Appendix C

Operational Phase Dolphin Monitoring Survey

AGREEMENT NO. HMWSD 1/2021 (EP)
Post-Construction Monitoring of Chinese White Dolphin (Line-transect Vessel Surveys) for Tuen Mun – Chek Lap Kok Link in Northeast and Northwest Lantau Survey Areas - Investigation

Final Review Report

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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 phase) and post-disturbance after the completion of construction works (operational 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. According to the EM&A Manual, the post-construction monitoring should be conducted for two years upon the completion of all marine-based construction activities for the TMCLKL, which were completed in May 2020. Subsequently, 15 months of post-construction dolphin monitoring had been carried out by the ET / ET Leader appointed under Contract No. HY/2012/08 from June 2020 to August 2021, while the remaining nine months of post-construction dolphin monitoring will be completed under this assignment under the Agreement No. HMWSD 1/2021 (EP), from September 2021 to May 2022.

1.6. 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. A comprehensive review and analysis of all CWD data collected under the TMCLKL EM&A programme is also required to be performed by HKCRP to review the success of the EM&A programme, including a review of the effectiveness and efficiency of the mitigation measures, and recommendations for any improvements in the EM&A programme with respect to the CWD.

1.7. As a requirement of the post-construction dolphin monitoring of CWD in NL waters, this final review report is prepared to review the TMCLKL post-construction monitoring results, and also to assess any recovery in dolphin usage in NL waters since the TMCLKL construction has been completed. Such review and assessment should adopt a holistic and comprehensive approach by covering all major dolphin parameters, and more importantly, using the same review, assessment and monitoring methodology as employed throughout the EM&A programme for the HZMB construction (including the two sections of the Hong Kong Link Road (HKLR) as well as the Hong Kong Boundary Crossing Facilities (HKBCF)). Other supplementary monitoring works funded by the Highways Department and Agriculture, Fisheries and Conservation Department (AFCD) should also be utilized to fill any information gap for the review and assessment.

2. Brief Summary of EM&A Requirement for the Final Review Report

2.1. According to Section 12.9 of the updated TMCLKL EM&A Manual, a number of requirements would need to be fulfilled by the Final Review Report to provide a comprehensive review and assessment of the overall CWD monitoring programme (including the baseline phase, construction phase and post-construction phase).

2.2. Firstly, the monitoring results for the line-transect vessel surveys in NL waters (e.g. dolphin encounter rates, abundance and density estimates, distribution and habitat use patterns, individual ranging patterns) should be presented for the two-year TMCLKL post-construction monitoring period.

2.3. Comparisons of various dolphin parameters should also be made between the baseline phase, construction phase and post-construction phase of TMCLKL construction. Monitoring data and results from other studies obtained under HZMB EM&A programmes (including any supplementary monitoring works) as well as AFCD long-term marine mammal monitoring works should be included for the review and assessment when appropriate.

2.4. Furthermore, the Final Review Report should review the validity of the predictions made by the TMCLKL EIA Report, and identify any shortcomings in the EIA recommendations. Comments including the effectiveness and efficiency of the mitigation measures should also be made after assessment.

2.5. Finally, the report should also provide recommendations and conclusion, including the adequacy of the post-construction phase EM&A programme.

3. Monitoring Methodology

3.1. Line-transect vessel-based monitoring surveys

3.1.1. According to the requirement of the updated EM&A manual of TMCLKL, the 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 phase. The co-ordinates of all transect lines are shown in Table 1, which was consistent with the baseline and construction phase monitoring.

3.1.2. It should be emphasized that the following monitoring protocol is consistent and completely compatible with the baseline and construction phase dolphin monitoring methodology for all HZMB EM&A works, which was designed and adopted by the HKCRP team for all HZMB monitoring since the baseline phase in 2011.

3.1.3. The HKCRP 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 past two decades of marine mammal monitoring surveys in Hong Kong developed by HKCRP (see Hung 2020). 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.

3.1.4. Two experienced observers (a data recorder and a primary observer) made up the on-effort survey team, and the survey vessel transited through different transect lines at a constant speed of 13-15 km per hour. The data recorder searched with unaided eyes and fill out the datasheets, while the primary observer searched for CWDs continuously through 7 x 50 *Fujinon* marine binoculars. Both observers searched the sea ahead of the vessel, between 270° and 90° (in relation to the bow, which is defined as 0°). One to two additional experienced observers were available on the boat to work in shift (i.e. rotate every 30 minutes) in order to minimize fatigue of the survey team members. All observers are experienced in small cetacean survey techniques and identifying local cetacean species.

3.1.5. 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*). Data including time, position and vessel speed were automatically and continuously logged by a handheld GPS throughout the entire survey for subsequent review.

3.1.6. 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 would be 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 were later calculated from the initial sighting distance and angle.

3.1.7. Survey effort being conducted along the parallel transect lines that were perpendicular to the coastlines was labeled as “primary” survey effort, while the survey effort being 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 have been similar in survey areas around Lantau Island. Therefore, both primary and secondary survey effort would be presented as on-effort survey effort.

3.2. Photo-identification work

3.2.1. When a group of CWDs 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.

3.2.2. One to two professional digital cameras (*Canon* EOS 7D Mark II model), 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 surface. The images were shot at the highest available resolution and stored on Compact Flash memory cards for downloading onto a computer.

3.2.3. 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 CWD photo-identification catalogue maintained by HKCRP since 1995.

3.2.4. Chinese White Dolphins were 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).

3.2.5. 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.

4. Approach for Review and Assessment

4.1. Overall Approach

4.1.1. To form the basis for the review of the validity of predictions made by the TMCLKL EIA report, the dolphin monitoring data collected in NL waters during the entire post-construction phase (i.e. June 2020 to May 2022) are analyzed to assess dolphin occurrence in various parameters, which includes their distribution, encounter rates, density and abundance estimates, habitat use, activities and individual ranging patterns.

4.1.2. Moreover, these parameters were also compared between the baseline phase, construction phase and post-construction phase of TMCLKL construction to examine any changes in dolphin occurrence, which could be linked to the potential impacts arising during and after the TMCLKL construction works.

4.1.3. The duration of the three phases varied from one year for the baseline phase (February 2011 to January 2012) to 6.5 years for the construction phase (November 2013 to May 2020) and two years for the post-construction phase (June 2020 to May 2022). There was also an additional transitional phase between the baseline and TMCLKL construction phase (i.e. November 2012 to October 2013), which was one year after the commencement of HKBCF and HKLR construction works, but before the commencement of TMCLKL construction works. These four phases are further subdivided into ten 12-month periods (i.e. one 12-month period each for baseline and transitional phase; six 12-month periods for construction phase; and two 12-month periods for post-construction phase). Such subdivision into ten 12-month periods before, during and after TMCLKL construction would allow comparison of various dolphin parameters being made among different periods with roughly equal sample size.

4.1.4. Notably, the last seven months of the construction phase (i.e. November 2019 to May 2020) would not be used for the comparison of various dolphin parameters between different phases, with the aim to attain equal sample size of 12 months among different time periods. Such omission is well justified with the fact that the dolphin encounter rates from the last seven months of the construction phase (i.e. November 2019 to May 2020; nil for both ER(STG) and ER(ANI) in NEL; 1.20 and 3.85 for ER(STG) and ER(ANI) respectively in NWL) were very similar to the ones from the last 12-month period of the construction phase in November 2018 to October 2019 (nil for both ER(STG) and ER(ANI) in NEL; 1.42 and 3.62 for ER(STG) and ER(ANI) respectively in NWL).

4.1.5. Furthermore, although the official baseline dolphin monitoring under the HZMB EM&A programme was conducted during the three-month period of September to November 2011 under the requirement, the relatively short study period would not be sufficient to reliably establish the baseline condition on dolphin occurrence in NWL and NEL survey areas, as the three-month period would not take into account the seasonal variation in dolphin occurrences (see Hung 2008). As additional monitoring data was collected before and after the three-month official baseline period under a separate assignment commissioned by the Highways Department, a 12-month baseline monitoring period from February 2011 to January 2012 (which has already included the original baseline period of September-November 2011) is adopted instead for the comparison of different 12-month periods in this Final Review Report. Such 12-month baseline period in 2011-12 was still well before the commencement of TMCLKL (as well as HKBCF and HKLR) construction.

4.2. Methodology on Data Analysis

<u>Distribution analysis</u>

4.2.1. 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 in details.

4.2.2. 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.

<u>Encounter rate analysis</u>

4.2.3. CWD encounter rates (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 the monitoring period. The encounter rates were calculated in two ways for comparisons with the HZMB baseline and construction phase monitoring results as well as to AFCD long-term marine mammal monitoring results.

4.2.4. For the comparison with the HZMB baseline and construction phase monitoring results, the encounter rates of sightings (STG) and dolphins (ANI) in both survey areas were deduced using primary survey effort alone, and only data collected under Beaufort 3 or below condition were used for encounter rate analysis. The encounter rates were deduced by dividing the total number of on-effort sightings and total number of dolphins by the amount of survey effort for the specific period examined (e.g. for the entire 24-month post-construction monitoring period, or the ten 12-month periods before, during and after TMCLKL construction).

4.2.5. For the comparison with the AFCD long-term monitoring result, the encounter rates of STG ANI were instead calculated using both primary and secondary survey effort collected under Beaufort 3 or below condition.

Line-transect analysis

4.2.6. For the three phases of TMCLKL construction (baseline/transitional, construction and post-construction) as well as the ten 12-month periods before, during and after the TMCLKL construction, the density and abundance of CWDs in NWL and NEL waters were estimated in each period by line-transect analysis using systematic line-transect vessel survey data collected throughout the TMCLKL EM&A study.

4.2.7. For the analysis, survey effort in each single survey day was used as the sample. Estimates were calculated only from dolphin sightings and effort data that were collected during conditions of Beaufort 0-3 (see Jefferson 2000) and using standard line-transect methods (Buckland et al. 2001). The estimates were made using the computer program DISTANCE Version 7.3, Release 2 (Thomas et al. 2009). The following formulae were used to estimate density, abundance, and their associated coefficient of variation:

$$\hat{D} = \frac{n\ \hat{f}(0)\ \hat{E}(s)}{2\ L\ \hat{g}(0)}$$

$$\hat{N} = \frac{n\ \hat{f}(0)\ \hat{E}(s)\ A}{2\ L\ \hat{g}(0)}$$

$$C\hat{V} = \sqrt{\frac{\hat{\mathrm{var}}\ (n)}{n^2} + \frac{\hat{\mathrm{var}}\ [\hat{f}(0)]}{[\hat{f}(0)]^2} + \frac{\hat{\mathrm{var}}\ [\hat{E}(s)]}{[\hat{E}(s)]^2} + \frac{\hat{\mathrm{var}}\ [\hat{g}(0)]}{[\hat{g}(0)]^2}}$$

where D = density (of individuals), n = number of on-effort sightings,
f(0) = trackline probability density at zero distance,
E(s) = unbiased estimate of average group size,
L = length of transect lines surveyed on effort,
g(0) = trackline detection probability,
N = abundance, A = size of the survey area,
CV = coefficient of variation, and var = variance.

4.2.8. A strategy of selective pooling and stratification was used in order to minimize bias and maximize precision in making the estimates of density and abundance (see Buckland et al.

2001). Distant sightings were truncated to remove outliers and accommodate modeling, and size-bias corrected estimate of group size was calculated by regressing $\log_e$ of group size against distance.

4.2.9. Three models (uniform, half- normal and hazard rate) were fitted to the data of perpendicular distances to estimate f(0) and the resulting dolphin density and abundance (Buckland et al. 2001). The best model (and thus its associated values for these parameters) was determined by the lowest Akaike's Information Criterion (AIC) value.

4.2.10. To perform the trend analysis to examine the temporal trend in dolphin abundance in NEL and NWL waters throughout the TMCLKL EM&A study, the linear regression model is considered as follow:

$$x_t = a + bt + u_t \qquad \text{for } t = 1, 2, \ldots, n$$

where x_t denotes the abundance data of dolphin at time t,
n is the number of observations,
u_t is an error term which follows normal distribution with mean zero and variance σ^2

Quantitative grid analysis on habitat use

4.2.11. To conduct quantitative grid analysis of habitat use, positions of on-effort sightings of CWDs collected during the specific monitoring period were plotted onto 1-km^2 grids in WL survey area 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. Sightings and dolphin density grids were then further normalized with the amount of survey effort conducted within each grid.

4.2.12. 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 within the study period. For example, when the survey boat traversed through a specific grid 50 times over a specific period, 50 units of survey effort was 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).

4.2.13. 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 values 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

4.2.14. 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 GIS.

4.2.15. 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.

Ranging pattern analysis

4.2.16. Location data of individual dolphins that occurred during the post-construction monitoring period were obtained from the CWD sighting database and photo-identification catalogue curated by HKCRP since 1996.

4.2.17. To deduce the home range of an individual dolphin using the fixed kernel method, the program Animal Movement Analyst Extension was loaded as an extension with ArcView© 3.1 along with another extension “Spatial Analyst 2.0”.

4.2.18. Using the fixed kernel method, the program could calculate kernel density estimates based on all sighting positions of an individual, and provide an active interface to display kernel density plots. The kernel estimator could then calculate and display the overall ranging area of an individual dolphin at the 95% UD level.

5. Post-Construction Dolphin Monitoring Results

5.1. Summary of survey effort and CWD sightings

5.1.1. During the two-year TMCLKL post-construction monitoring period from June 2020 to May 2022, a total of 48 sets of systematic line-transect vessel surveys were conducted to cover all transect lines in NWL and NEL survey areas twice per month.

5.1.2. From these surveys, 6,465.46 km of survey effort was collected, with 99.7% of the total survey effort being conducted under favourable weather conditions (i.e. Beaufort Sea State 3 or below with good visibility). The total survey effort conducted on primary lines was 4,632.73 km, while the effort on secondary lines was 1,832.73 km. Survey effort conducted on primary and secondary lines were both considered as on-effort survey data. A summary table of the survey effort is shown in Appendix I.

5.1.3. During the 24-month post-construction monitoring period in 2020-22, a total of 33 groups of 81 Chinese White Dolphins were sighted. All dolphin groups were sighted during on-effort search, with 28 of these sightings made on primary lines. Notably, all dolphin groups sighted during the post-construction monitoring period were made in NWL, but none was sighted at all in NEL. In fact, since August 2014, only two sightings of two lone dolphins were made respectively in NEL during the HKLR/TMCLKL monitoring surveys. A summary table of the dolphin sightings is shown in Appendix II.

5.1.4. Overall, for the entire HKLR/TMCLKL EM&A monitoring programme conducted in NL waters, 3,458.74 km of survey effort were conducted during the 12-month baseline monitoring period in 2011-12, another 3,569.01 km during the 12-month transitional period in 2012-13, as well as 20,373.12 km of survey effort during the 72-month construction phase monitoring period in 2013-19. From these surveys, 288 groups of 952 dolphins were sighted during the baseline phase, 186 groups of 624 during the transitional phase, and 349 groups of 1,258 dolphins were sighted during the construction phase, respectively.

5.2. Distribution

5.2.1. Distribution of dolphin sightings made during the post-construction monitoring surveys from June 2020 to May 2022 is shown in Figure 2. During this two-year period, almost all dolphin sightings were concentrated toward the western end of the NL region near the western territorial border. In particular, concentration of sightings can be found around Lung Kwu Chau and to the west of the airport platform (or just to the north of the HKLR09 bridge alignment), while other sightings scattered within the Urmston Road section between Lung Kwu Tan and Lung Kwu Chau, as well as near Sha Chau. On the contrary, they have completely avoided the central and eastern portions of the NL waters, including the footprints of the entire TMCLKL alignment as well as the HKBCF/ HKLR03 reclamation sites during the two-year post-construction monitoring period.

5.2.2. In the comparison of dolphin distribution patterns before, during and after the TMCLKL construction, notable differences were found (Figure 3). During the two years of baseline phase in 2011-12 and transitional phase in 2012-13, dolphins were widely distributed throughout the entire NL region, and were frequently observed around the Brothers Islands, the Sha Chau and Lung Kwu Chau Marine Park as well as the southwestern end of the region where the HKLR09 bridge construction began in mid-2013.

5.2.3. However, during the first two years of TMCLKL construction phase in 2013-15, dolphins started to disappear from eastern and central portions of NL waters (which overlapped with the TMCLKL alignment) with only a handful of sightings made there (Figure 3). However, dolphins still frequently observed within the Sha Chau and Lung Kwu Chau Marine Park, but their occurrence also diminished noticeably near the HKLR09 alignment to the west of the airport platform.

5.2.4. In the subsequent two-year periods of TMCLKL construction phase in 2015-17 and 2017-19, dolphin occurrences continued to diminish in NL waters, with little or no occurrence at all in the central and eastern portions of the NL region. During the middle and later stages of the TMCLKL construction, almost all sightings were only concentrated at the northwestern portion of the NL region around Lung Kwu Chau, Sha Chau and to a lesser extent near Black Point as well as near the HKLR09 alignment. Notably, the final two-year period of the TMCLKL construction phase in 2017-19 also coincided with the peak construction period for the third runway expansion (3RS) reclamation project that resulted in another 650 hectares of dolphin habitat loss in NL waters.

5.2.5. Then in the post-construction phase in 2020-22 when TMCLKL construction has been completed and the reclamation works for the 3RS project were also mostly completed, dolphin occurrences further diminished and were mostly restricted to the waters around Lung Kwu Chau, with several sightings also made to the north of the HKLR09 alignment (Figure 3). Notably, there was no sign of any recovery in dolphin occurrences in central and eastern portions of the NL region, and there was a drastic difference in dolphin distribution in this region before and after the TMCLKL construction.

5.3. Encounter rate

5.3.1. For the entire post-construction monitoring period (June 2020 to May 2022), the CWD encounter rates (deduced from the survey effort and on-effort sighting data from the primary transect lines under favourable condition of Beaufort 3 or below) in NWL waters are shown in Table 2 (for each monthly period) and Table 3 (for each quarterly period). As no dolphin was sighted at all in NEL waters throughout the two-year monitoring period, the encounter rate was not deduced in this area.

5.3.2. Some seasonal variations in dolphin encounter rates were observed during the first and second years of post-construction monitoring period, with the highest occurrence recorded during the winter months of December-February in both years (Table 3).

5.3.3. A comparison is made among the ten 12-month periods before, during and after the TMCLKL construction (Tables 4a and 4b). In NEL, dolphin encounter rates were moderately high during the baseline period in 2011-12, and then quickly declined to a much lower level during the transition period in 2012-13 (Table 4a). Thereafter, such rates dropped to extremely low levels in the first two years of construction period in 2013-14 and 2014-15, and subsequently to zero for the rest of the construction period in 2015-19 as well as the entire post-construction period in 2020-22 (Table 4a).

5.3.4. Furthermore, dolphin encounter rates in NWL remained high (albeit with a very small decline) across the baseline period in 2011-12, transition period in 2012-13 and first year of TMCLKL construction period in 2013-14, but such rates have steadily declined in subsequent years, finally dropping to a very low level in the second year of TMCLKL post-construction period in 2021-22 (Table 4b). Notably, even during the two-year TMCLKL post-construction period, a further decline in dolphin encounter rate was still detected between 2020-21 and 2021-22 (Table 4b).

5.4. Density and abundance

5.4.1. Densities and abundance of CWDs were estimated in both NEL and NWL waters during different phases of TMCLKL construction using the line-transect analysis method, following similar approach as in AFCD long-term marine mammal monitoring study (see Hung 2020, 2021). Two types of comparisons are conducted to review the impact of TMCLKL construction on the dolphin densities and abundance: 1) between the three phases of construction (baseline/transition phase vs. construction phase vs. post-construction phase); and 2) between the ten 12-month periods before, during and after TMCLKL construction as in other analyses.

5.4.2. Only effort and sighting data collected during the HKLR/TMCLKL EM&A surveys in 2011-22 under Beaufort 0-3 conditions were used in the analysis, which included 12,701.2 km of survey effort and 94 dolphin groups in NEL, as well as 19,430.7 km of survey effort and 646 dolphin groups in NWL for the density and abundance estimations (Tables 5 and 6).

5.4.3. For the comparison across the three phases of TMCLKL construction in NEL, the baseline/transitional phase in 2011-13 recorded the highest dolphin density and abundance, with 11.17 individuals per 100 km^2 or six individuals. However, such estimates dropped to near-zero during the construction phase in 2013-19 (with 0.31 individuals per 100 km^2 in density or zero individual in abundance), and then with no dolphin being sighted for the entire post-construction phase in 2020-22 (Table 5). Notably, the coefficient of variation (CV) of the estimate during the baseline/transitional phase was low (17.28%) but became fairly high during the construction phase (74.17%).

5.4.4. Although the decline in dolphin density and estimate was not as dramatic as in NEL, there was also a large decline in NWL between the three phases, with the highest level recorded during the baseline/transitional phase with 45.73 individuals per 100 km^2 (or 40 individuals), then to a much lower level during the construction phase with 13.08 individuals per 100 km^2 (or 11 individuals) before falling to the lowest level during the post-construction phase with 2.96 individuals per 100 km^2 (or three individuals) (Table 6). The CVs for the estimates during the baseline/transitional phase (9.76%) as well as the construction phase (10.25%) were very low, but was moderate during the post-construction phase (32.29%).

5.4.5. Among the ten 12-month periods before, during and after the TMCLKL construction, a noticeable drop was already observed before construction (only 4.25 individuals per 100 km^2 during the transitional phase as compared to 18.11 individuals per 100 km^2 during the baseline phase) in NEL waters. Since the start of the TMCLKL construction in 2013-14, the density estimate in NEL dropped further to only 1.65 individuals per 100 km^2, and thereafter only one dolphin was observed in 2014-15 and none after the 2015-16 period (Table 5).

5.4.6. In NWL waters, the decline in dolphin density and abundance was more gradual during the first three 12-month periods, with very similar estimates during the baseline period (44.76 individuals per 100 km^2) and transitional period (43.84 individuals per 100 km^2), then dropped to a lower level during the first year of TMCLKL construction in 2013-14 (32.67 individuals per 100 km^2). In the five subsequent 12-month periods of the TMCLKL construction phase, their density estimates fell to a much lower level from 11.15-12.99 individuals per 100 km^2 in 2014-17 to only 7.08 and 2.95 individuals per 100 km^2 respectively for the 2017-18 and 2018-19 periods (Table 6). There appeared to be a slight rebound in the first year of post-construction period with 4.59 individuals per 100 km^2, but then such estimate fell to the lowest ever level during the second year of post-construction period with only 0.13 individuals per 100 km^2.

5.4.7. For the examination of any significant temporal trend among the ten 12-month periods using linear regression models in NWL, the test statistics for hypotheses H_o: $b = 0$ vs. H_1: $b < 0$ *is -6.5091* whose p-value = 0.0001 < 5%. Therefore, the hypothesis H_o is rejected at 5% level of significance. It can be concluded that the dolphin abundance estimates from the ten 12-month periods in NWL possesses a downward sloping trend, and the decline was statistically significant. The temporal trend in dolphin abundance in NEL cannot be examined using the same statistical method due to the fact that they were mostly absent in seven of the ten 12-month periods.

5.5. Group size

5.5.1. During the post-construction period in 2020-22, group size of CWDs ranged from singletons to eight animals per group in the NWL survey area. Among the 33 groups of dolphins, 84.8% of them were in small group sizes of only 1-4 dolphins. On the contrary, there were five groups that were moderate in size with 5-8 dolphins (Appendix II).

5.5.2. The average dolphin group sizes in NEL and NWL across the ten 12-month periods before, during and after TMCLKL construction were also compared (see Tables 7a & 7b). In NEL survey area, the average dolphin group sizes were similar between the baseline and transitional periods, but such average was noticeably higher during the first year of TMCLKL construction (albeit based on a very small sample size of three groups) (Table 7a).

5.5.3. In NWL survey area, the average dolphin group sizes during the transitional phase as well as the first, third, fourth and fifth year of TMCLKL construction were relatively similar to the one recorded during the baseline phase, while the one during the second year of construction phase was noticeably higher (Table 7b). On the contrary, the average dolphin group sizes during the last three 12-month periods (including the sixth year of construction period and both years of post-construction period) were much lower than the baseline level, with the lowest level recorded during the second year of the post-construction monitoring phase (Table 7b).

5.5.4. Distribution of dolphins with larger group sizes (with five or more animals per group) was also examined during the post-construction monitoring period and is shown in Figure 4. The five medium-sized groups (with 5-9 animals per group) were scattered across the western end of the NL region, with no particular concentration (Figure 4).

5.5.5. Across different periods before, during and after the TMCLKL construction, the distribution pattern of dolphins with larger group sizes varied greatly, with more even distribution and much higher occurrences during the baseline and transitional phases (Figure 5). In these earlier years, even the larger dolphin groups could be found regularly in the NEL survey area especially around the Brothers Islands with large aggregations.

5.5.6. However, the occurrences of dolphin group sizes have dramatically diminished in subsequent years during the TMCLKL construction phase, and were largely restricted to the western end of the NL region with a progressive decline in frequency of occurrences (Figure 5). Such decline still continued during the post-construction phase with only a handful of groups that were with moderate size, and this was drastically different from the distribution pattern observed before the TMCLKL construction.

5.6. Habitat use

5.6.1. During the entire post-construction monitoring period in 2020-22, all grids that recorded occurrences of dolphins were low in densities, and located at the western end of the NL region (Figures 6a & 6b).

5.6.2. When comparing the habitat use pattern among the ten 12-month periods before, during and after the TMCLKL construction, there was apparently a dramatic decline in dolphin habitat use in the NL region, with widespread distribution and high densities of dolphins occurring around the Brothers Islands and to the north of Lung Kwu Chau during the baseline and transitional periods, but diminishing to infrequent occurrences with low dolphin densities mostly restricted to the western end of NL region during both years of post-construction phase (Figure 7).

5.6.3. In the past decade of HZMB monitoring, the most notable decline in dolphin habitat use in NL waters occurred between the transitional phase and the first two years of TMCLKL construction phase, while such patterns during the middle and later stages of construction phase remained fairly similar until a further decline was observed during the last three 12-months periods (Figure 7).

5.7. Mother-calf pairs

5.7.1. Only one young calf (an unspotted juvenile) was sighted with the mother throughout the entire post-construction monitoring period from June 2020 to May 2022. The lone young calf comprised 1.2% of all animals sighted during the post-construction monitoring periods (n=81), which was much lower than the percentages recorded during the baseline/ transitional phase (5.6% of 1,583 animals) and construction phase (2.8% of 1,268 animals).

5.7.2. The only mother-calf pair sighted during the post-construction monitoring period was located near the Pillar Point (Figure 8). In contrast, the occurrences of young dolphin calves were much more frequent with widespread distribution throughout the NL region (including the Brothers Islands in NEL) during the baseline/transitional phase (Figure 9).

5.7.3. However, such occurrences noticeably diminished during the first two years of TMCLKL construction phase and restricted to the waters around Lung Kwu Chau. Thereafter, the occurrences of young calves were very rare in the last four years of construction phase in 2015-19 and throughout the entire post-construction phase in 2020-22, and these rare sightings were only scattered at the western portion of NL region with no particular concentration (Figure 9).

5.8. Activities and associations with fishing boats

5.8.1. For the entire post-construction monitoring period in 2020-22, a total of five groups of dolphins were engaged in feeding activities, while none of the 33 dolphin groups was engaged in socializing, traveling or milling/resting activity. These dolphin groups engaged in feeding activities were found near Lung Kwu Chau, Sha Chau and to the west of the airport platform (Figure 10).

5.8.2. Distribution of feeding and socializing activities engaged by dolphins before, during and after TMCLKL construction was also compared. During the baseline/transitional phase, these activities occurred frequently and distribution of these dolphin groups was widespread with two main concentrations around the Sha Chau and Lung Kwu Chau Marine Park and the Brothers Islands (Figure 11). However, such occurrences started to diminish and become more restricted to the western portion of the NL region during the first two years of the construction phase, and then progressively declined further in subsequent years, before reaching the lowest level during the post-construction phase.

5.8.3. Notably, among the 33 dolphin groups sighted during the post-construction monitoring period, none of them was associated with any operating fishing vessels (Appendix II). In comparison, 17 of the 474 dolphin groups (3.6%) and six of the 349 dolphin groups (1.7%) were associated with operating fishing vessels during the baseline/transitional and construction monitoring periods respectively.

5.9. Summary of photo-identification works

5.9.1. From June 2020 to May 2022, over 5,000 digital photographs of CWDs were taken during the TMCLKL post-construction phase monitoring surveys for the photo-identification work. In total, 33 individuals sighted 61 times altogether were identified (see summary table in Appendix III).

5.9.2. The majority of these individuals were re-sighted only once or twice during the 2020-22 post-construction monitoring period. However, there were six individuals that were re-sighted three times or more during the two-year period, including two individuals (NL123 and WL179) being re-sighted five times and one individual (NL202) being re-sighted seven times, showing their reliance to NWL waters in the past two years (Appendix III).

5.10. Individual range use

5.10.1. Ranging patterns of the 33 individuals identified during the TMCLKL post-construction monitoring period and with at least five re-sightings were determined by fixed kernel method, as shown in Appendix IV.

5.10.2. Among these 33 individuals, 14 of them were primarily sighted in NL waters in the past, with six of them (e.g. NL98, NL123, NL259) started to expand their range use into WL and SWL waters in the past decade that coincided with the HZMB construction period. Along with these individuals, there were a total of 13 individuals that covered a range across NL and WL waters and also sighted during the TMCLKL post-construction monitoring period.

5.10.3. The re-sightings of these individuals that have their ranges either primarily centered in NL waters or covering both NL and WL regions were all made well within their normal individual ranges (Appendix IV).

5.10.4. On the other hand, there were 12 individuals (e.g. CH105, WL79, WL227, WL254) that occurred primarily in WL waters in the past but have somewhat extended their ranges to cover NL waters, and their re-sightings made during the TMCLKL post-construction monitoring period were away from their primary range use (Appendix IV). Notably, most of these re-sightings of individuals were actually made near the juncture between NL and WL survey areas (i.e. near the HKLR09 alignment or to the west of the airport platform; e.g. WL243, WL294, WL304) but some also occurred further north to the Sha Chau and Lung Kwu Chau region (e.g. WL79, WL227, WL254).

5.10.5. In a comprehensive review of the photo-ID catalogue curated by HKCRP, there were a total of 25 individuals that occurred during the baseline phase in 2011-12 and then re-sighted again during the post-construction phase of TMCLKL monitoring in 2020-22. Some of these individuals that occurred during the two-year TMCLKL post-construction period were actually sighted outside of the NL region. Their ranging patterns before and after the TMCLKL construction were compared to examine whether there has been any changes in their range use between the two periods that were a decade apart (see Appendix V).

5.10.6. For these 25 individuals, several parameters were evaluated for any temporal changes in their range use, which includes the change in level of utilization, any expansion, contraction or shifts in range use, and how shift and expansion from one area to another have occurred.

5.10.7. On the level of utilization, the majority of individuals (18) have occurred less often in the western waters of Hong Kong during the post-construction monitoring, while one individual (WL179) actually increased its occurrence when compared to the baseline period (Appendix V). On the contrary, another six individuals (CH108, NL49, NL242, NL259, NL261 and WL05) have occurred more or less the same between the baseline and post-construction phases.

5.10.8. Furthermore, all 15 individuals that have utilized NEL waters as part of their home ranges during the baseline period have shifted their ranges away from this region, which is not surprising as dolphins were mostly absent from this region since 2015. Also, a total of 14 individuals have either shifted or expanded their range use noticeably from NL waters to WL waters or even to SWL survey area (e.g. NL98, NL120) during the post-construction monitoring period (Appendix V). On the contrary, the range utilization remained similar between the baseline and post-construction phases for a number of individuals (e.g. CH108, NL104, NL202, WL46).

5.10.9. Notably, the ranges of 11 individuals have shrunk considerably during the post-construction period (e.g. EL01, NL46, NL104, NL226, NL286), but at the same time ten other individuals have expanded their range use (e.g. NL98, NL259, NL272), mostly as a result of range shift or expansion from NL waters to WL and SWL waters (Appendix V). However, four individuals (CH108, NL33, NL261 and WL179) have similar range sizes without any considerable expansion or shrinkage between the baseline and post-construction phases.

6. Summary of Findings from HKLR EM&A Monitoring in NL

6.1. Comparison between Baseline, Construction & Post-Construction Phase Monitoring

6.1.1. Dolphin occurrences in both NEL and NWL waters have diminished dramatically during and after the construction periods of TMCLKL. In NEL, dolphin started to disappear during the first two years of TMCLKL construction phase (2013-15), while such decline in dolphin occurrences expanded to the entire NL waters with little or no occurrence in the central and eastern portions of the region during the middle and later stages of the construction. Even during the post-construction phase in 2020-22, dolphin occurrences continued to diminish and mostly restricted to the waters around Lung Kwu Chau.

6.1.2. Dolphin encounter rates in NEL were moderately high during the baseline period but quickly declined to a much lower level during the transitional period and then dropped to extremely low levels in the first two years of TMCLKL construction periods. Since 2015, such rate remained zero in NEL waters including the entire post-construction period. On the contrary, dolphin encounter rates in NWL remained high before and during the first year of TMCLKL construction, but were on a steady decline in subsequent years, finally dropping to a very low level in the second year of post-construction period.

6.1.3. Similar temporal trends in dolphin density and abundance estimates were observed in both NEL and NWL waters, with significant downward sloping trend being confirmed to be statistically significant.

6.1.4. Across the ten 12-month periods before, during and after TMCLKL construction, the average dolphin groups sizes in NWL remained fairly similar in the earlier years across the baseline and transitional periods as well as the first five years of construction period, but then dropped to a lower level in the final year of construction period as well as both years of the post-construction period. Notable changes in distribution of larger dolphin groups over the past decade were similar to the overall dolphin distribution in NL waters.

6.1.5. Occurrences of young calves in the NL region have dramatically diminished during and after TMCLKL construction when compared to the baseline level. For the dolphin groups engaged in feeding and socializing activities, their distribution started to diminish and became more restricted to the western portion of the NL region during the first two years of TMCLKL construction period, and then continuously declined to the lowest level during the post-construction phase.

6.1.6. Among the 25 individuals being assessed for their range use before and after TMCLKL construction, the majority of them have occurred less often during the post-construction monitoring, with many also shifted their range use away from the NEL waters. Furthermore, more than half of these individuals have either shifted or expanded their range use noticeably from NL to WL or even SWL waters during the post-construction period.

6.2. Supplementary Studies

6.2.1. During the EIA stage, there were concerns that even though the bored piling works were considered significantly less-noisy and would not affect the dolphins as much as the percussive piling method, such works could still be loud and take longer to complete, thereby affecting the dolphins at some levels.

6.2.2. As a result, a number of supplementary studies were conducted under the TMCLKL EM&A Programme, which included underwater noise measurements, study of dolphin acoustic behaviour and tracking their movement from land before, during and after bored piling works, in order to study the impact of bored piling works on the dolphins. These studies were conducted in the vicinity of the TMCLKL construction work sites in NL waters, and were useful for complementing the vessel-based line-transect survey results as detailed above. They would also facilitate the review on the validity of EIA predictions and assessment on the effectiveness of mitigation measures for various impacts.

Land-based Monitoring on North-South Movement of CWD

6.2.3. Before, during and after the bored piling works for the TMCLKL construction, a shore-based theodolite tracking study at Pak Mong Station near Tai Ho Wan was completed to study dolphin behaviours and movements around the bored piling sites of the TMCLKL Southern Viaduct section. Thirty days each of shore-based theodolite tracking were conducted in September-October 2013 (baseline phase), March-April 2014 (construction phase) and June-September 2018 (post-construction phase).

6.2.4. The dolphins were tracked only on two days (with three dolphin groups) during the 30-day baseline period, with only one track made near Siu Ho Wan and Shum Shui Kok that that can meet the conditions for analysis. However, such track was quite far from the TMCLKL alignment, and may not provide any indicative information to establish the baseline condition.

6.2.5. On the contrary, no dolphin was sighted at all throughout the land-based observation periods during both construction and post-construction phases. Absence of dolphins from the land-based study concurred with the findings from visual line-transect vessel surveys as well as passive acoustic monitoring (see below) that the area overlapped with the TMCLKL bored piling sites was not frequently used by dolphins even before the bored piling works were commenced.

6.2.6. Notably, the number of vessels tracked during the land-based study increased steadily throughout the baseline, construction and post-construction phases. For example, the number of construction boats tracked were 175 before construction, 1,074 during construction and 431 after construction. Furthermore, the number of transportation boats tracked in relation to the construction activities were 1,812 before construction, 3,332 during construction and 7,089 after construction.

6.2.7. Such high intensity of vessel traffic in the vicinity of the TMCLKL southern viaduct alignment was mostly attributable to the construction activities of TMCLKL, HKBCF and HKLR03 during the construction phase in 2014, and TMCLKL, 3RS Project and Tung Chung New Town Development Project during the post-construction phase in 2018.

6.2.8. In reference to the bored piling monitoring results of HKLR09, it is expected that the presence of so many more vessels would certainly affect the movement and behaviour of any dolphins in the study area. However, due to the near-absence of dolphins in the area, it was impossible to assess the true impacts of bored piling works on dolphin movement in relation to TMCLKL construction, and whether there is any recovery in dolphin usage after the bored piling works have ceased.

Monitoring of Underwater Noise in relation to Bored Piling

6.2.9. As the noise contributed by bored piling activities was a major concern to the dolphins at the TMCLKL EIA stage, another study was conducted to measure noise levels at different distances from several bored piling sites of TMCLKL southern viaduct alignment before and during the initial phase of the piling works in 2014.

6.2.10. The monitoring study found that in the vicinity of the bored piling operations, there was an increase of approximately 11 dB between the baseline phase and construction phase. However, such increase was not strictly the result of construction-related sounds emanating from the bored piling pier locations, as the acoustic records and observation logs confirmed that the soundscape was dominated by transient vessel noise in relation to the bored piling operation. In fact, based on propagation modeling results from this study, the transient noise likely masked the noise generated by the bored piling works.

6.2.11. Therefore, the study concluded that while bored piling noise was quiet and considered negligible as compared to other anthropogenic noise, vessel traffic was actually the greatest contributor to the local soundscape in both baseline and the initial phase of bored piling works.

Monitoring of Dolphin Acoustic Behaviour

6.2.12. Another dolphin acoustic behavioural monitoring study was also conducted to record and note any changes in response of dolphins to the TMCLKL bored piling noise during the baseline phase (September-October 2013) and the initial phase of bored piling works

(March-April 2014).

6.2.13. Results from the acoustic monitoring using dipping hydrophone revealed that dolphin occurrences in NEL waters changed considerably during the construction phase with only four encounters, and they were considered mostly vacated from the study area at the initial phase of the bored piling works. Unfortunately, the small sample size of data obtained during the construction phase as compared to the 51 encounters recorded during the baseline phase did not warrant to draw any conclusions on the comparisons of dolphin whistling and clicking rates as a function of behavioural state, group size, the distance to the nearest vessel and the time of day.

6.2.14. On the other hand, results form the passive acoustic monitoring using Ecological Acoustic Recorders (EARs) revealed that significantly fewer files contained dolphin detections during the construction phase at both the impact site near TMCLKL southern viaduct as well as the control site between Lung Kwu Chau and Sha Chau.

6.2.15. The EAR data also supported the conclusion from the acoustic behavioural study that a substantial reduction in dolphin occurrences took place during the initial construction period, with the change at the impact site dramatically greater, where the mean daily percentage of recordings with detections changed from 1.61% during the baseline to 0.05% during construction, a more than 32-fold decrease. This is in contrast to less than a two-fold decrease at the control site with percentage dropped from 12.8% to 7.0% between the two phases.

6.2.16. Notably, the EARs also measured the ambient noise levels at the impact and control sites, and the data revealed significant increases in the ambient noise levels at both sites during the construction phases, further confirming the findings of the underwater noise measurements by the dipping hydrophone.

7. Review on Validity of EIA predictions

7.1. EIA predictions on Potential Impacts

7.1.1. The potential impacts of TMCLKL construction that consisted of the Southern Connection Viaduct Section (a 1.6 km long dual 2-lane viaduct between HKBCF and North Lantau Highway and associated road at Tai Ho) and the Northern Connection Sub-sea Tunnel Section (including the sub-sea TBM tunnels across the Urmston Road to connect Tuen Mun Area 40 and HKBCF as well as the northern landfall reclamation of approximately 16.5 hectares and about 20 km long seawalls) were evaluated during the EIA stage. In this review report, such impacts identified specifically for CWD in the

EIA report were re-assessed here, based on the information collected from the EM&A programme conducted before, during and after the TMCLKL construction works.

7.1.2. The EIA report provided a background of the impact assessment stating that the NL waters have been the focus of developments and the associated disturbance, together with general habitat degradation and destruction that represent significant potential threats to the long-term sustainability of the local dolphin population. The TMCLKL construction along with the cumulative impacts of HZMB construction activities associated with HKBCF and HKLR could introduce further potential stresses and impacts to the dolphins.

7.1.3. The ecological surveys conducted during the TMCLKL EIA stage clearly highlighted the study area (i.e. NEL waters) was heavily utilized by the dolphins, and that the nearby Brothers Islands and Shum Shui Kok area are critical dolphin habitats. Impacts from the construction of TMCLKL (involving reclamation works with dredging and filling activities, as well as the bored piling works for the marine viaduct) were predicted and addressed with proposed mitigation measures.

7.1.4. The four main categories of potential impacts included the blocking of dolphin travel corridors, acoustic disturbance from construction activities, impacts of suspended solids and bio-accumulation due to dredging and backfilling, and increased vessel traffic, which are further detailed below.

Blocking of Dolphin Travel Corridors

7.1.5. Dolphin density was found to be high in area near Tuen Mun/Lung Kwu Chau area as well as around the Brothers Islands/Shum Shui Kok, but the area in between these two regions did not show particularly high densities. Nevertheless, this area is known to be used as a travel corridor for the dolphins to move between these two high-density areas, which should still be considered important dolphin habitat and should not be degraded to the point that would affect their movement to and from the Brothers Islands/Shum Shui Kok area.

7.1.6. The assessment predicted that there would not be a complete physical blockage of traveling corridors as a result of TMCLKL construction, as the dolphins can still be able to move through area, especially considering the use of TBM for tunnel construction to minimize impacts. However, the reclamation for northern landfall and potential noise associated with TMCLKL construction may still have some impacts in terms of reducing dolphin use of these traveling corridors between the two high-density areas.

Acoustic Disturbance from Construction Activities

7.1.7. To construct the 50 bridge piers (each with 12 piles) for the southern marine viaduct section, the TMCLKL construction programme would adopt bored piling method instead of percussive piling, as the bored piling method was considered significantly less-noisy and does not generate any shock waves. However, the bored piling works would still be loud and can take longer to complete, thereby lengthening the overall time period of the project.

7.1.8. In addition, to build wall for protection of work areas from the water flow, temporary sheet pile would be driven into sediment layer to about 20 metres deep by vibratory tools, but not into the rock level.

7.1.9. The EIA report assumed that both bored and sheet piling may cause behavioural disturbance in the same way as percussive piling, but the effects were expected to be much less severe. The noisiest aspect of bored piling works would be when the metal caisson was bored into the rocky layer.

7.1.10. Beside the piling noise, dredging noise would also be expected, but such noise were expected to generally produce very low frequency sound, which would cause less impact to the dolphins with their increased use of high-frequency sound spectrum.

7.1.11. The EIA report predicted that the acoustic disturbances from bored piling, sheet piling and other dredging works may result in at least temporary abandonment of habitat by the dolphins, and such impact would be minor to moderate impact and appropriate mitigation measures would be needed. These measures included the acoustic decoupling of noisy equipment from work vessels and the use of dolphin exclusion zones (with a 250 metres radius) during these works. Furthermore, the work to drive the metal case into sediment or bedrock would be avoided during the peak calving months of May and June.

7.1.12. In addition, a monitoring programme was implemented as part of the EM&A programme to study the impacts specifically from bored piling works, which included underwater noise measurements and tracking of dolphin movement on land before, during and after bored piling works.

Impact from Suspended Solids and Bio-accumulation

7.1.13. The EIA report evaluated that the dredging and backfilling works would increase the suspended solid concentrations, which may in turn potentially influence the dolphins' prey and affect them indirectly by the loss of food supply due to disturbance and increased sedimentation.

7.1.14. Moreover, contaminants during dredging can be stirred up and redistributed into the water column, and such re-suspension of environmental contaminants may increase the bioaccumulation in dolphins through intake of prey items in the vicinity of the work area.

7.1.15. However, modeling results showed that no excessive exceedances of the Water Quality Objective for suspended solids are predicted except in the immediate vicinity or within the works area, as the natural fluctuation of suspended solids within the normal range of dolphins would be even higher. Therefore, it was concluded that such potential impact would be mainly limited to within 500 metres of the work site, and the application of the recommended silt curtain as a mitigation measure would be appropriate (which was in addition to the exclusion zone with 250 metres radius in place to protect dolphins from acoustic disturbance during dredging works).

<u>Impact of Vessel Traffic</u>

7.1.16. The TMCLKL construction would substantially increase the number of vessels in the vicinity of the work area, which would potentially increase the chance of dolphins being killed or injured by vessel collisions, and also result in increased acoustic disturbance to the dolphins.

7.1.17. Acoustic disturbance from large vessels were expected to be well below the primary acoustic range for dolphins; nevertheless, they may still need to alter their diving and surfacing patterns to avoid collisions with these marine vessels, which could result in some short-term disturbance to the dolphins or may even displace them from their preferred habitats.

7.1.18. On the other hand, high-speed vessels in association with the construction activities would also travel through the dolphin habitats and cause impacts as they cannot always get out of their way. These vessels could potentially strike, injure or even kill them.

7.1.19. The EIA report predicted that the vessels involved in construction activities for this project would be largely restricted to slow-moving barges, dredgers and crew boats, and would not be expected to have a serious impact on dolphin behaviour. Nevertheless, given the large volume of vessel traffic, disruption to dolphins could still occur.

7.1.20. Depending upon the speed of marine vessels traveling through the construction area, the impact would be of minor to moderate, and some mitigation measures would be required to minimize the level of impact. The mitigation measures adopted included a speed limit of 10 knots to be strictly observed for construction vessels within the works area where dolphins are likely to occur (i.e. all areas to the north and west of Lantau Island), and a requirement for all vessels traversing through the work areas to use predefined and regular routes to reduce their disturbance to dolphins.

Operational Phase Impacts

7.1.21. During the operational phase, direct impacts due to the reclamation for the tunnel landfalls and bridge piers is predicted to result from the permanent loss of approximately 600 metres of existing seawall and about 46.7 hectares of mostly soft-bottom seabed.

7.1.22. Moreover, indirect change to water quality as a result of changes to the waters flows due to the presence of new landforms was expected during the operational phase, and this would need to be jointly assessed along with HKBCF and HKLR03 reclamation works. Modeling results indicated that these reclamation works and associated facilities would not cause significant large-scale regional changes in hydrodynamics or water quality, although some localized changes are predicted. As significant impacts on water quality as a result of the project were not expected by the water quality modeling, no significant impacts to ecological resources from changes to tidal flow with adverse impact on marine water quality were predicted in the EIA report.

Cumulative Impacts

7.1.23. The EIA report predicted the impacts arisen from TMCLKL construction which were predominantly confined to construction phase and of short duration (a maximum of about three years), while some permanent loss of habitat would result but considered to be not significant when compared to other proposed projects.

7.1.24. Nevertheless, there were many projects being proposed to be implemented in the same area and that were concurrent to TMCLKL construction phase may cause cumulative impacts, including prolonged period of disturbance and increased intensity of impacts, and induced synergistic impacts.

7.1.25. Notably, the entire HZMB comprised bridge and tunnel sections, together with two artificial islands at either end of the tunnel section in Guangdong waters. HZMB connects with HKLR viaduct at the western territorial boundary of Hong Kong, with the road then running along the southern end of the airport island, tunnel and viaduct sections built on reclaimed land to the east before connecting to HKBCF, to which the TMCLKL is directly connected.

7.1.26. The key issues of these construction activities is related to habitat loss as a result of reclamations needed for HKLR and HKBCF, which are large (168 hectares in total) and located in areas of ecological importance to the dolphins. As a major contributor, the key impact would be from HKBCF construction which would have a moderate to major contribution to overall cumulative impacts on the local dolphin population.

7.1.27. Other cumulative impacts associated with reclamation involved dredging and backfilling works, bored piling works for the HKLR viaduct and also additional marine traffic. For acoustic disturbance, the increased number of construction vessels in the area could increase the impacts on dolphins, and also the bored piling works for HKLR comprised the construction of about 135 piers in addition to the 50 more to be constructed by the TMCLKL southern viaduct. The increased amount of construction activities would also potentially disturb the dolphins further or block their key travel corridors.

7.1.28. With so many marine infrastructure projects being constructed in parallel in the same area, the EIA report stated that this was unusual in Hong Kong, especially considering the area to be a dolphin habitat. Therefore, the report concluded that efforts to lessen the cumulative impact would be required, and a marine park to be designated around the Brothers Islands as a firm commitment from the Hong Kong Government is made in order to enhance the dolphin habitat (note: this marine park was later established in 2016). The report considered such commitment to significantly help conserve the dolphins and serve as an effective mitigation measure for the loss of dolphin habitat arising from these HZMB projects. With this measure, the residual cumulative impacts to the dolphins in terms of permanent habitat loss would be considered acceptable.

7.1.29. As the number of vessels moving in the area would increase significantly when considering the concurrent contracts of TMCLKL, HKBCF and HKLR, the cumulative risk of injury or mortality from collisions with vessels would also increase substantially. However, the report considered that all three projects have already specified and implemented a similar level of mitigation strategies, and the cumulative impacts would then be reduced to acceptable levels. Similar logic could also be applied for cumulative impacts on acoustic disturbance and possible blockage of traveling corridors.

7.2. Identification of shortcomings in EIA predictions

7.2.1. Dolphin occurrence during/after construction works vs. baseline condition

7.2.1.1. <u>Vessel-based line-transect monitoring</u>: dolphin occurrences in both NEL and NWL waters have diminished dramatically during and after the construction periods of TMCLKL. While dolphins have completely disappeared from NEL waters since 2015, their occurrence in NWL waters was mostly restricted to the water around Lung Kwu Chau in the later stage of TMCLKL construction and the entire post-construction monitoring. Occurrence of calves and activities were also greatly diminished during and after the TMCLKL construction with no sign of recovery at all.

7.2.1.2. Land-based study on movements: no dolphin was sighted at all throughout the observation period during and after bored piling works, but dolphins were already rarely sighted before bored piling works began, with only a few groups tracked on two days. Moreover, the number of vessels tracked increased steadily throughout the baseline, construction and post-construction phases, and such high intensity of vessel traffic was mostly attributable to the construction activities of TMCLKL and other nearby marine infrastructure projects.

7.2.1.3. Underwater noise monitoring: in the vicinity of the bored piling operations, there was a noticeable increase in underwater noise, which was mainly contributed by the transient vessel noise rather than the bored piling noise. Such elevated ambient noise levels were also recorded by the passive acoustic monitoring works. The study concluded that bored piling noise was quiet and considered negligible when compared to other noise, with the vessel traffic being the greatest contributor to the local soundscape.

7.2.1.4. Acoustic behaviour monitoring: from the dipping hydrophone measurements, dolphin occurrences in NEL waters changed considerably during the construction phase, but the small sample size of data prohibited the study to draw any conclusions on the comparison of dolphin acoustic behaviour before and after bored piling works. On the other hand, passive acoustic monitoring results revealed that there was a substantial reduction in dolphin occurrences during the initial phase of the bored piling works.

7.2.2. EIA predictions vs. actual situation

7.2.2.1. In contrary to the EIA predictions that the TMCLKL construction would not cause significant impact to the dolphins in NL waters with sufficient mitigation measures in place, their occurrences have been on a significant and dramatic decline during the construction phase, and there has been no sign of recovery but even further decline was detected during the post-construction phase.

7.2.2.2. In addition to the vessel-based monitoring programme, several supplementary studies were conducted to verify the predictions made in the EIA report. Those studies concurred with the vessel survey data that dolphin occurrences have dramatically decreased during the initial phase of bored piling works, although such decline may have already occurred before the TMCLKL construction works were commenced in 2014. The study results also revealed that the significantly increased amount of vessel traffic traversing through the work area in relation to the TMCLKL construction works have contributed to elevated levels of ambient noise and thereby affecting the dolphin usage in the area.

7.2.2.3. Notably, an Event and Action Plan was in place as part of the EM&A programme, and throughout the construction period of TMCLKL, the Limit Levels have been repeatedly triggered in consecutive quarters. However, very limited action has been taken to address the dire situation. The adaptive management as promised in the EIA report and the EM&A programme was almost non-existent throughout the TMCLKL construction period even with the dramatic decline in dolphin occurrences in NL waters.

7.2.3. Possible contributions to discrepancies between the two

7.2.3.1. There are several plausible explanations behind the discrepancies between the EIA predictions and the actual outcome of the TMCLKL EM&A programme.

7.2.3.2. It is apparent that the TMCLKL EIA report has underestimated the magnitude of its predictions for some temporary impacts to the dolphins. For example, the noise associated with the bored piling works was significantly higher. Even though the bored piling procedure itself may not cause too much noise, but the associated transient noise of moving vessels near the bored piling works (such as the ones transporting workers to and from work barges) was the likely source that have primarily contributed to the elevated noise level. This would in turn affect the dolphin acoustic behaviour and deter them to move away from the work sites. Such impact would certainly cause some temporary displacements of dolphins from their favourable habitat during the marine construction works, and may even affect the movement of dolphins (or blocking their traveling corridors) to and from their favourite habitats such as the Brothers Islands.

7.2.3.3. Also, the EIA report has predicted that the vessels involved in the TMCLKL construction works would mostly be slow-moving and emit low-frequency noise that would not affect the dolphins. However, it has been frequently observed from land (during the shored-based theodolite tracking) and boat (during vessel surveys and acoustic monitoring surveys) that there are large number of construction-related boats (mostly fast-moving transportation boats shuttling workers to and from various work fronts at sea) within and in the vicinity of the TMCLKL construction area. As a result, the dolphins may have to shift their acoustic behavioural patterns in response as suggested by the acoustic monitoring study at the early stage of construction works. Similar to the noise impact, such intense and fast-moving marine traffic would also cause some temporary displacements of dolphins from their favourable habitat.

7.2.3.4. Due to the underestimation of construction impact, the mitigation measures suggested by the EIA report and adopted during construction to minimize the impact of noise and marine traffic have not been as effective as originally predicted, which is evidenced by the dramatic decline in dolphin occurrence in NEL waters at the initial phase of the TMCLKL construction, then further extending to the entire NL region in the later stage of the construction programme.

7.2.3.5. Nevertheless, even though the abovementioned impacts may have resulted in the decline of dolphin occurrences in NL waters during the marine construction works of TMCLKL, these impacts should be temporary in nature, and one would have assumed that these impacts would only affect the dolphins during the construction phase. Once the construction is completed and the marine traffic with associated noise have subsided, it would be a reasonable assumption that the dolphins would return to the NL waters back to the baseline level, especially after the establishment of the Brothers Marine Park in 2016 as a compensation measure for the permanent habitat loss resulted from HZMB projects. However, as observed in the TMCLKL post-construction monitoring results, there has been no sign of such recovery at all. In fact, the dolphin occurrence still continued to fall in NL waters during the two-year TMCLKL post-construction period.

7.2.3.6. It should also be mentioned that the duration of TMCLKL construction was originally planned for a maximum of about three years as stated in the EIA report, but in reality the construction period has stretched from the first half of 2014 to mid-2020, more than doubling of the original forecast. Such prolonged period of construction may have also affected the recovery of dolphin usage in NL waters.

7.2.3.7. Finally, it should be mentioned that the cumulative impacts of habitat degradation in NL waters in the past decade has beem seriously underestimated, while the effectiveness of establish a marine park around the Brothers Island as a compensation measure for the permanent habitat loss from HZMB projects have been partially or completely offset by the additional impact of the massive reclamation works of the 3RS project. It was a serious oversight that this marine infrastructure project has been largely ignored in the cumulative impact assessment of the TMCLKL EIA report (as well as in other EIA reports of HZMB projects) for the permanent dolphin habitat loss in NL waters, even though the planning of such project has been in place since 2006 when the Hong Kong International Airport Master Plan 2025 was released.

7.2.3.8. Notably, the 650 hectares of dolphin habitat loss as a result of the massive reclamation in relation to the 3RS project has clearly contributed to the further decline in dolphin occurrence in NL waters since the project commencement in 2016. The large-scale habitat loss from this infrastructure project is situated in the vicinity of the TMCLKL, HKBCF and HKLR project sites, at an area where individual dolphins have utilized as the main traveling corridors to move between three main dolphin habitats in Hong Kong including the Brothers Islands, the Sha Chau and Lung Kwu Cha Marine Park, and the

West Lantau waters (Hung 2013). This would further contribute to the impact of dolphin movement to and from the TMCLKL project area as well as the Brothers Marine Park, and result in further decline in dolphin occurrences in the NL region toward the end of and after the TMCLKL construction.

8. Recommendations and Conclusions

8.1. The TMCLKL post-construction dolphin monitoring works in NL waters have been completed in 2020-22, with the results being assessed in comparison with the baseline and construction phase monitoring data collected before and during the TMCLKL construction.

8.2. It is obvious that the baseline phase, construction phase and post-construction phase dolphin monitoring as well as several supplementary studies completed under the TMCLKL EM&A programme provided critical information for the evaluation on the predictions of impact assessment during the TMCLKL EIA stage, as well as the adequacy and effectiveness of suggested mitigation measures. More importantly, lessons can be learnt from such comprehensive monitoring programme for future EIA studies and EM&A programmes in Hong Kong, especially the ones within marine mammal habitats.

8.3. As the decline in dolphin usage in NL waters was dramatic throughout the TMCLKL construction phase, and such decline still continued during the post-construction phase monitoring works with no sign of recovery to be anywhere near the baseline level, the two-year TMCLKL post-construction monitoring programme is considered inadequate, and it may take a longer period to assess the residual impacts of the TMCLKL construction works (and other HZMB project works) as well as other cumulative impacts on the dolphins.

8.4. Furthermore, the passive acoustic monitoring studies conducted by AFCD and various consultancies studies in western waters of Hong Kong have provided critical information on night-time occurrence of dolphins in the past decade. In fact, these studies revealed that in some areas such as the Brothers Islands were mostly utilized by dolphins outside of daylight hours. The passive acoustic monitoring method also showed promising results to detect trend in dolphin occurrence in areas of very low occurrences such as the NEL waters (Wang and Hung 2020, 2021). Therefore, it is highly recommended to adopt this method in monitoring dolphin usage throughout the NL region in order to assess any sign of recovery of their usage after the completion of HZMB projects.

8.5. The overall EM&A programme to examine the potential impacts of TMCLKL and evaluate the predictions of the EIA report has provided solid proof that it is working well according to the intention of the EIA framework in Hong Kong. The authority should take advantage of the important findings of this EM&A programme to fill information gap and facilitate further monitoring works, as well as to improve the impact predictions and associated mitigation measures for future infrastructure project. This review report would also provide a good example of how EIA studies should be routinely reviewed in the future.

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Table 1. Co-cordinates of transect lines in NWL & NEL survey areas

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

Table 2. Monthly dolphin encounter rates (no. of on-effort dolphin sighting and no. of dolphins from all on-effort sightings per 100 km of survey effort) in NWL survey area during the post-construction monitoring period of June 2020 to May 2022

Monitoring Month	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)
Jun 2020	0.0	0.0
Jul 2020	0.6	0.6
Aug 2020	0.6	0.6
Sep 2020	0.6	1.2
Oct 2020	0.0	0.0
Nov 2020	0.6	1.3
Dec 2020	0.7	1.4
Jan 2021	4.9	15.5
Feb 2021	2.4	7.3
Mar 2021	1.8	4.3
Apr 2021	0.0	0.0
May 2021	0.6	3.1
Jun 2021	0.0	0.0
Jul 2021	0.0	0.0
Aug 2021	0.0	0.0
Sep 2021	0.6	0.6
Oct 2021	0.0	0.0
Nov 2021	1.2	2.3
Dec 2021	0.0	0.0
Jan 2022	2.9	5.8
Feb 2022	1.8	4.7
Mar 2022	0.0	0.0
Apr 2022	0.0	0.0
May 2022	0.0	0.0

Table 3. Quarterly dolphin encounter rates in NWL during the 2020-22 post-construction phase monitoring (± 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)
June-August 2020	0.57 ± 0.89	0.57 ± 0.89
September-November 2020	0.54 ± 0.84	1.09 ± 1.69
December 2020-February 2021	3.01 ± 2.83	8.47 ± 9.07
March-May 2021	1.13 ± 1.37	3.44 ± 4.26
June-August 2021	0	0
September-October 2021	0.81 ± 1.36	1.35 ± 2.61
December 2021-February 2022	1.63 ± 1.47	3.52 ± 3.87
March-May 2022	0	0

Table 4a. Comparison of average dolphin encounter rates in NEL across the ten 12-month periods before, during and after construction of TMCLKL (± 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)
Feb 2011 – Jan 2012 (Baseline)	4.67 ± 2.84	13.21 ± 9.99
Nov 2012 - Oct 2013 (Transitional)	1.70 ± 2.26	4.75 ± 7.61
Nov 2013 – Oct 2014 (Construction)	0.22 ± 0.74	0.76 ± 2.59
Nov 2014 – Oct 2015 (Construction)	0.11 ± 0.54	0.11 ± 0.54
Nov 2015 – Oct 2016 (Construction)	0	0
Nov 2016 – Oct 2017 (Construction)	0	0
Nov 2017 – Oct 2018 (Construction)	0	0
Nov 2018 – Oct 2019 (Construction)	0	0
Jun 2020 - May 2021 (Post-Construction)	0	0
Jun 2021 - May 2022 (Post-Construction)	0	0

Table 4b. Comparison of average dolphin encounter rates in NWL across the ten 12-month periods before, during and after construction of TMCLKL (± 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)
Feb 2011 – Jan 2012 (Baseline)	8.28 ± 3.41	28.65 ± 20.18
Nov 2012 - Oct 2013 (Transitional)	7.68 ± 4.36	27.51 ± 18.06
Nov 2013 – Oct 2014 (Construction)	6.93 ± 4.08	26.31 ± 17.56
Nov 2014 – Oct 2015 (Construction)	2.54 ± 2.49	11.64 ± 14.04
Nov 2015 – Oct 2016 (Construction)	2.10 ± 1.83	8.54 ± 8.53
Nov 2016 – Oct 2017 (Construction)	2.35 ± 2.62	8.57 ± 11.05
Nov 2017 – Oct 2018 (Construction)	2.68 ± 3.04	9.02 ± 14.63
Nov 2018 – Oct 2019 (Construction)	1.42 ± 1.80	3.62 ± 4.93
Jun 2020 - May 2021 (Post-Construction)	1.31 ± 1.88	3.39 ± 5.73
Jun 2021 - May 2022 (Post-Construction)	0.73 ± 1.24	1.46 ± 2.82

Table 5. Line transects parameters and estimates of density and abundance for Chinese White Dolphins in NEL waters before, during and after the TMCLKL construction (2011-22)

([1]unit for encounter rate: number of on-effort sightings per 100 km of survey effort; [2]unit for individual density: number of dolphins per 100 km^2)

	Effort	Number of Sightings	Encounter Rate[1]	Individual Density[2]	Abundance	95% C.I. (Abundance)	%CV
Baseline (2011-12)	1332.1	68	5.10	18.11	10	6-16	25.08
Transitional (2012-13)	1362.1	22	1.62	4.25	2	1-5	36.29
Construction (2013-14)	1327.0	3	0.23	1.65	1	0-4	78.10
Construction (2014-15)	1373.8	1	0.07	N/A	N/A	N/A	N/A
Construction (2015-16)	1333.4	0	0.00	N/A	N/A	N/A	N/A
Construction (2016-17)	1222.1	0	0.00	N/A	N/A	N/A	N/A
Construction (2017-18)	1153.0	0	0.00	N/A	N/A	N/A	N/A
Construction (2018-19)	1129.2	0	0.00	N/A	N/A	N/A	N/A
Post-Construction (2020-21)	1140.9	0	0.00	N/A	N/A	N/A	N/A
Post-Construction (2021-22)	1327.6	0	0.00	N/A	N/A	N/A	N/A
Baseline & Transitional	2694.2	90	3.34	11.17	6	4-8	17.28
Construction	7538.5	4	0.05	0.31	0	0-1	74.17
Post-Construction	2468.5	0	0.00	N/A	N/A	N/A	N/A

Table 6. Line transects parameters and estimates of density and abundance for Chinese White Dolphins in NWL waters before, during and after the TMCLKL construction (2011-22)

([1]unit for encounter rate: number of on-effort sightings per 100 km of survey effort; [2]unit for individual density: number of dolphins per 100 km^2)

	Effort	**Number of Sightings**	**Encounter Rate[1]**	**Individual Density[2]**	**Abundance**	**95% C.I. (Abundance)**	**%CV**
Baseline (2011-12)	1910.0	163	8.53	44.76	39	30-50	12.88
Transitional (2012-13)	1894.6	143	7.55	43.84	38	29-51	14.31
Construction (2013-14)	2019.1	125	6.19	32.67	28	21-38	14.94
Construction (2014-15)	2103.2	48	2.28	12.99	11	7-19	26.63
Construction (2015-16)	1976.1	36	1.82	12.27	11	6-19	30.90
Construction (2016-17)	1883.5	37	1.96	11.15	10	6-17	28.09
Construction (2017-18)	1798.7	38	2.11	7.08	6	4-11	27.71
Construction (2018-19)	1869.9	23	1.23	2.95	3	1-5	37.15
Post-Construction (2020-21)	1928.6	22	1.14	4.59	4	2-9	41.76
Post-Construction (2021-22)	2047.0	11	0.54	0.13	1	0-3	54.61
Baseline & Transitional	3804.6	306	8.04	45.73	40	33-48	9.76
Construction	11650.5	307	2.64	13.08	11	9-14	10.25
Post-Construction	3975.6	33	0.83	2.96	3	1-5	32.29

Table 7a. Comparison of average dolphin group sizes in NEL across the ten 12-month periods before, during and after construction of TMCLKL (± denotes the standard deviation of the average group sizes)

	Average Dolphin Group Sizes
Feb 2011 – Jan 2012 (Baseline)	2.78 ± 2.13 (n = 68)
Nov 2012 - Oct 2013 (Transitional)	2.59 ± 2.30 (n = 22)
Nov 2013 – Oct 2014 (Construction)	5.33 ± 3.21 (n = 3)
Nov 2014 – Oct 2015 (Construction)	1.0 (n = 1)
Nov 2015 – Oct 2016 (Construction)	0
Nov 2016 – Oct 2017 (Construction)	0
Nov 2017 – Oct 2018 (Construction)	0
Nov 2018 – Oct 2019 (Construction)	0
Jun 2020 - May 2021 (Post-Construction)	0
Jun 2021 - May 2022 (Post-Construction)	0

Table 7b. Comparison of average dolphin group sizes in NWL across the ten 12-month periods before, during and after construction of TMCLKL (± denotes the standard deviation of the average group sizes)

	Average Dolphin Group Sizes
Feb 2011 – Jan 2012 (Baseline)	3.59 ± 3.02 (n = 163)
Nov 2012 - Oct 2013 (Transitional)	3.61 ± 3.17 (n = 143)
Nov 2013 – Oct 2014 (Construction)	3.66 ± 2.46 (n = 125)
Nov 2014 – Oct 2015 (Construction)	4.44 ± 3.20 (n = 48)
Nov 2015 – Oct 2016 (Construction)	3.89 ± 2.95 (n = 36)
Nov 2016 – Oct 2017 (Construction)	3.54 ± 2.73 (n = 37)
Nov 2017 – Oct 2018 (Construction)	3.32 ± 2.94 (n = 38)
Nov 2018 – Oct 2019 (Construction)	2.52 ± 1.50 (n = 23)
Jun 2020 - May 2021 (Post-Construction)	2.64 ± 2.08 (n = 22)
Jun 2021 - May 2022 (Post-Construction)	2.09 ± 1.64 (n = 11)

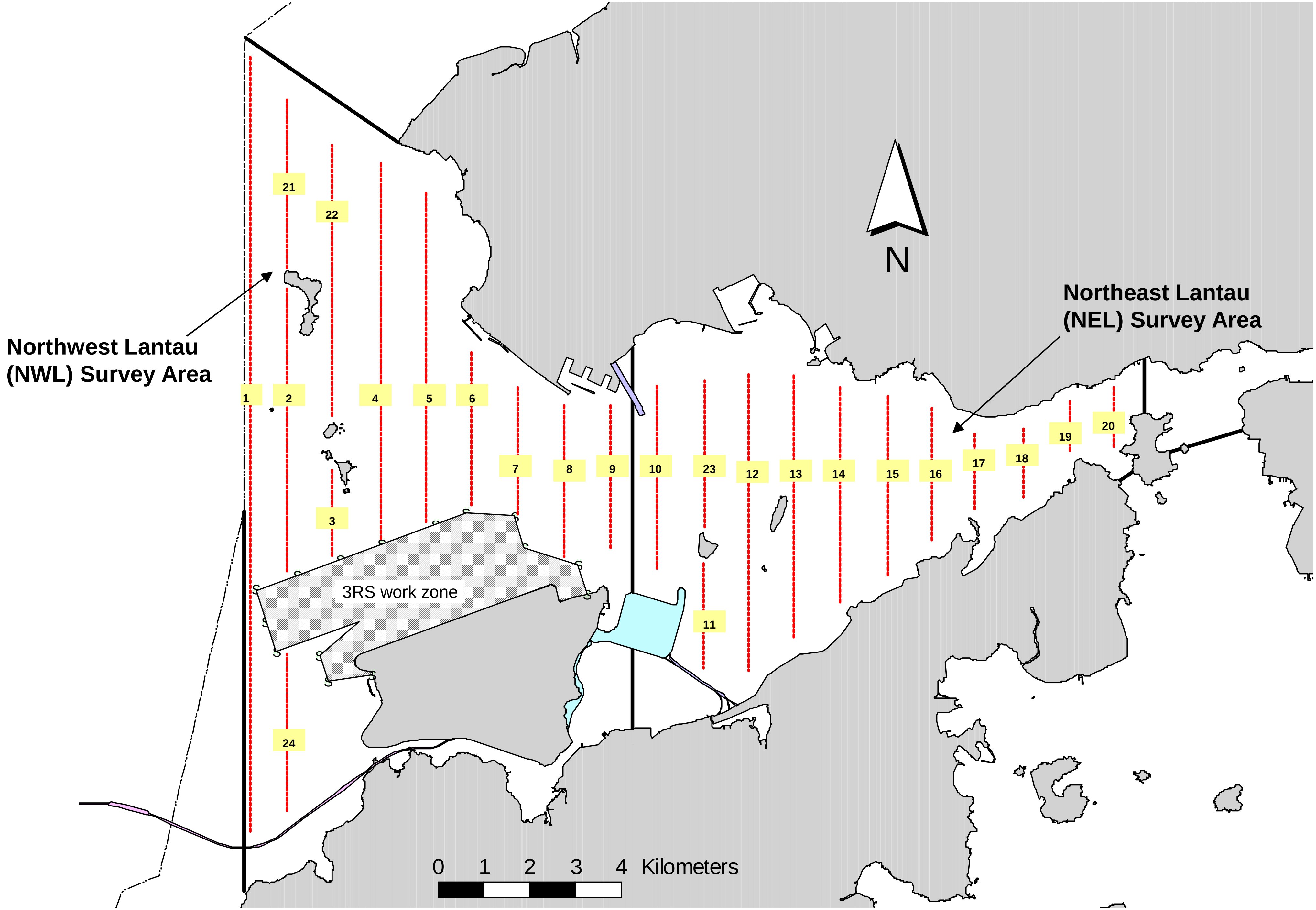


Figure 1. Transect Line Layout in Northwest and Northeast Lantau Survey Areas

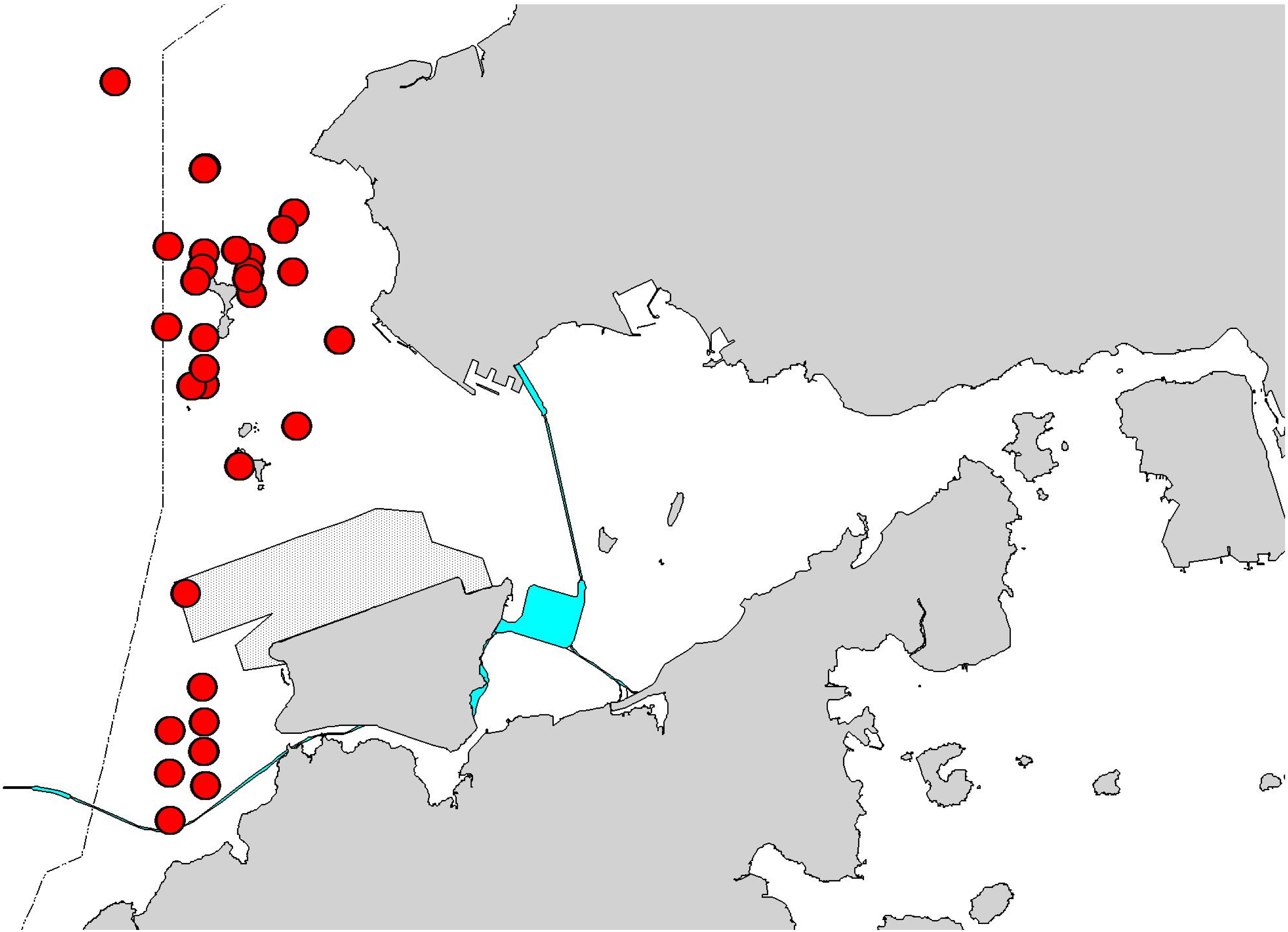
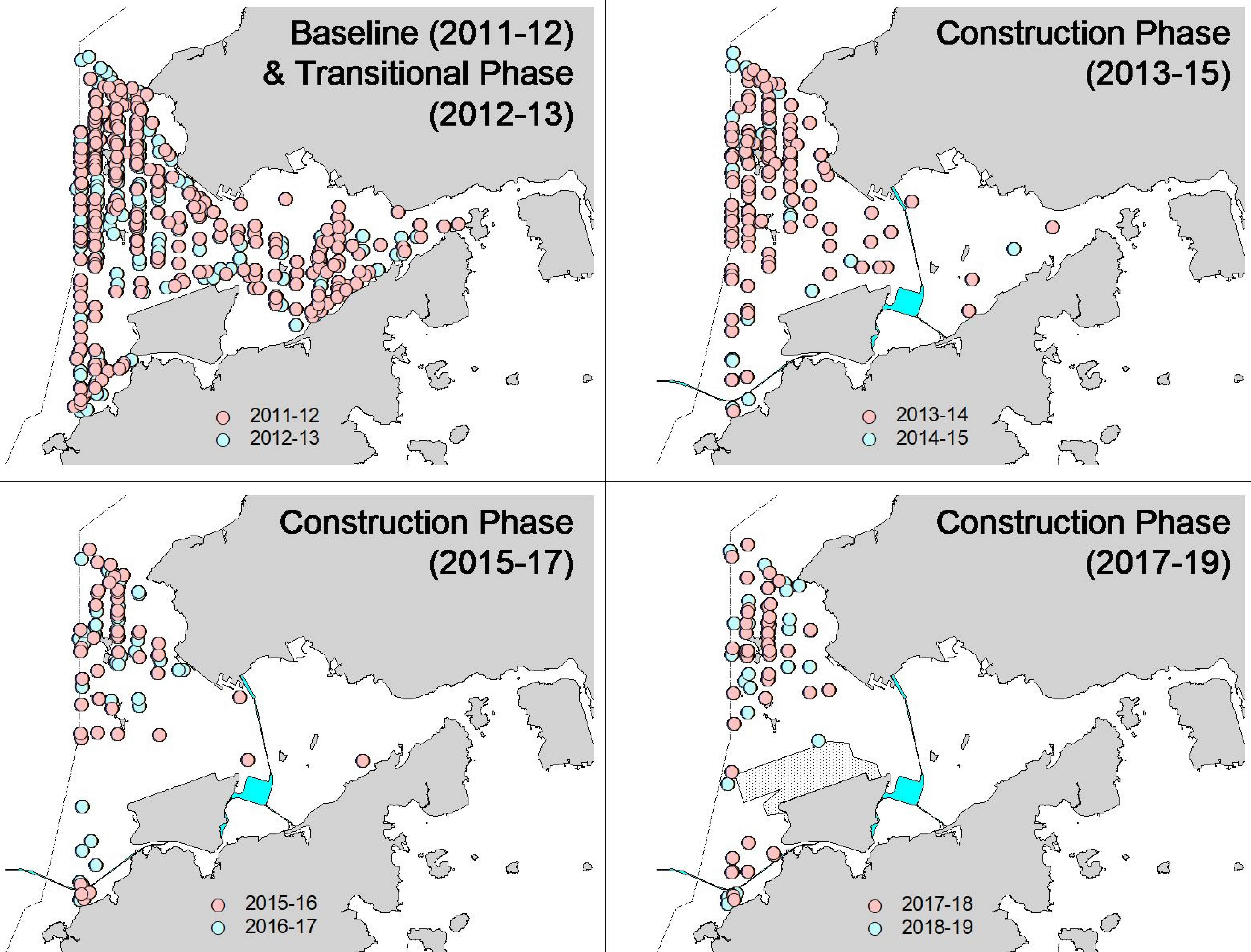


Figure 2. Distribution of Chinese White Dolphin sightings in North Lantau waters during TMCLKL post-construction phase monitoring (June 2020 – May 2022)



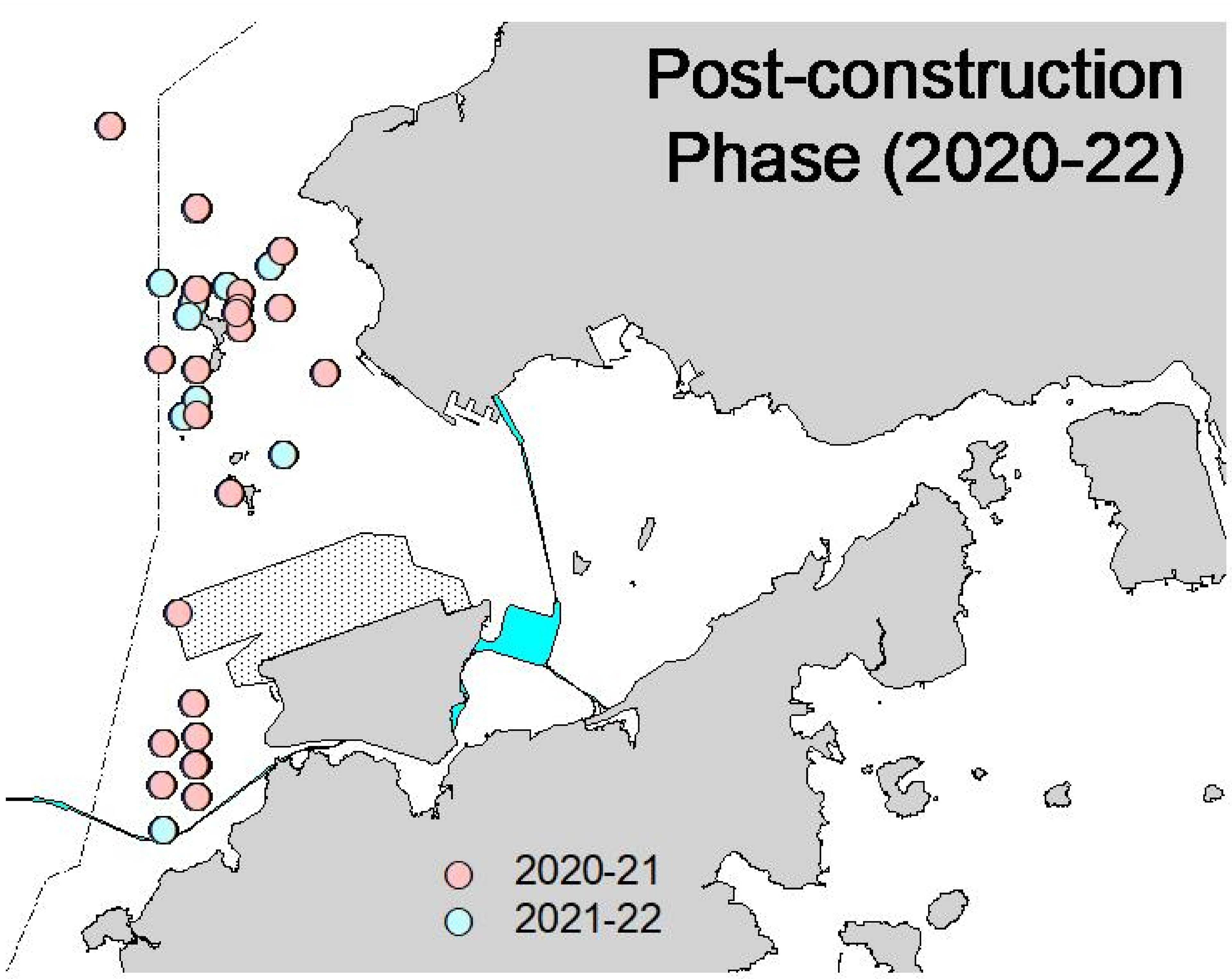


Figure 3. Distribution of Chinese White Dolphin sightings in North Lantau waters during the baseline phase (Feb11-Jan12), transitional phase (Nov12-Oct13), six years of construction phase (Nov13-Oct19) and two years of post-construction phase monitoring (June 2020 – May 2022)

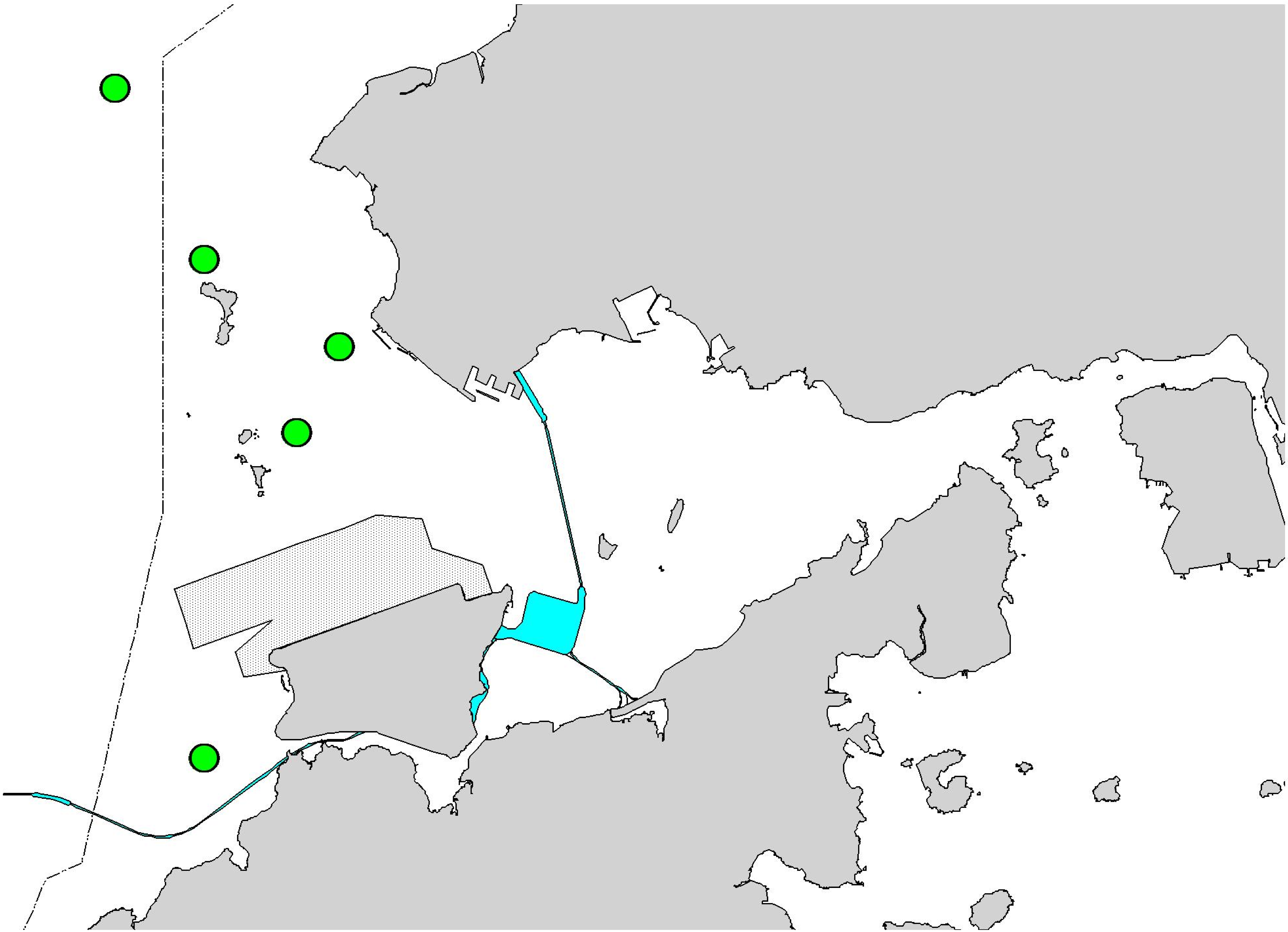


Figure 4. Distribution of Chinese White Dolphin sightings with large group sizes during TMCLKL post-construction phase monitoring in 2020-22 (green dots: group sizes of 5 or more)

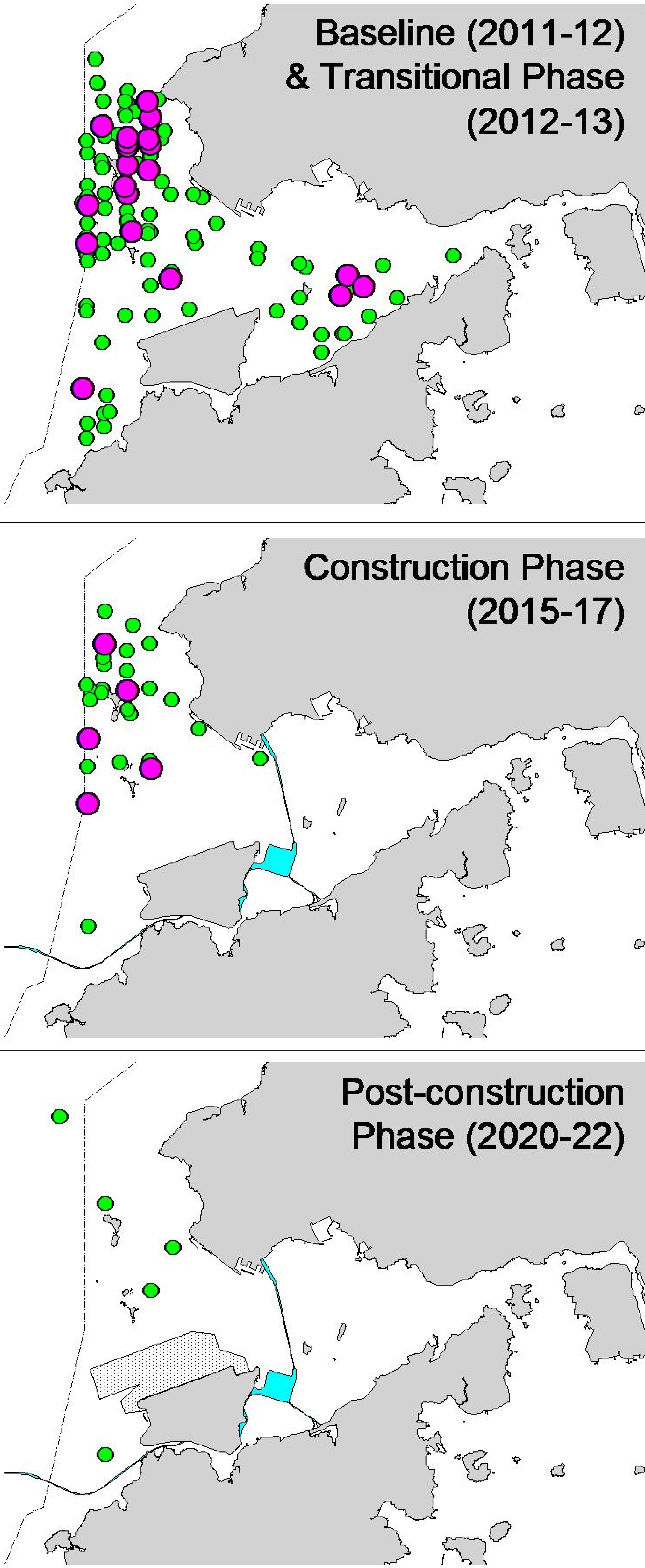


Figure 5. Distribution of Chinese White Dolphin sightings with large group sizes (green dots: group sizes of 5 or more; purple dots: group sizes of 10 or more) during the baseline phase (Feb11-Jan12), transitional phase (Nov12-Oct13), six years of construction phase (Nov13-Oct19) and two years of post-construction phase monitoring (June 2020 – May 2022)

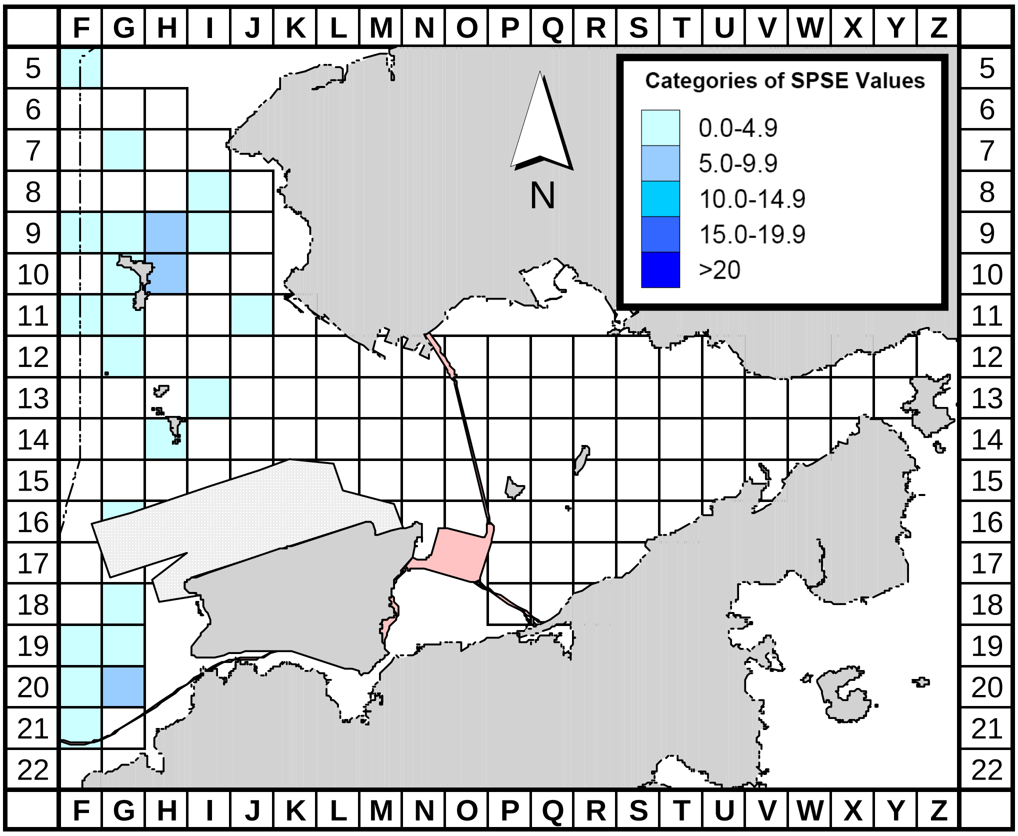


Figure 6a. Sighting density of Chinese White Dolphins with corrected survey effort per km^2 in Northeast and Northwest Lantau survey areas, using data collected during the TMCLKL post-construction monitoring period in June 2020 - May 2022 (SPSE = no. of on-effort sightings per 100 units of survey effort)

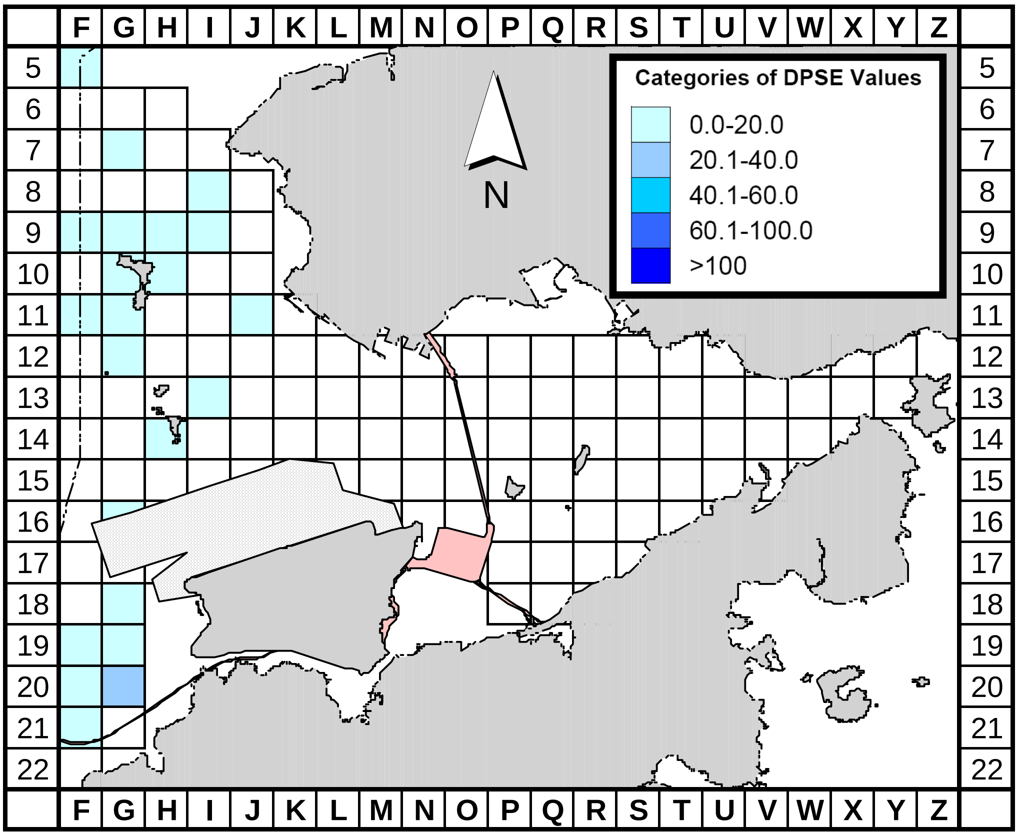


Figure 6b. Density of Chinese White Dolphins with corrected survey effort per km^2 in Northeast and Northwest Lantau survey areas, using data collected during the TMCLKL post-construction monitoring period in June 2020 - May 2022 (DPSE = no. of dolphins per 100 units of survey effort)

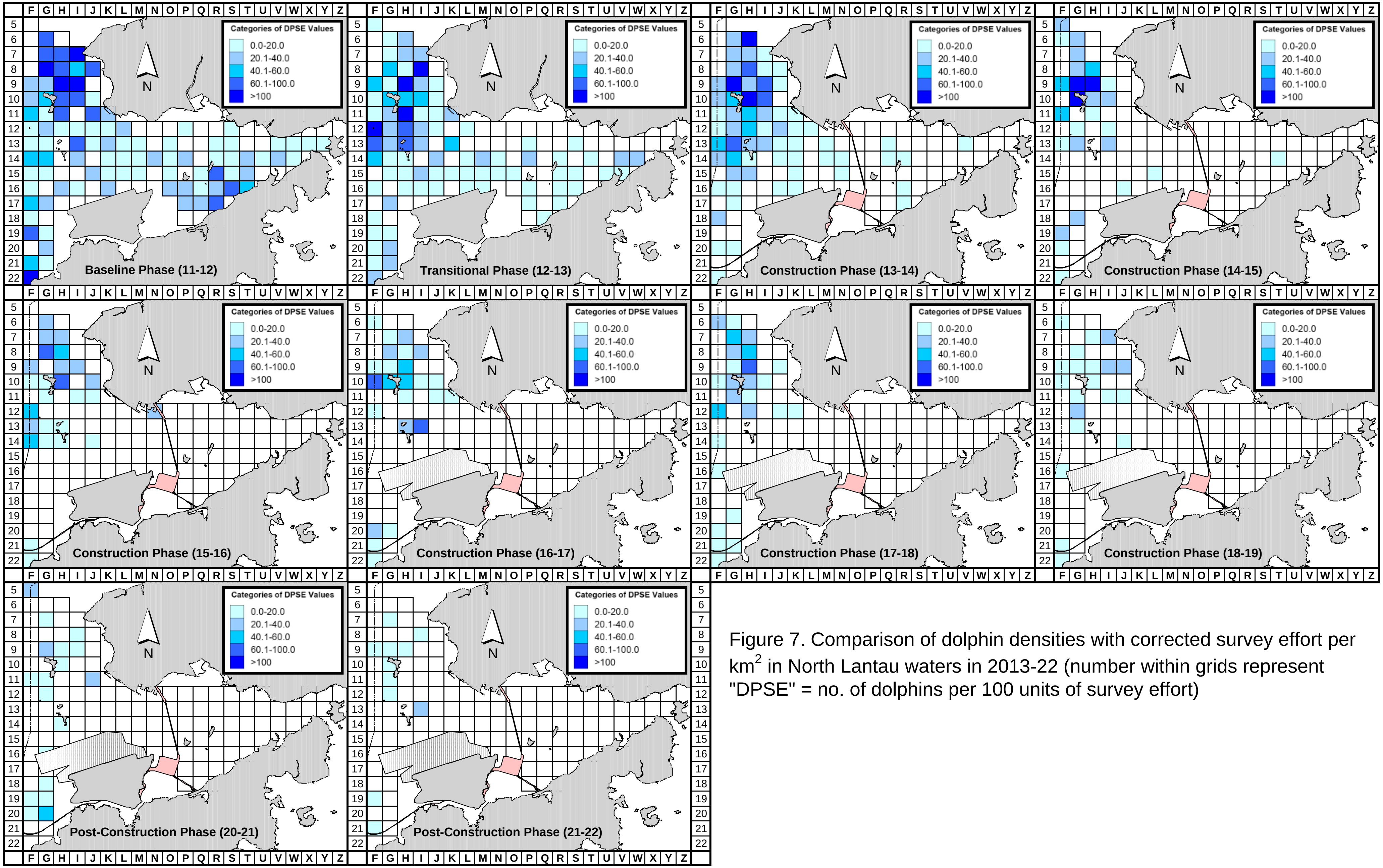


Figure 7. Comparison of dolphin densities with corrected survey effort per km^2 in North Lantau waters in 2013-22 (number within grids represent "DPSE" = no. of dolphins per 100 units of survey effort)

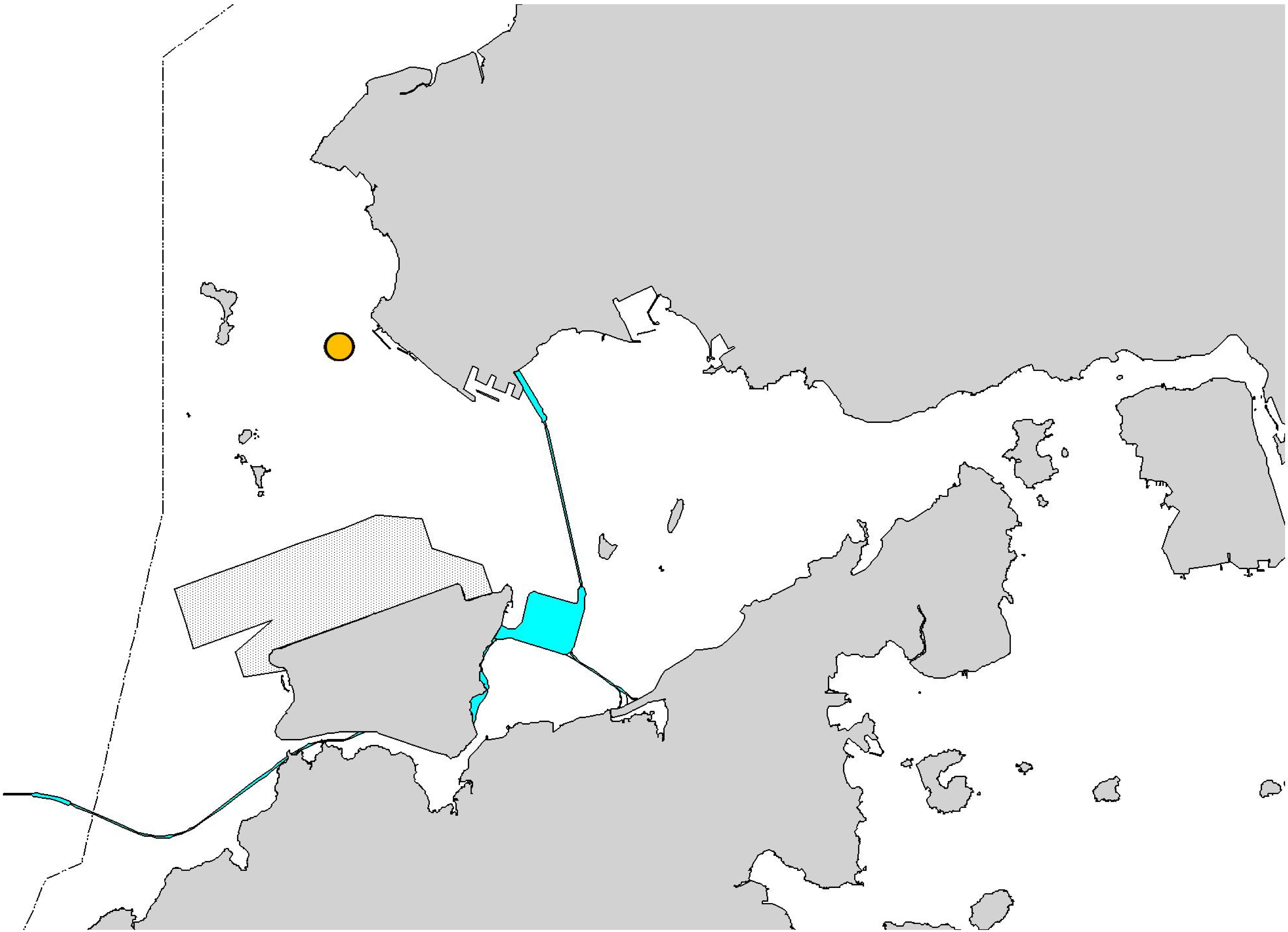
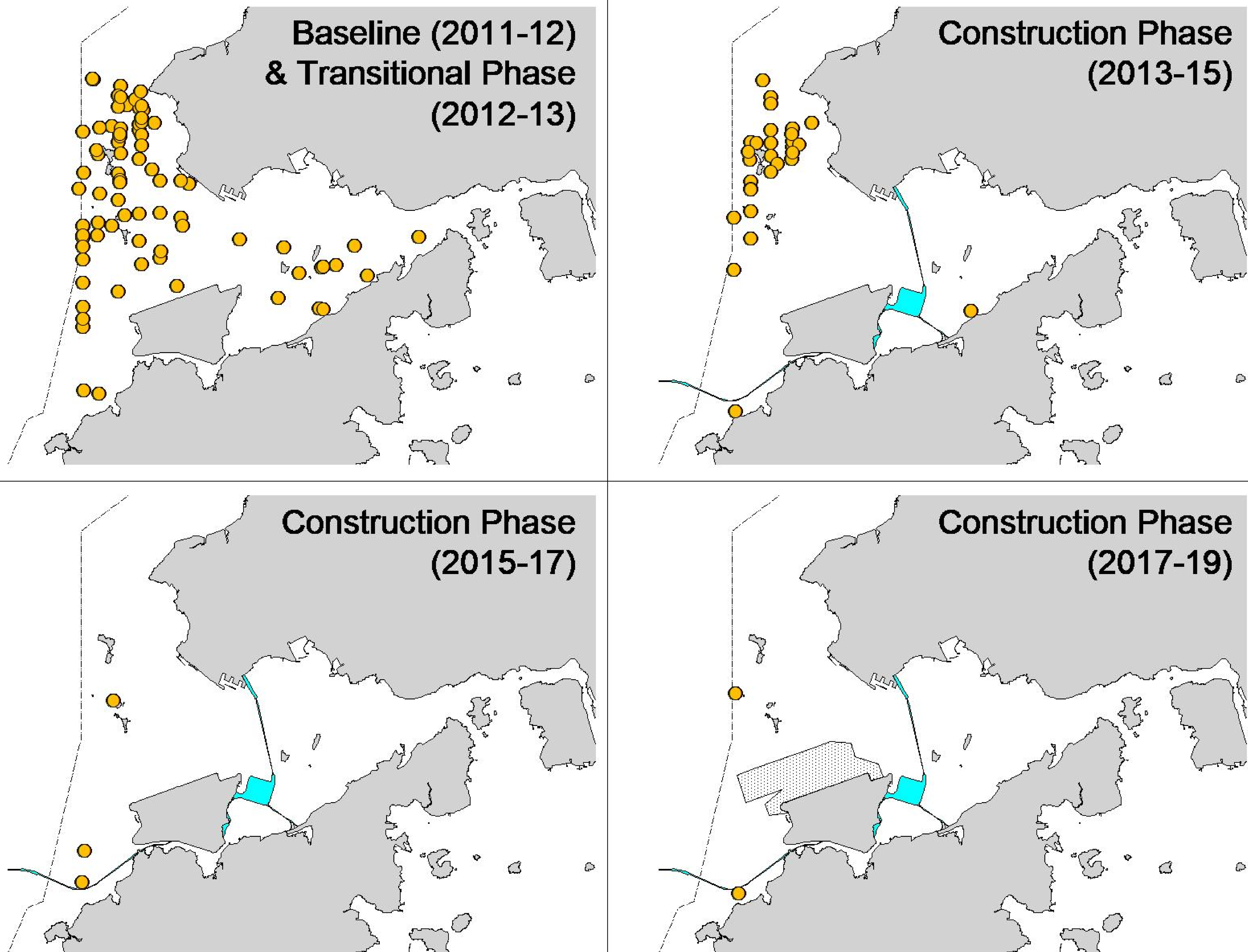


Figure 8. Distribution of young calf of Chinese White Dolphin during TMCLKL post-construction phase monitoring (June 2020 – May 2022)



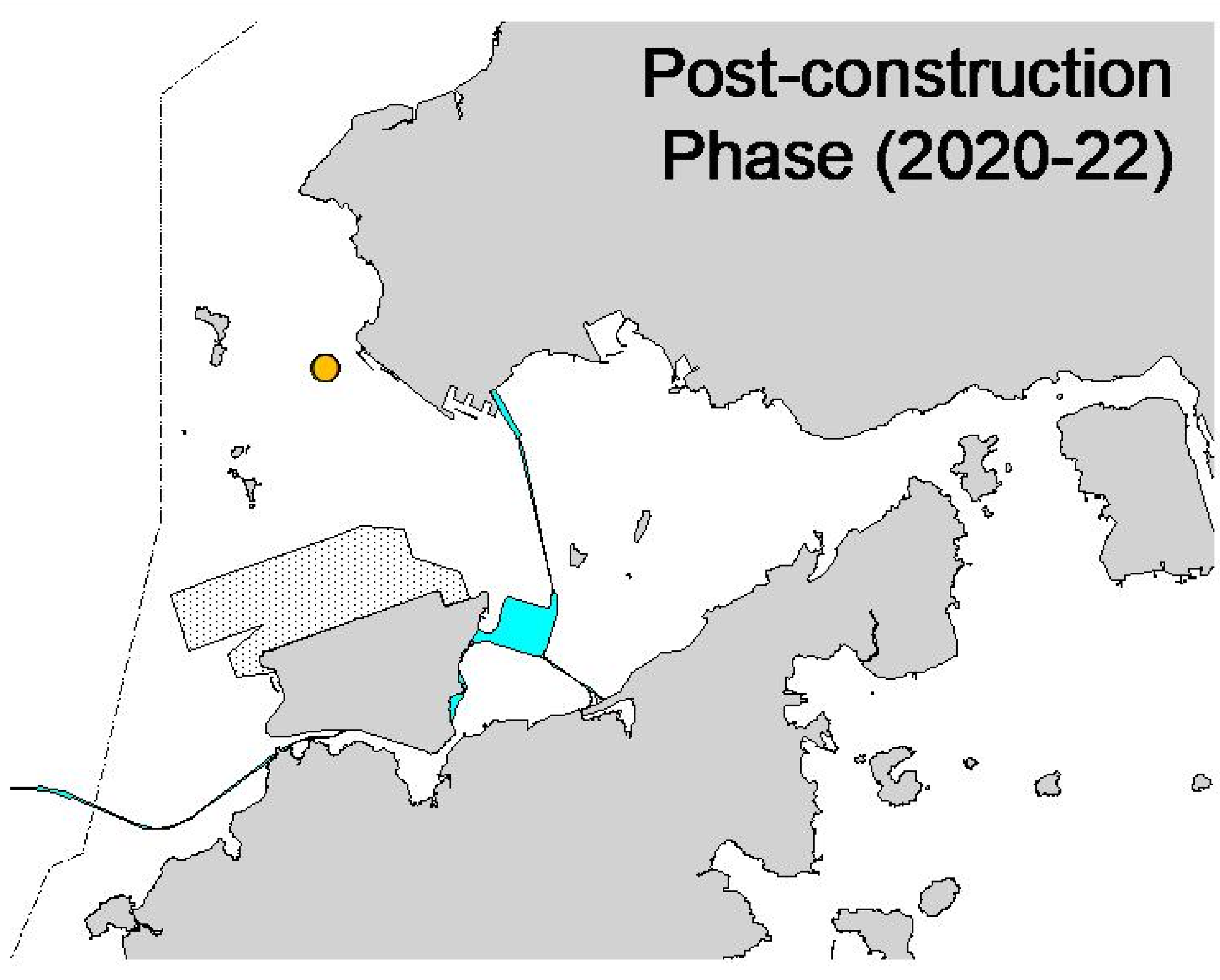


Figure 9. Distribution of young calves of Chinese White Dolphins during the baseline phase (Feb11-Jan12), transitional phase (Nov12-Oct13), six years of construction phase (Nov13-Oct19) and two years of post-construction phase monitoring (June 2020 – May 2022)

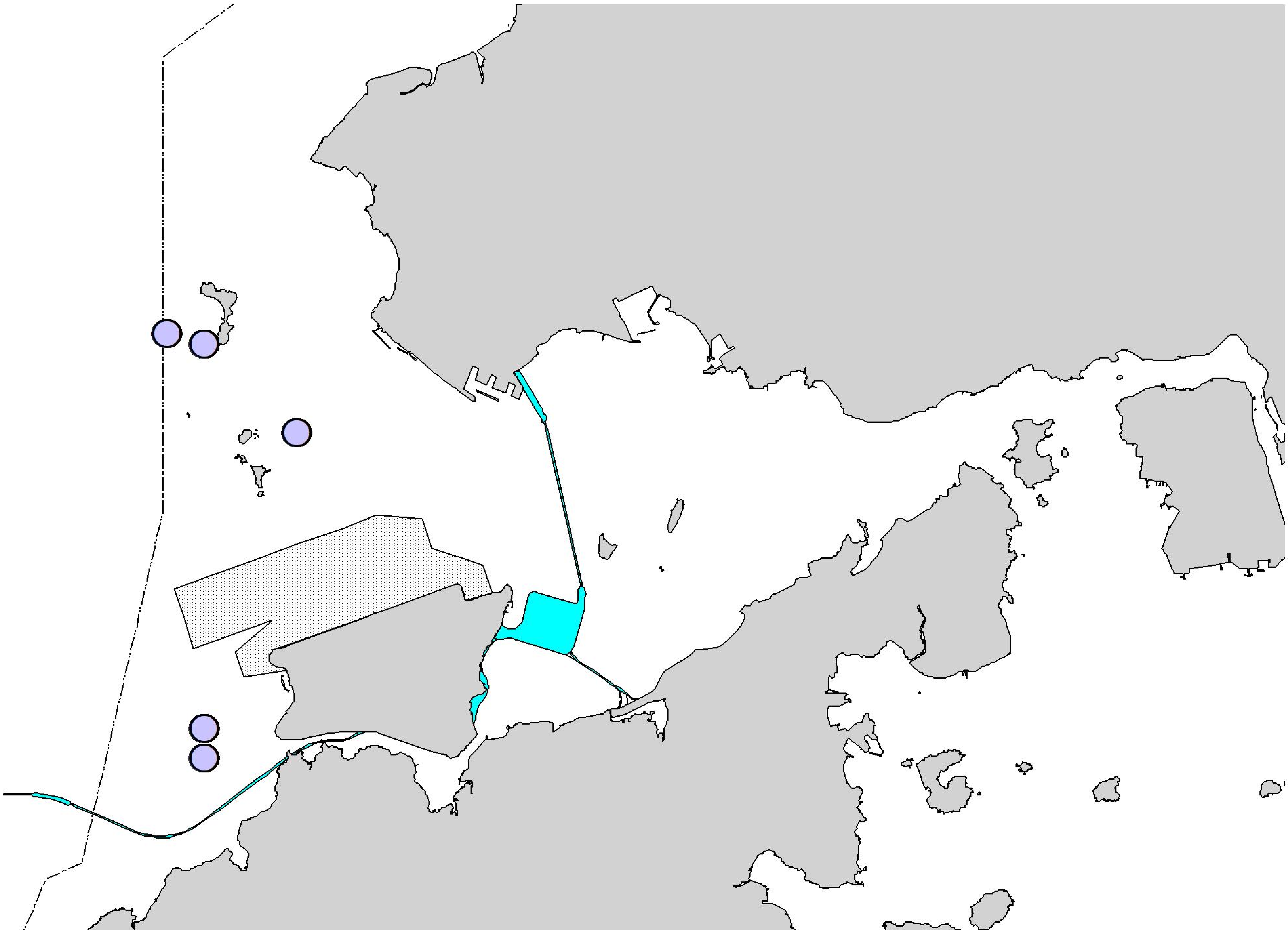
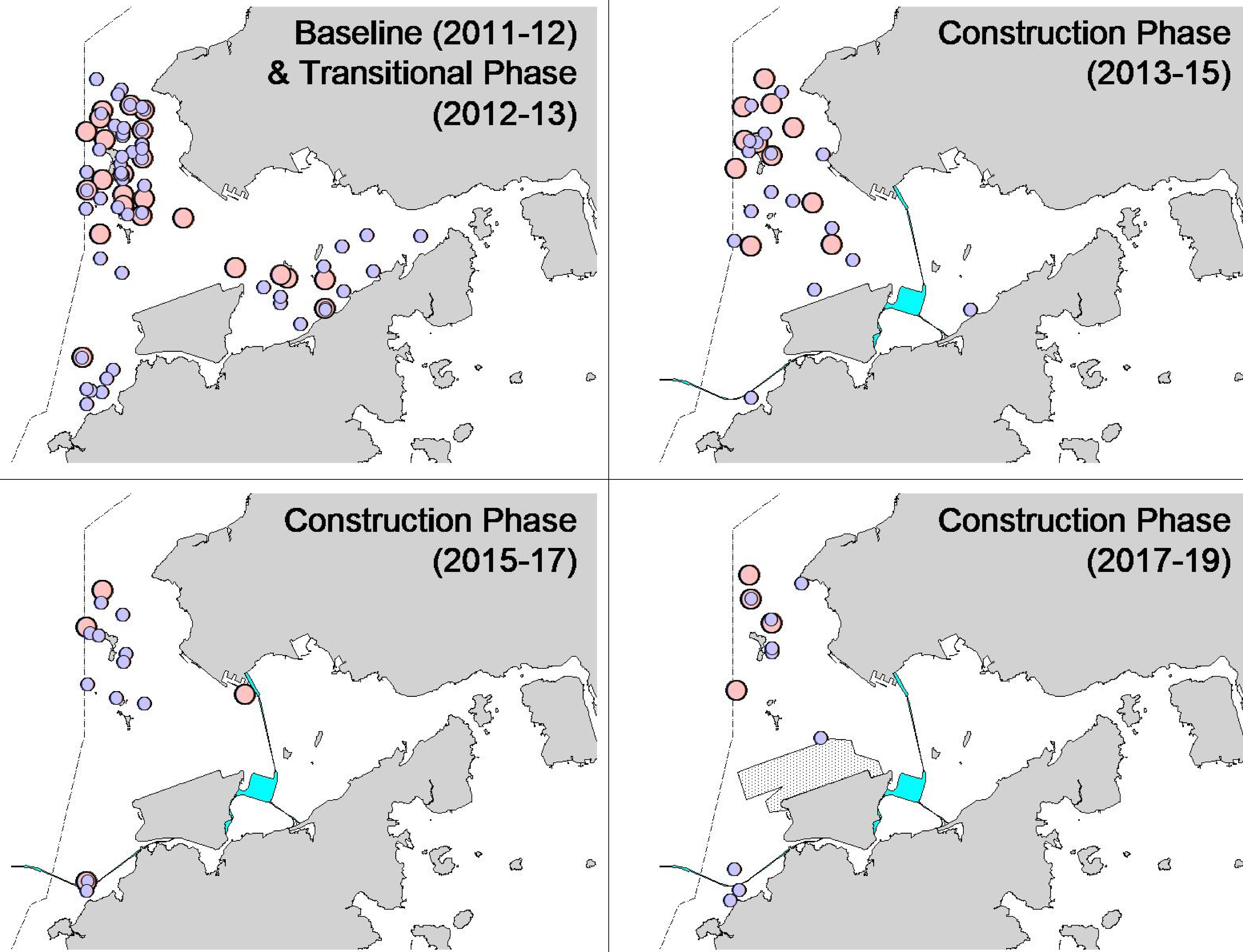


Figure 10. Distribution of Chinese White Dolphin groups engaged in feeding (in purple) during TMCLKL post-construction phase monitoring (June 2020 – May 2022)



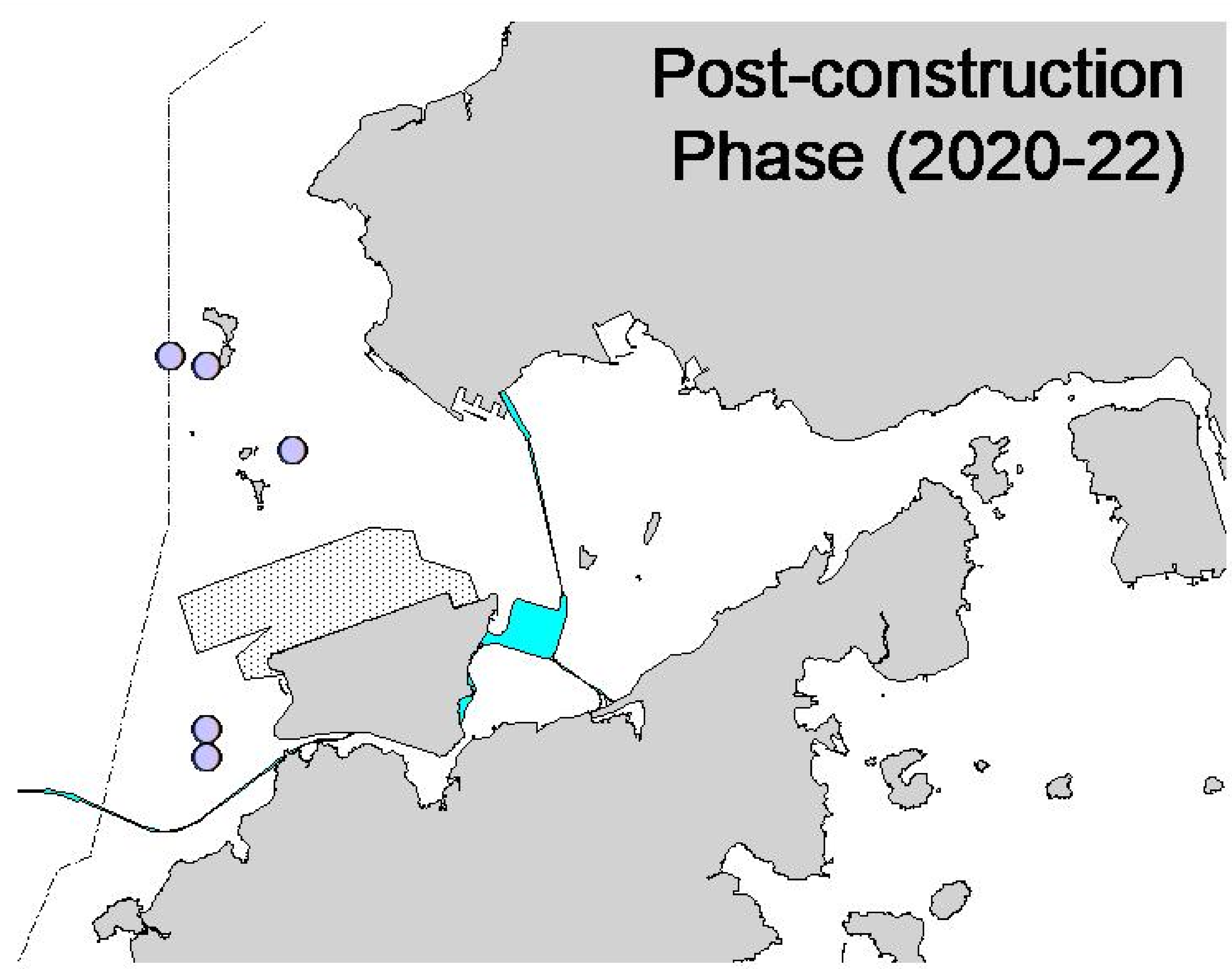


Figure 11. Distribution of Chinese White Dolphin groups engaged in feeding (in purple) and socializing activities (in pink) during the baseline phase (Feb11-Jan12), transitional phase (Nov12-Oct13), six years of construction phase (Nov13-Oct19) and two years of post-construction phase monitoring (June 2020 – May 2022)

Appendix I. TMCLKL Post-construction Survey Effort Database (2020-2022)

(Note: P = Primary Line Effort; S = Secondary Line Effort)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
4-Jun-20	NW LANTAU	2	8.70	SUMMER	STANDARD36826	P
4-Jun-20	NW LANTAU	3	17.62	SUMMER	STANDARD36826	P
4-Jun-20	NW LANTAU	2	3.50	SUMMER	STANDARD36826	S
4-Jun-20	NW LANTAU	3	9.58	SUMMER	STANDARD36826	S
4-Jun-20	NE LANTAU	2	25.33	SUMMER	STANDARD36826	P
4-Jun-20	NE LANTAU	3	8.60	SUMMER	STANDARD36826	P
4-Jun-20	NE LANTAU	2	11.57	SUMMER	STANDARD36826	S
4-Jun-20	NE LANTAU	3	1.10	SUMMER	STANDARD36826	S
9-Jun-20	NW LANTAU	2	27.60	SUMMER	STANDARD36826	P
9-Jun-20	NW LANTAU	3	5.50	SUMMER	STANDARD36826	P
9-Jun-20	NW LANTAU	2	9.10	SUMMER	STANDARD36826	S
9-Jun-20	NW LANTAU	3	2.10	SUMMER	STANDARD36826	S
11-Jun-20	NW LANTAU	2	20.23	SUMMER	STANDARD36826	P
11-Jun-20	NW LANTAU	3	5.70	SUMMER	STANDARD36826	P
11-Jun-20	NW LANTAU	2	9.87	SUMMER	STANDARD36826	S
11-Jun-20	NE LANTAU	2	27.09	SUMMER	STANDARD36826	P
11-Jun-20	NE LANTAU	3	8.40	SUMMER	STANDARD36826	P
11-Jun-20	NE LANTAU	2	8.71	SUMMER	STANDARD36826	S
11-Jun-20	NE LANTAU	3	2.10	SUMMER	STANDARD36826	S
16-Jun-20	NW LANTAU	2	23.10	SUMMER	STANDARD36826	P
16-Jun-20	NW LANTAU	3	12.79	SUMMER	STANDARD36826	P
16-Jun-20	NW LANTAU	2	10.11	SUMMER	STANDARD36826	S
16-Jun-20	NW LANTAU	3	0.50	SUMMER	STANDARD36826	S
2-Jul-20	NW LANTAU	2	13.11	SUMMER	STANDARD36826	P
2-Jul-20	NW LANTAU	3	15.06	SUMMER	STANDARD36826	P
2-Jul-20	NW LANTAU	2	7.43	SUMMER	STANDARD36826	S
2-Jul-20	NW LANTAU	3	2.10	SUMMER	STANDARD36826	S
2-Jul-20	NE LANTAU	1	2.38	SUMMER	STANDARD36826	P
2-Jul-20	NE LANTAU	2	31.42	SUMMER	STANDARD36826	P
2-Jul-20	NE LANTAU	2	11.80	SUMMER	STANDARD36826	S
7-Jul-20	NW LANTAU	2	21.74	SUMMER	STANDARD36826	P
7-Jul-20	NW LANTAU	3	9.90	SUMMER	STANDARD36826	P
7-Jul-20	NW LANTAU	2	2.01	SUMMER	STANDARD36826	S
7-Jul-20	NW LANTAU	3	6.60	SUMMER	STANDARD36826	S
9-Jul-20	NW LANTAU	3	24.11	SUMMER	STANDARD36826	P
9-Jul-20	NW LANTAU	4	4.60	SUMMER	STANDARD36826	P
9-Jul-20	NW LANTAU	3	10.69	SUMMER	STANDARD36826	S
9-Jul-20	NE LANTAU	2	26.80	SUMMER	STANDARD36826	P
9-Jul-20	NE LANTAU	3	8.75	SUMMER	STANDARD36826	P
9-Jul-20	NE LANTAU	2	11.35	SUMMER	STANDARD36826	S
9-Jul-20	NE LANTAU	3	1.10	SUMMER	STANDARD36826	S
20-Jul-20	NW LANTAU	2	23.18	SUMMER	STANDARD36826	P
20-Jul-20	NW LANTAU	3	8.71	SUMMER	STANDARD36826	P
20-Jul-20	NW LANTAU	2	11.11	SUMMER	STANDARD36826	S
20-Jul-20	NW LANTAU	3	1.00	SUMMER	STANDARD36826	S
4-Aug-20	NW LANTAU	1	20.77	SUMMER	STANDARD36826	P
4-Aug-20	NW LANTAU	2	7.90	SUMMER	STANDARD36826	P
4-Aug-20	NW LANTAU	1	7.33	SUMMER	STANDARD36826	S
4-Aug-20	NW LANTAU	2	3.50	SUMMER	STANDARD36826	S
4-Aug-20	NE LANTAU	2	18.34	SUMMER	STANDARD36826	P
4-Aug-20	NE LANTAU	3	16.56	SUMMER	STANDARD36826	P
4-Aug-20	NE LANTAU	2	8.60	SUMMER	STANDARD36826	S
4-Aug-20	NE LANTAU	3	4.60	SUMMER	STANDARD36826	S
14-Aug-20	NW LANTAU	1	7.35	SUMMER	STANDARD36826	P
14-Aug-20	NW LANTAU	2	23.38	SUMMER	STANDARD36826	P

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
14-Aug-20	NW LANTAU	3	1.15	SUMMER	STANDARD36826	P
14-Aug-20	NW LANTAU	2	6.42	SUMMER	STANDARD36826	S
14-Aug-20	NW LANTAU	3	2.40	SUMMER	STANDARD36826	S
18-Aug-20	NW LANTAU	1	3.24	SUMMER	STANDARD36826	P
18-Aug-20	NW LANTAU	2	21.53	SUMMER	STANDARD36826	P
18-Aug-20	NW LANTAU	3	3.40	SUMMER	STANDARD36826	P
18-Aug-20	NW LANTAU	1	4.16	SUMMER	STANDARD36826	S
18-Aug-20	NW LANTAU	2	3.67	SUMMER	STANDARD36826	S
18-Aug-20	NW LANTAU	3	2.40	SUMMER	STANDARD36826	S
18-Aug-20	NE LANTAU	1	10.37	SUMMER	STANDARD36826	P
18-Aug-20	NE LANTAU	2	5.19	SUMMER	STANDARD36826	P
18-Aug-20	NE LANTAU	1	3.03	SUMMER	STANDARD36826	S
18-Aug-20	NE LANTAU	2	1.71	SUMMER	STANDARD36826	S
21-Aug-20	NW LANTAU	1	2.56	SUMMER	STANDARD36826	P
21-Aug-20	NW LANTAU	2	30.10	SUMMER	STANDARD36826	P
21-Aug-20	NW LANTAU	1	2.80	SUMMER	STANDARD36826	S
21-Aug-20	NW LANTAU	2	7.90	SUMMER	STANDARD36826	S
21-Aug-20	NE LANTAU	1	9.62	SUMMER	STANDARD36826	P
21-Aug-20	NE LANTAU	2	10.89	SUMMER	STANDARD36826	P
21-Aug-20	NE LANTAU	1	1.10	SUMMER	STANDARD36826	S
21-Aug-20	NE LANTAU	2	6.49	SUMMER	STANDARD36826	S
9-Sep-20	NW LANTAU	1	12.70	AUTUMN	STANDARD36826	P
9-Sep-20	NW LANTAU	2	16.50	AUTUMN	STANDARD36826	P
9-Sep-20	NW LANTAU	1	5.92	AUTUMN	STANDARD36826	S
9-Sep-20	NW LANTAU	2	5.48	AUTUMN	STANDARD36826	S
9-Sep-20	NE LANTAU	1	7.01	AUTUMN	STANDARD36826	P
9-Sep-20	NE LANTAU	2	28.49	AUTUMN	STANDARD36826	P
9-Sep-20	NE LANTAU	1	5.00	AUTUMN	STANDARD36826	S
9-Sep-20	NE LANTAU	2	7.80	AUTUMN	STANDARD36826	S
15-Sep-20	NW LANTAU	1	4.25	AUTUMN	STANDARD36826	P
15-Sep-20	NW LANTAU	2	26.45	AUTUMN	STANDARD36826	P
15-Sep-20	NW LANTAU	3	2.28	AUTUMN	STANDARD36826	P
15-Sep-20	NW LANTAU	2	10.93	AUTUMN	STANDARD36826	S
21-Sep-20	NW LANTAU	1	1.77	AUTUMN	STANDARD36826	P
21-Sep-20	NW LANTAU	2	15.75	AUTUMN	STANDARD36826	P
21-Sep-20	NW LANTAU	3	9.30	AUTUMN	STANDARD36826	P
21-Sep-20	NW LANTAU	2	7.08	AUTUMN	STANDARD36826	S
21-Sep-20	NW LANTAU	3	5.10	AUTUMN	STANDARD36826	S
21-Sep-20	NE LANTAU	2	13.67	AUTUMN	STANDARD36826	P
21-Sep-20	NE LANTAU	3	21.76	AUTUMN	STANDARD36826	P
21-Sep-20	NE LANTAU	2	6.48	AUTUMN	STANDARD36826	S
21-Sep-20	NE LANTAU	3	5.39	AUTUMN	STANDARD36826	S
23-Sep-20	NW LANTAU	1	14.56	AUTUMN	STANDARD36826	P
23-Sep-20	NW LANTAU	2	16.32	AUTUMN	STANDARD36826	P
23-Sep-20	NW LANTAU	3	2.00	AUTUMN	STANDARD36826	P
23-Sep-20	NW LANTAU	2	8.42	AUTUMN	STANDARD36826	S
7-Oct-20	NW LANTAU	2	6.09	AUTUMN	STANDARD36826	P
7-Oct-20	NW LANTAU	3	20.74	AUTUMN	STANDARD36826	P
7-Oct-20	NW LANTAU	2	3.90	AUTUMN	STANDARD36826	S
7-Oct-20	NW LANTAU	3	7.77	AUTUMN	STANDARD36826	S
7-Oct-20	NE LANTAU	2	31.32	AUTUMN	STANDARD36826	P
7-Oct-20	NE LANTAU	3	3.11	AUTUMN	STANDARD36826	P
7-Oct-20	NE LANTAU	2	10.22	AUTUMN	STANDARD36826	S
7-Oct-20	NE LANTAU	3	2.25	AUTUMN	STANDARD36826	S
12-Oct-20	NW LANTAU	2	16.39	AUTUMN	STANDARD36826	P
12-Oct-20	NW LANTAU	3	15.53	AUTUMN	STANDARD36826	P
12-Oct-20	NW LANTAU	2	8.68	AUTUMN	STANDARD36826	S
19-Oct-20	NW LANTAU	2	14.73	AUTUMN	STANDARD36826	P

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
19-Oct-20	NW LANTAU	3	11.54	AUTUMN	STANDARD36826	P
19-Oct-20	NW LANTAU	2	7.60	AUTUMN	STANDARD36826	S
19-Oct-20	NW LANTAU	3	4.63	AUTUMN	STANDARD36826	S
19-Oct-20	NE LANTAU	1	3.80	AUTUMN	STANDARD36826	P
19-Oct-20	NE LANTAU	2	28.13	AUTUMN	STANDARD36826	P
19-Oct-20	NE LANTAU	3	3.00	AUTUMN	STANDARD36826	P
19-Oct-20	NE LANTAU	1	1.20	AUTUMN	STANDARD36826	S
19-Oct-20	NE LANTAU	2	9.47	AUTUMN	STANDARD36826	S
19-Oct-20	NE LANTAU	3	0.80	AUTUMN	STANDARD36826	S
22-Oct-20	NW LANTAU	3	32.58	AUTUMN	STANDARD36826	P
22-Oct-20	NW LANTAU	2	0.90	AUTUMN	STANDARD36826	S
22-Oct-20	NW LANTAU	3	9.62	AUTUMN	STANDARD36826	S
4-Nov-20	NW LANTAU	2	19.01	AUTUMN	STANDARD36826	P
4-Nov-20	NW LANTAU	3	9.69	AUTUMN	STANDARD36826	P
4-Nov-20	NW LANTAU	2	7.30	AUTUMN	STANDARD36826	S
4-Nov-20	NW LANTAU	3	3.10	AUTUMN	STANDARD36826	S
4-Nov-20	NE LANTAU	2	34.20	AUTUMN	STANDARD36826	P
4-Nov-20	NE LANTAU	3	2.70	AUTUMN	STANDARD36826	P
4-Nov-20	NE LANTAU	2	12.50	AUTUMN	STANDARD36826	S
4-Nov-20	NE LANTAU	3	1.00	AUTUMN	STANDARD36826	S
9-Nov-20	NW LANTAU	2	12.64	AUTUMN	STANDARD36826	P
9-Nov-20	NW LANTAU	3	19.96	AUTUMN	STANDARD36826	P
9-Nov-20	NW LANTAU	2	7.26	AUTUMN	STANDARD36826	S
9-Nov-20	NW LANTAU	3	1.54	AUTUMN	STANDARD36826	S
17-Nov-20	NW LANTAU	2	3.80	AUTUMN	STANDARD36826	P
17-Nov-20	NW LANTAU	3	24.32	AUTUMN	STANDARD36826	P
17-Nov-20	NW LANTAU	2	3.47	AUTUMN	STANDARD36826	S
17-Nov-20	NW LANTAU	3	7.33	AUTUMN	STANDARD36826	S
17-Nov-20	NE LANTAU	2	32.10	AUTUMN	STANDARD36826	P
17-Nov-20	NE LANTAU	3	3.38	AUTUMN	STANDARD36826	P
17-Nov-20	NE LANTAU	2	12.72	AUTUMN	STANDARD36826	S
23-Nov-20	NW LANTAU	2	11.30	AUTUMN	STANDARD36826	P
23-Nov-20	NW LANTAU	3	20.90	AUTUMN	STANDARD36826	P
23-Nov-20	NW LANTAU	2	8.30	AUTUMN	STANDARD36826	S
1-Dec-20	NW LANTAU	2	9.10	WINTER	STANDARD36826	P
1-Dec-20	NW LANTAU	3	13.63	WINTER	STANDARD36826	P
1-Dec-20	NW LANTAU	4	4.83	WINTER	STANDARD36826	P
1-Dec-20	NW LANTAU	2	9.00	WINTER	STANDARD36826	S
1-Dec-20	NW LANTAU	3	2.44	WINTER	STANDARD36826	S
1-Dec-20	NE LANTAU	1	2.50	WINTER	STANDARD36826	P
1-Dec-20	NE LANTAU	2	32.93	WINTER	STANDARD36826	P
1-Dec-20	NE LANTAU	1	1.20	WINTER	STANDARD36826	S
1-Dec-20	NE LANTAU	2	11.77	WINTER	STANDARD36826	S
3-Dec-20	NW LANTAU	2	1.43	WINTER	STANDARD36826	P
3-Dec-20	NW LANTAU	3	23.50	WINTER	STANDARD36826	P
3-Dec-20	NW LANTAU	4	8.46	WINTER	STANDARD36826	P
3-Dec-20	NW LANTAU	2	1.84	WINTER	STANDARD36826	S
3-Dec-20	NW LANTAU	3	6.47	WINTER	STANDARD36826	S
8-Dec-20	NW LANTAU	2	5.40	WINTER	STANDARD36826	P
8-Dec-20	NW LANTAU	3	22.14	WINTER	STANDARD36826	P
8-Dec-20	NW LANTAU	2	3.60	WINTER	STANDARD36826	S
8-Dec-20	NW LANTAU	3	8.06	WINTER	STANDARD36826	S
8-Dec-20	NE LANTAU	2	35.51	WINTER	STANDARD36826	P
8-Dec-20	NE LANTAU	2	12.49	WINTER	STANDARD36826	S
10-Dec-20	NW LANTAU	2	27.88	WINTER	STANDARD36826	P
10-Dec-20	NW LANTAU	3	4.95	WINTER	STANDARD36826	P

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
10-Dec-20	NW LANTAU	2	8.26	WINTER	STANDARD36826	S
25-Jan-21	NW LANTAU	1	4.08	WINTER	STANDARD36826	P
25-Jan-21	NW LANTAU	2	28.26	WINTER	STANDARD36826	P
25-Jan-21	NW LANTAU	2	8.25	WINTER	STANDARD36826	S
26-Jan-21	NW LANTAU	1	4.74	WINTER	STANDARD36826	P
26-Jan-21	NW LANTAU	2	24.42	WINTER	STANDARD36826	P
26-Jan-21	NW LANTAU	1	1.50	WINTER	STANDARD36826	S
26-Jan-21	NW LANTAU	2	8.81	WINTER	STANDARD36826	S
26-Jan-21	NE LANTAU	1	2.60	WINTER	STANDARD36826	P
26-Jan-21	NE LANTAU	2	33.98	WINTER	STANDARD36826	P
26-Jan-21	NE LANTAU	1	2.30	WINTER	STANDARD36826	S
26-Jan-21	NE LANTAU	2	9.92	WINTER	STANDARD36826	S
27-Jan-21	NW LANTAU	1	6.50	WINTER	STANDARD36826	P
27-Jan-21	NW LANTAU	2	26.15	WINTER	STANDARD36826	P
27-Jan-21	NW LANTAU	1	3.90	WINTER	STANDARD36826	S
27-Jan-21	NW LANTAU	2	6.75	WINTER	STANDARD36826	S
28-Jan-21	NW LANTAU	1	0.52	WINTER	STANDARD36826	P
28-Jan-21	NW LANTAU	2	22.11	WINTER	STANDARD36826	P
28-Jan-21	NW LANTAU	3	3.73	WINTER	STANDARD36826	P
28-Jan-21	NW LANTAU	1	2.53	WINTER	STANDARD36826	S
28-Jan-21	NW LANTAU	2	9.50	WINTER	STANDARD36826	S
28-Jan-21	NE LANTAU	2	21.46	WINTER	STANDARD36826	P
28-Jan-21	NE LANTAU	3	14.01	WINTER	STANDARD36826	P
28-Jan-21	NE LANTAU	2	8.40	WINTER	STANDARD36826	S
28-Jan-21	NE LANTAU	3	4.03	WINTER	STANDARD36826	S
2-Feb-21	NW LANTAU	1	3.60	WINTER	STANDARD36826	P
2-Feb-21	NW LANTAU	2	24.81	WINTER	STANDARD36826	P
2-Feb-21	NW LANTAU	1	2.45	WINTER	STANDARD36826	S
2-Feb-21	NW LANTAU	2	7.70	WINTER	STANDARD36826	S
2-Feb-21	NE LANTAU	0	1.60	WINTER	STANDARD36826	P
2-Feb-21	NE LANTAU	1	15.60	WINTER	STANDARD36826	P
2-Feb-21	NE LANTAU	2	18.77	WINTER	STANDARD36826	P
2-Feb-21	NE LANTAU	1	5.60	WINTER	STANDARD36826	S
2-Feb-21	NE LANTAU	2	8.33	WINTER	STANDARD36826	S
8-Feb-21	NW LANTAU	2	9.76	WINTER	STANDARD36826	P
8-Feb-21	NW LANTAU	3	23.48	WINTER	STANDARD36826	P
8-Feb-21	NW LANTAU	2	0.90	WINTER	STANDARD36826	S
8-Feb-21	NW LANTAU	3	7.33	WINTER	STANDARD36826	S
18-Feb-21	NW LANTAU	1	5.60	WINTER	STANDARD36826	P
18-Feb-21	NW LANTAU	2	18.88	WINTER	STANDARD36826	P
18-Feb-21	NW LANTAU	3	3.50	WINTER	STANDARD36826	P
18-Feb-21	NW LANTAU	1	1.50	WINTER	STANDARD36826	S
18-Feb-21	NW LANTAU	2	10.02	WINTER	STANDARD36826	S
18-Feb-21	NE LANTAU	1	9.55	WINTER	STANDARD36826	P
18-Feb-21	NE LANTAU	2	20.88	WINTER	STANDARD36826	P
18-Feb-21	NE LANTAU	3	4.70	WINTER	STANDARD36826	P
18-Feb-21	NE LANTAU	1	2.74	WINTER	STANDARD36826	S
18-Feb-21	NE LANTAU	2	8.73	WINTER	STANDARD36826	S
18-Feb-21	NE LANTAU	3	1.20	WINTER	STANDARD36826	S
23-Feb-21	NW LANTAU	1	9.54	WINTER	STANDARD36826	P
23-Feb-21	NW LANTAU	2	18.92	WINTER	STANDARD36826	P
23-Feb-21	NW LANTAU	3	5.20	WINTER	STANDARD36826	P
23-Feb-21	NW LANTAU	1	7.39	WINTER	STANDARD36826	S
23-Feb-21	NW LANTAU	2	3.55	WINTER	STANDARD36826	S
3-Mar-21	NW LANTAU	2	17.29	SPRING	STANDARD36826	P
3-Mar-21	NW LANTAU	3	10.70	SPRING	STANDARD36826	P
3-Mar-21	NW LANTAU	2	6.60	SPRING	STANDARD36826	S
3-Mar-21	NW LANTAU	3	4.75	SPRING	STANDARD36826	S
3-Mar-21	NE LANTAU	2	32.08	SPRING	STANDARD36826	P
3-Mar-21	NE LANTAU	3	3.05	SPRING	STANDARD36826	P
3-Mar-21	NE LANTAU	2	11.87	SPRING	STANDARD36826	S

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
3-Mar-21	NE LANTAU	3	1.00	SPRING	STANDARD36826	S
8-Mar-21	NW LANTAU	2	7.06	SPRING	STANDARD36826	P
8-Mar-21	NW LANTAU	3	25.36	SPRING	STANDARD36826	P
8-Mar-21	NW LANTAU	2	2.86	SPRING	STANDARD36826	S
8-Mar-21	NW LANTAU	3	5.32	SPRING	STANDARD36826	S
17-Mar-21	NW LANTAU	1	9.65	SPRING	STANDARD36826	P
17-Mar-21	NW LANTAU	2	18.44	SPRING	STANDARD36826	P
17-Mar-21	NW LANTAU	1	3.10	SPRING	STANDARD36826	S
17-Mar-21	NW LANTAU	2	7.99	SPRING	STANDARD36826	S
17-Mar-21	NE LANTAU	1	3.50	SPRING	STANDARD36826	P
17-Mar-21	NE LANTAU	2	31.93	SPRING	STANDARD36826	P
17-Mar-21	NE LANTAU	1	2.00	SPRING	STANDARD36826	S
17-Mar-21	NE LANTAU	2	9.37	SPRING	STANDARD36826	S
25-Mar-21	NW LANTAU	2	6.30	SPRING	STANDARD36826	P
25-Mar-21	NW LANTAU	3	26.28	SPRING	STANDARD36826	P
25-Mar-21	NW LANTAU	2	5.92	SPRING	STANDARD36826	S
25-Mar-21	NW LANTAU	3	4.90	SPRING	STANDARD36826	S
8-Apr-21	NW LANTAU	2	25.85	SPRING	STANDARD36826	P
8-Apr-21	NW LANTAU	3	6.95	SPRING	STANDARD36826	P
8-Apr-21	NW LANTAU	2	10.80	SPRING	STANDARD36826	S
8-Apr-21	NE LANTAU	2	34.14	SPRING	STANDARD36826	P
8-Apr-21	NE LANTAU	2	11.56	SPRING	STANDARD36826	S
22-Apr-21	NW LANTAU	1	5.79	SPRING	STANDARD36826	P
22-Apr-21	NW LANTAU	2	26.60	SPRING	STANDARD36826	P
22-Apr-21	NW LANTAU	2	11.11	SPRING	STANDARD36826	S
27-Apr-21	NW LANTAU	2	15.81	SPRING	STANDARD36826	P
27-Apr-21	NW LANTAU	3	12.76	SPRING	STANDARD36826	P
27-Apr-21	NW LANTAU	2	8.23	SPRING	STANDARD36826	S
27-Apr-21	NW LANTAU	3	3.00	SPRING	STANDARD36826	S
27-Apr-21	NE LANTAU	2	5.30	SPRING	STANDARD36826	P
27-Apr-21	NE LANTAU	3	31.17	SPRING	STANDARD36826	P
27-Apr-21	NE LANTAU	2	3.70	SPRING	STANDARD36826	S
27-Apr-21	NE LANTAU	3	8.43	SPRING	STANDARD36826	S
29-Apr-21	NW LANTAU	2	16.60	SPRING	STANDARD36826	P
29-Apr-21	NW LANTAU	3	11.22	SPRING	STANDARD36826	P
29-Apr-21	NW LANTAU	2	7.08	SPRING	STANDARD36826	S
29-Apr-21	NW LANTAU	3	1.40	SPRING	STANDARD36826	S
3-May-21	NW LANTAU	3	26.45	SPRING	STANDARD36826	P
3-May-21	NW LANTAU	2	1.10	SPRING	STANDARD36826	S
3-May-21	NW LANTAU	3	11.85	SPRING	STANDARD36826	S
3-May-21	NE LANTAU	2	15.62	SPRING	STANDARD36826	P
3-May-21	NE LANTAU	3	18.05	SPRING	STANDARD36826	P
3-May-21	NE LANTAU	2	4.70	SPRING	STANDARD36826	S
3-May-21	NE LANTAU	3	7.33	SPRING	STANDARD36826	S
11-May-21	NW LANTAU	2	2.72	SPRING	STANDARD36826	P
11-May-21	NW LANTAU	3	25.99	SPRING	STANDARD36826	P
11-May-21	NW LANTAU	2	4.46	SPRING	STANDARD36826	S
11-May-21	NW LANTAU	3	6.24	SPRING	STANDARD36826	S
25-May-21	NW LANTAU	1	2.78	SPRING	STANDARD36826	P
25-May-21	NW LANTAU	2	26.32	SPRING	STANDARD36826	P
25-May-21	NW LANTAU	2	7.40	SPRING	STANDARD36826	S
26-May-21	NW LANTAU	1	1.60	SPRING	STANDARD138716	P
26-May-21	NW LANTAU	2	30.69	SPRING	STANDARD138716	P
26-May-21	NW LANTAU	1	4.80	SPRING	STANDARD138716	S
26-May-21	NW LANTAU	2	6.61	SPRING	STANDARD138716	S
26-May-21	NE LANTAU	1	11.39	SPRING	STANDARD138716	P
26-May-21	NE LANTAU	2	14.50	SPRING	STANDARD138716	P
26-May-21	NE LANTAU	3	5.80	SPRING	STANDARD138716	P
26-May-21	NE LANTAU	1	3.51	SPRING	STANDARD138716	S
26-May-21	NE LANTAU	2	8.00	SPRING	STANDARD138716	S
26-May-21	NE LANTAU	3	1.60	SPRING	STANDARD138716	S

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
17-Jun-21	NW LANTAU	2	10.99	SUMMER	STANDARD138716	P
17-Jun-21	NW LANTAU	3	24.81	SUMMER	STANDARD138716	P
17-Jun-21	NW LANTAU	3	13.60	SUMMER	STANDARD138716	S
17-Jun-21	NE LANTAU	2	10.21	SUMMER	STANDARD138716	P
17-Jun-21	NE LANTAU	3	4.40	SUMMER	STANDARD138716	P
17-Jun-21	NE LANTAU	2	11.29	SUMMER	STANDARD138716	S
24-Jun-21	NW LANTAU	1	4.00	SUMMER	STANDARD138716	P
24-Jun-21	NW LANTAU	2	22.55	SUMMER	STANDARD138716	P
24-Jun-21	NW LANTAU	1	0.70	SUMMER	STANDARD138716	S
24-Jun-21	NW LANTAU	2	8.35	SUMMER	STANDARD138716	S
24-Jun-21	NE LANTAU	1	6.20	SUMMER	STANDARD138716	P
24-Jun-21	NE LANTAU	2	10.36	SUMMER	STANDARD138716	P
24-Jun-21	NE LANTAU	3	2.70	SUMMER	STANDARD138716	P
24-Jun-21	NE LANTAU	1	4.20	SUMMER	STANDARD138716	S
24-Jun-21	NE LANTAU	2	6.24	SUMMER	STANDARD138716	S
28-Jun-21	NW LANTAU	2	30.81	SUMMER	STANDARD138716	P
28-Jun-21	NW LANTAU	3	4.10	SUMMER	STANDARD138716	P
28-Jun-21	NW LANTAU	2	14.19	SUMMER	STANDARD138716	S
28-Jun-21	NE LANTAU	2	11.99	SUMMER	STANDARD138716	P
28-Jun-21	NE LANTAU	3	3.60	SUMMER	STANDARD138716	P
28-Jun-21	NE LANTAU	2	8.91	SUMMER	STANDARD138716	S
28-Jun-21	NE LANTAU	3	1.30	SUMMER	STANDARD138716	S
29-Jun-21	NW LANTAU	2	1.77	SUMMER	STANDARD36826	P
29-Jun-21	NW LANTAU	3	21.57	SUMMER	STANDARD36826	P
29-Jun-21	NW LANTAU	4	2.32	SUMMER	STANDARD36826	P
29-Jun-21	NW LANTAU	3	9.09	SUMMER	STANDARD36826	S
29-Jun-21	NW LANTAU	4	1.30	SUMMER	STANDARD36826	S
29-Jun-21	NE LANTAU	2	17.57	SUMMER	STANDARD36826	P
29-Jun-21	NE LANTAU	3	1.85	SUMMER	STANDARD36826	P
29-Jun-21	NE LANTAU	2	10.58	SUMMER	STANDARD36826	S
13-Jul-21	NW LANTAU	1	3.60	SUMMER	STANDARD36826	P
13-Jul-21	NW LANTAU	2	32.90	SUMMER	STANDARD36826	P
13-Jul-21	NW LANTAU	2	13.50	SUMMER	STANDARD36826	S
13-Jul-21	NE LANTAU	1	3.80	SUMMER	STANDARD36826	P
13-Jul-21	NE LANTAU	2	13.70	SUMMER	STANDARD36826	P
13-Jul-21	NE LANTAU	2	8.80	SUMMER	STANDARD36826	S
21-Jul-21	NW LANTAU	2	20.30	SUMMER	STANDARD138716	P
21-Jul-21	NW LANTAU	3	5.40	SUMMER	STANDARD138716	P
21-Jul-21	NW LANTAU	2	10.60	SUMMER	STANDARD138716	S
21-Jul-21	NE LANTAU	2	11.47	SUMMER	STANDARD138716	P
21-Jul-21	NE LANTAU	3	8.19	SUMMER	STANDARD138716	P
21-Jul-21	NE LANTAU	2	10.04	SUMMER	STANDARD138716	S
27-Jul-21	NW LANTAU	1	32.40	SUMMER	STANDARD36826	P
27-Jul-21	NW LANTAU	2	5.50	SUMMER	STANDARD36826	P
27-Jul-21	NW LANTAU	1	11.10	SUMMER	STANDARD36826	S
27-Jul-21	NW LANTAU	2	2.20	SUMMER	STANDARD36826	S
27-Jul-21	NE LANTAU	1	10.70	SUMMER	STANDARD36826	P
27-Jul-21	NE LANTAU	2	6.57	SUMMER	STANDARD36826	P
27-Jul-21	NE LANTAU	1	4.02	SUMMER	STANDARD36826	S
27-Jul-21	NE LANTAU	2	5.41	SUMMER	STANDARD36826	S
29-Jul-21	NW LANTAU	1	10.90	SUMMER	STANDARD138716	P
29-Jul-21	NW LANTAU	2	17.54	SUMMER	STANDARD138716	P
29-Jul-21	NW LANTAU	1	2.10	SUMMER	STANDARD138716	S
29-Jul-21	NW LANTAU	2	6.56	SUMMER	STANDARD138716	S
29-Jul-21	NE LANTAU	1	5.11	SUMMER	STANDARD138716	P
29-Jul-21	NE LANTAU	2	11.45	SUMMER	STANDARD138716	P
29-Jul-21	NE LANTAU	3	2.83	SUMMER	STANDARD138716	P
29-Jul-21	NE LANTAU	1	4.00	SUMMER	STANDARD138716	S
29-Jul-21	NE LANTAU	2	4.72	SUMMER	STANDARD138716	S
29-Jul-21	NE LANTAU	3	1.27	SUMMER	STANDARD138716	S
3-Aug-21	NW LANTAU	1	1.10	SUMMER	STANDARD36826	P

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
3-Aug-21	NW LANTAU	2	13.28	SUMMER	STANDARD36826	P
3-Aug-21	NW LANTAU	3	23.12	SUMMER	STANDARD36826	P
3-Aug-21	NW LANTAU	2	9.30	SUMMER	STANDARD36826	S
3-Aug-21	NW LANTAU	3	2.60	SUMMER	STANDARD36826	S
3-Aug-21	NE LANTAU	1	1.20	SUMMER	STANDARD36826	P
3-Aug-21	NE LANTAU	2	13.39	SUMMER	STANDARD36826	P
3-Aug-21	NE LANTAU	3	2.60	SUMMER	STANDARD36826	P
3-Aug-21	NE LANTAU	1	1.40	SUMMER	STANDARD36826	S
3-Aug-21	NE LANTAU	2	7.31	SUMMER	STANDARD36826	S
5-Aug-21	NW LANTAU	2	2.90	SUMMER	STANDARD138716	P
5-Aug-21	NW LANTAU	3	27.11	SUMMER	STANDARD138716	P
5-Aug-21	NW LANTAU	2	1.20	SUMMER	STANDARD138716	S
5-Aug-21	NW LANTAU	3	4.09	SUMMER	STANDARD138716	S
5-Aug-21	NE LANTAU	2	7.89	SUMMER	STANDARD138716	P
5-Aug-21	NE LANTAU	3	10.89	SUMMER	STANDARD138716	P
5-Aug-21	NE LANTAU	2	2.10	SUMMER	STANDARD138716	S
5-Aug-21	NE LANTAU	3	8.42	SUMMER	STANDARD138716	S
9-Aug-21	NW LANTAU	2	16.60	SUMMER	STANDARD138716	P
9-Aug-21	NW LANTAU	3	18.90	SUMMER	STANDARD138716	P
9-Aug-21	NW LANTAU	1	2.20	SUMMER	STANDARD138716	S
9-Aug-21	NW LANTAU	2	6.30	SUMMER	STANDARD138716	S
9-Aug-21	NW LANTAU	3	3.90	SUMMER	STANDARD138716	S
9-Aug-21	NE LANTAU	2	17.30	SUMMER	STANDARD138716	P
9-Aug-21	NE LANTAU	2	6.30	SUMMER	STANDARD138716	S
9-Aug-21	NE LANTAU	3	1.30	SUMMER	STANDARD138716	S
24-Aug-21	NW LANTAU	2	28.93	SUMMER	STANDARD36826	P
24-Aug-21	NW LANTAU	2	7.97	SUMMER	STANDARD36826	S
24-Aug-21	NE LANTAU	1	5.95	SUMMER	STANDARD36826	P
24-Aug-21	NE LANTAU	2	10.48	SUMMER	STANDARD36826	P
24-Aug-21	NE LANTAU	3	2.70	SUMMER	STANDARD36826	P
24-Aug-21	NE LANTAU	1	3.27	SUMMER	STANDARD36826	S
24-Aug-21	NE LANTAU	2	7.10	SUMMER	STANDARD36826	S
24-Aug-21	NE LANTAU	3	0.30	SUMMER	STANDARD36826	S
7-Sep-21	NW LANTAU	1	0.40	AUTUMN	STANDARD36826	P
7-Sep-21	NW LANTAU	2	32.70	AUTUMN	STANDARD36826	P
7-Sep-21	NW LANTAU	3	4.00	AUTUMN	STANDARD36826	P
7-Sep-21	NW LANTAU	1	1.10	AUTUMN	STANDARD36826	S
7-Sep-21	NW LANTAU	2	6.70	AUTUMN	STANDARD36826	S
7-Sep-21	NW LANTAU	3	5.50	AUTUMN	STANDARD36826	S
7-Sep-21	NE LANTAU	2	12.16	AUTUMN	STANDARD36826	P
7-Sep-21	NE LANTAU	3	3.69	AUTUMN	STANDARD36826	P
7-Sep-21	NE LANTAU	2	6.02	AUTUMN	STANDARD36826	S
7-Sep-21	NE LANTAU	3	3.33	AUTUMN	STANDARD36826	S
13-Sep-21	NW LANTAU	2	25.31	AUTUMN	STANDARD138716	P
13-Sep-21	NW LANTAU	2	10.49	AUTUMN	STANDARD138716	S
13-Sep-21	NE LANTAU	1	1.20	AUTUMN	STANDARD138716	P
13-Sep-21	NE LANTAU	2	18.20	AUTUMN	STANDARD138716	P
13-Sep-21	NE LANTAU	1	1.80	AUTUMN	STANDARD138716	S
13-Sep-21	NE LANTAU	2	8.40	AUTUMN	STANDARD138716	S
14-Sep-21	NW LANTAU	2	27.80	AUTUMN	STANDARD36826	P
14-Sep-21	NW LANTAU	3	6.90	AUTUMN	STANDARD36826	P
14-Sep-21	NW LANTAU	2	8.10	AUTUMN	STANDARD36826	S
14-Sep-21	NW LANTAU	3	4.80	AUTUMN	STANDARD36826	S
14-Sep-21	NE LANTAU	2	16.76	AUTUMN	STANDARD36826	P
14-Sep-21	NE LANTAU	2	9.34	AUTUMN	STANDARD36826	S
14-Sep-21	NE LANTAU	3	0.40	AUTUMN	STANDARD36826	S
21-Sep-21	NW LANTAU	2	25.33	AUTUMN	STANDARD36826	P
21-Sep-21	NW LANTAU	2	10.67	AUTUMN	STANDARD36826	S
21-Sep-21	NE LANTAU	2	13.40	AUTUMN	STANDARD36826	P
21-Sep-21	NE LANTAU	3	5.60	AUTUMN	STANDARD36826	P
21-Sep-21	NE LANTAU	2	6.10	AUTUMN	STANDARD36826	S

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
21-Sep-21	NE LANTAU	3	4.20	AUTUMN	STANDARD36826	S
7-Oct-21	NW LANTAU	3	25.70	AUTUMN	STANDARD138716	P
7-Oct-21	NW LANTAU	3	10.20	AUTUMN	STANDARD138716	S
7-Oct-21	NE LANTAU	2	7.50	AUTUMN	STANDARD138716	P
7-Oct-21	NE LANTAU	3	11.60	AUTUMN	STANDARD138716	P
7-Oct-21	NE LANTAU	2	2.80	AUTUMN	STANDARD138716	S
7-Oct-21	NE LANTAU	3	6.50	AUTUMN	STANDARD138716	S
19-Oct-21	NW LANTAU	2	24.98	AUTUMN	STANDARD36826	P
19-Oct-21	NW LANTAU	3	10.76	AUTUMN	STANDARD36826	P
19-Oct-21	NW LANTAU	2	10.36	AUTUMN	STANDARD36826	S
19-Oct-21	NW LANTAU	3	3.70	AUTUMN	STANDARD36826	S
19-Oct-21	NE LANTAU	2	16.49	AUTUMN	STANDARD36826	P
19-Oct-21	NE LANTAU	2	10.71	AUTUMN	STANDARD36826	S
26-Oct-21	NW LANTAU	2	12.60	AUTUMN	STANDARD36826	P
26-Oct-21	NW LANTAU	3	14.65	AUTUMN	STANDARD36826	P
26-Oct-21	NW LANTAU	2	6.90	AUTUMN	STANDARD36826	S
26-Oct-21	NW LANTAU	3	2.15	AUTUMN	STANDARD36826	S
26-Oct-21	NE LANTAU	2	19.60	AUTUMN	STANDARD36826	P
26-Oct-21	NE LANTAU	2	10.90	AUTUMN	STANDARD36826	S
27-Oct-21	NW LANTAU	2	31.21	AUTUMN	STANDARD36826	P
27-Oct-21	NW LANTAU	3	4.09	AUTUMN	STANDARD36826	P
27-Oct-21	NW LANTAU	2	13.10	AUTUMN	STANDARD36826	S
27-Oct-21	NE LANTAU	2	15.95	AUTUMN	STANDARD36826	P
27-Oct-21	NE LANTAU	2	9.85	AUTUMN	STANDARD36826	S
1-Nov-21	NW LANTAU	2	30.50	AUTUMN	STANDARD138716	P
1-Nov-21	NW LANTAU	3	4.60	AUTUMN	STANDARD138716	P
1-Nov-21	NW LANTAU	2	11.40	AUTUMN	STANDARD138716	S
1-Nov-21	NW LANTAU	3	2.40	AUTUMN	STANDARD138716	S
1-Nov-21	NE LANTAU	2	8.53	AUTUMN	STANDARD138716	P
1-Nov-21	NE LANTAU	3	8.07	AUTUMN	STANDARD138716	P
1-Nov-21	NE LANTAU	2	8.81	AUTUMN	STANDARD138716	S
1-Nov-21	NE LANTAU	3	1.39	AUTUMN	STANDARD138716	S
9-Nov-21	NW LANTAU	2	15.50	AUTUMN	STANDARD36826	P
9-Nov-21	NW LANTAU	3	12.36	AUTUMN	STANDARD36826	P
9-Nov-21	NW LANTAU	2	7.50	AUTUMN	STANDARD36826	S
9-Nov-21	NW LANTAU	3	1.94	AUTUMN	STANDARD36826	S
9-Nov-21	NE LANTAU	2	17.85	AUTUMN	STANDARD36826	P
9-Nov-21	NE LANTAU	3	1.40	AUTUMN	STANDARD36826	P
9-Nov-21	NE LANTAU	2	10.45	AUTUMN	STANDARD36826	S
16-Nov-21	NW LANTAU	2	11.17	AUTUMN	STANDARD36826	P
16-Nov-21	NW LANTAU	3	25.75	AUTUMN	STANDARD36826	P
16-Nov-21	NW LANTAU	2	6.00	AUTUMN	STANDARD36826	S
16-Nov-21	NW LANTAU	3	7.00	AUTUMN	STANDARD36826	S
16-Nov-21	NE LANTAU	2	12.07	AUTUMN	STANDARD36826	P
16-Nov-21	NE LANTAU	3	2.30	AUTUMN	STANDARD36826	P
16-Nov-21	NE LANTAU	2	12.13	AUTUMN	STANDARD36826	S
17-Nov-21	NW LANTAU	2	22.62	AUTUMN	STANDARD138716	P
17-Nov-21	NW LANTAU	3	1.93	AUTUMN	STANDARD138716	P
17-Nov-21	NW LANTAU	2	10.85	AUTUMN	STANDARD138716	S
17-Nov-21	NE LANTAU	1	4.20	AUTUMN	STANDARD138716	P
17-Nov-21	NE LANTAU	2	15.37	AUTUMN	STANDARD138716	P
17-Nov-21	NE LANTAU	1	1.80	AUTUMN	STANDARD138716	S
17-Nov-21	NE LANTAU	2	8.33	AUTUMN	STANDARD138716	S
2-Dec-21	NW LANTAU	2	16.61	WINTER	STANDARD138716	P
2-Dec-21	NW LANTAU	3	19.19	WINTER	STANDARD138716	P
2-Dec-21	NW LANTAU	2	8.40	WINTER	STANDARD138716	S
2-Dec-21	NW LANTAU	3	5.10	WINTER	STANDARD138716	S
2-Dec-21	NE LANTAU	2	15.98	WINTER	STANDARD138716	P
2-Dec-21	NE LANTAU	2	10.62	WINTER	STANDARD138716	S
3-Dec-21	NW LANTAU	2	2.60	WINTER	STANDARD138716	P
3-Dec-21	NW LANTAU	3	24.09	WINTER	STANDARD138716	P

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
3-Dec-21	NW LANTAU	2	2.70	WINTER	STANDARD138716	S
3-Dec-21	NW LANTAU	3	8.21	WINTER	STANDARD138716	S
3-Dec-21	NE LANTAU	2	17.85	WINTER	STANDARD138716	P
3-Dec-21	NE LANTAU	3	1.50	WINTER	STANDARD138716	P
3-Dec-21	NE LANTAU	2	7.55	WINTER	STANDARD138716	S
3-Dec-21	NE LANTAU	3	2.40	WINTER	STANDARD138716	S
14-Dec-21	NW LANTAU	2	16.31	WINTER	STANDARD36826	P
14-Dec-21	NW LANTAU	3	10.60	WINTER	STANDARD36826	P
14-Dec-21	NW LANTAU	2	6.99	WINTER	STANDARD36826	S
14-Dec-21	NW LANTAU	3	2.00	WINTER	STANDARD36826	S
14-Dec-21	NE LANTAU	2	14.67	WINTER	STANDARD36826	P
14-Dec-21	NE LANTAU	3	4.10	WINTER	STANDARD36826	P
14-Dec-21	NE LANTAU	2	4.23	WINTER	STANDARD36826	S
14-Dec-21	NE LANTAU	3	6.10	WINTER	STANDARD36826	S
15-Dec-21	NW LANTAU	2	34.20	WINTER	STANDARD138716	P
15-Dec-21	NW LANTAU	2	14.30	WINTER	STANDARD138716	S
15-Dec-21	NE LANTAU	2	16.72	WINTER	STANDARD138716	P
15-Dec-21	NE LANTAU	2	9.98	WINTER	STANDARD138716	S
3-Jan-22	NW LANTAU	1	3.14	WINTER	STANDARD36826	P
3-Jan-22	NW LANTAU	2	21.72	WINTER	STANDARD36826	P
3-Jan-22	NW LANTAU	2	11.14	WINTER	STANDARD36826	S
3-Jan-22	NE LANTAU	2	14.45	WINTER	STANDARD36826	P
3-Jan-22	NE LANTAU	3	4.81	WINTER	STANDARD36826	P
3-Jan-22	NE LANTAU	2	10.34	WINTER	STANDARD36826	S
4-Jan-22	NW LANTAU	2	20.76	WINTER	STANDARD36826	P
4-Jan-22	NW LANTAU	3	14.76	WINTER	STANDARD36826	P
4-Jan-22	NW LANTAU	2	6.94	WINTER	STANDARD36826	S
4-Jan-22	NW LANTAU	3	6.70	WINTER	STANDARD36826	S
4-Jan-22	NE LANTAU	2	9.20	WINTER	STANDARD36826	P
4-Jan-22	NE LANTAU	3	7.30	WINTER	STANDARD36826	P
4-Jan-22	NE LANTAU	2	6.53	WINTER	STANDARD36826	S
4-Jan-22	NE LANTAU	3	3.47	WINTER	STANDARD36826	S
21-Jan-22	NW LANTAU	2	17.36	WINTER	STANDARD36826	P
21-Jan-22	NW LANTAU	3	9.05	WINTER	STANDARD36826	P
21-Jan-22	NW LANTAU	2	10.49	WINTER	STANDARD36826	S
21-Jan-22	NE LANTAU	2	14.56	WINTER	STANDARD36826	P
21-Jan-22	NE LANTAU	3	4.79	WINTER	STANDARD36826	P
21-Jan-22	NE LANTAU	2	10.75	WINTER	STANDARD36826	S
25-Jan-22	NW LANTAU	2	28.02	WINTER	STANDARD36826	P
25-Jan-22	NW LANTAU	3	7.68	WINTER	STANDARD36826	P
25-Jan-22	NW LANTAU	2	13.80	WINTER	STANDARD36826	S
25-Jan-22	NE LANTAU	1	6.55	WINTER	STANDARD36826	P
25-Jan-22	NE LANTAU	2	8.92	WINTER	STANDARD36826	P
25-Jan-22	NE LANTAU	1	5.59	WINTER	STANDARD36826	S
25-Jan-22	NE LANTAU	2	4.24	WINTER	STANDARD36826	S
10-Feb-22	NW LANTAU	2	21.03	WINTER	STANDARD36826	P
10-Feb-22	NW LANTAU	3	5.70	WINTER	STANDARD36826	P
10-Feb-22	NW LANTAU	2	7.32	WINTER	STANDARD36826	S
10-Feb-22	NW LANTAU	3	1.55	WINTER	STANDARD36826	S
10-Feb-22	NE LANTAU	2	18.50	WINTER	STANDARD36826	P
10-Feb-22	NE LANTAU	2	10.40	WINTER	STANDARD36826	S
11-Feb-22	NW LANTAU	2	10.84	WINTER	STANDARD36826	P
11-Feb-22	NW LANTAU	3	24.96	WINTER	STANDARD36826	P
11-Feb-22	NW LANTAU	2	11.10	WINTER	STANDARD36826	S
11-Feb-22	NW LANTAU	3	2.60	WINTER	STANDARD36826	S
11-Feb-22	NE LANTAU	2	16.21	WINTER	STANDARD36826	P
11-Feb-22	NE LANTAU	2	9.39	WINTER	STANDARD36826	S
24-Feb-22	NW LANTAU	2	18.70	WINTER	STANDARD36826	P
24-Feb-22	NW LANTAU	3	16.54	WINTER	STANDARD36826	P
24-Feb-22	NW LANTAU	2	8.70	WINTER	STANDARD36826	S
24-Feb-22	NW LANTAU	3	5.16	WINTER	STANDARD36826	S

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
24-Feb-22	NE LANTAU	2	7.92	WINTER	STANDARD36826	P
24-Feb-22	NE LANTAU	3	7.07	WINTER	STANDARD36826	P
24-Feb-22	NE LANTAU	2	8.90	WINTER	STANDARD36826	S
24-Feb-22	NE LANTAU	3	1.11	WINTER	STANDARD36826	S
25-Feb-22	NW LANTAU	2	16.14	WINTER	STANDARD36826	P
25-Feb-22	NW LANTAU	3	9.58	WINTER	STANDARD36826	P
25-Feb-22	NW LANTAU	2	7.22	WINTER	STANDARD36826	S
25-Feb-22	NW LANTAU	3	3.36	WINTER	STANDARD36826	S
25-Feb-22	NE LANTAU	2	17.97	WINTER	STANDARD36826	P
25-Feb-22	NE LANTAU	3	1.00	WINTER	STANDARD36826	P
25-Feb-22	NE LANTAU	2	7.73	WINTER	STANDARD36826	S
25-Feb-22	NE LANTAU	3	2.60	WINTER	STANDARD36826	S
8-Mar-22	NW LANTAU	2	20.79	SPRING	STANDARD36826	P
8-Mar-22	NW LANTAU	3	5.50	SPRING	STANDARD36826	P
8-Mar-22	NW LANTAU	2	9.11	SPRING	STANDARD36826	S
8-Mar-22	NE LANTAU	2	7.98	SPRING	STANDARD36826	P
8-Mar-22	NE LANTAU	3	10.90	SPRING	STANDARD36826	P
8-Mar-22	NE LANTAU	2	4.22	SPRING	STANDARD36826	S
8-Mar-22	NE LANTAU	3	6.40	SPRING	STANDARD36826	S
11-Mar-22	NW LANTAU	2	28.90	SPRING	STANDARD36826	P
11-Mar-22	NW LANTAU	3	6.30	SPRING	STANDARD36826	P
11-Mar-22	NW LANTAU	2	8.90	SPRING	STANDARD36826	S
11-Mar-22	NW LANTAU	3	4.60	SPRING	STANDARD36826	S
11-Mar-22	NE LANTAU	2	16.52	SPRING	STANDARD36826	P
11-Mar-22	NE LANTAU	2	9.08	SPRING	STANDARD36826	S
14-Mar-22	NW LANTAU	2	26.50	SPRING	STANDARD36826	P
14-Mar-22	NW LANTAU	2	9.50	SPRING	STANDARD36826	S
14-Mar-22	NE LANTAU	2	18.38	SPRING	STANDARD36826	P
14-Mar-22	NE LANTAU	2	10.92	SPRING	STANDARD36826	S
15-Mar-22	NW LANTAU	2	34.30	SPRING	STANDARD36826	P
15-Mar-22	NW LANTAU	3	1.30	SPRING	STANDARD36826	P
15-Mar-22	NW LANTAU	2	13.00	SPRING	STANDARD36826	S
15-Mar-22	NE LANTAU	2	15.31	SPRING	STANDARD36826	P
15-Mar-22	NE LANTAU	2	9.89	SPRING	STANDARD36826	S
12-Apr-22	NW LANTAU	2	36.20	SPRING	STANDARD36826	P
12-Apr-22	NW LANTAU	2	13.10	SPRING	STANDARD36826	S
12-Apr-22	NE LANTAU	2	13.65	SPRING	STANDARD36826	P
12-Apr-22	NE LANTAU	3	1.50	SPRING	STANDARD36826	P
12-Apr-22	NE LANTAU	2	9.95	SPRING	STANDARD36826	S
13-Apr-22	NW LANTAU	2	26.55	SPRING	STANDARD36826	P
13-Apr-22	NW LANTAU	2	10.25	SPRING	STANDARD36826	S
13-Apr-22	NE LANTAU	2	19.84	SPRING	STANDARD36826	P
13-Apr-22	NE LANTAU	2	9.46	SPRING	STANDARD36826	S
21-Apr-22	NW LANTAU	2	36.80	SPRING	STANDARD36826	P
21-Apr-22	NW LANTAU	2	11.60	SPRING	STANDARD36826	S
21-Apr-22	NE LANTAU	2	16.33	SPRING	STANDARD36826	P
21-Apr-22	NE LANTAU	2	9.07	SPRING	STANDARD36826	S
25-Apr-22	NW LANTAU	2	22.55	SPRING	STANDARD36826	P
25-Apr-22	NW LANTAU	3	2.90	SPRING	STANDARD36826	P
25-Apr-22	NW LANTAU	2	6.63	SPRING	STANDARD36826	S
25-Apr-22	NW LANTAU	3	3.82	SPRING	STANDARD36826	S
25-Apr-22	NE LANTAU	2	14.73	SPRING	STANDARD36826	P
25-Apr-22	NE LANTAU	3	3.58	SPRING	STANDARD36826	P
25-Apr-22	NE LANTAU	2	9.66	SPRING	STANDARD36826	S
25-Apr-22	NE LANTAU	3	0.43	SPRING	STANDARD36826	S
3-May-22	NW LANTAU	2	18.19	SPRING	STANDARD36826	P
3-May-22	NW LANTAU	3	8.05	SPRING	STANDARD36826	P
3-May-22	NW LANTAU	2	8.96	SPRING	STANDARD36826	S
3-May-22	NW LANTAU	3	1.30	SPRING	STANDARD36826	S
3-May-22	NE LANTAU	2	18.33	SPRING	STANDARD36826	P
3-May-22	NE LANTAU	2	10.67	SPRING	STANDARD36826	S

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
5-May-22	NW LANTAU	2	22.38	SPRING	STANDARD140232	P
5-May-22	NW LANTAU	3	13.82	SPRING	STANDARD140232	P
5-May-22	NW LANTAU	2	8.60	SPRING	STANDARD140232	S
5-May-22	NW LANTAU	3	5.10	SPRING	STANDARD140232	S
5-May-22	NE LANTAU	2	6.01	SPRING	STANDARD140232	P
5-May-22	NE LANTAU	3	9.43	SPRING	STANDARD140232	P
5-May-22	NE LANTAU	2	7.06	SPRING	STANDARD140232	S
5-May-22	NE LANTAU	3	2.70	SPRING	STANDARD140232	S
17-May-22	NW LANTAU	2	20.06	SPRING	STANDARD138716	P
17-May-22	NW LANTAU	3	6.73	SPRING	STANDARD138716	P
17-May-22	NW LANTAU	2	7.30	SPRING	STANDARD138716	S
17-May-22	NW LANTAU	3	2.51	SPRING	STANDARD138716	S
17-May-22	NE LANTAU	2	15.98	SPRING	STANDARD138716	P
17-May-22	NE LANTAU	3	2.78	SPRING	STANDARD138716	P
17-May-22	NE LANTAU	2	10.09	SPRING	STANDARD138716	S
17-May-22	NE LANTAU	3	1.05	SPRING	STANDARD138716	S
19-May-22	NW LANTAU	1	5.80	SPRING	STANDARD138716	P
19-May-22	NW LANTAU	2	26.30	SPRING	STANDARD138716	P
19-May-22	NW LANTAU	3	3.21	SPRING	STANDARD138716	P
19-May-22	NW LANTAU	2	13.90	SPRING	STANDARD138716	S
19-May-22	NE LANTAU	2	14.41	SPRING	STANDARD138716	P
19-May-22	NE LANTAU	3	1.50	SPRING	STANDARD138716	P
19-May-22	NE LANTAU	2	8.08	SPRING	STANDARD138716	S
19-May-22	NE LANTAU	3	1.11	SPRING	STANDARD138716	S

Appendix II. TMCLKL Post-construction Chinese White Dolphin Sighting Database (2020-2022)
(Note: P = sightings made on primary lines; S = sightings made on secondary lines)

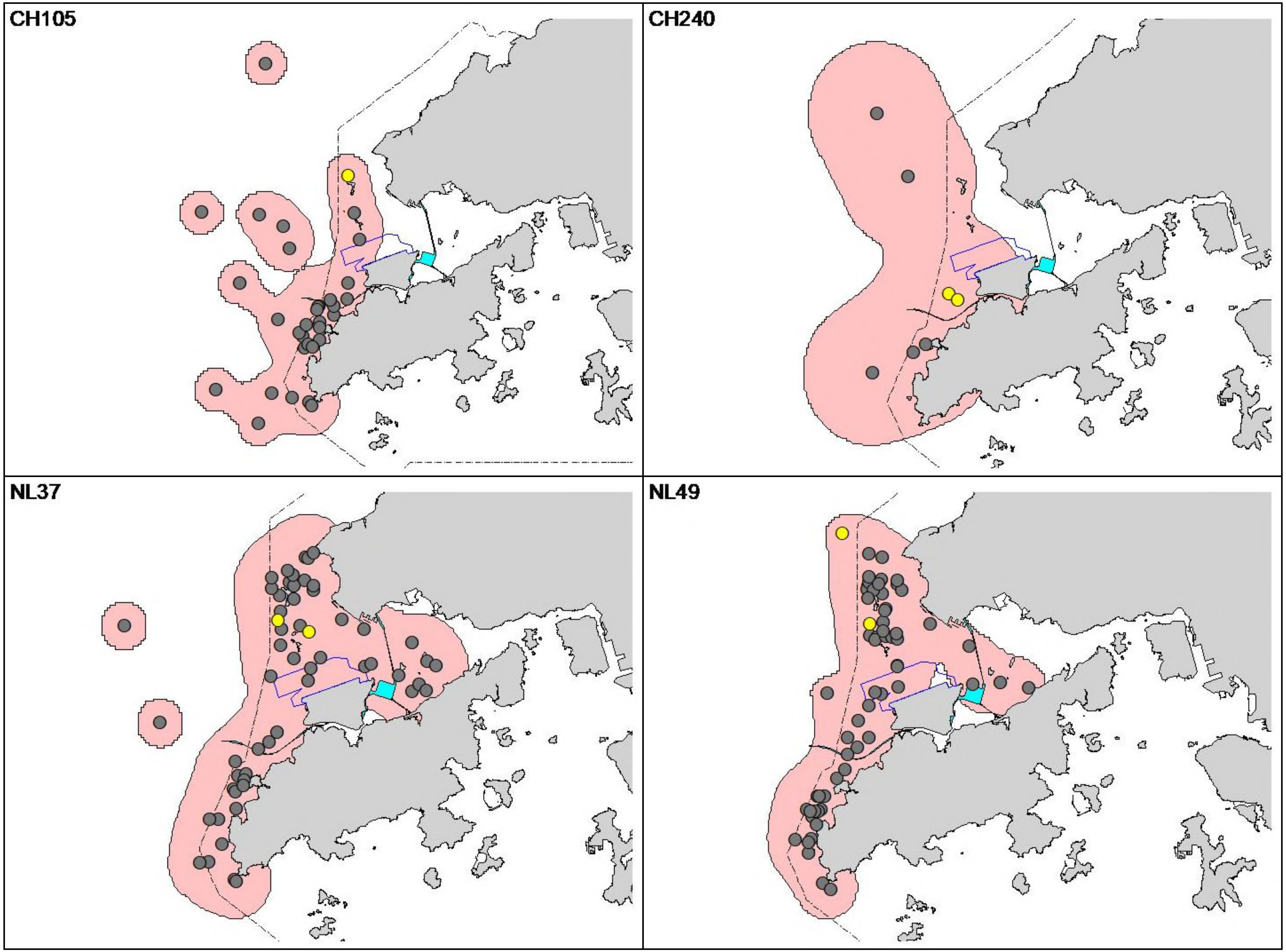
DATE	STG #	TIME	HRD SZ	AREA	BEAU	PSD	EFFORT	TYPE	NORTHING	EASTING	SEASON	BOAT ASSOC.	P/S
20-Jul-20	1	1201	1	NW LANTAU	2	208	ON	TMCLKL	827414	806478	SUMMER	NONE	P
21-Aug-20	1	1022	1	NW LANTAU	1	341	ON	TMCLKL	817308	804686	SUMMER	NONE	P
15-Sep-20	1	1213	2	NW LANTAU	1	218	ON	TMCLKL	827104	806457	AUTUMN	NONE	P
17-Nov-20	1	1018	2	NW LANTAU	3	105	ON	TMCLKL	818225	805409	AUTUMN	NONE	P
10-Dec-20	1	1326	2	NW LANTAU	2	6	ON	TMCLKL	822941	806253	AUTUMN	NONE	S
25-Jan-21	1	1057	1	NW LANTAU	2	237	ON	TMCLKL	825934	804590	WINTER	NONE	P
25-Jan-21	2	1123	8	NW LANTAU	2	852	ON	TMCLKL	831175	803417	WINTER	NONE	P
25-Jan-21	3	1329	2	NW LANTAU	2	165	ON	TMCLKL	826628	806507	WINTER	NONE	P
26-Jan-21	1	1013	1	NW LANTAU	1	55	ON	TMCLKL	817461	805469	WINTER	NONE	P
28-Jan-21	1	1052	1	NW LANTAU	3	67	ON	TMCLKL	824681	805453	WINTER	NONE	P
28-Jan-21	2	1105	4	NW LANTAU	2	85	ON	TMCLKL	825689	805465	WINTER	NONE	P
28-Jan-21	3	1133	6	NW LANTAU	2	62	ON	TMCLKL	827494	805469	WINTER	NONE	S
28-Jan-21	4	1213	2	NW LANTAU	2	74	ON	TMCLKL	827103	807466	WINTER	NONE	P
2-Feb-21	1	1011	7	NW LANTAU	1	215	ON	TMCLKL	816841	805468	WINTER	NONE	P
2-Feb-21	2	1050	1	NW LANTAU	2	1589	ON	TMCLKL	820219	805032	WINTER	NONE	S
2-Feb-21	3	1127	1	NW LANTAU	2	112	ON	TMCLKL	829332	805473	WINTER	NONE	P
8-Feb-21	1	1022	3	NW LANTAU	2	172	ON	TMCLKL	816378	804643	WINTER	NONE	P
23-Feb-21	1	1136	1	NW LANTAU	2	71	ON	TMCLKL	826949	806446	WINTER	NONE	P
3-Mar-21	1	1011	3	NW LANTAU	3	404	ON	TMCLKL	816830	805427	SPRING	NONE	P
3-Mar-21	2	1151	2	NW LANTAU	2	121	ON	TMCLKL	828365	807489	SPRING	NONE	P
17-Mar-21	1	1016	2	NW LANTAU	1	786	ON	TMCLKL	816121	805487	SPRING	NONE	P
11-May-21	1	1046	5	NW LANTAU	3	191	ON	TMCLKL	825639	808524	SPRING	NONE	P
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 post-construction period (2020-2022)

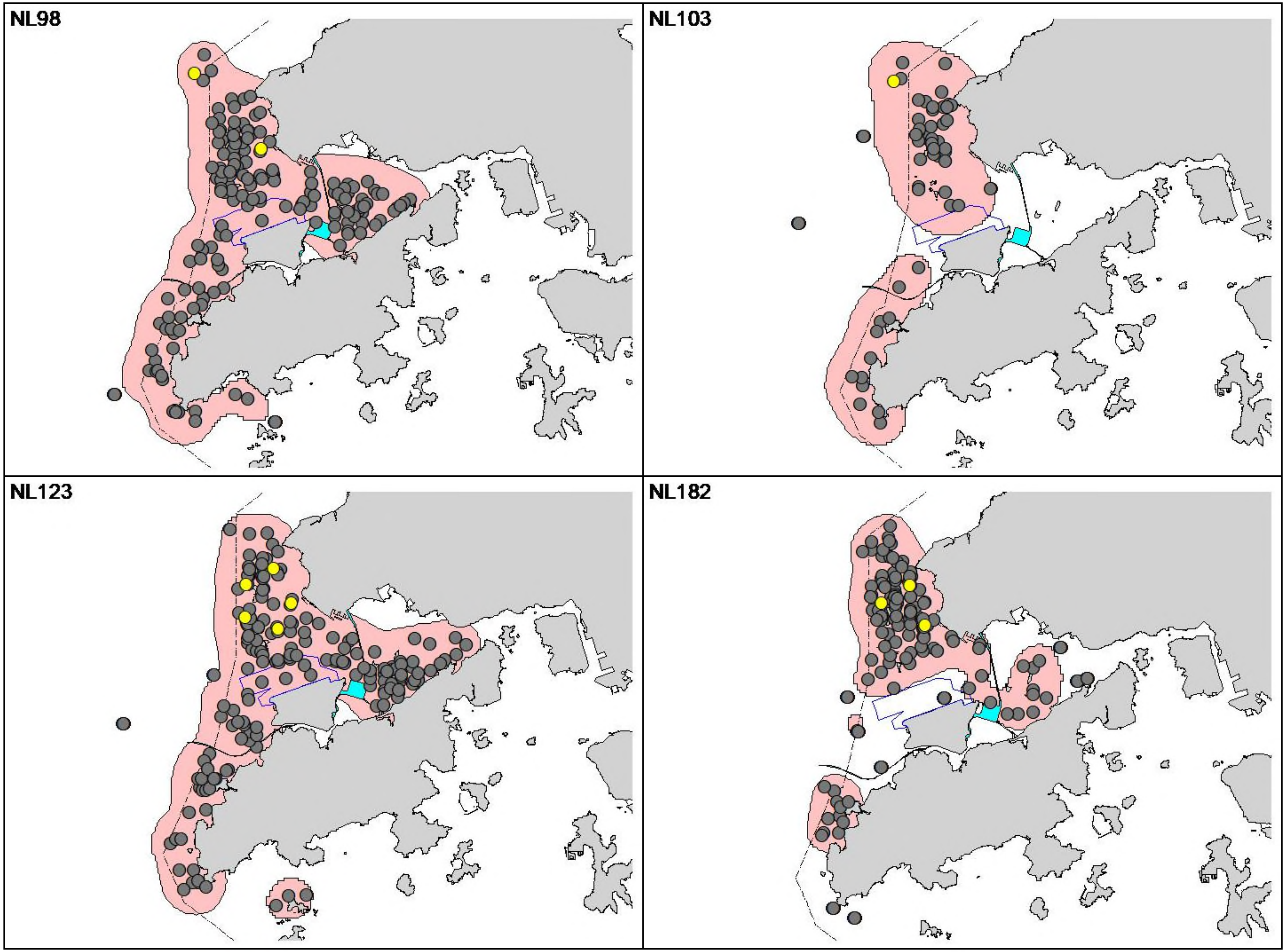
DOLPHIN ID	DATE	STG#	AREA
CH105	28/01/21	3	NWL
CH240	21/08/20	1	NWL
	02/02/21	1	NWL
NL37	04/01/22	2	NWL
	10/02/22	1	NWL
NL49	25/01/21	2	NWL
	28/01/21	1	NWL
NL98	25/01/21	2	NWL
	11/05/21	1	NWL
NL103	25/01/21	2	NWL
NL123	11/05/21	1	NWL
	17/11/21	1	NWL
	03/01/22	1	NWL
	04/01/22	2	NWL
	10/02/22	1	NWL
NL182	03/03/21	2	NWL
	11/05/21	1	NWL
	13/09/21	1	NWL
NL202	20/07/20	1	NWL
	15/09/20	1	NWL
	28/01/21	4	NWL
	23/02/21	1	NWL
	03/03/21	2	NWL
	17/11/21	1	NWL
	10/02/22	1	NWL
NL242	25/01/21	2	NWL
	04/01/22	2	NWL
NL259	21/01/22	1	NWL
NL261	10/12/20	1	NWL
NL272	11/05/21	1	NWL
NL280	28/01/21	2	NWL
NL286	15/09/20	1	NWL
NL299	25/01/21	2	NWL
NL321	25/01/21	3	NWL
NL331	17/11/20	1	NWL
	26/01/21	1	NWL
	02/02/21	1	NWL

DOLPHIN ID	DATE	STG#	AREA
SL67	10/12/20	1	NWL
WL05	25/01/21	2	NWL
	17/11/21	1	NWL
WL11	04/01/22	2	NWL
WL79	03/03/21	1	NWL
	03/01/22	2	NWL
	10/02/22	1	NWL
WL98	08/02/21	1	NWL
WL145	02/02/21	1	NWL
WL167	10/02/22	1	NWL
WL179	25/01/21	1	NWL
	02/02/21	3	NWL
	03/03/21	1	NWL
	03/01/22	2	NWL
	25/02/22	1	NWL
WL227	28/01/21	3	NWL
WL243	17/11/20	1	NWL
	16/11/21	1	NWL
WL254	10/02/22	1	NWL
WL283	02/02/21	1	NWL
WL294	03/03/21	1	NWL
	04/01/22	1	NWL
WL301	02/02/21	1	NWL
WL304	08/02/21	1	NWL

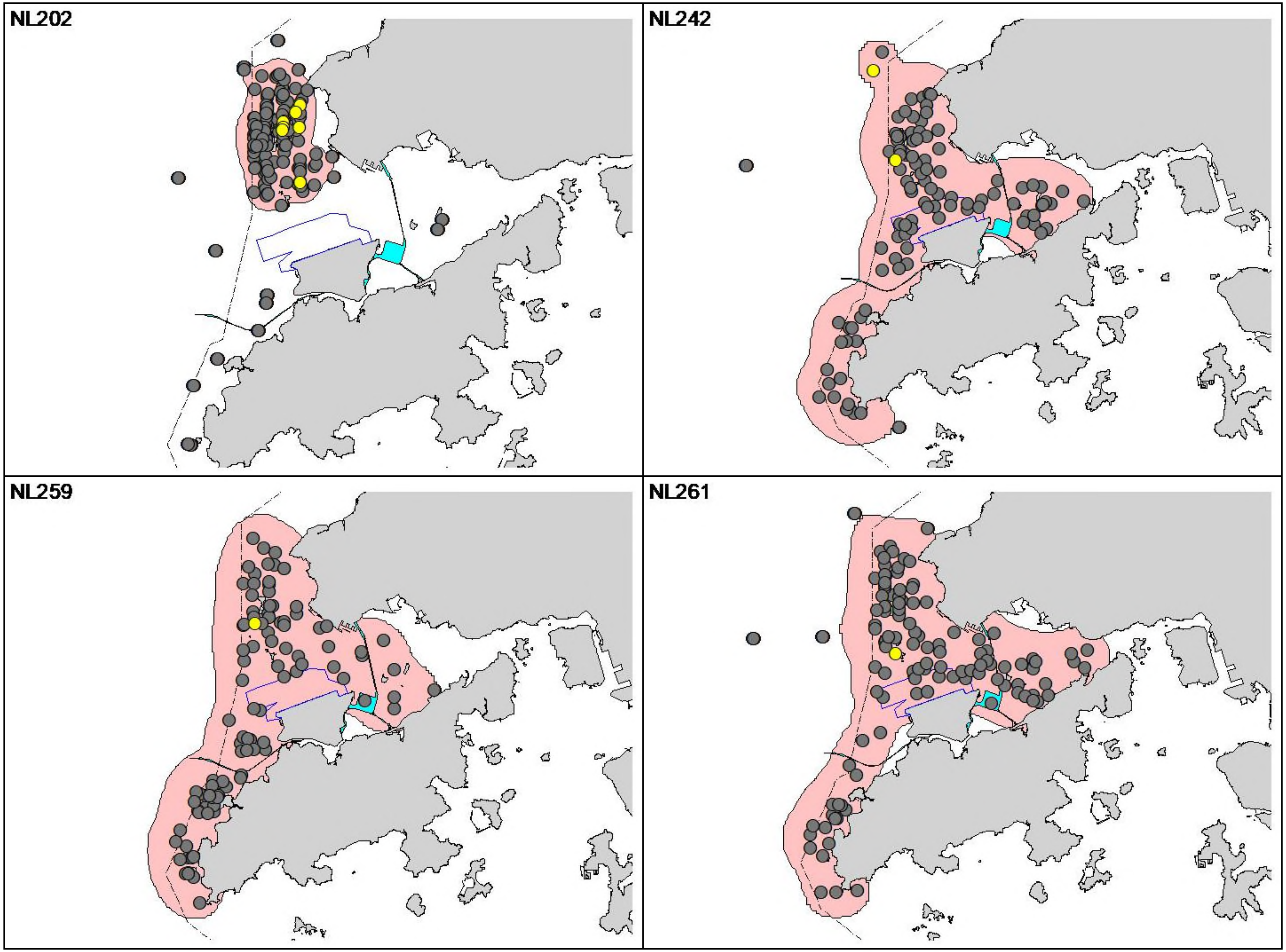
Appendix IV. Ranging patterns (95% kernel ranges) of 33 individual dolphins that were sighted during TMCLKL post-construction monitoring period (note: yellow dots indicate individual re-sightings made between June 2020-May 2022)



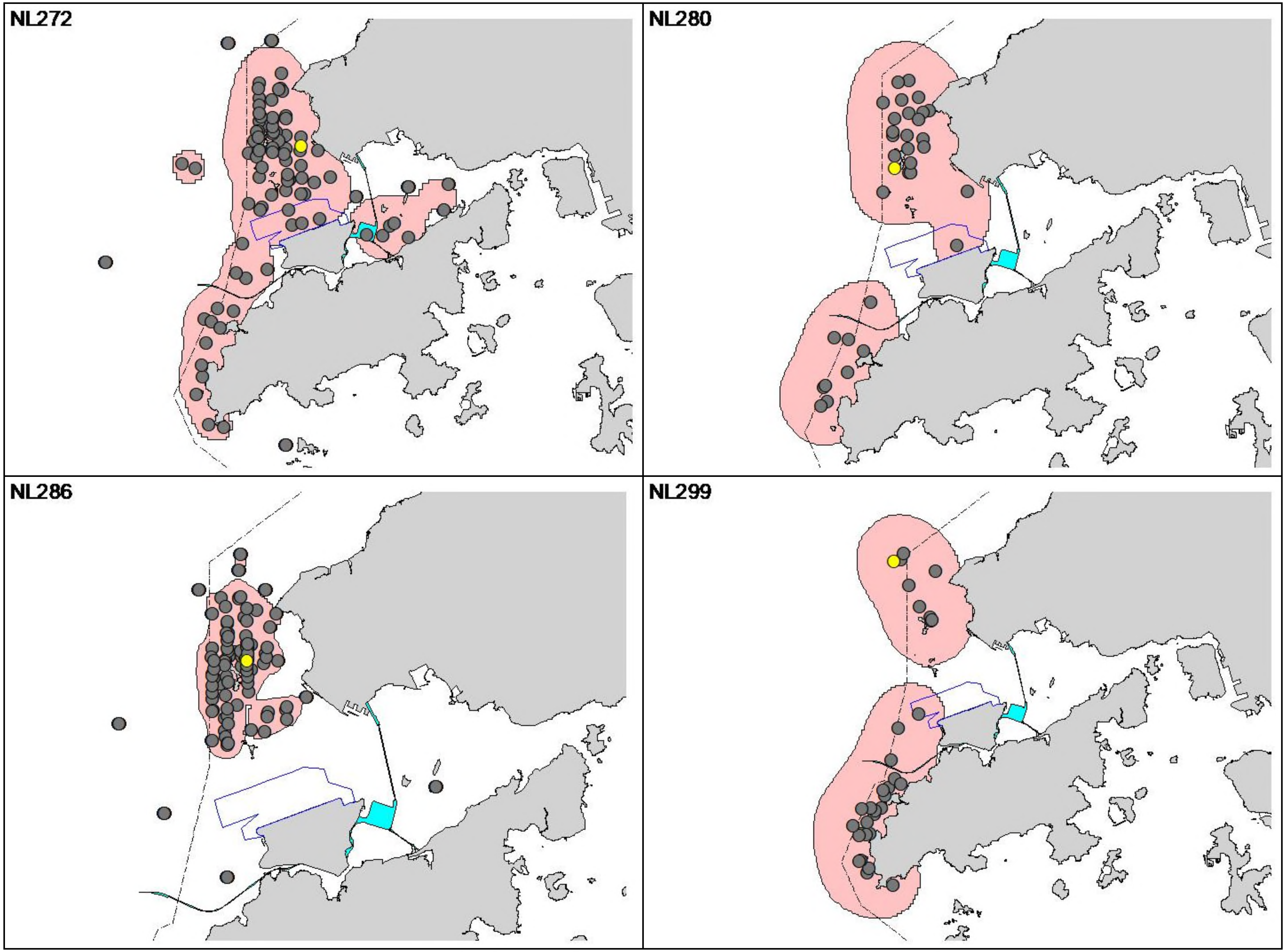
Appendix IV. (cont'd)



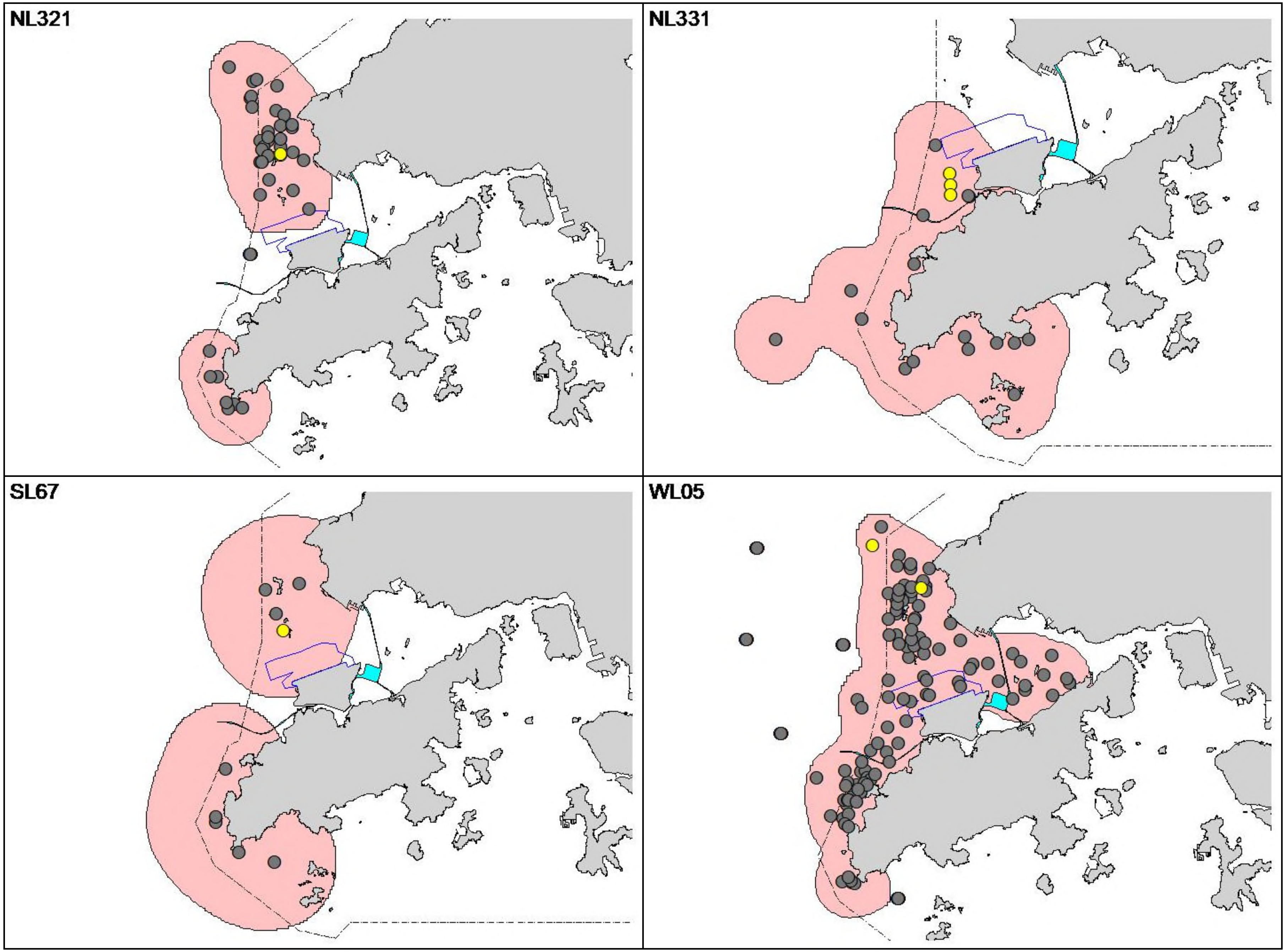
Appendix IV. (cont'd)



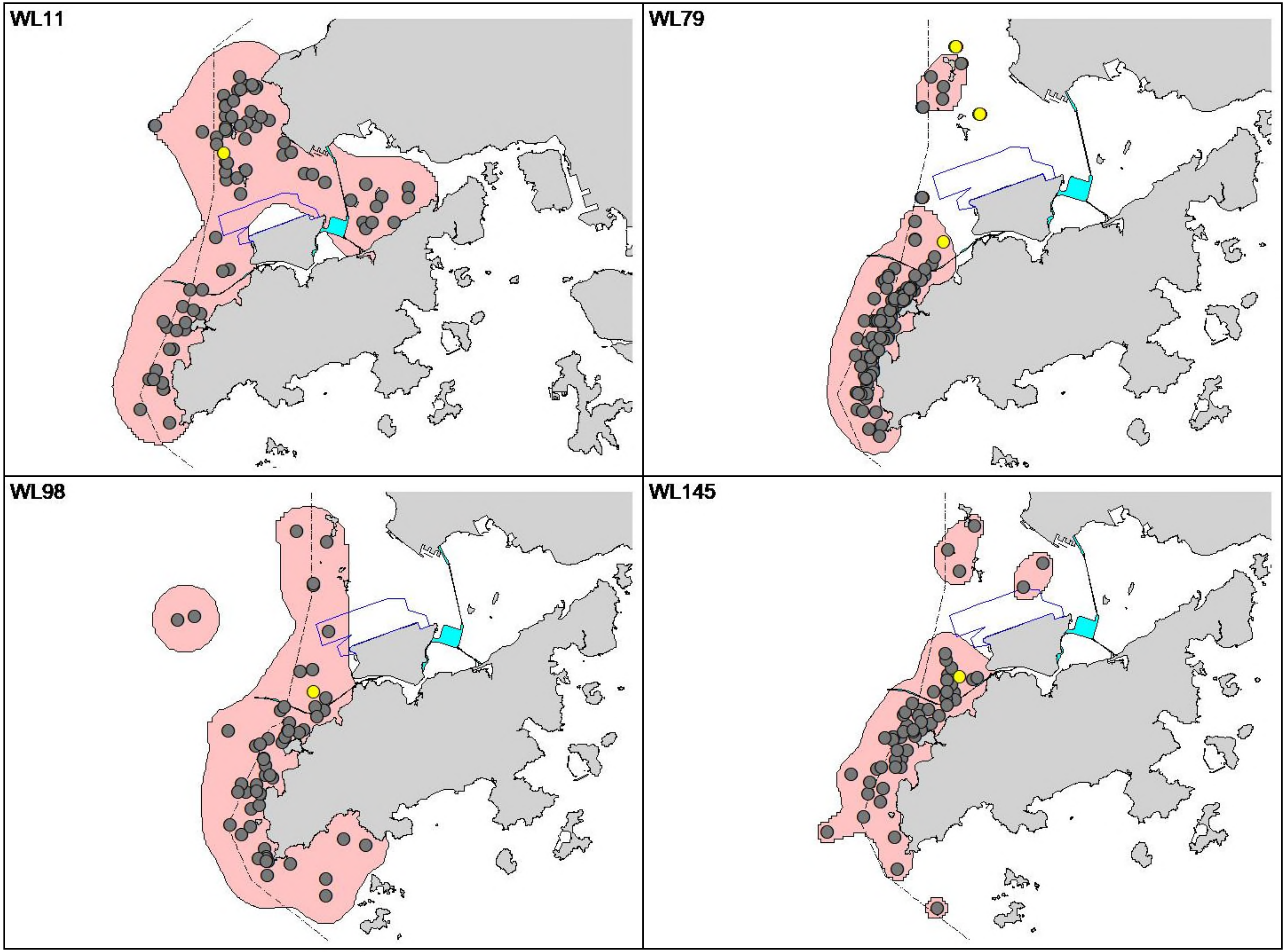
Appendix IV. (cont'd)



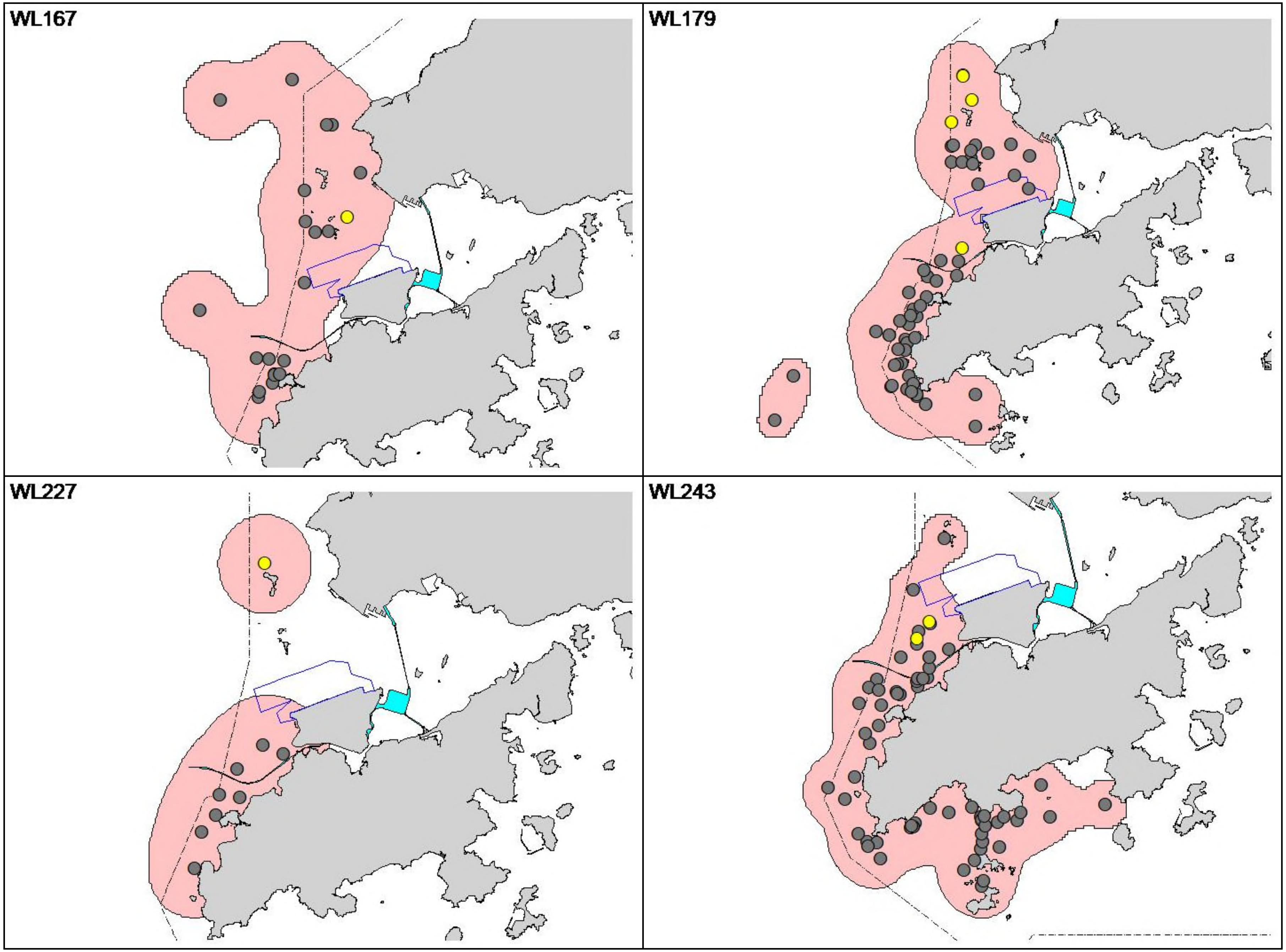
Appendix IV. (cont'd)



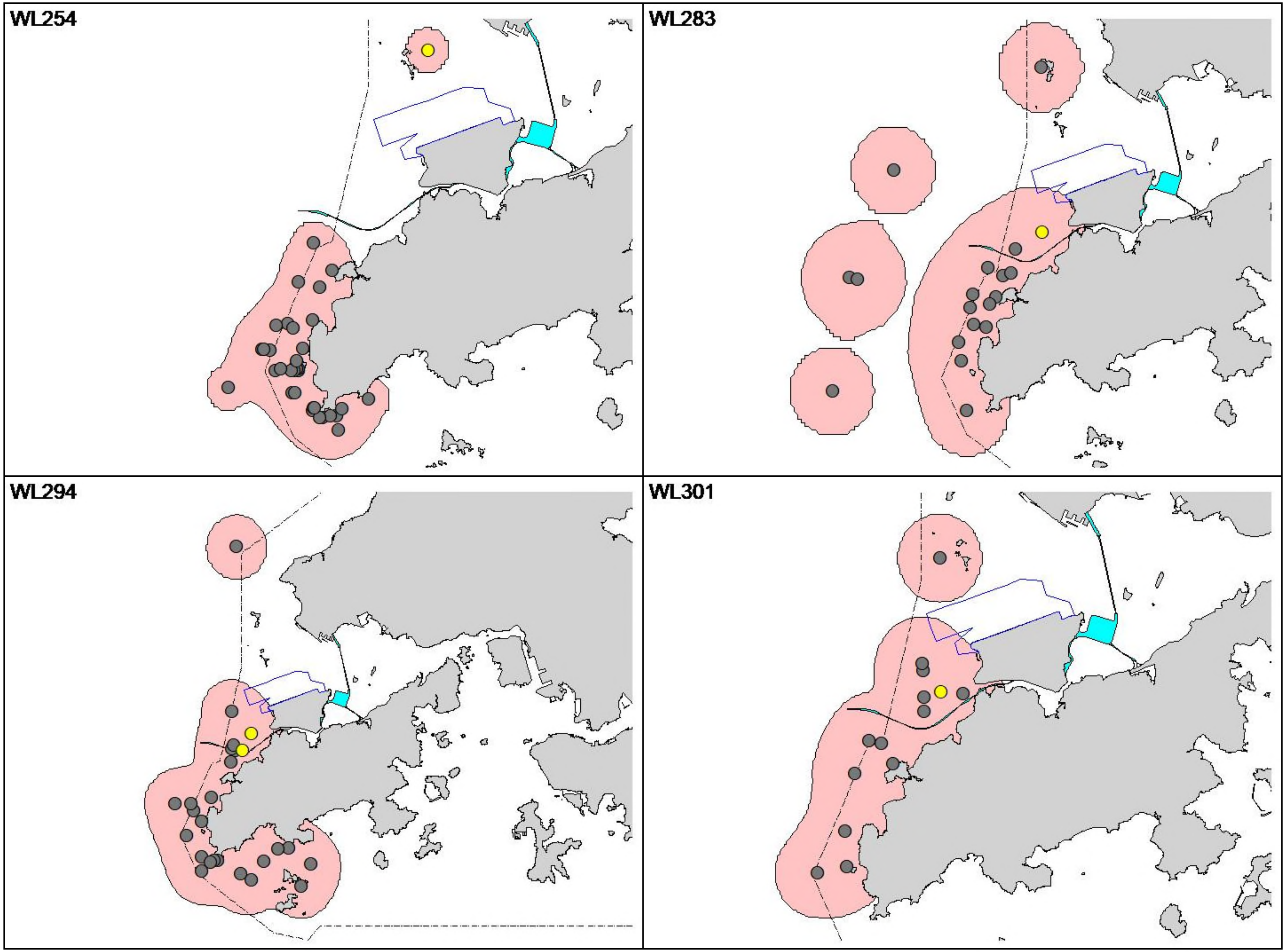
Appendix IV. (cont'd)



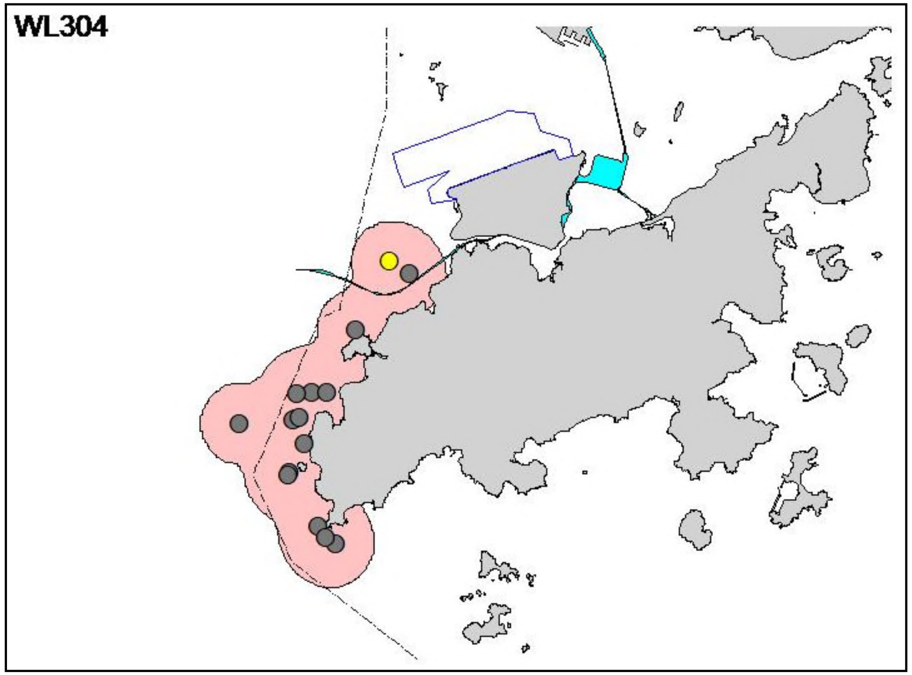
Appendix IV. (cont'd)



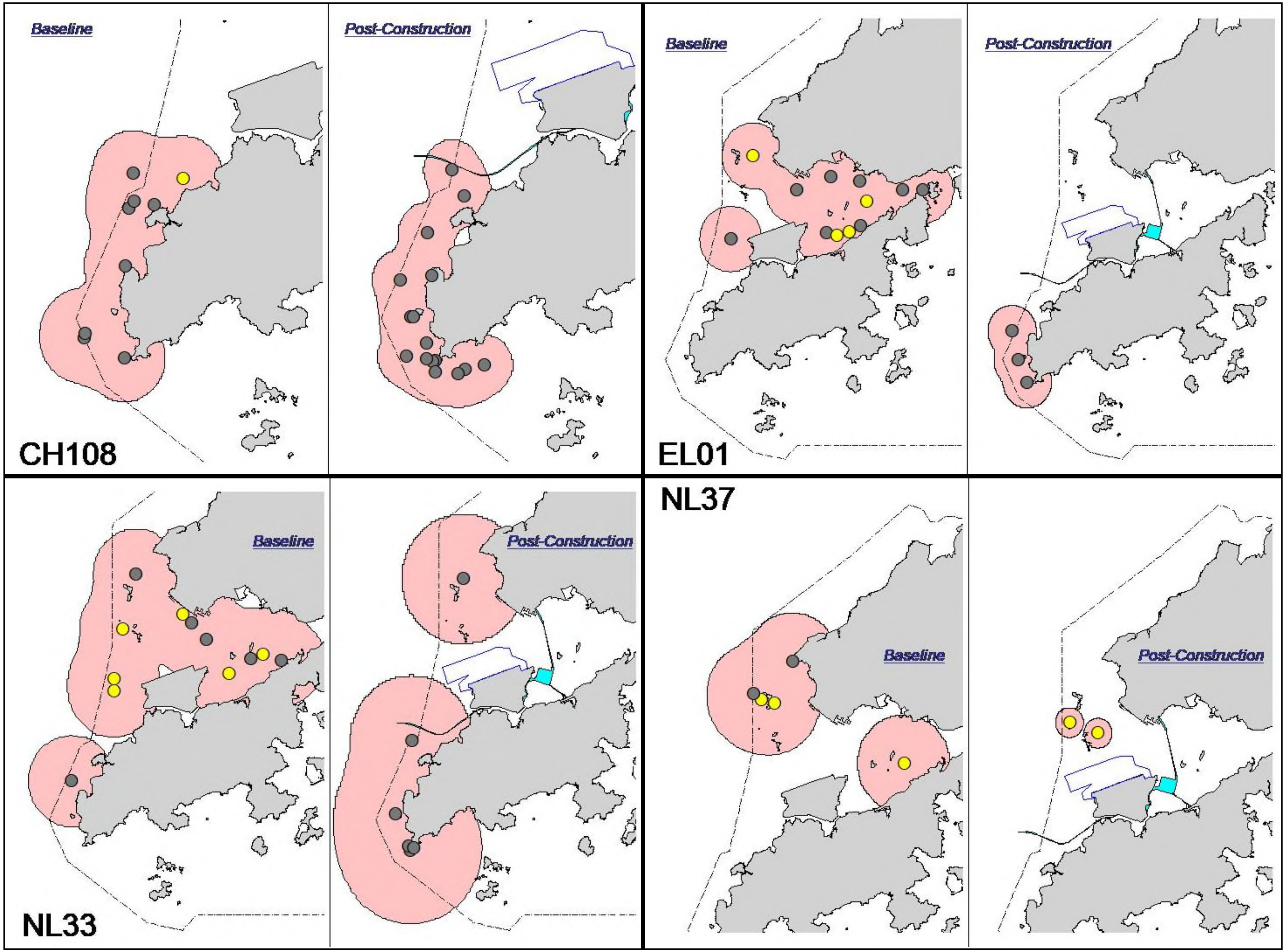
Appendix IV. (cont'd)



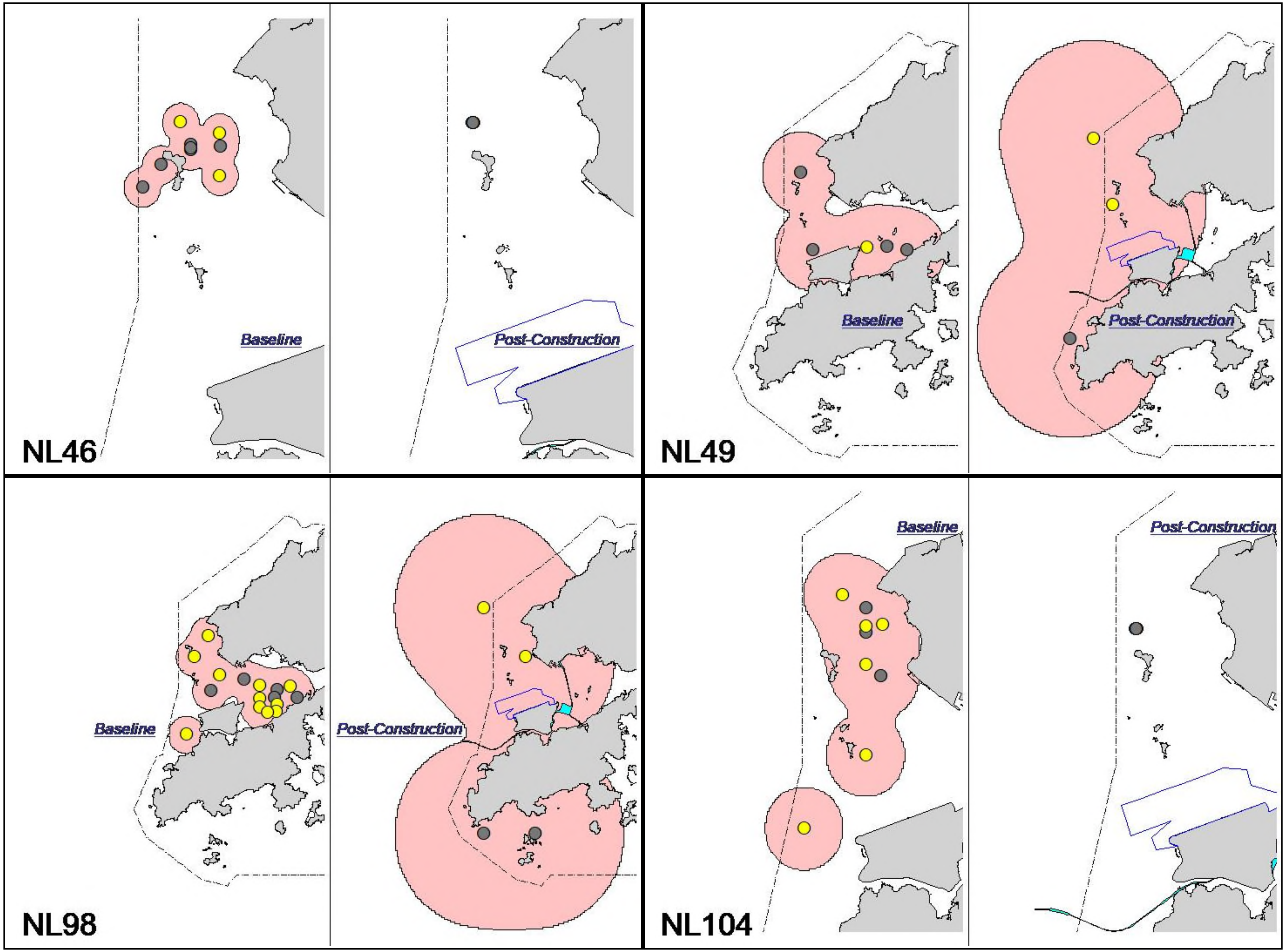
Appendix IV. (cont'd)



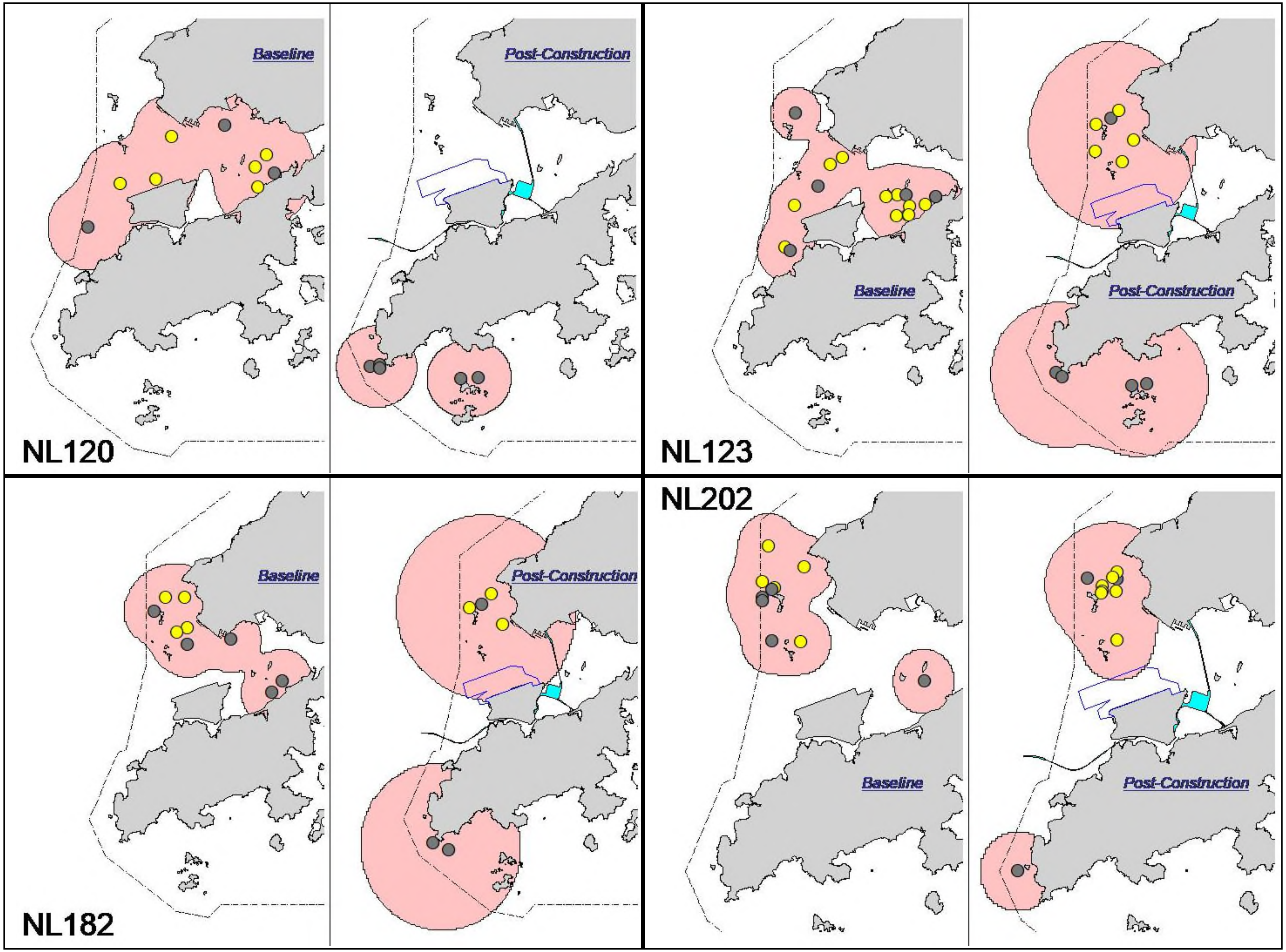
Appendix V. Comparison of ranging patterns (95% kernel ranges) of 25 individual dolphins before (i.e. baseline) and after TMCLKL construction (i.e. post-construction)
(note: yellow dots indicate individual re-sightings made during TMCLKL EM&A surveys in NL waters)



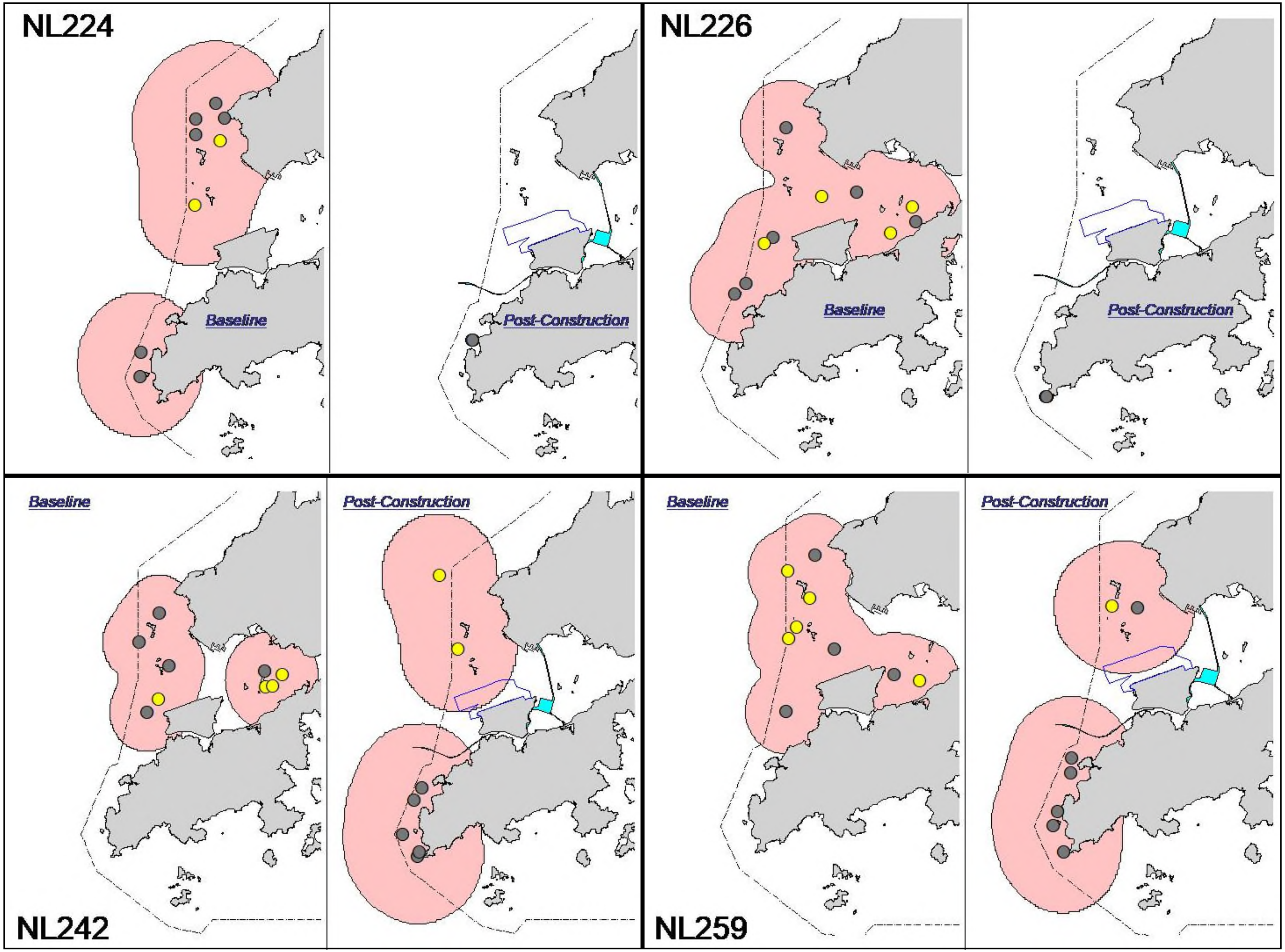
Appendix V. (cont'd)



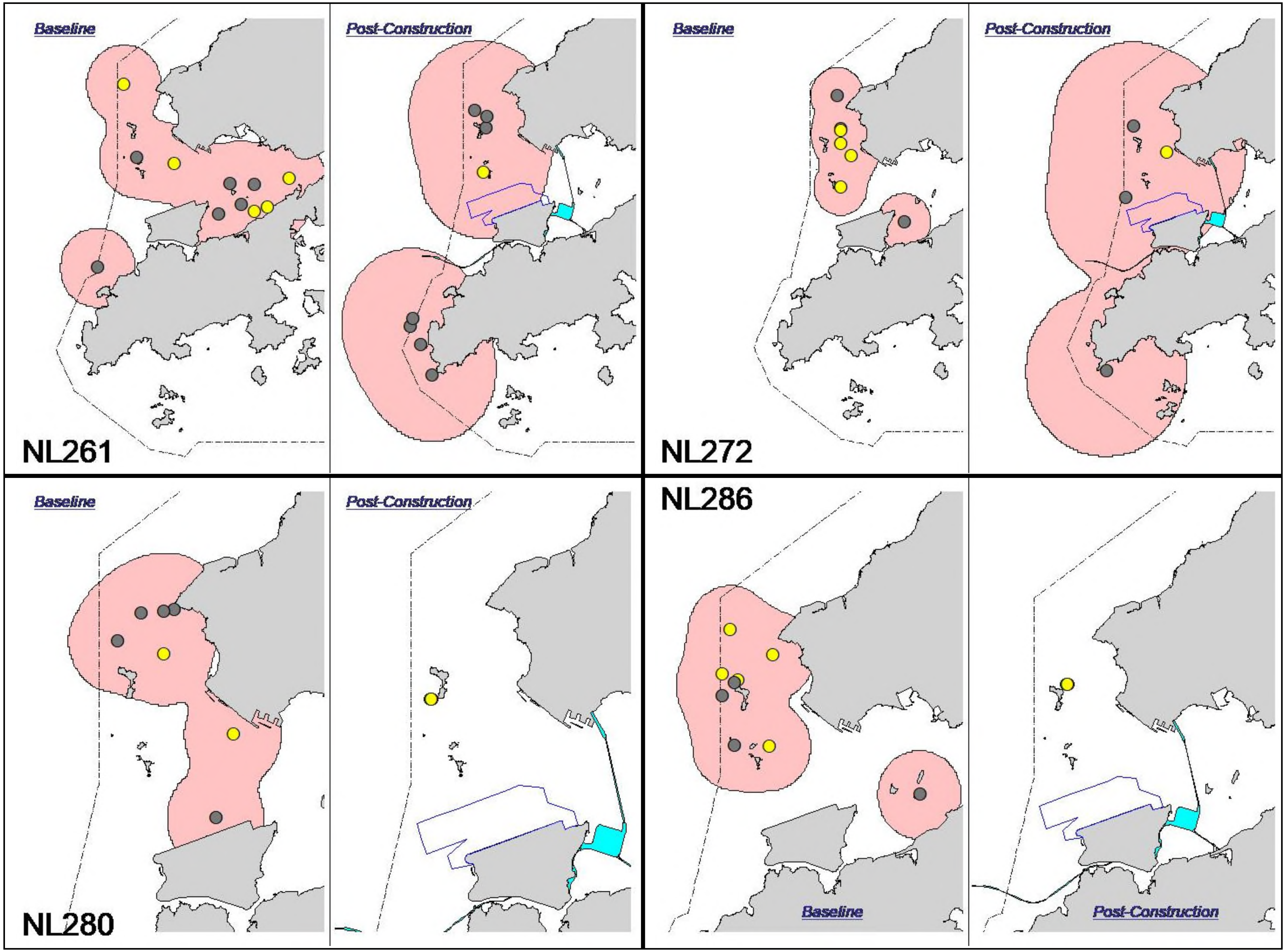
Appendix V. (cont'd)



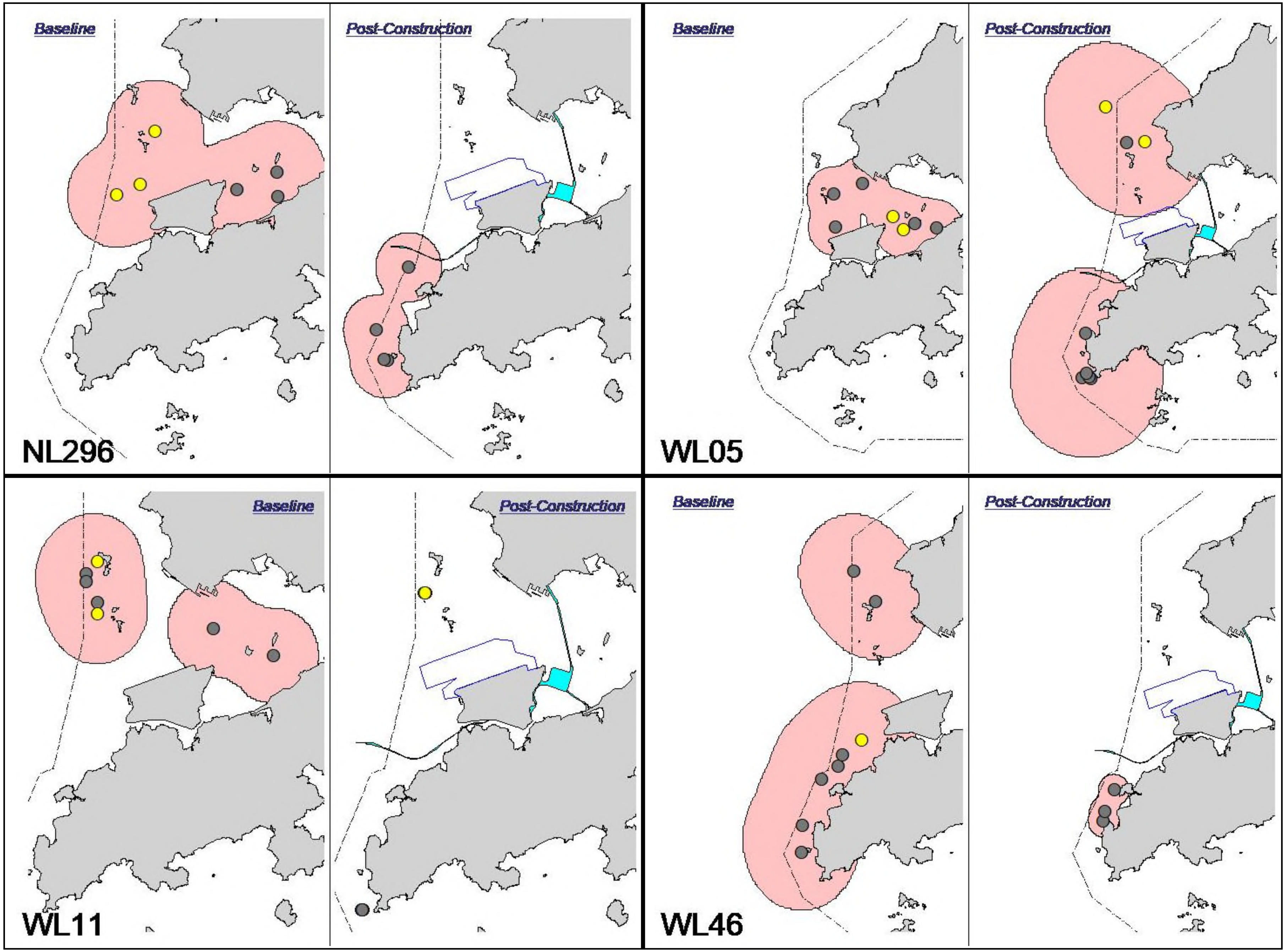
Appendix V. (cont'd)



Appendix V. (cont'd)



Appendix V. (cont'd)



Appendix V. (cont'd)