

CONTRACT NO. HY/2012/08

**Hong Kong-Zhuhai-Macao Bridge Tuen Mun – Chek Lap Kok Link
(Northern Connection Sub-sea Tunnel Section)
Dolphin Quarterly Monitoring**

*4th Quarterly Progress Report (September-November 2014)
submitted to Dragages – Bouygues Joint Venture & ERM Hong Kong Ltd.*

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1. Introduction

- 1.1. As part of the Hong Kong-Zhuhai-Macao Bridge, the Tuen Mun-Chek Lap Kok Link (TM-CLKL) Northern Connection Sub-sea Tunnel Section (Contract no. HY/2012/08) comprises the sub-sea TBM tunnels (two tubes with cross passages) across the Urmston Road to connect Tuen Area 40 and Hong Kong Boundary Crossing Facilities (HKBCF) of approximately 4 km in length with dual 2-lane carriageway, the tunnels at both the southern landfall and the northern landfall for construction of approach roads to the sub-sea TBM tunnels of approximately 1.5 km in length, as well as the northern landfall reclamation of approximately 16.5 hectares and about 20.km long seawalls. Dragages – Bouygues Joint Venture (hereinafter called the “Contractor”) was awarded as the main contractor for the Northern Connection Sub-sea Tunnel Section, and ERM Hong Kong Limited would serve as the Environmental Team to implement the Environmental Monitoring and Audit (EM&A) programme.
- 1.2. According to the updated EM&A Manual (for TM-CLKL), monthly line-transect vessel surveys for Chinese White Dolphin should be conducted to cover the Northwest (NWL) and Northeast Lantau (NEL) survey areas as in AFCD annual marine mammal monitoring programme. However, as such surveys have been undertaken by the HKLR03 and HKBCF projects in the same areas (i.e. NWL and NEL), a combined monitoring approach is recommended by the Highways Department, that the TM-CLKL EM&A project can utilize the monitoring data collected by HKLR03 or HKBCF project to avoid any redundancy in monitoring effort. Such exemption for the dolphin monitoring will end upon the completion of the dolphin monitoring carried out by HKLR03 contract.
- 1.3. In November 2013, the Director of Hong Kong Cetacean Research Project (HKCRP), Dr. Samuel Hung, has been appointed by ERM Hong Kong Limited as the dolphin specialist for the TM-CLKL Northern Connection Sub-sea Tunnel Section EM&A project. He is responsible for the dolphin monitoring study, including the data collection on Chinese White

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Dolphins during the construction phase (i.e. impact period) of the TM-CLKL project in Northwest Lantau (NWL) and Northeast Lantau (NEL) survey areas.

- 1.4. During the construction period of HKLR, the dolphin specialist would be in charge of reviewing and collating information collected by HKLR03 dolphin monitoring programme to examine any potential impacts of TM-CLKL construction works on the dolphins.
- 1.5. From the monitoring results, any changes in dolphin occurrence within the study area will be examined for possible causes, and appropriate actions and additional mitigation measures will be recommended as necessary.
- 1.6. This report is the fourth quarterly progress report under the TM-CLKL construction phase dolphin monitoring programme submitted to the Contractor, summarizing the results of the surveys findings during the period of September to November 2014 utilizing the survey data collected by HKLR03 project.

2. Monitoring Methodology

2.1. Vessel-based Line-transect Survey

- 2.1.1. According to the requirement of the updated EM&A manual, dolphin monitoring programme should cover all transect lines in NEL and NWL survey areas (see Figure 1) twice per month throughout the entire construction period. The co-ordinates of all transect lines conducted during the HKLR03 dolphin monitoring surveys are shown in Table 1.

Table 1 Co-ordinates of transect lines conducted by HKLR03 project

Line No.		Easting	Northing		Line No.		Easting	Northing
1	Start Point	804671	814577		13	Start Point	816506	819480
1	End Point	804671	831404		13	End Point	816506	824859
2	Start Point	805475	815457		14	Start Point	817537	820220
2	End Point	805477	826654		14	End Point	817537	824613
3	Start Point	806464	819435		15	Start Point	818568	820735
3	End Point	806464	822911		15	End Point	818568	824433
4	Start Point	807518	819771		16	Start Point	819532	821420
4	End Point	807518	829230		16	End Point	819532	824209
5	Start Point	808504	820220		17	Start Point	820451	822125
5	End Point	808504	828602		17	End Point	820451	823671
6	Start Point	809490	820466		18	Start Point	821504	822371
6	End Point	809490	825352		18	End Point	821504	823761
7	Start Point	810499	820690		19	Start Point	822513	823268
7	End Point	810499	824613		19	End Point	822513	824321

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8	Start Point	811508	820847		20	Start Point	823477	823402
8	End Point	811508	824254		20	End Point	823477	824613
9	Start Point	812516	820892		21	Start Point	805476	827081
9	End Point	812516	824254		21	End Point	805476	830562
10	Start Point	813525	820872		22	Start Point	806464	824033
10	End Point	813525	824657		22	End Point	806464	829598
11	Start Point	814556	818449		23	Start Point	814559	821739
11	End Point	814556	820992		23	End Point	814559	824768
12	Start Point	815542	818807					
12	End Point	815542	824882					

- 2.1.2. The HKLR03 survey team used standard line-transect methods (Buckland et al. 2001) to conduct the systematic vessel surveys, and followed the same technique of data collection that has been adopted over the last 16 years of marine mammal monitoring surveys in Hong Kong developed by HKCRP (see Hung 2013, 2014). For each monitoring vessel survey, a 15-m inboard vessel with an open upper deck (about 4.5 m above water surface) was used to make observations from the flying bridge area.
- 2.1.3. Two experienced observers (a data recorder and a primary observer) made up the on-effort survey team, and the survey vessel transited different transect lines at a constant speed of 13-15 km per hour. The data recorder searched with unaided eyes and filled out the datasheets, while the primary observer searched for dolphins and porpoises continuously through 7 x 50 *Fujinon* marine binoculars. Both observers searched the sea ahead of the vessel, between 270° and 90° (in relation to the bow, which is defined as 0°). One to two additional experienced observers were available on the boat to work in shift (i.e. rotate every 30 minutes) in order to minimize fatigue of the survey team members. All observers were experienced in small cetacean survey techniques and identifying local cetacean species.
- 2.1.4. During on-effort survey periods, the survey team recorded effort data including time, positions (latitude and longitude), weather conditions (Beaufort sea state and visibility), and distance traveled in each series (a continuous period of search effort) with the assistance of a handheld GPS (*Garmin eTrex Legend*).
- 2.1.5. Data including time, position and vessel speed were also automatically and continuously logged by handheld GPS throughout the entire survey for subsequent review.
- 2.1.6. When dolphins were sighted, the survey team would end the survey effort, and immediately record the initial sighting distance and angle of the dolphin group from the survey vessel, as well as the sighting time and position. Then the research vessel was diverted from its course to approach the animals for species identification, group size estimation, assessment of group composition, and behavioural observations. The perpendicular distance (PSD) of the dolphin group to the transect line was later calculated from the initial sighting distance and angle.

- 2.1.7. Survey effort being conducted along the parallel transect lines that were perpendicular to the coastlines (as indicated in Figure 1) was labeled as “primary” survey effort, while the survey effort conducted along the connecting lines between parallel lines was labeled as “secondary” survey effort. According to HKCRP long-term dolphin monitoring data, encounter rates of Chinese white dolphins deduced from effort and sighting data collected along primary and secondary lines were similar in NEL and NWL survey areas. Therefore, both primary and secondary survey effort were presented as on-effort survey effort in this report.

2.2. *Photo-identification Work*

- 2.2.1. When a group of Chinese White Dolphins were sighted during the line-transect survey, the HKLR03 survey team would end effort and approach the group slowly from the side and behind to take photographs of them. Every attempt was made to photograph every dolphin in the group, and even photograph both sides of the dolphins, since the colouration and markings on both sides may not be symmetrical.
- 2.2.2. A professional digital camera (*Canon EOS 7D* or *60D* model), equipped with long telephoto lenses (100-400 mm zoom), were available on board for researchers to take sharp, close-up photographs of dolphins as they surfaced. The images were shot at the highest available resolution and stored on Compact Flash memory cards for downloading onto a computer.
- 2.2.3. All digital images taken in the field were first examined, and those containing potentially identifiable individuals were sorted out. These photographs would then be examined in greater detail, and were carefully compared to the existing Chinese White Dolphin photo-identification catalogue maintained by HKCRP since 1995.
- 2.2.4. Chinese White Dolphins can be identified by their natural markings, such as nicks, cuts, scars and deformities on their dorsal fin and body, and their unique spotting patterns were also used as secondary identifying features (Jefferson 2000).
- 2.2.5. All photographs of each individual were then compiled and arranged in chronological order, with data including the date and location first identified (initial sighting), re-sightings, associated dolphins, distinctive features, and age classes entered into a computer database.

2.3. *Data Analysis*

- 2.3.1. Distribution Analysis – The line-transect survey data was integrated with the Geographic Information System (GIS) in order to visualize and interpret different spatial and temporal patterns of dolphin distribution using sighting positions. Location data of dolphin groups were plotted on map layers of Hong Kong using a desktop GIS (ArcView[®] 3.1) to examine their distribution patterns in details. The dataset was also stratified into different subsets to examine distribution patterns of dolphin groups with different categories of group sizes, young calves and activities.

- 2.3.2. Encounter rate analysis – Encounter rates of Chinese white dolphins (number of on-effort sightings per 100 km of survey effort, and total number of dolphins sighted on-effort per 100 km of survey effort) were calculated in NEL and NWL survey areas in relation to the amount of survey effort conducted during each month of monitoring survey. Only data collect under Beaufort 3 or below condition would be used for the encounter rate analyses. Dolphin encounter rates were calculated in two ways for comparisons with the HZMB baseline monitoring results as well as to AFCD long-term marine mammal monitoring results.

Firstly, for the comparison with the HZMB baseline monitoring results, the encounter rates were calculated using primary survey effort alone. The average encounter rate of sightings (STG) and average encounter rate of dolphins (ANI) were deduced based on the encounter rates from six events during the present quarter (i.e. six sets of line-transect surveys in North Lantau), which was also compared with the one deduced from the six events during the baseline period (i.e. six sets of line-transect surveys in North Lantau).

Secondly, the encounter rates were calculated using both primary and secondary survey effort collected under Beaufort 3 or below condition as in AFCD long-term monitoring study. The encounter rate of sightings and dolphins were deduced by dividing the total number of on-effort sightings (STG) and total number of dolphins (ANI) by the amount of survey effort for the quarterly period of September to November 2014.

- 2.3.3. Quantitative grid analysis on habitat use – To conduct quantitative grid analysis of habitat use, positions of on-effort sightings of Chinese White Dolphins collected during the quarterly impact phase monitoring period were plotted onto 1-km² grids among NWL and NEL survey areas on GIS. Sighting densities (number of on-effort sightings per km²) and dolphin densities (total number of dolphins from on-effort sightings per km²) were then calculated for each 1 km by 1 km grid with the aid of GIS. Sighting density grids and dolphin density grids were then further normalized with the amount of survey effort conducted within each grid. The total amount of survey effort spent on each grid was calculated by examining the survey coverage on each line-transect survey to determine how many times the grid was surveyed during the study period. For example, when the survey boat traversed through a specific grid 50 times, 50 units of survey effort were counted for that grid. With the amount of survey effort calculated for each grid, the sighting density and dolphin density of each grid were then normalized (i.e. divided by the unit of survey effort).

The newly-derived unit for sighting density was termed SPSE, representing the number of on-effort sightings per 100 units of survey effort. In addition, the derived unit for actual dolphin density was termed DPSE, representing the number of dolphins per 100 units of survey effort. Among the 1-km² grids that were partially covered by land, the percentage of sea area was calculated using GIS tools, and their SPSE and DPSE values were adjusted accordingly. The following formulae were used to estimate SPSE and DPSE in each 1-km² grid within the study area:

$$SPSE = ((S / E) \times 100) / SA\%$$

$$DPSE = ((D / E) \times 100) / SA\%$$

where S = total number of on-effort sightings
 D = total number of dolphins from on-effort sightings
 E = total number of units of survey effort
 SA% = percentage of sea area

- 2.3.4. Behavioural analysis – When dolphins were sighted during vessel surveys, their behaviour was observed. Different activities were categorized (i.e. feeding, socializing, traveling, and milling/resting) and recorded on sighting datasheets. This data was then input into a separate database with sighting information, which can be used to determine the distribution of behavioural data with a desktop GIS. Distribution of sightings of dolphins engaged in different activities and behaviours would then be plotted on GIS and carefully examined to identify important areas for different activities of the dolphins.
- 2.3.5. Ranging pattern analysis – Location data of individual dolphins that occurred during the 3-month impact phase monitoring period were obtained from the dolphin sighting database and photo-identification catalogue. To deduce home ranges for individual dolphins using the fixed kernel methods, the program Animal Movement Analyst Extension, was loaded as an extension with ArcView[®] 3.1 along with another extension Spatial Analyst 2.0. Using the fixed kernel method, the program calculated kernel density estimates based on all sighting positions, and provided an active interface to display kernel density plots. The kernel estimator then calculated and displayed the overall ranging area at 95% UD level.

3. Monitoring Results

3.1. *Summary of survey effort and dolphin sightings*

- 3.1.1. During the period of September to November 2014, six sets of systematic line-transect vessel surveys were conducted under the HKLR03 monitoring works to cover all transect lines in NWL and NEL survey areas twice per month.
- 3.1.2. From these HKLR03 surveys, a total of 892.88 km of survey effort was collected, with 97.1% of the total survey effort being conducted under favourable weather conditions (i.e. Beaufort Sea State 3 or below with good visibility). Among the two areas, 343.71 km and 549.17 km of survey effort were conducted in NEL and NWL survey areas respectively.
- 3.1.3. The total survey effort conducted on primary lines was 644.60 km, while the effort on secondary lines was 248.28 km. Both survey effort conducted on primary and secondary lines were considered as on-effort survey data. Summary table of the survey effort is shown in Appendix I.
- 3.1.4. During the six sets of HKLR03 monitoring surveys from September to November 2014, a total of 24 groups of 93 Chinese White Dolphins were sighted. All except two dolphin sightings were made during on-effort search. Twenty on-effort sightings were made on

primary lines, while another two on-effort sightings were made on secondary lines. In this quarterly period, all dolphin groups were sighted in NWL, while none of them were sighted in NEL. A summary table of the dolphin sightings is shown in Appendix II.

3.2. *Distribution*

- 3.2.1. Distribution of dolphin sightings made during the HKLR03 monitoring surveys in September to November 2014 is shown in Figure 1. The majority of dolphin sightings made in the present quarter were concentrated in the northwestern end of the North Lantau region, with higher concentration around Lung Kwu Chau (Figure 1). A few other sightings were scattered around Sha Chau and to the north of the airport platform. No dolphin sighting was made in NEL in the present quarter.
- 3.2.2. Notably, none of the dolphin groups were sighted in the vicinity of TMCLKL northern landfall or southern viaduct section, and the HKLR03/HKBCF reclamation site (Figure 1).
- 3.2.3. Sighting distribution of the present impact phase monitoring period (September to November 2014) was compared to the one during the baseline monitoring period (September to November 2011). In the present quarter, dolphins have completely avoided the NEL region, which was in stark contrast to their frequent occurrence around the Brothers Islands and in the vicinity of HKBCF reclamation site during the baseline period (Figure 1). The nearly complete abandonment of NEL region by the dolphins has been consistently recorded in the past three quarters, which have resulted in extremely low dolphin encounter rates in this area.
- 3.2.4. In NWL survey area, dolphin occurrence was also very different between the baseline and impact phase quarters. During the present impact monitoring period, there appeared to be much fewer dolphins occurred in the middle portion of North Lantau region than during the baseline period, where dolphins supposedly moved between their core areas around Lung Kwu Chau and the Brothers Islands (Figure 1). Moreover, more dolphins were sighted near Sha Chau and Black Point during the baseline period than during the present impact monitoring period (Figure 1). Notably, a number of dolphin sightings were made to the west of Chek Lap Kok airport (especially near the HKLR09 alignment) during the baseline period, but the dolphins were not sighted there at all during the present impact phase period.
- 3.2.5. Another comparison in dolphin distribution was made between the two quarterly periods of autumn months in 2013 and 2014 was also made (Figure 2). Among the two autumn periods, no dolphin sighting was made in NEL in the autumn of 2014, while there were two sightings made there in the autumn of 2013. Moreover, a lot more dolphin sightings were made in the middle and western portions of North Lantau waters (especially between Black Point and Lung Kwu Chau, as well as around Sha Chau) in the autumn of 2013 than in the autumn of 2014. The comparison indicated that dolphin usage in North Lantau waters was further diminished in autumn of 2014 from the same period in the previous year.

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3.3. Encounter rate

3.3.1. During the present quarterly period, the encounter rates of Chinese White Dolphins deduced from the survey effort and on-effort sighting data from the primary transect lines under favourable conditions (Beaufort 3 or below) for each set of the HKLR03 surveys in NEL and NWL are shown in Table 2. The average encounter rates deduced from the six sets of HKLR03 surveys were also compared with the ones deduced from the baseline monitoring period (September – November 2011) (Table 3).

Table 2. Dolphin encounter rates (sightings per 100 km of survey effort) during September – November 2014 deduced from HKLR03 monitoring surveys

SURVEY AREA	HKLR03 DOLPHIN MONITORING DATES	Encounter rate (STG) (no. of on-effort dolphin sightings per 100 km of survey effort)	Encounter rate (ANI) (no. of dolphins from all on-effort sightings per 100 km of survey effort)
		Primary Lines Only	Primary Lines Only
Northeast Lantau	Set 1 (2 & 11 Sep 2014)	0.00	0.00
	Set 2 (19 & 22 Sep 2014)	0.00	0.00
	Set 3 (7 & 13 Oct 2014)	0.00	0.00
	Set 4 (16 & 23 Oct 2014)	0.00	0.00
	Set 5 (4 & 10 Nov 2014)	0.00	0.00
	Set 6 (12 & 18 Nov 2014)	0.00	0.00
Northwest Lantau	Set 1 (2 & 11 Sep 2014)	5.72	28.58
	Set 2 (19 & 22 Sep 2014)	4.34	18.80
	Set 3 (7 & 13 Oct 2014)	13.13	42.67
	Set 4 (16 & 23 Oct 2014)	0.00	0.00
	Set 5 (4 & 10 Nov 2014)	4.60	24.54
	Set 6 (12 & 18 Nov 2014)	2.84	8.53

Table 3. Comparison of average dolphin encounter rates from impact monitoring period (September – November 2014) and baseline monitoring period (September – November 2011) (Note: encounter rates deduced from the baseline monitoring period have been recalculated based only on survey effort and on-effort sighting data made along the primary transect lines under favourable conditions)

	Encounter rate (STG) (no. of on-effort dolphin sightings per 100 km of survey effort)		Encounter rate (ANI) (no. of dolphins from all on-effort sightings per 100 km of survey effort)	
	September - November 2014	September - November 2011	September - November 2014	September - November 2011
Northeast Lantau	0.00	6.00 ± 5.05	0.00	22.19 ± 26.81
Northwest Lantau	5.10 ± 4.40	9.85 ± 5.85	20.52 ± 15.10	44.66 ± 29.85

3.3.2. To facilitate the comparison with the AFCD long-term monitoring results, the encounter rates were also calculated for the present quarter using both primary and secondary survey

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effort. The encounter rates of sightings (STG) and dolphins (ANI) in NWL were 4.18 sightings and 16.17 dolphins per 100 km of survey effort respectively, while the encounter rates of sightings (STG) and dolphins (ANI) in NEL were both nil.

- 3.3.3. In NEL, the average dolphin encounter rates (both STG and ANI) in the present three-month impact monitoring period were zero, and such low occurrence of dolphins in NEL have been consistently recorded in the past seven quarters of HKLR03 monitoring (Table 4).

Table 4. Comparison of average dolphin encounter rates in Northeast Lantau survey area from all quarters of HKLR03 impact monitoring period and baseline monitoring period (September-November 2011) (Note: encounter rates deduced from the baseline monitoring period have been recalculated based only on survey effort and on-effort sighting data made along the primary transect lines under favourable conditions)

	Encounter rate (STG) (no. of on-effort dolphin sightings per 100 km of survey effort)	Encounter rate (ANI) (no. of dolphins from all on-effort sightings per 100 km of survey effort)
September-November 2011 (Baseline)	6.00 ± 5.05	22.19 ± 26.81
December 2012-February 2013 (Impact)	3.14 ± 3.21	6.33 ± 8.64
March-May 2013 (Impact)	0.42 ± 1.03	0.42 ± 1.03
June-August 2013 (Impact)	0.88 ± 1.36	3.91 ± 8.36
September-November 2013 (Impact)	1.01 ± 1.59	3.77 ± 6.49
December 2013-February 2014 (Impact)	0.45 ± 1.10	1.34 ± 3.29
March-May 2014 (Impact)	0.00	0.00
June-August 2014 (Impact)	0.42 ± 1.04	1.69 ± 4.15
September-November 2014 (Impact)	0.00	0.00

- 3.3.4. It is a serious concern that dolphin occurrence in NEL in the seven quarters (0.0-1.0 for ER(STG) and 0.0-3.9 for ER(ANI)) of HKLR03 monitoring have been exceptionally low when compared to the baseline period (Table 4). As discussed recently in Hung (2014), the dramatic decline in dolphin usage of NEL waters in 2012 and 2013 (including the declines in abundance, encounter rate and habitat use in NEL, as well as shifts of individual core areas and ranges away from NEL waters) was possibly related to the HZMB construction works that were commenced in 2012.
- 3.3.5. Moreover, the average dolphin encounter rates (STG and ANI) in NWL during the present impact phase monitoring period were also much lower (reductions of 48.2% and 54.1% respectively) than the ones recorded in the 3-month baseline period, indicating a noticeable decline in dolphin usage of this survey area during the present construction period (Table 5).

Table 5. Comparison of average dolphin encounter rates in Northwest Lantau survey area from all quarters of HKLR03 impact monitoring period and baseline monitoring period (September-November 2011) (Note:

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encounter rates deduced from the baseline monitoring period have been recalculated based only on survey effort and on-effort sighting data made along the primary transect lines under favourable conditions)

	Encounter rate (STG) (no. of on-effort dolphin sightings per 100 km of survey effort)	Encounter rate (ANI) (no. of dolphins from all on-effort sightings per 100 km of survey effort)
September-November 2011 (Baseline)	9.85 ± 5.85	44.66 ± 29.85
December 2012-February 2013 (Impact)	8.36 ± 5.03	35.90 ± 23.10
March-May 2013 (Impact)	7.75 ± 3.96	24.23 ± 18.05
June-August 2013 (Impact)	6.56 ± 3.68	27.00 ± 18.71
September-November 2013 (Impact)	8.04 ± 1.10	32.48 ± 26.51
December 2013-February 2014 (Impact)	8.21 ± 2.21	32.58 ± 11.21
March-May 2014 (Impact)	6.51 ± 3.34	19.14 ± 7.19
June-August 2014 (Impact)	4.74 ± 3.84	17.52 ± 15.12
September-November 2014 (Impact)	5.10 ± 4.40	20.52 ± 15.10

- 3.3.6. A two-way ANOVA with repeated measures and unequal sample size was conducted to examine whether there were any significant differences in the average encounter rates between the baseline and impact monitoring periods. The two variables that were examined included the two periods (baseline and impact phases) and two locations (NEL and NWL).
- 3.3.7. For the comparison between the baseline period and the present quarter (eighth quarter of the HKLR03 impact phase being assessed), the p-value for the differences in average dolphin encounter rates of STG and ANI were 0.0222 and 0.0662 respectively. If the alpha value is set at 0.1, significant difference was detected between the baseline and present quarters in both dolphin encounter rates of STG and ANI.
- 3.3.8. For the comparison between the baseline period and the cumulative quarters in impact phase (i.e. first eight quarters of the HKLR03 impact phase being assessed), the p-value for the differences in average dolphin encounter rates of STG and ANI were 0.0019 and 0.0006 respectively. Even if the alpha value is set at 0.01, significant differences were detected in both the average dolphin encounter rates of STG and ANI (i.e. between the two periods and the locations).
- 3.3.9. As indicated in both dolphin distribution patterns and encounter rates, dolphin usage has been significantly reduced in NEL waters in the present quarterly period, and such low occurrence has been consistently documented in previous quarters. This raises serious concern, as the decline in dolphin usage could possibly link to the HZMB-related construction activities in NEL waters.
- 3.3.10. It should also be noted that dolphin usage in NWL have been diminished progressively in the past few quarters (Table 5), and such downward trend should be closely monitored, as

the potential impacts of HZMB-related works on the dolphins may have been extended to the entire North Lantau region.

3.4. *Group size*

- 3.4.1. Group size of Chinese White Dolphins ranged from one to 13 individuals per group in North Lantau region during September – November 2014. The average dolphin group sizes from these three months were compared with the ones deduced from the baseline period in September to November 2011, as shown in Table 6.

Table 6. Comparison of average dolphin group sizes from impact monitoring period (September – November 2014) and baseline monitoring period (September – November 2011)

	Average Dolphin Group Size	
	September – November 2014	September – November 2011
Overall	3.88 ± 2.69 (n = 24)	3.72 ± 3.13 (n = 66)
Northeast Lantau	0.00	3.18 ± 2.16 (n = 17)
Northwest Lantau	3.88 ± 2.69 (n = 24)	3.92 ± 3.40 (n = 49)

- 3.4.2. The average dolphin group sizes in the entire North Lantau region as well as in NWL waters during September – November 2014 were similar to the ones recorded during the three-month baseline period (Table 6). Sixteen of the 24 groups were composed of 1-4 individuals only, while there was only one dolphin group with more than 10 individuals.
- 3.4.3. Distribution of dolphins with larger group sizes (five individuals or more per group) during the present quarter is shown in Figure 3, with comparison to the one in baseline period. During autumn of 2014, distribution of the majority of larger dolphin groups were concentrated near Lung Kwu Chau (Figure 3). This distribution pattern was quite different from the baseline period, when the larger dolphin groups were distributed more evenly in NWL waters with a few more sighted in NEL waters (Figure 3).
- ### 3.5. *Habitat use*
- 3.5.1. From September to November 2014, the most heavily utilized habitats by Chinese White Dolphins mainly concentrated around Lung Kwu Chau (Figures 4a and 4b). None of the grids in NEL recorded the presence of dolphins. Moreover, all grids near TMCLKL and HKLR09 alignments as well as the HKLR03/HKBCF reclamation sites did not record any presence of dolphins during on-effort search in the present quarterly period.
- 3.5.2. However, it should be emphasized that the amount of survey effort collected in each grid during the three-month period was fairly low (6-12 units of survey effort for most grids), and therefore the habitat use pattern derived from the three-month dataset should be treated with caution. A more complete picture of dolphin habitat use pattern will be presented when more survey effort for each grid will be collected throughout the impact

phase monitoring programme.

- 3.5.3. When compared with the habitat use patterns during the baseline period, dolphin usage in NEL was dramatically different from the present impact monitoring period (Figure 5). During the baseline period, nine grids between Siu Mo To and Shum Shui Kok recorded moderately high to high dolphin densities, which was in stark contrast to complete absence of dolphins during the present impact phase period (Figure 5).
- 3.5.4. The density patterns between the baseline and impact phase monitoring periods were also different in NWL, with higher dolphin usage around Sha Chau, near Black Point, to the west of the airport, as well as between Pillar Point and airport platform during the baseline period (Figure 5).
- 3.6. *Mother-calf pairs*
- 3.6.1. During the three-month study period, only four unspotted juveniles (UJ) were sighted in NWL survey areas. These young calves comprised of 4.3% of all animals sighted, which was lower than the percentage recorded during the baseline monitoring period (6.8%).
- 3.6.2. All four young calves were sighted around Lung Kwu Chau (Figure 6), which was very different from their distribution pattern during the baseline period when young calves were sighted throughout the NWL survey area as well as a few sighted in NEL waters. None of these young calves were sighted in the vicinity of the TMCLKL/HKLR09 alignments and HKBCF/HKLR03 reclamation sites during the present quarter (Figure 6).
- 3.7. *Activities and associations with fishing boats*
- 3.7.1. A total of three dolphin sightings were associated with feeding and socializing activities respectively during the three-month study period. The percentage of sightings associated with feeding activities during the present quarter (8.3%) was lower than the one recorded during the baseline period (11.6%). On the contrary, the percentage of socializing activities during the present impact phase monitoring period (4.2%) was slightly lower than the one recorded during the baseline period (5.4%). One group of five dolphins was also engaged in traveling activity during the present quarter.
- 3.7.2. Distribution of dolphins engaged in feeding, socializing and traveling activities during the present three-month period is shown in Figure 7. The three sightings associated with feeding and traveling activities all occurred to the north of Lung Kwu Chau, while the lone sighting associated with socializing activity was located to the north of the airport (Figure 7). Distribution of dolphin sightings associated with these activities during the impact phase was very different from the distribution pattern of these activities during the baseline period (Figure 7).
- 3.7.3. During the three-month period, none of the 24 dolphin groups was found to be associated with an operating fishing vessels in North Lantau waters. The extremely rare events of fishing boat association in the present and previous quarters were consistently found, and were likely related to the recent trawl ban being implemented in December 2012 in Hong Kong waters.

3.8. *Summary of photo-identification works*

- 3.8.1. From September to November 2014, over 2,000 digital photographs of Chinese White Dolphins were taken during the HKLR03 impact phase monitoring surveys for the photo-identification work.
- 3.8.2. In total, 26 individuals sighted 49 times altogether were identified (see summary table in Appendix III and photographs of identified individuals in Appendix IV). All of these 49 re-sightings were made in NWL.
- 3.8.3. The majority of identified individuals were sighted only once or twice during the three-month period, with the exception of five individuals (NL202, NL214, NL233, NL286 and WL05) being sighted thrice and two individuals (NL48 and NL182) being sighted four times.
- 3.8.4. Five of these 26 individuals were also sighted in West Lantau waters during the HKLR09 monitoring surveys for the same three-month period, showing their movement between North and West Lantau regions.
- 3.8.5. Five recognized females (NL104, NL182, NL202, NL233 and NL256) were accompanied with their calves during their re-sightings.
- 3.9. *Individual range use*
- 3.9.1. Ranging patterns of the 26 individuals identified during the three-month study period were determined by fixed kernel method, and are shown in Appendix V.
- 3.9.2. All identified dolphins sighted in this quarter were utilizing their range use in NWL (and some also in WL), but have avoided the NEL waters where many of them have utilized as their core areas in the past (Appendix V). This is in contrary to the extensive movements between NEL and NWL survey areas observed in the earlier HKLR03 impact monitoring quarters as well as during the baseline period.
- 3.9.3. For many individuals that have previously utilized the Brothers Islands as their major core area of activities, they have apparently shifted their range use away from this important habitat (e.g. NL136, NL182, NL259; Appendix V). Such shifts of range use and core area use were also documented by Hung (2014), as well as in the past monitoring quarters in 2013 and 2014 under the HKLR03 monitoring study.
- 3.9.4. On the other hand, there were a few individuals sighted in NWL and NEL waters consistently in the past, but have extended their range use to WL waters in the present quarter (e.g. NL259). It should be further monitored to examine whether there has been any consistent shifts of home ranges of individuals from North Lantau to West Lantau, which could also possibly be related to the HZMB-related construction works.

4. Conclusion

- 4.1. During this quarter of dolphin monitoring, no adverse impact from the activities of the TMCLKL construction project on Chinese White Dolphins was noticeable from general observations.
- 4.2. Although the dolphins infrequently occurred along the alignment of TMCLKL northern connection sub-sea tunnel section in the past and during the baseline monitoring period, it is apparent that dolphin usage has been significantly reduced in NEL, and many individuals have shifted away from the important habitat around the Brothers Islands.
- 4.3. It is critical to monitor the dolphin usage in North Lantau region in the upcoming quarters, to determine whether the dolphins are continuously affected by the various construction activities in relation to the HZMB-related works, and whether suitable mitigation measure can be applied to revert the situation.

5. References

- Buckland, S. T., Anderson, D. R., Burnham, K. P., Laake, J. L., Borchers, D. L., and Thomas, L. 2001. Introduction to distance sampling: estimating abundance of biological populations. Oxford University Press, London.
- Hung, S. K. 2013. Monitoring of Marine Mammals in Hong Kong waters: final report (2012-13). An unpublished report submitted to the Agriculture, Fisheries and Conservation Department, 168 pp.
- Hung, S. K. 2014. Monitoring of marine mammals in Hong Kong waters – data collection: final report (2013-14). An unpublished report submitted to the Agriculture, Fisheries and Conservation Department of Hong Kong SAR Government, 231 pp.
- Jefferson, T. A. 2000. Population biology of the Indo-Pacific hump-backed dolphin in Hong Kong waters. Wildlife Monographs 144:1-65.

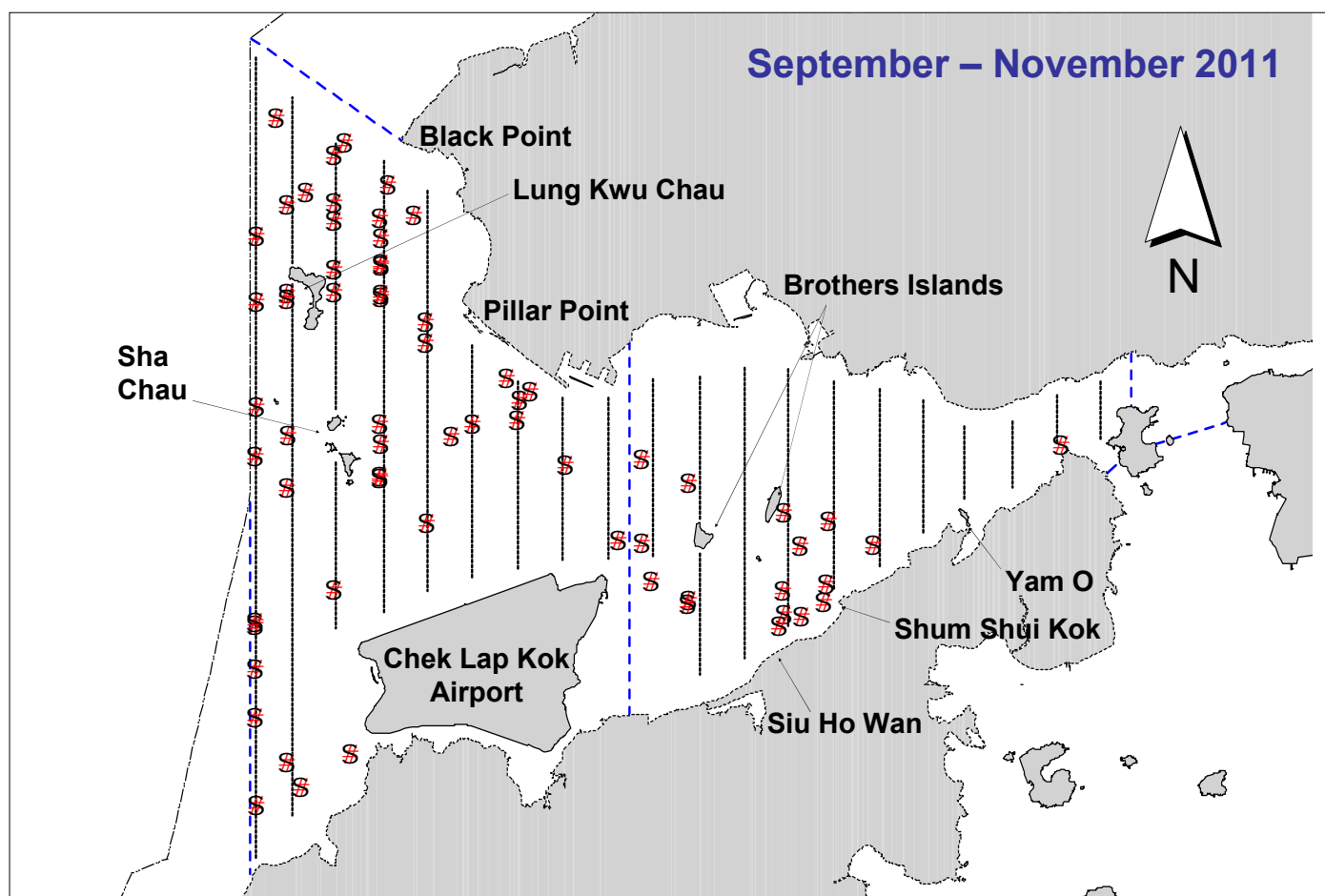
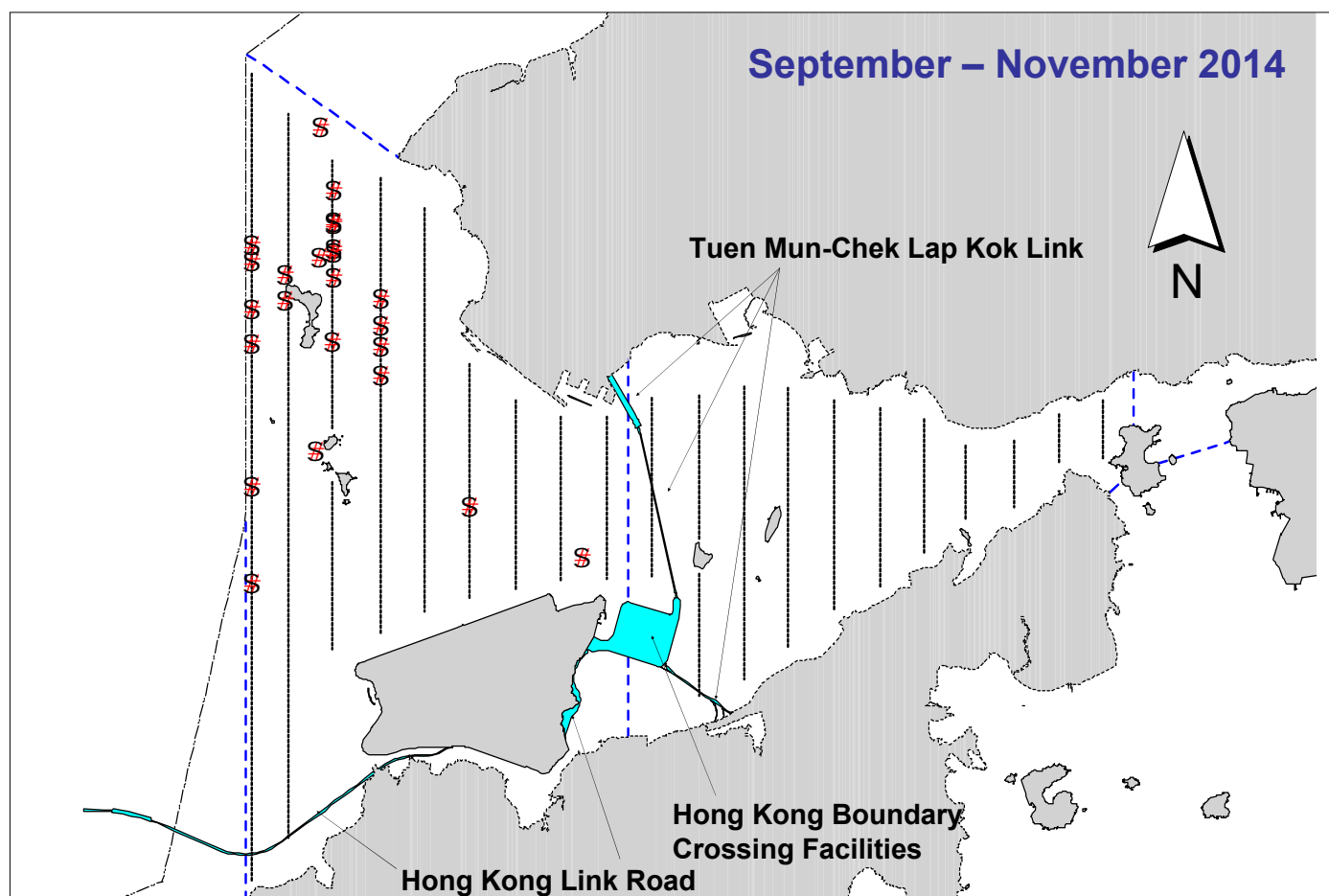


Figure 1. Distribution of Chinese white dolphin sighting in Northwest and Northeast Lantau during HKLR03 impact phase (top) and baseline monitoring surveys (bottom)

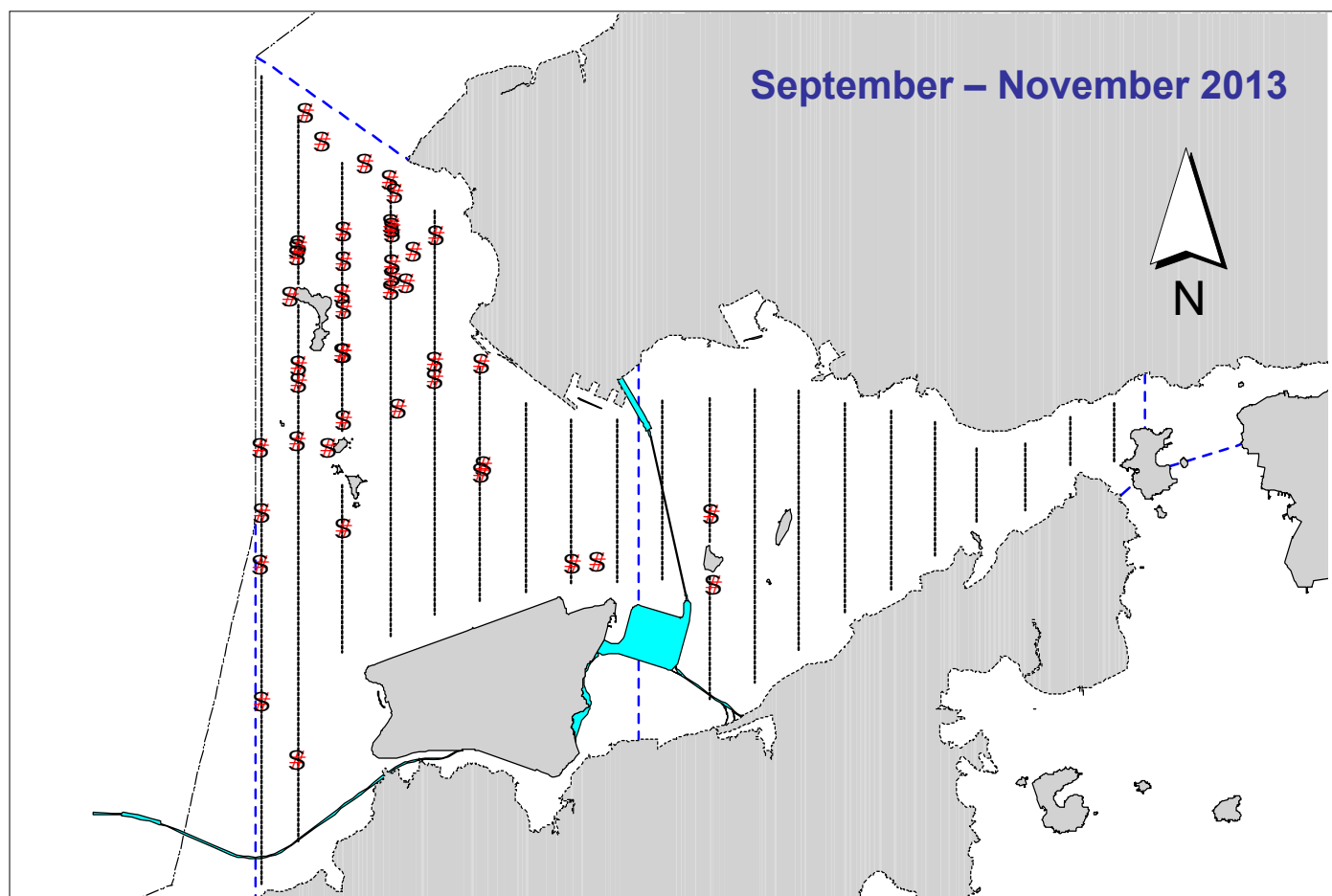
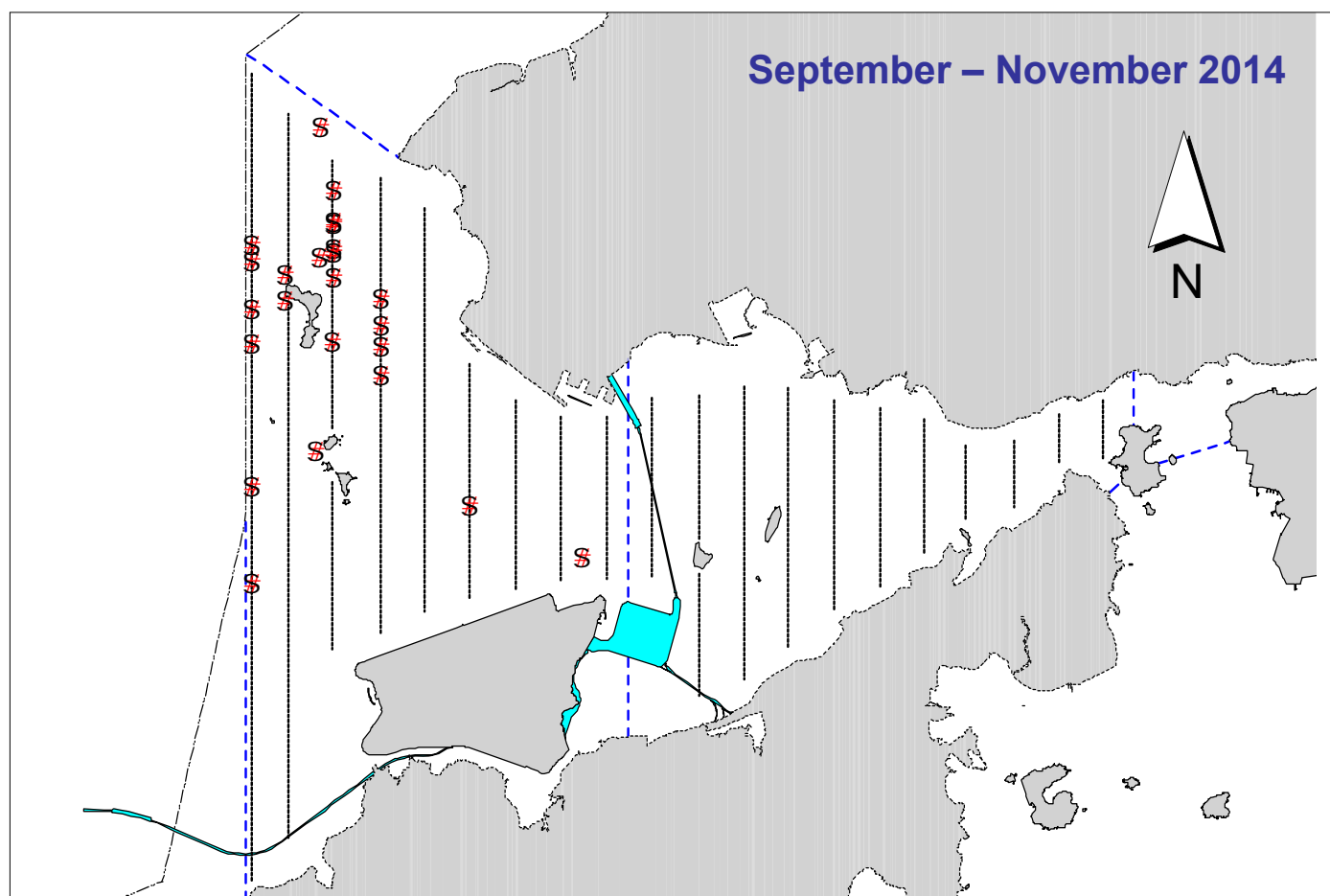


Figure 2. Distribution of Chinese white dolphin sighting in Northwest and Northeast Lantau during the same autumn quarters of HKLR03 impact phase in 2014 (top) and 2013 (bottom)

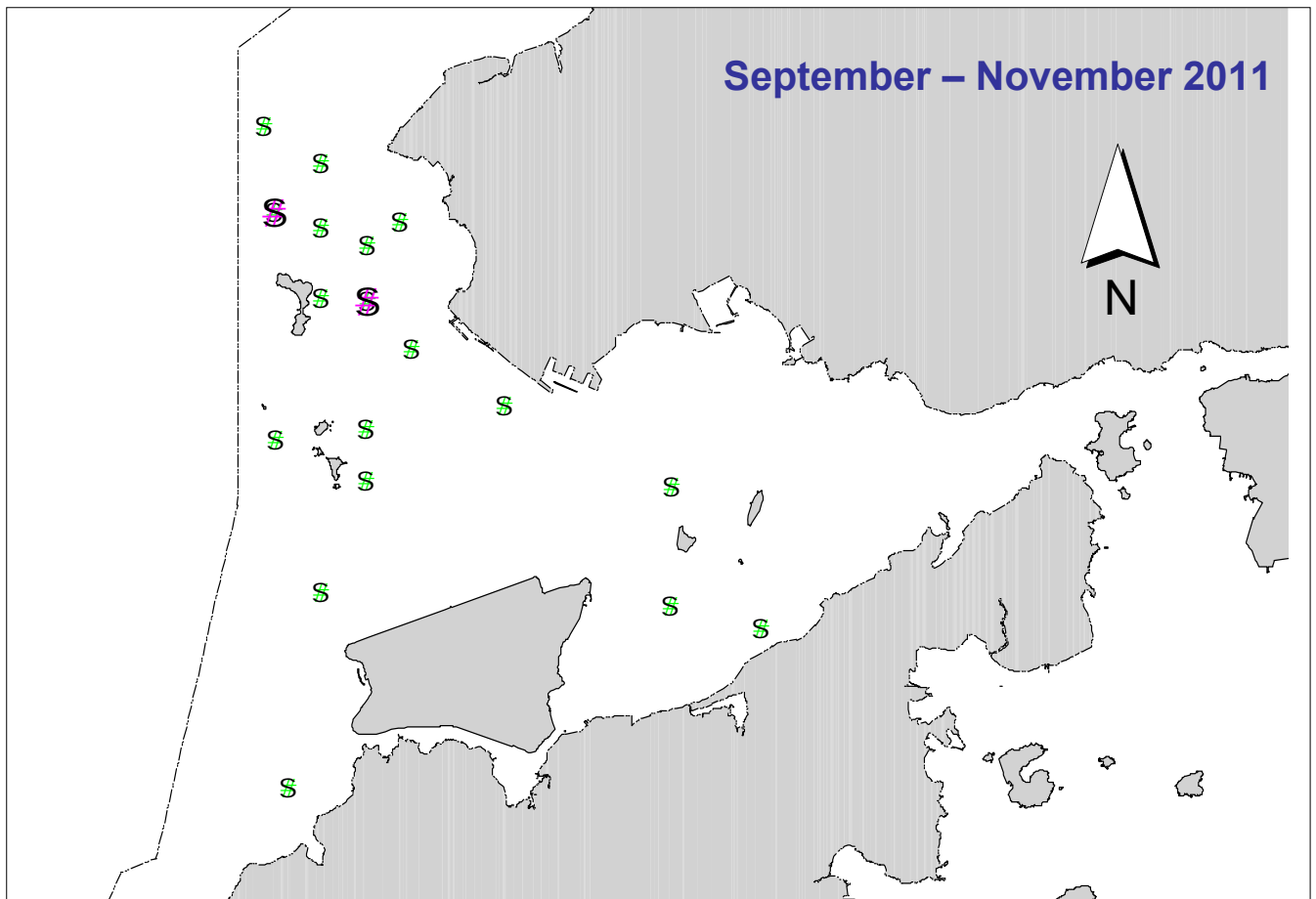
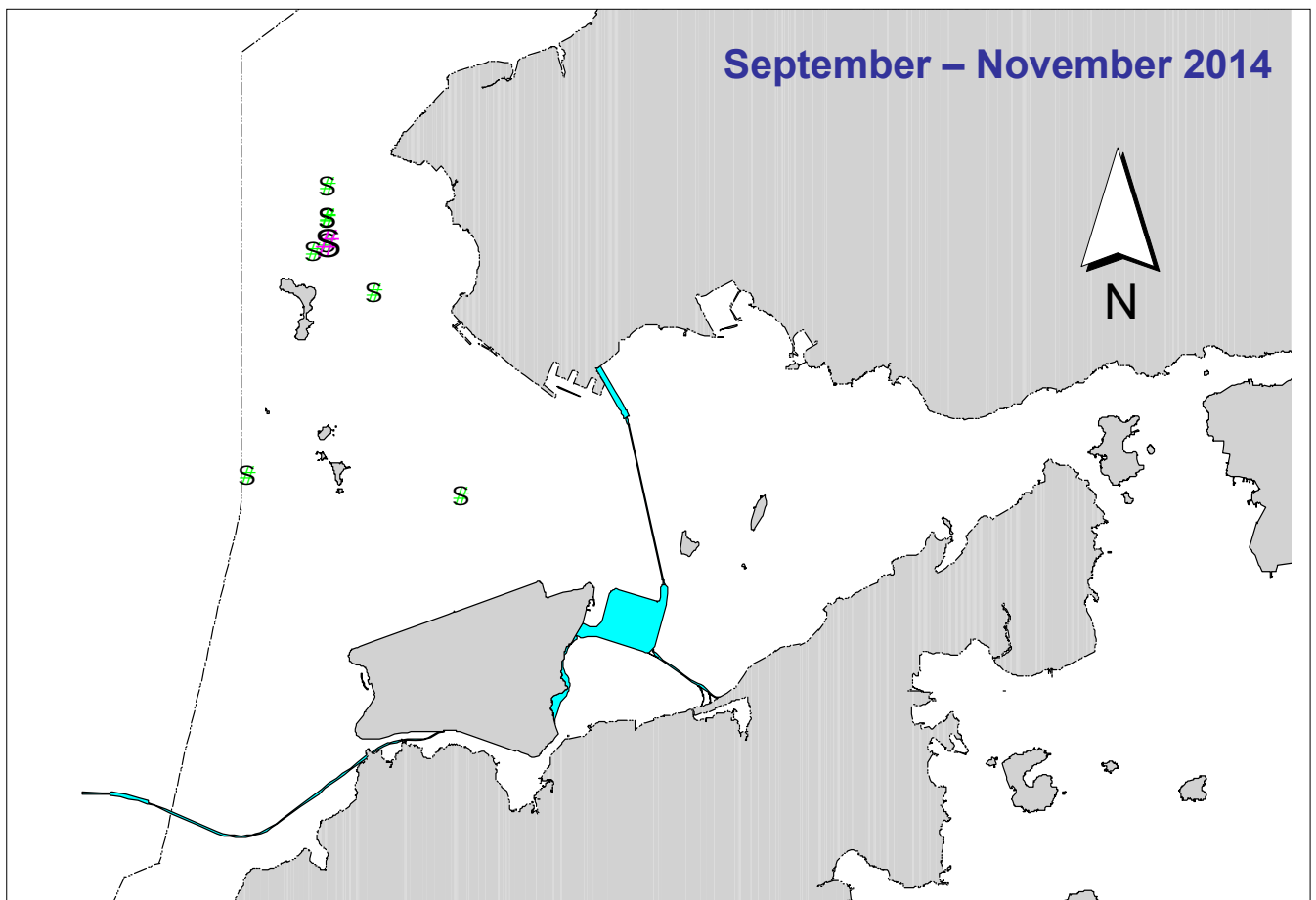


Figure 3. Distribution of Chinese white dolphins with larger group sizes during HKLR03 impact phase (top) and baseline monitoring surveys (bottom) (green dots: group sizes of 5 or more; purple dots: group sizes of 10 or more)

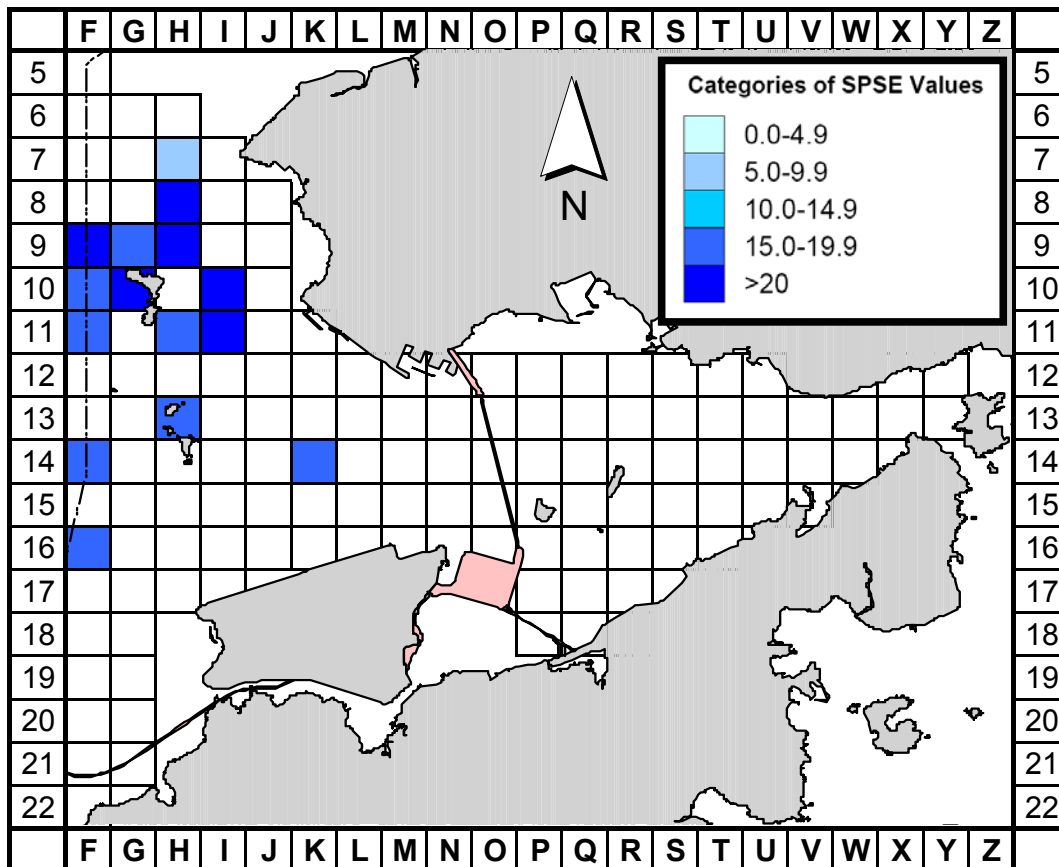


Figure 4a. Sighting density of Chinese white dolphins with corrected survey effort per km² in Northeast and Northwest Lantau survey areas, using data collected during HKLR03 impact monitoring period (Sep-Nov 14) (SPSE = no. of on-effort sightings per 100 units of survey effort)

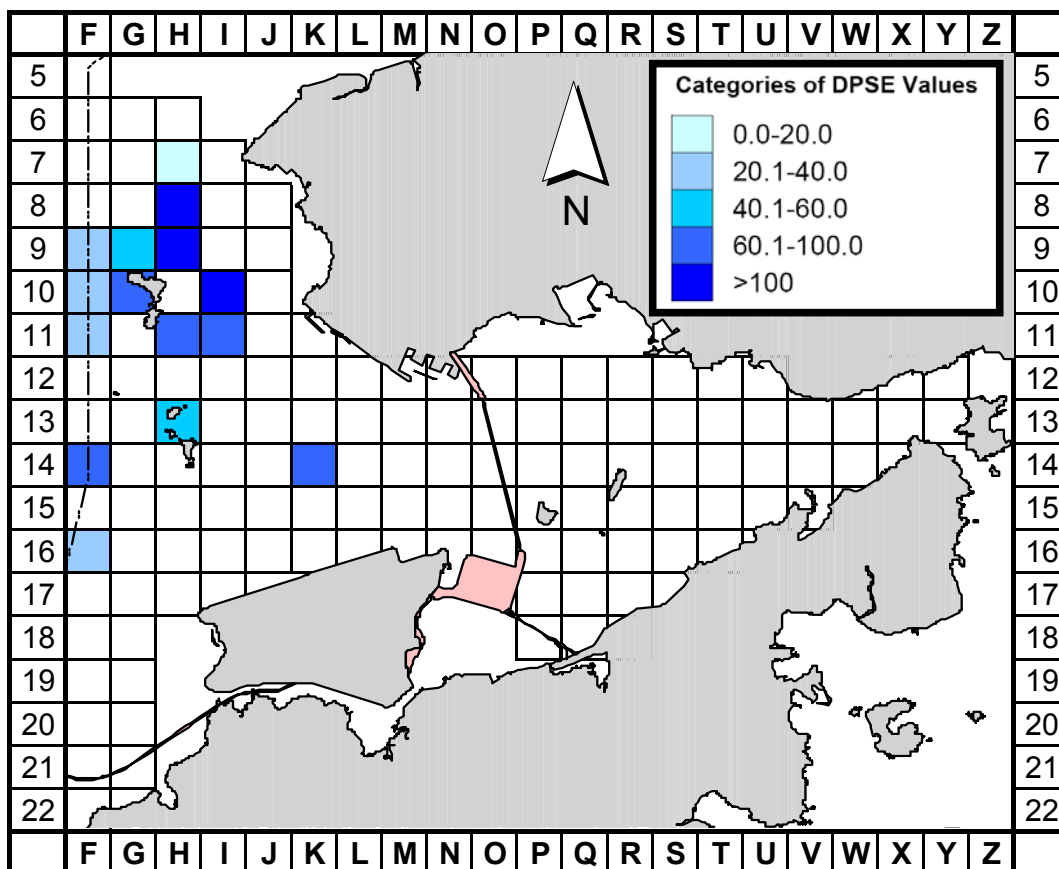


Figure 4b. Density of Chinese white dolphins with corrected survey effort per km² in Northeast and Northwest Lantau survey areas, using data collected during HKLR03 impact monitoring period (Sep-Nov 14) (DPSE = no. of dolphins per 100 units of survey effort)

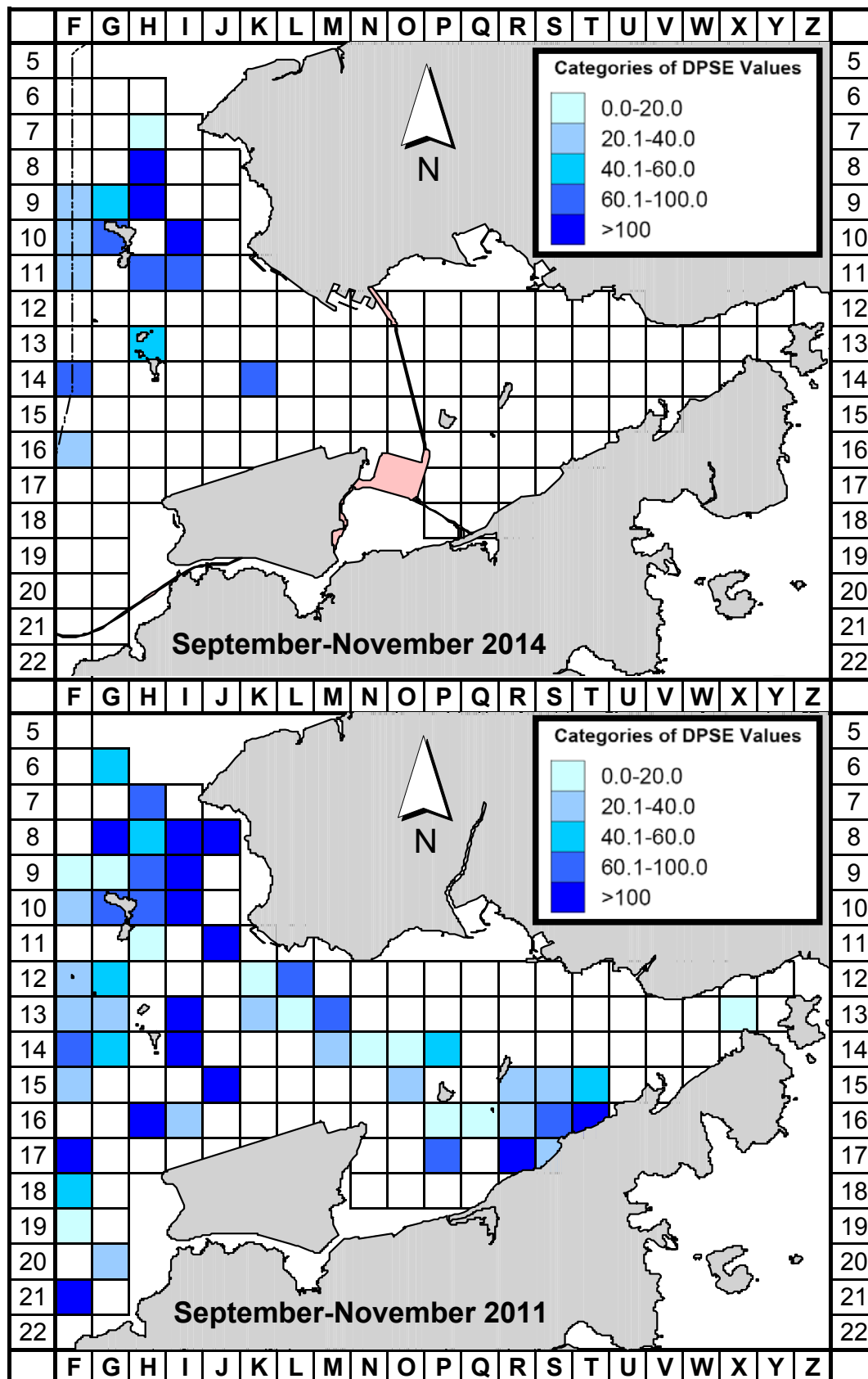


Figure 5. Comparison of density of Chinese white dolphins with corrected survey effort per km² in Northwest and Northeast Lantau survey area between the impact monitoring period (September-November 2014) and baseline monitoring period (September-November 2011) (DPSE = no. of dolphins per 100 units of survey effort)

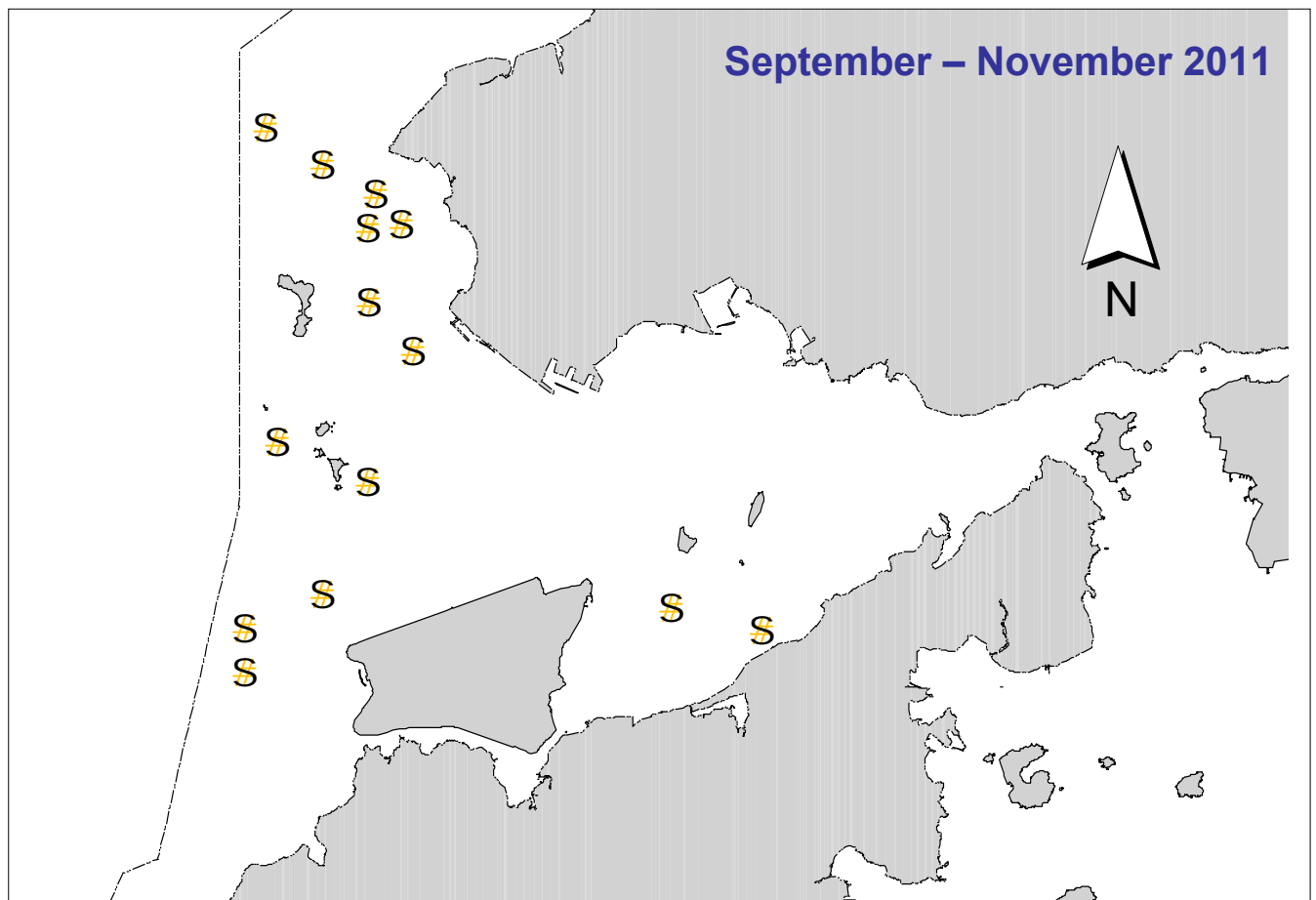
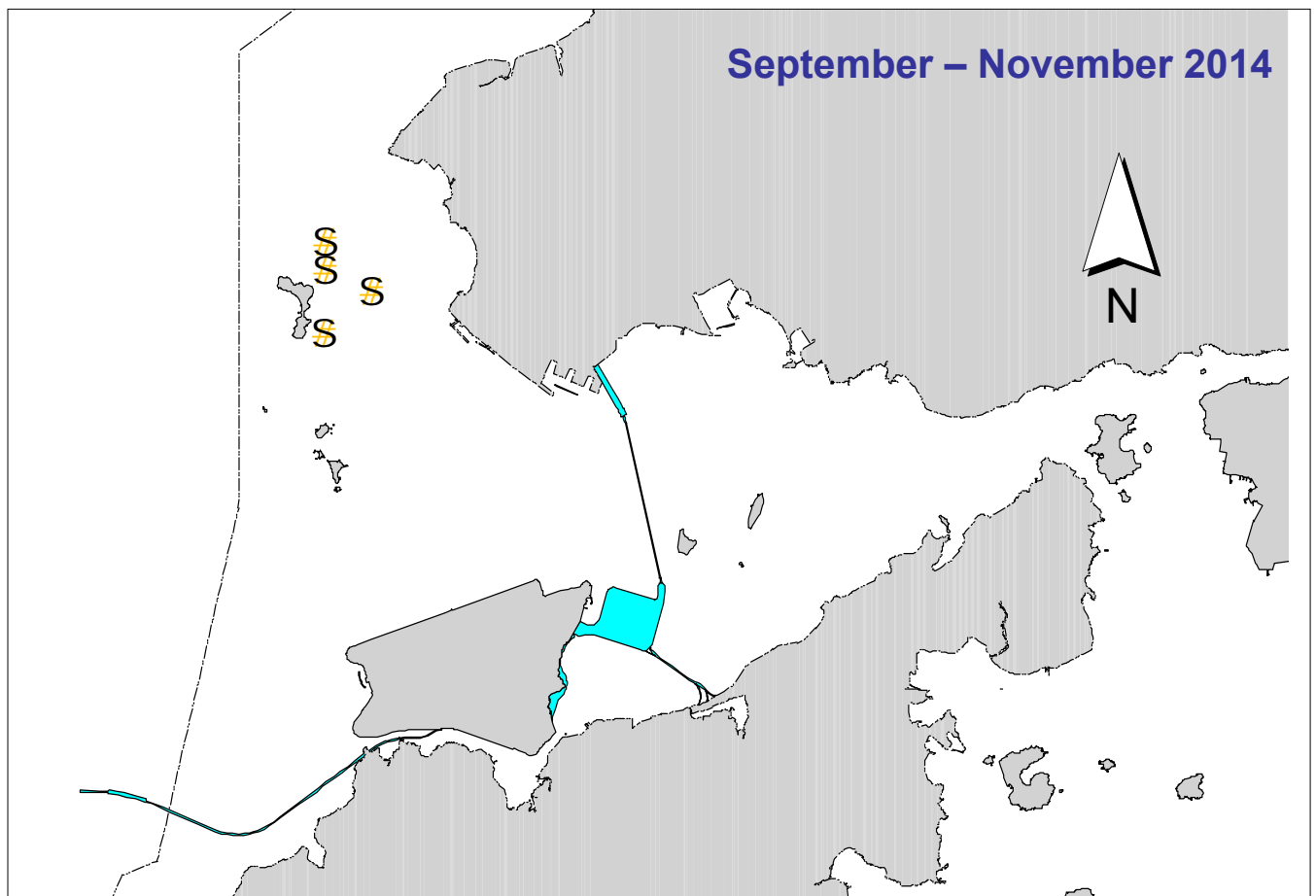


Figure 6. Distribution of young calves of Chinese white dolphins during HKLR03 impact phase (top) and baseline monitoring surveys (bottom)

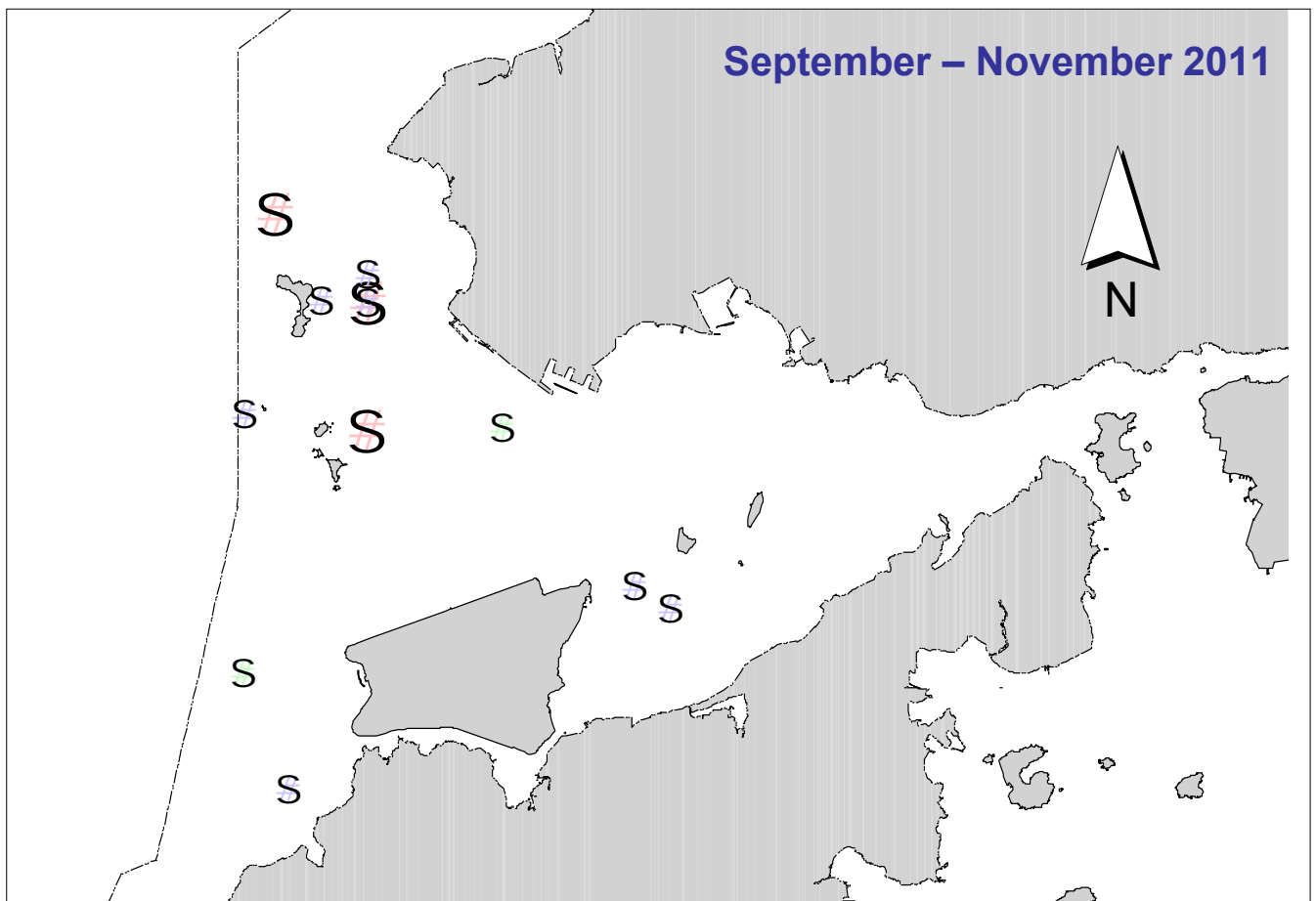
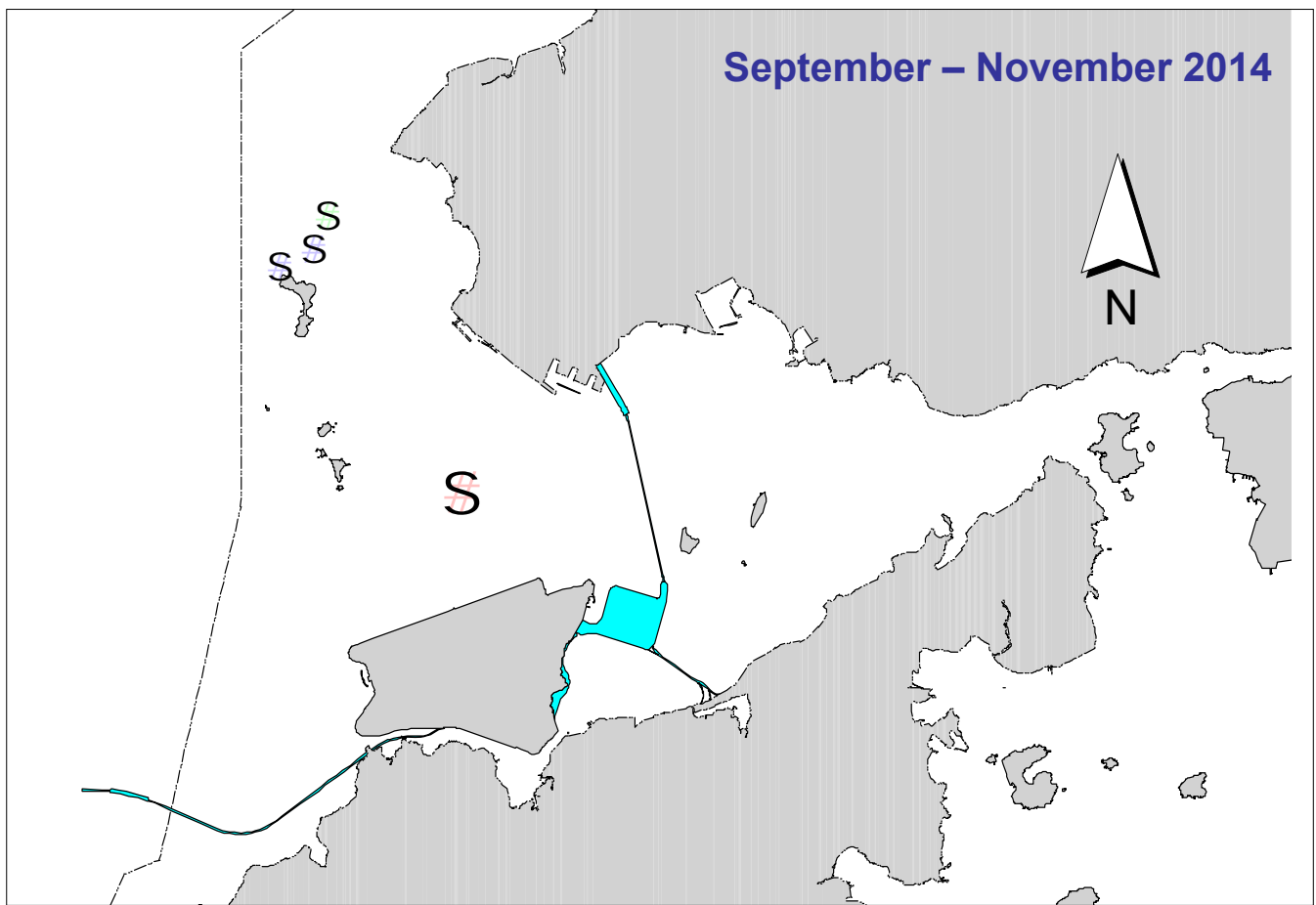


Figure 7. Distribution of Chinese white dolphins engaged in feeding (purple dots), socializing (pink dots) and traveling (green dots) activities during HKLR03 impact phase (top) and baseline monitoring surveys (bottom)

Appendix I. HKLR03 Survey Effort Database (September-November 2014)

(Abbreviations: BEAU = Beaufort Sea State; P = Primary Line Effort; S = Secondary Line Effort)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	TYPE	P/S
2-Sep-14	NW LANTAU	1	7.96	AUTUMN	STANDARD31516	HKLR	P
2-Sep-14	NW LANTAU	2	14.28	AUTUMN	STANDARD31516	HKLR	P
2-Sep-14	NW LANTAU	3	16.44	AUTUMN	STANDARD31516	HKLR	P
2-Sep-14	NW LANTAU	2	7.13	AUTUMN	STANDARD31516	HKLR	S
2-Sep-14	NW LANTAU	3	5.72	AUTUMN	STANDARD31516	HKLR	S
2-Sep-14	NE LANTAU	2	15.63	AUTUMN	STANDARD31516	HKLR	P
2-Sep-14	NE LANTAU	3	2.18	AUTUMN	STANDARD31516	HKLR	P
2-Sep-14	NE LANTAU	2	8.31	AUTUMN	STANDARD31516	HKLR	S
2-Sep-14	NE LANTAU	3	1.28	AUTUMN	STANDARD31516	HKLR	S
11-Sep-14	NW LANTAU	1	4.75	AUTUMN	STANDARD31516	HKLR	P
11-Sep-14	NW LANTAU	2	23.23	AUTUMN	STANDARD31516	HKLR	P
11-Sep-14	NW LANTAU	3	3.33	AUTUMN	STANDARD31516	HKLR	P
11-Sep-14	NW LANTAU	1	0.70	AUTUMN	STANDARD31516	HKLR	S
11-Sep-14	NW LANTAU	2	5.11	AUTUMN	STANDARD31516	HKLR	S
11-Sep-14	NW LANTAU	3	1.50	AUTUMN	STANDARD31516	HKLR	S
11-Sep-14	NE LANTAU	1	1.64	AUTUMN	STANDARD31516	HKLR	P
11-Sep-14	NE LANTAU	2	18.53	AUTUMN	STANDARD31516	HKLR	P
11-Sep-14	NE LANTAU	2	10.73	AUTUMN	STANDARD31516	HKLR	S
19-Sep-14	NW LANTAU	2	30.50	AUTUMN	STANDARD31516	HKLR	P
19-Sep-14	NW LANTAU	3	0.60	AUTUMN	STANDARD31516	HKLR	P
19-Sep-14	NW LANTAU	2	8.90	AUTUMN	STANDARD31516	HKLR	S
19-Sep-14	NW LANTAU	3	0.80	AUTUMN	STANDARD31516	HKLR	S
19-Sep-14	NE LANTAU	2	18.62	AUTUMN	STANDARD31516	HKLR	P
19-Sep-14	NE LANTAU	3	1.43	AUTUMN	STANDARD31516	HKLR	P
19-Sep-14	NE LANTAU	2	10.55	AUTUMN	STANDARD31516	HKLR	S
22-Sep-14	NE LANTAU	2	14.44	AUTUMN	STANDARD31516	HKLR	P
22-Sep-14	NE LANTAU	3	2.95	AUTUMN	STANDARD31516	HKLR	P
22-Sep-14	NE LANTAU	2	10.11	AUTUMN	STANDARD31516	HKLR	S
22-Sep-14	NW LANTAU	1	1.20	AUTUMN	STANDARD31516	HKLR	P
22-Sep-14	NW LANTAU	2	36.86	AUTUMN	STANDARD31516	HKLR	P
22-Sep-14	NW LANTAU	2	12.01	AUTUMN	STANDARD31516	HKLR	S
22-Sep-14	NW LANTAU	3	1.10	AUTUMN	STANDARD31516	HKLR	S
7-Oct-14	NE LANTAU	2	11.15	AUTUMN	STANDARD 31516	HKLR	P
7-Oct-14	NE LANTAU	3	6.75	AUTUMN	STANDARD 31516	HKLR	P
7-Oct-14	NE LANTAU	2	8.44	AUTUMN	STANDARD 31516	HKLR	S
7-Oct-14	NE LANTAU	3	1.46	AUTUMN	STANDARD 31516	HKLR	S
7-Oct-14	NW LANTAU	1	1.90	AUTUMN	STANDARD 31516	HKLR	P
7-Oct-14	NW LANTAU	2	25.80	AUTUMN	STANDARD 31516	HKLR	P
7-Oct-14	NW LANTAU	3	11.94	AUTUMN	STANDARD 31516	HKLR	P
7-Oct-14	NW LANTAU	2	9.13	AUTUMN	STANDARD 31516	HKLR	S
7-Oct-14	NW LANTAU	3	3.26	AUTUMN	STANDARD 31516	HKLR	S
13-Oct-14	NE LANTAU	2	10.59	AUTUMN	STANDARD 31516	HKLR	P
13-Oct-14	NE LANTAU	3	8.72	AUTUMN	STANDARD 31516	HKLR	P
13-Oct-14	NE LANTAU	2	7.91	AUTUMN	STANDARD 31516	HKLR	S
13-Oct-14	NE LANTAU	3	2.38	AUTUMN	STANDARD 31516	HKLR	S
13-Oct-14	NW LANTAU	2	4.96	AUTUMN	STANDARD 31516	HKLR	P
13-Oct-14	NW LANTAU	3	16.34	AUTUMN	STANDARD 31516	HKLR	P
13-Oct-14	NW LANTAU	4	4.95	AUTUMN	STANDARD 31516	HKLR	P
13-Oct-14	NW LANTAU	2	3.81	AUTUMN	STANDARD 31516	HKLR	S
13-Oct-14	NW LANTAU	3	7.23	AUTUMN	STANDARD 31516	HKLR	S
13-Oct-14	NW LANTAU	4	1.20	AUTUMN	STANDARD 31516	HKLR	S
16-Oct-14	NE LANTAU	2	12.51	AUTUMN	STANDARD 31516	HKLR	P

Appendix I. (cont'd)

(Abbreviations: BEAU = Beaufort Sea State; P = Primary Line Effort; S = Secondary Line Effort)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	TYPE	P/S
16-Oct-14	NE LANTAU	3	6.72	AUTUMN	STANDARD 31516	HKLR	P
16-Oct-14	NE LANTAU	2	8.04	AUTUMN	STANDARD 31516	HKLR	S
16-Oct-14	NE LANTAU	3	2.53	AUTUMN	STANDARD 31516	HKLR	S
16-Oct-14	NW LANTAU	2	3.81	AUTUMN	STANDARD 31516	HKLR	P
16-Oct-14	NW LANTAU	3	21.23	AUTUMN	STANDARD 31516	HKLR	P
16-Oct-14	NW LANTAU	4	6.50	AUTUMN	STANDARD 31516	HKLR	P
16-Oct-14	NW LANTAU	2	4.30	AUTUMN	STANDARD 31516	HKLR	S
16-Oct-14	NW LANTAU	3	3.56	AUTUMN	STANDARD 31516	HKLR	S
23-Oct-14	NE LANTAU	2	15.42	AUTUMN	STANDARD 31516	HKLR	P
23-Oct-14	NE LANTAU	3	1.90	AUTUMN	STANDARD 31516	HKLR	P
23-Oct-14	NE LANTAU	2	9.28	AUTUMN	STANDARD 31516	HKLR	S
23-Oct-14	NE LANTAU	3	0.70	AUTUMN	STANDARD 31516	HKLR	S
23-Oct-14	NW LANTAU	2	30.11	AUTUMN	STANDARD 31516	HKLR	P
23-Oct-14	NW LANTAU	3	10.91	AUTUMN	STANDARD 31516	HKLR	P
23-Oct-14	NW LANTAU	1	1.60	AUTUMN	STANDARD 31516	HKLR	S
23-Oct-14	NW LANTAU	2	9.19	AUTUMN	STANDARD 31516	HKLR	S
23-Oct-14	NW LANTAU	3	1.99	AUTUMN	STANDARD 31516	HKLR	S
4-Nov-14	NE LANTAU	2	7.47	AUTUMN	STANDARD31516	HKLR	P
4-Nov-14	NE LANTAU	3	9.93	AUTUMN	STANDARD31516	HKLR	P
4-Nov-14	NE LANTAU	2	7.41	AUTUMN	STANDARD31516	HKLR	S
4-Nov-14	NE LANTAU	3	1.59	AUTUMN	STANDARD31516	HKLR	S
4-Nov-14	NW LANTAU	1	1.50	AUTUMN	STANDARD31516	HKLR	P
4-Nov-14	NW LANTAU	2	25.21	AUTUMN	STANDARD31516	HKLR	P
4-Nov-14	NW LANTAU	3	12.20	AUTUMN	STANDARD31516	HKLR	P
4-Nov-14	NW LANTAU	2	12.82	AUTUMN	STANDARD31516	HKLR	S
4-Nov-14	NW LANTAU	3	0.60	AUTUMN	STANDARD31516	HKLR	S
10-Nov-14	NE LANTAU	2	8.28	AUTUMN	STANDARD31516	HKLR	P
10-Nov-14	NE LANTAU	3	9.93	AUTUMN	STANDARD31516	HKLR	P
10-Nov-14	NE LANTAU	2	9.49	AUTUMN	STANDARD31516	HKLR	S
10-Nov-14	NE LANTAU	3	1.00	AUTUMN	STANDARD31516	HKLR	S
10-Nov-14	NW LANTAU	3	26.28	AUTUMN	STANDARD31516	HKLR	P
10-Nov-14	NW LANTAU	4	6.12	AUTUMN	STANDARD31516	HKLR	P
10-Nov-14	NW LANTAU	3	4.40	AUTUMN	STANDARD31516	HKLR	S
10-Nov-14	NW LANTAU	4	1.20	AUTUMN	STANDARD31516	HKLR	S
10-Nov-14	NW LANTAU	5	1.10	AUTUMN	STANDARD31516	HKLR	S
12-Nov-14	NW LANTAU	2	1.30	AUTUMN	STANDARD31516	HKLR	P
12-Nov-14	NW LANTAU	3	30.29	AUTUMN	STANDARD31516	HKLR	P
12-Nov-14	NW LANTAU	2	0.60	AUTUMN	STANDARD31516	HKLR	S
12-Nov-14	NW LANTAU	3	5.98	AUTUMN	STANDARD31516	HKLR	S
12-Nov-14	NW LANTAU	4	0.63	AUTUMN	STANDARD31516	HKLR	S
12-Nov-14	NE LANTAU	2	8.30	AUTUMN	STANDARD31516	HKLR	P
12-Nov-14	NE LANTAU	3	9.41	AUTUMN	STANDARD31516	HKLR	P
12-Nov-14	NE LANTAU	4	2.40	AUTUMN	STANDARD31516	HKLR	P
12-Nov-14	NE LANTAU	2	7.11	AUTUMN	STANDARD31516	HKLR	S
12-Nov-14	NE LANTAU	3	3.48	AUTUMN	STANDARD31516	HKLR	S
18-Nov-14	NW LANTAU	2	13.70	AUTUMN	STANDARD31516	HKLR	P
18-Nov-14	NW LANTAU	3	25.02	AUTUMN	STANDARD31516	HKLR	P
18-Nov-14	NW LANTAU	4	1.76	AUTUMN	STANDARD31516	HKLR	P
18-Nov-14	NW LANTAU	2	2.19	AUTUMN	STANDARD31516	HKLR	S
18-Nov-14	NW LANTAU	3	10.43	AUTUMN	STANDARD31516	HKLR	S
18-Nov-14	NE LANTAU	1	1.78	AUTUMN	STANDARD31516	HKLR	P
18-Nov-14	NE LANTAU	2	14.94	AUTUMN	STANDARD31516	HKLR	P
18-Nov-14	NE LANTAU	3	2.00	AUTUMN	STANDARD31516	HKLR	P
18-Nov-14	NE LANTAU	1	1.20	AUTUMN	STANDARD31516	HKLR	S
18-Nov-14	NE LANTAU	2	7.09	AUTUMN	STANDARD31516	HKLR	S

Appendix II. HKLR03 Chinese White Dolphin Sighting Database (September-November 2014)

(Abbreviations: STG# = Sighting Number; HRD SZ = Dolphin Herd Size; BEAU = Beaufort Sea State; PSD = Perpendicular Distance; BOAT ASSOC. = Fishing Boat Association; P/S: Sighting Made on Primary/Secondary Line)

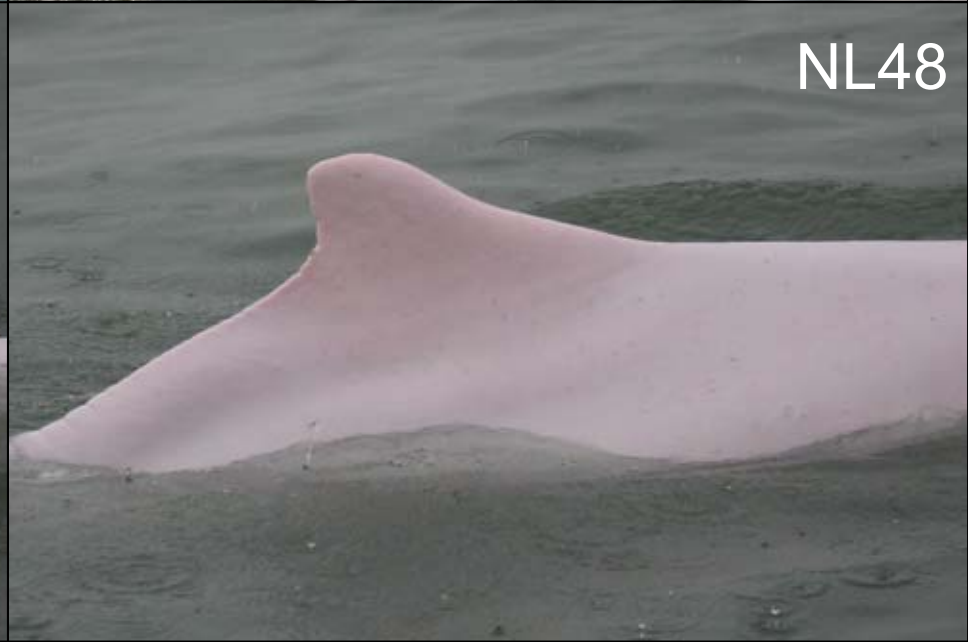
DATE	STG #	TIME	HRD SZ	AREA	BEAU	PSD	EFFORT	TYPE	NORTHING	EASTING	SEASON	BOAT ASSOC.	P/S
2-Sep-14	1	1106	3	NW LANTAU	1	201	ON	HKLR	827206	805396	AUTUMN	NONE	P
2-Sep-14	2	1215	5	NW LANTAU	2	562	ON	HKLR	828278	806459	AUTUMN	NONE	P
11-Sep-14	1	1132	6	NW LANTAU	2	374	ON	HKLR	826693	807517	AUTUMN	NONE	P
11-Sep-14	2	1215	6	NW LANTAU	2	1742	ON	HKLR	822381	809476	AUTUMN	NONE	P
19-Sep-14	1	1336	1	NW LANTAU	2	ND	OFF	HKLR	821325	811947	AUTUMN	NONE	N/A
22-Sep-14	1	1432	5	NW LANTAU	2	198	ON	HKLR	828289	806480	AUTUMN	NONE	P
22-Sep-14	2	1559	6	NW LANTAU	2	955	ON	HKLR	822811	804656	AUTUMN	NONE	P
22-Sep-14	3	1612	2	NW LANTAU	2	153	ON	HKLR	820785	804662	AUTUMN	NONE	P
7-Oct-14	1	1403	3	NW LANTAU	2	284	ON	HKLR	823528	806089	AUTUMN	NONE	S
7-Oct-14	2	1423	4	NW LANTAU	2	130	ON	HKLR	825820	806454	AUTUMN	NONE	P
7-Oct-14	3	1445	4	NW LANTAU	2	75	ON	HKLR	827149	806457	AUTUMN	NONE	P
7-Oct-14	4	1515	6	NW LANTAU	2	125	ON	HKLR	828943	806471	AUTUMN	NONE	P
7-Oct-14	5	1556	1	NW LANTAU	2	300	ON	HKLR	827474	804666	AUTUMN	NONE	P
7-Oct-14	6	1603	2	NW LANTAU	2	707	ON	HKLR	826499	804664	AUTUMN	NONE	P
13-Oct-14	1	1207	4	NW LANTAU	3	116	ON	HKLR	825098	807514	AUTUMN	NONE	P
13-Oct-14	2	1220	2	NW LANTAU	3	252	ON	HKLR	825707	807525	AUTUMN	NONE	P
13-Oct-14	3	1232	3	NW LANTAU	3	335	ON	HKLR	826161	807516	AUTUMN	NONE	P
13-Oct-14	4	1258	1	NW LANTAU	2	311	ON	HKLR	830272	806185	AUTUMN	NONE	S
4-Nov-14	1	1435	13	NW LANTAU	1	73	ON	HKLR	827747	806468	AUTUMN	NONE	P
4-Nov-14	2	1539	1	NW LANTAU	2	0	ON	HKLR	827839	804666	AUTUMN	NONE	P
4-Nov-14	3	1558	2	NW LANTAU	2	118	ON	HKLR	825757	804662	AUTUMN	NONE	P
12-Nov-14	1	1050	4	NW LANTAU	3	105	ON	HKLR	826686	805385	AUTUMN	NONE	P
18-Nov-14	1	1255	2	NW LANTAU	2	334	ON	HKLR	827669	806479	AUTUMN	NONE	P
18-Nov-14	2	1307	7	NW LANTAU	3	ND	OFF	HKLR	827559	806149	AUTUMN	NONE	N/A

Appendix III. Individual dolphins identified during HKLR03 monitoring surveys in September-November 2014

ID#	DATE	STG#	AREA
CH34	13/10/14	4	NW LANTAU
	18/11/14	2	NW LANTAU
CH153	22/09/14	3	NW LANTAU
NL46	11/09/14	1	NW LANTAU
	04/11/14	1	NW LANTAU
NL48	19/09/14	1	NW LANTAU
	13/10/14	1	NW LANTAU
	04/11/14	1	NW LANTAU
	18/11/14	2	NW LANTAU
NL80	11/09/14	2	NW LANTAU
NL104	02/09/14	1	NW LANTAU
	04/11/14	1	NW LANTAU
NL136	07/10/14	1	NW LANTAU
	13/10/14	1	NW LANTAU
NL150	22/09/14	3	NW LANTAU
NL182	11/09/14	1	NW LANTAU
	07/10/14	1	NW LANTAU
	13/10/14	2	NW LANTAU
	18/11/14	2	NW LANTAU
NL202	12/11/14	1	NW LANTAU
	18/11/14	1	NW LANTAU
	18/11/14	2	NW LANTAU
NL210	11/09/14	2	NW LANTAU
	12/11/14	1	NW LANTAU
NL213	13/10/14	1	NW LANTAU
NL214	02/09/14	1	NW LANTAU
	07/10/14	3	NW LANTAU
	13/10/14	2	NW LANTAU
NL233	11/09/14	1	NW LANTAU
	22/09/14	1	NW LANTAU
	07/10/14	2	NW LANTAU
NL236	22/09/14	3	NW LANTAU
NL256	07/10/14	3	NW LANTAU
	04/11/14	1	NW LANTAU
NL259	13/10/14	1	NW LANTAU
	04/11/14	1	NW LANTAU

ID#	DATE	STG#	AREA
NL272	12/11/14	1	NW LANTAU
NL278	07/10/14	2	NW LANTAU
NL286	04/11/14	1	NW LANTAU
	18/11/14	1	NW LANTAU
	18/11/14	2	NW LANTAU
NL295	07/10/14	1	NW LANTAU
NL300	07/10/14	5	NW LANTAU
NL301	11/09/14	2	NW LANTAU
NL302	11/09/14	2	NW LANTAU
WL05	04/11/14	1	NW LANTAU
	04/11/14	3	NW LANTAU
	12/11/14	1	NW LANTAU
WL97	12/11/14	1	NW LANTAU

Appendix IV. Twenty-six individual dolphins that were identified during September – November 2014 under HKLR03 impact phase monitoring surveys



Appendix IV. (cont'd)



Appendix IV. (cont'd)

NL182



NL202



NL210



NL213



Appendix IV. (cont'd)

NL214



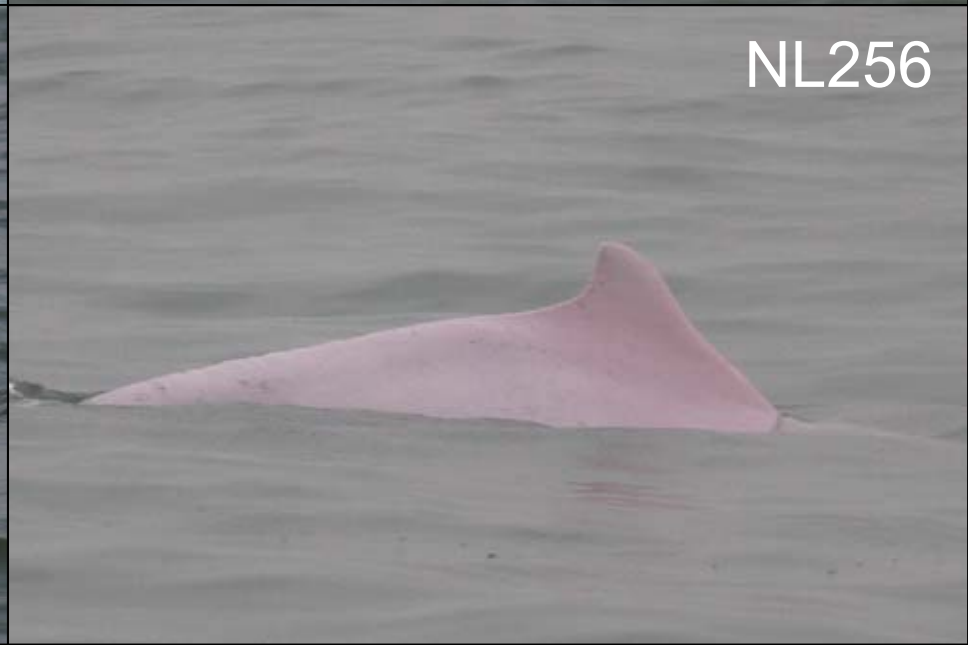
NL233



NL236



NL256



Appendix IV. (cont'd)



Appendix IV. (cont'd)

NL295



NL300



NL301



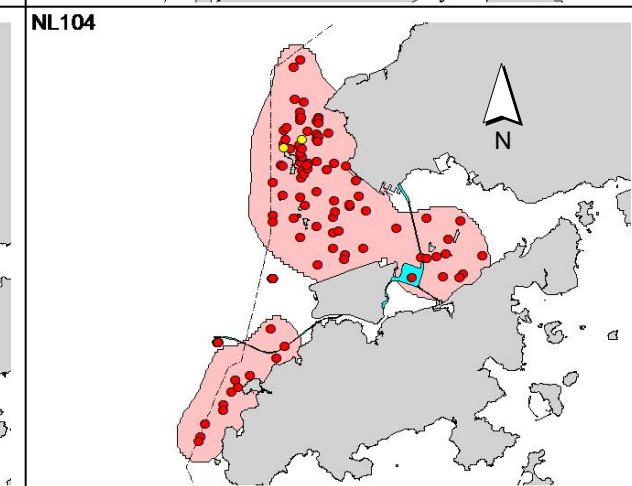
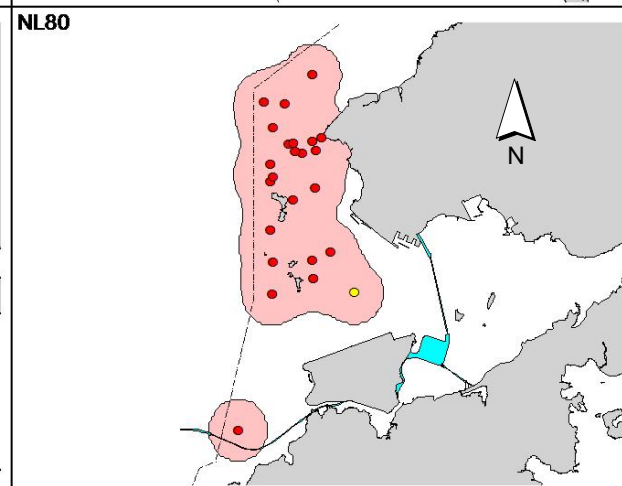
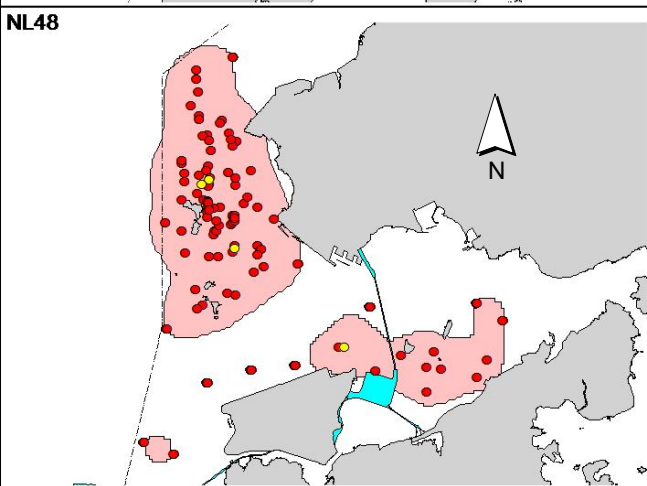
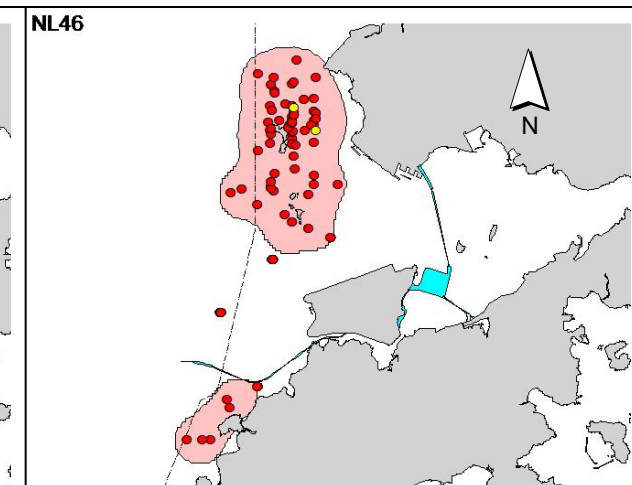
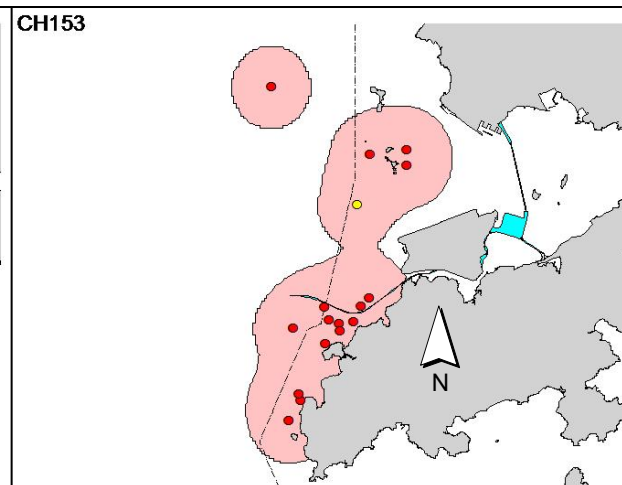
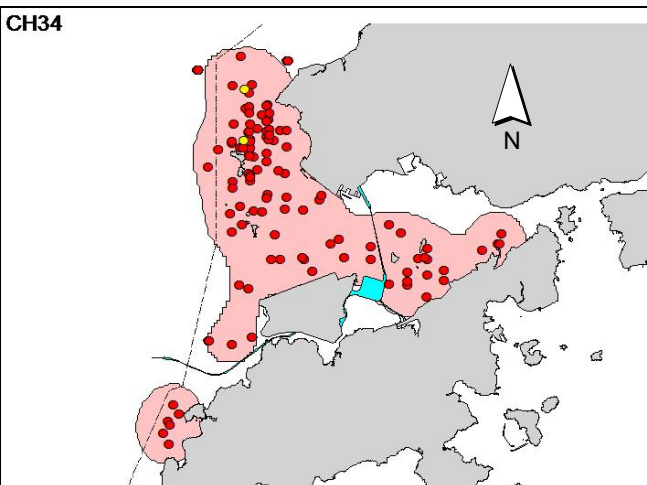
NL302



Appendix IV. (cont'd)

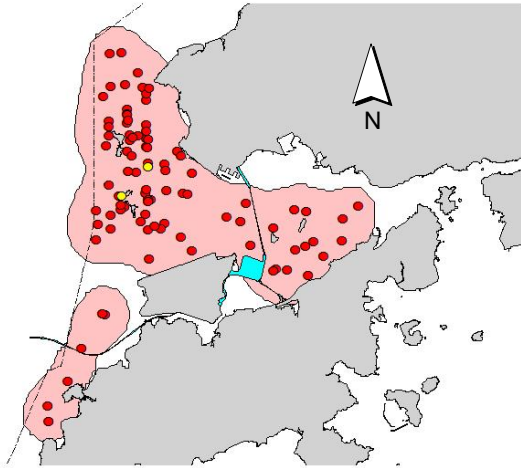


Appendix V. Ranging patterns (95% kernel ranges) of 26 individual dolphins that were sighted during HKLR03 impact phase monitoring period (note: yellow dots indicates sightings made in September – November 2014)

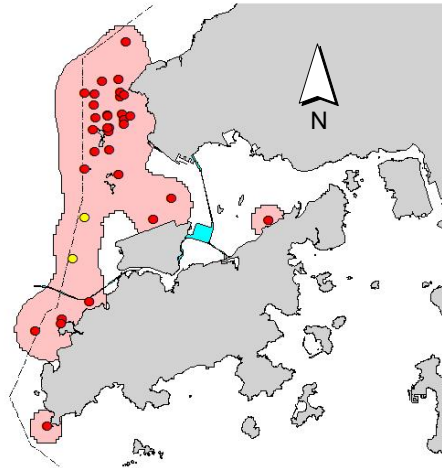


Appendix V. (cont'd)

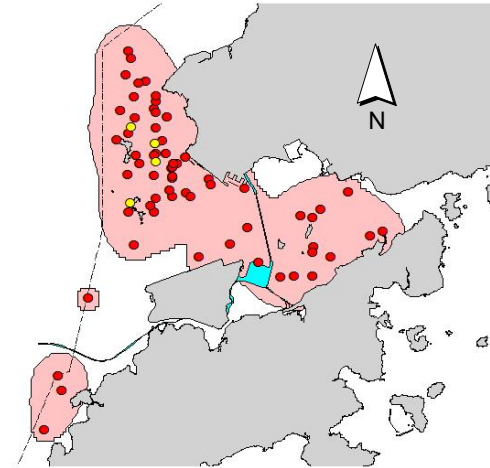
NL136



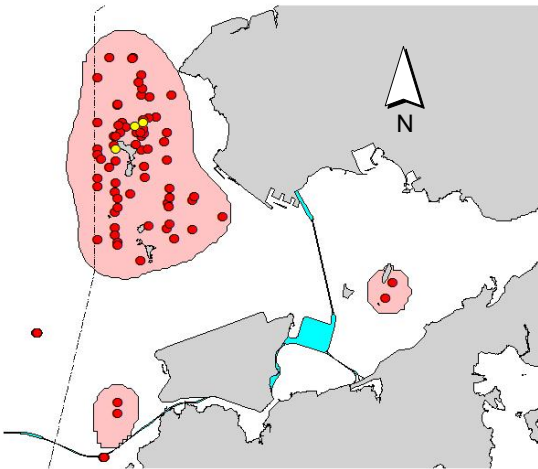
NL150



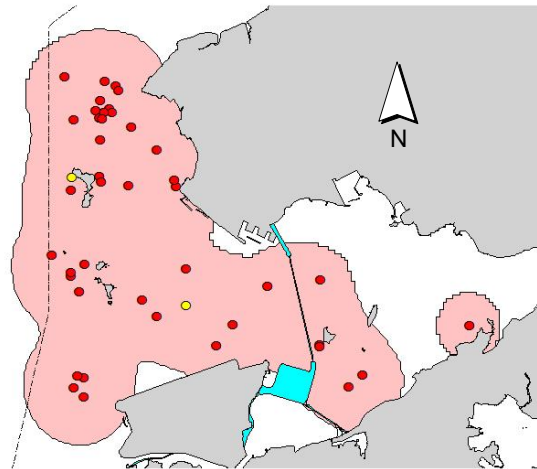
NL182



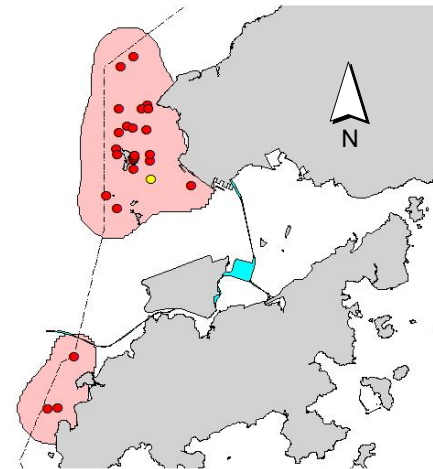
NL202



NL210

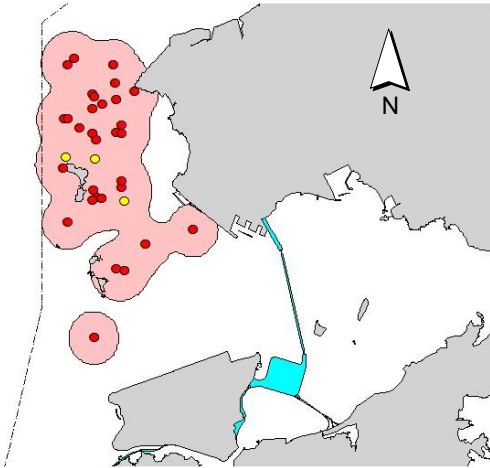


NL213

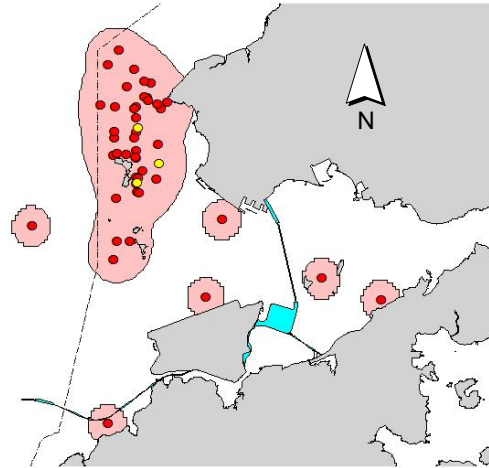


Appendix V. (cont'd)

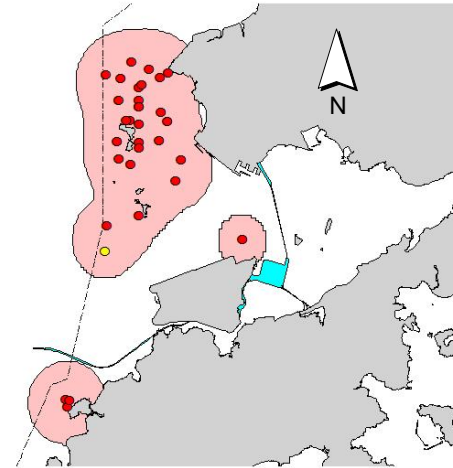
NL214



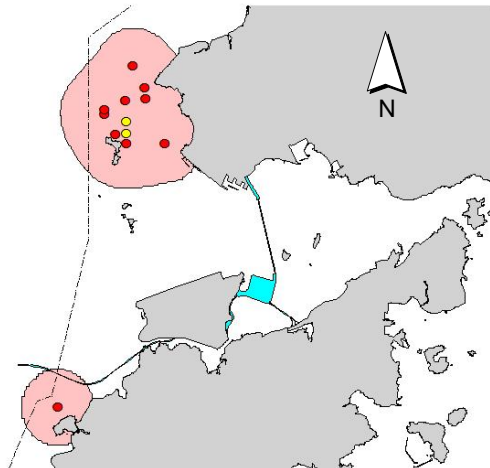
NL233



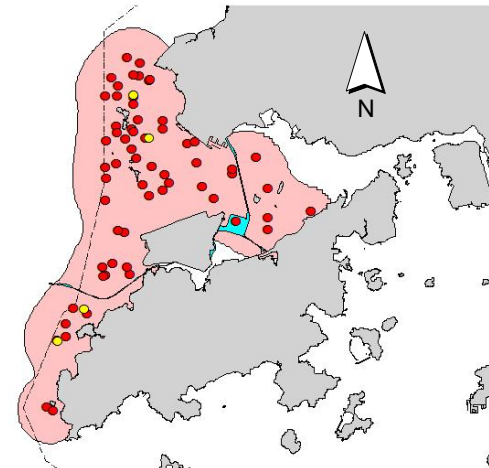
NL236



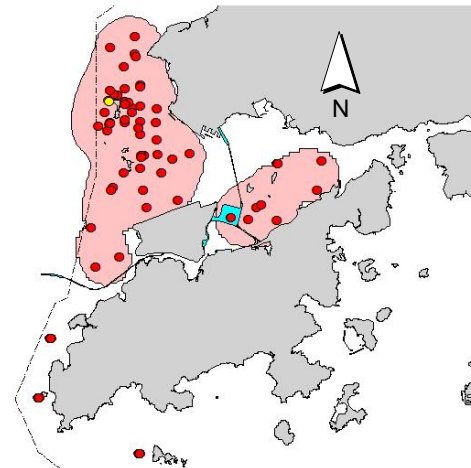
NL256



NL259

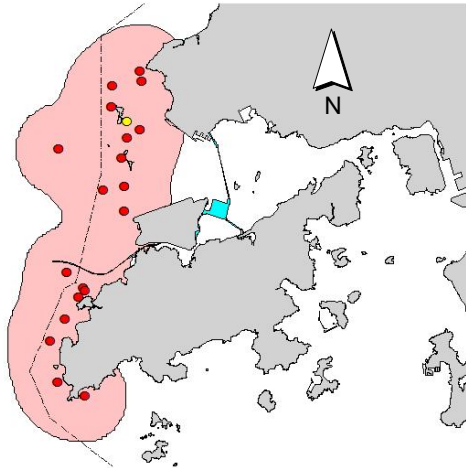


NL272

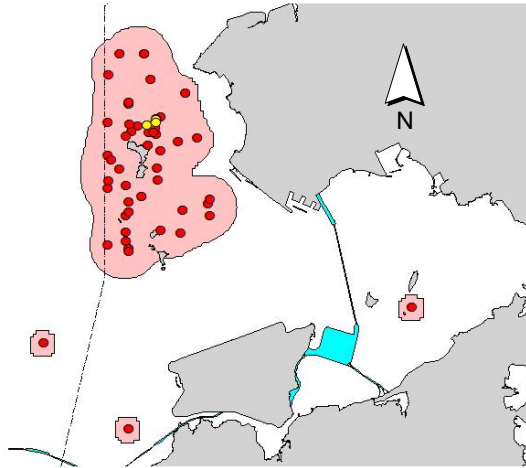


Appendix V. (cont'd)

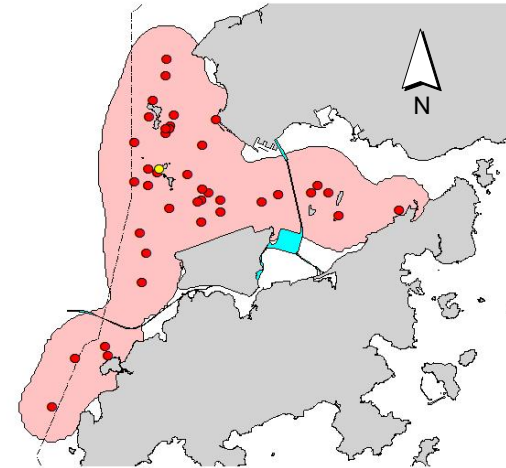
NL278



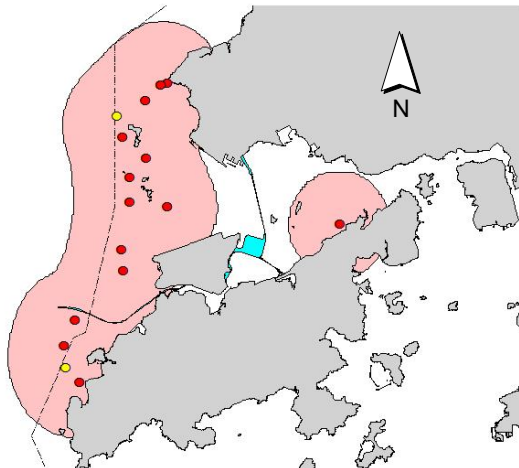
NL286



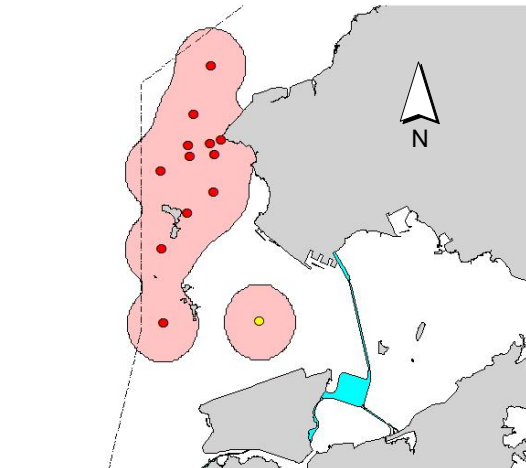
NL295



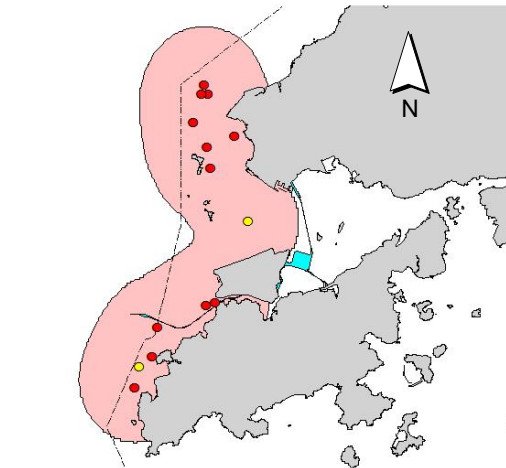
NL300



NL301



NL302



Appendix V. (cont'd)

