Expansion of Hong Kong International Airport into a Three-Runway System

Chinese White Dolphin Baseline Monitoring Report

Airport Authority Hong Kong

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This Chinese White Dolphin Baseline Monitoring Report

has been reviewed and certified by

the Environmental Team Leader (ETL) in accordance with

Condition 3.4 of Environmental Permit No. EP-489/2014.

Certified by:

Terence Kong
Environmental Team Leader (ETL)
Mott MacDonald Hong Kong Limited

Date 15 July 2016

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By Email

Airport Authority Hong Kong
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Attn: Mr. Lawrence Tsui, Senior Manager

15 July 2016

Dear Sir,

Contract No. 3102
3RS Independent Environmental Checker Consultancy Services

Baseline Chinese White Dolphin Monitoring Report

Reference is made to the Environmental Team's submission of Baseline Chinese White Dolphin Monitoring Report under Condition 3.4 of the Environmental Permit No. EP-489/2014 certified by the ET Leader on 15 July 2016.

We would like to inform you that we have no further comment on the captioned submission. Therefore we write to verify the captioned submission in accordance with the requirement stipulated in Condition 1.9 of EP-489/2014.

Should you have any query, please feel free to contact our Isabella Yeung at 3922 9348 or the undersigned at 3922 9376.

Yours faithfully,
AECOM Asia Co. Ltd.

Jackel Law
Independent Environmental Checker

Contents

Tables

Figures

Appendices

1 Introduction

1.1 Background

On 7 November 2014, the Environment Impact Assessment (EIA) for the proposed "Expansion of Hong Kong International Airport into a Three-Runway System" (AEIAR-185/2014, hereafter referred to as "the Project") was approved and an Environmental Permit (EP) (EP-489/2014) for the construction and operation of the Project was issued by the Environmental Protection Department (EPD).

On 29 April 2016, Airport Authority Hong Kong (AAHK) received the Chief Executive-in-Council's approval for draft Chek Lap Kok Outline Zoning Plan, as well as the authorization of the reclamation under the Foreshore and Sea-bed (Reclamations) Ordinance for the expansion of Hong Kong International Airport (HKIA) into a three-runway system.

Mott MacDonald Hong Kong Limited (MMHK) was commissioned by the AAHK to undertake the role of Environmental Team (ET) for carrying out the Environmental Monitoring and Audit (EM&A) works during the construction phase of the Project in accordance with the Updated EM&A Manual. A six-month baseline monitoring on Chinese White Dolphin (CWD, also known as the Indo-Pacific Humpback Dolphin, *Sousa chinensis*) was proposed under the Updated EM&A Manual before the commencement of land-formation related construction works. This CWD baseline monitoring report has the aim of summarising the findings of the baseline monitoring results to establish pre-construction conditions prior to the commencement of the marine construction works. The values of Action and Limit Levels for CWD monitoring during the construction of the project are proposed based on the findings of this baseline report for consolidating the Event Action Plan as part of the EM&A.

1.2 Project Description

The project covers the expansion of the existing airport into a three-runway system (3RS) with key project components comprising land formation of about 650 ha and all associated facilities and infrastructure including taxiways, aprons, aircraft stands, a passenger concourse, an expanded Terminal 2, all related airside and landside works and associated ancillary and supporting facilities. The existing submarine aviation fuel pipelines and submarine power cables also require diversion as part of the works.

Construction will proceed in the general order of diversion of the submarine aviation fuel pipelines, diversion of the submarine power cables, land formation, and construction of infrastructure, followed by construction of superstructures. The land-based construction works of horizontal directional drilling (HDD) for diversion of the submarine aviation fuel pipelines were commenced on 28 December 2015 on the airport island. Other construction works are targeted to commence from 1 August 2016.

1.3 Purpose of this Report

This Chinese White Dolphin Baseline Monitoring Report is submitted to fulfil the requirements stated in Sections 10.2.3, 10.2.4, 10.5 and 10.6.1 of the Updated EM&A Manual and the baseline monitoring has been undertaken based on the approach and methodology presented in the Updated EM&A Manual. The Action and Limit Levels for CWD were established based on the review of historical information and the recent data collected under this baseline study.

2 Baseline Monitoring Methodology

2.1 Introduction

The CWD baseline monitoring was undertaken between 18 December 2015 and 17 June 2016, covering small vessel line-transect surveys, land-based surveys and theodolite tracking, and passive acoustic monitoring. This section provides the details of baseline monitoring methodology for the CWD.

2.2 Small Vessel Line-transect Surveys

Small vessel line-transect surveys provided data for density and abundance estimation and other assessments using distance-sampling methodologies, specifically, line-transect methods. These surveys also included photo-identification of individual dolphins within the monitoring area when conditions were suitable, to provide data on individual use of this specific area. Focal follow data from the vessel survey were also collected where feasible, depending on a series of factors, such as the presence of special features for identification of individuals (like presence of scratches, nick marks, cuts, wounds and distinguished colour patterns) and favourable weather conditions.

The surveys involved small vessel line-transect data collection and have been designed to be similar to, and consistent with, previous surveys for Agriculture, Fisheries and Conservation Department (AFCD) monitoring of small cetaceans in Hong Kong. The survey was designed to provide systematic, quantitative measurements of density, abundance and habitat use.

The transects covered Northeast Lantau (NEL), Northwest Lantau (NWL) covering the Airport West (AW), West Lantau (WL) and Southwest Lantau (SWL) as proposed in the Updated EM&A Manual and are consistent with the AFCD long-term monitoring programme (except AW). There are two types of transect lines:

- Primary transect lines: the parallel and zigzag transect lines as shown in **Figure 2.1;** and
- Secondary transect lines: transect lines connecting between the primary transect lines and crossing islands.

All on-effort data collected under conditions of Beaufort 0-3 and visibility of approximately 1200 m or greater, on both primary and secondary transect lines, were used for analysis. The AW transect has not been previously surveyed in the AFCD programme due to the restrictions of HKIA Exclusion Zone, nevertheless, this transect was established during the EIA of the 3RS project with the aim to collect project specific baseline information within the HKIA Approach Area to fill the data gap that was not covered by the AFCD programme. This provided a larger sample size for estimating the densities and patterns of movements in the broader study area of the project.

A 15-20 m vessel with a flying bridge observation platform about 4 to 5 m above water level and unobstructed forward view, and a team of three to four observers were deployed to undertake the surveys. Two observers were on search effort at all times when following the transect lines with a constant speed of 7 to 8 knots (i.e. 13 to 15 km per hour), one using 7X handheld binoculars and the other using unaided eyes and recording data.

When CWDs were seen, the observer team was taken off-effort, the dolphins were approached and photographed for photo-ID information (using a Canon 7D [or similar] camera and long 300 mm+ telephoto lens), then followed until they left the study area or were lost. At that point, the boat returned (off effort) to the next survey line and began to survey on effort again. Survey was postponed when visibility was below 1200 m and/or when Beaufort 5 was reached. CWD density (D), abundance (N), and their associated precision (CV) will only be presented when 12-month monitoring data by conventional line transect methods is available. These will be based on dolphin sightings and effort data collected under conditions of Beaufort 0-3 and visibility of approximately 1200 m or greater. The formulae as detailed below (see Jefferson 2000):

$$\hat{D} = \frac{n\ \hat{f}(0)\ \hat{E}(s)}{2\ L\ \hat{g}(0)}$$

$$\hat{N} = \frac{n\ \hat{f}(0)\ \hat{E}(s)\ A}{2\ L\ \hat{g}(0)}$$

$$C\hat{V} = \sqrt{\frac{\hat{\text{var}}\ (n)}{n^2} + \frac{\hat{\text{var}}\ [\hat{f}(0)]}{[\hat{f}(0)]^2} + \frac{\hat{\text{var}}\ [\hat{E}(s)]}{[\hat{E}(s)]^2} + \frac{\hat{\text{var}}\ [\hat{g}(0)]}{[\hat{g}(0)]^2}}$$

Based on the vessel survey data, seasonal differences in dolphin density and use of the study area will be examined, using the solar seasons (Winter: December-February, Spring: March-May, Summer: June-August, Autumn: September-November) and/or oceanographic seasons (Dry: October-March, Wet: April-September).

Focal follows of dolphins were conducted during this 6-month baseline survey where practicable (i.e. when individual dolphins or small stable groups of dolphins with at least one member that could be readily identifiable with unaided eyes during observations and weather conditions are favourable). These involved the boat following (at an appropriate distance to minimize disturbance) an identifiable individual dolphin for an extended period of time, and collecting detailed data on its location, behaviour, response to vessels, and associates. This type of data allows information to be gathered on the movement paths and travel corridors used by dolphins in the survey region. The data collected were comparable to data being collected during focal follows in the AFCD-funded long-term monitoring surveys, and the combined dataset of both sets of focal follows allows the evaluation of travel corridors for the greater Hong Kong region to be undertaken, with potential emphasis on and near the land formation area.

Two full sets of transect surveys covering all transects in the survey areas were completed per survey month (survey months were considered as being from 18 December 2015 to 17 January 2016, from 18 January to 17 February 2016, and so on).

2.3 Land-based Surveys and Theodolite Tracking

Land-based monitoring obtains fine-scale information on the time of day and movement patterns of the CWDs. A digital theodolite (Sokkia/Sokkisha Model DT5 or similar equipment) with 30-power magnification and 5-s precision was used to obtain the vertical and horizontal angle of each dolphin and vessel position. Angles were converted to geographic coordinates (latitude and longitude) and data were recorded using *Pythagoras* software, Version 1.2 (Gailey & Ortega-Ortiz, 2002). This method delivers precise positions of multiple spatially distant targets in a short amount of time. The technique is fully non-invasive, and allows for time and cost-effective descriptions of dolphin habitat use patterns at all times of daylight (Würsig et al. 1991; Piwetz et al. 2012). Examples of modern statistical techniques to describe movements relative to habitat and anthropogenic influences are described in Gailey et al. (2007) and Lundquist et al. (2012).

Land-based observation and theodolite tracking stations were set up at two locations facing east/south/west on the southern slopes of the island of Sha Chau (SC), and an audit location for SkyPier High Speed Ferries (HSF) facing north/northeast/northwest, at Lung Kwu Chau (LKC). The locations (D and E) are shown with position coordinates, height of station and approximate distances of consistent theodolite tracking capabilities for CWDs in **Table 2.1** and **Figure 2.2**.

Table 2.1: Land-based Survey Stations Details

Station	Location	Geographical Coordinates	Station Height (m)	Approx. Tracking Distance (km)
D	SHA CHAU	22° 20' 43.5" N 113° 53' 24.66" E	45.66	2
E	LUNG KWU CHAU	22° 22' 44.83" N 113° 53' 0.2" E	70.40	3

The frequency of the theodolite tracking was two days per month at the SC station and three days per month at the LKC Station (one more survey day conducted for LKC station than the SC station for auditing the SkyPier High Speed Ferries (HSFs) Route Diversion and Speed Restriction Plan) during the six-month baseline monitoring. Surveys were undertaken during a period of about 5-6 hours per survey day from the monitoring station, with some days longer than this but others truncated due to weather-related deterioration of sighting conditions. Three surveyors (one theodolite operator, one computer operator, and one observer) were involved in each survey. Observers searched for dolphins using unaided eyes and handheld binoculars (7X50). Theodolite tracking sessions were initiated whenever an individual CWD or group of CWDs was located. Where possible, a distinguishable individual was selected, based on colouration, within the group. The focal individual was then continuously tracked via the theodolite, with a position recorded each time the dolphin surfaced. In case an individual could not be positively distinguished from other members, the group was tracked by recording positions based on a central point within the group whenever the CWDs surfaced (Bejder, 2005; Martinez, 2010). Tracking continued until animals were lost from view, moved beyond the range of reliable visibility (>1-3 km, depending on station height), or environmental conditions obstructed visibility (e.g., intense haze, Beaufort sea state >4, or sunset), at which time the research effort was terminated. In addition to the tracking of CWDs, all vessels that moved within 2-3 km of the station were tracked, with effort made to obtain at least two positions for each vessel.

Theodolite Tracking Data Analysis

Theodolite tracking included focal follows of CWD groups and vessels. Priority was given to tracking individual or groups of CWDs. We also attempted to track all vessels moving within 1 km of the focal CWDs. Focal follow data were filtered to include only CWD tracks with greater than 2 positional fixes and 10 minutes or greater in duration. If two consecutive dolphin tracks were more than 10 minutes apart, they were split and analysed separately. Because CWD focal follows varied in duration, to standardize data, each CWD track was split into 10-minute segments, comprising 6 interpolated positional fixes per segment. The ten minute window has been statistically validated for theodolite tracking analyses (Gailey et al. 2007, Lundquist 2012), and such a logical bound is also described in

Turchin (1998). Standardized data were used to analyse group size and behaviour and will be used for future analyses of movement patterns. CWD response variables that will be calculated for each track include mean reorientation rate, swimming speed and linearity. Reorientation rate is the degrees per minute of changes in direction of a tracked individual or group of CWDs. Mean swimming speed is calculated by dividing the distance travelled by the duration between two consecutive positions (Gailey et al. 2007). Linearity is an index of net movement ranging from 0 to 1, with 0 equating to no net movement and 1 equating to straight line movement. It is calculated by taking the sum of distances travelled for each segment and dividing by the net distance between the first and last fix of a track.

In order to evaluate variation in CWD movement patterns in the presence of vessels, it is necessary to establish a distance threshold. Consistent with general practice and the data gathered for the EIA of this study, when vessels are within 500m of the focal individual or group, they are considered present. The 500m threshold was chosen since Sims et al. (2012) showed that most vessels exceeded background noise when less than 500m away, but not at greater distances. The threshold has been used in other marine mammal situations for similar reasons and direct measurement of animal reactions, such as in Lundquist et al. (2012) for southern right whales (*Eubalaena australis*). As it is not possible to record geographic locations of all targets simultaneously, positions for CWDs and vessels were interpolated post hoc (i.e. during analysis in the lab), allowing for a more precise estimation of vessel distances from dolphins at a given time. All types of vessels within 500m will be considered, including high speed ferries. The high speed ferries travel through the area much more rapidly than fishing, recreational, and industrial vessels carrying cargo and will therefore be noted and assessed as a separate category.

ArcMap was used to plot CWD and vessel positions, *Microsoft Excel* was used to conduct computational analysis and R statistical software was used to perform statistical analyses. Data were tested for normality and transformed when residuals were not normally distributed. In order to reduce pseudo-replication, analysis was run to determine the temporal lag at which two segments from the same focal group are no longer auto-correlated. Univariate statistical analyses (one-factor Analysis of Variance, ANOVA) were run to evaluate variation between factors.

Similar to vessel-based surveys, seasonal differences in relative CWD relative occurrence and use of the study area were examined for land-based surveys, using both the solar seasons (Winter: Dec-Feb, Spring: Mar-May, Summer: Jun-Aug, Autumn: Sep-Nov) and oceanographic seasons (Dry: Oct-Mar, Wet: Apr-Sep; see Chen et al. 2010). In addition, behavioural descriptions and potential avoidance/association by CWDs relative to vessels or other on-water anthropogenic activities will be analysed by multi-variate analyses, as in Gailey et al. (2007) and Lundquist et al (2012).

2.4 Passive Acoustic Monitoring

Acoustic data were gathered to listen for CWDs occurrence patterns and to obtain anthropogenic noise information simultaneously. This work involves a type of Passive Acoustic Monitor (PAM) (Wiggins and Hildebrand 2007) termed an Ecological Acoustic Recorder (EAR) (Lammers et al. 2008), with bottom-mounted broad-band recording capability operable from 20 Hz (for lower frequency anthropogenic noise) up to a flat response of 32kHz (for echolocating and communicating CWDs). An EAR was positioned at south of Sha Chau Island to coincide with the land based theodolite survey (**Figure 2.3**). The duty cycle of the PAM was 20% for the baseline and construction phases.

Analysis (by a specialized team of acousticians) involved manually browsing through every acoustic recording and logging the occurrence of dolphin signals. This approach for data analysis was adopted because generally high ambient noise conditions in these waters have meant that an automatic algorithm cannot be reliably used to detect dolphin sounds. All data therefore were re-played by computer and listened to by human ears for accurate assessment of dolphin group presence. In addition, ambient sound levels were quantified using a customised Matlab algorithm over the entire effective bandwidth and within frequency bands of 0-2 kHz, 2-4 kHz, 4-8 kHz, 8-16 kHz, and 16-32 kHz.

Comparisons of CWD and vessel sounds during theodolite tracks of those dolphins and vessels were made post hoc, that was after both sets of data have been separately analysed in the laboratory, positions were known, and the positions can be compared to loudness and frequencies of those sounds.

A review of CWD sightings from the land-based survey data in relation to the EAR device was also undertaken to provide data on the approximate locations of the CWDs at the time their signals were detected. Thus, overlaps of land-based CWD sightings and the EAR recorded sounds of CWDs were analysed.

3 Monitoring Results

3.1 Small Vessel Line-transect Survey

3.1.1 Survey Effort

During the monitoring period of 18 December 2015 to 17 June 2016, two sets of small vessel line-transect surveys were conducted per survey month covering NEL, NWL, AW, WL and SWL. In other words, a total of 12 sets of transect covering the above-mentioned survey areas were conducted during the six-month baseline monitoring period.

A total of 2,841.29 km of survey effort was collected during the six-month baseline monitoring period, with 90.9% of the total survey effort (i.e. 2,583.73 km) being conducted under favourable weather conditions (i.e. Beaufort Sea State 3 or below). Details of survey effort are presented in **Appendix A**.

3.1.2 Sighting Distribution

During the six-month baseline monitoring, a total number of 83 groups of 353 CWDs were sighted, of which 80 groups of 339 individuals were sighted under favourable weather conditions, including 71 on-effort sightings and nine off-effort sightings.

In addition to CWDs, Indo-Pacific Finless Porpoises (FPs) (*Neophocaena phocaenoides*) were also sighted in SWL during the baseline monitoring. A total number of 23 groups of 115 individuals including 20 on-effort sightings and three off-effort sightings were recorded under favourable weather conditions. CWD and FP sightings information are presented in detail in **Appendix B** and summarised in **Table 3.1**.

Table 3.1: Summary of Dolphin and Porpoise Sightings

	On-effort Sightings Under Favourable Weather Conditions (i.e. Beaufort 0 to 3)								All Sightings	
	NL		WL		SWL		Overall			
	No. of Sightings	No. of Individuals	No. of Sightings	No. of Individuals	No. of Sightings	No. of Individuals	No. of Sightings	No. of Individuals	No. of Sightings	No. of Individuals
CWD	17	76	33	142	21	96	**71**	**314**	83	353
FP	N/A	N/A	N/A	N/A	20	101	**20**	**101**	23	115

Sighting distribution of CWDs during on-effort survey and under favourable weather condition is presented in **Figure 3.1**. CWDs occurred in all survey areas except NEL. Sightings from NEL, NWL and AW within the North Lantau waters were combined as NL for the following discussion. In North Lantau waters (i.e. NEL, NWL and AW), CWDs mostly occurred in areas around Sha Chau and Lung Kwu Chau Marine Park (SCLKCMP), particularly at the northern and western waters of the marine park. In West Lantau waters, some CWD sightings occurred around Tai O. Other sightings within West Lantau survey area from Yi O to Fan Lau with the majority recorded relatively off-shore except a few recorded close to the coast of Peaked Hill (Kai Yet Kok) and Fan Lau. In southwestern waters of Lantau, CWDs frequently occurred along the coast from Fan Lau to Shek Pik. CWDs were also occasionally recorded in areas around Soko Islands.

Sighting locations of FPs recorded during the baseline monitoring are shown in **Figure 3.2**. During the baseline monitoring, FPs were only recorded in the SWL survey area. They were mainly recorded on transects between Shek Pik and Tong Fuk, and also waters around Soko Islands, with the majority of the sightings clustered around the eastern part of the SWL survey area.

Although CWDs and FPs co-occurred in SWL waters, CWDs dominated in the western part while FPs were more frequently sighted in the east.

Figure 3.1: Sightings Distribution of Chinese White Dolphins
[Pink circle: Sighting locations of CWD, White line: Vessel survey transects, Blue polygon: Sha Chau and Lung Kwu Chau Marine Park (SCLKCMP), Red polygon: 3RS land-formation footprint]

Figure 3.2: Sightings Distribution of Finless Porpoises
[Blue spot: sighting locations of FP, White line: Vessel survey transects]

3.1.3 Encounter Rate

Two types of dolphin encounter rates were calculated based on the records of CWD baseline monitoring. They included the number of dolphin sightings per 100km survey effort (STG) and total number of dolphins per 100km survey effort (ANI). In the calculation of dolphin encounter rates, only survey data collected under favourable weather condition (i.e. Beaufort 0-3) were used, since detection capability of cetacean tends to be biased in Beaufort conditions higher than 3. Formulation of the encounter rates are shown as below:

Encounter Rate of Number of Dolphin Sightings (STG)

$$STG = \frac{Total\ No. of\ \ On - effort\ Sightings}{Total\ Amount\ of\ Survey\ Effort\ (km)}\ x\ 100$$

Encounter Rate of Number of Dolphins (ANI)

$$ANI = \frac{Total\ No. of\ Dolphins\ from\ On - effort\ Sightings}{Total\ Amount\ of\ Survey\ Effort\ (km)}\ x\ 100$$

(Notes: Only data collected under Beaufort 3 or below condition was used)

The STG and ANI for the combined survey area in each survey month and for survey quarters are summarised in **Table 3.2** and **Table 3.3** for this 6-month baseline survey period. The results show that the lowest record for STG was during the first survey month i.e. 18 December 2015 to 17 January 2016 and the quarterly STG was also observed to be the lowest in the first survey quarter between 18 December 2015 and 17 March 2016.

Table 3.2: Monthly and Quarterly STG and ANI for Combined Survey Areas (NEL, NWL, AW, WL, SWL)

Survey Month Number	Survey Period	No. of Sighting	No. of Dolphin	On-Effort (km)	m ER (STG)	m ER (ANI)	*Run STG	*Run ANI
1	18 Dec 2015 to 17 Jan 2016	6	37	436.049	1.38	8.49		
2	18 Jan 2016 to 17 Feb 2016	10	61	446.783	2.24	13.65		
3	18 Feb 2016 to 17 Mar 2016	9	28	464.582	1.94	6.03	**1.86**	**9.35**
4	18 Mar 2016 to 17 Apr 2016	11	30	412.931	2.66	7.27	**2.27**	**8.99**
5	18 Apr 2016 to 17 May 2016	15	80	452.975	3.31	17.66	**2.63**	**10.37**
6	18 May 2016 to 17 Jun 2016	20	78	370.405	5.40	21.06	**3.72**	**15.21**
	Total	**71**	**314**	2583.725				

Notes: 1. Both Effort and Sighting have excluded data collected at Beaufort 4 or above.
2. m ER denoted monthly Encounter Rate
3.*Running STG and Running ANI were calculated by combining three preceding survey months data (e.g. STG/ANI for Survey Month 3 were calculated by combining the data between 18 Dec 2015 and 17 Mar 2016, STG/ANI for Survey Month 4 were calculated by combining the data between 18 Jan 2016 to 17 Apr 2016)

Table 3.3: Quarterly STG and ANI for Combined Survey Areas (NEL, NWL, AW, WL, SWL)

Combined (NEL, NWL, AW, WL, SWL)	STG	ANI
18 Dec 2015 to 17 Mar 2016	1.86	9.35
18 Jan 2016 to 17 Apr 2016	2.27	8.99
18 Feb 2016 to 17 May 2016	2.63	10.37
18 Mar 2016 to 17 Jun 2016	3.72	15.21

In regard of summarising all the six-month baseline survey data, the combined STG and ANI of all survey areas were 2.75 and 12.15 respectively. In respect of separate survey areas, standalone STG and ANI for NL (including NEL, NWL and AW) were 1.15 and 5.15 respectively. No CWD was recorded in NEL during the current study period. In WL, the STG and ANI of CWD were 9.53 and 41.01 respectively. For SWL, the STG and ANI of CWD were 2.75 and 12.59. Amongst the aforementioned survey areas, the encounter rates in term of both STG and ANI were the highest in WL, and the lowest in NL. **Table 3.4** summarises the STG and ANI for NL, WL and SWL.

Table 3.4: STG and ANI for NL, WL, SWL and Combined Survey Areas

	NL (NEL, NWL, AW)	WL	SWL	Combined
STG	1.15	9.53	2.75	2.75
ANI	5.15	41.01	12.59	12.15

Source: Based on baseline survey data from 18 December 2015 to 17 June 2016

3.1.4 Group Size

Group size of CWD sightings ranged from one to 19 individuals per group during the baseline monitoring. The average group size of CWDs was 4.42 ± 3.54. Amongst the 71 groups of CWDs sighted during the on-effort baseline monitoring under favourable weather conditions, there were 26 small groups with group size composed of only one to two dolphins per group, while five were large groups with 10 or more individuals. The sighting distribution of CWDs with different group sizes was presented in **Figure 3.3**. Group size of FPs ranged from 1 to 15 individuals per group during the baseline monitoring. The average group size of Finless Porpoises was 5.05 ± 4.58. The sighting distribution of FPs with different group sizes was presented in **Figure 3.4**.

Figure 3.3: Distribution of Chinese White Dolphins with Different Group Sizes
[Pink spots: 1-2 individuals, Green spots: 3-9 individuals, Red spots: 10 or more individuals, White line: Vessel survey transects, Blue polygon: SCLKCMP, Red polygon: 3RS land-formation footprint]

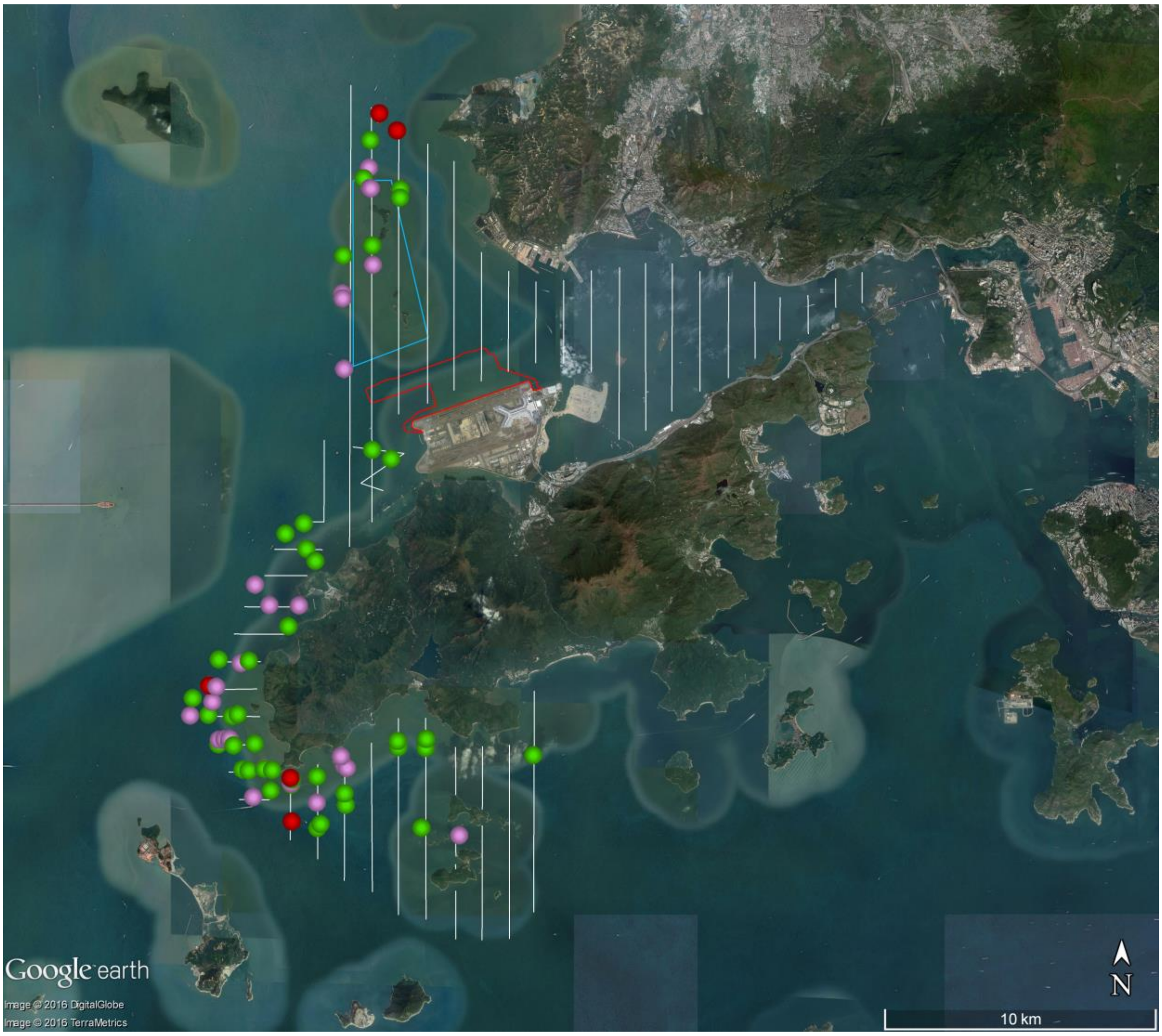
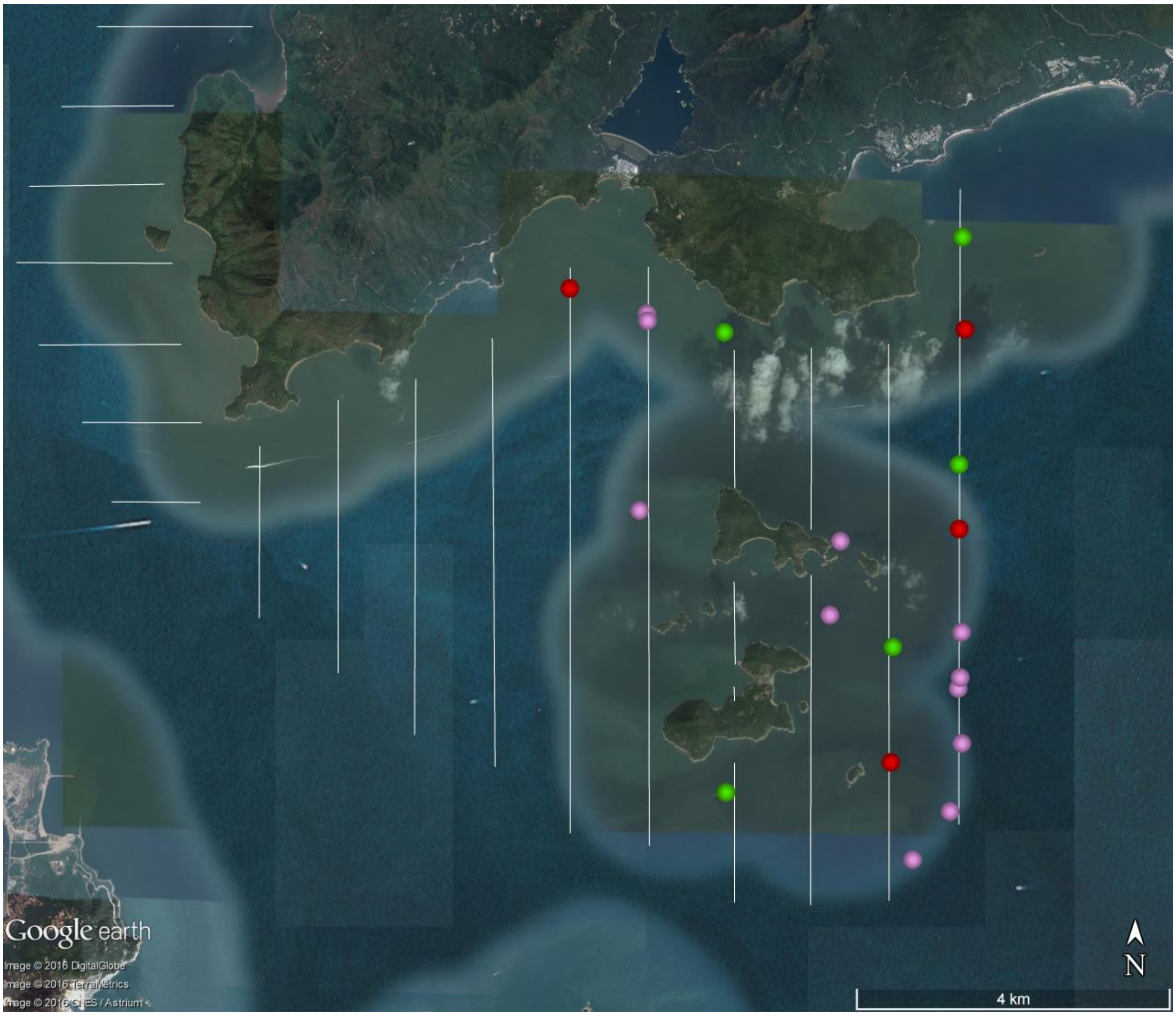


Figure 3.4: Distribution of Finless Porpoises with Different Group Sizes
[Pink spots: 1-2 individuals, Green spots: 3-9 individuals, Red spots: 10 or more individuals, White line: Vessel survey transects]



3.1.5 Activities and Association with Fishing Boats

During the six-month baseline monitoring period, 29 dolphin sightings were observed with feeding activities. Amongst these 29 dolphin sightings, five were associated with fishing boats including single trawlers, purse seiners and gillnetters.

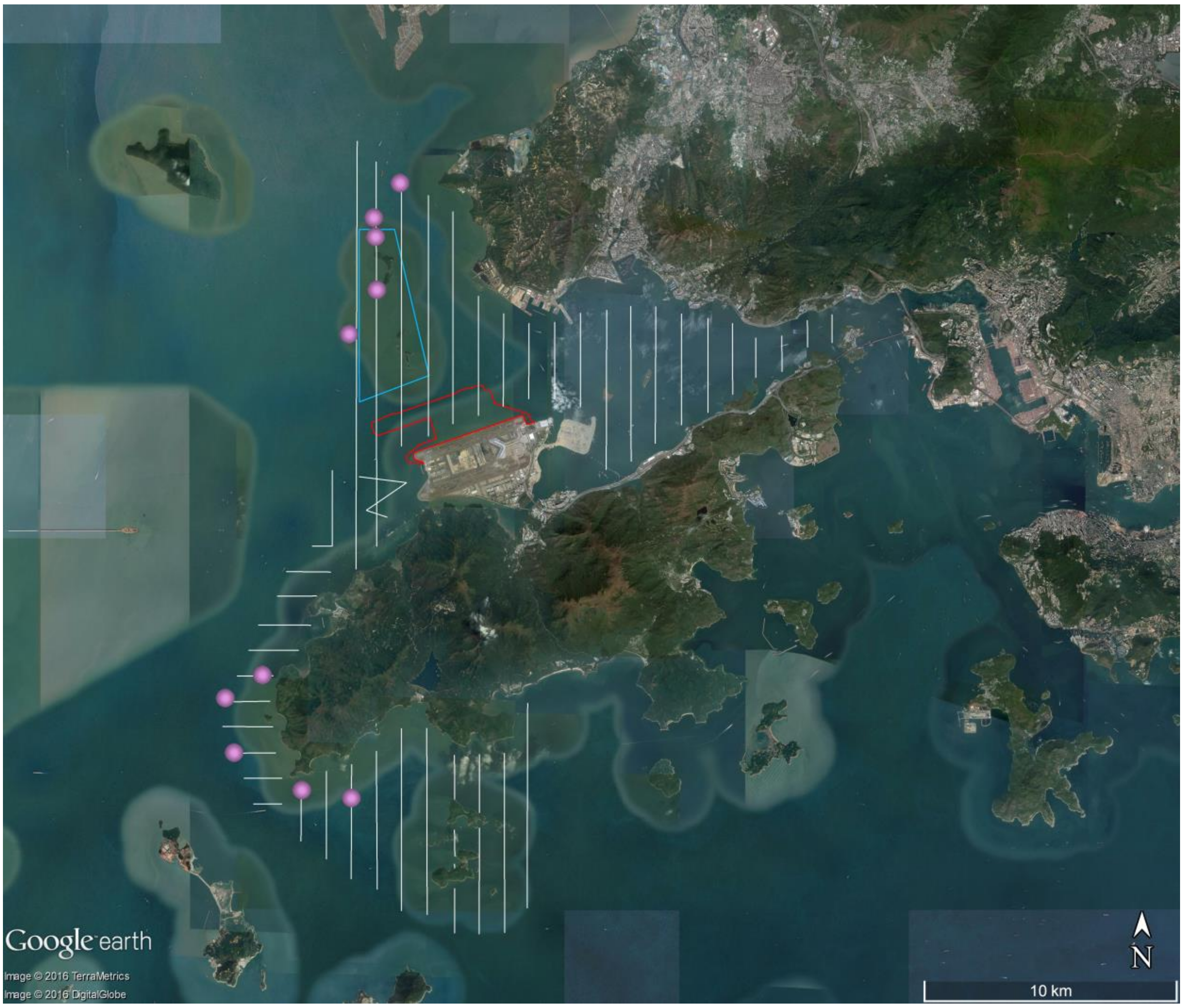
The sighting locations of dolphins with feeding, socializing, resting and travelling behaviours are shown in **Figure 3.5**.

Figure 3.5: Distribution of Chinese White Dolphins Engaged in Different Behaviours
[Indigo rhombus: Feeding, Green circle: Socializing, Pink square: Resting, Yellow triangle: Travelling, White line: Vessel survey transects, Blue polygon: SCLKCMP, Red polygon: 3RS land-formation footprint]

3.1.6 Mother-calf Pairs

In the six-month CWD baseline monitoring, mother and calf, unspotted juvenile (UJ) or spotted juvenile (SJ) pairs were observed in 10 sightings (including one sighting recorded under Beaufort 4). Mother-calf pairs were observed in NWL, WL and SWL between February and June 2016. Sighting locations of the mother-and-calf pairs were shown in **Figure 3.6**.

Figure 3.6: Sighting Locations of Mother and Calf Pairs
[Pink spot: Sighting locations of mother and calf pairs, White line: Vessel survey transects, Blue polygon: SCLKCMP, Red polygon: 3RS land-formation footprint]



3.1.7 Summary of Photo-identification Works

In the six-month CWD baseline monitoring, a total number of 96 CWD individuals were identified based on their natural markings, like nicks, cuts, scars, wounds, and deformities on their dorsal fin and body, and also their unique spotting patterns. These 96 identified CWD individuals were added to a newly established photo-identification catalogue for this Project. The identified dolphins were divided into three clusters, namely NL, WL and SL based on their first sighting location. Representative photos of all 96 identified CWD individuals were presented in **Appendix C**.

Amongst these 96 identified CWD individuals, 31 were re-sighted at least twice. The most frequently sighted individual was SLMM010 which were sighted five times in WL and SWL particularly areas around Peaked Hill and Fan Lau. SLMM010 is a rather energetic animal that showed frequent aerial behaviours such as breaching and sky-hopping. There were three pairs of mother-and-calf, UJ or SJ identified. They were NLMM006 and NLMM013, WLMM028 and WLMM029 and WLMM036 and WLMM037.

Re-sighting information of CWD individuals provides an initial idea of their range use and apparent connection between different areas around Lantau. Individuals like NLMM018, NLMM019, NLMM021, WLMM021, WLMM027, WLMM028, WLMM029, SLMM003, SLMM007, SLMM010, SLMM012, SLMM018, SLMM022 and SLMM023 were re-sighted in different survey areas. The re-sighting locations of those 31 individuals were shown on maps as presented in the figures of **Appendix D**.

3.2 Land-based Surveys and Theodolite Tracking

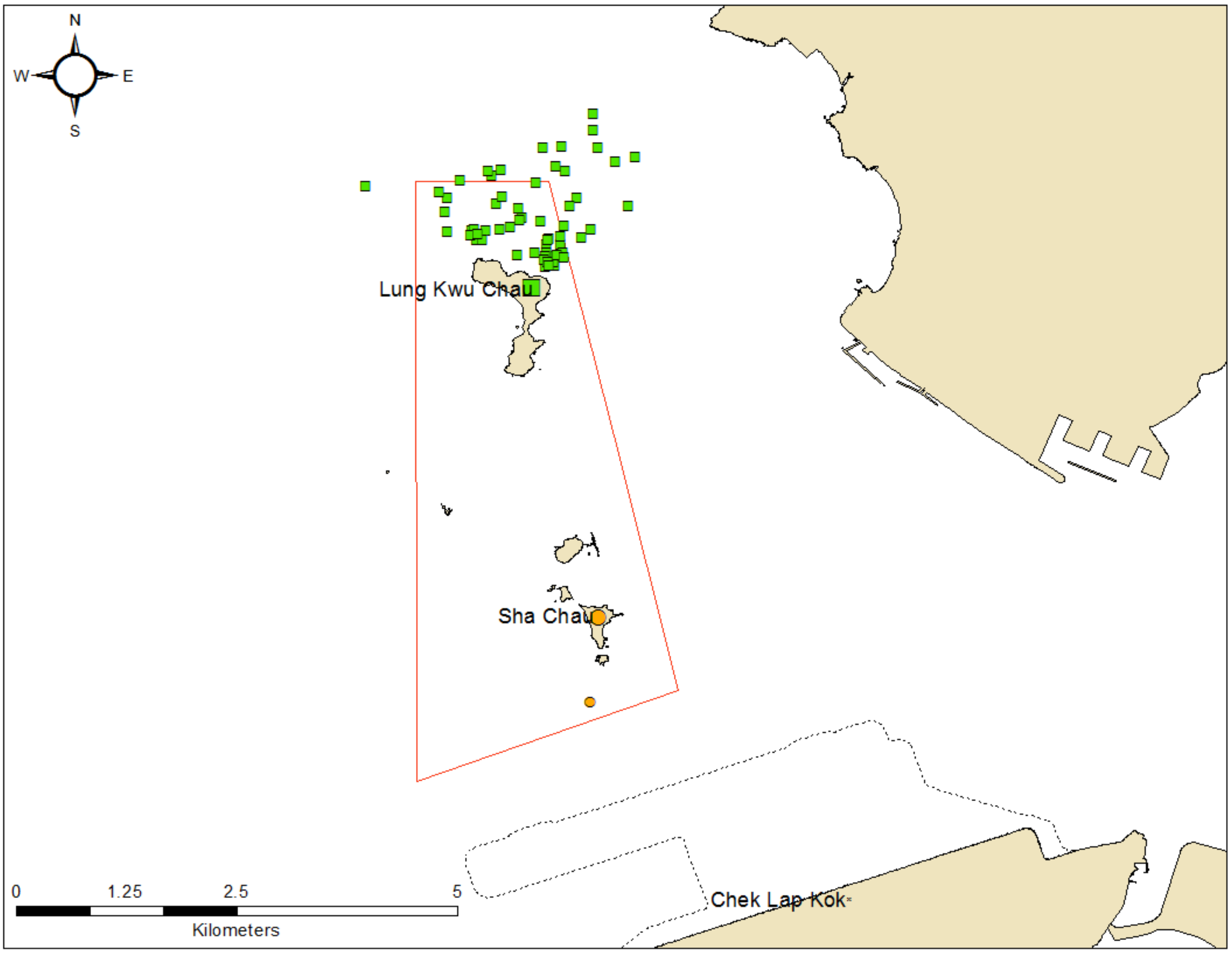
3.2.1 Survey Effort

The land-based surveys commenced on 28 December 2015, the day that SkyPier HSF route diversions and speed restrictions were implemented. A total of 29 days (including 30 survey sessions) and 180:22 (hh:mm) of land-based theodolite survey effort have been accomplished (**Table 3.5**)**.** See Table 1 of **Appendix E** for a detailed description by day. A total of 53 CWD groups were tracked from land, all from the LKC station, except one CWD group was observed from the SC station during this study period (**Table 3.5**, **Figure 3.7**). After the raw data were filtered, 23 CWD group focal follows fit criteria for analyses (**Table 3.5**). From these focal follow tracks, 33 10-minute segments were extracted for analyses (**Table 3.5**). CWD group sighting per survey effort was the greatest from LKC (0.48).

Table 3.5: Land-based Survey, Theodolite Effort and CWD Group Summary

Land-based Station	# of Survey Sessions	Survey Effort (hh:mm)	# CWD Groups Sighted	CWD Group Sighting per Survey Hr	# Groups After Filtering	# of 10-minutes segments
Sha Chau	12	72:23	1	0.014	1	3
Lung Kwu Chau	18	107:59	52	0.48	22	30
TOTAL	**30**	**180:22**	**53**	**0.29**	**23**	**33**

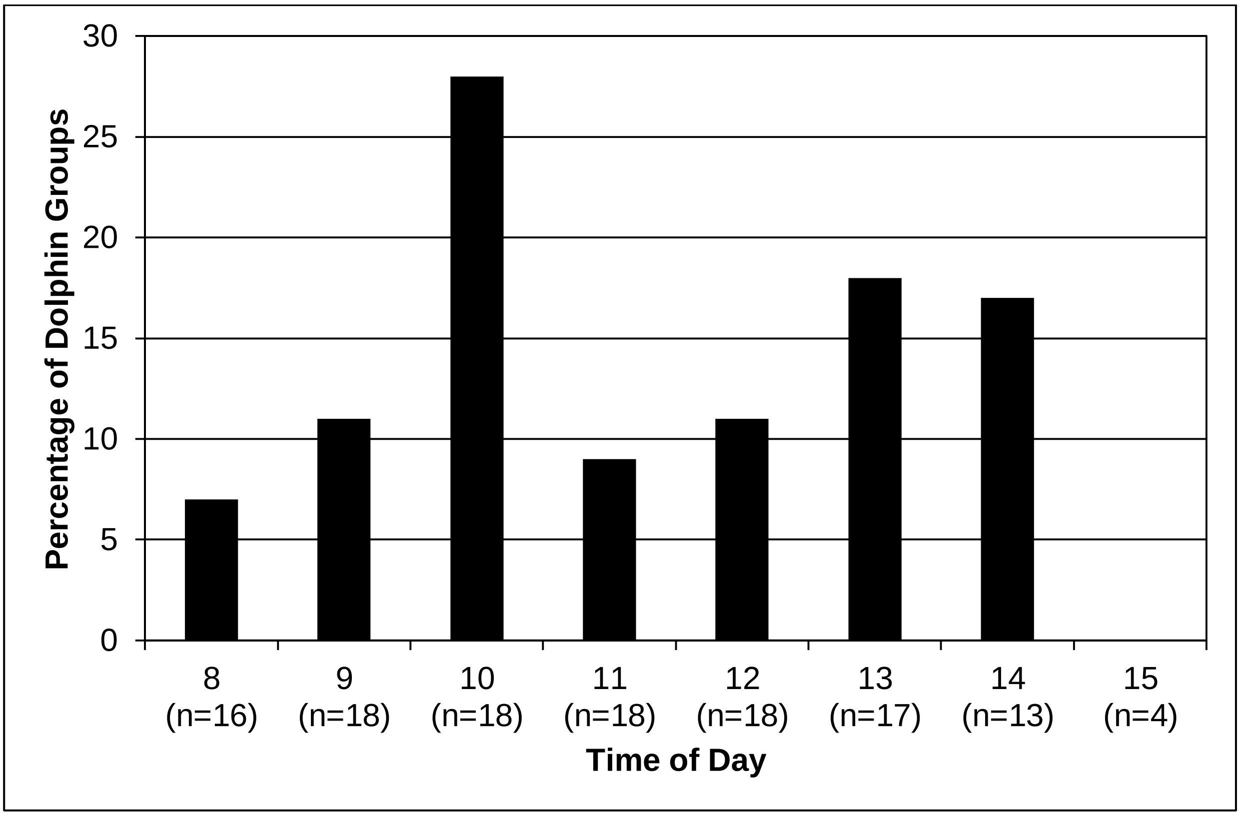
Figure 3.7: Plots of First Sightings of All CWD Groups (prior to filtering out short-track data) obtained from Land-based Stations
[Large green square on land: LKC station; Small green squares: CWD groups off LKC; Large orange circle on land: SC station; small orange circle: CWD group off SC Red line: SCLKCMP boundary]



3.2.2 Time of Day

The diurnal pattern of CWD relative occurrence per station was calculated by dividing the sum of CWD groups tracked (based on the hour block in which they were first sighted, prior to filtering data) by the effort per hour block. These percentages give a good representation of times that groups moved into view at each station, but since they are first recordings of a group, they do not by themselves give indication of length of stay within the survey area. Off LKC, the highest percentage of CWD groups (per hour of effort) were first observed during the 1000 hour block (27.60%) (**Figure 3.8**). The only group recorded off SC was first observed during the 1100 hour block.

Figure 3.8: CWD Groups Sighted (per hour of effort) and Tracked from Lung Kwu Chau (prior to filtering binned data) based on Time of Day
[Time indicates the hour block when group was first sighted. The "n" in parentheses represents the number of days that survey effort was carried out during the associated hour block.]



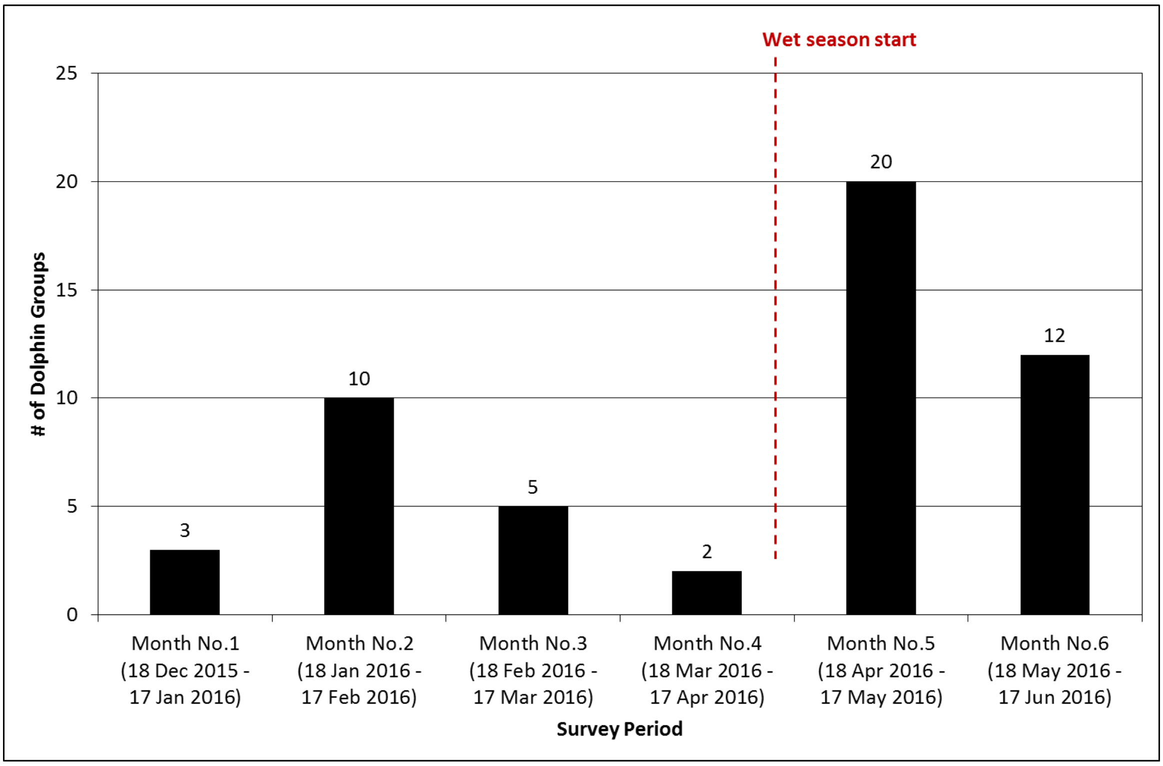
3.2.3 Time of Year

The highest percentage of CWD groups observed from LKC was during the 5th study period, between 18 April and 17 May 2016 (38.46%), as the wet season began, and the lowest percentage observed was during the 4th study period, between 18 March and 17 April 2016 (3.85%) (**Table 3.6**, **Figure 3.9**). CWDs were only observed from SC during the 6th survey month between 18 May and 17 June 2016.

Table 3.6: CWD Groups Sighted and Tracked from Land-based Station by Month of the Year

Month	# of CWD Groups per Sha Chau Station	# of CWD Groups per Lung Kwu Chau Station	TOTAL
1st Survey Month (18 Dec 2015 – 17 Jan 2016)	0	3	3
2nd Survey Month (18 Jan 2016 – 17 Feb 2016)	0	10	10
3rd Survey Month (18 Feb 2016 – 17 Mar 2016)	0	5	5
4th Survey Month (18 Mar 2016 – 17 Apr 2016)	0	2	2
5th Survey Month (18 Apr 2016 – 17 May 2016)	0	20	20
6th Survey Month (18 May 2016 – 17 Jun 2016)	1	12	13
TOTAL	**1**	**52**	**53**

Figure 3.9: CWD Groups Sighted and Tracked from Lung Kwu Chau based on Month of the Year
[The numbers above the bars indicate the total number of CWD groups tracked per study period (prior to filtering data)]



3.2.4 Group Size

The mean group size of CWDs off LKC was 3.54±2.49, ranging from singletons to a maximum group size of 9 (**Table 3.7**). The sighting distribution of CWDs relative to group sizes is represented in **Figure 3.10**. Group sizes of CWDs were generally smaller closer to shore, with the largest groups occurring farther from shore, at times just beyond the SCLKCMP boundary where ferry traffic is routed. Only one group, with 4 individuals, was observed off SC (**Table 3.7, Figure 3.11**).

Table 3.7: Land-based CWD Focal Group Size Summary

Station	n (sample size)	Minimum # Individuals	Maximum # Individuals	Mean Grp Size	Standard Deviation
Sha Chau	1	4	4	4	0
Lung Kwu Chau	30	1	9	3.54	2.49

Figure 3.10: Plots of CWD Short-track Positions (Standardized Segments) relative to Group Size obtained from Lung Kwu Chau
[Station is indicated by large green square on land, fix positions of the CWD groups by green circles (increasing in size with CWD group size), and SCLKCMP boundary by red lines.]

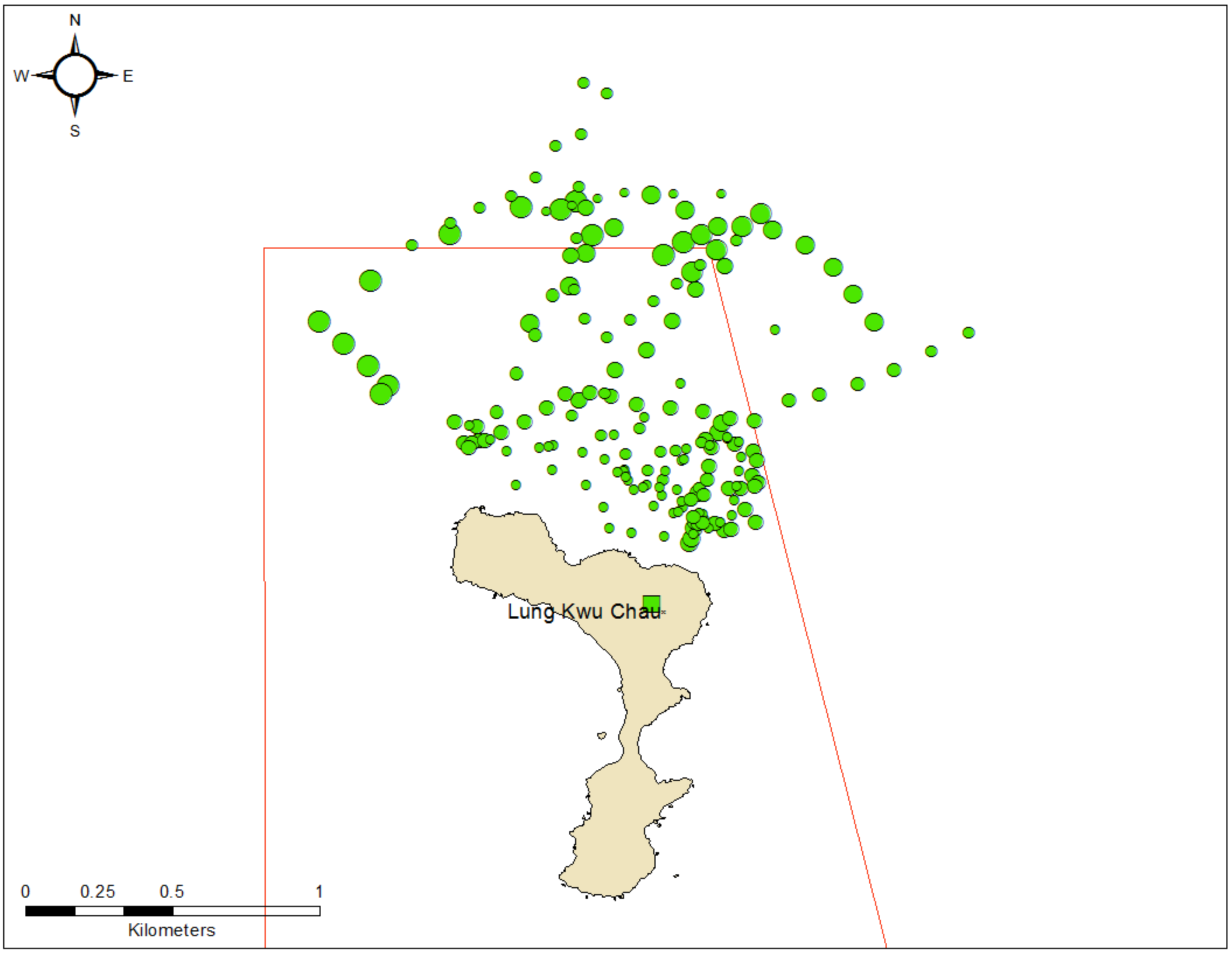
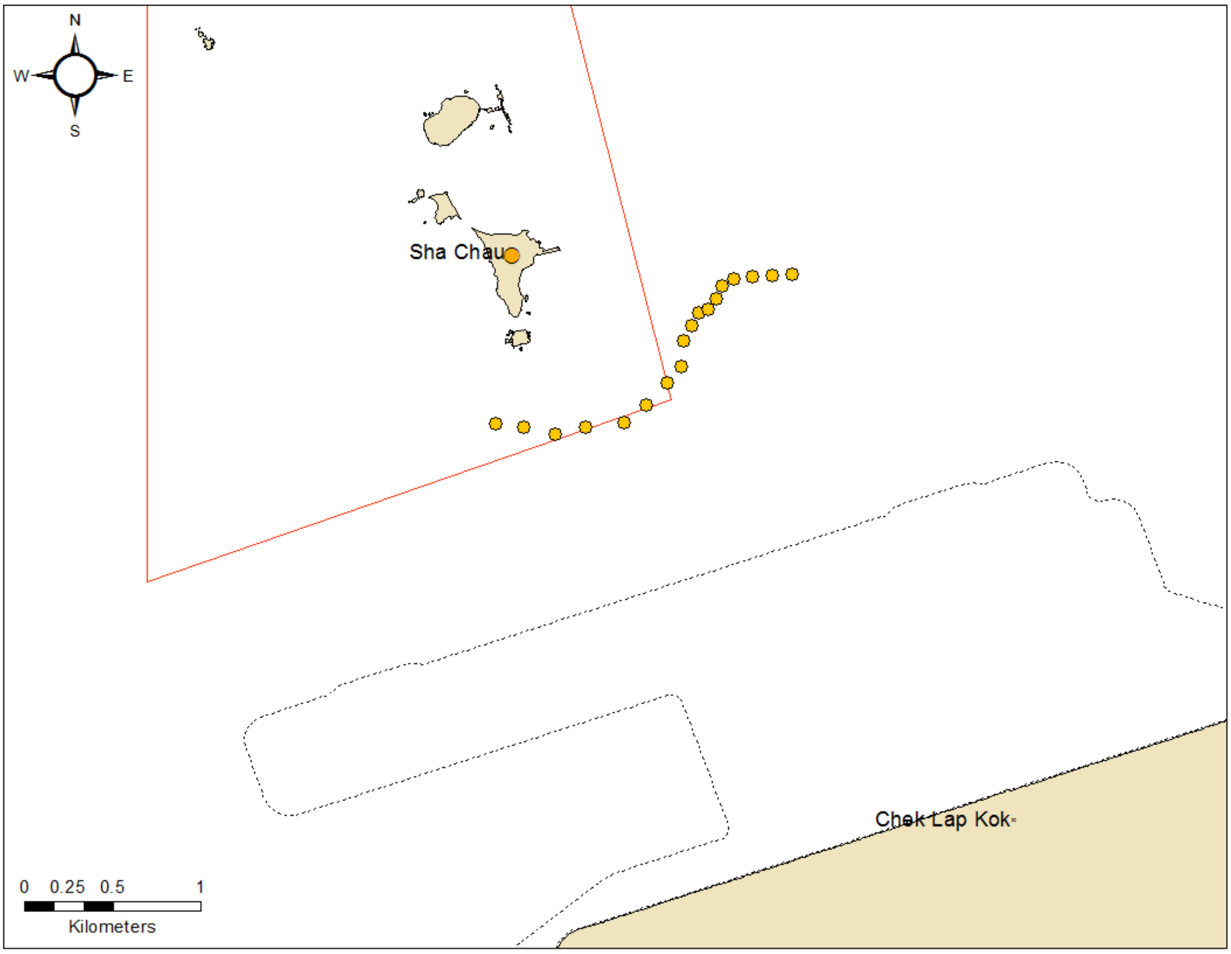


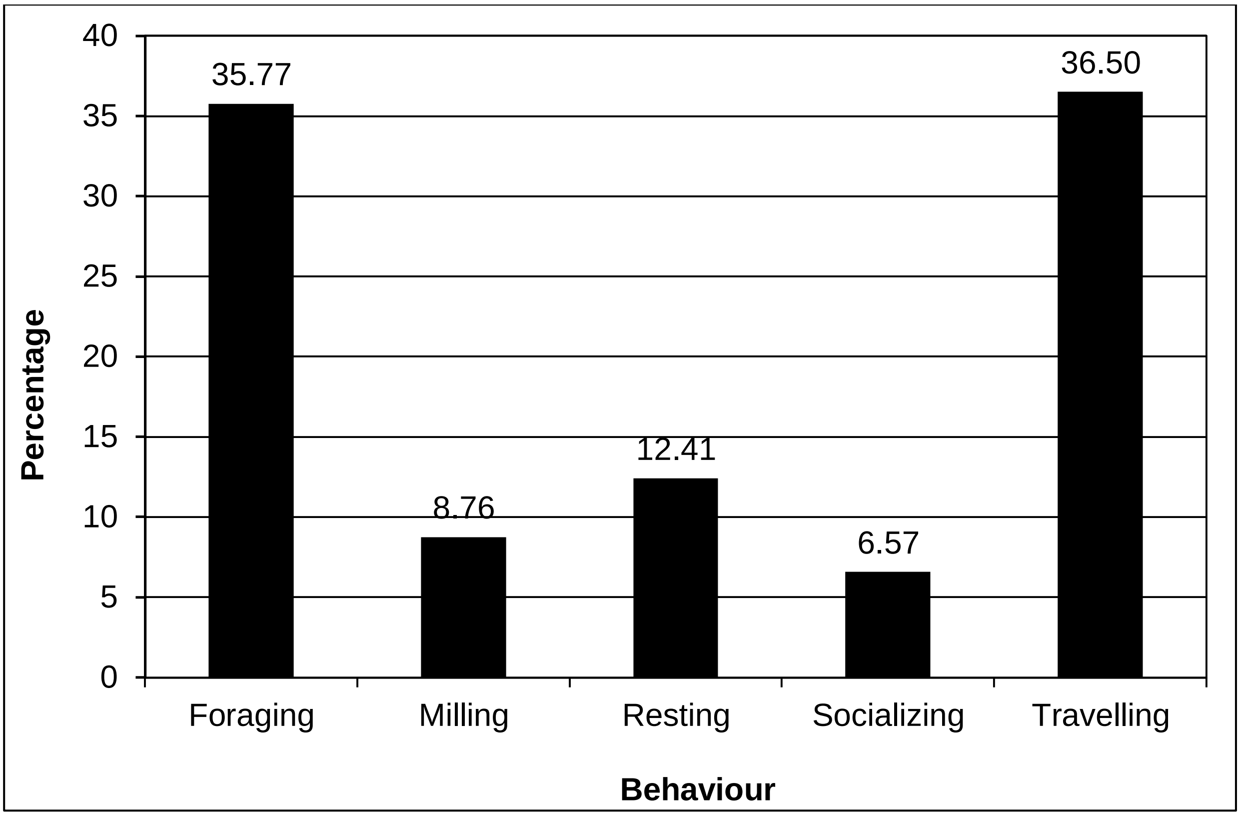
Figure 3.11: Plots of CWD Short-track Positions (Standardized Segments) relative to Group Size obtained from Sha Chau
[Station is indicated by large orange circle on land, fix positions of the CWD group by orange circles, and SCLKCMP boundary by red lines.]



3.2.5 Behavioural State

From the filtered segments, travelling and foraging were observed most frequently (36.50% and 35.77%, respectively) off LKC and socialising was observed least frequently (6.57%) off LKC (**Figure 3.12**). Travelling was the only behaviour recorded off SC, excluding unknown category.

Figure 3.12: Percentages of CWD Behavioural States, excluding Unknown Category, recorded from Lung Kwu Chau



3.2.6 Vessel Activity

Plots of vessels, including high speed ferries under speed restriction (<15 knots) and high speed ferries (≥15 knots), and CWDs show overlap in habitat off LKC during the baseline monitoring (**Figure 3.13**). Nearly 30% of the ferries tracked off LKC had a mean speed of greater than 15 knots. Same plot except high speed ferries under speed restriction was also made in **Figure 3.14** for SC station.

Figure 3.13: Plots of All Vessel Positions and All CWD Positions (prior to filtering out short-track data) obtained from Lung Kwu Chau
[Station is indicated by large green square on land, fix positions of CWD groups by small green squares, high speed ferries (<15 knots) by dark grey triangles, high speed ferries (≥15 knots) by black triangles), all other vessels by light grey triangles, and SCLKCMP boundary by red lines]

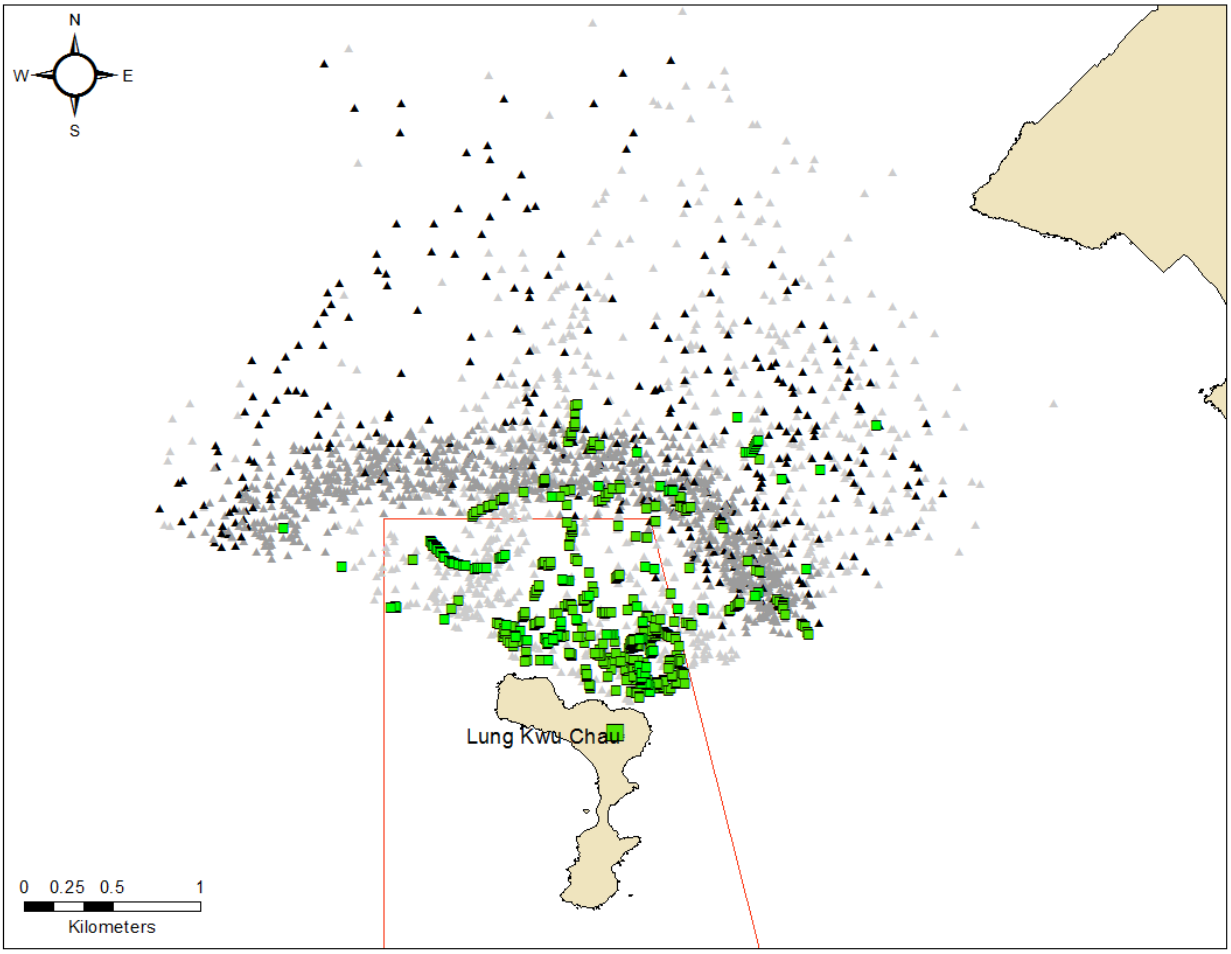
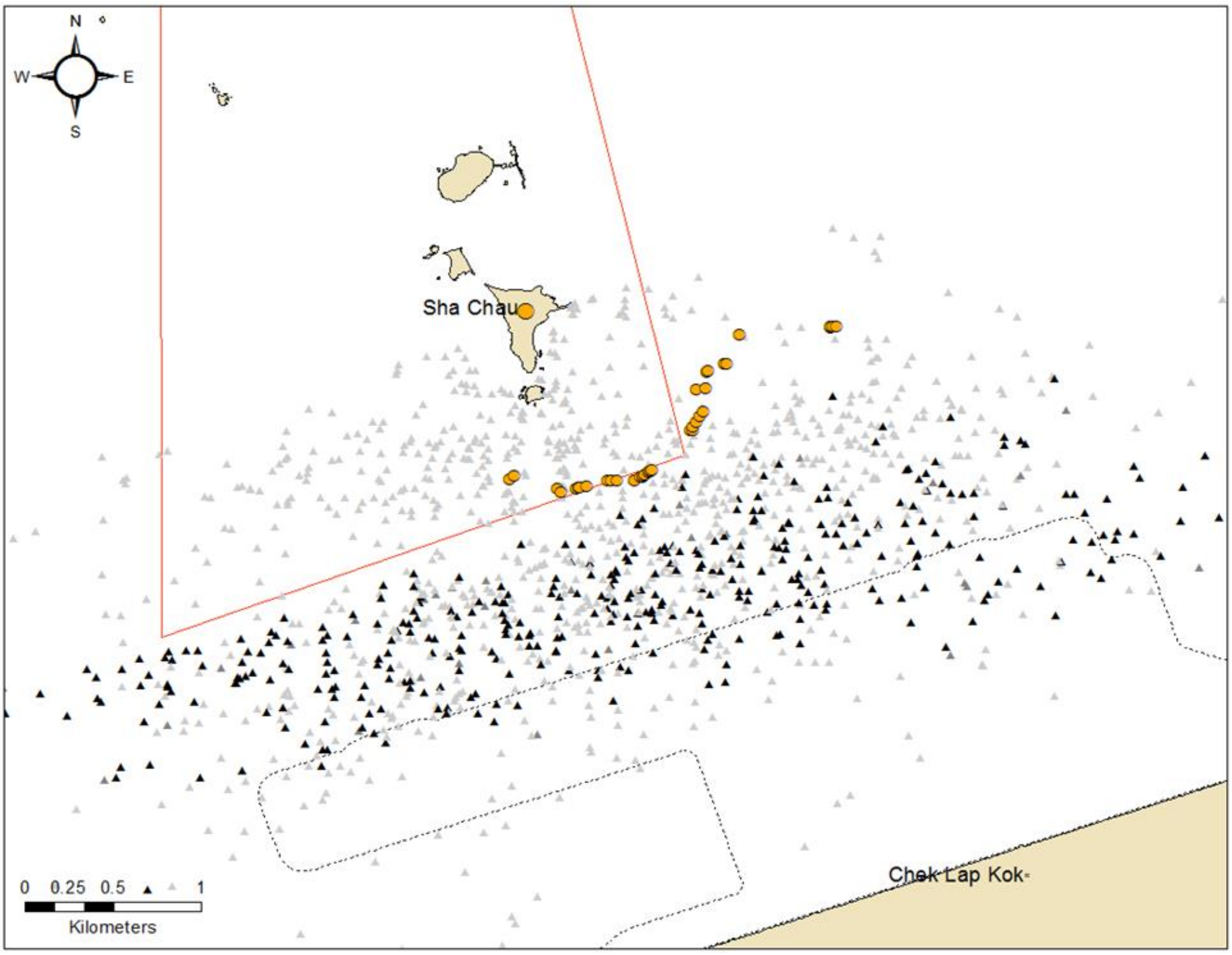


Figure 3.14: Plots of All Vessel Positions and All CWD Positions (prior to filtering out short-track data) obtained from Sha Chau
[Station is indicated by large orange circle on land, fix position of CWD group by smaller orange circles, high speed ferries by black triangles, all other vessels by light grey triangles, and SCLKCMP boundary by red lines]



3.3 Passive Acoustic Monitoring

3.3.1 Dolphin Detection Rates Per Day

During the period of 8 January to 13 May 2016, dolphins were detected in a total of 151 of 31,276 files (0.48% of files) (**Table 3.8**). Dolphins were detected on 49 of 80 (61%) days with recording effort (**Figure 3.15**). On days with dolphins detected, the mean percentage of files with detections per day was 0.7%, and the maximum percentage of files with dolphin detections was 1.7%, on 29 April 2016. Clicks were the only type of dolphin signal detected. No whistles were detected in data from this monitoring period.

These values represent reductions in the same metrics compared to previous monitoring at site A5 in 2013. During the comparable time period of 8 January to 29 March 2013, dolphins were detected in 289 of approximately 21,000 files (1.4% of files), and were present on 60 of 73 recording days (82%) (**Figure 3.16**). On those days with dolphins detected during the 2013 period, the mean percentage of files with detections per day was 1.7%, and the maximum was 5.9%. The percentage of files per day with dolphin detections exceeded 4% on 8 days during the 2013 time period, whereas in 2016 the percentage of files with dolphin detections exceeded 4% on only one day.

Table 3.8: Summary of PAM Deployments and Files Recorded

Site	Dep #	Lat*	Lon*	Data start	Data end	# recording days	Total # files	# files with dolphins	analysis status
A5	1	22 20.295N	113 53.918E	8 Jan 2016	22 Feb 2016	46	13120	82	Complete
A5	2	22 20.295N	113 53.918E	25 Feb 2016	29 Mar 2016	34	9652	45	Complete
A5	3	22 20.295N	113 53.918E	14 Apr 2016	13 May 2016	30	8504	24	Complete

Note: *coordinates obtained from the 3RS EIA (December 2012 - December 2013) A5 site
Source: Based on monitoring results from 7 January 2016 to April 2016

Figure 3.15: Dolphin Detections as Percentage of Files Per Day, 8 January to 13 May 2016
[Grey shading indicates no recording]

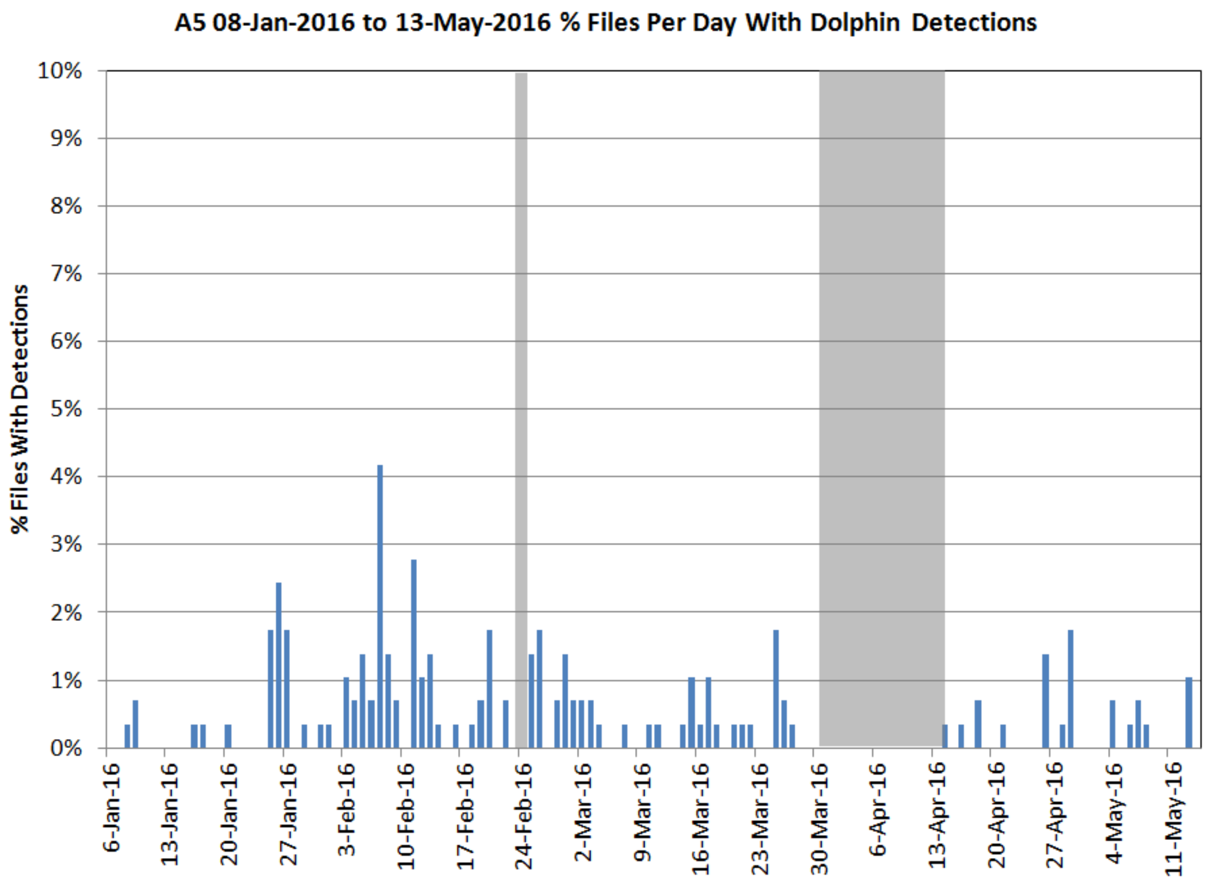
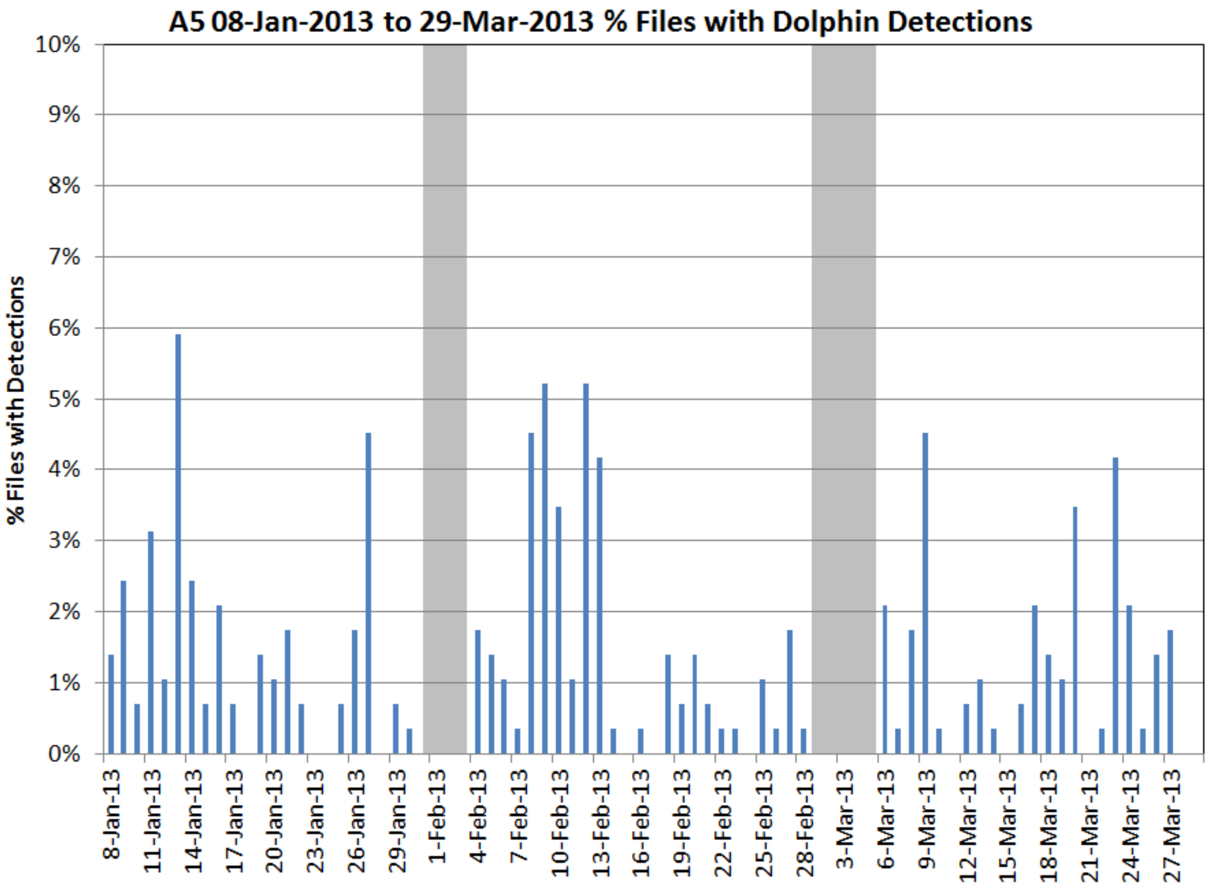


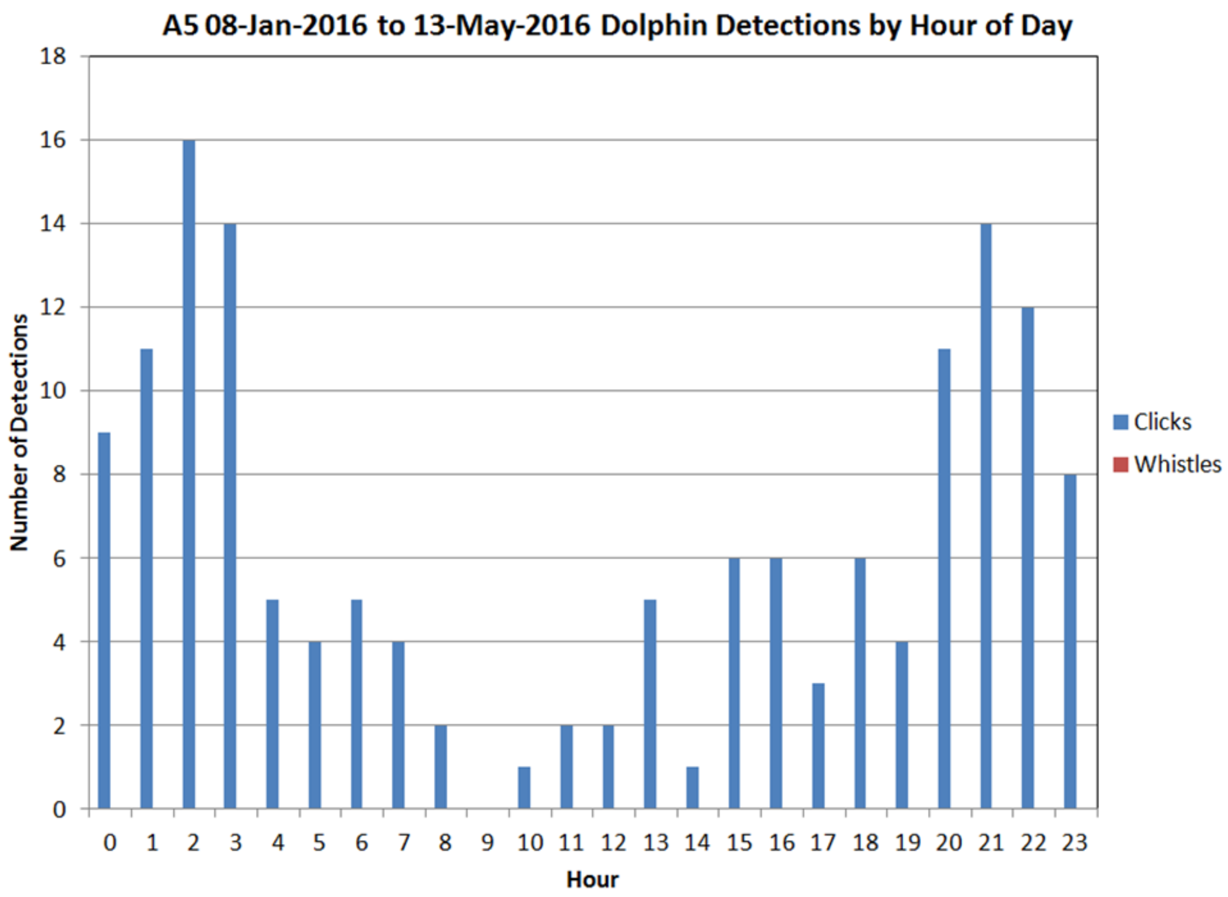
Figure 3.16: Dolphin Detections as Percentage of Files Per Day from Previous Airport Monitoring Project, 8 January to 29 March 2013
[Grey shading indicates no recording]



3.3.2 Dolphin Diel Pattern

Dolphin detection rates at A5 from 8 January to 13 May 2016 were greater at night than during daytime and exhibited an obvious diel pattern, with peak detection hours between 0200-0300 and 2100-2200 (**Figure 3.17**). This pattern of detection was similar compared to the 2013 monitoring period, with higher numbers of detections during night-time and fewest detections at midday (as seen throughout Hong Kong waters, in general).

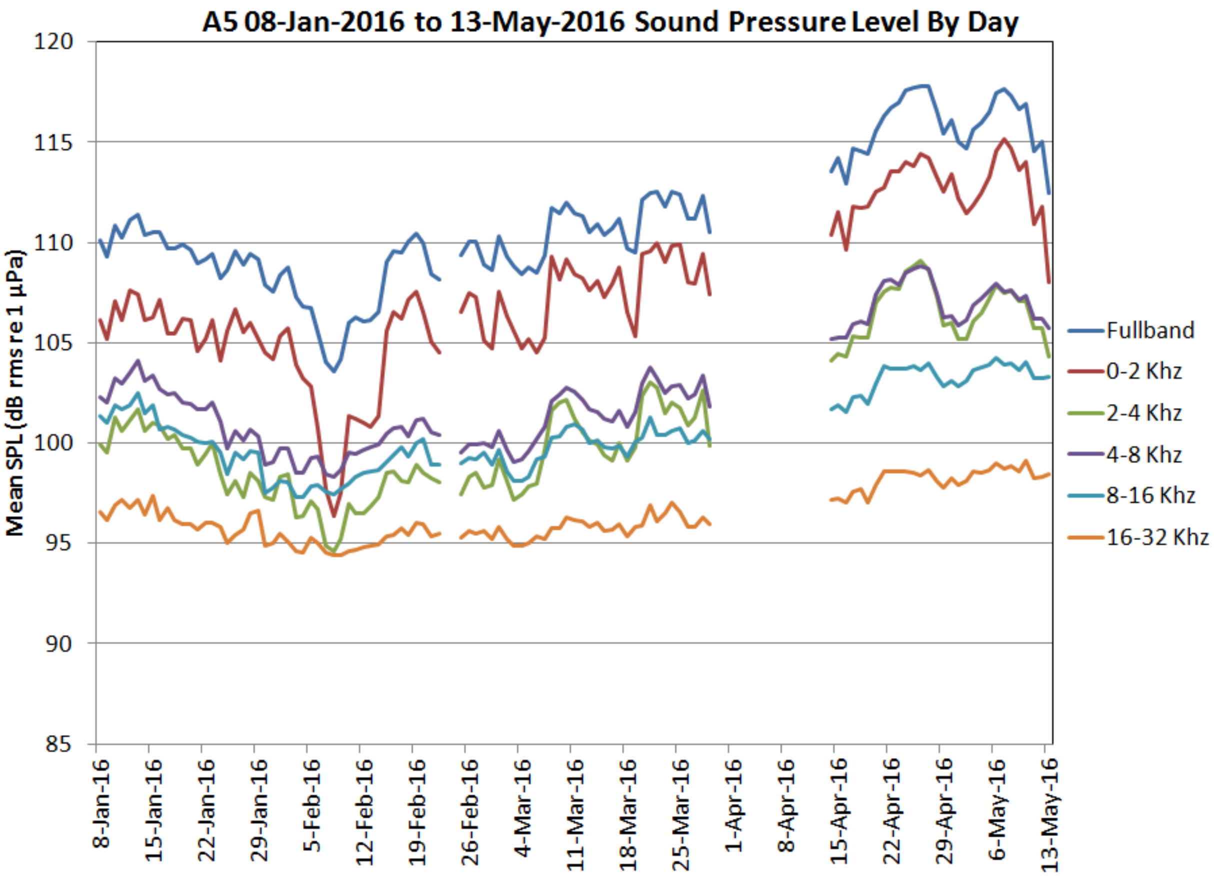
Figure 3.17: Dolphin Detections by Hour of Day, 8 January to 13 May 2016
[No whistles were detected in the data from this period]



3.3.3 Sound Pressure Levels Per Day

Ambient received noise levels (referred to as sound pressure levels or SPL) at the EAR were calculated for each recording within the full frequency bandwidth as well as octave bands of 0-2 kHz, 2-4 kHz, 4-8 kHz, 8-16 kHz, and 16-32 kHz. Mean sound pressure levels over the full effective recording bandwidth (~0 to 32 kHz) ranged from 104 to 117 dB rms re 1 µPa over the recording period (**Figure 3.18**). Sound pressure levels in higher octave bands were approximately 3 to 20 dB lower than full band levels. During the period of 5-10 February 2016, sound pressure levels in the 0-2 kHz band declined sharply by approximately 7 dB (affecting the full band level as well), this likely due to less marine traffic during the period of Lunar Chinese New Year contributing to this "dip", and "normal" levels resumed after the public holiday. Indo-Pacific humpback dolphin click and whistle frequencies are above 16 kHz and below 10 kHz, respectively (Sims et al. 2011); however, these sounds were very rare in the data compared to other sound sources and would not be distinguishable in ambient noise plots.

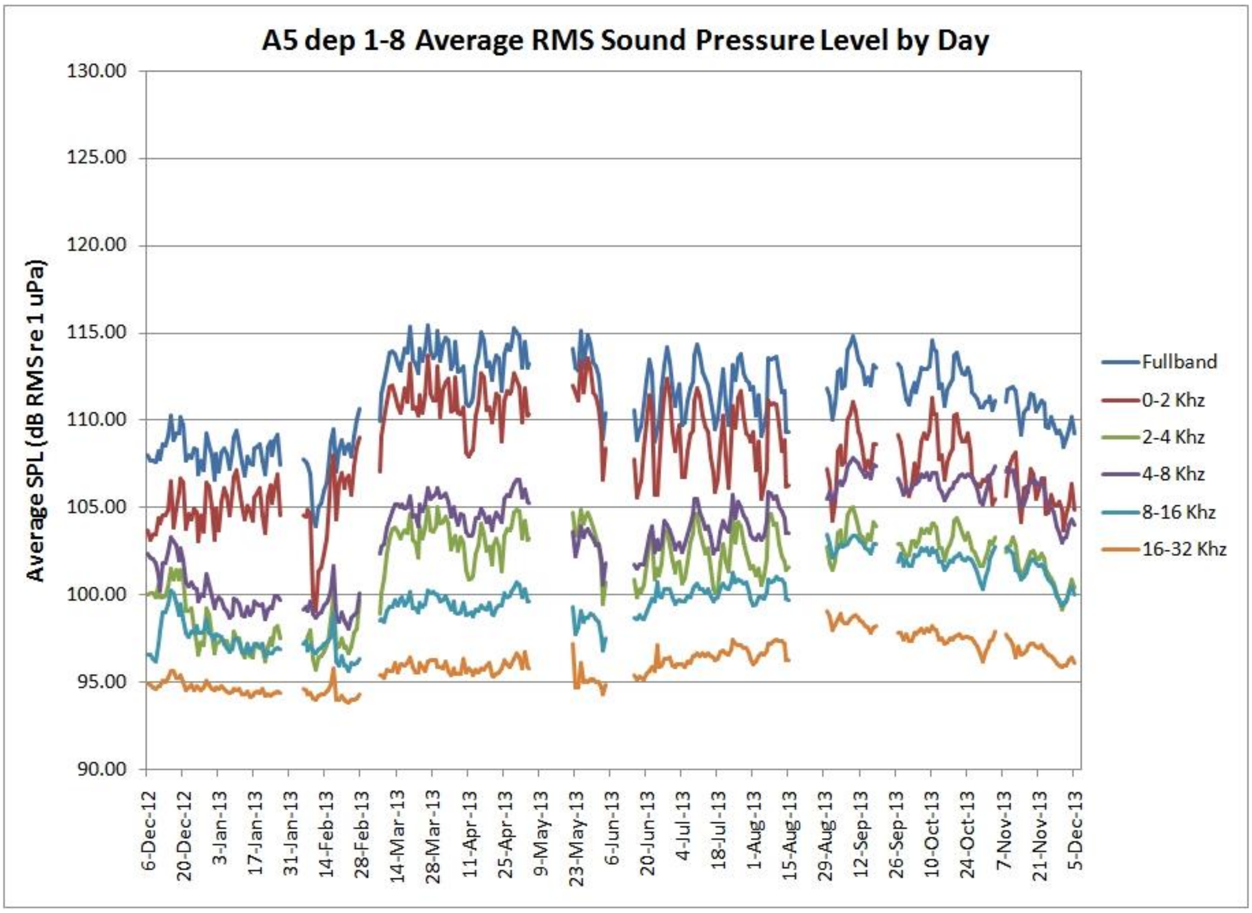
Figure 3.18: Daily Mean Sound Pressure Level (dB rms re 1 µPa), 8 January to 13 May 2016
[Blank area represents no recording]



3.3.4 Influence of Ambient Sound Level on Dolphin Detections

The extent to which ambient received sound levels influenced detectability of dolphin signals is not quantified for this data set. However, the daily mean SPL for A5 in 2016 was similar to values reported for the same site over the same period in corresponding octave bands in 2013, to within approximately ± 2 dB (**Figure 3.19**). Therefore, the potential masking effect of background noise on dolphin signals in 2016 was comparable to any masking effect in 2013. This suggests that the lower dolphin detection rate in 2016 compared to 2013 reflects a true reduction in dolphin signals, rather than an increase in background noise resulting in increased masking of signals.

Figure 3.19: Daily mean Sound Pressure Level for Site A5 during Previous Airport Project, 2012-2013



3.3.5 Diel Sound Pressure Level

Mean sound pressure levels plotted by hour revealed a daily peak during the hours of 1500-1700, which was most pronounced in the lowest frequency band (**Figure 3.20** and **Figure 3.21**). This is similar to the diel pattern of sound pressure levels at the same time of year reported during previous Hong Kong PAM efforts, and is hypothesized to be related to a local fish chorus, possibly croakers (family Sciaenidae).

Figure 3.20: Sound Pressure Level (SPL) by Hour of Day, 8 January to 29 March 2016

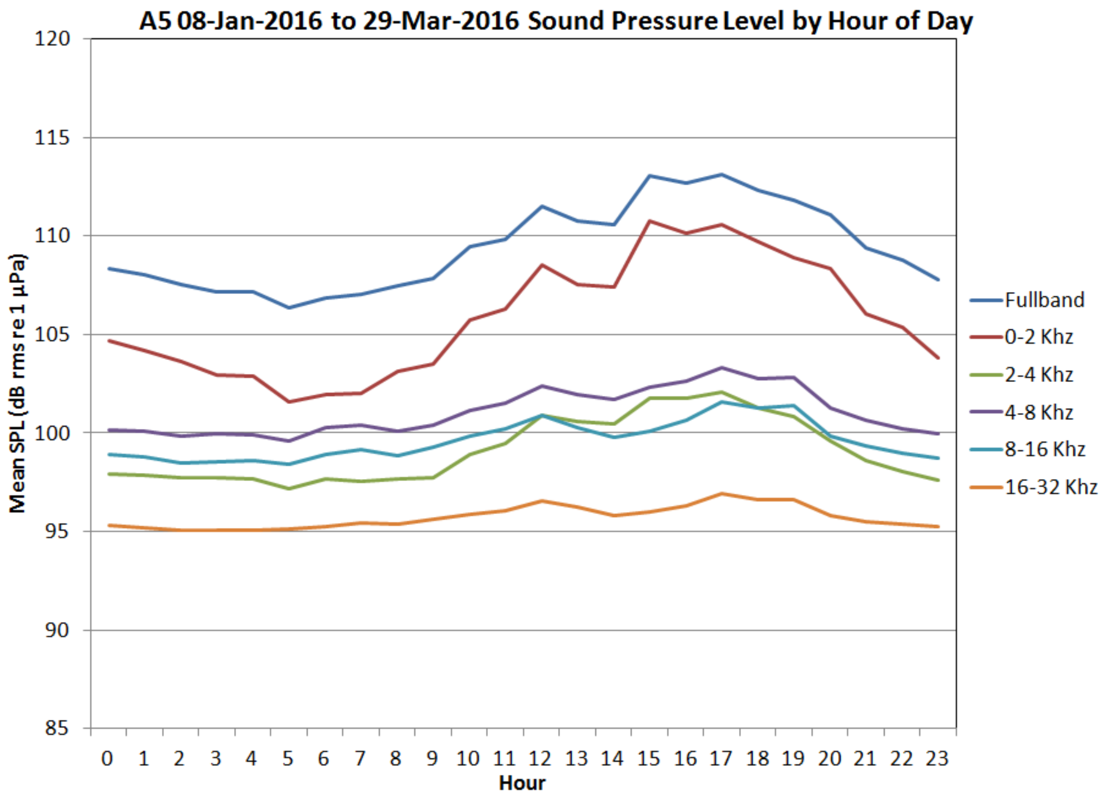
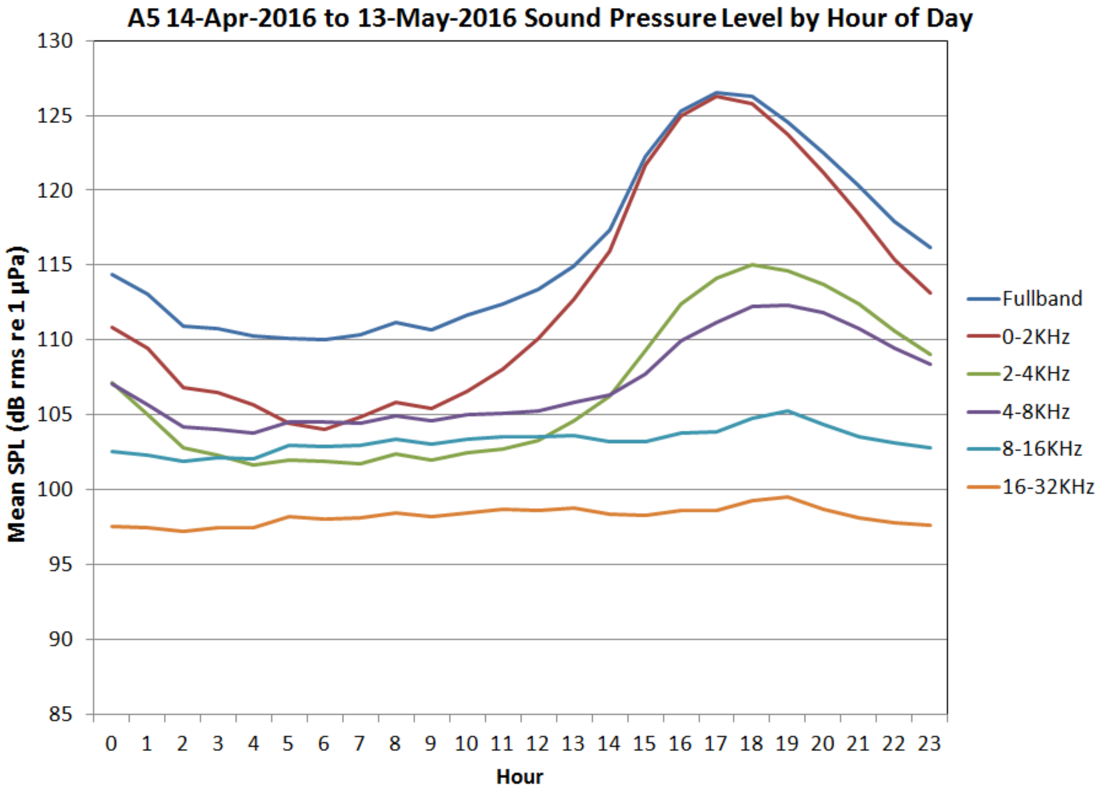


Figure 3.21: Sound Pressure Level (SPL) by Hour of Day, 14 April to 13 May 2016



4 Event and Action Plan for Chinese White Dolphin Monitoring

4.1 Introduction

Section 10.5 of the Updated EM&A Manual stated that Action and Limit Levels and an Event Action Plan for Chinese White Dolphin (CWD) as part of the mitigation measures for the construction of the Project, shall be proposed by the ET and be agreed with the Agriculture, Fisheries and Conservation Department (AFCD) and EPD. This section proposed a consolidated Event Action Plan for CWD during the construction of the Project, for the agreement with AFCD and EPD.

As mentioned in the Updated EM&A Manual and the EIA, it is expected that the 3RS reclamation activities would result in the temporary movement of CWDs away from 3RS works areas during the construction period, and this may be indicated by a further decline in CWD abundance in the Northwest Lantau survey area over the period of construction. As part of the set of required mitigation measures for the construction of the project, an Event and Action Plan framework has been developed that is intended to detect any deterioration in ambient environmental quality that could endanger CWDs or result in an overall decline in CWD numbers in Lantau waters (NEL, NWL, AW, WL and SWL) as a whole below a certain threshold level. Appropriate remedial actions are described and taken as part of the plan, intended to prevent unacceptable deterioration in environmental quality or a reduction in CWD numbers in Lantau waters as a whole below the limit level that may be caused by 3RS construction works.

The Event and Action Plan makes use of data from the baseline CWD monitoring surveys, makes reference from historical data on some key parameters that are indicative of the health of the CWD population (and specifically the portion that uses Hong Kong waters as part of their range), and can be monitored as part of regular EM&A efforts during construction, providing early warning when particularly serious impacts may be occurring. The results would be used as a management tool, so that if the impact on CWD is determined to be from the 3RS construction process, appropriate measures may then be triggered / considered to minimise possible impacts. A set of criteria that may trigger certain actions identified have been developed and are detailed in the following sections.

4.2 Action Response Approach

The approach proposed in the Updated EM&A Manual for formulating the Action Level (AL) and Limit Level (LL) for construction phase CWD monitoring involved using the encounter rate. Encounter rate provides a direct indicator of the health of CWD population and it can be determined from the EM&A effort (i.e. CWD monitoring). Actions will be taken when these levels in Lantau waters have been triggered. Both the Encounter Rate of Number of Dolphin Sightings (STG) and Encounter Rate of Number of Dolphins (ANI) from the baseline survey are adopted as the parameters for determining the AL and LL. The calculation of the CWD encounter rates for determining AL and LL made use of the dataset from the CWD Baseline Monitoring undertaken for this Project (conducted between 18 December 2015 and 17 June 2016) as part of the EM&A requirement under the Environmental Impact Assessment Ordinance (EIAO).

Formulation of Quarterly Encounter Rates

Quarterly Encounter Rate of Number of Dolphin Sightings (STG)

$$STG = \frac{Total\ No.of\ \ On - effort\ Sightings}{Total\ Amount\ of\ Survey\ Effort\ (km)}\ x\ 100$$

Quarterly Encounter Rate of Number of Dolphins (ANI)

$$ANI = \frac{Total\ No.of\ Dolphins\ from\ On - effort\ Sightings}{Total\ Amount\ of\ Survey\ Effort\ (km)}\ x\ 100$$

(Notes: 1. Only data collected under Beaufort 3 or below condition was used;
2. A quarter refers to three survey months, and data collected within a quarter was counted and calculated to obtain the total no. of on-effort sightings, total no. of dolphins from on-effort sightings and total amount of survey effort)

The 3RS Project construction works are expected to result in CWDs temporarily moving away from the 3RS works area, therefore this encounter rate approach using quarterly dolphin vessel survey findings to compare with baseline STG and ANI values, is intended to provide a short to medium term frequency method for monitoring and responding appropriately to changes in CWD abundance as project works progress. It is proposed to set the AL and LL in Lantau waters covering Northeast Lantau (NEL), Northwest Lantau (NWL), Airport West (AW), West Lantau (WL) and Southwest Lantau (SWL) as a whole as it has been anticipated in the Project EIA that the number of CWDs in North Lantau waters will decline due the Project and CWDs may move to other areas around Lantau including West Lantau and Southwest Lantau. A combined encounter rate can present a general picture of the entire waters around the Project area and Lantau. The combined quarterly encounter rates STG and ANI calculated from the dataset of the CWD Baseline Monitoring for the Project (18 December 2015 to 17 June 2016) are presented in **Table 4.1** below.

Table 4.1: STG and ANI for Hong Kong Western Waters

	Combined (NEL/NWL/AW/WL/SWL) Quarterly Encounter Rate	
	18 December 2015 – 17 March 2016	18 March – 17 June 2016
STG	1.86	3.72
ANI	9.35	15.21

Source: CWD Baseline Monitoring (18 December 2015 to 17 June 2016)

Natural seasonal fluctuations of CWD encounter rates across the four seasons may cause non-project related exceedances of AL and/or LL, therefore historical CWD data has been reviewed to take into account the effect of seasonal fluctuations of CWD encounter rate. The seasonal variations of CWD quarterly encounter rates based on the AFCD long term marine mammals monitoring in the past six years (2010 to early 2016) covering the NEL, NWL, WL and SWL waters were reviewed (**Figure 4.1 and Figure 4.2**). The findings showed that in general, the first quarter or winter/spring (Q1, i.e. January to March) of the year is the low season for CWD encounters, with the values of STG and ANI consistently being the lowest during Q1 amongst the four quarters over the years with a decreasing trend (except for one year when Q4 appeared to be the lowest in 2012). The CWD encounter rates generally increase in Q2 or summer (except for 2013), with the CWD baseline monitoring for the 3RS project also showing a similar trend (i.e. encounter rates increase from the first survey quarter (winter/spring) to the second survey quarter (late spring/early summer)). Although the encounter rates were lower than the AFCD records, this is possibly due to various factors not limited to surveys being conducted by different surveyors, different survey effort in certain waters and different days for the surveys.

The dataset of the CWD Baseline Monitoring for this Project has been taken mainly during Q1 to Q2 of 2016 during which time the quarterly encounter rates for STG and ANI were collected in the first quarter (18 December 2015 to 17 March 2016), thereby capturing the low season. The dataset is therefore suitable for establishing the AL and/or LL for future impact monitoring. As the baseline survey did not cover the full year to cover the peak season encounter rate, the AL and/or LL is subject to further review when a full year data set is collected. The criteria for triggering the AL and LL during CWD impact monitoring are detailed in **Table 4.2** and **Table 4.3** below.

Figure 4.1: Quarterly Encounter Rates of AFCD's Monitoring Data

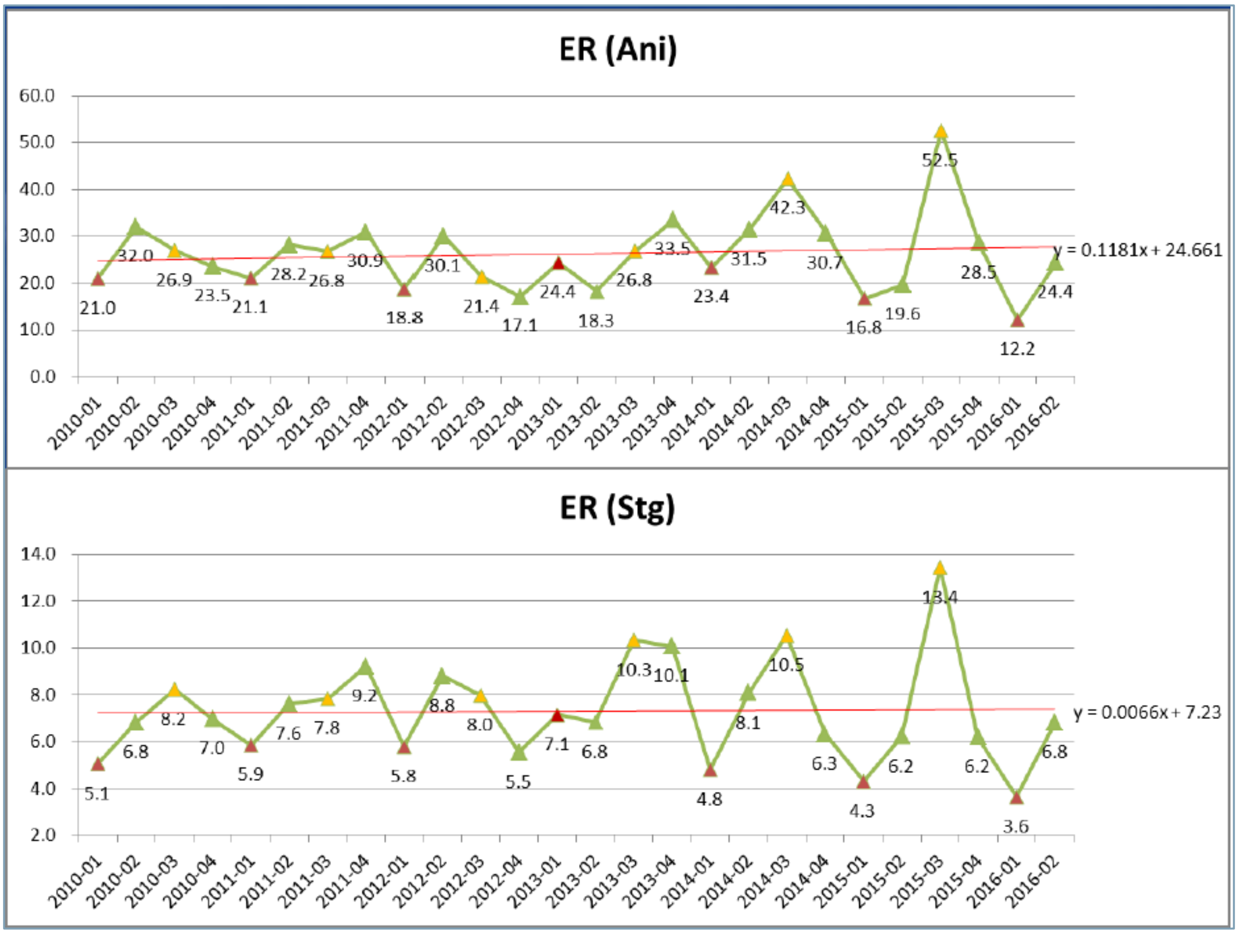


Figure 4.2: Quarterly Encounter Rates and Running Average Encounter Rates of AFCD's Monitoring Data

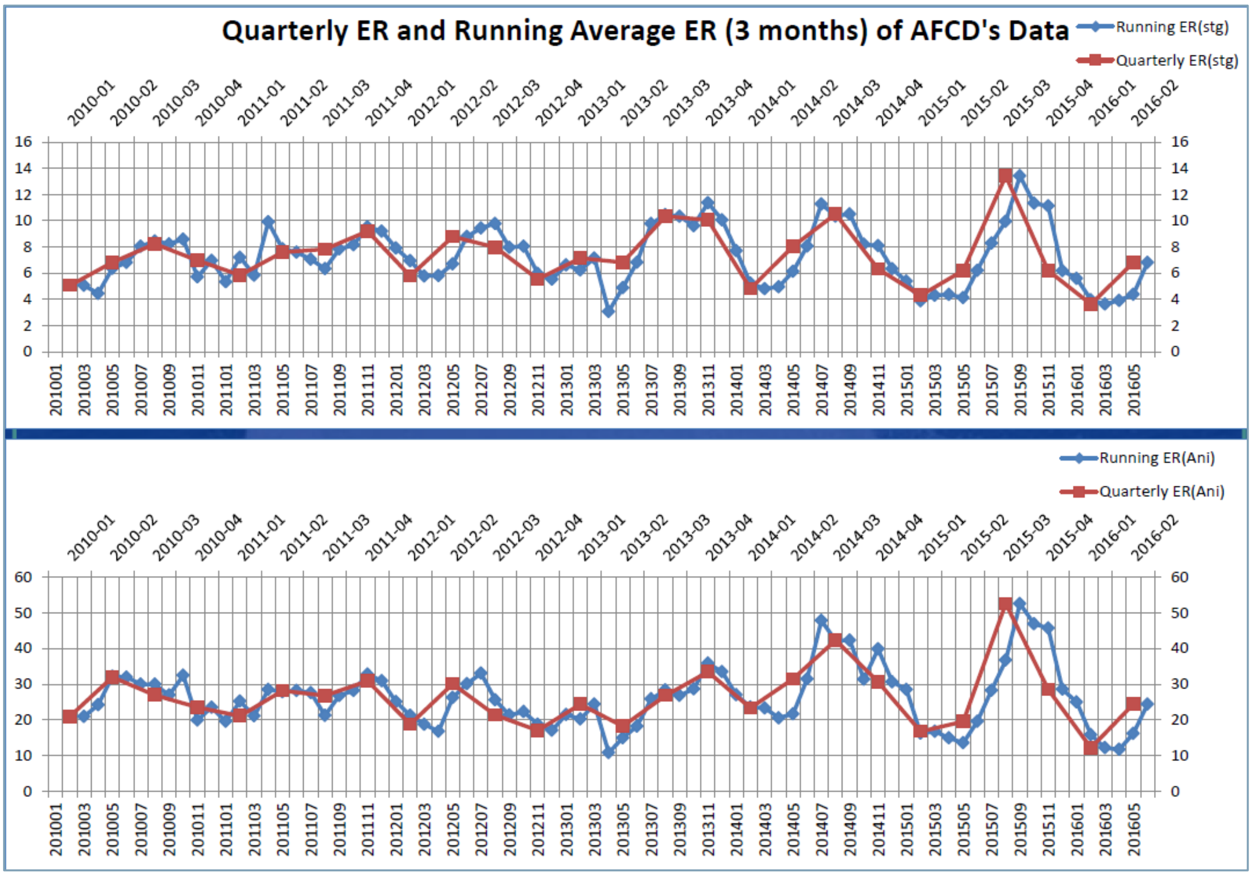


Table 4.2: Approach to Define Action Level (AL) and Limit Level (LL)

	NEL, NWL, AW, WL and SWL as a Whole
Action Level	Running quarterly* STG & ANI < low season quarterly encounter rates derived from baseline monitoring data
Limit Level	Two consecutive running quarterly^ (3-month) STG & ANI < low season quarterly encounter rates derived from baseline monitoring data

Table 4.3: Derived Values of Action Level (AL) and Limit Level (LL)

	NEL, NWL, AW, WL and SWL as a Whole
Action Level	Running quarterly* STG < 1.86 & ANI < 9.35
Limit Level	Two consecutive running quarterly^ (3-month) STG < 1.86 & ANI < 9.35

[Notes for Table 4.2 and Table 4.3:
*Action Level – running quarterly STG & ANI will be calculated from the three preceding survey months, e.g. if works commence on 1 August 2016, the CWD impact monitoring report will review the data from 18 May to 17 June 2016 covering two sets of transect surveys for all monitoring areas and the data to be collected in July and August 2016 (also with two sets of transect surveys for all monitoring areas) for calculating the quarterly encounter rates STG & ANI. For CWD impact monitoring for September 2016, data from 1 July to 30 September 2016 will be used to calculate the quarterly encounter rates STG & ANI;
^Limit Level – two consecutive running quarters mean if works commenced in August 2016, the first running quarter for reporting will be 18 May to 17 June 2016, July 2016 to August 2016, and the second running quarter will be July 2016 to September 2016.
AL and/or LL will be triggered if both STG and ANI fall below the criteria.]

After the impact monitoring commences, the combined data from the baseline monitoring, pre-construction monitoring and the construction phase monitoring data will be used for the calculation of the quarterly encounter rate. If works commence on 1 August 2016, the CWD impact monitoring report will refer to data from 18 May to 17 June 2016 to ensure that two sets of transect surveys for all monitoring areas are used for the first month in the quarter with data to be collected in July and August 2016 (also covering two sets of transect surveys for all monitoring areas) when calculating the quarterly STG and ANI encounter rates. For CWD impact monitoring for September 2016, data from 1 July to 30 September 2016 will be used to calculate the quarterly STG and ANI encounter rates. If both quarterly STG and ANI are lower than the baseline values 1.86 and 9.35 respectively, the action level will be triggered.

For the Limit Level, the second reporting month will be September 2016 if works commence on 1 August 2016. The two consecutive running quarterly encounter rates as described above will be reviewed. If both STG and ANI for two consecutive running quarters be lowered than the baseline values, the Limit Level will be triggered.

The adoption of running quarter encounter rate approach will allow short term response to events that triggered the action / limit levels after review the monitoring data for each month, which is preferable than the traditional quarterly encounter rate approach that action/limit levels may only be triggered after 3 to 4 months of the impact monitoring. Therefore, the running quarter encounter rate approach will also allow more effective measures to be adopted to mitigate the short term effect encountered during the construction phase.

To further strengthen the Event and Action Plan for CWD, it is recommended that upon the collection of 12 months CWD monitoring data, a review of the annual encounter rate be made. These will also include the review of potential peak season that have not be realised in this 6-month baseline monitoring. Should any of the Event and Action Plan be updated, agreement will be seek from the EPD/AFCD, certify by ET Leader and verify by IEC prior to implementation of the updated Event and Action Plan.

4.3 Consolidated Event and Action Plan for CWD Monitoring

The Event and Action Plan, which is proposed in the Updated EM&A Manual has been reviewed and consolidated based on the CWD baseline study. Details of the events and actions corresponding to the action and limit levels are presented in **Table 4.4**.

Table 4.4: Event and Action Plan for CWD

	Action			
Event	**Dolphin Expert/ET Leader**	**IEC**	**AAHK / PM**	**Contractor**
Action Level	1. Check monitoring data; 2. Repeat data analysis to confirm findings; 3. Review all available and relevant data covered in the EM&A and the survey data collected at the Lantau waters, i.e. NWL, SWL, WL and NEL, to ascertain if the exceedance is due to natural variation or works related; 4. Identify source(s) of impact; 5. Inform the IEC, AAHK/ PM and Contractor; 6. Instruct an increase in the DEZ area to be monitored from 250m to 500m for daytime works; and 7. Increase site inspection and audit frequency to ensure all the dolphin protective and/or precautionary measures (e.g. consider enhancing dolphin watch patrols, phasing of construction works, review of construction methods, etc.) and other relevant measures are fully and properly implemented.	1. Check monitoring data submitted by ET and the Contractor; 2. Check the data review outcome by ET with the ETL; and 3. Conduct additional site inspection and audit with ET to ensure all the dolphin protective and/or precautionary measures are fully and properly implemented and advise AAHK / PM the audit results and findings accordingly.	1. Discuss the need for increased site inspection and audit frequency proposed by ET with the ETL, IEC, and the Contractor; and 2. Check the audit results and findings from ET and IEC.	1. Inform the AAHK /PM and confirm notification of the non-compliance in writing; 2. Conduct site inspection and audit with the ETL and IEC; and 3. Ensure all the dolphin protective and/or precautionary measures are fully and properly Implemented.
Limit Level	1. Check monitoring data; 2. Repeat statistical data analysis to confirm findings; 3. Review all available and relevant data covered in the EM&A and the survey data collected at the Lantau waters, i.e. NWL, SWL, WL and NEL, to ascertain if the exceedance is due to natural variation or project related; 4. Identify source(s) of impact; 5. Inform the IEC, AAHK / PM and Contractor; 6. Repeat review with the Contractor representatives and IEC to ensure all the dolphin protective measures are fully and properly implemented and advise on additional measures, if necessary; 7. Review previous occurrence of non-compliance events to investigate if there is a longer term trend that needs attention; and 8. ET provides evidence of the	1. Check monitoring data submitted by ET and Contractor; 2. Discussing monitoring results and findings with the ET, Dolphin Experts and the Contractor; 3. Review with the Contractor representatives and ET to ensure all the dolphin protective measures are fully and properly implemented; 4. Discuss further mitigation measures with the ET, AAHK/PM and the Contractor; 5. Review proposals for additional monitoring and any other mitigation measures submitted by ET and Contractor and advise AAHK/ PM of the results and	1. Convene an expert panel involving IEC (and dolphin experts), AFCD and EPD to review the situation and determine any necessary actions based on the options / mitigation details as proposed by the ET/ Contractors. 2. Discuss further mitigation measures with the ET, IEC and the Contractor; and 3. Supervise the implementation of additional monitoring and/or any other mitigation measures.	1. Inform the AAHK/ PM and confirm notification of the non-compliance in writing; 2. Discuss further mitigation measures with the ETL, IEC and AAHK/ PM; 3. Review with ET and IEC again to ensure all the dolphin protective measures are fully and properly implemented and carried out additional measures, if necessary; 4. Jointly submit with ET to IEC and expert panel a proposal of additional dolphin monitoring

	Action			
Event	Dolphin Expert/ET Leader	IEC	AAHK / PM	Contractor
	suspected source of impact that may be caused by any of the construction activity under works contracts of the project, ET arranges a meeting to discuss with IEC, AAHK and Contractors on the need for further monitoring and/or any other potential mitigation measures (e.g. consider modified design, or consider controlling or temporarily stopping relevant marine works etc.), consultation with AFCD and EPD and submit to IEC any proposal on additional dolphin monitoring and/or mitigation measures for certification where necessary.	findings accordingly; and 6. Supervise / audit the implementation of additional monitoring and/or any other mitigation measures and advise AAHK/PM the results and findings accordingly.		and/or any other mitigation measures when necessary; and 5. Implement the agreed additional dolphin monitoring and/or any other mitigation measures.

5 Discussions and Conclusions

This report summarises the findings of the 6-month CWD baseline monitoring results and the pre-construction conditions prior to the commencement of the marine construction works of the 3RS Project. Vessel survey data from this monitoring period found no CWD in the NEL area. There is initial indication that SWL and WL areas are being more heavily used by CWDs, and this may have resulted from CWDs shifting their activities to parts of their home range in SWL and WL waters to avoid the NEL area. However, despite these changes, some regions within the North Lantau waters are still being used as important dolphin habitat (especially the area around Lung Kwu Chau and the Urmston Road area near Castle Peak).

Vessel surveys have provided data for estimating the density and abundance of dolphins in Hong Kong during the baseline phase before 3RS construction (note the baseline period occurred mostly during winter and spring months, when the dolphin encounter rate in Hong Kong waters tend to be lower compared to other seasons). There is evidence of decreased use of NEL and NWL and increased use of the WL and SWL areas.

Based on theodolite data, the waters off Lung Kwu Chau are still an important foraging area for CWDs. Relative occurrence peaked in April 2016, concurrent with the beginning of the wet season. Group sizes of CWDs were generally smaller closer to shore, with the largest groups occurring farther from shore, at times beyond the SCLKCMP boundary within the SkyPier HSFs route diversion and speed restriction zone.

The PAM data continue to provide useful information, especially on patterns of dolphin vocalization at night, which has previously been unavailable to us. The single EAR unit (A5) showed reduced levels of dolphin detections from previous periods. The diurnal detection of clicks showed a consistent pattern of higher levels at night compared with the day, which may be indicative of increased use of echolocation by dolphins during hours of darkness.

The Action and Limit Levels have been established based on the recent CWD baseline monitoring data collected for this project. The running quarterly encounter rates levels will be adopted as the criteria for triggering any short term to medium term event actions during the construction phase of the project, with the aim to minimise the impacts on CWDs.

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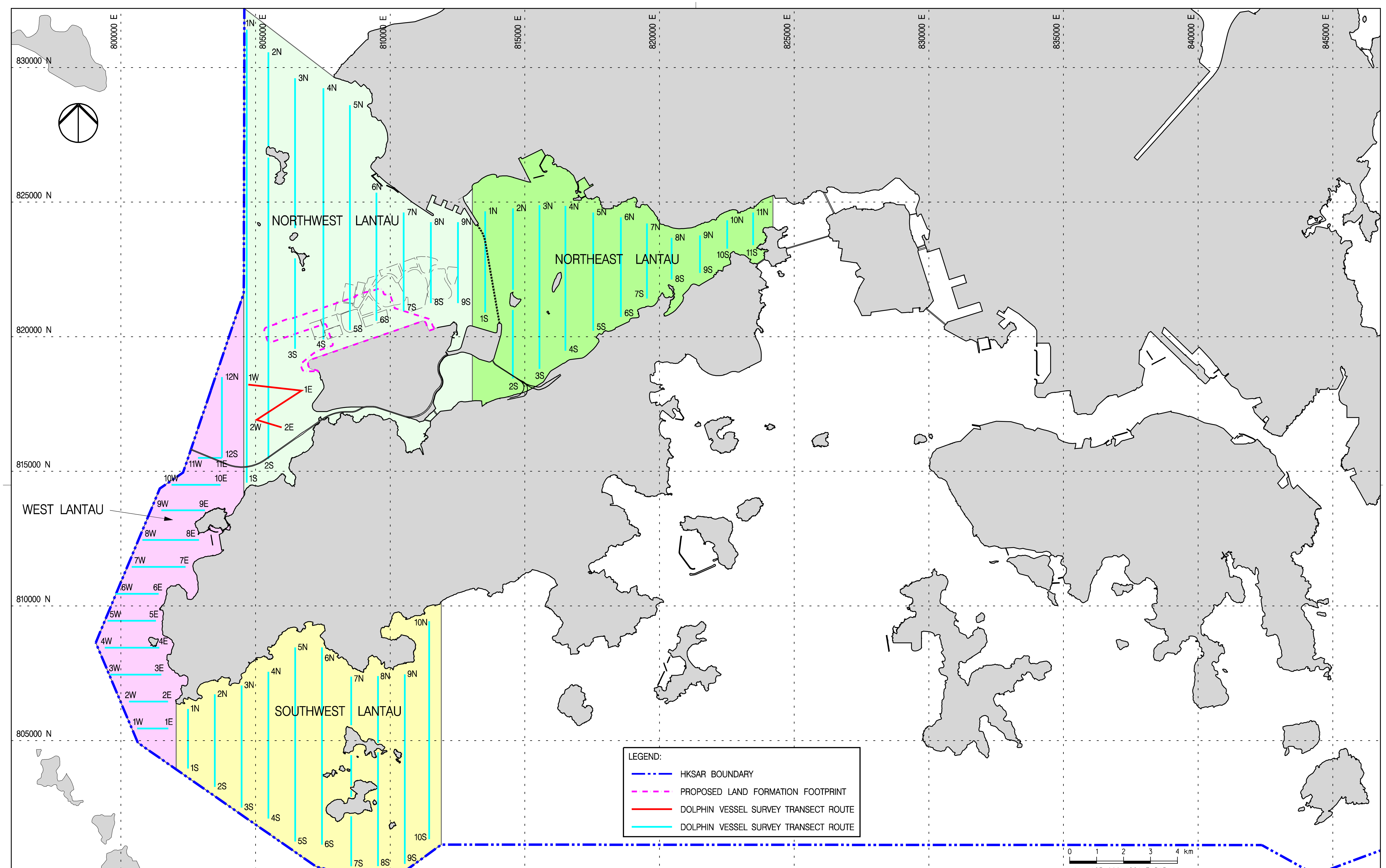
Figures



Rev.	Date	Description	Checked
A	02DEC15	FIRST ISSUE	JC

香港國際機場 HONG KONG INTERNATIONAL AIRPORT

Mott MacDonald

Title

VESSEL BASED DOLPHIN MONITORING TRANSECTS IN BASELINE MONITORING

Consultant's Signatures for Approval		Date
Design	JC	02DEC15
Checkers	JC / TK	02DEC15
Approver	EC	02DEC15

EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No. FIGURE 2.1

Scale at A3 1 : 125000

Rev. A

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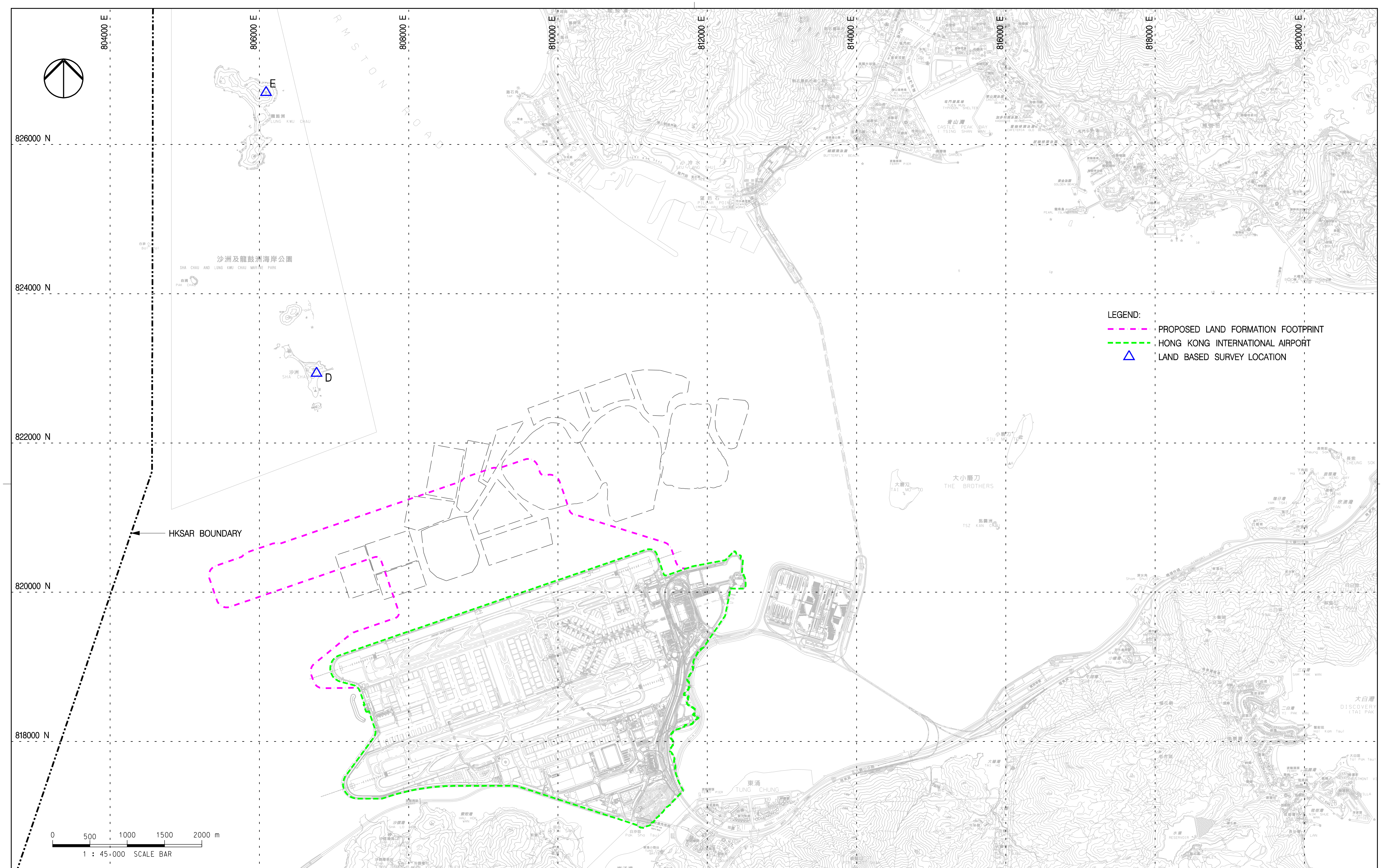

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LAND BASED DOLPHIN MONITORING
IN BASELINE AND CONSTRUCTION PHASES

Consultant's Signatures for Approval		Date
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Approver	EC	02DEC15

EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No.

FIGURE 2.2

Scale at A3: 1 : 45000

Rev.: A

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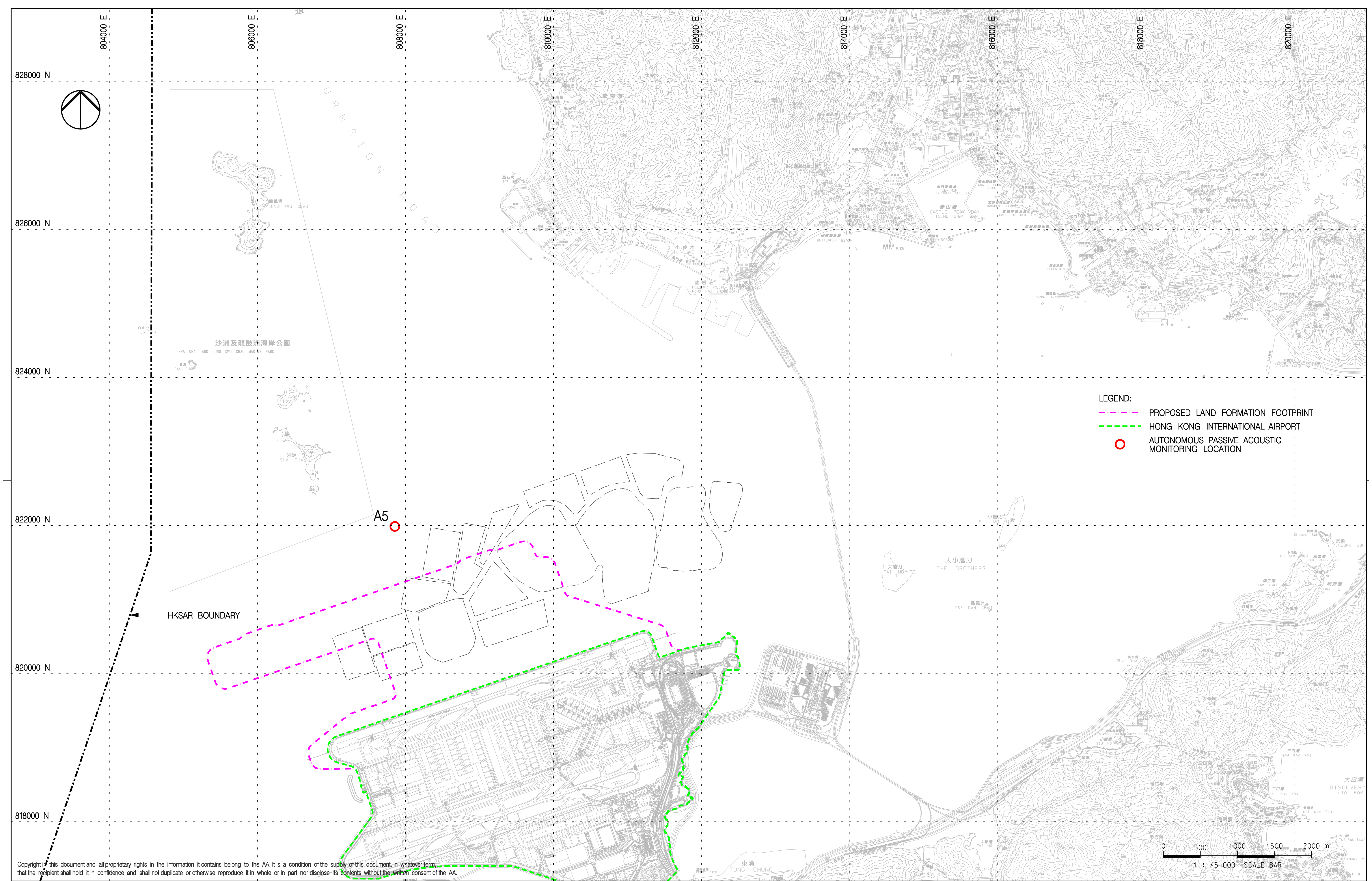

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LOCATIONS FOR AUTONOMOUS PASSIVE ACOUSTIC MONITORING IN BASELINE AND CONSTRUCTION PHASES

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EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No.

FIGURE 2.3

Scale at A3: 1 : 45000

Rev.: A

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Appendices

Appendix A Survey Effort Database

DATE	AREA	BEAU	KM SEARCHED	SEASON	VESSEL
18-Dec-15	AW	3	5.45	WINTER	32166
18-Dec-15	WL	3	15.50	WINTER	32166
18-Dec-15	WL	4	18.74	WINTER	32166
18-Dec-15	SWL	2	0.29	WINTER	32166
18-Dec-15	SWL	3	3.56	WINTER	32166
18-Dec-15	SWL	4	2.71	WINTER	32166
21-Dec-15	NEL	1	1.70	WINTER	32166
21-Dec-15	NEL	2	46.00	WINTER	32166
21-Dec-15	NWL	1	1.08	WINTER	32166
21-Dec-15	NWL	2	24.22	WINTER	32166
21-Dec-15	NWL	3	12.50	WINTER	32166
23-Dec-15	SWL	1	0.66	WINTER	32166
23-Dec-15	SWL	2	38.70	WINTER	32166
23-Dec-15	SWL	3	23.60	WINTER	32166
29-Dec-15	NEL	2	19.14	WINTER	32166
29-Dec-15	NEL	3	28.26	WINTER	32166
29-Dec-15	NWL	2	16.29	WINTER	32166
29-Dec-15	NWL	3	20.61	WINTER	32166
4-Jan-16	SWL	1	11.46	WINTER	32166
4-Jan-16	SWL	2	50.04	WINTER	32166
5-Jan-16	NWL	2	1.72	WINTER	32166
5-Jan-16	NWL	3	31.52	WINTER	32166
5-Jan-16	NWL	4	11.15	WINTER	32166
6-Jan-16	AW	2	3.47	WINTER	32166
6-Jan-16	WL	2	8.10	WINTER	32166
6-Jan-16	WL	3	26.47	WINTER	32166
6-Jan-16	SWL	3	7.01	WINTER	32166
15-Jan-16	NWL	2	2.23	WINTER	32166
15-Jan-16	NWL	3	36.47	WINTER	32166
15-Jan-16	NWL	4	6.30	WINTER	32166
18-Jan-16	NEL	1	6.90	WINTER	32166
18-Jan-16	NEL	2	36.79	WINTER	32166
18-Jan-16	NEL	3	3.71	WINTER	32166
18-Jan-16	NWL	1	1.21	WINTER	32166
18-Jan-16	NWL	2	16.19	WINTER	32166
18-Jan-16	NWL	3	19.50	WINTER	32166
19-Jan-16	AW	2	5.09	WINTER	32166
19-Jan-16	WL	2	9.17	WINTER	32166
19-Jan-16	WL	3	22.49	WINTER	32166
19-Jan-16	WL	4	3.44	WINTER	32166
19-Jan-16	SWL	2	2.92	WINTER	32166
19-Jan-16	SWL	3	3.55	WINTER	32166
20-Jan-16	NEL	3	46.50	WINTER	32166
20-Jan-16	NEL	4	1.60	WINTER	32166
20-Jan-16	NWL	2	7.40	WINTER	32166
20-Jan-16	NWL	3	29.30	WINTER	32166
20-Jan-16	NWL	4	1.10	WINTER	32166

DATE	AREA	BEAU	KM SEARCHED	SEASON	VESSEL
22-Jan-16	SWL	2	4.20	WINTER	32166
22-Jan-16	SWL	3	50.41	WINTER	32166
22-Jan-16	SWL	4	7.60	WINTER	32166
27-Jan-16	NWL	2	11.20	WINTER	32166
27-Jan-16	NWL	3	29.53	WINTER	32166
27-Jan-16	NWL	4	4.47	WINTER	32166
29-Jan-16	SWL	1	1.20	WINTER	32166
29-Jan-16	SWL	2	48.04	WINTER	32166
29-Jan-16	SWL	3	12.15	WINTER	32166
1-Feb-16	AW	3	4.66	WINTER	32166
1-Feb-16	WL	3	4.92	WINTER	32166
2-Feb-16	WL	3	33.43	WINTER	32166
2-Feb-16	SWL	3	3.64	WINTER	32166
2-Feb-16	SWL	3	3.29	WINTER	32166
5-Feb-16	NWL	2	5.03	WINTER	32166
5-Feb-16	NWL	3	24.37	WINTER	32166
5-Feb-16	NWL	4	14.57	WINTER	32166
18-Feb-16	AW	1	0.36	WINTER	32166
18-Feb-16	AW	2	4.22	WINTER	32166
18-Feb-16	WL	1	4.40	WINTER	32166
18-Feb-16	WL	2	29.85	WINTER	32166
18-Feb-16	SWL	2	9.62	WINTER	32166
18-Feb-16	SWL	3	3.10	WINTER	32166
19-Feb-16	SWL	1	1.10	WINTER	32166
19-Feb-16	SWL	2	53.10	WINTER	32166
19-Feb-16	SWL	3	2.50	WINTER	32166
29-Feb-16	NWL	2	11.14	WINTER	32166
29-Feb-16	NWL	3	32.57	WINTER	32166
1-Mar-16	NEL	2	14.10	SPRING	32166
1-Mar-16	NEL	3	32.80	SPRING	32166
1-Mar-16	NWL	2	2.49	SPRING	32166
1-Mar-16	NWL	3	35.01	SPRING	32166
2-Mar-16	AW	3	4.68	SPRING	32166
2-Mar-16	WL	2	14.23	SPRING	32166
2-Mar-16	WL	3	15.38	SPRING	32166
2-Mar-16	WL	4	4.40	SPRING	32166
2-Mar-16	SWL	3	7.09	SPRING	32166
2-Mar-16	SWL	4	5.41	SPRING	32166
7-Mar-16	NEL	1	16.75	SPRING	32166
7-Mar-16	NEL	2	20.35	SPRING	32166
7-Mar-16	NEL	3	10.30	SPRING	32166
7-Mar-16	NWL	3	37.80	SPRING	32166
8-Mar-16	NWL	2	11.94	SPRING	32166
8-Mar-16	NWL	3	33.06	SPRING	32166
9-Mar-16	SWL	1	2.50	SPRING	32166
9-Mar-16	SWL	2	51.03	SPRING	32166
9-Mar-16	SWL	3	3.11	SPRING	32166
18-Mar-16	SWL	2	50.85	SPRING	32166
18-Mar-16	SWL	3	6.09	SPRING	32166
21-Mar-16	NEL	2	2.06	SPRING	32166

DATE	AREA	BEAU	KM SEARCHED	SEASON	VESSEL
21-Mar-16	NEL	3	34.44	SPRING	32166
21-Mar-16	NEL	4	11.50	SPRING	32166
21-Mar-16	NWL	3	18.91	SPRING	32166
21-Mar-16	NWL	4	8.49	SPRING	32166
22-Mar-16	NWL	2	10.95	SPRING	32166
22-Mar-16	NWL	3	33.65	SPRING	32166
22-Mar-16	NWL	4	8.10	SPRING	32166
23-Mar-16	NWL	2	5.90	SPRING	32166
23-Mar-16	NWL	3	38.52	SPRING	32166
5-Apr-16	SWL	1	2.86	SPRING	32166
5-Apr-16	SWL	2	39.58	SPRING	32166
5-Apr-16	SWL	3	20.20	SPRING	32166
6-Apr-16	AW	2	2.31	SPRING	32166
6-Apr-16	AW	3	2.66	SPRING	32166
6-Apr-16	WL	1	1.06	SPRING	32166
6-Apr-16	WL	2	11.05	SPRING	32166
6-Apr-16	WL	3	16.28	SPRING	32166
6-Apr-16	WL	4	5.02	SPRING	32166
6-Apr-16	SWL	2	1.26	SPRING	32166
6-Apr-16	SWL	3	4.28	SPRING	32166
12-Apr-16	AW	4	5.06	SPRING	32166
12-Apr-16	WL	2	0.57	SPRING	32166
12-Apr-16	WL	3	9.05	SPRING	32166
12-Apr-16	WL	4	23.66	SPRING	32166
12-Apr-16	SWL	3	8.76	SPRING	32166
12-Apr-16	SWL	4	3.84	SPRING	32166
13-Apr-16	NEL	1	10.27	SPRING	32166
13-Apr-16	NEL	2	42.87	SPRING	32166
13-Apr-16	NWL	1	2.70	SPRING	32166
13-Apr-16	NWL	2	35.80	SPRING	32166
21-Apr-16	AW	1	3.92	SPRING	32166
21-Apr-16	AW	2	0.80	SPRING	32166
21-Apr-16	WL	1	6.80	SPRING	32166
21-Apr-16	WL	2	14.74	SPRING	32166
21-Apr-16	WL	3	10.92	SPRING	32166
21-Apr-16	SWL	1	3.80	SPRING	32166
21-Apr-16	SWL	2	3.06	SPRING	32166
22-Apr-16	NWL	2	33.02	SPRING	32166
22-Apr-16	NWL	3	11.05	SPRING	32166
26-Apr-16	NEL	1	0.88	SPRING	32166
26-Apr-16	NEL	2	27.41	SPRING	32166
26-Apr-16	NEL	3	16.11	SPRING	32166
26-Apr-16	NEL	4	3.00	SPRING	32166
26-Apr-16	NWL	2	11.78	SPRING	32166
26-Apr-16	NWL	3	22.02	SPRING	32166
26-Apr-16	NWL	4	3.40	SPRING	32166
27-Apr-16	SWL	1	14.11	SPRING	32166
27-Apr-16	SWL	2	43.88	SPRING	32166
27-Apr-16	SWL	3	2.90	SPRING	32166
3-May-16	SWL	1	36.55	SPRING	32166

DATE	AREA	BEAU	KM SEARCHED	SEASON	VESSEL
3-May-16	SWL	2	15.42	SPRING	32166
3-May-16	SWL	3	8.80	SPRING	32166
4-May-16	NEL	1	1.60	SPRING	32166
4-May-16	NEL	2	35.94	SPRING	32166
4-May-16	NEL	3	9.96	SPRING	32166
4-May-16	NWL	1	2.50	SPRING	32166
4-May-16	NWL	2	30.90	SPRING	32166
4-May-16	NWL	3	4.00	SPRING	32166
9-May-16	AW	2	0.96	SPRING	32166
9-May-16	AW	3	3.39	SPRING	32166
9-May-16	WL	2	6.37	SPRING	32166
9-May-16	WL	3	21.94	SPRING	32166
9-May-16	WL	4	5.81	SPRING	32166
9-May-16	SWL	2	2.57	SPRING	32166
9-May-16	SWL	3	4.34	SPRING	32166
10-May-16	NWL	2	22.30	SPRING	32166
10-May-16	NWL	3	18.24	SPRING	32166
10-May-16	NWL	4	4.36	SPRING	32166
19-May-16	NEL	2	4.18	SPRING	32166
19-May-16	NEL	3	26.02	SPRING	32166
19-May-16	NEL	4	17.30	SPRING	32166
23-May-16	NWL	2	55.49	SPRING	32166
23-May-16	NWL	3	16.07	SPRING	32166
23-May-16	NWL	4	0.50	SPRING	32166
24-May-16	AW	2	4.58	SPRING	32166
24-May-16	WL	1	11.26	SPRING	32166
24-May-16	WL	2	16.40	SPRING	32166
24-May-16	WL	3	2.19	SPRING	32166
24-May-16	SWL	2	2.70	SPRING	32166
24-May-16	SWL	3	1.64	SPRING	32166
25-May-16	SWL	2	11.20	SPRING	32166
25-May-16	SWL	3	21.20	SPRING	32166
25-May-16	SWL	4	27.25	SPRING	32166
25-May-16	SWL	5	2.50	SPRING	32166
30-May-16	NWL	2	5.40	SPRING	32166
30-May-16	NWL	3	47.88	SPRING	32166
30-May-16	NWL	4	28.49	SPRING	32166
31-May-16	NEL	1	2.47	SPRING	32166
31-May-16	NEL	2	28.90	SPRING	32166
31-May-16	NEL	3	15.63	SPRING	32166
31-May-16	NWL	4	10.40	SPRING	32166
6-Jun-16	AW	2	4.91	SUMMER	32166
6-Jun-16	WL	2	28.70	SUMMER	32166
6-Jun-16	WL	3	4.97	SUMMER	32166
6-Jun-16	SWL	2	2.40	SUMMER	32166
6-Jun-16	SWL	3	1.16	SUMMER	32166
7-Jun-16	SWL	2	9.90	SUMMER	32166
7-Jun-16	SWL	3	45.15	SUMMER	32166
7-Jun-16	SWL	4	7.40	SUMMER	32166

Appendix B Sighting Database

DATE	STG #	TIME	CWD/FP	HRD SZ	AREA	BEAU	PSD	EFFORT	TYPE	DEC LAT	DEC LON	SEASON	BOAT ASSOC.
18-Dec-15	1	1028	CWD	4	WL	3	N/A	OFF	3RS ET BASELINE	22.2616	113.8561	WINTER	NONE
18-Dec-15	2	1149	CWD	10	WL	4	273	ON	3RS ET BASELINE	22.2196	113.8157	WINTER	NONE
18-Dec-15	3	1321	CWD	12	SWL	3	498	ON	3RS ET BASELINE	22.1791	113.8500	WINTER	NONE
18-Dec-15	4	1413	CWD	2	SWL	3	47	ON	3RS ET BASELINE	22.1967	113.8696	WINTER	NONE
23-Dec-15	1	1043	FP	2	SWL	2	170	ON	3RS ET BASELINE	22.1713	113.9363	WINTER	NONE
04-Jan-16	1	1137	FP	1	SWL	2	115	ON	3RS ET BASELINE	22.1817	113.9213	WINTER	NONE
04-Jan-16	2	1351	CWD	4	SWL	2	187	ON	3RS ET BASELINE	22.2056	113.8877	WINTER	PURSE SEINE
05-Jan-16	1	1019	CWD	4	NWL	3	242	ON	3RS ET BASELINE	22.3908	113.8754	WINTER	NONE
06-Jan-16	1	0924	CWD	6	AW	2	206	ON	3RS ET BASELINE	22.3014	113.8786	WINTER	NONE
06-Jan-16	2	1217	CWD	9	WL	3	143	ON	3RS ET BASELINE	22.2041	113.8293	WINTER	NONE
06-Jan-16	3	1334	CWD	5	SWL	3	N/A	OFF	3RS ET BASELINE	22.1929	113.8461	WINTER	NONE
19-Jan-16	1	1106	CWD	8	WL	3	419	ON	3RS ET BASELINE	22.2433	113.8488	WINTER	NONE
19-Jan-16	2	1319	CWD	13	SWL	3	23	ON	3RS ET BASELINE	22.1934	113.8496	WINTER	GILLNET
19-Jan-16	3	1416	CWD	6	SWL	2	524	ON	3RS ET BASELINE	22.1939	113.8589	WINTER	NONE
22-Jan-16	1	1029	CWD	5	SWL	3	3	ON	3RS ET BASELINE	22.2010	113.9359	WINTER	NONE
29-Jan-16	1	1324	FP	1	SWL	2	343	ON	3RS ET BASELINE	22.1852	113.8964	WINTER	NONE
02-Feb-16	1	1025	CWD	2	WL	3	48	ON	3RS ET BASELINE	22.2502	113.8525	WINTER	NONE
02-Feb-16	2	1106	CWD	1	WL	3	39	ON	3RS ET BASELINE	22.2312	113.8318	WINTER	NONE
02-Feb-16	3	1159	CWD	1	WL	3	47	ON	3RS ET BASELINE	22.2063	113.8279	WINTER	NONE
02-Feb-16	4	1240	CWD	2	SWL	3	N/A	OFF	3RS ET BASELINE	22.1949	113.8460	WINTER	NONE
02-Feb-16	5	1347	CWD	2	SWL	2	N/A	OFF	3RS ET BASELINE	22.2104	113.9337	WINTER	GILLNET
05-Feb-16	1	1001	CWD	19	NWL	3	182	ON	3RS ET BASELINE	22.4065	113.8873	WINTER	SINGLE TRAWLER
05-Feb-16	2	1110	CWD	4	NWL	2	92	ON	3RS ET BASELINE	22.3686	113.8785	WINTER	NONE
05-Feb-16	3	1128	CWD	2	NWL	2	396	ON	3RS ET BASELINE	22.3623	113.8788	WINTER	NONE
05-Feb-16	4	1247	CWD	1	NWL	4	88	ON	3RS ET BASELINE	22.3309	113.8681	WINTER	NONE
18-Feb-16	1	0933	CWD	4	AW	2	N/A	OFF	3RS ET BASELINE	22.2993	113.8908	WINTER	NONE
18-Feb-16	2	0953	CWD	4	AW	2	149	ON	3RS ET BASELINE	22.2984	113.8853	WINTER	NONE
18-Feb-16	3	1224	CWD	2	WL	2	75	ON	3RS ET BASELINE	22.2060	113.8240	WINTER	NONE

DATE	STG #	TIME	CWD/FP	HRD SZ	AREA	BEAU	PSD	EFFORT	TYPE	DEC LAT	DEC LON	SEASON	BOAT ASSOC.
18-Feb-16	4	1423	FP	10	SWL	1	N/A	OFF	3RS ET BASELINE	22.1741	113.8859	WINTER	NONE
29-Feb-16	1	1142	CWD	2	NWL	2	134	ON	3RS ET BASELINE	22.3280	113.8685	WINTER	NONE
29-Feb-16	2	1220	CWD	2	NWL	2	114	ON	3RS ET BASELINE	22.3529	113.8678	WINTER	NONE
29-Feb-16	3	1239	CWD	3	NWL	3	527	ON	3RS ET BASELINE	22.3653	113.8682	WINTER	NONE
02-Mar-16	1	1045	CWD	6	WL	2	590	ON	3RS ET BASELINE	22.2738	113.8477	SPRING	NONE
08-Mar-16	1	1014	CWD	1	NWL	3	141	ON	3RS ET BASELINE	22.3876	113.8776	SPRING	NONE
09-Mar-16	1	1020	FP	3	SWL	1	N/A	OFF	3RS ET BASELINE	22.2210	113.9466	SPRING	NONE
09-Mar-16	2	1226	FP	1	SWL	1	N/A	OFF	3RS ET BASELINE	22.1608	113.8977	SPRING	NONE
09-Mar-16	3	1305	FP	2	SWL	2	6	ON	3RS ET BASELINE	22.2070	113.8974	SPRING	NONE
09-Mar-16	4	1342	CWD	5	SWL	2	310	ON	3RS ET BASELINE	22.2063	113.8978	SPRING	NONE
09-Mar-16	5	1503	CWD	3	SWL	2	244	ON	3RS ET BASELINE	22.2036	113.8879	SPRING	NONE
18-Mar-16	1	1231	CWD	1	SWL	2	121	ON	3RS ET BASELINE	22.1746	113.9096	SPRING	NONE
18-Mar-16	2	1304	FP	4	SWL	2	19	ON	3RS ET BASELINE	22.2056	113.9069	SPRING	NONE
18-Mar-16	3	1316	FP	2	SWL	2	66	ON	3RS ET BASELINE	22.2078	113.8974	SPRING	NONE
18-Mar-16	4	1338	CWD	4	SWL	2	197	ON	3RS ET BASELINE	22.1771	113.8961	SPRING	NONE
18-Mar-16	5	1441	FP	15	SWL	2	135	ON	3RS ET BASELINE	22.2107	113.8878	SPRING	NONE
23-Mar-16	1	0949	CWD	5	NWL	3	492	ON	3RS ET BASELINE	22.3844	113.8884	SPRING	PURSE SEINE
23-Mar-16	2	1051	CWD	2	NWL	2	74	ON	3RS ET BASELINE	22.3942	113.8773	SPRING	NONE
23-Mar-16	3	1110	CWD	2	NWL	2	26	ON	3RS ET BASELINE	22.3874	113.8779	SPRING	NONE
05-Apr-16	1	1027	FP	9	SWL	1	124	ON	3RS ET BASELINE	22.2166	113.9364	SPRING	NONE
05-Apr-16	2	1452	CWD	3	SWL	3	240	ON	3RS ET BASELINE	22.1846	113.8692	SPRING	NONE
05-Apr-16	3	1543	CWD	1	SWL	2	N/A	OFF	3RS ET BASELINE	22.2032	113.9094	SPRING	NONE
06-Apr-16	1	1016	CWD	3	WL	2	83	ON	3RS ET BASELINE	22.2772	113.8542	SPRING	NONE
06-Apr-16	2	1139	CWD	4	WL	3	42	ON	3RS ET BASELINE	22.2320	113.8347	SPRING	GILLNET
06-Apr-16	3	1329	CWD	1	SWL	2	263	ON	3RS ET BASELINE	22.1916	113.8497	SPRING	NONE
06-Apr-16	4	1409	CWD	1	SWL	2	21	ON	3RS ET BASELINE	22.1853	113.8589	SPRING	NONE
12-Apr-16	1	1037	CWD	4	WL	3	38	ON	3RS ET BASELINE	22.2648	113.8583	SPRING	NONE
12-Apr-16	2	1220	CWD	3	WL	4	156	ON	3RS ET BASELINE	22.2135	113.8325	SPRING	NONE
21-Apr-16	1	1133	CWD	16	WL	3	13	ON	3RS ET BASELINE	22.2238	113.8205	SPRING	NONE
21-Apr-16	2	1235	CWD	4	WL	3	51	ON	3RS ET BASELINE	22.2047	113.8368	SPRING	NONE
21-Apr-16	3	1304	CWD	1	WL	3	262	ON	3RS ET BASELINE	22.2061	113.8260	SPRING	NONE
21-Apr-16	4	1330	CWD	5	WL	3	19	ON	3RS ET BASELINE	22.1962	113.8324	SPRING	NONE

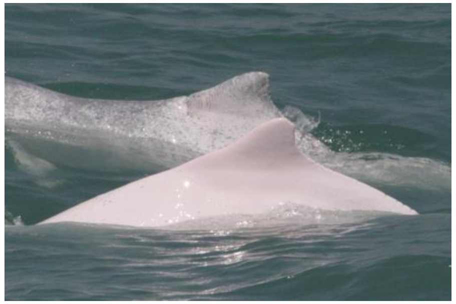
DATE	STG #	TIME	CWD/FP	HRD SZ	AREA	BEAU	PSD	EFFORT	TYPE	DEC LAT	DEC LON	SEASON	BOAT ASSOC.
21-Apr-16	5	1355	CWD	7	WL	3	43	ON	3RS ET BASELINE	22.1964	113.8402	SPRING	NONE
21-Apr-16	6	1423	CWD	7	WL	3	191	ON	3RS ET BASELINE	22.1893	113.8425	SPRING	NONE
22-Apr-16	1	1017	CWD	5	NWL	2	54	ON	3RS ET BASELINE	22.3871	113.8885	SPRING	NONE
27-Apr-16	1	1035	FP	5	SWL	2	57	ON	3RS ET BASELINE	22.1905	113.9360	SPRING	NONE
27-Apr-16	2	1056	FP	1	SWL	2	33	ON	3RS ET BASELINE	22.1648	113.9359	SPRING	NONE
27-Apr-16	3	1109	FP	2	SWL	1	148	ON	3RS ET BASELINE	22.1507	113.9349	SPRING	NONE
27-Apr-16	4	1501	CWD	7	SWL	2	346	ON	3RS ET BASELINE	22.1884	113.8688	SPRING	NONE
03-May-16	1	1022	FP	12	SWL	2	180	ON	3RS ET BASELINE	22.2060	113.9368	SPRING	NONE
03-May-16	2	1048	FP	13	SWL	2	156	ON	3RS ET BASELINE	22.1831	113.9360	SPRING	NONE
03-May-16	3	1106	FP	2	SWL	2	37	ON	3RS ET BASELINE	22.1585	113.9363	SPRING	NONE
03-May-16	4	1128	FP	10	SWL	1	161	ON	3RS ET BASELINE	22.1563	113.9276	SPRING	NONE
03-May-16	5	1141	FP	9	SWL	1	113	ON	3RS ET BASELINE	22.1696	113.9278	SPRING	NONE
03-May-16	6	1225	FP	2	SWL	1	57	ON	3RS ET BASELINE	22.1732	113.9200	SPRING	NONE
03-May-16	7	1253	FP	6	SWL	1	163	ON	3RS ET BASELINE	22.1529	113.9072	SPRING	NONE
03-May-16	8	1527	CWD	2	SWL	3	16	ON	3RS ET BASELINE	22.1975	113.8686	SPRING	NONE
09-May-16	1	1032	CWD	4	WL	2	678	ON	3RS ET BASELINE	22.2688	113.8552	SPRING	NONE
09-May-16	2	1102	CWD	1	WL	3	368	ON	3RS ET BASELINE	22.2570	113.8369	SPRING	NONE
09-May-16	3	1146	CWD	4	WL	3	111	ON	3RS ET BASELINE	22.2324	113.8240	SPRING	NONE
09-May-16	4	1308	CWD	2	WL	3	44	ON	3RS ET BASELINE	22.1966	113.8401	SPRING	NONE
09-May-16	5	1324	CWD	9	WL	3	178	ON	3RS ET BASELINE	22.1960	113.8430	SPRING	NONE
09-May-16	6	1406	CWD	6	SWL	2	357	ON	3RS ET BASELINE	22.1929	113.8500	SPRING	NONE
09-May-16	7	1512	CWD	4	WL	3	N/A	OFF	3RS ET BASELINE	22.2158	113.8331	SPRING	NONE
23-May-16	1	1230	CWD	11	NWL	3	206	ON	3RS ET BASELINE	22.4122	113.8810	SPRING	NONE
23-May-16	2	1310	CWD	3	NWL	3	6	ON	3RS ET BASELINE	22.4033	113.8777	SPRING	NONE
24-May-16	1	1131	CWD	2	WL	3	17	ON	3RS ET BASELINE	22.2234	113.8231	SPRING	NONE
24-May-16	2	1150	CWD	7	WL	2	38	ON	3RS ET BASELINE	22.2196	113.8147	SPRING	NONE
24-May-16	3	1217	CWD	7	WL	2	141	ON	3RS ET BASELINE	22.2141	113.8203	SPRING	NONE
24-May-16	4	1243	CWD	3	WL	2	295	ON	3RS ET BASELINE	22.2143	113.8308	SPRING	NONE
24-May-16	5	1310	CWD	1	WL	2	289	ON	3RS ET BASELINE	22.2055	113.8278	SPRING	NONE
24-May-16	6	1319	CWD	8	WL	2	35	ON	3RS ET BASELINE	22.2044	113.8239	SPRING	NONE
24-May-16	7	1339	CWD	2	WL	2	20	ON	3RS ET BASELINE	22.2184	113.8217	SPRING	NONE
24-May-16	8	1351	CWD	4	WL	2	83	ON	3RS ET BASELINE	22.1959	113.8346	SPRING	NONE

DATE	STG #	TIME	CWD/FP	HRD SZ	AREA	BEAU	PSD	EFFORT	TYPE	DEC LAT	DEC LON	SEASON	BOAT ASSOC.
24-May-16	9	1409	CWD	1	WL	3	16	ON	3RS ET BASELINE	22.1871	113.8363	SPRING	NONE
24-May-16	10	1427	CWD	2	WL	2	N/A	OFF	3RS ET BASELINE	22.1936	113.8471	SPRING	NONE
24-May-16	11	1451	CWD	6	SWL	3	1294	ON	3RS ET BASELINE	22.1769	113.8591	SPRING	NONE
25-May-16	1	1057	FP	1	SWL	2	183	ON	3RS ET BASELINE	22.1661	113.9361	SPRING	NONE
25-May-16	2	1115	FP	2	SWL	2	183	ON	3RS ET BASELINE	22.1452	113.9303	SPRING	NONE
30-May-16	1	1435	CWD	1	NWL	3	60	ON	3RS ET BASELINE	22.3513	113.8679	SPRING	NONE
06-Jun-16	1	1132	CWD	1	WL	2	100	ON	3RS ET BASELINE	22.2503	113.8420	SUMMER	NONE
06-Jun-16	2	1303	CWD	2	WL	2	68	ON	3RS ET BASELINE	22.2139	113.8138	SUMMER	NONE
06-Jun-16	3	1317	CWD	4	WL	3	227	ON	3RS ET BASELINE	22.2137	113.8287	SUMMER	NONE
06-Jun-16	4	1425	CWD	1	WL	2	N/A	OFF	3RS ET BASELINE	22.1914	113.8434	SUMMER	NONE
06-Jun-16	5	1431	CWD	5	SWL	2	137	ON	3RS ET BASELINE	22.1912	113.8498	SUMMER	NONE
06-Jun-16	6	1509	CWD	3	SWL	3	1680	ON	3RS ET BASELINE	22.1783	113.8602	SUMMER	NONE
07-Jun-16	1	1306	CWD	5	SWL	2	66	ON	3RS ET BASELINE	22.2033	113.8976	SUMMER	NONE
07-Jun-16	2	1544	CWD	2	SWL	3	150	ON	3RS ET BASELINE	22.2006	113.8675	SUMMER	NONE

Appendix C Photo Identification Catalogue

NL Cluster

			
NLMM001	NLMM002	NLMM003	NLMM004
			
NLMM005	NLMM006	NLMM007	NLMM008

			
NLMM009	NLMM010	NLMM011	NLMM012
			
NLMM013 (Bottom One)	NLMM014	NLMM015	NLMM016

			
NLMM017	NLMM018	NLMM019	NLMM020
			
NLMM021	NLMM022	NLMM023	NLMM024

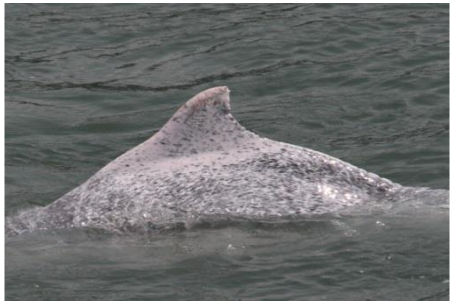
			
NLMM025	NLMM026	NLMM027	NLMM028
			
NLMM029			

WL Cluster

			
WLMM001	WLMM002	WLMM003	WLMM004
			
WLMM005	WLMM006	WLMM007	WLMM008

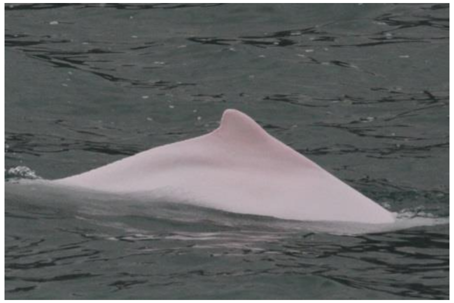
			
WLMM009	WLMM010	WLMM011	WLMM012
			
WLMM013	WLMM014	WLMM015	WLMM016

			
WLMM017	WLMM018	WLMM019	WLMM020
			
WLMM021	WLMM022	WLMM023	WLMM024

			
WLMM025	WLMM026	WLMM027	WLMM028
			
WLMM029	WLMM030	WLMM031	WLMM032

			
WLMM033	WLMM034	WLMM035	WLMM036
			
WLMM037 (Right One)	WLMM038	WLMM039	

SL Cluster

			
SLMM001	SLMM002	SLMM003	SLMM004 (Upper One)
			
SLMM005	SLMM006 (Upper One)	SLMM007	SLMM008

			
SLMM009	SLMM010	SLMM011	SLMM012
			
SLMM013	SLMM014	SLMM015	SLMM016

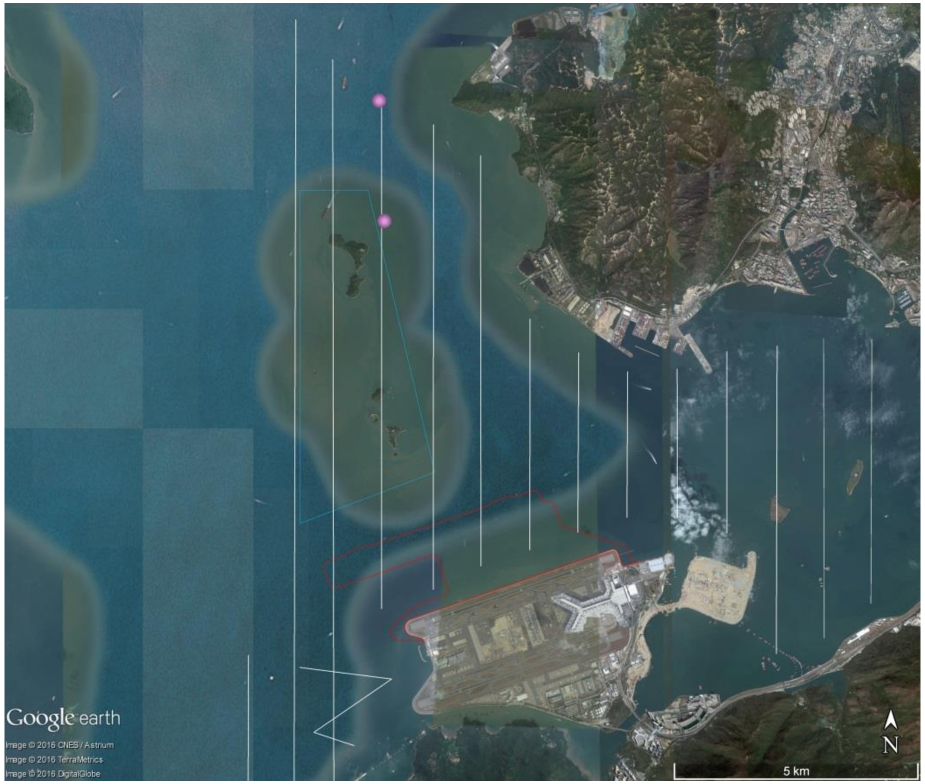
			
SLMM017	SLMM018	SLMM019	SLMM020
			
SLMM021	SLMM022	SLMM023	SLMM024

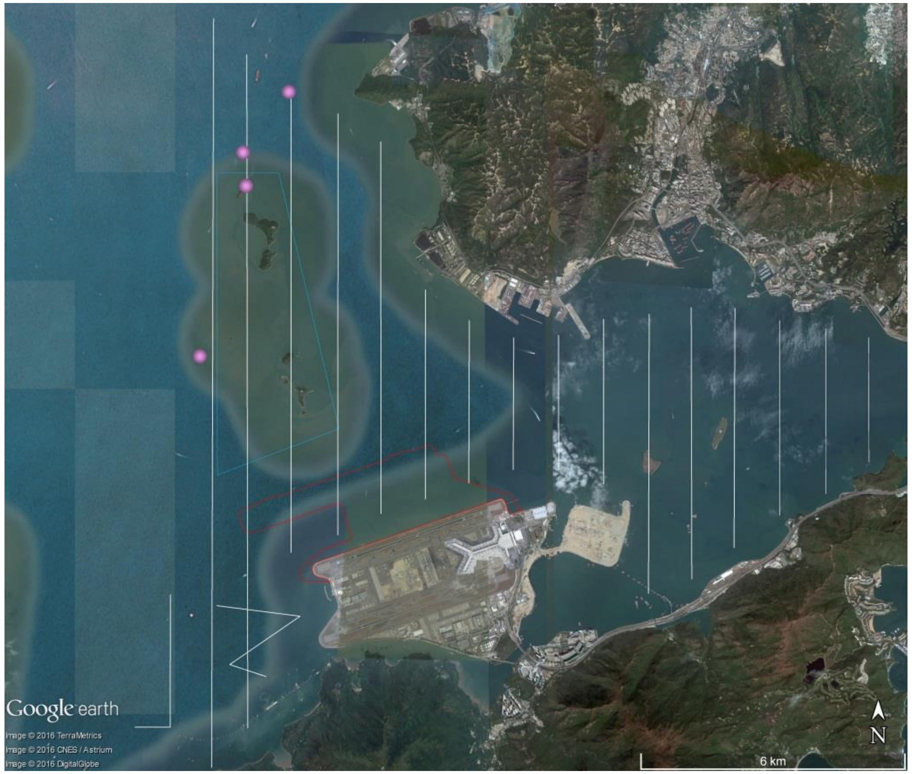
			
SLMM025	SLMM026	SLMM027	SLMM028

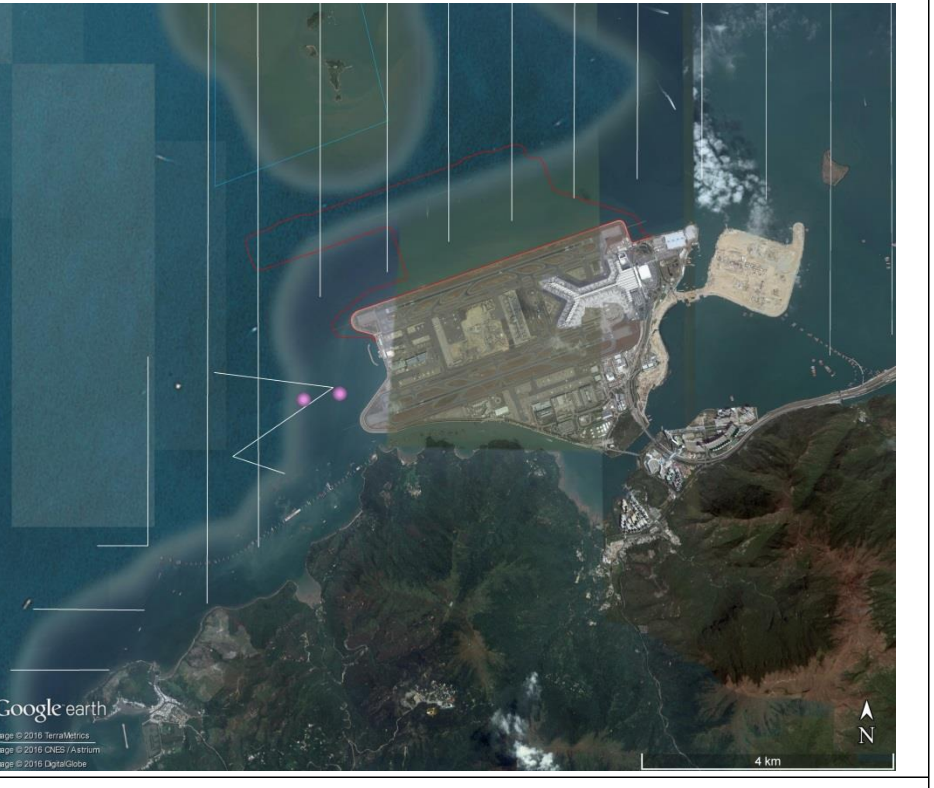
Appendix D Re-sightings of the Identified CWD Individuals

NL Cluster

	
NLMM002	NLMM004

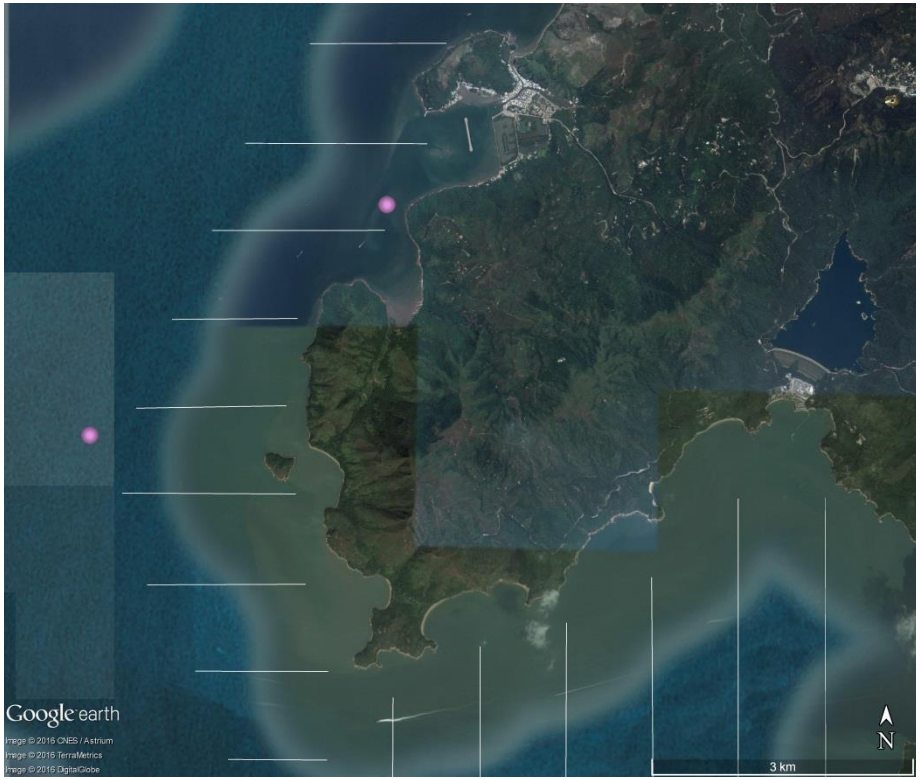
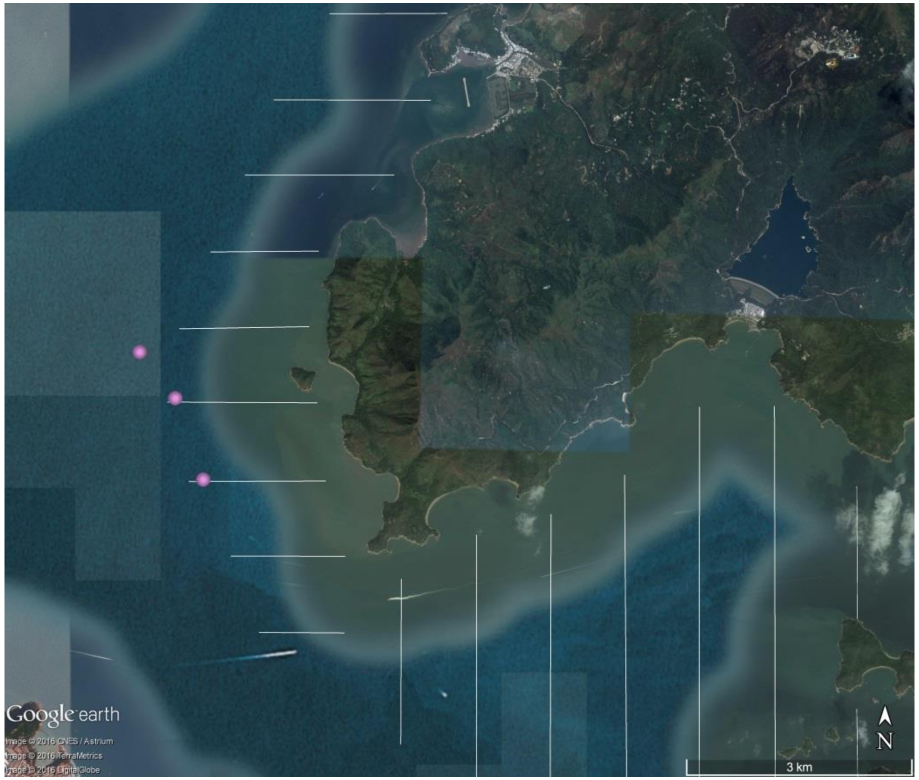
	
NLMM006	NLMM010

	
NLMM013	NLMM018

	
NLMM019	NLMM020

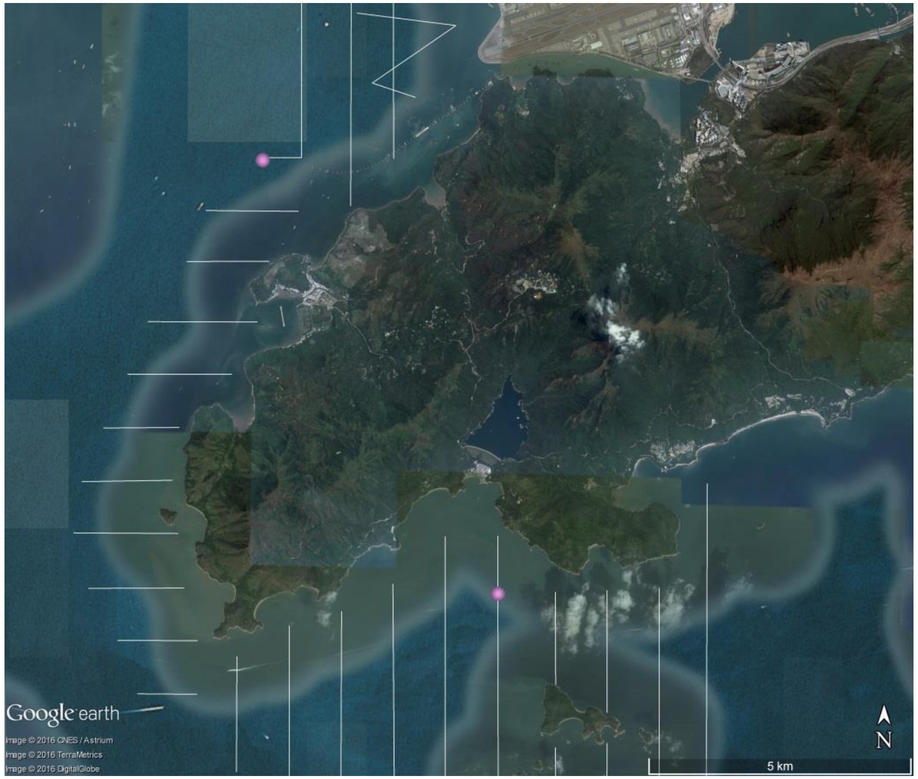
	
NLMM021	

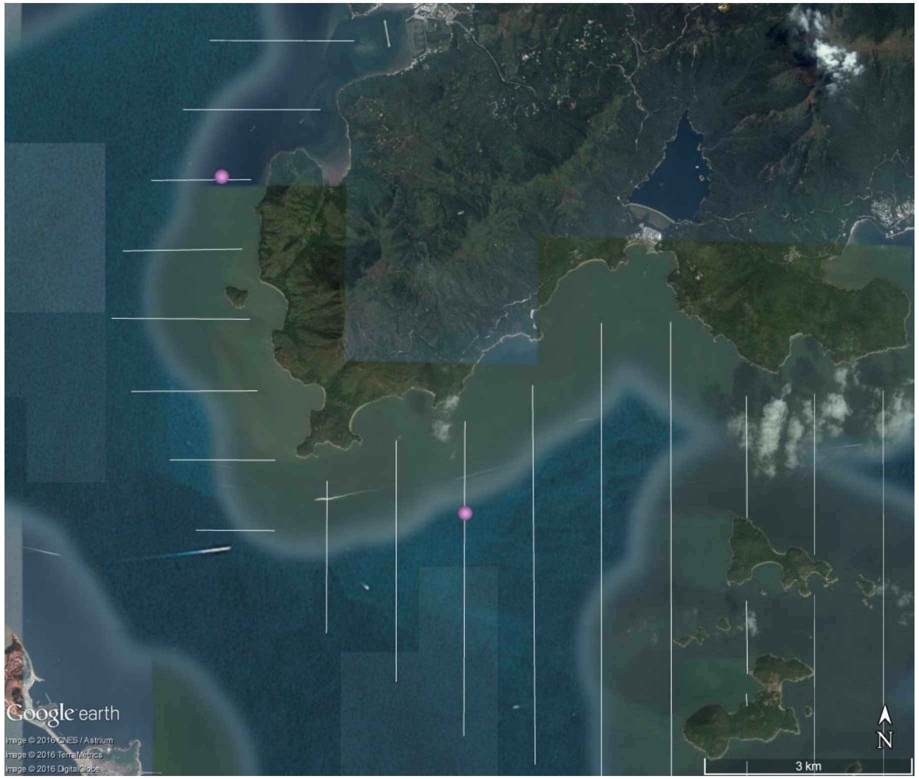
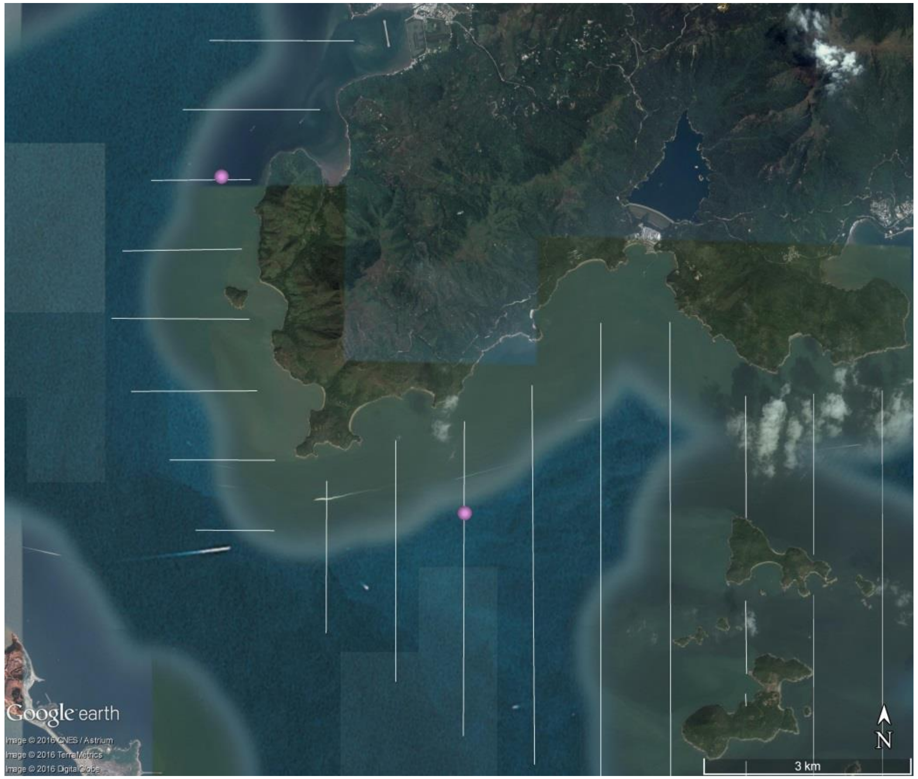
WL Cluster

	
WLMM003	WLMM005

WLMM007

WLMM015

	
WLMM021	WLMM027

	
WLMM028	WLMM029

SL Cluster

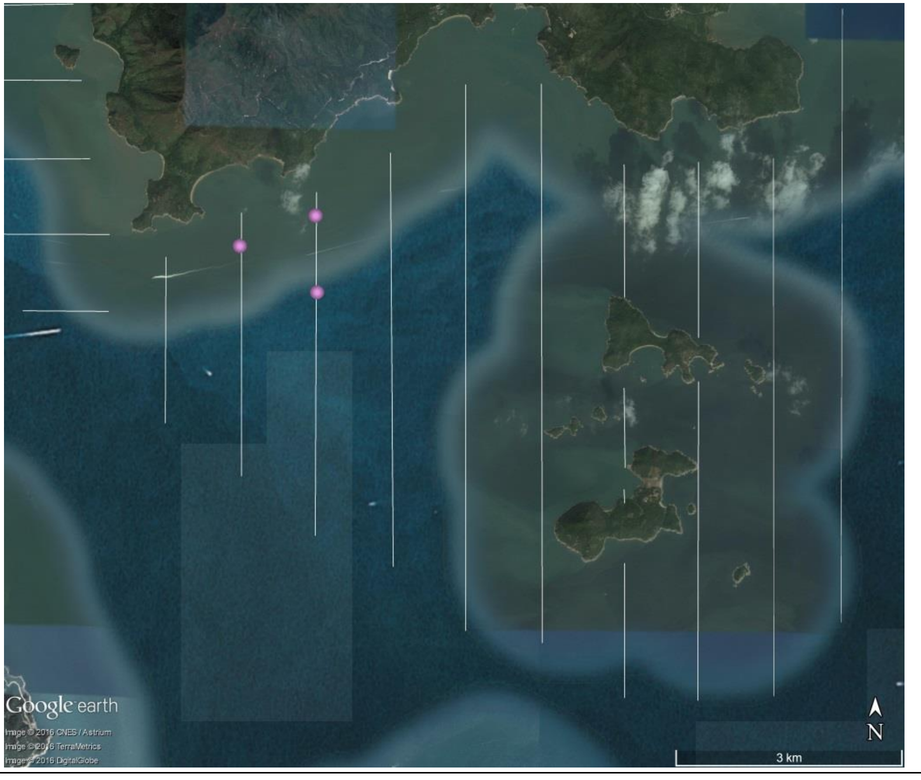
SLMM002

SLMM003

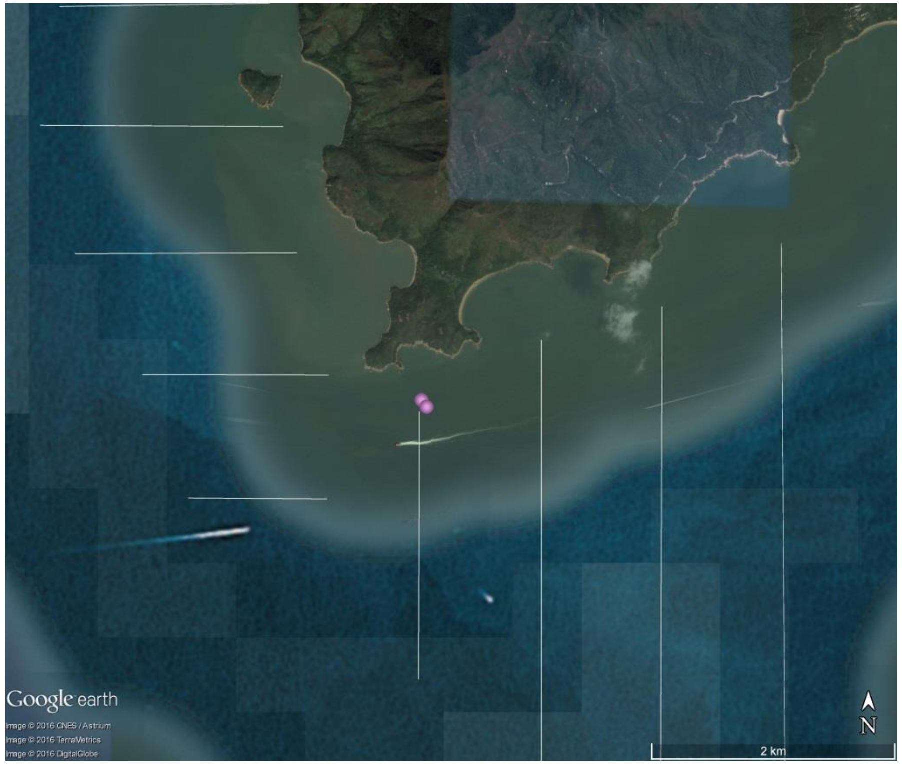
	
SLMM007	SLMM010

	
SLMM011	SLMM012

	
SLMM013	SLMM014

	
SLMM015	SLMM018

	
SLMM021	SLMM022

	
SLMM023	SLMM026

Appendix E Land-based Tracking and CWD Sightings by Survey Date

Table 1: Survey Effort and CWD sighting obtained from land-based tracking

Date	Station	Start Time	End Time	Duration	Beaufort Range	Visibility	# of Focal Follow Dolphin Groups Tracked
28 Dec 2015	Sha Chau	8:30	14:30	6:00	2-3	2	0
4 Jan 2016	Lung Kwu Chau	9:12	15:17	6:05	2	3	2
5 Jan 2016	Sha Chau	8:51	15:06	6:15	2-3	2-3	0
12 Jan 2016	Lung Kwu Chau	8:45	14:45	6:00	3	2	1
15 Jan 2016	Lung Kwu Chau	8:50	13:50	5:00	3	3-4	0
26 Jan 2016	Lung Kwu Chau	8:58	14:58	6:00	2-4	2-3	5
26 Jan 2016	Sha Chau	8:51	14:51	6:00	2-3	2	0
1 Feb 2016	Sha Chau	8:49	14:49	6:00	2-3	3	0
2 Feb 2016	Lung Kwu Chau	8:45	14:00	5:15	3	2-3	0
4 Feb 2016	Lung Kwu Chau	8:45	15:30	6:45	2-3	3	5
26 Feb 2016	Lung Kwu Chau	8:45	14:45	6:00	2-4	3-4	1
29 Feb 2016	Sha Chau	9:03	15:03	6:00	2	2-3	0
2 Mar 2016	Lung Kwu Chau	8:48	14:48	6:00	2-3	3	3
7 Mar 2016	Lung Kwu Chau	8:44	14:44	6:00	2-3	3	1
8 Mar 2016	Sha Chau	8:44	14:44	6:00	2-3	2.5-3	0
1 Apr 2016	Sha Chau	8:33	14:33	6:00	1-2	3	0
8 Apr 2016	Lung Kwu Chau	8:36	14:36	6:00	2-3	3	0
13 Apr 2016	Sha Chau	10:36	16:36	6:00	2	1-4	0
14 Apr 2016	Lung Kwu Chau	9:12	15:12	6:00	1-2	3-4	2
15 Apr 2016	Lung Kwu Chau	8:53	14:53	6:00	3	2-3	0

Date	Station	Start Time	End Time	Duration	Beaufort Range	Visibility	# of Focal Follow Dolphin Groups Tracked
28 Apr 2016	Lung Kwu Chau	8:44	14:49	6:05	2-3	3	2
29 Apr 2016	Sha Chau	8:56	14:56	6:00	3	3	0
5 May 2016	Lung Kwu Chau	8:44	14:44	6:00	2-3	2	5
6 May 2016	Sha Chau	8:28	14:33	6:05	2-4	2	0
11 May 2016	Lung Kwu Chau	8:34	14:49	6:15	2-3	2	13
26 May 2016	Sha Chau	8:51	14:54	6:03	2-3	2	0
3 Jun 2016	Lung Kwu Chau	8:47	14:50	6:03	2-4	2	1
6 Jun 2016	Sha Chau	8:40	14:40	6:00	2	1-2	1
7 Jun 2016	Lung Kwu Chau	8:45	14:45	6:00	2	2	5
8 Jun 2016	Lung Kwu Chau	8:32	15:03	6:31	2	1	6