# 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

*9th Quarterly Progress Report (September-November 2014)*
*submitted to China State Construction Engineering (HK) Ltd.*

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## 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 ninth 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 2014.

## 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 twice per month throughout the entire construction period. The co-ordinates of all transect lines are shown in Table 1.

Table 1. Co-ordinates of transect lines

| 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 |
| 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 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 entire quarterly period (September-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-$km^2$ 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 2014, 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 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. A summary table of the survey effort is shown in Annex I.

3.1.4. During the six sets of monitoring surveys in 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 Annex II.

*3.2. Distribution*

3.2.1. Distribution of dolphin sightings made during monitoring surveys in September to November 2014 is shown in Figure 1. Similar to recent quarters, 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 was sighted in the vicinity of the HKLR03/ HKBCF reclamation sites or along the entire alignment of Tuen Mun-Chek Lap Kok Link (TMCLKL) during this quarterly period (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 seven 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.

*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).

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

| 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 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 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 (Table 4).

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)) have been exceptionally low when compared to the baseline period (Table 4). In fact, the present quarter was the eighth consecutive quarters being assessed that have triggered the Action Levels under the Event and Action Plan. 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 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)

| | **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 |

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)

| | **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 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 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. To ensure the continuous usage of NEL waters by the dolphins, every possible measure should be implemented by the contractors and relevant authorities to minimize all disturbances to the dolphins, as a future marine park around the Brothers Islands will be established in this important dolphin habitat as a compensation measure for the habitat loss resulted from the HKBCF reclamation works. Unless such declining trend can be reverted after the establishment of the Brothers Islands Marine Park, there should be a presumption against further reclamation in North Lantau waters as suggested in Hung (2013, 2014).

3.3.11. It should be noted that dolphin usage in NWL have also 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 the 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).

3.4.4. Notably, none of the larger dolphin groups were sighted near the HKLR03 reclamation site in the present monitoring period (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 in the present quarter. Moreover, all grids near HKLR03/HKBCF reclamation sites, HKLR09 or TMCLKL alignment 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).

3.5.5. The absence of dolphins in the identified important habitats around the Brothers Islands and Shum Shui Kok in consecutive quarters in 2013-14 is of serious concern. The future Brothers Islands Marine Park will be established in this area upon the completion of HKBCF reclamation works, as an important compensation measure for the associated habitat loss. As suggested recently in Hung (2014), such low usage of dolphins in this important habitat in the past two years was likely related to the on-going HZMB-related construction works. Continuous monitoring of such diminished use should be continued in this important dolphin habitat in the upcoming quarters.

*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 the four young calves were sighted in the vicinity of the HKBCF/HKLR03 reclamation sites and HKLR09/TMCLKL alignments 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 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 Annex III and photographs of identified individuals in Annex 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. Some of these mothers were frequently sighted with their calves throughout the HKLR03 impact phase monitoring period since October 2012.

*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 Annex 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 (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 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; Annex 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 present 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 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 in 2012-14, 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. 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.

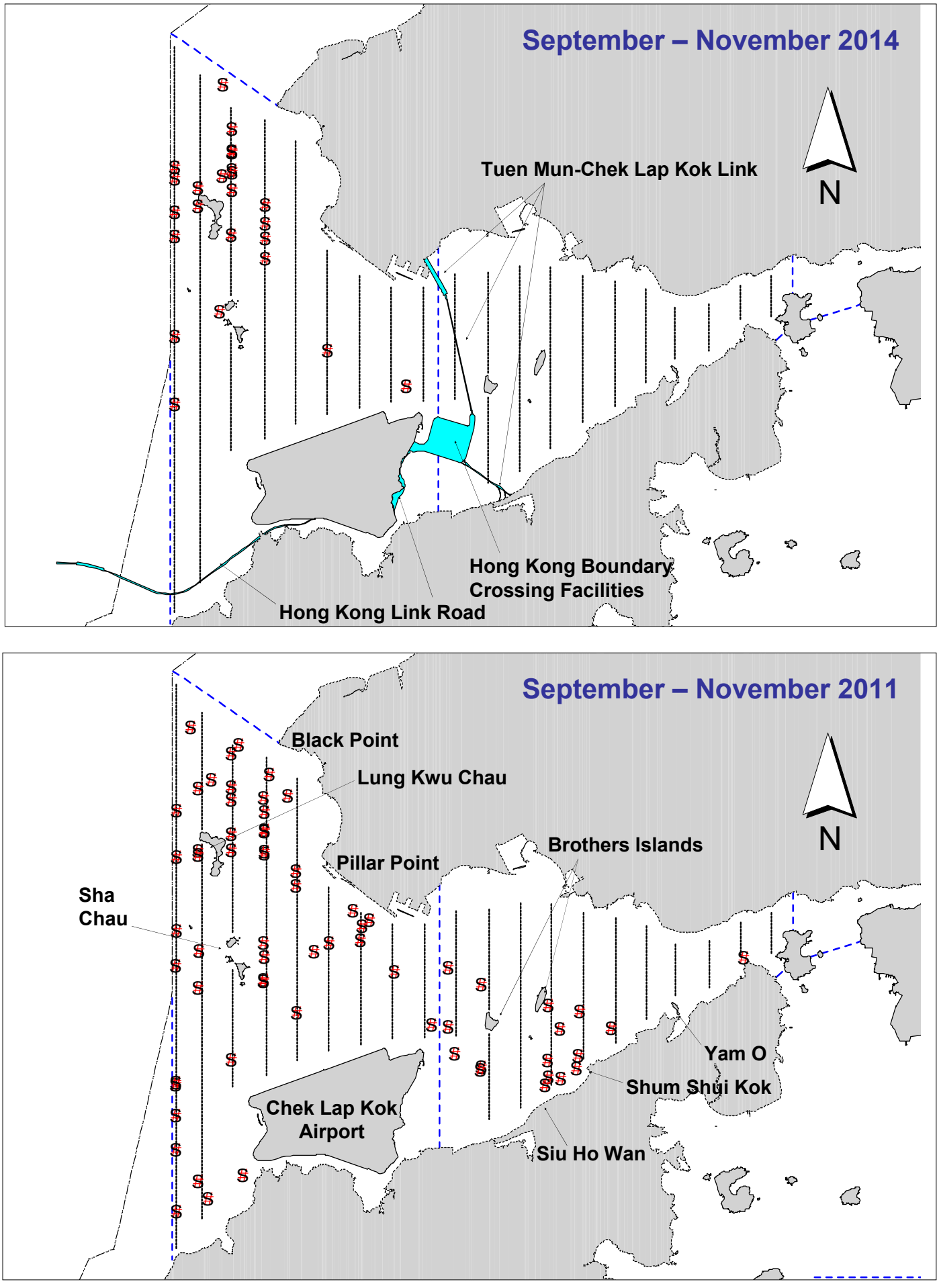
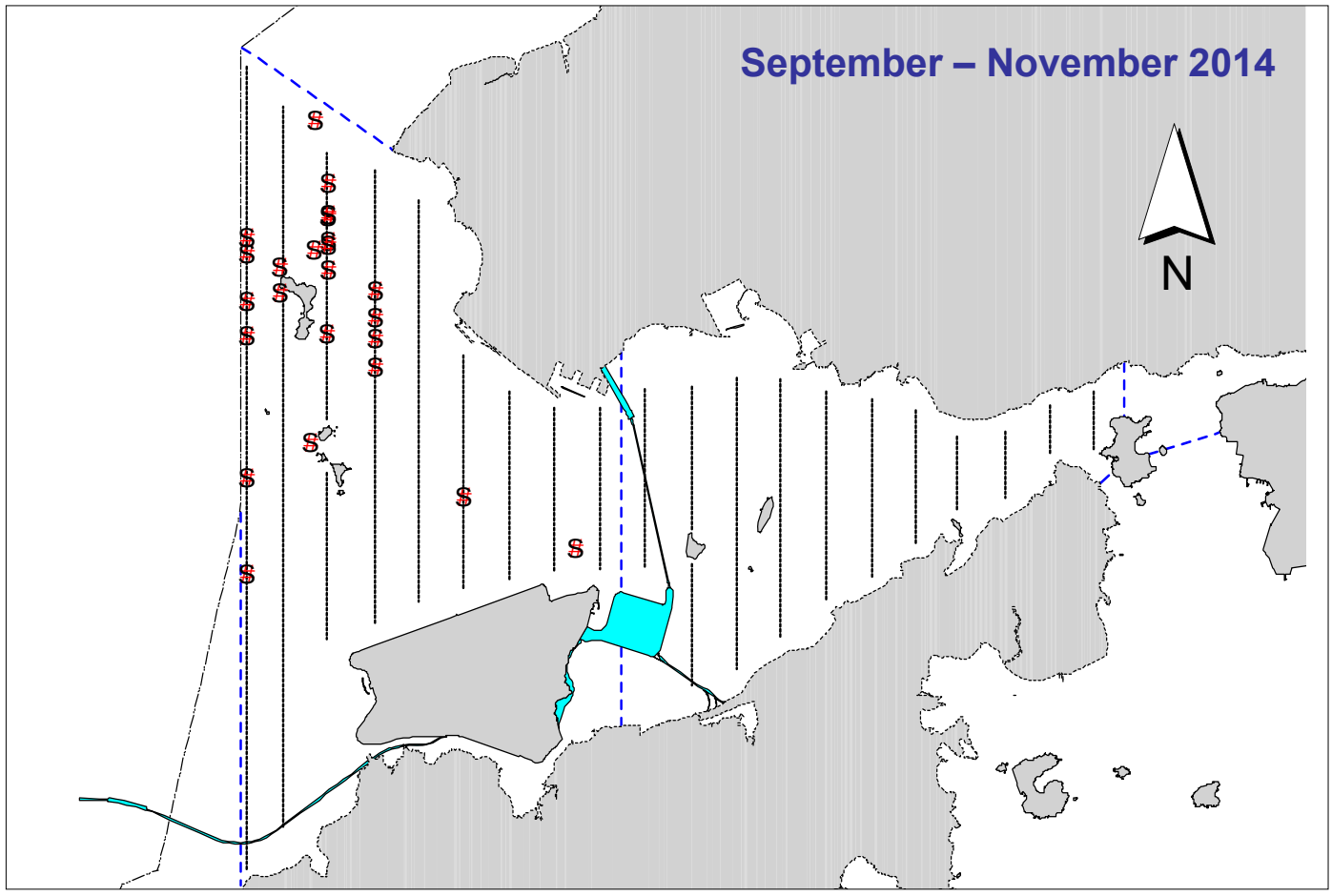



Figure 1. Distribution of Chinese white dolphin sighting in Northwest and Northeast Lantau during HKLR03 impact phase (top) and baseline monitoring surveys (bottom)



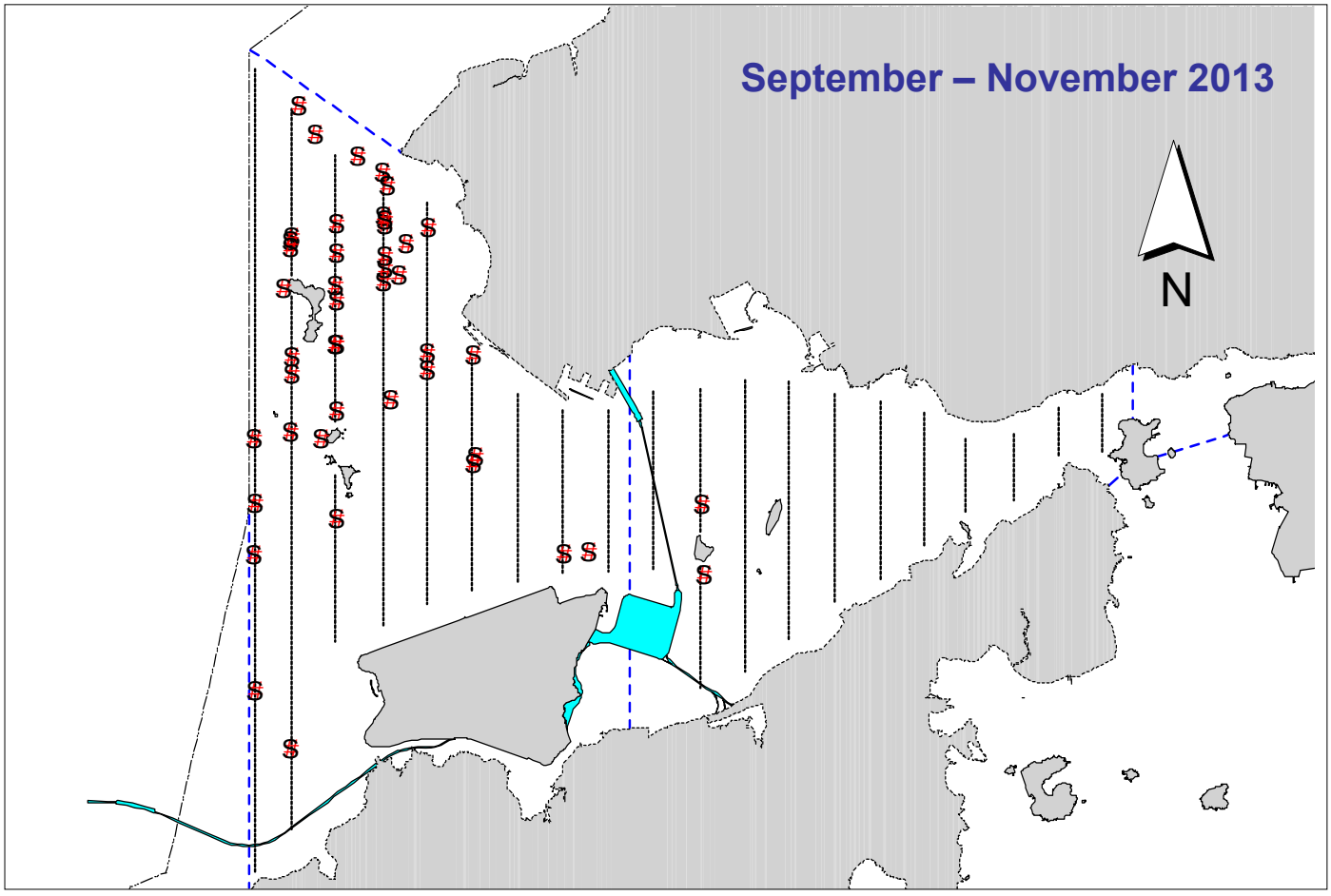




Figure 2. Distribution of Chinese white dolphin sighting in Northwest and Northeast Lantau during the same autumn quarters of HKLR03 impact phase in 2014 (top) and 2013 (bottom)

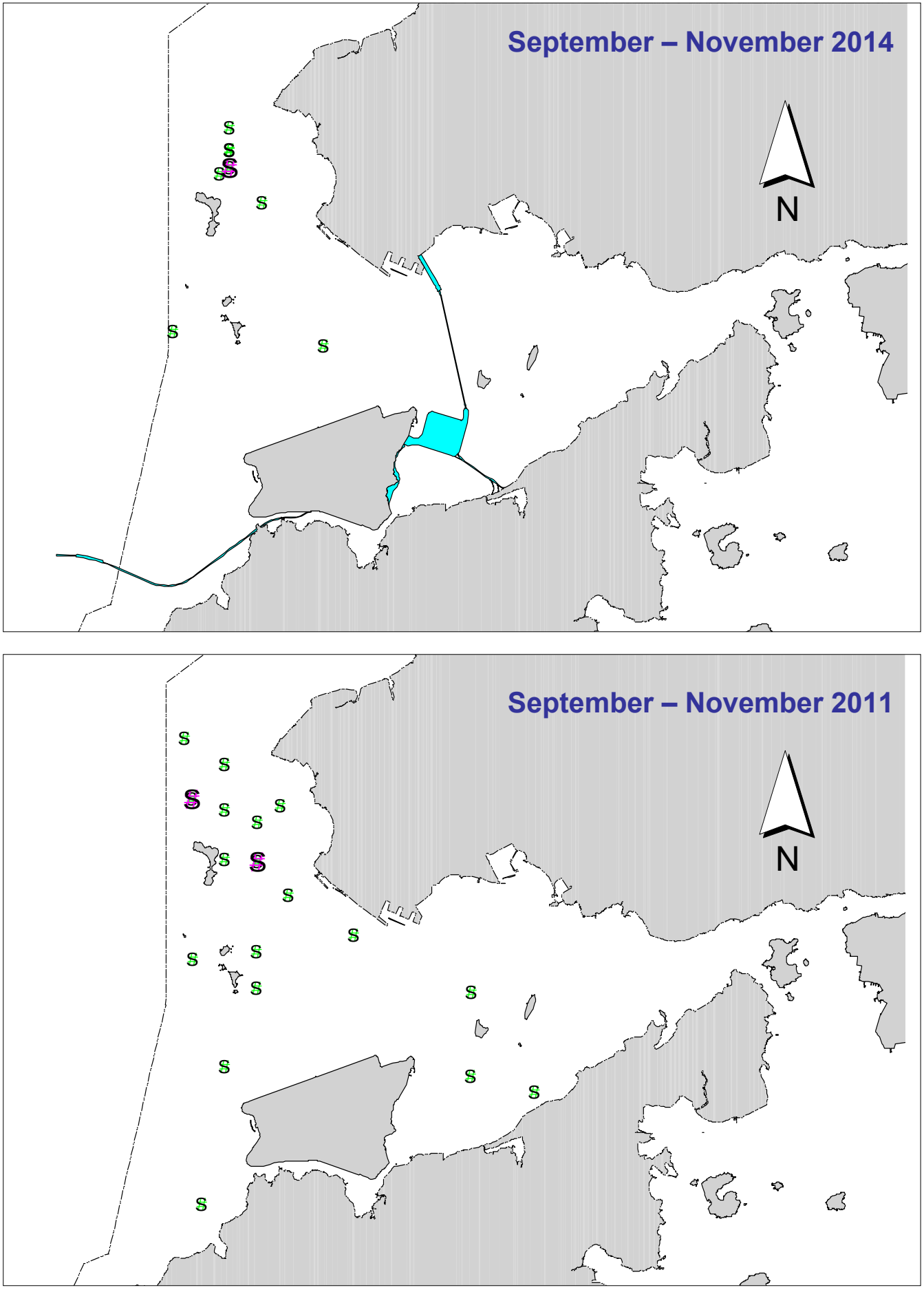



Figure 3. Distribution of Chinese white dolphins with larger group sizes during HKLR03 impact phase (top) and baseline monitoring surveys (bottom) (green dots: group sizes of 5 or more; purple dots: group sizes of 10 or more)

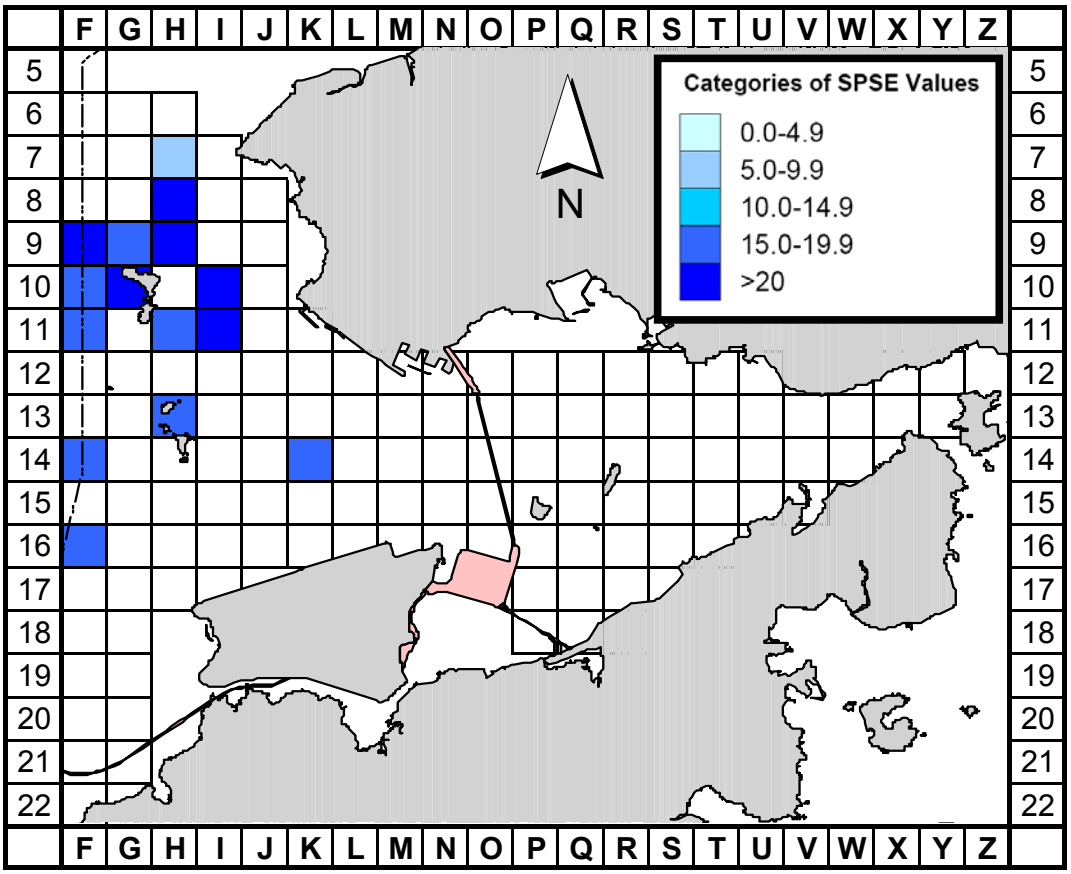



Figure 4a. Sighting density of Chinese white dolphins with corrected survey effort per km$^2$ in Northeast and Northwest Lantau survey areas, using data collected during HKLR03 impact monitoring period monitoring period (Sep-Nov 14) (SPSE = no. of on-effort sightings per 100 units of survey effort)

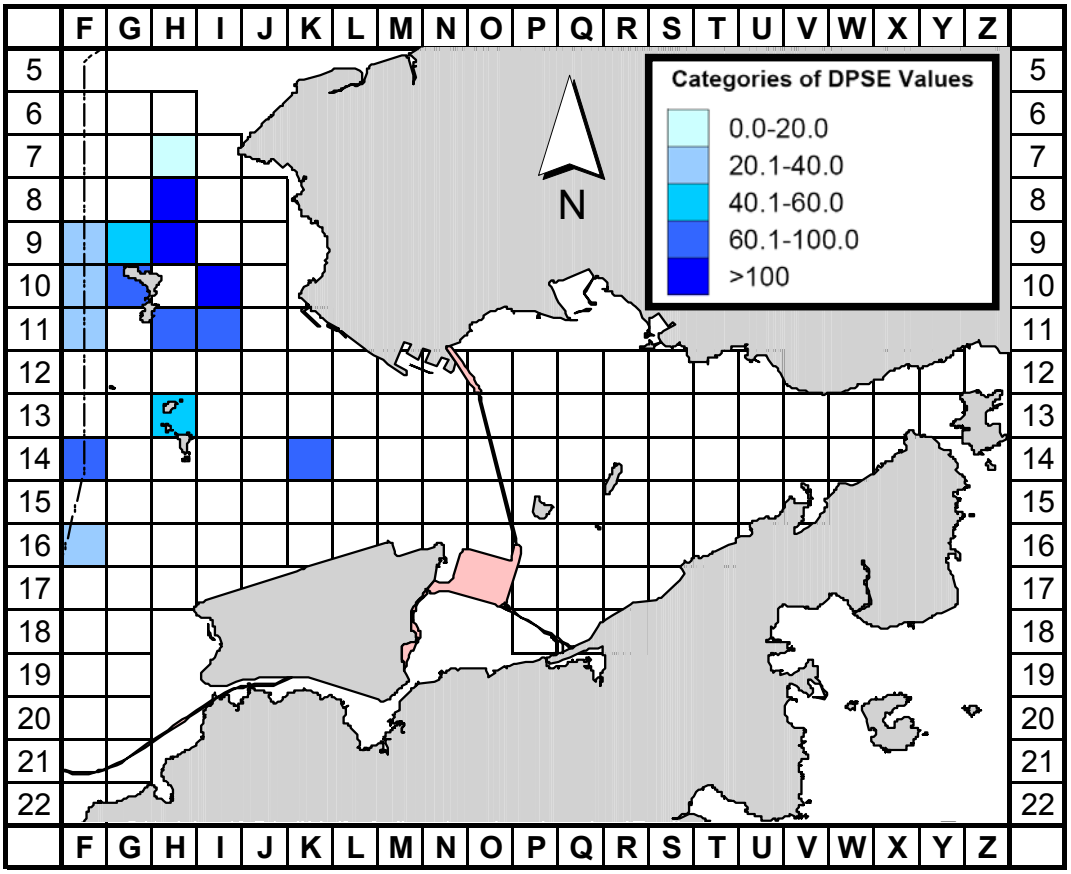



Figure 4b. Density of Chinese white dolphins with corrected survey effort per km$^2$ in Northeast and Northwest Lantau survey areas, using data collected during HKLR03 impact monitoring period (Sep-Nov 14) (DPSE = no. of dolphins per 100 units of survey effort)

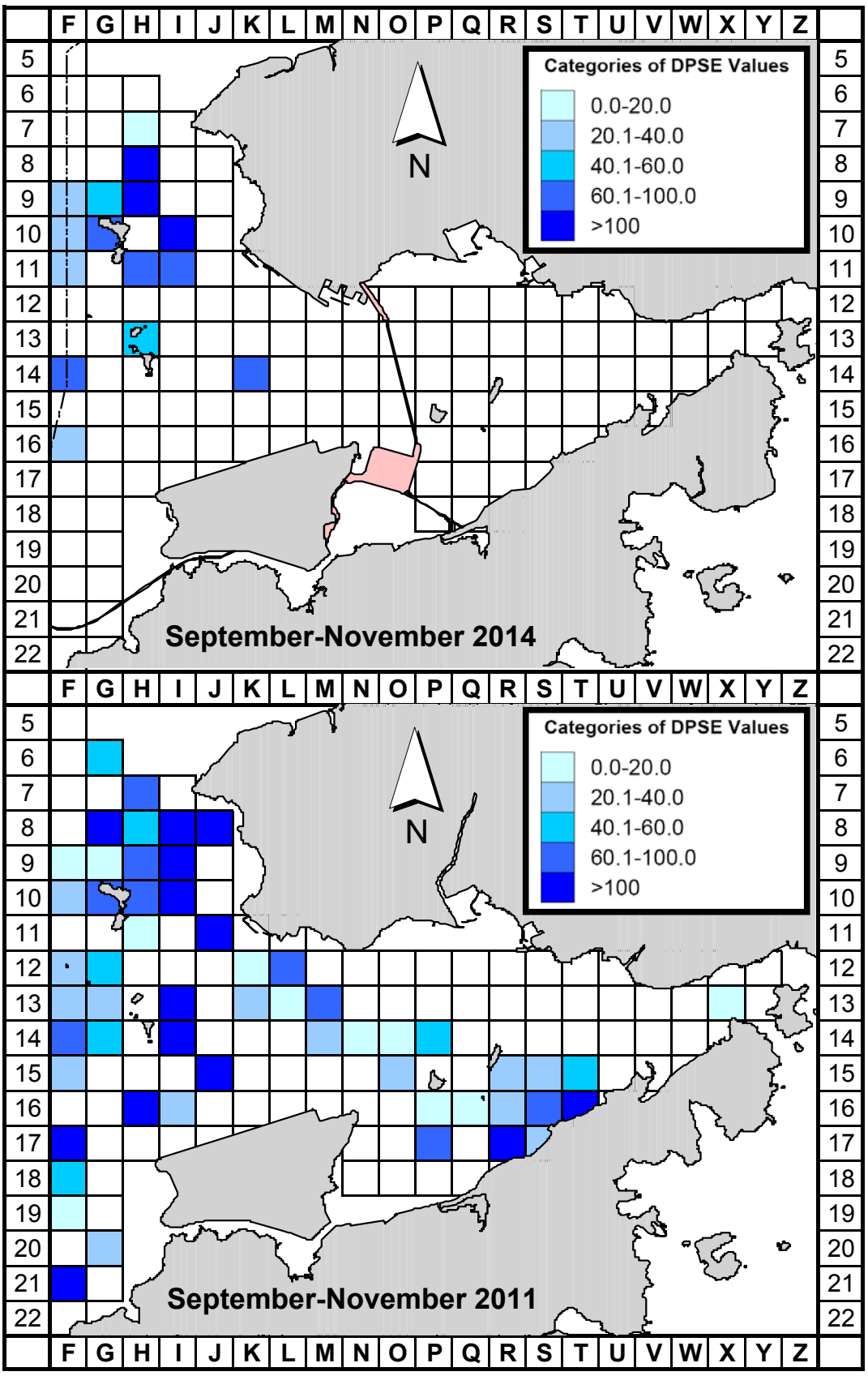
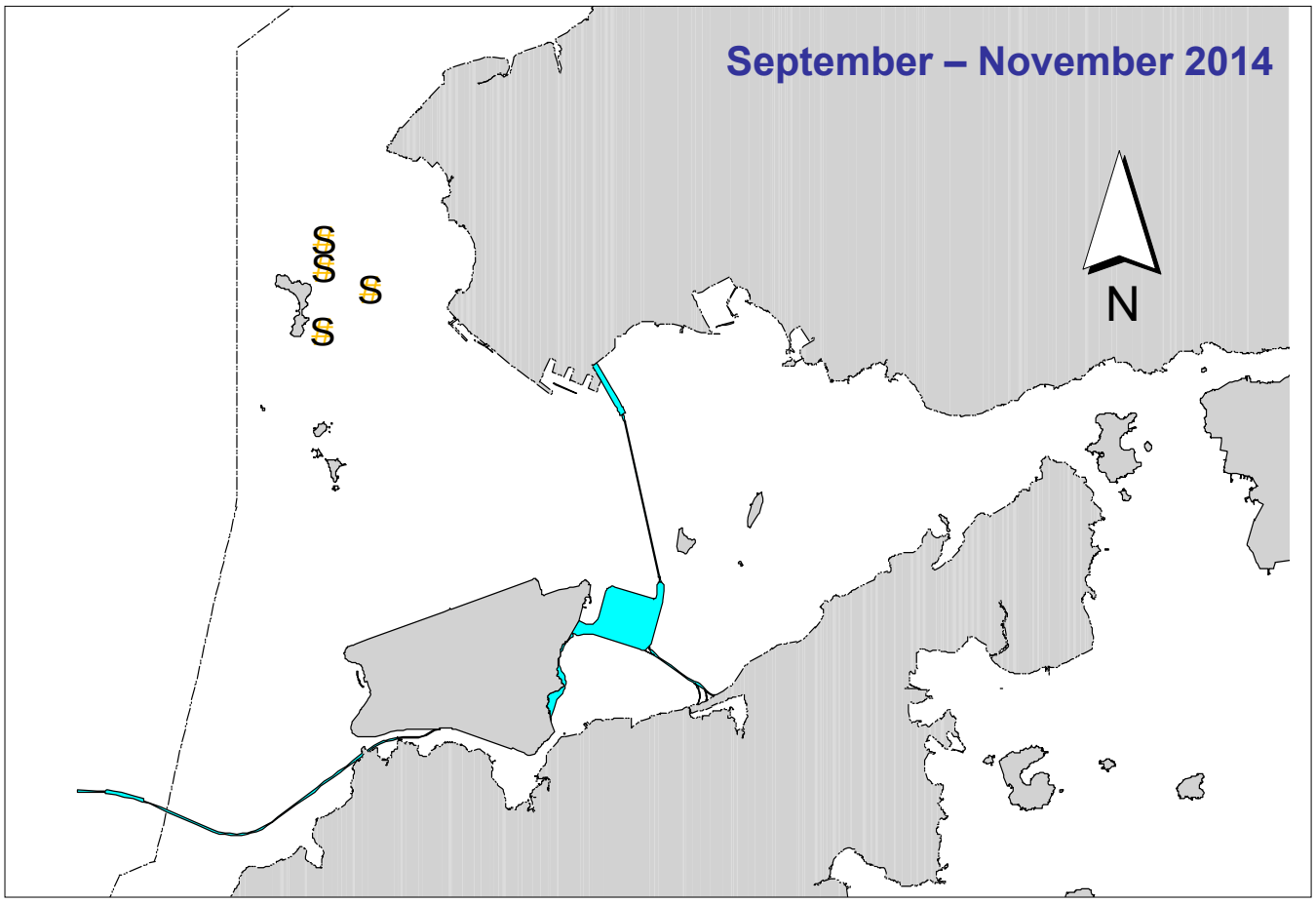



Figure 5. Comparison of density of Chinese white dolphins with corrected survey effort per km$^2$ in Northwest and Northeast Lantau survey area between the impact monitoring period (September-November 2014) and baseline monitoring period (September-November 2011)
(DPSE = no. of dolphins per 100 units of survey effort)



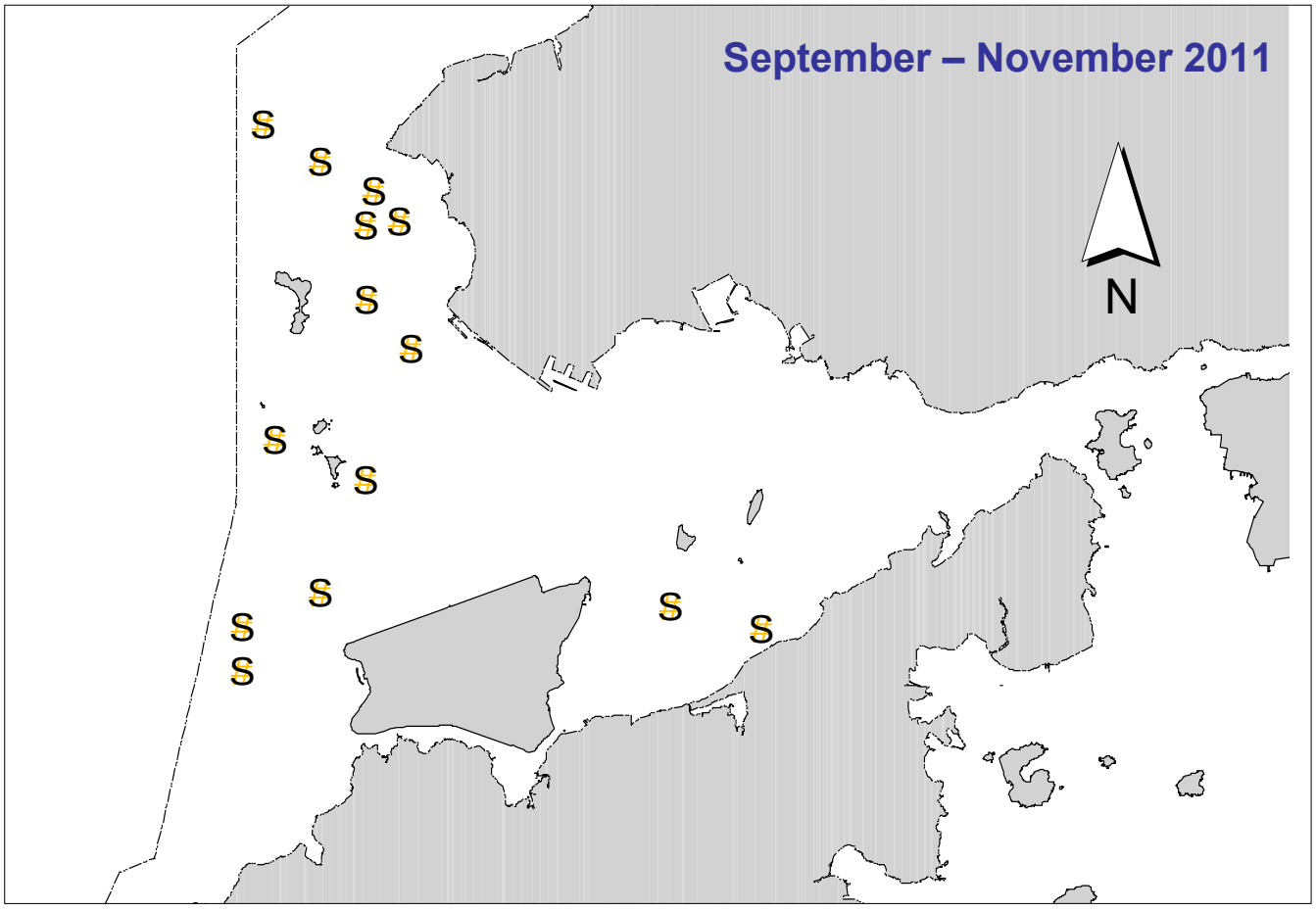




Figure 6. Distribution of young calves of Chinese white dolphins during HKLR03 impact phase (top) and baseline monitoring surveys (bottom)

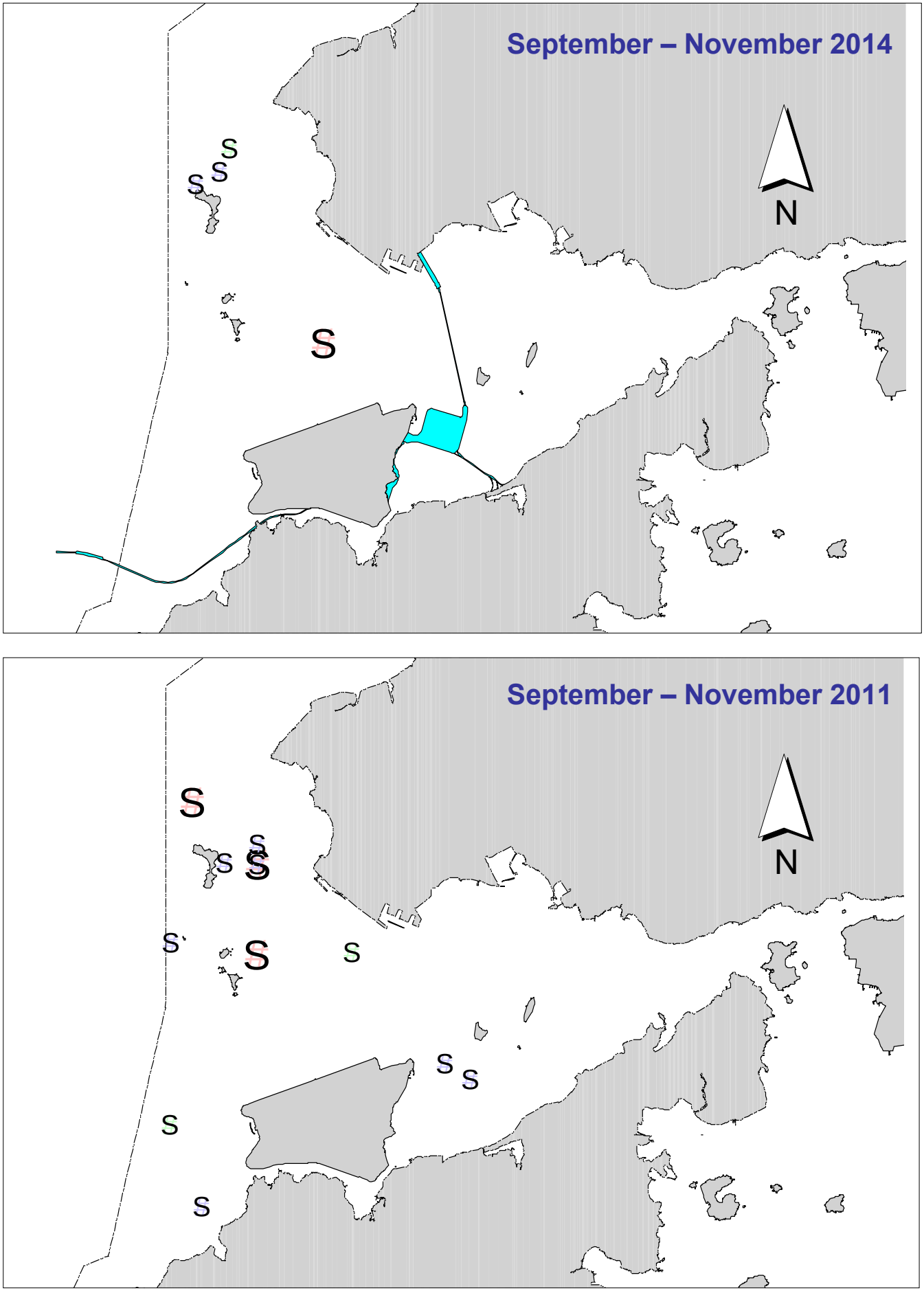



Figure 7. Distribution of Chinese white dolphins engaged in feeding (purple dots), socializing (pink dots) and traveling (green dots) activities during HKLR03 impact phase (top) and baseline monitoring surveys (bottom)

## Annex 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 |

## 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 |
|---|---|---|---|---|---|---|---|
| 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 |

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

(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)

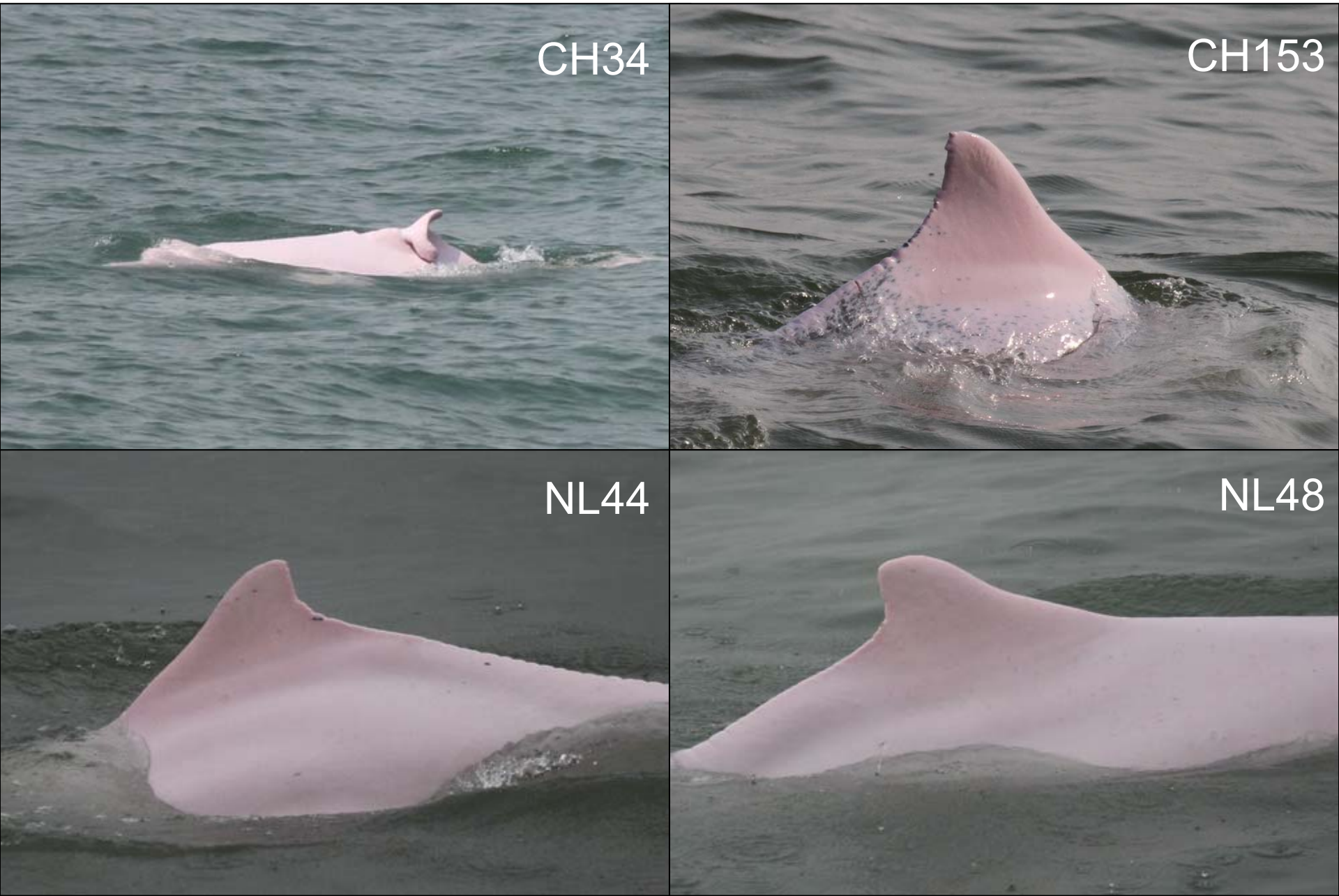
| DATE | STG # | TIME | HRD SZ | AREA | BEAU | PSD | EFFORT | TYPE | NORTHING | EASTING | SEASON | BOAT ASSOC. | P/S |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2-Sep-14 | 1 | 1106 | 3 | NW LANTAU | 1 | 201 | ON | HKLR | 827206 | 805396 | AUTUMN | NONE | P |
| 2-Sep-14 | 2 | 1215 | 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 |

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

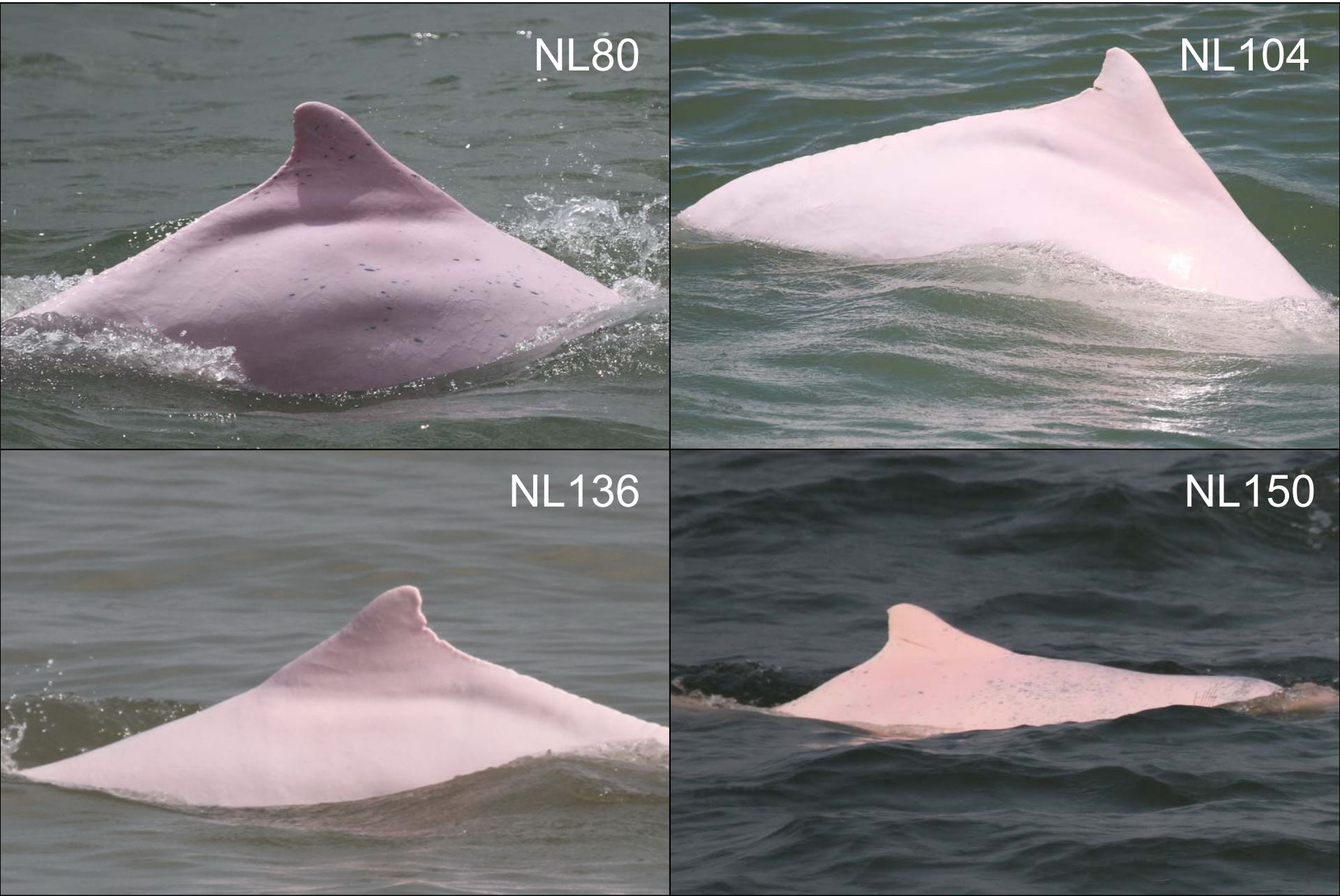
| ID# | DATE | STG# | AREA |
|---|---|---|---|
| CH34 | 13/10/14 | 4 | NW LANTAU |
| | 18/11/14 | 2 | NW LANTAU |
| CH153 | 22/09/14 | 3 | NW LANTAU |
| NL46 | 11/09/14 | 1 | NW LANTAU |
| | 04/11/14 | 1 | NW LANTAU |
| NL48 | 19/09/14 | 1 | NW LANTAU |
| | 13/10/14 | 1 | NW LANTAU |
| | 04/11/14 | 1 | 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 |

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



Annex IV. (cont'd)

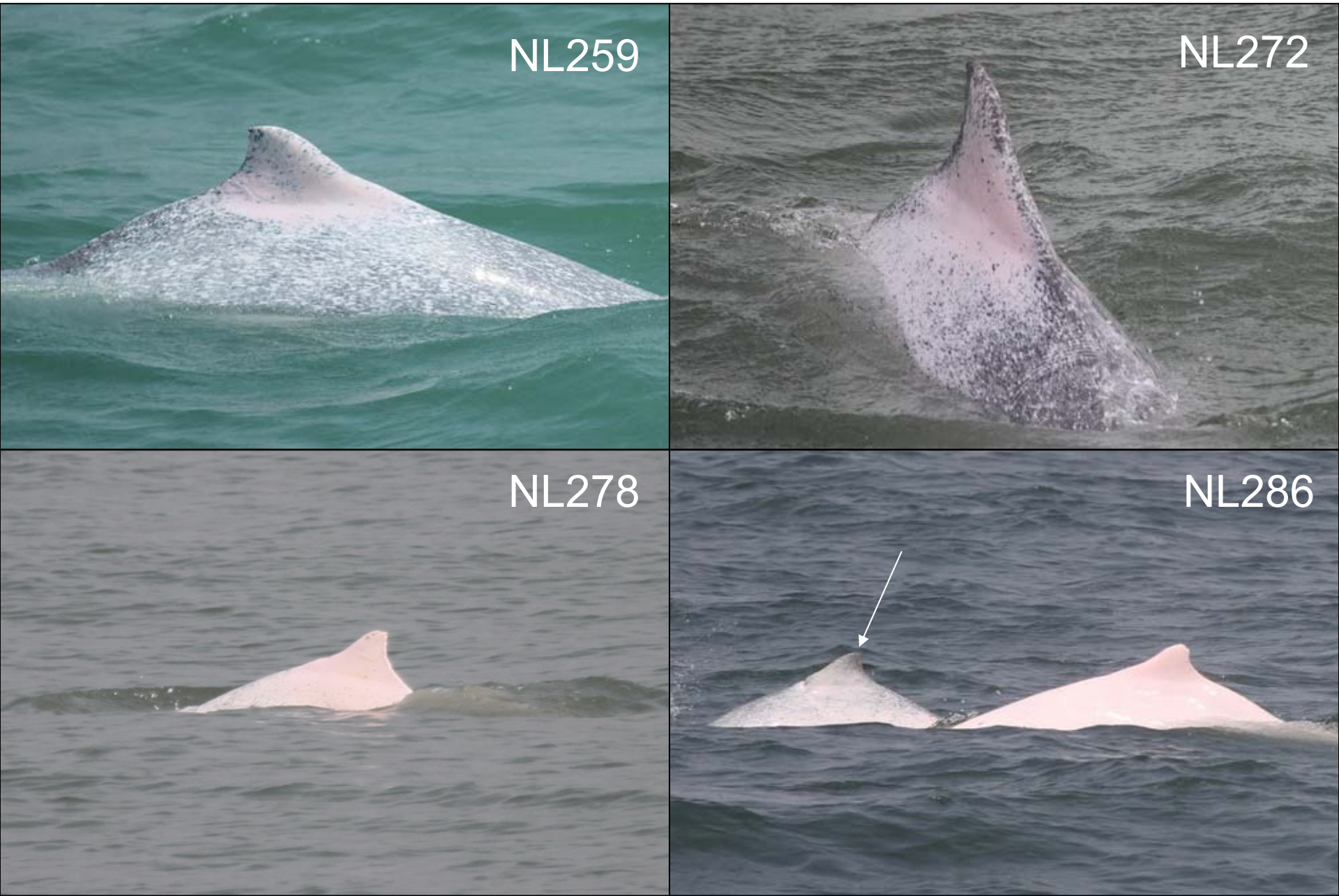


Annex IV. (cont'd)

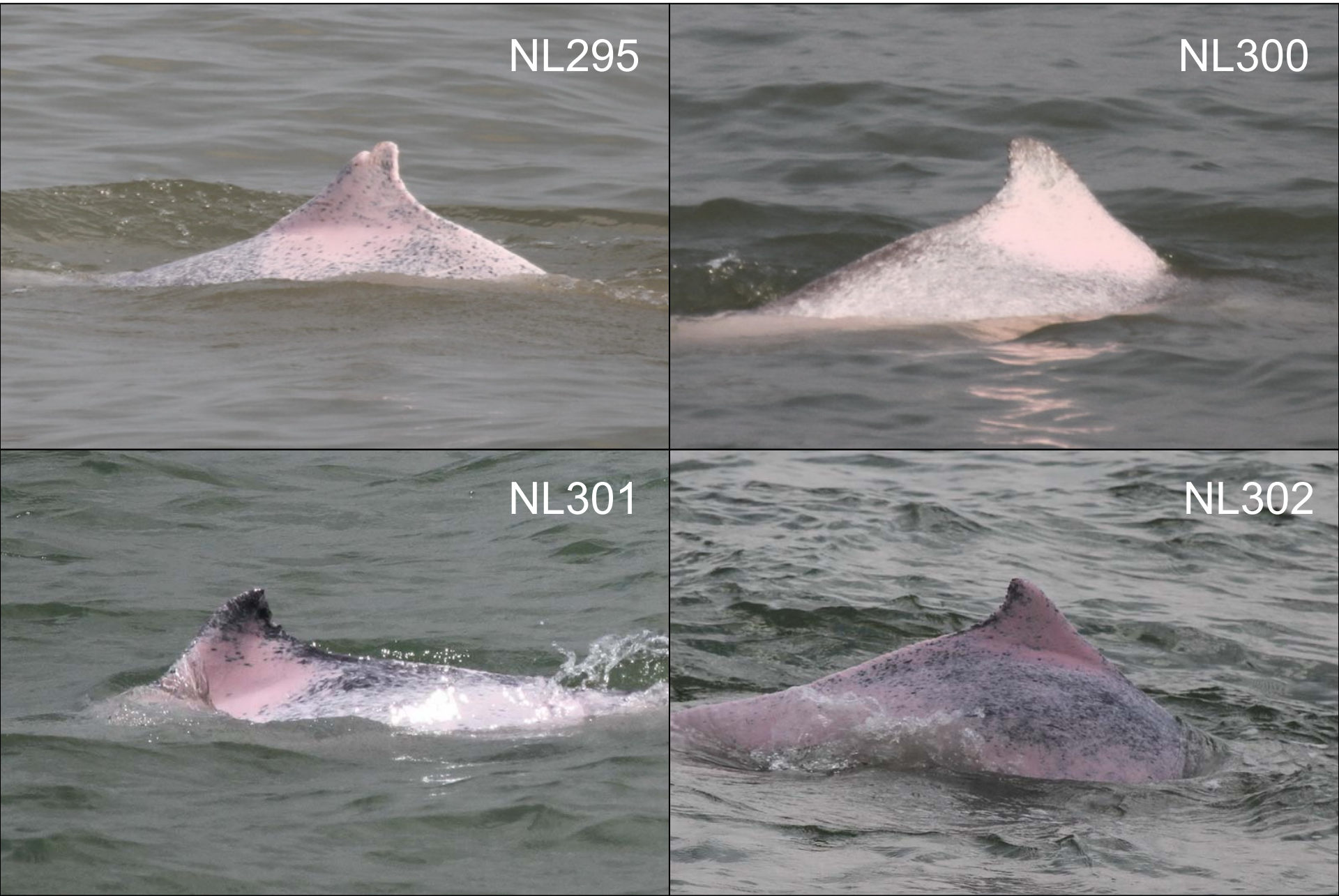



Annex IV. (cont'd)

Annex IV. (cont'd)

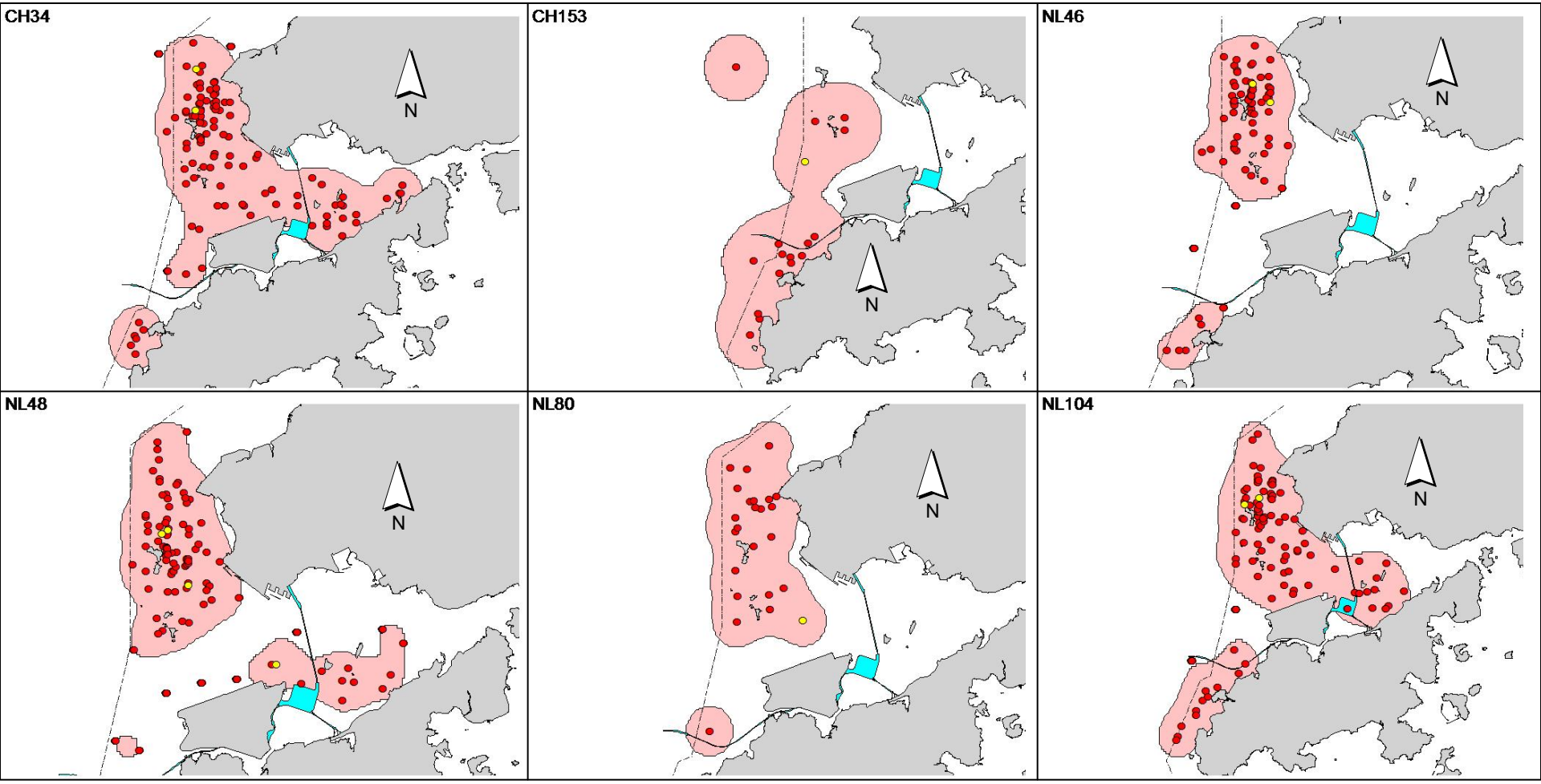


Annex IV. (cont'd)

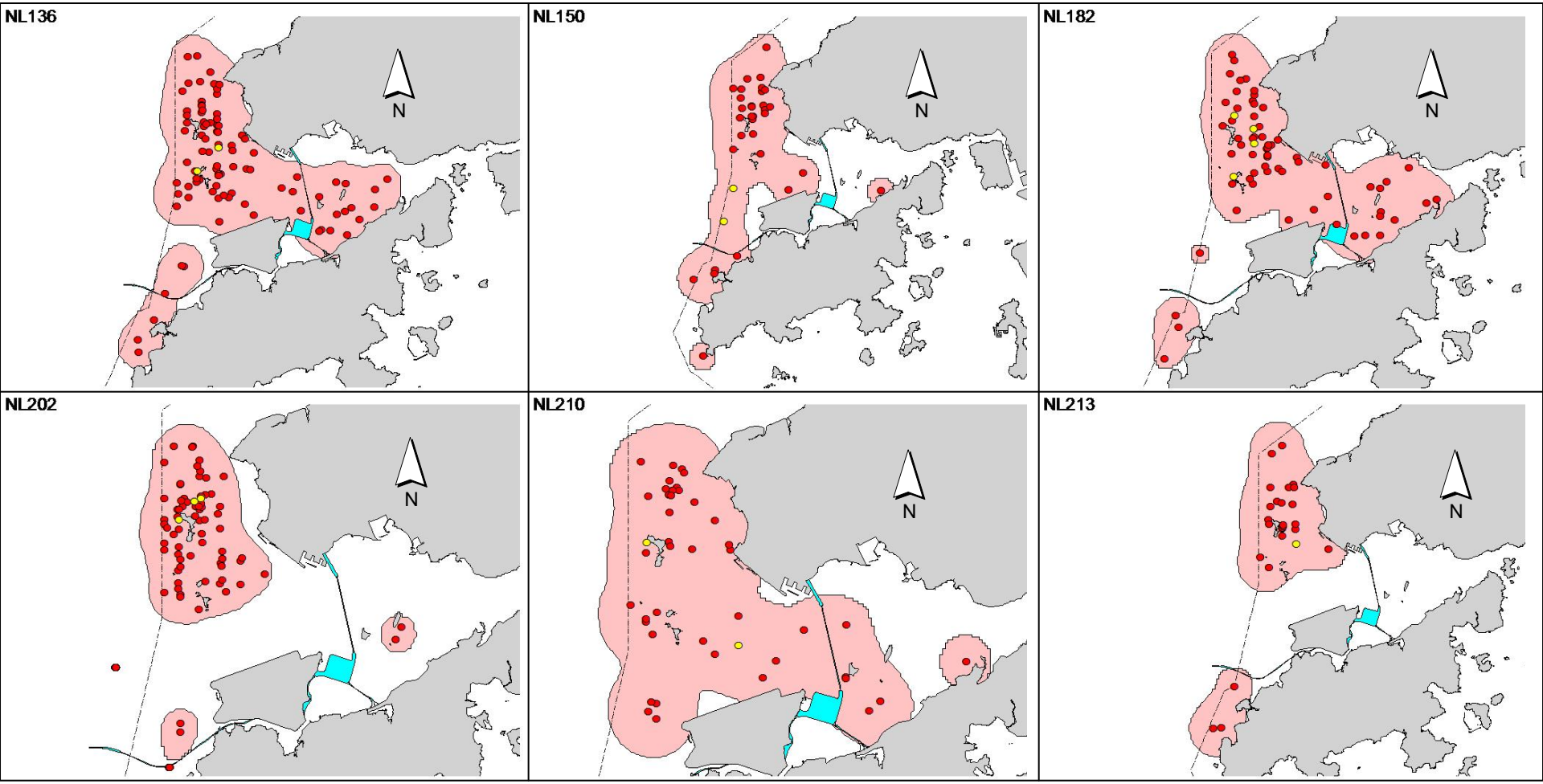


Annex IV. (cont'd)

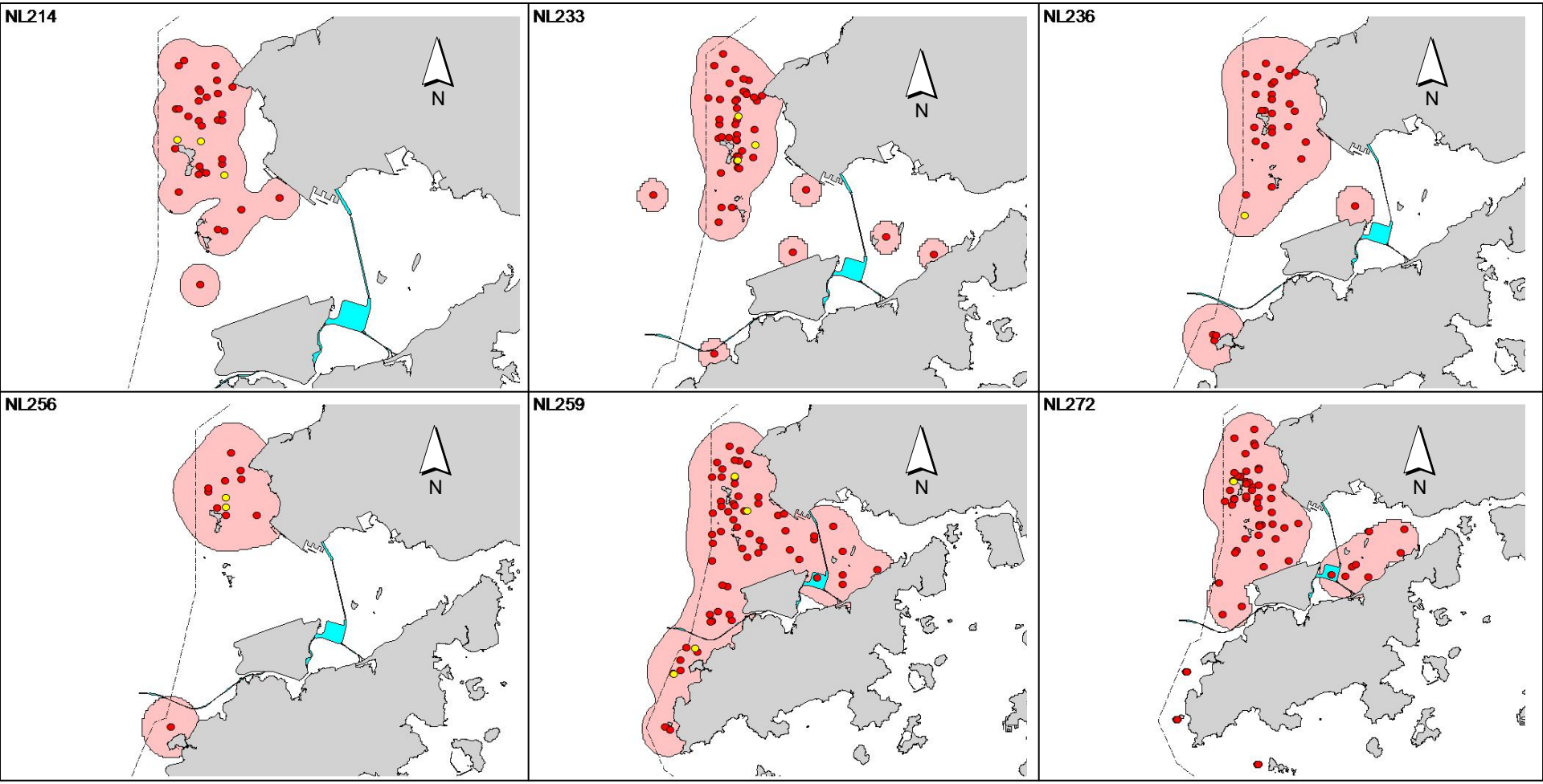
Annex V. Ranging patterns (95% kernel ranges) of 26 individual dolphins that were sighted during HKLR03 impact phase monitoring period (note: yellow dots indicates sightings made in September – November 2014)



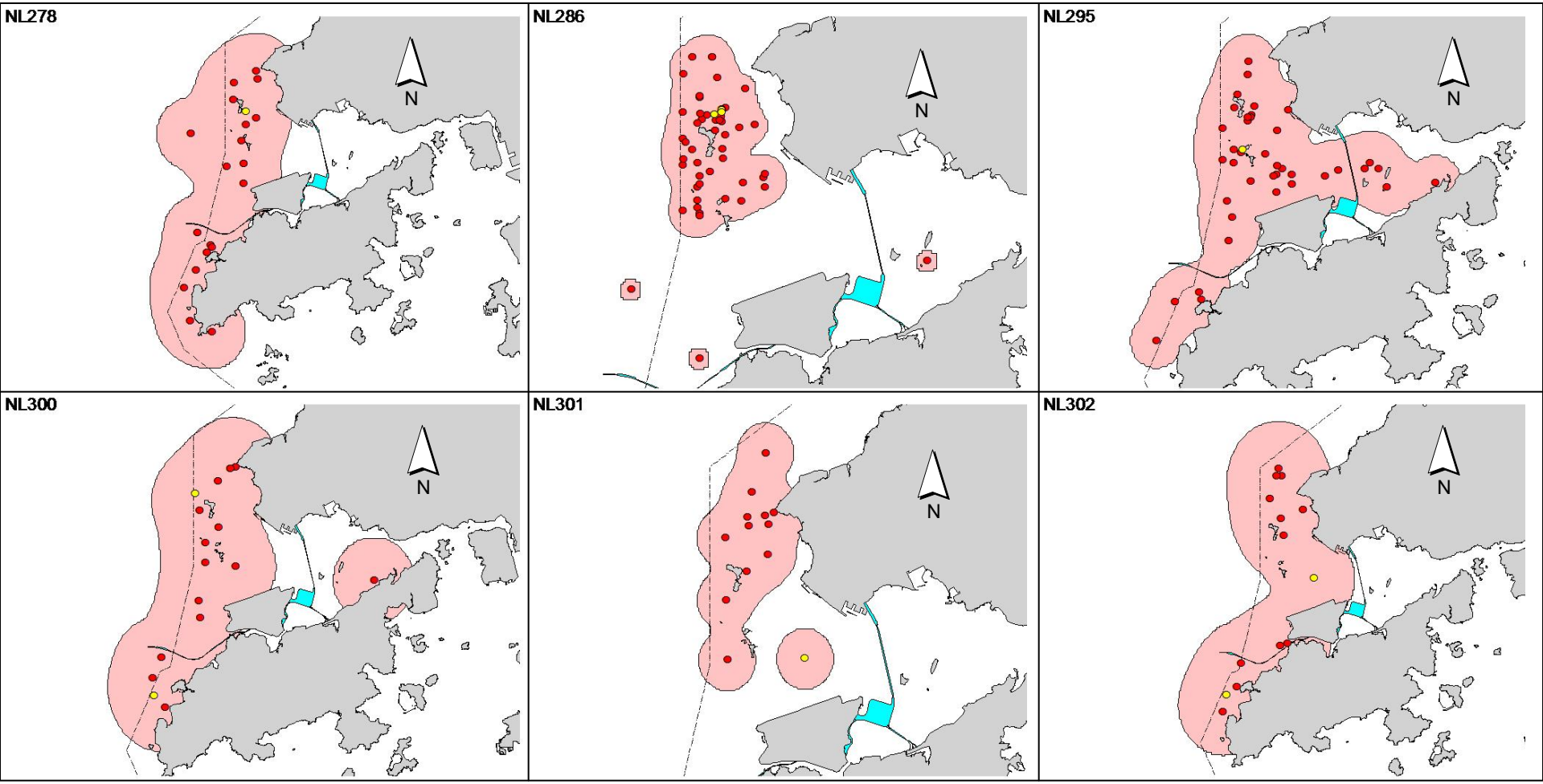
Annex V. (cont'd)



Annex V. (cont'd)



Annex V. (cont'd)



Annex V. (cont'd)