MONITORING OF MARINE MAMMALS IN HONG KONG WATERS (2021-22)

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FINAL REPORT

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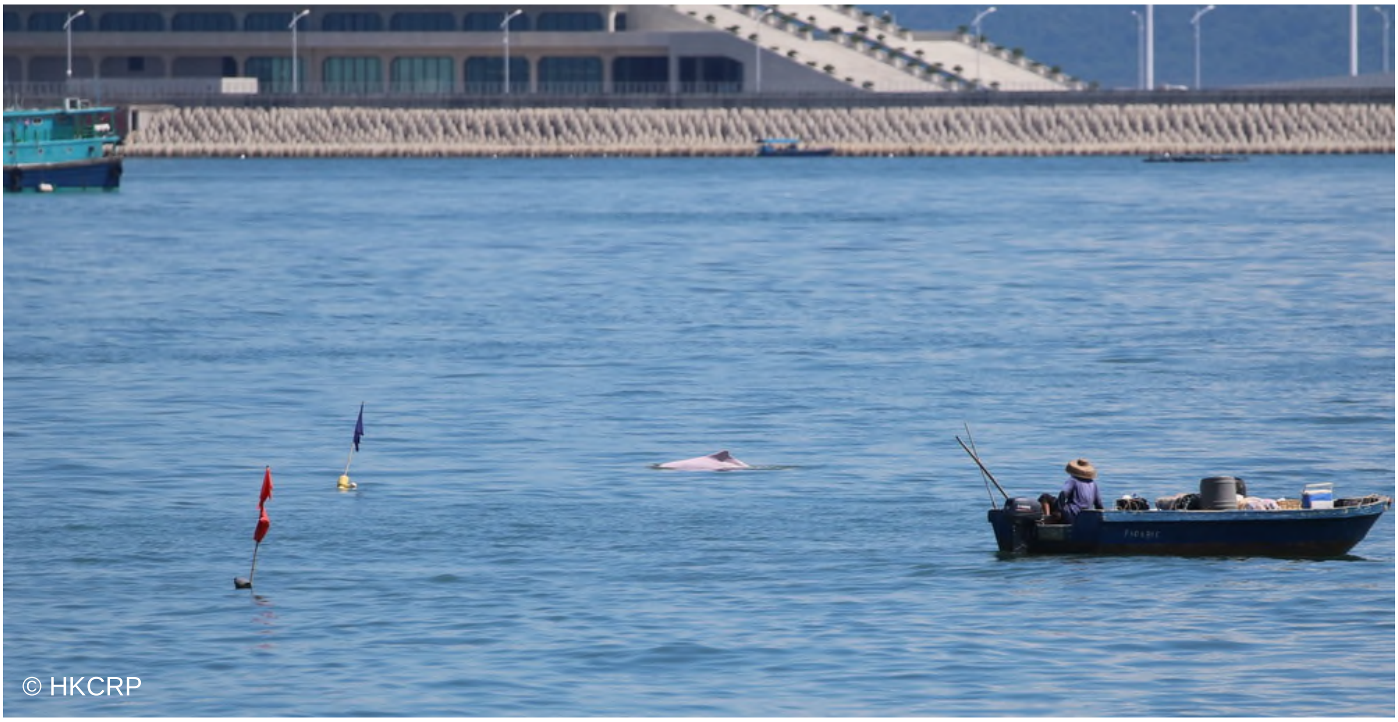

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EXECUTIVE SUMMARY

For more than two decades, a longitudinal study on Chinese White Dolphins and Indo-Pacific finless porpoises has been conducted in Hong Kong. The present monitoring study represents a continuation and extension of this research programme with the funding support from the Agriculture, Fisheries and Conservation Department of the Hong Kong SAR Government, covering the period of April 2021 to March 2022.

During the one-year study period, 165 line-transect vessel surveys with 6,566.1 km of survey effort were conducted among ten survey areas in Hong Kong. A total of 158 groups of 554 Chinese White Dolphins and 73 groups of 158 finless porpoises were sighted during vessel and helicopter surveys. The dolphins were frequently sighted along the west coast of Lantau Island and near Fan Lau Peninsula, but they seldom occurred in northern portion of SWL waters and only a handful of sightings were made at the western end of the North Lantau region. For the porpoises, the only concentration of their sightings occurred to the south and east of the Soko Islands.

In 2021, the most important dolphin habitats were concentrated along the West Lantau coastline as well as the western end of South Lantau waters, mainly extending from Tai O Peninsula toward Fan Lau Peninsula. In the past decade, dolphin occurrence in the North Lantau region has greatly diminished and is largely confined to the western end in recent years, with no apparent signs of recovery owing to the consecutive implementation of major reclamation and coastal development works. Continuous and alarming declines in dolphin usage were observed within the Brothers Marine Park and the Sha Chau and Lung Kwu Chau Marine Park, which were also confirmed by the concurrent passive acoustic monitoring works. On the contrary their usage has remained fairly steady and high within the Southwest Lantau Marine Park in the past decade.

For finless porpoises, their most heavily utilized habitats in 2021 were limited to the east and west of the Soko Islands. Temporal changes in porpoise habitat use were notable at the offshore waters between Shek Kwu Chau and the Soko Islands as well as to the south of Cheung Chau, with consistently high usage in 2015-17 before a noticeable decline in 2018-21, especially around Shek Kwu Chau where the reclamation works for the Integrated Waste Management Facilities occurred.

The marine mammal habitat index for two five-year periods, 2006-10 and 2016-20, were assessed and compared to examine the potential degradation of marine mammal

habitats within the marine parks as a result of coastal development. For both marine parks in the North Lantau region, dolphin habitat qualities have quickly and significantly deteriorated after the implementation of coastal development projects. On the contrary, the habitat quality of the Southwest Lantau Marine Park has remained unchanged, while the importance of the South Lantau Marine Park as a marine mammal habitat has increased in recent years, demonstrating the urgency to establish this marine park as soon as possible to safeguard the remaining marine mammal habitats in western waters of Hong Kong.

In 2021, the combined estimate of dolphin abundance in Hong Kong waters in the four main survey areas of dolphin occurrences (i.e. SWL, WL, NWL and NEL) was 40 (the combined estimates for the last five years, i.e. 2016 to 2020, were 47, 47, 32, 52, and 37 respectively). Significant declines in dolphin abundances were detected in each of the three survey areas in NEL, NWL and WL over the past two decades, as well as the combined abundance from the four main areas of dolphin occurrences in the past decade.

During the 2021-22 monitoring period, 106 individual dolphins were identified with 370 re-sightings, and three quarters of all re-sightings were made in WL waters. A total of seven new individuals have been added to the photo-ID catalogue, while 11 individuals that were frequently sighted in Hong Kong waters in the past have disappeared in 2021. Continuous decline in dolphin movements between NWL and WL survey areas as well as between WL and SWL survey areas were evident in recent years.

HKCRP researchers delivered a total of 11 education seminars at local schools regarding the conservation of local dolphins and porpoises in 2021-22. Through this integrated approach of long-term research and publicity programme, the Hong Kong public can gain first-hand information from the researchers.

行政摘要 (中文翻譯)

一項有關本地中華白海豚及印度太平洋江豚的長期研究，在過去二十多年以來一直在進行中，而此項為期一年 (由 2021 年 4 月至 2022 年 3 月)、獲香港特別行政區政府漁農自然護理署資助的研究工作，正是這長期監察的延伸。

在十二個月研究期間，研究員共進行了 165 次樣條線船上調查，在全港十個調查區航行了 6,566.1 公里，並在船上及直昇機上共觀察到 158 群中華白海豚 (總數達 554 隻) 及 73 群江豚 (總數達 158 隻)。在 2021-22 年間，中華白海豚經常在西大嶼山水域及分流半島一帶出沒，卻較少在西南大嶼山的北部出沒，在北大嶼山更只有西端的水域有零星出沒紀錄。另一方面，江豚的目擊記錄主要集中於索罟群島以東及以南的水域。

中華白海豚在 2021 年的重要棲身地，主要集中在西大嶼山近岸及南大嶼山西端的水域，即大澳半島與分流半島之間一帶的水域。在過去十年，海豚在北大嶼山水域的使用率大幅下降，並在近年只集中出沒於此水域的西端，而且因為大型填海及近岸發展工程相繼推行，其使用量並未有任何回復的跡象。在過去十年間，海豚在大小磨刀海岸公園、沙洲及龍鼓洲海岸公園內的使用量均持續地大幅減少，此趨勢亦與同期進行的被動水底聲音監察研究結果吻合；相反地，在過去十年，大嶼山西南海岸公園仍錄得穩定而持續高企的海豚使用量。

江豚在 2021 年錄得最高使用量的棲身地，均位處於索罟群島以東及以西的水域。江豚於不同時間在石鼓洲及索罟群島之間外海水域、以及在長洲以南水域的棲身地使用出現改變。在 2015-17 年間，於石鼓洲及索罟群島之間水域曾錄得持續高企的江豚使用量，但隨後卻在 2018-21 年間明顯減少，此下降趨勢尤其在毗鄰「綜合廢物管理設施」填海工程的石鼓洲水域更為明顯。

透過評估和比較海洋哺乳類動物棲息地指標於兩個五年期間 (2006-10 年及 2016-20 年) 的數值，可藉此檢視各個海岸公園的生境有否因為近岸發展工程而受損。評估顯示，位處北大嶼山兩個海岸公園內的海豚棲息地，其質素在近岸發展項目推行後急速及顯著地惡化；而位處大嶼山西南海岸公園內的棲身地質素，在大橋興建前後並沒有太大分別。反之，在南大嶼海岸公園內的海洋哺乳類動物棲息地，其重要性於近年正在提升，足證有必要儘快設立此海岸公園、以保護在香港西部水域僅存的海洋哺乳類動物生境。

在 2021 年，中華白海豚在大嶼山西南、西、西北及東北四個調查區域的整體數目估計為 40 隻 (過去五年的年度數目分別為 47、47、32、52 及 37 隻)。在過去廿年，大嶼山東北、西北及西面的調查區域的海豚數量均各自錄得明顯下降趨

勢；而四個調查區域合共的整體海豚數目在過去十年亦錄得明顯下降趨勢。

於 2021-22 監察年度期間，研究員辨認出 106 隻個別海豚、共 370 次的目擊紀錄，其中四分之三均出現在大嶼山西面水域。2021 年內共有七隻新的個別海豚被加入相片辨認名錄，而在過去一些經常出沒於香港水域的海豚個體，共有 11 隻於 2021 年間不見所蹤。於大嶼山西北面及西面調查區之間、與大嶼山西面及西南面調查區之間移動的個別海豚，兩者的數量均於近數年持續下降。

在本年度，研究員為本地中小學主持了共十一場講座，內容主要圍繞香港中華白海豚及江豚的最新保育狀況。透過揉合長期研究監察及公眾教育活動，香港市民可從研究員獲得更多有關鯨豚的最新資訊。

1. INTRODUCTION

For more than two decades, the Hong Kong Cetacean Research Project (HKCRP) has been conducting a longitudinal study on Chinese White Dolphins (*Sousa chinensis*) and Indo-Pacific finless porpoises (*Neophocaena phocaenoides*) in Hong Kong and the Pearl River Delta region. Such multi-disciplinary research study in the past two decades has been primarily funded by AFCD as well as various government departments and NGOs, aiming to provide critical scientific information to the Hong Kong SAR Government for formulation of sound management and conservation strategies for the local populations of dolphins and porpoises. In addition, HKCRP has been extensively involved in numerous environmental consultancy studies to assess potential impacts of marine construction works on cetaceans in Hong Kong waters and the Pearl River Estuary, and to provide suggestions and guidance on mitigation measures to lessen the pressures of the development projects on dolphins and porpoises. Results from these integrated studies have been used to establish several systematic databases, which can be used to estimate population size, to monitor trends in abundance, distribution, habitat use and behaviour over time, and to keep track of levels and changes in mortality rates of local cetaceans (e.g. Hung 2008, 2020, 2021; Jefferson et al. 2002, 2009, 2012; Wang and Hung 2019, 2020, 2021).

The present monitoring project represents a continuation and extension of this research programme, with funding support from AFCD of HKSAR Government. The main goal of this one-year monitoring study is to collect systematic monitoring data for in-depth analysis and assessment of spatial and temporal patterns on distribution, abundance and habitat use of Chinese White Dolphins (CWD) and Indo-Pacific finless porpoises (FP) in Hong Kong, to take photographic records of individual dolphins, and to analyze the monitoring data for better understanding of various aspects of local dolphins and porpoises. The one-year project covers the period of 1 April 2021 to 31 March 2022, and this revised draft final report is submitted to AFCD as a summary of this monitoring project, covering the entire 12-month study.

2. OBJECTIVES OF PRESENT STUDY

The main goal of this one-year monitoring study was to collect systematic monitoring data for an in-depth analysis and assessment of distribution, abundance and habitat use of CWD and FP in Hong Kong, to take photographic records of individual dolphins, and to analyze the monitoring data for better understanding of various aspects of local dolphins and porpoises. To achieve this main goal, several specific objectives were set for the present study. The first objective was to assess the spatial and temporal patterns of distribution, abundance and habitat use of CWD and FP in Hong Kong in detail. This objective was achieved through data collection on dolphins and porpoises by conducting regular systematic line-transect vessel surveys and helicopter surveys.

The second objective was to identify individual CWD by their natural markings using photo-identification technique. This objective was achieved by obtaining high-quality photographs of CWD for photo-identification analysis. Photographs of re-sighted and newly identified individuals were compiled and added to the current photo-identification catalogue, with associated descriptions for each newly identified individual. Photographic records of FP were also taken during vessel and helicopter surveys for educational purposes.

The third objective was to analyze the monitoring data for better understanding of the various aspects of local dolphin and porpoise populations. This objective was achieved by conducting various data analyses, including line-transect analysis, encounter rate analysis, distribution analysis, behavioural analysis and quantitative grid analysis to assess the spatial and temporal patterns of abundance, distribution and habitat use and trends of occurrence of CWD and FP using vessel survey data. The fourth objective was to conduct ranging pattern analysis and residency pattern analysis to study individual core area, ranging pattern, habitat use and movement pattern of CWD based on the data obtained from both the line-transect vessel surveys and the associated photo-identification works.

The final objective was to educate the members of the public on local dolphins and porpoises, by disseminating the study findings from the long-term monitoring research programme. This objective was achieved by providing public seminars to local primary and secondary school students through the arrangement of AFCD.

3. RESEARCH TASKS

During the study period, several tasks were completed to satisfy the objectives set for the present marine mammal monitoring study. These tasks were:

- to collect monitoring data for assessment on spatial and temporal patterns of distribution, abundance and habitat use of local dolphins and porpoises through systematic line-transect vessel surveys and helicopter surveys;

- to analyze line-transect survey data for assessment on spatial and temporal patterns of distribution, abundance, habitat use and trends of occurrence of dolphins and porpoises in Hong Kong;

- to take photographic records of CWD for photo-identification analysis and update the photo-identification catalogue;

- to analyze photo-identification data of individual CWD to assess their ranging patterns, core area use and movement patterns;

- to take photographic records of FP; and

- to assist AFCD in arousing public awareness on local dolphins and porpoises through school seminars.

4. METHODOLOGY

4.1. Vessel Survey

The survey team used standard line-transect methods (Buckland et al. 2001) to conduct regular vessel surveys, and followed the same technique of data collection that has been adopted in the past two decades of marine mammal monitoring surveys in Hong Kong developed by HKCRP (Hung 2005, 2020, 2021; Jefferson 2000a, b; Jefferson et al. 2002). The territorial waters of Hong Kong Special Administrative Region are divided into twelve different survey areas, and line-transect surveys were conducted among ten survey areas (i.e. Northwest (NWL), Northeast (NEL), West (WL), Southwest (SWL) and Southeast Lantau (SEL), Deep Bay (DB), East Lantau (EL), Lamma (LM), Po Toi (PT) and Ninepins (NP)) (Figure 1).

For each 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. Two experienced observers (a data recorder and a primary observer) made up the on-effort survey team, and the survey vessel transited different transect lines at a constant speed of 13-15 km per hour. The data recorder searched with unaided eyes and filled out the datasheets, while the primary observer searched for dolphins and porpoises continuously using 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 board to work in shifts (i.e. rotating every 30 minutes) in order to minimize fatigue of the survey team members. All observers were experienced in small cetacean survey techniques and identifying local cetacean species and had participated in rigorous at-sea training program provided by the principal investigator.

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 (e.g. *Garmin eTrex*). When dolphins or porpoises were sighted, the survey team would end the survey effort, and immediately record the initial sighting distance and angle of the dolphin/porpoise group from the survey vessel, as well as the sighting time and position. Then the research vessel was diverted from its course to approach the animals for species identification, group size estimation, assessment of group composition, and behavioural observations. The perpendicular distance (PSD) of the dolphin/porpoise group to the transect line was later calculated from the initial sighting distance and angle.

The line-transect data collected during the present study were compatible with the long-term databases maintained by HKCRP in a way that it can be analyzed by established computer programmes (e.g. all recent versions of DISTANCE programme including version 6.0, ArcView© GIS programme) for examination of population status including trends in abundance, distribution and habitat use of CWD and FP in Hong Kong waters.

4.2. Helicopter Survey

Several helicopter surveys arranged by the Government Flying Service (GFS) through AFCD were conducted during the 2021-22 monitoring period to survey mainly the remote areas that were relatively inaccessible by boat (e.g. Sai Kung, Mirs Bay) (Figure 2). The survey coverage of each helicopter survey largely depended on weather conditions such as visibility, sea state, cloud cover and wind direction, and the planned flight route could be changed with some flexibility according to the final decision by the GFS pilot.

The helicopter survey usually lasted 1.5 hours, flying at an altitude of about 150 metres and a speed of 150-200 km/hr. Two to three observers were on board to search for dolphins and porpoises on both sides of the helicopter. Data on sighting position, environmental conditions, group size and behaviour of the dolphins or porpoises were recorded when they were sighted. The off-effort helicopter surveys were mainly used to collect data for distribution of CWD and FP, but individual dolphins with very distinct identifying features were occasionally identified from pictures taken from the helicopter.

4.3. Photo-identification Work

When a group of CWD were sighted during the line-transect vessel 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 each dolphin in the group, and even photograph both sides of the dolphins, since the colouration and markings on both sides differ. One or two professional digital cameras (e.g. *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 surfaced. The images were shot at the highest available resolution and stored on Compact Flash memory cards for downloading onto a computer.

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 details, and were carefully compared to all identified dolphins in the Pearl River Estuary CWD photo-identification catalogue compiled and curated by HKCRP. Chinese White Dolphins can be identified by their natural markings, such as nicks, cuts, scars and deformities on their dorsal fin and body, and their unique spotting patterns were also used as secondary identifying features (Jefferson 2000a; Jefferson and Leatherwood 1997). 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 database. Any individuals not in the current catalogue were given a new identification number and added to the catalogue along with their data and text descriptions including age class, gender, any nickname or unique markings. The updated photo-identification catalogue incorporated all new photographs of individual dolphins taken during the present study.

4.4. Data Analyses

4.4.1. Distribution pattern analysis

The line-transect survey data were integrated with a Geographic Information System (GIS) to visualize and interpret different spatial and temporal patterns of dolphin and porpoise distribution using their sighting positions collected from vessel and helicopter surveys. Location data of dolphin and porpoise groups were plotted on map layers of Hong Kong using a desktop GIS (ArcView© 3.1) to examine their distribution patterns in detail. The dataset was also stratified into different subsets to examine distribution patterns of dolphin groups with different categories of group sizes, fishing boat associations, young calves and behavioural activities. Data from the long-term sighting databases were used to compare past distribution patterns of dolphins and porpoises in recent years to data from the present study period.

4.4.2. Encounter rate analysis

Since the line-transect survey effort was uneven among different survey areas and across different years, the encounter rates of CWD and FP (number of on-effort sightings per 100 km of survey effort) were calculated separately for each survey area to correct for the uneven survey effort. As such, encounter rates could be useful indicators of the relative importance of different regions within the study area to the dolphins and porpoises.

4.4.3. Line-transect analysis

Density and abundance of CWD were estimated by line-transect analysis using systematic line-transect vessel survey data collected during the present study. 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 2000a) and using standard line-transect methods (Buckland et al. 2001). The estimates were made using the computer program DISTANCE Version 6.0, Release 2 (Thomas et al. 2009). The following formulae were used to estimate density, abundance, and their associated coefficient of variation:

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

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

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

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.

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. 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.

Besides estimating dolphin abundance for the four main areas of dolphin occurrences (i.e. NEL, NWL, WL and SWL) in 2021, annual abundance estimates were also generated for every year since 2001 in NWL and NEL survey areas and since 2003 in WL survey areas, to investigate any significant temporal trend using linear regression model. To perform such trend analysis, the linear regression model is considered in the four areas 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, and u_t is an error term which follows normal distribution with mean zero and variance σ^2.

4.4.4. Quantitative grid analysis on habitat use

To conduct quantitative grid analysis of habitat use (Hung 2008), positions of on-effort sightings of CWD and FP were retrieved from their long-term sighting databases, and then plotted onto 1-km^2 grids among the nine survey areas on GIS. Sighting densities (number of on-effort sightings per km^2) and dolphin/porpoise densities (total number of dolphins/porpoises from on-effort sightings per km^2) were then calculated for each 1 km by 1 km grid with the aid of GIS. Sighting density grids and dolphin/porpoise density grids were further normalized with the amount of survey effort conducted within each grid. The total amount of survey effort spent in each grid was calculated by examining the survey coverage on each line-transect survey to determine how many times the grid was surveyed during the study period. For example, when the survey boat traversed through a specific grid 50 times, 50 units of survey effort were counted for that grid. With the amount of survey effort calculated for each grid, the sighting density and dolphin/porpoise density of each grid were then normalized (i.e. divided by the unit of survey effort).

The newly-derived unit for sighting density was termed SPSE, representing the number of on-effort **s**ightings **p**er 100 units of **s**urvey **e**ffort. In addition, the derived unit for actual dolphin/porpoise density was termed DPSE, representing the number of **d**olphins/porpoises **p**er 100 units of **s**urvey **e**ffort. Among the 1-km^2 grids that were partially covered by land, the percentage of sea area was calculated using GIS tools, and their SPSE and DPSE values were adjusted accordingly. The following formulae were used to estimate SPSE and DPSE in each 1-km^2 grid within the study area:

$$SPSE = ((S / E) \times 100) / SA\%$$

$$DPSE = ((D / E) \times 100) / SA\%$$

where S = total number of on-effort sightings, D = total number of dolphins/ porpoises from on-effort sightings, E = total number of units of survey effort, SA% = percentage of sea area

Both SPSE and DPSE values are useful for examining relative dolphin/porpoise usage within a one square kilometre area. For the present monitoring study, both SPSE and DPSE values were calculated in each 1-km^2 grid among all survey areas for the entire one-year period in 2021 for both CWD and FP, and in the past five years of monitoring (i.e. 2017-21) for FP.

4.4.5. Behavioural analysis

When dolphins were sighted during vessel surveys, their behaviours were observed. Different behaviours were categorized (i.e. feeding, milling/resting, traveling, socializing) and recorded. These data were then input into a separate database with sighting information, which was used to determine the distribution of behavioural data using a desktop GIS. Distribution of sightings of dolphins engaged in different activities and behaviours would then be plotted on GIS and carefully examined to identify important areas for different activities, and compared with past distribution patterns of such activities. The behavioural data was also used in the quantitative analysis on habitat use to identify important dolphin habitats for feeding and socializing activities and examine trends in habitat use over the past two decades.

4.4.6. Ranging pattern analysis

For the examination of individual ranging patterns, location data of identified dolphins with 10 or more re-sightings and sighted during the present study period were obtained from the dolphin sighting database and photo-identification catalogue. To deduce home range for individual dolphins using the fixed kernel methods, the program

Animal Movement Analyst Extension, created by the Alaska Biological Science Centre, USGS (Hooge and Eichenlaub 1997), was loaded as an extension of ArcView© 3.1 along with another extension Spatial Analyst 2.0. Using the fixed kernel method, the program calculated kernel density estimates based on all sighting positions, and provided an active interface to display kernel density plots. The kernel estimator then calculated and displayed the overall ranging area at 95% UD (utilization distribution) level. The core areas of individuals at two different levels (50% and 25% UD) were also examined to investigate their range use in greater detail.

4.4.7. Residency pattern analysis

To examine the monthly and annual occurrence patterns of individual dolphins, their residency patterns in Hong Kong were carefully evaluated. “Residents” were defined as individuals that were regularly sighted in Hong Kong for at least eight years in the past 12 years (i.e. 2010-2021), or five years in a row within the same period. Other individuals that were intermittently sighted during the past years were defined as “Visitors”. In addition, monthly matrix of occurrence was also examined to differentiate individuals that occurred year-round (i.e. individuals that occur in every month of the year) or seasonally (i.e. individuals that occur only in certain months of the year). Using both yearly and monthly matrices of occurrence, “year-round residents” were the individual dolphins that were regularly sighted in Hong Kong throughout the year, while “seasonal visitors” were the ones that were sighted sporadically in Hong Kong and only during certain months of the year within the study period.

5. RESULTS AND DISCUSSIONS

5.1. Summary of Data Collection

5.1.1. Survey effort

During the 2021-22 monitoring period, a total of 165 line-transect vessel surveys were conducted among ten survey areas in Hong Kong waters from April 2021 to March 2022. These included 12 surveys in DB, 16 surveys in NEL, 20 surveys in NWL, 28 surveys in WL, 28 surveys in SWL, 23 surveys in SEL, 10 surveys in EL, 15 surveys in LM, eight surveys in PT and five surveys in NP. The details of these survey effort data collected are presented in Appendix I.

More effort was allocated to survey areas outside of North Lantau waters during the 2021-22 monitoring period, as additional surveys have already been conducted in

NWL and NEL survey areas concurrently under the Tuen Mun-Chek Lap Kok Link (TMCLKL) regular line-transect monitoring surveys as part of the EM&A works for the Hong Kong-Zhuhai-Macau Bridge (HZMB) construction. These additional HZMB-related marine mammal monitoring surveys employed the same HKCRP personnel, survey methodology and research vessels to ensure consistency and full compatibility with the AFCD long-term marine mammal monitoring programme. In order to increase the overall sample size for the present monitoring study, such EM&A data were combined with the AFCD monitoring data for various data analyses presented throughout this report, which can provide valuable supplementary information on dolphin and porpoise occurrences.

Furthermore, two helicopter surveys were conducted with the Government Flying Services through the arrangement of AFCD on May 14th and September 28th of 2021, which covered the eastern and southern waters of Hong Kong. Such off-effort data on local dolphins and porpoises collected from the helicopter survey were also included in the distribution analysis and group size analysis.

From April 2021 to March 2022, 607.5 hours were spent collecting 6,566.1 km of survey effort during the AFCD vessel line-transect surveys among the ten survey areas. Nearly two-third of the total survey effort was conducted among six areas where dolphins occurred regularly, which included 19.3% in NEL/NWL, 13.6% in WL, 28.5% in SWL/SEL and 2.9% in DB. On the other hand, 64.1% of total survey effort was allocated to survey areas in southern and eastern waters of Hong Kong (i.e. SWL, SEL, EL, LM, PT and NP) where porpoises regularly occurred. It should be mentioned that 98.8% of all survey effort was conducted under favourable sea conditions (Beaufort 3 or below, with good visibility). Such high percentage of survey effort conducted in favourable conditions is crucial to the success of the marine mammal data collection programme in Hong Kong, as only such data can be used in various analyses to examine the encounter rates and habitat use of both dolphins and porpoises, as well as to estimate the density and abundance of dolphins.

During the same 12-month monitoring period in 2021-22, a total of 3,325.2 km of survey effort was also conducted in NEL and NWL survey areas under the HZMB-related EM&A dolphin monitoring surveys. This brings the total survey effort to 4,592.8 km for the combined dataset from AFCD and HZMB-related surveys in North Lantau waters. Over 95% of the survey effort of HZMB-related EM&A surveys was also conducted under favourable sea conditions, which can be combined with the AFCD monitoring data for various analyses.

Since 1996, the long-term marine mammal monitoring programme coordinated by HKCRP has collected 265,896.0 km of line-transect survey effort in Hong Kong and Guangdong waters of the Pearl River Estuary under different government-sponsored monitoring projects, consultancy studies and private studies, with 46.9% of the total effort funded by AFCD. The survey effort in 2021 alone comprised 4.65% of the total survey effort collected since 1996.

5.1.2. Marine mammal sightings

Chinese White Dolphins - From the AFCD monitoring surveys alone, 158 groups of 554 dolphins were sighted during the 2021-22 monitoring period (see Appendix II). Combined with the additional sightings (12 groups of 28 dolphins) contributed from the HZMB-related EM&A surveys, a total of 170 groups of 582 dolphins were sighted altogether during the same 12-month period. Among them, 160 groups of 552 dolphins were sighted during on-effort line-transect vessel surveys.

In 2021-22, dolphin sightings were only made in the WL (124 sightings), SWL (31) and NWL (15) survey areas while none was sighted in DB, NEL, SEL or EL survey areas, despite a considerable amount of effort (>2,100 km) surveying these areas. As in previous monitoring periods, no dolphin was sighted in LM, PT or NP survey areas, where porpoises primarily occur on a regular basis.

Notably, for the first time since 2009, systematic line-transect surveys were conducted in EL survey area in the current monitoring period in 2021-22, but no dolphin or porpoise was sighted. In fact, dolphin or porpoise was rarely sighted in this area in the past: with more than 8,000 km of survey effort conducted in EL between 2001 and 2009, only six groups of eight dolphins and one group of two porpoises were sighted at the northern and southern ends of the survey area, respectively (HKCRP unpublished data). Therefore, it is not surprising to see the lack of dolphin or porpoise sighting in this area during the present monitoring period. Nevertheless, it is important to continue such survey effort in this area to fill a huge data gap in the past decade, as a massive reclamation project is being proposed to construct the Artificial Islands in the Central Waters of Hong Kong, and such proposed project site to be investigated would mostly overlap with the EL survey area.

Similar to the survey results from recent years of AFCD monitoring work, no dolphin was sighted in NEL for the entire year of 2021 as well as the first three months of 2022. However, the passive acoustic monitoring (PAM) conducted concurrently by HKCRP with the funding support of AFCD revealed that dolphins have not completely abandoned this area (at least not around the Brothers Islands where the PAM units were deployed) in recent years. For example, there were a total of 41 days in the past four years (including 12 days in the second half of 2017, 19 days in 2018, eight days in 2019, one day in 2020 and two days in the first half of 2021) where at least 10 DPMs (a **D**etection **P**ositive **M**inute is any one minute period where at least one click train was detected) were recorded per day at Siu Ho Wan. In addition, the PAM units deployed at Tai Mo To also recorded at least 10 DPMs per day during ten days in the past four years (including two days in the second half of 2017, six days in 2018, one day each in 2019 and 2020, but none in the first half of 2021). Notably, in the past PAM monitoring periods, a strong diel pattern with significantly more dolphin detections at night than during the day was found among all sites within the Brothers Marine Park (Wang and Hung 2018, 2019, 2020). Even though dolphin detections were still very low and declining around the Brothers Islands in NEL, the continuing night-time usage by dolphins of this once-important habitat should not be overlooked, and the on-going PAM studies would be critical to fill important data gaps in monitoring dolphin occurrences 24 hours a day within this marine park as well as for the NEL survey area.

Finless Porpoises – A total of 73 groups of 158 porpoises were sighted from vessel surveys and helicopter surveys during the 2021-22 monitoring period (see Appendix III). Among these porpoise sightings, 67 of them were made during on-effort search, which can be used in the encounter rate analysis and habitat use analysis. The porpoises were mainly sighted in the SWL and SEL survey areas with 29 and 16 groups, respectively. They also occurred occasionally in LM and PT survey areas with 13 and 11 sightings in these two areas respectively, but seldom occurred in NP survey area with only four sightings. As in previous monitoring periods, the porpoises were absent from the WL, NWL, NEL and DB survey areas, where dolphins primarily occur throughout the past two decades.

For the most part, no porpoise was sighted in survey areas where dolphins regularly occurred in the past, but it should be mentioned that there have been some unexpected findings from the recent PAM studies, which revealed the possible presence of porpoises in WL waters. For example, there were some limited detections of porpoises at Fan Lau and Peaked Hill in 2019, 2020 and the first half of 2021 (Wang and Hung 2019, 2020, 2021). Notably, the porpoises have never been sighted to the north of Fan Lau in more than two decades of visual surveys conducted by HKCRP, until the very recent sighting made in March 2021 (Hung 2021). It is possible that the source of these clicks that were automatically classified as finless porpoises were not produced by them, but instead, the source could be from some CWD, which may periodically produce click trains with characteristics that resemble those of porpoises. Even if these detections were FP, such rare events may have little biological significance (which also applies to the recent visual sighting made near Fan Lau). Nevertheless, data from continued PAM monitoring are needed before conclusions can be made about the occurrence of porpoises in the West and North Lantau regions, which have long been considered areas not utilized by porpoises.

5.1.3. Photo-identification of individual dolphins

During the 2021-22 monitoring period, approximately 16,500 digital photographs of CWD were taken during AFCD monitoring surveys for the photo-identification of individual dolphins. All photographs taken in the field were compared with existing individuals from the photo-identification catalogue compiled and curated by HKCRP since 1995. All new photographs identified as existing or new individuals during the study period, as well as any updated information on gender and age class of individual dolphins, were incorporated into the photo-identification catalogue. A significant amount of photo-identification data was also contributed from the HZMB-related surveys during the same 12-month period.

Up to January 2022, a cumulative total of 1,130 individual dolphins (including 16 that were confirmed to be dead) have been identified by HKCRP researchers in Hong Kong waters and the rest of the Pearl River Estuary. The current catalogue contained 580 individuals being first identified within Hong Kong's territorial waters and another 550 individuals being first identified in Guangdong waters of the Pearl River Estuary. In 2021, seven newly identified individuals from Hong Kong waters were added to the catalogue.

The catalogue summary revealed that 259 individuals have been seen 15 times or more; 162 individuals have been seen 30 times or more; and 108 individuals have been seen 50 times or more. In contrast, 39.6% of the identified individuals have only been seen once or twice, with most of these being first identified in Guangdong waters (327 out of 447 individuals). Temporal trends in the total number of identified individuals, the total number of re-sightings made, and the number of individuals within several categories of number of re-sightings showed good advancement in the photo-identification works during the 2021-22 monitoring period (Figure 3).

Between April 2021 and March 2022, a total of 106 individual dolphins, sighted 370 times altogether, were identified during AFCD regular vessel surveys (Appendix IV). With the addition of the HZMB-related monitoring survey data collected in the

NWL and WL survey areas, there was a combined total of 111 individual dolphins being identified 395 times during the 12-month period. About three quarters (75.2%) of all re-sightings made during the AFCD/HZMB surveys were in the WL survey area. Only 63 and 35 re-sightings were made in SWL and NWL respectively, but no individual dolphins were sighted at all in the NEL, SEL or DB survey areas during the 2021-22 monitoring period.

Among the 111 identified individuals from the AFCD/HZMB combined dataset, most of them were re-sighted only a few times, but some of them were repeatedly re-sighted, indicating their strong reliance of Hong Kong's waters as an important part of their home range. For example, 32 individuals were re-sighted five times or more, while six individuals (WL79, WL91, WL123, WL152, WL168 and WL180) were re-sighted ten times or more in the combined dataset during the relatively short study period. Notably, these frequently-sighted individuals are all considered year-round residents from their pattern of occurrences (see Section 5.7.1).

In 2021-22, only twelve individuals were re-sighted with their calves. The mothers that were re-sighted with young calves (either unspotted calf or unspotted juvenile) will be closely monitored, as their survival is critical for the long-term viability of the dolphin population, especially in light of the dramatic decline in calf occurrence in the past decade (see Section 5.4.2).

Since 2015, a total of 83 frequently-occurring individuals (with 15 or more re-sightings in the past decade) have disappeared from Hong Kong's territorial waters. After reaching the highest level in 2020 with 25 individuals, the total number of missing individuals from Hong Kong's waters fell to a lower level with only 11 individuals missing in 2021. In fact, eight and four individuals that have disappeared from Hong Kong waters in 2020 and 2019 respectively have once again reappeared in 2021. Some notable missing individuals during 2021 included NL136 and NL286, which were re-sighted 52 and 41 times during the five-year period of 2016-20. However, neither individual was observed in 2021 or during the first three months of 2022. It is also notable that among the 83 disappeared individuals, only eight of them have been sighted across the border since their absence in Hong Kong's waters, but 2019 was the last year when monitoring surveys and associated photo-ID works were conducted in Guangdong waters. This highlights the importance of the cross-boundary survey works across the entire Pearl River Estuary, as not only this would provide information on cross-boundary movements of individual dolphins, but could also confirm if individuals that have disappeared from Hong Kong's waters may still be alive across the border.

5.2. Distribution

5.2.1 Distribution of Chinese White Dolphins

During the 2021-22 monitoring period, CWD were frequently sighted along the west coast of Lantau Island and near the Fan Lau Peninsula in SWL waters (Figure 4). In contrast, they seldom occurred in the northern portion of SWL survey area, while only a handful of dolphin sightings were made at the western end of NWL survey area. Moreover, no dolphins were sighted at all in DB, the central and eastern portions of North Lantau waters, as well as in SEL waters (Figure 4).

In 2021 alone, from the combined effort of the AFCD and HZMB-related surveys, dolphin occurrence was the highest along the west coast of Lantau, while they also occurred regularly in the northwest portion of the South Lantau waters (Figure 5). In the North Lantau region, the dolphins mostly occurred in northwestern (mainly around Lung Kwu Chau area) and southwestern (to the west of the airport) ends of the region (Figure 5). With a closer look at the dolphin distribution in North Lantau waters (Figure 6), the majority of sightings could be found at the northwestern portion near Lung Kwu Chau, while some sightings were also made near Black Point, Pillar Point, Sha Chau and to the north of Hong Kong Link Road (HKLR) alignment (or to the west of the airport). However, no dolphin was found at all in the central and eastern portions of the region, including most of the peripheral area of the Three Runway System (3RS, also known as the Airport's Third Runway) project work zone as well as the footprints of the HZMB at the juncture of NWL and NEL survey areas (Figure 6).

In WL waters, dolphins occurred much more frequently and evenly distributed throughout the area in 2021 (Figure 7). Slightly higher concentration of dolphin sightings can be found near Tai O Peninsula, Kai Kung Shan, and the stretch of coastal waters between Peaked Hill and Fan Lau Peninsula. Overall, as in recent years, the dolphins appeared to occur more frequently along the inshore waters of WL, but less frequently further offshore along the western territorial border, especially at the southern portion of WL survey area. It is also notable that dolphins occurred much less frequently at the southern and northern ends of the survey area, with the latter overlapped with the HKLR alignment (Figure 7).

In the South Lantau region, the dolphins occurred regularly near the Fan Lau Peninsula, and to a lesser extent near Shui Hau Peninsula and Siu A Chau. On the contrary, they have mostly disappeared in the southern portion of the SWL survey area, as well as the entire SEL survey area (except a lone dolphin sighted to the west of Chi Ma Wan Peninsula), despite a considerable amount of survey effort made in these areas (Figure 7).

5.2.2. Distribution of finless porpoises

From April 2021 to March 2022, the only concentration of porpoise sightings occurred to the south and east of the Soko Islands (Figure 8). On the contrary, only a handful of porpoise sightings were made to the west of the Soko Islands, near Shui Hau Peninsula, to the south of Cheung Chau and Lamma Island, and to the east of the Po Toi Islands, respectively.

Examination of temporal changes in porpoise distributions in the past four years (2018-21) revealed that the offshore waters between the Soko Islands and Shek Kwu Chau have been consistently and frequently used by porpoises in recent years (Figure 9). Moreover, a few porpoise sightings were made at the western portion of the South Lantau region (or to the west of the Soko Islands) in 2021, where porpoises were mostly absent in this area in previous years. Notably, despite the consistently higher porpoise usage of the waters between Shek Kwu Chau and the Soko Islands in the past four years, they still have avoided the nearshore waters around Shek Kwu Chau, and such avoidance has been extended to the southern waters of Cheung Chau in 2021 (Figure 9). In the eastern survey areas, although the porpoise usage has fluctuated across the four-year period, the porpoises appeared to occur more frequently around the Po Toi Islands in 2019 and 2021 (Figure 9).

5.3. Habitat Use

5.3.1. Habitat use patterns of Chinese White Dolphins

Habitat use patterns of CWD were examined using the quantitative grid analysis, to calculate the SPSE and DPSE values (i.e. sighting densities and dolphin densities, respectively) in all grids among the six survey areas where they occurred regularly in the past. These patterns were also compared to the annual patterns observed in recent years.

In 2021, all grids with high dolphin densities were concentrated along the WL coastline as well as the western end of SWL survey area, mainly extending from Tai O Peninsula toward Fan Lau Peninsula (Figure 10). Such habitat use pattern has also been consistently recorded in recent past years (Hung 2020, 2021). On the contrary, the grids with records of dolphin occurrences within the NWL survey area were mostly in low to moderately low densities (except one grid to the north of Lung Kwu Chau with moderate density), while the rest of the North Lantau region (including Deep Bay) have been avoided by dolphins altogether. Furthermore, the central portion of South Lantau waters (mainly near Shui Hau Peninsula and around the Soko Islands) only recorded low to moderate dolphin densities, while the eastern portion did not record any dolphin occurrence at all for the entire year despite the considerable amount of effort being spent (Figure 10).

Temporal changes in dolphin habitat use patterns

A comparison was made among the habitat use patterns over the past nine years (2013-21) to examine the temporal changes in dolphin densities in the western waters of Hong Kong. In WL, more intense habitat use was recorded with high densities in most grids during the period of 2013-15. Since then, dolphin densities diminished progressively in most parts of the area, even though there appears to be slight rebounds observed in 2018, 2019 and 2021 (Figure 11). Notably, dolphin usage in the northern portion of the WL survey area, which overlapped with the HKLR alignment, have been fairly low since 2016, when compared to the earlier years during the initial phase of HKLR construction. Dolphin usage should be continuously monitored in their priority habitats in WL waters, especially for the examination of the long-term impact of the bridge alignment on the north-south movement of individual dolphins between the North and West Lantau regions.

In SWL waters, after a resurgence of dolphin habitat use in 2014-15, such use has continued to diminish in recent years, especially in 2020 and 2021 (Figure 11). In the past three years, Fan Lau Peninsula has been the only area with consistently high dolphin densities recorded, whereas their usage elsewhere has been low to moderately low, and quite scattered mostly in the northern portion of the survey area.

In the North Lantau region, a dramatic decline in dolphin habitat use pattern has been well documented in recent years, with greatly diminished dolphin occurrences since 2013 (see Hung 2020, 2021). Such trend continued in 2021, with dolphin occurrence declining to very low level in this region, with the exception of a single grid to the north of Lung Kwu Chau (Figure 12). In the past six years, dolphin usage has been largely confined to the western end of the North Lantau region, and in the past three years their habitat utilization was mostly restricted to the SCLKCMP in generally low densities (Figure 12). The continuous absence of dolphins in the central and eastern portions of the region since 2015 is of great concern, as there have been no signs of recovery in dolphin habitat use after the completion of marine works associated with the HZMB construction in 2016, and with the majority of the massive reclamation works associated with the third runway expansion nearly completed in 2020.

Temporal changes in dolphin habitat use patterns among six key habitats

Temporal trends in dolphin usage at six key habitats were examined for the 18-year period of 2004-21, which included the four existing marine parks around Sha Chau and Lung Kwu Chau, the Brothers Islands, the southwestern corner of Lantau, and the Soko Islands, as well as two other "hot spots" at Tai O and Black Point where dolphins regularly occurred in the past (Figure 13). To examine dolphin usage over these six key habitats that encompass a suite of grids, the number of on-effort sightings and amount of survey effort were pooled together from those grids, to calculate dolphin densities (DPSE) as a whole for each year during the 2004-21 period to track any changes over the years.

Within the Sha Chau and Lung Kwu Chau Marine Park (SCLKCMP, with 17 grids), there has been a continuous decline in dolphin usage since 2013, and such usage fell even further to the lowest level in the past three years of 2019-21 (Figure 14). Such an alarming decline raises serious concerns because this area has long been considered important dolphin habitat in Hong Kong (Hung 2008). Even at the historically lowest level of dolphin occurrence in recent years, the waters around Lung Kwu Chau remain the only habitat that is still being consistently utilized by dolphins in the North Lantau region.

Furthermore, after a dramatic decline in dolphin usage since 2011, the Brothers Marine Park (BMP, with 15 grids) recorded zero dolphin density in seven consecutive years in 2015-21. Although dolphin usage was expected to recover after the completion of most marine works associated with HZMB construction and the establishment of the BMP in December 2016, their occurrence around the Brothers Islands remains extremely rare in recent years. Notably, passive acoustic monitoring revealed that a very low level of dolphin detections was recorded within this marine park in the past several years, and most of these rare detections were made during night-time (e.g. Wang and Hung 2020, 2021). With the near-absence of dolphins in this once-important dolphin habitat for quite a long time now, continuous acoustic monitoring of this area would become even more critical for detecting any signs of recovery in dolphin usage even at very low levels.

In fact, the recent PAM monitoring studies have also revealed clear declines in dolphin usage within the two marine parks in North Lantau waters since 2017 (and even just between single monitoring periods). At both PAM sites that have been monitored acoustically for multiple years within each of the SCLKCMP and BMP, there are clear decreases in dolphin detections (Wang and Hung 2021). At Lung Kwu Chau N site, the proportion of logged days with at least one detection (DPD % of logged days) decreased from 99.1% in 2017-18 to 96.3% in 2018-19, 91.5% in 2019-20 and then to only 77.8% in 2020-21. Similar consistent declines were also seen in this metric at BMP sites (Siu Ho Wan site – 25.8% to 17.0% to 5.2% to 3.3%; and Tai Mo To site – 22.5% to 12.1% to 4.0% to 1.8%) while at the Sha Chau SE site within SCLKCMP, there was a slight increase from 2017-18 (36.5%) to 2018-19 (40.6%) before declining further to much lower levels in 2019-20 (28.4%) and 2020-21 (1.4%). The exact same patterns were observed at these sites in the mean detection positive minute per day (DPM/day) metric and clearly indicated decreasing occurrence of dolphins in the two marine parks to becoming very rare events at the two BMP sites and Sha Chau SE site (Wang and Hung 2021).

Continuing declines in dolphin acoustic detections in these two marine parks over just a one-year period is concerning, as this suggests that the continuing construction activities in waters adjacent to the marine parks (e.g. the 3RS project and the Tung Chung New Town Development reclamation project) are having noticeable impacts on dolphin occurrence within the protected waters of SCLKCMP and BMP even over a fairly short period of time. As such, the protection afforded by the marine parks is clearly ineffective at mitigating such threats that originate outside the marine parks (Wang and Hung 2021). Continuous monitoring of these two marine parks with visual surveys and passive acoustic methods concurrently would be essential in the coming years to provide further understanding of the anthropogenic impacts on the dolphins' usage of and the effectiveness of the protection provided by these two marine parks.

Besides a noticeable increase in dolphin usage in 2014 and 2015 within the Southwest Lantau Marine Park (SWLMP, with 15 grids), such usage has remained fairly steady and high in the past decade (Figure 14). It should be noted that this marine park has consistently recorded the highest levels of dolphin usage among all key dolphin habitats in western Hong Kong in the past 18 years, and this last remaining stronghold of the top priority dolphin habitats should be closely monitored to examine any sign of temporal changes in their future usage (Figure 14).

After a dramatic decline in dolphin densities was detected in the South Lantau Marine Park (SLMP, with 30 grids) in 2018, dolphin usage there rebounded to a slightly higher level in 2019 and 2020, before falling back to a lower level once again in 2021 (Figure 14). The previous rebound was thought to be linked to the drop in high-speed ferry volume in the South Lantau Vessel Fairway in 2019 followed by a complete halt since February 2020 due to the Covid-19 pandemic (Hung 2021), but it was puzzling to observe the very low level of dolphin occurrence within this marine park in 2021 even though the complete halt of high-speed ferry traffic continued throughout the year. Such trend in dolphin usage within this marine park should be continuously monitored in the next few years especially after the resumption of the ferry traffic.

Once identified as a critical dolphin habitat in the western waters of Hong Kong, the waters around Tai O Peninsula (with four grids) also recorded a steady decline in dolphin densities from the highest in 2009 to the lowest in 2017, 2018 and 2020 (even though slight rebounds were recorded in 2019 and 2021) (Figure 14). On the other hand, the dolphin usage at Black Point (with four grids) fluctuated greatly in earlier years with no apparent trend. After a near-complete absence from this area between 2014 and 2018, dolphin usage has climbed back to a slightly higher level in 2019 before falling to a very low level in 2020 then a complete absence once again in 2021 (Figure 14). As this area is situated at the border of a proposed large-scale reclamation site at Lung Kwu Tan and only a few kilometres away from the Sha Chau and Lung Kwu Chau Marine Park, special attention on dolphin habitat use in this area in the near future is needed.

5.3.2. Habitat use patterns of finless porpoises

The spatial pattern of porpoise habitat use in 2021 revealed that the more heavily utilized habitats by the porpoises were limited to the east and west of the Soko Islands, while the rest of the grids in South Lantau and Lamma waters with porpoise occurrences only recorded low to moderately low densities (Figure 15). In particular, the waters near Shek Kwu Chau were rarely utilized in 2021, and such diminished occurrences of porpoises have occurred since the construction activities (including 29 hectares of reclamation) for the Integrated Waste Management Facilities (IWMF) commenced at the southwest side of the island a few years ago. On the other hand, although a number of grids in the eastern part of LM survey area as well as the PT and NP survey areas recorded very high porpoise densities in 2021 (Figure 15), those results should be treated with cautions, which could be heavily biased by the relatively low amount of survey effort conducted among those areas during the 12-month study period.

In order to increase the overall sample size, the survey effort and porpoise data collected from 2017-21 (for SWL, SEL and LM survey areas) and 2012-21 (for PT, LM and Sai Kung (SK) survey areas) were pooled and analyzed for a longer period in order to obtain sufficient survey data to provide a better representation of porpoise habitat use pattern in the southern and eastern waters of Hong Kong in recent years. Since the porpoises in Hong Kong exhibit pronounced seasonal patterns of distribution, with rare occurrence in each survey area during certain periods of the year (Hung 2005, 2008; Jefferson et al. 2002), the five-year dataset for SWL, SEL and LM survey areas was further stratified into winter/spring (December through May) and summer/autumn (June through November) periods to deduce habitat use patterns of porpoises for the respective dry and wet seasons. For the eastern survey areas, since almost all survey effort has been conducted during the wet season (i.e. summer and autumn months), the ten-year dataset was only accounted for the survey effort and porpoise sightings recorded during the wet season.

For the examination of porpoise habitat use patterns in South Lantau and Lamma waters during the dry season (i.e. winter and spring months) in 2017-21, the grids with high porpoise densities mainly clustered in waters between Shek Kwu Chau and the Soko Islands, as well as to the east of Tai A Chau and at the southeast corner of Cheung Chau (Figure 16). However, it should be noted that there has been a dramatic decline in porpoise densities near Shek Kwu Chau since the construction of the IWMF commenced in 2018 (see below on temporal changes in porpoise habitat use patterns). Furthermore, during the dry season of 2017-21, porpoises seldom utilized the western portion of the South Lantau region, the offshore waters to the south of Cheung Chau, and the northern portion of the LM survey area (Figure 16).

On the contrary, the porpoise usage during the wet season in South Lantau and Lamma waters was drastically different from the dry season. For example, almost all grids recorded porpoise usage in South Lantau waters during the wet season were located at the offshore waters (with the exception of a few grids near Shui Hau Peninsula) with low to moderately low densities, while only a handful of grids to the southwest of Lamma Island recorded very low porpoise usage (Figure 17). Notably, a few grids at the northern and eastern portions of LM survey area recorded relatively high porpoise densities during the wet season, but these results could be biased as the survey effort accumulated over the five-year period in these areas was relatively low with less than six units of survey effort in each grid.

In the eastern survey areas, the porpoise habitat use pattern during the wet season in the past decade (2012-21) has been less pronounced, and even though many grids in the PT survey area (mainly the western and central portions) and NP survey area (mostly in the offshore waters and at the southern end) recorded porpoise occurrences, with almost all of them in low to moderately low densities (Figure 18). Notably, a few grids at the offshore waters in PT, NP and SK survey areas recorded moderately high porpoise densities, but even with the ten-year datasheet the survey effort among these grids in the offshore waters (especially in SK and northern portion of NP survey areas) were still relatively low. Therefore, the porpoise habitat use patterns in these poorly surveyed areas could be considered preliminary, and a lot more survey effort would be needed to depict a more accurate picture of their habitat use in the eastern waters of Hong Kong.

<u>Temporal changes in porpoise habitat use patterns</u>

To examine the recent temporal changes in porpoise densities at various important habitats in southern waters of Hong Kong, comparisons were made on annual patterns of porpoise habitat use across the past seven years in 2015-21. During the three-year period of 2015-17, porpoise usage at the offshore waters between Shek Kwu Chau and the Soko Islands as well as to the south of Cheung Chau was at a consistently high level. However, such usage evidently changed in the past four years of 2018-21, with noticeable decline at the abovementioned important porpoise habitats, especially around Shek Kwu Chau and to the south of Cheung Chau (Figure 19). Such dramatic decline could be linked to the reclamation and other construction activities in relation to the construction of IWMF. Furthermore, porpoise usage of the waters to the west of Lamma Island has fluctuated across the years, with more extensive and intense usage in 2016 and 2017 but more sporadic occurrences in 2019 and 2020 before falling to the lowest level in 2021 (Figure 19).

Three key porpoise habitats in South Lantau (including the SLMP, Shek Kwu Chau and Pui O Wan; see Figure 13) were examined for temporal trends in their usage across the 16-year period between 2004 and 2021. Similar to the CWD, to examine temporal trends in porpoise usage of these key habitats that encompass a suite of grids, the number of on-effort porpoise sightings and unit of survey effort were pooled together from those grids, to calculate porpoise densities (DPSE) as a whole for each year from 2004 to 2021.

Porpoise usage fluctuated greatly at the SLMP (with 30 grids) in the past 18 years, starting at very low levels between 2004-09 (albeit a strong surge occurred in 2007) (Figure 20). Since 2010, there was a steady increase in porpoise usage of this area to the highest level in 2014. However, in the past six years, porpoise usage within this marine park has become more unstable, with notable drops in 2016, 2019 and 2021 (Figure 20). Notably, PAM data from the past three monitoring periods revealed that after a significant decline in porpoise detections at SLMP sites from 2018-19 to 2019-20, there was a significant rebound in 2020-21 (Wang and Hung 2021). Further monitoring would be needed to confirm whether the recovery in porpoise occurrence within SLMP revealed in the PAM data is valid or not.

The inshore waters of Pui O Wan (with nine grids) were consistently used by porpoises in the earlier years and such usage maintained at a higher level until 2010, when the porpoises began to use these waters infrequently between 2010 and 2013 (Figure 20). Since then, porpoise usage rebounded to a higher level in the subsequent years, with the exception of noticeable drops in 2018, 2020 and 2021, which coincided with the dramatic decline in porpoise usage at the nearby Shek Kwu Chau in recent years.

Since 2007, the surrounding waters of Shek Kwu Chau (with eight grids) were consistently utilized by the porpoises as an important habitat, and there had been a steady increase in porpoise usage starting from 2013 to reach a much higher level in 2016 (Figure 20). However, there has been a sharp decline in porpoise usage since 2018 to reach the lowest level (near complete absence) in 2021. The dramatic decline in porpoise usage of this habitat in the past four consecutive years has been closely linked to the construction activities near Shek Kwu Chau in association with the reclamation works for IWMF, as the preparation works began in March 2018, while the reclamation works commenced in June 2018. Such a sharp decline at this once-critical porpoise habitat raises grave concerns on the impacts of the IWMF project and whether the waters around Shek Kwu Chau could still serve important functions for porpoises that regularly occur in southern waters of Hong Kong. Temporal trends in their habitat use near Shek Kwu Chau as well as for the entire southern waters of Hong Kong should be closely monitored as the IWMF construction works will be completed soon.

5.3.3. Comparison of marine mammal habitat index in 2016-20 vs. 2006-10

<u>Rationale and Methodology</u>

A habitat rating system and associated habitat index for marine mammals in Hong Kong was first established by Hung (2008) for Chinese White Dolphins and later by Hung (2015) for finless porpoises to locate their priority habitats, with the objective to delineate the boundary of marine mammal protected areas and evaluate their effectiveness to conserve important and critical dolphin and porpoise habitats. The marine mammal habitat index has been instrumental in the establishments of the BMP in 2016, the SWLMP in 2019, and the SLMP that is still under planning.

In this report, the habitat indices of both CWD and FP are assessed and compared across two five-year periods in 2006-10 and 2016-20, in light of the potential degradation of marine mammal habitats associated with coastal development. In particular, a significant decline in dolphin abundance was detected in the past decade (Hung 2020, 2021; also see Section 5.6 in this report), which was linked to the HZMB construction in North and West Lantau waters as well as the 3RS project construction in North Lantau. As the construction activities of the HZMB commenced in 2012, the five-year period in 2006-2010 represents the baseline period before construction. Construction activities of the HZMB reached the peak in 2014-15, and then the 3RS project construction commenced in 2016 and is still ongoing. The habitat index for CWD for the five-year period in 2016-20 therefore reflects the combined effects of the HZMB (post-construction) and the 3RS (during construction). Such comparison will provide insights on how the priority habitats of dolphins and porpoises have been affected by the on-going habitat deterioration as a result of existing and new threats, and also the effectiveness of marine parks to withstand pressure from these anthropogenic threats.

To establish the dolphin and porpoise habitat index, quantitative data on various aspects of their habitat use are used, including the SPSE and DPSE values, to deduce habitat ratings among 352 grids around Lantau waters (i.e. among the six survey areas in DB, NEL, NWL, WL, SWL and SEL). For CWD, the criteria were selected with reference to recommendations made by Hoyt (2005) as well as Evans and Pascual (2001), that the critical habitat should encompass areas with high overall dolphin densities (i.e. high SPSE and DPSE values for overall densities), important areas for feeding and socializing activities (i.e. high SPSE values for feeding and socializing activities), as well as important areas for raising young calves (i.e. high DPSE values of unspotted calves and unspotted juveniles). Moreover, critical dolphin habitats should include areas that have been used year-round and consistently over time, with the areas recorded dolphin occurrence with large numbers of months and years during the study period. In the original dolphin habitat index designed by Hung (2008), there were criteria to consider from the individual dolphin perspective, that the critical habitat should also include areas with intensive use by a majority of resident dolphins as core areas within their individual ranges. However, such criteria were dropped from the current sets of dolphin habitat index, due to the complexity in dealing with different sets of individual dolphins across the two different time periods (2006-10 vs. 2016-20), as many individuals have been newly identified or disappeared during the latter period, which makes direct comparison of individual core area use impossible between the two periods.

For FP, similar approach to utilize quantitative data on various aspects of their habitat use has been adopted but with a different set of scoring criteria (Hung 2015). This is due to the fact that porpoises are very shy and elusive, and their calves and engaged activities are very difficult to be observed at sea and identified consistently. Another important consideration to establish the porpoise habitat index is their distinct seasonal occurrence in Hong Kong, with the porpoises primarily occurring in South Lantau waters during winter and spring months (i.e. the dry season), and largely absent from these waters during summer and autumn months (i.e. the wet season) (see Hung 2005, 2008). Therefore, the criteria used to evaluate their habitat use should be separated into the respective dry and wet seasons, and this has been commonly done in assessing porpoise habitat use in the past and present. After careful consideration of different options, the eight scoring criteria for porpoise habitat index to identify their priority habitats include areas with high overall porpoise densities (i.e. high SPSE and DPSE values in dry and wet seasons respectively), areas with porpoise occurrence with the large number of years during the study period in dry and wet season respectively, and areas with high average group sizes in dry and wet seasons respectively (with the assumption that their larger group sizes would imply their engagement in important foraging and socializing activities, as observed in CWD).

Among the 16 criteria considered for the dolphin and porpoise habitat ratings (see these scoring criteria and associated ranks in Table 1), each of them was assessed among the 352 grids around Lantau Island, with five different ranks or scores (1 being least important and 5 being very important) given for each criterion to develop the marine mammal index for the assessment of relative importance of each grid area to dolphins and porpoises. For example, the scores of 5 were given to grids with the highest overall SPSE and DPSE values of dolphins and porpoises, the highest SPSE values for feeding and socializing activities (CWD), highest DPSE values of UCs and UJs (CWD), the largest number of months and years with dolphin and porpoise occurrence, and the highest average group size (FP). After summing up the scores from the 16 criteria, the habitat ratings were assessed based on the total over score, with the maximum possible total score of 40. Marine mammal habitats were rated as “Marginal” for grids with total scores of 8 or below. Conversely, the grids with total scores of 33-40 and 25-32 were rated as “Critical” and “Important” marine mammal habitats respectively. Finally, for the evaluation of the effectiveness of the existing marine parks (i.e. BMP, SCLKCMP, SWLMP and SLMP), the average scores among the suite of grids in each marine park were compared before and after the HZMB construction (i.e. 2006-10 vs. 2016-20).

Dolphin Habitat Ratings and Habitat Index (2006-10 vs. 2016-20)

In 2006-10, a total of 1,646 on-effort sightings with 6,247 dolphins were made among the 352 grids with 28,963 units of survey effort around Lantau waters. The number of on-effort sightings per grid ranged from 0-60 (mean = 4.7 ± 9.31), and the total number of dolphins sighted per grid ranged from 0-253 (mean = 17.7 ± 37.63). After normalizing the sighting densities and dolphin densities by the amount of survey effort in each grid, the mean SPSE value per grid was 4.0 ± 6.13 (range = 0.0-36.7), and the mean DPSE value per grid was 14.8 ± 26.20 (range = 0.0-173.3).

In comparison, a total of 1,524 on-effort sightings with 5,104 dolphins were made among the 352 grids with 51,499 units of survey effort around Lantau waters in 2016-20. During this latter period, the number of on-effort sightings per grid ranged from 0-89 (mean = 4.3 ± 10.58), while the total number of dolphins sighted per grid ranged from 0-367 (mean = 14.5 ± 38.81). After normalizing the sighting densities and dolphin densities by the amount of survey effort, the mean SPSE value per grid in 2016-20 was 2.4 ± 5.10 (range = 0.0-36.9), and the mean DPSE value per grid was 7.9 ± 18.59 (range = 0.0-142.2).

When examining the spatial patterns of sighting and dolphin densities per grid, several areas around Lantau waters were identified with very high SPSE and DPSE values for both five-year periods. In 2006-2010, these high density grids were concentrated within SCLKCMP as well as the inshore waters along the WL and SWL coastlines from Tai O Peninsula toward Fan Lau Peninsula (Figures 21a and 21b). In contrast, the high density grids were only concentrated in WL waters in 2016-20, while their densities in North Lantau waters were very low (except one grid at the northeast corner of Lung Kwu Chau with medium density) with a near absence in central and eastern portions which overlapped with the HZMB construction sites (i.e. HKBCF, TMCLKL and HKLR03 bridge alignment) (Figures 21a and 21b).

For feeding activities, there were 293 and 143 sightings with dolphins engaged in such activities during on-effort surveys in 2006-10 and 2016-20 respectively. The SPSE values of these sightings ranged from 0.0 to 8.6 per grid with a mean of 0.7 ± 1.38 per grid in 2006-10, while such value ranged from 0.0 to 4.7 per grid with a mean of 0.2 ± 0.58 per grid in 2016-20. The grids with high sighting densities associated with feeding activities were located near Lung Kwu Chau, Tai O Peninsula and Kai Kung Shan in 2006-10, while only a few grids near Kai Kung Shan recorded moderate density of this activity with all other grids recorded very low densities in 2016-20 (Figure 22a). Furthermore, for socializing activities, there were 127 and 65 sightings with dolphins engaged in such activities during on-effort surveys in 2006-10 and 2016-20 respectively. In 2006-10, the SPSE values of these sightings ranged from 0.0 to 4.5 with a mean of 0.3 ± 0.70 per grid, and the grids with moderate to high SPSE values with socializing activities were located around Lung Kwu Chau, Black Point and near Tai O Peninsula (Figure 22b). In comparison, such value in 2016-20 ranged from 0.0 to 2.3 with a mean of 0.1 ± 0.29 per grid, and most grids recorded sightings with socializing activities were at the western end of North Lantau, the entire WL waters as well as the northern part of SWL waters but in very low densities (Figure 22b).

A total of 51 unspotted calves (UCs) and 340 unspotted juveniles (UJs) were sighted around Lantau waters during on-effort vessel surveys in 2006-10, but there were only 10 UCs and 92 UJs sighted during the 2016-20 period. In 2006-10, the mean DPSE values were 0.14 ± 0.50 for UCs (with a range of 0.0-5.3) and 0.88 ± 1.90 for UJs (with a range of 0.0-11.7), whereas in 2016-20, such values were 0.01 ± 0.11 for UCs (with a range of 0.0-1.5) and 0.13 ± 0.44 for UJs (with a range of 0.0-3.5). Grids with moderate to high densities of UCs were mainly located around Lung Kwu Chau and along the west coast of Lantau in 2006-2010, while only a handful of grids with low densities of newborn calves were found exclusively in WL waters in 2016-2020 (Figure 23a). For the UJs, moderate to high densities of these older calves could be found throughout the North Lantau region (except the central portion) as well as WL waters in 2006-10, with a few also located near Fan Lau Peninsula and Kau Ling Chung (Figure 23b). In contrast, these older calves mostly occurred near the western territorial border in very low densities in 2016-20, with the exception of a few grids along the stretch of waters between Kai Kung Shan and Fan Lau with slightly higher densities (Figure 23b).

The number of years recorded dolphin usage among the 352 grids around Lantau waters in 2006-10 and 2016-20 both ranged from zero to 5 years, with a mean of 1.6 ±1.80 and 1.3 ± 1.72 for the two periods respectively. A total of 43 grids recorded consistent dolphin usage (i.e. five consecutive years with dolphin sightings) in 2006-10, and these were located throughout WL waters, among the majority of grids within the SCLKCMP in NWL, several grids around the Brothers Islands and Shum Shui Kok in NEL, and a few grids near Kau Ling Chung and Fan Lau in SWL (Figure 24a). On the other hand, there were 32 grids with consistent dolphin usage in 2016-20, which were located in most grids in WL waters, a few grids to the east and northeast of Lung Kwu Chau in NWL, as well as several grids near Fan Lau Peninsula and Shui Hau

Peninsula in SWL (Figure 24a).

The average numbers of months recorded dolphin usage in each of the 352 grids were 2.5 ± 3.43 in 2006-10 and 2.0 ± 3.21 in 2016-20, respectively. A total of 11 grids recorded dolphin usage in every month of the year during the five-year period of 2006-10, and these were located to the north and east of Lung Kwu Chau, near Tai O Peninsula, Kai Kung Shan, Peaked Hill and Fan Lau (Figure 24b). On the other hand, there were 10 grids with dolphin usage in every month of the year in 2016-20, which were distributed along the inshore waters in WL as well as the northeast corner of Lung Kwu Chau (Figure 24b).

After summing the scores from each of the eight scoring criteria, the dolphin habitat ratings were given to all 352 grids around Lantau waters for both five-year periods. In 2006-10, 150 grids did not receive any score at all, and another 106 grids were considered "Marginal" dolphin habitats with total scores of 8 or below. Moreover, 26 grids were considered "Above Average" dolphin habitats (with scores of 17-24), while another 17 grids were considered either "Important" or "Critical" dolphin habitats (scores of 25-32 and 33-40, respectively). The majority of grids rated as "Above Average", "Important" and "Critical" habitats in 2006-20 (which are all considered priority dolphin habitats) were clustered along the west coast of Lantau as well as near and to the north of Lung Kwu Chau, with the four grids rated as critical dolphin habitats located to the east and north of Lung Kwu Chau as well as at Tai O Peninsula and Kai Kung Shan (Figure 25).

In comparison, there were 188 grids that did not receive any score at all in 2016-20, along with another 104 grids considered "Marginal" dolphin habitats. Furthermore, 15 and four grids were considered "Above Average" and "Important" dolphin habitats respectively, but no grid was identified as "Critical" dolphin habitat in 2016-20. With the exception of a grid to the northeast of Lung Kwu Chau, the other 18 grids as priority dolphin habitats were all located along the west coast of Lantau (including the entire Fan Lau Peninsula).

There were several notable differences in the overall dolphin habitat indices between the two five-year periods. Among the 17 grids that were considered either "Important" or "Critical" dolphin habitats in 2006-10, the habitat quality of 15 grids have been downgraded or deteriorated in 2016-20 (Figure 25). For example, one grid to the north of Lung Kwu Chau (08H) was considered "Critical" habitat in 2006-10 with a score of 34, but was subsequently considered "Average" habitat in 2016-20 with a score of 8. Another grid to the northeast of Sha Chau (12I) was considered "Important" habitat in 2006-10 with a score of 26 has become a "Marginal" habitat in 2016-20 with a score of 4. Overall, it appeared that the area around Lung Kwu Chau was once an important dolphin habitat in the earlier years before the construction activities, but has become an average dolphin habitat afterwards (Figure 25). Even more strikingly, most grids in NEL received a "Average" habitat rating in 2006-10 with one grid considered "Above Average" habitat, but in 2016-20, with the exception of one grid being considered "Average" (note: this was only based on a single dolphin group of five animals sighted in February 2018), dolphin has completely abandoned this survey area during 2016-20.

<u>Porpoise Habitat Ratings and Habitat Index (2006-10 vs. 2016-20)</u>

Among the six survey areas in western waters of Hong Kong, the porpoises only occurred in SWL and SEL waters during the two five-year periods, and therefore habitat ratings were only deduced among the 135 grids in South Lantau waters based on eight scoring criteria (see Table 1) to establish the porpoise habitat index. All survey effort and porpoise sighting data have been stratified into wet and dry seasons to take into the account of their distinct seasonal occurrences as explained above.

For the period of 2006-10, a total of 205 sightings with 490 porpoises were made during the dry season (from 4,447 units of survey effort), while only 22 sightings with 52 porpoises were made during the wet season (from 2,949 units of survey effort) during the same five-year period. The mean number of on-effort sightings per grid and total number of porpoises sighted per grid were 1.5 ± 1.96 and 3.6 ± 5.19 respectively during the dry season, while these means were 0.2 ± 0.43 and 0.4 ± 1.12 respectively during the wet season. After normalizing the densities by the amount of survey effort, the mean SPSE and DPSE values per grid in South Lantau waters were 5.0 ± 7.09 and 12.0 ± 18.36 during the dry season, and such mean values were 0.7 ± 1.87 and 1.7 ± 5.02 during the wet season.

In comparison, a total of 424 sightings with 1,171 porpoises were made during the dry season (from 8,328 units of survey effort) in 2016-20, while 112 sightings with 313 porpoises were made during the wet season (from 8,333 units of survey effort) during the same five-year period. The mean number of on-effort sightings per grid and total number of porpoises sighted per grid were 3.1 ± 3.65 and 8.7 ± 11.37 respectively during the dry season, and these means were 0.8 ± 1.41 and 2.3 ± 5.01 respectively during the wet season. After normalizing the porpoise densities by the amount of survey effort, the mean SPSE and DPSE values per grid in South Lantau waters were

5.5 ± 6.66 and 15.3 ± 20.51 during the dry season, while such mean values were 1.4 ± 2.46 and 4.0 ± 8.56 during the wet season.

Between the two five-year periods, the grids with higher porpoise densities (SPSE and DPSE values) during the dry season were more widespread at the offshore waters extending from Tai A Chau to Shek Kwu Chau in 2016-2020, while such grids were only located near the southern territorial boundaries and near Shek Kwu Chau in SEL survey area during 2006-10 (Figures 26a and 27a). Notably, the grid at the southwest corner of Shek Kwu Chau recorded similarly high porpoise densities in both 2006-10 and 2016-20. During the wet season, there were a greater number of grids with porpoise occurrences in 2016-20; however, such occurrence was more restricted near Shek Kwu Chau, Cheung Chau and to the south of Tai A Chau in 2006-10 (Figures 26b and 27b).

For the interannual occurrences, the mean numbers of years recorded porpoise usage in 2006-10 were 1.1 ± 1.19 and 0.1 ± 0.38 during the dry and wet seasons, respectively. In comparison, such means in 2016-20 were 1.7 ± 1.55 and 0.5 ± 0.85 during the dry and wet seasons respectively. There was only one grid that consistently recorded high annual porpoise usage (i.e. five consecutive years with porpoise sightings) during the dry season of 2006-10 at the south of Tai A Chau, but there were five grids with consistently high annual porpoise usage during the dry season of 2016-10 which were located between Shek Kwu Chau and the Soko Islands as well as near Pui O Peninsula (Figure 28a). On the contrary, most grids recorded porpoise presence during the wet season of 2006-10 only had their sightings in one of the five years. Similarly, the majority of grids with porpoise presence during the wet season of 2016-20 only had their sightings in one or two years during the five-year period, but a handful of grids at the southern territorial boundary recorded consistent porpoise usage across different years (Figure 28b).

During the dry season of 2006-10, the average group size of porpoise per grid ranged from 1.0 to 12.0, with a mean of 2.5 ± 1.92 per grid, and the grids with high average group sizes were sporadically distributed near Kau Ling Chung, at the periphery of the Soko Islands region, near Shek Kwu Chau and to the southwest of Cheung Chau (Figure 29a). During the wet season of 2006-10, such average group size per grid ranged from 1.0 to 6.0, with a mean of 2.4 ± 1.42 per grid, and only two grids to the south of Shek Kwu Chau and at the offshore waters of SEL recorded high average porpoise group sizes (Figure 29b). On the other hand, the average group size of porpoises per grids during the dry and wet seasons of 2016-20 both ranged from 1.0

to 9.0 respectively, and they also had very similar mean of 2.7 ± 1.46 per grid (dry season) and 2.7 ± 1.86 per grid (wet season). During the dry season of 2016-20, the grids with high average group sizes were located within Pui O Peninsula, between Shek Kwu Chau and Siu A Chau, and to the west of Tai A Chau, while such grids were located to the south and east of Tai A Chau as well as to the south of Shek Kwu Chau during the wet season (Figure 29b).

After summing up the scores from each of the eight scoring criteria, porpoise habitat ratings were given to all 135 grids in South Lantau waters for the two periods (Figure 30). In 2006-10, 55 grids did not receive any score, and another 53 grids received total scores of 10 or below. Twenty-seven grids are considered priority habitats for the porpoises with scores of 11 or above, with ten of them received scores of 16 or more. In comparison, there were 39 grids with no score at all in 2016-20, while another 48 received total scores of 10 or below. The recent five-year period had 48 grids considered priority habitats with scores of 11 or above, and these included 31 grids with scores of 16 or above.

During the earlier years in 2006-10, the ten grids considered “Important” porpoise habitats (with scores of 16 or above) can only be found in several distinct clusters of grids near Shek Kwu Chau, to the south of Tai A Chau, and the offshore waters between the two islands (Figure 30). In contrast, there were 31 grids considered “Important” porpoise habitats in 2016-20, which were widely distributed at the large stretch of waters between Shek Kwu Chau and Tai A Chau, as well as to the southeast of Shek Kwu Chau. Another notable observation is that the northwest portion as well as at the southeast and northeast corners of South Lantau waters were consistently used by porpoises at a very low level in both five-year periods (Figure 30).

<u>Combined Marine Mammal Habitat Index (2006-10 vs. 2016-20)</u>

Since both CWD and FP occurred regularly in the South Lantau region, a combined marine mammal habitat index was established from the combined dolphin and porpoise habitat ratings from the considerations of 16 scoring criteria altogether (eight of each from dolphin and porpoise habitat ratings; Table 1). After summing up the scores from each of the 16 scoring criteria, there were 99 grids in 2006-10 that did not receive any score (as compared to 150 grids for dolphin habitat index with no score), while 128 grids in 2016-20 did not receive any score (as compared to 188 grids for dolphin habitat index with no score). Furthermore, with the combination of dolphin and porpoise habitat ratings, the overall habitat ratings with both marine mammals have increased noticeably among 28 grids and 36 grids in South Lantau waters during

2006-10 and 2016-20, respectively (Figure 31). Overall, the number of grids that can be considered marine mammal priority habitats (including the "Above Average", "Important" and "Critical" habitats) have also increased to 59 grids in 2006-10 (as compared to 43 grids under the dolphin habitat index) and 56 grids in 2016-20 (as compared to 19 grids under the dolphin habitat index) (Figure 31). Apparently, in order to fully evaluate the habitat quality at an area where distribution of both marine mammal species overlaps (i.e. South Lantau waters in this case), a combined marine mammal habitat index would be a more useful approach by taking both occurrences of dolphins and porpoises into account.

<u>Evaluation of Effectiveness of Marine Parks to Conserve Marine Mammal Habitats</u>

The average habitat ratings for CWD, FP and with the two species combined at each of the four existing marine parks were compared between the two five-year periods, to evaluate the effectiveness of marine parks over time and to assess the anthropogenic impacts of coastal development on these marine protected areas. Among the 15 grids within BMP with only CWD occurrences in the past two decades, the average dolphin habitat rating was 10.1 (classified as "Average" habitat") in 2006-10, but such rating has dramatically dropped to zero in 2016-20 with no dolphin occurrence at all. Notably, this marine park was established in 2016 as a compensation for the habitat loss as a result of the HKBCF reclamation in association with HZMB construction. However, dolphin usage has dramatically reduced to a near-absence level with no sign of recovery at all, while the habitat quality for the dolphins has quickly and significantly deteriorated in recent years.

The SCLKCMP is another marine protected area in the North Lantau region that was established in 1996, with only dolphin occurrence recorded in the past 25 years. Among the 17 grids within this marine park, the average dolphin habitat rating was 18.8 in 2006-10 (classified as "Above Average" habitat), while such rating has decreased noticeably to only 7.0 in 2016-20 (classified as "Marginal" habitat). Such alarming decline in habitat quality within this marine park between the two periods was consistent with the significant decline in dolphin abundance recorded in NWL (see Section 5.6).

The SWLMP is a recently established marine protected area in 2020, which is mostly utilized by CWD but also with a very low level of porpoise occurrence at the eastern end of this marine park (i.e. near Kau Ling Chung). Among the 15 grids within this marine park, there were only slight differences in average habitat ratings between 2006-10 and 2016-20 for CWD (19.5 and 19.2 respectively), FP (0.8 and 0.6

respectively) and combined total of the two species (20.3 and 19.8). It appeared that the habitat quality of this marine park (which also recorded the highest usage of dolphins among the four existing marine protected areas in western waters of Hong Kong) has remained relatively unchanged before and after the HZMB construction, and continues to be the main area with good habitat quality for CWD in Hong Kong.

On the contrary, the SLMP with regular occurrences of both FPs and CWDs is the only marine protected area with increased habitat ratings between the two five-year periods. Among the 30 grids within this marine park, the average marine mammal habitat ratings has increased from 8.9 in 2006-10 (classified as "Average Habitat") to 16.7 in 2016-20 (classified as "Above Average Habitat"), with the porpoise habitat ratings going up from 6.4 to 13.3 while the dolphin habitat ratings going up from 2.5 to 3.4 between the two five-year periods. Evidently, the importance of this marine park as a marine mammal habitat (especially as a porpoise habitat) has increased in the past decade, which is a positive sign and also demonstrates the urgency to establish this marine park as soon as possible to safeguard the remaining marine mammal habitats in western waters of Hong Kong. This is especially important in light of the dramatic decline in porpoise usage around Shek Kwu Chau as observed in the past several years (see Section 5.3.2).

5.4. Group Size, Calf Occurrence and Activities

5.4.1. Group sizes of dolphins and porpoises

During the 2021-22 monitoring period, the group sizes of CWD varied from singletons to 18 animals, with an overall mean of 3.4 ± 3.00 (n = 170). Among the three areas where dolphins occurred in 2021-22, the mean group sizes were the lowest in SWL (2.4) and the highest in WL (3.8) (Table 2a). Mean group sizes were similar across the four seasons as it was only slightly higher in autumn (3.6) and slightly lower in summer (3.2). Similar to past monitoring periods, the majority of dolphin groups sighted in 2021-22 were small, with 51.2% of the groups composed of 1-2 animals, and 72.9% of the groups with fewer than five animals. Only ten out of the 170 dolphin groups consisted of more than ten animals (Figure 32).

The examination of long-term trend in annual mean dolphin group sizes since 2002 revealed that the mean group sizes in recent years have stabilized with remarkably similar levels (i.e. 3.23-3.28) in six consecutive years of 2016-21 (Figure 33). However, it should be noted that among different survey areas, the mean group size in NWL was at the lowest level in the past four consecutive years of 2018-21, while mean group size in SWL has dropped steadily in the past three years of 2019-21. Temporal changes in mean dolphin group sizes should be continuously monitored, as this could be indicative of changes in their foraging strategies in response to increased disturbance from various sources or changes in prey distribution and overall prey resources in the western waters of Hong Kong.

Distribution of dolphins in different group size categories in 2021 is shown in Figure 34. Larger dolphin groups occurred predominantly along the WL coastline and at the tip of Fan Lau Peninsula, with the very large groups (10+ dolphins per group) mostly occurred between Kai Kung Shan and Peaked Hill (Figure 34). Elsewhere, only a few larger groups occurred in the North Lantau region that were scattered to the north of Lung Kwu Chau, near the northwestern territorial border and Pillar Point, and also at the western portion of SWL survey area. In contrast, distribution of the smaller dolphin groups closely resembled the overall distribution around Lantau waters, even though most groups that occurred at the periphery of the overall distribution (e.g. along the southern coast of Lantau and around the Soko Islands) were very small (Figure 34).

On the other hand, porpoise group sizes during the 2021-22 monitoring period varied from singletons to eight animals, with an overall mean of 2.2 ± 1.36 (n=73). The majority of these groups were very small, with 67.1% being composed of 1-2 animals, and all except five groups (or 93.2% of all groups) had fewer than five animals (Figure 35). The mean porpoise group size in the SEL (2.7) was above the overall mean, but the ones among the other four areas were similar to each other (all within the range of 2.0-2.1) and slightly below the overall mean (Table 2b).

Temporal trend in annual mean porpoise group sizes were examined between 2007 and 2021 (Figure 36). Over the 15-year period, mean porpoise group sizes were on a steady rise from the lowest in 2009 to the second highest recorded in 2016 (albeit a large spike observed in 2012). Since then, except another spike recorded in 2019, such figures have fallen to a lower level in recent years, reaching the lowest ever in 2021. It would be beneficial to continue monitoring the trend in porpoise group sizes, to determine whether there are any changes in the porpoises' foraging strategies in response to anthropogenic impacts such as increased vessel traffic disturbance or changes in prey distribution and resources.

Distribution of porpoises in different group sizes in 2021 showed that the larger porpoise groups mainly occurred at the southern end of South Lantau waters (Figure 37). In contrast, porpoise groups sighted in the eastern survey areas of PT, NP as well as in LM waters were generally small. The important porpoise habitat identified in the offshore waters between Shek Kwu Chau and the Soko Islands in recent years were also dominated by smaller groups of porpoises (Figure 37).

5.4.2. Occurrence of dolphin calves

Of the 646 dolphins sighted altogether in 2021, 72.4% of them were categorized into six age classes according to Jefferson (2000a). The spotted adults (26.9%) and spotted juveniles (17.3%) comprised the largest proportion of dolphins being identified with their age classes, and this is similar to the past several years. One unspotted calf (UC, or newborn calf) and 17 unspotted juveniles (UJ, or older calves) were sighted in 2021, with these combined comprising only 2.8% of the total.

After a steady decline in the past six years in young calf occurrence in Hong Kong's waters, with the annual percentage falling from 5.8% in 2013 to the lowest in 2018 with only 1.5%, there appears to be a small rebound in 2019-21 with 2.2-2.8% (Table 3; Figure 38). However, calf occurrence in these past three years still remains at a very low level when compared to earlier years. The declining occurrence of dolphin calves in recent years is of great concern, with such low levels of recruitment casting a very worrisome future for the local dolphin population. Notably, a recent examination on life history parameters deduced from the long-term photo-identification data also confirmed once again a low survival rate of newborns (Hung 2021). As mother-calf pairs are more susceptible to anthropogenic disturbances, the exceptionally low percentages of young calves in recent years certainly raises concerns about the suitability of Hong Kong's waters for reproduction and the rearing of calves, with the presence of the ever increasing adverse impacts from various coastal development projects and high level of vessel activities within their habitats around Lantau Island.

Distribution of young calves in 2021 is also examined (Figure 39). With the exception of the two UJs sighted near Pillar Point and to the north of Tai O Peninsula respectively, sightings of all other young claves were concentrated between Kai Kung Shan and Tai O Peninsula in WL waters, with the lone UC located to the west of Fan Lau. In contrast, no young calves were found in the South Lantau region and almost the entire North Lantau Region in 2021.

5.4.3. Activities of dolphins

In 2021, 26 (or 13.1%) and six (or 3.0%) groups of all dolphin sightings were observed to be engaged in feeding and socializing activities, respectively. Only one other group was observed to be engaged in traveling activity, while none was observed to be engaged in milling/resting activity. Annual percentages of socializing activities remained at similarly low levels over the past six years, but the percentage of feeding activities has rebounded noticeably in 2021 after remaining at very low levels in the past five consecutive years between 2016 and 2020 (Figure 40).

Distribution of dolphins engaged in different activities in 2021 is shown in Figure 41. Besides the two groups to the southwest of Lung Kwu Chau, and another two groups scattered near Shui Hau Peninsula and Chi Ma Wan Peninsula respectively, the majority of dolphin groups associated with feeding activities were found along the stretch of WL coastlines, ranging from the waters to the west of airport platform to the Fan Lau Peninsula. On the other hand, dolphin sightings associated with socializing activities were scattered near the western territorial boundary, with half of these sightings made near Peaked Hill. The lone group associated with traveling activity was located near the HKLR09 alignment overlapped with the western territorial boundary.

5.4.4. Dolphin associations with fishing boats

Of the 170 groups of dolphins sighted during the 2021-22 monitoring period, 16 (or 9.4% of all groups) were associated with operating fishing boats. Nine of these groups were associated with purse-seiners, while the other seven groups were associated with gill-netters.

After remaining at low levels in the past three years of 2018-20, the overall annual percentage of dolphin sightings associated with fishing boats in 2021 (7.1%) was at a much higher level in 2021, also reaching the highest in the past decade. During 2021, the four dolphin groups associated with operating gill-netters were all sighted adjacent to the HKLR09 alignment, while the majority of the nine groups associated with operating purse-seiners were found at Fan Lau Peninsula (Figure 42).

5.5. Encounter Rate

5.5.1. Encounter rates of Chinese White Dolphins

To calculate the encounter rates of CWD, only survey data collected in Beaufort 0-3 conditions was included in the analysis as in past monitoring periods. From April 2021 to March 2022, the combined encounter rates of dolphins from the four survey areas of NEL, NWL, WL and SWL was 2.4, which was the lowest ever among all monitoring periods since 2002-03 (with the previous lowest of 3.0 recorded in 2018-19; Figure 43a & Table 4). After a steady decline of dolphin encounter rates in the past eight monitoring periods in 2011-19 and followed by a slight rebound in 2019-20, the rate dropped slightly to a lower level in 2020-21 but then fell even further in 2021-22 to the lowest level in the past two decades. Among different survey areas, the encounter rates in NWL during the past three monitoring periods were at the historic lows, while the 2021-22 encounter rate in the WL survey area rebound slightly after falling to the lowest level in 2020-21 (Figure 43b). Steady decline of dolphin encounter rates in SWL was also detected in the past three monitoring periods.

As consistently recorded in all past monitoring periods, WL continued to have the highest encounter rate (13.1) among the three survey areas with dolphin occurrences, and was considerably higher than the rates in SWL (2.5) and NWL (0.5) (Table 4). The encounter rate in NEL was once again zero, as no on-effort dolphin sighting was made during 1,807 km of survey effort. Similar to the previous eight monitoring periods, dolphin encounter rate in 2021-22 was once again higher in SWL than in NWL, which is the opposite of observations made in earlier years (Table 4).

<u>Temporal trend in annual encounter rate</u>

Temporal trends in annual dolphin encounter rates since 2002 were examined for the overall combined areas (i.e. NEL, NWL, WL and SWL), as well as the North Lantau and West/Southwest Lantau regions. The overall encounter rate of the combined areas in 2021 has rebounded from the previous low levels in 2018-20, and returned to similar levels as in 2016 and 17 (Figure 44a). Nevertheless, there was still a clear declining trend over the past two decades but continuous monitoring would allow the examination for any sign in recovery of dolphin occurrences of Hong Kong waters. Notably, the dolphin encounter rate in the entire North Lantau region (NEL and NWL survey areas combined) in 2021 remained at the lowest level as was also observed in 2019 and 2020, while the rate for the West/Southwest Lantau region has fluctuated in recent years with drops in 2018 and 2020 followed by slight rebounds in 2019 and 2021 respectively (Figure 44b).

5.5.2. Encounter rates of finless porpoises

Porpoise encounter rates were calculated using data collected in Beaufort 0-2 conditions, since their encounter rate was once again much lower in Beaufort 3 or more conditions (0.4 porpoises per 100 km of survey effort) than in Beaufort 0-2 conditions (2.5) in 2021-22 and this difference remains consistent with that documented in past monitoring periods.

From April 2021 to March 2022, the combined porpoise encounter rate of SWL, SEL, LM and PT survey areas was 2.5 sightings per 100 km of survey effort (Table 5). This rate was the second lowest among the past 15 monitoring periods, with the lowest being recorded in the previous monitoring period in 2020-21 (Figure 45). Among the six survey areas with porpoise occurrences, the encounter rates were the highest in SWL (3.6) and PT (3.3). In contrast, the encounter rates for SEL (2.1), LM (1.6) and NP (1.2) were all lower than the overall rate.

Annual porpoise encounter rate from the combined areas of SWL, SEL, LM and PT indicates that the overall porpoise usage of Hong Kong's waters have steadily increased from the lowest in 2005 to the highest in 2014, then followed by a steady decline from 2014 to a much lower level in recent years (Figure 46a). In fact, such encounter rate in 2021 (2.4) was the lowest in the past 15 years and the second lowest ever recorded (previous lowest was recorded in 2005 with 2.1). To account for the potential frequent movements across the SEL, SWL and LM survey areas in winter and spring months (i.e. their peak season of occurrences), data from these three areas were pooled to calculate the annual porpoise encounter rates in the southern waters of Hong Kong collectively during the dry season, for another examination of temporal trends over the past decade. Since reaching the highest level in 2013 in the past decade, such encounter rate has been on a decline, reaching the lowest ever in 2021 (Figure 46b)

Among the four survey areas with regular porpoise occurrences, great variability in their annual encounter rates was evident, with no apparent long-term trend in any of these four areas (Figure 47). However, the SEL survey area apparently experienced a dramatic drop in 2021, and such encounter rate (2.5) was only a small fraction of the previous high in 2013 (15.1). Despite a noticeable spike in the annual encounter rate in SWL in 2020, such rate has fallen back to a much lower level in 2021, which was similar to the ones recorded in 2018 and 2019 (Figure 47). Moreover, the annual encounter rate remained very low in LM for five consecutive years in 2017-21, and the one in PT has increased noticeably in 2021, which was the second highest in the past decade (Figure 47).

5.6. Density and Abundance

5.6.1. Estimates of dolphin density and abundance in 2021

Densities and abundance of CWD were estimated for the NEL, NWL, WL and SWL survey areas using the line-transect analysis method, following similar approach as in previous years of dolphin monitoring in Hong Kong (see Hung 2020, 2021). The annual estimates deduced from the 2021 monitoring data can be used to assess the long-term temporal trend in dolphin occurrence in Hong Kong. Only effort and sighting data collected from the four areas during Beaufort 0-3 conditions were used in the analysis and this included 6,990.1 km of survey effort and 185 dolphin groups from the four areas for density and abundance estimation in 2021 (Table 6a).

Among the four survey areas, WL recorded the highest dolphin density, with 88.60 individuals/100 km^2, which was almost five times and 17.5 times higher than the densities in SWL and NWL, respectively (Table 6a). Notably, the WL figures have fluctuated in recent years with no consistent trend, as they have rebounded in 2019 and 2021 after dropping to lower levels in 2017-18 and 2020 respectively. Dolphin density in SWL fell in two consecutive years of 2020 and 2021, after a noticeable increase from 2018 to 2019. In contrast, the density estimate for NWL (5.06 individuals/100 km^2) has slightly rebounded from the previous lowest level in 2020, but still remained at a very low level when compared to previous years. Furthermore, as in the previous six years, dolphin density and abundance could not be estimated for NEL in 2021 because no dolphin was sighted in this area for the entire year.

In 2021, the abundance estimates of CWD were 24, 12 and 4 dolphins in the WL, SWL and NWL survey areas, respectively, while no dolphins were observed in the NEL survey area. As a result, the combined estimate for the four areas was 40 dolphins (Table 6b). The coefficient of variations (CVs) remained moderate for the 2021 estimates in WL (24%), SWL (33%) and NWL (26%) and therefore the abundance estimates for the year should be fairly reliable (Table 6a). After a steady decline in combined abundance estimates from 188 dolphins in 2003 to the lowest of 32 dolphins in 2018, a sharp rebound was observed in 2019 (52 dolphins), but followed by noticeable drops in the most recent estimates in 2020 and 2021 (Figure 48; Table 6b).

5.6.2. Temporal trends in dolphin abundance

Temporal trends of annual dolphin abundance in NWL/NEL (2001-21), SWL (2002-21) as well as WL (2003-21) were further examined, where consistent amount of survey effort (at least 500 km of annual survey effort) has been conducted in these four areas of major dolphin occurrence. In SWL, temporal trend of annual estimates was only examined for the past decade (2010-21) but not for a longer period, as consistent survey effort (at least 500 km of survey effort per year) was not collected annually prior to 2010. Alternatively, biennial estimates were deduced in SWL for 2002-03, 2004-05, 2006-07 and 2008-09 to examine the overall temporal trend in dolphin abundance over a longer period.

Firstly, the temporal trend in SWL showed fluctuations across the years, with a marked decline from the highest in 2002-03 (30 dolphins) to the lowest in 2006-07 (six dolphins) (Figure 49). Since then, the annual abundance estimates have remained at a lower level in subsequent periods, before a noticeable rebound in 2014 and 2015. Thereafter, abundance estimates dropped again and to much lower levels in the three subsequent years of 2016-18, before another rebound occurred in 2019, then followed by a steady decline in 2020 and 2021 (Figure 49; Table 6b). Notably, the associated CVs of the annual abundance estimates in SWL always remained moderate and within the range of 20-40% (except for the biennial estimates in 2002-03 (45%) as well as the annual estimates in 2010 (67%) and 2012 (54%)), so the estimates should be reliable for most years.

In WL, dolphin abundance steadily decreased from 54 dolphins in 2007 to only 17 dolphins in 2012 (Figure 50; Table 6b). After a rebound in 2013 and 2014 (with 23 and 36 dolphins, respectively), there was another steady decline in the following years of 2015-17. Thereafter, the annual abundance has fluctuated in the past four years with no consistent trend (Figure 50). In contrast, dolphin abundance in the North Lantau region showed a dramatic and consistent decline in the past two decades. In NEL, the decline was appalling, dropping from the highest in 2001 (20 dolphins) to one dolphin in 2014 and then to zero for seven consecutive years (2015-21) (Figure 50). Dolphin abundance in NWL also dropped steadily and steeply from the highest in 2003 (84 dolphins) to the lowest level in the past three years (with only 3-4 dolphins), which is more than 95% decline since 2003, or more than 90% drop since 2012 (Figure 50).

Using linear regression models, the test statistics for hypotheses $H_0{:}b=0$ vs. $H_1{:}b<0$ in the respective four areas were found to be as follow:

- NEL (2001-21): the test statistic for the hypotheses was -9.0776 ($p \ll 0.0000$). Therefore, the hypothesis H_0 was rejected at the 5% level of significance, so the decline in dolphin abundance in NEL was statistically significant.

- NWL (2001-21): the test statistic for the hypotheses was -16.6498 ($p \ll 0.0000$). Therefore, the hypothesis H_0 was rejected at the 5% level of significance, so the decline in dolphin abundance in NWL was statistically significant.

- WL (2003-21): the test statistic for the hypotheses was -6.2632 ($p \ll 0.0000$). Therefore, the hypothesis H_0 was rejected at the 5% level of significance, so the decline in dolphin abundance in WL was statistically significant.

- SWL (2010-21): the test statistic for the hypotheses was -0.1743 ($p = 0.4326$). Therefore, the hypothesis H_0 was not rejected at the 5% level of significance, so there was no statistically significant decline.

- Combined estimates from NEL, NWL, WL and SWL (2010-21): the test statistic for the hypotheses was -6.5311 (p = 0.0004). Therefore, the hypothesis H_0 was rejected at the 5% level of significance, so the decline in the combined dolphin abundance was statistically significant.

In summary, clearly significant declines in annual dolphin abundance were detected in each of the three survey areas in NEL, NWL and WL in the past two decades. When the abundance estimates of SWL were considered together with the other three areas collectively, there was also a significant downward trend in overall annual dolphin abundance over the past decade.

5.7. Range Use, Residency and Movement Patterns of Individual Dolphins

5.7.1. Individual range use, residency pattern and core area use

Individual Range Use

In order to examine the range use of individual dolphins, the 95% UD kernel ranges of 101 individuals that occurred in Hong Kong's survey areas in 2021 (as identified through photo-identification works) were deduced using the fixed kernel method, and their ranging patterns are shown in Appendix V. In addition, 94 of these individual dolphins that occurred in 2021 and also had a history of being sighted ≥15 times were further examined for their range use and residency patterns (Table 7).

Among these 94 individuals, all of them had occurred in WL in the past, while the majority of them had also occurred in NWL (67.0%) and SWL (81.9%), and to a lesser extent in NEL (17.0%) and DB (12.8%) (Table 7). In contrast, only four and one individuals had been re-sighted in the SEL or EL survey areas, respectively, as part of their historical range. Furthermore, 79 of these 94 individuals (or 84.0%) occupied ranges that spanned the waters of Hong Kong and the Mainland (Table 7), indicating cross-boundary movements by many individual dolphins that occur regularly in Hong Kong's waters. However, many of these individuals occurred just to the west of the territorial boundary without venturing much further into Lingding Bay (see Appendix V).

Residency Pattern

The residency patterns of 89 individuals were further assessed by examining their annual and monthly occurrences in Hong Kong, as five other individuals (i.e. NL331, SL48, WL288, WL304 and WL305) were only recently identified and re-sighted in the past several years, and therefore their annual occurrence could not be reliably assessed. Overall, 60 and 27 individuals were identified as year-round and seasonal residents respectively, while two individuals (CH105 and WL249) were identified as seasonal visitors (Table 7). Therefore, 97.8% of the assessed individuals were considered residents in Hong Kong, as they have been sighted consistently in the past 12 years (i.e. 2010-21), or in at least the past five consecutive years. However, the proportion of visitors (2.2%) that utilized Hong Kong's waters could be seriously underestimated, as these visitors would have infrequently utilized Hong Kong waters, and it will be harder for them to reach the minimum threshold on the number of re-sightings required for this analysis. Furthermore, based on the monthly occurrences of these 89 individuals, 32.6% of them only occurred in Hong Kong during certain months of the year, while the rest occurred here year-round (Table 7).

In addition to their residency patterns, attempts were made to classify the 94 individuals into the two social clusters that occurred regularly in Hong Kong (see Dungan et al. 2012), based on their overall range use at 95% UD level as well as core area use at 50% UD and 25% UD levels. Results indicated that 12 individuals (12.8%) and 71 individuals (75.5%) belonged to the northern and southern social clusters, respectively (Table 7). In addition, there were also 11 individuals that spanned their range use more or less evenly across North and West Lantau waters with frequent occurrences in both waters, and some of them (e.g. NL123, NL224, NL259) actually shifted their range use from North Lantau waters to WL and SWL waters in recent years (see Appendix V).

Core Area Use

The analysis on individual core area use revealed that four major core areas of dolphin activities are located around Lung Kwu Chau, the Brothers Islands, in SWL waters, and along the coast of West Lantau, with the latter further subdivided into Tai O, Peaked Hill and Fan Lau. Among the 94 individuals, 22 and 20 individuals occupied Lung Kwu Chau as their 50% and 25% UD core areas, respectively, while only five and four individuals occupied the Brothers Islands as their 50% and 25% UD core areas, respectively (Table 7). Notably, half of these individuals that utilized Lung Kwu Chau and the Brothers Islands as their core areas belonged to the northern social cluster.

In contrast, 78 individuals utilized the waters along the west coast of Lantau as their 50% UD and 25% UD core areas, respectively, with the majority of them belonging to the southern social cluster (Table 7). As there has been a surge of individuals expanding or shifting their range use into SWL waters in recent years, there were also eight and two individuals that have utilized South Lantau waters as their 50% and 25% UD core areas, respectively (Table 7).

5.7.2. Individual movement pattern

By combining all photo-identification data collected through the present monitoring study and other studies, movement patterns of individual dolphins within Hong Kong territorial waters in 2021-22 were broadly examined. From April 2021 to March 2022, 111 individuals were re-sighted a total of 395 times, with 74 individuals being re-sighted more than once (i.e. occurred at more than one location).

The examination of individual movement patterns between re-sightings revealed that only 39 individuals moved across different survey areas around Lantau in 2021-22. That included 12 individuals that occurred across NWL and WL survey areas, and 31 individuals that were re-sighted in both SWL and WL survey areas (Table 8). Moreover, four individuals (NL123, NL272, WL243 and WL294) occurred in all three areas of NWL, WL and SWL, covering extensive ranges during the 12-month study period. As in recent monitoring periods, no sighting was made in NEL during the 2021-22 monitoring period so there was no movement of individuals into this once-important habitat.

With an extensive amount of photo-identification data being collected from different surveys during 2021-22, there were still a significant portion of individual dolphins sighted repeatedly within just a single survey area and did not range into neighbouring areas. These included 31 individuals that occurred exclusively in the WL survey area, and four individuals that were only re-sighted in the NWL waters. Their restricted movements within Hong Kong's waters could be a concern, as this could be related to potential obstructions to movements across different survey areas as a result of human activities (e.g. high-speed ferry traffic) or infrastructure projects (e.g. reclamation).

The temporal trend in individual movement patterns across different survey areas was examined among the past 12 monitoring periods, in order to provide insights into temporal changes in their intensity of movements as a result of various anthropogenic factors. Besides the dramatic decline in dolphin movements between NEL and NWL survey areas due to the absence of dolphin occurrence in NEL in recent years, there were other notable changes. For example, there was a continuous decline in dolphin movements across the NWL and WL survey areas during the past four monitoring periods, and the level in 2021-22 was the lowest among all monitoring periods in the past decade (Figure 51; Table 8). Furthermore, there was a continuous decline in dolphin movements across SWL and WL in recent years, with a dramatic drop also observed during the 2021-22 monitoring period (Figure 51; Table 8). Such decline in individual movement patterns across different survey areas is of grave concern, and should be continuously examined in the near future.

6. SCHOOL SEMINARS AND PUBLIC AWARENESS

Due to the Covid-19 pandemic, HKCRP researchers were only able to deliver 11 education seminars at local primary and secondary schools (with some held online) on behalf of AFCD to increase public awareness on the conservation of local cetaceans during the 2021-22 monitoring period. PowerPoint presentations were prepared for the school talks with up-to-date information on both dolphins and porpoises gained from the present long-term monitoring programme. The talk materials included content such as the threats faced by local cetaceans, and conservation measures that AFCD has implemented to protect them in Hong Kong. Through this integrated approach of the long-term monitoring programme and publicity/education programme, the Hong Kong public can gain first-hand information from our HKCRP researchers, and their support will be vital to the long-term success in conservation of local cetaceans.

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Table 1. Scoring criteria for each 1 km^2 grid in assessment of habitat ratings for Chinese White Dolphins and finless porpoises with associated total scores

	Criteria\Score	1	2	3	4	5
For Chinese White Dolphins	1. SPSE (overall)	0.1-5.0	5.1-10.0	10.1-15.0	15.1-20.0	>20.0
	2. DPSE (overall)	0.1-20.0	20.1-40.0	40.1-60.0	61.0-80.0	>80.0
	3. SPSE for Feeding Activity	0.1-1.0	1.1-3.0	3.1-5.0	5.1-10.0	>10.0
	4. SPSE for Sociallizing Activity	0.1-1.0	1.1-2.0	2.1-3.0	3.1-4.0	>4.0
	5. DPSE for UCs		0.1-1.0	1.1-2.0	2.1-3.0	3.1-4.0
	6. DPSE for UJs	0.1-2.0	2.1-4.0	4.1-6.0	6.1-8.0	>8.0
	7. Interannual Occurrence	1	2	3	4	5
	8. Monthly Occurrence	1-3	4-6	7-8	9-10	11-12
For Finless Porpoises	1. SPSE (dry season)	0.1-5.0	5.1-10.0	10.1-15.0	15.1-20.0	>20.0
	2. SPSE (wet season)	0.1-5.0	5.1-10.0	10.1-15.0	15.1-20.0	>20.0
	3. DPSE (dry season)	0.1-20.0	20.1-40.0	40.1-60.0	61.0-80.0	>80.0
	4. DPSE (wet season)	0.1-20.0	20.1-40.0	40.1-60.0	61.0-80.0	>80.0
	5. Interannual (dry season)	1	2	3	4	5
	6. Interannual (wet season)	1	2	3	4	5
	7. Ave. Grp Size (dry season)	0.1-1.0	1.1-2.0	2.1-3.0	3.1-4.0	>4.0
	8. Ave. Grp Size (wet season)	0.1-1.0	1.1-2.0	2.1-3.0	3.1-4.0	>4.0

Total Score	CWD Habitat Rating
1-8	Marginal
9-16	Average
17-24	Above Average
25-32	Important
33-40	Critical

Total Score	FP Habitat Rating
1-5	Marginal
6-10	Average
11-15	Above Average
16-25	Important
26-40	Critical

	Scoring criteria for each 1 km^2 grid
For Chinese White Dolphins	1. SPSE (overall): No. of on-effort dolphin sightings per 100 units of survey effort
	2. DPSE (overall): No. of dolphins from on-effort sightings per 100 units of survey effort
	3. SPSE for Feeding Activity: No. of on-effort sightings associated with feeding activities per 100 units of survey effort
	4. SPSE for Socializing Activity: No. of on-effort sightings associated with socializing activities per 100 units of survey effort
	5. DPSE for UCs: No. of unspotted calves from on-effort sightings per 100 units of survey effort
	6. DPSE for UJs: No. of unspotted juveniles from on-effort sightings per 100 units of survey effort
	7. Interannual Occurrence: No. of years (maximum: 10) with on-effort dolphin sightings made within that grid
	8. Monthly Occurrence: No. of months (maximum: 12) with on-effort sightings made within that grid
For Finless Porpoises	1. SPSE: No. of on-effort porpoise sightings per 100 units of survey effort during dry season
	2. SPSE: No. of on-effort porpoise sightings per 100 units of survey effort during wet season
	3. DPSE: No. of porpoises from on-effort sightings per 100 units of survey effort during dry season
	4. DPSE: No. of porpoises from on-effort sightings per 100 units of survey effort during wet season
	5. Interannual: No. of years (maximum: 10) with on-effort porpoise sightings made within that grid during dry season
	6. Interannual: No. of years (maximum: 10) with on-effort porpoise sightings made within that grid during wet season
	7. Ave. Grp Size: Average group size of poproises during dry season
	8. Ave. Grp Size: Average group size of poproises during wet season

Table 2a. Mean group size of Chinese White Dolphins among different survey areas in recent monitoring periods
(* denote the mean group size calculated from a sample size of one group)

Monitoring Period	Overall	Deep Bay	NE Lantau	NW Lantau	W Lantau	SW Lantau	SE Lantau
2013-14	3.4	4.0	3.2	3.5	3.4	3.2	N/A
2014-15	4.1	5.1	2.7	3.5	4.4	4.0	1.0
2015-16	3.8	2.0	1.0*	4.1	3.8	3.7	2.5
2016-17	3.3	N/A	1.0*	3.8	3.5	2.4	1.4
2017-18	3.0	3.7	5.0*	3.3	3.0	2.8	1.5
2018-19	3.1	2.3	N/A	2.4	3.6	2.7	1.0
2019-20	3.2	2.0	N/A	2.7	3.2	3.6	1.0
2020-21	3.1	N/A	N/A	2.4	3.3	3.1	1.0*
2021-22	3.4	N/A	N/A	2.6	3.8	2.4	N/A

Table 2b. Mean group size of finless porpoises among different survey areas in recent monitoring periods
(* denote the mean group size calculated from a sample size of one group)

Monitoring Period	Overall	SW Lantau	SE Lantau	Lamma	Po Toi	Ninepins
2013-14	2.3	2.8	1.9	2.6	N/A	1.3
2014-15	2.7	3.5	2.6	3.1	1.9	2.6
2015-16	3.1	3.1	2.9	4.4	2.5	1.7
2016-17	2.7	2.4	2.7	3.3	3.3	2.2
2017-18	2.5	2.8	2.5	1.9	2.7	1.5
2018-19	2.7	2.1	3.1	2.3	2.0	3.0*
2019-20	2.6	2.7	2.2	2.4	3.4	3.5
2020-21	2.7	2.8	3.2	2.1	1.8	3.5
2021-22	2.2	2.0	2.7	2.0	2.1	2.0

Table 3. Occurrences of unspotted calves (UC) and unspotted juveniles (UJ) in Hong Kong, including the their annual total number and percentage of the total

Year	No. of UC	UC% of total	No. of UJ	UJ% of total
2002	13	1.0%	74	5.5%
2003	22	1.0%	153	6.9%
2004	18	1.1%	75	4.7%
2005	29	1.4%	123	5.9%
2006	24	1.1%	97	4.4%
2007	11	0.8%	56	4.1%
2008	12	1.0%	58	4.7%
2009	6	0.5%	87	6.9%
2010	4	0.3%	91	7.2%
2011	26	1.2%	80	3.7%
2012	27	1.5%	59	3.2%
2013	21	1.0%	102	4.8%
2014	15	0.7%	64	2.9%
2015	12	0.6%	32	1.6%
2016	1	0.1%	20	1.7%
2017	1	0.1%	20	1.7%
2018	2	0.2%	14	1.3%
2019	3	0.3%	23	2.2%
2020	3	0.4%	14	1.8%
2021	1	0.2%	17	2.6%

Table 4. Encounter rates (no. of on-effort sightings per 100 km^2) of Chinese White Dolphins among different survey areas in the past 20 monitoring periods

Monitoring Period	Overall	NE Lantau	NW Lantau	W Lantau	SW Lantau
2002-03	8.6	4.6	10.8	22.6	2.4
2003-04	10.8	5.0	11.3	25.9	2.5
2004-05	8.2	2.9	8.3	21.4	2.6
2005-06	7.8	2.7	8.7	20.2	1.6
2006-07	6.9	2.3	5.7	20.6	1.0
2007-08	9.9	4.7	10.5	26.1	3.7
2008-09	7.2	2.2	7.2	17.9	2.4
2009-10	6.3	1.7	4.9	18.0	2.2
2010-11	6.8	2.6	7.5	13.4	2.4
2011-12	7.7	5.0	8.7	15.3	2.6
2012-13	7.3	1.6	7.8	19.2	3.5
2013-14	7.2	0.7	6.3	19.6	6.8
2014-15	5.5	0.1	3.6	18.4	5.6
2015-16	4.7	0.1	2.2	15.5	5.5
2016-17	4.0	0.0	1.9	14.9	3.2
2017-18	3.4	0.0	2.4	11.8	4.1
2018-19	3.0	0.0	1.7	13.0	2.0
2019-20	3.5	0.0	0.7	13.3	3.8
2020-21	3.3	0.0	1.1	11.6	3.1
2021-22	2.4	0.0	0.5	13.1	2.5

Table 5. Encounter rates (no. of on-effort sightings per 100 km^2) of finless porpoises among different survey areas in the past 15 monitoring periods

Monitoring Period	Overall	SW Lantau	SE Lantau	Lamma	Po Toi
2007-08	3.0	2.7	5.1	1.9	1.9
2008-09	3.3	2.8	1.4	7.8	2.9
2009-10	3.5	1.9	6.1	1.0	5.5
2010-11	3.3	2.7	5.4	3.0	3.4
2011-12	4.9	3.0	5.8	9.6	3.4
2012-13	4.7	5.9	8.4	4.6	2.2
2013-14	6.4	7.4	12.5	7.6	0.0
2014-15	4.2	2.6	8.7	2.9	2.2
2015-16	3.8	2.3	5.3	6.4	5.2
2016-17	3.7	2.8	8.1	2.5	1.8
2017-18	3.3	3.9	6.2	1.5	2.7
2018-19	2.9	2.9	5.1	1.9	1.2
2019-20	3.3	3.9	5.6	1.9	2.2
2020-21	1.9	2.8	2.3	1.4	1.5
2021-22	2.5	3.6	2.1	1.6	3.3

Table 6a. Line transects parameters and estimates of density and abundance for Chinese White Dolphins in western waters of Hong Kong in 2021

([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)

	NE Lantau	NW Lantau	W Lantau	SW Lantau
Effort	1671.1	2606.6	940.3	1772.1
Number of Sightings	N/A	22	123	40
Average Group Size	N/A	2.64	3.53	2.60
Encounter Rate[1]	N/A	0.84	13.08	2.95
Individual Density[2]	N/A	5.06	88.60	18.37
Abundance	N/A	4	24	12
95% C.I. (Abundance)	N/A	2-9	15-39	6-23
%CV	N/A	26	24	33

Table 6b. Annual abundance estimates of Chinese White Dolphins from each survey area in western waters of Hong Kong in 2003-21
(figures in red derived from biennial estimates; figures in blue indicate no or only one on-effort sighting made in that area for that year)

Year	*Combined*	NE Lantau	NW Lantau	W Lantau	SW Lantau
2003	*188*	18	84	56	30
2004	*143*	9	62	51	21
2005	*128*	7	58	42	21
2006	*113*	9	54	44	6
2007	*130*	10	60	54	6
2008	*108*	11	42	43	12
2009	*100*	5	40	43	12
2010	*86*	7	35	33	11
2011	*88*	11	39	28	10
2012	*80*	4	40	17	19
2013	*73*	3	36	23	11
2014	*87*	1	24	36	26
2015	*65*	0	10	31	24
2016	*47*	0	11	27	9
2017	*47*	0	21	16	10
2018	*32*	0	6	19	7
2019	*52*	0	4	29	19
2020	*37*	0	3	19	15
2021	*40*	0	4	24	12

Table 7. Range use (50%/25% UD core areas and sighting coverage) and residency patterns of 94 individuals with 15+ sightings and appeared in 2021

(abbreviations: SR=Seasonal Resident; YR=Year-round Resident; SV=Seasonal Visitor; UD= Utilization Distribution; LKC = Lung Kwu Chau Marine Park; CLK= northeast corner of airport; BR= Brothers Islands; TO= Tai O; PH= Peaked Hill; FL= Fan Lau; SL= South Lantau; WL= West Lantau; DB= Deep Bay; EL= East Lantau; NEL= Notheast Lantau; NWL= Northwest Lantau; SWL= Southwest Lantau; SEL= Southeast Lantau; CH=Chinese waters; * denotes individuals that have their gender determined by biopsy sampling)

				Primary	Occurrence in Survey Areas								50% UD Core Area						25% UD Core Area					
ID#	# STG	Gender	Residency	Range	DB	EL	NEL	NWL	WL	SWL	SEL	CH	LKC	BR	TO	PH	FL	SL	LKC	BR	TO	PH	FL	SL
CH12	105	F?	YR	WL					√	√		√				√	√					√	√	
CH38	127	?	YR	WL					√	√		√				√	√					√	√	
CH105	34	F	SV	WL				√	√			√			√						√			
CH108	145	F	YR	WL				√	√	√		√				√	√						√	
CH113	64	F	SR	WL				√	√	√		√			√	√						√		
CH141	52	F	YR	WL					√	√		√				√	√					√	√	
EL01	131	M*	SR	NL		√	√	√	√	√		√		√						√				
NL33	162	F*	YR	NL			√	√	√	√			√	√						√				
NL46	98	F*	SR	NL				√	√			√	√						√					
NL49	71	F*	SR	NL			√	√	√	√			√		√	√			√			√		
NL98	185	F*	YR	NL			√	√	√	√		√	√	√					√	√				
NL103	62	?	SR	NL	√			√	√			√	√						√					
NL104	143	F	YR	NL	√		√	√	√	√		√	√						√					
NL123	194	F	YR	NL/WL	√		√	√	√	√		√	√	√					√	√				
NL182	140	F	YR	NL	√		√	√	√	√			√						√					
NL202	159	F	YR	NL	√		√	√	√			√	√						√					
NL206	78	F*	YR	WL				√	√	√		√				√	√					√	√	
NL224	79	?	SR	NL/WL	√		√	√	√	√		√	√		√	√			√		√	√		
NL236	45	?	SR	NL/WL				√	√			√	√						√					
NL242	104	F*	YR	NL/WL			√	√	√	√		√	√	√					√					
NL247	38	?	SR	WL				√	√			√			√	√					√	√		
NL259	100	?	YR	NL/WL			√	√	√				√		√				√		√			
NL261	119	M?	YR	NL/WL	√		√	√	√	√		√	√						√					
NL269	74	?	YR	NL/WL				√	√	√		√				√	√					√		
NL272	97	?	YR	NL	√		√	√	√	√		√	√						√					
NL280	33	?	SR	NL/WL	√			√	√				√						√					
NL296	79	F?	SR	NL/WL			√	√	√	√		√	√		√	√			√			√		
NL299	33	?	SR	WL	√			√	√	√		√			√	√					√	√		
NL301	34	?	SR	NL	√			√	√			√	√						√					
NL306	46	?	YR	WL				√	√	√	√						√	√					√	√
NL311	36	?	YR	WL				√	√	√		√			√	√	√				√	√	√	
NL313	17	?	SR	WL				√	√	√		√				√						√		
NL317	19	?	SR	WL				√	√			√	√		√	√			√		√	√		
NL321	40	?	YR	NL	√			√	√	√		√	√						√					
NL331	19	?	N.D.	WL				√	√	√		√			√			√			√			
SL40	114	F	YR	WL					√	√		√					√						√	
SL44	76	?	YR	WL					√	√		√			√	√	√					√	√	
SL58	24	?	N.D.	WL					√	√					√	√					√	√		
SL59	36	?	YR	WL				√	√	√		√			√	√	√				√	√	√	
SL60	81	?	YR	WL					√	√		√					√						√	
WL05	119	F?	YR	NL/WL			√	√	√	√		√	√		√				√		√			
WL28	42	F	YR	WL				√	√	√		√			√						√			
WL29	56	F	SR	WL					√	√		√				√						√		
WL42	164	?	YR	WL				√	√	√		√				√	√					√	√	
WL46	97	?	YR	WL			√	√	√	√		√			√	√					√			
WL61	131	?	YR	WL				√	√	√		√				√	√						√	
WL66	29	F	SR	WL					√			√			√	√					√			
WL68	85	F*	YR	WL					√	√		√				√	√					√		
WL72	150	F	YR	WL				√	√	√		√				√	√					√	√	
WL79	121	?	YR	WL				√	√			√			√	√					√			
WL91	121	?	YR	WL					√	√	√	√				√	√					√	√	

Table 7. (cont'd)

ID#	# STG	Gender	Residency	Primary Range	Occurrence in Survey Areas								50% UD Core Area						25% UD Core Area					
					DB	EL	NEL	NWL	WL	SWL	SEL	CH	LKC	BR	TO	PH	FL	SL	LKC	BR	TO	PH	FL	SL
WL92	54	?	YR	WL					√	√		√				√	√						√	
WL94	93	F	YR	WL					√	√		√				√	√						√	
WL98	59	F	YR	WL				√	√	√		√			√	√	√				√	√		
WL109	133	F	YR	WL				√	√	√		√			√	√	√					√	√	
WL114	99	F?	YR	WL				√	√	√		√				√	√					√	√	
WL118	87	F	YR	WL					√	√		√				√	√					√		
WL123	177	F?	YR	WL				√	√	√		√				√	√						√	
WL128	63	?	SR	WL					√	√		√				√	√					√	√	
WL129	39	F	SR	WL					√	√		√				√	√					√	√	
WL130	115	?	YR	WL				√	√	√							√						√	
WL131	171	F?	YR	WL				√	√	√		√				√	√					√	√	
WL142	95	?	YR	WL					√	√		√					√						√	
WL145	60	F	YR	WL				√	√	√		√			√						√			
WL152	144	F?	YR	WL				√	√	√						√	√						√	
WL166	32	?	SR	WL					√	√						√	√					√		
WL168	74	?	YR	WL					√	√		√			√	√	√					√	√	
WL169	19	F	SR	WL					√	√		√				√	√					√		
WL171	39	F	SR	WL					√	√		√				√	√					√	√	
WL179	57	F	YR	NL/WL				√	√	√		√	√		√	√	√					√	√	
WL180	131	F?	YR	WL					√	√		√				√	√						√	
WL191	38	?	SR	WL				√	√			√			√	√					√	√		
WL208	56	F	YR	WL				√	√	√					√	√	√					√	√	
WL210	39	F?	YR	WL					√	√		√			√	√	√					√	√	
WL213	20	F	SR	WL				√	√						√	√						√		
WL214	34	F	YR	WL				√	√			√			√	√					√	√		
WL216	47	?	SR	WL				√	√	√		√			√	√						√		
WL220	90	?	YR	WL					√	√		√				√	√					√	√	
WL221	82	?	YR	WL				√	√	√		√			√	√	√	√					√	
WL229	34	?	YR	WL					√	√		√			√	√	√					√	√	
WL233	30	?	SR	WL				√	√	√		√			√	√	√	√			√	√	√	
WL243	61	?	YR	WL				√	√	√	√				√			√			√			√
WL249	16	?	SV	WL					√			√				√	√					√		
WL250	55	F	YR	WL					√	√	√	√					√	√					√	
WL254	34	F	YR	WL					√	√		√				√	√					√		
WL273	41	F?	YR	WL				√	√	√		√				√	√						√	
WL283	20	?	SR	WL				√	√			√			√	√					√			
WL286	27	?	YR	WL					√	√		√				√		√				√		
WL288	15	?	N.D.	WL				√	√	√		√			√						√			
WL291	21	F?	YR	WL				√	√	√		√			√	√					√	√		
WL294	25	?	YR	WL				√	√	√		√			√	√	√	√			√	√	√	
WL295	15	?	SR	WL					√	√		√				√						√		
WL304	16	?	N.D.	WL				√	√	√						√						√		
WL305	20	?	N.D.	WL					√	√						√	√					√	√	

Table 8. Number of individual dolphins involved in movements across different survey areas around Lantau in recent mointoring periods

Monitoring Period	Total No. of Ind.	NEL-NWL	NWL-WL	WL-SWL	NEL-NWL-WL	NWL-WL-SWL	NEL-NWL-WL-SWL
2010-11	169	29	23	14	9	1	0
2011-12	217	50	66	40	16	8	1
2012-13	200	39	50	34	18	3	1
2013-14	199	19	52	52	12	9	2
2014-15	227	6	62	72	5	14	0
2015-16	210	1	35	87	1	9	0
2016-17	208	0	50	81	0	20	0
2017-18	185	5	48	65	2	17	1
2018-19	172	0	37	52	0	9	0
2019-20	168	0	19	69	0	8	0
2020-21	135	0	25	61	0	13	0
2021-22	111	0	12	31	0	4	0

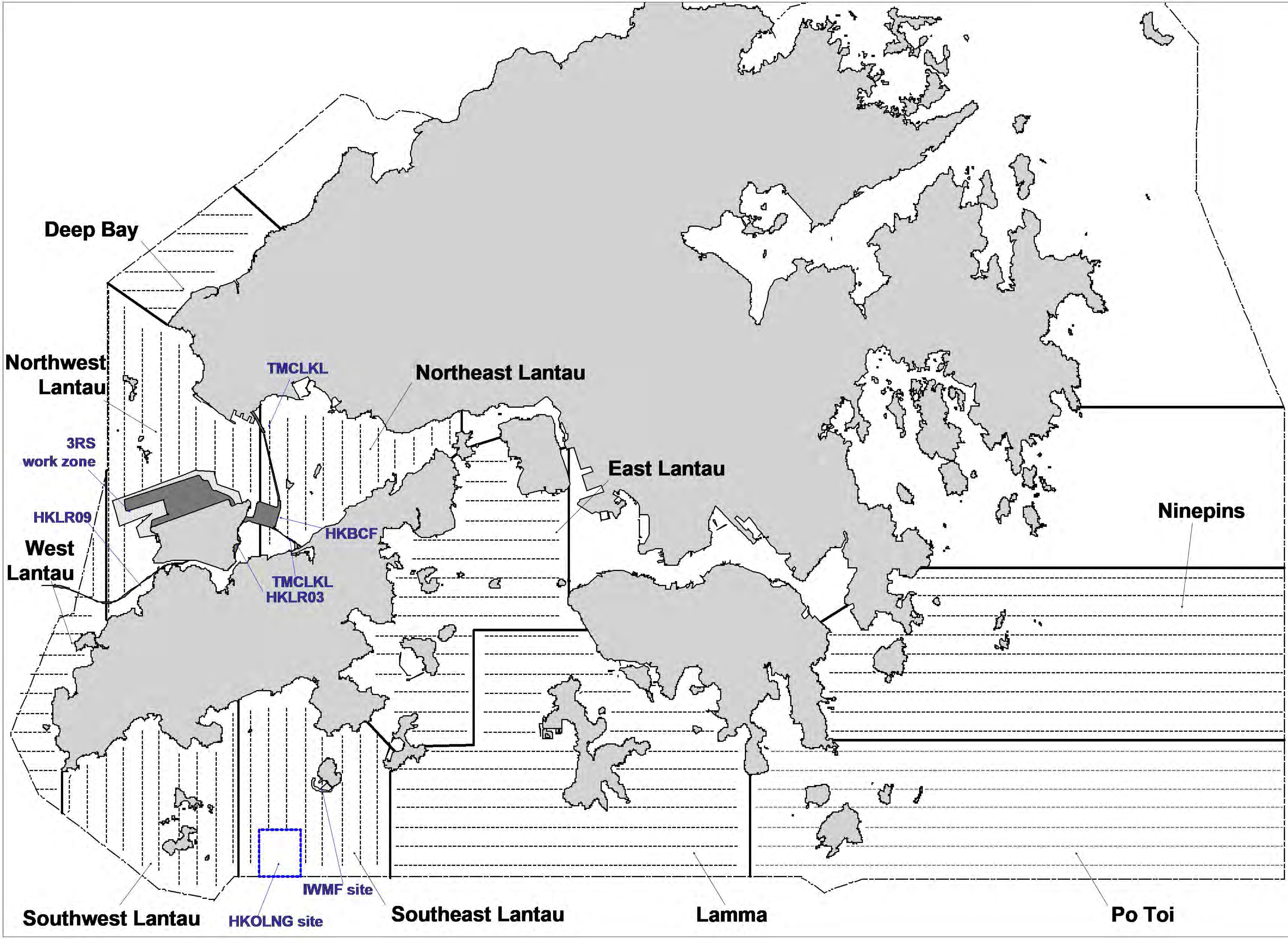


Figure 1. Ten Line-Transect Survey Areas within the Study Area chosen for the 2021-22 AFCD Monitoring Study

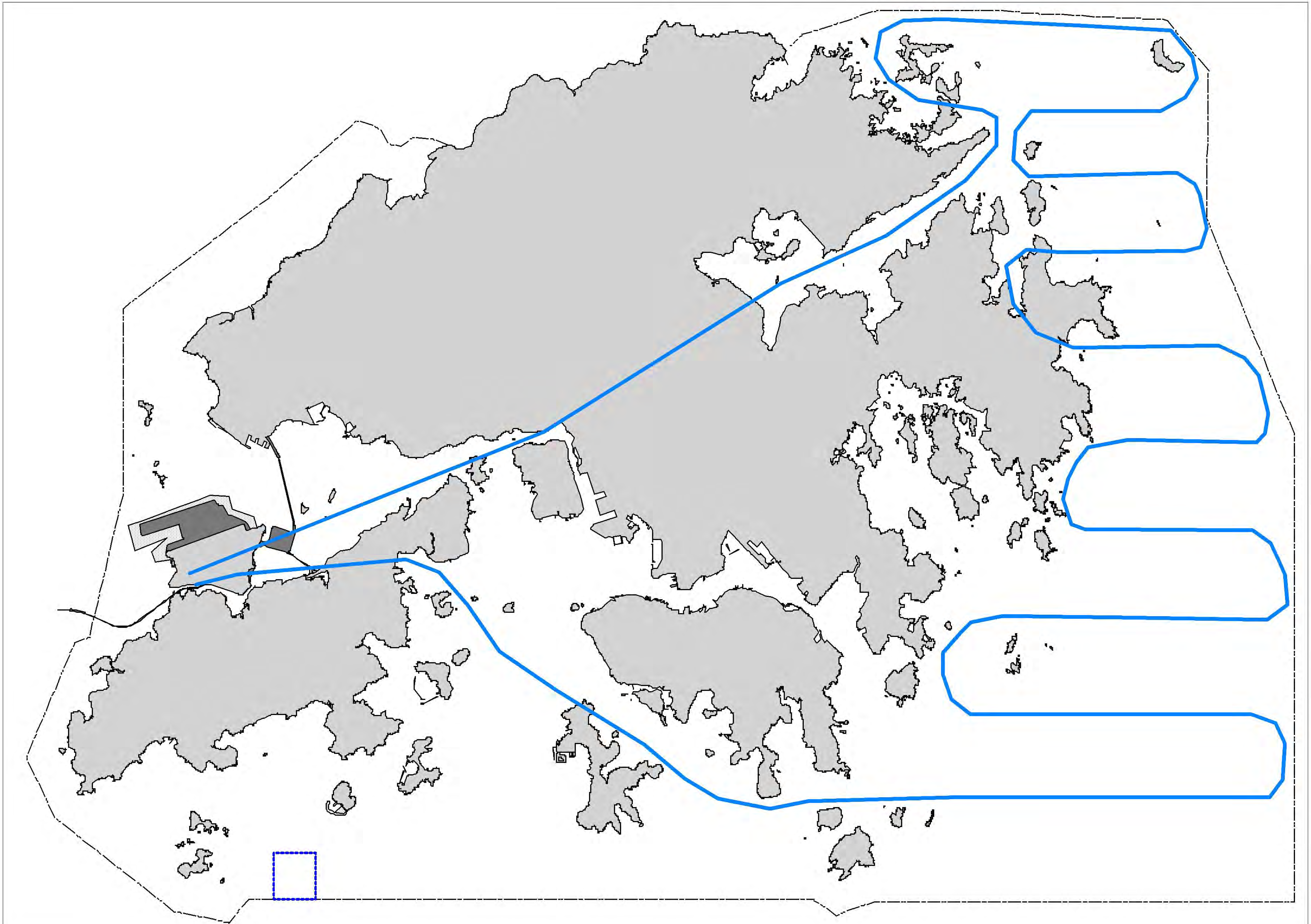


Figure 2. Indicative Survey Route for Helicopter Surveys in Eastern and Southern Waters of Hong Kong

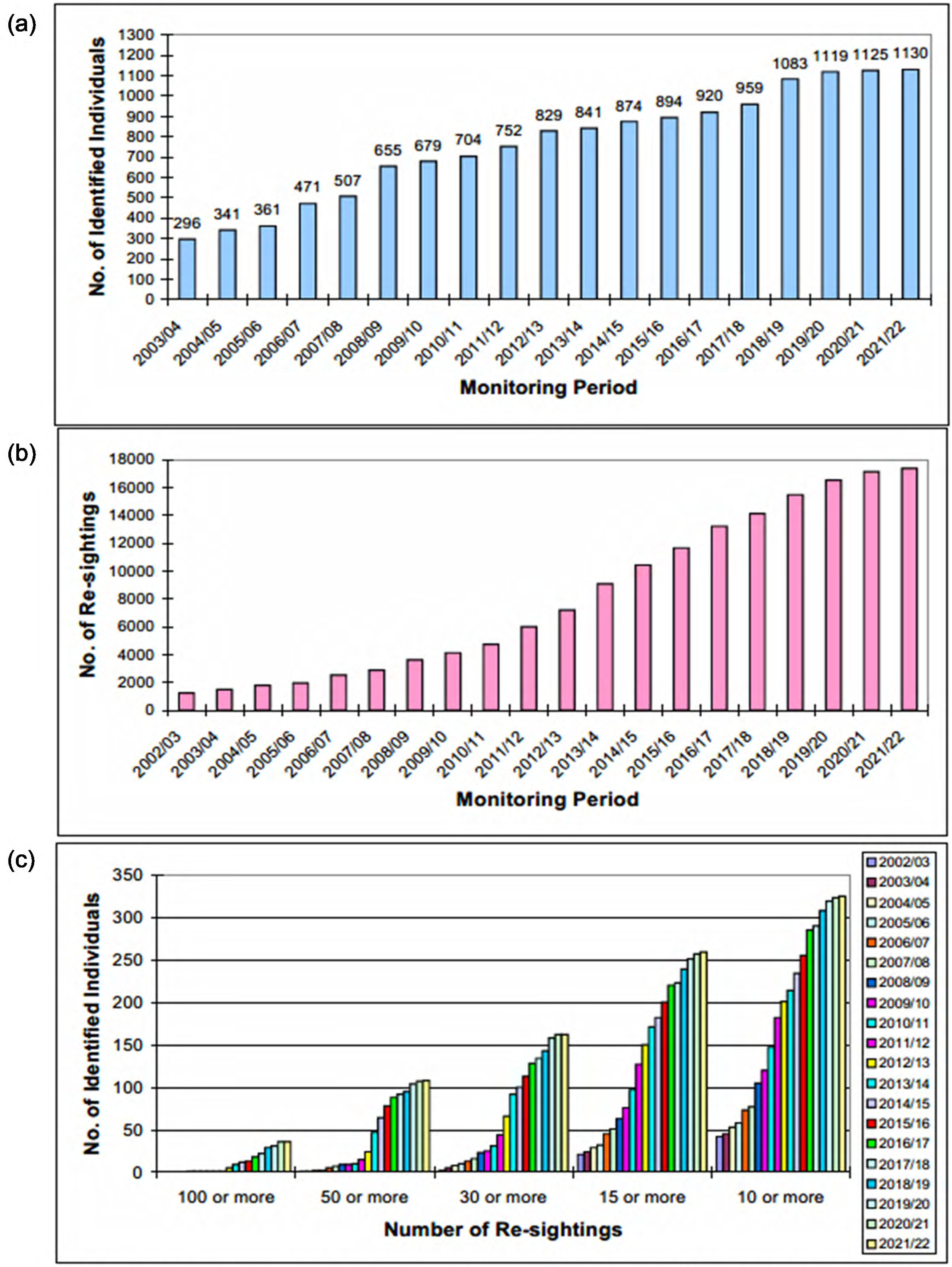


Figure 3. Temporal trends of (a) cumulative number of identified individuals; (b) total number of re-sightings made; and (c) number of identified individuals within several categories of number of re-sightings in the past 20 monitoring periods (2002-2022)

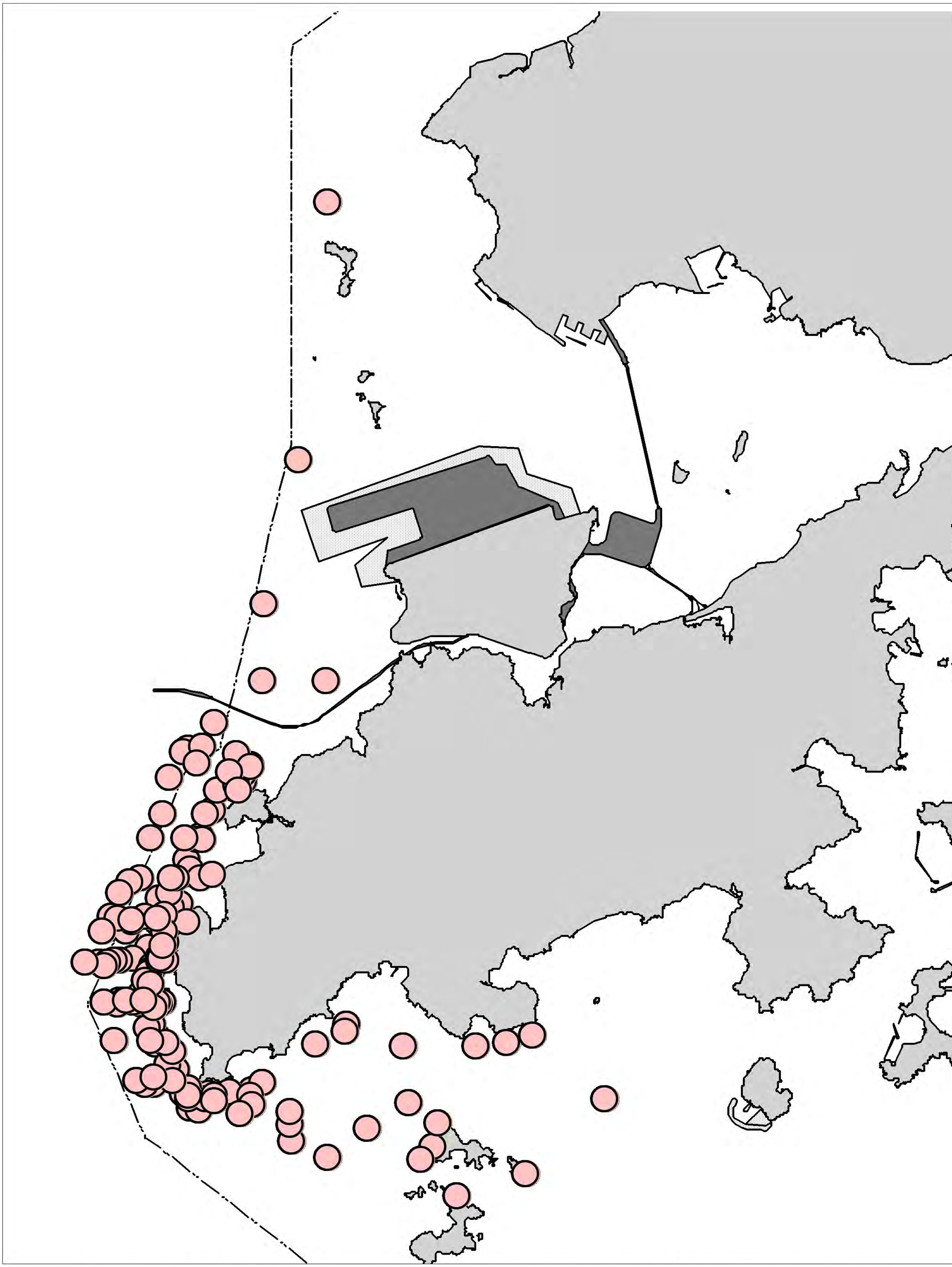


Figure 4. Distribution of CWD sightings in Hong Kong waters during AFCD monitoring surveys (April 2021 – March 2022)

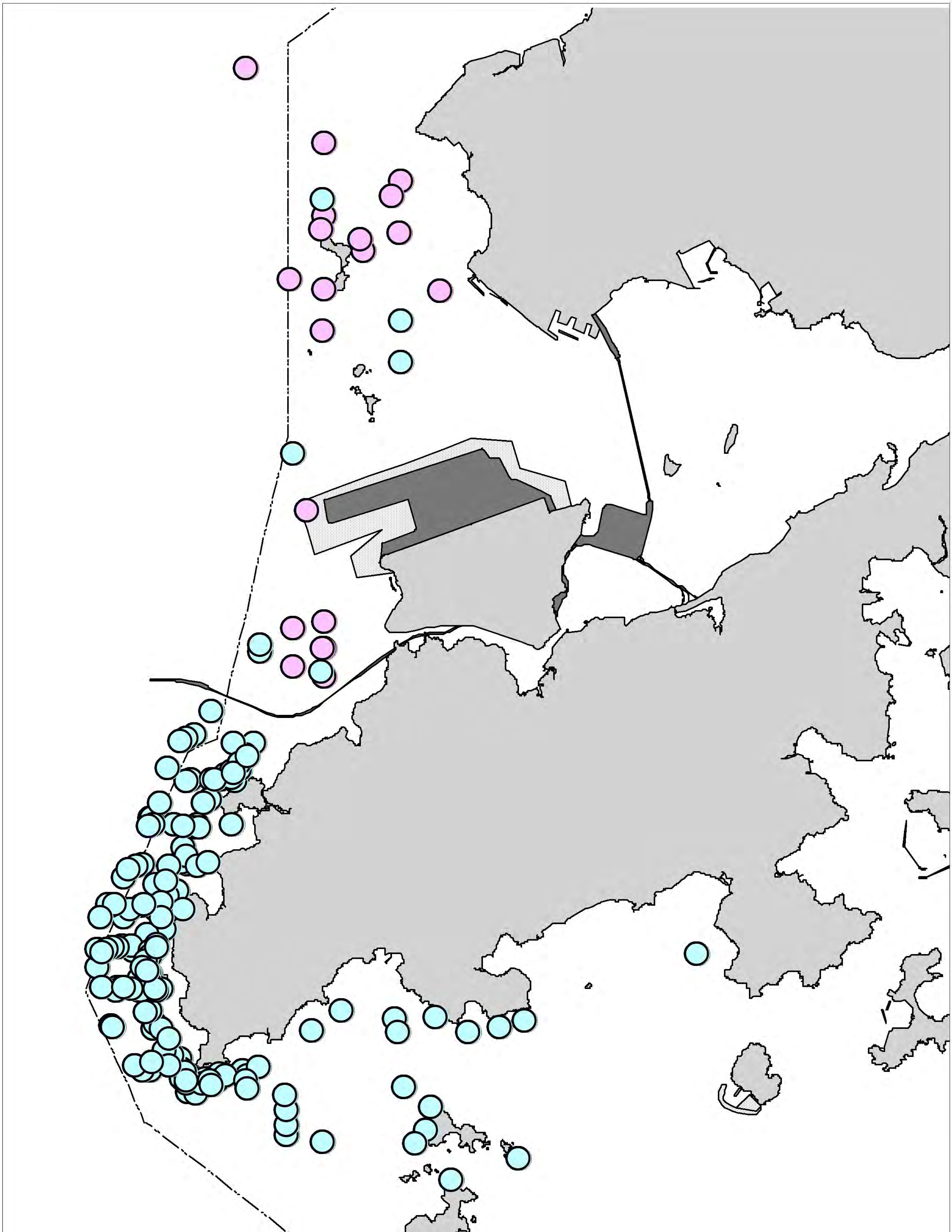


Figure 5. Distribution of all CWD sightings in Hong Kong waters in 2021
(blue dots: AFCD survey sightings; purple dots: HZMB survey sightings)

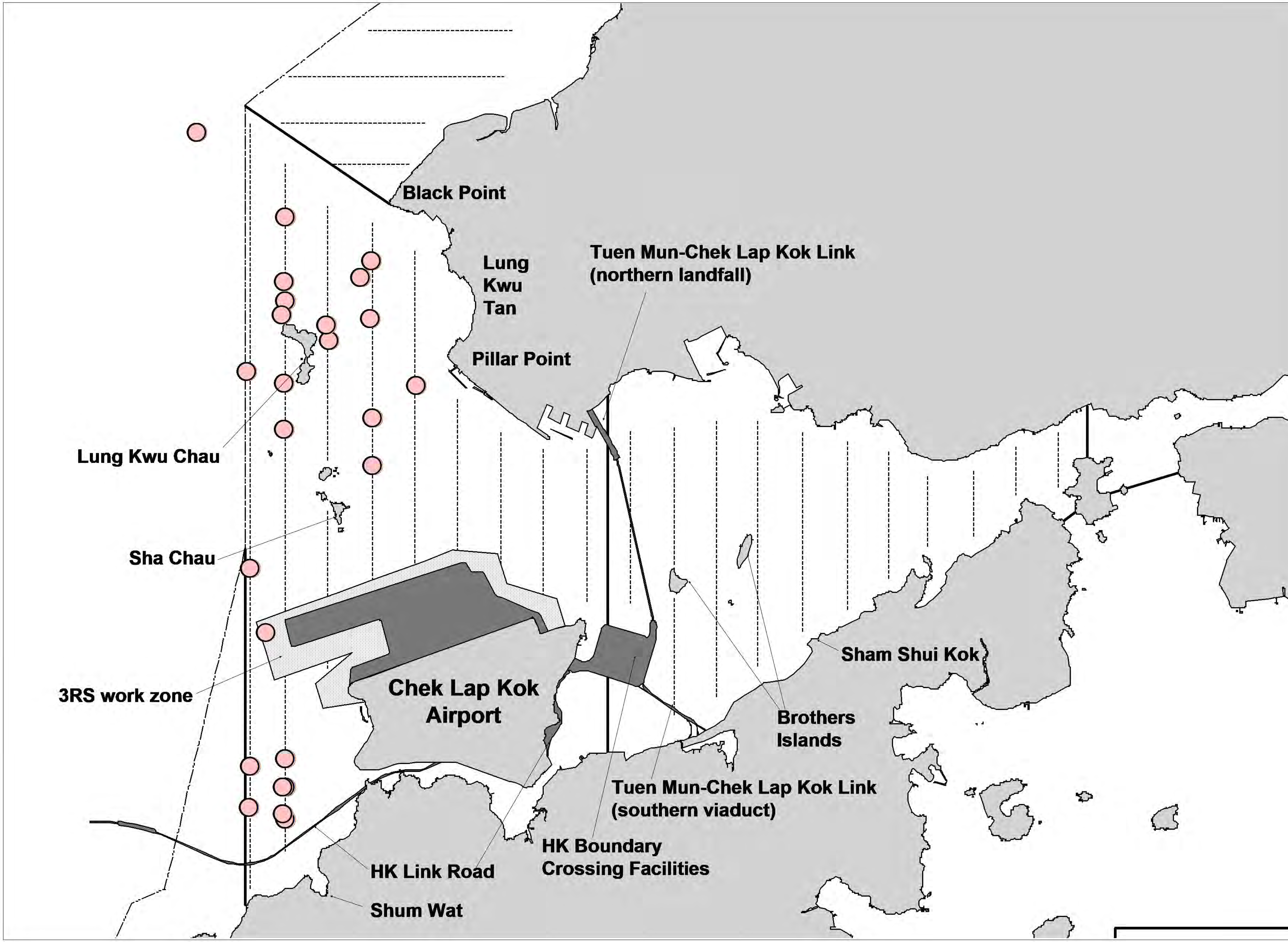


Figure 6. Distribution of Chinese White Dolphin sightings in North Lantau (2021)

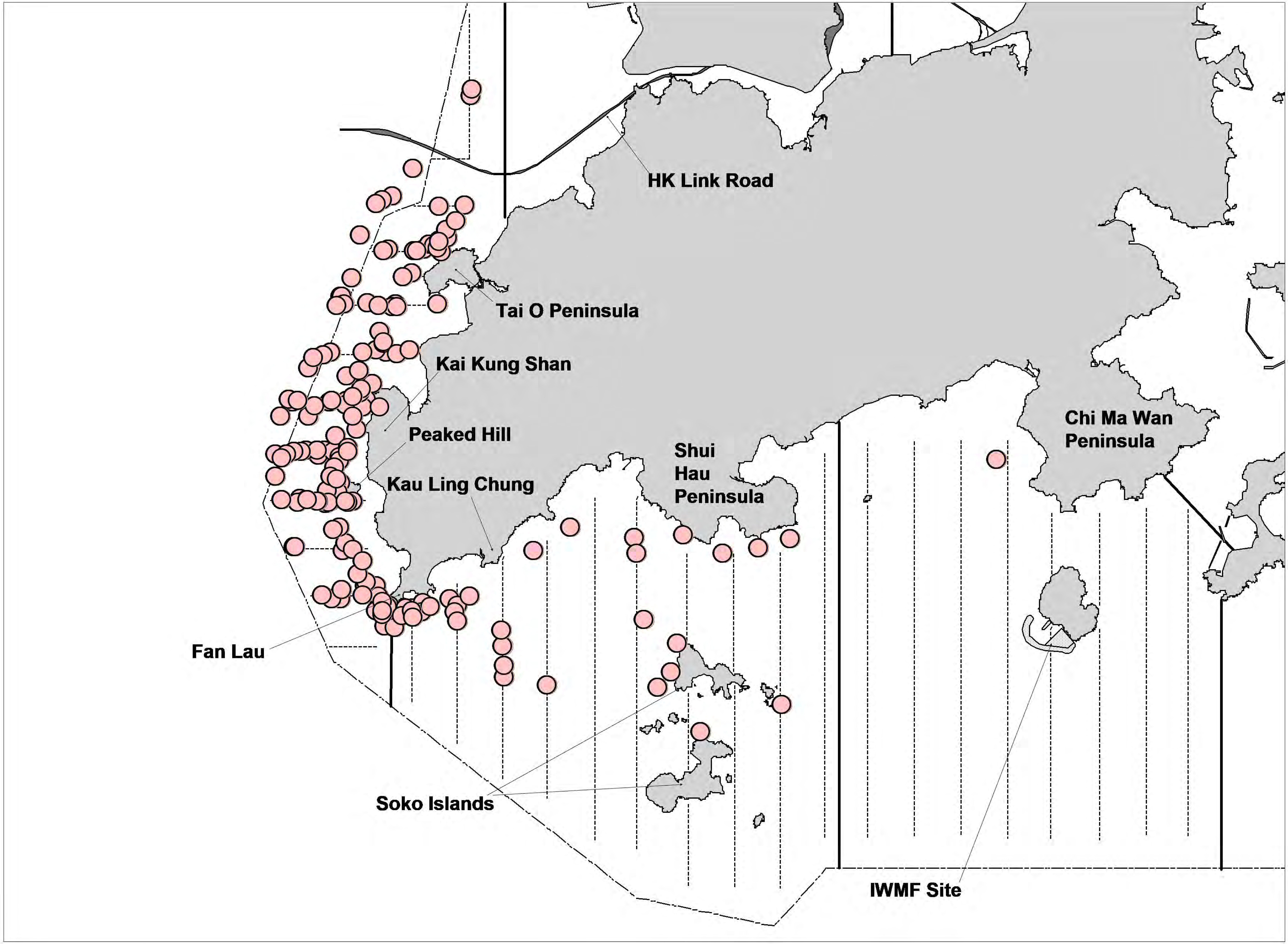


Figure 7. Distribution of Chinese White Dolphin sightings in West and South Lantau waters (2021)

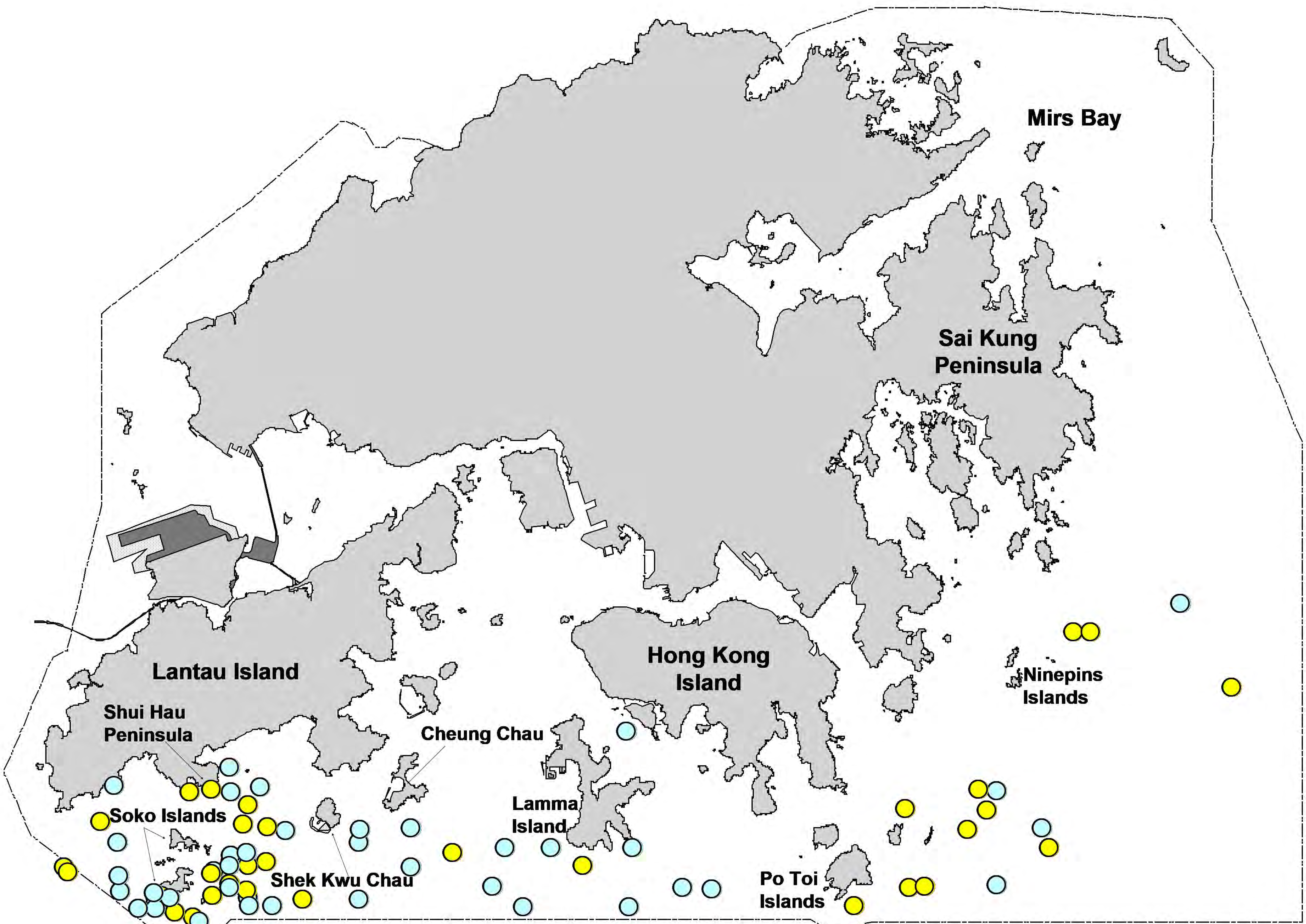


Figure 8. Distribution of finless porpoise sightings made during AFCD surveys (April 2021 – March 2022)
(blue dots: sightings made during winter/spring months; yellow dots: sightings made during summer/autumn months)

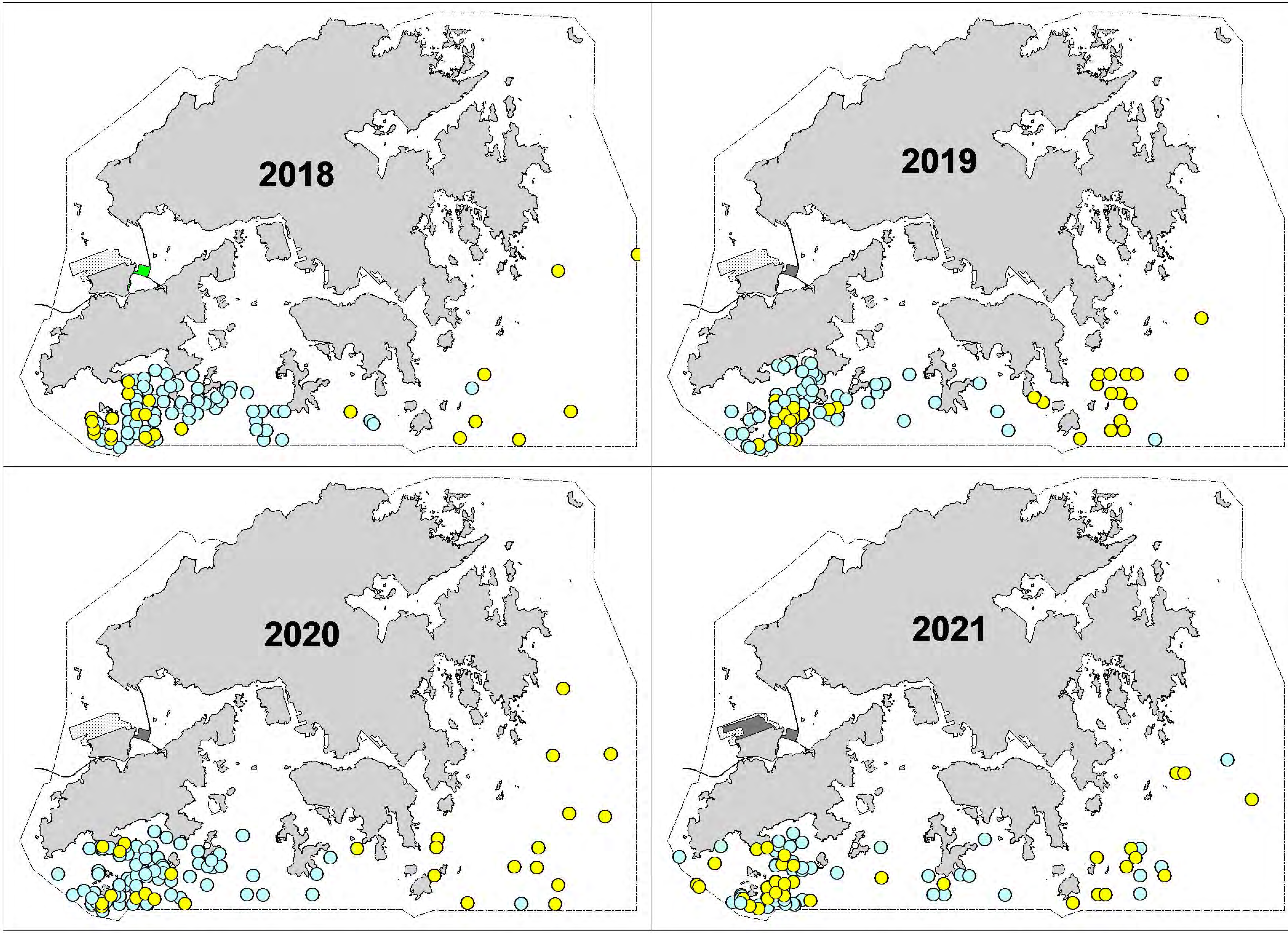


Figure 9. Comparison of annual porpoise distribution patterns from 2018-21
(blue dots: sightings made during winter/spring months; yellow dots: sightings made during summer/autumn months)

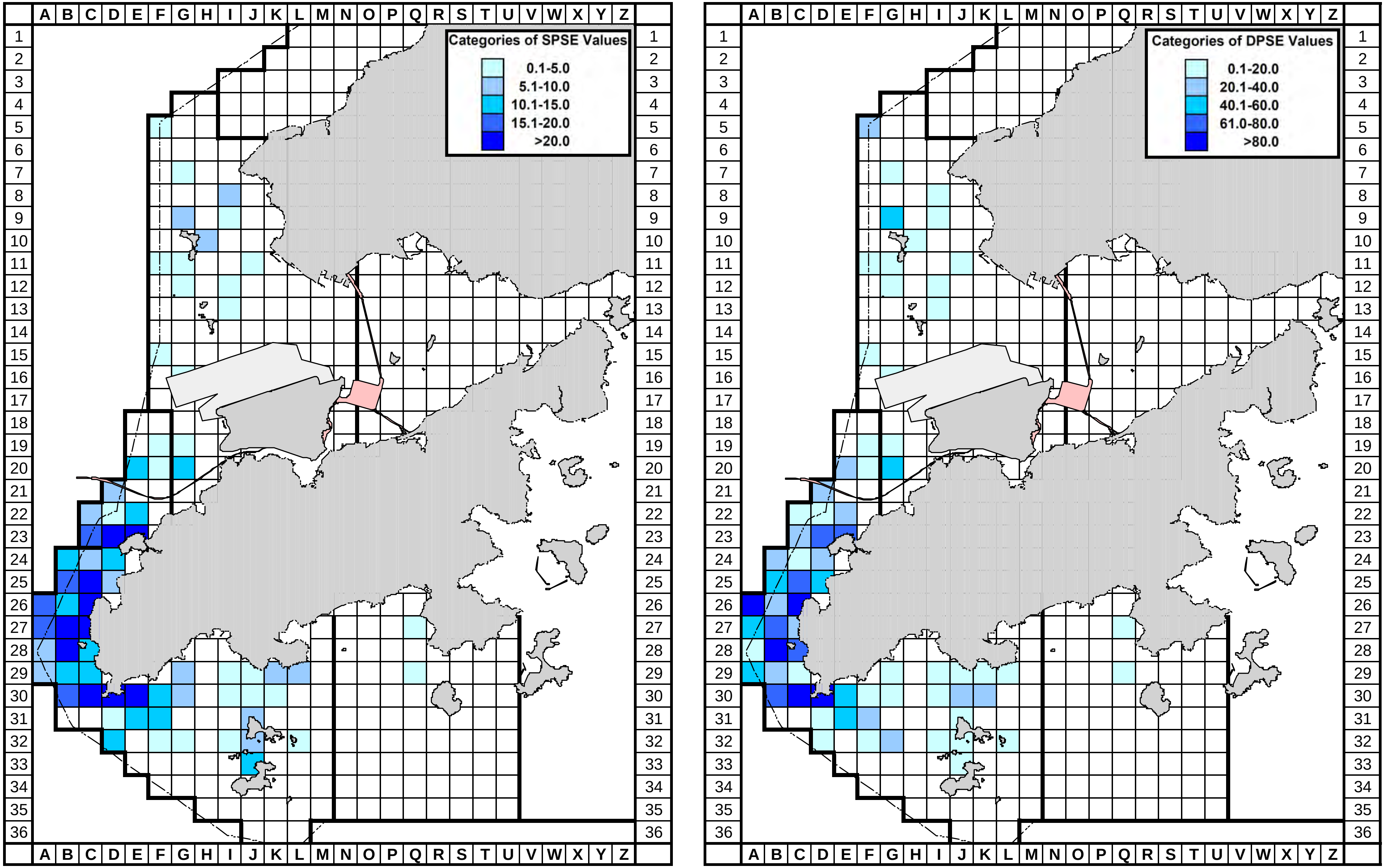


Figure 10. (left) Sighting density of Chinese white dolphins with corrected survey effort per km^2 in waters around Lantau Island (number within grids represent "SPSE" no. of on-effort dolphin sightings per 100 units of survey effort) (using data from January - December 2021)

(right) Density of Chinese white dolphins with corrected survey effort per km^2 in waters around Lantau Island (number within grids represent "DPSE" = no. o dolphins per 100 units of survey effort) (using data from January - December 2021)

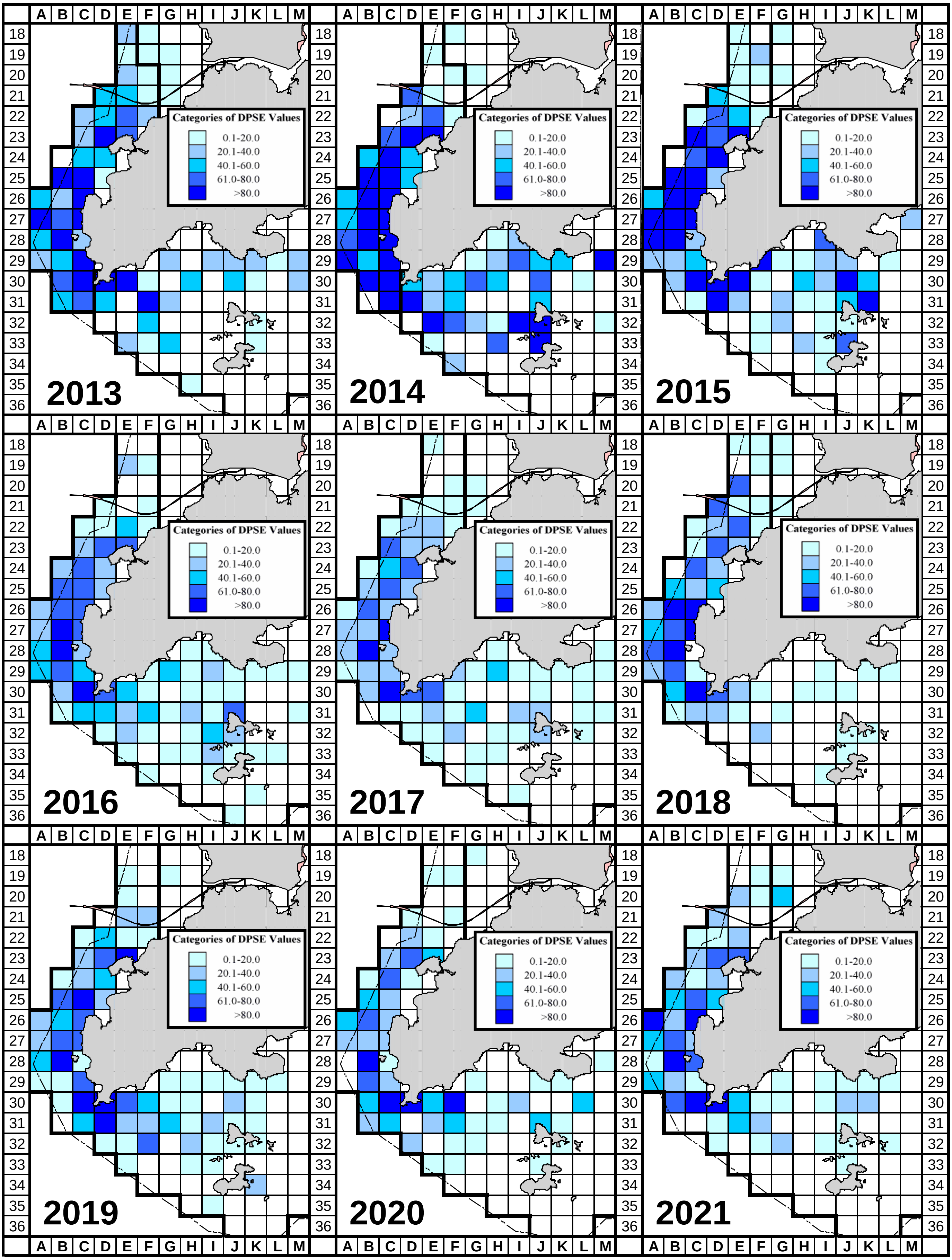


Figure 11. Comparison of Chinese White Dolphin densities with corrected survey effort per km^2 in West and Southwest Lantau Waters in 2013-21 (number within grids represent "DPSE" = no. of dolphins per 100 units of survey effort)

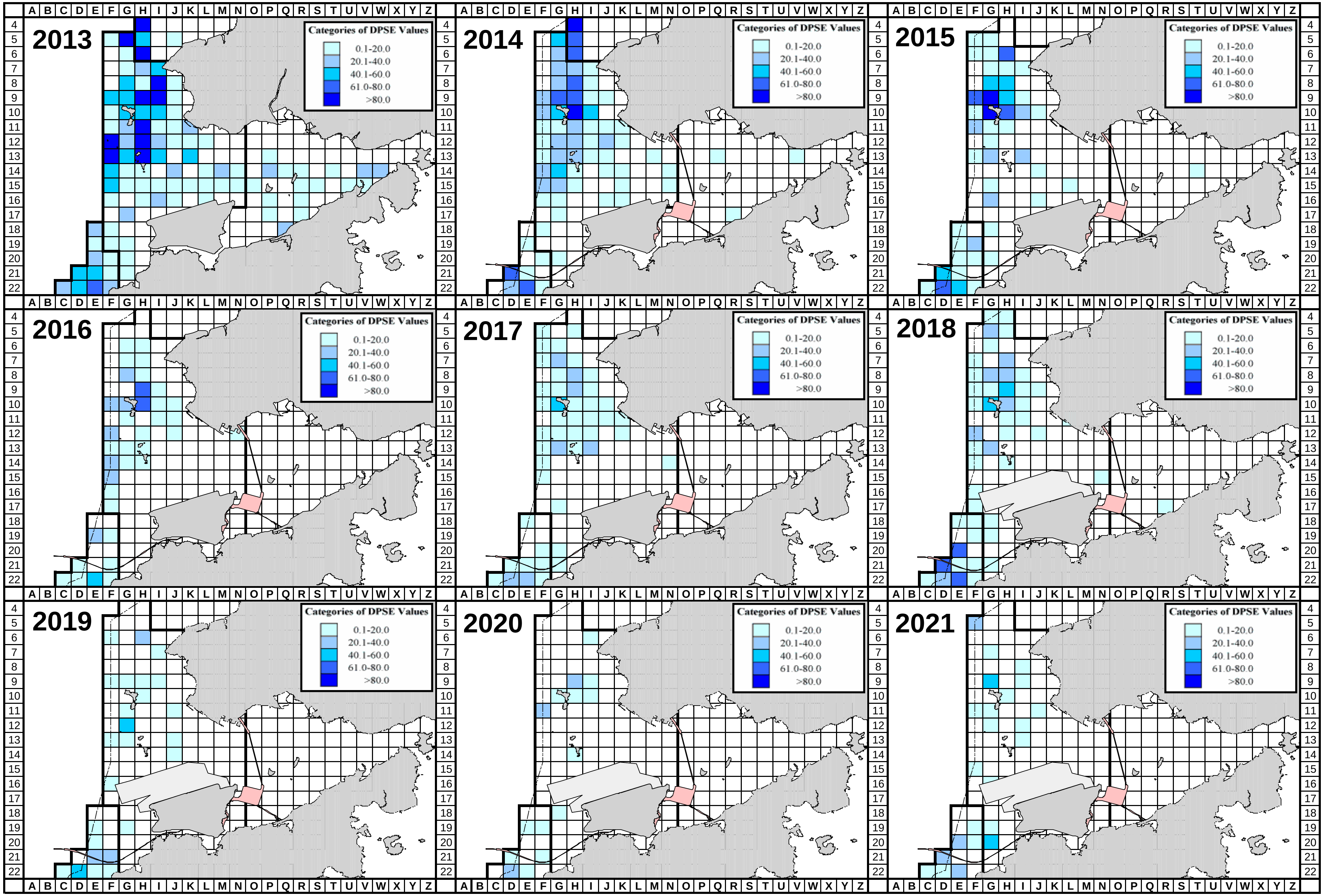


Figure 12. Comparison of dolphin densities with corrected survey effort per km^2 in North Lantau waters in 2013-21 (number within grids represent "DPSE" = no. of dolphins per 100 units of survey effort)

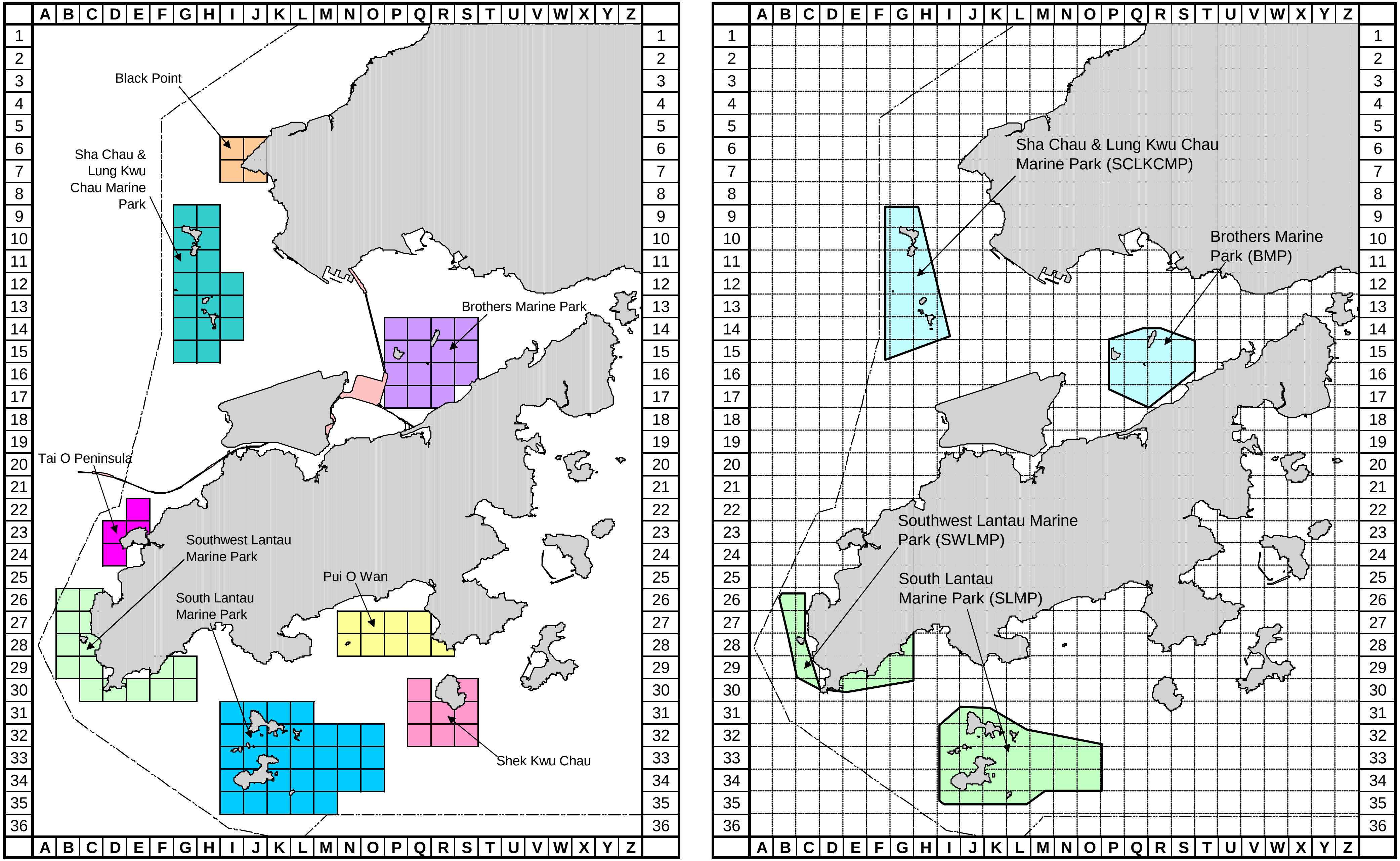


Figure 13. Grids of key marine mammal habitats in western HK waters that were examined for temporal trend in dolphin and porpoise densities

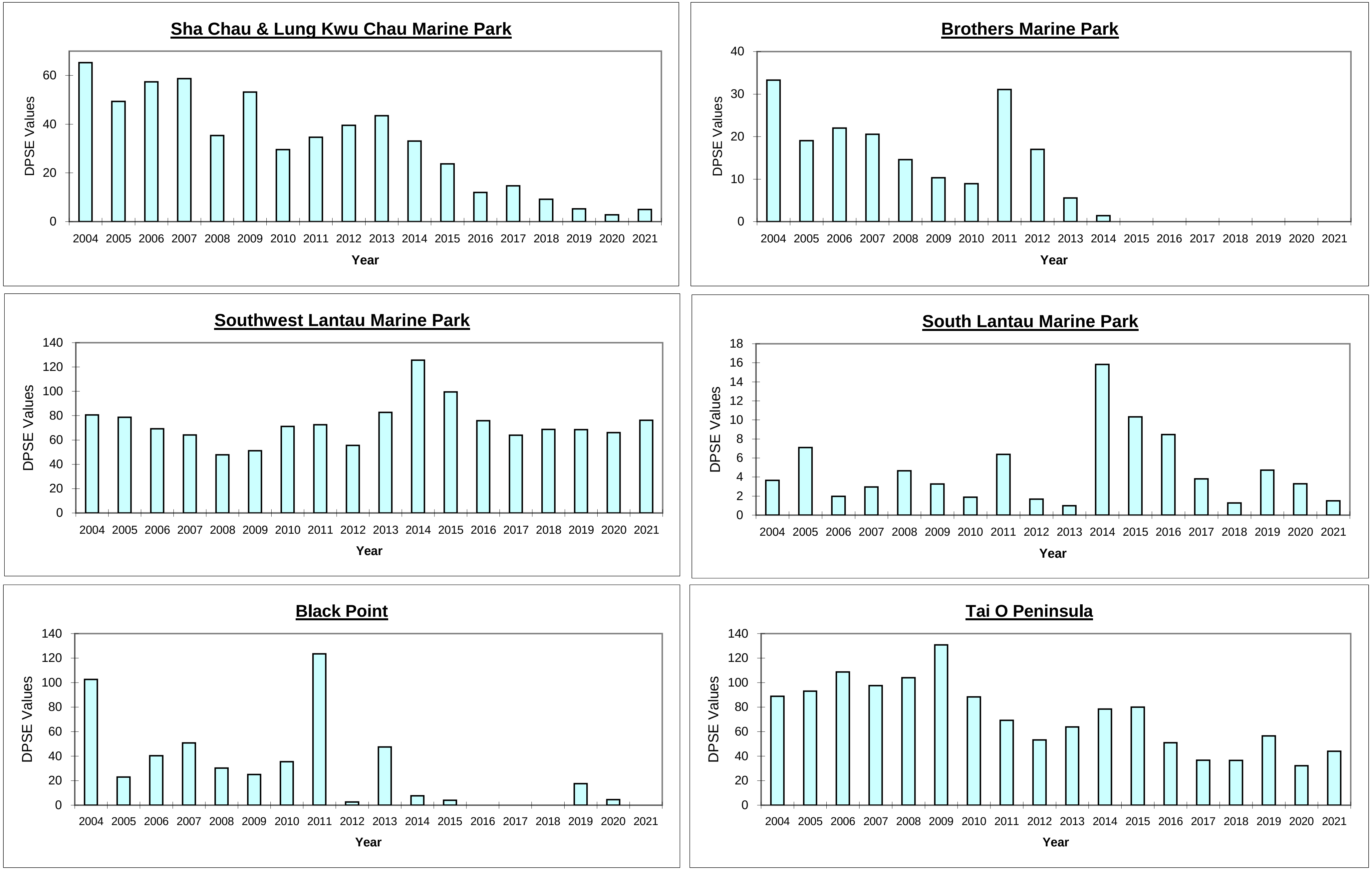


Figure 14. Temporal trend of dolphin densities (DPSE Values) at six key dolphin habitats in Lantau waters

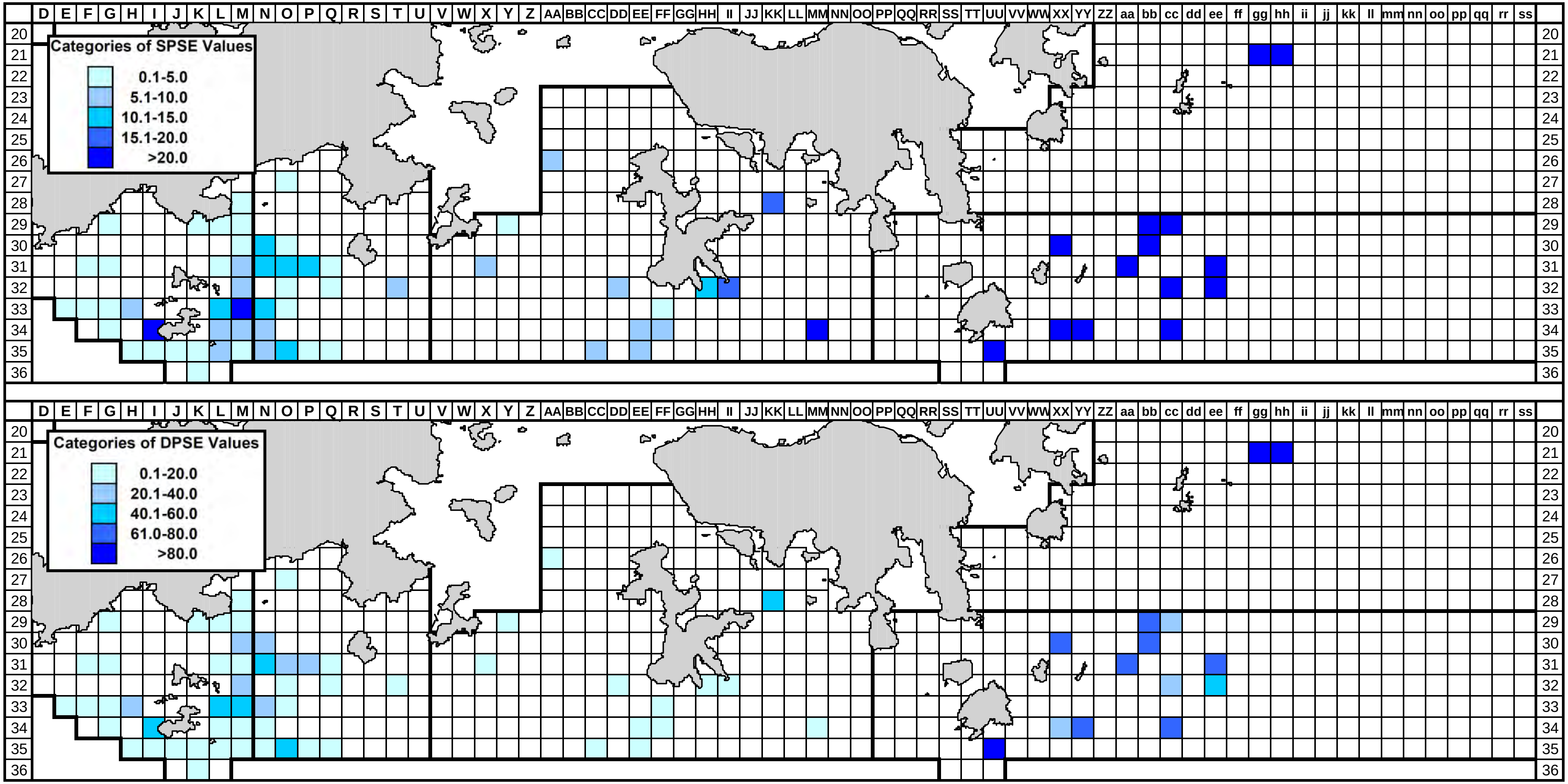


Figure 15. (top) Sighting density of finless porpoises with corrected survey effort per km^2 in southern waters of Hong Kong (number within grids represent "SPSE" = no. of on-effort porpoise sightings per 100 units of survey effort) (using data from January - December 2021)

(bottom) Density of finless porpoises with corrected survey effort per km^2 in southern waters of Hong Kong (number within grids represents "DPSE" = no. of porpoises per 100 units of survey effort) (using data from January - December 2021)

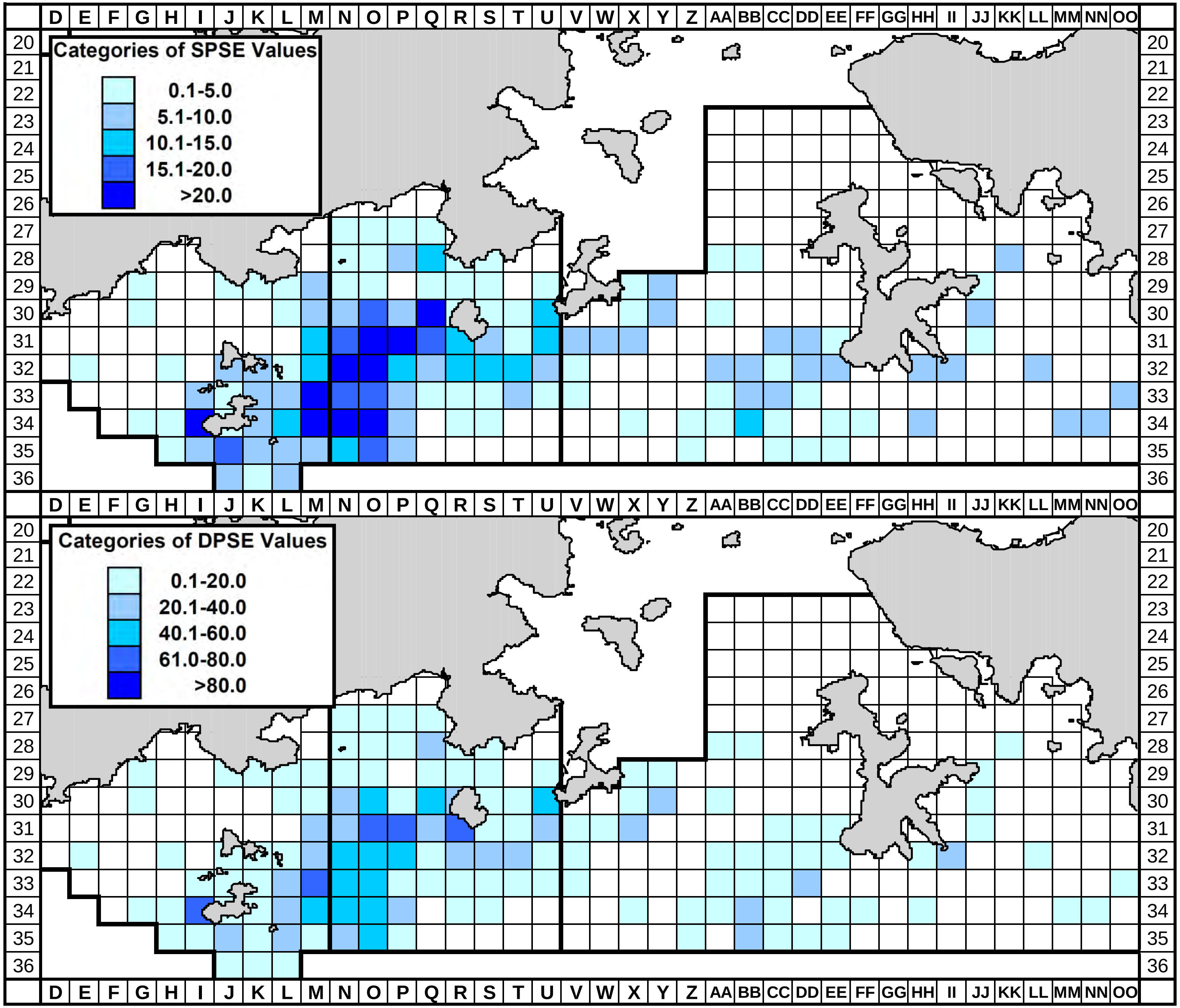


Figure 16. Density of finless porpoises with corrected survey effort per km^2 in southern waters of Hong Kong during dry season (December to May), using data collected during 2017-21 (SPSE = no. of on-effort porpoise sightings per 100 units of survey effort; DPSE = no. of porpoises per 100 units of survey effort)

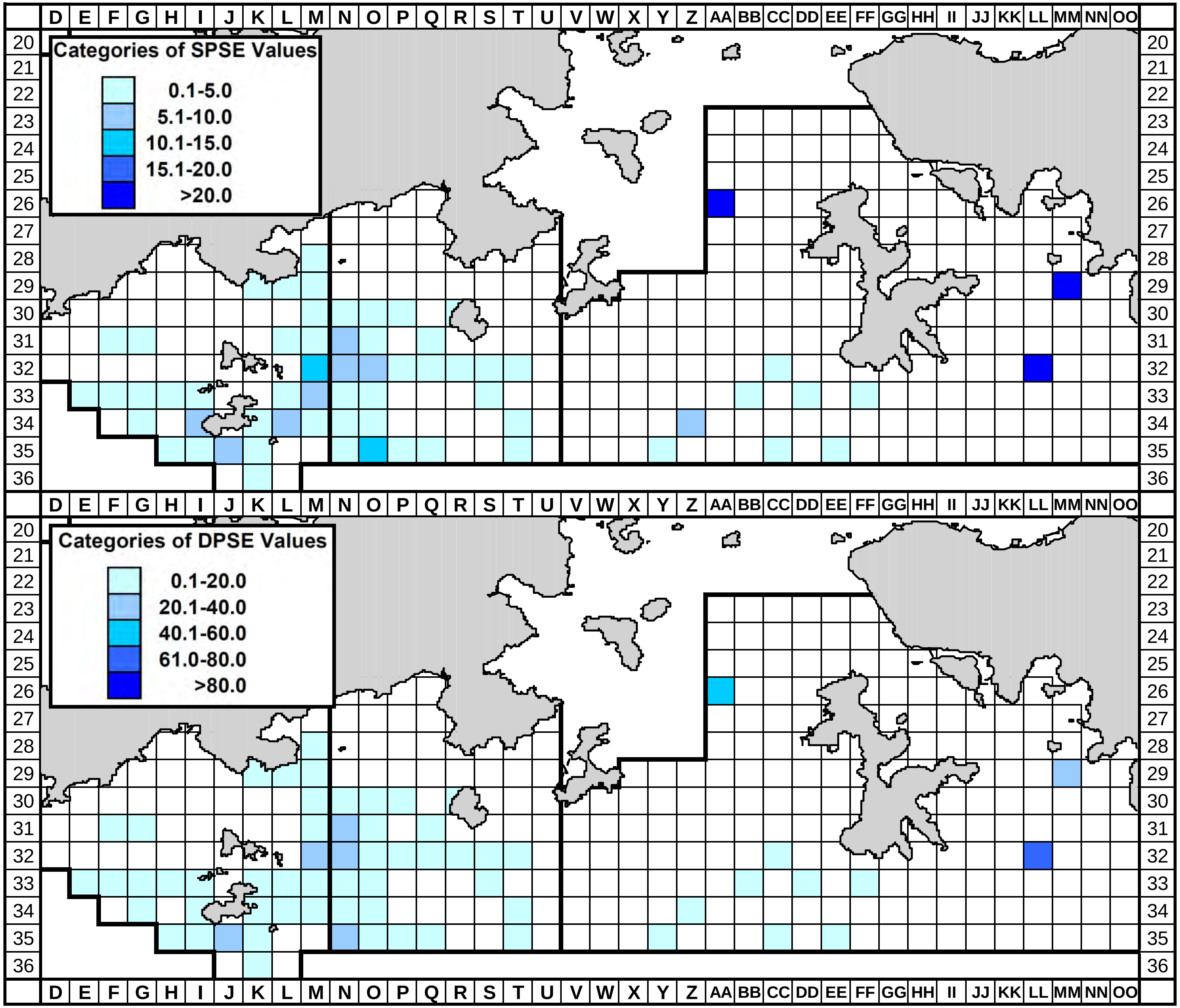


Figure 17. Density of finless porpoises with corrected survey effort per km^2 in southern waters of Hong Kong during wet season (June-November), using data collected during 2017-21 (SPSE = no. of on-effort porpoise sightings per 100 units of survey effort; DPSE = no. of porpoises per 100 units of survey effort)

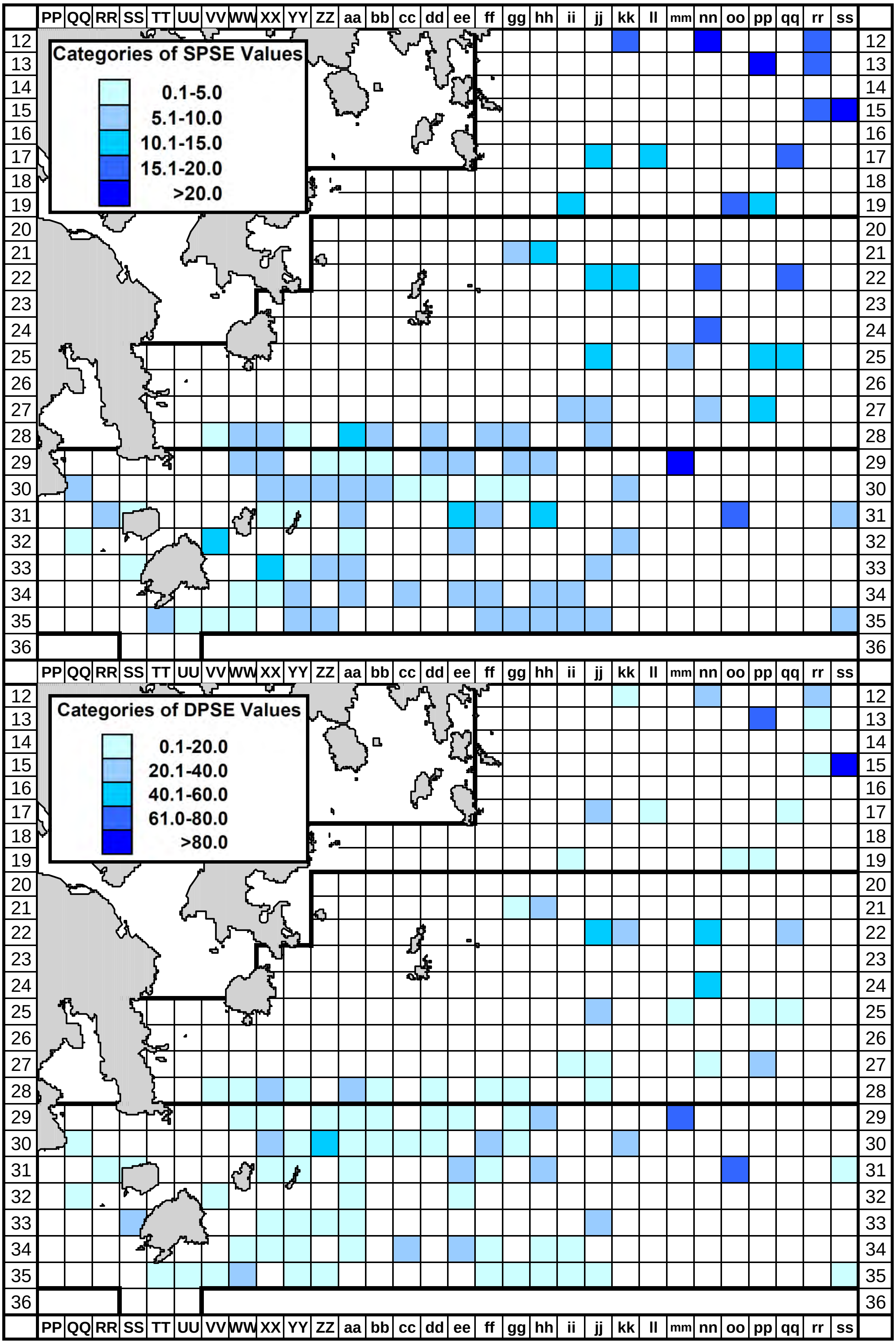
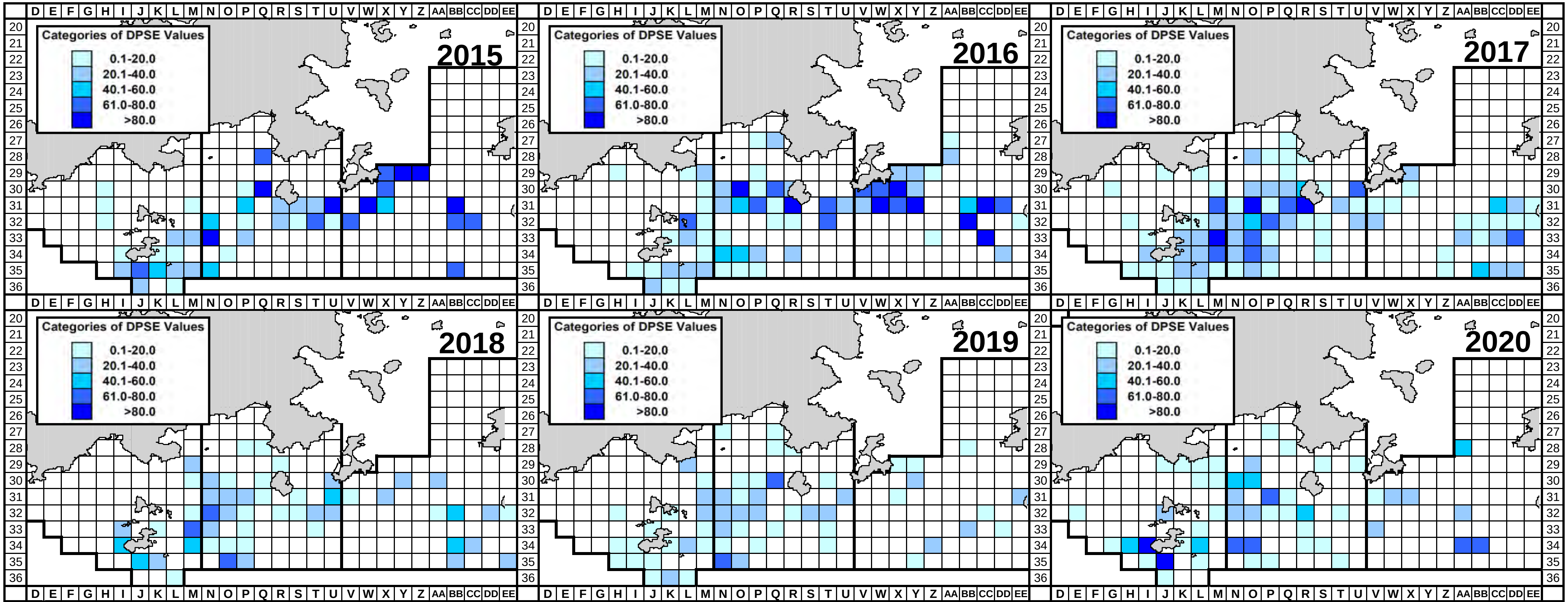


Figure 18. Density of finless porpoises with corrected survey effort per km^2 in eastern waters of Hong Kong during wet season (June to November), using data collected during 2012-21 (SPSE = no. of on-effort porpoise sightings per 100 units of survey effort; DPSE = no. of porpoises per 100 units of survey effort)



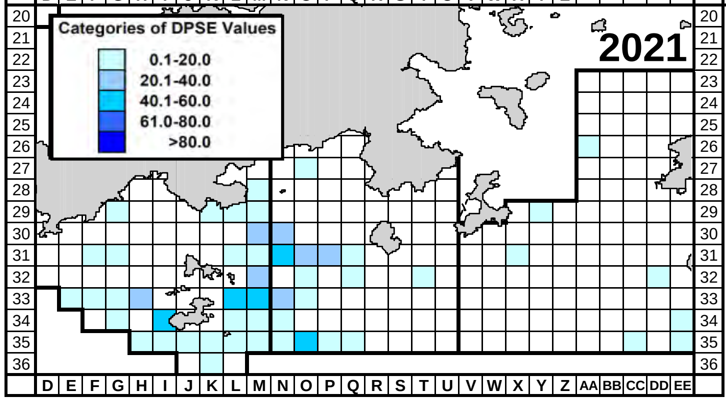


Figure 19. Comparison of porpoise densities with corrected survey effort per km^2 in South Lantau and Western Lamma waters in 2015-21 (number within grids represent "DPSE" = no. of porpoises per 100 units of survey effort)

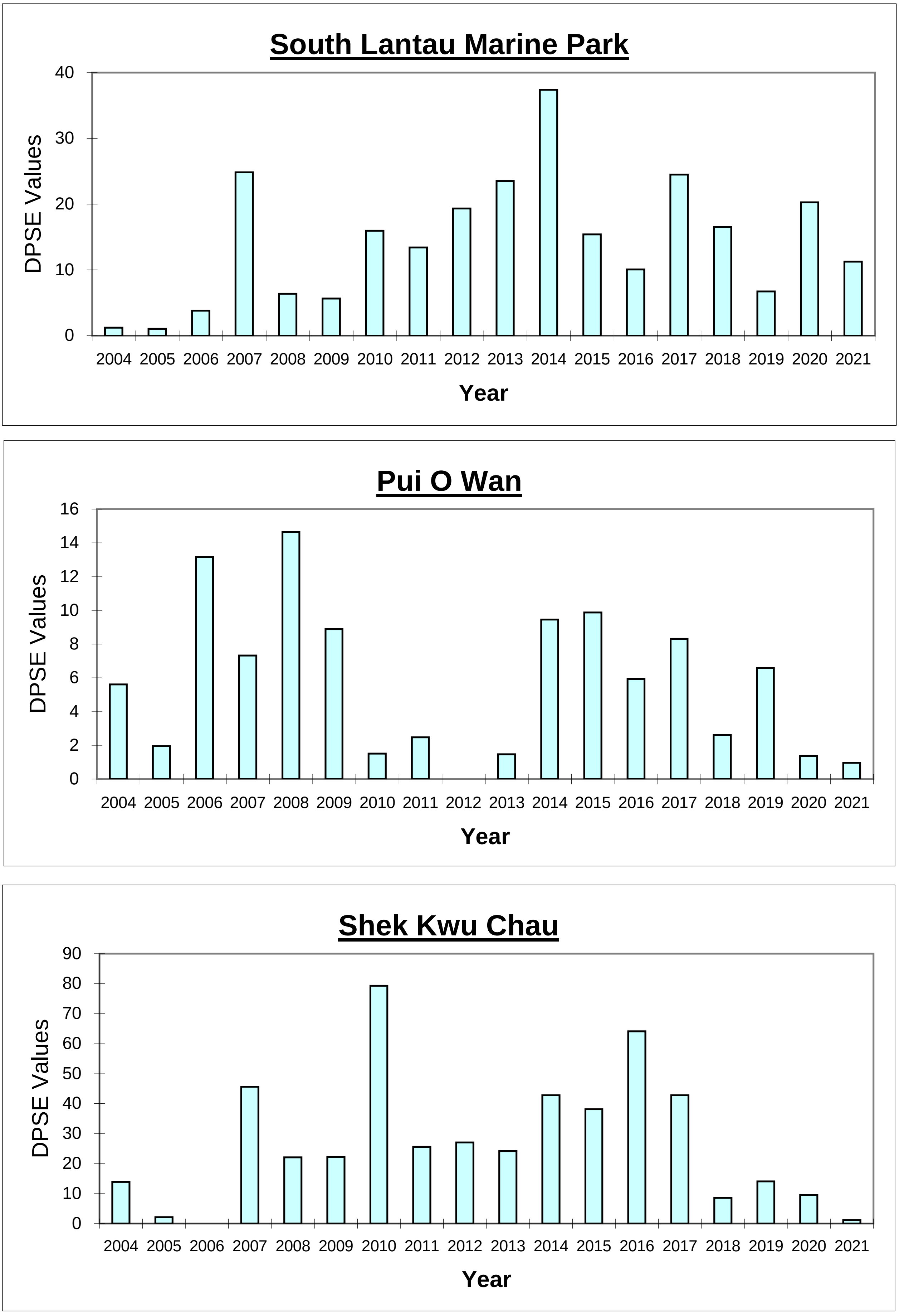


Figure 20. Temporal trend of porpoise densities (DPSE Values) at three key porpoise habitats in South Lantau waters

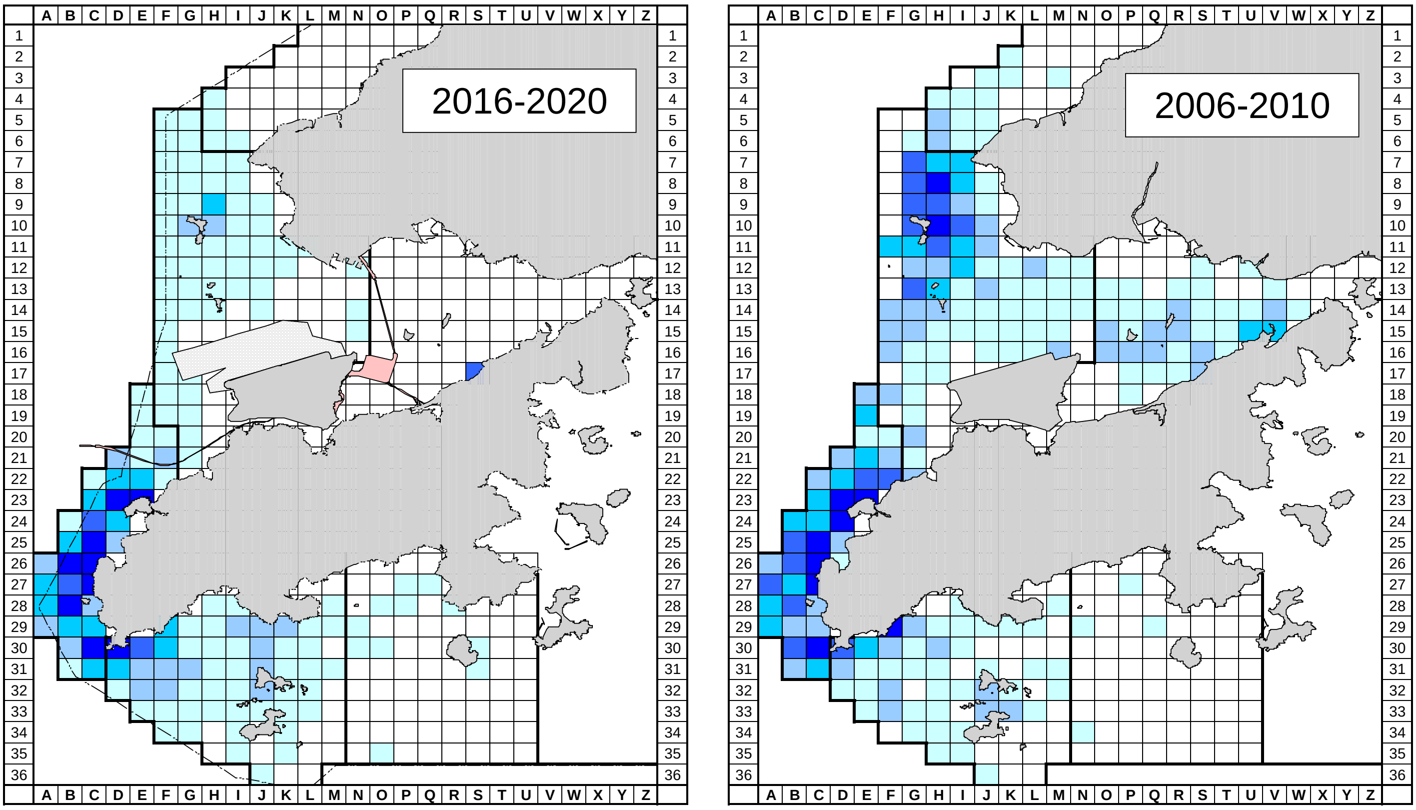


Figure 21a. Habitat ratings of CWD assessed among 352 grids around Lantau under the scoring criteria of **SPSE (Overall)**
(= Rank 1; = Rank 2; = Rank 3; = Rank 4; = Rank 5; ranking/scoring criteria for Chinese White Dolphins can be referred to Table 1)

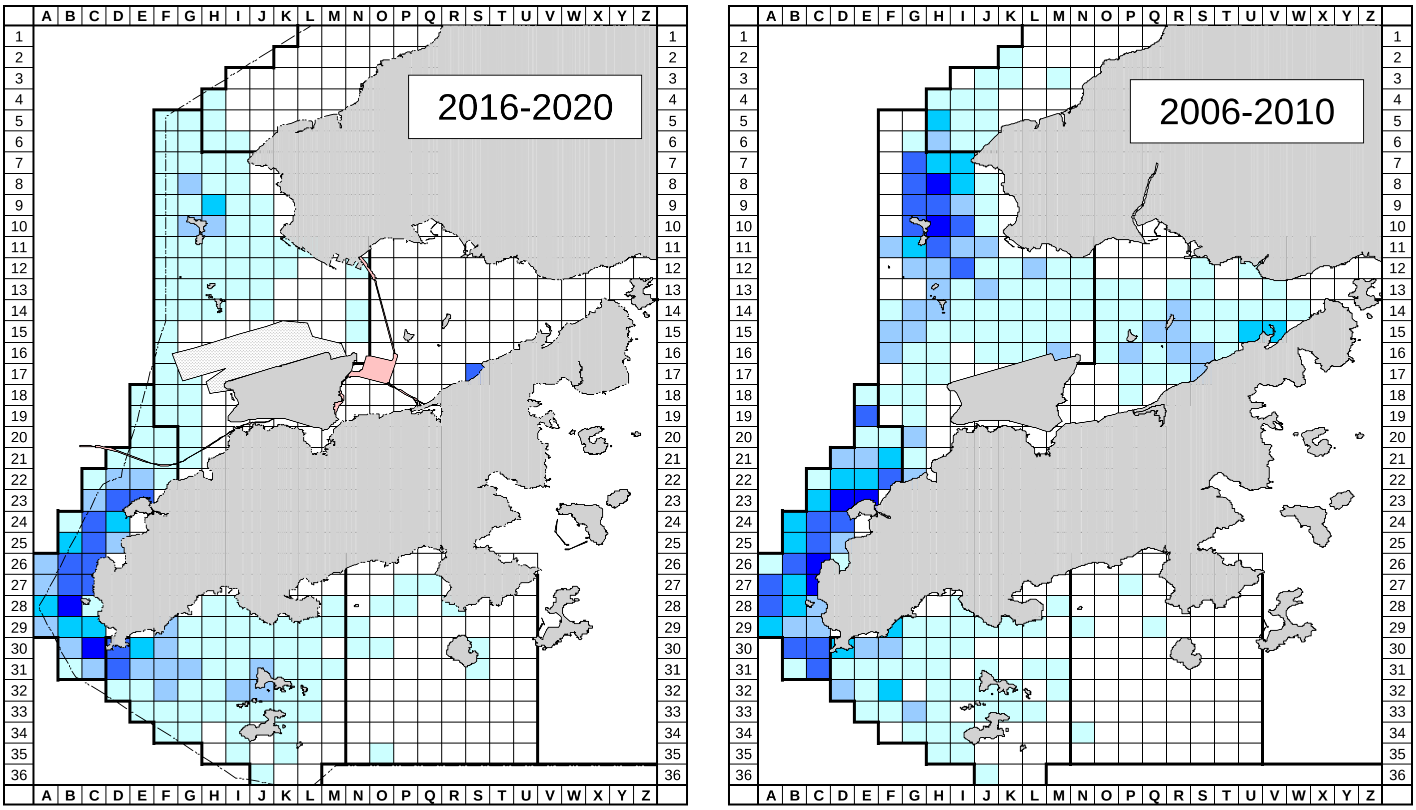


Figure 21b. Habitat ratings of CWD assessed among 352 grids around Lantau under the scoring criteria of **DPSE (Overall)**
(= Rank 1; = Rank 2; = Rank 3; = Rank 4; = Rank 5; ranking/scoring criteria for Chinese White Dolphins can be referred to Table 1)

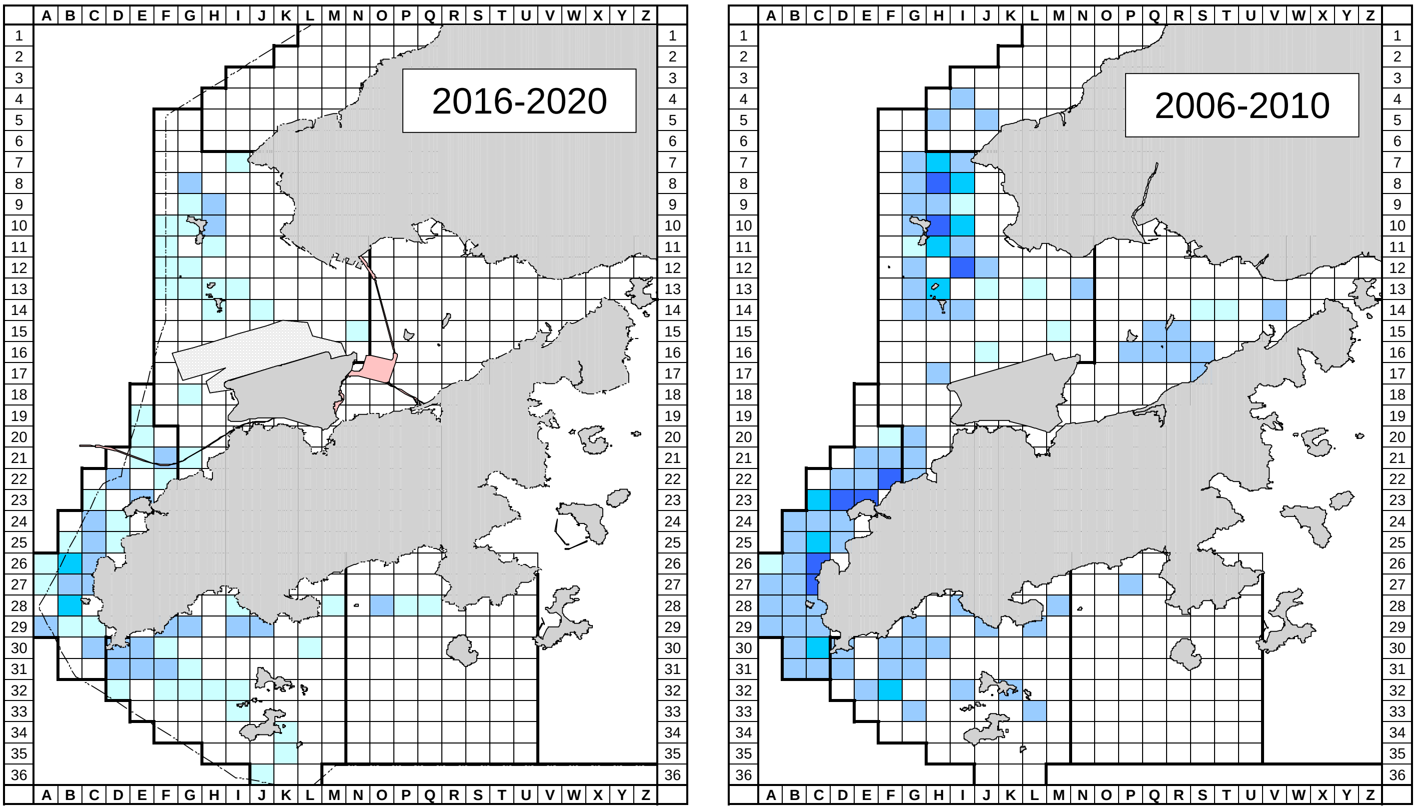


Figure 22a. Habitat ratings of CWD assessed among 352 grids around Lantau under the scoring criteria of **SPSE (Feeding Activities)**
(= Rank 1; = Rank 2; = Rank 3; = Rank 4; = Rank 5; ranking/scoring criteria for Chinese White Dolphins can be referred to Table 1)

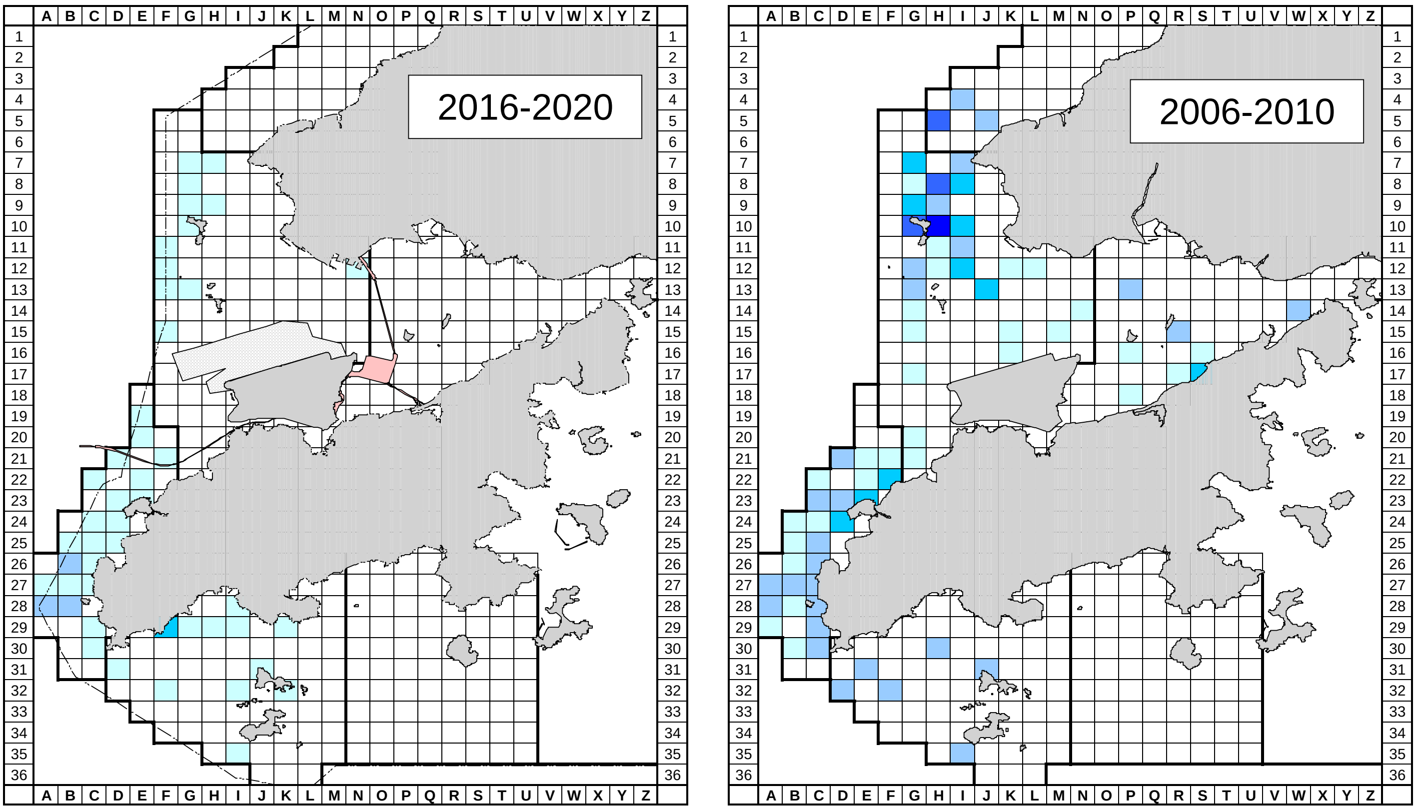


Figure 22b. Habitat ratings of CWD assessed among 352 grids around Lantau under the scoring criteria of **SPSE (Socializing Activities)**
(= Rank 1; = Rank 2; = Rank 3; = Rank 4; = Rank 5; ranking/scoring criteria for Chinese White Dolphins can be referred to Table 1)

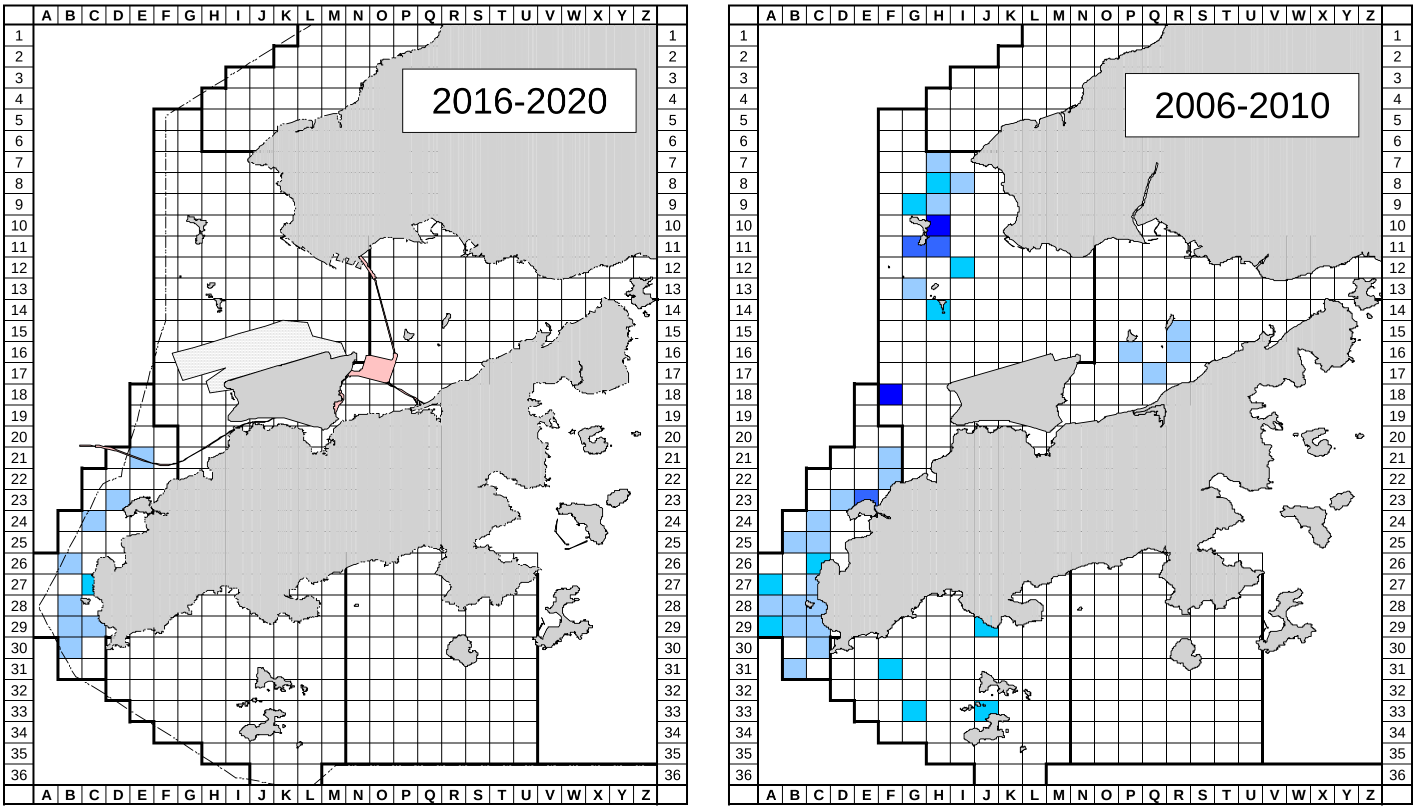


Figure 23a. Habitat ratings of CWD assessed among 352 grids around Lantau under the scoring criteria of **DPSE (Unspotted Calves)**
(= Rank 1; = Rank 2; = Rank 3; = Rank 4; = Rank 5; ranking/scoring criteria for Chinese White Dolphins can be referred to Table 1)

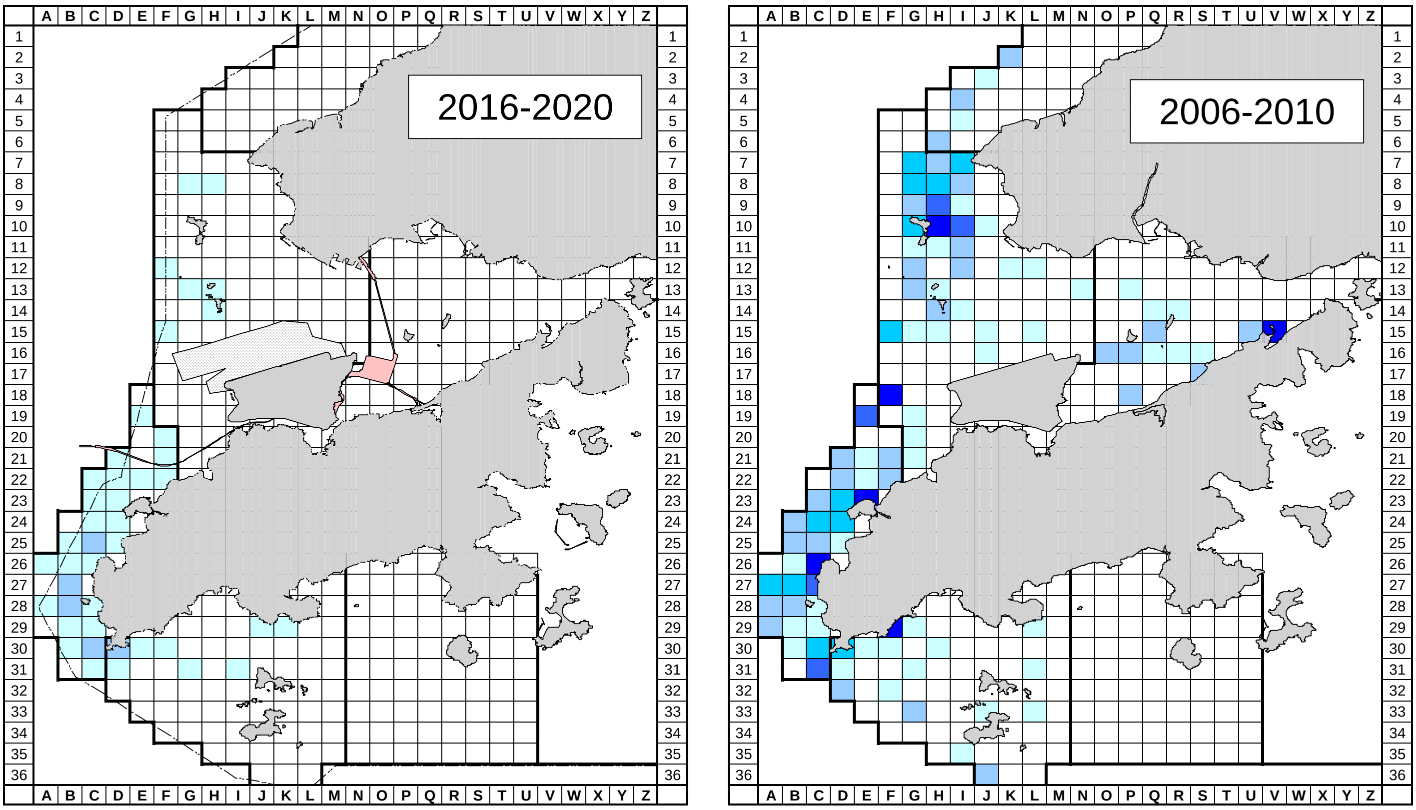


Figure 23b. Habitat ratings of CWD assessed among 352 grids around Lantau under the scoring criteria of **DPSE (Unspotted Juveniles)**
(= Rank 1; = Rank 2; = Rank 3; = Rank 4; = Rank 5; ranking/scoring criteria for Chinese White Dolphins can be referred to Table 1)

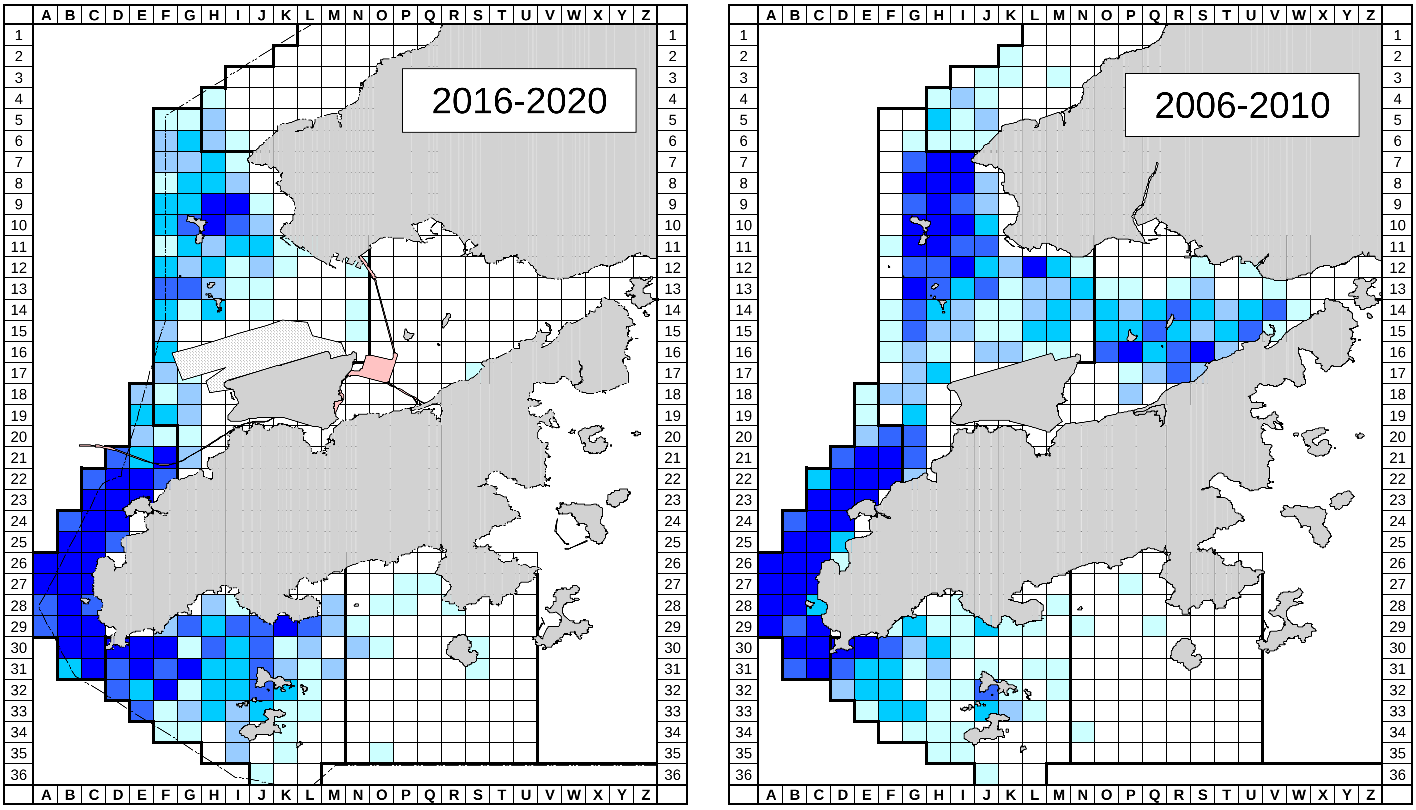


Figure 24a. Habitat ratings of CWD assessed among 352 grids around Lantau under the scoring criteria of **Interannual Occurrence**
(= Rank 1; = Rank 2; = Rank 3; = Rank 4; = Rank 5; ranking/scoring criteria for Chinese White Dolphins can be referred to Table 1)

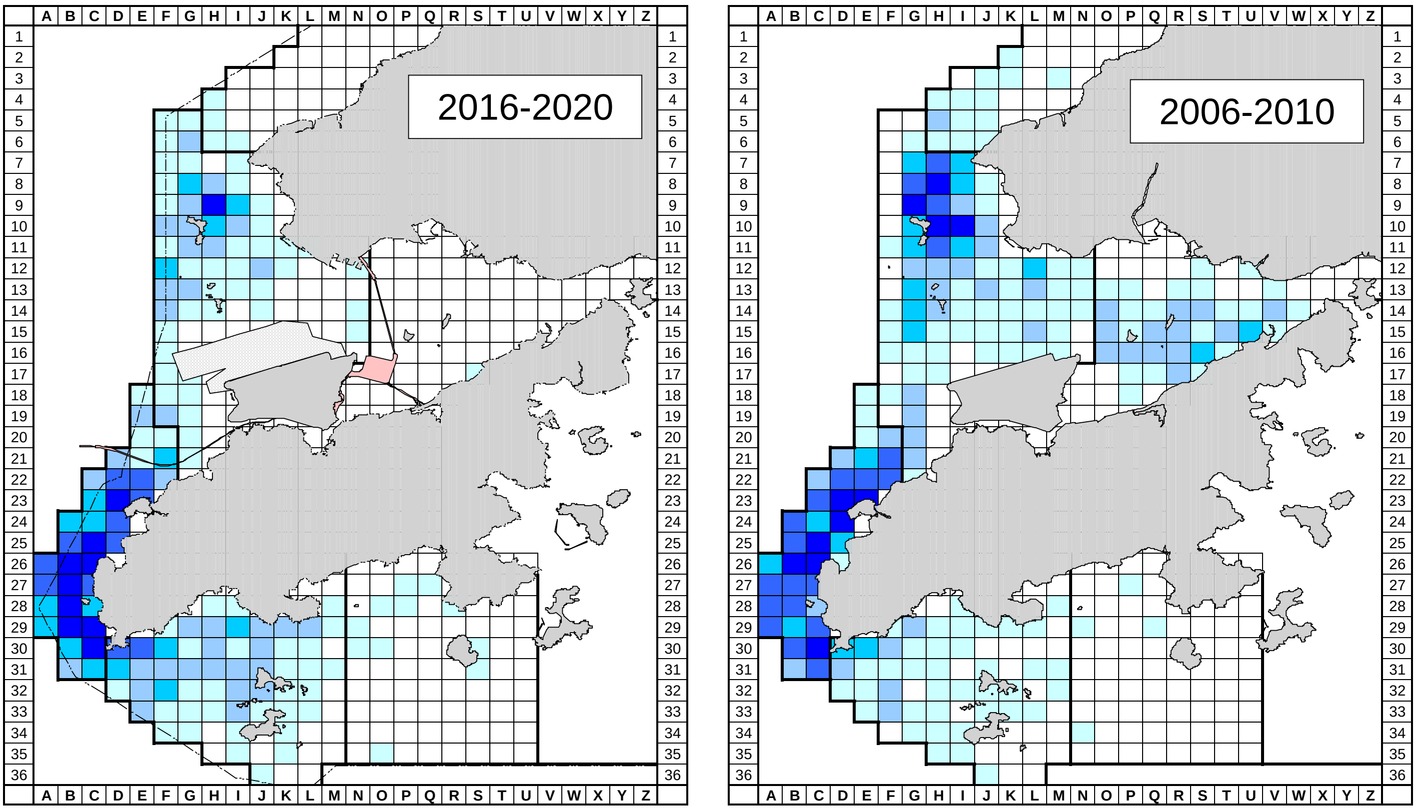


Figure 24b. Habitat ratings of CWD assessed among 352 grids around Lantau under the scoring criteria of **Seasonal Occurrence**
(= Rank 1; = Rank 2; = Rank 3; = Rank 4; = Rank 5; ranking/scoring criteria for Chinese White Dolphins can be referred to Table 1)

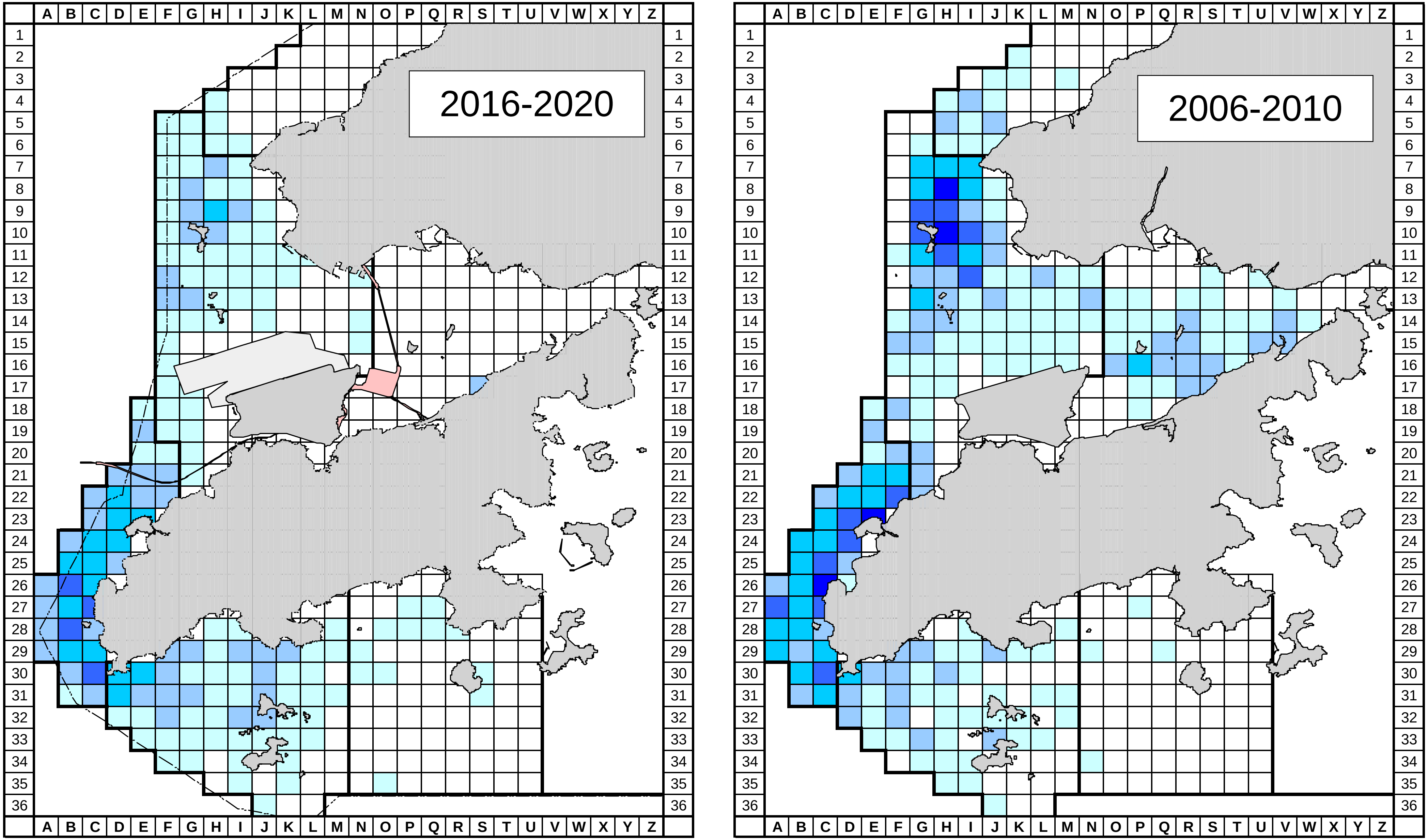


Figure 25. Overall CWD Habitat Ratings using quantitative dolphin habitat use information collected during 2016-2020 & 2006-2010

(=score 1-8; =score 9-16; = score 17-24; = score 25-32; = score 33-40)

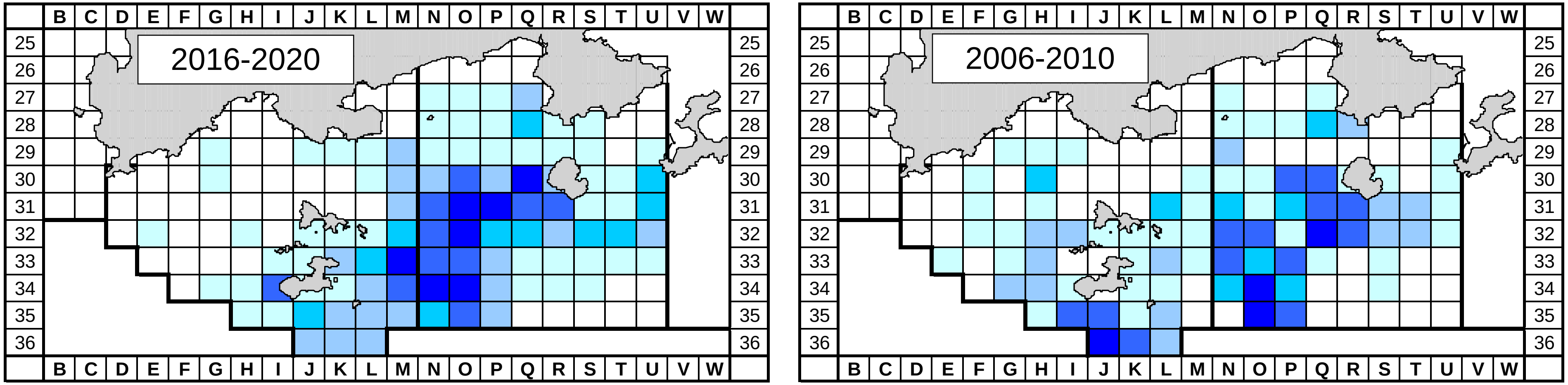


Figure 26a. Habitat ratings of FP assessed among 135 grids in South Lantau waters under the scoring criteria of **SPSE during dry season**
(= Rank 1; = Rank 2; = Rank 3; = Rank 4; = Rank 5; ranking/scoring criteria for finless porpoises can be referred to Table 1)

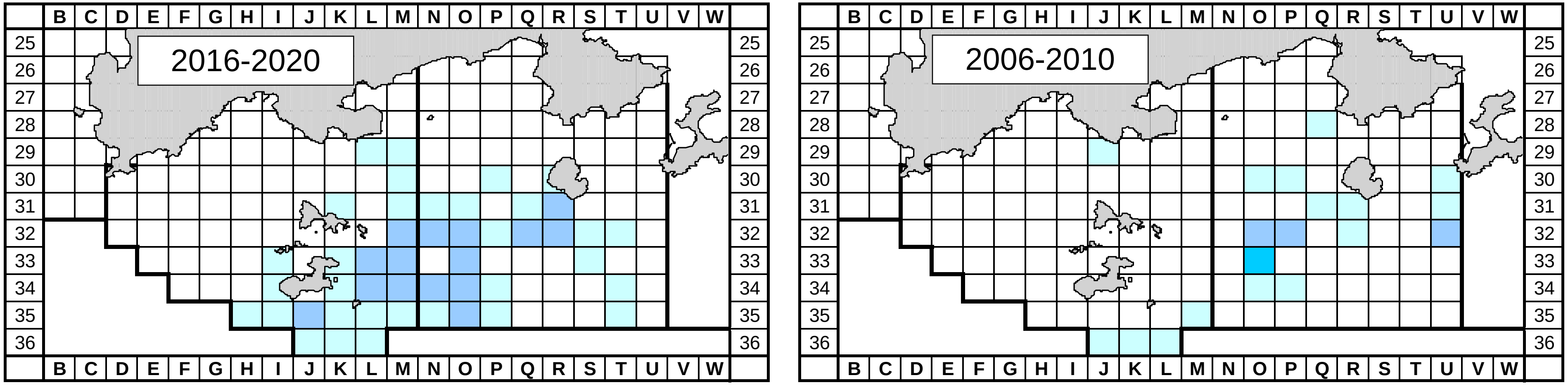


Figure 26b. Habitat ratings of FP assessed among 135 grids in South Lantau waters under the scoring criteria of **SPSE during wet season**
(= Rank 1; = Rank 2; = Rank 3; = Rank 4; = Rank 5; ranking/scoring criteria for finless porpoises can be referred to Table 1)

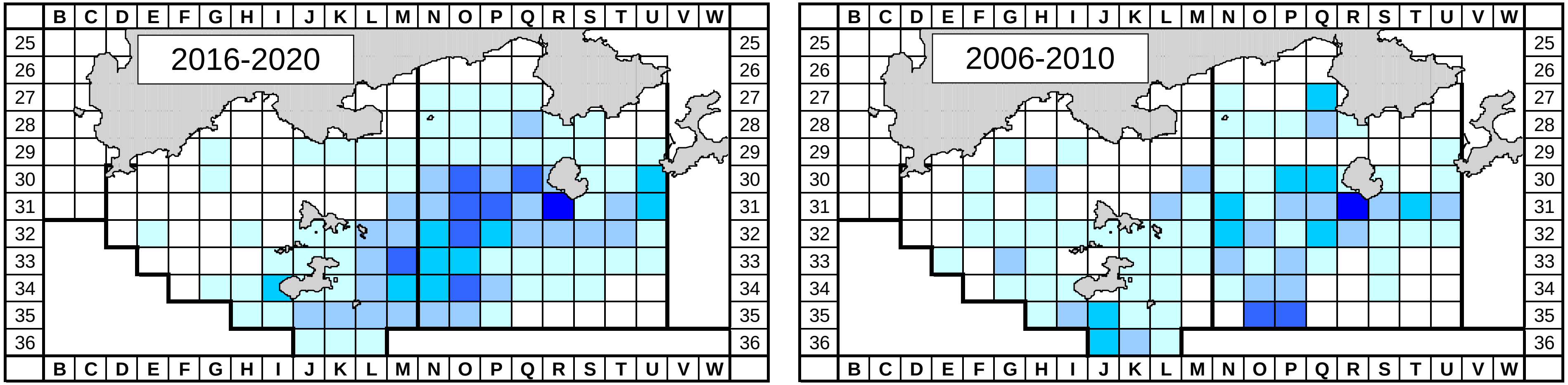


Figure 27a. Habitat ratings of FP assessed among 135 grids in South Lantau waters under the scoring criteria of **DPSE during dry season**
(= Rank 1; = Rank 2; = Rank 3; = Rank 4; = Rank 5; ranking/scoring criteria for finless porpoises can be referred to Table 1)

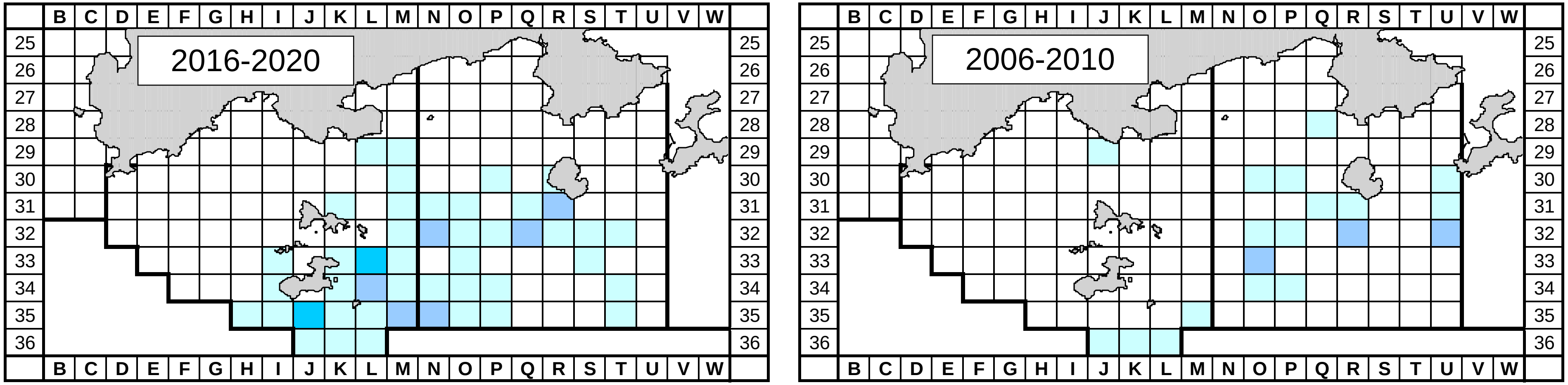


Figure 27b. Habitat ratings of FP assessed among 135 grids in South Lantau waters under the scoring criteria of **DPSE during wet season**
(= Rank 1; = Rank 2; = Rank 3; = Rank 4; = Rank 5; ranking/scoring criteria for finless porpoises can be referred to Table 1)

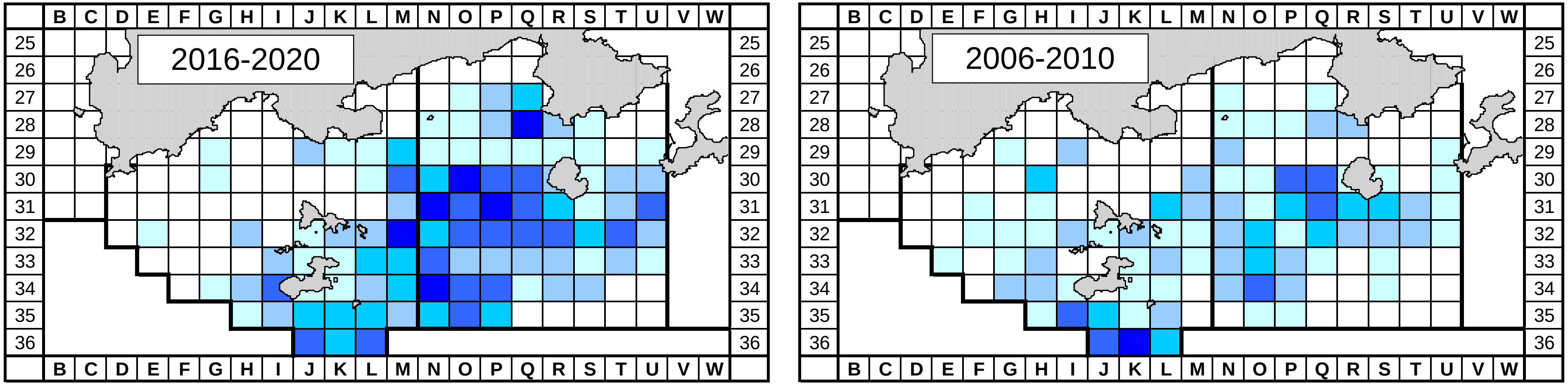


Figure 28a. Habitat ratings of FP assessed among 135 grids in South Lantau waters under the scoring criteria of **Interannual Occurence during dry season** (= Rank 1; = Rank 2; = Rank 3; = Rank 4; = Rank 5; ranking/scoring criteria for finless porpoises can be referred to Table 1)

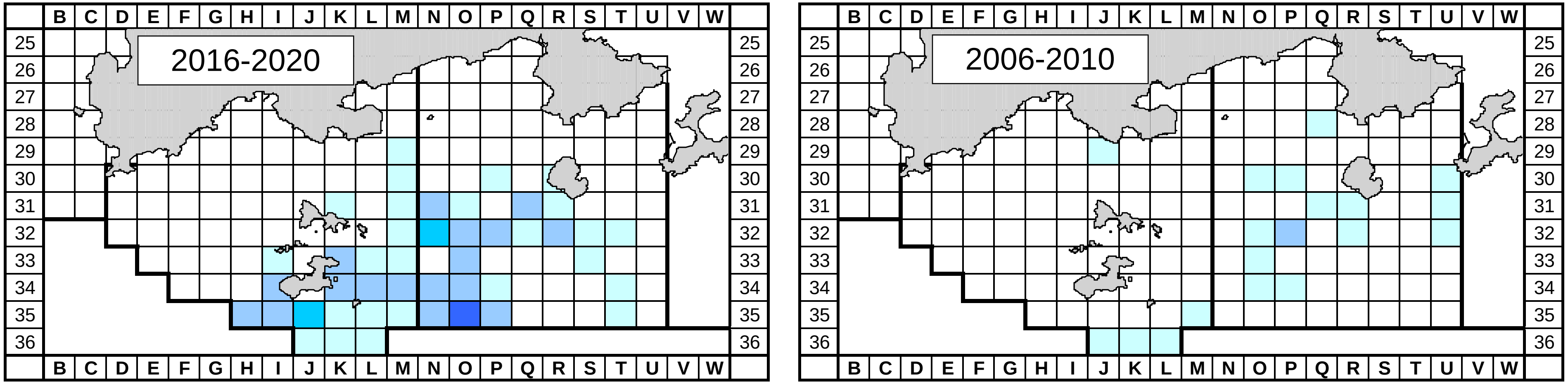


Figure 28b. Habitat ratings of FP assessed among 135 grids in South Lantau waters under the scoring criteria of **Interannual Occurrence during wet season** (= Rank 1; = Rank 2; = Rank 3; = Rank 4; = Rank 5; ranking/scoring criteria for finless porpoises can be referred to Table 1)

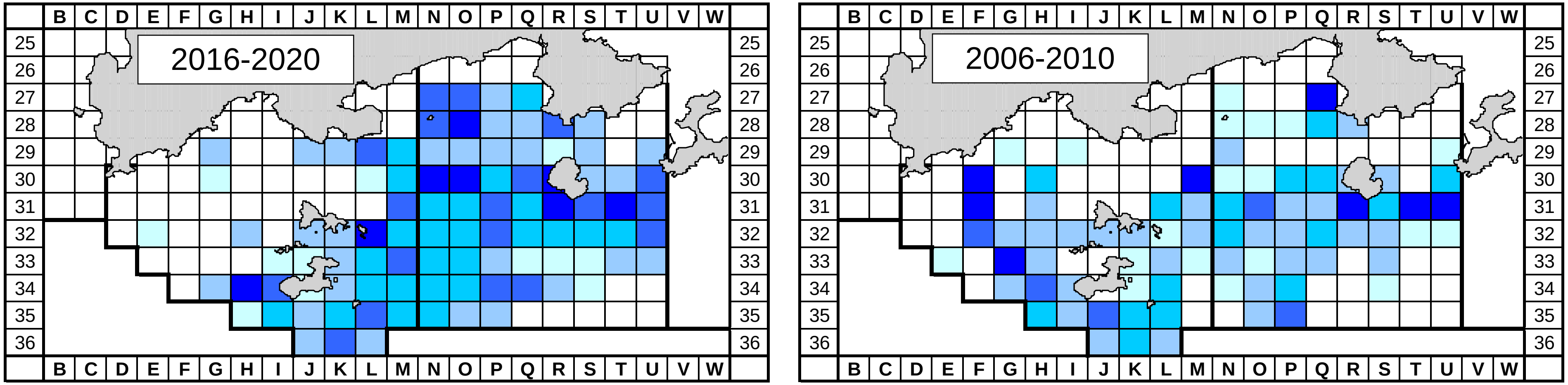


Figure 29a. Habitat ratings of FP assessed among 135 grids in South Lantau waters under the scoring criteria of **Average Group Size during dry season** (= Rank 1; = Rank 2; = Rank 3; = Rank 4; = Rank 5; ranking/scoring criteria for finless porpoises can be referred to Table 1)

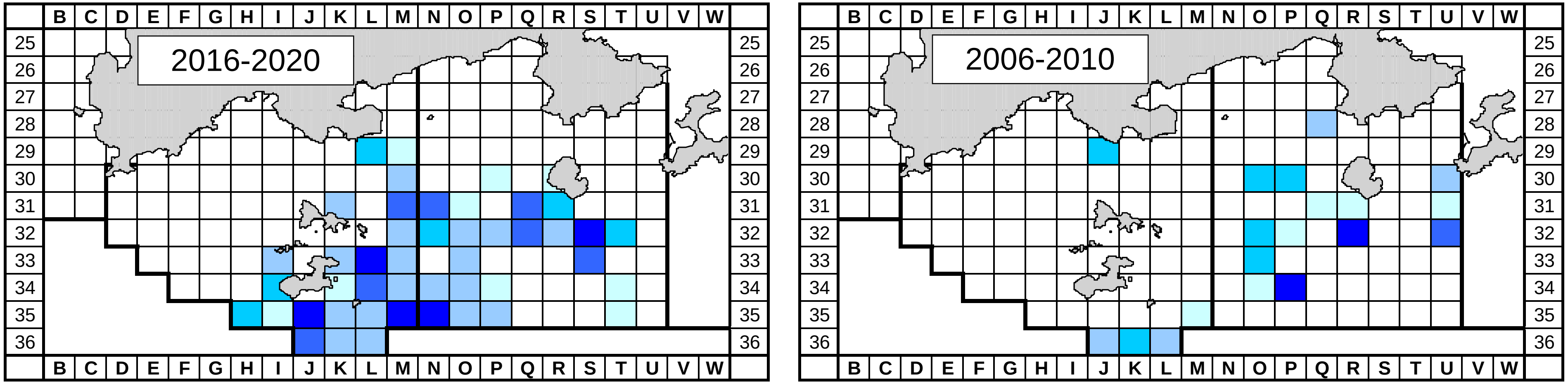
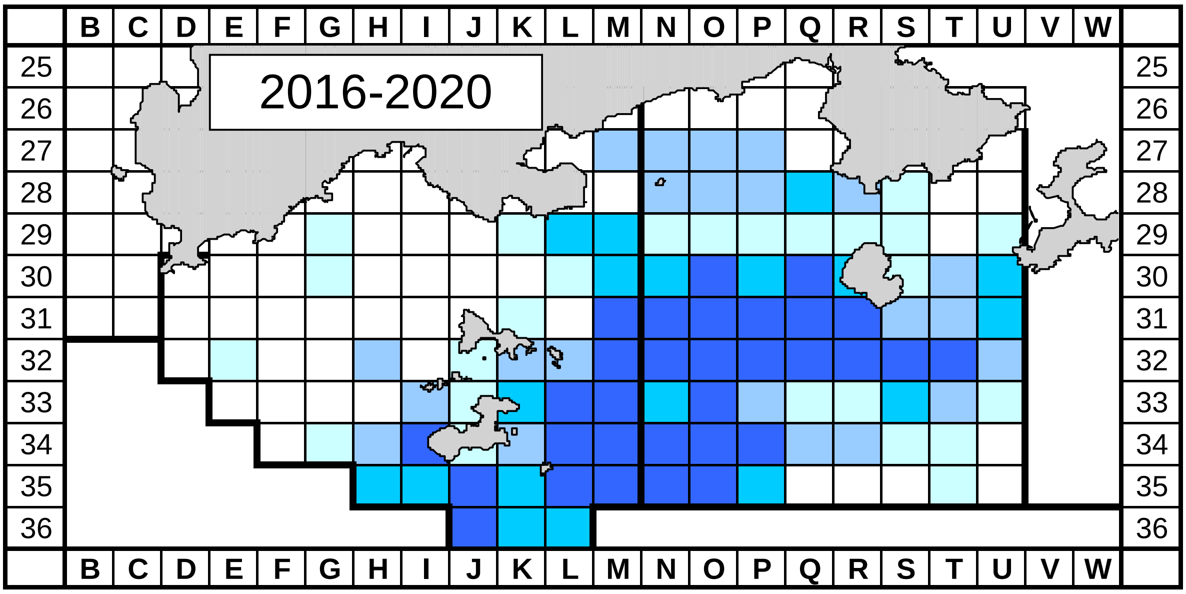


Figure 29b. Habitat ratings of FP assessed among 135 grids in South Lantau waters under the scoring criteria of **Average Group Size during wet season** (= Rank 1; = Rank 2; = Rank 3; = Rank 4; = Rank 5; ranking/scoring criteria for finless porpoises can be referred to Table 1)



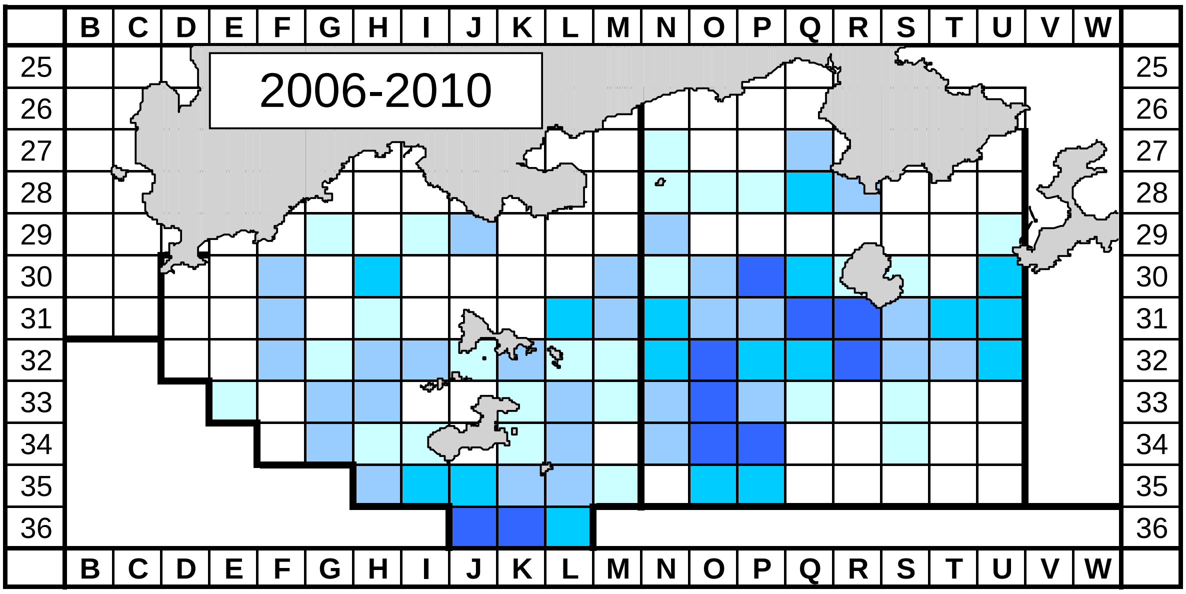


Figure 30. Overall FP Habitat Ratings using quantitative porpoise habitat use information collected during 2016-2020 & 2006-2010

(= score 1-5; = score 6-10; = score 11-15;
= score 16-25; = score 26-40)

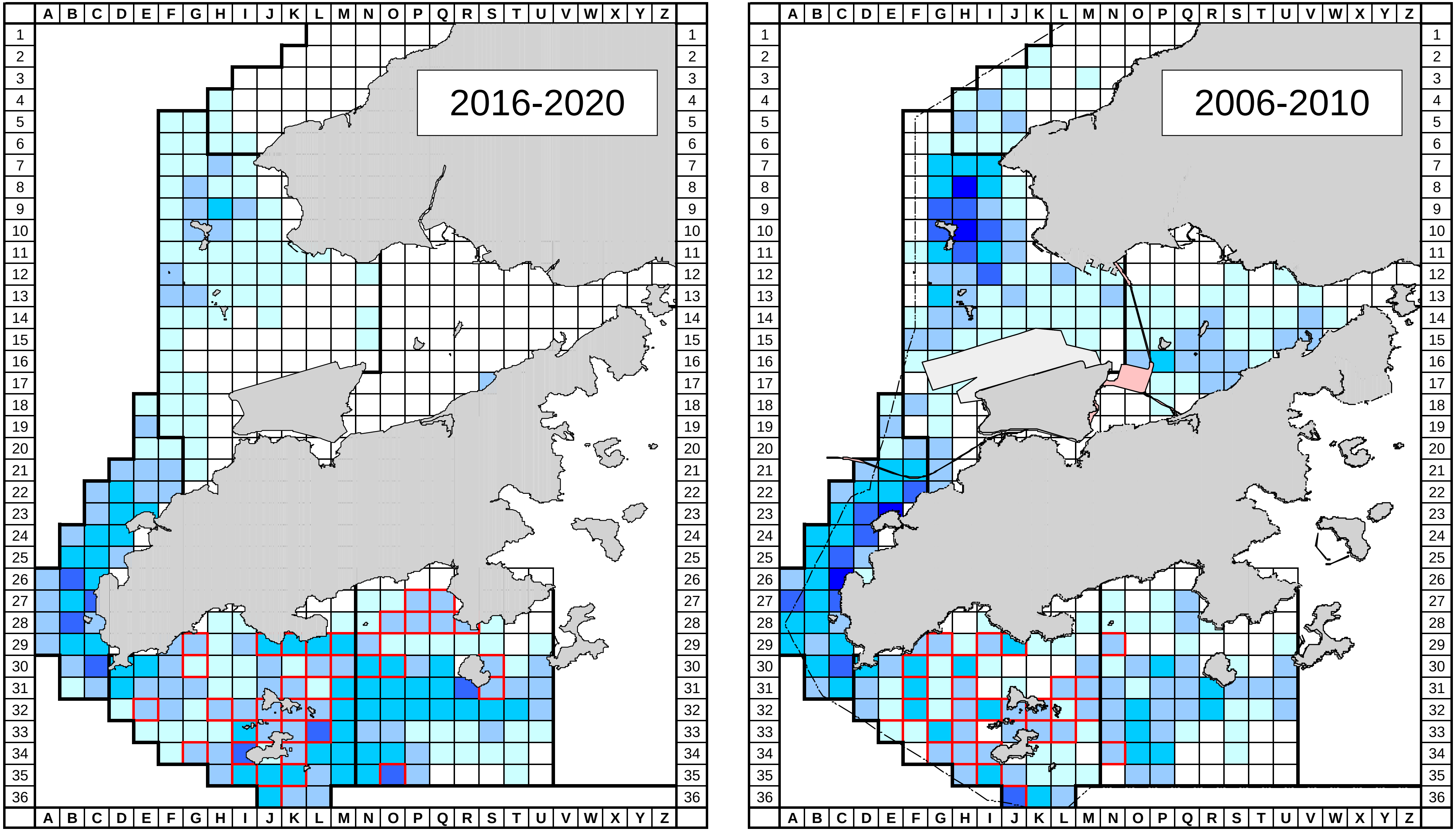


Figure 31. Overall Marine Mammal Habitat Ratings using quantitative habitat use information of Chinese White Dolphins and finless porpoises collected during 2016-2020 & 2006-2010

(= grid with occurrences of both CWD and FP; =score 1-8; =score 9-16; = score 17-24; = score 25-32; = score 33-40)

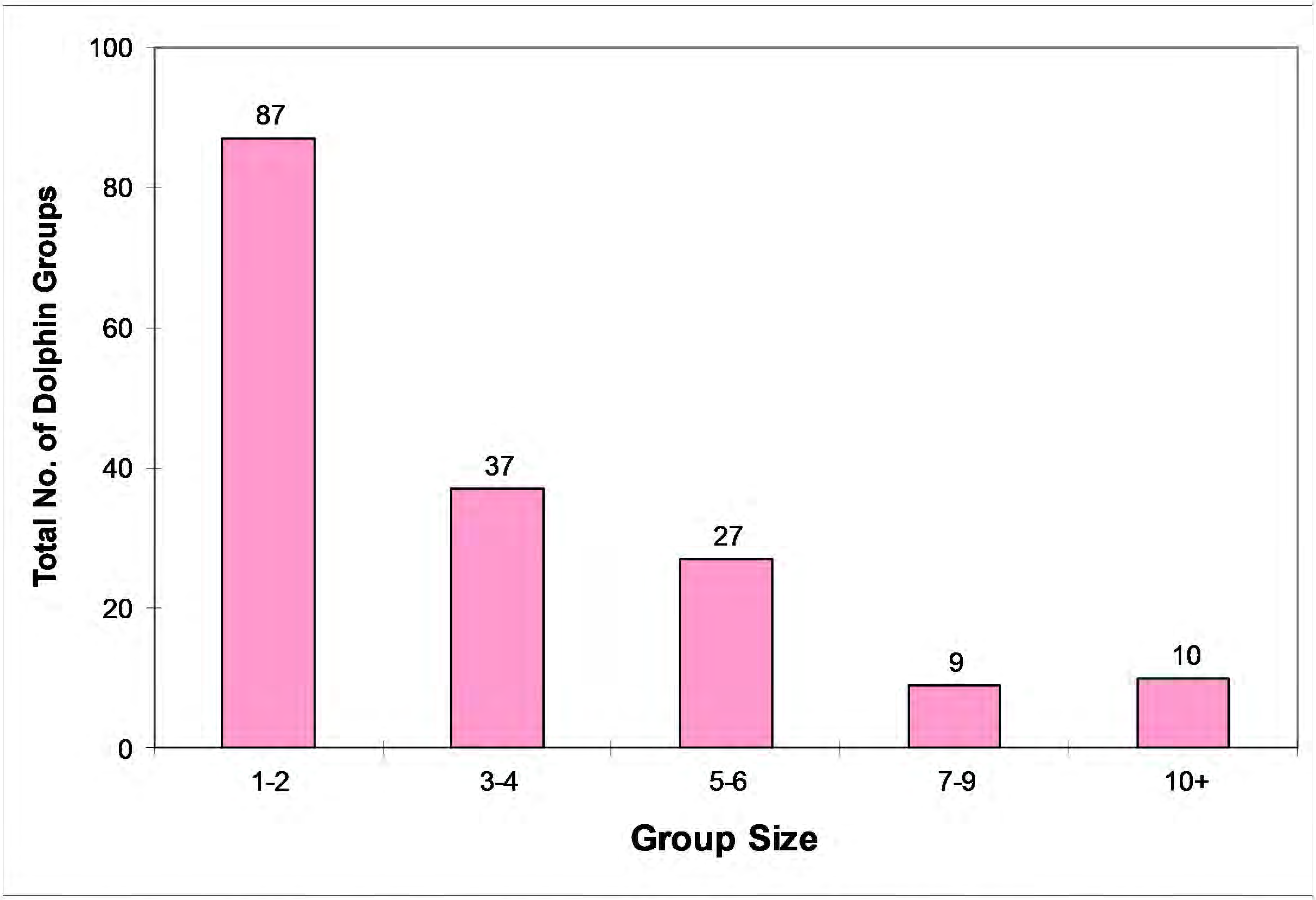


Figure 32. Total number of dolphin groups with different group sizes during April 2021 to March 2022

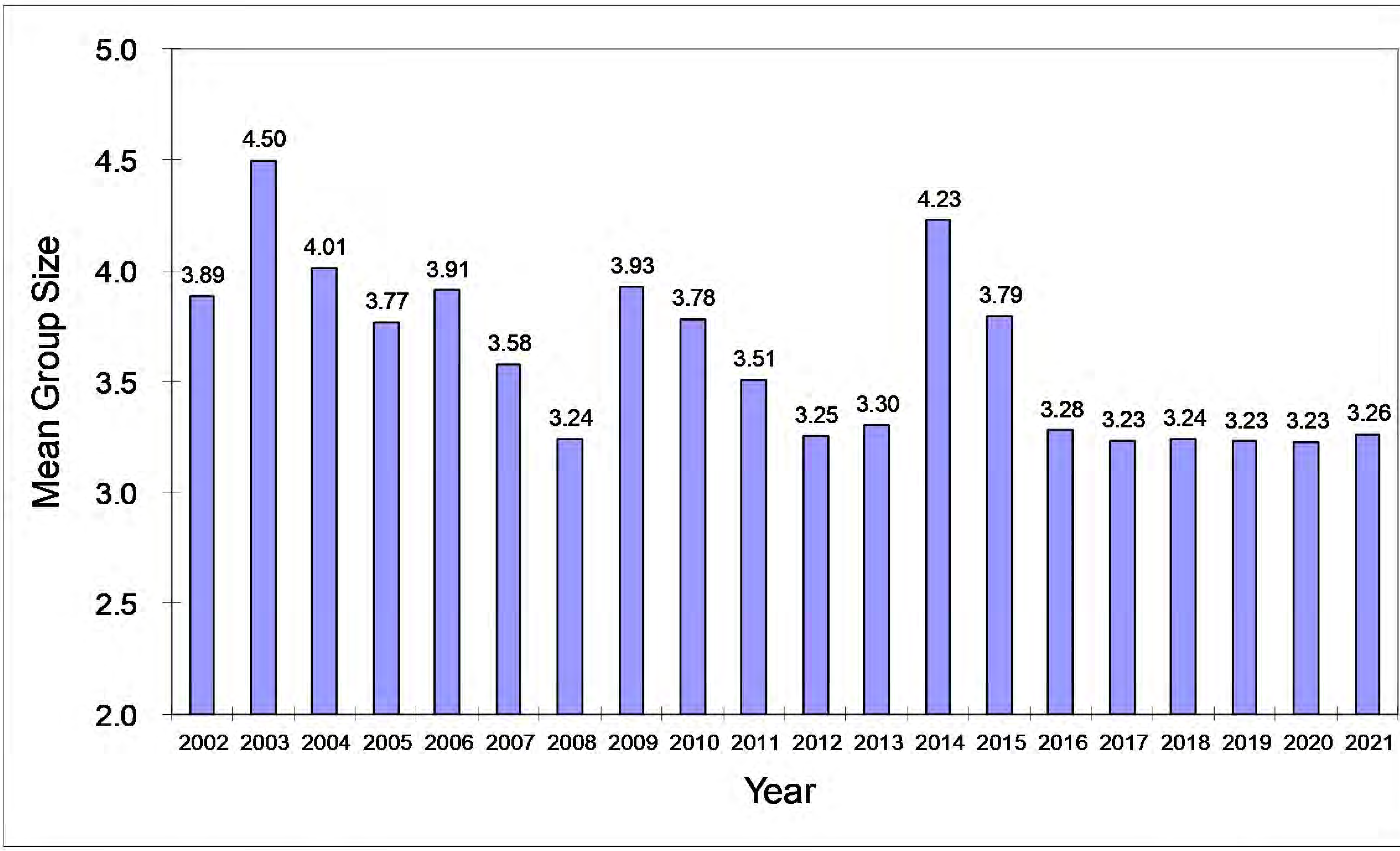


Figure 33. Temporal trend of mean dolphin group size in 2002-21

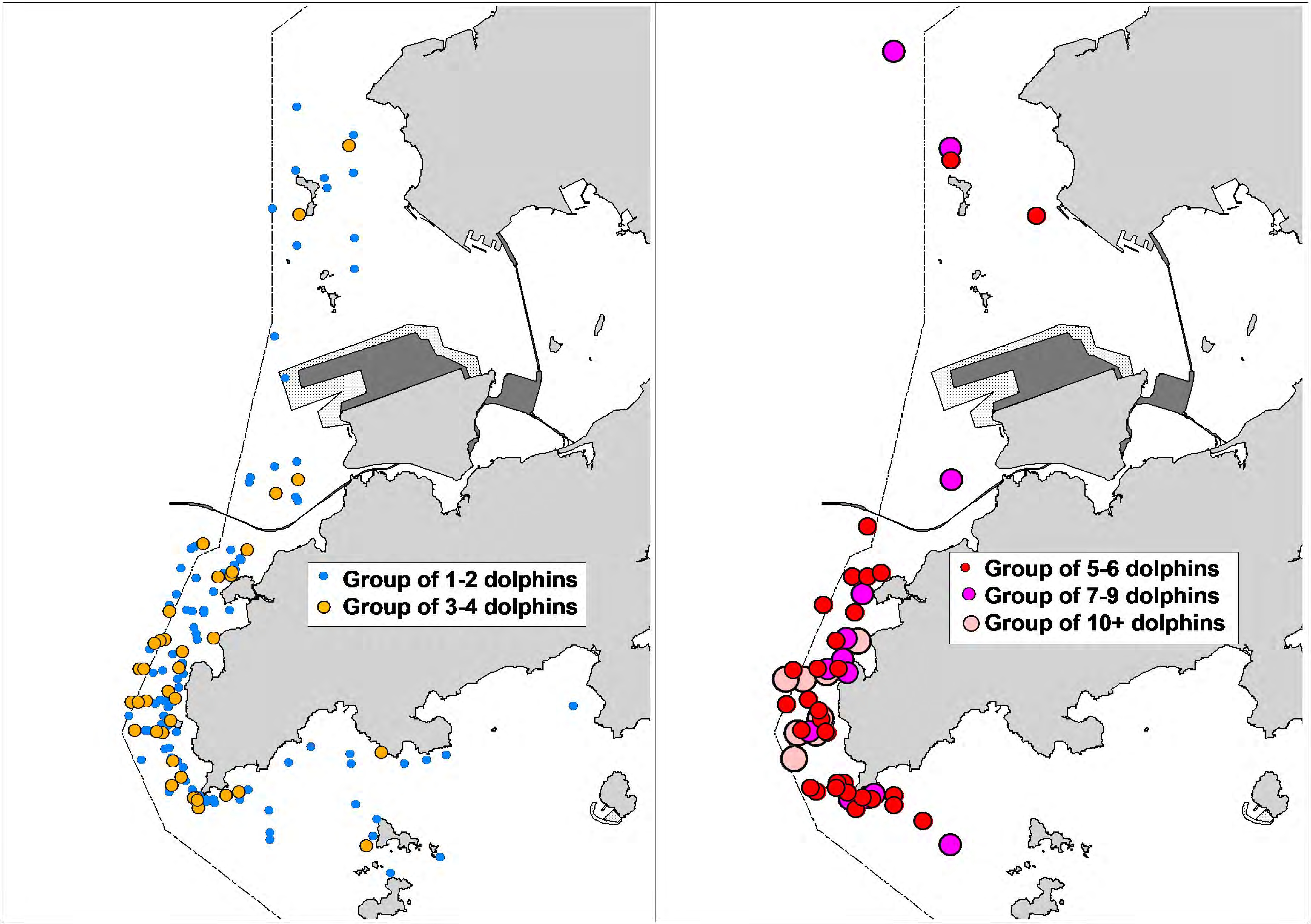


Figure 34. Distribution of Chinese White Dolphins with different group sizes in 2021

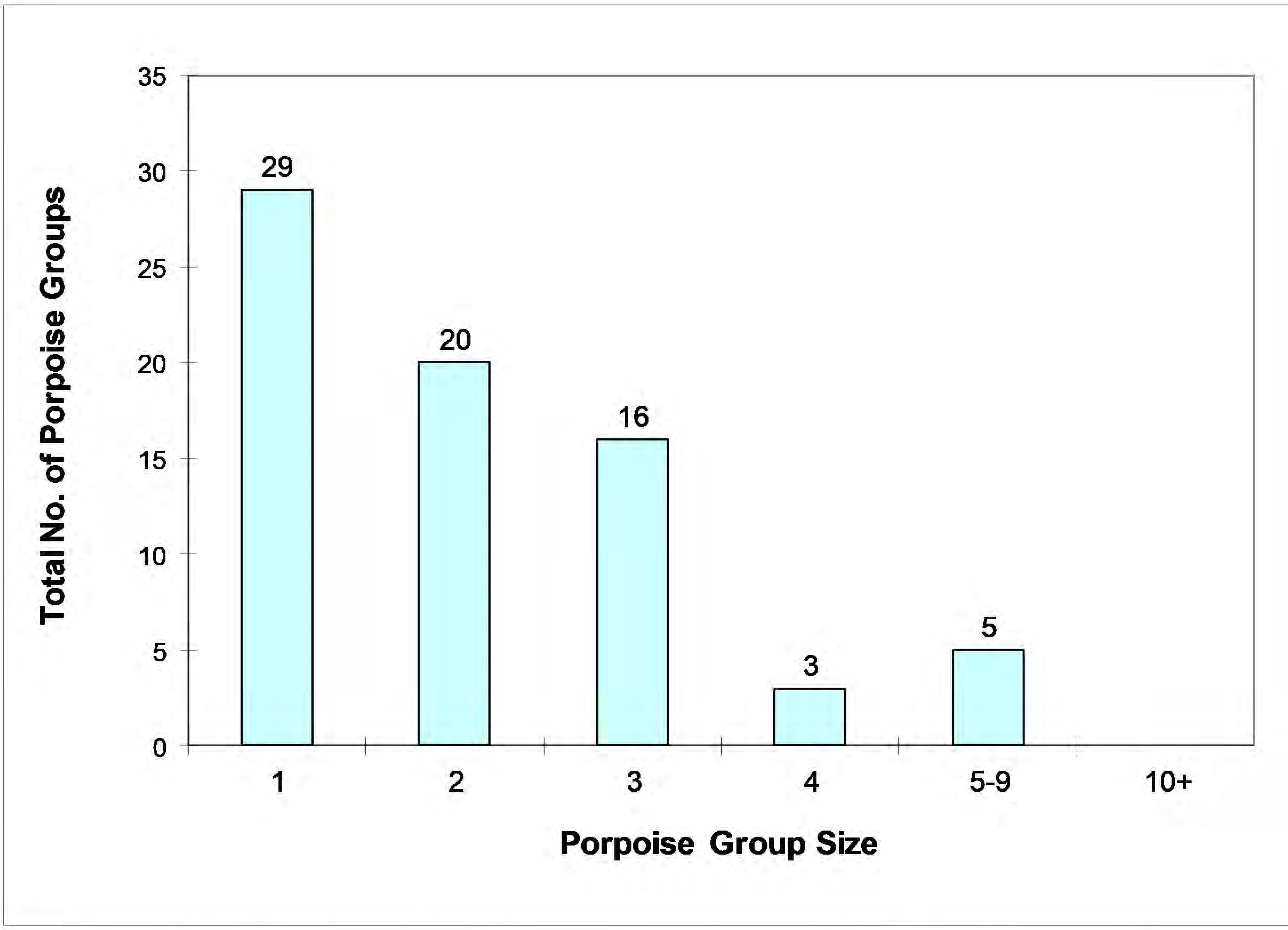


Figure 35. Total number of porpoise groups with different group sizes during April 2021 to March 2022

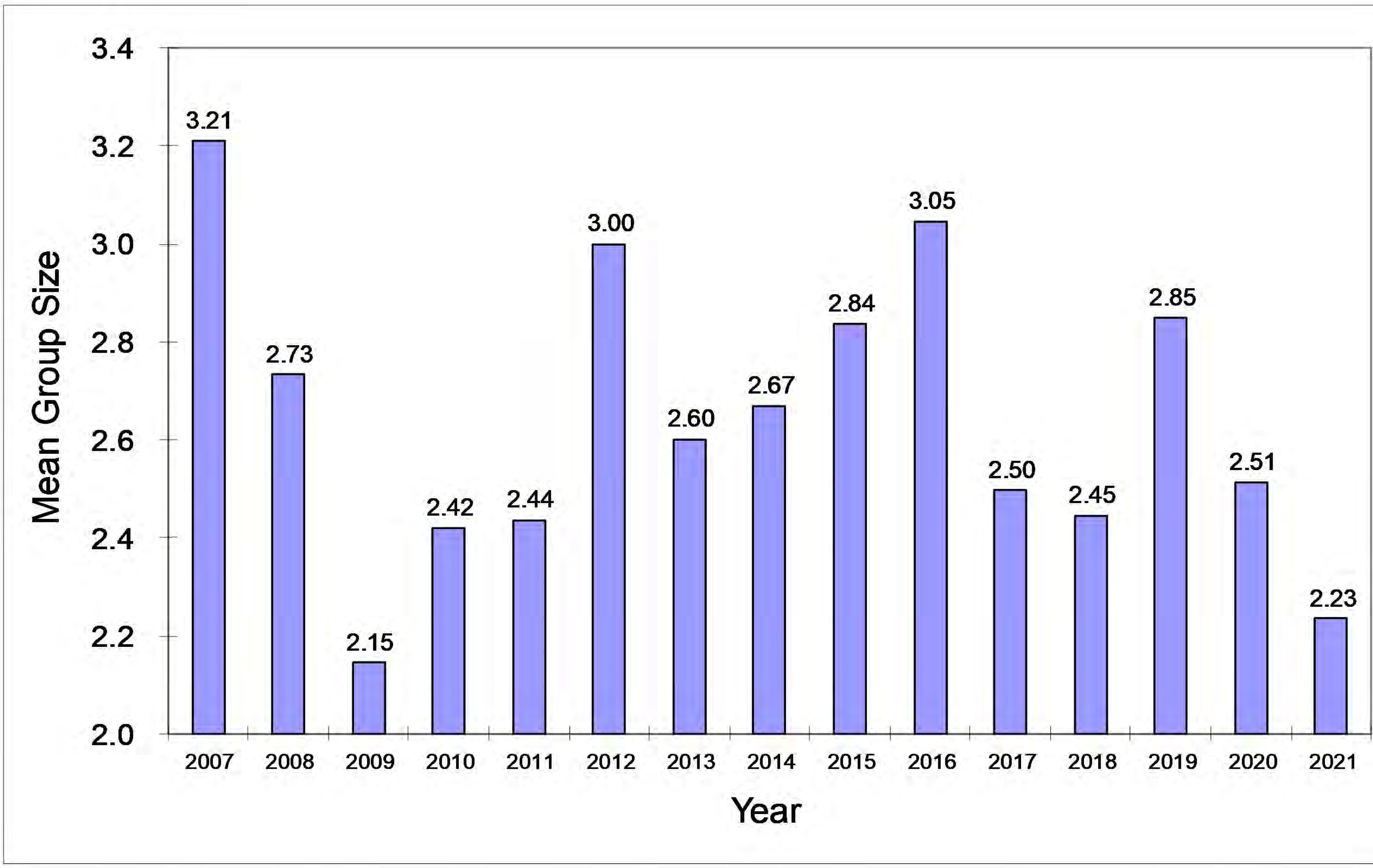


Figure 36. Temporal trend of mean porpoise group size in 2007-21

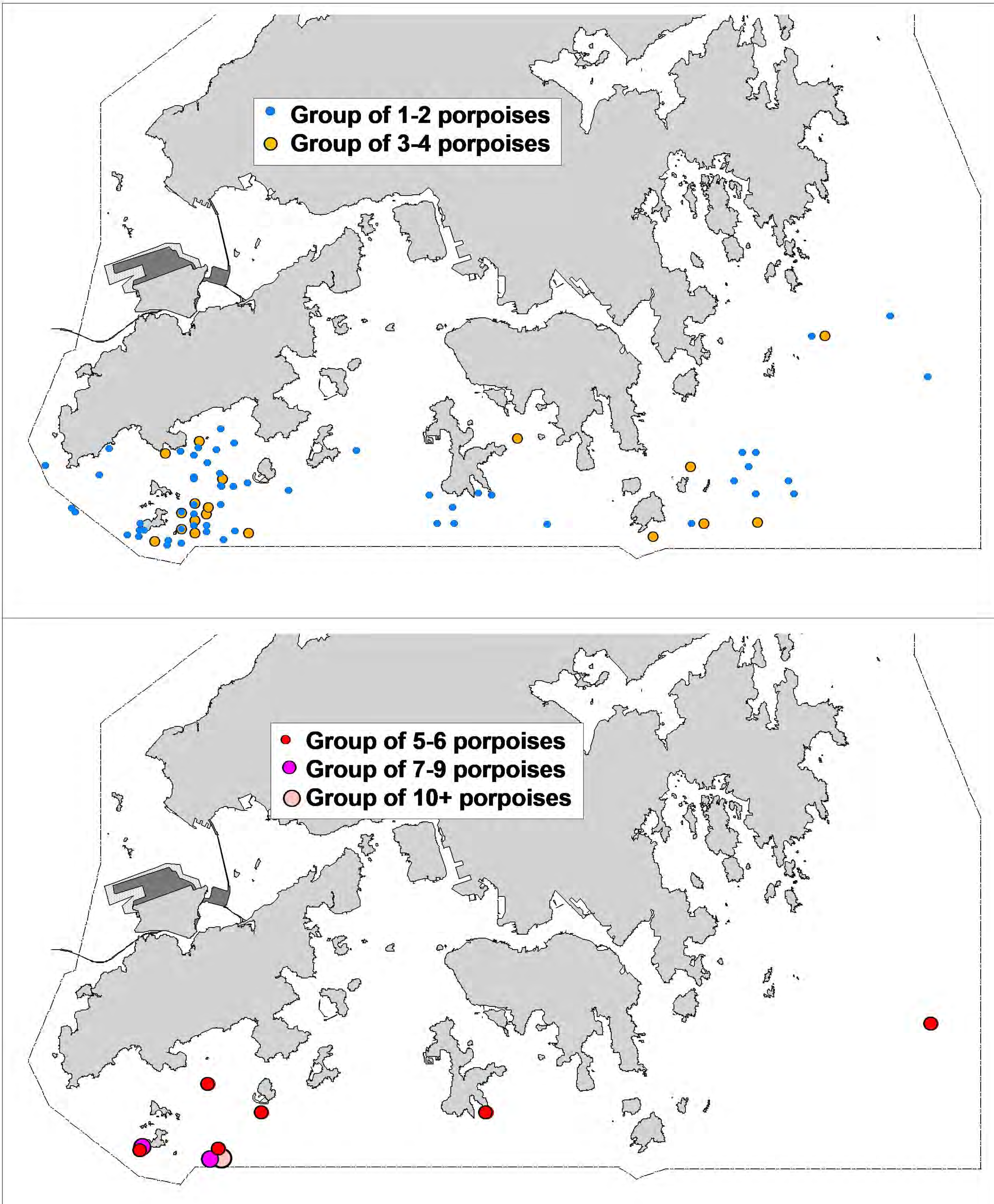


Figure 37. Distribution of finless porpoises with different group sizes in 2021

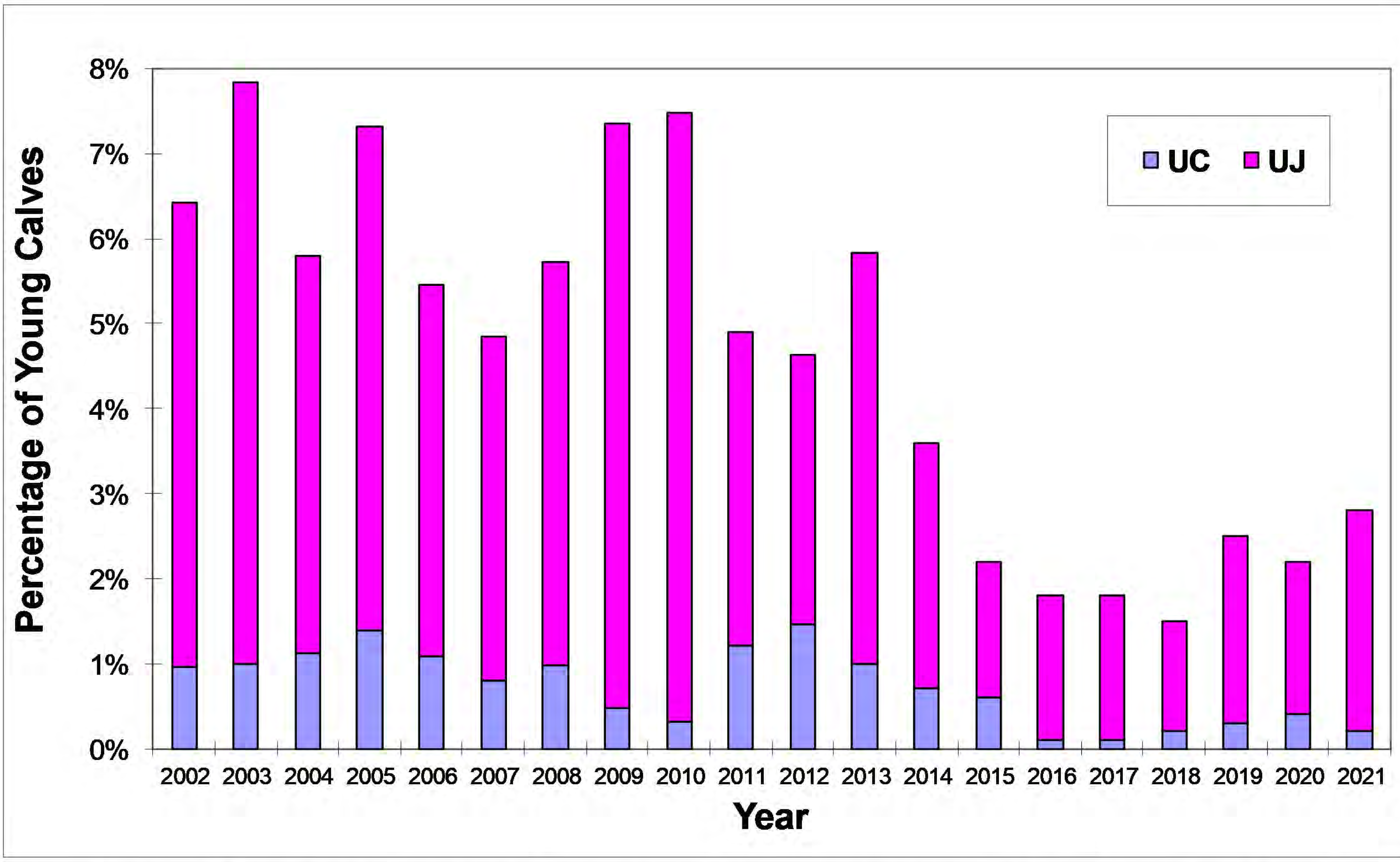


Figure 38. Percentages of young calves (i.e. Unspotted Calves (UC) and Unspotted Juveniles (UJ)) among all dolphin groups during 2002-21

Figure 39. Distribution of Unspotted Calves (purple dots) & Unspotted Juveniles (blue dots) in 2021

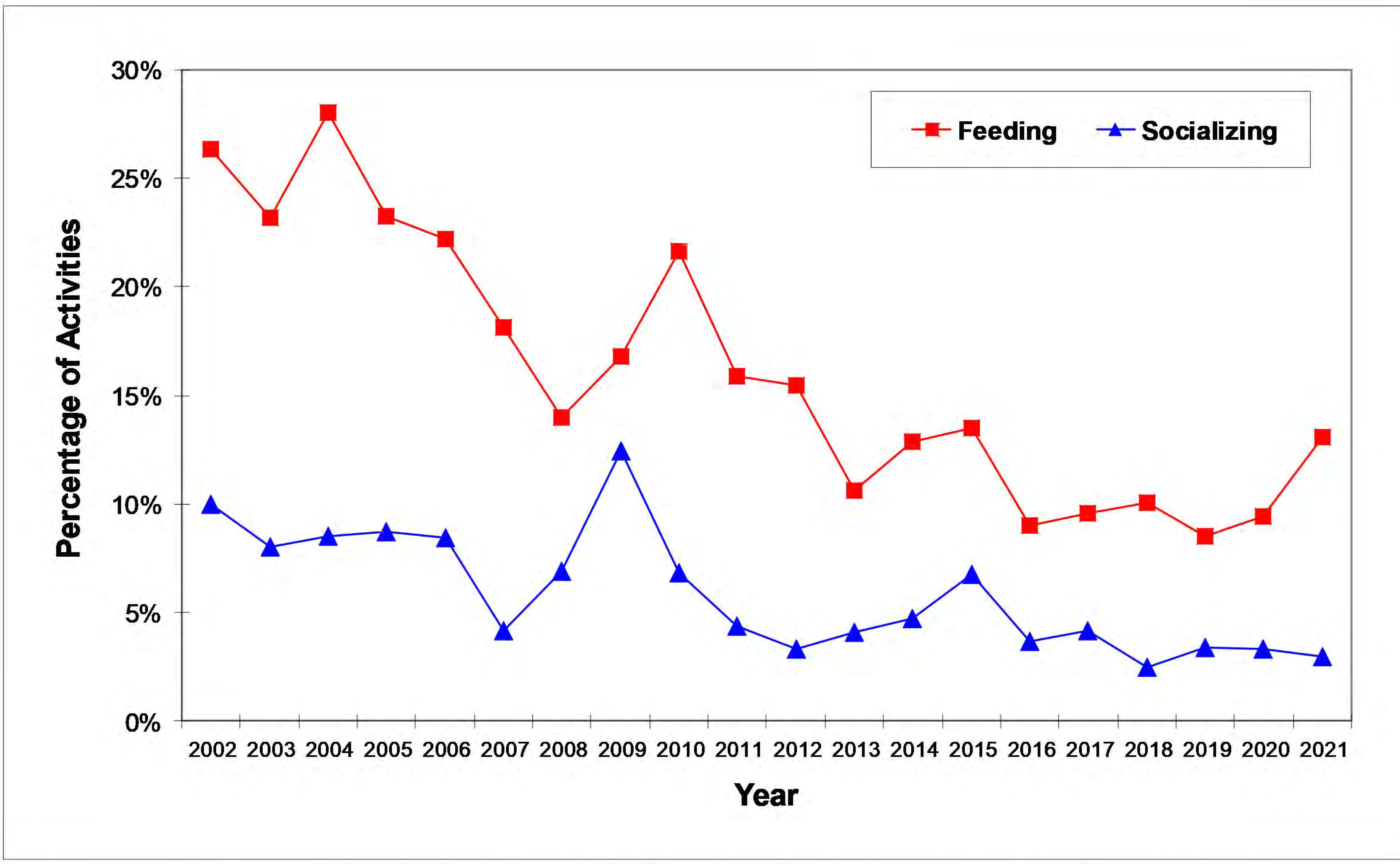


Figure 40. Percentages of feeding and socializing activities among all dolphin groups sighted in Hong Kong during 2002-21

Figure 41. Distribution of Chinese white dolphins engaged in feeding (orange dots), socializing (blue dots) and traveling (green dot) activities in 2021

Figure 42. Distribution of dolphin sightings associated with fishing boats (green dots: purse-seiners; blue dots: gill-netters) in 2021

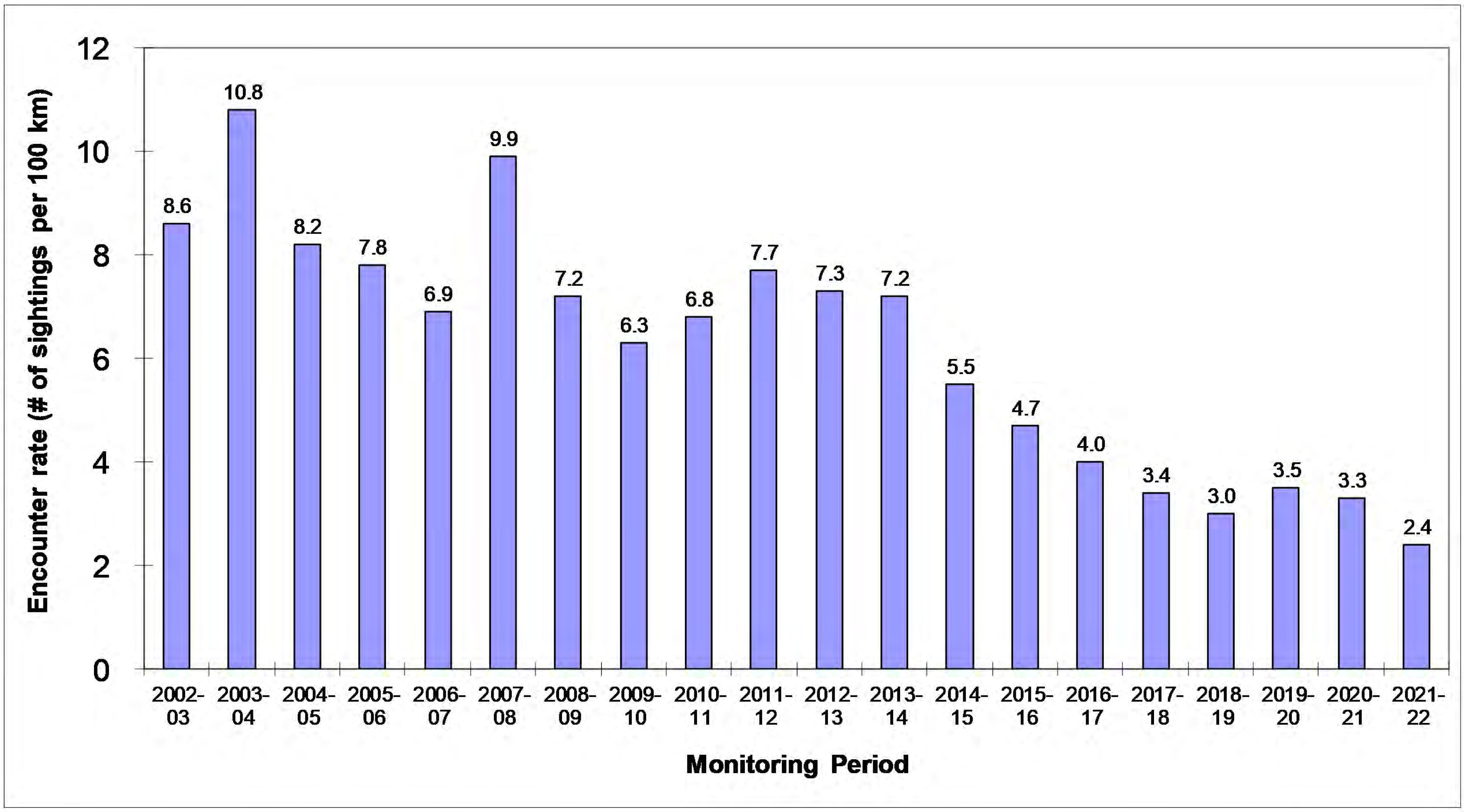


Figure 43a. Temporal trend in encounter rates of Chinese White Dolphins (combined from WL, NWL, NEL and SWL survey areas) in the past 20 monitoring periods from 2002-22

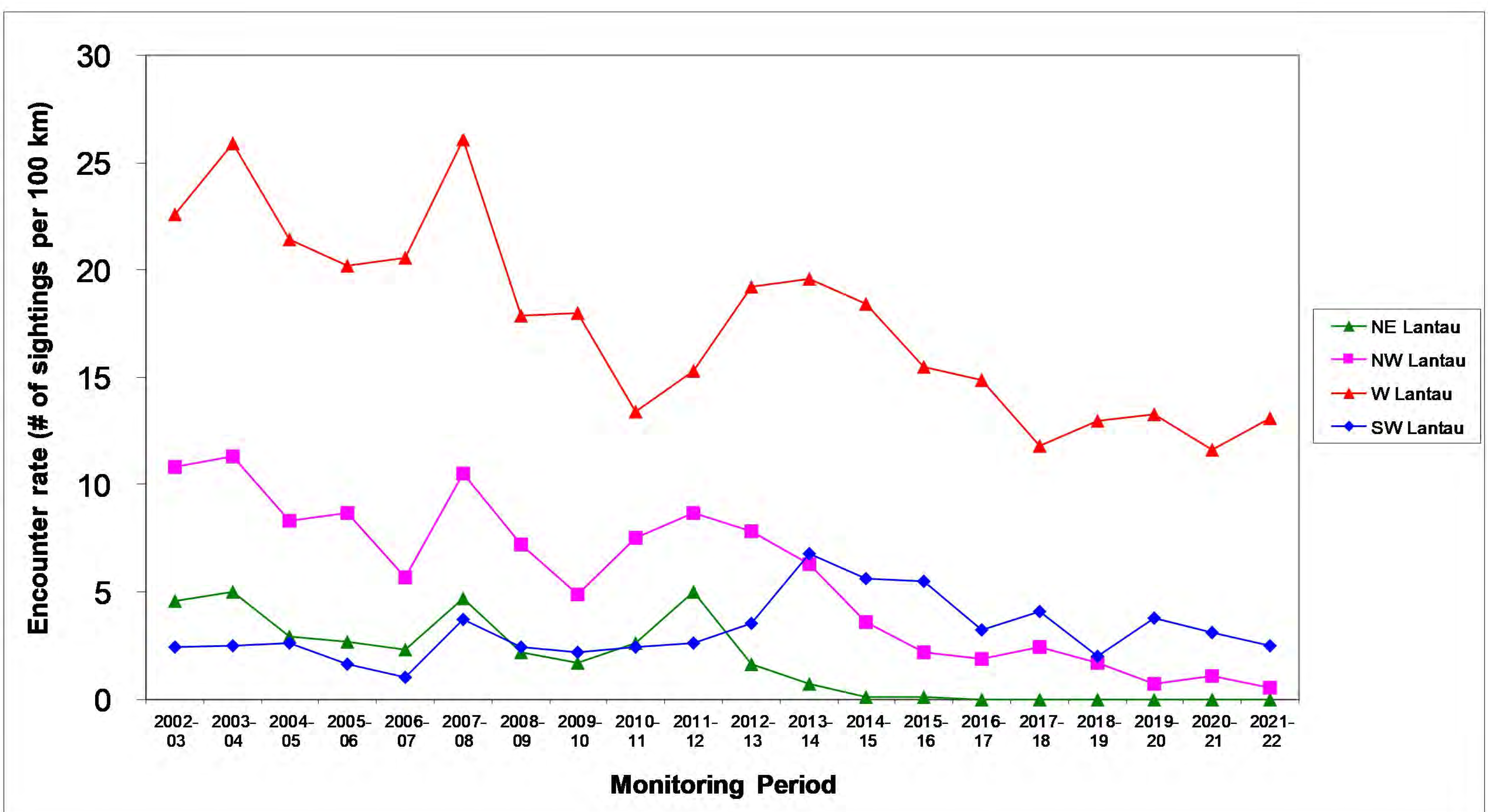


Figure 43b. Temporal trend in encounter rates of Chinese White Dolphins in each of the survey areas in WL, NWL, NEL and SWL waters in the past 20 monitoring periods from 2002-22

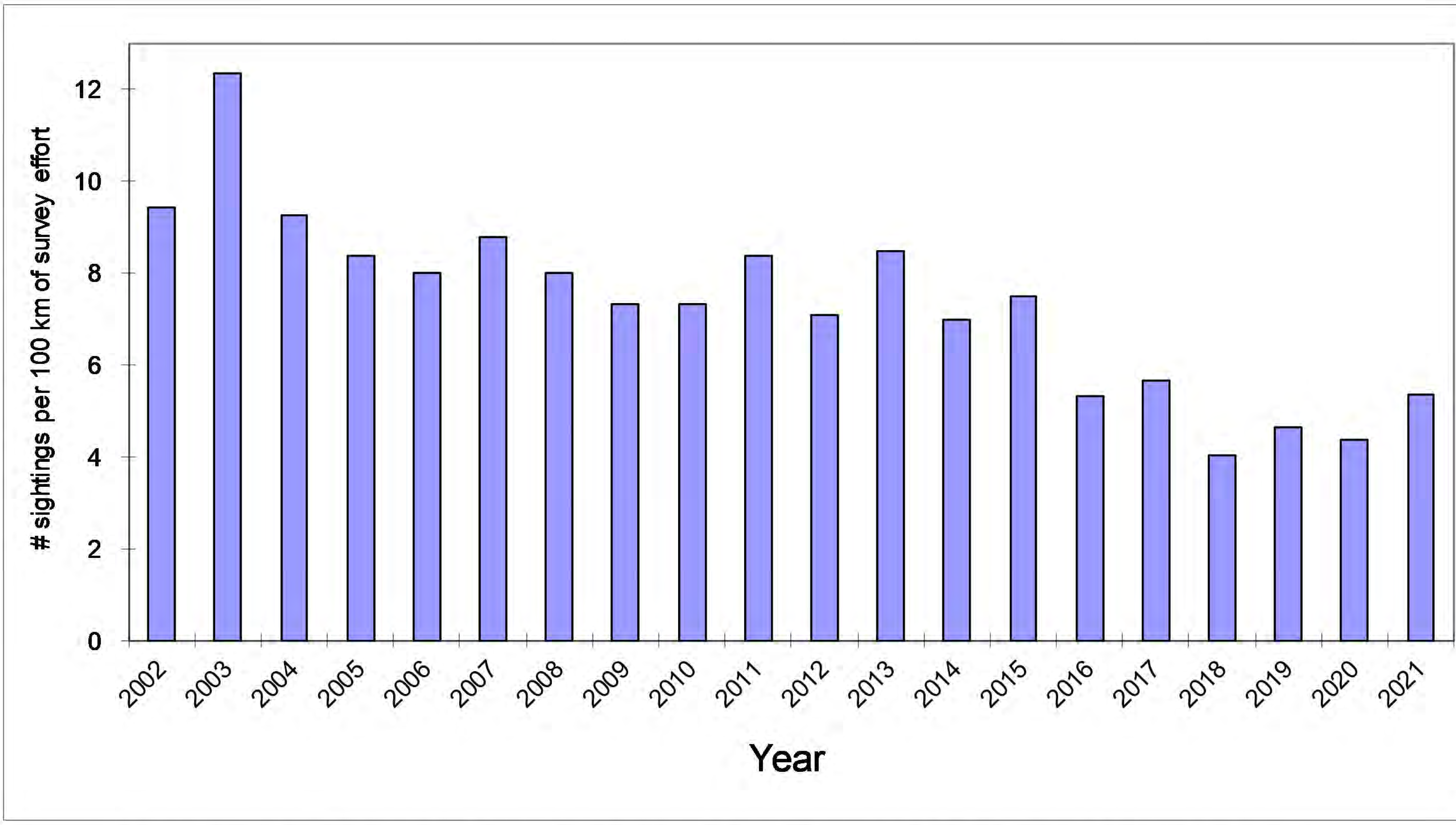


Figure 44a. Temporal trends in combined annual dolphin encounter rates from four survey areas in NEL, NWL, WL and SWL

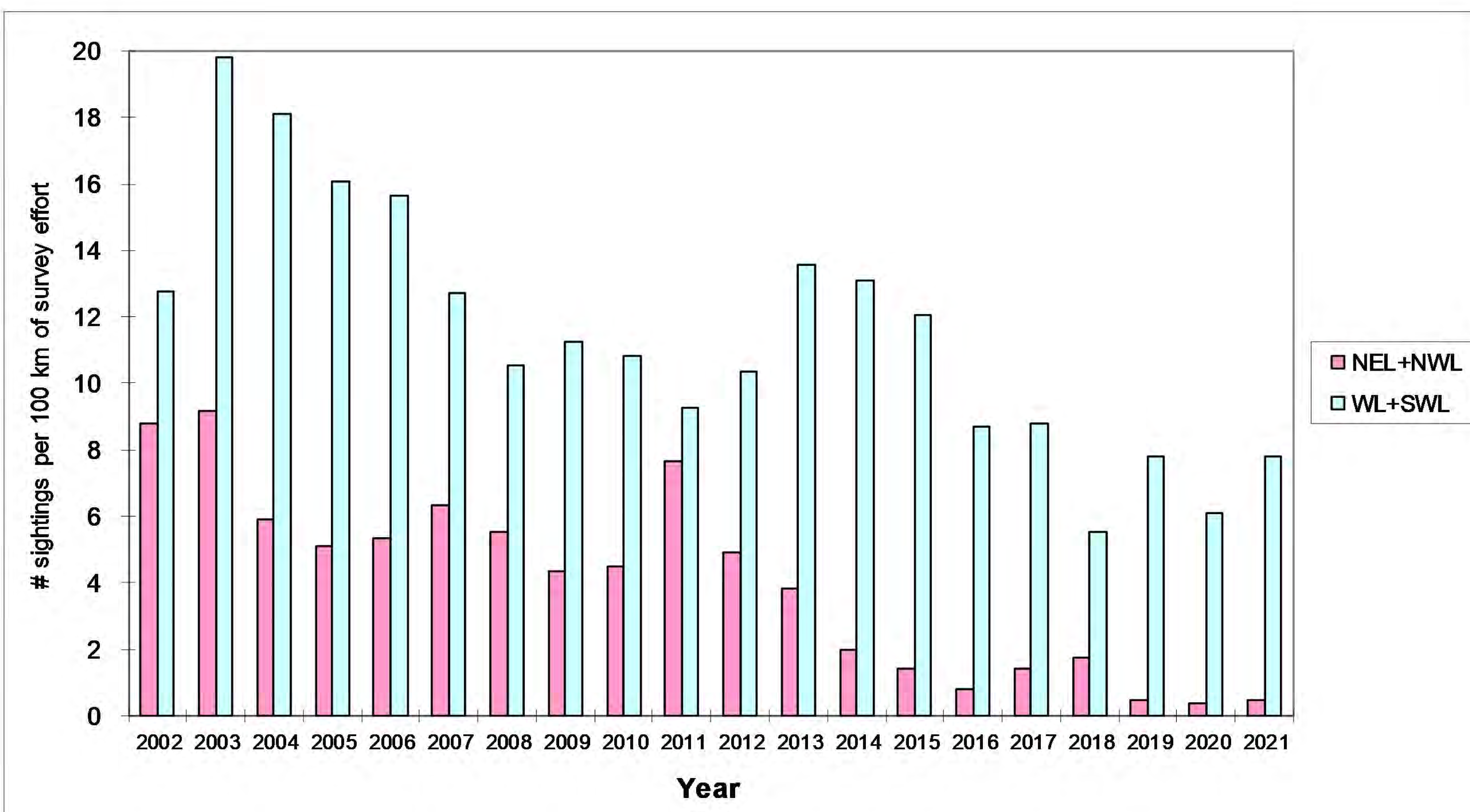


Figure 44b. Temporal trends in annual dolphin encounter rates in North Lantau and West/Southwest Lantau regions

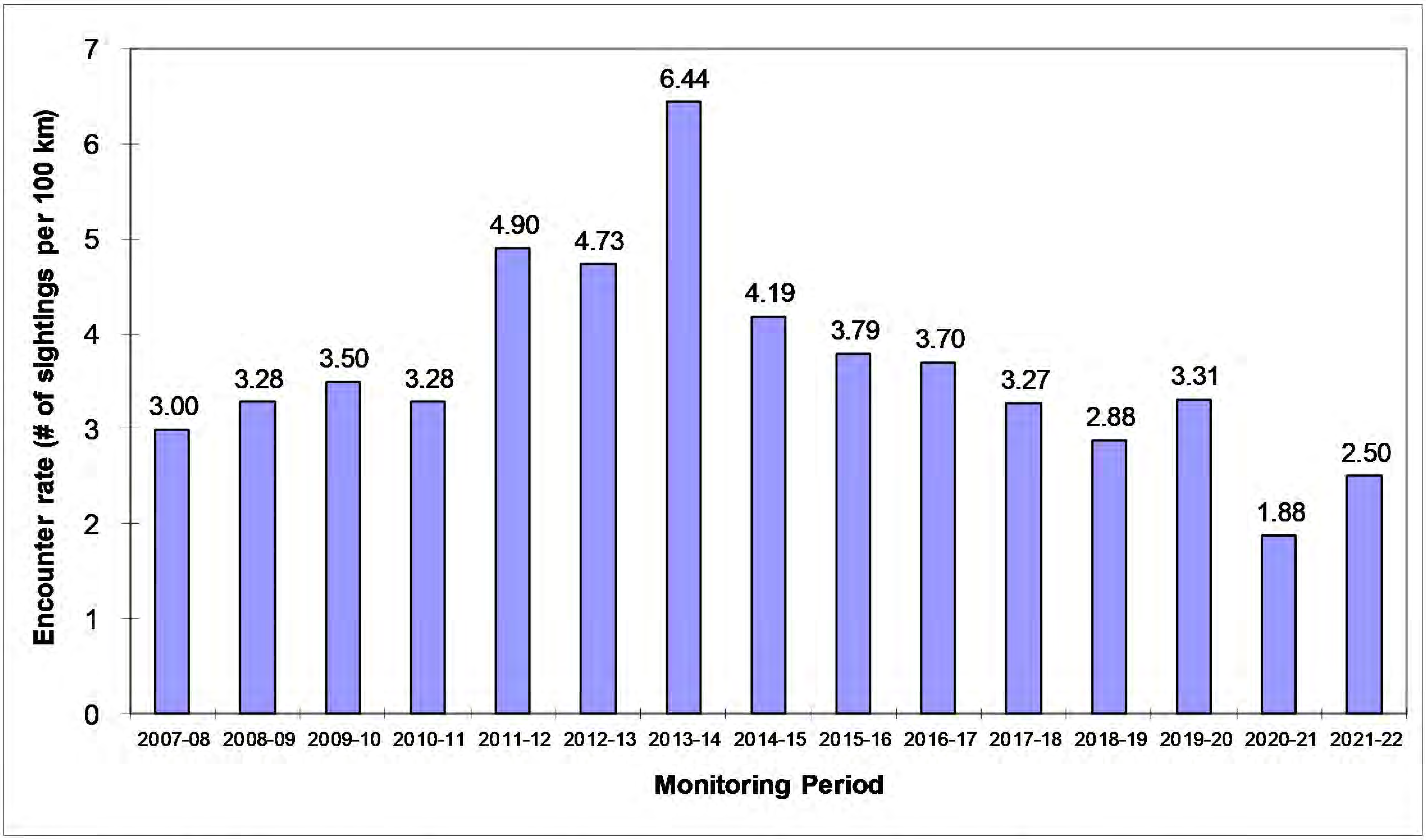


Figure 45. Temporal trend in encounter rates of finless porpoises (combined from SWL, SEL, LM and PT survey areas) in the past 15 monitoring periods from 2007-22

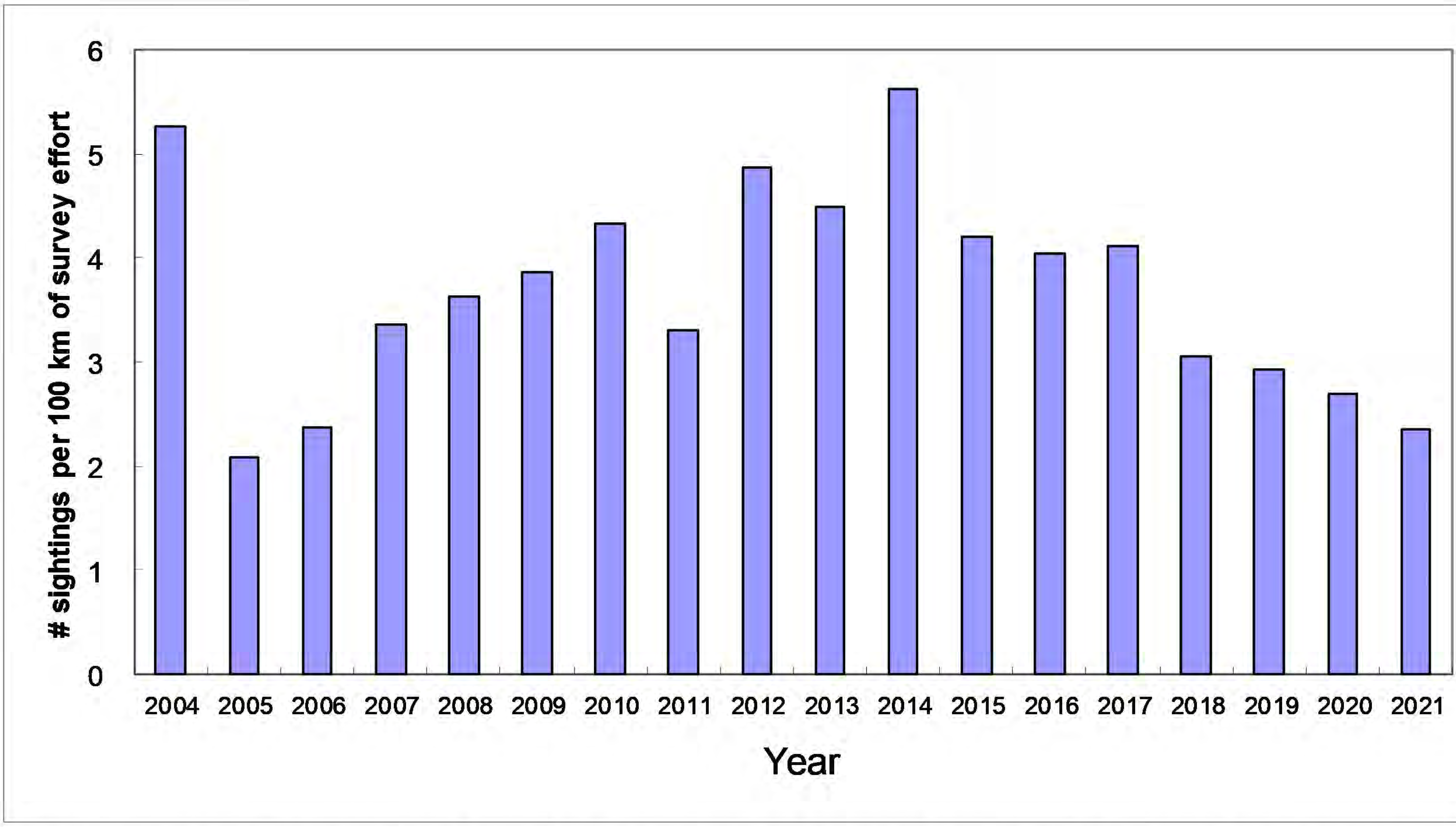


Figure 46a. Temporal trend of annual encounter rates of finless porpoises (combined from SWL, SEL, LM and PT survey areas)

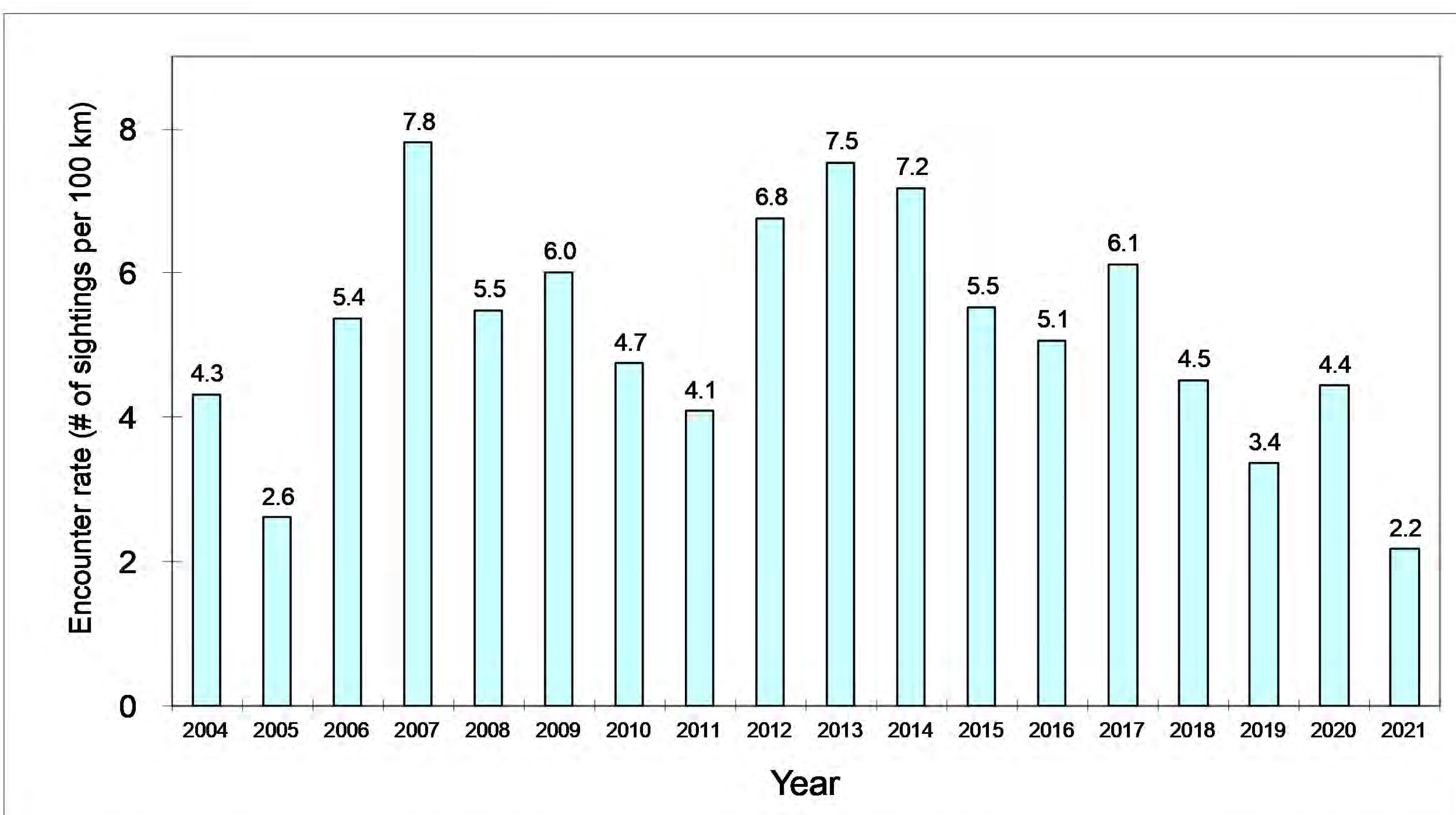


Figure 46b. Temporal trend of annual porpoise encounter rates in South Lantau and Lamma waters combined from winter/spring months

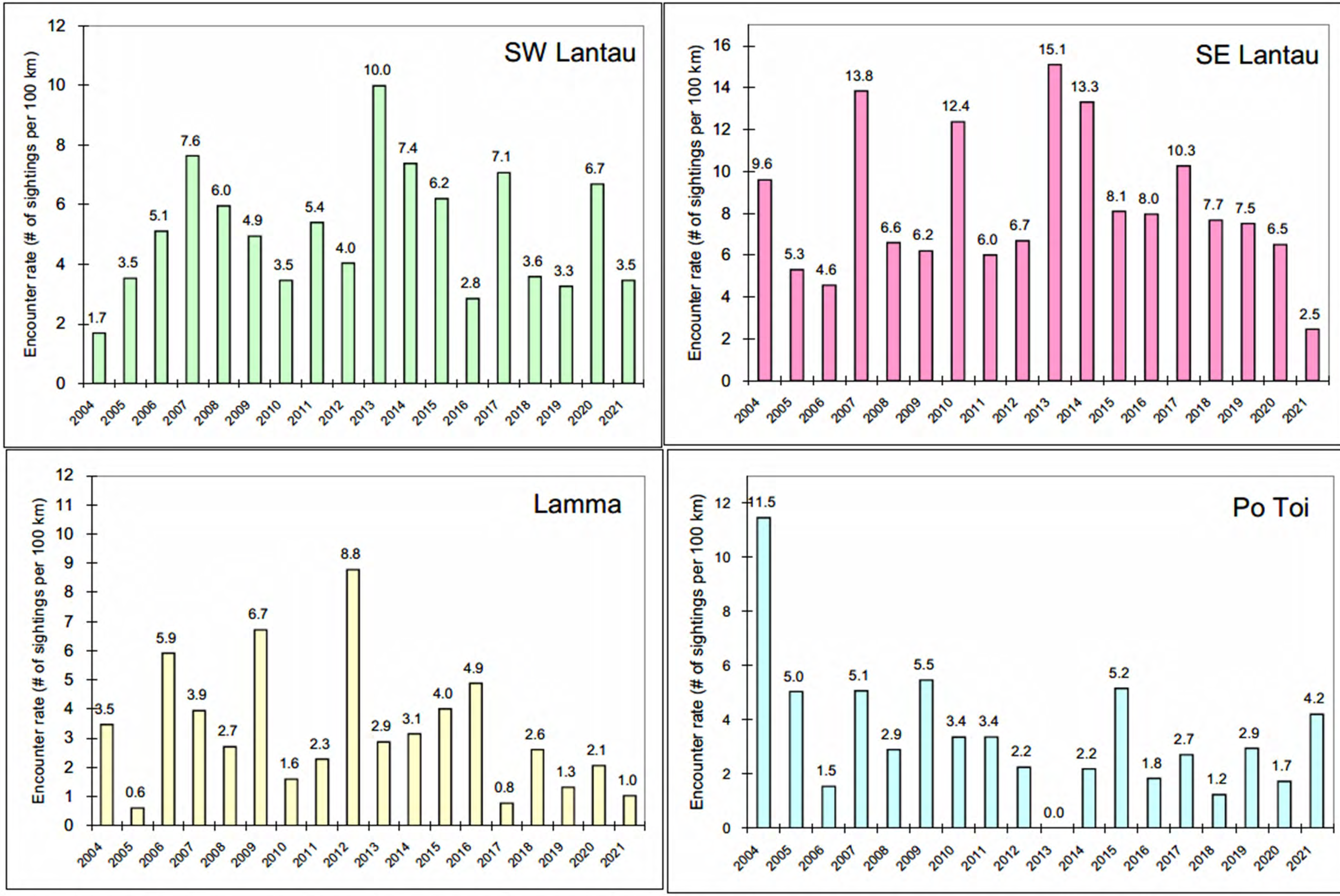


Figure 47. Temporal trends in annual encounter rates of finless porpoises among different survey areas

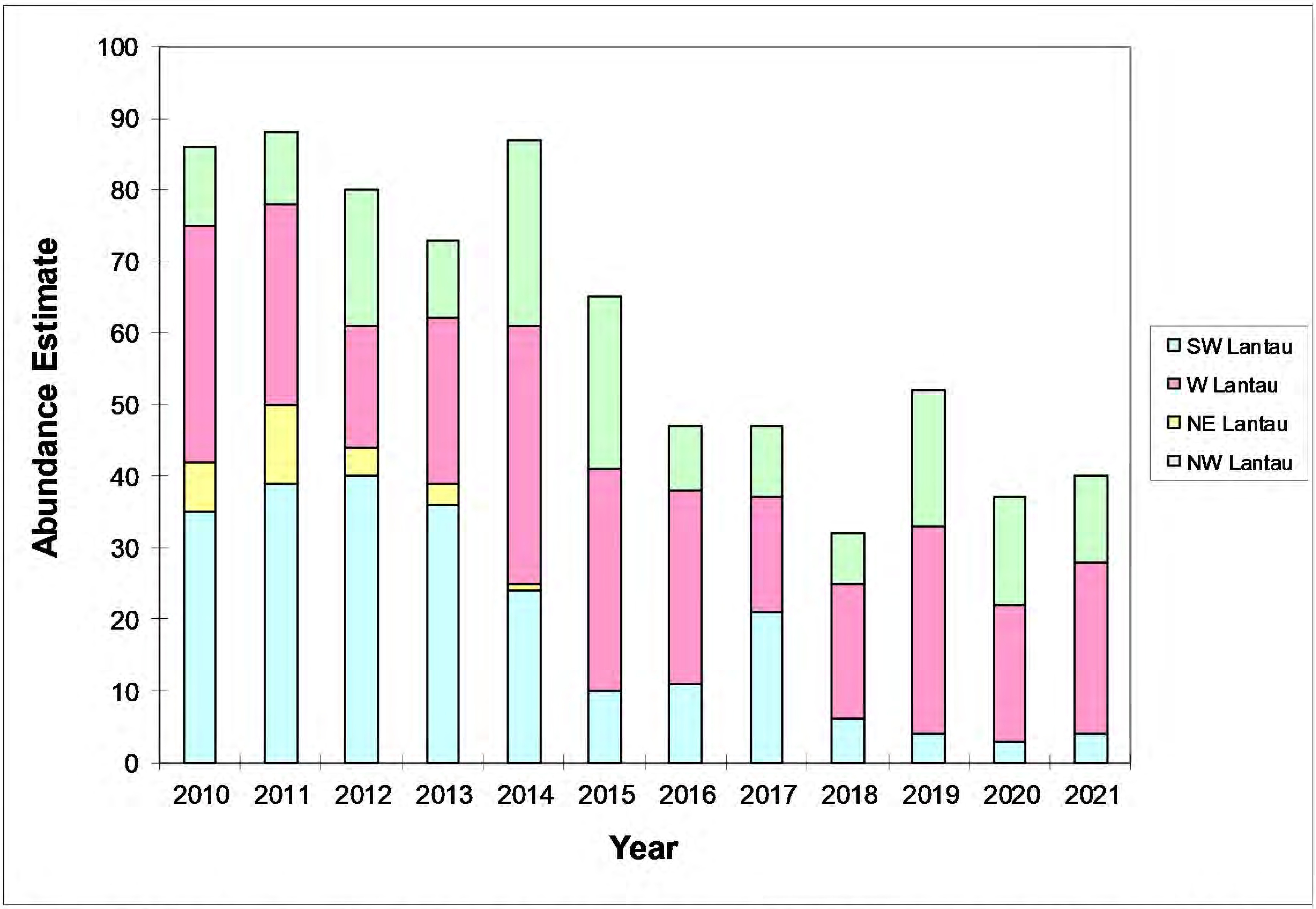


Figure 48. Temporal trends in combined abundance estimates of Chinese White Dolphins in Southwest, West, Northwest & Northeast Lantau from 2010-21

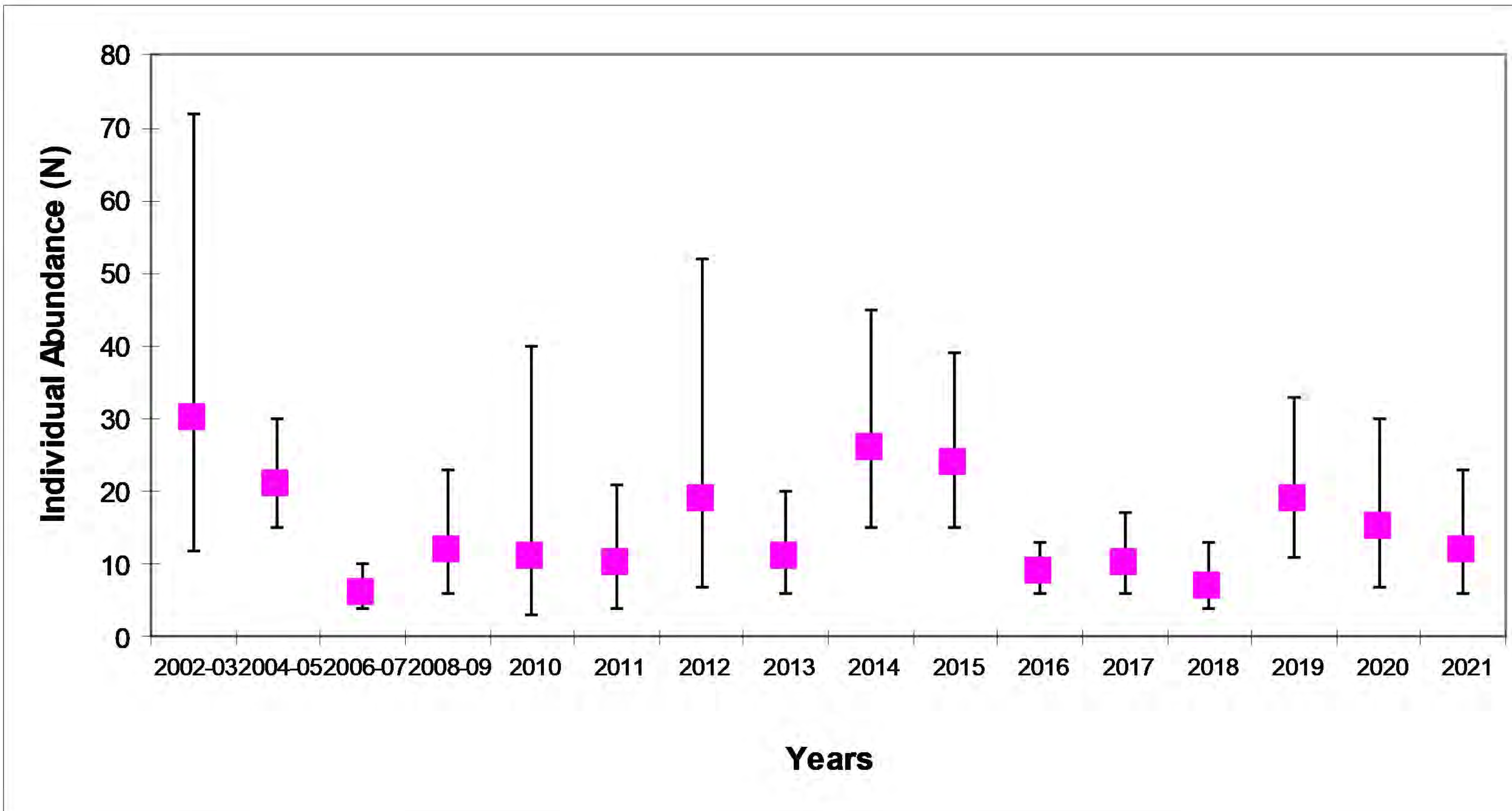


Figure 49. Temporal trend in abundance estimates of Chinese White Dolphins in Southwest Lantau from 2002-21 (error bars: 95% confidence interval of abundance estimates)

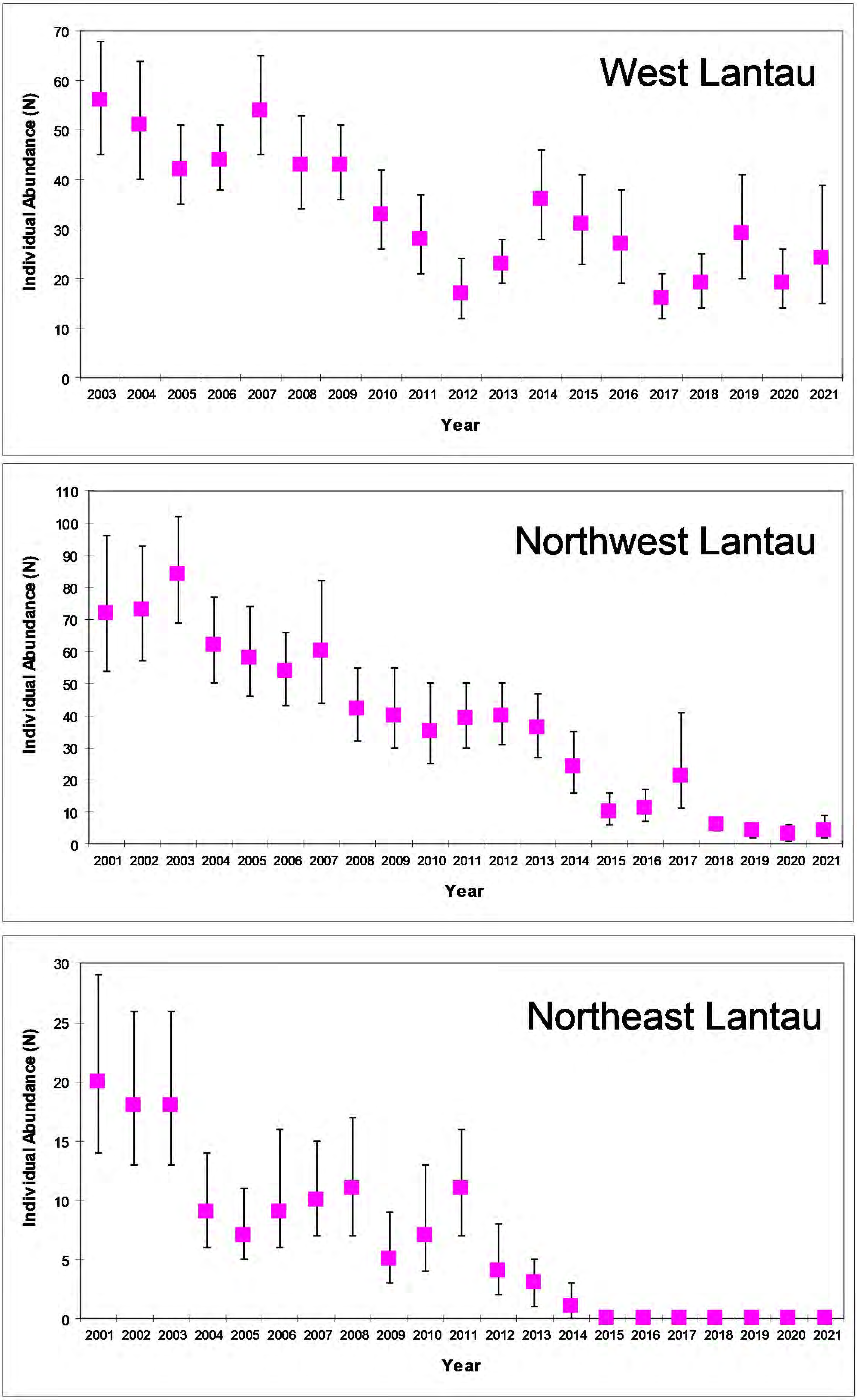


Figure 50. Temporal trends in annual abundance estimates of Chinese White Dolphins in WL, NWL & NEL from 2001-21 (error bars: 95% confidence interval of abundance estimates)

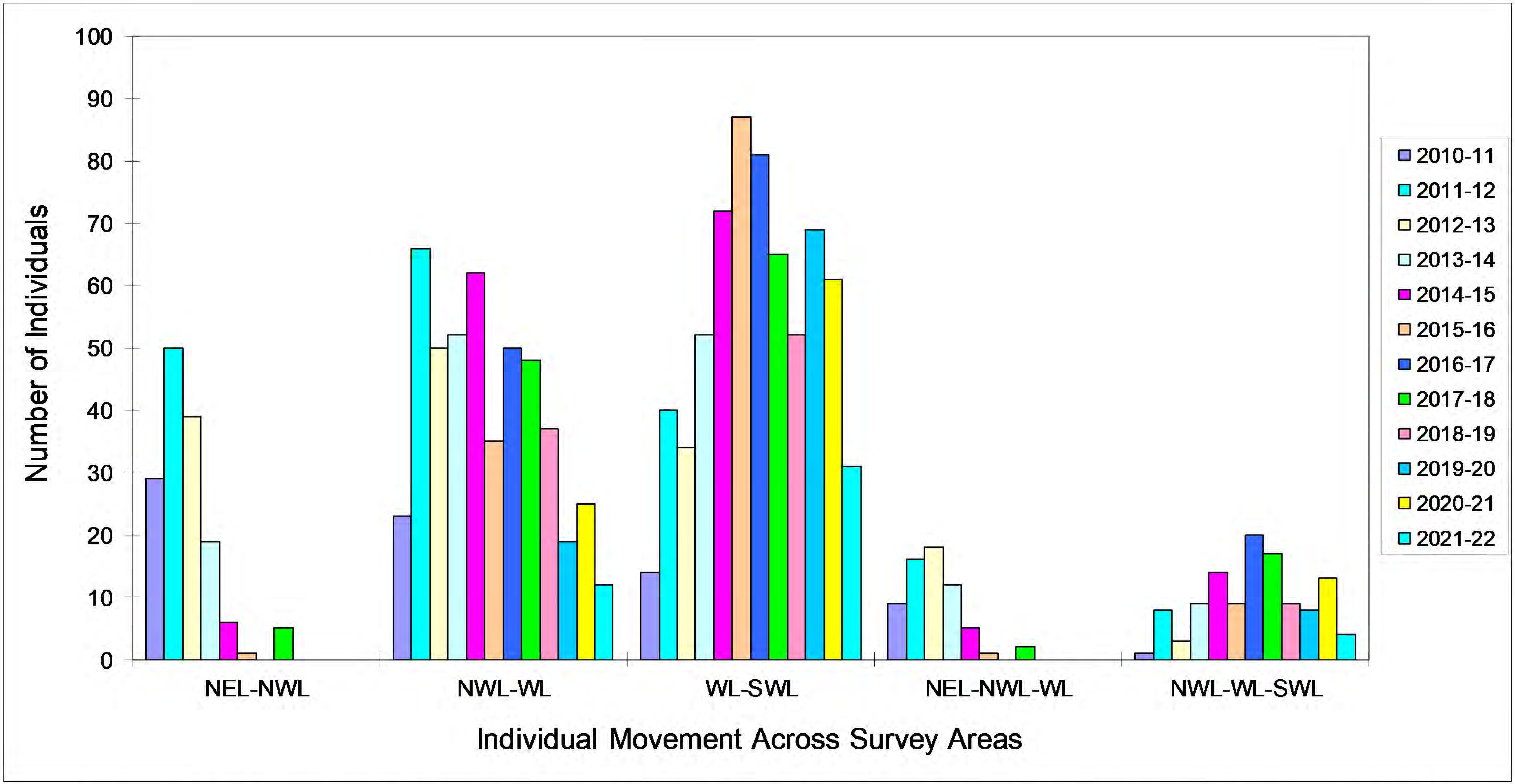


Figure 51. Temporal trends in number of individual dolphins involved in movements across different survey areas around Lantau in the past 12 monitoring periods

Appendix I. HKCRP-AFCD Survey Effort Database (April 2021 - March 2022)
(Note: P = Primary Line Effort; S = Secondary Line Effort)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
1-Apr-21	SE LANTAU	1	3.30	SPRING	STANDARD36826	P
1-Apr-21	SE LANTAU	2	25.65	SPRING	STANDARD36826	P
1-Apr-21	SE LANTAU	3	0.87	SPRING	STANDARD36826	P
1-Apr-21	SE LANTAU	2	6.78	SPRING	STANDARD36826	S
1-Apr-21	SW LANTAU	1	2.48	SPRING	STANDARD36826	P
1-Apr-21	SW LANTAU	2	27.16	SPRING	STANDARD36826	P
1-Apr-21	SW LANTAU	1	2.15	SPRING	STANDARD36826	S
1-Apr-21	SW LANTAU	2	7.18	SPRING	STANDARD36826	S
7-Apr-21	W LANTAU	2	10.12	SPRING	STANDARD36826	P
7-Apr-21	W LANTAU	3	10.04	SPRING	STANDARD36826	P
7-Apr-21	W LANTAU	4	0.88	SPRING	STANDARD36826	P
7-Apr-21	W LANTAU	2	5.57	SPRING	STANDARD36826	S
7-Apr-21	W LANTAU	3	4.89	SPRING	STANDARD36826	S
7-Apr-21	W LANTAU	4	0.93	SPRING	STANDARD36826	S
7-Apr-21	SW LANTAU	3	19.97	SPRING	STANDARD36826	P
7-Apr-21	SW LANTAU	2	1.40	SPRING	STANDARD36826	S
7-Apr-21	SW LANTAU	3	11.58	SPRING	STANDARD36826	S
7-Apr-21	SW LANTAU	4	1.25	SPRING	STANDARD36826	S
13-Apr-21	LAMMA	1	16.45	SPRING	STANDARD36826	P
13-Apr-21	LAMMA	2	18.35	SPRING	STANDARD36826	P
13-Apr-21	LAMMA	1	6.90	SPRING	STANDARD36826	S
13-Apr-21	LAMMA	2	2.70	SPRING	STANDARD36826	S
13-Apr-21	PO TOI	2	47.54	SPRING	STANDARD36826	P
13-Apr-21	PO TOI	2	14.96	SPRING	STANDARD36826	S
14-Apr-21	E LANTAU	2	5.21	SPRING	STANDARD36826	P
14-Apr-21	E LANTAU	3	36.01	SPRING	STANDARD36826	P
14-Apr-21	E LANTAU	2	11.69	SPRING	STANDARD36826	S
14-Apr-21	E LANTAU	3	13.29	SPRING	STANDARD36826	S
14-Apr-21	LAMMA	2	2.26	SPRING	STANDARD36826	P
14-Apr-21	LAMMA	3	17.48	SPRING	STANDARD36826	P
14-Apr-21	LAMMA	4	10.70	SPRING	STANDARD36826	P
14-Apr-21	LAMMA	2	5.32	SPRING	STANDARD36826	S
14-Apr-21	LAMMA	3	5.94	SPRING	STANDARD36826	S
14-Apr-21	LAMMA	4	1.86	SPRING	STANDARD36826	S
22-Apr-21	W LANTAU	2	8.04	SPRING	STANDARD36826	P
22-Apr-21	W LANTAU	3	4.69	SPRING	STANDARD36826	P
22-Apr-21	W LANTAU	2	6.78	SPRING	STANDARD36826	S
22-Apr-21	W LANTAU	3	1.95	SPRING	STANDARD36826	S
23-Apr-21	SE LANTAU	1	1.04	SPRING	STANDARD36826	P
23-Apr-21	SE LANTAU	2	25.29	SPRING	STANDARD36826	P
23-Apr-21	SE LANTAU	2	10.29	SPRING	STANDARD36826	S
23-Apr-21	SW LANTAU	2	18.15	SPRING	STANDARD36826	P
23-Apr-21	SW LANTAU	3	4.50	SPRING	STANDARD36826	P
23-Apr-21	SW LANTAU	2	12.15	SPRING	STANDARD36826	S
23-Apr-21	SW LANTAU	3	1.20	SPRING	STANDARD36826	S
28-Apr-21	NW LANTAU	2	22.24	SPRING	STANDARD36826	P
28-Apr-21	NW LANTAU	3	9.91	SPRING	STANDARD36826	P
28-Apr-21	NW LANTAU	2	11.25	SPRING	STANDARD36826	S
28-Apr-21	W LANTAU	2	14.36	SPRING	STANDARD36826	P
28-Apr-21	W LANTAU	3	3.60	SPRING	STANDARD36826	P
28-Apr-21	W LANTAU	2	8.34	SPRING	STANDARD36826	S
28-Apr-21	W LANTAU	3	2.20	SPRING	STANDARD36826	S
28-Apr-21	SW LANTAU	2	9.71	SPRING	STANDARD36826	S
29-Apr-21	DEEP BAY	1	2.52	SPRING	STANDARD36826	P
29-Apr-21	DEEP BAY	2	7.44	SPRING	STANDARD36826	P

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
29-Apr-21	DEEP BAY	1	5.33	SPRING	STANDARD36826	S
29-Apr-21	DEEP BAY	2	0.81	SPRING	STANDARD36826	S
29-Apr-21	NE LANTAU	2	22.75	SPRING	STANDARD36826	P
29-Apr-21	NE LANTAU	3	4.08	SPRING	STANDARD36826	P
29-Apr-21	NE LANTAU	2	11.50	SPRING	STANDARD36826	S
29-Apr-21	NE LANTAU	3	1.07	SPRING	STANDARD36826	S
6-May-21	W LANTAU	2	1.15	SPRING	STANDARD36826	P
6-May-21	W LANTAU	3	16.79	SPRING	STANDARD36826	P
6-May-21	W LANTAU	4	2.41	SPRING	STANDARD36826	P
6-May-21	W LANTAU	2	2.16	SPRING	STANDARD36826	S
6-May-21	W LANTAU	3	7.61	SPRING	STANDARD36826	S
6-May-21	W LANTAU	4	0.89	SPRING	STANDARD36826	S
6-May-21	SW LANTAU	3	23.27	SPRING	STANDARD36826	P
6-May-21	SW LANTAU	4	1.62	SPRING	STANDARD36826	P
6-May-21	SW LANTAU	3	9.27	SPRING	STANDARD36826	S
6-May-21	SW LANTAU	4	1.40	SPRING	STANDARD36826	S
7-May-21	SE LANTAU	1	15.92	SPRING	STANDARD36826	P
7-May-21	SE LANTAU	2	11.06	SPRING	STANDARD36826	P
7-May-21	SE LANTAU	1	4.12	SPRING	STANDARD36826	S
7-May-21	SE LANTAU	2	6.40	SPRING	STANDARD36826	S
7-May-21	SW LANTAU	1	8.62	SPRING	STANDARD36826	P
7-May-21	SW LANTAU	2	12.61	SPRING	STANDARD36826	P
7-May-21	SW LANTAU	1	4.03	SPRING	STANDARD36826	S
7-May-21	SW LANTAU	2	8.31	SPRING	STANDARD36826	S
11-May-21	W LANTAU	2	3.48	SPRING	STANDARD36826	P
11-May-21	W LANTAU	3	13.48	SPRING	STANDARD36826	P
11-May-21	W LANTAU	2	1.89	SPRING	STANDARD36826	S
11-May-21	W LANTAU	3	7.33	SPRING	STANDARD36826	S
11-May-21	W LANTAU	4	1.30	SPRING	STANDARD36826	S
11-May-21	SW LANTAU	2	9.51	SPRING	STANDARD36826	S
12-May-21	SE LANTAU	2	12.26	SPRING	STANDARD36826	P
12-May-21	SE LANTAU	3	17.03	SPRING	STANDARD36826	P
12-May-21	SE LANTAU	2	3.60	SPRING	STANDARD36826	S
12-May-21	SE LANTAU	3	4.31	SPRING	STANDARD36826	S
12-May-21	SW LANTAU	2	9.21	SPRING	STANDARD36826	P
12-May-21	SW LANTAU	3	13.06	SPRING	STANDARD36826	P
12-May-21	SW LANTAU	2	3.30	SPRING	STANDARD36826	S
12-May-21	SW LANTAU	3	6.23	SPRING	STANDARD36826	S
13-May-21	E LANTAU	2	16.21	SPRING	STANDARD36826	P
13-May-21	E LANTAU	3	18.29	SPRING	STANDARD36826	P
13-May-21	E LANTAU	2	11.18	SPRING	STANDARD36826	S
13-May-21	E LANTAU	3	10.35	SPRING	STANDARD36826	S
13-May-21	LAMMA	2	24.06	SPRING	STANDARD36826	P
13-May-21	LAMMA	3	10.49	SPRING	STANDARD36826	P
13-May-21	LAMMA	2	6.89	SPRING	STANDARD36826	S
13-May-21	LAMMA	3	4.26	SPRING	STANDARD36826	S
18-May-21	LAMMA	2	13.10	SPRING	STANDARD36826	P
18-May-21	LAMMA	3	52.55	SPRING	STANDARD36826	P
18-May-21	LAMMA	4	6.20	SPRING	STANDARD36826	P
18-May-21	LAMMA	2	11.87	SPRING	STANDARD36826	S
18-May-21	LAMMA	3	22.28	SPRING	STANDARD36826	S
20-May-21	NW LANTAU	2	1.96	SPRING	STANDARD138716	P
20-May-21	NW LANTAU	3	23.66	SPRING	STANDARD138716	P
20-May-21	NW LANTAU	2	2.34	SPRING	STANDARD138716	S
20-May-21	NW LANTAU	3	7.74	SPRING	STANDARD138716	S
20-May-21	W LANTAU	3	10.91	SPRING	STANDARD138716	P
20-May-21	W LANTAU	3	9.80	SPRING	STANDARD138716	S
20-May-21	SW LANTAU	2	6.74	SPRING	STANDARD138716	S

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
20-May-21	SW LANTAU	3	2.80	SPRING	STANDARD138716	S
24-May-21	PO TOI	1	24.55	SPRING	STANDARD138716	P
24-May-21	PO TOI	2	50.36	SPRING	STANDARD138716	P
24-May-21	PO TOI	3	16.27	SPRING	STANDARD138716	P
24-May-21	PO TOI	2	6.54	SPRING	STANDARD138716	S
24-May-21	PO TOI	3	3.20	SPRING	STANDARD138716	S
25-May-21	DEEP BAY	1	0.90	SPRING	STANDARD36826	P
25-May-21	DEEP BAY	2	7.20	SPRING	STANDARD36826	P
25-May-21	DEEP BAY	1	2.77	SPRING	STANDARD36826	S
25-May-21	DEEP BAY	2	7.63	SPRING	STANDARD36826	S
25-May-21	NE LANTAU	1	4.90	SPRING	STANDARD36826	P
25-May-21	NE LANTAU	2	16.15	SPRING	STANDARD36826	P
25-May-21	NE LANTAU	1	6.70	SPRING	STANDARD36826	S
25-May-21	NE LANTAU	2	5.25	SPRING	STANDARD36826	S
3-Jun-21	SW LANTAU	2	19.83	SUMMER	STANDARD138716	P
3-Jun-21	SW LANTAU	2	11.37	SUMMER	STANDARD138716	S
3-Jun-21	SE LANTAU	2	41.23	SUMMER	STANDARD138716	P
3-Jun-21	SE LANTAU	2	10.37	SUMMER	STANDARD138716	S
9-Jun-21	W LANTAU	2	13.69	SUMMER	STANDARD138716	P
9-Jun-21	W LANTAU	3	7.63	SUMMER	STANDARD138716	P
9-Jun-21	W LANTAU	2	7.26	SUMMER	STANDARD138716	S
9-Jun-21	W LANTAU	3	4.54	SUMMER	STANDARD138716	S
9-Jun-21	SW LANTAU	1	1.20	SUMMER	STANDARD138716	P
9-Jun-21	SW LANTAU	2	16.89	SUMMER	STANDARD138716	P
9-Jun-21	SW LANTAU	3	12.04	SUMMER	STANDARD138716	P
9-Jun-21	SW LANTAU	1	2.10	SUMMER	STANDARD138716	S
9-Jun-21	SW LANTAU	2	5.74	SUMMER	STANDARD138716	S
9-Jun-21	SW LANTAU	3	2.4	SUMMER	STANDARD138716	S
10-Jun-21	SE LANTAU	2	13.81	SUMMER	STANDARD138716	P
10-Jun-21	SE LANTAU	3	17.61	SUMMER	STANDARD138716	P
10-Jun-21	SE LANTAU	2	3.00	SUMMER	STANDARD138716	S
10-Jun-21	SE LANTAU	3	3.78	SUMMER	STANDARD138716	S
10-Jun-21	SW LANTAU	2	2.06	SUMMER	STANDARD138716	P
10-Jun-21	SW LANTAU	3	13.54	SUMMER	STANDARD138716	P
10-Jun-21	SW LANTAU	4	5.58	SUMMER	STANDARD138716	P
10-Jun-21	SW LANTAU	2	4.39	SUMMER	STANDARD138716	S
10-Jun-21	SW LANTAU	3	7.13	SUMMER	STANDARD138716	S
10-Jun-21	SW LANTAU	4	2.10	SUMMER	STANDARD138716	S
16-Jun-21	NW LANTAU	2	2.80	SUMMER	STANDARD138716	P
16-Jun-21	NW LANTAU	3	32.96	SUMMER	STANDARD138716	P
16-Jun-21	NW LANTAU	3	11.74	SUMMER	STANDARD138716	S
16-Jun-21	DEEP BAY	3	9.37	SUMMER	STANDARD138716	P
16-Jun-21	DEEP BAY	3	6.43	SUMMER	STANDARD138716	S
16-Jun-21	NE LANTAU	2	13.79	SUMMER	STANDARD138716	P
16-Jun-21	NE LANTAU	3	7.21	SUMMER	STANDARD138716	P
16-Jun-21	NE LANTAU	2	10.50	SUMMER	STANDARD138716	S
22-Jun-21	NE LANTAU	2	19.83	SUMMER	STANDARD36826	P
22-Jun-21	NE LANTAU	2	11.07	SUMMER	STANDARD36826	S
22-Jun-21	NW LANTAU	1	8.80	SUMMER	STANDARD36826	P
22-Jun-21	NW LANTAU	2	28.31	SUMMER	STANDARD36826	P
22-Jun-21	NW LANTAU	3	7.42	SUMMER	STANDARD36826	P
22-Jun-21	NW LANTAU	1	1.10	SUMMER	STANDARD36826	S
22-Jun-21	NW LANTAU	2	9.55	SUMMER	STANDARD36826	S
22-Jun-21	NW LANTAU	3	1.22	SUMMER	STANDARD36826	S
2-Jul-21	E LANTAU	2	36.21	SUMMER	STANDARD138716	P
2-Jul-21	E LANTAU	3	30.47	SUMMER	STANDARD138716	P

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
2-Jul-21	E LANTAU	2	21.52	SUMMER	STANDARD138716	S
2-Jul-21	E LANTAU	3	13.80	SUMMER	STANDARD138716	S
5-Jul-21	NINEPINS	3	6.54	SUMMER	STANDARD138716	P
5-Jul-21	NINEPINS	4	1.99	SUMMER	STANDARD138716	P
5-Jul-21	NINEPINS	3	7.29	SUMMER	STANDARD138716	S
5-Jul-21	NINEPINS	4	1.38	SUMMER	STANDARD138716	S
5-Jul-21	PO TOI	3	8.53	SUMMER	STANDARD138716	P
5-Jul-21	PO TOI	4	0.60	SUMMER	STANDARD138716	P
5-Jul-21	PO TOI	2	0.52	SUMMER	STANDARD138716	S
5-Jul-21	PO TOI	3	12.15	SUMMER	STANDARD138716	S
5-Jul-21	LAMMA	2	1.70	SUMMER	STANDARD138716	P
5-Jul-21	LAMMA	3	42.20	SUMMER	STANDARD138716	P
5-Jul-21	LAMMA	2	2.70	SUMMER	STANDARD138716	S
5-Jul-21	LAMMA	3	8.20	SUMMER	STANDARD138716	S
7-Jul-21	W LANTAU	2	2.28	SUMMER	STANDARD138716	P
7-Jul-21	W LANTAU	3	17.20	SUMMER	STANDARD138716	P
7-Jul-21	W LANTAU	4	1.52	SUMMER	STANDARD138716	P
7-Jul-21	W LANTAU	2	8.55	SUMMER	STANDARD138716	S
7-Jul-21	W LANTAU	3	9.94	SUMMER	STANDARD138716	S
7-Jul-21	W LANTAU	4	2.49	SUMMER	STANDARD138716	S
7-Jul-21	NW LANTAU	2	3.27	SUMMER	STANDARD138716	P
7-Jul-21	NW LANTAU	3	10.68	SUMMER	STANDARD138716	P
7-Jul-21	NW LANTAU	2	5.10	SUMMER	STANDARD138716	S
7-Jul-21	NW LANTAU	3	5.85	SUMMER	STANDARD138716	S
8-Jul-21	W LANTAU	2	6.13	SUMMER	STANDARD138716	S
8-Jul-21	W LANTAU	3	3.87	SUMMER	STANDARD138716	S
12-Jul-21	NINEPINS	1	5.53	SUMMER	STANDARD138716	P
12-Jul-21	NINEPINS	2	49.82	SUMMER	STANDARD138716	P
12-Jul-21	NINEPINS	3	4.90	SUMMER	STANDARD138716	P
12-Jul-21	NINEPINS	2	2.85	SUMMER	STANDARD138716	S
12-Jul-21	NINEPINS	3	3.90	SUMMER	STANDARD138716	S
12-Jul-21	PO TOI	1	2.67	SUMMER	STANDARD138716	P
12-Jul-21	PO TOI	2	17.59	SUMMER	STANDARD138716	P
12-Jul-21	PO TOI	3	8.20	SUMMER	STANDARD138716	P
15-Jul-21	W LANTAU	1	5.78	SUMMER	STANDARD138716	S
15-Jul-21	W LANTAU	2	2.65	SUMMER	STANDARD138716	S
15-Jul-21	W LANTAU	3	1.28	SUMMER	STANDARD138716	S
22-Jul-21	SW LANTAU	1	13.65	SUMMER	STANDARD138716	P
22-Jul-21	SW LANTAU	2	12.90	SUMMER	STANDARD138716	P
22-Jul-21	SW LANTAU	1	8.27	SUMMER	STANDARD138716	S
22-Jul-21	SW LANTAU	2	2.08	SUMMER	STANDARD138716	S
22-Jul-21	SE LANTAU	2	30.92	SUMMER	STANDARD138716	P
22-Jul-21	SE LANTAU	2	5.38	SUMMER	STANDARD138716	S
22-Jul-21	SE LANTAU	3	0.90	SUMMER	STANDARD138716	S
26-Jul-21	W LANTAU	0	3.14	SUMMER	STANDARD138716	P
26-Jul-21	W LANTAU	1	8.43	SUMMER	STANDARD138716	P
26-Jul-21	W LANTAU	2	8.66	SUMMER	STANDARD138716	P
26-Jul-21	W LANTAU	1	6.15	SUMMER	STANDARD138716	S
26-Jul-21	W LANTAU	2	3.92	SUMMER	STANDARD138716	S
26-Jul-21	SW LANTAU	2	11.43	SUMMER	STANDARD138716	P
26-Jul-21	SW LANTAU	3	1.24	SUMMER	STANDARD138716	P
26-Jul-21	SW LANTAU	2	7.85	SUMMER	STANDARD138716	S
26-Jul-21	SW LANTAU	3	2.98	SUMMER	STANDARD138716	S
28-Jul-21	NW LANTAU	1	3.38	SUMMER	STANDARD138716	P
28-Jul-21	NW LANTAU	2	22.93	SUMMER	STANDARD138716	P
28-Jul-21	NW LANTAU	1	2.52	SUMMER	STANDARD138716	S
28-Jul-21	NW LANTAU	2	5.27	SUMMER	STANDARD138716	S
28-Jul-21	DEEP BAY	1	3.59	SUMMER	STANDARD138716	P
28-Jul-21	DEEP BAY	2	5.76	SUMMER	STANDARD138716	P
28-Jul-21	DEEP BAY	1	1.60	SUMMER	STANDARD138716	S
28-Jul-21	DEEP BAY	2	4.95	SUMMER	STANDARD138716	S

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
28-Jul-21	NE LANTAU	2	20.25	SUMMER	STANDARD138716	P
28-Jul-21	NE LANTAU	3	3.80	SUMMER	STANDARD138716	P
28-Jul-21	NE LANTAU	2	8.53	SUMMER	STANDARD138716	S
28-Jul-21	NE LANTAU	3	3.92	SUMMER	STANDARD138716	S
2-Aug-21	W LANTAU	1	9.43	SUMMER	STANDARD138716	P
2-Aug-21	W LANTAU	2	11.09	SUMMER	STANDARD138716	P
2-Aug-21	W LANTAU	1	5.62	SUMMER	STANDARD138716	S
2-Aug-21	W LANTAU	2	5.97	SUMMER	STANDARD138716	S
2-Aug-21	SW LANTAU	1	8.74	SUMMER	STANDARD138716	P
2-Aug-21	SW LANTAU	2	16.69	SUMMER	STANDARD138716	P
2-Aug-21	SW LANTAU	3	4.80	SUMMER	STANDARD138716	P
2-Aug-21	SW LANTAU	1	2.36	SUMMER	STANDARD138716	S
2-Aug-21	SW LANTAU	2	9.52	SUMMER	STANDARD138716	S
6-Aug-21	NW LANTAU	2	22.80	SUMMER	STANDARD138716	P
6-Aug-21	NW LANTAU	3	14.06	SUMMER	STANDARD138716	P
6-Aug-21	NW LANTAU	2	6.90	SUMMER	STANDARD138716	S
6-Aug-21	NW LANTAU	3	3.64	SUMMER	STANDARD138716	S
6-Aug-21	DEEP BAY	2	6.96	SUMMER	STANDARD138716	P
6-Aug-21	DEEP BAY	3	1.60	SUMMER	STANDARD138716	P
6-Aug-21	DEEP BAY	2	4.74	SUMMER	STANDARD138716	S
6-Aug-21	DEEP BAY	3	2.00	SUMMER	STANDARD138716	S
6-Aug-21	NE LANTAU	2	14.53	SUMMER	STANDARD138716	P
6-Aug-21	NE LANTAU	3	2.76	SUMMER	STANDARD138716	P
6-Aug-21	NE LANTAU	2	9.30	SUMMER	STANDARD138716	S
6-Aug-21	NE LANTAU	3	1.51	SUMMER	STANDARD138716	S
10-Aug-21	W LANTAU	2	6.09	SUMMER	STANDARD36826	S
10-Aug-21	W LANTAU	3	4.97	SUMMER	STANDARD36826	S
19-Aug-21	E LANTAU	1	0.80	SUMMER	STANDARD138716	P
19-Aug-21	E LANTAU	2	26.51	SUMMER	STANDARD138716	P
19-Aug-21	E LANTAU	3	8.53	SUMMER	STANDARD138716	P
19-Aug-21	E LANTAU	1	1.70	SUMMER	STANDARD138716	S
19-Aug-21	E LANTAU	2	16.06	SUMMER	STANDARD138716	S
19-Aug-21	E LANTAU	3	1.30	SUMMER	STANDARD138716	S
19-Aug-21	SE LANTAU	2	24.38	SUMMER	STANDARD138716	P
19-Aug-21	SE LANTAU	3	2.31	SUMMER	STANDARD138716	P
19-Aug-21	SE LANTAU	2	10.21	SUMMER	STANDARD138716	S
19-Aug-21	SW LANTAU	2	2.19	SUMMER	STANDARD138716	P
19-Aug-21	SW LANTAU	3	4.32	SUMMER	STANDARD138716	P
20-Aug-21	PO TOI	1	18.79	SUMMER	STANDARD138716	P
20-Aug-21	PO TOI	2	53.42	SUMMER	STANDARD138716	P
20-Aug-21	PO TOI	3	5.60	SUMMER	STANDARD138716	P
20-Aug-21	PO TOI	1	1.80	SUMMER	STANDARD138716	S
20-Aug-21	PO TOI	2	9.93	SUMMER	STANDARD138716	S
20-Aug-21	PO TOI	3	3.50	SUMMER	STANDARD138716	S
23-Aug-21	NINEPINS	1	17.69	SUMMER	STANDARD138716	P
23-Aug-21	NINEPINS	2	66.72	SUMMER	STANDARD138716	P
23-Aug-21	NINEPINS	2	7.10	SUMMER	STANDARD138716	S
25-Aug-21	W LANTAU	2	7.73	SUMMER	STANDARD138716	S
25-Aug-21	W LANTAU	3	2.77	SUMMER	STANDARD138716	S
25-Aug-21	SW LANTAU	1	7.22	SUMMER	STANDARD138716	P
25-Aug-21	SW LANTAU	2	15.96	SUMMER	STANDARD138716	P
25-Aug-21	SW LANTAU	1	3.28	SUMMER	STANDARD138716	S
25-Aug-21	SW LANTAU	2	11.79	SUMMER	STANDARD138716	S
25-Aug-21	SE LANTAU	1	15.97	SUMMER	STANDARD138716	P
25-Aug-21	SE LANTAU	2	13.07	SUMMER	STANDARD138716	P
25-Aug-21	SE LANTAU	3	0.40	SUMMER	STANDARD138716	P
25-Aug-21	SE LANTAU	2	5.86	SUMMER	STANDARD138716	S
30-Aug-21	W LANTAU	2	18.86	SUMMER	STANDARD138716	P
30-Aug-21	W LANTAU	3	2.88	SUMMER	STANDARD138716	P
30-Aug-21	W LANTAU	2	9.53	SUMMER	STANDARD138716	S
30-Aug-21	W LANTAU	3	2.03	SUMMER	STANDARD138716	S

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
30-Aug-21	SW LANTAU	2	5.40	SUMMER	STANDARD138716	P
30-Aug-21	SW LANTAU	3	20.96	SUMMER	STANDARD138716	P
30-Aug-21	SW LANTAU	4	2.10	SUMMER	STANDARD138716	P
30-Aug-21	SW LANTAU	3	10.57	SUMMER	STANDARD138716	S
30-Aug-21	SE LANTAU	2	2.74	SUMMER	STANDARD138716	P
30-Aug-21	SE LANTAU	3	4.85	SUMMER	STANDARD138716	P
30-Aug-21	SE LANTAU	2	6.21	SUMMER	STANDARD138716	S
1-Sep-21	NW LANTAU	1	5.02	AUTUMN	STANDARD138716	P
1-Sep-21	NW LANTAU	2	20.12	AUTUMN	STANDARD138716	P
1-Sep-21	NW LANTAU	3	1.70	AUTUMN	STANDARD138716	P
1-Sep-21	NW LANTAU	1	2.22	AUTUMN	STANDARD138716	S
1-Sep-21	NW LANTAU	2	4.44	AUTUMN	STANDARD138716	S
1-Sep-21	DEEP BAY	2	8.44	AUTUMN	STANDARD138716	P
1-Sep-21	DEEP BAY	2	7.06	AUTUMN	STANDARD138716	S
1-Sep-21	NE LANTAU	1	2.93	AUTUMN	STANDARD138716	P
1-Sep-21	NE LANTAU	2	18.41	AUTUMN	STANDARD138716	P
1-Sep-21	NE LANTAU	3	3.49	AUTUMN	STANDARD138716	P
1-Sep-21	NE LANTAU	1	1.81	AUTUMN	STANDARD138716	S
1-Sep-21	NE LANTAU	2	6.30	AUTUMN	STANDARD138716	S
1-Sep-21	NE LANTAU	3	1.86	AUTUMN	STANDARD138716	S
3-Sep-21	PO TOI	0	2.93	AUTUMN	STANDARD138716	P
3-Sep-21	PO TOI	1	19.95	AUTUMN	STANDARD138716	P
3-Sep-21	PO TOI	2	52.07	AUTUMN	STANDARD138716	P
3-Sep-21	PO TOI	3	1.90	AUTUMN	STANDARD138716	P
3-Sep-21	PO TOI	1	2.43	AUTUMN	STANDARD138716	S
3-Sep-21	PO TOI	2	5.53	AUTUMN	STANDARD138716	S
3-Sep-21	NINEPINS	1	3.40	AUTUMN	STANDARD138716	P
3-Sep-21	NINEPINS	2	15.50	AUTUMN	STANDARD138716	P
6-Sep-21	E LANTAU	1	4.63	AUTUMN	STANDARD138716	P
6-Sep-21	E LANTAU	2	33.88	AUTUMN	STANDARD138716	P
6-Sep-21	E LANTAU	3	1.30	AUTUMN	STANDARD138716	P
6-Sep-21	E LANTAU	1	1.40	AUTUMN	STANDARD138716	S
6-Sep-21	E LANTAU	2	25.29	AUTUMN	STANDARD138716	S
6-Sep-21	E LANTAU	3	2.10	AUTUMN	STANDARD138716	S
6-Sep-21	SE LANTAU	1	9.80	AUTUMN	STANDARD138716	P
6-Sep-21	SE LANTAU	2	12.43	AUTUMN	STANDARD138716	P
6-Sep-21	SE LANTAU	1	6.07	AUTUMN	STANDARD138716	S
6-Sep-21	SE LANTAU	2	3.90	AUTUMN	STANDARD138716	S
9-Sep-21	W LANTAU	1	9.89	AUTUMN	STANDARD36826	S
9-Sep-21	W LANTAU	2	1.21	AUTUMN	STANDARD36826	S
14-Sep-21	W LANTAU	1	10.20	AUTUMN	STANDARD138716	S
15-Sep-21	LAMMA	1	2.86	AUTUMN	STANDARD138716	P
15-Sep-21	LAMMA	2	17.36	AUTUMN	STANDARD138716	P
15-Sep-21	LAMMA	3	7.00	AUTUMN	STANDARD138716	P
15-Sep-21	LAMMA	1	1.68	AUTUMN	STANDARD138716	S
15-Sep-21	LAMMA	2	6.71	AUTUMN	STANDARD138716	S
15-Sep-21	LAMMA	3	1.90	AUTUMN	STANDARD138716	S
15-Sep-21	PO TOI	2	2.70	AUTUMN	STANDARD138716	P
15-Sep-21	PO TOI	3	34.01	AUTUMN	STANDARD138716	P
15-Sep-21	PO TOI	4	4.40	AUTUMN	STANDARD138716	P
15-Sep-21	PO TOI	3	7.39	AUTUMN	STANDARD138716	S
15-Sep-21	NINEPINS	2	4.50	AUTUMN	STANDARD138716	P
15-Sep-21	NINEPINS	3	6.40	AUTUMN	STANDARD138716	P
15-Sep-21	NINEPINS	3	1.01	AUTUMN	STANDARD138716	S
17-Sep-21	W LANTAU	1	7.04	AUTUMN	STANDARD138716	P
17-Sep-21	W LANTAU	2	13.63	AUTUMN	STANDARD138716	P
17-Sep-21	W LANTAU	1	1.02	AUTUMN	STANDARD138716	S
17-Sep-21	W LANTAU	2	8.30	AUTUMN	STANDARD138716	S
17-Sep-21	SW LANTAU	1	1.21	AUTUMN	STANDARD138716	P
17-Sep-21	SW LANTAU	2	16.37	AUTUMN	STANDARD138716	P
17-Sep-21	SW LANTAU	1	3.22	AUTUMN	STANDARD138716	S

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
17-Sep-21	SW LANTAU	2	9.20	AUTUMN	STANDARD138716	S
17-Sep-21	SW LANTAU	3	2.70	AUTUMN	STANDARD138716	S
17-Sep-21	SE LANTAU	1	6.23	AUTUMN	STANDARD138716	S
17-Sep-21	SE LANTAU	2	0.74	AUTUMN	STANDARD138716	S
4-Oct-21	NW LANTAU	2	9.30	AUTUMN	STANDARD138716	P
4-Oct-21	NW LANTAU	3	26.50	AUTUMN	STANDARD138716	P
4-Oct-21	NW LANTAU	2	2.60	AUTUMN	STANDARD138716	S
4-Oct-21	NW LANTAU	3	7.00	AUTUMN	STANDARD138716	S
4-Oct-21	DEEP BAY	2	6.52	AUTUMN	STANDARD138716	P
4-Oct-21	DEEP BAY	3	3.48	AUTUMN	STANDARD138716	P
4-Oct-21	DEEP BAY	2	4.91	AUTUMN	STANDARD138716	S
4-Oct-21	DEEP BAY	3	0.39	AUTUMN	STANDARD138716	S
4-Oct-21	NE LANTAU	2	10.36	AUTUMN	STANDARD138716	P
4-Oct-21	NE LANTAU	3	10.12	AUTUMN	STANDARD138716	P
4-Oct-21	NE LANTAU	2	8.54	AUTUMN	STANDARD138716	S
4-Oct-21	NE LANTAU	3	1.08	AUTUMN	STANDARD138716	S
5-Oct-21	W LANTAU	2	5.52	AUTUMN	STANDARD36826	S
5-Oct-21	W LANTAU	3	5.27	AUTUMN	STANDARD36826	S
6-Oct-21	W LANTAU	2	10.40	AUTUMN	STANDARD138716	P
6-Oct-21	W LANTAU	3	8.27	AUTUMN	STANDARD138716	P
6-Oct-21	W LANTAU	4	0.73	AUTUMN	STANDARD138716	P
6-Oct-21	W LANTAU	2	5.72	AUTUMN	STANDARD138716	S
6-Oct-21	W LANTAU	3	15.90	AUTUMN	STANDARD138716	S
6-Oct-21	W LANTAU	4	1.04	AUTUMN	STANDARD138716	S
6-Oct-21	NW LANTAU	2	8.02	AUTUMN	STANDARD138716	P
6-Oct-21	NW LANTAU	3	7.60	AUTUMN	STANDARD138716	P
6-Oct-21	NW LANTAU	2	4.48	AUTUMN	STANDARD138716	S
6-Oct-21	NW LANTAU	3	2.30	AUTUMN	STANDARD138716	S
18-Oct-21	W LANTAU	2	3.42	AUTUMN	STANDARD138716	P
18-Oct-21	W LANTAU	3	16.73	AUTUMN	STANDARD138716	P
18-Oct-21	W LANTAU	2	2.16	AUTUMN	STANDARD138716	S
18-Oct-21	W LANTAU	3	8.87	AUTUMN	STANDARD138716	S
18-Oct-21	SW LANTAU	2	26.65	AUTUMN	STANDARD138716	P
18-Oct-21	SW LANTAU	3	1.84	AUTUMN	STANDARD138716	P
18-Oct-21	SW LANTAU	2	10.04	AUTUMN	STANDARD138716	S
19-Oct-21	W LANTAU	1	5.62	AUTUMN	STANDARD138716	P
19-Oct-21	W LANTAU	2	16.03	AUTUMN	STANDARD138716	P
19-Oct-21	W LANTAU	1	2.30	AUTUMN	STANDARD138716	S
19-Oct-21	W LANTAU	2	9.30	AUTUMN	STANDARD138716	S
19-Oct-21	SW LANTAU	3	4.47	AUTUMN	STANDARD138716	P
19-Oct-21	SW LANTAU	1	4.39	AUTUMN	STANDARD138716	S
19-Oct-21	SW LANTAU	2	4.34	AUTUMN	STANDARD138716	S
19-Oct-21	SE LANTAU	2	9.86	AUTUMN	STANDARD138716	P
19-Oct-21	SE LANTAU	3	12.05	AUTUMN	STANDARD138716	P
19-Oct-21	SE LANTAU	2	3.89	AUTUMN	STANDARD138716	S
19-Oct-21	SE LANTAU	3	2.00	AUTUMN	STANDARD138716	S
21-Oct-21	NW LANTAU	2	5.86	AUTUMN	STANDARD138716	P
21-Oct-21	NW LANTAU	2	2.11	AUTUMN	STANDARD138716	S
21-Oct-21	NE LANTAU	2	4.01	AUTUMN	STANDARD138716	P
21-Oct-21	NE LANTAU	3	8.11	AUTUMN	STANDARD138716	P
21-Oct-21	NE LANTAU	2	8.38	AUTUMN	STANDARD138716	S
21-Oct-21	NE LANTAU	3	2.20	AUTUMN	STANDARD138716	S
21-Oct-21	E LANTAU	2	11.84	AUTUMN	STANDARD138716	P
21-Oct-21	E LANTAU	3	25.60	AUTUMN	STANDARD138716	P
21-Oct-21	E LANTAU	4	1.70	AUTUMN	STANDARD138716	P
21-Oct-21	E LANTAU	2	10.01	AUTUMN	STANDARD138716	S
21-Oct-21	E LANTAU	3	15.65	AUTUMN	STANDARD138716	S
25-Oct-21	LAMMA	2	17.19	AUTUMN	STANDARD138716	P
25-Oct-21	LAMMA	3	29.79	AUTUMN	STANDARD138716	P
25-Oct-21	LAMMA	2	2.82	AUTUMN	STANDARD138716	S
25-Oct-21	LAMMA	3	6.50	AUTUMN	STANDARD138716	S

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
25-Oct-21	SE LANTAU	2	23.71	AUTUMN	STANDARD138716	P
25-Oct-21	SE LANTAU	2	14.11	AUTUMN	STANDARD138716	S
25-Oct-21	SW LANTAU	2	6.77	AUTUMN	STANDARD138716	P
2-Nov-21	NW LANTAU	2	12.59	AUTUMN	STANDARD36826	P
2-Nov-21	NW LANTAU	3	14.61	AUTUMN	STANDARD36826	P
2-Nov-21	NW LANTAU	2	4.80	AUTUMN	STANDARD36826	S
2-Nov-21	NW LANTAU	3	2.40	AUTUMN	STANDARD36826	S
2-Nov-21	DEEP BAY	2	5.23	AUTUMN	STANDARD36826	P
2-Nov-21	DEEP BAY	3	3.11	AUTUMN	STANDARD36826	P
2-Nov-21	DEEP BAY	2	10.16	AUTUMN	STANDARD36826	S
2-Nov-21	NE LANTAU	2	9.47	AUTUMN	STANDARD36826	P
2-Nov-21	NE LANTAU	2	11.63	AUTUMN	STANDARD36826	S
3-Nov-21	W LANTAU	2	7.32	AUTUMN	STANDARD138716	S
3-Nov-21	W LANTAU	3	2.24	AUTUMN	STANDARD138716	S
4-Nov-21	W LANTAU	2	19.27	AUTUMN	STANDARD138716	P
4-Nov-21	W LANTAU	3	1.20	AUTUMN	STANDARD138716	P
4-Nov-21	W LANTAU	1	1.61	AUTUMN	STANDARD138716	S
4-Nov-21	W LANTAU	2	18.89	AUTUMN	STANDARD138716	S
4-Nov-21	NW LANTAU	2	13.21	AUTUMN	STANDARD138716	P
4-Nov-21	NW LANTAU	2	4.83	AUTUMN	STANDARD138716	S
12-Nov-21	W LANTAU	2	5.78	AUTUMN	STANDARD138716	S
12-Nov-21	W LANTAU	3	3.62	AUTUMN	STANDARD138716	S
15-Nov-21	W LANTAU	2	20.46	AUTUMN	STANDARD36826	P
15-Nov-21	W LANTAU	2	10.19	AUTUMN	STANDARD36826	S
15-Nov-21	SW LANTAU	2	6.55	AUTUMN	STANDARD36826	P
15-Nov-21	SW LANTAU	3	11.90	AUTUMN	STANDARD36826	P
15-Nov-21	SW LANTAU	2	7.85	AUTUMN	STANDARD36826	S
15-Nov-21	SW LANTAU	3	3.20	AUTUMN	STANDARD36826	S
18-Nov-21	W LANTAU	2	4.01	AUTUMN	STANDARD138716	S
18-Nov-21	W LANTAU	3	5.83	AUTUMN	STANDARD138716	S
18-Nov-21	SW LANTAU	2	12.83	AUTUMN	STANDARD138716	P
18-Nov-21	SW LANTAU	3	17.14	AUTUMN	STANDARD138716	P
18-Nov-21	SW LANTAU	2	7.91	AUTUMN	STANDARD138716	S
18-Nov-21	SW LANTAU	3	4.35	AUTUMN	STANDARD138716	S
18-Nov-21	SE LANTAU	2	29.78	AUTUMN	STANDARD138716	P
18-Nov-21	SE LANTAU	2	6.07	AUTUMN	STANDARD138716	S
23-Nov-21	NW LANTAU	2	12.80	AUTUMN	STANDARD36826	P
23-Nov-21	NW LANTAU	3	22.20	AUTUMN	STANDARD36826	P
23-Nov-21	NW LANTAU	4	1.50	AUTUMN	STANDARD36826	P
23-Nov-21	NW LANTAU	2	10.30	AUTUMN	STANDARD36826	S
23-Nov-21	NW LANTAU	3	3.00	AUTUMN	STANDARD36826	S
23-Nov-21	NE LANTAU	2	20.93	AUTUMN	STANDARD36826	P
23-Nov-21	NE LANTAU	3	4.55	AUTUMN	STANDARD36826	P
23-Nov-21	NE LANTAU	2	8.03	AUTUMN	STANDARD36826	S
23-Nov-21	NE LANTAU	3	1.79	AUTUMN	STANDARD36826	S
24-Nov-21	W LANTAU	2	1.48	AUTUMN	STANDARD36826	S
24-Nov-21	W LANTAU	3	9.05	AUTUMN	STANDARD36826	S
24-Nov-21	SW LANTAU	2	21.06	AUTUMN	STANDARD36826	P
24-Nov-21	SW LANTAU	3	1.91	AUTUMN	STANDARD36826	P
24-Nov-21	SW LANTAU	2	11.47	AUTUMN	STANDARD36826	S
24-Nov-21	SW LANTAU	3	2.55	AUTUMN	STANDARD36826	S
24-Nov-21	SE LANTAU	2	19.56	AUTUMN	STANDARD36826	P
24-Nov-21	SE LANTAU	2	8.80	AUTUMN	STANDARD36826	S
25-Nov-21	E LANTAU	2	28.92	AUTUMN	STANDARD36826	P
25-Nov-21	E LANTAU	3	5.60	AUTUMN	STANDARD36826	P
25-Nov-21	E LANTAU	2	17.88	AUTUMN	STANDARD36826	S
25-Nov-21	E LANTAU	3	1.60	AUTUMN	STANDARD36826	S
25-Nov-21	LAMMA	2	29.51	AUTUMN	STANDARD36826	P
25-Nov-21	LAMMA	3	6.98	AUTUMN	STANDARD36826	P
25-Nov-21	LAMMA	2	6.28	AUTUMN	STANDARD36826	S
25-Nov-21	LAMMA	3	2.33	AUTUMN	STANDARD36826	S

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
1-Dec-21	W LANTAU	3	4.15	WINTER	STANDARD138716	S
1-Dec-21	W LANTAU	4	5.82	WINTER	STANDARD138716	S
1-Dec-21	SW LANTAU	2	18.71	WINTER	STANDARD138716	P
1-Dec-21	SW LANTAU	3	11.44	WINTER	STANDARD138716	P
1-Dec-21	SW LANTAU	2	4.39	WINTER	STANDARD138716	S
1-Dec-21	SW LANTAU	3	7.56	WINTER	STANDARD138716	S
1-Dec-21	SE LANTAU	2	30.18	WINTER	STANDARD138716	P
1-Dec-21	SE LANTAU	2	6.02	WINTER	STANDARD138716	S
6-Dec-21	LAMMA	1	2.20	WINTER	STANDARD138716	P
6-Dec-21	LAMMA	2	42.59	WINTER	STANDARD138716	P
6-Dec-21	LAMMA	3	43.60	WINTER	STANDARD138716	P
6-Dec-21	LAMMA	1	1.10	WINTER	STANDARD138716	S
6-Dec-21	LAMMA	2	17.71	WINTER	STANDARD138716	S
6-Dec-21	LAMMA	3	12.50	WINTER	STANDARD138716	S
7-Dec-21	E LANTAU	2	26.63	WINTER	STANDARD36826	P
7-Dec-21	E LANTAU	3	14.35	WINTER	STANDARD36826	P
7-Dec-21	E LANTAU	2	19.22	WINTER	STANDARD36826	S
7-Dec-21	E LANTAU	3	3.90	WINTER	STANDARD36826	S
7-Dec-21	SE LANTAU	2	1.33	WINTER	STANDARD36826	P
7-Dec-21	SE LANTAU	3	6.32	WINTER	STANDARD36826	P
7-Dec-21	SE LANTAU	2	4.01	WINTER	STANDARD36826	S
7-Dec-21	SE LANTAU	3	3.54	WINTER	STANDARD36826	S
9-Dec-21	W LANTAU	2	10.71	WINTER	STANDARD138716	P
9-Dec-21	W LANTAU	3	7.92	WINTER	STANDARD138716	P
9-Dec-21	W LANTAU	2	7.38	WINTER	STANDARD138716	S
9-Dec-21	W LANTAU	3	2.81	WINTER	STANDARD138716	S
9-Dec-21	SW LANTAU	2	19.62	WINTER	STANDARD138716	P
9-Dec-21	SW LANTAU	2	12.88	WINTER	STANDARD138716	S
9-Dec-21	SE LANTAU	2	7.57	WINTER	STANDARD138716	S
10-Dec-21	NW LANTAU	2	14.27	WINTER	STANDARD138716	P
10-Dec-21	NW LANTAU	3	10.85	WINTER	STANDARD138716	P
10-Dec-21	NW LANTAU	2	4.62	WINTER	STANDARD138716	S
10-Dec-21	NW LANTAU	3	3.10	WINTER	STANDARD138716	S
10-Dec-21	DEEP BAY	2	8.60	WINTER	STANDARD138716	P
10-Dec-21	DEEP BAY	3	0.60	WINTER	STANDARD138716	P
10-Dec-21	DEEP BAY	2	6.50	WINTER	STANDARD138716	S
10-Dec-21	NE LANTAU	2	10.20	WINTER	STANDARD138716	P
10-Dec-21	NE LANTAU	3	10.04	WINTER	STANDARD138716	P
10-Dec-21	NE LANTAU	2	8.70	WINTER	STANDARD138716	S
10-Dec-21	NE LANTAU	3	1.76	WINTER	STANDARD138716	S
16-Dec-21	LAMMA	2	36.20	WINTER	STANDARD138716	P
16-Dec-21	LAMMA	3	52.64	WINTER	STANDARD138716	P
16-Dec-21	LAMMA	2	13.10	WINTER	STANDARD138716	S
16-Dec-21	LAMMA	3	12.06	WINTER	STANDARD138716	S
5-Jan-22	SE LANTAU	2	14.63	WINTER	STANDARD36826	P
5-Jan-22	SE LANTAU	3	15.78	WINTER	STANDARD36826	P
5-Jan-22	SE LANTAU	2	3.00	WINTER	STANDARD36826	S
5-Jan-22	SE LANTAU	3	4.09	WINTER	STANDARD36826	S
5-Jan-22	SW LANTAU	2	28.11	WINTER	STANDARD36826	P
5-Jan-22	SW LANTAU	2	10.01	WINTER	STANDARD36826	S
6-Jan-22	NE LANTAU	2	12.00	WINTER	STANDARD36826	S
6-Jan-22	NW LANTAU	2	6.01	WINTER	STANDARD36826	S
6-Jan-22	NW LANTAU	3	3.04	WINTER	STANDARD36826	S
6-Jan-22	W LANTAU	2	8.33	WINTER	STANDARD36826	P
6-Jan-22	W LANTAU	3	3.86	WINTER	STANDARD36826	P
6-Jan-22	W LANTAU	2	7.83	WINTER	STANDARD36826	S
6-Jan-22	W LANTAU	3	2.89	WINTER	STANDARD36826	S
6-Jan-22	SW LANTAU	2	9.43	WINTER	STANDARD36826	P
6-Jan-22	SW LANTAU	3	15.30	WINTER	STANDARD36826	P
6-Jan-22	SW LANTAU	2	7.97	WINTER	STANDARD36826	S
6-Jan-22	SW LANTAU	3	5.40	WINTER	STANDARD36826	S

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
10-Jan-22	NW LANTAU	2	35.47	WINTER	STANDARD36826	P
10-Jan-22	NW LANTAU	2	10.83	WINTER	STANDARD36826	S
10-Jan-22	DEEP BAY	2	9.87	WINTER	STANDARD36826	P
10-Jan-22	DEEP BAY	2	6.63	WINTER	STANDARD36826	S
10-Jan-22	NE LANTAU	2	18.25	WINTER	STANDARD36826	P
10-Jan-22	NE LANTAU	2	10.15	WINTER	STANDARD36826	S
17-Jan-22	LAMMA	2	19.90	WINTER	STANDARD36826	P
17-Jan-22	LAMMA	3	20.05	WINTER	STANDARD36826	P
17-Jan-22	LAMMA	2	6.35	WINTER	STANDARD36826	S
17-Jan-22	LAMMA	3	1.00	WINTER	STANDARD36826	S
17-Jan-22	E LANTAU	1	2.23	WINTER	STANDARD36826	P
17-Jan-22	E LANTAU	2	21.85	WINTER	STANDARD36826	P
17-Jan-22	E LANTAU	3	10.70	WINTER	STANDARD36826	P
17-Jan-22	E LANTAU	2	15.92	WINTER	STANDARD36826	S
17-Jan-22	E LANTAU	3	4.60	WINTER	STANDARD36826	S
18-Jan-22	SE LANTAU	1	9.90	WINTER	STANDARD36826	P
18-Jan-22	SE LANTAU	2	17.82	WINTER	STANDARD36826	P
18-Jan-22	SE LANTAU	1	2.90	WINTER	STANDARD36826	S
18-Jan-22	SE LANTAU	2	6.78	WINTER	STANDARD36826	S
18-Jan-22	SW LANTAU	2	9.65	WINTER	STANDARD36826	P
18-Jan-22	SW LANTAU	3	14.01	WINTER	STANDARD36826	P
18-Jan-22	SW LANTAU	2	8.02	WINTER	STANDARD36826	S
18-Jan-22	SW LANTAU	3	7.02	WINTER	STANDARD36826	S
19-Jan-22	LAMMA	1	4.61	WINTER	STANDARD36826	P
19-Jan-22	LAMMA	2	37.57	WINTER	STANDARD36826	P
19-Jan-22	LAMMA	3	3.42	WINTER	STANDARD36826	P
19-Jan-22	LAMMA	2	14.26	WINTER	STANDARD36826	S
19-Jan-22	LAMMA	3	2.10	WINTER	STANDARD36826	S
19-Jan-22	SE LANTAU	2	20.25	WINTER	STANDARD36826	P
19-Jan-22	SE LANTAU	3	3.80	WINTER	STANDARD36826	P
19-Jan-22	SE LANTAU	2	6.65	WINTER	STANDARD36826	S
19-Jan-22	SE LANTAU	3	0.40	WINTER	STANDARD36826	S
20-Jan-22	W LANTAU	2	8.03	WINTER	STANDARD36826	P
20-Jan-22	W LANTAU	3	12.04	WINTER	STANDARD36826	P
20-Jan-22	W LANTAU	2	7.91	WINTER	STANDARD36826	S
20-Jan-22	W LANTAU	3	14.76	WINTER	STANDARD36826	S
20-Jan-22	NW LANTAU	2	20.56	WINTER	STANDARD36826	P
20-Jan-22	NW LANTAU	3	1.12	WINTER	STANDARD36826	P
20-Jan-22	NW LANTAU	2	10.12	WINTER	STANDARD36826	S
20-Jan-22	NE LANTAU	2	5.33	WINTER	STANDARD36826	P
20-Jan-22	NE LANTAU	2	8.97	WINTER	STANDARD36826	S
24-Jan-22	SE LANTAU	1	11.75	WINTER	STANDARD36826	P
24-Jan-22	SE LANTAU	2	7.73	WINTER	STANDARD36826	P
24-Jan-22	SE LANTAU	1	2.24	WINTER	STANDARD36826	S
24-Jan-22	SE LANTAU	2	7.21	WINTER	STANDARD36826	S
24-Jan-22	SW LANTAU	1	14.05	WINTER	STANDARD36826	P
24-Jan-22	SW LANTAU	2	15.22	WINTER	STANDARD36826	P
24-Jan-22	SW LANTAU	1	2.00	WINTER	STANDARD36826	S
24-Jan-22	SW LANTAU	2	9.69	WINTER	STANDARD36826	S
14-Feb-22	W LANTAU	3	21.12	WINTER	STANDARD36826	P
14-Feb-22	W LANTAU	2	2.66	WINTER	STANDARD36826	S
14-Feb-22	W LANTAU	3	7.12	WINTER	STANDARD36826	S
14-Feb-22	SW LANTAU	2	12.91	WINTER	STANDARD36826	P
14-Feb-22	SW LANTAU	3	4.24	WINTER	STANDARD36826	P
14-Feb-22	SW LANTAU	2	8.82	WINTER	STANDARD36826	S
14-Feb-22	SW LANTAU	3	2.51	WINTER	STANDARD36826	S
14-Feb-22	SE LANTAU	2	6.93	WINTER	STANDARD36826	S

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
15-Feb-22	E LANTAU	2	35.90	WINTER	STANDARD36826	P
15-Feb-22	E LANTAU	3	3.20	WINTER	STANDARD36826	P
15-Feb-22	E LANTAU	2	22.70	WINTER	STANDARD36826	S
15-Feb-22	LAMMA	2	24.91	WINTER	STANDARD36826	P
15-Feb-22	LAMMA	3	5.21	WINTER	STANDARD36826	P
15-Feb-22	LAMMA	2	8.18	WINTER	STANDARD36826	S
15-Feb-22	LAMMA	3	4.30	WINTER	STANDARD36826	S
16-Feb-22	NW LANTAU	2	5.69	WINTER	STANDARD36826	P
16-Feb-22	NW LANTAU	3	44.81	WINTER	STANDARD36826	P
16-Feb-22	NW LANTAU	2	2.43	WINTER	STANDARD36826	S
16-Feb-22	NW LANTAU	3	5.17	WINTER	STANDARD36826	S
16-Feb-22	DEEP BAY	2	7.93	WINTER	STANDARD36826	P
16-Feb-22	DEEP BAY	2	6.77	WINTER	STANDARD36826	S
16-Feb-22	NE LANTAU	2	5.00	WINTER	STANDARD36826	P
16-Feb-22	NE LANTAU	3	13.51	WINTER	STANDARD36826	P
16-Feb-22	NE LANTAU	2	6.40	WINTER	STANDARD36826	S
16-Feb-22	NE LANTAU	3	3.99	WINTER	STANDARD36826	S
28-Feb-22	W LANTAU	2	19.25	SPRING	STANDARD36826	P
28-Feb-22	W LANTAU	3	1.49	SPRING	STANDARD36826	P
28-Feb-22	W LANTAU	2	9.57	SPRING	STANDARD36826	S
28-Feb-22	W LANTAU	3	1.05	SPRING	STANDARD36826	S
28-Feb-22	SW LANTAU	3	21.70	SPRING	STANDARD36826	P
28-Feb-22	SW LANTAU	4	3.07	SPRING	STANDARD36826	P
28-Feb-22	SW LANTAU	2	3.56	SPRING	STANDARD36826	S
28-Feb-22	SW LANTAU	3	5.46	SPRING	STANDARD36826	S
28-Feb-22	SW LANTAU	4	5.27	SPRING	STANDARD36826	S
1-Mar-22	LAMMA	1	33.08	SPRING	STANDARD36826	P
1-Mar-22	LAMMA	2	53.57	SPRING	STANDARD36826	P
1-Mar-22	LAMMA	1	8.67	SPRING	STANDARD36826	S
1-Mar-22	LAMMA	2	16.78	SPRING	STANDARD36826	S
2-Mar-22	SE LANTAU	0	6.42	SPRING	STANDARD36826	P
2-Mar-22	SE LANTAU	1	19.70	SPRING	STANDARD36826	P
2-Mar-22	SE LANTAU	2	1.42	SPRING	STANDARD36826	P
2-Mar-22	SE LANTAU	0	2.20	SPRING	STANDARD36826	S
2-Mar-22	SE LANTAU	1	7.41	SPRING	STANDARD36826	S
2-Mar-22	SE LANTAU	2	0.54	SPRING	STANDARD36826	S
2-Mar-22	SW LANTAU	1	6.31	SPRING	STANDARD36826	P
2-Mar-22	SW LANTAU	2	15.29	SPRING	STANDARD36826	P
2-Mar-22	SW LANTAU	3	1.98	SPRING	STANDARD36826	P
2-Mar-22	SW LANTAU	1	2.17	SPRING	STANDARD36826	S
2-Mar-22	SW LANTAU	2	7.37	SPRING	STANDARD36826	S
2-Mar-22	SW LANTAU	3	3.47	SPRING	STANDARD36826	S
3-Mar-22	W LANTAU	1	0.39	SPRING	STANDARD36826	P
3-Mar-22	W LANTAU	2	15.74	SPRING	STANDARD36826	P
3-Mar-22	W LANTAU	3	3.20	SPRING	STANDARD36826	P
3-Mar-22	W LANTAU	4	1.15	SPRING	STANDARD36826	P
3-Mar-22	W LANTAU	1	5.98	SPRING	STANDARD36826	S
3-Mar-22	W LANTAU	2	9.74	SPRING	STANDARD36826	S
3-Mar-22	W LANTAU	3	5.03	SPRING	STANDARD36826	S
3-Mar-22	W LANTAU	4	0.49	SPRING	STANDARD36826	S
3-Mar-22	NW LANTAU	3	14.15	SPRING	STANDARD36826	P
3-Mar-22	NW LANTAU	4	5.60	SPRING	STANDARD36826	P
3-Mar-22	NW LANTAU	2	1.94	SPRING	STANDARD36826	S
3-Mar-22	NW LANTAU	3	6.31	SPRING	STANDARD36826	S
3-Mar-22	NW LANTAU	4	2.10	SPRING	STANDARD36826	S
3-Mar-22	NE LANTAU	3	3.77	SPRING	STANDARD36826	P
3-Mar-22	NE LANTAU	2	1.99	SPRING	STANDARD36826	S
3-Mar-22	NE LANTAU	3	7.64	SPRING	STANDARD36826	S

Appendix I. (cont'd.)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	P/S
4-Mar-22	LAMMA	2	57.37	SPRING	STANDARD36826	P
4-Mar-22	LAMMA	3	27.11	SPRING	STANDARD36826	P
4-Mar-22	LAMMA	2	20.59	SPRING	STANDARD36826	S
4-Mar-22	LAMMA	3	6.80	SPRING	STANDARD36826	S
9-Mar-22	NW LANTAU	2	30.79	SPRING	STANDARD36826	P
9-Mar-22	NW LANTAU	3	5.05	SPRING	STANDARD36826	P
9-Mar-22	NW LANTAU	2	10.56	SPRING	STANDARD36826	S
9-Mar-22	DEEP BAY	2	8.93	SPRING	STANDARD36826	P
9-Mar-22	DEEP BAY	2	5.97	SPRING	STANDARD36826	S
9-Mar-22	NE LANTAU	1	3.50	SPRING	STANDARD36826	P
9-Mar-22	NE LANTAU	2	26.01	SPRING	STANDARD36826	P
9-Mar-22	NE LANTAU	3	1.60	SPRING	STANDARD36826	P
9-Mar-22	NE LANTAU	2	8.57	SPRING	STANDARD36826	S
9-Mar-22	NE LANTAU	3	1.32	SPRING	STANDARD36826	S
10-Mar-22	W LANTAU	2	18.59	SPRING	STANDARD36826	P
10-Mar-22	W LANTAU	3	3.00	SPRING	STANDARD36826	P
10-Mar-22	W LANTAU	2	10.01	SPRING	STANDARD36826	S
10-Mar-22	W LANTAU	3	1.30	SPRING	STANDARD36826	S
10-Mar-22	SW LANTAU	2	1.27	SPRING	STANDARD36826	P
10-Mar-22	SW LANTAU	3	23.90	SPRING	STANDARD36826	P
10-Mar-22	SW LANTAU	2	3.15	SPRING	STANDARD36826	S
10-Mar-22	SW LANTAU	3	10.18	SPRING	STANDARD36826	S
10-Mar-22	SW LANTAU	4	1.10	SPRING	STANDARD36826	S

Appendix II. HKCRP-AFCD Chinese White Dolphin Sighting Database (April 2021 - March 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
7-Apr-21	1	1141	2	W LANTAU	2	329	ON	HKCRP	809420	800896	SPRING	NONE	P
7-Apr-21	2	1157	12	W LANTAU	2	ND	OFF	HKCRP	810164	800227	SPRING	NONE	
22-Apr-21	1	1427	2	W LANTAU	2	121	ON	HKCRP	808448	800058	SPRING	NONE	P
22-Apr-21	2	1450	3	W LANTAU	2	541	ON	HKCRP	807394	800994	SPRING	NONE	P
22-Apr-21	3	1505	2	W LANTAU	2	620	ON	HKCRP	807549	801036	SPRING	NONE	S
28-Apr-21	1	1504	1	SW LANTAU	2	ND	OFF	HKCRP	806106	802487	SPRING	NONE	
28-Apr-21	2	1534	1	SW LANTAU	2	67	ON	HKCRP	807333	809275	SPRING	NONE	S
28-Apr-21	3	1540	1	SW LANTAU	2	45	ON	HKCRP	807442	810069	SPRING	NONE	S
6-May-21	1	1122	8	W LANTAU	3	298	ON	HKCRP	810825	801621	SPRING	NONE	P
6-May-21	2	1208	1	W LANTAU	3	279	ON	HKCRP	807404	801201	SPRING	NONE	P
6-May-21	3	1236	4	W LANTAU	3	ND	OFF	HKCRP	805830	801898	SPRING	PURSE-SEINE	
6-May-21	4	1310	1	SW LANTAU	3	19	ON	HKCRP	806151	802250	SPRING	NONE	S
7-May-21	2	1358	1	SW LANTAU	1	228	ON	HKCRP	804887	808156	SPRING	NONE	S
11-May-21	1	1430	1	W LANTAU	3	ND	OFF	HKCRP	808401	801193	SPRING	NONE	
11-May-21	2	1517	6	SW LANTAU	2	0	ON	HKCRP	806127	802693	SPRING	PURSE-SEINE	S
12-May-21	1	1516	5	SW LANTAU	2	180	ON	HKCRP	806248	803477	SPRING	PURSE-SEINE	P
14-May-21	1	1144	5	W LANTAU	2	ND	OFF	HELI	805797	802104	SPRING	PURSE-SEINE	
14-May-21	2	1146	3	W LANTAU	2	ND	OFF	HELI	806196	801837	SPRING	NONE	
20-May-21	1	1340	1	W LANTAU	3	408	ON	HKCRP	813882	801360	SPRING	NONE	S
20-May-21	2	1445	5	W LANTAU	3	162	ON	HKCRP	808447	800182	SPRING	NONE	P
20-May-21	3	1517	2	SW LANTAU	2	204	ON	HKCRP	806446	803746	SPRING	NONE	S
9-Jun-21	1	1058	2	W LANTAU	2	149	ON	HKCRP	813822	803277	SUMMER	NONE	S
9-Jun-21	2	1157	2	W LANTAU	3	15	ON	HKCRP	810363	800372	SUMMER	NONE	P
9-Jun-21	3	1224	4	W LANTAU	2	245	ON	HKCRP	808347	800625	SUMMER	NONE	P
9-Jun-21	4	1320	3	SW LANTAU	2	93	ON	HKCRP	806238	802889	SUMMER	PURSE-SEINE	S
9-Jun-21	5	1530	2	SW LANTAU	2	34	ON	HKCRP	807618	810760	SUMMER	NONE	S
10-Jun-21	1	1344	1	SW LANTAU	2	94	ON	HKCRP	805474	808292	SUMMER	NONE	S
7-Jul-21	1	1026	8	W LANTAU	2	306	ON	HKCRP	811511	801725	SUMMER	NONE	S
7-Jul-21	2	1050	1	W LANTAU	4	83	ON	HKCRP	806750	801508	SUMMER	NONE	S
7-Jul-21	3	1109	3	W LANTAU	4	516	ON	HKCRP	806163	801724	SUMMER	NONE	S
7-Jul-21	4	1159	2	W LANTAU	3	0	ON	HKCRP	809432	800762	SUMMER	NONE	P
7-Jul-21	5	1209	1	W LANTAU	3	51	ON	HKCRP	809873	801278	SUMMER	NONE	S
8-Jul-21	1	1012	1	W LANTAU	2	130	ON	HKCRP	813701	802875	SUMMER	NONE	S

Appendix II. (cont'd.)

DATE	STG #	TIME	HRD SZ	AREA	BEAU	PSD	EFFORT	TYPE	NORTHING	EASTING	SEASON	BOAT ASSOC.	P/S
8-Jul-21	2	1035	1	W LANTAU	3	80	ON	HKCRP	808590	800873	SUMMER	NONE	S
8-Jul-21	3	1044	2	W LANTAU	3	52	ON	HKCRP	806240	801961	SUMMER	NONE	S
15-Jul-21	1	1018	2	W LANTAU	1	376	ON	HKCRP	814187	803443	SUMMER	NONE	S
15-Jul-21	2	1021	6	W LANTAU	1	192	ON	HKCRP	813679	802998	SUMMER	GILLNET	S
15-Jul-21	3	1035	2	W LANTAU	1	1048	ON	HKCRP	811666	801860	SUMMER	NONE	S
15-Jul-21	4	1045	3	W LANTAU	1	335	ON	HKCRP	809742	800824	SUMMER	NONE	S
15-Jul-21	5	1051	1	W LANTAU	3	40	ON	HKCRP	808624	800647	SUMMER	NONE	S
15-Jul-21	6	1054	1	W LANTAU	2	523	ON	HKCRP	807859	800913	SUMMER	NONE	S
15-Jul-21	7	1100	4	W LANTAU	2	301	ON	HKCRP	806895	801303	SUMMER	NONE	S
22-Jul-21	2	1513	1	SW LANTAU	1	31	ON	HKCRP	806115	803425	SUMMER	NONE	P
22-Jul-21	3	1534	1	SW LANTAU	1	ND	OFF	HKCRP	805952	807560	SUMMER	NONE	
26-Jul-21	1	1120	3	W LANTAU	2	431	ON	HKCRP	811425	800571	SUMMER	PURSE-SEINE	P
26-Jul-21	2	1141	2	W LANTAU	2	107	ON	HKCRP	810338	801414	SUMMER	NONE	P
26-Jul-21	3	1154	5	W LANTAU	2	221	ON	HKCRP	809466	800411	SUMMER	PURSE-SEINE	P
26-Jul-21	4	1218	3	W LANTAU	2	13	ON	HKCRP	809368	799514	SUMMER	NONE	P
26-Jul-21	5	1227	12	W LANTAU	2	93	ON	HKCRP	808370	800007	SUMMER	NONE	P
26-Jul-21	6	1305	1	W LANTAU	2	11	ON	HKCRP	807462	799943	SUMMER	NONE	P
26-Jul-21	7	1318	4	W LANTAU	2	74	ON	HKCRP	806096	801858	SUMMER	NONE	S
26-Jul-21	8	1426	2	SW LANTAU	2	36	ON	HKCRP	805016	804506	SUMMER	NONE	P
26-Jul-21	9	1459	3	SW LANTAU	2	703	ON	HKCRP	804578	807857	SUMMER	NONE	P
26-Jul-21	10	1549	2	SW LANTAU	2	209	ON	HKCRP	803668	808794	SUMMER	NONE	S
2-Aug-21	1	1117	5	W LANTAU	1	130	ON	HKCRP	810441	799898	SUMMER	NONE	S
2-Aug-21	2	1156	12	W LANTAU	1	46	ON	HKCRP	808369	800677	SUMMER	NONE	P
2-Aug-21	3	1229	1	W LANTAU	1	46	ON	HKCRP	806397	800930	SUMMER	NONE	P
2-Aug-21	4	1336	7	SW LANTAU	2	135	ON	HKCRP	804616	805433	SUMMER	PURSE-SEINE	P
10-Aug-21	1	1025	1	W LANTAU	3	458	ON	HKCRP	811899	801788	SUMMER	NONE	S
10-Aug-21	2	1035	1	W LANTAU	3	227	ON	HKCRP	809321	800906	SUMMER	NONE	S
30-Aug-21	1	1151	8	W LANTAU	3	126	ON	HKCRP	808403	800440	SUMMER	NONE	P
30-Aug-21	2	1245	1	W LANTAU	2	ND	OFF	HKCRP	806063	801858	SUMMER	NONE	
30-Aug-21	3	1249	6	SW LANTAU	3	158	ON	HKCRP	806195	802363	SUMMER	NONE	S
9-Sep-21	1	1031	2	W LANTAU	1	113	ON	HKCRP	813093	802482	AUTUMN	NONE	S
9-Sep-21	2	1037	1	W LANTAU	1	42	ON	HKCRP	811677	801870	AUTUMN	NONE	S
9-Sep-21	3	1042	2	W LANTAU	1	88	ON	HKCRP	810637	801373	AUTUMN	NONE	S
9-Sep-21	4	1102	1	SW LANTAU	2	ND	OFF	HKCRP	806051	802270	AUTUMN	NONE	

Appendix II. (cont'd.)

DATE	STG #	TIME	HRD SZ	AREA	BEAU	PSD	EFFORT	TYPE	NORTHING	EASTING	SEASON	BOAT ASSOC.	P/S
14-Sep-21	1	1025	1	W LANTAU	1	1027	ON	HKCRP	812463	802150	AUTUMN	NONE	S
14-Sep-21	2	1036	1	W LANTAU	1	89	ON	HKCRP	809232	800906	AUTUMN	NONE	S
14-Sep-21	3	1044	1	W LANTAU	1	460	ON	HKCRP	807182	801417	AUTUMN	NONE	S
14-Sep-21	4	1048	5	W LANTAU	1	91	ON	HKCRP	806329	801838	AUTUMN	NONE	S
17-Sep-21	1	1115	10	W LANTAU	2	363	ON	HKCRP	811444	802169	AUTUMN	NONE	P
17-Sep-21	2	1135	4	W LANTAU	2	95	ON	HKCRP	811371	800333	AUTUMN	NONE	S
17-Sep-21	3	1200	3	W LANTAU	2	130	ON	HKCRP	809422	800071	AUTUMN	NONE	P
17-Sep-21	4	1222	4	W LANTAU	1	334	ON	HKCRP	808414	800430	AUTUMN	NONE	P
17-Sep-21	5	1254	6	W LANTAU	2	111	ON	HKCRP	806387	800734	AUTUMN	NONE	P
17-Sep-21	6	1310	7	W LANTAU	2	76	ON	HKCRP	806140	801847	AUTUMN	NONE	S
17-Sep-21	7	1335	2	SW LANTAU	2	43	ON	HKCRP	806150	802497	AUTUMN	PURSE-SEINE	P
5-Oct-21	1	1021	8	W LANTAU	2	395	ON	HKCRP	813016	802306	AUTUMN	NONE	S
5-Oct-21	2	1031	1	W LANTAU	2	68	ON	HKCRP	810715	801383	AUTUMN	NONE	S
5-Oct-21	3	1037	5	W LANTAU	2	331	ON	HKCRP	809099	800802	AUTUMN	NONE	S
6-Oct-21	1	1019	1	W LANTAU	3	197	ON	HKCRP	813657	802978	AUTUMN	NONE	S
6-Oct-21	2	1027	5	W LANTAU	3	176	ON	HKCRP	812397	802057	AUTUMN	NONE	S
6-Oct-21	3	1039	2	W LANTAU	3	68	ON	HKCRP	810970	801064	AUTUMN	NONE	S
6-Oct-21	4	1051	1	W LANTAU	2	120	ON	HKCRP	808922	800730	AUTUMN	NONE	S
6-Oct-21	5	1055	2	W LANTAU	2	58	ON	HKCRP	807804	800779	AUTUMN	NONE	S
6-Oct-21	6	1131	6	W LANTAU	3	600	ON	HKCRP	808368	801100	AUTUMN	NONE	P
6-Oct-21	7	1153	3	W LANTAU	3	0	ON	HKCRP	808427	799646	AUTUMN	NONE	P
6-Oct-21	8	1212	14	W LANTAU	3	863	ON	HKCRP	810383	801032	AUTUMN	NONE	S
6-Oct-21	9	1240	6	W LANTAU	2	83	ON	HKCRP	811457	801416	AUTUMN	NONE	P
6-Oct-21	10	1307	4	W LANTAU	2	37	ON	HKCRP	812432	800862	AUTUMN	NONE	P
18-Oct-21	1	1043	4	W LANTAU	3	194	ON	HKCRP	813612	803060	AUTUMN	NONE	S
18-Oct-21	2	1132	3	W LANTAU	2	120	ON	HKCRP	810508	799816	AUTUMN	NONE	S
18-Oct-21	3	1251	1	SW LANTAU	3	ND	OFF	HKCRP	806006	802528	AUTUMN	NONE	
18-Oct-21	4	1302	5	SW LANTAU	2	448	ON	HKCRP	805926	803476	AUTUMN	NONE	P
18-Oct-21	5	1346	1	SW LANTAU	2	259	ON	HKCRP	807881	805945	AUTUMN	NONE	S
18-Oct-21	6	1400	2	SW LANTAU	2	65	ON	HKCRP	807325	807408	AUTUMN	NONE	P
19-Oct-21	1	1028	5	W LANTAU	1	373	ON	HKCRP	815242	802507	AUTUMN	NONE	S
19-Oct-21	2	1046	2	W LANTAU	1	149	ON	HKCRP	814476	803093	AUTUMN	NONE	P
19-Oct-21	3	1113	1	W LANTAU	2	342	ON	HKCRP	812396	802181	AUTUMN	NONE	P
19-Oct-21	4	1141	8	W LANTAU	2	5	ON	HKCRP	810348	801795	AUTUMN	NONE	P

Appendix II. (cont'd.)

DATE	STG #	TIME	HRD SZ	AREA	BEAU	PSD	EFFORT	TYPE	NORTHING	EASTING	SEASON	BOAT ASSOC.	P/S
19-Oct-21	5	1213	1	W LANTAU	2	52	ON	HKCRP	809423	799927	AUTUMN	NONE	P
3-Nov-21	1	1013	2	W LANTAU	2	62	ON	HKCRP	813779	803071	AUTUMN	NONE	S
3-Nov-21	2	1028	3	W LANTAU	2	477	ON	HKCRP	811080	801343	AUTUMN	NONE	S
3-Nov-21	3	1030	3	W LANTAU	2	105	ON	HKCRP	810549	801208	AUTUMN	NONE	S
4-Nov-21	1	1034	3	W LANTAU	2	200	ON	HKCRP	809508	801092	AUTUMN	NONE	S
4-Nov-21	2	1119	6	W LANTAU	2	7	ON	HKCRP	808401	801028	AUTUMN	NONE	S
4-Nov-21	3	1138	3	W LANTAU	2	131	ON	HKCRP	809368	799751	AUTUMN	NONE	P
4-Nov-21	4	1147	1	W LANTAU	2	210	ON	HKCRP	809431	801102	AUTUMN	NONE	P
4-Nov-21	5	1202	4	W LANTAU	2	126	ON	HKCRP	810474	799991	AUTUMN	NONE	P
4-Nov-21	6	1238	3	W LANTAU	2	1259	ON	HKCRP	813569	802586	AUTUMN	NONE	S
4-Nov-21	7	1251	1	W LANTAU	2	944	ON	HKCRP	813008	801172	AUTUMN	NONE	S
4-Nov-21	8	1319	1	W LANTAU	2	85	ON	HKCRP	814601	801856	AUTUMN	NONE	P
4-Nov-21	9	1401	1	NW LANTAU	2	148	ON	HKCRP	821638	804674	AUTUMN	NONE	P
12-Nov-21	1	1042	18	W LANTAU	3	219	ON	HKCRP	808856	800843	AUTUMN	NONE	S
15-Nov-21	1	1029	1	W LANTAU	2	405	ON	HKCRP	814523	801722	AUTUMN	NONE	S
15-Nov-21	2	1103	2	W LANTAU	2	13	ON	HKCRP	812430	801769	AUTUMN	NONE	P
15-Nov-21	3	1129	14	W LANTAU	2	59	ON	HKCRP	810143	799619	AUTUMN	NONE	S
15-Nov-21	4	1234	6	W LANTAU	2	344	ON	HKCRP	806487	800518	AUTUMN	NONE	P
15-Nov-21	5	1247	5	W LANTAU	2	0	ON	HKCRP	806485	801425	AUTUMN	NONE	P
15-Nov-21	6	1356	1	SW LANTAU	2	111	ON	HKCRP	807374	805160	AUTUMN	NONE	S
18-Nov-21	1	1011	1	W LANTAU	3	450	ON	HKCRP	813989	803246	AUTUMN	NONE	S
24-Nov-21	1	1018	3	W LANTAU	3	1580	ON	HKCRP	813734	803091	AUTUMN	NONE	P
24-Nov-21	2	1137	5	SW LANTAU	2	421	ON	HKCRP	805415	804486	AUTUMN	NONE	P
24-Nov-21	3	1151	2	SW LANTAU	2	444	ON	HKCRP	805747	804456	AUTUMN	NONE	P
1-Dec-21	1	1031	1	W LANTAU	4	172	ON	HKCRP	810162	801207	WINTER	NONE	S
9-Dec-21	1	1038	2	W LANTAU	2	185	ON	HKCRP	814165	803463	WINTER	GILLNET	S
9-Dec-21	2	1110	3	W LANTAU	2	532	ON	HKCRP	811521	802447	WINTER	NONE	S
9-Dec-21	3	1138	5	W LANTAU	3	308	ON	HKCRP	810484	800744	WINTER	NONE	P
9-Dec-21	4	1208	6	W LANTAU	2	126	ON	HKCRP	809290	799648	WINTER	NONE	P
9-Dec-21	5	1223	2	W LANTAU	2	68	ON	HKCRP	808436	800213	WINTER	NONE	P
9-Dec-21	6	1249	4	W LANTAU	2	137	ON	HKCRP	806585	800951	WINTER	NONE	P
9-Dec-21	7	1547	1	SW LANTAU	2	40	ON	HKCRP	804208	810569	WINTER	NONE	P
10-Dec-21	1	1006	1	NW LANTAU	2	86	ON	HKCRP	816254	805415	WINTER	NONE	P
10-Dec-21	2	1100	9	NW LANTAU	3	21	ON	HKCRP	827926	805449	WINTER	NONE	P

Appendix II. (cont'd.)

DATE	STG #	TIME	HRD SZ	AREA	BEAU	PSD	EFFORT	TYPE	NORTHING	EASTING	SEASON	BOAT ASSOC.	P/S
5-Jan-22	3	1536	5	SW LANTAU	2	285	ON	HKCRP	805706	803156	WINTER	NONE	P
6-Jan-22	1	1041	1	W LANTAU	3	174	ON	HKCRP	818107	803781	WINTER	NONE	P
6-Jan-22	2	1112	10	W LANTAU	2	111	ON	HKCRP	814666	802217	WINTER	GILLNET	S
6-Jan-22	3	1201	1	W LANTAU	2	1279	ON	HKCRP	811434	801509	WINTER	NONE	P
18-Jan-22	2	1422	1	SW LANTAU	3	267	ON	HKCRP	805322	806466	WINTER	NONE	P
20-Jan-22	1	1232	10	W LANTAU	2	365	ON	HKCRP	814235	802082	WINTER	NONE	P
20-Jan-22	2	1258	2	W LANTAU	3	430	ON	HKCRP	814011	802906	WINTER	NONE	P
20-Jan-22	3	1333	2	W LANTAU	2	7	ON	HKCRP	816269	803766	WINTER	NONE	P
14-Feb-22	1	1052	1	W LANTAU	3	648	ON	HKCRP	813601	803132	WINTER	NONE	S
14-Feb-22	2	1135	3	W LANTAU	3	60	ON	HKCRP	811083	800065	WINTER	NONE	S
14-Feb-22	3	1200	3	W LANTAU	2	183	ON	HKCRP	809431	801267	WINTER	NONE	S
14-Feb-22	4	1229	7	W LANTAU	2	702	ON	HKCRP	808291	800945	WINTER	NONE	S
14-Feb-22	5	1253	2	W LANTAU	3	77	ON	HKCRP	807415	801252	WINTER	NONE	P
14-Feb-22	6	1418	3	W LANTAU	2	102	ON	HKCRP	807704	805903	WINTER	NONE	S
28-Feb-22	1	1130	3	W LANTAU	2	11	ON	HKCRP	810429	800372	SPRING	GILLNET	P
28-Feb-22	2	1145	6	W LANTAU	2	31	ON	HKCRP	809475	801143	SPRING	GILLNET	S
28-Feb-22	3	1206	4	W LANTAU	2	368	ON	HKCRP	809391	799174	SPRING	NONE	P
28-Feb-22	4	1306	1	SW LANTAU	2	42	ON	HKCRP	806065	812624	SPRING	NONE	S
3-Mar-22	1	1038	3	W LANTAU	2	546	ON	HKCRP	809796	801185	SPRING	NONE	S
3-Mar-22	2	1138	8	W LANTAU	3	41	ON	HKCRP	807471	800860	SPRING	NONE	P
3-Mar-22	3	1200	6	W LANTAU	2	389	ON	HKCRP	808446	800687	SPRING	GILLNET	P
3-Mar-22	4	1233	2	W LANTAU	1	247	ON	HKCRP	810450	801043	SPRING	GILLNET	P
10-Mar-22	1	1123	3	W LANTAU	2	153	ON	HKCRP	811457	801416	SPRING	NONE	P

Appendix III. HKCRP-AFCD Finless Porpoise Sighting Database (April 2021 - March 2022)
(Note: P = sightings made on primary lines; S = sightings made on secondary lines)

DATE	STG #	TIME	HRD SZ	AREA	BEAU	PSD	EFFORT	NORTHING	EASTING	SEASON	P/S
1-Apr-21	1	1500	1	SW LANTAU	1	215	ON	807684	805212	SPRING	S
13-Apr-21	1	1523	1	PO TOI	2	152	ON	805471	855473	SPRING	P
14-Apr-21	1	1436	1	LAMMA	3	146	ON	804476	828896	SPRING	P
23-Apr-21	1	1142	6	SE LANTAU	2	246	ON	805342	814500	SPRING	P
23-Apr-21	2	1223	1	SE LANTAU	2	13	ON	801912	812453	SPRING	P
28-Apr-21	4	1601	2	SE LANTAU	2	ND	OFF	807603	813142	SPRING	
6-May-21	5	1446	2	SW LANTAU	3	34	ON	802021	807481	SPRING	P
7-May-21	1	1312	1	SW LANTAU	1	170	ON	803300	810608	SPRING	P
14-May-21	3	1220	1	NINE PINS	3	ND	OFF	816954	862982	SPRING	
24-May-21	1	1039	3	PO TOI	1	99	ON	802578	853053	SPRING	P
24-May-21	2	1552	1	PO TOI	1	80	ON	807439	853058	SPRING	P
12-Jul-21	1	1605	3	PO TOI	2	559	ON	806460	848099	SUMMER	P
22-Jul-21	1	1331	1	SW LANTAU	2	7	ON	800976	809521	SUMMER	P
20-Aug-21	1	1042	3	PO TOI	1	88	ON	801542	845338	SUMMER	P
20-Aug-21	2	1513	2	PO TOI	2	201	ON	805433	851472	SUMMER	P
20-Aug-21	3	1548	2	PO TOI	2	28	ON	807449	852037	SUMMER	P
23-Aug-21	1	1042	2	NINEPINS	2	123	ON	815539	857193	SUMMER	P
23-Aug-21	2	1048	3	NINEPINS	1	65	ON	815507	858100	SUMMER	P
25-Aug-21	1	1102	2	SW LANTAU	2	ND	OFF	803548	802491	SUMMER	
25-Aug-21	2	1106	1	SW LANTAU	2	125	ON	803270	802728	SUMMER	S
25-Aug-21	3	1128	1	SW LANTAU	2	16	ON	805847	804497	SUMMER	P
25-Aug-21	4	1313	3	SW LANTAU	2	21	ON	803211	810515	SUMMER	P
3-Sep-21	1	1020	1	PO TOI	1	19	ON	802496	848277	AUTUMN	P
3-Sep-21	2	1025	3	PO TOI	1	163	ON	802519	849133	AUTUMN	P
3-Sep-21	3	1242	2	PO TOI	2	82	ON	804519	855856	AUTUMN	P
3-Sep-21	4	1433	2	PO TOI	2	111	ON	806453	852523	AUTUMN	P
15-Sep-21	1	1117	1	LAMMA	1	233	ON	803578	830639	AUTUMN	S
17-Sep-21	8	1512	1	SW LANTAU	2	23	ON	802042	807790	AUTUMN	S
17-Sep-21	9	1540	3	SW LANTAU	2	23	ON	807377	809295	AUTUMN	S
17-Sep-21	10	1547	2	SW LANTAU	2	128	ON	807486	810502	AUTUMN	S
28-Sep-21	1	1619	2	NINEPINS	2	ND	OFF	812673	865804	AUTUMN	
28-Sep-21	2	1646	5	LAMMA	2	ND	OFF	804258	823574	AUTUMN	
28-Sep-21	3	1654	5	SE LANTAU	2	ND	OFF	805711	812190	AUTUMN	
25-Oct-21	1	1520	1	SE LANTAU	2	3	ON	802344	812412	AUTUMN	P
25-Oct-21	2	1541	1	SW LANTAU	2	83	ON	802059	810575	AUTUMN	P
18-Nov-21	2	1318	1	SW LANTAU	2	37	ON	803830	811517	AUTUMN	P
18-Nov-21	3	1325	3	SW LANTAU	2	314	ON	802656	811474	AUTUMN	P
18-Nov-21	4	1350	2	SE LANTAU	2	337	ON	803793	813477	AUTUMN	P
18-Nov-21	5	1358	3	SE LANTAU	2	91	ON	805576	813510	AUTUMN	P
24-Nov-21	4	1257	3	SW LANTAU	2	89	ON	801221	808500	AUTUMN	P
24-Nov-21	5	1427	3	SE LANTAU	2	112	ON	803584	812455	AUTUMN	P
24-Nov-21	6	1443	1	SE LANTAU	2	144	ON	806707	812460	AUTUMN	P
24-Nov-21	7	1542	3	SE LANTAU	2	26	ON	801853	815423	AUTUMN	S
1-Dec-21	1	1206	2	SW LANTAU	2	842	ON	801589	807439	WINTER	P
6-Dec-21	1	1149	1	LAMMA	3	7	ON	802392	837622	WINTER	P
5-Jan-22	1	1322	1	SW LANTAU	2	64	ON	802457	811484	WINTER	P
5-Jan-22	2	1446	1	SW LANTAU	2	37	ON	801434	807438	WINTER	P
18-Jan-22	1	1329	1	SW LANTAU	2	91	ON	801942	808244	WINTER	S
19-Jan-22	1	1142	1	LAMMA	2	163	ON	802469	836023	WINTER	P
19-Jan-22	2	1306	4	LAMMA	2	173	ON	803529	821305	WINTER	P
19-Jan-22	3	1341	2	LAMMA	2	74	ON	805467	821338	WINTER	P
24-Jan-22	1	1018	2	SE LANTAU	1	288	ON	804761	818470	WINTER	P
24-Jan-22	2	1202	3	SE LANTAU	1	111	ON	801523	813772	WINTER	S
24-Jan-22	3	1211	2	SE LANTAU	1	641	ON	801547	812565	WINTER	S
24-Jan-22	4	1229	1	SW LANTAU	1	190	ON	804129	811538	WINTER	P
24-Jan-22	5	1243	1	SW LANTAU	2	88	ON	807362	811533	WINTER	P
24-Jan-22	6	1251	1	SW LANTAU	2	127	ON	808569	811514	WINTER	P
24-Jan-22	7	1437	1	SW LANTAU	1	714	ON	804804	805423	WINTER	P
14-Feb-22	7	1510	2	SW LANTAU	2	15	ON	802187	807419	WINTER	P

Appendix III. (cont'd)

DATE	STG #	TIME	HRD SZ	AREA	BEAU	PSD	EFFORT	NORTHING	EASTING	SEASON	P/S
1-Mar-22	1	1055	2	LAMMA	2	13	ON	804485	833311	SPRING	S
1-Mar-22	2	1207	3	LAMMA	2	263	ON	801495	833135	SPRING	P
1-Mar-22	3	1233	2	LAMMA	1	37	ON	801487	827348	SPRING	P
1-Mar-22	4	1328	2	LAMMA	2	116	ON	802551	825760	SPRING	P
2-Mar-22	1	1025	4	SE LANTAU	1	265	ON	805403	818522	SPRING	P
2-Mar-22	2	1043	1	SE LANTAU	1	48	ON	801882	818487	SPRING	P
2-Mar-22	3	1234	4	SE LANTAU	2	9	ON	804260	812436	SPRING	P
2-Mar-22	4	1329	3	SW LANTAU	2	241	ON	803564	811496	SPRING	P
2-Mar-22	5	1351	5	SW LANTAU	1	149	ON	800765	809851	SPRING	S
2-Mar-22	6	1510	8	SW LANTAU	2	48	ON	802246	805563	SPRING	S
2-Mar-22	7	1527	2	SW LANTAU	2	129	ON	803054	805451	SPRING	P
4-Mar-22	1	938	1	LAMMA	2	23	ON	810443	832961	SPRING	P
4-Mar-22	2	1509	1	LAMMA	2	23	ON	804532	826401	SPRING	P
10-Mar-22	2	1418	3	SW LANTAU	3	110	ON	801413	806561	SPRING	P

Appendix IV. Individual dolphins identified during AFCD surveys (April 2021 to March 2022)

(*in bold & italics: new individuals*)

DOLPHIN ID	DATE	STG#	AREA
CH12	07/04/21	2	WL
	15/11/21	4	WL
CH38	26/07/21	7	WL
	26/07/21	8	SWL
	26/07/21	9	SWL
	26/07/21	10	SWL
	19/10/21	4	WL
	09/12/21	4	WL
	14/02/22	4	WL
CH108	07/04/21	2	WL
	18/10/21	4	SWL
	19/10/21	4	WL
	09/12/21	1	WL
	05/01/22	3	SWL
CH113	06/05/21	1	WL
	30/08/21	1	WL
	17/09/21	3	WL
CH141	02/08/21	4	SWL
	17/09/21	4	WL
	06/01/22	2	WL
	20/01/22	1	WL
CH196	03/03/22	2	WL
CH205	26/07/21	3	WL
EL01	02/08/21	2	WL
NL33	30/08/21	3	SWL
	12/11/21	1	WL
	06/01/22	2	WL
NL46	10/12/21	2	NWL
NL104	10/12/21	2	NWL
NL123	30/08/21	3	SWL
NL202	10/12/21	2	NWL
NL224	17/09/21	1	WL
NL236	20/05/21	2	WL
NL242	26/07/21	5	WL
	15/11/21	2	WL
NL247	06/10/21	8	WL
NL259	19/10/21	3	WL
	28/02/22	2	WL
NL261	14/09/21	4	WL
	12/11/21	1	WL
	10/12/21	2	NWL
NL269	07/07/21	1	WL
	09/09/21	3	WL
	12/11/21	1	WL
	14/02/22	5	WL
NL272	09/06/21	4	SWL
	04/11/21	9	NWL
	10/12/21	2	NWL
NL296	02/08/21	1	WL
	02/08/21	2	WL
	30/08/21	1	WL
	06/01/22	2	WL
NL306	06/05/21	3	WL
	06/05/21	4	SWL
	18/10/21	3	SWL
	18/10/21	6	SWL
NL311	12/11/21	1	WL
NL313	15/07/21	2	WL
NL317	17/09/21	1	WL
NL321	14/09/21	4	WL
	10/12/21	2	NWL
NL327	07/07/21	1	WL

DOLPHIN ID	DATE	STG#	AREA
NL331	09/06/21	5	SWL
NL332	09/06/21	4	SWL
	15/07/21	4	WL
	12/11/21	1	WL
SL40	12/05/21	1	SWL
	20/05/21	3	SWL
	26/07/21	5	WL
	17/09/21	6	WL
	14/02/22	4	WL
	03/03/22	2	WL
	10/03/22	1	WL
SL44	26/07/21	10	SWL
	30/08/21	3	SWL
	06/10/21	10	WL
	18/10/21	2	WL
	19/10/21	4	WL
	15/11/21	5	WL
	28/02/22	1	WL
	03/03/22	4	WL
SL57	12/05/21	1	SWL
SL58	02/08/21	2	WL
	17/09/21	2	WL
	18/10/21	1	WL
	09/12/21	2	WL
SL59	12/11/21	1	WL
SL60	22/04/21	2	WL
	07/05/21	2	SWL
	02/08/21	4	SWL
	04/11/21	2	WL
	15/11/21	3	WL
	24/11/21	2	SWL
	28/02/22	3	WL
SL66	05/01/22	3	SWL
	06/01/22	2	WL
SL67	11/05/21	2	SWL
	12/11/21	1	WL
SL68	04/11/21	5	WL
	09/12/21	4	WL
	20/01/22	1	WL
	14/02/22	4	WL
WL05	10/12/21	2	NWL
WL29	05/10/21	3	WL
	12/11/21	1	WL
	14/02/22	2	WL
WL42	07/04/21	2	WL
	06/10/21	8	WL
	12/11/21	1	WL
	15/11/21	3	WL
	09/12/21	4	WL
	14/02/22	4	WL
WL46	06/05/21	1	WL
	07/07/21	1	WL
WL61	28/04/21	2	SWL
	06/05/21	3	WL
	12/05/21	1	SWL
	02/08/21	4	SWL
	04/11/21	2	WL
	14/02/22	4	WL
WL66	26/07/21	2	WL
	26/07/21	5	WL
WL72	07/04/21	2	WL
	26/07/21	5	WL

DOLPHIN ID	DATE	STG#	AREA
WL72	06/10/21	8	WL
	18/10/21	1	WL
	19/10/21	4	WL
WL79	06/05/21	1	WL
	09/06/21	1	WL
	09/06/21	3	WL
	07/07/21	1	WL
	08/07/21	1	WL
	30/08/21	1	WL
	14/09/21	2	WL
	05/10/21	1	WL
	06/10/21	1	WL
	03/11/21	1	WL
	04/11/21	6	WL
	15/11/21	2	WL
	09/12/21	1	WL
	20/01/22	1	WL
	14/02/22	1	WL
WL91	12/05/21	1	SWL
	20/05/21	2	WL
	22/07/21	2	SWL
	05/10/21	1	WL
	04/11/21	2	WL
	09/12/21	3	WL
	14/02/22	6	SWL
	28/02/22	1	WL
	03/03/22	3	WL
	10/03/22	1	WL
WL92	26/07/21	5	WL
	04/11/21	5	WL
	12/11/21	1	WL
	15/11/21	3	WL
	06/01/22	2	WL
	14/02/22	4	WL
WL94	17/09/21	4	WL
	12/11/21	1	WL
	15/11/21	4	WL
	24/11/21	2	SWL
	28/02/22	3	WL
WL98	02/08/21	1	WL
	02/08/21	2	WL
WL109	06/05/21	1	WL
	15/07/21	2	WL
	26/07/21	5	WL
	17/09/21	5	WL
	06/10/21	6	WL
	04/11/21	3	WL
	15/11/21	4	WL
	09/12/21	6	WL
	20/01/22	1	WL
WL114	07/04/21	1	WL
	09/09/21	1	WL
	06/10/21	8	WL
	19/10/21	5	WL
	15/11/21	5	WL
WL118	12/11/21	1	WL
	15/11/21	4	WL
WL123	22/04/21	1	WL
	22/04/21	2	WL
	28/04/21	3	SWL
	02/08/21	4	SWL
	17/09/21	6	WL

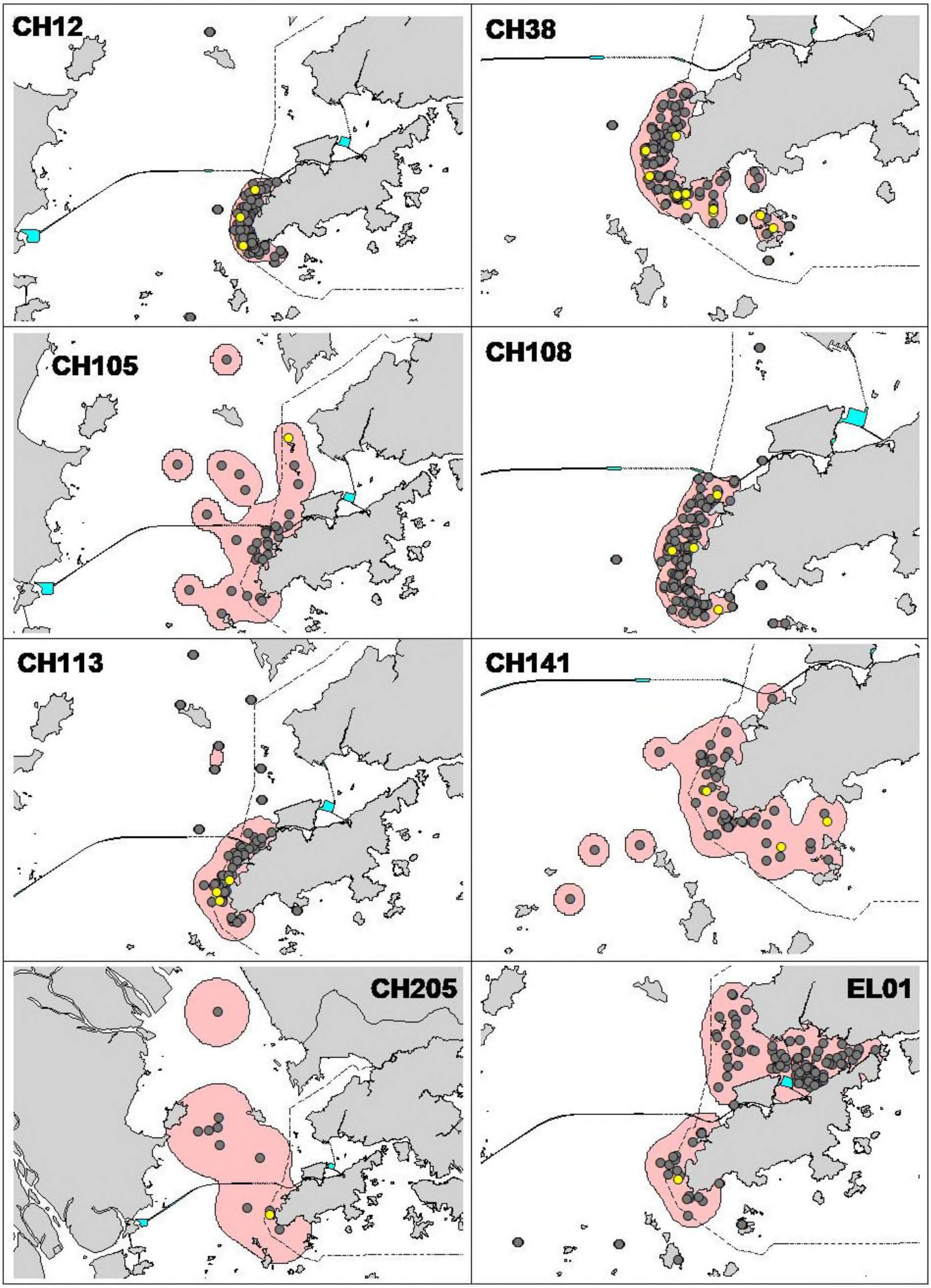
Appendix IV. (cont'd)
(***in bold & italics: new individuals***)

DOLPHIN ID	DATE	STG#	AREA
WL123	05/10/21	3	WL
	06/10/21	2	WL
	06/10/21	6	WL
	04/11/21	2	WL
	24/11/21	3	SWL
	05/01/22	3	SWL
	14/02/22	6	SWL
	03/03/22	3	WL
WL128	15/11/21	3	WL
WL129	09/06/21	3	WL
WL130	07/04/21	1	WL
	04/11/21	2	WL
	09/12/21	3	WL
	20/01/22	1	WL
	28/02/22	2	WL
	03/03/22	3	WL
	10/03/22	1	WL
WL131	15/07/21	2	WL
	26/07/21	7	WL
	26/07/21	9	SWL
	17/09/21	5	WL
	06/10/21	8	WL
	18/10/21	1	WL
	20/01/22	1	WL
WL142	26/07/21	5	WL
	18/10/21	2	WL
	15/11/21	3	WL
	09/12/21	3	WL
	28/02/22	2	WL
WL145	06/10/21	9	WL
	19/10/21	1	WL
WL152	06/05/21	1	WL
	07/07/21	3	WL
	26/07/21	5	WL
	14/09/21	4	WL
	17/09/21	6	WL
	06/10/21	2	WL
	06/10/21	6	WL
	04/11/21	3	WL
	09/12/21	6	WL
	05/01/22	3	SWL
	28/02/22	4	SWL
	03/03/22	2	WL
WL166	26/07/21	6	WL
WL168	22/04/21	2	WL
	06/05/21	3	WL
	11/05/21	2	SWL
	09/06/21	4	SWL
	15/07/21	4	WL
	22/07/21	3	SWL
	26/07/21	8	SWL
	26/07/21	9	SWL
	17/09/21	6	WL
	05/10/21	3	WL
	18/10/21	6	SWL
	03/03/22	3	WL
WL171	04/11/21	5	WL
WL179	19/10/21	4	WL
WL180	22/04/21	3	WL
	15/07/21	5	WL
	02/08/21	4	SWL
	17/09/21	6	WL

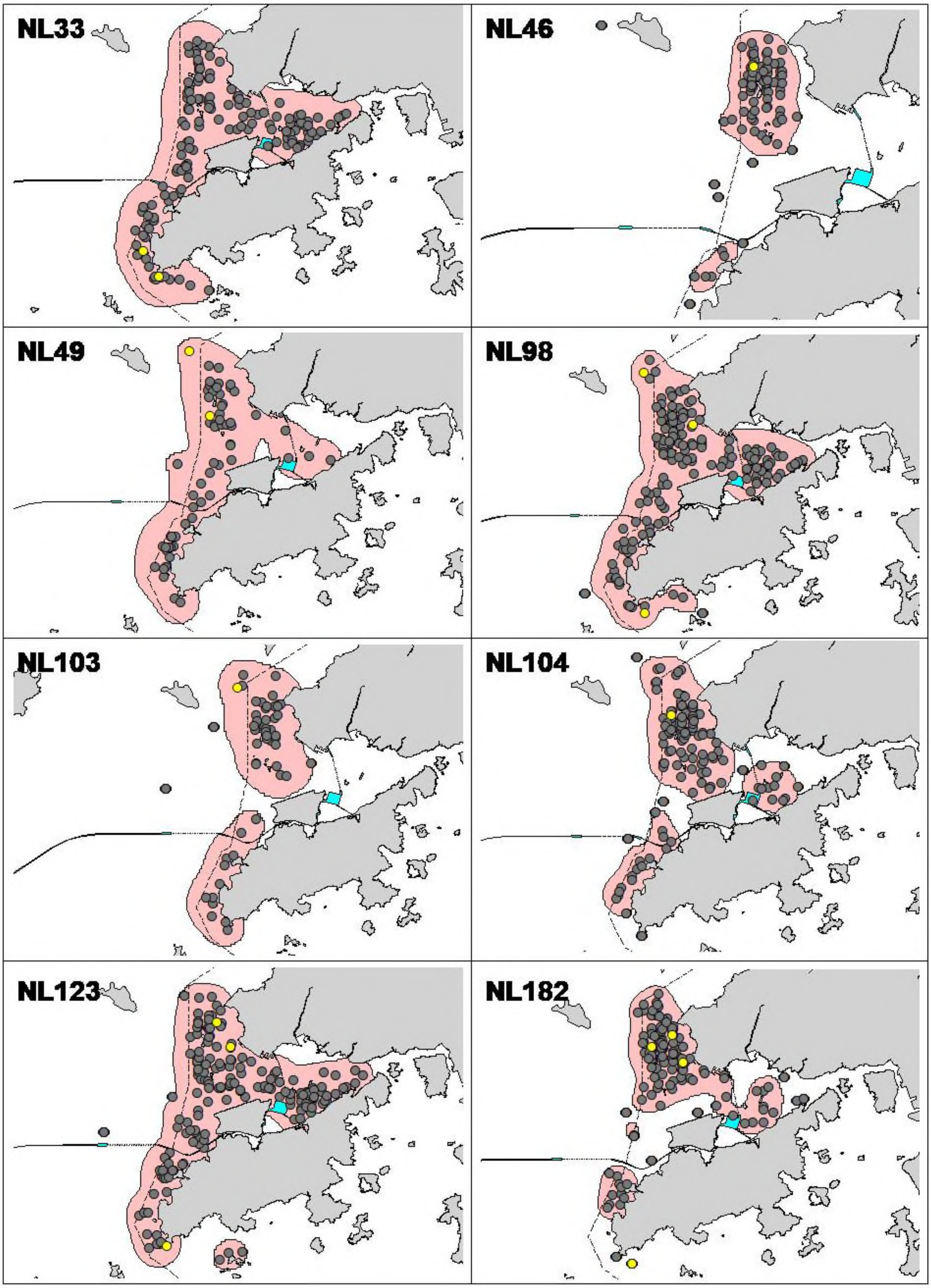
DOLPHIN ID	DATE	STG#	AREA
WL180	05/10/21	3	WL
	06/10/21	5	WL
	09/12/21	6	WL
	05/01/22	3	SWL
	14/02/22	5	WL
	03/03/22	2	WL
WL191	17/09/21	2	WL
WL206	17/09/21	2	WL
WL208	07/04/21	2	WL
	17/09/21	3	WL
	06/10/21	9	WL
	18/10/21	4	SWL
	18/11/21	1	WL
	09/12/21	2	WL
WL210	02/08/21	2	WL
	09/09/21	2	WL
	15/11/21	3	WL
	18/01/22	1	SWL
WL213	12/11/21	1	WL
	14/02/22	3	WL
	14/02/22	4	WL
	03/03/22	1	WL
	03/03/22	2	WL
WL214	07/07/21	1	WL
WL216	07/07/21	1	WL
WL220	22/04/21	3	WL
	02/08/21	4	SWL
	14/09/21	4	WL
	17/09/21	6	WL
	06/10/21	5	WL
	06/01/22	2	WL
	14/02/22	6	SWL
	03/03/22	2	WL
WL221	09/09/21	4	SWL
	04/11/21	1	WL
	04/11/21	2	WL
	24/11/21	2	SWL
WL229	12/05/21	1	SWL
WL236	15/11/21	3	WL
	06/01/22	2	WL
WL243	09/06/21	5	SWL
	17/09/21	4	WL
	10/12/21	1	NWL
	20/01/22	3	WL
WL249	26/07/21	3	WL
WL250	06/05/21	3	WL
	11/05/21	2	SWL
	12/05/21	1	SWL
	20/05/21	3	SWL
	26/07/21	1	WL
	26/07/21	3	WL
WL254	22/04/21	1	WL
	06/10/21	2	WL
	12/11/21	1	WL
	15/11/21	1	WL
	28/02/22	3	WL
WL259	26/07/21	1	WL
WL261	07/07/21	1	WL
WL273	30/08/21	2	WL
	17/09/21	6	WL
	17/09/21	7	SWL
	05/10/21	1	WL

DOLPHIN ID	DATE	STG#	AREA
WL273	18/10/21	4	SWL
	04/11/21	6	WL
	28/02/22	2	WL
	03/03/22	3	WL
WL286	07/04/21	2	WL
	06/05/21	1	WL
	02/08/21	2	WL
	03/11/21	3	WL
	12/11/21	1	WL
	15/11/21	5	WL
WL291	06/10/21	8	WL
WL294	26/07/21	7	WL
	02/08/21	4	SWL
WL295	02/08/21	2	WL
	30/08/21	1	WL
WL298	06/10/21	8	WL
WL299	15/11/21	3	WL
	28/02/22	1	WL
	28/02/22	2	WL
WL300	06/01/22	2	WL
	14/02/22	3	WL
	14/02/22	4	WL
	03/03/22	1	WL
	03/03/22	2	WL
WL302	06/05/21	1	WL
	20/05/21	2	WL
WL303	17/09/21	3	WL
WL304	09/06/21	1	WL
	09/06/21	3	WL
	17/09/21	1	WL
WL305	07/04/21	2	WL
	02/08/21	2	WL
	03/11/21	3	WL
	12/11/21	1	WL
	15/11/21	5	WL
	24/11/21	2	SWL
	28/02/22	3	WL
WL307	02/08/21	2	WL
	02/08/21	3	WL
	17/09/21	1	WL
WL308	26/07/21	3	WL
WL310	20/01/22	1	WL
WL311	09/06/21	3	WL
WL313	***02/08/21***	***1***	***WL***
	30/08/21	***1***	***WL***
	15/11/21	***3***	***WL***
WL314	***15/11/21***	***3***	***WL***
	14/02/22	***4***	***WL***
WL315	***02/08/21***	***1***	***WL***
WL317	***10/08/21***	***2***	***WL***
	04/11/21	***4***	***WL***
	09/12/21	***5***	***WL***
	28/02/22	***2***	***WL***
WL318	***30/08/21***	***1***	***WL***
	12/11/21	***1***	***WL***
	15/11/21	***5***	***WL***
	24/11/21	***2***	***SWL***
WL319	***14/09/21***	***4***	***WL***
	17/09/21	***4***	***WL***
	10/12/21	***2***	***NWL***

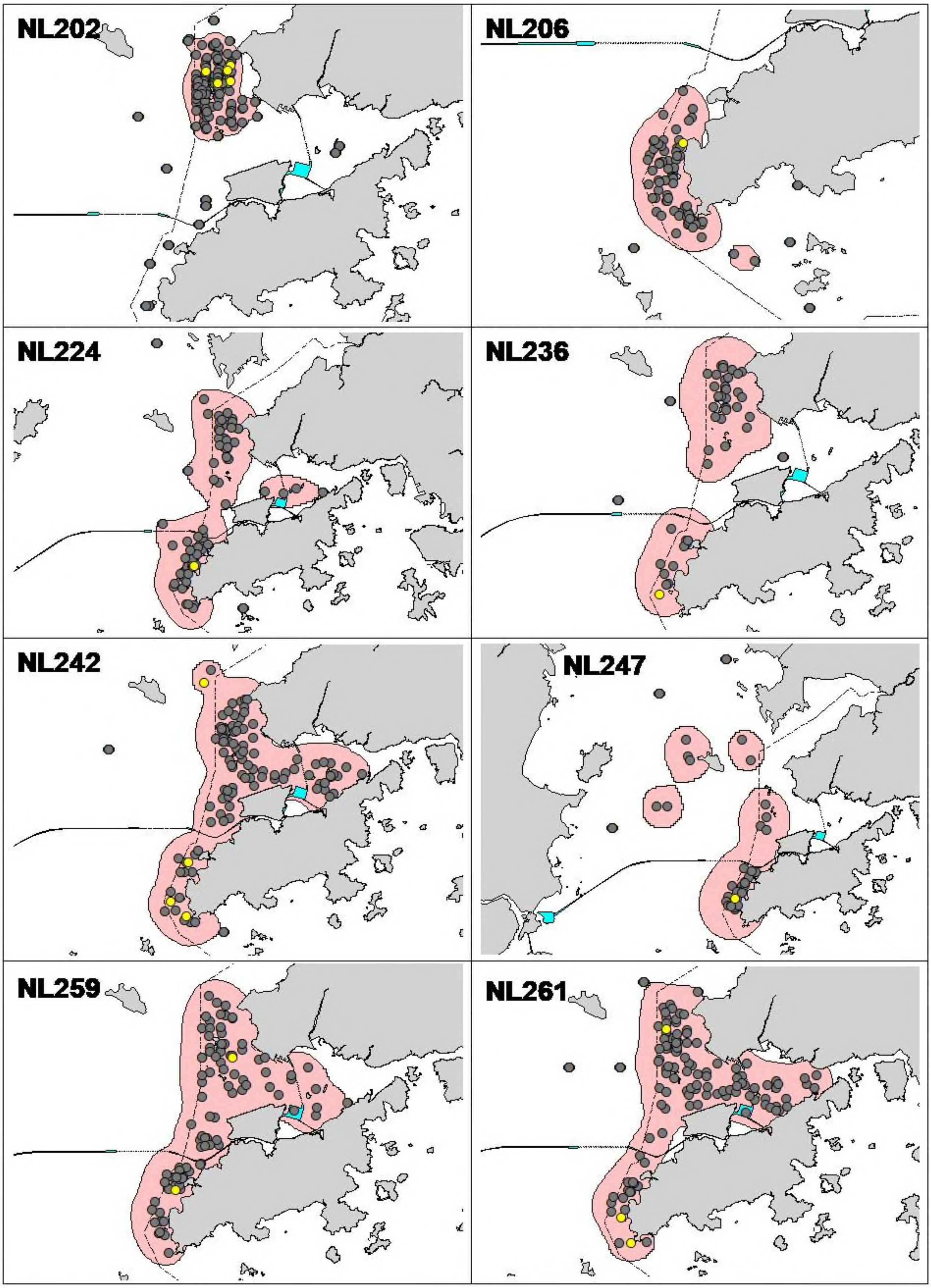
Appendix V. Ranging patterns (95% kernel ranges) of 101 individual dolphins with 10+ re-sightings that were sighted during 2021 (note: yellow dots indicates sightings made in 2021)



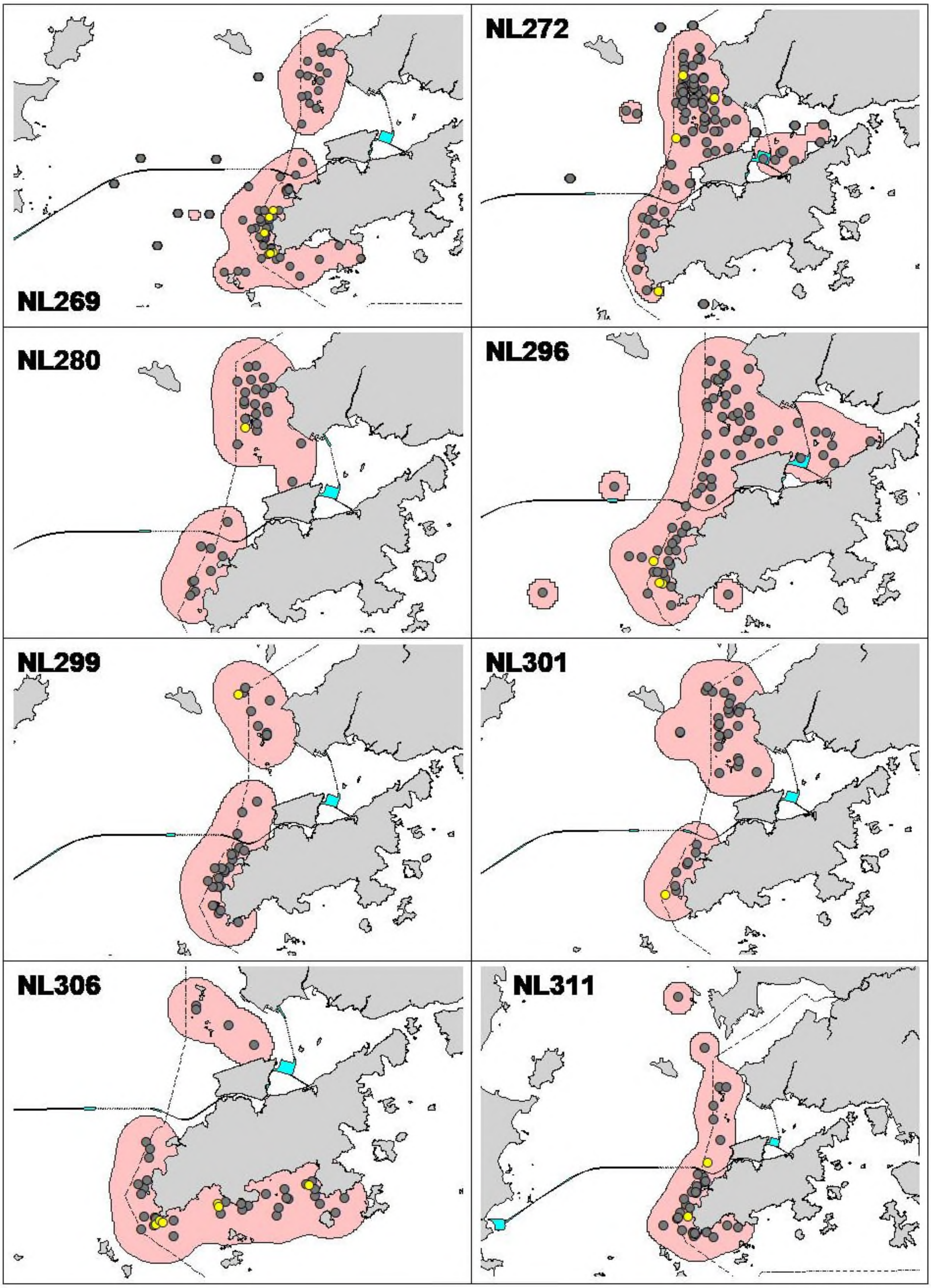
Appendix V. (cont'd).



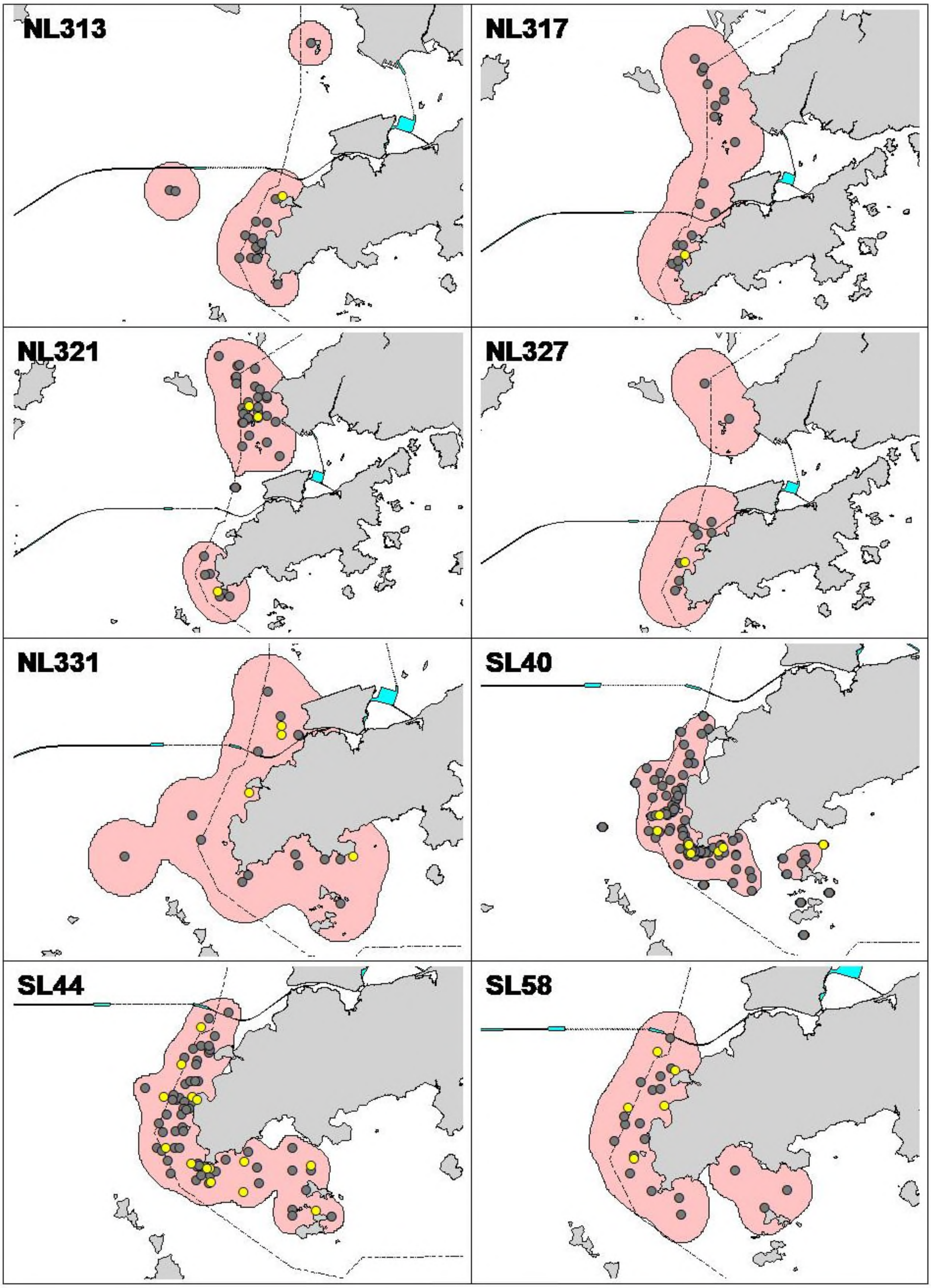
Appendix V. (cont'd).



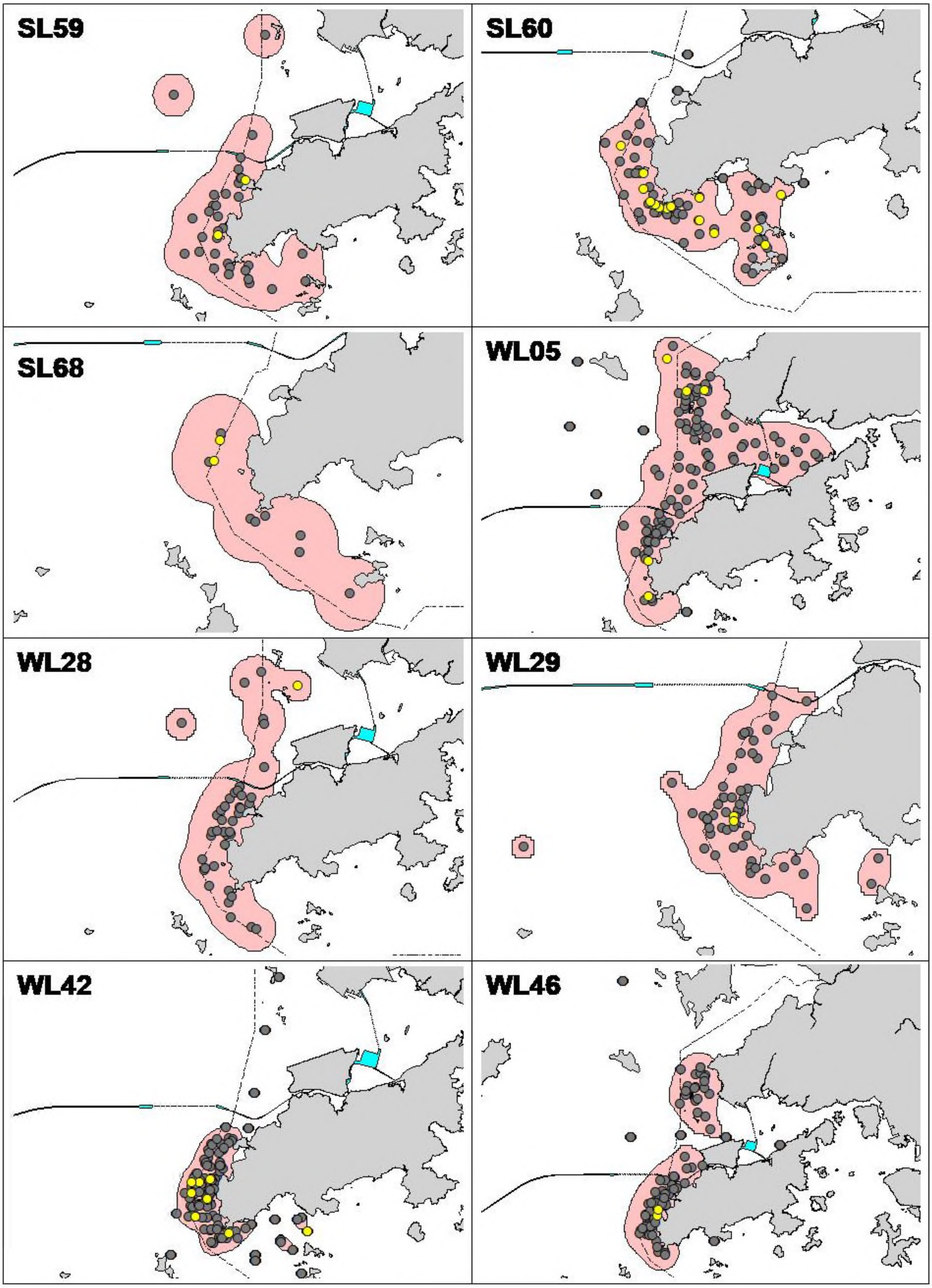
Appendix V. (cont'd).



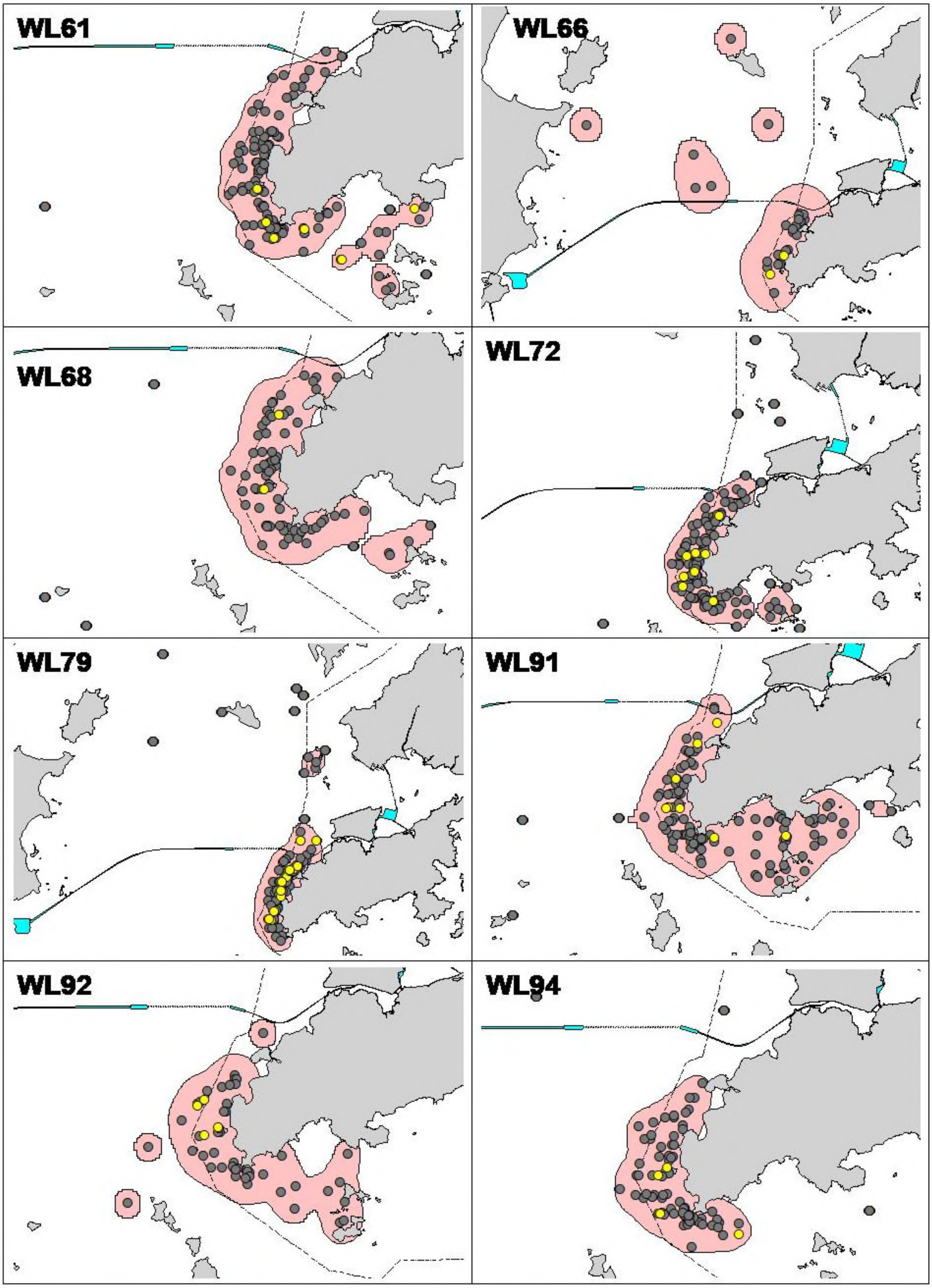
Appendix V. (cont'd).



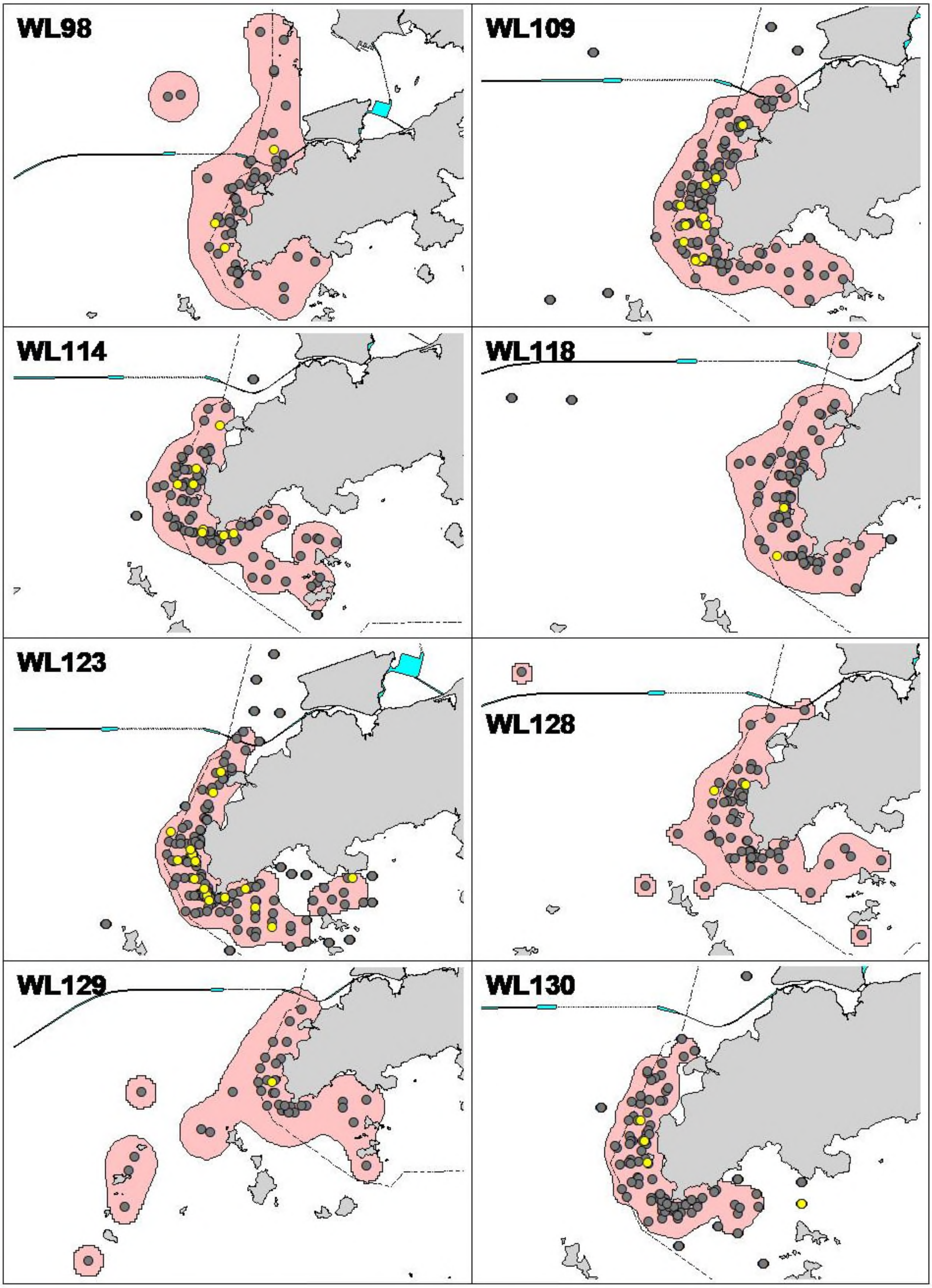
Appendix V. (cont'd).



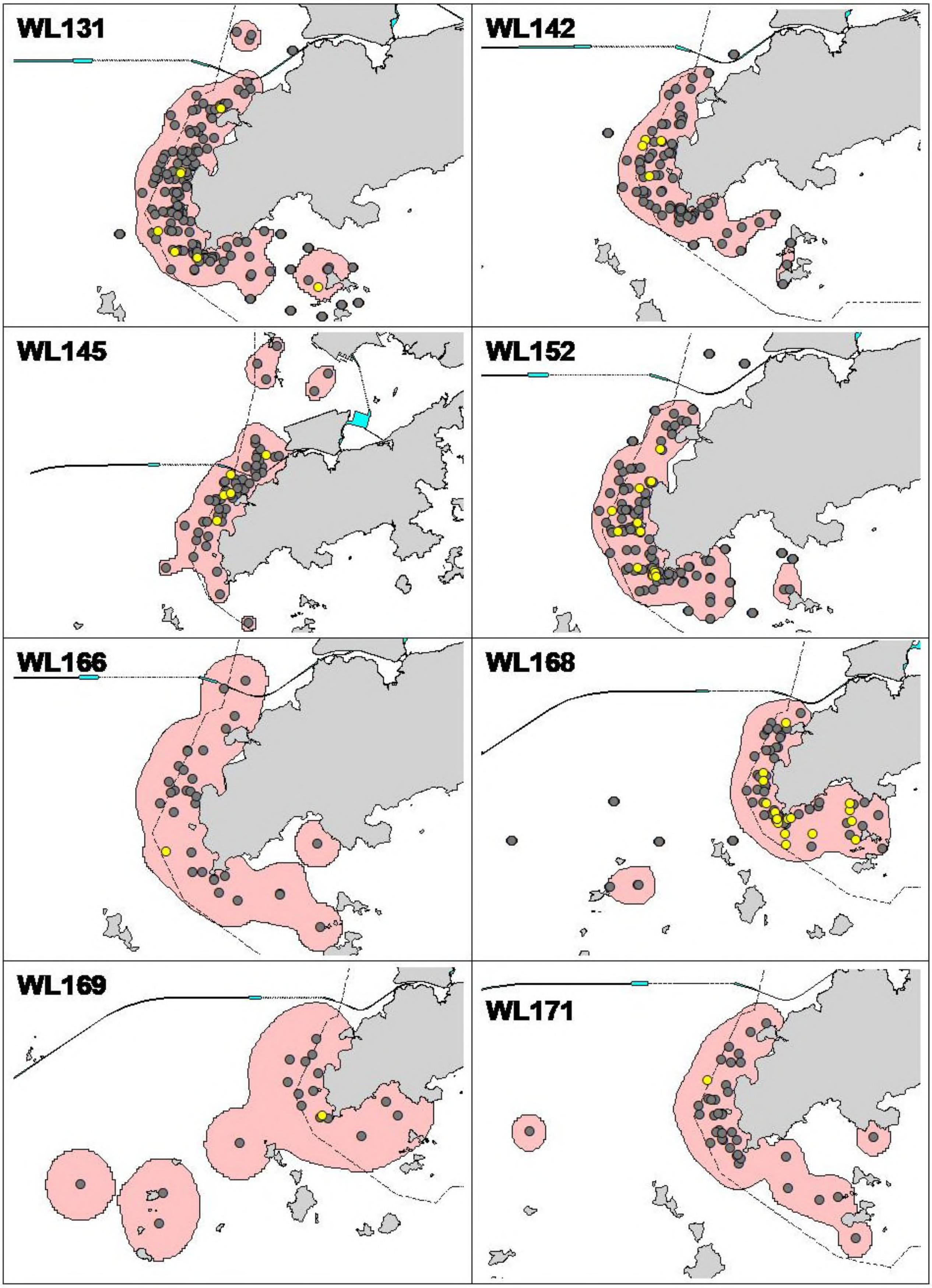
Appendix V. (cont'd).



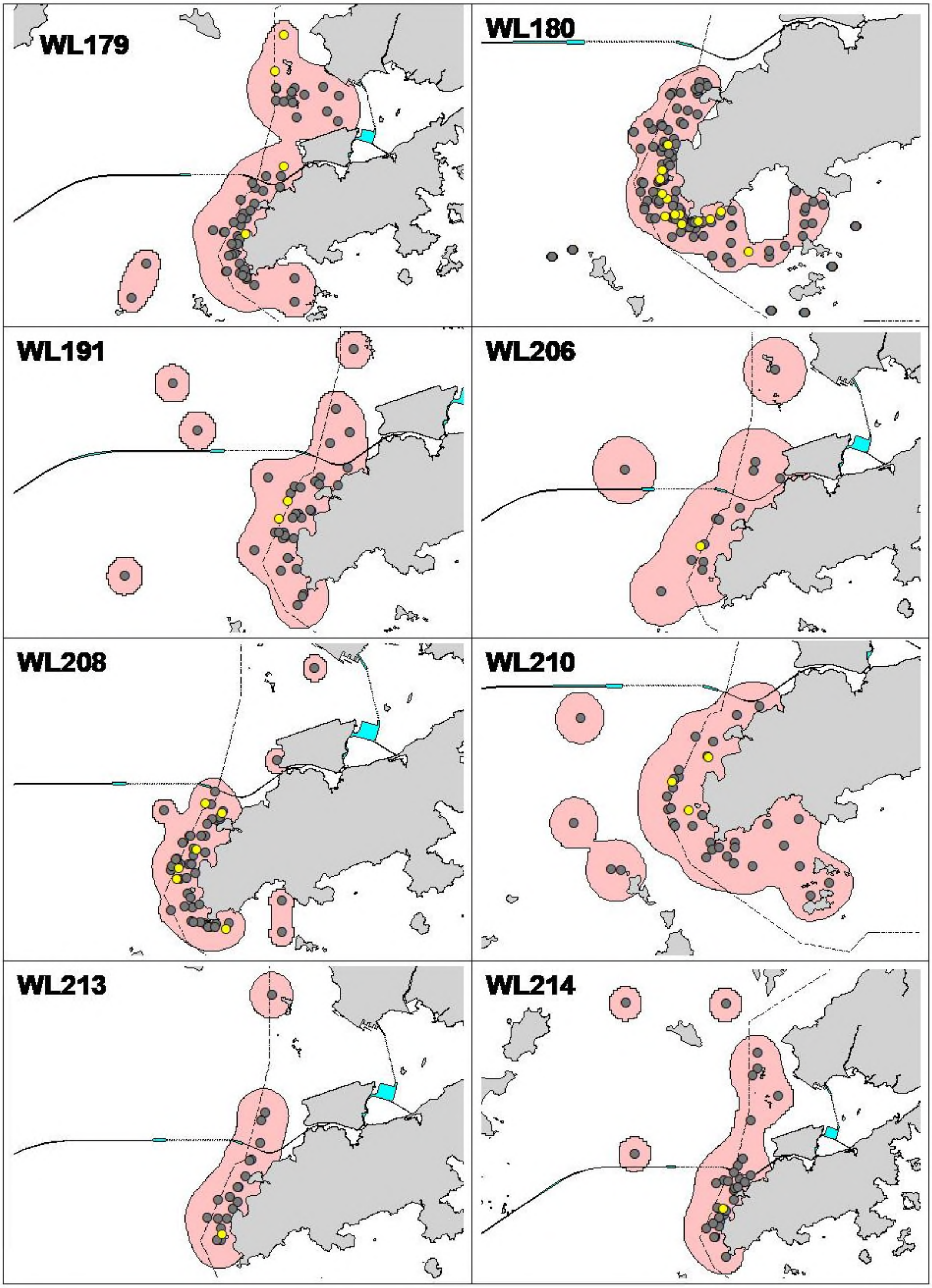
Appendix V. (cont'd).



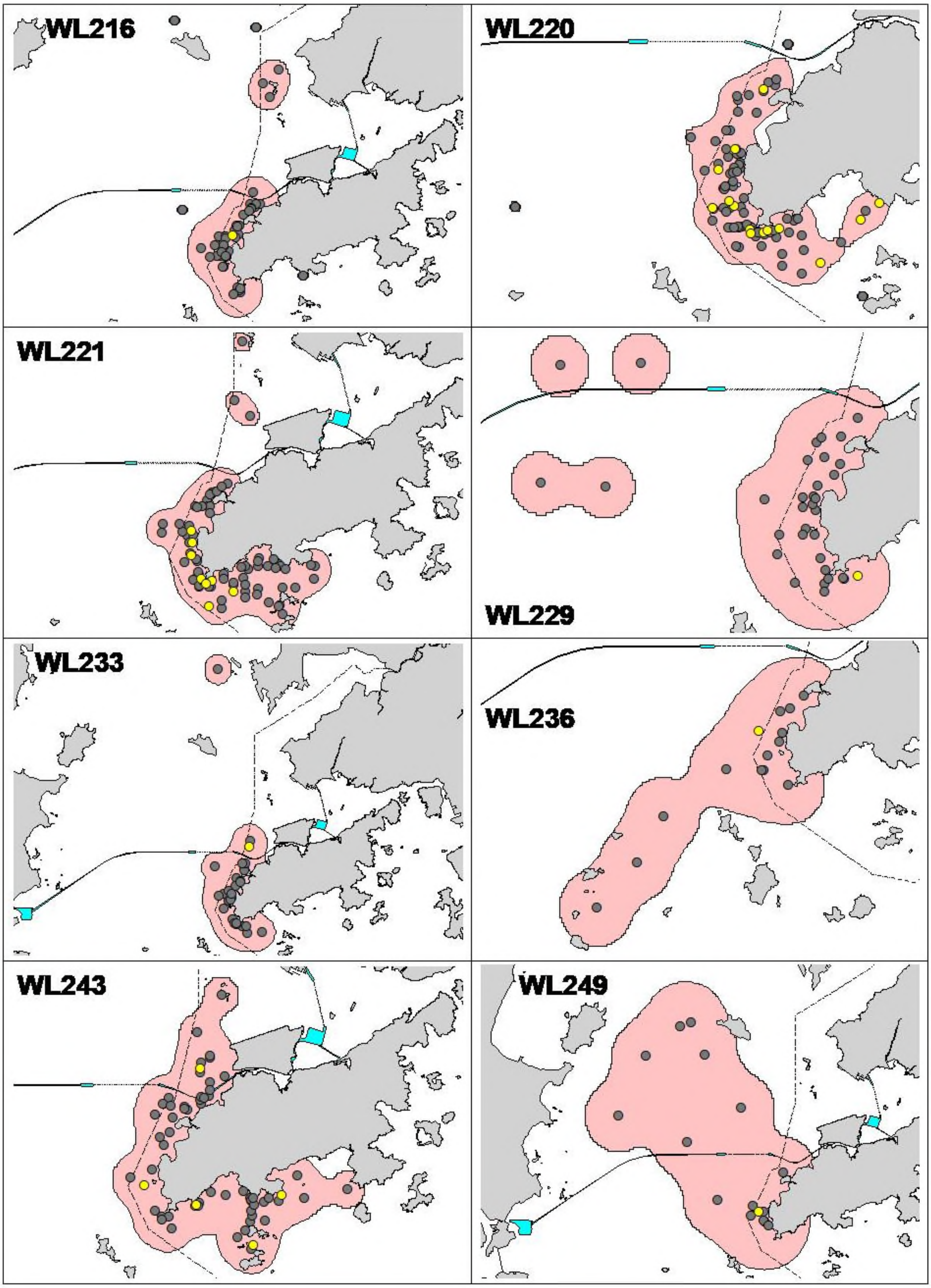
Appendix V. (cont'd).



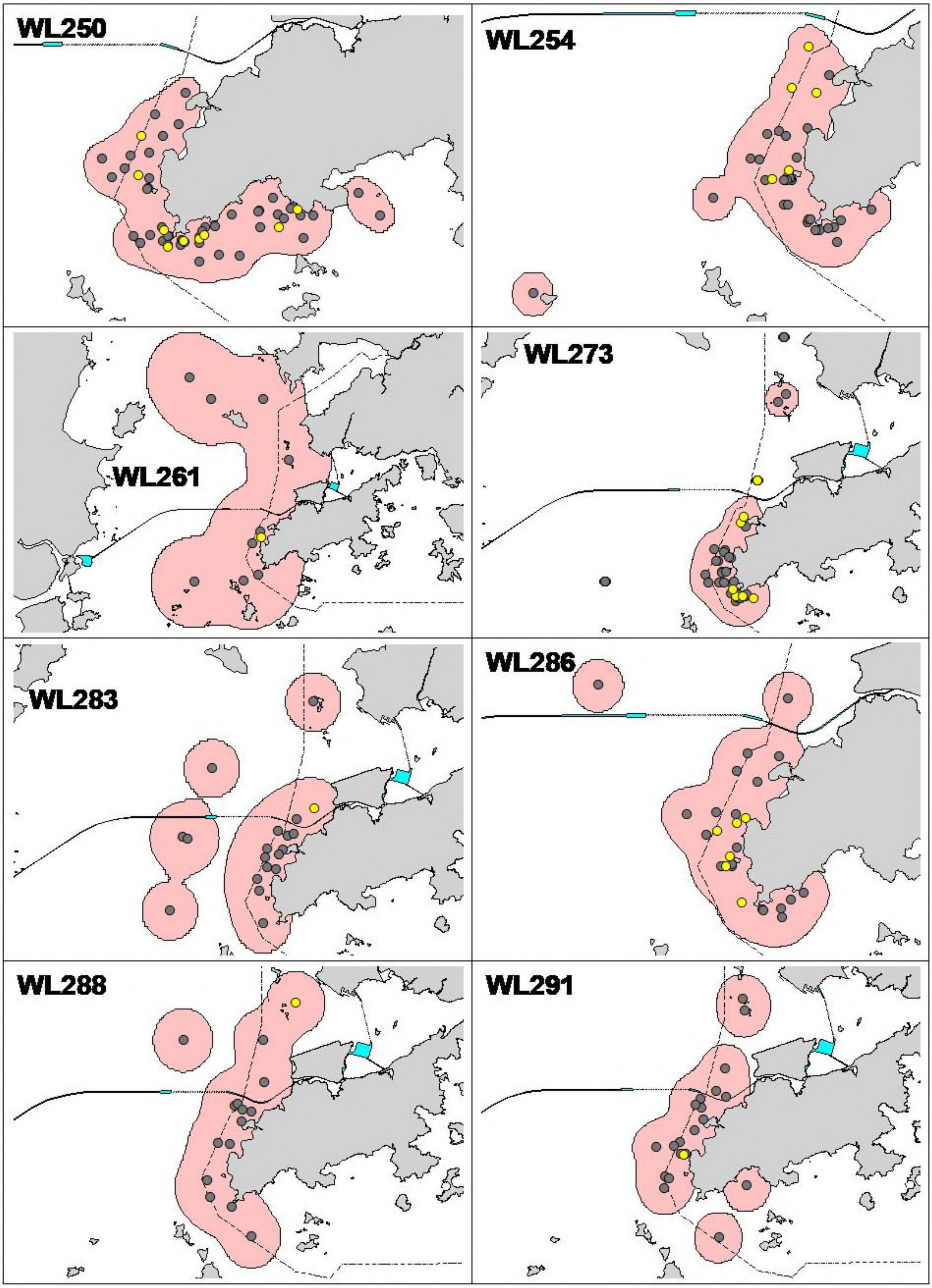
Appendix V. (cont'd).



Appendix V. (cont'd).



Appendix V. (cont'd).



Appendix V. (cont'd).