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

Quarterly Progress Report (March-May 2024)
submitted to China State Construction Engineering (HK) Ltd.

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July 11, 2024

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 throughout the construction period to cover the Northwest and Northeast Lantau survey areas as in AFCD annual marine mammal monitoring programme.

1.3. Since October 2012, Hong Kong Cetacean Research Project (HKCRP) has been commissioned to conduct the 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 ranging patterns. 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.

1.4. Notably, the HKLR03 marine works were temporarily suspended in July 2019. During this three-year hiatus of HKLR03 EM&A works, the TMCLKL EM&A team took over the responsibility of dolphin monitoring in North Lantau waters for their final phase of construction and then the subsequent post-construction period between June 2020 and May 2022, to ensure a seamless transition of dolphin monitoring works between different HZMB projects.

1.5. The present report is the 36th 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 survey findings during the quarterly period of March to May 2024.

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.

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	805476	820800		14	Start Point	817537	820220
2	End Point	805476	826654		14	End Point	817537	824613
3	Start Point	806464	821150		15	Start Point	818568	820735
3	End Point	806464	822911		15	End Point	818568	824433
4	Start Point	807518	821500		16	Start Point	819532	821420
4	End Point	807518	829230		16	End Point	819532	824209
5	Start Point	808504	821850		17	Start Point	820451	822125
5	End Point	808504	828602		17	End Point	820451	823671

6	Start Point	809490	822150		18	Start Point	821504	822371
6	End Point	809490	825352		18	End Point	821504	823761
7	Start Point	810499	822000		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	821176		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		24	Start Point	805476	815900
12	End Point	815542	824882		24	End Point	805476	819100

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 25 years of marine mammal monitoring surveys in Hong Kong developed by HKCRP (see Hung 2022). 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. 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 March to May 2024, 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 800.02 km of survey effort was collected, with 99.0% 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, 288.90 km and 511.12 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 572.26 km, while the effort on secondary lines was 227.76 km. Survey effort conducted on both primary and secondary lines were considered to be on-effort survey data. A summary table of the survey effort is shown in Appendix I.

3.1.4. During the six sets of monitoring surveys conducted between March and May 2024, a total of three groups of five Chinese White Dolphins were sighted, and the summary table of dolphin sightings is shown in Appendix II. All three dolphin groups were sighted on primary lines during on-effort search.

3.1.5. In the quarterly period, two of the three dolphin groups were sighted in NWL, and a single dolphin was sighted in NEL. Notably, this dolphin sighting made in NEL was exceptionally rare, as dolphins have not been sighted in NEL waters since February 2018, and only three groups of dolphins were sighted there in the past decade.

3.2. Distribution

3.2.1. Distribution of dolphin sightings made during the HKLR03 monitoring surveys conducted from March to May 2024 is shown in Figure 1. The three dolphin sightings were scattered at the southwestern corner of the NWL survey area, at the northeast corner of Lung Kwu Chau, and to the north of Siu Mo To near the Brothers Islands, respectively. The dolphin sightings were located very far away from the HKLR03 and HKBCF reclamation sites as well as along the TMCLKL bridge alignments (Figure 1).

3.2.2. Sighting distribution of dolphins during the present monitoring period (March-May 2024) was drastically different from the one during the baseline period (Figure 1). In the present quarter, only an exceptionally rare dolphin sighting was made in the NEL region, which was in stark contrast to their frequent occurrences around the Brothers Islands, near Shum Shui Kok and in the vicinity of HKBCF reclamation site during the baseline period (Figure 1). The near-absence of NEL region by the dolphins has been consistently recorded in the past decade of HKLR03/TMCLKL monitoring.

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

period, dolphins were rarely sighted there, and their distribution was restricted to the southwestern corner of the survey area and near Lung Kwu Chau. This was in stark contrast to their frequent occurrences throughout NWL waters during the baseline period (Figure 1).

3.2.4. Another comparison in dolphin distribution was made between the six quarterly periods of spring months in 2019-24. Across the six periods, the majority of dolphin sightings were made consistently and exclusively at the western end of the North Lantau region (except the exceptionally rare sighting made in NEL during the spring period of 2024 (Figure 2).

3.3. Encounter rate

3.3.1. During the present three-month impact phase 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 March-May 2024

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 (4 & 5 Mar 2024)	0.00	0.00
	Set 2 (15 & 20 Mar 2024)	0.00	0.00
	Set 3 (2 & 8 Apr 2024)	0.00	0.00
	Set 4 (11 & 18 Apr 2024)	2.87	2.87
	Set 5 (9 & 10 May 2024)	0.00	0.00
	Set 6 (23 & 28 May 2024)	0.00	0.00
Northwest Lantau	Set 1 (4 & 5 Mar 2024)	1.76	3.52
	Set 2 (15 & 20 Mar 2024)	1.67	3.34
	Set 3 (2 & 8 Apr 2024)	0.00	0.00
	Set 4 (11 & 18 Apr 2024)	0.00	0.00
	Set 5 (9 & 10 May 2024)	0.00	0.00
	Set 6 (23 & 28 May 2024)	0.00	0.00

Table 3. Comparison of average dolphin encounter rates from impact monitoring period (March – May 2024) 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)	
	March – May 2024	**September – November 2011**	**March – May 2024**	**September – November 2011**
Northeast Lantau	0.48 ± 1.17	6.00 ± 5.05	0.48 ± 1.17	22.19 ± 26.81
Northwest Lantau	0.57 ± 0.89	9.85 ± 5.85	1.14 ± 1.77	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. For this quarter, the encounter rates of sightings (STG) and dolphins (ANI) in NWL were 0.40 sightings and 0.80 dolphins per 100 km of survey effort respectively, while the encounter rates of sightings (STG) and dolphins (ANI) in NEL were 0.35 sightings and 0.35 dolphins per 100 km of survey effort respectively.

3.3.3. In NEL, the average dolphin encounter rates (both STG and ANI) in the present three-month impact monitoring period were both 0.48 at exceptionally low level (note: the sighting of this lone animal was extremely rare in NEL), and such near-absence of dolphins in NEL have been consistently recorded in past quarters of HKLR03/TMCLKL monitoring since HKLR03 construction began in late 2012 (Table 4). This is a serious concern as the dolphin occurrence in NEL in the past eight years have remained nil when compared to the baseline period. Dolphins have been virtually absent from NEL waters since the second half of 2015, 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 spring quarters of impact monitoring period and baseline monitoring period (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 2011 (Baseline)	6.00 ± 5.05	22.19 ± 26.81
March-May 2013 (HKLR03 Impact)	0.42 ± 1.03	0.42 ± 1.03
March-May 2014 (HKLR03 Impact)	0.00	0.00
March-May 2015 (HKLR03 Impact)	0.00	0.00
March-May 2016 (HKLR03 Impact)	0.00	0.00
March-May 2017 (HKLR03 Impact)	0.00	0.00
March-May 2018 (HKLR03 Impact)	0.00	0.00
March-May 2019 (HKLR03 Impact)	0.00	0.00
March-May 2020 (HKLR03 Impact)	0.00	0.00
March-May 2021 (TMCLKL Post-Construction)	0.00	0.00
March-May 2022 (TMCLKL Post-Construction)	0.00	0.00
March-May 2023 (HKLR03 Impact)	0.00	0.00
March-May 2024 (HKLR03 Impact)	0.48 ± 1.17	0.48 ± 1.17

3.3.4. On the other hand, the average dolphin encounter rates (STG and ANI) in NWL during the present impact phase monitoring period were only tiny fractions of the ones recorded during the three-month baseline period, indicating a dramatic decline in dolphin usage of this survey area during the present impact phase period (Table 5).

3.3.5. Notably, when comparing among the 11 quarterly periods in spring months since 2013, the quarterly encounter rates in NWL in the past three spring periods plummeted to an exceptionally low level (Table 5). The dramatic drop in dolphin occurrence in NWL in recent years should raise serious concerns, and such temporal trend should be closely monitored in the upcoming monitoring quarters as the construction activities of HKLR03 works will soon be completed in coming months.

Table 5. Comparison of average dolphin encounter rates in Northwest Lantau survey area from all spring quarters of impact monitoring period and baseline monitoring period (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 2011 (Baseline)	9.85 ± 5.85	44.66 ± 29.85
March-May 2013 (HKLR03 Impact)	7.75 ± 3.96	24.23 ± 18.05
March-May 2014 (HKLR03 Impact)	6.51 ± 3.34	19.14 ± 7.19
March-May 2015 (HKLR03 Impact)	0.47 ± 0.73	2.36 ± 4.07
March-May 2016 (HKLR03 Impact)	0.98 ± 1.10	4.78 ± 6.85
March-May 2017 (HKLR03 Impact)	0.93 ± 1.03	5.25 ± 9.53
March-May 2018 (HKLR03 Impact)	2.88 ± 4.81	11.12 ± 22.46
March-May 2019 (HKLR03 Impact)	1.13 ± 1.39	2.54 ± 3.00
March-May 2020 (HKLR03 Impact)	0.56 ± 0.86	0.56 ± 0.86
March-May 2021 (TMCLKL Post-Construction)	1.13 ± 1.37	3.44 ± 4.26
March-May 2022 (TMCLKL Post-Construction)	0.00	0.00
March-May 2023 (HKLR03 Impact)	0.55 ± 0.86	1.35 ± 2.56
March-May 2024 (HKLR03 Impact)	0.57 ± 0.89	1.14 ± 1.77

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 (36th quarter of the impact phase being assessed), the p-values for the differences in average dolphin encounter rates of STG and ANI were 0.0036 and 0.0151 respectively. If the alpha value is set at 0.05, significant differences were detected between the baseline and present quarters in both the average 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. the first 47 quarters of the HKLR03/TMCLKL monitoring programme being assessed), the p-values for the differences in average dolphin encounter rates of STG and ANI were 0.000000 and 0.000000 respectively. Even if the alpha value is set at 0.00001, 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).

3.3.9. As indicated in both dolphin distribution patterns and encounter rates, dolphin usage has been dramatically and significantly reduced in both NEL and NWL survey areas during the present quarterly period when compared to the baseline period, and such low occurrence of dolphins has also been consistently documented in previous quarters of the past eight years throughout the HZMB construction.

3.3.10. The significant decline in dolphin usage of North Lantau region 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 2018). Not only there has been no sign of recovery of dolphin usage, such usage has continued to fall to near-absence level, even though almost all marine works associated with the HZMB construction have been completed, and the Brothers Marine Park has been established in late 2016 as a compensation measure for the permanent habitat loss in association with the HKBCF reclamation works.

3.4. Group size

3.4.1. Three groups of five Chinese White Dolphins were sighted during March to May 2024, resulting in an average group size of 1.67. This was 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 (March – May 2024) and baseline monitoring period (September – November 2011) (Note: ± denotes the standard deviation of the average group size)

	Average Dolphin Group Size	
	March – May 2024	**September – November 2011**
Overall	1.67 ± 0.58 (n = 3)	3.72 ± 3.13 (n = 66)
Northeast Lantau	1.00 (n = 1)	3.18 ± 2.16 (n = 17)
Northwest Lantau	2.00 ± 0.00 (n = 2)	3.92 ± 3.40 (n = 49)

3.4.2. While the average dolphin group sizes in NWL and NEL waters during the present quarterly period were lower than the ones recorded during the three-month baseline period, it should be cautioned that the very small sample size of only three dolphin groups in the present quarter was only a tiny fraction of the sample size of 66 dolphin groups sighted during the baseline period (Table 6).

3.5. Habitat use

3.5.1. From March to May 2024, only three grids in North Lantau waters recorded dolphin occurrence (each with a single sighting) during on-effort search. They were located to the south of HKLR09 alignment, east of Lung Kwu Chau, and north of Siu Mo To, respectively (Figures 3a and 3b). Notably, all grids near HKLR03/HKBCF reclamation sites as well as TMCLKL bridge alignments did not record any presence of dolphins at all during on-effort search in the present quarterly period (Figures 3a and 3b).

3.5.2. 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 should be examined when more survey effort for each grid is 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 drastically diminished in both areas during the present impact monitoring period (Figure 4). During the baseline period, many grids between Siu Mo To and Shum Shui Kok in NEL recorded moderately high to high dolphin densities, which was in stark contrast to the near absence of dolphins there during the present impact phase period.

3.5.4. The density patterns were also drastically different in NWL between the baseline and impact phase monitoring periods, with high dolphin usage recorded throughout the area during the baseline period, especially around Sha Chau, near Black Point, to the west of the airport, as well as between Pillar Point and airport platform. In contrast, only two grids with one sighting each were located near Lung Kwu Chau and at the southwestern corner of the survey area during the present impact phase period (Figure 4).

3.6. Mother-calf pairs

3.6.1. During the present quarterly period, no young calf was sighted at all among the three dolphin groups.

3.7. Activities and associations with fishing boats

3.7.1. During the present quarterly period, one of the three dolphin groups was engaged in feeding activity, which was located just to the east of Lung Kwu Chau (Figure 5). On the contrary, none of these groups was engaged in socializing, traveling or milling/resting activities.

3.7.2. Furthermore, none of the three dolphin groups was found to be associated with any operating fishing vessel during the present impact phase period.

3.8. Summary of photo-identification works

3.8.1. From March to May 2024, around 300 digital photographs were taken during the impact phase monitoring surveys for the photo-identification work.

3.8.2. From two of the three dolphin sightings, a total of three individual dolphins were identified (see summary table in Appendix III and photographs of identified individuals in Appendix IV). All of them were re-sighted only once, and their re-sightings were only made in NWL during the quarterly period.

3.9. Individual range use

3.9.1. Ranging patterns of the three individual dolphins identified during the three-month study period was determined by fixed kernel method, and is shown in Appendix V. They were all utilizing NWL waters only, but have completely avoided NEL waters where many of them have utilized as their core areas in the past, which is in contrary to the extensive movements between NEL and NWL survey areas observed in the baseline period and the first two years of impact monitoring period.

3.9.2. Notably, two of these three individuals (SL67 and WL294) have primarily centered their range use in West and South Lantau waters in the past, but they were re-sighted within their normal ranges and extended further into North Lantau waters during this quarterly period (Appendix V).

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 dramatically reduced in NEL since 2012, and many individuals have shifted away completely from the important habitat around the Brothers Islands.

4.3. It is critical to continuously monitor the dolphin usage in North Lantau region to determine whether the dolphins are continuously affected by the construction activities in relation to the HZMB-related works, and whether suitable mitigation measure can be applied to revert the situation.

5. References

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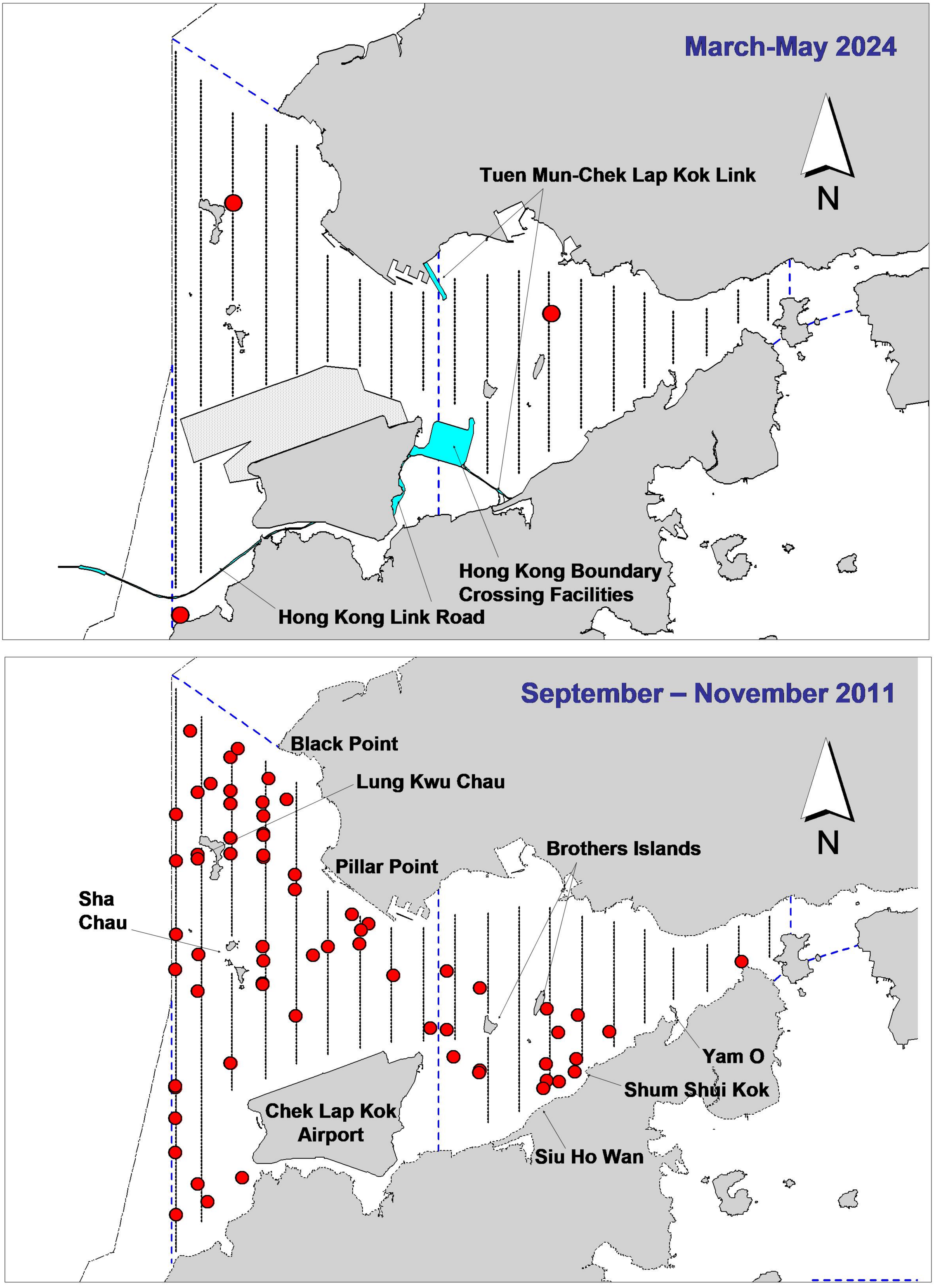

Figure 1. Distribution of Chinese White Dolphin sightings in Northwest and Northeast Lantau during HKLR03 impact phase (top) and baseline monitoring surveys (bottom)

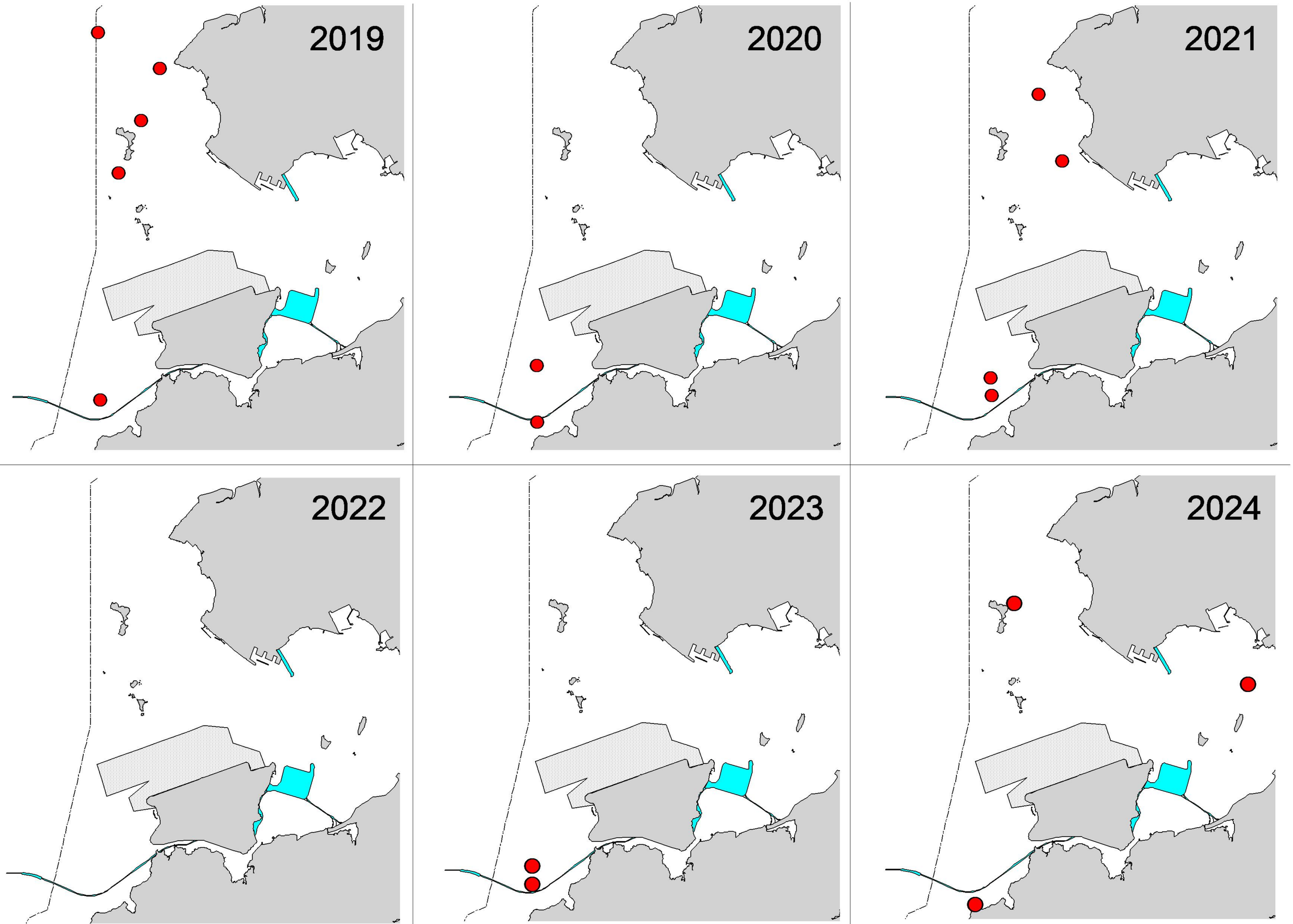

Figure 2. Distribution of Chinese white dolphin sightings in Northwest and Northeast Lantau during the past six spring quarters (March-May) of HKLR03/TMCLKL08 monitoring in 2019-2024

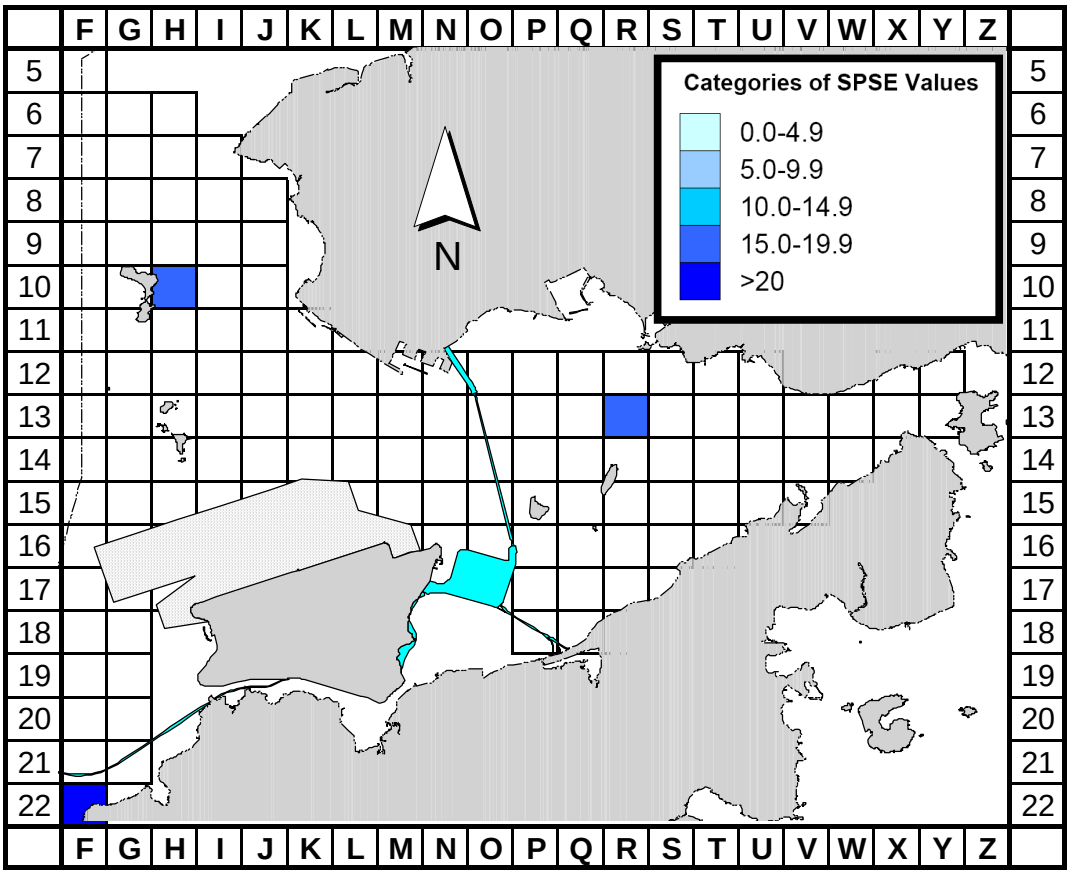

Figure 3a. Sighting density of Chinese White Dolphins with corrected survey effort per km^2 in Northeast and Northwest Lantau survey areas, using data collected during HKLR03 impact monitoring period monitoring period (March-May 2024) (SPSE = no. of on-effort sightings per 100 units of survey effort)

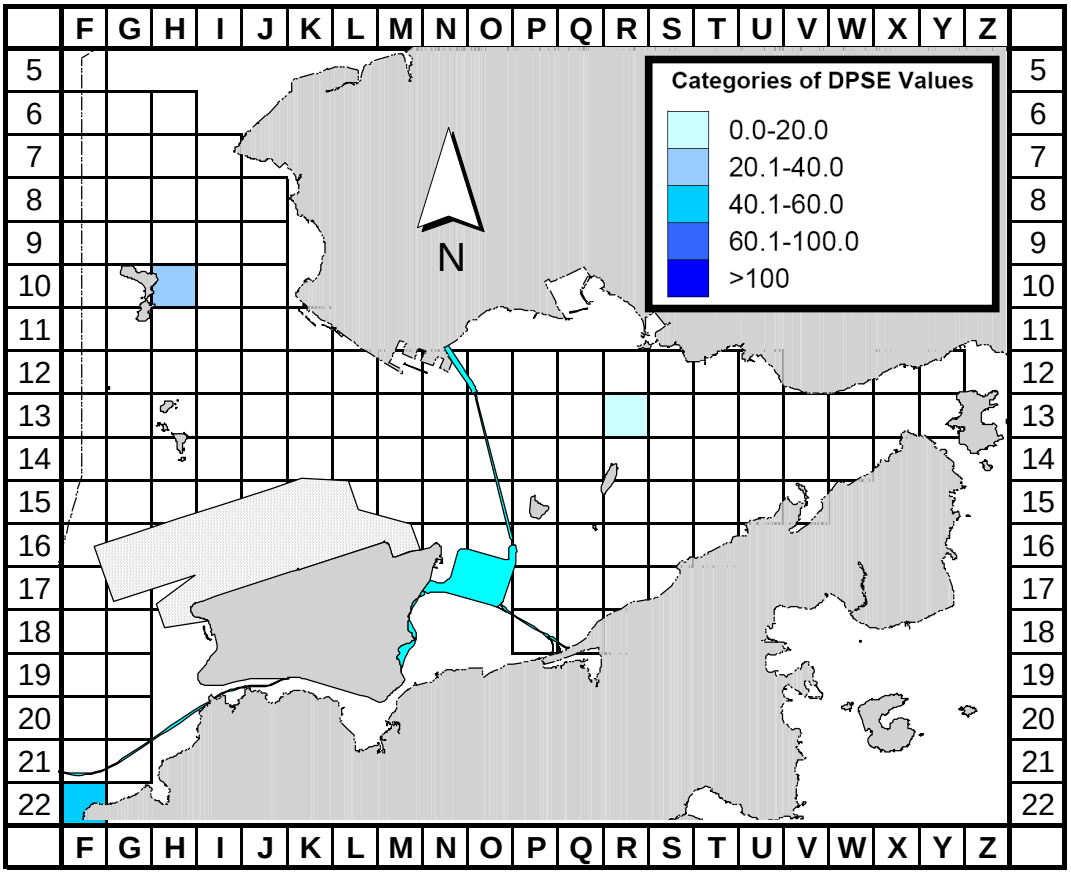

Figure 3b. Density of Chinese White Dolphins with corrected survey effort per km^2 in Northeast and Northwest Lantau survey areas, using data collected during HKLR03 impact monitoring period (March-May 2024) (DPSE = no. of dolphins per 100 units of survey effort)

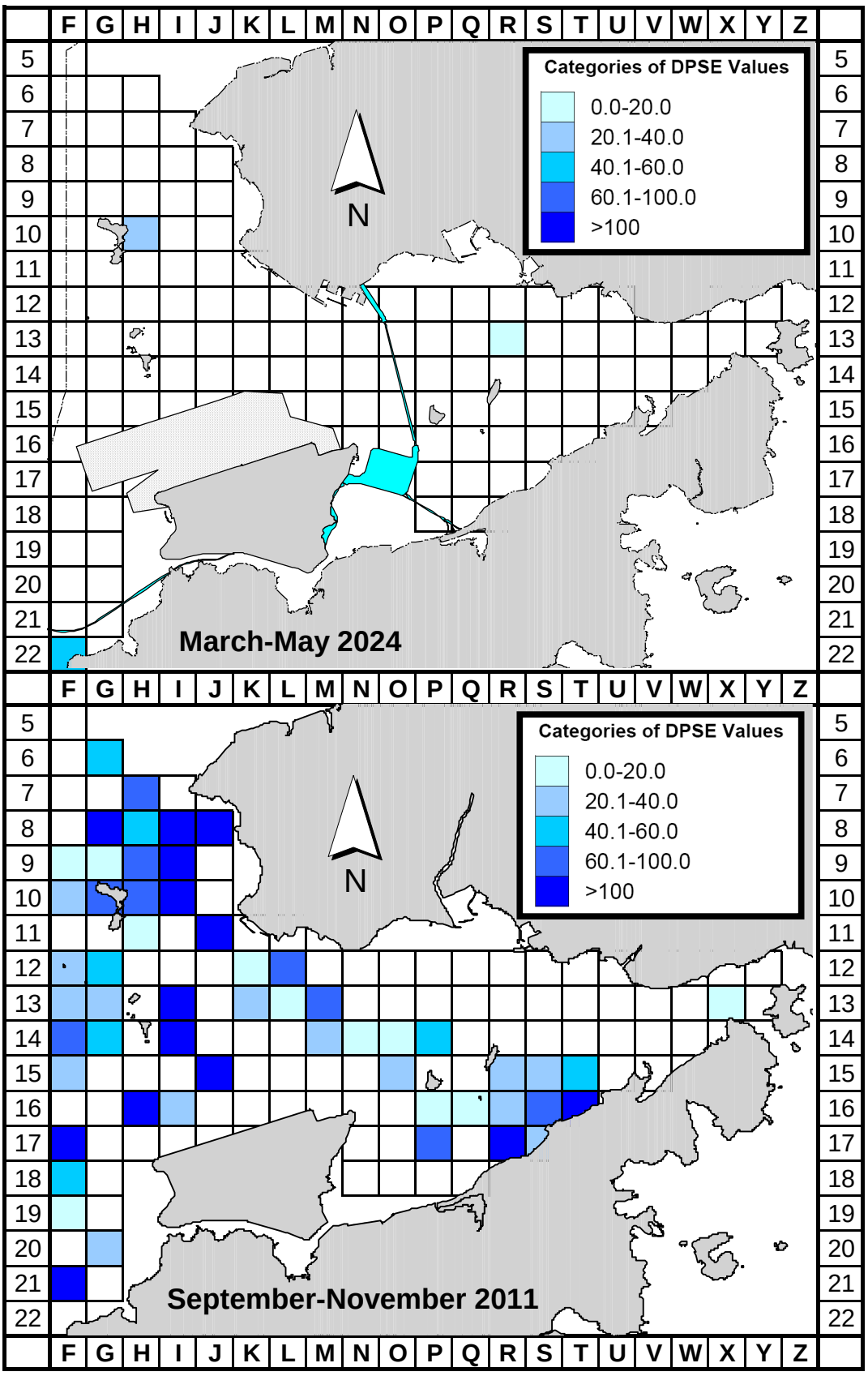

Figure 4. Comparison of density of Chinese White Dolphins with corrected survey effort per km^2 in Northwest and Northeast Lantau survey area between the impact monitoring period (March-May 2024) and baseline monitoring period (September-November 2011)
(DPSE = no. of dolphins per 100 units of survey effort)

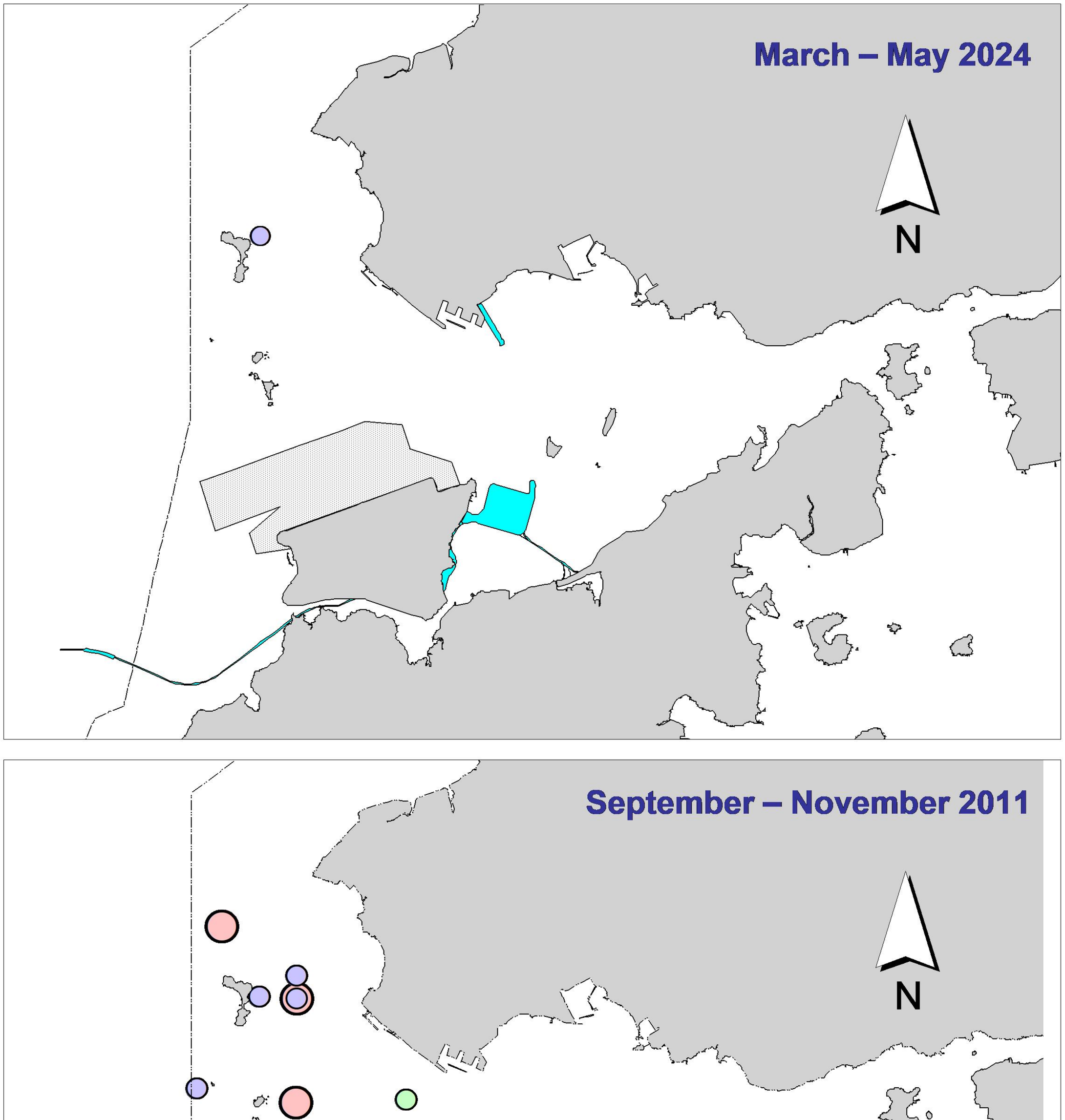

Figure 5. Distribution of Chinese white dolphins engaged in feeding (purple dots), socializing (pink dots) and traveling (green dots) activities during HKLR03 impact phase (top) and baseline monitoring surveys (bottom)

Annex I. HKLR03 Survey Effort Database (March-May 2024)

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

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	TYPE	P/S
04-Mar-24	NW LANTAU	2	0.89	SPRING	STANDARD36826	HKLR	P
04-Mar-24	NW LANTAU	3	32.32	SPRING	STANDARD36826	HKLR	P
04-Mar-24	NW LANTAU	3	13.39	SPRING	STANDARD36826	HKLR	S
04-Mar-24	NW LANTAU	4	2.00	SPRING	STANDARD36826	HKLR	S
04-Mar-24	NE LANTAU	2	21.49	SPRING	STANDARD36826	HKLR	P
04-Mar-24	NE LANTAU	3	13.54	SPRING	STANDARD36826	HKLR	P
04-Mar-24	NE LANTAU	2	6.41	SPRING	STANDARD36826	HKLR	S
04-Mar-24	NE LANTAU	3	6.36	SPRING	STANDARD36826	HKLR	S
05-Mar-24	NW LANTAU	2	9.83	SPRING	STANDARD36826	HKLR	P
05-Mar-24	NW LANTAU	3	13.80	SPRING	STANDARD36826	HKLR	P
05-Mar-24	NW LANTAU	4	1.50	SPRING	STANDARD36826	HKLR	P
05-Mar-24	NW LANTAU	2	4.27	SPRING	STANDARD36826	HKLR	S
05-Mar-24	NW LANTAU	3	5.00	SPRING	STANDARD36826	HKLR	S
05-Mar-24	NW LANTAU	4	1.70	SPRING	STANDARD36826	HKLR	S
15-Mar-24	NW LANTAU	2	12.92	SPRING	STANDARD36826	HKLR	P
15-Mar-24	NW LANTAU	3	21.19	SPRING	STANDARD36826	HKLR	P
15-Mar-24	NW LANTAU	2	3.50	SPRING	STANDARD36826	HKLR	S
15-Mar-24	NW LANTAU	3	12.09	SPRING	STANDARD36826	HKLR	S
15-Mar-24	NE LANTAU	2	11.40	SPRING	STANDARD36826	HKLR	P
15-Mar-24	NE LANTAU	3	23.18	SPRING	STANDARD36826	HKLR	P
15-Mar-24	NE LANTAU	2	6.44	SPRING	STANDARD36826	HKLR	S
15-Mar-24	NE LANTAU	3	6.68	SPRING	STANDARD36826	HKLR	S
20-Mar-24	NW LANTAU	2	20.80	SPRING	STANDARD36826	HKLR	P
20-Mar-24	NW LANTAU	3	4.96	SPRING	STANDARD36826	HKLR	P
20-Mar-24	NW LANTAU	2	6.33	SPRING	STANDARD36826	HKLR	S
20-Mar-24	NW LANTAU	3	1.72	SPRING	STANDARD36826	HKLR	S
02-Apr-24	NW LANTAU	2	3.04	SPRING	STANDARD36826	HKLR	P
02-Apr-24	NW LANTAU	3	30.64	SPRING	STANDARD36826	HKLR	P
02-Apr-24	NW LANTAU	3	15.32	SPRING	STANDARD36826	HKLR	S
02-Apr-24	NE LANTAU	2	15.34	SPRING	STANDARD36826	HKLR	P
02-Apr-24	NE LANTAU	3	19.77	SPRING	STANDARD36826	HKLR	P
02-Apr-24	NE LANTAU	2	6.98	SPRING	STANDARD36826	HKLR	S
02-Apr-24	NE LANTAU	3	5.61	SPRING	STANDARD36826	HKLR	S
08-Apr-24	NW LANTAU	2	22.93	SPRING	STANDARD25686	HKLR	P
08-Apr-24	NW LANTAU	3	2.91	SPRING	STANDARD25686	HKLR	P
08-Apr-24	NW LANTAU	2	11.76	SPRING	STANDARD25686	HKLR	S
11-Apr-24	NW LANTAU	1	3.29	SPRING	STANDARD25686	HKLR	P
11-Apr-24	NW LANTAU	2	7.81	SPRING	STANDARD25686	HKLR	P
11-Apr-24	NW LANTAU	3	23.31	SPRING	STANDARD25686	HKLR	P
11-Apr-24	NW LANTAU	2	8.40	SPRING	STANDARD25686	HKLR	S
11-Apr-24	NW LANTAU	3	6.10	SPRING	STANDARD25686	HKLR	S
11-Apr-24	NE LANTAU	2	20.55	SPRING	STANDARD25686	HKLR	P
11-Apr-24	NE LANTAU	3	14.29	SPRING	STANDARD25686	HKLR	P
11-Apr-24	NE LANTAU	2	10.67	SPRING	STANDARD25686	HKLR	S
11-Apr-24	NE LANTAU	3	2.69	SPRING	STANDARD25686	HKLR	S
18-Apr-24	NW LANTAU	2	6.82	SPRING	STANDARD25686	HKLR	P
18-Apr-24	NW LANTAU	3	19.46	SPRING	STANDARD25686	HKLR	P
18-Apr-24	NW LANTAU	2	2.99	SPRING	STANDARD25686	HKLR	S
18-Apr-24	NW LANTAU	3	8.63	SPRING	STANDARD25686	HKLR	S
09-May-24	NW LANTAU	3	31.89	SPRING	STANDARD25686	HKLR	P
09-May-24	NW LANTAU	4	2.96	SPRING	STANDARD25686	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
09-May-24	NW LANTAU	3	13.55	SPRING	STANDARD25686	HKLR	S
09-May-24	NE LANTAU	3	35.52	SPRING	STANDARD25686	HKLR	P
09-May-24	NE LANTAU	3	13.58	SPRING	STANDARD25686	HKLR	S
10-May-24	NW LANTAU	2	3.40	SPRING	STANDARD25686	HKLR	P
10-May-24	NW LANTAU	3	23.18	SPRING	STANDARD25686	HKLR	P
10-May-24	NW LANTAU	2	0.70	SPRING	STANDARD25686	HKLR	S
10-May-24	NW LANTAU	3	7.22	SPRING	STANDARD25686	HKLR	S
23-May-24	NW LANTAU	2	28.30	SPRING	STANDARD25686	HKLR	P
23-May-24	NW LANTAU	3	8.00	SPRING	STANDARD25686	HKLR	P
23-May-24	NW LANTAU	2	10.50	SPRING	STANDARD25686	HKLR	S
23-May-24	NW LANTAU	3	2.10	SPRING	STANDARD25686	HKLR	S
23-May-24	NE LANTAU	2	26.53	SPRING	STANDARD25686	HKLR	P
23-May-24	NE LANTAU	3	8.37	SPRING	STANDARD25686	HKLR	P
23-May-24	NE LANTAU	2	9.81	SPRING	STANDARD25686	HKLR	S
23-May-24	NE LANTAU	3	3.69	SPRING	STANDARD25686	HKLR	S
28-May-24	NW LANTAU	2	26.13	SPRING	STANDARD25686	HKLR	P
28-May-24	NW LANTAU	2	11.57	SPRING	STANDARD25686	HKLR	S

Annex II. HKLR03 Chinese White Dolphin Sighting Database (March-May 2024)

(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
4-Mar-24	1	1011	2	NW LANTAU	2	117	ON	HKLR	814628	804763	SPRING	NONE	P
15-Mar-24	1	1136	2	NW LANTAU	3	154	ON	HKLR	826883	806456	SPRING	NONE	P
11-Apr-24	1	1453	1	NE LANTAU	2	22	ON	HKLR	823600	816535	SPRING	NONE	P

Annex III. Individual dolphins identified during HKLR03 monitoring surveys in March-May 2024

ID#	DATE	STG#	AREA
NL261	15/03/24	1	NW LANTAU
SL67	15/03/24	1	NW LANTAU
WL294	04/03/24	1	NW LANTAU

Annex IV. Three individual dolphins that were identified between March and May 2024 under HKLR03 impact phase monitoring surveys

Annex V. Ranging pattern (95% kernel ranges) of three individual dolphins that were sighted during HKLR03 impact phase monitoring period (note: yellow dots indicate sightings made in March-May 2024 during HKLR03 monitoring surveys)