Appendix C

Operational Phase Dolphin Monitoring Survey

AGREEMENT NO. HMWSD 1/2021 (EP)
Post-Construction Monitoring of Chinese White Dolphin for Hong Kong-Zhuhai-Macao Bridge Tuen Mun – Chek Lap Kok Link

Second Annual Progress Report (June 2021 – May 2022)
submitted to ERM Hong Kong Ltd.

Submitted by
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1. Introduction

1.1. As part of the Hong Kong-Zhuhai-Macao Bridge (HZMB), the Tuen Mun-Chek Lap Kok Link (TMCLKL) is a designated project under the Environmental Impact Assessment Ordinance (EIAO). The Environmental Impact Assessment (EIA) Report and Environmental Monitoring and Audit (EM&A) Manual (EIA Register No.: AEIAR-146/2009) for the project were approved by the Director of Environmental Protection in October 2009 and the Environmental Permit No. EP-354/2009 (EP) was issued in November 2009. The EP has been subject to several variations and the current one is EP No. EP-354/2009/D.

1.2. The TMCLKL was constructed under two works contracts namely Contract No. HY/2012/07 (Southern Connection Viaduct Section) and Contract No. HY/2012/08 (North Connection Sub-sea Tunnel Section). In accordance with the EP, the Contractors of Contract No. HY/2012/07 and Contract No. HY/2012/08 have separately employed their own Environmental Team (ET) and ET Leader to conduct construction phase monitoring of Chinese White Dolphin (CWD) in the North Lantau (NL) waters, which included the Northeast Lantau (NEL) and Northwest Lantau (NWL) survey areas, following the requirements specified in the EM&A Manual and the relevant contract specifications of the two contracts.

1.3. In accordance with Section 6.1 of the EM&A Manual and the EP, an ecological monitoring and audit programme is needed to monitor potential impacts through construction and operation activities of TMCLKL. The construction and post-construction (operational) EM&A objectives are to ensure that the ecological contract works and construction mitigation procedures recommended in the EIA are carried out as specified and are effective. Post-construction phase EM&A will comprise the audit of the measures as appropriate. In order for such monitoring to be effective, it needs to be divided into three phases: pre-disturbance (i.e. baseline phase), the entire period of disturbance (i.e. construction or impact phase) and post-disturbance after the completion of construction works (i.e. post-construction phase). Survey techniques must

be held constant from phase to phase, and survey equipment and personnel should ideally be the same as well.

1.4. The main objective of the current assignment commissioned by the Highways Department is to conduct the post-construction monitoring of CWD in NL waters in compliance with the requirements stipulated in the EM&A Manual and the EP for the TMCLKL works. Such monitoring should be conducted for two years upon the completion of all marine-based construction activities for the TMCLKL according to the EM&A Manual, which were completed in May 2020. From June 2020 to August 2021, 15 months of post-construction dolphin monitoring had been carried out by the ET / ET Leader appointed under Contract No. HY/2012/08, while the remaining nine months of post-construction dolphin monitoring has been completed under this assignment, from September 2021 to May 2022.

1.5. In August 2021, the ERM Hong Kong (ERMHK) Limited has been appointed as the Consultant responsible for the nine months of post-construction monitoring of CWD in NL waters for the TMCLKL. Subsequently, the Hong Kong Cetacean Research Project (HKCRP) has been appointed by ERMHK to collaborate and undertake the dolphin monitoring tasks to conduct systematic line-transect vessel surveys

1.6. As part of the post-construction dolphin monitoring programme, this report is the second annual progress report summarizing the results of the surveys findings during the second annual post-construction monitoring period of June 2021 to May 2022.

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 post-construction monitoring period. The co-ordinates of all transect lines conducted during the post-construction dolphin monitoring surveys 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 teams 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 20 years of marine mammal monitoring surveys in Hong Kong developed by HKCRP (see Hung 2021). 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.

2.1.4. 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°). 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.

2.1.5. During on-effort survey periods, the survey team recorded effort data including time, positions (latitude and longitude), weather conditions (Beaufort sea state and visibility), and distance traveled in each series (a continuous period of search effort) with the assistance of a handheld GPS.

2.1.6. Data including time, position and vessel speed were also automatically and continuously logged by handheld GPS throughout the entire survey for subsequent review.

2.1.7. 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.

2.1.8. 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. A professional digital camera (*Canon* EOS 7D model), equipped with long telephoto lenses (100-400 mm zoom), were available on board for researchers to take sharp, close-up photographs of dolphins as they surfaced. The images were shot at the highest available resolution and stored on Compact Flash memory cards for downloading onto a computer.

2.2.3. All digital images taken in the field were first examined, and those containing potentially identifiable individuals were sorted out. These photographs would then be examined in greater detail, and were carefully compared to the existing Chinese White Dolphin photo-identification catalogue maintained by HKCRP since 1995.

2.2.4. Chinese White Dolphins can be identified by their natural markings, such as nicks, cuts, scars and deformities on their dorsal fin and body, and their unique spotting patterns were also used as secondary identifying features (Jefferson 2000).

2.2.5. All photographs of each individual were then compiled and arranged in chronological order, with data including the date and location first identified (initial sighting), re-sightings, associated dolphins, distinctive features, and age classes entered into a computer database.

2.3. Data Analysis

2.3.1. The following analyses were performed utilizing the dolphin monitoring data collected during the second year of TMCLKL post-construction dolphin monitoring from June 2021 to May 2022.

2.3.2. Furthermore, these analyses were also conducted for the one-year baseline phase (one year before commencement of HZMB construction works; i.e. February 2011 to January 2012); the one-year of transitional phase (one year after the commencement of HZMB construction works (HKBCF and HKLR works), but before the commencement of TMCLKL construction works; i.e. November 2012 to October 2013); the first to sixth years of TMCLKL construction (i.e. November 2013 to October 2014, November 2014 to October 2015, November 2015 to October 2016; November 2016 to October 2017; November 2017 to October 2018; and November 2018 to October 2019); and the first year after TMCLKL construction being completed (i.e. June 2020 to May 2021).

2.3.3. Along with the analyzed results from the baseline, transitional and impact phase as well as the first year of the post-construction phase, results from the second year of post-construction phase can then be interpreted from the examination of any temporal changes before, during and after the construction activities of TMCLKL (with a total of ten 12-month periods) on dolphin usage in North Lantau waters. Notably, for the baseline phase, both baseline monitoring data collected under HZMB contract as well as the AFCD long-term dolphin monitoring data were included to increase the sample size in order to match the similar amount of survey effort in transitional and impact phases.

Distribution analysis

2.3.4. 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 further stratified into different subsets to examine distribution patterns of dolphin groups with different categories of group sizes, young calves and activities.

Encounter rate analysis

2.3.5. Encounter rates of Chinese White Dolphins (number of on-effort sightings per 100 km of survey effort, and total number of dolphins sighted on-effort per 100 km of survey effort) were calculated in NEL and NWL survey areas in relation to the amount of survey effort

conducted during each month of monitoring survey. Only data collected under Beaufort 3 or below condition would be used for the encounter rate analyses. Dolphin encounter rates during the post-construction phase were calculated in two ways for comparisons with different phases of HZMB monitoring results as well as to the AFCD long-term marine mammal monitoring results.

2.3.6. Firstly, for the comparison with the HZMB monitoring results, the encounter rates were calculated using primary survey effort alone. The average encounter rate of sightings (STG) and average encounter rate of dolphins (ANI) were deduced based on the encounter rates from the 24 events during the present 12-month study period (i.e. 24 sets of line-transect surveys in North Lantau), which was also compared with the ones deduced from the events during the first year of post-construction phase, six years of impact phase as well as the transitional and baseline phases.

2.3.7. Secondly, the encounter rates were also calculated using both primary and secondary survey effort 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 12-month study period.

Quantitative grid analysis on habitat use

2.3.8. To conduct quantitative grid analysis of habitat use, positions of on-effort sightings of Chinese White Dolphins collected during the 12-month post-construction 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.

2.3.9. Sighting density grids and dolphin density grids were then 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).

2.3.10. 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

Behavioural analysis

2.3.11. When dolphins were sighted during vessel surveys, their behaviour was observed. Different activities were categorized (i.e. feeding, socializing, traveling, and milling/resting) and recorded on sighting datasheets. This data was then input into a separate database with sighting information, which can be used to determine the distribution of behavioural data with a desktop GIS. Sighting distribution 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.

Ranging pattern analysis

2.3.12. Location data of individual dolphins that occurred during the present 12-month post-construction 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 second year of TMCLKL post-construction phase monitoring from June 2021 to May 2022, a total of 24 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 3,378.22 km of survey effort was collected, with 99.89% 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, 1,327.58 km and 2,050.64 km of survey effort were conducted in NEL and NWL survey areas respectively.

3.1.3. Within the 12-month study period, the total survey effort conducted on primary lines was 2,341.24 km, while the effort on secondary lines was 1,036.98 km. The survey effort conducted on primary and secondary lines were both considered on-effort survey data. Summary table of the survey effort is shown in Appendix I.

3.1.4. From the 24 sets of 2021-22 monitoring surveys, a total of 11 groups of 23 Chinese White Dolphins were sighted. All dolphin groups were sighted in NWL during on-effort search, with nine made on primary lines, and the other two made on secondary lines. No dolphin was sighted at all in NEL. A summary table of the dolphin sightings is shown in

Appendix II.

3.2. Distribution

3.2.1. Distribution of dolphin sightings made during the second year of TMCLKL post-construction monitoring surveys is shown in Figure 1. Almost all of these sightings were concentrated at the western end of the North Lantau region, and mainly clustered at the northern potion of the Sha Chau and Lung Kwu Chau Marine Park (Figure 1). A few sightings were also made to the east of Sha Chau as well as near the HKLR09 alignment to the west of the airport platform.

3.2.2. Notably, none of the dolphin groups were sighted in the vicinity of the entire alignment of TMCLKL as well as the reclamation sites of HKLR03 and HKBCF (Figure 1). In general, dolphins appeared to have mostly avoided the construction areas of HZMB works during the present monitoring period, which was consistent with the dolphin distribution patterns observed throughout the TMCLKL EM&A programme.

3.2.3. Dolphin sighting distribution of the present post-construction monitoring period in 2021-22 was compared with the ones during the baseline phase in 2011-12, the transitional phase in 2012-13, the six years of impact phase (2013-14, 2014-15, 2015-16, 2016-17, 2017-18, and 2018-19), as well as the first year of post-construction phase in 2020-21. In 2021-22, dolphin distribution was quite similar to the five impact phase periods from 2014-19 and the first year of post-construction phase, with dolphins being largely vacated from the eastern and central portions of NL region, and mainly concentrated their occurrence around the northwestern portion of the region (Figure 2).

3.2.4. This was in stark contrast to their very frequent occurrence around the Brothers Islands, Shum Shui Kok, the waters between Pillar Point and airport platform, and the vicinity of HZMB-associated work sites during the baseline period (Figure 2). Even in the transitional phase, dolphins still utilized these waters in a moderate extent, but such usage has progressively diminished during the six annual periods during the TMCLKL construction as well as the two annual periods after the construction (Figure 2).

3.2.5. The only area where dolphin occurrence was relatively consistent across the ten annual periods was around the Lung Kwu Chau area, but even so, such occurrence has been diminishing progressively in the past eight annual periods. Such decline in dolphin usage was even more evident in the past three annual periods in 2108-19, 2020-21 and 2021-22, with much lower occurrences in this area during the most recent period (Figure 2).

3.3. Encounter rate

3.3.1. During the present 12-month post-construction phase monitoring period, the average daily encounter rates of Chinese White Dolphins were deduced in NEL and NWL survey areas, and compared to the ones deduced from the baseline, transitional and six years of impact phases (Table 2).

3.3.2. To facilitate the comparison with the AFCD long-term monitoring results, the encounter rates were also calculated for the same 12-month study period using both primary and

secondary survey effort. The encounter rates of sightings (STG) and dolphins (ANI) in NWL were 0.54 sightings and 1.12 dolphins per 100 km of survey effort respectively, while the encounter rates of sightings (STG) and dolphins (ANI) in NEL were both nil with no on-effort sighting being made there in 2021-22.

Table 2. Comparison of average daily dolphin encounter rates from the two years of post-construction phase, six years of impact phase, transitional phase and baseline phase monitoring periods (Note: encounter rates deduced were calculated based on survey 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)	
	Northeast Lantau	**Northwest Lantau**	**Northeast Lantau**	**Northwest Lantau**
Post-Construction Phase (2021-22)	0.00	0.73 ± 1.24	0.00	1.46 ± 2.82
Post-Construction Phase (2020-21)	0.00	1.31 ± 1.88	0.00	3.39 ± 5.73
Impact Phase (2018-19)	0.00	1.42 ± 1.80	0.00	3.62 ± 4.93
Impact Phase (2017-18)	0.00	2.68 ± 3.04	0.00	9.02 ± 14.63
Impact Phase (2016-17)	0.00	2.35 ± 2.62	0.00	8.57 ± 11.05
Impact Phase (2015-16)	0.00	2.10 ± 1.83	0.00	8.54 ± 8.53
Impact Phase (2014-15)	0.11 ± 0.54	2.54 ± 2.49	0.11 ± 0.54	11.64 ± 14.04
Impact Phase (2013-14)	0.22 ± 0.74	6.93 ± 4.08	0.76 ± 2.59	26.31 ± 17.56
Transitional Phase (2012-13)	1.70 ± 2.26	7.68 ± 4.36	4.75 ± 7.61	27.51 ± 18.06
Baseline Phase (2011-12)	6.05 ± 5.04	7.75 ± 5.69	19.91 ± 21.30	29.57 ± 26.96

3.3.3. In NEL, the dolphin encounter rates (both STG and ANI) during the second year of post-construction monitoring period were nil as in the previous five periods in 2015-16, 2016-17, 2017-18, 2018-19 and 2020-21, and these were in stark contrast to the higher averages during the baseline and transitional phases (Table 2). Such progressive decline in dolphin encounter rates actually existed in this area since the transitional phase in 2012-13 (i.e. well before the TMCLKL construction works commenced), with such averages being much lower than the ones in the baseline phase (with reductions of 71.9% for ER(STG) and 76.1% for ER(ANI)). Since then, dolphin occurrence diminished further to an extremely low level during the first and second impact phase periods of TMCLKL construction works, and then to complete absences in the subsequent annual periods (Table 2).

3.3.4. On the other hand, the average dolphin encounter rates (STG and ANI) in NWL during the present post-construction phase monitoring period were drastically lower (with reductions of 90.6% and 95.1% for ER(STG) and ER(ANI) respectively) than the ones recorded in the baseline period (Table 2), indicating a dramatic decline in dolphin usage of this survey area. Notably, those annual encounter rates remained at consistently low

levels in the past six consecutive periods since 2014-15, and there was still a decline between the two years of post-construction period in 2020-21 and 2021-22.

3.3.5. It should also be noted that the encounter rates in NWL during the first year of impact phase (2013-14) were only slightly lower than the baseline and transitional phases, but such decline has quickly accelerated during the subsequent annual periods during the impact and post-construction phases. The dramatic drop in dolphin occurrences between 2013-14 and 2014-15 at the peak of HZMB construction works signaled a further widespread of declining usage from NEL waters to the entire North Lantau region with no sign of recovery, even though most marine works associated with the HZMB construction has already been completed.

3.3.6. A two-way ANOVA with repeated measures of variance and unequal sample size was conducted to examine whether there were any significant differences in the average encounter rates between the ten monitoring periods throughout baseline, transitional, impact and post-construction phases. The two variables that were examined included the different periods and the two locations (i.e. NEL and NWL).

3.3.7. Such comparison revealed that the p-value for the differences in average dolphin encounter rates of STG and ANI were both 0.000000 and 0.00000 respectively. Even if the alpha value is set at 0.00001, significant differences were detected among the different periods in both dolphin encounter rates of STG and ANI.

3.4. Group size

3.4.1. Group size of Chinese White Dolphins ranged from singletons to six individuals per group in NL region during the second post-construction monitoring period in 2021-22. The average dolphin group sizes in the present monitoring period were compared with the ones deduced from different phases of TMCLKL construction, as shown in Table 3.

Table 3. Comparison of average dolphin group sizes from the monitoring periods in post-construction, impact, transitional and baseline phases (± denotes the standard deviation of the average encounter rates)

	Average Dolphin Group Size		
	Overall	**Northeast Lantau**	**Northwest Lantau**
Post-construction Phase (2021-22)	2.09 ± 1.64 (n = 11)	0.00	2.09 ± 1.64 (n = 11)
Post-construction Phase (2020-21)	2.64 ± 2.08 (n = 22)	0.00	2.64 ± 2.08 (n = 22)
Impact Phase (2018-19)	2.52 ± 1.45 (n = 27)	0.00	2.52 ± 1.45 (n = 27)
Impact Phase (2017-18)	3.12 ± 2.86 (n = 42)	0.00	3.12 ± 2.86 (n = 42)
Impact Phase (2016-17)	3.51 ± 2.68 (n = 43)	0.00	3.51 ± 2.68 (n = 43)
Impact Phase (2015-16)	3.73 ± 3.14 (n = 45)	1.00 (n = 1)	3.80 ± 3.14 (n = 44)
Impact Phase (2014-15)	4.24 ± 3.15 (n = 54)	1.00 (n = 1)	4.30 ± 3.15 (n = 53)
Impact Phase (2013-14)	3.76 ± 2.57 (n = 136)	5.00 ± 2.71 (n = 4)	3.73 ± 2.57 (n = 132)
Transitional Phase (2012-13)	3.37 ± 2.98 (n = 186)	2.64 ± 2.38 (n = 22)	3.47 ± 3.05 (n = 164)
Baseline Phase (2011-12)	3.32 ± 2.86 (n = 288)	2.80 ± 2.35 (n = 79)	3.52 ± 3.01 (n = 209)

3.4.2. The average dolphin group size in NWL waters (and also the entire North Lantau region as no dolphin was sighted in NEL waters) during the present post-construction phase monitoring period was the lowest among all annual periods of the baseline, transitional, construction and post-construction phases (Table 3). There was also a clear decline in average dolphin group size in recent annual periods.

3.4.3. Among the 11 dolphin groups sighted in 2021-22, ten of them were composed of 1-4 individuals only, while only one group was moderate in size with six animals (Appendix II), which was located to the east of Sha Chau (Figure 3).

3.4.4. Distribution of dolphins with larger group sizes (i.e. five individuals or more per group) during the present monitoring period is shown in Figure 3, with comparison to the ones from the first year of post-construction phase, six years of impact phase as well as the transitional and baseline phases.

3.4.5. Throughout the six impact phases as well as the two post-construction phases, distribution of these slightly larger groups has been consistently confined to the northwestern portion of the North Lantau region. Such limited distribution was drastically different from the baseline phase, when the larger dolphin groups were distributed more evenly in NWL waters with many of them also sighted in NEL waters (Figure 3). The dramatic decline in occurrences of larger dolphin groups was most evident in the past seven annual periods since 2014-15.

3.5. Habitat use

3.5.1. During the present post-construction phase monitoring period in 2021-22, only 11 grids recorded dolphin densities (each with only one on-effort sighting), and all of these grids were with very low densities, except a grid to the east of Sha Chau with moderately low density (Figures 4a and 4b). Moreover, all grids near the HKLR03 and HKBCF reclamation sites as well as the entire alignment of TMCLKL did not record any presence of dolphins in the present monitoring period in 2021-22 (Figures 4a and 4b).

3.5.2. When compared with the habitat use patterns during the baseline phase, dolphin usage in NEL has progressively diminished during the transitional phase and the subsequent six periods of impact phase as well as the two periods of post-construction phase (Figure 5). During the baseline period, a number of grids between Siu Mo To and Shum Shui Kok recorded moderately high to high dolphin densities, and most grids in NEL recorded dolphin usage. This was in stark contrast to the complete absence of dolphin in this area during the last four construction phase periods and the two post-construction phase periods (Figure 5).

3.5.3. Moreover, dolphin usage of NWL waters has also declined dramatically in recent years (including the most recent one in 2021-22) (Figure 5). This is in contrast to a more evenly spread usage in NWL during the baseline phase, transitional phase and the first year of impact phase monitoring. Apparently, there has been a more widespread decline of dolphin usage throughout the North Lantau waters in recent years of impact phase monitoring as well as the entire post-construction monitoring period, falling to the lowest

level in the most recent period (Figure 5).

3.6. Mother-calf pairs

3.6.1. During the second year of post-construction monitoring, no mother-calf pair was spotted at all among the 11 dolphin groups (Figure 6). Notably, the absence of young calves was consistent with their extremely low occurrences in recent impact phase monitoring periods as well as the first year of post-construction period, ranging from 0% in 2015-16 and 2017-18 to 1.5% in 2018-19 and 1.7% in 2020-21. This is in stark contrast to the higher percentages recorded during the first impact phase monitoring period in 2013-14 (5.7%), the transitional phase (6.7%) and the baseline phase (4.5%).

3.6.2. The extremely rare occurrence of young calves in NL region in the past seven monitoring periods was drastically different from the distribution patterns observed during the baseline phase, transitional phase and first year of impact phase when young calves were sighted throughout the region (Figure 6).

3.7. Activities and associations with fishing boats

3.7.1. Only one of the 11 dolphin groups was associated with feeding activity during the 2021-22 monitoring period, which was located to the east of Sha Chau (Figure 7). On the other hand, none of them was associated with any socializing, traveling or resting/milling activity.

3.7.2. The comparison in distribution of dolphins engaged in different activities during different monitoring phases revealed that feeding activities were more frequently sighted during the baseline and transitional periods along the Urmston Road, within the Sha Chau and Lung Kwu Chau Marine Park, to the west of the airport platform and around the Brothers Islands, while the socializing activities were more scattered throughout the North Lantau region for these periods (Figure 7). However, it is evident that the “hotspots” where dolphins engaged in different activities were considerably different between the baseline, transitional, impact phases as well as the post-construction phase, with drastic decline in frequency of such occurrences.

3.7.3. Notably, none of the 11 dolphin groups sighted during the present monitoring period in 2021-22 was found to be associated with any operating fishing vessel. The extremely rare events of fishing boat associations by the dolphins in recent years of TMCLKL monitoring (including the two post-construction periods in 2020-21 and 2021-22) were very different from the baseline period when 14 of 288 dolphin groups were associated with fishing boats.

3.8. Summary of photo-identification works

3.8.1. During the present post-construction phase monitoring period in 2021-22, a total of 14 individuals sighted 21 times altogether were identified (see Appendix III). All of these re-sightings were made in NWL.

3.8.2. Most of these identified individuals were sighted only once or twice, but one individual was sighted more than twice. This individual dolphin, NL123, was sighted four times in 2021-22 among the 11 dolphin sightings made during the period. Its relatively more

frequent occurrences during the second year of post-construction phase monitoring indicated slightly stronger reliance of NWL waters as part of its home range, while most identified individuals rarely ventured into NWL waters.

3.8.3. Notably, none of the individual dolphins was accompanied with any young calf during their re-sightings recorded in 2021-22 monitoring period.

3.9. Individual range use

3.9.1. Ranging patterns of the 14 individuals identified during the 12-month post-construction phase monitoring period in 2021-22 were determined by fixed kernel method, and are shown in Appendix IV.

3.9.2. The individual range use analysis revealed that only five of the 14 identified dolphins sighted in NWL waters within this 12-month period have been utilizing their ranges primarily in North Lantau in the past and present. On the contrary, five individuals split their range use between North and West Lantau waters in the past, while the other four individuals had their ranges primarily centered in WL and SWL waters but have infrequently ventured into NWL waters during the present post-construction monitoring period (Appendix IV).

3.9.3. Notably, all dolphins identified in 2021-22 have avoided the NEL waters, the area where many individual dolphins have utilized as their core areas of activities before the HZMB construction.

4. 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. 2021. Monitoring of marine mammals in Hong Kong waters: final report (2020-21). An unpublished report submitted to the Agriculture, Fisheries and Conservation Department of Hong Kong SAR Government, 154 pp.

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

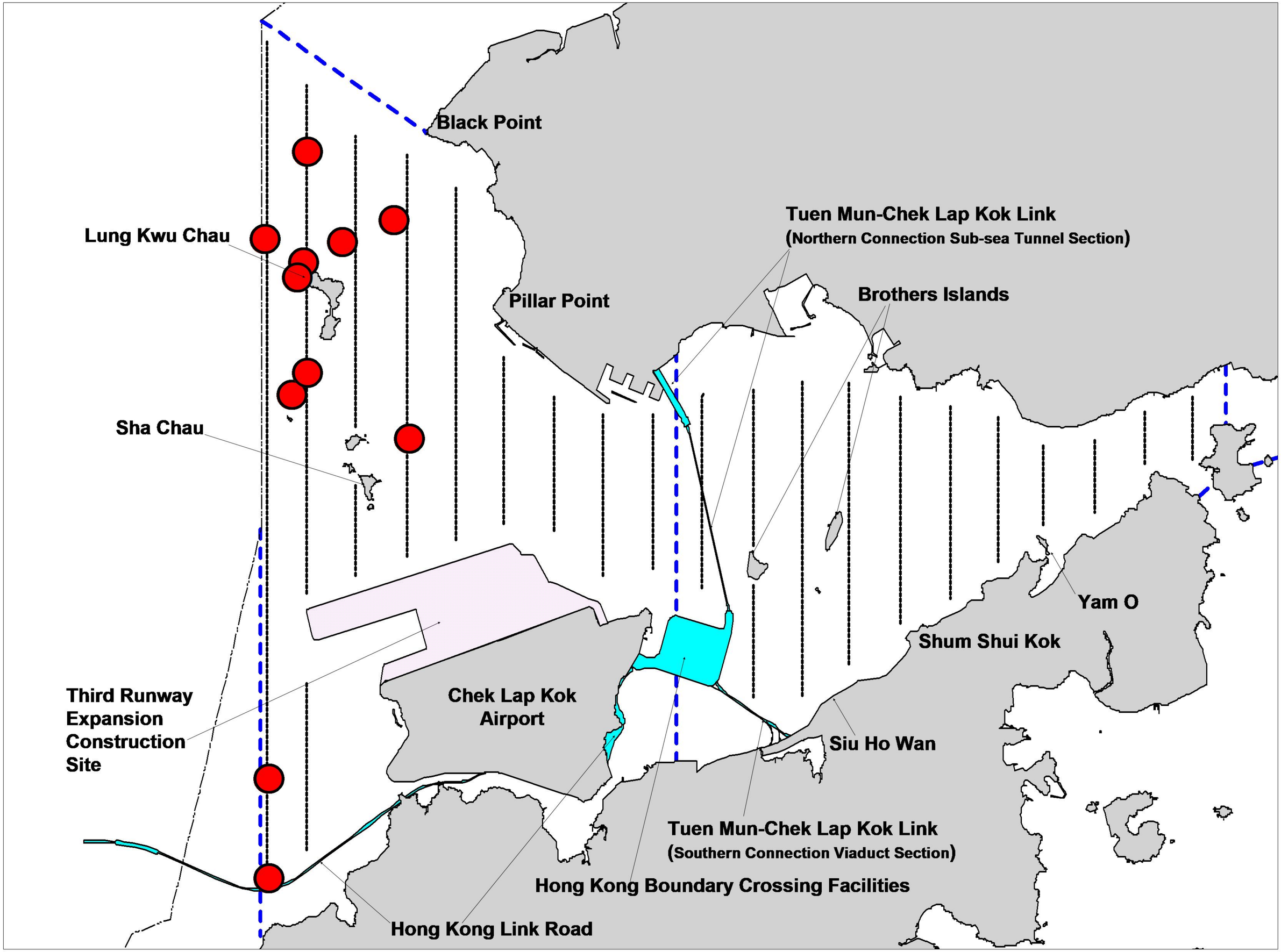


Figure 1. Distribution of Chinese White Dolphin sightings in North Lantau region during the second year of TMCLKL post- construction monitoring period from June 2021 to May 2022

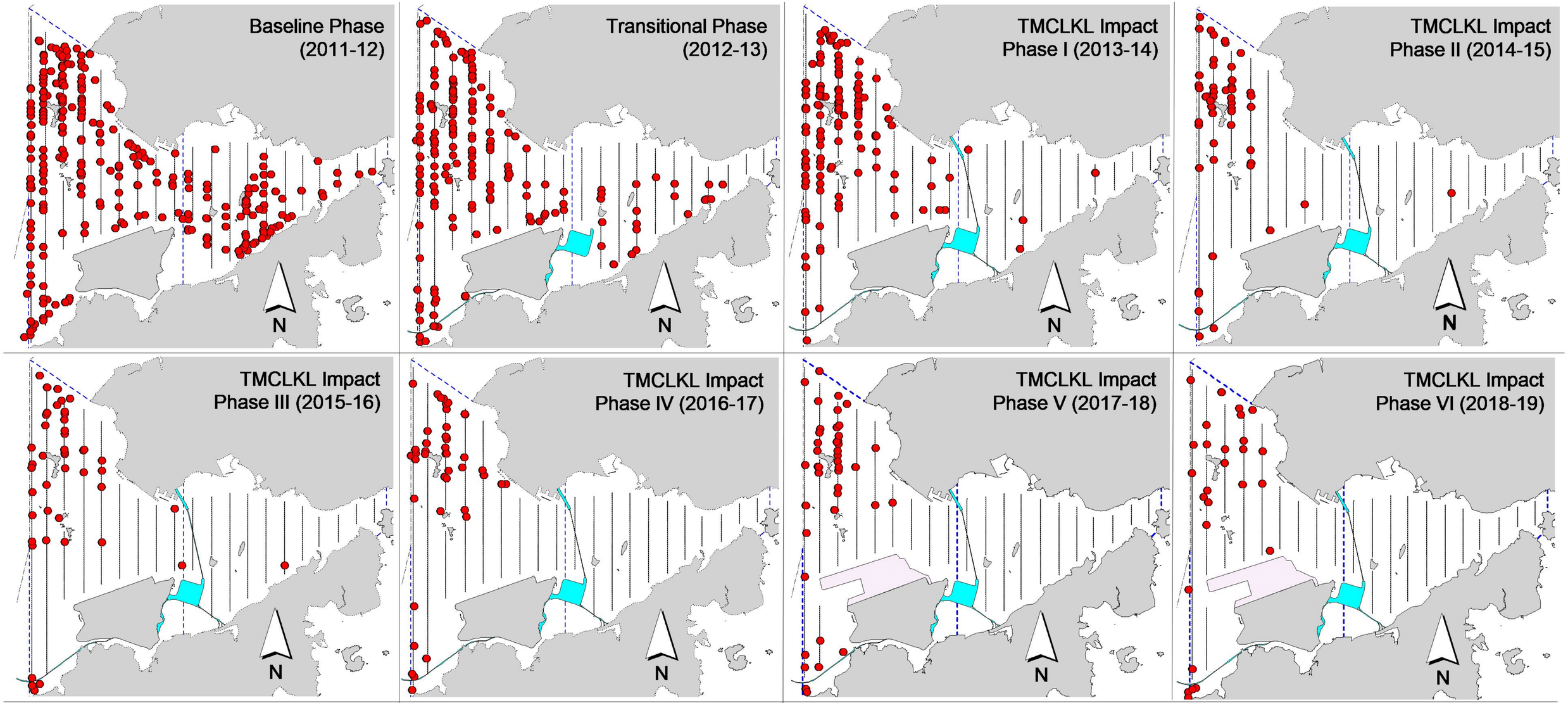


Figure 2. A comparison on distribution of Chinese White Dolphin sightings in North Lantau region during the baseline (2011-12), transitional (2012-13), six impact phases (2013-14, 2014-15, 2015-16, 2016-17, 2017-18 & 2018-19) and the two post-construction phase (2020-21 & 2021-22) of TMCLKL construction works

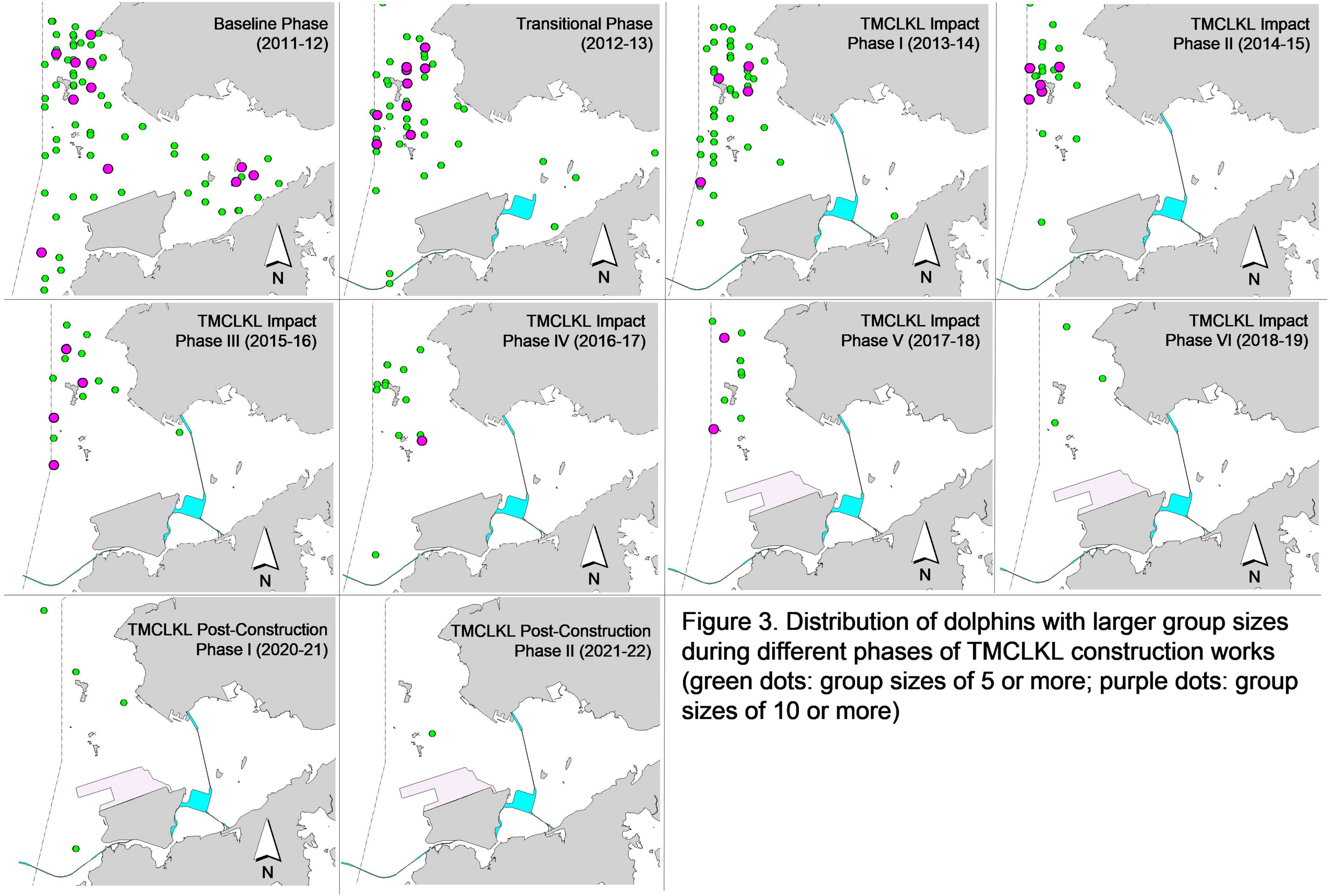


Figure 3. Distribution of dolphins with larger group sizes during different phases of TMCLKL construction works (green dots: group sizes of 5 or more; purple dots: group sizes of 10 or more)

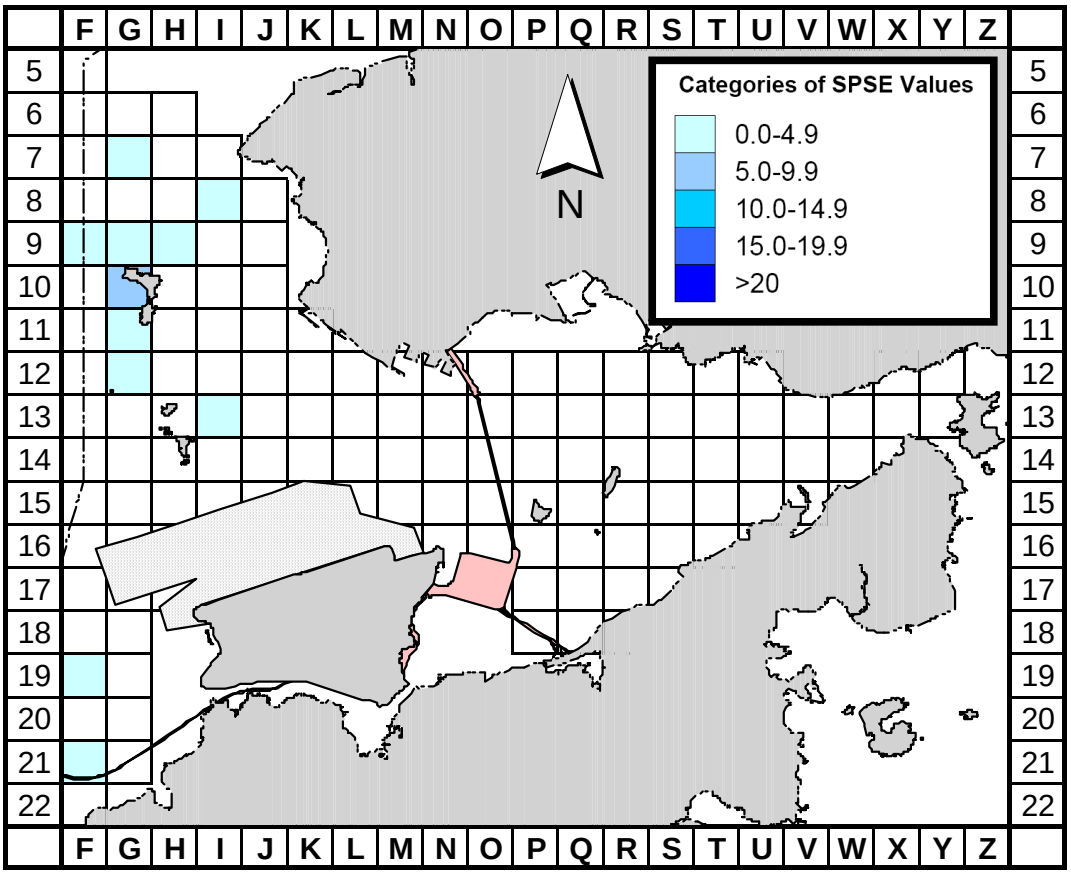


Figure 4a. Sighting density of Chinese white dolphins with corrected survey effort per km^2 in Northeast and Northwest Lantau survey areas, using data collected during the TMCLKL post-construction monitoring period in June 21-May 22 (SPSE = no. of on-effort sightings per 100 units of survey effort)

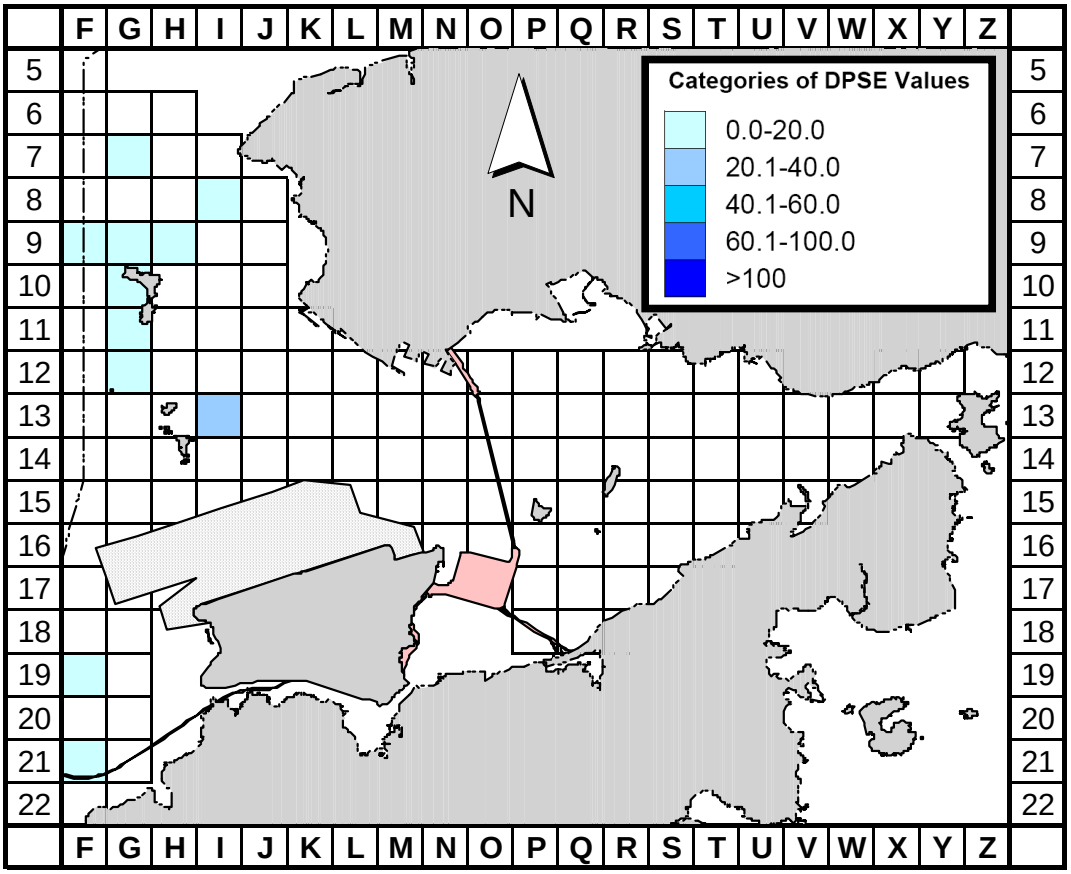


Figure 4b. Density of Chinese white dolphins with corrected survey effort per km^2 in Northeast and Northwest Lantau survey areas, using data collected during the TMCLKL post-construction monitoring period in June 21-May 22 (DPSE = no. of dolphins per 100 units of survey effort)

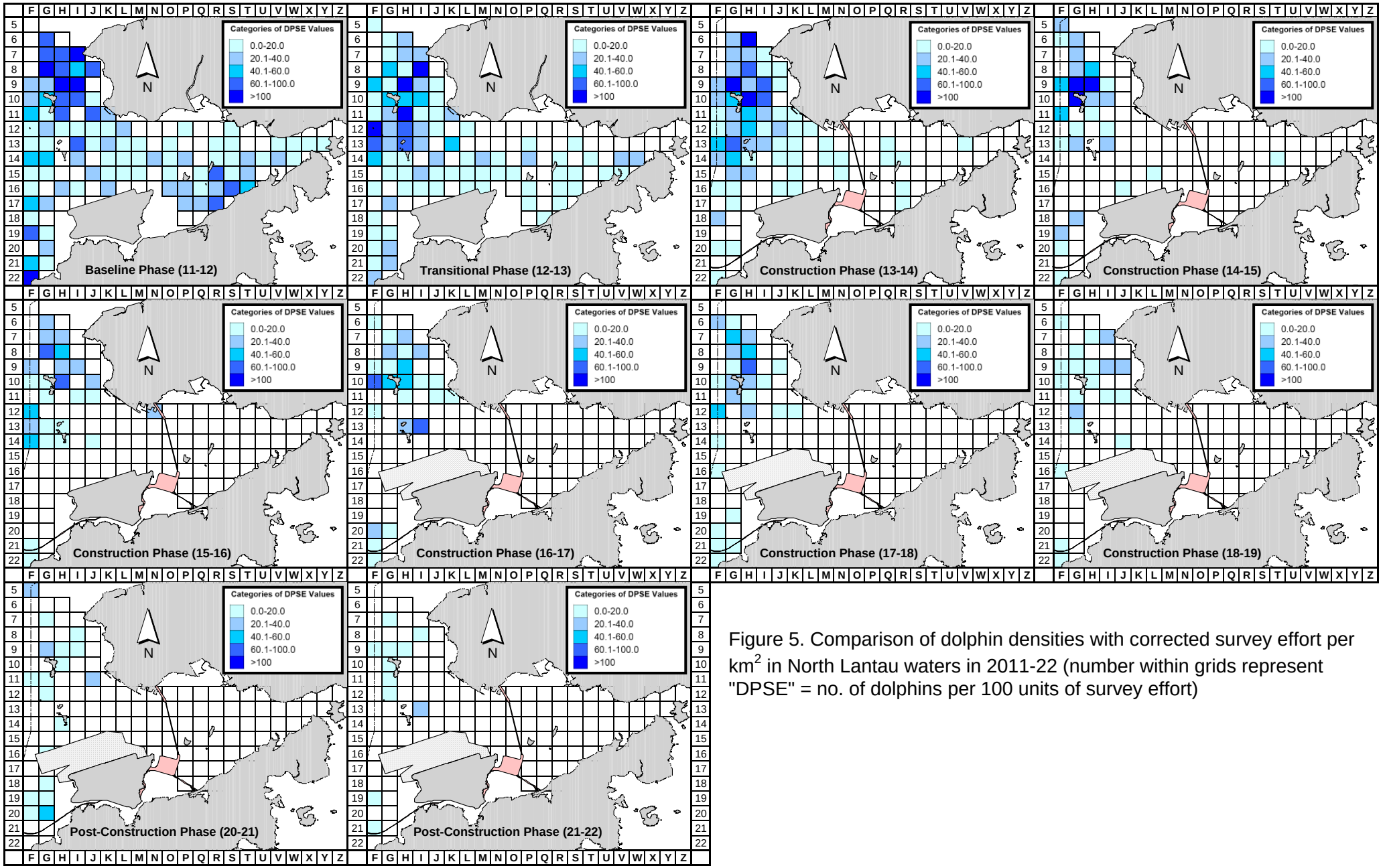


Figure 5. Comparison of dolphin densities with corrected survey effort per km^2 in North Lantau waters in 2011-22 (number within grids represent "DPSE" = no. of dolphins per 100 units of survey effort)

Figure 6. Distribution of young calves of Chinese white dolphins during different phases of TMCLKL construction works

Figure 7. Distribution of dolphins engaged in feeding (purple dots), socializing (pink dots) and traveling (green dots) activities during different phases of TMCLKL construction works

Appendix I. TMCLKL Survey Effort Database (June 2021 - May 2022)

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

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	TYPE	P/S
17-Jun-21	NW LANTAU	2	10.99	SUMMER	STANDARD138716	TMCLKL	P
17-Jun-21	NW LANTAU	3	24.81	SUMMER	STANDARD138716	TMCLKL	P
17-Jun-21	NW LANTAU	3	13.60	SUMMER	STANDARD138716	TMCLKL	S
17-Jun-21	NE LANTAU	2	10.21	SUMMER	STANDARD138716	TMCLKL	P
17-Jun-21	NE LANTAU	3	4.40	SUMMER	STANDARD138716	TMCLKL	P
17-Jun-21	NE LANTAU	2	11.29	SUMMER	STANDARD138716	TMCLKL	S
24-Jun-21	NW LANTAU	1	4.00	SUMMER	STANDARD138716	TMCLKL	P
24-Jun-21	NW LANTAU	2	22.55	SUMMER	STANDARD138716	TMCLKL	P
24-Jun-21	NW LANTAU	1	0.70	SUMMER	STANDARD138716	TMCLKL	S
24-Jun-21	NW LANTAU	2	8.35	SUMMER	STANDARD138716	TMCLKL	S
24-Jun-21	NE LANTAU	1	6.20	SUMMER	STANDARD138716	TMCLKL	P
24-Jun-21	NE LANTAU	2	10.36	SUMMER	STANDARD138716	TMCLKL	P
24-Jun-21	NE LANTAU	3	2.70	SUMMER	STANDARD138716	TMCLKL	P
24-Jun-21	NE LANTAU	1	4.20	SUMMER	STANDARD138716	TMCLKL	S
24-Jun-21	NE LANTAU	2	6.24	SUMMER	STANDARD138716	TMCLKL	S
28-Jun-21	NW LANTAU	2	30.81	SUMMER	STANDARD138716	TMCLKL	P
28-Jun-21	NW LANTAU	3	4.10	SUMMER	STANDARD138716	TMCLKL	P
28-Jun-21	NW LANTAU	2	14.19	SUMMER	STANDARD138716	TMCLKL	S
28-Jun-21	NE LANTAU	2	11.99	SUMMER	STANDARD138716	TMCLKL	P
28-Jun-21	NE LANTAU	3	3.60	SUMMER	STANDARD138716	TMCLKL	P
28-Jun-21	NE LANTAU	2	8.91	SUMMER	STANDARD138716	TMCLKL	S
28-Jun-21	NE LANTAU	3	1.30	SUMMER	STANDARD138716	TMCLKL	S
29-Jun-21	NW LANTAU	2	1.77	SUMMER	STANDARD36826	TMCLKL	P
29-Jun-21	NW LANTAU	3	21.57	SUMMER	STANDARD36826	TMCLKL	P
29-Jun-21	NW LANTAU	4	2.32	SUMMER	STANDARD36826	TMCLKL	P
29-Jun-21	NW LANTAU	3	9.09	SUMMER	STANDARD36826	TMCLKL	S
29-Jun-21	NW LANTAU	4	1.30	SUMMER	STANDARD36826	TMCLKL	S
29-Jun-21	NE LANTAU	2	17.57	SUMMER	STANDARD36826	TMCLKL	P
29-Jun-21	NE LANTAU	3	1.85	SUMMER	STANDARD36826	TMCLKL	P
29-Jun-21	NE LANTAU	2	10.58	SUMMER	STANDARD36826	TMCLKL	S
13-Jul-21	NW LANTAU	1	3.60	SUMMER	STANDARD36826	TMCLKL	P
13-Jul-21	NW LANTAU	2	32.90	SUMMER	STANDARD36826	TMCLKL	P
13-Jul-21	NW LANTAU	2	13.50	SUMMER	STANDARD36826	TMCLKL	S
13-Jul-21	NE LANTAU	1	3.80	SUMMER	STANDARD36826	TMCLKL	P
13-Jul-21	NE LANTAU	2	13.70	SUMMER	STANDARD36826	TMCLKL	P
13-Jul-21	NE LANTAU	2	8.80	SUMMER	STANDARD36826	TMCLKL	S
21-Jul-21	NW LANTAU	2	20.30	SUMMER	STANDARD138716	TMCLKL	P
21-Jul-21	NW LANTAU	3	5.40	SUMMER	STANDARD138716	TMCLKL	P
21-Jul-21	NW LANTAU	2	10.60	SUMMER	STANDARD138716	TMCLKL	S
21-Jul-21	NE LANTAU	2	11.47	SUMMER	STANDARD138716	TMCLKL	P
21-Jul-21	NE LANTAU	3	8.19	SUMMER	STANDARD138716	TMCLKL	P
21-Jul-21	NE LANTAU	2	10.04	SUMMER	STANDARD138716	TMCLKL	S
27-Jul-21	NW LANTAU	1	32.40	SUMMER	STANDARD36826	TMCLKL	P
27-Jul-21	NW LANTAU	2	5.50	SUMMER	STANDARD36826	TMCLKL	P
27-Jul-21	NW LANTAU	1	11.10	SUMMER	STANDARD36826	TMCLKL	S
27-Jul-21	NW LANTAU	2	2.20	SUMMER	STANDARD36826	TMCLKL	S
27-Jul-21	NE LANTAU	1	10.70	SUMMER	STANDARD36826	TMCLKL	P
27-Jul-21	NE LANTAU	2	6.57	SUMMER	STANDARD36826	TMCLKL	P
27-Jul-21	NE LANTAU	1	4.02	SUMMER	STANDARD36826	TMCLKL	S
27-Jul-21	NE LANTAU	2	5.41	SUMMER	STANDARD36826	TMCLKL	S
29-Jul-21	NW LANTAU	1	10.90	SUMMER	STANDARD138716	TMCLKL	P
29-Jul-21	NW LANTAU	2	17.54	SUMMER	STANDARD138716	TMCLKL	P

Appendix I. (cont'd)

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

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	TYPE	P/S
29-Jul-21	NW LANTAU	1	2.10	SUMMER	STANDARD138716	TMCLKL	S
29-Jul-21	NW LANTAU	2	6.56	SUMMER	STANDARD138716	TMCLKL	S
29-Jul-21	NE LANTAU	1	5.11	SUMMER	STANDARD138716	TMCLKL	P
29-Jul-21	NE LANTAU	2	11.45	SUMMER	STANDARD138716	TMCLKL	P
29-Jul-21	NE LANTAU	3	2.83	SUMMER	STANDARD138716	TMCLKL	P
29-Jul-21	NE LANTAU	1	4.00	SUMMER	STANDARD138716	TMCLKL	S
29-Jul-21	NE LANTAU	2	4.72	SUMMER	STANDARD138716	TMCLKL	S
29-Jul-21	NE LANTAU	3	1.27	SUMMER	STANDARD138716	TMCLKL	S
3-Aug-21	NW LANTAU	1	1.10	SUMMER	STANDARD36826	TMCLKL	P
3-Aug-21	NW LANTAU	2	13.28	SUMMER	STANDARD36826	TMCLKL	P
3-Aug-21	NW LANTAU	3	23.12	SUMMER	STANDARD36826	TMCLKL	P
3-Aug-21	NW LANTAU	2	9.30	SUMMER	STANDARD36826	TMCLKL	S
3-Aug-21	NW LANTAU	3	2.60	SUMMER	STANDARD36826	TMCLKL	S
3-Aug-21	NE LANTAU	1	1.20	SUMMER	STANDARD36826	TMCLKL	P
3-Aug-21	NE LANTAU	2	13.39	SUMMER	STANDARD36826	TMCLKL	P
3-Aug-21	NE LANTAU	3	2.60	SUMMER	STANDARD36826	TMCLKL	P
3-Aug-21	NE LANTAU	1	1.40	SUMMER	STANDARD36826	TMCLKL	S
3-Aug-21	NE LANTAU	2	7.31	SUMMER	STANDARD36826	TMCLKL	S
5-Aug-21	NW LANTAU	2	2.90	SUMMER	STANDARD138716	TMCLKL	P
5-Aug-21	NW LANTAU	3	27.11	SUMMER	STANDARD138716	TMCLKL	P
5-Aug-21	NW LANTAU	2	1.20	SUMMER	STANDARD138716	TMCLKL	S
5-Aug-21	NW LANTAU	3	4.09	SUMMER	STANDARD138716	TMCLKL	S
5-Aug-21	NE LANTAU	2	7.89	SUMMER	STANDARD138716	TMCLKL	P
5-Aug-21	NE LANTAU	3	10.89	SUMMER	STANDARD138716	TMCLKL	P
5-Aug-21	NE LANTAU	2	2.10	SUMMER	STANDARD138716	TMCLKL	S
5-Aug-21	NE LANTAU	3	8.42	SUMMER	STANDARD138716	TMCLKL	S
9-Aug-21	NW LANTAU	2	16.60	SUMMER	STANDARD138716	TMCLKL	P
9-Aug-21	NW LANTAU	3	18.90	SUMMER	STANDARD138716	TMCLKL	P
9-Aug-21	NW LANTAU	1	2.20	SUMMER	STANDARD138716	TMCLKL	S
9-Aug-21	NW LANTAU	2	6.30	SUMMER	STANDARD138716	TMCLKL	S
9-Aug-21	NW LANTAU	3	3.90	SUMMER	STANDARD138716	TMCLKL	S
9-Aug-21	NE LANTAU	2	17.30	SUMMER	STANDARD138716	TMCLKL	P
9-Aug-21	NE LANTAU	2	6.30	SUMMER	STANDARD138716	TMCLKL	S
9-Aug-21	NE LANTAU	3	1.30	SUMMER	STANDARD138716	TMCLKL	S
24-Aug-21	NW LANTAU	2	28.93	SUMMER	STANDARD36826	TMCLKL	P
24-Aug-21	NW LANTAU	2	7.97	SUMMER	STANDARD36826	TMCLKL	S
24-Aug-21	NE LANTAU	1	5.95	SUMMER	STANDARD36826	TMCLKL	P
24-Aug-21	NE LANTAU	2	10.48	SUMMER	STANDARD36826	TMCLKL	P
24-Aug-21	NE LANTAU	3	2.70	SUMMER	STANDARD36826	TMCLKL	P
24-Aug-21	NE LANTAU	1	3.27	SUMMER	STANDARD36826	TMCLKL	S
24-Aug-21	NE LANTAU	2	7.10	SUMMER	STANDARD36826	TMCLKL	S
24-Aug-21	NE LANTAU	3	0.30	SUMMER	STANDARD36826	TMCLKL	S
7-Sep-21	NW LANTAU	1	0.40	AUTUMN	STANDARD36826	TMCLKL	P
7-Sep-21	NW LANTAU	2	32.70	AUTUMN	STANDARD36826	TMCLKL	P
7-Sep-21	NW LANTAU	3	4.00	AUTUMN	STANDARD36826	TMCLKL	P
7-Sep-21	NW LANTAU	1	1.10	AUTUMN	STANDARD36826	TMCLKL	S
7-Sep-21	NW LANTAU	2	6.70	AUTUMN	STANDARD36826	TMCLKL	S
7-Sep-21	NW LANTAU	3	5.50	AUTUMN	STANDARD36826	TMCLKL	S
7-Sep-21	NE LANTAU	2	12.16	AUTUMN	STANDARD36826	TMCLKL	P
7-Sep-21	NE LANTAU	3	3.69	AUTUMN	STANDARD36826	TMCLKL	P
7-Sep-21	NE LANTAU	2	6.02	AUTUMN	STANDARD36826	TMCLKL	S
7-Sep-21	NE LANTAU	3	3.33	AUTUMN	STANDARD36826	TMCLKL	S
13-Sep-21	NW LANTAU	2	25.31	AUTUMN	STANDARD138716	TMCLKL	P
13-Sep-21	NW LANTAU	2	10.49	AUTUMN	STANDARD138716	TMCLKL	S

Appendix I. (cont'd)

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

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	TYPE	P/S
13-Sep-21	NE LANTAU	1	1.20	AUTUMN	STANDARD138716	TMCLKL	P
13-Sep-21	NE LANTAU	2	18.20	AUTUMN	STANDARD138716	TMCLKL	P
13-Sep-21	NE LANTAU	1	1.80	AUTUMN	STANDARD138716	TMCLKL	S
13-Sep-21	NE LANTAU	2	8.40	AUTUMN	STANDARD138716	TMCLKL	S
14-Sep-21	NW LANTAU	2	27.80	AUTUMN	STANDARD36826	TMCLKL	P
14-Sep-21	NW LANTAU	3	6.90	AUTUMN	STANDARD36826	TMCLKL	P
14-Sep-21	NW LANTAU	2	8.10	AUTUMN	STANDARD36826	TMCLKL	S
14-Sep-21	NW LANTAU	3	4.80	AUTUMN	STANDARD36826	TMCLKL	S
14-Sep-21	NE LANTAU	2	16.76	AUTUMN	STANDARD36826	TMCLKL	P
14-Sep-21	NE LANTAU	2	9.34	AUTUMN	STANDARD36826	TMCLKL	S
14-Sep-21	NE LANTAU	3	0.40	AUTUMN	STANDARD36826	TMCLKL	S
21-Sep-21	NW LANTAU	2	25.33	AUTUMN	STANDARD36826	TMCLKL	P
21-Sep-21	NW LANTAU	2	10.67	AUTUMN	STANDARD36826	TMCLKL	S
21-Sep-21	NE LANTAU	2	13.40	AUTUMN	STANDARD36826	TMCLKL	P
21-Sep-21	NE LANTAU	3	5.60	AUTUMN	STANDARD36826	TMCLKL	P
21-Sep-21	NE LANTAU	2	6.10	AUTUMN	STANDARD36826	TMCLKL	S
21-Sep-21	NE LANTAU	3	4.20	AUTUMN	STANDARD36826	TMCLKL	S
7-Oct-21	NW LANTAU	3	25.70	AUTUMN	STANDARD138716	TMCLKL	P
7-Oct-21	NW LANTAU	3	10.20	AUTUMN	STANDARD138716	TMCLKL	S
7-Oct-21	NE LANTAU	2	7.50	AUTUMN	STANDARD138716	TMCLKL	P
7-Oct-21	NE LANTAU	3	11.60	AUTUMN	STANDARD138716	TMCLKL	P
7-Oct-21	NE LANTAU	2	2.80	AUTUMN	STANDARD138716	TMCLKL	S
7-Oct-21	NE LANTAU	3	6.50	AUTUMN	STANDARD138716	TMCLKL	S
19-Oct-21	NW LANTAU	2	24.98	AUTUMN	STANDARD36826	TMCLKL	P
19-Oct-21	NW LANTAU	3	10.76	AUTUMN	STANDARD36826	TMCLKL	P
19-Oct-21	NW LANTAU	2	10.36	AUTUMN	STANDARD36826	TMCLKL	S
19-Oct-21	NW LANTAU	3	3.70	AUTUMN	STANDARD36826	TMCLKL	S
19-Oct-21	NE LANTAU	2	16.49	AUTUMN	STANDARD36826	TMCLKL	P
19-Oct-21	NE LANTAU	2	10.71	AUTUMN	STANDARD36826	TMCLKL	S
26-Oct-21	NW LANTAU	2	12.60	AUTUMN	STANDARD36826	TMCLKL	P
26-Oct-21	NW LANTAU	3	14.65	AUTUMN	STANDARD36826	TMCLKL	P
26-Oct-21	NW LANTAU	2	6.90	AUTUMN	STANDARD36826	TMCLKL	S
26-Oct-21	NW LANTAU	3	2.15	AUTUMN	STANDARD36826	TMCLKL	S
26-Oct-21	NE LANTAU	2	19.60	AUTUMN	STANDARD36826	TMCLKL	P
26-Oct-21	NE LANTAU	2	10.90	AUTUMN	STANDARD36826	TMCLKL	S
27-Oct-21	NW LANTAU	2	31.21	AUTUMN	STANDARD36826	TMCLKL	P
27-Oct-21	NW LANTAU	3	4.09	AUTUMN	STANDARD36826	TMCLKL	P
27-Oct-21	NW LANTAU	2	13.10	AUTUMN	STANDARD36826	TMCLKL	S
27-Oct-21	NE LANTAU	2	15.95	AUTUMN	STANDARD36826	TMCLKL	P
27-Oct-21	NE LANTAU	2	9.85	AUTUMN	STANDARD36826	TMCLKL	S
1-Nov-21	NW LANTAU	2	30.50	AUTUMN	STANDARD138716	TMCLKL	P
1-Nov-21	NW LANTAU	3	4.60	AUTUMN	STANDARD138716	TMCLKL	P
1-Nov-21	NW LANTAU	2	11.40	AUTUMN	STANDARD138716	TMCLKL	S
1-Nov-21	NW LANTAU	3	2.40	AUTUMN	STANDARD138716	TMCLKL	S
1-Nov-21	NE LANTAU	2	8.53	AUTUMN	STANDARD138716	TMCLKL	P
1-Nov-21	NE LANTAU	3	8.07	AUTUMN	STANDARD138716	TMCLKL	P
1-Nov-21	NE LANTAU	2	8.81	AUTUMN	STANDARD138716	TMCLKL	S
1-Nov-21	NE LANTAU	3	1.39	AUTUMN	STANDARD138716	TMCLKL	S
9-Nov-21	NW LANTAU	2	15.50	AUTUMN	STANDARD36826	TMCLKL	P
9-Nov-21	NW LANTAU	3	12.36	AUTUMN	STANDARD36826	TMCLKL	P
9-Nov-21	NW LANTAU	2	7.50	AUTUMN	STANDARD36826	TMCLKL	S
9-Nov-21	NW LANTAU	3	1.94	AUTUMN	STANDARD36826	TMCLKL	S
9-Nov-21	NE LANTAU	2	17.85	AUTUMN	STANDARD36826	TMCLKL	P
9-Nov-21	NE LANTAU	3	1.40	AUTUMN	STANDARD36826	TMCLKL	P

Appendix I. (cont'd)

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

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	TYPE	P/S
9-Nov-21	NE LANTAU	2	10.45	AUTUMN	STANDARD36826	TMCLKL	S
16-Nov-21	NW LANTAU	2	11.17	AUTUMN	STANDARD36826	TMCLKL	P
16-Nov-21	NW LANTAU	3	25.75	AUTUMN	STANDARD36826	TMCLKL	P
16-Nov-21	NW LANTAU	2	6.00	AUTUMN	STANDARD36826	TMCLKL	S
16-Nov-21	NW LANTAU	3	7.00	AUTUMN	STANDARD36826	TMCLKL	S
16-Nov-21	NE LANTAU	2	12.07	AUTUMN	STANDARD36826	TMCLKL	P
16-Nov-21	NE LANTAU	3	2.30	AUTUMN	STANDARD36826	TMCLKL	P
16-Nov-21	NE LANTAU	2	12.13	AUTUMN	STANDARD36826	TMCLKL	S
17-Nov-21	NW LANTAU	2	22.62	AUTUMN	STANDARD138716	TMCLKL	P
17-Nov-21	NW LANTAU	3	1.93	AUTUMN	STANDARD138716	TMCLKL	P
17-Nov-21	NW LANTAU	2	10.85	AUTUMN	STANDARD138716	TMCLKL	S
17-Nov-21	NE LANTAU	1	4.20	AUTUMN	STANDARD138716	TMCLKL	P
17-Nov-21	NE LANTAU	2	15.37	AUTUMN	STANDARD138716	TMCLKL	P
17-Nov-21	NE LANTAU	1	1.80	AUTUMN	STANDARD138716	TMCLKL	S
17-Nov-21	NE LANTAU	2	8.33	AUTUMN	STANDARD138716	TMCLKL	S
2-Dec-21	NW LANTAU	2	16.61	WINTER	STANDARD138716	TMCLKL	P
2-Dec-21	NW LANTAU	3	19.19	WINTER	STANDARD138716	TMCLKL	P
2-Dec-21	NW LANTAU	2	8.40	WINTER	STANDARD138716	TMCLKL	S
2-Dec-21	NW LANTAU	3	5.10	WINTER	STANDARD138716	TMCLKL	S
2-Dec-21	NE LANTAU	2	15.98	WINTER	STANDARD138716	TMCLKL	P
2-Dec-21	NE LANTAU	2	10.62	WINTER	STANDARD138716	TMCLKL	S
3-Dec-21	NW LANTAU	2	2.60	WINTER	STANDARD138716	TMCLKL	P
3-Dec-21	NW LANTAU	3	24.09	WINTER	STANDARD138716	TMCLKL	P
3-Dec-21	NW LANTAU	2	2.70	WINTER	STANDARD138716	TMCLKL	S
3-Dec-21	NW LANTAU	3	8.21	WINTER	STANDARD138716	TMCLKL	S
3-Dec-21	NE LANTAU	2	17.85	WINTER	STANDARD138716	TMCLKL	P
3-Dec-21	NE LANTAU	3	1.50	WINTER	STANDARD138716	TMCLKL	P
3-Dec-21	NE LANTAU	2	7.55	WINTER	STANDARD138716	TMCLKL	S
3-Dec-21	NE LANTAU	3	2.40	WINTER	STANDARD138716	TMCLKL	S
14-Dec-21	NW LANTAU	2	16.31	WINTER	STANDARD36826	TMCLKL	P
14-Dec-21	NW LANTAU	3	10.60	WINTER	STANDARD36826	TMCLKL	P
14-Dec-21	NW LANTAU	2	6.99	WINTER	STANDARD36826	TMCLKL	S
14-Dec-21	NW LANTAU	3	2.00	WINTER	STANDARD36826	TMCLKL	S
14-Dec-21	NE LANTAU	2	14.67	WINTER	STANDARD36826	TMCLKL	P
14-Dec-21	NE LANTAU	3	4.10	WINTER	STANDARD36826	TMCLKL	P
14-Dec-21	NE LANTAU	2	4.23	WINTER	STANDARD36826	TMCLKL	S
14-Dec-21	NE LANTAU	3	6.10	WINTER	STANDARD36826	TMCLKL	S
15-Dec-21	NW LANTAU	2	34.20	WINTER	STANDARD138716	TMCLKL	P
15-Dec-21	NW LANTAU	2	14.30	WINTER	STANDARD138716	TMCLKL	S
15-Dec-21	NE LANTAU	2	16.72	WINTER	STANDARD138716	TMCLKL	P
15-Dec-21	NE LANTAU	2	9.98	WINTER	STANDARD138716	TMCLKL	S
3-Jan-22	NW LANTAU	1	3.14	WINTER	STANDARD36826	TMCLKL	P
3-Jan-22	NW LANTAU	2	21.72	WINTER	STANDARD36826	TMCLKL	P
3-Jan-22	NW LANTAU	2	11.14	WINTER	STANDARD36826	TMCLKL	S
3-Jan-22	NE LANTAU	2	14.45	WINTER	STANDARD36826	TMCLKL	P
3-Jan-22	NE LANTAU	3	4.81	WINTER	STANDARD36826	TMCLKL	P
3-Jan-22	NE LANTAU	2	10.34	WINTER	STANDARD36826	TMCLKL	S
4-Jan-22	NW LANTAU	2	20.76	WINTER	STANDARD36826	TMCLKL	P
4-Jan-22	NW LANTAU	3	14.76	WINTER	STANDARD36826	TMCLKL	P
4-Jan-22	NW LANTAU	2	6.94	WINTER	STANDARD36826	TMCLKL	S
4-Jan-22	NW LANTAU	3	6.70	WINTER	STANDARD36826	TMCLKL	S
4-Jan-22	NE LANTAU	2	9.20	WINTER	STANDARD36826	TMCLKL	P
4-Jan-22	NE LANTAU	3	7.30	WINTER	STANDARD36826	TMCLKL	P
4-Jan-22	NE LANTAU	2	6.53	WINTER	STANDARD36826	TMCLKL	S

Appendix I. (cont'd)

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

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	TYPE	P/S
4-Jan-22	NE LANTAU	3	3.47	WINTER	STANDARD36826	TMCLKL	S
21-Jan-22	NW LANTAU	2	17.36	WINTER	STANDARD36826	TMCLKL	P
21-Jan-22	NW LANTAU	3	9.05	WINTER	STANDARD36826	TMCLKL	P
21-Jan-22	NW LANTAU	2	10.49	WINTER	STANDARD36826	TMCLKL	S
21-Jan-22	NE LANTAU	2	14.56	WINTER	STANDARD36826	TMCLKL	P
21-Jan-22	NE LANTAU	3	4.79	WINTER	STANDARD36826	TMCLKL	P
21-Jan-22	NE LANTAU	2	10.75	WINTER	STANDARD36826	TMCLKL	S
25-Jan-22	NW LANTAU	2	28.02	WINTER	STANDARD36826	TMCLKL	P
25-Jan-22	NW LANTAU	3	7.68	WINTER	STANDARD36826	TMCLKL	P
25-Jan-22	NW LANTAU	2	13.80	WINTER	STANDARD36826	TMCLKL	S
25-Jan-22	NE LANTAU	1	6.55	WINTER	STANDARD36826	TMCLKL	P
25-Jan-22	NE LANTAU	2	8.92	WINTER	STANDARD36826	TMCLKL	P
25-Jan-22	NE LANTAU	1	5.59	WINTER	STANDARD36826	TMCLKL	S
25-Jan-22	NE LANTAU	2	4.24	WINTER	STANDARD36826	TMCLKL	S
10-Feb-22	NW LANTAU	2	21.03	WINTER	STANDARD36826	TMCLKL	P
10-Feb-22	NW LANTAU	3	5.70	WINTER	STANDARD36826	TMCLKL	P
10-Feb-22	NW LANTAU	2	7.32	WINTER	STANDARD36826	TMCLKL	S
10-Feb-22	NW LANTAU	3	1.55	WINTER	STANDARD36826	TMCLKL	S
10-Feb-22	NE LANTAU	2	18.50	WINTER	STANDARD36826	TMCLKL	P
10-Feb-22	NE LANTAU	2	10.40	WINTER	STANDARD36826	TMCLKL	S
11-Feb-22	NW LANTAU	2	10.84	WINTER	STANDARD36826	TMCLKL	P
11-Feb-22	NW LANTAU	3	24.96	WINTER	STANDARD36826	TMCLKL	P
11-Feb-22	NW LANTAU	2	11.10	WINTER	STANDARD36826	TMCLKL	S
11-Feb-22	NW LANTAU	3	2.60	WINTER	STANDARD36826	TMCLKL	S
11-Feb-22	NE LANTAU	2	16.21	WINTER	STANDARD36826	TMCLKL	P
11-Feb-22	NE LANTAU	2	9.39	WINTER	STANDARD36826	TMCLKL	S
24-Feb-22	NW LANTAU	2	18.70	WINTER	STANDARD36826	TMCLKL	P
24-Feb-22	NW LANTAU	3	16.54	WINTER	STANDARD36826	TMCLKL	P
24-Feb-22	NW LANTAU	2	8.70	WINTER	STANDARD36826	TMCLKL	S
24-Feb-22	NW LANTAU	3	5.16	WINTER	STANDARD36826	TMCLKL	S
24-Feb-22	NE LANTAU	2	7.92	WINTER	STANDARD36826	TMCLKL	P
24-Feb-22	NE LANTAU	3	7.07	WINTER	STANDARD36826	TMCLKL	P
24-Feb-22	NE LANTAU	2	8.90	WINTER	STANDARD36826	TMCLKL	S
24-Feb-22	NE LANTAU	3	1.11	WINTER	STANDARD36826	TMCLKL	S
25-Feb-22	NW LANTAU	2	16.14	WINTER	STANDARD36826	TMCLKL	P
25-Feb-22	NW LANTAU	3	9.58	WINTER	STANDARD36826	TMCLKL	P
25-Feb-22	NW LANTAU	2	7.22	WINTER	STANDARD36826	TMCLKL	S
25-Feb-22	NW LANTAU	3	3.36	WINTER	STANDARD36826	TMCLKL	S
25-Feb-22	NE LANTAU	2	17.97	WINTER	STANDARD36826	TMCLKL	P
25-Feb-22	NE LANTAU	3	1.00	WINTER	STANDARD36826	TMCLKL	P
25-Feb-22	NE LANTAU	2	7.73	WINTER	STANDARD36826	TMCLKL	S
25-Feb-22	NE LANTAU	3	2.60	WINTER	STANDARD36826	TMCLKL	S
8-Mar-22	NW LANTAU	2	20.79	SPRING	STANDARD36826	TMCLKL	P
8-Mar-22	NW LANTAU	3	5.50	SPRING	STANDARD36826	TMCLKL	P
8-Mar-22	NW LANTAU	2	9.11	SPRING	STANDARD36826	TMCLKL	S
8-Mar-22	NE LANTAU	2	7.98	SPRING	STANDARD36826	TMCLKL	P
8-Mar-22	NE LANTAU	3	10.90	SPRING	STANDARD36826	TMCLKL	P
8-Mar-22	NE LANTAU	2	4.22	SPRING	STANDARD36826	TMCLKL	S
8-Mar-22	NE LANTAU	3	6.40	SPRING	STANDARD36826	TMCLKL	S
11-Mar-22	NW LANTAU	2	28.90	SPRING	STANDARD36826	TMCLKL	P
11-Mar-22	NW LANTAU	3	6.30	SPRING	STANDARD36826	TMCLKL	P
11-Mar-22	NW LANTAU	2	8.90	SPRING	STANDARD36826	TMCLKL	S
11-Mar-22	NW LANTAU	3	4.60	SPRING	STANDARD36826	TMCLKL	S

Appendix I. (cont'd)

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

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	TYPE	P/S
11-Mar-22	NE LANTAU	2	16.52	SPRING	STANDARD36826	TMCLKL	P
11-Mar-22	NE LANTAU	2	9.08	SPRING	STANDARD36826	TMCLKL	S
14-Mar-22	NW LANTAU	2	26.50	SPRING	STANDARD36826	TMCLKL	P
14-Mar-22	NW LANTAU	2	9.50	SPRING	STANDARD36826	TMCLKL	S
14-Mar-22	NE LANTAU	2	18.38	SPRING	STANDARD36826	TMCLKL	P
14-Mar-22	NE LANTAU	2	10.92	SPRING	STANDARD36826	TMCLKL	S
15-Mar-22	NW LANTAU	2	34.30	SPRING	STANDARD36826	TMCLKL	P
15-Mar-22	NW LANTAU	3	1.30	SPRING	STANDARD36826	TMCLKL	P
15-Mar-22	NW LANTAU	2	13.00	SPRING	STANDARD36826	TMCLKL	S
15-Mar-22	NE LANTAU	2	15.31	SPRING	STANDARD36826	TMCLKL	P
15-Mar-22	NE LANTAU	2	9.89	SPRING	STANDARD36826	TMCLKL	S
12-Apr-22	NW LANTAU	2	36.20	SPRING	STANDARD36826	TMCLKL	P
12-Apr-22	NW LANTAU	2	13.10	SPRING	STANDARD36826	TMCLKL	S
12-Apr-22	NE LANTAU	2	13.65	SPRING	STANDARD36826	TMCLKL	P
12-Apr-22	NE LANTAU	3	1.50	SPRING	STANDARD36826	TMCLKL	P
12-Apr-22	NE LANTAU	2	9.95	SPRING	STANDARD36826	TMCLKL	S
13-Apr-22	NW LANTAU	2	26.55	SPRING	STANDARD36826	TMCLKL	P
13-Apr-22	NW LANTAU	2	10.25	SPRING	STANDARD36826	TMCLKL	S
13-Apr-22	NE LANTAU	2	19.84	SPRING	STANDARD36826	TMCLKL	P
13-Apr-22	NE LANTAU	2	9.46	SPRING	STANDARD36826	TMCLKL	S
21-Apr-22	NW LANTAU	2	36.80	SPRING	STANDARD36826	TMCLKL	P
21-Apr-22	NW LANTAU	2	11.60	SPRING	STANDARD36826	TMCLKL	S
21-Apr-22	NE LANTAU	2	16.33	SPRING	STANDARD36826	TMCLKL	P
21-Apr-22	NE LANTAU	2	9.07	SPRING	STANDARD36826	TMCLKL	S
25-Apr-22	NW LANTAU	2	22.55	SPRING	STANDARD36826	TMCLKL	P
25-Apr-22	NW LANTAU	3	2.90	SPRING	STANDARD36826	TMCLKL	P
25-Apr-22	NW LANTAU	2	6.63	SPRING	STANDARD36826	TMCLKL	S
25-Apr-22	NW LANTAU	3	3.82	SPRING	STANDARD36826	TMCLKL	S
25-Apr-22	NE LANTAU	2	14.73	SPRING	STANDARD36826	TMCLKL	P
25-Apr-22	NE LANTAU	3	3.58	SPRING	STANDARD36826	TMCLKL	P
25-Apr-22	NE LANTAU	2	9.66	SPRING	STANDARD36826	TMCLKL	S
25-Apr-22	NE LANTAU	3	0.43	SPRING	STANDARD36826	TMCLKL	S
3-May-22	NW LANTAU	2	18.19	SPRING	STANDARD36826	TMCLKL	P
3-May-22	NW LANTAU	3	8.05	SPRING	STANDARD36826	TMCLKL	P
3-May-22	NW LANTAU	2	8.96	SPRING	STANDARD36826	TMCLKL	S
3-May-22	NW LANTAU	3	1.30	SPRING	STANDARD36826	TMCLKL	S
3-May-22	NE LANTAU	2	18.33	SPRING	STANDARD36826	TMCLKL	P
3-May-22	NE LANTAU	2	10.67	SPRING	STANDARD36826	TMCLKL	S
5-May-22	NW LANTAU	2	22.38	SPRING	STANDARD140232	TMCLKL	P
5-May-22	NW LANTAU	3	13.82	SPRING	STANDARD140232	TMCLKL	P
5-May-22	NW LANTAU	2	8.60	SPRING	STANDARD140232	TMCLKL	S
5-May-22	NW LANTAU	3	5.10	SPRING	STANDARD140232	TMCLKL	S
5-May-22	NE LANTAU	2	6.01	SPRING	STANDARD140232	TMCLKL	P
5-May-22	NE LANTAU	3	9.43	SPRING	STANDARD140232	TMCLKL	P
5-May-22	NE LANTAU	2	7.06	SPRING	STANDARD140232	TMCLKL	S
5-May-22	NE LANTAU	3	2.70	SPRING	STANDARD140232	TMCLKL	S
17-May-22	NW LANTAU	2	20.06	SPRING	STANDARD138716	TMCLKL	P
17-May-22	NW LANTAU	3	6.73	SPRING	STANDARD138716	TMCLKL	P
17-May-22	NW LANTAU	2	7.30	SPRING	STANDARD138716	TMCLKL	S
17-May-22	NW LANTAU	3	2.51	SPRING	STANDARD138716	TMCLKL	S
17-May-22	NE LANTAU	2	15.98	SPRING	STANDARD138716	TMCLKL	P
17-May-22	NE LANTAU	3	2.78	SPRING	STANDARD138716	TMCLKL	P
17-May-22	NE LANTAU	2	10.09	SPRING	STANDARD138716	TMCLKL	S

Appendix I. (cont'd)

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

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	TYPE	P/S
17-May-22	NE LANTAU	3	1.05	SPRING	STANDARD138716	TMCLKL	S
19-May-22	NW LANTAU	1	5.80	SPRING	STANDARD138716	TMCLKL	P
19-May-22	NW LANTAU	2	26.30	SPRING	STANDARD138716	TMCLKL	P
19-May-22	NW LANTAU	3	3.21	SPRING	STANDARD138716	TMCLKL	P
19-May-22	NW LANTAU	2	13.90	SPRING	STANDARD138716	TMCLKL	S
19-May-22	NE LANTAU	2	14.41	SPRING	STANDARD138716	TMCLKL	P
19-May-22	NE LANTAU	3	1.50	SPRING	STANDARD138716	TMCLKL	P
19-May-22	NE LANTAU	2	8.08	SPRING	STANDARD138716	TMCLKL	S
19-May-22	NE LANTAU	3	1.11	SPRING	STANDARD138716	TMCLKL	S

Appendix II. TMCLKL Chinese White Dolphin Sighting Database (June 2021 - May 2022)

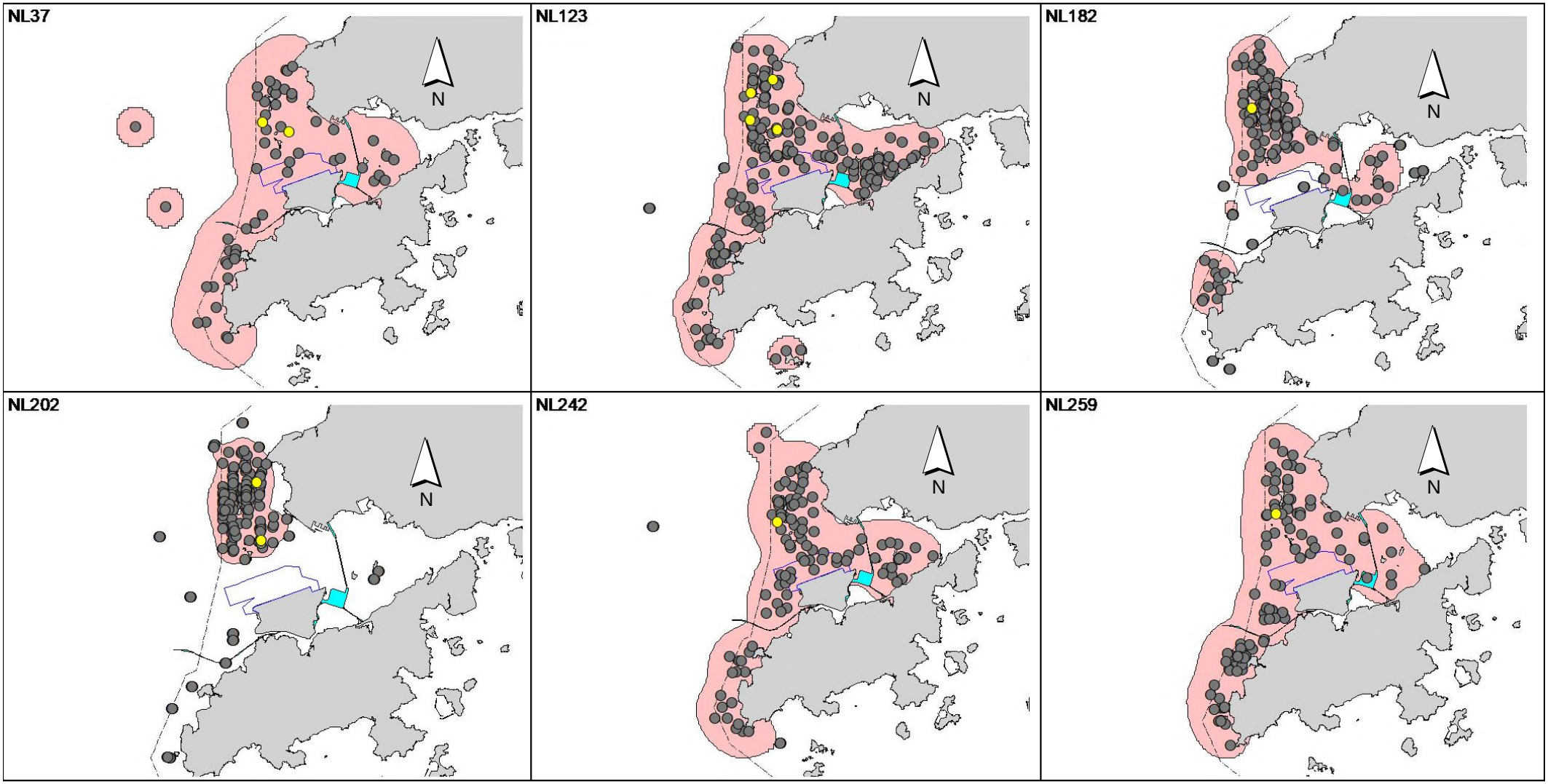
(Abberviations: STG# = Sighting Number; HRD SZ = Dolphin Herd Size; BEAU = Beaufort Sea State; PSD = Perpendicular Distance; BOAT ASSOC. = Fishing Boat Association; P/S: Sighting Made on Primary/Secondary Lines)

DATE	STG #	TIME	HRD SZ	AREA	BEAU	PSD	EFFORT	TYPE	NORTHING	EASTING	SEASON	BOAT ASSOC.	P/S
13-Sep-21	1	1053	1	NW LANTAU	2	3	ON	TMCLKL	827184	805396	AUTUMN	NONE	P
16-Nov-21	1	1023	1	NW LANTAU	2	238	ON	TMCLKL	817297	804676	AUTUMN	NONE	P
17-Nov-21	1	1125	3	NW LANTAU	2	152	ON	TMCLKL	828000	807231	AUTUMN	NONE	P
3-Jan-22	1	1104	1	NW LANTAU	2	142	ON	TMCLKL	826896	805262	WINTER	NONE	S
3-Jan-22	2	1116	2	NW LANTAU	2	392	ON	TMCLKL	827559	806169	WINTER	NONE	P
4-Jan-22	1	1020	2	NW LANTAU	2	28	ON	TMCLKL	815381	804682	WINTER	NONE	P
4-Jan-22	2	1205	4	NW LANTAU	2	1394	ON	TMCLKL	824649	805165	WINTER	NONE	S
21-Jan-22	1	1048	1	NW LANTAU	3	99	ON	TMCLKL	825047	805464	WINTER	NONE	P
10-Feb-22	1	1141	6	NW LANTAU	2	106	ON	TMCLKL	823813	807542	WINTER	NONE	P
24-Feb-22	1	1106	1	NW LANTAU	2	125	ON	TMCLKL	827629	804615	WINTER	NONE	P
25-Feb-22	1	1113	1	NW LANTAU	2	132	ON	TMCLKL	829288	805462	WINTER	NONE	P

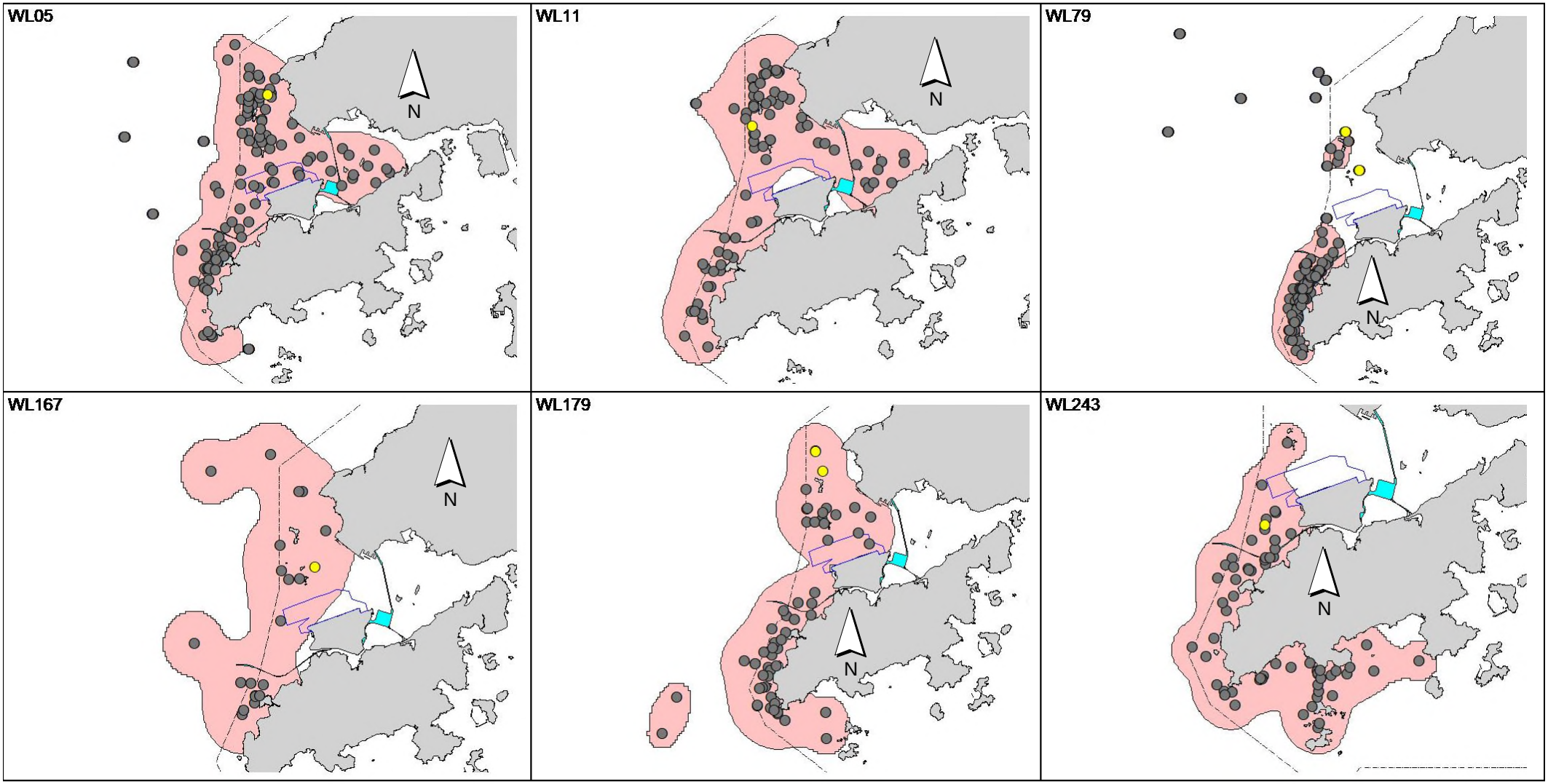
Appendix III. Individual dolphins identified during TMCLKL monitoring surveys conducted from June 2021 to May 2022

ID#	DATE	STG#	AREA
NL37	04/01/22	2	NW LANTAU
	10/02/22	1	NW LANTAU
NL123	17/11/21	1	NW LANTAU
	03/01/22	1	NW LANTAU
	04/01/22	2	NW LANTAU
	10/02/22	1	NW LANTAU
NL182	13/09/21	1	NW LANTAU
NL202	17/11/21	1	NW LANTAU
	10/02/22	1	NW LANTAU
NL242	04/01/22	2	NW LANTAU
NL259	21/01/22	1	NW LANTAU
WL05	17/11/21	1	NW LANTAU
WL11	04/01/22	2	NW LANTAU
WL79	03/01/22	2	NW LANTAU
	10/02/22	1	NW LANTAU
WL167	10/02/22	1	NW LANTAU
WL179	03/01/22	2	NW LANTAU
	25/02/22	1	NW LANTAU
WL243	16/11/21	1	NW LANTAU
WL254	10/02/22	1	NW LANTAU
WL294	04/01/22	1	NW LANTAU

Appendix IV. Ranging patterns (95% kernel ranges) of 14 individual dolphins that were sighted during the first year of TMCLKL post-construction period, utilizing the TMCLKL08 monitoring data collected in 2021-22
(note: yellow dots indicates sightings made in June 2021 to May 2022)



Appendix IV. (cont'd)



Appendix IV. (cont'd)