Contract No. HY/2011/03
Hong Kong-Zhuhai-Macao Bridge Hong Kong Link Road – Section between Scenic Hill and Hong Kong Boundary Crossing Facilities Dolphin Monitoring

13th Quarterly Progress Report (September-November 2015)
submitted to China State Construction Engineering (HK) Ltd.

Submitted by
Samuel K.Y. Hung, Ph.D., Hong Kong Cetacean Research Project

10 December 2015

1. Introduction

1.1. The Hong Kong Link Road (HKLR) serves to connect the Hong Kong-Zhuhai-Macao Bridge (HZMB) Main Bridge at the Hong Kong Special Administrative Region (HKSAR) Boundary and the HZMB Hong Kong Boundary Crossing Facilities (HKBCF) located at the northeastern waters of the Hong Kong International Airport. The construction of HKLR is separated into two sections, with the construction for the section between Scenic Hill and Hong Kong Boundary Crossing Facilities being commenced in October 2012.

1.2. According to the updated Environmental Monitoring and Audit (EM&A) Manual (for HKLR), monthly line-transect vessel surveys for Chinese White Dolphin should be conducted to cover the Northwest and Northeast Lantau survey areas as in AFCD annual marine mammal monitoring programme.

1.3. In October 2012, Hong Kong Cetacean Research Project (HKCRP) has been commissioned to conduct this 54-month dolphin monitoring study in order to collect data on Chinese White Dolphins during the construction phase (i.e. impact period) of the HKLR03 project in Northwest Lantau (NWL) and Northeast Lantau (NEL) survey areas, and to analyze the collected survey data to monitor distribution, encounter rate, activities and occurrence of dolphin calves. Photo-identification will also be collected from individual Chinese White Dolphins to examine their individual range patterns.

1.4. 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.

1.5. This report is the 13th quarterly progress report under the HKLR03 construction phase dolphin monitoring programme submitted to the China State Construction Engineering (HK) Limited, summarizing the results of the surveys findings during the period of September to November 2015.

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 are shown in Table 1. The coordinates of several starting points have been revised due to the obstruction of the permanent structures in association to the construction works of HKLR and the southern viaduct of TM-CLKL, as well as provision of adequate buffer distance from the Airport Restricted Areas. The EPD issued a memo and confirmed that they had no objection on the revised transect lines on 19 August 2015, and the revised coordinates are in red and marked with an asterisk in Table 1.

Table 1. Co-ordinates of transect lines

Line No.		Easting	Northing		Line No.		Easting	Northing
1	Start Point	804671	815456*		13	Start Point	816506	819480
1	End Point	804671	831404		13	End Point	816506	824859
2	Start Point	805475	815913*		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	820880*		19	Start Point	822513	823268
7	End Point	810499	824613		19	End Point	822513	824321
8	Start Point	811508	821123*		20	Start Point	823477	823402
8	End Point	811508	824254		20	End Point	823477	824613
9	Start Point	812516	821303*		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	818853*		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					

Note: Co-ordinates in red and marked with asterisk are revised co-ordinates of transect line.

2.1.2. The 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). 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^{o} and 90^{o} (in relation to the bow, which is defined as 0^{o}). 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, position (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 (Hung 2013). 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 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. One to two professional digital cameras (*Canon* EOS 7D and/or 60D models), each 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. 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, and only data collected under Beaufort 3 or below condition would be used for encounter

rate analysis. 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 present quarterly period.

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-km^2 grids among NWL and NEL survey areas on GIS. Sighting densities (number of on-effort sightings per km^2) and dolphin densities (total number of dolphins from on-effort sightings per km^2) 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 **s**ightings **p**er 100 units of **s**urvey **e**ffort. In addition, the derived unit for actual dolphin density was termed DPSE, representing the number of **d**olphins **p**er 100 units of **s**urvey **e**ffort. Among the 1-km^2 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-km^2

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, milling/resting, traveling, socializing) 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 2015, six sets of systematic line-transect vessel surveys were conducted to cover all transect lines in NWL and NEL survey areas twice per month.

3.1.2. From these surveys, a total of 902.25 km of survey effort was collected, with 95.0% 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, 346.64 km and 555.61 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 656.41 km, while the effort on secondary lines was 245.84 km. Survey effort conducted on both primary and secondary lines were considered as on-effort survey data. A summary table of the survey effort is shown in Annex I.

3.1.4. During the six sets of monitoring surveys in September-November 2015, a total of 18 groups of 95 Chinese White Dolphins were sighted. A summary table of the dolphin sightings is shown in Annex II.

3.1.5. For the present quarterly period, all dolphin sightings were made during on-effort search, and all except one dolphin sighting were made on primary lines. Moreover, all dolphin groups were sighted in NWL, while none was sighted at all in NEL. In fact, since July 2014, only one sighting of a lone dolphin was made in NEL during HKLR03 monitoring surveys.

3.2. Distribution

3.2.1. Distribution of dolphin sightings made during monitoring surveys in September to November 2015 is shown in Figure 1. Dolphin sightings made in the present quarter were mostly clustered around Lung Kwu Chau (Figure 1). A few other sightings were also made near Sha Chau and to the west of the airport platform (Figure 1).

3.2.2. Notably, all dolphin sightings were made far away from the HKLR03/HKBCF reclamation sites as well as along the entire alignment of Tuen Mun-Chek Lap Kok Link (TMCLKL) during the present quarterly period (Figure 1). On the other hand, two sightings with five dolphins were made in the vicinity of the HKLR09 alignment (Figure 1).

3.2.3. Sighting distribution of the present impact phase monitoring period (September to November 2015) was compared to the one during the baseline monitoring period (September to November 2011). In the present quarter, dolphins have disappeared from the NEL region, which was in stark contrast to their frequent occurrence around the Brothers Islands, near Shum Shui Kok 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 eleven quarters of HKLR03 monitoring, which has resulted in zero to extremely low dolphin encounter rates in this area.

3.2.4. In NWL survey area, dolphin occurrence was also drastically different between the baseline and impact phase periods. During the present impact monitoring

period, fewer dolphins occurred in this survey area than during the baseline period, when many of the dolphin sightings were concentrated between Lung Kwu Chau and Black Point, around Sha Chau, near Pillar Point and to the west of the Chek Lap Kok Airport (Figure 1).

3.2.5. Another comparison in dolphin distribution was made between the three quarterly periods of autumn months in 2013, 2014 and 2015 (Figure 2). Among the three autumn periods, no dolphin was sighted at all in NEL in both 2014 and 2015, while two sightings were made there in 2013 (Figure 2).

3.2.6. On the other hand, dramatic changes in dolphin distribution in NWL waters were also observed in the autumn months during the three-year period (Figure 2). In 2013, dolphins regularly occurred throughout the NWL survey area, with higher concentrations of sightings around Sha Chau, Lung Kwu Chau, near Black Point and Pillar Point. In 2014, dolphins still frequently occurred around Sha Chau and Lung Kwu Chau, but less frequently in the middle portion of the North Lantau region. In 2015, they infrequently occurred in NWL survey area with the only concentration of sightings around Lung Kwu Chau, while they generally absent for the rest of this area. Similar temporal changes in dolphin distribution were also observed in the spring and summer periods of 2013-15. The temporal trend indicated that dolphin usage in the NWL region has progressively diminished in recent years.

3.3. Encounter rate

3.3.1. During the present three-month study 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 surveys in NEL and NWL are shown in Table 2. The average encounter rates deduced from the six sets of surveys were also compared with the ones deduced from the baseline monitoring period (September – November 2011) (Table 3).

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 effort. The encounter rates of sightings (STG) and dolphins (ANI) in NWL were 3.31 sightings and 17.52 dolphins per 100 km of survey effort respectively, while the encounter rates of sightings (STG) and dolphins (ANI) in NEL were both nil for this quarter.

Table 2. Dolphin encounter rates (sightings per 100 km of survey effort) during September-November 2015

SURVEY AREA	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 2015)	0.00	0.00
	Set 2 (17 & 29 Sep 2015)	0.00	0.00
	Set 3 (6 & 13 Oct 2015)	0.00	0.00
	Set 4 (19 & 26 Oct 2015)	0.00	0.00
	Set 5 (2 & 6 Nov 2015)	0.00	0.00
	Set 6 (10 & 16 Nov 2015)	0.00	0.00
Northwest Lantau	Set 1 (2 & 11 Sep 2015)	5.47	51.95
	Set 2 (17 & 29 Sep 2015)	4.01	21.38
	Set 3 (6 & 13 Oct 2015)	5.86	24.91
	Set 4 (19 & 26 Oct 2015)	2.73	10.94
	Set 5 (2 & 6 Nov 2015)	3.84	15.38
	Set 6 (10 & 16 Nov 2015)	1.73	1.73

Table 3. Comparison of average dolphin encounter rates from impact monitoring period (September – November 2015) 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; ± denotes the standard deviation of the average encounter rates)

	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 2015	September - November 2011	September - November 2015	September - November 2011
Northeast Lantau	0.0	6.00 ± 5.05	0.0	22.19 ± 26.81
Northwest Lantau	3.94 ± 1.57	9.85 ± 5.85	21.05 ± 17.19	44.66 ± 29.85

3.3.3. In NEL, the average dolphin encounter rates (both STG and ANI) in the present three-month impact monitoring period were zero with no sighting made, and such low occurrence of dolphins in NEL have been consistently recorded in the past eleven quarters of HKLR03 monitoring (Table 4). This is a serious concern as the dolphin occurrence in NEL in the last eleven quarters (0.0-1.0 for ER(STG) and 0.0-3.9 for ER(ANI)) have been exceptionally low when compared to the baseline period (Table 4). Dolphins have almost vacated from NEL waters since January 2014, with only two groups of five dolphins

sighted there since then despite consistent and intensive survey effort being conducted in this survey area.

Table 4. Comparison of average dolphin encounter rates in Northeast Lantau survey area from all quarters of 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; the encounter rates in autumn months were highlighted in blue; ± denotes the standard deviation of the average encounter rates)

	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
December 2014-February 2015 (Impact)	0.00	0.00
March-May 2015 (Impact)	0.00	0.00
June-August 2015 (Impact)	0.44 ± 1.08	0.44 ± 1.08
September-November 2015 (Impact)	0.00	0.00

3.3.4. Moreover, the average dolphin encounter rates (STG and ANI) in NWL during the present impact phase monitoring period were also much lower (reductions of 60.0% and 52.9% respectively) than the ones recorded in the 3-month baseline period, indicating a dramatic decline in dolphin usage of this survey area as well during the present impact phase period (Table 5).

3.3.5. Even for the same autumn quarters, the dolphin encounter rates in NWL during autumn 2015 were much lower than the ones recorded in autumn 2013 and 2014 (Table 5).

3.3.6. It should be noted that the encounter rates in NWL in the present quarter have slightly rebounded from the exceptionally low level in the previous three quarters (Table 5). Such potential rebound in dolphin occurrence could be an encouraging sign, and should be continuously monitored in the upcoming monitoring quarters.

Table 5. Comparison of average dolphin encounter rates in Northwest Lantau survey area from all quarters of 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; the encounter rates in autumn months were highlighted in blue; ± denotes the standard deviation of the average encounter rates)

	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
December 2014-February 2015 (Impact)	2.91 ± 2.69	11.27 ± 15.19
March-May 2015 (Impact)	0.47 ± 0.73	2.36 ± 4.07
June-August 2015 (Impact)	2.53 ± 3.20	9.21 ± 11.57
September-November 2015 (Impact)	3.94 ± 1.57	21.05 ± 17.19

3.3.7. As discussed recently in Hung (2015), the dramatic decline in dolphin usage of NEL waters in the past few years (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 since 2012. It appeared that such noticeable decline has already extended to NWL waters progressively in 2013-2015.

3.3.8. 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).

3.3.9. For the comparison between the baseline period and the present quarter (twelfth quarter of the impact phase being assessed), the p-values for the differences in

average dolphin encounter rates of STG and ANI were 0.0079 and 0.071 respectively. If the alpha value is set at 0.05, significant differences were detected between the baseline and present quarters in the dolphin encounter rate of STG, but not in the dolphin encounter rate of ANI.

3.3.10. For the comparison between the baseline period and the cumulative quarters in impact phase (i.e. first twelve quarters of the impact phase being assessed), the p-values for the differences in average dolphin encounter rates of STG and ANI were 0.00009 and 0.00003 respectively. Even if the alpha value is set at 0.0001, significant differences were still detected in both the average dolphin encounter rates of STG and ANI (i.e. between the two periods and the locations).

3.3.11. As indicated in both dolphin distribution patterns and encounter rates, dolphin usage has been significantly reduced in both NEL and NWL survey areas during the present quarterly period, and such low occurrence of dolphins has also been consistently documented in previous quarters. This raises serious concern, as the timing of the decline in dolphin usage in North Lantau waters coincided well with the construction schedule of the HZMB-related projects (Hung 2015).

3.3.12. To ensure the continuous usage of North Lantau waters by the dolphins, every possible measure should be implemented by the contractors and relevant authorities of HZMB-related works to minimize all disturbances to the dolphins.

3.4. Group size

3.4.1. Group size of Chinese White Dolphins ranged from one to twelve individuals per group in North Lantau region during September to November 2015. 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 2015) and baseline monitoring period (September – November 2011) (Note: ± denotes the standard deviation of the average group size)

	Average Dolphin Group Size	
	September – November 2015	**September – November 2011**
Overall	5.28 ± 3.54 (n = 18)	3.72 ± 3.13 (n = 66)
Northeast Lantau	N/A	3.18 ± 2.16 (n = 17)
Northwest Lantau	5.28 ± 3.54 (n = 18)	3.92 ± 3.40 (n = 49)

3.4.2. The average dolphin group size in NWL waters during September to November 2015 was higher than the ones recorded during the three-month baseline period (Table 6). Seven of the 18 groups were composed of 1-3 individuals only, while five other groups were moderate in size with 4-6 individuals per group. Moreover, six large dolphin groups were sighted during the present quarterly period, including three groups with 7-9 individuals each, and another three groups with 10-12 individuals each.

3.4.3. Distribution of dolphins with larger group sizes (five individuals or more per group and ten individuals per group) during the present quarter is shown in Figure 3, with comparison to the one in baseline period. During the autumn months of 2015, distribution of these large groups of dolphins were all located around Lung Kwu Chau and Sha Chau, with the three exceptionally large groups of dolphins (i.e. with 10 or more individuals) sighted adjacent to Lung Kwu Chau (Figure 3). This distribution pattern was very 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 2015, the only area being heavily utilized by Chinese White Dolphins was around and to the north of Lung Kwu Chau, as well as both eastern and western sides of Sha Chau in North Lantau region (Figures 4a and 4b). All grids near HKLR03/HKBCF reclamation sites as well as TMCLKL alignment did not record any presence of dolphins during on-effort search in the present quarterly period, but one grid (F19) in the vicinity of HKLR09 alignment recorded moderately high dolphin densities (Figure 4b).

3.5.2. It should be emphasized though 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 should be examined 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 and NWL has dramatically diminished in both areas during the present impact monitoring period (Figure 5). During the baseline period, many grids between Siu Mo To and Shum Shui Kok recorded moderately high to high dolphin densities, which was in stark contrast to the complete absence of dolphins there during the present impact phase period

(Figure 5).

3.5.4. The density patterns were also very different in NWL between the baseline and impact phase monitoring periods, 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. In contrast, only the waters around Lung Kwu Chau and Sha Chau recorded high densities of dolphins during the present impact phase period (Figure 5).

3.6. Mother-calf pairs

3.6.1. During the present quarterly period, two young calves (i.e. unspotted calf or unspotted juvenile) were spotted with their mothers near Lung Kwu Chau

3.6.2. The rare occurrence of young calves in the present quarter was in stark contrast to their regular occurrence in North Lantau waters during the baseline period. This should be of a serious concern, and the occurrence of young calves in North Lantau waters should be closely monitored in the upcoming quarters.

3.7. Activities and associations with fishing boats

3.7.1. Four of the 18 dolphin groups were engaged in feeding activities, while two other dolphin groups were engaged in socializing activities. None of the dolphin groups were engaged in traveling or milling/resting activity during the three-month study period.

3.7.2. The percentages of sightings associated with feeding activities (22.2%) and socializing activities (11.1%) during the present impact phase period were both higher than the ones recorded during the baseline period (11.6% and 5.4% respectively). However, it should be noted the sample sizes on total numbers of dolphin sightings were very different between the two periods.

3.7.3. Distribution of dolphins engaged in various activities during the present three-month period and baseline period is shown in Figure 6. The four dolphin groups engaged in feeding activities were sighted near Lung Kwu Chau and Sha Chau as well as to the north of Lung Kwu Chau (Figure 6). The two groups engaged in socializing activities were both located to the west of Lung Kwu Chau.

3.7.4. When compared to the baseline period, distribution of various dolphin activities during the present impact phase monitoring period was drastically different with a much more restricted area of occurrences.

3.7.5. As consistently recorded in the past monitoring quarters, none of the 18 dolphin

groups was found to be associated with operating fishing vessels in North Lantau waters during the present impact phase period.

3.8. Summary of photo-identification works

3.8.1. From September to November 2015, over 2,500 digital photographs of Chinese White Dolphins were taken during the impact phase monitoring surveys for the photo-identification work.

3.8.2. In total, 34 individuals sighted 65 times altogether were identified (see summary table in Annex III and photographs of identified individuals in Annex IV). All of these 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 two individuals (NL46 and NL210) being 3-4 times and another three individuals (NL48, NL202 and NL286) being sighted 5-6 times.

3.8.4. Notably, eight of these 34 individuals (NL33, NL123, NL284, NL285, WL05, WL79, WL241 and WL243) were also sighted in West Lantau waters during the HKLR09 monitoring surveys from September to November 2015, implying that they have moved across the HKLR09 bridge alignment during the same three-month period.

3.9. Individual range use

3.9.1. Ranging patterns of the 34 individuals identified during the three-month study period were determined by fixed kernel method, and are shown in Annex V.

3.9.2. All identified dolphins sighted in the present quarter were utilizing NWL waters only, but have completely avoided NEL waters where many of them have utilized as their core areas in the past (Annex V). This is in contrary to the extensive movements between NEL and NWL survey areas observed in the earlier impact monitoring quarters as well as the baseline period.

3.9.3. Notably, several individuals (NL33, NL123, NL284, NL285 and WL05) consistently utilized both NWL and NEL waters in the past have extended their range use to WL waters (and even SWL waters in the case of NL33) during the present quarter. In the upcoming quarters, individual range use and movements should be continuously monitored to examine whether there has been any consistent shifts of individual home ranges from North Lantau to West or Southwest Lantau, as such shift could possibly be related to the HZMB-related construction works (see Hung 2015).

4. Conclusion

4.1. During the present quarter of dolphin monitoring, no adverse impact from the activities of this construction project on Chinese White Dolphins was noticeable from general observations.

4.2. Although dolphins rarely occurred in the area of HKLR03 construction in the past and during the baseline monitoring period, it is apparent that dolphin usage has been significantly reduced in NEL since 2012, 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. 2008. Habitat use of Indo-Pacific humpback dolphins (*Sousa chinensis*) in Hong Kong. Ph.D. dissertation. University of Hong Kong, Hong Kong, 266 p.

Hung, S. K. 2013. Monitoring of marine mammals in Hong Kong waters – data collection: final report (2012-13). An unpublished report submitted to the Agriculture, Fisheries and Conservation Department of Hong Kong SAR Government, 168 pp.

Hung, S. K. 2015. Monitoring of marine mammals in Hong Kong waters – data collection: final report (2014-15). An unpublished report submitted to the Agriculture, Fisheries and Conservation Department of Hong Kong SAR Government, 198 pp.

Jefferson, T. A. 2000. Population biology of the Indo-Pacific hump-backed dolphin in Hong Kong waters. Wildlife Monographs 144:1-65.

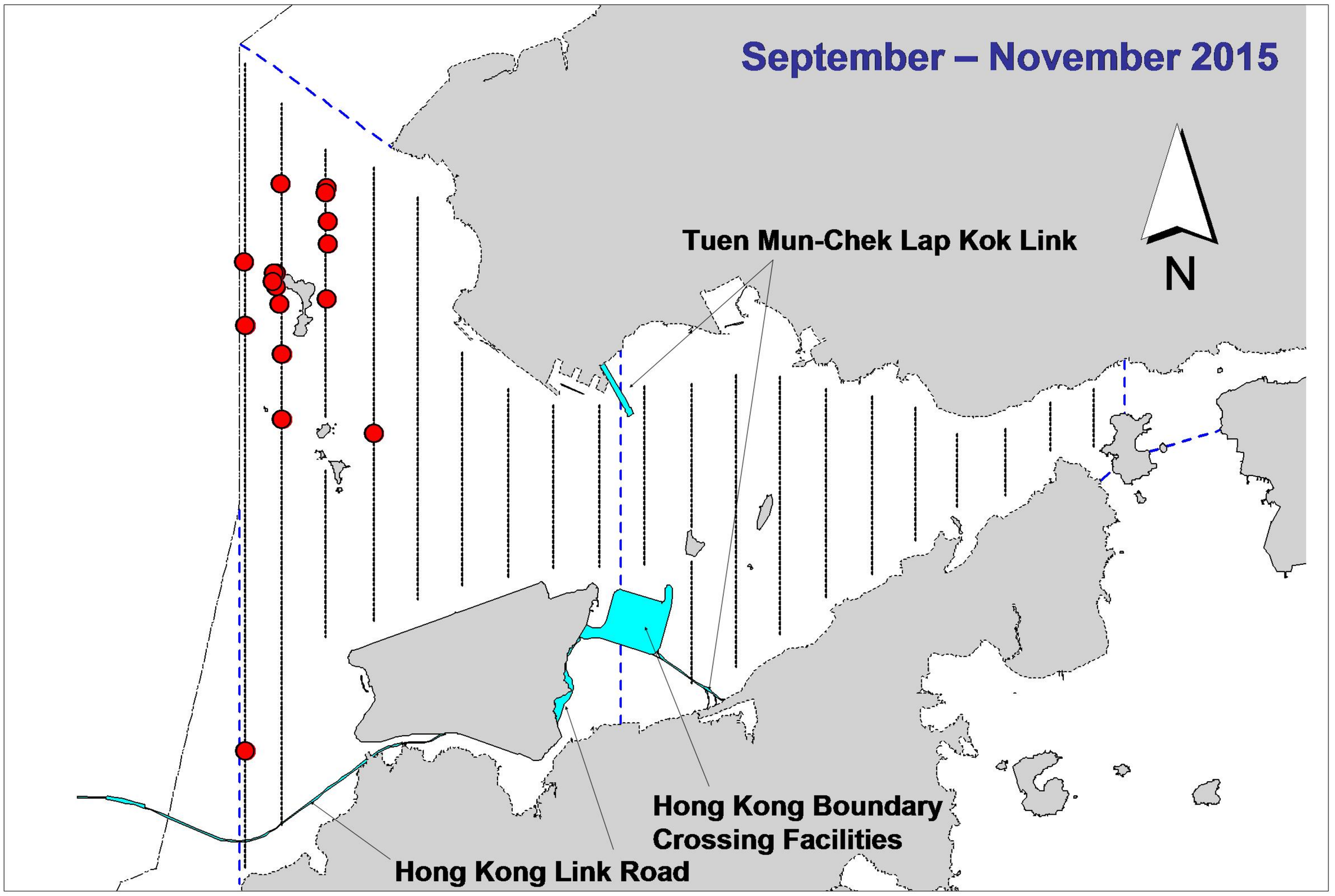


Figure 1. Distribution of Chinese white dolphin sighting in Northwest and Northeast Lantau during HKLR03 impact phase (top) and baseline monitoring surveys (bottom)

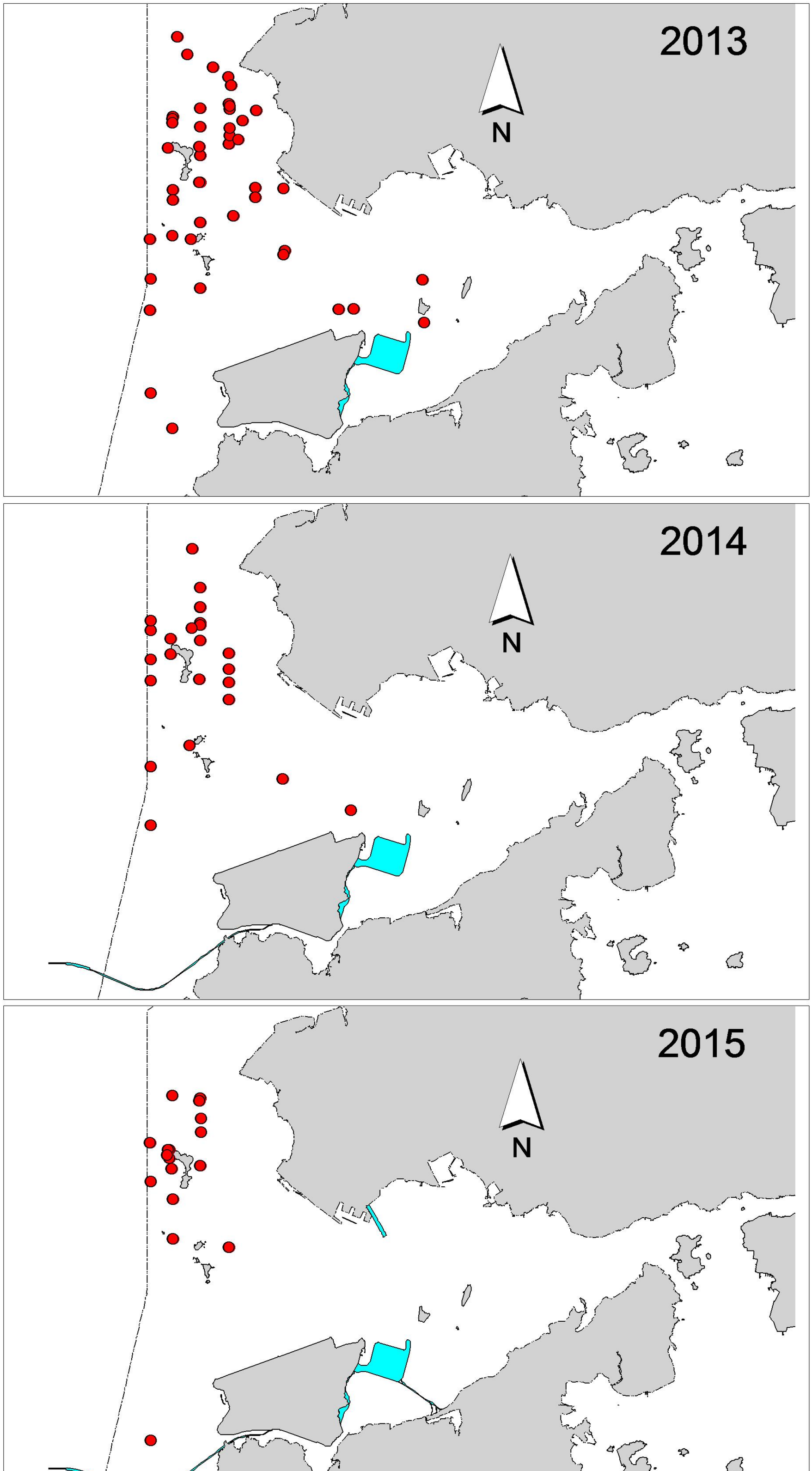


Figure 2. Distribution of Chinese white dolphin sightings in Northwest and Northeast Lantau during the same autumn quarters (June-August) of HKLR03 impact phase in 2013-15

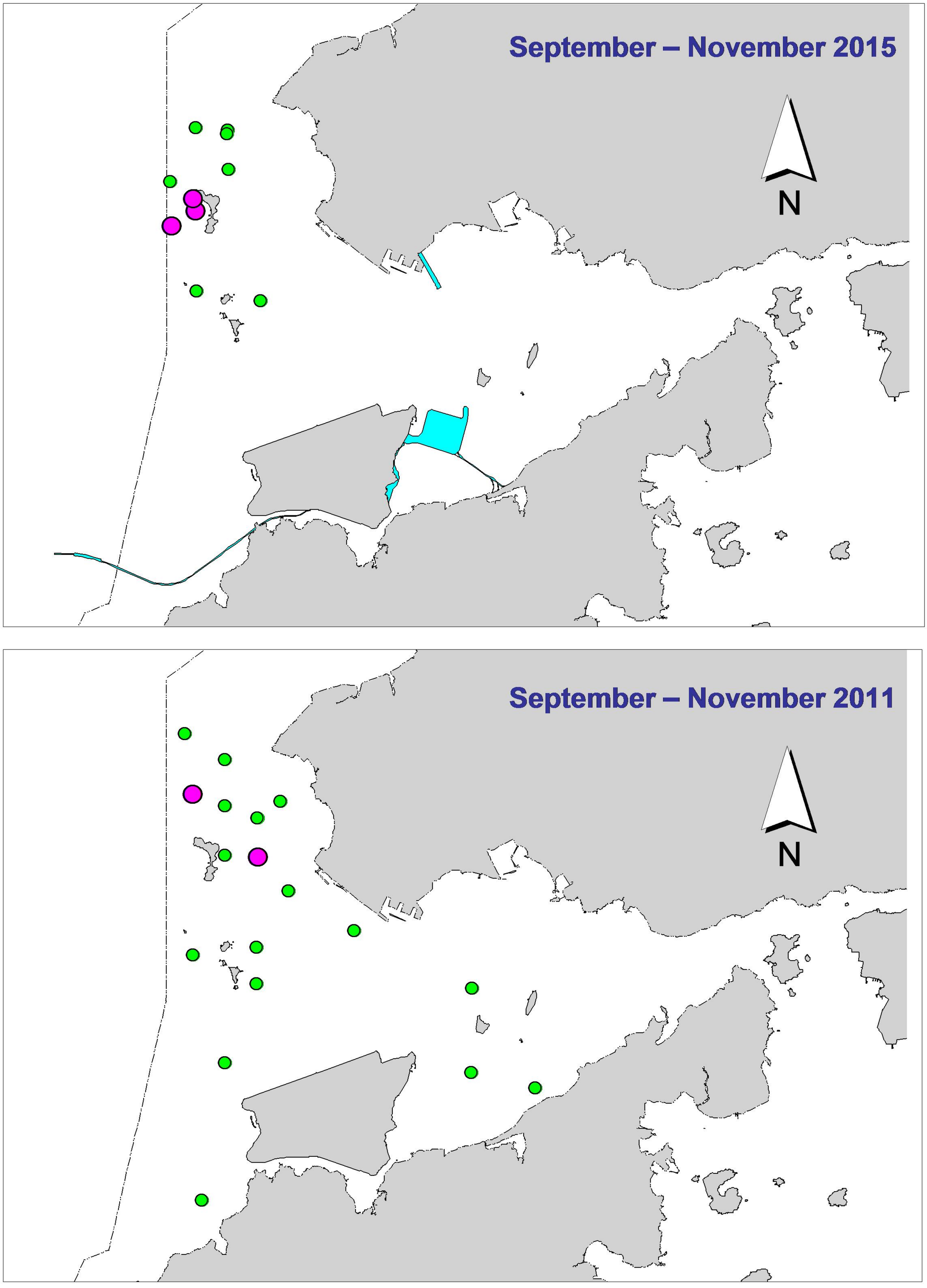


Figure 3. Distribution of Chinese white dolphins with larger group sizes during HKLR03 impact phase (top) and baseline monitoring surveys (bottom) (green dots: group sizes of 5 or more; purple dots: group sizes of 10 or more)

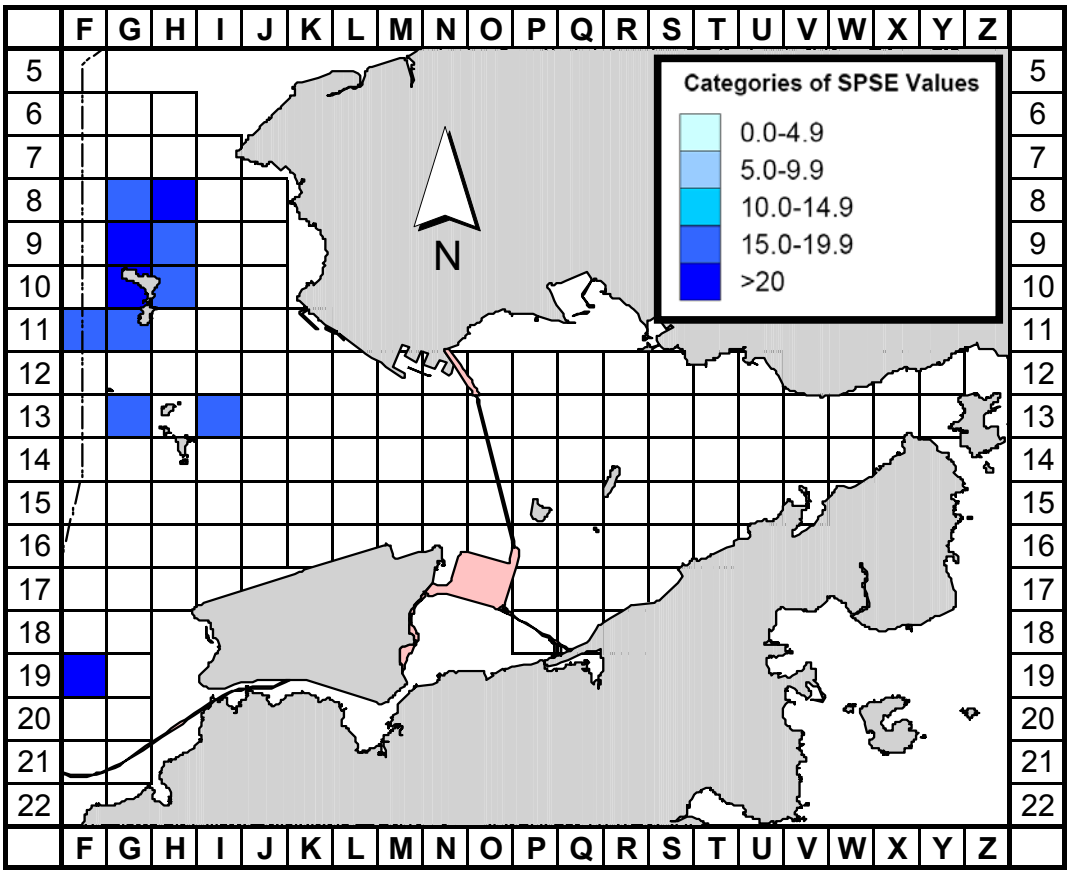


Figure 4a. Sighting density of Chinese white dolphins with corrected survey effort per km^2 in Northeast and Northwest Lantau survey areas, using data collected during HKLR03 impact monitoring period monitoring period (Sep-Nov 15) (SPSE = no. of on-effort sightings per 100 units of survey effort)

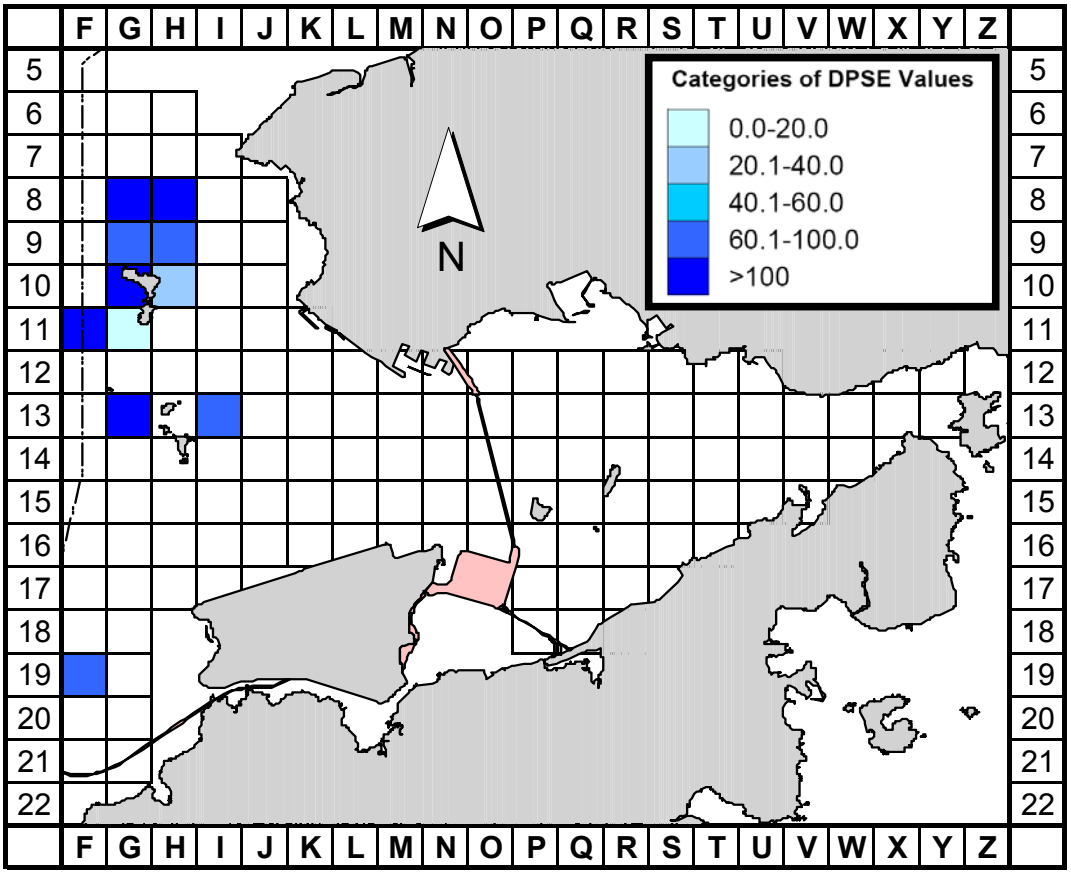


Figure 4b. Density of Chinese white dolphins with corrected survey effort per km^2 in Northeast and Northwest Lantau survey areas, using data collected during HKLR03 impact monitoring period (Sep-Nov 15) (DPSE = no. of dolphins per 100 units of survey effort)

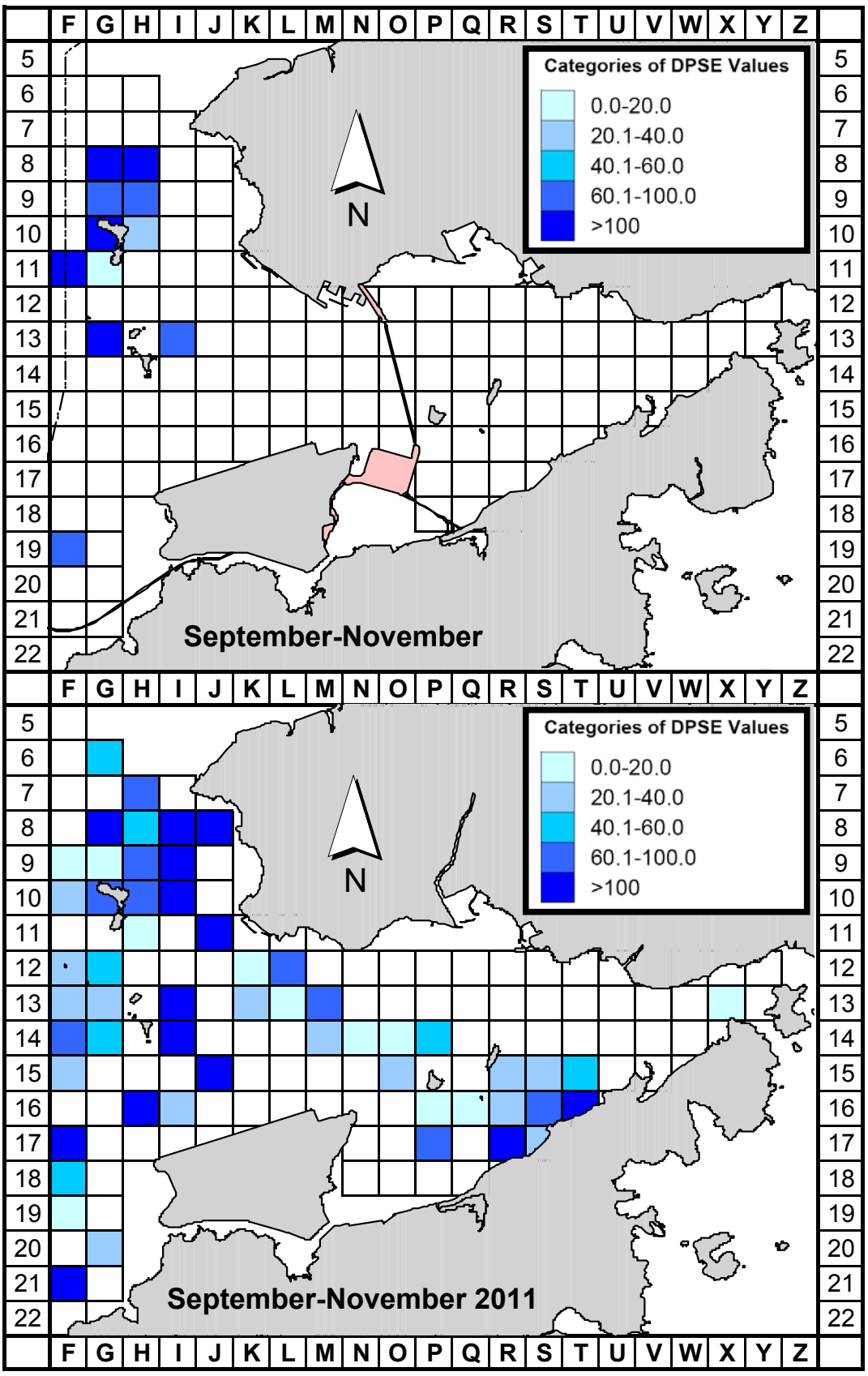


Figure 5. Comparison of density of Chinese white dolphins with corrected survey effort per km^2 in Northwest and Northeast Lantau survey area between the impact monitoring period September-November 2015) and baseline monitoring period (September-November 2011)
(DPSE = no. of dolphins per 100 units of survey effort)

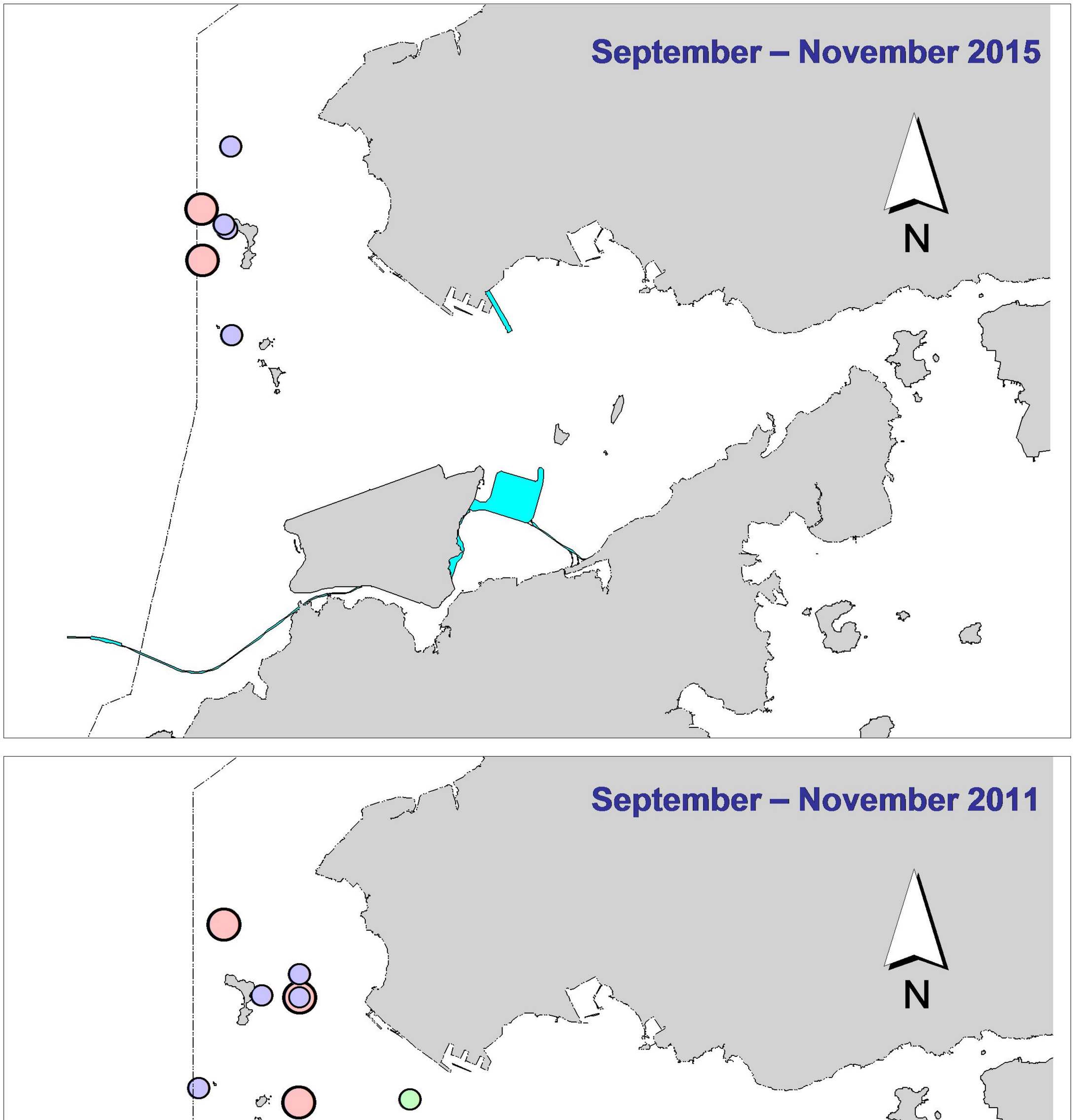


Figure 6. Distribution of Chinese white dolphins engaged in feeding (purple dots), socializing (pink dots) and traveling (green dots) activities during HKLR03 impact phase (top) and baseline monitoring surveys (bottom)

Annex I. HKLR03 Survey Effort Database (September-November 2015)

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

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	TYPE	P/S
2-Sep-15	NW LANTAU	2	1.92	AUTUMN	STANDARD31516	HKLR	P
2-Sep-15	NW LANTAU	3	30.24	AUTUMN	STANDARD31516	HKLR	P
2-Sep-15	NW LANTAU	3	6.89	AUTUMN	STANDARD31516	HKLR	S
2-Sep-15	NE LANTAU	2	11.59	AUTUMN	STANDARD31516	HKLR	P
2-Sep-15	NE LANTAU	3	7.98	AUTUMN	STANDARD31516	HKLR	P
2-Sep-15	NE LANTAU	2	8.83	AUTUMN	STANDARD31516	HKLR	S
2-Sep-15	NE LANTAU	3	2.00	AUTUMN	STANDARD31516	HKLR	S
11-Sep-15	NW LANTAU	2	30.26	AUTUMN	STANDARD31516	HKLR	P
11-Sep-15	NW LANTAU	3	10.73	AUTUMN	STANDARD31516	HKLR	P
11-Sep-15	NW LANTAU	2	4.41	AUTUMN	STANDARD31516	HKLR	S
11-Sep-15	NW LANTAU	3	8.40	AUTUMN	STANDARD31516	HKLR	S
11-Sep-15	NE LANTAU	2	7.75	AUTUMN	STANDARD31516	HKLR	P
11-Sep-15	NE LANTAU	3	8.95	AUTUMN	STANDARD31516	HKLR	P
11-Sep-15	NE LANTAU	2	7.97	AUTUMN	STANDARD31516	HKLR	S
11-Sep-15	NE LANTAU	3	2.11	AUTUMN	STANDARD31516	HKLR	S
17-Sep-15	NE LANTAU	2	9.43	AUTUMN	STANDARD31516	HKLR	P
17-Sep-15	NE LANTAU	3	10.80	AUTUMN	STANDARD31516	HKLR	P
17-Sep-15	NE LANTAU	2	5.51	AUTUMN	STANDARD31516	HKLR	S
17-Sep-15	NE LANTAU	3	5.22	AUTUMN	STANDARD31516	HKLR	S
17-Sep-15	NW LANTAU	2	4.70	AUTUMN	STANDARD31516	HKLR	P
17-Sep-15	NW LANTAU	3	28.06	AUTUMN	STANDARD31516	HKLR	P
17-Sep-15	NW LANTAU	3	7.34	AUTUMN	STANDARD31516	HKLR	S
29-Sep-15	NE LANTAU	2	3.00	AUTUMN	STANDARD31516	HKLR	P
29-Sep-15	NE LANTAU	3	12.12	AUTUMN	STANDARD31516	HKLR	P
29-Sep-15	NE LANTAU	4	1.90	AUTUMN	STANDARD31516	HKLR	P
29-Sep-15	NE LANTAU	2	3.06	AUTUMN	STANDARD31516	HKLR	S
29-Sep-15	NE LANTAU	3	6.02	AUTUMN	STANDARD31516	HKLR	S
29-Sep-15	NE LANTAU	4	1.10	AUTUMN	STANDARD31516	HKLR	S
29-Sep-15	NW LANTAU	2	25.66	AUTUMN	STANDARD31516	HKLR	P
29-Sep-15	NW LANTAU	3	16.42	AUTUMN	STANDARD31516	HKLR	P
29-Sep-15	NW LANTAU	2	1.60	AUTUMN	STANDARD31516	HKLR	S
29-Sep-15	NW LANTAU	3	11.49	AUTUMN	STANDARD31516	HKLR	S
6-Oct-15	NW LANTAU	2	10.62	AUTUMN	STANDARD31516	HKLR	P
6-Oct-15	NW LANTAU	3	18.78	AUTUMN	STANDARD31516	HKLR	P
6-Oct-15	NW LANTAU	2	0.59	AUTUMN	STANDARD31516	HKLR	S
6-Oct-15	NW LANTAU	3	7.02	AUTUMN	STANDARD31516	HKLR	S
6-Oct-15	NE LANTAU	2	20.01	AUTUMN	STANDARD31516	HKLR	P
6-Oct-15	NE LANTAU	3	10.79	AUTUMN	STANDARD31516	HKLR	S
13-Oct-15	NW LANTAU	2	23.12	AUTUMN	STANDARD31516	HKLR	P
13-Oct-15	NW LANTAU	3	15.72	AUTUMN	STANDARD31516	HKLR	P
13-Oct-15	NW LANTAU	2	8.61	AUTUMN	STANDARD31516	HKLR	S
13-Oct-15	NW LANTAU	3	4.20	AUTUMN	STANDARD31516	HKLR	S
13-Oct-15	NE LANTAU	2	7.15	AUTUMN	STANDARD31516	HKLR	P
13-Oct-15	NE LANTAU	3	9.80	AUTUMN	STANDARD31516	HKLR	P
13-Oct-15	NE LANTAU	2	4.56	AUTUMN	STANDARD31516	HKLR	S
13-Oct-15	NE LANTAU	3	5.59	AUTUMN	STANDARD31516	HKLR	S
19-Oct-15	NE LANTAU	2	14.52	AUTUMN	STANDARD31516	HKLR	P
19-Oct-15	NE LANTAU	3	2.90	AUTUMN	STANDARD31516	HKLR	P
19-Oct-15	NE LANTAU	1	2.10	AUTUMN	STANDARD31516	HKLR	S
19-Oct-15	NE LANTAU	2	7.68	AUTUMN	STANDARD31516	HKLR	S

Annex 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
19-Oct-15	NW LANTAU	2	14.07	AUTUMN	STANDARD31516	HKLR	P
19-Oct-15	NW LANTAU	3	27.17	AUTUMN	STANDARD31516	HKLR	P
19-Oct-15	NW LANTAU	2	6.61	AUTUMN	STANDARD31516	HKLR	S
19-Oct-15	NW LANTAU	3	6.25	AUTUMN	STANDARD31516	HKLR	S
26-Oct-15	NE LANTAU	2	10.41	AUTUMN	STANDARD31516	HKLR	P
26-Oct-15	NE LANTAU	3	10.00	AUTUMN	STANDARD31516	HKLR	P
26-Oct-15	NE LANTAU	2	8.99	AUTUMN	STANDARD31516	HKLR	S
26-Oct-15	NE LANTAU	3	1.60	AUTUMN	STANDARD31516	HKLR	S
26-Oct-15	NW LANTAU	2	1.22	AUTUMN	STANDARD31516	HKLR	P
26-Oct-15	NW LANTAU	3	30.67	AUTUMN	STANDARD31516	HKLR	P
26-Oct-15	NW LANTAU	2	0.10	AUTUMN	STANDARD31516	HKLR	S
26-Oct-15	NW LANTAU	3	7.51	AUTUMN	STANDARD31516	HKLR	S
2-Nov-15	NW LANTAU	2	6.50	AUTUMN	STANDARD31516	HKLR	P
2-Nov-15	NW LANTAU	3	27.18	AUTUMN	STANDARD31516	HKLR	P
2-Nov-15	NW LANTAU	4	7.13	AUTUMN	STANDARD31516	HKLR	P
2-Nov-15	NW LANTAU	2	2.30	AUTUMN	STANDARD31516	HKLR	S
2-Nov-15	NW LANTAU	3	7.55	AUTUMN	STANDARD31516	HKLR	S
2-Nov-15	NW LANTAU	4	2.74	AUTUMN	STANDARD31516	HKLR	S
2-Nov-15	NE LANTAU	2	14.92	AUTUMN	STANDARD31516	HKLR	P
2-Nov-15	NE LANTAU	3	1.70	AUTUMN	STANDARD31516	HKLR	P
2-Nov-15	NE LANTAU	2	7.98	AUTUMN	STANDARD31516	HKLR	S
2-Nov-15	NE LANTAU	3	2.40	AUTUMN	STANDARD31516	HKLR	S
6-Nov-15	NW LANTAU	3	18.35	AUTUMN	STANDARD31516	HKLR	P
6-Nov-15	NW LANTAU	4	13.86	AUTUMN	STANDARD31516	HKLR	P
6-Nov-15	NW LANTAU	3	6.79	AUTUMN	STANDARD31516	HKLR	S
6-Nov-15	NE LANTAU	2	5.90	AUTUMN	STANDARD31516	HKLR	P
6-Nov-15	NE LANTAU	3	14.15	AUTUMN	STANDARD31516	HKLR	P
6-Nov-15	NE LANTAU	2	6.70	AUTUMN	STANDARD31516	HKLR	S
6-Nov-15	NE LANTAU	3	3.95	AUTUMN	STANDARD31516	HKLR	S
10-Nov-15	NW LANTAU	2	2.44	AUTUMN	STANDARD31516	HKLR	P
10-Nov-15	NW LANTAU	3	27.80	AUTUMN	STANDARD31516	HKLR	P
10-Nov-15	NW LANTAU	4	0.98	AUTUMN	STANDARD31516	HKLR	P
10-Nov-15	NW LANTAU	2	0.28	AUTUMN	STANDARD31516	HKLR	S
10-Nov-15	NW LANTAU	3	6.23	AUTUMN	STANDARD31516	HKLR	S
10-Nov-15	NW LANTAU	4	1.30	AUTUMN	STANDARD31516	HKLR	S
10-Nov-15	NE LANTAU	2	9.09	AUTUMN	STANDARD31516	HKLR	P
10-Nov-15	NE LANTAU	3	10.38	AUTUMN	STANDARD31516	HKLR	P
10-Nov-15	NE LANTAU	2	8.03	AUTUMN	STANDARD31516	HKLR	S
10-Nov-15	NE LANTAU	3	2.70	AUTUMN	STANDARD31516	HKLR	S
16-Nov-15	NE LANTAU	2	5.26	AUTUMN	STANDARD31516	HKLR	P
16-Nov-15	NE LANTAU	3	12.22	AUTUMN	STANDARD31516	HKLR	P
16-Nov-15	NE LANTAU	2	7.72	AUTUMN	STANDARD31516	HKLR	S
16-Nov-15	NE LANTAU	3	2.10	AUTUMN	STANDARD31516	HKLR	S
16-Nov-15	NW LANTAU	2	6.48	AUTUMN	STANDARD31516	HKLR	P
16-Nov-15	NW LANTAU	3	21.03	AUTUMN	STANDARD31516	HKLR	P
16-Nov-15	NW LANTAU	4	9.27	AUTUMN	STANDARD31516	HKLR	P
16-Nov-15	NW LANTAU	5	4.10	AUTUMN	STANDARD31516	HKLR	P
16-Nov-15	NW LANTAU	2	2.53	AUTUMN	STANDARD31516	HKLR	S
16-Nov-15	NW LANTAU	3	7.79	AUTUMN	STANDARD31516	HKLR	S
16-Nov-15	NW LANTAU	4	2.60	AUTUMN	STANDARD31516	HKLR	S

Annex II. HKLR03 Chinese White Dolphin Sighting Database (September-November 2015)

(Abberviations: 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 Lines)

DATE	STG #	TIME	HRD SZ	AREA	BEAU	PSD	EFFORT	TYPE	NORTHING	EASTING	SEASON	BOAT ASSOC.	P/S
02-Sep-15	1	1045	8	NW LANTAU	3	629	ON	HKLR	823950	805482	AUTUMN	NONE	P
02-Sep-15	2	1122	12	NW LANTAU	2	240	ON	HKLR	826365	805436	AUTUMN	NONE	P
02-Sep-15	3	1143	12	NW LANTAU	2	75	ON	HKLR	826741	805344	AUTUMN	NONE	P
11-Sep-15	1	1155	6	NW LANTAU	2	349	ON	HKLR	828788	806460	AUTUMN	NONE	P
17-Sep-15	1	1411	7	NW LANTAU	3	134	ON	HKLR	828867	805462	AUTUMN	PURSE-SEINE	P
29-Sep-15	1	1445	5	NW LANTAU	2	430	ON	HKLR	827625	806489	AUTUMN	NONE	P
29-Sep-15	2	1512	4	NW LANTAU	2	281	ON	HKLR	828090	806500	AUTUMN	NONE	P
06-Oct-15	1	1113	2	NW LANTAU	2	72	ON	HKLR	827029	805334	AUTUMN	NONE	P
13-Oct-15	1	1025	2	NW LANTAU	3	195	ON	HKLR	817031	804665	AUTUMN	NONE	P
13-Oct-15	2	1036	3	NW LANTAU	3	102	ON	HKLR	817020	804675	AUTUMN	NONE	P
13-Oct-15	3	1123	10	NW LANTAU	2	745	ON	HKLR	825923	804673	AUTUMN	NONE	P
19-Oct-15	1	1407	2	NW LANTAU	3	14	ON	HKLR	826473	806476	AUTUMN	NONE	P
26-Oct-15	1	1326	6	NW LANTAU	3	73	ON	HKLR	823681	807511	AUTUMN	NONE	P
26-Oct-15	2	1444	2	NW LANTAU	2	107	ON	HKLR	827007	805303	AUTUMN	NONE	S
02-Nov-15	1	1143	7	NW LANTAU	2	181	ON	HKLR	828699	806450	AUTUMN	NONE	P
06-Nov-15	1	1106	1	NW LANTAU	3	77	ON	HKLR	826830	805262	AUTUMN	NONE	P
10-Nov-15	1	1042	1	NW LANTAU	3	465	ON	HKLR	825312	805475	AUTUMN	NONE	P
16-Nov-15	1	1455	5	NW LANTAU	5	662	ON	HKLR	827241	804645	AUTUMN	NONE	P

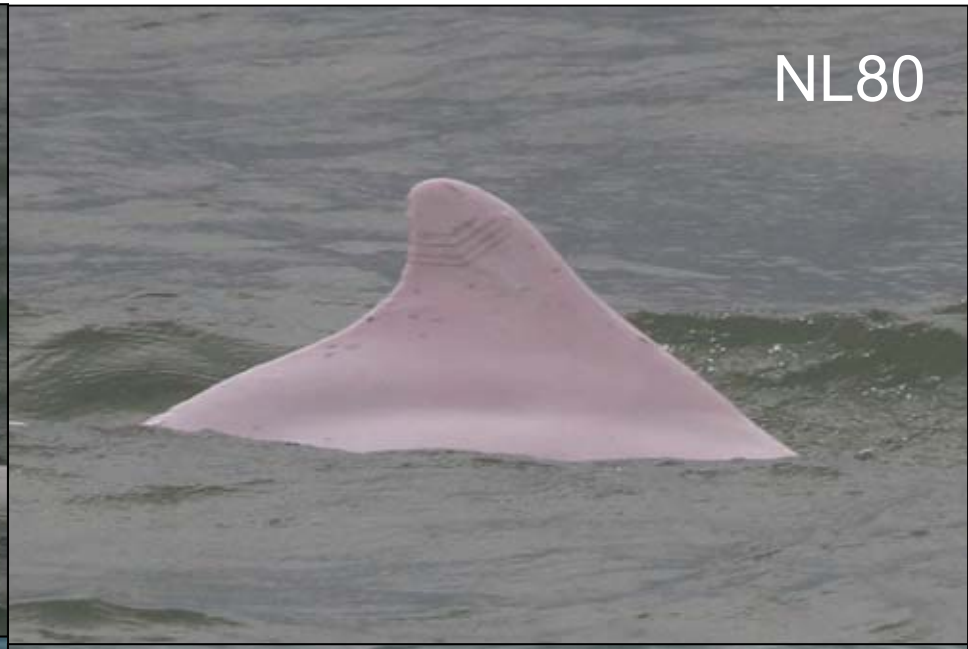
Annex III. Individual dolphins identified during HKLR03 monitoring surveys in September-November 2015

ID#	DATE	STG#	AREA
CH34	29/09/15	1	NW LANTAU
	19/10/15	1	NW LANTAU
CH84	02/09/15	3	NW LANTAU
NL33	13/10/15	1	NW LANTAU
	26/10/15	1	NW LANTAU
NL46	02/09/15	2	NW LANTAU
	17/09/15	1	NW LANTAU
	10/11/15	1	NW LANTAU
NL48	02/09/15	1	NW LANTAU
	11/09/15	1	NW LANTAU
	17/09/15	1	NW LANTAU
	02/11/15	1	NW LANTAU
	16/11/15	1	NW LANTAU
NL80	02/09/15	2	NW LANTAU
NL98	02/11/15	1	NW LANTAU
NL104	13/10/15	3	NW LANTAU
NL123	17/09/15	1	NW LANTAU
	02/11/15	1	NW LANTAU
NL136	29/09/15	1	NW LANTAU
	02/11/15	1	NW LANTAU
NL150	02/09/15	2	NW LANTAU
NL165	02/09/15	1	NW LANTAU
NL182	17/09/15	1	NW LANTAU
	02/11/15	1	NW LANTAU
NL202	02/09/15	2	NW LANTAU
	17/09/15	1	NW LANTAU
	29/09/15	2	NW LANTAU
	13/10/15	3	NW LANTAU
	26/10/15	2	NW LANTAU
	16/11/15	1	NW LANTAU
NL203	02/09/15	3	NW LANTAU
NL210	02/09/15	2	NW LANTAU
	13/10/15	3	NW LANTAU
	02/11/15	1	NW LANTAU
	16/11/15	1	NW LANTAU
NL214	13/10/15	3	NW LANTAU
NL220	19/10/15	1	NW LANTAU
	26/10/15	1	NW LANTAU
NL233	02/09/15	2	NW LANTAU

ID#	DATE	STG#	AREA
NL261	02/09/15	1	NW LANTAU
	26/10/15	1	NW LANTAU
NL272	26/10/15	1	NW LANTAU
NL284	13/10/15	3	NW LANTAU
	26/10/15	1	NW LANTAU
NL285	02/09/15	1	NW LANTAU
	11/09/15	1	NW LANTAU
NL286	02/09/15	2	NW LANTAU
	17/09/15	1	NW LANTAU
	06/10/15	1	NW LANTAU
	13/10/15	3	NW LANTAU
	26/10/15	2	NW LANTAU
	16/11/15	1	NW LANTAU
NL297	02/09/15	3	NW LANTAU
NL302	02/09/15	3	NW LANTAU
	11/09/15	1	NW LANTAU
NL308	02/09/15	2	NW LANTAU
NL319	29/09/15	2	NW LANTAU
SL47	13/10/15	2	NW LANTAU
WL05	02/09/15	1	NW LANTAU
	29/09/15	2	NW LANTAU
WL17	02/09/15	2	NW LANTAU
	17/09/15	1	NW LANTAU
WL79	13/10/15	3	NW LANTAU
WL241	13/10/15	2	NW LANTAU
WL243	13/10/15	2	NW LANTAU

Annex IV. Thirty-four individual dolphins that were identified during September-November 2015 under HKLR03 impact phase monitoring surveys

Annex IV. (cont'd)

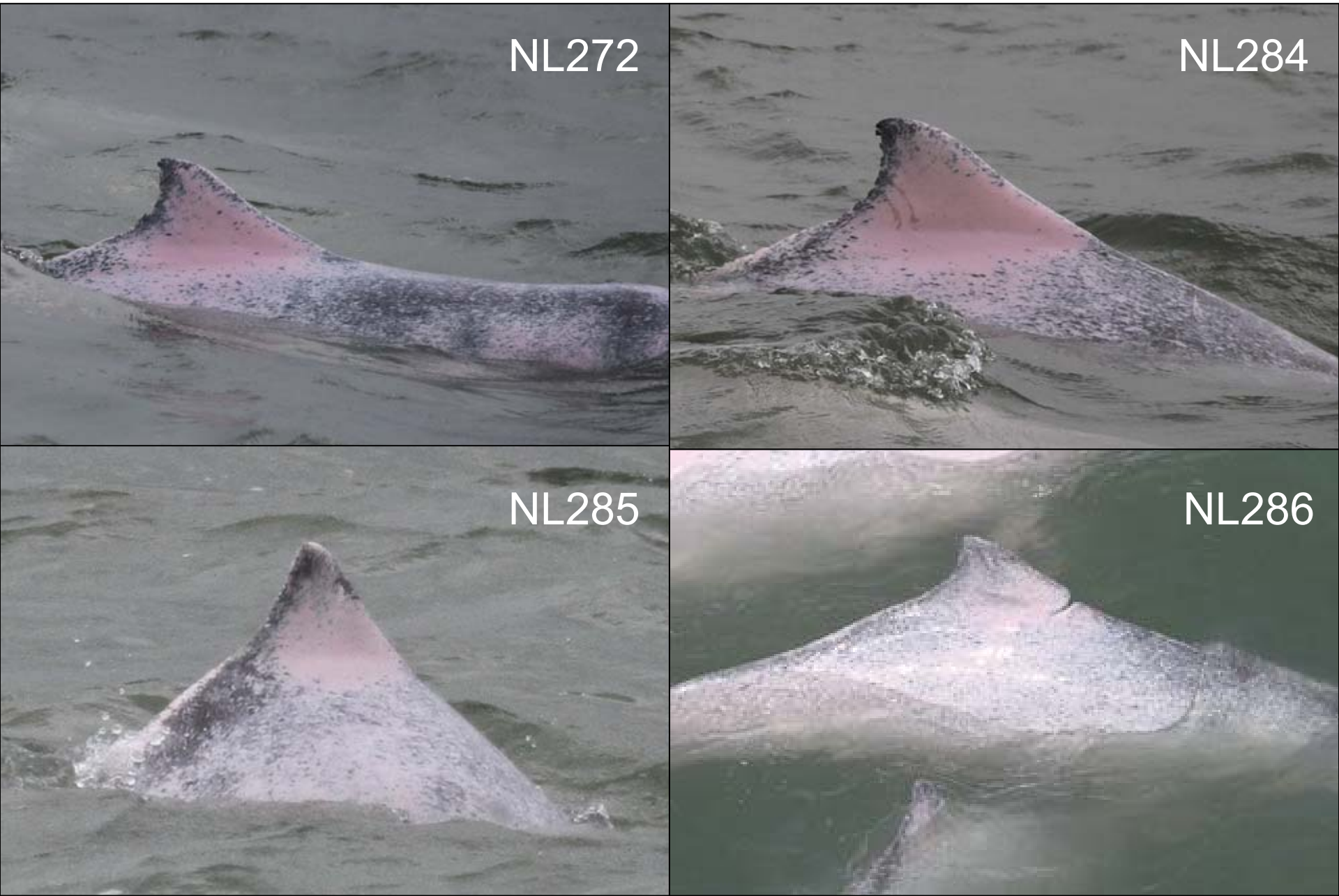


Annex IV. (cont'd)

Annex IV. (cont'd)

Annex IV. (cont'd)

Annex IV. (cont'd)

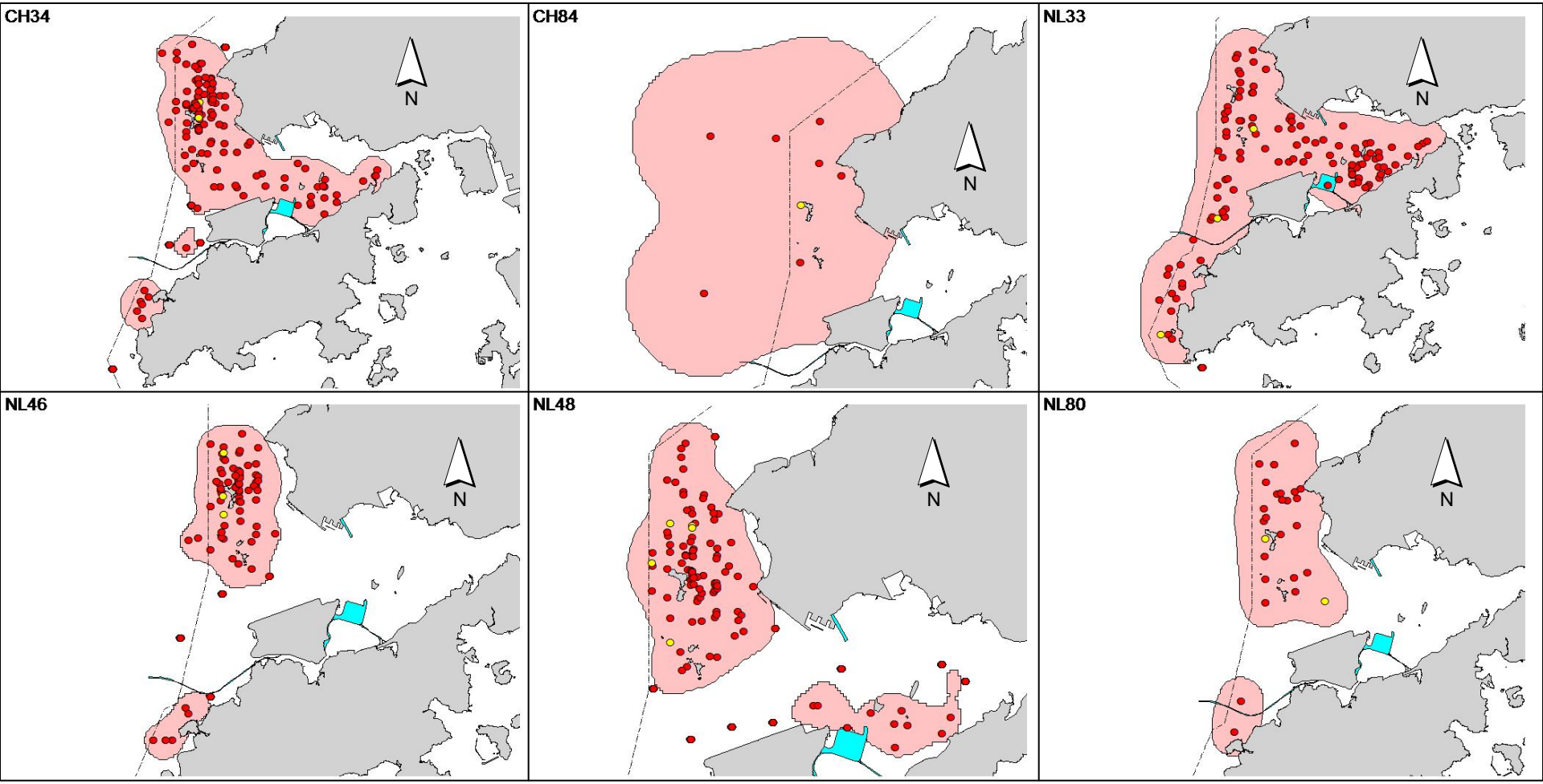


Annex IV. (cont'd)

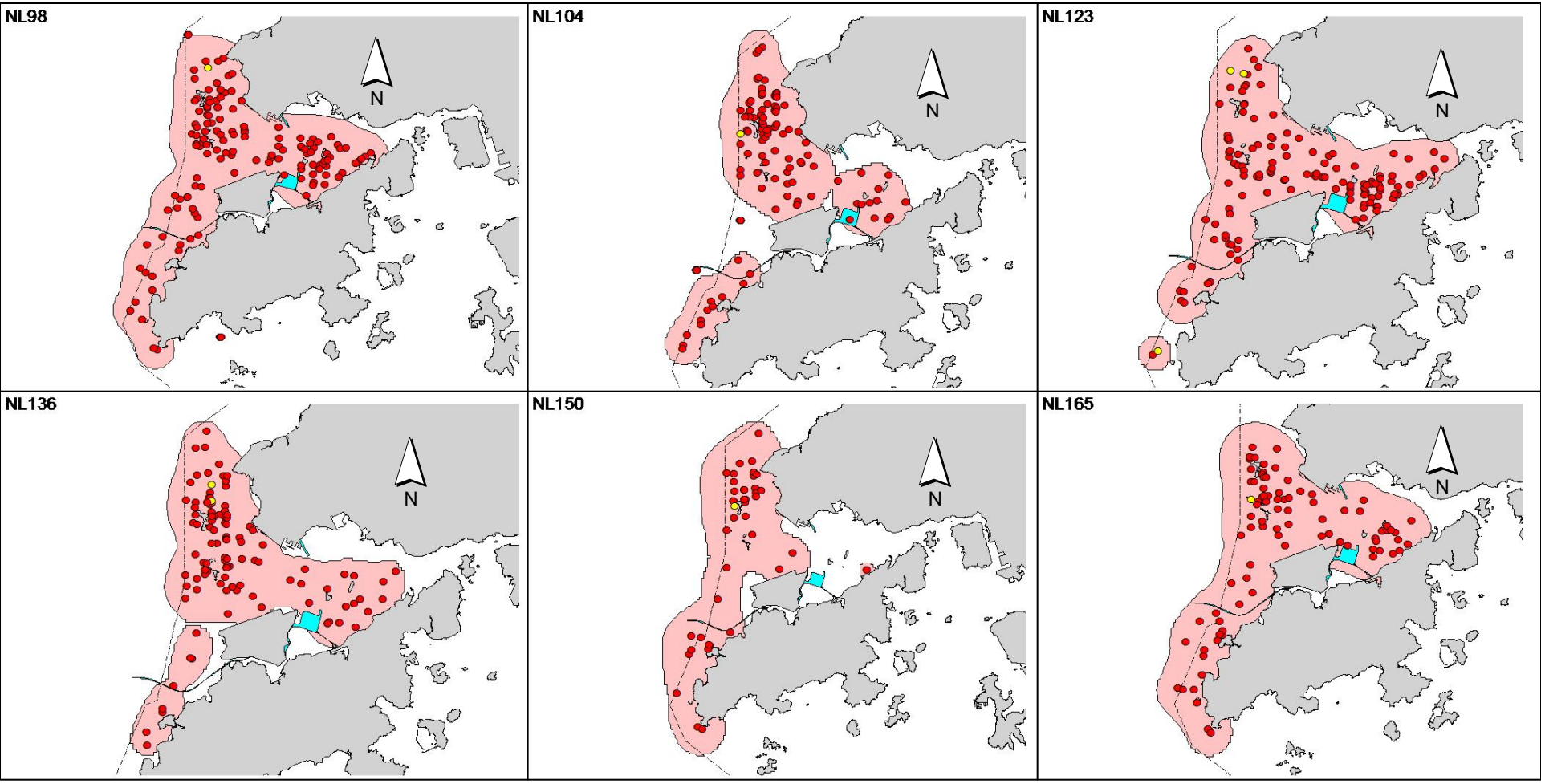
Annex IV. (cont'd)

Annex IV. (cont'd)

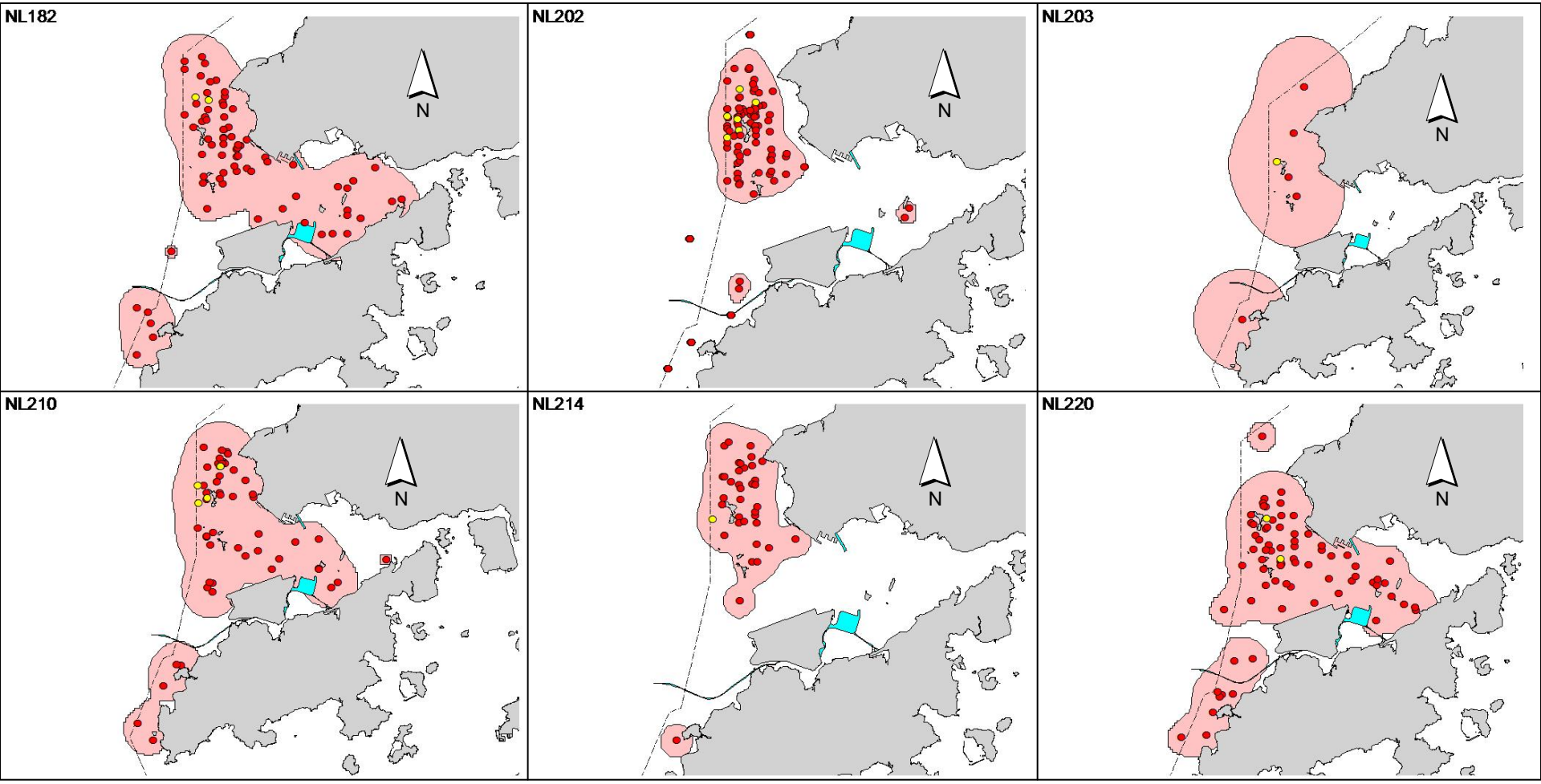
Annex V. Ranging patterns (95% kernel ranges) of 34 individual dolphins that were sighted during HKLR03 impact phase monitoring period (note: yellow dots indicates sightings made in September-November 2015)



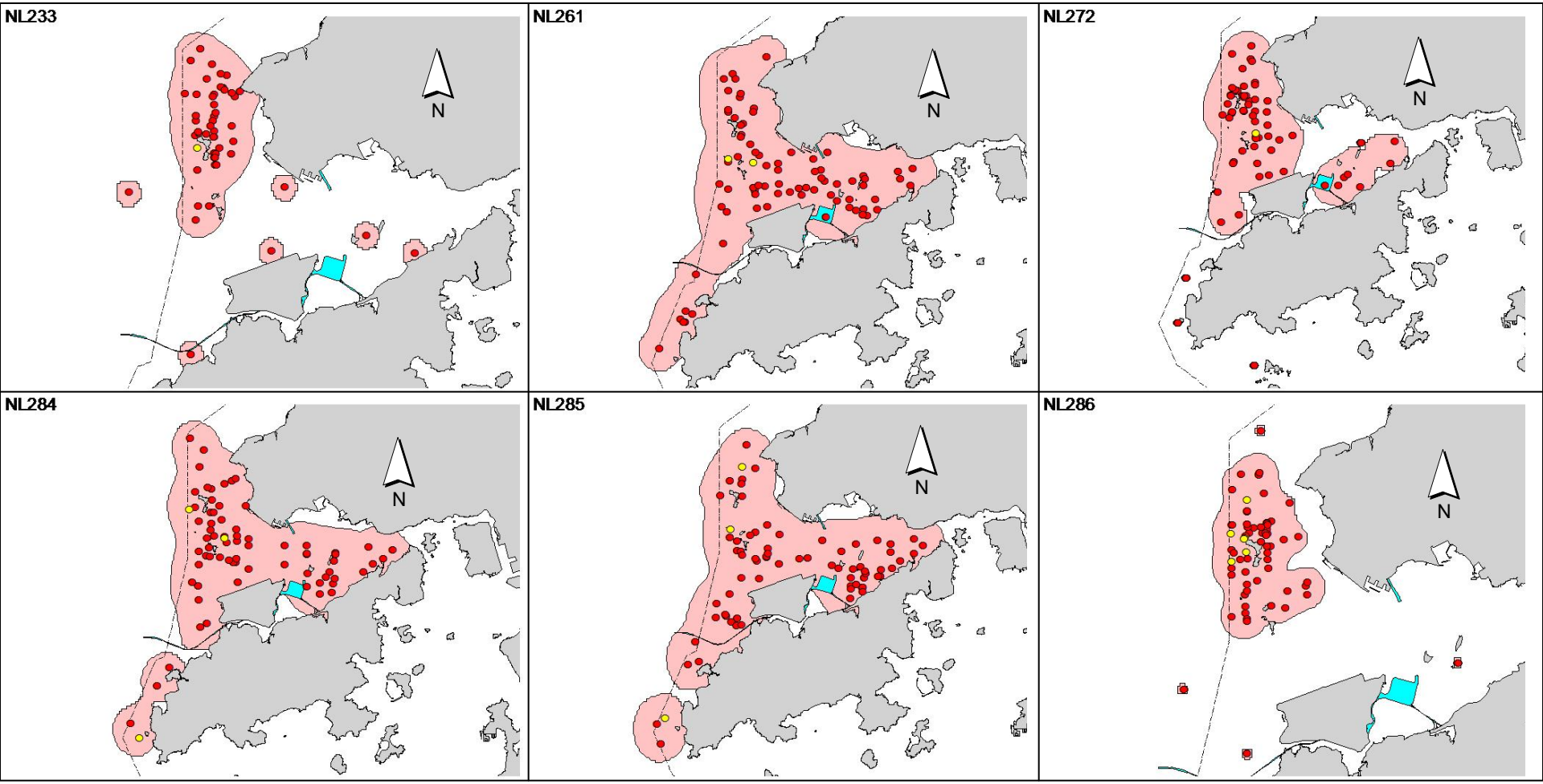
Annex V. (cont'd)



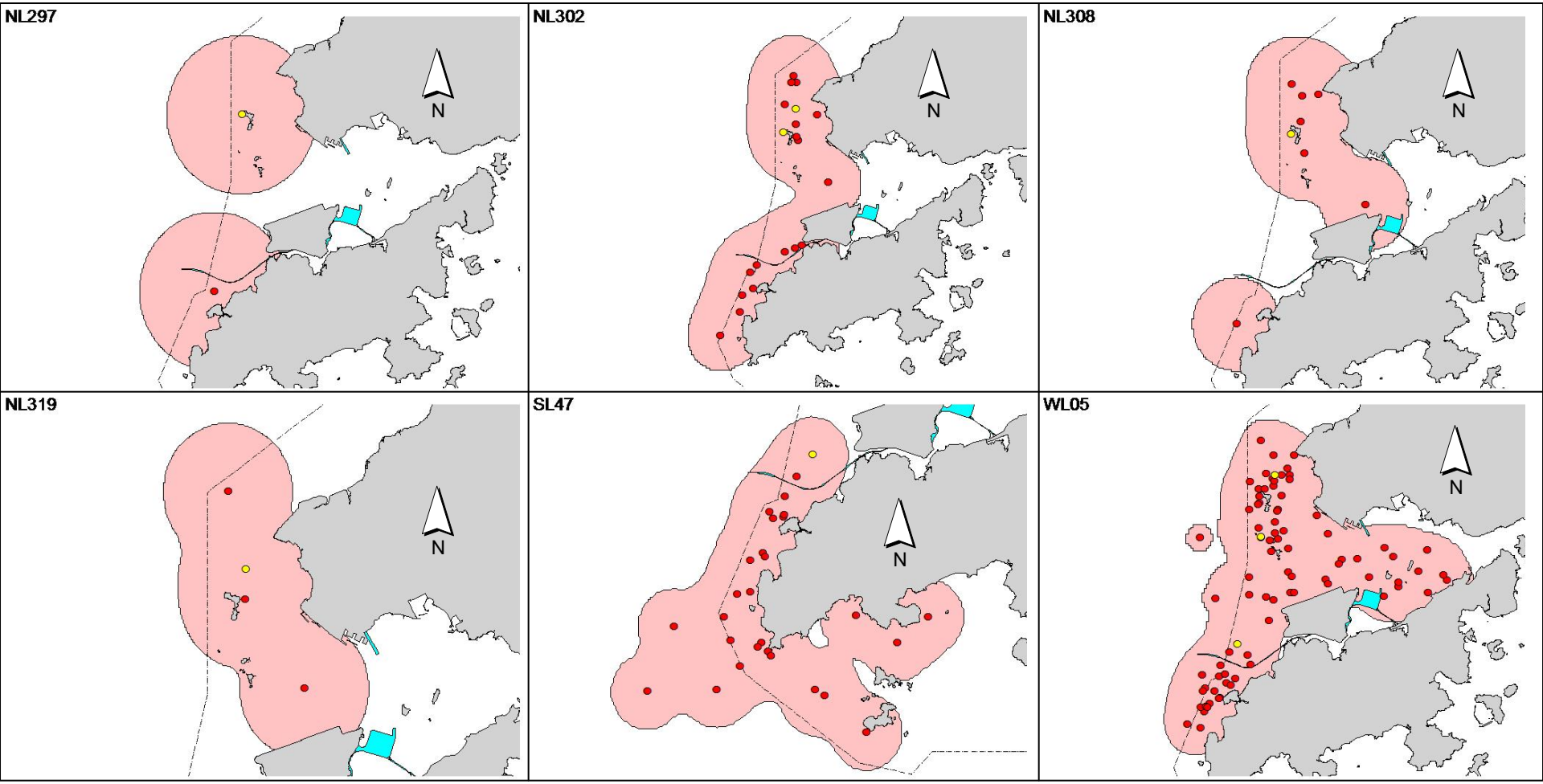
Annex V. (cont'd)



Annex V. (cont'd)



Annex V. (cont'd)



Annex V. (cont'd)