APPENDIX 10B

Hong Kong-Zhuhai-Macao Bridge Hong Kong Link Road – Verification Survey for Ecologcial Baseline Final Report, May 2009

1.0 BACKGROUND

1.1 The Verification Survey (hereafter known as the "current study") was designed to cover wet and dry seasons between the end of August 2008 and January 2009. Within this 5 month period, ecological surveys focused on the areas of sub-tidal, intertidal and terrestrial habitat that lie within a 500m distance of the Hong Kong Link Road (HKLR) alignment as well as sites/habitats of concern in the vicinity. Desktop studies have been employed in order to describe important habitats in the wider area.

1.2 The Assignment includes the following:

(a) undertake a desktop study of available data;
(b) undertake field surveys and investigations covering both the wet and dry seasons;
(c) investigate and describe the existing wildlife uses of various habitats;
(d) review and verify the validity of the ecological baseline information produced under Agreement No. MW 01/2003; and,
(e) establish the updated ecological profile of the Survey Area and description of the characteristics of each habitat found.

1.3 This Final Report on Verification Survey includes the results of the surveys carried in the wet and dry seasons and the dive survey.

2.0 LITERATURE REVIEW

2.0.1 Headings follow those in the previous study Final 9 Month Ecological Baseline Survey Report (hereafter known as the "Previous Study') produced by Meinhardt Mouchel in August 2004 for the Highways Department (HyD). The Brief for the Current Study differs slightly from that in 2004; the Study Area for the Current Study is much smaller than the Previous Study and specific surveys for some species groups were not required. However, it must be noted that whilst specific surveys were not directly required in the Current Brief (e.g. Freshwater and estuarine fish, Freshwater macroinvertebrates, Coral) these groups were surveyed under other survey headings (i.e. Stream Surveys, Intertidal Surveys, Dive Surveys). No surveys for Cetaceans were required in the Current Brief, though references to this group have been made by way of literature review. The following headings are those from the Previous Study. Those headings marked with an asterisk (*) are those which differ slightly from the requirements or headings in the Current Study Brief.

2.0.2 However, this section is intended to summarize findings from the Previous Study and to highlight those species or habitats of conservation interest of the species groups which were identified within the boundaries of the smaller, Current Study Area. The Current Study Area occupies a much smaller area terrestrial habitats than the Previous Study Area due to a change in the alignment of the proposed HKLR.

2.1 Freshwater and Estuarine Fish*

2.1.1 Streams in North Lantau have long been considered as important habitats for local freshwater fishes, for example Tung Chung Stream was once been considered to hold the second most diverse freshwater fish habitat in Hong Kong (Chong & Dudgeon 1992) and Tai Ho Stream is thought to be the only habitat for the Ayu *Plecoglossus altivelis* in Hong Kong (Lee *et al.* 2002). The Previous Study (HyD 2004) conducted a detailed freshwater and estuarine fish study in North Lantau

during 2003 and 2004 and found that, in addition to the aforementioned streams, the fish diversity in Sham Wat Stream was also high. A species of conservation concern, *Takifugu ocellatus*, was also recorded at a stream in San Tau. It should be noted that Tung Chung Stream and Tai Ho Stream are outside of the limits of the current Study Area.

2.2 Freshwater macroinvertebrates*

2.2.1 Aquatic macroinvertebrate surveys were conducted at five streams during the Previous Study (HyD 2004); three of these streams are not within the current Study Area. No species of conservation interest or importance were recorded during the Previous Study, though these streams were considered to provide nurseries for uncommon odonate and water beetle species (HyD 2004).

2.2.2 Aquatic invertebrates of high conservation concern (for example *Somanniathelphusa zanklon*) have been recorded in these North Lantau streams during other studies (DSD 2002). North Lantau streams are generally unpolluted and receive less human impact than most other local streams (HyD 2004), and these streams would be expected to support a greater diversity of invertebrates than disturbed freshwater habitats.

2.3 Marine Benthic Macrofauna

2.3.1 The marine benthic macrofauna exhibited distinct seasonal patterns during the Previous Study. In the wet season, species abundance and diversity was higher outside (32.6 individuals and 4.2 taxa grab^{-1}) than inside Tung Chung Channel (9.2 individuals and 2.4 taxa grab^{-1}; HyD 2004). In the dry season, conversely, species abundance and diversity was higher inside (46.2 individuals and 9.8 taxa grab^{-1}) than outside (23 individuals and 5.6 taxa grab^{-1}) Tung Chung Channel (HyD 2004).

2.3.2 The marine benthic macrofauna was comprised of a high diversity of polychaete species, in which *Sigambra hanaokai* was the dominant species in the wet season, while *Eunice indica* and *Prionospio* sp. dominated in the dry season (HyD 2004). Species diversity of other taxa (mainly crustaceans, echinoderms and molluscs) and the overall biomass were, however, low, which is typical in the northwestern waters of Hong Kong (ERM 2000; Shin 2002; Mouchel 2002). All the species recorded occur frequently in Hong Kong and no rare species were observed (Shin 2002). The biotic index of ~ 2 – 3 and the dominant species recorded implies the community is slightly disturbed (HyD 2004).

2.4 Intertidal Flora and Fauna (Hard and Soft Shores)

Soft Shore

2.4.1 Soft shore habitats (mudflats and sandflats) along the coast of northern Lantau are well-studied (Morton & Morton 1983), a result of their diversity of fauna and flora combined with the heavy development pressure on these habitats. Some of these soft shores have been identified as nursery habitats for horseshoe crabs (Chiu & Morton 1999, Shin *et al.* 2007), and San Tau, one of the soft shore sites surveyed in the Current Study, is known to be an important site for seagrass (Kwok *et al.* 2005a). Mangroves are common in some of these areas (Tam & Wong 2000). The shallow soft shores are considered to be nursery habitats for fishes in Hong Kong (Nip 2005). The Previous Study recorded low numbers of typical soft shore intertidal fauna, with species abundance similar during the wet and dry seasons (HyD 2004).

Soft Shore Flora

2.4.2 The mangrove stands along northern Lantau are dominated by *Aegiceras corniculatum, Kandelia obovata* and *Bruguiera gymnorrhiza*, with considerable patches of *Avicennia marina* and *Acanthus ilicifolitus*. Similar backshore vegetation was recorded in the Previous Study (HyD 2004), with some locally restricted species (such as *Celtis biondii*, *Ipomoea imperati*, *Stenoloma biflorum* and *Thespesia populnea*) also identified. Coastal vegetation between Tung Chung and Sham Wat is quite rich and four rare/protected species, including the herb *Drosera indica*, the seagrasses *Halophila ovalis* (reported as *Halophila ovata* in HyD 2004) and *Zostera japonica*, and the tree *Dodonaea viscosa*, were identified near Hau Hok Wan, at San Tau SSSI and Sha Lo Wan Beach respectively. Fong (1999, 2000) previously reported a complete disappearance of *Zostera japonica* and *Halophila ovalis* (Fong reported as *Halophila ovata* but Yip & Lai (2006) clarified that the reported *Halophila ovata* should be based on misidentification of *Halophila ovalis*) during the construction and reclamation works of the Chek Lap Kok new airport in early 1990s; the seagrass populations have gradually recovered following the completion of the airport.

San Tau SSSI

2.4.3 Part of San Tau SSSI occurs within the current study area and this area has been designated as a SSSI on account of the seagrass beds that occur. Seagrasses, flowering plants which are mostly distributed in shallow, sheltered soft-bottom marine coastlines or in estuarine waters, are uncommon in Hong Kong. This habitat is of conservation importance because it plays a crucial role in stabilizing coastlines and provides shelter and feeding grounds for a number of coastal fauna, including fishes, gastropods, crabs and horseshoe crabs (Kwok *et al.* 2005). Hence, the stability and size of seagrass beds are important to maintain the balance of the coastal ecosystem. According to TM-EIAO, established seagrass beds of any size are considered to be a valuable habitat in Hong Kong. The seagrass species recorded at San Tau SSSI are considered to be rare in Hong Kong (South China Institute of Botany & AFCD 2003, Kwok *et al.* 2005b).

2.4.4 San Tau was designated as SSSI in 1994 due to the presence of an extensive seagrass bed dominated by two seagrass species *Halophila ovalis* and *Zostera japonica*. According to the routine biodiversity survey of seagrass beds conducted by AFCD since 2002, a maximum extent of 3820 m^2 of *H. ovalis* and 20 m^2 of *Z. japonica* has been recorded in San Tau SSSI (Kwok *et al.* 2005).

2.4.5 According to Fong (2000), *Halophila ovalis* (reported as known as *Halophila minor* or *Halophila ovata* in Fong (2000) but Yip & Lai (2006) clarified that such *Halophila* spp. should be due to misidentification of *Halophila ovalis*), is a short-lived pioneer annual plant which can colonize suitable substratum in a short period of time, but rapidly disappears when abiotic factors become unfavorable. The degree of recovery each year shows considerable annual variation. Areas of extensive coverage of this species have been reported to disappear completely within a short period at San Tau. This unusual life cycle leads to seasonal variation in abundance of *Halophila ovalis* with regular annual cycles (Fong 2000). Although the sheltered flat at San Tau SSSI provides suitable substratum for *Halophila ovalis* and *Zostera japonica*, the specific growth requirements of these two seagrass species are easily influenced by abiotic factors (including temperature and turbidity of water), biotic factors (including macro-algal blooms during winter) and anthropogenic effects (Fong 2000, Huang *et al.* 2006). Temperature influences the growth, flowering period and seed germination of both species (Fong 2000); *Z. japonica* is favored by slightly warm temperature during the flowering period (from March to July, with a peak in May), whereas *Halophila ovalis* is favored by hot

summer temperatures. Anthropogenic factors could further hasten the disappearance of seagrass bed. Urban development and reclamation around Tung Chung Bay may increase the sedimentation rate and change the hydrology of the bay, which may directly or indirectly change the substratum of the seagrass bed in San Tau SSSI (Fong 2000). Seagrass beds at Hepu in Guangxi and Liusha in Guangdong have been affected by digging activity for shellfish collection (Huang *et al.* 2006). Similarly, regular digging for shellfish by local residents around the mudflat and low shores at San Tau SSSI could influence the roots of seagrasses and loosen the sand and mud of the shore, affecting the establishment and normal growth of seagrasses.

Hard Shores

2.4.6 The local hard-bottom intertidal habitats (i.e. boulder shore and rocky shore) usually contain fewer species of conservation concern. In Hong Kong, hard shore habitats are more common than soft shore habitats, and most species in the former habitats usually appear to be common and widespread (Morton & Morton 1983). Hard shore intertidal fauna recorded in the Previous Study were common in Hong Kong with low species diversity (HyD 2004).

2.5 Coral*

2.5.1 Around the proposed survey area, only one survey has been conducted previously on the subtidal community structure (The Oceanway Corporation Ltd 2003) as part of the Previous Study (HyD 2004). The survey involved spot dives at twenty-seven sites within the area potentially impacted.

2.5.2 No reef-building or hermatypic corals were observed in the east or west of the Chek Lap Kok Channel. An ahermatypic cup coral species, *Balanophyllia* sp., and a gorgonian soft coral species, *Echinomuricea* sp., were observed on the hard substrate. The abundance of both species was low (cover <5%), however, and high levels of partial mortality of the *Echinomuricea* colonies were observed. Both are commonly found in western Hong Kong waters but with a patchy distribution. Generally, hard substrate ended at ~3m depth, beyond which the substrate was sand and mud (HyD 2004).

2.6 Horseshoe Crabs

2.6.1 Territory-wide Horseshoe Crab surveys have been conducted by Chiu and Morton (1999) and Shin *et al.* (2007), with results indicating that the soft shores along the North Lantau coast provide suitable nursery habitats for Horseshoe Crabs. In addition, surveys conducted along the North Lantau coast as part of environmental impact assessment reports (e.g. MTRC 2003, HyD 2004) have identified the presence of Horseshoe Crabs in soft shore areas within the Current Study area.

2.6.2 The conservation importance of Horseshoe Crabs is well recognized and local populations are declining (Shin *et al.* 2007). The territory–wide surveys conducted between 2004 and 2006 (*ibid.*) found that local Horseshoe Crab populations declined dramatically compared to an earlier study in 2002 (Morton & Lee 2003).

2.6.3 The Previous Study for this Project (HyD 2004) recorded more than 50 individuals of two species (*Carcinoscorpius rotundicauda* and *Tachypleus tridentatus*) over a nine-month study period. Of the six soft shore sites for the 2008-09 study, Horseshoe Crabs were found at four during the 2003-04 studies (Tung Chung Bay, Sham Wat, San Tau and Hoi Hok Wan).

2.7 Cetaceans*

2.7.1 Whilst no specific surveys were conducted in the previous report, Impact Index analysis was conducted for Chinese White Dolphins *Sousa chinensis* for the proposed alignment in Hong Kong waters. It was concluded that the western section of the bridge (4.8km) passes through known areas of high dolphin density, whilst the section in eastern waters (4.1km) passes through an area of low dolphin density. No sightings of dolphins have been documented in the Airport Channel, between Airport Island and the northern coast of Lantau (HyD 2004).

2.8 Avifauna

2.8.1 Across the 9-month survey period, a total of 118 bird species, including 32 of conservation interest, was recorded during the Previous Study (HyD 2004). Fourteen species of conservation interest were recorded in the current Study Area, ten of which are considered to be wetland or wetland-associated species.

2.8.2 In September 2003, high numbers of both Cattle Egrets *Bubulcus ibis* and Little Egrets *Egretta garzetta* were recorded from Tung Chung Bay (over 700 individuals of each species) indicating this area is an important foraging site for these species (HyD 2004), although these numbers may also suggest that these birds are migratory in this area.

2.9 Terrestrial Mammals

2.9.1 Two species of mammal, Indian Muntjac *Muntiacus muntjac* and Brown Musk Shrew *Suncus murinus*, were recorded during the Previous Study (HyD 2004). Whilst listed as being of Potential Regional Concern (Fellowes *et al.* 2002), Indian Muntjac (as Red Muntjac) is listed as having a wide distribution in Hong Kong (Shek 2004) and several records occur along the north coast of Lantau. Brown Musk Shrew (as Musk Shrew) is described as having a wide distribution occupying a wide variety of habitats in Hong Kong (*ibid.*).

2.9.2 Several unidentified bat species were observed during the nocturnal surveys in 2003-04, though the report does not speculate the species observed. All bat species are protected in Hong Kong under the Wild Animals Protection Ordinance (Cap. 170).

2.10 Insects (Dragonflies and butterflies)

Dragonflies

2.10.1 Twenty-four species of dragonfly species were recorded in the Previous Study. This included three species of conservation interest, all of which were recorded outside of the current Study Area.

Butterflies

2.10.2 A total of 90 butterfly species was recorded during the Previous Study; including six species of conservation interest (HyD 2004). Two of these species, Common Albatross *Appias albina* and Danaid Eggfly *Hypolimnas misippus*, were recorded in the current Study Area.

2.10.3 The areas around San Tau and Sha Lo Wan are recognized as being important locations for rare and uncommon butterfly species (Young & Yiu 2002), including the protected Golden Birdwing Butterfly *Troides helena* (Young & Reels 1998, Young & Yiu 2004).

2.11 Herpetofauna

2.11.1 During the 2003-04 study, a total of 14 species of reptile was recorded. Only one of these is recognized as being of conservation interest: Tokay Gecko *Gekko gecko*, which occurs within the limits of the current Study Area. This species was seen on rocky outcrops and within villages in the vicinity of Sham Wat, San Shek Wan and San Tau (HyD 2004).

2.11.2 Of the amphibians surveyed in 2003-04, a total of seven species was recorded, including one species of conservation interest, the Lesser Spiny Frog *Paa exilispinosa (ibid.).* Lesser Spiny Frog was observed as tadpoles within several streams within the current Study Area.

2.11.3 The most significant herpetofauna record in the current Study Area is that of the endemic Romer's Tree Frog *Philautus romeri*, which is known to be extant on the northern side of Scenic Hill (HyD 2004, AFCD pers. comm.). This species has restricted local distribution (Karsen *et al.* 1998) and the remnant population on Chek Lap Kok is a fragment of a larger population that was present prior to the extensive construction work required for the current airport. Whilst a large number of adult and tadpoles was translocated, a small population remains within the abandoned village area at Scenic Hill, with breeding occurring within small water bodies amongst the ruins (AFCD 2005).

2.12 Habitats and vegetation (terrestrial)

2.12.1 A comprehensive botanical survey was conducted by the Previous Study (HyD 2004). A total of eleven habitats, including secondary woodland, plantation woodland, tall shrubland, shrubby grassland, mangrove, seagrass, coastal habitat and salt marsh, cultivated land/orchard, developed area, wasteland and stream/riparian habitats, were identified in the study. A total of 475 plant species were recorded in the botanical surveys, including five locally protected species (orchids *Cleisostoma simondii*, *Arundina chinensis*, *Acampe rigida*, *Eulophia graminea* and shrub *Pavetta hongkongensis*) and five rare species (herb *Drosera indica* found along the shoreline from Hau Hok Wan to Kau Liu, seagrass *Halophila ovalis* (reported as *Halophila ovata* in HyD 2004) and *Zostera japonica* in San Tau SSSI, sedge *Carex tristachya* along the footpath near a tall shrubland near Hau Hok Wan and tree *Dodonaea viscosa* along the back of the beach near Sha Lo Wan). With the exception of the sedge *Carex tristachya*, approximately 70 individuals of which were recorded, these protected and rare species were generally recorded in small patches within the Study Area. In addition, nine trees, four shrubs, 20 herbs and eight climber species are identified as restricted species by Xing *et al.* (2000). Of these species, the trees *Dimocarpus longan* and *Litchi chinensis* are widely cultivated as fruit trees in villages and orchards (Xing *et al.* 2000), the mangrove *Bruguiera gymnorrhiza* is quite widespread in the local mangrove stands (27 out of 43 mangrove stands surveyed in Tam *et al.* (1997)), and the shrubs *Boehmeria nivea* and *Ricinus communis* are often recorded in wastelands and shrubby grassland.

2.12.2 The Previous Study recorded a total of eleven habitats, dominated by developed area (on account of the large area occupied by the Airport Island). Of the remaining ten habitat types, three were considered to be of High Ecological value (Mangrove and Seagrass, Streams and Riparian (high base flow) and Secondary Woodland), with Tall Shrubland considered to be of Moderate to High ecological value.

3.0 FIELD SURVEY METHODOLOGIES FOR VERIFICATION OF ECOLOGICAL BASELINE STUDY

Marine Surveys

3.1 Marine Grab Survey

3.1.1 Marine grab samplings for benthic communities in soft substrate seabed were conducted at 9 stations along the most recent proposed HKLR alignment during both wet season and dry seasons (September 2008 and December 2008). The HKLR alignment and the sampling locations are shown in Appendix 1. Three grab sample replicates of 0.1m^2 were collected at each of the sampling stations by van Veen-type Grab and collected samples were sieved using a 0.5mm mesh-size sieve and then preserved in 70% ethanol. Organisms inside the samples were sorted from the sediments by staining with Rose Bengal and then identified to the lowest practicable taxonomic level. Species composition, abundance and biomass were reported and statistical analyses (Diversity index, evenness index and Abundance/Biomass Comparison (ABC) plots), were provided for evaluation and ranking of ecological values.

3.2 Dive Survey

3.2.1 Dive surveys for corals and other hard-substrate marine organisms were conducted at seven locations in the shallow coastal waters that will potentially be subject to direct loss (including the landing points of HKLR at both natural and artificial coastlines along Airport Channel and on Airport Island) or to indirect impacts due to changes in water quality and hydrodynamic condition (including the coastlines to the east and to the west of Airport Channel). The locations for dive survey are shown in Appendix 1.

3.2.2 A semi-quantitative Rapid Ecological Assessment (REA) survey was conducted at each survey location. The REA survey was performed along a 100m underwater transect parallel to the coastline. Transects of 50m to 100m (subject to the underwater visibility) perpendicular to the coastline were also performed. The depth and substrate along the perpendicular transects were recorded at 3m intervals, or at smaller intervals if the gradient significantly changed along the transect. The benthic cover, taxon abundance, and ecological attributes of the transects were recorded in a 2m wide strip, 1m either side of the transects (subject to the underwater visibility), following the Rapid Ecological Assessment (REA) technique. The exact locations and routes of the REA transects were recorded on site by GPS and map.

3.2.3 Video footage and photos of the transects and the surveyed areas were taken during the dive surveys.

3.2.4 The purpose of the REA survey was to quantitatively record the habitat types and ecological values of the area by SCUBA diving. The REA approach (see Appendix 3 for further detailed methodology) aimed to collect data on the type of substrate and the abundance of marine organisms, in particular the occurrence of corals and the extent of the coral distribution from the coastline, for ranking the ecological values. Other parameters recorded during the surveys included site condition (e.g. observations regarding the degree of exposure of the sites to wave action), species list of corals and other marine organisms, coral sizes, coral health status and translocation feasibility of corals.

3.3 Intertidal Survey

3.3.1 Intertidal surveys for epifaunal communities were conducted on both hard (including natural and artificial coastlines) and soft shores along the Airport Channel and on Airport Island, during both the wet season and dry season. All intertidal surveys were conducted during suitable tides. For both hard and soft shores, a detailed active search along the shore was also conducted to supplement the transect surveys with details of any other species present and their occurrence in the survey locations, so as to produce a comprehensive species list for each of the survey areas.

Hard shores

3.3.2 Horizontal transects (at least 50m in length) at three tidal levels (High, Middle and Low) were established on each of the landing points of HKLR, covering natural and artificial coastlines; each transect comprised ten 0.5m x 0.5m quadrats. The locations of the hard shore survey areas are shown in Figure 1. The epifauna in each quadrat were identified and their numbers/coverage percentages recorded. Species and abundance of biota in quadrats were reported and diversity index, evenness index and other statistical analyses were provided for evaluating and ranking the ecological values.

Soft shores

3.3.3 The embayments along and in the vicinity of Airport Channel, namely Sham Wat, San Shek Wan, Sha Lo Wan, Hau Hok Wan, San Tau and Tung Chung Bay, were surveyed. The locations of the embayments are shown in Appendix 1.

3.3.4 At each site, horizontal transects (at least 50m in length) at three tidal levels (High, Middle and Low) were established, with ten 0.5m x 0.5m quadrats along each transect. The epifauna and infauna (within the top 5cm sediment) in each quadrat were identified and their numbers/coverage percentages recorded. One core of 10cm diameter x 20cm depth was also collected within each quadrat, the sediments sieved using 2mm mesh-size sieve and the biota inside identified and counted. Species and abundance of biota in both cores and quadrats were reported and statistical analyses (diversity index and evenness index) were provided for evaluating and ranking the ecological values.

3.3.5 Seagrass surveys and horseshoe crab surveys were also conducted at the above soft shore sites. The sites were thoroughly searched for seagrasses and horseshoe crabs during suitable tides. The species, number and size of horseshoe crabs and the species, area and coverage percentages of seagrass beds were recorded, and the locations of horseshoe crabs and the locations and extents of seagrasses were mapped.

Terrestrial survey

3.4 Habitat & Vegetation

3.4.1 Habitat and vegetation surveys were conducted in the terrestrial areas within 500m from the HKLR alignment (see Appendix 1) on North Lantau and Airport Island, during both wet season and dry season. The walk-over survey locations were selected prior to the field survey through aerial photographs and data from the baseline surveys. During the surveys, locations of any rare or protected plant species were recorded and the number of individuals present counted.

3.5 Mammals

3.5.1 Traces, tracks and scats of mammals were searched and recorded, with specific night surveys conducted for this group in the land areas within 500m from the HKLR alignment (see Appendix 1) on North Lantau and Airport Island, during both wet season and dry season. All mammals were identified to species level (wherever possible) and abundance was recorded.

3.6 Birds

3.6.1 Transect count were used to survey the avifauna present within 500m of the HKLR alignment. In addition, night surveys, with binoculars and powerful search lights, were conducted in order to assess the activity of nocturnal species, (e.g. owls, nightjars). All birds were identified to species level and the abundance was recorded.

3.7 Herpetofauna

3.7.1 Reptiles and amphibian surveys within 500m of the HKLR alignment were conducted by active searching in all habitats, with particular attention given to potential shelter sites and microhabitats such as leaf-litter, rubble piles, streams and watercourses. Special attention was paid to Scenic Hill on Airport Island, where Romer's Tree Frogs have been recorded. Anurans were surveyed by auditory as well as visual detection. As most of the amphibian species are more active during the night time, nocturnal surveys were also conducted during the wet season. All herpetofauna were identified to species level and the abundance was recorded.

3.8 Dragonfly

3.8.1 Dragonflies were surveyed following the same transects used for bird surveys. Dragonflies were identified with the aid of binoculars, and a telescopic hand net was used to capture specimens for identification in the hand when necessary (all species thus trapped were released back to the wild following identification). All dragonflies were identified to species level and the abundance was recorded.

3.9 Butterfly

3.9.1 Butterfly surveys were conducted in tandem with the dragonfly surveys, using similar methodology. Potential microhabitats, (especially ground and canopy of woodland) were searched and swept with a long-handled butterfly net where appropriate. All butterflies were identified to species level and the abundance recorded.

3.10 Stream Fauna

3.10.1 Fish and invertebrates present in streams within 500m of the HKLR alignment were identified and recorded by direct observation, dip-netting and active sampling. All aquatic fauna were identified to species level as far as possible and abundance recorded.

3.11 General

3.11.1 Lists of all species recorded in wet and dry seasons in each habitat have been produced, with details of abundance and conservation status (including local, regional and international such as China Redlist and IUCN Redlist). Photos of any protected species were taken when possible.

4.0 RESULTS FROM VERIFICATION OF ECOLOGICAL BASELINE STUDY

4.1 Marine Grab Survey

4.1.1 A total of 985 macro-faunal specimens, comprising 90 species from 59 families in 9 phyla (Annelida, Arthropoda, Branchiopoda, Chordata, Cnidaria, Echinodermata, Mollusca, Nemertea and Platyhelminthes), were recorded in the wet season (Table 1). In the dry season, a total of 383 macro-faunal specimens comprising 58 species from 44 families in 6 phyla (Annelida, Arthropoda, Coelenterata, Echinodermata, Mollusca and Nemertea) were recorded (Table 1). Only 28 species were found in both seasons (Appendix 2). Polychaetes (Annelida) were collected at all stations and represented the highest species richness and abundance in both seasons (Appendix 2).

Table 1. *Summary of the macrofauna collected in wet season (September) and dry season (December) 2008.*

Phylum	Wet Season (September 2008)			Dry Season (December 2008)		
	Number of families	Total number of individuals	Total biomass (g)	Number of families	Total number of individuals	Total biomass (g)
Annelida	26	457	2.71	15	201	1.24
Arthropoda	10	90	5.47	9	71	20.77
Branchiopoda	1	1	0.03	0	0	0
Chordata	3	4	1.87	0	0	0
Cnidaria	1	4	0.01	0	0	0
Coelenterata	0	0	0	1	1	0.70
Echinodermata	3	72	0.31	3	34	40.77
Mollusca	19	285	22.07	15	53	67.92
Nemertea	10	70	0.14	1	23	0.08
Platyhelminthes	1	2	0.03	0	0	0
Total	**59**	**985**	**30.94**	**44**	**383**	**131.53**

4.1.2 The bivalves *Donax* sp. and *Theora lata* and the brittle star *Macrophiothrix longipeda* were the commonest species recorded in the wet season, whilst the polychaetes *Notomastus latericens* and *Euclymene* sp. and the pea crab *Xenophthalmus* sp. were the most abundant species recorded in the dry season (Appendix 2). Detailed data are presented in Appendix 2.

4.1.3 Species abundance and richness were higher in the wet season than in the dry season (using two-way ANOVA, $p < 0.001$; see Appendix 2), except in Station 7 where the species abundance and richness remained constant (Figures 1 & 2). The overall patterns were, however, similar in both seasons: higher in open waters (Stations 1-3, 8 & 9) and declining gradually towards the Airport Channel. In the wet season, Stations 2 and 3 possessed the highest species abundance and Station 1 had the highest species richness. The lowest species richness and abundance occurred in Station 7. In the dry season, the species abundance and richness were highest in Stations 2 and 3 and were lowest in Stations 5 and 6.

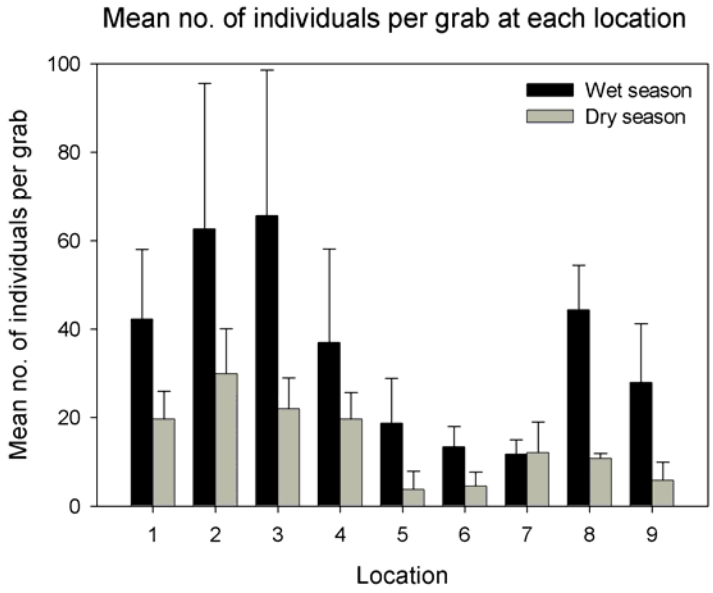

Figure 1. *Mean number of individuals per grab at each sampling location (wet and dry season)*

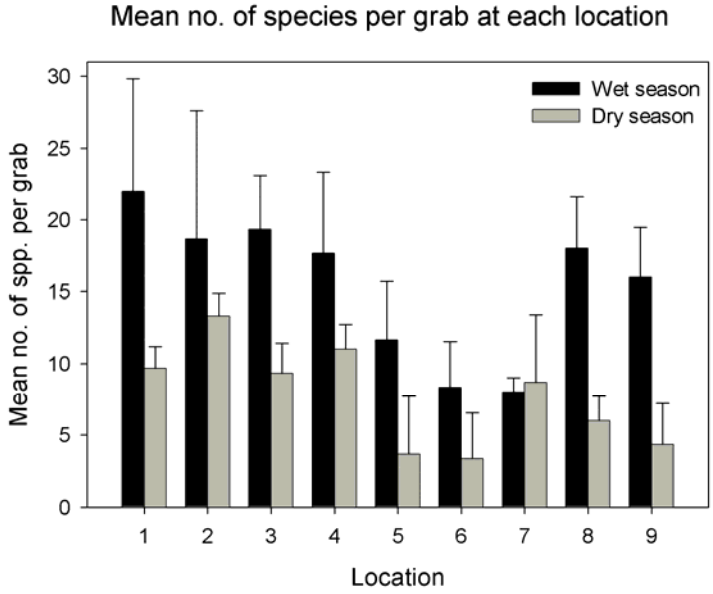

Figure 2. *Mean number of species per grab at each sampling location (wet and dry season)*

4.1.4 The Pielou's Index was similar between seasons and stations (wet season: 0.75 – 0.93, dry season: 0.79 – 0.99; Table 1). The Shannon-Wiener Diversity Index was slightly higher in the wet season than in the dry season, but the variation between stations is slight (wet season 2.68 – 3.37, dry season: 1.84 – 2.57).

4.1.5 The overall biomass was higher in the dry season than in the wet season (using two-way ANOVA, $p < 0.05$; see Appendix 2). The values in both seasons were, however, variable between stations and no general patterns could be deduced (Figure 3). Total biomass in the wet season was 30.94 g and was mainly due to the relatively high mass of molluscs (22.1 g) and arthropods (5.5 g; Table 1). Juveniles (~1 – 5 mm length) of bivalves and gastropods were recorded. Total biomass in the dry season was 131.53 g and was mainly due to the relatively high mass of molluscs (67.92 g), echinoderms (40.77 g) and arthropods (20.77 g). The biomass of other taxa in both seasons was low because of their small sizes and/or low abundance. Detailed biomass data are presented in Appendix 2.

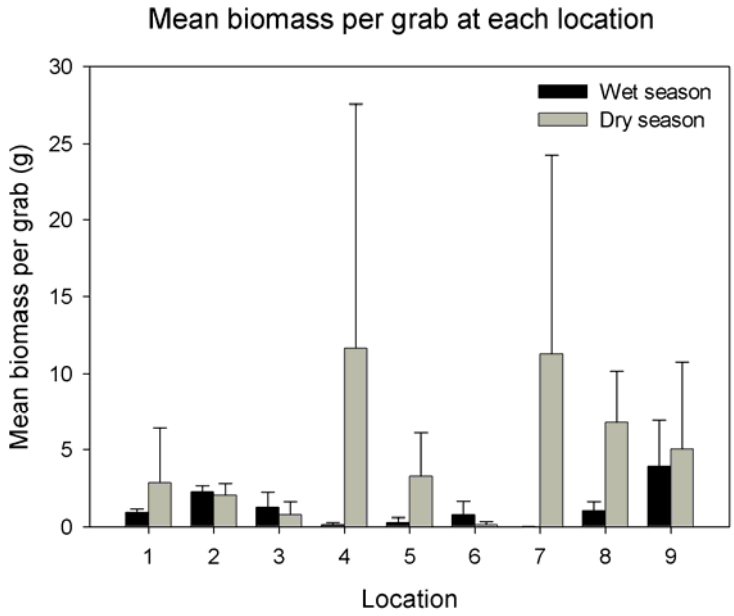

Figure 3. *Mean biomass per grab at each sampling location (wet and dry season)*

4.1.6 The W statistics for the 9 stations during the wet season were all positive and generally similar (0.225 – 0.411), although Station 7 possessed the lowest value of 0.11 and Station 9 had the highest value of 0.556 (Appendix 2). The W-statistics for the 9 stations during the dry season were also positive and the values were higher than those recorded in the wet season (0.264 – 0.739).

4.1.7 In both wet and dry seasons, none of the species are mentioned in the IUCN Red List (IUCN 2008). One species is listed in the China Species Red List (CSIS 2008): the Greasyback Shrimp *Metapenaeus ensis* is listed as Vulnerable. The conservation status of most annelids recorded in the Current Study is unclear, however, due to their poorly-known ecology.

4.1.8 The marine benthic macrofauna in North Lantau was composed of a high diversity of polychaete species and a low diversity of other taxa, which is characteristic in the northwestern waters of Hong Kong (ERM 2000; Shin, 2002; Mouchel, 2002; HyD, 2004). There was, however, a distinct spatial and temporal pattern, suggesting the benthic macrofauna are sensitive as a biological indicator to reflect changes in environmental conditions (Shin, 2002).

4.1.9 Spatially, species abundance and richness were higher outside than inside the Tung Chung Channel. The large error bars indicate that species abundance and richness varied considerably within sites.

4.1.10 Temporally, species abundance, richness and diversity (Shannon-Wiener Diversity Index) were higher in the wet season than in the dry season. The small individual sizes observed and the low biomass recorded in the wet season may suggest that the majority of the benthic macrofauna recruit during this time period. The decrease in species abundance and richness in the dry season is possibly an indication of post-recruitment mortality of the benthic macrofauna. The similarity in the Pielou's Evenness between seasons and stations indicates the species evenness was constant over time alike among the 9 stations.

4.1.11 Infauna diversity in the Study Area is relatively low when compared to other areas in Hong Kong (Hyd 2004). The impoverished assemblages present is likely due to the proximity of the Pearl River Estuary, leading to low salinity and possibly due to the predominantly silt-clay composition of the seabed which does not lend itself to supporting high diversity (HyD 2004). The wet and dry seasons results for species

diversity ranged between 2.68-3.37 and 1.84-2.70 respectively from the nine sampling stations (See Appendix 2, Table A2.5). These are comparable to other soft-bottom benthic communities in Hong Kong, which are characteristsed by an extensive homogeneous assemblage dominated by polychaete annelids, where species diversity was calculated to be 2.87 in the summer (wet season) and 2.82 in the winter (dry season); these data are averaged from 97 sampling stations from across Hong Kong. (Shin *et al.* 2004). Most species recorded occur frequently in Hong Kong and no species of conservation concern were observed.

4.2 Dive Survey

4.2.1 Dive surveys conducted at the seven dive survey sites between 18th and 26th October 2008 revealed that the diversity and abundance of hard and soft corals within and outside the Airport channel were low. Most hard substrates were dominated by barnacles, mussels and rock oysters. Dive survey locations can be seen in Appendix 3.

4.2.2 Only one genus of ahermatypic cup coral *Balanophyllia* (Dendrophylliidae) and one genus of octocoral, *Echinomuricea* sp. (Plexauridae) were recorded from two (DS1 and DS2) and four (DS1, DS2, DS6 and DS7) of the seven survey sites, respectively. Both the hard and soft corals were only present outside the Airport Channel. No coral was found within the Channel (i.e. DS3, DS4 and DS5).

4.2.3 No other taxa of high conservation interest were recorded in the seven survey sites. Full details of substrate type and fauna recorded are shown in Appendix 3.

4.2.4 Compared with the previous survey conducted in 2003 (Oceanway 2003), the spot dive in 2003 generated similar qualitative data as the present survey. In the previous survey, the ahermatypic cup coral *Balanophyllia* sp. was only recorded outside the Airport Channel at site SD5 (DS1 in present survey), SD9 (DS2) and SD22 (DS6). In the present survey, this cup coral was also recorded in DS1 and DS2 but not in DS6, which is probably due to the very low abundance and patchy distribution of the coral within same area. For the octocoral *Echinomuricea* sp., the results in this survey agree with the finding in the previous quantitative survey.

4.2.5 In Hong Kong context, the low salinity and murky water at the western Hong Kong limit the development of hard coral to few thriving species such as ahermatypic cup corals, *Oulastrea crispata, Plesiastrea versipora* and selected *Favia* species. At north and northwest Lantau, only *Oulastrea crispata* and ahermatypic cup corals have been reported. The low diversity and low abundance of corals in the present survey is typical for the western Hong Kong waters.

4.3 Intertidal Survey

Soft Shores

4.3.1 In the Current Study, six soft shore locations (Sham Wat (SW), Sha Lo Wan (SLW), Hau Hok Wan (HHW), Tung Chung Bay (TCB), San Tau (ST) and San Shek Wan (SSW)) along the northern coast of Lantau were surveyed in September and December 2008 to cover wet and dry seasons. The locations of these soft shore locations can be seen in Appendix 1.

4.3.2 A total of 155 species were recorded from several faunal groups, including ichthyofauna (fish), echinoderms (sea cucumber), arthropods (shrimp, crab and horseshoe crab), molluscs (bivalve, gastropod and tusk shell), annelids (segmented worm), sipunculids (peanut worm), nemerteans (ribbon worm), cnidarians (sea

anemone) and poriferans (sponge). Detailed data are presented in Appendix 4. Of these six sites, the highest species number was recorded at ST and TCB (76), and the lowest number was recorded at SW (57). Species numbers recorded at SSW, SLW and HHW were 69, 72 and 75, respectively.

4.3.3 During the transect and quadrat surveys, a total of 26,627 individuals belonging to 104 species were recorded (Appendix 4), including a single horseshoe crab individual. A total of 1,019 individuals belonging to 56 fauna species were found in the core samples (Appendix 4). Findings of quantitative surveys are summarized in the table below.

Table 2. *Species number, numerical abundance, Pielou's evenness index (J') and Shannon diversity index (H', Log $_e$) recorded at each soft shore site.*

	SW	SSW	SLW	HHW	ST	TCB
Epifauna						
Number of Species	29	42	44	49	55	50
Abundance	1259	4147	5079	3899	4222	8021
J'	0.46	0.49	0.47	0.53	0.55	0.43
H' (Log $_e$)	1.56	1.82	1.79	2.07	2.20	1.67
Infauna						
Number of Species	12	20	17	18	19	24
Abundance	164	265	83	56	115	336
J'	0.45	0.52	0.74	0.86	0.81	0.48
H' (Log $_e$)	1.11	1.56	2.10	2.47	2.38	1.51

4.3.4 Most species found during these surveys are common and widespread in Hong Kong. Six species of conservation concern were recorded (Table 3), details of which are given in the following paragraphs.

Table 3. *Species of conservation interest or potential conservation interest*

Species	SW	SSW	SLW	HHW	ST	TCB
Indo-Pacific Tropical Sand Goby *Favonigobius reichei*	+	+	+	+	+	+
Snowy Puffer *Takifugu niphobles*				+	+	
Predaceous Chub *Parazacco spilurus*		+				
Sea Cucumber *Holothuria leucospilota*	+					
Horseshoe Crab *Tachypleus tridentatus*	+				+	+
Greasyback Shrimp *Metapenaeus ensis*	+		+	+	+	

Key: SW=Sham Wat; SSW=San Shek Wan; SLW=Sha Lo Wan; HHW=Hau Hok Wan; ST=San Tau; TCB=Tung Chung Bay.

Fish

4.3.5 The Indo-Pacific Tropical Sand Goby *Favonigobius reichei*, which has been regarded as "Lower Risk/Near Threatened" by IUCN (2009), was found to be very common at all the study sites. Although it is regarded globally as Lower Risk/Near Threatened, this species is common and widespread in intertidal areas in Hong Kong (Lee *et al.* 2004, Nip 2005).

4.3.7 Another fish species observed, Snowy Puffer *Takifugu niphobles*, is regarded as "Data Deficient" by IUCN (2008). This fish is, however, considered to be common in Hong Kong (Nip 2005, AFCD 2008).

4.3.8 Two Predaceous Chub *Parazacco spilurus* were observed in a freshwater creek running across the shore in SSW. This species is considered to be Vulnerable in Mainland China (Yue & Chen 1998, CSIS 2008). This is primarily a freshwater species, however, and is not known to tolerate saline conditions; its presence on the surveys probably resulted from upstream populations having been washed into the lower reaches of the stream.

Horseshoe Crab

4.3.9 The Horseshoe Crab *Tachypleus tridentatus* was recorded at two of the soft shore sites, TCB and ST. Two records from TCB included a juvenile (max. width of prosoma = 40mm) and one dead subadult (max. width of prosoma = 150mm). The single crab at ST was one tiny juvenile (max. width of prosoma = 5mm). Horseshoe Crab tracks were observed at SW. Anecdotal evidence of a mating pair in the intertidal area just outside SW village in August 2008 was also gained from local residents. This Horseshoe Crab species is regarded as Vulnerable by CSIS (2008).

4.3.10 Two Horseshoe Crabs (of unknown species) were also recorded by AFCD staff at San Tau on 29th September 2008. (AFCD pers. comm.).

Other Invertebrates of Conservation Interest

4.3.11 The Sea Cucumber *Holothuria leucospilota* was found on the shore of SW. This species is usually found in the low tide/subtidal zone of boulder shores (Morton & Morton 1983) and the soft shore at SW is not optimal habitat for this species. It is the most common holothuroid in Hong Kong (Lai *et al.* 2006) but is regarded as Endangered in Mainland China due to over-exploitation (CSIS 2008).

4.3.12 Although *Metapenaeus* spp. are common in mangrove and estuarine areas in Hong Kong (Leung 1999, Vance 1999), all four species found in Hong Kong (including *M. ensis*) are considered to be Vulnerable in Mainland China due to over-exploitation (CSIS 2009). In the Current Study, individuals of *M. ensis* were found in SW, SLW, HHW and ST.

Artificial and Natural Rocky Shore

4.3.13 Five rocky shores, including those on the western and eastern sides of San Shek Wan headland (SSWW and SSWE), near Sha Lo Wan Pier (SLWP) and to the south and east of the Airport (AS and AE), were surveyed during September and December 2008 and January 2009. The former three sites are natural hard shores and the later two are artificial rocky shore.

4.3.14 A total of 54 species was recorded in the hard shore habitats (Appendix 4). None of these species are listed as being of conservation concern (IUCN 2008, CSIS 2009). During the quantitative survey, a total of 118,043 individuals belonging to 45 species were recorded (Appendix 4). The number of species and the diversity and evenness indices of natural rocky shores were in general slightly higher than those of the two artificial hard shores (Table 4). Sessile organisms such as Purplish Bifurcate Mussel, Rock Oyster and Striped Barnacle were the dominant species of all these sites. Other abundant species observed were Bearded Ark Shell, Limpets, *Nerita yoldii* and Periwinkles. Mobile crustaceans such as Sea Slater and Sesarmine Crabs were commonly observed at these sites during the wet season surveys but were almost absent in the dry season; this accounts for the lower diversities recorded in winter (Appendix 4).

Table 4. *Species number, numerical abundance, Pielou's evenness index (J') and Shannon diversity index (H', Log $_e$) recorded at each rocky shore site during quantitative surveys.*

	SSWW	SSWE	SLWP	AS	AE
Species Number	30	28	24	21	26
Abundance	23764	31477	24847	14234	23721
J'	0.37	0.37	0.26	0.26	0.33
H' (Log $_e$)	1.25	1.25	0.82	0.79	1.09

Key: SSWW=San Shek Wan Headland West; SSWE=San Shek Wan Headland East; SLWP=Sha Lo Wan Pier; AS=Airport South; AE=Airport East.

4.3.15 In the Current Study, the dominant species found, such as Bearded Ark Shell, Periwinkles, Purplish Bifurcate Mussel, Rock Oyster and Striped Barnacle, are common and widespread in Hong Kong rocky shores (Williams 2003, Lai *et al.* 2006). None of the species recorded are considered to be rare or of conservation concern.

4.4 Mammals

4.4.1 Only three species of mammal were recorded during both the wet and dry season surveys. A Red Muntjac *Muntiacus muntjac* was seen in the village section of San Tau stream on the evening of the 29th August 2008. In addition, footprints of Muntjac deer, presumably Red Muntjac, were observed in the soft sand at the beach close to the mouth of the Stream ST9 at San Tau. Red Muntjac (as Indian Muntjac) is listed as being of Potential Regional Concern following Fellowes *et al.* (2002) and is protected under the Wild Animals Protection Ordinance (WAPO). This small deer is widespread in Hong Kong (Shek 2006).

4.4.2 No other direct observations or field signs (e.g. scats, burrows) of terrestrial mammals were observed during the survey period.

4.4.3 The skull of a Eurasian Wild Pig *Sus scrofa* was found on the beach at Sha Lo Wan during surveys on 15th January 2009. This species has a widespread distribution in Hong Kong (Shek 2006).

4.4.4 A brief glimpse of a rat *Rattus* sp. was seen on the 29th August 2008 on the footpath leading to San Tau from Tung Chung, just outside of the 500m Study Area. In the Hau Hok Wan area, another rat species (possibly Indochinese Forest Rat *R. andamanensis*) was also observed during dry season botanical surveys.

4.5 Birds

4.5.1 A total of 61 bird species was recorded during wet (35 species) and dry (44 species) season surveys. These records come from both walked transects and incidental recordings during other surveys between 27th August and 16th September 2008 and between 5th and 7th January 2009. Specific bird surveys covered diurnal and nocturnal periods.

4.5.2 Of these 61 species, 14 are listed by Fellowes *et al.* (2002) as species of conservation concern; nine of the 14 species of conservation concern are also wetland dependant species, and were observed on the shoreline of northern Lantau and the artificial seawall of Chek Lap Kok. These species are listed in Appendix 6, with those of Conservation Importance, shown in Table 5.

4.5.3 In addition, eight species also appear on various China Red Lists. Six species are Class II protected species in China (www.sepa.gov.cn 2008); these are Pacific Reef Egret *Egretta sacra*, Black Kite *Milvus migrans* Crested Goshawk *Accipiter trivirgatus*, Common Buzzard *Buteo buteo*, Common Kestrel *Falco tinnunculus* and Collared Scops Owl *Otus bakkamoena.* Emerald Dove *Chalcophaps indica* and Hwamei *Garrulax canorus* are both listed as Near Threatened (CSIS 2008). Pacific Reef Egret and Emerald Dove are listed as Rare and Vulnerable respectively in the China Red Data Book (Zheng & Wang 1998).

4.5.4 Shrubland habitats produced the highest number of bird species, with a total of 18 species recorded during the wet season. None of these species are listed as being of conservation concern (Fellowes *et al.* 2002), although three species are listed in China Red Lists: Emerald Dove, Collared Scops Owl and Hwamei (CSIS 2008). Within the shrubland habitat, Chinese Bulbuls *Pycnonotus sinensis* were the most numerous species, and small parties of birds were frequently observed foraging in fruiting bushes.

4.5.5 Surveys of soft shore habitats revealed a total of nine species, including eight wetland-dependant species and two that are closely associated with wetlands. Overall bird abundance in this habitat was relatively low, however. The highest species count was of 11 Little Ringed Plovers *Charadrius dubius* at Sha Lo Wan on the 16th September. Migrant waders such as Whimbrel *Numenius phaeopus* and Grey-tailed Tattler *Heteroscelus brevipes* were also observed on soft shore habitats within the Study Area. These waders appeared to be utilizing the soft shore habitat for foraging.

4.5.6 Hard Shore Habitats included rocky headlands and artificial shorelines of the Airport Island and the north Lantau coast. A total of seven species were recorded in this habitat, the most numerous species being Little Egret *Egretta garzetta*, which was most abundant along the artificial shoreline of the Airport Island. These ardeids appeared to be utilizing the hard shore habitat as feeding areas. Common Sandpiper *Actitis hypoleucos* were frequently observed foraging along the hard shores.

Table 5. *Bird species of conservation interest recorded within the study area during wet and dry season surveys.*

Species	***Species of Conservation Interest***	China Red List	Habitats recorded
Grey Heron *Ardea cinerea* w	*PRC*		Soft Shore; Hard shore
Great Egret *Egretta alba* w	*PRC (RC)*		Soft Shore; Hard shore
Little Egret *Egretta garzetta* w	*PRC (RC)*		Soft Shore; Hard shore
Pacific Reef Egret *Egretta sacra* w	*(LC)*	Class II Protected* Rare***	Hard Shore
Striated Heron *Butorides striatus* w	*(LC)*		Intertidal Streams
Black-crowned Night Heron *Nycticorax nycticorax* w	*(LC)*		Intertidal Streams
Black Kite *Milvus migrans*	*(RC)*	Class II Protected*	Overhead
Crested Goshawk *Accipiter trivirgatus*		Class II Protected*	Overhead
Common Buzzard *Buteo buteo*		Class II Protected*	Overhead
Common Kestrel *Falco tinnunculus*		Class II Protected*	Overhead
Little Ringed Plover	*(LC)*		Soft Shore

Species	*Species of Conservation Interest*	China Red List	Habitats recorded
Charadrius dubius w			
Whimbrel *Numenius phaeopus* w	*LC*		Soft Shore
Grey-tailed Tattler *Heteroscelus brevipes* w	*LC*		Soft Shore
Collared Scops Owl *Otus bakkamoena*		Class II Protected*	Shrubland
Emerald Dove *Chalcophaps indica*		Near Threatened**; Vulnerable***	Shrubland
Hwamei *Garrulax canorus*		Near Threatened**	Shrubland
Blyth's Leaf Warbler *Phylloscopus reguloides*	*LC*		Shrubland
Common Rosefinch *Carpodacus erythrinus*	*LC*		Village/farmland
White-shouldered Starling *Sturnus sinensis*	*(LC)*		Village/farmland
Black-naped Oriole *Oriolus chinensis*	*LC*		Plantation

w= denotes wetland dependent bird species
PRC= Potential Regional Concern; RC=Regional Concern; LC = Local Concern, as of Fellowes *et al.* (2002). Those in parenthesis indicate that the assessment is on the basis of restrictedness in breeding and/or roosting rather than general occurrence.
*CSIS 2008; **www.sepa.giv.cn 2008; ***Zeng & Wang 1998.

4.6 Reptiles

4.6.1 Seven species of reptile, all common and widespread in Hong Kong, were seen across wet and dry season surveys. Six species of lizard were observed and one exotic species of terrapin, Red-eared Slider *Trachemys scripta*. No snakes were seen during any of the surveys. Two diurnal and two nocturnal surveys were conducted between 29th August and 16th September 2008 for the wet season, and between 5th and 7th January 2009 for dry season surveys.

4.6.2 Two species of gecko, Chinese Gecko *Gekko chinensis* and Bowring's Gecko *Hemidactylus bowringii*, were regularly encountered in village habitats, particularly the abandoned village houses on Scenic Hill. Three species of skink were seen (Chinese Skink *Eumeces chinensis*, Long-tailed Skink *Mabuya longicaudata* and Reeves' Smooth Skink *Scincella reevesii)* primarily on woodland/shrubland edges along footpaths, although juvenile Long-tailed Skinks were common amongst the leaf-litter of the abandoned village on Scenic Hill. Changeable Lizard *Calotes versicolor* was seen in waste ground on the edge of Sha Lo Wan. None of these lizards are of conservation concern and all are common and widespread in Hong Kong (Karsen *et al.* 1998).

4.7 Amphibians

4.7.1 Diurnal and nocturnal surveys were conducted between 29th August and 16th September 2008 for wet season surveys and between 5th and 7th January for dry season surveys. A total of four species of amphibian were recorded during the all surveys. Two of these are listed as species of conservation concern, these being the Chinese Bullfrog *Hoplobatrachus chinensis* and Lesser Spiny Frog *Paa exilispinosa*.

4.7.2 Chinese Bullfrog is a Class II Protected Animal in China and is considered to be of Potential Regional Concern in Hong Kong owing to depletion of wild populations for the food trade (Fellowes *et al.* 2002, Chan *et al.* 2005). An adult Chinese Bullfrog was seen in a drain at Scenic Hill. The origins of this species are unknown, and

there is some confusion between wild populations and animals originating from religious releases that occur in some areas of the territory. The species has previously been recorded on Chek Lap Kok (Chan *et al.* 2005).

4.7.3 Lesser Spiny Frog is regarded as Vulnerable by IUCN (2008) and is considered to be of Global Concern (Fellowes *et al.* 2002), although it is widely distributed and common in suitable habitat in Hong Kong (Chan *et al.* 2005). Tadpoles of this species were observed in the streams between San Tau and Hau Hok Wan (c.f. Stream Section 4.12).

4.7.4 Other amphibians seen included Asian Common Toad *Bufo melanostictus* and Asian Painted Frog *Kaloula pulchra*, which were common throughout the terrestrial habitats of northern Lantau. Both species are common and widespread in Hong Kong (Karsen *et al.* 1998, Chan *et al.* 2005).

4.7.5 Romer's Tree Frog *Philautus romeri* is known to occur on Chek Lap Kok (Karsen *et al.* 1998, Chan *et al.* 2005) though no evidence of adults or larvae were seen during the wet season surveys. Tadpoles of this species were seen earlier in 2008 as part of the on-going monitoring by AFCD (AFCD pers. comm.).

4.8 Dragonfly

4.8.1 Only seven dragonfly species were recorded in the Study Area, none of which are considered to be of conservation concern. These records come from both walked transects and incidental recordings during other surveys between 27th August and 16th September 2008 for the wet season, and on 6th and 8th January 2009 during the dry season survey. Species lists are given in Appendix 7.

4.8.2 By far the most numerous and widespread species recorded was the Wandering Glider *Pantala flavescens*, with many hundreds seen across the site over all habitats. This is the most common species in Hong Kong (Wilson 2004). Other than Wandering Glider, all other species were recorded only outside the proposed road alignment, within the limits of stream and/or irrigation ditches across the Study Area.

4.9 Butterfly

4.9.1 A total of 58 butterfly species was recorded during both seasonal surveys within the study area; one is considered to be species of conservation concern. These records come from both walked transects and incidental recordings during other surveys between 27th August and 16th September 2008 for the wet season, and on 6th and 8th January 2009 during the dry season survey. A full species list can be seen in Appendix 8. Most species occur in shrubland (32) with 24 species recorded in woodland and 15 species recorded from village habitats.

4.9.2 White Dragontail *Lamproptera curius* was recorded during soft shore surveys in December 2008 at a San Tau stream (ST9). This species is considered to be of Local Concern (Fellowes *et al.* 2002)

4.9.3 Few records of butterflies were made from the intertidal habitats (i.e. soft shore, hard shore and mangrove), as would be expected from the paucity of suitable food plants in this habitat. Common Mormon *Papilio polytes* was the most widespread species, occurring in five different habitat types; this species is very common and widespread in Hong Kong (Lo & Hui 2005).

4.10 Stream Fauna

4.10.1 Six streams were located within the Study Area and were surveyed on 25th and 30th September for wet season surveys and on 2nd and 3rd December 2008 for dry season surveys. Of the 10 streams surveyed, four (SL8, ST13, ST14 and HH1) were found to be dry during both wet and dry season surveys, and no fauna was observed in any of these dry stream beds. Several species of conservation interest were recorded and are listed below.

Table 6. *Species of conservation interest found in streams*

Species Name	ST9	ST12	HH2	HH3	HH5	SL3
Lesser Spiny Frog *Paa exilispinosa*			+	+		
Beijiang Thick-lipped Barb *Acrossocheilus beijiangensis*	+					
Indo-Pacific Tropical Sand Goby *Favonigobius reichei*	+				+	+
Dark-margined Flagtail *Kuhlia marginata*	+					
Rice Fish *Oryzias curvinotus*	+			+	+	
Predaceous Chub *Parazacco spilurus*	+					+
Sesarmine Crab *Chiromantes sereni*				+		+
Greasyback Shrimp *Metapenaeus ensis*	+					+
Freshwater Crab *Somanniathelphusa zanklon*		+				

Amphibians

4.10.2 Lesser Spiny Frogs tadpoles were observed in HH2 and HH3 during wet season surveys. This species is of conservation importance (see Section 4.9.3).

Fish

4.10.3 In Hong Kong, Beijiang Thick-lipped Barb *Acrossocheilus beijiangensis* is a rare species and only appears in several streams (Lee *et al.* 2004) and it is also considered to be of Global Concern (Fellowes *et al.* 2002). One individual was observed in the midstream section of ST9 in December 2008.

4.10.4 The Indo-Pacific Tropical Sand Goby *Favonigobius reichei*, which is regarded as "Lower Risk/ Near Threatened" by IUCN (2009), was found in the lower sections of several streams surveyed. Whilst it is regarded globally as Near Threatened, this species is common and widespread in the intertidal area in Hong Kong (Lee *et al.* 2004, Nip 2005).

4.10.5 Dark-margined Flagtail *Kuhlia marginata* was observed at ST9 in December 2008. This species is considered to be very rare in Hong Kong (AEC Staff pers. obs.) and was regarded as locally endangered in a recent EIA Study Report (DSD 2005). It is regarded to be of Regional Concern by Fellowes *et al.* (2002), but its status was not evaluated by Lee *et al.* (2004) or AFCD (2009). Since freshwater streams are important nursery habitats for this catadromous species (Oka & Tachihara 2008), ST9 is considered to have potential to be a nursery habitat for this species.

4.10.6 Rice Fish *Oryzias curvinotus* was found at three stream sites (see Table 6 and Appendix 9) and is a species considered to be of Global Concern (Fellowes et al.

2002) which is uncommon in the wild in Hong Kong (Lee *et al*. 2004). Although it is generally considered to be a freshwater species, it can inhabit brackish environments (Froses & Pauly 2008) and a large population can be found in the mangrove area of Tung Chung Bay (AEC Staff pers. obs.). In the lower reaches of ST9, a small population of Rice Fish was observed, and although not as numerous as that of Tung Chung Bay, it is considered to be self-sustaining. Only single individuals of this species were seen in the lower sections of the other two stream sites (HH3 and HH5).

4.10.7 Predaceous Chub *Parazacco spilurus* is common and widespread in Hong Kong (Lee *et al*. 2004), but is regarded as a vulnerable species in Mainland China (Yue & Chan 1998, CSIS 2008). Populations of over 100 individuals of this species were seen in the middle sections of ST9 and SL3.

Crustaceans

4.10.8 The Sesarmine Crab species *Chiromantes sereni* was found in the lower sections of HH3 and SL3. This species was first recorded in Hong Kong by Soh (1978) and is reported to be endemic (Kwok & Tang 2005). Although its conservation status is not fully understood, it was only found at four sites in a recent territory-wide Sesarmine Crab survey (Kwok & Tang 2005).

4.10.9 *Somanniathelphusa zanklon*, another endemic crab species, was also found in the Current Study. Although this species has been found to be quite abundant in Lantau and other places in Hong Kong (DSD 2002, EPD 2007), it is regarded as an endangered species by IUCN due to its restricted distribution (IUCN 2008). Two juveniles of this species were recorded in ST12. This small stream has potential to provide a nursery habitat for this endangered species.

4.10.10 Greasyback Shrimp *Metapenaeus ensis* juveniles were recorded in the lower section of the streams ST9 and SL3. Shrimps belonging to the genus *Metapenaeus* are commercially important and were extensively cultured in the *Gei Wai* of Mai Po in the past. They are common in mangrove and estuarine areas in Hong Kong (Leung 1999, Vance 1999). Due to over-exploitation, all four *Metapenaeus* species found in Hong Kong (including *M. ensis*) are considered to be Vulnerable in China (CSIS 2008). Shallow estuarine areas in Hong Kong have the potential to provide nursery habitats for these species.

Insects

4.10.11 Only two common insect species (Backswimmer *Enithares* sp. and the nymph of Green Skimmer *Orthetrum sabina*) were recorded in any of the streams.

4.11 Habitats and vegetation

4.11.1 Habitats within the Study Area were identified and mapped based on the recent aerial photographs and detailed ground-truthing survey. The aerial photographs aid in mapping the hilly terrestrial habitats that are inaccessible during the ground-truthing survey. Botanical survey of this verification study was conducted on 19th, 22nd September, 22nd October 2008 and 15th January 2009. Due to the potential impacts/disturbances on the seagrass bed located at San Tau SSSI, two additional surveys were carried out during low tides on 22nd October 2008 and 15th January 2009 to verify the current status and extent of the seagrass beds. Due to the limited survey period and the inaccessibility of most hilly terrestrial habitats, the survey was only conducted along the accessible footpath within the Study Area.

4.11.2 Fourteen habitat types were identified within the Study Area, shown in the Habitat Map (Appendix 5). Table 7 summarizes the areas of the fourteen habitats present. A total of 308 plant species were identified within the Study Area. Tall shrubland, secondary woodland, shrubby grassland and developed area support higher plant species diversities, with 123, 90, 96 and 111 plant species respectively, than other coastal and riparian habitats.

4.11.3 The terrestrial botanical survey focused on three terrestrial areas, namely Scenic Hill in Chek Lap Kok, North Lantau from San Tau to Sha Lo Wan and San Tau SSSI. All these regions comprise a number of typical habitat types which are dominated by different plant species. A general description of these habitats and their dominant plant species are presented in Section 6.0..

Table 7. *Overview of habitats within study area (excludes open water of the sea and shorelines – see text in section 4.11.4)*

Habitat	Area (ha)	% Cover
Active Dry Agriculture	0.05	0.02
Associated Mangrove	0.80	0.24
Developed Area	225.86	67.47
Grassland	0.40	0.12
Grassland/ Shrubland	15.22	4.55
Mangrove	0.14	0.04
Plantation	15.37	4.59
Mudflat	0.14	0.04
Seasonally Wet Grassland	0.64	0.19
Secondary Woodland	17.73	5.30
Shrubland	10.50	3.14
Stream	1.35	0.40
Tall Shrubland	42.70	12.76
Young Woodland	3.84	1.15
Total	**334.74**	**100.00**

4.11.4 Intertidal and marine habitats occupy a significant section of the current Study Area, with a total length of coastline of 12.71 km on Lantau and the Airport Island. Whilst difficult to quantify total areas due to the dynamic nature and interaction with the sea and tides, it can be further categorized as natural hard coastline (*c.* 5.527 km), artificial hard coastline (*c.* 4.705 km) and natural soft coastline (*c.* 2.478 km).

Scenic Hill

4.11.5 Scenic Hill is located at the south-eastern part of Chek Lap Kok and comprises five habitat types (grassland, plantation, grassland/shrubland, tall shrubland and secondary woodland). The latter three habitat types are the dominant areas identified and the vegetation of all three habitats are represented by common and widespread species typically found in similar habitats throughout the territory in Hong Kong.

4.11.6 The grassland and plantation habitats contain a composition and structural complexity typical of these habitats throughout the territory. The plantation area is dominated by species commonly found in parks for ornamental and visual greening purposes.

Airport landside area in Chek Lap Kok

4.11.7 All landside areas within the Chek Lap Kok Airport are regarded as developed area. Vegetation in this habitat is heavily managed by the Landscape Team of the Airport Authority so as to ensure that the plants do not attract large flocks of birds which may cause high risk of bird strike.

North Lantau from San Tau to Sha Lo Wan (Terrestrial)

4.11.8 This surveyed region contained a higher number of habitat types, ranging from human-dominated agricultural land and developed area to semi-natural habitats such as seasonally wet grassland, shrubland, tall shrubland, young woodland and secondary woodland. Apart from the human-dominated habitats which are similar to similar habitats throughout Hong Kong, these habitats (described further in Section 6.0) display higher floristic diversities and structural complexities.

Botanical Species of Conservation Interest

4.11.9 Eight species of conservation importance, either restricted range species or protected species, are discussed and their locations were marked on the habitat map.

4.11.10 Low numbers (3-5 individuals) of the tree *Pavetta hongkongensis* were identified in tall shrubland close to Hau Hok Wan. This species is protected under the Forestry Regulations (Cap. 96A) but it is a common tree species found in tall shrubland and young woodland in Hong Kong (Xing *et al.* 2000).

4.11.11 The insectivorous herb *Drosera indica* was identified on the rock surface of a stream at Hau Hok Wan. Approximately 40 individuals of *D. indica* were identified in both dry and wet season surveys. This herbaceous plant is identified as a very rare plant only found in Tung Chung (Xing *et al.* 2000) but receives no protection by law in Hong Kong (South China Institute of Botany & AFCD 2003). It has been listed as "Least Concern" in China.

4.11.12 Around six individuals of orchid *Eulophia graminea* were identified within the stone crevices along a stream at Hau Hok Wan. The orchids were flowering during the botanical survey conducted in September 2008 but the specimens disappeared during the following survey conducted in October 2008. This orchid species is a restricted terrestrial herb found in the grassland and highly disturbed areas (Siu 2000, Xing *et al.* 2000). However, the rapid disappearance of the *E. graminea* specimens within the survey period implies the high disturbance impacts and illegal collection by people. All wild native orchid species are protected under the Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586) and the Forestry Regulations (Cap. 96A) in Hong Kong. It is also classified as a restricted species by Siu (2000).

4.11.13 Several tree specimens and seedlings of *Aquilaria sinensis* were identified along the footpath near the tall shrubland from Hau Hok Wan to Sha Lo Wan and within the secondary woodland of the Scenic Hill in Chek Lap Kok Island. Due to potential threats of habitat destruction and over-exploitation in China, this tree species is regarded as "Near Threatened" in the China Plant Red Data Book and the Illustrations of Rare & Endangered Plants in Guangdong Province. It is listed as a Category II nationally protected species in China (South China Institute of Botany & AFCD 2003). This species is, however, common in lowland forest and *Feng Shui* woodlands (Xing *et al.* 2000) and currently is protected under the Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586).

4.11.14 Numerous individuals of tree *Thespesia populnea* were identified along the coastal and associated mangrove habitats of the Study Area. This is a tree species

restricted to coastal habitats (Xing *et al.* 2000) and is regarded as a rare associate mangrove species (present in only nine of 43 mangrove stands) in a terrestrial-wide mangrove study by Tam *et al.* (1997). However, *T. populnea* has no protection by law in Hong Kong.

4.11.15 An individual of shrub/small tree *Drosera viscosa* was recorded near the tall shrubland close to the coastline at Sha Lo Wan. This is regarded as a rare species only found in Ham Tin and Tung Chung (Xing *et al.* 2000), but it is not protected by law in Hong Kong.

Seagrass

4.11.16 Two seagrass species, *Halophila minor* (identification based on the taxonomic key in Yip & Lai (2006)) and *Zostera japonica* were recorded along the mangrove fringe within the San Tau SSSI. Small patches of seagrass *Z. japonica* were recorded in both seagrass surveys conducted in October 2008 and January 2009. Approximately seven patches of *Z. japonica* were identified, with sizes ranging from 0.1 m^2 to 16 m^2; the number of patches and patch sizes increased during the survey period. Three small patches of *Halophila minor*, with sizes of 0.2 m^2 to 1.5 m^2, were identified in surveys conducted in January 2009; all were found in association with the *Z. japonica* patches. Both seagrasses are rare species with restricted locations in San Tau and Tung Chung (Xing *et al.* 2000). The seagrass bed at San Tau mudflat and mangrove stands is regarded to be of high conservation value and its locality is designated as San Tau SSSI for better protection by law (South China Institute of Botany & AFCD 2003). In addition, all established seagrass beds are considered to be an importance habitat under the Environmental Impact Assessment Ordinances and any potential developmental disturbances and/or impacts should be avoided or minimized (Kwok *et al.* 2005).

4.11.17 Despite being recorded during the Previous Study (HyD 2004), no *Halophila ovalis* (reported as *Halophila ovata* in HyD (2004)) was identified on the mudflat and intertidal area at San Tau SSSI during the botanical survey conducted in low tide. This corresponds to a massive disappearance of seagrass bed after heavy rainfall in May 2008 (Fong pers. com. in RTHK TV Programme aired on 14th Feb 2009). Additionally, the same Programme indicated that further investigations into the substratum of the mudflat, revealed that the mud was black in colour (indicating a lack of oxygen) and degraded seagrass was also observed possibly due to increased sedimentation in substratum after the heavy rainfall. These factors may restrict the development of seagrass bed. Finally the Programme also mentioned that the growth of the seagrass bed is very variable (e.g. ~ 10,000 m^2 was recorded in 2003, but had completely disappeared in 2005), depending on the natural environments and human disturbance.

5.0 Current Ecological Profile – Species of Conservation Interest

5.1 Details of the species of Conservation Interest identified from both studies (HyD 2004 and the Current Study) and literature review where relevant are listed below in Table 8. This Table relates to species recorded within the Current Study Area. The findings of the Previous Study have been reviewed in light of the findings of the Current Study. As can be seen from Table 8 results of the two studies largely correspond and there were no new significant findings from the Current Study. As such it is concluded that the ecological baseline information produced from the Previous Study remain valid.

Table 8. *Flora and Fauna Species of Conservation Interest recorded within the Study Area during the Previous Study (HyD 2004) and the current wet and dry season surveys*

Species/Group	Species of Conservation Interest (Fellowes *et al.* 2002)	Protection/ China Red Data Book	Locations/ Habitats Recorded in Study Area	Study species recorded from	Rarity/HK Status
Marine Mammals					
Indo-pacific Humpback Dolphin *Sousa chinensis*	-	WAPO, AP, UN Biodiversity treaty	Mostly in waters north and west of Lantau, Seasonally in waters south and east of Lantau	Previous Study (literature review)	Approximately 100 individuals inhabiting northwestern waters of Hong Kong (Jefferson 2000)
Mammals					
Red Muntjac *Muntiacus muntjac*	PRC	WAPO	Scrubland, Streams	Both Studies	Widespread (Shek 2004)
Birds (all birds protected under WAPO)					(as of Carey *et al.* 2001)
Little Grebe *Tachybaptus ruficollis*	LC	-	Open water	Previous Study	Locally common
Grey Heron *Ardea cinerea* w	PRC	-	Soft Shore; Hard shore	Current Study	Abundant winter visitor
Great Egret *Egretta alba* w	PRC (RC)	-	Soft Shore; Hard shore	Current Study	Common to abundant resident
Little Egret *Egretta garzetta* w	PRC (RC)	-	Soft Shore; Hard shore	Current Study	Abundant resident
Pacific Reef Egret *Egretta sacra* w	(LC)	Class II Protected* Rare***	Hard Shore	Current Study	Locally uncommon resident
Cattle Egret *Bubulcus ibis*	(LC)	-	Soft Shore	Previous Study	Uncommon to common resident
Chinese Pond Heron *Ardeola bacchus*	(LC)	-	Hard Shore	Previous Study	Common resident
Striated Heron *Butorides striatus* w	(LC)	-	Intertidal Streams	Both Studies	Uncommon in summer, scare in winter
Black-crowned Night Heron *Nycticorax nycticorax* w	(LC)	-	Intertidal Streams	Both Studies	Common to abundant resident
Black Kite *Milvus migrans*	(RC)	Class II Protected*	Overhead	Both Studies	Abundant winter visitor and resident
Peregrine Falcon *Falco peregrinus*	LC	-	Overhead	Previous Study	Scare resident and winter visitor
Black-winged Stilt *Himantopus himantopus*	RC	-	Soft Shore	Previous Study	Common to uncommon winter visitor
Little Ringed Plover *Charadrius dubius* w	(LC)	-	Soft Shore	Current Study	Locally common winter visitor, scarce breeding.
Whimbrel *Numenius phaeopus* w	LC	-	Soft Shore	Current Study	Common passage migrant
Grey-tailed Tattler *Heteroscelus brevipes* w	LC	-	Soft Shore	Current Study	Passage migrant
Eurasian	LC	-	Secondary	Previous	Scare winter

Species/Group	Species of Conservation Interest (Fellowes *et al.* 2002)	Protection/ China Red Data Book	Locations/ Habitats Recorded in Study Area	Study species recorded from	Rarity/HK Status
Woodcock *Scolopax rusticola*			Woodland	Study	visitor
Collared Scops Owl *Otus bakkamoena*	-	Class II Protected*	Tall Shrubland	Current Study	Common and widespread resident
Pacific Swift *Apus pacificus*	(LC)	-	Overhead	Previous Study	Common spring migrant, localized summer visitor, scarce and irregular in autumn and winter
White-throated Kingfisher *Halcyon smyrnensis*	(LC)	-	Soft Shore, Hard Shore	Previous Study	Resident, locally common in autumn and winter
Emerald Dove *Chalcophaps indica*	-	Near Threatened**; Vulnerable***	Tall Shrubland	Current Study	Scarce but widespread resident
Hwamei *Garrulax canorus*	-	Near Threatened**	Shrubland	Current Study	Common and widespread resident
Blyth's Leaf Warbler *Phylloscopus reguloides*	LC	-	Shrubland	Current Study	Scarce winter visitor
Common Rosefinch *Carpodacus erythrinus*	LC	-	Village/farml and	Current Study	Rare winter visitor
Red-billed Starling *Sturnus sericeus*	GC	-	Coastal habitat, secondary woodland	Both Studies	Abundant but localized winter visitor
White-shouldered Starling *Sturnus sinensis*	(LC)	-	Village/farml and	Both Studies	Common passage migrant, scare and localized breeding summer visitor and winter visitor
Black-naped Oriole *Oriolus chinensis*	LC	-	Plantation	Current Study	Scarce autumn migrant and irregular breeder
Reptiles					
Tokay Gecko *Gekko gecko*	RC	-	San Tau Village	Previous Study	Rare (Karsen *et al.* 1998)
Amphibians					
Chinese Bullfrog *Hoplobatrachus chinensis*	PRC	IUCN Least Concern Class II Protected*	Scenic Hill – concrete drainage system	Current Study	Fairly common and widespread in NT and Lantau (Chan *et al.* 2005)
Lesser Spiny Frog *Paa exilispinosa*	GC	IUCN Vulnerable	Streams	Both Studies	Common & Widespread in protected areas (Chan *et al.* 2005).
Romer's Tree Frog *Philautus romeri*	PGC	IUCN Endangered	Literature review and	Not recorded during either	Endemic to Hong Kong.

Species/Group	Species of Conservation Interest (Fellowes *et al.* 2002)	Protection/ China Red Data Book	Locations/ Habitats Recorded in Study Area	Study species recorded from	Rarity/HK Status
			AFCD (Pers. comm.)	Study	Locally Common in protected areas (Chan *et al.* 2005)
Fish					
Beijiang Thick-lipped Barb *Acrossocheilus beijiangensis*	GC	-	Stream (ST9)	Current Study	Rare (Lee *et al.* 2004)
Indo-Pacific Tropical Sand Goby *Favonigobius reichei*	-	IUCN Lower Risk/Near Threatened	Stream (ST9, HH5, SL3)	Current Study	Common and widespread (Lee *et al.* 2004, Nip 2005)
Dark-margined Flagtail *Kuhlia marginata*	RC	-	Stream (ST9)	Current Study	Status unknown (Lee *et al.* 2004)
Rice Fish *Oryzias curvinotus*	GC	-	Stream (ST9, HH3, HH5)	Current Study	Uncommon (Lee *et al.* 2004)
Predaceous Chub *Parazacco spilurus*	-	Vulnerable***	Stream (ST9, SL3)	Current Study	Common and widespread (Lee *et al.* 2004)
Snowy Puffer *Takifugu niphobles*	-	IUCN "Data Deficient"	Soft Shore (ST)	Current Study	Considered to be common in Hong Kong (AFCD 2008).
Takifugu ocellatus	LC	-	Stream (ST9)	Previous Study	-
Butterflies					
White Dragontail *Lamproptera curius*	LC	-	Stream At San Tau (ST9)	Current Study	Limited Distribution (Lo 2005)
Common Albatross *Appias albina*	LC	-	Cultivated field at San Tau	Previous Study	Rare (Lo 2005)
Danaid Eggfly *Hypolimnas misippus*	LC	-	Shrubland at Scenic Hill	Previous Study	Uncommon (Lo 2005)
Crustaceans					
Sesarmine Crab *Chiromantes sereni*	-	-	Stream (HH3, SL3)	Current Study	Endemic. Only known from four sites(Kwok & Tang 2005)
Greasyback Shrimp *Metapenaeus ensis*	-	Vulnerable***	Stream (ST9, SL3)	Current Study	Found on sandy-mud or muddy bottoms. Major species cultivated at Mai Po Marshes Nature Reserve (AFCD 2004)
Freshwater Crab *Somanniathelphusa zanklon*	-	IUCN Endangered	Stream (SL12)	Current Study	Locally abundant in Lantau (DSD 2002, EPD 2007),
Horseshoe Crabs					
Tachypleus tridentatus	-	Vulnerable***	San Tau, Hau Hok Wan	Both Studies	Declining in range due to water pollution/ loss of nursery grounds (Morton

Species/Group	Species of Conservation Interest (Fellowes *et al.* 2002)	Protection/ China Red Data Book	Locations/ Habitats Recorded in Study Area	Study species recorded from	Rarity/HK Status
					& Lee 2003)
Carcinoscorpius rotundicauda	-	Vulnerable***	San Tau, Hau Hok Wan	Previous Study	Declining in range due to water pollution/ loss of nursery grounds (Morton & Lee 2003)
Coral					
Balanophyllia sp.,	-	AP	Sham Wat to San Shek Wan (2004); east of Chek Lap Kok (HyD 2004); DS1 and DS2 (Current Study)	Both Studies	Common in Hong Kong Waters (AFCD 2004)
Seagrass					
Dwarf Eel Grass *Zostera japonica*	-	-	San Tau SSSI	Both Studies	Locally Rare (Hu *et al.* 2003)
Halophila minor	-	-	San Tau SSSI	Current Study	Not previously recorded at San Tau. Locally Rare (Xing *et al.* 2000, South China Institute of Botany & AFCD 2003)
Oval Halophila *Halophila ovalis* (reported as *Halophila ovata* in HyD (2004))	-	-	San Tau SSSI	Previous Study	Rare (Xing *et al.* 2000)
Terrestrial Plants					
Hong Kong Pavetta *Pavetta hongkongensis*	-	Cap. 96	Tall Shrubland	Both Studies	Common (Xing *et al.* 2000)
Indian Sundew *Drosera indica*	-	-	Stream (HHW)	Both Studies	Rare (Xing *et al.* 2000)
Pale Purple Eulophia *Eulophia graminea*	-	Cap. 586; Cap. 96	Stone crevices in Stream (HHW	Both Studies	Restricted (Siu 2000)
Incense Tree *Aquilaria sinensis*	-	Cap. 586; Cap. 96;Near Threatened**; Class II Protected*	Tall Shrubland, Secondary woodland	Both Studies	Common (Xing *et al.* 2000)
Portia Tree *Thespesia populnea*	-	-	Coastline, Mangrove associate.	Both Studies	Limited range; coastal areas (Xing *et al.* 2000)
Clammy Hop Seed *Dodonaea viscosa*	-	-	Coastal habitat (SLW)	Both Studies	Rare (Xing *et al.* 2000)
Carex tristachya	-	-	Tall Shrubland (HHW)	Previous Study	Very rare (Xing *et al.* 2000)
Bamboo Orchid *Arundina graminifolia*	,	Cap. 586; Cap. 96	Shrubby grassland	Previous Study	Very Common (Siu 2000); Common (AFCD

Species/Group	Species of Conservation Interest (Fellowes *et al.* 2002)	Protection/ China Red Data Book	Locations/ Habitats Recorded in Study Area	Study species recorded from	Rarity/HK Status
					2001)

*CSIS 2008; **www.sepa.giv.cn 2008; ***Zeng & Wang 1998.
[w]= denotes wetland dependent bird species
PRC= Potential Regional Concern; RC=Regional Concern; LC = Local Concern, as of Fellowes *et al.* (2002). Those in parenthesis indicate that the assessment is on the basis of restrictedness in breeding and/or roosting rather than general occurrence.
WAPO = Wild Animals Protection Ordinance; AP = Animals and Plants (Protection of Endangered Species) Ordinance;

5.2 A total of 34 terrestrial and freshwater faunal species of conservation interest or restricted range have been recorded within the Study Area during literature review , surveys between September 2003 and January 2004 and/or from the Current Study. These include one species of mammal (Red Muntjac), 26 species of bird (listed in Table 8, one species of reptile (Tokay Gecko), three species of amphibian (Chinese Bullfrog, Lesser Spiny frog and Romer's Tree Frog) and three species of butterfly (White Dragontail, Common Albatross and Danaid Eggfly).

5.3 Eleven floral species of conservation interest have been identified through both studies (both terrestrial plants and seagrasses). Eight species identified in this current study were also found in the Previous Study (HyD 2004), while the sedge *Carex tristachya* and orchid *Arundina chinensis* were not recorded in the Current Study, possibly due to the difference in survey areas between both surveys. However, as these two species were recorded in tall shrubland and shrubby grassland in the Previous Study, the proposed development would not cause direct impact on these species.

5.4 Five marine species of conservation interest or have been highlighted through surveys and literature review within the Study Area. These include the Indo-Pacific Humpback Dolphin, the Snowy Puffer, two species of Horseshoe crab *(Tachypleus tridentatus* and *Carcinoscorpius rotundicauda)* and the hard coral *Balanophyllia* sp.

5.5 Nine stream species of conservation interest have been identified within the lower sections of the streams within the Study Area, including six fish species (Beijiang Thick-lipped Barb, Indo-Pacific Tropical Sand Goby, Dark-margined Flagtail, Rice Fish, Predaceous Chub and *Takifugu ocellatu)* and three crustaceans (*Chiromantes serene, Metapenaeus ensis and Somanniathelphusa zanklon*).

5.6 Table 9 attributes the number of species recorded during the current study to particular habitat types.

Table 9. *Number of terrestrial faunal species recorded in different habitat types within the Study Area (Sept 2008-Jan 2009)*

	Soft Shore	Hard Shore	Grassland /Shrubland	Tall Shrubland	Developed Land/Village	Plantation	Young and secondary Woodland	Agricultural land	Mangrove and associated mangrove	Stream
Mammal	1 (1)	-	-	1	-	-	-	-	-	1(1)
Bird	9 (8)	7 (4)		17 (4)	14 (2)	12 (1)	9	7	-	3
Reptile	-	-	-	2	2	-	2	-	-	1
Amphibian	-	-	-	2	2 (1)	-	-	-	-	2 (1)
Dragonfly	-	-	-	5	1	-	1	2	-	5
Butterfly	2	1	3	32	16	6	24	6	4	3 (1)
Flora	2	0	96	123	111	67	90	10	20	50
Total number of fauna species	12	8	3	59	35	18	36	15	4	15
Fauna of Conservation Interest	9	4	0	4	3	1	0	0	0	3
Flora of Conservation Interest	2	0	0	3	0	0	1	0	1	2

Nb. Numbers in parenthesis indicate number of species of conservation interest

5.7 From the details shown in Table 9, tall shrubland habitats contain the greatest number of species recorded, of both flora and fauna, within the Study Area during the current study. Soft shores and streams are also shown to be important habitat types within the Study Area; whilst the total number of terrestrial species are low, a high proportion of these are of conservation interest.

5.8 It must be noted that this table only includes terrestrial species and that the soft shore and stream habitats also provide suitable habitats, breeding, foraging and nursery for several fish and crustacean species which are listed in Table 8 as being of conservation importance.

6.0 Current Ecological Profile - Habitat Quality

Marine Habitats

6.1 Soft bottom benthic habitat

6.1.1 The marine benthic habitats present in north-western waters of Hong Kong are generally characterized by soft-bottom material composed of silts and clay (HyD 2004).

6.2 Marine hard subtidal substrate

6.2.1 The subtidal dive surveys identified the presence of a low abundance of sessile organisms (e.g. rock oysters, mussels and barnacles) at each of the seven Dive Sites, with subtidal substrates a mixture of natural and artificial habitats. One hard coral species *Balanophyllia* sp. and the octocoral *Echinomuricea* sp. were present in the Study Area, in limited numbers at sites outside of the Airport Island Channel.

6.3 Shoreline

6.3.1 Intertidal mudflats larger than one hectare and natural coastal shores longer than 500m are considered as important in Hong Kong. Of the 12.71 km of coastline within the Study Area, approximately 8km is considered to be natural (both hard and soft shores).

Soft shores

6.3.2 A total of approximately 2.48km of shoreline was considered to be soft shore. These sandy beaches and mudflats are often buffered by mangrove and their associates and provide nursery habitats for Horseshoe Crabs and many fishes and invertebrate species, and the mudflats at Tung Chung Bay/San Tau are known to support seagrass beds. The Current Study (HyD 2004) found more than 50 Horseshoe Crab individuals, consisting of two species (*Carcinoscorpius rotundicauda* and *T. tridentatus*) at Tung Chung Bay, San Tau, Hau Hok Wan and Sham Wan. Findings in 2003-04, from this study and from AFCD (*pers. comm.*) have revealed Horseshoe Crabs at Sham Wat, San Tau and Tung Chung Bay, indicating that these areas are still favourable habitat for this species

6.3.3 Local people from Tung Chung were frequently observed collecting clams at Tung Chung Bay and San Tau during the whole survey period; this process can be considered to be very destructive to seagrass beds (Huang *et al.* 2006).

Hard Shores

6.3.5 The intertidal rocky shores surveyed in the Current Study are not considered to be of particular conservation concern. The coastline of Hong Kong is rich in rocky shore habitats (Williams 2003, Lai *et al.* 2006), which are commoner than mangrove, sandy beach and mudflat coastal habitats in Hong Kong. Although at present a large portion of the rocky coastline has been transformed into artificial hard-bottom area (i.e. sea wall), a comparatively uniform habitat which would be less diverse than natural shores, most typical species inhabiting natural rocky shore would readily colonize artificial hard-bottom embankment (Morton and Morton 1983). Thus, natural rocky shore habitats are considered to be re-creatable in general.

6.4 Mangrove and Associates and Seagrass

6.4.1 Mangrove was identified within the San Tau SSSI, while two patches of associated mangrove were found along the coastlines of Tin Sam (just to the north of San Tau) and Hau Hok Wan. The mangrove habitat is dominated by a number of mangrove species, especially *Aegiceras corniculatum*, *Avicennia marina*, *Bruguiera gymnorrhiza*, *Kandelia obovata* and *Acanthus ilicifolius*. The associated mangrove habitats are dominated by herb *Limonium sinense*, shrubs *Clerodendrum inerme*, *Suaeda australis*, *Scaevola sericea* and *Pandanus tectorius* and trees *Cerbera manghas*, *Hibiscus tiliaceus* and *Thespesia populnea*.

6.5 Streams

6.5.1 Several of the streams in the Study Area are highly seasonal, and of the ten surveyed, three were dry throughout the study period. Streams are particularly important nursery habitats for a number of fish and invertebrate species.

6.6 Seasonally Wet Grassland

6.6.1 Two small seasonally wet grasslands are located close to Sha Lo Wan Chung Hau and Kau Liu. These were formerly agricultural land which has been abandoned for many years and has been progressively invaded with herbaceous vegetation, including creeping herbs *Commelina diffusa*, *Ipomoea cairica* and *Mikania micrantha*, and herbs *Polygonum chinensis*, *Alocasia odora*, *Colocasia esculenta* and *Coix lacryma-jobi*. Parts of the habitat were overgrown with aggressive climbers such as *Mikania micrantha* and *Rourea microphylla*. Isolated fruit trees such as *Artocarpus macrocarpus* and *Psidium guajava* were recorded around and within the seasonally wet grassland.

6.7 Grassland

6.7.1 Only one very small grassland patch is located close to the Scenic Hill. This grassland patch is a semi-natural habitat developed with low species diversity, including exotic herbs *Bidens alba*, *Conya canadensis* and grasses *Neyraudia reynaudiana* and *Panicum maximum*. This habitat is very common throughout the territory.

6.8 Woodland

Young Woodland

6.8.1 Several patches of young woodland and secondary woodland were identified close to Sha Lo Wan and Hau Hok Wan. Under natural succession, this young woodland has evolved from tall shrubland by developing a denser and more complex canopy coverage and structure. The young woodland is dominated by the trees *Sterculia lanceolata*, *Microcos paniculata*, *Ardisia quinquegona*, *Myrsine seguinii*, *Schefflera heptaphylla* and *Garcinia oblongifolia*, with the understorey containing shrubs such as *Psychotria asiatica*, *Desmos chinensis*, *Ardisia crenata*, *Ilex asprella*, *Ilex pubescens* and seedlings of tree species including *Daphniphyllum calycinum*, *Archidendron clypearia* and *Archidendron lucidum*.

Secondary Woodland

6.8.2 Secondary woodland is a more mature woodland which supports higher floristic diversity and abundance than young woodland. This woodland type is typically developed from plantations which were planted after 1945. The current botanical survey recorded a similar tree composition to that identified in the young woodland, but with trees which form a more complete canopy coverage and are taller in overstorey height. The secondary woodland mainly contains the trees *Pinus massoniana*, *Acronychia pedunculata*, *Celtis sinensis*, *Microcos paniculata* and *Litsea glutinosa* as the overstorey. Its understorey composition and diversity are similar to those of young woodland.

Scenic Hill Woodland

6.8.3 The secondary woodland is typical of other woodlands in Hong Kong. It is dominated by *Sterculia lanceolata*, *Schefflera heptaphylla*, *Celtis sinensis*, *Tetradium glabrifolium*

and *Microcos paniculata* as the overstorey (8 – 10 m high). Its understorey is dominated by common and widespread shade-tolerant species including shrubs and small tree species such as *Psychotria asiatica*, *Litsea rotundifolia* var. *oblongifolia*, *Melicope pteleifolia*, *Sarcandra glabra*, *Bredelia tomentosa*, *Zanthoxylum avicennae* and *Uvaria macrophylla*. Seedlings of the trees *Archidendron clypearia* and *Aquilaria sinensis* were found occasionally in the understorey.

6.9 Plantation

6.9.1 Plantation areas are located close to the villages at Tin Sam, Kau Liu and Sha Lo Wan. These areas are either dominated by a mix of cultivated fruit trees and native shrub and tree species or are planted with common roadside plantation species. The plantation identified at Tin Sam and Kau Liu is dominated by common fruit tree species including *Dimocarpus longan*, *Litchi chinensis*, *Artocarpus macrocarpus* and *Mangifera indica* and mix of *Cinnamomum camphora*, *Celtis sinensis*, *Ficus microcarpa* and *Microcos paniculata* as the overstorey. The plantation located along the bay of Sha Lo Wan is mainly planted with tree species *Acacia confusa*, *Hibiscus tiliaceus*, *Delonix regia* and *Sapium sebiferum* as the overstorey, while the area close to the developed area is dominated by several clumps of *Bambusa* spp. and small tree/tree species such as *Sterculia lanceolata*, *Aporusa dioica*, *Microcos paniculata*, *Mallotus paniculatus*, *Bridelia tomentosa* and *Syzygium jambos*.

6.10 Shrubland

Grassland/Shrubland

6.10.1 The grassland/shrubland habitat is typically dominated by grasses *Panicum maximum*, *Imperata koenigii*, *Ischaemum* spp., *Rhynchelytrum repens* and *Neyraudia reynaudiana*, herbs *Bidens alba*, *Eupatorium catarium*, *Mimosa pudica*, *Aster baccharoides*, *Inula cappa*, isolated shrubs *Melastoma candidum*, *Rhaphiolepis indica*, *Rhodomyrtus tomentosa*, *Ilex asprella*, *Osbeckia chinensis*, *Clerodendrum fortunatum*, *Baeckea frutescens*, *Breynia fruticosa* and *Eurya chinensis* and trees *Zanthoxylum avicennae*, *Litsea rotundifolia* var. *oblongifolia*, *Schefflera heptaphylla*, *Aporusa dioica*, *Ficus hirta*, *Ficus variolosa* and *Itea chinensis*. The shrubby coverage of this habitat is generally high, implying that this grassland/shrubland mosaic has undergone some succession to habitat of higher floristic diversity and richness. In time, this habitat would undergo further succession into tall shrubland dominated by taller shrubs and higher number of tree species. The floristic composition and structure of the tall shrubland habitat is similar to that of grassland/shrubland, but with greater canopy height and higher density of shrubs and trees.

Shrubland

6.10.2 The shrubland identified in the Study Area is typical of the habitat in Hong Kong and is dominated by common and widespread shrubby species and isolated tree species. This habitat type supports higher floristic diversity than the grassland and the identified shrubland is largely dominated by climbers such as *Smilax glabra*, *Embelia laeta*, *Embelia ribes*, *Strychnos umbellate*, *Millettia nitida* and *Zanthoxylum nitidum*, shrubs such as *Ilex asprella*, *Melastoma candidum*, *Melastoma sanguineum*, *Diospyros vaccinioides*, *Rhaphiolepis indica*, *Rhodomyrtus tomentosa*, *Baeckea frutescens*, *Breynia fruticosa*, *Helicteres angustifolia* and *Severinia buxifolia* and small trees such as *Alangium chinense*, *Phyllanthus emblica*, *Rhus chinensis*, *Rhus succedanea*, *Aporusa dioica* and *Cratoxylum cochinchinense*. With time, this habitat would develop into tall shrubland due to its close proximity to suitable seed sources. Plant species recorded in the shrubland habitat are presented together with grassland/shrubland habitat in Appendix 5.

Tall shrubland

6.10.3 Tall shrubland is the dominant habitat type along the surveyed North Lantau coast. It supports a higher floristic diversity and complexity than the shrubland, with dense populations of a mixture of native woody climber, shrubs and trees species, including two tree species (*Pavetta hongkongensis* and *Aquilaria sinensis*) protected under the Forestry Regulation Cap. 96. In addition to the shrub species found in the shrubland, tall shrubland contains a higher diversity of taller small tree species, including *Acronychia pedunculata*, *Cratoxylum cochinchinense*, *Schefflera heptaphylla*, *Mallotus paniculatus*, *Cerbera manghas*, *Celtis sinensis*, *Sapium discolor*, *Symplocos glauca*, *Gmelina chinensis* and *Scolopia saeva*. The understorey of the tall shrubland is dominated by wide range of species including climbers *Bauhinia championii*, *Rubus reflexus*, *Rourea microphylla*, *Strophanthus divaricatus* and *Alyxia sinensis*, and shrubs and trees species *Psychotria asiatica*, *Glochidion eriocarpum*, *Breynia fruticosa*, *Ardisia crenata*, *Archidendron clypearia* and *Antirhea chinensis*. Low numbers of the two protected tree species were identified along the hiking trail close to Hau Hok Wan.

6.11 Active Dry Agriculture

6.11.1 Active agriculture was restricted to areas around the villages of San Tau and Sha Lo Wan. A very small area, less than 0.1 ha, was mapped in the Study Area.

6.12 Developed Area

Chek Lap Kok – Airport Island

6.12.1 All landside areas within the Chek Lap Kok Airport are regarded as developed area. Under the regular maintenance and landscape management, the vegetation comprises herbs, shrubs and trees which do not produce fleshy fruits and plants with restricted height to prevent birds roosting. In general, the developed area contains common and widespread ornamental plants (including herbs such as *Wedelia trilobata*, *Panicum maximum*, *Imperata koenigii* and *Rhynchelytrum repens*, shrubs such as *Ixora chinensis*, *Calliandra haematocephala*, *Duranta erecta*, *Nerium oleander*, *Rhododendron* spp., *Bougainvillea glabra*, *Lantana montevidensis* and *Hibiscus rosa-sinensis*, trees such as *Ficus benjamina*, *Ficus microcarpa*, *Casuarina equisetifolia*, *Hibiscus tiliaceus*, *Acacia confusa*, *Melia azedarach*, *Delonix regia* and *Lagerstroemia speciosa* and palms such as *Roystonea regia* and *Phoenix roebelenii*).

Lantau Villages

6.12.2 Other developed areas within the Study Area include San Tau and Sha Lo Wan villages on Lantau. Some vegetation occurs in the low-density village areas, however this is of poor quality and of no particular ecological importance.

7.0 SUMMARY

7.1 The data from the 2003-04 Study was gathered from a larger Study Area over a longer period, incorporating a longer period of wet season surveys, than that of the Current Study. As such, any direct comparison between the species richness between the two studies is impractical. However, the longer wet season survey period for the Previous Study does provide an important ecological baseline,

particularly for the vegetation status of the major habitats along northern Lantau which is still considered to be relevant. Given that there has been no notable infrastructural development in the Study Area since the release of Previous Study, the majority of the botanical information and the status of species of conservation interest in the major studied habitats are taken in consideration.

7.2 A result of the larger scale of the Previous Study (in both Study Area and Survey Period) was that several species of conservation interest were recorded that were not observed during the Current Study e.g. Tokay Gecko *Gekko gecko,* Bamboo Orchid *Arundina chinensis* (See Table 8). However it is considered probable that these organisms still occur within the Study Area and the absence of records is more likely to be a combination of survey effort and seasonality. Other groups of conservation importance i.e. Birds, Horseshoe Crabs, Seagrasses, were found in higher numbers and/or greater abundance during the Previous Study, again this is likely to be the result of differences in survey effort and seasonality.

7.4 The Current Study has highlighted a number of additional species of conservation interest to compliment those found in the Previous Study (see Table 8), in particular, surveys have revealed further species of conservation interest at streams and intertidal locations at San Tau, Hau Hok Wan and Sha Lo Wan.

7.5 Overall, it is considered that the results of the Previous Study remain valid and that the combined results of these two studies are adequate for the purposes of impact evaluation.

7.6 Of all the habitats present within the Study Area, the soft shore habitats on the North Lantau coast (Tung Chung Bay, San Tau, Hau Hok Wan, Sha Lo Wan) are of high ecological value, due to the rich diversity of organisms present. Both the Current Study and the Previous Study (HyD 2004) recorded the presence of Horseshoe Crabs (with evidence of these areas also being utilized as nursery habitats by juvenile specimens). In addition, the shorelines are fringed with mangroves and mangrove associates, and two species of seagrass have been recorded at San Tau. The estuarine sections of the streams that enter these bays have been classified as being of Moderate-High ecological value, on account of fish and crustacean species of conservation interest present. These slack waters have potential to be utilized as nursery habitats for several of these species.

7.7 In addition, the secondary woodland at Scenic Hill has been classified as being of high ecological value, on account of the existing population of Romer's Tree Frogs. No evidence of this species, by way of adults, larvae or eggs, was discovered during this survey; largely because the surveys did not commence until late in the wet season when amphibians are less vocal and difficult to survey, particularly when dealing with a very small population. It is recommended that further surveys for this species are conducted in the early wet season 2009 in order to update the status of Romer's Tree Frog in this location.

7.8 It is generally recognized that the terrestrial habitats of North Lantau hold a diverse assemblage of butterfly species. The Current Study revealed 58 species, with the Previous Study recording over 90 species of butterfly (n.b. the Previous Study occupied a larger study area and surveys were conducted over a longer period of time, during more appropriate seasonality timings for observing butterflies on the wing); these results highlight the potential importance of this area for butterflies.

7.9 Both studies have identified the presence of corals along hard shores within the Study Area. It is anticipated that once the exact column locations are determined at the detailed design stage there will be a need to conduct pre-construction dive

survey to ensure that no ecological important habitat/species such as corals will be directly impacted.

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APPENDIX 1 – SURVEY LOCATION MAP AND HABITAT MAPS

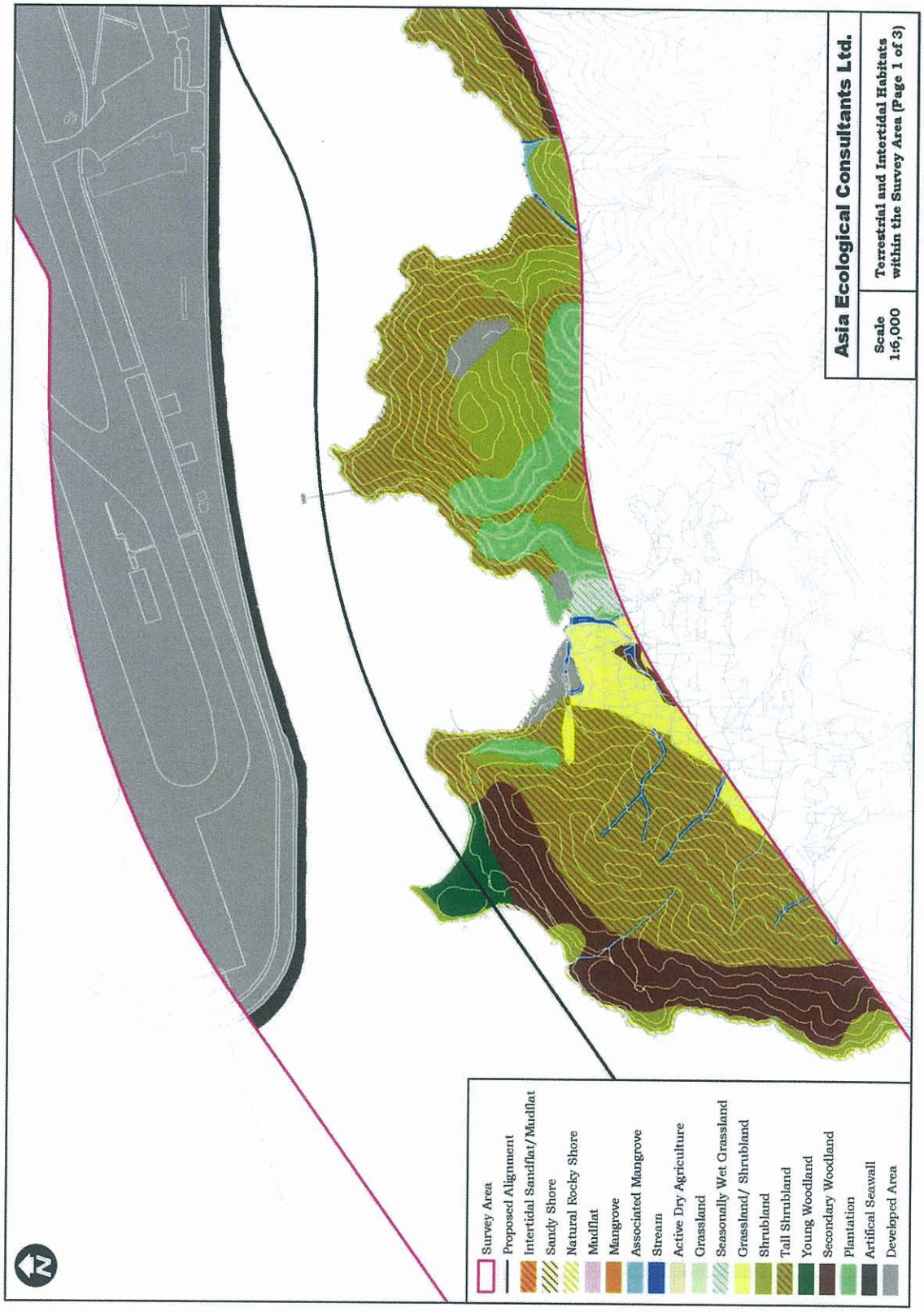


Figure A1.1.1. *Terrestrial and intertidal Habitats within the Survey Area (Page 1 of 3)*

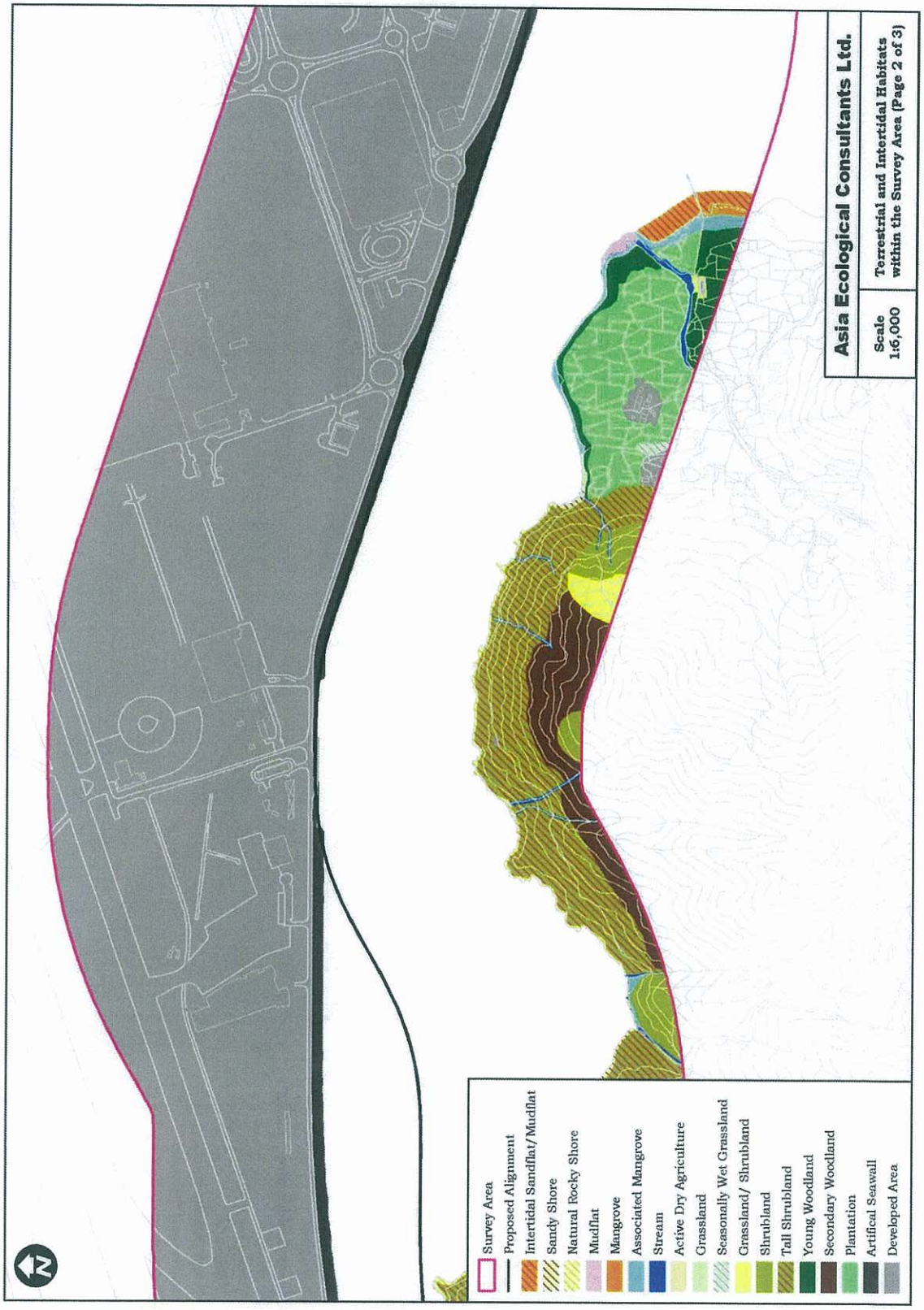


Figure A1.1.2. *Terrestrial and intertidal Habitats within the Survey Area (Page 2 of 3)*

Figure A1.1.3. *Terrestrial and intertidal Habitats within the Survey Area (Page 3 of 3)*

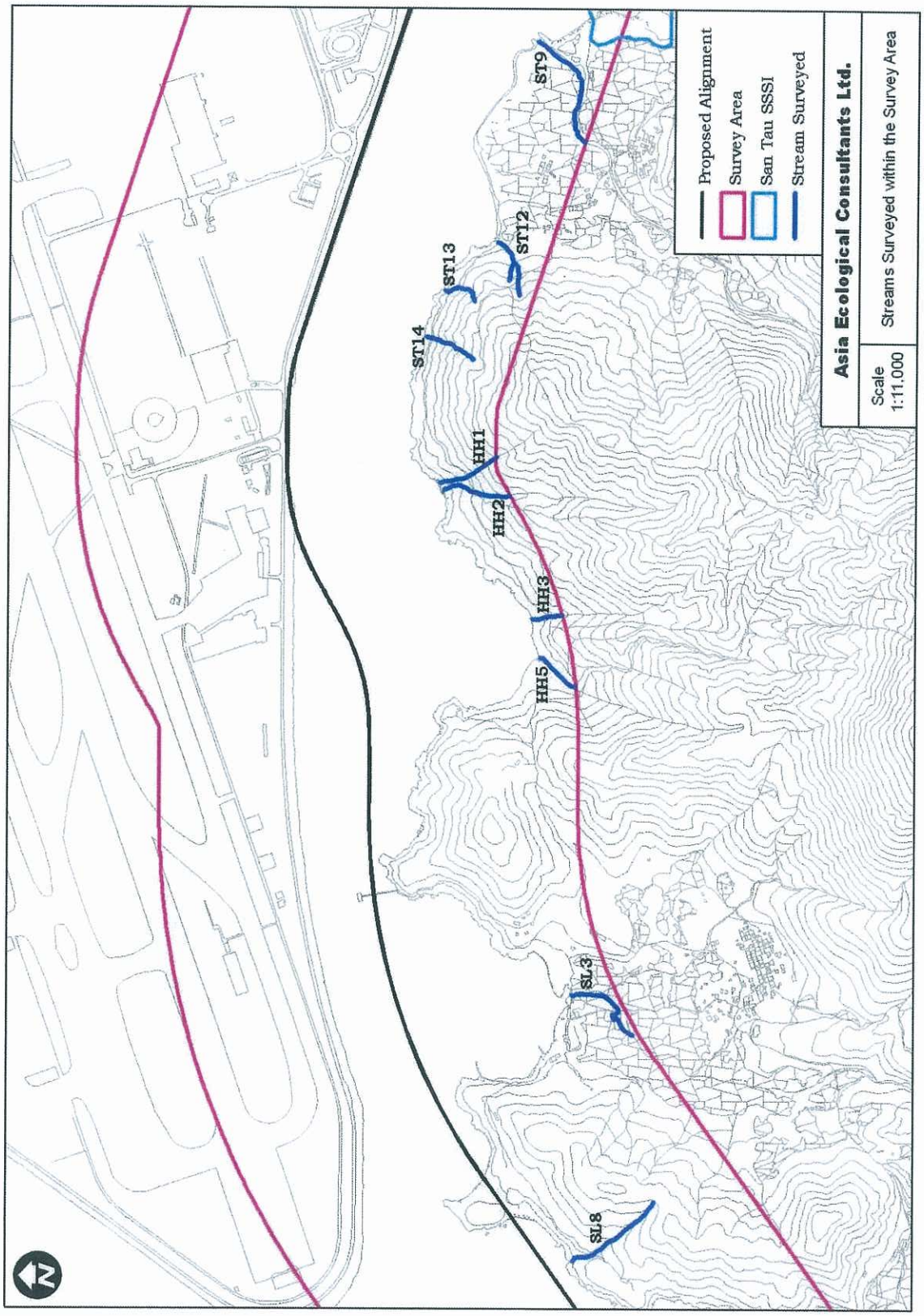


Figure A1.1.4. *Steams Surveyed within the Survey Area*

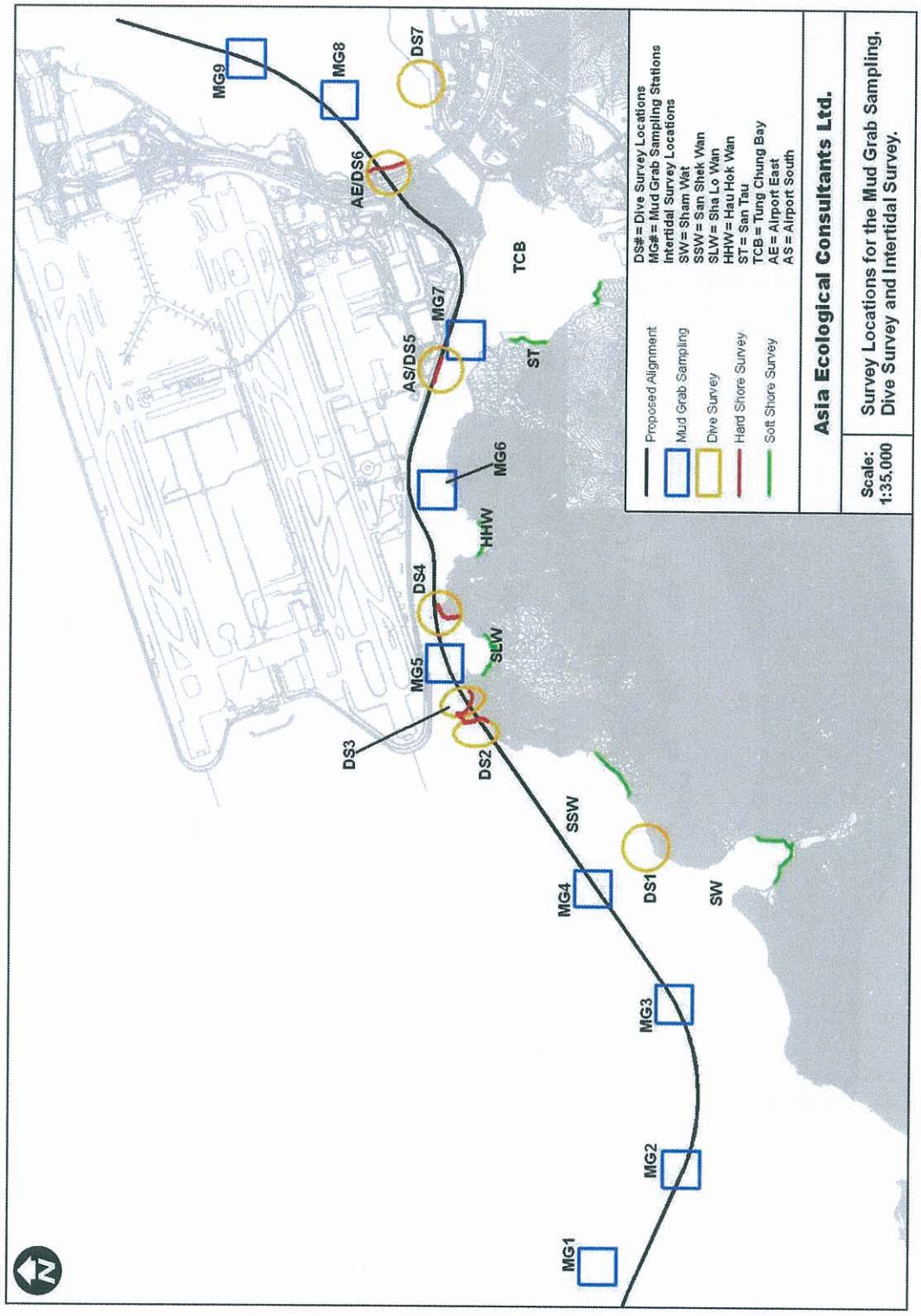


Figure A1.1.5. *Survey locations for the Mud Grab Sampling, Dive Survey and Intertidal Survey*

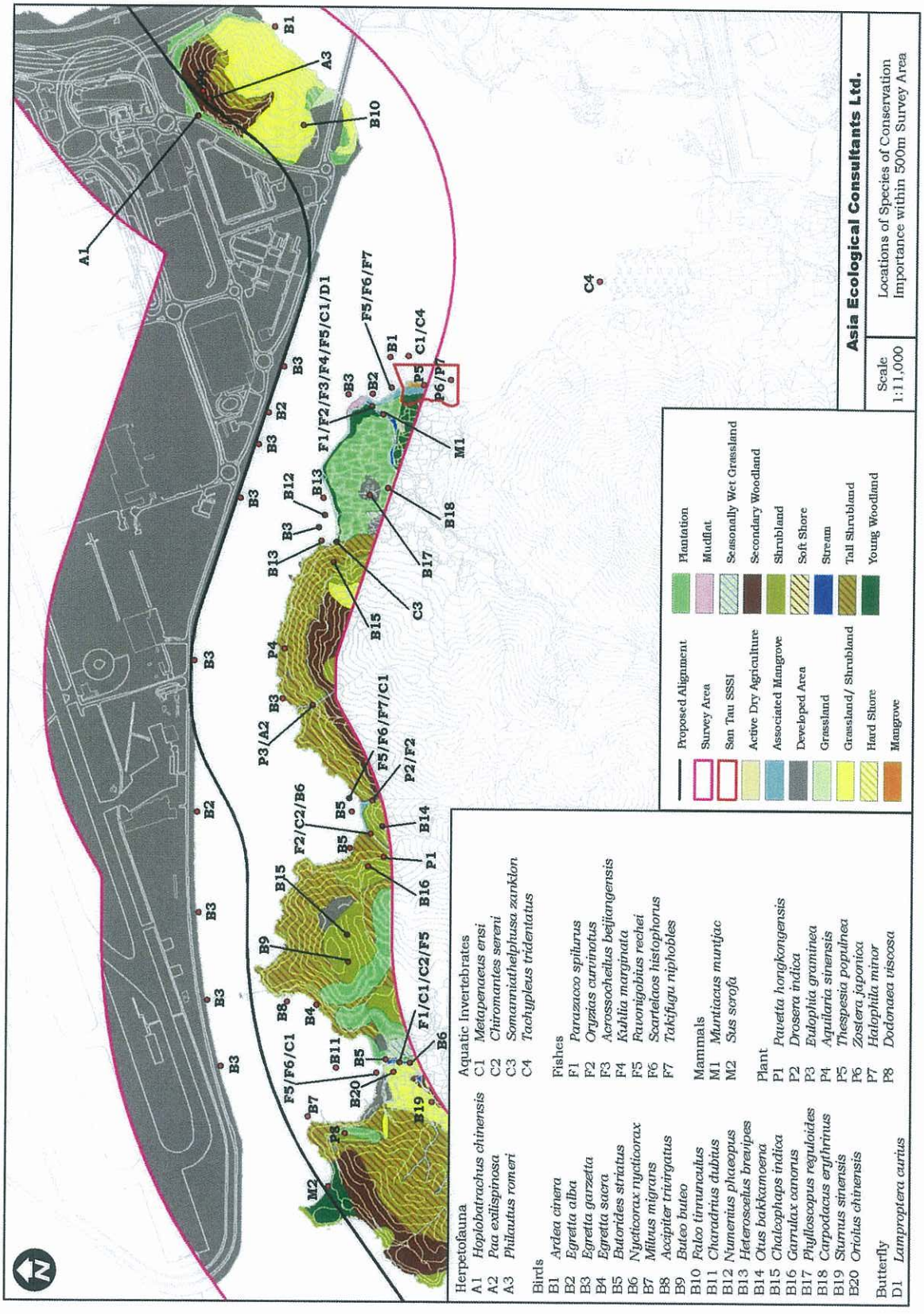


Figure A1.1.6. *Location of Species of Conservation Importance within 500m Survey Area.*

APPENDIX 2 – MARINE GRAB SURVEY RESULTS

Table A2.1. *Summary of the macrofauna families collected in wet season (September) and dry season (December) 2008*

Phylum	Family	Wet Season (September 2008)										Dry Season (December 2008)									
		1	2	3	4	5	6	7	8	9	Total	1	2	3	4	5	6	7	8	9	Total
Annelida	Amphinomidae		1								1										0
	Capitellidae	25	12	26	19	20	3	6	30	21	162	26	27	9	9	2	3	2		1	79
	Chaetopteridae		2								2										0
	Chrysopetalidae										0		1	1							2
	Cirratulidae	4		4	5		1	1	1		16										0
	Cossuridae	1	1		1	2	1	3	2	1	12										0
	Dorvilleidae	1							2	5	8		1								1
	Euphrosinidae	2				2			1	1	6										0
	Flabelligeridae		1		1		2		1	1	6										0
	Glyceridae	1	1	2	1						5	1	1					1			3
	Goniadidae										0		1								1
	Hesionidae			1	2	1			1	2	7										0
	Lumbrineridae	4	3	3	1	4	1		2	1	19	1	2				2				5
	Magelonidae			2							2										0
	Maldanidae	5	5	3	3	4	8		3	2	33	2	6	11	4		5	5	2	2	37
	Nephtyidae			9	5				1		15	8	4	9	4		1		1		27
	Nereididae	1		1		3	1	2		1	9		2							1	3
	Opheliidae			5							5	1	1								2
	Orbiniidae	3									3										0
	Paraonidae					1			1		2										0
	Phyllodocidae									1	1										0
	Pilargiidae	3	1	2	2	1		1	13	5	28		2	12	5			1	1		21
	Poecilochaetidae	2		1				1	1	1	6	1			1						2
	Polygordiidae		1								1										0
	Polynoidae	5	4	5	5		1				20										0
	Spionidae	7	4	12	7	3	4	4	5	3	49	2	1	2			1	5			11
	Sternaspidae	1				1	1				3										0
	Syllidae										0		1								1
	Terebellidae										0				3			1		2	6
Arthropoda	Alpheidae		1			1	1				3							2			2
	Ampeliscidae	1	1	5	4						11			1				1			2
	Bodotriidae	1		3							4		1								1
	Callianassidae		1		1	1					3										0
	Copepod							1			1										0
	Parthenopidae										0		1					5			6
	Penaeidae					1				1	2					1					1
	Pilumnidae	3	1	2			1		1	4	12	1	5	1	2	1		1	1	4	16
	Portunidae										0							1			1
	Squillidae			1							1		1								1
	Stenothoidae		2	3							5										0
	Pinnotherinae	10	12	13	6	1	4		2		48	7	12	6	13			1	1	1	41
Branchiopoda	Lingulidae		1								1										0
Chordata	Bregmacerotidae	1									1										0
	Gobiidae	1		1							2										0
	Syngnathidae			1							1										0
Cnidaria	Actiniidae	1	1			2					4										0
	Clavulariidae										0							1			1
Echinodermata	Amphiuridae		4								4										0
	Chiridotidae			1							1										0

Phylum	Family	Wet Season (September 2008)										Dry Season (December 2008)									
		1	2	3	4	5	6	7	8	9	Total	1	2	3	4	5	6	7	8	9	Total
	Molpadiidae										0				1	1			3		5
	Ophiotrichidae	4	35	21	5		1			1	67	3	16	5	2			2			28
	Phyllophoridae										0					1					1
Mollusca	Arcidae	1			2		1				4	1	1				1		3		6
	Calyptreidae										0							3			3
	Certhiidae		1	2							3										0
	Cylichnidae	1	1	1	2						5			2	2						4
	Dentaliidae	2	5	3	1					1	12				1	2				1	4
	Donacidae	7	32	26	12	1	3	7	12	5	105				1						1
	Ellobiidae				1						1										0
	Littorinidae	1	1								2										0
	Muricidae										0							1			1
	Nassariidae				2	1		2	6	1	12					1					1
	Nuculanidae										0							1			1
	Ostreoidae										0							1			1
	Psammbiidae										0	1			5						6
	Semelidae	9	37	10	12	3	1	1	12	7	92	1	1		1						3
	Solecurtidae				1						1										0
	Solenidae	2	1		1						4										0
	Strombidae									1	1										0
	Tellinidae										0		1	2	2	1			3	2	11
	Trochidae		2		1						3										0
	Unglulinidae					1					1										0
	Veneridae	7	4			1	1	4	7	4	28	3							5	3	11
Nemertea		6	5	14	7	4	3		13	5	57		1	5	3	1		1	12		23
Platyhelminthes					2						2										0

Table A2.2. *Number of individuals per taxa at each station in wet season (September) and dry season (December) 2008*

Taxonomic inventories	Wet Season (September 2008)										Dry Season (December 2008)									
	1	2	3	4	5	6	7	8	9	Total	1	2	3	4	5	6	7	8	9	Total
Amphipods	1	3	8	4	-	-	-	-	-	16	-	-	1	-	-	-	1	-	-	2
Bivalves	28	79	48	29	6	6	12	31	19	258	6	3	2	10	3	1	2	11	6	44
Brittle star	4	39	21	5	-	1	-	-	1	71	3	16	5	2	-	-	2	-	-	28
Copepod	-	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	0
Crab	13	13	15	6	1	5	-	3	4	60	8	18	7	15	1	-	8	2	5	64
Cumacea	1	-	3	-	-	-	-	-	-	4	-	1	-	-	-	-	-	-	-	1
Fish	2	-	2	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	0
Gastropods	2	5	3	6	1	-	2	6	2	27	-	-	2	2	1	-	4	-	-	9
Lampshell	-	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	0
Mantis shrimp	-	-	1	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-	-	1
Mud shrimp	-	1	-	1	1	-	-	-	-	3	-	-	-	-	-	-	-	-	-	0
Nemertea	13	4	20	2	6	3	1	15	7	70	-	1	5	3	1	-	1	12	-	23
Polychaetes	62	41	87	56	39	24	19	78	51	457	42	50	44	26	2	12	15	4	6	201
Sea anemone	1	1	-	-	2	-	-	-	-	4	-	-	-	-	-	-	-	-	-	0
Sea cucumber	-	-	1	-	-	-	-	-	-	1	-	-	-	1	2	-	-	3	-	6
Shrimp	-	1	-	-	2	1	-	-	1	5	-	-	-	-	1	-	2	-	-	3
Soft coral	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	-	1	-	-	1
Turbellarian	-	-	-	2	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	0
Total	**127**	**188**	**209**	**111**	**58**	**40**	**34**	**133**	**85**	**985**	**59**	**90**	**66**	**59**	**11**	**13**	**36**	**32**	**17**	**383**

Table A2.3. *Summary of the dominant macrofaunal species (> 30 individuals) collected in wet season (September) and dry season (December) 2008*

Phylum	Class	Order	Family	Species	Abundance
Wet Season (September 2008)					
Mollusca	Bivalvia	Veneroida	Donacidae	*Donax* sp.	114
Mollusca	Bivalvia	Veneroida	Semelidae	*Theora lata*	92
Echinodermata	Ophiuoidea	Ophiurida	Ophiodermatidae	*Macrophiothrix longipeda*	67
Nemertea	-	-	-	-	56
Arthropoda	Crustacea	Decapoda	Pinnotherinae	*Xenophthalmus* sp.	48
Annelida	Polychaeta	Scolecida	Maldanidae	*Euclymene* sp.	43
Annelida	Polychaeta	Spionida	Spionidae	*Paraprionospio pinnata*	40
Annelida	Polychaeta	Capitellida	Capitellidae	*Notomastus latericens*	38
Annelida	Polychaeta	Phyllodocida	Nephtyidae	*Aglaophamus dibranchis*	37
Annelida	Polychaeta	Capitellida	Capitellidae	*Heteromastus* sp.	31
Dry Season (December 2008)					
Annelida	Polychaeta	Capitellida	Capitellidae	*Notomastus latericens*	49
Arthropoda	Crustacea	Brachyura	Pinnotherinae	*Xenophthalmus* sp.	41
Annelida	Polychaeta	Scolecida	Maldanidae	*Euclymene* sp.	37

Table A2.4. *Two-way ANOVA (n = 3) to compare species abundance, species richness and biomass between wet (September 2008) and dry (December 2008) seasons and Stations (1 – 9). Significant differences are shown in bold*

Species abundance				
Source	*df*	MS	F	*p*-value
Season	1	2.41	50.80	**<0.001**
Station	8	0.76	10.03	**<0.001**
Season × Station	8	0.08	2.71	0.13
Error	36	0.05		
Transformation		log (x + 1)		
SNK-test		Station: 5 6 7 9 8 4 1 3 2		

Species richness				
Source	*df*	MS	F	*p*-value
Season	1	93.33	54.64	**<0.001**
Station	8	0.34	6.14	**<0.001**
Season × Station	8	0.04	1.80	0.11
Error	36	0.01		
Transformation		log (x + 10)		
SNK-test		Station: 6 5 7 9 8 3 4 1 2		

Biomass				
Source	*df*	MS	F	*p*-value
Season	1	181.10	6.55	**0.02**
Station	8	25.56	0.92	0.51
Season × Station	8	33.36	1.21	0.32
Error	36	27.66		
Transformation		None		
SNK-test		None		

Table A2.5. *Species Richness, Pielou's Evenness and Shannon-Wiener Diversity Index of each location in wet season (September) and dry season (December) 2008*

Station	Wet Season (September 2008)			Dry Season (December 2008)		
	Species Richness	Pielou's Evenness	Shannon-Wiener Diversity Index	Species Richness	Pielou's Evenness	Shannon-Wiener Diversity Index
1	8.26	0.91	3.37	3.92	0.82	2.32
2	7.26	0.75	2.76	5.56	0.79	2.57
3	6.74	0.85	3.07	3.34	0.88	2.38
4	7.01	0.90	3.19	4.66	0.90	2.70
5	6.65	0.93	3.10	3.75	0.99	2.27
6	5.15	0.90	2.68	2.73	0.88	1.84
7	5.34	0.93	2.78	5.58	0.93	1.84
8	6.75	0.89	3.15	3.17	0.84	2.08
9	7.65	0.93	3.30	3.18	0.95	2.18

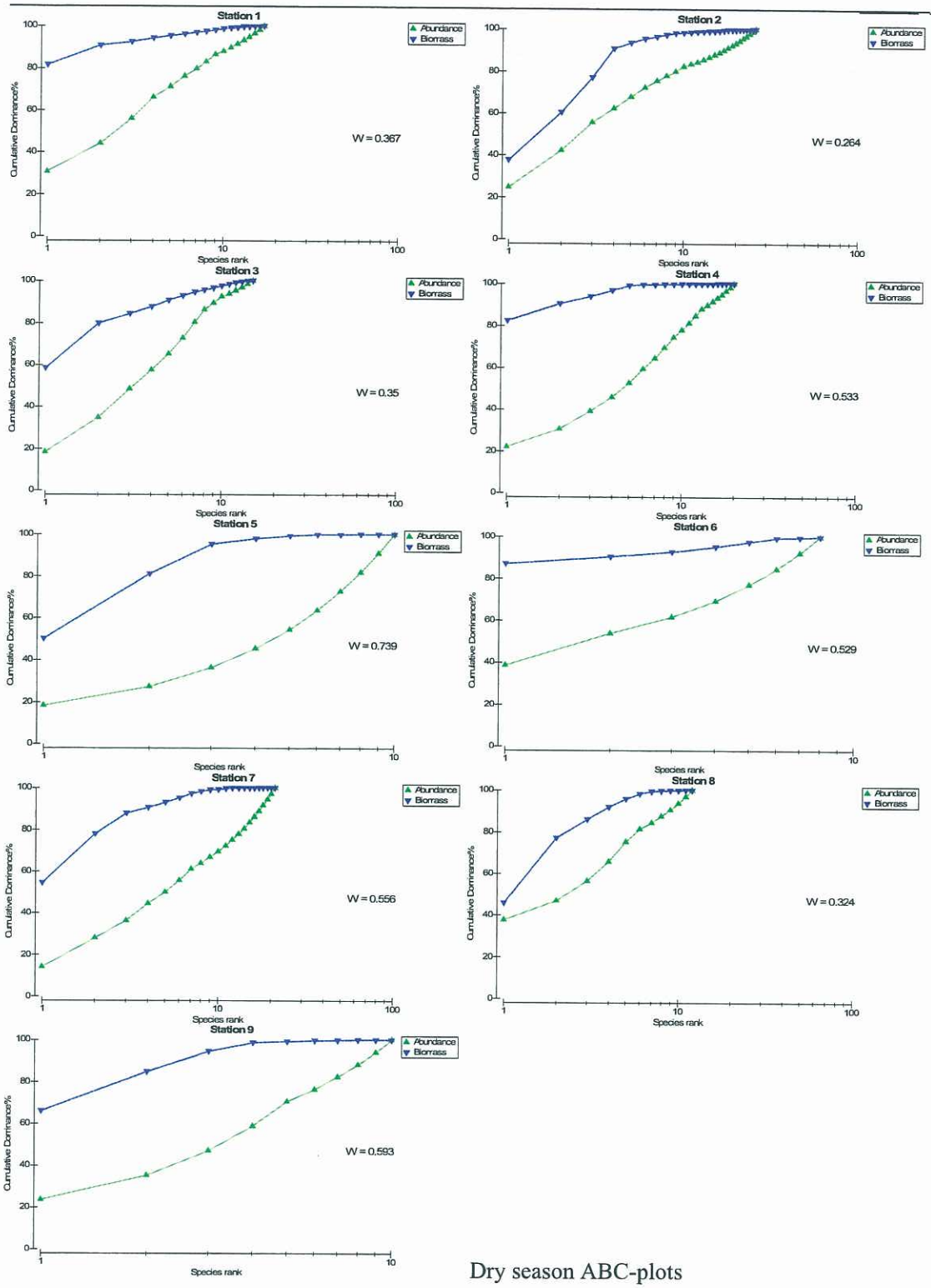


Figure. A2.1. *ABC plots of the benthic macro-fauna from grab samples collected at the 9 stations in September 2008*

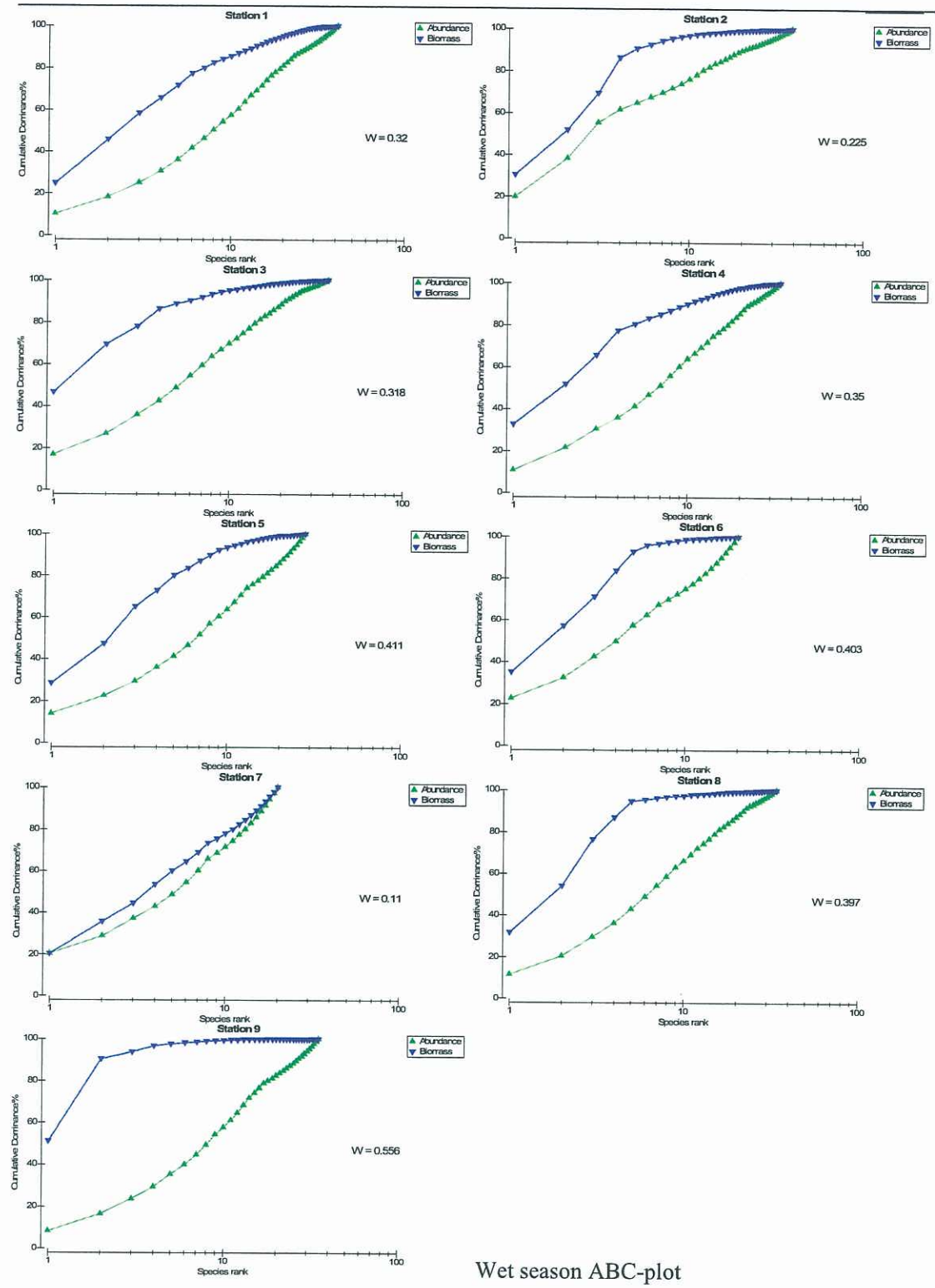


Figure. A2.2. *ABC plots of the benthic macro-fauna from grab samples collected at the 9 stations in December 2008*

APPENDIX 3 – DIVE SURVEYS

1. METHODOLOGY

1.1 Dive Survey - Rapid Ecological Assessment

1.1.1 Assessment of substrate and ecological attributes using a semi-quantitative, Rapid Ecological Assessment (REA) method was conducted at seven dive survey sites as shown in Fig. 3.1. The field data were collected by marine ecologists using SCUBA dive.

1.1.2 REA surveys provide information on the relative cover of coral and other major benthic groups, as well as inventory of sessile benthic taxa used to define community types. REA has been adopted in many regions to examine baseline information on coral reefs, such as the Great Barrier Reef (DeVantier *et al.* 1998). This method can be applied to a wide range of coral reef and community types and were also used in a coral community study in Hong Kong with some modification (OCL 2003).

1.1.3 At each site, the REA survey was performed along one parallel and one perpendicular transect with respect to the coastline. The length of the parallel transect was 100m, while the perpendicular transect was laid off-shoreward until the visibility was too low for underwater survey. The depth and substrate type along the perpendicular transects for REA were recorded at 2m intervals. The benthic cover, taxon abundance, and ecological attributes of the transects were recorded in a swathe of 2m wide, 1m either side of the transects.

1.1.4 The locations and routes (starting and end points) of the REA transects were recorded on site using GPS (Garmin GPS 60CS). Pictures of representative taxa and video footages along the transects were taken during the surveys.

1.1.5 Two types of information were recorded:

(1) Cover of the major benthic groups;

(2) Inventory of sessile benthic taxa.

These were performed according to Tier I and Tier II levels of information.

1.1.6 Tier I: Categorization of ecological (benthic cover) and environmental variables.

To describe the benthic cover, six substrate and seven ecological attributes (Table 1.1a) were assigned. Each attribute was given a rank, from 0 to 6 (Table 1.1b) based on the overall cover along the survey area.

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

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

Hard corals (Order Scleractinia) – to genus and species level where possible;
Soft corals (Subclass Octocorallia) – to genus level where possible;
Other benthos (such as sponges zoanthids, bryozoans, macroalgae etc) – to genus level where possible or phylum with growth form;

Each taxon in the inventory was given a rank (0 to 5) on the basis of its abundance in the community at the site (Table 3.1c). These broad categories rank the taxa in terms of the relative abundance of individuals, rather than the contribution to benthic cover, at each site.

Table A3.1. *Categories of a) benthic attributes, b) ordinal ranks of percentage cover of substrate, and (c) ordinal ranks of taxa abundance.*

a) Benthic attributes		b) Percentage Cover		c) Taxon abundance	
Substrate	**Ecological**	**Rank**	**Percentage Cover**	**Rank**	**Abundance**
Bedrock	Hard Corals	0	Not recorded	0	Absent
Boulders (diameter >50cm)	Dead Coral Skeleton	1	1-5%	1	Sparse
Cobbles (diameter < 50cm)	Soft Corals	2	6-10%	2	Uncommon
Rubble (dead corals)	Sea anemone beds	3	11-30%	3	Common
Sand with gravel	Encrusting Algae	4	31-50%	4	Abundant
Mud & Silt	Coralline Algae	5	51-75%	5	Dominant
	Erect Macroalgae	6	76-100%		

2 RESULTS

2.1 Dive Survey - Rapid Ecological Assessment

2.1.1 The dive surveys at the 7 survey sites were conducted on 18th, 19th, 25th and 26th October 2008.

2.1.2 At each site, one parallel and one perpendicular transects were used for the REA survey. The locations of the transects and survey conditions are shown in Fig. 2.1 and Table 2.1. Records of ecological and substrate attributes, as well as the taxonomic inventories are presented in Table 2.2. The depth profile and physical character of the transects are provided in Appendix Ia and Ib. Photographs of the survey sites and benthic organisms are shown in Appendix IIa and IIb.

Site DS1

2.1.3 Site DS1 is a natural shore to the west of the airport channel, with a substrate mainly composed of boulder and sand (Table 2.2). The boulder substrate only extends a short distance (~8m) offshore, then drops to a depth of about 5.5m and is replaced by the sandy substrate (Fig. 3.1; Annex I). The hard substrate was covered with low abundance of rock oysters, mussels (including *Perna viridis*) and sponges. Only one species of hard coral was recorded, an ahermatypic cup-coral *Balanophyllia* sp. (Dendrophyllidae). The recorded colonies showed no sign of suffering from sedimentation, bleaching or partial mortality. The octocoral *Echinomuricea* sp. (Plexauridae) was sparsely distributed on the boulder surface; most of the colonies recorded suffered from high level of partial mortality (Table 2.3; Appendix II). The coverage of both hard and soft corals was low (< 5%). No other flora or fauna of high conservation interest was observed.

Site DS2

2.1.4 Site DS2 is a natural cobble and sandy beach (Table 2.2). The hard substrate was narrow and limited to ~10m from the shore, the sea bed was then covered with sand in a gentle slope from ~10 to ~26m and subsequently replaced by mud and silt at a depth of ~6m (Fig. 3.1; Appendix I). The cobbles and boulders were generally covered by mussels, oysters and barnacles. Similar to DS1, only 1 species of hard coral (*Balanophyllia* sp.) and 1 soft coral species (*Echinomuricea* sp.) were observed, both occurring in low density (< 5%) and patchily distributed. The *Balanophyllia* colonies were generally in normal condition, while the *Echinomuricea* sp. suffered from a high level of partial mortality (Table 2.3; Appendix II).

Site DS3

2.1.5 Site DS3 is a sandy beach scattered with bedrock and cobbles (Table 2.2). The offshore profile was very gentle, extending to ~50m before becoming steeper towards the Airport Channel (Fig. 3.1; Annex I). The rock surface was mainly inhabited by oysters, mussels and barnacles which were common in all sites (Annex II). No hard and soft coral, or other taxa of high conservation interest, were recorded.

Table A3.2. *Location and Condition at the Dive Survey Sites. T1 and T2 are transects parallel and perpendicular to shore, respectively. Note site variation in length of T2 as a result of visibility or substrate type variation.*

Site	Transact (Length,		GPS Coordinates	Depth (m)	Visibility (m)	Weather	Tide	Current (knot)
DS1	T1 (100m)	Start	N 22°16'42.2" E 113°53'12.1"	4.2 – 4.9	0.1 – 0.4	Calm cloudy	Flood	0.5 – 1
		End	N 22°16'42.2" E 113°53'15.7"					
	T2 (20m)	Start	N 22°16'42.2" E 113°53'12.1"	4.5 – 6.7				
		End	N 22°16'42.5" E 113°53'11.4"					
DS2	T1 (100m)	Start	N 22°17'22.5" E 113°53'45.8"	1.8 – 3.6	0.2 – 0.5	Calm cloudy	Ebb	0
		End	N 22°17'28.8" E 113°53'45.9"					
	T2 (30m)	Start	N 22°17'22.5" E 113°53'45.8"	2.4 – 6.1				
		End	N 22°17'25.6" E 113°53'44.7"					
DS3	T1 (100m)	Start	N 22°17'30.7" E 113°53'50.2"	2.7 – 3.0	0.2 – 0.4	Calm; cloudy	Ebb	0 - 0.5
		End	N 22°17'28.6" E 113°53'53.0"					
	T2 (68m)	Start	N 22°17'30.7" E 113°53'50.2"	2.7 – 7.6				
		End	N 22°17'31.8" E 113°53'52.3"					
DS4	T1 (100m)	Start	N 22°17'36.5" E 114°54'16.0"	2.7 – 3.6	0.1 – 0.4	Calm; cloudy	Flood	0 – 0.5
		End	N 22°17'35.2" E 113°54'19.0"					
	T2 (52m)	Start	N 22°17'36.5" E 114°54'16.0"	3.0 – 8.8				
		End	N 22°17'38.1" E 113°54'16.6"					
DS5	T1 (100m)	Start	N 22°17'35.7" E 113°56'14.9"	2.7 – 3.3	0.1 – 0.2	Calm; sun patches	Flood	0.5 - 1
		End	N 22°17'34.7" E 113°55'23.0"					
	T2 (58m)	Start	N 22°17'35.7" E 113°56'14.9"	3.6 – 10.0				
		End	N 22°17'34.1" E 113°55'18.9"					
DS6	T1 (100m)	Start	N 22°17'54.1" E 113°56'14.9"	2.1 – 3.0	0.5 – 1.5	Calm; sun patches	Ebb	0
		End	N 22°17'51.0" E 113°56'15.3"					
	T2 (24m)	Start	N 22°17'54.1" E 113°56'14.9"	2.7 – 3.9				
		End	N 22°17'54.0" E 113°56'16.0"					
DS7	T1 (100m)	Start	N 22°17'43.9" E 113°56'38.6"	3.0 – 4.5	0.5 – 1.5	Calm; sun patches	Ebb	0
		End	N 22°17'46.6" E 113°56'40.6"					
	T2 (50m)	Start	N 22°17'43.9" E 113°56'38.6"	3.0 – 8.8				
		End	N 22°17'44.8" E 113°56'36.9"					

Site DS4

2.1.6 Site DS4 is a natural rocky shore at the southern side of the Airport Channel. The sea bed was covered with cobbles, sand and boulders (Table 2.2). The hard substrate extended to ~20m offshore, and was then replaced by a steady slope of sandy bottom to a depth of 8.8m (Fig. 3.1 and Annex I). As at Site DS3, oysters, mussels and barnacles were the major inhabitants on the rock surface. No hard and soft corals, or other taxa of high conservation interest, were observed.

Site DS5

2.1.7 Site DS5 is an artificial boulder shore at the northern side of the Airport Channel. The substrate was mainly covered by boulders and interspersed with cobbles and sandy substrate (Table 2.2). The offshore sea bed profile was gentle from the shore to ~26m, the sandy substrate dropped steeply to ~9m depth and was replaced by the mud and silt (Fig 3.1; Annex I). The rock surface in DS5 was sparsely inhabited by oysters, mussels and barnacles. No hard and soft corals, or other taxa of high conservation interest were recorded.

Site DS6

2.1.8 Site DS6 is a natural cobble beach at the south-eastern side of the Airport. The cobble substrate was narrow, and replaced by flat, sandy bottom from ~5m onward (Fig 3.1; Annex I). The hard substrate was inhabited by barnacles, mussels, oysters, encrusting algae and bryozoans (Annex II). No hard coral was recorded, but cover of octocoral *Echinomericea* sp. was relatively high (5 to 10%). Moreover, the level of partial mortality in *Echinomuricea* sp. was lower than at Sites DS1 and DS2 (Table 2.3).

Site DS7

2.1.9 Site DS7 is an artificial boulder shore at Tung Chung New Town. The substrate was dominated by rock boulders which formed a steep slope from the shore to ~12m, reaching the depth of ~6.4m and connecting to a mud and silt bottom (Fig 3.1 and Annex I). The rock surface was generally covered with barnacles, oysters, mussel, encrusting algae and bryozoans. Scattered colonies of octocoral *Echomuricea* sp. were observed (< 5%), in which the level of partial mortality was lower than at Sites DS1 and DS2 (Table 2.3; Annex II).

Fig. A3.1. *Map showing Locations of the Dive Survey Sites.*

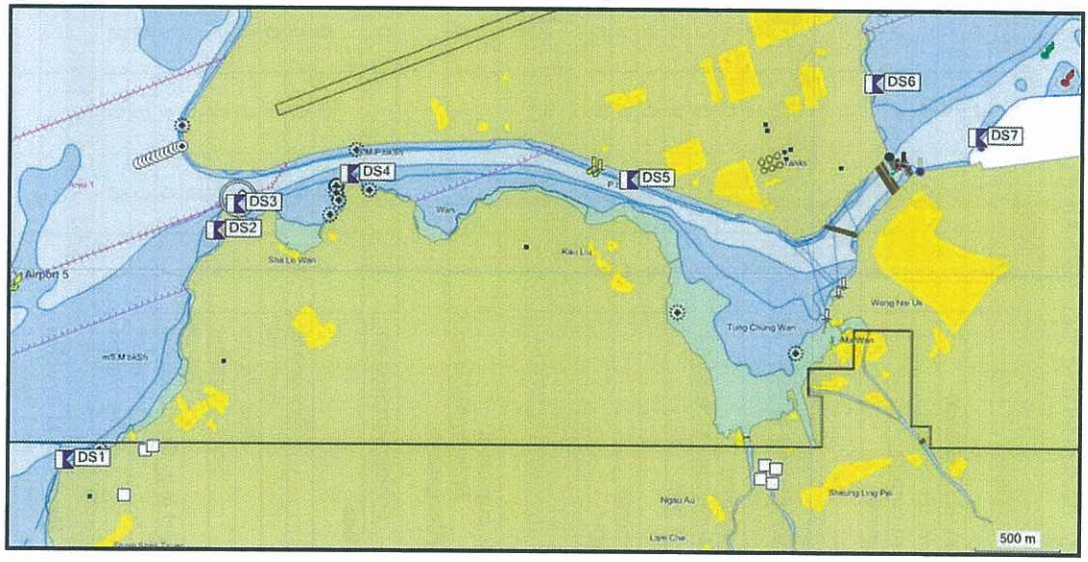


Table A3.3. *Ecological and Substrate Attributes, and Taxonomic Inventories. T1 and T2 are transects parallel and perpendicular to shore, respectively.*

	DS1		DS2		DS3		DS4		DS5		DS6		DS7	
Substrate attributes (0 – 6)	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**
Bedrock	1	0	0	0	3	0	0	0	0	0	0	0	0	0
Boulder (diameter >50cm)	5	3	2	3	1	0	3	0	5	0	1	3	6	3
Cobble (diameter<50cm)	0	0	4	0	3	3	4	3	3	5	6	0	3	0
Rubble (dead corals)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sand with gravel	3	3	4	5	5	5	4	6	3	3	3	6	2	0
Mud & Silt	0	4	0	3	0	0	0	0	0	3	0	0	0	5

	DS1		DS2		DS3		DS4		DS5		DS6		DS7	
Ecological attributes (0 – 6)	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**
Hard coral	1	0	1	0	0	0	0	0	0	0	0	0	0	0
Dead coral skeleton	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Soft coral (Gorgonian Octocoral)	2	1	2	0	0	0	0	0	0	0	2	1	1	0
Sea anemone bed	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Macroalgae	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Encrusting algae	0	0	0	0	0	0	0	0	0	0	2	0	2	0
Coralline algae	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	DS1		DS2		DS3		DS4		DS5		DS6		DS7	
Taxonomic inventories (0 – 5)	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**	**T1**	**T2**
Hard Coral														
Ahermatypic cup coral *Balanophyllia* sp.	1	0	1	0	0	0	0	0	0	0	0	0	0	0
Soft Coral (Gorgonian Octocoral)														
Echinomuricaea sp.	1	1	1	0	0	0	0	0	0	0	2	1	1	0
Other benthos														
Sponge	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Bryozoans	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Hydroid	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sea Urchin	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sea Cucumber	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oyster	1	0	3	0	3	1	4	0	1	0	2	0	3	1
Mussel (e.g. *Perna viridis*)	1	0	4	1	3	1	4	0	1	1	3	1	2	0
Barnacles	0	0	3	2	1	0	3	0	1	0	4	2	4	1
Tube worms	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	DS1	DS2	DS3	DS4	DS5	DS6	DS7
No. Hard Coral Species	1	1	0	0	0	0	0
No. Octocoral Species	1	1	0	0	0	1	1

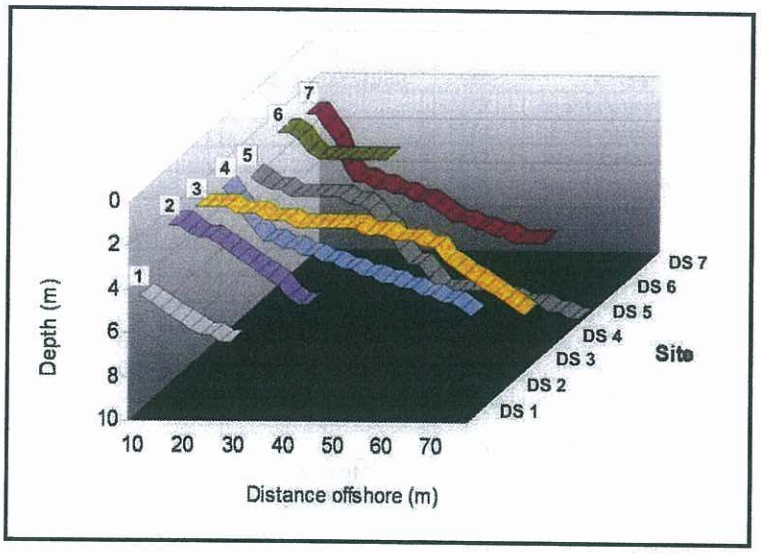


Fig. A3.2. Depth Profile of Perpendicular Transects at the Dive Survey Sites.

2.2 Coral community

Hard Coral

2.2.1 Only one species of hard coral was recorded in this survey, the ahermatypic cup-coral from the genus *Balanophyllia* (Dendrophylliidae). The genus mainly contains azooxanthellate species inhabiting deep waters and waters of low clarity. In local waters, the taxonomic identity and the distribution of the cup-coral has not been well described, with sightings mainly reported from the western waters (Highways Department 2001, Oceanway 2003).

2.2.2 Among the seven survey sites, *Balanophyllia* sp. was only observed in Sites DS1 and DS2 that are located outside Airport Channel to the west. The recorded colonies were solitary in form and occurred in patches of 5 to 20 colonies, the corallite size was < 1cm^2. In both sites, all the observed colonies were associated with boulders of diameter >50cm. Translocation of these colonies is not considered feasible due to the large associated substratum which are not readily moved without damaging the attached colonies. No colonies showed signs of suffering from sedimentation, bleaching or partial mortality.

Octocoral

2.2.3 One taxon of octocoral, *Echinomuricea* sp. (Plexauridae), was recorded from four of the seven survey sites (DS1, DS2, DS6 and DS7). No octocoral was found from the sites within the Airport Channel (DS3, DS4 and DS5). *Echinomuricea* sp. is a common octocoral in local seas, usually recorded at greater depth in eastern waters but occurring in shallow habitat in the more murky southern and western waters.

2.2.4 In these four survey sites, 37 *Echinomuricea* colonies were found sparsely distributed on the rock surface. All colonies recorded suffered from different levels of partial mortality (Table 2.3), with colonies at Sites DS1 and DS2 generally exhibiting higher percentages of sedimentation and mortality than those in other sites.

Table A3.4. *Octocoral Colonies, Percentage Area of Sedimentation and Partial Mortality in the Dive Survey Sites.*

No.	Species	Site	% Sedimentation	% Mortality
1	*Echinomuricea* sp.	DS1	50	60
2	*Echinomuricea* sp.	DS1	30	65
3	*Echinomuricea* sp.	DS1	35	80
4	*Echinomuricea* sp.	DS1	40	70
			Mean % mortality	**68.75**
5	*Echinomuricea* sp.	DS2	70	80
6	*Echinomuricea* sp.	DS2	80	70
7	*Echinomuricea* sp.	DS2	75	65
8	*Echinomuricea* sp.	DS2	80	85
9	*Echinomuricea* sp.	DS2	50	60
10	*Echinomuricea* sp.	DS2	55	60
11	*Echinomuricea* sp.	DS2	75	70
12	*Echinomuricea* sp.	DS2	65	70
			Mean % mortality	**70**
13	*Echinomuricea* sp.	DS6	15	25
14	*Echinomuricea* sp.	DS6	15	40
15	*Echinomuricea* sp.	DS6	25	50
16	*Echinomuricea* sp.	DS6	40	55
17	*Echinomuricea* sp.	DS6	10	15
18	*Echinomuricea* sp.	DS6	10	10
19	*Echinomuricea* sp.	DS6	45	80
20	*Echinomuricea* sp.	DS6	10	65
21	*Echinomuricea* sp.	DS6	20	75
22	*Echinomuricea* sp.	DS6	25	60
23	*Echinomuricea* sp.	DS6	30	55
24	*Echinomuricea* sp.	DS6	30	25
25	*Echinomuricea* sp.	DS6	20	50
26	*Echinomuricea* sp.	DS6	25	15
27	*Echinomuricea* sp.	DS6	10	80
28	*Echinomuricea* sp.	DS6	10	75
29	*Echinomuricea* sp.	DS6	45	55
30	*Echinomuricea* sp.	DS6	40	65
31	*Echinomuricea* sp.	DS6	15	65
32	*Echinomuricea* sp.	DS6	25	10
33	*Echinomuricea* sp.	DS6	15	55
34	*Echinomuricea* sp.	DS6	35	40
			Mean % mortality	**48.4**
35	*Echinomuricea* sp.	DS7	15	15
36	*Echinomuricea* sp.	DS7	10	15
37	*Echinomuricea* sp.	DS7	10	30
			Mean % mortality	**20**

Annex Ia. *Depth Profile and Substrate Type of the Parallel Transect of the Dive Survey Sites.*

	Depth (m)						
Meter	DS1	DS2	DS3	DS4	DS5	DS6	DS7
2	4.5	2.4	2.7	3.0	2.7	2.1	3.0
4	4.5	2.4	2.7	3.0	2.7	2.1	3.0
6	4.5	2.4	2.7	3.0	2.7	2.4	3.0
8	4.5	2.7	2.7	3.0	3.0	2.4	3.0
10	4.5	2.4	2.7	3.0	3.0	2.4	3.0
12	4.8	2.4	2.7	3.0	3.0	2.4	3.3
14	4.8	2.7	2.7	3.0	3.0	2.4	3.6
16	4.8	2.4	2.7	3.0	2.7	2.4	3.9
18	4.8	2.4	2.7	3.0	2.7	2.4	3.9
20	4.5	2.7	2.7	3.0	2.7	2.4	3.6
22	4.5	3.0	2.7	3.3	2.7	2.4	3.6
24	4.5	3.0	2.7	3.3	2.7	2.7	3.9
26	4.5	3.0	2.7	3.0	2.7	2.7	3.9
28	4.5	3.0	2.7	3.3	2.7	2.7	3.6
30	4.2	3.0	2.7	3.6	2.7	3.0	3.6
32	4.5	3.0	2.7	3.3	3.0	3.0	3.6
34	4.5	3.3	2.7	3.3	3.0	3.0	3.6
36	4.8	3.3	2.7	3.3	2.7	3.0	3.3
38	4.8	3.0	2.7	3.3	2.7	3.0	3.3
40	4.8	3.6	3.0	3.6	3.0	3.0	3.3
42	4.5	3.6	3.0	3.3	3.0	3.0	3.3
44	4.5	3.0	3.0	3.3	3.0	3.0	3.6
46	4.5	3.3	3.0	3.3	3.0	3.0	3.6
48	4.5	3.3	3.0	3.3	3.0	3.0	3.6
50	4.5	3.0	2.7	3.3	3.3	3.0	3.6
52	4.5	3.0	2.7	3.3	3.3	3.0	3.6
54	4.5	2.7	2.7	3.0	3.3	3.0	3.6
56	4.5	3.0	2.7	3.0	3.0	3.0	3.6
58	4.5	2.7	2.7	3.0	3.0	3.0	3.6
60	4.5	2.4	2.7	3.0	2.7	3.0	3.6
62	4.5	2.4	3.0	2.7	3.0	3.0	3.6
64	4.5	2.7	3.0	2.7	3.0	3.0	3.6
66	4.5	2.4	3.0	2.7	3.0	3.0	3.6
68	4.5	2.1	3.0	2.7	3.0	3.0	3.6
70	4.5	1.8	3.0	2.7	3.3	3.0	3.6
72	4.5	2.1	3.0	2.7	3.3	3.0	3.6
74	4.5	1.8	3.0	2.7	3.3	3.0	3.6
76	4.5	2.4	3.0	2.7	3.0	3.0	3.6
78	4.5	2.4	3.0	2.7	3.0	3.0	3.6
80	4.5	2.1	3.0	2.7	3.0	3.0	3.6
82	4.5	2.4	2.7	2.7	2.7	3.0	3.6
84	4.5	2.4	2.7	2.7	2.7	3.0	3.6

	Substrate type							
Meter	DS1	DS2	DS3	DS4	DS5	DS6	DS7	Legend
2	BD	BD	SD	SD	BD	SD	BD	BR = Bedrock
4	BD	BD	SD	SD	BD	CB	BD	BD = Boulder
6	BD	BD	SD	BD	BD	CB	BD	CB = Cobble
8	BD	BD	SD	BD	BD	BD	BD	RB = Rubble
10	BD	BD	SD	SD	BD	CB	BD	SD = Sand
12	BD	BD	CB	SD	BD	SD	BD	ST = Silt and Mud
14	BD	BD	SD	SD	BD	CB	BD	
16	BD	BD	CB	SD	BD	CB	BD	
18	BD	SD	CB	SD	BD	CB	BD	
20	BD	SD	SD	SD	BD	CB	BD	
22	BD	CB	CB	SD	BD	SD	BD	
24	BD	CB	CB	SD	BD	CB	SD	
26	BD	BD	CB	SD	BD	CB	SD	
28	BD	SD	CB	SD	BD	CB	BD	
30	BD	CB	CB	BD	BD	CB	BD	
32	BD	SD	CB	BD	BD	CB	BD	
34	BD	BD	CB	BD	BD	SD	BD	
36	SD	BD	SD	SD	SD	CB	SD	
38	SD	BD	SD	SD	CB	SD	CB	
40	SD	BD	SD	SD	SD	CB	SD	
42	BD	BD	SD	SD	BD	CB	BD	
44	BD	BD	SD	SD	BD	CB	BD	
46	BD	SD	SD	SD	BD	CB	BD	
48	BD	BD	BD	BD	BD	CB	CB	
50	BD	BD	BR	CB	BD	CB	SD	
52	SD	CB	BR	CB	CB	CB	BD	
54	SD	CB	BR	CB	CB	CB	BD	
56	SD	BD	BR	CB	SD	CB	BD	
58	BD	BD	BR	CB	BD	CB	BD	
60	BD	BD	BR	CB	BD	CB	BD	
62	BD	BD	BR	CB	BD	CB	BD	
64	BD	BD	CB	CB	BD	CB	BD	
66	SD	BD	SD	CB	CB	CB	BD	
68	SD	SD	SD	CB	CB	CB	BD	
70	SD	CB	SD	CB	CB	SD	BD	
72	BD	CB	SD	CB	BD	SD	BD	
74	BD	SD	SD	CB	BD	CB	BD	
76	BD	BD	SD	CB	BD	CB	BD	BR = Bedrock
78	BD	BD	SD	CB	BD	CB	BD	BD = Boulder
80	BD	BD	SD	CB	BD	CB	BD	CB = Cobble
82	BD	CB	SD	CB	BD	CB	BD	RB = Rubble
84	BD	SD	SD	CB	BD	CB	BD	SD = Sand

	Depth (m)						
Meter	DS1	DS2	DS3	DS4	DS5	DS6	DS7
86	4.2	2.4	2.7	2.7	2.7	3.0	3.6
88	4.5	2.7	2.7	3.0	2.7	3.0	3.6
90	4.5	2.7	2.7	3.0	2.7	3.0	3.6
92	4.5	2.7	2.7	3.0	3.0	3.0	3.9
94	4.5	2.4	2.7	3.0	3.0	2.7	3.9
96	4.5	3.0	2.7	3.0	2.7	2.7	3.9
98	4.5	3.0	2.7	3.0	2.7	2.7	4.2
100	4.5	3.0	2.7	3.0	2.7	2.7	4.5

	Substrate type							
Meter	DS1	DS2	DS3	DS4	DS5	DS6	DS7	Legend
86	SD	BD	SD	CB	CB	CB	BD	ST = Silt and Mud
88	SD	BD	SD	CB	SD	CB	BD	
90	SD	CB	SD	CB	SD	CB	BD	
92	SD	SD	SD	SD	SD	CB	BD	
94	BR	CB	SD	SD	BD	CB	CB	
96	SD	BD	SD	SD	CB	SD	CB	
98	SD	BD	CB	CB	SD	SD	CB	
100	BD	CB	CB	CB	BD	SD	CB	

Annex Ib. *Depth Profile and Substrate Type of the Perpendicular Transect of the Dive Survey Sites.*

	Depth (m)						
Meter	DS1	DS2	DS3	DS4	DS5	DS6	DS7
2	4.5	2.4	2.7	3.0	3.6	2.7	3.0
4	4.8	2.4	2.7	3.6	3.9	2.7	3.0
6	5.2	2.7	2.7	4.2	4.2	3.0	3.6
8	5.5	3.0	2.7	4.8	4.2	3.6	4.2
10	5.8	3.0	3.0	5.5	4.5	3.9	5.5
12	6.1	3.3	3.0	5.5	4.5	3.9	6.1
14	6.4	3.6	3.0	5.8	4.5	3.9	6.1
16	6.4	3.9	3.3	5.8	4.5	3.9	6.4
18	6.7	4.2	3.3	6.1	4.5	3.9	6.4
20	6.7	4.5	3.3	6.1	4.5	3.9	6.7
22		4.8	3.6	6.4	4.8	3.9	6.7
24		5.2	3.6	6.4	4.8	3.9	7.0
26		5.8	3.6	6.7	5.2		7.0
28		6.1	3.6	6.7	5.8		7.3
30		6.1	3.6	7.0	6.1		7.6
32			3.6	7.0	7.0		7.9
34			3.6	7.3	7.6		7.9
36			3.9	7.3	7.6		8.2
38			3.9	7.6	8.2		8.2
40			3.9	7.6	8.8		8.5
42			4.2	7.9	8.8		8.5
44			4.2	7.9	8.8		8.8
46			4.2	8.2	8.8		8.8
48			4.5	8.2	8.8		8.8
50			4.5	8.5	8.8		8.8
52			5.2	8.8	9.1		
54			5.5		9.1		
56			5.8		9.4		
58			6.1		9.4		

	Substrate type							
Meter	DS1	DS2	DS3	DS4	DS5	DS6	DS7	Legend
2	BD	BD	CB	SD	CB	BD	BD	BR = Bedrock
4	SD	BD	CB	SD	CB	BD	BD	BD = Boulder
6	BD	BD	CB	CB	CB	SD	BD	CB = Cobble
8	SD	SD	CB	SD	CB	SD	BD	RB = Rubble
10	SD	BD	CB	CB	CB	SD	BD	SD = Sand
12	ST	SD	CB	CB	CB	SD	BD	ST = Silt and Mud
14	ST	SD	CB	SD	CB	SD	BD	
16	ST	SD	CB	CB	CB	SD	ST	
18	ST	SD	SD	CB	CB	SD	ST	
20	ST	SD	CB	SD	CB	SD	ST	
22		SD	CB	SD	CB	SD	ST	
24		SD	SD	SD	CB	SD	ST	
26		SD	SD	SD	CB		ST	
28		ST	SD	SD	CB		ST	
30		ST	SD	SD	SD		ST	
32			SD	SD	SD		ST	
34			SD	SD	CB		ST	
36			SD	SD	SD		ST	
38			SD	SD	SD		ST	
40			SD	SD	ST		ST	
42			SD	SD	ST		ST	
44			SD	SD	ST		ST	
46			SD	SD	ST		ST	
48			SD	SD	ST		ST	
50			SD	SD	ST		ST	
52			SD	SD	ST			
54			SD		ST			
56			SD		ST			
58			SD		ST			

	Depth (m)						
Meter	**DS1**	**DS2**	**DS3**	**DS4**	**DS5**	**DS6**	**DS7**
60			6.4		9.4		
62			6.7		9.7		
64			7.0		9.7		
66			7.3		10.0		
68			7.6		10.0		
70							
72							

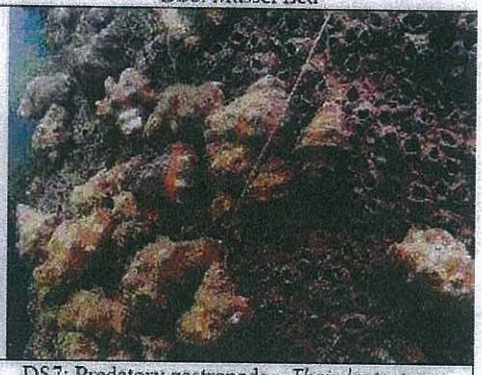
	Substrate type							
Meter	**DS1**	**DS2**	**DS3**	**DS4**	**DS5**	**DS6**	**DS7**	**Legend**
60			SD		ST			
62			SD		ST			
64			SD		ST			
66			SD		ST			
68			SD		ST			
70								
72								

Annex Ib.....Continued.

DS6: Rock Oysters

DS6: Mussel Bed

DS6: Pearl Oyster – *Pinctada* sp.



DS7: Predatory gastropods – *Thais lentostoma*

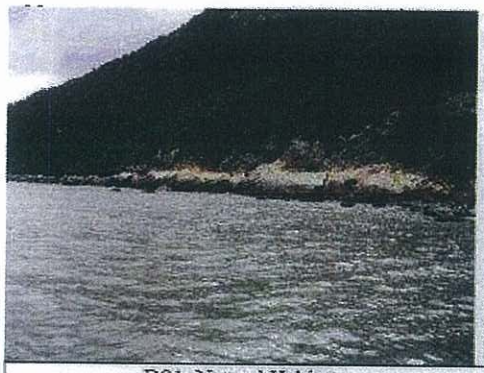
DS7: Gorgonians - *Echinomuricea sp.*

DS7: Predatory gastropods - *Gyrinum natator*

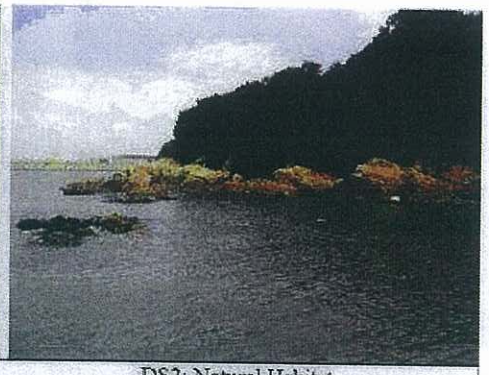
DS7: Rock Oysters

DS7: Barnacles

Annex IIa. *Photos of the Dive survey Sites*



DS1: Natural Habitat

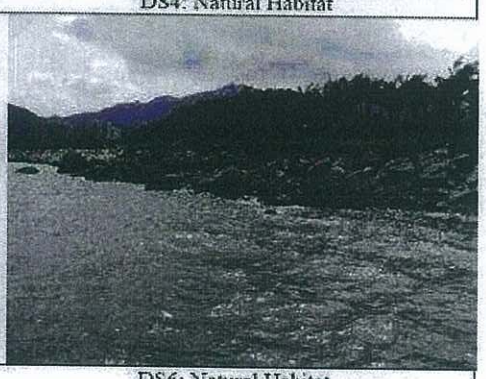


DS2: Natural Habitat

DS3: Natural Habitat

DS4: Natural Habitat

DS5: Artificial Habitat

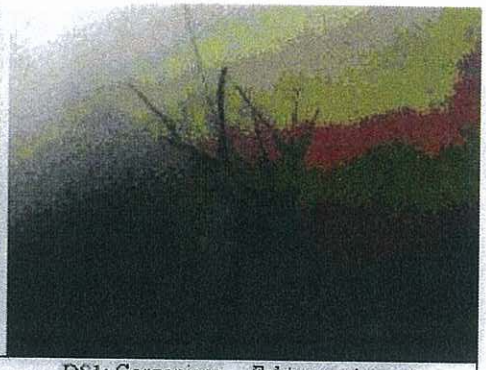


DS6: Natural Habitat

DS7: Artificial Habitat

Annex IIb. *Photos of Representative Taxa at the Dive Survey Sites*

DS1: Green Mussels – *Perna viridis*

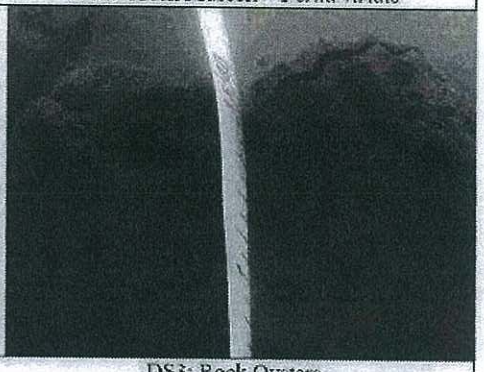


DS1: Gorgonians - *Echinomuricea sp.*

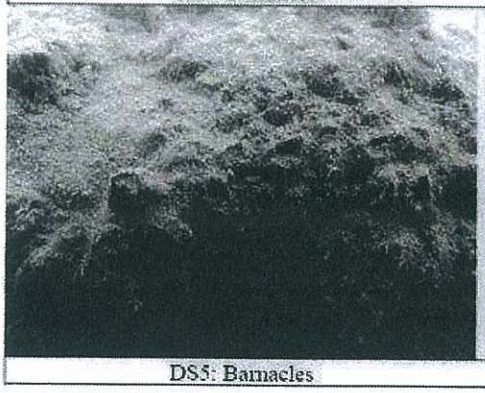
DS1 & DS2: Ahermatypic cup corals

DS2: Green Mussels – *Perna viridis*

DS2: Barnacles



DS3: Rock Oysters



DS5: Barnacles

DS6: Gorgonians - *Echinomuricea sp.*

APPENDIX 4 – INTERIDAL SURVEY RESULTS

Table A4.1. *Fauna observed in soft shore habitats during qualitative and quantitative surveys*

Species Name	Common Name	Conser-vation Status	SW	SSW	SLW	HHW	ST	TCB
Fish								
Bathygobius fuscus	Dusky Frillgoby	-		++				
Favonigobius reichei	Indo-Pacific Tropical Sand Goby	a	+++	+++	+++	++++	+++	+++
Gerres filamentosus	Whipfin Silver-biddy	-			+		++	
Gerres oyena	Common Silver-biddy	-	+		+	++		++
Liza sp.	Mullet		+++		+++	++	++++	+++
Lucigobius guttatus	Flat-headed Goby	b		+				
Lutjanus argentimaculatus	Mangrove Red Snapper	-		+*				
Mugilogobius abei	Goby	-	++		+++*			
Mugilogobius chulae	Yellowstripe Goby	-	++		+++*	++		
Omobranchus fasciolatoceps	Flesh-crested Blenny	-				+	+	
Omobranchus punctatus	Muzzled Blenny	-		+				
Oreochromis mossambicus	Mozambique Tilapia	-	++*					
Parazacco spilurus	Predaceous Chub	c		+*				
Periophthalmus modestus	Common Mudskipper	-	++++	++	++++	++++	++++	+++
Pterocryptis cochinchinensis	Vietnam Catfish	-		+*				
Scartelaos histophorus	Walking Goby	d	++		++	+	+	
Sillago sihama	Silver Sillago	-				++	+++	++
Takifugu niphobles	Snowy Puffer	e				+	+	
Terapon jarbua	Jarbua Terapon	-	++++	++	+++	+++	++++	+++
Tridentiger trigonocephalus	Chameleon Goby	-		+*	++*			
Echinoderm								
Holothuria leucospilota	Sea Cucumber	f	+					
Merostomata								
Tachypleus tridentatus	Horseshoe Crab	f					+	+
Unknown species	Horseshoe Crab		+#					
Crustacean								
Alpheus lobidens	Pistol Shrimp	-		+				
Alpheus sp.	Pistol Shrimp			+				
Balanus amphitrite	Striped Barnacle	-		+	+	+		+
Balanus reticulatus	Striped Barnacle	-	+++	+++	+++	+++	+++	+++
Charybdis acutifrons	Portunid Crab	-			+			
Clibanarius striolatus	Hermit Crab	-	++	++	++	+++	+++	++
Gaetice depressus	Grapsid Crab	-	+	+++	+	+	+	+
Hemigrapsus penicillatus	Grapsid Crab	-	+++	++	+++	+++	++	+++
Hemigrapsus sanguineus	Grapsid Crab	-	+	++	+	+	+	+
Leptodius exaratus	Xanthid Crab	-		+				
Ligia exotica	Sea Slater	-	++	++++	++	++	++	
Macrobrachium nipponense	Freshwater Shrimp	-			+*	+*		
Macrophthalmus boteltobagoe	Sentinel Crab	-			+	+	+	+
Macrophthalmus erato	Sentinel Crab	-	+	+	++	+	++	+
Matuta lunaris	Burrowing Sand Crab	-		+				

Species Name	Common Name	Conser-vation Status	SW	SSW	SLW	HHW	ST	TCB
Metapenaeus ensis	Greasyback Shrimp	g	+		+	+	+	
Metaplax elegans	Sesarmine Crab	-				+		
Metopograpsus quadridentatus	Grapsid Crab	-		+				
Nanosesarma minutum	Sesarmine Crab	-	+	+	+	+	+	
Ocypode ceratophthalma	Ghost Crab	-		++	+			
Pagurus dubius	Hermit Crab	-	++	+++	+++	+++	+++	+
Palaemon serrifer	Shrimp	-		+				
Parasesarma pictum	Sesarmine Crab	-				+	++	
Parasesarma plicata	Sesarmine Crab	-	+	+++	++	+	+	+
Penaeus japonica	Japanese King Prawn	-	+					
Perisesarma bidens	Sesarmine Crab	-	++++		++++	+++	+++	++++
Philyra carinata	Pebble Crab	-				+		
Portunus pelagicus	Blue Crab	-	+	+	+	+	++	+
Scopimera globosa	Sand Bubbler Crab	-		+				
Scylla serrata	Mud Crab	-	++		+			++
Sphaerozius nitidus	Xanthid Crab	-				+		
Tetraclita squamosa	Black Barnacle	-					+	
Uca acuta	Fiddler Crab	-	+++		+++			
Uca arcuata	Fiddler Crab	-	+		+			+
Uca borealis	Fiddler Crab	-			++	+++		++
Uca crassipes	Fiddler Crab	-	++		+++	+		++
Uca lactea	Fiddler Crab	-			++	+++		+++
Varuna sp.	Grapsid Crab				+			
Amphipoda	Amphipod		++++	++++	++	++	++	++
Amphipoda 2	Amphipod 2							+
Isopoda	Isopod		+			+		
Bivalve		-						
Barbatia virescens	Bearded Ark Shell	-	++	++	++	++	+++	++
Caecella chinensis	Small Sand Clam	-	+	++	+	+	++	+
Circe sp.	Venus Shell						+	+
Cyclina sinensis	Venus Shell	-					+	+
Dosinia japonica	Japanese Artemis	-	+			+	++	
Geloina erosa	Large Mangrove Clam	-	+			+		
Glauconome chinensis	Clam	-	+		+	+	+	
Gafrarium pectinatum	Mangrove Clam	-					+	
Isognomon isognomum	Hammer Oyster	-						+
Marcia sp.	Venus Shell							+
Meretrix meretrix	Asiatic Hard Clam	-		+	+	+		
Paphia undulata	Clam	-				+		
Perna viridis	Green Mussel	-			+			
Ruditapes philippinarum	Common Clam	-				+	++++	++
Ruditapes variegatus	Common Clam	-					+++	++
Saccostrea cucullata	Rock Oyster	-	++++	+++++	+++++	+++++	+++++	+++++
Septifer virgatus	Purplish Bifurcate Mussel	-	+	+++	+++	+++	++	+++
Soletellina diphos	Sunset Clam	-					+	
Trapezium sp.	Clam		+	+	+	++	++	+
Gastropod								

Species Name	Common Name	Conser-vation Status	SW	SSW	SLW	HHW	ST	TCB
Acanthopleura japonica	Chiton	-		+		+	+	
Batillaria multiformis	Sand Snail	-	++		+++	++	+++	+++
Batillaria zonalis	Sand Snail	-	+++		++++	++++	++++	+++
Cellana grata	Limpet	-				+		+
Cellana toreuma	Limpet	-					+	+
Cerithidea alata	Mud Snail	-					+++	+++
Cerithidea cingulata	Mud Snail	-	+++		+++++	++++	+++++	++++
Cerithidea djadjariensis	Mud Snail	-	++					++
Cerithidea rhizophorarum	Mud Snail	-	++		+			++
Clithon faba	Clithon	-		++	+	+		+
Clithon oualaniensis	Clithon	-	++	+++	+	++	++	++
Clithon retropictus	Clithon	-		+		+		
Clypeomorus sp.	Mud Snail	-			+	+	+	
Echinolittorina malaccana	Periwinkle	-		+				
Echinolittorina radiata	Periwinkle	-	+		+			
Echinolittorina vidua	Periwinkle	-						+
Littoraria ardouiniana	Periwinkle	-	++					++
Littoraria melanostoma	Black-mouth Littorine	-						++
Littoraria sinensis	Periwinkle	-	++	++	++	++	++	++
Lunella coronata	Common Turban Shell	-		+			+	+
Monodonta labio	Top Shell	-		++	+	++	++++	+++
Nassarius festivus	Festive Nassa	-		+	++	++	+	++
Nerita costata	Nerita	-		+			+	+
Nerita yoldii	Nerita	-	+++	+++	+++	+++	+++	+++
Nipponacmea concinna	Limpet	-						+
Omphalius nigerrimus	Top Shell	-				+	+	+
Onchidium hongkongensis	Seashore Slug	-			+			
Patelloida pygmaea	Limpet	-					++	
Planaxis sulcatus	Ribbed Clusterwink	-		+				
Siphonaria laciniosa	False Limpet						+	
Thais clavigera	Dog Whelk	-	+	+	+	+	+	+
Thais luteostoma	Dog Whelk	-			+			
Thais sp.	Dog Whelk			+				
Terebralia sulcata	Large Mangrove Snail	-					+	++
Turritella sp.	Turritella Snail			+				
Unknown Gastropod	Snail				+	+		
Scaphopod								
Dentalioida	Dentalioid						+	+
Annelid								
Aglaophamus dibranchis	Polychaete	-		+	+	+	+	+
Ampharetidae	Polychaete						+	
Capitella capitata	Polychaete	-					+	+
Ceratonereis sp.	Polychaete		+	+	+			
Chaetonzone sp.	Polychaete						+	+
Chone sp.	Polychaete			+			+	
Cirratulus sp.	Polychaete						+	+
Cossura sp.	Polychaete			+				
Diopatra neapolitana	Polychaete	-			+	+	+	+

Species Name	Common Name	Conser-vation Status	SW	SSW	SLW	HHW	ST	TCB
Euclymene sp.	Polychaete				+	+	+	+
Glycera sp.	Polychaete							+
Harmothoe imbricata	Polychaete	-			+			
Heteromastus sp.	Polychaete			+			+	+
Hydroides sp.	Tube Worm				+			
Laonice cirrata	Polychaete	-		++				
Lumbrineris sp.	Polychaete			+		+		
Maldanidae 1	Bamboo Worm 1		+				+	
Maldanidae 2	Bamboo Worm 2				+	+		
Mediomastus sp.	Polychaete							+
Nectoneanthes sp.	Polychaete		+					
Nephtys sp.	Polychaete						+	+
Nereis sp.	Polychaete		+++	+++	++	++	++	++
Pectinariidae	Polychaete			+				
Perinereis sp.	Polychaete		++	+	++	+		+
Poecilochaetus sp.	Polychaete					+		
Scolelepis sp.	Polychaete			+				
Scoloplos sp.	Polychaete			+				
Sigambra sp.	Polychaete		+	+		+		+
Spio sp.	Polychaete						+	
Sipunculid								
Phascolosoma sp.	Peanut Worm		++	++	++	++	++	++
Siphonosoma cumanense	Peanut Worm	-		+				
Nemertean								
Nemertean 1	Ribbon Worm 1		+		+	+	+	
Nemertean 2	Ribbon Worm 2						+	+
Nemertean 3	Ribbon Worm 3					+		
Cnidarian								
Haliplanella lineata	Sea Anemone	-		+	+	+		
Poriferan								
Unknown Sponge	Sponge			+				
Total Number of Species			**57**	**69**	**72**	**75**	**76**	**76**

Key
+++++: Dominant; ++++: Abundant; +++: Frequent; ++: Occasional; +: Scarce.
- = Not recorded/ evaluated in any local, China and global conservation lists.
a = IUCN red list: lower risk/ near threatened (www.iucnredlist.org)
b = Uncommon (Lee *et al.* 2002)
c = CSIS red list: vulnerable (www.baohu.org), vulnerable (Yue & Chen 1998)
d = Uncommon (AEC staff per. obs.)
e = IUCN red list: data deficient (www.iucnredlist.org)
f = CSIS red list: endangered (www.baohu.org)
g = CSIS red list: vulnerable (www.baohu.org)
* = Observed in intertidal creeks or freshwater streams running across the shore.
# = Only tracks were observed. Local villagers said that horseshoe crabs are common at Sham Wat and a mating pair had been collected in August 2008.

Table A4.2. *Epifauna (on and within the surface layer of sediment (5 cm)) observed in soft shore habitats during quantitative surveys*

Species Name	Common Name	SW		SSW		SLW		HHW		ST		TCB	
		W	D	W	D	W	D	W	D	W	D	W	D
Fish													
Bathygobius fuscus	Dusky Frillgoby				3								
Favonigobius reichei	Indo-Pacific Tropical Sand Goby							1					
Lucigobius guttatus	Flat-headed Goby				2								
Omobranchus fasciolatoceps	Flesh-crested Blenny							2			1		
Omobranchus punctatus	Muzzled Blenny				1								
Scartelaos histophorus	Walking Goby										2		
Merostomate													
Tachypleus tridentatus	Horseshoe Crab										1		
Crustacean													
Alpheus lobidens	Pistol Shrimp				3								
Alpheus sp.	Pistol Shrimp			4									
Balanus amphitrite	Striped Barnacle				3		1		2				13
Balanus reticulatus	Striped Barnacle	21	632	51	335	110	796	7	393	2	205	96	596
Charybdis acutifrons	Portunid Crab						1						
Clibanarius striolatus	Hermit Crab		5	2	2	7	3	7	4	12	4	2	1
Gaetice depressus	Grapsid Crab		1	86	19	4		2	6	14	5	12	
Hemigrapsus penicillatus	Grapsid Crab	9	11	1	3	30	28	55	27	7	23	27	17
Hemigrapsus sanguineus	Grapsid Crab		1	4	10	8	7		7	4			2
Leptodius exaratus	Xanthid Crab				1								
Ligia exotica	Sea Slater			26	16								
Macrophthalmus boteltobagoe	Sentinel Crab							2		1	1		1
Macrophthalmus erato	Sentinel Crab	6	5	2	18	3	4	10		4	8	1	9
Metapenaeus ensis	Greasyback Shrimp	4				1		3		1	2		
Nanosesarma minutum	Sesarmine Crab	1		5		4		14		1	7		
Pagurus dubius	Hermit Crab	3	20		23	31	32	31	10	3	7	3	6
Parasesarma plicata	Sesarmine Crab		2		140		37		7		5		4
Penaeus japonica	Japanese King Prawn		2										

Species Name	Common Name	SW		SSW		SLW		HHW		ST		TCB	
		W	D	W	D	W	D	W	D	W	D	W	D
Perisesarma bidens	Sesarmine Crab	1											
Philyra carinata	Pebble Crab							1					
Portunus pelagicus	Blue Crab				1	2				1			
Sphaerozius nitidus	Xanthid Crab							1					
Scylla serrata	Mud Crab						1						
Tetraclita squamosa	Black Barnacle										1		
Uca borealis	Fiddler Crab					2						1	
Uca lactea	Fiddler Crab							1	2			2	
Uca sp.	Fiddler Crab	1						13					
Amphipoda	Amphipod	10	56		1431		2		1		41		3
Amphipoda 2	Amphipod 2												1
Isopoda	Isopod		1						1				
Bivalve													
Barbatia virescens	Bearded Ark Shell				4			15	9	2	69	17	16
Caecella chinensis	Small Sand Clam	1				3		3	1	1	1	1	1
Circe sp.	Venus Shell										1	21	
Cyclina sinensis	Venus Shell										1	12	
Dosinia japonica	Japanese Artemis	2							1	12	17		
Glauconome chinensis	Clam						6		4		12		
Gafrarium pectinatum	Mangrove Clam									1			
Marcia sp.	Venus Shell											1	
Meretrix meretrix	Asiatic Hard Clam					2	1						
Paphia undulata	Clam								1				
Perna viridis	Green Mussel					13							
Ruditapes philippinarum	Common Clam								2	6	27		15
Ruditapes variegatus	Common Clam									3	30	1	
Saccostrea cucullata	Rock Oyster	70	275	542	844	141	658	266	466	60	745	265	644
Septifer virgatus	Purplish Bifurcate Mussel	1	7	1	324	6	77	6	204	1	8	58	38
Soletellina diphos	Sunset Clam									3	2		
Trapezium sp.	Clam		3	1		2	3	6	60		58		3
Gastropod													

		SW		SSW		SLW		HHW		ST		TCB	
Species Name	**Common Name**	**W**	**D**	**W**	**D**	**W**	**D**	**W**	**D**	**W**	**D**	**W**	**D**
Acanthopleura japonica	Chiton			1					1		2		
Batillaria spp.	Sand Snails	4	5			530	455	346	361	450	207	2248	884
Cellana grata	Limpet								1			2	
Cellana toreuma	Limpet									6	2	3	6
Cerithidea spp.	Mud Snails	4	9			1403	483	315	971	803	235	1562	934
Clithon faba	Clithon			4	9	1						1	
Clithon oualaniensis	Clithon		36	4	117	10	3	28	21	5	14	31	4
Clithon retropictus	Clithon			2				5					
Clypeomorus sp.	Mud Snail						1		1		22		
Echinolittorina vidua	Periwinkle												1
Littoraria sinensis	Periwinkle	12	5	6	3	16	7	3	8	2	10	10	32
Lunella coronata	Common Turban Shell				1							1	
Monodonta labio	Top Shell			3	1	4	2	58	10	217	666	264	21
Nassarius festivus	Festive Nassa				5	12	21	34	33	10	4	24	7
Nerita costata	Nerita				3						6		1
Nerita yoldii	Nerita	11	2	15	15	44	17	20	4	6	29	21	11
Nipponacmea concinna	Limpet												1
Omphalius nigerrimus	Top Shell							1	1	7	5		9
Patelloida pygmaea	Limpet										46		
Planaxis sulcatus	Ribbed Clusterwink				7								
Siphonaria laciniosa	False Limpet										1		
Thais clavigera	Dog Whelk			1	11		3	1	2		8		1
Thais luteostoma	Dog Whelk					1							
Thais sp.	Dog Whelk				2								
Unknown Gastropod	Gastropod					1		1					
Scaphopod													
Dentalioida	Dentalioid												3
Annelid													
Aglaophamus dibranchis	Polychaete								1		3		1
Ampharetidae	Polychaete									8			
Ceratonereis sp.	Polychaete				1		2						

		SW		SSW		SLW		HHW		ST		TCB	
Species Name	**Common Name**	**W**	**D**	**W**	**D**	**W**	**D**	**W**	**D**	**W**	**D**	**W**	**D**
Chaetozone sp.	Polychaete												2
Chone sp.	Polychaete										1		
Cirratulus sp.	Polychaete										6		2
Diopatra neapolitana	Polychaete							1					
Euclymene sp.	Polychaete										3		
Glycera sp.	Polychaete												1
Harmothoe imbricata	Polychaete						1						
Hydroides sp.	Tube Worm					2							
Laonice cirrata	Polychaete				1								
Maldanidae 1	Bamboo Worm 1	1											
Maldanidae 2	Bamboo Worm 2					2							
Mediomastus sp.	Polychaete												1
Nephtys sp.	Polychaete										1		
Nereis sp.	Polychaete	2	6	1	16		8		2			3	6
Perinereis sp.	Polychaete				1		4						1
Spio sp.	Polychaete									3			
Sipunculid													
Phascolosoma sp.	Peanut Worm	1	9	1	3	11	5	11	2	1	6	10	21
Nemertea													
Nemertean 1	Ribbon Worm 1		1			3				2			
Nemertean 2	Ribbon Worm 2									2		1	
Nemertean 3	Ribbon Worm 3								1				
Cnidarian													
Haliplanella lineata	Sea Anemone				5	1		1					
Number of Species		20	22	22	37	32	30	34	36	34	48	30	39
Pielou's Evenness Index		0.71	0.44	0.38	0.48	0.41	0.53	0.60	0.52	0.44	0.58	0.42	0.48
Shannon Diversity Index		2.11	1.36	1.17	1.75	1.43	1.81	2.12	1.88	1.53	2.26	1.42	1.77
Abundance		165	1094	763	3384	2410	2669	1271	2628	1661	2561	4701	3320
Ind./ m²		22	146	102	451	321	356	169	350	221	341	627	443

Key

W = wet season, D = dry season.

Table A4.3. *Infauna observed in soft shore habitats during quantitative surveys (core sampling)*

		SW		SSW		SLW		HHW		ST		TCB	
Species Name	**Common Name**	**W**	**D**	**W**	**D**	**W**	**D**	**W**	**D**	**W**	**D**	**W**	**D**
Crustacean													

		SW		SSW		SLW		HHW		ST		TCB	
Species Name	**Common Name**	**W**	**D**	**W**	**D**	**W**	**D**	**W**	**D**	**W**	**D**	**W**	**D**
Balanus reticulatus	Striped Barnacle					1							1
Clibanarius striolatus	Hermit Crab				1								
Hemigrapsus penicillatus	Grapsid Crab							2					1
Leptodius exaratus	Xanthid Crab				1								
Macrophthalmus boteltobagoe	Sentinel Crab							1					
Macrophthalmus erato	Sentinel Crab		2				2	1					
Parasesarma plicata	Sesarmine Crab		2				1						
Portunus pelagicus	Hermit Crab										1	1	
Uca borealis	Fiddler Crab					1							
Uca lactea	Fiddler Crab							2				1	
Uca sp.	Fiddler Crab	1											
Amphipoda	Amphipod				11								
Bivalve													
Caecella chinensis	Small Sand Clam			5		1			1			2	1
Circe sp.	Venus Shell											2	
Cyclina sinensis	Venus Shell											5	
Dosinia japonica	Japanese Artemis									11	5		
Glauconome chinensis	Clam		1								1		
Meretrix meretrix	Asiatic Hard Clam						1						
Ruditapes philippinarum	Common Clam									7	9		4
Ruditapes variegatus	Common Clam									5	9		
Saccostrea cucullata	Rock Oyster		1										
Gastropod													
Batillaria spp.	Sand Sanils					15	5	3	4	6	5	152	31
Cerithidea spp.	Mud Snails					19	6	1	14	7	12	50	33
Clithon faba	Clithon					1							
Clithon oualaniensis	Clithon	1			2							1	
Littoraria sinensis	Periwinkle											1	
Monodonta labio	Top Shell										2		
Nassarius festivus	Festive Nassa						1	1	2			10	1
Annelid													

		SW		SSW		SLW		HHW		ST		TCB	
Species Name	**Common Name**	**W**	**D**	**W**	**D**	**W**	**D**	**W**	**D**	**W**	**D**	**W**	**D**
Aglaophamus dibranchis	Polychaete				5		2		3		1		
Capitella capitata	Polychaete										1		1
Ceratonereis sp.	Polychaete		8				3						
Chaetozone sp.	Polychaete										2		1
Chone sp.	Polychaete				1								
Cirratulus sp.	Polychaete										2		1
Cossura sp.	Polychaete				4								
Diopatra neapolitana	Polychaete					1		2		1			1
Euclymene sp.	Polychaete						2		4		1		3
Heteromastus sp.	Polychaete				2						1		1
Laonice cirrata	Polychaete				84								
Lumbrineris sp.	Polychaete				1				1				
Maldanidae 1	Bamboo Worm 1									1			
Maldanidae 2	Bamboo Worm 2							1					
Nectoneanthes sp.	Polychaete		1										
Nephtys sp.	Polychaete												1
Nereis sp.	Polychaete	3	115	2	126	1	6	3	4	11		1	6
Pectinariidae	Polychaete				1								
Perinereis sp.	Polychaete		17		3		12		2				1
Poecilochaetus sp.	Polychaete								1				
Scolelepis sp.	Polychaete				2								
Scoloplos sp.	Polychaete				2								
Sigambra sp.	Polychaete		2		5				1				1
Spio sp.	Polychaete									1			
Sipunculid													
Phascolosoma sp.	Peanut Worm		10	1	3	1	1	1	1	4	9	6	15
Siphonosoma cumanense	Peanut Worm				2								
Nemertea													
Nemertean 1	Ribbon Worm 1				1								
Number of Species		3	10	3	19	9	12	11	12	10	15	12	18
Pielou's Evenness Index		0.86	0.46	0.82	0.51	0.62	0.86	0.96	0.83	0.89	0.86	0.45	0.67
Shannon Diversity Index		0.95	1.06	0.90	1.49	1.36	2.15	2.29	2.07	2.06	2.32	1.12	1.93

		SW		SSW		SLW		HHW		ST		TCB	
Species Name	**Common Name**	**W**	**D**	**W**	**D**	**W**	**D**	**W**	**D**	**W**	**D**	**W**	**D**
Abundance		5	159	8	257	41	42	18	38	54	61	232	104

Key

W = wet season, D = dry season.

Table A4.4. *Fauna observed in rocky shore habitats during qualitative and quantitative surveys*

Species Name	Common Name	Conser-vation Status	SSWW	SSWE	SLWP	AS	AE
Fish							
Ambassis gymnocephalus	Bald Glassy	-				++	
Bathygobius fuscus	Dusky Frillgoby	-		+			
Liza sp.	Mullet					++	
Lutjanus argentimaculatus	Mangrove Red Snapper	-				+	
Gerres oyena	Common Silver-biddy	-				+	
Omobranchus sp.	Blenny					++	
Periophthalmus modestus	Common Mudskipper	-			+++		
Siganus canaliculatus	White-spotted Spinefoot	-				++	
Terapon jarbua	Jarbua Terapon	-			+	++	
Crustacean							
Alpheus sp.	Pistol Shrimp		+				
Balanus reticulatus	Striped Barnacle	-	+++++	+++++	+++++	+++++	+++++
Capitulum mitella	Stalked Barnacle	-	+++				+
Clibanarius striolatus	Hermit Crab	-	+	+	+	+	+
Euraphia withersi	Barnacle	-			+		
Gaetice depressus	Grapsid Crab	-	+	+	+		
Hemigrapsus sanguineus	Grapsid Crab	-	++	+		+	
Leptodius exaratus	Xanthid Crab	-	+	+	+	+	
Ligia exotica	Sea Slater	-	+++	+++	+++	+++	+++
Metopograpsus quadridentatus	Grapsid Crab	-			+		
Nanosesarma minutum	Sesarmine Crab	-	++++	++++	++++	++	++
Pagurus dubius	Hermit Crab	-	+++	+	+		
Parasesarma pictum	Sesarmine Crab	-	++	+	+	+	
Tetraclita squamosa	Acorn Barnacle	-	+	+			++
Amphipoda	Amphipod		+				
Bivalve							
Barbatia virescens	Bearded Ark Shell	-	++++	++++	++++	++++	++++
Isognomon isognomum	Hammer Oyster	-	+	+	+		
Perna viridis	Green Mussel	-	+	+	+	+	+
Saccostrea cucullata	Rock Oyster	-	+++++	+++++	+++++	+++++	+++++
Septifer virgatus	Purplish Bifurcate Mussel	-	+++++	+++++	+++++	++	+++
Trapezium sp.	Clam			+	+++		
Gastropod							
Acanthopleura japonica	Chiton	-		+			+
Cellana grata	Limpet	-	++	++	+		+
Cellana toreuma	Limpet	-	+				+
Echinolittorina radiata	Periwinkle	-	++	++	++	++	++
Echinolittorina malaccana	Periwinkle	-		+			+
Echinolittorina vidua	Periwinkle	-					+
Littoraria melanostoma	Black-mouth Littorine	-			+		
Littoraria sinensis	Periwinkle	-	+++	+++	+++	+++	+++

Species Name	Common Name	Conser-vation Status	SSWW	SSWE	SLWP	AS	AE
Monodonta labio	Top Shell	-	+	+	++	+++	+
Monodonta neritoides	Top Shell	-				+	
Nerita yoldii	Nerita	-	++++	++++	++++	++++	++++
Nipponacmea concinna	Limpet	-					+
Omphalius nigerrimus	Top Shell	-				++	++
Patelloida pygmaea	Limpet	-	+	+	+	++++	++++
Planaxis sulcatus	Ribbed Clusterwink	-					+
Siphonaria japonica	False Limpet	-	+			+	++
Siphonaria laciniosa	False Limpet	-				+	++++
Thais clavigera	Dog Whelk	-	+++	+++	++	+++	+++
Thais luteostoma	Dog Whelk	-	+				
Thais sp.	Dog Whelk			+			
Unknown Gastropod				+			
Annelid							
Hydroides sp.	Tube Worm		+			+	
Cnidarian							
Haliplanella lineata	Sea Anemone	-	++	+	+		
Sipunculid							
Phascolosoma sp.	Peanut Worm				+++		
Total Number of Species			**30**	**29**	**28**	**29**	**26**

Table A4.5. *Fauna observed in rocky shore habitats during quantitative surveys*

		SSWW		SSWE		SLWP		AS		AE	
Species Name	**Common Name**	**W**	**D**	**W**	**D**	**W**	**D**	**W**	**D**	**W**	**D**
Fish											
Bathygobius fuscus	Dusky Frillgoby			1							
Crustacean											
Alpheus sp.	Pistol Shrimp	1									
Balanus reticulatus	Striped Barnacle	1825	2040	4590	1180	1265	440	350	1668	6550	4475
Capitulum mitella	Stalked Barnacle	3	8							2	
Clibanarius striolatus	Hermit Crab	5		1		5		1	2	1	
Euraphia withersi	Barnacle						1				
Gaetice depressus	Grapsid Crab	1		1		1					
Hemigrapsus sanguineus	Grapsid Crab	8		1				1			
Leptodius exaratus	Xanthid Crab	1			1	2		1			
Ligia exotica	Sea Slater	138				13		24		35	
Nanosesarma minutum	Sesarmine Crab	115	1	179		365		3		12	
Pagurus dubius	Hermit Crab	35	1	6	6	6	2				
Parasesarma pictum	Sesarmine Crab	24		3		7		1			
Tetraclita squamosa	Acorn Barnacle	5	6	2						15	20
Amphipoda	Amphipod	1									
Bivalve											
Barbatia virescens	Bearded Ark Shell	70	180	86	287	222	146	19	31	24	2
Isognomon isognomum	Hammer Oyster	1		1	1						
Perna viridis	Green Mussel	13	2	7	9	2	1		1	1	
Saccostrea cucullata	Rock Oyster	4230	9200	4116	9845	6780	13380	8610	2601	7510	3009
Septifer virgatus	Purplish Bifurcate Mussel	2654	2455	6100	4345	836	113	2	46	125	117
Trapezium sp.	Clam				6	55					
Gastropod											
Acanthopleura japonica	Chiton				1					1	
Cellana grata	Limpet		62		68		4			1	
Cellana toreuma	Limpet		5								13
Echinolittorina radiata	Periwinkle	11	11		1	3	9			2	44
Echinolittorina malaccana	Periwinkle										1
Echinolittorina vidua	Periwinkle										3
Littoraria melanostoma	Periwinkle					1					

Species Name	Common Name	SSWW		SSWE		SLWP		AS		AE	
		W	D	W	D	W	D	W	D	W	D
Littoraria sinensis	Periwinkle	182	161	64	270	484	450	5	140	32	91
Monodonta labio	Top Shell		2		2	11	8	52	16	7	10
Monodonta neritoides	Top Shell								10		
Nerita yoldii	Nerita	132	31	90	110	94	74	363	17	38	4
Nipponacmea concinna	Limpet										4
Omphalius nigerrimus	Top Shell				1			15	31	13	1
Patelloida pygmaea	Limpet	5	5		1	3		98	64	870	360
Planaxis sulcatus											4
Siphonaria japonica	False Limpet		1						8		35
Siphonaria laciniosa	False Limpet							11		211	11
Thais clavigera	Dog Whelk	67	11	37	46	9	1	32	10	39	28
Thais luteostoma	Dog Whelk	1									
Thais sp.	Dog Whelk				1						
Unknown Gastropod					1						
Annelid											
Hydroides sp.	Tube Worm	20						1			
Cnidarian											
Haliplanella lineata	Sea Anemone	14	20	5	5	2					
Sipunculid											
Phascolosoma sp.	Peanut Worm					52					
Number of Species		26	19	18	21	22	13	18	14	20	19
Pielou's Evenness Index		0.45	0.35	0.43	0.35	0.40	0.16	0.17	0.40	0.36	0.37
Shannon Diversity Index		1.45	1.04	1.25	1.08	1.23	0.42	0.49	1.05	1.07	1.08
Abundance		9562	14202	15290	16187	10218	14629	9589	4645	15489	8232
Ind./ m²		1275	1894	2039	2158	1362	1951	1279	619	2065	1098

Key

W = wet season, D = dry season.

APPENDIX 5- HABITATS AND VEGETATION SURVEYS

Species	Growth form	Status in Hong Kong	Grassland/ Shrubland	Tall Shrubland	Young woodland	Secondary woodland	Plantation	Stream/ Channel	Seasonally wet grassland	Mangrove	Associate mangrove	Developed Area
Abrus mollis	Climber	Restricted		Y								
Acacia auriculiformis	Tree	Exotic, common, often planted in plantation					Y					Y
Acacia confusa	Tree	Exotic, common, often planted in plantation	Y		Y	Y	Y					Y
Acacia mangium	Tree	Exotic, common, often planted in plantation					Y					Y
Acanthus ilicifolius	Shrub	Common						Y				
Achyranthes aspera	Herb	Common					Y					
Acronychia pedunculata	Tree	Very common		Y		Y		Y				
Adenosma glutinosum	Herb	Very common		Y								
Adiantum capillus-veneris	Herb	Common	Y	Y								
Aegiceras corniculatum	Shrub	Common								Y	Y	
Agave americana	Herb	Exotic, common					Y					Y
Ageratum conyzoides	Herb	Exotic, common		Y								Y
Aglaia odorata	Shrub/small tree	Exotic, often planted for ornamental purpose										Y
Alangium chinense	Shrub/small tree	Common	Y	Y		Y	Y					
Albizia lebbeck	Tree	Exotic, common, often planted										Y
Alchornea trewioides	Shrub	Common			Y			Y				
Alocasia odora	Herb	Very common					Y		Y			
Alpinia zerumbet	Herb	Very common										Y
Alternanthera nodiflora	Herb	Exotic, common										Y
Alternanthera sessilis	Herb	Common										Y
Alyxia sinensis	Climber	Common		Y		Y						
Annona squamosa	Tree	Exotic					Y					
Antidesma bunius	Tree	Common		Y								
Antirhea chinensis	Shrub/small tree	Very common	Y	Y								
Aporusa dioica	Tree	Very common	Y	Y	Y	Y	Y					
Aquilaria sinensis	Tree	Common		Y		Y		Y				
Archidendron	Tree	Common		Y	Y	Y						

Species	Growth form	Status in Hong Kong	Grassland/ Shrubland	Tall Shrubland	Young woodland	Secondary woodland	Plantation	Stream/ Channel	Seasonally wet grassland	Mangrove	Associate mangrove	Developed Area
clypearia												
Archidendron lucidum	Tree	Common			Y	Y						
Ardisia crenata	Shrub	Common		Y	Y	Y		Y				
Ardisia lindleyana	Shrub	Common				Y						
Ardisia quinquegona	Shrub	Very common			Y	Y						
Artocarpus macrocarpus	Tree	Exotic					Y		Y			
Asparagus cochinchinensis	Herb	Exotic		Y								
Aster baccharoides	Herb	Very common	Y	Y				Y				
Averrhoa carambola	Tree	Exotic			Y							
Axonopus compressus	Herb	Exotic										Y
Bambusa spp.	Bamboo	Exotic		Y	Y		Y					
Baeckea frutescens	Shrub	Very common	Y									
Bauhinia blakeana	Tree	Common, often planted										Y
Bauhinia championii	Climber	Common		Y								
Bauhinia purpurea	Tree	Exotic, common, often planted					Y					Y
Bauhinia variegata	Tree	Exotic, common, often planted										Y
Berchemia floribunda	Climber	Common	Y			Y						
Bidens alba	Herb	Exotic, very common	Y				Y					Y
Blechnum orientale	Herb	Very common		Y		Y	Y					
Boehmeria nivea	Shrub	Exotic, restricted			Y							
Bougainvillea glabra	Climber	Exotic, common, often planted										Y
Breynia fruticosa	Shrub	Very common	Y	Y		Y						
Bridelia tomentosa	Shrub/small tree	Very common		Y	Y	Y	Y		Y			
Bruguiera gymnorhiza	Shrub/small tree	Restricted in mangrove forest						Y		Y	Y	
Caesalpinia crista	Climber	Very common		Y						Y	Y	
Caesalpinia pulcherrima	Shrub/small tree	Exotic, often planted										Y
Calliandra haematocephala	Shrub	Exotic, common, often planted for ornamental purpose										Y
Callicarpa nudiflora	Shrub	Common				Y						

Species	Growth form	Status in Hong Kong	Grassland/ Shrubland	Tall Shrubland	Young woodland	Secondary woodland	Plantation	Stream/ Channel	Seasonally wet grassland	Mangrove	Associate mangrove	Developed Area
Callicarpa spp.	Shrub	Common			Y							
Callistemon vimilias	Tree	Exotic, often planted										Y
Carallia brachiata	Tree	Common		Y		Y						
Cassia siamea	Tree	Exotic, common										Y
Cassia surattensis	Shrub/small tree	Exotic, often planted										Y
Casuarina equisetifolia	Tree	Exotic, rare, often planted, apparently semi-naturalized					Y					
Celtis biondii	Tree	Restricted in coastal area			Y							
Celtis sinensis	Tree	Common, often planted	Y		Y	Y	Y					Y
Centotheca lappacea	Herb	Common	Y			Y						
Cerbera manghas	Tree	Common		Y						Y	Y	Y
Chloris barbata	Herb	Very common				Y	Y					
Chloris formosana	Herb	Common										Y
Chrysalidocarpus lutescens	Palm	Exotic, often planted										Y
Chrysopogon aciculatus	Herb	Very common		Y								
Cinnamomum camphora	Tree	Common					Y					Y
Clausena lansium	Tree	Exotic, common, fruit tree often planted			Y							
Clerodendrum cyrtophyllum	Shrub	Common		Y								
Clerodendrum fortunatum	Shrub	Common	Y									
Clerodendrum inerme	Shrub	Common								Y	Y	
Cocculus orbiculatus	Climber	Common		Y		Y						
Codiaeum variegatum	Shrub	Exotic, common, often planted										Y
Coix lacryma-jobi	Herb	Common							Y			
Colocasia esculenta	Herb	Common							Y			
Commelina diffusa	Herb	Common							Y			
Conyza canadensis	Herb	Exotic, very common	Y									
Conyza canadensis	Herb	Exotic, very common										Y
Cratoxylum cochinchinense	Shrub/small tree	Very common	Y	Y		Y		Y				
Cuscuta chinensis	Herb	Common						Y	Y			
Cyclosorus	Herb	Very common				Y	Y					

Species	Growth form	Status in Hong Kong	Grassland/ Shrubland	Tall Shrubland	Young woodland	Secondary woodland	Plantation	Stream/ Channel	Seasonally wet grassland	Mangrove	Associate mangrove	Developed Area
parasiticus												
Cyperus distans	Herb	Common										Y
Cyperus pilosus	Herb	Common						Y				
Cyrtococcum patens	Herb	Very common					Y	Y				Y
Dalbergia hancei	Climber	Common		Y								
Daphniphyllum calycinum	Shrub	Common		Y	Y	Y						
Delonix regia	Tree	Exotic, common, often planted	Y									Y
Derris trifoliata	Climber/shrub	Common						Y		Y	Y	
Desmodium gangeticum	Shrub	Common										Y
Desmodium heterocarpon	Subshrub	Very common	Y									
Desmos chinensis	Shrub	Common		Y	Y	Y						
Dianella ensifolia	Herb	Very common	Y	Y								
Dicranopteris pedata	Herb	Very common	Y	Y				Y				
Dimocarpus longan	Tree	Exotic, restricted, found in *Feng Shui* wood, widely cultivated and semi-naturalized	Y	Y	Y		Y					
Dioscorea cirrhosa	Climber	Common		Y								
Diospyros morrisiana	Tree	Very common	Y	Y								
Diospyros vaccinioides	Shrub	Very common	Y	Y		Y						
Diploclisia glaucescens	Climber	Common		Y		Y		Y				
Diplospora dubia	Shrub/small tree	Common		Y				Y				
Dodonaea viscosa	Shrub/small tree	Rare species found in coastal habitats in Ham Tin and Tung Chung										
Drosera indica	Herb	Very rare, found in Tung Chung						Y				
Duranta erecta	Climber/shrub	Exotic, common, often planted for ornamental purpose										Y
Elaeagnus loureiri	Climber	Common				Y						
Elephantopus scaber	Herb	Common	Y									
Elephantopus tomentosus	Herb	Common		Y								Y

Species	Growth form	Status in Hong Kong	Grassland/ Shrubland	Tall Shrubland	Young woodland	Secondary woodland	Plantation	Stream/ Channel	Seasonally wet grassland	Mangrove	Associate mangrove	Developed Area
Eleusine indica	Herb	Very common										Y
Embelia laeta	Climber	Very common	Y	Y				Y				
Embelia ribes	Climber	Common		Y		Y						
Emilia sonchifolia	Herb	Very common					Y					Y
Eragrostis unioloides	Herb	Common	Y									
Eriocaulon sexangulare	Herb	Very common		Y								
Eriochloa procera	Herb	Common		Y				Y				
Eupatorium catarium	Herb	Exotic, very common	Y	Y								Y
Euphorbia hirta	Herb	Exotic, very common	Y									Y
Euphorbia thymifolia	Herb	Very common										Y
Eurya chinensis	Shrub	Very common	Y									
Eurya nitida	Shrub/small tree	Very common	Y	Y								
Excoecaria agallocha	Tree	Common								Y	Y	
Ficus benejamina	Tree	Exotic, common, often planted										Y
Ficus elastica	Tree	Exotic, common, often planted										Y
Ficus hirta	Shrub/small tree	Common	Y	Y	Y	Y						Y
Ficus hispida	Shrub/small tree	Very common					Y		Y			
Ficus microcarpa	Tree	Common				Y	Y	Y				Y
Ficus microcarpa (golden leaves)	Shrub/small tree	Exotic, often planted										Y
Ficus pandurata	Shrub	Restricted, along margin of lowland forest and *Feng Shui* wood				Y						
Ficus pumila	Climber	Very common	Y									Y
Ficus superba var. *japonica*	Tree	Common										Y
Ficus variolosa	Shrub/small tree	Very common	Y			Y		Y				
Ficus virens var. *sublanceolata*	Tree	Common			Y	Y						
Gahnia tristis	Herb	Very common		Y								
Garcinia oblongifolia	Tree	Very common	Y	Y	Y	Y						
Gardenia jasminoides	Shrub	Common		Y								Y
Glochidion eriocarpum	Shrub	Very common	Y	Y								
Glochidion hirsutum	Shrub/small tree	Common		Y								
Gmelina chinensis	Tree	Common		Y								
Gnetum luofuense	Climber	Very common	Y	Y								
Gordonia	Shrub/small	Very common										Y

Species	Growth form	Status in Hong Kong	Grassland/ Shrubland	Tall Shrubland	Young woodland	Secondary woodland	Plantation	Stream/ Channel	Seasonally wet grassland	Mangrove	Associate mangrove	Developed Area
axillaris	tree											
Grevillea robusta	Tree	Exotic, often planted										Y
Gymnema sylvestre	Climber	Very common	Y	Y		Y						
Halophila minor	Herb	Very rare, found in mudflat								Y		
Hedychium coccineum	Herb	Exotic, often planted										Y
Hedyotis acutangula	Herb	Very common	Y	Y								
Helicteres angustifolia	Shrub	Very common	Y	Y				Y				Y
Hibiscus rosa-sinensis	Shrub	Exotic, often planted					Y					Y
Hibiscus tiliaceus	Shrub/small tree	Very common	Y				Y	Y			Y	Y
Hylocereus undatus	Herb	Exotic, common		Y								
Hymenocallis littoralis	Herb	Exotic		Y								Y
Ilex asprella	Shrub	Very common	Y	Y		Y						
Ilex pubescens	Shrub	Very common			Y	Y						
Ilex rotunda	Tree	Exotic, common			Y	Y						
Ilex viridis	Tree	Common	Y									
Imperata koenigii	Herb	Common										
Inula cappa	Herb	Common	Y									
Ipomoea cairica	Climber/herb	Exotic, very common						Y	Y			
Ipomoea pes-caprae	Herbaceous climber	Common										Y
Ipomoea triloba	Herb	Common										Y
Ischaemum spp.	Herb	Common	Y	Y								
Itea chinensis	Shrub/small tree	Very common	Y	Y								
Ixora chinensis	Shrub	Restricted, in lowland forest and *Feng Shui* wood, also widely cultivated										Y
Jarcaranda mimosifolia	Tree	Exotic, often planted										Y
Jasminum lanceolarium	Climber/shrub	Exotic, very common		Y		Y						
Kandelia obovata	Shrub/small tree	Very common								Y		
Kyllinga aromatica	Herb	Exotic, common										Y
Kyllinga brevifolia	Herb	Common				Y						
Kyllinga monocephala	Herb	Common				Y						
Lagerstroemia indica	Shrub/small tree	Exotic, rare species but widely cutivated in										Y

Species	Growth form	Status in Hong Kong	Grassland/ Shrubland	Tall Shrubland	Young woodland	Secondary woodland	Plantation	Stream/ Channel	Seasonally wet grassland	Mangrove	Associate mangrove	Developed Area
		developed area, protected by law										
Lagerstroemia speciosa	Tree	Exotic, often planted										
Lantana camara	Shrub	Exotic, very common	Y	Y	Y	Y	Y		Y			Y
Lantana montevidensis	Shrub	Exotic, often planted										Y
Lemmaphyllum microphyllum	Herb	Common				Y						
Leucaena leucocephala	Tree	Exotic, common				Y	Y					Y
Ligustrum sinense	Shrub/small tree	Common					Y			Y		
Lindernia antipoda	Herb	Common				Y						Y
Liriope spicata	Herb	Very common		Y								
Litchi chinensis	Tree	Exotic					Y					
Litsea glutinosa	Tree	Very common		Y		Y						Y
Litsea monopetala	Tree	Restricted, sometimes planted			Y		Y					
Litsea rotundifolia var. *oblongifolia*	Shrub	Very common	Y	Y		Y	Y	Y				
Lonicera japonica	Climber	Restricted, but often found in forest margin		Y		Y						
Lophatherum gracile	Herb	Very common		Y		Y						
Lophostemon confertus	Tree	Exotic, often planted					Y					Y
Lygodium flexuosum	Climber/herb	Very common	Y			Y						
Lygodium japonicum	Climber/herb	Very common	Y			Y		Y				
Lygodium scandens	Climber/herb	Common	Y									
Macaranga tanarius	Tree	Common	Y	Y	Y		Y					Y
Macrothelypteris torresiana	Herb	Very common	Y									
Maesa perlarius	Shrub	Common		Y	Y	Y						
Mallotus apelta	Shrub/small tree	Common										Y
Mallotus paniculatus	Shrub/small tree	Very common	Y	Y	Y	Y	Y	Y	Y			Y
Malvaviscus arboreus var. *penduliflorus*	Shrub	Exotic										Y
Mangifera indica	Tree	Exotic, fruit tree often planted					Y					
Melastoma candidum	Shrub	Common	Y									Y
Melastoma dodecandrum	Shrub	Common	Y	Y								
Melastoma sanguineum	Shrub	Common	Y			Y						
Melia azedarach	Tree	Exotic,				Y	Y					Y

Species	Growth form	Status in Hong Kong	Grassland/ Shrubland	Tall Shrubland	Young woodland	Secondary woodland	Plantation	Stream/ Channel	Seasonally wet grassland	Mangrove	Associate mangrove	Developed Area
		common										
Melicope pteleifolia	Shrub/small tree	Common		Y		Y		Y				
Microcos paniculata	Shrub/small tree	Common		Y	Y	Y	Y		Y			
Mikania micrantha	Climber/herb	Exotic, very common			Y	Y	Y		Y			
Millettia nitida	Climber/shrub	Very common	Y	Y		Y						
Millettia reticulata	Climber	Common		Y	Y	Y						
Millettia speciosa	Climber	Common		Y		Y						
Mimosa pudica	Shrub	Exotic, very common	Y									Y
Miscanthus sinensis	Herb	Very common	Y	Y				Y				
Monstera deliciosa	Climber/shrub	Exotic, often planted										Y
Murraya panciulata	Tree	Exotic, often planted										Y
Musa x paradisiaca	Herb	Exotic, common, often cultivated					Y					Y
Mussaenda pubescens	Climber/shrub	Very common					Y					
Myrsine seguinii	Tree	Common			Y	Y						
Nephrolepis auriculata	Herb	Common	Y									
Nerium oleander	Shrub	Exotic, often planted					Y					Y
Neyraudia reynaudiana	Herb	Very common	Y				Y					
Oplismenus compositus	Herb	Very common	Y		Y		Y					
Osbeckia chinensis	Herb/subshrub	Very common	Y									
Osmanthus fragrans	Shrub/small tree	Exotic, often planted										Y
Paederia scandens	Climber	Very common		Y	Y			Y				
Pandanus tectorius	Shrub/small tree	Very common	Y	Y		Y			Y	Y	Y	Y
Panicum maximum	Herb	Exotic, very common	Y									Y
Paspalum conjugatum	Herb	Exotic, common										Y
Paspalum orbiculare	Herb	Common										Y
Pavetta hongkongensis	Shrub/small tree	Protected, common		Y								
Pellionia scabra	Herb/shrub	Common		Y								
Pennisetum alopecuroides	Herb	Common					Y					
Pennisetum purpureum	Herb	Exotic, common										Y
Pentaphylax euryoides	Tree	Common	Y									
Pericampylus glaucus	Climber	Restricted, but often found in lowland forest and *Feng Shui*		Y				Y				

Species	Growth form	Status in Hong Kong	Grassland/ Shrubland	Tall Shrubland	Young woodland	Secondary woodland	Plantation	Stream/ Channel	Seasonally wet grassland	Mangrove	Associate mangrove	Developed Area
		wood										
Phoenix roebelenii	Palm tree	Exotic, often planted										Y
Photinia benthamiana	Shrub/small tree	Common				Y						
Phragmites australis	Herb	Very common						Y				
Phragmites karka	Herb	Very common						Y				
Phyllanthus cochinchinensis	Shrub	Very common		Y								
Phyllanthus emblica	Shrub/small tree	Very common	Y	Y		Y						Y
Phyllanthus urinaria	Herb	Common										Y
Phyllodium elegans	Shrub	Common	Y									
Pinus elliotii	Tree	Exotic, often planted in plantation		Y		Y						Y
Pinus massoniana	Tree	Common, often planted in plantation	Y			Y	Y					Y
Pittosporum glabratum	Shrub	Very common		Y		Y						
Plumeria rubra	Tree	Exotic, often planted										Y
Pogonatherum crinitum	Herb	Common		Y								
Polygonum chinense	Herb	Very common			Y				Y			
Psidium guajava	Tree	Exotic, common							Y			
Psychotria asiatica	Shrub/small tree	Very common	Y	Y	Y	Y	Y					
Psychotria serpens	Climber	Very common	Y	Y								
Pteris semipinnata	Herb	Very common				Y						
Pueraria lobata	Climber	Very common			Y		Y		Y			
Pycreus polystachyus	Herb	Common	Y									
Rhaphiolepis indica	Shrub/small tree	Very common	Y	Y								Y
Rhapis excelsa	Palm	Exotic, often planted										Y
Rhododendron pulchrum	Shrub	Exotic, often planted										Y
Rhododendron simsii	Shrub	Very common, wild population is protected by law, often planted										Y
Rhodomyrtus tomentosa	Shrub	Very common	Y			Y		Y				Y
Rhus chinensis	Shrub/small tree	Common	Y	Y			Y					
Rhus succedanea	Shrub/small tree	Common	Y	Y		Y	Y	Y				
Rhynchelytrum repens	Herb	Exotic, very common	Y	Y			Y	Y				Y

Species	Growth form	Status in Hong Kong	Grassland/ Shrubland	Tall Shrubland	Young woodland	Secondary woodland	Plantation	Stream/ Channel	Seasonally wet grassland	Mangrove	Associate mangrove	Developed Area
Rosa laevigata	Climber/shrub	Common				Y						
Rourea microphylla	Climber/shrub	Common	Y	Y	Y	Y	Y	Y	Y		Y	
Rourea minor	Climber/shrub	Common	Y	Y	Y	Y	Y	Y			Y	
Roystonea regia	Palm	Exotic, often planted										Y
Rubus reflexus	Climber/shrub	Very common		Y		Y		Y				
Sageretia thea	Shrub	Very common			Y							
Sapium discolor	Tree	Very common		Y		Y		Y				
Sapium sebiferum	Tree	Common	Y	Y			Y					Y
Sarcosperma laurinum	Tree	Very common		Y								
Scaevola taccada	Shrub	Very common					Y			Y	Y	Y
Schefflera arboricola	Climber/shrub	Exotic, often planted										Y
Schefflera heptaphylla	Climber/shrub	Very common	Y	Y	Y	Y		Y				
Scleria ciliaris	Herb	Common	Y								Y	
Scleria laevis	Herb	Common	Y	Y				Y		Y	Y	
Scolopia chinensis	Shrub/small tree	Common		Y	Y							
Scolopia saeva	Shrub/small tree	Common		Y								
Senecio scandens	Herb	Common		Y	Y							
Setaria glauca	Herb	Very common	Y	Y								
Severinia buxifolia	Shrub	Common	Y	Y	Y		Y					
Smilax china	Climber/shrub	Very common	Y	Y	Y	Y		Y				
Smilax glabra	Climber/shrub	Very common		Y		Y						
Solanum nigrum	Herb	Common										Y
Sterculia lanceolata	Tree	Very common	Y	Y	Y	Y	Y					
Strophanthus divaricatus	Climber	Common	Y	Y							Y	
Strychnos angustiflora	Climber	Common	Y	Y		Y		Y				
Strychnos umbellata	Climber	Common		Y		Y						
Stylidium uliginosum	Herb	Common						Y				
Suaeda australia	Shrub	Common								Y	Y	
Symplocos congesta	Tree	Common				Y						
Symplocos glauca	Tree	Common		Y								
Syngonium podophyllum	Herb	Exotic, often planted										Y
Syzygium jambos	Tree	Exotic, common					Y					
Tadehagi triquetrum	Shrub	Very common	Y									Y
Tetracera asiatica	Climber	Very common	Y	Y		Y		Y				
Tetradium glabrifolium	Tree	Common				Y						
Thespesia	Shrub/small	Restricted in		Y							Y	Y

Species	Growth form	Status in Hong Kong	Grassland/ Shrubland	Tall Shrubland	Young woodland	Secondary woodland	Plantation	Stream/ Channel	Seasonally wet grassland	Mangrove	Associate mangrove	Developed Area
populnea	tree	coastal area										
Thevetia peruviana	Shrub/small tree	Exotic, often planted										Y
Trema tomentosa	Shrub/small tree	Common	Y					Y				
Tridax procumbens	Herb	Exotic, very common										Y
Urena lobata	Herb/shrub	Common										Y
Uvaria macrophylla	Climber/shrub	Common		Y		Y	Y	Y				
Vernonia cinerea	Herb	Very common					Y					Y
Viburnum odoratissimum	Shrub/small tree	Very common			Y		Y					
Viola diffusa	Herb	Common		Y								
Vitex quinata	Tree	Common	Y		Y		Y					
Vitex rotundifolia	Shrub	Common	Y	Y			Y		Y	Y	Y	
Wedelia chinensis	Herb	Common								Y	Y	
Wedelia trilobata	Herb	Exotic, common					Y				Y	Y
Youngia japonica	Herb	Very common				Y						Y
Zanthoxylum avicennae	Tree	Common	Y	Y	Y	Y	Y	Y				
Zanthoxylum nitidum	Climber	Very common	Y	Y								
Zostera japonica	Herb	Rare, found in mudflat								Y		
Zoysia sinica	Herb	Common								Y		
			95	**121**	**49**	**90**	**66**	**48**	**19**	**18**	**20**	**109**

APPENDIX 6. AVIFAUNA RECORDED WITHIN STUDY AREA

Table A6.1. *Aviauna observed during wet and dry season surveys*

Bird Species	Season recorded	Species of Conservation Interest	Stream	Soft Shore (Sandy Shore and /or intertidal Sandflat/ Mudflat)	Hard Shore (Artificial and /or Natural Rocky Shores)	Shrubland	Developed Area	Plantation	Woodland	Active Dry Agriculture	Overhead	Total Habitats Recorded
Grey Heron *Ardea cinerea*	*d*	*PRC*		1	1							2
Great Egret *Egretta alba*	*w, d*	*PRC (RC)*			1							
Little Egret *Egretta garzetta*	*w, d*	*PRC (RC)*		3	23							
Pacific Reef Egret *Egretta sacra*	*w*	*(LC)*			1							
Striated Heron *Butorides striatus*	*w, d*	*(RC)*	2	1								
Black-crowned Night Heron *Nycticorax nycticorax*	*w, d*	*(LC)*	3									
Black Kite *Milvus migrans*	*w, d*										3	
Crested Goshawk *Accipiter trivirgatus*	*d*										2	
Common Buzzard *Buteo buteo*	*d*										2	
Common Kestrel *Falco tinnunculus*	*d*					1						
Little Ringed Plover *Charadrius dubius*	*w, d*	*(LC)*		14								
Whimbrel *Numenius phaeopus*	*w*	*LC*		5								
Common Sandpiper *Actitis hypoleucos*	*w, d*			7	6							
Grey-tailed Tattler *Heteroscelus brevipes*	*w*	*LC*		3								
Oriental Turtle Dove *Streptopelia orientalis*	*d*										1	
Spotted Dove *Streptopelia chinensis*	*w, d*					1	4					
Emerald Dove *Chalcophaps indica*	*w, d*					6						
Collared Scops Owl *Otus bakkamoena*	*w*					2						
Common Kingfisher *Alcedo atthis*	*w, d*				2							
Dollarbird *Eurystomus orientalis*	*w*									1		
Grey Wagtail *Motacilla cinerea*	*w, d*		1	2								
White Wagtail *Motacilla alba*	*w, d*			3								
Richard's Pipit *Anthus richardi*	*d*							1				
Olive-backed Pipit *Anthus hodgsoni*	*d*								2			
Black-winged Cuckoo-shrike *Coracina melaschistos*	*d*									1		
Red-whiskered Bulbul *Pycnonotus jocosus*	*w, d*					20	30			10		
Chinese Bulbul *Pycnonotus sinensis*	*w, d*					50	10			10		
Sooty-headed Bulbul *Pycnonotus aurigaster*	*d*					3						
Brown Shrike *Lanius cristatus*	*w*							1				
Long-tailed Shrike *Lanius schach*	*w, d*									1		
Rufous-tailed Robin *Luscinia sibilans*	*d*								2			
Oriental Magpie Robin *Copsychus saularis*	*w, d*			1		1	2					

Bird Species	***Season recorded***	***Species of Conservation Interest***	**Stream**	**Soft Shore (Sandy Shore and /or intertidal Sandflat/ Mudflat)**	**Hard Shore (Artificial and /or Natural Rocky Shores)**	**Shrubland**	**Developed Area**	**Plantation**	**Woodland**	**Active Dry Agriculture**	**Overhead**	**Total Habitats Recorded**
Blue Rock Thrush *Monticola solitarius*	*d*				3							
Grey-backed Thrush *Turdus hortulorum*	*d*					2						
Pale Thrush *Turdus pallidus*	*d*					2			15			
Masked Laughingthrush *Garrulax perspicillatus*	*w, d*					8	2		8			
Hwamei *Garrulax canorus*	*w*											
Japanese Bush Warbler *Cettia diphone*	*d*							1				
Yellow-bellied Prinia *Prinia flaviventris*	*d*					1						
Common Tailorbird *Orthotomus sutorius*	*w, d*					2	1	2				
Pallas's Leaf Warbler *Phylloscopus proregulus*	*d*								1			
Yellow-browed Warbler *Phylloscopus inornatus*	*d*					6	6	1				
Dusky Warbler *Phylloscopus fuscatus*	*d*							3				
Arctic Warbler *Phylloscopus borealis*	*w, d*							3				
Pale-legged/Sakhalin Leaf Warbler *Phylloscopus tenellipes*	*w*							1				
Blyth's Leaf Warbler *Phylloscopus reguloides*	*d*	*LC*						1				
Asian Brown Flycatcher *Muscicapa dauurica*	*d*								1			
Red-throated Flycatcher *Ficedula albicilla*	*d*								1			
Yellow-rumped Flycatcher *Ficedula zanthopygia*	*w*							1				
Great Tit *Parus major*	*w, d*					2			2			
Fork-tailed Sunbird *Aethopyga christinae*	*d*					1	1	1	1			
Japanese White-eye *Zosterops japonicus*	*w, d*					10						
Common Rosefinch *Carpodacus erythrinus*	*d*	*LC*					1					
Scaly-breasted Munia *Lonchura punctulata*	*d*									3		
Eurasian Tree Sparrow *Passer montanus*	*d*						5					
Black-collared Starling *Sturnus nigricollis*	*d*						4					
White-shouldered Starling *Sturnus sinensis*	*w*	*(LC)*								1		
Crested Myna *Acridotheres cristatellus*	*d*						2					
Black-naped Oriole *Oriolus chinensis*	*w*	*LC*					1					
Black Drongo *Dicrurus macrocercus*	*w*						1					
Common Magpie *Pica pica*	*d*					2						
Large-billed Crow *Corvus macrorhynchos*	*w, d*							1			2	
Total number of species recorded for each habitat			**3**	**10**	**7**	**18**	**14**	**12**	**9**	**7**	**5**	**61**

KEY:
*= denotes wetland dependent bird species
PRC= Potential Regional Concern; RC=Regional Concern; LC = Local Concern, as of Fellowes *et al.* (2002). Those in parenthesis indicate that the assessment is on the basis of restrictedness in breeding and/or roosting rather than general occurrence.
w = Recorded during wet season*; d* = recorded during dry season.

APPENDIX 7 – DRAGONFLIES RECORDED WITHIN STUDY AREA

Table A7.1. *Dragonfly species observed during total study period*

Species	Status and Distribution*	Scenic Hill	San Tau	Kau Liu	Hau Hok Wan	Sha Lo Wan
Indochinese Copperwing *Mnais mneme*	Common in Wooodland Streams				2	
Black-banded Gossamerwing *Euphaea decorata*	Abundant in Mountain Streams				1	
Chinese Yellowface *Agrimorpha fusca*	Abundant in woodland streams				1	
Orange-tailed Sprite *Ceriagrion auranticum*	Abundant and widespread					1
Red-faced Skimmer *Orthetrum chrysis*	Common and widespread.				2	
Common Blue Skimmer *Orthetrum glaucum*	Abundant and widespread.				2	4
Common Red Skimmer *Orthetrum pruinosum*	Abundant and widespread				2	2
Wandering Glider *Pantala flavescens*	Abundant and widespread	+++	+++	+++	+++	+++

*Following Wilson (2004)
+++= high numbers, i.e. 100+ individuals

APPENDIX 8. BUTTERFLY SPECIES RECORDED WITHIN STUDY AREA

Table A8.1. *Butterfly species observed during both wet and dry season surveys*

Species	Soft Shore (Sandy Shore and/or intertidal Sandflat/Mudflat)	Hard Shore (Artificial and /or Natural Rocky Shores)	Grassland	Shrubland	Developed Area	Plantation	Woodland	Active Dry Agriculture	Mangrove and Associate Mangrove	Total Number of Habitats Recorded
Chestnut Angle *Odontoptilum angulatum*				1			1			2
Chestnut Bob *Iambrix salsala*				1						1
Grass Demon *Udaspes folus*				1						1
Common Redeye *Matapa aria*						1				1
Dart Sp. *Potanthus sp.*							1			1
Contiguous Swift *Polytremis lubricans*				1						1
*White Dragontail Lamproptera curius**					1					1
Common Bluebottle *Graphium sarpedon*				2	1		1			3
Common Jay *Graphium doson*								1		1
Tailed Jay *Graphium agamemnon*							2			1
Five-bar Swordtail *Pathysa antiphates*	1		1							2
Lime Butterfly *Papilio demoleus*				1			1			2
Red Helen *Papilio helenus*					1		1			2
Common Mormon *Papilio polytes*				4	7	1		1	1	5
Great Mormon *Papilio memnon*					2		2			2
Spangle *Papilio protenor*							1			1
Chinese Peacock *Papilio bianor*				1	1					2
Paris Peacock *Papilio paris*					1					1
Red-base Jezebel *Delias pasithoe*	1	2		4	1	1				5
Indian Cabbage White *Pieris rapae*				1						1
Common Gull *Cepora nerissa*				2		2				2
Yellow Orange Tip *Ixias pyrene*							1			1
Great Orange Tip *Hebomoia glaucippe*							1	1		2
Lemon Emigrant *Catopsilia pomona*					1					1
Common Grass Yellow *Eurema hecabe*			1		1		22			3
Silver Streak Blue *Iraota timoleon*							1			1
Long-banded Silverline *Spindasis lohita*				1			1			2
Chocolate Royal *Remelana jangala*									1	1
Purple Sapphire *Heliophorus epicles*					1			1		2
Dark Cerulean *Jamides bochus*				1						1

Species	Soft Shore (Sandy Shore and/or intertidal Sandflat/Mudflat)	Hard Shore (Artificial and /or Natural Rocky Shores)	Grassland	Shrubland	Developed Area	Plantation	Woodland	Active Dry Agriculture	Mangrove and Associate Mangrove	Total Number of Habitats Recorded
Pale Grass Blue *Zizeeria maha*				1			1			2
Dark Grass Blue *Zizeeria karsandra*				2						1
Lesser Grass Blue *Zizina otis*				2						1
Tailed Cupid *Everes lacturnus*				1						1
Common Hedge Blue *Acytolepis puspa*				1						1
Lime Blue *Chilades lajus*				6						1
Plum Judy *Abisara echerius*				1		1	2			3
Common Evening Brown *Melanitis leda*							1			1
Dark Evening Brown *Melanitis phedima*							1			1
Common Palmfly *Elymnias hypermnestra*						1				1
Dark-brand Bush Brown *Mycalesis mineus*				6			1			2
South China Bush Brown *Mycalesis zonata*				1						1
Common Five-ring *Ypthima baldus*				2						1
Large Faun *Faunis eumeus*							5			1
Tawny Rajah *Charaxes bernardus*				1						1
Angled Castor *Ariadne ariadne*					1			1		2
Rustic *Cupha erymanthis*				25			1		1	3
Common Leopard *Phalanta phalanta*				1						1
Blue Admiral *Kaniska canace*				1						1
Peacock Pansy *Junonia almana*			1							1
Grey Pansy *Junonia atlites*				1	1			1		3
Lemon Pansy *Junonia lemonias*					1					1
Chocolate Pansy *Junonia iphita*							1			1
Great Egg-fly *Hypolimnas bolina*				2			2		1	3
Common Sailer *Neptis hylas*				1						1
Staff Sergeant *Athyma selenophora*				1						1
Black Prince *Rohana parisatis*							1			1
Glassy Tiger Parantica aglea					1					1
Common Tiger *Danaus genutia*				2	1					2
Total number of species per habitat	**2**	**1**	**3**	**32**	**16**	**6**	**24**	**6**	**4**	**59**

*Species of 'Local Concern' as per Fellowes *et al. (2002)*

APPENDIX 9 – STREAM FAUNA RECORDED WITHIN STUDY AREA

Table A9.1. *Aquatic fauna recorded during stream surveys*

		San Tau				Hau Hok Wan						Sha Lo Wan			
Species and Common Names	**Conser-vation Status**	**ST9**		**ST12**		**HH2**		**HH3**		**HH5**		**SL3**		**SL8**	
Season		**W**	**D**	**W**	**D**	**W**	**D**	**W**	**D**	**W**	**D**	**W**	**D**	**W**	**D**
Water Level					**Dried**		**#**		**#**		**#**			**#**	**Dried**
Reptile															
Trachemys scripta Red-eared Slider													1		
Amphibian															
Paa exilispinosa Lesser Spiny Frog (Tadpole)	a					*		2							
Fish															
Acanthopagrus latus Yellowfin Seabream											5		10		
Acrossocheilus beijiangensis Beijiang Thick-lipped Barb	b		1												
Ambassis gymnocephalus Glassperch			100+									100+			
Cyprinus carpio Ornamental Carp		1	1												
Favonigobius reichei Indo-Pacific Tropical Sand Goby	c		50+								1		30		
Gambusia affinis Mosquito Fish												1	5		
Gerres filamentosus Whipfin silverbiddy			50+												
Gerres oyena Silver-biddy		1								10		10			
Glossogobius sp. Goby		2	2									10	1		
Kuhlia marginata Dark-margined Flagtail	d		1												
Liza affinis Mullet										50		50			
Liza sp. 1 Mullet		50	100+							30		50	100+		
Liza sp. 2 Mullet		30								100		50			
Mugil cephalus Grey Mullet		1													
Mugilogobius chulae Yellowstripe Goby												30			
Mugilogobius abei Goby												10			
Oreochromis niloticus Nile Tilapia													2		
Oryzias curvinotus Rice Fish	e	20	100					1		1	1				
Parazacco spilurus Predaceous Chub	f	100+	100+									100+	100+		
Periophthalmus modestus Mudskipper		1	20	4				20	3	60	11	50	100+		
Redigobius sp. Goby											1				
Rhinogobius duospilus Freshwater Goby			8									20			
Scatophagus argus Scat		2													
Terapon jarbua Jarbua Terapon			100+							30		10	30		
Tridentiger trigonocephalus Chameleon Goby			1								1	3	20		

		San Tau				Hau Hok Wan						Sha Lo Wan			
Species and Common Names	**Conser -vation Status**	**ST9**		**ST12**		**HH2**		**HH3**		**HH5**		**SL3**		**SL8**	
Season		**W**	**D**	**W**	**D**	**W**	**D**	**W**	**D**	**W**	**D**	**W**	**D**	**W**	**D**
Valamugil sp. Mullet			100+										100+		
Xiphophorus hellerii Swordtail												30	35		
Zenarchopterus striga Hooghly Halfbeak										25		10			
Crustacean															
Amphipoda Amphipod			50+								20		10		
Caridina cantonensis Atyid Shrimp			10			2		30			4	60	100+		
Chiromantes sereni Sesarmine Crab	g							3				5			
Macrobrachium nipponense Long-armed Shrimp		100+	50+	1		1	5	6		1	22	30	50+		
Metapenaeus ensis Greasyback Shrimp	h		3									2			
Nanosesarma minutum Sesarmine Crab													50		
Pagurus dubius Hermit Crab			100+								3				
Parasesarma pictum Sesarmine Crab				2											
Perisesarma bidens Sesarmine Crab			10	7						20	1	30	50		
Portunus pelagicus Swimming Crab			1												
Somanniathelphusa zanklon Freshwater Crab	i			2											
Scylla serrata Mud Crab			1								1	1			
Varuna sp. Grapsid Crab		30	40								15		10		
Insect															
Coenagrionidae sp. Damselfly (Nymph)													25		
Enithares sp. Backswimmer						4		2		10				2	
Gomphidae sp. Dragonfly (Nymph)											2				
Libelluidae sp. Dragonfly (Nymph)															
Orthetrum Sabina Green Skimmer (Nymph)														1	
Platycnemididae sp. Damselfly (Nymph)													25		
Tipulidae sp. True Fly (Larvae)							1								
No. of Species		**12**	**24**	**5**	**0**	**3**	**2**	**7**	**1**	**11**	**14**	**22**	**21**	**2**	**0**
Total No. of Species		**28**		**5**		**4**		**7**		**21**		**32**		**2**	

Key
W = wet season, D = dry season.
a = IUCN and CSIS Red list: vulnerable (www.iucnredlist.org; www.baohu.org), potential global concern (Fellowes *et al.*, 2002)
b = rare (Lee *et al.* 2004), global concern (Fellowes *et al.* 2002)
c = IUCN red list: lower risk/ near threatened (www.iucnredlist.org)
d = IUCN red list: lower risk/ least concern (www.iucnredlist.org), regional concern (Fellowes *et al.* 2002), very rare (AEC Staff per. obs.)
e = uncommon (Lee *et al.*2004), global concern (Fellowes *et al.* 2002)
f = CSIS red list: vulnerable (www.baohu.org), vulnerable (Yue and Chen, 1998)
g = endemic (Kwok and Tang, 2005)
h = CSIS red list: vulnerable (www.baohu.org)
i = IUCN red list: endangered (www.iucnredlist.org), global concern (Fellowes *et al.* 2002)
* = Three Lesser Spiny Frog's tadpoles have been observed during other surveys.
# = Water level low

APPENDIX 10. PHOTOS OF SPECIES OF CONSERVATION CONCERN

Plate A.10.1. *Photos of Species of Conservation Concern in Intertidal Areas*

1: Horseshoe Crab Juvenile at TCB

2: Dead Horseshoe Crab Subadult at TCB

3: Horseshoe Crab Juvenile at ST

4: Horseshoe Crab's Footprints at SW

5: Indo-Pacific Tropical Sand Goby

6: Walking Goby

7: *Zostera japonica* at ST

8: *Halophila minor* at ST

Plate A10.2. *Photos of Species of Conservation Concern in Streams and Terrestrial Areas*

1: Tadpole of Lesser Spiny Frog

2: Rice Fish

3: Predaceous Chub

4: White Dragontail

5. *Eulophia graminea*

6. *Aquilaria sinensis*

7. *Dodonaea viscosa*

8. *Drosera indica*

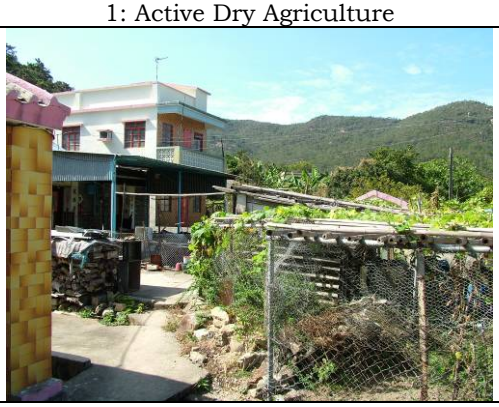
9: *Pavetta hongkongensis*

10: *Thespesia populnea*

APPENDIX 11. PHOTOS SHOWING EXAMPLES OF HABITATS PRESENT WITHIN STUDY AREA

1: Active Dry Agriculture

2: Associated Mangrove

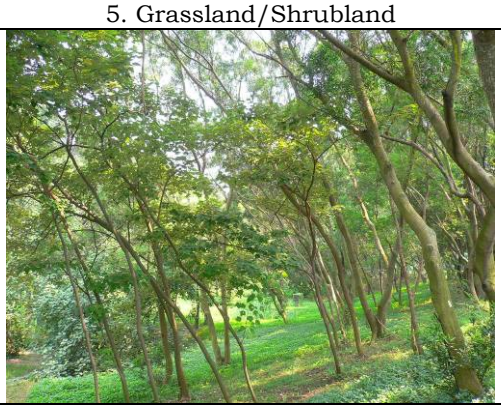


3: Developed Area

4: Grassland

5. Grassland/Shrubland

6. Mangrove



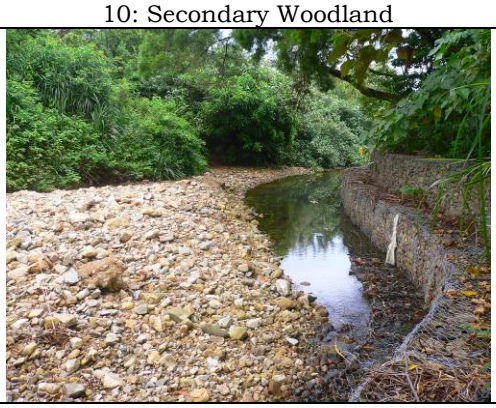
7. Plantation

8. Mudflat

9: Seasonally Wet Grassland

10: Secondary Woodland

11: Shrubland



12: Stream

13: Tall Shrubland

14: Young Woodland

APPENDIX 12. PHOTOS OF SOFT & HARD SHORE SURVEY LOCATIONS

Plate A12.1 *Photos of Soft Shore Survey Locations*

1: Sham Wat

2: San Shek Wan

3: Sha Lo Wan

4: Hau Hok Wan

5. San Tau

6. Tung Chung Bay

Plate A12.2 *Photos of Hard Shore Survey Locations*

1: San Shek Wan West

2: San Shek Wan East

3: Sha Lo Wan Pier

4: Airport South

5: Airport East