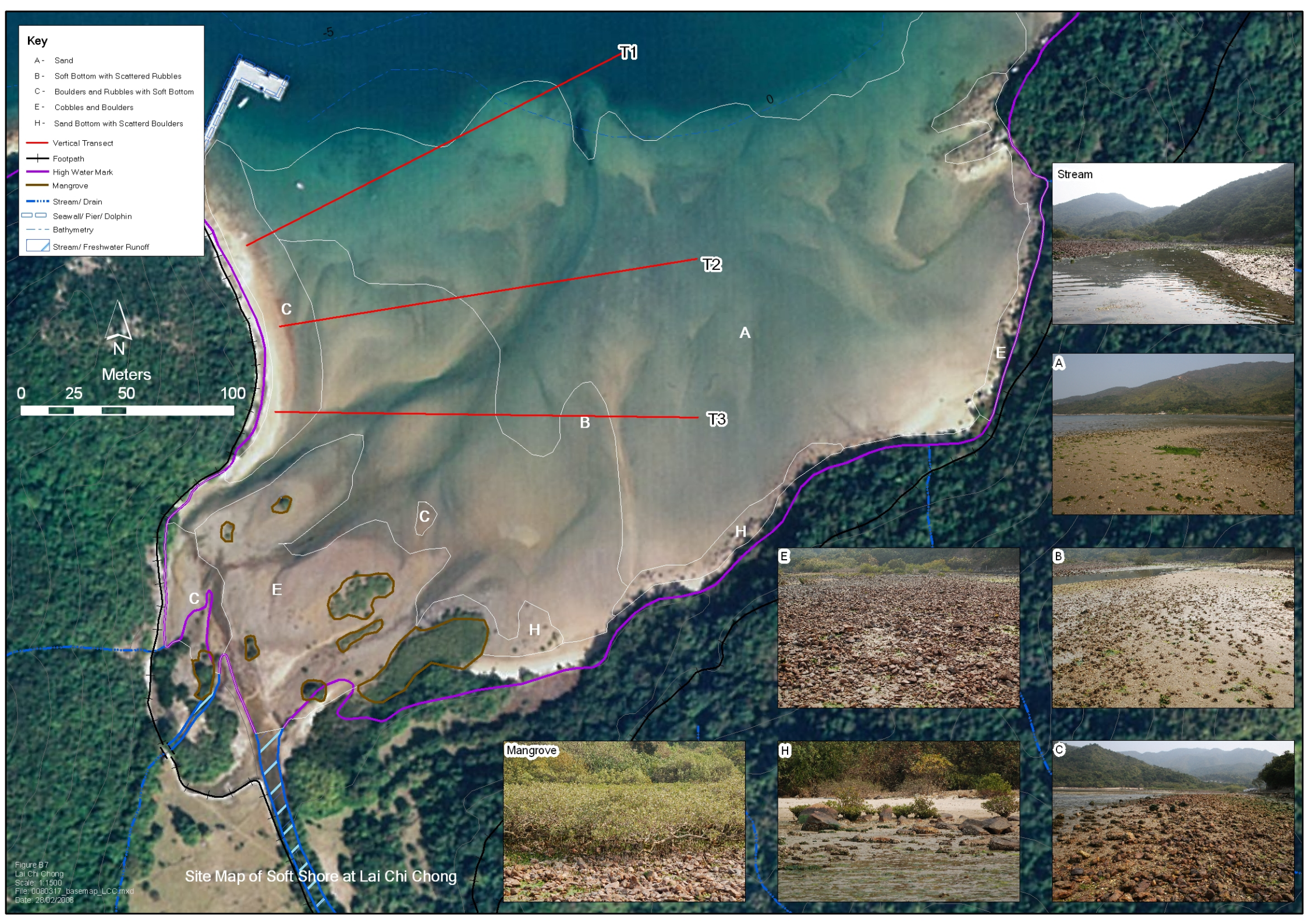

A
B
C
E
Mangrove
E
A
T3
A
C
C
A
B
T1
T2
N
Meters
0
50
100
Key
A - Sand
B - Soft Bottom with Scattered Rubbles
C - Boulders and Rubbles with Soft Bottom
E - Cobbles and Boulders
Vertical Transect
Footpath
High Water Mark
Mangrove
Seawall/ Pier/ Dolphin
Bathymetry
Site Map of Soft Shore at Wu Chau
Figure E6
Kei Hing Ha East
Scale: 1:1500
File: 0080317_basemap_KLH1
Date: 19/03/2008


A
G
Mangrove
B
Stream
C
E
F
Key
A - Sand
B - Soft Bottom with Scattered Rubbles
C - Boulders and Rubbles with Soft Bottom
E - Cobbles and Boulders
F - Big Boulders
G - Sand With Silt Polygon
Footpath
High Water Mark
Mangrove
Stream/ Drain
Bathymetry
Stream/ Freshwater Runoff
N
Meters
0 25 50 100
Subtidal Zone
Figure B6a
Yung Shue O
Scale: 1:1500
File: 0080317_basemap_YSO.mxd
Date: 17/03/2008
Site Map of Soft Shore at Yung Shue O (North)



Site Map at Soft Shore at Yung Shue O (North)

Figure 6B
Yung Shue O
Scale: 1:1500
File:0080317_basemap_YSO3.mxd
Date: 17/03/2008


Key
A - Sand
B - Soft Bottom with Scattered Rubbles
C - Boulders and Rubbles with Soft Bottom
E - Cobbles and Boulders
H - Sand Bottom with Scatterd Boulders
Vertical Transect
Footpath
High Water Mark
Mangrove
Stream/ Drain
Seawall/ Pier/ Dolphin
Bathymetry
Stream/ Freshwater Runoff
N
Meters
0 25 50 100
T1
T2
T3
-5
0
A
B
C
E
H
Stream
Mangrove
Figure B7
Lai Chi Chong
Scale: 1:1500
File: 0080317_basemap_LCC.mxd
Date: 28/02/2008
Site Map of Soft Shore at Lai Chi Chong

Subtidal Zone

Key

A - Sand
B - Soft Bottom with Scattered Rubbles
C - Boulders and Rubbles with Sand Bottom
D - Upper Shore Sand Beach
E - Cobbles and Boulders

Transect Line at 0.5m above CD
Transect Line at 1.0m above CD
Transect Line at 1.5m above CD
Footpath
High Water Mark
Stream/ Drain
Seawall/ Pier/ Dolphin
Bathymetry
Stream/ Freshwater Runoff

N

Meters

0 25 50 100

Figure C1
Lung Mei
Scale:1:1500
File: 0080317_basemap_LM2.mxd
Date: 28/02/2008

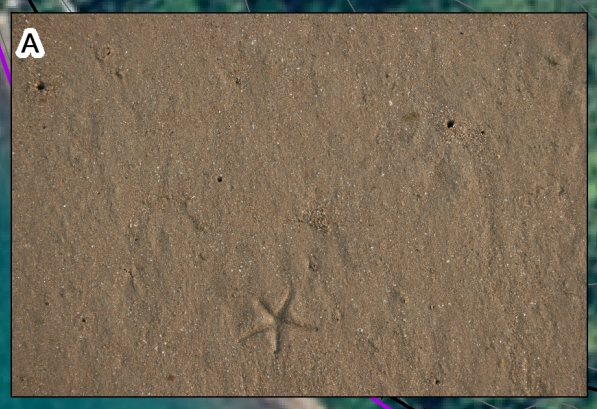
Transect Locations for Quantitative Survey at Lung Mei

C
C
C
C
C
C
C
B
B
B
A
Subtidal Zone
Subtidal Zone
-2
0
N
Meters
0 20 40 80

Key
A - Sand
B - Soft Bottom with Scattered Rubbles
C - Boulders and Rubbles with Soft Bottom
Transect Line at 0.5m above CD
Transect Line at 1.0m above CD
Transect Line at 1.5m above CD
Footpath
Mangrove
High Water Mark
Bathymetry
Stream/ Freshwater Runoff

Figure C2
Ting Kok East
Scale:1:1500
File:0080317_basemap_TKE2.mxd
Date: 28/02/2008

Transect Locations for Quantitative Survey at Ting Kok East



Key

- A - Sand
- B - Soft Bottom with Scattered Rubbles
- C - Boulders and Rubbles with Soft Bottom
- G - Sand With Silt Patch
- Transect Line at 0.5m above CD
- Transect Line at 1.0m above CD
- Transect Line at 1.5m above CD
- Footpath
- High Water Mark
- Stream/ Drain
- Bathymetry

Subtidal Zone

-2

N

Meters

0 25 50 100

A

C

B

A

G

Subtidal Zone

B

G

C

C

B

Transect Locations for Quantitative Survey at Yung Shue O (North)

Figure C3
Yung Shue O
Scale:1:1500
File:0080317_basemap_YSO2.mxd
Date: 17/03/2008

Key

A - Sand
B - Soft Bottom with Scattered Rubbles
C - Boulders and Rubbles with Soft Bottom
E - Cobbles and Boulders
H - Sand Bottom with Scatterd Boulders

Transect Line at 0.5m above CD
Transect Line at 1.0m above CD
Transect Line at 1.5m above CD
Footpath
High Water Mark
Mangrove
Stream/ Drain
Seawall/ Pier/ Dolphin
Bathymetry
Stream/ Freshwater Runoff

N

Meters
0 25 50 100

-5
0

A
B
C
C
C
E
E
H
H

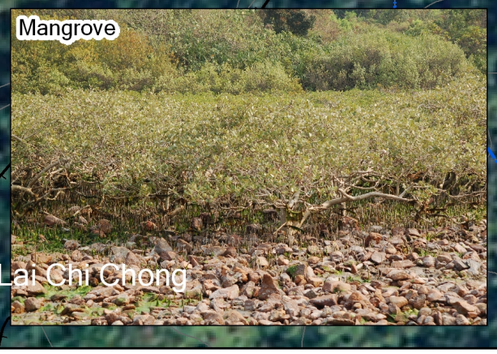
Stream

A

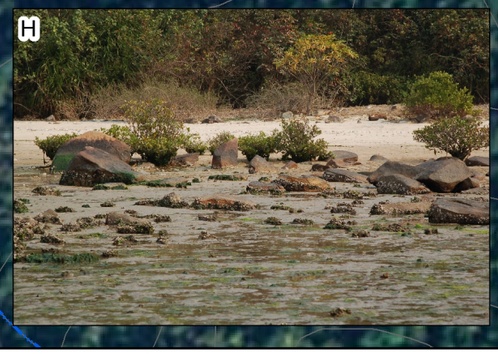
E

B

Mangrove



H



C

Figure C4
Lai Chi Chong
Scale: 1:1500
File: 0080317_basemap_LCC1.mxd
Date: 28/02/2008

Transect Locations for Quantitative Survey at Lai Chi Chong