

ANNEX 4A MARINE ECOLOGY - LITERATURE REVIEW

4A.1 Introduction

A literature review was conducted to review the baseline ecological characters of the Assessment Area, identify habitat resources and species of potential conservation importance, and identify information gaps to determine whether field surveys are required to provide sufficient information for the marine ecological impact assessment. This *Annex* presents the findings of this literature review.

4A.2 Legislative Requirements and Evaluation Criteria

4A.2.1 Marine Parks Ordinance (Cap. 476) and its Subsidiary Legislation

The *Marine Parks Ordinance (Cap. 476)* provides for the designation, control and management of marine parks and marine reserves. It also stipulates the Director of Agriculture, Fisheries and Conservation as the Country and Marine Parks Authority which is advised by the Country and Marine Parks Board. The *Marine Parks and Marine Reserves Regulation* was enacted in July 1996 to provide for the prohibition and control of certain activities in marine parks or marine reserves.

4A.2.2 Wild Animals Protection Ordinance (Cap. 170)

Under the *Wild Animals Protection Ordinance (Cap. 170)*, designated wild animals are protected from being hunted, whilst their nests and eggs are protected from destruction and removal. All birds and most mammals including all cetaceans are protected under this Ordinance, as well as certain reptiles (including all sea turtles), amphibians and invertebrates. The Second Schedule of the Ordinance that lists all the animals protected was last revised in June 1997.

4A.2.3 Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586)

The *Protection of Endangered Species of Animals and Plants Ordinance (Cap. 586)* was enacted to align Hong Kong's control regime with the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). With effect from 1 July 2006, it replaces the *Animals and Plants (Protection of Endangered Species) Ordinance (Cap. 187)*. The purpose of the *Protection of Endangered Species of Animals and Plants Ordinance* is to restrict the import and export of species listed in CITES Appendices so as to protect wildlife from overexploitation or extinction. The Ordinance is primarily related to controlling trade in threatened and endangered species and restricting the local possession of them. Certain types of corals are CITES listed, including Blue coral (*Heliopora coerulea*), Organ pipe corals (family Tubiporidae), Black corals (order Antipatharia), Stony coral (order Scleractinia), Fire corals (family Milleporidae) and Lace corals (family Stylasteridae). The import, export and possession of listed species, no matter dead or living, is restricted.

4A.2.4 Town Planning Ordinance (Cap. 131)

The *Town Planning Ordinance (Cap. 131)* provides for the designation of areas such as "Coastal Protection Areas", "Sites of Special Scientific Interest (SSSIs)", "Green Belt" and "Conservation Area" to promote conservation or protection or protect significant habitat.

4A.2.5 Environmental Impact Assessment Ordinance (Cap. 499) and the Technical Memorandum on Environmental Impact Assessment Process under the Environmental Impact Assessment Ordinance (EIAO-TM)

The Environmental Impact Assessment Ordinance (Cap. 499) specifies designated projects under Schedule 2 of the Ordinance, unless exempted, must follow the statutory environmental impact assessment (EIA) process and require environmental permits for their construction and operation. *Annex 16* of the *EIAO-TM* sets out the general approach and methodology for assessment of

ecological impacts arising from a project or proposal, to allow a complete and objective identification, prediction and evaluation of the potential ecological impacts. *Annex 8* recommends the criteria that can be used for evaluating ecological impacts.

4A.2.6 Environmental Impact Assessment Ordinance (EIAO) Guidance Notes No. 6/2010, 7/2010 and 11/2010

The guidance notes provide respectively the observations on ecological assessment from the EIAO perspective, the general guidelines for conducting an ecological baseline survey for ecological assessment and methodologies for marine ecological baseline surveys in order to fulfil the requirements stipulated in the EIAO-TM in respect of ecological assessment for the proposed development.

4A.2.7 Hong Kong Planning Standards and Guidelines Chapter 10 (HKPSG)

Chapter 10 of the HKPSG covers planning considerations relevant to conservation. This chapter details the principles of conservation, the conservation of natural landscape and habitats, historic buildings, archaeological sites and other antiquities. It also addresses the issue of enforcement. The appendices list the legislation and administrative controls for conservation, other conservation related measures in Hong Kong and Government departments involved in conservation.

4A.2.8 Other Relevant Legislation

The Peoples' Republic of China (PRC) is a Contracting Party to the United Nations Convention on Biological Diversity (CBD) of 1992 and it was extended to Hong Kong on 9 May 2011. The Convention requires signatories to make active efforts to protect and manage their biodiversity resources. The HKSAR Government has stated that it will be "committed to meeting the environmental objectives" of the Convention ⁽¹⁾. In the tenth meeting of the conference in 2010, the Parties adopted a revised and updated Strategic Plan for Biodiversity, including the Aichi Biodiversity Targets, for 2011-2020. This plan aims to "take effective and urgent action to halt the loss of biodiversity in order to ensure that by 2020 ecosystems are resilient and continue to provide essential services, thereby securing the planet's variety of life, and contributing to human well-being, and poverty eradication". The Strategic Plan consisted with five strategic goals, which included 20 headline Aichi Biodiversity targets. The goals and targets comprised a flexible framework for the establishment of national and regional targets for biodiversity conservation.

The Convention on International Trade in Endangered Species of Wild Fauna and Flora of Wild Fauna and Flora (CITES) was drafted and agreed at a meeting of members of International Union for Conservation of Nature (IUCN) with representative of 80 countries in 1972 and entered in force in 1975. This international agreement adheres voluntarily between government and aims to ensure that international trade in specimens of wild animals and plants does not threaten their survival.

The IUCN is the world's oldest and largest authority on the conservation status of species. The IUCN Red List of Threatened Species is widely recognised as the most comprehensive, objective global approach for evaluating the conservation status of plant and animal species. The goal of the IUCN Red List is to provide information and analyses on the status, trends and treats to species in order to inform and catalyse action for biodiversity conservation. In 1994, a scientifically rigorous approach was adopted to determine risks of extinction that is applicable to all species and it has become a world standard.

The PRC in 1988 ratified the Wild Animal Protection Law of the PRC, which lays down basic principles for protecting wild animals. The Law prohibits killing of protected animals, controls hunting, and protects the habitats of wild animals, both protected and non-protected. The Law also provides for the creation of lists of animals protected at the state level, under Class I and Class II. There are

(1) Planning Environment and Lands Bureau 1996. Environmental Policy Commitments.

96 animal species in Class I and over 230 species in Class II. Class I provides a higher level of protection for animals considered to be more threatened.

4A.3 Baseline Conditions of Marine Ecological Resources of the Assessment Area

4A.3.1 Information Reviewed

Baseline information on the marine ecological resources of the Assessment Area for marine ecology is available from the following key sources:

- Field guides and published studies/literature for marine habitats and fauna of Hong Kong;
- Consultancy Study on Marine Benthic Communities in Hong Kong (Agreement No. CE 69/2000);
- AFCD Marine Mammal Monitoring Reports;
- Ecological Restoration and Conservation Laboratory, HKU. Reptiles of Hong Kong;
- EIA and Final Site Selection Report for Detailed Site Selection Study for a Proposed Contaminated Mud Disposal Facility within the Airport East/East of Sha Chau Area (Agreement No. CE 12/2002(EP));
- EIA Review Report for Contaminated Sediment Disposal at South of Brothers (Agreement No. FM 2/2009);
- EIA Report for Development of a 100MW Offshore Wind Farm in Hong Kong (Register No.: AEIAR-152/2010);
- EIA Report for a 1,800MW Gas-Fired Power Station at Lamma Extension. (Register No.: AEIAR-010/1999);
- EIA Report for Development of the Integrated Waste Management Facilities Phase 1 (Register No.: AEIAR-163/2012);
- EIA Report for Hong Kong Offshore LNG Terminal (Register No.: AEIAR-218/2018);
- EIA Report for Improvement Dredging for Lamma Power Station Navigation Channel (Register No.: AEIAR-212/2017);
- EIA Report for Outlying Islands Sewerage Stage 2 - South Lantau Sewerage Works (Register No.: AEIAR-210/2017);
- ERM (1998) Fisheries Resources and Fishing Operations in Hong Kong Waters, for AFD;
- Marine Ecological Baseline Review Report for Improvement Dredging for Lamma Power Station Navigation Channel, submitted under Environmental Permit No. EP-535/2017; and
- Provision of Compensatory Marine Park for Integrated Waste Management Facilities at an Artificial Island near Shek Kwu Chau – Investigation (Agreement No. CE 14/2012 (EP)).

Findings of the review of these key sources is summarised in the following sections.

4A.4 Recognized Sites of Conservation Importance

There are no Special Areas or Conservation Areas that are relevant to marine ecology within and in the vicinity of the Study Area. Recognized sites of conservation importance include potential marine park at South Lamma, Sham Wan Site of Special Scientific Interest (SSSI) and the Sham Wan Restricted Area. These are further discussed below and their locations are provided in **Figure 4A.1**.

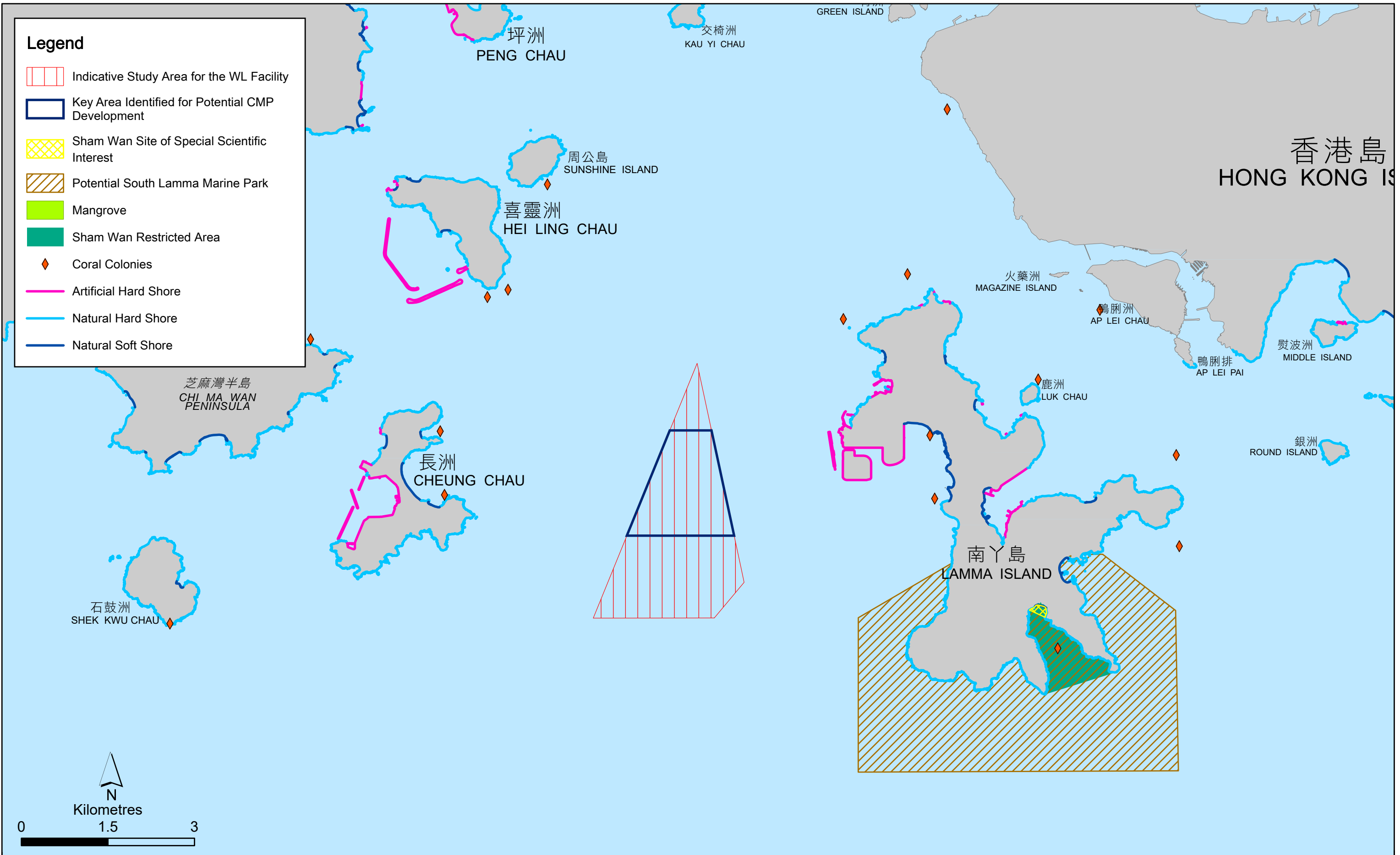


Figure 4A.1

Marine Habitats in the vicinity of the Study Area

4A.4.1 Potential South Lamma Marine Park

A study was conducted in 1999 to investigate the feasibility of designating South Lamma as a marine park ⁽²⁾. The study concluded that the coastal waters of South Lamma supported marine fauna of ecological value, mainly green turtles and finless porpoises. The indicative location of the potential South Lamma Marine Park is presented in **Figure 4A.1**. There is no information on the proposed timeline for designation of South Lamma Marine Park.

4A.4.2 Sham Wan SSSI

Designated in June 1999, the Sham Wan SSSI covers the sandy beach and adjoining shallow shore of about 4 ha at Sham Wan of South Lamma (**Figure 4A.1**), for important nesting sites for the locally and regionally rare green turtles. This SSSI is more than 3 km to the east of the Study Area.

4A.4.3 Sham Wan Restricted Area

Encompassed within the Sham Wan SSSI, 0.5 ha of the sandy beach at Sham Wan of South Lamma was designated as a Restricted Area under the *Wild Animals Protection Ordinance (Cap. 170)* in July 1999. The Sham Wan Restricted Area is more than 5 km to the east of the Study Area.

To strengthen the protection of the Green Turtle, with effect from 1 April 2021, AFCD has expanded the Restricted Area to cover about 98 hectares of waters in the bay of Sham Wan adjoining the beach as indicated in **Figure 4A.1** as well as extend the restricted period of this area to seven months each year (i.e. from 1 April to 31 October) for protection of nesting and breeding of green turtles.

4A.5 Intertidal Assemblages

Intertidal hard shores of Hong Kong display characteristic zonation patterns consisting of different algal and invertebrate species along the vertical gradient from terrestrial to marine environments. The Study Area mainly consists of hard shores (both natural shores and artificial shores) with some natural soft shores (e.g. sandy shores) as shown in **Figure 4A.1**. From the literature review, intertidal assemblages recorded in the vicinity of the Study Area are summarised in **Table 4A.1**. The species recorded were all very common and widespread species of Hong Kong.

Table 4A.1 Summary of Review on Intertidal Assemblages in the vicinity of the Study Area

Survey Period	Location (see Figure 4A.6)	Total No. of Species Recorded	Mean Abundance of Mobile Fauna and Sessile Flora and Fauna	Dominant Species
August 1998 (Wet Season)	Natural Rocky Shores (T1 – T6, L1)	37	125.6 individuals m ⁻² (Mobile Fauna) 39.8% m ⁻² (Sessile Flora & Fauna)	Chiton <i>Liolophura japonica</i> , the Limpets (<i>Cellana grata</i> , <i>C. toreuma</i> , <i>Patelloida pygmaea</i> , <i>P. saccharina</i> , <i>Siphonaria atra</i> and <i>S. sirius</i> , the snails <i>Monodonta labio</i> and <i>Planaxis sulcatus</i> , the nerites <i>Nerita albicilla</i> , <i>N. chamaeleon</i> , <i>N. costata</i> and <i>N. lineata</i> , littorinid snail <i>Echinolittorina radiata</i> , <i>E. trochoides</i> and <i>E. vidua</i> , the common dog whelks <i>Reishia clavigera</i> and <i>Morula musiva</i>

(2) AFCD (1999). Study on the Suitability of South Lamma to be Established as Marine Park or Marine Reserve.

Survey Period	Location (see Figure 4A.6)	Total No. of Species Recorded	Mean Abundance of Mobile Fauna and Sessile Flora and Fauna	Dominant Species
October 2008 (Wet Season)	Artificial Sloping Seawall (T7, T8 & T9)	23	38 individuals m ⁻² (Mobile Fauna) 13% m ⁻² (Sessile Flora & Fauna)	Littorinid snail <i>Echinolittorina</i> spp. in, the topshell <i>Monodonta labio</i> , the limpet <i>Cellana toreuma</i> , <i>C. toreuma</i> , <i>Siphonaria japonica</i> and <i>Patelloida saccharina</i> , the common dogwhelk <i>Reishia clavigera</i> , barnacle <i>Tetraclita squamosa</i> , the oyster <i>Saccostrea cucullata</i>
February 2009 (Dry Season)	Artificial Sloping Seawall (T7, T8 & T9)	22	64 individuals m ⁻² (Mobile Fauna) 21% m ⁻² (Sessile Flora & Fauna)	
May 2014 and September 2015 (Wet Season)	Artificial Sloping Seawall	23	60 individuals m ⁻² (Mobile Fauna) 33% m ⁻² (Sessile Flora & Fauna)	The sea roach <i>Ligia exotica</i> , the limpet <i>Patelloida pygmaea</i> , <i>Patelloida saccharina</i> , <i>Siphonaria japonica</i> and the encrusting alga <i>Hildenbrandia rubra</i>
November 2015 and January 2016 (Dry Season)	Artificial Sloping Seawall	21	37 individuals m ⁻² (Mobile Fauna) 33% m ⁻² (Sessile Flora & Fauna)	Littorinid snail <i>Echinolittorina radiata</i> , the topshell <i>Monodonta labio</i> , the limpet <i>Patelloida saccharina</i> , the chiton <i>Liolophura japonica</i> and the encrusting alga <i>Hildenbrandia rubra</i>
May 2014 and August 2015 (Wet Season)	Natural Rocky Shores at Lo So Shing and Ha Mei Tsui	47	80 individuals m ⁻² (Mobile Fauna) 30% m ⁻² (Sessile Flora & Fauna)	Littorinid snail <i>Echinolittorina radiata</i>
November 2015 and January 2016 (Dry Season)	Natural Rocky Shores at Lo So Shing and Ha Mei Tsui	34-39	70 individuals m ⁻² (Mobile Fauna) 30% m ⁻² (Sessile Flora & Fauna)	Littorinid snail <i>Echinolittorina radiata</i> , topshell <i>Monodonta labio</i> , encrusting alga <i>Hildenbrandia rubra</i>
August 2016 (Wet Season) and February 2017 (Dry Season)	Artificial Sloping Seawall (T7, T8 & T9)	20-22	10.4 - 14.2 individuals m ⁻² (Mobile Fauna) 13.4 – 18.9% m ⁻² (Sessile Flora & Fauna)	Limpets <i>Patelloida</i> spp., barnacles <i>Capitulum mitella</i> and <i>Tetraclita</i> spp.

4A.6 Coral Communities

Coral communities are commonly regarded as the most ecologically important and valuable subtidal hard bottom assemblages. The AFCD report that there are over 80 species of corals recorded in Hong Kong waters ⁽³⁾. The general trend for coral communities in Hong Kong is one of increasing abundance and diversity from west to east with the greatest diversity and abundance generally found in the eastern waters of Hong Kong. It has been suggested that the distribution of corals is primarily controlled by hydrodynamic conditions, in particular salinity level, turbidity and light penetration.

The western waters of Hong Kong, including the Deep Bay WCZ, North Western WCZ, North Western Supplementary WCZ, Second Southern Supplementary WCZ and western part of the Southern WCZ (i.e. southern waters of Lantau Island), are influenced by the Pearl River Estuary which reduces salinities, increases turbidity and therefore reduces light penetration. Due to the requirements for coral growth, the cumulative effect of these conditions results in sub-optimal conditions for recruitment and survival of most coral. Corals are therefore much less abundant and diverse in Hong Kong's western waters than eastern waters. Unlike the hermatypic hard corals, ahermatypic octocorals (including gorgonians, soft corals and black corals) which do not require light for zooxanthellae photosynthesis, are more widely distributed in western waters and often occur at greater depths.

Coral communities have been recorded in the vicinity of the Study Area and the records are summarised in **Table 4A.2**. The indicative locations of coral communities are presented in **Figure 4A.1**.

Table 4A.2 Summary of Review on Coral Communities in the vicinity of the Study Area

Source	Location	Summary of findings
AFCD (2004)	Intensive surveys in 2001-2002 to survey corals at 240 sites covering about 70 km of coastline in territorial waters	Hard corals were found in western waters of Hong Kong, but limited to southern Lantau waters (Tong Fuk, Soko Islands) and eastern (Cheung Chau, Hei Ling Chau) Lantau waters. Only sparse colonies or low-coverage communities composed of extremely tolerant and species were found
ERM (2010)	Seawall of LPS Extension and submarine cable route	A total of three (3) hard corals were identified on the seawall, including <i>Oulastrea crispata</i> , <i>Porites</i> sp. and ahermatypic cup coral under Family Dendrophyllidae. The coverage are generally low with <5% on the seawall. The seabed along the submarine cable route was mainly comprised of soft substrata and they were only sparsely colonized on the hard substrata. Octocorals <i>Echinomuricea</i> sp., <i>Menella</i> sp. and <i>Dendronephthya</i> sp. and black coral <i>Cirripathes</i> sp. were recorded on the dumped materials along the submarine cable route.
Mott MacDonald (2017)	Seawall of LPS Extension and natural shores along the	At the sloping artificial seawalls along the LPS Extension, only one hard coral species, <i>Oulastrea crispata</i> , was recorded with low coral cover (<1%). Soft corals were also

(3) Chan A, Choi C, McCorry D, Chan K, Lee MW, Put A Jr (2005) *Field Guide to Hard Coral of Hong Kong*. Friends of the Country Parks

Source	Location	Summary of findings
	western coast of Lamma Island	recorded including <i>Dendronephthya gigantea</i> , <i>Echinomuricea</i> spp., <i>Echinogorgia</i> sp. and <i>Carijoa</i> sp.. A total of 18 hard coral species were recorded at the natural shores along the western coast of Lamma. Coral cover was, however, low in general (<1% to <5% cover).
ERM (2018)	Artificial seawall of LPS	The site comprised large boulders and the toe of the seawall was covered with a layer of mud. On the hard substrata, algae were absent and sessile benthos comprised of isolated barnacles. Only sparse colonies of hard coral <i>Duncanopsammia peltata</i> , <i>Porites</i> sp. and <i>Oulastrea crispata</i> , ahermatypic hard coral <i>Tubastrea</i> / <i>Dendrophyllia</i> sp. and <i>Balanophyllia</i> sp. and octocoral colonies <i>Dendronephthya</i> sp., <i>Echinomuricea</i> sp. and <i>Menella</i> sp./ <i>Paraplexaura</i> sp. were identified. The coral cover was low (<5%).

4A.7 Subtidal Soft Bottom Assemblages

4A.7.1 Epifaunal Assemblages

Subtidal epifauna are organisms (> 1 mm in size) living either on or within the surface sediments of the seabed. Due to the nature of the Hong Kong's fishery and the typical subtidal substratum in Hong Kong being soft bottom (sandy or silty) habitat, data on subtidal epifaunal assemblages in Hong Kong are primarily available from studies on fisheries resources, collected by trawling surveys.

Information on the epifaunal assemblages of the Study Area have been taken from the AFCD-commissioned study on Fisheries Resources and Fishing Operations in Hong Kong ⁽⁴⁾. Trawl surveys undertaken as part of AFCD's study indicated that the highest biomasses recorded in the waters were contributed by mantis shrimp (e.g. *Oratosquilla oratoria*) which are common and widespread species. Other common species recorded during the trawl surveys were croakers (e.g. *Collichthys lucida*, *Johnius belangerii*, etc.) (near South Cheung Chau and Soko Islands) and blood cockle (e.g. *Anadara granosa*) (near South Lantau).

Overall, findings from the previous surveys suggested that the epifaunal assemblages of the Study Area are dominated by common and widespread species.

4A.7.2 Infaunal Assemblages

Subtidal infauna are organisms (> 0.5 mm in size) living either on or within the surface sediments of the seabed. In order to provide an indication of the potential ecological value of the infaunal assemblages around the Study Area in the context of seabed of Hong Kong waters, it is considered useful to review studies that have investigated infaunal assemblages in Hong Kong on a wide scale. Territory-wide surveys of Hong Kong subtidal infauna assemblages were conducted in 2001 ⁽⁵⁾. Findings of the surveys indicated that the benthic assemblages around the Study Area were mainly bivalves and polychaetes which were typical of Hong Kong waters and no species of conservation importance were found.

(4) ERM (1998) Fisheries Resources and Fishing Operations in Hong Kong Waters, for AFD.

(5) CityU Professional Services Limited (2002) Agreement No. CE 69/2000 *Consultancy Study on Marine Benthic Communities in Hong Kong*, for AFCD.

From the territory-wide surveys conducted in 2001, amphioxus *Branchiostoma belcheri* were not recorded in the vicinity of the Study Area. This species is regarded as a living fossil link in the evolution of marine invertebrates to vertebrates ⁽⁶⁾ and is listed as Class II protection species in China ⁽⁷⁾ due to over-exploitation, thus it is considered as a species with conservation importance.

4A.7.3 Horseshoe Crabs

Two species of horseshoe crab, *Tachypleus tridentatus* and *Carcinoscorpius rotundicauda*, have previously been recorded in around Hong Kong waters, whilst a third species of horseshoe crab *Tachypleus gigas* was not recorded in Hong Kong since March 1995 and its local status is uncertain, likely to be locally extinct ⁽⁸⁾ ⁽⁹⁾. Juvenile horseshoe crabs can be found at mudflats at Ha Pak Nai/ Pak Nai in Deep Bay, and on intertidal sandy shores or mudflats at Tai Ho Bay, Tung Chung Bay, San Tau, Hau Hok Wan, Sha Lo Wan, Sham Wat Wan, Yi O and Shui Hau, Lantau Island ⁽¹⁰⁾⁽¹¹⁾⁽¹²⁾⁽¹³⁾⁽¹⁴⁾. In the vicinity of the Study Area, there was a historical record of juvenile horseshoe crabs in Sok Kwu Wan of Lamma Island back in a study from 1995 to 1998 ⁽¹⁵⁾. However, there is no recent record of horseshoe crabs or confirmed nursery sites for horseshoe crabs in the vicinity of the Study Area.

4A.8 Marine Mammals

A total of 18 (and possibly up to 20) species of marine mammals (mostly cetaceans) have been recorded in Hong Kong waters (including one humpback whale sighted in 2009, one stranding of Omura's whale in 2014, one shortfin pilot whale sighted in 2015 and 2 false killer whale pods sighted in 2014 and 2020), two of which are considered residents, which are Finless Porpoise (FP) *Neophocaena phocaenoides* and the Chinese White Dolphin (CWD) *Sousa chinensis*. FP are mainly distributed in southern and eastern waters of Hong Kong, while CWD are mainly distributed in western and southwestern waters of Hong Kong. As the Study Area is located in southern waters of Hong Kong within the habitats utilized by FP, the following context focusses on FP.

FP is a tropical/ sub-tropical cetacean widely distributed in coastal marine waters, as well as some river mouths and estuaries, from the Arabian/Persian Gulf eastwards around the rim of the Indian Ocean to the Taiwan Strait area in southern Japan. It is protected locally by the *Wild Animals Protection Ordinance (Cap. 170)*, and is listed as "Vulnerable" in the IUCN Red List of Threatened Species ⁽¹⁶⁾. FP is also listed in CITES Appendix I (i.e. highest protection), and is listed as "Grade II National Key Protected Species" in China. As such FP is considered a species of conservation importance, both locally in Hong Kong and regionally in China and across the Asia Pacific.

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- (6) AFCD Marine Benthic Communities Website. Available at http://www.afcd.gov.hk/english/conservation/con_mar/con_mar_mar/con_mar_mar_ben/con_mar_mar_ben3.html
- (7) Huang, Z.G. (ed.) (2006). Diversity of Species in Xiamen Bay, China. Ocean Press, Beijing, China, 587 pp.
- (8) Chin, H. M., & Morton, B. (2000). The distribution of horseshoe crabs (*Tachypleus tridentatus* and *Carcinoscorpius rotundicauda*) in Hong Kong. *Asian Marine Biology* 16, 10, 185-196.
- (9) AFCD (2020): Horseshoe crabs in Hong Kong website. Available at http://www.afcd.gov.hk/english/conservation/con_mar/con_mar_hor/con_mar_hor.html.
- (10) Shin PKS, Li HY, Cheung SG (2009) *Horseshoe Crabs in Hong Kong: Current Population Status and Human Exploitation*. Biology and Conservation of Horseshoe Crabs. Springer US. 347-360.
- (11) Morton B, Lee CN (2011) *Spatial and temporal distribution of juvenile horseshoe crabs (Arthropoda: Chelicerata) approaching extinction along northwestern shoreline of the New Territories of Hong Kong SAR, China*. *Journal of Natural History* 45:227-251.
- (12) ARUP (2009) *Environmental Impact Assessment of the Hong Kong - Zhuhai - Macao Bridge Hong Kong Link Road*. Prepared for Highways Department.
- (13) ARUP (2009) *Environmental Impact Assessment of the Hong Kong - Zhuhai - Macao Bridge Hong Kong Boundary Crossing Facilities*. Prepared for Highways Department.
- (14) Mott McDonald (2014) *Environmental Impact Assessment of the Expansion of Hong Kong International Airport into a Three-Runway System. (EIA Study Brief ESB-250/2012)*. Prepared for Airport Authority Hong Kong.
- (15) Chiu HMC, Morton B (1999a) The biology, distribution and status of horseshoe crabs, *Tachypleus tridentatus* and *Carcinoscorpius rotundicauda* (Arthropoda: Chelicerata) in Hong Kong: Recommendations for conservation and management. Final Report. The Swire Institute of Marine Science, The University of Hong Kong
- (16) Wang, J.Y., Reeves, R. (2017). *Neophocaena phocaenoides*. The IUCN Red List of Threatened Species 2017: e.T198920A50386795. <http://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T198920A50386795.en>.

Studies on the distribution, abundance, habitat use, life history and behaviour of FP in Hong Kong have been undertaken since 1998. AFCD estimate indicated that there were at least 147 porpoises occurring in Chinese waters just south of Hong Kong, which makes the minimum population size estimate to be 217 animals ⁽¹⁷⁾.

In Hong Kong, FP occur year-round, and they can be found primarily in the southern (i.e. Po Toi, Lamma, Southeast and Southwest Lantau) and eastern (i.e. Mirs Bay, Sai Kung and Ninepins) waters of the territory ⁽¹⁸⁾ ⁽¹⁹⁾. The majority of porpoise sightings have been made to the south of Soko Islands and Cheung Chau, around Shek Kwu Chau, and between the waters of Soko Islands and Shek Kwu Chau. These areas are thus considered to be the main habitats for FP. The only area where FP and CWD showed overlap in distribution was in South Lantau waters especially around Soko Islands. A study adopting acoustic approach conducted in South Lantau, Southeast Lantau and East Lantau waters between 2018 and 2020 also showed that FPs were acoustically detected mainly around Soko Islands, South of Cheung Chau and between the waters of Soko Islands and Shek Kwu Chau ⁽²⁰⁾.

Seasonal variation in distribution is evident for FP in Hong Kong. FP move into the waters of south Lantau and Lamma in winter (from December to February), and peak abundance was recorded in spring (from March to May) when significant numbers occurred in southern waters. During summer (from June to August), FP generally vacated the waters of south Lantau and Lamma and moved to Po Toi, Ninepins and Sai Kung, and abundance appears to reach a low point in autumn (from September to November) ⁽²¹⁾. Their abundance in Hong Kong waters ranges from a high of approximately 152 individuals in spring to approximately 55 in autumn ⁽²²⁾.

A review of long-term marine mammal monitoring data conducted by AFCD up to the year of 2021 has been conducted ⁽²³⁾. The results showed that FP were mainly sighted to the south of Tai A Chau, Shek Kwu Chau, south of Cheung Chau and at the offshore waters between Shek Kwu Chau and the Soko Islands as important porpoise habitats during dry season and at Po Toi Islands and at the juncture of Po Toi and Ninepins areas during wet season. In Lamma waters, a low density of FP was sighted during wet and dry seasons within and in the vicinity of the Study Area during 2016-2020 (**Figure 4A.2**).

4A.9 Sea Turtles

Of the seven extant species of sea turtles, loggerhead turtle (*Caretta caretta*), leatherback turtle (*Dermochelys coriacea*), hawksbill turtle (*Eretmochelys imbricata*), olive ridley turtle (*Lepidochelys olivacea*) and green turtle (*Chelonia mydas*), have been reported to occur in the waters of Hong Kong ⁽²⁴⁾. However, green turtle is the only species confirmed to nest in Hong Kong ⁽²⁵⁾.

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- (17) AFCD (2020). Finless Porpoise. Available at: http://www.afcd.gov.hk/english/conservation/con_mar/con_mar_fin/con_mar_fin_fin/con_mar_fin_fin_dis_howmany.html
- (18) Jefferson TA, Braulik G T (1999) Preliminary report on the ecology of the finless porpoise in Hong Kong waters. *IBI Reports* 9: 41-54
- (19) Jefferson TA, Hung SK, Law L, Torey M, Tregenza N (2002) Distribution and abundance of finless porpoises in Hong Kong and adjacent waters of China. *Raffles Bulletin of Zoology* 10: 43-55.
- (20) SMRU Hong Kong (2021). What Do Dolphins Do At Night? MEEF2018010A Final Report. Funded by the Marine Ecology Enhancement Fund.
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- (25) Nesting refers to the laying of clutches of eggs by female turtles on their natal beaches. Female turtles usually migrate (up to thousands of kilometres) from their resident foraging areas to a coastal area, ie nesting beach, for nesting. Adult females return to their natal areas for breeding and both males and females show strong fidelity to their nesting and foraging areas

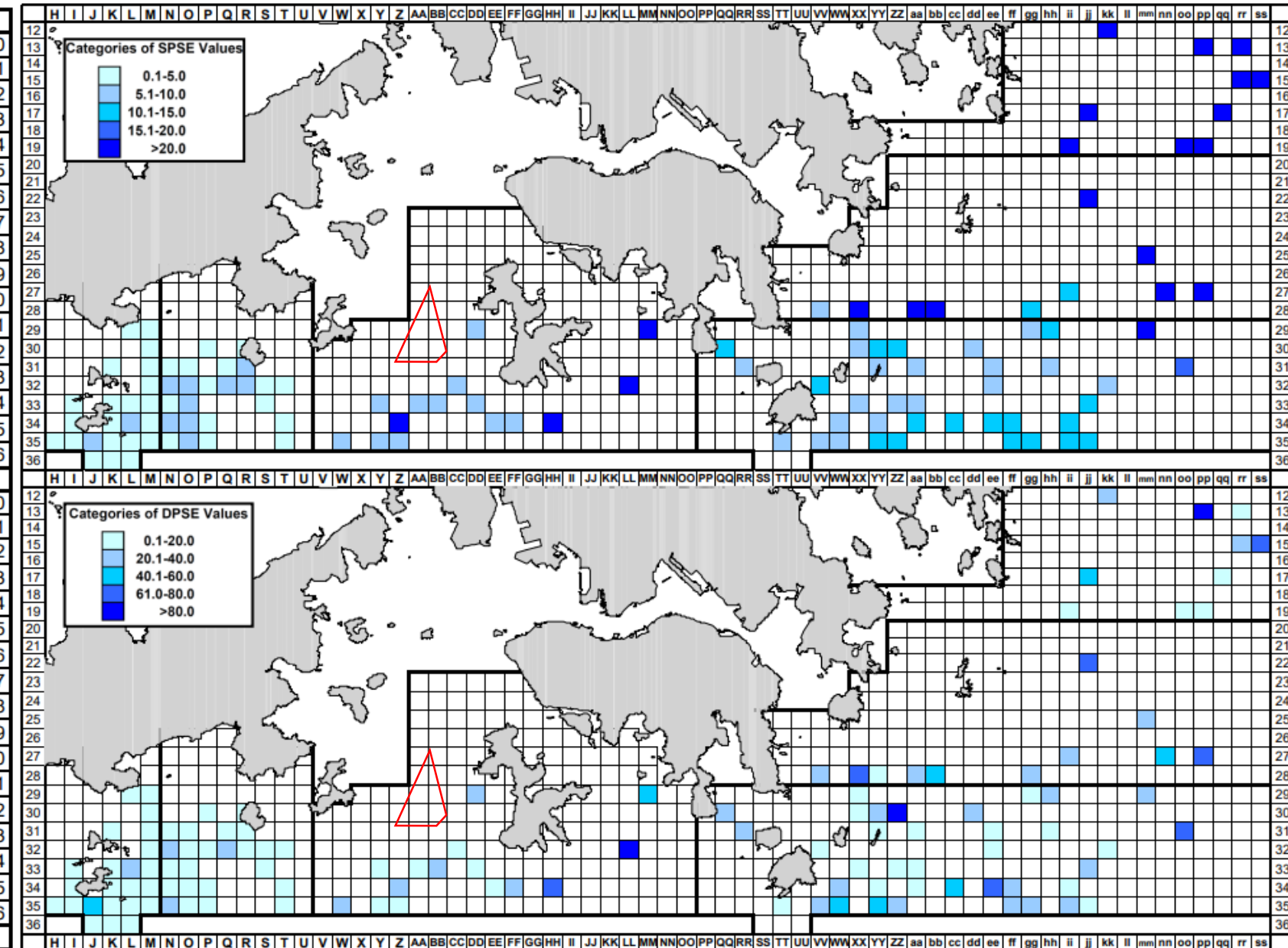
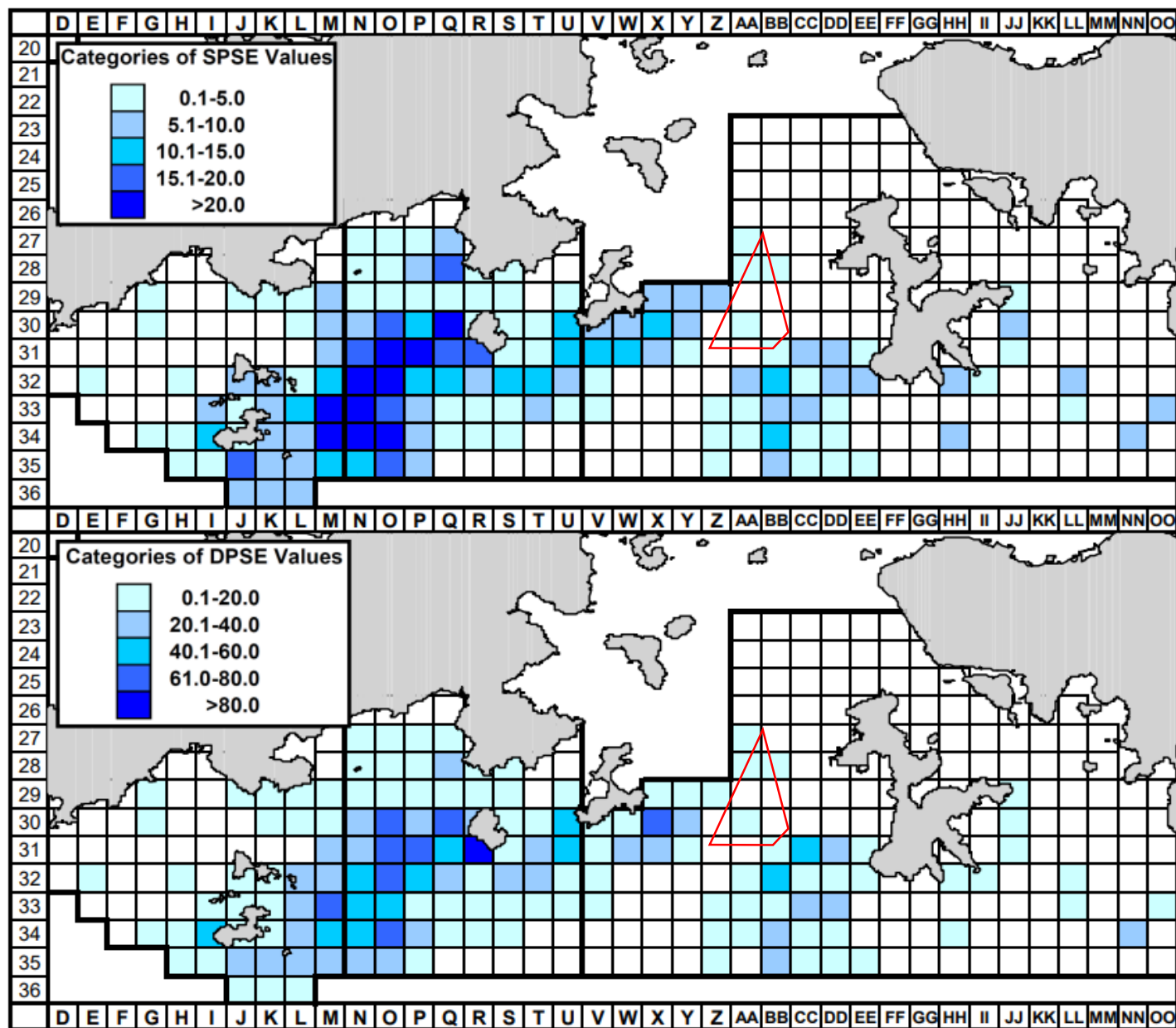


Figure 16. Density of finless porpoises with corrected survey effort per km² in southern waters of Hong Kong during dry season (December to May), using data collected during 2016-20 (SPSE = no. of on-effort porpoise sightings per 100 units of survey effort; DPSE = no. of porpoises per 100 units of survey effort)

Figure 17. Density of finless porpoises with corrected survey effort per km² in southern and eastern waters of Hong Kong during wet season (June to November), using data collected during 2016-20 (SPSE = no. of on-effort porpoise sightings per 100 units of survey effort; DPSE = no. of porpoises per 100 units of survey effort)

Green turtle *Chelonia mydas* is protected locally by the *Wild Animals Protection Ordinance (Cap. 170)*, and is listed as "Endangered" in the IUCN Red List of Threatened Species ⁽²⁶⁾. It is also listed in CITES Appendix I (i.e. highest protection), and is listed as "Critically Endangered" on the China Species Red List and a "Grade II National Key Protected Species" in China. As such green turtle is considered a species of conservation importance locally, regionally and globally.

The major nesting site for green turtles in Hong Kong is at Sham Wan, southern Lamma Island, which is over 5 km from the Study Area ⁽²⁷⁾⁽²⁸⁾⁽²⁹⁾. A small number of green turtles are known to nest at Sham Wan, although nesting does not occur every year. Some five green turtles were observed at Sham Wan in the nesting seasons between 1998 and 2012 ⁽³⁰⁾. The last record of green turtle nesting at Sham Wan was in 2012 when five clutches of eggs were laid, though none hatched ⁽³¹⁾.

Satellite tracking of female green turtles nesting at Sham Wan beach has been undertaken since 2002 to examine their regional migration patterns. Results of the tracking showed that the same nesting female (named "Hong Kong 2") tracked in June 2003, August 2008 and August 2012 used the waters close to Sham Wan, in the south and southeast of Lamma Island, between subsequent clutches (**Figures 4A.3-4A.5**). She maintained a distance of within 10 km of the beach during inter-nesting periods for just over two months before migrating back to foraging grounds in the coastal waters of Dao Bach Long Vi, Vietnam ⁽³²⁾.

Satellite tracking of a foraging green turtle in the Gangkou Sea Turtle National Nature Reserve populations in China indicated that it moved from its foraging grounds in Daya Bay to Wanshan Archipelago ⁽³³⁾, migrating past or through Hong Kong, by Basalt Island, Tung Lung Chau and other parts of Hong Kong waters, between nesting and foraging grounds. Another tracking study conducted on post-nesting green turtles populations in Taiwan also indicated that the turtles often utilise several coastal areas as temporal residential foraging sites as far as to the east coast of China ⁽³⁴⁾.

Apart from the nesting records at Sham Wan, nesting of green turtles has been recorded in Shek Pai Wan and Tung O on Lamma Island, Tai Wan in Sai Kung and Tai Long Wan in Shek O in the last two decades ⁽³⁵⁾. The most recent nesting of green turtle was reported on a beach on Lantau Island in October 2016 ⁽³⁶⁾. It indicated that the turtle may use the sandy shores in South Lantau. However, no systematic survey or satellite tracking survey have been conducted on the turtles that occurred in Lantau Island and in Sai Kung. Recent news records reported green turtles in Northeastern waters and Lantau waters, including a live adult female in Tai Po in December 2012 ⁽³⁷⁾, three juvenile turtles at Pak Lap Beach and Silverstrand Beach in Sai Kung and a refuse collection depot on Tin Hau

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(36) <http://www.ejinsight.com/20170904-marine-garbage-likely-to-keep-green-turtles-from-returning-to-hk/>

(37) <http://www.scmp.com/news/hong-kong/article/1138275/endangered-green-turtle-caught-tai-po-returned-sea>

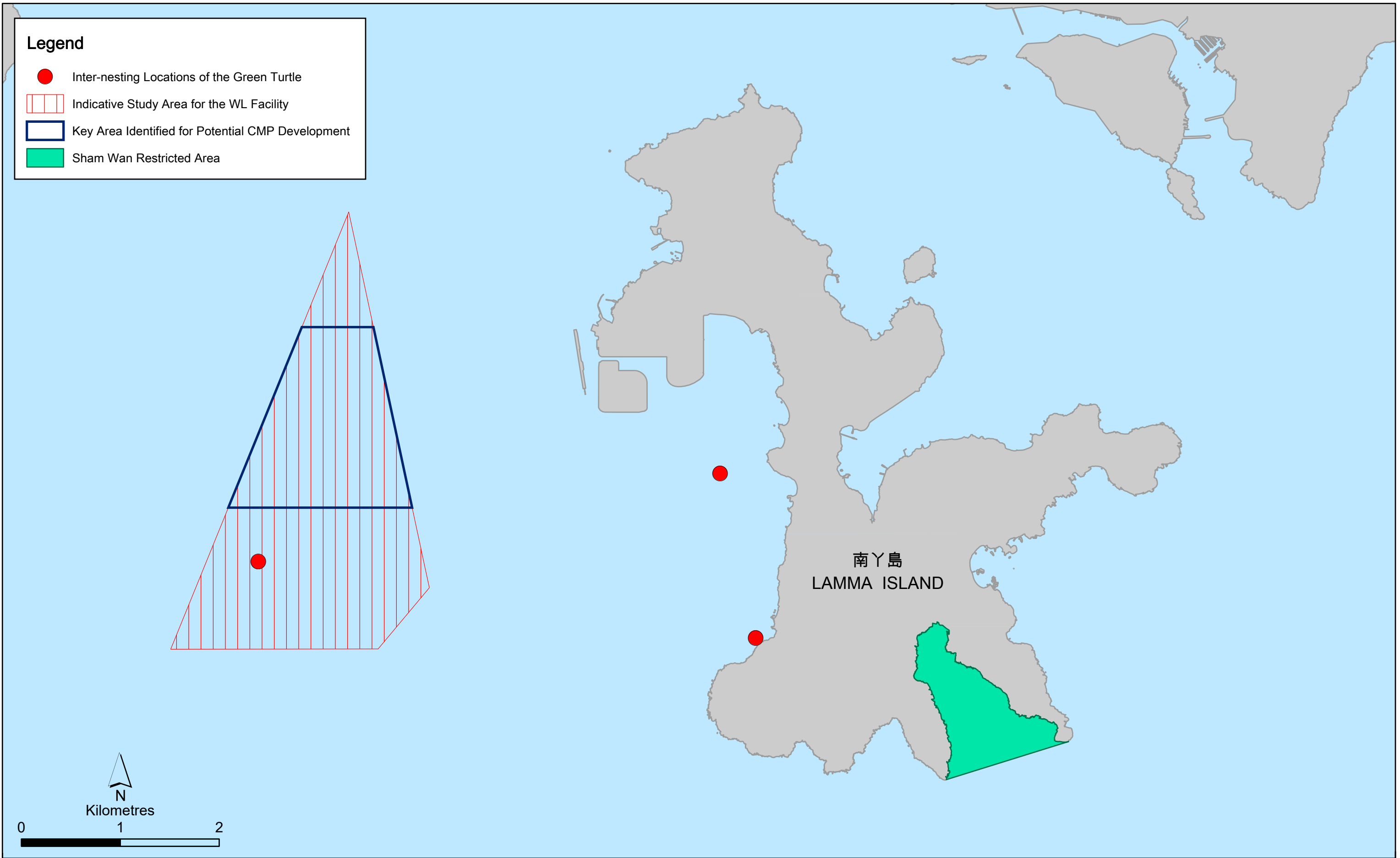


Figure 4A.3

Inter-nesting locations (red dots) from June 25 to September 4, 2003 of the green turtle (named “Hong Kong 2”) that nested on Sham Wan, Lamma Island. Map provided by AFCD

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Date: 6/12/2021

Environmental
Resources
Management



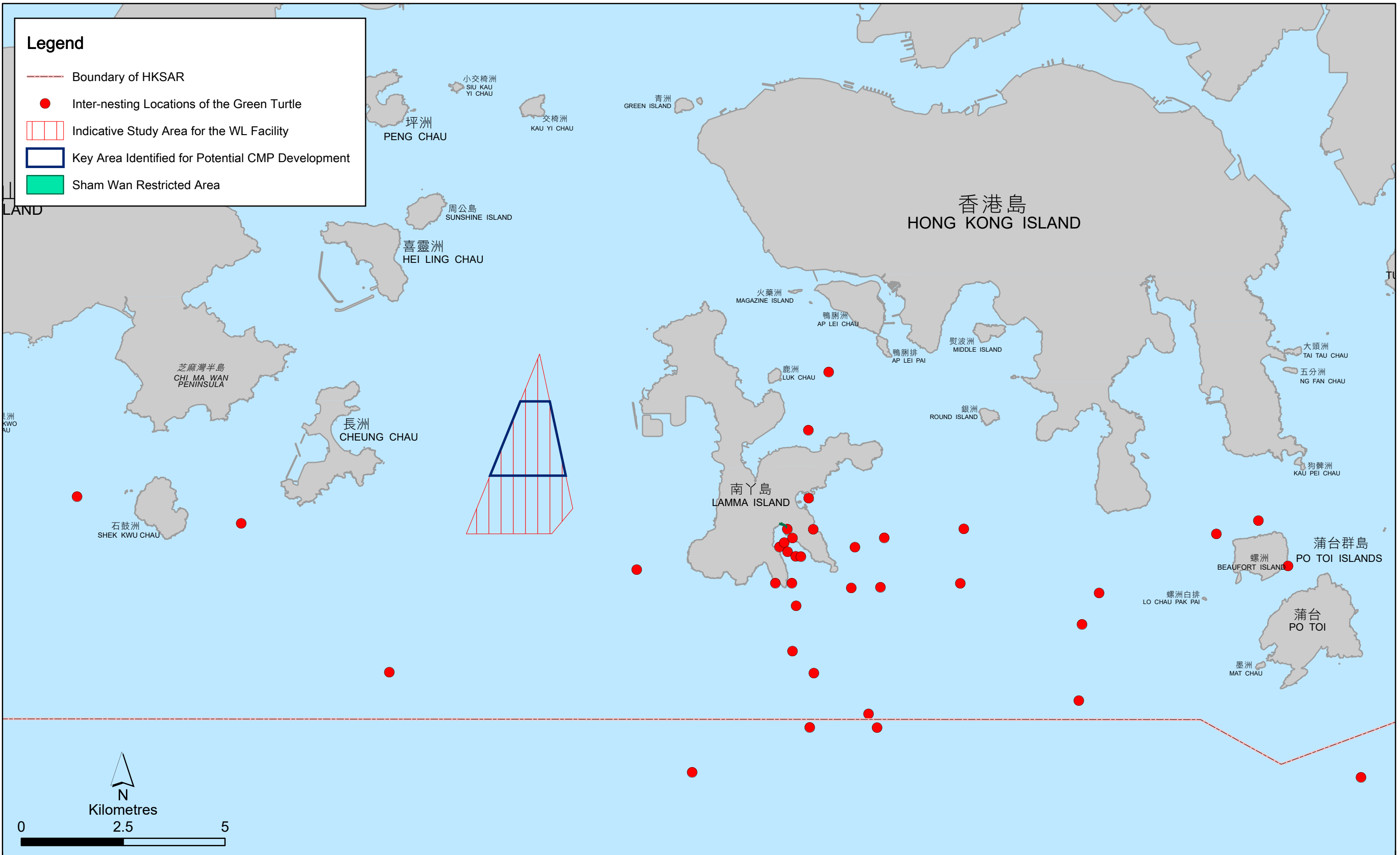


Figure 4A.4 Inter-nesting locations (red dots) from August 9 to October 12, 2008 of the green turtle (named “Hong Kong 2”) that nested on Sham Wan, Lamma Island. Map provided by AFCD

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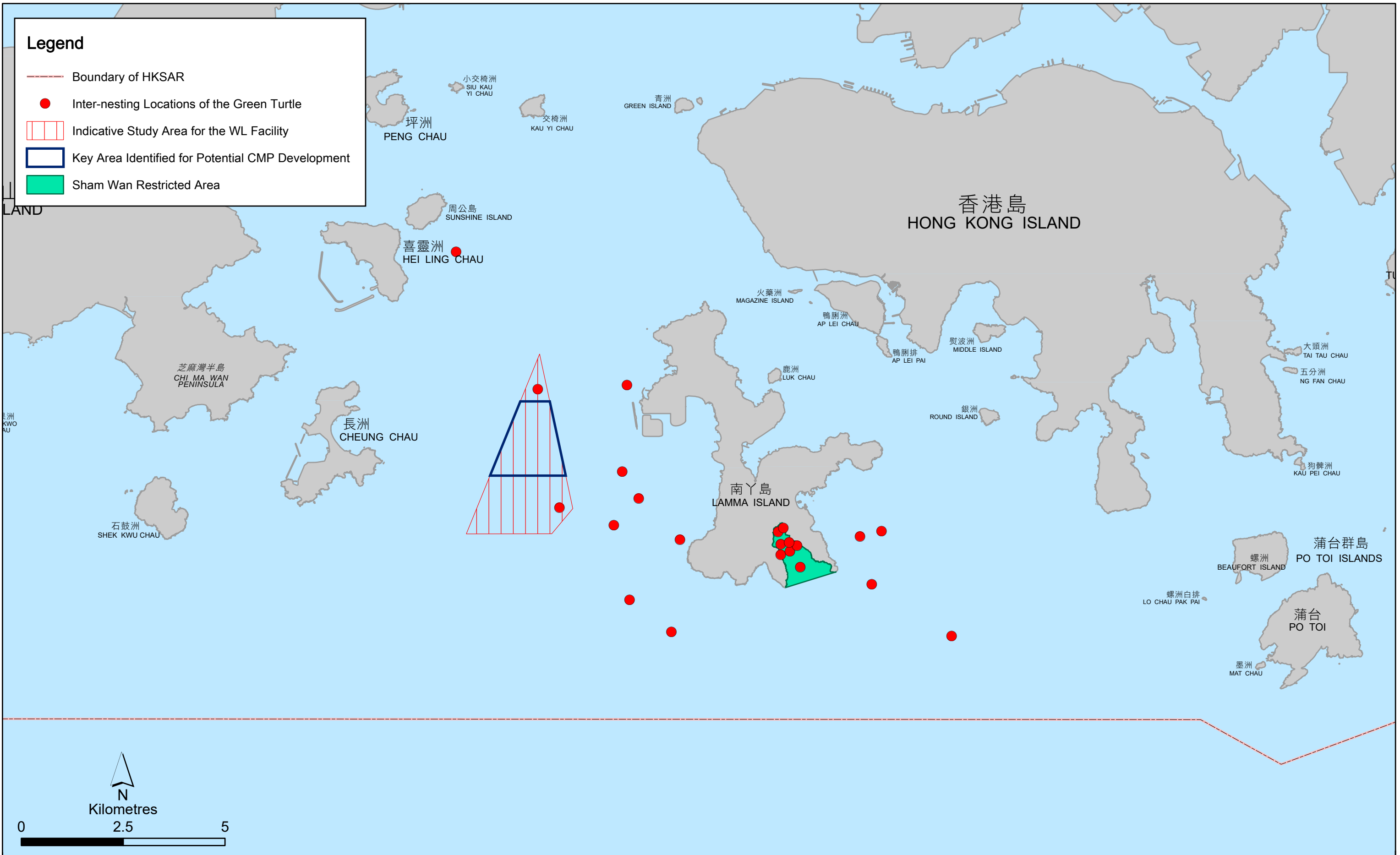





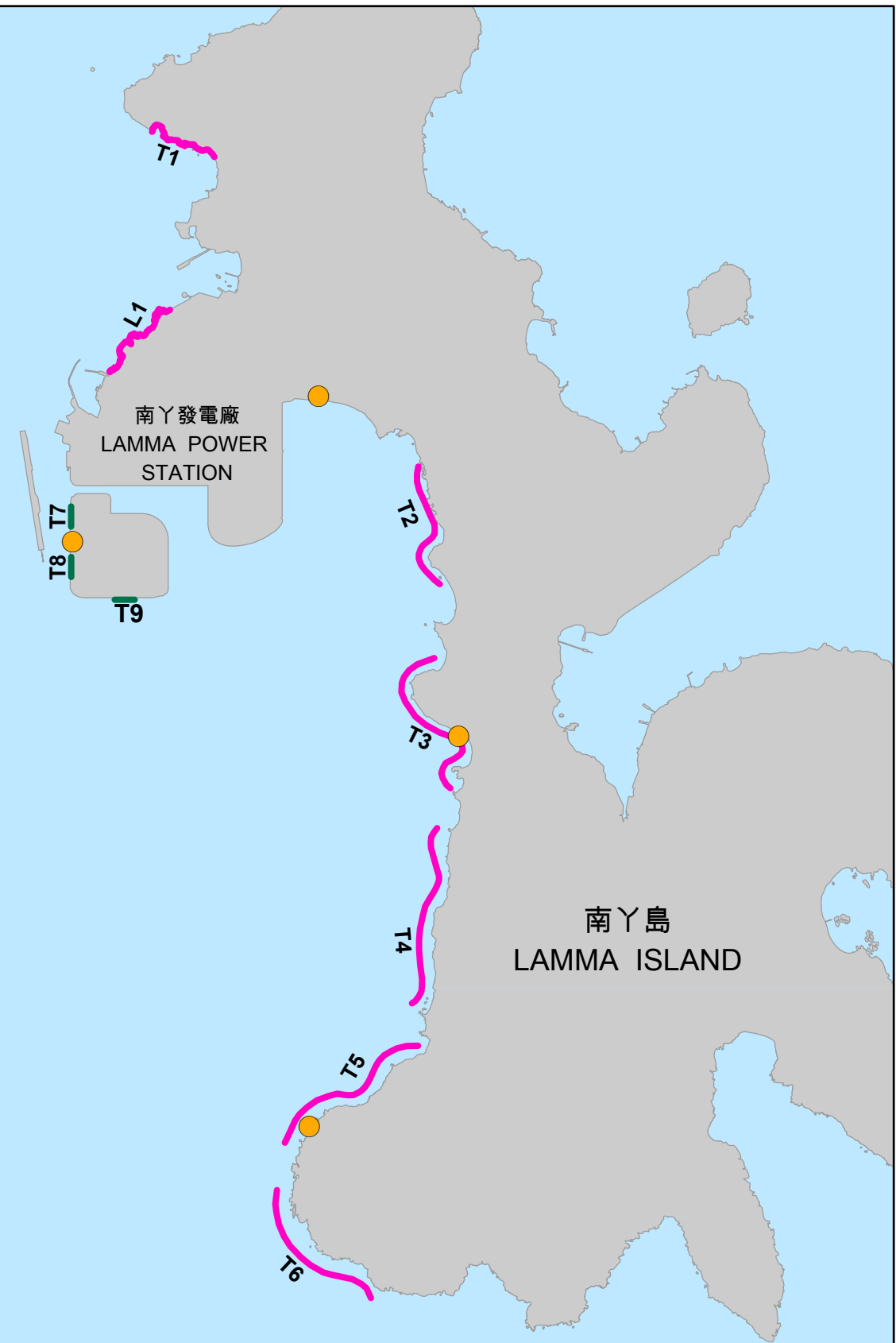
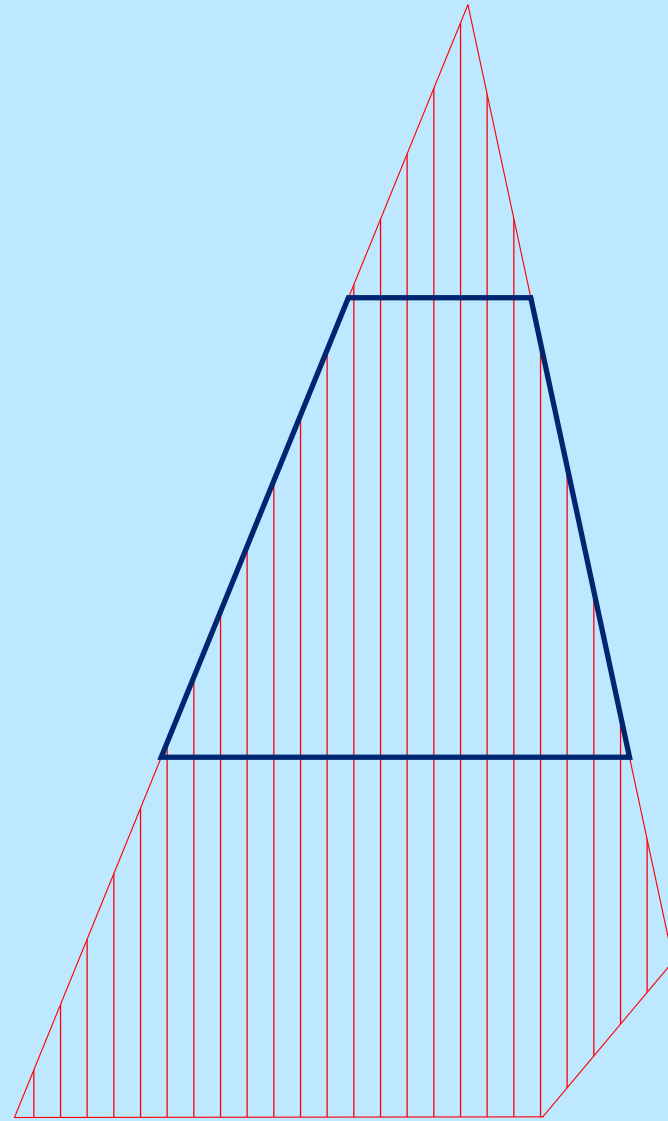


Figure 4A.5

Inter-nesting locations (red dots) from August 14 to September 30, 2012 of the green turtle that nested on Sham Wan, Lamma Island. Map provided by AFCD

Legend

-  Indicative Study Area for the WL Facility
-  Key Area Identified for Potential CMP Development
-  Intertidal Survey Transect in 1998
-  Intertidal Survey Transect in 2008-2009 and 2016-2017
-  Intertidal Survey in 2014 to 2016



Kilometres



Figure 4A.6

Previous Intertidal Survey Transect in Lamma Power Station
(Reproduced from ERM (1998, 2008 to 2009 and 2014 to 2017))

Temple Street in North Point in 2014 to 2016⁽³⁸⁾, a dead individual with marine debris inside its stomach on Pak Lap Beach in Sai Kung in October 2015⁽³⁹⁾, a dead juvenile turtle entangled with fishing net in Pui O Wan in January 2016⁽⁴⁰⁾ and a tagged individual (HK303) in Tai She Wan in Sai Kung in November 2017⁽⁴¹⁾. A green turtle was rescued in the waters of South Lantau in January 2021 and was then released into the southern waters of Hong Kong on 25 June 2021 with satellite transmitter attached to its carapace for tracking the movement and feeding grounds of the green turtle for future identification and monitoring⁽⁴²⁾. Another green turtle was rescued in the Yung Shue Au Fish Culture Zone in July 2021 and was then released into the southern waters of Hong Kong on 29 October 2021 with satellite transmitter attached to its carapace for tracking the movement and feeding grounds of the green turtle for future identification and monitoring⁽⁴³⁾.

Overall, it was reported that the nesting population of green turtles in Hong Kong was relatively small, while the potential for occurrences of this species in the Study Area exist as Hong Kong lies within the wider Pacific region where green turtles use as nesting, inter-nesting and foraging habitats⁽⁴⁴⁾⁽⁴⁵⁾.

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- (43) AFCD: Press Release. Available at: https://www.afcd.gov.hk/english/publications/publications_press/pr2490.html
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